

## fish2sphere documentation

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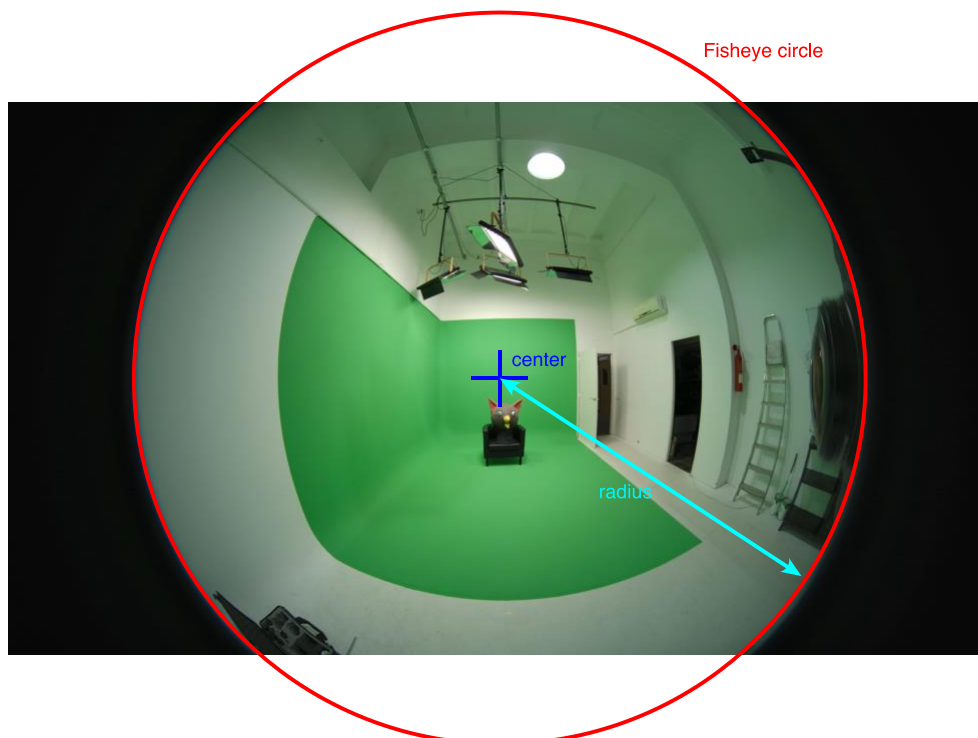
The command line options for the fish2sphere utility can be listed by typing just the program name without any image file name at the command line. At the time of writing this will give the following

```
Usage: fish2sphere [options] imagefile
```

Options

```
-w n          sets the output image size, default: 4 fisheye image width
-a n          sets antialiasing level, default: 2
-s n          fisheye fov (degrees), default: 180
-c x y       fisheye center, default: center of image
-r n          fisheye radius, default: half the fisheye image width
-ry n        the vertical fisheye radius if not circular, default: same as -r n
-x n          tilt camera, default: 0
-y n          roll camera, default: 0
-z n          pan camera, default: 0
-blo n n     longitude range for blending, default: no blending
-bla n n     latitude range for blending, default: no blending
-lom n       +- maximum longitude range clipping, default: no clipping
-lam n       +- maximum latitude range clipping, default: no clipping
-bg r g b    set background colour, default: grey or black for blending
-p n n n n   4th order lens correction, default: off
-o n         create a textured mesh as OBJ model, three types: 0,1,2
-h           create Hammer projection instead, default: off
-f           create PGM files for ffmpeg remap filter, default: off
-d           debug mode
```

As a bare minimum one needs to specify the file name of the fisheye image. But in practice one needs to also supply the field of view (FOV) of the fisheye (-s option), and the center (-c option) and radius (-r option) of the fisheye circle. These are the fundamental characteristics of the fisheye lens and need to be measured once for any new fisheye lens and/or attached camera. These are illustrated on the following fisheye image.



The field of view of the fisheye would normally be published by the supplier, for the purposes of fish2sphere it is the field of view of the fisheye circle illustrated above.

Both the center and radius are specified in pixels. The FOV is specified in degrees. The author uses the circular lasso in PhotoShop, followed by placing horizontal and vertical guides that snap to the center of the circular selection. The center is measured by snapping the rectangular selection tool to the center of the guides, reading the x,y value from the info pane. There are lots of other ways and software that could be used to measure the center and radius. The minimum command line to convert the above fisheye into the correct section of an equirectangular would be as follows

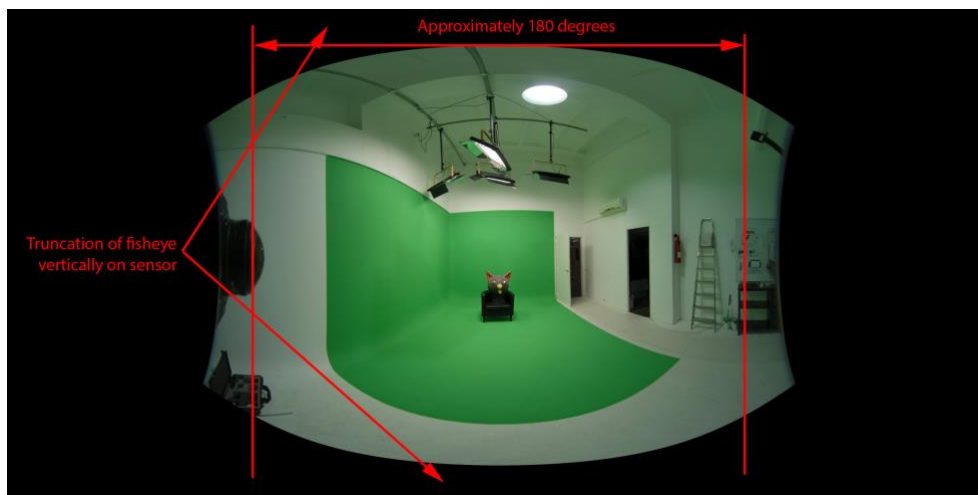
```
fish2sphere -c 968 540 -r 722 -s 220 cam1.jpg
```

The general order of these command line options does not matter. The exception is if rotations are being used (-x, -y, -z options) then the order of those is important. In reality one is going to want to specify the output equirectangular image resolution, as follows, the height will always be half the width.

```
fish2sphere -w 2048 -c 968 540 -r 722 -s 220 cam1.jpg
```

Note that the speed of the conversion only depends on the output image resolution and not the input image resolution. It depends on the number of pixels in the output image, so for example converting a 4096x2048 equirectangular will take 4 times longer that it would take to create a 2048x1024 pixel equirectangular.

The result with some annotations looks like this



When this image is viewed correctly (360 image viewer) then lines in the world that are straight, should appear straight. For example the edges between walls, or between walls and ceilings. In the above case, the edges of the green screen mat should appear straight. If this is not the case then the likely reasons are

- The radius and center parameters have not been estimated correctly.
- The field of view has been quoted incorrectly.
- The lens is not very linear, see more details at <http://paulbourke.net/dome/fisheyecorrect/>

The procedure for correcting for this non-linearity is discussed at the link above but normally the lens manufacturer provides that information in the form of tables of field angles against radius on the sensor. For the example fisheye image above the lens used is the iZugar MKX22, so for a more precise result the command line would be

```
fish2sphere -w 2048 -c 968 540 -r 722 -s 220 -p 0.6622 -0.0163 0.0029 -0.0169 cam1.jpg
```