

# **LyX's detailed Figure, Table, Floats, Notes, Boxes and External Material manual**

by the LyX Team\*

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# 1. Figures

## 1.1. Graphics Dialog

To insert an image into your document, place the cursor at the text position you want and click on the toolbar icon  or use the menu **Insert**▷**Graphics**. Then a dialog will appear to choose the file to load. The image will appear in the output exactly at the position where it is in the text.

The graphics dialog can be called at any time by clicking on an image. This dialog has three tabs:

**Graphics** Here you can choose an image file and adjust its appearance in the output.

The available units for the image size are explained in appendix A.

You can rotate images counter-clockwise by setting a rotation angle and a rotation origin. The image will also be rotated inside LyX.

Images can be scaled by using a percentage value or by setting the width and height explicitly. If you set only the width or only the height, the other size will be determined automatically. If you set both, then the image will be transformed to the given size, possibly distorting it. To prevent the image from distortion, use the option **Maintain aspect ratio**. The image will then be scaled so that its width and height don't exceed the specified dimensions.

Images can be opened in a program of your choice by right-clicking on it and choosing the entry **Edit externally** in the context menu. The program can be set for every image format in the file format settings in LyX's preferences.

**Clipping** Alternatively to the usage of scaling units it is possible to set image coordinates to adjust the height and width of the image in the output. The coordinates can also be calculated automatically by pressing the button **Get from File**. The option **Clip to bounding box** will only print the image region within the given coordinates. Normally you don't need to take care about image coordinates and can ignore this tab.

**L<sup>A</sup>T<sub>E</sub>X and LyX options** In this tab you can modify the appearance of the image within LyX and L<sup>A</sup>T<sub>E</sub>X experts can specify additional L<sup>A</sup>T<sub>E</sub>X options.

The option **Draft mode** makes the image appear in the output only as a frame with the size of the image.

The **Don't unzip on export** option only affects zipped EPS-graphics, e. g. *x.eps.gz*. When the option is used the images will not be unzipped on export, since L<sup>A</sup>T<sub>E</sub>X

## 1. Figures

can handle them as they are.

Zipped EPS-graphics are useful to save disk space when you choose PostScript as output format, see appendix B.2. To zip EPS-graphics, use the following commands in a UNIX-shell or a Windows console:

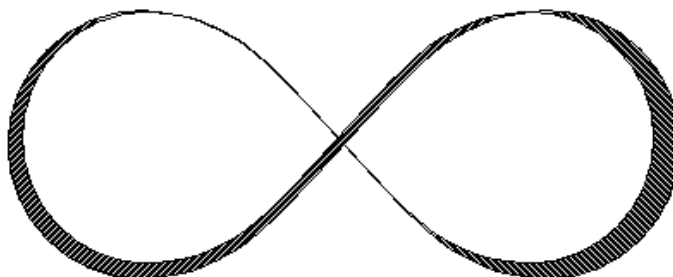
```
gzip x.eps
```

```
zgrep %%BoundingBox x.eps.gz > x.eps.bb
```

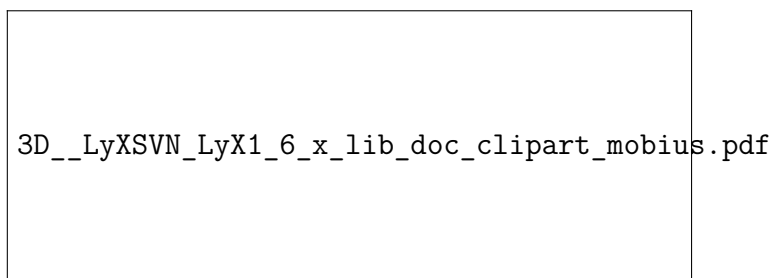
The second command creates the bounding box file “x.eps.bb” that is needed by  $\text{\LaTeX}$  for zipped graphics.

The field **Initialize Group Name** allows you define or join an image settings group. Images within such a group share their settings, so adjusting one image of the group automatically also adjusts all other images of the group in the same way. So you can for example change the size for a bunch of images without the need to manually change each of them. Joining an existing group can also be done using the context menu of the image by checking the name of the desired group.

This is an example image in EPS format<sup>1</sup> within a separate, horizontally centered paragraph:



This is the same image like the one above but in draft mode:



---

<sup>1</sup>Image formats are explained in section 1.3.



## 1.2. Figure Floats

For general explanations about floats, have a look at section 3.1.




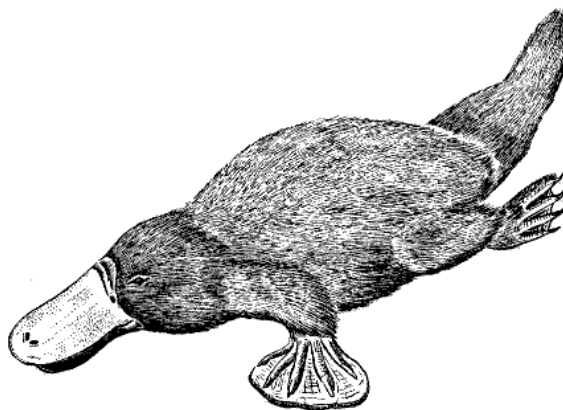
The toolbar button  and the menu **Insert**▷**Float**▷**Figure** inserts a float with a caption that has the label “Figure #:” (# is the actual number). You can insert the image above the caption, like in Figure 1.1 or below the caption, like in Figure 1.2. More about caption placement is described in section 3.10.

Figure 1.1 and 1.2 are examples of referenced figures. Figures can be referenced in the text by referencing their label. To do this insert a label in the caption using the menu **Insert**▷**Label** or the toolbar button . You can now refer to the label using the menu **Insert**▷**Cross reference** or the toolbar button . It is important to use references to floats, rather than using vague references like “the figure above”, because  $\LaTeX$  will reposition the floats in the final document and it might not be “above” at all.

Referencing is explained in detail in section 3.4.

Normally only one image is inserted to a figure float, but sometimes you might want to use two images with separate subcaptions. This can be done by inserting image floats into existing image floats. Note that only the main caption of the float is added to the List of Figures. Figure 1.3 is an example of a figure float with two images set side by side. You can also set the images one below the other. Figure 1.3a and 1.3b are the subfigures.



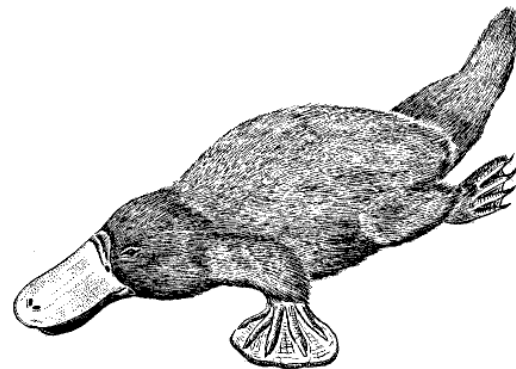
**Figure 1.1.:** A severely distorted platypus in a float.

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**Figure 1.2.:** M.C. Escher on acid.



**(a)** Undefinable structure.



**(b)** A Platypus.

**Figure 1.3.:** Two distorted images. Both images are in the image settings group named “distorted”.

## 1.3. Image Formats

You can insert images in any known file format. But as explained in appendix B, each output document format allows only a few image formats. LyX uses therefore the program `ImageMagick` in the background to convert the images to the right format. To increase your work flow by avoiding these conversions in the background, you can use only the image formats that can directly be embedded in the output file format. The output file formats are explained in appendix B.

Similar to fonts there are two types of image formats:

**Bitmap images** consist of pixel values, often in a compressed form. They are therefore not fully scalable and look pixelated in large zooms. Well-known bitmap image formats are “Graphics Interchange Format” (GIF, file extension “.gif”), “Portable Network Graphics” (PNG, file extension “.png”), and “Joint Photographic Experts Group” (JPG, file extension “.jpg” or “.jpeg”).

**Vector images** consist of vectors and can therefore be scaled to any size without data loss. The scaling ability is necessary if you want to create presentations, because presentations are always scaled by the video projector. Scaling is also useful for online documents to let the user zoom into diagrams.

Well-known scalable image formats are “Scalable Vector Graphics” (SVG, file extension “.svg”), “Encapsulated PostScript” (EPS, file extension “.eps”), “Portable Document Format” (PDF, file extension “.pdf”), and “Windows Metafile” (WMF, file extension “.wmf”). We wrote “can be”, because you can convert any bitmap image to a PDF or EPS-image and the result will still be a bitmap image. In such cases only a header with the image properties is added to the original image<sup>2</sup>. The PDF-files generated by Adobe Photoshop are for example bitmap images.

Normally it is not possible to convert a bitmap image into a scalable one, only vice versa. Only the image formats PDF and EPS can directly be embedded to PDF and PostScript output files, respectively. SVG and WMF-images are recalculated to bitmaps when the output file is generated because there is currently no adequate WMF/SVG→PDF/EPS converter available.


---

<sup>2</sup>In the case of PDF, the original image is additionally compressed.

1. *Figures*

## 2. Tables

### 2.1. Introduction

You can insert a table using either the toolbar button  or the menu **Insert > Table**. The toolbar button offers you a graphical selection: move the mouse to set the column/row number of the table that should be created and then press a mouse button. When you use the menu to create a table, a dialog will appear, asking you for the number of rows and columns.

The default table has lines around any cell and the first row appears separated from the rest of the table. This separation occurs due to a double line: The cells of the first row have a line below them and the cells of the second row have a line above them. Here is an example table:

	1	2	3
A			
B			
C			

### 2.2. Table Dialog

You can alter a table by clicking on it with the right mouse button, which brings up the table dialog. Here you can adjust the settings of that cell and row/column respectively where the cursor is currently placed. Most of the dialog options also work on selections. This means if you select more cells, columns or rows, the action is done for the whole selection. Note that there is a difference between selecting the *contents* of the cell, and the cell itself. You can alter tables with the following tabs of the table dialog:

**Table Settings** Here you can set the horizontal alignment and the width of the current column. When you have set a width you can also adjust the vertical alignment of the current row. A given width will allow the cell to have line breaks and multiple paragraphs of text, see section 2.8.1. If you set no width, the column is as wide as the content of the widest cell. Furthermore, you can mark one or multiple cells of one row as a multicolumn

## 2. Tables

cell, see section 2.8.2.

The rotate check boxes rotate the current cell, a selection, or the whole table counter-clockwise by 90°. The rotation is not shown within LyX, only in the output.

**Note:** Not all DVI-viewers are able to display rotations.

It is also possible to enter a L<sup>A</sup>T<sub>E</sub>X-argument which is needed for special table formattings, see section 2.8.2.2 and 2.11.

**Borders** In this tab you can add and delete border lines for the current row/column.

Using the style option **Formal** will convert the table to a formal table as described in section 2.9.

You can also add here space to table rows as described in section 2.12.1.

**Longtable** This tab is to make a table a so called “*longtable*” that can run over several pages. Sections 2.6 and 2.7 describe the longtable features in detail.

When the table dialog is open, you can move the cursor with the arrow keys from cell to cell and the property of the current cell will immediately be displayed in the dialog.

### 2.3. Table Toolbar

The table toolbar is an alternative to the table dialog to be able to alter tables faster. It should normally appear at the bottom of LyX’s main window when the cursor is inside a table. You can alternatively switch it on to appear always, by right-clicking in LyX’s main menu bar.

The toolbar has the following icons:



adds a row below the current cell or selection



adds a column right beside the current cell or selection



deletes the current row or selection



deletes the current column or selection



adds a line at the top of the current cell / row or of a selection



adds a line at the bottom of the current cell / row or of a selection



adds a line at the left side of the current cell / row or of a selection



adds a line at the right side of the current cell / row or of a selection



adds lines around the current or selected cells - if the current cell no multicolumn cell this also affects the current row and column



deletes all lines of the current or selected cells - if the current cell no multicolumn cell this also affects the current row and column



left-aligns the content of the current cell / column



centers the content of the current cell / column horizontally



right-aligns the content of the current cell / column



aligns the content of the current cell vertically to the top



centers the content of the current cell vertically



aligns the content of the current cell vertically to the bottom



rotates the current cell or selection counter-clockwise by 90°



rotates the whole table counter-clockwise by 90°



sets the current cell or selection as a multicolumn

**Note:** For the output the vertical alignment of the first cell in a row is used for all following cells in the row.

## 2.4. Edit Table Menu

Additionally to the table dialog and toolbar, the menu **Edit**▷**Table** allows you to add and delete border lines for the current row/column and to set the current selection as multicolumn. The menu is only available when the cursor is inside a table.

## 2.5. Table Floats

For general explanations about floats, have a look at section 3.1.

Table floats can be inserted using the menu **Insert**▷**Float**▷**Table** or the toolbar button



The float appears as a collapsible box with a caption that has the label “Table #:” (# is the actual table number). You can insert tables in the float above or below the caption.

**Table 2.1.:** A table float.



1	2	3
Joe	Mary	Ted
$\int x^2 dx$	$\begin{bmatrix} a & b \\ c & d \end{bmatrix}$	$1 + 1 = 2$

Table 2.1 is an example table within a table float.

Having the caption above the table is the common rule that is unfortunately not supported in L<sup>A</sup>T<sub>E</sub>X's standard classes. This means that, if you are using the document classes **article**, **book**, **letter**, or **report**, there will be no space between the caption and the table. To insert the needed space, add the following option to the load command of the L<sup>A</sup>T<sub>E</sub>X-package **caption** in your document preamble<sup>1</sup>:

**tableposition=top**

The package **caption**, which is described in section 3.9, is used to adjust the caption format.

Tables can be cross-referenced in the text by referencing their label. To do this insert a label in the caption using the menu **Insert**▷**Label** or the toolbar button . You can now refer to the label using the menu **Insert**▷**Cross reference** or the toolbar button .

Referencing is explained in detail in section 3.4.

## 2.6. Longtables

If the table is too long to fit on one page, you can use the option **Use long table** in the tab **Longtable** of the table dialog to split the table automatically over more pages. Doing this enables the following options:

**Header:** The current row is defined to be a header row that appears on all pages of the longtable; except for the first page, if **First header** is defined. This is therefore called the main header.

**First header:** The current row is defined to be a header row that appears on the first page of the longtable.

**Footer:** The current row is defined to be a footer row that appears on all pages of the longtable; except for the last page, if **Last footer** is defined.

**Last footer:** The current row is defined to be a footer row that appears on the last page of the longtable.

---

<sup>1</sup>For more information have a look at section 3.10.



**Caption:** The current row contains the table caption. The row is reset as single column and a caption is inserted. More about longtable captions is explained in sec. 2.6.3.

You can also specify a row where the table is split. See the following longtable to see how it works:

<b>Example Phone List (ignore the names)</b>		
<b>NAME</b>		<b>TEL.</b>
<b>Annovi</b>	Silvia	111
<b>Bertoli</b>	Stefano	111
<b>Bozzi</b>	Walter	111
<b>Cachia</b>	Maria	111
<b>Cachia</b>	Maurizio	111
<b>Cinquemani</b>	Giusi	111
<b>Colin</b>	Bernard	111
<b>Concli</b>	Gianfranco	111
<b>Dal Bosco</b>	Carolina	111
<b>Dalpiaz</b>	Annamaria	111
<b>Feliciello</b>	Domenico	111
<b>Focarelli</b>	Paola	111
<b>Galletti</b>	Oreste	111
<b>Gasparini</b>	Franca	111
<b>Rizzardi</b>	Paola	111
<b>Lassini</b>	Giancarlo	111
<b>Malfatti</b>	Luciano	111
<b>Malfatti</b>	Valeriano	111
<b>Meneguzzo</b>	Roberto	111
<b>Mezzadra</b>	Roberto	111
<b>Pirpamer</b>	Erich	111
<b>Pochiesa</b>	Paolo	111, 222
<b>Radina</b>	Claudio	111
<b>Stuffer</b>	Oskar	111
<b>Tacchelli</b>	Ugo	111
<b>Tezzele</b>	Margit	111
<b>Unterkalmsteiner</b>	Frieda	111
<b>Vieider</b>	Hilde	111
<b>Vigna</b>	Jürgen	111
<b>Weber</b>	Maurizio	111

continued on next page

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<b>Example Phone List</b>		
<b>NAME</b>		<b>TEL.</b>
<b>Winkler</b>	Franz	111
<b>Annovi</b>	Silvia	555
<b>Bertoli</b>	Stefano	555
<b>Bozzi</b>	Walter	555
<b>Cachia</b>	Maria	555
<b>Cachia</b>	Maurizio	555
<b>Cinquemani</b>	Giusi	555
<b>Colin</b>	Bernard	555
<b>Concli</b>	Gianfranco	555
<b>Dal Bosco</b>	Carolina	555
<b>Dalpiaz</b>	Annamaria	555
<b>Feliciello</b>	Domenico	555
<b>Focarelli</b>	Paola	555
<b>Galletti</b>	Oreste	555
<b>Gasparini</b>	Franca	555
<b>Rizzardi</b>	Paola	555
<b>Lassini</b>	Giancarlo	555
<b>Malfatti</b>	Luciano	555
<b>Malfatti</b>	Valeriano	555
<b>Meneguzzo</b>	Roberto	555
<b>Mezzadra</b>	Roberto	555
<b>Pirpamer</b>	Erich	555
<b>Pochiesa</b>	Paolo	555, 222
<b>Radina</b>	Claudio	555
<b>Stuffer</b>	Oskar	555
<b>Tacchelli</b>	Ugo	555
<b>Tezzele</b>	Margit	555
<b>Unterkalmsteiner</b>	Frieda	555
<b>Vieider</b>	Hilde	555
<b>Vigna</b>	Jürgen	999
<b>Weber</b>	Maurizio	555
<b>Winkler</b>	Franz	555

end

### 2.6.1. Footnotes in Longtables

Footnotes can be inserted to every longtable cell. They appear at the bottom of the page where the table cell with the footnote appears. Table 2.6 has for example a footnote.

### 2.6.2. Longtable Alignment

Longtables are by default centered. Unlike the alignment of the table columns and rows, the table alignment can currently not be changed in the table dialog. To change the alignment of longtables you have to change the value of the lengths `\LTleft` and `\LTright` by inserting this line as T<sub>E</sub>X-Code before the corresponding longtable:

```
\setlength{\LTleft}{value}
```

where the value can have any of the units listed in Table A.1. `\LTleft` controls the horizontal distance from the left page border to the longtable, `\LTright` the distance from the right side. The default value for both lengths is `\fill`, which is in this case the same as an horizontal fill in L<sub>A</sub>T<sub>E</sub>X.

The following longtable was left-aligned by setting `\LTleft` to 0 pt.

1	2	3	4	5
asd	s	s	s	asd
asd	s	s	s	asd
asd	s	s	s	asd
asd	asd	asd	asd	asd

### 2.6.3. Longtable Captions

A longtable cannot be put into a table float because floats can only be on one page. But the caption environment of floats can also be used for longtables when you use the longtable option `Caption` as described in sec. 2.6. Only one table row can contain the caption.

Here is a short longtable to see how it works:

**Table 2.2.:** Longtable with caption

1	2	3	4	5
asd	s	s	s	asd
asd	s	s	s	asd
asd	s	s	s	asd
asd	asd	asd	asd	asd

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**Note 1:** The table number is increased for every longtable, even if you did not set a caption for it. For this reason you could have the case that e. g. Table 2.4 follows Table 2.1 in the list of tables if there are two longtables without captions. To avoid this you can add the following command in T<sub>E</sub>X-Code after every longtable without a caption:

```
\addtocounter{table}{-1}
```

This is not needed when none of your longtables have a caption and you add the following code to the document preamble:

```
\let\myEnd\endlongtable
\renewcommand{\endlongtable}{\myEnd\addtocounter{table}{-1}}
```

**Note 2:** If you are using `hyperref` in the PDF Properties of the Document Settings dialog to link cross-references, the link to a longtable caption will always point to the beginning of the document.

### 2.6.3.1. References to Longtables

**Table 2.3.:** Referenced longtable

1	2	3	4	5
asd	s	s	s	asd
asd	s	s	s	asd
asd	s	s	s	asd
asd	sad	asd	asd	asd

To reference a longtable, insert a label into the caption.

This is a reference to Table 2.3.

The caption layout can be set together with all other captions of your document using the L<sup>A</sup>T<sub>E</sub>X-package `caption`, see section 3.9.

### 2.6.3.2. Caption Width

The maximal width of of caption lines is defined by the length `\LTcapwidth`. Its default value is 4in. To change it add the following command to your document preamble or as T<sub>E</sub>X-Code into your document before the longtable that should be affected

```
\setlength{\LTcapwidth}{width}
```

where the width could have one of the units listed in appendix A.

The following tables show the difference:

**Table 2.4.:** long full title with default width long full title with default width long full title with default width

1	2	3	4	5
asd	s	s	s	asd
asd	s	s	s	asd
asd	s	s	s	asd
asd	sad	asd	asd	asd

**Table 2.5.:** long full title with width set to 5 cm long full title with width set to 5 cm long full title with width set to 5 cm

1	2	3	4	5
asd	s	s	s	asd
asd	s	s	s	asd
asd	s	s	s	asd
asd	sad	asd	asd	asd

**Note:** When the  $\LaTeX$ -package **caption** is used, as in this document, the full page width is used for the caption when you use the default value of 4 in for `\LTcapwidth`. To get in this case exactly a 4 in wide caption, you can either use a value slightly different from 4.0 in, e. g. 3.99 in, or the  $\LaTeX$ -command `\captionsetup{width=value}` that is provided by the **caption**-package.

### 2.6.3.3. Different Captions for Table Pages

When the table captions for the following pages should differ from the one of the first table page, insert a caption with the  $\TeX$  code command

```
\caption*{caption text}\%
```

in a dummy caption row that is marked as a header. Table 2.6 is an example of a longtable with different heading where the second caption doesn't include the table number.

**Table 2.6.:** Example Phone List

<b>Example Phone List (ignore the names)</b>		
<b>NAME</b>		<b>TEL.</b>
<b>Annovi</b>	Silvia	111
<b>Bertoli</b>	Stefano	111
<b>Bozzi</b>	Walter	111
<b>Cachia</b>	Maria	111
<b>Cachia</b>	Maurizio	111
<b>Cinquemani</b>	Giusi	111
<b>Colin</b>	Bernard	111
<b>Concli</b>	Gianfranco	111
<b>Dal Bosco</b>	Carolina	111
<b>Dalpiaz</b>	Annamaria	111
<b>Feliciello</b>	Domenico	111
<b>Focarelli</b>	Paola	111
<b>Galletti</b>	Oreste	111
<b>Gasparini</b>	Franca	111
<b>Rizzardi<sup>2</sup></b>	Paola	111
<b>Lassini</b>	Giancarlo	111
<b>Malfatti</b>	Luciano	111
<b>Malfatti</b>	Valeriano	111
<b>Meneguzzo</b>	Roberto	111
<b>Mezzadra</b>	Roberto	111
<b>Pirpamer</b>	Erich	111
<b>Pochiesa</b>	Paolo	111, 222
<b>Radina</b>	Claudio	111
<b>Stuffer</b>	Oskar	111
<b>Tacchelli</b>	Ugo	111
<b>Tezzele</b>	Margit	111
<b>Unterkalmsteiner</b>	Frieda	111
<b>Vieider</b>	Hilde	111
<b>Vigna</b>	Jürgen	111
<b>Weber</b>	Maurizio	111
<b>Winkler</b>	Franz	111

continued on next page

---

<sup>2</sup>Example footnote

Continued Example Phone List

<b>Example Phone List</b>		
<b>NAME</b>		<b>TEL.</b>
<b>Annovi</b>	Silvia	555
<b>Bertoli</b>	Stefano	555
<b>Bozzi</b>	Walter	555
<b>Cachia</b>	Maria	555
<b>Cachia</b>	Maurizio	555
<b>Cinquemani</b>	Giusi	555
<b>Colin</b>	Bernard	555
<b>Concli</b>	Gianfranco	555
<b>Dal Bosco</b>	Carolina	555
<b>Dalpiaz</b>	Annamaria	555
<b>Feliciello</b>	Domenico	555
<b>Focarelli</b>	Paola	555
<b>Galletti</b>	Oreste	555
<b>Gasparini</b>	Franca	555
<b>Rizzardi</b>	Paola	555
<b>Lassini</b>	Giancarlo	555
<b>Malfatti</b>	Luciano	555
<b>Malfatti</b>	Valeriano	555
<b>Meneguzzo</b>	Roberto	555
<b>Mezzadra</b>	Roberto	555

## 2.7. Special Longtable Issues

### 2.7.1. Longtable Calculation

$\text{\LaTeX}$  calculates the height of table pages and their page breaks using so called chunks. Chunks are parts of tables that held at the same time in  $\text{\LaTeX}$ 's memory. The default value was historically set to only 20 table rows. If you are using longtables with many pages this may slow down the creation of your document. You can safely increase the chunk size to values of 100-1000 by adding this command line to your document preamble:

```
\setcounter{LTchunksize}{100}
```

### 2.7.2. Floats and Longtables

There might be problems when a float appears on the same page where a longtable starts. To avoid such a situation, insert a “clear page” (menu **Insert**▷**Formatting**▷**Clear Page**) before your longtable.

### 2.7.3. Forced Page Breaks

By default tables are only broken between rows. If you have a cell with multiples lines and want to have a page break within the cell, insert the new line command “`\`” as T<sub>E</sub>X-Code at the point of the cell where it can be broken. Before the `\` command you have to insert in T<sub>E</sub>X-Code as many “`&`” characters as the number of the following table columns. The `&` is the character to separate table cells. Write in T<sub>E</sub>X-Code after each `&` the content of the corresponding following cell and delete the content of these cells.

After the `\` command, insert as many `&` characters as the number of table columns before the current column. In Table 2.7 the cell that should be broken is in the second column followed by another column. Therefore the following command was inserted in the cell as T<sub>E</sub>X-Code after “*Castelchiodato*,”:

```
& 111\ \newpage
&
```

The “111” in the third column of the row was deleted. `\newpage` is only needed when a page break should definitely occur at this position, otherwise it would be a conditional break. If your footer row of the longtable has for a certain reason no upper line but you would have a horizontal line where the cell is broken, use this command instead:

```
& 111\
\hline &
```

When the cell to be broken is in the last column, the command

```
\setlength{\parfillskip}{0pt}
```

must be inserted as T<sub>E</sub>X-Code at the beginning of the cell. This ensures that the part of the cell that will be displayed on the new page appears with the full width.

**Table 2.7.:** Table with forced page break in table cell

Example Phone List (ignore the names)		
	NAME	TEL.
Annovi	Silvia	111
Bertoli	Stefano	111

continued on next page



## Continued Example Phone List

<b>Example Phone List</b>		
	<b>NAME</b>	<b>TEL.</b>
<b>Bozzi</b>	Walter	111
<b>Cachia</b>	Maria	111
<b>Cachia</b>	Maurizio	111
<b>Cinquemani</b>	Giusi	111
<b>Colin</b>	Bernard	111
<b>Concli</b>	Gianfranco	111
<b>Dal Bosco</b>	Carolina	111
<b>Dalpiaz</b>	Annamaria	111
<b>Feliciello</b>	Domenico	111
<b>Focarelli</b>	Paola	111
<b>Galletti</b>	Oreste	111
<b>Gasparini</b>	Franca	111
<b>Lassini</b>	Giancarlo	111
<b>Malfatti</b>	Luciano	111
<b>Malfatti</b>	Valeriano	111
<b>Meneguzzo</b>	Roberto	111
<b>Mezzadra</b>	Roberto	111
<b>Pirpamer</b>	Erich	111
<b>Pochiesa</b>	Paolo	111, 222
<b>Radina</b>	Claudio	111
<b>Rizzardi</b>	Paolo, 11. Fürst von Montecompatri, 11. Fürst von Sulmona und Vivaro, 10. Fürst von Rossano, 5. Herzog von Canemorte, 11. Herzog von Palombara, 5. Herzog von Castelchiodato,	111

continued on next page

## Continued Example Phone List

<b>Example Phone List</b>		
	<b>NAME</b>	<b>TEL.</b>
	11. Herzog von Poggionativo, 11. Markis von Mentana, Norma, Civitella, Pratica, Moricone und Percille, 11. Graf von Valinfreda, 11. Baron von Cropalati, 11. Herr von Scarpa, Edelmann von Rom, Patrizier von Venedig, Neapel und Genua	
<b>Stuffer</b>	Oskar	111
<b>Tacchelli</b>	Ugo	111
<b>Tezzele</b>	Margit	111
<b>Unterkalmsteiner</b>	Frieda	111
<b>Vieider</b>	Hilde	111
<b>Vigna</b>	Jürgen	111
<b>Weber</b>	Maurizio	111
<b>Winkler</b>	Franz	111

## 2.8. Multiple Lines Columns and Rows

### 2.8.1. Multiple Lines in Table Cells

**Table 2.8.:** Table with multiple lines in cells

multiple lines	b	c
d	e	f
g	h	i

Setting a fixed width for a column enables you to enter text as a paragraph with multiple lines and hyphenation.

To produce Table 2.8, create a 3×3 table, mark the first cell and right-click on it. In the appearing table dialog we set a cell width of 2.5 cm and choose centered for the vertical and horizontal alignment. The vertical alignment is used for all cells of the row. As our text is smaller than 2.5 cm, only one line will appear. To get two lines, a justified line break (shortcut **Ctrl+Shift+Return**) was added. If the text is wider than the set cell width, it will automatically be broken to several lines.

If you have a long word in a cell with a fixed width, it cannot be hyphenated by  $\text{\LaTeX}$  if it is the first entry. Therefore you need to insert something to prevent the word not being the first entry. So add a horizontal space of 0 pt before the word. As the space is zero, it doesn't change the output. Table 2.9 shows the effect.


**Table 2.9.:** Table with and without hyphenation

verylongtablecell word	b	c
d	e	f
g	h	i

very- longtablecell- word	b	c
d	e	f
g	h	i

## 2.8.2. Multicolumns

### 2.8.2.1. Multicolumn Basics

To merge cells over multiple columns, select as many cells within a row as you want to merge and use either the table-toolbar button , or the menu **Edit**▷**Table**▷

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**Multicolumn**, or right click on the marked cells and choose **Multicolumn** in the appearing context menu.

Multicolumns have their own cell settings. That means changing cell borders, cell alignment, and the width only affects the multicolumn. Here is an example table with a multicolumn cell in the first row and one in the last row without the upper border:

abc	def ghi		jkl
A	B	C	D
1	2	3	4

### 2.8.2.2. Multicolumn Calculations

LyX supports multicolumns directly, but we have to take account of the cell width of the columns spanned by the multicolumn cell.

**Table 2.10.:** Table with centered multicolumn text above two columns that have exactly half the width of the multicolumn cell

multiple lines multicolumn		c
d	e	f
g	h	i

To create for example Table 2.10, mark the first two cells in the first row of a  $3 \times 3$  table and right-click on them. Now choose for this cell *multicolumn*, *centered alignment* and a width of 2.5 cm in the table dialog. The merged columns should have exactly half the width of the multicolumn cell, so that you would set a width of 1.25 cm for the first column. The second column has then automatically a width of 1.25 cm (multicolumn width - width of first column). This was done for Table 2.11.

You can see that the first column is not half the width of the multicolumn cell, it is a bit bigger. The reason is that the specified width of a cell  $W_g$  is not its total width

**Table 2.11.:** Table where the spanned table columns are not exactly half the width of the multicolumn cell

multiple lines multicolumn		c
d	e	f
g	h	i

$W_{\text{tot}}$  because a cell is always a bit larger than specified. Appendix (C) explains this in detail.

The width  $W_{gn}$  which the user needs to set when  $n$  columns are spanned can be calculated, so that each column has a total width of  $W_{\text{tot multicolumn}}/n$ :

$$W_{gn} = (W_{g\text{ multicolumn}} + (1 - n) \cdot (12.4 \text{ pt})) / n \quad (2.1)$$

In our case we have  $n = 2$ ,  $W_{g\text{ multicolumn}} = 2.5 \text{ cm}$  and the default values for the lengths, so that equation 2.1 becomes

$$W_{g2} = 1.25 \text{ cm} - 6.2 \text{ pt} \quad (2.2)$$

To enable calculations in L<sup>A</sup>T<sub>E</sub>X, the L<sup>A</sup>T<sub>E</sub>X-package **calc** must be loaded with the document preamble line

```
\usepackage{calc}
```

LyX does not allow you to calculate lengths in the **Width** field of the table dialog. Therefore you have to format the column by inserting a L<sup>A</sup>T<sub>E</sub>X-argument in the dialog. Here is an overview about the arguments:

- **p{width}** creates cell with a fixed width, its text is vertically top-aligned
- **m{width}** creates cell with a fixed width, its text is vertically centered
- **b{width}** creates cell with a fixed width, its text is vertically bottom-aligned

By entering a L<sup>A</sup>T<sub>E</sub>X-argument, all cell settings set in the table dialog are overwritten.

**Note:** Due to a bug, LyX shows the overwritten settings anyway.

As the text should be horizontally centered, the command **\centering** is added. You can now enter the following L<sup>A</sup>T<sub>E</sub>X-argument for the first spanned column:

```
>\centeringm{1.25cm-6.2pt}
```

The command **>{ }** means, that the commands inside the braces are applied before the cell is created.

Although we have chosen centered alignment for the text of the multicolumn cell, it is still left aligned. This is because LyX only applies the alignment to single columns. So for the multicolumn cell we have to use the L<sup>A</sup>T<sub>E</sub>X-argument

```
>\centeringm{2.5cm}
```

### 2.8.3. Multirows

Unlike multicolumns multirows are not yet supported by LyX; so a bit of T<sub>E</sub>X-Code needs to be used. To use multirows load the L<sup>A</sup>T<sub>E</sub>X-package **multirow** in your document preamble with the command

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`\usepackage{multirow}`

Multirows are created with the command

`\multirow{number of rows}{cell width}{cell entry}`

To create the following table:

a	b	c
multirow	e	f
entry	h	i

create a 3×3 table. Unset the upper border of the last cell in the first column. The multirow is now created in the second row of the first column by inserting there the command

`\multirow{2}{2.5cm}{`

as `\TeX`-Code. According to the command parameters the multirow spans now two rows and has a width of 2.5 cm. The content of the multirow cell follows outside the `\TeX`-Code box and the command is finished with a right brace `}` in another `\TeX`-Code-box after the text.

`\multirow` left-aligns its content by default. To override the default, renew the command `\multirowsetup` with the command

`\renewcommand{\multirowsetup}{\centering}`

in `\TeX`-Code in the document preamble. Then all entries of multirow cells in the document are centered. If centering is only needed for several tables, you can renew the command in a `\TeX`-Code box just before the table instead of the preamble. If the text should be right-aligned, replace `\centering` by `\raggedleft`. To return to left-alignment `\raggedright` is used.

## 2.9. Formal Tables

Tables are often typeset in books similar to Table 2.12. This kind of tables is called “*formal*”. To make a table a formal table use the option **Formal** in the **Borders** tab of the table dialog.

Spaces to table rows can be added using the **Borders** tab of the table dialog as described in section 2.12.1.

Unlike normal tables, formal tables have no vertical table lines. The horizontal table lines can be set as for normal tables but they appear with different widths in the output:

The first and the last table line have a default width of 0.08 em while the other lines have a default width of 0.05 em.

**Table 2.12.:** Example booktabs-table

System	Medipix 1	Medipix 2	
Detector thickness [ $\mu\text{m}$ ]	300	300	700
Edge angle [ $^\circ$ ]	3.55	2.71	7.99
Spatial resolution [ $\mu\text{m}$ ]	4.26	10.17	10.56
MTF at $f_{\text{max}}$	0.53	0.37	0.39
LSF-spatial resolution			
in $\mu\text{m}$	129.7	52.75	50.78
in % of pixel size	76.3	95.9	92.3

The default widths can be changed with the following preamble lines

```
\let\mytoprule\toprule
\renewcommand{\toprule}{\mytoprule[width]}
```

This example is for the first line, the so called **toprule**. If you want to change the width for the last line, replace **toprule** by **bottomrule**. To change the width for the other lines replace **toprule** by **midrule**. You can use all units listed in appendix A to set the width.

Lines that do not span all table columns can be created by setting a table line for multicolumn cells.  $\text{L}\text{Y}\text{X}$  will then internally use the command `\cmidrule` to create this line. Its full scheme is

```
\cmidrule[width](trim){startcol-endcol}
```

The options of `\cmidrule` are currently not supported by  $\text{L}\text{Y}\text{X}$  so you have to use  $\text{T}\text{E}\text{X}$ -Code to be able to use them. `\cmidrulers` can manually be created by inserting the command as  $\text{T}\text{E}\text{X}$ -Code as the first cell entry of the first cell of a row. The line is then drawn in the output above the current row.

The default for the width is 0.03 em. Startcol is the number of the column where the line starts and endcol the column number where the line ends. The endcol always needs to be specified, also when the line should span only one column. The optional parameter trim could be either  $l\{\text{trimwidth}\}$ , or  $r\{\text{trimwidth}\}$  where the trimwidth is also optional. Using for example the parameter  $l\{2\text{pt}\}$  means that the line is trimmed from its left end by 2 pt. If you don't specify the trimwidth the lines are trimmed by the default of 0.5 em.

Table 2.12 was created using the commands

```
\cmidrule(r){2-2}\cmidrule(l){3-4}
```

at the beginning of the second row and

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`\cmidrule(1{10pt}){1-1}`

in the sixth row.

You might want to have overlapping `\cmidrules` as in in Table 2.13. This can be achieved with the `TEX-Code` command

`\morecmidrules`

The command that was used for the second row of Table 2.13 is

`\cmidrule(r){2-2}\cmidrule(l){3-4}\morecmidrules\cmidrule{2-4}`

The command for the sixth row is

`\midrule\morecmidrules\cmidrule{3-4}`

If you are anyway not satisfied with the border line spacing, you can use the following command to produce lines that span over all table columns:

`\specialrule{width}{space above}{space below}`

For more information about these features, refer to the manual of the `LATEX`-package `booktabs` [4].

**Table 2.13.:** Special booktabs-table

System	Medipix 1		Medipix 2	
Detector thickness [ $\mu\text{m}$ ]	300	300	700	
Edge angle [ $^\circ$ ]	3.55	2.71	7.99	
Spatial resolution [ $\mu\text{m}$ ]	4.26	10.17	10.56	
MTF at $f_{\text{max}}$	0.53	0.37	0.39	
LSF-spatial resolution				
in $\mu\text{m}$	129.7	52.75	50.78	
in % of pixel size	76.3	95.9	92.3	

## 2.10. Vertical Table Alignment

To align tables vertically in a text line the table must be inside a box. The box can then be vertically aligned as described in section 5.2.

In the following example the tables are inside a `minipage`<sup>3</sup> box that has a width of 15 col%:

<sup>3</sup>Minipages are described in section 5.4.



- test 

a	d	g
b	e	h
c	f	i

 test 

a	d	g
b	e	h
c	f	i
  
- test 

a	d	g
b	e	h
c	f	i
  
- test 

a	d	g
b	e	h
c	f	i

 test 

a	d	g
b	e	h
c	f	i

As you will see, the content of the first and last table row is not correctly aligned. To get this alignment, the minipage box must be set into a `raisebox`<sup>4</sup>. In the example above the second table in the first item is aligned using the  $\text{\TeX-Code-command}$

`\raisebox{0.85\baselineskip}{`

before the box. After the box the closing brace `}` is inserted as  $\text{\TeX-Code}$ . For the second table in the last item the command

`\raisebox{-0.32\baselineskip}{`

is used.

**Note:** The alignment of the table row content to the surrounding text line is not exact. The required value for the `\raisebox` command for this alignment depends on the document font, the font size, and the table line thickness.

## 2.11. Colored Tables

### 2.11.1. Colored Cells

**Table 2.14.:** Table colored without using the package `colortbl`

a	b	c
d	e	f
g	h	i

If you only need colored text, mark the cells and choose a color in the menu **Edit > Text Style**. This was used to create Table 2.14. In any other case you have to use the  $\text{\LaTeX}$ -package `colortbl`.

<sup>4</sup>Raiseboxes are described in section 5.6.2.

## 2. Tables

To create colored tables, `colortbl` must be loaded in the preamble with the line

```
\usepackage{colortbl}
```

The color of a column is adjusted with the command

```
\columncolor{name of color}
```

inside the command `>{ }`. More about the command `>{ }` is contained in section 2.8.2.2.

The following color names are predefined:

red, green, yellow, blue, cyan, magenta, black and white

You can also define your own color with the command

```
\definecolor{color name}{color model}{color values}
```

The color model can be

cmyk: cyan, magenta, yellow, black

rgb: red, green blue

gray gray

and the color values are comma separated numbers between 0 and 1 describing the factor for the corresponding color of the color model.

You can e. g. define the color "*darkgreen*" in the preamble with

```
\definecolor{darkgreen}{cmyk}{0.5, 0, 1, 0.5}
```

and the color "*lightgray*" with

```
\definecolor{lightgray}{gray}{0.8}
```

Lines are colored with the command

```
\rowcolor{name of color}
```

and cells are colored with the command

```
\cellcolor{name of color}
```

Both commands are inserted at the beginning of a cell as  $\TeX$ -Code.

To color characters in the table, mark the cells and use the  $\LaTeX$  menu **Edit**  $\triangleright$  **Text Style**. If a cell contains  $\TeX$ -Code mark only the characters, otherwise the colored  $\TeX$ -Code will cause  $\LaTeX$ -errors.

**Note:** Not all DVI-viewers are able to display self-defined colors.

To create Table 2.15 do the following: The color of the first column should be *darkgreen*. So insert

```
>{\columncolor{darkgreen}\centering}c
```

as  $\LaTeX$ -argument for this column. The first row should be blue, therefore the  $\TeX$ -Code command

```
\rowcolor{cyan}
```

is inserted to the first cell of this row. Note that this overwrites the column color for the first cell. The last cell of the last row is colored magenta by inserting the  $\TeX$ -Code command

```
\cellcolor{magenta}
```

The characters could now be colored using the menu `Edit`  $\triangleright$  `Text Style`.

**Table 2.15.:** Table colored using the package `colortbl`

a	b	c
d	e	f
g	h	i

### 2.11.2. Colored Lines

As described in section 2.12.4, the line thickness for all lines in a table can be adjusted with the length `\arrayrulewidth`. It is set to 1.5 pt for all tables of this section.

To color vertical lines for example with green, create the following column format in the document preamble, according to the description in section 2.12.3:

```
\newcolumnntype{W}{!{\color{green}\vline}}
```

For Table 2.16 the  $\LaTeX$ -argument `WcW` was used for the last column and `Wc` for the other columns.

If you want to have several colors, define more column formats.

**Table 2.16.:** Table with colored vertical lines

sd		
	sd	
		sd

To color horizontal lines for example with red, as in Table 2.17, insert these commands in  $\TeX$ -Code before the table or table float:

```
\let\myHlineC\hline
\renewcommand{\hline}
{\arrayrulecolor{red}\myHlineC\arrayrulecolor{black}}
```

**Table 2.17.:** Table with colored horizontal lines

sd		
	sd	
		sd

To return to the default line color black, insert this command in T<sub>E</sub>X-Code after the table or table float:

```
\renewcommand{\hline}{\myHlineC}
```

Table 2.18 is an example with colored vertical and horizontal lines.

**Table 2.18.:** Table with colored lines

sd		
	sd	
		sd

## 2.12. Table Customization

### 2.12.1. Row Spacing

You can add vertical space to table rows in the **Borders** tab of the table dialog. You find there three possibilities:

**Top of row** will add space above the characters of the table row. If the table is a formal table<sup>5</sup> L<sub>Y</sub>X will insert as default 0.5em space. For normal tables the inserted space will unfortunately destroy the vertical table lines as in the following table:

A
3 mm space top of row
C

So inserting space in the top of row for normal tables is only useful when you don't have vertical lines.

**Bottom of row** will add space below the characters of the table row. If the table is a formal table L<sub>Y</sub>X will insert as default 0.5em space, for normal tables the default size is 2 pt.

<sup>5</sup>Formal tables are explained in section 2.9.

**Between rows** adds space between the current and the following row. If the table is a formal table L<sup>A</sup>T<sub>E</sub>X will insert as default 0.5em space. For normal tables the inserted space will unfortunately destroy the vertical table lines as in the following table:

A
↓ 3 mm space between row ↓
↑ 3 mm space between row ↑

So inserting space between rows for normal tables is only useful when you don't have vertical lines.

When you want to add extra height to all cells of all tables, you can do this with the following preamble lines:

```
\@ifundefined{extrarowheight}
{\usepackage{array}}{}
\setlength{\extrarowheight}{height}
```

But this has the disadvantage that the cell texts are no longer exactly vertically centered. (The package **array** will be loaded automatically by L<sup>A</sup>T<sub>E</sub>X when you use self defined table formats. To avoid that it being loaded twice the command **\@ifundefined** is used in the above command.)

If you are using font sizes larger than the normal size, the table borders are often too close to the letters. This can be corrected by inserting the command **\strut** in T<sub>E</sub>X code at the beginning of a table row. Table 2.19 illustrates the effect.

**Table 2.19.:** Vertical alignment of text with large font sizes.

**(a)** Normal table.

Normal, g
Large
Larger
Largest
Huge
Huger

**(b)** Table using the command **\strut**.

Normal, g
Large
Larger
Largest
Huge
Huger

### 2.12.2. Special Cell Alignment

Sometimes it looks better when the cell entries of a column are aligned with a special character, e. g. with the decimal separator as in Table 2.20.

**Table 2.20.:** Table cells of a column aligned with the decimal separator.

heading
12.6
0.68
-123.0

This table was created with a  $4 \times 2$  table. The heading is a centered multicolumn. The first column is right-aligned and contains the digits before the decimal point and the decimal point. The second column is left aligned and contains the digits after the decimal point. To omit the space that is normally between two table columns, the following  $\text{\LaTeX}$ -argument was used for the second column:

`@{}l`

Table 2.21 shows some example alignments. For the alignment with the relation sign, you must add the second smallest math-space at the beginning of the last column to get the correct space surrounding the relation sign.

**Table 2.21.:** Several table cell alignments.

units	exponents	relations
12×24 bottles	$10 \cdot 10^{-17}$	$\Gamma(t) \propto \Upsilon(t)$
1024×768 Pixels	$5.78 \cdot 10^7$	$A \neq B_{\text{red}}$
32×6 cm	$-33.5 \cdot 10^4$	$\sin(\alpha) \geq \sin(\beta)$

There is also the  $\text{\LaTeX}$ -package **dcolumn** that provides table cell alignments. But this unfortunately treats the cell entries as math and does not allow formulas in table cells: The first column of Table 2.21 will look with **dcolumn** like the first column in Table 2.22 and only with some tricks as you would want. The alignment of the second and third column of Table 2.21 is not possible with **dcolumn**.

**Table 2.22.:** Alignments when L<sup>A</sup>T<sub>E</sub>X-package dcolumn is used. For all column alignments tricks have to be used to get the output.

units	units	units
$12 \times 24$ <i>bottles</i>	$12 \times 24$ bottles	$12 \times 24$ bottles
$1024 \times 768$ <i>Pixels</i>	$1024 \times 768$ Pixels	$1024 \times 768$ Pixels
$32 \times 6$ <i>cm</i>	$32 \times 6$ cm	$32 \times 6$ cm

### 2.12.3. Customized Cell/Column Format

Calculating the required width for spanned columns as in section 2.8.2.2 is very annoying if you have several tables with multicolumn cells. To make life easier, you can define a cell/column format in the preamble, so that it can be used in all tables of the document. The format is defined with the command

`\newcolumntype{name of format}[number of arguments]{commands}`

The format name may only consist of one letter. The letters *b*, *c*, *l*, *m*, *p* and *r* are predefined and cannot be used. But all letters are allowed as capitals.

For vertically and horizontally centered multicolumn cells with a fixed width you can define the cell format

`\newcolumntype{M}[1]{>{\centering\hspace{0pt}}m{#1}}`

where `\hspace{0pt}` avoids the problem of hyphenating the first word, as described in section 2.8.1. Now you can simply enter

`M{width}`

as L<sup>A</sup>T<sub>E</sub>X-argument in the table dialog to create a multicolumn.

For cells spanned by a multicolumn cell, you can define the format

`\newcolumntype{S}[2]{>{\centering\hspace{0pt}}m{(#1+(2\tabcolsep+\arrayrulewidth)*(1-#2))/#2}}`

This format uses equation (2.1) to calculate the required width so that each spanned cell has the same width.

You can now enter

`S{width of multicolumn cell}{number of spanned columns}`

as L<sup>A</sup>T<sub>E</sub>X-argument of the column.

For colored columns, you can define

`\newcolumntype{K}[1]{>{\columncolor{#1}\hspace{0pt}}c}`

## 2. Tables

The “c” at the end creates a column with a flexible width whose text is horizontally centered. You can now enter

**K{color name}**

as L<sup>A</sup>T<sub>E</sub>X-argument.

To create Table 2.23 use the L<sup>A</sup>T<sub>E</sub>X-arguments

**M{2.5cm}**

for the first column and the multicolumn,

**K{red}**

for the last column, and

**S{2.5cm}{2}**

for the cells in the second column.

**Table 2.23.:** Table using user-defined table formats

very-longtablecell-word	multiple lines multicolumn		c
d	e	f	g
h	i	j	k

### 2.12.4. Line Thickness

The line thickness for all lines in a table can be adjusted with the length `\arrayrulewidth`. To set for example a line thickness of 1.5 pt, as in Table 2.24, insert the command

```
\setlength{\arrayrulewidth}{1.5pt}
```

in T<sub>E</sub>X-Code before the table or table float. The changed thickness is valid for all subsequent tables. To use the default value again, set `\arrayrulewidth` to 0.4 pt in T<sub>E</sub>X-Code after the table or table float.

To set the line thickness to 1.5 pt only for horizontal lines, as in Table 2.25, insert these commands in T<sub>E</sub>X-Code before the table or table float:

```
\let\myHline\hline
\renewcommand{\hline}
{\noalign{\global\arrayrulewidth 1.5pt}
\myHline\noalign{\global\arrayrulewidth 0.4pt}}
```



**Table 2.24.:** Table with 1.5 pt thick lines

sd		
	sd	
		sd

**Table 2.25.:** Table with 1.5 pt thick horizontal lines

sd		
	sd	
		sd

To return to the default line thickness, insert this command in  $\text{T}_{\text{E}}\text{X}$ -Code after the table or table float:

```
\renewcommand{\hline}{\myHline}
```

To set the line thickness to 1.5 pt only for vertical lines, create the following column format in the document preamble, according to the description in section 2.12.3:

```
\newcolumntype{V}{!{\vrule width 1.5pt}}
```

For Table 2.26 the  $\text{L}_{\text{A}}\text{T}_{\text{E}}\text{X}$ -argument

**VcV**

was used for the last column and

**Vc**

for the other columns.

**Table 2.26.:** Table with 1.5 pt thick vertical lines

sd		
	sd	
		sd

### 2.12.5. Dashed Lines

**Table 2.27.:** Table with dashed lines

a	b	c	d	e
f	g	h	i	j
k	l	m	n	o
p	q	r	s	
t	u	v	w	x

L<sup>A</sup>T<sub>E</sub>X does not natively support dashed lines, so you have to use T<sub>E</sub>X-Code. As a prerequisite the L<sup>A</sup>T<sub>E</sub>X-package **arydshln** must be loaded in the document preamble with the command

```
\usepackage{arydshln}
```

To make a vertical line dashed, enter the colon “:” together with the character for the horizontal alignment as L<sup>A</sup>T<sub>E</sub>X-argument in the table cell dialog.

For a horizontal dashed line add the command

```
\hdashline
```

in T<sub>E</sub>X-Code as first element of the first cell in the table row.

For dashed multicolumn lines use the command

```
\cdashline{line number}
```

in T<sub>E</sub>X-Code as the first element of the first cell in the table row. If you have for example a multicolumn spanning columns 2 to 4 and you want to have a dashed line above, add the command

```
\cdashline{2-4}
```

as the first element of the first cell in the row of the multicolumn.

Table 2.27 was created using “:c” as L<sup>A</sup>T<sub>E</sub>X-argument of the third column. The T<sub>E</sub>X-Code command **\hdashline** was inserted in the first cell of the third row and the T<sub>E</sub>X-Code command

```
\cdashline{4-5}
```

was inserted in the first cell of the fourth row.


**Note:** The L<sup>A</sup>T<sub>E</sub>X-package **arydshln** is apparently not compatible with the L<sup>A</sup>T<sub>E</sub>X-package **colortbl** that is used for colored tables in section 2.11. That means colored tables cannot have dashed lines.

# 3. Floats

## 3.1. Introduction

A float is a block of text associated with some sort of label, which doesn't have a fixed location. It can “float” forward or backward a page or two, to wherever it fits best. **Footnotes** and **Margin Notes** are also floats, because they can float to the next page when there are too many notes on the page.

Floats allow a high quality layout. Images and tables can be spread evenly to the pages to avoid white space and pages without text. As the floating often destroys the context between the text and the image/table, every float can be referenced in the text. Floats are therefore numbered. Referencing is described in section 3.4.

To insert a float, use the menu **Insert**▷**Float**. This inserts the **Caption** inset, a box with a label. The label will automatically be translated to the document language in the output. After the label you can insert the caption text. The image or table is inserted above or below the caption in a separate paragraph within the float. More about the caption placement is contained in section 3.10. To keep your LyX-document readable, you can open and close the float box by left-clicking on the box label. A closed float box looks like this:  – a gray button with a red label.

It is recommended that you insert floats as a separate standard paragraph to avoid possible L<sup>A</sup>T<sub>E</sub>X-errors that can occur when the surrounding text is specially formatted.

Existing figures or tables can be put into a float by highlighting them and then pressing the corresponding toolbar button for a new float.

## 3.2. Float Types

Besides figure and table floats that are described in sections 1.2 and 2.5 respectively, LyX offers the float types **Algorithm** and **Wrap**.

### 3.2.1. Algorithm Floats

This float type is inserted with the menu **Insert**▷**Floats**▷**Algorithm**. It is used for program codes and descriptions of algorithms and can be seen as an alternative

---

**Algorithm 3.1** Example Algorithm float

---

```

for I in 1..N loop
  Sum:= Sum + A(I); /*comment*/
end loop

```

---

to program code listings that are explained in chapter 7. A possible environment for algorithms is the **LyX-Code**, described in LyX’s *Userguide*. Algorithm 3.1 is an example of an algorithm float where -4 mm vertical space was added at the end of the float to have the bottom rule exactly below the last text line.

The float label is not automatically translated into the document language. If your document is not in English, you have to do this manually by adding the following line to the document preamble:

```
\floatname{algorithm}{your name}
```

where *your name* is the word “*algorithm*” in your language.

To insert the list of algorithms you can use the menu **Insert**▷**List / TOC**▷**List of Algorithms** when your document has the same language as LyX’s menu names. In other cases use this command in **TeX-Code** instead:

```
\listof{algorithm}{your name}
```

where *your name* is the word “*List of Algorithms*” in your language.

Algorithm floats are not by default numbered in the scheme “chapter.algorithm” as is the case for table and figure floats in many document-classes. To number algorithm floats in the same scheme, add this command to your document preamble:

```
\numberwithin{algorithm}{chapter}
```

To be able to use the command `\numberwithin`, set in the tab **Math Options** in the document settings the option **Use AMS math package**.

### 3.2.2. Wrap Floats



**Figure 3.1.:** This is a figure wrap float.

This float type is used if you want to wrap text around a figure or table so that it only occupies some fraction of the column width. It can be inserted using the menu **Insert**▷**Floats**▷**Figure Wrap Float** or **Table Wrap Float** if the **L<sup>A</sup>T<sub>E</sub>X**-package **wrapfig** is installed.<sup>1</sup> The settings of the float can be modified by right-clicking on the float box. The mandatory settings are the float **Placement** and its **Width**. Optional are the **Overhang**

<sup>1</sup>Installing a **L<sup>A</sup>T<sub>E</sub>X**-package is explained it in the *L<sup>A</sup>T<sub>E</sub>X Configuration* manual.

that specifies how much the float is set into the paragraph/page margin, and the `Line span` that specifies how many text lines the float will approximately need. The line span is often hard to approximate; so it is better only to use it when you encounter float placement problems. You can furthermore decide if  $\LaTeX$  is allowed to let the float float within the paragraph or to surrounding paragraphs. Figure 3.1 is an example text wrap float with a width of `40 col%`, `1 cm` overhang, set to the left.<sup>2</sup>

**Note:** Text wrap float floats are fragile! E. g. having a figure too close to the bottom of the page can mess things up in such a way that the float does not appear in the output or that it is placed over some other text.

In general:

- Wrap floats should not be placed in paragraphs that run over a page break. That means that wrap floats are better inserted in their exact place when the document is almost finished and you are able to estimate where page breaks will appear.
- Wrap floats should either be placed in their own paragraph before the paragraph where they should wrap into or within a paragraph.
- Wrap floats in consecutive paragraphs may cause troubles, so ensure that there is a text paragraph between them as separator.
- Wrap floats are not allowed in section headings or tables.

### 3.3. Float Numbering

Floats are usually numbered either independently from the sections the floats are in, or in the scheme “chapter.number” or “section.number”. This depends on the document class used.

To change section-independent numbering, you can use this command in the document preamble:

```
\renewcommand{\thetable}{\roman{table}}
```

`\thetable` is the command that prints the table number, for figure floats, the command would be `\thefigure`. `\roman` in the command above prints the table number as small roman number.

To change the numbering scheme for example to “subsection.number”, use this command in the preamble:

```
\numberwithin{table}{subsection}
```

---


<sup>2</sup>Available units are explained in appendix A.


### 3. Floats

To be able to use the command `\numberwithin`, set in the tab **Math Options** in the document settings the option **Use AMS math package**.

Please also have a look at section 4.2.1 for the details and important notes about the numbering commands.

## 3.4. Referencing Floats

To reference a float, insert a label into its caption using the menu **Insert**▷**Label** or the toolbar button . A grey label box like this one: `fig.This-is-a` will be inserted and the label window pops up asking for the label text. LyX offers as text the first words of the caption with a prefix. The prefix depends on the float type, e.g. for figure floats the prefix will be "fig:".

The label is used as anchor and name for the reference. You can refer to the label using the menu **Insert**▷**Cross-reference** or the toolbar button . A grey cross-reference box like this one: `Ref. sec:Contrib` will be inserted and the cross-reference window appear showing all labels of the document. If you have multiple LyX-documents opened, choose the one you are working on from the drop-list at the top of the dialog. You can now sort the labels alphabetically and then choose one. At the position of the cross-reference box the float number will appear in the output.

It is recommended that you use a protected space between the cross-reference name and its number to avoid line breaks between them. If a cross-reference refers to a non-existing label, you will see two question marks in the output instead of the reference.

You can change labels at any time by clicking on the label box. References to the changed label will automatically change its link to the new label text, so that you don't need to take care about this.

The button **Go to Label** in the cross-reference window sets the cursor before the referred label. The button text changes then to **Go Back** and you can use it to set the cursor back to the cross-reference. Right-clicking on a cross-reference box also sets the cursor before the referenced label but without the possibility of going back.

### 3.4.1. Cross-Reference Formats

There are six varieties of cross-references:

**<reference>**: prints the float number, this is the default: 1.3

**(<reference>)**: prints the float number within two parentheses, this is the style normally used to reference formulas, especially when the reference name "Equation" is omitted: (2.1)

`<page>`: prints the page number: Page 4

`on page <page>`: prints the text "on page" and the page number: on page 4

`<reference> on page <page>`: prints the float number, the text "on page", and the page number: 1.3 on page 4

**Formatted reference:** prints a self defined cross-reference format.

**Note:** This feature is only available when you have the  $\LaTeX$ -package `prettyref` installed.

`<page>` will not print the page number if the label is on the previous, the same, or the next page. You will e. g. see the text “on this page” instead. The style `<reference> on page <page>` will not print anything about the page if the label is on the same page.

The number and current page of the part of the document referred to in the output is automatically calculated by  $\LaTeX$ . The varieties are adjusted in the field Format of the cross-reference window that appears when you click on the cross-reference box.

**Note:** The  $\LaTeX$ -package `prettyref` does not know all of LyX’s possible label shortcuts<sup>3</sup> and is not internationalized. To find out how to tell `prettyref` new shortcuts and translations, have a look at its documentation [16].

**Note:** Due to a bug in the  $\LaTeX$ -package `varioref` version 1.4w, some cross-reference formats will cause  $\LaTeX$  errors for document languages that make the period character active (like French). For a workaround, see <http://wiki.lyx.org/LaTeX/LatexBugs#toc5>.

### 3.4.2. Automatic Reference Naming

The  $\LaTeX$ -package `hyperref`, that is enabled in the PDF Properties of the Document Settings dialog, provides a very useful feature that cross-references automatically include the name of the referenced floats (or text parts like *section*). So you will save having to write e. g. the name “Figure” before every reference to a figure. To use this feature, enable `hyperref` and insert this line to the  $\LaTeX$  preamble:

```
\AtBeginDocument{\renewcommand{\ref}[1]{\mbox{\autoref{#1}}}}
```

When you prefer other reference names than the default ones, for example you want instead of “section” the name “sec. “, you can redefine the name by inserting this in the preamble:

```
\addto\extrasenglish{\renewcommand{\sectionautorefname}
{sec.\negthinspace}}
```

When you are using another document language than English, replace `\extrasenglish` by `\extras***`, where `***` is the name of the language used.

<sup>3</sup>“fig:” is for example LyX’s shortcut for labels in figure captions.

### 3. Floats

To get automatic names, but not for certain reference types, for example not for equations, use this preamble code:

```
\newlength{\abc}  
\settowidth{\abc}{\space}  
\addto\extrasenglish{\renewcommand{\equationautorefname}  
{\hspace{-\abc}}}
```

More about this topic can be found in **hyperref**'s documentation [10].

**Note:** Automatic reference naming cannot be used when you use cross-references in the Formatted reference style, as described in section 3.4.1.

The *Math* manual is an example where automatic reference naming is used.

#### 3.4.3. Reference Position

If you use **hyperref** in the PDF Properties of the Document Settings dialog to link cross-references in the output, you will see that clicking on an image float reference jumps to the image label. The caption will be the first text part on the screen, so that you cannot see the image without scrolling. This is because the reference link anchor is placed at the position of the label. With the use of the package **hyperc**, which is part of the L<sup>A</sup>T<sub>E</sub>X-package **oberdiek**, the link anchor is placed at the beginning of a float. To use this feature for figure floats, load **hyperc** in the document preamble with the line

```
\usepackage[figure]{hyperc}
```

You can also use **hyperc** for all float types but this is not recommended for stability reasons. For more information, have a look at **hyperc**'s manual [9].

**Note:** **hyperc** has no effect on references to subfigures.

## 3.5. Float Placement

Right-clicking on a float-box opens a dialog where you can alter the placement options that L<sup>A</sup>T<sub>E</sub>X uses for positioning the float.

The option **Span columns** is only useful for two-column documents: If you select it, the float will span both columns on the page instead of being confined to just one.

The option **Rotate sideways** is used to rotate floats, see section 3.6.

You can use one or more of the following options in the float dialog to set the placement for a particular float when you uncheck the option **Use default placement**:

**Here if possible** try to place the float on the position where it has been inserted

**Top of page** try to place the float at the top of the current page



**Bottom of page** try to place the float at the bottom of the current page

**Page of floats** try to place the float on its own page

The order of the above option is *always* used by L<sup>A</sup>T<sub>E</sub>X. That means, if you use the default placement, L<sup>A</sup>T<sub>E</sub>X will first try out **Here if possible**, then **Top of page**, and then the others. If you do not use the default, L<sup>A</sup>T<sub>E</sub>X will try only the checked options but in the same order. If none of the 4 placements are possible the procedure is internally repeated but it is tried to put the float on the following page.

By default, each option has its own rules:

**Top of page** only floats occupying less than 70 % of the page can be placed at the top of a page (`\topfraction`)

**Bottom of page:** only floats occupying less than 30 % of the page can be placed at the bottom of a page. (`\bottomfraction`)

**Page of floats:** only if more than 50 % of the page are occupied by floats, several floats can be set together on a page. (`\floatpagefraction`)

If you don't like these rules, you can ignore them by using the additional option `ignore LATEX rules`.

You can also redefine the rules with L<sup>A</sup>T<sub>E</sub>X-commands that are given in parentheses after the rules description above. To increase for example the often too small default of the bottom-rule to 50 % of the page, add this line to your document preamble:

```
\renewcommand{\bottomfraction}{0.5}
```

Sometimes you might need, under all circumstances, a float to be placed exactly at the position where it is inserted. For this case you can use the option **Here definitely**. Use this option very rarely and only if the document is almost ready to be printed, because the float is then no longer able to “float” when you change your document and this will often destroy the page layout.

There are no placement options for text wrap floats, because they are always surrounded by the text of a certain paragraph.

Sometimes you have the problem that a float is placed at the top of a page while its corresponding section starts at the middle of the page, so that the reader could think the float is part of the previous section. To avoid this the L<sup>A</sup>T<sub>E</sub>X-command `\suppressfloats` can be used. It suppresses a given float placement for the page where it is inserted and can therefore be used to avoid floats being set before a section starts. To get this, add these commands to your document preamble:

```
\let\mySection\section
\renewcommand{\section}{\suppressfloats[t]\mySection}
```

You can define the same for all section headings, like chapters and subsections. This definition is not recommended to be used for small text parts like subsubsections because L<sup>A</sup>T<sub>E</sub>X may then have problems finding a suitable placement.

### 3. Floats

In some cases it is required to have all figures/tables at the end of the document. For this purpose the L<sup>A</sup>T<sub>E</sub>X-package **endfloat** was developed. It puts all figure and table floats at the end of the document into their own sections. At the original float position a text hint like “[Figure 3.2 about here.]” is inserted. The endfloat-package is loaded in the preamble with the line

```
\usepackage[options]{endfloat}
```

There are various package options to format the created figure/table sections. For more information we refer to the **endfloat** documentation [6].

**Note:** **endfloat** doesn't provide an automatic translation for the text hint, you have to do this manually, see section 4 in [6].

**Note:** There is currently a bug in **endfloat** when the caption contains a German “ß”. Use in this case the command “\ss” in T<sub>E</sub>X-Code instead of “ß”.

For more details about float placements, have a look at L<sup>A</sup>T<sub>E</sub>X books, [1, 2, 3].

## 3.6. Rotated Floats

Especially for wide tables you might have floats rotated. To rotate a whole float including the caption, right-click on the float-box and use the option **Rotate sideways**.

Rotated floats are always placed on a page of their own (or column of their own; in case you have a multi-column document). You can let them span several columns using the float settings option **Span columns**. Floats are rotated so that you can read them from the outside margin. To force a certain rotation direction for all pages, you can add either the option **figuresleft** or **figuresright** to the document class options.

Referencing rotated floats is the same as for normal floats, the caption format is also the same: Table 3.1 is an example of a rotated table float.

**Note:** Not all DVI-viewers are able to display rotated floats.

## 3.7. Subfloats

Subfloats are for example used when a figure consists of several images. They are created by inserting a float into an existing float. The placement of the subfloats can be controlled in the same way as for paragraphs as shown in table 3.2 and 3.3.

Referencing subfloats works as for normal floats: Table 3.2a and 3.2b are subtables of table 3.2.

**Table 3.1.:** Rotated table

test	b	c	d	e
------	---	---	---	---

### 3. Floats

**Table 3.2.:** Two subtables placed side by side.

(a) This is subtable a.

test	b	c	d	e
------	---	---	---	---

(b) This is subtable b.

e	d	c	b	test
---	---	---	---	------

**Table 3.3.:** Two subtables placed one above the other. (a) table with 4 cells, (b) table with 5 cells.

(a)

test	test	test	test
------	------	------	------

(b)

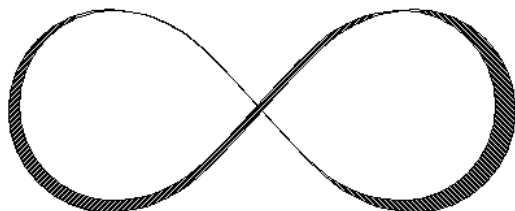
a	b	c	d	e
---	---	---	---	---

## 3.8. Floats Side by Side

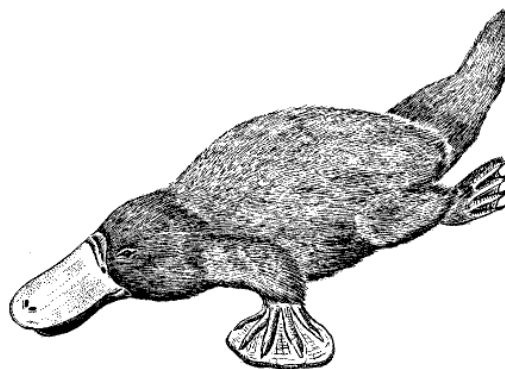
To place floats side by side, as in Figures 3.2 and 3.3, only *one* float is used. In it two minipage boxes are inserted.<sup>4</sup> The width is set to 45-50 column% and the box alignment to `Bottom` for each minipage. The minipage boxes contain the image and the caption in the same way as they are in a float. The only difference is that the image unit `Column Width %` is now calculated according to the width of the minipage boxes.

---

<sup>4</sup>Minipages are explained in section 5.4.



**Figure 3.2.:** Float on the left side.



**Figure 3.3.:** Float on the right side.

## 3.9. Caption Formatting

The `Caption` environment is the default paragraph environment for `Floats`. On the `LyX` screen captions appear as label, e. g. “Figure #:” followed by the caption text. “#” is the actual reference number. By default the label and the number are in the same font as the caption text and a colon follows the number to divide the label from the text. This caption format is not suitable for all document formats.

To change the default caption format, load the `LATEX`-package `caption` in the document preamble with this line:

```
\usepackage[format definition]{caption}
```

To have for example the label and the number in sans-serif bold font and the table captions always above the table as in this document, use the following command:

```
\usepackage[labelfont={bf,sf}, tableposition=top]{caption}
```

You can also define different caption formats for the different float types. In this case load the `caption` package without format specific options and define the different formats with the help of the command

```
\captionsetup[float type]{format definition}
```

in the document preamble. For example the caption formats of Figure 3.4 and Table 3.4 can be created using these commands in the document preamble:

```
\usepackage[tableposition=top]{caption}
\captionsetup[figure]{labelfont={tt}, textfont=it, indentation=1cm,%
    labelsep=period}
\captionsetup[table]{labelfont={bf,sf}}
```

**Note:** The option `tableposition=top` has no effect when a `KOMA-Script` document class is used. In this case the document class option `tablecaptionabove` must be used.

For more information about the package `caption` we refer to its documentation [5].

To change the label name from e. g. “Figure” to “Image” use this preamble command:

```
\renewcommand{\fnum@figure}{Image~\thefigure}
```

where `\thefigure` inserts the figure number and “~” creates a protected space.

If you are using a `KOMA-Script` document class (`article` (`KOMA-Script`), `book` (`KOMA-Script`), `letter` (`KOMA-Script`), or `report` (`KOMA-Script`)), you can alternatively to the `caption` package use `KOMA-Script`’s built-in command `\setkomafont`. For example, to have the caption label in bold, add this command to your document preamble:

```
\setkomafont{captionlabel}{\bfseries}
```

For more information about `\setkomafont` we refer to the `KOMA-Script` documentation [11].

## 3.10. Caption Placement

The common caption placement rule is:

**Figure:** Caption is set below the figure

**Table:** Caption is set above the table

Having the caption above the table is unfortunately not supported in L<sup>A</sup>T<sub>E</sub>X's standard classes. That means if you are using the document classes `article`, `book`, `letter`, or `report` there will be no space between the caption and the table. To insert the necessary space, add the following option to the load command of the L<sup>A</sup>T<sub>E</sub>X-package `caption` in your document preamble<sup>5</sup>:

**tableposition=top**

If you are using a **KOMA-Script** document class (`article` (KOMA-Script), `book` (KOMA-Script), `letter` (KOMA-Script), or `report` (KOMA-Script)), you can alternatively to the `caption` package set the document class option `tablecaptionabove`.

It is also possible to set the caption beside a figure or table. To get this the L<sup>A</sup>T<sub>E</sub>X-package `sidecap` has to be loaded in the document preamble with the line

```
\usepackage[option]{sidecap}
```

If you set no option, the caption is placed on the side of the outer page margin – to the right on odd pages, to the left on even pages. You can change the placement to inner margin with the option `innercaption`. To force the placement always to the right or left, use the option `rightcaption` or `leftcaption`, respectively.

To place in LyX the caption of a float on the side, it is necessary to add these commands to the document preamble:

---

```
\newcommand{\TabBesBeg}{%
\let\MyTable\table
\let\MyEndtable\endtable
\renewenvironment{table}{\begin{SCtable}}{\end{SCtable}}}

\newcommand{\TabBesEnd}{%
\let\table\MyTable
\let\endtable\MyEndtable

\newcommand{\FigBesBeg}{%
\let\MyFigure\figure
\let\MyEndfigure\endfigure
\renewenvironment{figure}{\begin{SCfigure}}{\end{SCfigure}}}
```

<sup>5</sup>See section 3.9 for more information of the package `caption`.

```
\newcommand{\FigBesEnd}{%
\let\figure\MyFigure
\let\endfigure\MyEndfigure}
```

---

The commands allow you to redefine the floats so that the caption is set on the side. For figure floats use the command

```
\FigBesBeg
```

in  $\text{\TeX}$ -Code before the float. After the float insert the command

```
\FigBesEnd
```

in  $\text{\TeX}$ -Code to get back to the original float definition.

For table floats use the corresponding commands

```
\TabBesBeg and \TabBesEnd
```

Figure 3.5 and Table 3.5 are examples where the caption is set beside.

You can see in the examples that the caption text appears at the top of the floats for table floats and at the bottom for figure floats. To change this, you can use the command

```
\sidecaptionvpos{float type}{placement}
```

in the document preamble or in  $\text{\TeX}$ -Code before the float. The float type is either `figure` or `table`, the placement can be “t” for top, “c” for center, or “b” for bottom. To have for example the caption of figure floats vertically centered, use the command

```
\sidecaptionvpos{figure}{c}
```

This was used for Figure 3.6.

For more information about the package `sidecap` we refer to its documentation [15].

**Note:** The  $\text{\LaTeX}$ -package `hypcap`, described in section 3.4.3, has no effect on floats with the caption set beside.

## 3.11. Listings of Floats

Similar to the table of contents where the sections of the document are listed, there are listings for all float types, like the figures of the documents. You can insert them via the Insert▷List / TOC sub menus.

The list entries are the float captions or its short title, the float number, and the page number where they appear in the document.

You can find the list of figures and tables at the end of this document.

### 3. Floats

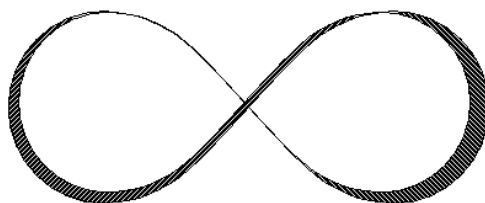


Figure 3.4.. *This is an example figure caption that is longer than one line to show the different caption format. Here a self-defined caption format is used.*

**Table 3.4.:** This is an example table caption that is longer than one line to show the different caption format. Here the standard caption format for tables in this document is used.

a	b	c	d	e
---	---	---	---	---



**Figure 3.5:** This is a caption beside a figure.

**Table 3.5:** This is a caption beside a table.

a		b		c
	d		e	
f		g		h
	i		j	

**Figure 3.6:** This is a vertically centered caption beside a figure.





# 4. Notes

## 4.1. LyX Notes

Notes are inserted with the toolbar button  or the menu `Insert > Note`. There are three types of notes:

**LyX Note** This note type is for internal notes that won't appear in the output. Its note-box looks like this:

**Note** This is text in a note box that doesn't appear in the output.

**Comment** This note also doesn't appear in the output but it appears as  $\LaTeX$ -comment, when you export the document to  $\LaTeX$  via the menu `File > Export >  $\LaTeX$  (pdflatex) / (plain)`. Its note-box looks like this:


**Comment** This is text in a note box that only appears as comment in  $\LaTeX$ -files.

**Greyed Out** This note will appear in the output as grey text. Its note-box looks like this:

**Greyed out** This is text of a comment that appears in the output as grey text.

This is text<sup>1</sup> of a comment that appears in the output as grey text.

As you can see in the example, the first line of greyed out notes is a bit indented and greyed out notes can have footnotes.

When you use the toolbar button  to insert notes, a **LyX Note** is inserted. You can switch between the five note types by right-clicking on the note-box. If you want to turn existing text into a note, mark it and click on the note toolbar button. To change a note to text, press the backspace key when the cursor is in the first position of a note, or press the delete key when the cursor is in the very last position of the note, respectively.

---

<sup>1</sup>This is an example footnote within a greyed out note.

## 4. Notes

You can change the text color of the greyed out notes in the preamble with the following command:

```
\renewenvironment{lyxgreyedout}
{\textcolor{color}\bgroup}\egroup}
```

The available colors and the method to define colors is explained in section 2.11.

Notes that appear in blue in this document are set using greyed out notes with blue text.

## 4.2. Footnotes

Footnotes can be inserted using the toolbar button  or the menu Insert▷Footnote.

You'll see then the following footnote-box: foot 1 where you can enter the footnote text. If you want to turn existing text into a footnote, mark it and click on the footnote toolbar button. To change a footnote to text, press the Backspace key when the cursor is in the first position of a footnote, or press the Delete key when the cursor is in the very last position of the footnote, respectively.

Here is an example footnote:<sup>2</sup>

The footnote will appear in the output as a superscript number at the text position where the footnote box is placed. The footnote text is placed at the bottom of the current page. The footnote number is calculated by L<sup>A</sup>T<sub>E</sub>X; the numbers are consecutive. It depends on your document-class, whether the footnote number is reset for every chapter.

Footnotes can be referenced like floats: Insert a label into the footnote and cross-reference this label in the text as described in section 3.4.

This is a cross-reference of Footnote 2.

Footnotes in tables are not printed by L<sup>A</sup>T<sub>E</sub>X due to technical reasons. However there exists another method to print them: Instead of the footnote the command `\footnotemark{}` is inserted as T<sub>E</sub>X-code. The text of the footnote is entered as an argument of the T<sub>E</sub>X-code command `\footnotetext` after the table.

This was done for the following table with the command

```
\footnotetext{Printed table footnote.}
```

This an example text. <sup>3</sup>
This an example text. <sup>4</sup>

Footnotes in longtables are described in section 2.6.1.

---

<sup>2</sup>This is an example footnote.

<sup>4</sup>Printed table footnote.

Footnotes in minipage boxes are printed, but inside the box and with a different numbering because a minipage box is like a page inside a page. (For more about minipages, see section 5.4.) To get a footnote in the minipage that is output at the bottom of the page like normal footnotes, also use the method of `\footnotemark{}` and `\footnotetext`.

This an example text in a minipage.<sup>a</sup>  
 This an example text in a minipage.<sup>5</sup>

---

<sup>a</sup>Footnote in the minipage.

To refer to the same footnote several times without printing the footnote text every time, use the command `\footnotemark[number]` in  $\TeX$ -code.

As you do not know the number of the repeating footnote while you are writing the text, you have to store its number. For the following footnote mark example, these commands were inserted in  $\TeX$ -code after Footnote 2 to store the footnote number:

```
\newcounter{MyRepeatFoot}
\setcounter{MyRepeatFoot}{\thefootnote}
```

The footnote mark was then created with this command:

```
\footnotemark[\theMyRepeatFoot]
```

Here is a repeated footnote:<sup>2</sup>

If you want to repeat the previous footnote, you can omit the storage of the footnote number and just use this command instead:

```
\footnotemark[\thefootnote]
```

Here is another repeated footnote:<sup>5</sup>

### 4.2.1. Footnote Numbering

To reset the footnote number back to 1 after each section, add this command to your document preamble:

```
\@addtoreset{footnote}{section}
```

The following preamble command changes the footnote numbering style to small roman numerals:

```
\renewcommand{\thefootnote}{\roman{footnote}}
```

This is a footnote with roman numbering:<sup>vi</sup>

---

<sup>5</sup>Footnote outside the minipage.

<sup>vi</sup>This is an example footnote with roman numbering.

## 4. Notes

To change the numbering style to capital roman numerals replace in the command above `\roman` by `\Roman`. To “number” footnotes with capital or small Latin letters use `\Alph` or `\alph`, respectively. To “number” footnotes with symbols use `\fnsymbol`.

**Note:** You can only number 26 footnotes with Latin letters, because this numbering is limited to single letters.

**Note:** You can only number 9 footnotes with symbols.

To return to the default numbering style after you have changed to another one, use `\arabic` instead of `\roman` in the command above.

If you want to have footnotes numbered in the scheme “chapter.footnote”, add the following command to your document preamble:

```
\numberwithin{footnote}{chapter}
```

To be able to use the command `\numberwithin`, set in the tab **Math Options** in the document settings the option **Use AMS math package**.

This is another example footnote:<sup>4.7</sup>

**Note:** `\numberwithin` always prints out the footnote number as arabic number; previous redefinitions to get non-arabic numbers are overwritten.

So to get for example the scheme “chapter.\Roman{footnote}”, use this command instead of `\numberwithin`:

```
\renewcommand{\thefootnote}{\thechapter.\Roman{footnote}}
```

### 4.2.2. Footnote Placement

If you have several footnotes in one page, they appear without vertical space between them at the bottom of the page. To make them more readable you can e.g. add 1.5 mm space with the following preamble command:

```
\let\myFoot\footnote
\renewcommand{\footnote}[1]{\myFoot{#1\vspace{1.5mm}}}
```

In a two-column document the footnotes appear at the bottom of every column, see Figure 4.1. If the footnotes should only appear at the bottom of the right column, as in Figure 4.2, use the L<sup>A</sup>T<sub>E</sub>X-package **ftnright** with this command in the document preamble:

```
\usepackage{ftnright}
```

In some scientific literature it is usual to collect the footnotes and print them in a separate paragraph at the end of a section, as in Figure 4.3. They are then called

---

<sup>4.7</sup>This is a footnote numbered in the scheme “chapter.footnote”.

<p>Sei nun <math>S</math> unser normiertes Ausgangssignal und <math>P</math> die Phasenverteilungsfunktion, so ergibt sich die Beziehung</p> $S(t) = S_0(t) \int_{-\infty}^{\infty} P(\phi, t) e^{i\phi} d\phi \quad (2)$ <p>wobei <math>S_0</math> das Signal ohne Gradient ist und die Normierungsbedingung</p>	<p>Das Spektrum wird fouriertransformiert. Die Fouriertransformation wird verwendet, um die überlagerten Signale (Netzwerk, Lösungsmittel) zu trennen. Nachdem wir die Phasenverschiebung bestimmen konnten, interessiert uns nun das Aussehen des Ausgangssignals. Im Experiment haben wir es mit sehr vielen Teilchen zu tun, so dass</p>
<p><sup>1</sup>Fourier transformation <sup>2</sup>Phase distribution function</p>	<p><sup>3</sup>Fourier transformation <sup>4</sup>Phase distribution function</p>
1	

**Figure 4.1.:** Standard footnote placement in two-column documents.

<p>man über alle Phasen integrieren muss. Sei nun <math>S</math> unser normiertes Ausgangssignal und <math>P</math> die Phasenverteilungsfunktion, so ergibt sich die Beziehung</p> $S(t) = S_0(t) \int_{-\infty}^{\infty} P(\phi, t) e^{i\phi} d\phi \quad (2)$ <p>wobei <math>S_0</math> das Signal ohne Gradient ist und die Normierungsbedingung <math>\int_{-\infty}^{\infty} P(\phi, t) d\phi = 1</math> gilt. Nun dürfen</p>	<p>Das Spektrum wird fouriertransformiert. Die Fouriertransformation wird verwendet, um die überlagerten Signale (Netzwerk, Lösungsmittel) zu trennen. Nachdem wir die Phasenverschiebung bestimmen konnten, interessiert uns nun das Aussehen des</p>
<p>1. Fourier transformation 2. Phase distribution function</p>	<p>3. Fourier transformation 4. Phase distribution function</p>
1	

**Figure 4.2.:** Footnote placement in two-column documents when the  $\LaTeX$ -package `ftnright` is used.

“endnotes”. To use endnotes instead of footnotes in your document, load in the menu **Document**  $\triangleright$  **Settings**  $\triangleright$  **Modules** the module **Foot to End**. To insert the collected footnotes, insert the command

`\theendnotes`

in  $\TeX$ -Code at the end of a section or chapter.

The paragraph heading for the endnotes isn’t automatically translated into the document language, this must be done manually. The following preamble command translates the default English “Notes” into the German “Anmerkungen”:

`\renewcommand{\notesname}{Anmerkungen}`

man über alle Phasen integrieren muss. Sei nun  $S$  unser normiertes Ausgangssignal und  $P$  die Phasenverteilungsfunktion, so ergibt sich die Beziehung

$$S(t) = S_0(t) \int_{-\infty}^{\infty} P(\phi, t) e^{i\phi} d\phi \quad (2)$$

wobei  $S_0$  das Signal ohne Gradient ist und die Normierungsbedingung  $\int_{-\infty}^{\infty} P(\phi, t) d\phi = 1$  gilt. Nun dürfen

## Notes

<sup>1</sup>Fourier transformation

<sup>2</sup>Phase distribution function

<sup>3</sup>Fourier transformation

<sup>4</sup>Phase distribution function

**Figure 4.3.:** Endnotes – footnotes are printed in a separate paragraph at the end of sections or chapters.


The numbering of endnotes can be changed like the footnote numbering as described in section 4.2.1; just replace the command `\thefootnote` by `\theendnote`. To reset the endnote number use the command `\@addtoreset` as described in section 4.2.1 and replace the command parameter `footnote` by `endnote`.

For endnotes there is the command `\endnotemark[number]` similar to the command `\footnotemark`, that is described in section 4.2.

Footnotes can also be placed in the page margin and the footnote text alignment can be changed, see the L<sup>A</sup>T<sub>E</sub>X-package `footmisc`, [8] for more information about this.

For various further footnote formatting issues have a look at L<sup>A</sup>T<sub>E</sub>X-books, [1, 2, 3].

## 4.3. Margin Notes

Margin notes look and behave in LyX like footnotes. They are inserted via the menu `Insert > Marginal Note` or the toolbar button . A grey box with the red label “margin” appears where you can enter the text of the margin note.

This is a margin note.

At the side is an example margin note.

Margin notes appear at the right side in single-sided documents. In double-sided documents they appear in the outer margin – left on even pages, right on odd pages. The text of margin notes is aligned opposite to the outer margin – right-aligned when the note appears in the left margin. The first line of the margin note is placed at the position of the text line where it is inserted in the document.

To place the margin note in the inner margin, add the command

`\reversemarginpar`

in  $\text{\TeX}$ -Code before a margin note. The new placement is valid for all subsequent margin notes.

**Note:** There is often not enough space in the inner margin so that the notes are not correctly displayed in the output.

To return to the default placement insert the command

`\normalmarginpar`

in  $\text{\TeX}$ -Code. **Note:** The command is ignored when it is within a paragraph where also the command `\reversemarginpar` is inserted.

Similar to the case described in section 2.8.1, long words cannot be hyphenated when they are the first word in a margin note. To avoid this, insert 0pt horizontal space before the word.

**Note:** Margin notes can normally not be used inside tables, floats, and footnotes.

This restriction can be evaded by using the  $\text{\LaTeX}$ -package `marginnote`. By adding these two lines to your document preamble, the command used by  $\text{\LyX}$  for margin notes is redefined to use the command provided by the `marginnote`-package:

```
\usepackage{marginnote}
\let\marginpar\marginnote
```

This is also used in this document because `marginnote` has another useful feature: You can set a vertical offset for the note. This is often needed when too many margin notes are too close together or for a better page layout. The offset is set in  $\text{\LyX}$  as  $\text{\TeX}$ -Code directly after the margin note in the scheme

[offset]

where the offset is a length with one of the units listed in Table A.1. A negative value shifts the note up, a positive value shifts it down. For example the margin note beside this text line is shifted up 1.5 cm with the  $\text{\TeX}$ -Code-command “`[-1.5cm]`”

With `marginnote` you can also change the alignment of the text in the margin note. For example the commands

```
\renewcommand*{\raggedleftmarginnote}{\centering}
\renewcommand*{\raggedrightmarginnote}{\centering}
```

set the alignment to centered. `\raggedleftmarginnote` denotes margin notes that appear at the left side. The default is

```
\renewcommand*{\raggedleftmarginnote}{\raggedleft}
\renewcommand*{\raggedrightmarginnote}{\raggedright}
```

For the other features of `marginnote` refer to its documentation [13].

AVeryLongMarg  
that isn't  
hyphenated.  
AVeryLong  
MarginPar-  
Word that is  
hyphenated.

This margin  
note is shifted  
up 1.5 cm  
from its  
original  
position.

The text of  
this margin  
note is  
centered.

#### 4. Notes

You can adjust the layout of margin notes by changing its definition. To create for example a header for all margin notes with the underlined, sans-serif, and bold header text “**Attention!**”, add this to your document preamble:

```
\let\myMarginpar\marginpar
\renewcommand{\marginpar}[1]{\myMarginpar{%
\hspace{0pt}\textsf{\textbf{\underbar{Attention!}}}}%
\vspace{1.5mm}\#1}}
```


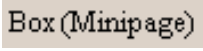
**Attention!**  
This is a  
margin note  
with a  
defined  
heading.



# 5. Boxes

## 5.1. Introduction

Boxes are used to format a block of text. Boxes can be used to write documents with multiple languages, see section 5.4, to frame texts, see section 5.2.3, to prevent words to be hyphenated, see section 5.6.1, to align text, see section 5.6.2, or to set the background color of texts, see section 5.7.

Boxes can be inserted with the menu `Insert > Box` or the toolbar button . A grey box with the label `Box (Minipage)`:  will be inserted. The box type can be specified by right-clicking on the box. The appearing box dialog offers the Inner Box types `Parbox` and `Minipage`. The type `Minipage` is the default for new boxes and is explained in section 5.4; the type `Parbox` is described in section 5.5.

Boxes are not numbered and can therefore not be referenced like floats or footnotes.

**Note:** Boxes must not be the item in an `Itemize` or `Description` environment.

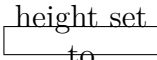
**Note:** For an unknown reason you can only set the Inner Box type to `None` when you use a framed box. Boxes without an Inner Box type and without frames are explained in section 5.6.1.

## 5.2. Box Dialog

### 5.2.1. Size

In the box dialog you can adjust the box geometry in the fields `Width` and `Height`. The available units for the geometry are explained in Table A.1. The field `Height` offers the following additional sizes:

**Depth** This is the plain text “height”. It ignores the total depth when there are multiple text lines in the box:

Box  
  
1 Depth

## 5. Boxes

**Height** This is the height of the text that is inside the box. A value of e. g. 2 for this size will set the box height to 2 times the text height:

Box height set  
to 2 Height

**Total Height** This is the Height + Depth:

Box height set  
to 1 Total Height

**Width** This sets the width of the box as height:

Box  
height set  
to  
1 Width

### 5.2.2. Alignment

When you have chosen an **Inner Box**, the vertical box alignment can be:

**Top** This is an example text line. This is an example text line.

This box  
is top-  
aligned.

**Middle** This is an example text line. This is an example text line.

This box  
is middle-  
aligned.

**Bottom** This is an example text line. This is an example text line.

This box  
is  
bottom-  
aligned.

**Note:** The vertical box alignment can be lost in the output when you have two boxes in a line and one has e. g. a shadow and the other one not.

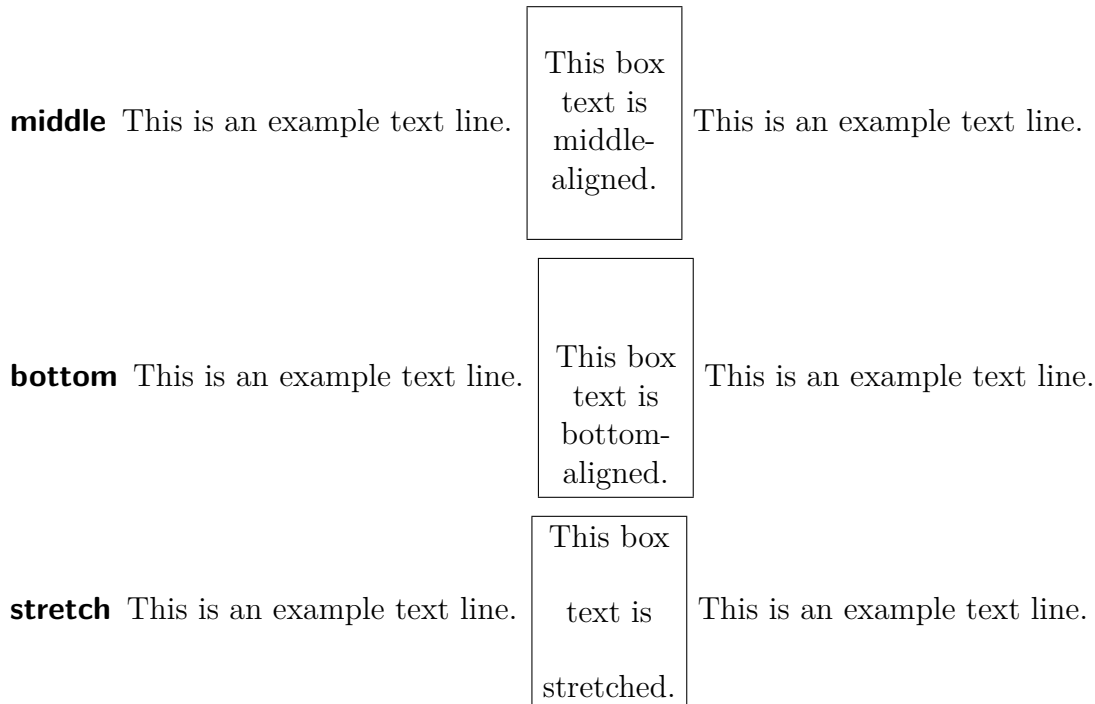
The horizontal box alignment can be set via LyX's paragraph dialog when you set the box into its own paragraph.

When you have chosen an **Inner Box**, the box content can be aligned vertically to:

**top** This is an example text line.

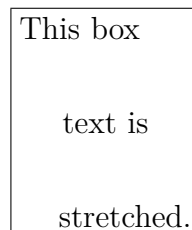
This box  
text is  
top-  
aligned.

This is an example text line.

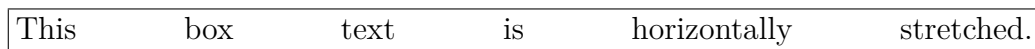


To stretch the box content, it must consist of more than one paragraph. In the example above every text line is in an own paragraph.

To align the box content horizontally you can use LyX's paragraph dialog when you have chosen an **Inner Box**.



If you have not set an **Inner Box**, you can align the box content horizontally in the box dialog.



### 5.2.3. Decoration

The type of the box can be specified in the box dialog in the drop-down list **Decoration**. The following types are possible:

**Simple rectangular frame** This draws a rectangular frame around the box. The frame line thickness has the size of `\fboxrule`. Rectangular box

**Allow page break** When you use the decoration `simple rectangular frame` and no inner box, you can allow page breaks within a box. Note that then, in contrary to other framed boxes, the frame always uses the whole column width, the box is set as its own paragraph, and `\fboxrule` and `\fboxsep` have no effect on this box type. The frame line thickness has the size of `\FrameRule`.

Allow page break box

**Oval box, thin** This draws an oval frame around the box. The frame line thickness has the size 0.4 pt. Oval box, thin

**Oval box, thick** This draws an oval frame around the box. The frame line thickness has the size 0.8 pt. Oval box, thick

**Drop shadow** This draws a rectangular frame with a shadow around the box. The frame line thickness has the size of `\fboxrule`, the shadow has a width of 4 pt.

Shadow box

**Shaded background** This draws a box with red background color. In contrary to colored boxes<sup>1</sup>, it always uses the whole column width and the box is set as its own paragraph.

Shaded background box

**Double rectangular frame** This draws a double-line rectangular frame around the box. The line thickness of the inner frame is  $0.75 \text{ \fboxrule}$ , the thickness of the outer frame is  $1.5 \text{ \fboxrule}$ . The distance between the lines is  $1.5 \text{ \fboxrule} + 0.5 \text{ pt}$ .

Double  
rectangular box

L<sup>A</sup>T<sub>E</sub>X's box label will reflect the different frame types. To be able to use all types, the L<sup>A</sup>T<sub>E</sub>X-package `fancybox` must be installed.

### 5.3. Box Customization

The default value for the size `\fboxrule` is 0.4 pt. It can be changed with the following command in T<sub>E</sub>X-Code to e. g. 2 pt:

```
\setlength{\fboxrule}{2pt}
```

Rectangular box  
with  
`\fboxrule = 2 pt`

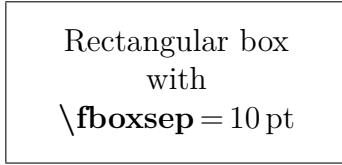
---

<sup>1</sup>see sec. 5.7

The space between the frame and the box content is for all frame styles by default 3 pt. You can change it by setting the length `\fboxsep` to another value. For example the command

```
\setlength{\fboxsep}{10pt}
```

sets the value to 10 pt, like for the following box:



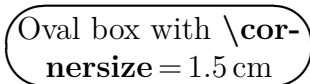
The diameter of the round corners of the oval boxes can be set with the command `\cornersize`. The command

```
\cornersize*{1cm}
```

sets the diameter to 1 cm. The command

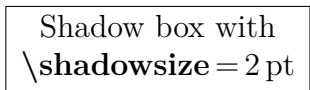
```
\cornersize{num}
```

sets the diameter to  $\text{num} \times \text{minimum}(\text{width and height of box})$ . The default is `\cornersize{0.5}`.



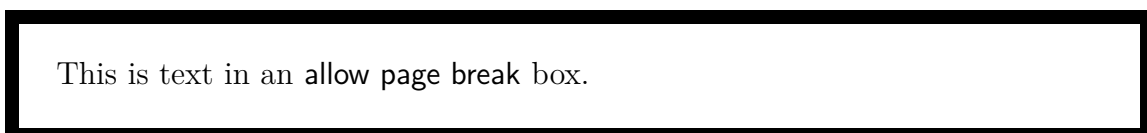
The size of the shadow can be adjusted by changing the length `\shadowsize`. It is set to 2 pt for the following box by this command:

```
\setlength{\shadowsize}{2pt}
```



The default value for the size `\FrameRule` is 0.4 pt. The default space between the note content and the frame is 9 pt and can be changed with the value of `\FrameSep`. For example the frame appearance of the following box is set with the TeX-Code commands

```
\setlength{\FrameRule}{5pt}
\setlength{\FrameSep}{0.5cm}
```



## 5. Boxes

For shaded background boxes the default space between the box content and the box border is 3pt and can be changed with the value of `\fboxsep`. The default background color red can either be changed locally with the command `\definecolor{shadecolor}` or globally with the menu **Tools**▷**Preferences**▷**Colors**▷**shaded box**. The scheme of the `\definecolor` command is explained in section 2.11.<sup>2</sup> For example the appearance of the following shaded background box is set with the T<sub>E</sub>X-Code commands

```
\setlength{\fboxsep}{0.5cm}  
\definecolor{shadecolor}{cmyk}{0.5,0,1,0.5}
```

This is yellow text in a shaded background box with dark green background.

Changed lengths and widths are valid for all boxes following the commands that change them.

### 5.4. Minipages

Minipages are treated by L<sup>A</sup>T<sub>E</sub>X as pages within pages and can therefore for example have their own footnotes.

Minipages are useful when you write documents with different languages.

Below are two example minipages side by side. Their width is set to 45 col% and they are separated by a horizontal fill, that was inserted via the menu **Insert**▷**Special Formatting**▷**Horizontal Fill**.

---

<sup>2</sup>Note that `\definecolor` requires the L<sup>A</sup>T<sub>E</sub>X-package **color** in the preamble, see section 5.7.

Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text. Dies ist ein deutscher Text.<sup>a</sup> Dies ist ein deutscher Text. Dies ist ein deutscher Text.

---

<sup>a</sup>Dies ist eine deutsche Fußnote.

This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text. This is an English Text.<sup>a</sup> This is an English Text.

---

<sup>a</sup>This is an English footnote.

The document-wide paragraph settings are ignored within minipages. That means that there will be no space between paragraphs in minipages although you set it to e. g. `MedSkip` in the document settings.

Minipages can also be used to set a background color for text parts, see section 5.7.2.

**Note:** You cannot have floats or margin notes inside minipages but minipages can be used inside tables, floats, and other boxes.

## 5.5. Parboxes

Parboxes are very similar to minipages with the difference that they cannot have footnotes. The main difference to minipages is that minipages are in contrary to parboxes no real boxes but  $\text{\LaTeX}$ -environments.

This a text within a parbox.  
 This a text within a parbox.  
 This footnote won't appear:<sup>3</sup>

## 5.6. Boxes for Words and Characters

### 5.6.1. Prevent Hyphenation

You can use a special kind of boxes to prevent words or text to be hyphenated. Here is an example text:

## 5. Boxes

This line is an example to show how you can prevent the hyphenation of “veryverylongword”.

To prevent the hyphenation of the word “veryverylongword”, add the command

`\mbox{`

in `TeX-Code` before the word. Behind the word insert a closing brace “`}`” in `TeX-Code`.

This is the result:

This line is an example to show how you can prevent the hyphenation of “veryverylongword”.

You can alternatively set the command “`\-`” as `TeX-Code` directly before the word:

This line is an example to show how you can prevent the hyphenation of “veryverylongword”.

Of course the word now protrudes over the side margin. To avoid this, add via the menu **Insert**▷**Special Formatting**▷**Line Break** (shortcut **Ctrl+Return**) a line break before the word:

This line is an example to show how you can prevent the hyphenation of “veryverylongword”.

### 5.6.2. Vertical Alignment

With the help of the command `\raisebox` you can align words, characters or other boxes vertically to the surrounding text. `\raisebox` is used with the following scheme:

`\raisebox{lift}[height][depth]{box content}`

The lift can be a positive value to raise the box or a negative value to lower the box.

To align for example the word “preventing” so that the bottom of the “deepest” character “p” is at the baseline, insert the command

`\raisebox{\depth}{`

in `TeX-Code` before the word. Behind the word insert a closing brace “`}`” in `TeX-Code`.

This is the result:

This is a text line with the word “preventing” as raised word.

When you raise or lower characters in a line, the line distance will be spread:

This is a text line with the word “preventing” as lowered word.  
“testing”

This is a text line with the word as raised word.

If you want to prevent this for a certain reason, set the box height to a zero value. For example use



```
\raisebox{-\depth}[0pt]{
```

This is a text line with the word “preventing” as lowered word.

This is a text line with the word “preventing” as raised word.

## 5.7. Colored Boxes

### 5.7.1. Color for Text

To color the background of text the text must be put into a so called “colorbox”. This requires that the  $\text{\LaTeX}$ -package **color** is loaded in the document preamble with the command

```
\@ifundefined{textcolor}
{\usepackage{color}}{}
```

The package **color** will be loaded automatically by  $\text{\LaTeX}$  when you color text<sup>4</sup>.

Colorboxes are created with the command `\colorbox`. This will be used with the following scheme:

```
\colorbox{color}{box content}
```

The box content can also be a box and colorboxes can also be within other boxes.

The following colors are predefined:

black, blue, cyan, green, magenta, red, white, and yellow.

You can also define your own color as described in section 2.11.

To have e.g. a red background for a word, insert the command

```
\colorbox{red}{
```

before the word in  $\text{\TeX}$ -Code. Behind the word insert a closing brace “}” in  $\text{\TeX}$ -Code.

This is the result:

This is a line where the word **Attention!** has a red background.

If you would have the box frame in a different color, you can use the command `\fcolorbox` with the following scheme:

```
\fcolorbox{frame color}{box color}{box content}
```

`\fcolorbox` is an extension to `\colorbox`. The frame thickness and the space between the frame and the box content can be adjusted with the lengths `\fboxrule` and `\fboxsep`, respectively, as described in section 5.2.3.

---

<sup>4</sup>To avoid that it is loaded twice the command `\@ifundefined` is used.

## 5. Boxes

For the following example the command

```
\fcolorbox{cyan}{magenta}{
```

was used.

Here is an example where the frame line thickness was set to 1 mm:

This is text within a colored, framed box.

Of course you can also have colored text inside a colorbox:

This is colored text within a colored, framed box.

**Note:** Text in colorboxes cannot have line breaks. To color multiple text lines or paragraphs, use a box inside a colorbox as described in the following.

### 5.7.2. Color for Paragraphs

To set the background color for more than one text line, put the text into a minipage. Before the minipage insert the `\colorbox` command

```
\colorbox{color}{
```

in  $\text{T}_{\text{E}}\text{X}$ -Code. Behind the minipage insert a closing brace “}” in  $\text{T}_{\text{E}}\text{X}$ -Code.

This is text with background color. This is text with background color.

The text can have footnotes<sup>a</sup> and can include tables and figures.

a	!	3
<	b2”	>
1	§	c

---

<sup>a</sup>Another example footnote

## 5.8. Rotated and Scaled Boxes

To use the commands described in this section, the  $\text{L}^{\text{A}}\text{T}_{\text{E}}\text{X}$ -package **graphicx** needs to be loaded in the document preamble with the command

```
\@ifundefined{rotatebox}  
{\usepackage{graphicx}}{}
```

**Note:** Some DVI-viewers can’t display rotated or scaled material.

**Note:** Floats mustn’t be inside a rotated or scaled box.


### 5.8.1. Rotated Boxes

To rotate material, you can put it into a rotated box. Such a box is created using the command `\rotatebox` in T<sub>E</sub>X-Code with the following scheme:

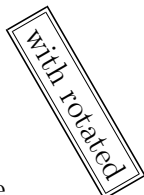
`\rotatebox[rotation origin]{rotation angle}{box content}`

The rotation origin is specified in the form **origin=position**. The following positions are possible: *c* (center), *l* (left), *r* (right), *b* (bottom), *t* (top), and also expedient combinations of the four base positions. For example *lt* means, that the rotation origin is at the top left corner of the box. When no rotation origin is specified, the position *l* will be used. The rotation angle is a number that can be negative that specifies the angle in degrees. The rotation direction is counterclockwise.

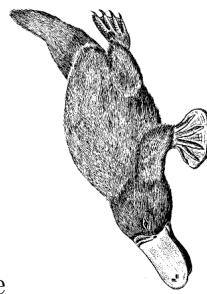
In the following example the command `\rotatebox[origin=c]{60}` was inserted as T<sub>E</sub>X-Code before the text “with rotated”; after the text the box was closed by a closing brace `}` in T<sub>E</sub>X-Code.

This is a line  text.

The box content can also be another box or an inline formula:

This is a line  framed text  $\int A dx = B$  and a formula.

or an image or table:

This is a line  with a rotated image 

e	b
r	w

 and table.

### 5.8.2. Scaled Boxes

To scale material the commands `\scalebox` and `\resizebox` can be used as T<sub>E</sub>X-Code.

## 5. Boxes

`\scalebox` is used with the following scheme:

`\scalebox{horizontal}[vertical]{box content}`

Horizontal and vertical are the corresponding scaling factors. If no vertical scaling factor is given, the horizontal factor will also be used as vertical one.

The command `\scalebox{2}{Hello}` creates for example a double size **Hello**, compared to the document text size.

`\scalebox{2}[1]{Hello}` in contrary distorts the **Hello**.

If a the scaling factor is negative, the box content will be mirrored. Therefore the command `\scalebox{-1}[1]{Hello}` can be used to create mirror writing: olǝH

`\scalebox{1}[-1]{Hello}` reflects the  $\text{H}\ell\text{o}$  at the base line.

Equivalent to `\scalebox{-1}[1]{box content}` there exists the command `\reflectbox{box content}`.

The command `\resizebox` is used to scale the box to a defined width and height. The command scheme is:

`\resizebox{width}{height}{box content}`

Is one of the two command arguments given as exclamation mark `!`, the size is set so that the aspect ratio of the box content is kept.

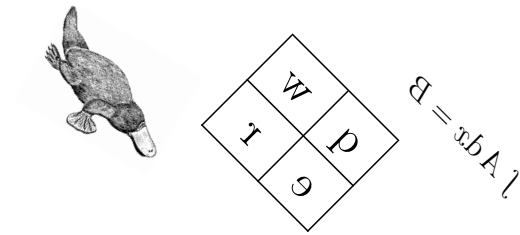
The command `\resizebox{2cm}{1cm}{Hello}` produces: **Hello**  
The command `\resizebox{2cm}{!}{Hello}` produces: **Hello**

**Note:** When arguments of `\scalebox` or `\resizebox` are set to zero, no L<sup>A</sup>T<sub>E</sub>X-errors occur when exporting the document but the exported files can not or only partly be displayed.

The boxes can be combined in any order. E. g. the command `\rotatebox[origin=c]{-45}{\resizebox{2cm}{!}{\reflectbox{Hello}}}` produces:

**Hello**

Images, tables, and inline formulas are allowed as box content:



When the global formula style **fleqn** is used in the document<sup>5</sup>, also display formulas can be scaled.

---

<sup>5</sup>When “fleqn” is added to the document class options.

## 5. Boxes

## 6. External Document Parts

With the menu `Insert▷File` you can insert external material to your document. This can be:

**LyX Document** Another LyX document; its content is directly inserted to your document.

**Plain Text** A text document; every of its text lines is inserted to your document as own paragraph.

**Plain Text, Join Lines** A text document; its text lines are inserted as they are. Empty text lines creates a new paragraph in your document.

**External Material** Files in various formats.

**Child Document** LyX or L<sup>A</sup>T<sub>E</sub>X-documents.

### 6.1. External Material

The external material feature allows you to insert files to your document without converting them previously to a format that can be read by the document output format because LyX takes care of needed conversions. This is similar to images that can be inserted in various image formats to LyX documents. When you have enabled Instant Preview in LyX's preferences under `Look and feel▷Graphics`, the external material types Dia and Xfig is directly shown in LyX.

External material can be inserted via the `External Material` dialog that is accessible with the menu `Insert▷File▷External Material`. Currently the following file types (Templates) are allowed:

**ChessDiagram** This template supports chess position diagrams made with the program [XBoard](#).

**Date** This inserts the date in the form *Day-Month-Year*. This is a date inserted as external material: 26-07-2010

The date is not shown within LyX, only in the output. There are two other methods of inserting a date: Via menu `Insert▷Date` and with the L<sup>A</sup>T<sub>E</sub>X command `\today` as T<sub>E</sub>X-Code. The different methods are compared in Table 6.1.

**Dia** This template supports diagrams created with the program [Dia](#).

## 6. External Document Parts

**LilyPond** This template is used for music notation typeset with the program [LilyPond](#).

**PDFPages** With this template you can insert PDF documents to your document. To insert certain or all pages of a PDF, use the *pages* option in the **Option** field in the **LaTeX and LyX options** tab according to the template description in the dialog. When no *pages* option is given, only the first page of the PDF will be inserted.

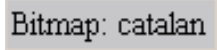
**RasterImage** This can be used for bitmap images. Nearly all popular image formats are supported. The image can be treated in the **External material** dialog like the images that are usually included via the **Graphics** dialog as described in section 1.1. The difference is that only raster images are allowed, that means that PDF and EPS-images are not supported.

**XFig** This template supports images created with the program [Xfig](#).

**Table 6.1.:** Comparison of the date input methods.

Document format	External Material▷Date	Insert▷Date	command <code>\today</code>
LyX	as inset box	as date	as TeX-Code inset box
LaTeX	as date	as date	as command
DVI, PDF, PS	as date	as date	as date

When you use the option **Draft** in the **File** tab of the **External Material** dialog, only the path to the inserted file is shown in the output.

External material is displayed in LyX either as box like this:  or as image, depending on the option **Show in LyX** in the **LaTeX and LyX options** tab of the dialog.

The *Customization* manual explains how you can define your own templates.

## 6.2. Child Documents

Child documents are used when you have a long document consisting of several larger parts or sections. For maintenance it is often useful and sometimes even required to split the document in several files that can be revised separately. The different documents are then the so called child documents and a master document connects them to print the full document or parts of it. A child documents inherits contents of its master, for example the LaTeX preamble, the bibliography, and labels for cross-references.

To be able to work on child documents without the need to open its master, specify in the child document the master in the menu **Document▷Settings▷Document Class**.



This master document will then be used in the background by LyX when you edit the child document.

Included documents are displayed in LyX as a box like this: `Include: Customization.lyx`

To include child documents to a master document use the menu **Insert**  $\triangleright$  **File**  $\triangleright$  **Child Documents**. A dialog pops up where you can choose between four include methods:

**Include** You can include LyX and L<sup>A</sup>T<sub>E</sub>X-documents. When you press the **Load** button in the **Child Document** dialog, the included documents will be opened in LyX in a new file tab so that you can modify it.

Here is a child document inserted using **Include**:

## 6. *External Document Parts*

### **6.2.1. External Subsection 1**

This is a small dummy child document to show how files can be inserted to another document.

The section numbering includes the sections of the included files in the order they are inserted in the master document. The included example document has for example a subsection that is numbered as subsection of this section. Labels of included documents can be referenced: Subsection 6.2.1

The preamble of the child document is ignored, only the preamble of the master document is used. Branches in child documents will be ignored by the master document when the master document does not have a branch with the same name. Included documents are inserted starting on a new page and end with a page break.

In case you are only working on a certain chapter of a large document and want to save compiling time, you can put each included file into a branch.<sup>1</sup> By enabling/disabling branches you can decide what included files will appear in the output.

**Note:** Due to a bug in LyX the L<sup>A</sup>T<sub>E</sub>X command `\includeonly` can currently not be used as alternative to decide what files should be included.

**Note:** When you have included a LyX- or L<sup>A</sup>T<sub>E</sub>X-file, you are warned when you export/view the document in case that the child document uses another document class than the master document as this will lead to unexpected outputs.

**Input** This method is very similar to the Include method. The differences are:

- Input files don't start with a new page and don't end with a page break.
- Input files can be previewed in LyX when Instant Preview is enabled in LyX's preferences under Look and feel▷Graphics.
- The L<sup>A</sup>T<sub>E</sub>X-command `\includeonly` cannot be used.

Here is a child document inserted using Input:

### 6.2.2. External Subsection 2

This is another small dummy child document to show how files can be inserted to a document.

**Verbatim** With this method every text file can be included. The file is shown in the output with its source code, no command used in the text is invoked. You can use the option Mark spaces in output that displays the character “□” for every space character in the source code. The difference to the method via the menu Insert▷File▷Plain Text is that the document content is not shown in LyX.

Here is a child document inserted as Verbatim:

This is a small dummy child text document to show how files can be inserted to a document.

---

<sup>1</sup>Branches are described in section *Branches* of the LyX *Userguide*.

## 6. External Document Parts

Here is a child document inserted as Verbatim using the `Mark spaces in output` option:

```
This is a small dummy child text document to show how files can be inserted to a
```

**Note:** As you can see in the examples above, the text of the documents included as `verbatim` is not broken at the end of the document lines.

**Listings** This type is described in chapter 7.

**Note:** Including the same document twice in a document using different methods could cause `LATEX`-problems.

## 7. Program Code Listings

To include and typeset program code you can use the Listings inset that can be inserted via the menu **Insert**▷**Program Listing**. The L<sup>A</sup>T<sub>E</sub>X-package **listings** provides a powerful and flexible way to insert program source code to your document.

Right-clicking on a listings inset opens the context menu containing where you can set the listings format.

By default, a listing starts a new paragraph in the output. The placement option **Inline listing** prints the listing inline like this: `int a=5;`

The option **Float** creates a listings float where you can specify the placement options “h”, “t”, “b”, and “p” corresponding to the float placement options described in section 3.5. The placement options can be mixed and are inserted without any separation, e.g. “htbp”. The option “h” has sometimes no effect, but you don’t need to use the **Float** option in this case as also non-float listings can have captions and be referenced.

You can add captions to listings with the menu **Insert**▷**Caption**. Listings can be referenced like floats: Listing 7.1

**Listing 7.1:** Example Listing float

```
# Example listing float  
def func(param):  
    'this is a python function'  
pass
```

When you have set a programming language in the listings dialog, the keywords of this language will be recognized and specially typeset in the output. In the example listings the Python keyword “def” is recognized and printed bold in the output.

**Note:** If you don’t get bold keywords when using typewriter fonts, your typewriter font probably doesn’t provide a bold shape. In this case select a different one in the menu **Document**▷**Settings**▷**Fonts**. (The fonts *LuxiMono*, *BeraMono* and *Courier* provide bold shapes.)

In section **Line numbering** of the listings dialog you can specify the line numbering style. You can insert a number to specify which lines are numbered to the field **Step**. When you insert e.g. “3”, only every 3rd line will be numbered.

You can furthermore specify a range of lines, only these will then appear in the output. The option **Extended character table** should be used when you use national

## 7. Program Code Listings

characters like the German umlauts in the listing.

Here is an example listing with left line numbering, step “3”, language “Python”, options “Extended character table” and “Space as symbol”, range lines 3-8:

```

    pass
2 def func (param):
    'This is a German word: Tschüß'
    pass
5 def func (param):
    'this is a python function'
```

When you have tabulators in your listing, you can specify the number of characters that are spanned by a tabulator in the field **Tabulator size**.

**Note:** Due to a bug in the **listings** package the line numbering is shifted by a line by every previous listing. That’s the reason why the lines 2 and 5 are numbered in the above listing and not the lines 3 and 6.

It is also possible to print lines from a file as listing. To do this, use the menu **Insert**▷**File**▷**Child Document** and choose the type **Listings**.<sup>1</sup> In the child document dialog you can specify the listing parameters in a text box. To show a list of all available parameters, type in a question mark “?” in the text box.

To reference child document listings, write a label text into the corresponding field of the child document dialog. The label can then be referenced using the menu **Insert**▷**Cross-Reference**.

Listing 7.2 is an example for a listing of a file; there the lines 10-15 of this LyX file are listed.

### **Listing 7.2:** Lines 10 - 15 of this LyX file

```
% set fonts for nicer pdf view
\IfFileExists{lmodern.sty}
{\usepackage{lmodern}}{}

\fi % end if pdflatex is used
```

Global listings settings can be set in the **Document**▷**Settings**▷**Text Layout** dialog. To get there a list of available options, type in a question mark “?” in the **Listings settings** field.

For more information about the **listings** package, we refer to its documentation [12].

---

<sup>1</sup>The other child document types are described in section 6.2.

# A. Units available in LyX

To understand the units described in this documentation, Table A.1 explains all units available in LyX.

**Table A.1.:** Units

unit	name/description
mm	millimeter
cm	centimeter
in	inch
pt	point (72.27 pt = 1 in)
pc	pica (1 pc = 12 pt)
sp	scaled point (65536 sp = 1 pt)
bp	big point (72 bp = 1 in)
dd	didot (1 dd $\approx$ 0.376 mm)
cc	cicero (1 cc = 12 dd)
Scale%	% of original image width
text%	% of text width
col%	% of column width
page%	% of paper width
line%	% of line width
theight%	% of text height
pheight%	% of paper height
ex	height of letter $x$ in current font
em	width of letter $M$ in current font
mu	math unit (1 mu = 1/18 em)

A. *Units available in LyX*




# B. Output File Formats with Graphics

## B.1. DVI

This file type has the extension “.dvi”. It is called “device-independent” (DVI), because it is completely portable; you can move them from one machine to another without needing to do any sort of conversion. At the time when this file-format was developed, this was no matter of course. DVIs are used for quick previews and as pre-stage for other output formats, like PostScript.

**Note:** DVI-files doesn't contain images, they will only be a linked. So don't forget this, if you move your .dvi file to another computer. This property can also slow down your computer when you view the DVI. Because the DVI-viewer has to convert the image in the background to make it visible when you scroll in the DVI. So we recommend to use PDF for files with many images.

You can export your document to DVI by using the menu **File**▷**Export**▷**DVI**. You can view your document as DVI via the **View** menu or by using the toolbar button .

## B.2. PostScript


This file type has the extension “.ps”. PostScript was developed by the company Adobe as printer language. The file contains therefore commands that the printer uses to print the file. PostScript can be seen as “programming language”; you can calculate with it and draw diagrams and images<sup>1</sup>. Due to this ability, the files are often bigger than PDFs.

PostScript can only contain images in the format “Encapsulated PostScript” (EPS, file extension “.eps”). As LyX allows you to use any known image format in your document, it has to convert images in the background to EPS. If you have e.g 50 images in your document, LyX has to do 50 conversions whenever you view or export your document. This will slow down your work flow with LyX drastically. So if you plan to use PostScript, you can insert your images directly as EPS to avoid this problem.

---

<sup>1</sup>If you are interested to learn more about this, have a look at the L<sup>A</sup>T<sub>E</sub>X-package **PSTricks** [14].

## B. Output File Formats with Graphics

You can export your document to PostScript using the menu **File**▷**Export**▷**Postscript**. You can view your document as PostScript via the **View** menu or by using the toolbar button .

### B.3. PDF

This file type has the extension “.pdf”. The “Portable Document Format” (PDF) is developed by **Adobe** as derivative from PostScript. It is more compressed and it uses much less commands than PostScript. As the name “portable” implies, it can be processed at any computer system and the printed output looks exactly the same.

PDF can contain images in its own PDF format, in the format “Joint Photographic Experts Group” (JPG, file extension “.jpg” or “.jpeg”), and in the format “Portable Network Graphics” (PNG, file extension “.png”). Nevertheless you can use any other image format, because LyX converts them in the background to one of these formats. But as described in the section about PostScript, the image conversion will slow down your work flow. So it is recommended to use images in one of the three mentioned formats.


You can export your document to PDF via the menu **File**▷**Export** in three different ways:

**PDF (ps2pdf)** This uses the program `ps2pdf` that creates a PDF from a PostScript-version of your file. The PostScript-version is produced by the program `dvips` which uses a DVI-version as intermediate step. So this export variant consist of three conversions.

**PDF (dvi2pdf)** This uses the program `dvi2pdf` that converts your file in the background to DVI and in a second step to PDF.

**PDF (pdflatex)** This uses the program `pdftex` that converts your file directly to PDF.

It is recommended to use PDF (`pdflatex`) because `pdftex` supports all features of actual PDF-versions, is quick and works stable without problems. The program `dvi2pdf` is not under development and therefore a bit outdated.

You can view your document as PDF via the **View** menu or by using the toolbar button  (that uses PDF (`pdflatex`)).

## C. Explanation of Equation (2.1)

The total width of  $n$  table cells  $W_{\text{tot } n}$  can be calculated to

$$W_{\text{tot } n} = n \cdot (W_{gn} + 2 \cdot \text{\tabcolsep}) + (n + 1) \cdot \text{\arrayrulewidth} \quad (\text{C.1})$$

Where  $W_{gn}$  is the given width of all cells. `\tabcolsep` is the L<sup>A</sup>T<sub>E</sub>X-length between the cell text and the cell border, its default value is 6 pt. `\arrayrulewidth` is the thickness of the cell border line, the default is 0.4 pt.

Following equation (C.1), the total width of a multicolumn  $W_{\text{tot mult}}$  is

$$W_{\text{tot mult}} = W_{g\text{mult}} + 2 \cdot \text{\tabcolsep} + 2 \cdot \text{\arrayrulewidth} \quad (\text{C.2})$$

By setting equation (C.1) and (C.2) equal we can calculate the needed given width  $W_{gn}$  when  $n$  columns are spanned, so that each column has a total width of  $W_{\text{tot mult}}/n$ :

$$W_{gn} = (W_{g\text{mult}} + (1 - n) \cdot (2 \cdot \text{\tabcolsep} + \text{\arrayrulewidth}))/n \quad (\text{C.3})$$

*C. Explanation of Equation (2.1)*

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