

# The code of the package **nicematrix**<sup>\*</sup>

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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 translation: **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}

3 \ProvidesExplPackage
4   {nicematrix}
5   {\myfiledate}
6   {\myfileversion}
7   {Enhanced arrays with the help of PGF/TikZ}

8 \msg_new:nnn { nicematrix } { latex-too-old }
9 {
10   Your-LaTeX-release-is-too-old. \\
11   You-need-at-least-the-version-of-2025-06-01. \\
12   If-you-use-Overleaf,-you-need-at-least-"TeXLive-2025". \\
13   The-package-'nicematrix'-won't-be-loaded.
14 }

15 \providecommand { \IfFormatAtLeastTF } { \@ifl@t@r \fmtversion }
16 \IfFormatAtLeastTF
17   { 2025-06-01 }
18   { }
19   { \msg_critical:nn { nicematrix } { latex-too-old } }
```

---

<sup>\*</sup>This document corresponds to the version 7.4a of **nicematrix**, at the date of 2025/11/04.

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

```

20 \RequirePackage { amsmath }

21 \RequirePackage{array} [=2025/06/08] % v2.6j

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

With Overleaf (and also in TeXPage), 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).

```

30 \cs_new_protected:Npn \@@_msg_new:nnn #1 #2 #3
31 {
32     \bool_if:NTF \g_@@_messages_for_Overleaf_bool
33         { \msg_new:nnn { nicematrix } { #1 } { #2 \\ #3 } }
34         { \msg_new:nnnn { nicematrix } { #1 } { #2 } { #3 } }
35 }
```

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

```

36 \cs_new_protected:Npn \@@_error_or_warning:n
37 {
38     \bool_if:NTF \g_@@_messages_for_Overleaf_bool
39         { \@@_warning:n }
40         { \@@_error:n }
41 }
```

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”.

```

42 \bool_new:N \g_@@_messages_for_Overleaf_bool
43 \bool_gset:Nn \g_@@_messages_for_Overleaf_bool
44 {
45     \str_if_eq_p:on \c_sys_jobname_str { _region_ } % for Emacs
46     || \str_if_eq_p:ee \c_sys_jobname_str { output } % for Overleaf
47 }

48 \@@_msg_new:nn { mdwtab-loaded }
49 {
50     The~packages~'mdwtab'~and~'nicematrix'~are~incompatible.~
51     This~error~is~fatal.
52 }

53 \hook_gput_code:nnn { begindocument / end } { . }
54     { \IfPackageLoadedT { mdwtab } { \@@_fatal:n { mdwtab-loaded } } }
```

## 2 Collecting options

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

*Example :*

```
\@@_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).

```
55 \cs_new_protected:Npn \@@_collect_options:n #1
56 {
57   \peek_meaning:NTF [
58     { \@@_collect_options:nw { #1 } }
59     { #1 { } }
60 }
```

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

```
61 \NewDocumentCommand \@@_collect_options:nw { m r[] }
62   { \@@_collect_options:nn { #1 } { #2 } }
63
64 \cs_new_protected:Npn \@@_collect_options:nn #1 #2
65 {
66   \peek_meaning:NTF [
67     { \@@_collect_options:nnw { #1 } { #2 } }
68     { #1 { #2 } }
69 }
70
71 \cs_new_protected:Npn \@@_collect_options:nnw #1#2[#3]
72   { \@@_collect_options:nn { #1 } { #2 , #3 } }
```

## 3 Technical definitions

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

```
73 \tl_const:Nn \c_@@_c_tl { c }
74 \tl_const:Nn \c_@@_l_tl { l }
75 \tl_const:Nn \c_@@_r_tl { r }
76 \tl_const:Nn \c_@@_all_tl { all }
77 \tl_const:Nn \c_@@_dot_tl { . }
78 \str_const:Nn \c_@@_r_str { r }
79 \str_const:Nn \c_@@_c_str { c }
80 \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).

```
81 \tl_new:N \l_@@_argspec_tl
```

```

82 \cs_generate_variant:Nn \seq_set_split:Nnn { N o }
83 \cs_generate_variant:Nn \str_set:Nn { N o }
84 \cs_generate_variant:Nn \tl_build_put_right:Nn { N o }
85 \prg_generate_conditional_variant:Nnn \clist_if_in:Nn { N e } { T , F, TF }
86 \prg_generate_conditional_variant:Nnn \tl_if_empty:n { e } { T }
87 \prg_generate_conditional_variant:Nnn \tl_if_head_eq_meaning:nN { o N } { TF }
88 \cs_generate_variant:Nn \dim_min:nn { v }
89 \cs_generate_variant:Nn \dim_max:nn { v }

90 \hook_gput_code:nnn { begindocument } { . }
91 {
92     \IfPackageLoadedTF { tikz }
93     {

```

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.

```

94     \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \tikzpicture }
95     \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endtikzpicture }
96 }
97 {
98     \tl_const:Nn \c_@@_pgfortikzpicture_tl { \exp_not:N \pgfpicture }
99     \tl_const:Nn \c_@@_endpgfortikzpicture_tl { \exp_not:N \endpgfpicture }
100 }
101 }

```

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 programmation. At the date April 2025, the current version `revtex4-2` is 4.2f (compatible with `booktabs`).

```

102 \IfClassLoadedTF { revtex4-1 }
103 {
104     \bool_const:Nn \c_@@_revtex_bool { \c_true_bool }
105 }
106 \IfClassLoadedTF { revtex4-2 }
107 {
108     \bool_const:Nn \c_@@_revtex_bool { \c_true_bool }
109 }
110
111 }
112

```

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

```

108 \cs_if_exist:NT \rvtx@iffORMAT@geq
109 {
110     \bool_const:Nn \c_@@_revtex_bool { \c_true_bool }
111     \bool_const:Nn \c_@@_revtex_bool { \c_false_bool }
112 }

```

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.

```

113 \cs_new_protected:Npn \@@_provide_pgfsyspdfmark:
114 {
115     \iow_now:Nn \mainaux
116     {
117         \ExplSyntaxOn
118         \cs_if_free:NT \pgfsyspdfmark
119             { \cs_set_eq:NN \pgfsyspdfmark \gobblethree }
120         \ExplSyntaxOff
121     }
122     \cs_gset_eq:NN \@@_provide_pgfsyspdfmark: \prg_do_nothing:
123 }

```

We define a command `\iddots` similar to `\ddots` (‘..) but with dots going forward (‘..). 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.

```

124 \ProvideDocumentCommand \iddots { }
125 {
126   \mathinner
127   {
128     \mkern 1 mu
129     \box_move_up:n { 1 pt } { \hbox { . } }
130     \mkern 2 mu
131     \box_move_up:n { 4 pt } { \hbox { . } }
132     \mkern 2 mu
133     \box_move_up:n { 7 pt }
134     { \vbox:n { \kern 7 pt \hbox { . } } }
135     \mkern 1 mu
136   }
137 }
```

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.

```

138 \hook_gput_code:nnn { begindocument } { . }
139 {
140   \IfPackageLoadedT { booktabs }
141   { \iow_now:Nn \mainaux { \nicematrix@redefine@check@rerun } }
142 }
143 \cs_set_protected:Npn \nicematrix@redefine@check@rerun
144 {
145   \let \@@_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`).

```

146   \cs_set_protected:Npn \pgfutil@check@rerun ##1 ##2
147   {
\str_if_eq:ee(TF) is faster than \str_if_eq:nn(TF).
148   \str_if_eq:eeF { nm- } { \tl_range:nnn { ##1 } { 1 } { 3 } }
149   { \@@_old_pgfutil@check@rerun { ##1 } { ##2 } }
150 }
151 }
```

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

```

152 \hook_gput_code:nnn { begindocument } { . }
153 {
154   \cs_set_protected:Npe \@@_everycr:
155   {
156     \IfPackageLoadedTF { colortbl } { \CT@everycr } { \everycr }
157     { \noalign { \@@_in_everycr: } }
158   }
159   \IfPackageLoadedTF { colortbl }
160   {
161     \cs_set_eq:NN \@@_old_cellcolor: \cellcolor
162     \cs_set_eq:NN \@@_old_rowcolor: \rowcolor
163     \cs_new_protected:Npn \@@_revert_colortbl:
164     {
165       \hook_gput_code:nnn { env / tabular / begin } { nicematrix }
166       {
167         \cs_set_eq:NN \cellcolor \@@_old_cellcolor:
168         \cs_set_eq:NN \rowcolor \@@_old_rowcolor:
```

```

169 }
170 }

```

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).

```

171 \cs_new_protected:Npn \@@_replace_columncolor:
172 {
173     \tl_replace_all:Nnn \g_@@_array_preamble_tl
174     { \columncolor }
175     { \@@_columncolor_preamble }

```

`\@@_column_preamble`, despite its name, will be defined with `\NewDocumentCommand` because it takes in an optional argument between square brackets in first position for the colorimetric space.

```

176 }
177 }
178 {
179     \cs_new_protected:Npn \@@_revert_colortbl: { }
180     \cs_new_protected:Npn \@@_replace_columncolor:
181         { \cs_set_eq:NN \columncolor \@@_columncolor_preamble }

```

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.

```

182 \def \CT@arc@ { }
183 \def \arrayrulecolor #1 # { \CT@arc { #1 } }
184 \def \CT@arc #1 #2
185 {
186     \dim_compare:nNnT { \baselineskip } = { \c_zero_dim } { \noalign }
187     { \cs_gset_nopar:Npn \CT@arc@ { \color #1 { #2 } } }
188 }

```

Idem for `\CT@drs@`.

```

189 \def \doublerulesepcolor #1 # { \CT@drs { #1 } }
190 \def \CT@drs #1 #2
191 {
192     \dim_compare:nNnT { \baselineskip } = { \c_zero_dim } { \noalign }
193     { \cs_gset:Npn \CT@drsc@ { \color #1 { #2 } } }
194 }
195 \def \hline
196 {
197     \noalign { \ifnum 0 = `} \fi
198     \cs_set_eq:NN \hskip \vskip
199     \cs_set_eq:NN \vrule \hrule
200     \cs_set_eq:NN \width \height
201     { \CT@arc@ \vline }
202     \futurelet \reserved@a
203     \xhline
204 }
205 }
206 }

```

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.

```

207 \cs_set_nopar:Npn \@@_standard_cline: #1 { \@@_standard_cline:w #1 \q_stop }
208 \cs_set_nopar:Npn \@@_standard_cline:w #1-#2 \q_stop
209 {
210     \int_if_zero:nT { \l_@@_first_col_int } { \omit & }
211     \int_compare:nNnT { #1 } > { \c_one_int }
212     { \multispan { \int_eval:n { #1 - 1 } } & }
213     \multispan { \int_eval:n { #2 - #1 + 1 } } \\
214 }
215 \CT@arc@
216 \leaders \hrule \height \arrayrulewidth \hfill

```

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

```
217     \skip_horizontal:N \c_zero_dim
218 }
```

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`.

```
219     \everycr { }
220     \cr
221     \noalign { \skip_vertical:n { - \arrayrulewidth } }
222 }
```

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.

```
223 \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`.

```
224 { \@@_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*.

```
225 \cs_set:Npn \@@_cline_i:nn #1 #2 { \@@_cline_i:w #1|#2- \q_stop }
226 \cs_generate_variant:Nn \@@_cline_i:nn { e }
227 \cs_set:Npn \@@_cline_i:w #1|#2-#3 \q_stop
228 {
229     \tl_if_empty:nTF { #3 }
230     { \@@_cline_iii:w #1|#2-#2 \q_stop }
231     { \@@_cline_ii:w #1|#2-#3 \q_stop }
232 }
233 \cs_set:Npn \@@_cline_ii:w #1|#2-#3- \q_stop
234 { \@@_cline_iii:w #1|#2-#3 \q_stop }
235 \cs_set:Npn \@@_cline_iii:w #1|#2-#3 \q_stop
236 { }
```

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).

```
237 \int_compare:nNnT { #1 } < { #2 }
238 { \multispan { \int_eval:n { #2 - #1 } } & }
239 \multispan { \int_eval:n { #3 - #2 + 1 } } }
240 {
241     \CT@arc@
242     \leaders \hrule \height \arrayrulewidth \hfill
243     \skip_horizontal:N \c_zero_dim
244 }
```

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

```
245 \peek_meaning_remove_ignore_spaces:NTF \cline
246 { & \@@_cline_i:en { \int_eval:n { #3 + 1 } } }
247 { \everycr { } \cr }
248 }
```

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

```
249 \cs_set:Nn \@@_math_toggle: { $ } % $
```

---

<sup>1</sup>See question 99041 on TeX StackExchange.

```

250 \cs_new_protected:Npn \@@_set_CTarc:n #1
251 {
252     \tl_if_blank:nF { #1 }
253     {
254         \tl_if_head_eq_meaning:nNTF { #1 } [
255             { \def \CT@arc@ { \color #1 } }
256             { \def \CT@arc@ { \color { #1 } } }
257         ]
258     }
259 \cs_generate_variant:Nn \@@_set_CTarc:n { o }

260 \cs_new_protected:Npn \@@_set_CTdrsc:n #1
261 {
262     \tl_if_head_eq_meaning:nNTF { #1 } [
263         { \def \CT@drsc@ { \color #1 } }
264         { \def \CT@drsc@ { \color { #1 } } }
265     ]

```

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

```

266 \cs_new:Npn \@@_exp_color_arg:Nn #1 #2
267 {
268     \tl_if_head_eq_meaning:nNTF { #2 } [
269         { #1 #2 }
270         { #1 { #2 } }
271     ]
272 \cs_generate_variant:Nn \@@_exp_color_arg:Nn { N o }

```

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

```

273 \cs_new_protected:Npn \@@_color:n #1
274     { \tl_if_blank:nF { #1 } { \@@_exp_color_arg:Nn \color { #1 } } }
275 \cs_generate_variant:Nn \@@_color:n { o }

```

```

276 \cs_new_protected:Npn \@@_rescan_for_spanish:N #1
277 {
278     \tl_set_rescan:Nno
279         #1
280     {
281         \char_set_catcode_other:N >
282         \char_set_catcode_other:N <
283     }
284     #1
285 }

```

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

```

286 \dim_new:N \l_@@_tmpc_dim
287 \dim_new:N \l_@@_tmpd_dim

288 \tl_new:N \l_@@_tmpc_tl
289 \tl_new:N \l_@@_tmpd_tl

290 \int_new:N \l_@@_tmpc_int

```

## 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.

```
291 \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).

```
292 \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.

```
293 \NewExpandableDocumentCommand \NiceMatrixLastEnv { } { \int_use:N \g_@@_env_int }
```

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

```
294 \box_new:N \l_@@_the_array_box
```

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

```
295 \cs_new_protected:Npn \@@_qpoint:n #1  
296   { \pgfpointanchor { \@@_env: - #1 } { center } }
```

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

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

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

```
298 \bool_new:N \g_@@_delims_bool  
299 \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.

```
300 \bool_new:N \l_@@_preamble_bool  
301 \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.

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

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

```
303 \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.

```
304 \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).

```
305 \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.).

```
306 \dim_new:N \l_@@_col_width_dim
307 \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.

```
308 \int_new:N \g_@@_row_total_int
309 \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).

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

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

```
311 \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.

```
312 \tl_new:N \l_@@_hpos_cell_tl
313 \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`.

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

Idem for the mono-row blocks.

```
315 \dim_new:N \g_@@_blocks_ht_dim
316 \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}`).

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

The clist `\g_@@_names_clist` 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`.

```
318 \clist_new:N \g_@@_names_clist
```

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.

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

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

```
320 \bool_new:N \l_@@_notes_detect_duplicates_bool
321 \bool_set_true:N \l_@@_notes_detect_duplicates_bool
```

```

322 \bool_new:N \l_@@_initial_open_bool
323 \bool_new:N \l_@@_final_open_bool
324 \bool_new:N \l_@@_Vbrace_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.

```
325 \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).

```
326 \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).

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

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

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

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

```
329 \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`). You will use that flag for the blocks.

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

`\l_@@_V_of_X_bool` during the construction of the preamble when a column of type `X` uses the key `V` (whose name is inspired by the columns `V` of the extension `varwidth`).

```
331 \bool_new:N \l_@@_V_of_X_bool
```

The flag `g_@@_V_of_X_bool` will be raised when there is at least in the tabular a column of type `X` using the key `V`.

```
332 \bool_new:N \g_@@_V_of_X_bool
```

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

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

```
334 \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 contain of that token list will be written on the `aux` file at the end of the environment (in an instruction `\tl_gset:cn { g_@@_ \int_use:N \g_@@_env_int _ tl }`).

```
335 \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.

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

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

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

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

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

The token list `\g_@@_user_preamble_t1` will contain the preamble provided by the the final user of `nicematrix` (eg the preamble of an environment `{NiceTabular}`).

```
340 \tl_new:N \g_@@_user_preamble_t1
```

The token list `\g_@@_array_preamble_t1` will contain the preamble constructed by `nicematrix` for the environment `{array}` (of array).

```
341 \tl_new:N \g_@@_array_preamble_t1
```

For `\multicolumn`.

```
342 \tl_new:N \g_@@_preamble_t1
```

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

```
343 \tl_new:N \l_@@_columns_type_t1
```

```
344 \str_set:Nn \l_@@_columns_type_t1 { 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 that keys directly because he uses the syntax with the embellishments `_`, `^` and `:`.

```
345 \tl_new:N \l_@@_xdots_down_t1
```

```
346 \tl_new:N \l_@@_xdots_up_t1
```

```
347 \tl_new:N \l_@@_xdots_middle_t1
```

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

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

```
349 \cs_new_protected:Npn \g_@@_test_if_math_mode:
```

```
350 {
```

```
351   \if_mode_math: \else:
```

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

```
353   \fi:
```

```
354 }
```

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.

```
355 \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”.

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

```
357 \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`).

```
358 \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`.

```
359 \str_new:N \g_@@_com_or_env_str
```

```
360 \str_gset:Nn \g_@@_com_or_env_str { environment }
```

```
361 \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)`.

```

362 \cs_new:Npn \@@_full_name_env:
363 {
364     \str_if_eq:eeTF { \g_@@_com_or_env_str } { command }
365     { command \space \c_backslash_str \g_@@_name_env_str }
366     { environment \space \{ \g_@@_name_env_str \} }
367 }
```

368 \tl\_new:N \g\_@@\_cell\_after\_hook\_tl % 2025/03/22

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

```
369 \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.

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

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

```

371 \tl_new:N \g_@@_pre_code_before_tl
372 \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 split in two parts because we want to control the order of execution of some instructions.

```

373 \tl_new:N \g_@@_pre_code_after_tl
374 \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.

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

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

```
376 \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.

```

377 \int_new:N \l_@@_old_iRow_int
378 \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).

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

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

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

The sum of the weights of all the X-columns in the preamble.

```
381 \fp_new:N \g_@@_total_X_weight_fp
```

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 1.0 (the width of a column of weight  $x$  will be that dimension multiplied by  $x$ ). That value is computed after the construction of the array during the first compilation in order to be used in the following run.

```
382 \bool_new:N \l_@@_X_columns_aux_bool  
383 \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.

```
384 \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).

```
385 \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).

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

```
387 \tl_new:N \l_@@_code_before_tl  
388 \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).

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

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

```
390 \dim_new:N \l_@@_x_initial_dim  
391 \dim_new:N \l_@@_y_initial_dim  
392 \dim_new:N \l_@@_x_final_dim  
393 \dim_new:N \l_@@_y_final_dim  
  
394 \dim_new:N \g_@@_dp_row_zero_dim  
395 \dim_new:N \g_@@_ht_row_zero_dim  
396 \dim_new:N \g_@@_ht_row_one_dim  
397 \dim_new:N \g_@@_dp_ante_last_row_dim  
398 \dim_new:N \g_@@_ht_last_row_dim  
399 \dim_new:N \g_@@_dp_last_row_dim
```

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

```
400 \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”.

```
401 \dim_new:N \g_@@_width_last_col_dim  
402 \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.

403 `\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!).

404 `\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.

405 `\seq_new:N \g_@@_future_pos_of_blocks_seq`

The, after the execution of the `\CodeBefore`, the sequence `\g_@@_pos_of_blocks_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}`.

406 `\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.

407 `\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`).

408 `\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`).

409 `\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.

410 `\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).

411 `\seq_new:N \g_@@_multicolumn_cells_seq`

412 `\seq_new:N \g_@@_multicolumn_sizes_seq`

By default, the diagonal lines will be parallelized<sup>2</sup>. There are two types of diagonals lines: the \Ddots diagonals and the \Idots 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.

```
413 \int_new:N \g_@@_ddots_int
414 \int_new:N \g_@@_iddots_int
```

The dimensions \g\_@@\_delta\_x\_one\_dim and \g\_@@\_delta\_y\_one\_dim will contain the  $\Delta_x$  and  $\Delta_y$  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  $\Delta_x$  and  $\Delta_y$  of the first \Idots diagonal.

```
415 \dim_new:N \g_@@_delta_x_one_dim
416 \dim_new:N \g_@@_delta_y_one_dim
417 \dim_new:N \g_@@_delta_x_two_dim
418 \dim_new:N \g_@@_delta_y_two_dim
```

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 `before`).

```
419 \int_new:N \l_@@_row_min_int
420 \int_new:N \l_@@_row_max_int
421 \int_new:N \l_@@_col_min_int
422 \int_new:N \l_@@_col_max_int

423 \int_new:N \l_@@_initial_i_int
424 \int_new:N \l_@@_initial_j_int
425 \int_new:N \l_@@_final_i_int
426 \int_new:N \l_@@_final_j_int
```

The following counters will be used when drawing the rules.

```
427 \int_new:N \l_@@_start_int
428 \int_set_eq:NN \l_@@_start_int \c_one_int
429 \int_new:N \l_@@_end_int
430 \int_new:N \l_@@_local_start_int
431 \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.

```
432 \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).

```
433 \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.

```
434 \tl_new:N \l_@@_fill_tl
435 \tl_new:N \l_@@_opacity_tl
436 \tl_new:N \l_@@_draw_tl
437 \seq_new:N \l_@@_tikz_seq
438 \clist_new:N \l_@@_borders_clist
439 \dim_new:N \l_@@_rounded_corners_dim
```

---

<sup>2</sup>It's possible to use the option `parallelize-diags` to disable this parallelization.

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.

```
440 \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`.

```
441 \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.

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

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

```
443 \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`).

```
444 \str_new:N \l_@@_hpos_block_str
445 \str_set:Nn \l_@@_hpos_block_str { c }
446 \bool_new:N \l_@@_hpos_of_block_cap_bool
447 \bool_new:N \l_@@_p_block_bool
```

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

```
448 \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).

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

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

```
450 \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).

```
451 \bool_new:N \l_@@_vlines_block_bool
452 \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.

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

```
454 \dim_new:N \l_@@_submatrix_extra_height_dim
455 \dim_new:N \l_@@_submatrix_left_xshift_dim
456 \dim_new:N \l_@@_submatrix_right_xshift_dim
457 \clist_new:N \l_@@_hlines_clist
458 \clist_new:N \l_@@_vlines_clist
459 \clist_new:N \l_@@_submatrix_hlines_clist
460 \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}`).

```
461 \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.

```
462 \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`).

```
463 \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.

```
464 \int_new:N \l_@@_first_row_int
465 \int_set_eq:NN \l_@@_first_row_int \c_one_int
```

- **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.

```
466 \int_new:N \l_@@_first_col_int
467 \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).

```
468 \int_new:N \l_@@_last_row_int
469 \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”.<sup>3</sup>

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

Idem for `\l_@@_last_col_without_value_bool`

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

---

<sup>3</sup>We 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.

- **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  $0$ .

```
472 \int_new:N \l_@@_last_col_int
473 \int_set:Nn \l_@@_last_col_int { -2 }
```

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

```
\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.

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

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

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

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

## Some utilities

```
476 \cs_new_protected:Npn \@@_cut_on_hyphen:w #1-#2 \q_stop
477 {
```

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

```
478 \def \l_tmpa_tl { #1 }
479 \def \l_tmpb_tl { #2 }
480 }
```

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. The second argument is `\c@iRow` or `\c@jCol`.

```
481 \cs_new_protected:Npn \@@_expand_clist_hvlines:NN #1 #2
482 {
483   \clist_if_in:NnF #1 { all }
484   {
485     \clist_clear:N \l_tmpa_clist
486     \clist_map_inline:Nn #1
487     {
488       \tl_if_head_eq_meaning:nNTF { ##1 } -
489       {

```

If we have yet the number of columns or the number of columns (because they have been computed during a previous run and written on the aux file), we can compute the actual position of the rule with a negative position.

```
490 \int_if_zero:nF { #2 }
491 {
492   \clist_put_right:Ne \l_tmpa_clist
493   { \int_eval:n { #2 + (#1) + 1 } }
494 }
495 }
496 {
```

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

```
497     \tl_if_in:nNTF { ##1 } { - }
498         { \@@_cut_on_hyphen:w ##1 \q_stop }
499     { }
```

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

```
500         \def \l_tmpa_tl { ##1 }
501         \def \l_tmpb_tl { ##1 }
502     }
503     \int_step_inline:nnn { \l_tmpa_tl } { \l_tmpb_tl }
504         { \clist_put_right:Nn \l_tmpa_clist { #####1 } }
505     }
506 }
507 \tl_set_eq:NN #1 \l_tmpa_clist
508 }
509 }
```

The following internal parameters are for:

- `\Ldots` with both extremities open (and hence also `\Hdotsfor` in an exterior row);
- 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.

```
510 \hook_gput_code:nnn { begindocument } { . }
511 {
512     \dim_const:Nn \c_@@_shift_Ldots_last_row_dim { 0.5 em }
513     \dim_const:Nn \c_@@_innersep_middle_dim { 0.17 em }
514 }
```

## 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`.<sup>4</sup>
  - 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 `\NoValue`).

---

<sup>4</sup>More precisely, it’s the number of tabular notes which do not use the optional argument of `\tabularnote`.

- 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.

```
515 \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`.

```
516 \int_new:N \g_@@_tabularnote_int
517 \cs_set:Npn \theHtabularnote { \int_use:N \g_@@_tabularnote_int }
518 \seq_new:N \g_@@_notes_seq
519 \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.

```
520 \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.

```
521 \seq_new:N \l_@@_notes_labels_seq
522 \newcounter { nicematrix_draft }
523 \cs_new_protected:Npn \@@_notes_format:n #1
  {
    \setcounter { nicematrix_draft } { #1 }
    \@@_notes_style:n { nicematrix_draft }
  }
```

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

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

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

```
529 \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`.

```
530 \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`.

```
531 \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`).

```
532 \hook_gput_code:nnn { begindocument } { . }
533 {
  \IfPackageLoadedTF { enumitem }
  {
    
```

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.

```

536     \newlist { tabularnotes } { enumerate } { 1 }
537     \setlist [ tabularnotes ]
538     {
539         topsep = \c_zero_dim ,
540         noitemsep ,
541         leftmargin = * ,
542         align = left ,
543         labelsep = \c_zero_dim ,
544         label =
545             \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotesi } } ,
546     }
547     \newlist { tabularnotes* } { enumerate* } { 1 }
548     \setlist [ tabularnotes* ]
549     {
550         afterlabel = \nobreak ,
551         itemjoin = \quad ,
552         label =
553             \@@_notes_label_in_list:n { \@@_notes_style:n { tabularnotes*i } }
554     }

```

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`.

```

555 \NewDocumentCommand \tabularnote { o m }
556   {
557     \bool_lazy_or:nnT { \cs_if_exist_p:N \captype } { \l_@@_in_env_bool }
558     {
559       \bool_lazy_and:nnTF { ! \l_@@_tabular_bool } { \l_@@_in_env_bool }
560       {
561         \error:n { tabularnote~forbidden }
562         {
563           \bool_if:NTF \l_@@_in_caption_bool
564             \@@_tabularnote_caption:nn
565             \@@_tabularnote:nn
566             { #1 } { #2 }
567         }
568       }
569     }
570   {
571     \NewDocumentCommand \tabularnote { o m }
572       { \@@_err_enumitem_not_loaded: }
573   }
574 }

575 \cs_new_protected:Npn \@@_err_enumitem_not_loaded:
576   {
577     \error_or_warning:n { enumitem-not-loaded }
578     \cs_gset:Npn \@@_err_enumitem_not_loaded: { }
579   }

580 \cs_new_protected:Npn \@@_test_first_novalue:nnn #1 #2 #3
581   { \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 `\NoValue`) and #2 is the mandatory argument of `\tabularnote`.

```

582 \cs_new_protected:Npn \@@_tabularnote:nn #1 #2
583   {

```

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).

```
584     \int_zero:N \l_tmpa_int
585     \bool_if:NT \l_@@_notes_detect_duplicates_bool
586     {
```

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 `\NoValue`.

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`.

```
587     \int_zero:N \l_tmpb_int
588     \seq_map_indexed_inline:Nn \g_@@_notes_seq
589     {
590         \@@_test_first_novalue:nnn ##2 { \int_incr:N \l_tmpb_int }
591         \tl_if_eq:nnT { { #1 } { #2 } } { ##2 }
592         {
593             \tl_if_novalue:nTF { #1 }
594             { \int_set_eq:NN \l_tmpa_int \l_tmpb_int }
595             { \int_set:Nn \l_tmpa_int { ##1 } }
596             \seq_map_break:
597         }
598     }
599     \int_if_zero:nF { \l_tmpa_int }
600     { \int_add:Nn \l_tmpa_int { \g_@@_notes_caption_int } }
601 }
602 \int_if_zero:nT { \l_tmpa_int }
603 {
604     \seq_gput_right:Nn \g_@@_notes_seq { { #1 } { #2 } }
605     \tl_if_novalue:nT { #1 } { \int_gincr:N \c@tabularnote }
606 }
607 \seq_put_right:Ne \l_@@_notes_labels_seq
608 {
609     \tl_if_novalue:nTF { #1 }
610     {
611         \@@_notes_format:n
612         {
613             \int_eval:n
614             {
615                 \int_if_zero:nTF { \l_tmpa_int }
616                 { \c@tabularnote }
617                 { \l_tmpa_int }
618             }
619         }
620     }
621     { #1 }
622 }
623 \peek_meaning:NF \tabularnote
624 {
```

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`.

```
625     \hbox_set:Nn \l_tmpa_box
626     {
```

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

```

627          \@@_notes_label_in_tabular:n
628          {
629              \seq_use:Nnnn
630                  \l_@@_notes_labels_seq { , } { , } { , }
631          }
632      }

```

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

```

633     \int_gdecr:N \c@tabularnote
634     \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.

```

635     \int_gincr:N \g_@@_tabularnote_int
636     \refstepcounter { tabularnote }
637     \int_compare:nNnT { \l_tmpa_int } = { \c@tabularnote }
638         { \int_gincr:N \c@tabularnote }
639     \seq_clear:N \l_@@_notes_labels_seq
640     \bool_lazy_or:nnTF
641         { \str_if_eq_p:ee \l_@@_hpos_cell_tl { c } }
642         { \str_if_eq_p:ee \l_@@_hpos_cell_tl { r } }
643     {
644         \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).

```

645         \skip_horizontal:n { \box_wd:N \l_tmpa_box }
646     }
647     { \box_use:N \l_tmpa_box }
648 }
649

```

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`.

```

650 \cs_new_protected:Npn \@@_tabularnote_caption:nn #1 #2
651 {
652     \bool_if:NTF \g_@@_caption_finished_bool
653     {
654         \int_compare:nNnT { \c@tabularnote } = { \g_@@_notes_caption_int }
655         { \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`!

```

656     \seq_if_in:NnF \g_@@_notes_in_caption_seq { { #1 } { #2 } }
657         { \@@_error:n { Identical-notes-in-caption } }
658     }
659

```

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

```

660     \seq_if_in:NnTF \g_@@_notes_in_caption_seq { { #1 } { #2 } }
661         {

```

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.

```

662         \bool_gset_true:N \g_@@_caption_finished_bool

```

```

663     \int_gset_eq:NN \g_@@_notes_caption_int \c@tabularnote
664     \int_gzero:N \c@tabularnote
665   }
666   { \seq_gput_right:Nn \g_@@_notes_in_caption_seq { { #1 } { #2 } } }
667 }

```

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!

```

668 \tl_if_novalue:nT { #1 } { \int_gincr:N \c@tabularnote }
669 \seq_put_right:Ne \l_@@_notes_labels_seq
670 {
671   \tl_if_novalue:nTF { #1 }
672   { \@@_notes_format:n { \int_use:N \c@tabularnote } }
673   { #1 }
674 }
675 \peek_meaning:NF \tabularnote
676 {
677   \@@_notes_label_in_tabular:n
678   { \seq_use:Nnnn \l_@@_notes_labels_seq { , } { , } { , } }
679   \seq_clear:N \l_@@_notes_labels_seq
680 }
681 }

682 \cs_new_protected:Npn \@@_count_novalue_first:nn #1 #2
683 { \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.

```

684 \cs_new_protected:Npn \@@_pgf_rect_node:nnnn #1 #2 #3 #4 #5
685 {
686   \begin{pgfscope}
687   \pgfset
688   {
689     inner~sep = \c_zero_dim ,
690     minimum~size = \c_zero_dim
691   }
692   \pgftransformshift { \pgfpoint { 0.5 * ( #2 + #4 ) } { 0.5 * ( #3 + #5 ) } }
693   \pgfnode
694   {
695     rectangle
696     center
697   }
698   \vbox_to_ht:nn
699   {
700     \dim_abs:n { #5 - #3 }
701     \vfill
702     \hbox_to_wd:nn { \dim_abs:n { #4 - #2 } }
703   }
704   { #1 }
705   {
706     \end{pgfscope}
707   }

```

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

```

708 \cs_new_protected:Npn \@@_pgf_rect_node:nnn #1 #2 #3
709 {

```

```

710  \begin{pgfscope}
711    \pgfset
712    {
713      inner sep = \c_zero_dim ,
714      minimum size = \c_zero_dim
715    }
716    \pgftransformshift { \pgfpointscale { 0.5 } { \pgfpointadd { #2 } { #3 } } }
717    \pgfpointdiff { #3 } { #2 }
718    \pgfgetlastxy \l_tmpa_dim \l_tmpb_dim
719    \pgfnode
720    {
721      rectangle
722      center
723    }
724    \vbox_to_ht:nn
725    {
726      \dim_abs:n \l_tmpb_dim
727      \vfill \hbox_to_wd:nn { \dim_abs:n \l_tmpa_dim } { }
728    }
729    { #1 }
730  }
731 \end{pgfscope}

```

## 7 The options

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

```

731 \tl_new:N \l_@@_caption_tl
732 \tl_new:N \l_@@_short_caption_tl
733 \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).

```
734 \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`.

```
735 \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`).

```

736 \dim_new:N \l_@@_cell_space_top_limit_dim
737 \dim_new:N \l_@@_cell_space_bottom_limit_dim

```

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

```
738 \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.

```

739 \dim_new:N \l_@@_xdots_inter_dim
740 \hook_gput_code:nnn { begindocument } { . }
741   { \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).

```
742 \dim_new:N \l_@@_xdots_shorten_start_dim
743 \dim_new:N \l_@@_xdots_shorten_end_dim
744 \hook_gput_code:nnn { begindocument } { . }
745 {
746   \dim_set:Nn \l_@@_xdots_shorten_start_dim { 0.3 em }
747   \dim_set:Nn \l_@@_xdots_shorten_end_dim { 0.3 em }
748 }
```

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.

```
749 \dim_new:N \l_@@_xdots_radius_dim
750 \hook_gput_code:nnn { begindocument } { . }
751 { \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.

```
752 \tl_new:N \l_@@_xdots_line_style_tl
753 \tl_const:Nn \c_@@_standard_tl { standard }
754 \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`.

```
755 \bool_new:N \l_@@_light_syntax_bool
756 \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).

```
757 \tl_new:N \l_@@_baseline_tl
758 \tl_set:Nn \l_@@_baseline_tl { c }
```

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

```
759 \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`).

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

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

```
761 \bool_new:N \l_@@_parallelize_diags_bool
762 \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.

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

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 `\phantom` (and so the constructed matrix has exactly the same size as a matrix constructed with the classical `{matrix}` and `\ldots`, `\vdots`, etc.).

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

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

```
765 \cs_new_protected:Npn \@@_reset_arraystretch: { \def \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).

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

The following boolean corresponds to the key `create-cell-nodes` of the keyword `\CodeBefore`. When that key is used the “cell nodes” will be created before the `\CodeBefore` but, of course, they are *always* available in the main tabular and after!

```
767 \bool_new:N \g_@@_create_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.

```
768 \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”.

```
769 \bool_new:N \l_@@_medium_nodes_bool
```

```
770 \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).

```
771 \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`).

```
772 \dim_new:N \l_@@_left_margin_dim
```

```
773 \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`.

```
774 \dim_new:N \l_@@_extra_left_margin_dim
```

```
775 \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.

```
776 \tl_new:N \l_@@_end_of_row_tl
```

```
777 \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 “`:`”.

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

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

```
779 \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 function 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.

```

780 \bool_new:N \l_@@_delimiters_max_width_bool

781 \keys_define:nn { nicematrix / xdots }
782 {
783   Vbrace .bool_set:N = \l_@@_Vbrace_bool ,
784   shorten-start .code:n =
785     \hook_gput_code:nnn { begindocument } { . }
786     { \dim_set:Nn \l_@@_xdots_shorten_start_dim { #1 } } ,
787   shorten-end .code:n =
788     \hook_gput_code:nnn { begindocument } { . }
789     { \dim_set:Nn \l_@@_xdots_shorten_end_dim { #1 } } ,
790   shorten-start .value_required:n = true ,
791   shorten-end .value_required:n = true ,
792   shorten .code:n =
793     \hook_gput_code:nnn { begindocument } { . }
794     {
795       \dim_set:Nn \l_@@_xdots_shorten_start_dim { #1 }
796       \dim_set:Nn \l_@@_xdots_shorten_end_dim { #1 }
797     } ,
798   shorten .value_required:n = true ,
799   horizontal-labels .bool_set:N = \l_@@_xdots_h_labels_bool ,
800   horizontal-labels .default:n = true ,
801   horizontal-label .bool_set:N = \l_@@_xdots_h_labels_bool ,
802   horizontal-label .default:n = true ,
803   line-style .code:n =
804   {
805     \bool_lazy_or:nnTF
806     { \cs_if_exist_p:N \tikzpicture }
807     { \str_if_eq_p:nn { #1 } { standard } }
808     { \tl_set:Nn \l_@@_xdots_line_style_tl { #1 } }
809     { \@@_error:n { bad-option-for-line-style } }
810   } ,
811   line-style .value_required:n = true ,
812   color .tl_set:N = \l_@@_xdots_color_tl ,
813   color .value_required:n = true ,
814   radius .code:n =
815     \hook_gput_code:nnn { begindocument } { . }
816     { \dim_set:Nn \l_@@_xdots_radius_dim { #1 } } ,
817   radius .value_required:n = true ,
818   inter .code:n =
819     \hook_gput_code:nnn { begindocument } { . }
820     { \dim_set:Nn \l_@@_xdots_inter_dim { #1 } } ,
821   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 `~{...}`.

```

822   down .code:n = \tl_put_right:Nn \l_@@_xdots_down_tl { #1 } ,
823   up .code:n = \tl_put_right:Nn \l_@@_xdots_up_tl { #1 } ,
824   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 `\Idots`, will be caught when `\Ddots` or `\Idots` is used (during the construction of the array and not when we draw the dotted lines).

```

825   draw-first .code:n = \prg_do_nothing: ,

```

```

826     unknown .code:n = \@@_error:n { Unknown~key~for~xdots }
827 }

828 \keys_define:nn { nicematrix / rules }
829 {
830     color .tl_set:N = \l_@@_rules_color_tl ,
831     color .value_required:n = true ,
832     width .dim_set:N = \arrayrulewidth ,
833     width .value_required:n = true ,
834     unknown .code:n = \@@_error:n { Unknown~key~for~rules }
835 }

```

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

```

836 \keys_define:nn { nicematrix / Global }
837 {
838     caption-above .code:n = \@@_error_or_warning:n { caption-above-in-env } ,
839     show-cell-names .code = \@@_error_or_warning:n { show-cell-names } ,
840     color-inside .code:n = \@@_fatal:n { key~color-inside } ,
841     colortbl-like .code:n = \@@_fatal:n { key~color-inside } ,
842     ampersand-in-blocks .bool_set:N = \l_@@_amp_in_blocks_bool ,
843     ampersand-in-blocks .default:n = true ,
844     &-in-blocks .meta:n = ampersand-in-blocks ,
845     no-cell-nodes .code:n =
846         \bool_set_true:N \l_@@_no_cell_nodes_bool
847         \cs_set_protected:Npn \@@_node_cell:
848             { \set@color \box_use_drop:N \l_@@_cell_box } ,
849     no-cell-nodes .value_forbidden:n = true ,
850     rounded-corners .dim_set:N = \l_@@_tab_rounded_corners_dim ,
851     rounded-corners .default:n = 4 pt ,
852     custom-line .code:n = \@@_custom_line:n { #1 } ,
853     rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
854     rules .value_required:n = true ,
855     standard-cline .bool_set:N = \l_@@_standard_cline_bool ,
856     standard-cline .default:n = true ,
857     cell-space-top-limit .dim_set:N = \l_@@_cell_space_top_limit_dim ,
858     cell-space-top-limit .value_required:n = true ,
859     cell-space-bottom-limit .dim_set:N = \l_@@_cell_space_bottom_limit_dim ,
860     cell-space-bottom-limit .value_required:n = true ,
861     cell-space-limits .meta:n =
862         {
863             cell-space-top-limit = #1 ,
864             cell-space-bottom-limit = #1 ,
865         } ,
866     cell-space-limits .value_required:n = true ,
867     xdots .code:n = \keys_set:nn { nicematrix / xdots } { #1 } ,
868     light-syntax .code:n =
869         \bool_set_true:N \l_@@_light_syntax_bool
870         \bool_set_false:N \l_@@_light_syntax_expanded_bool ,
871     light-syntax .value_forbidden:n = true ,
872     light-syntax-expanded .code:n =
873         \bool_set_true:N \l_@@_light_syntax_bool
874         \bool_set_true:N \l_@@_light_syntax_expanded_bool ,
875     light-syntax-expanded .value_forbidden:n = true ,
876     end-of-row .tl_set:N = \l_@@_end_of_row_tl ,
877     end-of-row .value_required:n = true ,
878     first-col .code:n = \int_zero:N \l_@@_first_col_int ,
879     first-row .code:n = \int_zero:N \l_@@_first_row_int ,
880     last-row .int_set:N = \l_@@_last_row_int ,
881     last-row .default:n = -1 ,
882     code-for-first-col .tl_set:N = \l_@@_code_for_first_col_tl ,
883     code-for-first-col .value_required:n = true ,

```

```

884 code-for-last-col .tl_set:N = \l_@@_code_for_last_col_tl ,
885 code-for-last-col .value_required:n = true ,
886 code-for-first-row .tl_set:N = \l_@@_code_for_first_row_tl ,
887 code-for-first-row .value_required:n = true ,
888 code-for-last-row .tl_set:N = \l_@@_code_for_last_row_tl ,
889 code-for-last-row .value_required:n = true ,
890 hlines .clist_set:N = \l_@@_hlines_clist ,
891 vlines .clist_set:N = \l_@@_vlines_clist ,
892 hlines .default:n = all ,
893 vlines .default:n = all ,
894 vlines-in-sub-matrix .code:n =
895 {
896     \tl_if_single_token:nTF { #1 }
897     {
898         \tl_if_in:NnTF \c_@@_forbidden_letters_tl { #1 }
899         { \@@_error:nn { Forbidden-letter } { #1 } }

```

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

```

900     { \cs_set_eq:cN { @@_ #1 : } \@@_make_preamble_vlism:n }
901     }
902     { \@@_error:n { One-letter~allowed } }
903     } ,
904 vlines-in-sub-matrix .value_required:n = true ,
905 hvlines .code:n =
906 {
907     \bool_set_true:N \l_@@_hvlines_bool
908     \tl_set_eq:NN \l_@@_vlines_clist \c_@@_all_tl
909     \tl_set_eq:NN \l_@@_hlines_clist \c_@@_all_tl
910     } ,
911 hvlines .value_forbidden:n = true ,
912 hvlines-except-borders .code:n =
913 {
914     \tl_set_eq:NN \l_@@_vlines_clist \c_@@_all_tl
915     \tl_set_eq:NN \l_@@_hlines_clist \c_@@_all_tl
916     \bool_set_true:N \l_@@_hvlines_bool
917     \bool_set_true:N \l_@@_except_borders_bool
918     } ,
919 hvlines-except-borders .value_forbidden:n = true ,
920 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.

```

921 renew-dots .bool_set:N = \l_@@_renew_dots_bool ,
922 renew-dots .value_forbidden:n = true ,
923 nullify-dots .bool_set:N = \l_@@_nullify_dots_bool ,
924 create-medium-nodes .bool_set:N = \l_@@_medium_nodes_bool ,
925 create-large-nodes .bool_set:N = \l_@@_large_nodes_bool ,
926 create-extra-nodes .meta:n =
927     { create-medium-nodes , create-large-nodes } ,
928 left-margin .dim_set:N = \l_@@_left_margin_dim ,
929 left-margin .default:n = \arraycolsep ,
930 right-margin .dim_set:N = \l_@@_right_margin_dim ,
931 right-margin .default:n = \arraycolsep ,
932 margin .meta:n = { left-margin = #1 , right-margin = #1 } ,
933 margin .default:n = \arraycolsep ,
934 extra-left-margin .dim_set:N = \l_@@_extra_left_margin_dim ,
935 extra-right-margin .dim_set:N = \l_@@_extra_right_margin_dim ,
936 extra-margin .meta:n =
937     { extra-left-margin = #1 , extra-right-margin = #1 } ,
938 extra-margin .value_required:n = true ,
939 respect-arraystretch .code:n =
940     \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,
941 respect-arraystretch .value_forbidden:n = true ,

```

```

942     pgf-node-code .tl_set:N = \l_@@_pgf_node_code_tl ,
943     pgf-node-code .value_required:n = true
944 }

```

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

```

945 \keys_define:nn { nicematrix / environments }
946 {
947     corners .clist_set:N = \l_@@_corners_clist ,
948     corners .default:n = { NW , SW , NE , SE } ,
949     code-before .code:n =
950     {
951         \tl_if_empty:nF { #1 }
952         {
953             \tl_gput_left:Nn \g_@@_pre_code_before_tl { #1 }
954             \bool_set_true:N \l_@@_code_before_bool
955         }
956     },
957     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}`.

```

958     c .code:n = \tl_set:Nn \l_@@_baseline_tl c ,
959     t .code:n = \tl_set:Nn \l_@@_baseline_tl t ,
960     b .code:n = \tl_set:Nn \l_@@_baseline_tl b ,
961     baseline .tl_set:N = \l_@@_baseline_tl ,
962     baseline .value_required:n = true ,
963     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)`.

```

964     \str_if_eq:eeTF { #1 } { auto }
965         { \bool_set_true:N \l_@@_auto_columns_width_bool }
966         { \dim_set:Nn \l_@@_columns_width_dim { #1 } },
967     columns-width .value_required:n = true ,
968     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.

```

969     \legacy_if:nF { measuring@ }
970     {
971         \str_set:Ne \l_@@_name_str { #1 }
972         \clist_if_in:NnoTF \g_@@_names_clist \l_@@_name_str
973         { \@@_err_duplicate_names:n { #1 } }
974         { \clist_gpush:No \g_@@_names_clist \l_@@_name_str }
975     },
976     name .value_required:n = true ,
977     code-after .tl_gset:N = \g_nicematrix_code_after_tl ,
978     code-after .value_required:n = true ,
979 }
980 \cs_set:Npn \@@_err_duplicate_names:n
981 { \@@_error:nn { Duplicate-name } { #1 } }
982 \keys_define:nn { nicematrix / notes }
983 {
984     para .bool_set:N = \l_@@_notes_para_bool ,
985     para .default:n = true ,
986     code-before .tl_set:N = \l_@@_notes_code_before_tl ,
987     code-before .value_required:n = true ,
988     code-after .tl_set:N = \l_@@_notes_code_after_tl ,
989     code-after .value_required:n = true ,
990     bottomrule .bool_set:N = \l_@@_notes_bottomrule_bool ,
991     bottomrule .default:n = true ,

```

```

992 style .cs_set:Np = \@@_notes_style:n #1 ,
993 style .value_required:n = true ,
994 label-in-tabular .cs_set:Np = \@@_notes_label_in_tabular:n #1 ,
995 label-in-tabular .value_required:n = true ,
996 label-in-list .cs_set:Np = \@@_notes_label_in_list:n #1 ,
997 label-in-list .value_required:n = true ,
998 enumitem-keys .code:n =
999 {
1000     \hook_gput_code:nnn { begindocument } { . }
1001     {
1002         \IfPackageLoadedT { enumitem }
1003         { \setlist* [ tabularnotes ] { #1 } }
1004     }
1005 },
1006 enumitem-keys .value_required:n = true ,
1007 enumitem-keys-para .code:n =
1008 {
1009     \hook_gput_code:nnn { begindocument } { . }
1010     {
1011         \IfPackageLoadedT { enumitem }
1012         { \setlist* [ tabularnotes* ] { #1 } }
1013     }
1014 },
1015 enumitem-keys-para .value_required:n = true ,
1016 detect-duplicates .bool_set:N = \l_@@_notes_detect_duplicates_bool ,
1017 detect-duplicates .default:n = true ,
1018 unknown .code:n = \@@_error:n { Unknown-key-for-notes }
1019 }

1020 \keys_define:nn { nicematrix / delimiters }
1021 {
1022     max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1023     max-width .default:n = true ,
1024     color .tl_set:N = \l_@@_delimiters_color_tl ,
1025     color .value_required:n = true ,
1026 }

```

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

```

1027 \keys_define:nn { nicematrix }
1028 {
1029     NiceMatrixOptions .inherit:n =
1030     { nicematrix / Global } ,
1031     NiceMatrixOptions / xdots .inherit:n = nicematrix / xdots ,
1032     NiceMatrixOptions / rules .inherit:n = nicematrix / rules ,
1033     NiceMatrixOptions / notes .inherit:n = nicematrix / notes ,
1034     NiceMatrixOptions / sub-matrix .inherit:n = nicematrix / sub-matrix ,
1035     SubMatrix / rules .inherit:n = nicematrix / rules ,
1036     CodeAfter / xdots .inherit:n = nicematrix / xdots ,
1037     CodeBefore / sub-matrix .inherit:n = nicematrix / sub-matrix ,
1038     CodeAfter / sub-matrix .inherit:n = nicematrix / sub-matrix ,
1039     NiceMatrix .inherit:n =
1040     {
1041         nicematrix / Global ,
1042         nicematrix / environments ,
1043     },
1044     NiceMatrix / xdots .inherit:n = nicematrix / xdots ,
1045     NiceMatrix / rules .inherit:n = nicematrix / rules ,
1046     NiceTabular .inherit:n =
1047     {
1048         nicematrix / Global ,
1049         nicematrix / environments
1050     },

```

```

1051 NiceTabular / xdots .inherit:n = nicematrix / xdots ,
1052 NiceTabular / rules .inherit:n = nicematrix / rules ,
1053 NiceTabular / notes .inherit:n = nicematrix / notes ,
1054 NiceArray .inherit:n =
1055 {
1056     nicematrix / Global ,
1057     nicematrix / environments ,
1058 },
1059 NiceArray / xdots .inherit:n = nicematrix / xdots ,
1060 NiceArray / rules .inherit:n = nicematrix / rules ,
1061 pNiceArray .inherit:n =
1062 {
1063     nicematrix / Global ,
1064     nicematrix / environments ,
1065 },
1066 pNiceArray / xdots .inherit:n = nicematrix / xdots ,
1067 pNiceArray / rules .inherit:n = nicematrix / rules ,
1068 }

```

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

```

1069 \keys_define:nn { nicematrix / NiceMatrixOptions }
1070 {
1071     delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1072     delimiters / color .value_required:n = true ,
1073     delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1074     delimiters / max-width .default:n = true ,
1075     delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
1076     delimiters .value_required:n = true ,
1077     width .dim_set:N = \l_@@_width_dim ,
1078     width .value_required:n = true ,
1079     last-col .code:n =
1080         \tl_if_empty:nF { #1 }
1081         { \@@_error:n { last-col~non~empty~for~NiceMatrixOptions } }
1082         \int_zero:N \l_@@_last_col_int ,
1083     small .bool_set:N = \l_@@_small_bool ,
1084     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.

```

1085 renew-matrix .code:n = \@@_renew_matrix: ,
1086 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}`.

```

1087 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.

```

1088 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)`.

```

1089 \str_if_eq:eeTF { #1 } { auto }
1090     { \@@_error:n { Option-auto~for~columns-width } }
1091     { \dim_set:Nn \l_@@_columns_width_dim { #1 } } ,

```

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

```

1092 allow-duplicate-names .code:n =

```

```

1093 \cs_set:Nn \@@_err_duplicate_names:n { } ,
1094 allow-duplicate-names .value_forbidden:n = true ,
1095 notes .code:n = \keys_set:nn { nicematrix / notes } { #1 } ,
1096 notes .value_required:n = true ,
1097 sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1098 sub-matrix .value_required:n = true ,
1099 matrix / columns-type .tl_set:N = \l_@@_columns_type_tl ,
1100 matrix / columns-type .value_required:n = true ,
1101 caption-above .bool_set:N = \l_@@_caption_above_bool ,
1102 caption-above .default:n = true ,
1103 unknown .code:n = \@@_error:n { Unknown-key-for-NiceMatrixOptions }
1104 }
```

`\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.

```

1105 \NewDocumentCommand \NiceMatrixOptions { m }
1106 { \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.

```

1107 \keys_define:nn { nicematrix / NiceMatrix }
1108 {
1109     last-col .code:n = \tl_if_empty:nTF { #1 }
1110         {
1111             \bool_set_true:N \l_@@_last_col_without_value_bool
1112             \int_set:Nn \l_@@_last_col_int { -1 }
1113         }
1114         { \int_set:Nn \l_@@_last_col_int { #1 } } ,
1115     columns-type .tl_set:N = \l_@@_columns_type_tl ,
1116     columns-type .value_required:n = true ,
1117     l .meta:n = { columns-type = 1 } ,
1118     r .meta:n = { columns-type = r } ,
1119     delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1120     delimiters / color .value_required:n = true ,
1121     delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1122     delimiters / max-width .default:n = true ,
1123     delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
1124     delimiters .value_required:n = true ,
1125     small .bool_set:N = \l_@@_small_bool ,
1126     small .value_forbidden:n = true ,
1127     unknown .code:n = \@@_error:n { Unknown-key-for-NiceMatrix }
1128 }
```

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

```

1129 \keys_define:nn { nicematrix / NiceArray }
1130 {
```

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.

```

1131     small .bool_set:N = \l_@@_small_bool ,
1132     small .value_forbidden:n = true ,
1133     last-col .code:n = \tl_if_empty:nF { #1 }
1134         { \@@_error:n { last-col-non-empty-for-NiceArray } }
1135         \int_zero:N \l_@@_last_col_int ,
1136     r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1137     l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1138     unknown .code:n = \@@_error:n { Unknown-key-for-NiceArray }
1139 }
```

```

1140 \keys_define:nn { nicematrix / pNiceArray }
1141 {
1142   first-col .code:n = \int_zero:N \l_@@_first_col_int ,
1143   last-col .code:n = \tl_if_empty:nF { #1 }
1144     { \@@_error:n { last-col-non-empty-for-NiceArray } }
1145     \int_zero:N \l_@@_last_col_int ,
1146   first-row .code:n = \int_zero:N \l_@@_first_row_int ,
1147   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1148   delimiters / color .value_required:n = true ,
1149   delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
1150   delimiters / max-width .default:n = true ,
1151   delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
1152   delimiters .value_required:n = true ,
1153   small .bool_set:N = \l_@@_small_bool ,
1154   small .value_forbidden:n = true ,
1155   r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1156   l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1157   unknown .code:n = \@@_error:n { Unknown-key-for-NiceMatrix }
1158 }

```

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

```

1159 \keys_define:nn { nicematrix / NiceTabular }
1160 {

```

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.

```

1161   width .code:n = \dim_set:Nn \l_@@_width_dim { #1 }
1162     \bool_set_true:N \l_@@_width_used_bool ,
1163   width .value_required:n = true ,
1164   notes .code:n = \keys_set:nn { nicematrix / notes } { #1 } ,
1165   tabularnote .tl_gset:N = \g_@@_tabularnote_tl ,
1166   tabularnote .value_required:n = true ,
1167   caption .tl_set:N = \l_@@_caption_tl ,
1168   caption .value_required:n = true ,
1169   short-caption .tl_set:N = \l_@@_short_caption_tl ,
1170   short-caption .value_required:n = true ,
1171   label .tl_set:N = \l_@@_label_tl ,
1172   label .value_required:n = true ,
1173   last-col .code:n = \tl_if_empty:nF { #1 }
1174     { \@@_error:n { last-col-non-empty-for-NiceArray } }
1175     \int_zero:N \l_@@_last_col_int ,
1176   r .code:n = \@@_error:n { r-or-l-with-preamble } ,
1177   l .code:n = \@@_error:n { r-or-l-with-preamble } ,
1178   unknown .code:n = \@@_error:n { Unknown-key-for-NiceTabular }
1179 }

```

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
```

```

1180 \keys_define:nn { nicematrix / CodeAfter }
1181 {
1182   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1183   delimiters / color .value_required:n = true ,
1184   rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
1185   rules .value_required:n = true ,
1186   xdots .code:n = \keys_set:nn { nicematrix / xdots } { #1 } ,
1187   sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1188   sub-matrix .value_required:n = true ,

```

```

1189     unknown .code:n = \@@_error:n { Unknown~key~for~CodeAfter }
1190 }

```

## 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}`).

```

1191 \cs_new_protected:Npn \@@_cell_begin:
1192 {

```

`\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.

```

1193 \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).

```

1194 \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:

```

The following link only to have a better error message when `\Hline` is used in another place than the beginning of a line.

```

1195 \cs_set_eq:NN \Hline \@@_Hline_in_cell:

```

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

```

1196 \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.

```

1197 \int_compare:nNnT { \c@jCol } = { \c_one_int }
1198 {
1199   \int_compare:nNnT { \l_@@_first_col_int } = { \c_one_int }
1200   { \@@_begin_of_row: }
1201 }

```

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:`.

```

1202 \hbox_set:Nw \l_@@_cell_box

```

The following command is nullified in the tabulars.

```

1203 \@@_tuning_not_tabular_begin:
1204 \@@_tuning_first_row:
1205 \@@_tuning_last_row:
1206 \g_@@_row_style_tl
1207 }

```

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_if_zero:nF { \c@jCol }
    {
      \l_@@_code_for_first_row_tl
      \xglobal \colorlet { nicematrix-first-row } { . }
    }
  }
}

```

We will use a version a little more efficient.

```

1208 \cs_new_protected:Npn \@@_tuning_first_row:
1209 {
1210   \if_int_compare:w \c@iRow = \c_zero_int
1211     \if_int_compare:w \c@jCol > \c_zero_int
1212       \l_@@_code_for_first_row_tl
1213       \xglobal \colorlet{nicematrix-first-row}{.}
1214     \fi:
1215   \fi:
1216 }

```

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.

```

1217 \cs_new_protected:Npn \@@_tuning_last_row:
1218 {
1219   \if_int_compare:w \c@iRow = \l_@@_last_row_int
1220     \l_@@_code_for_last_row_tl
1221     \xglobal \colorlet{nicematrix-last-row}{.}
1222   \fi:
1223 }

```

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

```
1224 \cs_set_eq:NN \@@_tuning_key_small: \prg_do_nothing:
```

The following commands are nullified in the tabulars.

```

1225 \cs_set_nopar:Npn \@@_tuning_not_tabular_begin:
1226 {
1227   \m@th
1228   $ % $

```

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

```

1229   \@@_tuning_key_small:
1230 }
1231 \cs_set:Nn \@@_tuning_not_tabular_end: { $ } % $

```

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.

```

1232 \cs_new_protected:Npn \@@_begin_of_row:
1233 {
1234   \int_gincr:N \c@iRow
1235   \dim_gset_eq:NN \g_@@_dp_ante_last_row_dim \g_@@_dp_last_row_dim
1236   \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \carstrutbox }
1237   \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \carstrutbox }
1238   \pgfpicture
1239   \pgfrememberpicturepositiononpagetrue
1240   \pgfcoordinate
1241     { \@@_env: - row - \int_use:N \c@iRow - base }
1242     { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
1243   \str_if_empty:NF \l_@@_name_str
1244   {
1245     \pgfnodealias
1246       { \l_@@_name_str - row - \int_use:N \c@iRow - base }

```

```

1247      { \@@_env: - row - \int_use:N \c@iRow - base }
1248    }
1249  \endpgfpicture
1250 }

```

Remark: If the key `create-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 information 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.

```

1251 \cs_new_protected:Npn \@@_update_for_first_and_last_row:
1252 {
1253   \int_if_zero:nTF { \c@iRow }
1254   {
1255     \dim_compare:nNnT
1256     { \box_dp:N \l_@@_cell_box } > { \g_@@_dp_row_zero_dim }
1257     { \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \l_@@_cell_box } }
1258     \dim_compare:nNnT
1259     { \box_ht:N \l_@@_cell_box } > { \g_@@_ht_row_zero_dim }
1260     { \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \l_@@_cell_box } }
1261   }
1262   {
1263     \int_compare:nNnT { \c@iRow } = { \c_one_int }
1264     {
1265       \dim_compare:nNnT
1266       { \box_ht:N \l_@@_cell_box } > { \g_@@_ht_row_one_dim }
1267       { \dim_gset:Nn \g_@@_ht_row_one_dim { \box_ht:N \l_@@_cell_box } }
1268     }
1269   }
1270 }
1271 \cs_new_protected:Npn \@@_rotate_cell_box:
1272 {
1273   \box_rotate:Nn \l_@@_cell_box { 90 }
1274   \bool_if:NTF \g_@@_rotate_c_bool
1275   {
1276     \hbox_set:Nn \l_@@_cell_box
1277     {
1278       \m@th
1279       $ % $
1280       \vcenter { \box_use:N \l_@@_cell_box }
1281       $ % $
1282     }
1283   }
1284   {
1285     \int_compare:nNnT { \c@iRow } = { \l_@@_last_row_int }
1286     {
1287       \vbox_set_top:Nn \l_@@_cell_box
1288       {
1289         \vbox_to_zero:n { }
1290         \skip_vertical:n { - \box_ht:N \carstrutbox + 0.8 ex }
1291         \box_use:N \l_@@_cell_box
1292       }
1293     }
1294   }
1295   \bool_gset_false:N \g_@@_rotate_bool
1296   \bool_gset_false:N \g_@@_rotate_c_bool
1297 }
1298 \cs_new_protected:Npn \@@_adjust_size_box:
1299 {
1300   \dim_compare:nNnT { \g_@@_blocks_wd_dim } > { \c_zero_dim }
1301   {

```

```

1302     \box_set_wd:Nn \l_@@_cell_box
1303         { \dim_max:nn { \box_wd:N \l_@@_cell_box } { \g_@@_blocks_wd_dim } }
1304         \dim_gzero:N \g_@@_blocks_wd_dim
1305     }
1306     \dim_compare:nNnT { \g_@@_blocks_dp_dim } > { \c_zero_dim }
1307     {
1308         \box_set_dp:Nn \l_@@_cell_box
1309             { \dim_max:nn { \box_dp:N \l_@@_cell_box } { \g_@@_blocks_dp_dim } }
1310             \dim_gzero:N \g_@@_blocks_dp_dim
1311     }
1312     \dim_compare:nNnT { \g_@@_blocks_ht_dim } > { \c_zero_dim }
1313     {
1314         \box_set_ht:Nn \l_@@_cell_box
1315             { \dim_max:nn { \box_ht:N \l_@@_cell_box } { \g_@@_blocks_ht_dim } }
1316             \dim_gzero:N \g_@@_blocks_ht_dim
1317     }
1318 }
1319 \cs_new_protected:Npn \@@_cell_end:
1320 {

```

The following command is nullified in the tabulars.

```

1321     \@@_tuning_not_tabular_end:
1322     \hbox_set_end:
1323     \@@_cell_end_i:
1324 }
1325 \cs_new_protected:Npn \@@_cell_end_i:
1326 {

```

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.

```

1327     \g_@@_cell_after_hook_tl
1328     \bool_if:NT \g_@@_rotate_bool { \@@_rotate_cell_box: }
1329     \@@_adjust_size_box:
1330     \box_set_ht:Nn \l_@@_cell_box
1331         { \box_ht:N \l_@@_cell_box + \l_@@_cell_space_top_limit_dim }
1332     \box_set_dp:Nn \l_@@_cell_box
1333         { \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”).

```
1334     \@@_update_max_cell_width:
```

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

```
1335     \@@_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 technique:

- 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.

```

1336   \bool_if:NTF \g_@@_empty_cell_bool
1337     { \box_use_drop:N \l_@@_cell_box }
1338   {
1339     \bool_if:NTF \g_@@_not_empty_cell_bool
1340       { \@@_print_node_cell: }
1341       {
1342         \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > { \c_zero_dim }
1343           { \@@_print_node_cell: }
1344           { \box_use_drop:N \l_@@_cell_box }
1345       }
1346     }
1347   \int_compare:nNnT { \c@jCol } > { \g_@@_col_total_int }
1348     { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
1349   \bool_gset_false:N \g_@@_empty_cell_bool
1350   \bool_gset_false:N \g_@@_not_empty_cell_bool
1351 }
```

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

```

1352 \cs_new_protected:Npn \@@_update_max_cell_width:
1353   {
1354     \dim_gset:Nn \g_@@_max_cell_width_dim
1355       { \dim_max:nn { \g_@@_max_cell_width_dim } { \box_wd:N \l_@@_cell_box } }
1356 }
```

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`).

```

1357 \cs_new_protected:Npn \@@_cell_end_for_w_s:
1358   {
1359     \@@_math_toggle:
1360     \hbox_set_end:
1361     \bool_if:NF \g_@@_rotate_bool
1362     {
1363       \hbox_set:Nn \l_@@_cell_box
1364       {
1365         \makebox [ \l_@@_col_width_dim ] [ s ]
1366           { \hbox_unpack_drop:N \l_@@_cell_box }
1367       }
1368     }
1369     \@@_cell_end_i:
1370   }

1371 \pgfset
1372   {
1373     nicematrix / cell-node /.style =
1374     {
1375       inner sep = \c_zero_dim ,
1376       minimum width = \c_zero_dim
1377     }
1378 }
```

In the cells of a column of type `S` (of `siunitx`), we have to wrap the command `\@@_node_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.

```

1379 \socket_new:nn { nicematrix / siunitx-wrap } { 1 }
1380 \socket_new_plug:nnn { nicematrix / siunitx-wrap } { active }
1381 {
1382   \use:c
1383   {
1384     __siunitx_table_align_
1385     \bool_if:NTF \l__siunitx_table_text_bool
1386       { \l__siunitx_table_align_text_tl }
1387       { \l__siunitx_table_align_number_tl }
1388     :n
1389   }
1390   { #1 }
1391 }
```

Now, a socket which deal with `create-cell-nodes` of the keyword `\CodeBefore`. When that key is used the “cell nodes” will be created before the `\CodeBefore` but, of course, they are *always* available in the main tabular and after!

```

1392 \socket_new:nn { nicematrix / create-cell-nodes } { 1 }
1393 \socket_new_plug:nnn { nicematrix / create-cell-nodes } { active }
1394 {
1395   \box_move_up:nn { \box_ht:N \l_@@_cell_box }
1396   \hbox:n
1397   {
1398     \pgf@sys@markposition
1399     { \c@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol - NW }
1400   }
1401 #1
1402   \box_move_down:nn { \box_dp:N \l_@@_cell_box }
1403   \hbox:n
1404   {
1405     \pgf@sys@markposition
1406     { \c@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol - SE }
1407   }
1408 }
```

  

```

1409 \cs_new_protected:Npn \@@_print_node_cell:
1410 {
1411   \socket_use:nn { nicematrix / siunitx-wrap }
1412   { \socket_use:nn { nicematrix / create-cell-nodes } { \@@_node_cell: } }
1413 }
```

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

```

1414 \cs_new_protected:Npn \@@_node_cell:
1415 {
1416   \pgfpicture
1417   \pgfsetbaseline \c_zero_dim
1418   \pgfrememberpicturepositiononpagetrue
1419   \pgfset { nicematrix / cell-node }
1420   \pgfnode
1421     { rectangle }
1422     { base }
1423 }
```

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

```

1424   \sys_if_engine_xetex:T { \set@color }
1425   \box_use:N \l_@@_cell_box
1426 }
1427 { \c@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1428 { \l_@@_pgf_node_code_tl }
```

```

1429   \str_if_empty:NF \l_@@_name_str
1430   {
1431     \pgfnodealias
1432       { \l_@@_name_str - \int_use:N \c@iRow - \int_use:N \c@jCol }
1433       { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1434   }
1435   \endpgfpicture
1436 }

```

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}

```

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

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).

```

1437 \cs_new_protected:Npn \@@_instruction_of_type:nnn #1 #2 #3
1438 {
1439   \bool_if:NTF { #1 } { \tl_gput_left:ce } { \tl_gput_right:ce }
1440   { g_@@_#2 _ lines _ tl }
1441   {
1442     \use:c { @@ _ draw _ #2 : nnn }
1443     { \int_use:N \c@iRow }
1444     { \int_use:N \c@jCol }
1445     { \exp_not:n { #3 } }
1446   }
1447 }

1448 \cs_new_protected:Npn \@@_array:n
1449 {
1450   \dim_set:Nn \col@sep
1451   { \bool_if:NTF \l_@@_tabular_bool { \tabcolsep } { \arraycolsep } }
1452   \dim_compare:nNnTF { \l_@@_tabular_width_dim } = { \c_zero_dim }
1453   { \def \halignto { } }
1454   { \cs_set_nopar:Npe \halignto { to \dim_use:N \l_@@_tabular_width_dim } }

```

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

```

1455   \@tabarray
1456   \l_@@_baseline_tl may have the value t, c or b. However, if the value is b, we compose
1457   the \array (of array) with the option t and the right translation will be done further. Remark
1458   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).
1456   [ \str_if_eq:eeTF { \l_@@_baseline_tl } { c } { c } { t } ]
1457   }
1458 \cs_generate_variant:Nn \@@_array:n { o }

```

We keep in memory the standard version of `\ar@ialign` because we will redefine `\ialign` in the environment `{NiceArrayWithDelims}` but restore the standard version for use in the cells of the array. However, it seems that RevTeX goes on with a redefinition of `array` which uses `\ialign`.

```
1459 \bool_if:NTF \c_@@_revtex_bool
1460   { \cs_set_eq:NN \c_@@_old_ialign: \ialign }
```

We use here a `\cs_set_eq:cN` instead of a `\cs_set_eq:NN` in order to avoid a message when `explcheck` is used on `nicematrix.sty`.

```
1461   { \cs_set_eq:cN { \c_@@_old_ar@ialign: } \ar@ialign }
```

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

```
1462 \cs_new_protected:Npn \c_@@_create_row_node:
1463 {
1464   \int_compare:nNnT { \c@iRow } > { \g_@@_last_row_node_int }
1465   {
1466     \int_gset_eq:NN \g_@@_last_row_node_int \c@iRow
1467     \c_@@_create_row_node_i:
1468   }
1469 }
1470 \cs_new_protected:Npn \c_@@_create_row_node_i:
1471 {
```

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

```
1472 \hbox
1473 {
1474   \bool_if:NT \l_@@_code_before_bool
1475   {
1476     \vtop
1477     {
1478       \skip_vertical:N 0.5\arrayrulewidth
1479       \pgfsys@markposition
1480       { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1481       \skip_vertical:N -0.5\arrayrulewidth
1482     }
1483   }
1484   \pgfpicture
1485   \pgfrememberpicturepositiononpagetrue
1486   \pgfcoordinate { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1487   { \pgfpoint \c_zero_dim { - 0.5 \arrayrulewidth } }
1488   \str_if_empty:NF \l_@@_name_str
1489   {
1490     \pgfnodealias
1491     { \l_@@_name_str - row - \int_eval:n { \c@iRow + 1 } }
1492     { \@@_env: - row - \int_eval:n { \c@iRow + 1 } }
1493   }
1494   \endpgfpicture
1495 }
```

```
1497 \cs_new_protected:Npn \c_@@_in_everycr:
1498 {
1499   \tbl_if_row_was_started:T { \UseTaggingSocket { \tbl / row / end } }
1500   \tbl_update_cell_data_for_next_row:
1501   \int_gzero:N \c@jCol
1502   \bool_gset_false:N \g_@@_after_col_zero_bool
1503   \bool_if:NF \g_@@_row_of_col_done_bool
1504   {
1505     \c_@@_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).

```
1506 \clist_if_empty:NF \l_@@_hlines_clist
1507 {
```

```

1508     \str_if_eq:eeF { \l_@@_hlines_clist } { all }
1509     {
1510         \clist_if_in:NeT
1511         \l_@@_hlines_clist
1512         { \int_eval:n { \c@iRow + 1 } }
1513     }
1514 
```

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.

```

1515     \int_compare:nNnT { \c@iRow } > { -1 }
1516     {
1517         \int_compare:nNnF { \c@iRow } = { \l_@@_last_row_int }
1518         { \hrule height \arrayrulewidth width \c_zero_dim }
1519     }
1520 }
1521 }
1522 }
1523 
```

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

```

1524 \cs_set_protected:Npn \@@_renew_dots:
1525 {
1526     \cs_set_eq:NN \ldots \@@_Ldots:
1527     \cs_set_eq:NN \cdots \@@_Cdots:
1528     \cs_set_eq:NN \vdots \@@_Vdots:
1529     \cs_set_eq:NN \ddots \@@_Ddots:
1530     \cs_set_eq:NN \iddots \@@_Iddots:
1531     \cs_set_eq:NN \dots \@@_Ldots:
1532     \cs_set_eq:NN \hdotsfor \@@_Hdotsfor:
1533 }
```

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<sup>5</sup>.

```

1534 \hook_gput_code:nnn { begindocument } { . }
1535 {
1536     \IfPackageLoadedTF { booktabs }
1537     {
1538         \cs_new_protected:Npn \@@_patch_booktabs:
1539         { \tl_put_left:Nn \@BTnormal \@@_create_row_node_i: }
1540     }
1541     { \cs_new_protected:Npn \@@_patch_booktabs: { } }
1542 }
```

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`<sup>6</sup> 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`.

```

1543 \cs_new_protected:Npn \@@_some_INITIALIZATION:
1544 {
```

---

<sup>5</sup>cf. `\nicematrix@redefine@check@rerun`

<sup>6</sup>The option `small` of `nicematrix` changes (among others) the value of `\arraystretch`. This is done, of course, before the call of `{array}`.

```

1545 \@@_everycr:
1546 \dim_gset:Nn \g_@@_dp_row_zero_dim { \box_dp:N \arstrutbox }
1547 \dim_gset:Nn \g_@@_ht_row_zero_dim { \box_ht:N \arstrutbox }
1548 \dim_gset_eq:NN \g_@@_ht_row_one_dim \g_@@_ht_row_zero_dim
1549 \dim_gzero:N \g_@@_dp_ante_last_row_dim
1550 \dim_gset:Nn \g_@@_ht_last_row_dim { \box_ht:N \arstrutbox }
1551 \dim_gset:Nn \g_@@_dp_last_row_dim { \box_dp:N \arstrutbox }
1552 }

```

\@@\_pre\_array\_after\_CodeBefore: will be executed in \@@\_pre\_array: *after* the execution of the \CodeBefore. It contains all the code before the beginning of the construction of \l\_@@\_the\_array\_box.

```

1553 \cs_new_protected:Npn \@@_pre_array_after_CodeBefore:
1554 {

```

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.

```

1555 \seq_gset_eq:NN \g_@@_pos_of_blocks_seq \g_@@_future_pos_of_blocks_seq
1556 \seq_gclear:N \g_@@_future_pos_of_blocks_seq

```

Idem for other sequences written on the aux file.

```

1557 \seq_gclear_new:N \g_@@_multicolumn_cells_seq
1558 \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.

```

1559 \int_gset:Nn \g_@@_last_row_node_int { -2 }

```

The value  $-2$  is important.

The total weight of the letters X in the preamble of the array.

```

1560 \fp_gzero:N \g_@@_total_X_weight_fp
1561 \bool_gset_false:N \g_@@_V_of_X_bool
1562 \@@_expand_clist_hvlines:NN \l_@@_hlines_clist \c@iRow
1563 \@@_expand_clist_hvlines:NN \l_@@_vlines_clist \c@jCol
1564 \@@_patch_booktabs:
1565 \box_clear_new:N \l_@@_cell_box
1566 \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{}).

```

1567 \bool_if:NT \l_@@_small_bool
1568 {
1569     \def \arraystretch { 0.47 }
1570     \dim_set:Nn \arraycolsep { 1.45 pt }

```

By default, \@@\_tuning\_key\_small: is no-op.

```

1571 \cs_set_eq:NN \@@_tuning_key_small: \scriptstyle
1572 }

```

The boolean `\g_@@_create_cell_nodes_bool` corresponds to the key `create-cell-nodes` of the keyword `\CodeBefore`. When that key is used the “cell nodes” will be created before the `\CodeBefore` but, of course, they are *always* available in the main tabular and after!

```

1573     \bool_if:NT \g_@@_create_cell_nodes_bool
1574     {
1575         \tl_put_right:Nn \@@_begin_of_row:
1576         {
1577             \pgfsys@markposition
1578             { \@@_env: - row - \int_use:N \c@iRow - base }
1579         }
1580         \socket_assign_plug:nn { nicematrix / create-cell-nodes } { active }
1581     }

```

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

```

1582     \bool_if:NF \c_@@_revtex_bool
1583     {
1584         \def \ar@ialign
1585         {
1586             \tbl_init_cell_data_for_table:
1587             \@@_some_initialization:
1588             \dim_zero:N \tabskip

```

After its first use, the definition of `\ar@ialign` will revert automatically to its default definition. With this programmation, we will have, in the cells of the array, a clean version of `\ar@ialign`. We use `\cs_set_eq:Nc` instead of `\cs_set_eq>NN` in order to avoid a message when `explcheck` is used on `nicematrix.sty`.

```

1589         \cs_set_eq:Nc \ar@ialign { @@_old_ar@ialign: }
1590         \halign
1591     }
1592 }

```

It seems that there is a problem when `nicematrix` is used with `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).

```

1593     \bool_if:NT \c_@@_revtex_bool
1594     {
1595         \IfPackageLoadedT { colortbl }
1596         { \cs_set_protected:Npn \CT@setup { } }
1597     }

```

We keep in memory the old versions of `\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).

```

1598     \cs_set_eq:NN \@@_old_ldots: \ldots
1599     \cs_set_eq:NN \@@_old_cdots: \cdots
1600     \cs_set_eq:NN \@@_old_vdots: \vdots
1601     \cs_set_eq:NN \@@_old_ddots: \ddots
1602     \cs_set_eq:NN \@@_old_iddots: \iddots
1603     \bool_if:NTF \l_@@_standard_cline_bool
1604         { \cs_set_eq:NN \cline \@@_standard_cline: }
1605         { \cs_set_eq:NN \cline \@@_cline: }
1606     \cs_set_eq:NN \Ldots \@@_Ldots:
1607     \cs_set_eq:NN \Cdots \@@_Cdots:
1608     \cs_set_eq:NN \Vdots \@@_Vdots:
1609     \cs_set_eq:NN \Ddots \@@_Ddots:
1610     \cs_set_eq:NN \Iddots \@@_Iddots:
1611     \cs_set_eq:NN \Hline \@@_Hline:
1612     \cs_set_eq:NN \Hspace \@@_Hspace:
1613     \cs_set_eq:NN \Hdotsfor \@@_Hdotsfor:

```

```

1614 \cs_set_eq:NN \Vdotsfor \@@_Vdotsfor:
1615 \cs_set_eq:NN \Block \@@_Block:
1616 \cs_set_eq:NN \rotate \@@_rotate:
1617 \cs_set_eq:NN \OnlyMainNiceMatrix \@@_OnlyMainNiceMatrix:n
1618 \cs_set_eq:NN \dotfill \@@_dotfill:
1619 \cs_set_eq:NN \CodeAfter \@@_CodeAfter:
1620 \cs_if_free:NT \Body { \cs_set_eq:NN \Body \@@_Body: }
1621 \cs_set_eq:NN \diagbox \@@_diagbox:nn
1622 \cs_set_eq:NN \NotEmpty \@@_NotEmpty:
1623 \cs_set_eq:NN \TopRule \@@_TopRule
1624 \cs_set_eq:NN \MidRule \@@_MidRule
1625 \cs_set_eq:NN \BottomRule \@@_BottomRule
1626 \cs_set_eq:NN \RowStyle \@@_RowStyle:n
1627 \cs_set_eq:NN \Hbrace \@@_Hbrace
1628 \cs_set_eq:NN \Vbrace \@@_Vbrace
1629 \seq_map_inline:Nn \l_@@_custom_line_commands_seq
  { \cs_set_eq:cc { ##1 } { nicematrix - ##1 } }
1630 \cs_set_eq:NN \cellcolor \@@_cellcolor_tabular
1631 \cs_set_eq:NN \rowcolor \@@_rowcolor_tabular
1632 \cs_set_eq:NN \rowcolors \@@_rowcolors_tabular
1633 \cs_set_eq:NN \rowlistcolors \@@_rowlistcolors_tabular
1634 \int_compare:nNnT { \l_@@_first_row_int } > { \c_zero_int }
  { \cs_set_eq:NN \@@_tuning_first_row: \prg_do_nothing: }
1635 \int_compare:nNnT { \l_@@_last_row_int } < { \c_zero_int }
  { \cs_set_eq:NN \@@_tuning_last_row: \prg_do_nothing: }
1636 \bool_if:NT \l_@@_renew_dots_bool { \@@_renew_dots: }
1637
1638
1639

```

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:`.

```

1640 \cs_set_eq:NN \multicolumn \@@_multicolumn:nnn
1641 \hook_gput_code:nnn { env / tabular / begin } { nicematrix }
1642   { \cs_set_eq:NN \multicolumn \@@_old_multicolumn: }
1643 \@@_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!).

```

1644 \tl_if_exist:NT \l_@@_note_in_caption_tl
1645   {
1646     \tl_if_empty:NF \l_@@_note_in_caption_tl
1647       {
1648         \int_gset:Nn \g_@@_notes_caption_int { \l_@@_note_in_caption_tl }
1649         \int_gset:Nn \c@tabularnote { \l_@@_note_in_caption_tl }
1650       }
1651   }

```

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).

```

1652 \seq_gclear:N \g_@@_multicolumn_cells_seq
1653 \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).

```

1654 \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 of rows excepted the last row (if `\l_@@_last_row_bool` has been raised with the option `last-row`).

```

1655 \int_gzero: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.

```
1656 \int_gzero:N \g_@@_col_total_int
1657 \cs_set_eq:NN \c@ifnextchar \new@ifnextchar
1658 \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.

```
1659 \tl_gclear_new:N \g_@@_Cdots_lines_tl
1660 \tl_gclear_new:N \g_@@_Ldots_lines_tl
1661 \tl_gclear_new:N \g_@@_Vdots_lines_tl
1662 \tl_gclear_new:N \g_@@_Ddots_lines_tl
1663 \tl_gclear_new:N \g_@@_Idots_lines_tl
1664 \tl_gclear_new:N \g_@@_HVdotsfor_lines_tl

1665 \tl_gclear:N \g_nicematrix_code_before_tl
1666 \tl_gclear:N \g_@@_pre_code_before_tl
```

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]`).

```
1667 \dim_zero_new:N \l_@@_left_delim_dim
1668 \dim_zero_new:N \l_@@_right_delim_dim
1669 \bool_if:NTF \g_@@_delims_bool
1670 {
```

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

```
1671 \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_left_delim_tl $ }
1672 \dim_set:Nn \l_@@_left_delim_dim { \box_wd:N \l_tmpa_box }
1673 \hbox_set:Nn \l_tmpa_box { $ \bBigg@ 5 \g_@@_right_delim_tl $ }
1674 \dim_set:Nn \l_@@_right_delim_dim { \box_wd:N \l_tmpa_box }
1675 }
1676 {
1677 \dim_gset:Nn \l_@@_left_delim_dim
1678 { 2 \bool_if:NTF \l_@@_tabular_bool { \tabcolsep } { \arraycolsep } }
1679 \dim_gset_eq:NN \l_@@_right_delim_dim \l_@@_left_delim_dim
1680 }
1681 }
```

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

The command `\@@_pre_array:` will be executed after analysis of the keys of the environment. If will, in particular, read the potential informations written on the `aux` file.

```
1682 \cs_new_protected:Npn \@@_pre_array:
1683 {
1684 \cs_if_exist:NT \theiRow { \int_set_eq:NN \l_@@_old_iRow_int \c@iRow }
1685 \int_gzero_new:N \c@iRow
1686 \cs_if_exist:NT \thejCol { \int_set_eq:NN \l_@@_old_jCol_int \c@jCol }
1687 \int_gzero_new:N \c@jCol
```

We give values to the LaTeX counters `iRow` and `jCol`. We remind that before and after the main array (in particular in the `\CodeBefore` and 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).

```
1688 \int_compare:nNnT \l_@@_last_row_int > 0
1689 { \int_set:Nn \c@iRow { \l_@@_last_row_int - 1 } }
1690 \int_compare:nNnT \l_@@_last_col_int > 0
1691 { \int_set:Nn \c@jCol { \l_@@_last_col_int - 1 } }
1692 \bool_if:NT \g_@@_aux_found_bool
1693 {
1694 \int_set:Nn \c@iRow { \seq_item:Nn \g_@@_size_seq { 2 } }
```

```

1695     \int_set:Nn \c@jCol { \seq_item:Nn \g_@@size_seq { 5 } }
1696     \int_gset:Nn \g_@@row_total_int { \seq_item:Nn \g_@@size_seq { 3 } }
1697     \int_gset:Nn \g_@@col_total_int { \seq_item:Nn \g_@@size_seq { 6 } }
1698 }

```

We recall that `\l_@@last_row_int` and `\l_@@last_col_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-col` (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).

```

1699     \int_compare:nNnT { \l_@@last_row_int } = { -1 }
1700     {
1701         \bool_set_true:N \l_@@last_row_without_value_bool
1702         \bool_if:NT \g_@@aux_found_bool
1703             { \int_set:Nn \l_@@last_row_int { \seq_item:Nn \g_@@size_seq { 3 } } }
1704     }
1705     \int_compare:nNnT { \l_@@last_col_int } = { -1 }
1706     {
1707         \bool_if:NT \g_@@aux_found_bool
1708             { \int_set:Nn \l_@@last_col_int { \seq_item:Nn \g_@@size_seq { 6 } } }
1709     }

```

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”.

```

1710     \int_compare:nNnT { \l_@@last_row_int } > { -2 }
1711     {
1712         \tl_put_right:Nn \@@update_for_first_and_last_row:
1713         {
1714             \dim_compare:nNnT { \g_@@ht_last_row_dim } < { \box_ht:N \l_@@cell_box }
1715                 { \dim_gset:Nn \g_@@ht_last_row_dim { \box_ht:N \l_@@cell_box } }
1716             \dim_compare:nNnT { \g_@@dp_last_row_dim } < { \box_dp:N \l_@@cell_box }
1717                 { \dim_gset:Nn \g_@@dp_last_row_dim { \box_dp:N \l_@@cell_box } }
1718         }
1719     }

1720     \seq_gclear:N \g_@@cols_vlism_seq
1721     \seq_gclear:N \g_@@submatrix_seq

```

Now the `\CodeBefore`.

```

1722     \bool_if:NT \l_@@code_before_bool { \@@exec_code_before: }

```

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

```

1723     \@@pre_array_after_CodeBefore:

```

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 \$ also).

```

1724     \hbox_set:Nw \l_@@the_array_box
1725     \skip_horizontal:N \l_@@left_margin_dim
1726     \skip_horizontal:N \l_@@extra_left_margin_dim
1727     \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).

```

1728     \m@th
1729     $ %
1730     \bool_if:NTF \l_@@light_syntax_bool
1731         { \use:c { @@light-syntax } }
1732         { \use:c { @@normal-syntax } }
1733 }

```

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

```

1734 \cs_new_protected_nopar:Npn \@@_CodeBefore_Body:w #1 \Body
1735 {
1736   \tl_set:Nn \l_tmpa_tl { #1 }
1737   \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
1738     { \@@_rescan_for_spanish:N \l_tmpa_tl }
1739   \tl_gput_left:No \g_@@_pre_code_before_tl \l_tmpa_tl
1740   \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...

```

1741   \@@_pre_array:
1742 }
```

## 9 The `\CodeBefore`

```
1743 \cs_new_protected_nopar:Npn \@@_Body: { \@@_fatal:n { Body-alone } }
```

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).

```

1744 \cs_new_protected:Npn \@@_pre_code_before:
1745 {
```

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

```

1746 \pgfsys@markposition { \@@_env: - position }
1747 \pgfsys@getposition { \@@_env: - position } \@@_picture_position:
1748 \pgfpicture
1749 \pgf@relevantforpicturesizefalse
```

First, the recreation of the `row` nodes.

```

1750 \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int + 1 }
1751 {
1752   \pgfsys@getposition { \@@_env: - row - ##1 } \@@_node_position:
1753   \pgfcoordinate { \@@_env: - row - ##1 }
1754     { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1755 }
```

Now, the recreation of the `col` nodes.

```

1756 \int_step_inline:nnn { \l_@@_first_col_int } { \g_@@_col_total_int + 1 }
1757 {
1758   \pgfsys@getposition { \@@_env: - col - ##1 } \@@_node_position:
1759   \pgfcoordinate { \@@_env: - col - ##1 }
1760     { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1761 }
```

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

```
1762 \@@_create_diag_nodes:
```

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

```

1763 \bool_if:NT \g_@@_create_cell_nodes_bool { \@@_recreate_cell_nodes: }
1764 \endpgfpicture
```

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

```

1765 \@@_create_blocks_nodes:
1766 \IfPackageLoadedT { tikz }
1767 {
1768   \tikzset
1769   {
```

```

1770         every-picture / .style =
1771             { overlay , name-prefix = \@@_env: - }
1772         }
1773     }
1774 \cs_set_eq:NN \cellcolor \@@_cellcolor
1775 \cs_set_eq:NN \rectanglecolor \@@_rectanglecolor
1776 \cs_set_eq:NN \roundedrectanglecolor \@@_roundedrectanglecolor
1777 \cs_set_eq:NN \rowcolor \@@_rowcolor
1778 \cs_set_eq:NN \rowcolors \@@_rowcolors
1779 \cs_set_eq:NN \rowlistcolors \@@_rowlistcolors
1780 \cs_set_eq:NN \arraycolor \@@_arraycolor
1781 \cs_set_eq:NN \columncolor \@@_columncolor
1782 \cs_set_eq:NN \chessboardcolors \@@_chessboardcolors
1783 \cs_set_eq:NN \SubMatrix \@@_SubMatrix_in_code_before
1784 \cs_set_eq:NN \ShowCellNames \@@_ShowCellNames
1785 \cs_set_eq:NN \TikzEveryCell \@@_TikzEveryCell
1786 \cs_set_eq:NN \EmptyColumn \@@_EmptyColumn:n
1787 \cs_set_eq:NN \EmptyRow \@@_EmptyRow:n
1788 }

1789 \cs_new_protected:Npn \@@_exec_code_before:
1790 {

```

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...

```

1791 \clist_map_inline:Nn \l_@@_corners_cells_clist
1792     { \cs_set_nopar:cpn { \@@_corner_##1 } { } }
1793 \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`.

```

1794 \@@_add_to_colors_seq:nn { { nocolor } } { }
1795 \bool_gset_false:N \g_@@_create_cell_nodes_bool
1796 \group_begin:

```

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

```

1797 \if_mode_math:
1798     \@@_exec_code_before_i:
1799 \else:
1800     $ % $
1801     \@@_exec_code_before_i:
1802     $ % $
1803 \fi:
1804 \group_end:
1805 }

```

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`).

```

1806 \cs_new_protected:Npn \@@_exec_code_before_i:
1807 {
1808     \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
1809     { \@@_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`.

```

1810 \exp_last_unbraced:No \@@_CodeBefore_keys:
1811 \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.

```

1812 \@@_actually_color:
1813 \l_@@_code_before_tl
1814 \q_stop
1815 }

1816 \keys_define:nn { nicematrix / CodeBefore }
1817 {
1818   create-cell-nodes .bool_gset:N = \g_@@_create_cell_nodes_bool ,
1819   create-cell-nodes .default:n = true ,
1820   sub-matrix .code:n = \keys_set:nn { nicematrix / sub-matrix } { #1 } ,
1821   sub-matrix .value_required:n = true ,
1822   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
1823   delimiters / color .value_required:n = true ,
1824   unknown .code:n = \@@_error:n { Unknown~key~for~CodeBefore }
1825 }

1826 \NewDocumentCommand \@@_CodeBefore_keys: { O { } }
1827 {
1828   \keys_set:nn { nicematrix / CodeBefore } { #1 }
1829   \@@_CodeBefore:w
1830 }
```

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.

```

1831 \cs_new_protected:Npn \@@_CodeBefore:w #1 \q_stop
1832 {
1833   \bool_if:NT \g_@@_aux_found_bool
1834   {
1835     \@@_pre_code_before:
1836     \legacy_if:nF { measuring@ } { #1 }
1837   }
1838 }
```

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.

```

1839 \cs_new_protected:Npn \@@_recreate_cell_nodes:
1840 {
1841   \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
1842   {
1843     \pgfsys@getposition { \@@_env: - ##1 - base } \@@_node_position:
1844     \pgfcoordinate { \@@_env: - row - ##1 - base }
1845     { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1846   \int_step_inline:nnn { \l_@@_first_col_int } { \g_@@_col_total_int }
1847   {
1848     \cs_if_exist:cT
1849     { pgf @ sys @ pdf @ mark @ pos @ \@@_env: - ##1 - ####1 - NW }
1850     {
1851       \pgfsys@getposition
1852       { \@@_env: - ##1 - ####1 - NW }
1853       \@@_node_position:
1854     \pgfsys@getposition
1855       { \@@_env: - ##1 - ####1 - SE }
1856       \@@_node_position_i:
1857     \@@_pgf_rect_node:nnn
1858       { \@@_env: - ##1 - ####1 }
1859       { \pgfpointdiff \@@_picture_position: \@@_node_position: }
1860       { \pgfpointdiff \@@_picture_position: \@@_node_position_i: }
```

```

1861         }
1862     }
1863 }
1864 \@@_create_extra_nodes:
1865 \@@_create_aliases_last:
1866 }

1867 \cs_new_protected:Npn \@@_create_aliases_last:
1868 {
1869     \int_step_inline:nn { \c@iRow }
1870     {
1871         \pgfnodealias
1872         { \@@_env: - ##1 - last }
1873         { \@@_env: - ##1 - \int_use:N \c@jCol }
1874     }
1875     \int_step_inline:nn { \c@jCol }
1876     {
1877         \pgfnodealias
1878         { \@@_env: - last - ##1 }
1879         { \@@_env: - \int_use:N \c@iRow - ##1 }
1880     }
1881     \pgfnodealias
1882     { \@@_env: - last - last }
1883     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
1884 }

1885 \cs_new_protected:Npn \@@_create_blocks_nodes:
1886 {
1887     \pgfpicture
1888     \pgf@relevantforpicturesizefalse
1889     \pgfrememberpicturepositiononpagetrue
1890     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
1891     {
1892         \@@_create_one_block_node:nnnnn ##1 }
1893     \endpgfpicture
1894 }
```

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.<sup>7</sup>

```

1894 \cs_new_protected:Npn \@@_create_one_block_node:nnnnn #1 #2 #3 #4 #5
1895 {
1896     \tl_if_empty:nF { #5 }
1897     {
1898         \@@_qpoint:n { col - #2 }
1899         \dim_set_eq:NN \l_tmpa_dim \pgf@x
1900         \@@_qpoint:n { #1 }
1901         \dim_set_eq:NN \l_tmpb_dim \pgf@y
1902         \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
1903         \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
1904         \@@_qpoint:n { \int_eval:n { #3 + 1 } }
1905         \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
1906         \@@_pgf_rect_node:nnnnn
1907             { \@@_env: - #5 }
1908             { \dim_use:N \l_tmpa_dim }
1909             { \dim_use:N \l_tmpb_dim }
1910             { \dim_use:N \l_@@_tmpc_dim }
1911             { \dim_use:N \l_@@_tmpd_dim }
1912     }
1913 }
```

---

<sup>7</sup>Moreover, 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).

```

1914 \cs_new_protected:Npn \@@_patch_for_revtex:
1915 {
1916     \cs_set_eq:NN \caddamp \caddamp@LaTeX
1917     \cs_set_eq:NN \carray \carray@array
1918     \cs_set_eq:NN \ctabular \ctabular@array
1919     \cs_set:Npn \ctabarray { \cifnextchar [ { \carray } { \carray [ c ] } } }
1920     \cs_set_eq:NN \array \array@array
1921     \cs_set_eq:NN \endarray \endarray@array
1922     \cs_set:Npn \endtabular { \endarray $ \egroup } % $
1923     \cs_set_eq:NN \cmkpream \cmkpream@array
1924     \cs_set_eq:NN \classx \classx@array
1925     \cs_set_eq:NN \insert@column \insert@column@array
1926     \cs_set_eq:NN \arraycr \arraycr@array
1927     \cs_set_eq:NN \xarraycr \xarraycr@array
1928     \cs_set_eq:NN \xargarraycr \xargarraycr@array
1929 }

```

## 10 The environment {NiceArrayWithDelims}

```

1930 \NewDocumentEnvironment { NiceArrayWithDelims }
1931   { m m O { } m ! O { } t \CodeBefore }
1932   {
1933     \bool_if:NT \c_@@_revtex_bool { \@@_patch_for_revtex: }
1934     \@@_provide_pgfspdfmark:
1935     \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 exposant to a matrix in a mathematical formula.

```

1936 \bgroup
1937   \tl_gset:Nn \g_@@_left_delim_tl { #1 }
1938   \tl_gset:Nn \g_@@_right_delim_tl { #2 }
1939   \tl_gset:Nn \g_@@_user_preamble_tl { #4 }
1940   \tl_if_empty:NT \g_@@_user_preamble_tl { \@@_fatal:n { empty~preamble } }

1941   \int_gzero:N \g_@@_block_box_int
1942   \dim_gzero:N \g_@@_width_last_col_dim
1943   \dim_gzero:N \g_@@_width_first_col_dim
1944   \bool_gset_false:N \g_@@_row_of_col_done_bool
1945   \str_if_empty:NT \g_@@_name_env_str
1946     { \str_gset:Nn \g_@@_name_env_str { NiceArrayWithDelims } }
1947   \bool_if:NTF \l_@@_tabular_bool
1948     { \mode_leave_vertical: }
1949     { \@@_test_if_math_mode: }
1950   \bool_if:NT \l_@@_in_env_bool { \@@_fatal:n { Yet~in~env } }
1951   \bool_set_true:N \l_@@_in_env_bool

```

The command `\CT@arc@` contains the instruction of color for the rules of the array<sup>8</sup>. 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.

```

1952   \cs_gset_eq:cN { @@_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.

```

1953   \cs_if_exist:NT \tikz@library@external@loaded

```

---

<sup>8</sup>e.g. `\color[rgb]{0.5,0.5,0}`

```

1954 {
1955   \tikzexternaldisable
1956   \cs_if_exist:N \ifstandalone
1957     { \tikzset { external / optimize = false } }
1958 }
```

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

```

1959 \int_gincr:N \g_@@_env_int
1960 \bool_if:NF \l_@@_block_auto_columns_width_bool
1961   { \dim_gzero_new:N \g_@@_max_cell_width_dim }
```

The sequence `\g_@@_blocks_seq` will contain the characteristics of the blocks (specified by `\Block`) of the array. The sequence `\g_@@_pos_of_blocks_seq` will contain only the position of the blocks.

```

1962 \seq_gclear:N \g_@@_blocks_seq
1963 \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`.

```

1964 \seq_gclear:N \g_@@_pos_of_stroken_blocks_seq
1965 \seq_gclear:N \g_@@_pos_of_xdots_seq
1966 \tl_gclear_new:N \g_@@_code_before_tl
1967 \tl_gclear:N \g_@@_row_style_tl
```

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

```

1968 \tl_if_exist:cTF { g_@@_int_use:N \g_@@_env_int _ tl }
1969 {
1970   \bool_gset_true:N \g_@@_aux_found_bool
1971   \use:c { g_@@_int_use:N \g_@@_env_int _ tl }
1972 }
1973 { \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.

```

1974 \tl_gclear:N \g_@@_aux_tl
1975 \tl_if_empty:NF \g_@@_code_before_tl
1976 {
1977   \bool_set_true:N \l_@@_code_before_bool
1978   \tl_put_right:No \l_@@_code_before_tl \g_@@_code_before_tl
1979 }
1980 \tl_if_empty:NF \g_@@_pre_code_before_tl
1981 { \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`.

```

1982 \bool_if:NTF \g_@@_delims_bool
1983   { \keys_set:nn { nicematrix / pNiceArray } }
1984   { \keys_set:nn { nicematrix / NiceArray } }
1985   { #3 , #5 }

1986 \@@_set_CTarc:o \l_@@_rules_color_tl % noqa: w302
```

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:`.

```

1987 \bool_if:nTF { #6 } { \@@_CodeBefore_Body:w } { \@@_pre_array: }
1988 }
```

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

```

1989 {
1990   \bool_if:NTF \l_@@_light_syntax_bool
```

```

1991 { \use:c { end @@-light-syntax } }
1992 { \use:c { end @@-normal-syntax } }
1993 $ % $
1994 \skip_horizontal:N \l_@@_right_margin_dim
1995 \skip_horizontal:N \l_@@_extra_right_margin_dim
1996 \hbox_set_end:
1997 \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.

```

1998 \bool_if:NT \l_@@_width_used_bool
1999 {
2000   \fp_compare:nNnT { \g_@@_total_X_weight_fp } = { \c_zero_fp }
2001     { \@@_error_or_warning:n { width-without-X-columns } }
2002 }

```

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 1.0. For a X-column of weight  $x$ , the width will be `\l_@@_X_columns_dim` multiplied by  $x$ .

```

2003 \fp_compare:nNnT { \g_@@_total_X_weight_fp } > { \c_zero_fp }
2004   { \@@_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).

```

2005 \int_compare:nNnT { \l_@@_last_row_int } > { -2 }
2006 {
2007   \bool_if:NF \l_@@_last_row_without_value_bool
2008   {
2009     \int_compare:nNnF { \l_@@_last_row_int } = { \c@iRow }
2010     {
2011       \@@_error:n { Wrong-last-row }
2012       \int_set_eq:NN \l_@@_last_row_int \c@iRow
2013     }
2014   }
2015 }

```

Now, the definition of `\c@jCol` and `\g_@@_col_total_int` changes: `\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”.<sup>9</sup>

```

2016 \int_gset_eq:NN \c@jCol \g_@@_col_total_int
2017 \bool_if:NTF \g_@@_last_col_found_bool
2018   { \int_gdecr:N \c@jCol }
2019   {
2020     \int_compare:nNnT { \l_@@_last_col_int } > { -1 }
2021     { \@@_error:n { last-col-not-used } }
2022   }

```

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

```

2023 \int_gset_eq:NN \g_@@_row_total_int \c@iRow
2024 \int_compare:nNnT { \l_@@_last_row_int } > { -1 }
2025   { \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. 92).

```

2026 \int_if_zero:nT { \l_@@_first_col_int }
2027   { \skip_horizontal:N \g_@@_width_first_col_dim }

```

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

```

2028 \bool_if:nTF { ! \g_@@_delims_bool }

```

---

<sup>9</sup>We remind that the potential “first column” (exterior) has the number 0.

```

2029 {
2030   \str_if_eq:eeTF { \l_@@_baseline_tl } { c }
2031   { \@@_use_arraybox_with_notes_c: }
2032   {
2033     \str_if_eq:eeTF { \l_@@_baseline_tl } { b }
2034     { \@@_use_arraybox_with_notes_b: }
2035     { \@@_use_arraybox_with_notes: }
2036   }
2037 }

```

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).

```

2038 {
2039   \int_if_zero:nTF { \l_@@_first_row_int }
2040   {
2041     \dim_set_eq:NN \l_tmpa_dim \g_@@_dp_row_zero_dim
2042     \dim_add:Nn \l_tmpa_dim \g_@@_ht_row_zero_dim
2043   }
2044   { \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”.<sup>10</sup>

```

2045 \int_compare:nNnTF { \l_@@_last_row_int } > { -2 }
2046 {
2047   \dim_set_eq:NN \l_tmpb_dim \g_@@_ht_last_row_dim
2048   \dim_add:Nn \l_tmpb_dim \g_@@_dp_last_row_dim
2049 }
2050 { \dim_zero:N \l_tmpb_dim }

2051 \hbox_set:Nn \l_tmpa_box
2052 {
2053   \m@th
2054   $ % $
2055   \@@_color:o \l_@@_delimiters_color_tl
2056   \exp_after:wN \left \g_@@_left_delim_tl
2057   \vcenter
2058   {

```

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.

```

2059   \skip_vertical:n { - \l_tmpa_dim - \arrayrulewidth }
2060   \hbox
2061   {
2062     \bool_if:NTF \l_@@_tabular_bool
2063     { \skip_horizontal:n { - \tabcolsep } }
2064     { \skip_horizontal:n { - \arraycolsep } }
2065     \@@_use_arraybox_with_notes_c:
2066     \bool_if:NTF \l_@@_tabular_bool
2067     { \skip_horizontal:n { - \tabcolsep } }
2068     { \skip_horizontal:n { - \arraycolsep } }
2069   }

```

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

```

2070   \skip_vertical:n { - \l_tmpb_dim + \arrayrulewidth }
2071   }
2072   \exp_after:wN \right \g_@@_right_delim_tl
2073   $ % $
2074 }

```

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.

```

2075 \bool_if:NTF \l_@@_delimiters_max_width_bool

```

---

<sup>10</sup>A value of  $-1$  for  $\l_@@_last_row_int$  means that there is a “last row” but the user have not set the value with the option `last row` (and we are in the first compilation).

```

2076      {
2077          \@@_put_box_in_flow_bis:nn
2078              { \g_@@_left_delim_tl }
2079              { \g_@@_right_delim_tl }
2080      }
2081      \@@_put_box_in_flow:
2082  }

```

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. 93).

```

2083 \bool_if:NT \g_@@_last_col_found_bool
2084     { \skip_horizontal:N \g_@@_width_last_col_dim }
2085 \bool_if:NT \l_@@_preamble_bool
2086     {
2087         \int_compare:nNnT { \c@jCol } < { \g_@@_static_num_of_col_int }
2088         { \@@_err_columns_not_used: }
2089     }
2090 \@@_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.

```
2091 \egroup
```

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

```

2092 \iow_now:Nn \mainaux { \ExplSyntaxOn }
2093 \iow_now:Nn \mainaux { \char_set_catcode_space:n { 32 } }
2094 \iow_now:Ne \mainaux
2095 {
2096     \tl_gclear_new:c { \g_@@_int_use:N \g_@@_env_int _ tl }
2097     \tl_gset:cn { \g_@@_int_use:N \g_@@_env_int _ tl }
2098     { \exp_not:o \g_@@_aux_tl }
2099 }
2100 \iow_now:Nn \mainaux { \ExplSyntaxOff }

2101 \bool_if:NT \g_@@_footnote_bool { \endsavenotes }
2102 }

```

This is the end of the environment `{NiceArrayWithDelims}`.

```

2103 \cs_new_protected:Npn \@@_err_columns_not_used:
2104 {
2105     \@@_warning:n { columns-not-used }
2106     \cs_gset:Npn \@@_err_columns_not_used: { }
2107 }

```

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 1.0. For a X-column of weight  $x$ , the width will be `\l_@@_X_columns_dim` multiplied by  $x$ .

```

2108 \cs_new_protected:Npn \@@_compute_width_X:
2109 {
2110     \tl_gput_right:Ne \g_@@_aux_tl
2111     {
2112         \bool_set_true:N \l_@@_X_columns_aux_bool
2113         \dim_set:Nn \l_@@_X_columns_dim
2114     }

```

The flag `\g_@@_V_of_X_bool` is raised when there is at least in the tabular a column of type X using the key V. In that case, the width of the X column may be considered as correct even though the tabular has not (of course) a width equal to `\l_@@_width_dim`

```

2115 \bool_lazy_and:nnTF
2116     { \g_@@_V_of_X_bool }
2117     { \l_@@_X_columns_aux_bool }
2118     { \dim_use:N \l_@@_X_columns_dim }

```

```

2119 {
2120   \dim_compare:nNnTF
2121   {
2122     \dim_abs:n
2123     { \l_@@_width_dim - \box_wd:N \l_@@_the_array_box }
2124   }
2125   <
2126   { 0.001 pt }
2127   { \dim_use:N \l_@@_X_columns_dim }
2128   {
2129     \dim_eval:n
2130     {
2131       \l_@@_X_columns_dim
2132       +
2133       \fp_to_dim:n
2134       {
2135         (
2136           \dim_eval:n
2137           { \l_@@_width_dim - \box_wd:N \l_@@_the_array_box }
2138         )
2139         / \fp_use:N \g_@@_total_X_weight_fp
2140       }
2141     }
2142   }
2143 }
2144 }
2145 }
2146 }
```

## 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_tl`. The modified version will be stored in `\g_@@_array_preamble_tl`.

```

2147 \cs_new_protected:Npn \@@_transform_preamble:
2148 {
2149   \@@_transform_preamble_i:
2150   \@@_transform_preamble_ii:
2151 }
```

```

2152 \cs_new_protected:Npn \@@_transform_preamble_i:
2153 {
2154   \int_gzero:N \c@jCol
```

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

```
2155 \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.

```
2156 \bool_gset_false:N \g_tmpb_bool
```

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

```
2157 \tl_gclear_new:N \g_@@_pre_cell_tl
```

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

```

2158 \int_zero:N \l_tmpa_int
2159 \tl_gclear:N \g_@@_array_preamble_tl
2160 \str_if_eq:eeTF { \l_@@_vlines_clist } { all }
```

```

2161 {
2162   \tl_gset:Nn \g_@@_array_preamble_tl
2163     { ! { \skip_horizontal:N \arrayrulewidth } }
2164   }
2165   {
2166     \clist_if_in:NnT \l_@@_vlines_clist 1
2167     {
2168       \tl_gset:Nn \g_@@_array_preamble_tl
2169         { ! { \skip_horizontal:N \arrayrulewidth } }
2170     }
2171   }

```

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

```

2172   \exp_last_unbraced:No \@@_rec_preamble:n \g_@@_user_preamble_tl \s_stop
2173   \int_gset_eq:NN \g_@@_static_num_of_col_int \c@jCol

2174   \@@_replace_columncolor:
2175 }

2176 \cs_new_protected:Npn \@@_transform_preamble_ii:
2177   {

```

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

```

2178 \tl_if_eq:NNTF \g_@@_left_delim_tl \c_@@_dot_tl
2179   {
2180     \tl_if_eq:NNF \g_@@_right_delim_tl \c_@@_dot_tl
2181       { \bool_gset_true:N \g_@@_delims_bool }
2182   }
2183   { \bool_gset_true:N \g_@@_delims_bool }

```

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

```
2184 \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).

```

2185 \int_if_zero:nTF { \l_@@_first_col_int }
2186   { \tl_gput_left:No \g_@@_array_preamble_tl \c_@@_preamble_first_col_tl }
2187   {
2188     \bool_if:NF \g_@@_delims_bool
2189     {
2190       \bool_if:NF \l_@@_tabular_bool
2191         {
2192           \clist_if_empty:NT \l_@@_vlines_clist
2193             {
2194               \bool_if:NF \l_@@_exterior_arraycolsep_bool
2195                 { \tl_gput_left:Nn \g_@@_array_preamble_tl { @ { } } }
2196             }
2197           }
2198         }
2199       }
2200 \int_compare:nNnTF { \l_@@_last_col_int } > { -1 }
2201   { \tl_gput_right:No \g_@@_array_preamble_tl \c_@@_preamble_last_col_tl }
2202   {
2203     \bool_if:NF \g_@@_delims_bool
2204     {
2205       \bool_if:NF \l_@@_tabular_bool
2206         {
2207           \clist_if_empty:NT \l_@@_vlines_clist
2208             {
2209               \bool_if:NF \l_@@_exterior_arraycolsep_bool

```

```

2210           { \tl_gput_right:Nn \g_@@_array_preamble_tl { @ { } } }
2211       }
2212   }
2213 }
2214 }
```

We try to give a good error message when the final user puts more columns than allowed by the preamble of the array. The mechanism consists of an extra column. However, if tagging is in force, that dummy extra column will be tagged (with <TD> tags) and that's why we disable that mechanism when tagging is in force.

```

2215 \tag_if_active:F
2216 {
```

Moreover, when `{NiceTabular*}` is used, the mechanism can't be used for technical reasons. We test that situation with `\l_@@_tabular_width_dim`.

```

2217 \dim_compare:nNnT { \l_@@_tabular_width_dim } = { \c_zero_dim }
2218 {
2219     \tl_gput_right:Nn \g_@@_array_preamble_tl
2220     { > { \@@_err_too_much_cols: } 1 }
2221 }
2222 }
2223 }
```

We have used to add a last column to raise a good error message when the user puts more columns than allowed by its preamble. For technical reasons, it was not possible to do that in `{NiceTabular*}` and that's why we used to control that with the value of `\l_@@_tabular_width_dim`.

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.

```

2224 \cs_new_protected:Npn \@@_rec_preamble:n #1
2225 {
```

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.<sup>11</sup>

```

2226 \cs_if_exist:cTF { @@ _ \token_to_str:N #1 : }
2227 { \use:c { @@ _ \token_to_str:N #1 : } { #1 } }
2228 {
```

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

```

2229 \cs_if_exist:cTF { NC @ find @ #1 }
2230 {
2231     \tl_set_eq:Nc \l_tmpb_tl { NC @ rewrite @ #1 }
2232     \exp_last_unbraced:Nno \@@_rec_preamble:n \l_tmpb_tl
2233 }
2234 {
2235     \str_if_eq:nnTF { #1 } { S }
2236     { \@@_fatal:n { unknown-column-type-S } }
2237     { \@@_fatal:nn { unknown-column-type } { #1 } }
2238 }
2239 }
2240 }
```

For `c`, `l` and `r`

```

2241 \cs_new_protected:Npn \@@_c: #1
2242 {
2243     \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2244     \tl_gclear:N \g_@@_pre_cell_tl
2245     \tl_gput_right:Nn \g_@@_array_preamble_tl
2246     { > \@@_cell_begin: c < \@@_cell_end: }
```

---

<sup>11</sup>We 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`.

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

```

2247 \int_gincr:N \c@jCol
2248 \@@_rec_preamble_after_col:n
2249 }
2250 \cs_new_protected:Npn \@@_l: #1
2251 {
2252 \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2253 \tl_gclear:N \g_@@_pre_cell_tl
2254 \tl_gput_right:Nn \g_@@_array_preamble_tl
2255 {
2256 > { \@@_cell_begin: \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_l_tl }
2257 1
2258 < \@@_cell_end:
2259 }
2260 \int_gincr:N \c@jCol
2261 \@@_rec_preamble_after_col:n
2262 }
2263 \cs_new_protected:Npn \@@_r: #1
2264 {
2265 \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2266 \tl_gclear:N \g_@@_pre_cell_tl
2267 \tl_gput_right:Nn \g_@@_array_preamble_tl
2268 {
2269 > { \@@_cell_begin: \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_r_tl }
2270 r
2271 < \@@_cell_end:
2272 }
2273 \int_gincr:N \c@jCol
2274 \@@_rec_preamble_after_col:n
2275 }
```

For ! and @

```

2276 \cs_new_protected:cpn { @@ _ \token_to_str:N ! : } #1 #2
2277 {
2278 \tl_gput_right:Nn \g_@@_array_preamble_tl { #1 { #2 } }
2279 \@@_rec_preamble:n
2280 }
2281 \cs_set_eq:cc { @@ _ \token_to_str:N @ : } { @@ _ \token_to_str:N ! : }
```

For |

```

2282 \cs_new_protected:cpn { @@ _ | : } #1
2283 {
```

\l\_tmpa\_int is the number of successive occurrences of |

```

2284 \int_incr:N \l_tmpa_int
2285 \@@_make_preamble_i_i:n
2286 }
2287 \cs_new_protected:Npn \@@_make_preamble_i_i:n #1
2288 {
```

Here, we can't use \str\_if\_eq:eeTF.

```

2289 \str_if_eq:nnTF { #1 } { | }
2290 { \use:c { @@ _ | : } | }
2291 { \@@_make_preamble_i_i:nn { } #1 }
2292 }
```

The following constructions aims to allow cumulative blocks of options between square brackets such as in |[color=blue][tikz=dashed].

```

2293 \cs_new_protected:Npn \@@_make_preamble_i_i:nn #1 #2
2294 {
2295 \str_if_eq:nnTF { #2 } { [ }
2296 { \@@_make_preamble_i_i:nw { #1 } [ }
```

```

2297     { \@@_make_preamble_i_iii:nn { #2 } { #1 } }
2298   }
2299 \cs_new_protected:Npn \@@_make_preamble_i_ii:nw #1 [ #2 ]
2300   { \@@_make_preamble_i_ii:nn { #1 , #2 } }
2301 \cs_new_protected:Npn \@@_make_preamble_i_iii:nn #1 #2
2302   {
2303     \@@_compute_rule_width:n { multiplicity = \l_tmpa_int , #2 }
2304     \tl_gput_right:Ne \g_@@_array_preamble_tl
2305   }

```

Here, the command `\dim_use:N` is mandatory.

```

2306   \exp_not:N ! { \skip_horizontal:N \dim_use:N \l_@@_rule_width_dim }
2307   }
2308 \tl_gput_right:Ne \g_@@_pre_code_after_tl
2309   {
2310     \@@_vline:n
2311   {
2312     position = \int_eval:n { \c@jCol + 1 } ,
2313     multiplicity = \int_use:N \l_tmpa_int ,
2314     total-width = \dim_use:N \l_@@_rule_width_dim ,
2315     #2
2316   }

```

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.

```

2317   }
2318   \int_zero:N \l_tmpa_int
2319   \str_if_eq:nnT { #1 } { \s_stop } { \bool_gset_true:N \g_tmpb_bool }
2320   \@@_rec_preamble:n #1
2321 }

2322 \cs_new_protected:cpn { @@ _ > : } #1 #2
2323   {
2324     \tl_gput_right:Nn \g_@@_pre_cell_tl { > { #2 } }
2325     \@@_rec_preamble:n
2326   }
2327 \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.

```

2328 \keys_define:nn { nicematrix / p-column }
2329   {
2330     r .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_r_str ,
2331     r .value_forbidden:n = true ,
2332     c .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_c_str ,
2333     c .value_forbidden:n = true ,
2334     l .code:n = \str_set_eq:NN \l_@@_hpos_col_str \c_@@_l_str ,
2335     l .value_forbidden:n = true ,
2336     S .code:n = \str_set:Nn \l_@@_hpos_col_str { si } ,
2337     S .value_forbidden:n = true ,
2338     p .code:n = \str_set:Nn \l_@@_vpos_col_str { p } ,
2339     p .value_forbidden:n = true ,
2340     t .meta:n = p ,
2341     m .code:n = \str_set:Nn \l_@@_vpos_col_str { m } ,
2342     m .value_forbidden:n = true ,
2343     b .code:n = \str_set:Nn \l_@@_vpos_col_str { b } ,
2344     b .value_forbidden:n = true
2345   }

```

For `p` but also `b` and `m`.

```

2346 \cs_new_protected:Npn \@@_p: #1
2347   {
2348     \str_set:Nn \l_@@_vpos_col_str { #1 }

```

Now, you look for a potential character [ after the letter of the specifier (for the options).

```

2349     \@@_make_preamble_ii_i:n
2350 }
2351 \cs_set_eq:NN \@@_b: \@@_p:
2352 \cs_set_eq:NN \@@_m: \@@_p:
2353 \cs_new_protected:Npn \@@_make_preamble_ii_i:n #1
2354 {
2355     \str_if_eq:nnTF { #1 } { [ }
2356     { \@@_make_preamble_ii_ii:w [ ]
2357     { \@@_make_preamble_ii_ii:w [ ] { #1 } }
2358 }
2359 \cs_new_protected:Npn \@@_make_preamble_ii_ii:w [ #1 ]
2360 { \@@_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.

```

2361 \cs_new_protected:Npn \@@_make_preamble_ii_iii:nn #1 #2
2362 {
```

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).

```

2363     \str_set:Nn \l_@@_hpos_col_str { j }
2364     \@@_keys_p_column:n { #1 }
```

We apply `setlength` in order to allow a width of column of the form `\widthof{Some words}`. `\widthof` is a command of the package `calc` (not loaded by `nicematrix`) which redefines the command `\setlength`. Of course, even if `calc` is not loaded, the following code will work with the standard version of `\setlength`.

```

2365     \setlength { \l_tmpa_dim } { #2 }
2366     \@@_make_preamble_ii_iv:nnn { \dim_use:N \l_tmpa_dim } { minipage } { }
2367 }
2368 \cs_new_protected:Npn \@@_keys_p_column:n #1
2369 { \keys_set_known:nnN { nicematrix / p-column } { #1 } \l_tmpa_t1 }
```

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.

```

2370 \cs_new_protected:Npn \@@_make_preamble_ii_iv:nnn #1 #2 #3
2371 {
```

Here, `\expanded` would probably be slightly faster than `\use:e`

```

2372     \use:e
2373     {
2374         \@@_make_preamble_ii_vi:nnnnnnn
2375         { \str_if_eq:eeTF { \l_@@_vpos_col_str } { p } { t } { b } }
2376         { #1 }
2377     }
```

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_t1` which will provide the horizontal alignment of the column to which belongs the cell.

```

2378     \str_if_eq:eeTF { \l_@@_hpos_col_str } { j }
2379     { \tl_clear:N \exp_not:N \l_@@_hpos_cell_t1 }
2380 }
```

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

```

2381     \def \exp_not:N \l_@@_hpos_cell_t1
2382     { \str_lowercase:f { \l_@@_hpos_col_str } }
2383     }
2384     \IfPackageLoadedTF { ragged2e }
2385     {
2386         \str_case:on \l_@@_hpos_col_str
2387         {
```

The following \exp\_not:N are mandatory.

```

2388     c { \exp_not:N \Centering }
2389     l { \exp_not:N \RaggedRight }
2390     r { \exp_not:N \RaggedLeft }
2391   }
2392 }
2393 {
2394   \str_case:on \l_@@_hpos_col_str
2395   {
2396     c { \exp_not:N \centering }
2397     l { \exp_not:N \raggedright }
2398     r { \exp_not:N \raggedleft }
2399   }
2400 }
2401 #3
2402 }
2403 { \str_if_eq:eeT { \l_@@_vpos_col_str } { m } \@@_center_cell_box: }
2404 { \str_if_eq:eeT { \l_@@_hpos_col_str } { si } \siunitx_cell_begin:w }
2405 { \str_if_eq:eeT { \l_@@_hpos_col_str } { si } \siunitx_cell_end: }
2406 { #2 }
2407 {
2408   \str_case:onF \l_@@_hpos_col_str
2409   {
2410     { j } { c }
2411     { si } { c }
2412   }

```

We use \str\_lowercase:n to convert R to r, etc.

```

2413   { \str_lowercase:f \l_@@_hpos_col_str }
2414 }
2415 }
```

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

```

2416   \int_gincr:N \c@jCol
2417   \@@_rec_preamble_after_col:n
2418 }
```

#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\_t1 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.

```

2419 \cs_new_protected:Npn \@@_make_preamble_ii_vi:nnnnnnnn #1 #2 #3 #4 #5 #6 #7 #8
2420 {
2421   \str_if_eq:eeTF { \l_@@_hpos_col_str } { si }
2422   {
2423     \tl_gput_right:Nn \g_@@_array_preamble_tl
2424     { > \@@_test_if_empty_for_S: }
2425   }
2426   { \tl_gput_right:Nn \g_@@_array_preamble_tl { > \@@_test_if_empty: } }
2427   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2428   \tl_gclear:N \g_@@_pre_cell_tl
2429   \tl_gput_right:Nn \g_@@_array_preamble_tl
2430   {
2431     > {
```

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.

```
2432     \dim_set:Nn \l_@@_col_width_dim { #2 }
2433     \@@_cell_begin:
```

We use the form `\minipage–\endminipage` (`\varwidth–\endvarwidth`) for compatibility with `colcell` (2023-10-31).

```
2434     \use:c { #7 } [ #1 ] { #2 }
```

The following lines have been taken from `array.sty`.

```
2435     \everypar
2436     {
2437         \vrule height \box_ht:N \carstrutbox width \c_zero_dim
2438         \everypar { }
2439     }
```

Now, the potential code for the horizontal position of the content of the cell (`\centering`, `\raggedright`, `\RaggedRight`, etc.).

```
2440     #3
```

The following code is to allow something like `\centering` in `\RowStyle`.

```
2441     \g_@@_row_style_tl
2442     \arraybackslash
2443     #5
2444     }
2445     #8
2446     < {
2447     #6
```

The following line has been taken from `array.sty`.

```
2448     \finalstrut \carstrutbox
2449     \use:c { end #7 }
```

If the letter in the preamble is `m`, `#4` will be equal to `\@@_center_cell_box`: (see just below).

```
2450     #4
2451     \@@_cell_end:
2452     }
2453     }
2454 }
```

The cell always begins with `\ignorespaces` with `array` and that's why we retrieve that token.

```
2455 \cs_new_protected:Npn \@@_test_if_empty: \ignorespaces
2456 {
```

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 `&`).

```
2457     \group_align_safe_begin:
2458     \peek_meaning:NTF &
2459     { \@@_the_cell_is_empty: }
2460     {
2461         \peek_meaning:NTF \\
2462         { \@@_the_cell_is_empty: }
2463         {
2464             \peek_meaning:NTF \crcr
2465             \@@_the_cell_is_empty:
2466             \group_align_safe_end:
2467         }
2468     }
2469 }
```

```

2470 \cs_new_protected:Npn \@@_the_cell_is_empty:
2471 {
2472     \group_align_safe_end:
2473     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2474 }

```

Be careful: here, we can't merely use `\bool_gset_true: \g_@@_empty_cell_bool`, in particular because of the columns of type X.

```

2475     \box_set_wd:Nn \l_@@_cell_box \c_zero_dim
2476     \skip_horizontal:N \l_@@_col_width_dim
2477 }
2478 }

2479 \cs_new_protected:Npn \@@_test_if_empty_for_S:
2480 {
2481     \peek_meaning:NT \_siunitx_table_skip:n
2482     { \bool_gset_true:N \g_@@_empty_cell_bool }
2483 }

```

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 than the height of `\strutbox`, there is only one row.

```

2484 \cs_new_protected:Npn \@@_center_cell_box:
2485 {

```

By putting instructions in `\g_@@_cell_after_hook_tl`, we require a post-action of the box `\l_@@_cell_box`.

```

2486     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2487     {
2488         \dim_compare:nNnT
2489         { \box_ht:N \l_@@_cell_box }
2490     }

```

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).

```

2491     { \box_ht:N \strutbox }
2492 {
2493     \hbox_set:Nn \l_@@_cell_box
2494     {
2495         \box_move_down:nn
2496         {
2497             ( \box_ht:N \l_@@_cell_box - \box_ht:N \arstrutbox
2498             + \baselineskip ) / 2
2499         }
2500         { \box_use:N \l_@@_cell_box }
2501     }
2502 }
2503 }
2504 }

```

For V (similar to the V of `varwidth`).

```

2505 \cs_new_protected:Npn \@@_V: #1 #2
2506 {
2507     \str_if_eq:nnTF { #2 } { [ ]
2508         { \@@_make_preamble_V_i:w [ ]
2509         { \@@_make_preamble_V_i:w [ ] { #2 } }
2510     }
2511 \cs_new_protected:Npn \@@_make_preamble_V_i:w [ #1 ]
2512     { \@@_make_preamble_V_ii:nn { #1 } }
2513 \cs_new_protected:Npn \@@_make_preamble_V_ii:nn #1 #2

```

```

2514 {
2515   \str_set:Nn \l_@@_vpos_col_str { p }
2516   \str_set:Nn \l_@@_hpos_col_str { j }
2517   \@@_keys_p_column:n { #1 }

```

We apply `\setlength` in order to allow a width of column of the form `\widthof{Some words}`. `\widthof` is a command of the package `calc` (not loaded by `nicematrix`) which redefines the command `\setlength`. Of course, even if `calc` is not loaded, the following code will work with the standard version of `\setlength`.

```

2518 \setlength { \l_tmpa_dim } { #2 }
2519 \IfPackageLoadedTF { varwidth }
2520   { \@@_make_preamble_ii_iv:nnn { \dim_use:N \l_tmpa_dim } { varwidth } { } }
2521   {
2522     \@@_error_or_warning:n { varwidth-not-loaded }
2523     \@@_make_preamble_ii_iv:nnn { \dim_use:N \l_tmpa_dim } { minipage } { }
2524   }
2525 }

```

For `w` and `W`

```

2526 \cs_new_protected:Npn \@@_w: { \@@_make_preamble_w:nnnn { } }
2527 \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.

```

2528 \cs_new_protected:Npn \@@_make_preamble_w:nnnn #1 #2 #3 #4
2529 {
2530   \str_if_eq:nnTF { #3 } { s }
2531   { \@@_make_preamble_w_i:nnnn { #1 } { #4 } }
2532   { \@@_make_preamble_w_ii:nnnn { #1 } { #2 } { #3 } { #4 } }
2533 }

```

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.

```

2534 \cs_new_protected:Npn \@@_make_preamble_w_i:nnnn #1 #2
2535 {
2536   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2537   \tl_gclear:N \g_@@_pre_cell_tl
2538   \tl_gput_right:Nn \g_@@_array_preamble_tl
2539   {
2540     > {

```

We use `\setlength` in order to allow `\widthof` which is a command of `calc` (when loaded `calc` redefines `\setlength`). Of course, even if `calc` is not loaded, the following code will work with the standard version of `\setlength`.

```

2541   \setlength { \l_@@_col_width_dim } { #2 }
2542   \@@_cell_begin:
2543   \tl_set_eq:NN \l_@@_hpos_cell_tl \c_@@_c_tl
2544 }
2545 c
2546 < {
2547   \@@_cell_end_for_w_s:
2548   #1
2549   \@@_adjust_size_box:
2550   \box_use_drop:N \l_@@_cell_box
2551 }
2552 }
2553 \int_gincr:N \c@jCol
2554 \@@_rec_preamble_after_col:n
2555 }

```

Then, the most important version, for the horizontal alignments types of **c**, **l** and **r** (and not **s**).

```

2556 \cs_new_protected:Npn \@@_make_preamble_w_i:nnnn #1 #2 #3 #4
2557 {
2558   \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2559   \tl_gclear:N \g_@@_pre_cell_tl
2560   \tl_gput_right:Nn \g_@@_array_preamble_tl
2561   {
2562     > {

```

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.

We use `\setlength` in order to allow `\widthof` which is a command of `calc` (when loaded `calc` redefines `\setlength`). Of course, even if `calc` is not loaded, the following code will work with the standard version of `\setlength`.

```

2563           \setlength { \l_@@_col_width_dim } { #4 }
2564           \hbox_set:Nw \l_@@_cell_box
2565           \@@_cell_begin:
2566           \tl_set:Nn \l_@@_hpos_cell_tl { #3 }
2567       }
2568       c
2569       < {
2570         \@@_cell_end:
2571         \hbox_set_end:
2572         #1
2573         \@@_adjust_size_box:
2574         \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
2575       }
2576     }

```

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

```

2577   \int_gincr:N \c@jCol
2578   \@@_rec_preamble_after_col:n
2579 }

2580 \cs_new_protected:Npn \@@_special_W:
2581 {
2582   \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > { \l_@@_col_width_dim }
2583   { \@@_warning:n { W-warning } }
2584 }

```

For **S** (of `siunitx`).

```

2585 \cs_new_protected:Npn \@@_S: #1 #2
2586 {
2587   \str_if_eq:nnTF { #2 } { [ ]
2588     { \@@_make_preamble_S:w [ ]
2589     { \@@_make_preamble_S:w [ ] { #2 } }
2590   }
2591   \cs_new_protected:Npn \@@_make_preamble_S:w [ #1 ]
2592   { \@@_make_preamble_S_i:n { #1 } }
2593   \cs_new_protected:Npn \@@_make_preamble_S_i:n #1
2594   {
2595     \IfPackageLoadedF { siunitx } { \@@_fatal:n { siunitx-not-loaded } }
2596     \tl_gput_right:No \g_@@_array_preamble_tl \g_@@_pre_cell_tl
2597     \tl_gclear:N \g_@@_pre_cell_tl
2598     \tl_gput_right:Nn \g_@@_array_preamble_tl
2599     {
2600       > {

```

In the cells of a column of type **S**, we have to wrap the command `\@@_node_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).

```

2601     \socket_assign_plug:nn { nicematrix / siunitx-wrap } { active }
2602     \keys_set:nn { siunitx } { #1 }
2603     \@@_cell_begin:
2604     \siunitx_cell_begin:w
2605   }
2606   c
2607   <
2608   {
2609     \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, it will stay local within the cell of the underlying `\halign`).

```

2610     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2611   {
2612     \bool_if:NTF \l_siunitx_table_text_bool
2613       { \bool_set_true:N }
2614       { \bool_set_false:N }
2615     \l_siunitx_table_text_bool
2616   }
2617   \@@_cell_end:
2618 }
2619 }
```

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

```

2620   \int_gincr:N \c@jCol
2621   \@@_rec_preamble_after_col:n
2622 }
```

For `(`, `[` and `\{`.

```

2623 \cs_new_protected:cpn { @@ _ \token_to_str:N ( : } #1 #2
2624 {
2625   \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.

```

2626   \int_if_zero:nTF { \c@jCol }
2627   {
2628     \tl_if_eq:NNTF \g_@@_left_delim_tl \c_@@_dot_tl
2629   }
```

In that case, in fact, the first letter of the preamble must be considered as the left delimiter of the array.

```

2630   \tl_gset:Nn \g_@@_left_delim_tl { #1 }
2631   \tl_gset_eq:NN \g_@@_right_delim_tl \c_@@_dot_tl
2632   \@@_rec_preamble:n #2
2633 }
2634 {
2635   \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2636   \@@_make_preamble_iv:nn { #1 } { #2 }
2637 }
2638 {
2639   \@@_make_preamble_iv:nn { #1 } { #2 }
2640 }
2641 \cs_set_eq:cc { @@ _ \token_to_str:N [ : } { @@ _ \token_to_str:N ( : }
2642 \cs_set_eq:cc { @@ _ \token_to_str:N \{ : } { @@ _ \token_to_str:N ( : }
2643 \cs_new_protected:Npn \@@_make_preamble_iv:nn #1 #2
2644 {
2645   \tl_gput_right:Nn \g_@@_pre_code_after_tl
2646   { \@@_delimiter:nnn #1 { \int_eval:n { \c@jCol + 1 } } \c_true_bool }
2647   \tl_if_in:nnTF { ( [ \{ ) ] \} } \left \right { #2 }
2648   {
2649     \@@_error:nn { delimiter-after-opening } { #2 }
2650     \@@_rec_preamble:n
```

```

2651     }
2652     { \@@_rec_preamble:n #2 }
2653 }

```

In fact, if would be possible to define `\left` and `\right` as no-op.

```

2654 \cs_new_protected:cpn { @@ _ \token_to_str:N \left : } #1
2655   { \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}`).

```

2656 \cs_new_protected:cpn { @@ _ \token_to_str:N ) : } #1 #2
2657 {
2658   \bool_if:NT \l_@@_small_bool { \@@_fatal:n { Delimiter-with-small } }
2659   \tl_if_in:nnTF { ) ] \} } { #2 }
2660   { \@@_make_preamble_v:nnn #1 #2 }
2661   {
2662     \str_if_eq:nnTF { \s_stop } { #2 }
2663     {
2664       \tl_if_eq:NNTF \g_@@_right_delim_tl \c_@@_dot_tl
2665         { \tl_gset:Nn \g_@@_right_delim_tl { #1 } }
2666         {
2667           \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2668           \tl_gput_right:Ne \g_@@_pre_code_after_tl
2669             { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2670             \@@_rec_preamble:n #2
2671         }
2672     }
2673   {
2674     \tl_if_in:nnT { ( [ \{ \left } { #2 }
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         \@@_rec_preamble:n #2
2679     }
2680   }
2681 }
2682 \cs_set_eq:cc { @@ _ \token_to_str:N ] : } { @@ _ \token_to_str:N ) : }
2683 \cs_set_eq:cc { @@ _ \token_to_str:N \} : } { @@ _ \token_to_str:N ) : }
2684 \cs_new_protected:Npn \@@_make_preamble_v:nnn #1 #2 #3
2685 {
2686   \str_if_eq:nnTF { \s_stop } { #3 }
2687   {
2688     \tl_if_eq:NNTF \g_@@_right_delim_tl \c_@@_dot_tl
2689     {
2690       \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2691       \tl_gput_right:Ne \g_@@_pre_code_after_tl
2692         { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2693         \tl_gset:Nn \g_@@_right_delim_tl { #2 }
2694     }
2695   {
2696     \tl_gput_right:Nn \g_@@_array_preamble_tl { ! { \enskip } }
2697     \tl_gput_right:Ne \g_@@_pre_code_after_tl
2698       { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2699       \@@_error:nn { double-closing-delimiter } { #2 }
2700   }
2701 }
2702 {
2703   \tl_gput_right:Ne \g_@@_pre_code_after_tl
2704     { \@@_delimiter:nnn #1 { \int_use:N \c@jCol } \c_false_bool }
2705     \@@_error:nn { double-closing-delimiter } { #2 }
2706     \@@_rec_preamble:n #3

```

```

2707     }
2708 }

2709 \cs_new_protected:cpn { @@ _ \token_to_str:N \right : } #1
2710   { \use:c { @@ _ \token_to_str:N ) : } }

2711 \cs_new_protected:Npn \@@_rec_preamble_after_col:n #1
2712 {
2713   \str_if_eq:nnTF { #1 } { < }
2714     { \@@_rec_preamble_after_col_i:n }
2715   {
2716     \str_if_eq:nnTF { #1 } { @ }
2717       { \@@_rec_preamble_after_col_ii:n }
2718     {
2719       \str_if_eq:eeTF { \l_@@_vlines_clist } { all }
2720         {
2721           \tl_gput_right:Nn \g_@@_array_preamble_tl
2722             { ! { \skip_horizontal:N \arrayrulewidth } }
2723         }
2724       {
2725         \clist_if_in:NeT \l_@@_vlines_clist
2726           { \int_eval:n { \c@jCol + 1 } }
2727         {
2728           \tl_gput_right:Nn \g_@@_array_preamble_tl
2729             { ! { \skip_horizontal:N \arrayrulewidth } }
2730         }
2731       }
2732     \@@_rec_preamble:n { #1 }
2733   }
2734 }
2735 }

2736 \cs_new_protected:Npn \@@_rec_preamble_after_col_i:n #1
2737 {
2738   \tl_gput_right:Nn \g_@@_array_preamble_tl { < { #1 } }
2739   \@@_rec_preamble_after_col:n
2740 }

```

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.

```

2741 \cs_new_protected:Npn \@@_rec_preamble_after_col_ii:n #1
2742 {
2743   \str_if_eq:eeTF { \l_@@_vlines_clist } { all }
2744   {
2745     \tl_gput_right:Nn \g_@@_array_preamble_tl
2746       { @ { #1 \skip_horizontal:N \arrayrulewidth } }
2747   }
2748   {
2749     \clist_if_in:NeTF \l_@@_vlines_clist { \int_eval:n { \c@jCol + 1 } }
2750       {
2751         \tl_gput_right:Nn \g_@@_array_preamble_tl
2752           { @ { #1 \skip_horizontal:N \arrayrulewidth } }
2753       }
2754     { \tl_gput_right:Nn \g_@@_array_preamble_tl { @ { #1 } } }
2755   }
2756 \@@_rec_preamble:n
2757 }

2758 \cs_new_protected:cpn { @@ _ * : } #1 #2 #3

```

```

2759 {
2760   \tl_clear:N \l_tmpa_tl
2761   \int_step_inline:nn { #2 } { \tl_put_right:Nn \l_tmpa_tl { #3 } }
2762   \exp_last_unbraced:No \@@_rec_preamble:n \l_tmpa_tl
2763 }

```

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.

```

2764 \cs_new_protected:cpn { @_ _ \token_to_str:N \NC@find : } #1
2765   { \@@_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`.

```

2766 \cs_new_protected:Npn \@@_X: #1 #2
2767 {
2768   \str_if_eq:nnTF { #2 } { [ ]
2769     { \@@_make_preamble_X:w [ ]
2770     { \@@_make_preamble_X:w [ ] #2 }
2771   }
2772 \cs_new_protected:Npn \@@_make_preamble_X:w [ #1 ]
2773   { \@@_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 `V` and also a key which corresponds to a positive number (1, 2, 0.5, etc.) which is the *weight* of the columns. The following set of keys will be used to retrieve that value and store it in `\l_tmpa_fp`.

```

2774 \keys_define:nn { nicematrix / X-column }
2775 {
2776   V .code:n =
2777     \IfPackageLoadedTF { varwidth }
2778     {
2779       \bool_set_true:N \l_@@_V_of_X_bool
2780       \bool_gset_true:N \g_@@_V_of_X_bool
2781     }
2782     { \@@_error_or_warning:n { varwidth-not-loaded-in-X } } ,
2783   unknown .code:n =
2784     \regex_if_match:nVTF { \A[0-9]*\.[0-9]*\Z } \l_keys_key_str
2785     { \fp_set:Nn \l_tmpa_fp { \l_keys_key_str } }
2786     { \@@_error_or_warning:n { invalid-weight } }
2787 }

```

In the following command, `#1` is the list of the options of the specifier `X`.

```

2788 \cs_new_protected:Npn \@@_make_preamble_X_i:n #1
2789   {

```

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`).

```

2790   \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`).

```

2791   \str_set:Nn \l_@@_vpos_col_str { p }

```

We will store in `\l_tmpa_fp` the weight of the column (`\l_tmpa_fp` also appears in `{nicematrix/X-column}` and the error message `invalid~weight`).

```

2792   \fp_set:Nn \l_tmpa_fp { 1.0 }
2793   \@@_keys_p_column:n { #1 }

```

The unknown keys have been stored by `\@@_keys_p_column:n` in `\l_tmpa_t1` and we use them right away in the set of keys `nicematrix/X-column` in order to retrieve the potential weight explicitly provided by the final user.

```
2794     \bool_set_false:N \l_@@_V_of_X_bool
2795     \keys_set:no { nicematrix / X-column } \l_tmpa_t1
```

Now, the weight of the column is stored in `\l_tmpa_t1`.

```
2796     \fp_gadd:Nn \g_@@_total_X_weight_fp \l_tmpa_fp
```

We test whether we know the actual 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).

```
2797     \bool_if:NTF \l_@@_X_columns_aux_bool
2798     {
2799         \@@_make_preamble_ii_iv:nnn
```

Of course, the weight of a column depends of its weight (in `\l_tmpa_fp`).

```
2800         { \fp_use:N \l_tmpa_fp \l_@@_X_columns_dim }
2801         { \bool_if:NTF \l_@@_V_of_X_bool { varwidth } { minipage } }
2802         { \@@_no_update_width: }
2803     }
```

In the current compilation, we don't know the actual width of the X column. However, you have to construct the cells of that column! By convention, we have decided to compose in a `{minipage}` of width 5 cm even though we will nullify `\l_@@_cell_box` after its composition.

```
2804     {
2805         \tl_gput_right:Nn \g_@@_array_preamble_tl
2806         {
2807             > {
2808                 \@@_cell_begin:
2809                 \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`.

```
2810         \NotEmpty
```

The following code will nullify the box of the cell.

```
2811         \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2812             { \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`.

```
2813             \begin{minipage}{5cm} \arraybackslash
2814             }
2815             c
2816             < {
2817                 \end{minipage}
2818                 \@@_cell_end:
2819             }
2820             }
2821             \int_gincr:N \c@jCol
2822             \@@_rec_preamble_after_col:n
2823         }
2824     }

2825 \cs_new_protected:Npn \@@_no_update_width:
2826 {
2827     \tl_gput_right:Nn \g_@@_cell_after_hook_tl
2828         { \cs_set_eq:NN \@@_update_max_cell_width: \prg_do_nothing: }
2829 }
```

For the letter set by the user with `vlines-in-sub-matrix` (`vlism`).

```

2830 \cs_new_protected:Npn \@@_make_preamble_vlism:n #1
2831 {
2832   \seq_gput_right:Ne \g_@@_cols_vlism_seq
2833   { \int_eval:n { \c@jCol + 1 } }
2834   \tl_gput_right:Ne \g_@@_array_preamble_tl
2835   { \exp_not:N ! { \skip_horizontal:N \arrayrulewidth } }
2836   \@@_rec_preamble:n
2837 }
```

The token `\s_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.

```
2838 \cs_set_eq:cN { @C _ \token_to_str:N \s_stop : } \use_none:n
```

The following lines try to catch some errors (when the final user has forgotten the preamble of its environment).

```

2839 \cs_new_protected:cpn { @C _ \token_to_str:N \hline : }
2840   { \@@_fatal:n { Preamble-forgotten } }
2841 \cs_set_eq:cc { @C _ \token_to_str:N \Hline : } { @C _ \token_to_str:N \hline : }
2842 \cs_set_eq:cc { @C _ \token_to_str:N \toprule : }
2843   { @C _ \token_to_str:N \hline : }
2844 \cs_set_eq:cc { @C _ \token_to_str:N \Block : } { @C _ \token_to_str:N \hline : }
2845 \cs_set_eq:cc { @C _ \token_to_str:N \CodeBefore : }
2846   { @C _ \token_to_str:N \hline : }
2847 \cs_set_eq:cc { @C _ \token_to_str:N \RowStyle : }
2848   { @C _ \token_to_str:N \hline : }
2849 \cs_set_eq:cc { @C _ \token_to_str:N \diagbox : }
2850   { @C _ \token_to_str:N \hline : }
2851 \cs_set_eq:cc { @C _ \token_to_str:N & : }
2852   { @C _ \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).

```

2853 \cs_new:Npn \@@_multicolumn:nnn #1 #2 #3
2854 {
```

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`.

```

2855   \multispan { #1 }
2856   \cs_set_eq:NN \@@_update_max_cell_width: \prg_do_nothing:
2857   \begingroup
2858   \tbl_update_multicolumn_cell_data:n { #1 }
```

Now, we patch the (small) preamble as we have done with the main preamble of the array.

```

2859   \tl_gclear:N \g_@@_preamble_tl
2860   \@@_make_m_preamble:n #2 \q_stop
```

The following lines are an adaptation of the definition of `\multicolumn` in `array`.

```

2861 \def \@addamp
2862 {
2863   \legacy_if:nTF { @firstamp }
2864   { \legacy_if_set_false:n { @firstamp } }
2865   { \@preamerr 5 }
2866 }
2867 \exp_args:No \mkpream \g_@@_preamble_tl
2868 \@addtopreamble \empty
```

```

2869 \endgroup
2870 \UseTaggingSocket {tbl / colspan} { #1 }

```

Now, we do a treatment specific to `nicematrix` which has no equivalent in the original definition of `\multicolumn`.

```

2871 \int_compare:nNnT { #1 } > { \c_one_int }
2872 {
2873     \seq_gput_left:N \g_@@_multicolumn_cells_seq
2874     { \int_use:N \c@iRow - \int_eval:n { \c@jCol + 1 } }
2875     \seq_gput_left:Nn \g_@@_multicolumn_sizes_seq { #1 }
2876     \seq_gput_right:N \g_@@_pos_of_blocks_seq
2877     {
2878         {
2879             \int_if_zero:nTF { \c@jCol }
2880             { \int_eval:n { \c@iRow + 1 } }
2881             { \int_use:N \c@iRow }
2882         }
2883         { \int_eval:n { \c@jCol + 1 } }
2884         {
2885             \int_if_zero:nTF { \c@jCol }
2886             { \int_eval:n { \c@iRow + 1 } }
2887             { \int_use:N \c@iRow }
2888         }
2889         { \int_eval:n { \c@jCol + #1 } }

```

The last argument is for the name of the block.

```

2890     { }
2891     }
2892 }

```

We want `\cellcolor` to be available in `\multicolumn` because `\cellcolor` of `colortbl` is available in `\multicolumn`.

```

2893 \RenewDocumentCommand { \cellcolor } { O { } m }
2894 {
2895     \tl_gput_right:N \g_@@_pre_code_before_tl
2896     {
2897         \@@_rectanglecolor [ ##1 ]
2898         { \exp_not:n { ##2 } }
2899         { \int_use:N \c@iRow - \int_use:N \c@jCol }
2900         { \int_use:N \c@iRow - \int_eval:n { \c@jCol + #1 } }
2901     }
2902     \ignorespaces
2903 }

```

The following lines were in the original definition of `\multicolumn`.

```

2904 \def \@sharp { #3 }
2905 \carstrut
2906 \@preamble
2907 \null

```

We add some lines.

```

2908 \int_gadd:Nn \c@jCol { #1 - 1 }
2909 \int_compare:nNnT { \c@jCol } > { \g_@@_col_total_int }
2910     { \int_gset_eq:NN \g_@@_col_total_int \c@jCol }
2911     \ignorespaces
2912 }

```

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`.

```

2913 \cs_new_protected:Npn \@@_make_m_preamble:n #1
2914 {
2915     \str_case:nnF { #1 }

```

```

2916    {
2917        c { \@@_make_m_preamble_i:n #1 }
2918        l { \@@_make_m_preamble_i:n #1 }
2919        r { \@@_make_m_preamble_i:n #1 }
2920        > { \@@_make_m_preamble_ii:nn #1 }
2921        ! { \@@_make_m_preamble_ii:nn #1 }
2922        @ { \@@_make_m_preamble_ii:nn #1 }
2923        | { \@@_make_m_preamble_iii:n #1 }
2924        p { \@@_make_m_preamble_iv:nnn t #1 }
2925        m { \@@_make_m_preamble_iv:nnn c #1 }
2926        b { \@@_make_m_preamble_iv:nnn b #1 }
2927        w { \@@_make_m_preamble_v:nnnn { } #1 }
2928        W { \@@_make_m_preamble_v:nnnn { \@@_special_W: } #1 }
2929        \q_stop { }
2930    }
2931    {
2932        \cs_if_exist:cTF { NC @ find @ #1 }
2933        {
2934            \tl_set_eq:Nc \l_tmpa_tl { NC @ rewrite @ #1 }
2935            \exp_last_unbraced:No \@@_make_m_preamble:n \l_tmpa_tl
2936        }
2937        {
2938            \str_if_eq:nnTF { #1 } { S }
2939                { \@@_fatal:n { unknown~column~type~S~multicolumn } }
2940                { \@@_fatal:nn { unknown~column~type~multicolumn } { #1 } }
2941        }
2942    }
2943 }

```

For c, l and r

```

2944 \cs_new_protected:Npn \@@_make_m_preamble_i:n #1
2945 {
2946     \tl_gput_right:Nn \g_@@_preamble_tl
2947     {
2948         > { \@@_cell_begin: \tl_set:Nn \l_@@_hpos_cell_tl { #1 } }
2949         #1
2950         < \@@_cell_end:
2951     }

```

We test for the presence of a <.

```

2952     \@@_make_m_preamble_x:n
2953 }

```

For >, ! and @

```

2954 \cs_new_protected:Npn \@@_make_m_preamble_ii:nn #1 #2
2955 {
2956     \tl_gput_right:Nn \g_@@_preamble_tl { #1 { #2 } }
2957     \@@_make_m_preamble:n
2958 }

```

For |

```

2959 \cs_new_protected:Npn \@@_make_m_preamble_iii:n #1
2960 {
2961     \tl_gput_right:Nn \g_@@_preamble_tl { #1 }
2962     \@@_make_m_preamble:n
2963 }

```

For p, m and b

```

2964 \cs_new_protected:Npn \@@_make_m_preamble_iv:nnn #1 #2 #3
2965 {
2966     \tl_gput_right:Nn \g_@@_preamble_tl
2967     {
2968         > {
2969             \@@_cell_begin:

```

We use `\setlength` instead of `\dim_set:N` to allow a specifier like `p{widthof{Some words}}`. `widthof` is a command provided by `calc`. Of course, even if `calc` is not loaded, the following code will work with the standard version of `\setlength`.

```

2970         \setlength { \l_tmpa_dim } { #3 }
2971         \begin { minipage } [ #1 ] { \l_tmpa_dim }
2972         \mode_leave_vertical:
2973         \arraybackslash
2974         \vrule height \box_ht:N \carstrutbox depth \c_zero_dim width \c_zero_dim
2975     }
2976     c
2977     < {
2978         \vrule height \c_zero_dim depth \box_dp:N \carstrutbox width \c_zero_dim
2979         \end { minipage }
2980         \@@_cell_end:
2981     }
2982 }
```

We test for the presence of a <.

```

2983     \@@_make_m_preamble_x:n
2984 }
```

For w and W

```

2985 \cs_new_protected:Npn \@@_make_m_preamble_v:nnnn #1 #2 #3 #4
2986 {
2987     \tl_gput_right:Nn \g_@@_preamble_tl
2988     {
2989         > {
2990             \dim_set:Nn \l_@@_col_width_dim { #4 }
2991             \hbox_set:Nw \l_@@_cell_box
2992             \@@_cell_begin:
2993             \tl_set:Nn \l_@@_hpos_cell_tl { #3 }
2994         }
2995         c
2996         < {
2997             \@@_cell_end:
2998             \hbox_set_end:
2999             \bool_if:NT \g_@@_rotate_bool { \@@_rotate_cell_box: }
3000             #1
3001             \@@_adjust_size_box:
3002             \makebox [ #4 ] [ #3 ] { \box_use_drop:N \l_@@_cell_box }
3003         }
3004     }
3005 }
```

We test for the presence of a <.

```

3005     \@@_make_m_preamble_x:n
3006 }
```

After a specifier of column, we have to test whether there is one or several <{..}.

```

3007 \cs_new_protected:Npn \@@_make_m_preamble_x:n #1
3008 {
3009     \str_if_eq:nnTF { #1 } { < }
3010     { \@@_make_m_preamble_ix:n }
3011     { \@@_make_m_preamble:n { #1 } }
3012 }
3013 \cs_new_protected:Npn \@@_make_m_preamble_ix:n #1
3014 {
3015     \tl_gput_right:Nn \g_@@_preamble_tl { < { #1 } }
3016     \@@_make_m_preamble_x:n
3017 }
```

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  $\l_1_{tmpa\_dim}$  and the total height of the potential last row in  $\l_1_{tmpb\_dim}$ ).

```

3018 \cs_new_protected:Npn \@@_put_box_in_flow:
3019 {
3020   \box_set_ht:Nn \l_tmpa_box { \box_ht:N \l_tmpa_box + \l_tmpa_dim }
3021   \box_set_dp:Nn \l_tmpa_box { \box_dp:N \l_tmpa_box + \l_tmpb_dim }
3022   \str_if_eq:eeTF { \l_@@_baseline_t1 } { c }
3023     { \box_use_drop:N \l_tmpa_box }
3024     { \@@_put_box_in_flow_i: }
3025 }
```

The command  $\@@_put_box_in_flow_i:$  is used when the value of  $\l_1_{@@_baseline_t1}$  is different of  $c$  (the initial value).

```

3026 \cs_new_protected:Npn \@@_put_box_in_flow_i:
3027 {
3028   \pgfpicture
3029     \@@_qpoint:n { row - 1 }
3030     \dim_gset_eq:NN \g_tmpa_dim \pgf@y
3031     \@@_qpoint:n { row - \int_eval:n { \c@iRow + 1 } }
3032     \dim_gadd:Nn \g_tmpa_dim \pgf@y
3033     \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).

```

3034 \tl_if_in:NnTF \l_@@_baseline_t1 { line- }
3035 {
3036   \int_set:Nn \l_tmpa_int
3037     { \str_range:Nnn \l_@@_baseline_t1 { 6 } { -1 } }
3038   \bool_lazy_or:nnT
3039     { \int_compare_p:nNn { \l_tmpa_int } < { 1 } }
3040     { \int_compare_p:nNn { \l_tmpa_int } > { \c@iRow + 1 } }
3041   {
3042     \@@_error:n { bad-value-for~baseline-line }
3043     \int_set_eq:NN \l_tmpa_int \c_one_int
3044   }
3045   \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
3046 }
3047 {
3048   \str_if_eq:eeTF { \l_@@_baseline_t1 } { t }
3049     { \int_set_eq:NN \l_tmpa_int \c_one_int }
3050     {
3051       \str_if_eq:onTF \l_@@_baseline_t1 { b }
3052         { \int_set_eq:NN \l_tmpa_int \c@iRow }
3053         { \int_set:Nn \l_tmpa_int \l_@@_baseline_t1 }
3054     }
3055   \bool_lazy_or:nnT
3056     { \int_compare_p:nNn { \l_tmpa_int } < { \l_@@_first_row_int } }
3057     { \int_compare_p:nNn { \l_tmpa_int } > { \g_@@_row_total_int } }
3058   {
3059     \@@_error:n { bad-value-for~baseline }
3060     \int_set_eq:NN \l_tmpa_int \c_one_int
3061   }
3062   \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
```

We take into account the position of the mathematical axis.

```

3063   \dim_gsub:Nn \g_tmpa_dim { \fontdimen22 \textfont2 }
3064 }
3065 \dim_gsub:Nn \g_tmpa_dim \pgf@y
```

Now,  $\g_tmpa_dim$  contains the value of the  $y$  translation we have to to.

```

3066 \endpgfpicture
3067 \box_move_up:nn \g_tmpa_dim { \box_use_drop:N \l_tmpa_box }
3068 \box_use_drop:N \l_tmpa_box
3069 }
```

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).

```
3070 \cs_new_protected:Npn \@@_use_arraybox_with_notes_c:
3071 {
```

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.

```
3072 \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3073 {
3074     \int_compare:nNnT { \c@jCol } > { \c_one_int }
3075     {
3076         \box_set_wd:Nn \l_@@_the_array_box
3077             { \box_wd:N \l_@@_the_array_box - \arraycolsep }
3078     }
3079 }
```

We need a `{minipage}` because we will insert a LaTeX list for the tabular notes (that means that a `\vtop{\hsize=...}` is not enough).

```
3080 \begin{minipage} [ t ] { \box_wd:N \l_@@_the_array_box }
3081 \bool_if:NT \l_@@_caption_above_bool
3082 {
3083     \tl_if_empty:NF \l_@@_caption_tl
3084     {
3085         \bool_set_false:N \g_@@_caption_finished_bool
3086         \int_gzero:N \c@tabularnote
3087         \@@_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).

```
3088 \int_compare:nNnT { \g_@@_notes_caption_int } > { \c_zero_int }
3089 {
3090     \tl_gput_right:Ne \g_@@_aux_tl
3091     {
3092         \tl_set:Nn \exp_not:N \l_@@_note_in_caption_tl
3093             { \int_use:N \g_@@_notes_caption_int }
3094     }
3095     \int_gzero:N \g_@@_notes_caption_int
3096 }
3097 }
3098 }
```

The `\hbox` avoids that the `pgfpicture` inside `\@@_draw_blocks` adds a extra vertical space before the notes.

```
3099 \hbox
3100 {
3101     \box_use_drop:N \l_@@_the_array_box
```

We have to draw the blocks right away 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.

```
3102 \@@_create_extra_nodes:
3103 \seq_if_empty:NF \g_@@_blocks_seq { \@@_draw_blocks: }
3104 }
```

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 it compiles twice its tabular).

```
3105 \bool_lazy_any:nT
3106 {
3107     { ! \seq_if_empty_p:N \g_@@_notes_seq }
```

```

3108     { ! \seq_if_empty_p:N \g_@@_notes_in_caption_seq }
3109     { ! \tl_if_empty_p:o \g_@@_tabularnote_tl }
3110   }
3111   \@@_insert_tabularnotes:
3112   \cs_set_eq:NN \tabularnote \@@_tabularnote_error:n
3113   \bool_if:NF \l_@@_caption_above_bool { \@@_insert_caption: }
3114   \end { minipage }
3115 }

3116 \cs_new_protected:Npn \@@_insert_caption:
3117 {
3118   \tl_if_empty:NF \l_@@_caption_tl
3119   {
3120     \cs_if_exist:NTF \c@captiontype
3121     { \@@_insert_caption_i: }
3122     { \@@_error:n { caption-outside-float } }
3123   }
3124 }

3125 \cs_new_protected:Npn \@@_insert_caption_i:
3126 {
3127   \group_begin:

```

The flag `\l_@@_in_caption_bool` affects only the behavior of the command `\tabularnote` when used in the caption.

```
3128   \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.

```

3129   \IfPackageLoadedT { floatrow } { \cs_set_eq:NN \@makecaption \FR@makecaption }
3130   \tl_if_empty:NTF \l_@@_short_caption_tl
3131   {
3132     \caption
3133     { \caption [ \l_@@_short_caption_tl ] }
3134     { \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.

```

3134   \bool_if:NF \g_@@_caption_finished_bool
3135   {
3136     \bool_gset_true:N \g_@@_caption_finished_bool
3137     \int_gset_eq:NN \g_@@_notes_caption_int \c@tabularnote
3138     \int_gzero:N \c@tabularnote
3139   }
3140   \tl_if_empty:NF \l_@@_label_tl { \label { \l_@@_label_tl } }
3141   \group_end:
3142 }

3143 \cs_new_protected:Npn \@@_tabularnote_error:n #1
3144 {
3145   \@@_error_or_warning:n { tabularnote-below-the-tabular }
3146   \cs_gset:Npn \@@_tabularnote_error:n ##1 { }
3147 }

3148 \cs_new_protected:Npn \@@_insert_tabularnotes:
3149 {
3150   \seq_gconcat:NNN \g_@@_notes_seq \g_@@_notes_in_caption_seq \g_@@_notes_seq
3151   \int_set:Nn \c@tabularnote { \seq_count:N \g_@@_notes_seq }
3152   \skip_vertical:N 0.65ex

```

The TeX group is for potential specifications in the `\l_@@_notes_code_before_tl`.

```

3153 \group_begin:
3154 \l_@@_notes_code_before_tl
3155 \tl_if_empty:NF \g_@@_tabularnote_tl
3156 {
3157     \g_@@_tabularnote_tl \par
3158     \tl_gclear:N \g_@@_tabularnote_tl
3159 }

```

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.

```

3160 \int_compare:nNnT { \c@tabularnote } > { \c_zero_int }
3161 {
3162     \bool_if:NTF \l_@@_notes_para_bool
3163     {
3164         \begin { tabularnotes* }
3165             \seq_map_inline:Nn \g_@@_notes_seq
3166                 { \@@_one_tabularnote:nn ##1 }
3167             \strut
3168         \end { tabularnotes* }

```

The following `\par` is mandatory for the event that the user has put `\footnotesize` (for example) in the `notes/code-before`.

```

3169         \par
3170     }
3171     {
3172         \tabularnotes
3173             \seq_map_inline:Nn \g_@@_notes_seq
3174                 { \@@_one_tabularnote:nn ##1 }
3175             \strut
3176         \endtabularnotes
3177     }
3178 }
3179 \unskip
3180 \group_end:
3181 \bool_if:NT \l_@@_notes_bottomrule_bool
3182 {
3183     \IfPackageLoadedTF { booktabs }
3184 }

```

The two dimensions `\aboverulesep` et `\heavyrulewidth` are parameters defined by `booktabs`.

```

3185 \skip_vertical:N \aboverulesep

```

`\CT@arc@` is the specification of color defined by `colortbl` but you use it even if `colortbl` is not loaded.

```

3186     { \CT@arc@ \hrule height \heavyrulewidth }
3187     }
3188     { \@@_error_or_warning:n { bottomrule~without~booktabs } }
3189 }
3190 \l_@@_notes_code_after_tl
3191 \seq_gclear:N \g_@@_notes_seq
3192 \seq_gclear:N \g_@@_notes_in_caption_seq
3193 \int_gzero:N \c@tabularnote
3194 }

```

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 curryfication.

```

3195 \cs_set_protected:Npn \@@_one_tabularnote:nn #
3196 {
3197     \tl_if_novalue:nTF { #1 }
3198         { \item }
3199         { \item [ \@@_notes_label_in_list:n { #1 } ] }
3200 }

```

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`.

```

3201 \cs_new_protected:Npn \@@_use_arraybox_with_notes_b:
3202 {
3203     \pgfpicture
3204         \@@_qpoint:n { row - 1 }
3205         \dim_gset_eq:NN \g_tmpa_dim \pgf@y
3206         \@@_qpoint:n { row - \int_use:N \c@iRow - base }
3207         \dim_gsub:Nn \g_tmpa_dim \pgf@y
3208     \endpgfpicture
3209     \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
3210     \int_if_zero:nT { \l_@@_first_row_int }
3211     {
3212         \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
3213         \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
3214     }
3215     \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
3216 }
```

Now, the general case.

```

3217 \cs_new_protected:Npn \@@_use_arraybox_with_notes:
3218 {
```

We convert a value of `t` to a value of 1.

```

3219 \str_if_eq:eeT { \l_@@_baseline_tl } { t }
3220 { \tl_set:Nn \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`.

```

3221 \pgfpicture
3222 \@@_qpoint:n { row - 1 }
3223 \dim_gset_eq:NN \g_tmpa_dim \pgf@y
3224 \tl_if_in:NnTF \l_@@_baseline_tl { line- }
3225 {
3226     \int_set:Nn \l_tmpa_int
3227     {
3228         \str_range:Nnn
3229             \l_@@_baseline_tl
3230             { 6 }
3231             { \tl_count:o \l_@@_baseline_tl }
3232     }
3233     \@@_qpoint:n { row - \int_use:N \l_tmpa_int }
3234 }
3235 {
3236     \int_set:Nn \l_tmpa_int \l_@@_baseline_tl
3237     \bool_lazy_or:nnT
3238     { \int_compare_p:nNn { \l_tmpa_int } < { \l_@@_first_row_int } }
3239     { \int_compare_p:nNn { \l_tmpa_int } > { \g_@@_row_total_int } }
3240     {
3241         \@@_error:n { bad-value-for-baseline }
3242         \int_set:Nn \l_tmpa_int 1
3243     }
3244     \@@_qpoint:n { row - \int_use:N \l_tmpa_int - base }
3245 }
3246 \dim_gsub:Nn \g_tmpa_dim \pgf@y
3247 \endpgfpicture
3248 \dim_gadd:Nn \g_tmpa_dim \arrayrulewidth
3249 \int_if_zero:nT { \l_@@_first_row_int }
3250 {
3251     \dim_gadd:Nn \g_tmpa_dim \g_@@_ht_row_zero_dim
3252     \dim_gadd:Nn \g_tmpa_dim \g_@@_dp_row_zero_dim
3253 }
3254 \box_move_up:nn \g_tmpa_dim { \hbox { \@@_use_arraybox_with_notes_c: } }
```

```
3255 }
```

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.

```
3256 \cs_new_protected:Npn \@@_put_box_in_flow_bis:nn #1 #2
3257 {
```

We will compute the real width of both delimiters used.

```
3258 \dim_zero:N \l_@@_real_left_delim_dim
3259 \dim_zero:N \l_@@_real_right_delim_dim
3260 \hbox_set:Nn \l_tmpb_box
3261 {
3262   \m@th
3263   $ % $
3264   \left #1
3265   \vcenter
3266   {
3267     \vbox_to_ht:nn
3268     { \box_ht_plus_dp:N \l_tmpa_box }
3269     { }
3270   }
3271   \right .
3272   $ % $
3273 }
3274 \dim_set:Nn \l_@@_real_left_delim_dim
3275 { \box_wd:N \l_tmpb_box - \nulldelimiterspace }
3276 \hbox_set:Nn \l_tmpb_box
3277 {
3278   \m@th
3279   $ % $
3280   \left .
3281   \vbox_to_ht:nn
3282   { \box_ht_plus_dp:N \l_tmpa_box }
3283   { }
3284   \right #2
3285   $ % $
3286 }
3287 \dim_set:Nn \l_@@_real_right_delim_dim
3288 { \box_wd:N \l_tmpb_box - \nulldelimiterspace }
```

Now, we can put the box in the TeX flow with the horizontal adjustments on both sides.

```
3289 \skip_horizontal:n { \l_@@_left_delim_dim - \l_@@_real_left_delim_dim }
3290 \@@_put_box_in_flow:
3291 \skip_horizontal:n { \l_@@_right_delim_dim - \l_@@_real_right_delim_dim }
3292 }
```

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).

```
3293 \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).

```
3294 {
3295   \peek_remove_spaces:n
3296   {
3297     \peek_meaning:NTF \end
3298     { \@@_analyze_end:Nn }
```

```

3299      {
3300          \@@_transform_preamble:
3301          \@@_array:o \g_@@_array_preamble_tl
3302      }
3303  }
3304  }
3305  {
3306      \@@_create_col_nodes:
3307      \endarray
3308  }

```

When the key `light-syntax` is in force, we use an environment which takes its whole body as an argument (with the specifier `b`).

```

3309 \NewDocumentEnvironment { @@-light-syntax } { b }
3310 {

```

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`.

```

3311     \tl_if_empty:nT { #1 }
3312         { \@@_fatal:n { empty~environment } }
3313     \tl_if_in:nnT { #1 } { & }
3314         { \@@_fatal:n { ampersand-in-light-syntax } }
3315     \tl_if_in:nnT { #1 } { \\ }
3316         { \@@_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`.

```
3317     \@@_light_syntax_i:w #1 \CodeAfter \q_stop
```

The command `\array` is hidden somewhere in `\@@_light_syntax_i:w`.

```
3318 }
```

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.

```

3319 {
3320     \@@_create_col_nodes:
3321     \endarray
3322 }
3323 \cs_new_protected:Npn \@@_light_syntax_i:w #1\CodeAfter #2 \q_stop
3324 {
3325     \tl_gput_right:Nn \g_nicematrix_code_after_tl { #2 }

```

The body of the array, which is stored in the argument `#1`, is now split into items (and *not* tokens).

```
3326     \seq_clear_new:N \l_@@_rows_seq
```

We rescan the character of end of line in order to have the correct catcode.

```

3327     \tl_set_rescan:Nno \l_@@_end_of_row_tl { } \l_@@_end_of_row_tl
3328     \bool_if:NTF \l_@@_light_syntax_expanded_bool
3329         { \seq_set_split:Nee }
3330         { \seq_set_split:Non }
3331     \l_@@_rows_seq \l_@@_end_of_row_tl { #1 }

```

We delete the last row if it is empty.

```

3332     \seq_pop_right:NN \l_@@_rows_seq \l_tmpa_tl
3333     \tl_if_empty:NF \l_tmpa_tl
3334         { \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_t1` is not empty, we will use directly where it should be.

```
3335     \int_compare:nNnT { \l_@@_last_row_int } = { -1 }
3336         { \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 `\backslash` and `&`) of the environment will be stored in `\l_@@_new_body_t1` in order to allow the use of commands such as `\hline` or `\hdottedline` with the key `light-syntax`.

```
3337     \tl_build_begin:N \l_@@_new_body_t1
3338     \int_zero_new:N \l_@@_nb_cols_int
```

First, we treat the first row.

```
3339     \seq_pop_left:NN \l_@@_rows_seq \l_tmpa_t1
3340         \@@_line_with_light_syntax:o \l_tmpa_t1
```

Now, the other rows (with the same treatment, excepted that we have to insert `\backslash` between the rows).

```
3341     \seq_map_inline:Nn \l_@@_rows_seq
3342     {
3343         \tl_build_put_right:Nn \l_@@_new_body_t1 { \backslash }
3344         \@@_line_with_light_syntax:n { ##1 }
3345     }
3346     \tl_build_end:N \l_@@_new_body_t1
3347     \int_compare:nNnT { \l_@@_last_col_int } = { -1 }
3348     {
3349         \int_set:Nn \l_@@_last_col_int
3350             { \l_@@_nb_cols_int - 1 + \l_@@_first_col_int }
3351     }
```

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.

```
3352     \@@_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`).

```
3353     \@@_array:o \g_@@_array_preamble_t1 \l_@@_new_body_t1
3354 }
3355 \cs_new_protected:Npn \@@_line_with_light_syntax:n #1
3356 {
3357     \seq_clear_new:N \l_@@_cells_seq
3358     \seq_set_split:Nnn \l_@@_cells_seq { ~ } { #1 }
3359     \int_set:Nn \l_@@_nb_cols_int
3360     {
3361         \int_max:nn
3362             { \l_@@_nb_cols_int }
3363             { \seq_count:N \l_@@_cells_seq }
3364     }
3365     \seq_pop_left:NN \l_@@_cells_seq \l_tmpa_t1
3366     \tl_build_put_right:No \l_@@_new_body_t1 \l_tmpa_t1
3367     \seq_map_inline:Nn \l_@@_cells_seq
3368         { \tl_build_put_right:Nn \l_@@_new_body_t1 { & ##1 } }
3369 }
3370 \cs_generate_variant:Nn \@@_line_with_light_syntax:n { o }
```

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`.

```
3371 \cs_new_protected:Npn \@@_analyze_end:Nn #1 #2
3372 {
3373     \str_if_eq:eeT { \g_@@_name_env_str } { #2 }
3374         { \@@_fatal:n { empty~environment } }
```

We reput in the stream the `\end{...}` we have extracted and the user will have an error for incorrect nested environments.

```
3375     \end { #2 }
3376 }
```

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`).

```
3377 \cs_new:Npn \@@_create_col_nodes:
3378 {
3379     \crr
3380     \int_if_zero:nT { \l_@@_first_col_int }
3381     {
3382         \omit
3383         \hbox_overlap_left:n
3384         {
3385             \bool_if:NT \l_@@_code_before_bool
3386                 { \pgfsys@markposition { \@@_env: - col - 0 } }
3387             \pgfpicture
3388             \pgfrememberpicturepositiononpagetrue
3389             \pgfcoordinate { \@@_env: - col - 0 } \pgfpointorigin
3390             \str_if_empty:NF \l_@@_name_str
3391                 { \pgfnodealias { \l_@@_name_str - col - 0 } { \@@_env: - col - 0 } }
3392             \endpgfpicture
3393             \skip_horizontal:n { 2 \colsep + \g_@@_width_first_col_dim }
3394         }
3395         &
3396     }
3397     \omit
```

The following instruction must be put after the instruction `\omit` since, of course, it is not expandable.

```
3398 \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`).

```
3399 \int_if_zero:nTF { \l_@@_first_col_int }
3400 {
3401     \@@_mark_position:n { 1 }
3402     \pgfpicture
3403     \pgfrememberpicturepositiononpagetrue
3404     \pgfcoordinate { \@@_env: - col - 1 }
3405         { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3406     \str_if_empty:NF \l_@@_name_str
3407         { \pgfnodealias { \l_@@_name_str - col - 1 } { \@@_env: - col - 1 } }
3408     \endpgfpicture
3409 }
3410 {
3411     \bool_if:NT \l_@@_code_before_bool
3412     {
3413         \hbox
3414         {
3415             \skip_horizontal:n { 0.5 \arrayrulewidth }
3416             \pgfsys@markposition { \@@_env: - col - 1 }
3417             \skip_horizontal:n { -0.5 \arrayrulewidth }
3418         }
3419     }
3420     \pgfpicture
3421     \pgfrememberpicturepositiononpagetrue
3422     \pgfcoordinate { \@@_env: - col - 1 }
3423         { \pgfpoint { 0.5 \arrayrulewidth } \c_zero_dim }
3424     \@@_node_alias:n { 1 }
3425     \endpgfpicture
3426 }
```

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.

```

3427 \skip_gset:Nn \g_tmpa_skip { 0 pt~plus 1 fill }
3428 \bool_if:NF \l_@@_auto_columns_width_bool
3429   { \dim_compare:nNnT { \l_@@_columns_width_dim } > { \c_zero_dim } }
3430   {
3431     \bool_lazy_and:nnTF
3432       { \l_@@_auto_columns_width_bool }
3433       { \bool_not_p:n \l_@@_block_auto_columns_width_bool }
3434       { \skip_gadd:Nn \g_tmpa_skip \g_@@_max_cell_width_dim }
3435       { \skip_gadd:Nn \g_tmpa_skip \l_@@_columns_width_dim }
3436       \skip_gadd:Nn \g_tmpa_skip { 2 \col@sep }
3437   }
3438 \skip_horizontal:N \g_tmpa_skip
3439 \hbox
3440   {
3441     \@@_mark_position:n { 2 }
3442     \pgfpicture
3443     \pgfrememberpicturepositiononpagetrue
3444     \pgfcoordinate { \@@_env: - col - 2 }
3445       { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3446     \@@_node_alias:n { 2 }
3447     \endpgfpicture
3448   }

```

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.

```

3449 \int_gset_eq:NN \g_tmpa_int \c_one_int
3450 \bool_if:NTF \g_@@_last_col_found_bool
3451   { \prg_replicate:nn { \int_max:nn { \g_@@_col_total_int - 3 } { 0 } } }
3452   { \prg_replicate:nn { \int_max:nn { \g_@@_col_total_int - 2 } { 0 } } }
3453   {
3454     &
3455     \omit
3456     \int_gincr:N \g_tmpa_int

```

The incrementation of the counter `\g_tmpa_int` must be done after the `\omit` of the cell.

```

3457 \skip_horizontal:N \g_tmpa_skip
3458 \@@_mark_position:n { \int_eval:n { \g_tmpa_int + 1 } }

```

We create the `col` node on the right of the current column.

```

3459 \pgfpicture
3460   \pgfrememberpicturepositiononpagetrue
3461   \pgfcoordinate { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3462     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3463     \@@_node_alias:n { \int_eval:n { \g_tmpa_int + 1 } }
3464   \endpgfpicture
3465 }

3466 % &      % moved on 2025-11-02
3467 % \omit

```

If there is only one column (and a potential “last column”), we don't have to put the following code (there is only one column and we have put the correct code previously).

```

3468 \bool_lazy_or:nnF
3469   { \int_compare_p:nNn \g_@@_col_total_int = 1 }
3470   { \int_compare_p:nNn \g_@@_col_total_int = 2 && \g_@@_last_col_found_bool }
3471   {
3472     &

```

```

3473     \omit
3474     \skip_horizontal:N \g_tmpa_skip
3475     \int_gincr:N \g_tmpa_int
3476     \bool_lazy_any:nF
3477     {
3478         \g_@@_delims_bool
3479         \l_@@_tabular_bool
3480         { ! \clist_if_empty_p:N \l_@@_vlines_clist }
3481         \l_@@_exterior_arraycolsep_bool
3482         \l_@@_bar_at_end_of_pream_bool
3483     }
3484     { \skip_horizontal:n { - \col@sep } }
3485     \bool_if:NT \l_@@_code_before_bool
3486     {
3487         \hbox
3488         {
3489             \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.

```

3490             \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3491                 { \skip_horizontal:n { - \arraycolsep } }
3492             \pgfsys@markposition
3493                 { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3494                 \skip_horizontal:n { 0.5 \arrayrulewidth }
3495                 \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3496                     { \skip_horizontal:N \arraycolsep }
3497                 }
3498             }
3499             \pgfpicture
3500                 \pgfrememberpicturepositiononpagetrue
3501                 \pgfcoordinate { \@@_env: - col - \int_eval:n { \g_tmpa_int + 1 } }
3502                 {
3503                     \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3504                     {
3505                         \pgfpoint
3506                             { - 0.5 \arrayrulewidth - \arraycolsep }
3507                             \c_zero_dim
3508                     }
3509                     { \pgfpoint { - 0.5 \arrayrulewidth } \c_zero_dim }
3510                 }
3511                 \@@_node_alias:n { \int_eval:n { \g_tmpa_int + 1 } }
3512             \endpgfpicture
3513         }

3514         \bool_if:NT \g_@@_last_col_found_bool
3515         {
3516             \hbox_overlap_right:n
3517             {
3518                 \skip_horizontal:N \g_@@_width_last_col_dim
3519                 \skip_horizontal:N \col@sep
3520                 \bool_if:NT \l_@@_code_before_bool
3521                 {
3522                     \pgfsys@markposition
3523                     { \@@_env: - col - \int_eval:n { \g_@@_col_total_int + 1 } }
3524                 }
3525             \pgfpicture
3526                 \pgfrememberpicturepositiononpagetrue
3527                 \pgfcoordinate
3528                     { \@@_env: - col - \int_eval:n { \g_@@_col_total_int + 1 } }
3529                     \pgfpointorigin
3530                     \@@_node_alias:n { \int_eval:n { \g_@@_col_total_int + 1 } }

```

```

3531         \endpgfpicture
3532     }
3533   }
3534 }

3535 \cs_new_protected:Npn \@@_mark_position:n #1
3536 {
3537   \bool_if:NT \l_@@_code_before_bool
3538   {
3539     \hbox
3540     {
3541       \skip_horizontal:n { -0.5 \arrayrulewidth }
3542       \pgfsys@markposition { \@@_env: - col - #1 }
3543       \skip_horizontal:n { 0.5 \arrayrulewidth }
3544     }
3545   }
3546 }

3547 \cs_new_protected:Npn \@@_node_alias:n #1
3548 {
3549   \str_if_empty:NF \l_@@_name_str
3550   { \pgfnodealias { \l_@@_name_str - col - #1 } { \@@_env: - col - #1 } }
3551 }

```

Here is the preamble for the “first column” (if the user uses the key `first-col`)

```

3552 \tl_const:Nn \c_@@_preamble_first_col_tl
3553 {
3554   >
3555 }
```

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

```

3556 \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:
3557 \bool_gset_true:N \g_@@_after_col_zero_bool
3558 \@@_begin_of_row:
3559 \hbox_set:Nw \l_@@_cell_box
3560 \@@_math_toggle:
3561 \@@_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”.

```

3562 \int_compare:nNnT { \c@iRow } > { \c_zero_int }
3563   {
3564     \bool_lazy_or:nnT
3565     { \int_compare_p:nNn { \l_@@_last_row_int } < { \c_zero_int } }
3566     { \int_compare_p:nNn { \c@iRow } < { \l_@@_last_row_int } }
3567   {
3568     \l_@@_code_for_first_col_tl
3569     \xglobal \colorlet { nicematrix-first-col } { . }
3570   }
3571 }
```

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`.

```

3573 l
3574 <
3575 {
3576   \@@_math_toggle:
3577   \hbox_set_end:
3578   \bool_if:NT \g_@@_rotate_bool { \@@_rotate_cell_box: }
3579   \@@_adjust_size_box:
3580   \@@_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.

```
3581     \dim_gset:Nn \g_@@_width_first_col_dim
3582         { \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.

```
3583     \hbox_overlap_left:n
3584     {
3585         \dim_compare:nNnTF { \box_wd:N \l_@@_cell_box } > { \c_zero_dim }
3586             { \c_node_cell: }
3587             { \box_use_drop:N \l_@@_cell_box }
3588             \skip_horizontal:N \l_@@_left_delim_dim
3589             \skip_horizontal:N \l_@@_left_margin_dim
3590             \skip_horizontal:N \l_@@_extra_left_margin_dim
3591         }
3592         \bool_gset_false:N \g_@@_empty_cell_bool
3593         \skip_horizontal:n { -2 \col@sep }
3594     }
3595 }
```

Here is the preamble for the “last column” (if the user uses the key `last-col`).

```
3596 \tl_const:Nn \c_@@_preamble_last_col_tl
3597 {
3598     >
3599     {
3600         \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).

```
3601     \cs_set_eq:NN \CodeAfter \c_@@_CodeAfter_i:
```

With the flag `\g_@@_last_col_found_bool`, we will know that the “last column” is really used.

```
3602     \bool_gset_true:N \g_@@_last_col_found_bool
3603     \int_gincr:N \c@jCol
3604     \int_gset_eq:NN \g_@@_col_total_int \c@jCol
3605     \hbox_set:Nw \l_@@_cell_box
3606         \c@_math_toggle:
3607         \c@_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”.

```
3608     \int_compare:nNnT { \c@iRow } > { \c_zero_int }
3609     {
3610         \bool_lazy_or:nnT
3611             { \int_compare_p:nNn { \l_@@_last_row_int } < { \c_zero_int } }
3612             { \int_compare_p:nNn { \c@iRow } < { \l_@@_last_row_int } }
3613         {
3614             \l_@@_code_for_last_col_tl
3615             \xglobal \colorlet { nicematrix-last-col } { . }
3616         }
3617     }
3618 }
3619 l
3620 <
3621 {
3622     \c@_math_toggle:
3623     \hbox_set_end:
3624     \bool_if:NT \g_@@_rotate_bool { \c@_rotate_cell_box: }
3625     \c@_adjust_size_box:
3626     \c@_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.

```
3627     \dim_gset:Nn \g_@@_width_last_col_dim
3628         { \dim_max:nn { \g_@@_width_last_col_dim } { \box_wd:N \l_@@_cell_box } }
3629     \skip_horizontal:n { -2 \col@sep }
```

The content of the cell is inserted in an overlapping position.

```

3630 \hbox_overlap_right:n
3631 {
3632     \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } > { \c_zero_dim }
3633     {
3634         \skip_horizontal:N \l_@@_right_delim_dim
3635         \skip_horizontal:N \l_@@_right_margin_dim
3636         \skip_horizontal:N \l_@@_extra_right_margin_dim
3637         \c_@@_node_cell:
3638     }
3639 }
3640 \bool_gset_false:N \g_@@_empty_cell_bool
3641 }
3642 }
```

The environment `{NiceArray}` is constructed upon the environment `{NiceArrayWithDelims}`.

```

3643 \NewDocumentEnvironment { NiceArray } { }
3644 {
3645     \bool_gset_false:N \g_@@_delims_bool
3646     \str_if_empty:NT \g_@@_name_env_str
3647     { \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).

```

3648     \NiceArrayWithDelims . .
3649 }
3650 { \endNiceArrayWithDelims }
```

We create the variants of the environment `{NiceArrayWithDelims}`.

```

3651 \cs_new_protected:Npn \@@_def_env:NNN #1 #2 #3
3652 {
3653     \NewDocumentEnvironment { #1 NiceArray } { }
3654     {
3655         \bool_gset_true:N \g_@@_delims_bool
3656         \str_if_empty:NT \g_@@_name_env_str
3657         { \str_gset:Nn \g_@@_name_env_str { #1 NiceArray } }
3658         \c_@@_test_if_math_mode:
3659         \NiceArrayWithDelims #2 #3
3660     }
3661 { \endNiceArrayWithDelims }
3662 }

3663 \c_@@_def_env:NNN p ( )
3664 \c_@@_def_env:NNN b [ ]
3665 \c_@@_def_env:NNN B \{ \}
3666 \c_@@_def_env:NNN v \vert \vert
3667 \c_@@_def_env:NNN V \Vert \Vert
```

## 13 The environment `{NiceMatrix}` and its variants

```

3668 \cs_new_protected:Npn \@@_begin_of_NiceMatrix:nn #1 #2
3669 {
3670     \bool_set_false:N \l_@@_preamble_bool
3671     \tl_clear:N \l_tmpa_tl
3672     \bool_if:NT \l_@@_NiceMatrix_without_vlines_bool
3673     { \tl_set:Nn \l_tmpa_tl { @ { } } }
3674     \tl_put_right:Nn \l_tmpa_tl
```

```

3675   {
3676     *
3677     {
3678       \int_case:nnF \l_@@_last_col_int
3679       {
3680         { -2 } { \c@MaxMatrixCols }
3681         { -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).

```

3682       }
3683       { \int_eval:n { \l_@@_last_col_int - 1 } }
3684     }
3685     { #2 }
3686   }
3687   \tl_set:Nn \l_tmpb_tl { \use:c { #1 NiceArray } }
3688   \exp_args:No \l_tmpb_tl \l_tmpa_tl
3689 }
3690 \cs_generate_variant:Nn \@@_begin_of_NiceMatrix:nn { n o }
3691 \clist_map_inline:nn { p , b , B , v , V }
3692 {
3693   \NewDocumentEnvironment { #1 NiceMatrix } { ! 0 { } }
3694   {
3695     \bool_gset_true:N \g_@@_delims_bool
3696     \str_gset:Nn \g_@@_name_env_str { #1 NiceMatrix }
3697     \int_if_zero:nT { \l_@@_last_col_int }
3698     {
3699       \bool_set_true:N \l_@@_last_col_without_value_bool
3700       \int_set:Nn \l_@@_last_col_int { -1 }
3701     }
3702     \keys_set:nn { nicematrix / NiceMatrix } { ##1 }
3703     \@@_begin_of_NiceMatrix:no { #1 } { \l_@@_columns_type_tl }
3704   }
3705   { \use:c { end #1 NiceArray } }
3706 }

```

We define also an environment {NiceMatrix}

```

3707 \NewDocumentEnvironment { NiceMatrix } { ! 0 { } }
3708 {
3709   \str_gset:Nn \g_@@_name_env_str { NiceMatrix }
3710   \int_if_zero:nT { \l_@@_last_col_int }
3711   {
3712     \bool_set_true:N \l_@@_last_col_without_value_bool
3713     \int_set:Nn \l_@@_last_col_int { -1 }
3714   }
3715   \keys_set:nn { nicematrix / NiceMatrix } { #1 }
3716   \bool_lazy_or:nnT
3717   {
3718     { \clist_if_empty_p:N \l_@@_vlines_clist }
3719     { \l_@@_except_borders_bool }
3720     { \bool_set_true:N \l_@@_NiceMatrix_without_vlines_bool }
3721   }
3722   \@@_begin_of_NiceMatrix:no { } { \l_@@_columns_type_tl }
3723   { \endNiceArray }

```

The following command will be linked to \NotEmpty in the environments of nicematrix.

```

3723 \cs_new_protected:Npn \@@_NotEmpty:
3724   { \bool_gset_true:N \g_@@_not_empty_cell_bool }

```

## 14 {NiceTabular}, {NiceTabularX} and {NiceTabular\*}

```

3725 \NewDocumentEnvironment { NiceTabular } { 0 { } m ! 0 { } }
3726 {

```

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`.

```

3727   \dim_compare:nNnT { \l_@@_width_dim } = { \c_zero_dim }
3728     { \dim_set_eq:NN \l_@@_width_dim \linewidth }
3729   \str_gset:Nn \g_@@_name_env_str { NiceTabular }
3730   \keys_set:nn { nicematrix / NiceTabular } { #1 , #3 }
3731   \tl_if_empty:NF \l_@@_short_caption_tl
3732   {
3733     \tl_if_empty:NT \l_@@_caption_tl
3734     {
3735       \@@_error_or_warning:n { short-caption-without-caption }
3736       \tl_set_eq:NN \l_@@_caption_tl \l_@@_short_caption_tl
3737     }
3738   }
3739   \tl_if_empty:NF \l_@@_label_tl
3740   {
3741     \tl_if_empty:NT \l_@@_caption_tl
3742     { \@@_error_or_warning:n { label-without-caption } }
3743   }
3744 \NewDocumentEnvironment { TabularNote } { b }
3745   {
3746     \bool_if:NTF \l_@@_in_code_after_bool
3747       { \@@_error_or_warning:n { TabularNote-in-CodeAfter } }
3748       {
3749         \tl_if_empty:NF \g_@@_tabularnote_tl
3750           { \tl_gput_right:Nn \g_@@_tabularnote_tl { \par } }
3751           \tl_gput_right:Nn \g_@@_tabularnote_tl { ##1 }
3752       }
3753     }
3754   {
3755     \@@_settings_for_tabular:
3756     \NiceArray { #2 }
3757   }
3758   { \endNiceArray }

3759 \cs_new_protected:Npn \@@_settings_for_tabular:
3760   {
3761     \bool_set_true:N \l_@@_tabular_bool
3762     \cs_set_eq:NN \@@_math_toggle: \prg_do_nothing:
3763     \cs_set_eq:NN \@@_tuning_not_tabular_begin: \prg_do_nothing:
3764     \cs_set_eq:NN \@@_tuning_not_tabular_end: \prg_do_nothing:
3765   }

3766 \NewDocumentEnvironment { NiceTabularX } { m O { } m ! O { } }
3767   {
3768     \str_gset:Nn \g_@@_name_env_str { NiceTabularX }
3769     \dim_set:Nn \l_@@_width_dim { #1 }
3770     \keys_set:nn { nicematrix / NiceTabular } { #2 , #4 }
3771     \@@_settings_for_tabular:
3772     \NiceArray { #3 }
3773   }
3774   {
3775     \endNiceArray
3776     \fp_compare:nNnT { \g_@@_total_X_weight_fp } = { \c_zero_fp }
3777       { \@@_error:n { NiceTabularX-without-X } }
3778   }

3779 \NewDocumentEnvironment { NiceTabular* } { m O { } m ! O { } }
3780   {
3781     \str_gset:Nn \g_@@_name_env_str { NiceTabular* }
3782     \dim_set:Nn \l_@@_tabular_width_dim { #1 }
3783     \keys_set:nn { nicematrix / NiceTabular } { #2 , #4 }
3784     \@@_settings_for_tabular:

```

```

3785     \NiceArray { #3 }
3786 }
3787 { \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`).

```

3788 \cs_new_protected:Npn \@@_deal_with_rounded_corners:
3789 {
3790     \bool_lazy_all:nT
3791     {
3792         { \dim_compare_p:nNn { \l_@@_tab_rounded_corners_dim } > { \c_zero_dim } }
3793         { \l_@@_hvlines_bool }
3794         { ! \g_@@_delims_bool }
3795         { ! \l_@@_except_borders_bool }
3796     }
3797     {
3798         \bool_set_true:N \l_@@_except_borders_bool
3799         \clist_if_empty:NF \l_@@_corners_clist
3800         { \@@_error:n { hvlines,~rounded-corners-and~corners } }
3801         \tl_gput_right:Nn \g_@@_pre_code_after_tl
3802         {
3803             \@@_stroke_block:nnn
3804             {
3805                 rounded-corners = \dim_use:N \l_@@_tab_rounded_corners_dim ,
3806                 draw = \l_@@_rules_color_tl
3807             }
3808             { 1-1 }
3809             { \int_use:N \c@iRow - \int_use:N \c@jCol }
3810         }
3811     }
3812 }
```

  

```

3813 \cs_new_protected:Npn \@@_after_array:
3814 {
```

There was a `\hook_gput_code:nnn { env / tabular / begin } { nicematrix }` in the command `\@@_pre_array_after_CodeBefore:` 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`.

```

3815     \hook_gremove_code:nn { env / tabular / begin } { nicematrix }
3816     \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.

```

3817     \bool_if:NT \g_@@_last_col_found_bool
3818     { \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`.

```

3819     \bool_if:NT \l_@@_last_col_without_value_bool
3820     { \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.

```

3821   \bool_if:NT \l_@@_last_row_without_value_bool
3822     { \int_set_eq:NN \l_@@_last_row_int \g_@@_row_total_int }

3823   \tl_gput_right:N \g_@@_aux_tl
3824   {
3825     \seq_gset_from_clist:Nn \exp_not:N \g_@@_size_seq
3826     {
3827       \int_use:N \l_@@_first_row_int ,
3828       \int_use:N \c@iRow ,
3829       \int_use:N \g_@@_row_total_int ,
3830       \int_use:N \l_@@_first_col_int ,
3831       \int_use:N \c@jCol ,
3832       \int_use:N \g_@@_col_total_int
3833     }
3834   }

```

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`.

```

3835   \seq_if_empty:NF \g_@@_pos_of_blocks_seq
3836   {
3837     \tl_gput_right:N \g_@@_aux_tl
3838     {
3839       \seq_gset_from_clist:Nn \exp_not:N \g_@@_pos_of_blocks_seq
3840       { \seq_use:Nnnn \g_@@_pos_of_blocks_seq , , , }
3841     }
3842   }
3843   \seq_if_empty:NF \g_@@_multicolumn_cells_seq
3844   {
3845     \tl_gput_right:N \g_@@_aux_tl
3846     {
3847       \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_cells_seq
3848       { \seq_use:Nnnn \g_@@_multicolumn_cells_seq , , , }
3849       \seq_gset_from_clist:Nn \exp_not:N \g_@@_multicolumn_sizes_seq
3850       { \seq_use:Nnnn \g_@@_multicolumn_sizes_seq , , , }
3851     }
3852   }

```

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

```
3853   \@@_create_diag_nodes:
```

We create the aliases using `last` for the nodes of the cells in the last row and the last column.

```

3854   \pgfpicture
3855   \@@_create_aliases_last:
3856   \str_if_empty:NF \l_@@_name_str { \@@_create_alias_nodes: }
3857   \endpgfpicture

```

By default, the diagonal lines will be parallelized<sup>12</sup>. There are two types of diagonals lines: the `\Ddots` diagonals and the `\Idots` 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.

```

3858   \bool_if:NT \l_@@_parallelize_diags_bool
3859   {
3860     \int_gzero:N \g_@@_ddots_int
3861     \int_gzero:N \g_@@_iddots_int

```

The dimensions `\g_@@_delta_x_one_dim` and `\g_@@_delta_y_one_dim` will contain the  $\Delta_x$  and  $\Delta_y$  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  $\Delta_x$  and  $\Delta_y$  of the first `\Idots` diagonal.

---

<sup>12</sup>It's possible to use the option `parallelize-diags` to disable this parallelization.

```

3862     \dim_gzero:N \g_@@_delta_x_one_dim
3863     \dim_gzero:N \g_@@_delta_y_one_dim
3864     \dim_gzero:N \g_@@_delta_x_two_dim
3865     \dim_gzero:N \g_@@_delta_y_two_dim
3866 }
3867 \bool_set_false:N \l_@@_initial_open_bool
3868 \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.

```

3869 \bool_if:NT \l_@@_small_bool { \@@_tuning_key_small_for_dots: }

```

Now, we actually draw the dotted lines (specified by `\Cdots`, `\Vdots`, etc.).

```

3870 \@@_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.

```

3871 \clist_if_empty:NF \l_@@_corners_clist
3872 {
3873     \bool_if:NTF \l_@@_no_cell_nodes_bool
3874     { \@@_error:n { corners-with-no-cell-nodes } }
3875     { \@@_compute_corners: }
3876 }

```

The sequence `\g_@@_pos_of_blocks_seq` must be “adjusted” (for the case where the user have written something like `\Block{1-*}`).

```

3877 \@@_adjust_pos_of_blocks_seq:
3878 \@@_deal_with_rounded_corners:
3879 \clist_if_empty:NF \l_@@_hlines_clist { \@@_draw_hlines: }
3880 \clist_if_empty:NF \l_@@_vlines_clist { \@@_draw_vlines: }

```

Now, the pre-code-after and then, the `\CodeAfter`.

```

3881 \IfPackageLoadedT { tikz }
3882 {
3883     \tikzset
3884     {
3885         every~picture / .style =
3886         {
3887             overlay ,
3888             remember~picture ,
3889             name-prefix = \@@_env: -
3890         }
3891     }
3892 }
3893 \cs_set_eq:NN \ar@ialign \@@_old_ar@ialign:
3894 \cs_set_eq:NN \SubMatrix \@@_SubMatrix
3895 \cs_set_eq:NN \UnderBrace \@@_UnderBrace
3896 \cs_set_eq:NN \OverBrace \@@_OverBrace
3897 \cs_set_eq:NN \ShowCellNames \@@_ShowCellNames
3898 \cs_set_eq:NN \TikzEveryCell \@@_TikzEveryCell
3899 \cs_set_eq:NN \line \@@_line

```

The LaTeX-style boolean `\ifmeasuring@` is used by `amsmath` during the phase of measure in environments such as `{align}`, etc.

```

3900 \legacy_if:nF { measuring@ } { \g_@@_pre_code_after_tl }
3901 \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.

```
3902     \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).

```
3903     \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`).

```
3904     \int_compare:nNnT { \char_value_catcode:n { 60 } } = { 13 }
3905         { \@@_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`:

```
3906     \bool_set_true:N \l_@@_in_code_after_bool
3907     \exp_last_unbraced:No \@@_CodeAfter_keys: \g_nicematrix_code_after_tl
3908     \scan_stop:
3909     \tl_gclear:N \g_nicematrix_code_after_tl
3910     \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.

```
3911     \seq_if_empty:NF \g_@@_rowlistcolors_seq { \@@_clear_rowlistcolors_seq: }
3912     \tl_if_empty:NF \g_@@_pre_code_before_tl
3913     {
3914         \tl_gput_right:Ne \g_@@_aux_tl
3915         {
3916             \tl_gset:Nn \exp_not:N \g_@@_pre_code_before_tl
3917             { \exp_not:o \g_@@_pre_code_before_tl }
3918         }
3919         \tl_gclear:N \g_@@_pre_code_before_tl
3920     }
3921     \tl_if_empty:NF \g_nicematrix_code_before_tl
3922     {
3923         \tl_gput_right:Ne \g_@@_aux_tl
3924         {
3925             \tl_gset:Nn \exp_not:N \g_@@_code_before_tl
3926             { \exp_not:o \g_nicematrix_code_before_tl }
3927         }
3928         \tl_gclear:N \g_nicematrix_code_before_tl
3929     }

3930     \str_gclear:N \g_@@_name_env_str
3931     \@@_restore_iRow_jCol:
```

The command `\CT@arc@` contains the instruction of color for the rules of the array<sup>13</sup>. 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`.

```
3932     \cs_gset_eq:NN \CT@arc@ \@@_old_CT@arc@
3933 }
```

---

<sup>13</sup>e.g. `\color[rgb]{0.5,0.5,0}`

```

3934 \cs_new_protected:Npn \@@_tuning_key_small_for_dots:
3935 {
3936     \dim_set:Nn \l_@@_xdots_radius_dim { 0.7 \l_@@_xdots_radius_dim }
3937     \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.

```

3938     \dim_set:Nn \l_@@_xdots_shorten_start_dim
3939         { 0.6 \l_@@_xdots_shorten_start_dim }
3940     \dim_set:Nn \l_@@_xdots_shorten_end_dim
3941         { 0.6 \l_@@_xdots_shorten_end_dim }
3942 }

```

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`.

```

3943 \NewDocumentCommand \@@_CodeAfter_keys: { O { } }
3944     { \keys_set:nn { nicematrix / CodeAfter } { #1 } }

```

```

3945 \cs_new_protected:Npn \@@_create_alias_nodes:
3946 {
3947     \int_step_inline:nn { \c@iRow }
3948     {
3949         \pgfnodealias
3950             { \l_@@_name_str - ##1 - last }
3951             { \@@_env: - ##1 - \int_use:N \c@jCol }
3952     }
3953     \int_step_inline:nn { \c@jCol }
3954     {
3955         \pgfnodealias
3956             { \l_@@_name_str - last - ##1 }
3957             { \@@_env: - \int_use:N \c@iRow - ##1 }
3958     }
3959     \pgfnodealias
3960         { \l_@@_name_str - last - last }
3961         { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol }
3962 }

```

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).

```

3963 \cs_new_protected:Npn \@@_adjust_pos_of_blocks_seq:
3964 {
3965     \seq_gset_map_e:NNn \g_@@_pos_of_blocks_seq \g_@@_pos_of_blocks_seq
3966         { \@@_adjust_pos_of_blocks_seq_i:nnnnn ##1 }
3967 }

```

The following command must *not* be protected.

```

3968 \cs_new:Npn \@@_adjust_pos_of_blocks_seq_i:nnnnn #1 #2 #3 #4 #5
3969 {
3970     { #1 }
3971     { #2 }
3972     {
3973         \int_compare:nNnTF { #3 } > { 98 }
3974             { \int_use:N \c@iRow }
3975             { #3 }
3976 }

```

```

3977   {
3978     \int_compare:nNnTF { #4 } > { 98 }
3979       { \int_use:N \c@jCol }
3980       { #4 }
3981   }
3982   { #5 }
3983 }

```

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).

```

3984 \hook_gput_code:nnn { begindocument } { . . }
3985 {
3986   \cs_new_protected:Npe \@@_draw_dotted_lines:
3987   {
3988     \c_@@_pgfortikzpicture_tl
3989     \@@_draw_dotted_lines_i:
3990     \c_@@_endpgfortikzpicture_tl
3991   }
3992 }

```

The following command *must* be protected because it will appear in the construction of the command `\@@_draw_dotted_lines:`.

```

3993 \cs_new_protected:Npn \@@_draw_dotted_lines_i:
3994 {
3995   \pgfrememberpicturepositiononpagetrue
3996   \pgf@relevantforpicturesizefalse
3997   \g_@@_Hdotsfor_lines_tl
3998   \g_@@_Vdots_lines_tl
3999   \g_@@_Ddots_lines_tl
4000   \g_@@_Idots_lines_tl
4001   \g_@@_Cdots_lines_tl
4002   \g_@@_Ldots_lines_tl
4003 }

4004 \cs_new_protected:Npn \@@_restore_iRow_jCol:
4005 {
4006   \cs_if_exist:NT \theiRow { \int_gset_eq:NN \c@iRow \l_@@_old_iRow_int }
4007   \cs_if_exist:NT \thejCol { \int_gset_eq:NN \c@jCol \l_@@_old_jCol_int }
4008 }

```

We define a new PGF shape for the diag nodes because we want to provide an anchor called `.5` for those nodes.

```

4009 \pgfdeclareshape { @@_diag_node }
4010 {
4011   \savedanchor { \five }
4012   {
4013     \dim_gset_eq:NN \pgf@x \l_tmpa_dim
4014     \dim_gset_eq:NN \pgf@y \l_tmpb_dim
4015   }
4016   \anchor { 5 } { \five }
4017   \anchor { center } { \pgfpointorigin }
4018   \anchor { 1 } { \five \pgf@x = 0.2 \pgf@x \pgf@y = 0.2 \pgf@y }
4019   \anchor { 2 } { \five \pgf@x = 0.4 \pgf@x \pgf@y = 0.4 \pgf@y }
4020   \anchor { 25 } { \five \pgf@x = 0.5 \pgf@x \pgf@y = 0.5 \pgf@y }
4021   \anchor { 3 } { \five \pgf@x = 0.6 \pgf@x \pgf@y = 0.6 \pgf@y }
4022   \anchor { 4 } { \five \pgf@x = 0.8 \pgf@x \pgf@y = 0.8 \pgf@y }
4023   \anchor { 6 } { \five \pgf@x = 1.2 \pgf@x \pgf@y = 1.2 \pgf@y }
4024   \anchor { 7 } { \five \pgf@x = 1.4 \pgf@x \pgf@y = 1.4 \pgf@y }
4025   \anchor { 75 } { \five \pgf@x = 1.5 \pgf@x \pgf@y = 1.5 \pgf@y }
4026   \anchor { 8 } { \five \pgf@x = 1.6 \pgf@x \pgf@y = 1.6 \pgf@y }
4027   \anchor { 9 } { \five \pgf@x = 1.8 \pgf@x \pgf@y = 1.8 \pgf@y }
4028 }

```

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).

```

4029 \cs_new_protected:Npn \@@_create_diag_nodes:
4030 {
4031     \pgfpicture
4032     \pgfrememberpicturepositiononpagetrue
4033     \int_step_inline:nn { \int_max:nn { \c@iRow } { \c@jCol } }
4034     {
4035         \@@_qpoint:n { col - \int_min:nn { ##1 } { \c@jCol + 1 } }
4036         \dim_set_eq:NN \l_tmpa_dim \pgf@x
4037         \@@_qpoint:n { row - \int_min:nn { ##1 } { \c@iRow + 1 } }
4038         \dim_set_eq:NN \l_tmpb_dim \pgf@y
4039         \@@_qpoint:n { col - \int_min:nn { ##1 + 1 } { \c@jCol + 1 } }
4040         \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
4041         \@@_qpoint:n { row - \int_min:nn { ##1 + 1 } { \c@iRow + 1 } }
4042         \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
4043         \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.

```

4044 \dim_set:Nn \l_tmpa_dim { ( \l_@@_tmpc_dim - \l_tmpa_dim ) / 2 }
4045 \dim_set:Nn \l_tmpb_dim { ( \l_@@_tmpd_dim - \l_tmpb_dim ) / 2 }
4046 \pgfnode { @@_diag_node } { center } { } { \@@_env: - ##1 } { }
4047 \str_if_empty:NF \l_@@_name_str
4048     { \pgfnodealias { \l_@@_name_str - ##1 } { \@@_env: - ##1 } }
4049 }

```

Now, the last node. Of course, that is only a coordinate because there is not .5 anchor for that node.

```

4050 \int_set:Nn \l_tmpa_int { \int_max:nn { \c@iRow } { \c@jCol } + 1 }
4051 \@@_qpoint:n { row - \int_min:nn { \l_tmpa_int } { \c@iRow + 1 } }
4052 \dim_set_eq:NN \l_tmpa_dim \pgf@y
4053 \@@_qpoint:n { col - \int_min:nn { \l_tmpa_int } { \c@jCol + 1 } }
4054 \pgfcordinate
4055     { \@@_env: - \int_use:N \l_tmpa_int } { \pgfpoint \pgf@x \l_tmpa_dim }
4056 \pgfnodealias
4057     { \@@_env: - last }
4058     { \@@_env: - \int_eval:n { \int_max:nn { \c@iRow } { \c@jCol } + 1 } }
4059 \str_if_empty:NF \l_@@_name_str
4060 {
4061     \pgfnodealias
4062         { \l_@@_name_str - \int_use:N \l_tmpa_int }
4063         { \@@_env: - \int_use:N \l_tmpa_int }
4064     \pgfnodealias
4065         { \l_@@_name_str - last }
4066         { \@@_env: - last }
4067 }
4068 \endpgfpicture
4069 }

```

## 16 We draw the dotted lines

A dotted line will be said *open* in one of its extremities when it stops on the edge of the matrix and *closed* otherwise. In the following matrix, the dotted line is closed on its left extremity and open on its right.

$$\begin{pmatrix} a+b+c & a+b & a \\ & \dots & \\ a & a+b & a+b+c \end{pmatrix}$$

The command `\@_find_extremities_of_line:nnnn` takes four arguments:

- the first argument is the row of the cell where the command was issued;
- the second argument is the column of the cell where the command was issued;
- the third argument is the  $x$ -value of the orientation vector of the line;
- the fourth argument is the  $y$ -value of the orientation vector of the line.

This command computes:

- `\l @_initial_i_int` and `\l @_initial_j_int` which are the coordinates of one extremity of the line;
- `\l @_final_i_int` and `\l @_final_j_int` which are the coordinates of the other extremity of the line;
- `\l @_initial_open_bool` and `\l @_final_open_bool` to indicate whether the extremities are open or not.

```
4070 \cs_new_protected:Npn \@_find_extremities_of_line:nnnn #1 #2 #3 #4
4071 {
```

First, we declare the current cell as “dotted” because we forbide intersections of dotted lines.

```
4072 \cs_set_nopar:cpn { @_ dotted _ #1 - #2 } { }
```

Initialization of variables.

```
4073 \int_set:Nn \l @_initial_i_int { #1 }
4074 \int_set:Nn \l @_initial_j_int { #2 }
4075 \int_set:Nn \l @_final_i_int { #1 }
4076 \int_set:Nn \l @_final_j_int { #2 }
```

We will do two loops: one when determining the initial cell and the other when determining the final cell. The boolean `\l @_stop_loop_bool` will be used to control these loops. In the first loop, we search the “final” extremity of the line.

```
4077 \bool_set_false:N \l @_stop_loop_bool
4078 \bool_do_until:Nn \l @_stop_loop_bool
4079 {
4080     \int_add:Nn \l @_final_i_int { #3 }
4081     \int_add:Nn \l @_final_j_int { #4 }
4082     \bool_set_false:N \l @_final_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.

```
4083 \if_int_compare:w \l @_final_i_int > \l @_row_max_int
4084     \if_int_compare:w #3 = \c_one_int
4085         \bool_set_true:N \l @_final_open_bool
4086     \else:
4087         \if_int_compare:w \l @_final_j_int > \l @_col_max_int
4088             \bool_set_true:N \l @_final_open_bool
4089         \fi:
4090     \fi:
4091 \else:
4092     \if_int_compare:w \l @_final_j_int < \l @_col_min_int
4093         \if_int_compare:w #4 = -1
4094             \bool_set_true:N \l @_final_open_bool
4095         \fi:
4096     \else:
4097         \if_int_compare:w \l @_final_j_int > \l @_col_max_int
4098             \if_int_compare:w #4 = \c_one_int
4099                 \bool_set_true:N \l @_final_open_bool
4100             \fi:
4101         \fi:
4102     \fi:
4103 \fi:
```

```
4104 \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.

```
4105 {
```

We do a step backwards.

```
4106     \int_sub:Nn \l_@@_final_i_int { #3 }
4107     \int_sub:Nn \l_@@_final_j_int { #4 }
4108     \bool_set_true:N \l_@@_stop_loop_bool
4109 }
```

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`.

```
4110 {
4111     \cs_if_exist:cTF
4112     {
4113         @@ _ dotted _
4114         \int_use:N \l_@@_final_i_int -
4115         \int_use:N \l_@@_final_j_int
4116     }
4117     {
4118         \int_sub:Nn \l_@@_final_i_int { #3 }
4119         \int_sub:Nn \l_@@_final_j_int { #4 }
4120         \bool_set_true:N \l_@@_final_open_bool
4121         \bool_set_true:N \l_@@_stop_loop_bool
4122     }
4123     {
4124         \cs_if_exist:cTF
4125         {
4126             pgf @ sh @ ns @ \@@_env:
4127             - \int_use:N \l_@@_final_i_int
4128             - \int_use:N \l_@@_final_j_int
4129         }
4130         { \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.

```
4131 {
4132     \cs_set_nopar:cpn
4133     {
4134         @@ _ dotted _
4135         \int_use:N \l_@@_final_i_int -
4136         \int_use:N \l_@@_final_j_int
4137     }
4138     {
4139     }
4140   }
4141 }
4142 }
```

For `\l_@@_initial_i_int` and `\l_@@_initial_j_int` the programmation is similar to the previous one.

```
4143 \bool_set_false:N \l_@@_stop_loop_bool
```

The following line of code is only for efficiency in the following loop.

```
4144 \int_set:Nn \l_tmpa_int { \l_@@_col_min_int - 1 }
4145 \bool_do_until:Nn \l_@@_stop_loop_bool
4146 {
4147     \int_sub:Nn \l_@@_initial_i_int { #3 }
4148     \int_sub:Nn \l_@@_initial_j_int { #4 }
4149     \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.

```

4150      \if_int_compare:w \l_@@_initial_i_int < \l_@@_row_min_int
4151          \if_int_compare:w #3 = \c_one_int
4152              \bool_set_true:N \l_@@_initial_open_bool
4153      \else:
4154
4155      \l_tmpa_int contains \l_@@_col_min_int - 1 (only for efficiency).
4156          \if_int_compare:w \l_@@_initial_j_int = \l_tmpa_int
4157              \bool_set_true:N \l_@@_initial_open_bool
4158          \fi:
4159      \else:
4160          \if_int_compare:w \l_@@_initial_j_int < \l_@@_col_min_int
4161              \if_int_compare:w #4 = \c_one_int
4162                  \bool_set_true:N \l_@@_initial_open_bool
4163              \fi:
4164          \else:
4165              \if_int_compare:w \l_@@_initial_j_int > \l_@@_col_max_int
4166                  \if_int_compare:w #4 = -1
4167                      \bool_set_true:N \l_@@_initial_open_bool
4168                  \fi:
4169              \else:
4170                  \bool_if:NTF \l_@@_initial_open_bool
4171                  {
4172                      \int_add:Nn \l_@@_initial_i_int { #3 }
4173                      \int_add:Nn \l_@@_initial_j_int { #4 }
4174                      \bool_set_true:N \l_@@_stop_loop_bool
4175                  }
4176                  {
4177                      \cs_if_exist:cTF
4178                      {
4179                          @@ _ dotted _
4180                          \int_use:N \l_@@_initial_i_int -
4181                          \int_use:N \l_@@_initial_j_int
4182                      }
4183                      {
4184                          \int_add:Nn \l_@@_initial_i_int { #3 }
4185                          \int_add:Nn \l_@@_initial_j_int { #4 }
4186                          \bool_set_true:N \l_@@_initial_open_bool
4187                          \bool_set_true:N \l_@@_stop_loop_bool
4188                      }
4189                      {
4190                          \cs_if_exist:cTF
4191                          {
4192                              pgf @ sh @ ns @ \@@_env:
4193                              - \int_use:N \l_@@_initial_i_int
4194                              - \int_use:N \l_@@_initial_j_int
4195                          }
4196                          { \bool_set_true:N \l_@@_stop_loop_bool }
4197                          {
4198                              \cs_set_nopar:cpn
4199                              {
4200                                  @@ _ dotted _
4201                                  \int_use:N \l_@@_initial_i_int -
4202                                  \int_use:N \l_@@_initial_j_int
4203                              }
4204                              { }
4205                          }
4206                      }
4207                  }
4208

```

```
4209 }
```

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.

```
4210 \seq_gput_right:Ne \g_@@_pos_of_xdots_seq
4211 {
4212     { \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`.

```
4213     { \int_min:nn { \l_@@_initial_j_int } { \l_@@_final_j_int } }
4214     { \int_use:N \l_@@_final_i_int }
4215     { \int_max:nn { \l_@@_initial_j_int } { \l_@@_final_j_int } }
4216     { }
4217 }
4218 }
```

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 whether the extremities are closed or open) but before the analysis 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.

```
4219 \cs_new_protected:Npn \@@_open_shorten:
4220 {
4221     \bool_if:NT \l_@@_initial_open_bool
4222         { \dim_zero:N \l_@@_xdots_shorten_start_dim }
4223     \bool_if:NT \l_@@_final_open_bool
4224         { \dim_zero:N \l_@@_xdots_shorten_end_dim }
4225 }
```

The following command (*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).

```
4226 \cs_new_protected:Npn \@@_adjust_to_submatrix:nn #1 #2
4227 {
4228     \int_set_eq:NN \l_@@_row_min_int \c_one_int
4229     \int_set_eq:NN \l_@@_col_min_int \c_one_int
4230     \int_set_eq:NN \l_@@_row_max_int \c@iRow
4231     \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`.

```
4232 \seq_if_empty:NF \g_@@_submatrix_seq
4233 {
4234     \seq_map_inline:Nn \g_@@_submatrix_seq
4235         { \@@_adjust_to_submatrix:nnnnnn { #1 } { #2 } ##1 }
4236     }
4237 }
```

#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 programmation of that command with the the standard syntax of L3.

```
\cs_new_protected:Npn \@@_adjust_to_submatrix:nnnnnn #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.

```

4238 \cs_new_protected:Npn \@@_adjust_to_submatrix:nnnnnn #1 #2 #3 #4 #5 #6
4239 {
4240     \if_int_compare:w #3 > #1
4241     \else:
4242         \if_int_compare:w #1 > #5
4243         \else:
4244             \if_int_compare:w #4 > #2
4245             \else:
4246                 \if_int_compare:w #2 > #6
4247                 \else:
4248                     \if_int_compare:w \l_@@_row_min_int < #3 \l_@@_row_min_int = #3 \fi:
4249                     \if_int_compare:w \l_@@_col_min_int < #4 \l_@@_col_min_int = #4 \fi:
4250                     \if_int_compare:w \l_@@_row_max_int < #5 \l_@@_row_max_int = #5 \fi:
4251                     \if_int_compare:w \l_@@_col_max_int < #6 \l_@@_col_max_int = #6 \fi:
4252                 \fi:
4253             \fi:
4254         \fi:
4255     \fi:
4256 }
4257
4258 \cs_new_protected:Npn \@@_set_initial_coords:
4259 {
4260     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4261     \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4262 }
4263 \cs_new_protected:Npn \@@_set_final_coords:
4264 {
4265     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4266     \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
4267 }
4268 \cs_new_protected:Npn \@@_set_initial_coords_from_anchor:n #1
4269 {
4270     \pgfpointanchor
4271     {
4272         \@@_env:
4273         - \int_use:N \l_@@_initial_i_int
4274         - \int_use:N \l_@@_initial_j_int
4275     }
4276     { #1 }
4277     \@@_set_initial_coords:
4278 }
4279 \cs_new_protected:Npn \@@_set_final_coords_from_anchor:n #1
4280 {
4281     \pgfpointanchor
4282     {
4283         \@@_env:
4284         - \int_use:N \l_@@_final_i_int
4285         - \int_use:N \l_@@_final_j_int
4286     }
4287     { #1 }
4288     \@@_set_final_coords:
4289 }

```

```

4289 \cs_new_protected:Npn \@@_open_x_initial_dim:
4290 {
4291     \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
4292     \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
4293     {
4294         \cs_if_exist:cT
4295             { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
4296             {
4297                 \pgfpointanchor
4298                     { \@@_env: - ##1 - \int_use:N \l_@@_initial_j_int }
4299                     { west }
4300                 \dim_set:Nn \l_@@_x_initial_dim
4301                     { \dim_min:nn { \l_@@_x_initial_dim } { \pgf@x } }
4302             }
4303     }

```

If, in fact, all the cells of the column are empty (no PGF/Tikz nodes in those cells).

```

4304 \dim_compare:nNnT { \l_@@_x_initial_dim } = { \c_max_dim }
4305 {
4306     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4307     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4308     \dim_add:Nn \l_@@_x_initial_dim \col@sep
4309 }
4310 }

4311 \cs_new_protected:Npn \@@_open_x_final_dim:
4312 {
4313     \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }
4314     \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
4315     {
4316         \cs_if_exist:cT
4317             { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
4318             {
4319                 \pgfpointanchor
4320                     { \@@_env: - ##1 - \int_use:N \l_@@_final_j_int }
4321                     { east }
4322                 \dim_compare:nNnT { \pgf@x } > { \l_@@_x_final_dim }
4323                     { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
4324             }
4325     }

```

If, in fact, all the cells of the columns are empty (no PGF/Tikz nodes in those cells).

```

4326 \dim_compare:nNnT { \l_@@_x_final_dim } = { - \c_max_dim }
4327 {
4328     \@@_qpoint:n { col - \int_eval:n { \l_@@_final_j_int + 1 } }
4329     \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
4330     \dim_sub:Nn \l_@@_x_final_dim \col@sep
4331 }
4332

```

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.

```

4333 \cs_new_protected:Npn \@@_draw_Ldots:nnn #1 #2 #3
4334 {
4335     \@@_adjust_to_submatrix:nn { #1 } { #2 }
4336     \cs_if_free:cT { @_ dotted _ #1 - #2 }
4337     {
4338         \@@_find_extremities_of_line:nnnn { #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.

```

4339 \group_begin:
4340     \@@_open_shorten:

```

```

4341     \int_if_zero:nTF { #1 }
4342         { \color { nicematrix-first-row } }
4343         {

```

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.

```

4344     \int_compare:nNnT { #1 } = { \l_@@_last_row_int }
4345         { \color { nicematrix-last-row } }
4346         }
4347         \keys_set:nn { nicematrix / xdots } { #3 }
4348         \color:o \l_@@_xdots_color_tl
4349         \actually_draw_Ldots:
4350         \group_end:
4351     }
4352 }

```

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`.

```

4353 \cs_new_protected:Npn \@@_actually_draw_Ldots:
4354 {
4355     \bool_if:NTF \l_@@_initial_open_bool
4356     {
4357         \@@_open_x_initial_dim:
4358         \qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
4359         \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
4360     }
4361     \@@_set_initial_coords_from_anchor:n { base-east }
4362     \bool_if:NTF \l_@@_final_open_bool
4363     {
4364         \@@_open_x_final_dim:
4365         \qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
4366         \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
4367     }
4368     \@@_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.

```

4369 \bool_lazy_all:nTF
4370 {
4371     \l_@@_initial_open_bool
4372     \l_@@_final_open_bool
4373     \int_compare_p:nNn { \l_@@_initial_i_int } = { \l_@@_last_row_int } }
4374 }
4375 {
4376     \dim_add:Nn \l_@@_y_initial_dim \c_@@_shift_Ldots_last_row_dim
4377     \dim_add:Nn \l_@@_y_final_dim \c_@@_shift_Ldots_last_row_dim
4378 }

```

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 (?).

```

4379 {
4380     \dim_add:Nn \l_@@_y_initial_dim \l_@@_xdots_radius_dim

```

```

4381     \dim_add:Nn \l_@@_y_final_dim \l_@@_xdots_radius_dim
4382   }
4383 \@@_draw_line:
4384 }
```

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.

```

4385 \cs_new_protected:Npn \@@_draw_Cdots:nnn #1 #2 #3
4386 {
4387   \@@_adjust_to_submatrix:nn { #1 } { #2 }
4388   \cs_if_free:cT { @_ dotted _ #1 - #2 }
4389   {
4390     \@@_find_extremities_of_line:nnnn { #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.

```

4391 \group_begin:
4392   \@@_open_shorten:
4393   \int_if_zero:nTF { #1 }
4394     { \color { nicematrix-first-row } }
4395 }
```

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.

```

4396   \int_compare:nNnT { #1 } = { \l_@@_last_row_int }
4397     { \color { nicematrix-last-row } }
4398   }
4399   \keys_set:nn { nicematrix / xdots } { #3 }
4400   \@@_color:o \l_@@_xdots_color_tl
4401   \@@_actually_draw_Cdots:
4402   \group_end:
4403 }
4404 }
```

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`.

```

4405 \cs_new_protected:Npn \@@_actually_draw_Cdots:
4406 {
4407   \bool_if:NTF \l_@@_initial_open_bool
4408     { \@@_open_x_initial_dim: }
4409     { \@@_set_initial_coords_from_anchor:n { mid-east } }
4410   \bool_if:NTF \l_@@_final_open_bool
4411     { \@@_open_x_final_dim: }
4412     { \@@_set_final_coords_from_anchor:n { mid-west } }
4413   \bool_lazy_and:nnTF
4414     { \l_@@_initial_open_bool }
4415     { \l_@@_final_open_bool }
4416   {
4417     \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int }
4418     \dim_set_eq:NN \l_tmpa_dim \pgf@y
4419     \@@_qpoint:n { row - \int_eval:n { \l_@@_initial_i_int + 1 } }
4420     \dim_set:Nn \l_@@_y_initial_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
```

```

4421 \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim
4422 }
4423 {
4424     \bool_if:NT \l_@@_initial_open_bool
4425         { \dim_set_eq:NN \l_@@_y_initial_dim \l_@@_y_final_dim }
4426     \bool_if:NT \l_@@_final_open_bool
4427         { \dim_set_eq:NN \l_@@_y_final_dim \l_@@_y_initial_dim }
4428 }
4429 \@@_draw_line:
4430 }

4431 \cs_new_protected:Npn \@@_open_y_initial_dim:
4432 {
4433     \dim_set:Nn \l_@@_y_initial_dim { - \c_max_dim }
4434     \int_step_inline:nnn { \l_@@_first_col_int } { \g_@@_col_total_int }
4435     {
4436         \cs_if_exist:cT
4437             { \pgf @ sh @ ns @ \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
4438             {
4439                 \pgfpointanchor
4440                     { \@@_env: - \int_use:N \l_@@_initial_i_int - ##1 }
4441                     { north }
4442                 \dim_compare:nNnT { \pgf@y } > { \l_@@_y_initial_dim }
4443                     { \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y }
4444             }
4445         }
4446     \dim_compare:nNnT { \l_@@_y_initial_dim } = { - \c_max_dim }
4447     {
4448         \@@_qpoint:n { row - \int_use:N \l_@@_initial_i_int - base }
4449         \dim_set:Nn \l_@@_y_initial_dim
4450         {
4451             \fp_to_dim:n
4452             {
4453                 \pgf@y
4454                 + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch
4455             }
4456         }
4457     }
4458 }

4459 \cs_new_protected:Npn \@@_open_y_final_dim:
4460 {
4461     \dim_set_eq:NN \l_@@_y_final_dim \c_max_dim
4462     \int_step_inline:nnn { \l_@@_first_col_int } { \g_@@_col_total_int }
4463     {
4464         \cs_if_exist:cT
4465             { \pgf @ sh @ ns @ \@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
4466             {
4467                 \pgfpointanchor
4468                     { \@@_env: - \int_use:N \l_@@_final_i_int - ##1 }
4469                     { south }
4470                 \dim_compare:nNnT { \pgf@y } < { \l_@@_y_final_dim }
4471                     { \dim_set_eq:NN \l_@@_y_final_dim \pgf@y }
4472             }
4473     }
4474     \dim_compare:nNnT { \l_@@_y_final_dim } = { \c_max_dim }
4475     {
4476         \@@_qpoint:n { row - \int_use:N \l_@@_final_i_int - base }
4477         \dim_set:Nn \l_@@_y_final_dim
4478             { \fp_to_dim:n { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch } }
4479     }
4480 }

```

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.

```

4481 \cs_new_protected:Npn \@@_draw_Vdots:nnn #1 #2 #3
4482 {
4483     \@@_adjust_to_submatrix:n { #1 } { #2 }
4484     \cs_if_free:cT { @@ _ dotted _ #1 - #2 }
4485     {
4486         \@@_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.

```

4487 \group_begin:
4488     \@@_open_shorten:
4489     \int_if_zero:nTF { #2 }
4490     {
4491         \color { nicematrix-first-col } }
4492     \int_compare:nNnT { #2 } = { \l_@@_last_col_int }
4493         \color { nicematrix-last-col } }
4494     }
4495     \keys_set:nn { nicematrix / xdots } { #3 }
4496     \color:o \l_@@_xdots_color_tl
4497     \bool_if:NTF \l_@@_Vbrace_bool
4498         { \@@_actually_draw_Vbrace: }
4499         { \@@_actually_draw_Vdots: }
4500     \group_end:
4501 }
4502

```

The following function is used by regular calls of `\Vdots` or `\Vdotsfor` but not by `\Vbrace`. 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.`

```

4503 \cs_new_protected:Npn \@@_actually_draw_Vdots:
4504 {
4505     \bool_lazy_and:nnTF { \l_@@_initial_open_bool } { \l_@@_final_open_bool }
4506         { \@@_actually_draw_Vdots_i: }
4507         { \@@_actually_draw_Vdots_ii: }
4508     \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
4509     \@@_draw_line:
4510 }

```

First, the case of a dotted line open on both sides.

```

4511 \cs_new_protected:Npn \@@_actually_draw_Vdots_i:
4512 {
4513     \@@_open_y_initial_dim:
4514     \@@_open_y_final_dim:
4515     \int_if_zero:nTF { \l_@@_initial_j_int }

```

We have a dotted line open on both sides in the “first column”.

```

4516 {
4517     \@@_qpoint:n { col - 1 }
4518     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4519     \dim_sub:Nn \l_@@_x_initial_dim
4520         { \@@_colsep: + \l_@@_left_margin_dim + \l_@@_extra_left_margin_dim }
4521 }
4522 {

```

```

4523 \bool_lazy_and:nNF
4524   { \int_compare_p:nNn { \l_@@_last_col_int } > { -2 } }
4525   {
4526     \int_compare_p:nNn
4527       { \l_@@_initial_j_int } = { \g_@@_col_total_int }
4528   }

```

We have a dotted line open on both sides and which is in the “last column”.

```

4529   {
4530     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4531     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4532     \dim_add:Nn \l_@@_x_initial_dim
4533       { \@@_colsep: + \l_@@_right_margin_dim + \l_@@_extra_right_margin_dim }
4534   }

```

We have a dotted line open on both sides which is *not* in an exterior column.

```

4535   {
4536     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4537     \dim_set_eq:NN \l_tmpa_dim \pgf@x
4538     \@@_qpoint:n { col - \int_eval:n { \l_@@_initial_j_int + 1 } }
4539     \dim_set:Nn \l_@@_x_initial_dim { ( \pgf@x + \l_tmpa_dim ) / 2 }
4540   }
4541 }
4542 }

```

The command `\@@_draw_line:` is in `\@@_actually_draw_Vdots:`

Now, the dotted line is *not* open on both sides (maybe open on only one side).

The main task is to determine the  $x$ -value of the dotted line to draw.

The boolean `\l_tmpa_bool` will indicate whether the column is of type 1 or may be considered as if.

```

4543 \cs_new_protected:Npn \@@_actually_draw_Vdots_ii:
4544   {
4545     \bool_set_false:N \l_tmpa_bool
4546     \bool_if:NTF \l_@@_initial_open_bool
4547       {
4548         \bool_if:NTF \l_@@_final_open_bool
4549           {
4550             \@@_set_initial_coords_from_anchor:n { south-west }
4551             \@@_set_final_coords_from_anchor:n { north-west }
4552             \bool_set:Nn \l_tmpa_bool
4553               {
4554                 \dim_compare_p:nNn
4555                   { \l_@@_x_initial_dim } = { \l_@@_x_final_dim }
4556               }
4557           }
4558       }
4559   }

```

Now, we try to determine whether the column is of type c or may be considered as if.

```

4559 \bool_if:NTF \l_@@_initial_open_bool
4560   {
4561     \@@_open_y_initial_dim:
4562     \@@_set_final_coords_from_anchor:n { north }
4563     \dim_set_eq:NN \l_@@_x_initial_dim \l_@@_x_final_dim
4564   }
4565   {
4566     \@@_set_initial_coords_from_anchor:n { south }
4567     \bool_if:NTF \l_@@_final_open_bool
4568       { \@@_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.

```

4569   {
4570     \@@_set_final_coords_from_anchor:n { north }
4571     \dim_compare:nNnf { \l_@@_x_initial_dim } = { \l_@@_x_final_dim }
4572       {

```

```

4573     \dim_set:Nn \l_@@_x_initial_dim
4574     {
4575         \bool_if:NTF \l_tmpa_bool { \dim_min:nn } { \dim_max:nn }
4576             \l_@@_x_initial_dim \l_@@_x_final_dim
4577     }
4578 }
4579 }
4580 }
4581 }

```

The following function is used by `\Vbrace` but not by regular uses of `\Vdots` or `\Vdotsfor`. The command `\@@_actually_draw_Vbrace:` 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.`

```

4582 \cs_new_protected:Npn \@@_actually_draw_Vbrace:
4583 {
4584     \bool_if:NTF \l_@@_initial_open_bool
4585         { \@@_open_y_initial_dim: }
4586         { \@@_set_initial_coords_from_anchor:n { south } }
4587     \bool_if:NTF \l_@@_final_open_bool
4588         { \@@_open_y_final_dim: }
4589         { \@@_set_final_coords_from_anchor:n { north } }

```

Now, we have the correct values for the  $y$ -values of both extremities of the brace. We have to compute the  $x$ -value (there is only one  $x$ -value since, of course, the brace is vertical).

If we are in the first (exterior) column, the brace must be drawn right flush.

```

4590 \int_if_zero:nTF { \l_@@_initial_j_int }
4591 {
4592     \@@_qpoint:n { col - 1 }
4593     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4594     \dim_sub:Nn \l_@@_x_initial_dim
4595         { \@@_colsep: + \l_@@_left_margin_dim + \l_@@_extra_left_margin_dim }
4596 }

```

Elsewhere, the brace must be drawn left flush.

```

4597 {
4598     \@@_qpoint:n { col - \int_use:N \l_@@_initial_j_int }
4599     \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
4600     \dim_add:Nn \l_@@_x_initial_dim
4601         { \@@_colsep: + \l_@@_right_margin_dim + \l_@@_extra_right_margin_dim }
4602 }

```

We draw a vertical rule and that's why, of course, both  $x$ -values are equal.

```

4603 \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
4604 \@@_draw_line:
4605 }
4606 \cs_new:Npn \@@_colsep:
4607     { \bool_if:NTF \l_@@_tabular_bool { \tabcolsep } { \arraycolsep } }

```

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.

```
4608 \cs_new_protected:Npn \@@_draw_Ddots:nnn #1 #2 #3
4609 {
4610     \@@_adjust_to_submatrix:nn { #1 } { #2 }
4611     \cs_if_free:cT { @_ dotted _ #1 - #2 }
4612     {
4613         \@@_find_extremities_of_line:nnnn { #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.

```
4614 \group_begin:
4615     \@@_open_shorten:
4616     \keys_set:nn { nicematrix / xdots } { #3 }
4617     \@@_color:o \l_@_xdots_color_tl
4618     \@@_actually_draw_Ddots:
4619     \group_end:
4620 }
4621 }
```

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.`

```
4622 \cs_new_protected:Npn \@@_actually_draw_Ddots:
4623 {
4624     \bool_if:NTF \l_@_initial_open_bool
4625     {
4626         \@@_open_y_initial_dim:
4627         \@@_open_x_initial_dim:
4628     }
4629     { \@@_set_initial_coords_from_anchor:n { south-east } }
4630     \bool_if:NTF \l_@_final_open_bool
4631     {
4632         \@@_open_x_final_dim:
4633         \dim_set_eq:NN \l_@_x_final_dim \pgf@x
4634     }
4635     { \@@_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.

```
4636     \bool_if:NT \l_@_parallelize_diags_bool
4637     {
4638         \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).

```
4639     \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  $\Delta_x$  and the  $\Delta_y$  of the line because these values will be used to draw the others diagonal lines parallels to the first one.

```
4640     {
```

```

4641         \dim_gset:Nn \g_@@_delta_x_one_dim
4642             { \l_@@_x_final_dim - \l_@@_x_initial_dim }
4643         \dim_gset:Nn \g_@@_delta_y_one_dim
4644             { \l_@@_y_final_dim - \l_@@_y_initial_dim }
4645     }

```

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`.

```

4646     {
4647         \dim_compare:nNnF { \g_@@_delta_x_one_dim } = { \c_zero_dim }
4648             {
4649                 \dim_set:Nn \l_@@_y_final_dim
4650                     {
4651                         \l_@@_y_initial_dim +
4652                             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4653                                 \dim_ratio:nn \g_@@_delta_y_one_dim \g_@@_delta_x_one_dim
4654                     }
4655                 }
4656             }
4657         }
4658     \@@_draw_line:
4659 }

```

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.

```

4660 \cs_new_protected:Npn \@@_draw_Iddots:nnn #1 #2 #3
4661 {
4662     \@@_adjust_to_submatrix:nn { #1 } { #2 }
4663     \cs_if_free:cT { @_ dotted _ #1 - #2 }
4664     {
4665         \@@_find_extremities_of_line:nnnn { #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.

```

4666     \group_begin:
4667         \@@_open_shorten:
4668         \keys_set:nn { nicematrix / xdots } { #3 }
4669         \@@_color:o \l_@@_xdots_color_tl
4670         \@@_actually_draw_Iddots:
4671     \group_end:
4672 }
4673 }

```

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`.

```

4674 \cs_new_protected:Npn \@@_actually_draw_Iddots:
4675 {
4676     \bool_if:NTF \l_@@_initial_open_bool
4677         {
4678             \@@_open_y_initial_dim:
4679             \@@_open_x_initial_dim:
4680         }

```

```

4681 { \@@_set_initial_coords_from_anchor:n { south-west } }
4682 \bool_if:NTF \l_@@_final_open_bool
4683 {
4684     \@@_open_y_final_dim:
4685     \@@_open_x_final_dim:
4686 }
4687 { \@@_set_final_coords_from_anchor:n { north-east } }
4688 \bool_if:NT \l_@@_parallelize_diags_bool
4689 {
4690     \int_gincr:N \g_@@_iddots_int
4691     \int_compare:nNnTF { \g_@@_iddots_int } = { \c_one_int }
4692     {
4693         \dim_gset:Nn \g_@@_delta_x_two_dim
4694         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
4695         \dim_gset:Nn \g_@@_delta_y_two_dim
4696         { \l_@@_y_final_dim - \l_@@_y_initial_dim }
4697     }
4698     {
4699         \dim_compare:nNnF { \g_@@_delta_x_two_dim } = { \c_zero_dim }
4700         {
4701             \dim_set:Nn \l_@@_y_final_dim
4702             {
4703                 \l_@@_y_initial_dim +
4704                 ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4705                 \dim_ratio:nn \g_@@_delta_y_two_dim \g_@@_delta_x_two_dim
4706             }
4707         }
4708     }
4709 }
4710 \@@_draw_line:
4711 }

```

## 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`

```

4712 \cs_new_protected:Npn \@@_draw_line:
4713 {
4714     \pgfrememberpicturepositiononpagetrue
4715     \pgf@relevantforpicturesizefalse
4716     \bool_lazy_or:nnTF
4717     { \tl_if_eq_p:NN \l_@@_xdots_line_style_tl \c_@@_standard_tl }
4718     { \l_@@_dotted_bool }
4719     { \@@_draw_standard_dotted_line: }
4720     { \@@_draw_unstandard_dotted_line: }
4721 }

```

We have to do a special construction with `\exp_args:Npn` to be able to put in the list of options in the correct place in the Tikz instruction.

```
4722 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:
4723 {
4724     \begin { scope }
4725     \@@_draw_unstandard_dotted_line:o
4726         { \l_@@_xdots_line_style_tl , \l_@@_xdots_color_tl }
4727 }
```

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 diretly `\l_@@_xdots_color_tl`).

The argument of `\@@_draw_unstandard_dotted_line:n` is, in fact, the list of options.

```
4728 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:n #1
4729 {
4730     \@@_draw_unstandard_dotted_line:nooo
4731         { #1 }
4732         \l_@@_xdots_up_tl
4733         \l_@@_xdots_down_tl
4734         \l_@@_xdots_middle_tl
4735 }
4736 \cs_generate_variant:Nn \@@_draw_unstandard_dotted_line:n { o }
```

The following Tikz styles are for the three labels (set by the symbols `_`, `^` and `=`) of a continuous line with a non-standard style.

```
4737 \hook_gput_code:nnn { begindocument } { . }
4738 {
4739     \IfPackageLoadedT { tikz }
4740     {
4741         \tikzset
4742             {
4743                 @@_node_above / .style = { sloped , above } ,
4744                 @@_node_below / .style = { sloped , below } ,
4745                 @@_node_middle / .style =
4746                     {
4747                         sloped ,
4748                         inner_sep = \c_@@_innersep_middle_dim
4749                     }
4750             }
4751     }
4752 }
```

  

```
4753 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line:nnnn #1 #2 #3 #4
4754 {
```

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  $\ell$  of the line to draw. We use the floating point reals of the L3 programming layer to compute this length.

```
4755 \dim_zero_new:N \l_@@_l_dim
4756 \dim_set:Nn \l_@@_l_dim
4757 {
4758     \fp_to_dim:n
4759     {
4760         sqrt
4761         (
4762             ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
4763             +
4764             ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
4765         )
4766     }
4767 }
```

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.

```

4768 \dim_compare:nNnT { \l_@@_l_dim } < { \c_@@_max_l_dim }
4769 {
4770     \dim_compare:nNnT { \l_@@_l_dim } > { 1 pt }
4771     \@@_draw_unstandard_dotted_line_i:
4772 }
```

If the key xdots/horizontal-labels has been used.

```

4773 \bool_if:NT \l_@@_xdots_h_labels_bool
4774 {
4775     \tikzset
4776     {
4777         @@_node_above / .style = { auto = left } ,
4778         @@_node_below / .style = { auto = right } ,
4779         @@_node_middle / .style = { inner sep = \c_@@_innersep_middle_dim }
4780     }
4781 }
4782 \tl_if_empty:nF { #4 }
4783 { \tikzset { @@_node_middle / .append style = { fill = white } } }
\draw
[ #1 ]
( \l_@@_x_initial_dim , \l_@@_y_initial_dim )
-- node [ @@_node_middle] { $ \scriptstyle #4 $ }
node [ @@_node_below ] { $ \scriptstyle #3 $ }
node [ @@_node_above ] { $ \scriptstyle #2 $ }
( \l_@@_x_final_dim , \l_@@_y_final_dim ) ;
\end { scope }
}
4793 \cs_generate_variant:Nn \@@_draw_unstandard_dotted_line:nnnn { n o o o }
4794 \cs_new_protected:Npn \@@_draw_unstandard_dotted_line_i:
{
\dim_set:Nn \l_tmpa_dim
{
\l_@@_x_initial_dim
+ ( \l_@@_x_final_dim - \l_@@_x_initial_dim )
* \dim_ratio:nn \l_@@_xdots_shorten_start_dim \l_@@_l_dim
}
\dim_set:Nn \l_tmpb_dim
{
\l_@@_y_initial_dim
+ ( \l_@@_y_final_dim - \l_@@_y_initial_dim )
* \dim_ratio:nn \l_@@_xdots_shorten_start_dim \l_@@_l_dim
}
\dim_set:Nn \l_@@_tmpc_dim
{
\l_@@_x_final_dim
- ( \l_@@_x_final_dim - \l_@@_x_initial_dim )
* \dim_ratio:nn \l_@@_xdots_shorten_end_dim \l_@@_l_dim
}
\dim_set:Nn \l_@@_tmpd_dim
{
\l_@@_y_final_dim
- ( \l_@@_y_final_dim - \l_@@_y_initial_dim )
* \dim_ratio:nn \l_@@_xdots_shorten_end_dim \l_@@_l_dim
}
\dim_set_eq:NN \l_@@_x_initial_dim \l_tmpa_dim
\dim_set_eq:NN \l_@@_y_initial_dim \l_tmpb_dim
\dim_set_eq:NN \l_@@_x_final_dim \l_@@_tmpc_dim
\dim_set_eq:NN \l_@@_y_final_dim \l_@@_tmpd_dim
}
```

The command `\@@_draw_standard_dotted_line:` draws the line with our system of dots (which gives a dotted line with real rounded dots).

```
4825 \cs_new_protected:Npn \@@_draw_standard_dotted_line:
4826 {
4827     \group_begin:
```

The dimension `\l_@@_l_dim` is the length  $\ell$  of the line to draw. We use the floating point reals of the L3 programming layer to compute this length.

```
4828     \dim_zero_new:N \l_@@_l_dim
4829     \dim_set:Nn \l_@@_l_dim
4830     {
4831         \fp_to_dim:n
4832         {
4833             sqrt
4834             (
4835                 ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) ^ 2
4836                 +
4837                 ( \l_@@_y_final_dim - \l_@@_y_initial_dim ) ^ 2
4838             )
4839         }
4840     }
```

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.

```
4841     \dim_compare:nNnT { \l_@@_l_dim } < { \c_@@_max_l_dim }
4842     {
4843         \dim_compare:nNnT { \l_@@_l_dim } > { 1 pt }
4844         { \@@_draw_standard_dotted_line_i: }
4845     }
4846     \group_end:
4847     \bool_lazy_all:nF
4848     {
4849         { \tl_if_empty_p:N \l_@@_xdots_up_tl }
4850         { \tl_if_empty_p:N \l_@@_xdots_down_tl }
4851         { \tl_if_empty_p:N \l_@@_xdots_middle_tl }
4852     }
4853     { \@@_labels_standard_dotted_line: }
4854 }
```

```
4855 \dim_const:Nn \c_@@_max_l_dim { 50 cm }
4856 \cs_new_protected:Npn \@@_draw_standard_dotted_line_i:
4857 {
```

The number of dots will be `\l_tmpa_int + 1`.

```
4858     \int_set:Nn \l_tmpa_int
4859     {
4860         \dim_ratio:nn
4861         {
4862             \l_@@_l_dim
4863             - \l_@@_xdots_shorten_start_dim
4864             - \l_@@_xdots_shorten_end_dim
4865         }
4866         { \l_@@_xdots_inter_dim }
4867     }
```

The dimensions `\l_tmpa_dim` and `\l_tmpb_dim` are the coordinates of the vector between two dots in the dotted line.

```
4868     \dim_set:Nn \l_tmpa_dim
4869     {
4870         ( \l_@@_x_final_dim - \l_@@_x_initial_dim ) *
4871         \dim_ratio:nn \l_@@_xdots_inter_dim \l_@@_l_dim
```

```

4872     }
4873 \dim_set:Nn \l_tmpb_dim
4874 {
4875     ( \l@@y_final_dim - \l@@y_initial_dim ) *
4876     \dim_ratio:nn \l@@xdots_inter_dim \l@@l_dim
4877 }

```

In the loop over the dots, the dimensions `\l@@x_initial_dim` and `\l@@y_initial_dim` will be used for the coordinates of the dots. But, before the loop, we must move until the first dot.

```

4878 \dim_gadd:Nn \l@@x_initial_dim
4879 {
4880     ( \l@@x_final_dim - \l@@x_initial_dim ) *
4881     \dim_ratio:nn
4882     {
4883         \l@@l_dim - \l@@xdots_inter_dim * \l_tmpa_int
4884         + \l@@xdots_shorten_start_dim - \l@@xdots_shorten_end_dim
4885     }
4886     { 2 \l@@l_dim }
4887 }
4888 \dim_gadd:Nn \l@@y_initial_dim
4889 {
4890     ( \l@@y_final_dim - \l@@y_initial_dim ) *
4891     \dim_ratio:nn
4892     {
4893         \l@@l_dim - \l@@xdots_inter_dim * \l_tmpa_int
4894         + \l@@xdots_shorten_start_dim - \l@@xdots_shorten_end_dim
4895     }
4896     { 2 \l@@l_dim }
4897 }
4898 \pgf@relevantforpicturesizefalse
4899 \int_step_inline:nnn { \c_zero_int } { \l_tmpa_int }
4900 {
4901     \pgfpathcircle
4902     { \pgfpoint \l@@x_initial_dim \l@@y_initial_dim }
4903     { \l@@xdots_radius_dim }
4904     \dim_add:Nn \l@@x_initial_dim \l_tmpa_dim
4905     \dim_add:Nn \l@@y_initial_dim \l_tmpb_dim
4906 }
4907 \pgfusepathqfill
4908 }

4909 \cs_new_protected:Npn \@@_labels_standard_dotted_line:
4910 {
4911     \pgfscope
4912     \pgftransformshift
4913     {
4914         \pgfpointlineatime { 0.5 }
4915         { \pgfpoint \l@@x_initial_dim \l@@y_initial_dim }
4916         { \pgfpoint \l@@x_final_dim \l@@y_final_dim }
4917     }
4918     \fp_set:Nn \l_tmpa_fp
4919     {
4920         atand
4921         (
4922             \l@@y_final_dim - \l@@y_initial_dim ,
4923             \l@@x_final_dim - \l@@x_initial_dim
4924         )
4925     }
4926     \pgftransformrotate { \fp_use:N \l_tmpa_fp }
4927     \bool_if:NF \l@@xdots_h_labels_bool { \fp_zero:N \l_tmpa_fp }
4928     \tl_if_empty:NF \l@@xdots_middle_tl
4929     {
4930         \begin{pgfscope}

```

```

4931 \pgfset { inner~sep = \c_@@_innersep_middle_dim }
4932 \pgfnode
4933   { rectangle }
4934   { center }
4935   {
4936     \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4937     {
4938       $ \% $
4939       \scriptstyle \l_@@_xdots_middle_tl
4940       $ \% $
4941     }
4942   }
4943   {
4944   {
4945     \pgfsetfillcolor { white }
4946     \pgfusepath { fill }
4947   }
4948   \end { pgfscope }
4949 }
4950 \tl_if_empty:NF \l_@@_xdots_up_tl
4951 {
4952   \pgfnode
4953   { rectangle }
4954   { south }
4955   {
4956     \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4957     {
4958       $ \% $
4959       \scriptstyle \l_@@_xdots_up_tl
4960       $ \% $
4961     }
4962   }
4963   {
4964   {
4965     \pgfusepath { } }
4966   }
4967 \tl_if_empty:NF \l_@@_xdots_down_tl
4968 {
4969   \pgfnode
4970   { rectangle }
4971   { north }
4972   {
4973     \rotatebox { \fp_eval:n { - \l_tmpa_fp } }
4974     {
4975       $ \% $
4976       \scriptstyle \l_@@_xdots_down_tl
4977       $ \% $
4978     }
4979   }
4980   {
4981   {
4982     \pgfusepath { } }
4983   }
4984 \endpgfscope
}

```

## 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.

```
4984 \hook_gput_code:nnn { begindocument } { . }
4985 {
```

We rescan the *argspec* in order the correct catcode of `_` in the main document (and that's why we are in a `\AtBeginDocument`).

```
4986 \tl_set_rescan:Nnn \l_@@_argspec_tl { } { m E { _ ^ : } { { } { } { } } }
4987 \cs_new_protected:Npn \@@_Ldots:
4988   { \@@_collect_options:n { \@@_Ldots_i } }
4989 \exp_args:NNo \NewDocumentCommand \@@_Ldots_i \l_@@_argspec_tl
4990 {
4991   \int_if_zero:nTF { \c@jCol }
4992     { \@@_error:nn { in-first-col } { \Ldots } }
4993   {
4994     \int_compare:nNnTF { \c@jCol } = { \l_@@_last_col_int }
4995       { \@@_error:nn { in-last-col } { \Ldots } }
4996     {
4997       \@@_instruction_of_type:nmm { \c_false_bool } { Ldots }
4998         { #1 , down = #2 , up = #3 , middle = #4 }
4999     }
5000   }
5001   \bool_if:NF \l_@@_nullify_dots_bool
5002     { \phantom { \ensuremath { \olddots } } }
5003   \bool_gset_true:N \g_@@_empty_cell_bool
5004 }

5005 \cs_new_protected:Npn \@@_Cdots:
5006   { \@@_collect_options:n { \@@_Cdots_i } }
5007 \exp_args:NNo \NewDocumentCommand \@@_Cdots_i \l_@@_argspec_tl
5008 {
5009   \int_if_zero:nTF { \c@jCol }
5010     { \@@_error:nn { in-first-col } { \Cdots } }
5011   {
5012     \int_compare:nNnTF { \c@jCol } = { \l_@@_last_col_int }
5013       { \@@_error:nn { in-last-col } { \Cdots } }
5014     {
5015       \@@_instruction_of_type:nmm { \c_false_bool } { Cdots }
5016         { #1 , down = #2 , up = #3 , middle = #4 }
5017     }
5018   }
5019   \bool_if:NF \l_@@_nullify_dots_bool
5020     { \phantom { \ensuremath { \oldcdots } } }
5021   \bool_gset_true:N \g_@@_empty_cell_bool
5022 }

5023 \cs_new_protected:Npn \@@_Vdots:
5024   { \@@_collect_options:n { \@@_Vdots_i } }
5025 \exp_args:NNo \NewDocumentCommand \@@_Vdots_i \l_@@_argspec_tl
5026 {
5027   \int_if_zero:nTF { \c@iRow }
5028     { \@@_error:nn { in-first-row } { \Vdots } }
5029   {
5030     \int_compare:nNnTF { \c@iRow } = { \l_@@_last_row_int }
5031       { \@@_error:nn { in-last-row } { \Vdots } }
5032     {
5033       \@@_instruction_of_type:nmm { \c_false_bool } { Vdots }
5034         { #1 , down = #2 , up = #3 , middle = #4 }
```

```

5035         }
5036     }
5037     \bool_if:NF \l_@@_nullify_dots_bool
5038     { \phantom { \ensuremath { \old_vdots } } }
5039     \bool_gset_true:N \g_@@_empty_cell_bool
5040   }

5041 \cs_new_protected:Npn \@@_Ddots:
5042   { \@@_collect_options:n { \@@_Ddots_i } }
5043 \exp_args:NNo \NewDocumentCommand \@@_Ddots_i \l_@@_argspec_tl
5044   {
5045     \int_case:nnF \c@iRow
5046     {
5047       0           { \@@_error:nn { in-first-row } { \Ddots } }
5048       \l_@@_last_row_int { \@@_error:nn { in-last-row } { \Ddots } }
5049     }
5050   {
5051     \int_case:nnF \c@jCol
5052     {
5053       0           { \@@_error:nn { in-first-col } { \Ddots } }
5054       \l_@@_last_col_int { \@@_error:nn { in-last-col } { \Ddots } }
5055     }
5056   {
5057     \keys_set_known:nn { nicematrix / Ddots } { #1 }
5058     \@@_instruction_of_type:nnn \l_@@_draw_first_bool { Ddots }
5059     { #1 , down = #2 , up = #3 , middle = #4 }
5060   }
5061 }
5062 \bool_if:NF \l_@@_nullify_dots_bool
5063   { \phantom { \ensuremath { \old_ddots } } }
5064   \bool_gset_true:N \g_@@_empty_cell_bool
5065 }

5066 \cs_new_protected:Npn \@@_Iddots:
5067   { \@@_collect_options:n { \@@_Iddots_i } }
5068 \exp_args:NNo \NewDocumentCommand \@@_Iddots_i \l_@@_argspec_tl
5069   {
5070     \int_case:nnF \c@iRow
5071     {
5072       0           { \@@_error:nn { in-first-row } { \Iddots } }
5073       \l_@@_last_row_int { \@@_error:nn { in-last-row } { \Iddots } }
5074     }
5075   {
5076     \int_case:nnF \c@jCol
5077     {
5078       0           { \@@_error:nn { in-first-col } { \Iddots } }
5079       \l_@@_last_col_int { \@@_error:nn { in-last-col } { \Iddots } }
5080     }
5081   {
5082     \keys_set_known:nn { nicematrix / Ddots } { #1 }
5083     \@@_instruction_of_type:nnn { \l_@@_draw_first_bool } { Iddots }
5084     { #1 , down = #2 , up = #3 , middle = #4 }
5085   }
5086 }
5087 \bool_if:NF \l_@@_nullify_dots_bool
5088   { \phantom { \ensuremath { \old_iddots } } }
5089   \bool_gset_true:N \g_@@_empty_cell_bool
5090 }

5091 }
5092 }

End of the \AddToHook.

```

Despite its name, the following set of keys will be used for \Ddots but also for \Iddots.

```
5093 \keys_define:nn { nicematrix / Ddots }
5094 {
5095   draw-first .bool_set:N = \l_@@_draw_first_bool ,
5096   draw-first .default:n = true ,
5097   draw-first .value_forbidden:n = true
5098 }
```

The command \@@\_Hspace: will be linked to \hspace in {NiceArray}.

```
5099 \cs_new_protected:Npn \@@_Hspace:
5100 {
5101   \bool_gset_true:N \g_@@_empty_cell_bool
5102   \hspace
5103 }
```

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`.

```
5104 \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`.

```
5105 \cs_new:Npn \@@_Hdotsfor:
5106 {
5107   \bool_lazy_and:nnTF
5108     { \int_if_zero_p:n { \c@jCol } }
5109     { \int_if_zero_p:n { \l_@@_first_col_int } }
5110   {
5111     \bool_if:NTF \g_@@_after_col_zero_bool
5112     {
5113       \multicolumn { 1 } { c } { }
5114       \@@_Hdotsfor_i:
5115     }
5116     { \@@_fatal:n { Hdotsfor-in-col~0 } }
5117   }
5118   {
5119     \multicolumn { 1 } { c } { }
5120     \@@_Hdotsfor_i:
5121   }
5122 }
```

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:).

```
5123 \hook_gput_code:nnn { begindocument } { . }
5124 {
```

We don't put ! before the last optional argument for homogeneity with \Cdots, etc. which have only one optional argument.

```
5125 \cs_new_protected:Npn \@@_Hdotsfor_i:
5126   { \@@_collect_options:n { \@@_Hdotsfor_ii } }
```

We rescan the `argspec` in order the correct catcode of \_ in the main document (and that's why we are in a `\AtBeginDocument`).

```
5127 \tl_set_rescan:Nnn \l_tmpa_tl { } { m m O { } E { _ ^ : } { { } { } { } } } }
5128 \exp_args:NNo \NewDocumentCommand \@@_Hdotsfor_ii \l_tmpa_tl
5129 {
5130   \tl_gput_right:Ne \g_@@_HVdotsfor_lines_tl
5131   {
5132     \@@_Hdotsfor:nnnn
5133     { \int_use:N \c@iRow }
```

```

5134     { \int_use:N \c@jCol }
5135     { #2 }
5136     {
5137         #1 , #3 ,
5138         down = \exp_not:n { #4 } ,
5139         up = \exp_not:n { #5 } ,
5140         middle = \exp_not:n { #6 }
5141     }
5142 }
5143 \prg_replicate:nn { #2 - 1 }
5144 {
5145     &
5146     \multicolumn { 1 } { c } { }
5147     \cs_set_eq:NN \CodeAfter \@@_CodeAfter_i:
5148 }
5149 }
5150 }

5151 \cs_new_protected:Npn \@@_Hdotsfor:nnnn #1 #2 #3 #4
5152 {
5153     \bool_set_false:N \l_@@_initial_open_bool
5154     \bool_set_false:N \l_@@_final_open_bool

```

For the row, it's easy.

```

5155 \int_set:Nn \l_@@_initial_i_int { #1 }
5156 \int_set_eq:NN \l_@@_final_i_int \l_@@_initial_i_int

```

For the column, it's a bit more complicated.

```

5157 \int_compare:nNnTF { #2 } = { \c_one_int }
5158 {
5159     \int_set_eq:NN \l_@@_initial_j_int \c_one_int
5160     \bool_set_true:N \l_@@_initial_open_bool
5161 }
5162 {
5163     \cs_if_exist:cTF
5164     {
5165         pgf @ sh @ ns @ \@@_env:
5166         - \int_use:N \l_@@_initial_i_int
5167         - \int_eval:n { #2 - 1 }
5168     }
5169     { \int_set:Nn \l_@@_initial_j_int { #2 - 1 } }
5170     {
5171         \int_set:Nn \l_@@_initial_j_int { #2 }
5172         \bool_set_true:N \l_@@_initial_open_bool
5173     }
5174 }
5175 \int_compare:nNnTF { #2 + #3 - 1 } = { \c@jCol }
5176 {
5177     \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
5178     \bool_set_true:N \l_@@_final_open_bool
5179 }
5180 {
5181     \cs_if_exist:cTF
5182     {
5183         pgf @ sh @ ns @ \@@_env:
5184         - \int_use:N \l_@@_final_i_int
5185         - \int_eval:n { #2 + #3 }
5186     }
5187     { \int_set:Nn \l_@@_final_j_int { #2 + #3 } }
5188     {
5189         \int_set:Nn \l_@@_final_j_int { #2 + #3 - 1 }
5190         \bool_set_true:N \l_@@_final_open_bool
5191     }
5192 }

```

```

5193 \group_begin:
5194 \@@_open_shorten:
5195 \int_if_zero:nTF { #1 }
5196   { \color { nicematrix-first-row } }
5197   {
5198     \int_compare:nNnT { #1 } = { \g_@@_row_total_int }
5199       { \color { nicematrix-last-row } }
5200   }
5201 \keys_set:nn { nicematrix / xdots } { #4 }
5202 \@@_color:o \l_@@_xdots_color_tl
5203 \@@_actually_draw_Ldots:
5204 \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).

```

5205 \int_step_inline:nnn { #2 } { #2 + #3 - 1 }
5206   { \cs_set_nopar:cpn { @@ _ dotted _ #1 - ##1 } { } }
5207 }

```

```

5208 \hook_gput_code:nnn { begindocument } { . }
5209 {
5210   \cs_new_protected:Npn \@@_Vdotsfor:
5211     { \@@_collect_options:n { \@@_Vdotsfor_i } }

```

We rescan the *argspec* in order the correct catcode of `_` in the main document (and that's why we are in a `\AtBeginDocument`).

```

5212 \tl_set_rescan:Nnn \l_tmpa_tl { } { m m O { } E { _ ^ : } { { } { } { } } }
5213 \exp_args:NNo \NewDocumentCommand \@@_Vdotsfor_i \l_tmpa_tl
5214   {
5215     \bool_gset_true:N \g_@@_empty_cell_bool
5216     \tl_gput_right:Ne \g_@@_HVdotsfor_lines_tl
5217     {
5218       \@@_Vdotsfor:nnnn
5219         { \int_use:N \c@iRow }
5220         { \int_use:N \c@jCol }
5221         { #2 }
5222         {
5223           #1 , #3 ,
5224           down = \exp_not:n { #4 } ,
5225           up = \exp_not:n { #5 } ,
5226           middle = \exp_not:n { #6 }
5227         }
5228       }
5229     }
5230   }

```

#1 is the number of row;  
#2 is the number of column;  
#3 is the numbers of rows which are involved;

```

5231 \cs_new_protected:Npn \@@_Vdotsfor:nnnn #1 #2 #3 #4
5232   {
5233     \bool_set_false:N \l_@@_initial_open_bool
5234     \bool_set_false:N \l_@@_final_open_bool

```

For the column, it's easy.

```

5235 \int_set:Nn \l_@@_initial_j_int { #2 }
5236 \int_set_eq:NN \l_@@_final_j_int \l_@@_initial_j_int

```

For the row, it's a bit more complicated.

```

5237 \int_compare:nNnTF { #1 } = { \c_one_int }
5238 {
5239     \int_set_eq:NN \l_@@_initial_i_int \c_one_int
5240     \bool_set_true:N \l_@@_initial_open_bool
5241 }
5242 {
5243     \cs_if_exist:cTF
5244     {
5245         pgf @ sh @ ns @ \@@_env:
5246         - \int_eval:n { #1 - 1 }
5247         - \int_use:N \l_@@_initial_j_int
5248     }
5249     { \int_set:Nn \l_@@_initial_i_int { #1 - 1 } }
5250     {
5251         \int_set:Nn \l_@@_initial_i_int { #1 }
5252         \bool_set_true:N \l_@@_initial_open_bool
5253     }
5254 }
5255 \int_compare:nNnTF { #1 + #3 - 1 } = { \c@iRow }
5256 {
5257     \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
5258     \bool_set_true:N \l_@@_final_open_bool
5259 }
5260 {
5261     \cs_if_exist:cTF
5262     {
5263         pgf @ sh @ ns @ \@@_env:
5264         - \int_eval:n { #1 + #3 }
5265         - \int_use:N \l_@@_final_j_int
5266     }
5267     { \int_set:Nn \l_@@_final_i_int { #1 + #3 } }
5268     {
5269         \int_set:Nn \l_@@_final_i_int { #1 + #3 - 1 }
5270         \bool_set_true:N \l_@@_final_open_bool
5271     }
5272 }

5273 \group_begin:
5274 \@@_open_shorten:
5275 \int_if_zero:nTF { #2 }
5276     { \color { nicematrix-first-col } }
5277 {
5278     \int_compare:nNnT { #2 } = { \g_@@_col_total_int }
5279     { \color { nicematrix-last-col } }
5280 }
5281 \keys_set:nn { nicematrix / xdots } { #4 }
5282 \@@_color:o \l_@@_xdots_color_tl
5283 \bool_if:NTF \l_@@_Vbrace_bool
5284     { \@@_actually_draw_Vbrace: }
5285     { \@@_actually_draw_Vdots: }
5286 \group_end:

```

We declare all the cells concerned by the `\Vdots` 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).

```

5287 \int_step_inline:nnn { #1 } { #1 + #3 - 1 }
5288     { \cs_set_nopar:cpn { @@ _ dotted _ ##1 - #2 } { } }
5289 }
```

The command `\@@_rotate:` will be linked to `\rotate` in `{NiceArrayWithDelims}`.

```

5290 \NewDocumentCommand \@@_rotate: { O { } }
5291 {
5292   \bool_gset_true:N \g_@@_rotate_bool
5293   \keys_set:nn { nicematrix / rotate } { #1 }
5294   \ignorespaces
5295 }

5296 \keys_define:nn { nicematrix / rotate }
5297 {
5298   c .code:n = \bool_gset_true:N \g_@@_rotate_c_bool ,
5299   c .value_forbidden:n = true ,
5300   unknown .code:n = \@@_error:n { Unknown~key~for~rotate }
5301 }

```

## 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).<sup>14</sup>

```

5302 \cs_new:Npn \@@_double_int_eval:n #1-#2 \q_stop
5303 {
5304   \tl_if_empty:nTF { #2 }
5305   { #1 }
5306   { \@@_double_int_eval_i:n #1-#2 \q_stop }
5307 }
5308 \cs_new:Npn \@@_double_int_eval_i:n #1-#2- \q_stop
5309 { \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).

```

5310 \hook_gput_code:nnn { begindocument } { . }
5311 {

```

We rescan the *argspec* in order the correct catcode of `_` in the main document (and that's why we are in a `\AtBeginDocument`).

```

5312 \tl_set_rescan:Nnn \l_tmpa_tl { }
5313   { O { } m m ! O { } E { _ ^ : } { { } { } { } } }
5314 \exp_args:NNo \NewDocumentCommand \@@_line \l_tmpa_tl
5315 {
5316   \group_begin:
5317   \keys_set:nn { nicematrix / xdots } { #1 , #4 , down = #5 , up = #6 }
5318   \@@_color:o \l_@@_xdots_color_tl
5319   \use:e
5320   {
5321     \@@_line_i:nn

```

---

<sup>14</sup>Indeed, we want that the user may use the command `\line` in `\CodeAfter` with LaTeX counters in the arguments — with the command `\value`.

```

5322     { \@@_double_int_eval:n #2 - \q_stop }
5323     { \@@_double_int_eval:n #3 - \q_stop }
5324   }
5325   \group_end:
5326 }
5327 }

5328 \cs_new_protected:Npn \@@_line_i:nn #1 #2
5329 {
5330   \bool_set_false:N \l_@@_initial_open_bool
5331   \bool_set_false:N \l_@@_final_open_bool
5332   \bool_lazy_or:nnTF
5333     { \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #1 } }
5334     { \cs_if_free_p:c { pgf @ sh @ ns @ \@@_env: - #2 } }
5335   { \@@_error:nnn { unknown-cell-for-line-in-CodeAfter } { #1 } { #2 } }

```

The test of `measuring@` is a security (cf. question 686649 on TeX StackExchange).

```

5336   { \legacy_if:nF { measuring@ } { \@@_draw_line_ii:nn { #1 } { #2 } } }
5337 }

5338 \hook_gput_code:nnn { begindocument } { . }
5339 {
5340   \cs_new_protected:Npe \@@_draw_line_ii:nn #1 #2
5341   {

```

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::`.

```

5342   \c_@@_pgfortikzpicture_tl
5343   \@@_draw_line_iii:nn { #1 } { #2 }
5344   \c_@@_endpgfortikzpicture_tl
5345 }
5346

```

The following command *must* be protected (it’s used in the construction of `\@@_draw_line_ii:nn`).

```

5347 \cs_new_protected:Npn \@@_draw_line_iii:nn #1 #2
5348 {
5349   \pgfrememberpicturepositiononpagetrue
5350   \pgfpointshapeborder { \@@_env: - #1 } { \@@_qpoint:n { #2 } }
5351   \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
5352   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
5353   \pgfpointshapeborder { \@@_env: - #2 } { \@@_qpoint:n { #1 } }
5354   \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
5355   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
5356   \@@_draw_line:
5357 }

```

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_then: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_then:nn` is *not* protected.

#1 is the first row *after* the scope of the instructions in #2

However, both arguments are implicit because they are taken by curryfication.

```
5358 \cs_new:Npn \@@_if_row_less_than:nn { \int_compare:nNnT { \c@iRow } < }
5359 \cs_new:Npn \@@_if_col_greater_than:nn { \int_compare:nNnF { \c@jCol } < }
```

`\@@_put_in_row_style` will be used several times in `\RowStyle`.

```
5360 \cs_set_protected:Npn \@@_put_in_row_style:n #1
5361 {
5362     \tl_gput_right:Ne \g_@@_row_style_tl
5363     {
```

Be careful, `\exp_not:N \@@_if_row_less_than:nn` can't be replaced by a protected version of `\@@_if_row_less_than:nn`.

```
5364     \exp_not:N
5365     \@@_if_row_less_than:nn
5366     { \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`).

```
5367     {
5368         \exp_not:N
5369         \@@_if_col_greater_than:nn
5370         { \int_eval:n { \c@jCol } }
5371         { \exp_not:n { #1 } \scan_stop: }
5372     }
5373 }
5374 }
```

```
5375 \cs_generate_variant:Nn \@@_put_in_row_style:n { e }
```

```
5376 \keys_define:nn { nicematrix / RowStyle }
5377 {
5378     cell-space-top-limit .dim_set:N = \l_tmpa_dim ,
5379     cell-space-top-limit .value_required:n = true ,
5380     cell-space-bottom-limit .dim_set:N = \l_tmpb_dim ,
5381     cell-space-bottom-limit .value_required:n = true ,
5382     cell-space-limits .meta:n =
5383     {
5384         cell-space-top-limit = #1 ,
5385         cell-space-bottom-limit = #1 ,
5386     },
5387     color .tl_set:N = \l_@@_color_tl ,
5388     color .value_required:n = true ,
5389     bold .bool_set:N = \l_@@_bold_row_style_bool ,
5390     bold .default:n = true ,
5391     nb-rows .code:n =
5392         \str_if_eq:eeTF { #1 } { * }
5393         { \int_set:Nn \l_@@_key_nb_rows_int { 500 } }
5394         { \int_set:Nn \l_@@_key_nb_rows_int { #1 } } ,
5395     nb-rows .value_required:n = true ,
5396     fill .tl_set:N = \l_@@_fill_tl ,
5397     fill .value_required:n = true ,
5398     opacity .tl_set:N = \l_@@_opacity_tl ,
5399     opacity .value_required:n = true ,
5400     rowcolor .tl_set:N = \l_@@_fill_tl ,
5401     rowcolor .value_required:n = true ,
5402     rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
5403     rounded-corners .default:n = 4 pt ,
5404     unknown .code:n = \@@_error:n { Unknown-key-for-RowStyle }
5405 }
```

```

5406 \NewDocumentCommand \@@_RowStyle:n { O { } m }
5407 {
5408   \group_begin:
5409   \tl_clear:N \l_@@_fill_tl
5410   \tl_clear:N \l_@@_opacity_tl
5411   \tl_clear:N \l_@@_color_tl
5412   \int_set_eq:NN \l_@@_key_nb_rows_int \c_one_int
5413   \dim_zero:N \l_@@_rounded_corners_dim
5414   \dim_zero:N \l_tmpa_dim
5415   \dim_zero:N \l_tmpb_dim
5416   \keys_set:nn { nicematrix / RowStyle } { #1 }

```

If the key `fill` (or its alias `rowcolor`) has been used.

```

5417 \tl_if_empty:NF \l_@@_fill_tl
5418 {
5419   \@@_add_opacity_to_fill:
5420   \tl_gput_right:Ne \g_@@_pre_code_before_tl
5421   {

```

The command `\@@_exp_color_arg:No` is *fully expandable*.

```

5422 \@@_exp_color_arg:No \@@_roundedrectanglecolor \l_@@_fill_tl
5423   { \int_use:N \c@iRow - \int_use:N \c@jCol }
5424   {
5425     \int_eval:n { \c@iRow + \l_@@_key_nb_rows_int - 1 }
5426     -
5427     *
5428   { \dim_use:N \l_@@_rounded_corners_dim }
5429   }
5430 }
5431 \@@_put_in_row_style:n { \exp_not:n { #2 } }

```

`\l_tmpa_dim` is the value of the key `cell-space-top-limit` of `\RowStyle`.

```

5432 \dim_compare:nNnT { \l_tmpa_dim } > { \c_zero_dim }
5433 {
5434   \@@_put_in_row_style:e
5435   {
5436     \tl_gput_right:Nn \exp_not:N \g_@@_cell_after_hook_tl
5437   }

```

It's not possible to change the following code by using `\dim_set_eq:NN` (because of expansion).

```

5438 \dim_set:Nn \l_@@_cell_space_top_limit_dim
5439   { \dim_use:N \l_tmpa_dim }
5440   }
5441 }
5442 }

```

`\l_tmpb_dim` is the value of the key `cell-space-bottom-limit` of `\RowStyle`.

```

5443 \dim_compare:nNnT { \l_tmpb_dim } > { \c_zero_dim }
5444 {
5445   \@@_put_in_row_style:e
5446   {
5447     \tl_gput_right:Nn \exp_not:N \g_@@_cell_after_hook_tl
5448     {
5449       \dim_set:Nn \l_@@_cell_space_bottom_limit_dim
5450         { \dim_use:N \l_tmpb_dim }
5451     }
5452   }
5453 }

```

`\l_@@_color_tl` is the value of the key `color` of `\RowStyle`.

```

5454 \tl_if_empty:NF \l_@@_color_tl
5455 {
5456   \@@_put_in_row_style:e
5457   {
5458     \mode_leave_vertical:
5459     \color:n { \l_@@_color_tl }

```

```

5460         }
5461     }
\\l_@@_bold_row_style_bool is the value of the key bold.
5462     \bool_if:NT \\l_@@_bold_row_style_bool
5463     {
5464         \@@_put_in_row_style:n
5465         {
5466             \exp_not:n
5467             {
5468                 \if_mode_math:
5469                 $ % $
5470                 \bfseries \boldmath
5471                 $ % $
5472             \else:
5473                 \bfseries \boldmath
5474             \fi:
5475         }
5476     }
5477 }
5478 \group_end:
5479 \g_@@_row_style_tl
5480 \ignorespaces
5481 }

```

The following command must *not* be protected.

```

5482 \cs_new:Npn \@@_rounded_from_row:n #1
5483 {
5484     \@@_exp_color_arg:No \@@_roundedrectanglecolor \\l_@@_fill_tl

```

In the following code, the “ $- 1$ ” is *not* a subtraction.

```

5485 { \int_eval:n { #1 } - 1 }
5486 {
5487     \int_eval:n { \c@iRow + \\l_@@_key_nb_rows_int - 1 }
5488     - \exp_not:n { \int_use:N \c@jCol }
5489 }
5490 { \dim_use:N \\l_@@_rounded_corners_dim }
5491 }

```

## 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).

```
5492 \cs_new_protected:Npn \@@_add_to_colors_seq:nn #1 #2
5493 {
```

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.

```
5494 \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`.

```
5495 \str_if_in:nnF { #1 } { !! }
5496 {
5497     \seq_map_indexed_inline:Nn \g_@@_colors_seq
```

We use `\str_if_eq:eeTF` which is slightly faster than `\tl_if_eq:nnTF`.

```
5498     { \str_if_eq:eeT { #1 } { ##2 } { \int_set:Nn \l_tmpa_int { ##1 } } }
5499 }
5500 \int_if_zero:nTF { \l_tmpa_int }
```

First, the case where the color is a *new* color (not in the sequence).

```
5501 {
5502     \seq_gput_right:Nn \g_@@_colors_seq { #1 }
5503     \tl_gset:ce { g_@@_color _ \seq_count:N \g_@@_colors_seq _ tl } { #2 }
5504 }
```

Now, the case where the color is *not* a new color (the color is in the sequence at the position `\l_tmpa_int`).

```
5505     { \tl_gput_right:ce { g_@@_color _ \int_use:N \l_tmpa_int _ tl } { #2 } }
5506 }
5507 \cs_generate_variant:Nn \@@_add_to_colors_seq:nn { e }
5508 \cs_generate_variant:Nn \@@_add_to_colors_seq:nn { e e }
```

The following command must be used within a `\pgfpicture`.

```
5509 \cs_new_protected:Npn \@@_clip_with_rounded_corners:
5510 {
5511     \dim_compare:nNnT { \l_@@_tab_rounded_corners_dim } > { \c_zero_dim }
5512 }
```

The TeX group is for `\pgfsetcornersarced` (whose scope is the TeX scope).

```
5513     \group_begin:
5514     \pgfsetcornersarced
5515     {
5516         \pgfpoint
5517             { \l_@@_tab_rounded_corners_dim }
5518             { \l_@@_tab_rounded_corners_dim }
5519     }
```

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.

```
5520 \bool_if:NTF \l_@@_hvlines_bool
5521 {
5522     \pgfpathrectanglecorners
5523     {
5524         \pgfpointadd
5525             { \@@_qpoint:n { row-1 } }
5526             { \pgfpoint { 0.5 \arrayrulewidth } { \c_zero_dim } }
5527     }
5528     {
5529         \pgfpointadd
5530             {
```

```

5531          \@@_qpoint:n
5532              { \int_eval:n { \int_max:nn { \c@iRow } { \c@jCol } + 1 } }
5533      }
5534      { \pgfpoint \c_zero_dim { 0.5 \arrayrulewidth } }
5535  }
5536  {
5537      \pgfpathrectanglecorners
5538          { \@@_qpoint:n { row-1 } }
5539      {
5540          \pgfpointadd
5541          {
5542              \@@_qpoint:n
5543                  { \int_eval:n { \int_max:nn { \c@iRow } { \c@jCol } + 1 } }
5544              }
5545              { \pgfpoint \c_zero_dim \arrayrulewidth }
5546          }
5547      }
5548  }
5549  \pgfusepath { clip }
5550  \group_end:

```

The TeX group was for `\pgfsetcornersarced`.

```

5551  }
5552 }

```

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`).

```

5553 \cs_new_protected:Npn \@@_actually_color:
5554 {
5555     \pgfpicture
5556     \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.

```

5557     \@@_clip_with_rounded_corners:
5558     \seq_map_indexed_inline:Nn \g_@@_colors_seq
5559     {
5560         \int_compare:nNnTF { ##1 } = { \c_one_int }
5561         {
5562             \cs_set_eq:NN \@@_cartesian_path:n \@@_cartesian_path_nocolor:n
5563             \use:c { g_@@_color _ 1 _tl }
5564             \cs_set_eq:NN \@@_cartesian_path:n \@@_cartesian_path_normal:n
5565         }
5566     {
5567         \begin { pgfscope }
5568             \@@_color_opacity: ##2
5569             \use:c { g_@@_color _ ##1 _tl }
5570             \tl_gclear:c { g_@@_color _ ##1 _tl }
5571             \pgfusepath { fill }
5572         \end { pgfscope }
5573     }
5574 }
5575 \endpgfpicture
5576 }

```

The following command will extract the potential key `opacity` in its optional argument (between square brackets) and (of course) then apply the command `\color`.

```

5577 \cs_new_protected:Npn \@@_color_opacity:
5578 {
5579     \peek_meaning:NTF [
5580         { \@@_color_opacity:w }
5581         { \@@_color_opacity:w [ ] }
5582     }

```

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.

```

5583 \cs_new_protected:Npn \@@_color_opacity:w [ #1 ]
5584 {
5585   \tl_clear:N \l_tmpa_tl
5586   \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.
5587   \tl_if_empty:NF \l_tmpa_tl { \exp_args:No \pgfsetfillcolor \l_tmpa_tl }
5588   \tl_if_empty:NTF \l_tmpb_tl
      { \@declaredcolor }
      { \use:e { \exp_not:N \@undeclaredcolor [ \l_tmpb_tl ] } }
5591 }
```

The following set of keys is used by the command `\@@_color_opacity:wn`.

```

5592 \keys_define:nn { nicematrix / color-opacity }
5593 {
5594   opacity .tl_set:N      = \l_tmpa_tl ,
5595   opacity .value_required:n = true
5596 }
```

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

```

5597 \cs_new_protected:Npn \@@_cartesian_color:nn #1 #2
5598 {
5599   \def \l_@@_rows_tl { #1 }
5600   \def \l_@@_cols_tl { #2 }
5601   \@@_cartesian_path:
5602 }
```

Here is an example : `\@@_rowcolor {red!15} {1,3,5-7,10-}`

```

5603 \NewDocumentCommand \@@_rowcolor { O { } m m }
5604 {
5605   \tl_if_blank:nF { #2 }
5606   {
5607     \@@_add_to_colors_seq:en
5608     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5609     { \@@_cartesian_color:nn { #3 } { - } }
5610   }
5611 }
```

Here an example: `\@@_columncolor:nn {red!15} {1,3,5-7,10-}`

```

5612 \NewDocumentCommand \@@_columncolor { O { } m m }
5613 {
5614   \tl_if_blank:nF { #2 }
5615   {
5616     \@@_add_to_colors_seq:en
5617     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5618     { \@@_cartesian_color:nn { - } { #3 } }
5619   }
5620 }
```

Here is an example: `\@@_rectanglecolor{red!15}{2-3}{5-6}`

```

5621 \NewDocumentCommand \@@_rectanglecolor { O { } m m m }
5622 {
5623   \tl_if_blank:nF { #2 }
5624   {
5625     \@@_add_to_colors_seq:en
5626     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5627     { \@@_rectanglecolor:nnn { #3 } { #4 } { \c_zero_dim } }
5628   }
5629 }
```

The last argument is the radius of the corners of the rectangle.

```

5630 \NewDocumentCommand \@@_roundedrectanglecolor { 0 { } m m m m }
5631 {
5632   \tl_if_blank:nF { #2 }
5633   {
5634     \@@_add_to_colors_seq:en
5635     { \tl_if_blank:nF { #1 } { [ #1 ] } { #2 } }
5636     { \@@_rectanglecolor:nnn { #3 } { #4 } { #5 } }
5637   }
5638 }
```

The last argument is the radius of the corners of the rectangle.

```

5639 \cs_new_protected:Npn \@@_rectanglecolor:nnn #1 #2 #3
5640 {
5641   \@@_cut_on_hyphen:w #1 \q_stop
5642   \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
5643   \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
5644   \@@_cut_on_hyphen:w #2 \q_stop
5645   \tl_set:Ne \l_@@_rows_tl { \l_@@_tmpc_tl - \l_tmpa_tl }
5646   \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`.

```

5647   \@@_cartesian_path:n { #3 }
5648 }
```

Here is an example: `\@@_cellcolor[rgb]{0.5,0.5,0}{2-3,3-4,4-5,5-6}`

```

5649 \NewDocumentCommand \@@_cellcolor { 0 { } m m }
5650 {
5651   \clist_map_inline:nn { #3 }
5652   { \@@_rectanglecolor [ #1 ] { #2 } { ##1 } { ##1 } }
5653 }

5654 \NewDocumentCommand \@@_chessboardcolors { 0 { } m m }
5655 {
5656   \int_step_inline:nn { \c@iRow }
5657   {
5658     \int_step_inline:nn { \c@jCol }
5659     {
5660       \int_if_even:nTF { ####1 + ##1 }
5661       { \@@_cellcolor [ #1 ] { #2 } }
5662       { \@@_cellcolor [ #1 ] { #3 } }
5663       { ##1 - ####1 }
5664     }
5665   }
5666 }
```

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”.

```

5667 \NewDocumentCommand \@@_arraycolor { 0 { } m }
5668 {
5669   \@@_rectanglecolor [ #1 ] { #2 }
5670   { 1 - 1 }
5671   { \int_use:N \c@iRow - \int_use:N \c@jCol }
5672 }

5673 \keys_define:nn { nicematrix / rowcolors }
5674 {
5675   respect-blocks .bool_set:N = \l_@@_respect_blocks_bool ,
```

```

5676     respect-blocks .default:n = true ,
5677     cols .tl_set:N = \l_@@_cols_tl ,
5678     restart .bool_set:N = \l_@@_rowcolors_restart_bool ,
5679     restart .default:n = true ,
5680     unknown .code:n = \@@_error:n { Unknown~key~for~rowcolors }
5681   }

```

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`.

```

5682 \NewDocumentCommand \@@_rowlistcolors { 0 { } m m 0 { } }
5683 {

```

The group is for the options. `\l_@@_colors_seq` will be the list of colors.

```

5684 \group_begin:
5685 \seq_clear_new:N \l_@@_colors_seq
5686 \seq_set_split:Nnn \l_@@_colors_seq { , } { #3 }
5687 \tl_clear_new:N \l_@@_cols_tl
5688 \tl_set:Nn \l_@@_cols_tl { - }
5689 \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).

```

5690 \int_zero_new:N \l_@@_color_int
5691 \int_set_eq:NN \l_@@_color_int \c_one_int
5692 \bool_if:NT \l_@@_respect_blocks_bool
5693 {

```

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`).

```

5694 \seq_set_eq:NN \l_tmpb_seq \g_@@_pos_of_blocks_seq
5695 \seq_set_filter:NNn \l_tmpa_seq \l_tmpb_seq
5696   { \@@_not_in_exterior_p:nnnn ##1 }
5697 }
5698 \pgfpicture
5699 \pgf@relevantforpicturesizefalse

```

#2 is the list of intervals of rows.

```

5700 \clist_map_inline:nn { #2 }
5701 {
5702   \tl_set:Nn \l_tmpa_tl { ##1 }
5703   \tl_if_in:NnTF \l_tmpa_tl { - }
5704     { \@@_cut_on_hyphen:w ##1 \q_stop }
5705     { \tl_set:Nn \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.

```

5706 \int_set:Nn \l_tmpa_int \l_tmpa_tl
5707 \int_set:Nn \l_@@_color_int
5708   { \bool_if:NTF \l_@@_rowcolors_restart_bool { 1 } { \l_tmpa_tl } }
5709 \int_set:Nn \l_@@_tmpc_int \l_tmpb_tl
5710 \int_do_until:nNn \l_tmpa_int > \l_@@_tmpc_int
5711 {

```

We will compute in `\l_tmpb_int` the last row of the "block".

```

5712 \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).

```

5713 \bool_if:NT \l_@@_respect_blocks_bool
5714 {
5715     \seq_set_filter:Nnn \l_tmpb_seq \l_tmpa_seq
5716     { \@@_intersect_our_row_p:nnnnn #####1 }
5717     \seq_map_inline:Nn \l_tmpb_seq { \@@_rowcolors_i:nnnnn #####1 }

```

Now, the last row of the block is computed in `\l_tmpb_int`.

```

5718 }
5719 \tl_set:Ne \l_@@_rows_tl
5720 { \int_use:N \l_tmpa_int - \int_use:N \l_tmpb_int }

```

`\l_@@_tmpc_tl` will be the color that we will use.

```

5721 \tl_set:Ne \l_@@_color_tl
5722 {
5723     \@@_color_index:n
5724     {
5725         \int_mod:nn
5726         { \l_@@_color_int - 1 }
5727         { \seq_count:N \l_@@_colors_seq }
5728         + 1
5729     }
5730 }
5731 \tl_if_empty:NF \l_@@_color_tl
5732 {
5733     \@@_add_to_colors_seq:ee
5734     { \tl_if_blank:nF { #1 } { [ #1 ] } { \l_@@_color_tl } }
5735     { \@@_cartesian_color:nn { \l_@@_rows_tl } { \l_@@_cols_tl } }
5736 }
5737 \int_incr:N \l_@@_color_int
5738 \int_set:Nn \l_tmpa_int { \l_tmpb_int + 1 }
5739 }
5740 }
5741 \endpgfpicture
5742 \group_end:
5743 }

```

The command `\@@_color_index:n` peekes 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.

```

5744 \cs_new:Npn \@@_color_index:n #1
5745 {

```

Be careful: this command `\@@_color_index:n` must be “*fully expandable*”.

```

5746 \str_if_eq:eeTF { \seq_item:Nn \l_@@_colors_seq { #1 } } { = }
5747 { \@@_color_index:n { #1 - 1 } }
5748 { \seq_item:Nn \l_@@_colors_seq { #1 } }
5749 }

```

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.

```

5750 \NewDocumentCommand \@@_rowcolors { O{ } m m m }
5751 { \@@_rowlistcolors [ #1 ] { #2 } { { #3 } , { #4 } } }

```

The braces around #3 and #4 are mandatory.

```

5752 \cs_new_protected:Npn \@@_rowcolors_i:nnnnn #1 #2 #3 #4 #5
5753 {
5754     \int_compare:nNnT { #3 } > { \l_tmpb_int }
5755     { \int_set:Nn \l_tmpb_int { #3 } }
5756 }

```

```

5757 \prg_new_conditional:Nnn \c@_not_in_exterior:nnnnn { p }
5758 {
5759     \int_if_zero:nTF { #4 }
5760     { \prg_return_false: }
5761     {
5762         \int_compare:nNnTF { #2 } > { \c@jCol }
5763         { \prg_return_false: }
5764         { \prg_return_true: }
5765     }
5766 }

```

The following command return `true` when the block intersects the row `\l_tmpa_int`.

```

5767 \prg_new_conditional:Nnn \c@_intersect_our_row:nnnnn { p }
5768 {
5769     \int_compare:nNnTF { #1 } > { \l_tmpa_int }
5770     { \prg_return_false: }
5771     {
5772         \int_compare:nNnTF { \l_tmpa_int } > { #3 }
5773         { \prg_return_false: }
5774         { \prg_return_true: }
5775     }
5776 }

```

The following command uses two implicit arguments: `\l_@@_rows_t1` and `\l_@@_cols_t1` 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 `\c@_cartesian_path:` which corresponds to a value 0 pt for the radius of the corners. This command is, in particular, used in `\c@_rectanglecolor:nnn` (used in `\c@_rectanglecolor`, itself used in `\c@_cellcolor`).

```

5777 \cs_new_protected:Npn \c@_cartesian_path_normal:n #1
5778 {
5779     \dim_compare:nNnTF { #1 } = { \c_zero_dim }
5780     {
5781         \bool_if:NTF \l_@@_nocolor_used_bool
5782             { \c@_cartesian_path_normal_ii: }
5783             {
5784                 \clist_if_empty:NTF \l_@@_corners_cells_clist
5785                     { \c@_cartesian_path_normal_i:n { #1 } }
5786                     { \c@_cartesian_path_normal_ii: }
5787             }
5788     }
5789     { \c@_cartesian_path_normal_i:n { #1 } }
5790 }

```

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.

```

5791 \cs_new_protected:Npn \c@_cartesian_path_normal_i:n #1
5792 {
5793     \pgfsetcornersarced { \pgfpoint { #1 } { #1 } }

```

We begin the loop over the columns.

```

5794     \clist_map_inline:Nn \l_@@_cols_t1
5795     {

```

We use `\def` instead of `\tl_set:Nn` for efficiency only.

```

5796     \def \l_tmpa_tl { ##1 }
5797     \tl_if_in:NnTF \l_tmpa_tl { - }
5798         { \c@_cut_on_hyphen:w ##1 \q_stop }
5799         { \def \l_tmpb_tl { ##1 } } % 2025-04-16
5800     \tl_if_empty:NTF \l_tmpa_tl
5801         { \def \l_tmpa_tl { 1 } }
5802         {

```

```

5803     \str_if_eq:eeT { \l_tmpa_t1 } { * }
5804     { \def \l_tmpa_t1 { 1 } }
5805   }
5806   \int_compare:nNnT { \l_tmpa_t1 } > { \g_@@_col_total_int }
5807   { \@@_error:n { Invalid~col~number } }
5808   \tl_if_empty:NTF \l_tmpb_t1
5809   { \tl_set:No \l_tmpb_t1 { \int_use:N \c@jCol } }
5810   {
5811     \str_if_eq:eeT { \l_tmpb_t1 } { * }
5812     { \tl_set:No \l_tmpb_t1 { \int_use:N \c@jCol } }
5813   }
5814   \int_compare:nNnT { \l_tmpb_t1 } > { \g_@@_col_total_int }
5815   { \tl_set:No \l_tmpb_t1 { \int_use:N \g_@@_col_total_int } }

\l_@@_tmpc_t1 will contain the number of column.

5816   \tl_set_eq:NN \l_@@_tmpc_t1 \l_tmpa_t1
5817   \@@_qpoint:n { col - \l_tmpa_t1 }
5818   \int_compare:nNnTF { \l_@@_first_col_int } = { \l_tmpa_t1 }
5819   { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
5820   { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
5821   \@@_qpoint:n { col - \int_eval:n { \l_tmpb_t1 + 1 } }
5822   \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }

```

We begin the loop over the rows. We use `\def` instead of `\tl_set:Nn` for efficiency only.

```

5823   \clist_map_inline:Nn \l_@@_rows_t1
5824   {
5825     \def \l_tmpa_t1 { #####1 }
5826     \tl_if_in:NnTF \l_tmpa_t1 { - }
5827     { \@@_cut_on_hyphen:w #####1 \q_stop }
5828     { \@@_cut_on_hyphen:w #####1 - #####1 \q_stop }
5829     \tl_if_empty:NTF \l_tmpa_t1
5830     { \def \l_tmpa_t1 { 1 } }
5831     {
5832       \str_if_eq:eeT { \l_tmpa_t1 } { * }
5833       { \def \l_tmpa_t1 { 1 } }
5834     }
5835     \tl_if_empty:NTF \l_tmpb_t1
5836     { \tl_set:No \l_tmpb_t1 { \int_use:N \c@iRow } }
5837     {
5838       \str_if_eq:eeT { \l_tmpb_t1 } { * }
5839       { \tl_set:No \l_tmpb_t1 { \int_use:N \c@iRow } }
5840     }
5841     \int_compare:nNnT { \l_tmpa_t1 } > { \g_@@_row_total_int }
5842     { \@@_error:n { Invalid~row~number } }
5843     \int_compare:nNnT { \l_tmpb_t1 } > { \g_@@_row_total_int }
5844     { \tl_set:No \l_tmpb_t1 { \int_use:N \g_@@_row_total_int } }

```

Now, the numbers of both rows are in `\l_tmpa_t1` and `\l_tmpb_t1`.

```

5845   \cs_if_exist:cF
5846   { @@ _ nocolor _ \l_tmpa_t1 - \l_@@_tmpc_t1 }
5847   {
5848     \@@_qpoint:n { row - \int_eval:n { \l_tmpb_t1 + 1 } }
5849     \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
5850     \@@_qpoint:n { row - \l_tmpa_t1 }
5851     \dim_set:Nn \l_@@_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
5852     \pgfpathrectanglecorners
5853     { \pgfpoint \l_@@_tmpc_dim \l_@@_tmpd_dim }
5854     { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
5855   }
5856 }
5857 }
5858

```

Now, the case where the cells will be colored cell by cell (it's mandatory for example if the key `corners` is used).

```

5859 \cs_new_protected:Npn \@@_cartesian_path_normal_i:
5860 {
5861     \@@_expand_clist:NN \l_@@_cols_tl \c@jCol
5862     \@@_expand_clist:NN \l_@@_rows_tl \c@iRow

```

We begin the loop over the columns.

```

5863 \clist_map_inline:Nn \l_@@_cols_tl
5864 {
5865     \@@_qpoint:n { col - ##1 }
5866     \int_compare:nNnTF { \l_@@_first_col_int } = { ##1 }
5867         { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x - 0.5 \arrayrulewidth } }
5868         { \dim_set:Nn \l_@@_tmpc_dim { \pgf@x + 0.5 \arrayrulewidth } }
5869     \@@_qpoint:n { col - \int_eval:n { ##1 + 1 } }
5870     \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \arrayrulewidth }

```

We begin the loop over the rows.

```

5871 \clist_map_inline:Nn \l_@@_rows_tl
5872 {
5873     \@@_if_in_corner:nF { #####1 - ##1 }
5874     {
5875         \@@_qpoint:n { row - \int_eval:n { #####1 + 1 } }
5876         \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \arrayrulewidth }
5877         \@@_qpoint:n { row - #####1 }
5878         \dim_set:Nn \l_@@_tmpd_dim { \pgf@y + 0.5 \arrayrulewidth }
5879         \cs_if_exist:cF { @_nocolor _ #####1 - ##1 }
5880         {
5881             \pgfpathrectanglecorners
5882                 { \pgfpoint \l_@@_tmpc_dim \l_@@_tmpd_dim }
5883                 { \pgfpoint \l_tmpa_dim \l_tmpb_dim }
5884         }
5885     }
5886 }
5887 }
5888 }

```

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`).

```
5889 \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

```

5890 \cs_new_protected:Npn \@@_cartesian_path_nocolor:n #1
5891 {
5892     \bool_set_true:N \l_@@_nocolor_used_bool
5893     \@@_expand_clist:NN \l_@@_cols_tl \c@jCol
5894     \@@_expand_clist:NN \l_@@_rows_tl \c@iRow

```

We begin the loop over the columns.

```

5895 \clist_map_inline:Nn \l_@@_rows_tl
5896 {
5897     \clist_map_inline:Nn \l_@@_cols_tl
5898     { \cs_set_nopar:cpn { @_nocolor _ ##1 - #####1 } { } }
5899 }
5900 }

```

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 list `\l_@@_cols_tl` will be replaced by `2,4,5,6,8,9,10`.

```

5901 \cs_new_protected:Npn \@@_expand_clist:NN #1 #
5902 {
5903     \clist_set_eq:NN \l_tmpa_list #1

```

```

5904   \clist_clear:N #1
5905   \clist_map_inline:Nn \l_tmpa_clist
5906   {

```

We use `\def` instead of `\tl_set:Nn` for efficiency only.

```

5907   \def \l_tmpa_tl { ##1 }
5908   \tl_if_in:NnTF \l_tmpa_tl { - }
5909     { \@@_cut_on_hyphen:w ##1 \q_stop }
5910     { \@@_cut_on_hyphen:w ##1 - ##1 \q_stop }
5911   \bool_lazy_or:nnT
5912     { \str_if_eq_p:ee { \l_tmpa_tl } { * } }
5913     { \tl_if_blank_p:o \l_tmpa_tl }
5914     { \def \l_tmpa_tl { 1 } }
5915   \bool_lazy_or:nnT
5916     { \str_if_eq_p:ee { \l_tmpb_tl } { * } }
5917     { \tl_if_blank_p:o \l_tmpb_tl }
5918     { \tl_set:Nn \l_tmpb_tl { \int_use:N #2 } }
5919     \int_compare:nNnT { \l_tmpb_tl } > { #2 }
5920       { \tl_set:Nn \l_tmpb_tl { \int_use:N #2 } }
5921     \int_step_inline:nnn { \l_tmpa_tl } { \l_tmpb_tl }
5922       { \clist_put_right:Nn #1 { #####1 } }
5923   }
5924 }

```

The following command will be linked to `\cellcolor` in the tabular.

```

5925 \NewDocumentCommand \@@_cellcolor_tabular { O { } m }
5926 {
5927   \tl_gput_right:Ne \g_@@_pre_code_before_tl
5928   {

```

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).

```

5929   \@@_cellcolor [ #1 ] { \exp_not:n { #2 } }
5930     { \int_use:N \c@iRow - \int_use:N \c@jCol }
5931   }
5932   \ignorespaces
5933 }

```

The following command will be linked to `\rowcolor` in the tabular.

```

5934 \NewDocumentCommand \@@_rowcolor_tabular { O { } m }
5935 {
5936   \tl_gput_right:Ne \g_@@_pre_code_before_tl
5937   {
5938     \@@_rectanglecolor [ #1 ] { \exp_not:n { #2 } }
5939       { \int_use:N \c@iRow - \int_use:N \c@jCol }
5940       { \int_use:N \c@iRow - \exp_not:n { \int_use:N \c@jCol } }
5941   }
5942   \ignorespaces
5943 }

```

The following command will be linked to `\rowcolors` in the tabular. The last argument (an optional argument between square brackets is taken by curryfication).

```

5944 \NewDocumentCommand { \@@_rowcolors_tabular } { O { } m m }
5945   { \@@_rowlistcolors_tabular [ #1 ] { { #2 } , { #3 } } }

```

The braces around #2 and #3 are mandatory.

The following command will be linked to `\rowlistcolors` in the tabular.

```

5946 \NewDocumentCommand { \@@_rowlistcolors_tabular } { O { } m O { } }
5947   {

```

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`.

```

5948   \seq_gclear:N \g_tmpa_seq
5949   \seq_map_inline:Nn \g_@@_rowlistcolors_seq
5950     { \@@_rowlistcolors_tabular:nnnn ##1 }
5951   \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`.

```

5952   \seq_gput_right:Ne \g_@@_rowlistcolors_seq
5953   {
5954     { \int_use:N \c@iRow }
5955     { \exp_not:n { #1 } }
5956     { \exp_not:n { #2 } }
5957     { restart , cols = \int_use:N \c@jCol - , \exp_not:n { #3 } }
5958   }
5959   \ignorespaces
5960 }

```

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`).

```

5961 \cs_new_protected:Npn \@@_rowlistcolors_tabular:nnnn #1 #2 #3 #4
5962 {
5963   \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).

```

5964   { \seq_gput_right:Nn \g_tmpa_seq { { #1 } { #2 } { #3 } { #4 } } }
5965   {
5966     \tl_gput_right:Ne \g_@@_pre_code_before_tl
5967     {
5968       \@@_rowlistcolors
5969         [ \exp_not:n { #2 } ]
5970         { #1 - \int_eval:n { \c@iRow - 1 } }
5971         { \exp_not:n { #3 } }
5972         [ \exp_not:n { #4 } ]
5973     }
5974   }
5975 }

```

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.

```

5976 \cs_new_protected:Npn \@@_clear_rowlistcolors_seq:
5977 {
5978   \seq_map_inline:Nn \g_@@_rowlistcolors_seq
5979     { \@@_rowlistcolors_tabular_ii:nnnn ##1 }
5980   \seq_gclear:N \g_@@_rowlistcolors_seq
5981 }

```

```

5982 \cs_new_protected:Npn \@@_rowlistcolors_tabular_i:nnnn #1 #2 #3 #4
5983 {
5984     \tl_gput_right:Nn \g_@@_pre_code_before_tl
5985         { \@@_rowlistcolors [ #2 ] { #1 } { #3 } [ #4 ] }
5986 }

```

The first mandatory argument of the command `\@@_rowlistcolors` which is written 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.

```

5987 \NewDocumentCommand \@@_columncolor_preamble { O { } m }
5988 {

```

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).

```

5989 \int_compare:nNnT { \c@jCol } > { \g_@@_col_total_int }
5990 {

```

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).

```

5991 \tl_gput_left:Ne \g_@@_pre_code_before_tl
5992 {
5993     \exp_not:N \columncolor [ #1 ]
5994         { \exp_not:n { #2 } } { \int_use:N \c@jCol }
5995     }
5996 }
5997 }

5998 \cs_new_protected:Npn \@@_EmptyColumn:n #1
5999 {
6000     \clist_map_inline:nn { #1 }
6001     {
6002         \seq_gput_right:Nn \g_@@_future_pos_of_blocks_seq
6003             { { -2 } { #1 } { 98 } { ##1 } { } } % 98 and not 99 !
6004         \columncolor { nocolor } { ##1 }
6005     }
6006 }
6007 \cs_new_protected:Npn \@@_EmptyRow:n #1
6008 {
6009     \clist_map_inline:nn { #1 }
6010     {
6011         \seq_gput_right:Nn \g_@@_future_pos_of_blocks_seq
6012             { { ##1 } { -2 } { ##1 } { 98 } { } } % 98 and not 99 !
6013         \rowcolor { nocolor } { ##1 }
6014     }
6015 }

```

## 22 The vertical and horizontal rules

### OnlyMainNiceMatrix

We give to the user the possibility to define new types of columns (with `\newcolumntype` 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`.

```
6016 \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`.

```
6017 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix:n #1
6018 {
6019     \int_if_zero:nTF { \l_@@_first_col_int }
6020         { \@@_OnlyMainNiceMatrix_i:n { #1 } }
6021     {
6022         \int_if_zero:nTF { \c@jCol }
6023             {
6024                 \int_compare:nNnF { \c@iRow } = { -1 }
6025                     {
6026                         \int_compare:nNnF { \c@iRow } = { \l_@@_last_row_int - 1 }
6027                             { #1 }
6028                     }
6029             }
6030         { \@@_OnlyMainNiceMatrix_i:n { #1 } }
6031     }
6032 }
```

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.

```
6033 \cs_new_protected:Npn \@@_OnlyMainNiceMatrix_i:n #1
6034 {
6035     \int_if_zero:nF { \c@iRow }
6036         {
6037             \int_compare:nNnF { \c@iRow } = { \l_@@_last_row_int }
6038                 {
6039                     \int_compare:nNnT { \c@jCol } > { \c_zero_int }
6040                         { \bool_if:NF \l_@@_in_last_col_bool { #1 } }
6041                 }
6042         }
6043 }
```

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`.

```
6044 \cs_new:Npn \@@_tikz_booktabs_loaded:nn #1 #2
6045 {
6046     \IfPackageLoadedTF { tikz }
6047         {
6048             \IfPackageLoadedTF { booktabs }
6049                 {
6050                     \@@_error:nn { TopRule~without~booktabs } { #1 } }
6051                 }
6052             { \@@_error:nn { TopRule~without~tikz } { #1 } }
6053         }
6054 \NewExpandableDocumentCommand { \@@_TopRule } { }
6055     { \@@_tikz_booktabs_loaded:nn { \TopRule } { \@@_TopRule_i: } }
6056 \cs_new:Npn \@@_TopRule_i:
6057 {
6058     \noalign \bgroup
6059     \peek_meaning:NTF [
6060         { \@@_TopRule_ii: }
```

```

6061     { \@@_TopRule_ii: [ \dim_use:N \heavyrulewidth ] }
6062 }
6063 \NewDocumentCommand \@@_TopRule_ii: { o }
6064 {
6065     \tl_gput_right:Nn \g_@@_pre_code_after_tl
6066     {
6067         \@@_hline:n
6068         {
6069             position = \int_eval:n { \c@iRow + 1 } ,
6070             tikz =
6071             {
6072                 line-width = #1 ,
6073                 yshift = 0.25 \arrayrulewidth ,
6074                 shorten< = - 0.5 \arrayrulewidth
6075             } ,
6076             total-width = #1
6077         }
6078     }
6079     \skip_vertical:n { \belowrulesep + #1 }
6080     \egroup
6081 }
6082 \NewExpandableDocumentCommand { \@@_BottomRule } { }
6083 { \@@_tikz_booktabs_loaded:nn { \BottomRule } { \@@_BottomRule_i: } }
6084 \cs_new:Npn \@@_BottomRule_i:
6085 {
6086     \noalign \bgroup
6087     \peek_meaning:NTF [
6088         { \@@_BottomRule_ii: }
6089         { \@@_BottomRule_ii: [ \dim_use:N \heavyrulewidth ] }
6090     ]
6091 \NewDocumentCommand \@@_BottomRule_ii: { o }
6092 {
6093     \tl_gput_right:Nn \g_@@_pre_code_after_tl
6094     {
6095         \@@_hline:n
6096         {
6097             position = \int_eval:n { \c@iRow + 1 } ,
6098             tikz =
6099             {
6100                 line-width = #1 ,
6101                 yshift = 0.25 \arrayrulewidth ,
6102                 shorten< = - 0.5 \arrayrulewidth
6103             } ,
6104             total-width = #1 ,
6105         }
6106     }
6107     \skip_vertical:N \aboverulesep
6108     \@@_create_row_node_i:
6109     \skip_vertical:n { #1 }
6110     \egroup
6111 }
6112 \NewExpandableDocumentCommand { \@@_MidRule } { }
6113 { \@@_tikz_booktabs_loaded:nn { \MidRule } { \@@_MidRule_i: } }
6114 \cs_new:Npn \@@_MidRule_i:
6115 {
6116     \noalign \bgroup
6117     \peek_meaning:NTF [
6118         { \@@_MidRule_ii: }
6119         { \@@_MidRule_ii: [ \dim_use:N \lightrulewidth ] }
6120     ]
6121 \NewDocumentCommand \@@_MidRule_ii: { o }

```

```

6122 {
6123   \skip_vertical:N \aboverulesep
6124   \@@_create_row_node_i:
6125   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6126   {
6127     \@@_hline:n
6128     {
6129       position = \int_eval:n { \c@iRow + 1 } ,
6130       tikz =
6131       {
6132         line-width = #1 ,
6133         yshift = 0.25 \arrayrulewidth ,
6134         shorten< = - 0.5 \arrayrulewidth
6135       } ,
6136       total-width = #1 ,
6137     }
6138   }
6139   \skip_vertical:n { \belowrulesep + #1 }
6140   \egroup
6141 }
```

## 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.

```

6142 \keys_define:nn { nicematrix / Rules }
6143 {
6144   position .int_set:N = \l_@@_position_int ,
6145   position .value_required:n = true ,
6146   start .int_set:N = \l_@@_start_int ,
6147   end .code:n =
6148   \bool_lazy_or:nTF
6149     { \tl_if_empty_p:n { #1 } }
6150     { \str_if_eq_p:ee { #1 } { last } }
6151     { \int_set_eq:NN \l_@@_end_int \c@jCol }
6152     { \int_set:Nn \l_@@_end_int { #1 } }
6153 }
```

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 analysis 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.

```

6154 \keys_define:nn { nicematrix / RulesBis }
6155 {
6156   multiplicity .int_set:N = \l_@@_multiplicity_int ,
6157   multiplicity .initial:n = 1 ,
6158   dotted .bool_set:N = \l_@@_dotted_bool ,
6159   dotted .initial:n = false ,
6160   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].

```

6161   color .code:n =
6162   \@@_set_CTarc:n { #1 }
```

```

6163   \tl_set:Nn \l_@@_rule_color_tl { #1 } ,
6164   color .value_required:n = true ,
6165   sep-color .code:n = \@@_set_CTDrsC:n { #1 } ,
6166   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.

```

6167   tikz .code:n =
6168     \IfPackageLoadedTF { tikz }
6169       { \clist_put_right:Nn \l_@@_tikz_rule_tl { #1 } }
6170       { \@@_error:n { tikz-without-tikz } },
6171   tikz .value_required:n = true ,
6172   total-width .dim_set:N = \l_@@_rule_width_dim ,
6173   total-width .value_required:n = true ,
6174   width .meta:n = { total-width = #1 } ,
6175   unknown .code:n = \@@_error:n { Unknown~key~for~RulesBis }
6176 }

```

## The vertical rules

The following command will be executed in the internal `\CodeAfter`. The argument `#1` is a list of `key=value` pairs.

```

6177 \cs_new_protected:Npn \@@_vline:n #1
6178 {

```

The group is for the options.

```

6179 \group_begin:
6180 \int_set_eq:NN \l_@@_end_int \c@iRow
6181 \keys_set_known:nnN { 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).

```

6182 \int_compare:nNnT { \l_@@_position_int } < { \c@jCol + 2 }
6183   \@@_vline_i:
6184 \group_end:
6185 }

6186 \cs_new_protected:Npn \@@_vline_i:
6187 {

```

`\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`.

```

6188 \tl_set:No \l_tmpb_tl { \int_use:N \l_@@_position_int }
6189 \int_step_variable:nnNn \l_@@_start_int \l_@@_end_int
6190   \l_tmpa_tl
6191   {

```

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.

```

6192 \bool_gset_true:N \g_tmpa_bool
6193 \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6194   { \@@_test_vline_in_block:nnnnn ##1 }
6195 \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
6196   { \@@_test_vline_in_block:nnnnn ##1 }
6197 \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
6198   { \@@_test_vline_in_stroken_block:nnnn ##1 }
6199 \clist_if_empty:NF \l_@@_corners_clist { \@@_test_in_corner_v: }
6200 \bool_if:NTF \g_tmpa_bool
6201   {
6202     \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.

```

6203     { \int_set:Nn \l_@@_local_start_int \l_tmpa_tl }
6204   }
6205   {
6206     \int_compare:nNnT { \l_@@_local_start_int } > { \c_zero_int }
6207     {
6208       \int_set:Nn \l_@@_local_end_int { \l_tmpa_tl - 1 }
6209       \@@_vline_ii:
6210       \int_zero:N \l_@@_local_start_int
6211     }
6212   }
6213 }
6214 \int_compare:nNnT { \l_@@_local_start_int } > { \c_zero_int }
6215 {
6216   \int_set_eq:NN \l_@@_local_end_int \l_@@_end_int
6217   \@@_vline_ii:
6218 }
6219 }

6220 \cs_new_protected:Npn \@@_test_in_corner_v:
6221 {
6222   \int_compare:nNnTF { \l_tmpb_tl } = { \c@jCol + 1 }
6223   {
6224     \@@_if_in_corner:nT { \l_tmpa_tl - \int_eval:n { \l_tmpb_tl - 1 } }
6225     { \bool_set_false:N \g_tmpa_bool }
6226   }
6227   {
6228     \@@_if_in_corner:nT { \l_tmpa_tl - \l_tmpb_tl }
6229     {
6230       \int_compare:nNnTF { \l_tmpb_tl } = { \c_one_int }
6231       { \bool_set_false:N \g_tmpa_bool }
6232       {
6233         \@@_if_in_corner:nT
6234           { \l_tmpa_tl - \int_eval:n { \l_tmpb_tl - 1 } }
6235           { \bool_set_false:N \g_tmpa_bool }
6236       }
6237     }
6238   }
6239 }

6240 \cs_new_protected:Npn \@@_vline_ii:
6241 {
6242   \tl_clear:N \l_@@_tikz_rule_tl
6243   \keys_set:no { nicematrix / RulesBis } \l_@@_other_keys_tl
6244   \bool_if:NTF \l_@@_dotted_bool
6245     { \@@_vline_iv: }
6246     {
6247       \tl_if_empty:NTF \l_@@_tikz_rule_tl
6248         { \@@_vline_iii: }
6249         { \@@_vline_v: }
6250     }
6251 }

```

First the case of a standard rule: the user has not used the key `dotted` nor the key `tikz`.

```

6252 \cs_new_protected:Npn \@@_vline_iii:
6253 {
6254   \pgfpicture
6255   \pgfrememberpicturepositiononpagetrue
6256   \pgf@relevantforpicturesizefalse
6257   \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }

```

```

6258 \dim_set_eq:NN \l_tmpa_dim \pgf@y
6259 \@@_qpoint:n { col - \int_use:N \l_@@_position_int }
6260 \dim_set:Nn \l_tmpb_dim
6261 {
6262   \pgf@x
6263   - 0.5 \l_@@_rule_width_dim
6264   +
6265   ( \arrayrulewidth * \l_@@_multiplicity_int
6266     + \doublerulesep * ( \l_@@_multiplicity_int - 1 ) ) / 2
6267 }
6268 \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }
6269 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
6270 \bool_lazy_all:nT
6271 {
6272   { \int_compare_p:nNn { \l_@@_multiplicity_int } > { \c_one_int } }
6273   { \cs_if_exist_p:N \CT@drsc@ }
6274   { ! \tl_if_blank_p:o \CT@drsc@ }
6275 }
6276 {
6277   \group_begin:
6278   \CT@drsc@
6279   \dim_add:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }
6280   \dim_sub:Nn \l_@@_tmpc_dim { 0.5 \arrayrulewidth }
6281   \dim_set:Nn \l_@@_tmpd_dim
6282   {
6283     \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth )
6284     * ( \l_@@_multiplicity_int - 1 )
6285   }
6286   \pgfpathrectanglecorners
6287   { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6288   { \pgfpoint \l_@@_tmpd_dim \l_@@_tmpc_dim }
6289   \pgfusepath { fill }
6290   \group_end:
6291 }
6292 \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6293 \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
6294 \prg_replicate:nn { \l_@@_multiplicity_int - 1 }
6295 {
6296   \dim_sub:Nn \l_tmpb_dim { \arrayrulewidth + \doublerulesep }
6297   \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
6298   \pgfpathlineto { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
6299 }
6300 \CT@arc@
6301 \pgfsetlinewidth { 1.1 \arrayrulewidth }
6302 \pgfsetrectcap
6303 \pgfusepathqstroke
6304 \endpgfpicture
6305 }

```

The following code is for the case of a dotted rule (with our system of rounded dots).

```

6306 \cs_new_protected:Npn \@@_vline_iv:
6307 {
6308   \pgfpicture
6309   \pgfrememberpicturepositiononpagetrue
6310   \pgf@relevantforpicturesizefalse
6311   \@@_qpoint:n { col - \int_use:N \l_@@_position_int }
6312   \dim_set:Nn \l_@@_x_initial_dim { \pgf@x - 0.5 \l_@@_rule_width_dim }
6313   \dim_set_eq:NN \l_@@_x_final_dim \l_@@_x_initial_dim
6314   \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }
6315   \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
6316   \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }
6317   \dim_set_eq:NN \l_@@_y_final_dim \pgf@y
6318   \CT@arc@

```

```

6319      \@@_draw_line:
6320      \endpgfpicture
6321 }

```

The following code is for the case when the user uses the key `tikz`.

```

6322 \cs_new_protected:Npn \@@_vline_v:
6323 {
6324     \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).

```

6325 \CT@arc@  

6326 \tl_if_empty:NF \l_@@_rule_color_tl  

6327     { \tl_put_right:Ne \l_@@_tikz_rule_tl { , color = \l_@@_rule_color_tl } }  

6328 \pgfrememberpicturepositiononpagetrue  

6329 \pgf@relevantforpicturesizefalse  

6330 \@@_qpoint:n { row - \int_use:N \l_@@_local_start_int }  

6331 \dim_set_eq:NN \l_tmpa_dim \pgf@y  

6332 \@@_qpoint:n { col - \int_use:N \l_@@_position_int }  

6333 \dim_set:Nn \l_tmpb_dim { \pgf@x - 0.5 \l_@@_rule_width_dim }  

6334 \@@_qpoint:n { row - \int_eval:n { \l_@@_local_end_int + 1 } }  

6335 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y  

6336 \exp_args:No \tikzset \l_@@_tikz_rule_tl  

6337 \use:e { \exp_not:N \draw [ \l_@@_tikz_rule_tl ] }  

6338     ( \l_tmpb_dim , \l_tmpa_dim ) --  

6339     ( \l_tmpb_dim , \l_@@_tmpc_dim ) ;  

6340 \end{tikzpicture}  

6341 }

```

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).

```

6342 \cs_new_protected:Npn \@@_draw_vlines:
6343 {
6344     \int_step_inline:nnn
6345     {
6346         \bool_lazy_or:nnTF { \g_@@_delims_bool } { \l_@@_except_borders_bool }
6347             { 2 }
6348             { 1 }
6349     }
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_set_eq:NN \l_@@_end_int \c@jCol
6365 \keys_set_known:nnN { nicematrix / Rules } { #1 } \l_@@_other_keys_tl
6366 \@@_hline_i:
6367 \group_end:
6368 }

6369 \cs_new_protected:Npn \@@_hline_i:
6370 {

```

$\l_@@_tmpa_tl$  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  $\l_@@_tmpc_tl$ .

```

6371 \tl_set:No \l_@@_tmpa_tl { \int_use:N \l_@@_position_int }
6372 \int_step_variable:nnNn \l_@@_start_int \l_@@_end_int
6373 \l_@@_tmpb_tl
6374 {

```

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.

```
6375 \bool_gset_true:N \g_@@_tmpa_bool
```

We test whether we are in a block.

```

6376 \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6377   { \@@_test_hline_in_block:nnnn ##1 }

6378 \seq_map_inline:Nn \g_@@_pos_of_xdots_seq
6379   { \@@_test_hline_in_block:nnnn ##1 }
6380 \seq_map_inline:Nn \g_@@_pos_of_stroken_blocks_seq
6381   { \@@_test_hline_in_stroken_block:nnnn ##1 }
6382 \clist_if_empty:NF \l_@@_corners_clist { \@@_test_in_corner_h: }
6383 \bool_if:NTF \g_@@_tmpa_bool
6384   {
6385     \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.

```

6386   { \int_set:Nn \l_@@_local_start_int \l_@@_tmpb_tl }
6387 }
6388 {
6389   \int_compare:nNnT { \l_@@_local_start_int } > { \c_zero_int }
6390   {
6391     \int_set:Nn \l_@@_local_end_int { \l_@@_tmpb_tl - 1 }
6392     \@@_hline_ii:
6393     \int_zero:N \l_@@_local_start_int
6394   }
6395 }
6396 }
6397 \int_compare:nNnT { \l_@@_local_start_int } > { \c_zero_int }
6398 {
6399   \int_set_eq:NN \l_@@_local_end_int \l_@@_end_int
6400   \@@_hline_ii:
6401 }
6402 }

6403 \cs_new_protected:Npn \@@_test_in_corner_h:
6404 {
6405   \int_compare:nNnTF { \l_@@_tmpa_tl } = { \c@iRow + 1 }
6406   {
6407     \@@_if_in_corner:nT { \int_eval:n { \l_@@_tmpa_tl - 1 } - \l_@@_tmpb_tl }
6408     { \bool_set_false:N \g_@@_tmpa_bool }
6409   }

```

```

6410    {
6411        \@@_if_in_corner:nT { \l_tmpa_tl - \l_tmpb_tl }
6412        {
6413            \int_compare:nNnTF { \l_tmpa_tl } = { \c_one_int }
6414            { \bool_set_false:N \g_tmpa_bool }
6415            {
6416                \@@_if_in_corner:nT
6417                { \int_eval:n { \l_tmpa_tl - 1 } - \l_tmpb_tl }
6418                { \bool_set_false:N \g_tmpa_bool }
6419            }
6420        }
6421    }
6422 }

6423 \cs_new_protected:Npn \@@_hline_ii:
6424 {
6425     \tl_clear:N \l_@@_tikz_rule_tl
6426     \keys_set:no { nicematrix / RulesBis } \l_@@_other_keys_tl
6427     \bool_if:NTF \l_@@_dotted_bool
6428     { \@@_hline_iv: }
6429     {
6430         \tl_if_empty:NTF \l_@@_tikz_rule_tl
6431         { \@@_hline_iii: }
6432         { \@@_hline_v: }
6433     }
6434 }

```

First the case of a standard rule (without the keys dotted and tikz).

```

6435 \cs_new_protected:Npn \@@_hline_iii:
6436 {
6437     \pgfpicture
6438     \pgfrememberpicturepositiononpagetrue
6439     \pgf@relevantforpicturesizefalse
6440     \@@_qpoint:n { col - \int_use:N \l_@@_local_start_int }
6441     \dim_set_eq:NN \l_tmpa_dim \pgf@x
6442     \@@_qpoint:n { row - \int_use:N \l_@@_position_int }
6443     \dim_set:Nn \l_tmpb_dim
6444     {
6445         \pgf@y
6446         - 0.5 \l_@@_rule_width_dim
6447         +
6448         ( \arrayrulewidth * \l_@@_multiplicity_int
6449           + \doublerulesep * ( \l_@@_multiplicity_int - 1 ) ) / 2
6450     }
6451     \@@_qpoint:n { col - \int_eval:n { \l_@@_local_end_int + 1 } }
6452     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
6453     \bool_lazy_all:nT
6454     {
6455         { \int_compare_p:nNn { \l_@@_multiplicity_int } > { \c_one_int } }
6456         { \cs_if_exist_p:N \CT@drsc@ }
6457         { ! \tl_if_blank_p:o \CT@drsc@ }
6458     }
6459     {
6460         \group_begin:
6461         \CT@drsc@
6462         \dim_set:Nn \l_@@_tmpd_dim
6463         {
6464             \l_tmpb_dim - ( \doublerulesep + \arrayrulewidth )
6465             * ( \l_@@_multiplicity_int - 1 )
6466         }
6467         \pgfpathrectanglecorners
6468         { \pgfpoint \l_tmpa_dim \l_tmpb_dim }

```

```

6469      { \pgfpoint {\l_@_tmpc_dim} {\l_@_tmpd_dim} }
6470      \pgfusepathqfill
6471      \group_end:
6472    }
6473    \pgfpathmoveto { \pgfpoint {\l_tmpa_dim} {\l_tmpb_dim} }
6474    \pgfpathlineto { \pgfpoint {\l_@_tmpc_dim} {\l_@_tmpb_dim} }
6475    \prg_replicate:nn { \l_@_multiplicity_int - 1 }
6476    {
6477      \dim_sub:Nn {\l_@_tmpb_dim} { \arrayrulewidth + \doublerulesep }
6478      \pgfpathmoveto { \pgfpoint {\l_tmpa_dim} {\l_@_tmpb_dim} }
6479      \pgfpathlineto { \pgfpoint {\l_@_tmpc_dim} {\l_@_tmpb_dim} }
6480    }
6481    \CT@arc@%
6482    \pgfsetlinewidth { 1.1 \arrayrulewidth }
6483    \pgfsetrectcap
6484    \pgfusepathqstroke
6485    \endpgfpicture
6486  }

```

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}
```

$$\begin{array}{cccc} 1 & 2 & 3 & 4 \\ \hline 1 & 2 & 3 & 4 \\ \cdot & \cdot & \cdot & \cdot \\ 1 & 2 & 3 & 4 \end{array}$$

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}
```

$$\begin{array}{cccc} 1 & 2 & 3 & 4 \\ \hline 1 & 2 & 3 & 4 \\ \cdot & \cdot & \cdot & \cdot \\ 1 & 2 & 3 & 4 \end{array}$$

```
6487 \cs_new_protected:Npn \@@_hline_iv:
```

```
{

```

```
  \pgfpicture
```

```
  \pgfrememberpicturepositiononpagetrue
```

```
  \pgf@relevantforpicturesizefalse
```

```
  \Qpoint:n { row - \int_use:N \l_@_position_int }
```

```
  \dim_set:Nn \l_@_y_initial_dim { \pgf@y - 0.5 \l_@_rule_width_dim }
```

```
  \dim_set_eq:NN \l_@_y_final_dim \l_@_y_initial_dim
```

```
  \Qpoint:n { col - \int_use:N \l_@_local_start_int }
```

```
  \dim_set_eq:NN \l_@_x_initial_dim \pgf@x
```

```
  \int_compare:nNnT { \l_@_local_start_int } = { \c_one_int }
```

```
{
```

```
  \dim_sub:Nn \l_@_x_initial_dim \l_@_left_margin_dim
```

```
  \bool_if:NF \g_@_delims_bool
```

```
    { \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.

```

6502 \tl_if_eq:NnF \g_@_left_delim_tl (
6503   { \dim_add:Nn \l_@_x_initial_dim { 0.5 \l_@_xdots_inter_dim } }
6504 )
6505 \Qpoint:n { col - \int_eval:n { \l_@_local_end_int + 1 } }
6506 \dim_set_eq:NN \l_@_x_final_dim \pgf@x
6507 \int_compare:nNnT { \l_@_local_end_int } = { \c@jCol }
6508 {
6509   \dim_add:Nn \l_@_x_final_dim \l_@_right_margin_dim

```

```

6510     \bool_if:NF \g_@@_delims_bool
6511         { \dim_add:Nn \l_@@_x_final_dim \arraycolsep }
6512         \tl_if_eq:NnF \g_@@_right_delim_tl )
6513             { \dim_gsub:Nn \l_@@_x_final_dim { 0.5 \l_@@_xdots_inter_dim } }
6514     }
6515     \CT@arc@
6516     \@@_draw_line:
6517     \endpgfpicture
6518 }
```

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`).

```

6519 \cs_new_protected:Npn \@@_hline_v:
6520 {
6521     \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).

```

6522     \CT@arc@
6523     \tl_if_empty:NF \l_@@_rule_color_tl
6524         { \tl_put_right:Ne \l_@@_tikz_rule_tl { , color = \l_@@_rule_color_tl } }
6525     \pgfrememberpicturepositiononpagetrue
6526     \pgf@relevantforpicturesizefalse
6527     \@@_qpoint:n { col - \int_use:N \l_@@_local_start_int }
6528     \dim_set_eq:NN \l_tmpa_dim \pgf@x
6529     \@@_qpoint:n { row - \int_use:N \l_@@_position_int }
6530     \dim_set:Nn \l_tmpb_dim { \pgf@y - 0.5 \l_@@_rule_width_dim }
6531     \@@_qpoint:n { col - \int_eval:n { \l_@@_local_end_int + 1 } }
6532     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@x
6533     \exp_args:No \tikzset \l_@@_tikz_rule_tl
6534     \use:e { \exp_not:N \draw [ \l_@@_tikz_rule_tl ] }
6535         ( \l_tmpa_dim , \l_tmpb_dim ) --
6536         ( \l_@@_tmpc_dim , \l_tmpb_dim ) ;
6537     \end{tikzpicture}
6538 }
```

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).

```

6539 \cs_new_protected:Npn \@@_draw_hlines:
6540 {
6541     \int_step_inline:nnn
6542         { \bool_lazy_or:nnTF \g_@@_delims_bool \l_@@_except_borders_bool 2 1 }
6543     {
6544         \bool_lazy_or:nnTF { \g_@@_delims_bool } { \l_@@_except_borders_bool }
6545             { \c@iRow }
6546             { \int_eval:n { \c@iRow + 1 } }
6547     }
6548     {
6549         \str_if_eq:eeF { \l_@@_hlines_clist } { all }
6550             { \clist_if_in:NnT \l_@@_hlines_clist { ##1 } }
6551             { \@@_hline:n { position = ##1 , total-width = \arrayrulewidth } }
6552     }
6553 }
```

The command `\@@_Hline:` will be linked to `\Hline` in the environments of `nicematrix`.

```

6554 \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.

```

6555 \cs_set:Npn \@@_Hline_i:n #1
6556     {
```

```

6557 \peek_remove_spaces:n
6558 {
6559   \peek_meaning:NTF \Hline
6560   { \@@_Hline_ii:nn { #1 + 1 } }
6561   { \@@_Hline_iii:n { #1 } }
6562 }
6563 }

6564 \cs_set:Npn \@@_Hline_ii:nn #1 #2 { \@@_Hline_i:n { #1 } }

6565 \cs_set:Npn \@@_Hline_iii:n #
6566 { \@@_collect_options:n { \@@_Hline_iv:nn { #1 } } }

6567 \cs_set_protected:Npn \@@_Hline_iv:nn #1 #2
6568 {
6569   \@@_compute_rule_width:n { multiplicity = #1 , #2 }
6570   \skip_vertical:N \l_@@_rule_width_dim
6571   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6572   {
6573     \@@_hline:n
6574     {
6575       multiplicity = #1 ,
6576       position = \int_eval:n { \c@iRow + 1 } ,
6577       total-width = \dim_use:N \l_@@_rule_width_dim ,
6578       #2
6579     }
6580   }
6581   \egroup
6582 }

```

### 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`).

```

6583 \cs_new_protected:Npn \@@_custom_line:n #
6584 {
6585   \str_clear_new:N \l_@@_command_str
6586   \str_clear_new:N \l_@@_ccommand_str
6587   \str_clear_new:N \l_@@_letter_str
6588   \tl_clear_new:N \l_@@_other_keys_tl
6589   \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.

```

6590 \bool_lazy_all:nTF
6591 {
6592   { \str_if_empty_p:N \l_@@_letter_str }
6593   { \str_if_empty_p:N \l_@@_command_str }
6594   { \str_if_empty_p:N \l_@@_ccommand_str }
6595 }
6596 { \@@_error:n { No~letter~and~no~command } }
6597 { \@@_custom_line_i:o \l_@@_other_keys_tl }
6598 }

6599 \keys_define:nn { nicematrix / custom-line }
6600 {
6601   letter .str_set:N = \l_@@_letter_str ,
6602   letter .value_required:n = true ,
6603   command .str_set:N = \l_@@_command_str ,
6604   command .value_required:n = true ,
6605   ccommand .str_set:N = \l_@@_ccommand_str ,

```

```

6606     ccommand .value_required:n = true ,
6607 }

6608 \cs_new_protected:Npn \@@_custom_line_i:n #1
6609 {

```

The following flags will be raised when the keys `tikz`, `dotted` and `color` are used (in the `custom-line`).

```

6610     \bool_set_false:N \l_@@_tikz_rule_bool
6611     \bool_set_false:N \l_@@_dotted_rule_bool
6612     \bool_set_false:N \l_@@_color_bool
6613     \keys_set:nn { nicematrix / custom-line-bis } { #1 }
6614     \bool_if:NT \l_@@_tikz_rule_bool
6615     {
6616         \IfPackageLoadedF { tikz }
6617         { \@@_error:n { tikz-in-custom-line-without-tikz } }
6618         \bool_if:NT \l_@@_color_bool
6619         { \@@_error:n { color-in-custom-line-with-tikz } }
6620     }
6621     \bool_if:NT \l_@@_dotted_rule_bool
6622     {
6623         \int_compare:nNt { \l_@@_multiplicity_int } > { \c_one_int }
6624         { \@@_error:n { key-multiplicity-with-dotted } }
6625     }
6626     \str_if_empty:NF \l_@@_letter_str
6627     {
6628         \int_compare:nTF { \str_count:N \l_@@_letter_str != 1 }
6629         { \@@_error:n { Several~letters } }
6630         {
6631             \tl_if_in:NoTF
6632             \c_@@_forbidden_letters_str
6633             \l_@@_letter_str
6634             { \@@_error:ne { Forbidden-letter } \l_@@_letter_str }
6635             {

```

During the analysis 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.

```

6636         \cs_set_nopar:cpn { @@ _ \l_@@_letter_str : } ##1
6637         { \@@_v_custom_line:nn { #1 } }
6638     }
6639 }
6640 }
6641 \str_if_empty:NF \l_@@_command_str { \@@_h_custom_line:n { #1 } }
6642 \str_if_empty:NF \l_@@_ccommand_str { \@@_c_custom_line:n { #1 } }
6643 }
6644 \cs_generate_variant:Nn \@@_custom_line_i:n { o }
6645 \tl_const:Nn \c_@@_forbidden_letters_tl { lcrpmbVX|()[]!@<> }
6646 \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.

```

6647 \keys_define:nn { nicematrix / custom-line-bis }
6648 {
6649     multiplicity .int_set:N = \l_@@_multiplicity_int ,
6650     multiplicity .initial:n = 1 ,
6651     multiplicity .value_required:n = true ,
6652     color .code:n = \bool_set_true:N \l_@@_color_bool ,
6653     color .value_required:n = true ,

```

```

6654 tikz .code:n = \bool_set_true:N \l_@@_tikz_rule_bool ,
6655 tikz .value_required:n = true ,
6656 dotted .code:n = \bool_set_true:N \l_@@_dotted_rule_bool ,
6657 dotted .value_forbidden:n = true ,
6658 total-width .code:n = { } ,
6659 total-width .value_required:n = true ,
6660 width .code:n = { } ,
6661 width .value_required:n = true ,
6662 sep-color .code:n = { } ,
6663 sep-color .value_required:n = true ,
6664 unknown .code:n = \@@_error:n { Unknown~key~for~custom-line }
6665 }

```

The following keys will indicate whether the keys `dotted`, `tikz` and `color` are used in the use of a `custom-line`.

```

6666 \bool_new:N \l_@@_dotted_rule_bool
6667 \bool_new:N \l_@@_tikz_rule_bool
6668 \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`.

```

6669 \keys_define:nn { nicematrix / custom-line-width }
6670 {
6671   multiplicity .int_set:N = \l_@@_multiplicity_int ,
6672   multiplicity .initial:n = 1 ,
6673   multiplicity .value_required:n = true ,
6674   tikz .code:n = \bool_set_true:N \l_@@_tikz_rule_bool ,
6675   total-width .code:n = \dim_set:Nn \l_@@_rule_width_dim { #1 }
6676           \bool_set_true:N \l_@@_total_width_bool ,
6677   total-width .value_required:n = true ,
6678   width .meta:n = { total-width = #1 } ,
6679   dotted .code:n = \bool_set_true:N \l_@@_dotted_rule_bool ,
6680 }

```

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`).

```

6681 \cs_new_protected:Npn \@@_h_custom_line:n #1
6682 {

```

We use `\cs_set:cfn` and not `\cs_new:cfn` because we want a local definition. Moreover, the command must *not* be protected since it begins with `\noalign` (which is in `\Hline`).

```

6683 \cs_set_nopar:cfn { nicematrix - \l_@@_command_str } { \Hline [ #1 ] }
6684 \seq_put_left:No \l_@@_custom_line_commands_seq \l_@@_command_str
6685 }

```

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`).

```

6686 \cs_new_protected:Npn \@@_c_custom_line:n #1
6687 {

```

Here, we need an expandable command since it begins with an `\noalign`.

```

6688 \exp_args:Nc \NewExpandableDocumentCommand
6689   { nicematrix - \l_@@_ccommand_str }
6690   { O { } m }
6691   {
6692     \noalign
6693     {
6694       \@@_compute_rule_width:n { #1 , ##1 }

```

```

6695     \skip_vertical:n { \l_@@_rule_width_dim }
6696     \clist_map_inline:nn
6697         { ##2 }
6698         { \@@_c_custom_line_i:nn { #1 , ##1 } { #####1 } }
6699     }
6700   }
6701 \seq_put_left:No \l_@@_custom_line_commands_seq \l_@@_ccommand_str
6702 }

```

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*.

```

6703 \cs_new_protected:Npn \@@_c_custom_line_i:nn #1 #2
6704 {
6705   \tl_if_in:nnTF { #2 } { - }
6706   { \@@_cut_on_hyphen:w #2 \q_stop }
6707   { \@@_cut_on_hyphen:w #2 - #2 \q_stop }
6708   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6709   {
6710     \@@_hline:n
6711     {
6712       #1 ,
6713       start = \l_tmpa_tl ,
6714       end = \l_tmpb_tl ,
6715       position = \int_eval:n { \c@iRow + 1 } ,
6716       total-width = \dim_use:N \l_@@_rule_width_dim
6717     }
6718   }
6719 }
6720 \cs_new_protected:Npn \@@_compute_rule_width:n #1
6721 {
6722   \bool_set_false:N \l_@@_tikz_rule_bool
6723   \bool_set_false:N \l_@@_total_width_bool
6724   \bool_set_false:N \l_@@_dotted_rule_bool
6725   \keys_set_known:nn { nicematrix / custom-line-width } { #1 }
6726   \bool_if:NF \l_@@_total_width_bool
6727   {
6728     \bool_if:NTF \l_@@_dotted_rule_bool
6729     { \dim_set:Nn \l_@@_rule_width_dim { 2 \l_@@_xdots_radius_dim } }
6730     {
6731       \bool_if:NF \l_@@_tikz_rule_bool
6732       {
6733         \dim_set:Nn \l_@@_rule_width_dim
6734         {
6735           \arrayrulewidth * \l_@@_multiplicity_int
6736           + \doublerulesep * ( \l_@@_multiplicity_int - 1 )
6737         }
6738       }
6739     }
6740   }
6741 }

```

The following constructions aims to allow cumulative blocks of options between square brackets such as in `I[color=blue] [tikz=dashed]`.

```

6742 \cs_new_protected:Npn \@@_v_custom_line:nn #1 #2
6743 {
6744   \str_if_eq:nnTF { #2 } { [ ]
6745   { \@@_v_custom_line_i:nw { #1 } [ ]
6746   { \@@_v_custom_line_ii:nn { #2 } { #1 } }
6747 }
6748 \cs_new_protected:Npn \@@_v_custom_line_i:nw #1 [ #2 ]
6749 { \@@_v_custom_line:nn { #1 , #2 } }
6750 \cs_new_protected:Npn \@@_v_custom_line_ii:nn #1 #2
6751 {
6752   \@@_compute_rule_width:n { #2 }

```

In the following line, the `\dim_use:N` is mandatory since we do an expansion.

```

6753   \tl_gput_right:Ne \g_@@_array_preamble_tl
6754     { \exp_not:N ! { \skip_horizontal:n { \dim_use:N \l_@@_rule_width_dim } } }
6755   \tl_gput_right:Ne \g_@@_pre_code_after_tl
6756   {
6757     \@@_vline:n
6758     {
6759       #2 ,
6760       position = \int_eval:n { \c@jCol + 1 } ,
6761       total_width = \dim_use:N \l_@@_rule_width_dim
6762     }
6763   }
6764 \@@_rec_preamble:n #1
6765 }

6766 \@@_custom_line:n
6767 { 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`.

```

6768 \cs_new_protected:Npn \@@_test_hline_in_block:nnnnn #1 #2 #3 #4 #5
6769 {
6770   \int_compare:nNnT { \l_tmpa_tl } > { #1 }
6771   {
6772     \int_compare:nNnT { \l_tmpa_tl } < { #3 + 1 }
6773     {
6774       \int_compare:nNnT { \l_tmpb_tl } > { #2 - 1 }
6775       {
6776         \int_compare:nNnT { \l_tmpb_tl } < { #4 + 1 }
6777         { \bool_gset_false:N \g_tmpa_bool }
6778       }
6779     }
6780   }
6781 }
```

The same for vertical rules.

```

6782 \cs_new_protected:Npn \@@_test_vline_in_block:nnnnn #1 #2 #3 #4 #5
6783 {
6784   \int_compare:nNnT { \l_tmpa_tl } > { #1 - 1 }
6785   {
6786     \int_compare:nNnT { \l_tmpa_tl } < { #3 + 1 }
6787     {
6788       \int_compare:nNnT { \l_tmpb_tl } > { #2 }
6789       {
6790         \int_compare:nNnT { \l_tmpb_tl } < { #4 + 1 }
6791         { \bool_gset_false:N \g_tmpa_bool }
6792       }
6793     }
6794   }
6795 }

6796 \cs_new_protected:Npn \@@_test_hline_in_stroken_block:nnnn #1 #2 #3 #4
6797 {
6798   \int_compare:nNnT { \l_tmpb_tl } > { #2 - 1 }
6799   {
6800     \int_compare:nNnT { \l_tmpb_tl } < { #4 + 1 }
6801     {
6802       \int_compare:nNnTF { \l_tmpa_tl } = { #1 }
6803         { \bool_gset_false:N \g_tmpa_bool }
6804       { }
```

```

6805     \int_compare:nNnT { \l_tmpa_t1 } = { #3 + 1 }
6806     { \bool_gset_false:N \g_tmpa_bool }
6807   }
6808 }
6809 }
6810 }

6811 \cs_new_protected:Npn \@@_test_vline_in_stroken_block:nnnn #1 #2 #3 #4
6812 {
6813   \int_compare:nNnT { \l_tmpa_t1 } > { #1 - 1 }
6814   {
6815     \int_compare:nNnT { \l_tmpa_t1 } < { #3 + 1 }
6816     {
6817       \int_compare:nNnTF { \l_tmpb_t1 } = { #2 }
6818       { \bool_gset_false:N \g_tmpa_bool }
6819     {
6820       \int_compare:nNnT { \l_tmpb_t1 } = { #4 + 1 }
6821       { \bool_gset_false:N \g_tmpa_bool }
6822     }
6823   }
6824 }
6825 }

```

## 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.

```

6826 \cs_new_protected:Npn \@@_compute_corners:
6827 {
6828   \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
6829   { \@@_mark_cells_of_block:nnnn ##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 `cclist` instead of a `seq` because we will frequently search in that list (and searching in a `cclist` is faster than searching in a `seq`).

```

6830   \cclist_clear:N \l_@@_corners_cells_clist
6831   \cclist_map_inline:Nn \l_@@_corners_clist
6832   {
6833     \str_case:nnF { ##1 }
6834     {
6835       { NW }
6836       { \@@_compute_a_corner:nnnnnn 1 1 1 1 \c@iRow \c@jCol }
6837       { NE }
6838       { \@@_compute_a_corner:nnnnnn 1 \c@jCol 1 { -1 } \c@iRow 1 }
6839       { SW }
6840       { \@@_compute_a_corner:nnnnnn \c@iRow 1 { -1 } 1 1 \c@jCol }
6841       { SE }
6842       { \@@_compute_a_corner:nnnnnn \c@iRow \c@jCol { -1 } { -1 } 1 1 }
6843     }
6844     { \@@_error:nn { bad-corner } { ##1 } }
6845   }

```

Even if the user has used the key `corners` the list of cells in the corners may be empty.

```

6846   \cclist_if_empty:NF \l_@@_corners_cells_clist
6847   {

```

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.

```

6848     \tl_gput_right:Ne \g_@@_aux_tl
6849     {
6850         \clist_set:Nn \exp_not:N \l_@@_corners_cells_clist
6851         { \l_@@_corners_cells_clist }
6852     }
6853 }
6854 }

6855 \cs_new_protected:Npn \@@_mark_cells_of_block:nnnnn #1 #2 #3 #4 #5
6856 {
6857     \int_step_inline:nnn { #1 } { #3 }
6858     {
6859         \int_step_inline:nnn { #2 } { #4 }
6860         { \cs_set_nopar:cpn { @@_block _ ##1 - #####1 } { } }
6861     }
6862 }
6863 \prg_new_conditional:Npnn \@@_if_in_block:nn #1 #2 { p }
6864 {
6865     \cs_if_exist:cTF
6866     { @@_block _ \int_eval:n { #1 } - \int_eval:n { #2 } }
6867     { \prg_return_true: }
6868     { \prg_return_false: }
6869 }

```

“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.

```

6870 \cs_new_protected:Npn \@@_compute_a_corner:nnnnnn #1 #2 #3 #4 #5 #6
6871 {

```

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.

```

6872     \bool_set_false:N \l_tmpa_bool
6873     \int_zero_new:N \l_@@_last_empty_row_int
6874     \int_set:Nn \l_@@_last_empty_row_int { #1 }
6875     \int_step_inline:nnnn { #1 } { #3 } { #5 }
6876     {
6877         \bool_lazy_or:nnTF
6878         {
6879             \cs_if_exist_p:c
6880             { pgf @ sh @ ns @ \@@_env: - ##1 - \int_eval:n { #2 } }
6881         }
6882         { \@@_if_in_block_p:nn { ##1 } { #2 } }
6883         { \bool_set_true:N \l_tmpa_bool }
6884         {
6885             \bool_if:NF \l_tmpa_bool
6886             { \int_set:Nn \l_@@_last_empty_row_int { ##1 } }
6887         }
6888     }

```

Now, you determine the last empty cell in the row of number 1.

```

6889 \bool_set_false:N \l_tmpa_bool
6890 \int_zero_new:N \l_@@_last_empty_column_int
6891 \int_set:Nn \l_@@_last_empty_column_int { #2 }
6892 \int_step_inline:nnn { #2 } { #4 } { #6 }
6893 {
6894     \bool_lazy_or:nnTF
6895     {
6896         \cs_if_exist_p:c
6897         { \pgf @ sh @ ns @ \@@_env: - \int_eval:n { #1 } - ##1 }
6898     }
6899     { \@@_if_in_block_p:nn { #1 } { ##1 } }
6900     { \bool_set_true:N \l_tmpa_bool }
6901     {
6902         \bool_if:NF \l_tmpa_bool
6903         { \int_set:Nn \l_@@_last_empty_column_int { ##1 } }
6904     }
6905 }
```

Now, we loop over the rows.

```

6906 \int_step_inline:nnn { #1 } { #3 } { \l_@@_last_empty_row_int }
6907 {
```

We treat the row number ##1 with another loop.

```

6908 \bool_set_false:N \l_tmpa_bool
6909 \int_step_inline:nnn { #2 } { #4 } { \l_@@_last_empty_column_int }
6910 {
6911     \bool_lazy_or:nnTF
6912     { \cs_if_exist_p:c { \pgf @ sh @ ns @ \@@_env: - ##1 - ####1 } }
6913     { \@@_if_in_block_p:nn { ##1 } { ####1 } }
6914     { \bool_set_true:N \l_tmpa_bool }
6915     {
6916         \bool_if:NF \l_tmpa_bool
6917         {
6918             \int_set:Nn \l_@@_last_empty_column_int { ####1 }
6919             \clist_put_right:Nn
6920             \l_@@_corners_cells_clist
6921             { ##1 - ####1 }
6922             \cs_set_nopar:cpn { @@ _ corner _ ##1 - ####1 } { }
6923         }
6924     }
6925 }
6926 }
```

Of course, instead of the following lines, we could have use \prg\_new\_conditional:Npnn.

```

6928 \cs_new:Npn \@@_if_in_corner:nT #1 { \cs_if_exist:cT { @@ _ corner _ #1 } }
6929 \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.

```
6930 \bool_new:N \l_@@_block_auto_columns_width_bool
```

Up to now, there is only one option available for the environment `{NiceMatrixBlock}`.

```

6931 \keys_define:nn { nicematrix / NiceMatrixBlock }
6932 {
6933   auto-columns-width .code:n =
6934   {
6935     \bool_set_true:N \l_@@_block_auto_columns_width_bool
6936     \dim_gzero_new:N \g_@@_max_cell_width_dim
6937     \bool_set_true:N \l_@@_auto_columns_width_bool
6938   }
6939 }

6940 \NewDocumentEnvironment { NiceMatrixBlock } { ! O { } }
6941 {
6942   \int_gincr:N \g_@@_NiceMatrixBlock_int
6943   \dim_zero:N \l_@@_columns_width_dim
6944   \keys_set:nn { nicematrix / NiceMatrixBlock } { #1 }
6945   \bool_if:NT \l_@@_block_auto_columns_width_bool
6946   {
6947     \cs_if_exist:cT
6948       { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
6949     {
6950       \dim_set:Nn \l_@@_columns_width_dim
6951       {
6952         \use:c
6953           { @@_max_cell_width_ \int_use:N \g_@@_NiceMatrixBlock_int }
6954       }
6955     }
6956   }
6957 }
6958 }
```

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`).

```

6958 {
6959   \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.

```

6960 { \int_gdecr:N \g_@@_NiceMatrixBlock_int }
6961 {
6962   \bool_if:NT \l_@@_block_auto_columns_width_bool
6963   {
6964     \iow_shipout:Nn \c@mainaux \ExplSyntaxOn
6965     \iow_shipout:Ne \c@mainaux
6966     {
6967       \cs_gset:cpn
6968         { @@ _ 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.

```

6969   { \dim_eval:n { \g_@@_max_cell_width_dim + \arrayrulewidth } }
6970   }
6971   \iow_shipout:Nn \c@mainaux \ExplSyntaxOff
6972   }
6973 }
6974 \ignorespacesafterend
6975 }
```

## 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).

```

6976 \cs_new_protected:Npn \@@_create_extra_nodes:
6977 {
6978     \bool_if:nTF \l_@@_medium_nodes_bool
6979     {
6980         \bool_if:NTF \l_@@_no_cell_nodes_bool
6981         { \@@_error:n { extra-nodes-with-no-cell-nodes } }
6982         {
6983             \bool_if:NTF \l_@@_large_nodes_bool
6984                 \@@_create_medium_and_large_nodes:
6985                 \@@_create_medium_nodes:
6986             }
6987         }
6988     {
6989         \bool_if:NT \l_@@_large_nodes_bool
6990         {
6991             \bool_if:NTF \l_@@_no_cell_nodes_bool
6992                 { \@@_error:n { extra-nodes-with-no-cell-nodes } }
6993                 \@@_create_large_nodes:
6994             }
6995         }
6996     }
6997 }
```

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`.

```

6997 \cs_new_protected:Npn \@@_computations_for_medium_nodes:
6998 {
6999     \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7000     {
7001         \dim_zero_new:c { \l_@@_row_ \@@_i: _min_dim }
7002         \dim_set_eq:cN { \l_@@_row_ \@@_i: _min_dim } \c_max_dim
7003         \dim_zero_new:c { \l_@@_row_ \@@_i: _max_dim }
7004         \dim_set:cn { \l_@@_row_ \@@_i: _max_dim } { - \c_max_dim }
7005     }
7006     \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7007     {
7008         \dim_zero_new:c { \l_@@_column_ \@@_j: _min_dim }
7009         \dim_set_eq:cN { \l_@@_column_ \@@_j: _min_dim } \c_max_dim
7010         \dim_zero_new:c { \l_@@_column_ \@@_j: _max_dim }
7011         \dim_set:cn { \l_@@_column_ \@@_j: _max_dim } { - \c_max_dim }
7012     }
7013 }
```

We begin the two nested loops over the rows and the columns of the array.

```
7013 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7014 {
7015     \int_step_variable:nnNn
7016         \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.

```
7017 {
7018     \cs_if_exist:cT
7019         { 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`.

```
7020 {
7021     \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { south-west }
7022     \dim_set:cn { l_@@_row_ \@@_i: _min_dim }
7023         { \dim_min:vn { l_@@_row_ \@@_i: _min_dim } \pgf@y }
7024     \seq_if_in:NcF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
7025         {
7026             \dim_set:cn { l_@@_column_ \@@_j: _min_dim }
7027                 { \dim_min:vn { l_@@_column_ \@@_j: _min_dim } \pgf@x }
7028         }
```

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`.

```
7029     \pgfpointanchor { \@@_env: - \@@_i: - \@@_j: } { north-east }
7030     \dim_set:cn { l_@@_row_ \@@_i: _max_dim }
7031         { \dim_max:vn { l_@@_row_ \@@_i: _max_dim } { \pgf@y } }
7032     \seq_if_in:NcF \g_@@_multicolumn_cells_seq { \@@_i: - \@@_j: }
7033         {
7034             \dim_set:cn { l_@@_column_ \@@_j: _max_dim }
7035                 { \dim_max:vn { l_@@_column_ \@@_j: _max_dim } { \pgf@x } }
7036         }
7037     }
7038 }
7039 }
```

Now, we have to deal with empty rows or empty columns since we don't have created nodes in such rows and columns.

```
7040 \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7041 {
7042     \dim_compare:nNnT
7043         { \dim_use:c { l_@@_row_ \@@_i: _min_dim } } = \c_max_dim
7044     {
7045         \@@_qpoint:n { row - \@@_i: - base }
7046         \dim_set:cn { l_@@_row_ \@@_i: _max_dim } \pgf@y
7047         \dim_set:cn { l_@@_row_ \@@_i: _min_dim } \pgf@y
7048     }
7049 }
7050 \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7051 {
7052     \dim_compare:nNnT
7053         { \dim_use:c { l_@@_column_ \@@_j: _min_dim } } = \c_max_dim
7054     {
7055         \@@_qpoint:n { col - \@@_j: }
7056         \dim_set:cn { l_@@_column_ \@@_j: _max_dim } \pgf@y
7057         \dim_set:cn { l_@@_column_ \@@_j: _min_dim } \pgf@y
7058     }
7059 }
7060 }
```

Here is the command `\@@_create_medium_nodes:`. When this command is used, the “medium nodes” are created.

```

7061 \cs_new_protected:Npn \@@_create_medium_nodes:
7062 {
7063     \pgfpicture
7064         \pgfrememberpicturepositiononpagetrue
7065         \pgf@relevantforpicturesizefalse
7066     \@@_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”.

```

7067 \tl_set:Nn \l_@@_suffix_tl { -medium }
7068 \@@_create_nodes:
7069 \endpgfpicture
7070 }

```

The command `\@@_create_large_nodes:` must be used when we want to create only the “large nodes” and not the medium ones<sup>15</sup>. 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:`.

```

7071 \cs_new_protected:Npn \@@_create_large_nodes:
7072 {
7073     \pgfpicture
7074         \pgfrememberpicturepositiononpagetrue
7075         \pgf@relevantforpicturesizefalse
7076         \@@_computations_for_medium_nodes:
7077         \@@_computations_for_large_nodes:
7078         \tl_set:Nn \l_@@_suffix_tl { - large }
7079         \@@_create_nodes:
7080     \endpgfpicture
7081 }
7082 \cs_new_protected:Npn \@@_create_medium_and_large_nodes:
7083 {
7084     \pgfpicture
7085         \pgfrememberpicturepositiononpagetrue
7086         \pgf@relevantforpicturesizefalse
7087         \@@_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”.

```

7088 \tl_set:Nn \l_@@_suffix_tl { - medium }
7089 \@@_create_nodes:
7090 \@@_computations_for_large_nodes:
7091 \tl_set:Nn \l_@@_suffix_tl { - large }
7092 \@@_create_nodes:
7093 \endpgfpicture
7094 }

```

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.

```

7095 \cs_new_protected:Npn \@@_computations_for_large_nodes:
7096 {
7097     \int_set_eq:NN \l_@@_first_row_int \c_one_int
7098     \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`.

```

7099 \int_step_variable:nNn { \c@iRow - 1 } \@@_i:
7100 {
7101     \dim_set:cn { \l_@@_row _ \@@_i: _ min _ dim }

```

---

<sup>15</sup>If we want to create both, we have to use `\@@_create_medium_and_large_nodes:`

```

7102    {
7103        (
7104            \dim_use:c { l_@@_row_ \@@_i: _ min _ dim } +
7105            \dim_use:c { l_@@_row_ \int_eval:n { \@@_i: + 1 } _ max _ dim }
7106        )
7107        / 2
7108    }
7109    \dim_set_eq:cc { l_@@_row_ \int_eval:n { \@@_i: + 1 } _ max _ dim }
7110    { l_@@_row_ \@@_i: _ min_dim }
7111 }
7112 \int_step_variable:nNn { \c@jCol - 1 } \@@_j:
7113 {
7114     \dim_set:cn { l_@@_column_ \@@_j: _ max _ dim }
7115     {
7116         (
7117             \dim_use:c { l_@@_column_ \@@_j: _ max _ dim } +
7118             \dim_use:c
7119                 { l_@@_column_ \int_eval:n { \@@_j: + 1 } _ min _ dim }
7120             )
7121             / 2
7122         }
7123     \dim_set_eq:cc { l_@@_column_ \int_eval:n { \@@_j: + 1 } _ min _ dim }
7124     { l_@@_column_ \@@_j: _ max _ dim }
7125 }

```

Here, we have to use `\dim_sub:cn` because of the number 1 in the name.

```

7126     \dim_sub:cn
7127     { l_@@_column_ 1 _ min _ dim }
7128     \l_@@_left_margin_dim
7129     \dim_add:cn
7130     { l_@@_column_ \int_use:N \c@jCol _ max _ dim }
7131     \l_@@_right_margin_dim
7132 }

```

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_t1` (-medium or -large).

```

7133 \cs_new_protected:Npn \@@_create_nodes:
7134 {
7135     \int_step_variable:nnNn \l_@@_first_row_int \g_@@_row_total_int \@@_i:
7136     {
7137         \int_step_variable:nnNn \l_@@_first_col_int \g_@@_col_total_int \@@_j:
7138     }

```

We draw the rectangular node for the cell  $(\@@_i, \@@_j)$ .

```

7139     \@@_pgf_rect_node:nnnn
7140     { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_t1 }
7141     { \dim_use:c { l_@@_column_ \@@_j: _ min_dim } }
7142     { \dim_use:c { l_@@_row_ \@@_i: _ min_dim } }
7143     { \dim_use:c { l_@@_column_ \@@_j: _ max_dim } }
7144     { \dim_use:c { l_@@_row_ \@@_i: _ max_dim } }
7145     \str_if_empty:NF \l_@@_name_str
7146     {
7147         \pgfnodealias
7148             { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_t1 }
7149             { \@@_env: - \@@_i: - \@@_j: \l_@@_suffix_t1 }
7150     }
7151 }
7152 }
7153 \int_step_inline:nn { \c@iRow }

```

```

7154 {
7155     \pgfnodealias
7156         { \@@_env: - ##1 - last \l_@@_suffix_tl }
7157         { \@@_env: - ##1 - \int_use:N \c@jCol \l_@@_suffix_tl }
7158     }
7159 \int_step_inline:nn { \c@jCol }
7160 {
7161     \pgfnodealias
7162         { \@@_env: - last - ##1 \l_@@_suffix_tl }
7163         { \@@_env: - \int_use:N \c@iRow - ##1 \l_@@_suffix_tl }
7164     }
7165 \pgfnodealias % added 2025-04-05
7166     { \@@_env: - last - last \l_@@_suffix_tl }
7167     { \@@_env: - \int_use:N \c@iRow - \int_use:N \c@jCol \l_@@_suffix_tl }

```

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  $n$ .

```

7168 \seq_map_pairwise_function:NNN
7169 \g_@@_multicolumn_cells_seq
7170 \g_@@_multicolumn_sizes_seq
7171 \@@_node_for_multicolumn:nn
7172 }

7173 \cs_new_protected:Npn \@@_extract_coords_values: #1 - #2 \q_stop
7174 {
7175     \cs_set_nopar:Npn \@@_i: { #1 }
7176     \cs_set_nopar:Npn \@@_j: { #2 }
7177 }

```

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”).

```

7178 \cs_new_protected:Npn \@@_node_for_multicolumn:nn #1 #2
7179 {
7180     \@@_extract_coords_values: #1 \q_stop
7181     \@@_pgf_rect_node:nnnn
7182         { \@@_i: - \@@_j: \l_@@_suffix_tl }
7183         { \dim_use:c { l_@@_column _ \@@_j: _ min _ dim } }
7184         { \dim_use:c { l_@@_row _ \@@_i: _ min _ dim } }
7185         { \dim_use:c { l_@@_column _ \int_eval:n { \@@_j: +#2-1 } _ max _ dim } }
7186         { \dim_use:c { l_@@_row _ \@@_i: _ max _ dim } }
7187     \str_if_empty:NF \l_@@_name_str
7188     {
7189         \pgfnodealias
7190             { \l_@@_name_str - \@@_i: - \@@_j: \l_@@_suffix_tl }
7191             { \int_use:N \g_@@_env_int - \@@_i: - \@@_j: \l_@@_suffix_tl }
7192     }
7193 }

```

## 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).

```

7194 \keys_define:nn { nicematrix / Block / FirstPass }
7195 {
7196   j .code:n = \str_set:Nn \l_@@_hpos_block_str j
7197   \bool_set_true:N \l_@@_p_block_bool ,
7198   j .value_forbidden:n = true ,
7199   l .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7200   l .value_forbidden:n = true ,
7201   r .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7202   r .value_forbidden:n = true ,
7203   c .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7204   c .value_forbidden:n = true ,
7205   L .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7206   L .value_forbidden:n = true ,
7207   R .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7208   R .value_forbidden:n = true ,
7209   C .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7210   C .value_forbidden:n = true ,
7211   t .code:n = \str_set:Nn \l_@@_vpos_block_str t ,
7212   t .value_forbidden:n = true ,
7213   T .code:n = \str_set:Nn \l_@@_vpos_block_str T ,
7214   T .value_forbidden:n = true ,
7215   b .code:n = \str_set:Nn \l_@@_vpos_block_str b ,
7216   b .value_forbidden:n = true ,
7217   B .code:n = \str_set:Nn \l_@@_vpos_block_str B ,
7218   B .value_forbidden:n = true ,
7219   m .code:n = \str_set:Nn \l_@@_vpos_block_str c ,
7220   m .value_forbidden:n = true ,
7221   v-center .meta:n = m ,
7222   p .code:n = \bool_set_true:N \l_@@_p_block_bool ,
7223   p .value_forbidden:n = true ,
7224   color .code:n =
7225     \@@_color:n { #1 }
7226   \tl_set_rescan:Nnn
7227     \l_@@_draw_tl
7228     { \char_set_catcode_other:N ! }
7229     { #1 },
7230   color .value_required:n = true ,
7231   respect-arraystretch .code:n =
7232     \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,
7233   respect-arraystretch .value_forbidden:n = true ,
7234 }

```

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.

```
7235 \cs_new_protected:Npn \@@_Block: { \@@_collect_options:n { \@@_Block_i: } }
```

```
7236 \NewExpandableDocumentCommand \@@_Block_i: { m m D < > { } +m }
7237 {
```

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).

```

7238 \tl_if_blank:nTF { #2 }
7239   { \@@_Block_ii:nnnn \c_one_int \c_one_int }
7240   {
7241     \tl_if_in:nnTF { #2 } { - }
7242     {
7243       \int_compare:nNnTF { \char_value_catcode:n { 45 } } = { 13 }
7244       \@@_Block_i_czech:w \@@_Block_i:w
7245       #2 \q_stop
7246     }
7247   {
7248     \@@_error:nn { Bad-argument-for-Block } { #2 }

```

```

7249          \@@_Block_i:i:nnnnn \c_one_int \c_one_int
7250      }
7251  }
7252 { #1 } { #3 } { #4 }
7253 \ignorespaces
7254 }
```

With the following construction, we extract the values of  $i$  and  $j$  in the first mandatory argument of the command.

```
7255 \cs_new:Npn \@@_Block_i:w #1-#2 \q_stop { \@@_Block_i:i: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`.

```

7256 {
7257   \char_set_catcode_active:N -
7258   \cs_new:Npn \@@_Block_i_czech:w #1-#2 \q_stop { \@@_Block_i:i:nnnnn { #1 } { #2 } }
7259 }
```

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.

```
7260 \cs_new_protected:Npn \@@_Block_i:i:nnnnn #1 #2 #3 #4 #5
7261 {
```

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).

```

7262 \bool_lazy_or:nnTF
7263 { \tl_if_blank_p:n { #1 } }
7264 { \str_if_eq_p:ee { * } { #1 } }
7265 { \int_set:Nn \l_tmpa_int { 100 } }
7266 { \int_set:Nn \l_tmpa_int { #1 } }
7267 \bool_lazy_or:nnTF
7268 { \tl_if_blank_p:n { #2 } }
7269 { \str_if_eq_p:ee { * } { #2 } }
7270 { \int_set:Nn \l_tmpb_int { 100 } }
7271 { \int_set:Nn \l_tmpb_int { #2 } }
```

If the block is mono-column.

```

7272 \int_compare:nNnTF { \l_tmpb_int } = { \c_one_int }
7273 {
7274   \tl_if_empty:NTF \l_@@_hpos_cell_tl
7275   { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_c_str }
7276   { \str_set:No \l_@@_hpos_block_str \l_@@_hpos_cell_tl }
7277 }
7278 { \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.

```

7279 \keys_set_known:nn { nicematrix / Block / FirstPass } { #3 }
7280 \tl_set:Ne \l_tmpa_tl
7281 {
7282   { \int_use:N \c@iRow }
7283   { \int_use:N \c@jCol }
7284   { \int_eval:n { \c@iRow + \l_tmpa_int - 1 } }
7285   { \int_eval:n { \c@jCol + \l_tmpb_int - 1 } }
7286 }
```

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:nnnn`, `\@@_Block_v:nnnn`, `\@@_Block_vi:nnnn`, etc. (the five arguments of those macros are provided by curryfication).

```

7287     \bool_set_false:N \l_tmpa_bool
7288     \bool_if:NT \l_@@_amp_in_blocks_bool
\tl_if_in:nnT is slightly faster than \str_if_in:nnT.
7289     { \tl_if_in:nnT { #5 } { & } { \bool_set_true:N \l_tmpa_bool } }
7290     \bool_case:nF
7291     {
7292         \l_tmpa_bool                                { \@@_Block_vii:eennn }
7293         \l_@@_p_block_bool                         { \@@_Block_vi:eennn }

```

For the blocks mono-column, we will compose right away 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.

```

7294     \l_@@_X_bool                                { \@@_Block_v:eennn }
7295     { \tl_if_empty_p:n { #5 } }                 { \@@_Block_v:eennn }
7296     { \int_compare_p:nNn \l_tmpa_int = \c_one_int } { \@@_Block_iv:eennn }
7297     { \int_compare_p:nNn \l_tmpb_int = \c_one_int } { \@@_Block_iv:eennn }
7298     }
7299     { \@@_Block_v:eennn }
7300     { \l_tmpa_int } { \l_tmpb_int } { #3 } { #4 } { #5 }
7301 }

```

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 away 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.

```

7302 \cs_new_protected:Npn \@@_Block_iv:nnnnn #1 #2 #3 #4 #5
7303 {
7304     \int_gincr:N \g_@@_block_box_int
7305     \cs_set_protected_nopar:Npn \diagbox ##1 ##2
7306     {
7307         \tl_gput_right:Ne \g_@@_pre_code_after_tl
7308         {
7309             \@@_actually_diagbox:nnnnnn
7310             { \int_use:N \c@iRow }
7311             { \int_use:N \c@jCol }
7312             { \int_eval:n { \c@iRow + #1 - 1 } }
7313             { \int_eval:n { \c@jCol + #2 - 1 } }
7314             { \g_@@_row_style_tl \exp_not:n { ##1 } }
7315             { \g_@@_row_style_tl \exp_not:n { ##2 } }
7316         }
7317     }
7318     \box_gclear_new:c
7319     { \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!

```

7320   \hbox_gset:cn
7321     { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7322   {

```

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`).

```

7323   \tl_if_empty:NTF \l_@@_color_tl
7324     { \int_compare:nNnT { #2 } = { \c_one_int } { \set@color } }
7325     { \c@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`.

```

7326   \int_compare:nNnT { #1 } = { \c_one_int }
7327     {
7328       \int_if_zero:nTF { \c@iRow }
7329     {

```

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`.

```
$\begin{bNiceMatrix}%
[ r,
  first-row,
  last-col,
  code-for-first-row = \Block{}{\scriptstyle\color{blue} \arabic{jCol}},
  code-for-last-col = \scriptstyle \color{blue} \arabic{iRow}
]
& & & & \\
-2 & 3 & -4 & 5 & \\
3 & -4 & 5 & -6 & \\
-4 & 5 & -6 & 7 & \\
5 & -6 & 7 & -8 &
\end{bNiceMatrix}$
```

```

7330   \cs_set_eq:NN \Block \@@_NullBlock:
7331     \l_@@_code_for_first_row_tl
7332   }
7333   {
7334     \int_compare:nNnT { \c@iRow } = { \l_@@_last_row_int }
7335     {
7336       \cs_set_eq:NN \Block \@@_NullBlock:
7337         \l_@@_code_for_last_row_tl
7338     }
7339   }
7340   \g_@@_row_style_tl
7341 }
```

The following command will be no-op when `respect-arraystretch` is in force.

```

7342   \@@_reset_arraystretch:
7343   \dim_zero:N \extrarowheight

```

`#4` is the optional argument of the command `\Block`, provided with the syntax `<...>`.

```

7344   #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.).

```

7345   \@@_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}`.

```
7346   \bool_if:NTF \l_@@_tabular_bool
7347   {
7348     \bool_lazy_all:nTF
7349     {
7350       { \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`.

```
7351   {
7352     ! \dim_compare_p:nNn
7353       { \l_@@_col_width_dim } < { \c_zero_dim }
7354     }
7355     { ! \g_@@_rotate_bool }
7356   }
```

When the block is mono-column in a column with a fixed width (e.g. `p{3cm}`), we use a `{minipage}`.

```
7357   {
7358     \use:e
7359   }
```

Curiously, `\exp_not:N` is still mandatory when `tagging=on`.

```
7360   \exp_not:N \begin{minipage}
7361     [ \str_lowercase:f \l_@@_vpos_block_str ]
7362     { \l_@@_col_width_dim }
7363     \str_case:on \l_@@_hpos_block_str
7364       { c \centering r \raggedleft l \raggedright }
7365     }
7366     #5
7367   \end{minipage}
7368 }
```

In the other cases, we use a `{tabular}`.

```
7369   {
7370     \use:e
7371   }
```

Curiously, `\exp_not:N` is still mandatory when `tagging=on`.

```
7372   \exp_not:N \begin{tabular}
7373     [ \str_lowercase:f \l_@@_vpos_block_str ]
7374     { @ { } \l_@@_hpos_block_str @ { } }
7375   }
7376   #5
7377   \end{tabular}
7378 }
7379 }
```

If we are in a mathematical array (`\l_@@_tabular_bool` is `false`). The composition is always done with an `{array}` (never with a `{minipage}`).

```
7380   {
7381     $ % $
7382     \use:e
7383   }
```

Curiously, `\exp_not:N` is still mandatory when `tagging=on`.

```
7384   \exp_not:N \begin{array}
7385     [ \str_lowercase:f \l_@@_vpos_block_str ]
7386     { @ { } \l_@@_hpos_block_str @ { } }
7387   }
7388   #5
7389   \end{array}
```

```

7390      $ % $
7391      }
7392  }
```

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).

```
7393 \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.

```

7394 \int_compare:nNnT { #2 } = { \c_one_int }
7395 {
7396     \dim_gset:Nn \g_@@_blocks_wd_dim
7397     {
7398         \dim_max:nn
7399         { \g_@@_blocks_wd_dim }
7400         {
7401             \box_wd:c
7402             { \g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7403         }
7404     }
7405 }
```

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 explicitely an option of vertical position T or B. Remind that if the user has not used a key for the vertical position of the block, then `\l_@@_vpos_block_str` remains empty.

```

7406 \int_compare:nNnT { #1 } = { \c_one_int }
7407 {
7408     \bool_lazy_any:nT
7409     {
7410         { \str_if_empty_p:N \l_@@_vpos_block_str }
7411         { \str_if_eq_p:ee { \l_@@_vpos_block_str } { t } }
7412         { \str_if_eq_p:ee { \l_@@_vpos_block_str } { b } }
7413     }
7414     { \@@_adjust_blocks_ht_dp: }
7415 }
7416 \seq_gput_right:Ne \g_@@_blocks_seq
7417 {
7418     \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.

```

7419 {
7420     \exp_not:n { #3 } ,
7421     \l_@@_hpos_block_str ,
```

Now, we put a key for the vertical alignment.

```

7422 \bool_if:NT \g_@@_rotate_bool
7423 {
7424     \bool_if:NTF \g_@@_rotate_c_bool
7425     { m }
7426     {
7427         \int_compare:nNnT { \c@iRow } = { \l_@@_last_row_int }
7428         { T }
7429     }
7430 }
7431 {
7432     \box_use_drop:c
7433     { \g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
```

```

7435     }
7436   }
7437   \bool_set_false:N \g_@@_rotate_c_bool
7438 }

7439 \cs_new_protected:Npn \@@_adjust_blocks_ht_dp:
7440 {
7441   \dim_gset:Nn \g_@@_blocks_ht_dim
7442   {
7443     \dim_max:nn
7444     { \g_@@_blocks_ht_dim }
7445     {
7446       \box_ht:c
7447       { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7448     }
7449   }
7450   \dim_gset:Nn \g_@@_blocks_dp_dim
7451   {
7452     \dim_max:nn
7453     { \g_@@_blocks_dp_dim }
7454     {
7455       \box_dp:c
7456       { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7457     }
7458   }
7459 }

7460 \cs_new:Npn \@@_adjust_hpos_rotate:
7461 {
7462   \bool_if:NT \g_@@_rotate_bool
7463   {
7464     \str_set:Ne \l_@@_hpos_block_str
7465     {
7466       \bool_if:NTF \g_@@_rotate_c_bool
7467       { c }
7468       {
7469         \str_case:onF \l_@@_vpos_block_str
7470         { b l B l t r T r }
7471         {
7472           \int_compare:nNnTF { \c@iRow } = { \l_@@_last_row_int }
7473             { r }
7474             { l }
7475           }
7476         }
7477       }
7478     }
7479   }
7480 \cs_generate_variant:Nn \@@_Block_iv:nnnnn { e e }

```

Despite its name the following command rotates the box of the block *but also does vertical adjustment of the baseline of the block*.

```

7481 \cs_new_protected:Npn \@@_rotate_box_of_block:
7482 {
7483   \box_grotate:cn
7484   { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7485   { 90 }
7486   \int_compare:nNnT { \c@iRow } = { \l_@@_last_row_int }
7487   {
7488     \vbox_gset_top:cn
7489     { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7490     {
7491       \skip_vertical:n { 0.8 ex }

```

```

7492     \box_use:c
7493     { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7494   }
7495 }
7496 \bool_if:NT \g_@@_rotate_c_bool
7497 {
7498   \hbox_gset:cn
7499   { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7500   {
7501     $ % $
7502     \vcenter
7503     {
7504       \box_use:c
7505       { g_@@_block _ box _ \int_use:N \g_@@_block_box_int _ box }
7506     }
7507     $ % $
7508   }
7509 }
7510 }

```

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 away 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:nnnnnn).

#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.

```

7511 \cs_new_protected:Npn \@@_Block_v:nnnnn #1 #2 #3 #4 #5
7512 {
7513   \seq_gput_right:Ne \g_@@_blocks_seq
7514   {
7515     \l_tmpa_tl
7516     { \exp_not:n { #3 } }
7517     {
7518       \bool_if:NTF \l_@@_tabular_bool
7519       {
7520         \group_begin:

```

The following command will be no-op when `respect-arraystretch` is in force.

```

7521   \@@_reset_arraystretch:
7522   \exp_not:n
7523   {
7524     \dim_zero:N \extrarowheight
7525     #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).

```

7526   \tag_if_active:T { \tag_stop:n { table } }
7527   \use:e
7528   {
7529     \exp_not:N \begin { tabular } [ \l_@@_vpos_block_str ]
7530     { @ { } \l_@@_hpos_block_str @ { } }
7531   }
7532   #5
7533   \end { tabular }
7534 }
7535 \group_end:
7536 }

```

When we are *not* in an environment `{NiceTabular}` (or similar).

```

7537 {
7538     \group_begin:
7539     \@@_reset_arraystretch:
7540     \exp_not:n
7541     {
7542         \dim_zero:N \extrarowheight
7543         #4
7544         $ % $
7545         \use:e
7546         {
7547             \exp_not:N \begin { array } [ \l_@@_vpos_block_str ]
7548             { @ { } \l_@@_hpos_block_str @ { } }
7549         }
7550         #5
7551         \end { array }
7552         $ % $
7553     }
7554     \group_end:
7555 }
7556 }
7557 }
7558 }
7559 \cs_generate_variant:Nn \@@_Block_v:nnnnn { e e }
```

The following macro is for the case of a `\Block` which uses the key `p`.

```

7560 \cs_new_protected:Npn \@@_Block_vi:nnnnn #1 #2 #3 #4 #5
7561 {
7562     \seq_gput_right:Ne \g_@@_blocks_seq
7563     {
7564         \l_tmpa_tl
7565         { \exp_not:n { #3 } }
```

Here, the curly braces for the group are mandatory.

```

7566     { { \exp_not:n { #4 #5 } } }
7567 }
7568 }
7569 \cs_generate_variant:Nn \@@_Block_vi:nnnnn { e e }
```

The following macro is also for the case of a `\Block` which uses the key `p`.

```

7570 \cs_new_protected:Npn \@@_Block_vii:nnnnn #1 #2 #3 #4 #5
7571 {
7572     \seq_gput_right:Ne \g_@@_blocks_seq
7573     {
7574         \l_tmpa_tl
7575         { \exp_not:n { #3 } }
7576         { \exp_not:n { #4 #5 } }
7577     }
7578 }
7579 \cs_generate_variant:Nn \@@_Block_vii:nnnnn { e e }
```

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).

```

7580 \keys_define:nn { nicematrix / Block / SecondPass }
7581 {
7582     ampersand-in-blocks .bool_set:N = \l_@@_amp_in_blocks_bool ,
7583     ampersand-in-blocks .default:n = true ,
7584     &-in-blocks .meta:n = ampersand-in-blocks ,
```

The sequence `\l_@@_tikz_seq` will contain a sequence of comma-separated lists of keys.

```

7585 tikz .code:n =
7586   \IfPackageLoadedTF { tikz }
7587   { \seq_put_right:Nn \l_@@_tikz_seq { { #1 } } }
7588   { \@@_error:n { tikz-key~without-tikz } },
7589 tikz .value_required:n = true ,
7590 fill .code:n =
7591   \tl_set_rescan:Nnn
7592     \l_@@_fill_tl
7593     { \char_set_catcode_other:N ! }
7594     { #1 },
7595 fill .value_required:n = true ,
7596 opacity .tl_set:N = \l_@@_opacity_tl ,
7597 opacity .value_required:n = true ,
7598 draw .code:n =
7599   \tl_set_rescan:Nnn
7600     \l_@@_draw_tl
7601     { \char_set_catcode_other:N ! }
7602     { #1 },
7603 draw .default:n = default ,
7604 rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
7605 rounded-corners .default:n = 4 pt ,
7606 color .code:n =
7607   \@@_color:n { #1 }
7608 \tl_set_rescan:Nnn
7609   \l_@@_draw_tl
7610   { \char_set_catcode_other:N ! }
7611   { #1 },
7612 borders .clist_set:N = \l_@@_borders_clist ,
7613 borders .value_required:n = true ,
7614 hlines .meta:n = { vlines , hlines } ,
7615 vlines .bool_set:N = \l_@@_vlines_block_bool,
7616 vlines .default:n = true ,
7617 hlines .bool_set:N = \l_@@_hlines_block_bool,
7618 hlines .default:n = true ,
7619 line-width .dim_set:N = \l_@@_line_width_dim ,
7620 line-width .value_required:n = true ,

```

Some keys have not a property `.value_required:n` (or similar) because they are in `FirstPass`.

```

7621 j .code:n = \str_set:Nn \l_@@_hpos_block_str j
7622   \bool_set_true:N \l_@@_p_block_bool ,
7623 l .code:n = \str_set:Nn \l_@@_hpos_block_str l ,
7624 r .code:n = \str_set:Nn \l_@@_hpos_block_str r ,
7625 c .code:n = \str_set:Nn \l_@@_hpos_block_str c ,
7626 L .code:n = \str_set:Nn \l_@@_hpos_block_str l
7627   \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7628 R .code:n = \str_set:Nn \l_@@_hpos_block_str r
7629   \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7630 C .code:n = \str_set:Nn \l_@@_hpos_block_str c
7631   \bool_set_true:N \l_@@_hpos_of_block_cap_bool ,
7632 t .code:n = \str_set:Nn \l_@@_vpos_block_str t ,
7633 T .code:n = \str_set:Nn \l_@@_vpos_block_str T ,
7634 b .code:n = \str_set:Nn \l_@@_vpos_block_str b ,
7635 B .code:n = \str_set:Nn \l_@@_vpos_block_str B ,
7636 m .code:n = \str_set:Nn \l_@@_vpos_block_str c ,
7637 m .value_forbidden:n = true ,
7638 v-center .meta:n = m ,
7639 p .code:n = \bool_set_true:N \l_@@_p_block_bool ,
7640 p .value_forbidden:n = true ,
7641 name .tl_set:N = \l_@@_block_name_str , % .str_set:N ?
7642 name .value_required:n = true ,
7643 name .initial:n = ,
7644 respect-arraystretch .code:n =
7645   \cs_set_eq:NN \@@_reset_arraystretch: \prg_do_nothing: ,

```

```

7646 respect-arraystretch .value_forbidden:n = true ,
7647 transparent .bool_set:N = \l_@@_transparent_bool ,
7648 transparent .default:n = true ,
7649 transparent .initial:n = false ,
7650 unknown .code:n = \@@_error:n { Unknown~key~for~Block }
7651 }

```

The command `\@@_draw_blocks:` will draw all the blocks. This command is used after the construction 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.

```

7652 \cs_new_protected:Npn \@@_draw_blocks:
7653 {
7654     \bool_if:NTF \c_@@_revtex_bool
7655         { \cs_set_eq:NN \ialign \@@_old_ialign: }
7656         { \cs_set_eq:NN \ar@ialign \@@_old_ar@ialign: }
7657     \seq_map_inline:Nn \g_@@_blocks_seq { \@@_Block_iv:nnnnnn ##1 }
7658 }
7659 \cs_new_protected:Npn \@@_Block_iv:nnnnnn #1 #2 #3 #4 #5 #6
7660 {

```

The integer `\l_@@_last_row_int` will be the last row of the block and `\l_@@_last_col_int` its last column.

```

7661 \int_zero:N \l_@@_last_row_int
7662 \int_zero: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”).

```

7663 \int_compare:nNnTF { #3 } > { 98 }
7664     { \int_set_eq:NN \l_@@_last_row_int \c@iRow }
7665     { \int_set:Nn \l_@@_last_row_int { #3 } }
7666 \int_compare:nNnTF { #4 } > { 98 }
7667     { \int_set_eq:NN \l_@@_last_col_int \c@jCol }
7668     { \int_set:Nn \l_@@_last_col_int { #4 } }

7669 \int_compare:nNnTF { \l_@@_last_col_int } > { \g_@@_col_total_int }
7670 {
7671     \bool_lazy_and:nnTF
7672         { \l_@@_preamble_bool }
7673         {
7674             \int_compare_p:n
7675                 { \l_@@_last_col_int <= \g_@@_static_num_of_col_int }
7676         }
7677         {
7678             \msg_error:nnnn { nicematrix } { Block-too-large-2 } { #1 } { #2 }
7679             \@@_msg_redirect_name:nn { Block-too-large-2 } { none }
7680             \@@_msg_redirect_name:nn { columns-not-used } { none }
7681         }
7682         { \msg_error:nnnn { nicematrix } { Block-too-large-1 } { #1 } { #2 } }
7683     }
7684     {
7685         \int_compare:nNnTF { \l_@@_last_row_int } > { \g_@@_row_total_int }
7686             { \msg_error:nnnn { nicematrix } { Block-too-large-1 } { #1 } { #2 } }
7687             {
7688                 \@@_Block_v:nneenn
7689                     { #1 }
7690                     { #2 }
7691                     { \int_use:N \l_@@_last_row_int }
7692                     { \int_use:N \l_@@_last_col_int }
7693                     { #5 }

```

```

7694     { #6 }
7695   }
7696 }
7697 }
```

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

```

7698 \cs_new_protected:Npn \@_Block_v:nnnnnn #1 #2 #3 #4 #5 #6
7699 {
```

The group is for the keys.

```

7700 \group_begin:
7701 \int_compare:nNnT { #1 } = { #3 }
7702   { \str_set:Nn \l_@_vpos_block_str { t } }
7703 \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`.

```

7704 \tl_if_in:nnT { #6 } { & } { \bool_set_true:N \l_@_ampersand_bool }
7705 \bool_lazy_and:nnT
7706   { \l_@_vlines_block_bool }
7707   { ! \l_@_ampersand_bool }
7708 {
7709   \tl_gput_right:Ne \g_nicematrix_code_after_tl
7710   {
7711     \@_vlines_block:nnn
7712     { \exp_not:n { #5 } }
7713     { #1 - #2 }
7714     { \int_use:N \l_@_last_row_int - \int_use:N \l_@_last_col_int }
7715   }
7716 }
7717 \bool_if:NT \l_@_hlines_block_bool
7718 {
7719   \tl_gput_right:Ne \g_nicematrix_code_after_tl
7720   {
7721     \@_hlines_block:nnn
7722     { \exp_not:n { #5 } }
7723     { #1 - #2 }
7724     { \int_use:N \l_@_last_row_int - \int_use:N \l_@_last_col_int }
7725   }
7726 }
7727 \bool_if:NF \l_@_transparent_bool
7728 {
7729   \bool_lazy_and:nnF { \l_@_vlines_block_bool } { \l_@_hlines_block_bool }
7730 }
```

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).

```

7731 \seq_gput_left:Ne \g_@_pos_of_blocks_seq
7732   { { #1 } { #2 } { #3 } { #4 } { \l_@_block_name_str } }
7733 }
7734 }

7735 \tl_if_empty:NF \l_@_draw_tl
7736 {
7737   \bool_lazy_or:nnT \l_@_hlines_block_bool \l_@_vlines_block_bool
7738   { \@_error:n { hlines-with-color } }
7739   \tl_gput_right:Ne \g_nicematrix_code_after_tl
7740   {
7741     \@_stroke_block:nnn
```

```

#5 are the options
7742     { \exp_not:n { #5 } }
7743     { #1 - #2 }
7744     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7745   }
7746   \seq_gput_right:Nn \g_@@_pos_of_stroken_blocks_seq
7747   { { #1 } { #2 } { #3 } { #4 } }
7748 }

7749 \clist_if_empty:NF \l_@@_borders_clist
7750 {
7751   \tl_gput_right:Ne \g_nicematrix_code_after_tl
7752   {
7753     \@@_stroke_borders_block:nnn
7754     { \exp_not:n { #5 } }
7755     { #1 - #2 }
7756     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7757   }
7758 }

7759 \tl_if_empty:NF \l_@@_fill_tl
7760 {
7761   \@@_add_opacity_to_fill:
7762   \tl_gput_right:Ne \g_@@_pre_code_before_tl
7763   {
7764     \@@_exp_color_arg:No \@@_roundedrectanglecolor \l_@@_fill_tl
7765     { #1 - #2 }
7766     { \int_use:N \l_@@_last_row_int - \int_use:N \l_@@_last_col_int }
7767     { \dim_use:N \l_@@_rounded_corners_dim }
7768   }
7769 }

7770 \seq_if_empty:NF \l_@@_tikz_seq
7771 {
7772   \tl_gput_right:Ne \g_nicematrix_code_before_tl
7773   {
7774     \@@_block_tikz:nnnnn
7775     { \seq_use:Nn \l_@@_tikz_seq { , } }
7776     { #1 }
7777     { #2 }
7778     { \int_use:N \l_@@_last_row_int }
7779     { \int_use:N \l_@@_last_col_int }

```

We will have in that last field a list of lists of Tikz keys.

```

7780   }
7781 }

7782 \cs_set_protected_nopar:Npn \diagbox ##1 ##2
7783 {
7784   \tl_gput_right:Ne \g_@@_pre_code_after_tl
7785   {
7786     \@@_actually_diagbox:nnnnnn
7787     { #1 }
7788     { #2 }
7789     { \int_use:N \l_@@_last_row_int }
7790     { \int_use:N \l_@@_last_col_int }
7791     { \exp_not:n { ##1 } }
7792     { \exp_not:n { ##2 } }
7793   }
7794 }
```

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.

```
7795 \pgfpicture
7796 \pgfrememberpicturepositiononpagetrue
7797 \pgf@relevantforpicturesizefalse
7798 \@@_qpoint:n { row - #1 }
7799 \dim_set_eq:NN \l_tmpa_dim \pgf@y
7800 \@@_qpoint:n { col - #2 }
7801 \dim_set_eq:NN \l_tmpb_dim \pgf@x
7802 \@@_qpoint:n { row - \int_eval:n { \l_@@_last_row_int + 1 } }
7803 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7804 \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7805 \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:nnnn` takes in as arguments the name of the node and the four coordinates of two opposite corner points of the rectangle.

```
7806 \@@_pgf_rect_node:nnnn
7807 { \@@_env: - #1 - #2 - block }
7808 \l_tmpb_dim \l_tmpa_dim \l_@@_tmpd_dim \l_@@_tmpc_dim
7809 \str_if_empty:NF \l_@@_block_name_str
7810 {
7811     \pgfnodealias
7812     { \@@_env: - \l_@@_block_name_str }
7813     { \@@_env: - #1 - #2 - block }
7814 \str_if_empty:NF \l_@@_name_str
7815 {
7816     \pgfnodealias
7817     { \l_@@_name_str - \l_@@_block_name_str }
7818     { \@@_env: - #1 - #2 - block }
7819 }
7820 }
```

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.

```
7821 \bool_if:NF \l_@@_hpos_of_block_cap_bool
7822 {
7823     \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.

```
7824 \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
7825 {
```

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.

```
7826 \cs_if_exist:cT
7827 { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
```

```

7828     {
7829         \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
7830         {
7831             \pgfpointanchor { \@@_env: - ##1 - #2 } { west }
7832             \dim_set:Nn \l_tmpb_dim { \dim_min:nn \l_tmpb_dim \pgf@x }
7833         }
7834     }
7835 }
```

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.

```

7836 \dim_compare:nNnT { \l_tmpb_dim } = { \c_max_dim }
7837     {
7838         \@@_qpoint:n { col - #2 }
7839         \dim_set_eq:NN \l_tmpb_dim \pgf@x
7840     }
7841 \dim_set:Nn \l_@@_tmpd_dim { - \c_max_dim }
7842 \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
7843     {
7844         \cs_if_exist:cT
7845             { pgf @ sh @ ns @ \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
7846             {
7847                 \seq_if_in:NnF \g_@@_multicolumn_cells_seq { ##1 - #2 }
7848                 {
7849                     \pgfpointanchor
7850                         { \@@_env: - ##1 - \int_use:N \l_@@_last_col_int }
7851                         { east }
7852                     \dim_set:Nn \l_@@_tmpd_dim
7853                         { \dim_max:nn { \l_@@_tmpd_dim } { \pgf@x } }
7854                 }
7855             }
7856         }
7857 \dim_compare:nNnT { \l_@@_tmpd_dim } = { - \c_max_dim }
7858     {
7859         \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7860         \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x
7861     }
7862 \@@_pgf_rect_node:nnnn
7863     { \@@_env: - #1 - #2 - block - short }
7864     \l_tmpb_dim \l_tmpa_dim \l_@@_tmpd_dim \l_@@_tmpc_dim
7865 }
```

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.

```

7866 \bool_if:NT \l_@@_medium_nodes_bool
7867     {
7868         \@@_pgf_rect_node:nnn
7869             { \@@_env: - #1 - #2 - block - medium }
7870             { \pgfpointanchor { \@@_env: - #1 - #2 - medium } { north-west } }
7871             {
7872                 \pgfpointanchor
7873                     { \@@_env:
7874                         - \int_use:N \l_@@_last_row_int
7875                         - \int_use:N \l_@@_last_col_int - medium
7876                     }
7877                     { south-east }
7878             }
7879     }
7880 \endpgfpicture
7881
7882 \bool_if:NTF \l_@@_ampersand_bool
7883     {
```

```

7884 \seq_set_split:Nnn \l_tmpa_seq { & } { #6 }
7885 \int_zero_new:N \l_@@_split_int
7886 \int_set:Nn \l_@@_split_int { \seq_count:N \l_tmpa_seq }
7887 \pgfpicture
7888 \pgfrememberpicturepositiononpagetrue
7889 \pgf@relevantforpicturesizefalse
7890
7891 \@@_qpoint:n { row - #1 }
7892 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7893 \@@_qpoint:n { row - \int_eval:n { #3 + 1 } }
7894 \dim_set_eq:NN \l_@@_tmpd_dim \pgf@y
7895 \@@_qpoint:n { col - #2 }
7896 \dim_set_eq:NN \l_tmpa_dim \pgf@x
7897 \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
7898 \dim_set:Nn \l_tmpb_dim
7899 { ( \pgf@x - \l_tmpa_dim ) / \int_use:N \l_@@_split_int }
7900 \bool_lazy_or:nnT
7901 { \l_@@_vlines_block_bool }
7902 { \str_if_eq_p:ee { \l_@@_vlines_clist } { all } }
7903 {
7904     \int_step_inline:nn { \l_@@_split_int - 1 }
7905     {
7906         \pgfpathmoveto
7907         {
7908             \pgfpoint
7909             { \l_tmpa_dim + ##1 \l_tmpb_dim }
7910             \l_@@_tmpc_dim
7911         }
7912         \pgfpathlineto
7913         {
7914             \pgfpoint
7915             { \l_tmpa_dim + ##1 \l_tmpb_dim }
7916             \l_@@_tmpd_dim
7917         }
7918         \CT@arc@%
7919         \pgfsetlinewidth { 1.1 \arrayrulewidth }
7920         \pgfsetrectcap
7921         \pgfusepathqstroke
7922     }
7923 }
7924 \@@_qpoint:n { row - #1 - base }
7925 \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
7926 \int_step_inline:nn { \l_@@_split_int }
7927 {
7928     \group_begin:
7929     \dim_set:Nn \col@sep
7930     { \bool_if:NTF \l_@@_tabular_bool { \tabcolsep } { \arraycolsep } }
7931     \pgftransformshift
7932     {
7933         \pgfpoint
7934         {
7935             \l_tmpa_dim + ##1 \l_tmpb_dim -
7936             \str_case:on \l_@@_hpos_block_str
7937             {
7938                 l { \l_tmpb_dim + \col@sep}
7939                 c { 0.5 \l_tmpb_dim }
7940                 r { \col@sep }
7941             }
7942         }
7943         { \l_@@_tmpc_dim }
7944     }
7945     \pgfset { inner sep = \c_zero_dim }
7946     \pgfnode

```

```

7947     { rectangle }
7948     {
7949         \str_case:on \l_@@_hpos_block_str
7950         {
7951             c { base }
7952             l { base~west }
7953             r { base~east }
7954         }
7955     }
7956     { \seq_item:Nn \l_tmpa_seq { ##1 } } { } { }
7957     \group_end:
7958 }
7959 \endpgfpicture
7960 }
```

Now the case where there is no ampersand & in the content of the block.

```

7961 {
7962     \bool_if:NTF \l_@@_p_block_bool
7963     { }
```

When the final user has used the key p, we have to compute the width.

```

7964 \pgfpicture
7965     \pgfrememberpicturepositiononpagetrue
7966     \pgf@relevantforpicturesizefalse
7967     \bool_if:NTF \l_@@_hpos_of_block_cap_bool
7968     {
7969         \@@_qpoint:n { col - #2 }
7970         \dim_gset_eq:NN \g_tmpa_dim \pgf@x
7971         \@@_qpoint:n { col - \int_eval:n { \l_@@_last_col_int + 1 } }
7972     }
7973     {
7974         \pgfpointanchor { \@@_env: - #1 - #2 - block - short } { west }
7975         \dim_gset_eq:NN \g_tmpa_dim \pgf@x
7976         \pgfpointanchor { \@@_env: - #1 - #2 - block - short } { east }
7977     }
7978     \dim_gset:Nn \g_tmpb_dim { \pgf@x - \g_tmpa_dim }
7979     \endpgfpicture
7980     \hbox_set:Nn \l_@@_cell_box
7981     {
7982         \begin { minipage } [ \str_lowercase:f \l_@@_vpos_block_str ]
7983             { \g_tmpb_dim }
7984         \str_case:on \l_@@_hpos_block_str
7985             { c \centering r \raggedleft l \raggedright j { } }
7986             #6
7987             \end { minipage }
7988     }
7989 }
7990 { \hbox_set:Nn \l_@@_cell_box { \set@color #6 } }
7991 \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.

```

7992 \pgfpicture
7993     \pgfrememberpicturepositiononpagetrue
7994     \pgf@relevantforpicturesizefalse
7995     \bool_lazy_any:nTF
7996     {
7997         { \str_if_empty_p:N \l_@@_vpos_block_str }
7998         { \str_if_eq_p:ee { \l_@@_vpos_block_str } { c } }
7999         { \str_if_eq_p:ee { \l_@@_vpos_block_str } { T } }
8000         { \str_if_eq_p:ee { \l_@@_vpos_block_str } { B } }
8001     }
8002 { }
```

If we are in the first column, we must put the block as if it was with the key `r`.

```
8003     \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`.

```
8004     \bool_if:nT \g_@@_last_col_found_bool
8005     {
8006         \int_compare:nNnT { #2 } = { \g_@@_col_total_int }
8007             { \str_set_eq:NN \l_@@_hpos_block_str \c_@@_l_str }
8008     }
```

`\l_tmpa_tl` will contain the anchor of the PGF node which will be used.

```
8009     \tl_set:Ne \l_tmpa_tl
8010     {
8011         \str_case:on \l_@@_vpos_block_str
8012             {
```

We recall that `\l_@@_vpos_block_str` is empty when the user has not used a key for the vertical position of the block.

```
8013     { } {
8014         \str_case:on \l_@@_hpos_block_str
8015             {
8016                 c { center }
8017                 l { west }
8018                 r { east }
8019                 j { center }
8020             }
8021     }
8022     c {
8023         \str_case:on \l_@@_hpos_block_str
8024             {
8025                 c { center }
8026                 l { west }
8027                 r { east }
8028                 j { center }
8029             }
8030     }
8031     }
8032     T {
8033         \str_case:on \l_@@_hpos_block_str
8034             {
8035                 c { north }
8036                 l { north-west }
8037                 r { north-east }
8038                 j { north }
8039             }
8040     }
8041     }
8042     B {
8043         \str_case:on \l_@@_hpos_block_str
8044             {
8045                 c { south }
8046                 l { south-west }
8047                 r { south-east }
8048                 j { south }
8049             }
8050     }
8051     }
8052     }
8053 }
8054 \pgftransformshift
8055 {
8056     \pgfpointanchor
8057     {
8058         \@@_env: - #1 - #2 - block
```

```

8059           \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
8060       }
8061     { \l_tmpa_t1 }
8062   }
8063 \pgfset { inner-sep = \c_zero_dim }
8064 \pgfnode
8065   { rectangle }
8066   { \l_tmpa_t1 }
8067   { \box_use_drop:N \l_@@_cell_box } { } { }
8068 }

```

End of the case when `\l_@@_vpos_block_str` is equal to c, T or B. Now, the other cases.

```

8069 {
8070   \pgfextracty \l_tmpa_dim
8071   {
8072     \@@_qpoint:n
8073     {
8074       row - \str_if_eq:eeTF { \l_@@_vpos_block_str } { b } { #3 } { #1 }
8075       - base
8076     }
8077   }
8078   \dim_sub:Nn \l_tmpa_dim { 0.5 \arrayrulewidth }

```

We retrieve (in `\pgf@x`) the *x*-value of the center of the block.

```

8079 \pgfpointanchor
8080   {
8081     \@@_env: - #1 - #2 - block
8082     \bool_if:NF \l_@@_hpos_of_block_cap_bool { - short }
8083   }
8084   {
8085     \str_case:on \l_@@_hpos_block_str
8086     {
8087       c { center }
8088       l { west }
8089       r { east }
8090       j { center }
8091     }
8092   }

```

We put the label of the block which has been composed in `\l_@@_cell_box`.

```

8093 \pgftransformshift { \pgfpoint \pgf@x \l_tmpa_dim }
8094 \pgfset { inner-sep = \c_zero_dim }
8095 \pgfnode
8096   { rectangle }
8097   {
8098     \str_case:on \l_@@_hpos_block_str
8099     {
8100       c { base }
8101       l { base-west }
8102       r { base-east }
8103       j { base }
8104     }
8105   }
8106   { \box_use_drop:N \l_@@_cell_box } { } { }
8107 }
8108 \endpgfpicture
8109 }
8110 \group_end:
8111 }
8112 \cs_generate_variant:Nn \@@_Block_v:nnnnnn { n n e e }

```

For the command `\cellcolor` used within a sub-cell of a `\Block` (when the character & is used inside the cell).

```

8113 \cs_set_protected:Npn \l@_fill:nnnn #1 #2 #3 #4 #5
8114 {
8115     \pgfpicture
8116     \pgfrememberpicturepositiononpagetrue
8117     \pgf@relevantforpicturesizefalse
8118     \pgfpathrectanglecorners
8119         { \pgfpoint{#2}{#3} }
8120         { \pgfpoint{#4}{#5} }
8121     \pgfsetfillcolor{#1}
8122     \pgfusepath{fill}
8123     \endpgfpicture
8124 }
```

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).

```

8125 \cs_new_protected:Npn \l@_add_opacity_to_fill:
8126 {
8127     \tl_if_empty:NF \l_@@_opacity_tl
8128         {
8129             \tl_if_head_eq_meaning:oNTF \l_@@_fill_tl [
8130                 {
8131                     \tl_set:Ne \l_@@_fill_tl
8132                         {
8133                             [ opacity = \l_@@_opacity_tl ,
8134                             \tl_tail:o \l_@@_fill_tl
8135                         ]
8136                 }
8137             {
8138                 \tl_set:Ne \l_@@_fill_tl
8139                     { [ opacity = \l_@@_opacity_tl ] { \exp_not:o \l_@@_fill_tl } }
8140             }
8141         }
8142 }
```

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).

```

8143 \cs_new_protected:Npn \l@_stroke_block:nnn #1 #2 #3
8144 {
8145     \group_begin:
8146     \tl_clear:N \l_@@_draw_tl
8147     \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
8148     \keys_set_known:nn { nicematrix / BlockStroke } { #1 }
8149     \pgfpicture
8150     \pgfrememberpicturepositiononpagetrue
8151     \pgf@relevantforpicturesizefalse
8152     \tl_if_empty:NF \l_@@_draw_tl
8153         {
```

If the user has used the key `color` of the command `\Block` without value, the color fixed by `\arrayrulecolor` is used.

```

8154     \tl_if_eq:NnTF \l_@@_draw_tl { default }
8155         { \CT@arc0 }
8156         { \l_@@_color:o \l_@@_draw_tl }
8157     }
8158     \pgfsetcornersarced
8159     {
8160         \pgfpoint
8161             { \l_@@_rounded_corners_dim }
8162             { \l_@@_rounded_corners_dim }
8163     }
```

```

8164 \@@_cut_on_hyphen:w #2 \q_stop
8165 \int_compare:nNnF { \l_tmpa_tl } > { \c@iRow }
8166 {
8167   \int_compare:nNnF { \l_tmpb_tl } > { \c@jCol }
8168   {
8169     \@@_qpoint:n { row - \l_tmpa_tl }
8170     \dim_set_eq:NN \l_tmpb_dim \pgf@y
8171     \@@_qpoint:n { col - \l_tmpb_tl }
8172     \dim_set_eq:NN \l_@@tmpc_dim \pgf@x
8173     \@@_cut_on_hyphen:w #3 \q_stop
8174     \int_compare:nNnT { \l_tmpa_tl } > { \c@iRow }
8175       { \tl_set:No \l_tmpa_tl { \int_use:N \c@iRow } }
8176     \int_compare:nNnT { \l_tmpb_tl } > { \c@jCol }
8177       { \tl_set:No \l_tmpb_tl { \int_use:N \c@jCol } }
8178     \@@_qpoint:n { row - \int_eval:n { \l_tmpa_tl + 1 } }
8179     \dim_set_eq:NN \l_tmpa_dim \pgf@y
8180     \@@_qpoint:n { col - \int_eval:n { \l_tmpb_tl + 1 } }
8181     \dim_set_eq:NN \l_@@tmpd_dim \pgf@x
8182     \pgfsetlinewidth { 1.1 \l_@@line_width_dim }
8183     \pgfpathrectanglecorners
8184       { \pgfpoint \l_@@tmpc_dim \l_tmpb_dim }
8185       { \pgfpoint \l_@@tmpd_dim \l_tmpa_dim }
8186     \dim_compare:nNnTF { \l_@@rounded_corners_dim } = { \c_zero_dim }
8187       { \pgfusepathqstroke }
8188       { \pgfusepath { stroke } }
8189   }
8190 }
8191 \endpgfpicture
8192 \group_end:
8193 }

```

Here is the set of keys for the command `\@@_stroke_block:nnn`.

```

8194 \keys_define:nn { nicematrix / BlockStroke }
8195 {
8196   color .tl_set:N = \l_@@_draw_tl ,
8197   draw .code:n =
8198     \tl_if_empty:eF { #1 } { \tl_set:Nn \l_@@_draw_tl { #1 } } ,
8199   draw .default:n = default ,
8200   line-width .dim_set:N = \l_@@line_width_dim ,
8201   rounded-corners .dim_set:N = \l_@@rounded_corners_dim ,
8202   rounded-corners .default:n = 4 pt
8203 }

```

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).

```

8204 \cs_new_protected:Npn \@@_vlines_block:nnn #1 #2 #3
8205 {
8206   \group_begin:
8207   \dim_set_eq:NN \l_@@line_width_dim \arrayrulewidth
8208   \keys_set_known:nn { nicematrix / BlockBorders } { #1 }
8209   \dim_set_eq:NN \arrayrulewidth \l_@@line_width_dim
8210   \@@_cut_on_hyphen:w #2 \q_stop
8211   \tl_set_eq:NN \l_@@tmpc_tl \l_tmpa_tl
8212   \tl_set_eq:NN \l_@@tmpd_tl \l_tmpb_tl
8213   \@@_cut_on_hyphen:w #3 \q_stop
8214   \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8215   \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8216   \int_step_inline:nnn { \l_@@tmpd_tl } { \l_tmpb_tl }
8217   {
8218     \use:e
8219     {
8220       \@@_vline:n

```

```

8221     {
8222         position = ##1 ,
8223         start = \l_@@_tmpc_tl ,
8224         end = \int_eval:n { \l_tmpa_tl - 1 } ,
8225         total-width = \dim_use:N \l_@@_line_width_dim
8226     }
8227 }
8228 }
8229 \group_end:
8230 }

8231 \cs_new_protected:Npn \@@_hlines_block:nnn #1 #2 #3
8232 {
8233     \group_begin:
8234     \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
8235     \keys_set_known:nn { nicematrix / BlockBorders } { #1 }
8236     \dim_set_eq:NN \arrayrulewidth \l_@@_line_width_dim
8237     \@@_cut_on_hyphen:w #2 \q_stop
8238     \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
8239     \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
8240     \@@_cut_on_hyphen:w #3 \q_stop
8241     \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8242     \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8243     \int_step_inline:nnn { \l_@@_tmpc_tl } { \l_tmpa_tl }
8244     {
8245         \use:e
8246         {
8247             \@@_hline:n
8248             {
8249                 position = ##1 ,
8250                 start = \l_@@_tmpd_tl ,
8251                 end = \int_eval:n { \l_tmpb_tl - 1 } ,
8252                 total-width = \dim_use:N \l_@@_line_width_dim
8253             }
8254         }
8255     }
8256     \group_end:
8257 }

```

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).

```

8258 \cs_new_protected:Npn \@@_stroke_borders_block:nnn #1 #2 #3
8259 {
8260     \dim_set_eq:NN \l_@@_line_width_dim \arrayrulewidth
8261     \keys_set_known:nn { nicematrix / BlockBorders } { #1 }
8262     \dim_compare:nNnTF { \l_@@_rounded_corners_dim } > { \c_zero_dim }
8263     { \@@_error:n { borders-forbidden } }
8264     {
8265         \tl_clear_new:N \l_@@_borders_tikz_tl
8266         \keys_set:no
8267             { nicematrix / OnlyForTikzInBorders }
8268             \l_@@_borders_clist
8269             \@@_cut_on_hyphen:w #2 \q_stop
8270             \tl_set_eq:NN \l_@@_tmpc_tl \l_tmpa_tl
8271             \tl_set_eq:NN \l_@@_tmpd_tl \l_tmpb_tl
8272             \@@_cut_on_hyphen:w #3 \q_stop
8273             \tl_set:Ne \l_tmpa_tl { \int_eval:n { \l_tmpa_tl + 1 } }
8274             \tl_set:Ne \l_tmpb_tl { \int_eval:n { \l_tmpb_tl + 1 } }
8275             \@@_stroke_borders_block_i:
8276     }
8277 }

8278 \hook_gput_code:nnn { begindocument } { . }

```

```

8279 {
8280   \cs_new_protected:Npn \@@_stroke_borders_block_i:
8281   {
8282     \c_@@_pgfortikzpicture_tl
8283     \@@_stroke_borders_block_ii:
8284     \c_@@_endpgfortikzpicture_tl
8285   }
8286 }
8287 \cs_new_protected:Npn \@@_stroke_borders_block_ii:
8288 {
8289   \pgfrememberpicturepositiononpagetrue
8290   \pgf@relevantforpicturesizefalse
8291   \CT@arc@  

8292   \pgfsetlinewidth { 1.1 \l_@@_line_width_dim }
8293   \clist_if_in:NnT \l_@@_borders_clist { right }
8294   { \@@_stroke_vertical:n \l_tmpb_tl }
8295   \clist_if_in:NnT \l_@@_borders_clist { left }
8296   { \@@_stroke_vertical:n \l_@@_tmpd_tl }
8297   \clist_if_in:NnT \l_@@_borders_clist { bottom }
8298   { \@@_stroke_horizontal:n \l_tmpa_tl }
8299   \clist_if_in:NnT \l_@@_borders_clist { top }
8300   { \@@_stroke_horizontal:n \l_@@_tmpc_tl }
8301 }
8302 \keys_define:nn { nicematrix / OnlyForTikzInBorders }
8303 {
8304   tikz .code:n =
8305   \cs_if_exist:NTF \tikzpicture
8306   { \tl_set:Nn \l_@@_borders_tikz_tl { #1 } }
8307   { \@@_error:n { tikz-in-borders-without-tikz } },
8308   tikz .value_required:n = true ,
8309   top .code:n = ,
8310   bottom .code:n = ,
8311   left .code:n = ,
8312   right .code:n = ,
8313   unknown .code:n = \@@_error:n { bad-border }
8314 }

```

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).

```

8315 \cs_new_protected:Npn \@@_stroke_vertical:n #1
8316 {
8317   \@@_qpoint:n \l_@@_tmpc_tl
8318   \dim_set:Nn \l_tmpb_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
8319   \@@_qpoint:n \l_tmpa_tl
8320   \dim_set:Nn \l_@@_tmpc_dim { \pgf@y + 0.5 \l_@@_line_width_dim }
8321   \@@_qpoint:n { #1 }
8322   \tl_if_empty:NTF \l_@@_borders_tikz_tl
8323   {
8324     \pgfpathmoveto { \pgfpoint \pgf@x \l_tmpb_dim }
8325     \pgfpathlineto { \pgfpoint \pgf@x \l_@@_tmpc_dim }
8326     \pgfusepathqstroke
8327   }
8328   {
8329     \use:e { \exp_not:N \draw [ \l_@@_borders_tikz_tl ] }
8330     ( \pgf@x , \l_tmpb_dim ) -- ( \pgf@x , \l_@@_tmpc_dim ) ;
8331   }
8332 }

```

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).

```

8333 \cs_new_protected:Npn \@@_stroke_horizontal:n #1
8334 {

```

```

8335  \@@_qpoint:n \l_@@_tmpd_t1
8336  \clist_if_in:NnTF \l_@@_borders_clist { left }
8337  { \dim_set:Nn \l_tmpa_dim { \pgf@x - 0.5 \l_@@_line_width_dim } }
8338  { \dim_set:Nn \l_tmpa_dim { \pgf@x + 0.5 \l_@@_line_width_dim } }
8339  \@@_qpoint:n \l_tmpb_t1
8340  \dim_set:Nn \l_tmpb_dim { \pgf@x + 0.5 \l_@@_line_width_dim }
8341  \@@_qpoint:n { #1 }
8342  \tl_if_empty:NTF \l_@@_borders_tikz_t1
8343  {
8344    \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }
8345    \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
8346    \pgfusepathqstroke
8347  }
8348  {
8349    \use:e { \exp_not:N \draw [ \l_@@_borders_tikz_t1 ] }
8350    ( \l_tmpa_dim , \pgf@y ) -- ( \l_tmpb_dim , \pgf@y ) ;
8351  }
8352 }

```

Here is the set of keys for the command `\@@_stroke_borders_block:nnn`.

```

8353 \keys_define:nn { nicematrix / BlockBorders }
8354 {
8355   borders .clist_set:N = \l_@@_borders_clist ,
8356   rounded-corners .dim_set:N = \l_@@_rounded_corners_dim ,
8357   rounded-corners .default:n = 4 pt ,
8358   line-width .dim_set:N = \l_@@_line_width_dim
8359 }

```

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:* `\Block[tikz={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.

```

8360 \cs_new_protected:Npn \@@_block_tikz:nnnnn #1 #2 #3 #4 #5
8361 {
8362   \begin{tikzpicture}
8363     \@@_clip_with_rounded_corners:

```

We use `clist_map_inline:nn` because `#5` is a list of lists.

```

8364 \clist_map_inline:nn { #1 }
8365 {

```

We extract the key `offset` which is *not* a key of TikZ but a key added by `nicematrix`.

```

8366 \keys_set_known:nnN { nicematrix / SpecialOffset } { ##1 } \l_tmpa_t1
8367 \use:e { \exp_not:N \path [ \l_tmpa_t1 ] }
8368 (
8369 [
8370   xshift = \dim_use:N \l_@@_offset_dim ,
8371   yshift = - \dim_use:N \l_@@_offset_dim
8372 ]
8373 #2 -| #3
8374 )
8375 rectangle
8376 (
8377 [
8378   xshift = - \dim_use:N \l_@@_offset_dim ,
8379   yshift = \dim_use:N \l_@@_offset_dim
8380 ]
8381 \int_eval:n { #4 + 1 } -| \int_eval:n { #5 + 1 }
8382 );

```

```

8383     }
8384     \end{tikzpicture}
8385 }
8386 \cs_generate_variant:Nn \@@_block_tikz:nnnn { o }

8387 \keys_define:nn { nicematrix / SpecialOffset }
8388   { 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.

```

8389 \cs_new_protected:Npn \@@_NullBlock:
8390   { \@@_collect_options:n { \@@_NullBlock_i: } }
8391 \NewExpandableDocumentCommand \@@_NullBlock_i: { m m D < > { } +m }
8392   { }

```

## 27 How to draw the dotted lines transparently

```

8393 \cs_set_protected:Npn \@@_renew_matrix:
8394 {
8395   \RenewDocumentEnvironment { pmatrix } { }
8396   { \pNiceMatrix }
8397   { \endpNiceMatrix }
8398   \RenewDocumentEnvironment { vmatrix } { }
8399   { \vNiceMatrix }
8400   { \endvNiceMatrix }
8401   \RenewDocumentEnvironment { Vmatrix } { }
8402   { \VNiceMatrix }
8403   { \endVNiceMatrix }
8404   \RenewDocumentEnvironment { bmatrix } { }
8405   { \bNiceMatrix }
8406   { \endbNiceMatrix }
8407   \RenewDocumentEnvironment { Bmatrix } { }
8408   { \BNiceMatrix }
8409   { \endBNiceMatrix }
8410 }

```

## 28 Automatic arrays

We will extract some keys and pass the other keys to the environment `{NiceArrayWithDelims}`.

```

8411 \keys_define:nn { nicematrix / Auto }
8412 {
8413   columns-type .tl_set:N = \l_@@_columns_type_tl ,
8414   columns-type .value_required:n = true ,
8415   l .meta:n = { columns-type = l } ,
8416   r .meta:n = { columns-type = r } ,
8417   c .meta:n = { columns-type = c } ,
8418   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8419   delimiters / color .value_required:n = true ,
8420   delimiters / max-width .bool_set:N = \l_@@_delimiters_max_width_bool ,
8421   delimiters / max-width .default:n = true ,
8422   delimiters .code:n = \keys_set:nn { nicematrix / delimiters } { #1 } ,
8423   delimiters .value_required:n = true ,
8424   rounded-corners .dim_set:N = \l_@@_tab_rounded_corners_dim ,
8425   rounded-corners .default:n = 4 pt
8426 }

```

```

8427 \NewDocumentCommand \AutoNiceMatrixWithDelims
8428 { m m 0 { } > { \SplitArgument { 1 } { - } } m 0 { } m ! 0 { } }
8429 { \@@_auto_nice_matrix:nnnnnn { #1 } { #2 } #4 { #6 } { #3 , #5 , #7 } }
8430 \cs_new_protected:Npn \@@_auto_nice_matrix:nnnnnn #1 #2 #3 #4 #5 #6
8431 {

```

The group is for the protection of the keys.

```

8432 \group_begin:
8433 \keys_set_known:nnN { nicematrix / Auto } { #6 } \l_tmpa_tl
8434 \use:e
8435 {
8436 \exp_not:N \begin { NiceArrayWithDelims } { #1 } { #2 }
8437 { * { #4 } { \exp_not:o \l_@@_columns_type_tl } }
8438 [ \exp_not:o \l_tmpa_tl ]
8439 }
8440 \int_if_zero:nT { \l_@@_first_row_int }
8441 {
8442 \int_if_zero:nT { \l_@@_first_col_int } { & }
8443 \prg_replicate:nn { #4 - 1 } { & }
8444 \int_compare:nNnT { \l_@@_last_col_int } > { -1 } { & } \\
8445 }
8446 \prg_replicate:nn { #3 }
8447 {
8448 \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).

```

8449 \prg_replicate:nn { #4 - 1 } { { } #5 & } #5
8450 \int_compare:nNnT { \l_@@_last_col_int } > { -1 } { & } \\
8451 }
8452 \int_compare:nNnT { \l_@@_last_row_int } > { -2 }
8453 {
8454 \int_if_zero:nT { \l_@@_first_col_int } { & }
8455 \prg_replicate:nn { #4 - 1 } { & }
8456 \int_compare:nNnT { \l_@@_last_col_int } > { -1 } { & } \\
8457 }
8458 \end { NiceArrayWithDelims }
8459 \group_end:
8460 }
8461 \cs_set_protected:Npn \@@_define_com:NNN #1 #2 #3
8462 {
8463 \cs_set_protected:cpx { #1 AutoNiceMatrix }
8464 {
8465 \bool_gset_true:N \g_@@_delims_bool
8466 \str_gset:Ne \g_@@_name_env_str { #1 AutoNiceMatrix }
8467 \AutoNiceMatrixWithDelims { #2 } { #3 }
8468 }
8469 }

```

We define also a command \AutoNiceMatrix similar to the environment {NiceMatrix}.

```

8470 \NewDocumentCommand \AutoNiceMatrix { 0 { } m 0 { } m ! 0 { } }
8471 {
8472 \group_begin:
8473 \bool_gset_false:N \g_@@_delims_bool
8474 \AutoNiceMatrixWithDelims . . { #2 } { #4 } [ #1 , #3 , #5 ]
8475 \group_end:
8476 }

```

## 29 The redefinition of the command \dotfill

```
8477 \cs_set_eq:NN \@@_old_dotfill: \dotfill
8478 \cs_new_protected:Npn \@@_dotfill:
8479 {
```

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}`).

```
8480 \@@_old_dotfill:
8481 \tl_gput_right:Nn \g_@@_cell_after_hook_tl \@@_dotfill_i:
8482 }
```

Now, if the box if not empty (unfortunately, we can't actually test whether the box is empty and that's why we only consider it's 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`.

```
8483 \cs_new_protected:Npn \@@_dotfill_i:
8484 {
8485 \dim_compare:nNnT { \box_wd:N \l_@@_cell_box } = { \c_zero_dim }
8486 { \@@_old_dotfill: }
8487 }
```

## 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.

```
8488 \cs_new_protected:Npn \@@_diagbox:nn #1 #
8489 {
8490 \tl_gput_right:Ne \g_@@_pre_code_after_tl
8491 {
8492 \@@_actually_diagbox:nnnnnn
8493 { \int_use:N \c@iRow }
8494 { \int_use:N \c@jCol }
8495 { \int_use:N \c@iRow }
8496 { \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.

```
8497 { \g_@@_row_style_tl \exp_not:n { #1 } }
8498 { \g_@@_row_style_tl \exp_not:n { #2 } }
8499 }
```

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`.

```
8500 \seq_gput_right:Ne \g_@@_pos_of_blocks_seq
8501 {
8502 { \int_use:N \c@iRow }
8503 { \int_use:N \c@jCol }
8504 { \int_use:N \c@iRow }
8505 { \int_use:N \c@jCol }
```

The last argument is for the name of the block.

```
8506 { }
8507 }
8508 }
```

The command `\diagbox` is also redefined locally when we draw a block.

The first four arguments of `\@@_actually_diagbox:nnnnn` 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.

```

8509 \cs_new_protected:Npn \@@_actually_diagbox:nnnnn #1 #2 #3 #4 #5 #6
8510 {
8511     \pgfpicture
8512     \pgf@relevantforpicturesizefalse
8513     \pgfrememberpicturepositiononpagetrue
8514     \@@_qpoint:n { row - #1 }
8515     \dim_set_eq:NN \l_tmpa_dim \pgf@y
8516     \@@_qpoint:n { col - #2 }
8517     \dim_set_eq:NN \l_tmpb_dim \pgf@x
8518     \pgfpathmoveto { \pgfpoint \l_tmpb_dim \l_tmpa_dim }
8519     \@@_qpoint:n { row - \int_eval:n { #3 + 1 } }
8520     \dim_set_eq:NN \l_@@_tmpc_dim \pgf@y
8521     \@@_qpoint:n { col - \int_eval:n { #4 + 1 } }
8522     \dim_set_eq:NN \l_@@_tmpd_dim \pgf@x
8523     \pgfpathlineto { \pgfpoint \l_@@_tmpd_dim \l_@@_tmpc_dim }
8524 }
```

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.

```

8525     \CT@arc@
8526     \pgfsetroundcap
8527     \pgfusepathqstroke
8528 }
8529 \pgfset { inner-sep = 1 pt }
8530 \pgfscope
8531 \pgftransformshift { \pgfpoint \l_tmpb_dim \l_@@_tmpc_dim }
8532 \pgfnode { rectangle } { south-west }
8533 {
8534     \begin { minipage } { 20 cm }
```

The `\scan_stop:` avoids an error in math mode when the argument #5 is empty.

```

8535     \@@_math_toggle: \scan_stop: #5 \@@_math_toggle:
8536     \end { minipage }
8537 }
8538 {
8539 {
8540 \endpgfscope
8541 \pgftransformshift { \pgfpoint \l_@@_tmpd_dim \l_tmpa_dim }
8542 \pgfnode { rectangle } { north-east }
8543 {
8544     \begin { minipage } { 20 cm }
8545     \raggedleft
8546     \@@_math_toggle: \scan_stop: #6 \@@_math_toggle:
8547     \end { minipage }
8548 }
8549 {
8550 {
8551 \endpgfpicture
8552 }
```

## 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. 86.

In the environments of `nicematrix`, `\CodeAfter` will be linked to `\@@_CodeAfter::`. That macro must *not* be protected since it begins with `\omit`.

```
8553 \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 `\``.

```
8554 \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`.

```
8555 \cs_new_protected:Npn \@@_CodeAfter_ii:n #1 \end
8556 {
8557   \tl_gput_right:Nn \g_nicematrix_code_after_tl { #1 }
8558   \@@_CodeAfter_iv:n
8559 }
```

We catch the argument of the command `\end` (in `#1`).

```
8560 \cs_new_protected:Npn \@@_CodeAfter_iv:n #1
8561 {
```

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.

```
8562 \str_if_eq:eeTF { \currenvir } { #1 }
8563 { \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`.

```
8564 {
8565   \tl_gput_right:Nn \g_nicematrix_code_after_tl { \end { #1 } }
8566   \@@_CodeAfter_ii:n
8567 }
8568 }
```

## 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 column. 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.

```
8569 \cs_new_protected:Npn \@@_delimiter:nnn #1 #2 #3
8570 {
8571   \pgfpicture
8572   \pgfrememberpicturepositiononpagetrue
8573   \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.

```
8574 \@@_qpoint:n { row - 1 }
8575 \dim_set_eq:NN \l_@@_y_initial_dim \pgf@y
8576 \@@_qpoint:n { row - \int_eval:n { \c@iRow + 1 } }
8577 \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).

```

8578  \bool_if:nTF { #3 }
8579    { \dim_set_eq:NN \l_tmpa_dim \c_max_dim }
8580    { \dim_set:Nn \l_tmpa_dim { - \c_max_dim } }
8581  \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int }
8582  {
8583    \cs_if_exist:cT
8584      { pgf @ sh @ ns @ \@@_env: - ##1 - #2 }
8585    {
8586      \pgfpointanchor
8587        { \@@_env: - ##1 - #2 }
8588        { \bool_if:nTF { #3 } { west } { east } }
8589    \dim_set:Nn \l_tmpa_dim
8590    {
8591      \bool_if:nTF { #3 }
8592        { \dim_min:nn }
8593        { \dim_max:nn }
8594      \l_tmpa_dim
8595        { \pgf@x }
8596    }
8597  }
8598 }
```

Now we can put the delimiter with a node of PGF.

```

8599  \pgfset { inner_sep = \c_zero_dim }
8600  \dim_zero:N \nulldelimertospace
8601  \pgftransformshift
8602  {
8603    \pgfpoint
8604      { \l_tmpa_dim }
8605      { ( \l_@@_y_initial_dim + \l_@@_y_final_dim + \arrayrulewidth ) / 2 }
8606  }
8607  \pgfnode
8608    { rectangle }
8609    { \bool_if:nTF { #3 } { east } { west } }
8610  }
```

Here is the content of the PGF node, that is to say the delimiter, constructed with its right size.

```

8611  \nullfont
8612  $ % $
8613  \@@_color:o \l_@@_delimiters_color_tl
8614  \bool_if:nTF { #3 } { \left #1 } { \left . }
8615  \vcenter
8616  {
8617    \nullfont
8618    \hrule \height
8619      \dim_eval:n { \l_@@_y_initial_dim - \l_@@_y_final_dim }
8620      \depth \c_zero_dim
8621      \width \c_zero_dim
8622  }
8623  \bool_if:nTF { #3 } { \right . } { \right #1 }
8624  $ % $
8625  }
8626  { }
8627  { }
8628  \endpgfpicture
8629 }
```

### 33 The command `\SubMatrix`

```

8630 \keys_define:nn { nicematrix / sub-matrix }
8631 {
8632   extra-height .dim_set:N = \l_@@_submatrix_extra_height_dim ,
8633   extra-height .value_required:n = true ,
8634   left-xshift .dim_set:N = \l_@@_submatrix_left_xshift_dim ,
8635   left-xshift .value_required:n = true ,
8636   right-xshift .dim_set:N = \l_@@_submatrix_right_xshift_dim ,
8637   right-xshift .value_required:n = true ,
8638   xshift .meta:n = { left-xshift = #1, right-xshift = #1 } ,
8639   xshift .value_required:n = true ,
8640   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8641   delimiters / color .value_required:n = true ,
8642   slim .bool_set:N = \l_@@_submatrix_slim_bool ,
8643   slim .default:n = true ,
8644   hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
8645   hlines .default:n = all ,
8646   vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
8647   vlines .default:n = all ,
8648   hvlines .meta:n = { hlines, vlines } ,
8649   hvlines .value_forbidden:n = true
8650 }
8651 \keys_define:nn { nicematrix }
8652 {
8653   SubMatrix .inherit:n = nicematrix / sub-matrix ,
8654   NiceArray / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8655   pNiceArray / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8656   NiceMatrixOptions / sub-matrix .inherit:n = nicematrix / sub-matrix ,
8657 }

```

The following keys set is for the command `\SubMatrix` itself (not the tuning of `\SubMatrix` that can be done elsewhere).

```

8658 \keys_define:nn { nicematrix / SubMatrix }
8659 {
8660   delimiters / color .tl_set:N = \l_@@_delimiters_color_tl ,
8661   delimiters / color .value_required:n = true ,
8662   hlines .clist_set:N = \l_@@_submatrix_hlines_clist ,
8663   hlines .default:n = all ,
8664   vlines .clist_set:N = \l_@@_submatrix_vlines_clist ,
8665   vlines .default:n = all ,
8666   hvlines .meta:n = { hlines, vlines } ,
8667   hvlines .value_forbidden:n = true ,
8668   name .code:n =
8669     \tl_if_empty:nTF { #1 }
8670     { \@@_error:n { Invalid-name } }
8671     {
8672       \regex_if_match:nnTF { \A[A-Za-z][A-Za-z0-9]*\Z } { #1 }
8673       {
8674         \seq_if_in:NnTF \g_@@_submatrix_names_seq { #1 }
8675           { \@@_error:nn { Duplicate-name-for-SubMatrix } { #1 } }
8676           {
8677             \str_set:Nn \l_@@_submatrix_name_str { #1 }
8678             \seq_gput_right:Nn \g_@@_submatrix_names_seq { #1 }
8679           }
8680       }
8681       { \@@_error:n { Invalid-name } }
8682     },
8683   name .value_required:n = true ,
8684   rules .code:n = \keys_set:nn { nicematrix / rules } { #1 } ,
8685   rules .value_required:n = true ,
8686   code .tl_set:N = \l_@@_code_tl ,
8687   code .value_required:n = true ,
8688   unknown .code:n = \@@_error:n { Unknown-key-for-SubMatrix }
8689 }

```

```

8690 \NewDocumentCommand \@@_SubMatrix_in_code_before { m m m m ! 0 { } }
8691 {
8692     \tl_gput_right:Nn \g_@@_pre_code_after_tl
8693     {
8694         \SubMatrix { #1 } { #2 } { #3 } { #4 }
8695         [
8696             delimiter / color = \l_@@_delimiters_color_tl ,
8697             hlines = \l_@@_submatrix_hlines_clist ,
8698             vlines = \l_@@_submatrix_vlines_clist ,
8699             extra-height = \dim_use:N \l_@@_submatrix_extra_height_dim ,
8700             left-xshift = \dim_use:N \l_@@_submatrix_left_xshift_dim ,
8701             right-xshift = \dim_use:N \l_@@_submatrix_right_xshift_dim ,
8702             slim = \bool_to_str:N \l_@@_submatrix_slim_bool ,
8703             #5
8704         ]
8705     }
8706     \@@_SubMatrix_in_code_before_i { #2 } { #3 }
8707     \ignorespaces
8708 }
8709 \NewDocumentCommand \@@_SubMatrix_in_code_before_i
8710 { > { \SplitArgument { 1 } { - } } m > { \SplitArgument { 1 } { - } } m }
8711 { \@@_SubMatrix_in_code_before_i:nnnn #1 #2 }
8712 \cs_new_protected:Npn \@@_SubMatrix_in_code_before_i:nnnn #1 #2 #3 #4
8713 {
8714     \seq_gput_right:Nn \g_@@_submatrix_seq
8715     {

```

We use `\str_if_eq:eeTF` because it is fully expandable (and slightly faster than `\tl_if_eq:nnTF`).

```

8716     { \str_if_eq:eeTF { #1 } { last } { \int_use:N \c@iRow } { #1 } }
8717     { \str_if_eq:eeTF { #2 } { last } { \int_use:N \c@jCol } { #2 } }
8718     { \str_if_eq:eeTF { #3 } { last } { \int_use:N \c@iRow } { #3 } }
8719     { \str_if_eq:eeTF { #4 } { last } { \int_use:N \c@jCol } { #4 } }
8720 }
8721 }
```

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).

```

8722 \NewDocumentCommand \@@_compute_i_j:nn
8723 { > { \SplitArgument { 1 } { - } } m > { \SplitArgument { 1 } { - } } m }
8724 { \@@_compute_i_j:nnnn #1 #2 }

8725 \cs_new_protected:Npn \@@_compute_i_j:nnnn #1 #2 #3 #4
8726 {
8727     \def \l_@@_first_i_tl { #1 }
8728     \def \l_@@_first_j_tl { #2 }
8729     \def \l_@@_last_i_tl { #3 }
8730     \def \l_@@_last_j_tl { #4 }
8731     \tl_if_eq:NnT \l_@@_first_i_tl { last }
8732     { \tl_set:NV \l_@@_first_i_tl \c@iRow }
8733     \tl_if_eq:NnT \l_@@_first_j_tl { last }
8734     { \tl_set:NV \l_@@_first_j_tl \c@jCol }
8735     \tl_if_eq:NnT \l_@@_last_i_tl { last }
8736     { \tl_set:NV \l_@@_last_i_tl \c@iRow }
8737     \tl_if_eq:NnT \l_@@_last_j_tl { last }
8738     { \tl_set:NV \l_@@_last_j_tl \c@jCol }
8739 }
```

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`.

```

8740 \hook_gput_code:nnn { begindocument } { . }
8741 {
8742   \tl_set_rescan:Nnn \l_tmpa_tl { } { m m m m O { } E { _ ^ } { { } { } } }
8743   \exp_args:NNo \NewDocumentCommand \@@_SubMatrix \l_tmpa_tl
8744     { \@@_sub_matrix:nnnnnnn { #1 } { #2 } { #3 } { #4 } { #5 } { #6 } { #7 } }
8745 }
8746 \cs_new_protected:Npn \@@_sub_matrix:nnnnnnn #1 #2 #3 #4 #5 #6 #7
8747 {
8748   \group_begin:

```

The four following token lists correspond to the position of the `\SubMatrix`.

```

8749   \@@_compute_i_j:nn { #2 } { #3 }
8750   \int_compare:nNnT { \l_@@_first_i_tl } = { \l_@@_last_i_tl }
8751     { \def \arraystretch { 1 } }
8752   \bool_lazy_or:nnTF
8753     { \int_compare_p:nNn { \l_@@_last_i_tl } > { \g_@@_row_total_int } }
8754     { \int_compare_p:nNn { \l_@@_last_j_tl } > { \g_@@_col_total_int } }
8755     { \@@_error:nn { Construct-too-large } { \SubMatrix } }
8756   {
8757     \str_clear_new:N \l_@@_submatrix_name_str
8758     \keys_set:nn { nicematrix / SubMatrix } { #5 }
8759     \pgfpicture
8760     \pgfrememberpicturepositiononpagetrue
8761     \pgf@relevantforpicturesizefalse
8762     \pgfset { inner-sep = \c_zero_dim }
8763     \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
8764     \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }

```

The last value of `\int_step_inline:nnn` is provided by curryfication.

```

8765 \bool_if:NTF \l_@@_submatrix_slim_bool
8766   { \int_step_inline:nnn { \l_@@_first_i_tl } { \l_@@_last_i_tl } }
8767   { \int_step_inline:nnn { \l_@@_first_row_int } { \g_@@_row_total_int } }
8768   {
8769     \cs_if_exist:cT
8770       { \pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_first_j_tl }
8771       {
8772         \pgfpointanchor { \@@_env: - ##1 - \l_@@_first_j_tl } { west }
8773         \dim_compare:nNnT { \pgf@x } < { \l_@@_x_initial_dim }
8774           { \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x }
8775       }
8776     \cs_if_exist:cT
8777       { \pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_last_j_tl }
8778       {
8779         \pgfpointanchor { \@@_env: - ##1 - \l_@@_last_j_tl } { east }
8780         \dim_compare:nNnT { \pgf@x } > { \l_@@_x_final_dim }
8781           { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
8782       }
8783     }
8784   \dim_compare:nNnTF { \l_@@_x_initial_dim } = { \c_max_dim }
8785     { \@@_error:nn { Impossible-delimiter } { left } }
8786     {
8787       \dim_compare:nNnTF { \l_@@_x_final_dim } = { - \c_max_dim }

```

```

8788     { \@@_error:nn { Impossible-delimiter } { right } }
8789     { \@@_sub_matrix_i:nnnn { #1 } { #4 } { #6 } { #7 } }
8790   }
8791   \endpgfpicture
8792 }
8793 \group_end:
8794 \ignorespaces
8795 }

```

#1 is the left delimiter, #2 is the right one, #3 is the subscript and #4 is the superscript.

```

8796 \cs_new_protected:Npn \@@_sub_matrix_i:nnnn #1 #2 #3 #4
8797 {
8798   \@@_qpoint:n { row - \l_@@_first_i_tl - base }
8799   \dim_set:Nn \l_@@_y_initial_dim
8800   {
8801     \fp_to_dim:n
8802     {
8803       \pgf@y
8804       + ( \box_ht:N \strutbox + \extrarowheight ) * \arraystretch
8805     }
8806   }
8807   \@@_qpoint:n { row - \l_@@_last_i_tl - base }
8808   \dim_set:Nn \l_@@_y_final_dim
8809   { \fp_to_dim:n { \pgf@y - ( \box_dp:N \strutbox ) * \arraystretch } }
8810   \int_step_inline:nnn { \l_@@_first_col_int } { \g_@@_col_total_int }
8811   {
8812     \cs_if_exist:cT
8813     { \pgf @ sh @ ns @ \@@_env: - \l_@@_first_i_tl - ##1 }
8814     {
8815       \pgfpointanchor { \@@_env: - \l_@@_first_i_tl - ##1 } { north }
8816       \dim_set:Nn \l_@@_y_initial_dim
8817       { \dim_max:nn { \l_@@_y_initial_dim } { \pgf@y } }
8818     }
8819     \cs_if_exist:cT
8820     { \pgf @ sh @ ns @ \@@_env: - \l_@@_last_i_tl - ##1 }
8821     {
8822       \pgfpointanchor { \@@_env: - \l_@@_last_i_tl - ##1 } { south }
8823       \dim_compare:nNnT { \pgf@y } < { \l_@@_y_final_dim }
8824       { \dim_set_eq:NN \l_@@_y_final_dim \pgf@y }
8825     }
8826   }
8827   \dim_set:Nn \l_tmpa_dim
8828   {
8829     \l_@@_y_initial_dim - \l_@@_y_final_dim +
8830     \l_@@_submatrix_extra_height_dim - \arrayrulewidth
8831   }
8832   \dim_zero:N \nulldelimerspace

```

We will draw the rules in the \SubMatrix.

```

8833 \group_begin:
8834 \pgfsetlinewidth { 1.1 \arrayrulewidth }
8835 \@@_set_Carc:o \l_@@_rules_color_tl
8836 \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`.

```

8837 \seq_map_inline:Nn \g_@@_cols_vlism_seq
8838 {
8839   \int_compare:nNnT { \l_@@_first_j_tl } < { ##1 }
8840   {
8841     \int_compare:nNnT
8842     { ##1 } < { \int_eval:n { \l_@@_last_j_tl + 1 } }

```

```
8843 {
```

First, we extract the value of the abscissa of the rule we have to draw.

```
8844     \@@_qpoint:n { col - ##1 }
8845     \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
8846     \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
8847     \pgfusepathqstroke
8848   }
8849 }
8850 }
```

Now, we draw the vertical rules specified in the key `vlines` of `\SubMatrix`. The last argument of `\int_step_inline:nn` or `\clist_map_inline:Nn` is given by curryification.

```
8851 \str_if_eq:eeTF { \l_@@_submatrix_vlines_clist } { all }
8852   { \int_step_inline:nn { \l_@@_last_j_tl - \l_@@_first_j_tl } }
8853   { \clist_map_inline:Nn \l_@@_submatrix_vlines_clist }
8854   {
8855     \bool_lazy_and:nnTF
8856       { \int_compare_p:nNn { ##1 } > { \c_zero_int } }
8857       {
8858         \int_compare_p:nNn
8859           { ##1 } < { \l_@@_last_j_tl - \l_@@_first_j_tl + 1 }
8860       {
8861         \@@_qpoint:n { col - \int_eval:n { ##1 + \l_@@_first_j_tl } }
8862         \pgfpathmoveto { \pgfpoint \pgf@x \l_@@_y_initial_dim }
8863         \pgfpathlineto { \pgfpoint \pgf@x \l_@@_y_final_dim }
8864         \pgfusepathqstroke
8865       }
8866       { \@@_error:nnn { Wrong~line~in~SubMatrix } { vertical } { ##1 } }
8867   }
```

Now, we draw the horizontal rules specified in the key `hlines` of `\SubMatrix`. The last argument of `\int_step_inline:nn` or `\clist_map_inline:Nn` is given by curryification.

```
8868 \str_if_eq:eeTF { \l_@@_submatrix_hlines_clist } { all }
8869   { \int_step_inline:nn { \l_@@_last_i_tl - \l_@@_first_i_tl } }
8870   { \clist_map_inline:Nn \l_@@_submatrix_hlines_clist }
8871   {
8872     \bool_lazy_and:nnTF
8873       { \int_compare_p:nNn { ##1 } > { \c_zero_int } }
8874       {
8875         \int_compare_p:nNn
8876           { ##1 } < { \l_@@_last_i_tl - \l_@@_first_i_tl + 1 }
8877       {
8878         \@@_qpoint:n { row - \int_eval:n { ##1 + \l_@@_first_i_tl } }
```

We use a group to protect `\l_tmpa_dim` and `\l_tmpb_dim`.

```
8879 \group_begin:
```

We compute in `\l_tmpa_dim` the *x*-value of the left end of the rule.

```
8880 \dim_set:Nn \l_tmpa_dim
8881   { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
8882 \str_case:nn { #1 }
8883   {
8884     ( { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
8885     [ { \dim_sub:Nn \l_tmpa_dim { 0.2 mm } }
8886     \{ { \dim_sub:Nn \l_tmpa_dim { 0.9 mm } }
8887   }
8888 \pgfpathmoveto { \pgfpoint \l_tmpa_dim \pgf@y }
```

We compute in `\l_tmpb_dim` the *x*-value of the right end of the rule.

```
8889 \dim_set:Nn \l_tmpb_dim
8890   { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
8891 \str_case:nn { #2 }
8892   {
8893     ) { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
```

```

8894     ] { \dim_add:Nn \l_tmpb_dim { 0.2 mm } }
8895     \} { \dim_add:Nn \l_tmpb_dim { 0.9 mm } }
8896   }
8897   \pgfpathlineto { \pgfpoint \l_tmpb_dim \pgf@y }
8898   \pgfusepathqstroke
8899   \group_end:
8900 }
8901 { @@_error:nnn { Wrong~line~in~SubMatrix } { horizontal } { ##1 } }
8902 }

```

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).

```

8903   \str_if_empty:NF \l_@@_submatrix_name_str
8904   {
8905     \@@_pgf_rect_node:nnnn \l_@@_submatrix_name_str
8906     \l_@@_x_initial_dim \l_@@_y_initial_dim
8907     \l_@@_x_final_dim \l_@@_y_final_dim
8908   }
8909   \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`.

```

8910   \begin{pgfscope}
8911     \pgftransformshift
8912     {
8913       \pgfpoint
8914         { \l_@@_x_initial_dim - \l_@@_submatrix_left_xshift_dim }
8915         { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
8916     }
8917     \str_if_empty:NTF \l_@@_submatrix_name_str
8918       { \@@_node_left:nn #1 { } }
8919       { \@@_node_left:nn #1 { \@@_env: - \l_@@_submatrix_name_str - left } }
8920   \end{pgfscope}

```

Now, we deal with the right delimiter.

```

8921   \pgftransformshift
8922   {
8923     \pgfpoint
8924       { \l_@@_x_final_dim + \l_@@_submatrix_right_xshift_dim }
8925       { ( \l_@@_y_initial_dim + \l_@@_y_final_dim ) / 2 }
8926   }
8927   \str_if_empty:NTF \l_@@_submatrix_name_str
8928     { \@@_node_right:nnnn #2 { } { #3 } { #4 } }
8929     {
8930       \@@_node_right:nnnn #2
8931         { \@@_env: - \l_@@_submatrix_name_str - right } { #3 } { #4 }
8932     }

```

Now, we deal with the key `code` of `\SubMatrix`. That key should contain a TikZ instruction and the nodes in that instruction will be relative to the current `\SubMatrix`. That's why we need a redefinition of `\pgfpointanchor`.

```

8933   \cs_set_eq:NN \pgfpointanchor \@@_pgfpointanchor:n
8934   \flag_clear_new:N \l_@@_code_flag
8935   \l_@@_code_tl
8936 }

```

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`.

```

8937   \cs_set_eq:NN \@@_old_pgfpointraw: \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.

The original command `\pgfpointanchor` takes in two arguments: the name of the name and the name of the anchor. However, you don't have to modify the anchor, and that's why we do a redefinition of `\pgfpointanchor` by curryfication.

```
8938 \cs_new:Npn \@@_pgfpointanchor:n #1
8939 { \exp_args:Ne \@@_old_pgfpontanchor: { \@@_pgfpointanchor_i:n { #1 } } }
```

First, we must detect whether the argument is of the form `\tikz@pp@name{...}` (the command `\tikz@pp@name` is a command of TikZ that adds the prefix and the suffix of the name. If the name refers to a TikZ node which does not exist, there isn't the wrapper `\tikz@pp@name`.

```
8940 \cs_new:Npn \@@_pgfpointanchor_i:n #1
8941 { \@@_pgfpointanchor_ii:w #1 \tikz@pp@name \q_stop }
8942 \cs_new:Npn \@@_pgfpointanchor_ii:w #1 \tikz@pp@name #2 \q_stop
8943 {
```

The command `\str_if_empty:nTF` is “fully expandable”.

```
8944 \str_if_empty:nTF { #1 }
```

First, when the name of the name begins with `\tikz@pp@name`.

```
8945 { \@@_pgfpointanchor_iv:w #2 }
```

And now, when there is no `\tikz@pp@name`.

```
8946 { \@@_pgfpointanchor_ii:n { #1 } }
8947 }
```

In the case where the name begins with `\tikz@pp@name`, we must retrieve the second `\tikz@pp@name`, that is to say to marker that we have added at the end (cf. `\@@_pgfpointanchor_i:n`).

```
8948 \cs_new:Npn \@@_pgfpointanchor_iv:w #1 \tikz@pp@name
8949 { \@@_pgfpointanchor_ii:n { #1 } }
```

With the command `\@@_pgfpointanchor_ii:n`, we deal with the actual name of the node (without the `\tikz@pp@name`). First, we have to detect whether it is of the form `i` or the form `i-j` (with an hyphen).

Remark: It would be possible to test the presence of the hyphen in an expandable way to using `\etl_if_in:nnTF` of the package `etl` but, as of now, we do not load `etl`.

```
8950 \cs_new:Npn \@@_pgfpointanchor_ii:n #1 { \@@_pgfpointanchor_i:w #1- \q_stop }
```

```
8951 \cs_new:Npn \@@_pgfpointanchor_i:w #1-#2 \q_stop
8952 {
```

The command `\str_if_empty:nTF` is “fully expandable”.

```
8953 \str_if_empty:nTF { #2 }
```

First the case where the argument does *not* contain an hyphen.

```
8954 { \@@_pgfpointanchor_iii:n { #1 } }
```

And now the case the argument contains a hyphen. In that case, we have a weird construction because we must retrieve the extra hyphen we have added as marker (cf. `\@@_pgfpointanchor_ii:n`).

```
8955 { \@@_pgfpointanchor_iii:w { #1 } #2 }
8956 }
```

The following function is for the case when the name contains an hyphen.

```
8957 \cs_new:Npn \@@_pgfpointanchor_iii:w #1 #2 -
8958 {
```

We have to add the prefix `\@@_env:` “by hand” since we have retrieved the potential `\tikz@pp@name`.

```
8959 \@@_env:
8960 - \int_eval:n { #1 + \l_@@_first_i_tl - 1 }
8961 - \int_eval:n { #2 + \l_@@_first_j_tl - 1 }
8962 }
```

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.

```

8963 \tl_const:Nn \c_@@_integers alist_tl
8964 {
8965   { 1 } { } { 2 } { } { 3 } { } { 4 } { } { 5 } { }
8966   { 6 } { } { 7 } { } { 8 } { } { 9 } { } { 10 } { }
8967   { 11 } { } { 12 } { } { 13 } { } { 14 } { } { 15 } { }
8968   { 16 } { } { 17 } { } { 18 } { } { 19 } { } { 20 } { }
8969 }

8970 \cs_new:Npn \@@_pgfpointanchor_iii:n #1
8971 {

```

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  $i-|j$ . That special form is the reason of the special form of the argument of `\pgfpointanchor` which arises with its command `\name_of_command` (see above).

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`.

```

8972 \str_case:nVTF { #1 } \c_@@_integers alist_tl
8973 {
8974   \flag_raise:N \l_@@_code_flag

```

We have to add the prefix `\@@_env`: “by hand” since we have retrieved the potential `\tikz@pp@name`.

```

8975 \@@_env: -
8976 \int_if_even:nTF { \flag_height:N \l_@@_code_flag }
8977   { \int_eval:n { #1 + \l_@@_first_i_tl - 1 } }
8978   { \int_eval:n { #1 + \l_@@_first_j_tl - 1 } }
8979 }
8980 {
8981   \str_if_eq:eeTF { #1 } { last }
8982   {
8983     \flag_raise:N \l_@@_code_flag
8984     \@@_env: -
8985     \int_if_even:nTF { \flag_height:N \l_@@_code_flag }
8986       { \int_eval:n { \l_@@_last_i_tl + 1 } }
8987       { \int_eval:n { \l_@@_last_j_tl + 1 } }
8988     }
8989   { #1 }
8990 }
8991

```

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`).

```

8992 \cs_new_protected:Npn \@@_node_left:nn #1 #2
8993 {
8994   \pgfnode
8995     { rectangle }
8996     { east }
8997   {
8998     \nullfont
8999     $ % $
9000     \@@_color:o \l_@@_delimiters_color_tl
9001     \left #1
9002     \vcenter
9003     {
9004       \nullfont
9005       \hrule \height \l_tmpa_dim
9006         \depth \c_zero_dim

```

```

9007           \@width \c_zero_dim
9008       }
9009       \right .
9010       $ % $
9011   }
9012   { #2 }
9013   { }
9014 }
```

The command `\@@_node_right:nn` 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.

```

9015 \cs_new_protected:Npn \@@_node_right:nnnn #1 #2 #3 #4
9016 {
9017     \pgfnode
9018         { rectangle }
9019         { west }
9020         {
9021             \nullfont
9022             $ % $
9023             \colorlet{current-color}{.}
9024             \@@_color:o \l_@@_delimiters_color_tl
9025             \left .
9026             \vcenter
9027             {
9028                 \nullfont
9029                 \hrule \@height \l_tmpa_dim
9030                     \@depth \c_zero_dim
9031                     \@width \c_zero_dim
9032             }
9033             \right #1
9034             \tl_if_empty:nF {#3} { _ { \smash {#3} } }
9035             ^ { \color{current-color} \smash {#4} }
9036             $ % $
9037         }
9038         { #2 }
9039         { }
9040 }
```

## 34 Les commandes \UnderBrace et \OverBrace

The following commands will be linked to `\UnderBrace` and `\OverBrace` in the `\CodeAfter`.

```

9041 \NewDocumentCommand \@@_UnderBrace { O { } m m m O { } }
9042 {
9043     \@@_brace:nnnn {#2} {#3} {#4} {#1, #5} {under}
9044     \ignorespaces
9045 }
9046 \NewDocumentCommand \@@_OverBrace { O { } m m m O { } }
9047 {
9048     \@@_brace:nnnn {#2} {#3} {#4} {#1, #5} {over}
9049     \ignorespaces
9050 }
9051 \keys_define:nn { nicematrix / Brace }
9052 {
9053     left-shorten .bool_set:N = \l_@@_brace_left_shorten_bool ,
9054     left-shorten .default:n = true ,
9055     left-shorten .value_forbidden:n = true ,
```

```

9056 right-shorten .bool_set:N = \l_@@_brace_right_shorten_bool ,
9057 right-shorten .default:n = true ,
9058 right-shorten .value_forbidden:n = true ,
9059 shorten .meta:n = { left-shorten , right-shorten } ,
9060 shorten .value_forbidden:n = true ,
9061 yshift .dim_set:N = \l_@@_brace_yshift_dim ,
9062 yshift .value_required:n = true ,
9063 yshift .initial:n = \c_zero_dim ,
9064 color .tl_set:N = \l_tmpa_tl ,
9065 color .value_required:n = true ,
9066 unknown .code:n = \@@_error:n { Unknown~key~for~Brace }
9067 }

```

#1 is the first cell of the rectangle (with the syntax  $i-lj$ ; #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.

```

9068 \cs_new_protected:Npn \@@_brace:nnnn #1 #2 #3 #4 #5
9069 {
9070 \group_begin:

```

The four following token lists correspond to the position of the sub-matrix to which a brace will be attached.

```

9071 \@@_compute_i_j:nn { #1 } { #2 }
9072 \bool_lazy_or:nnTF
9073 { \int_compare_p:nNn { \l_@@_last_i_tl } > { \g_@@_row_total_int } }
9074 { \int_compare_p:nNn { \l_@@_last_j_tl } > { \g_@@_col_total_int } }
9075 {
9076 \str_if_eq:eeTF { #5 } { under }
9077 { \@@_error:nn { Construct-too-large } { \UnderBrace } }
9078 { \@@_error:nn { Construct-too-large } { \OverBrace } }
9079 }
9080 {
9081 \tl_clear:N \l_tmpa_tl
9082 \keys_set:nn { nicematrix / Brace } { #4 }
9083 \tl_if_empty:NF \l_tmpa_tl { \color { \l_tmpa_tl } }
9084 \pgfpicture
9085 \pgfrememberpicturepositiononpagetrue
9086 \pgf@relevantforpicturesizefalse
9087 \bool_if:NT \l_@@_brace_left_shorten_bool
9088 {
9089 \dim_set_eq:NN \l_@@_x_initial_dim \c_max_dim
9090 \int_step_inline:nnn { \l_@@_first_i_tl } { \l_@@_last_i_tl }
9091 {
9092 \cs_if_exist:cT
9093 { \pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_first_j_tl }
9094 {
9095 \pgfpointanchor { \@@_env: - ##1 - \l_@@_first_j_tl } { west }
9096
9097 \dim_compare:nNnT { \pgf@x } < { \l_@@_x_initial_dim }
9098 { \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x }
9099 }
9100 }
9101 }
9102 \bool_lazy_or:nnT
9103 { \bool_not_p:n \l_@@_brace_left_shorten_bool }
9104 { \dim_compare_p:nNn { \l_@@_x_initial_dim } = { \c_max_dim } }
9105 {
9106 \@@_qpoint:n { col - \l_@@_first_j_tl }
9107 \dim_set_eq:NN \l_@@_x_initial_dim \pgf@x
9108 }
9109 \bool_if:NT \l_@@_brace_right_shorten_bool
9110 {
9111 \dim_set:Nn \l_@@_x_final_dim { - \c_max_dim }
9112 \int_step_inline:nnn { \l_@@_first_i_tl } { \l_@@_last_i_tl }
9113 {

```

```

9114     \cs_if_exist:cT
9115         { pgf @ sh @ ns @ \@@_env: - ##1 - \l_@@_last_j_tl }
9116         {
9117             \pgfpointanchor { \@@_env: - ##1 - \l_@@_last_j_tl } { east }
9118             \dim_compare:nNnT { \pgf@x } > { \l_@@_x_final_dim }
9119                 { \dim_set_eq:NN \l_@@_x_final_dim \pgf@x }
9120             }
9121         }
9122     }
9123 \bool_lazy_or:nnT
9124     { \bool_not_p:n \l_@@_brace_right_shorten_bool }
9125     { \dim_compare_p:nNn { \l_@@_x_final_dim } = { - \c_max_dim } }
9126     {
9127         \@@_qpoint:n { col - \int_eval:n { \l_@@_last_j_tl + 1 } }
9128         \dim_set_eq:NN \l_@@_x_final_dim \pgf@x
9129     }
9130 \pgfset { inner_sep = \c_zero_dim }
9131 \str_if_eq:eeTF { #5 } { under }
9132     { \@@_underbrace_i:n { #3 } }
9133     { \@@_overbrace_i:n { #3 } }
9134 \endpgfpicture
9135 }
9136 \group_end:
9137 }
```

The argument is the text to put above the brace.

```

9138 \cs_new_protected:Npn \@@_overbrace_i:n #1
9139 {
9140     \@@_qpoint:n { row - \l_@@_first_i_tl }
9141     \pgftransformshift
9142     {
9143         \pgfpoint
9144             { ( \l_@@_x_initial_dim + \l_@@_x_final_dim ) / 2 }
9145             { \pgf@y + \l_@@_brace_yshift_dim - 3 pt }
9146     }
9147 \pgfnode
9148     { rectangle }
9149     { south }
9150     {
9151         \vtop
9152         {
9153             \group_begin:
9154             \everycr { }
9155             \halign
9156             {
9157                 \hfil ## \hfil \crcr
9158                 \bool_if:NTF \l_@@_tabular_bool
9159                     { \begin { tabular } { c } #1 \end { tabular } }
9160                     { $ \begin { array } { c } #1 \end { array } $ }
9161                 \cr
9162                 $ % $
9163                 \overbrace
9164                 {
9165                     \hbox_to_wd:nn
9166                         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
9167                         { }
9168                 }
9169                 $ % $
9170                 \cr
9171                 }
9172             \group_end:
9173         }
9174     }
9175 }
```

```

9176     { }
9177 }

```

The argument is the text to put under the brace.

```

9178 \cs_new_protected:Npn \@@_underbrace_i:n #1
9179 {
9180     \@@_qpoint:n { row - \int_eval:n { \l_@@_last_i_tl + 1 } }
9181     \pgftransformshift
9182     {
9183         \pgfpoint
9184             { ( \l_@@_x_initial_dim + \l_@@_x_final_dim ) / 2 }
9185             { \pgf@y - \l_@@_brace_yshift_dim + 3 pt }
9186     }
9187     \pgfnode
9188     { rectangle }
9189     { north }
9190     {
9191         \group_begin:
9192         \everycr { }
9193         \vbox
9194         {
9195             \halign
9196             {
9197                 \hfil ## \hfil \cr\cr
9198                 $ % $
9199                 \underbrace
9200                 {
9201                     \hbox_to_wd:nn
9202                         { \l_@@_x_final_dim - \l_@@_x_initial_dim }
9203                         { }
9204                 }
9205                 $ % $
9206                 \cr
9207                 \bool_if:NTF \l_@@_tabular_bool
9208                     { \begin { tabular } { c } #1 \end { tabular } }
9209                     { $ \begin { array } { c } #1 \end { array } $ }
9210                 \cr
9211             }
9212             }
9213             \group_end:
9214         }
9215     { }
9216     { }
9217 }

```

## 35 The commands HBrace et VBrace

The TikZ style `nicematrix/brace` is a TikZ style used to draw the braces created by `\Hbrace` and `\Vbrace`.

We can't load that definition right away because of course, maybe the final user has not yet loaded TikZ (`\Hbrace` and `\Vbrace` are available only when TikZ is loaded and also its library `decorations.pathreplacing`).

```

9218 \AddToHook { package / tikz / after }
9219 {
9220     \tikzset
9221     {
9222         nicematrix / brace / .style =

```

```

9223     {
9224         decoration = { brace , raise = -0.15 em } ,
9225         decorate ,
9226     } ,

```

Unlike the previous one, the following set of keys is internal. It won't be provided by the final user.

```

9227     nicematrix / mirrored-brace / .style =
9228     {
9229         nicematrix / brace ,
9230         decoration = mirror ,
9231     }
9232 }
9233 }

```

The following set of keys will be used only for security since the keys will be sent to the command `\Ldots` or `\Vdots`.

```

9234 \keys_define:nn { nicematrix / Hbrace }
9235 {
9236     color .code:n = ,
9237     horizontal-label .code:n = ,
9238     horizontal-labels .code:n = ,
9239     shorten .code:n = ,
9240     shorten-start .code:n = ,
9241     shorten-end .code:n = ,
9242     unknown .code:n = \@@_fatal:n { Unknown~key~for~Hbrace }
9243 }

```

Here we need an “fully expandable” command.

```

9244 \NewExpandableDocumentCommand { \@@_Hbrace } { O { } m m }
9245 {
9246     \cs_if_exist:cTF { tikz@library@decorations.pathreplacing@loaded }
9247     { \@@_hbrace:nnn { #1 } { #2 } { #3 } }
9248     { \@@_error:nn { Hbrace-not-allowed } { \Hbrace } }
9249 }

```

The following command must *not* be protected because of the `\Hdotsfor` which contains a `\multicolumn` (whereas the similar command `\@@_vbrace:nnn` *must* be protected).

```

9250 \cs_new:Npn \@@_hbrace:nnn #1 #2 #3
9251 {
9252     \int_compare:nNnTF { \c@iRow } < { 2 }
9253     {

```

We recall that `\str_if_eq:nnTF` is “fully expandable”.

```

9254 \str_if_eq:nnTF { #2 } { * }
9255 {
9256     \bool_set_true:N \l_@@_nullify_dots_bool
9257     \Ldots
9258     [
9259         line-style = nicematrix / brace ,
9260         #1 ,
9261         up =
9262             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9263     ]
9264 }
9265 {
9266     \Hdotsfor
9267     [
9268         line-style = nicematrix / brace ,
9269         #1 ,
9270         up =
9271             \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9272     ]

```

```

9273     { #2 }
9274   }
9275 }
9276 {
9277   \str_if_eq:nnTF { #2 } { * }
9278   {
9279     \bool_set_true:N \l_@@_nullify_dots_bool
9280     \Ldots
9281     [
9282       line-style = nicematrix / mirrored-brace ,
9283       #1 ,
9284       down =
9285         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9286     ]
9287   }
9288   {
9289     \Hdotsfor
9290     [
9291       line-style = nicematrix / mirrored-brace ,
9292       #1 ,
9293       down =
9294         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9295     ]
9296     { #2 }
9297   }
9298 }
9299 \keys_set:nn { nicematrix / Hbrace } { #1 }
9300 }

9301 \NewDocumentCommand { \@@_Vbrace } { O{ } m m }
9302 {
9303   \cs_if_exist:cTF { tikz@library@decorations.pathreplacing@loaded }
9304   { \@@_vbrace:nnn { #1 } { #2 } { #3 } }
9305   { \@@_error:nn { Hbrace-not~allowed } { \Vbrace } }
9306 }

```

The following command must be protected (whereas the similar command `\@@_hbrace:nnn` must not).

```

9307 \cs_new_protected:Npn \@@_vbrace:nnn #1 #2 #3
9308 {
9309   \int_compare:nNnTF { \c@jCol } < { 2 }
9310   {
9311     \str_if_eq:nnTF { #2 } { * }
9312     {
9313       \bool_set_true:N \l_@@_nullify_dots_bool
9314       \Vdots
9315       [
9316         Vbrace ,
9317         line-style = nicematrix / mirrored-brace ,
9318         #1 ,
9319         down =
9320           \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9321       ]
9322     }
9323   {
9324     \Vdotsfor
9325     [
9326       Vbrace ,
9327       line-style = nicematrix / mirrored-brace ,
9328       #1 ,
9329       down =
9330         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9331     ]
9332 }

```

```

9332     { #2 }
9333   }
9334 }
9335 {
9336   \str_if_eq:nnTF { #2 } { * }
9337   {
9338     \bool_set_true:N \l_@@_nullify_dots_bool
9339     \Vdots
9340     [
9341       Vbrace ,
9342       line-style = nicematrix / brace ,
9343       #1 ,
9344       up =
9345         \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9346     ]
9347   }
9348 {
9349   \Vdotsfor
9350   [
9351     Vbrace ,
9352     line-style = nicematrix / brace ,
9353     #1 ,
9354     up =
9355       \bool_if:NT \l_@@_tabular_bool \text { \exp_not:n { #3 } }
9356     ]
9357     { #2 }
9358   }
9359 }
9360 \keys_set:nn { nicematrix / Hbrace } { #1 }
9361 }
```

## 36 The command `TikzEveryCell`

```

9362 \bool_new:N \l_@@_not_empty_bool
9363 \bool_new:N \l_@@_empty_bool
9364
9365 \keys_define:nn { nicematrix / TikzEveryCell }
9366 {
9367   not-empty .code:n =
9368   \bool_lazy_or:nnTF
9369     { \l_@@_in_code_after_bool }
9370     { \g_@@_create_cell_nodes_bool }
9371     { \bool_set_true:N \l_@@_not_empty_bool }
9372     { \@@_error:n { detection-of-empty-cells } } ,
9373   not-empty .value_forbidden:n = true ,
9374   empty .code:n =
9375   \bool_lazy_or:nnTF
9376     { \l_@@_in_code_after_bool }
9377     { \g_@@_create_cell_nodes_bool }
9378     { \bool_set_true:N \l_@@_empty_bool }
9379     { \@@_error:n { detection-of-empty-cells } } ,
9380   empty .value_forbidden:n = true ,
9381   unknown .code:n = \@@_error:n { Unknown-key-for-TikzEveryCell }
9382 }
9383
9384
9385 \NewDocumentCommand { \@@_TikzEveryCell } { O{ } m }
9386 {
9387   \IfPackageLoadedTF { tikz }
```

```

9388 {
9389     \group_begin:
9390     \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.
9391     \tl_set:Nn \l_tmpa_tl { { #2 } }
9392     \seq_map_inline:Nn \g_@@_pos_of_blocks_seq
9393         { \@@_for_a_block:nnnnn ##1 }
9394     \@@_all_the_cells:
9395     \group_end:
9396 }
9397 { \@@_error:n { TikzEveryCell~without~tikz } }
9398 }
9399
9400
9401 \cs_new_protected:Nn \@@_all_the_cells:
9402 {
9403     \int_step_inline:nn \c@iRow
9404     {
9405         \int_step_inline:nn \c@jCol
9406         {
9407             \cs_if_exist:cF { cell - ##1 - #####1 }
9408             {
9409                 \clist_if_in:NeF \l_@@_corners_cells_clist
9410                     { ##1 - #####1 }
9411                     {
9412                         \bool_set_false:N \l_tmpa_bool
9413                         \cs_if_exist:cTF
9414                             { pgf @ sh @ ns @ \@@_env: - ##1 - #####1 }
9415                             {
9416                                 \bool_if:NF \l_@@_empty_bool
9417                                     { \bool_set_true:N \l_tmpa_bool }
9418                             }
9419                             {
9420                                 \bool_if:NF \l_@@_not_empty_bool
9421                                     { \bool_set_true:N \l_tmpa_bool }
9422                             }
9423                         \bool_if:NT \l_tmpa_bool
9424                             {
9425                                 \@@_block_tikz:onnnn
9426                                     \l_tmpa_tl { ##1 } { #####1 } { ##1 } { #####1 }
9427                             }
9428                         }
9429                     }
9430                 }
9431             }
9432         }
9433
9434 \cs_new_protected:Nn \@@_for_a_block:nnnn
9435 {
9436     \bool_if:NF \l_@@_empty_bool
9437     {
9438         \@@_block_tikz:onnnn
9439             \l_tmpa_tl { #1 } { #2 } { #3 } { #4 }
9440         }
9441     \@@_mark_cells_of_block:nnnn { #1 } { #2 } { #3 } { #4 }
9442 }
9443
9444 \cs_new_protected:Nn \@@_mark_cells_of_block:nnnn
9445 {
9446     \int_step_inline:nnn { #1 } { #3 }
9447     {
9448         \int_step_inline:nnn { #2 } { #4 }

```

```

9449     { \cs_set_nopar:cpn { cell - ##1 - #####1 } { } }
9450   }
9451 }

```

## 37 The command \ShowCellNames

```

9452 \NewDocumentCommand \@@_ShowCellNames { }
9453 {
9454   \bool_if:NT \l_@@_in_code_after_bool
9455   {
9456     \pgfpicture
9457     \pgfrememberpicturepositiononpagetrue
9458     \pgf@relevantforpicturesizefalse
9459     \pgfpathrectanglecorners
9460     { \@@_qpoint:n { 1 } }
9461     {
9462       \@@_qpoint:n
9463       { \int_eval:n { \int_max:nn { \c@iRow } { \c@jCol } + 1 } }
9464     }
9465     \pgfsetfillcolor { 0.75 }
9466     \pgfsetfillcolor { white }
9467     \pgfusepathqfill
9468     \endpgfpicture
9469   }
9470   \dim_gzero_new:N \g_@@_tmpc_dim
9471   \dim_gzero_new:N \g_@@_tmpd_dim
9472   \dim_gzero_new:N \g_@@_tmpe_dim
9473   \int_step_inline:nn { \c@iRow }
9474   {
9475     \bool_if:NTF \l_@@_in_code_after_bool
9476     {
9477       \pgfpicture
9478       \pgfrememberpicturepositiononpagetrue
9479       \pgf@relevantforpicturesizefalse
9480     }
9481     { \begin { pgfpicture } }
9482     \@@_qpoint:n { row - ##1 }
9483     \dim_set_eq:NN \l_tmpa_dim \pgf@y
9484     \@@_qpoint:n { row - \int_eval:n { ##1 + 1 } }
9485     \dim_gset:Nn \g_tmpa_dim { ( \l_tmpa_dim + \pgf@y ) / 2 }
9486     \dim_gset:Nn \g_tmpb_dim { \l_tmpa_dim - \pgf@y }
9487     \bool_if:NTF \l_@@_in_code_after_bool
9488     { \endpgfpicture }
9489     { \end { pgfpicture } }
9490     \int_step_inline:nn { \c@jCol }
9491     {
9492       \hbox_set:Nn \l_tmpa_box
9493       {
9494         \normalfont \Large \sffamily \bfseries
9495         \bool_if:NTF \l_@@_in_code_after_bool
9496           { \color { red } }
9497           { \color { red ! 50 } }
9498           ##1 - ####1
9499         }
9500         \bool_if:NTF \l_@@_in_code_after_bool
9501         {
9502           \pgfpicture
9503           \pgfrememberpicturepositiononpagetrue
9504           \pgf@relevantforpicturesizefalse
9505         }
9506         { \begin { pgfpicture } }
9507         \@@_qpoint:n { col - ####1 }

```

```

9508     \dim_gset_eq:NN \g_@@_tmpc_dim \pgf@x
9509     \g_@@_qpoint:n { col - \int_eval:n { #####1 + 1 } }
9510     \dim_gset:Nn \g_@@_tmpd_dim { \pgf@x - \g_@@_tmpc_dim }
9511     \dim_gset_eq:NN \g_@@_tmpc_dim \pgf@x
9512     \bool_if:NTF \l_@@_in_code_after_bool
9513         { \endpgfpicture }
9514         { \end { pgfpicture } }
9515     \fp_set:Nn \l_tmpa_fp
9516     {
9517         \fp_min:nn
9518         {
9519             \fp_min:nn
9520                 { \dim_ratio:nn \g_@@_tmpd_dim { \box_wd:N \l_tmpa_box } }
9521                 { \dim_ratio:nn \g_tmpb_dim { \box_ht_plus_dp:N \l_tmpa_box } }
9522             }
9523             { 1.0 }
9524         }
9525     \box_scale:Nnn \l_tmpa_box { \fp_use:N \l_tmpa_fp } { \fp_use:N \l_tmpa_fp }
9526     \pgfpicture
9527     \pgfrememberpicturepositiononpagetrue
9528     \pgf@relevantforpicturesizefalse
9529     \pgftransformshift
9530     {
9531         \pgfpoint
9532             { 0.5 * ( \g_@@_tmpc_dim + \g_@@_tmpc_dim ) }
9533             { \dim_use:N \g_tmpa_dim }
9534     }
9535     \pgfnode
9536         { rectangle }
9537         { center }
9538         { \box_use:N \l_tmpa_box }
9539         { }
9540         { }
9541     \endpgfpicture
9542 }
9543 }
9544 }

```

## 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.

```
9545 \bool_new:N \g_@@_footnotehyper_bool
```

The boolean `\g_@@_footnote_bool` will indicate if the option `footnote` is used, but quickly, it will also be set to true if the option `footnotehyper` is used.

```

9546 \bool_new:N \g_@@_footnote_bool
9547 \msg_new:nnnn { nicematrix } { Unknown-key-for-package }
9548 {
9549     You~have~used~the~key~' \l_keys_key_str '~when~loading~nicematrix~
9550     but~that~key~is~unknown. \\
9551     It~will~be~ignored. \\
9552     For~a~list~of~the~available~keys,~type~H~<return>.
9553 }
9554 {
9555     The~available~keys~are~(in~alphabetic~order):~
```

```

9556     footnote,~  

9557     footnotehyper,~  

9558     messages-for-Overleaf,~  

9559     renew-dots~and~  

9560     renew-matrix.  

9561   }  

9562 \keys_define:nn { nicematrix }  

9563   {  

9564     renew-dots .bool_set:N = \l_@@_renew_dots_bool ,  

9565     renew-dots .value_forbidden:n = true ,  

9566     renew-matrix .code:n = \@@_renew_matrix: ,  

9567     renew-matrix .value_forbidden:n = true ,  

9568     messages-for-Overleaf .bool_set:N = \g_@@_messages_for_Overleaf_bool ,  

9569     footnote .bool_set:N = \g_@@_footnote_bool ,  

9570     footnotehyper .bool_set:N = \g_@@_footnotehyper_bool ,  

9571     unknown .code:n = \@@_error:n { Unknown-key-for-package }  

9572   }  

9573 \ProcessKeyOptions  

  

9574 \@@_msg_new:nn { footnote-with-footnotehyper-package }  

9575 {  

9576   You~can't~use~the~option~'footnote'~because~the~package~  

9577   footnotehyper~has~already~been~loaded.~  

9578   If~you~want,~you~can~use~the~option~'footnotehyper'~and~the~footnotes~  

9579   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~  

9580   of~the~package~footnotehyper.\\  

9581   The~package~footnote~won't~be~loaded.  

9582 }  

9583 \@@_msg_new:nn { footnotehyper-with-footnote-package }  

9584 {  

9585   You~can't~use~the~option~'footnotehyper'~because~the~package~  

9586   footnote~has~already~been~loaded.~  

9587   If~you~want,~you~can~use~the~option~'footnote'~and~the~footnotes~  

9588   within~the~environments~of~nicematrix~will~be~extracted~with~the~tools~  

9589   of~the~package~footnote.\\  

9590   The~package~footnotehyper~won't~be~loaded.  

9591 }  

  

9592 \bool_if:NT \g_@@_footnote_bool  

9593 {  


```

The class `beamer` has its own system to extract footnotes and that's why we have nothing to do if `beamer` is used.

```

9594 \IfClassLoadedTF { beamer }  

9595   { \bool_set_false:N \g_@@_footnote_bool }  

9596   {  

9597     \IfPackageLoadedTF { footnotehyper }  

9598       { \@@_error:n { footnote-with-footnotehyper-package } }  

9599       { \usepackage { footnote } }  

9600     }  

9601 }  

9602 \bool_if:NT \g_@@_footnotehyper_bool  

9603 {  


```

The class `beamer` has its own system to extract footnotes and that's why we have nothing to do if `beamer` is used.

```

9604 \IfClassLoadedTF { beamer }  

9605   { \bool_set_false:N \g_@@_footnote_bool }  

9606   {  

9607     \IfPackageLoadedTF { footnote }  

9608       { \@@_error:n { footnotehyper-with-footnote-package } }  


```

```

9609     { \usepackage { footnotehyper } }
9610   }
9611   \bool_set_true:N \g_@@_footnote_bool
9612 }
```

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.

```

9613 \bool_new:N \l_@@_underscore_loaded_bool
9614 \IfPackageLoadedT { underscore }
9615   { \bool_set_true:N \l_@@_underscore_loaded_bool }
9616 \hook_gput_code:nnn { begindocument } { . }
9617 {
9618   \bool_if:NF \l_@@_underscore_loaded_bool
9619   {
9620     \IfPackageLoadedT { underscore }
9621     { \C @_error:n { underscore~after~nicematrix } }
9622   }
9623 }
```

## 40 Error messages of the package

```

9624 \str_const:Ne \c_@@_available_keys_str
9625 {
9626   \bool_if:nTF { ! \g_@@_messages_for_Overleaf_bool }
9627   { For~a~list~of~the~available~keys,~type~H~<return>. }
9628   { }
9629 }
9630 \seq_new:N \g_@@_types_of_matrix_seq
9631 \seq_gset_from_clist:Nn \g_@@_types_of_matrix_seq
9632 {
9633   NiceMatrix ,
9634   pNiceMatrix , bNiceMatrix , vNiceMatrix, BNiceMatrix, VNiceMatrix
9635 }
9636 \seq_gset_map_e:NNn \g_@@_types_of_matrix_seq \g_@@_types_of_matrix_seq
9637 { \tl_to_str:n { #1 } }
```

If the user uses too much columns, the command `\C @_err_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:N` 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 `\C @_fatal:n`.

```

9638 \cs_new_protected:Npn \C @_err_too_much_cols:
9639 {
9640   \seq_if_in:N \g_@@_types_of_matrix_seq \g_@@_name_env_str
9641   { \C @_fatal:nn { too~much~cols~for~array } }
9642   \int_compare:nNnT { \l_@@_last_col_int } = { -2 }
9643   { \C @_fatal:n { too~much~cols~for~matrix } }
9644   \int_compare:nNnT { \l_@@_last_col_int } = { -1 }
9645   { \C @_fatal:n { too~much~cols~for~matrix } }
```

```

9646     \bool_if:NF \l_@@_last_col_without_value_bool
9647         { \@@_fatal:n { too-much-cols-for-matrix-with-last-col } }
9648     }

The following command must not be protected since it's used in an error message.
9649 \cs_new:Npn \@@_message_hdotsfor:
9650 {
9651     \tl_if_empty:oF \g_@@_Hdotsfor_lines_tl
9652         { ~Maybe~your~use~of~ \token_to_str:N \Hdotsfor \ or~
9653             \token_to_str:N \Hbrace \ is~incorrect. }
9654 }

9655 \cs_new_protected:Npn \@@_Hline_in_cell:
9656     { \@@_fatal:n { Misuse~of~Hline } }

9657 \@@_msg_new:nn { Misuse~of~Hline }
9658 {
9659     Misuse~of~Hline. \\
9660     \token_to_str:N \Hline\ must~be~used~only~at~the~beginning~of~a~row.\\
9661     That~error~is~fatal.
9662 }

9663 \@@_msg_new:nn { hvlines,~rounded-corners~and~corners }
9664 {
9665     Incompatible~options.\\
9666     You~should~not~use~'hvlines',~'rounded-corners'~and~'corners'~at~the~same~time.\\
9667     The~output~will~not~be~reliable.
9668 }

9669 \@@_msg_new:nn { Body~alone }
9670 {
9671     \token_to_str:N \Body\ alone. \\
9672     You~have~used~\token_to_str:N \Body\ without~\token_to_str:N \CodeBefore.\\
9673     That~error~is~fatal.
9674 }

9675 \@@_msg_new:nn { key~color~inside }
9676 {
9677     Deleted~key.\\
9678     The~key~'color~inside'~(and~its~alias~'colortbl~like')~has~been~deleted~in
9679     ~'nicematrix'~and~must~not~be~used.\\
9680     This~error~is~fatal.
9681 }

9682 \@@_msg_new:nn { invalid~weight }
9683 {
9684     Unknown~key.\\
9685     The~key~' \l_keys_key_str '~of~your~column~X~is~unknown~and~will~be~ignored.
9686 }

9687 \@@_msg_new:nn { last~col~not~used }
9688 {
9689     Column~not~used.\\
9690     The~key~'last~col'~is~in~force~but~you~have~not~used~that~last~column~
9691     in~your~\@@_full_name_env: .~\\
9692     However,~you~can~go~on.
9693 }

9694 \@@_msg_new:nn { too~much~cols~for~matrix~with~last~col }
9695 {
9696     Too~much~columns.\\
9697     In~the~row~ \int_eval:n { \c@iRow },~\\
9698     you~try~to~use~more~columns~\\
9699     than~allowed~by~your~ \@@_full_name_env: .\\
9700     \@@_message_hdotsfor: \\
9701     The~maximal~number~of~columns~is~ \int_eval:n { \l_@@_last_col_int - 1 }~\\
9702     (plus~the~exterior~columns).~This~error~is~fatal.
9703 }

```

```

9704 \@@_msg_new:nn { too-much-cols-for-matrix }
9705 {
9706   Too-much-columns.\\
9707   In-the-row~ \int_eval:n { \c@iRow } ,~
9708   you~try~to~use~more~columns~than~allowed~by~your~ \@@_full_name_env: .
9709   \@@_message_hdotsfor: \
9710   Recall~that~the~maximal~number~of~columns~for~a~matrix~
9711   (excepted~the~potential~exterior~columns)~is~fixed~by~the~
9712   LaTeX~counter~'MaxMatrixCols'.~
9713   Its~current~value~is~ \int_use:N \c@MaxMatrixCols \
9714   (use~ \token_to_str:N \setcounter \ to~change~that~value).~
9715   This~error~is~fatal.
9716 }

9717 \@@_msg_new:nn { too-much-cols-for-array }
9718 {
9719   Too-much-columns.\\
9720   In-the-row~ \int_eval:n { \c@iRow } ,~
9721   ~you~try~to~use~more~columns~than~allowed~by~your~\@@_full_name_env: . \@@_message_hdotsfor: \
9722   The~maximal~number~of~columns~is~\int_use:N \g_@@_static_num_of_col_int \
9723   \bool_if:nT
9724     { \int_compare_p:n { \l_@@_first_col_int = 0 } || \g_@@_last_col_found_bool }
9725     { ~(plus~the~exterior~ones) }
9726   since~the~preamble~is~' \g_@@_user_preamble_tl '.\\\
9727   This~error~is~fatal.
9728 }

9729 \@@_msg_new:nn { columns-not-used }
9730 {
9731   Columns-not-used.\\
9732   The~preamble~of~your~ \@@_full_name_env: \ is~' \g_@@_user_preamble_tl ' .~
9733   It~announces~ \int_use:N \g_@@_static_num_of_col_int \
9734   columns~but~you~only~used~ \int_use:N \c@jCol .\\\
9735   The~columns~you~did~not~used~won't~be~created.\\\
9736   You~won't~have~similar~warning~till~the~end~of~the~document.
9737 }

9738 \@@_msg_new:nn { empty-preamble }
9739 {
9740   Empty-preamble.\\
9741   The~preamble~of~your~ \@@_full_name_env: \ is~empty.\\\
9742   This~error~is~fatal.
9743 }

9744 \@@_msg_new:nn { in-first-col }
9745 {
9746   Erroneous-use.\\\
9747   You~can't~use~the~command~#1 in~the~first~column~(number~0)~of~the~array.\\\
9748   That~command~will~be~ignored.
9749 }

9750 \@@_msg_new:nn { in-last-col }
9751 {
9752   Erroneous-use.\\\
9753   You~can't~use~the~command~#1 in~the~last~column~(exterior)~of~the~array.\\\
9754   That~command~will~be~ignored.
9755 }

9756 \@@_msg_new:nn { in-first-row }
9757 {
9758   Erroneous-use.\\\
9759   You~can't~use~the~command~#1 in~the~first~row~(number~0)~of~the~array.\\\
9760   That~command~will~be~ignored.
9761 }

9762 \@@_msg_new:nn { in-last-row }
9763

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```

9764 {
9765   Erroneous~use.\\
9766   You~can't~use~the~command~#1~in~the~last~row~(exterior)~of~the~array.\\
9767   That~command~will~be~ignored.
9768 }
9769 \@@_msg_new:nn { TopRule~without~booktabs }
9770 {
9771   Erroneous~use.\\
9772   You~can't~use~the~command~ #1~because~'booktabs'~is~not~loaded.\\
9773   That~command~will~be~ignored.
9774 }
9775 \@@_msg_new:nn { TopRule~without~tikz }
9776 {
9777   Erroneous~use.\\
9778   You~can't~use~the~command~ #1~because~'tikz'~is~not~loaded.\\
9779   That~command~will~be~ignored.
9780 }
9781 \@@_msg_new:nn { caption~outside~float }
9782 {
9783   Key~caption~forbidden.\\
9784   You~can't~use~the~key~'caption'~because~you~are~not~in~a~floating~
9785   environment~(such~as~\{table\}).~This~key~will~be~ignored.
9786 }
9787 \@@_msg_new:nn { short-caption~without~caption }
9788 {
9789   You~should~not~use~the~key~'short-caption'~without~'caption'.~
9790   However,~your~'short-caption'~will~be~used~as~'caption'.
9791 }
9792 \@@_msg_new:nn { double~closing~delimiter }
9793 {
9794   Double~delimiter.\\
9795   You~can't~put~a~second~closing~delimiter~"#1"~just~after~a~first~closing~
9796   delimiter.~This~delimiter~will~be~ignored.
9797 }
9798 \@@_msg_new:nn { delimiter~after~opening }
9799 {
9800   Double~delimiter.\\
9801   You~can't~put~a~second~delimiter~"#1"~just~after~a~first~opening~
9802   delimiter.~That~delimiter~will~be~ignored.
9803 }
9804 \@@_msg_new:nn { bad-option~for~line~style }
9805 {
9806   Bad~line~style.\\
9807   Since~you~haven't~loaded~Tikz,~the~only~value~you~can~give~to~'line-style'~
9808   is~'standard'.~That~key~will~be~ignored.
9809 }
9810 \@@_msg_new:nn { corners~with~no~cell~nodes }
9811 {
9812   Incompatible~keys.\\
9813   You~can't~use~the~key~'corners'~here~because~the~key~'no-cell-nodes'~
9814   is~in~force.\\
9815   If~you~go~on,~that~key~will~be~ignored.
9816 }
9817 \@@_msg_new:nn { extra-nodes~with~no~cell~nodes }
9818 {
9819   Incompatible~keys.\\
9820   You~can't~create~'extra-nodes'~here~because~the~key~'no-cell-nodes'~
9821   is~in~force.\\
9822   If~you~go~on,~those~extra~nodes~won't~be~created.
9823 }

```

```

9824 \@@_msg_new:nn { Identical~notes~in~caption }
9825 {
9826   Identical~tabular~notes.\\
9827   You~can't~put~several~notes~with~the~same~content~in~
9828   \token_to_str:N \caption \ (but~you~can~in~the~main~tabular).\\
9829   If~you~go~on,~the~output~will~probably~be~erroneous.
9830 }

9831 \@@_msg_new:nn { tabularnote~below~the~tabular }
9832 {
9833   \token_to_str:N \tabularnote \ forbidden\
9834   You~can't~use~ \token_to_str:N \tabularnote \ in~the~caption~
9835   of~your~tabular~because~the~caption~will~be~composed~below~
9836   the~tabular.~If~you~want~the~caption~above~the~tabular~use~the~
9837   key~'caption~above'~in~ \token_to_str:N \NiceMatrixOptions .\\\
9838   Your~ \token_to_str:N \tabularnote \ will~be~discarded~and~
9839   no~similar~error~will~raised~in~this~document.
9840 }

9841 \@@_msg_new:nn { Unknown~key~for~rules }
9842 {
9843   Unknown~key.\
9844   There~is~only~two~keys~available~here:~width~and~color.\
9845   Your~key~' \l_keys_key_str ' ~will~be~ignored.
9846 }

9847 \@@_msg_new:nn { Unknown~key~for~Hbrace }
9848 {
9849   Unknown~key.\
9850   You~have~used~the~key~' \l_keys_key_str ' ~but~the~only~
9851   keys~allowed~for~the~commands~ \token_to_str:N \Hbrace \
9852   and~ \token_to_str:N \Vbrace \ are:~'color',~
9853   'horizontal-label(s)',~'shorten'~'shorten-end'~
9854   and~'shorten-start'.\
9855   That~error~is~fatal.
9856 }

9857 \@@_msg_new:nn { Unknown~key~for~TikzEveryCell }
9858 {
9859   Unknown~key.\
9860   There~is~only~two~keys~available~here:~
9861   'empty'~and~'not~empty'.\
9862   Your~key~' \l_keys_key_str ' ~will~be~ignored.
9863 }

9864 \@@_msg_new:nn { Unknown~key~for~rotate }
9865 {
9866   Unknown~key.\
9867   The~only~key~available~here~is~'c'.\
9868   Your~key~' \l_keys_key_str ' ~will~be~ignored.
9869 }

9870 \@@_msg_new:nnn { Unknown~key~for~custom~line }
9871 {
9872   Unknown~key.\
9873   The~key~' \l_keys_key_str ' ~is~unknown~in~a~'custom-line'.~
9874   It~you~go~on,~you~will~probably~have~other~errors. \
9875   \c_@@_available_keys_str
9876 }

9877 {
9878   The~available~keys~are~(in~alphabetic~order):~
9879   ccommand,~
9880   color,~
9881   command,~
9882   dotted,~
9883   letter,~
9884   multiplicity,~

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9885     sep-color,~  

9886     tikz,~and~total-width.  

9887 }  

9888 \@@_msg_new:nnn { Unknown~key~for~xdots }  

9889 {  

9890   Unknown~key.\\  

9891   The~key~' \l_keys_key_str ' ~is~unknown~for~a~command~for~drawing~dotted~rules.\\  

9892   \c_@@_available_keys_str  

9893 }  

9894 {  

9895   The~available~keys~are~(in~alphabetic~order):~  

9896   'color',~  

9897   'horizontal(s)-labels',~  

9898   'inter',~  

9899   'line-style',~  

9900   'radius',~  

9901   'shorten',~  

9902   'shorten-end'~and~'shorten-start'.  

9903 }  

9904 \@@_msg_new:nn { Unknown~key~for~rowcolors }  

9905 {  

9906   Unknown~key.\\  

9907   As~for~now,~there~is~only~two~keys~available~here:~'cols'~and~'respect-blocks'~  

9908   (and~you~try~to~use~' \l_keys_key_str ')\\  

9909   That~key~will~be~ignored.  

9910 }  

9911 \@@_msg_new:nn { label~without~caption }  

9912 {  

9913   You~can't~use~the~key~'label'~in~your~\{NiceTabular\}~because~  

9914   you~have~not~used~the~key~'caption'.~The~key~'label'~will~be~ignored.  

9915 }  

9916 \@@_msg_new:nn { W-warning }  

9917 {  

9918   Line~ \msg_line_number: .~The~cell~is~too~wide~for~your~column~'W'~  

9919   (row~ \int_use:N \c@iRow ).  

9920 }  

9921 \@@_msg_new:nn { Construct~too~large }  

9922 {  

9923   Construct~too~large.\\  

9924   Your~command~ \token_to_str:N #1  

9925   can't~be~drawn~because~your~matrix~is~too~small.\\  

9926   That~command~will~be~ignored.  

9927 }  

9928 \@@_msg_new:nn { underscore~after~nicematrix }  

9929 {  

9930   Problem~with~'underscore'.\\  

9931   The~package~'underscore'~should~be~loaded~before~'nicematrix'.~  

9932   You~can~go~on~but~you~won't~be~able~to~write~something~such~as:\\  

9933   ' \token_to_str:N \Cdots \token_to_str:N _  

9934   \{ n \token_to_str:N \text \{ ~times \} \}.  

9935 }  

9936 \@@_msg_new:nn { ampersand~in~light~syntax }  

9937 {  

9938   Ampersand~forbidden.\\  

9939   You~can't~use~an~ampersand~( \token_to_str:N &)~to~separate~columns~because~  

9940   ~the~key~'light~syntax'~is~in~force.~This~error~is~fatal.  

9941 }  

9942 \@@_msg_new:nn { double-backslash~in~light~syntax }  

9943 {  

9944   Double-backslash~forbidden.\\

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9945 You~can't~use~ \token_to_str:N \\~to~separate~rows~because~the~key~'light-syntax'~is~in~force.~You~must~use~the~character~' \l_@@_end_of_row_tl ' ~(set~by~the~key~'end-of-row').~This~error~is~fatal.
9946 }
9947
9948 \@@_msg_new:nn { hlines~with~color }
9949 {
9950   Incompatible~keys.\\
9951   You~can't~use~the~keys~'hlines',~'vlines'~or~'hvlines'~for~a~\token_to_str:N \Block \ when~the~key~'color'~or~'draw'~is~used.\\
9952   However,~you~can~put~several~commands~ \token_to_str:N \Block.\\
9953   Your~key~will~be~discarded.
9954 }
9955
9956 \@@_msg_new:nn { bad-value~for~baseline }
9957 {
9958   Bad~value~for~baseline.\\
9959   The~value~given~to~'baseline'~( \int_use:N \l_tmpa_int )~is~not~valid.~The~value~must~be~between~\int_use:N \l_@@_first_row_int\ and~\int_use:N \g_@@_row_total_int \ or~equal~to~'t',~'c'~or~'b'~or~of~the~form~'line-i'.\\
9960   A~value~of~1~will~be~used.
9961 }
9962
9963 \@@_msg_new:nn { bad-value~for~baseline-line }
9964 {
9965   Bad~value~for~baseline~with~line.\\
9966   The~value~given~to~'baseline'~( \int_use:N \l_tmpa_int )~is~not~valid.~The~number~of~the~line~must~be~between~1~and~\int_eval:n { \c@iRow + 1 } \\
9967   A~value~of~'line-1'~will~be~used.
9968 }
9969
9970 \@@_msg_new:nn { detection~of~empty~cells }
9971 {
9972   Problem~with~'not-empty'\\
9973   For~technical~reasons,~you~must~activate~'create-cell-nodes'~in~ \token_to_str:N \CodeBefore \\
9974   in~order~to~use~the~key~' \l_keys_key_str '.\\
9975   That~key~will~be~ignored.
9976 }
9977
9978 \@@_msg_new:nn { siunitx~not~loaded }
9979 {
9980   siunitx~not~loaded\\
9981   You~can't~use~the~columns~'S'~because~'siunitx'~is~not~loaded.\\
9982   That~error~is~fatal.
9983 }
9984
9985 \@@_msg_new:nn { Invalid~name }
9986 {
9987   Invalid~name.\\
9988   You~can't~give~the~name~' \l_keys_value_tl ' ~to~a~ \token_to_str:N \SubMatrix \ of~your~ \@@_full_name_env: .\\
9989   A~name~must~be~accepted~by~the~regular~expression~[A-Za-z] [A-Za-z0-9]*.\\
9990   This~key~will~be~ignored.
9991 }
9992
9993 \@@_msg_new:nn { Hbrace~not~allowed }
9994 {
9995   Command~not~allowed.\\
9996   You~can't~use~the~command~ \token_to_str:N #1 because~you~have~not~loaded~\IfPackageLoadedTF { tikz } { the~TikZ~library~'decoration.pathreplacing'.~Use~ } { TikZ.~ Use:~ \token_to_str:N \usepackage \{tikz\}~and~ } \token_to_str:N \usetikzlibrary \{decoration.pathreplacing\}. \\
9997
9998
9999
10000
10001
10002
10003
10004
10005

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10006      That~command~will~be~ignored.
10007  }
10008 \@@_msg_new:nn { Vbrace~not~allowed }
10009 {
10010   Command~not~allowed.\\
10011   You~can't~use~the~command~ \token_to_str:N \Vbrace \\
10012   because~you~have~not~loaded~TikZ~
10013   and~the~TikZ~library~'decorations.pathreplacing'.\\
10014   Use: ~\token_to_str:N \usepackage \{tikz\}~
10015   \token_to_str:N \usetikzlibrary \{decorations.pathreplacing\} \\
10016   That~command~will~be~ignored.
10017 }

10018 \@@_msg_new:nn { Wrong~line~in~SubMatrix }
10019 {
10020   Wrong~line.\\
10021   You~try~to~draw~a~#1~line~of~number~'#2'~in~a~\\
10022   \token_to_str:N \SubMatrix \\ of~your~ \@@_full_name_env: \ but~that~
10023   number~is~not~valid.~It~will~be~ignored.
10024 }

10025 \@@_msg_new:nn { Impossible~delimiter }
10026 {
10027   Impossible~delimiter.\\
10028   It's~impossible~to~draw~the~#1~delimiter~of~your~\\
10029   \token_to_str:N \SubMatrix \\ because~all~the~cells~are~empty~\\
10030   in~that~column.
10031   \bool_if:NT \l_@@_submatrix_slim_bool
10032     { ~Maybe~you~should~try~without~the~key~'slim'. } \\
10033   This~ \token_to_str:N \SubMatrix \\ will~be~ignored.
10034 }

10035 \@@_msg_new:nnn { width~without~X~columns }
10036 {
10037   You~have~used~the~key~'width'~but~you~have~put~no~'X'~column~in~\\
10038   the~preamble~(' \g_@@_user_preamble_tl ')~of~your~ \@@_full_name_env: .\\
10039   That~key~will~be~ignored.
10040 }
10041 {
10042   This~message~is~the~message~'width~without~X~columns'~\\
10043   of~the~module~'nicematrix'.~\\
10044   The~experimented~users~can~disable~that~message~with~\\
10045   \token_to_str:N \msg_redirect_name:nnn .\\
10046 }
10047

10048 \@@_msg_new:nn { key~multiplicity~with~dotted }
10049 {
10050   Incompatible~keys. \\
10051   You~have~used~the~key~'multiplicity'~with~the~key~'dotted'~\\
10052   in~a~'custom-line'.~They~are~incompatible. \\
10053   The~key~'multiplicity'~will~be~discarded.
10054 }

10055 \@@_msg_new:nn { empty~environment }
10056 {
10057   Empty~environment.\\
10058   Your~ \@@_full_name_env: \ is~empty.~This~error~is~fatal.
10059 }

10060 \@@_msg_new:nn { No~letter~and~no~command }
10061 {
10062   Erroneous~use.\\
10063   Your~use~of~'custom-line'~is~no~op~since~you~don't~have~used~the~\\
10064   key~'letter'~(for~a~letter~for~vertical~rules)~nor~the~keys~'command'~or~\\
10065   ~'ccommand'~(to~draw~horizontal~rules).\\
10066   However,~you~can~go~on.

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10067 }
10068 \@@_msg_new:nn { Forbidden~letter }
10069 {
10070   Forbidden~letter.\\
10071   You~can't~use~the~letter~'#1'~for~a~customized~line.~
10072   It~will~be~ignored.\\
10073   The~forbidden~letters~are:~\c_@@_forbidden_letters_str
10074 }

10075 \@@_msg_new:nn { Several~letters }
10076 {
10077   Wrong~name.\\
10078   You~must~use~only~one~letter~as~value~for~the~key~'letter'~(and~you~
10079   have~used~'~\l_@@_letter_str~').\\
10080   It~will~be~ignored.
10081 }

10082 \@@_msg_new:nn { Delimiter~with~small }
10083 {
10084   Delimiter~forbidden.\\
10085   You~can't~put~a~delimiter~in~the~preamble~of~your~
10086   \@@_full_name_env: ~
10087   because~the~key~'small'~is~in~force.\\
10088   This~error~is~fatal.
10089 }

10090 \@@_msg_new:nn { unknown~cell~for~line~in~CodeAfter }
10091 {
10092   Unknown~cell.\\
10093   Your~command~ \token_to_str:N \line \{ #1 \} \{ #2 \}~in~
10094   the~ \token_to_str:N \CodeAfter \ of~your~ \@@_full_name_env: ~
10095   can't~be~executed~because~a~cell~doesn't~exist.\\
10096   This~command~ \token_to_str:N \line \ will~be~ignored.
10097 }

10098 \@@_msg_new:nnn { Duplicate~name~for~SubMatrix }
10099 {
10100   Duplicate~name.\\
10101   The~name~'#1'~is~already~used~for~a~ \token_to_str:N \SubMatrix ~
10102   in~this~ \@@_full_name_env: .\\
10103   This~key~will~be~ignored.\\
10104   \bool_if:NF \g_@@_messages_for_Overleaf_bool
10105     { For~a~list~of~the~names~already~used,~type~H~<return>. }
10106 }
10107 {
10108   The~names~already~defined~in~this~ \@@_full_name_env: ~ are:~ ~
10109   \seq_use:Nnnn \g_@@_submatrix_names_seq { ~and~ } { ,~ } { ~and~ } .
10110 }

10111 \@@_msg_new:nn { r-or-l-with-preamble }
10112 {
10113   Erroneous~use.\\
10114   You~can't~use~the~key~' \l_keys_key_str ' ~in~your~ \@@_full_name_env: ~.
10115   You~must~specify~the~alignment~of~your~columns~with~the~preamble~of~
10116   your~ \@@_full_name_env: .\\
10117   This~key~will~be~ignored.
10118 }

10119 \@@_msg_new:nn { Hdotsfor~in~col~0 }
10120 {
10121   Erroneous~use.\\
10122   You~can't~use~ \token_to_str:N \Hdotsfor ~ in~an~exterior~column~of~
10123   the~array.~This~error~is~fatal.
10124 }

10125 \@@_msg_new:nn { bad-corner }
10126 {

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10127 Bad~corner.\\
10128 #1~is~an~incorrect~specification~for~a~corner~(in~the~key~
10129 'corners').~The~available~values~are:~NW,~SW,~NE~and~SE.\\
10130 This~specification~of~corner~will~be~ignored.
10131 }

10132 \\@@_msg_new:nn { bad-border }
10133 {
10134   Bad~border.\\
10135   \l_keys_key_str \space ~is~an~incorrect~specification~for~a~border~
10136   (in~the~key~'borders'~of~the~command~ \token_to_str:N \Block )..~
10137   The~available~values~are:~left,~right,~top~and~bottom~(and~you~can~
10138   also~use~the~key~'tikz'
10139   \IfPackageLoadedF { tikz }
10140     { ~if~you~load~the~LaTeX~package~'tikz' } ).\\
10141   This~specification~of~border~will~be~ignored.
10142 }

10143 \\@@_msg_new:nn { TikzEveryCell~without~tikz }
10144 {
10145   TikZ~not~loaded.\\
10146   You~can't~use~ \token_to_str:N \TikzEveryCell \
10147   because~you~have~not~loaded~tikz.~
10148   This~command~will~be~ignored.
10149 }

10150 \\@@_msg_new:nn { tikz~key~without~tikz }
10151 {
10152   TikZ~not~loaded.\\
10153   You~can't~use~the~key~'tikz'~for~the~command~' \token_to_str:N
10154   \Block '~because~you~have~not~loaded~tikz.~
10155   This~key~will~be~ignored.
10156 }

10157 \\@@_msg_new:nn { Bad~argument~for~Block }
10158 {
10159   Bad~argument.\\
10160   The~first~mandatory~argument~of~\token_to_str:N \Block\ must~
10161   be~of~the~form~'i-j'~(or~completely~empty)~and~you~have~used:~
10162   '#1'. \\
10163   If~you~go~on,~the~\token_to_str:N \Block\ will~be~mono-cell~(as~if~
10164   the~argument~was~empty).
10165 }

10166 \\@@_msg_new:nn { last-col~non~empty~for~NiceArray }
10167 {
10168   Erroneous~use.\\
10169   In~the~ \\@@_full_name_env: ,~you~must~use~the~key~
10170   'last-col'~without~value.\\
10171   However,~you~can~go~on~for~this~time~
10172   (the~value~' \l_keys_value_tl ' ~will~be~ignored).
10173 }

10174 \\@@_msg_new:nn { last-col~non~empty~for~NiceMatrixOptions }
10175 {
10176   Erroneous~use. \\
10177   In~\token_to_str:N \NiceMatrixOptions ,~you~must~use~the~key~
10178   'last-col'~without~value. \\
10179   However,~you~can~go~on~for~this~time~
10180   (the~value~' \l_keys_value_tl ' ~will~be~ignored).
10181 }

10182 \\@@_msg_new:nn { Block~too~large~1 }
10183 {
10184   Block~too~large. \\
10185   You~try~to~draw~a~block~in~the~cell~#1-#2~of~your~matrix~but~the~matrix~is~
10186   too~small~for~that~block. \\
10187   This~block~and~maybe~others~will~be~ignored.

```

```

10188 }
10189 \@@_msg_new:nn { Block-too-large~2 }
10190 {
10191   Block-too-large. \\
10192   The-preamble-of-your~ \@@_full_name_env: \ announces~ \int_use:N
10193   \g_@@_static_num_of_col_int \
10194   columns~but~you~use~only~ \int_use:N \c@jCol \ and~that's~why~a~block~
10195   specified~in~the~cell~#1-#2~can't~be~drawn.~You~should~add~some~ampersands~
10196   (&)~at~the~end~of~the~first~row~of~your~ \@@_full_name_env: . \\
10197   This~block~and~maybe~others~will~be~ignored.
10198 }

10199 \@@_msg_new:nn { unknown-column-type }
10200 {
10201   Bad~column~type. \\
10202   The~column~type~'#1'~in~your~ \@@_full_name_env: \
10203   is~unknown. \\
10204   This~error~is~fatal.
10205 }

10206 \@@_msg_new:nn { unknown-column-type~multicolumn }
10207 {
10208   Bad~column~type. \\
10209   The~column~type~'#1'~in~the~command~\token_to_str:N \multicolumn \
10210   ~of~your~ \@@_full_name_env: \
10211   is~unknown. \\
10212   This~error~is~fatal.
10213 }

10214 \@@_msg_new:nn { unknown-column-type~S }
10215 {
10216   Bad~column~type. \\
10217   The~column~type~'S'~in~your~ \@@_full_name_env: \ is~unknown. \\
10218   If~you~want~to~use~the~column~type~'S'~of~siunitx,~you~should~
10219   load~that~package. \\
10220   This~error~is~fatal.
10221 }

10222 \@@_msg_new:nn { unknown-column-type~S~multicolumn }
10223 {
10224   Bad~column~type. \\
10225   The~column~type~'S'~in~the~command~\token_to_str:N \multicolumn \
10226   of~your~ \@@_full_name_env: \ is~unknown. \\
10227   If~you~want~to~use~the~column~type~'S'~of~siunitx,~you~should~
10228   load~that~package. \\
10229   This~error~is~fatal.
10230 }

10231 \@@_msg_new:nn { tabularnote~forbidden }
10232 {
10233   Forbidden~command. \\
10234   You~can't~use~the~command~ \token_to_str:N \tabularnote \
10235   ~here.~This~command~is~available~only~in~
10236   \{NiceTabular\},~\{NiceTabular*\}~and~\{NiceTabularX\}~or~in~
10237   the~argument~of~a~command~\token_to_str:N \caption \ included~
10238   in~an~environment~\{table\}. \\
10239   This~command~will~be~ignored.
10240 }

10241 \@@_msg_new:nn { borders~forbidden }
10242 {
10243   Forbidden~key.\\
10244   You~can't~use~the~key~'borders'~of~the~command~ \token_to_str:N \Block \
10245   because~the~option~'rounded-corners'~
10246   is~in~force~with~a~non-zero~value.\\
10247   This~key~will~be~ignored.
10248 }

```

```

10249 \@@_msg_new:nn { bottomrule-without-booktabs }
10250 {
10251   booktabs-not-loaded.\\
10252   You-can't-use-the-key-'tabular/bottomrule'~because~you-haven't~
10253   loaded-'booktabs'.\\
10254   This-key~will~be~ignored.
10255 }

10256 \@@_msg_new:nn { enumitem-not-loaded }
10257 {
10258   enumitem-not-loaded. \\
10259   You-can't-use-the-command- \token_to_str:N \tabularnote \
10260   ~because~you-haven't-loaded-'enumitem'. \\
10261   All-the-commands- \token_to_str:N \tabularnote \ will-be-
10262   ignored-in-the-document.
10263 }

10264 \@@_msg_new:nn { tikz-without-tikz }
10265 {
10266   Tikz-not-loaded. \\
10267   You-can't-use-the-key-'tikz'~here~because~Tikz-is-not-
10268   loaded.~If~you-go-on,~that-key~will~be~ignored.
10269 }

10270 \@@_msg_new:nn { tikz-in-custom-line-without-tikz }
10271 {
10272   Tikz-not-loaded. \\
10273   You-have-used-the-key-'tikz'~in~the~definition~of~a~
10274   customized-line~(with~'custom-line')~but~tikz-is-not-loaded.~
10275   You~can~go~on~but~you~will~have~another~error~if~you~actually~
10276   use~that~custom~line.
10277 }

10278 \@@_msg_new:nn { tikz-in-borders-without-tikz }
10279 {
10280   Tikz-not-loaded. \\
10281   You~have~used~the~key~'tikz'~in~a~key~'borders'~(of~a~
10282   command~' \token_to_str:N \Block ')~but~tikz-is-not-loaded.~
10283   That~key~will~be~ignored.
10284 }

10285 \@@_msg_new:nn { color-in-custom-line-with-tikz }
10286 {
10287   Erroneous-use.\\
10288   In~a~'custom-line',~you~have~used~both~'tikz'~and~'color',~
10289   which~is~forbidden~(you~should~use~'color'~inside~the~key~'tikz').~
10290   The~key~'color'~will~be~discarded.
10291 }

10292 \@@_msg_new:nn { Wrong-last-row }
10293 {
10294   Wrong-number.\\
10295   You~have~used~'last-row= \int_use:N \l_@@_last_row_int '~but~your~
10296   \@@_full_name_env: \ seems~to~have~ \int_use:N \c@iRow \ rows.~
10297   If~you~go~on,~the~value~of~ \int_use:N \c@iRow \ will~be~used~for~
10298   last~row~but~you~should~correct~your~code.~You~can~avoid~this~
10299   problem~by~using~'last-row'~without~value~(more~compilations~
10300   might~be~necessary).
10301 }

10302 \@@_msg_new:nn { Yet-in-env }
10303 {
10304   Nested-environments.\\
10305   Environments~of~nicematrix~can't~be~nested.\\
10306   This~error~is~fatal.
10307 }

10308 \@@_msg_new:nn { Outside-math-mode }

```

```

10309 {
10310   Outside~math~mode.\\
10311   The~`@@_full_name_env: \ can-be-used-only-in-math-mode~
10312   (and-not-in~ \token_to_str:N \vcenter ).\\
10313   This~error~is~fatal.
10314 }
10315 \@@_msg_new:nn { One-letter~allowed }
10316 {
10317   Bad~name.\\
10318   The~value~of~key~' \l_keys_key_str ' ~must~be~of~length~1~and~
10319   you~have~used~' \l_keys_value_tl '.\\
10320   It~will~be~ignored.
10321 }
10322 \@@_msg_new:nn { TabularNote~in~CodeAfter }
10323 {
10324   Environment~`\{TabularNote\}`~forbidden.\\
10325   You~must~use~`\{TabularNote\}`~at~the~end~of~your~`\{NiceTabular\}`~
10326   but~*before*~the~ \token_to_str:N \CodeAfter . \\
10327   This~environment~`\{TabularNote\}`~will~be~ignored.
10328 }
10329 \@@_msg_new:nn { varwidth~not~loaded }
10330 {
10331   varwidth~not~loaded.\\
10332   You~can't~use~the~column~type~'V'~because~'varwidth'~is~not~
10333   loaded.\\
10334   Your~column~will~behave~like~'p'.
10335 }
10336 \@@_msg_new:nn { varwidth~not~loaded~in~X }
10337 {
10338   varwidth~not~loaded.\\
10339   You~can't~use~the~key~'V'~in~your~column~'X'~
10340   because~'varwidth'~is~not~loaded.\\
10341   It~will~be~ignored. \\
10342 }
10343 \@@_msg_new:nnn { Unknown~key~for~RulesBis }
10344 {
10345   Unknown~key.\\
10346   Your~key~' \l_keys_key_str ' ~is~unknown~for~a~rule.\\
10347   \c_@@_available_keys_str
10348 }
10349 {
10350   The~available~keys~are~(in~alphabetic~order):~
10351   color,~
10352   dotted,~
10353   multiplicity,~
10354   sep-color,~
10355   tikz,~and~total-width.
10356 }
10357
10358 \@@_msg_new:nnn { Unknown~key~for~Block }
10359 {
10360   Unknown~key. \\
10361   The~key~' \l_keys_key_str ' ~is~unknown~for~the~command~
10362   \token_to_str:N \Block . \\
10363   It~will~be~ignored. \\
10364   \c_@@_available_keys_str
10365 }
10366 {
10367   The~available~keys~are~(in~alphabetic~order):~&~in~blocks,~ampersand~in~blocks,~
10368   b,~B,~borders,~c,~draw,~fill,~hlines,~hvlines,~l,~line-width,~name,~
10369   opacity,~rounded~corners,~r,~respect~arraystretch,~t,~T,~tikz,~transparent~
```

```

10370     and~vlines.
10371 }
10372 \@@_msg_new:nnn { Unknown~key~for~Brace }
10373 {
10374     Unknown~key.\\
10375     The~key~' \l_keys_key_str '~is~unknown~for~the~commands~
10376     \token_to_str:N \UnderBrace \ and~ \token_to_str:N \OverBrace . \\
10377     It~will~be~ignored. \\
10378     \c_@@_available_keys_str
10379 }
10380 {
10381     The~available~keys~are~(in~alphabetic~order):~color,~left~shorten,~
10382     right~shorten,~shorten~(which~fixes~both~left~shorten~and~
10383     right~shorten)~and~yshift.
10384 }

10385 \@@_msg_new:nnn { Unknown~key~for~CodeAfter }
10386 {
10387     Unknown~key.\\
10388     The~key~' \l_keys_key_str '~is~unknown.\\
10389     It~will~be~ignored. \\
10390     \c_@@_available_keys_str
10391 }
10392 {
10393     The~available~keys~are~(in~alphabetic~order):~
10394     delimiters/color,~
10395     rules~(with~the~subkeys~'color'~and~'width'),~
10396     sub-matrix~(several~subkeys)~
10397     and~xdots~(several~subkeys).~
10398     The~latter~is~for~the~command~ \token_to_str:N \line .
10399 }

10400 \@@_msg_new:nnn { Unknown~key~for~CodeBefore }
10401 {
10402     Unknown~key.\\
10403     The~key~' \l_keys_key_str '~is~unknown.\\
10404     It~will~be~ignored. \\
10405     \c_@@_available_keys_str
10406 }
10407 {
10408     The~available~keys~are~(in~alphabetic~order):~
10409     create-cell-nodes,~
10410     delimiters/color~and~
10411     sub-matrix~(several~subkeys).
10412 }

10413 \@@_msg_new:nnn { Unknown~key~for~SubMatrix }
10414 {
10415     Unknown~key.\\
10416     The~key~' \l_keys_key_str '~is~unknown.\\
10417     That~key~will~be~ignored. \\
10418     \c_@@_available_keys_str
10419 }
10420 {
10421     The~available~keys~are~(in~alphabetic~order):~
10422     'delimiters/color',~
10423     'extra-height',~
10424     'hlines',~
10425     'hvlines',~
10426     'left-xshift',~
10427     'name',~
10428     'right-xshift',~
10429     'rules'~(with~the~subkeys~'color'~and~'width'),~
10430     'slim',~
10431     'vlines'~and~'xshift'~(which~sets~both~'left-xshift'~

```

```

10432     and~'right-xshift').\\
10433 }
10434 \\@@_msg_new:nnn { Unknown~key~for~notes }
10435 {
10436     Unknown~key.\\
10437     The~key~' \\l_keys_key_str '~is~unknown.\\\
10438     That~key~will~be~ignored. \\\
10439     \\c_@@_available_keys_str
10440 }
10441 {
10442     The~available~keys~are~(in~alphabetic~order):~\\
10443     bottomrule,~\\
10444     code~after,~\\
10445     code~before,~\\
10446     detect~duplicates,~\\
10447     enumitem~keys,~\\
10448     enumitem~keys~para,~\\
10449     para,~\\
10450     label~in~list,~\\
10451     label~in~tabular~and~\\
10452     style.
10453 }
10454 \\@@_msg_new:nnn { Unknown~key~for~RowStyle }
10455 {
10456     Unknown~key.\\
10457     The~key~' \\l_keys_key_str '~is~unknown~for~the~command~\\
10458     \\token_to_str:N \\RowStyle . \\\
10459     That~key~will~be~ignored. \\\
10460     \\c_@@_available_keys_str
10461 }
10462 {
10463     The~available~keys~are~(in~alphabetic~order):~\\
10464     bold,~\\
10465     cell~space~top~limit,~\\
10466     cell~space~bottom~limit,~\\
10467     cell~space~limits,~\\
10468     color,~\\
10469     fill~(alias:~rowcolor),~\\
10470     nb~rows,~\\
10471     opacity~and~\\
10472     rounded~corners.
10473 }
10474 \\@@_msg_new:nnn { Unknown~key~for~NiceMatrixOptions }
10475 {
10476     Unknown~key.\\
10477     The~key~' \\l_keys_key_str '~is~unknown~for~the~command~\\
10478     \\token_to_str:N \\NiceMatrixOptions . \\\
10479     That~key~will~be~ignored. \\\
10480     \\c_@@_available_keys_str
10481 }
10482 {
10483     The~available~keys~are~(in~alphabetic~order):~\\
10484     &~in~blocks,~\\
10485     allow~duplicate~names,~\\
10486     ampersand~in~blocks,~\\
10487     caption~above,~\\
10488     cell~space~bottom~limit,~\\
10489     cell~space~limits,~\\
10490     cell~space~top~limit,~\\
10491     code~for~first~col,~\\
10492     code~for~first~row,~\\
10493     code~for~last~col,~\\
10494     code~for~last~row,~\\

```

```

10495 corners,~
10496 custom-key,~
10497 create-extra-nodes,~
10498 create-medium-nodes,~
10499 create-large-nodes,~
10500 custom-line,~
10501 delimiters~(several~subkeys),~
10502 end-of-row,~
10503 first-col,~
10504 first-row,~
10505 hlines,~
10506 hvlines,~
10507 hvlines-except-borders,~
10508 last-col,~
10509 last-row,~
10510 left-margin,~
10511 light-syntax,~
10512 light-syntax-expanded,~
10513 matrix/columns-type,~
10514 no-cell-nodes,~
10515 notes~(several~subkeys),~
10516 nullify-dots,~
10517 pgf-node-code,~
10518 renew-dots,~
10519 renew-matrix,~
10520 respect-arraystretch,~
10521 rounded-corners,~
10522 right-margin,~
10523 rules~(with~the~subkeys~'color'~and~'width'),~
10524 small,~
10525 sub-matrix~(several~subkeys),~
10526 vlines,~
10527 xdots~(several~subkeys).
10528 }

```

For '{NiceArray}', the set of keys is the same as for {NiceMatrix} except that there is no `l` and `r`.

```

10529 \@@_msg_new:nnn { Unknown~key~for~NiceArray }
10530 {
10531   Unknown~key.\\
10532   The~key~' \l_keys_key_str '~is~unknown~for~the~environment~\\
10533   \{NiceArray\}. \\
10534   That~key~will~be~ignored. \\
10535   \c_@@_available_keys_str
10536 }
10537 {
10538   The~available~keys~are~(in~alphabetic~order):~\\
10539   &-in-blocks,~
10540   ampersand-in-blocks,~
10541   b,~
10542   baseline,~
10543   c,~
10544   cell-space-bottom-limit,~
10545   cell-space-limits,~
10546   cell-space-top-limit,~
10547   code-after,~
10548   code-for-first-col,~
10549   code-for-first-row,~
10550   code-for-last-col,~
10551   code-for-last-row,~
10552   columns-width,~
10553   corners,~
10554   create-extra-nodes,~
10555   create-medium-nodes,~

```

```

10556   create-large-nodes,~
10557   extra-left-margin,~
10558   extra-right-margin,~
10559   first-col,~
10560   first-row,~
10561   hlines,~
10562   hvlines,~
10563   hvlines-except-borders,~
10564   last-col,~
10565   last-row,~
10566   left-margin,~
10567   light-syntax,~
10568   light-syntax-expanded,~
10569   name,~
10570   no-cell-nodes,~
10571   nullify-dots,~
10572   pgf-node-code,~
10573   renew-dots,~
10574   respect-arraystretch,~
10575   right-margin,~
10576   rounded-corners,~
10577   rules~(with~the~subkeys~'color'~and~'width'),~
10578   small,~
10579   t,~
10580   vlines,~
10581   xdots/color,~
10582   xdots/shorten-start,~
10583   xdots/shorten-end,~
10584   xdots/shorten-and~
10585   xdots/line-style.
10586 }

```

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`).

```

10587 \@@_msg_new:nnn { Unknown~key~for~NiceMatrix }
10588 {
10589   Unknown~key.\\
10590   The~key~' \l_keys_key_str '~is~unknown~for~the~
10591   \@@_full_name_env: . \\%
10592   That~key~will~be~ignored. \\
10593   \c_@@_available_keys_str
10594 }
10595 {
10596   The~available~keys~are~(in~alphabetic~order):~
10597   &-in-blocks,~
10598   ampersand-in-blocks,~
10599   b,~
10600   baseline,~
10601   c,~
10602   cell-space-bottom-limit,~
10603   cell-space-limits,~
10604   cell-space-top-limit,~
10605   code-after,~
10606   code-for-first-col,~
10607   code-for-first-row,~
10608   code-for-last-col,~
10609   code-for-last-row,~
10610   columns-type,~
10611   columns-width,~
10612   corners,~
10613   create-extra-nodes,~
10614   create-medium-nodes,~
10615   create-large-nodes,~
10616   extra-left-margin,~

```

```

10617 extra-right-margin,~
10618 first-col,~
10619 first-row,~
10620 hlines,~
10621 hvlines,~
10622 hvlines-except-borders,~
10623 l,~
10624 last-col,~
10625 last-row,~
10626 left-margin,~
10627 light-syntax,~
10628 light-syntax-expanded,~
10629 name,~
10630 no-cell-nodes,~
10631 nullify-dots,~
10632 pgf-node-code,~
10633 r,~
10634 renew-dots,~
10635 respect-arraystretch,~
10636 right-margin,~
10637 rounded-corners,~
10638 rules~(with~the~subkeys~'color'~and~'width'),~
10639 small,~
10640 t,~
10641 vlines,~
10642 xdots/color,~
10643 xdots/shorten-start,~
10644 xdots/shorten-end,~
10645 xdots/shorten-and~
10646 xdots/line-style.
10647 }
10648 \@@_msg_new:nnn { Unknown-key-for-NiceTabular }
10649 {
10650   Unknown-key.\\
10651   The~key~' \l_keys_key_str '~is~unknown~for~the~environment~\\
10652   \{NiceTabular\}. \\
10653   That~key~will~be~ignored. \\
10654   \c_@@_available_keys_str
10655 }
10656 {
10657   The~available~keys~are~(in~alphabetic~order):~\\
10658   &-in-blocks,~
10659   ampersand-in-blocks,~
10660   b,~
10661   baseline,~
10662   c,~
10663   caption,~
10664   cell-space-bottom-limit,~
10665   cell-space-limits,~
10666   cell-space-top-limit,~
10667   code-after,~
10668   code-for-first-col,~
10669   code-for-first-row,~
10670   code-for-last-col,~
10671   code-for-last-row,~
10672   columns-width,~
10673   corners,~
10674   custom-line,~
10675   create-extra-nodes,~
10676   create-medium-nodes,~
10677   create-large-nodes,~
10678   extra-left-margin,~
10679   extra-right-margin,~

```

```

10680   first-col,~
10681   first-row,~
10682   hlines,~
10683   hvlines,~
10684   hvlines-except-borders,~
10685   label,~
10686   last-col,~
10687   last-row,~
10688   left-margin,~
10689   light-syntax,~
10690   light-syntax-expanded,~
10691   name,~
10692   no-cell-nodes,~
10693   notes~(several~subkeys),~
10694   nullify-dots,~
10695   pgf-node-code,~
10696   renew-dots,~
10697   respect-arraystretch,~
10698   right-margin,~
10699   rounded-corners,~
10700   rules~(with~the~subkeys~'color'~and~'width'),~
10701   short-caption,~
10702   t,~
10703   tabularnote,~
10704   vlines,~
10705   xdots/color,~
10706   xdots/shorten-start,~
10707   xdots/shorten-end,~
10708   xdots/shorten-and~
10709   xdots/line-style.
10710 }

10711 \@@_msg_new:nnn { Duplicate~name }
10712 {
10713   Duplicate~name.\\
10714   The~name~' \l_keys_value_tl ' ~is~already~used~and~you~shouldn't~use~
10715   the~same~environment~name~twice.~You~can~go~on,~but,~
10716   maybe,~you~will~have~incorrect~results~especially~
10717   if~you~use~'columns-width=auto'.~If~you~don't~want~to~see~this~
10718   message~again,~use~the~key~'allow-duplicate-names'~in~
10719   ' \token_to_str:N \NiceMatrixOptions '.\\\
10720   \bool_if:NF \g_@@_messages_for_Overleaf_bool
10721     { For~a~list~of~the~names~already~used,~type~H~<return>. }
10722 }
10723 {
10724   The~names~already~defined~in~this~document~are:~
10725   \clist_use:Nnnn \g_@@_names_clist { ~and~ } { ,~ } { ~and~ } .
10726 }

10727 \@@_msg_new:nn { caption-above-in-env }
10728 {
10729   The~key~'caption-above'~must~be~used~in~\token_to_str:N \NiceMatrixOptions.\\\
10730   That~key~will~be~ignored.
10731 }

10732 \@@_msg_new:nn { show-cell-names }
10733 {
10734   There~is~no~key~'show-cell-names'~in~nicematrix.\\\
10735   You~should~use~the~command~\token_to_str:N \ShowCellNames\
10736   in~the~\token_to_str:N \CodeBefore\ or~the~\token_to_str:N
10737   \CodeAfter. \\
10738   That~key~will~be~ignored.
10739 }

10740 \@@_msg_new:nn { Option~auto~for~columns~width }
10741 {

```

```

10742 Erroneous~use.\\
10743 You~can't~give~the~value~'auto'~to~the~key~'columns-width'~here.~
10744 That~key~will~be~ignored.
10745 }

10746 \@@_msg_new:nn { NiceTabularX-without-X }
10747 {
10748   NiceTabularX-without-X.\\
10749   You~should~not~use~\{NiceTabularX\}~without-X~columns.\\
10750   However,~you~can~go~on.
10751 }

10752 \@@_msg_new:nn { Preamble-forgotten }
10753 {
10754   Preamble-forgotten.\\
10755   You~have~probably~forgotten~the~preamble~of~your~
10756   \@@_full_name_env: . \\
10757   This~error~is~fatal.
10758 }

10759 \@@_msg_new:nn { Invalid~col~number }
10760 {
10761   Invalid~column~number.\\
10762   A~color~instruction~in~the~ \token_to_str:N \CodeBefore \
10763   specifies~a~column~which~is~outside~the~array.~It~will~be~ignored.
10764 }

10765 \@@_msg_new:nn { Invalid~row~number }
10766 {
10767   Invalid~row~number.\\
10768   A~color~instruction~in~the~ \token_to_str:N \CodeBefore \
10769   specifies~a~row~which~is~outside~the~array.~It~will~be~ignored.
10770 }

10771 \@@_define_com:NNN p  ( )
10772 \@@_define_com:NNN b  [ ]
10773 \@@_define_com:NNN v  | |
10774 \@@_define_com:NNN V  \|  \|
10775 \@@_define_com:NNN B  \{  \}

```

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