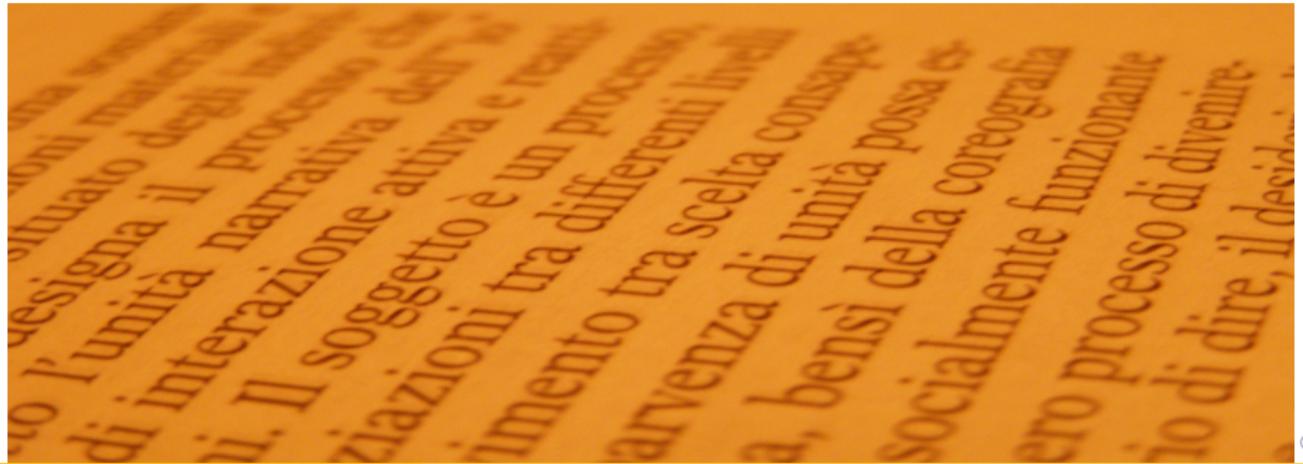


Org Beamer quick reference card

Fabrice Niessen

June 14, 2014



Plan

Description

Welcome to **Org Beamer reference card**. It contains the reference documentation that describes how to **write presentations** based on:

- Org mode 8 and
- the **LATEX** Beamer class.

Those **free** tools allow you to easily produce **high quality PDF files** which are going to be displayed on *every* computer exactly the way they looked on *your* computer.

Features

Since they are like any other Org mode document, authoring presentations with Org Beamer is very easy, thanks to its straightforward syntax.

The obvious advantages of this approach are that:

- you don't have to know L^AT_EX in order to create Beamer presentations.
- you are more productive when editing presentations:
 - ▶ you can expand and collapse slides,
 - ▶ you can switch quickly between slides by using navigation (speed) commands,
 - ▶ you can incorporate code blocks (in R or in many other languages) for illustration, and evaluate them to actually render output (including plots).

Requirements

- A working \LaTeX installation is required for exporting to PDF. If it is not yet installed on your system, install $\text{\TeX} \text{ Live}$ (for example).
- You must define a beamer class in org-latex-export-classes:

```
(eval-after-load "ox-latex"  
  
  ;; update the list of LaTeX classes and associated header (encoding, etc.)  
  ;; and structure  
  '(add-to-list 'org-latex-classes  
    `("beamer"  
      ,(concat "\\\documentclass[presentation]{beamer}\n"  
              "[DEFAULT-PACKAGES]"  
              "[PACKAGES]"  
              "[EXTRA]\n")  
      ("\\\section{%s}" . "\\\section*{%s}")  
      ("\\\subsection{%s}" . "\\\subsection*{%s}")  
      ("\\\subsubsection{%s}" . "\\\subsubsection*{%s}"))))
```

Creating a title page I

The very first slide (called **frame** in a Beamer presentation) is the **title page**. By default, it will automatically be displayed with the following elements:

- the document **title**

```
#+TITLE: Document title
```

(file name, if none specified)

- the **author(s)**'s name

```
#+AUTHOR: John Doe
```

(Emacs Lisp variable `user-full-name`, if none specified)

- a **date**

```
#+DATE: 2014-06-11
```

(**LATEX** macro `\today`, if none specified)

Creating a title page II

The author's email can be included with:

```
#+AUTHOR:      \href{mailto:email@example.com}{John Doe}
#+AUTHOR:      \texorpdfstring{John Doe\nline\url{email@example.com}}{John Doe} % D
#+BEAMER_HEADER: \author{\texorpdfstring{John Doe\nline\url{email@example.com}}{J}
```

Other elements:

- the document **subtitle**,
- their affiliation (**institute**), and
- a **title graphic**

can be included with the following commands:

```
#+BEAMER_HEADER: \subtitle{Document subtitle}
#+BEAMER_HEADER: \institute[INST]{Institute}\url{http://www.institute.edu}
#+BEAMER_HEADER: \titlegraphic{\includegraphics[height=1.5cm]{InstLogo}}
```

XXX Why do I have to use :eval no (in Org blocks)?

The **inner theme** dictates how the title page is rendered.

```
#+BEAMER_HEADER: \logo{\includegraphics[height=.9cm]{InstLogo}}
```

Structure basics

Org mode presentations contain headings at different levels.
By default,

- Headings at the **first** outline level will become **titles** of the different frames.
- **Deeper** levels will be used as **structural environments**.
- The **table of contents** frame is created but is blank (***you'll understand later***).

You can remove it by setting the `toc` option (default: `t`) from the `#+OPTIONS:` keyword to `nil`:

```
#+OPTIONS: toc:nil

* Frame 1

Some content.

** Block

This is a block.
```

Creating a simple frame

To create a frame with bullets, you simply use standard Org mode bullets:

```
* A title
#+Beamer: \frame{A subtitle}

- Bullet 1
- Bullet 2
- Bullet 3
```

Content within frames is formatted using standard Org mode syntax.

The optional **subtitle** does not have an Org syntax because it's specific to the Beamer back-end only.

Frame with code

Here is a simple R code block...

```
#+begin_src R :exports both  
summary(cars)  
#+end_src
```

... that will display the code and show its output in the frame:

```
summary(cars)
```

Min. : 4.0	Min. : 2.00
1st Qu.:12.0	1st Qu.: 26.00
Median :15.0	Median : 36.00
Mean :15.4	Mean : 42.98
3rd Qu.:19.0	3rd Qu.: 56.00
Max. :25.0	Max. :120.00

XXX Is this needed?

```
#+LATEX_HEADER: \lstdefinelanguage{R}{}{}
```

Frame with code only

To display a code block without evaluating it, you specify the `:eval no` option:

```
#+begin_src R :eval no
summary(cars)
#+end_src
```

It only renders the code:

```
summary(cars)
```

Frame with output only

To display the output of a code block without echoing the underlying code, you specify the :exports results option:

```
#+begin_src R :exports results
summary(cars)
#+end_src
```

It only renders the results:

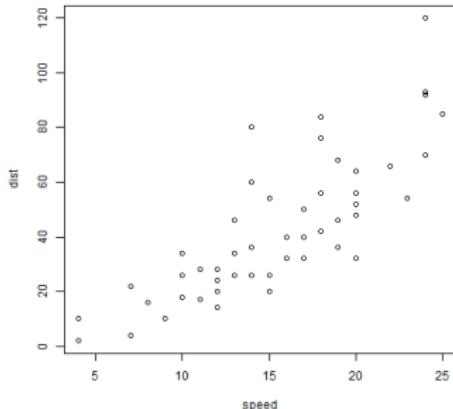
Min. : 4.0	Min. : 2.00
1st Qu.:12.0	1st Qu.: 26.00
Median :15.0	Median : 36.00
Mean :15.4	Mean : 42.98
3rd Qu.:19.0	3rd Qu.: 56.00
Max. :25.0	Max. :120.00

Frame with plot

Code blocks can also be used to include plots within presentations.

To display a plot while omitting the code used to generate it, you can include a code block like this:

```
#+begin_src R :exports results :results graphics :file qplot.png
plot(cars)
#+end_src
```



Creating a table of contents I

If you set the H option from the `#+OPTIONS:` keyword (or the `org-beamer-frame-level` variable) to 2:

```
#+OPTIONS: H:2 toc:t
```

then:

- First-level headings become **sections** listed in the table of contents¹, and
- Second-level headings become the **frames**.

XXX Misplaced footnote!

Creating a table of contents II

If you set the `H` value to 3 in the `OPTIONS` line:

```
#+OPTIONS: H:3 toc:t
```

then:

- First- and second-level headings become **sections** and **subsections** listed in the table of contents, and
- Third-level headings become the **frames**.

In many themes, sections (and subsections, when `H:3`) appear in the sidebar or heading.

¹The items in the TOC are clickable and take you to specific frames in the presentation.

Present a bibliography

Exporting to PDF

Type:

```
M-x load-library RET ox-beamer RET
```

to load the Beamer back-end library, and to obtain **extra commands** in the \LaTeX export menu:

C-c C-e l B Export as \LaTeX buffer (Beamer).

C-c C-e l b Export as \LaTeX file (Beamer).

C-c C-e l P **Export as PDF file** (Beamer).

C-c C-e l O Export as PDF file and **open** (Beamer).

Support editing

Type:

```
M-x org-beamer-mode RET
```

to load the minor mode `org-beamer-mode` easing the edition of the **document structure** (through the key binding `C-c C-b`, which offers fast selection of a **Beamer environment**). You can also turn it on with:

```
#+STARTUP: beamer
```

in your document.

Create a handout

You can distribute your presentation in the form of handouts. Presentations exported in this manner are entirely animation-free: overlays are removed and just the last “slide” of each frame is printed.

```
#+LATEX_CLASS_OPTIONS: [handout]

#+LATEX_HEADER: \usepackage{pgfpages}
#+LATEX_HEADER: \mode
#+LATEX_HEADER: {
#+LATEX_HEADER:   ... see below ...
#+LATEX_HEADER: }
```

- with **one frame** per A4 page (extending page size)

```
#+LATEX_HEADER: \pgfpagesuselayout{resize to}[a4paper, landscape]
```

- with **two frames** per A4 page

```
#+LATEX_HEADER: \pgfpagesuselayout{2 on 1}[a4paper, border shrink=5mm]
```

- with **four frames** per A4 page

```
#+LATEX_HEADER: \pgfpagesuselayout{4 on 1}[a4paper, border shrink=5mm, %
```

Draw a border around the frames

Add a rectangle around each frame in the handout:

```
#+LATEX_HEADER: \setbeamertemplate{background canvas}{  
#+LATEX_HEADER:   \tikz \draw (current page.north west) rectangle  
#+LATEX_HEADER:           (current page.south east);  
#+LATEX_HEADER: }
```

Show speaker notes

Show reminders about what to say during each part of your presentation.

Your laptop monitor and your projector should have the same resolution.

[http://freakazoid.teamblind.de/2011/03/30/
latex-presentations-with-notes-on-windows-7/](http://freakazoid.teamblind.de/2011/03/30/latex-presentations-with-notes-on-windows-7/)

Print handout with speaker notes

See <http://tex.stackexchange.com/questions/38084/displaying-slides-with-beamer-and-article-class/38146#38146>

See Guido Diepen's `handoutWithNotes.sty` for PowerPoint like handout.

```
#+LATEX_HEADER: \usepackage{handoutWithNotes}
#+LATEX_HEADER: \pgfpagesuselayout{3 on 1 with notes}[a4paper,border shrink=5mm]
```

Print as article

Using beamerarticle

L^AT_EX class (XXX not necessary, does work???)

```
#+LATEX_CLASS_OPTIONS:
```

Common options:

- 8pt, 9pt, 10pt, 11pt, 12pt, 14pt, 17pt, 20pt
- draft: no graphics, footlines,...
- handout: no overlays

```
,#+LATEX_CLASS_OPTIONS: [bigger,allowframebreaks]
```

\LaTeX preamble

Append any line of code in the \LaTeX preamble with keywords specific to the \LaTeX and Beamer back-ends:

```
#+LATEX_HEADER:      \usepackage{...}
#+LATEX_HEADER_EXTRA: \usepackage{...}
#+BEAMER_HEADER:     \institute[short name]{Institute}
```

It will go (in that order) in the [EXTRA] placeholder of the header associated to the beamer \LaTeX class (see [org-latex-classes](#)).

InLine LATEX I

You can include raw LATEX in your Org presentations and it will get kept as LATEX when it's exported.

```
#+begin_LaTeX  
\begin{minipage}{4cm}  
...  
\end{minipage}  
#+end_LaTeX
```

```
#+LaTeX: \parbox{4cm}{...}
```

Such LATEX code will only be present in the exports to LATEX and Beamer.

```
#+begin_Beamer  
\begin{minipage}{4cm}  
...  
\end{minipage}  
#+end_Beamer
```

```
#+Beamer: \parbox{4cm}{...}
```

Such LATEX code will only be present in the export to Beamer.

InLine LATEX II

It is especially useful for more **advanced stuff** like images or tables where you need more control of the LATEX options than Org mode actually gives you.

For example, to insert a table with colspan or rowspan support:

```
#+begin_LaTeX
\begin{tabular}{|l|l|l|}
\hline
Text1 & Text2 & Text3 \\
\hline
\multicolumn{3}{|c|}{Merged text here} \\
\hline
\end{tabular}
#+end_LaTeX
```

Text1	Text2	Text3
Merged text here		

Affiliated keywords

The Beamer back-end reads both

- `#+ATTR_LATEX:` and
- `#+ATTR_BEAMER:`

affiliated keywords.

XXX Code with figure or table

Using a custom theme

You can specify a Beamer theme using the `#+BEAMER_THEME` keyword.

For example:

```
#+BEAMER_THEME: Boadilla
```

which is equivalent (for Boadilla) to:

```
#+BEAMER_COLOR_THEME: dolphin
#+BEAMER_FONT_THEME: default
#+BEAMER_INNER_THEME: [shadow]rounded
#+BEAMER_OUTER_THEME: infolines
```

Changing the frame font

Fonts must be present on the system you're presenting on or it will go back to a fallback font.

Font Risque.

```
#+LATEX_HEADER: \usepackage[frenchstyle]{kpfonts}
```

Adding an image on the title slide

Insert an image in the title slide that fills the whole width of the slide but limits to half height.

```
#+BEAMER_HEADER: \titlegraphic{\includegraphics[width=\textwidth,height=.5\textheight]}
```

Column view

For a column view of options and configurations for the individual frames

```
#+COLUMNS: %4ITEM %10BEAMER_env(Env) %10BEAMER_act(Act) %4BEAMER_col(Col) %8BEAMER_
#+COLUMNS: %20ITEM %13BEAMER_env(Env) %6BEAMER_envargs(Args) %4BEAMER_col(Col) %7BEAMER_
```

Environment specification: BEAMER_env

XXX Put = around BEAMER_env in title...

- This becomes visible through the `B_frame` tag (visual aid only).

frame

If a heading in the current tree has a BEAMER_env property set to either frame or fullframe, its level overrides the H value, giving you some flexibility in deciding what is and what isn't a frame.

```
#+OPTIONS: H:2 toc:t

* Section 1

** Frame

* Section 2

** Subsection 2.1

*** Frame :B_frame:

:PROPERTIES:
:BEAMER_env: frame
:END:
```

This becomes a frame, instead of a block!

This works in both “directions”: to add or to remove sectioning levels above the current heading (which becomes

- A frame automatically display its title unless it is specified as a `fullframe`.
- `fullframe` is the same as the `frame` specification, but with an ignored title (`frametitle` is set to the empty string).

Blocks

Environment specification (BEAMER_env property)

XXX Use \sim or $=$ in title

Use a different **block type** for the current “block”
environment (default: `block`).

structureenv environment

- For highlighting text.
- To help the audience see the structure of your presentation.

Paragraph Heading.

block environment

Answered Questions

How many primes are there?

Open Questions

Is every even number the sum of two primes?

block environment = the default? Yes, but white lines NOT suppressed!

Answered Questions

How many primes are there?

Open Questions

Is every even number the sum of two primes?

alertblock environment

- Inserts a block whose title is highlighted.
- Behaves like the block environment otherwise.

Wrong theorem

$1=2.$

exampleblock environment

- Inserts a block that is supposed to be an example.
- Behaves like the block environment otherwise.

Example

The set $\{1,2,3,5\}$ has four elements.

theorem environment

- Inserts a theorem.

Theorem (This title won't be displayed)

There is no largest prime number.

Org mode + Beamer = productivity²



If there is nothing after the block, no need to insert a heading for demarcating the end.

theorem environment

- Inserts a theorem.
- Simpler solution
 - ▶ More readable
 - ▶ Less powerful: you can't nest blocks of the same type with this syntax

Theorem

There is no largest prime number.

corollary environment

lemma environment

definition environment

- Behaves like the `theorem` environment, except that the theorem style definition is used.
- In this style, the body of a `theorem` is typeset in an upright font.

Definition (definition)

Contents of definition

definitions environment

fact environment

example environment

- Behaves like the theorem environment, except that the theorem style `example` is used.
- A side-effect of using this theorem style is that the contents is put in an `exampleblock` instead of a `block`.

Example (Example)

Contents of example

example environment

- Simpler solution:

Contents of example

examples environment

proof environment

- Typesets a proof. FINAL dot added...

proof.

- Suppose p were the largest prime number.
- But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers. □

proof environment

- Typesets a proof. FINAL dot added...

proof.

- Suppose p were the largest prime number.
- Let q be the product of the first p numbers.
- But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers.



proof environment

- Typesets a proof. FINAL dot added...

proof.

- Suppose p were the largest prime number.
- Let q be the product of the first p numbers.
- Then $q + 1$ is not divisible by any of them.
- But $q + 1$ is greater than 1, thus divisible by some prime number not in the first p numbers.



beamercolorbox environment

- Create colored boxes.
- The beamer color is the heading text, for example title in head/foot.

Text

verse environment

Contents of verse

verse environment

- Simpler solution:

Contents of verse

quotation environment

- Use quote or quotation to typeset quoted text.
- quotation has paragraph indentation.

Contents of quotation

quote environment

- Use quote or quotation to typeset quoted text.
- quote hasn't paragraph indentation.

Contents of quote

quote environment

- Use quote or quotation to typeset quoted text.
- quote hasn't paragraph indentation.
- Simpler solution:

Contents of quote

“Getting ragged-left text in a Beamer presentation exported from Org does not seem as easy as I expected.”

XXX

Add extra environments

For simple environments, use:

I think we should change some environment placeholders:

- Introduce `%r` which would stand for the raw heading (without any processing)
- `%H` and `%U` would use the raw heading text instead.

The previous definition would become:

WDYT?

- Environment options may be given using the `BEAMER_opt` property. They will be enclosed in square brackets and inserted where `%o` appears in the environment definition. (with an example, but I can't think of one now)
- Additional arguments may be written into the environment's heading, and inserted into the `LATEX` string using `%r` (raw heading text, no processing).

You can add an appendix (frames that you do not intend to show during your talk, but which might be useful to answer a question) by inserting such a **Level 1 heading** after the last regular slide of your actual presentation:

```
* Appendix material follows :B_appendix:  
:PROPERTIES:  
:BEAMER_env: appendix  
:END:  
  
# Backup slides
```

Ignoring page number in backup slides can be achieved by setting the option `noframenumbering` on all “backup” slides.

Note with its title ignored.

againframe

You can “continue” frames that you previously started somewhere (but where certain details have been suppressed) at a much later point (for example only in the appendix) to show additional slides there.

For convenience (since those are mandatory), when asking for an `againframe`, Org Beamer always asks for:

- BEAMER_ref property to `refer`, using link syntax, to (the label of) the `frame being resumed`, and
- BEAMER_act property to set the `overlay specification`.

An advantage is that you don't need to know the label of the frame being resumed: `:BEAMER_ref: *My frame title.`

```
\againframe<BEAMER_act>{BEAMER_ref's name}
```

Contents are ignored.

XXX How to label a frame? Via `:BEAMER_opt: label=id` or via other means?

- A heading with an `ignoreheading` environment will have only its contents inserted in the output.
 - ▶ Contents is not inserted in any `frame` environment...
- This special value is useful to have data between frames, or to properly **close a column environment**.

overprint

> What may not be easy or possible is to use the directive, which is > what I used in my previous response to you.

You can always use the `only` environment. <https://github.com/suvayu/.emacs.d/blob/master/org-mode-config.el#L215>

That said, I think overlays with `only` is not as smooth as with simple overlay specifications to regular environments or macros like `\includegraphics`, `\item`, etc.

As for an `:overlay` specification, I believe it is already supported but only for lists (`ox-beamer.el:725`). I would love to have that for images too!

Overlay specification: BEAMER_act

Set `overlay` specifications in current block to **create dynamic effects** (*multiple slides*, called *overlays*, for a single frame)
= old BEAMER_envargs property.

Headings support the BEAMER_act property:

```
* Heading
:PROPERTIES:
:BEAMER_act: [+-]
:END:

# Diff with [<+->]?

- Item
- Item
```

It is translated as:

- an overlay/action specification, or

XXX <> seem to be added when they aren't present.

Copied as is if present

Overlay specification: BEAMER_act

Set `overlay` specifications in current block to **create dynamic effects** (*multiple slides*, called *overlays*, for a single frame)
= old BEAMER_envargs property.

Headings support the BEAMER_act property:

```
* Heading
:PROPERTIES:
:BEAMER_act: [+-]
:END:

# Diff with [<+->]?

- Item
- Item
```

It is translated as:

- an overlay/action specification, or
- a default overlay specification when enclosed within square brackets.

XXX <> seem to be added when they aren't present.

Copied as is if present

Overlay specification: BEAMER_act

The Queen's old armchair

- Princess Anne
- Prince Charles
- corgis

Question on ML

```
\begin{figure}
\begin{center}
\includegraphics<1>[width=.7\textwidth]{figure1}
\includegraphics<2>[width=.7\textwidth]{figure2}
\includegraphics<3>[width=.7\textwidth]{figure3}
\end{center}
\end{figure}
```

The following works for me:

```
#+Beamer: \only<1>{
[[file:figure1.png]]
#+Beamer: }\only<2>{
[[file:figure2.png]]
#+Beamer: }\only<3->{
[[file:figures3.png]]
#+Beamer: }
```

There is the BEAMER_act property that can be used to apply overlay information on blocks but I don't think it's possible on individual figures. Of course, you could put each figure in a separate block. The following/attached will match what you had originally.

Option specification: BEAMER_opt

Insert **optional arguments for the current frame environment** using the BEAMER_OPT property.

XXX or block? See

<http://orgmode.org/manual/Beamer-export.html>.

I'd still like to see something more like a "for-dummies" explanation of passing options and arguments to \LaTeX entities. I'm not saying the documentation is woefully inadequate (hardly that – Suvayu's page got me rather far, and I got stuck on a couple of details). My experience was: it never would have occurred to me on my own to use the heading text for \LaTeX code, and if there was a hint anywhere in the docs to suggest that this would be the way to go, I didn't find it. That's a conceptual leap that passed me by.

- This is for frames, and for environments within a frame
- It specifies options for the current frame or block, and will automatically be enclosed within square brackets.



Column specification: BEAMER_COL

Splitting a frame into multiple columns

To get multiple columns in a frame:

- ① Press C-c C-b | (BMCOL) on the headings (inside the frame) which will become columns
The heading of column environments won't be outputted in the PDF file.
- ② Specify the **column width** as a **percentage** of `\textwidth`
!CAUTION! No absolute width, such as 4cm, which wouldn't be correctly translated...

Instead of `block`, those structural environments will become `column` (with the width parameter as a factor of `\textwidth`). Consecutive `column` environments will be put in a `columns` environment.

First column

Two
lines.

The arithmetic mean is

Second column

One line (but aligned).

$$\frac{1}{n} \sum_{i=1}^n x_i$$

column

You can change the percent space of each column.
If you want like one column to take 70% and the other to take 30%, you can change that as follows:

XXX

columns

Frame structure (Explicit page breaking) I

If the text does not fit on a single slide, all you have to do to automatically break up the frame into several frames, is set the option `allowframebreaks`.

- For allowing frame breaks on a **frame by frame** basis²

```
** A very long "frame" with breaks
:PROPERTIES:
:BEAMER_opt: allowframebreaks,label=
:END:
```

XXX This property shouldn't be interpreted for the current slide!

- For allowing frame breaks for the **whole** document³

```
#+BIND: org-beamer-frame-default-options "allowframebreaks"
```

²Until the Beamer issue #265 is solved, we need to unset the `frametlabel` as shown above (`label=`).

³Till Tantau (author of Beamer) was really not keen on the idea of setting the auto-breaking frames option globally.

Vertical alignment

You can specify *top vertical alignment* globally by the `t` class option:

```
#+LaTeX_CLASS_OPTIONS: [t]
```

For single frames, you can use the same option locally:

```
* Vertically top-aligned
:PROPERTIES:
:BEAMER_opt: t
:END:

...
```

You can add that **special property** by editing the `Opt` column within the “column view” (first press `C-c C-x C-c`).

Result of an evaluation on two columns

Balancing text in columns.

... a fancy verbatim block

...

- Lorem ipsum dolor sit amet, consectetur adipisicing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.
- Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex

ea commodo consequat.

- Duis aute irure dolor in reprehenderit in voluptate velit esse cillum dolore eu fugiat nulla pariatur.
- Excepteur sint occaecat cupidatat non proident, sunt in culpa qui officia deserunt mollit anim id est laborum.

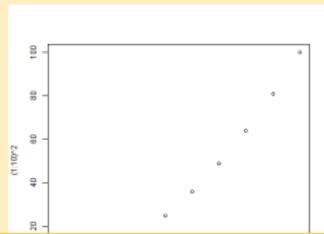
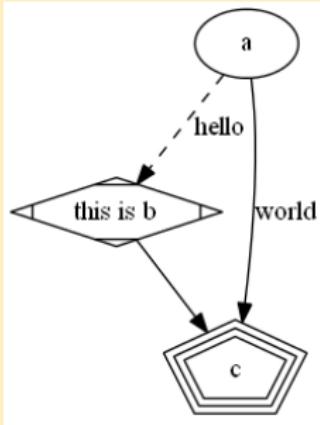
Big title in the middle

This is my BIG title!

Using graphics

How to center pictures horizontally?

Figures



Absolute positioning

You can also place the logo on an absolute position of the titlepage using tikz or textpos.

Note – textpos is incompatible to pgfpages, even though it is mentioned in the beamer userguide as the way to go for absolute positioning.

Here an example using tikz:

```
\XXXbegin{frame}
  \tikz [remember picture,overlay]
    \node at
      ([yshift=3cm]current page.south)
      %or: (current page.center)
      {\includegraphics[width=\textwidth,height=.5\textheight]{someimage}};
  \titlepage
\XXXend{frame}
```

More on Org: Exporting a subtree

Skip proof
nil

Summary

For further reading



A. Salomaa.
Formal Languages.
Academic Press, 1973.

For further reading



A. Salomaa.

Formal Languages.

Academic Press, 1973.



E. Dijkstra.

Smoothsort, an alternative for sorting in situ.

Science of Computer Programming, 1(3):223–233, 1982.

For further reading



A. Salomaa.

Formal Languages.

Academic Press, 1973.



E. Dijkstra.

Smoothsort, an alternative for sorting in situ.

Science of Computer Programming, 1(3):223–233, 1982.



E. Feldman and J. Owings, Jr.

A class of universal linear bounded automata.

Information Sciences, 6:187–190, 1973.

For further reading



A. Salomaa.

Formal Languages.

Academic Press, 1973.



E. Dijkstra.

Smoothsort, an alternative for sorting in situ.

Science of Computer Programming, 1(3):223–233, 1982.



E. Feldman and J. Owings, Jr.

A class of universal linear bounded automata.

Information Sciences, 6:187–190, 1973.



P. Jančar, F. Mráz, M. Plátek, and J. Vogel.

Restarting automata.

FCT Conference 1995, LNCS 985, pages 282–292. 1995.

Proof details

Text omitted in main talk.

More details

Even more additional material.

Abbreviations