

Figures in Beamer – A detailed tutorial

 By Admin September 2, 2021



In this tutorial, we are going to make a complete review of the main functionalities that beamer offers regarding the use of images in presentations.

- We will start, as a warm-up, with a quick review of how to insert images in general LaTeX documents, and the differences that beamer presents with respect to other document classes.
- We will then see how to customize the caption of our figures: their color, size, appearance, etc. Then, we will look at different options on how to position and align images inside a beamer frame, and we will even see how to insert them in arbitrary positions using coordinates.
- After that, we will move to slightly more advanced features, like using overlays and combining them with TikZ features to make an image gain opacity progressively. We will also see how to write text around and over an image.
- Finally, we will see how to insert subfigures.

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1. How do I insert a picture in Beamer?

In beamer, figures are inserted essentially in the same way as in any other LaTeX document, with very small differences. In LaTeX, we use the `graphicx` package to insert images (although in beamer we will not have to import it explicitly, since beamer does it for us), which provides the command:

```
\includegraphics{file}
```

where **file** is the file name (or the file path, if the image is not included in the current working directory) that we want to insert.

The above command accepts a series of optional arguments, the most important ones being:

- **height** and **width** to scale the size of the figure.

When only one of these options is set, the other dimension is scaled so that the aspect ratio of the original image is preserved.

Other less common options are also provided:

- **angle** can be passed a rotation angle in degrees, and the image will be rotated this amount counter-clockwise,
- **keepaspectratio** is a boolean that forces the image to preserve its aspect ratio.



In case that both **height** and **width** are specified, along with **keepaspectratio**, the image is scaled so that it preserves its aspect ratio and neither the width nor the height dimensions are exceeded.

But if you want to do very fancy things, like both rescaling and rotating an image, be aware that the order in which the options are given matters. The package `graphicx` interprets the keys from left to right; this means that rotating and then scaling is not the same as scaling and then rotating.

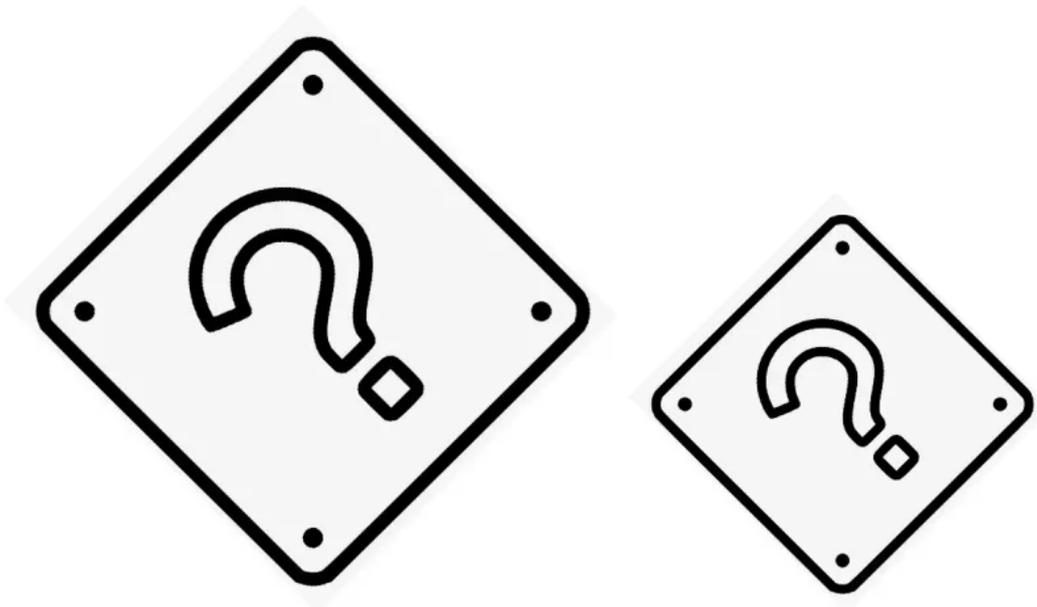
Illustrative example:

In the following example, you can see the difference:

```
1. % Rotate an image in Beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. \begin{document}
8.
9. \begin{frame}{First images in beamer}
10. \centering
11.     \includegraphics[width=4cm,angle=45]{Ques}
12.     \includegraphics[angle=45,width=4cm]{Ques}
13. \end{frame}
14.
15. \end{document}
```

Copy

which produces:



The two images are not the same due to the fact that the scaling and the rotation are done in a different order.

Observe how the two images are slightly different.



It should be noted that for the width of images we can use a multiple of the text width via the `\textwidth` command. It is very useful when specifying the dimensions of an image since you can set them to a relative amount of width of the text, without having to worry about low-level TEX dimensions.

2. Add figure caption in Beamer

Although with this we have a totally functional way of inserting images, in practice we don't insert them this way, since the image has neither a caption nor a way to reference it. It is more convenient to wrap the `\includegraphics` command inside the figure environment. This is a

floating environment that lets us set a caption and a label, and also use position specifiers to control where the image will be placed. However, and this is the main point where beamer differs from other LaTeX documents, the position specifiers have no effect in beamer presentations. They are ignored, and the image is simply placed in the same position as in the source code.

Illustrative example:

In the following example, we show how to use the figure environment to insert images:

```
1. % Add numbered caption in Beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % set captions with numbers
8. \setbeamertemplate{caption}[numbered]
9.
10. \begin{document}
11.
12. \begin{frame}{Images in beamer}
13.
14. Observe Figure \ref{fig:question}: it is the
15. first figure I have inserted in beamer.
16.
17. \begin{figure}
18. \centering
19. \includegraphics[width=0.25\textwidth]{Ques}
20. \caption{My first figure in beamer.}
21. \label{fig:question}
22. \end{figure}
23.
24. \end{frame}
25.
26. \end{document}
```

Copy

Compiling this code yields:

Observe Figure 1: it is the first figure I have inserted in beamer.



Figure 1: My first figure in beamer.

How a complete use of the figure environment looks in beamer.

Observe that I have added the declaration:

```
\setbeamertemplate{caption}[numbered]
```

in the preamble. The reason for this is that, by default, beamer does not number the pictures (this is another key difference with the usual LaTeX documents), but since I wanted the figure numbered to reference it, I had to change how the caption looks in the beamer template.

Usually, you will not need the number, since every frame will contain one, at most two, images to be explained, and it is not convenient to use numbers as references throughout a presentation (as it is in a document, where you can easily go back and forth).

3. Customize figure caption

We have already seen how to slightly change the caption appearance, by adding a number to it or not. But we can further customize it by changing its font size and color. The following example shows the beamer theme options that we have to modify in order to customize our caption:

```
1. % Customize figure caption in Beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % customize the caption
8. \setbeamerfont{caption}{size=\large}
9. \setbeamerfont{caption}{fg=blue}
10. \setbeamerfont{caption name}{fg=red}
11.
12. \begin{document}
13.
14. \begin{frame}{Customized caption}
15.
16. \begin{figure}
17. \centering
18. \includegraphics[width=0.25\textwidth]{Ques}
19. \caption{My first figure in beamer.}
20. \label{fig:question}
21. \end{figure}
22.
23. \end{frame}
24.
25. \end{document}
```

Copy

which yields the following result:



Figure: My first figure in beamer.

A customized caption inside a beamer frame

4. Figure and text side by side LaTeX beamer

It is common to write a frame with a figure next to a certain explanation. For this purpose, we can use beamer's columns environment, as it is done in the following example:

```
1. % Text and figure side by side
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7.
8. \begin{document}
9.
10. \begin{frame}{Figure with other content}
11.
12. \begin{columns}
13. % Column 1
14. \begin{column}{0.5\textwidth}
```

Copy

```

15.         Here I can explain in detail what the figure represents.
16.     \end{column}
17.
18.     % Column 2
19.     \begin{column}{0.5\textwidth}
20.         \begin{figure}
21.             \centering
22.             \includegraphics[width=0.7\textwidth]{Ques.png}
23.             \caption{A figure that is next to a certain explanation.}
24.         \end{figure}
25.     \end{column}
26.
27. \end{columns}
28.
29. \end{frame}
30.
31. \end{document}

```

The frame produced by this code is shown below:

Figure with other content

Here I can explain in detail what the figure represents.



Figure: A figure that is next to a certain explanation.

An image next to its explanation in a beamer frame.

Observe that the `\textwidth` command in the line:

```
\begin{column}{0.5\textwidth}
```

represents the whole text width of the frame, whereas the `\textwidth` in the `\includegraphics` declaration only represents the text width of the column, which is half of the total text width.

This means that, although we pass to the image the option `width=0.7\textwidth`, it doesn't take 70% of the frame, but instead, it takes 70% of the column.



Although in this case, we accompanied the image with text, any kind of content can be used next to it: text, tables, equations, other images, and so on.

5. How to align an image inside a beamer frame?

Almost all of the time we have been using the figure environment to wrap the `\includegraphics` command so that beamer treats the images as floating objects. However, we can also use the raw `\includegraphics` command, and align it using pure TeX filling commands. The reason behind this is that the `\includegraphics` command just creates a TeX's box with the image inside it; that is, for the TeX system it is just as any other letter.

To easily centre the image, as we have been doing throughout all the tutorial, we can use the `\centering` command just before `\includegraphics`. However, if we want to left-align the image, we will have to use the command `\hfill` just after including the image, so that all the horizontal space after the image is filled by TeX.

Let me show you a complete minimal example of how this would work:

```
1. % Right aligned figure
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. \begin{document}
8.
9. \begin{frame}{Right-aligned figure}
10.     \hfill
11.     \includegraphics[width=0.2\textwidth]{Ques.png}
12. \end{frame}
13.
14. \end{document}
```

Compiling this code yields:

Right-aligned figure



As you may have already guessed, if instead of filling the left space we fill the right space (that is, we put the `\hfill` command after the `\includegraphics` command) what we get is a left aligned figure.



And going further we can apply the same principles for the vertical alignment. By default, the image will be vertically centered. However, we can use the `\vfill` command to fill in vertical space, and thus move the image up and down. If we use it before the image, it will be aligned at the bottom, and if we use it after the image, it will be aligned at the top.

6. Position an image arbitrarily inside a frame

This part is considered in this step-by-step tutorial “[Precise positioning of an image in Beamer](#)”. It uses TikZ to position images at any position relative to the frame.

7. Changing the opacity of an image in Beamer

Although we are not going to dive into all of TikZ possibilities, here we are going to explore another functionality that the tikzpicture environment offers: changing the opacity of a figure.

This option is especially interesting when combined with beamer overlay specifications because you can put an image with half its opacity and totally uncover it once you are going to actually talk about it. Even further, you could even decrease the image's transparency as you get closer to talking about it; this would look very cool.

The following example shows a small implementation of this idea:

```
1. % Opacity of images in Beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % Required package
8. \usepackage{tikz}
9. \begin{document}
10.
11. \begin{frame}{Opacity of an image}
12.
13. \begin{tikzpicture}[remember picture, overlay]
14. \onslide<1>
15. \node
16. [
17.     left=1cm,
18.     opacity=0.3] at (current page.east)
19. {
20.     \includegraphics[width=0.3\textwidth]{Ques.png}
21. };
22.
23. \onslide<2>
24. \node
25. [
26.     left=1cm,
27.     opacity=1] at (current page.east)
28. {
29.     \includegraphics[width=0.3\textwidth]{Ques.png}
30. };
31. \end{tikzpicture}
32. \end{frame}
33.
34. \end{document}
```

Copy

which yields the following slides:

Opacity of an image





In the above code, we placed the image 1 cm far from the left side of the frame using absolute positioning provided by TikZ. The first version of the image has 30% opacity and the second one has 100% opacity.

8. Overlay specifications and figures

However, if we don't want such a fancy implementation of opacity, and just want the image to be shown on a given slide, beamer offers us the possibility to pass an overlay specification to the **\includegraphics** command. For example, the declaration:

```
\includegraphics<2-4>[width=\textwidth]{image.png}
```

will make the image.png file appear only on slides 2 to 4. More details are presented in this lesson: [“Creating Overlays in Beamer”](#).

9. Wrapping text around an image

In beamer, we can wrap text around a figure, but not with beamer built-in commands. We have to use the external `wrapfig` package. In the following example, we use the environment `wrapfigure` that this package provides to wrap text around a figure:

```
1. % Wrapping text around image in beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % Required package
8. \usepackage{wrapfig}
9.
10. % to generate some dummy text
11. \usepackage{blindtext}
12.
13. \begin{document}
14.
15. \begin{frame}{How to wrap text around a graphic.}
16.
17. \begin{wrapfigure}{r}{0.5\textwidth}
18.     \centering
19.     \includegraphics[width=0.2\textwidth]{Ques.png}
20.     \caption{Wrapping text around figures}
21. \end{wrapfigure}
22.
23. \small \blindtext
24. \end{frame}
25.
26. \end{document}
```

Copy

which produces the following output:

How to wrap text around a graphic.

Lorem

ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem

ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.



Figure: Wrapping text around figures

Text wrapped around an image

Observe that the `wrapfigure` environment works as the `figure` environment, in the sense that it makes the image floating, and you can add a `\caption` and a `\label` to the figure. However, this command accepts two mandatory arguments:

- the first one is to select where we want the image, it can be `r` or `l`, that is, right or left;
- the second one is the width to be reserved for the image.

?

But what if we want the text to be over the image, instead of on the side or wrapping it?

10. Writing text over an image

This can also be done inside a beamer frame, but for that purpose, we have to load the versatile TikZ package. In the following example, we illustrate an easy way to do it:

```
1. % Text over an image in beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % Required package
8. \usepackage{tikz}
9.
10. \begin{document}
11.
12. \begin{frame}{Text over an image}
13.
14. \centering
15. \begin{tikzpicture}
16. \node (image)
17. {
18.     \includegraphics[width=0.7\textwidth]{nature1.png}
19. };
20.
21. \node
22. [
23.     fill=teal,
24.     align=center,
25.     text=white,
26.     font={\huge\bfseries}
27. ] at (image.center) {A beautiful photo!};
28.
29. \end{tikzpicture}
30. \end{frame}
31.
32. \end{document}
```

Copy

Compiling this code yields:



Text over an image in a beamer frame.

Let's dissection the commands used in this example:

- First, we insert an image inside the `tikzpicture` environment as a node called `(image)`.
- Then, we create a second node where its content is aligned at centre, with options to use a white, huge and bold font. Moreover, we added the option `fill=teal` to fill the node with a teal color.
- The key is that we position this node at the centre of the previous one; this position is easily identified with `(image.center)`.
- Finally, we create the contents of the node itself, which are just the text string
`A beautiful photo!`.

11. Image as a frame background

It is easy to use an image as a frame background in beamer, both globally and locally. In the following example, we put both into practice:

```
1. % Background image (local and global options)
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % global background must be put in the preamble
8. \setbeamertemplate{background canvas}
9. {%
10.     \includegraphics[width=\paperwidth, height=\paperheight]
11.     {nature1.png}%
12. }
13.
14. \begin{document}
15.
16. \begin{frame} {Default background}
17.
18. \end{frame}
19.
20.
21. % to use a specific background for a frame or a series
22. % of frames, we have to enclose the command and the frames
23. % inside the same group
24. {
25.     \setbeamertemplate{background canvas}
26.     {%
27.         \includegraphics[width=\paperwidth,height=\paperheight]
28.         {nature2.png}
29.     }
30. \begin{frame} {Special background}
31.
32. \end{frame}
33. }
34.
35. \end{document}
```

Copy

which yields:

Default background



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Special background



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2 / 2

You can see that the procedure is very intuitive: we just change the background canvas option of the beamer theme to the image that we want to use as background. However, when importing it we should make sure that the size is adjusted to the frame size; otherwise, we will get undesired results.

12. How to produce a title page with an image

To add an image to the title page and get something similar to the following illustration, I recommend the following step-by-step tutorial: [“How to add an image to the title page in beamer?”](#).



A new presentation

The author

The Institute that pays him

August 24, 2021



13. Inserting subfigures in beamer

With the [subcaption package](#), we can build floating figure environments that contain more than one image, each with its corresponding caption and label. The following example shows how to do so:

```
1. % Subfigures in Beamer
2. \documentclass{beamer}
3.
4. % Theme choice
5. \usetheme{AnnArbor}
6.
7. % Required package
8. \usepackage{subcaption}
9.
10. % so that the captions are numerated
11. \setbeamertemplate{caption}[numbered]
12.
13. \begin{document}
14.
15. \begin{frame}{Subfigures in Beamer}
16.
17. You can see in Figure \ref{fig:images} that I have inserted two
    images, Figures \ref{fig:nature1} and \ref{fig:nature2}, that I can
    reference independently.
18.
19. \begin{figure}
20. \centering
21. \begin{subfigure}[t]{0.4\textwidth}
22. \includegraphics[width=0.5\textwidth]{nature2.png}
23. \caption{Image of the nature V1.}
24. \label{fig:nature1}
25. \end{subfigure}
26. \begin{subfigure}[b]{0.4\textwidth}
27. \includegraphics[width=\textwidth]{nature1.png}
28. \caption{Image of the nature V2.}
29. \label{fig:nature2}
30. \end{subfigure}
31. \caption{Two images I want to insert.}
32. \label{fig:images}
33. \end{figure}
34.
35. \end{frame}
36.
37. \end{document}
```

Here is the obtained result:

Subfigures in Beamer

You can see in Figure 1 that I have inserted two images, Figures 1a and 1b, that I can reference independently.



(a) Image of the nature V1.



(b) Image of the nature V2.

Figure 1: Two images I want to insert.

Subfigures inside a beamer frame

- As you can see, first we create a usual figure environment with its corresponding `\caption` and `\label`.
- Then, inside of it, for every subfigure we create a `subfigure` environment, which works essentially as a figure environment, with its corresponding `\includegraphics` to insert the image, its `\caption` and its `\label`.
- However, this environment takes a mandatory argument, which is the space to be allocated for the corresponding image (in the previous example, `0.4\textwidth`) and also an optional argument, which determines the positioning of the image inside its allocated space. This argument can be either `c`, `t` or `b`, standing for centre, top and bottom.
- By default the image is centred, but in the previous example I have used `t` and `b`, so that you can see the difference between the two options.
- As you can see, different labels enable us to reference either each one of the subfigures or the figure as a whole.

Conclusion

- In this lesson, we have addressed a lot of possible scenarios regarding the use of figures that you may face when writing your presentation. However, the options offered by beamer are inscrutable, and you can always combine what you have learned here to produce new and surprising results.
- If you want to learn more about graphics and beamer, I strongly suggest you learn about the tikz package, which is the main graphical tool used in LaTeX documents. In the tutorial you have had a small taste of what this package is capable to do; but it is just a very small portion of the cake. I would recommend you read tikz's documentation, but since it is a +1000 page document, maybe it is not the best place to start. However, in [this page](#) you can find a nice set of tikz tutorials, that will teach you in a much more didactic way how to use this powerful tool.

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