

The code of the package `nicematrix`*

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Abstract

This document is the documented code of the LaTeX package `nicematrix`. It is *not* its user's guide. The guide of utilisation is the document `nicematrix.pdf` (with a French traduction: `nicematrix-french.pdf`).

The development of the extension `nicematrix` is done on the following GitHub depot:
<https://github.com/fpantigny/nicematrix>

1 Declaration of the package and packages loaded

The prefix `nicematrix` has been registered for this package.

See: <http://mirrors.ctan.org/macros/latex/contrib/l3kernel/l3prefixes.pdf>
<@@=nicematrix>

First, we load `pgfcore` and the module `shapes`. We do so because it's not possible to use `\usepgfmodule` in `\ExplSyntaxOn`.

```
1 \RequirePackage{pgfcore}
2 \usepgfmodule{shapes}
```

We give the traditional declaration of a package written with the L3 programming layer.

```
3 \RequirePackage{l3keys2e}
4 \ProvidesExplPackage
5   {nicematrix}
6   {\myfiledate}
7   {\myfileversion}
8   {Enhanced arrays with the help of PGF/TikZ}
9 \ProvideDocumentCommand{\IfPackageLoadedT}{mm}
10  {\IfPackageLoadedTF{#1}{#2}{}}
11
12 \ProvideDocumentCommand{\IfPackageLoadedF}{mm}
13  {\IfPackageLoadedTF{#1}{#2}}
```

The command for the treatment of the options of `\usepackage` is at the end of this package for technical reasons.

```
14 \RequirePackage { amsmath }

15 \RequirePackage { array }
```

*This document corresponds to the version 7.1 of `nicematrix`, at the date of 2025/02/01.

In the version 2.6a of array, important modifications have been done for the Tagging Project.

```

16 \bool_const:Nn \c_@@_recent_array_bool
17 { \IfPackageAtLeastTF { array } { 2024/05/01 } \c_true_bool \c_false_bool }
18 \bool_const:Nn \c_@@_testphase_table_bool
19 { \IfPackageLoadedTF { latex-lab-testphase-table } \c_true_bool \c_false_bool }

20 \cs_new_protected:Npn \@@_error:n { \msg_error:nn { nicematrix } }
21 \cs_new_protected:Npn \@@_warning:n { \msg_warning:nn { nicematrix } }
22 \cs_new_protected:Npn \@@_error:nn { \msg_error:nnn { nicematrix } }
23 \cs_generate_variant:Nn \@@_error:nn { n e }
24 \cs_new_protected:Npn \@@_error:nnn { \msg_error:nnnn { nicematrix } }
25 \cs_new_protected:Npn \@@_fatal:n { \msg_fatal:nn { nicematrix } }
26 \cs_new_protected:Npn \@@_fatal:nn { \msg_fatal:nnn { nicematrix } }
27 \cs_new_protected:Npn \@@_msg_new:nn { \msg_new:nnn { nicematrix } }

```

With Overleaf, by default, a document is compiled in non-stop mode. When there is an error, there is no way to the user to use the key H in order to have more information. That's why we decide to put that piece of information (for the messages with such information) in the main part of the message when the key `messages-for-Overleaf` is used (at load-time).

```

28 \cs_new_protected:Npn \@@_msg_new:nnn #1 #2 #3
29 {
30   \bool_if:NTF \g_@@_messages_for_Overleaf_bool
31     { \msg_new:nnn { nicematrix } { #1 } { #2 \ \ #3 } }
32     { \msg_new:nnnn { nicematrix } { #1 } { #2 } { #3 } }
33 }

```

We also create a command which will generate usually an error but only a warning on Overleaf. The argument is given by curryfication.

```

34 \cs_new_protected:Npn \@@_error_or_warning:n
35 { \bool_if:NTF \g_@@_messages_for_Overleaf_bool \@@_warning:n \@@_error:n }

```

We try to detect whether the compilation is done on Overleaf. We use `\c_sys_jobname_str` because, with Overleaf, the value of `\c_sys_jobname_str` is always "output".

```

36 \bool_new:N \g_@@_messages_for_Overleaf_bool
37 \bool_gset:Nn \g_@@_messages_for_Overleaf_bool
38 {
39   \str_if_eq_p:on \c_sys_jobname_str { _region_ } % for Emacs
40   || \str_if_eq_p:ee \c_sys_jobname_str { output } % for Overleaf
41 }

```

```

42 \cs_new_protected:Npn \@@_msg_redirect_name:nn
43 { \msg_redirect_name:nnn { nicematrix } }
44 \cs_new_protected:Npn \@@_gredirect_none:n #1
45 {
46   \group_begin:
47   \globaldefs = 1
48   \@@_msg_redirect_name:nn { #1 } { none }
49   \group_end:
50 }
51 \cs_new_protected:Npn \@@_err_gredirect_none:n #1
52 {
53   \@@_error:n { #1 }
54   \@@_gredirect_none:n { #1 }
55 }
56 \cs_new_protected:Npn \@@_warning_gredirect_none:n #1
57 {
58   \@@_warning:n { #1 }
59   \@@_gredirect_none:n { #1 }
60 }

```

We will delete in the future the following lines which are only a security.

```

61 \cs_set:Npn \int_if_zero:NT #1 { \int_compare:nNnT #1 = \c_zero_int }
62 \cs_set:Npn \int_if_zero:NTF #1 { \int_compare:nNnTF #1 = \c_zero_int }

63 \@@_msg_new:nn { mdwtab~loaded }
64 {
65   The~packages~'mdwtab'~and~'nicematrix'~are~incompatible.~
66   This~error~is~fatal.
67 }

68 \hook_gput_code:nnn { begindocument / end } { . }
69 { \IfPackageLoadedT { mdwtab } { \@@_fatal:n { mdwtab-loaded } } }

```

2 Collecting options

The following technic allows to create user commands with the ability to put an arbitrary number of *[list of (key=val)]* after the name of the command.

Exemple :

```
\@@_collect_options:n { \F } [x=a,y=b] [z=c,t=d] { arg }
```

will be transformed in : `\F{x=a,y=b,z=c,t=d}{arg}`

Therefore, by writing : `\def\G{\@@_collect_options:n{\F}}`, the command `\G` takes in an arbitrary number of optional arguments between square brackets. Be careful: that command is *not* “fully expandable” (because of `\peek_meaning:NTF`).

```

70 \cs_new_protected:Npn \@@_collect_options:n #1
71 {
72   \peek_meaning:NTF [
73     { \@@_collect_options:nw { #1 } }
74     { #1 { } }
75 }

```

We use `\NewDocumentCommand` in order to be able to allow nested brackets within the argument between `[` and `]`.

```

76 \NewDocumentCommand \@@_collect_options:nw { m r[] }
77 { \@@_collect_options:nn { #1 } { #2 } }
78
79 \cs_new_protected:Npn \@@_collect_options:nn #1 #2
80 {
81   \peek_meaning:NTF [
82     { \@@_collect_options:nw { #1 } { #2 } }
83     { #1 { #2 } }
84 }
85
86 \cs_new_protected:Npn \@@_collect_options:nw #1#2[#3]
87 { \@@_collect_options:nn { #1 } { #2 , #3 } }

```

3 Technical definitions

The following constants are defined only for efficiency in the tests.

```

88 \tl_const:Nn \c_@@_b_tl { b }
89 \tl_const:Nn \c_@@_c_tl { c }
90 \tl_const:Nn \c_@@_l_tl { l }
91 \tl_const:Nn \c_@@_r_tl { r }
92 \tl_const:Nn \c_@@_all_tl { all }
93 \tl_const:Nn \c_@@_dot_tl { . }
94 \str_const:Nn \c_@@_r_str { r }
95 \str_const:Nn \c_@@_c_str { c }
96 \str_const:Nn \c_@@_l_str { l }

```

The following token list will be used for definitions of user commands (with `\NewDocumentCommand`) with an embellishment using an *underscore* (there may be problems because of the catcode of the underscore).

```

97 \tl_new:N \l_@@_argspec_tl

98 \cs_generate_variant:Nn \seq_set_split:Nnn { N o }
99 \cs_generate_variant:Nn \str_lowercase:n { o }
100 \cs_generate_variant:Nn \str_set:Nn { N o }
101 \cs_generate_variant:Nn \tl_build_put_right:Nn { N o }
102 \prg_generate_conditional_variant:Nnn \clist_if_in:Nn { N e } { T , F, TF }
103 \prg_generate_conditional_variant:Nnn \tl_if_empty:n { e } { T }
104 \prg_generate_conditional_variant:Nnn \tl_if_head_eq_meaning:nN { o N } { TF }
105 \cs_generate_variant:Nn \dim_min:nn { v }
106 \cs_generate_variant:Nn \dim_max:nn { v }

107 \hook_gput_code:nnn { begindocument } { . }
108 {
109   \IfPackageLoadedTF { tikz }
110   {

```

In some constructions, we will have to use a `{pgfpicture}` which *must* be replaced by a `{tikzpicture}` if Tikz is loaded. However, this switch between `{pgfpicture}` and `{tikzpicture}` can't be done dynamically with a conditional because, when the Tikz library `external` is loaded by the user, the pair `\tikzpicture-\endtikzpicture` (or `\begin{tikzpicture}-\end{tikzpicture}`) must be statically “visible” (even when externalization is not activated).

That's why we create `\c_@@_pgfortikzpicture_tl` and `\c_@@_endpgfortikzpicture_tl` which will be used to construct in a `\hook_gput_code:nnn { begindocument } { . }` the correct version of some commands. The tokens `\exp_not:N` are mandatory.

```

111   \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \tikzpicture }
112   \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endtikzpicture }
113   }
114   {
115   \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \pgfpicture }
116   \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endpgfpicture }
117   }
118 }

```

We test whether the current class is `revtex4-1` (deprecated) or `revtex4-2` because these classes redefines `\array` (of `array`) in a way incompatible with our programming. At the date April 2024, the current version `revtex4-2` is 4.2f (compatible with `booktabs`).

```

119 \IfClassLoadedTF { revtex4-1 }
120 { \bool_const:Nn \c_@@_revtex_bool \c_true_bool }
121 {
122   \IfClassLoadedTF { revtex4-2 }
123   { \bool_const:Nn \c_@@_revtex_bool \c_true_bool }
124   {

```

Maybe one of the previous classes will be loaded inside another class... We try to detect that situation.

```

125     \cs_if_exist:NT \rvtx@ifformat@geq
126     { \bool_const:Nn \c_@@_revtex_bool \c_true_bool }
127     { \bool_const:Nn \c_@@_revtex_bool \c_false_bool }
128   }
129 }

```

If the final user uses `nicematrix`, PGF/Tikz will write instruction `\pgfsyspdfmark` in the `aux` file. If he changes its mind and no longer loads `nicematrix`, an error may occur at the next compilation because of remanent instructions `\pgfsyspdfmark` in the `aux` file. With the following code, we try to avoid that situation.

```

130 \cs_new_protected:Npn \@@_provide_pgfsyspdfmark:
131 {
132   \iow_now:Nn \@mainaux
133   {
134     \ExplSyntaxOn
135     \cs_if_free:NT \pgfsyspdfmark
136     { \cs_set_eq:NN \pgfsyspdfmark \@gobblethree }
137     \ExplSyntaxOff
138   }
139   \cs_gset_eq:NN \@@_provide_pgfsyspdfmark: \prg_do_nothing:
140 }

```

We define a command `\iddots` similar to `\ddots` (`'\ddots'`) but with dots going forward (`'\iddots'`). We use `\ProvideDocumentCommand` and so, if the command `\iddots` has already been defined (for example by the package `mathdots`), we don't define it again.

```

141 \ProvideDocumentCommand \iddots { }
142 {
143   \mathinner
144   {
145     \tex_mkern:D 1 mu
146     \box_move_up:nn { 1 pt } { \hbox { . } }
147     \tex_mkern:D 2 mu
148     \box_move_up:nn { 4 pt } { \hbox { . } }
149     \tex_mkern:D 2 mu
150     \box_move_up:nn { 7 pt }
151     { \vbox:n { \kern 7 pt \hbox { . } } }
152     \tex_mkern:D 1 mu
153   }
154 }

```

This definition is a variant of the standard definition of `\ddots`.

In the `aux` file, we will have the references of the PGF/Tikz nodes created by `nicematrix`. However, when `booktabs` is used, some nodes (more precisely, some `row` nodes) will be defined twice because their position will be modified. In order to avoid an error message in this case, we will redefine `\pgfutil@check@rerun` in the `aux` file.

```

155 \hook_gput_code:nnn { begindocument } { . }
156 {
157   \IfPackageLoadedT { booktabs }
158   { \iow_now:Nn \@mainaux \nicematrix@redefine@check@rerun }
159 }
160 \cs_set_protected:Npn \nicematrix@redefine@check@rerun
161 {
162   \cs_set_eq:NN \@@_old_pgfutil@check@rerun \pgfutil@check@rerun

```

The new version of `\pgfutil@check@rerun` will not check the PGF nodes whose names start with `nm-` (which is the prefix for the nodes created by `nicematrix`).

```

163   \cs_set_protected:Npn \pgfutil@check@rerun ##1 ##2
164   {

```

`\str_if_eq:ee(TF)` is faster than `\str_if_eq:nn(TF)`.

```
165     \str_if_eq:eeF { nm- } { \tl_range:nnn { ##1 } 1 3 }
166     { \@@_old_pgfulil@check@rerun { ##1 } { ##2 } }
167   }
168 }
```

We have to know whether `colortbl` is loaded in particular for the redefinition of `\everycr`.

```
169 \hook_gput_code:nnn { begindocument } { . }
170 {
171   \IfPackageLoadedF { colortbl }
172   {
```

The command `\CT@arc@` is a command of `colortbl` which sets the color of the rules in the array. We will use it to store the instruction of color for the rules even if `colortbl` is not loaded.

```
173     \cs_set_protected:Npn \CT@arc@ { }
174     \cs_set_nopar:Npn \arrayrulecolor #1 # { \CT@arc { #1 } }
175     \cs_set_nopar:Npn \CT@arc #1 #2
176     {
177       \dim_compare:nNnT \baselineskip = \c_zero_dim \noalign
178       { \cs_gset_nopar:Npn \CT@arc@ { \color #1 { #2 } } }
179     }
```

Idem for `\CT@drs@`.

```
180     \cs_set_nopar:Npn \doublerulesepcolor #1 # { \CT@drs { #1 } }
181     \cs_set_nopar:Npn \CT@drs #1 #2
182     {
183       \dim_compare:nNnT \baselineskip = \c_zero_dim \noalign
184       { \cs_gset:Npn \CT@drsc@ { \color #1 { #2 } } }
185     }
186     \cs_set_nopar:Npn \hline
187     {
188       \noalign { \ifnum 0 = ` } \fi
189       \cs_set_eq:NN \hskip \vskip
190       \cs_set_eq:NN \vrule \hrule
191       \cs_set_eq:NN \@width \@height
192       { \CT@arc@ \vline }
193       \futurelet \reserved@a
194       \@xhline
195     }
196   }
197 }
```

We have to redefine `\cline` for several reasons. The command `\@@_cline` will be linked to `\cline` in the beginning of `{NiceArrayWithDelims}`. The following commands must *not* be protected.

```
198 \cs_set_nopar:Npn \@@_standard_cline #1 { \@@_standard_cline:w #1 \q_stop }
199 \cs_set_nopar:Npn \@@_standard_cline:w #1-#2 \q_stop
200 {
201   \int_if_zero:nT \l_@@_first_col_int { \omit & }
202   \int_compare:nNnT { #1 } > \c_one_int
203   { \multispan { \int_eval:n { #1 - 1 } } & }
204   \multispan { \int_eval:n { #2 - #1 + 1 } }
205   {
206     \CT@arc@
207     \leaders \hrule \@height \arrayrulewidth \hfill
```

The following `\skip_horizontal:N \c_zero_dim` is to prevent a potential `\unskip` to delete the `\leaders`¹

```
208     \skip_horizontal:N \c_zero_dim
209   }
```

¹See question 99041 on TeX StackExchange.

Our `\everycr` has been modified. In particular, the creation of the `row` node is in the `\everycr` (maybe we should put it with the incrementation of `\c@iRow`). Since the following `\cr` correspond to a “false row”, we have to nullify `\everycr`.

```

210   \everycr { }
211   \cr
212   \noalign { \skip_vertical:N -\arrayrulewidth }
213 }

```

The following version of `\cline` spreads the array of a quantity equal to `\arrayrulewidth` as does `\hline`. It will be loaded excepted if the key `standard-cline` has been used.

```

214 \cs_set:Npn \@@_cline

```

We have to act in a fully expandable way since there may be `\noalign` (in the `\multispan`) to detect. That’s why we use `\@@_cline_i:en`.

```

215 { \@@_cline_i:en \l_@@_first_col_int }

```

The command `\cline_i:nn` has two arguments. The first is the number of the current column (it *must* be used in that column). The second is a standard argument of `\cline` of the form *i-j* or the form *i*.

```

216 \cs_set:Npn \@@_cline_i:nn #1 #2 { \@@_cline_i:w #1|#2- \q_stop }
217 \cs_generate_variant:Nn \@@_cline_i:nn { e }
218 \cs_set:Npn \@@_cline_i:w #1|#2-#3 \q_stop
219 {
220   \tl_if_empty:nTF { #3 }
221     { \@@_cline_iii:w #1|#2-#2 \q_stop }
222     { \@@_cline_ii:w #1|#2-#3 \q_stop }
223 }
224 \cs_set:Npn \@@_cline_ii:w #1|#2-#3-\q_stop
225 { \@@_cline_iii:w #1|#2-#3 \q_stop }
226 \cs_set:Npn \@@_cline_iii:w #1|#2-#3 \q_stop
227 {

```

Now, `#1` is the number of the current column and we have to draw a line from the column `#2` to the column `#3` (both included).

```

228   \int_compare:nNnT { #1 } < { #2 }
229     { \multispan { \int_eval:n { #2 - #1 } } & }
230   \multispan { \int_eval:n { #3 - #2 + 1 } }
231   {
232     \CT@arc@
233     \leaders \hrule \@height \arrayrulewidth \hfill
234     \skip_horizontal:N \c_zero_dim
235   }

```

You look whether there is another `\cline` to draw (the final user may put several `\cline`).

```

236   \peek_meaning_remove_ignore_spaces:NTF \cline
237     { & \@@_cline_i:en { \int_eval:n { #3 + 1 } } }
238     { \everycr { } \cr }
239 }

```

The following command will be nullified in the environment `{NiceTabular}`, `{NiceTabular*}` and `{NiceTabularX}`.

```

240 \cs_set_eq:NN \@@_math_toggle: \c_math_toggle_token

241 \cs_generate_variant:Nn \@@_set_CT@arc@:n { o }
242 \cs_new_protected:Npn \@@_set_CT@arc@:n #1
243 {
244   \tl_if_blank:nF { #1 }
245   {
246     \tl_if_head_eq_meaning:nNTF { #1 } [
247       { \cs_set_nopar:Npn \CT@arc@ { \color #1 } }
248       { \cs_set_nopar:Npn \CT@arc@ { \color { #1 } } }
249     ]
250 }

```

```

251 \cs_generate_variant:Nn \@@_set_CT@drsc@:n { o }
252 \cs_new_protected:Npn \@@_set_CT@drsc@:n #1
253 {
254   \tl_if_head_eq_meaning:nNTF { #1 } [
255     { \cs_set_nopar:Npn \CT@drsc@ { \color #1 } }
256     { \cs_set_nopar:Npn \CT@drsc@ { \color { #1 } } }
257   ]

```

The following command must *not* be protected since it will be used to write instructions in the `\g_@@_pre_code_before_tl`.

```

258 \cs_generate_variant:Nn \@@_exp_color_arg:Nn { N o }
259 \cs_new:Npn \@@_exp_color_arg:Nn #1 #2
260 {
261   \tl_if_head_eq_meaning:nNTF { #2 } [
262     { #1 #2 }
263     { #1 { #2 } }
264   ]

```

The following command must be protected because of its use of the command `\color`.

```

265 \cs_generate_variant:Nn \@@_color:n { o }
266 \cs_new_protected:Npn \@@_color:n #1
267 { \tl_if_blank:nF { #1 } { \@@_exp_color_arg:Nn \color { #1 } } }

```

```

268 \cs_new_protected:Npn \@@_rescan_for_spanish:N #1
269 {
270   \tl_set_rescan:Nno
271     #1
272     {
273       \char_set_catcode_other:N >
274       \char_set_catcode_other:N <
275     }
276   #1
277 }

```

4 Parameters

The following counter will count the environments `{NiceArray}`. The value of this counter will be used to prefix the names of the Tikz nodes created in the array.

```

278 \int_new:N \g_@@_env_int

```

The following command is only a syntactic shortcut. It must *not* be protected (it will be used in names of PGF nodes).

```

279 \cs_new:Npn \@@_env: { nm - \int_use:N \g_@@_env_int }

```

The command `\NiceMatrixLastEnv` is not used by the package `nicematrix`. It's only a facility given to the final user. It gives the number of the last environment (in fact the number of the current environment but it's meant to be used after the environment in order to refer to that environment — and its nodes — without having to give it a name). This command *must* be expandable since it will be used in `pgf` nodes.

```

280 \NewExpandableDocumentCommand \NiceMatrixLastEnv { }
281 { \int_use:N \g_@@_env_int }

```

The following command is only a syntactic shortcut. The `q` in `qpoint` means *quick*.

```

282 \cs_new_protected:Npn \@@_qpoint:n #1
283 { \pgfpointanchor { \@@_env: - #1 } { center } }

```

If the user uses `{NiceTabular}`, `{NiceTabular*}` or `{NiceTabularX}`, we will raise the following flag.

```
284 \bool_new:N \l_@@_tabular_bool
```

`\g_@@_delims_bool` will be true for the environments with delimiters (ex. : `{pNiceMatrix}`, `{pNiceArray}`, `\pAutoNiceMatrix`, etc.).

```
285 \bool_new:N \g_@@_delims_bool
286 \bool_gset_true:N \g_@@_delims_bool
```

In fact, if there is delimiters in the preamble of `{NiceArray}` (eg: `[cccc]`), this boolean will be set to false.

The following boolean will be equal to `true` in the environments which have a preamble (provided by the final user): `{NiceTabular}`, `{NiceArray}`, `{pNiceArray}`, etc.

```
287 \bool_new:N \l_@@_preamble_bool
288 \bool_set_true:N \l_@@_preamble_bool
```

We need a special treatment for `{NiceMatrix}` when `vlines` is not used, in order to retrieve `\arraycolsep` on both sides.

```
289 \bool_new:N \l_@@_NiceMatrix_without_vlines_bool
```

The following counter will count the environments `{NiceMatrixBlock}`.

```
290 \int_new:N \g_@@_NiceMatrixBlock_int
```

It's possible to put tabular notes (with `\tabularnote`) in the caption if that caption is composed *above* the tabular. In such case, we will count in `\g_@@_notes_caption_int` the number of uses of the command `\tabularnote` *without optional argument* in that caption.

```
291 \int_new:N \g_@@_notes_caption_int
```

The dimension `\l_@@_columns_width_dim` will be used when the options specify that all the columns must have the same width (but, if the key `columns-width` is used with the special value `auto`, the boolean `\l_@@_auto_columns_width_bool` also will be raised).

```
292 \dim_new:N \l_@@_columns_width_dim
```

The dimension `\l_@@_col_width_dim` will be available in each cell which belongs to a column of fixed width: `w{...}{...}`, `W{...}{...}`, `p{...}`, `m{...}`, `b{...}` but also `X` (when the actual width of that column is known, that is to say after the first compilation). It's the width of that column. It will be used by some commands `\Block`. A non positive value means that the column has no fixed width (it's a column of type `c`, `r`, `l`, etc.).

```
293 \dim_new:N \l_@@_col_width_dim
294 \dim_set:Nn \l_@@_col_width_dim { -1 cm }
```

The following counters will be used to count the numbers of rows and columns of the array.

```
295 \int_new:N \g_@@_row_total_int
296 \int_new:N \g_@@_col_total_int
```

The following parameter will be used by `\@@_create_row_node`: to avoid to create the same row-node twice (at the end of the array).

```
297 \int_new:N \g_@@_last_row_node_int
```

The following counter corresponds to the key `nb-rows` of the command `\RowStyle`.

```
298 \int_new:N \l_@@_key_nb_rows_int
```

The following token list will contain the type of horizontal alignment of the current cell as provided by the corresponding column. The possible values are `r`, `l`, `c` and `j`. For example, a column `p[1]{3cm}` will provide the value `l` for all the cells of the column.

```
299 \tl_new:N \l_@@_hpos_cell_tl
300 \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_c_tl
```

When there is a mono-column block (created by the command `\Block`), we want to take into account the width of that block for the width of the column. That's why we compute the width of that block in the `\g_@@_blocks_wd_dim` and, after the construction of the box `\l_@@_cell_box`, we change the width of that box to take into account the length `\g_@@_blocks_wd_dim`.

```
301 \dim_new:N \g_@@_blocks_wd_dim
```

Idem for the mono-row blocks.

```
302 \dim_new:N \g_@@_blocks_ht_dim
```

```
303 \dim_new:N \g_@@_blocks_dp_dim
```

The following dimension correspond to the key `width` (which may be fixed in `\NiceMatrixOptions` but also in an environment `{NiceTabular}`).

```
304 \dim_new:N \l_@@_width_dim
```

The sequence `\g_@@_names_seq` will be the list of all the names of environments used (via the option `name`) in the document: two environments must not have the same name. However, it's possible to use the option `allow-duplicate-names`.

```
305 \seq_new:N \g_@@_names_seq
```

We want to know whether we are in an environment of `nicematrix` because we will raise an error if the user tries to use nested environments.

```
306 \bool_new:N \l_@@_in_env_bool
```

The following key corresponds to the key `notes/detect_duplicates`.

```
307 \bool_new:N \l_@@_notes_detect_duplicates_bool
```

```
308 \bool_set_true:N \l_@@_notes_detect_duplicates_bool
```

If the user uses `{NiceTabular*}`, the width of the tabular (in the first argument of the environment `{NiceTabular*}`) will be stored in the following dimension.

```
309 \dim_new:N \l_@@_tabular_width_dim
```

The following dimension will be used for the total width of composite rules (*total* means that the spaces on both sides are included).

```
310 \dim_new:N \l_@@_rule_width_dim
```

The key `color` in a command of rule such as `\Hline` (or the specifier “|” in the preamble of an environment).

```
311 \tl_new:N \l_@@_rule_color_tl
```

The following boolean will be raised when the command `\rotate` is used.

```
312 \bool_new:N \g_@@_rotate_bool
```

The following boolean will be raised when the command `\rotate` is used with the key `c`.

```
313 \bool_new:N \g_@@_rotate_c_bool
```

In a cell, it will be possible to know whether we are in a cell of a column of type `X` thanks to that flag (the `X` columns of `nicematrix` are inspired by those of `tabularx`).

```
314 \bool_new:N \l_@@_X_bool
```

```
315 \bool_new:N \g_@@_caption_finished_bool
```

The following boolean will be raised when the key `no-cell-nodes` is used.

```
316 \bool_new:N \l_@@_no_cell_nodes_bool
```

We will write in `\g_@@_aux_tl` all the instructions that we have to write on the `aux` file for the current environment. The content of that token list will be written on the `aux` file at the end of the environment (in an instruction `\tl_gset:cn { c_@@_ \int_use:N \g_@@_env_int _ tl }`).

```
317 \tl_new:N \g_@@_aux_tl
```

During the second run, if information concerning the current environment has been found in the `aux` file, the following flag will be raised.

```
318 \bool_new:N \g_@@_aux_found_bool
```

In particular, in that `aux` file, there will be, for each environment of `nicematrix`, an affectation for the following sequence that will contain information about the size of the array.

```
319 \seq_new:N \g_@@_size_seq
```

```
320 \tl_new:N \g_@@_left_delim_tl
```

```
321 \tl_new:N \g_@@_right_delim_tl
```

The token list `\g_@@_user_preamble_tl` will contain the preamble provided by the final user of `nicematrix` (eg the preamble of an environment `{NiceTabular}`).

```
322 \tl_new:N \g_@@_user_preamble_tl
```

The token list `\g_@@_array_preamble_tl` will contain the preamble constructed by `nicematrix` for the environment `{array}` (of `array`).

```
323 \tl_new:N \g_@@_array_preamble_tl
```

For `\multicolumn`.

```
324 \tl_new:N \g_@@_preamble_tl
```

The following parameter corresponds to the key `columns-type` of the environments `{NiceMatrix}`, `{pNiceMatrix}`, etc. and also the key `matrix / columns-type` of `\NiceMatrixOptions`.

```
325 \tl_new:N \l_@@_columns_type_tl
```

```
326 \str_set:Nn \l_@@_columns_type_tl { c }
```

The following parameters correspond to the keys `down`, `up` and `middle` of a command such as `\Cdots`. Usually, the final user doesn't use those keys directly because he uses the syntax with the embellishments `_`, `^` and `:`.

```
327 \tl_new:N \l_@@_xdots_down_tl
```

```
328 \tl_new:N \l_@@_xdots_up_tl
```

```
329 \tl_new:N \l_@@_xdots_middle_tl
```

We will store in the following sequence information provided by the instructions `\rowlistcolors` in the main array (not in the `\CodeBefore`).

```
330 \seq_new:N \g_@@_rowlistcolors_seq
```

```
331 \cs_new_protected:Npn \@@_test_if_math_mode:
```

```
332 {
```

```
333   \if_mode_math: \else:
```

```
334     \@@_fatal:n { Outside~math~mode }
```

```
335   \fi:
```

```
336 }
```

The list of the columns where vertical lines in sub-matrices (`vlism`) must be drawn. Of course, the actual value of this sequence will be known after the analysis of the preamble of the array.

```
337 \seq_new:N \g_@@_cols_vlism_seq
```

The following colors will be used to memorize the color of the potential “first col” and the potential “first row”.

```
338 \colorlet { nicematrix-last-col } { . }
```

```
339 \colorlet { nicematrix-last-row } { . }
```

The following string is the name of the current environment or the current command of `nicematrix` (despite its name which contains `env`).

```
340 \str_new:N \g_@@_name_env_str
```

The following string will contain the word `command` or `environment` whether we are in a command of `nicematrix` or in an environment of `nicematrix`. The default value is `environment`.

```
341 \tl_new:N \g_@@_com_or_env_str
342 \tl_gset:Nn \g_@@_com_or_env_str { environment }
```

```
343 \bool_new:N \l_@@_bold_row_style_bool
```

The following command will be able to reconstruct the full name of the current command or environment (despite its name which contains `env`). This command must *not* be protected since it will be used in error messages and we have to use `\str_if_eq:eeTF` and not `\tl_if_eq:eeTF` because we need to be fully expandable). `\str_if_eq:ee(TF)` is faster than `\str_if_eq:nn(TF)`.

```
344 \cs_new:Npn \@@_full_name_env:
345 {
346   \str_if_eq:eeTF \g_@@_com_or_env_str { command }
347   { command \space \c_backslash_str \g_@@_name_env_str }
348   { environment \space \{ \g_@@_name_env_str \} }
349 }
```

For the key code of the command `\SubMatrix` (itself in the main `\CodeAfter`), we will use the following token list.

```
350 \tl_new:N \l_@@_code_tl
```

For the key `pgf-node-code`. That code will be used when the nodes of the cells (that is to say the nodes of the form `i-j`) will be created.

```
351 \tl_new:N \l_@@_pgf_node_code_tl
```

The so-called `\CodeBefore` is splitted in two parts because we want to control the order of execution of some instructions.

```
352 \tl_new:N \g_@@_pre_code_before_tl
353 \tl_new:N \g_nicematrix_code_before_tl
```

The value of the key `code-before` will be added to the left of `\g_@@_pre_code_before_tl`. Idem for the code between `\CodeBefore` and `\Body`.

The so-called `\CodeAfter` is splitted in two parts because we want to control the order of execution of some instructions.

```
354 \tl_new:N \g_@@_pre_code_after_tl
355 \tl_new:N \g_nicematrix_code_after_tl
```

The `\CodeAfter` provided by the final user (with the key `code-after` or the keyword `\CodeAfter`) will be stored in the second token list.

```
356 \bool_new:N \l_@@_in_code_after_bool
```

The following parameter will be raised when a block contains an ampersand (`&`) in its content (`=label`).

```
357 \bool_new:N \l_@@_ampersand_bool
```

The counters `\l_@@_old_iRow_int` and `\l_@@_old_jCol_int` will be used to save the values of the potential LaTeX counters `iRow` and `jCol`. These LaTeX counters will be restored at the end of the environment.

```
358 \int_new:N \l_@@_old_iRow_int
359 \int_new:N \l_@@_old_jCol_int
```

The TeX counters `\c@iRow` and `\c@jCol` will be created in the beginning of `{NiceArrayWithDelims}` (if they don't exist previously).

The following sequence will contain the names (without backslash) of the commands created by `custom-line` by the key `command` or `ccommand` (commands used by the final user in order to draw horizontal rules).

```
360 \seq_new:N \l_@@_custom_line_commands_seq
```

The following token list corresponds to the key `rules/color` available in the environments.

```
361 \tl_new:N \l_@@_rules_color_tl
```

The sum of the weights of all the X-columns in the preamble. The weight of a X-column is given as an optional argument between square brackets. The default value, of course, is 1.

```
362 \int_new:N \g_@@_total_X_weight_int
```

If there is at least one X-column in the preamble of the array, the following flag will be raised via the `aux` file. The length `\l_@@_x_columns_dim` will be the width of X-columns of weight 1 (the width of a column of weight n will be that dimension multiplied by n). That value is computed after the construction of the array during the first compilation in order to be used in the following run.

```
363 \bool_new:N \l_@@_X_columns_aux_bool
```

```
364 \dim_new:N \l_@@_X_columns_dim
```

This boolean will be used only to detect in an expandable way whether we are at the beginning of the (potential) column zero, in order to raise an error if `\Hdotsfor` is used in that column.

```
365 \bool_new:N \g_@@_after_col_zero_bool
```

A kind of false row will be inserted at the end of the array for the construction of the `col` nodes (and also to fix the width of the columns when `columns-width` is used). When this special row will be created, we will raise the flag `\g_@@_row_of_col_done_bool` in order to avoid some actions set in the redefinition of `\everycr` when the last `\cr` of the `\halign` will occur (after that row of `col` nodes).

```
366 \bool_new:N \g_@@_row_of_col_done_bool
```

It's possible to use the command `\NotEmpty` to specify explicitly that a cell must be considered as non empty by `nicematrix` (the Tikz nodes are constructed only in the non empty cells).

```
367 \bool_new:N \g_@@_not_empty_cell_bool
```

The use of `\l_@@_code_before_tl` is not clear. Maybe that, with the evolutions of `nicematrix`, it has become obsolete. We should have a look at that.

```
368 \tl_new:N \l_@@_code_before_tl
```

```
369 \bool_new:N \l_@@_code_before_bool
```

The following token list will contain the code inserted in each cell of the current row (this token list will be cleared at the beginning of each row).

```
370 \tl_new:N \g_@@_row_style_tl
```

The following dimensions will be used when drawing the dotted lines.

```
371 \dim_new:N \l_@@_x_initial_dim
```

```
372 \dim_new:N \l_@@_y_initial_dim
```

```
373 \dim_new:N \l_@@_x_final_dim
```

```
374 \dim_new:N \l_@@_y_final_dim
```

The L3 programming layer provides scratch dimensions `\l_tmpa_dim` and `\l_tmpb_dim`. We creates several more in the same spirit.

```
375 \dim_new:N \l_@@_tmpc_dim
```

```
376 \dim_new:N \l_@@_tmpd_dim
```

```
377 \dim_new:N \l_@@_tmppe_dim
```

```
378 \dim_new:N \l_@@_tmpf_dim
```

```

379 \dim_new:N \g_@@_dp_row_zero_dim
380 \dim_new:N \g_@@_ht_row_zero_dim
381 \dim_new:N \g_@@_ht_row_one_dim
382 \dim_new:N \g_@@_dp_ante_last_row_dim
383 \dim_new:N \g_@@_ht_last_row_dim
384 \dim_new:N \g_@@_dp_last_row_dim

```

Some cells will be declared as “empty” (for example a cell with an instruction `\Cdots`).

```

385 \bool_new:N \g_@@_empty_cell_bool

```

The following dimensions will be used internally to compute the width of the potential “first column” and “last column”.

```

386 \dim_new:N \g_@@_width_last_col_dim
387 \dim_new:N \g_@@_width_first_col_dim

```

The following sequence will contain the characteristics of the blocks of the array, specified by the command `\Block`. Each block is represented by 6 components surrounded by curly braces: `{imin}{jmin}{imax}{jmax}{options}{contents}`.

The variable is global because it will be modified in the cells of the array.

```

388 \seq_new:N \g_@@_blocks_seq

```

We also manage a sequence of the *positions* of the blocks. In that sequence, each block is represented by only five components: `{imin}{jmin}{imax}{jmax}{ name}`. A block with the key `hvlines` won’t appear in that sequence (otherwise, the lines in that block would not be drawn!).

```

389 \seq_new:N \g_@@_pos_of_blocks_seq

```

In fact, this sequence will also contain the positions of the cells with a `\diagbox`. The sequence `\g_@@_pos_of_blocks_seq` will be used when we will draw the rules (which respect the blocks).

In the `\CodeBefore`, the value of `\g_@@_pos_of_blocks_seq` will be the value read in the aux file from a previous run. However, in the `\CodeBefore`, the commands `\EmptyColumn` and `\EmptyRow` will write virtual positions of blocks in the following sequence.

```

390 \seq_new:N \g_@@_future_pos_of_blocks_seq

```

The, after the execution of the `\CodeBefore`, the sequence `\g_@@_pos_of_blocs_seq` will be erased and replaced by the value of `\g_@@_future_pos_of_blocks_seq`.

We will also manage a sequence for the positions of the dotted lines. These dotted lines are created in the array by `\Cdots`, `\Vdots`, `\Ddots`, etc. However, their positions, that is to say, their extremities, will be determined only after the construction of the array. In this sequence, each item contains five components: `{imin}{jmin}{imax}{jmax}{ name}`.

```

391 \seq_new:N \g_@@_pos_of_xdots_seq

```

The sequence `\g_@@_pos_of_xdots_seq` will be used when we will draw the rules required by the key `hvlines` (these rules won’t be drawn within the virtual blocks corresponding to the dotted lines).

The final user may decide to “stroke” a block (using, for example, the key `draw=red!15` when using the command `\Block`). In that case, the rules specified, for instance, by `hvlines` must not be drawn around the block. That’s why we keep the information of all that stroken blocks in the following sequence.

```

392 \seq_new:N \g_@@_pos_of_stroken_blocks_seq

```

If the user has used the key `corners`, all the cells which are in an (empty) corner will be stored in the following list. We use a `clist` instead of a `seq` because we will frequently search in that list (and searching in a `clist` is faster than searching in a `seq`).

```

393 \clist_new:N \l_@@_corners_cells_clist

```

The list of the names of the potential `\SubMatrix` in the `\CodeAfter` of an environment. Unfortunately, that list has to be global (we have to use it inside the group for the options of a given `\SubMatrix`).

```

394 \seq_new:N \g_@@_submatrix_names_seq

```

The following flag will be raised if the key `width` is used in an environment `{NiceTabular}` (not in a command `\NiceMatrixOptions`). You use it to raise an error when this key is used while no column `X` is used.

```
395 \bool_new:N \l_@@_width_used_bool
```

The sequence `\g_@@_multicolumn_cells_seq` will contain the list of the cells of the array where a command `\multicolumn{n}{...}{...}` with $n > 1$ is issued. In `\g_@@_multicolumn_sizes_seq`, the “sizes” (that is to say the values of n) correspondent will be stored. These lists will be used for the creation of the “medium nodes” (if they are created).

```
396 \seq_new:N \g_@@_multicolumn_cells_seq
397 \seq_new:N \g_@@_multicolumn_sizes_seq
```

The following counters will be used when searching the extremities of a dotted line (we need these counters because of the potential “open” lines in the `\SubMatrix`—the `\SubMatrix` in the `code-before`).

```
398 \int_new:N \l_@@_row_min_int
399 \int_new:N \l_@@_row_max_int
400 \int_new:N \l_@@_col_min_int
401 \int_new:N \l_@@_col_max_int
```

The following counters will be used when drawing the rules.

```
402 \int_new:N \l_@@_start_int
403 \int_set_eq:NN \l_@@_start_int \c_one_int
404 \int_new:N \l_@@_end_int
405 \int_new:N \l_@@_local_start_int
406 \int_new:N \l_@@_local_end_int
```

The following sequence will be used when the command `\SubMatrix` is used in the `\CodeBefore` (and not in the `\CodeAfter`). It will contain the position of all the sub-matrices specified in the `\CodeBefore`. Each sub-matrix is represented by an “object” of the form `{i}{j}{k}{l}` where i and j are the number of row and column of the upper-left cell and k and l the number of row and column of the lower-right cell.

```
407 \seq_new:N \g_@@_submatrix_seq
```

We are able to determine the number of columns specified in the preamble (for the environments with explicit preamble of course and without the potential exterior columns).

```
408 \int_new:N \g_@@_static_num_of_col_int
```

The following parameters correspond to the keys `fill`, `opacity`, `draw`, `tikz`, `borders`, and `rounded-corners` of the command `\Block`.

```
409 \tl_new:N \l_@@_fill_tl
410 \tl_new:N \l_@@_opacity_tl
411 \tl_new:N \l_@@_draw_tl
412 \seq_new:N \l_@@_tikz_seq
413 \clist_new:N \l_@@_borders_clist
414 \dim_new:N \l_@@_rounded_corners_dim
```

The last parameter has no direct link with the [empty] corners of the array (which are computed and taken into account by `nicematrix` when the key `corners` is used).

The following dimension corresponds to the key `rounded-corners` available in an individual environment `{NiceTabular}`. When that key is used, a clipping is applied in the `\CodeBefore` of the environment in order to have rounded corners for the potential colored panels.

```
415 \dim_new:N \l_@@_tab_rounded_corners_dim
```

The following token list correspond to the key `color` of the command `\Block` and also the key `color` of the command `\RowStyle`.

```
416 \tl_new:N \l_@@_color_tl
```

In the key `tikz` of a command `\Block` or in the argument of a command `\TikzEveryCell`, the final user puts a list of `tikz` keys. But, you have added another key, named `offset` (which means that an offset will be used for the frame of the block or the cell). The following parameter corresponds to that key.

```
417 \dim_new:N \l_@@_offset_dim
```

Here is the dimension for the width of the rule when a block (created by `\Block`) is stroked.

```
418 \dim_new:N \l_@@_line_width_dim
```

The parameters of the horizontal position of the label of a block. If the user uses the key `c` or `C`, the value is `c`. If the user uses the key `l` or `L`, the value is `l`. If the user uses the key `r` or `R`, the value is `r`. If the user has used a capital letter, the boolean `\l_@@_hpos_of_block_cap_bool` will be raised (in the second pass of the analyze of the keys of the command `\Block`).

```
419 \str_new:N \l_@@_hpos_block_str
420 \str_set:Nn \l_@@_hpos_block_str { c }
421 \bool_new:N \l_@@_hpos_of_block_cap_bool
422 \bool_new:N \l_@@_p_block_bool
```

If the final user has used the special color “`nocolor`”, the following flag will be raised.

```
423 \bool_new:N \l_@@_nocolor_used_bool
```

For the vertical position, the possible values are `c`, `t`, `b`, `T` and `B` (but `\l_@@_vpos_block_str` will remain empty if the user doesn’t use a key for the vertical position).

```
424 \str_new:N \l_@@_vpos_block_str
```

Used when the key `draw-first` is used for `\Ddots` or `\Iddots`.

```
425 \bool_new:N \l_@@_draw_first_bool
```

The following flag corresponds to the keys `vlines` and `hlines` of the command `\Block` (the key `hvlines` is the conjunction of both).

```
426 \bool_new:N \l_@@_vlines_block_bool
427 \bool_new:N \l_@@_hlines_block_bool
```

The blocks which use the key `-` will store their content in a box. These boxes are numbered with the following counter.

```
428 \int_new:N \g_@@_block_box_int

429 \dim_new:N \l_@@_submatrix_extra_height_dim
430 \dim_new:N \l_@@_submatrix_left_xshift_dim
431 \dim_new:N \l_@@_submatrix_right_xshift_dim
432 \clist_new:N \l_@@_hlines_clist
433 \clist_new:N \l_@@_vlines_clist
434 \clist_new:N \l_@@_submatrix_hlines_clist
435 \clist_new:N \l_@@_submatrix_vlines_clist
```

The following key is set when the keys `hvlines` and `hvlines-except-borders` are used. It’s used only to change slightly the clipping path set by the key `rounded-corners` (for a `{tabular}`).

```
436 \bool_new:N \l_@@_hvlines_bool
```

The following flag will be used by (for instance) `\@@_vline_ii:`. When `\l_@@_dotted_bool` is true, a dotted line (with our system) will be drawn.

```
437 \bool_new:N \l_@@_dotted_bool
```

The following flag will be set to true during the composition of a caption specified (by the key `caption`).

```
438 \bool_new:N \l_@@_in_caption_bool
```

Variables for the exterior rows and columns

The keys for the exterior rows and columns are `first-row`, `first-col`, `last-row` and `last-col`. However, internally, these keys are not coded in a similar way.

- **First row**

The integer `\l_@@_first_row_int` is the number of the first row of the array. The default value is 1, but, if the option `first-row` is used, the value will be 0.

```
439 \int_new:N \l_@@_first_row_int
440 \int_set:Nn \l_@@_first_row_int 1
```

- **First column**

The integer `\l_@@_first_col_int` is the number of the first column of the array. The default value is 1, but, if the option `first-col` is used, the value will be 0.

```
441 \int_new:N \l_@@_first_col_int
442 \int_set_eq:NN \l_@@_first_col_int \c_one_int
```

- **Last row**

The counter `\l_@@_last_row_int` is the number of the potential “last row”, as specified by the key `last-row`. A value of `-2` means that there is no “last row”. A value of `-1` means that there is a “last row” but we don’t know the number of that row (the key `last-row` has been used without value and the actual value has not still been read in the `aux` file).

```
443 \int_new:N \l_@@_last_row_int
444 \int_set:Nn \l_@@_last_row_int { -2 }
```

If, in an environment like `{pNiceArray}`, the option `last-row` is used without value, we will globally raise the following flag. It will be used to know if we have, after the construction of the array, to write in the `aux` file the number of the “last row”.²

```
445 \bool_new:N \l_@@_last_row_without_value_bool
```

Idem for `\l_@@_last_col_without_value_bool`

```
446 \bool_new:N \l_@@_last_col_without_value_bool
```

- **Last column**

For the potential “last column”, we use an integer. A value of `-2` means that there is no last column. A value of `-1` means that we are in an environment without preamble (e.g. `{bNiceMatrix}`) and there is a last column but we don’t know its value because the user has used the option `last-col` without value. A value of 0 means that the option `last-col` has been used in an environment with preamble (like `{pNiceArray}`): in this case, the key was necessary without argument. The command `\NiceMatrixOptions` also sets `\l_@@_last_col_int` to 0.

```
447 \int_new:N \l_@@_last_col_int
448 \int_set:Nn \l_@@_last_col_int { -2 }
```

However, we have also a boolean. Consider the following code:

²We can’t use `\l_@@_last_row_int` for this usage because, if `nicematrix` has read its value from the `aux` file, the value of the counter won’t be `-1` any longer.

```

\begin{pNiceArray}{cc}[last-col]
1 & 2 \\
3 & 4
\end{pNiceArray}

```

In such a code, the “last column” specified by the key `last-col` is not used. We want to be able to detect such a situation and we create a boolean for that job.

```
449 \bool_new:N \g_@@_last_col_found_bool
```

This boolean is set to `false` at the end of `\@@_pre_array_ii:`.

In the last column, we will raise the following flag (it will be used by `\OnlyMainNiceMatrix`).

```
450 \bool_new:N \l_@@_in_last_col_bool
```

Some utilities

```
451 \cs_new_protected:Npn \@@_cut_on_hyphen:w #1-#2\q_stop
452 {
```

Here, we use `\cs_set_nopar:Npn` instead of `\tl_set:Nn` for efficiency only.

```
453 \cs_set_nopar:Npn \l_tmpa_tl { #1 }
454 \cs_set_nopar:Npn \l_tmpb_tl { #2 }
455 }
```

The following takes as argument the name of a `clist` and which should be a list of intervals of integers. It *expands* that list, that is to say, it replaces (by a sort of `mapcan` or `flat_map`) the interval by the explicit list of the integers.

```
456 \cs_new_protected:Npn \@@_expand_clist:N #1
457 {
458 \clist_if_in:NnF #1 { all }
459 {
460 \clist_clear:N \l_tmpa_clist
461 \clist_map_inline:Nn #1
462 {
```

We recall that `\tl_if_in:nnTF` is slightly faster than `\str_if_in:nnTF`.

```
463 \tl_if_in:nnTF { ##1 } { - }
464 { \@@_cut_on_hyphen:w ##1 \q_stop }
465 {
```

Here, we use `\cs_set_nopar:Npn` instead of `\tl_set:Nn` for efficiency only.

```
466 \cs_set_nopar:Npn \l_tmpa_tl { ##1 }
467 \cs_set_nopar:Npn \l_tmpb_tl { ##1 }
468 }
469 \int_step_inline:nnn \l_tmpa_tl \l_tmpb_tl
470 { \clist_put_right:Nn \l_tmpa_clist { ####1 } }
471 }
472 \tl_set_eq:NN #1 \l_tmpa_clist
473 }
474 }
```

The following internal parameters are for:

- `\Ldots` with both extremities open (and hence also `\Hdotsfor` in an exterior row);
- `\Vdots` with both extremities open (and hence also `\Vdotsfor` in an exterior column);
- when the special character “:” is used in order to put the label of a so-called “dotted line” on the line, a margin of `\c_@@_innersep_middle_dim` will be added around the label.

```
475 \hook_gput_code:nnn { begindocument } { . }
476 {
477 \dim_const:Nn \c_@@_shift_Ldots_last_row_dim { 0.5 em }
478 \dim_const:Nn \c_@@_shift_exterior_Vdots_dim { 0.6 em }
479 \dim_const:Nn \c_@@_innersep_middle_dim { 0.17 em }
480 }
```

5 The command `\tabularnote`

Of course, it's possible to use `\tabularnote` in the main tabular. But there is also the possibility to use that command in the caption of the tabular. And the caption may be specified by two means:

- The caption may of course be provided by the command `\caption` in a floating environment. Of course, a command `\tabularnote` in that `\caption` makes sens only if the `\caption` is *before* the `{tabular}`.
- It's also possible to use `\tabularnote` in the value of the key `caption` of the `{NiceTabular}` when the key `caption-above` is in force. However, in that case, one must remind that the caption is composed *after* the composition of the box which contains the main tabular (that's mandatory since that caption must be wrapped with a line width equal to the width of the tabular). However, we want the labels of the successive tabular notes in the logical order. That's why:
 - The number of tabular notes present in the caption will be written on the aux file and available in `\g_@@_notes_caption_int`.³
 - During the composition of the main tabular, the tabular notes will be numbered from `\g_@@_notes_caption_int+1` and the notes will be stored in `\g_@@_notes_seq`. Each component of `\g_@@_notes_seq` will be a kind of couple of the form : `{label}{text of the tabularnote}`. The first component is the optional argument (between square brackets) of the command `\tabularnote` (if the optional argument is not used, the value will be the special marker expressed by `\c_novalue_tl`).
 - During the composition of the caption (value of `\l_@@_caption_tl`), the tabular notes will be numbered from 1 to `\g_@@_notes_caption_int` and the notes themselves will be stored in `\g_@@_notes_in_caption_seq`. The structure of the components of that sequence will be the same as for `\g_@@_notes_seq`.
 - After the composition of the main tabular and after the composition of the caption, the sequences `\g_@@_notes_in_caption_seq` and `\g_@@_notes_seq` will be merged (in that order) and the notes will be composed.

The LaTeX counter `tabularnote` will be used to count the tabular notes during the construction of the array (this counter won't be used during the composition of the notes at the end of the array). You use a LaTeX counter because we will use `\refstepcounter` in order to have the tabular notes referenceable.

```
481 \newcounter { tabularnote }
```

We want to avoid error messages for duplicate labels when the package `hyperref` is used. That's why we will count all the tabular notes of the whole document with `\g_@@_tabularnote_int`.

```
482 \int_new:N \g_@@_tabularnote_int
```

```
483 \cs_set:Npn \theHtabularnote { \int_use:N \g_@@_tabularnote_int }
```

```
484 \seq_new:N \g_@@_notes_seq
```

```
485 \seq_new:N \g_@@_notes_in_caption_seq
```

Before the actual tabular notes, it's possible to put a text specified by the key `tabularnote` of the environment. The token list `\g_@@_tabularnote_tl` corresponds to the value of that key.

```
486 \tl_new:N \g_@@_tabularnote_tl
```

We prepare the tools for the formatting of the references of the footnotes (in the tabular itself). There may have several references of footnote at the same point and we have to take into account that point.

```
487 \seq_new:N \l_@@_notes_labels_seq
```

```
488 \newcounter { nicematrix_draft }
```

³More precisely, it's the number of tabular notes which do not use the optional argument of `\tabularnote`.

```

489 \cs_new_protected:Npn \@@_notes_format:n #1
490 {
491   \setcounter { nicematrix_draft } { #1 }
492   \@@_notes_style:n { nicematrix_draft }
493 }

```

The following function can be redefined by using the key `notes/style`.

```

494 \cs_new:Npn \@@_notes_style:n #1 { \textit { \alph { #1 } } }

```

The following function can be redefined by using the key `notes/label-in-tabular`.

```

495 \cs_new:Npn \@@_notes_label_in_tabular:n #1 { \textsuperscript { #1 } }

```

The following function can be redefined by using the key `notes/label-in-list`.

```

496 \cs_new:Npn \@@_notes_label_in_list:n #1 { \textsuperscript { #1 } }

```

We define `\thetabularnote` because it will be used by LaTeX if the user want to reference a tabular which has been marked by a `\label`. The TeX group is for the case where the user has put an instruction such as `\color{red}` in `\@@_notes_style:n`.

```

497 \cs_set:Npn \thetabularnote { { \@@_notes_style:n { tabularnote } } }

```

The tabular notes will be available for the final user only when `enumitem` is loaded. Indeed, the tabular notes will be composed at the end of the array with a list customized by `enumitem` (a list `tabularnotes` in the general case and a list `tabularnotes*` if the key `para` is in force). However, we can test whether `enumitem` has been loaded only at the beginning of the document (we want to allow the user to load `enumitem` after `nicematrix`).

```

498 \hook_gput_code:nnn { begindocument } { . }
499 {
500   \IfPackageLoadedTF { enumitem }
501   {

```

The type of list `tabularnotes` will be used to format the tabular notes at the end of the array in the general case and `tabularnotes*` will be used if the key `para` is in force.

```

502   \newlist { tabularnotes } { enumerate } { 1 }
503   \setlist [ tabularnotes ]
504   {
505     topsep = 0pt ,
506     noitemsep ,
507     leftmargin = * ,
508     align = left ,
509     labelsep = 0pt ,
510     label =
511     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotesi } } ,
512   }
513   \newlist { tabularnotes* } { enumerate* } { 1 }
514   \setlist* [ tabularnotes* ]
515   {
516     afterlabel = \nobreak ,
517     itemjoin = \quad ,
518     label =
519     \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotes*i } }
520   }

```

One must remind that we have allowed a `\tabular` in the caption and that caption may also be found in the list of tables (`\listoftables`). We want the command `\tabularnote` be no-op during the composition of that list. That's why we program `\tabularnote` to be no-op excepted in a floating environment or in an environment of `nicematrix`.

```

521   \NewDocumentCommand \tabularnote { o m }
522   {
523     \bool_lazy_or:nnT { \cs_if_exist_p:N \capttype } \l_@@_in_env_bool

```

```

524     {
525         \bool_lazy_and:nnTF { ! \l_@@_tabular_bool } \l_@@_in_env_bool
526         { \@@_error:n { tabularnote~forbidden } }
527     {
528         \bool_if:NTF \l_@@_in_caption_bool
529         \@@_tabularnote_caption:nn
530         \@@_tabularnote:mn
531         { #1 } { #2 }
532     }
533 }
534 }
535 }
536 {
537     \NewDocumentCommand \tabularnote { o m }
538     {
539         \@@_error_or_warning:n { enumitem~not~loaded }
540         \@@_gredirect_none:n { enumitem~not~loaded }
541     }
542 }
543 }
544 \cs_new_protected:Npn \@@_test_first_novalue:nnn #1 #2 #3
545 { \tl_if_novalue:nT { #1 } { #3 } }

```

For the version in normal conditions, that is to say not in the caption. #1 is the optional argument of `\tabularnote` (maybe equal to the special marker expressed by `\c_novalue_tl`) and #2 is the mandatory argument of `\tabularnote`.

```

546 \cs_new_protected:Npn \@@_tabularnote:nn #1 #2
547 {

```

You have to see whether the argument of `\tabularnote` has yet been used as argument of another `\tabularnote` in the same tabular. In that case, there will be only one note (for both commands `\tabularnote`) at the end of the tabular. We search the argument of our command `\tabularnote` in `\g_@@_notes_seq`. The position in the sequence will be stored in `\l_tmpa_int` (0 if the text is not in the sequence yet).

```

548     \int_zero:N \l_tmpa_int
549     \bool_if:NT \l_@@_notes_detect_duplicates_bool
550     {

```

We recall that each component of `\g_@@_notes_seq` is a kind of couple of the form

$$\{label\}\{text\ of\ the\ tabularnote\}.$$

If the user have used `\tabularnote` without the optional argument, the *label* will be the special marker expressed by `\c_novalue_tl`.

When we will go through the sequence `\g_@@_notes_seq`, we will count in `\l_tmpb_int` the notes without explicit label in order to have the “current” value of the counter `\c@tabularnote`.

```

551     \int_zero:N \l_tmpb_int
552     \seq_map_indexed_inline:Nn \g_@@_notes_seq
553     {
554         \@@_test_first_novalue:nnn ##2 { \int_incr:N \l_tmpb_int }
555         \tl_if_eq:nnT { { #1 } { #2 } } { ##2 }
556         {
557             \tl_if_novalue:nTF { #1 }
558             { \int_set_eq:NN \l_tmpa_int \l_tmpb_int }
559             { \int_set:Nn \l_tmpa_int { ##1 } }
560             \seq_map_break:
561         }
562     }
563     \int_if_zero:nF \l_tmpa_int
564     { \int_add:Nn \l_tmpa_int \g_@@_notes_caption_int }
565 }
566 \int_if_zero:nT \l_tmpa_int
567 {

```

```

568     \seq_gput_right:Nn \g_@@_notes_seq { { #1 } { #2 } }
569     \tl_if_novalue:nT { #1 } { \int_gincr:N \c@tabularnote }
570   }
571   \seq_put_right:Ne \l_@@_notes_labels_seq
572   {
573     \tl_if_novalue:nTF { #1 }
574     {
575       \@@_notes_format:n
576       {
577         \int_eval:n
578         {
579           \int_if_zero:nTF \l_tmpa_int
580             \c@tabularnote
581             \l_tmpa_int
582         }
583       }
584     }
585     { #1 }
586   }
587   \peek_meaning:NF \tabularnote
588   {

```

If the following token is *not* a `\tabularnote`, we have finished the sequence of successive commands `\tabularnote` and we have to format the labels of these tabular notes (in the array). We compose those labels in a box `\l_tmpa_box` because we will do a special construction in order to have this box in an overlapping position if we are at the end of a cell when `\l_@@_hpos_cell_tl` is equal to `c` or `r`.

```

589     \hbox_set:Nn \l_tmpa_box
590     {

```

We remind that it is the command `\@@_notes_label_in_tabular:n` that will put the labels in a `\textsuperscript`.

```

591     \@@_notes_label_in_tabular:n
592     {
593       \seq_use:Nnnn
594       \l_@@_notes_labels_seq { , } { , } { , }
595     }
596   }

```

We want the (last) tabular note referenceable (with the standard command `\label`).

```

597     \int_gdecr:N \c@tabularnote
598     \int_set_eq:NN \l_tmpa_int \c@tabularnote

```

The following line is only to avoid error messages for multiply defined labels when the package `hyperref` is used.

```

599     \int_gincr:N \g_@@_tabularnote_int
600     \refstepcounter { tabularnote }
601     \int_compare:nNnT \l_tmpa_int = \c@tabularnote
602       { \int_gincr:N \c@tabularnote }
603     \seq_clear:N \l_@@_notes_labels_seq
604     \bool_lazy_or:nnTF
605     { \str_if_eq_p:ee \l_@@_hpos_cell_tl { c } }
606     { \str_if_eq_p:ee \l_@@_hpos_cell_tl { r } }
607     {
608       \hbox_overlap_right:n { \box_use:N \l_tmpa_box }

```

If the command `\tabularnote` is used exactly at the end of the cell, the `\unskip` (inserted by `array`?) will delete the skip we insert now and the label of the footnote will be composed in an overlapping position (by design).

```

609     \skip_horizontal:n { \box_wd:N \l_tmpa_box }
610   }
611   { \box_use:N \l_tmpa_box }
612 }
613 }

```

Now the version when the command is used in the key `caption`. The main difficulty is that the argument of the command `\caption` is composed several times. In order to know the number of commands `\tabularnote` in the caption, we will consider that there should not be the same tabular note twice in the caption (in the main tabular, it's possible). Once we have found a tabular note which has yet been encountered, we consider that you are in a new composition of the argument of `\caption`.

```

614 \cs_new_protected:Npn \@@_tabularnote_caption:nn #1 #2
615   {
616     \bool_if:NTF \g_@@_caption_finished_bool
617       {
618         \int_compare:nNnT \c@tabularnote = \g_@@_notes_caption_int
619           { \int_gzero:N \c@tabularnote }

```

Now, we try to detect duplicate notes in the caption. Be careful! We must put `\tl_if_in:NnF` and not `\tl_if_in:NnT`!

```

620     \seq_if_in:NnF \g_@@_notes_in_caption_seq { { #1 } { #2 } }
621     { \@@_error:n { Identical-notes-in-caption } }
622   }
623   {

```

In the following code, we are in the first composition of the caption or at the first `\tabularnote` of the second composition.

```

624     \seq_if_in:NnTF \g_@@_notes_in_caption_seq { { #1 } { #2 } }
625     {

```

Now, we know that are in the second composition of the caption since we are reading a tabular note which has yet been read. Now, the value of `\g_@@_notes_caption_int` won't change anymore: it's the number of uses *without optional argument* of the command `\tabularnote` in the caption.

```

626         \bool_gset_true:N \g_@@_caption_finished_bool
627         \int_gset_eq:NN \g_@@_notes_caption_int \c@tabularnote
628         \int_gzero:N \c@tabularnote
629       }
630     { \seq_gput_right:Nn \g_@@_notes_in_caption_seq { { #1 } { #2 } } }
631   }

```

Now, we will compose the label of the footnote (in the caption). Even if we are not in the first composition, we have to compose that label!

```

632   \tl_if_novalue:nT { #1 } { \int_gincr:N \c@tabularnote }
633   \seq_put_right:Ne \l_@@_notes_labels_seq
634   {
635     \tl_if_novalue:nTF { #1 }
636       { \@@_notes_format:n { \int_use:N \c@tabularnote } }
637       { #1 }
638   }
639   \peek_meaning:NF \tabularnote
640   {
641     \@@_notes_label_in_tabular:n
642     { \seq_use:Nnnn \l_@@_notes_labels_seq { , } { , } { , } }
643     \seq_clear:N \l_@@_notes_labels_seq
644   }
645 }

646 \cs_new_protected:Npn \@@_count_novalue_first:nn #1 #2
647   { \tl_if_novalue:nT { #1 } { \int_gincr:N \g_@@_notes_caption_int } }

```

6 Command for creation of rectangle nodes

The following command should be used in a `{pgfpicture}`. It creates a rectangle (empty but with a name).

`#1` is the name of the node which will be created; `#2` and `#3` are the coordinates of one of the corner of the rectangle; `#4` and `#5` are the coordinates of the opposite corner.

```

648 \cs_new_protected:Npn \@@_pgf_rect_node:nnnnn #1 #2 #3 #4 #5
649 {
650   \begin { pgfscope }
651   \pgfset
652   {
653     inner~sep = \c_zero_dim ,
654     minimum~size = \c_zero_dim
655   }
656   \pgftransformshift { \pgfpoint { 0.5 * ( #2 + #4 ) } { 0.5 * ( #3 + #5 ) } }
657   \pgfnode
658   { rectangle }
659   { center }
660   {
661     \vbox_to_ht:nn
662     { \dim_abs:n { #5 - #3 } }
663     {
664       \vfill
665       \hbox_to_wd:nn { \dim_abs:n { #4 - #2 } } { }
666     }
667   }
668   { #1 }
669   { }
670   \end { pgfscope }
671 }

```

The command `\@@_pgf_rect_node:nnn` is a variant of `\@@_pgf_rect_node:nnnnn`: it takes two PGF points as arguments instead of the four dimensions which are the coordinates.

```

672 \cs_new_protected:Npn \@@_pgf_rect_node:nnn #1 #2 #3
673 {
674   \begin { pgfscope }
675   \pgfset
676   {
677     inner~sep = \c_zero_dim ,
678     minimum~size = \c_zero_dim
679   }
680   \pgftransformshift { \pgfpoint scale { 0.5 } { \pgfpointadd { #2 } { #3 } } }
681   \pgfpointdiff { #3 } { #2 }
682   \pgfgetlastxy \l_tmpa_dim \l_tmpb_dim
683   \pgfnode
684   { rectangle }
685   { center }
686   {
687     \vbox_to_ht:nn
688     { \dim_abs:n \l_tmpb_dim }
689     { \vfill \hbox_to_wd:nn { \dim_abs:n \l_tmpa_dim } { } }
690   }
691   { #1 }
692   { }
693   \end { pgfscope }
694 }

```

7 The options

The following parameter corresponds to the keys `caption`, `short-caption` and `label` of the environment `{NiceTabular}`.

```

695 \tl_new:N \l_@@_caption_tl
696 \tl_new:N \l_@@_short_caption_tl
697 \tl_new:N \l_@@_label_tl

```

The following parameter corresponds to the key `caption-above` of `\NiceMatrixOptions`. When this parameter is `true`, the captions of the environments `{NiceTabular}`, specified with the key `caption` are put above the tabular (and below elsewhere).

```
698 \bool_new:N \l_@@_caption_above_bool
```

By default, the behaviour of `\cline` is changed in the environments of `nicematrix`: a `\cline` spreads the array by an amount equal to `\arrayrulewidth`. It's possible to disable this feature with the key `\l_@@_standard_line_bool`.

```
699 \bool_new:N \l_@@_standard_cline_bool
```

The following dimensions correspond to the options `cell-space-top-limit` and `co` (these parameters are inspired by the package `cellspace`).

```
700 \dim_new:N \l_@@_cell_space_top_limit_dim
701 \dim_new:N \l_@@_cell_space_bottom_limit_dim
```

The following parameter corresponds to the key `xdots/horizontal_labels`.

```
702 \bool_new:N \l_@@_xdots_h_labels_bool
```

The following dimension is the distance between two dots for the dotted lines (when `line-style` is equal to `standard`, which is the initial value). The initial value is 0.45 em but it will be changed if the option `small` is used.

```
703 \dim_new:N \l_@@_xdots_inter_dim
704 \hook_gput_code:nnn { begindocument } { . }
705 { \dim_set:Nn \l_@@_xdots_inter_dim { 0.45 em } }
```

The unit is `em` and that's why we fix the dimension after the preamble.

The following dimension is the distance between a node (in fact an anchor of that node) and a dotted line (for real dotted lines, the actual distance may, of course, be a bit larger, depending of the exact position of the dots).

```
706 \dim_new:N \l_@@_xdots_shorten_start_dim
707 \dim_new:N \l_@@_xdots_shorten_end_dim
708 \hook_gput_code:nnn { begindocument } { . }
709 {
710   \dim_set:Nn \l_@@_xdots_shorten_start_dim { 0.3 em }
711   \dim_set:Nn \l_@@_xdots_shorten_end_dim { 0.3 em }
712 }
```

The unit is `em` and that's why we fix the dimension after the preamble.

The following dimension is the radius of the dots for the dotted lines (when `line-style` is equal to `standard`, which is the initial value). The initial value is 0.53 pt but it will be changed if the option `small` is used.

```
713 \dim_new:N \l_@@_xdots_radius_dim
714 \hook_gput_code:nnn { begindocument } { . }
715 { \dim_set:Nn \l_@@_xdots_radius_dim { 0.53 pt } }
```

The unit is `em` and that's why we fix the dimension after the preamble.

The token list `\l_@@_xdots_line_style_tl` corresponds to the option `tikz` of the commands `\Cdots`, `\Ldots`, etc. and of the options `line-style` for the environments and `\NiceMatrixOptions`. The constant `\c_@@_standard_tl` will be used in some tests.

```
716 \tl_new:N \l_@@_xdots_line_style_tl
717 \tl_const:Nn \c_@@_standard_tl { standard }
718 \tl_set_eq:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl
```

The boolean `\l_@@_light_syntax_bool` corresponds to the option `light-syntax` and the boolean `\l_@@_light_syntax_expanded_bool` correspond to the the option `light-syntax-expanded`.

```
719 \bool_new:N \l_@@_light_syntax_bool
720 \bool_new:N \l_@@_light_syntax_expanded_bool
```

The string `\l_@@_baseline_tl` may contain one of the three values `t`, `c` or `b` as in the option of the environment `{array}`. However, it may also contain **an integer** (which represents the number of the row to which align the array).

```
721 \tl_new:N \l_@@_baseline_tl
722 \tl_set:Nn \l_@@_baseline_tl { c }
```

The following parameter corresponds to the key `ampersand-in-blocks`

```
723 \bool_new:N \l_@@_amp_in_blocks_bool
```

The flag `\l_@@_exterior_arraycolsep_bool` corresponds to the option `exterior-arraycolsep`. If this option is set, a space equal to `\arraycolsep` will be put on both sides of an environment `{NiceArray}` (as it is done in `{array}` of `array`).

```
724 \bool_new:N \l_@@_exterior_arraycolsep_bool
```

The flag `\l_@@_parallelize_diags_bool` controls whether the diagonals are parallelized. The initial value is `true`.

```
725 \bool_new:N \l_@@_parallelize_diags_bool
726 \bool_set_true:N \l_@@_parallelize_diags_bool
```

The following parameter correspond to the key `corners`. The elements of that `clist` must be within `NW`, `SW`, `NE` and `SE`.

```
727 \clist_new:N \l_@@_corners_clist
```

```
728 \dim_new:N \l_@@_notes_above_space_dim
729 \hook_gput_code:nnn { begindocument } { . }
730 { \dim_set:Nn \l_@@_notes_above_space_dim { 1 mm } }
```

We use a hook only by security in case `revtex4-1` is used (even though it is obsolete).

The flag `\l_@@_nullify_dots_bool` corresponds to the option `nullify-dots`. When the flag is down, the instructions like `\vdots` are inserted within a `\hphantom` (and so the constructed matrix has exactly the same size as a matrix constructed with the classical `{matrix}` and `\ldots`, `\vdots`, etc.).

```
731 \bool_new:N \l_@@_nullify_dots_bool
```

When the key `respect-arraystretch` is used, the following command will be nullified.

```
732 \cs_new_protected:Npn \@@_reset_arraystretch:
733 { \cs_set_nopar:Npn \arraystretch { 1 } }
```

The following flag will be used when the current options specify that all the columns of the array must have the same width equal to the largest width of a cell of the array (except the cells of the potential exterior columns).

```
734 \bool_new:N \l_@@_auto_columns_width_bool
```

The following boolean corresponds to the key `create-cell-nodes` of the keyword `\CodeBefore`.

```
735 \bool_new:N \g_@@_recreate_cell_nodes_bool
```

The string `\l_@@_name_str` will contain the optional name of the environment: this name can be used to access to the Tikz nodes created in the array from outside the environment.

```
736 \str_new:N \l_@@_name_str
```

The boolean `\l_@@_medium_nodes_bool` will be used to indicate whether the “medium nodes” are created in the array. Idem for the “large nodes”.

```
737 \bool_new:N \l_@@_medium_nodes_bool
738 \bool_new:N \l_@@_large_nodes_bool
```

The boolean `\l_@@_except_borders_bool` will be raised when the key `hvlines-except-borders` will be used (but that key has also other effects).

```
739 \bool_new:N \l_@@_except_borders_bool
```

The dimension `\l_@@_left_margin_dim` correspond to the option `left-margin`. Idem for the right margin. These parameters are involved in the creation of the “medium nodes” but also in the placement of the delimiters and the drawing of the horizontal dotted lines (`\hdottedline`).

```
740 \dim_new:N \l_@@_left_margin_dim
741 \dim_new:N \l_@@_right_margin_dim
```

The dimensions `\l_@@_extra_left_margin_dim` and `\l_@@_extra_right_margin_dim` correspond to the options `extra-left-margin` and `extra-right-margin`.

```
742 \dim_new:N \l_@@_extra_left_margin_dim
743 \dim_new:N \l_@@_extra_right_margin_dim
```

The token list `\l_@@_end_of_row_tl` corresponds to the option `end-of-row`. It specifies the symbol used to mark the ends of rows when the light syntax is used.

```
744 \tl_new:N \l_@@_end_of_row_tl
745 \tl_set:Nn \l_@@_end_of_row_tl { ; }
```

The following parameter is for the color the dotted lines drawn by `\Cdots`, `\Ldots`, `\Vdots`, `\Ddots`, `\Iddots` and `\Hdotsfor` but *not* the dotted lines drawn by `\hdottedline` and “:”.

```
746 \tl_new:N \l_@@_xdots_color_tl
```

The following token list corresponds to the key `delimiters/color`.

```
747 \tl_new:N \l_@@_delimiters_color_tl
```

Sometimes, we want to have several arrays vertically juxtaposed in order to have an alignment of the columns of these arrays. To achieve this goal, one may wish to use the same width for all the columns (for example with the option `columns-width` or the option `auto-columns-width` of the environment `{NiceMatrixBlock}`). However, even if we use the same type of delimiters, the width of the delimiters may be different from an array to another because the width of the delimiter is fonction of its size. That’s why we create an option called `delimiters/max-width` which will give to the delimiters the width of a delimiter (of the same type) of big size. The following boolean corresponds to this option.

```
748 \bool_new:N \l_@@_delimiters_max_width_bool
```

```
749 \keys_define:nn { nicematrix / xdots }
750 {
751   shorten-start .code:n =
752     \hook_gput_code:nnn { begindocument } { . }
753     { \dim_set:Nn \l_@@_xdots_shorten_start_dim { #1 } } ,
754   shorten-end .code:n =
755     \hook_gput_code:nnn { begindocument } { . }
756     { \dim_set:Nn \l_@@_xdots_shorten_end_dim { #1 } } ,
757   shorten-start .value_required:n = true ,
758   shorten-end .value_required:n = true ,
759   shorten .code:n =
760     \hook_gput_code:nnn { begindocument } { . }
761     {
762       \dim_set:Nn \l_@@_xdots_shorten_start_dim { #1 }
763       \dim_set:Nn \l_@@_xdots_shorten_end_dim { #1 }
764     } ,
765   shorten .value_required:n = true ,
766   horizontal-labels .bool_set:N = \l_@@_xdots_h_labels_bool ,
767   horizontal-labels .default:n = true ,
768   line-style .code:n =
769     {
770       \bool_lazy_or:nnTF
771         { \cs_if_exist_p:N \tikzpicture }
```

```

772     { \str_if_eq_p:n { #1 } { standard } }
773     { \tl_set:Nn \l_@@_xdots_line_style_tl { #1 } }
774     { \@@_error:n { bad-option-for-line-style } }
775   } ,
776   line-style .value_required:n = true ,
777   color .tl_set:N = \l_@@_xdots_color_tl ,
778   color .value_required:n = true ,
779   radius .code:n =
780     \hook_gput_code:nnn { begindocument } { . }
781     { \dim_set:Nn \l_@@_xdots_radius_dim { #1 } } ,
782   radius .value_required:n = true ,
783   inter .code:n =
784     \hook_gput_code:nnn { begindocument } { . }
785     { \dim_set:Nn \l_@@_xdots_inter_dim { #1 } } ,
786   radius .value_required:n = true ,

```

The options `down`, `up` and `middle` are not documented for the final user because he should use the syntax with `^`, `_` and `:`. We use `\tl_put_right:Nn` and not `\tl_set:Nn` (or `.tl_set:N`) because we don't want a direct use of `up=...` erased by an absent `^{\dots}`.

```

787   down .code:n = \tl_put_right:Nn \l_@@_xdots_down_tl { #1 } ,
788   up .code:n = \tl_put_right:Nn \l_@@_xdots_up_tl { #1 } ,
789   middle .code:n = \tl_put_right:Nn \l_@@_xdots_middle_tl { #1 } ,

```

The key `draw-first`, which is meant to be used only with `\Ddots` and `\Iddots`, will be caught when `\Ddots` or `\Iddots` is used (during the construction of the array and not when we draw the dotted lines).

```

790   draw-first .code:n = \prg_do_nothing: ,
791   unknown .code:n = \@@_error:n { Unknown-key-for-xdots }
792 }

```

```

793 \keys_define:nn { nicematrix / rules }
794 {
795   color .tl_set:N = \l_@@_rules_color_tl ,
796   color .value_required:n = true ,
797   width .dim_set:N = \arrayrulewidth ,
798   width .value_required:n = true ,
799   unknown .code:n = \@@_error:n { Unknown-key-for-rules }
800 }

```

First, we define a set of keys “`nicematrix / Global`” which will be used (with the mechanism of `.inherit:n`) by other sets of keys.

```

801 \keys_define:nn { nicematrix / Global }
802 {
803   color-inside .code:n =
804     \@@_warning_gredirect_none:n { key-color-inside } ,
805   colortbl-like .code:n =
806     \@@_warning_gredirect_none:n { key-color-inside } ,
807   ampersand-in-blocks .bool_set:N = \l_@@_amp_in_blocks_bool ,
808   ampersand-in-blocks .default:n = true ,
809   &-in-blocks .meta:n = ampersand-in-blocks ,
810   no-cell-nodes .code:n =
811     \bool_set_true:N \l_@@_no_cell_nodes_bool
812     \cs_set_protected:Npn \@@_node_for_cell:
813     { \set@color \box_use_drop:N \l_@@_cell_box } ,
814   no-cell-nodes .value_forbidden:n = true ,
815   rounded-corners .dim_set:N = \l_@@_tab_rounded_corners_dim ,
816   rounded-corners .default:n = 4 pt ,
817   custom-line .code:n = \@@_custom_line:n { #1 } ,
818   rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
819   rules .value_required:n = true ,
820   standard-cline .bool_set:N = \l_@@_standard_cline_bool ,
821   standard-cline .default:n = true ,

```

```

822 cell-space-top-limit .dim_set:N = \l_@@_cell_space_top_limit_dim ,
823 cell-space-top-limit .value_required:n = true ,
824 cell-space-bottom-limit .dim_set:N = \l_@@_cell_space_bottom_limit_dim ,
825 cell-space-bottom-limit .value_required:n = true ,
826 cell-space-limits .meta:n =
827 {
828     cell-space-top-limit = #1 ,
829     cell-space-bottom-limit = #1 ,
830 } ,
831 cell-space-limits .value_required:n = true ,
832 xdots .code:n = \keys_set:nn { nicematrix / xdots } { #1 } ,
833 light-syntax .code:n =
834     \bool_set_true:N \l_@@_light_syntax_bool
835     \bool_set_false:N \l_@@_light_syntax_expanded_bool ,
836 light-syntax .value_forbidden:n = true ,
837 light-syntax-expanded .code:n =
838     \bool_set_true:N \l_@@_light_syntax_bool
839     \bool_set_true:N \l_@@_light_syntax_expanded_bool ,
840 light-syntax-expanded .value_forbidden:n = true ,
841 end-of-row .tl_set:N = \l_@@_end_of_row_tl ,
842 end-of-row .value_required:n = true ,
843 first-col .code:n = \int_zero:N \l_@@_first_col_int ,
844 first-row .code:n = \int_zero:N \l_@@_first_row_int ,
845 last-row .int_set:N = \l_@@_last_row_int ,
846 last-row .default:n = -1 ,
847 code-for-first-col .tl_set:N = \l_@@_code_for_first_col_tl ,
848 code-for-first-col .value_required:n = true ,
849 code-for-last-col .tl_set:N = \l_@@_code_for_last_col_tl ,
850 code-for-last-col .value_required:n = true ,
851 code-for-first-row .tl_set:N = \l_@@_code_for_first_row_tl ,
852 code-for-first-row .value_required:n = true ,
853 code-for-last-row .tl_set:N = \l_@@_code_for_last_row_tl ,
854 code-for-last-row .value_required:n = true ,
855 hlines .clist_set:N = \l_@@_hlines_clist ,
856 vlines .clist_set:N = \l_@@_vlines_clist ,
857 hlines .default:n = all ,
858 vlines .default:n = all ,
859 vlines-in-sub-matrix .code:n =
860 {
861     \tl_if_single_token:nTF { #1 }
862     {
863         \tl_if_in:NnTF \c_@@_forbidden_letters_tl { #1 }
864         { \@@_error:nn { Forbidden~letter } { #1 } }

```

We write directly a command for the automata which reads the preamble provided by the final user.

```

865     { \cs_set_eq:cN { @@_#1 } \@@_make_preamble_vlism:n }
866 }
867 { \@@_error:n { One~letter~allowed } }
868 } ,
869 vlines-in-sub-matrix .value_required:n = true ,
870 hvlines .code:n =
871 {
872     \bool_set_true:N \l_@@_hvlines_bool
873     \tl_set_eq:NN \l_@@_vlines_clist \c_@@_all_tl
874     \tl_set_eq:NN \l_@@_hlines_clist \c_@@_all_tl
875 } ,
876 hvlines-except-borders .code:n =
877 {
878     \tl_set_eq:NN \l_@@_vlines_clist \c_@@_all_tl
879     \tl_set_eq:NN \l_@@_hlines_clist \c_@@_all_tl
880     \bool_set_true:N \l_@@_hvlines_bool
881     \bool_set_true:N \l_@@_except_borders_bool
882 } ,
883 parallelize-diags .bool_set:N = \l_@@_parallelize_diags_bool ,

```

With the option `renew-dots`, the command `\cdots`, `\ldots`, `\vdots`, `\ddots`, etc. are redefined and behave like the commands `\Cdots`, `\Ldots`, `\Vdots`, `\Ddots`, etc.

```

884   renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
885   renew-dots .value_forbidden:n = true ,
886   nullify-dots .bool_set:N = \l_@@_nullify_dots_bool ,
887   create-medium-nodes .bool_set:N = \l_@@_medium_nodes_bool ,
888   create-large-nodes .bool_set:N = \l_@@_large_nodes_bool ,
889   create-extra-nodes .meta:n =
890     { create-medium-nodes , create-large-nodes } ,
891   left-margin .dim_set:N = \l_@@_left_margin_dim ,
892   left-margin .default:n = \arraycolsep ,
893   right-margin .dim_set:N = \l_@@_right_margin_dim ,
894   right-margin .default:n = \arraycolsep ,
895   margin .meta:n = { left-margin = #1 , right-margin = #1 } ,
896   margin .default:n = \arraycolsep ,
897   extra-left-margin .dim_set:N = \l_@@_extra_left_margin_dim ,
898   extra-right-margin .dim_set:N = \l_@@_extra_right_margin_dim ,
899   extra-margin .meta:n =
900     { extra-left-margin = #1 , extra-right-margin = #1 } ,
901   extra-margin .value_required:n = true ,
902   respect-arraystretch .code:n =
903     \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,
904   respect-arraystretch .value_forbidden:n = true ,
905   pgf-node-code .tl_set:N = \l_@@_pgf_node_code_tl ,
906   pgf-node-code .value_required:n = true
907 }

```

We define a set of keys used by the environments of `nicematrix` (but not by the command `\NiceMatrixOptions`).

```

908 \keys_define:mn { nicematrix / environments }
909   {
910     corners .clist_set:N = \l_@@_corners_clist ,
911     corners .default:n = { NW , SW , NE , SE } ,
912     code-before .code:n =
913       {
914         \tl_if_empty:nF { #1 }
915         {
916           \tl_gput_left:Nn \g_@@_pre_code_before_tl { #1 }
917           \bool_set_true:N \l_@@_code_before_bool
918         }
919       } ,
920     code-before .value_required:n = true ,

```

The options `c`, `t` and `b` of the environment `{NiceArray}` have the same meaning as the option of the classical environment `{array}`.

```

921   c .code:n = \tl_set:Nn \l_@@_baseline_tl c ,
922   t .code:n = \tl_set:Nn \l_@@_baseline_tl t ,
923   b .code:n = \tl_set:Nn \l_@@_baseline_tl b ,
924   baseline .tl_set:N = \l_@@_baseline_tl ,
925   baseline .value_required:n = true ,
926   columns-width .code:n =

```

We use `\str_if_eq:nnTF` which is slightly faster than `\tl_if_eq:nnTF` (and is expandable). `\str_if_eq:ee(TF)` is faster than `\str_if_eq:nn(TF)`.

```

927   \str_if_eq:eeTF { #1 } { auto }
928   { \bool_set_true:N \l_@@_auto_columns_width_bool }
929   { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,
930   columns-width .value_required:n = true ,
931   name .code:n =

```

We test whether we are in the measuring phase of an environment of `amsmath` (always loaded by `nicematrix`) because we want to avoid a fallacious message of duplicate name in this case.

```

932 \legacy_if:nF { measuring@ }
933 {
934   \str_set:Ne \l_tmpa_str { #1 }
935   \seq_if_in:NoTF \g_@@_names_seq \l_tmpa_str
936   { \@@_error:nn { Duplicate~name } { #1 } }
937   { \seq_gput_left:No \g_@@_names_seq \l_tmpa_str }
938   \str_set_eq:NN \l_@@_name_str \l_tmpa_str
939 } ,
940 name .value_required:n = true ,
941 code-after .tl_gset:N = \g_nicematrix_code_after_tl ,
942 code-after .value_required:n = true ,
943 }
944 \keys_define:nn { nicematrix / notes }
945 {
946   para .bool_set:N = \l_@@_notes_para_bool ,
947   para .default:n = true ,
948   code-before .tl_set:N = \l_@@_notes_code_before_tl ,
949   code-before .value_required:n = true ,
950   code-after .tl_set:N = \l_@@_notes_code_after_tl ,
951   code-after .value_required:n = true ,
952   bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
953   bottomrule .default:n = true ,
954   style .cs_set:Np = \@@_notes_style:n #1 ,
955   style .value_required:n = true ,
956   label-in-tabular .cs_set:Np = \@@_notes_label_in_tabular:n #1 ,
957   label-in-tabular .value_required:n = true ,
958   label-in-list .cs_set:Np = \@@_notes_label_in_list:n #1 ,
959   label-in-list .value_required:n = true ,
960   enumitem-keys .code:n =
961   {
962     \hook_gput_code:nnn { begindocument } { . }
963     {
964       \IfPackageLoadedT { enumitem }
965       { \setlist* [ tabularnotes ] { #1 } }
966     }
967   } ,
968   enumitem-keys .value_required:n = true ,
969   enumitem-keys-para .code:n =
970   {
971     \hook_gput_code:nnn { begindocument } { . }
972     {
973       \IfPackageLoadedT { enumitem }
974       { \setlist* [ tabularnotes* ] { #1 } }
975     }
976   } ,
977   enumitem-keys-para .value_required:n = true ,
978   detect-duplicates .bool_set:N = \l_@@_notes_detect_duplicates_bool ,
979   detect-duplicates .default:n = true ,
980   unknown .code:n = \@@_error:n { Unknown~key~for~notes }
981 }
982 \keys_define:nn { nicematrix / delimiters }
983 {
984   max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
985   max-width .default:n = true ,
986   color .tl_set:N = \l_@@_delimiters_color_tl ,
987   color .value_required:n = true ,
988 }

```

We begin the construction of the major sets of keys (used by the different user commands and environments).

```

989 \keys_define:nn { nicematrix }
990 {

```

```

991 NiceMatrixOptions .inherit:n =
992   { nicematrix / Global } ,
993 NiceMatrixOptions / xdots .inherit:n = nicematrix / xdots ,
994 NiceMatrixOptions / rules .inherit:n = nicematrix / rules ,
995 NiceMatrixOptions / notes .inherit:n = nicematrix / notes ,
996 NiceMatrixOptions / sub-matrix .inherit:n = nicematrix / sub-matrix ,
997 SubMatrix / rules .inherit:n = nicematrix / rules ,
998 CodeAfter / xdots .inherit:n = nicematrix / xdots ,
999 CodeBefore / sub-matrix .inherit:n = nicematrix / sub-matrix ,
1000 CodeAfter / sub-matrix .inherit:n = nicematrix / sub-matrix ,
1001 NiceMatrix .inherit:n =
1002   {
1003     nicematrix / Global ,
1004     nicematrix / environments ,
1005   } ,
1006 NiceMatrix / xdots .inherit:n = nicematrix / xdots ,
1007 NiceMatrix / rules .inherit:n = nicematrix / rules ,
1008 NiceTabular .inherit:n =
1009   {
1010     nicematrix / Global ,
1011     nicematrix / environments
1012   } ,
1013 NiceTabular / xdots .inherit:n = nicematrix / xdots ,
1014 NiceTabular / rules .inherit:n = nicematrix / rules ,
1015 NiceTabular / notes .inherit:n = nicematrix / notes ,
1016 NiceArray .inherit:n =
1017   {
1018     nicematrix / Global ,
1019     nicematrix / environments ,
1020   } ,
1021 NiceArray / xdots .inherit:n = nicematrix / xdots ,
1022 NiceArray / rules .inherit:n = nicematrix / rules ,
1023 pNiceArray .inherit:n =
1024   {
1025     nicematrix / Global ,
1026     nicematrix / environments ,
1027   } ,
1028 pNiceArray / xdots .inherit:n = nicematrix / xdots ,
1029 pNiceArray / rules .inherit:n = nicematrix / rules ,
1030 }

```

We finalise the definition of the set of keys “nicematrix / NiceMatrixOptions” with the options specific to `\NiceMatrixOptions`.

```

1031 \keys_define:nm { nicematrix / NiceMatrixOptions }
1032 {
1033   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1034   delimiters / color .value_required:n = true ,
1035   delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1036   delimiters / max-width .default:n = true ,
1037   delimiters .code:n = \keys_set:nm { nicematrix / delimiters } { #1 } ,
1038   delimiters .value_required:n = true ,
1039   width .dim_set:N = \l_@@_width_dim ,
1040   width .value_required:n = true ,
1041   last-col .code:n =
1042     \tl_if_empty:nF { #1 }
1043     { \@@_error:n { last-col-non-empty-for-NiceMatrixOptions } }
1044     \int_zero:N \l_@@_last_col_int ,
1045   small .bool_set:N = \l_@@_small_bool ,
1046   small .value_forbidden:n = true ,

```

With the option `renew-matrix`, the environment `{matrix}` of `amsmath` and its variants are redefined to behave like the environment `{NiceMatrix}` and its variants.

```

1047   renew-matrix .code:n = \@@_renew_matrix: ,
1048   renew-matrix .value_forbidden:n = true ,

```

The option `exterior-arraycolsep` will have effect only in `{NiceArray}` for those who want to have for `{NiceArray}` the same behaviour as `{array}`.

```
1049 exterior-arraycolsep .bool_set:N = \l_@@_exterior_arraycolsep_bool ,
```

If the option `columns-width` is used, all the columns will have the same width. In `\NiceMatrixOptions`, the special value `auto` is not available.

```
1050 columns-width .code:n =
```

We use `\str_if_eq:nnTF` which is slightly faster than `\tl_if_eq:nnTF`. `\str_if_eq:ee(TF)` is faster than `\str_if_eq:nn(TF)`.

```
1051 \str_if_eq:eeTF { #1 } { auto }
1052 { \@@_error:n { Option~auto~for~columns~width } }
1053 { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,
```

Usually, an error is raised when the user tries to give the same name to two distinct environments of `nicematrix` (these names are global and not local to the current TeX scope). However, the option `allow-duplicate-names` disables this feature.

```
1054 allow-duplicate-names .code:n =
1055 \@@_msg_redirect_name:nn { Duplicate~name } { none } ,
1056 allow-duplicate-names .value_forbidden:n = true ,
1057 notes .code:n = \keys_set:nn { nicematrix / notes } { #1 } ,
1058 notes .value_required:n = true ,
1059 sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1060 sub-matrix .value_required:n = true ,
1061 matrix / columns-type .tl_set:N = \l_@@_columns_type_tl ,
1062 matrix / columns-type .value_required:n = true ,
1063 caption-above .bool_set:N = \l_@@_caption_above_bool ,
1064 caption-above .default:n = true ,
1065 unknown .code:n = \@@_error:n { Unknown~key~for~NiceMatrixOptions }
1066 }
```

`\NiceMatrixOptions` is the command of the `nicematrix` package to fix options at the document level. The scope of these specifications is the current TeX group.

```
1067 \NewDocumentCommand \NiceMatrixOptions { m }
1068 { \keys_set:nn { nicematrix / NiceMatrixOptions } { #1 } }
```

We finalise the definition of the set of keys “`nicematrix / NiceMatrix`”. That set of keys will be used by `{NiceMatrix}`, `{pNiceMatrix}`, `{bNiceMatrix}`, etc.

```
1069 \keys_define:nn { nicematrix / NiceMatrix }
1070 {
1071 last-col .code:n = \tl_if_empty:nTF { #1 }
1072 {
1073 \bool_set_true:N \l_@@_last_col_without_value_bool
1074 \int_set:Nn \l_@@_last_col_int { -1 }
1075 }
1076 { \int_set:Nn \l_@@_last_col_int { #1 } } ,
1077 columns-type .tl_set:N = \l_@@_columns_type_tl ,
1078 columns-type .value_required:n = true ,
1079 l .meta:n = { columns-type = l } ,
1080 r .meta:n = { columns-type = r } ,
1081 delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1082 delimiters / color .value_required:n = true ,
1083 delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1084 delimiters / max-width .default:n = true ,
1085 delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
1086 delimiters .value_required:n = true ,
1087 small .bool_set:N = \l_@@_small_bool ,
1088 small .value_forbidden:n = true ,
1089 unknown .code:n = \@@_error:n { Unknown~key~for~NiceMatrix }
1090 }
```

We finalise the definition of the set of keys “nicematrix / NiceArray” with the options specific to {NiceArray}.

```
1091 \keys_define:nn { nicematrix / NiceArray }
1092 {
```

In the environments {NiceArray} and its variants, the option last-col must be used without value because the number of columns of the array is read from the preamble of the array.

```
1093     small .bool_set:N = \l_@@_small_bool ,
1094     small .value_forbidden:n = true ,
1095     last-col .code:n = \tl_if_empty:nF { #1 }
1096         { \@@_error:n { last-col-non-empty-for-NiceArray } }
1097         \int_zero:N \l_@@_last_col_int ,
1098     r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1099     l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1100     unknown .code:n = \@@_error:n { Unknown-key-for-NiceArray }
1101 }

1102 \keys_define:nn { nicematrix / pNiceArray }
1103 {
1104     first-col .code:n = \int_zero:N \l_@@_first_col_int ,
1105     last-col .code:n = \tl_if_empty:nF { #1 }
1106         { \@@_error:n { last-col-non-empty-for-NiceArray } }
1107         \int_zero:N \l_@@_last_col_int ,
1108     first-row .code:n = \int_zero:N \l_@@_first_row_int ,
1109     delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1110     delimiters / color .value_required:n = true ,
1111     delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1112     delimiters / max-width .default:n = true ,
1113     delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
1114     delimiters .value_required:n = true ,
1115     small .bool_set:N = \l_@@_small_bool ,
1116     small .value_forbidden:n = true ,
1117     r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1118     l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1119     unknown .code:n = \@@_error:n { Unknown-key-for-NiceMatrix }
1120 }
```

We finalise the definition of the set of keys “nicematrix / NiceTabular” with the options specific to {NiceTabular}.

```
1121 \keys_define:nn { nicematrix / NiceTabular }
1122 {
```

The dimension width will be used if at least a column of type X is used. If there is no column of type X, an error will be raised.

```
1123     width .code:n = \dim_set:Nn \l_@@_width_dim { #1 }
1124         \bool_set_true:N \l_@@_width_used_bool ,
1125     width .value_required:n = true ,
1126     notes .code:n = \keys_set:nn { nicematrix / notes } { #1 } ,
1127     tabularnote .tl_gset:N = \g_@@_tabularnote_tl ,
1128     tabularnote .value_required:n = true ,
1129     caption .tl_set:N = \l_@@_caption_tl ,
1130     caption .value_required:n = true ,
1131     short-caption .tl_set:N = \l_@@_short_caption_tl ,
1132     short-caption .value_required:n = true ,
1133     label .tl_set:N = \l_@@_label_tl ,
1134     label .value_required:n = true ,
1135     last-col .code:n = \tl_if_empty:nF { #1 }
1136         { \@@_error:n { last-col-non-empty-for-NiceArray } }
1137         \int_zero:N \l_@@_last_col_int ,
1138     r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1139     l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1140     unknown .code:n = \@@_error:n { Unknown-key-for-NiceTabular }
1141 }
```

The `\CodeAfter` (inserted with the key `code-after` or after the keyword `\CodeAfter`) may always begin with a list of pairs `key=value` between square brackets. Here is the corresponding set of keys. We *must* put the following instructions *after* the :

```
CodeAfter / sub-matrix .inherit:n = nicematrix / sub-matrix

1142 \keys_define:nn { nicematrix / CodeAfter }
1143 {
1144   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1145   delimiters / color .value_required:n = true ,
1146   rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
1147   rules .value_required:n = true ,
1148   xdots .code:n = \keys_set:nn { nicematrix / xdots } { #1 } ,
1149   sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1150   sub-matrix .value_required:n = true ,
1151   unknown .code:n = \@@_error:n { Unknown~key~for~CodeAfter }
1152 }
```

8 Important code used by `{NiceArrayWithDelims}`

The pseudo-environment `\@@_cell_begin:-\@@_cell_end:` will be used to format the cells of the array. In the code, the affectations are global because this pseudo-environment will be used in the cells of a `\halign` (via an environment `{array}`).

```
1153 \cs_new_protected:Npn \@@_cell_begin:
1154 {
```

`\g_@@_cell_after_hook_tl` will be set during the composition of the box `\l_@@_cell_box` and will be used *after* the composition in order to modify that box.

```
1155   \tl_gclear:N \g_@@_cell_after_hook_tl
```

At the beginning of the cell, we link `\CodeAfter` to a command which do begin with `\` (whereas the standard version of `\CodeAfter` does not).

```
1156   \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:
```

We increment the LaTeX counter `jCol`, which is the counter of the columns.

```
1157   \int_gincr:N \c@jCol
```

Now, we increment the counter of the rows. We don't do this incrementation in the `\everycr` because some packages, like `arydshln`, create special rows in the `\halign` that we don't want to take into account.

```
1158   \int_compare:nNnT \c@jCol = \c_one_int
1159     { \int_compare:nNnT \l_@@_first_col_int = \c_one_int \@@_begin_of_row: }
```

The content of the cell is composed in the box `\l_@@_cell_box`. The `\hbox_set_end:` corresponding to this `\hbox_set:Nw` is in the `\@@_cell_end:`.

```
1160   \hbox_set:Nw \l_@@_cell_box
```

The following command is nullified in the tabulars.

```
1161   \@@_tuning_not_tabular_begin:
1162   \@@_tuning_first_row:
1163   \@@_tuning_last_row:
1164   \g_@@_row_style_tl
1165 }
```

The following command will be nullified unless there is a first row. Here is a version with the standard syntax of L3.

```

\cs_new_protected:Npn \@@_tuning_first_row:
{
  \int_if_zero:nT \c@iRow
  {
    \int_compare:nNnT \c@jCol > 0
    {
      \l_@@_code_for_first_row_tl
      \xglobal \colorlet { nicematrix-first-row } { . }
    }
  }
}

```

We will use a version a little more efficient.

```

1166 \cs_new_protected:Npn \@@_tuning_first_row:
1167 {
1168   \if_int_compare:w \c@iRow = \c_zero_int
1169     \if_int_compare:w \c@jCol > \c_zero_int
1170       \l_@@_code_for_first_row_tl
1171       \xglobal \colorlet { nicematrix-first-row } { . }
1172     \fi:
1173   \fi:
1174 }

```

The following command will be nullified unless there is a last row and we know its value (*ie*: `\l_@@_lat_row_int > 0`).

```

\cs_new_protected:Npn \@@_tuning_last_row:
{
  \int_compare:nNnT \c@iRow = \l_@@_last_row_int
  {
    \l_@@_code_for_last_row_tl
    \xglobal \colorlet { nicematrix-last-row } { . }
  }
}

```

We will use a version a little more efficient.

```

1175 \cs_new_protected:Npn \@@_tuning_last_row:
1176 {
1177   \if_int_compare:w \c@iRow = \l_@@_last_row_int
1178     \l_@@_code_for_last_row_tl
1179     \xglobal \colorlet { nicematrix-last-row } { . }
1180   \fi:
1181 }

```

A different value will be provided to the following command when the key `small` is in force.

```

1182 \cs_set_eq:NN \@@_tuning_key_small: \prg_do_nothing:

```

The following commands are nullified in the tabulars.

```

1183 \cs_set_nopar:Npn \@@_tuning_not_tabular_begin:
1184 {
1185   \m@th % added 2024/11/21
1186   \c_math_toggle_token

```

A special value is provided by the following control sequence when the key `small` is in force.

```

1187   \@@_tuning_key_small:
1188 }
1189 \cs_set_eq:NN \@@_tuning_not_tabular_end: \c_math_toggle_token

```

The following macro `\@@_begin_of_row` is usually used in the cell number 1 of the row. However, when the key `first-col` is used, `\@@_begin_of_row` is executed in the cell number 0 of the row.

```

1190 \cs_new_protected:Npn \@@_begin_of_row:
1191 {
1192   \int_gincr:N \c@iRow

```

```

1193 \dim_gset_eq:NN \g_@@_dp_ante_last_row_dim \g_@@_dp_last_row_dim
1194 \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }
1195 \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
1196 \pgfpicture
1197 \pgfrememberpicturepositiononpagetrue
1198 \pgfcoordinate
1199 { \@@_env: - row - \int_use:N \c@iRow - base }
1200 { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
1201 \str_if_empty:NF \l_@@_name_str
1202 {
1203   \pgfnodealias
1204   { \l_@@_name_str - row - \int_use:N \c@iRow - base }
1205   { \@@_env: - row - \int_use:N \c@iRow - base }
1206 }
1207 \endpgfpicture
1208 }

```

Remark: If the key `recreate-cell-nodes` of the `\CodeBefore` is used, then we will add some lines to that command.

The following code is used in each cell of the array. It actualises quantities that, at the end of the array, will give informations about the vertical dimension of the two first rows and the two last rows. If the user uses the `last-row`, some lines of code will be dynamically added to this command.

```

1209 \cs_new_protected:Npn \@@_update_for_first_and_last_row:
1210 {
1211   \int_if_zero:nTF \c@iRow
1212   {
1213     \dim_compare:nNnT { \box_dp:N \l_@@_cell_box } > \g_@@_dp_row_zero_dim
1214     { \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \l_@@_cell_box } }
1215     \dim_compare:nNnT { \box_ht:N \l_@@_cell_box } > \g_@@_ht_row_zero_dim
1216     { \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \l_@@_cell_box } }
1217   }
1218   {
1219     \int_compare:nNnT \c@iRow = \c_one_int
1220     {
1221       \dim_compare:nNnT { \box_ht:N \l_@@_cell_box } > \g_@@_ht_row_one_dim
1222       { \dim_gset:Nn \g_@@_ht_row_one_dim { \box_ht:N \l_@@_cell_box } }
1223     }
1224   }
1225 }
1226 \cs_new_protected:Npn \@@_rotate_cell_box:
1227 {
1228   \box_rotate:Nn \l_@@_cell_box { 90 }
1229   \bool_if:NTF \g_@@_rotate_c_bool
1230   {
1231     \hbox_set:Nn \l_@@_cell_box
1232     {
1233       \m@th % add 2024/11/21
1234       \c_math_toggle_token
1235       \vcenter { \box_use:N \l_@@_cell_box }
1236       \c_math_toggle_token
1237     }
1238   }
1239   {
1240     \int_compare:nNnT \c@iRow = \l_@@_last_row_int
1241     {
1242       \vbox_set_top:Nn \l_@@_cell_box
1243       {
1244         \vbox_to_zero:n { }
1245         \skip_vertical:n { - \box_ht:N \@arstrutbox + 0.8 ex }
1246         \box_use:N \l_@@_cell_box
1247       }
1248     }

```

```

1249     }
1250     \bool_gset_false:N \g_@@_rotate_bool
1251     \bool_gset_false:N \g_@@_rotate_c_bool
1252   }
1253   \cs_new_protected:Npn \@@_adjust_size_box:
1254   {
1255     \dim_compare:nNnT \g_@@_blocks_wd_dim > \c_zero_dim
1256     {
1257       \box_set_wd:Nn \l_@@_cell_box
1258       { \dim_max:nn { \box_wd:N \l_@@_cell_box } \g_@@_blocks_wd_dim }
1259       \dim_gzero:N \g_@@_blocks_wd_dim
1260     }
1261     \dim_compare:nNnT \g_@@_blocks_dp_dim > \c_zero_dim
1262     {
1263       \box_set_dp:Nn \l_@@_cell_box
1264       { \dim_max:nn { \box_dp:N \l_@@_cell_box } \g_@@_blocks_dp_dim }
1265       \dim_gzero:N \g_@@_blocks_dp_dim
1266     }
1267     \dim_compare:nNnT \g_@@_blocks_ht_dim > \c_zero_dim
1268     {
1269       \box_set_ht:Nn \l_@@_cell_box
1270       { \dim_max:nn { \box_ht:N \l_@@_cell_box } \g_@@_blocks_ht_dim }
1271       \dim_gzero:N \g_@@_blocks_ht_dim
1272     }
1273   }
1274   \cs_new_protected:Npn \@@_cell_end:
1275   {

```

The following command is nullified in the tabulars.

```

1276     \@@_tuning_not_tabular_end:
1277     \hbox_set_end:
1278     \@@_cell_end_i:
1279   }
1280   \cs_new_protected:Npn \@@_cell_end_i:
1281   {

```

The token list `\g_@@_cell_after_hook_tl` is (potentially) set during the composition of the box `\l_@@_cell_box` and is used now *after* the composition in order to modify that box.

```

1282     \g_@@_cell_after_hook_tl
1283     \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
1284     \@@_adjust_size_box:
1285     \box_set_ht:Nn \l_@@_cell_box
1286     { \box_ht:N \l_@@_cell_box + \l_@@_cell_space_top_limit_dim }
1287     \box_set_dp:Nn \l_@@_cell_box
1288     { \box_dp:N \l_@@_cell_box + \l_@@_cell_space_bottom_limit_dim }

```

We want to compute in `\g_@@_max_cell_width_dim` the width of the widest cell of the array (except the cells of the “first column” and the “last column”).

```

1289     \@@_update_max_cell_width:

```

The following computations are for the “first row” and the “last row”.

```

1290     \@@_update_for_first_and_last_row:

```

If the cell is empty, or may be considered as if, we must not create the PGF node, for two reasons:

- it’s a waste of time since such a node would be rather pointless;
- we test the existence of these nodes in order to determine whether a cell is empty when we search the extremities of a dotted line.

However, it’s difficult to determine whether a cell is empty. Up to now we use the following technic:

- for the columns of type p, m, b, V (of varwidth) or X, we test whether the cell is syntactically empty with `\@@_test_if_empty:` and `\@@_test_if_empty_for_S:`

- if the width of the box `\l_@@_cell_box` (created with the content of the cell) is equal to zero, we consider the cell as empty (however, this is not perfect since the user may have used a `\rlap`, `\llap`, `\clap` or a `\mathclap` of `mathtools`).
- the cells with a command `\Ldots` or `\Cdots`, `\Vdots`, etc., should also be considered as empty; if `nullify-dots` is in force, there would be nothing to do (in this case the previous commands only write an instruction in a kind of `\CodeAfter`); however, if `nullify-dots` is not in force, a phantom of `\ldots`, `\cdots`, `\vdots` is inserted and its width is not equal to zero; that's why these commands raise a boolean `\g_@@_empty_cell_bool` and we begin by testing this boolean.

```

1291   \bool_if:NTF \g_@@_empty_cell_bool
1292     { \box_use_drop:N \l_@@_cell_box }
1293     {
1294       \bool_if:NTF \g_@@_not_empty_cell_bool
1295         \@@_print_node_cell:
1296         {
1297           \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
1298             \@@_print_node_cell:
1299             { \box_use_drop:N \l_@@_cell_box }
1300         }
1301     }
1302   \int_compare:nNnT \c@jCol > \g_@@_col_total_int
1303     { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
1304   \bool_gset_false:N \g_@@_empty_cell_bool
1305   \bool_gset_false:N \g_@@_not_empty_cell_bool
1306 }

```

The following command will be nullified in our redefinition of `\multicolumn`.

```

1307 \cs_new_protected:Npn \@@_update_max_cell_width:
1308   {
1309     \dim_gset:Nn \g_@@_max_cell_width_dim
1310     { \dim_max:nn \g_@@_max_cell_width_dim { \box_wd:N \l_@@_cell_box } }
1311   }

```

The following variant of `\@@_cell_end:` is only for the columns of type `w{s}{...}` or `W{s}{...}` (which use the horizontal alignment key `s` of `\makebox`).

```

1312 \cs_new_protected:Npn \@@_cell_end_for_w_s:
1313   {
1314     \@@_math_toggle:
1315     \hbox_set_end:
1316     \bool_if:NF \g_@@_rotate_bool
1317       {
1318         \hbox_set:Nn \l_@@_cell_box
1319         {
1320           \makebox [ \l_@@_col_width_dim ] [ s ]
1321           { \hbox_unpack_drop:N \l_@@_cell_box }
1322         }
1323       }
1324     \@@_cell_end_i:
1325   }

```

```

1326 \pgfset
1327   {
1328     nicematrix / cell-node /.style =
1329     {
1330       inner~sep = \c_zero_dim ,
1331       minimum~width = \c_zero_dim
1332     }
1333   }

```

In the cells of a column of type `S` (of `siunitx`), we have to wrap the command `\@@_node_for_cell:` inside a command of `siunitx` to enforce the correct horizontal alignment. In the cells of the columns with other columns type, we don't have to do that job. That's why we create a socket with its default plug (`identity`) and a plug when we have to do the wrapping.

```

1334 \socket_new:nn { nicematrix / siunitx-wrap } { 1 }
1335 \socket_new_plug:nnn { nicematrix / siunitx-wrap } { active }
1336 {
1337   \use:c
1338   {
1339     __siunitx_table_align_
1340     \bool_if:NTF \l__siunitx_table_text_bool
1341     \l__siunitx_table_align_text_tl
1342     \l__siunitx_table_align_number_tl
1343     :n
1344   }
1345   { #1 }
1346 }
1347 \cs_new_protected:Npn \@@_print_node_cell:
1348 { \socket_use:nn { nicematrix / siunitx-wrap } { \@@_node_for_cell: } }

```

The following command creates the PGF name of the node with, of course, `\l_@@_cell_box` as the content.

```

1349 \cs_new_protected:Npn \@@_node_for_cell:
1350 {
1351   \pgfpicture
1352   \pgfsetbaseline \c_zero_dim
1353   \pgfrememberpicturepositiononpagetrue
1354   \pgfset { nicematrix / cell-node }
1355   \pgfnode
1356   { rectangle }
1357   { base }
1358   {

```

The following instruction `\set@color` has been added on 2022/10/06. It's necessary only with Xe-LaTeX and not with the other engines (we don't know why).

```

1359     \set@color
1360     \box_use_drop:N \l_@@_cell_box
1361   }
1362   { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1363   { \l_@@_pgf_node_code_tl }
1364   \str_if_empty:NF \l_@@_name_str
1365   {
1366     \pgfnodealias
1367     { \l_@@_name_str - \int_use:N \c@iRow - \int_use:N \c@jCol }
1368     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1369   }
1370   \endpgfpicture
1371 }

```

As its name says, the following command is a patch for the command `\@@_node_for_cell:`. This patch will be appended on the left of `\@@_node_for_the_cell:` when the construction of the cell nodes (of the form $(i-j)$) in the `\CodeBefore` is required.

```

1372 \cs_new_protected:Npn \@@_patch_node_for_cell:n #1
1373 {
1374   \cs_new_protected:Npn \@@_patch_node_for_cell:
1375   {
1376     \hbox_set:Nn \l_@@_cell_box
1377     {
1378       \box_move_up:nn { \box_ht:N \l_@@_cell_box}
1379       \hbox_overlap_left:n
1380       {
1381         \pgfsys@markposition
1382         { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol - NW }

```

I don't know why the following adjustment is needed when the compilation is done with XeLaTeX or with the classical way latex, dvips, ps2pdf (or Adobe Distiller). However, it seems to work.

```

1383         #1
1384     }
1385     \box_use:N \l_@@_cell_box
1386     \box_move_down:nn { \box_dp:N \l_@@_cell_box }
1387     \hbox_overlap_left:n
1388     {
1389         \pgfsys@markposition
1390         { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol - SE }
1391         #1
1392     }
1393 }
1394 }
1395 }

```

We have no explanation for the different behaviour between the TeX engines...

```

1396 \bool_lazy_or:nnTF \sys_if_engine_xetex_p: \sys_if_output_dvi_p:
1397 {
1398     \@@_patch_node_for_cell:n
1399     { \skip_horizontal:n { 0.5 \box_wd:N \l_@@_cell_box } }
1400 }
1401 { \@@_patch_node_for_cell:n { } }

```

The second argument of the following command `\@@_instruction_of_type:nnn` defined below is the type of the instruction (`Cdots`, `Vdots`, `Ddots`, etc.). The third argument is the list of options. This command writes in the corresponding `\g_@@_type_lines_tl` the instruction which will actually draw the line after the construction of the matrix.

For example, for the following matrix,

```

\begin{pNiceMatrix}
1 & 2 & 3 & 4 \\
5 & \Cdots & & 6 \\
7 & \Cdots[color=red] & & 
\end{pNiceMatrix}

```

$$\begin{pmatrix} 1 & 2 & 3 & 4 \\ 5 \dots \dots \dots 6 \\ 7 \dots \dots \dots \end{pmatrix}$$

the content of `\g_@@_Cdots_lines_tl` will be:

```

\@@_draw_Cdots:nnn {2}{2}{}
\@@_draw_Cdots:nnn {3}{2}{color=red}

```

The first argument is a boolean which indicates whether you must put the instruction on the left or on the right on the list of instructions (with consequences for the parallelisation of the diagonal lines).

```

1402 \cs_new_protected:Npn \@@_instruction_of_type:nnn #1 #2 #3
1403 {
1404     \bool_if:nTF { #1 } \tl_gput_left:ce \tl_gput_right:ce
1405     { \g_@@_#2_lines_tl }
1406     {
1407         \use:c { @@_draw_#2 : nnn }
1408         { \int_use:N \c@iRow }
1409         { \int_use:N \c@jCol }
1410         { \exp_not:n { #3 } }
1411     }
1412 }

```

```

1413 \cs_generate_variant:Nn \@@_array:n { o }
1414 \cs_new_protected:Npn \@@_array:n
1415 {
1416 % \begin{macrocode}
1417 \dim_set:Nn \col@sep

```

```

1418     { \bool_if:NTF \l_@@_tabular_bool \tabcolsep \arraycolsep }
1419 \dim_compare:nNnTF \l_@@_tabular_width_dim = \c_zero_dim
1420     { \cs_set_nopar:Npn \@halignto { } }
1421     { \cs_set_nopar:Npe \@halignto { to \dim_use:N \l_@@_tabular_width_dim } }

```

It colortbl is loaded, \@tabarray has been redefined to incorporate \CT@start.

```

1422     \@tabarray

```

\l_@@_baseline_tl may have the value t, c or b. However, if the value is b, we compose the \array (of array) with the option t and the right translation will be done further. Remark that \str_if_eq:eeTF is fully expandable and we need something fully expandable here. \str_if_eq:ee(TF) is faster than \str_if_eq:nn(TF).

```

1423     [ \str_if_eq:eeTF \l_@@_baseline_tl c c t ]
1424     }

```

We keep in memory the standard version of \ialign because we will redefine \ialign in the environment {NiceArrayWithDelims} but restore the standard version for use in the cells of the array. However, since version 2.6a (version for the Tagging Project), array uses \ar@ialign instead of \ialign. In that case, of course, you do a saving of \ar@ialign.

```

1425 \bool_if:nTF
1426   { \c_@@_recent_array_bool && ! \c_@@_revtex_bool }
1427   { \cs_set_eq:NN \@@_old_ar@ialign: \ar@ialign }
1428   { \cs_set_eq:NN \@@_old_ialign: \ialign }

```

The following command creates a row node (and not a row of nodes!).

```

1429 \cs_new_protected:Npn \@@_create_row_node:
1430   {
1431     \int_compare:nNnT \c@iRow > \g_@@_last_row_node_int
1432     {
1433       \int_gset_eq:NN \g_@@_last_row_node_int \c@iRow
1434       \@@_create_row_node_i:
1435     }
1436   }
1437 \cs_new_protected:Npn \@@_create_row_node_i:
1438   {

```

The \hbox:n (or \hbox) is mandatory.

```

1439     \hbox
1440     {
1441       \bool_if:NT \l_@@_code_before_bool
1442       {
1443         \vtop
1444         {
1445           \skip_vertical:N 0.5\arrayrulewidth
1446           \pgfsys@markposition
1447           { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1448           \skip_vertical:N -0.5\arrayrulewidth
1449         }
1450       }
1451       \pgfpicture
1452       \pgfrememberpicturepositiononpagetrue
1453       \pgfcoordinate { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1454       { \pgfpoint \c_zero_dim { - 0.5 \arrayrulewidth } }
1455       \str_if_empty:NF \l_@@_name_str
1456       {
1457         \pgfnodealias
1458         { \l_@@_name_str - row - \int_eval:n { \c@iRow + 1 } }
1459         { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1460       }
1461       \endpgfpicture
1462     }
1463   }

```

```

1464 \cs_new_protected:Npn \@@_in_everycr:
1465 {
1466   \bool_if:NT \c_@@_recent_array_bool
1467   {
1468     \tbl_if_row_was_started:T { \UseTaggingSocket { tbl / row / end } }
1469     \tbl_update_cell_data_for_next_row:
1470   }
1471   \int_gzero:N \c@jCol
1472   \bool_gset_false:N \g_@@_after_col_zero_bool
1473   \bool_if:NF \g_@@_row_of_col_done_bool
1474   {
1475     \@@_create_row_node:

```

We don't draw now the rules of the key `hlines` (or `hvlines`) but we reserve the vertical space for these rules (the rules will be drawn by PGF).

```

1476   \clist_if_empty:NF \l_@@_hlines_clist
1477   {
1478     \str_if_eq:eeF \l_@@_hlines_clist { all }
1479     {
1480       \clist_if_in:NeT
1481         \l_@@_hlines_clist
1482         { \int_eval:n { \c@iRow + 1 } }
1483     }
1484   }

```

The counter `\c@iRow` has the value `-1` only if there is a “first row” and that we are before that “first row”, i.e. just before the beginning of the array.

```

1485       \int_compare:nNnT \c@iRow > { -1 }
1486       {
1487         \int_compare:nNnF \c@iRow = \l_@@_last_row_int
1488         { \hrule height \arrayrulewidth width \c_zero_dim }
1489       }
1490     }
1491   }
1492 }
1493 }

```

When the key `renew-dots` is used, the following code will be executed.

```

1494 \cs_set_protected:Npn \@@_renew_dots:
1495 {
1496   \cs_set_eq:NN \ldots \@@_Ldots
1497   \cs_set_eq:NN \cdots \@@_Cdots
1498   \cs_set_eq:NN \vdots \@@_Vdots
1499   \cs_set_eq:NN \ddots \@@_Ddots
1500   \cs_set_eq:NN \iddots \@@_Iddots
1501   \cs_set_eq:NN \dots \@@_Ldots
1502   \cs_set_eq:NN \hdotsfor \@@_Hdotsfor:
1503 }

```

The following code has been simplified in the version 6.29a.

```

1504 \hook_gput_code:nnn { begindocument } { . }
1505 {
1506   \IfPackageLoadedTF { colortbl }
1507   {
1508     \cs_set_protected:Npn \@@_everycr:
1509     { \CT@everycr { \noalign { \@@_in_everycr: } } }
1510   }
1511   {
1512     \cs_new_protected:Npn \@@_everycr:
1513     { \everycr { \noalign { \@@_in_everycr: } } }
1514   }
1515 }

```

If `booktabs` is loaded, we have to patch the macro `\@BTnormal` which is a macro of `booktabs`. The macro `\@BTnormal` draws an horizontal rule but it occurs after a vertical skip done by a low level TeX command. When this macro `\@BTnormal` occurs, the `row` node has yet been inserted by `nicematrix` before the vertical skip (and thus, at a wrong place). That why we decide to create a new `row` node (for the same row). We patch the macro `\@BTnormal` to create this `row` node. This new `row` node will overwrite the previous definition of that `row` node and we have managed to avoid the error messages of that redefinition ⁴.

```

1516 \hook_gput_code:nnn { begindocument } { . }
1517 {
1518   \IfPackageLoadedTF { booktabs }
1519   {
1520     \cs_new_protected:Npn \@_patch_booktabs:
1521     { \tl_put_left:Nn \@BTnormal \@_create_row_node_i: }
1522   }
1523   { \cs_new_protected:Npn \@_patch_booktabs: { } }
1524 }

```

The box `\@arstrutbox` is a box constructed in the beginning of the environment `{array}`. The construction of that box takes into account the current value of `\arraystretch`⁵ and `\extrarowheight` (of `array`). That box is inserted (via `\@arstrut`) in the beginning of each row of the array. That's why we use the dimensions of that box to initialize the variables which will be the dimensions of the potential first and last row of the environment. This initialization must be done after the creation of `\@arstrutbox` and that's why we do it in the `\ialign`.

```

1525 \cs_new_protected:Npn \@_some_initialization:
1526 {
1527   \@_everycr:
1528   \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \@arstrutbox }
1529   \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \@arstrutbox }
1530   \dim_gset_eq:NN \g_@@_ht_row_one_dim \g_@@_ht_row_zero_dim
1531   \dim_gzero:N \g_@@_dp_ante_last_row_dim
1532   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \@arstrutbox }
1533   \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \@arstrutbox }
1534 }

```

```

1535 \cs_new_protected:Npn \@_pre_array_ii:
1536 {

```

The number of letters `X` in the preamble of the array.

```

1537   \int_gzero:N \g_@@_total_X_weight_int
1538   \@_expand_clist:N \l_@@_hlines_clist
1539   \@_expand_clist:N \l_@@_vlines_clist
1540   \@_patch_booktabs:
1541   \box_clear_new:N \l_@@_cell_box
1542   \normalbaselines

```

If the option `small` is used, we have to do some tuning. In particular, we change the value of `\arraystretch` (this parameter is used in the construction of `\@arstrutbox` in the beginning of `{array}`).

```

1543   \bool_if:NT \l_@@_small_bool
1544   {
1545     \cs_set_nopar:Npn \arraystretch { 0.47 }
1546     \dim_set:Nn \arraycolsep { 1.45 pt }

```

⁴cf. `\nicematrix@redefine@check@rerun`

⁵The option `small` of `nicematrix` changes (among others) the value of `\arraystretch`. This is done, of course, before the call of `{array}`.

By default, `\@@_tuning_key_small:` is no-op.

```

1547     \cs_set_eq:NN \@@_tuning_key_small: \scriptstyle
1548   }

1549   \bool_if:NT \g_@@_recreate_cell_nodes_bool
1550     {
1551       \tl_put_right:Nn \@@_begin_of_row:
1552         {
1553           \pgfsys@markposition
1554             { \@@_env: - row - \int_use:N \c@iRow - base }
1555         }
1556     }

```

The environment `{array}` (since version 2.6) uses internally the command `\ar@ialign` (and previously, it was `\ialign`). We change that command for several reasons. In particular, `\ar@ialign` sets `\everycr` to `{ }` and we *need* to change the value of `\everycr`.

```

1557   \bool_if:nTF
1558     { \c_@@_recent_array_bool && ! \c_@@_revtex_bool }
1559     {
1560       \cs_set_nopar:Npn \ar@ialign
1561         {
1562           \bool_if:NT \c_@@_testphase_table_bool
1563             \tbl_init_cell_data_for_table:
1564             \@@_some_initialization:
1565             \dim_zero:N \tabskip

```

After its first use, the definition of `\ar@ialign` will revert automatically to its default definition. With this programming, we will have, in the cells of the array, a clean version of `\ar@ialign`.

```

1566       \cs_set_eq:NN \ar@ialign \@@_old_ar@ialign:
1567       \halign
1568     }
1569   }

```

The following part should be deleted when we will delete the boolean `\c_@@_recent_array_bool` (when we consider the version 2.6a of `array` is required). Moreover, `revtex4-2` modifies `array` and provides commands which are meant to be the standard version of `array` but, at the date of november 2024, these commands corresponds to the *old* version of `array`, that is to say without the `\ar@ialign`.

```

1570   {
1571     \cs_set_nopar:Npn \ialign
1572     {
1573       \@@_some_initialization:
1574       \dim_zero:N \tabskip
1575       \cs_set_eq:NN \ialign \@@_old_ialign:
1576       \halign
1577     }
1578   }

```

It seems that there is a problem when `nicematrix` is used with in `revtex4-2` with the package `colortbl` loaded. The following code prevent that problem but it does *not* treat the actual problem! It's only a patch *ad hoc*.

That patch has been added in version 7.0x, 2024-11-27 (question by mail of Tamra Nebabu).

```

1579   \bool_if:NT \c_@@_revtex_bool
1580     {
1581       \IfPackageLoadedT { colortbl }
1582         { \cs_set_protected:Npn \CT@setup { } }
1583     }

```

We keep in memory the old versions or `\ldots`, `\cdots`, etc. only because we use them inside `\phantom` commands in order that the new commands `\Ldots`, `\Cdots`, etc. give the same spacing (except when the option `nullify-dots` is used).

```

1584   \cs_set_eq:NN \@@_old_ldots \ldots
1585   \cs_set_eq:NN \@@_old_cdots \cdots

```

```

1586 \cs_set_eq:NN \@@_old_vdots \vdots
1587 \cs_set_eq:NN \@@_old_ddots \ddots
1588 \cs_set_eq:NN \@@_old_iddots \iddots
1589 \bool_if:NTF \l_@@_standard_cline_bool
1590   { \cs_set_eq:NN \cline \@@_standard_cline }
1591   { \cs_set_eq:NN \cline \@@_cline }
1592 \cs_set_eq:NN \Ldots \@@_Ldots
1593 \cs_set_eq:NN \Cdots \@@_Cdots
1594 \cs_set_eq:NN \Vdots \@@_Vdots
1595 \cs_set_eq:NN \Ddots \@@_Ddots
1596 \cs_set_eq:NN \Iddots \@@_Iddots
1597 \cs_set_eq:NN \Hline \@@_Hline:
1598 \cs_set_eq:NN \Hspace \@@_Hspace:
1599 \cs_set_eq:NN \Hdotsfor \@@_Hdotsfor:
1600 \cs_set_eq:NN \Vdotsfor \@@_Vdotsfor:
1601 \cs_set_eq:NN \Block \@@_Block:
1602 \cs_set_eq:NN \rotate \@@_rotate:
1603 \cs_set_eq:NN \OnlyMainNiceMatrix \@@_OnlyMainNiceMatrix:n
1604 \cs_set_eq:NN \dotfill \@@_dotfill:
1605 \cs_set_eq:NN \CodeAfter \@@_CodeAfter:
1606 \cs_set_eq:NN \diagbox \@@_diagbox:nn
1607 \cs_set_eq:NN \NotEmpty \@@_NotEmpty:
1608 \cs_set_eq:NN \TopRule \@@_TopRule
1609 \cs_set_eq:NN \MidRule \@@_MidRule
1610 \cs_set_eq:NN \BottomRule \@@_BottomRule
1611 \cs_set_eq:NN \RowStyle \@@_RowStyle:n
1612 \cs_set_eq:NN \Hbrace \@@_Hbrace
1613 \cs_set_eq:NN \Vbrace \@@_Vbrace
1614 \seq_map_inline:Nn \l_@@_custom_line_commands_seq
1615   { \cs_set_eq:cc { ##1 } { nicematrix - ##1 } }
1616 \cs_set_eq:NN \cellcolor \@@_cellcolor_tabular
1617 \cs_set_eq:NN \rowcolor \@@_rowcolor_tabular
1618 \cs_set_eq:NN \rowcolors \@@_rowcolors_tabular
1619 \cs_set_eq:NN \rowlistcolors \@@_rowlistcolors_tabular
1620 \int_compare:nNnT \l_@@_first_row_int > \c_zero_int
1621   { \cs_set_eq:NN \@@_tuning_first_row: \prg_do_nothing: }
1622 \int_compare:nNnT \l_@@_last_row_int < \c_zero_int
1623   { \cs_set_eq:NN \@@_tuning_last_row: \prg_do_nothing: }
1624 \bool_if:NT \l_@@_renew_dots_bool \@@_renew_dots:

```

We redefine `\multicolumn` and, since we want `\multicolumn` to be available in the potential environments `{tabular}` nested in the environments of `nicematrix`, we patch `{tabular}` to go back to the original definition. A `\hook_gremove_code:nn` will be put in `\@@_after_array:`.

```

1625 \cs_set_eq:NN \multicolumn \@@_multicolumn:nnn
1626 \hook_gput_code:nnn { env / tabular / begin } { nicematrix }
1627   { \cs_set_eq:NN \multicolumn \@@_old_multicolumn }
1628 \@@_revert_colortbl:

```

If there is one or several commands `\tabularnote` in the caption specified by the key `caption` and if that caption has to be composed above the tabular, we have now that information because it has been written in the aux file at a previous run. We use that information to start counting the tabular notes in the main array at the right value (we remember that the caption will be composed *after* the array!).

```

1629 \tl_if_exist:NT \l_@@_note_in_caption_tl
1630   {
1631     \tl_if_empty:NF \l_@@_note_in_caption_tl
1632     {
1633       \int_gset_eq:NN \g_@@_notes_caption_int \l_@@_note_in_caption_tl
1634       \int_gset:Nn \c@tabularnote { \l_@@_note_in_caption_tl }
1635     }
1636   }

```

The sequence `\g_@@_multicolumn_cells_seq` will contain the list of the cells of the array where a command `\multicolumn{n}{...}{...}` with $n > 1$ is issued. In `\g_@@_multicolumn_sizes_seq`,

the “sizes” (that is to say the values of n) correspondent will be stored. These lists will be used for the creation of the “medium nodes” (if they are created).

```
1637 \seq_gclear:N \g_@@_multicolumn_cells_seq
1638 \seq_gclear:N \g_@@_multicolumn_sizes_seq
```

The counter `\c@iRow` will be used to count the rows of the array (its incrementation will be in the first cell of the row).

```
1639 \int_gset:Nn \c@iRow { \l_@@_first_row_int - 1 }
```

At the end of the environment `{array}`, `\c@iRow` will be the total number de rows.

`\g_@@_row_total_int` will be the number or rows excepted the last row (if `\l_@@_last_row_bool` has been raised with the option `last-row`).

```
1640 \int_gzero_new:N \g_@@_row_total_int
```

The counter `\c@jCol` will be used to count the columns of the array. Since we want to know the total number of columns of the matrix, we also create a counter `\g_@@_col_total_int`. These counters are updated in the command `\@@_cell_begin`: executed at the beginning of each cell.

```
1641 \int_gzero_new:N \g_@@_col_total_int
1642 \cs_set_eq:NN \@ifnextchar \new@ifnextchar
1643 \bool_gset_false:N \g_@@_last_col_found_bool
```

During the construction of the array, the instructions `\Cdots`, `\Ldots`, etc. will be written in token lists `\g_@@_Cdots_lines_tl`, etc. which will be executed after the construction of the array.

```
1644 \tl_gclear_new:N \g_@@_Cdots_lines_tl
1645 \tl_gclear_new:N \g_@@_Ldots_lines_tl
1646 \tl_gclear_new:N \g_@@_Vdots_lines_tl
1647 \tl_gclear_new:N \g_@@_Ddots_lines_tl
1648 \tl_gclear_new:N \g_@@_Iddots_lines_tl
1649 \tl_gclear_new:N \g_@@_HVdotsfor_lines_tl
```

```
1650 \tl_gclear:N \g_nicematrix_code_before_tl
1651 \tl_gclear:N \g_@@_pre_code_before_tl
1652 }
```

This is the end of `\@@_pre_array_ii:`.

The command `\@@_pre_array:` will be executed after analyse of the keys of the environment.

```
1653 \cs_new_protected:Npn \@@_pre_array:
1654 {
1655 \cs_if_exist:NT \theiRow { \int_set_eq:NN \l_@@_old_iRow_int \c@iRow }
1656 \int_gzero_new:N \c@iRow
1657 \cs_if_exist:NT \thejCol { \int_set_eq:NN \l_@@_old_jCol_int \c@jCol }
1658 \int_gzero_new:N \c@jCol
```

We recall that `\l_@@_last_row_int` and `\l_@@_last_column_int` are *not* the numbers of the last row and last column of the array. There are only the values of the keys `last-row` and `last-column` (maybe the user has provided erroneous values). The meaning of that counters does not change during the environment of `nicematrix`. There is only a slight adjustment: if the user have used one of those keys without value, we provide now the right value as read on the `aux` file (of course, it's possible only after the first compilation).

```
1659 \int_compare:nNnT \l_@@_last_row_int = { -1 }
1660 {
1661 \bool_set_true:N \l_@@_last_row_without_value_bool
1662 \bool_if:NT \g_@@_aux_found_bool
1663 { \int_set:Nn \l_@@_last_row_int { \seq_item:Nn \g_@@_size_seq 3 } }
1664 }
1665 \int_compare:nNnT \l_@@_last_col_int = { -1 }
1666 {
1667 \bool_if:NT \g_@@_aux_found_bool
1668 { \int_set:Nn \l_@@_last_col_int { \seq_item:Nn \g_@@_size_seq 6 } }
1669 }
```

If there is an exterior row, we patch a command used in `\@@_cell_begin:` in order to keep track of some dimensions needed to the construction of that “last row”.

```

1670   \int_compare:nNnT \l_@@_last_row_int > { -2 }
1671   {
1672     \tl_put_right:Nn \@@_update_for_first_and_last_row:
1673     {
1674       \dim_compare:nNnT \g_@@_ht_last_row_dim < { \box_ht:N \l_@@_cell_box }
1675       { \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \l_@@_cell_box } }
1676       \dim_compare:nNnT \g_@@_dp_last_row_dim < { \box_dp:N \l_@@_cell_box }
1677       { \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \l_@@_cell_box } }
1678     }
1679   }

1680   \seq_gclear:N \g_@@_cols_vlism_seq
1681   \seq_gclear:N \g_@@_submatrix_seq

```

Now the `\CodeBefore`.

```

1682   \bool_if:NT \l_@@_code_before_bool \@@_exec_code_before:

```

The value of `\g_@@_pos_of_blocks_seq` has been written on the aux file and loaded before the (potential) execution of the `\CodeBefore`. Now, we clear that variable because it will be reconstructed during the creation of the array.

```

1683   \seq_gset_eq:NN \g_@@_pos_of_blocks_seq \g_@@_future_pos_of_blocks_seq
1684   \seq_gclear:N \g_@@_future_pos_of_blocks_seq

```

Idem for other sequences written on the aux file.

```

1685   \seq_gclear_new:N \g_@@_multicolumn_cells_seq
1686   \seq_gclear_new:N \g_@@_multicolumn_sizes_seq

```

The command `\create_row_node:` will create a row-node (and not a row of nodes!). However, at the end of the array we construct a “false row” (for the col-nodes) and it interferes with the construction of the last row-node of the array. We don’t want to create such row-node twice (to avoid warnings or, maybe, errors). That’s why the command `\@@_create_row_node:` will use the following counter to avoid such construction.

```

1687   \int_gset:Nn \g_@@_last_row_node_int { -2 }

```

The value `-2` is important.

The code in `\@@_pre_array_ii:` is used only here.

```

1688   \@@_pre_array_ii:

```

The array will be composed in a box (named `\l_@@_the_array_box`) because we have to do manipulations concerning the potential exterior rows.

```

1689   \box_clear_new:N \l_@@_the_array_box

```

We compute the width of both delimiters. We remind that, when the environment `{NiceArray}` is used, it’s possible to specify the delimiters in the preamble (eg `[ccc]`).

```

1690   \dim_zero_new:N \l_@@_left_delim_dim
1691   \dim_zero_new:N \l_@@_right_delim_dim
1692   \bool_if:NTF \g_@@_delims_bool
1693   {

```

The command `\bBigg@` is a command of `amsmath`.

```

1694     \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_left_delim_t1 $ }
1695     \dim_set:Nn \l_@@_left_delim_dim { \box_wd:N \l_tmpa_box }
1696     \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_right_delim_t1 $ }
1697     \dim_set:Nn \l_@@_right_delim_dim { \box_wd:N \l_tmpa_box }
1698   }
1699   {
1700     \dim_gset:Nn \l_@@_left_delim_dim
1701     { 2 \bool_if:NTF \l_@@_tabular_bool \tabcolsep \arraycolsep }
1702     \dim_gset_eq:NN \l_@@_right_delim_dim \l_@@_left_delim_dim
1703   }

```

Here is the beginning of the box which will contain the array. The `\hbox_set_end:` corresponding to this `\hbox_set:Nw` will be in the second part of the environment (and the closing `\c_math_toggle_token` also).

```

1704   \hbox_set:Nw \l_@@_the_array_box
1705   \skip_horizontal:N \l_@@_left_margin_dim
1706   \skip_horizontal:N \l_@@_extra_left_margin_dim
1707   \bool_if:NT \c_@@_recent_array_bool
1708     { \UseTaggingSocket { tbl / hmode / begin } }

```

The following code is a workaround to specify to the tagging system that the following code is *fake math* (it raises `\l__math_fakemath_bool` in recent versions of LaTeX).

```

1709   \m@th
1710   \c_math_toggle_token
1711   \bool_if:NTF \l_@@_light_syntax_bool
1712     { \use:c { @@-light-syntax } }
1713     { \use:c { @@-normal-syntax } }
1714 }

```

The following command `\@@_CodeBefore_Body:w` will be used when the keyword `\CodeBefore` is present at the beginning of the environment.

```

1715 \cs_new_protected_nopar:Npn \@@_CodeBefore_Body:w #1 \Body
1716 {
1717   \tl_set:Nn \l_tmpa_tl { #1 }
1718   \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
1719     { \@@_rescan_for_spanish:N \l_tmpa_tl }
1720   \tl_gput_left:No \g_@@_pre_code_before_tl \l_tmpa_tl
1721   \bool_set_true:N \l_@@_code_before_bool

```

We go on with `\@@_pre_array:` which will (among other) execute the `\CodeBefore` (specified in the key `code-before` or after the keyword `\CodeBefore`). By definition, the `\CodeBefore` must be executed before the body of the array...

```

1722   \@@_pre_array:
1723 }

```

9 The `\CodeBefore`

The following command will be executed if the `\CodeBefore` has to be actually executed (that command will be used only once and is present alone only for legibility).

```

1724 \cs_new_protected:Npn \@@_pre_code_before:
1725 {

```

First, we give values to the LaTeX counters `iRow` and `jCol`. We remind that, in the `\CodeBefore` (and in the `\CodeAfter`) they represent the numbers of rows and columns of the array (without the potential last row and last column). The value of `\g_@@_row_total_int` is the number of the last row (with potentially a last exterior row) and `\g_@@_col_total_int` is the number of the last column (with potentially a last exterior column).

```

1726   \int_set:Nn \c@iRow { \seq_item:Nn \g_@@_size_seq 2 }
1727   \int_set:Nn \c@jCol { \seq_item:Nn \g_@@_size_seq 5 }
1728   \int_set_eq:NN \g_@@_row_total_int { \seq_item:Nn \g_@@_size_seq 3 }
1729   \int_set_eq:NN \g_@@_col_total_int { \seq_item:Nn \g_@@_size_seq 6 }

```

Now, we will create all the `col` nodes and `row` nodes with the informations written in the `aux` file. You use the technique described in the page 1247 of `pgfmanual.pdf`, version 3.1.10.

```

1730   \pgfsys@markposition { \@@_env: - position }
1731   \pgfsys@getposition { \@@_env: - position } \@@_picture_position:
1732   \pgfpicture
1733   \pgf@relevantforpicturesizefalse

```

First, the recreation of the row nodes.

```

1734 \int_step_inline:nnn \l_@@_first_row_int { \g_@@_row_total_int + 1 }
1735 {
1736   \pgfsys@getposition { \@@_env: - row - ##1 } \@@_node_position:
1737   \pgfcoordinate { \@@_env: - row - ##1 }
1738   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1739 }

```

Now, the recreation of the col nodes.

```

1740 \int_step_inline:nnn \l_@@_first_col_int { \g_@@_col_total_int + 1 }
1741 {
1742   \pgfsys@getposition { \@@_env: - col - ##1 } \@@_node_position:
1743   \pgfcoordinate { \@@_env: - col - ##1 }
1744   { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1745 }

```

Now, you recreate the diagonal nodes by using the row nodes and the col nodes.

```

1746 \@@_create_diag_nodes:

```

Now, the creation of the cell nodes (i-j), and, maybe also the “medium nodes” and the “large nodes”.

```

1747 \bool_if:NT \g_@@_recreate_cell_nodes_bool \@@_recreate_cell_nodes:
1748 \endpgfpicture

```

Now, the recreation of the nodes of the blocks *which have a name*.

```

1749 \@@_create_blocks_nodes:
1750 \IfPackageLoadedT { tikz }
1751 {
1752   \tikzset
1753   {
1754     every-picture / .style =
1755     { overlay , name-prefix = \@@_env: - }
1756   }
1757 }
1758 \cs_set_eq:NN \cellcolor \@@_cellcolor
1759 \cs_set_eq:NN \rectanglecolor \@@_rectanglecolor
1760 \cs_set_eq:NN \roundedrectanglecolor \@@_roundedrectanglecolor
1761 \cs_set_eq:NN \rowcolor \@@_rowcolor
1762 \cs_set_eq:NN \rowcolors \@@_rowcolors
1763 \cs_set_eq:NN \rowlistcolors \@@_rowlistcolors
1764 \cs_set_eq:NN \arraycolor \@@_arraycolor
1765 \cs_set_eq:NN \columncolor \@@_columncolor
1766 \cs_set_eq:NN \chessboardcolors \@@_chessboardcolors
1767 \cs_set_eq:NN \SubMatrix \@@_SubMatrix_in_code_before
1768 \cs_set_eq:NN \ShowCellNames \@@_ShowCellNames
1769 \cs_set_eq:NN \TikzEveryCell \@@_TikzEveryCell
1770 \cs_set_eq:NN \EmptyColumn \@@_EmptyColumn:n
1771 \cs_set_eq:NN \EmptyRow \@@_EmptyRow:n
1772 }

```

```

1773 \cs_new_protected:Npn \@@_exec_code_before:
1774 {

```

We mark the cells which are in the (empty) corners because those cells must not be colored. We should try to find a way to detected whether we actually have coloring instructions to execute...

```

1775 \clist_map_inline:Nn \l_@@_corners_cells_clist
1776 { \cs_set_nopar:cpn { @@ _ corner _ ##1 } { } }
1777 \seq_gclear_new:N \g_@@_colors_seq

```

The sequence `\g_@@_colors_seq` will always contain as first element the special color `nocolor`: when that color is used, no color will be applied in the corresponding cells by the other coloring commands of `nicematrix`.

```
1778 \@@_add_to_colors_seq:nn { { nocolor } } { }
1779 \bool_gset_false:N \g_@@_recreate_cell_nodes_bool
1780 \group_begin:
```

We compose the `\CodeBefore` in math mode in order to nullify the spaces put by the user between instructions in the `\CodeBefore`.

```
1781 \bool_if:NT \l_@@_tabular_bool \c_math_toggle_token
```

The following code is a security for the case the user has used `babel` with the option `spanish`: in that case, the characters `<` (de code ASCII 60) and `>` are activated and Tikz is not able to solve the problem (even with the Tikz library `babel`).

```
1782 \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
1783 { \@@_rescan_for_spanish:N \l_@@_code_before_tl }
```

Here is the `\CodeBefore`. The construction is a bit complicated because `\g_@@_pre_code_before_tl` may begin with keys between square brackets. Moreover, after the analyze of those keys, we sometimes have to decide to do *not* execute the rest of `\g_@@_pre_code_before_tl` (when it is asked for the creation of cell nodes in the `\CodeBefore`). That's why we use a `\q_stop`: it will be used to discard the rest of `\g_@@_pre_code_before_tl`.

```
1784 \exp_last_unbraced:No \@@_CodeBefore_keys:
1785 \g_@@_pre_code_before_tl
```

Now, all the cells which are specified to be colored by instructions in the `\CodeBefore` will actually be colored. It's a two-stages mechanism because we want to draw all the cells with the same color at the same time to absolutely avoid thin white lines in some PDF viewers.

```
1786 \@@_actually_color:
1787 \l_@@_code_before_tl
1788 \q_stop
1789 \bool_if:NT \l_@@_tabular_bool \c_math_toggle_token
1790 \group_end:
1791 \bool_if:NT \g_@@_recreate_cell_nodes_bool
1792 { \tl_put_left:Nn \@@_node_for_cell: \@@_patch_node_for_cell: }
1793 }
```

```
1794 \keys_define:nn { nicematrix / CodeBefore }
1795 {
1796   create-cell-nodes .bool_gset:N = \g_@@_recreate_cell_nodes_bool ,
1797   create-cell-nodes .default:n = true ,
1798   sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1799   sub-matrix .value_required:n = true ,
1800   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1801   delimiters / color .value_required:n = true ,
1802   unknown .code:n = \@@_error:n { Unknown~key~for~CodeBefore }
1803 }
1804 \NewDocumentCommand \@@_CodeBefore_keys: { 0 { } }
1805 {
1806   \keys_set:nn { nicematrix / CodeBefore } { #1 }
1807   \@@_CodeBefore:w
1808 }
```

We have extracted the options of the keyword `\CodeBefore` in order to see whether the key `create-cell-nodes` has been used. Now, you can execute the rest of the `\CodeBefore`, excepted, of course, if we are in the first compilation.

```
1809 \cs_new_protected:Npn \@@_CodeBefore:w #1 \q_stop
1810 {
1811   \bool_if:NT \g_@@_aux_found_bool
1812   {
1813     \@@_pre_code_before:
1814     #1
```

```

1815     }
1816 }

```

By default, if the user uses the `\CodeBefore`, only the `col` nodes, `row` nodes and `diag` nodes are available in that `\CodeBefore`. With the key `create-cell-nodes`, the cell nodes, that is to say the nodes of the form `(i-j)` (but not the extra nodes) are also available because those nodes also are recreated and that recreation is done by the following command.

```

1817 \cs_new_protected:Npn \@@_recreate_cell_nodes:
1818 {
1819   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
1820   {
1821     \pgfsys@getposition { \@@_env: - ##1 - base } \@@_node_position:
1822     \pgfcoordinate { \@@_env: - row - ##1 - base }
1823     { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1824     \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
1825     {
1826       \cs_if_exist:cT
1827       { pgf @ sys @ pdf @ mark @ pos @ \@@_env: - ##1 - #####1 - NW }
1828       {
1829         \pgfsys@getposition
1830         { \@@_env: - ##1 - #####1 - NW }
1831         \@@_node_position:
1832         \pgfsys@getposition
1833         { \@@_env: - ##1 - #####1 - SE }
1834         \@@_node_position_i:
1835         \@@_pgf_rect_node:nnn
1836         { \@@_env: - ##1 - #####1 }
1837         { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1838         { \pgfpointdiff \@@_picture_position: \@@_node_position_i: }
1839       }
1840     }
1841   }
1842   \int_step_inline:nn \c@iRow
1843   {
1844     \pgfnodealias
1845     { \@@_env: - ##1 - last }
1846     { \@@_env: - ##1 - \int_use:N \c@jCol }
1847   }
1848   \int_step_inline:nn \c@jCol
1849   {
1850     \pgfnodealias
1851     { \@@_env: - last - ##1 }
1852     { \@@_env: - \int_use:N \c@iRow - ##1 }
1853   }
1854   \@@_create_extra_nodes:
1855 }

```

```

1856 \cs_new_protected:Npn \@@_create_blocks_nodes:
1857 {
1858   \pgfpicture
1859   \pgf@relevantforpicturesizefalse
1860   \pgfrememberpicturepositiononpagetrue
1861   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
1862   { \@@_create_one_block_node:nnnnn ##1 }
1863   \endpgfpicture
1864 }

```

The following command is called `\@@_create_one_block_node:nnnnn` but, in fact, it creates a node only if the last argument (`#5`) which is the name of the block, is not empty.⁶

⁶Moreover, there is also in the list `\g_@@_pos_of_blocks_seq` the positions of the dotted lines (created by `\Cdots`, etc.) and, for these entries, there is, of course, no name (the fifth component is empty).

```

1865 \cs_new_protected:Npn \@@_create_one_block_node:nnnnn #1 #2 #3 #4 #5
1866 {
1867   \tl_if_empty:nF { #5 }
1868   {
1869     \@@_qpoint:n { col - #2 }
1870     \dim_set_eq:NN \l_tmpa_dim \pgf@x
1871     \@@_qpoint:n { #1 }
1872     \dim_set_eq:NN \l_tmpb_dim \pgf@y
1873     \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
1874     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
1875     \@@_qpoint:n { \int_eval:n { #3 + 1 } }
1876     \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
1877     \@@_pgf_rect_node:nnnnn
1878     { \@@_env: - #5 }
1879     { \dim_use:N \l_tmpa_dim }
1880     { \dim_use:N \l_tmpb_dim }
1881     { \dim_use:N \l_@@_tmpc_dim }
1882     { \dim_use:N \l_@@_tmpd_dim }
1883   }
1884 }

1885 \cs_new_protected:Npn \@@_patch_for_revtex:
1886 {
1887   \cs_set_eq:NN \@addamp \@addamp@LaTeX
1888   \cs_set_eq:NN \@array \@array@array
1889   \cs_set_eq:NN \@tabular \@tabular@array
1890   \cs_set:Npn \@tabarray { \ifnextchar [ { \@array } { \@array [ c ] } }
1891   \cs_set_eq:NN \array \array@array
1892   \cs_set_eq:NN \endarray \endarray@array
1893   \cs_set:Npn \endtabular { \endarray $\egroup} % $
1894   \cs_set_eq:NN \@mkpream \@mkpream@array
1895   \cs_set_eq:NN \@classx \@classx@array
1896   \cs_set_eq:NN \insert@column \insert@column@array
1897   \cs_set_eq:NN \@arraycr \@arraycr@array
1898   \cs_set_eq:NN \@xarraycr \@xarraycr@array
1899   \cs_set_eq:NN \@xargarraycr \@xargarraycr@array
1900 }

```

10 The environment `{NiceArrayWithDelims}`

```

1901 \NewDocumentEnvironment { NiceArrayWithDelims }
1902 { m m 0 { } m ! 0 { } t \CodeBefore }
1903 {
1904   \bool_if:NT \c_@@_revtex_bool \@@_patch_for_revtex:
1905   \@@_provide_pgfsyspdfmark:
1906   \bool_if:NT \g_@@_footnote_bool \savenotes

```

The aim of the following `\bgroup` (the corresponding `\egroup` is, of course, at the end of the environment) is to be able to put an expositant to a matrix in a mathematical formula.

```

1907   \bgroup

1908   \tl_gset:Nn \g_@@_left_delim_tl { #1 }
1909   \tl_gset:Nn \g_@@_right_delim_tl { #2 }
1910   \tl_gset:Nn \g_@@_user_preamble_tl { #4 }
1911   \tl_if_empty:NT \g_@@_user_preamble_tl { \@@_fatal:n { empty-preamble } }

1912   \int_gzero:N \g_@@_block_box_int
1913   \dim_zero:N \g_@@_width_last_col_dim

```

```

1914 \dim_zero:N \g_@@_width_first_col_dim
1915 \bool_gset_false:N \g_@@_row_of_col_done_bool
1916 \str_if_empty:NT \g_@@_name_env_str
1917 { \str_gset:Nn \g_@@_name_env_str { NiceArrayWithDelims } }
1918 \bool_if:NTF \l_@@_tabular_bool
1919 \mode_leave_vertical:
1920 \@@_test_if_math_mode:
1921 \bool_if:NT \l_@@_in_env_bool { \@@_fatal:n { Yet~in~env } }
1922 \bool_set_true:N \l_@@_in_env_bool

```

The command `\CT@arc@` contains the instruction of color for the rules of the array⁷. This command is used by `\CT@arc@` but we use it also for compatibility with `colortbl`. But we want also to be able to use color for the rules of the array when `colortbl` is *not* loaded. That's why we do the following instruction which is in the patch of the beginning of arrays done by `colortbl`. Of course, we restore the value of `\CT@arc@` at the end of our environment.

```

1923 \cs_gset_eq:NN \@@_old_CT@arc@ \CT@arc@

```

We deactivate Tikz externalization because we will use PGF pictures with the options `overlay` and `remember picture` (or equivalent forms). We deactivate with `\tikzexternaldisable` and not with `\tikzset{external/export=false}` which is *not* equivalent.

```

1924 \cs_if_exist:NT \tikz@library@external@loaded
1925 {
1926 \tikzexternaldisable
1927 \cs_if_exist:NT \ifstandalone
1928 { \tikzset { external / optimize = false } }
1929 }

```

We increment the counter `\g_@@_env_int` which counts the environments of the package.

```

1930 \int_gincr:N \g_@@_env_int
1931 \bool_if:NF \l_@@_block_auto_columns_width_bool
1932 { \dim_gzero_new:N \g_@@_max_cell_width_dim }

```

The sequence `\g_@@_blocks_seq` will contain the carateristics of the blocks (specified by `\Block`) of the array. The sequence `\g_@@_pos_of_blocks_seq` will contain only the position of the blocks (except the blocks with the key `hvlines`).

```

1933 \seq_gclear:N \g_@@_blocks_seq
1934 \seq_gclear:N \g_@@_pos_of_blocks_seq

```

In fact, the sequence `\g_@@_pos_of_blocks_seq` will also contain the positions of the cells with a `\diagbox` and the `\multicolumn`.

```

1935 \seq_gclear:N \g_@@_pos_of_stroken_blocks_seq
1936 \seq_gclear:N \g_@@_pos_of_xdots_seq
1937 \tl_gclear_new:N \g_@@_code_before_tl
1938 \tl_gclear:N \g_@@_row_style_tl

```

We load all the informations written in the aux file during previous compilations corresponding to the current environment.

```

1939 \tl_if_exist:cTF { c_@@ _ \int_use:N \g_@@_env_int _ tl }
1940 {
1941 \bool_gset_true:N \g_@@_aux_found_bool
1942 \use:c { c_@@ _ \int_use:N \g_@@_env_int _ tl }
1943 }
1944 { \bool_gset_false:N \g_@@_aux_found_bool }

```

Now, we prepare the token list for the instructions that we will have to write on the aux file at the end of the environment.

```

1945 \tl_gclear:N \g_@@_aux_tl
1946 \tl_if_empty:NF \g_@@_code_before_tl
1947 {
1948 \bool_set_true:N \l_@@_code_before_bool
1949 \tl_put_right:No \l_@@_code_before_tl \g_@@_code_before_tl
1950 }

```

⁷e.g. `\color[rgb]{0.5,0.5,0}`

```

1951 \tl_if_empty:NF \g_@@_pre_code_before_tl
1952 { \bool_set_true:N \l_@@_code_before_bool }

```

The set of keys is not exactly the same for `{NiceArray}` and for the variants of `{NiceArray}` (`{pNiceArray}`, `{bNiceArray}`, etc.) because, for `{NiceArray}`, we have the options `t`, `c`, `b` and `baseline`.

```

1953 \bool_if:NTF \g_@@_delims_bool
1954 { \keys_set:nn { nicematrix / pNiceArray } }
1955 { \keys_set:nn { nicematrix / NiceArray } }
1956 { #3 , #5 }

```

```

1957 \@@_set_CT@arc@:o \l_@@_rules_color_tl

```

The argument `#6` is the last argument of `{NiceArrayWithDelims}`. With that argument of type “`t \CodeBefore`”, we test whether there is the keyword `\CodeBefore` at the beginning of the body of the environment. If that keyword is present, we have now to extract all the content between that keyword `\CodeBefore` and the (other) keyword `\Body`. It's the job that will do the command `\@@_CodeBefore_Body:w`. After that job, the command `\@@_CodeBefore_Body:w` will go on with `\@@_pre_array:`.

```

1958 \bool_if:nTF { #6 } \@@_CodeBefore_Body:w \@@_pre_array:
1959 }

```

Now, the second part of the environment `{NiceArrayWithDelims}`.

```

1960 {
1961 \bool_if:NTF \l_@@_light_syntax_bool
1962 { \use:c { end @@-light-syntax } }
1963 { \use:c { end @@-normal-syntax } }
1964 \c_math_toggle_token
1965 \skip_horizontal:N \l_@@_right_margin_dim
1966 \skip_horizontal:N \l_@@_extra_right_margin_dim
1967
1968 % awful workaround
1969 \int_compare:nNnT \g_@@_col_total_int = \c_one_int
1970 {
1971 \dim_compare:nNnT \l_@@_columns_width_dim > \c_zero_dim
1972 {
1973 \skip_horizontal:N - \l_@@_columns_width_dim
1974 \bool_if:NTF \l_@@_tabular_bool
1975 { \skip_horizontal:n { - 2 \tabcolsep } }
1976 { \skip_horizontal:n { - 2 \arraycolsep } }
1977 }
1978 }
1979 \hbox_set_end:
1980 \bool_if:NT \c_@@_recent_array_bool
1981 { \UseTaggingSocket { tbl / hmode / end } }

```

End of the construction of the array (in the box `\l_@@_the_array_box`).

If the user has used the key `width` without any column `X`, we raise an error.

```

1982 \bool_if:NT \l_@@_width_used_bool
1983 {
1984 \int_if_zero:nT \g_@@_total_X_weight_int
1985 { \@@_error_or_warning:n { width-without-X-columns } }
1986 }

```

Now, if there is at least one `X`-column in the environment, we compute the width that those columns will have (in the next compilation). In fact, `\l_@@_X_columns_dim` will be the width of a column of weight 1. For a `X`-column of weight `n`, the width will be `\l_@@_X_columns_dim` multiplied by `n`.

```

1987 \int_compare:nNnT \g_@@_total_X_weight_int > \c_zero_int
1988 { \@@_compute_width_X: }

```

If the user has used the key `last-row` with a value, we control that the given value is correct (since we have just constructed the array, we know the actual number of rows of the array).

```

1989 \int_compare:nNnT \l_@@_last_row_int > { -2 }
1990 {
1991   \bool_if:NF \l_@@_last_row_without_value_bool
1992   {
1993     \int_compare:nNnF \l_@@_last_row_int = \c@iRow
1994     {
1995       \@@_error:n { Wrong~last~row }
1996       \int_gset_eq:NN \l_@@_last_row_int \c@iRow
1997     }
1998   }
1999 }

```

Now, the definition of `\c@jCol` and `\g_@@_col_total_int` change: `\c@jCol` will be the number of columns without the “last column”; `\g_@@_col_total_int` will be the number of columns with this “last column”.⁸

```

2000 \int_gset_eq:NN \c@jCol \g_@@_col_total_int
2001 \bool_if:NTF \g_@@_last_col_found_bool
2002 { \int_gdecr:N \c@jCol }
2003 {
2004   \int_compare:nNnT \l_@@_last_col_int > { -1 }
2005   { \@@_error:n { last~col~not~used } }
2006 }

```

We fix also the value of `\c@iRow` and `\g_@@_row_total_int` with the same principle.

```

2007 \int_gset_eq:NN \g_@@_row_total_int \c@iRow
2008 \int_compare:nNnT \l_@@_last_row_int > { -1 } { \int_gdecr:N \c@iRow }

```

Now, we begin the real construction in the output flow of TeX. First, we take into account a potential “first column” (we remind that this “first column” has been constructed in an overlapping position and that we have computed its width in `\g_@@_width_first_col_dim`: see p. 90).

```

2009 \int_if_zero:nT \l_@@_first_col_int
2010 { \skip_horizontal:N \g_@@_width_first_col_dim }

```

The construction of the real box is different whether we have delimiters to put.

```

2011 \bool_if:nTF { ! \g_@@_delims_bool }
2012 {
2013   \str_if_eq:eeTF \l_@@_baseline_tl { c }
2014   \@@_use_arraybox_with_notes_c:
2015   {
2016     \str_if_eq:eeTF \l_@@_baseline_tl { b }
2017     \@@_use_arraybox_with_notes_b:
2018     \@@_use_arraybox_with_notes:
2019   }
2020 }

```

Now, in the case of an environment with delimiters. We compute `\l_tmpa_dim` which is the total height of the “first row” above the array (when the key `first-row` is used).

```

2021 {
2022   \int_if_zero:nTF \l_@@_first_row_int
2023   {
2024     \dim_set_eq:NN \l_tmpa_dim \g_@@_dp_row_zero_dim
2025     \dim_add:Nn \l_tmpa_dim \g_@@_ht_row_zero_dim
2026   }
2027   { \dim_zero:N \l_tmpa_dim }

```

We compute `\l_tmpb_dim` which is the total height of the “last row” below the array (when the key `last-row` is used). A value of `-2` for `\l_@@_last_row_int` means that there is no “last row”.⁹

```

2028 \int_compare:nNnTF \l_@@_last_row_int > { -2 }
2029 {
2030   \dim_set_eq:NN \l_tmpb_dim \g_@@_ht_last_row_dim
2031   \dim_add:Nn \l_tmpb_dim \g_@@_dp_last_row_dim

```

⁸We remind that the potential “first column” (exterior) has the number 0.

⁹A value of `-1` for `\l_@@_last_row_int` means that there is a “last row” but the the user have not set the value with the option `last row` (and we are in the first compilation).

```

2032     }
2033     { \dim_zero:N \l_tmpb_dim }
2034 \hbox_set:Nn \l_tmpa_box
2035     {
2036     \m@th % added 2024/11/21
2037     \c_math_toggle_token
2038     \@@_color:o \l_@@_delimiters_color_tl
2039     \exp_after:wN \left \g_@@_left_delim_tl
2040     \vcenter
2041     {

```

We take into account the “first row” (we have previously computed its total height in `\l_tmpa_dim`). The `\hbox:n` (or `\hbox`) is necessary here.

```

2042     \skip_vertical:n { -\l_tmpa_dim - \arrayrulewidth }
2043     \hbox
2044     {
2045     \bool_if:NTF \l_@@_tabular_bool
2046     { \skip_horizontal:N -\tabcolsep }
2047     { \skip_horizontal:N -\arraycolsep }
2048     \@@_use_arraybox_with_notes_c:
2049     \bool_if:NTF \l_@@_tabular_bool
2050     { \skip_horizontal:N -\tabcolsep }
2051     { \skip_horizontal:N -\arraycolsep }
2052     }

```

We take into account the “last row” (we have previously computed its total height in `\l_tmpb_dim`).

```

2053     \skip_vertical:N -\l_tmpb_dim
2054     \skip_vertical:N \arrayrulewidth
2055     }
2056     \exp_after:wN \right \g_@@_right_delim_tl
2057     \c_math_toggle_token
2058     }

```

Now, the box `\l_tmpa_box` is created with the correct delimiters.

We will put the box in the TeX flow. However, we have a small work to do when the option `delimiters/max-width` is used.

```

2059     \bool_if:NTF \l_@@_delimiters_max_width_bool
2060     {
2061     \@@_put_box_in_flow_bis:nn
2062     \g_@@_left_delim_tl
2063     \g_@@_right_delim_tl
2064     }
2065     \@@_put_box_in_flow:
2066     }

```

We take into account a potential “last column” (this “last column” has been constructed in an overlapping position and we have computed its width in `\g_@@_width_last_col_dim`: see p. 91).

```

2067     \bool_if:NT \g_@@_last_col_found_bool
2068     { \skip_horizontal:N \g_@@_width_last_col_dim }
2069     \bool_if:NT \l_@@_preamble_bool
2070     {
2071     \int_compare:nNnT \c@jCol < \g_@@_static_num_of_col_int
2072     { \@@_warning_gredirect_none:n { columns-not-used } }
2073     }
2074     \@@_after_array:

```

The aim of the following `\egroup` (the corresponding `\bgroup` is, of course, at the beginning of the environment) is to be able to put an exposant to a matrix in a mathematical formula.

```

2075     \egroup

```

We write on the aux file all the informations corresponding to the current environment.

```

2076     \iow_now:Nn \@mainaux { \ExplSyntaxOn }
2077     \iow_now:Nn \@mainaux { \char_set_catcode_space:n { 32 } }
2078     \iow_now:Ne \@mainaux
2079     {

```

```

2080     \tl_gset:cn { c_@@_ \int_use:N \g_@@_env_int _ t1 }
2081     { \exp_not:o \g_@@_aux_t1 }
2082   }
2083   \iow_now:Nn \@mainaux { \ExplSyntaxOff }

2084   \bool_if:NT \g_@@_footnote_bool \endsavenotes
2085 }

```

This is the end of the environment {NiceArrayWithDelims}.

The following command will be used only once. We have written that command for legibility. If there is at least one X-column in the environment, we compute the width that those columns will have (in the next compilation). In fact, `l_@@_X_columns_dim` will be the width of a column of weight 1. For a X-column of weight n , the width will be `l_@@_X_columns_dim` multiplied by n .

```

2086 \cs_new_protected:Npn \@@_compute_width_X:
2087 {
2088   \tl_gput_right:Ne \g_@@_aux_t1
2089   {
2090     \bool_set_true:N \l_@@_X_columns_aux_bool
2091     \dim_set:Nn \l_@@_X_columns_dim
2092     {
2093       \dim_compare:nNnTF
2094       {
2095         \dim_abs:n
2096         { \l_@@_width_dim - \box_wd:N \l_@@_the_array_box }
2097       }
2098       <
2099       { 0.001 pt }
2100       { \dim_use:N \l_@@_X_columns_dim }
2101       {
2102         \dim_eval:n
2103         {
2104           ( \l_@@_width_dim - \box_wd:N \l_@@_the_array_box )
2105           / \int_use:N \g_@@_total_X_weight_int
2106           + \l_@@_X_columns_dim
2107         }
2108       }
2109     }
2110   }
2111 }

```

11 Construction of the preamble of the array

The final user provides a preamble, but we must convert that preamble into a preamble which will be given to {array} (of the package array).

The preamble given by the final user is stored in `g_@@_user_preamble_t1`. The modified version will be stored in `g_@@_array_preamble_t1` also.

```

2112 \cs_new_protected:Npn \@@_transform_preamble:
2113 {
2114   \@@_transform_preamble_i:
2115   \@@_transform_preamble_ii:
2116 }

2117 \cs_new_protected:Npn \@@_transform_preamble_i:
2118 {
2119   \int_gzero:N \c@jCol

```

The sequence `\g_@@_cols_vlism_seq` will contain the numbers of the columns where you will to have to draw vertical lines in the potential sub-matrices (hence the name `vlism`).

```
2120 \seq_gclear:N \g_@@_cols_vlism_seq
```

`\g_tmpb_bool` will be raised if you have a `|` at the end of the preamble provided by the final user.

```
2121 \bool_gset_false:N \g_tmpb_bool
```

The following sequence will store the arguments of the successive `>` in the preamble.

```
2122 \tl_gclear_new:N \g_@@_pre_cell_tl
```

The counter `\l_tmpa_int` will count the number of consecutive occurrences of the symbol `|`.

```
2123 \int_zero:N \l_tmpa_int
2124 \tl_gclear:N \g_@@_array_preamble_tl
2125 \str_if_eq:eeTF \l_@@_vlines_clist { all }
2126 {
2127   \tl_gset:Nn \g_@@_array_preamble_tl
2128     { ! { \skip_horizontal:N \arrayrulewidth } }
2129 }
2130 {
2131   \clist_if_in:NnT \l_@@_vlines_clist 1
2132   {
2133     \tl_gset:Nn \g_@@_array_preamble_tl
2134       { ! { \skip_horizontal:N \arrayrulewidth } }
2135   }
2136 }
```

Now, we actually make the preamble (which will be given to `{array}`). It will be stored in `\g_@@_array_preamble_tl`.

```
2137 \exp_last_unbraced:No \@@_rec_preamble:n \g_@@_user_preamble_tl \@@_stop:
2138 \int_gset_eq:NN \g_@@_static_num_of_col_int \c@jCol
```

```
2139 \@@_replace_columncolor:
2140 }
```

```
2141 \hook_gput_code:nnn { begindocument } { . }
2142 {
2143   \IfPackageLoadedTF { colortbl }
2144   {
```

When `colortbl` is used, we have to catch the tokens `\columncolor` in the preamble because, otherwise, `colortbl` will catch them and the colored panels won't be drawn by `nicematrix` but by `colortbl` (with an output which is not perfect).

```
2145   \regex_const:Nn \c_@@_columncolor_regex { \c { columncolor } }
2146   \cs_new_protected:Npn \@@_replace_columncolor:
2147     {
2148       \regex_replace_all:NnN
2149         \c_@@_columncolor_regex
2150         { \c { @@_columncolor_preamble } }
2151         \g_@@_array_preamble_tl
2152     }
2153   }
2154   {
2155     \cs_new_protected:Npn \@@_replace_columncolor:
2156       { \cs_set_eq:NN \columncolor \@@_columncolor_preamble }
2157   }
2158 }
```

```
2159 \cs_new_protected:Npn \@@_transform_preamble_ii:
2160 {
```

If there were delimiters at the beginning or at the end of the preamble, the environment `{NiceArray}` is transformed into an environment `{xNiceMatrix}`.

```

2161     \tl_if_eq:NNTF \g_@@_left_delim_tl \c_@@_dot_tl
2162     {
2163         \tl_if_eq:NNF \g_@@_right_delim_tl \c_@@_dot_tl
2164         { \bool_gset_true:N \g_@@_delims_bool }
2165     }
2166     { \bool_gset_true:N \g_@@_delims_bool }

```

We want to remind whether there is a specifier `|` at the end of the preamble.

```

2167     \bool_if:NT \g_tmpb_bool { \bool_set_true:N \l_@@_bar_at_end_of_pream_bool }

```

We complete the preamble with the potential “exterior columns” (on both sides).

```

2168     \int_if_zero:nTF \l_@@_first_col_int
2169     { \tl_gput_left:No \g_@@_array_preamble_tl \c_@@_preamble_first_col_tl }
2170     {
2171         \bool_if:NF \g_@@_delims_bool
2172         {
2173             \bool_if:NF \l_@@_tabular_bool
2174             {
2175                 \clist_if_empty:NT \l_@@_vlines_clist
2176                 {
2177                     \bool_if:NF \l_@@_exterior_arraycolsep_bool
2178                     { \tl_gput_left:Nn \g_@@_array_preamble_tl { @ { } } }
2179                 }
2180             }
2181         }
2182     }
2183     \int_compare:nNnTF \l_@@_last_col_int > { -1 }
2184     { \tl_gput_right:No \g_@@_array_preamble_tl \c_@@_preamble_last_col_tl }
2185     {
2186         \bool_if:NF \g_@@_delims_bool
2187         {
2188             \bool_if:NF \l_@@_tabular_bool
2189             {
2190                 \clist_if_empty:NT \l_@@_vlines_clist
2191                 {
2192                     \bool_if:NF \l_@@_exterior_arraycolsep_bool
2193                     { \tl_gput_right:Nn \g_@@_array_preamble_tl { @ { } } }
2194                 }
2195             }
2196         }
2197     }

```

We add a last column to raise a good error message when the user puts more columns than allowed by its preamble. However, for technical reasons, it’s not possible to do that in `{NiceTabular*}` (we control that with the value of `\l_@@_tabular_width_dim`).

```

2198     \dim_compare:nNnT \l_@@_tabular_width_dim = \c_zero_dim
2199     {

```

If the tagging of the tabulars is done (part of the Tagging Project), you don’t activate that mechanism because it would create a dummy column of tagged empty cells.

```

2200         \bool_if:NF \c_@@_testphase_table_bool
2201         {
2202             \tl_gput_right:Nn \g_@@_array_preamble_tl
2203             { > { \@@_error_too_much_cols: } 1 }
2204         }
2205     }
2206 }

```

The preamble provided by the final user will be read by a finite automata. The following function `\@@_rec_preamble:n` will read that preamble (usually letter by letter) in a recursive way (hence the name of that function). in the preamble.

```

2207 \cs_new_protected:Npn \@@_rec_preamble:n #1
2208 {

```

For the majority of the letters, we will trigger the corresponding action by calling directly a function in the main hashtable of TeX (thanks to the mechanism `\csname...\endcsname`. Be careful: all these functions take in as first argument the letter (or token) itself.¹⁰

```

2209     \cs_if_exist:cTF { @@ _ \token_to_str:N #1 }
2210     { \use:c { @@ _ \token_to_str:N #1 } { #1 } }
2211     {

```

Now, the columns defined by `\newcolumntype` of array.

```

2212         \cs_if_exist:cTF { NC @ find @ #1 }
2213         {
2214             \tl_set_eq:Nc \l_tmpb_tl { NC @ rewrite @ #1 }
2215             \exp_last_unbraced:No \@@_rec_preamble:n \l_tmpb_tl
2216         }
2217         {
2218             \str_if_eq:nnTF { #1 } { S }
2219             { \@@_fatal:n { unknown~column~type~S } }
2220             { \@@_fatal:nn { unknown~column~type } { #1 } }
2221         }
2222     }
2223 }

```

For c, l and r

```

2224 \cs_new_protected:Npn \@@_c #1
2225 {
2226     \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2227     \tl_gclear:N \g_@@_pre_cell_tl
2228     \tl_gput_right:Nn \g_@@_array_preamble_tl
2229     { > \@@_cell_begin: c < \@@_cell_end: }

```

We increment the counter of columns and then we test for the presence of a <.

```

2230     \int_gincr:N \c@jCol
2231     \@@_rec_preamble_after_col:n
2232 }

2233 \cs_new_protected:Npn \@@_l #1
2234 {
2235     \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2236     \tl_gclear:N \g_@@_pre_cell_tl
2237     \tl_gput_right:Nn \g_@@_array_preamble_tl
2238     {
2239         > { \@@_cell_begin: \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_l_tl }
2240         l
2241         < \@@_cell_end:
2242     }
2243     \int_gincr:N \c@jCol
2244     \@@_rec_preamble_after_col:n
2245 }

2246 \cs_new_protected:Npn \@@_r #1
2247 {
2248     \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2249     \tl_gclear:N \g_@@_pre_cell_tl
2250     \tl_gput_right:Nn \g_@@_array_preamble_tl
2251     {
2252         > { \@@_cell_begin: \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_r_tl }
2253         r
2254         < \@@_cell_end:

```

¹⁰We do that because it's an easy way to insert the letter at some places in the code that we will add to `\g_@@_array_preamble_tl`.

```

2255     }
2256     \int_gincr:N \c@jCol
2257     \@@_rec_preamble_after_col:n
2258 }

```

For ! and @

```

2259 \cs_new_protected:cpn { @@ _ \token_to_str:N ! } #1 #2
2260 {
2261     \tl_gput_right:Nn \g_@@_array_preamble_tl { #1 { #2 } }
2262     \@@_rec_preamble:n
2263 }
2264 \cs_set_eq:cc { @@ _ \token_to_str:N @ } { @@ _ \token_to_str:N ! }

```

For |

```

2265 \cs_new_protected:cpn { @@ _ | } #1
2266 {

```

\l_tmpa_int is the number of successive occurrences of |

```

2267     \int_incr:N \l_tmpa_int
2268     \@@_make_preamble_i_i:n
2269 }

```

```

2270 \cs_new_protected:Npn \@@_make_preamble_i_i:n #1
2271 {
2272     \str_if_eq:nnTF { #1 } { | }
2273     { \use:c { @@ _ | } | }
2274     { \@@_make_preamble_i_ii:nn { } #1 }
2275 }

```

```

2276 \cs_new_protected:Npn \@@_make_preamble_i_ii:nn #1 #2
2277 {
2278     \str_if_eq:nnTF { #2 } { [ ]
2279     { \@@_make_preamble_i_ii:nw { #1 } [ ]
2280     { \@@_make_preamble_i_iii:nn { #2 } { #1 } }
2281 }

```

```

2282 \cs_new_protected:Npn \@@_make_preamble_i_ii:nw #1 [ #2 ]
2283 { \@@_make_preamble_i_ii:nn { #1 , #2 } }

```

```

2284 \cs_new_protected:Npn \@@_make_preamble_i_iii:nn #1 #2
2285 {
2286     \@@_compute_rule_width:n { multiplicity = \l_tmpa_int , #2 }
2287     \tl_gput_right:Ne \g_@@_array_preamble_tl
2288     {

```

Here, the command \dim_use:N is mandatory.

```

2289     \exp_not:N ! { \skip_horizontal:N \dim_use:N \l_@@_rule_width_dim }
2290     }
2291     \tl_gput_right:Ne \g_@@_pre_code_after_tl
2292     {
2293         \@@_vline:n
2294         {
2295             position = \int_eval:n { \c@jCol + 1 } ,
2296             multiplicity = \int_use:N \l_tmpa_int ,
2297             total-width = \dim_use:N \l_@@_rule_width_dim ,
2298             #2
2299         }

```

We don't have provided value for start nor for end, which means that the rule will cover (potentially) all the rows of the array.

```

2300     }
2301     \int_zero:N \l_tmpa_int
2302     \str_if_eq:nnT { #1 } { \@@_stop: } { \bool_gset_true:N \g_tmpb_bool }
2303     \@@_rec_preamble:n #1
2304 }

```

```

2305 \cs_new_protected:cpn { @@ _ > } #1 #2
2306 {
2307   \tl_gput_right:Nn \g_@@_pre_cell_tl { > { #2 } }
2308   \@@_rec_preamble:n
2309 }
2310 \bool_new:N \l_@@_bar_at_end_of_pream_bool

```

The specifier `p` (and also the specifiers `m`, `b`, `V` and `X`) have an optional argument between square brackets for a list of *key-value* pairs. Here are the corresponding keys.

```

2311 \keys_define:nn { nicematrix / p-column }
2312 {
2313   r .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_r_str ,
2314   r .value_forbidden:n = true ,
2315   c .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_c_str ,
2316   c .value_forbidden:n = true ,
2317   l .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_l_str ,
2318   l .value_forbidden:n = true ,
2319   S .code:n = \str_set:Nn \l_@@_hpos_col_str { si } ,
2320   S .value_forbidden:n = true ,
2321   p .code:n = \str_set:Nn \l_@@_vpos_col_str { p } ,
2322   p .value_forbidden:n = true ,
2323   t .meta:n = p ,
2324   m .code:n = \str_set:Nn \l_@@_vpos_col_str { m } ,
2325   m .value_forbidden:n = true ,
2326   b .code:n = \str_set:Nn \l_@@_vpos_col_str { b } ,
2327   b .value_forbidden:n = true
2328 }

```

For `p` but also `b` and `m`.

```

2329 \cs_new_protected:Npn \@@_p #1
2330 {
2331   \str_set:Nn \l_@@_vpos_col_str { #1 }

```

Now, you look for a potential character [after the letter of the specifier (for the options).

```

2332   \@@_make_preamble_ii_i:n
2333 }
2334 \cs_set_eq:NN \@@_b \@@_p
2335 \cs_set_eq:NN \@@_m \@@_p
2336 \cs_new_protected:Npn \@@_make_preamble_ii_i:n #1
2337 {
2338   \str_if_eq:nnTF { #1 } { [ ]
2339     { \@@_make_preamble_ii_ii:w [ ]
2340       { \@@_make_preamble_ii_ii:w [ ] { #1 } }
2341     }
2342   \cs_new_protected:Npn \@@_make_preamble_ii_ii:w [ #1 ]
2343     { \@@_make_preamble_ii_iii:nn { #1 } }

```

#1 is the optional argument of the specifier (a list of *key-value* pairs).

#2 is the mandatory argument of the specifier: the width of the column.

```

2344 \cs_new_protected:Npn \@@_make_preamble_ii_iii:nn #1 #2
2345 {

```

The possible values of `\l_@@_hpos_col_str` are `j` (for *justified* which is the initial value), `l`, `c`, `r`, `L`, `C` and `R` (when the user has used the corresponding key in the optional argument of the specifier).

```

2346   \str_set:Nn \l_@@_hpos_col_str { j }
2347   \@@_keys_p_column:n { #1 }
2348   \@@_make_preamble_ii_iv:nnn { #2 } { minipage } { }
2349 }
2350 \cs_new_protected:Npn \@@_keys_p_column:n #1
2351 { \keys_set_known:nnN { nicematrix / p-column } { #1 } \l_tmpa_tl }

```

The first argument is the width of the column. The second is the type of environment: `minipage` or `varwidth`. The third is some code added at the beginning of the cell.

```

2352 \cs_new_protected:Npn \@@_make_preamble_ii_iv:nnn #1 #2 #3
2353 {
2354   \use:e
2355   {
2356     \@@_make_preamble_ii_v:nnnnnnn
2357     { \str_if_eq:eeTF \l_@@_vpos_col_str { p } { t } { b } }
2358     { \dim_eval:n { #1 } }
2359     {

```

The parameter `\l_@@_hpos_col_str` (as `\l_@@_vpos_col_str`) exists only during the construction of the preamble. During the composition of the array itself, you will have, in each cell, the parameter `\l_@@_hpos_cell_tl` which will provide the horizontal alignment of the column to which belongs the cell.

```

2360     \str_if_eq:eeTF \l_@@_hpos_col_str { j }
2361     { \tl_clear:N \exp_not:N \l_@@_hpos_cell_tl }
2362     {

```

Here, we use `\cs_set_nopar:Npn` instead of `\tl_set:Nn` for efficiency only.

```

2363         \cs_set_nopar:Npn \exp_not:N \l_@@_hpos_cell_tl
2364         { \str_lowercase:o \l_@@_hpos_col_str }
2365     }
2366     \IfPackageLoadedTF { ragged2e }
2367     {
2368       \str_case:on \l_@@_hpos_col_str
2369       {
2370         c { \exp_not:N \Centering }
2371         l { \exp_not:N \RaggedRight }
2372         r { \exp_not:N \RaggedLeft }
2373       }
2374     }
2375     {
2376       \str_case:on \l_@@_hpos_col_str
2377       {
2378         c { \exp_not:N \centering }
2379         l { \exp_not:N \raggedright }
2380         r { \exp_not:N \raggedleft }
2381       }
2382     }
2383     #3
2384   }
2385   { \str_if_eq:eeT \l_@@_vpos_col_str { m } \@@_center_cell_box: }
2386   { \str_if_eq:eeT \l_@@_hpos_col_str { si } \siunitx_cell_begin:w }
2387   { \str_if_eq:eeT \l_@@_hpos_col_str { si } \siunitx_cell_end: }
2388   { #2 }
2389   {
2390     \str_case:onF \l_@@_hpos_col_str
2391     {
2392       { j } { c }
2393       { si } { c }
2394     }

```

We use `\str_lowercase:n` to convert R to r, etc.

```

2395     { \str_lowercase:o \l_@@_hpos_col_str }
2396   }
2397 }

```

We increment the counter of columns, and then we test for the presence of a `<`.

```

2398   \int_gincr:N \c@jCol
2399   \@@_rec_preamble_after_col:n
2400 }

```

#1 is the optional argument of `{minipage}` (or `{varwidth}`): `t` or `b`. Indeed, for the columns of type `m`, we use the value `b` here because there is a special post-action in order to center vertically the box (see #4).

#2 is the width of the `{minipage}` (or `{varwidth}`), that is to say also the width of the column.

#3 is the coding for the horizontal position of the content of the cell (`\centering`, `\raggedright`, `\raggedleft` or nothing). It's also possible to put in that #3 some code to fix the value of `\l_@@_hpos_cell_tl` which will be available in each cell of the column.

#4 is an extra-code which contains `\@@_center_cell_box`: (when the column is a `m` column) or nothing (in the other cases).

#5 is a code put just before the `c` (or `r` or `l`: see #8).

#6 is a code put just after the `c` (or `r` or `l`: see #8).

#7 is the type of environment: `minipage` or `varwidth`.

#8 is the letter `c` or `r` or `l` which is the basic specifier of column which is used *in fine*.

```

2401 \cs_new_protected:Npn \@@_make_preamble_ii_v:nnnnnnn #1 #2 #3 #4 #5 #6 #7 #8
2402 {
2403   \str_if_eq:eeTF \l_@@_hpos_col_str { si }
2404   {
2405     \tl_gput_right:Nn \g_@@_array_preamble_tl
2406     { > \@@_test_if_empty_for_S: }
2407   }
2408   { \tl_gput_right:Nn \g_@@_array_preamble_tl { > \@@_test_if_empty: } }
2409   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2410   \tl_gclear:N \g_@@_pre_cell_tl
2411   \tl_gput_right:Nn \g_@@_array_preamble_tl
2412   {
2413     > {

```

The parameter `\l_@@_col_width_dim`, which is the width of the current column, will be available in each cell of the column. It will be used by the mono-column blocks.

```

2414   \dim_set:Nn \l_@@_col_width_dim { #2 }
2415   \bool_if:NT \c_@@_testphase_table_bool
2416   { \tag_struct_begin:n { tag = Div } }
2417   \@@_cell_begin:

```

We use the form `\minipage–\endminipage` (`\varwidth–\endvarwidth`) for compatibility with `colcell` (2023-10-31).

```

2418   \use:c { #7 } [ #1 ] { #2 }

```

The following lines have been taken from `array.sty`.

```

2419   \everypar
2420   {
2421     \vrule height \box_ht:N \@arstrutbox width \c_zero_dim
2422     \everypar { }
2423   }
2424   \bool_if:NT \c_@@_testphase_table_bool \tagpdfpara0n

```

Now, the potential code for the horizontal position of the content of the cell (`\centering`, `\raggedright`, `\RaggedRight`, etc.).

```

2425   #3

```

The following code is to allow something like `\centering` in `\RowStyle`.

```

2426   \g_@@_row_style_tl
2427   \arraybackslash
2428   #5
2429   }
2430   #8
2431   < {
2432   #6

```

The following line has been taken from `array.sty`.

```

2433   \@finalstrut \@arstrutbox
2434   \use:c { end #7 }

```

If the letter in the preamble is m, #4 will be equal to \@@_center_cell_box: (see just below).

```

2435         #4
2436         \@@_cell_end:
2437         \bool_if:NT \c_@@_testphase_table_bool \tag_struct_end:
2438     }
2439 }
2440 }

```

The cell always begins with \ignorespaces with array and that's why we retrieve that token.

```

2441 \cs_new_protected:Npn \@@_test_if_empty: \ignorespaces
2442 {

```

We open a special group with \group_align_safe_begin:. Thus, when \peek_meaning:NTF will read the & (when the cell is empty), that lecture won't trigger the end of the cell (since we are in a lower group...). If the end of cell was triggered, we would have other tokens in the TeX flow (and not &).

```

2443     \group_align_safe_begin:
2444     \peek_meaning:NTF &
2445     \@@_the_cell_is_empty:
2446     {
2447         \peek_meaning:NTF \
2448         \@@_the_cell_is_empty:
2449         {
2450             \peek_meaning:NTF \crrc
2451             \@@_the_cell_is_empty:
2452             \group_align_safe_end:
2453         }
2454     }
2455 }

2456 \cs_new_protected:Npn \@@_the_cell_is_empty:
2457 {
2458     \group_align_safe_end:
2459     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2460     {

```

Be careful: here, we can't merely use \bool_gset_true: \g_@@_empty_cell_bool, in particular because of the columns of type X.

```

2461         \box_set_wd:Nn \l_@@_cell_box \c_zero_dim
2462         \skip_horizontal:N \l_@@_col_width_dim
2463     }
2464 }

2465 \cs_new_protected:Npn \@@_test_if_empty_for_S:
2466 {
2467     \peek_meaning:NT \__siunitx_table_skip:n
2468     { \bool_gset_true:N \g_@@_empty_cell_bool }
2469 }

```

The following command will be used in m-columns in order to center vertically the box. In fact, despite its name, the command does not always center the cell. Indeed, if there is only one row in the cell, it should not be centered vertically. It's not possible to know the number of rows of the cell. However, we consider (as in array) that if the height of the cell is no more that the height of \strutbox, there is only one row.

```

2470 \cs_new_protected:Npn \@@_center_cell_box:
2471 {

```

By putting instructions in \g_@@_cell_after_hook_tl, we require a post-action of the box \l_@@_cell_box.

```

2472     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2473     {
2474         \int_compare:nNnT
2475         { \box_ht:N \l_@@_cell_box }
2476         >

```

Previously, we had `\@arstrutbox` and not `\strutbox` in the following line but the code in `array` has changed in v 2.5g and we follow the change (see *array: Correctly identify single-line m-cells* in LaTeX News 36).

```

2477     { \box_ht:N \strutbox }
2478     {
2479     \hbox_set:Nn \l_@@_cell_box
2480     {
2481     \box_move_down:nn
2482     {
2483     ( \box_ht:N \l_@@_cell_box - \box_ht:N \@arstrutbox
2484     + \baselineskip ) / 2
2485     }
2486     { \box_use:N \l_@@_cell_box }
2487     }
2488     }
2489 }
2490 }

```

For V (similar to the V of `varwidth`).

```

2491 \cs_new_protected:Npn \@@_V #1 #2
2492 {
2493 \str_if_eq:nnTF { #1 } { [ ]
2494 { \@@_make_preamble_V_i:w [ ]
2495 { \@@_make_preamble_V_i:w [ ] { #2 } }
2496 }
2497 \cs_new_protected:Npn \@@_make_preamble_V_i:w [ #1 ]
2498 { \@@_make_preamble_V_ii:nn { #1 } }
2499 \cs_new_protected:Npn \@@_make_preamble_V_ii:nn #1 #2
2500 {
2501 \str_set:Nn \l_@@_vpos_col_str { p }
2502 \str_set:Nn \l_@@_hpos_col_str { j }
2503 \@@_keys_p_column:n { #1 }
2504 \IfPackageLoadedTF { varwidth }
2505 { \@@_make_preamble_ii_iv:nnn { #2 } { varwidth } { } }
2506 {
2507 \@@_error_or_warning:n { varwidth-not-loaded }
2508 \@@_make_preamble_ii_iv:nnn { #2 } { minipage } { }
2509 }
2510 }

```

For w and W

```

2511 \cs_new_protected:Npn \@@_w { \@@_make_preamble_w:nnnn { } }
2512 \cs_new_protected:Npn \@@_W { \@@_make_preamble_w:nnnn { \@@_special_W: } }

```

#1 is a special argument: empty for w and equal to `\@@_special_W:` for W;

#2 is the type of column (w or W);

#3 is the type of horizontal alignment (c, l, r or s);

#4 is the width of the column.

```

2513 \cs_new_protected:Npn \@@_make_preamble_w:nnnn #1 #2 #3 #4
2514 {
2515 \str_if_eq:nnTF { #3 } { s }
2516 { \@@_make_preamble_w_i:nnnn { #1 } { #4 } }
2517 { \@@_make_preamble_w_ii:nnnn { #1 } { #2 } { #3 } { #4 } }
2518 }

```

First, the case of an horizontal alignment equal to s (for *stretch*).

#1 is a special argument: empty for w and equal to `\@@_special_W:` for W;

#2 is the width of the column.

```

2519 \cs_new_protected:Npn \@@_make_preamble_w_i:nnnn #1 #2
2520 {
2521 \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2522 \tl_gc clear:N \g_@@_pre_cell_tl

```

```

2523 \tl_gput_right:Nn \g_@@_array_preamble_tl
2524 {
2525   > {
2526     \dim_set:Nn \l_@@_col_width_dim { #2 }
2527     \@@_cell_begin:
2528     \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_c_tl
2529   }
2530   c
2531   < {
2532     \@@_cell_end_for_w_s:
2533     #1
2534     \@@_adjust_size_box:
2535     \box_use_drop:N \l_@@_cell_box
2536   }
2537 }
2538 \int_gincr:N \c@jCol
2539 \@@_rec_preamble_after_col:n
2540 }

```

Then, the most important version, for the horizontal alignments types of c, l and r (and not s).

```

2541 \cs_new_protected:Npn \@@_make_preamble_w_ii:nnnn #1 #2 #3 #4
2542 {
2543   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2544   \tl_gclear:N \g_@@_pre_cell_tl
2545   \tl_gput_right:Nn \g_@@_array_preamble_tl
2546   {
2547     > {

```

The parameter `\l_@@_col_width_dim`, which is the width of the current column, will be available in each cell of the column. It will be used by the mono-column blocks.

```

2548     \dim_set:Nn \l_@@_col_width_dim { #4 }
2549     \hbox_set:Nw \l_@@_cell_box
2550     \@@_cell_begin:
2551     \cs_set_nopar:Npn \l_@@_hpos_cell_tl { #3 }
2552   }
2553   c
2554   < {
2555     \@@_cell_end:
2556     \hbox_set_end:
2557     #1
2558     \@@_adjust_size_box:
2559     \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
2560   }
2561 }

```

We increment the counter of columns and then we test for the presence of a <.

```

2562 \int_gincr:N \c@jCol
2563 \@@_rec_preamble_after_col:n
2564 }

```

```

2565 \cs_new_protected:Npn \@@_special_W:
2566 {
2567   \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \l_@@_col_width_dim
2568   { \@@_warning:n { W~warning } }
2569 }

```

For S (of siunitx).

```

2570 \cs_new_protected:Npn \@@_S #1 #2
2571 {
2572   \str_if_eq:nnTF { #2 } { [ ] }
2573   { \@@_make_preamble_S:w [ ] }
2574   { \@@_make_preamble_S:w [ ] { #2 } }
2575 }

```

```

2576 \cs_new_protected:Npn \@@_make_preamble_S:w [ #1 ]
2577 { \@@_make_preamble_S_i:n { #1 } }
2578 \cs_new_protected:Npn \@@_make_preamble_S_i:n #1
2579 {
2580   \IfPackageLoadedF { siunitx } { \@@_fatal:n { siunitx~not~loaded } }
2581   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2582   \tl_gcLEAR:N \g_@@_pre_cell_tl
2583   \tl_gput_right:Nn \g_@@_array_preamble_tl
2584   {
2585     > {

```

In the cells of a column of type S, we have to wrap the command `\@@_node_for_cell:` for the horizontal alignment of the content of the cell (siunitx has done a job but it's without effect since we have to put the content in a box for the PGF/TikZ node and that's why we have to do the job of horizontal alignment once again).

```

2586     \socket_assign_plug:n { nicematrix / siunitx-wrap } { active }
2587     \keys_set:n { siunitx } { #1 }
2588     \@@_cell_begin:
2589     \siunitx_cell_begin:w
2590   }
2591   c
2592   <
2593   {
2594     \siunitx_cell_end:

```

We want the value of `\l__siunitx_table_text_bool` available *after* `\@@_cell_end:` because we need it to know how to align our box after the construction of the PGF/TikZ node. That's why we use `\g_@@_cell_after_hook_tl` to reset the correct value of `\l__siunitx_table_text_bool` (of course, if will stay local within the cell of the underlying `\halign`).

```

2595     \tl_gput_right:Ne \g_@@_cell_after_hook_tl
2596     {
2597       \bool_if:NTF \l__siunitx_table_text_bool
2598       \bool_set_true:N
2599       \bool_set_false:N
2600       \l__siunitx_table_text_bool
2601     }
2602     \@@_cell_end:
2603   }
2604 }

```

We increment the counter of columns and then we test for the presence of a `<`.

```

2605   \int_gincr:N \c@jCol
2606   \@@_rec_preamble_after_col:n
2607 }

```

For `(`, `[` and `\{`.

```

2608 \cs_new_protected:cpn { @@ _ \token_to_str:N ( } #1 #2
2609 {
2610   \bool_if:NT \l_@@_small_bool { \@@_fatal:n { Delimiter~with~small } }

```

If we are before the column 1 and not in `{NiceArray}`, we reserve space for the left delimiter.

```

2611   \int_if_zero:nTF \c@jCol
2612   {
2613     \tl_if_eq:NNTF \g_@@_left_delim_tl \c_@@_dot_tl
2614     {

```

In that case, in fact, the first letter of the preamble must be considered as the left delimiter of the array.

```

2615     \tl_gset:Nn \g_@@_left_delim_tl { #1 }
2616     \tl_gset_eq:NN \g_@@_right_delim_tl \c_@@_dot_tl
2617     \@@_rec_preamble:n #2
2618   }
2619   {
2620     \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }

```

```

2621         \@@_make_preamble_iv:nn { #1 } { #2 }
2622     }
2623 }
2624 { \@@_make_preamble_iv:nn { #1 } { #2 } }
2625 }
2626 \cs_set_eq:cc { @@ _ \token_to_str:N [ ] { @@ _ \token_to_str:N ( }
2627 \cs_set_eq:cc { @@ _ \token_to_str:N \{ } { @@ _ \token_to_str:N ( }
2628 \cs_new_protected:Npn \@@_make_preamble_iv:nn #1 #2
2629 {
2630     \tl_gput_right:Ne \g_@@_pre_code_after_tl
2631     { \@@_delimiter:nnn #1 { \int_eval:n { \c@jCol + 1 } } \c_true_bool }
2632     \tl_if_in:nnTF { ( [ \{ ) ] \} \left \right } { #2 }
2633     {
2634         \@@_error:nn { delimiter~after~opening } { #2 }
2635         \@@_rec_preamble:n
2636     }
2637     { \@@_rec_preamble:n #2 }
2638 }

```

In fact, it would be possible to define `\left` and `\right` as no-op.

```

2639 \cs_new_protected:cpn { @@ _ \token_to_str:N \left } #1
2640 { \use:c { @@ _ \token_to_str:N ( } }

```

For the closing delimiters. We have two arguments for the following command because we directly read the following letter in the preamble (we have to see whether we have a opening delimiter following and we also have to see whether we are at the end of the preamble because, in that case, our letter must be considered as the right delimiter of the environment if the environment is `{NiceArray}`).

```

2641 \cs_new_protected:cpn { @@ _ \token_to_str:N ) } #1 #2
2642 {
2643     \bool_if:NT \l_@@_small_bool { \@@_fatal:n { Delimiter~with~small } }
2644     \tl_if_in:nnTF { ) ] \} } { #2 }
2645     { \@@_make_preamble_v:nnn #1 #2 }
2646     {
2647         \str_if_eq:nnTF { \@@_stop: } { #2 }
2648         {
2649             \tl_if_eq:NNTF \g_@@_right_delim_tl \c_@@_dot_tl
2650             { \tl_gset:Nn \g_@@_right_delim_tl { #1 } }
2651             {
2652                 \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2653                 \tl_gput_right:Ne \g_@@_pre_code_after_tl
2654                 { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2655                 \@@_rec_preamble:n #2
2656             }
2657         }
2658         {
2659             \tl_if_in:nnT { ( [ \{ \left } } { #2 }
2660             { \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } } }
2661             \tl_gput_right:Ne \g_@@_pre_code_after_tl
2662             { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2663             \@@_rec_preamble:n #2
2664         }
2665     }
2666 }
2667 \cs_set_eq:cc { @@ _ \token_to_str:N ] } { @@ _ \token_to_str:N ) }
2668 \cs_set_eq:cc { @@ _ \token_to_str:N \} } { @@ _ \token_to_str:N ) }
2669 \cs_new_protected:Npn \@@_make_preamble_v:nnn #1 #2 #3
2670 {
2671     \str_if_eq:nnTF { \@@_stop: } { #3 }
2672     {
2673         \tl_if_eq:NNTF \g_@@_right_delim_tl \c_@@_dot_tl
2674         {
2675             \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }

```

```

2676     \tl_gput_right:Ne \g_@@_pre_code_after_tl
2677     { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2678     \tl_gset:Nn \g_@@_right_delim_tl { #2 }
2679   }
2680   {
2681     \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2682     \tl_gput_right:Ne \g_@@_pre_code_after_tl
2683     { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2684     \@@_error:nn { double~closing~delimiter } { #2 }
2685   }
2686 }
2687 {
2688   \tl_gput_right:Ne \g_@@_pre_code_after_tl
2689   { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2690   \@@_error:nn { double~closing~delimiter } { #2 }
2691   \@@_rec_preamble:n #3
2692 }
2693 }

2694 \cs_new_protected:cpn { @@ _ \token_to_str:N \right } #1
2695 { \use:c { @@ _ \token_to_str:N ) } }

```

After a specifier of column, we have to test whether there is one or several <{. .} because, after those potential <{. .}, we have to insert !{\skip_horizontal:N ...} when the key vlines is used. In fact, we have also to test whether there is, after the <{. .}, a @{...}.

```

2696 \cs_new_protected:Npn \@@_rec_preamble_after_col:n #1
2697 {
2698   \str_if_eq:nnTF { #1 } { < }
2699   \@@_rec_preamble_after_col_i:n
2700   {
2701     \str_if_eq:nnTF { #1 } { @ }
2702     \@@_rec_preamble_after_col_ii:n
2703     {
2704       \str_if_eq:eeTF \l_@@_vlines_clist { all }
2705       {
2706         \tl_gput_right:Nn \g_@@_array_preamble_tl
2707         { ! { \skip_horizontal:N \arrayrulewidth } }
2708       }
2709       {
2710         \clist_if_in:NeT \l_@@_vlines_clist
2711         { \int_eval:n { \c@jCol + 1 } }
2712         {
2713           \tl_gput_right:Nn \g_@@_array_preamble_tl
2714           { ! { \skip_horizontal:N \arrayrulewidth } }
2715         }
2716       }
2717       \@@_rec_preamble:n { #1 }
2718     }
2719   }
2720 }

2721 \cs_new_protected:Npn \@@_rec_preamble_after_col_i:n #1
2722 {
2723   \tl_gput_right:Nn \g_@@_array_preamble_tl { < { #1 } }
2724   \@@_rec_preamble_after_col:n
2725 }

```

We have to catch a @{...} after a specifier of column because, if we have to draw a vertical rule, we have to add in that @{...} a \hskip corresponding to the width of the vertical rule.

```

2726 \cs_new_protected:Npn \@@_rec_preamble_after_col_ii:n #1
2727 {
2728   \str_if_eq:eeTF \l_@@_vlines_clist { all }
2729   {

```

```

2730     \tl_gput_right:Nn \g_@@_array_preamble_tl
2731     { @ { #1 \skip_horizontal:N \arrayrulewidth } }
2732   }
2733   {
2734     \clist_if_in:NeTF \l_@@_vlines_clist { \int_eval:n { \c@jCol + 1 } }
2735     {
2736       \tl_gput_right:Nn \g_@@_array_preamble_tl
2737       { @ { #1 \skip_horizontal:N \arrayrulewidth } }
2738     }
2739     { \tl_gput_right:Nn \g_@@_array_preamble_tl { @ { #1 } } }
2740   }
2741   \@@_rec_preamble:n
2742 }

2743 \cs_new_protected:cpn { @@ _ * } #1 #2 #3
2744 {
2745   \tl_clear:N \l_tmpa_tl
2746   \int_step_inline:nn { #2 } { \tl_put_right:Nn \l_tmpa_tl { #3 } }
2747   \exp_last_unbraced:No \@@_rec_preamble:n \l_tmpa_tl
2748 }

```

The token `\NC@find` is at the head of the definition of the columns type done by `\newcolumntype`. We want that token to be no-op here.

```

2749 \cs_new_protected:cpn { @@ _ \token_to_str:N \NC@find } #1 { \@@_rec_preamble:n }

```

For the case of a letter `X`. This specifier may take in an optional argument (between square brackets). That's why we test whether there is a `[` after the letter `X`.

```

2750 \cs_new_protected:Npn \@@_X #1 #2
2751 {
2752   \str_if_eq:nnTF { #2 } { [ ]
2753     { \@@_make_preamble_X:w [ ] }
2754     { \@@_make_preamble_X:w [ ] #2 }
2755   }
2756   \cs_new_protected:Npn \@@_make_preamble_X:w [ #1 ]
2757   { \@@_make_preamble_X:i:n { #1 } }

```

`#1` is the optional argument of the `X` specifier (a list of *key-value* pairs).

The following set of keys is for the specifier `X` in the preamble of the array. Such specifier may have as keys all the keys of `{ nicematrix / p-column }` but also a key as 1, 2, 3, etc. The following set of keys will be used to retrieve that value (in the counter `\l_@@_weight_int`).

```

2758 \keys_define:nn { nicematrix / X-column }
2759 { unknown .code:n = \int_set:Nn \l_@@_weight_int { \l_keys_key_str } }

```

In the following command, `#1` is the list of the options of the specifier `X`.

```

2760 \cs_new_protected:Npn \@@_make_preamble_X:i:n #1
2761 {

```

The possible values of `\l_@@_hpos_col_str` are `j` (for *justified* which is the initial value), `l`, `c` and `r` (when the user has used the corresponding key in the optional argument of the specifier `X`).

```

2762   \str_set:Nn \l_@@_hpos_col_str { j }

```

The possible values of `\l_@@_vpos_col_str` are `p` (the initial value), `m` and `b` (when the user has used the corresponding key in the optional argument of the specifier `X`).

```

2763   \str_set:Nn \l_@@_vpos_col_str { p }

```

The integer `\l_@@_weight_int` will be the weight of the `X` column (the initial value is 1). The user may specify a different value (such as 2, 3, etc.) by putting that value in the optional argument of the specifier. The weights of the `X` columns are used in the computation of the actual width of those columns as in `tabu` (now obsolete) or `tabularray`.

```

2764   \int_zero_new:N \l_@@_weight_int
2765   \int_set_eq:NN \l_@@_weight_int \c_one_int
2766   \@@_keys_p_column:n { #1 }

```

The unknown keys are put in `\l_tmpa_tl`

```

2767 \keys_set:no { nicematrix / X-column } \l_tmpa_tl
2768 \int_compare:nNnT \l_@@_weight_int < \c_zero_int
2769 {
2770 \@@_error_or_warning:n { negative-weight }
2771 \int_set:Nn \l_@@_weight_int { - \l_@@_weight_int }
2772 }
2773 \int_gadd:Nn \g_@@_total_X_weight_int \l_@@_weight_int

```

We test whether we know the width of the X-columns by reading the aux file (after the first compilation, the width of the X-columns is computed and written in the aux file).

```

2774 \bool_if:NTF \l_@@_X_columns_aux_bool
2775 {
2776 \@@_make_preamble_ii_iv:nnn
2777 { \l_@@_weight_int \l_@@_X_columns_dim }
2778 { minipage }
2779 { \@@_no_update_width: }
2780 }
2781 {
2782 \tl_gput_right:Nn \g_@@_array_preamble_tl
2783 {
2784 > {
2785 \@@_cell_begin:
2786 \bool_set_true:N \l_@@_X_bool

```

You encounter a problem on 2023-03-04: for an environment with X columns, during the first compilations (which are not the definitive one), sometimes, some cells are declared empty even if they should not. That's a problem because user's instructions may use these nodes. That's why we have added the following `\NotEmpty`.

```

2787 \NotEmpty

```

The following code will nullify the box of the cell.

```

2788 \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2789 { \hbox_set:Nn \l_@@_cell_box { } }

```

We put a `{minipage}` to give to the user the ability to put a command such as `\centering` in the `\RowStyle`.

```

2790 \begin { minipage } { 5 cm } \arraybackslash
2791 }
2792 c
2793 < {
2794 \end { minipage }
2795 \@@_cell_end:
2796 }
2797 }
2798 \int_gincr:N \c@jCol
2799 \@@_rec_preamble_after_col:n
2800 }
2801 }

2802 \cs_new_protected:Npn \@@_no_update_width:
2803 {
2804 \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2805 { \cs_set_eq:NN \@@_update_max_cell_width: \prg_do_nothing: }
2806 }

```

For the letter set by the user with `vlines-in-sub-matrix` (`vlism`).

```

2807 \cs_new_protected:Npn \@@_make_preamble_vlism:n #1
2808 {
2809 \seq_gput_right:Ne \g_@@_cols_vlism_seq
2810 { \int_eval:n { \c@jCol + 1 } }
2811 \tl_gput_right:Ne \g_@@_array_preamble_tl
2812 { \exp_not:N ! { \skip_horizontal:N \arrayrulewidth } }
2813 \@@_rec_preamble:n
2814 }

```

The token `\@@_stop:` is a marker that we have inserted to mark the end of the preamble (as provided by the final user) that we have inserted in the TeX flow.

```
2815 \cs_set_eq:cN { @@ _ \token_to_str:N \@@_stop: } \use_none:n
```

The following lines try to catch some errors (when the final user has forgotten the preamble of its environment).

```
2816 \cs_new_protected:cpn { @@ _ \token_to_str:N \hline }
2817 { \@@_fatal:n { Preamble-forgotten } }
2818 \cs_set_eq:cc { @@ _ \token_to_str:N \Hline } { @@ _ \token_to_str:N \hline }
2819 \cs_set_eq:cc { @@ _ \token_to_str:N \toprule } { @@ _ \token_to_str:N \hline }
2820 \cs_set_eq:cc { @@ _ \token_to_str:N \Block } { @@ _ \token_to_str:N \hline }
2821 \cs_set_eq:cc { @@ _ \token_to_str:N \CodeBefore } { @@ _ \token_to_str:N \hline }
2822 \cs_set_eq:cc { @@ _ \token_to_str:N \RowStyle } { @@ _ \token_to_str:N \hline }
2823 \cs_set_eq:cc { @@ _ \token_to_str:N \diagbox } { @@ _ \token_to_str:N \hline }
```

12 The redefinition of `\multicolumn`

The following command must *not* be protected since it begins with `\multispan` (a TeX primitive).

```
2824 \cs_new:Npn \@@_multicolumn:nnn #1 #2 #3
2825 {
```

The following lines are from the definition of `\multicolumn` in `array` (and *not* in standard LaTeX). The first line aims to raise an error if the user has put more than one column specifier in the preamble of `\multicolumn`.

```
2826 \multispan { #1 }
2827 \cs_set_eq:NN \@@_update_max_cell_width: \prg_do_nothing:
2828 \begingroup
2829 \bool_if:NT \c_@@_testphase_table_bool
2830 { \tbl_update_multicolumn_cell_data:n { #1 } }
2831 \cs_set_nopar:Npn \@addamp
2832 { \legacy_if:nTF { @firstamp } { \@firstampfalse } { \@preamerr 5 } }
```

Now, we patch the (small) preamble as we have done with the main preamble of the array.

```
2833 \tl_gclear:N \g_@@_preamble_tl
2834 \@@_make_m_preamble:n #2 \q_stop
```

The following lines are an adaptation of the definition of `\multicolumn` in `array`.

```
2835 \exp_args:No \@mkpream \g_@@_preamble_tl
2836 \addtopreamble \@empty
2837 \endgroup
2838 \bool_if:NT \c_@@_recent_array_bool
2839 { \UseTaggingSocket { tbl / colspan } { #1 } }
```

Now, we do a treatment specific to `nicematrix` which has no equivalent in the original definition of `\multicolumn`.

```
2840 \int_compare:nNnT { #1 } > \c_one_int
2841 {
2842 \seq_gput_left:Ne \g_@@_multicolumn_cells_seq
2843 { \int_use:N \c@iRow - \int_eval:n { \c@jCol + 1 } }
2844 \seq_gput_left:Nn \g_@@_multicolumn_sizes_seq { #1 }
2845 \seq_gput_right:Ne \g_@@_pos_of_blocks_seq
2846 {
2847 {
2848 \int_if_zero:nTF \c@jCol
2849 { \int_eval:n { \c@iRow + 1 } }
2850 { \int_use:N \c@iRow }
2851 }
2852 { \int_eval:n { \c@jCol + 1 } }
```

```

2853     {
2854         \int_if_zero:nTF \c@jCol
2855             { \int_eval:n { \c@iRow + 1 } }
2856             { \int_use:N \c@iRow }
2857     }
2858     { \int_eval:n { \c@jCol + #1 } }
2859     { } % for the name of the block
2860 }
2861 }

```

We want `\cellcolor` to be available in `\multicolumn` because `\cellcolor` of `colortbl` is available in `\multicolumn`.

```

2862 \RenewDocumentCommand \cellcolor { 0 { } m }
2863 {
2864     \tl_gput_right:Ne \g_@@_pre_code_before_tl
2865     {
2866         \@@_rectanglecolor [ ##1 ]
2867         { \exp_not:n { ##2 } }
2868         { \int_use:N \c@iRow - \int_use:N \c@jCol }
2869         { \int_use:N \c@iRow - \int_eval:n { \c@jCol + #1 } }
2870     }
2871     \ignorespaces
2872 }

```

The following lines were in the original definition of `\multicolumn`.

```

2873 \cs_set_nopar:Npn \@sharp { #3 }
2874 \@arstrut
2875 \@preamble
2876 \null

```

We add some lines.

```

2877 \int_gadd:Nn \c@jCol { #1 - 1 }
2878 \int_compare:nNnT \c@jCol > \g_@@_col_total_int
2879     { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
2880 \ignorespaces
2881 }

```

The following commands will patch the (small) preamble of the `\multicolumn`. All those commands have a `m` in their name to recall that they deal with the redefinition of `\multicolumn`.

```

2882 \cs_new_protected:Npn \@_make_m_preamble:n #1
2883 {
2884     \str_case:nnF { #1 }
2885     {
2886         c { \@_make_m_preamble_i:n #1 }
2887         l { \@_make_m_preamble_i:n #1 }
2888         r { \@_make_m_preamble_i:n #1 }
2889         > { \@_make_m_preamble_ii:nn #1 }
2890         ! { \@_make_m_preamble_ii:nn #1 }
2891         @ { \@_make_m_preamble_ii:nn #1 }
2892         | { \@_make_m_preamble_iii:n #1 }
2893         p { \@_make_m_preamble_iv:nnn t #1 }
2894         m { \@_make_m_preamble_iv:nnn c #1 }
2895         b { \@_make_m_preamble_iv:nnn b #1 }
2896         w { \@_make_m_preamble_v:nnnn { } #1 }
2897         W { \@_make_m_preamble_v:nnnn { \@_special_W: } #1 }
2898         \q_stop { }
2899     }
2900     {
2901         \cs_if_exist:cTF { NC @ find @ #1 }
2902         {
2903             \tl_set_eq:Nc \l_tmpa_tl { NC @ rewrite @ #1 }
2904             \exp_last_unbraced:No \@_make_m_preamble:n \l_tmpa_tl

```

```

2905     }
2906     {
2907         \str_if_eq:nnTF { #1 } { S }
2908         { \@@_fatal:n { unknown~column~type~S } }
2909         { \@@_fatal:nn { unknown~column~type } { #1 } }
2910     }
2911 }
2912 }

```

For c, l and r

```

2913 \cs_new_protected:Npn \@@_make_m_preamble_i:n #1
2914 {
2915     \tl_gput_right:Nn \g_@@_preamble_tl
2916     {
2917         > { \@@_cell_begin: \cs_set_nopar:Npn \l_@@_hpos_cell_tl { #1 } }
2918         #1
2919         < \@@_cell_end:
2920     }

```

We test for the presence of a <.

```

2921     \@@_make_m_preamble_x:n
2922 }

```

For >, ! and @

```

2923 \cs_new_protected:Npn \@@_make_m_preamble_ii:nn #1 #2
2924 {
2925     \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
2926     \@@_make_m_preamble:n
2927 }

```

For |

```

2928 \cs_new_protected:Npn \@@_make_m_preamble_iii:n #1
2929 {
2930     \tl_gput_right:Nn \g_@@_preamble_tl { #1 }
2931     \@@_make_m_preamble:n
2932 }

```

For p, m and b

```

2933 \cs_new_protected:Npn \@@_make_m_preamble_iv:nnn #1 #2 #3
2934 {
2935     \tl_gput_right:Nn \g_@@_preamble_tl
2936     {
2937         > {
2938             \@@_cell_begin:
2939             \begin { minipage } [ #1 ] { \dim_eval:n { #3 } }
2940             \mode_leave_vertical:
2941             \arraybackslash
2942             \vrule height \box_ht:N \@arstrutbox depth 0 pt width 0 pt
2943         }
2944         c
2945         < {
2946             \vrule height 0 pt depth \box_dp:N \@arstrutbox width 0 pt
2947             \end { minipage }
2948             \@@_cell_end:
2949         }
2950     }

```

We test for the presence of a <.

```

2951     \@@_make_m_preamble_x:n
2952 }

```

For w and W

```

2953 \cs_new_protected:Npn \@@_make_m_preamble_v:nnnn #1 #2 #3 #4
2954 {
2955   \tl_gput_right:Nn \g_@@_preamble_tl
2956   {
2957     > {
2958       \dim_set:Nn \l_@@_col_width_dim { #4 }
2959       \hbox_set:Nw \l_@@_cell_box
2960       \@@_cell_begin:
2961       \cs_set_nopar:Npn \l_@@_hpos_cell_tl { #3 }
2962     }
2963     c
2964     < {
2965       \@@_cell_end:
2966       \hbox_set_end:
2967       \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
2968       #1
2969       \@@_adjust_size_box:
2970       \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
2971     }
2972   }

```

We test for the presence of a <.

```

2973   \@@_make_m_preamble_x:n
2974 }

```

After a specifier of column, we have to test whether there is one or several <{. .}.

```

2975 \cs_new_protected:Npn \@@_make_m_preamble_x:n #1
2976 {
2977   \str_if_eq:nnTF { #1 } { < }
2978   \@@_make_m_preamble_ix:n
2979   { \@@_make_m_preamble:n { #1 } }
2980 }
2981 \cs_new_protected:Npn \@@_make_m_preamble_ix:n #1
2982 {
2983   \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
2984   \@@_make_m_preamble_x:n
2985 }

```

The command `\@@_put_box_in_flow:` puts the box `\l_tmpa_box` (which contains the array) in the flow. It is used for the environments with delimiters. First, we have to modify the height and the depth to take back into account the potential exterior rows (the total height of the first row has been computed in `\l_tmpa_dim` and the total height of the potential last row in `\l_tmpb_dim`).

```

2986 \cs_new_protected:Npn \@@_put_box_in_flow:
2987 {
2988   \box_set_ht:Nn \l_tmpa_box { \box_ht:N \l_tmpa_box + \l_tmpa_dim }
2989   \box_set_dp:Nn \l_tmpa_box { \box_dp:N \l_tmpa_box + \l_tmpb_dim }
2990   \str_if_eq:eeTF \l_@@_baseline_tl { c }
2991   { \box_use_drop:N \l_tmpa_box }
2992   \@@_put_box_in_flow_i:
2993 }

```

The command `\@@_put_box_in_flow_i:` is used when the value of `\l_@@_baseline_tl` is different of `c` (the initial value).

```

2994 \cs_new_protected:Npn \@@_put_box_in_flow_i:
2995 {
2996   \pgfpicture
2997   \@@_qpoint:n { row - 1 }
2998   \dim_gset_eq:NN \g_tmpa_dim \pgf@y
2999   \@@_qpoint:n { row - \int_eval:n { \c@iRow + 1 } }
3000   \dim_gadd:Nn \g_tmpa_dim \pgf@y
3001   \dim_gset:Nn \g_tmpa_dim { 0.5 \g_tmpa_dim }

```

Now, `\g_tmpa_dim` contains the y -value of the center of the array (the delimiters are centered in relation with this value).

```

3002     \tl_if_in:NnTF \l_@@_baseline_tl { line-
3003     {
3004         \int_set:Nn \l_tmpa_int
3005         {
3006             \str_range:Nnn
3007             \l_@@_baseline_tl
3008             6
3009             { \tl_count:o \l_@@_baseline_tl }
3010         }
3011     \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
3012 }
3013 {
3014     \str_if_eq:eeTF \l_@@_baseline_tl { t }
3015     { \int_set_eq:NN \l_tmpa_int \c_one_int }
3016     {
3017         \str_if_eq:onTF \l_@@_baseline_tl { b }
3018         { \int_set_eq:NN \l_tmpa_int \c_iRow }
3019         { \int_set:Nn \l_tmpa_int \l_@@_baseline_tl }
3020     }
3021     \bool_lazy_or:nnT
3022     { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
3023     { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
3024     {
3025         \@@_error:n { bad-value-for-baseline }
3026         \int_set_eq:NN \l_tmpa_int \c_one_int
3027     }
3028     \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }

```

We take into account the position of the mathematical axis.

```

3029     \dim_gsub:Nn \g_tmpa_dim { \fontdimen22 \textfont2 }
3030 }
3031 \dim_gsub:Nn \g_tmpa_dim \pgf@y

```

Now, `\g_tmpa_dim` contains the value of the y translation we have to do.

```

3032 \endpgfpicture
3033 \box_move_up:nn \g_tmpa_dim { \box_use_drop:N \l_tmpa_box }
3034 \box_use_drop:N \l_tmpa_box
3035 }

```

The following command is *always* used by `{NiceArrayWithDelims}` (even if, in fact, there is no tabular notes: in fact, it's not possible to know whether there is tabular notes or not before the composition of the blocks).

```

3036 \cs_new_protected:Npn \@@_use_arraybox_with_notes_c:
3037 {

```

With an environment `{Matrix}`, you want to remove the exterior `\arraycolsep` but we don't know the number of columns (since there is no preamble) and that's why we can't put `@{}` at the end of the preamble. That's why we remove a `\arraycolsep` now.

```

3038     \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3039     {
3040         \int_compare:nNnT \c@jCol > \c_one_int
3041         {
3042             \box_set_wd:Nn \l_@@_the_array_box
3043             { \box_wd:N \l_@@_the_array_box - \arraycolsep }
3044         }
3045     }

```

We need a `{minipage}` because we will insert a LaTeX list for the tabular notes (that means that a `\vtop{\hsize=...}` is not enough).

```

3046     \begin { minipage } [ t ] { \box_wd:N \l_@@_the_array_box }
3047     \bool_if:NT \l_@@_caption_above_bool
3048     {

```

```

3049     \tl_if_empty:NF \l_@@_caption_tl
3050     {
3051         \bool_set_false:N \g_@@_caption_finished_bool
3052         \int_gzero:N \c@tabularnote
3053         \@@_insert_caption:

```

If there is one or several commands `\tabularnote` in the caption, we will write in the aux file the number of such tabular notes... but only the tabular notes for which the command `\tabularnote` has been used without its optional argument (between square brackets).

```

3054         \int_compare:nNnT \g_@@_notes_caption_int > \c_zero_int
3055         {
3056             \tl_gput_right:Ne \g_@@_aux_tl
3057             {
3058                 \tl_set:Nn \exp_not:N \l_@@_note_in_caption_tl
3059                 { \int_use:N \g_@@_notes_caption_int }
3060             }
3061             \int_gzero:N \g_@@_notes_caption_int
3062         }
3063     }
3064 }

```

The `\hbox` avoids that the `pgfpicture` inside `\@@_draw_blocks` adds a extra vertical space before the notes.

```

3065     \hbox
3066     {
3067         \box_use_drop:N \l_@@_the_array_box

```

We have to draw the blocks right now because there may be tabular notes in some blocks (which are not mono-column: the blocks which are mono-column have been composed in boxes yet)... and we have to create (potentially) the extra nodes before creating the blocks since there are `medium` nodes to create for the blocks.

```

3068         \@@_create_extra_nodes:
3069         \seq_if_empty:NF \g_@@_blocks_seq \@@_draw_blocks:
3070     }

```

We don't do the following test with `\c@tabularnote` because the value of that counter is not reliable when the command `\ttabbox` of `floatrow` is used (because `\ttabbox` de-activate `\stepcounter` because if compiles several times its tabular).

```

3071     \bool_lazy_any:nT
3072     {
3073         { ! \seq_if_empty_p:N \g_@@_notes_seq }
3074         { ! \seq_if_empty_p:N \g_@@_notes_in_caption_seq }
3075         { ! \tl_if_empty_p:o \g_@@_tabularnote_tl }
3076     }
3077     \@@_insert_tabularnotes:
3078     \cs_set_eq:NN \tabularnote \@@_tabularnote_error:n
3079     \bool_if:NF \l_@@_caption_above_bool \@@_insert_caption:
3080     \end { minipage }
3081 }

```

```

3082 \cs_new_protected:Npn \@@_insert_caption:
3083 {
3084     \tl_if_empty:NF \l_@@_caption_tl
3085     {
3086         \cs_if_exist:NTF \@capttype
3087         { \@@_insert_caption_i: }
3088         { \@@_error:n { caption~outside~float } }
3089     }
3090 }

```

```

3091 \cs_new_protected:Npn \@@_insert_caption_i:
3092 {
3093     \group_begin:

```

The flag `\l_@@_in_caption_bool` affects only the behavior of the command `\tabularnote` when used in the caption.

```
3094 \bool_set_true:N \l_@@_in_caption_bool
```

The package `floatrow` does a redefinition of `\@makecaption` which will extract the caption from the tabular. However, the old version of `\@makecaption` has been stored by `floatrow` in `\FR@makecaption`. That's why we restore the old version.

```
3095 \IfPackageLoadedT { floatrow }
3096 { \cs_set_eq:NN \@makecaption \FR@makecaption }
3097 \tl_if_empty:NTF \l_@@_short_caption_tl
3098 { \caption }
3099 { \caption [ \l_@@_short_caption_tl ] }
3100 { \l_@@_caption_tl }
```

In some circumstances (in particular when the package `caption` is loaded), the caption is composed several times. That's why, when the same tabular note is encountered (in the caption!), we consider that you are in the second compilation and you can give to `\g_@@_notes_caption_int` its final value, which is the number of tabular notes in the caption. But sometimes, the caption is composed only once. In that case, we fix the value of `\g_@@_caption_finished_bool` now.

```
3101 \bool_if:NF \g_@@_caption_finished_bool
3102 {
3103   \bool_gset_true:N \g_@@_caption_finished_bool
3104   \int_gset_eq:NN \g_@@_notes_caption_int \c@tabularnote
3105   \int_gzero:N \c@tabularnote
3106 }
3107 \tl_if_empty:NF \l_@@_label_tl { \label { \l_@@_label_tl } }
3108 \group_end:
3109 }

3110 \cs_new_protected:Npn \@@_tabularnote_error:n #1
3111 {
3112   \@@_error_or_warning:n { tabularnote~below~the~tabular }
3113   \@@_gredirect_none:n { tabularnote~below~the~tabular }
3114 }

3115 \cs_new_protected:Npn \@@_insert_tabularnotes:
3116 {
3117   \seq_gconcat:NNN \g_@@_notes_seq \g_@@_notes_in_caption_seq \g_@@_notes_seq
3118   \int_set:Nn \c@tabularnote { \seq_count:N \g_@@_notes_seq }
3119   \skip_vertical:N 0.65ex
```

The TeX group is for potential specifications in the `\l_@@_notes_code_before_tl`.

```
3120 \group_begin:
3121 \l_@@_notes_code_before_tl
3122 \tl_if_empty:NF \g_@@_tabularnote_tl
3123 {
3124   \g_@@_tabularnote_tl \par
3125   \tl_gclear:N \g_@@_tabularnote_tl
3126 }
```

We compose the tabular notes with a list of `enumitem`. The `\strut` and the `\unskip` are designed to give the ability to put a `\bottomrule` at the end of the notes with a good vertical space.

```
3127 \int_compare:nNnT \c@tabularnote > \c_zero_int
3128 {
3129   \bool_if:NTF \l_@@_notes_para_bool
3130   {
3131     \begin { tabularnotes* }
3132       \seq_map_inline:Nn \g_@@_notes_seq
3133       { \@@_one_tabularnote:nn ##1 }
3134       \strut
3135     \end { tabularnotes* }

```

The following `\par` is mandatory for the event that the user has put `\footnotesize` (for example) in the `notes/code-before`.

```
3136 \par
```

```

3137     }
3138     {
3139         \tabularnotes
3140         \seq_map_inline:Nn \g_@@_notes_seq
3141         { \@@_one_tabularnote:nn #1 }
3142         \strut
3143         \endtabularnotes
3144     }
3145 }
3146 \unskip
3147 \group_end:
3148 \bool_if:NT \l_@@_notes_bottomrule_bool
3149 {
3150     \IfPackageLoadedTF { booktabs }
3151     {

```

The two dimensions `\aboverulesep` et `\heavyrulewidth` are parameters defined by `booktabs`.

```

3152         \skip_vertical:N \aboverulesep

```

`\CT@arc@` is the specification of color defined by `colortbl` but you use it even if `colortbl` is not loaded.

```

3153         { \CT@arc@ \hrule height \heavyrulewidth }
3154     }
3155     { \@@_error_or_warning:n { bottomrule~without~booktabs } }
3156 }
3157 \l_@@_notes_code_after_tl
3158 \seq_gclear:N \g_@@_notes_seq
3159 \seq_gclear:N \g_@@_notes_in_caption_seq
3160 \int_gzero:N \c@tabularnote
3161 }

```

The following command will format (after the main `tabular`) one `tabularnote` (with the command `\item`). `#1` is the label (when the command `\tabularnote` has been used with an optional argument between square brackets) and `#2` is the text of the note. The second argument is provided by currying.

```

3162 \cs_set_protected:Npn \@@_one_tabularnote:nn #1
3163 {
3164     \tl_if_novalue:nTF { #1 }
3165     { \item }
3166     { \item [ \@@_notes_label_in_list:n { #1 } ] }
3167 }

```

The case of `baseline` equal to `b`. Remember that, when the key `b` is used, the `{array}` (of `array`) is constructed with the option `t` (and not `b`). Now, we do the translation to take into account the option `b`.

```

3168 \cs_new_protected:Npn \@@_use_arraybox_with_notes_b:
3169 {
3170     \pgfpicture
3171     \@@_qpoint:n { row - 1 }
3172     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
3173     \@@_qpoint:n { row - \int_use:N \c@iRow - base }
3174     \dim_gsub:Nn \g_tmpa_dim \pgf@y
3175     \endpgfpicture
3176     \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
3177     \int_if_zero:nT \l_@@_first_row_int
3178     {
3179         \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
3180         \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
3181     }
3182     \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
3183 }

```

Now, the general case.

```

3184 \cs_new_protected:Npn \@@_use_arraybox_with_notes:
3185 {

```

We convert a value of `t` to a value of 1.

```
3186 \str_if_eq:eeT \l_@@_baseline_tl { t }
3187 { \cs_set_nopar:Npn \l_@@_baseline_tl { 1 } }
```

Now, we convert the value of `\l_@@_baseline_tl` (which should represent an integer) to an integer stored in `\l_tmpa_int`.

```
3188 \pgfpicture
3189 \@@_qpoint:n { row - 1 }
3190 \dim_gset_eq:NN \g_tmpa_dim \pgf@y
3191 \tl_if_in:NnTF \l_@@_baseline_tl { line- }
3192 {
3193   \int_set:Nn \l_tmpa_int
3194   {
3195     \str_range:Nnn
3196     \l_@@_baseline_tl
3197     6
3198     { \tl_count:o \l_@@_baseline_tl }
3199   }
3200   \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
3201 }
3202 {
3203   \int_set:Nn \l_tmpa_int \l_@@_baseline_tl
3204   \bool_lazy_or:nnT
3205   { \int_compare_p:nNn \l_tmpa_int < \l_@@_first_row_int }
3206   { \int_compare_p:nNn \l_tmpa_int > \g_@@_row_total_int }
3207   {
3208     \@@_error:n { bad-value-for~baseline }
3209     \int_set:Nn \l_tmpa_int 1
3210   }
3211   \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
3212 }
3213 \dim_gsub:Nn \g_tmpa_dim \pgf@y
3214 \endpgfpicture
3215 \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
3216 \int_if_zero:nT \l_@@_first_row_int
3217 {
3218   \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
3219   \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
3220 }
3221 \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
3222 }
```

The command `\@@_put_box_in_flow_bis:` is used when the option `delimiters/max-width` is used because, in this case, we have to adjust the widths of the delimiters. The arguments `#1` and `#2` are the delimiters specified by the user.

```
3223 \cs_new_protected:Npn \@@_put_box_in_flow_bis:nn #1 #2
3224 {
```

We will compute the real width of both delimiters used.

```
3225 \dim_zero_new:N \l_@@_real_left_delim_dim
3226 \dim_zero_new:N \l_@@_real_right_delim_dim
3227 \hbox_set:Nn \l_tmpb_box
3228 {
3229   \m@th % added 2024/11/21
3230   \c_math_toggle_token
3231   \left #1
3232   \vcenter
3233   {
3234     \vbox_to_ht:nn
3235     { \box_ht_plus_dp:N \l_tmpa_box }
3236     { }
3237   }
3238   \right .
```

```

3239     \c_math_toggle_token
3240   }
3241   \dim_set:Nn \l_@@_real_left_delim_dim
3242     { \box_wd:N \l_tmpb_box - \nulldelimiterspace }
3243   \hbox_set:Nn \l_tmpb_box
3244     {
3245     \m@th % added 2024/11/21
3246     \c_math_toggle_token
3247     \left .
3248     \vbox_to_ht:nn
3249       { \box_ht_plus_dp:N \l_tmpa_box }
3250       { }
3251     \right #2
3252     \c_math_toggle_token
3253   }
3254   \dim_set:Nn \l_@@_real_right_delim_dim
3255     { \box_wd:N \l_tmpb_box - \nulldelimiterspace }

```

Now, we can put the box in the TeX flow with the horizontal adjustments on both sides.

```

3256   \skip_horizontal:N \l_@@_left_delim_dim
3257   \skip_horizontal:N -\l_@@_real_left_delim_dim
3258   \@@_put_box_in_flow:
3259   \skip_horizontal:N \l_@@_right_delim_dim
3260   \skip_horizontal:N -\l_@@_real_right_delim_dim
3261 }

```

The construction of the array in the environment `{NiceArrayWithDelims}` is, in fact, done by the environment `{@@-light-syntax}` or by the environment `{@@-normal-syntax}` (whether the option `light-syntax` is in force or not). When the key `light-syntax` is not used, the construction is a standard environment (and, thus, it's possible to use `verbatim` in the array).

```

3262 \NewDocumentEnvironment { @@-normal-syntax } { }

```

First, we test whether the environment is empty. If it is empty, we raise a fatal error (it's only a security). In order to detect whether it is empty, we test whether the next token is `\end` and, if it's the case, we test if this is the end of the environment (if it is not, a standard error will be raised by LaTeX for incorrect nested environments).

```

3263 {
3264   \peek_remove_spaces:n
3265   {
3266     \peek_meaning:NTF \end
3267     \@@_analyze_end:Nn
3268     {
3269       \@@_transform_preamble:

```

Here is the call to `\array` (we have a dedicated macro `\@@_array:n` because of compatibility with the classes `revtex4-1` and `revtex4-2`).

```

3270     \@@_array:o \g_@@_array_preamble_tl
3271   }
3272 }
3273 }
3274 {
3275   \@@_create_col_nodes:
3276   \endarray
3277 }

```

When the key `light-syntax` is in force, we use an environment which takes its whole body as an argument (with the specifier `b`).

```

3278 \NewDocumentEnvironment { @@-light-syntax } { b }
3279 {

```

First, we test whether the environment is empty. It's only a security. Of course, this test is more easy than the similar test for the "normal syntax" because we have the whole body of the environment in #1.

```

3280 \tl_if_empty:nT { #1 }
3281   { \@@_fatal:n { empty~environment } }
3282 \tl_if_in:nnT { #1 } { & }
3283   { \@@_fatal:n { ampersand~in~light~syntax } }
3284 \tl_if_in:nnT { #1 } { \ }
3285   { \@@_fatal:n { double~backslash~in~light~syntax } }

```

Now, you extract the `\CodeAfter` of the body of the environment. Maybe, there is no command `\CodeAfter` in the body. That's why you put a marker `\CodeAfter` after #1. If there is yet a `\CodeAfter` in #1, this second (or third...) `\CodeAfter` will be caught in the value of `\g_nicematrix_code_after_tl`. That doesn't matter because `\CodeAfter` will be set to *no-op* before the execution of `\g_nicematrix_code_after_tl`.

```

3286 \@@_light_syntax_i:w #1 \CodeAfter \q_stop

```

The command `\array` is hidden somewhere in `\@@_light_syntax_i:w`.

```

3287 }

```

Now, the second part of the environment. We must leave these lines in the second part (and not put them in the first part even though we caught the whole body of the environment with an argument of type b) in order to have the columns S of `siunitx` working fine.

```

3288 {
3289   \@@_create_col_nodes:
3290   \endarray
3291 }
3292 \cs_new_protected:Npn \@@_light_syntax_i:w #1\CodeAfter #2\q_stop
3293 {
3294   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #2 }

```

The body of the array, which is stored in the argument #1, is now splitted into items (and *not* tokens).

```

3295 \seq_clear_new:N \l_@@_rows_seq

```

We rescan the character of end of line in order to have the correct catcode.

```

3296 \tl_set_rescan:Nno \l_@@_end_of_row_tl { } \l_@@_end_of_row_tl
3297 \bool_if:NTF \l_@@_light_syntax_expanded_bool
3298   \seq_set_split:Nee
3299   \seq_set_split:Nnon
3300   \l_@@_rows_seq \l_@@_end_of_row_tl { #1 }

```

We delete the last row if it is empty.

```

3301 \seq_pop_right:NN \l_@@_rows_seq \l_tmpa_tl
3302 \tl_if_empty:NF \l_tmpa_tl
3303   { \seq_put_right:No \l_@@_rows_seq \l_tmpa_tl }

```

If the environment uses the option `last-row` without value (i.e. without saying the number of the rows), we have now the opportunity to compute that value. We do it, and so, if the token list `\l_@@_code_for_last_row_tl` is not empty, we will use directly where it should be.

```

3304 \int_compare:nNnT \l_@@_last_row_int = { -1 }
3305   { \int_set:Nn \l_@@_last_row_int { \seq_count:N \l_@@_rows_seq } }

```

The new value of the body (that is to say after replacement of the separators of rows and columns by `\` and `&`) of the environment will be stored in `\l_@@_new_body_tl` in order to allow the use of commands such as `\hline` or `\hdottedline` with the key `light-syntax`).

```

3306 \tl_build_begin:N \l_@@_new_body_tl
3307 \int_zero_new:N \l_@@_nb_cols_int

```

First, we treat the first row.

```

3308 \seq_pop_left:NN \l_@@_rows_seq \l_tmpa_tl
3309 \@@_line_with_light_syntax:o \l_tmpa_tl

```

Now, the other rows (with the same treatment, excepted that we have to insert `\\` between the rows).

```

3310   \seq_map_inline:Nn \l_@@_rows_seq
3311   {
3312     \tl_build_put_right:Nn \l_@@_new_body_tl { \\ }
3313     \@@_line_with_light_syntax:n { #1 }
3314   }
3315   \tl_build_end:N \l_@@_new_body_tl
3316   \int_compare:nNnT \l_@@_last_col_int = { -1 }
3317   {
3318     \int_set:Nn \l_@@_last_col_int
3319     { \l_@@_nb_cols_int - 1 + \l_@@_first_col_int }
3320   }

```

Now, we can construct the preamble: if the user has used the key `last-col`, we have the correct number of columns even though the user has used `last-col` without value.

```

3321   \@@_transform_preamble:

```

The call to `\array` is in the following command (we have a dedicated macro `\@@_array:` because of compatibility with the classes `revtex4-1` and `revtex4-2`).

```

3322   \@@_array:o \g_@@_array_preamble_tl \l_@@_new_body_tl
3323   }
3324   \cs_generate_variant:Nn \@@_line_with_light_syntax:n { o }
3325   \cs_new_protected:Npn \@@_line_with_light_syntax:n #1
3326   {
3327     \seq_clear_new:N \l_@@_cells_seq
3328     \seq_set_split:Nnn \l_@@_cells_seq { ~ } { #1 }
3329     \int_set:Nn \l_@@_nb_cols_int
3330     {
3331       \int_max:nn
3332       \l_@@_nb_cols_int
3333       { \seq_count:N \l_@@_cells_seq }
3334     }
3335     \seq_pop_left:NN \l_@@_cells_seq \l_tmpa_tl
3336     \tl_build_put_right:No \l_@@_new_body_tl \l_tmpa_tl
3337     \seq_map_inline:Nn \l_@@_cells_seq
3338     { \tl_build_put_right:Nn \l_@@_new_body_tl { & #1 } }
3339   }

```

The following command is used by the code which detects whether the environment is empty (we raise a fatal error in this case: it's only a security). When this command is used, `#1` is, in fact, always `\end`.

```

3340   \cs_new_protected:Npn \@@_analyze_end:Nn #1 #2
3341   {
3342     \str_if_eq:eeT \g_@@_name_env_str { #2 }
3343     { \@@_fatal:n { empty-environment } }

```

We repute in the stream the `\end{...}` we have extracted and the user will have an error for incorrect nested environments.

```

3344     \end { #2 }
3345   }

```

The command `\@@_create_col_nodes:` will construct a special last row. That last row is a false row used to create the `col` nodes and to fix the width of the columns (when the array is constructed with an option which specifies the width of the columns such as `columns-width`).

```

3346   \cs_new:Npn \@@_create_col_nodes:
3347   {
3348     \crrc
3349     \int_if_zero:nT \l_@@_first_col_int
3350     {
3351       \omit

```

```

3352 \hbox_overlap_left:n
3353 {
3354   \bool_if:NT \l_@@_code_before_bool
3355   { \pgfsys@markposition { \@@_env: - col - 0 } }
3356   \pgfpicture
3357   \pgfrememberpicturepositiononpagetrue
3358   \pgfcoordinate { \@@_env: - col - 0 } \pgfpintorigin
3359   \str_if_empty:NF \l_@@_name_str
3360   { \pgfnodealias { \l_@@_name_str - col - 0 } { \@@_env: - col - 0 } }
3361   \endpgfpicture
3362   \skip_horizontal:N 2\col@sep
3363   \skip_horizontal:N \g_@@_width_first_col_dim
3364 }
3365 &
3366 }
3367 \omit

```

The following instruction must be put after the instruction `\omit`.

```

3368 \bool_gset_true:N \g_@@_row_of_col_done_bool

```

First, we put a `col` node on the left of the first column (of course, we have to do that *after* the `\omit`).

```

3369 \int_if_zero:nTF \l_@@_first_col_int
3370 {
3371   \bool_if:NT \l_@@_code_before_bool
3372   {
3373     \hbox
3374     {
3375       \skip_horizontal:N -0.5\arrayrulewidth
3376       \pgfsys@markposition { \@@_env: - col - 1 }
3377       \skip_horizontal:N 0.5\arrayrulewidth
3378     }
3379   }
3380   \pgfpicture
3381   \pgfrememberpicturepositiononpagetrue
3382   \pgfcoordinate { \@@_env: - col - 1 }
3383   { \pgfpint { - 0.5 \arrayrulewidth } \c_zero_dim }
3384   \str_if_empty:NF \l_@@_name_str
3385   { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
3386   \endpgfpicture
3387 }
3388 {
3389   \bool_if:NT \l_@@_code_before_bool
3390   {
3391     \hbox
3392     {
3393       \skip_horizontal:N 0.5\arrayrulewidth
3394       \pgfsys@markposition { \@@_env: - col - 1 }
3395       \skip_horizontal:N -0.5\arrayrulewidth
3396     }
3397   }
3398   \pgfpicture
3399   \pgfrememberpicturepositiononpagetrue
3400   \pgfcoordinate { \@@_env: - col - 1 }
3401   { \pgfpint { 0.5 \arrayrulewidth } \c_zero_dim }
3402   \str_if_empty:NF \l_@@_name_str
3403   { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
3404   \endpgfpicture
3405 }

```

We compute in `\g_tmpa_skip` the common width of the columns (it's a skip and not a dimension). We use a global variable because we are in a cell of an `\halign` and because we have to use that variable in other cells (of the same row). The affectation of `\g_tmpa_skip`, like all the affectations, must be done after the `\omit` of the cell.

We give a default value for `\g_tmpa_skip` (0 pt plus 1 fill) but we will add some dimensions to it.

```

3406 \skip_gset:Nn \g_tmpa_skip { 0 pt~plus 1 fill }
3407 \bool_if:NF \l_@@_auto_columns_width_bool
3408 { \dim_compare:nNnT \l_@@_columns_width_dim > \c_zero_dim }
3409 {
3410 \bool_lazy_and:nnTF
3411 \l_@@_auto_columns_width_bool
3412 { \bool_not_p:n \l_@@_block_auto_columns_width_bool }
3413 { \skip_gadd:Nn \g_tmpa_skip \g_@@_max_cell_width_dim }
3414 { \skip_gadd:Nn \g_tmpa_skip \l_@@_columns_width_dim }
3415 \skip_gadd:Nn \g_tmpa_skip { 2 \col@sep }
3416 }
3417 \skip_horizontal:N \g_tmpa_skip
3418 \hbox
3419 {
3420 \bool_if:NT \l_@@_code_before_bool
3421 {
3422 \hbox
3423 {
3424 \skip_horizontal:N -0.5\arrayrulewidth
3425 \pgfsys@markposition { \@@_env: - col - 2 }
3426 \skip_horizontal:N 0.5\arrayrulewidth
3427 }
3428 }
3429 \pgfpicture
3430 \pgfrememberpicturepositiononpagetrue
3431 \pgfcoordinate { \@@_env: - col - 2 }
3432 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3433 \str_if_empty:NF \l_@@_name_str
3434 { \pgfnodealias { \l_@@_name_str - col - 2 } { \@@_env: - col - 2 } }
3435 \endpgfpicture
3436 }

```

We begin a loop over the columns. The integer `\g_tmpa_int` will be the number of the current column. This integer is used for the Tikz nodes.

```

3437 \int_gset_eq:NN \g_tmpa_int \c_one_int
3438 \bool_if:NTF \g_@@_last_col_found_bool
3439 { \prg_replicate:nn { \int_max:nn { \g_@@_col_total_int - 3 } \c_zero_int } }
3440 { \prg_replicate:nn { \int_max:nn { \g_@@_col_total_int - 2 } \c_zero_int } }
3441 {
3442 &
3443 \omit
3444 \int_gincr:N \g_tmpa_int

```

The incrementation of the counter `\g_tmpa_int` must be done after the `\omit` of the cell.

```

3445 \skip_horizontal:N \g_tmpa_skip
3446 \bool_if:NT \l_@@_code_before_bool
3447 {
3448 \hbox
3449 {
3450 \skip_horizontal:N -0.5\arrayrulewidth
3451 \pgfsys@markposition
3452 { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3453 \skip_horizontal:N 0.5\arrayrulewidth
3454 }
3455 }

```

We create the `col` node on the right of the current column.

```

3456 \pgfpicture
3457 \pgfrememberpicturepositiononpagetrue
3458 \pgfcoordinate { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3459 { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3460 \str_if_empty:NF \l_@@_name_str

```

```

3461     {
3462         \pgfnodealias
3463         { \l_@@_name_str - col - \int_eval:n { \g_tmpa_int + 1 } }
3464         { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3465     }
3466 \endpgfpicture
3467 }

3468 &
3469 \omit

```

The two following lines have been added on 2021-12-15 to solve a bug mentioned by Joao Luis Soares by mail.

```

3470 \int_if_zero:nT \g_@@_col_total_int
3471   { \skip_gset:Nn \g_tmpa_skip { 0 pt+plus 1 fill } }
3472 \skip_horizontal:N \g_tmpa_skip
3473 \int_gincr:N \g_tmpa_int
3474 \bool_lazy_any:nF
3475   {
3476     \g_@@_delims_bool
3477     \l_@@_tabular_bool
3478     { ! \clist_if_empty_p:N \l_@@_vlines_clist }
3479     \l_@@_exterior_arraycolsep_bool
3480     \l_@@_bar_at_end_of_pream_bool
3481   }
3482   { \skip_horizontal:N -\col@sep }
3483 \bool_if:NT \l_@@_code_before_bool
3484   {
3485     \hbox
3486     {
3487       \skip_horizontal:N -0.5\arrayrulewidth

```

With an environment `{Matrix}`, you want to remove the exterior `\arraycolsep` but we don't know the number of columns (since there is no preamble) and that's why we can't put `@{}` at the end of the preamble. That's why we remove a `\arraycolsep` now.

```

3488     \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3489     { \skip_horizontal:N -\arraycolsep }
3490 \pgfsys@markposition
3491   { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3492   \skip_horizontal:N 0.5\arrayrulewidth
3493   \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3494   { \skip_horizontal:N \arraycolsep }
3495   }
3496 }
3497 \pgfpicture
3498 \pgfrememberpicturepositiononpagetrue
3499 \pgfcoordinate { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3500   {
3501     \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3502     {
3503       \pgfpoint
3504       { - 0.5 \arrayrulewidth - \arraycolsep }
3505       \c_zero_dim
3506     }
3507     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3508   }
3509 \str_if_empty:NF \l_@@_name_str
3510   {
3511     \pgfnodealias
3512     { \l_@@_name_str - col - \int_eval:n { \g_tmpa_int + 1 } }
3513     { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3514   }
3515 \endpgfpicture

```

```

3516 \bool_if:NT \g_@@_last_col_found_bool
3517 {
3518   \hbox_overlap_right:n
3519   {
3520     \skip_horizontal:N \g_@@_width_last_col_dim
3521     \skip_horizontal:N \col@sep
3522     \bool_if:NT \l_@@_code_before_bool
3523     {
3524       \pgfsys@markposition
3525       { \@@_env: - col - \int_eval:n { \g_@@_col_total_int + 1 } }
3526     }
3527     \pgfpicture
3528     \pgfrememberpicturepositiononpagetrue
3529     \pgfcoordinate
3530     { \@@_env: - col - \int_eval:n { \g_@@_col_total_int + 1 } }
3531     \pgfpointorigin
3532     \str_if_empty:NF \l_@@_name_str
3533     {
3534       \pgfnodealias
3535       {
3536         \l_@@_name_str - col
3537         - \int_eval:n { \g_@@_col_total_int + 1 }
3538       }
3539       { \@@_env: - col - \int_eval:n { \g_@@_col_total_int + 1 } }
3540     }
3541     \endpgfpicture
3542   }
3543 }
3544 % \cr
3545 }

```

Here is the preamble for the “first column” (if the user uses the key `first-col`)

```

3546 \tl_const:Nn \c_@@_preamble_first_col_tl
3547 {
3548   >
3549   {

```

At the beginning of the cell, we link `\CodeAfter` to a command which begins with `\` (whereas the standard version of `\CodeAfter` begins does not).

```

3550     \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:
3551     \bool_gset_true:N \g_@@_after_col_zero_bool
3552     \@@_begin_of_row:
3553     \hbox_set:Nw \l_@@_cell_box
3554     \@@_math_toggle:
3555     \@@_tuning_key_small:

```

We insert `\l_@@_code_for_first_col_tl...` but we don’t insert it in the potential “first row” and in the potential “last row”.

```

3556     \int_compare:nNnT \c@iRow > \c_zero_int
3557     {
3558       \bool_lazy_or:nnT
3559       { \int_compare_p:nNn \l_@@_last_row_int < \c_zero_int }
3560       { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
3561       {
3562         \l_@@_code_for_first_col_tl
3563         \xglobal \colorlet { nicematrix-first-col } { . }
3564       }
3565     }
3566 }

```

Be careful: despite this letter `l` the cells of the “first column” are composed in a `R` manner since they are composed in a `\hbox_overlap_left:n`.

```

3567   l

```

```

3568 <
3569 {
3570   \@@_math_toggle:
3571   \hbox_set_end:
3572   \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:
3573   \@@_adjust_size_box:
3574   \@@_update_for_first_and_last_row:

```

We actualise the width of the “first column” because we will use this width after the construction of the array.

```

3575   \dim_gset:Nn \g_@@_width_first_col_dim
3576   { \dim_max:nn \g_@@_width_first_col_dim { \box_wd:N \l_@@_cell_box } }

```

The content of the cell is inserted in an overlapping position.

```

3577   \hbox_overlap_left:n
3578   {
3579     \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > \c_zero_dim
3580     \@@_node_for_cell:
3581     { \box_use_drop:N \l_@@_cell_box }
3582     \skip_horizontal:N \l_@@_left_delim_dim
3583     \skip_horizontal:N \l_@@_left_margin_dim
3584     \skip_horizontal:N \l_@@_extra_left_margin_dim
3585   }
3586   \bool_gset_false:N \g_@@_empty_cell_bool
3587   \skip_horizontal:N -2\col@sep
3588 }
3589 }

```

Here is the preamble for the “last column” (if the user uses the key `last-col`).

```

3590 \tl_const:Nn \c_@@_preamble_last_col_tl
3591 {
3592   >
3593   {
3594     \bool_set_true:N \l_@@_in_last_col_bool

```

At the beginning of the cell, we link `\CodeAfter` to a command which begins with `\` (whereas the standard version of `\CodeAfter` begins does not).

```

3595     \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:

```

With the flag `\g_@@_last_col_found_bool`, we will know that the “last column” is really used.

```

3596     \bool_gset_true:N \g_@@_last_col_found_bool
3597     \int_gincr:N \c@jCol
3598     \int_gset_eq:NN \g_@@_col_total_int \c@jCol
3599     \hbox_set:Nw \l_@@_cell_box
3600     \@@_math_toggle:
3601     \@@_tuning_key_small:

```

We insert `\l_@@_code_for_last_col_tl...` but we don’t insert it in the potential “first row” and in the potential “last row”.

```

3602     \int_compare:nNnT \c@iRow > \c_zero_int
3603     {
3604       \bool_lazy_or:nnT
3605       { \int_compare_p:nNn \l_@@_last_row_int < \c_zero_int }
3606       { \int_compare_p:nNn \c@iRow < \l_@@_last_row_int }
3607       {
3608         \l_@@_code_for_last_col_tl
3609         \xglobal \colorlet { nicematrix-last-col } { . }
3610       }
3611     }
3612   }
3613   l
3614   <
3615   {
3616     \@@_math_toggle:
3617     \hbox_set_end:
3618     \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:

```

```

3619     \@@_adjust_size_box:
3620     \@@_update_for_first_and_last_row:

```

We actualise the width of the “last column” because we will use this width after the construction of the array.

```

3621     \dim_gset:Nn \g_@@_width_last_col_dim
3622     { \dim_max:nn \g_@@_width_last_col_dim { \box_wd:N \l_@@_cell_box } }
3623     \skip_horizontal:N -2\col@sep

```

The content of the cell is inserted in an overlapping position.

```

3624     \hbox_overlap_right:n
3625     {
3626         \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > \c_zero_dim
3627         {
3628             \skip_horizontal:N \l_@@_right_delim_dim
3629             \skip_horizontal:N \l_@@_right_margin_dim
3630             \skip_horizontal:N \l_@@_extra_right_margin_dim
3631             \@@_node_for_cell:
3632         }
3633     }
3634     \bool_gset_false:N \g_@@_empty_cell_bool
3635 }
3636 }

```

The environment `{NiceArray}` is constructed upon the environment `{NiceArrayWithDelims}`.

```

3637 \NewDocumentEnvironment { NiceArray } { }
3638 {
3639     \bool_gset_false:N \g_@@_delims_bool
3640     \str_if_empty:NT \g_@@_name_env_str
3641     { \str_gset:Nn \g_@@_name_env_str { NiceArray } }

```

We put `.` and `.` for the delimiters but, in fact, that doesn’t matter because these arguments won’t be used in `{NiceArrayWithDelims}` (because the flag `\g_@@_delims_bool` is set to false).

```

3642     \NiceArrayWithDelims . .
3643 }
3644 { \endNiceArrayWithDelims }

```

We create the variants of the environment `{NiceArrayWithDelims}`.

```

3645 \cs_new_protected:Npn \@@_def_env:nnn #1 #2 #3
3646 {
3647     \NewDocumentEnvironment { #1 NiceArray } { }
3648     {
3649         \bool_gset_true:N \g_@@_delims_bool
3650         \str_if_empty:NT \g_@@_name_env_str
3651         { \str_gset:Nn \g_@@_name_env_str { #1 NiceArray } }
3652         \@@_test_if_math_mode:
3653         \NiceArrayWithDelims #2 #3
3654     }
3655     { \endNiceArrayWithDelims }
3656 }
3657 \@@_def_env:nnn p ( )
3658 \@@_def_env:nnn b [ ]
3659 \@@_def_env:nnn B \{ \}
3660 \@@_def_env:nnn v | |
3661 \@@_def_env:nnn V \| \|

```

13 The environment `{NiceMatrix}` and its variants

```

3662 \cs_generate_variant:Nn \@@_begin_of_NiceMatrix:nn { n o }
3663 \cs_new_protected:Npn \@@_begin_of_NiceMatrix:nn #1 #2
3664 {
3665   \bool_set_false:N \l_@@_preamble_bool
3666   \tl_clear:N \l_tmpa_tl
3667   \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3668     { \tl_set:Nn \l_tmpa_tl { @ { } } }
3669   \tl_put_right:Nn \l_tmpa_tl
3670     {
3671       *
3672       {
3673         \int_case:nnF \l_@@_last_col_int
3674           {
3675             { -2 } { \c@MaxMatrixCols }
3676             { -1 } { \int_eval:n { \c@MaxMatrixCols + 1 } }

```

The value 0 can't occur here since we are in a matrix (which is an environment without preamble).

```

3677       }
3678       { \int_eval:n { \l_@@_last_col_int - 1 } }
3679     }
3680     { #2 }
3681   }
3682   \tl_set:Nn \l_tmpb_tl { \use:c { #1 NiceArray } }
3683   \exp_args:No \l_tmpb_tl \l_tmpa_tl
3684 }
3685 \clist_map_inline:nn { p , b , B , v , V }
3686 {
3687   \NewDocumentEnvironment { #1 NiceMatrix } { ! O { } }
3688   {
3689     \bool_gset_true:N \g_@@_delims_bool
3690     \str_gset:Nn \g_@@_name_env_str { #1 NiceMatrix }
3691     \int_if_zero:nT \l_@@_last_col_int
3692     {
3693       \bool_set_true:N \l_@@_last_col_without_value_bool
3694       \int_set:Nn \l_@@_last_col_int { -1 }
3695     }
3696     \keys_set:nn { nicematrix / NiceMatrix } { ##1 }
3697     \@@_begin_of_NiceMatrix:no { #1 } \l_@@_columns_type_tl
3698   }
3699   { \use:c { end #1 NiceArray } }
3700 }

```

We define also an environment `{NiceMatrix}`

```

3701 \NewDocumentEnvironment { NiceMatrix } { ! O { } }
3702 {
3703   \str_gset:Nn \g_@@_name_env_str { NiceMatrix }
3704   \int_if_zero:nT \l_@@_last_col_int
3705   {
3706     \bool_set_true:N \l_@@_last_col_without_value_bool
3707     \int_set:Nn \l_@@_last_col_int { -1 }
3708   }
3709   \keys_set:nn { nicematrix / NiceMatrix } { #1 }
3710   \bool_lazy_or:nnT
3711     { \clist_if_empty_p:N \l_@@_vlines_clist }
3712     { \l_@@_except_borders_bool }
3713     { \bool_set_true:N \l_@@_NiceMatrix_without_vlines_bool }
3714   \@@_begin_of_NiceMatrix:no { } \l_@@_columns_type_tl
3715 }
3716 { \endNiceArray }

```

The following command will be linked to `\NotEmpty` in the environments of `nicematrix`.

```
3717 \cs_new_protected:Npn \@@_NotEmpty:
3718 { \bool_gset_true:N \g_@@_not_empty_cell_bool }
```

14 {NiceTabular}, {NiceTabularX} and {NiceTabular*}

```
3719 \NewDocumentEnvironment { NiceTabular } { 0 { } m ! 0 { } }
3720 {
```

If the dimension `\l_@@_width_dim` is equal to 0 pt, that means that it has not been set by a previous use of `\NiceMatrixOptions`.

```
3721   \dim_compare:nNt \l_@@_width_dim = \c_zero_dim
3722     { \dim_set_eq:NN \l_@@_width_dim \linewidth }
3723   \str_gset:Nn \g_@@_name_env_str { NiceTabular }
3724   \keys_set:nn { nicematrix / NiceTabular } { #1 , #3 }
3725   \tl_if_empty:NF \l_@@_short_caption_tl
3726     {
3727     \tl_if_empty:NT \l_@@_caption_tl
3728       {
3729         \@@_error_or_warning:n { short-caption-without-caption }
3730         \tl_set_eq:NN \l_@@_caption_tl \l_@@_short_caption_tl
3731       }
3732     }
3733   \tl_if_empty:NF \l_@@_label_tl
3734     {
3735     \tl_if_empty:NT \l_@@_caption_tl
3736       { \@@_error_or_warning:n { label-without-caption } }
3737     }
3738   \NewDocumentEnvironment { TabularNote } { b }
3739     {
3740     \bool_if:NTF \l_@@_in_code_after_bool
3741       { \@@_error_or_warning:n { TabularNote~in~CodeAfter } }
3742       {
3743         \tl_if_empty:NF \g_@@_tabularnote_tl
3744           { \tl_gput_right:Nn \g_@@_tabularnote_tl { \par } }
3745           \tl_gput_right:Nn \g_@@_tabularnote_tl { ##1 }
3746         }
3747       }
3748     { }
3749   \@@_settings_for_tabular:
3750   \NiceArray { #2 }
3751 }
3752 { \endNiceArray }
3753 \cs_new_protected:Npn \@@_settings_for_tabular:
3754 {
3755   \bool_set_true:N \l_@@_tabular_bool
3756   \cs_set_eq:NN \@@_math_toggle: \prg_do_nothing:
3757   \cs_set_eq:NN \@@_tuning_not_tabular_begin: \prg_do_nothing:
3758   \cs_set_eq:NN \@@_tuning_not_tabular_end: \prg_do_nothing:
3759 }

3760 \NewDocumentEnvironment { NiceTabularX } { m 0 { } m ! 0 { } }
3761 {
3762   \str_gset:Nn \g_@@_name_env_str { NiceTabularX }
3763   \dim_zero_new:N \l_@@_width_dim
3764   \dim_set:Nn \l_@@_width_dim { #1 }
3765   \keys_set:nn { nicematrix / NiceTabular } { #2 , #4 }
3766   \@@_settings_for_tabular:
3767   \NiceArray { #3 }
3768 }
3769 {
3770   \endNiceArray
```

```

3771 \int_if_zero:nT \g_@@_total_X_weight_int
3772 { \@@_error:n { NiceTabularX~without~X } }
3773 }

3774 \NewDocumentEnvironment { NiceTabular* } { m 0 { } m ! 0 { } }
3775 {
3776 \str_gset:Nn \g_@@_name_env_str { NiceTabular* }
3777 \dim_set:Nn \l_@@_tabular_width_dim { #1 }
3778 \keys_set:nn { nicematrix / NiceTabular } { #2 , #4 }
3779 \@@_settings_for_tabular:
3780 \NiceArray { #3 }
3781 }
3782 { \endNiceArray }

```

15 After the construction of the array

The following command will be used when the key `rounded-corners` is in force (this is the key `rounded-corners` for the whole environment and *not* the key `rounded-corners` of a command `\Block`).

```

3783 \cs_new_protected:Npn \@@_deal_with_rounded_corners:
3784 {
3785 \bool_lazy_all:nT
3786 {
3787 { \int_compare_p:nNn \l_@@_tab_rounded_corners_dim > \c_zero_dim }
3788 \l_@@_hvlines_bool
3789 { ! \g_@@_delims_bool }
3790 { ! \l_@@_except_borders_bool }
3791 }
3792 {
3793 \bool_set_true:N \l_@@_except_borders_bool
3794 \clist_if_empty:NF \l_@@_corners_clist
3795 { \@@_error:n { hvlines,~rounded-corners~and~corners } }
3796 \tl_gput_right:Nn \g_@@_pre_code_after_tl
3797 {
3798 \@@_stroke_block:nnn
3799 {
3800 rounded-corners = \dim_use:N \l_@@_tab_rounded_corners_dim ,
3801 draw = \l_@@_rules_color_tl
3802 }
3803 { 1-1 }
3804 { \int_use:N \c@iRow - \int_use:N \c@jCol }
3805 }
3806 }
3807 }

```

```

3808 \cs_new_protected:Npn \@@_after_array:
3809 {

```

There was a `\hook_gput_code:nnn { env / tabular / begin } { nicematrix }` in the command `\@@_pre_array_ii:` in order to come back to the standard definition of `\multicolumn` (in the tabulars used by the final user in the cells of our array of `nicematrix`) and maybe another linked to `colortbl`.

```

3810 \hook_gremove_code:nn { env / tabular / begin } { nicematrix }
3811 \group_begin:

```

When the option `last-col` is used in the environments with explicit preambles (like `{NiceArray}`, `{pNiceArray}`, etc.) a special type of column is used at the end of the preamble in order to compose the cells in an overlapping position (with `\hbox_overlap_right:n`) but (if `last-col` has been used), we don't have the number of that last column. However, we have to know that number for the

color of the potential `\Vdots` drawn in that last column. That's why we fix the correct value of `\l_@@_last_col_int` in that case.

```
3812   \bool_if:NT \g_@@_last_col_found_bool
3813     { \int_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int }
```

If we are in an environment without preamble (like `{NiceMatrix}` or `{pNiceMatrix}`) and if the option `last-col` has been used without value we also fix the real value of `\l_@@_last_col_int`.

```
3814   \bool_if:NT \l_@@_last_col_without_value_bool
3815     { \int_set_eq:NN \l_@@_last_col_int \g_@@_col_total_int }
```

It's also time to give to `\l_@@_last_row_int` its real value.

```
3816   \bool_if:NT \l_@@_last_row_without_value_bool
3817     { \int_set_eq:NN \l_@@_last_row_int \g_@@_row_total_int }
```

```
3818   \tl_gput_right:Ne \g_@@_aux_tl
3819     {
3820       \seq_gset_from_clist:Nn \exp_not:N \g_@@_size_seq
3821       {
3822         \int_use:N \l_@@_first_row_int ,
3823         \int_use:N \c@iRow ,
3824         \int_use:N \g_@@_row_total_int ,
3825         \int_use:N \l_@@_first_col_int ,
3826         \int_use:N \c@jCol ,
3827         \int_use:N \g_@@_col_total_int
3828       }
3829     }
```

We write also the potential content of `\g_@@_pos_of_blocks_seq`. It will be used to recreate the blocks with a name in the `\CodeBefore` and also if the command `\rowcolors` is used with the key `respect-blocks`).

```
3830   \seq_if_empty:NF \g_@@_pos_of_blocks_seq
3831     {
3832       \tl_gput_right:Ne \g_@@_aux_tl
3833       {
3834         \seq_gset_from_clist:Nn \exp_not:N \g_@@_pos_of_blocks_seq
3835         { \seq_use:Nnnn \g_@@_pos_of_blocks_seq , , , }
3836       }
3837     }
3838   \seq_if_empty:NF \g_@@_multicolumn_cells_seq
3839     {
3840       \tl_gput_right:Ne \g_@@_aux_tl
3841       {
3842         \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_cells_seq
3843         { \seq_use:Nnnn \g_@@_multicolumn_cells_seq , , , }
3844         \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_sizes_seq
3845         { \seq_use:Nnnn \g_@@_multicolumn_sizes_seq , , , }
3846       }
3847     }
```

Now, you create the diagonal nodes by using the row nodes and the col nodes.

```
3848   \@@_create_diag_nodes:
```

We create the aliases using `last` for the nodes of the cells in the last row and the last column.

```
3849   \pgfpicture
3850   \int_step_inline:nn \c@iRow
3851     {
3852       \pgfnodealias
3853       { \@@_env: - ##1 - last }
3854       { \@@_env: - ##1 - \int_use:N \c@jCol }
3855     }
3856   \int_step_inline:nn \c@jCol
3857     {
3858       \pgfnodealias
```

```

3859     { \@@_env: - last - ##1 }
3860     { \@@_env: - \int_use:N \c@iRow - ##1 }
3861   }
3862   \str_if_empty:NF \l_@@_name_str
3863   {
3864     \int_step_inline:nn \c@iRow
3865     {
3866       \pgfnodealias
3867       { \l_@@_name_str - ##1 - last }
3868       { \@@_env: - ##1 - \int_use:N \c@jCol }
3869     }
3870     \int_step_inline:nn \c@jCol
3871     {
3872       \pgfnodealias
3873       { \l_@@_name_str - last - ##1 }
3874       { \@@_env: - \int_use:N \c@iRow - ##1 }
3875     }
3876   }
3877   \endpgfpicture

```

By default, the diagonal lines will be parallelized¹¹. There are two types of diagonals lines: the `\Ddots` diagonals and the `\Iddots` diagonals. We have to count both types in order to know whether a diagonal is the first of its type in the current `{NiceArray}` environment.

```

3878   \bool_if:NT \l_@@_parallelize_diags_bool
3879   {
3880     \int_gzero_new:N \g_@@_ddots_int
3881     \int_gzero_new:N \g_@@_iddots_int

```

The dimensions `\g_@@_delta_x_one_dim` and `\g_@@_delta_y_one_dim` will contain the Δ_x and Δ_y of the first `\Ddots` diagonal. We have to store these values in order to draw the others `\Ddots` diagonals parallel to the first one. Similarly `\g_@@_delta_x_two_dim` and `\g_@@_delta_y_two_dim` are the Δ_x and Δ_y of the first `\Iddots` diagonal.

```

3882     \dim_gzero_new:N \g_@@_delta_x_one_dim
3883     \dim_gzero_new:N \g_@@_delta_y_one_dim
3884     \dim_gzero_new:N \g_@@_delta_x_two_dim
3885     \dim_gzero_new:N \g_@@_delta_y_two_dim
3886   }
3887   \int_zero_new:N \l_@@_initial_i_int
3888   \int_zero_new:N \l_@@_initial_j_int
3889   \int_zero_new:N \l_@@_final_i_int
3890   \int_zero_new:N \l_@@_final_j_int
3891   \bool_set_false:N \l_@@_initial_open_bool
3892   \bool_set_false:N \l_@@_final_open_bool

```

If the option `small` is used, the values `\l_@@_xdots_radius_dim` and `\l_@@_xdots_inter_dim` (used to draw the dotted lines created by `\hdottedline` and `\vdottedline` and also for all the other dotted lines when `line-style` is equal to `standard`, which is the initial value) are changed.

```

3893   \bool_if:NT \l_@@_small_bool
3894   {
3895     \dim_set:Nn \l_@@_xdots_radius_dim { 0.7 \l_@@_xdots_radius_dim }
3896     \dim_set:Nn \l_@@_xdots_inter_dim { 0.55 \l_@@_xdots_inter_dim }

```

The dimensions `\l_@@_xdots_shorten_start_dim` and `\l_@@_xdots_shorten_end_dim` correspond to the options `xdots/shorten-start` and `xdots/shorten-end` available to the user.

```

3897     \dim_set:Nn \l_@@_xdots_shorten_start_dim
3898     { 0.6 \l_@@_xdots_shorten_start_dim }
3899     \dim_set:Nn \l_@@_xdots_shorten_end_dim
3900     { 0.6 \l_@@_xdots_shorten_end_dim }
3901   }

```

¹¹It's possible to use the option `parallelize-diags` to disable this parallelization.

Now, we actually draw the dotted lines (specified by `\Cdots`, `\Vdots`, etc.).

```
3902 \@@_draw_dotted_lines:
```

The following computes the “corners” (made up of empty cells) but if there is no corner to compute, it won’t do anything. The corners are computed in `\l_@@_corners_cells_clist` which will contain all the cells which are empty (and not in a block) considered in the corners of the array.

```
3903 \clist_if_empty:NF \l_@@_corners_clist
3904 {
3905   \bool_if:NTF \l_@@_no_cell_nodes_bool
3906     { \@@_error:n { corners~with~no~cell~nodes } }
3907     { \@@_compute_corners: }
3908 }
```

The sequence `\g_@@_pos_of_blocks_seq` must be “adjusted” (for the case where the user have written something like `\Block{1-*}`).

```
3909 \@@_adjust_pos_of_blocks_seq:
3910 \@@_deal_with_rounded_corners:
3911 \clist_if_empty:NF \l_@@_hlines_clist \@@_draw_hlines:
3912 \clist_if_empty:NF \l_@@_vlines_clist \@@_draw_vlines:
```

Now, the pre-code-after and then, the `\CodeAfter`.

```
3913 \IfPackageLoadedT { tikz }
3914 {
3915   \tikzset
3916   {
3917     every-picture / .style =
3918     {
3919       overlay ,
3920       remember~picture ,
3921       name~prefix = \@@_env: -
3922     }
3923   }
3924 }
3925 \bool_if:NT \c_@@_recent_array_bool
3926 { \cs_set_eq:NN \ar@ialign \@@_old_ar@ialign: }
3927 \cs_set_eq:NN \SubMatrix \@@_SubMatrix
3928 \cs_set_eq:NN \UnderBrace \@@_UnderBrace
3929 \cs_set_eq:NN \OverBrace \@@_OverBrace
3930 \cs_set_eq:NN \ShowCellNames \@@_ShowCellNames
3931 \cs_set_eq:NN \TikzEveryCell \@@_TikzEveryCell
3932 \cs_set_eq:NN \line \@@_line
3933 \g_@@_pre_code_after_tl
3934 \tl_gclear:N \g_@@_pre_code_after_tl
```

When `light-syntax` is used, we insert systematically a `\CodeAfter` in the flow. Thus, it’s possible to have two instructions `\CodeAfter` and the second may be in `\g_nicematrix_code_after_tl`. That’s why we set `\CodeAfter` to be *no-op* now.

```
3935 \cs_set_eq:NN \CodeAfter \prg_do_nothing:
```

We clear the list of the names of the potential `\SubMatrix` that will appear in the `\CodeAfter` (unfortunately, that list has to be global).

```
3936 \seq_gclear:N \g_@@_submatrix_names_seq
```

The following code is a security for the case the user has used `babel` with the option `spanish`: in that case, the characters `>` and `<` are activated and Tikz is not able to solve the problem (even with the Tikz library `babel`).

```
3937 \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
3938 { \@@_rescan_for_spanish:N \g_nicematrix_code_after_tl }
```

And here's the `\CodeAfter`. Since the `\CodeAfter` may begin with an “argument” between square brackets of the options, we extract and treat that potential “argument” with the command `\@@_CodeAfter_keys:`.

```

3939   \bool_set_true:N \l_@@_in_code_after_bool
3940   \exp_last_unbraced:No \@@_CodeAfter_keys: \g_nicematrix_code_after_tl
3941   \scan_stop:
3942   \tl_gclear:N \g_nicematrix_code_after_tl
3943   \group_end:

```

`\g_@@_pre_code_before_tl` is for instructions in the cells of the array such as `\rowcolor` and `\cellcolor`. These instructions will be written on the aux file to be added to the `code-before` in the next run.

```

3944   \seq_if_empty:NF \g_@@_rowlistcolors_seq { \@@_clear_rowlistcolors_seq: }
3945   \tl_if_empty:NF \g_@@_pre_code_before_tl
3946   {
3947     \tl_gput_right:Ne \g_@@_aux_tl
3948     {
3949       \tl_gset:Nn \exp_not:N \g_@@_pre_code_before_tl
3950       { \exp_not:o \g_@@_pre_code_before_tl }
3951     }
3952     \tl_gclear:N \g_@@_pre_code_before_tl
3953   }
3954   \tl_if_empty:NF \g_nicematrix_code_before_tl
3955   {
3956     \tl_gput_right:Ne \g_@@_aux_tl
3957     {
3958       \tl_gset:Nn \exp_not:N \g_@@_code_before_tl
3959       { \exp_not:o \g_nicematrix_code_before_tl }
3960     }
3961     \tl_gclear:N \g_nicematrix_code_before_tl
3962   }

3963   \str_gclear:N \g_@@_name_env_str
3964   \@@_restore_iRow_jCol:

```

The command `\CT@arc@` contains the instruction of color for the rules of the array¹². This command is used by `\CT@arc@` but we use it also for compatibility with `colortbl`. But we want also to be able to use color for the rules of the array when `colortbl` is *not* loaded. That's why we do the following instruction which is in the patch of the end of arrays done by `colortbl`.

```

3965   \cs_gset_eq:NN \CT@arc@ \@@_old_CT@arc@
3966   }

```

The following command will extract the potential options (between square brackets) at the beginning of the `\CodeAfter` (that is to say, when `\CodeAfter` is used, the options of that “command” `\CodeAfter`). Idem for the `\CodeBefore`.

```

3967 \NewDocumentCommand \@@_CodeAfter_keys: { 0 { } }
3968 { \keys_set:nn { nicematrix / CodeAfter } { #1 } }

```

We remind that the first mandatory argument of the command `\Block` is the size of the block with the special format $i-j$. However, the user is allowed to omit i or j (or both). This will be interpreted as: the last row (resp. column) of the block will be the last row (resp. column) of the block (without the potential exterior row—resp. column—of the array). By convention, this is stored in `\g_@@_pos_of_blocks_seq` (and `\g_@@_blocks_seq`) as a number of rows (resp. columns) for the block equal to 100. It's possible, after the construction of the array, to replace these values by the correct ones (since we know the number of rows and columns of the array).

```

3969 \cs_new_protected:Npn \@@_adjust_pos_of_blocks_seq:
3970 {

```

¹²e.g. `\color[rgb]{0.5,0.5,0}`

```

3971 \seq_gset_map_e:NNn \g_@@_pos_of_blocks_seq \g_@@_pos_of_blocks_seq
3972 { \@@_adjust_pos_of_blocks_seq_i:nnnnn ##1 }
3973 }

```

The following command must *not* be protected.

```

3974 \cs_new:Npn \@@_adjust_pos_of_blocks_seq_i:nnnnn #1 #2 #3 #4 #5
3975 {
3976   { #1 }
3977   { #2 }
3978   {
3979     \int_compare:nNnTF { #3 } > { 98 }
3980     { \int_use:N \c@iRow }
3981     { #3 }
3982   }
3983   {
3984     \int_compare:nNnTF { #4 } > { 98 }
3985     { \int_use:N \c@jCol }
3986     { #4 }
3987   }
3988   { #5 }
3989 }

```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible”. That’s why we have to define the adequate version of `\@@_draw_dotted_lines`: whether Tikz is loaded or not (in that case, only PGF is loaded).

```

3990 \hook_gput_code:nnn { begindocument } { . }
3991 {
3992   \cs_new_protected:Npe \@@_draw_dotted_lines:
3993   {
3994     \c_@@_pgfortikzpicture_tl
3995     \@@_draw_dotted_lines_i:
3996     \c_@@_endpgfortikzpicture_tl
3997   }
3998 }

```

The following command *must* be protected because it will appear in the construction of the command `\@@_draw_dotted_lines:`.

```

3999 \cs_new_protected:Npn \@@_draw_dotted_lines_i:
4000 {
4001   \pgfrememberpicturepositiononpagetrue
4002   \pgf@relevantforpicturesizefalse
4003   \g_@@_HVdotsfor_lines_tl
4004   \g_@@_Vdots_lines_tl
4005   \g_@@_Ddots_lines_tl
4006   \g_@@_Iddots_lines_tl
4007   \g_@@_Cdots_lines_tl
4008   \g_@@_Ldots_lines_tl
4009 }

4010 \cs_new_protected:Npn \@@_restore_iRow_jCol:
4011 {
4012   \cs_if_exist:NT \theiRow { \int_gset_eq:NN \c@iRow \l_@@_old_iRow_int }
4013   \cs_if_exist:NT \thejCol { \int_gset_eq:NN \c@jCol \l_@@_old_jCol_int }
4014 }

```

We define a new PGF shape for the diag nodes because we want to provide an anchor called `.5` for those nodes.

```

4015 \pgfdeclareshape { @@_diag_node }
4016 {
4017   \savedanchor { \five }
4018   {
4019     \dim_gset_eq:NN \pgf@x \l_tmpa_dim

```

```

4020     \dim_gset_eq:NN \pgf@y \l_tmpb_dim
4021   }
4022   \anchor { 5 } { \five }
4023   \anchor { center } { \pgfpointorigin }
4024   \anchor { 1 } { \five \pgf@x = 0.2 \pgf@x \pgf@y = 0.2 \pgf@y }
4025   \anchor { 2 } { \five \pgf@x = 0.4 \pgf@x \pgf@y = 0.4 \pgf@y }
4026   \anchor { 25 } { \five \pgf@x = 0.5 \pgf@x \pgf@y = 0.5 \pgf@y }
4027   \anchor { 3 } { \five \pgf@x = 0.6 \pgf@x \pgf@y = 0.6 \pgf@y }
4028   \anchor { 4 } { \five \pgf@x = 0.8 \pgf@x \pgf@y = 0.8 \pgf@y }
4029   \anchor { 6 } { \five \pgf@x = 1.2 \pgf@x \pgf@y = 1.2 \pgf@y }
4030   \anchor { 7 } { \five \pgf@x = 1.4 \pgf@x \pgf@y = 1.4 \pgf@y }
4031   \anchor { 75 } { \five \pgf@x = 1.5 \pgf@x \pgf@y = 1.5 \pgf@y }
4032   \anchor { 8 } { \five \pgf@x = 1.6 \pgf@x \pgf@y = 1.6 \pgf@y }
4033   \anchor { 9 } { \five \pgf@x = 1.8 \pgf@x \pgf@y = 1.8 \pgf@y }
4034 }

```

The following command creates the diagonal nodes (in fact, if the matrix is not a square matrix, not all the nodes are on the diagonal).

```

4035 \cs_new_protected:Npn \@@_create_diag_nodes:
4036 {
4037   \pgfpicture
4038   \pgfrememberpicturepositiononpagetrue
4039   \int_step_inline:nn { \int_max:nn \c@iRow \c@jCol }
4040   {
4041     \@@_qpoint:n { col - \int_min:nn { ##1 } { \c@jCol + 1 } }
4042     \dim_set_eq:NN \l_tmpa_dim \pgf@x
4043     \@@_qpoint:n { row - \int_min:nn { ##1 } { \c@iRow + 1 } }
4044     \dim_set_eq:NN \l_tmpb_dim \pgf@y
4045     \@@_qpoint:n { col - \int_min:nn { ##1 + 1 } { \c@jCol + 1 } }
4046     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
4047     \@@_qpoint:n { row - \int_min:nn { ##1 + 1 } { \c@iRow + 1 } }
4048     \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
4049     \pgftransformshift { \pgfpoint \l_tmpa_dim \l_tmpb_dim }

```

Now, `\l_tmpa_dim` and `\l_tmpb_dim` become the width and the height of the node (of shape `\@@_diag_node`) that we will construct.

```

4050     \dim_set:Nn \l_tmpa_dim { ( \l_@@_tmpc_dim - \l_tmpa_dim ) / 2 }
4051     \dim_set:Nn \l_tmpb_dim { ( \l_@@_tmpd_dim - \l_tmpb_dim ) / 2 }
4052     \pgfnode { \@@_diag_node } { center } { } { \@@_env: - ##1 } { }
4053     \str_if_empty:NF \l_@@_name_str
4054     { \pgfnodealias { \l_@@_name_str - ##1 } { \@@_env: - ##1 } }
4055   }

```

Now, the last node. Of course, that is only a coordinate because there is not `.5` anchor for that node.

```

4056   \int_set:Nn \l_tmpa_int { \int_max:nn \c@iRow \c@jCol + 1 }
4057   \@@_qpoint:n { row - \int_min:nn { \l_tmpa_int } { \c@iRow + 1 } }
4058   \dim_set_eq:NN \l_tmpa_dim \pgf@y
4059   \@@_qpoint:n { col - \int_min:nn { \l_tmpa_int } { \c@jCol + 1 } }
4060   \pgfcoordinate
4061   { \@@_env: - \int_use:N \l_tmpa_int } { \pgfpoint \pgf@x \l_tmpa_dim }
4062   \pgfnodealias
4063   { \@@_env: - last }
4064   { \@@_env: - \int_eval:n { \int_max:nn \c@iRow \c@jCol + 1 } }
4065   \str_if_empty:NF \l_@@_name_str
4066   {
4067     \pgfnodealias
4068     { \l_@@_name_str - \int_use:N \l_tmpa_int }
4069     { \@@_env: - \int_use:N \l_tmpa_int }
4070     \pgfnodealias
4071     { \l_@@_name_str - last }
4072     { \@@_env: - last }
4073   }

```


We test if we are still in the matrix. Since this is the core of the loop, we **optimize** the code by using a TeX-style of conditionals.

```

4089     \if_int_compare:w \l_@@_final_i_int > \l_@@_row_max_int
4090     \if_int_compare:w #3 = \c_one_int
4091     \bool_set_true:N \l_@@_final_open_bool
4092     \else:
4093     \if_int_compare:w \l_@@_final_j_int > \l_@@_col_max_int
4094     \bool_set_true:N \l_@@_final_open_bool
4095     \fi:
4096     \fi:
4097     \else:
4098     \if_int_compare:w \l_@@_final_j_int < \l_@@_col_min_int
4099     \if_int_compare:w #4 = -1
4100     \bool_set_true:N \l_@@_final_open_bool
4101     \fi:
4102     \else:
4103     \if_int_compare:w \l_@@_final_j_int > \l_@@_col_max_int
4104     \if_int_compare:w #4 = \c_one_int
4105     \bool_set_true:N \l_@@_final_open_bool
4106     \fi:
4107     \fi:
4108     \fi:
4109     \fi:
4110     \bool_if:NTF \l_@@_final_open_bool

```

If we are outside the matrix, we have found the extremity of the dotted line and it's an *open* extremity.

```

4111     {

```

We do a step backwards.

```

4112         \int_sub:Nn \l_@@_final_i_int { #3 }
4113         \int_sub:Nn \l_@@_final_j_int { #4 }
4114         \bool_set_true:N \l_@@_stop_loop_bool
4115     }

```

If we are in the matrix, we test whether the cell is empty. If it's not the case, we stop the loop because we have found the correct values for `\l_@@_final_i_int` and `\l_@@_final_j_int`.

```

4116     {
4117     \cs_if_exist:cTF
4118     {
4119     @@ _ dotted _
4120     \int_use:N \l_@@_final_i_int -
4121     \int_use:N \l_@@_final_j_int
4122     }
4123     {
4124     \int_sub:Nn \l_@@_final_i_int { #3 }
4125     \int_sub:Nn \l_@@_final_j_int { #4 }
4126     \bool_set_true:N \l_@@_final_open_bool
4127     \bool_set_true:N \l_@@_stop_loop_bool
4128     }
4129     {
4130     \cs_if_exist:cTF
4131     {
4132     pgf @ sh @ ns @ \@@_env:
4133     - \int_use:N \l_@@_final_i_int
4134     - \int_use:N \l_@@_final_j_int
4135     }
4136     { \bool_set_true:N \l_@@_stop_loop_bool }

```

If the case is empty, we declare that the cell as non-empty. Indeed, we will draw a dotted line and the cell will be on that dotted line. All the cells of a dotted line have to be marked as “dotted” because we don't want intersections between dotted lines. We recall that the research of the extremities of the lines are all done in the same TeX group (the group of the environment), even though, when the extremities are found, each line is drawn in a TeX group that we will open for the options of the line.

```

4137     {

```

```

4138         \cs_set_nopar:cpn
4139         {
4140             @@ _ dotted _
4141             \int_use:N \l_@@_final_i_int -
4142             \int_use:N \l_@@_final_j_int
4143         }
4144         { }
4145     }
4146 }
4147 }
4148 }

```

For $\l_@@_initial_i_int$ and $\l_@@_initial_j_int$ the programming is similar to the previous one.

```

4149     \bool_set_false:N \l_@@_stop_loop_bool

```

The following line of code is only for efficiency in the following loop.

```

4150     \int_set:Nn \l_tmpa_int { \l_@@_col_min_int - 1 }
4151     \bool_do_until:Nn \l_@@_stop_loop_bool
4152     {
4153         \int_sub:Nn \l_@@_initial_i_int { #3 }
4154         \int_sub:Nn \l_@@_initial_j_int { #4 }
4155         \bool_set_false:N \l_@@_initial_open_bool

```

We test if we are still in the matrix. Since this is the core of the loop, we **optimize** the code by using a TeX-style of conditionals.

```

4156         \if_int_compare:w \l_@@_initial_i_int < \l_@@_row_min_int
4157         \if_int_compare:w #3 = \c_one_int
4158             \bool_set_true:N \l_@@_initial_open_bool
4159         \else:

```

\l_tmpa_int contains $\l_@@_col_min_int - 1$ (only for efficiency).

```

4160         \if_int_compare:w \l_@@_initial_j_int = \l_tmpa_int
4161             \bool_set_true:N \l_@@_initial_open_bool
4162         \fi:
4163     \fi:
4164 \else:
4165     \if_int_compare:w \l_@@_initial_j_int < \l_@@_col_min_int
4166         \if_int_compare:w #4 = \c_one_int
4167             \bool_set_true:N \l_@@_initial_open_bool
4168         \fi:
4169     \else:
4170         \if_int_compare:w \l_@@_initial_j_int > \l_@@_col_max_int
4171             \if_int_compare:w #4 = -1
4172                 \bool_set_true:N \l_@@_initial_open_bool
4173             \fi:
4174         \fi:
4175     \fi:
4176 \fi:
4177 \bool_if:NTF \l_@@_initial_open_bool
4178 {
4179     \int_add:Nn \l_@@_initial_i_int { #3 }
4180     \int_add:Nn \l_@@_initial_j_int { #4 }
4181     \bool_set_true:N \l_@@_stop_loop_bool
4182 }
4183 {
4184     \cs_if_exist:cTF
4185     {
4186         @@ _ dotted _
4187         \int_use:N \l_@@_initial_i_int -
4188         \int_use:N \l_@@_initial_j_int
4189     }

```

```

4190     {
4191         \int_add:Nn \l_@@_initial_i_int { #3 }
4192         \int_add:Nn \l_@@_initial_j_int { #4 }
4193         \bool_set_true:N \l_@@_initial_open_bool
4194         \bool_set_true:N \l_@@_stop_loop_bool
4195     }
4196     {
4197         \cs_if_exist:cTF
4198         {
4199             pgf @ sh @ ns @ \@@_env:
4200             - \int_use:N \l_@@_initial_i_int
4201             - \int_use:N \l_@@_initial_j_int
4202         }
4203         { \bool_set_true:N \l_@@_stop_loop_bool }
4204     {
4205         \cs_set_nopar:cpn
4206         {
4207             @@ _ dotted _
4208             \int_use:N \l_@@_initial_i_int -
4209             \int_use:N \l_@@_initial_j_int
4210         }
4211         { }
4212     }
4213 }
4214 }
4215 }

```

We remind the rectangle described by all the dotted lines in order to respect the corresponding virtual “block” when drawing the horizontal and vertical rules.

```

4216     \seq_gput_right:Ne \g_@@_pos_of_xdots_seq
4217     {
4218         { \int_use:N \l_@@_initial_i_int }

```

Be careful: with `\Iddots`, `\l_@@_final_j_int` is inferior to `\l_@@_initial_j_int`. That’s why we use `\int_min:nn` and `\int_max:nn`.

```

4219         { \int_min:nn \l_@@_initial_j_int \l_@@_final_j_int }
4220         { \int_use:N \l_@@_final_i_int }
4221         { \int_max:nn \l_@@_initial_j_int \l_@@_final_j_int }
4222         { } % for the name of the block
4223     }
4224 }

```

If the final user uses the key `xdots/shorten` in `\NiceMatrixOptions` or at the level of an environment (such as `{pNiceMatrix}`, etc.), only the so called “closed extremities” will be shortened by that key. The following command will be used *after* the detection of the extremities of a dotted line (hence at a time when we known wheter the extremities are closed or open) but before the analyse of the keys of the individual command `\Cdots`, `\Vdots`. Hence, the keys `shorten`, `shorten-start` and `shorten-end` of that individual command will be applied.

```

4225     \cs_new_protected:Npn \@@_open_shorten:
4226     {
4227         \bool_if:NT \l_@@_initial_open_bool
4228         { \dim_zero:N \l_@@_xdots_shorten_start_dim }
4229         \bool_if:NT \l_@@_final_open_bool
4230         { \dim_zero:N \l_@@_xdots_shorten_end_dim }
4231     }

```

The following commmand (*when it will be written*) will set the four counters `\l_@@_row_min_int`, `\l_@@_row_max_int`, `\l_@@_col_min_int` and `\l_@@_col_max_int` to the intersections of the submatrices which contains the cell of row #1 and column #2. As of now, it’s only the whole array (excepted exterior rows and columns).

```

4232     \cs_new_protected:Npn \@@_adjust_to_submatrix:nn #1 #2
4233     {
4234         \int_set_eq:NN \l_@@_row_min_int \c_one_int

```

```

4235 \int_set_eq:NN \l_@@_col_min_int \c_one_int
4236 \int_set_eq:NN \l_@@_row_max_int \c@iRow
4237 \int_set_eq:NN \l_@@_col_max_int \c@jCol

```

We do a loop over all the submatrices specified in the code-before. We have stored the position of all those submatrices in `\g_@@_submatrix_seq`.

```

4238 \seq_if_empty:NF \g_@@_submatrix_seq
4239 {
4240   \seq_map_inline:Nn \g_@@_submatrix_seq
4241     { \@@_adjust_to_submatrix:nnnnn { #1 } { #2 } ##1 }
4242 }
4243 }

```

`#1` and `#2` are the numbers of row and columns of the cell where the command of dotted line (ex.: `\Vdots`) has been issued. `#3`, `#4`, `#5` and `#6` are the specification (in i and j) of the submatrix we are analyzing.

Here is the programming of that command with the the standard syntax of L3.

```

\cs_new_protected:Npn \@@_adjust_to_submatrix:nnnnn #1 #2 #3 #4 #5 #6
{
  \bool_if:nT
  {
    \int_compare_p:n { #3 <= #1 <= #5 }
    &&
    \int_compare_p:n { #4 <= #2 <= #6 }
  }
  {
    \int_set:Nn \l_@@_row_min_int { \int_max:nn \l_@@_row_min_int { #3 } }
    \int_set:Nn \l_@@_col_min_int { \int_max:nn \l_@@_col_min_int { #4 } }
    \int_set:Nn \l_@@_row_max_int { \int_min:nn \l_@@_row_max_int { #5 } }
    \int_set:Nn \l_@@_col_max_int { \int_min:nn \l_@@_col_max_int { #6 } }
  }
}

```

However, for efficiency, we will use the following version.

```

4244 \cs_new_protected:Npn \@@_adjust_to_submatrix:nnnnn #1 #2 #3 #4 #5 #6
4245 {
4246   \if_int_compare:w #3 > #1
4247   \else:
4248     \if_int_compare:w #1 > #5
4249     \else:
4250       \if_int_compare:w #4 > #2
4251       \else:
4252         \if_int_compare:w #2 > #6
4253         \else:
4254           \if_int_compare:w \l_@@_row_min_int < #3 \l_@@_row_min_int = #3 \fi:
4255           \if_int_compare:w \l_@@_col_min_int < #4 \l_@@_col_min_int = #4 \fi:
4256           \if_int_compare:w \l_@@_row_max_int < #5 \l_@@_row_max_int = #5 \fi:
4257           \if_int_compare:w \l_@@_col_max_int < #6 \l_@@_col_max_int = #6 \fi:
4258         \fi:
4259       \fi:
4260     \fi:
4261   \fi:
4262 }

4263 \cs_new_protected:Npn \@@_set_initial_coords:
4264 {
4265   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4266   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4267 }
4268 \cs_new_protected:Npn \@@_set_final_coords:
4269 {

```

```

4270 \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4271 \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
4272 }
4273 \cs_new_protected:Npn \@@_set_initial_coords_from_anchor:n #1
4274 {
4275 \pgfpointanchor
4276 {
4277 \@@_env:
4278 - \int_use:N \l_@@_initial_i_int
4279 - \int_use:N \l_@@_initial_j_int
4280 }
4281 { #1 }
4282 \@@_set_initial_coords:
4283 }
4284 \cs_new_protected:Npn \@@_set_final_coords_from_anchor:n #1
4285 {
4286 \pgfpointanchor
4287 {
4288 \@@_env:
4289 - \int_use:N \l_@@_final_i_int
4290 - \int_use:N \l_@@_final_j_int
4291 }
4292 { #1 }
4293 \@@_set_final_coords:
4294 }
4295 \cs_new_protected:Npn \@@_open_x_initial_dim:
4296 {
4297 \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
4298 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4299 {
4300 \cs_if_exist:cT
4301 { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
4302 {
4303 \pgfpointanchor
4304 { \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
4305 { west }
4306 \dim_set:Nn \l_@@_x_initial_dim
4307 { \dim_min:nn \l_@@_x_initial_dim \pgf@x }
4308 }
4309 }
4310 \dim_compare:nNnT \l_@@_x_initial_dim = \c_max_dim
4311 {
4312 \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4313 \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4314 \dim_add:Nn \l_@@_x_initial_dim \col@sep
4315 }
4316 }
4317 \cs_new_protected:Npn \@@_open_x_final_dim:
4318 {
4319 \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }
4320 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
4321 {
4322 \cs_if_exist:cT
4323 { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
4324 {
4325 \pgfpointanchor
4326 { \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
4327 { east }
4328 \dim_compare:nNnT \pgf@x > \l_@@_x_final_dim
4329 { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
4330 }

```

If, in fact, all the cells of the column are empty (no PGF/Tikz nodes in those cells).

```
4331     }
```

If, in fact, all the cells of the columns are empty (no PGF/Tikz nodes in those cells).

```
4332     \dim_compare:nNnT \l_@@_x_final_dim = { - \c_max_dim }
4333     {
4334         \@@_qpoint:n { col - \int_eval:n { \l_@@_final_j_int + 1 } }
4335         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4336         \dim_sub:Nn \l_@@_x_final_dim \col@sep
4337     }
4338 }
```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```
4339 \cs_new_protected:Npn \@@_draw_Ldots:nnn #1 #2 #3
4340 {
4341     \@@_adjust_to_submatrix:nn { #1 } { #2 }
4342     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4343     {
4344         \@@_find_extremities_of_line:nmmm { #1 } { #2 } 0 1
```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```
4345         \group_begin:
4346         \@@_open_shorten:
4347         \int_if_zero:nTF { #1 }
4348         { \color { nicematrix-first-row } }
4349         {
```

We remind that, when there is a “last row” `\l_@@_last_row_int` will always be (after the construction of the array) the number of that “last row” even if the option `last-row` has been used without value.

```
4350             \int_compare:nNnT { #1 } = \l_@@_last_row_int
4351             { \color { nicematrix-last-row } }
4352         }
4353         \keys_set:nn { nicematrix / xdots } { #3 }
4354         \@@_color:o \l_@@_xdots_color_tl
4355         \@@_actually_draw_Ldots:
4356     \group_end:
4357 }
4358 }
```

The command `\@@_actually_draw_Ldots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool`.

The following function is also used by `\Hdotsfor`.

```
4359 \cs_new_protected:Npn \@@_actually_draw_Ldots:
4360 {
4361     \bool_if:NTF \l_@@_initial_open_bool
4362     {
4363         \@@_open_x_initial_dim:
4364         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
4365         \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4366     }
4367     { \@@_set_initial_coords_from_anchor:n { base-east } }
```

```

4368 \bool_if:NTF \l_@@_final_open_bool
4369 {
4370   \@@_open_x_final_dim:
4371   \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
4372   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
4373 }
4374 { \@@_set_final_coords_from_anchor:n { base-west } }

```

Now the case of a `\Hdotsfor` (or when there is only a `\Ldots`) in the “last row” (that case will probably arise when the final user draws an arrow to indicate the number of columns of the matrix). In the “first row”, we don’t need any adjustment.

```

4375 \bool_lazy_all:nTF
4376 {
4377   \l_@@_initial_open_bool
4378   \l_@@_final_open_bool
4379   { \int_compare_p:nNn \l_@@_initial_i_int = \l_@@_last_row_int }
4380 }
4381 {
4382   \dim_add:Nn \l_@@_y_initial_dim \c_@@_shift_Ldots_last_row_dim
4383   \dim_add:Nn \l_@@_y_final_dim \c_@@_shift_Ldots_last_row_dim
4384 }

```

We raise the line of a quantity equal to the radius of the dots because we want the dots really “on” the line of text. Of course, maybe we should not do that when the option `line-style` is used (?).

```

4385 {
4386   \dim_add:Nn \l_@@_y_initial_dim \l_@@_xdots_radius_dim
4387   \dim_add:Nn \l_@@_y_final_dim \l_@@_xdots_radius_dim
4388 }
4389 \@@_draw_line:
4390 }

```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

4391 \cs_new_protected:Npn \@@_draw_Cdots:nmn #1 #2 #3
4392 {
4393   \@@_adjust_to_submatrix:nn { #1 } { #2 }
4394   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4395   {
4396     \@@_find_extremities_of_line:nmmn { #1 } { #2 } 0 1

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

4397   \group_begin:
4398   \@@_open_shorten:
4399   \int_if_zero:nTF { #1 }
4400   { \color { nicematrix-first-row } }
4401   {

```

We remind that, when there is a “last row” `\l_@@_last_row_int` will always be (after the construction of the array) the number of that “last row” even if the option `last-row` has been used without value.

```

4402     \int_compare:nNnT { #1 } = \l_@@_last_row_int
4403     { \color { nicematrix-last-row } }
4404   }
4405   \keys_set:nn { nicematrix / xdots } { #3 }
4406   \@@_color:o \l_@@_xdots_color_tl
4407   \@@_actually_draw_Cdots:
4408   \group_end:
4409 }
4410 }

```

The command `\@@_actually_draw_Cdots:` has the following implicit arguments:

- `\l_@@_initial_i_int`

- \l_@@_initial_j_int
- \l_@@_initial_open_bool
- \l_@@_final_i_int
- \l_@@_final_j_int
- \l_@@_final_open_bool.

```

4411 \cs_new_protected:Npn \@@_actually_draw_Cdots:
4412 {
4413   \bool_if:NTF \l_@@_initial_open_bool
4414     { \@@_open_x_initial_dim: }
4415     { \@@_set_initial_coords_from_anchor:n { mid-east } }
4416   \bool_if:NTF \l_@@_final_open_bool
4417     { \@@_open_x_final_dim: }
4418     { \@@_set_final_coords_from_anchor:n { mid-west } }
4419   \bool_lazy_and:mnTF
4420     \l_@@_initial_open_bool
4421     \l_@@_final_open_bool
4422   {
4423     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
4424     \dim_set_eq:NN \l_tmpa_dim \pgf@y
4425     \@@_qpoint:n { row - \int_eval:n { \l_@@_initial_i_int + 1 } }
4426     \dim_set:Nn \l_@@_y_initial_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
4427     \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim
4428   }
4429   {
4430     \bool_if:NT \l_@@_initial_open_bool
4431       { \dim_set_eq:NN \l_@@_y_initial_dim \l_@@_y_final_dim }
4432     \bool_if:NT \l_@@_final_open_bool
4433       { \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim }
4434   }
4435   \@@_draw_line:
4436 }

4437 \cs_new_protected:Npn \@@_open_y_initial_dim:
4438 {
4439   \dim_set:Nn \l_@@_y_initial_dim { - \c_max_dim }
4440   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
4441   {
4442     \cs_if_exist:cT
4443       { pgf @ sh @ ns @ \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
4444       {
4445         \pgfpointanchor
4446           { \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
4447           { north }
4448         \dim_compare:nNnT \pgf@y > \l_@@_y_initial_dim
4449           { \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y }
4450       }
4451   }
4452   \dim_compare:nNnT \l_@@_y_initial_dim = { - \c_max_dim }
4453   {
4454     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
4455     \dim_set:Nn \l_@@_y_initial_dim
4456       {
4457         \fp_to_dim:n
4458           {
4459             \pgf@y
4460             + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch
4461           }
4462       }
4463   }
4464 }

```

```

4465 \cs_new_protected:Npn \l_@@_open_y_final_dim:
4466 {
4467   \dim_set_eq:NN \l_@@_y_final_dim \c_max_dim
4468   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
4469   {
4470     \cs_if_exist:cT
4471     { \pgf @ sh @ ns @ \@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
4472     {
4473       \pgfpointanchor
4474       { \@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
4475       { south }
4476       \dim_compare:nNnT \pgf@y < \l_@@_y_final_dim
4477       { \dim_set_eq:NN \l_@@_y_final_dim \pgf@y }
4478     }
4479   }
4480   \dim_compare:nNnT \l_@@_y_final_dim = \c_max_dim
4481   {
4482     \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
4483     \dim_set:Nn \l_@@_y_final_dim
4484     { \fp_to_dim:n { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch } }
4485   }
4486 }

```

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

4487 \cs_new_protected:Npn \@@_draw_Vdots:nnn #1 #2 #3
4488 {
4489   \@@_adjust_to_submatrix:nn { #1 } { #2 }
4490   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4491   {
4492     \@@_find_extremities_of_line:nnnn { #1 } { #2 } 1 0

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

4493   \group_begin:
4494   \@@_open_shorten:
4495   \int_if_zero:nTF { #2 }
4496   { \color { nicematrix-first-col } }
4497   {
4498     \int_compare:nNnT { #2 } = \l_@@_last_col_int
4499     { \color { nicematrix-last-col } }
4500   }
4501   \keys_set:nn { nicematrix / xdots } { #3 }
4502   \@@_color:o \l_@@_xdots_color_tl
4503   \@@_actually_draw_Vdots:
4504   \group_end:
4505 }
4506 }

```

The command `\@@_actually_draw_Vdots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool`.

The following function is also used by `\Vdotsfor`.

```

4507 \cs_new_protected:Npn \@@_actually_draw_Vdots:
4508 {

```

First, the case of a dotted line open on both sides.

```
4509     \bool_lazy_and:nnTF \l_@@_initial_open_bool \l_@@_final_open_bool
```

We have to determine the x -value of the vertical rule that we will have to draw.

```
4510     {
4511         \@@_open_y_initial_dim:
4512         \@@_open_y_final_dim:
4513         \int_if_zero:nTF \l_@@_initial_j_int
```

We have a dotted line open on both sides in the “first column”.

```
4514         {
4515             \@@_qpoint:n { col - 1 }
4516             \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4517             \dim_sub:Nn \l_@@_x_initial_dim \l_@@_left_margin_dim
4518             \dim_sub:Nn \l_@@_x_initial_dim \l_@@_extra_left_margin_dim
4519             \dim_sub:Nn \l_@@_x_initial_dim \c_@@_shift_exterior_Vdots_dim
4520         }
4521         {
4522             \bool_lazy_and:nnTF
4523             { \int_compare_p:nNn \l_@@_last_col_int > { -2 } }
4524             { \int_compare_p:nNn \l_@@_initial_j_int = \g_@@_col_total_int }
```

We have a dotted line open on both sides in the “last column”.

```
4525         {
4526             \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4527             \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4528             \dim_add:Nn \l_@@_x_initial_dim \l_@@_right_margin_dim
4529             \dim_add:Nn \l_@@_x_initial_dim \l_@@_extra_right_margin_dim
4530             \dim_add:Nn \l_@@_x_initial_dim \c_@@_shift_exterior_Vdots_dim
4531         }
```

We have a dotted line open on both sides which is *not* in an exterior column.

```
4532         {
4533             \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4534             \dim_set_eq:NN \l_tmpa_dim \pgf@x
4535             \@@_qpoint:n { col - \int_eval:n { \l_@@_initial_j_int + 1 } }
4536             \dim_set:Nn \l_@@_x_initial_dim { ( \pgf@x + \l_tmpa_dim ) / 2 }
4537         }
4538     }
4539 }
```

Now, the dotted line is *not* open on both sides (maybe open on only one side).

The boolean `\l_tmpa_bool` will indicate whether the column is of type 1 or may be considered as if.

```
4540     {
4541         \bool_set_false:N \l_tmpa_bool
4542         \bool_if:NF \l_@@_initial_open_bool
4543         {
4544             \bool_if:NF \l_@@_final_open_bool
4545             {
4546                 \@@_set_initial_coords_from_anchor:n { south-west }
4547                 \@@_set_final_coords_from_anchor:n { north-west }
4548                 \bool_set:Nn \l_tmpa_bool
4549                 { \dim_compare_p:nNn \l_@@_x_initial_dim = \l_@@_x_final_dim }
4550             }
4551         }
```

Now, we try to determine whether the column is of type c or may be considered as if.

```
4552     \bool_if:NTF \l_@@_initial_open_bool
4553     {
4554         \@@_open_y_initial_dim:
4555         \@@_set_final_coords_from_anchor:n { north }
4556         \dim_set_eq:NN \l_@@_x_initial_dim \l_@@_x_final_dim
4557     }
4558     {
4559         \@@_set_initial_coords_from_anchor:n { south }
4560         \bool_if:NTF \l_@@_final_open_bool
```

```
4561 \@@_open_y_final_dim:
```

Now the case where both extremities are closed. The first conditional tests whether the column is of type `c` or may be considered as if.

```
4562 {
4563   \@@_set_final_coords_from_anchor:n { north }
4564   \dim_compare:nNnF \l_@@_x_initial_dim = \l_@@_x_final_dim
4565   {
4566     \dim_set:Nn \l_@@_x_initial_dim
4567     {
4568       \bool_if:NTF \l_tmpa_bool \dim_min:nn \dim_max:nn
4569       \l_@@_x_initial_dim \l_@@_x_final_dim
4570     }
4571   }
4572 }
4573 }
4574 }
4575 \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
4576 \@@_draw_line:
4577 }
```

For the diagonal lines, the situation is a bit more complicated because, by default, we parallelize the diagonals lines. The first diagonal line is drawn and then, all the other diagonal lines are drawn parallel to the first one.

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```
4578 \cs_new_protected:Npn \@@_draw_Ddots:nmn #1 #2 #3
4579 {
4580   \@@_adjust_to_submatrix:nn { #1 } { #2 }
4581   \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4582   {
4583     \@@_find_extremities_of_line:nmmn { #1 } { #2 } 1 1
```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```
4584   \group_begin:
4585     \@@_open_shorten:
4586     \keys_set:nn { nicematrix / xdots } { #3 }
4587     \@@_color:o \l_@@_xdots_color_tl
4588     \@@_actually_draw_Ddots:
4589   \group_end:
4590 }
4591 }
```

The command `\@@_actually_draw_Ddots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool.`

```
4592 \cs_new_protected:Npn \@@_actually_draw_Ddots:
4593 {
4594   \bool_if:NTF \l_@@_initial_open_bool
4595   {
4596     \@@_open_y_initial_dim:
4597     \@@_open_x_initial_dim:
```

```

4598     }
4599     { \@@_set_initial_coords_from_anchor:n { south-east } }
4600 \bool_if:NTF \l_@@_final_open_bool
4601     {
4602     \@@_open_x_final_dim:
4603     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4604     }
4605     { \@@_set_final_coords_from_anchor:n { north-west } }

```

We have retrieved the coordinates in the usual way (they are stored in `\l_@@_x_initial_dim`, etc.). If the parallelization of the diagonals is set, we will have (maybe) to adjust the fourth coordinate.

```

4606     \bool_if:NT \l_@@_parallelize_diags_bool
4607     {
4608     \int_gincr:N \g_@@_ddots_int

```

We test if the diagonal line is the first one (the counter `\g_@@_ddots_int` is created for this usage).

```

4609     \int_compare:nNnTF \g_@@_ddots_int = \c_one_int

```

If the diagonal line is the first one, we have no adjustment of the line to do but we store the Δ_x and the Δ_y of the line because these values will be used to draw the others diagonal lines parallels to the first one.

```

4610     {
4611     \dim_gset:Nn \g_@@_delta_x_one_dim
4612     { \l_@@_x_final_dim - \l_@@_x_initial_dim }
4613     \dim_gset:Nn \g_@@_delta_y_one_dim
4614     { \l_@@_y_final_dim - \l_@@_y_initial_dim }
4615     }

```

If the diagonal line is not the first one, we have to adjust the second extremity of the line by modifying the coordinate `\l_@@_x_initial_dim`.

```

4616     {
4617     \dim_compare:nNnF \g_@@_delta_x_one_dim = \c_zero_dim
4618     {
4619     \dim_set:Nn \l_@@_y_final_dim
4620     {
4621     \l_@@_y_initial_dim +
4622     ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4623     \dim_ratio:nn \g_@@_delta_y_one_dim \g_@@_delta_x_one_dim
4624     }
4625     }
4626     }
4627 }
4628 \@@_draw_line:
4629 }

```

We draw the `\Iddots` diagonals in the same way.

The first and the second arguments are the coordinates of the cell where the command has been issued. The third argument is the list of the options.

```

4630 \cs_new_protected:Npn \@@_draw_Iddots:nnn #1 #2 #3
4631 {
4632 \@@_adjust_to_submatrix:nn { #1 } { #2 }
4633 \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4634 {
4635 \@@_find_extremities_of_line:nmmm { #1 } { #2 } 1 { -1 }

```

The previous command may have changed the current environment by marking some cells as “dotted”, but, fortunately, it is outside the group for the options of the line.

```

4636 \group_begin:
4637 \@@_open_shorten:
4638 \keys_set:nn { nicematrix / xdots } { #3 }
4639 \@@_color:o \l_@@_xdots_color_tl
4640 \@@_actually_draw_Iddots:
4641 \group_end:
4642 }
4643 }

```

The command `\@@_actually_draw_Iddots:` has the following implicit arguments:

- `\l_@@_initial_i_int`
- `\l_@@_initial_j_int`
- `\l_@@_initial_open_bool`
- `\l_@@_final_i_int`
- `\l_@@_final_j_int`
- `\l_@@_final_open_bool.`

```

4644 \cs_new_protected:Npn \@@_actually_draw_Iddots:
4645   {
4646     \bool_if:NTF \l_@@_initial_open_bool
4647       {
4648         \@@_open_y_initial_dim:
4649         \@@_open_x_initial_dim:
4650       }
4651     { \@@_set_initial_coords_from_anchor:n { south-west } }
4652   \bool_if:NTF \l_@@_final_open_bool
4653     {
4654       \@@_open_y_final_dim:
4655       \@@_open_x_final_dim:
4656     }
4657   { \@@_set_final_coords_from_anchor:n { north-east } }
4658   \bool_if:NT \l_@@_parallelize_diags_bool
4659     {
4660       \int_gincr:N \g_@@_iddots_int
4661       \int_compare:nNnTF \g_@@_iddots_int = \c_one_int
4662         {
4663           \dim_gset:Nn \g_@@_delta_x_two_dim
4664             { \l_@@_x_final_dim - \l_@@_x_initial_dim }
4665           \dim_gset:Nn \g_@@_delta_y_two_dim
4666             { \l_@@_y_final_dim - \l_@@_y_initial_dim }
4667         }
4668         {
4669           \dim_compare:nNnF \g_@@_delta_x_two_dim = \c_zero_dim
4670             {
4671               \dim_set:Nn \l_@@_y_final_dim
4672                 {
4673                   \l_@@_y_initial_dim +
4674                   ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4675                   \dim_ratio:nn \g_@@_delta_y_two_dim \g_@@_delta_x_two_dim
4676                 }
4677             }
4678         }
4679     }
4680   \@@_draw_line:
4681 }

```

17 The actual instructions for drawing the dotted lines with Tikz

The command `\@@_draw_line:` should be used in a `{pgfpicture}`. It has six implicit arguments:

- `\l_@@_x_initial_dim`

- `\l_@@_y_initial_dim`
- `\l_@@_x_final_dim`
- `\l_@@_y_final_dim`
- `\l_@@_initial_open_bool`
- `\l_@@_final_open_bool`

```

4682 \cs_new_protected:Npn \@@_draw_line:
4683 {
4684   \pgfrememberpicturepositiononpagetrue
4685   \pgf@relevantforpicturesizefalse
4686   \bool_lazy_or:nnTF
4687     { \tl_if_eq_p:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl }
4688     \l_@@_dotted_bool
4689     \@@_draw_standard_dotted_line:
4690     \@@_draw_unstandard_dotted_line:
4691 }

```

We have to do a special construction with `\exp_args:No` to be able to put in the list of options in the correct place in the Tikz instruction.

```

4692 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:
4693 {
4694   \begin { scope }
4695     \@@_draw_unstandard_dotted_line:o
4696     { \l_@@_xdots_line_style_tl , \l_@@_xdots_color_tl }
4697 }

```

We have used the fact that, in PGF, un color name can be put directly in a list of options (that's why we have put directly `\l_@@_xdots_color_tl`).

The argument of `\@@_draw_unstandard_dotted_line:n` is, in fact, the list of options.

```

4698 \cs_generate_variant:Nn \@@_draw_unstandard_dotted_line:n { o }
4699 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:n #1
4700 {
4701   \@@_draw_unstandard_dotted_line:nooo
4702   { #1 }
4703   \l_@@_xdots_up_tl
4704   \l_@@_xdots_down_tl
4705   \l_@@_xdots_middle_tl
4706 }

```

The following Tikz styles are for the three labels (set by the symbols `_`, `^` and `=`) of a continuous line with a non-standard style.

```

4707 \hook_gput_code:nnn { begindocument } { . }
4708 {
4709   \IfPackageLoadedT { tikz }
4710   {
4711     \tikzset
4712     {
4713       @@_node_above / .style = { sloped , above } ,
4714       @@_node_below / .style = { sloped , below } ,
4715       @@_node_middle / .style =
4716       {
4717         sloped ,
4718         inner~sep = \c_@@_innersep_middle_dim
4719       }
4720     }
4721   }
4722 }

```

```

4723 \cs_generate_variant:Nn \@@_draw_unstandard_dotted_line:nmmn { n o o o }
4724 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:nmmn #1 #2 #3 #4
4725 {

```

We take into account the parameters `xdots/shorten-start` and `xdots/shorten-end` “by hand” because, when we use the key `shorten >` and `shorten <` of TikZ in the command `\draw`, we don’t have the expected output with `{decorate,decoration=brace}` is used.

The dimension `\l_@@_l_dim` is the length ℓ of the line to draw. We use the floating point reals of the L3 programming layer to compute this length.

```

4726 \dim_zero_new:N \l_@@_l_dim
4727 \dim_set:Nn \l_@@_l_dim
4728 {
4729 \fp_to_dim:n
4730 {
4731 sqrt
4732 (
4733 (\l_@@_x_final_dim - \l_@@_x_initial_dim) ^ 2
4734 +
4735 (\l_@@_y_final_dim - \l_@@_y_initial_dim) ^ 2
4736 )
4737 }
4738 }

```

It seems that, during the first compilations, the value of `\l_@@_l_dim` may be erroneous (equal to zero or very large). We must detect these cases because they would cause errors during the drawing of the dotted line. Maybe we should also write something in the aux file to say that one more compilation should be done.

```

4739 \dim_compare:nNnT \l_@@_l_dim < \c_@@_max_l_dim
4740 {
4741 \dim_compare:nNnT \l_@@_l_dim > { 1 pt }
4742 \@@_draw_unstandard_dotted_line_i:
4743 }

```

If the key `xdots/horizontal-labels` has been used.

```

4744 \bool_if:NT \l_@@_xdots_h_labels_bool
4745 {
4746 \tikzset
4747 {
4748 @@_node_above / .style = { auto = left } ,
4749 @@_node_below / .style = { auto = right } ,
4750 @@_node_middle / .style = { inner~sep = \c_@@_innersep_middle_dim }
4751 }
4752 }
4753 \tl_if_empty:nF { #4 }
4754 { \tikzset { @@_node_middle / .append~style = { fill = white } } }
4755 \draw
4756 [ #1 ]
4757 ( \l_@@_x_initial_dim , \l_@@_y_initial_dim )

```

Be careful: We can’t put `\c_math_toggle_token` instead of `$` in the following lines because we are in the contents of Tikz nodes (and they will be *rescanned* if the Tikz library `babel` is loaded).

```

4758 -- node [ @@_node_middle ] { $ \scriptstyle #4 $ }
4759 node [ @@_node_below ] { $ \scriptstyle #3 $ }
4760 node [ @@_node_above ] { $ \scriptstyle #2 $ }
4761 ( \l_@@_x_final_dim , \l_@@_y_final_dim ) ;
4762 \end { scope }
4763 }
4764 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line_i:
4765 {
4766 \dim_set:Nn \l_tmpa_dim
4767 {
4768 \l_@@_x_initial_dim
4769 + ( \l_@@_x_final_dim - \l_@@_x_initial_dim )

```

```

4770     * \dim_ratio:nn \l_@@_xdots_shorten_start_dim \l_@@_l_dim
4771   }
4772 \dim_set:Nn \l_tmpb_dim
4773 {
4774   \l_@@_y_initial_dim
4775   + ( \l_@@_y_final_dim - \l_@@_y_initial_dim )
4776   * \dim_ratio:nn \l_@@_xdots_shorten_start_dim \l_@@_l_dim
4777 }
4778 \dim_set:Nn \l_@@_tmpc_dim
4779 {
4780   \l_@@_x_final_dim
4781   - ( \l_@@_x_final_dim - \l_@@_x_initial_dim )
4782   * \dim_ratio:nn \l_@@_xdots_shorten_end_dim \l_@@_l_dim
4783 }
4784 \dim_set:Nn \l_@@_tmpd_dim
4785 {
4786   \l_@@_y_final_dim
4787   - ( \l_@@_y_final_dim - \l_@@_y_initial_dim )
4788   * \dim_ratio:nn \l_@@_xdots_shorten_end_dim \l_@@_l_dim
4789 }
4790 \dim_set_eq:NN \l_@@_x_initial_dim \l_tmpa_dim
4791 \dim_set_eq:NN \l_@@_y_initial_dim \l_tmpb_dim
4792 \dim_set_eq:NN \l_@@_x_final_dim \l_@@_tmpc_dim
4793 \dim_set_eq:NN \l_@@_y_final_dim \l_@@_tmpd_dim
4794 }

```

The command `\@@_draw_standard_dotted_line:` draws the line with our system of dots (which gives a dotted line with real rounded dots).

```

4795 \cs_new_protected:Npn \@@_draw_standard_dotted_line:
4796 {
4797   \group_begin:

```

The dimension `\l_@@_l_dim` is the length ℓ of the line to draw. We use the floating point reals of the L3 programming layer to compute this length.

```

4798   \dim_zero_new:N \l_@@_l_dim
4799   \dim_set:Nn \l_@@_l_dim
4800   {
4801     \fp_to_dim:n
4802     {
4803       sqrt
4804       (
4805         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
4806         +
4807         ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
4808       )
4809     }
4810   }

```

It seems that, during the first compilations, the value of `\l_@@_l_dim` may be erroneous (equal to zero or very large). We must detect these cases because they would cause errors during the drawing of the dotted line. Maybe we should also write something in the aux file to say that one more compilation should be done.

```

4811   \dim_compare:nNnT \l_@@_l_dim < \c_@@_max_l_dim
4812   {
4813     \dim_compare:nNnT \l_@@_l_dim > { 1 pt }
4814     \@@_draw_standard_dotted_line_i:
4815   }
4816 \group_end:
4817 \bool_lazy_all:nF
4818 {
4819   { \tl_if_empty_p:N \l_@@_xdots_up_tl }
4820   { \tl_if_empty_p:N \l_@@_xdots_down_tl }
4821   { \tl_if_empty_p:N \l_@@_xdots_middle_tl }

```

```

4822     }
4823     \l_@@_labels_standard_dotted_line:
4824 }
4825 \dim_const:Nn \c_@@_max_l_dim { 50 cm }
4826 \cs_new_protected:Npn \@@_draw_standard_dotted_line_i:
4827 {

```

The number of dots will be $\l_1\text{tmpa_int} + 1$.

```

4828     \int_set:Nn \l_1tmpa_int
4829     {
4830         \dim_ratio:nn
4831         {
4832             \l_@@_l_dim
4833             - \l_@@_xdots_shorten_start_dim
4834             - \l_@@_xdots_shorten_end_dim
4835         }
4836         \l_@@_xdots_inter_dim
4837     }

```

The dimensions $\l_1\text{tmpa_dim}$ and $\l_1\text{tmpb_dim}$ are the coordinates of the vector between two dots in the dotted line.

```

4838     \dim_set:Nn \l_1tmpa_dim
4839     {
4840         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4841         \dim_ratio:nn \l_@@_xdots_inter_dim \l_@@_l_dim
4842     }
4843     \dim_set:Nn \l_1tmpb_dim
4844     {
4845         ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
4846         \dim_ratio:nn \l_@@_xdots_inter_dim \l_@@_l_dim
4847     }

```

In the loop over the dots, the dimensions $\l_1\text{@@_x_initial_dim}$ and $\l_1\text{@@_y_initial_dim}$ will be used for the coordinates of the dots. But, before the loop, we must move until the first dot.

```

4848     \dim_gadd:Nn \l_@@_x_initial_dim
4849     {
4850         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4851         \dim_ratio:nn
4852         {
4853             \l_@@_l_dim - \l_@@_xdots_inter_dim * \l_1tmpa_int
4854             + \l_@@_xdots_shorten_start_dim - \l_@@_xdots_shorten_end_dim
4855         }
4856         { 2 \l_@@_l_dim }
4857     }
4858     \dim_gadd:Nn \l_@@_y_initial_dim
4859     {
4860         ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) *
4861         \dim_ratio:nn
4862         {
4863             \l_@@_l_dim - \l_@@_xdots_inter_dim * \l_1tmpa_int
4864             + \l_@@_xdots_shorten_start_dim - \l_@@_xdots_shorten_end_dim
4865         }
4866         { 2 \l_@@_l_dim }
4867     }
4868     \pgf@relevantforpicturesizefalse
4869     \int_step_inline:nnn \c_zero_int \l_1tmpa_int
4870     {
4871         \pgfpathcircle
4872         { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
4873         { \l_@@_xdots_radius_dim }
4874         \dim_add:Nn \l_@@_x_initial_dim \l_1tmpa_dim
4875         \dim_add:Nn \l_@@_y_initial_dim \l_1tmpb_dim
4876     }

```

```

4877   \pgfusepathqfill
4878 }

4879 \cs_new_protected:Npn \l_@@_labels_standard_dotted_line:
4880 {
4881   \pgfscope
4882   \pgftransformshift
4883   {
4884     \pgfpointlineattime { 0.5 }
4885     { \pgfpoint \l_@@_x_initial_dim \l_@@_y_initial_dim }
4886     { \pgfpoint \l_@@_x_final_dim \l_@@_y_final_dim }
4887   }
4888   \fp_set:Nn \l_tmpa_fp
4889   {
4890     atand
4891     (
4892       \l_@@_y_final_dim - \l_@@_y_initial_dim ,
4893       \l_@@_x_final_dim - \l_@@_x_initial_dim
4894     )
4895   }
4896   \pgftransformrotate { \fp_use:N \l_tmpa_fp }
4897   \bool_if:NF \l_@@_xdots_h_labels_bool { \fp_zero:N \l_tmpa_fp }
4898   \tl_if_empty:NF \l_@@_xdots_middle_tl
4899   {
4900     \begin { pgfscope }
4901     \pgfset { inner~sep = \c_@@_innersep_middle_dim }
4902     \pgfnode
4903     { rectangle }
4904     { center }
4905     {
4906       \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4907       {
4908         \c_math_toggle_token
4909         \scriptstyle \l_@@_xdots_middle_tl
4910         \c_math_toggle_token
4911       }
4912     }
4913     { }
4914     {
4915       \pgfsetfillcolor { white }
4916       \pgfusepath { fill }
4917     }
4918     \end { pgfscope }
4919   }
4920   \tl_if_empty:NF \l_@@_xdots_up_tl
4921   {
4922     \pgfnode
4923     { rectangle }
4924     { south }
4925     {
4926       \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4927       {
4928         \c_math_toggle_token
4929         \scriptstyle \l_@@_xdots_up_tl
4930         \c_math_toggle_token
4931       }
4932     }
4933     { }
4934     { \pgfusepath { } }
4935   }
4936   \tl_if_empty:NF \l_@@_xdots_down_tl
4937   {
4938     \pgfnode

```

```

4939     { rectangle }
4940     { north }
4941     {
4942       \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4943       {
4944         \c_math_toggle_token
4945         \scriptstyle \l_@@_xdots_down_tl
4946         \c_math_toggle_token
4947       }
4948     }
4949     { }
4950     { \pgfusepath { } }
4951   }
4952 \endpgfscope
4953 }

```

18 User commands available in the new environments

The commands `\@@_Ldots`, `\@@_Cdots`, `\@@_Vdots`, `\@@_Ddots` and `\@@_Iddots` will be linked to `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots` and `\Iddots` in the environments `{NiceArray}` (the other environments of `nicematrix` rely upon `{NiceArray}`).

The syntax of these commands uses the character `_` as embellishment and that's why we have to insert a character `_` in the *arg spec* of these commands. However, we don't know the future catcode of `_` in the main document (maybe the user will use `underscore`, and, in that case, the catcode is 13 because `underscore` activates `_`). That's why these commands will be defined in a `\hook_gput_code:nnn { begindocument } { . }` and the *arg spec* will be rescanned.

```

4954 \hook_gput_code:nnn { begindocument } { . }
4955 {
4956   \cs_set_nopar:Npn \l_@@_argspec_tl { m E { _ ^ : } { { } { } { } } }
4957   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
4958   \cs_new_protected:Npn \@@_Ldots
4959     { \@@_collect_options:n { \@@_Ldots_i } }
4960   \exp_args:NNo \NewDocumentCommand \@@_Ldots_i \l_@@_argspec_tl
4961     {
4962       \int_if_zero:nTF \c@jCol
4963       { \@@_error:nn { in~first~col } \Ldots }
4964       {
4965         \int_compare:nNnTF \c@jCol = \l_@@_last_col_int
4966         { \@@_error:nn { in~last~col } \Ldots }
4967         {
4968           \@@_instruction_of_type:nnn \c_false_bool { Ldots }
4969           { #1 , down = #2 , up = #3 , middle = #4 }
4970         }
4971       }
4972       \bool_if:NF \l_@@_nullify_dots_bool
4973       { \phantom { \ensuremath { \@@_old_ldots } } }
4974       \bool_gset_true:N \g_@@_empty_cell_bool
4975     }

4976   \cs_new_protected:Npn \@@_Cdots
4977     { \@@_collect_options:n { \@@_Cdots_i } }
4978   \exp_args:NNo \NewDocumentCommand \@@_Cdots_i \l_@@_argspec_tl
4979     {
4980       \int_if_zero:nTF \c@jCol
4981       { \@@_error:nn { in~first~col } \Cdots }
4982       {
4983         \int_compare:nNnTF \c@jCol = \l_@@_last_col_int

```

```

4984         { \@@_error:nn { in~last~col } \Cdots }
4985         {
4986             \@@_instruction_of_type:nnn \c_false_bool { Cdots }
4987             { #1 , down = #2 , up = #3 , middle = #4 }
4988         }
4989     }
4990     \bool_if:NF \l_@@_nullify_dots_bool
4991     { \phantom { \ensuremath { \@@_old_cdots } } }
4992     \bool_gset_true:N \g_@@_empty_cell_bool
4993 }

4994 \cs_new_protected:Npn \@@_Vdots
4995 { \@@_collect_options:n { \@@_Vdots_i } }
4996 \exp_args:NNo \NewDocumentCommand \@@_Vdots_i \l_@@_argspec_tl
4997 {
4998     \int_if_zero:nTF \c@iRow
4999     { \@@_error:nn { in~first~row } \Vdots }
5000     {
5001         \int_compare:nNnTF \c@iRow = \l_@@_last_row_int
5002         { \@@_error:nn { in~last~row } \Vdots }
5003         {
5004             \@@_instruction_of_type:nnn \c_false_bool { Vdots }
5005             { #1 , down = #2 , up = #3 , middle = #4 }
5006         }
5007     }
5008     \bool_if:NF \l_@@_nullify_dots_bool
5009     { \phantom { \ensuremath { \@@_old_vdots } } }
5010     \bool_gset_true:N \g_@@_empty_cell_bool
5011 }

5012 \cs_new_protected:Npn \@@_Ddots
5013 { \@@_collect_options:n { \@@_Ddots_i } }
5014 \exp_args:NNo \NewDocumentCommand \@@_Ddots_i \l_@@_argspec_tl
5015 {
5016     \int_case:nnF \c@iRow
5017     {
5018         0 { \@@_error:nn { in~first~row } \Ddots }
5019         \l_@@_last_row_int { \@@_error:nn { in~last~row } \Ddots }
5020     }
5021     {
5022         \int_case:nnF \c@jCol
5023         {
5024             0 { \@@_error:nn { in~first~col } \Ddots }
5025             \l_@@_last_col_int { \@@_error:nn { in~last~col } \Ddots }
5026         }
5027         {
5028             \keys_set_known:nn { nicematrix / Ddots } { #1 }
5029             \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Ddots }
5030             { #1 , down = #2 , up = #3 , middle = #4 }
5031         }
5032     }
5033 }
5034 \bool_if:NF \l_@@_nullify_dots_bool
5035 { \phantom { \ensuremath { \@@_old_ddots } } }
5036 \bool_gset_true:N \g_@@_empty_cell_bool
5037 }

5038 \cs_new_protected:Npn \@@_Iddots
5039 { \@@_collect_options:n { \@@_Iddots_i } }
5040 \exp_args:NNo \NewDocumentCommand \@@_Iddots_i \l_@@_argspec_tl
5041 {

```

```

5042     \int_case:nnF \c@iRow
5043     {
5044         0           { \@@_error:nn { in~first~row } \Iddots }
5045         \l_@@_last_row_int { \@@_error:nn { in~last~row } \Iddots }
5046     }
5047     {
5048         \int_case:nnF \c@jCol
5049         {
5050             0           { \@@_error:nn { in~first~col } \Iddots }
5051             \l_@@_last_col_int { \@@_error:nn { in~last~col } \Iddots }
5052         }
5053         {
5054             \keys_set_known:nn { nicematrix / Ddots } { #1 }
5055             \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Iddots }
5056             { #1 , down = #2 , up = #3 , middle = #4 }
5057         }
5058     }
5059     \bool_if:NF \l_@@_nullify_dots_bool
5060     { \phantom { \ensuremath { \@@_old_iddots } } }
5061     \bool_gset_true:N \g_@@_empty_cell_bool
5062 }
5063 }

```

End of the `\AddToHook`.

Despite its name, the following set of keys will be used for `\Ddots` but also for `\Iddots`.

```

5064 \keys_define:nn { nicematrix / Ddots }
5065 {
5066     draw-first .bool_set:N = \l_@@_draw_first_bool ,
5067     draw-first .default:n = true ,
5068     draw-first .value_forbidden:n = true
5069 }

```

The command `\@@_Hspace:` will be linked to `\hspace` in `{NiceArray}`.

```

5070 \cs_new_protected:Npn \@@_Hspace:
5071 {
5072     \bool_gset_true:N \g_@@_empty_cell_bool
5073     \hspace
5074 }

```

In the environments of `nicematrix`, the command `\multicolumn` is redefined. We will patch the environment `{tabular}` to go back to the previous value of `\multicolumn`.

```

5075 \cs_set_eq:NN \@@_old_multicolumn \multicolumn

```

The command `\@@_Hdotsfor` will be linked to `\Hdotsfor` in `{NiceArrayWithDelims}`. Tikz nodes are created also in the implicit cells of the `\Hdotsfor` (maybe we should modify that point).

This command must *not* be protected since it begins with `\multicolumn`.

```

5076 \cs_new:Npn \@@_Hdotsfor:
5077 {
5078     \bool_lazy_and:nnTF
5079     { \int_if_zero_p:n \c@jCol }
5080     { \int_if_zero_p:n \l_@@_first_col_int }
5081     {
5082         \bool_if:NTF \g_@@_after_col_zero_bool
5083         {
5084             \multicolumn { 1 } { c } { }
5085             \@@_Hdotsfor_i
5086         }
5087         { \@@_fatal:n { Hdotsfor~in~col~0 } }
5088     }
5089 }

```

```

5090     \multicolumn { 1 } { c } { }
5091     \@@_Hdotsfor_i
5092   }
5093 }

```

The command `\@@_Hdotsfor_i` is defined with `\NewDocumentCommand` because it has an optional argument. Note that such a command defined by `\NewDocumentCommand` is protected and that's why we have put the `\multicolumn` before (in the definition of `\@@_Hdotsfor:`).

```

5094 \hook_gput_code:nnn { begindocument } { . }
5095 {
5096   \cs_set_nopar:Npn \l_@@_argspec_tl { m m 0 { } E { _ ^ : } { { } { } { } } }
5097   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl

```

We don't put `!` before the last optional argument for homogeneity with `\Cdots`, etc. which have only one optional argument.

```

5098   \cs_new_protected:Npn \@@_Hdotsfor_i
5099     { \@@_collect_options:n { \@@_Hdotsfor_ii } }
5100   \exp_args:NNno \NewDocumentCommand \@@_Hdotsfor_ii \l_@@_argspec_tl
5101     {
5102       \tl_gput_right:Ne \g_@@_HVdotsfor_lines_tl
5103       {
5104         \@@_Hdotsfor:nnnn
5105         { \int_use:N \c@iRow }
5106         { \int_use:N \c@jCol }
5107         { #2 }
5108         {
5109           #1 , #3 ,
5110           down = \exp_not:n { #4 } ,
5111           up = \exp_not:n { #5 } ,
5112           middle = \exp_not:n { #6 }
5113         }
5114       }
5115       \prg_replicate:nn { #2 - 1 }
5116       {
5117         &
5118         \multicolumn { 1 } { c } { }
5119         \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:
5120       }
5121     }
5122 }

```

```

5123 \cs_new_protected:Npn \@@_Hdotsfor:nnnn #1 #2 #3 #4
5124 {
5125   \bool_set_false:N \l_@@_initial_open_bool
5126   \bool_set_false:N \l_@@_final_open_bool

```

For the row, it's easy.

```

5127   \int_set:Nn \l_@@_initial_i_int { #1 }
5128   \int_set_eq:NN \l_@@_final_i_int \l_@@_initial_i_int

```

For the column, it's a bit more complicated.

```

5129   \int_compare:nNnTF { #2 } = \c_one_int
5130     {
5131       \int_set_eq:NN \l_@@_initial_j_int \c_one_int
5132       \bool_set_true:N \l_@@_initial_open_bool
5133     }
5134     {
5135       \cs_if_exist:cTF
5136         {
5137           pgf @ sh @ ns @ \@@_env:
5138           - \int_use:N \l_@@_initial_i_int
5139           - \int_eval:n { #2 - 1 }
5140         }
5141         { \int_set:Nn \l_@@_initial_j_int { #2 - 1 } }
5142         {

```

```

5143         \int_set:Nn \l_@@_initial_j_int { #2 }
5144         \bool_set_true:N \l_@@_initial_open_bool
5145     }
5146 }
5147 \int_compare:nNnTF { #2 + #3 - 1 } = \c@jCol
5148 {
5149     \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
5150     \bool_set_true:N \l_@@_final_open_bool
5151 }
5152 {
5153     \cs_if_exist:cTF
5154     {
5155         pgf @ sh @ ns @ \@@_env:
5156         - \int_use:N \l_@@_final_i_int
5157         - \int_eval:n { #2 + #3 }
5158     }
5159     { \int_set:Nn \l_@@_final_j_int { #2 + #3 } }
5160     {
5161         \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
5162         \bool_set_true:N \l_@@_final_open_bool
5163     }
5164 }
5165 \group_begin:
5166 \@@_open_shorten:
5167 \int_if_zero:nTF { #1 }
5168 { \color { nicematrix-first-row } }
5169 {
5170     \int_compare:nNnT { #1 } = \g_@@_row_total_int
5171     { \color { nicematrix-last-row } }
5172 }
5173
5174 \keys_set:nn { nicematrix / xdots } { #4 }
5175 \@@_color:o \l_@@_xdots_color_tl
5176 \@@_actually_draw_Ldots:
5177 \group_end:

```

We declare all the cells concerned by the `\Hdotsfor` as “dotted” (for the dotted lines created by `\Cdots`, `\Ldots`, etc., this job is done by `\@@_find_extremities_of_line:nnnn`). This declaration is done by defining a special control sequence (to nil).

```

5178     \int_step_inline:nnn { #2 } { #2 + #3 - 1 }
5179     { \cs_set_nopar:cpn { @@ _ dotted _ #1 - ##1 } { } }
5180 }

5181 \hook_gput_code:nnn { begindocument } { . }
5182 {
5183     \cs_set_nopar:Npn \l_@@_argspec_tl { m m 0 { } E { _ ^ : } { { } { } { } } }
5184     \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
5185     \cs_new_protected:Npn \@@_Vdotsfor:
5186     { \@@_collect_options:n { \@@_Vdotsfor_i } }
5187     \exp_args:NNNo \NewDocumentCommand \@@_Vdotsfor_i \l_@@_argspec_tl
5188     {
5189         \bool_gset_true:N \g_@@_empty_cell_bool
5190         \tl_gput_right:Ne \g_@@_HVdotsfor_lines_tl
5191         {
5192             \@@_Vdotsfor:nnnn
5193             { \int_use:N \c@iRow }
5194             { \int_use:N \c@jCol }
5195             { #2 }
5196             {
5197                 #1 , #3 ,
5198                 down = \exp_not:n { #4 } ,
5199                 up = \exp_not:n { #5 } ,

```

```

5200         middle = \exp_not:n { #6 }
5201     }
5202 }
5203 }
5204 }

```

```

5205 \cs_new_protected:Npn \l_@@_Vdotsfor:nmmn #1 #2 #3 #4
5206 {
5207     \bool_set_false:N \l_@@_initial_open_bool
5208     \bool_set_false:N \l_@@_final_open_bool

```

For the column, it's easy.

```

5209     \int_set:Nn \l_@@_initial_j_int { #2 }
5210     \int_set_eq:NN \l_@@_final_j_int \l_@@_initial_j_int

```

For the row, it's a bit more complicated.

```

5211     \int_compare:nNnTF { #1 } = \c_one_int
5212     {
5213         \int_set_eq:NN \l_@@_initial_i_int \c_one_int
5214         \bool_set_true:N \l_@@_initial_open_bool
5215     }
5216     {
5217         \cs_if_exist:cTF
5218         {
5219             pgf @ sh @ ns @ \l_@@_env:
5220             - \int_eval:n { #1 - 1 }
5221             - \int_use:N \l_@@_initial_j_int
5222         }
5223         { \int_set:Nn \l_@@_initial_i_int { #1 - 1 } }
5224         {
5225             \int_set:Nn \l_@@_initial_i_int { #1 }
5226             \bool_set_true:N \l_@@_initial_open_bool
5227         }
5228     }
5229     \int_compare:nNnTF { #1 + #3 - 1 } = \c_iRow
5230     {
5231         \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
5232         \bool_set_true:N \l_@@_final_open_bool
5233     }
5234     {
5235         \cs_if_exist:cTF
5236         {
5237             pgf @ sh @ ns @ \l_@@_env:
5238             - \int_eval:n { #1 + #3 }
5239             - \int_use:N \l_@@_final_j_int
5240         }
5241         { \int_set:Nn \l_@@_final_i_int { #1 + #3 } }
5242         {
5243             \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
5244             \bool_set_true:N \l_@@_final_open_bool
5245         }
5246     }
5247     \group_begin:
5248     \l_@@_open_shorten:
5249     \int_if_zero:nTF { #2 }
5250     { \color { nicematrix-first-col } }
5251     {
5252         \int_compare:nNnT { #2 } = \g_@@_col_total_int
5253         { \color { nicematrix-last-col } }
5254     }
5255     \keys_set:nn { nicematrix / xdots } { #4 }
5256     \l_@@_color:o \l_@@_xdots_color_tl
5257     \l_@@_actually_draw_Vdots:
5258     \group_end:

```

We declare all the cells concerned by the `\Vdotsfor` as “dotted” (for the dotted lines created by `\Cdots`, `\Ldots`, etc., this job is done by `\@@_find_extremities_of_line:nnnn`). This declaration is done by defining a special control sequence (to nil).

```

5259 \int_step_inline:nnn { #1 } { #1 + #3 - 1 }
5260   { \cs_set_nopar:cpn { @@ _ dotted _ ##1 - #2 } { } }
5261 }

```

The command `\@@_rotate:` will be linked to `\rotate` in `{NiceArrayWithDelims}`.

```

5262 \NewDocumentCommand \@@_rotate: { 0 { } }
5263 {
5264   \peek_remove_spaces:n
5265   {
5266     \bool_gset_true:N \g_@@_rotate_bool
5267     \keys_set:nn { nicematrix / rotate } { #1 }
5268   }
5269 }

5270 \keys_define:nn { nicematrix / rotate }
5271 {
5272   c .code:n = \bool_gset_true:N \g_@@_rotate_c_bool ,
5273   c .value_forbidden:n = true ,
5274   unknown .code:n = \@@_error:n { Unknown~key~for~rotate }
5275 }

```

19 The command `\line` accessible in code-after

In the `\CodeAfter`, the command `\@@_line:nn` will be linked to `\line`. This command takes two arguments which are the specifications of two cells in the array (in the format $i-j$) and draws a dotted line between these cells. In fact, it also works with names of blocks.

First, we write a command with the following behaviour:

- If the argument is of the format $i-j$, our command applies the command `\int_eval:n` to i and j ;
- If not (that is to say, when it’s a name of a `\Block`), the argument is left unchanged.

This must *not* be protected (and is, of course fully expandable).¹³

```

5276 \cs_new:Npn \@@_double_int_eval:n #1-#2 \q_stop
5277 {
5278   \tl_if_empty:nTF { #2 }
5279   { #1 }
5280   { \@@_double_int_eval_i:n #1-#2 \q_stop }
5281 }
5282 \cs_new:Npn \@@_double_int_eval_i:n #1-#2- \q_stop
5283 { \int_eval:n { #1 } - \int_eval:n { #2 } }

```

With the following construction, the command `\@@_double_int_eval:n` is applied to both arguments before the application of `\@@_line_i:nn` (the construction uses the fact the `\@@_line_i:nn` is protected and that `\@@_double_int_eval:n` is fully expandable).

```

5284 \hook_gput_code:nnn { begindocument } { . }
5285 {

```

¹³Indeed, we want that the user may use the command `\line` in `\CodeAfter` with LaTeX counters in the arguments — with the command `\value`.

```

5286 \cs_set_nopar:Npn \l_@@_argspec_tl
5287   { 0 { } m m ! 0 { } E { _ ^ : } { { } { } { } } }
5288 \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
5289 \exp_args:NNo \NewDocumentCommand \@@_line \l_@@_argspec_tl
5290   {
5291     \group_begin:
5292     \keys_set:nn { nicematrix / xdots } { #1 , #4 , down = #5 , up = #6 }
5293     \@@_color:o \l_@@_xdots_color_tl
5294     \use:e
5295     {
5296       \@@_line_i:nn
5297       { \@@_double_int_eval:n #2 - \q_stop }
5298       { \@@_double_int_eval:n #3 - \q_stop }
5299     }
5300     \group_end:
5301   }
5302 }

5303 \cs_new_protected:Npn \@@_line_i:nn #1 #2
5304   {
5305     \bool_set_false:N \l_@@_initial_open_bool
5306     \bool_set_false:N \l_@@_final_open_bool
5307     \bool_lazy_or:nnTF
5308       { \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #1 } }
5309       { \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #2 } }
5310     { \@@_error:nnn { unknown~cell~for~line~in~CodeAfter } { #1 } { #2 } }

```

The test of `measuring@` is a security (cf. question 686649 on TeX StackExchange).

```

5311   { \legacy_if:nF { measuring@ } { \@@_draw_line_ii:nn { #1 } { #2 } } }
5312 }

5313 \hook_gput_code:nnn { begindocument } { . }
5314 {
5315   \cs_new_protected:Npe \@@_draw_line_ii:nn #1 #2
5316   {

```

We recall that, when externalization is used, `\tikzpicture` and `\endtikzpicture` (or `\pgfpicture` and `\endpgfpicture`) must be directly “visible” and that why we do this static construction of the command `\@@_draw_line_ii:.`

```

5317     \c_@@_pgfortikzpicture_tl
5318     \@@_draw_line_iii:nn { #1 } { #2 }
5319     \c_@@_endpgfortikzpicture_tl
5320   }
5321 }

```

The following command *must* be protected (it’s used in the construction of `\@@_draw_line_ii:nn`).

```

5322 \cs_new_protected:Npn \@@_draw_line_iii:nn #1 #2
5323   {
5324     \pgfrememberpicturepositiononpagetrue
5325     \pgfpointshapeborder { \@@_env: - #1 } { \@@_qpoint:n { #2 } }
5326     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
5327     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
5328     \pgfpointshapeborder { \@@_env: - #2 } { \@@_qpoint:n { #1 } }
5329     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
5330     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
5331     \@@_draw_line:
5332   }

```

The commands `\Ldots`, `\Cdots`, `\Vdots`, `\Ddots`, and `\Iddots` don’t use this command because they have to do other settings (for example, the diagonal lines must be parallelized).

20 The command `\RowStyle`

`\g_@@_row_style_tl` may contain several instructions of the form:

```
\@@_if_row_less_than:nn { number } { instructions }
```

Then, `\g_@@_row_style_tl` will be inserted in all the cells of the array (and also in both components of a `\diagbox` in a cell of in a mono-row block).

The test `\@@_if_row_less_than:nn` ensures that the instructions are inserted only if you are in a row which is (still) in the scope of that instructions (which depends on the value of the key `nb-rows` of `\RowStyle`).

That test will be active even in an expandable context because `\@@_if_row_less_than:nn` is *not* protected.

`#1` is the first row *after* the scope of the instructions in `#2`

```
5333 \cs_new:Npn \@@_if_row_less_than:nn #1 #2
5334   { \int_compare:nNnT { \c@iRow } < { #1 } { #2 } }

5335 \cs_new:Npn \@@_if_col_greater_than:nn #1 #2
5336   { \int_compare:nNnF { \c@jCol } < { #1 } { #2 } }
```

`\@@_put_in_row_style` will be used several times in `\RowStyle`.

```
5337 \cs_generate_variant:Nn \@@_put_in_row_style:n { e }
5338 \cs_set_protected:Npn \@@_put_in_row_style:n #1
5339   {
5340     \tl_gput_right:Ne \g_@@_row_style_tl
5341     {
```

Be careful, `\exp_not:N \@@_if_row_less_than:nn` can't be replaced by a protected version of `\@@_if_row_less_than:nn`.

```
5342     \exp_not:N
5343     \@@_if_row_less_than:nn
5344     { \int_eval:n { \c@iRow + \l_@@_key_nb_rows_int } }
```

The `\scan_stop:` is mandatory (for ex. for the case where `\rotate` is used in the argument of `\RowStyle`).

```
5345     {
5346       \exp_not:N
5347       \@@_if_col_greater_than:nn
5348       { \int_eval:n { \c@jCol } }
5349       { \exp_not:n { #1 } \scan_stop: }
5350     }
5351   }
5352 }
```

```
5353 \keys_define:nn { nicematrix / RowStyle }
5354   {
5355     cell-space-top-limit .dim_set:N = \l_tmpa_dim ,
5356     cell-space-top-limit .value_required:n = true ,
5357     cell-space-bottom-limit .dim_set:N = \l_tmpb_dim ,
5358     cell-space-bottom-limit .value_required:n = true ,
5359     cell-space-limits .meta:n =
5360     {
5361       cell-space-top-limit = #1 ,
5362       cell-space-bottom-limit = #1 ,
5363     } ,
5364     color .tl_set:N = \l_@@_color_tl ,
5365     color .value_required:n = true ,
5366     bold .bool_set:N = \l_@@_bold_row_style_bool ,
5367     bold .default:n = true ,
5368     nb-rows .code:n =
5369     \str_if_eq:eeTF { #1 } { * }
5370     { \int_set:Nn \l_@@_key_nb_rows_int { 500 } }
5371     { \int_set:Nn \l_@@_key_nb_rows_int { #1 } } ,
```

```

5372     nb-rows .value_required:n = true ,
5373     fill .tl_set:N = \l_@@_fill_tl ,
5374     fill .value_required:n = true ,
5375     opacity .tl_set:N = \l_@@_opacity_tl ,
5376     opacity .value_required:n = true ,
5377     rowcolor .tl_set:N = \l_@@_fill_tl ,
5378     rowcolor .value_required:n = true ,
5379     rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
5380     rounded-corners .default:n = 4 pt ,
5381     unknown .code:n = \@@_error:n { Unknown~key~for~RowStyle }
5382 }

```

```

5383 \NewDocumentCommand \@@_RowStyle:n { 0 { } m }
5384 {
5385     \group_begin:
5386     \tl_clear:N \l_@@_fill_tl
5387     \tl_clear:N \l_@@_opacity_tl
5388     \tl_clear:N \l_@@_color_tl
5389     \int_set_eq:NN \l_@@_key_nb_rows_int \c_one_int
5390     \dim_zero:N \l_@@_rounded_corners_dim
5391     \dim_zero:N \l_tmpa_dim
5392     \dim_zero:N \l_tmpb_dim
5393     \keys_set:nm { nicematrix / RowStyle } { #1 }

```

If the key rowcolor (of its alias fill) has been used.

```

5394     \tl_if_empty:NF \l_@@_fill_tl
5395     {
5396         \@@_add_opacity_to_fill:
5397         \tl_gput_right:Ne \g_@@_pre_code_before_tl
5398         {

```

First, the case when the command `\RowStyle` is *not* issued in the first column of the array. In that case, the command applies to the end of the row in the row where the command `\RowStyle` is issued, but in the other whole rows, if the key `nb-rows` is used.

```

5399             \int_compare:nNnTF \c@jCol > \c_one_int
5400             {

```

First, the end of the current row (we remind that `\RowStyle` applies to the *end* of the current row). The command `\@@_exp_color_arg:No` is *fully expandable*.

```

5401                 \@@_exp_color_arg:No \@@_roundedrectanglecolor \l_@@_fill_tl
5402                 { \int_use:N \c@iRow - \int_use:N \c@jCol }
5403                 { \int_use:N \c@iRow - * }
5404                 { \dim_use:N \l_@@_rounded_corners_dim }

```

Then, the other rows (if there are several rows).

```

5405                 \int_compare:nNnT \l_@@_key_nb_rows_int > \c_one_int
5406                 { \@@_rounded_from_row:n { \c@iRow + 1 } }
5407             }

```

Now, directly all the rows in the case of a command `\RowStyle` issued in the first column of the array.

```

5408                 { \@@_rounded_from_row:n { \c@iRow } }
5409             }
5410     }
5411     \@@_put_in_row_style:n { \exp_not:n { #2 } }

```

`\l_tmpa_dim` is the value of the key `cell-space-top-limit` of `\RowStyle`.

```

5412     \dim_compare:nNnT \l_tmpa_dim > \c_zero_dim
5413     {
5414         \@@_put_in_row_style:e
5415         {
5416             \tl_gput_right:Nn \exp_not:N \g_@@_cell_after_hook_tl
5417             {

```

It's not possible to change the following code by using `\dim_set_eq:NN` (because of expansion).

```

5418         \dim_set:Nn \l_@@_cell_space_top_limit_dim
5419         { \dim_use:N \l_tmpa_dim }
5420     }
5421 }
5422 }

```

`\l_tmpb_dim` is the value of the key `cell-space-bottom-limit` of `\RowStyle`.

```

5423 \dim_compare:nNnT \l_tmpb_dim > \c_zero_dim
5424 {
5425     \@@_put_in_row_style:e
5426     {
5427         \tl_gput_right:Nn \exp_not:N \g_@@_cell_after_hook_tl
5428         {
5429             \dim_set:Nn \l_@@_cell_space_bottom_limit_dim
5430             { \dim_use:N \l_tmpb_dim }
5431         }
5432     }
5433 }

```

`\l_@@_color_tl` is the value of the key `color` of `\RowStyle`.

```

5434 \tl_if_empty:NF \l_@@_color_tl
5435 {
5436     \@@_put_in_row_style:e
5437     {
5438         \mode_leave_vertical:
5439         \@@_color:n { \l_@@_color_tl }
5440     }
5441 }

```

`\l_@@_bold_row_style_bool` is the value of the key `bold`.

```

5442 \bool_if:NT \l_@@_bold_row_style_bool
5443 {
5444     \@@_put_in_row_style:n
5445     {
5446         \exp_not:n
5447         {
5448             \if_mode_math:
5449                 \c_math_toggle_token
5450                 \bfseries \boldmath
5451                 \c_math_toggle_token
5452             \else:
5453                 \bfseries \boldmath
5454             \fi:
5455         }
5456     }
5457 }
5458 \group_end:
5459 \g_@@_row_style_tl
5460 \ignorespaces
5461 }

```

The following commande must *not* be protected.

```

5462 \cs_new:Npn \@@_rounded_from_row:n #1
5463 {
5464     \@@_exp_color_arg:No \@@_roundedrectanglecolor \l_@@_fill_tl

```

In the following code, the “`- 1`” is *not* a subtraction.

```

5465     { \int_eval:n { #1 } - 1 }
5466     {
5467         \int_eval:n { \c@iRow + \l_@@_key_nb_rows_int - 1 }
5468         - \exp_not:n { \int_use:N \c@jCol }
5469     }
5470     { \dim_use:N \l_@@_rounded_corners_dim }
5471 }

```

21 Colors of cells, rows and columns

We want to avoid the thin white lines that are shown in some PDF viewers (eg: with the engine MuPDF used by SumatraPDF). That's why we try to draw rectangles of the same color in the same instruction `\pgfusepath { fill }` (and they will be in the same instruction `fill`—coded `f`—in the resulting PDF).

The commands `\@@_rowcolor`, `\@@_columncolor`, `\@@_rectanglecolor` and `\@@_rowlistcolors` don't directly draw the corresponding rectangles. Instead, they store their instructions color by color:

- A sequence `\g_@@_colors_seq` will be built containing all the colors used by at least one of these instructions. Each *color* may be prefixed by its color model (eg: `[gray]{0.5}`).
- For the color whose index in `\g_@@_colors_seq` is equal to *i*, a list of instructions which use that color will be constructed in the token list `\g_@@_color_i_tl`. In that token list, the instructions will be written using `\@@_cartesian_color:nn` and `\@@_rectanglecolor:nn`.

`#1` is the color and `#2` is an instruction using that color. Despite its name, the command `\@@_add_to_colors_seq:nn` doesn't only add a color to `\g_@@_colors_seq`: it also updates the corresponding token list `\g_@@_color_i_tl`. We add in a global way because the final user may use the instructions such as `\cellcolor` in a loop of `pgffor` in the `\CodeBefore` (and we recall that a loop of `pgffor` is encapsulated in a group).

```
5472 \cs_generate_variant:Nn \@@_add_to_colors_seq:nn { e }
5473 \cs_generate_variant:Nn \@@_add_to_colors_seq:nn { e e }
5474 \cs_new_protected:Npn \@@_add_to_colors_seq:nn #1 #2
5475 {
```

First, we look for the number of the color and, if it's found, we store it in `\l_tmpa_int`. If the color is not present in `\l_@@_colors_seq`, `\l_tmpa_int` will remain equal to 0.

```
5476 \int_zero:N \l_tmpa_int
```

We don't take into account the colors like `myserie!+` because those colors are special color from a `\definecolorseries` of `xcolor`. `\str_if_in:nnF` is mandatory: don't use `\tl_if_in:nnF`.

```
5477 \str_if_in:nnF { #1 } { !! }
5478 {
5479 \seq_map_indexed_inline:Nn \g_@@_colors_seq
```

We use `\str_if_eq:eeTF` which is slightly faster than `\tl_if_eq:nnTF`.

```
5480 { \str_if_eq:eeT { #1 } { ##2 } { \int_set:Nn \l_tmpa_int { ##1 } } }
5481 }
5482 \int_if_zero:nTF \l_tmpa_int
```

First, the case where the color is a *new* color (not in the sequence).

```
5483 {
5484 \seq_gput_right:Nn \g_@@_colors_seq { #1 }
5485 \tl_gset:ce { g_@@_color _ \seq_count:N \g_@@_colors_seq _ tl } { #2 }
5486 }
```

Now, the case where the color is *not* a new color (the color is in the sequence at the position `\l_tmpa_int`).

```
5487 { \tl_gput_right:ce { g_@@_color _ \int_use:N \l_tmpa_int _ tl } { #2 } }
5488 }
```

The following command must be used within a `\pgfpicture`.

```
5489 \cs_new_protected:Npn \@@_clip_with_rounded_corners:
5490 {
5491 \dim_compare:nNnT \l_@@_tab_rounded_corners_dim > \c_zero_dim
5492 {
```

The TeX group is for `\pgfsetcornersarced` (whose scope is the TeX scope).

```

5493     \group_begin:
5494     \pgfsetcornersarced
5495     {
5496         \pgfpoint
5497         { \l_@@_tab_rounded_corners_dim }
5498         { \l_@@_tab_rounded_corners_dim }
5499     }

```

Because we want `nicematrix` compatible with arrays constructed by `array`, the nodes for the rows and columns (that is to say the nodes `row-i` and `col-j`) have not always the expected position, that is to say, there is sometimes a slight shifting of something such as `\arrayrulewidth`. Now, for the clipping, we have to change slightly the position of that clipping whether a rounded rectangle around the array is required. That's the point which is tested in the following line.

```

5500     \bool_if:NTF \l_@@_hvlines_bool
5501     {
5502         \pgfpathrectanglecorners
5503         {
5504             \pgfpointadd
5505             { \@@_qpoint:n { row-1 } }
5506             { \pgfpoint { 0.5 \arrayrulewidth } { \c_zero_dim } }
5507         }
5508         {
5509             \pgfpointadd
5510             {
5511                 \@@_qpoint:n
5512                 { \int_eval:n { \int_max:nn \c@iRow \c@jCol + 1 } }
5513             }
5514             { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
5515         }
5516     }
5517     {
5518         \pgfpathrectanglecorners
5519         { \@@_qpoint:n { row-1 } }
5520         {
5521             \pgfpointadd
5522             {
5523                 \@@_qpoint:n
5524                 { \int_eval:n { \int_max:nn \c@iRow \c@jCol + 1 } }
5525             }
5526             { \pgfpoint \c_zero_dim \arrayrulewidth }
5527         }
5528     }
5529     \pgfusepath { clip }
5530     \group_end:

```

The TeX group was for `\pgfsetcornersarced`.

```

5531     }
5532 }

```

The macro `\@@_actually_color:` will actually fill all the rectangles, color by color (using the sequence `\l_@@_colors_seq` and all the token lists of the form `\l_@@_color_i_tl`).

```

5533 \cs_new_protected:Npn \@@_actually_color:
5534 {
5535     \pgfpicture
5536     \pgf@relevantforpicturesizefalse

```

If the final user has used the key `rounded-corners` for the environment `{NiceTabular}`, we will clip to a rectangle with rounded corners before filling the rectangles.

```

5537     \@@_clip_with_rounded_corners:
5538     \seq_map_indexed_inline:Nn \g_@@_colors_seq
5539     {
5540         \int_compare:nNnTF { ##1 } = \c_one_int

```

```

5541     {
5542     \cs_set_eq:NN \@@_cartesian_path:n \@@_cartesian_path_nocolor:n
5543     \use:c { g_@@_color _ 1 _tl }
5544     \cs_set_eq:NN \@@_cartesian_path:n \@@_cartesian_path_normal:n
5545     }
5546     {
5547     \begin { pgfscope }
5548     \@@_color_opacity ##2
5549     \use:c { g_@@_color _ ##1 _tl }
5550     \tl_gclear:c { g_@@_color _ ##1 _tl }
5551     \pgfusepath { fill }
5552     \end { pgfscope }
5553     }
5554     }
5555 \endpgfpicture
5556 }

```

The following command will extract the potential key `opacity` in its optional argument (between square brackets) and (of course) then apply the command `\color`.

```

5557 \cs_new_protected:Npn \@@_color_opacity
5558 {
5559   \peek_meaning:NTF [
5560     { \@@_color_opacity:w }
5561     { \@@_color_opacity:w [ ] }
5562   }

```

The command `\@@_color_opacity:w` takes in as argument only the optional argument. One may consider that the second argument (the actual definition of the color) is provided by curryfication.

```

5563 \cs_new_protected:Npn \@@_color_opacity:w [ #1 ]
5564 {
5565   \tl_clear:N \l_tmpa_tl
5566   \keys_set_known:nnN { nicematrix / color-opacity } { #1 } \l_tmpb_tl

```

`\l_tmpa_tl` (if not empty) is now the opacity and `\l_tmpb_tl` (if not empty) is now the colorimetric space.

```

5567   \tl_if_empty:NF \l_tmpa_tl { \exp_args:No \pgfsetfillopacity \l_tmpa_tl }
5568   \tl_if_empty:NTF \l_tmpb_tl
5569     { \@declaredcolor }
5570     { \use:e { \exp_not:N \@undeclaredcolor [ \l_tmpb_tl ] } }
5571 }

```

The following set of keys is used by the command `\@@_color_opacity:wn`.

```

5572 \keys_define:nn { nicematrix / color-opacity }
5573 {
5574   opacity .tl_set:N          = \l_tmpa_tl ,
5575   opacity .value_required:n = true
5576 }

```

```

5577 \cs_new_protected:Npn \@@_cartesian_color:nn #1 #2
5578 {
5579   \cs_set_nopar:Npn \l_@@_rows_tl { #1 }
5580   \cs_set_nopar:Npn \l_@@_cols_tl { #2 }
5581   \@@_cartesian_path:
5582 }

```

Here is an example : `\@@_rowcolor {red!15} {1,3,5-7,10-}`

```

5583 \NewDocumentCommand \@@_rowcolor { 0 { } m m }
5584 {
5585   \tl_if_blank:nF { #2 }
5586   {

```

```

5587     \@@_add_to_colors_seq:en
5588     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5589     { \@@_cartesian_color:nn { #3 } { - } }
5590   }
5591 }

```

Here an example : `\@@_columncolor:nn {red!15} {1,3,5-7,10-}`

```

5592 \NewDocumentCommand \@@_columncolor { 0 { } m m }
5593 {
5594   \tl_if_blank:nF { #2 }
5595   {
5596     \@@_add_to_colors_seq:en
5597     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5598     { \@@_cartesian_color:nn { - } { #3 } }
5599   }
5600 }

```

Here is an example : `\@@_rectanglecolor{red!15}{2-3}{5-6}`

```

5601 \NewDocumentCommand \@@_rectanglecolor { 0 { } m m m }
5602 {
5603   \tl_if_blank:nF { #2 }
5604   {
5605     \@@_add_to_colors_seq:en
5606     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5607     { \@@_rectanglecolor:nnn { #3 } { #4 } { \c_zero_dim } }
5608   }
5609 }

```

The last argument is the radius of the corners of the rectangle.

```

5610 \NewDocumentCommand \@@_roundedrectanglecolor { 0 { } m m m m }
5611 {
5612   \tl_if_blank:nF { #2 }
5613   {
5614     \@@_add_to_colors_seq:en
5615     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5616     { \@@_rectanglecolor:nnn { #3 } { #4 } { #5 } }
5617   }
5618 }

```

The last argument is the radius of the corners of the rectangle.

```

5619 \cs_new_protected:Npn \@@_rectanglecolor:nnn #1 #2 #3
5620 {
5621   \@@_cut_on_hyphen:w #1 \q_stop
5622   \tl_clear_new:N \l_@@_tmpc_tl
5623   \tl_clear_new:N \l_@@_tmpd_tl
5624   \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
5625   \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
5626   \@@_cut_on_hyphen:w #2 \q_stop
5627   \tl_set:Ne \l_@@_rows_tl { \l_@@_tmpc_tl - \l_tmpa_tl }
5628   \tl_set:Ne \l_@@_cols_tl { \l_@@_tmpd_tl - \l_tmpb_tl }

```

The command `\@@_cartesian_path:n` takes in two implicit arguments: `\l_@@_cols_tl` and `\l_@@_rows_tl`.

```

5629   \@@_cartesian_path:n { #3 }
5630 }

```

Here is an example : `\@@_cellcolor[rgb]{0.5,0.5,0}{2-3,3-4,4-5,5-6}`

```

5631 \NewDocumentCommand \@@_cellcolor { 0 { } m m }
5632 {
5633   \clist_map_inline:nn { #3 }
5634   { \@@_rectanglecolor [ #1 ] { #2 } { ##1 } { ##1 } }
5635 }

```

```

5636 \NewDocumentCommand \@@_chessboardcolors { 0 { } m m }
5637 {
5638   \int_step_inline:nn \c@iRow
5639   {
5640     \int_step_inline:nn \c@jCol
5641     {
5642       \int_if_even:nTF { ####1 + #1 }
5643       { \@@_cellcolor [ #1 ] { #2 } }
5644       { \@@_cellcolor [ #1 ] { #3 } }
5645       { #1 - ####1 }
5646     }
5647   }
5648 }

```

The command `\@@_arraycolor` (linked to `\arraycolor` at the beginning of the `\CodeBefore`) will color the whole tabular (excepted the potential exterior rows and columns) and the cells in the “corners”.

```

5649 \NewDocumentCommand \@@_arraycolor { 0 { } m }
5650 {
5651   \@@_rectanglecolor [ #1 ] { #2 }
5652   { 1 - 1 }
5653   { \int_use:N \c@iRow - \int_use:N \c@jCol }
5654 }

```

```

5655 \keys_define:nn { nicematrix / rowcolors }
5656 {
5657   respect-blocks .bool_set:N = \l_@@_respect_blocks_bool ,
5658   respect-blocks .default:n = true ,
5659   cols .tl_set:N = \l_@@_cols_tl ,
5660   restart .bool_set:N = \l_@@_rowcolors_restart_bool ,
5661   restart .default:n = true ,
5662   unknown .code:n = \@@_error:n { Unknown-key-for-rowcolors }
5663 }

```

The command `\rowcolors` (accessible in the `\CodeBefore`) is inspired by the command `\rowcolors` of the package `xcolor` (with the option `table`). However, the command `\rowcolors` of `nicematrix` has *not* the optional argument of the command `\rowcolors` of `xcolor`.

Here is an example: `\rowcolors{1}{blue!10}{}[respect-blocks]`.

In `nicematrix`, the command `\@@_rowcolors` appears as a special case of `\@@_rowlistcolors`.

`#1` (optional) is the color space; `#2` is a list of intervals of rows; `#3` is the list of colors; `#4` is for the optional list of pairs *key=value*.

```

5664 \NewDocumentCommand \@@_rowlistcolors { 0 { } m m 0 { } }
5665 {

```

The group is for the options. `\l_@@_colors_seq` will be the list of colors.

```

5666   \group_begin:
5667   \seq_clear_new:N \l_@@_colors_seq
5668   \seq_set_split:Nnn \l_@@_colors_seq { , } { #3 }
5669   \tl_clear_new:N \l_@@_cols_tl
5670   \cs_set_nopar:Npn \l_@@_cols_tl { - }
5671   \keys_set:nn { nicematrix / rowcolors } { #4 }

```

The counter `\l_@@_color_int` will be the rank of the current color in the list of colors (modulo the length of the list).

```

5672   \int_zero_new:N \l_@@_color_int
5673   \int_set_eq:NN \l_@@_color_int \c_one_int
5674   \bool_if:NT \l_@@_respect_blocks_bool
5675   {

```

We don't want to take into account a block which is completely in the "first column" (number 0) or in the "last column" and that's why we filter the sequence of the blocks (in the sequence `\l_tmpa_seq`).

```

5676     \seq_set_eq:NN \l_tmpb_seq \g_@@_pos_of_blocks_seq
5677     \seq_set_filter:NNn \l_tmpa_seq \l_tmpb_seq
5678     { \@@_not_in_exterior_p:nnnnn ##1 }
5679   }
5680   \pgfpicture
5681   \pgf@relevantforpicturesizefalse

```

#2 is the list of intervals of rows.

```

5682   \clist_map_inline:nn { #2 }
5683   {
5684     \cs_set_nopar:Npn \l_tmpa_tl { ##1 }
5685     \tl_if_in:NnTF \l_tmpa_tl { - }
5686     { \@@_cut_on_hyphen:w ##1 \q_stop }
5687     { \tl_set:No \l_tmpb_tl { \int_use:N \c@iRow } }

```

Now, `\l_tmpa_tl` and `\l_tmpb_tl` are the first row and the last row of the interval of rows that we have to treat. The counter `\l_tmpa_int` will be the index of the loop over the rows.

```

5688     \int_set:Nn \l_tmpa_int \l_tmpa_tl
5689     \int_set:Nn \l_@@_color_int
5690     { \bool_if:NTF \l_@@_rowcolors_restart_bool 1 \l_tmpa_tl }
5691     \int_zero_new:N \l_@@_tmpc_int
5692     \int_set:Nn \l_@@_tmpc_int \l_tmpb_tl
5693     \int_do_until:nNnn \l_tmpa_int > \l_@@_tmpc_int
5694     {

```

We will compute in `\l_tmpb_int` the last row of the "block".

```

5695         \int_set_eq:NN \l_tmpb_int \l_tmpa_int

```

If the key `respect-blocks` is in force, we have to adjust that value (of course).

```

5696         \bool_if:NT \l_@@_respect_blocks_bool
5697         {
5698           \seq_set_filter:NNn \l_tmpb_seq \l_tmpa_seq
5699           { \@@_intersect_our_row_p:nnnnn #####1 }
5700           \seq_map_inline:Nn \l_tmpb_seq { \@@_rowcolors_i:nnnnn #####1 }

```

Now, the last row of the block is computed in `\l_tmpb_int`.

```

5701         }
5702         \tl_set:No \l_@@_rows_tl
5703         { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }

```

`\l_@@_tmpc_tl` will be the color that we will use.

```

5704         \tl_clear_new:N \l_@@_color_tl
5705         \tl_set:Ne \l_@@_color_tl
5706         {
5707           \@@_color_index:n
5708           {
5709             \int_mod:nn
5710             { \l_@@_color_int - 1 }
5711             { \seq_count:N \l_@@_colors_seq }
5712             + 1
5713           }
5714         }
5715         \tl_if_empty:NF \l_@@_color_tl
5716         {
5717           \@@_add_to_colors_seq:ee
5718           { \tl_if_blank:nF { #1 } { [ #1 ] } { \l_@@_color_tl } }
5719           { \@@_cartesian_color:nn { \l_@@_rows_tl } { \l_@@_cols_tl } }
5720         }
5721         \int_incr:N \l_@@_color_int
5722         \int_set:Nn \l_tmpa_int { \l_tmpb_int + 1 }
5723       }
5724     }
5725   \endpgfpicture

```

```

5726   \group_end:
5727 }

```

The command `\@@_color_index:n` peeks in `\l_@@_colors_seq` the color at the index #1. However, if that color is the symbol =, the previous one is poken. This macro is recursive.

```

5728 \cs_new:Npn \@@_color_index:n #1
5729 {

```

Be careful: this command `\@@_color_index:n` must be “*fully expandable*”.

```

5730   \str_if_eq:eeTF { \seq_item:Nn \l_@@_colors_seq { #1 } } { = }
5731   { \@@_color_index:n { #1 - 1 } }
5732   { \seq_item:Nn \l_@@_colors_seq { #1 } }
5733 }

```

The command `\rowcolors` (available in the `\CodeBefore`) is a specialisation of the more general command `\rowlistcolors`. The last argument, which is a optional argument between square brackets is provided by curryfication.

```

5734 \NewDocumentCommand \@@_rowcolors { 0 { } m m m }
5735 { \@@_rowlistcolors [ #1 ] { #2 } { { #3 } , { #4 } } }

```

The braces around #3 and #4 are mandatory.

```

5736 \cs_new_protected:Npn \@@_rowcolors_i:nnnnn #1 #2 #3 #4 #5
5737 {
5738   \int_compare:nNnT { #3 } > \l_tmpb_int
5739   { \int_set:Nn \l_tmpb_int { #3 } }
5740 }

```

```

5741 \prg_new_conditional:Nnn \@@_not_in_exterior:nnnnn p
5742 {
5743   \int_if_zero:nTF { #4 }
5744   \prg_return_false:
5745   {
5746     \int_compare:nNnTF { #2 } > \c@jCol
5747     \prg_return_false:
5748     \prg_return_true:
5749   }
5750 }

```

The following command return true when the block intersects the row `\l_tmpa_int`.

```

5751 \prg_new_conditional:Nnn \@@_intersect_our_row:nnnnn p
5752 {
5753   \int_compare:nNnTF { #1 } > \l_tmpa_int
5754   \prg_return_false:
5755   {
5756     \int_compare:nNnTF \l_tmpa_int > { #3 }
5757     \prg_return_false:
5758     \prg_return_true:
5759   }
5760 }

```

The following command uses two implicit arguments: `\l_@@_rows_tl` and `\l_@@_cols_tl` which are specifications for a set of rows and a set of columns. It creates a path but does *not* fill it. It must be filled by another command after. The argument is the radius of the corners. We define below a command `\@@_cartesian_path:` which corresponds to a value 0 pt for the radius of the corners. This command is, in particular, used in `\@@_rectanglecolor:nnn` (used in `\@@_rectanglecolor`, itself used in `\@@_cellcolor`).

```

5761 \cs_new_protected:Npn \@@_cartesian_path_normal:n #1
5762 {
5763   \dim_compare:nNnTF { #1 } = \c_zero_dim

```

```

5764 {
5765   \bool_if:NTF
5766     \l_@@_nocolor_used_bool
5767     \@@_cartesian_path_normal_ii:
5768     {
5769       \clist_if_empty:NTF \l_@@_corners_cells_clist
5770       { \@@_cartesian_path_normal_i:n { #1 } }
5771       \@@_cartesian_path_normal_ii:
5772     }
5773   }
5774   { \@@_cartesian_path_normal_i:n { #1 } }
5775 }

```

First, the situation where is a rectangular zone of cells will be colored as a whole (in the instructions of the resulting PDF). The argument is the radius of the corners.

```

5776 \cs_new_protected:Npn \@@_cartesian_path_normal_i:n #1
5777 {
5778   \pgfsetcornersarced { \pgfpoint { #1 } { #1 } }

```

We begin the loop over the columns.

```

5779   \clist_map_inline:Nn \l_@@_cols_tl
5780   {
5781     \cs_set_nopar:Npn \l_tmpa_tl { ##1 }
5782     \tl_if_in:NnTF \l_tmpa_tl { - }
5783       { \@@_cut_on_hyphen:w ##1 \q_stop }
5784       { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
5785     \tl_if_empty:NTF \l_tmpa_tl
5786       { \cs_set_nopar:Npn \l_tmpa_tl { 1 } }
5787       {
5788         \str_if_eq:eeT \l_tmpa_tl { * }
5789         { \cs_set_nopar:Npn \l_tmpa_tl { 1 } }
5790       }
5791     \int_compare:nNnT \l_tmpa_tl > \g_@@_col_total_int
5792       { \@@_error:n { Invalid-col-number } }
5793     \tl_if_empty:NTF \l_tmpb_tl
5794       { \tl_set:No \l_tmpb_tl { \int_use:N \c@jCol } }
5795       {
5796         \str_if_eq:eeT \l_tmpb_tl { * }
5797         { \tl_set:No \l_tmpb_tl { \int_use:N \c@jCol } }
5798       }
5799     \int_compare:nNnT \l_tmpb_tl > \g_@@_col_total_int
5800       { \tl_set:No \l_tmpb_tl { \int_use:N \g_@@_col_total_int } }

```

`\l_@@_tmpc_tl` will contain the number of column.

```

5801   \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
5802   \@@_qpoint:n { col - \l_tmpa_tl }
5803   \int_compare:nNnTF \l_@@_first_col_int = \l_tmpa_tl
5804     { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
5805     { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
5806   \@@_qpoint:n { col - \int_eval:n { \l_tmpb_tl + 1 } }
5807   \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }

```

We begin the loop over the rows.

```

5808   \clist_map_inline:Nn \l_@@_rows_tl
5809   {
5810     \cs_set_nopar:Npn \l_tmpa_tl { ####1 }
5811     \tl_if_in:NnTF \l_tmpa_tl { - }
5812       { \@@_cut_on_hyphen:w ####1 \q_stop }
5813       { \@@_cut_on_hyphen:w ####1 - ####1 \q_stop }
5814     \tl_if_empty:NTF \l_tmpa_tl
5815       { \cs_set_nopar:Npn \l_tmpa_tl { 1 } }
5816       {
5817         \str_if_eq:eeT \l_tmpa_tl { * }
5818         { \cs_set_nopar:Npn \l_tmpa_tl { 1 } }

```

```

5819     }
5820     \tl_if_empty:NTF \l_tmpb_tl
5821     { \tl_set:No \l_tmpb_tl { \int_use:N \c@iRow } }
5822     {
5823         \str_if_eq:eeT \l_tmpb_tl { * }
5824         { \tl_set:No \l_tmpb_tl { \int_use:N \c@iRow } }
5825     }
5826     \int_compare:nNnT \l_tmpa_tl > \g_@@_row_total_int
5827     { \@@_error:n { Invalid-row-number } }
5828     \int_compare:nNnT \l_tmpb_tl > \g_@@_row_total_int
5829     { \tl_set:No \l_tmpb_tl { \int_use:N \g_@@_row_total_int } }

```

Now, the numbers of both rows are in \l_tmpa_tl and \l_tmpb_tl.

```

5830     \cs_if_exist:cF
5831     { @@ _ nocolor _ \l_tmpa_tl - \l_@@_tmpc_tl }
5832     {
5833         \@@_qpoint:n { row - \int_eval:n { \l_tmpb_tl + 1 } }
5834         \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
5835         \@@_qpoint:n { row - \l_tmpa_tl }
5836         \dim_set:Nn \l_@@_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
5837         \pgfpathrectanglecorners
5838         { \pgfpoint \l_@@_tmpc_dim \l_@@_tmpd_dim }
5839         { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
5840     }
5841     }
5842 }
5843 }

```

Now, the case where the cells will be colored cell by cell (it's mandatory for example if the key `corners` is used).

```

5844 \cs_new_protected:Npn \@@_cartesian_path_normal_ii:
5845 {
5846     \@@_expand_clist:NN \l_@@_cols_tl \c@jCol
5847     \@@_expand_clist:NN \l_@@_rows_tl \c@iRow

```

We begin the loop over the columns.

```

5848     \clist_map_inline:Nn \l_@@_cols_tl
5849     {
5850         \@@_qpoint:n { col - ##1 }
5851         \int_compare:nNnTF \l_@@_first_col_int = { ##1 }
5852         { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
5853         { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
5854         \@@_qpoint:n { col - \int_eval:n { ##1 + 1 } }
5855         \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }

```

We begin the loop over the rows.

```

5856     \clist_map_inline:Nn \l_@@_rows_tl
5857     {
5858         \@@_if_in_corner:nF { #####1 - ##1 }
5859         {
5860             \@@_qpoint:n { row - \int_eval:n { #####1 + 1 } }
5861             \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
5862             \@@_qpoint:n { row - #####1 }
5863             \dim_set:Nn \l_@@_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
5864             \cs_if_exist:cF { @@ _ nocolor _ #####1 - ##1 }
5865             {
5866                 \pgfpathrectanglecorners
5867                 { \pgfpoint \l_@@_tmpc_dim \l_@@_tmpd_dim }
5868                 { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
5869             }
5870         }
5871     }
5872 }
5873 }

```

The following command corresponds to a radius of the corners equal to 0 pt. This command is used by the commands `\@@_rowcolors`, `\@@_columncolor` and `\@@_rowcolor:n` (used in `\@@_rowcolor`).

```
5874 \cs_new_protected:Npn \@@_cartesian_path: { \@@_cartesian_path:n \c_zero_dim }
```

Despite its name, the following command does not create a PGF path. It declares as colored by the “empty color” all the cells in what would be the path. Hence, the other coloring instructions of `nicematrix` won’t put color in those cells. the

```
5875 \cs_new_protected:Npn \@@_cartesian_path_nocolor:n #1
5876 {
5877   \bool_set_true:N \l_@@_nocolor_used_bool
5878   \@@_expand_clist:NN \l_@@_cols_tl \c@jCol
5879   \@@_expand_clist:NN \l_@@_rows_tl \c@iRow
```

We begin the loop over the columns.

```
5880   \clist_map_inline:Nn \l_@@_rows_tl
5881     {
5882       \clist_map_inline:Nn \l_@@_cols_tl
5883         { \cs_set_nopar:cpn { @@ _ nocolor _ ##1 - ####1 } { } }
5884     }
5885 }
```

The following command will be used only with `\l_@@_cols_tl` and `\c@jCol` (first case) or with `\l_@@_rows_tl` and `\c@iRow` (second case). For instance, with `\l_@@_cols_tl` equal to `2,4-6,8-*` and `\c@jCol` equal to 10, the clist `\l_@@_cols_tl` will be replaced by `2,4,5,6,8,9,10`.

```
5886 \cs_new_protected:Npn \@@_expand_clist:NN #1 #2
5887 {
5888   \clist_set_eq:NN \l_tmpa_clist #1
5889   \clist_clear:N #1
5890   \clist_map_inline:Nn \l_tmpa_clist
5891     {
5892       \cs_set_nopar:Npn \l_tmpa_tl { ##1 }
5893       \tl_if_in:NnTF \l_tmpa_tl { - }
5894         { \@@_cut_on_hyphen:w ##1 \q_stop }
5895         { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
5896       \bool_lazy_or:nnT
5897         { \str_if_eq_p:ee \l_tmpa_tl { * } }
5898         { \tl_if_blank_p:o \l_tmpa_tl }
5899         { \cs_set_nopar:Npn \l_tmpa_tl { 1 } }
5900       \bool_lazy_or:nnT
5901         { \str_if_eq_p:ee \l_tmpb_tl { * } }
5902         { \tl_if_blank_p:o \l_tmpb_tl }
5903         { \tl_set:No \l_tmpb_tl { \int_use:N #2 } }
5904       \int_compare:nNnT \l_tmpb_tl > #2
5905         { \tl_set:No \l_tmpb_tl { \int_use:N #2 } }
5906       \int_step_inline:nnn \l_tmpa_tl \l_tmpb_tl
5907         { \clist_put_right:Nn #1 { ####1 } }
5908     }
5909 }
```

The following command will be linked to `\cellcolor` in the tabular.

```
5910 \NewDocumentCommand \@@_cellcolor_tabular { 0 { } m }
5911 {
5912   \tl_gput_right:Ne \g_@@_pre_code_before_tl
5913   {
```

We must not expand the color (`#2`) because the color may contain the token `!` which may be activated by some packages (ex.: `babel` with the option `french` on `latex` and `pdflatex`).

```
5914     \@@_cellcolor [ #1 ] { \exp_not:n { #2 } }
5915     { \int_use:N \c@iRow - \int_use:N \c@jCol }
5916   }
5917   \ignorespaces
5918 }
```

The following command will be linked to `\rowcolor` in the tabular.

```

5919 \NewDocumentCommand \@@_rowcolor_tabular { 0 { } m }
5920 {
5921   \tl_gput_right:Ne \g_@@_pre_code_before_tl
5922   {
5923     \@@_rectanglecolor [ #1 ] { \exp_not:n { #2 } }
5924     { \int_use:N \c@iRow - \int_use:N \c@jCol }
5925     { \int_use:N \c@iRow - \exp_not:n { \int_use:N \c@jCol } }
5926   }
5927   \ignorespaces
5928 }

```

The following command will be linked to `\rowcolors` in the tabular. The last argument (an optional argument between square brackets is taken by curryfication).

```

5929 \NewDocumentCommand { \@@_rowcolors_tabular } { 0 { } m m }
5930 { \@@_rowlistcolors_tabular [ #1 ] { { #2 } , { #3 } } }

```

The braces around `#2` and `#3` are mandatory.

The following command will be linked to `\rowlistcolors` in the tabular.

```

5931 \NewDocumentCommand { \@@_rowlistcolors_tabular } { 0 { } m 0 { } }
5932 {
5933   \peek_remove_spaces:n
5934   { \@@_rowlistcolors_tabular:nnn { #1 } { #2 } { #3 } }
5935 }

```

```

5936 \cs_new_protected:Npn \@@_rowlistcolors_tabular:nnn #1 #2 #3
5937 {

```

A use of `\rowlistcolors` in the tabular erases the instructions `\rowlistcolors` which are in force. However, it's possible to put *several* instructions `\rowlistcolors` in the same row of a tabular: it may be useful when those instructions `\rowlistcolors` concerns different columns of the tabular (thanks to the key `cols` of `\rowlistcolors`). That's why we store the different instructions `\rowlistcolors` which are in force in a sequence `\g_@@_rowlistcolors_seq`. Now, we will filter that sequence to keep only the elements which have been issued on the actual row. We will store the elements to keep in the `\g_tmpa_seq`.

```

5938   \seq_gclear:N \g_tmpa_seq
5939   \seq_map_inline:Nn \g_@@_rowlistcolors_seq
5940   { \@@_rowlistcolors_tabular_i:nnnn ##1 }
5941   \seq_gset_eq:NN \g_@@_rowlistcolors_seq \g_tmpa_seq

```

Now, we add to the sequence `\g_@@_rowlistcolors_seq` (which is the list of the commands `\rowlistcolors` which are in force) the current instruction `\rowlistcolors`.

```

5942   \seq_gput_right:Ne \g_@@_rowlistcolors_seq
5943   {
5944     { \int_use:N \c@iRow }
5945     { \exp_not:n { #1 } }
5946     { \exp_not:n { #2 } }
5947     { restart , cols = \int_use:N \c@jCol - , \exp_not:n { #3 } }
5948   }
5949 }

```

The following command will be applied to each component of `\g_@@_rowlistcolors_seq`. Each component of that sequence is a kind of 4-uple of the form `{#1}{#2}{#3}{#4}`.

- #1** is the number of the row where the command `\rowlistcolors` has been issued.
- #2** is the colorimetric space (optional argument of the `\rowlistcolors`).
- #3** is the list of colors (mandatory argument of `\rowlistcolors`).
- #4** is the list of *key=value* pairs (last optional argument of `\rowlistcolors`).

```

5950 \cs_new_protected:Npn \@@_rowlistcolors_tabular_i:nnnn #1 #2 #3 #4
5951 {
5952   \int_compare:nNnTF { #1 } = \c@iRow

```

We (temporary) keep in memory in `\g_tmpa_seq` the instructions which will still be in force after the current instruction (because they have been issued in the same row of the tabular).

```

5953     { \seq_gput_right:Nn \g_tmpa_seq { { #1 } { #2 } { #3 } { #4 } } }
5954     {
5955       \tl_gput_right:Ne \g_@@_pre_code_before_tl
5956       {
5957         \@@_rowlistcolors
5958         [ \exp_not:n { #2 } ]
5959         { #1 - \int_eval:n { \c@iRow - 1 } }
5960         { \exp_not:n { #3 } }
5961         [ \exp_not:n { #4 } ]
5962       }
5963     }
5964 }

```

The following command will be used at the end of the tabular, just before the execution of the `\g_@@_pre_code_before_tl`. It clears the sequence `\g_@@_rowlistcolors_seq` of all the commands `\rowlistcolors` which are (still) in force.

```

5965 \cs_new_protected:Npn \@@_clear_rowlistcolors_seq:
5966   {
5967     \seq_map_inline:Nn \g_@@_rowlistcolors_seq
5968     { \@@_rowlistcolors_tabular_ii:nnnn ##1 }
5969     \seq_gclear:N \g_@@_rowlistcolors_seq
5970   }

5971 \cs_new_protected:Npn \@@_rowlistcolors_tabular_ii:nnnn #1 #2 #3 #4
5972   {
5973     \tl_gput_right:Nn \g_@@_pre_code_before_tl
5974     { \@@_rowlistcolors [ #2 ] { #1 } { #3 } [ #4 ] }
5975   }

```

The first mandatory argument of the command `\@@_rowlistcolors` which is writtent in the pre-`\CodeBefore` is of the form `i`: it means that the command must be applied to all the rows from the row `i` until the end of the tabular.

```

5976 \NewDocumentCommand \@@_columncolor_preamble { 0 { } m }
5977   {

```

With the following line, we test whether the cell is the first one we encounter in its column (don't forget that some rows may be incomplete).

```

5978     \int_compare:nNnT \c@jCol > \g_@@_col_total_int
5979     {

```

You use `gput_left` because we want the specification of colors for the columns drawn before the specifications of color for the rows (and the cells). Be careful: maybe this is not effective since we have an analyze of the instructions in the `\CodeBefore` in order to fill color by color (to avoid the thin white lines).

```

5980     \tl_gput_left:Ne \g_@@_pre_code_before_tl
5981     {
5982       \exp_not:N \columncolor [ #1 ]
5983       { \exp_not:n { #2 } } { \int_use:N \c@jCol }
5984     }
5985   }
5986 }

```

```

5987 \hook_gput_code:nnn { begindocument } { . }
5988   {
5989     \IfPackageLoadedTF { colortbl }
5990     {
5991       \cs_set_eq:NN \@@_old_cellcolor \cellcolor
5992       \cs_set_eq:NN \@@_old_rowcolor \rowcolor
5993       \cs_new_protected:Npn \@@_revert_colortbl:

```

```

5994     {
5995         \hook_gput_code:nnn { env / tabular / begin } { nicematrix }
5996     {
5997         \cs_set_eq:NN \cellcolor \@@_old_cellcolor
5998         \cs_set_eq:NN \rowcolor \@@_old_rowcolor
5999     }
6000 }
6001 }
6002 { \cs_new_protected:Npn \@@_revert_colortbl: { } }
6003 }

6004 \cs_new_protected:Npn \@@_EmptyColumn:n #1
6005 {
6006     \clist_map_inline:nn { #1 }
6007     {
6008         \seq_gput_right:Nn \g_@@_future_pos_of_blocks_seq
6009         { { -2 } { #1 } { 98 } { ##1 } { } } % 98 and not 99 !
6010         \columncolor { nocolor } { ##1 }
6011     }
6012 }

6013 \cs_new_protected:Npn \@@_EmptyRow:n #1
6014 {
6015     \clist_map_inline:nn { #1 }
6016     {
6017         \seq_gput_right:Nn \g_@@_future_pos_of_blocks_seq
6018         { { ##1 } { -2 } { ##1 } { 98 } { } } % 98 and not 99 !
6019         \rowcolor { nocolor } { ##1 }
6020     }
6021 }

```

22 The vertical and horizontal rules

OnlyMainNiceMatrix

We give to the user the possibility to define new types of columns (with `\newcolumnntype` of `array`) for special vertical rules (*e.g.* rules thicker than the standard ones) which will not extend in the potential exterior rows of the array.

We provide the command `\OnlyMainNiceMatrix` in that goal. However, that command must be no-op outside the environments of `nicematrix` (and so the user will be allowed to use the same new type of column in the environments of `nicematrix` and in the standard environments of `array`).

That's why we provide first a global definition of `\OnlyMainNiceMatrix`.

```
6022 \cs_set_eq:NN \OnlyMainNiceMatrix \use:n
```

Another definition of `\OnlyMainNiceMatrix` will be linked to the command in the environments of `nicematrix`. Here is that definition, called `\@@_OnlyMainNiceMatrix:n`.

```

6023 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix:n #1
6024 {
6025     \int_if_zero:nTF \l_@@_first_col_int
6026     { \@@_OnlyMainNiceMatrix_i:n { #1 } }
6027     {
6028         \int_if_zero:nTF \c@jCol
6029         {
6030             \int_compare:nNf \c@iRow = { -1 }
6031             { \int_compare:nNf \c@iRow = { \l_@@_last_row_int - 1 } { #1 } }
6032         }
6033         { \@@_OnlyMainNiceMatrix_i:n { #1 } }

```

```

6034     }
6035 }

```

This definition may seem complicated but we must remind that the number of row `\c@iRow` is incremented in the first cell of the row, *after* a potential vertical rule on the left side of the first cell.

The command `\@@_OnlyMainNiceMatrix_i:n` is only a short-cut which is used twice in the above command. This command must *not* be protected.

```

6036 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix_i:n #1
6037 {
6038   \int_if_zero:nF \c@iRow
6039   {
6040     \int_compare:nNnF \c@iRow = \l_@@_last_row_int
6041     {
6042       \int_compare:nNnT \c@jCol > \c_zero_int
6043       { \bool_if:NF \l_@@_in_last_col_bool { #1 } }
6044     }
6045   }
6046 }

```

Remember that `\c@iRow` is not always inferior to `\l_@@_last_row_int` because `\l_@@_last_row_int` may be equal to -2 or -1 (we can't write `\int_compare:nNnT \c@iRow < \l_@@_last_row_int`).

The following command will be used for `\Toprule`, `\BottomRule` and `\MidRule`.

```

6047 \cs_new:Npn \@@_tikz_booktabs_loaded:nn #1 #2
6048 {
6049   \IfPackageLoadedTF { tikz }
6050   {
6051     \IfPackageLoadedTF { booktabs }
6052     { #2 }
6053     { \@@_error:nn { TopRule~without~booktabs } { #1 } }
6054   }
6055   { \@@_error:nn { TopRule~without~tikz } { #1 } }
6056 }
6057 \NewExpandableDocumentCommand { \@@_TopRule } { }
6058 { \@@_tikz_booktabs_loaded:nn \TopRule \@@_TopRule_i: }
6059 \cs_new:Npn \@@_TopRule_i:
6060 {
6061   \noalign \bgroup
6062   \peek_meaning:NTF [
6063   { \@@_TopRule_ii: }
6064   { \@@_TopRule_ii: [ \dim_use:N \heavyrulewidth ] }
6065 }
6066 \NewDocumentCommand \@@_TopRule_ii: { o }
6067 {
6068   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6069   {
6070     \@@_hline:n
6071     {
6072       position = \int_eval:n { \c@iRow + 1 } ,
6073       tikz =
6074       {
6075         line-width = #1 ,
6076         yshift = 0.25 \arrayrulewidth ,
6077         shorten-< = - 0.5 \arrayrulewidth
6078       } ,
6079       total-width = #1
6080     }
6081   }
6082   \skip_vertical:n { \belowrulesep + #1 }
6083   \egroup
6084 }

```

```

6085 \NewExpandableDocumentCommand { \@@_BottomRule } { }
6086 { \@@_tikz_booktabs_loaded:nn \BottomRule \@@_BottomRule_i: }
6087 \cs_new:Npn \@@_BottomRule_i:
6088 {
6089   \noalign \bgroup
6090   \peek_meaning:NTF [
6091     { \@@_BottomRule_ii: }
6092     { \@@_BottomRule_ii: [ \dim_use:N \heavyrulewidth ] }
6093   }
6094 \NewDocumentCommand \@@_BottomRule_ii: { o }
6095 {
6096   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6097   {
6098     \@@_hline:n
6099     {
6100       position = \int_eval:n { \c@iRow + 1 } ,
6101       tikz =
6102       {
6103         line-width = #1 ,
6104         yshift = 0.25 \arrayrulewidth ,
6105         shorten-< = - 0.5 \arrayrulewidth
6106       } ,
6107       total-width = #1 ,
6108     }
6109   }
6110   \skip_vertical:N \aboverulesep
6111   \@@_create_row_node_i:
6112   \skip_vertical:n { #1 }
6113   \egroup
6114 }
6115 \NewExpandableDocumentCommand { \@@_MidRule } { }
6116 { \@@_tikz_booktabs_loaded:nn \MidRule \@@_MidRule_i: }
6117 \cs_new:Npn \@@_MidRule_i:
6118 {
6119   \noalign \bgroup
6120   \peek_meaning:NTF [
6121     { \@@_MidRule_ii: }
6122     { \@@_MidRule_ii: [ \dim_use:N \lightrulewidth ] }
6123   }
6124 \NewDocumentCommand \@@_MidRule_ii: { o }
6125 {
6126   \skip_vertical:N \aboverulesep
6127   \@@_create_row_node_i:
6128   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6129   {
6130     \@@_hline:n
6131     {
6132       position = \int_eval:n { \c@iRow + 1 } ,
6133       tikz =
6134       {
6135         line-width = #1 ,
6136         yshift = 0.25 \arrayrulewidth ,
6137         shorten-< = - 0.5 \arrayrulewidth
6138       } ,
6139       total-width = #1 ,
6140     }
6141   }
6142   \skip_vertical:n { \belowrulesep + #1 }
6143   \egroup
6144 }

```

General system for drawing rules

When a command, environment or “subsystem” of `nicematrix` wants to draw a rule, it will write in the internal `\CodeAfter` a command `\@@_vline:n` or `\@@_hline:n`. Both commands take in as argument a list of `key=value` pairs. That list will first be analyzed with the following set of keys. However, unknown keys will be analyzed further with another set of keys.

```
6145 \keys_define:nn { nicematrix / Rules }
6146 {
6147   position .int_set:N = \l_@@_position_int ,
6148   position .value_required:n = true ,
6149   start .int_set:N = \l_@@_start_int ,
6150   end .code:n =
6151     \bool_lazy_or:nnTF
6152     { \tl_if_empty_p:n { #1 } }
6153     { \str_if_eq_p:ee { #1 } { last } }
6154     { \int_set_eq:NN \l_@@_end_int \c@jCol }
6155     { \int_set:Nn \l_@@_end_int { #1 } }
6156 }
```

It’s possible that the rule won’t be drawn continuously from `start` to `end` because of the blocks (created with the command `\Block`), the virtual blocks (created by `\Cdots`, etc.), etc. That’s why an analyse is done and the rule is cut in small rules which will actually be drawn. The small continuous rules will be drawn by `\@@_vline_ii:` and `\@@_hline_ii:`. Those commands use the following set of keys.

```
6157 \keys_define:nn { nicematrix / RulesBis }
6158 {
6159   multiplicity .int_set:N = \l_@@_multiplicity_int ,
6160   multiplicity .initial:n = 1 ,
6161   dotted .bool_set:N = \l_@@_dotted_bool ,
6162   dotted .initial:n = false ,
6163   dotted .default:n = true ,
```

We want that, even when the rule has been defined with TikZ by the key `tikz`, the user has still the possibility to change the color of the rule with the key `color` (in the command `\Hline`, not in the key `tikz` of the command `\Hline`). The main use is, when the user has defined its own command `\MyDashedLine` by `\newcommand{\MyDashedRule}{\Hline[tikz=dashed]}`, to give the ability to write `\MyDashedRule[color=red]`.

```
6164   color .code:n =
6165     \@@_set_CT@arc@:n { #1 }
6166     \tl_set:Nn \l_@@_rule_color_tl { #1 } ,
6167   color .value_required:n = true ,
6168   sep-color .code:n = \@@_set_CT@drsc@:n { #1 } ,
6169   sep-color .value_required:n = true ,
```

If the user uses the key `tikz`, the rule (or more precisely: the different sub-rules since a rule may be broken by blocks or others) will be drawn with Tikz.

```
6170   tikz .code:n =
6171     \IfPackageLoadedTF { tikz }
6172     { \clist_put_right:Nn \l_@@_tikz_rule_tl { #1 } }
6173     { \@@_error:n { tikz-without-tikz } } ,
6174   tikz .value_required:n = true ,
6175   total-width .dim_set:N = \l_@@_rule_width_dim ,
6176   total-width .value_required:n = true ,
6177   width .meta:n = { total-width = #1 } ,
6178   unknown .code:n = \@@_error:n { Unknow-key-for-RulesBis }
6179 }
```

The vertical rules

The following command will be executed in the internal `\CodeAfter`. The argument `#1` is a list of `key=value` pairs.

```
6180 \cs_new_protected:Npn \@@_vline:n #1
6181 {
```

The group is for the options.

```

6182   \group_begin:
6183   \int_set_eq:NN \l_@@_end_int \c@iRow
6184   \keys_set_known:nN { nicematrix / Rules } { #1 } \l_@@_other_keys_tl

```

The following test is for the case where the user does not use all the columns specified in the preamble of the environment (for instance, a preamble of |c|c|c| but only two columns used).

```

6185   \int_compare:nNnT \l_@@_position_int < { \c@jCol + 2 }
6186   \@@_vline_i:
6187   \group_end:
6188   }

6189   \cs_new_protected:Npn \@@_vline_i:
6190   {

```

`\l_tmpa_tl` is the number of row and `\l_tmpb_tl` the number of column. When we have found a row corresponding to a rule to draw, we note its number in `\l_@@_tmpc_tl`.

```

6191   \tl_set:No \l_tmpb_tl { \int_use:N \l_@@_position_int }
6192   \int_step_variable:nNn \l_@@_start_int \l_@@_end_int
6193   \l_tmpa_tl
6194   {

```

The boolean `\g_tmpa_bool` indicates whether the small vertical rule will be drawn. If we find that it is in a block (a real block, created by `\Block` or a virtual block corresponding to a dotted line, created by `\Cdots`, `\Vdots`, etc.), we will set `\g_tmpa_bool` to `false` and the small vertical rule won't be drawn.

```

6195   \bool_gset_true:N \g_tmpa_bool

6196   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6197   { \@@_test_vline_in_block:nnnn #1 }
6198   \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
6199   { \@@_test_vline_in_block:nnnn #1 }
6200   \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
6201   { \@@_test_vline_in_stroken_block:nnn #1 }
6202   \clist_if_empty:NF \l_@@_corners_clist \@@_test_in_corner_v:
6203   \bool_if:NTF \g_tmpa_bool
6204   {
6205   \int_if_zero:nT \l_@@_local_start_int

```

We keep in memory that we have a rule to draw. `\l_@@_local_start_int` will be the starting row of the rule that we will have to draw.

```

6206   { \int_set:Nn \l_@@_local_start_int \l_tmpa_tl }
6207   }
6208   {
6209   \int_compare:nNnT \l_@@_local_start_int > \c_zero_int
6210   {
6211   \int_set:Nn \l_@@_local_end_int { \l_tmpa_tl - 1 }
6212   \@@_vline_ii:
6213   \int_zero:N \l_@@_local_start_int
6214   }
6215   }
6216   }
6217   \int_compare:nNnT \l_@@_local_start_int > \c_zero_int
6218   {
6219   \int_set_eq:NN \l_@@_local_end_int \l_@@_end_int
6220   \@@_vline_ii:
6221   }
6222   }

```

```

6223   \cs_new_protected:Npn \@@_test_in_corner_v:
6224   {
6225   \int_compare:nNnTF \l_tmpb_tl = { \c@jCol + 1 }
6226   {
6227   \@@_if_in_corner:nT { \l_tmpa_tl - \int_eval:n { \l_tmpb_tl - 1 } }

```

```

6228     { \bool_set_false:N \g_tmpa_bool }
6229   }
6230   {
6231     \@@_if_in_corner:nT { \l_tmpa_tl - \l_tmpb_tl }
6232     {
6233       \int_compare:nNnTF \l_tmpb_tl = \c_one_int
6234       { \bool_set_false:N \g_tmpa_bool }
6235       {
6236         \@@_if_in_corner:nT
6237         { \l_tmpa_tl - \int_eval:n { \l_tmpb_tl - 1 } }
6238         { \bool_set_false:N \g_tmpa_bool }
6239       }
6240     }
6241   }
6242 }

```

```

6243 \cs_new_protected:Npn \@@_vline_ii:
6244 {
6245   \tl_clear:N \l_@@_tikz_rule_tl
6246   \keys_set:no { nicematrix / RulesBis } \l_@@_other_keys_tl
6247   \bool_if:NTF \l_@@_dotted_bool
6248     \@@_vline_iv:
6249     {
6250       \tl_if_empty:NTF \l_@@_tikz_rule_tl
6251       \@@_vline_iii:
6252       \@@_vline_v:
6253     }
6254 }

```

First the case of a standard rule: the user has not used the key `dotted` nor the key `tikz`.

```

6255 \cs_new_protected:Npn \@@_vline_iii:
6256 {
6257   \pgfpicture
6258   \pgfrememberpicturepositiononpagetrue
6259   \pgf@relevantforpicturesizefalse
6260   \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }
6261   \dim_set_eq:NN \l_tmpa_dim \pgf@y
6262   \@@_qpoint:n { col - \int_use:N \l_@@_position_int }
6263   \dim_set:Nn \l_tmpb_dim
6264   {
6265     \pgf@x
6266     - 0.5 \l_@@_rule_width_dim
6267     +
6268     ( \arrayrulewidth * \l_@@_multiplicity_int
6269       + \doublerulesep * ( \l_@@_multiplicity_int - 1 ) ) / 2
6270   }
6271   \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }
6272   \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
6273   \bool_lazy_all:nT
6274   {
6275     { \int_compare_p:nNn \l_@@_multiplicity_int > \c_one_int }
6276     { \cs_if_exist_p:N \CT@drsc@ }
6277     { ! \tl_if_blank_p:o \CT@drsc@ }
6278   }
6279   {
6280     \group_begin:
6281     \CT@drsc@
6282     \dim_add:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }
6283     \dim_sub:Nn \l_@@_tmpc_dim { 0.5 \arrayrulewidth }
6284     \dim_set:Nn \l_@@_tmpd_dim
6285     {
6286       \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth )

```

```

6287         * ( \l_@@_multiplicity_int - 1 )
6288     }
6289     \pgfpathrectanglecorners
6290     { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6291     { \pgfpoint \l_@@_tmpd_dim \l_@@_tmpc_dim }
6292     \pgfusepath { fill }
6293     \group_end:
6294 }
6295 \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6296 \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
6297 \prg_replicate:nn { \l_@@_multiplicity_int - 1 }
6298 {
6299     \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
6300     \dim_sub:Nn \l_tmpb_dim \doublerulesep
6301     \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6302     \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
6303 }
6304 \CT@arc@
6305 \pgfsetlinewidth { 1.1 \arrayrulewidth }
6306 \pgfsetrectcap
6307 \pgfusepathqstroke
6308 \endpgfpicture
6309 }

```

The following code is for the case of a dotted rule (with our system of rounded dots).

```

6310 \cs_new_protected:Npn \@@_vline_iv:
6311 {
6312     \pgfpicture
6313     \pgfrememberpicturepositiononpagetrue
6314     \pgf@relevantforpicturesizefalse
6315     \@@_qpoint:n { col - \int_use:N \l_@@_position_int }
6316     \dim_set:Nn \l_@@_x_initial_dim { \pgf@x - 0.5 \l_@@_rule_width_dim }
6317     \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
6318     \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }
6319     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
6320     \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }
6321     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
6322     \CT@arc@
6323     \@@_draw_line:
6324     \endpgfpicture
6325 }

```

The following code is for the case when the user uses the key `tikz`.

```

6326 \cs_new_protected:Npn \@@_vline_v:
6327 {
6328     \begin {tikzpicture }

```

By default, the color defined by `\arrayrulecolor` or by `rules/color` will be used, but it's still possible to change the color by using the key `color` or, of course, the key `color` inside the key `tikz` (that is to say the key `color` provided by PGF).

```

6329     \CT@arc@
6330     \tl_if_empty:NF \l_@@_rule_color_tl
6331     { \tl_put_right:Ne \l_@@_tikz_rule_tl { , color = \l_@@_rule_color_tl } }
6332     \pgfrememberpicturepositiononpagetrue
6333     \pgf@relevantforpicturesizefalse
6334     \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }
6335     \dim_set_eq:NN \l_tmpa_dim \pgf@y
6336     \@@_qpoint:n { col - \int_use:N \l_@@_position_int }
6337     \dim_set:Nn \l_tmpb_dim { \pgf@x - 0.5 \l_@@_rule_width_dim }
6338     \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }
6339     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
6340     \exp_args:No \tikzset \l_@@_tikz_rule_tl
6341     \use:e { \exp_not:N \draw [ \l_@@_tikz_rule_tl ] }

```

```

6342     ( \l_tmpb_dim , \l_tmpa_dim ) --
6343     ( \l_tmpb_dim , \l_@@_tmpc_dim ) ;
6344 \end { tikzpicture }
6345 }

```

The command `\@@_draw_vlines:` draws all the vertical rules excepted in the blocks, in the virtual blocks (determined by a command such as `\Cdots`) and in the corners (if the key `corners` is used).

```

6346 \cs_new_protected:Npn \@@_draw_vlines:
6347 {
6348   \int_step_inline:nnn
6349     { \bool_lazy_or:nnTF \g_@@_delims_bool \l_@@_except_borders_bool 2 1 }
6350     {
6351       \bool_lazy_or:nnTF \g_@@_delims_bool \l_@@_except_borders_bool
6352         \c@jCol
6353         { \int_eval:n { \c@jCol + 1 } }
6354     }
6355     {
6356       \str_if_eq:eeF \l_@@_vlines_clist { all }
6357       { \clist_if_in:NnT \l_@@_vlines_clist { ##1 } }
6358       { \@@_vline:n { position = ##1 , total-width = \arrayrulewidth } }
6359     }
6360 }

```

The horizontal rules

The following command will be executed in the internal `\CodeAfter`. The argument `#1` is a list of `key=value` pairs of the form `{nicematrix/Rules}`.

```

6361 \cs_new_protected:Npn \@@_hline:n #1
6362 {

```

The group is for the options.

```

6363   \group_begin:
6364   \int_zero_new:N \l_@@_end_int
6365   \int_set_eq:NN \l_@@_end_int \c@jCol
6366   \keys_set_known:nnN { nicematrix / Rules } { #1 } \l_@@_other_keys_tl
6367   \@@_hline_i:
6368   \group_end:
6369 }

6370 \cs_new_protected:Npn \@@_hline_i:
6371 {
6372   \int_zero_new:N \l_@@_local_start_int
6373   \int_zero_new:N \l_@@_local_end_int

```

`\l_tmpa_tl` is the number of row and `\l_tmpb_tl` the number of column. When we have found a column corresponding to a rule to draw, we note its number in `\l_@@_tmpc_tl`.

```

6374   \tl_set:No \l_tmpa_tl { \int_use:N \l_@@_position_int }
6375   \int_step_variable:nnNn \l_@@_start_int \l_@@_end_int
6376     \l_tmpb_tl
6377   {

```

The boolean `\g_tmpa_bool` indicates whether the small horizontal rule will be drawn. If we find that it is in a block (a real block, created by `\Block` or a virtual block corresponding to a dotted line, created by `\Cdots`, `\Vdots`, etc.), we will set `\g_tmpa_bool` to `false` and the small horizontal rule won't be drawn.

```

6378     \bool_gset_true:N \g_tmpa_bool

```

We test whether we are in a block.

```

6379     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6380     { \@@_test_hline_in_block:nnnnn ##1 }

```

```

6381 \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
6382 { \@@_test_hline_in_block:nnnnn ##1 }
6383 \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
6384 { \@@_test_hline_in_stroken_block:nnnn ##1 }
6385 \clist_if_empty:NF \l_@@_corners_clist \@@_test_in_corner_h:
6386 \bool_if:NTF \g_tmpa_bool
6387 {
6388 \int_if_zero:nT \l_@@_local_start_int

```

We keep in memory that we have a rule to draw. `\l_@@_local_start_int` will be the starting row of the rule that we will have to draw.

```

6389     { \int_set:Nn \l_@@_local_start_int \l_tmpb_tl }
6390   }
6391   {
6392     \int_compare:nNnT \l_@@_local_start_int > \c_zero_int
6393     {
6394       \int_set:Nn \l_@@_local_end_int { \l_tmpb_tl - 1 }
6395       \@@_hline_ii:
6396       \int_zero:N \l_@@_local_start_int
6397     }
6398   }
6399 }
6400 \int_compare:nNnT \l_@@_local_start_int > \c_zero_int
6401 {
6402   \int_set_eq:NN \l_@@_local_end_int \l_@@_end_int
6403   \@@_hline_ii:
6404 }
6405 }

```

```

6406 \cs_new_protected:Npn \@@_test_in_corner_h:
6407 {
6408   \int_compare:nNnTF \l_tmpa_tl = { \c@iRow + 1 }
6409   {
6410     \@@_if_in_corner:nT { \int_eval:n { \l_tmpa_tl - 1 } - \l_tmpb_tl }
6411     { \bool_set_false:N \g_tmpa_bool }
6412   }
6413   {
6414     \@@_if_in_corner:nT { \l_tmpa_tl - \l_tmpb_tl }
6415     {
6416       \int_compare:nNnTF \l_tmpa_tl = \c_one_int
6417       { \bool_set_false:N \g_tmpa_bool }
6418       {
6419         \@@_if_in_corner:nT
6420         { \int_eval:n { \l_tmpa_tl - 1 } - \l_tmpb_tl }
6421         { \bool_set_false:N \g_tmpa_bool }
6422       }
6423     }
6424   }
6425 }

```

```

6426 \cs_new_protected:Npn \@@_hline_ii:
6427 {
6428   \tl_clear:N \l_@@_tikz_rule_tl
6429   \keys_set:no { nicematrix / RulesBis } \l_@@_other_keys_tl
6430   \bool_if:NTF \l_@@_dotted_bool
6431   \@@_hline_iv:
6432   {
6433     \tl_if_empty:NTF \l_@@_tikz_rule_tl
6434     \@@_hline_iii:
6435     \@@_hline_v:
6436   }
6437 }

```

First the case of a standard rule (without the keys dotted and tikz).

```

6438 \cs_new_protected:Npn \@@_hline_iii:
6439 {
6440   \pgfpicture
6441   \pgfrememberpicturepositiononpagetrue
6442   \pgf@relevantforpicturesizefalse
6443   \@@_qpoint:n { col - \int_use:N \l_@@_local_start_int }
6444   \dim_set_eq:NN \l_tmpa_dim \pgf@x
6445   \@@_qpoint:n { row - \int_use:N \l_@@_position_int }
6446   \dim_set:Nn \l_tmpb_dim
6447     {
6448     \pgf@y
6449     - 0.5 \l_@@_rule_width_dim
6450     +
6451     ( \arrayrulewidth * \l_@@_multiplicity_int
6452       + \doublerulesep * ( \l_@@_multiplicity_int - 1 ) ) / 2
6453     }
6454   \@@_qpoint:n { col - \int_eval:n { \l_@@_local_end_int + 1 } }
6455   \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
6456   \bool_lazy_all:nT
6457     {
6458     { \int_compare_p:nNn \l_@@_multiplicity_int > \c_one_int }
6459     { \cs_if_exist_p:N \CT@drsc@ }
6460     { ! \tl_if_blank_p:o \CT@drsc@ }
6461     }
6462     {
6463     \group_begin:
6464     \CT@drsc@
6465     \dim_set:Nn \l_@@_tmpd_dim
6466       {
6467       \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth )
6468       * ( \l_@@_multiplicity_int - 1 )
6469       }
6470     \pgfpathrectanglecorners
6471       { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
6472       { \pgfpoint \l_@@_tmpc_dim \l_@@_tmpd_dim }
6473     \pgfusepathqfill
6474     \group_end:
6475     }
6476   \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
6477   \pgfpathlineto { \pgfpoint \l_@@_tmpc_dim \l_tmpb_dim }
6478   \prg_replicate:nn { \l_@@_multiplicity_int - 1 }
6479     {
6480     \dim_sub:Nn \l_tmpb_dim \arrayrulewidth
6481     \dim_sub:Nn \l_tmpb_dim \doublerulesep
6482     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
6483     \pgfpathlineto { \pgfpoint \l_@@_tmpc_dim \l_tmpb_dim }
6484     }
6485   \CT@arc@
6486   \pgfsetlinewidth { 1.1 \arrayrulewidth }
6487   \pgfsetrectcap
6488   \pgfusepathqstroke
6489   \endpgfpicture
6490 }

```

The following code is for the case of a dotted rule (with our system of rounded dots). The aim is that, by standard the dotted line fits between square brackets (`\hline` doesn't).

```

\begin{bNiceMatrix}
1 & 2 & 3 & 4 \\
\hline
1 & 2 & 3 & 4 \\
\hdottedline
1 & 2 & 3 & 4
\end{bNiceMatrix}

```

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ \hline 1 & 2 & 3 & 4 \\ \hdottedline 1 & 2 & 3 & 4 \end{bmatrix}$$

But, if the user uses `margin`, the dotted line extends to have the same width as a `\hline`.

```

\begin{bNiceMatrix}[margin]
1 & 2 & 3 & 4 \\
\hline
1 & 2 & 3 & 4 \\
\hdottedline
1 & 2 & 3 & 4
\end{bNiceMatrix}

```

$$\begin{bmatrix} 1 & 2 & 3 & 4 \\ \hline 1 & 2 & 3 & 4 \\ \hdottedline 1 & 2 & 3 & 4 \end{bmatrix}$$

```

6491 \cs_new_protected:Npn \@@_hline_iv:
6492 {
6493   \pgfpicture
6494   \pgfrememberpicturepositiononpagetrue
6495   \pgf@relevantforpicturesizefalse
6496   \@@_qpoint:n { row - \int_use:N \l_@@_position_int }
6497   \dim_set:Nn \l_@@_y_initial_dim { \pgf@y - 0.5 \l_@@_rule_width_dim }
6498   \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim
6499   \@@_qpoint:n { col - \int_use:N \l_@@_local_start_int }
6500   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
6501   \int_compare:nNnT \l_@@_local_start_int = \c_one_int
6502   {
6503     \dim_sub:Nn \l_@@_x_initial_dim \l_@@_left_margin_dim
6504     \bool_if:NF \g_@@_delims_bool
6505     { \dim_sub:Nn \l_@@_x_initial_dim \arraycolsep }

```

For reasons purely aesthetic, we do an adjustment in the case of a rounded bracket. The correction by `0.5 \l_@@_xdots_inter_dim` is *ad hoc* for a better result.

```

6506     \tl_if_eq:NnF \g_@@_left_delim_tl (
6507       { \dim_add:Nn \l_@@_x_initial_dim { 0.5 \l_@@_xdots_inter_dim } }
6508     )
6509     \@@_qpoint:n { col - \int_eval:n { \l_@@_local_end_int + 1 } }
6510     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
6511     \int_compare:nNnT \l_@@_local_end_int = \c_jCol
6512     {
6513       \dim_add:Nn \l_@@_x_final_dim \l_@@_right_margin_dim
6514       \bool_if:NF \g_@@_delims_bool
6515       { \dim_add:Nn \l_@@_x_final_dim \arraycolsep }
6516       \tl_if_eq:NnF \g_@@_right_delim_tl )
6517       { \dim_gsub:Nn \l_@@_x_final_dim { 0.5 \l_@@_xdots_inter_dim } }
6518     }
6519     \CT@arc@
6520     \@@_draw_line:
6521     \endpgfpicture
6522   }

```

The following code is for the case when the user uses the key `tikz` (in the definition of a customized rule by using the key `custom-line`).

```

6523 \cs_new_protected:Npn \@@_hline_v:
6524 {
6525   \begin { tikzpicture }

```

By default, the color defined by `\arrayrulecolor` or by `rules/color` will be used, but it's still possible to change the color by using the key `color` or, of course, the key `color` inside the key `tikz` (that is to say the key `color` provided by PGF).

```

6526     \CT@arc@
6527     \tl_if_empty:NF \l_@@_rule_color_tl

```

```

6528     { \tl_put_right:Ne \l_@@_tikz_rule_tl { , color = \l_@@_rule_color_tl } }
6529 \pgfrememberpicturepositiononpagetrue
6530 \pgf@relevantforpicturesizefalse
6531 \@@_qpoint:n { col - \int_use:N \l_@@_local_start_int }
6532 \dim_set_eq:NN \l_tmpa_dim \pgf@x
6533 \@@_qpoint:n { row - \int_use:N \l_@@_position_int }
6534 \dim_set:Nn \l_tmpb_dim { \pgf@y - 0.5 \l_@@_rule_width_dim }
6535 \@@_qpoint:n { col - \int_eval:n { \l_@@_local_end_int + 1 } }
6536 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
6537 \exp_args:No \tikzset \l_@@_tikz_rule_tl
6538 \use:e { \exp_not:N \draw [ \l_@@_tikz_rule_tl ] }
6539   ( \l_tmpa_dim , \l_tmpb_dim ) --
6540   ( \l_@@_tmpc_dim , \l_tmpb_dim ) ;
6541 \end { tikzpicture }
6542 }

```

The command `\@@_draw_hlines:` draws all the horizontal rules excepted in the blocks (even the virtual blocks determined by commands such as `\Cdots` and in the corners — if the key `corners` is used).

```

6543 \cs_new_protected:Npn \@@_draw_hlines:
6544 {
6545   \int_step_inline:nnn
6546     { \bool_lazy_or:nnTF \g_@@_delims_bool \l_@@_except_borders_bool 2 1 }
6547     {
6548       \bool_lazy_or:nnTF \g_@@_delims_bool \l_@@_except_borders_bool
6549         \c@iRow
6550         { \int_eval:n { \c@iRow + 1 } }
6551     }
6552     {
6553       \str_if_eq:eeF \l_@@_hlines_clist { all }
6554       { \clist_if_in:NnT \l_@@_hlines_clist { ##1 } }
6555       { \@@_hline:n { position = ##1 , total-width = \arrayrulewidth } }
6556     }
6557 }

```

The command `\@@_Hline:` will be linked to `\Hline` in the environments of `nicematrix`.

```

6558 \cs_set:Npn \@@_Hline: { \noalign \bgroup \@@_Hline_i:n { 1 } }

```

The argument of the command `\@@_Hline_i:n` is the number of successive `\Hline` found.

```

6559 \cs_set:Npn \@@_Hline_i:n #1
6560 {
6561   \peek_remove_spaces:n
6562     {
6563       \peek_meaning:NTF \Hline
6564       { \@@_Hline_ii:n { #1 + 1 } }
6565       { \@@_Hline_iii:n { #1 } }
6566     }
6567 }
6568 \cs_set:Npn \@@_Hline_ii:n #1 #2 { \@@_Hline_i:n { #1 } }
6569 \cs_set:Npn \@@_Hline_iii:n #1
6570 { \@@_collect_options:n { \@@_Hline_iv:nn { #1 } } }
6571 \cs_set_protected:Npn \@@_Hline_iv:nn #1 #2
6572 {
6573   \@@_compute_rule_width:n { multiplicity = #1 , #2 }
6574   \skip_vertical:N \l_@@_rule_width_dim
6575   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6576   {
6577     \@@_hline:n
6578     {
6579       multiplicity = #1 ,
6580       position = \int_eval:n { \c@iRow + 1 } ,

```

```

6581         total-width = \dim_use:N \l_@@_rule_width_dim ,
6582         #2
6583     }
6584 }
6585 \egroup
6586 }

```

Customized rules defined by the final user

The final user can define a customized rule by using the key `custom-line` in `\NiceMatrixOptions`. That key takes in as value a list of `key=value` pairs.

The following command will create the customized rule (it is executed when the final user uses the key `custom-line`, for example in `\NiceMatrixOptions`).

```

6587 \cs_new_protected:Npn \@@_custom_line:n #1
6588 {
6589     \str_clear_new:N \l_@@_command_str
6590     \str_clear_new:N \l_@@_ccommand_str
6591     \str_clear_new:N \l_@@_letter_str
6592     \tl_clear_new:N \l_@@_other_keys_tl
6593     \keys_set_known:nnN { nicematrix / custom-line } { #1 } \l_@@_other_keys_tl

```

If the final user only wants to draw horizontal rules, he does not need to specify a letter (for the vertical rules in the preamble of the array). On the other hand, if he only wants to draw vertical rules, he does not need to define a command (which is the tool to draw horizontal rules in the array). Of course, a definition of custom lines with no letter and no command would be point-less.

```

6594     \bool_lazy_all:nTF
6595     {
6596         { \str_if_empty_p:N \l_@@_letter_str }
6597         { \str_if_empty_p:N \l_@@_command_str }
6598         { \str_if_empty_p:N \l_@@_ccommand_str }
6599     }
6600     { \@@_error:n { No~letter~and~no~command } }
6601     { \@@_custom_line_i:o \l_@@_other_keys_tl }
6602 }
6603 \keys_define:nn { nicematrix / custom-line }
6604 {
6605     letter .str_set:N = \l_@@_letter_str ,
6606     letter .value_required:n = true ,
6607     command .str_set:N = \l_@@_command_str ,
6608     command .value_required:n = true ,
6609     ccommand .str_set:N = \l_@@_ccommand_str ,
6610     ccommand .value_required:n = true ,
6611 }

```

```

6612 \cs_generate_variant:Nn \@@_custom_line_i:n { o }
6613 \cs_new_protected:Npn \@@_custom_line_i:n #1
6614 {

```

The following flags will be raised when the keys `tikz`, `dotted` and `color` are used (in the `custom-line`).

```

6615     \bool_set_false:N \l_@@_tikz_rule_bool
6616     \bool_set_false:N \l_@@_dotted_rule_bool
6617     \bool_set_false:N \l_@@_color_bool
6618     \keys_set:nn { nicematrix / custom-line-bis } { #1 }
6619     \bool_if:NT \l_@@_tikz_rule_bool
6620     {
6621         \IfPackageLoadedF { tikz }
6622         { \@@_error:n { tikz-in-custom-line-without-tikz } }
6623         \bool_if:NT \l_@@_color_bool
6624         { \@@_error:n { color-in-custom-line-with-tikz } }
6625     }

```

```

6626 \bool_if:NT \l_@@_dotted_rule_bool
6627   {
6628     \int_compare:nNnT \l_@@_multiplicity_int > \c_one_int
6629     { \@@_error:n { key~multiplicity~with~dotted } }
6630   }
6631 \str_if_empty:NF \l_@@_letter_str
6632   {
6633     \int_compare:nTF { \str_count:N \l_@@_letter_str != 1 }
6634     { \@@_error:n { Several~letters } }
6635     {
6636       \tl_if_in:NoTF
6637         \c_@@_forbidden_letters_str
6638         \l_@@_letter_str
6639         { \@@_error:ne { Forbidden~letter } \l_@@_letter_str }
6640     }

```

During the analyse of the preamble provided by the final user, our automaton, for the letter corresponding at the custom line, will directly use the following command that you define in the main hash table of TeX.

```

6641         \cs_set_nopar:cpn { @@ _ \l_@@_letter_str } ##1
6642         { \@@_v_custom_line:n { #1 } }
6643     }
6644 }
6645 }
6646 \str_if_empty:NF \l_@@_command_str { \@@_h_custom_line:n { #1 } }
6647 \str_if_empty:NF \l_@@_ccommand_str { \@@_c_custom_line:n { #1 } }
6648 }
6649 \tl_const:Nn \c_@@_forbidden_letters_tl { lcrpmbVX|() []!@<> }
6650 \str_const:Nn \c_@@_forbidden_letters_str { lcrpmbVX|() []!@<> }

```

The previous command `\@@_custom_line_i:n` uses the following set of keys. However, the whole definition of the customized lines (as provided by the final user as argument of `custom-line`) will also be used further with other sets of keys (for instance `{nicematrix/Rules}`). That's why the following set of keys has some keys which are no-op.

```

6651 \keys_define:nn { nicematrix / custom-line-bis }
6652   {
6653     multiplicity .int_set:N = \l_@@_multiplicity_int ,
6654     multiplicity .initial:n = 1 ,
6655     multiplicity .value_required:n = true ,
6656     color .code:n = \bool_set_true:N \l_@@_color_bool ,
6657     color .value_required:n = true ,
6658     tikz .code:n = \bool_set_true:N \l_@@_tikz_rule_bool ,
6659     tikz .value_required:n = true ,
6660     dotted .code:n = \bool_set_true:N \l_@@_dotted_rule_bool ,
6661     dotted .value_forbidden:n = true ,
6662     total-width .code:n = { } ,
6663     total-width .value_required:n = true ,
6664     width .code:n = { } ,
6665     width .value_required:n = true ,
6666     sep-color .code:n = { } ,
6667     sep-color .value_required:n = true ,
6668     unknown .code:n = \@@_error:n { Unknown~key~for~custom~line }
6669   }

```

The following keys will indicate whether the keys `dotted`, `tikz` and `color` are used in the use of a `custom-line`.

```

6670 \bool_new:N \l_@@_dotted_rule_bool
6671 \bool_new:N \l_@@_tikz_rule_bool
6672 \bool_new:N \l_@@_color_bool

```

The following keys are used to determine the total width of the line (including the spaces on both sides of the line). The key `width` is deprecated and has been replaced by the key `total-width`.

```

6673 \keys_define:nm { nicematrix / custom-line-width }
6674 {
6675   multiplicity .int_set:N = \l_@@_multiplicity_int ,
6676   multiplicity .initial:n = 1 ,
6677   multiplicity .value_required:n = true ,
6678   tikz .code:n = \bool_set_true:N \l_@@_tikz_rule_bool ,
6679   total-width .code:n = \dim_set:Nn \l_@@_rule_width_dim { #1 }
6680   \bool_set_true:N \l_@@_total_width_bool ,
6681   total-width .value_required:n = true ,
6682   width .meta:n = { total-width = #1 } ,
6683   dotted .code:n = \bool_set_true:N \l_@@_dotted_rule_bool ,
6684 }

```

The following command will create the command that the final user will use in its array to draw an horizontal rule (hence the ‘h’ in the name) with the full width of the array. #1 is the whole set of keys to pass to the command \@@_hline:n (which is in the internal \CodeAfter).

```

6685 \cs_new_protected:Npn \@@_h_custom_line:n #1
6686 {

```

We use \cs_set:cpn and not \cs_new:cpn because we want a local definition. Moreover, the command must *not* be protected since it begins with \noalign (which is in \Hline).

```

6687   \cs_set_nopar:cpn { nicematrix - \l_@@_command_str } { \Hline [ #1 ] }
6688   \seq_put_left:No \l_@@_custom_line_commands_seq \l_@@_command_str
6689 }

```

The following command will create the command that the final user will use in its array to draw an horizontal rule on only some of the columns of the array (hence the letter c as in \cline). #1 is the whole set of keys to pass to the command \@@_hline:n (which is in the internal \CodeAfter).

```

6690 \cs_new_protected:Npn \@@_c_custom_line:n #1
6691 {

```

Here, we need an expandable command since it begins with an \noalign.

```

6692   \exp_args:Nc \NewExpandableDocumentCommand
6693   { nicematrix - \l_@@_ccommand_str }
6694   { 0 { } m }
6695   {
6696     \noalign
6697     {
6698       \@@_compute_rule_width:n { #1 , ##1 }
6699       \skip_vertical:n { \l_@@_rule_width_dim }
6700       \clist_map_inline:nn
6701       { ##2 }
6702       { \@@_c_custom_line_i:nn { #1 , ##1 } { #####1 } }
6703     }
6704   }
6705   \seq_put_left:No \l_@@_custom_line_commands_seq \l_@@_ccommand_str
6706 }

```

The first argument is the list of key-value pairs characteristic of the line. The second argument is the specification of columns for the \cline with the syntax *a-b*.

```

6707 \cs_new_protected:Npn \@@_c_custom_line_i:nn #1 #2
6708 {
6709   \tl_if_in:nnTF { #2 } { - }
6710   { \@@_cut_on_hyphen:w #2 \q_stop }
6711   { \@@_cut_on_hyphen:w #2 - #2 \q_stop }
6712   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6713   {
6714     \@@_hline:n
6715     {
6716       #1 ,
6717       start = \l_tmpa_tl ,

```

```

6718         end = \l_tmpb_tl ,
6719         position = \int_eval:n { \c@iRow + 1 } ,
6720         total-width = \dim_use:N \l_@@_rule_width_dim
6721     }
6722 }
6723 }
6724 \cs_new_protected:Npn \@@_compute_rule_width:n #1
6725 {
6726     \bool_set_false:N \l_@@_tikz_rule_bool
6727     \bool_set_false:N \l_@@_total_width_bool
6728     \bool_set_false:N \l_@@_dotted_rule_bool
6729     \keys_set_known:n { nicematrix / custom-line-width } { #1 }
6730     \bool_if:NF \l_@@_total_width_bool
6731     {
6732         \bool_if:NTF \l_@@_dotted_rule_bool
6733         { \dim_set:Nn \l_@@_rule_width_dim { 2 \l_@@_xdots_radius_dim } }
6734         {
6735             \bool_if:NF \l_@@_tikz_rule_bool
6736             {
6737                 \dim_set:Nn \l_@@_rule_width_dim
6738                 {
6739                     \arrayrulewidth * \l_@@_multiplicity_int
6740                     + \doublerulesep * ( \l_@@_multiplicity_int - 1 )
6741                 }
6742             }
6743         }
6744     }
6745 }
6746 \cs_new_protected:Npn \@@_v_custom_line:n #1
6747 {
6748     \@@_compute_rule_width:n { #1 }

```

In the following line, the `\dim_use:N` is mandatory since we do an expansion.

```

6749     \tl_gput_right:Ne \g_@@_array_preamble_tl
6750     { \exp_not:N ! { \skip_horizontal:n { \dim_use:N \l_@@_rule_width_dim } } }
6751     \tl_gput_right:Ne \g_@@_pre_code_after_tl
6752     {
6753         \@@_vline:n
6754         {
6755             #1 ,
6756             position = \int_eval:n { \c@jCol + 1 } ,
6757             total-width = \dim_use:N \l_@@_rule_width_dim
6758         }
6759     }
6760     \@@_rec_preamble:n
6761 }
6762 \@@_custom_line:n
6763 { letter = : , command = hdottedline , ccommand = cdottedline , dotted }

```

The key hvlines

The following command tests whether the current position in the array (given by `\l_tmpa_tl` for the row and `\l_tmpb_tl` for the column) would provide an horizontal rule towards the right in the block delimited by the four arguments #1, #2, #3 and #4. If this rule would be in the block (it must not be drawn), the boolean `\l_tmpa_bool` is set to false.

```

6764 \cs_new_protected:Npn \@@_test_hline_in_block:nnnnn #1 #2 #3 #4 #5
6765 {
6766     \int_compare:nNnT \l_tmpa_tl > { #1 }
6767     {
6768         \int_compare:nNnT \l_tmpa_tl < { #3 + 1 }
6769         {
6770             \int_compare:nNnT \l_tmpb_tl > { #2 - 1 }

```

```

6771         {
6772         \int_compare:nNnT \l_tmpb_tl < { #4 + 1 }
6773         { \bool_gset_false:N \g_tmpa_bool }
6774         }
6775     }
6776 }
6777 }

```

The same for vertical rules.

```

6778 \cs_new_protected:Npn \@@_test_vline_in_block:nnnnn #1 #2 #3 #4 #5
6779 {
6780     \int_compare:nNnT \l_tmpa_tl > { #1 - 1 }
6781     {
6782         \int_compare:nNnT \l_tmpa_tl < { #3 + 1 }
6783         {
6784             \int_compare:nNnT \l_tmpb_tl > { #2 }
6785             {
6786                 \int_compare:nNnT \l_tmpb_tl < { #4 + 1 }
6787                 { \bool_gset_false:N \g_tmpa_bool }
6788             }
6789         }
6790     }
6791 }

6792 \cs_new_protected:Npn \@@_test_hline_in_stroken_block:nnnn #1 #2 #3 #4
6793 {
6794     \int_compare:nNnT \l_tmpb_tl > { #2 - 1 }
6795     {
6796         \int_compare:nNnT \l_tmpb_tl < { #4 + 1 }
6797         {
6798             \int_compare:nNnTF \l_tmpa_tl = { #1 }
6799             { \bool_gset_false:N \g_tmpa_bool }
6800             {
6801                 \int_compare:nNnT \l_tmpa_tl = { #3 + 1 }
6802                 { \bool_gset_false:N \g_tmpa_bool }
6803             }
6804         }
6805     }
6806 }

6807 \cs_new_protected:Npn \@@_test_vline_in_stroken_block:nnnn #1 #2 #3 #4
6808 {
6809     \int_compare:nNnT \l_tmpa_tl > { #1 - 1 }
6810     {
6811         \int_compare:nNnT \l_tmpa_tl < { #3 + 1 }
6812         {
6813             \int_compare:nNnTF \l_tmpb_tl = { #2 }
6814             { \bool_gset_false:N \g_tmpa_bool }
6815             {
6816                 \int_compare:nNnT \l_tmpb_tl = { #4 + 1 }
6817                 { \bool_gset_false:N \g_tmpa_bool }
6818             }
6819         }
6820     }
6821 }

```

23 The empty corners

When the key `corners` is raised, the rules are not drawn in the corners; they are not colored and `\TikzEveryCell` does not apply. Of course, we have to compute the corners before we begin to draw the rules.

```

6822 \cs_new_protected:Npn \@@_compute_corners:
6823 {
6824   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6825     { \@@_mark_cells_of_block:nnnnn ##1 }

```

The list `\l_@@_corners_cells_clist` will be the list of all the empty cells (and not in a block) considered in the corners of the array. We use a `clist` instead of a `seq` because we will frequently search in that list (and searching in a `clist` is faster than searching in a `seq`).

```

6826   \clist_clear:N \l_@@_corners_cells_clist
6827   \clist_map_inline:Nn \l_@@_corners_clist
6828     {
6829       \str_case:nnF { ##1 }
6830         {
6831           { NW }
6832           { \@@_compute_a_corner:nnnnnn 1 1 1 1 \c@iRow \c@jCol }
6833           { NE }
6834           { \@@_compute_a_corner:nnnnnn 1 \c@jCol 1 { -1 } \c@iRow 1 }
6835           { SW }
6836           { \@@_compute_a_corner:nnnnnn \c@iRow 1 { -1 } 1 1 \c@jCol }
6837           { SE }
6838           { \@@_compute_a_corner:nnnnnn \c@iRow \c@jCol { -1 } { -1 } 1 1 }
6839         }
6840       { \@@_error:nn { bad~corner } { ##1 } }
6841     }

```

Even if the user has used the key `corners` the list of cells in the corners may be empty.

```

6842   \clist_if_empty:NF \l_@@_corners_cells_clist
6843   {

```

You write on the `aux` file the list of the cells which are in the (empty) corners because you need that information in the `\CodeBefore` since the commands which colors the rows, columns and cells must not color the cells in the corners.

```

6844     \tl_gput_right:Ne \g_@@_aux_tl
6845     {
6846       \cs_set_nopar:Npn \exp_not:N \l_@@_corners_cells_clist
6847         { \l_@@_corners_cells_clist }
6848     }
6849   }
6850 }

```

```

6851 \cs_new_protected:Npn \@@_mark_cells_of_block:nnnnn #1 #2 #3 #4 #5
6852 {
6853   \int_step_inline:nnn { #1 } { #3 }
6854   {
6855     \int_step_inline:nnn { #2 } { #4 }
6856     { \cs_set_nopar:cpn { @@ _ block _ ##1 - #####1 } { } }
6857   }
6858 }

```

```

6859 \prg_new_conditional:Npnn \@@_if_in_block:nn #1 #2 { p }
6860 {
6861   \cs_if_exist:cTF
6862     { @@ _ block _ \int_eval:n { #1 } - \int_eval:n { #2 } }
6863     \prg_return_true:
6864     \prg_return_false:
6865 }

```

“Computing a corner” is determining all the empty cells (which are not in a block) that belong to that corner. These cells will be added to the sequence `\l_@@_corners_cells_clist`.

The six arguments of `\@@_compute_a_corner:nnnnnn` are as follow:

- **#1** and **#2** are the number of row and column of the cell which is actually in the corner;

- #3 and #4 are the steps in rows and the step in columns when moving from the corner;
- #5 is the number of the final row when scanning the rows from the corner;
- #6 is the number of the final column when scanning the columns from the corner.

```
6866 \cs_new_protected:Npn \@@_compute_a_corner:nnnnnn #1 #2 #3 #4 #5 #6
6867 {
```

For the explanations and the name of the variables, we consider that we are computing the left-upper corner.

First, we try to determine which is the last empty cell (and not in a block: we won't add that precision any longer) in the column of number 1. The flag `\l_tmpa_bool` will be raised when a non-empty cell is found.

```
6868 \bool_set_false:N \l_tmpa_bool
6869 \int_zero_new:N \l_@@_last_empty_row_int
6870 \int_set:Nn \l_@@_last_empty_row_int { #1 }
6871 \int_step_inline:nnnn { #1 } { #3 } { #5 }
6872 {
6873   \bool_lazy_or:nnTF
6874   {
6875     \cs_if_exist_p:c
6876     { pgf @ sh @ ns @ \@@_env: - ##1 - \int_eval:n { #2 } }
6877   }
6878   { \@@_if_in_block_p:nn { ##1 } { #2 } }
6879   { \bool_set_true:N \l_tmpa_bool }
6880   {
6881     \bool_if:NF \l_tmpa_bool
6882     { \int_set:Nn \l_@@_last_empty_row_int { ##1 } }
6883   }
6884 }
```

Now, you determine the last empty cell in the row of number 1.

```
6885 \bool_set_false:N \l_tmpa_bool
6886 \int_zero_new:N \l_@@_last_empty_column_int
6887 \int_set:Nn \l_@@_last_empty_column_int { #2 }
6888 \int_step_inline:nnnn { #2 } { #4 } { #6 }
6889 {
6890   \bool_lazy_or:nnTF
6891   {
6892     \cs_if_exist_p:c
6893     { pgf @ sh @ ns @ \@@_env: - \int_eval:n { #1 } - ##1 }
6894   }
6895   { \@@_if_in_block_p:nn { #1 } { ##1 } }
6896   { \bool_set_true:N \l_tmpa_bool }
6897   {
6898     \bool_if:NF \l_tmpa_bool
6899     { \int_set:Nn \l_@@_last_empty_column_int { ##1 } }
6900   }
6901 }
```

Now, we loop over the rows.

```
6902 \int_step_inline:nnnn { #1 } { #3 } \l_@@_last_empty_row_int
6903 {
```

We treat the row number `##1` with another loop.

```
6904 \bool_set_false:N \l_tmpa_bool
6905 \int_step_inline:nnnn { #2 } { #4 } \l_@@_last_empty_column_int
6906 {
6907   \bool_lazy_or:nnTF
6908   { \cs_if_exist_p:c { pgf @ sh @ ns @ \@@_env: - ##1 - #####1 } }
6909   { \@@_if_in_block_p:nn { ##1 } { #####1 } }
6910   { \bool_set_true:N \l_tmpa_bool }
6911   {
6912     \bool_if:NF \l_tmpa_bool
```

```

6913         {
6914             \int_set:Nn \l_@@_last_empty_column_int { ##### }
6915             \clist_put_right:Nn
6916                 \l_@@_corners_cells_clist
6917                 { ##1 - ##### }
6918             \cs_set_nopar:cpn { @@ _ corner _ ##1 - ##### } { }
6919         }
6920     }
6921 }
6922 }
6923 }

```

Of course, instead of the following lines, we could have use `\prg_new_conditional:Npnn`.

```

6924 \cs_new:Npn \@@_if_in_corner:nT #1 { \cs_if_exist:cT { @@ _ corner _ #1 } }
6925 \cs_new:Npn \@@_if_in_corner:nF #1 { \cs_if_exist:cF { @@ _ corner _ #1 } }

```

Instead of the previous lines, we could have used `\l_@@_corners_cells_clist` but it's less efficient: `\clist_if_in:NeT \l_@@_corners_cells_clist { #1 } ...`

24 The environment {NiceMatrixBlock}

The following flag will be raised when all the columns of the environments of the block must have the same width in “auto” mode.

```

6926 \bool_new:N \l_@@_block_auto_columns_width_bool

```

Up to now, there is only one option available for the environment {NiceMatrixBlock}.

```

6927 \keys_define:nn { nicematrix / NiceMatrixBlock }
6928 {
6929     auto-columns-width .code:n =
6930     {
6931         \bool_set_true:N \l_@@_block_auto_columns_width_bool
6932         \dim_gzero_new:N \g_@@_max_cell_width_dim
6933         \bool_set_true:N \l_@@_auto_columns_width_bool
6934     }
6935 }

6936 \NewDocumentEnvironment { NiceMatrixBlock } { ! 0 { } }
6937 {
6938     \int_gincr:N \g_@@_NiceMatrixBlock_int
6939     \dim_zero:N \l_@@_columns_width_dim
6940     \keys_set:nn { nicematrix / NiceMatrixBlock } { #1 }
6941     \bool_if:NT \l_@@_block_auto_columns_width_bool
6942     {
6943         \cs_if_exist:cT
6944             { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
6945         {
6946             \dim_set:Nn \l_@@_columns_width_dim
6947             {
6948                 \use:c
6949                     { @@_max_cell_width _ \int_use:N \g_@@_NiceMatrixBlock_int }
6950             }
6951         }
6952     }
6953 }

```

At the end of the environment `{NiceMatrixBlock}`, we write in the main `aux` file instructions for the column width of all the environments of the block (that's why we have stored the number of the first environment of the block in the counter `\l_@@_first_env_block_int`).

```
6954 {
6955   \legacy_if:nTF { measuring@ }
```

If `{NiceMatrixBlock}` is used in an environment of `amsmath` such as `{align}`: cf. question 694957 on TeX StackExchange. The most important line in that case is the following one.

```
6956   { \int_gdecr:N \g_@@_NiceMatrixBlock_int }
6957   {
6958     \bool_if:NT \l_@@_block_auto_columns_width_bool
6959     {
6960       \iow_shipout:Nn \@mainaux \ExplSyntaxOn
6961       \iow_shipout:Ne \@mainaux
6962       {
6963         \cs_gset:cpn
6964         { @@ _ max _ cell _ width _ \int_use:N \g_@@_NiceMatrixBlock_int }
```

For technical reasons, we have to include the width of a potential rule on the right side of the cells.

```
6965         { \dim_eval:n { \g_@@_max_cell_width_dim + \arrayrulewidth } }
6966       }
6967       \iow_shipout:Nn \@mainaux \ExplSyntaxOff
6968     }
6969   }
6970   \ignorespacesafterend
6971 }
```

25 The extra nodes

The following command is called in `\@@_use_arraybox_with_notes_c:` just before the construction of the blocks (if the creation of medium nodes is required, medium nodes are also created for the blocks and that construction uses the standard medium nodes).

```
6972 \cs_new_protected:Npn \@@_create_extra_nodes:
6973 {
6974   \bool_if:nTF \l_@@_medium_nodes_bool
6975   {
6976     \bool_if:NTF \l_@@_no_cell_nodes_bool
6977     { \@@_error:n { extra-nodes-with-no-cell-nodes } }
6978     {
6979       \bool_if:NTF \l_@@_large_nodes_bool
6980       \@@_create_medium_and_large_nodes:
6981       \@@_create_medium_nodes:
6982     }
6983   }
6984   {
6985     \bool_if:NT \l_@@_large_nodes_bool
6986     {
6987       \bool_if:NTF \l_@@_no_cell_nodes_bool
6988       { \@@_error:n { extra-nodes-with-no-cell-nodes } }
6989       \@@_create_large_nodes:
6990     }
6991   }
6992 }
```

We have three macros of creation of nodes: `\@@_create_medium_nodes:`, `\@@_create_large_nodes:` and `\@@_create_medium_and_large_nodes:`.

We have to compute the mathematical coordinates of the “medium nodes”. These mathematical coordinates are also used to compute the mathematical coordinates of the “large nodes”. That’s why we write a command `\@@_computations_for_medium_nodes:` to do these computations.

The command `\@@_computations_for_medium_nodes:` must be used in a `{pgfpicture}`.

For each row i , we compute two dimensions `l_@@_row_i_min_dim` and `l_@@_row_i_max_dim`. The dimension `l_@@_row_i_min_dim` is the minimal y -value of all the cells of the row i . The dimension `l_@@_row_i_max_dim` is the maximal y -value of all the cells of the row i .

Similarly, for each column j , we compute two dimensions `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`. The dimension `l_@@_column_j_min_dim` is the minimal x -value of all the cells of the column j . The dimension `l_@@_column_j_max_dim` is the maximal x -value of all the cells of the column j .

Since these dimensions will be computed as maximum or minimum, we initialize them to `\c_max_dim` or `-\c_max_dim`.

```

6993 \cs_new_protected:Npn \@@_computations_for_medium_nodes:
6994 {
6995   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
6996   {
6997     \dim_zero_new:c { l_@@_row_\@@_i: _min_dim }
6998     \dim_set_eq:cN { l_@@_row_\@@_i: _min_dim } \c_max_dim
6999     \dim_zero_new:c { l_@@_row_\@@_i: _max_dim }
7000     \dim_set:cn { l_@@_row_\@@_i: _max_dim } { - \c_max_dim }
7001   }
7002   \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7003   {
7004     \dim_zero_new:c { l_@@_column_\@@_j: _min_dim }
7005     \dim_set_eq:cN { l_@@_column_\@@_j: _min_dim } \c_max_dim
7006     \dim_zero_new:c { l_@@_column_\@@_j: _max_dim }
7007     \dim_set:cn { l_@@_column_\@@_j: _max_dim } { - \c_max_dim }
7008   }

```

We begin the two nested loops over the rows and the columns of the array.

```

7009   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7010   {
7011     \int_step_variable:nnNn
7012     \l_@@_first_col_int \g_@@_col_total_int \@@_j:

```

If the cell $(i-j)$ is empty or an implicit cell (that is to say a cell after implicit ampersands `&`) we don’t update the dimensions we want to compute.

```

7013     {
7014       \cs_if_exist:cT
7015       { pgf @ sh @ ns @ \@@_env: - \@@_i: - \@@_j: }

```

We retrieve the coordinates of the anchor south west of the (normal) node of the cell $(i-j)$. They will be stored in `\pgf@x` and `\pgf@y`.

```

7016     {
7017       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { south-west }
7018       \dim_set:cn { l_@@_row_\@@_i: _min_dim }
7019       { \dim_min:vn { l_@@_row _ \@@_i: _min_dim } \pgf@y }
7020       \seq_if_in:NeF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
7021       {
7022         \dim_set:cn { l_@@_column _ \@@_j: _min_dim }
7023         { \dim_min:vn { l_@@_column _ \@@_j: _min_dim } \pgf@x }
7024       }

```

We retrieve the coordinates of the anchor north east of the (normal) node of the cell $(i-j)$. They will be stored in `\pgf@x` and `\pgf@y`.

```

7025       \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { north-east }
7026       \dim_set:cn { l_@@_row _ \@@_i: _ max_dim }
7027       { \dim_max:vn { l_@@_row _ \@@_i: _ max_dim } \pgf@y }
7028       \seq_if_in:NeF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
7029       {
7030         \dim_set:cn { l_@@_column _ \@@_j: _ max_dim }

```

```

7031             { \dim_max:vn { l_@@_column _ \@@_j: _max_dim } \pgf@x }
7032         }
7033     }
7034 }
7035 }

```

Now, we have to deal with empty rows or empty columns since we don't have created nodes in such rows and columns.

```

7036 \int_step_variable:nNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7037 {
7038     \dim_compare:nNnT
7039     { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } } = \c_max_dim
7040     {
7041         \@@_qpoint:n { row - \@@_i: - base }
7042         \dim_set:cn { l_@@_row _ \@@_i: _ max _ dim } \pgf@y
7043         \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim } \pgf@y
7044     }
7045 }
7046 \int_step_variable:nNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7047 {
7048     \dim_compare:nNnT
7049     { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } } = \c_max_dim
7050     {
7051         \@@_qpoint:n { col - \@@_j: }
7052         \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim } \pgf@y
7053         \dim_set:cn { l_@@_column _ \@@_j: _ min _ dim } \pgf@y
7054     }
7055 }
7056 }

```

Here is the command `\@@_create_medium_nodes:`. When this command is used, the “medium nodes” are created.

```

7057 \cs_new_protected:Npn \@@_create_medium_nodes:
7058 {
7059     \pgfpicture
7060     \pgfrememberpicturepositiononpagetrue
7061     \pgf@relevantforpicturesizefalse
7062     \@@_computations_for_medium_nodes:

```

Now, we can create the “medium nodes”. We use a command `\@@_create_nodes:` because this command will also be used for the creation of the “large nodes”.

```

7063     \cs_set_nopar:Npn \l_@@_suffix_tl { -medium }
7064     \@@_create_nodes:
7065     \endpgfpicture
7066 }

```

The command `\@@_create_large_nodes:` must be used when we want to create only the “large nodes” and not the medium ones¹⁴. However, the computation of the mathematical coordinates of the “large nodes” needs the computation of the mathematical coordinates of the “medium nodes”. Hence, we use first `\@@_computations_for_medium_nodes:` and then the command `\@@_computations_for_large_nodes:`.

```

7067 \cs_new_protected:Npn \@@_create_large_nodes:
7068 {
7069     \pgfpicture
7070     \pgfrememberpicturepositiononpagetrue
7071     \pgf@relevantforpicturesizefalse
7072     \@@_computations_for_medium_nodes:
7073     \@@_computations_for_large_nodes:
7074     \cs_set_nopar:Npn \l_@@_suffix_tl { - large }
7075     \@@_create_nodes:

```

¹⁴If we want to create both, we have to use `\@@_create_medium_and_large_nodes:`

```

7076 \endpgfpicture
7077 }
7078 \cs_new_protected:Npn \@@_create_medium_and_large_nodes:
7079 {
7080 \pgfpicture
7081 \pgfrememberpicturepositiononpagetrue
7082 \pgf@relevantforpicturesizefalse
7083 \@@_computations_for_medium_nodes:

```

Now, we can create the “medium nodes”. We use a command `\@@_create_nodes:` because this command will also be used for the creation of the “large nodes”.

```

7084 \cs_set_nopar:Npn \l_@@_suffix_tl { - medium }
7085 \@@_create_nodes:
7086 \@@_computations_for_large_nodes:
7087 \cs_set_nopar:Npn \l_@@_suffix_tl { - large }
7088 \@@_create_nodes:
7089 \endpgfpicture
7090 }

```

For “large nodes”, the exterior rows and columns don’t interfere. That’s why the loop over the columns will start at 1 and stop at `\c@jCol` (and not `\g_@@_col_total_int`). Idem for the rows.

```

7091 \cs_new_protected:Npn \@@_computations_for_large_nodes:
7092 {
7093 \int_set_eq:NN \l_@@_first_row_int \c_one_int
7094 \int_set_eq:NN \l_@@_first_col_int \c_one_int

```

We have to change the values of all the dimensions `l_@@_row_i_min_dim`, `l_@@_row_i_max_dim`, `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`.

```

7095 \int_step_variable:nNn { \c@iRow - 1 } \@@_i:
7096 {
7097 \dim_set:cn { l_@@_row _ \@@_i: _ min _ dim }
7098 {
7099 (
7100 \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } +
7101 \dim_use:c { l_@@_row _ \int_eval:n { \@@_i: + 1 } _ max _ dim }
7102 )
7103 / 2
7104 }
7105 \dim_set_eq:cc { l_@@_row _ \int_eval:n { \@@_i: + 1 } _ max _ dim }
7106 { l_@@_row _ \@@_i: _ min _ dim }
7107 }
7108 \int_step_variable:nNn { \c@jCol - 1 } \@@_j:
7109 {
7110 \dim_set:cn { l_@@_column _ \@@_j: _ max _ dim }
7111 {
7112 (
7113 \dim_use:c { l_@@_column _ \@@_j: _ max _ dim } +
7114 \dim_use:c
7115 { l_@@_column _ \int_eval:n { \@@_j: + 1 } _ min _ dim }
7116 )
7117 / 2
7118 }
7119 \dim_set_eq:cc { l_@@_column _ \int_eval:n { \@@_j: + 1 } _ min _ dim }
7120 { l_@@_column _ \@@_j: _ max _ dim }
7121 }

```

Here, we have to use `\dim_sub:cn` because of the number 1 in the name.

```

7122 \dim_sub:cn
7123 { l_@@_column _ 1 _ min _ dim }
7124 \l_@@_left_margin_dim
7125 \dim_add:cn
7126 { l_@@_column _ \int_use:N \c@jCol _ max _ dim }
7127 \l_@@_right_margin_dim
7128 }

```

The command `\@@_create_nodes:` is used twice: for the construction of the “medium nodes” and for the construction of the “large nodes”. The nodes are constructed with the value of all the dimensions `l_@@_row_i_min_dim`, `l_@@_row_i_max_dim`, `l_@@_column_j_min_dim` and `l_@@_column_j_max_dim`. Between the construction of the “medium nodes” and the “large nodes”, the values of these dimensions are changed.

The function also uses `\l_@@_suffix_tl` (`-medium` or `-large`).

```

7129 \cs_new_protected:Npn \@@_create_nodes:
7130 {
7131   \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7132   {
7133     \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7134     {

```

We draw the rectangular node for the cell (`\@@_i-\@@_j`).

```

7135     \@@_pgf_rect_node:nnnnn
7136     { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
7137     { \dim_use:c { l_@@_column_ \@@_j: _min_dim } }
7138     { \dim_use:c { l_@@_row_ \@@_i: _min_dim } }
7139     { \dim_use:c { l_@@_column_ \@@_j: _max_dim } }
7140     { \dim_use:c { l_@@_row_ \@@_i: _max_dim } }
7141     \str_if_empty:NF \l_@@_name_str
7142     {
7143       \pgfnodealias
7144       { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
7145       { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
7146     }
7147   }
7148 }

```

Now, we create the nodes for the cells of the `\multicolumn`. We recall that we have stored in `\g_@@_multicolumn_cells_seq` the list of the cells where a `\multicolumn{n}{...}{...}` with $n > 1$ was issued and in `\g_@@_multicolumn_sizes_seq` the correspondent values of n .

```

7149   \seq_map_pairwise_function:NNN
7150   \g_@@_multicolumn_cells_seq
7151   \g_@@_multicolumn_sizes_seq
7152   \@@_node_for_multicolumn:nn
7153 }

7154 \cs_new_protected:Npn \@@_extract_coords_values: #1 - #2 \q_stop
7155 {
7156   \cs_set_nopar:Npn \@@_i: { #1 }
7157   \cs_set_nopar:Npn \@@_j: { #2 }
7158 }

```

The command `\@@_node_for_multicolumn:nn` takes two arguments. The first is the position of the cell where the command `\multicolumn{n}{...}{...}` was issued in the format $i-j$ and the second is the value of n (the length of the “multi-cell”).

```

7159 \cs_new_protected:Npn \@@_node_for_multicolumn:nn #1 #2
7160 {
7161   \@@_extract_coords_values: #1 \q_stop
7162   \@@_pgf_rect_node:nnnnn
7163   { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_tl }
7164   { \dim_use:c { l_@@_column_ \@@_j: _min_dim } }
7165   { \dim_use:c { l_@@_row_ \@@_i: _min_dim } }
7166   { \dim_use:c { l_@@_column_ \int_eval:n { \@@_j: +#2-1 } _max_dim } }
7167   { \dim_use:c { l_@@_row_ \@@_i: _max_dim } }
7168   \str_if_empty:NF \l_@@_name_str
7169   {
7170     \pgfnodealias
7171     { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
7172     { \int_use:N \g_@@_env_int - \@@_i: - \@@_j: \l_@@_suffix_tl }
7173   }
7174 }

```

26 The blocks

The following code deals with the command `\Block`. This command has no direct link with the environment `{NiceMatrixBlock}`.

The options of the command `\Block` will be analyzed first in the cell of the array (and once again when the block will be put in the array). Here is the set of keys for the first pass (in the cell of the array).

```

7175 \keys_define:nm { nicematrix / Block / FirstPass }
7176 {
7177   j .code:n = \str_set:Nn \l_@@_hpos_block_str j
7178             \bool_set_true:N \l_@@_p_block_bool ,
7179   j .value_forbidden:n = true ,
7180   l .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7181   l .value_forbidden:n = true ,
7182   r .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7183   r .value_forbidden:n = true ,
7184   c .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7185   c .value_forbidden:n = true ,
7186   L .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7187   L .value_forbidden:n = true ,
7188   R .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7189   R .value_forbidden:n = true ,
7190   C .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7191   C .value_forbidden:n = true ,
7192   t .code:n = \str_set:Nn \l_@@_vpos_block_str t ,
7193   t .value_forbidden:n = true ,
7194   T .code:n = \str_set:Nn \l_@@_vpos_block_str T ,
7195   T .value_forbidden:n = true ,
7196   b .code:n = \str_set:Nn \l_@@_vpos_block_str b ,
7197   b .value_forbidden:n = true ,
7198   B .code:n = \str_set:Nn \l_@@_vpos_block_str B ,
7199   B .value_forbidden:n = true ,
7200   m .code:n = \str_set:Nn \l_@@_vpos_block_str c ,
7201   m .value_forbidden:n = true ,
7202   v-center .meta:n = m ,
7203   p .code:n = \bool_set_true:N \l_@@_p_block_bool ,
7204   p .value_forbidden:n = true ,
7205   color .code:n =
7206     \@@_color:n { #1 }
7207     \tl_set_rescan:Nnn
7208     \l_@@_draw_tl
7209     { \char_set_catcode_other:N ! }
7210     { #1 } ,
7211   color .value_required:n = true ,
7212   respect-arraystretch .code:n =
7213     \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,
7214   respect-arraystretch .value_forbidden:n = true ,
7215 }

```

The following command `\@@_Block:` will be linked to `\Block` in the environments of `nicematrix`. We define it with `\NewExpandableDocumentCommand` because it has an optional argument between `<` and `>`. It's mandatory to use an expandable command.

```

7216 \cs_new_protected:Npn \@@_Block: { \@@_collect_options:n { \@@_Block_i: } }

7217 \NewExpandableDocumentCommand \@@_Block_i: { m m D < > { } +m }
7218 {

```

If the first mandatory argument of the command (which is the size of the block with the syntax $i-j$) has not been provided by the user, you use 1-1 (that is to say a block of only one cell).

```

7219   \peek_remove_spaces:n

```

```

7220 {
7221   \tl_if_blank:nTF { #2 }
7222     { \@@_Block_ii:nnnnn \c_one_int \c_one_int }
7223     {
7224       \int_compare:nNnTF { \char_value_catcode:n { 45 } } = { 13 }
7225       \@@_Block_i_czech \@@_Block_i
7226       #2 \q_stop
7227     }
7228   { #1 } { #3 } { #4 }
7229 }
7230 }

```

With the following construction, we extract the values of i and j in the first mandatory argument of the command.

```

7231 \cs_new:Npn \@@_Block_i #1-#2 \q_stop { \@@_Block_ii:nnnnn { #1 } { #2 } }

```

With `babel` with the key `czech`, the character `-` (hyphen) is active. That's why we need a special version. Remark that we could not use a preprocessor in the command `\@@_Block:` to do the job because the command `\@@_Block:` is defined with the command `\NewExpandableDocumentCommand`.

```

7232 {
7233   \char_set_catcode_active:N -
7234   \cs_new:Npn \@@_Block_i_czech #1-#2 \q_stop { \@@_Block_ii:nnnnn { #1 } { #2 } }
7235 }

```

Now, the arguments have been extracted: `#1` is i (the number of rows of the block), `#2` is j (the number of columns of the block), `#3` is the list of `key=values` pairs, `#4` are the tokens to put before the math mode and before the composition of the block and `#5` is the label (=content) of the block.

```

7236 \cs_new_protected:Npn \@@_Block_ii:nnnnn #1 #2 #3 #4 #5
7237 {

```

We recall that `#1` and `#2` have been extracted from the first mandatory argument of `\Block` (which is of the syntax $i-j$). However, the user is allowed to omit i or j (or both). We detect that situation by replacing a missing value by 100 (it's a convention: when the block will actually be drawn these values will be detected and interpreted as *maximal possible value* according to the actual size of the array).

```

7238   \bool_lazy_or:nnTF
7239     { \tl_if_blank_p:n { #1 } }
7240     { \str_if_eq_p:ee { * } { #1 } }
7241     { \int_set:Nn \l_tmpa_int { 100 } }
7242     { \int_set:Nn \l_tmpa_int { #1 } }
7243   \bool_lazy_or:nnTF
7244     { \tl_if_blank_p:n { #2 } }
7245     { \str_if_eq_p:ee { * } { #2 } }
7246     { \int_set:Nn \l_tmpb_int { 100 } }
7247     { \int_set:Nn \l_tmpb_int { #2 } }

```

If the block is mono-column.

```

7248   \int_compare:nNnTF \l_tmpb_int = \c_one_int
7249     {
7250       \tl_if_empty:NTF \l_@@_hpos_cell_tl
7251         { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_c_str }
7252         { \str_set:No \l_@@_hpos_block_str \l_@@_hpos_cell_tl }
7253     }
7254     { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_c_str }

```

The value of `\l_@@_hpos_block_str` may be modified by the keys of the command `\Block` that we will analyze now.

```

7255   \keys_set_known:nn { nicematrix / Block / FirstPass } { #3 }

```

```

7256   \tl_set:Nc \l_tmpa_tl
7257   {
7258     { \int_use:N \c@iRow }
7259     { \int_use:N \c@jCol }
7260     { \int_eval:n { \c@iRow + \l_tmpa_int - 1 } }
7261     { \int_eval:n { \c@jCol + \l_tmpb_int - 1 } }
7262   }

```

Now, `\l_tmpa_tl` contains an “object” corresponding to the position of the block with four components, each of them surrounded by curly brackets: `{imin}{jmin}{imax}{jmax}`.

We have different treatments when the key `p` is used and when the block is mono-column or mono-row, etc. That’s why we have several macros: `\@@_Block_iv:nnnnn`, `\@@_Block_v:nnnnn`, `\@@_Block_vi:nnnn`, etc. (the five arguments of those macros are provided by curryfication).

```

7263   \bool_set_false:N \l_tmpa_bool
7264   \bool_if:NT \l_@@_amp_in_blocks_bool

```

`\tl_if_in:nnT` is slightly faster than `\str_if_in:nnT`.

```

7265   { \tl_if_in:nnT { #5 } { & } { \bool_set_true:N \l_tmpa_bool } }
7266   \bool_case:nF
7267   {
7268     \l_tmpa_bool                { \@@_Block_vii:eennn }
7269     \l_@@_p_block_bool         { \@@_Block_vi:eennn }

```

For the blocks mono-column, we will compose right now in a box in order to compute its width and take that width into account for the width of the column. However, if the column is a `X` column, we should not do that since the width is determined by another way. This should be the same for the `p`, `m` and `b` columns and we should modify that point. However, for the `X` column, it’s imperative. Otherwise, the process for the determination of the widths of the columns will be wrong.

```

7270   \l_@@_X_bool                { \@@_Block_v:eennn }
7271   { \tl_if_empty_p:n { #5 } } { \@@_Block_v:eennn }
7272   { \int_compare_p:nNn \l_tmpa_int = \c_one_int } { \@@_Block_iv:eennn }
7273   { \int_compare_p:nNn \l_tmpb_int = \c_one_int } { \@@_Block_iv:eennn }
7274   }
7275   { \@@_Block_v:eennn }
7276   { \l_tmpa_int } { \l_tmpb_int } { #3 } { #4 } { #5 }
7277   }

```

The following macro is for the case of a `\Block` which is mono-row or mono-column (or both) and don’t use the key `p`. In that case, the content of the block is composed right now in a box (because we have to take into account the dimensions of that box for the width of the current column or the height and the depth of the current row). However, that box will be put in the array *after the construction of the array* (by using PGF) with `\@@_draw_blocks:` and above all `\@@_Block_v:nnnnnn` which will do the main job.

`#1` is i (the number of rows of the block), `#2` is j (the number of columns of the block), `#3` is the list of `key=values` pairs, `#4` are the tokens to put before the potential math mode and before the composition of the block and `#5` is the label (=content) of the block.

```

7278   \cs_generate_variant:Nn \@@_Block_iv:nnnnn { e e }
7279   \cs_new_protected:Npn \@@_Block_iv:nnnnn #1 #2 #3 #4 #5
7280   {
7281     \int_gincr:N \g_@@_block_box_int
7282     \cs_set_protected_nopar:Npn \diagbox ##1 ##2
7283     {
7284       \tl_gput_right:Ne \g_@@_pre_code_after_tl
7285       {
7286         \@@_actually_diagbox:nnnnnn
7287         { \int_use:N \c@iRow }
7288         { \int_use:N \c@jCol }
7289         { \int_eval:n { \c@iRow + #1 - 1 } }
7290         { \int_eval:n { \c@jCol + #2 - 1 } }
7291         { \g_@@_row_style_tl \exp_not:n { ##1 } }
7292         { \g_@@_row_style_tl \exp_not:n { ##2 } }

```

```

7293     }
7294   }
7295   \box_gclear_new:c
7296   { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }

```

Now, we will actually compose the content of the `\Block` in a TeX box. *Be careful:* if after the construction of the box, the boolean `\g_@@_rotate_bool` is raised (which means that the command `\rotate` was present in the content of the `\Block`) we will rotate the box but also, maybe, change the position of the baseline!

```

7297   \hbox_gset:cn
7298   { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7299   {

```

For a mono-column block, if the user has specified a color for the column in the preamble of the array, we want to fix that color in the box we construct. We do that with `\set@color` and not `\color_ensure_current:` (in order to use `\color_ensure_current:` safely, you should load `l3backend` before the `\documentclass` with `\RequirePackage{expl3}`).

```

7300     \tl_if_empty:NTF \l_@@_color_tl
7301     { \int_compare:nNnT { #2 } = \c_one_int \set@color }
7302     { \@@_color:o \l_@@_color_tl }

```

If the block is mono-row, we use `\g_@@_row_style_tl` even if it has yet been used in the beginning of the cell where the command `\Block` has been issued because we want to be able to take into account a potential instruction of color of the font in `\g_@@_row_style_tl`.

```

7303     \int_compare:nNnT { #1 } = \c_one_int
7304     {
7305       \int_if_zero:nTF \c@iRow
7306       {

```

In the following code, the value of `code-for-first-row` contains a `\Block` (in order to have the “first row” centered). But, that block will be executed, since it is entirely contained in the first row, the value of `code-for-first-row` will be inserted once again... with the same command `\Block`. That’s why we have to nullify the command `\Block`.

```

 $\begin{bNiceMatrix}%
[
  r,
  first-row,
  last-col,
  code-for-first-row = \Block{}{\scriptstyle\color{blue} \arabic{jCol}},
  code-for-last-col = \scriptstyle \color{blue} \arabic{iRow}
]
& & & & \\
-2 & 3 & -4 & 5 & \\
3 & -4 & 5 & -6 & \\
-4 & 5 & -6 & 7 & \\
5 & -6 & 7 & -8 & \\
\end{bNiceMatrix}$ 

```

```

7307     \cs_set_eq:NN \Block \@@_NullBlock:
7308     \l_@@_code_for_first_row_tl
7309   }
7310   {
7311     \int_compare:nNnT \c@iRow = \l_@@_last_row_int
7312     {
7313       \cs_set_eq:NN \Block \@@_NullBlock:
7314       \l_@@_code_for_last_row_tl
7315     }
7316   }
7317   \g_@@_row_style_tl
7318 }

```

The following command will be no-op when `respect-arraystretch` is in force.

```
7319     \@@_reset_arraystretch:
7320     \dim_zero:N \extrarowheight
```

`#4` is the optional argument of the command `\Block`, provided with the syntax `<...>`.

```
7321     #4
```

We adjust `\l_@@_hpos_block_str` when `\rotate` has been used (in the cell where the command `\Block` is used but maybe in `#4`, `\RowStyle`, `code-for-first-row`, etc.).

```
7322     \@@_adjust_hpos_rotate:
```

The boolean `\g_@@_rotate_bool` will be also considered *after the composition of the box* (in order to rotate the box).

Remind that we are in the command of composition of the box of the block. Previously, we have only done some tuning. Now, we will actually compose the content with a `{tabular}`, an `{array}` or a `{minipage}`.

```
7323     \bool_if:NTF \l_@@_tabular_bool
7324     {
7325         \bool_lazy_all:nTF
7326         {
7327             { \int_compare_p:nNn { #2 } = \c_one_int }
```

Remind that, when the column has not a fixed width, the dimension `\l_@@_col_width_dim` has the conventional value of `-1 cm`.

```
7328         { ! \dim_compare_p:nNn \l_@@_col_width_dim < \c_zero_dim }
7329         { ! \g_@@_rotate_bool }
7330     }
```

When the block is mono-column in a column with a fixed width (e.g. `p{3cm}`), we use a `{minipage}`.

```
7331     {
7332         \use:e
7333     }
```

The `\exp_not:N` is mandatory before `\begin`.

```
7334         \exp_not:N \begin { minipage }%
7335         [ \str_lowercase:o \l_@@_vpos_block_str ]
7336         { \l_@@_col_width_dim }
7337         \str_case:on \l_@@_hpos_block_str
7338         { c \centering r \raggedleft l \raggedright }
7339     }
7340     #5
7341     \end { minipage }
7342 }
```

In the other cases, we use a `{tabular}`.

```
7343     {
7344         \bool_if:NT \c_@@_testphase_table_bool
7345         { \tagpdfsetup { table / tagging = presentation } }
7346         \use:e
7347         {
7348             \exp_not:N \begin { tabular }%
7349             [ \str_lowercase:o \l_@@_vpos_block_str ]
7350             { @ { } \l_@@_hpos_block_str @ { } }
7351         }
7352         #5
7353         \end { tabular }
7354     }
7355 }
```

If we are in a mathematical array (`\l_@@_tabular_bool` is false). The composition is always done with an `{array}` (never with a `{minipage}`).

```
7356     {
7357         \c_math_toggle_token
7358         \use:e
7359     }
```

```

7360         \exp_not:N \begin { array }%
7361         [ \str_lowercase:o \l_@@_vpos_block_str ]
7362         { @ { } \l_@@_hpos_block_str @ { } }
7363     }
7364     #5
7365     \end { array }
7366     \c_math_toggle_token
7367 }
7368 }

```

The box which will contain the content of the block has now been composed.

If there were `\rotate` (which raises `\g_@@_rotate_bool`) in the content of the `\Block`, we do a rotation of the box (and we also adjust the baseline of the rotated box).

```

7369     \bool_if:NT \g_@@_rotate_bool \@@_rotate_box_of_block:

```

If we are in a mono-column block, we take into account the width of that block for the width of the column.

```

7370     \int_compare:nNnT { #2 } = \c_one_int
7371     {
7372         \dim_gset:Nn \g_@@_blocks_wd_dim
7373         {
7374             \dim_max:nn
7375             \g_@@_blocks_wd_dim
7376             {
7377                 \box_wd:c
7378                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7379             }
7380         }
7381     }

```

If we are in a mono-row block we take into account the height and the depth of that block for the height and the depth of the row, excepted when the block uses explicitly an option of vertical position.

```

7382     \bool_lazy_and:nnT
7383     { \int_compare_p:nNn { #1 } = \c_one_int }

```

If the user has not used a key for the vertical position of the block, then `\l_@@_vpos_block_str` remains empty.

```

7384     { \str_if_empty_p:N \l_@@_vpos_block_str }
7385     {
7386         \dim_gset:Nn \g_@@_blocks_ht_dim
7387         {
7388             \dim_max:nn
7389             \g_@@_blocks_ht_dim
7390             {
7391                 \box_ht:c
7392                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7393             }
7394         }
7395         \dim_gset:Nn \g_@@_blocks_dp_dim
7396         {
7397             \dim_max:nn
7398             \g_@@_blocks_dp_dim
7399             {
7400                 \box_dp:c
7401                 { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7402             }
7403         }
7404     }
7405     \seq_gput_right:Ne \g_@@_blocks_seq
7406     {
7407         \l_tmpa_tl

```

In the list of options #3, maybe there is a key for the horizontal alignment (l, r or c). In that case, that key has been read and stored in `\l_@@_hpos_block_str`. However, maybe there were no key of the horizontal alignment and that's why we put a key corresponding to the value of `\l_@@_hpos_block_str`, which is fixed by the type of current column.

```

7408     {
7409         \exp_not:n { #3 } ,
7410         \l_@@_hpos_block_str ,

```

Now, we put a key for the vertical alignment.

```

7411         \bool_if:NT \g_@@_rotate_bool
7412         {
7413             \bool_if:NTF \g_@@_rotate_c_bool
7414             { m }
7415             { \int_compare:nNnT \c@iRow = \l_@@_last_row_int T }
7416         }
7417     }
7418     {
7419         \box_use_drop:c
7420         { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7421     }
7422 }
7423 \bool_set_false:N \g_@@_rotate_c_bool
7424 }

```

```

7425 \cs_new:Npn \@@_adjust_hpos_rotate:
7426 {
7427     \bool_if:NT \g_@@_rotate_bool
7428     {
7429         \str_set:Ne \l_@@_hpos_block_str
7430         {
7431             \bool_if:NTF \g_@@_rotate_c_bool
7432             { c }
7433             {
7434                 \str_case:onF \l_@@_vpos_block_str
7435                 { b l B l t r T r }
7436                 { \int_compare:nNnTF \c@iRow = \l_@@_last_row_int r l }
7437             }
7438         }
7439     }
7440 }

```

Despite its name the following command rotates the box of the block *but also does vertical adjustment of the baseline of the block*.

```

7441 \cs_new_protected:Npn \@@_rotate_box_of_block:
7442 {
7443     \box_grotate:cn
7444     { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7445     { 90 }
7446     \int_compare:nNnT \c@iRow = \l_@@_last_row_int
7447     {
7448         \vbox_gset_top:cn
7449         { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7450         {
7451             \skip_vertical:n { 0.8 ex }
7452             \box_use:c
7453             { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7454         }
7455     }
7456     \bool_if:NT \g_@@_rotate_c_bool
7457     {
7458         \hbox_gset:cn
7459         { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }

```

```

7460     {
7461     \c_math_toggle_token
7462     \vcenter
7463     {
7464     \box_use:c
7465     { g_@@_ block _ box _ \int_use:N \g_@@_block_box_int _ box }
7466     }
7467     \c_math_toggle_token
7468     }
7469   }
7470 }

```

The following macro is for the standard case, where the block is not mono-row and not mono-column and does not use the key p). In that case, the content of the block is *not* composed right now in a box. The composition in a box will be done further, just after the construction of the array (cf. `\@@_draw_blocks:` and above all `\@@_Block_v:nnnnn`).

#1 is i (the number of rows of the block), #2 is j (the number of columns of the block), #3 is the list of *key=values* pairs, #4 are the tokens to put before the math mode and before the composition of the block and #5 is the label (=content) of the block.

```

7471 \cs_generate_variant:Nn \@@_Block_v:nnnnn { e e }
7472 \cs_new_protected:Npn \@@_Block_v:nnnnn #1 #2 #3 #4 #5
7473 {
7474   \seq_gput_right:Ne \g_@@_blocks_seq
7475   {
7476     \l_tmpa_tl
7477     { \exp_not:n { #3 } }
7478     {
7479       \bool_if:NTF \l_@@_tabular_bool
7480       {
7481         \group_begin:

```

The following command will be no-op when `respect-arraystretch` is in force.

```

7482   \@@_reset_arraystretch:
7483   \exp_not:n
7484   {
7485     \dim_zero:N \extrarowheight
7486     #4

```

If the box is rotated (the key `\rotate` may be in the previous #4), the tabular used for the content of the cell will be constructed with a format `c`. In the other cases, the tabular will be constructed with a format equal to the key of position of the box. In other words: the alignment internal to the tabular is the same as the external alignment of the tabular (that is to say the position of the block in its zone of merged cells).

```

7487     \bool_if:NT \c_@@_testphase_table_bool
7488     { \tag_stop:n { table } }
7489     \use:e
7490     {
7491       \exp_not:N \begin { tabular } [ \l_@@_vpos_block_str ]
7492       { @ { } \l_@@_hpos_block_str @ { } }
7493     }
7494     #5
7495     \end { tabular }
7496   }
7497   \group_end:
7498 }

```

When we are *not* in an environment `{NiceTabular}` (or similar).

```

7499   {
7500     \group_begin:

```

The following will be no-op when `respect-arraystretch` is in force.

```

7501     \@@_reset_arraystretch:
7502     \exp_not:n
7503     {

```

```

7504         \dim_zero:N \extrarowheight
7505         #4
7506         \c_math_toggle_token
7507         \use:e
7508         {
7509             \exp_not:N \begin { array } [ \l_@@_vpos_block_str ]
7510             { @ { } \l_@@_hpos_block_str @ { } }
7511         }
7512         #5
7513         \end { array }
7514         \c_math_toggle_token
7515     }
7516     \group_end:
7517 }
7518 }
7519 }
7520 }

```

The following macro is for the case of a `\Block` which uses the key `p`.

```

7521 \cs_generate_variant:Nn \@@_Block_vi:nnnnn { e e }
7522 \cs_new_protected:Npn \@@_Block_vi:nnnnn #1 #2 #3 #4 #5
7523 {
7524     \seq_gput_right:Ne \g_@@_blocks_seq
7525     {
7526         \l_tmpa_tl
7527         { \exp_not:n { #3 } }

```

Here, the curly braces for the group are mandatory.

```

7528         { { \exp_not:n { #4 #5 } } }
7529     }
7530 }

```

The following macro is also for the case of a `\Block` which uses the key `p`.

```

7531 \cs_generate_variant:Nn \@@_Block_vii:nnnnn { e e }
7532 \cs_new_protected:Npn \@@_Block_vii:nnnnn #1 #2 #3 #4 #5
7533 {
7534     \seq_gput_right:Ne \g_@@_blocks_seq
7535     {
7536         \l_tmpa_tl
7537         { \exp_not:n { #3 } }
7538         { \exp_not:n { #4 #5 } }
7539     }
7540 }

```

We recall that the options of the command `\Block` are analyzed twice: first in the cell of the array and once again when the block will be put in the array *after the construction of the array* (by using PGF).

```

7541 \keys_define:nn { nicematrix / Block / SecondPass }
7542 {
7543     ampersand-in-blocks .bool_set:N = \l_@@_amp_in_blocks_bool ,
7544     ampersand-in-blocks .default:n = true ,
7545     &-in-blocks .meta:n = ampersand-in-blocks ,

```

The sequence `\l_@@_tikz_seq` will contain a sequence of comma-separated lists of keys.

```

7546     tikz .code:n =
7547         \IfPackageLoadedTF { tikz }
7548             { \seq_put_right:Nn \l_@@_tikz_seq { { #1 } } }
7549             { \@@_error:n { tikz-key-without-tikz } } ,
7550     tikz .value_required:n = true ,
7551     fill .code:n =
7552         \tl_set_rescan:Nnn

```

```

7553     \l_@@_fill_tl
7554     { \char_set_catcode_other:N ! }
7555     { #1 } ,
7556 fill .value_required:n = true ,
7557 opacity .tl_set:N = \l_@@_opacity_tl ,
7558 opacity .value_required:n = true ,
7559 draw .code:n =
7560     \tl_set_rescan:Nnn
7561     \l_@@_draw_tl
7562     { \char_set_catcode_other:N ! }
7563     { #1 } ,
7564 draw .default:n = default ,
7565 rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
7566 rounded-corners .default:n = 4 pt ,
7567 color .code:n =
7568     \@@_color:n { #1 }
7569     \tl_set_rescan:Nnn
7570     \l_@@_draw_tl
7571     { \char_set_catcode_other:N ! }
7572     { #1 } ,
7573 borders .clist_set:N = \l_@@_borders_clist ,
7574 borders .value_required:n = true ,
7575 hvlines .meta:n = { vlines , hlines } ,
7576 vlines .bool_set:N = \l_@@_vlines_block_bool ,
7577 vlines .default:n = true ,
7578 hlines .bool_set:N = \l_@@_hlines_block_bool ,
7579 hlines .default:n = true ,
7580 line-width .dim_set:N = \l_@@_line_width_dim ,
7581 line-width .value_required:n = true ,

```

Some keys have not a property `.value_required:n` (or similar) because they are in `FirstPass`.

```

7582 j .code:n = \str_set:Nn \l_@@_hpos_block_str j
7583     \bool_set_true:N \l_@@_p_block_bool ,
7584 l .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7585 r .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7586 c .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7587 L .code:n = \str_set:Nn \l_@@_hpos_block_str l
7588     \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7589 R .code:n = \str_set:Nn \l_@@_hpos_block_str r
7590     \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7591 C .code:n = \str_set:Nn \l_@@_hpos_block_str c
7592     \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7593 t .code:n = \str_set:Nn \l_@@_vpos_block_str t ,
7594 T .code:n = \str_set:Nn \l_@@_vpos_block_str T ,
7595 b .code:n = \str_set:Nn \l_@@_vpos_block_str b ,
7596 B .code:n = \str_set:Nn \l_@@_vpos_block_str B ,
7597 m .code:n = \str_set:Nn \l_@@_vpos_block_str c ,
7598 m .value_forbidden:n = true ,
7599 v-center .meta:n = m ,
7600 p .code:n = \bool_set_true:N \l_@@_p_block_bool ,
7601 p .value_forbidden:n = true ,
7602 name .tl_set:N = \l_@@_block_name_str ,
7603 name .value_required:n = true ,
7604 name .initial:n = ,
7605 respect-arraystretch .code:n =
7606     \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,
7607 respect-arraystretch .value_forbidden:n = true ,
7608 transparent .bool_set:N = \l_@@_transparent_bool ,
7609 transparent .default:n = true ,
7610 transparent .initial:n = false ,
7611 unknown .code:n = \@@_error:n { Unknown~key~for~Block }
7612 }

```

The command `\@@_draw_blocks:` will draw all the blocks. This command is used after the construc-

tion of the array. We have to revert to a clean version of `\ialign` because there may be tabulars in the `\Block` instructions that will be composed now.

```

7613 \cs_new_protected:Npn \@@_draw_blocks:
7614 {
7615   \bool_if:NTF \c_@@_recent_array_bool
7616     { \cs_set_eq:NN \ar@ialign \@@_old_ar@ialign: }
7617     { \cs_set_eq:NN \ialign \@@_old_ialign: }
7618   \seq_map_inline:Nn \g_@@_blocks_seq { \@@_Block_iv:nnnnnn ##1 }
7619 }
7620 \cs_new_protected:Npn \@@_Block_iv:nnnnnn #1 #2 #3 #4 #5 #6
7621 {

```

The integer `\l_@@_last_row_int` will be the last row of the block and `\l_@@_last_col_int` its last column.

```

7622   \int_zero_new:N \l_@@_last_row_int
7623   \int_zero_new:N \l_@@_last_col_int

```

We remind that the first mandatory argument of the command `\Block` is the size of the block with the special format i - j . However, the user is allowed to omit i or j (or both). This will be interpreted as follows: the last row (resp. column) of the block will be the last row (resp. column) of the block (without the potential exterior row—resp. column—of the array). By convention, this is stored in `\g_@@_blocks_seq` as a number of rows (resp. columns) for the block equal to 100. That’s what we detect now (we write 98 for the case the the command `\Block` has been issued in the “first row”).

```

7624   \int_compare:nNnTF { #3 } > { 98 }
7625     { \int_set_eq:NN \l_@@_last_row_int \c@iRow }
7626     { \int_set:Nn \l_@@_last_row_int { #3 } }
7627   \int_compare:nNnTF { #4 } > { 98 }
7628     { \int_set_eq:NN \l_@@_last_col_int \c@jCol }
7629     { \int_set:Nn \l_@@_last_col_int { #4 } }
7630   \int_compare:nNnTF \l_@@_last_col_int > \g_@@_col_total_int
7631     {
7632       \bool_lazy_and:nnTF
7633         \l_@@_preamble_bool
7634         {
7635           \int_compare_p:n
7636             { \l_@@_last_col_int <= \g_@@_static_num_of_col_int }
7637         }
7638         {
7639           \msg_error:nnnn { nicematrix } { Block-too-large-2 } { #1 } { #2 }
7640           \@@_msg_redirect_name:nn { Block-too-large-2 } { none }
7641           \@@_msg_redirect_name:nn { columns-not-used } { none }
7642         }
7643         { \msg_error:nnnn { nicematrix } { Block-too-large-1 } { #1 } { #2 } }
7644     }
7645   {
7646     \int_compare:nNnTF \l_@@_last_row_int > \g_@@_row_total_int
7647       { \msg_error:nnnn { nicematrix } { Block-too-large-1 } { #1 } { #2 } }
7648       {
7649         \@@_Block_v:nneenn
7650           { #1 }
7651           { #2 }
7652           { \int_use:N \l_@@_last_row_int }
7653           { \int_use:N \l_@@_last_col_int }
7654           { #5 }
7655           { #6 }
7656       }
7657     }
7658 }

```

The following command `\@@_Block_v:nnnnnn` will actually draw the block. `#1` is the first row of the block; `#2` is the first column of the block; `#3` is the last row of the block; `#4` is the last column of the block; `#5` is a list of `key=value` options; `#6` is the label

```

7659 \cs_generate_variant:Nn \@@_Block_v:nnnnnn { n n e e }
7660 \cs_new_protected:Npn \@@_Block_v:nnnnnn #1 #2 #3 #4 #5 #6
7661 {

```

The group is for the keys.

```

7662 \group_begin:
7663 \int_compare:nNt { #1 } = { #3 }
7664 { \str_set:Nn \l_@@_vpos_block_str { t } }
7665 \keys_set:nn { nicematrix / Block / SecondPass } { #5 }

```

If the content of the block contains &, we will have a special treatment (since the cell must be divided in several sub-cells). Remark that `\tl_if_in:nnT` is faster than `\str_if_in:nnT`.

```

7666 \tl_if_in:nnT { #6 } { & } { \bool_set_true:N \l_@@_ampersand_bool }
7667 \bool_lazy_and:nnT
7668 \l_@@_vlines_block_bool
7669 { ! \l_@@_ampersand_bool }
7670 {
7671 \tl_gput_right:Ne \g_nicematrix_code_after_tl
7672 {
7673 \@@_vlines_block:nnn
7674 { \exp_not:n { #5 } }
7675 { #1 - #2 }
7676 { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7677 }
7678 }
7679 \bool_if:NT \l_@@_hlines_block_bool
7680 {
7681 \tl_gput_right:Ne \g_nicematrix_code_after_tl
7682 {
7683 \@@_hlines_block:nnn
7684 { \exp_not:n { #5 } }
7685 { #1 - #2 }
7686 { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7687 }
7688 }
7689 \bool_if:NF \l_@@_transparent_bool
7690 {
7691 \bool_lazy_and:nnF \l_@@_vlines_block_bool \l_@@_hlines_block_bool
7692 {

```

The sequence of the positions of the blocks (excepted the blocks with the key `hlines`) will be used when drawing the rules (in fact, there is also the `\multicolumn` and the `\diagbox` in that sequence).

```

7693 \seq_gput_left:Ne \g_@@_pos_of_blocks_seq
7694 { { #1 } { #2 } { #3 } { #4 } { \l_@@_block_name_str } }
7695 }
7696 }

```

```

7697 \tl_if_empty:NF \l_@@_draw_tl
7698 {
7699 \bool_lazy_or:nnT \l_@@_hlines_block_bool \l_@@_vlines_block_bool
7700 { \@@_error:n { hlines~with~color } }
7701 \tl_gput_right:Ne \g_nicematrix_code_after_tl
7702 {
7703 \@@_stroke_block:nnn

```

#5 are the options

```

7704 { \exp_not:n { #5 } }
7705 { #1 - #2 }
7706 { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7707 }
7708 \seq_gput_right:Nn \g_@@_pos_of_stroken_blocks_seq
7709 { { #1 } { #2 } { #3 } { #4 } }
7710 }

```

```

7711 \clist_if_empty:NF \l_@@_borders_clist
7712 {
7713   \tl_gput_right:Ne \g_nicematrix_code_after_tl
7714   {
7715     \@@_stroke_borders_block:nnn
7716     { \exp_not:n { #5 } }
7717     { #1 - #2 }
7718     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7719   }
7720 }
7721 \tl_if_empty:NF \l_@@_fill_tl
7722 {
7723   \@@_add_opacity_to_fill:
7724   \tl_gput_right:Ne \g_@@_pre_code_before_tl
7725   {
7726     \@@_exp_color_arg:No \@@_roundedrectanglecolor \l_@@_fill_tl
7727     { #1 - #2 }
7728     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7729     { \dim_use:N \l_@@_rounded_corners_dim }
7730   }
7731 }
7732 \seq_if_empty:NF \l_@@_tikz_seq
7733 {
7734   \tl_gput_right:Ne \g_nicematrix_code_before_tl
7735   {
7736     \@@_block_tikz:nnnnn
7737     { \seq_use:Nn \l_@@_tikz_seq { , } }
7738     { #1 }
7739     { #2 }
7740     { \int_use:N \l_@@_last_row_int }
7741     { \int_use:N \l_@@_last_col_int }

```

We will have in that last field a list of lists of Tikz keys.

```

7742   }
7743 }
7744 \cs_set_protected_nopar:Npn \diagbox ##1 ##2
7745 {
7746   \tl_gput_right:Ne \g_@@_pre_code_after_tl
7747   {
7748     \@@_actually_diagbox:nnnnnn
7749     { #1 }
7750     { #2 }
7751     { \int_use:N \l_@@_last_row_int }
7752     { \int_use:N \l_@@_last_col_int }
7753     { \exp_not:n { ##1 } }
7754     { \exp_not:n { ##2 } }
7755   }
7756 }

```

Let's consider the following `{NiceTabular}`. Because of the instruction `!\hspace{1cm}` in the preamble which increases the space between the columns (by adding, in fact, that space to the previous column, that is to say the second column of the tabular), we will create *two* nodes relative to the block: the node `1-1-block` and the node `1-1-block-short`.

```

\begin{NiceTabular}{cc!\hspace{1cm}}c}
\Block{2-2}{our block} & & one & \\\
& & two & \\\
three & & four & five & \\\
six & & seven & eight & \\\
\end{NiceTabular}

```

We highlight the node 1-1-block

our block		one
three	four	two
six	seven	five
		eight

We highlight the node 1-1-block-short

our block		one
three	four	two
six	seven	five
		eight

The construction of the node corresponding to the merged cells.

```

7757 \pgfpicture
7758 \pgfrememberpicturepositiononpagetrue
7759 \pgf@relevantforpicturesizefalse
7760 \@@_qpoint:n { row - #1 }
7761 \dim_set_eq:NN \l_tmpa_dim \pgf@y
7762 \@@_qpoint:n { col - #2 }
7763 \dim_set_eq:NN \l_tmpb_dim \pgf@x
7764 \@@_qpoint:n { row - \int_eval:n { \l_@@_last_row_int + 1 } }
7765 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7766 \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7767 \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x

```

We construct the node for the block with the name (#1-#2-block).

The function `\@@_pgf_rect_node:nnnnn` takes in as arguments the name of the node and the four coordinates of two opposite corner points of the rectangle.

```

7768 \@@_pgf_rect_node:nnnnn
7769 { \@@_env: - #1 - #2 - block }
7770 \l_tmpb_dim \l_tmpa_dim \l_@@_tmpd_dim \l_@@_tmpc_dim
7771 \str_if_empty:NF \l_@@_block_name_str
7772 {
7773 \pgfnodealias
7774 { \@@_env: - \l_@@_block_name_str }
7775 { \@@_env: - #1 - #2 - block }
7776 \str_if_empty:NF \l_@@_name_str
7777 {
7778 \pgfnodealias
7779 { \l_@@_name_str - \l_@@_block_name_str }
7780 { \@@_env: - #1 - #2 - block }
7781 }
7782 }

```

Now, we create the “short node” which, in general, will be used to put the label (that is to say the content of the node). However, if one the keys L, C or R is used (that information is provided by the boolean `\l_@@_hpos_of_block_cap_bool`), we don’t need to create that node since the normal node is used to put the label.

```

7783 \bool_if:NF \l_@@_hpos_of_block_cap_bool
7784 {
7785 \dim_set_eq:NN \l_tmpb_dim \c_max_dim

```

The short node is constructed by taking into account the *contents* of the columns involved in at least one cell of the block. That’s why we have to do a loop over the rows of the array.

```

7786 \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
7787 {

```

We recall that, when a cell is empty, no (normal) node is created in that cell. That’s why we test the existence of the node before using it.

```

7788 \cs_if_exist:cT
7789 { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
7790 {
7791 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
7792 {
7793 \pgfpointanchor { \@@_env: - ##1 - #2 } { west }
7794 \dim_set:Nn \l_tmpb_dim { \dim_min:nn \l_tmpb_dim \pgf@x }
7795 }
7796 }
7797 }

```

If all the cells of the column were empty, `\l_tmpb_dim` has still the same value `\c_max_dim`. In that case, you use for `\l_tmpb_dim` the value of the position of the vertical rule.

```

7798     \dim_compare:nNnT \l_tmpb_dim = \c_max_dim
7799     {
7800       \@@_qpoint:n { col - #2 }
7801       \dim_set_eq:NN \l_tmpb_dim \pgf@x
7802     }
7803     \dim_set:Nn \l_@@_tmpd_dim { - \c_max_dim }
7804     \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
7805     {
7806       \cs_if_exist:cT
7807       { \pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
7808       {
7809         \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
7810         {
7811           \pgfpointanchor
7812           { \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
7813           { east }
7814           \dim_set:Nn \l_@@_tmpd_dim { \dim_max:nn \l_@@_tmpd_dim \pgf@x }
7815         }
7816       }
7817     }
7818     \dim_compare:nNnT \l_@@_tmpd_dim = { - \c_max_dim }
7819     {
7820       \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7821       \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x
7822     }
7823     \@@_pgf_rect_node:nnnnn
7824     { \@@_env: - #1 - #2 - block - short }
7825     \l_tmpb_dim \l_tmpa_dim \l_@@_tmpd_dim \l_@@_tmpc_dim
7826   }

```

If the creation of the “medium nodes” is required, we create a “medium node” for the block. The function `\@@_pgf_rect_node:nnn` takes in as arguments the name of the node and two PGF points.

```

7827     \bool_if:NT \l_@@_medium_nodes_bool
7828     {
7829       \@@_pgf_rect_node:nnn
7830       { \@@_env: - #1 - #2 - block - medium }
7831       { \pgfpointanchor { \@@_env: - #1 - #2 - medium } { north-west } }
7832       {
7833         \pgfpointanchor
7834         { \@@_env:
7835           - \int_use:N \l_@@_last_row_int
7836           - \int_use:N \l_@@_last_col_int - medium
7837         }
7838         { south-east }
7839       }
7840     }
7841     \endpgfpicture

7842     \bool_if:NTF \l_@@_ampersand_bool
7843     {
7844       \seq_set_split:Nnn \l_tmpa_seq { & } { #6 }
7845       \int_zero_new:N \l_@@_split_int
7846       \int_set:Nn \l_@@_split_int { \seq_count:N \l_tmpa_seq }
7847       \pgfpicture
7848       \pgfrememberpicturepositiononpagetrue
7849       \pgf@relevantforpicturesizefalse
7850
7851       \@@_qpoint:n { row - #1 }
7852       \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7853       \@@_qpoint:n { row - \int_eval:n { #3 + 1 } }

```

```

7854 \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
7855 \@@_qpoint:n { col - #2 }
7856 \dim_set_eq:NN \l_tmpa_dim \pgf@x
7857 \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
7858 \dim_set:Nn \l_tmpb_dim
7859 { ( \pgf@x - \l_tmpa_dim ) / \int_use:N \l_@@_split_int }
7860 \bool_lazy_or:nnT
7861 \l_@@_vlines_block_bool
7862 { \str_if_eq_p:ee \l_@@_vlines_clist { all } }
7863 {
7864 \int_step_inline:nn { \l_@@_split_int - 1 }
7865 {
7866 \pgfpathmoveto
7867 {
7868 \pgfpoint
7869 { \l_tmpa_dim + ##1 \l_tmpb_dim }
7870 \l_@@_tmpc_dim
7871 }
7872 \pgfpathlineto
7873 {
7874 \pgfpoint
7875 { \l_tmpa_dim + ##1 \l_tmpb_dim }
7876 \l_@@_tmpd_dim
7877 }
7878 \CT@arc@
7879 \pgfsetlinewidth { 1.1 \arrayrulewidth }
7880 \pgfsetrectcap
7881 \pgfusepathqstroke
7882 }
7883 }
7884 \@@_qpoint:n { row - #1 - base }
7885 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7886 \int_step_inline:nn \l_@@_split_int
7887 {
7888 \group_begin:
7889 \dim_set:Nn \col@sep
7890 { \bool_if:NTF \l_@@_tabular_bool \tabcolsep \arraycolsep }
7891 \pgftransformshift
7892 {
7893 \pgfpoint
7894 {
7895 \l_tmpa_dim + ##1 \l_tmpb_dim -
7896 \str_case:on \l_@@_hpos_block_str
7897 {
7898 l { \l_tmpb_dim + \col@sep }
7899 c { 0.5 \l_tmpb_dim }
7900 r { \col@sep }
7901 }
7902 }
7903 { \l_@@_tmpc_dim }
7904 }
7905 \pgfset { inner~sep = \c_zero_dim }
7906 \pgfnode
7907 { rectangle }
7908 {
7909 \str_case:on \l_@@_hpos_block_str
7910 {
7911 c { base }
7912 l { base~west }
7913 r { base~east }
7914 }
7915 }
7916 { \seq_item:Nn \l_tmpa_seq { ##1 } } { } { }

```

```

7917     \group_end:
7918   }
7919   \endpgfpicture
7920 }

```

Now the case where there is no ampersand & in the content of the block.

```

7921 {
7922   \bool_if:NTF \l_@@_p_block_bool
7923   {

```

When the final user has used the key p, we have to compute the width.

```

7924     \pgfpicture
7925     \pgfrememberpicturepositiononpagetrue
7926     \pgf@relevantforpicturesizefalse
7927     \bool_if:NTF \l_@@_hpos_of_block_cap_bool
7928     {
7929       \@@_qpoint:n { col - #2 }
7930       \dim_gset_eq:NN \g_tmpa_dim \pgf@x
7931       \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7932     }
7933     {
7934       \pgfpointanchor { \@@_env: - #1 - #2 - block - short } { west }
7935       \dim_gset_eq:NN \g_tmpa_dim \pgf@x
7936       \pgfpointanchor { \@@_env: - #1 - #2 - block - short } { east }
7937     }
7938     \dim_gset:Nn \g_tmpb_dim { \pgf@x - \g_tmpa_dim }
7939   \endpgfpicture
7940   \hbox_set:Nn \l_@@_cell_box
7941   {
7942     \begin { minipage } [ \str_lowercase:o \l_@@_vpos_block_str ]
7943     { \g_tmpb_dim }
7944     \str_case:on \l_@@_hpos_block_str
7945     { c \centering r \raggedleft l \raggedright j { } }
7946     #6
7947     \end { minipage }
7948   }
7949 }
7950 { \hbox_set:Nn \l_@@_cell_box { \set@color #6 } }
7951 \bool_if:NT \g_@@_rotate_bool \@@_rotate_cell_box:

```

Now, we will put the label of the block. We recall that \l_@@_vpos_block_str is empty when the user has not used a key for the vertical position of the block.

```

7952   \pgfpicture
7953   \pgfrememberpicturepositiononpagetrue
7954   \pgf@relevantforpicturesizefalse
7955   \bool_lazy_any:nTF
7956   {
7957     { \str_if_empty_p:N \l_@@_vpos_block_str } % added 2024/06/29
7958     { \str_if_eq_p:ee \l_@@_vpos_block_str { c } }
7959     { \str_if_eq_p:ee \l_@@_vpos_block_str { T } }
7960     { \str_if_eq_p:ee \l_@@_vpos_block_str { B } }
7961   }
7962   {

```

If we are in the first column, we must put the block as if it was with the key r.

```

7963     \int_if_zero:nT { #2 } { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_r_str }

```

If we are in the last column, we must put the block as if it was with the key l.

```

7964     \bool_if:nT \g_@@_last_col_found_bool
7965     {
7966       \int_compare:nNnT { #2 } = \g_@@_col_total_int
7967       { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_l_str }
7968     }

```

`\l_tmpa_tl` will contain the anchor of the PGF node which will be used.

```

7969         \tl_set:Ne \l_tmpa_tl
7970         {
7971             \str_case:on \l_@@_vpos_block_str
7972             {

```

We recall that `\l_@@_vpos_block_str` is empty when the user has not used a key for the vertical position of the block.

```

7973             { } { % added 2024-06-29
7974                 \str_case:on \l_@@_hpos_block_str
7975                 {
7976                     c { center }
7977                     l { west }
7978                     r { east }
7979                     j { center }
7980                 }
7981             }
7982         c {
7983             \str_case:on \l_@@_hpos_block_str
7984             {
7985                 c { center }
7986                 l { west }
7987                 r { east }
7988                 j { center }
7989             }
7990         }
7991     }
7992     T {
7993         \str_case:on \l_@@_hpos_block_str
7994         {
7995             c { north }
7996             l { north-west }
7997             r { north-east }
7998             j { north }
7999         }
8000     }
8001 }
8002 B {
8003     \str_case:on \l_@@_hpos_block_str
8004     {
8005         c { south }
8006         l { south-west }
8007         r { south-east }
8008         j { south }
8009     }
8010 }
8011 }
8012 }
8013 }
8014 \pgftransformshift
8015 {
8016     \pgfpointanchor
8017     {
8018         \@@_env: - #1 - #2 - block
8019         \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
8020     }
8021     { \l_tmpa_tl }
8022 }
8023 \pgfset { inner~sep = \c_zero_dim }
8024 \pgfnode
8025 { rectangle }
8026 { \l_tmpa_tl }
8027 { \box_use_drop:N \l_@@_cell_box } { } { }

```

```
8028     }
```

End of the case when `\l_@@_vpos_block_str` is equal to `c`, `T` or `B`. Now, the other cases.

```
8029     {
8030         \pgfextracty \l_tmpa_dim
8031         {
8032             \@@_qpoint:n
8033             {
8034                 row - \str_if_eq:eeTF \l_@@_vpos_block_str { b } { #3 } { #1 }
8035                 - base
8036             }
8037         }
8038         \dim_sub:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }
```

We retrieve (in `\pgf@x`) the x -value of the center of the block.

```
8039         \pgfpointanchor
8040         {
8041             \@@_env: - #1 - #2 - block
8042             \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
8043         }
8044         {
8045             \str_case:on \l_@@_hpos_block_str
8046             {
8047                 c { center }
8048                 l { west }
8049                 r { east }
8050                 j { center }
8051             }
8052         }
```

We put the label of the block which has been composed in `\l_@@_cell_box`.

```
8053         \pgftransformshift { \pgfpoint \pgf@x \l_tmpa_dim }
8054         \pgfset { inner-sep = \c_zero_dim }
8055         \pgfnode
8056         { rectangle }
8057         {
8058             \str_case:on \l_@@_hpos_block_str
8059             {
8060                 c { base }
8061                 l { base~west }
8062                 r { base~east }
8063                 j { base }
8064             }
8065         }
8066         { \box_use_drop:N \l_@@_cell_box } { } { }
8067     }
8068     \endpgfpicture
8069 }
8070 \group_end:
8071 }
```

For the command `\cellcolor` used within a sub-cell of a `\Block` (when the character `&` is used inside the cell).

```
8072 \cs_set_protected:Npn \@@_fill:nnnnn #1 #2 #3 #4 #5
8073 {
8074     \pgfpicture
8075     \pgfrememberpicturepositiononpagetrue
8076     \pgf@relevantforpicturesizefalse
8077     \pgfpathrectanglecorners
8078     { \pgfpoint { #2 } { #3 } }
8079     { \pgfpoint { #4 } { #5 } }
8080     \pgfsetfillcolor { #1 }
8081     \pgfusepath { fill }
```

```

8082 \endpgfpicture
8083 }

```

The following command adds the value of `\l_@@_opacity_tl` (if not empty) to the specification of color set in `\l_@@_fill_tl` (the information of opacity is added in between square brackets before the color itself).

```

8084 \cs_new_protected:Npn \@@_add_opacity_to_fill:
8085 {
8086   \tl_if_empty:NF \l_@@_opacity_tl
8087   {
8088     \tl_if_head_eq_meaning:oNTF \l_@@_fill_tl [
8089     {
8090       \tl_set:Ne \l_@@_fill_tl
8091       {
8092         [ opacity = \l_@@_opacity_tl ,
8093         \tl_tail:o \l_@@_fill_tl
8094       }
8095     }
8096     {
8097       \tl_set:Ne \l_@@_fill_tl
8098       { [ opacity = \l_@@_opacity_tl ] { \exp_not:o \l_@@_fill_tl } }
8099     }
8100   }
8101 }

```

The first argument of `\@@_stroke_block:nnn` is a list of options for the rectangle that you will stroke. The second argument is the upper-left cell of the block (with, as usual, the syntax *i-j*) and the third is the last cell of the block (with the same syntax).

```

8102 \cs_new_protected:Npn \@@_stroke_block:nnn #1 #2 #3
8103 {
8104   \group_begin:
8105   \tl_clear:N \l_@@_draw_tl
8106   \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
8107   \keys_set_known:n { nicematrix / BlockStroke } { #1 }
8108   \pgfpicture
8109   \pgfrememberpicturepositiononpagetrue
8110   \pgf@relevantforpicturesizefalse
8111   \tl_if_empty:NF \l_@@_draw_tl
8112   {

```

If the user has used the key `color` of the command `\Block` without value, the color fixed by `\arrayrulecolor` is used.

```

8113     \tl_if_eq:NnTF \l_@@_draw_tl { default }
8114     { \CT@arc@ }
8115     { \@@_color:o \l_@@_draw_tl }
8116   }
8117   \pgfsetcornersarced
8118   {
8119     \pgfpoint
8120     { \l_@@_rounded_corners_dim }
8121     { \l_@@_rounded_corners_dim }
8122   }
8123   \@@_cut_on_hyphen:w #2 \q_stop
8124   \int_compare:nNnF \l_tmpa_tl > \c@iRow
8125   {
8126     \int_compare:nNnF \l_tmpb_tl > \c@jCol
8127     {
8128       \@@_qpoint:n { row - \l_tmpa_tl }
8129       \dim_set_eq:NN \l_tmpb_dim \pgf@y
8130       \@@_qpoint:n { col - \l_tmpb_tl }
8131       \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
8132       \@@_cut_on_hyphen:w #3 \q_stop

```

```

8133 \int_compare:nNnT \l_tmpa_tl > \c@iRow
8134 { \tl_set:No \l_tmpa_tl { \int_use:N \c@iRow } }
8135 \int_compare:nNnT \l_tmpb_tl > \c@jCol
8136 { \tl_set:No \l_tmpb_tl { \int_use:N \c@jCol } }
8137 @@_qpoint:n { row - \int_eval:n { \l_tmpa_tl + 1 } }
8138 \dim_set_eq:NN \l_tmpa_dim \pgf@y
8139 @@_qpoint:n { col - \int_eval:n { \l_tmpb_tl + 1 } }
8140 \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x
8141 \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }
8142 \pgfpathrectanglecorners
8143 { \pgfpoint \l_@@_tmpc_dim \l_tmpb_dim }
8144 { \pgfpoint \l_@@_tmpd_dim \l_tmpa_dim }
8145 \dim_compare:nNnTF \l_@@_rounded_corners_dim = \c_zero_dim
8146 { \pgfusepathqstroke }
8147 { \pgfusepath { stroke } }
8148 }
8149 }
8150 \endpgfpicture
8151 \group_end:
8152 }

```

Here is the set of keys for the command `\@@_stroke_block:nnn`.

```

8153 \keys_define:nn { nicematrix / BlockStroke }
8154 {
8155   color .tl_set:N = \l_@@_draw_tl ,
8156   draw .code:n =
8157     \tl_if_empty:eF { #1 } { \tl_set:Nn \l_@@_draw_tl { #1 } } ,
8158   draw .default:n = default ,
8159   line-width .dim_set:N = \l_@@_line_width_dim ,
8160   rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
8161   rounded-corners .default:n = 4 pt
8162 }

```

The first argument of `\@@_vlines_block:nnn` is a list of options for the rules that we will draw. The second argument is the upper-left cell of the block (with, as usual, the syntax *i-j*) and the third is the last cell of the block (with the same syntax).

```

8163 \cs_new_protected:Npn \@@_vlines_block:nnn #1 #2 #3
8164 {
8165   \group_begin:
8166   \keys_set_known:nn { nicematrix / BlockBorders } { #1 }
8167   \dim_set_eq:NN \arrayrulewidth \l_@@_line_width_dim
8168   @@_cut_on_hyphen:w #2 \q_stop
8169   \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
8170   \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
8171   @@_cut_on_hyphen:w #3 \q_stop
8172   \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8173   \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8174   \int_step_inline:nnn \l_@@_tmpd_tl \l_tmpb_tl
8175   {
8176     \use:e
8177     {
8178       @@_vline:n
8179       {
8180         position = ##1 ,
8181         start = \l_@@_tmpc_tl ,
8182         end = \int_eval:n { \l_tmpa_tl - 1 } ,
8183         total-width = \dim_use:N \l_@@_line_width_dim
8184       }
8185     }
8186   }
8187   \group_end:
8188 }
8189 \cs_new_protected:Npn \@@_hlines_block:nnn #1 #2 #3

```

```

8190 {
8191   \group_begin:
8192   \keys_set_known:n { nicematrix / BlockBorders } { #1 }
8193   \dim_set_eq:NN \arrayrulewidth \l_@@_line_width_dim
8194   \@@_cut_on_hyphen:w #2 \q_stop
8195   \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
8196   \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
8197   \@@_cut_on_hyphen:w #3 \q_stop
8198   \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8199   \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8200   \int_step_inline:nnn \l_@@_tmpc_tl \l_tmpa_tl
8201     {
8202       \use:e
8203       {
8204         \@@_hline:n
8205         {
8206           position = ##1 ,
8207           start = \l_@@_tmpd_tl ,
8208           end = \int_eval:n { \l_tmpb_tl - 1 } ,
8209           total-width = \dim_use:N \l_@@_line_width_dim
8210         }
8211       }
8212     }
8213   \group_end:
8214 }

```

The first argument of `\@@_stroke_borders_block:nnn` is a list of options for the borders that you will stroke. The second argument is the upper-left cell of the block (with, as usual, the syntax $i-j$) and the third is the last cell of the block (with the same syntax).

```

8215 \cs_new_protected:Npn \@@_stroke_borders_block:nnn #1 #2 #3
8216 {
8217   \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
8218   \keys_set_known:n { nicematrix / BlockBorders } { #1 }
8219   \dim_compare:nNnTF \l_@@_rounded_corners_dim > \c_zero_dim
8220     { \@@_error:n { borders~forbidden } }
8221     {
8222       \tl_clear_new:N \l_@@_borders_tikz_tl
8223       \keys_set:no
8224         { nicematrix / OnlyForTikzInBorders }
8225         \l_@@_borders_clist
8226       \@@_cut_on_hyphen:w #2 \q_stop
8227       \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
8228       \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
8229       \@@_cut_on_hyphen:w #3 \q_stop
8230       \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8231       \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8232       \@@_stroke_borders_block_i:
8233     }
8234 }
8235 \hook_gput_code:nnn { begindocument } { . }
8236 {
8237   \cs_new_protected:Npe \@@_stroke_borders_block_i:
8238   {
8239     \c_@@_pgfortikzpicture_tl
8240     \@@_stroke_borders_block_ii:
8241     \c_@@_endpgfortikzpicture_tl
8242   }
8243 }
8244 \cs_new_protected:Npn \@@_stroke_borders_block_ii:
8245 {
8246   \pgfrememberpicturepositiononpagetrue
8247   \pgf@relevantforpicturesizefalse

```

```

8248 \CT@arc@
8249 \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }
8250 \clist_if_in:NnT \l_@@_borders_clist { right }
8251   { \@@_stroke_vertical:n \l_tmpb_tl }
8252 \clist_if_in:NnT \l_@@_borders_clist { left }
8253   { \@@_stroke_vertical:n \l_@@_tmpd_tl }
8254 \clist_if_in:NnT \l_@@_borders_clist { bottom }
8255   { \@@_stroke_horizontal:n \l_tmpa_tl }
8256 \clist_if_in:NnT \l_@@_borders_clist { top }
8257   { \@@_stroke_horizontal:n \l_@@_tmpc_tl }
8258 }
8259 \keys_define:nn { nicematrix / OnlyForTikzInBorders }
8260 {
8261   tikz .code:n =
8262     \cs_if_exist:NTF \tikzpicture
8263     { \tl_set:Nn \l_@@_borders_tikz_tl { #1 } }
8264     { \@@_error:n { tikz-in-borders-without-tikz } } ,
8265   tikz .value_required:n = true ,
8266   top .code:n = ,
8267   bottom .code:n = ,
8268   left .code:n = ,
8269   right .code:n = ,
8270   unknown .code:n = \@@_error:n { bad-border }
8271 }

```

The following command is used to stroke the left border and the right border. The argument #1 is the number of column (in the sense of the col node).

```

8272 \cs_new_protected:Npn \@@_stroke_vertical:n #1
8273 {
8274   \@@_qpoint:n \l_@@_tmpc_tl
8275   \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
8276   \@@_qpoint:n \l_tmpa_tl
8277   \dim_set:Nn \l_@@_tmpc_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
8278   \@@_qpoint:n { #1 }
8279   \tl_if_empty:NTF \l_@@_borders_tikz_tl
8280   {
8281     \pgfpathmoveto { \pgfpoint \pgf@x \l_tmpb_dim }
8282     \pgfpathlineto { \pgfpoint \pgf@x \l_@@_tmpc_dim }
8283     \pgfusepathqstroke
8284   }
8285   {
8286     \use:e { \exp_not:N \draw [ \l_@@_borders_tikz_tl ] }
8287     ( \pgf@x , \l_tmpb_dim ) -- ( \pgf@x , \l_@@_tmpc_dim ) ;
8288   }
8289 }

```

The following command is used to stroke the top border and the bottom border. The argument #1 is the number of row (in the sense of the row node).

```

8290 \cs_new_protected:Npn \@@_stroke_horizontal:n #1
8291 {
8292   \@@_qpoint:n \l_@@_tmpd_tl
8293   \clist_if_in:NnTF \l_@@_borders_clist { left }
8294     { \dim_set:Nn \l_tmpa_dim { \pgf@x - 0.5 \l_@@_line_width_dim } }
8295     { \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \l_@@_line_width_dim } }
8296   \@@_qpoint:n \l_tmpb_tl
8297   \dim_set:Nn \l_tmpb_dim { \pgf@x + 0.5 \l_@@_line_width_dim }
8298   \@@_qpoint:n { #1 }
8299   \tl_if_empty:NTF \l_@@_borders_tikz_tl
8300   {
8301     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }
8302     \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
8303     \pgfusepathqstroke
8304   }

```

```

8305     {
8306     \use:e { \exp_not:N \draw [ \l_@@_borders_tikz_tl ] }
8307     ( \l_tmpa_dim , \pgf@y ) -- ( \l_tmpb_dim , \pgf@y ) ;
8308     }
8309 }

```

Here is the set of keys for the command `\@@_stroke_borders_block:nnn`.

```

8310 \keys_define:nn { nicematrix / BlockBorders }
8311 {
8312   borders .clist_set:N = \l_@@_borders_clist ,
8313   rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
8314   rounded-corners .default:n = 4 pt ,
8315   line-width .dim_set:N = \l_@@_line_width_dim
8316 }

```

The following command will be used if the key `tikz` has been used for the command `\Block`. `#1` is a *list of lists* of Tikz keys used with the path.

Example: `{\offset=1pt,draw,red},{\offset=2pt,draw,blue}`

which arises from a command such as :

`\Block[tikz={\offset=1pt,draw,red},tikz={\offset=2pt,draw,blue}]{2-2}{}`

The arguments `#2` and `#3` are the coordinates of the first cell and `#4` and `#5` the coordinates of the last cell of the block.

```

8317 \cs_generate_variant:Nn \@@_block_tikz:nnnnn { o }
8318 \cs_new_protected:Npn \@@_block_tikz:nnnnn #1 #2 #3 #4 #5
8319 {
8320   \begin { tikzpicture }
8321   \@@_clip_with_rounded_corners:

```

We use `clist_map_inline:nn` because `#5` is a list of lists.

```

8322   \clist_map_inline:nn { #1 }
8323   {

```

We extract the key `offset` which is *not* a key of TikZ but a key added by `nicematrix`.

```

8324     \keys_set_known:nnN { nicematrix / SpecialOffset } { ##1 } \l_tmpa_tl
8325     \use:e { \exp_not:N \path [ \l_tmpa_tl ] }
8326     (
8327     [
8328       xshift = \dim_use:N \l_@@_offset_dim ,
8329       yshift = - \dim_use:N \l_@@_offset_dim
8330     ]
8331     #2 -| #3
8332     )
8333     rectangle
8334     (
8335     [
8336       xshift = - \dim_use:N \l_@@_offset_dim ,
8337       yshift = \dim_use:N \l_@@_offset_dim
8338     ]
8339     \int_eval:n { #4 + 1 } -| \int_eval:n { #5 + 1 }
8340     ) ;
8341     }
8342   \end { tikzpicture }
8343 }

```

```

8344 \keys_define:nn { nicematrix / SpecialOffset }
8345 { offset .dim_set:N = \l_@@_offset_dim }

```

In some circumstances, we want to nullify the command `\Block`. In order to reach that goal, we will link the command `\Block` to the following command `\@@_NullBlock`: which has the same syntax as the standard command `\Block` but which is no-op.

```

8346 \cs_new_protected:Npn \@@_NullBlock:

```

```

8347 { \@@_collect_options:n { \@@_NullBlock_i: } }
8348 \NewExpandableDocumentCommand \@@_NullBlock_i: { m m D < > { } +m }
8349 { }

```

27 How to draw the dotted lines transparently

```

8350 \cs_set_protected:Npn \@@_renew_matrix:
8351 {
8352   \RenewDocumentEnvironment { pmatrix } { }
8353     { \pNiceMatrix }
8354     { \endpNiceMatrix }
8355   \RenewDocumentEnvironment { vmatrix } { }
8356     { \vNiceMatrix }
8357     { \endvNiceMatrix }
8358   \RenewDocumentEnvironment { Vmatrix } { }
8359     { \VNiceMatrix }
8360     { \endVNiceMatrix }
8361   \RenewDocumentEnvironment { bmatrix } { }
8362     { \bNiceMatrix }
8363     { \endbNiceMatrix }
8364   \RenewDocumentEnvironment { Bmatrix } { }
8365     { \BNiceMatrix }
8366     { \endBNiceMatrix }
8367 }

```

28 Automatic arrays

We will extract some keys and pass the other keys to the environment `{NiceArrayWithDelims}`.

```

8368 \keys_define:nn { nicematrix / Auto }
8369 {
8370   columns-type .tl_set:N = \l_@@_columns_type_tl ,
8371   columns-type .value_required:n = true ,
8372   l .meta:n = { columns-type = l } ,
8373   r .meta:n = { columns-type = r } ,
8374   c .meta:n = { columns-type = c } ,
8375   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8376   delimiters / color .value_required:n = true ,
8377   delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
8378   delimiters / max-width .default:n = true ,
8379   delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
8380   delimiters .value_required:n = true ,
8381   rounded-corners .dim_set:N = \l_@@_tab_rounded_corners_dim ,
8382   rounded-corners .default:n = 4 pt
8383 }
8384 \NewDocumentCommand \AutoNiceMatrixWithDelims
8385 { m m O { } } > { \SplitArgument { 1 } { - } } m O { } m ! O { } }
8386 { \@@_auto_nice_matrix:nnnnn { #1 } { #2 } #4 { #6 } { #3 , #5 , #7 } }
8387 \cs_new_protected:Npn \@@_auto_nice_matrix:nnnnn #1 #2 #3 #4 #5 #6
8388 {

```

The group is for the protection of the keys.

```

8389   \group_begin:
8390   \keys_set_known:nnN { nicematrix / Auto } { #6 } \l_tmpa_tl
8391   \use:e
8392   {
8393     \exp_not:N \begin { NiceArrayWithDelims } { #1 } { #2 }
8394       { * { #4 } { \exp_not:o \l_@@_columns_type_tl } }
8395       [ \exp_not:o \l_tmpa_tl ]

```

```

8396     }
8397     \int_if_zero:nT \l_@@_first_row_int
8398     {
8399         \int_if_zero:nT \l_@@_first_col_int { & }
8400         \prg_replicate:nn { #4 - 1 } { & }
8401         \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
8402     }
8403     \prg_replicate:nn { #3 }
8404     {
8405         \int_if_zero:nT \l_@@_first_col_int { & }

```

We put { } before #6 to avoid a hasty expansion of a potential `\arabic{iRow}` at the beginning of the row which would result in an incorrect value of that `iRow` (since `iRow` is incremented in the first cell of the row of the `\halign`).

```

8406         \prg_replicate:nn { #4 - 1 } { { } #5 & } #5
8407         \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
8408     }
8409     \int_compare:nNnT \l_@@_last_row_int > { -2 }
8410     {
8411         \int_if_zero:nT \l_@@_first_col_int { & }
8412         \prg_replicate:nn { #4 - 1 } { & }
8413         \int_compare:nNnT \l_@@_last_col_int > { -1 } { & } \\
8414     }
8415     \end { NiceArrayWithDelims }
8416     \group_end:
8417 }

8418 \cs_set_protected:Npn \@@_define_com:nnn #1 #2 #3
8419 {
8420     \cs_set_protected:cpn { #1 AutoNiceMatrix }
8421     {
8422         \bool_gset_true:N \g_@@_delims_bool
8423         \str_gset:Nx \g_@@_name_env_str { #1 AutoNiceMatrix }
8424         \AutoNiceMatrixWithDelims { #2 } { #3 }
8425     }
8426 }

8427 \@@_define_com:nnn p ( )
8428 \@@_define_com:nnn b [ ]
8429 \@@_define_com:nnn v | |
8430 \@@_define_com:nnn V \| \|
8431 \@@_define_com:nnn B \{ \}

```

We define also a command `\AutoNiceMatrix` similar to the environment `{NiceMatrix}`.

```

8432 \NewDocumentCommand \AutoNiceMatrix { O { } m O { } m ! O { } }
8433 {
8434     \group_begin:
8435     \bool_gset_false:N \g_@@_delims_bool
8436     \AutoNiceMatrixWithDelims . . { #2 } { #4 } [ #1 , #3 , #5 ]
8437     \group_end:
8438 }

```

29 The redefinition of the command `\dotfill`

```

8439 \cs_set_eq:NN \@@_old_dotfill \dotfill
8440 \cs_new_protected:Npn \@@_dotfill:
8441 {

```

First, we insert `\@@_dotfill` (which is the saved version of `\dotfill`) in case of use of `\dotfill` “internally” in the cell (e.g. `\hbox to 1cm {\dotfill}`).

```

8442     \@@_old_dotfill
8443     \tl_gput_right:Nn \g_@@_cell_after_hook_tl \@@_dotfill_i:
8444 }

```

Now, if the box is not empty (unfortunately, we can't actually test whether the box is empty and that's why we only consider its width), we insert `\@@_dotfill` (which is the saved version of `\dotfill`) in the cell of the array, and it will extend, since it is no longer in `\l_@@_cell_box`.

```

8445 \cs_new_protected:Npn \@@_dotfill_i:
8446 { \dim_compare:nNt { \box_wd:N \l_@@_cell_box } = \c_zero_dim \@@_old_dotfill }

```

30 The command `\diagbox`

The command `\diagbox` will be linked to `\diagbox:nn` in the environments of `nicematrix`. However, there are also redefinitions of `\diagbox` in other circumstances.

```

8447 \cs_new_protected:Npn \@@_diagbox:nn #1 #2
8448 {
8449     \tl_gput_right:Ne \g_@@_pre_code_after_tl
8450     {
8451         \@@_actually_diagbox:nnnnnn
8452         { \int_use:N \c@iRow }
8453         { \int_use:N \c@jCol }
8454         { \int_use:N \c@iRow }
8455         { \int_use:N \c@jCol }

```

`\g_@@_row_style_tl` contains several instructions of the form:

```
\@@_if_row_less_than:nn { number } { instructions }
```

The command `\@@_if_row_less:nn` is fully expandable and, thus, the instructions will be inserted in the `\g_@@_pre_code_after_tl` only if `\diagbox` is used in a row which is the scope of that chunk of instructions.

```

8456     { \g_@@_row_style_tl \exp_not:n { #1 } }
8457     { \g_@@_row_style_tl \exp_not:n { #2 } }
8458 }

```

We put the cell with `\diagbox` in the sequence `\g_@@_pos_of_blocks_seq` because a cell with `\diagbox` must be considered as non empty by the key corners.

```

8459     \seq_gput_right:Ne \g_@@_pos_of_blocks_seq
8460     {
8461         { \int_use:N \c@iRow }
8462         { \int_use:N \c@jCol }
8463         { \int_use:N \c@iRow }
8464         { \int_use:N \c@jCol }

```

The last argument is for the name of the block.

```

8465     { }
8466 }
8467 }

```

The command `\diagbox` is also redefined locally when we draw a block.

The first four arguments of `\@@_actually_diagbox:nnnnnn` correspond to the rectangle (=block) to slash (we recall that it's possible to use `\diagbox` in a `\Block`). The other two are the elements to draw below and above the diagonal line.

```

8468 \cs_new_protected:Npn \@@_actually_diagbox:nnnnnn #1 #2 #3 #4 #5 #6
8469 {
8470     \pgfpicture
8471     \pgf@relevantforpicturesizefalse
8472     \pgfrememberpicturepositiononpagetrue
8473     \@@_qpoint:n { row - #1 }
8474     \dim_set_eq:NN \l_tmpa_dim \pgf@y
8475     \@@_qpoint:n { col - #2 }
8476     \dim_set_eq:NN \l_tmpb_dim \pgf@x
8477     \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }

```

```

8478 \@@_qpoint:n { row - \int_eval:n { #3 + 1 } }
8479 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
8480 \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
8481 \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x
8482 \pgfpathlineto { \pgfpoint \l_@@_tmpd_dim \l_@@_tmpc_dim }
8483 {

```

The command `\CT@arc@` is a command of `colortbl` which sets the color of the rules in the array. The package `nicematrix` uses it even if `colortbl` is not loaded.

```

8484 \CT@arc@
8485 \pgfsetroundcap
8486 \pgfusepathqstroke
8487 }
8488 \pgfset { inner~sep = 1 pt }
8489 \pgfscope
8490 \pgftransformshift { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
8491 \pgfnode { rectangle } { south~west }
8492 {
8493 \begin { minipage } { 20 cm }

```

The `\scan_stop:` avoids an error in math mode when the argument #5 is empty.

```

8494 \@@_math_toggle: \scan_stop: #5 \@@_math_toggle:
8495 \end { minipage }
8496 }
8497 { }
8498 { }
8499 \endpgfscope
8500 \pgftransformshift { \pgfpoint \l_@@_tmpd_dim \l_tmpa_dim }
8501 \pgfnode { rectangle } { north~east }
8502 {
8503 \begin { minipage } { 20 cm }
8504 \raggedleft
8505 \@@_math_toggle: \scan_stop: #6 \@@_math_toggle:
8506 \end { minipage }
8507 }
8508 { }
8509 { }
8510 \endpgfpicture
8511 }

```

31 The keyword `\CodeAfter`

In fact, in this subsection, we define the user command `\CodeAfter` for the case of the “normal syntax”. For the case of “light-syntax”, see the definition of the environment `{@@-light-syntax}` on p. 83.

In the environments of `nicematrix`, `\CodeAfter` will be linked to `\@@_CodeAfter:`. That macro must *not* be protected since it begins with `\omit`.

```

8512 \cs_new:Npn \@@_CodeAfter: { \omit \@@_CodeAfter_ii:n }

```

However, in each cell of the environment, the command `\CodeAfter` will be linked to the following command `\@@_CodeAfter_ii:n` which begins with `\`.

```

8513 \cs_new_protected:Npn \@@_CodeAfter_i: { \ \omit \@@_CodeAfter_ii:n }

```

We have to catch everything until the end of the current environment (of `nicematrix`). First, we go until the next command `\end`.

```

8514 \cs_new_protected:Npn \@@_CodeAfter_ii:n #1 \end
8515 {
8516 \tl_gput_right:Nn \g_nicematrix_code_after_tl { #1 }

```

```

8517   \@@_CodeAfter_iv:n
8518 }

```

We catch the argument of the command `\end` (in #1).

```

8519 \cs_new_protected:Npn \@@_CodeAfter_iv:n #1
8520 {

```

If this is really the end of the current environment (of `nicematrix`), we put back the command `\end` and its argument in the TeX flow.

```

8521   \str_if_eq:eeTF \@currenvir { #1 }
8522   { \end { #1 } }

```

If this is not the `\end` we are looking for, we put those tokens in `\g_nicematrix_code_after_tl` and we go on searching for the next command `\end` with a recursive call to the command `\@@_CodeAfter:n`.

```

8523   {
8524     \tl_gput_right:Nn \g_nicematrix_code_after_tl { \end { #1 } }
8525     \@@_CodeAfter_ii:n
8526   }
8527 }

```

32 The delimiters in the preamble

The command `\@@_delimiter:nnn` will be used to draw delimiters inside the matrix when delimiters are specified in the preamble of the array. It does *not* concern the exterior delimiters added by `{NiceArrayWithDelims}` (and `{pNiceArray}`, `{pNiceMatrix}`, etc.).

A delimiter in the preamble of the array will write an instruction `\@@_delimiter:nnn` in the `\g_@@_pre_code_after_tl` (and also potentially add instructions in the preamble provided to `\array` in order to add space between columns).

The first argument is the type of delimiter (`(`, `[`, `\{`, `)`, `]` or `\}`). The second argument is the number of columnn. The third argument is a boolean equal to `\c_true_bool` (resp. `\c_false_true`) when the delimiter must be put on the left (resp. right) side.

```

8528 \cs_new_protected:Npn \@@_delimiter:nnn #1 #2 #3
8529 {
8530   \pgfpicture
8531   \pgfrememberpicturepositiononpagetrue
8532   \pgf@relevantforpicturesizefalse

```

`\l_@@_y_initial_dim` and `\l_@@_y_final_dim` will be the y -values of the extremities of the delimiter we will have to construct.

```

8533   \@@_qpoint:n { row - 1 }
8534   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
8535   \@@_qpoint:n { row - \int_eval:n { \c@iRow + 1 } }
8536   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y

```

We will compute in `\l_tmpa_dim` the x -value where we will have to put our delimiter (on the left side or on the right side).

```

8537   \bool_if:nTF { #3 }
8538   { \dim_set_eq:NN \l_tmpa_dim \c_max_dim }
8539   { \dim_set:Nn \l_tmpa_dim { - \c_max_dim } }
8540   \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int
8541   {
8542     \cs_if_exist:cT
8543     { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
8544     {
8545       \pgfpointanchor
8546       { \@@_env: - ##1 - #2 }
8547       { \bool_if:nTF { #3 } { west } { east } }
8548       \dim_set:Nn \l_tmpa_dim

```

```

8549         { \bool_if:nTF { #3 } \dim_min:nn \dim_max:nn \l_tmpa_dim \pgf@x }
8550     }
8551 }

```

Now we can put the delimiter with a node of PGF.

```

8552 \pgfset { inner~sep = \c_zero_dim }
8553 \dim_zero:N \nulldelimiterspace
8554 \pgftransformshift
8555 {
8556     \pgfpoint
8557     { \l_tmpa_dim }
8558     { ( \l_@@_y_initial_dim + \l_@@_y_final_dim + \arrayrulewidth ) / 2 }
8559 }
8560 \pgfnode
8561 { rectangle }
8562 { \bool_if:nTF { #3 } { east } { west } }
8563 {

```

Here is the content of the PGF node, that is to say the delimiter, constructed with its right size.

```

8564     \nullfont
8565     \c_math_toggle_token
8566     \@@_color:o \l_@@_delimiters_color_tl
8567     \bool_if:nTF { #3 } { \left #1 } { \left . }
8568     \vcenter
8569     {
8570         \nullfont
8571         \hrule \@height
8572             \dim_eval:n { \l_@@_y_initial_dim - \l_@@_y_final_dim }
8573             \@depth \c_zero_dim
8574             \@width \c_zero_dim
8575     }
8576     \bool_if:nTF { #3 } { \right . } { \right #1 }
8577     \c_math_toggle_token
8578 }
8579 { }
8580 { }
8581 \endpgfpicture
8582 }

```

33 The command `\SubMatrix`

```

8583 \keys_define:nn { nicematrix / sub-matrix }
8584 {
8585     extra-height .dim_set:N = \l_@@_submatrix_extra_height_dim ,
8586     extra-height .value_required:n = true ,
8587     left-xshift .dim_set:N = \l_@@_submatrix_left_xshift_dim ,
8588     left-xshift .value_required:n = true ,
8589     right-xshift .dim_set:N = \l_@@_submatrix_right_xshift_dim ,
8590     right-xshift .value_required:n = true ,
8591     xshift .meta:n = { left-xshift = #1, right-xshift = #1 } ,
8592     xshift .value_required:n = true ,
8593     delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8594     delimiters / color .value_required:n = true ,
8595     slim .bool_set:N = \l_@@_submatrix_slim_bool ,
8596     slim .default:n = true ,
8597     hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
8598     hlines .default:n = all ,
8599     vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
8600     vlines .default:n = all ,
8601     hvlines .meta:n = { hlines, vlines } ,
8602     hvlines .value_forbidden:n = true

```

```

8603 }
8604 \keys_define:nn { nicematrix }
8605 {
8606   SubMatrix .inherit:n = nicematrix / sub-matrix ,
8607   NiceArray / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8608   pNiceArray / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8609   NiceMatrixOptions / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8610 }

```

The following keys set is for the command `\SubMatrix` itself (not the tuning of `\SubMatrix` that can be done elsewhere).

```

8611 \keys_define:nn { nicematrix / SubMatrix }
8612 {
8613   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8614   delimiters / color .value_required:n = true ,
8615   hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
8616   hlines .default:n = all ,
8617   vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
8618   vlines .default:n = all ,
8619   hvlines .meta:n = { hlines, vlines } ,
8620   hvlines .value_forbidden:n = true ,
8621   name .code:n =
8622     \tl_if_empty:nTF { #1 }
8623     { \@@_error:n { Invalid-name } }
8624     {
8625       \regex_match:nnTF { \A[A-Za-z][A-Za-z0-9]*\Z } { #1 }
8626       {
8627         \seq_if_in:NnTF \g_@@_submatrix_names_seq { #1 }
8628         { \@@_error:nn { Duplicate~name~for~SubMatrix } { #1 } }
8629         {
8630           \str_set:Nn \l_@@_submatrix_name_str { #1 }
8631           \seq_gput_right:Nn \g_@@_submatrix_names_seq { #1 }
8632         }
8633       }
8634       { \@@_error:n { Invalid-name } }
8635     } ,
8636   name .value_required:n = true ,
8637   rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
8638   rules .value_required:n = true ,
8639   code .tl_set:N = \l_@@_code_tl ,
8640   code .value_required:n = true ,
8641   unknown .code:n = \@@_error:n { Unknown~key~for~SubMatrix }
8642 }

8643 \NewDocumentCommand \@@_SubMatrix_in_code_before { m m m m ! O { } }
8644 {
8645   \peek_remove_spaces:n
8646   {
8647     \tl_gput_right:Ne \g_@@_pre_code_after_tl
8648     {
8649       \SubMatrix { #1 } { #2 } { #3 } { #4 }
8650       [
8651         delimiters / color = \l_@@_delimiters_color_tl ,
8652         hlines = \l_@@_submatrix_hlines_clist ,
8653         vlines = \l_@@_submatrix_vlines_clist ,
8654         extra-height = \dim_use:N \l_@@_submatrix_extra_height_dim ,
8655         left-xshift = \dim_use:N \l_@@_submatrix_left_xshift_dim ,
8656         right-xshift = \dim_use:N \l_@@_submatrix_right_xshift_dim ,
8657         slim = \bool_to_str:N \l_@@_submatrix_slim_bool ,
8658         #5
8659       ]
8660     }
8661     \@@_SubMatrix_in_code_before_i { #2 } { #3 }

```

```

8662     }
8663 }
8664 \NewDocumentCommand \@@_SubMatrix_in_code_before_i
8665 { > { \SplitArgument { 1 } { - } } m > { \SplitArgument { 1 } { - } } m }
8666 { \@@_SubMatrix_in_code_before_i:nnnn #1 #2 }
8667 \cs_new_protected:Npn \@@_SubMatrix_in_code_before_i:nnnn #1 #2 #3 #4
8668 {
8669   \seq_gput_right:Ne \g_@@_submatrix_seq
8670   {

```

We use `\str_if_eq:eeTF` because it is fully expandable (and slightly faster than `\tl_if_eq:nnTF`).

```

8671     { \str_if_eq:eeTF { #1 } { last } { \int_use:N \c@iRow } { #1 } }
8672     { \str_if_eq:eeTF { #2 } { last } { \int_use:N \c@jCol } { #2 } }
8673     { \str_if_eq:eeTF { #3 } { last } { \int_use:N \c@iRow } { #3 } }
8674     { \str_if_eq:eeTF { #4 } { last } { \int_use:N \c@jCol } { #4 } }
8675   }
8676 }

```

In the pre-code-after and in the `\CodeAfter` the following command `\@@_SubMatrix` will be linked to `\SubMatrix`.

- #1 is the left delimiter;
- #2 is the upper-left cell of the matrix with the format $i-j$;
- #3 is the lower-right cell of the matrix with the format $i-j$;
- #4 is the right delimiter;
- #5 is the list of options of the command;
- #6 is the potential subscript;
- #7 is the potential superscript.

For explanations about the construction with rescanning of the preamble, see the documentation for the user command `\Cdots`.

```

8677 \hook_gput_code:nnn { begindocument } { . }
8678 {
8679   \cs_set_nopar:Npn \l_@@_argspec_tl { m m m m 0 { } E { _ ^ } { { } { } } }
8680   \tl_set_rescan:Nno \l_@@_argspec_tl { } \l_@@_argspec_tl
8681   \exp_args:NNo \NewDocumentCommand \@@_SubMatrix \l_@@_argspec_tl
8682     {
8683       \peek_remove_spaces:n
8684       {
8685         \@@_sub_matrix:nnnnnnn
8686         { #1 } { #2 } { #3 } { #4 } { #5 } { #6 } { #7 }
8687       }
8688     }
8689 }

```

The following macro will compute `\l_@@_first_i_tl`, `\l_@@_first_j_tl`, `\l_@@_last_i_tl` and `\l_@@_last_j_tl` from the arguments of the command as provided by the user (for example 2-3 and 5-last).

```

8690 \NewDocumentCommand \@@_compute_i_j:nn
8691 { > { \SplitArgument { 1 } { - } } m > { \SplitArgument { 1 } { - } } m }
8692 { \@@_compute_i_j:nnnn #1 #2 }
8693 \cs_new_protected:Npn \@@_compute_i_j:nnnn #1 #2 #3 #4
8694 {
8695   \cs_set_nopar:Npn \l_@@_first_i_tl { #1 }
8696   \cs_set_nopar:Npn \l_@@_first_j_tl { #2 }
8697   \cs_set_nopar:Npn \l_@@_last_i_tl { #3 }
8698   \cs_set_nopar:Npn \l_@@_last_j_tl { #4 }
8699   \tl_if_eq:NnT \l_@@_first_i_tl { last }

```

```

8700     { \tl_set:NV \l_@@_first_i_tl \c{iRow }
8701 \tl_if_eq:NnT \l_@@_first_j_tl { last }
8702     { \tl_set:NV \l_@@_first_j_tl \c{jCol }
8703 \tl_if_eq:NnT \l_@@_last_i_tl { last }
8704     { \tl_set:NV \l_@@_last_i_tl \c{iRow }
8705 \tl_if_eq:NnT \l_@@_last_j_tl { last }
8706     { \tl_set:NV \l_@@_last_j_tl \c{jCol }
8707 }
8708 \cs_new_protected:Npn \@@_sub_matrix:nnnnnnn #1 #2 #3 #4 #5 #6 #7
8709 {
8710     \group_begin:

```

The four following token lists correspond to the position of the \SubMatrix.

```

8711     \@@_compute_i_j:nn { #2 } { #3 }
8712     \int_compare:nNnT \l_@@_first_i_tl = \l_@@_last_i_tl
8713     { \cs_set_nopar:Npn \arraystretch { 1 } }
8714     \bool_lazy_or:nnTF
8715     { \int_compare_p:nNn \l_@@_last_i_tl > \g_@@_row_total_int }
8716     { \int_compare_p:nNn \l_@@_last_j_tl > \g_@@_col_total_int }
8717     { \@@_error:nn { Construct~too-large } { \SubMatrix } }
8718     {
8719         \str_clear_new:N \l_@@_submatrix_name_str
8720         \keys_set:nn { nicematrix / SubMatrix } { #5 }
8721         \pgfpicture
8722         \pgfrememberpicturepositiononpagetrue
8723         \pgf@relevantforpicturesizefalse
8724         \pgfset { inner-sep = \c_zero_dim }
8725         \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
8726         \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }

```

The last value of \int_step_inline:nnn is provided by currification.

```

8727     \bool_if:NTF \l_@@_submatrix_slim_bool
8728     { \int_step_inline:nnn \l_@@_first_i_tl \l_@@_last_i_tl }
8729     { \int_step_inline:nnn \l_@@_first_row_int \g_@@_row_total_int }
8730     {
8731         \cs_if_exist:cT
8732         { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_first_j_tl }
8733         {
8734             \pgfpointanchor { \@@_env: - ##1 - \l_@@_first_j_tl } { west }
8735             \dim_compare:nNnT \pgf@x < \l_@@_x_initial_dim
8736             { \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x }
8737         }
8738         \cs_if_exist:cT
8739         { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_last_j_tl }
8740         {
8741             \pgfpointanchor { \@@_env: - ##1 - \l_@@_last_j_tl } { east }
8742             \dim_compare:nNnT \pgf@x > \l_@@_x_final_dim
8743             { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
8744         }
8745     }
8746     \dim_compare:nNnTF \l_@@_x_initial_dim = \c_max_dim
8747     { \@@_error:nn { Impossible-delimiter } { left } }
8748     {
8749         \dim_compare:nNnTF \l_@@_x_final_dim = { - \c_max_dim }
8750         { \@@_error:nn { Impossible-delimiter } { right } }
8751         { \@@_sub_matrix_i:nnnn { #1 } { #4 } { #6 } { #7 } }
8752     }
8753     \endpgfpicture
8754 }
8755 \group_end:
8756 }

```

#1 is the left delimiter, #2 is the right one, #3 is the subscript and #4 is the superscript.

```

8757 \cs_new_protected:Npn \l_@@_sub_matrix_i:n #1 #2 #3 #4
8758 {
8759   \l_@@_qpoint:n { row - \l_@@_first_i_tl - base }
8760   \dim_set:Nn \l_@@_y_initial_dim
8761     {
8762     \fp_to_dim:n
8763     {
8764     \pgf@y
8765     + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch
8766     }
8767     }
8768   \l_@@_qpoint:n { row - \l_@@_last_i_tl - base }
8769   \dim_set:Nn \l_@@_y_final_dim
8770   { \fp_to_dim:n { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch } }
8771   \int_step_inline:nnn \l_@@_first_col_int \g_@@_col_total_int
8772   {
8773     \cs_if_exist:cT
8774     { \pgf @ sh @ ns @ \l_@@_env: - \l_@@_first_i_tl - ##1 }
8775     {
8776     \pgfpointanchor { \l_@@_env: - \l_@@_first_i_tl - ##1 } { north }
8777     \dim_set:Nn \l_@@_y_initial_dim
8778     { \dim_max:nn \l_@@_y_initial_dim \pgf@y }
8779     }
8780     \cs_if_exist:cT
8781     { \pgf @ sh @ ns @ \l_@@_env: - \l_@@_last_i_tl - ##1 }
8782     {
8783     \pgfpointanchor { \l_@@_env: - \l_@@_last_i_tl - ##1 } { south }
8784     \dim_compare:nNnT \pgf@y < \l_@@_y_final_dim
8785     { \dim_set_eq:NN \l_@@_y_final_dim \pgf@y }
8786     }
8787     }
8788   \dim_set:Nn \l_tmpa_dim
8789   {
8790   \l_@@_y_initial_dim - \l_@@_y_final_dim +
8791   \l_@@_submatrix_extra_height_dim - \arrayrulewidth
8792   }
8793   \dim_zero:N \nulldelimiterspace

```

We will draw the rules in the `\SubMatrix`.

```

8794   \group_begin:
8795   \pgfsetlinewidth { 1.1 \arrayrulewidth }
8796   \l_@@_set_CT@arc@:o \l_@@_rules_color_tl
8797   \CT@arc@

```

Now, we draw the potential vertical rules specified in the preamble of the environments with the letter fixed with the key `vlines-in-sub-matrix`. The list of the columns where there is such rule to draw is in `\g_@@_cols_vlism_seq`.

```

8798   \seq_map_inline:Nn \g_@@_cols_vlism_seq
8799   {
8800     \int_compare:nNnT \l_@@_first_j_tl < { ##1 }
8801     {
8802       \int_compare:nNnT
8803       { ##1 } < { \int_eval:n { \l_@@_last_j_tl + 1 } }
8804       {

```

First, we extract the value of the abscissa of the rule we have to draw.

```

8805     \l_@@_qpoint:n { col - ##1 }
8806     \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
8807     \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
8808     \pgfusepathqstroke
8809   }
8810 }
8811 }

```

Now, we draw the vertical rules specified in the key `vlines` of `\SubMatrix`. The last argument of `\int_step_inline:n` or `\clist_map_inline:Nn` is given by curryfication.

```

8812   \str_if_eq:eeTF \l_@@_submatrix_vlines_clist { all }
8813   { \int_step_inline:n { \l_@@_last_j_tl - \l_@@_first_j_tl } }
8814   { \clist_map_inline:Nn \l_@@_submatrix_vlines_clist }
8815   {
8816     \bool_lazy_and:nnTF
8817     { \int_compare_p:nNn { ##1 } > \c_zero_int }
8818     {
8819       \int_compare_p:nNn
8820       { ##1 } < { \l_@@_last_j_tl - \l_@@_first_j_tl + 1 } }
8821     {
8822       \@@_qpoint:n { col - \int_eval:n { ##1 + \l_@@_first_j_tl } }
8823       \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
8824       \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
8825       \pgfusepathqstroke
8826     }
8827     { \@@_error:nmn { Wrong~line~in~SubMatrix } { vertical } { ##1 } }
8828   }

```

Now, we draw the horizontal rules specified in the key `hlines` of `\SubMatrix`. The last argument of `\int_step_inline:n` or `\clist_map_inline:Nn` is given by curryfication.

```

8829   \str_if_eq:eeTF \l_@@_submatrix_hlines_clist { all }
8830   { \int_step_inline:n { \l_@@_last_i_tl - \l_@@_first_i_tl } }
8831   { \clist_map_inline:Nn \l_@@_submatrix_hlines_clist }
8832   {
8833     \bool_lazy_and:nnTF
8834     { \int_compare_p:nNn { ##1 } > \c_zero_int }
8835     {
8836       \int_compare_p:nNn
8837       { ##1 } < { \l_@@_last_i_tl - \l_@@_first_i_tl + 1 } }
8838     {
8839       \@@_qpoint:n { row - \int_eval:n { ##1 + \l_@@_first_i_tl } }

```

We use a group to protect `\l_tmpa_dim` and `\l_tmpb_dim`.

```

8840   \group_begin:

```

We compute in `\l_tmpa_dim` the x -value of the left end of the rule.

```

8841   \dim_set:Nn \l_tmpa_dim
8842   { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
8843   \str_case:nn { #1 }
8844   {
8845     ( { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
8846     [ { \dim_sub:Nn \l_tmpa_dim { 0.2 mm } }
8847     \{ { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
8848     }
8849     \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }

```

We compute in `\l_tmpb_dim` the x -value of the right end of the rule.

```

8850   \dim_set:Nn \l_tmpb_dim
8851   { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
8852   \str_case:nn { #2 }
8853   {
8854     ) { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
8855     ] { \dim_add:Nn \l_tmpb_dim { 0.2 mm } }
8856     \} { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
8857   }
8858   \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
8859   \pgfusepathqstroke
8860   \group_end:
8861   }
8862   { \@@_error:nmn { Wrong~line~in~SubMatrix } { horizontal } { ##1 } }
8863   }

```

If the key name has been used for the command `\SubMatrix`, we create a PGF node with that name for the submatrix (this node does not encompass the delimiters that we will put after).

```

8864   \str_if_empty:NF \l_@@_submatrix_name_str
8865   {
8866     \@@_pgf_rect_node:nnnn \l_@@_submatrix_name_str
8867     \l_@@_x_initial_dim \l_@@_y_initial_dim
8868     \l_@@_x_final_dim \l_@@_y_final_dim
8869   }
8870   \group_end:

```

The group was for `\CT@arc@` (the color of the rules).

Now, we deal with the left delimiter. Of course, the environment `{pgfscope}` is for the `\pgftransformshift`.

```

8871   \begin { pgfscope }
8872   \pgftransformshift
8873   {
8874     \pgfpoint
8875     { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
8876     { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
8877   }
8878   \str_if_empty:NTF \l_@@_submatrix_name_str
8879   { \@@_node_left:nn #1 { } }
8880   { \@@_node_left:nn #1 { \@@_env: - \l_@@_submatrix_name_str - left } }
8881   \end { pgfscope }

```

Now, we deal with the right delimiter.

```

8882   \pgftransformshift
8883   {
8884     \pgfpoint
8885     { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
8886     { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
8887   }
8888   \str_if_empty:NTF \l_@@_submatrix_name_str
8889   { \@@_node_right:nnnn #2 { } { #3 } { #4 } }
8890   {
8891     \@@_node_right:nnnn #2
8892     { \@@_env: - \l_@@_submatrix_name_str - right } { #3 } { #4 }
8893   }
8894   \cs_set_eq:NN \pgfpointanchor \@@_pgfpointanchor:n
8895   \flag_clear_new:N \l_@@_code_flag
8896   \l_@@_code_tl
8897   }

```

In the key code of the command `\SubMatrix` there may be Tikz instructions. We want that, in these instructions, the i and j in specifications of nodes of the forms $i-j$, $row-i$, $col-j$ and $i-|j$ refer to the number of row and column *relative* of the current `\SubMatrix`. That's why we will patch (locally in the `\SubMatrix`) the command `\pgfpointanchor`.

```

8898   \cs_set_eq:NN \@@_old_pgfpointanchor \pgfpointanchor

```

The following command will be linked to `\pgfpointanchor` just before the execution of the option code of the command `\SubMatrix`. In this command, we catch the argument #1 of `\pgfpointanchor` and we apply to it the command `\@@_pgfpointanchor_i:nn` before passing it to the original `\pgfpointanchor`. We have to act in an expandable way because the command `\pgfpointanchor` is used in names of Tikz nodes which are computed in an expandable way.

```

8899   \cs_new_protected:Npn \@@_pgfpointanchor:n #1
8900   {
8901     \use:e
8902     { \exp_not:N \@@_old_pgfpointanchor { \@@_pgfpointanchor_i:nn #1 } }
8903   }

```

In fact, the argument of `\pgfpointanchor` is always of the form `\a_command { name_of_node }` where “name_of_node” is the name of the Tikz node without the potential prefix and suffix. That’s why we catch two arguments and work only on the second by trying (first) to extract an hyphen -.

```
8904 \cs_new:Npn \@@_pgfpointanchor_i:nn #1 #2
8905   { #1 { \@@_pgfpointanchor_ii:w #2 - \q_stop } }
```

Since `\seq_if_in:NnTF` and `\clist_if_in:NnTF` are not expandable, we will use the following token list and `\str_case:nVTF` to test whether we have an integer or not.

```
8906 \tl_const:Nn \c_@@_integers_alist_tl
8907   {
8908     { 1 } { } { 2 } { } { 3 } { } { 4 } { } { 5 } { }
8909     { 6 } { } { 7 } { } { 8 } { } { 9 } { } { 10 } { }
8910     { 11 } { } { 12 } { } { 13 } { } { 14 } { } { 15 } { }
8911     { 16 } { } { 17 } { } { 18 } { } { 19 } { } { 20 } { }
8912   }
```

```
8913 \cs_new:Npn \@@_pgfpointanchor_ii:w #1-#2\q_stop
8914   {
```

If there is no hyphen, that means that the node is of the form of a single number (ex.: 5 or 11). In that case, we are in an analysis which result from a specification of node of the form $i-|j$. In that case, the i of the number of row arrives first (and alone) in a `\pgfpointanchor` and, the, the j arrives (alone) in the following `\pgfpointanchor`. In order to know whether we have a number of row or a number of column, we keep track of the number of such treatments by the expandable flag called `nicematrix`.

```
8915   \tl_if_empty:nTF { #2 }
8916     {
8917       \str_case:nVTF { #1 } \c_@@_integers_alist_tl
8918         {
8919           \flag_raise:N \l_@@_code_flag
8920           \int_if_even:nTF { \flag_height:N \l_@@_code_flag }
8921             { \int_eval:n { #1 + \l_@@_first_i_tl - 1 } }
8922             { \int_eval:n { #1 + \l_@@_first_j_tl - 1 } }
8923         }
8924     { #1 }
8925   }
```

If there is an hyphen, we have to see whether we have a node of the form $i-j$, $row-i$ or $col-j$.

```
8926     { \@@_pgfpointanchor_iii:w { #1 } #2 }
8927   }
```

There was an hyphen in the name of the node and that’s why we have to retrieve the extra hyphen we have put (cf. `\@@_pgfpointanchor_i:nn`).

```
8928 \cs_new:Npn \@@_pgfpointanchor_iii:w #1 #2 -
8929   {
8930     \str_case:nnF { #1 }
8931       {
8932         { row } { row - \int_eval:n { #2 + \l_@@_first_i_tl - 1 } }
8933         { col } { col - \int_eval:n { #2 + \l_@@_first_j_tl - 1 } }
8934       }
8935   }
```

Now the case of a node of the form $i-j$.

```
8935   {
8936     \int_eval:n { #1 + \l_@@_first_i_tl - 1 }
8937     - \int_eval:n { #2 + \l_@@_first_j_tl - 1 }
8938   }
8939 }
```

The command `\@@_node_left:nn` puts the left delimiter with the correct size. The argument #1 is the delimiter to put. The argument #2 is the name we will give to this PGF node (if the key name has been used in `\SubMatrix`).

```

8940 \cs_new_protected:Npn \@@_node_left:nn #1 #2
8941 {
8942   \pgfnode
8943     { rectangle }
8944     { east }
8945     {
8946       \nullfont
8947       \c_math_toggle_token
8948       \@@_color:o \l_@@_delimiters_color_tl
8949       \left #1
8950       \vcenter
8951         {
8952           \nullfont
8953           \hrule \@height \l_tmpa_dim
8954             \@depth \c_zero_dim
8955             \@width \c_zero_dim
8956         }
8957       \right .
8958       \c_math_toggle_token
8959     }
8960     { #2 }
8961     { }
8962 }

```

The command `\@@_node_right:nnnn` puts the right delimiter with the correct size. The argument #1 is the delimiter to put. The argument #2 is the name we will give to this PGF node (if the key name has been used in `\SubMatrix`). The argument #3 is the subscript and #4 is the superscript.

```

8963 \cs_new_protected:Npn \@@_node_right:nnnn #1 #2 #3 #4
8964 {
8965   \pgfnode
8966     { rectangle }
8967     { west }
8968     {
8969       \nullfont
8970       \c_math_toggle_token
8971       \colorlet { current-color } { . }
8972       \@@_color:o \l_@@_delimiters_color_tl
8973       \left .
8974       \vcenter
8975         {
8976           \nullfont
8977           \hrule \@height \l_tmpa_dim
8978             \@depth \c_zero_dim
8979             \@width \c_zero_dim
8980         }
8981       \right #1
8982       \tl_if_empty:nF { #3 } { _ { \smash { #3 } } }
8983       ^ { \color { current-color } \smash { #4 } }
8984       \c_math_toggle_token
8985     }
8986     { #2 }
8987     { }
8988 }

```

34 Les commandes `\UnderBrace` et `\OverBrace`

The following commands will be linked to `\UnderBrace` and `\OverBrace` in the `\CodeAfter`.

```

8989 \NewDocumentCommand \@@_UnderBrace { 0 { } m m m 0 { } }
8990 {
8991   \peek_remove_spaces:n
8992   { \@@_brace:nnnnn { #2 } { #3 } { #4 } { #1 , #5 } { under } }
8993 }

8994 \NewDocumentCommand \@@_OverBrace { 0 { } m m m 0 { } }
8995 {
8996   \peek_remove_spaces:n
8997   { \@@_brace:nnnnn { #2 } { #3 } { #4 } { #1 , #5 } { over } }
8998 }

8999 \keys_define:nn { nicematrix / Brace }
9000 {
9001   left-shorten .bool_set:N = \l_@@_brace_left_shorten_bool ,
9002   left-shorten .default:n = true ,
9003   left-shorten .value_forbidden:n = true ,
9004   right-shorten .bool_set:N = \l_@@_brace_right_shorten_bool ,
9005   right-shorten .default:n = true ,
9006   right-shorten .value_forbidden:n = true ,
9007   shorten .meta:n = { left-shorten , right-shorten } ,
9008   shorten .value_forbidden:n = true ,
9009   yshift .dim_set:N = \l_@@_brace_yshift_dim ,
9010   yshift .value_required:n = true ,
9011   yshift .initial:n = \c_zero_dim ,
9012   color .tl_set:N = \l_tmpa_tl ,
9013   color .value_required:n = true ,
9014   unknown .code:n = \@@_error:n { Unknown~key~for~Brace }
9015 }

```

#1 is the first cell of the rectangle (with the syntax $i-j$; **#2** is the last cell of the rectangle; **#3** is the label of the text; **#4** is the optional argument (a list of *key-value* pairs); **#5** is equal to `under` or `over`.

```

9016 \cs_new_protected:Npn \@@_brace:nnnnn #1 #2 #3 #4 #5
9017 {
9018   \group_begin:

```

The four following token lists correspond to the position of the sub-matrix to which a brace will be attached.

```

9019 \@@_compute_i_j:nn { #1 } { #2 }
9020 \bool_lazy_or:nnTF
9021   { \int_compare_p:nNn \l_@@_last_i_tl > \g_@@_row_total_int }
9022   { \int_compare_p:nNn \l_@@_last_j_tl > \g_@@_col_total_int }
9023   {
9024     \str_if_eq:eeTF { #5 } { under }
9025     { \@@_error:nn { Construct-too-large } { \UnderBrace } }
9026     { \@@_error:nn { Construct-too-large } { \OverBrace } }
9027   }
9028   {
9029     \tl_clear:N \l_tmpa_tl
9030     \keys_set:nn { nicematrix / Brace } { #4 }
9031     \tl_if_empty:NF \l_tmpa_tl { \color { \l_tmpa_tl } }
9032     \pgfpicture
9033     \pgfrememberpicturepositiononpagetrue
9034     \pgf@relevantforpicturesizefalse
9035     \bool_if:NT \l_@@_brace_left_shorten_bool
9036     {
9037       \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
9038       \int_step_inline:nnn \l_@@_first_i_tl \l_@@_last_i_tl
9039       {

```

```

9040     \cs_if_exist:cT
9041     { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_first_j_tl }
9042     {
9043         \pgfpointanchor { \@@_env: - ##1 - \l_@@_first_j_tl } { west }
9044
9045         \dim_compare:nNnT \pgf@x < \l_@@_x_initial_dim
9046         { \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x }
9047     }
9048 }
9049 }
9050 \bool_lazy_or:nnT
9051 { \bool_not_p:n \l_@@_brace_left_shorten_bool }
9052 { \dim_compare_p:nNn \l_@@_x_initial_dim = \c_max_dim }
9053 {
9054     \@@_qpoint:n { col - \l_@@_first_j_tl }
9055     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
9056 }
9057 \bool_if:NT \l_@@_brace_right_shorten_bool
9058 {
9059     \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }
9060     \int_step_inline:nnn \l_@@_first_i_tl \l_@@_last_i_tl
9061     {
9062         \cs_if_exist:cT
9063         { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_last_j_tl }
9064         {
9065             \pgfpointanchor { \@@_env: - ##1 - \l_@@_last_j_tl } { east }
9066             \dim_compare:nNnT \pgf@x > \l_@@_x_final_dim
9067             { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
9068         }
9069     }
9070 }
9071 \bool_lazy_or:nnT
9072 { \bool_not_p:n \l_@@_brace_right_shorten_bool }
9073 { \dim_compare_p:nNn \l_@@_x_final_dim = { - \c_max_dim } }
9074 {
9075     \@@_qpoint:n { col - \int_eval:n { \l_@@_last_j_tl + 1 } }
9076     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
9077 }
9078 \pgfset { inner~sep = \c_zero_dim }
9079 \str_if_eq:eeTF { #5 } { under }
9080 { \@@_underbrace_i:n { #3 } }
9081 { \@@_overbrace_i:n { #3 } }
9082 \endpgfpicture
9083 }
9084 \group_end:
9085 }

```

The argument is the text to put above the brace.

```

9086 \cs_new_protected:Npn \@@_overbrace_i:n #1
9087 {
9088     \@@_qpoint:n { row - \l_@@_first_i_tl }
9089     \pgftransformshift
9090     {
9091         \pgfpoint
9092         { ( \l_@@_x_initial_dim + \l_@@_x_final_dim ) / 2 }
9093         { \pgf@y + \l_@@_brace_yshift_dim - 3 pt }
9094     }
9095     \pgfnode
9096     { rectangle }
9097     { south }
9098     {
9099         \vtop
9100         {
9101             \group_begin:

```

```

9102     \everycr { }
9103     \halign
9104     {
9105         \hfil ## \hfil \crcr
9106         \bool_if:NTF \l_@@_tabular_bool
9107         { \begin { tabular } { c } #1 \end { tabular } }
9108         { $ \begin { array } { c } #1 \end { array } $ }
9109     \cr
9110     \c_math_toggle_token
9111     \overbrace
9112     {
9113         \hbox_to_wd:nn
9114         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
9115         { }
9116     }
9117     \c_math_toggle_token
9118     \cr
9119     }
9120     \group_end:
9121 }
9122 }
9123 { }
9124 { }
9125 }

```

The argument is the text to put under the brace.

```

9126 \cs_new_protected:Npn \@@_underbrace_i:n #1
9127 {
9128     \@@_qpoint:n { row - \int_eval:n { \l_@@_last_i_tl + 1 } }
9129     \pgftransformshift
9130     {
9131         \pgfpoint
9132         { ( \l_@@_x_initial_dim + \l_@@_x_final_dim ) / 2 }
9133         { \pgf@y - \l_@@_brace_yshift_dim + 3 pt }
9134     }
9135     \pgfnode
9136     { rectangle }
9137     { north }
9138     {
9139         \group_begin:
9140         \everycr { }
9141         \vbox
9142         {
9143             \halign
9144             {
9145                 \hfil ## \hfil \crcr
9146                 \c_math_toggle_token
9147                 \underbrace
9148                 {
9149                     \hbox_to_wd:nn
9150                     { \l_@@_x_final_dim - \l_@@_x_initial_dim }
9151                     { }
9152                 }
9153                 \c_math_toggle_token
9154                 \cr
9155                 \bool_if:NTF \l_@@_tabular_bool
9156                 { \begin { tabular } { c } #1 \end { tabular } }
9157                 { $ \begin { array } { c } #1 \end { array } $ }
9158                 \cr
9159             }
9160         }
9161         \group_end:
9162     }
9163 }

```

```

9164   { }
9165 }

```

35 The commands HBrace et VBrace

```

9166 \hook_gput_code:nnn { begindocument } { . }
9167 {
9168   \cs_if_exist:cT { tikz@library@decorations.pathreplacing@loaded }
9169   {
9170     \tikzset
9171     {
9172       nicematrix-normal-brace / .style =
9173       {
9174         decoration = brace ,
9175         decorate ,
9176         outer-sep = 0.25 em
9177       } ,
9178       nicematrix-mirrored-brace / .style =
9179       {
9180         decoration = { brace , mirror } ,
9181         decorate ,
9182         outer-sep = 0.25 em
9183       }
9184     }
9185   }
9186 }

```

The following set of keys will be used only for security since the keys will be sent to the command `\Ldots` or `\Vdots`.

```

9187 \keys_define:nn { nicematrix / Hbrace }
9188 {
9189   color .code:n = ,
9190   horizontal-labels .code:n = ,
9191   shorten .code:n = ,
9192   shorten-start .code:n = ,
9193   shorten-end .code:n = ,
9194   unknown .code:n = \@@_error:n { Unknown~key~for~Hbrace }
9195 }

```

Here we need an “fully expandable” command.

```

9196 \NewExpandableDocumentCommand { \@@_Hbrace } { 0 { } m m }
9197 {
9198   \cs_if_exist:cTF { tikz@library@decorations.pathreplacing@loaded }
9199   { \@@_hbrace:nnn { #1 } { #2 } { #3 } }
9200   { \@@_error:n { Hbrace~not~allowed } }
9201 }

```

The following command must *not* be protected.

```

9202 \cs_new:Npn \@@_hbrace:nnn #1 #2 #3
9203 {
9204   \int_compare:nNnTF \c@iRow < 1
9205   {

```

We recall that `\str_if_eq:nnTF` is “fully expandable”.

```

9206     \str_if_eq:nnTF { #2 } { * }
9207     {
9208       \NiceMatrixOptions{nullify-dots}

```

```

9209     \Ldots
9210     [
9211         line-style = nicematrix~normal~brace ,
9212         #1 ,
9213         up =
9214         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9215     ]
9216 }
9217 {
9218     \Hdotsfor
9219     [
9220         line-style = nicematrix~normal~brace ,
9221         #1 ,
9222         up =
9223         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9224     ]
9225     { #2 }
9226 }
9227 }
9228 {
9229     \str_if_eq:nnTF { #2 } { * }
9230     {
9231         \NiceMatrixOptions{nullify-dots}
9232         \Ldots
9233         [
9234             line-style = nicematrix~mirrored~brace ,
9235             #1 ,
9236             down =
9237             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9238         ]
9239     }
9240     {
9241         \Hdotsfor
9242         [
9243             line-style = nicematrix~mirrored~brace ,
9244             #1 ,
9245             down =
9246             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9247         ]
9248         { #2 }
9249     }
9250 }
9251 \keys_set:nn { nicematrix / Hbrace } { #1 }
9252 }

```

Here we need an “fully expandable” command.

```

9253 \NewExpandableDocumentCommand { \@@_Vbrace } { 0 { } m m }
9254 {
9255     \cs_if_exist:cTF { tikz@library@decorations.pathreplacing@loaded }
9256     { \@@_vbrace:nnn { #1 } { #2 } { #3 } }
9257     { \@@_error:n { Vbrace-not-allowed } }
9258 }

```

The following command must *not* be protected.

```

9259 \cs_new:Npn \@@_vbrace:nnn #1 #2 #3
9260 {
9261     \int_compare:nNnTF \c@jCol = 0
9262     {
9263         \str_if_eq:nnTF { #2 } { * }
9264         {
9265             \NiceMatrixOptions{nullify-dots}
9266             \Vdots
9267             [
9268                 line-style = nicematrix~mirrored~brace ,

```

```

9269         #1 ,
9270         down =
9271         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9272     ]
9273 }
9274 {
9275     \Vdotsfor
9276     [
9277         line-style = nicematrix~mirrored~brace ,
9278         #1 ,
9279         down =
9280         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9281     ]
9282     { #2 }
9283 }
9284 }
9285 {
9286     \str_if_eq:nnTF { #2 } { * }
9287     {
9288         \NiceMatrixOptions{nullify-dots}
9289         \Vdots
9290         [
9291             line-style = nicematrix~normal~brace ,
9292             #1 ,
9293             up =
9294             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9295         ]
9296     }
9297     {
9298         \Vdotsfor
9299         [
9300             line-style = nicematrix~normal~brace ,
9301             #1 ,
9302             up =
9303             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9304         ]
9305         { #2 }
9306     }
9307 }
9308 \keys_set:nn { nicematrix / Hbrace } { #1 }
9309 }

```

36 The command TikzEveryCell

```

9310 \bool_new:N \l_@@_not_empty_bool
9311 \bool_new:N \l_@@_empty_bool
9312
9313 \keys_define:nn { nicematrix / TikzEveryCell }
9314 {
9315     not-empty .code:n =
9316     \bool_lazy_or:nnTF
9317     \l_@@_in_code_after_bool
9318     \g_@@_recreate_cell_nodes_bool
9319     { \bool_set_true:N \l_@@_not_empty_bool }
9320     { \@@_error:n { detection~of~empty~cells } } } ,
9321 not-empty .value_forbidden:n = true ,
9322 empty .code:n =
9323 \bool_lazy_or:nnTF
9324 \l_@@_in_code_after_bool
9325 \g_@@_recreate_cell_nodes_bool
9326 { \bool_set_true:N \l_@@_empty_bool }
9327 { \@@_error:n { detection~of~empty~cells } } } ,

```

```

9328     empty .value_forbidden:n = true ,
9329     unknown .code:n = \@@_error:n { Unknown~key~for~TikzEveryCell }
9330 }
9331
9332
9333 \NewDocumentCommand { \@@_TikzEveryCell } { 0 { } m }
9334 {
9335     \IfPackageLoadedTF { tikz }
9336     {
9337         \group_begin:
9338         \keys_set:nn { nicematrix / TikzEveryCell } { #1 }

```

The inner pair of braces in the following line is mandatory because, the last argument of `\@@_tikz:nnnn` is a *list of lists* of TikZ keys.

```

9339     \tl_set:Nn \l_tmpa_tl { { #2 } }
9340     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
9341     { \@@_for_a_block:nnnn #1 }
9342     \@@_all_the_cells:
9343     \group_end:
9344 }
9345 { \@@_error:n { TikzEveryCell~without~tikz } }
9346 }
9347
9348 \tl_new:N \@@_i_tl
9349 \tl_new:N \@@_j_tl
9350
9351
9352 \cs_new_protected:Nn \@@_all_the_cells:
9353 {
9354     \int_step_variable:nNn \c@iRow \@@_i_tl
9355     {
9356         \int_step_variable:nNn \c@jCol \@@_j_tl
9357         {
9358             \cs_if_exist:cF { cell - \@@_i_tl - \@@_j_tl }
9359             {
9360                 \clist_if_in:Nef \l_@@_corners_cells_clist
9361                 { \@@_i_tl - \@@_j_tl }
9362                 {
9363                     \bool_set_false:N \l_tmpa_bool
9364                     \cs_if_exist:cTF
9365                     { pgf @ sh @ ns @ \@@_env: - \@@_i_tl - \@@_j_tl }
9366                     {
9367                         \bool_if:NF \l_@@_empty_bool
9368                         { \bool_set_true:N \l_tmpa_bool }
9369                     }
9370                     {
9371                         \bool_if:NF \l_@@_not_empty_bool
9372                         { \bool_set_true:N \l_tmpa_bool }
9373                     }
9374                     \bool_if:NT \l_tmpa_bool
9375                     {
9376                         \@@_block_tikz:nnnn
9377                         \l_tmpa_tl \@@_i_tl \@@_j_tl \@@_i_tl \@@_j_tl
9378                     }
9379                 }
9380             }
9381         }
9382     }
9383 }
9384
9385 \cs_new_protected:Nn \@@_for_a_block:nnnn
9386 {
9387     \bool_if:NF \l_@@_empty_bool
9388     {

```

```

9389     \@@_block_tikz:onn\nn
9390     \l_tmpa_tl { #1 } { #2 } { #3 } { #4 }
9391   }
9392   \@@_mark_cells_of_block:nnnn { #1 } { #2 } { #3 } { #4 }
9393 }
9394
9395 \cs_new_protected:Nn \@@_mark_cells_of_block:nnnn
9396 {
9397   \int_step_inline:nnn { #1 } { #3 }
9398   {
9399     \int_step_inline:nnn { #2 } { #4 }
9400     { \cs_set_nopar:cpn { cell - ##1 - #####1 } { } }
9401   }
9402 }

```

37 The command `\ShowCellNames`

```

9403 \NewDocumentCommand \@@_ShowCellNames { }
9404 {
9405   \bool_if:NT \l_@@_in_code_after_bool
9406   {
9407     \pgfpicture
9408     \pgfrememberpicturepositiononpagetrue
9409     \pgf@relevantforpicturesizefalse
9410     \pgfpathrectanglecorners
9411     { \@@_qpoint:n { 1 } }
9412     {
9413       \@@_qpoint:n
9414       { \int_eval:n { \int_max:nn \c@iRow \c@jCol + 1 } }
9415     }
9416     \pgfsetfillopacity { 0.75 }
9417     \pgfsetfillcolor { white }
9418     \pgfusepathqfill
9419     \endpgfpicture
9420   }
9421   \dim_gzero_new:N \g_@@_tmpc_dim
9422   \dim_gzero_new:N \g_@@_tmpd_dim
9423   \dim_gzero_new:N \g_@@_tmpe_dim
9424   \int_step_inline:nn \c@iRow
9425   {
9426     \bool_if:NTF \l_@@_in_code_after_bool
9427     {
9428       \pgfpicture
9429       \pgfrememberpicturepositiononpagetrue
9430       \pgf@relevantforpicturesizefalse
9431     }
9432     { \begin { pgfpicture } }
9433     \@@_qpoint:n { row - ##1 }
9434     \dim_set_eq:NN \l_tmpa_dim \pgf@y
9435     \@@_qpoint:n { row - \int_eval:n { ##1 + 1 } }
9436     \dim_gset:Nn \g_tmpa_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
9437     \dim_gset:Nn \g_tmpb_dim { \l_tmpa_dim - \pgf@y }
9438     \bool_if:NTF \l_@@_in_code_after_bool
9439     { \endpgfpicture }
9440     { \end { pgfpicture } }
9441     \int_step_inline:nn \c@jCol
9442     {
9443       \hbox_set:Nn \l_tmpa_box
9444       {
9445         \normalfont \Large \sffamily \bfseries
9446         \bool_if:NTF \l_@@_in_code_after_bool
9447         { \color { red } }

```

```

9448         { \color { red ! 50 } }
9449         ##1 - ####1
9450     }
9451     \bool_if:NTF \l_@@_in_code_after_bool
9452     {
9453         \pgfpicture
9454         \pgfrememberpicturepositiononpagetrue
9455         \pgf@relevantforpicturesizefalse
9456     }
9457     { \begin { pgfpicture } }
9458     \@@_qpoint:n { col - ####1 }
9459     \dim_gset_eq:NN \g_@@_tmpc_dim \pgf@x
9460     \@@_qpoint:n { col - \int_eval:n { ####1 + 1 } }
9461     \dim_gset:Nn \g_@@_tmpd_dim { \pgf@x - \g_@@_tmpc_dim }
9462     \dim_gset_eq:NN \g_@@_tmpe_dim \pgf@x
9463     \bool_if:NTF \l_@@_in_code_after_bool
9464     { \endpgfpicture }
9465     { \end { pgfpicture } }
9466     \fp_set:Nn \l_tmpa_fp
9467     {
9468         \fp_min:nn
9469         {
9470             \fp_min:nn
9471             { \dim_ratio:nn \g_@@_tmpd_dim { \box_wd:N \l_tmpa_box } }
9472             { \dim_ratio:nn \g_tmpb_dim { \box_ht_plus_dp:N \l_tmpa_box } }
9473         }
9474         { 1.0 }
9475     }
9476     \box_scale:Nnn \l_tmpa_box { \fp_use:N \l_tmpa_fp } { \fp_use:N \l_tmpa_fp }
9477     \pgfpicture
9478     \pgfrememberpicturepositiononpagetrue
9479     \pgf@relevantforpicturesizefalse
9480     \pgftransformshift
9481     {
9482         \pgfpoint
9483         { 0.5 * ( \g_@@_tmpc_dim + \g_@@_tmpe_dim ) }
9484         { \dim_use:N \g_tmpa_dim }
9485     }
9486     \pgfnode
9487     { rectangle }
9488     { center }
9489     { \box_use:N \l_tmpa_box }
9490     { }
9491     { }
9492     \endpgfpicture
9493 }
9494 }
9495 }

```

38 We process the options at package loading

We process the options when the package is loaded (with `\usepackage`) but we recommend to use `\NiceMatrixOptions` instead.

We must process these options after the definition of the environment `{NiceMatrix}` because the option `renew-matrix` executes the code `\cs_set_eq:NN \env@matrix \NiceMatrix`.

Of course, the command `\NiceMatrix` must be defined before such an instruction is executed.

The boolean `\g_@@_footnotehyper_bool` will indicate if the option `footnotehyper` is used.

```
9496 \bool_new:N \g_@@_footnotehyper_bool
```

The boolean `\g_@@_footnote_bool` will indicate if the option `footnote` is used, but quicky, it will also be set to `true` if the option `footnotehyper` is used.

```

9497 \bool_new:N \g_@@_footnote_bool
9498 \msg_new:nnnn { nicematrix } { Unknown~key~for~package }
9499 {
9500   The~key~'\l_keys_key_str'~is~unknown. \\
9501   That~key~will~be~ignored. \\
9502   For~a~list~of~the~available~keys,~type~H~<return>.
9503 }
9504 {
9505   The~available~keys~are~(in~alphabetic~order):~
9506   footnote,~
9507   footnotehyper,~
9508   messages-for-Overleaf,~
9509   renew-dots,~and~
9510   renew-matrix.
9511 }
9512 \keys_define:nn { nicematrix / Package }
9513 {
9514   renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
9515   renew-dots .value_forbidden:n = true ,
9516   renew-matrix .code:n = \@@_renew_matrix: ,
9517   renew-matrix .value_forbidden:n = true ,
9518   messages-for-Overleaf .bool_set:N = \g_@@_messages_for_Overleaf_bool ,
9519   footnote .bool_set:N = \g_@@_footnote_bool ,
9520   footnotehyper .bool_set:N = \g_@@_footnotehyper_bool ,
9521   unknown .code:n = \@@_error:n { Unknown~key~for~package }
9522 }
9523 \ProcessKeysOptions { nicematrix / Package }

9524 \@@_msg_new:nn { footnote-with-footnotehyper~package }
9525 {
9526   You~can't~use~the~option~'footnote'~because~the~package~
9527   footnotehyper~has~already~been~loaded.~
9528   If~you~want,~you~can~use~the~option~'footnotehyper'~and~the~footnotes~
9529   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
9530   of~the~package~footnotehyper.\\
9531   The~package~footnote~won't~be~loaded.
9532 }
9533 \@@_msg_new:nn { footnotehyper-with-footnote~package }
9534 {
9535   You~can't~use~the~option~'footnotehyper'~because~the~package~
9536   footnote~has~already~been~loaded.~
9537   If~you~want,~you~can~use~the~option~'footnote'~and~the~footnotes~
9538   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~
9539   of~the~package~footnote.\\
9540   The~package~footnotehyper~won't~be~loaded.
9541 }

9542 \bool_if:NT \g_@@_footnote_bool
9543 {

```

The class beamer has its own system to extract footnotes and that's why we have nothing to do if beamer is used.

```

9544 \IfClassLoadedTF { beamer }
9545 { \bool_set_false:N \g_@@_footnote_bool }
9546 {
9547   \IfPackageLoadedTF { footnotehyper }
9548   { \@@_error:n { footnote-with-footnotehyper~package } }
9549   { \usepackage { footnote } }
9550 }
9551 }

```

```

9552 \bool_if:NT \g_@@_footnotehyper_bool
9553 {

```

The class beamer has its own system to extract footnotes and that's why we have nothing to do if beamer is used.

```

9554 \IfClassLoadedTF { beamer }
9555 { \bool_set_false:N \g_@@_footnote_bool }
9556 {
9557   \IfPackageLoadedTF { footnote }
9558   { \@@_error:n { footnotehyper~with~footnote~package } }
9559   { \usepackage { footnotehyper } }
9560 }
9561 \bool_set_true:N \g_@@_footnote_bool
9562 }

```

The flag `\g_@@_footnote_bool` is raised and so, we will only have to test `\g_@@_footnote_bool` in order to know if we have to insert an environment `{savenotes}`.

39 About the package underscore

If the user loads the package underscore, it must be loaded *before* the package nicematrix. If it is loaded after, we raise an error.

```

9563 \bool_new:N \l_@@_underscore_loaded_bool
9564 \IfPackageLoadedT { underscore }
9565 { \bool_set_true:N \l_@@_underscore_loaded_bool }
9566 \hook_gput_code:nnn { begindocument } { . }
9567 {
9568   \bool_if:NF \l_@@_underscore_loaded_bool
9569   {
9570     \IfPackageLoadedT { underscore }
9571     { \@@_error:n { underscore~after~nicematrix } }
9572   }
9573 }

```

40 Error messages of the package

```

9574 \bool_if:NTF \g_@@_messages_for_Overleaf_bool
9575 { \str_const:Nn \c_@@_available_keys_str { } }
9576 {
9577   \str_const:Nn \c_@@_available_keys_str
9578   { For~a~list~of~the~available~keys,~type~H~<return>. }
9579 }
9580 \seq_new:N \g_@@_types_of_matrix_seq
9581 \seq_gset_from_clist:Nn \g_@@_types_of_matrix_seq
9582 {
9583   NiceMatrix ,
9584   pNiceMatrix , bNiceMatrix , vNiceMatrix, BNiceMatrix, VNiceMatrix
9585 }
9586 \seq_gset_map_e:NNn \g_@@_types_of_matrix_seq \g_@@_types_of_matrix_seq
9587 { \tl_to_str:n { #1 } }

```

If the user uses too much columns, the command `\@@_error_too_much_cols:` is triggered. This command raises an error but also tries to give the best information to the user in the error message.

The command `\seq_if_in:NoF` is not expandable and that's why we can't put it in the error message itself. We have to do the test before the `\@@_fatal:n`.

```

9588 \cs_new_protected:Npn \@@_error_too_much_cols:
9589 {
9590   \seq_if_in:NoF \g_@@_types_of_matrix_seq \g_@@_name_env_str
9591     { \@@_fatal:nn { too-much-cols-for-array } }
9592   \int_compare:nNnT \l_@@_last_col_int = { -2 }
9593     { \@@_fatal:n { too-much-cols-for-matrix } }
9594   \int_compare:nNnT \l_@@_last_col_int = { -1 }
9595     { \@@_fatal:n { too-much~cols~for~matrix } }
9596   \bool_if:NF \l_@@_last_col_without_value_bool
9597     { \@@_fatal:n { too-much~cols~for~matrix~with~last~col } }
9598 }

```

The following command must *not* be protected since it's used in an error message.

```

9599 \cs_new:Npn \@@_message_hdotsfor:
9600 {
9601   \tl_if_empty:oF \g_@@_HVdotsfor_lines_tl
9602     { ~Maybe~your~use~of~\token_to_str:N \Hdotsfor\ is~incorrect.}
9603 }
9604 \@@_msg_new:nn { hvlines,~rounded-corners~and~corners }
9605 {
9606   Incompatible~options.\\
9607   You~should~not~use~'hvlines',~'rounded-corners'~and~'corners'~at~this~time.\\
9608   The~output~will~not~be~reliable.
9609 }
9610 \@@_msg_new:nn { key~color~inside }
9611 {
9612   Key~deprecated.\\
9613   The~key~'color~inside'~(and~its~alias~'colortbl~like')~is~now~point~less~
9614   and~have~been~deprecated.\\
9615   You~won't~have~similar~message~till~the~end~of~the~document.
9616 }
9617 \@@_msg_new:nn { negative~weight }
9618 {
9619   Negative~weight.\\
9620   The~weight~of~the~'X'~columns~must~be~positive~and~you~have~used~
9621   the~value~'\int_use:N \l_@@_weight_int'.\\
9622   The~absolute~value~will~be~used.
9623 }
9624 \@@_msg_new:nn { last~col~not~used }
9625 {
9626   Column~not~used.\\
9627   The~key~'last~col'~is~in~force~but~you~have~not~used~that~last~column~
9628   in~your~\@@_full_name_env:..~However,~you~can~go~on.
9629 }
9630 \@@_msg_new:nn { too~much~cols~for~matrix~with~last~col }
9631 {
9632   Too~much~columns.\\
9633   In~the~row~\int_eval:n { \c@iRow },~
9634   you~try~to~use~more~columns~
9635   than~allowed~by~your~\@@_full_name_env:.\@@_message_hdotsfor:\
9636   The~maximal~number~of~columns~is~\int_eval:n { \l_@@_last_col_int - 1 }~
9637   (plus~the~exterior~columns).~This~error~is~fatal.
9638 }
9639 \@@_msg_new:nn { too~much~cols~for~matrix }
9640 {
9641   Too~much~columns.\\
9642   In~the~row~\int_eval:n { \c@iRow },~
9643   you~try~to~use~more~columns~than~allowed~by~your~
9644   \@@_full_name_env:.\@@_message_hdotsfor:\ Recall~that~the~maximal~
9645   number~of~columns~for~a~matrix~(excepted~the~potential~exterior~

```

```

9646     columns)-is-fixed-by-the-LaTeX-counter-'MaxMatrixCols'.~
9647     Its-current-value-is-\int_use:N \c@MaxMatrixCols\ (use~
9648     \token_to_str:N \setcounter\ to-change-that-value).~
9649     This-error-is-fatal.
9650 }

9651 \@@_msg_new:nn { too-much-cols-for-array }
9652 {
9653   Too-much-columns.\\
9654   In-the-row~\int_eval:n { \c@iRow },~
9655   ~you-try-to-use-more-columns-than-allowed-by-your~
9656   \@@_full_name_env:.\@@_message_hdotsfor:\ The-maximal-number-of-columns-is~
9657   \int_use:N \g_@@_static_num_of_col_int
9658   \bool_if:nT
9659     { \int_compare_p:nNn \l_@@_first_col_int = 0 || \g_@@_last_col_found_bool }
9660     { ~(plus-the-exterior-ones) }.~
9661   This-error-is-fatal.
9662 }

9663 \@@_msg_new:nn { columns-not-used }
9664 {
9665   Columns-not-used.\\
9666   The-preamble-of-your~\@@_full_name_env:\ announces~\int_use:N
9667   \g_@@_static_num_of_col_int\ columns-but-you-use-only~\int_use:N \c@jCol.\\
9668   The-columns-you-did-not-used-won't-be-created.\\
9669   You-won't-have-similar-error-message-till-the-end-of-the-document.
9670 }

9671 \@@_msg_new:nn { empty-preamble }
9672 {
9673   Empty-preamble.\\
9674   The-preamble-of-your~\@@_full_name_env:\ is-empty.\\
9675   This-error-is-fatal.
9676 }

9677 \@@_msg_new:nn { in-first-col }
9678 {
9679   Erroneous-use.\\
9680   You-can't-use-the-command~#1 in-the-first-column-(number~0)-of-the-array.\\
9681   That-command-will-be-ignored.
9682 }

9683 \@@_msg_new:nn { in-last-col }
9684 {
9685   Erroneous-use.\\
9686   You-can't-use-the-command~#1 in-the-last-column-(exterior)-of-the-array.\\
9687   That-command-will-be-ignored.
9688 }

9689 \@@_msg_new:nn { in-first-row }
9690 {
9691   Erroneous-use.\\
9692   You-can't-use-the-command~#1 in-the-first-row-(number~0)-of-the-array.\\
9693   That-command-will-be-ignored.
9694 }

9695 \@@_msg_new:nn { in-last-row }
9696 {
9697   Erroneous-use.\\
9698   You-can't-use-the-command~#1 in-the-last-row-(exterior)-of-the-array.\\
9699   That-command-will-be-ignored.
9700 }

9701 \@@_msg_new:nn { TopRule-without-booktabs }
9702 {
9703   Erroneous-use.\\
9704   You-can't-use-the-command~ #1 because-'booktabs'~is-not-loaded.\\
9705   That-command-will-be-ignored.

```

```

9706 }
9707 \@@_msg_new:nn { TopRule~without~tikz }
9708 {
9709   Erroneous~use.\\
9710   You~can't~use~the~command~ #1 because~'tikz'~is~not~loaded.\\
9711   That~command~will~be~ignored.
9712 }
9713 \@@_msg_new:nn { caption~outside~float }
9714 {
9715   Key~caption~forbidden.\\
9716   You~can't~use~the~key~'caption'~because~you~are~not~in~a~floating~
9717   environment.~This~key~will~be~ignored.
9718 }
9719 \@@_msg_new:nn { short~caption~without~caption }
9720 {
9721   You~should~not~use~the~key~'short~caption'~without~'caption'.~
9722   However,~your~'short~caption'~will~be~used~as~'caption'.
9723 }
9724 \@@_msg_new:nn { double~closing~delimiter }
9725 {
9726   Double~delimiter.\\
9727   You~can't~put~a~second~closing~delimiter~"#1"~just~after~a~first~closing~
9728   delimiter.~This~delimiter~will~be~ignored.
9729 }
9730 \@@_msg_new:nn { delimiter~after~opening }
9731 {
9732   Double~delimiter.\\
9733   You~can't~put~a~second~delimiter~"#1"~just~after~a~first~opening~
9734   delimiter.~That~delimiter~will~be~ignored.
9735 }
9736 \@@_msg_new:nn { bad~option~for~line~style }
9737 {
9738   Bad~line~style.\\
9739   Since~you~haven't~loaded~Tikz,~the~only~value~you~can~give~to~'line~style'~
9740   is~'standard'.~That~key~will~be~ignored.
9741 }
9742 \@@_msg_new:nn { corners~with~no~cell~nodes }
9743 {
9744   Incompatible~keys.\\
9745   You~can't~use~the~key~'corners'~here~because~the~key~'no~cell~nodes'~
9746   is~in~force.\\
9747   If~you~go~on,~that~key~will~be~ignored.
9748 }
9749 \@@_msg_new:nn { extra~nodes~with~no~cell~nodes }
9750 {
9751   Incompatible~keys.\\
9752   You~can't~create~'extra~nodes'~here~because~the~key~'no~cell~nodes'~
9753   is~in~force.\\
9754   If~you~go~on,~those~extra~nodes~won't~be~created.
9755 }
9756 \@@_msg_new:nn { Identical~notes~in~caption }
9757 {
9758   Identical~tabular~notes.\\
9759   You~can't~put~several~notes~with~the~same~content~in~
9760   \token_to_str:N \caption\ (but~you~can~in~the~main~tabular).\\
9761   If~you~go~on,~the~output~will~probably~be~erroneous.
9762 }
9763 \@@_msg_new:nn { tabularnote~below~the~tabular }
9764 {

```

```

9765 \token_to_str:N \tabularnote\ forbidden\\
9766 You-can't-use-\token_to_str:N \tabularnote\ in-the-caption~
9767 of~your~tabular~because~the~caption~will~be~composed~below~
9768 the~tabular.~If~you~want~the~caption~above~the~tabular~use~the~
9769 key~'caption-above'~in~\token_to_str:N \NiceMatrixOptions.\\
9770 Your~\token_to_str:N \tabularnote\ will~be~discarded~and~
9771 no~similar~error~will~raised~in~this~document.
9772 }

9773 \@@_msg_new:nn { Unknown-key~for~rules }
9774 {
9775   Unknown~key.\\
9776   There~is~only~two~keys~available~here:~width~and~color.\\
9777   Your~key~'\l_keys_key_str'~will~be~ignored.
9778 }

9779 \@@_msg_new:nn { Unknown-key~for~Hbrace }
9780 {
9781   Unknown~key.\\
9782   You~have~used~the~key~'\l_keys_key_str'~but~the~only~
9783 keys~allowed~for~the~commands~\token_to_str:N \Hbrace\
9784 and~\token_to_str:N \Vbrace\ are:~'color',~
9785 'horizontal-labels',~'shorten'~'shorten-end'~
9786 and~'shorten-start'.
9787 }

9788 \@@_msg_new:nn { Unknown-key~for~TikzEveryCell }
9789 {
9790   Unknown~key.\\
9791   There~is~only~two~keys~available~here:~
9792 'empty'~and~'not-empty'.\\
9793   Your~key~'\l_keys_key_str'~will~be~ignored.
9794 }

9795 \@@_msg_new:nn { Unknown-key~for~rotate }
9796 {
9797   Unknown~key.\\
9798   The~only~key~available~here~is~'c'.\\
9799   Your~key~'\l_keys_key_str'~will~be~ignored.
9800 }

9801 \@@_msg_new:nnn { Unknown-key~for~custom-line }
9802 {
9803   Unknown~key.\\
9804   The~key~'\l_keys_key_str'~is~unknown~in~a~'custom-line'.~
9805   It~you~go~on,~you~will~probably~have~other~errors. \\
9806   \c_@@_available_keys_str
9807 }
9808 {
9809   The~available~keys~are~(in~alphabetic~order):~
9810   ccommand,~
9811   color,~
9812   command,~
9813   dotted,~
9814   letter,~
9815   multiplicity,~
9816   sep-color,~
9817   tikz,~and~total-width.
9818 }

9819 \@@_msg_new:nnn { Unknown~key~for~xdots }
9820 {
9821   Unknown~key.\\
9822   The~key~'\l_keys_key_str'~is~unknown~for~a~command~for~drawing~dotted~rules.\\
9823   \c_@@_available_keys_str
9824 }
9825 {

```

```

9826 The~available~keys~are~(in~alphabetic~order):~
9827 'color',~
9828 'horizontal~labels',~
9829 'inter',~
9830 'line~style',~
9831 'radius',~
9832 'shorten',~
9833 'shorten~end'~and~'shorten~start'.
9834 }
9835 \@@_msg_new:nn { Unknown~key~for~rowcolors }
9836 {
9837   Unknown~key.\\
9838   As~for~now,~there~is~only~two~keys~available~here:~'cols'~and~'respect~blocks'~
9839   (and~you~try~to~use~'\l_keys_key_str')\\
9840   That~key~will~be~ignored.
9841 }
9842 \@@_msg_new:nn { label~without~caption }
9843 {
9844   You~can't~use~the~key~'label'~in~your~'{NiceTabular}'~because~
9845   you~have~not~used~the~key~'caption'.~The~key~'label'~will~be~ignored.
9846 }
9847 \@@_msg_new:nn { W~warning }
9848 {
9849   Line~\msg_line_number:~The~cell~is~too~wide~for~your~column~'W'~
9850   (row~\int_use:N \c@iRow).
9851 }
9852 \@@_msg_new:nn { Construct~too~large }
9853 {
9854   Construct~too~large.\\
9855   Your~command~\token_to_str:N #1
9856   can't~be~drawn~because~your~matrix~is~too~small.\\
9857   That~command~will~be~ignored.
9858 }
9859 \@@_msg_new:nn { underscore~after~nicematrix }
9860 {
9861   Problem~with~'underscore'.\\
9862   The~package~'underscore'~should~be~loaded~before~'nicematrix'.~
9863   You~can~go~on~but~you~won't~be~able~to~write~something~such~as:\\
9864   '\token_to_str:N \Cdots\token_to_str:N _{n~\token_to_str:N \text{~times}}'.
9865 }
9866 \@@_msg_new:nn { ampersand~in~light~syntax }
9867 {
9868   Ampersand~forbidden.\\
9869   You~can't~use~an~ampersand~(\token_to_str:N &)~to~separate~columns~because~
9870   ~the~key~'light~syntax'~is~in~force.~This~error~is~fatal.
9871 }
9872 \@@_msg_new:nn { double~backslash~in~light~syntax }
9873 {
9874   Double~backslash~forbidden.\\
9875   You~can't~use~\token_to_str:N
9876   \\~to~separate~rows~because~the~key~'light~syntax'~
9877   is~in~force.~You~must~use~the~character~'\l_@@_end_of_row_tl'~
9878   (set~by~the~key~'end~of~row').~This~error~is~fatal.
9879 }
9880 \@@_msg_new:nn { hlines~with~color }
9881 {
9882   Incompatible~keys.\\
9883   You~can't~use~the~keys~'hlines',~'vlines'~or~'hvlines'~for~a~
9884   '\token_to_str:N \Block'~when~the~key~'color'~or~'draw'~is~used.\\
9885   However,~you~can~put~several~commands~\token_to_str:N \Block.\\

```

```

9886     Your-key-will-be-discarded.
9887   }
9888 \@@_msg_new:nn { bad-value-for-baseline }
9889   {
9890     Bad-value-for-baseline.\
9891     The-value-given-to-'baseline'~(\int_use:N \l_tmpa_int)~is-not~
9892     valid.~The-value-must-be-between~\int_use:N \l_@@_first_row_int\ and~
9893     \int_use:N \g_@@_row_total_int\ or~equal~to~'t',~'c'~or~'b'~or~of~
9894     the-form-'line-i'.\
9895     A-value-of~1~will-be-used.
9896   }
9897 \@@_msg_new:nn { detection-of-empty-cells }
9898   {
9899     Problem-with-'not-empty'\
9900     For-technical-reasons,~you-must-activate~
9901     'create-cell-nodes'~in~\token_to_str:N \CodeBefore\
9902     in-order-to-use-the-key~'\l_keys_key_str'.\
9903     That-key-will-be-ignored.
9904   }
9905 \@@_msg_new:nn { siunitx-not-loaded }
9906   {
9907     siunitx-not-loaded\
9908     You-can't-use-the-columns-'S'~because-'siunitx'~is-not-loaded.\
9909     That-error-is-fatal.
9910   }
9911 \@@_msg_new:nn { Invalid-name }
9912   {
9913     Invalid-name.\
9914     You-can't-give-the-name~'\l_keys_value_tl'~to~a~\token_to_str:N
9915     \SubMatrix\ of~your~\@@_full_name_env:.\
9916     A-name-must-be-accepted-by-the-regular-expression~[A-Za-z][A-Za-z0-9]*.\
9917     This-key-will-be-ignored.
9918   }
9919 \@@_msg_new:nn { Hbrace-not-allowed }
9920   {
9921     Command-not-allowed.\
9922     You-can't-use-the-command~\token_to_str:N \Hbrace\
9923     because-you-have-not-loaded-TikZ~
9924     and-the-TikZ-library~'decorations.pathreplacing'.\
9925     Use:~\token_to_str:N \usepackage\{tikz}\~
9926     \token_to_str:N \usetikzlibrary \{ decorations.pathreplacing \} \
9927     That-command-will-be-ignored.
9928   }
9929 \@@_msg_new:nn { Vbrace-not-allowed }
9930   {
9931     Command-not-allowed.\
9932     You-can't-use-the-command~\token_to_str:N \Vbrace\
9933     because-you-have-not-loaded-TikZ~
9934     and-the-TikZ-library~'decorations.pathreplacing'.\
9935     Use:~\token_to_str:N \usepackage\{tikz}\~
9936     \token_to_str:N \usetikzlibrary \{ decorations.pathreplacing \} \
9937     That-command-will-be-ignored.
9938   }
9939 \@@_msg_new:nn { Wrong-line-in-SubMatrix }
9940   {
9941     Wrong-line.\
9942     You-try-to-draw-a-#1~line-of-number~'#2'~in-a~
9943     \token_to_str:N \SubMatrix\ of~your~\@@_full_name_env:\ but~that~
9944     number~is~not~valid.~It~will~be~ignored.
9945   }

```

```

9946 \@@_msg_new:nn { Impossible-delimiter }
9947 {
9948   Impossible~delimiter.\\
9949   It's~impossible~to~draw~the~#1~delimiter~of~your~
9950   \token_to_str:N \SubMatrix\ because~all~the~cells~are~empty~
9951   in~that~column.
9952   \bool_if:NT \l_@@_submatrix_slim_bool
9953   { ~Maybe~you~should~try~without~the~key~'slim'. } \\
9954   This~\token_to_str:N \SubMatrix\ will~be~ignored.
9955 }

9956 \@@_msg_new:nnn { width-without-X-columns }
9957 {
9958   You~have~used~the~key~'width'~but~you~have~put~no~'X'~column.~
9959   That~key~will~be~ignored.
9960 }
9961 {
9962   This~message~is~the~message~'width~without~X~columns'~
9963   of~the~module~'nicematrix'.~
9964   The~experimented~users~can~disable~that~message~with~
9965   \token_to_str:N \msg_redirect_name:nnn.\\
9966 }
9967

9968 \@@_msg_new:nn { key-multiplicity-with-dotted }
9969 {
9970   Incompatible~keys. \\
9971   You~have~used~the~key~'multiplicity'~with~the~key~'dotted'~
9972   in~a~'custom-line'.~They~are~incompatible. \\
9973   The~key~'multiplicity'~will~be~discarded.
9974 }

9975 \@@_msg_new:nn { empty-environment }
9976 {
9977   Empty~environment.\\
9978   Your~\@@_full_name_env:\ is~empty.~This~error~is~fatal.
9979 }

9980 \@@_msg_new:nn { No-letter-and-no-command }
9981 {
9982   Erroneous~use.\\
9983   Your~use~of~'custom-line'~is~no~op~since~you~don't~have~used~the~
9984   key~'letter'~(for~a~letter~for~vertical~rules)~nor~the~keys~'command'~or~
9985   '~command'~(to~draw~horizontal~rules).\\
9986   However,~you~can~go~on.
9987 }

9988 \@@_msg_new:nn { Forbidden-letter }
9989 {
9990   Forbidden~letter.\\
9991   You~can't~use~the~letter~'#1'~for~a~customized~line.\\
9992   It~will~be~ignored.
9993 }

9994 \@@_msg_new:nn { Several-letters }
9995 {
9996   Wrong~name.\\
9997   You~must~use~only~one~letter~as~value~for~the~key~'letter'~(and~you~
9998   have~used~'\l_@@_letter_str').\\
9999   It~will~be~ignored.
10000 }

10001 \@@_msg_new:nn { Delimiter-with-small }
10002 {
10003   Delimiter~forbidden.\\
10004   You~can't~put~a~delimiter~in~the~preamble~of~your~\@@_full_name_env:\
10005   because~the~key~'small'~is~in~force.\\
10006   This~error~is~fatal.

```

```

10007 }
10008 \@@_msg_new:nn { unknown~cell~for~line~in~CodeAfter }
10009 {
10010   Unknown~cell.\\
10011   Your~command~\token_to_str:N\line\{#1\}\{#2\}~in~
10012   the~\token_to_str:N \CodeAfter\ of~your~\@@_full_name_env:\
10013   can't~be~executed~because~a~cell~doesn't~exist.\\
10014   This~command~\token_to_str:N \line\ will~be~ignored.
10015 }
10016 \@@_msg_new:nnn { Duplicate~name~for~SubMatrix }
10017 {
10018   Duplicate~name.\\
10019   The~name~'#1'~is~already~used~for~a~\token_to_str:N \SubMatrix\
10020   in~this~\@@_full_name_env:.\\
10021   This~key~will~be~ignored.\\
10022   \bool_if:NF \g_@@_messages_for_Overleaf_bool
10023   { For~a~list~of~the~names~already~used,~type-H~<return>. }
10024 }
10025 {
10026   The~names~already~defined~in~this~\@@_full_name_env:\ are:~
10027   \seq_use:Nnnn \g_@@_submatrix_names_seq { ~and~ } { ,~ } { ~and~ }.
10028 }
10029 \@@_msg_new:nn { r~or~l~with~preamble }
10030 {
10031   Erroneous~use.\\
10032   You~can't~use~the~key~'\l_keys_key_str'~in~your~\@@_full_name_env:~.~
10033   You~must~specify~the~alignment~of~your~columns~with~the~preamble~of~
10034   your~\@@_full_name_env:.\\
10035   This~key~will~be~ignored.
10036 }
10037 \@@_msg_new:nn { Hdotsfor~in~col~0 }
10038 {
10039   Erroneous~use.\\
10040   You~can't~use~\token_to_str:N \Hdotsfor\ in~an~exterior~column~of~
10041   the~array.~This~error~is~fatal.
10042 }
10043 \@@_msg_new:nn { bad~corner }
10044 {
10045   Bad~corner.\\
10046   #1~is~an~incorrect~specification~for~a~corner~(in~the~key~
10047   'corners').~The~available~values~are:~NW,~SW,~NE~and~SE.\\
10048   This~specification~of~corner~will~be~ignored.
10049 }
10050 \@@_msg_new:nn { bad~border }
10051 {
10052   Bad~border.\\
10053   \l_keys_key_str\space~is~an~incorrect~specification~for~a~border~
10054   (in~the~key~'borders'~of~the~command~\token_to_str:N \Block).~
10055   The~available~values~are:~left,~right,~top~and~bottom~(and~you~can~
10056   also~use~the~key~'tikz'
10057   \IfPackageLoadedF { tikz }
10058   {~if~you~load~the~LaTeX~package~'tikz'}).\\
10059   This~specification~of~border~will~be~ignored.
10060 }
10061 \@@_msg_new:nn { TikzEveryCell~without~tikz }
10062 {
10063   TikZ~not~loaded.\\
10064   You~can't~use~\token_to_str:N \TikzEveryCell\
10065   because~you~have~not~loaded~tikz.~
10066   This~command~will~be~ignored.
10067 }

```

```

10068 \@@_msg_new:nn { tikz-key-without-tikz }
10069 {
10070   TikZ-not-loaded.\\
10071   You-can't-use-the-key~'tikz'~for-the-command~'\token_to_str:N
10072   \Block'~because~you-have~not~loaded~tikz.~
10073   This-key-will-be-ignored.
10074 }
10075 \@@_msg_new:nn { last-col-non-empty-for-NiceArray }
10076 {
10077   Erroneous-use.\\
10078   In-the~\@@_full_name_env:,~you-must-use-the-key~
10079   'last-col'~without-value.\\
10080   However,~you-can-go-on-for-this-time~
10081   (the-value~'\l_keys_value_tl'~will-be-ignored).
10082 }
10083 \@@_msg_new:nn { last-col-non-empty-for-NiceMatrixOptions }
10084 {
10085   Erroneous-use.\\
10086   In~\token_to_str:N \NiceMatrixOptions,~you-must-use-the-key~
10087   'last-col'~without-value.\\
10088   However,~you-can-go-on-for-this-time~
10089   (the-value~'\l_keys_value_tl'~will-be-ignored).
10090 }
10091 \@@_msg_new:nn { Block-too-large-1 }
10092 {
10093   Block-too-large.\\
10094   You-try-to-draw-a-block-in-the-cell~#1-#2-of-your-matrix-but-the-matrix-is~
10095   too-small-for-that-block. \\
10096   This-block-and-maybe-others-will-be-ignored.
10097 }
10098 \@@_msg_new:nn { Block-too-large-2 }
10099 {
10100   Block-too-large.\\
10101   The-preamble-of~your~\@@_full_name_env:\ announces~\int_use:N
10102   \g_@@_static_num_of_col_int\
10103   columns-but-you-use-only~\int_use:N \c@jCol\ and-that's-why-a-block~
10104   specified-in-the-cell~#1-#2-can't-be-drawn.~You-should-add-some-ampersands~
10105   (&)~at-the-end-of-the-first-row-of~your~\@@_full_name_env:.\\
10106   This-block-and-maybe-others-will-be-ignored.
10107 }
10108 \@@_msg_new:nn { unknown-column-type }
10109 {
10110   Bad-column-type.\\
10111   The-column-type~'#1'~in-your~\@@_full_name_env:\
10112   is-unknown. \\
10113   This-error-is-fatal.
10114 }
10115 \@@_msg_new:nn { unknown-column-type-S }
10116 {
10117   Bad-column-type.\\
10118   The-column-type~'S'~in-your~\@@_full_name_env:\ is-unknown. \\
10119   If-you-want-to-use-the-column-type~'S'~of~siunitx,~you-should~
10120   load~that~package. \\
10121   This-error-is-fatal.
10122 }
10123 \@@_msg_new:nn { tabularnote-forbidden }
10124 {
10125   Forbidden-command.\\
10126   You-can't-use-the-command~\token_to_str:N\tabularnote\
10127   ~here.~This-command-is-available-only-in~
10128   \{NiceTabular\},~\{NiceTabular*\}~and~\{NiceTabularX\}~or~in~

```

```

10129     the~argument~of~a~command~\token_to_str:N \caption\ included-
10130     in~an~environment~{table}. \\
10131     This~command~will~be~ignored.
10132   }
10133   \@@_msg_new:nn { borders~forbidden }
10134   {
10135     Forbidden~key.\\
10136     You~can't~use~the~key~'borders'~of~the~command~\token_to_str:N \Block\
10137     because~the~option~'rounded~corners'~
10138     is~in~force~with~a~non~zero~value.\\
10139     This~key~will~be~ignored.
10140   }
10141   \@@_msg_new:nn { bottomrule~without~booktabs }
10142   {
10143     booktabs~not~loaded.\\
10144     You~can't~use~the~key~'tabular/bottomrule'~because~you~haven't~
10145     loaded~'booktabs'.\\
10146     This~key~will~be~ignored.
10147   }
10148   \@@_msg_new:nn { enumitem~not~loaded }
10149   {
10150     enumitem~not~loaded.\\
10151     You~can't~use~the~command~\token_to_str:N\tabularnote\
10152     ~because~you~haven't~loaded~'enumitem'.\\
10153     All~the~commands~\token_to_str:N\tabularnote\ will~be~
10154     ignored~in~the~document.
10155   }
10156   \@@_msg_new:nn { tikz~without~tikz }
10157   {
10158     Tikz~not~loaded.\\
10159     You~can't~use~the~key~'tikz'~here~because~Tikz~is~not~
10160     loaded.~If~you~go~on,~that~key~will~be~ignored.
10161   }
10162   \@@_msg_new:nn { tikz~in~custom~line~without~tikz }
10163   {
10164     Tikz~not~loaded.\\
10165     You~have~used~the~key~'tikz'~in~the~definition~of~a~
10166     customized~line~(with~'custom~line')~but~tikz~is~not~loaded.~
10167     You~can~go~on~but~you~will~have~another~error~if~you~actually~
10168     use~that~custom~line.
10169   }
10170   \@@_msg_new:nn { tikz~in~borders~without~tikz }
10171   {
10172     Tikz~not~loaded.\\
10173     You~have~used~the~key~'tikz'~in~a~key~'borders'~(of~a~
10174     command~'\token_to_str:N\Block')~but~tikz~is~not~loaded.~
10175     That~key~will~be~ignored.
10176   }
10177   \@@_msg_new:nn { color~in~custom~line~with~tikz }
10178   {
10179     Erroneous~use.\\
10180     In~a~'custom~line',~you~have~used~both~'tikz'~and~'color',~
10181     which~is~forbidden~(you~should~use~'color'~inside~the~key~'tikz').~
10182     The~key~'color'~will~be~discarded.
10183   }
10184   \@@_msg_new:nn { Wrong~last~row }
10185   {
10186     Wrong~number.\\
10187     You~have~used~'last~row=\int_use:N \l_@@_last_row_int'~but~your~
10188     \@@_full_name_env:\ seems~to~have~\int_use:N \c@iRow \ rows.~

```

```

10189     If-you-go-on,~the-value-of~\int_use:N \c@iRow \ will-be-used-for~
10190     last-row.~You-can-avoid-this-problem-by~using~'last-row'~
10191     without~value~(more~compilations~might~be~necessary).
10192   }
10193   \@@_msg_new:nn { Yet~in~env }
10194   {
10195     Nested~environments.\\
10196     Environments-of~nicematrix~can't-be-nested.\\
10197     This~error~is~fatal.
10198   }
10199   \@@_msg_new:nn { Outside~math~mode }
10200   {
10201     Outside~math~mode.\\
10202     The~\@@_full_name_env:\ can-be-used-only~in~math~mode~
10203     (and~not~in~\token_to_str:N \vcenter).\\
10204     This~error~is~fatal.
10205   }
10206   \@@_msg_new:nn { One~letter~allowed }
10207   {
10208     Bad~name.\\
10209     The~value~of~key~'\l_keys_key_str'~must~be~of~length~1.\\
10210     It~will~be~ignored.
10211   }
10212   \@@_msg_new:nn { TabularNote~in~CodeAfter }
10213   {
10214     Environment~{TabularNote}~forbidden.\\
10215     You~must~use~{TabularNote}~at~the~end~of~your~{NiceTabular}~
10216     but~*before*~the~\token_to_str:N \CodeAfter.\\
10217     This~environment~{TabularNote}~will~be~ignored.
10218   }
10219   \@@_msg_new:nn { varwidth~not~loaded }
10220   {
10221     varwidth~not~loaded.\\
10222     You~can't~use~the~column~type~'V'~because~'varwidth'~is~not~
10223     loaded.\\
10224     Your~column~will~behave~like~'p'.
10225   }
10226   \@@_msg_new:nnn { Unknow~key~for~RulesBis }
10227   {
10228     Unknown~key.\\
10229     Your~key~'\l_keys_key_str'~is~unknown~for~a~rule.\\
10230     \c_@@_available_keys_str
10231   }
10232   {
10233     The~available~keys~are~(in~alphabetic~order):~
10234     color,~
10235     dotted,~
10236     multiplicity,~
10237     sep-color,~
10238     tikz,~and~total-width.
10239   }
10240
10241   \@@_msg_new:nnn { Unknow~key~for~Block }
10242   {
10243     Unknown~key.\\
10244     The~key~'\l_keys_key_str'~is~unknown~for~the~command~\token_to_str:N
10245     \Block.\\ It~will~be~ignored. \\
10246     \c_@@_available_keys_str
10247   }
10248   {
10249     The~available~keys~are~(in~alphabetic~order):~&~in~blocks,~ampersand~in~blocks,~

```

```

10250   b,~B,~borders,~c,~draw,~fill,~hlines,~hvlines,~l,~line-width,~name,~
10251   opacity,~rounded-corners,~r,~respect-arraystretch,~t,~T,~tikz,~transparent~
10252   and~vlines.
10253 }
10254 \@@_msg_new:nnn { Unknown~key~for~Brace }
10255 {
10256   Unknown~key.\\
10257   The~key~'\l_keys_key_str'~is~unknown~for~the~commands~\token_to_str:N
10258   \UnderBrace\ and~\token_to_str:N \OverBrace.\\
10259   It~will~be~ignored. \\
10260   \c_@@_available_keys_str
10261 }
10262 {
10263   The~available~keys~are~(in~alphabetic~order):~color,~left~shorten,~
10264   right~shorten,~shorten~(which~fixes~both~left~shorten~and~
10265   right~shorten)~and~yshift.
10266 }
10267 \@@_msg_new:nnn { Unknown~key~for~CodeAfter }
10268 {
10269   Unknown~key.\\
10270   The~key~'\l_keys_key_str'~is~unknown.\\
10271   It~will~be~ignored. \\
10272   \c_@@_available_keys_str
10273 }
10274 {
10275   The~available~keys~are~(in~alphabetic~order):~
10276   delimiters/color,~
10277   rules~(with~the~subkeys~'color'~and~'width'),~
10278   sub~matrix~(several~subkeys)~
10279   and~xdots~(several~subkeys).~
10280   The~latter~is~for~the~command~\token_to_str:N \line.
10281 }
10282 \@@_msg_new:nnn { Unknown~key~for~CodeBefore }
10283 {
10284   Unknown~key.\\
10285   The~key~'\l_keys_key_str'~is~unknown.\\
10286   It~will~be~ignored. \\
10287   \c_@@_available_keys_str
10288 }
10289 {
10290   The~available~keys~are~(in~alphabetic~order):~
10291   create~cell~nodes,~
10292   delimiters/color~and~
10293   sub~matrix~(several~subkeys).
10294 }
10295 \@@_msg_new:nnn { Unknown~key~for~SubMatrix }
10296 {
10297   Unknown~key.\\
10298   The~key~'\l_keys_key_str'~is~unknown.\\
10299   That~key~will~be~ignored. \\
10300   \c_@@_available_keys_str
10301 }
10302 {
10303   The~available~keys~are~(in~alphabetic~order):~
10304   'delimiters/color',~
10305   'extra~height',~
10306   'hlines',~
10307   'hvlines',~
10308   'left~xshift',~
10309   'name',~
10310   'right~xshift',~
10311   'rules'~(with~the~subkeys~'color'~and~'width'),~

```

```

10312     'slim',~
10313     'vlines'~and~'xshift'~(which~sets~both~'left-xshift'~
10314     and~'right-xshift').\\
10315 }
10316 \@@_msg_new:nnn { Unknown~key~for~notes }
10317 {
10318     Unknown~key.\\
10319     The~key~'\l_keys_key_str'~is~unknown.\\
10320     That~key~will~be~ignored. \\
10321     \c_@@_available_keys_str
10322 }
10323 {
10324     The~available~keys~are~(in~alphabetic~order):~
10325     bottomrule,~
10326     code~after,~
10327     code~before,~
10328     detect~duplicates,~
10329     enumitem~keys,~
10330     enumitem~keys~para,~
10331     para,~
10332     label~in~list,~
10333     label~in~tabular~and~
10334     style.
10335 }
10336 \@@_msg_new:nnn { Unknown~key~for~RowStyle }
10337 {
10338     Unknown~key.\\
10339     The~key~'\l_keys_key_str'~is~unknown~for~the~command~
10340     \token_to_str:N \RowStyle. \\
10341     That~key~will~be~ignored. \\
10342     \c_@@_available_keys_str
10343 }
10344 {
10345     The~available~keys~are~(in~alphabetic~order):~
10346     bold,~
10347     cell~space~top~limit,~
10348     cell~space~bottom~limit,~
10349     cell~space~limits,~
10350     color,~
10351     fill~(alias:~rowcolor),~
10352     nb~rows,
10353     opacity~and~
10354     rounded~corners.
10355 }
10356 \@@_msg_new:nnn { Unknown~key~for~NiceMatrixOptions }
10357 {
10358     Unknown~key.\\
10359     The~key~'\l_keys_key_str'~is~unknown~for~the~command~
10360     \token_to_str:N \NiceMatrixOptions. \\
10361     That~key~will~be~ignored. \\
10362     \c_@@_available_keys_str
10363 }
10364 {
10365     The~available~keys~are~(in~alphabetic~order):~
10366     &~in~blocks,~
10367     allow~duplicate~names,~
10368     ampersand~in~blocks,~
10369     caption~above,~
10370     cell~space~bottom~limit,~
10371     cell~space~limits,~
10372     cell~space~top~limit,~
10373     code~for~first~col,~
10374     code~for~first~row,~

```

```

10375 code-for-last-col,~
10376 code-for-last-row,~
10377 corners,~
10378 custom-key,~
10379 create-extra-nodes,~
10380 create-medium-nodes,~
10381 create-large-nodes,~
10382 custom-line,~
10383 delimiters~(several~subkeys),~
10384 end-of-row,~
10385 first-col,~
10386 first-row,~
10387 hlines,~
10388 hvlines,~
10389 hvlines-except-borders,~
10390 last-col,~
10391 last-row,~
10392 left-margin,~
10393 light-syntax,~
10394 light-syntax-expanded,~
10395 matrix/columns-type,~
10396 no-cell-nodes,~
10397 notes~(several~subkeys),~
10398 nullify-dots,~
10399 pgf-node-code,~
10400 renew-dots,~
10401 renew-matrix,~
10402 respect-arraystretch,~
10403 rounded-corners,~
10404 right-margin,~
10405 rules~(with~the~subkeys~'color'~and~'width'),~
10406 small,~
10407 sub-matrix~(several~subkeys),~
10408 vlins,~
10409 xdots~(several~subkeys).
10410 }

```

For ‘{NiceArray}’, the set of keys is the same as for {NiceMatrix} excepted that there is no `l` and `r`.

```

10411 \@@_msg_new:nnn { Unknown~key~for~NiceArray }
10412 {
10413   Unknown~key.\\
10414   The~key~'\l_keys_key_str'~is~unknown~for~the~environment~
10415   \{NiceArray\}. \\
10416   That~key~will~be~ignored. \\
10417   \c_@@_available_keys_str
10418 }
10419 {
10420   The~available~keys~are~(in~alphabetic~order):~
10421   &~in~blocks,~
10422   ampersand~in~blocks,~
10423   b,~
10424   baseline,~
10425   c,~
10426   cell-space-bottom-limit,~
10427   cell-space-limits,~
10428   cell-space-top-limit,~
10429   code-after,~
10430   code-for-first-col,~
10431   code-for-first-row,~
10432   code-for-last-col,~
10433   code-for-last-row,~
10434   columns-width,~
10435   corners,~

```

```

10436 create-extra-nodes,~
10437 create-medium-nodes,~
10438 create-large-nodes,~
10439 extra-left-margin,~
10440 extra-right-margin,~
10441 first-col,~
10442 first-row,~
10443 hlines,~
10444 hvlines,~
10445 hvlines-except-borders,~
10446 last-col,~
10447 last-row,~
10448 left-margin,~
10449 light-syntax,~
10450 light-syntax-expanded,~
10451 name,~
10452 no-cell-nodes,~
10453 nullify-dots,~
10454 pgf-node-code,~
10455 renew-dots,~
10456 respect-arraystretch,~
10457 right-margin,~
10458 rounded-corners,~
10459 rules~(with~the~subkeys~'color'~and~'width'),~
10460 small,~
10461 t,~
10462 vlines,~
10463 xdots/color,~
10464 xdots/shorten-start,~
10465 xdots/shorten-end,~
10466 xdots/shorten-and~
10467 xdots/line-style.
10468 }

```

This error message is used for the set of keys `nicematrix/NiceMatrix` and `nicematrix/pNiceArray` (but not by `nicematrix/NiceArray` because, for this set of keys, there is no `l` and `r`).

```

10469 \@@_msg_new:nnn { Unknown~key~for~NiceMatrix }
10470 {
10471   Unknown~key.\\
10472   The~key~'\l_keys_key_str'~is~unknown~for~the~
10473   \@@_full_name_env:. \\
10474   That~key~will~be~ignored. \\
10475   \c_@@_available_keys_str
10476 }
10477 {
10478   The~available~keys~are~(in~alphabetic~order):~
10479   &~in~blocks,~
10480   ampersand~in~blocks,~
10481   b,~
10482   baseline,~
10483   c,~
10484   cell-space-bottom-limit,~
10485   cell-space-limits,~
10486   cell-space-top-limit,~
10487   code~after,~
10488   code~for~first~col,~
10489   code~for~first~row,~
10490   code~for~last~col,~
10491   code~for~last~row,~
10492   columns~type,~
10493   columns~width,~
10494   corners,~
10495   create-extra-nodes,~
10496   create-medium-nodes,~

```

```

10497 create-large-nodes,~
10498 extra-left-margin,~
10499 extra-right-margin,~
10500 first-col,~
10501 first-row,~
10502 hlines,~
10503 hvlines,~
10504 hvlines-except-borders,~
10505 l,~
10506 last-col,~
10507 last-row,~
10508 left-margin,~
10509 light-syntax,~
10510 light-syntax-expanded,~
10511 name,~
10512 no-cell-nodes,~
10513 nullify-dots,~
10514 pgf-node-code,~
10515 r,~
10516 renew-dots,~
10517 respect-arraystretch,~
10518 right-margin,~
10519 rounded-corners,~
10520 rules~(with~the~subkeys~'color'~and~'width'),~
10521 small,~
10522 t,~
10523 vlines,~
10524 xdots/color,~
10525 xdots/shorten-start,~
10526 xdots/shorten-end,~
10527 xdots/shorten-and~
10528 xdots/line-style.
10529 }
10530 \@@_msg_new:nnn { Unknown~key~for~NiceTabular }
10531 {
10532   Unknown~key.\\
10533   The~key~'\l_keys_key_str'~is~unknown~for~the~environment~
10534   \{NiceTabular\}. \\
10535   That~key~will~be~ignored. \\
10536   \c_@@_available_keys_str
10537 }
10538 {
10539   The~available~keys~are~(in~alphabetic~order):~
10540   &~in~blocks,~
10541   ampersand~in~blocks,~
10542   b,~
10543   baseline,~
10544   c,~
10545   caption,~
10546   cell-space-bottom-limit,~
10547   cell-space-limits,~
10548   cell-space-top-limit,~
10549   code-after,~
10550   code-for-first-col,~
10551   code-for-first-row,~
10552   code-for-last-col,~
10553   code-for-last-row,~
10554   columns-width,~
10555   corners,~
10556   custom-line,~
10557   create-extra-nodes,~
10558   create-medium-nodes,~
10559   create-large-nodes,~

```

```

10560 extra-left-margin,~
10561 extra-right-margin,~
10562 first-col,~
10563 first-row,~
10564 hlines,~
10565 hvlines,~
10566 hvlines-except-borders,~
10567 label,~
10568 last-col,~
10569 last-row,~
10570 left-margin,~
10571 light-syntax,~
10572 light-syntax-expanded,~
10573 name,~
10574 no-cell-nodes,~
10575 notes~(several~subkeys),~
10576 nullify-dots,~
10577 pgf-node-code,~
10578 renew-dots,~
10579 respect-arraystretch,~
10580 right-margin,~
10581 rounded-corners,~
10582 rules~(with~the~subkeys~'color'~and~'width'),~
10583 short-caption,~
10584 t,~
10585 tabularnote,~
10586 vlines,~
10587 xdots/color,~
10588 xdots/shorten-start,~
10589 xdots/shorten-end,~
10590 xdots/shorten-and~
10591 xdots/line-style.
10592 }

10593 \@@_msg_new:nnn { Duplicate-name }
10594 {
10595 Duplicate-name.\
10596 The-name-'\l_keys_value_tl'-is-already-used-and-you-shouldn't-use-
10597 the-same-environment-name-twice.-You-can-go-on,-but,-
10598 maybe,-you-will-have-incorrect-results-especially-
10599 if-you-use-'columns-width=auto'.-If-you-don't-want-to-see-this-
10600 message-again,-use-the-key-'allow-duplicate-names'-in-
10601 '\token_to_str:N \NiceMatrixOptions'.\
10602 \bool_if:NF \g_@@_messages_for_Overleaf_bool
10603 { For-a-list-of-the-names-already-used,-type-H-<return>. }
10604 }
10605 {
10606 The-names-already-defined-in-this-document-are:-
10607 \seq_use:Nnnn \g_@@_names_seq { ~and~ } { ,~ } { ~and~ }.
10608 }

10609 \@@_msg_new:nn { Option-auto-for-columns-width }
10610 {
10611 Erroneous-use.\
10612 You-can't-give-the-value-'auto'-to-the-key-'columns-width'-here.-
10613 That-key-will-be-ignored.
10614 }

10615 \@@_msg_new:nn { NiceTabularX-without-X }
10616 {
10617 NiceTabularX-without-X.\
10618 You-should-not-use-{NiceTabularX}-without-X-columns.\
10619 However,-you-can-go-on.
10620 }

10621 \@@_msg_new:nn { Preamble-forgotten }

```

```

10622 {
10623   Preamble-forgotten.\\
10624   You-have-probably-forgotten-the-preamble-of-your-
10625   \@_full_name_env:. \\
10626   This-error-is-fatal.
10627 }

10628 \@_msg_new:nn { Invalid-column-number }
10629 {
10630   Invalid-column-number.\\
10631   A-color-instruction-the-\token_to_str:N \CodeBefore\
10632   specifies-a-column-which-is-outside-the-array.-It-will-be-ignored.
10633 }

10634 \@_msg_new:nn { Invalid-row-number }
10635 {
10636   Invalid-row-number.\\
10637   A-color-instruction-the-\token_to_str:N \CodeBefore\
10638   specifies-a-row-which-is-outside-the-array.-It-will-be-ignored.
10639 }

```

Contents

1	Declaration of the package and packages loaded	1
2	Collecting options	3
3	Technical definitions	4
4	Parameters	8
5	The command <code>\tabularnote</code>	19
6	Command for creation of rectangle nodes	23
7	The options	24
8	Important code used by <code>{NiceArrayWithDelims}</code>	35
9	The <code>\CodeBefore</code>	49
10	The environment <code>{NiceArrayWithDelims}</code>	53
11	Construction of the preamble of the array	58
12	The redefinition of <code>\multicolumn</code>	74
13	The environment <code>{NiceMatrix}</code> and its variants	92
14	<code>{NiceTabular}</code> , <code>{NiceTabularX}</code> and <code>{NiceTabular*}</code>	93
15	After the construction of the array	94
16	We draw the dotted lines	101
17	The actual instructions for drawing the dotted lines with Tikz	114
18	User commands available in the new environments	120
19	The command <code>\line</code> accessible in code-after	126
20	The command <code>\RowStyle</code>	128
21	Colors of cells, rows and columns	131
22	The vertical and horizontal rules	143
23	The empty corners	159
24	The environment <code>{NiceMatrixBlock}</code>	162
25	The extra nodes	163
26	The blocks	168
27	How to draw the dotted lines transparently	192
28	Automatic arrays	192
29	The redefinition of the command <code>\dotfill</code>	193
30	The command <code>\diagbox</code>	194

31	The keyword <code>\CodeAfter</code>	195
32	The delimiters in the preamble	196
33	The command <code>\SubMatrix</code>	197
34	Les commandes <code>\UnderBrace</code> et <code>\OverBrace</code>	206
35	The commands <code>HBrace</code> et <code>VBrace</code>	209
36	The command <code>TikzEveryCell</code>	211
37	The command <code>\ShowCellNames</code>	213
38	We process the options at package loading	214
39	About the package underscore	216
40	Error messages of the package	216