

## LadyBug-3 training notes

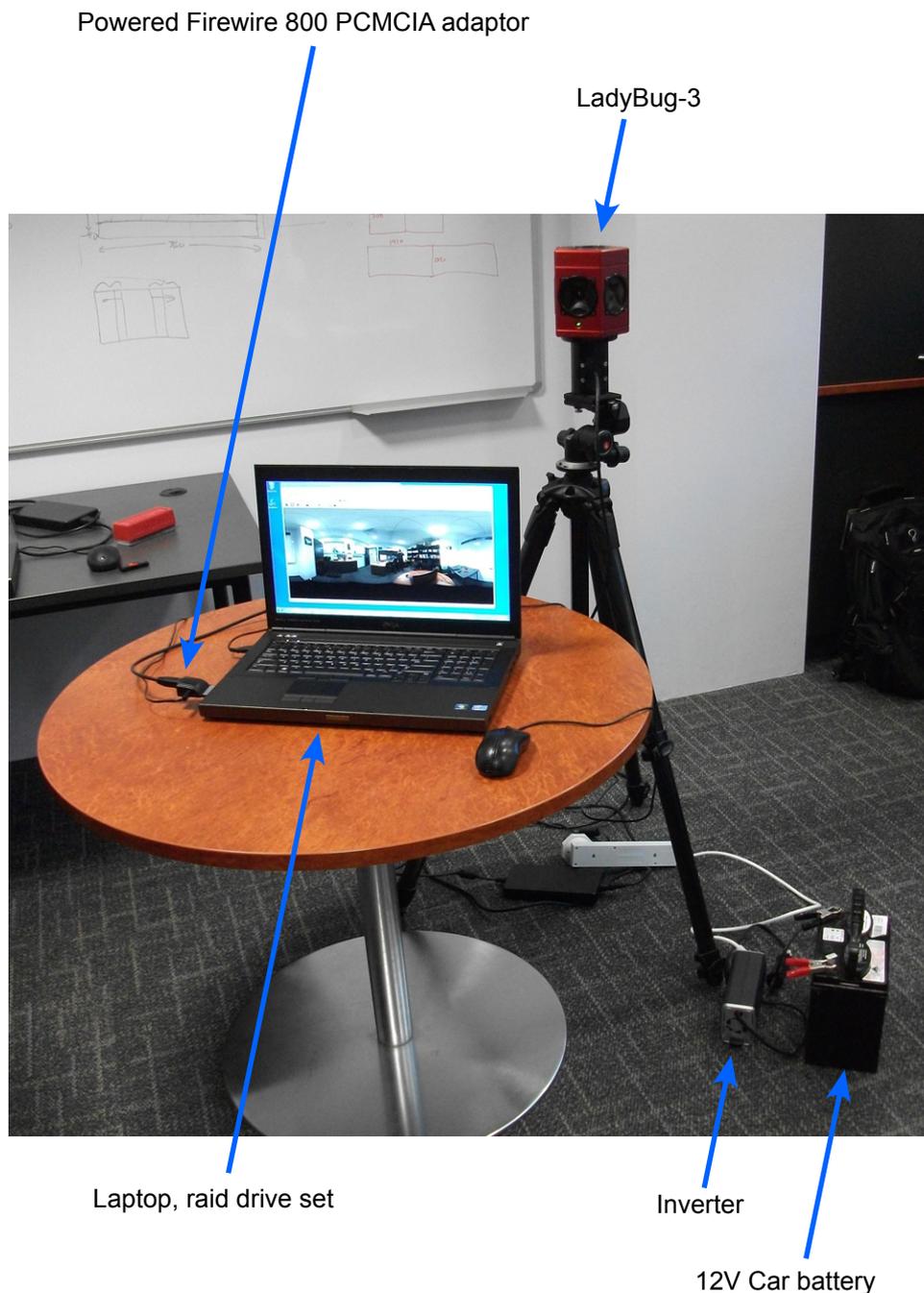
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The following are some brief notes regarding the use of the LadyBug-3 camera. It assumes a particular laptop configuration and version 1.8 of the PtGrey LadyBugPro software. Further indepth information can be found on the PtGrey web site (<http://www.ptgrey.com>), this document is not intended to be a complete guide but rather a "fast start" document to new users of the camera.

### Typical installation (without mains power).

The hardware configuration used in this document is shown below. The laptop has a raided pair of disks configured at installation by Dell. The powered PCMCIA Firewire-800 adaptor is recommended and sourced from PtGrey. The camera is powered over the FireWire-800 interface, if mains power is not available then a car battery and inverter is shown providing power to the Firewire-800 interface and laptop.

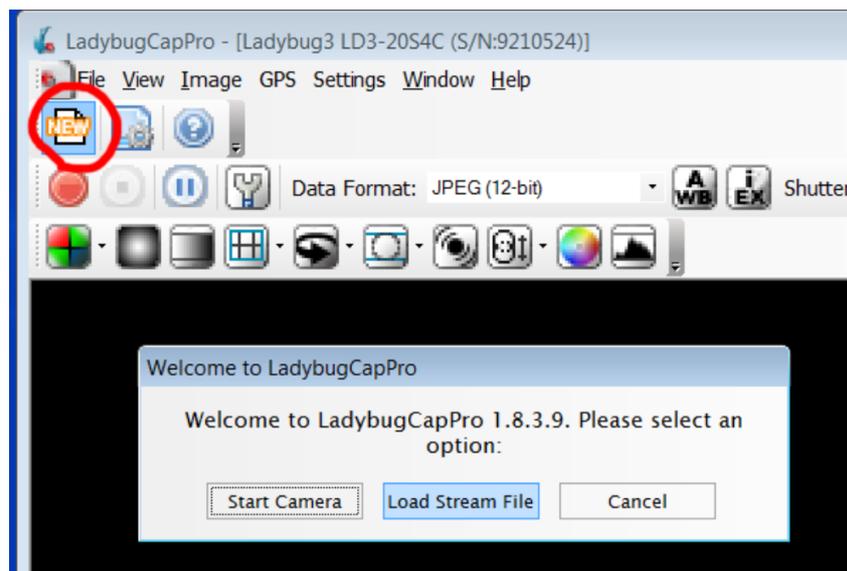


## Typical workflows involve the following steps

- Run the LadyBugCapPro software and connect to the camera.
- Choose appropriate settings on the control panel as well as in the options window.
- Capture video.
- Using the same LadyBugCapPro software open a recorded stream file.
- Choose appropriate export settings.
- Export the frames.
- Perform post production and editing: colour grading, adding audio.
- Export spherical (equirectangular) movie.

## New recording

The same LadyBugCapPro software is used for controlling the camera for recording as well as for exporting frames from existing recordings. Recordings are saved as “.pgr” (Point Grey Research) files, called “stream files”. These are raw per sensor recordings from each camera. The capture software performs all image blending and panorama construction, both as an approximation during realtime preview and higher quality when exporting frames.



The recording files are saved in 2GB chunks with sequentially numbered file names. For example, if you chose filename “myrecording” then the 2GB PGR files would be called myrecording-000000.pgr, myrecording-000001.pgr, myrecording-000002.pgr, etc.

While stream files are broken up into 2GB pieces, one only needs to load the first one in LadybugCapPro and all the frames from all sequential stream files will be loaded.

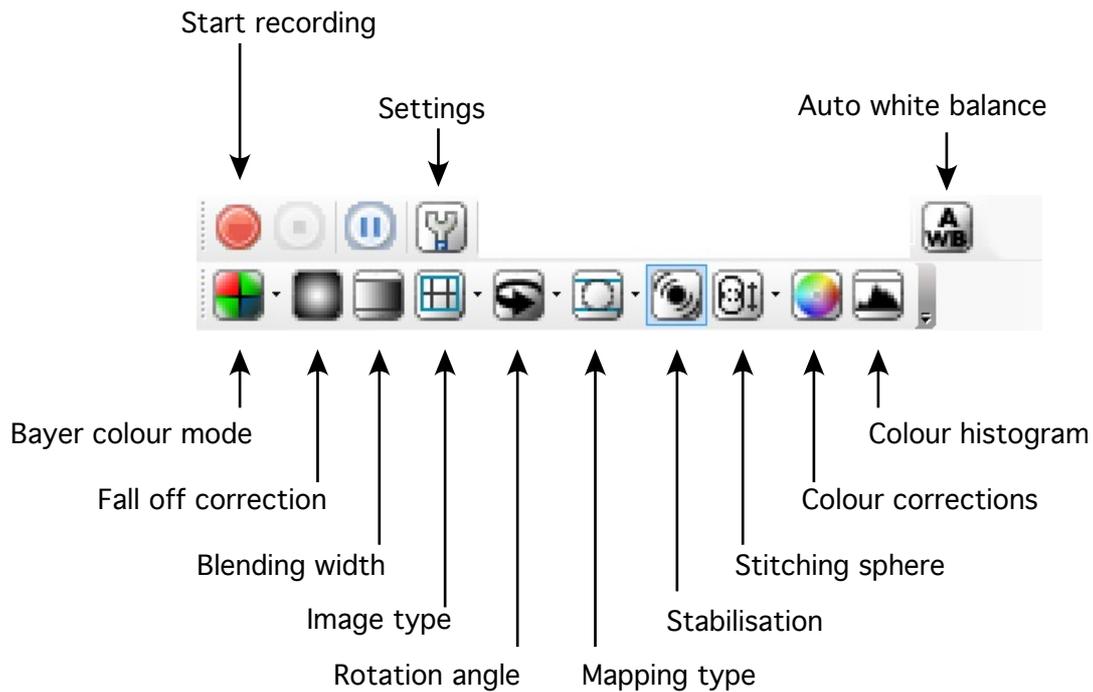
During recording the bottom of the record window shows various statistics. The display rate doesn't matter but the grab rate should remain steady. The sustainable data capture rate depends on the speed of the drive, in the authors laptop a data rate between 40-50MB/sec should not result in any dropped frames.

Display Rate: 15.0 fps

Grab Rate: 15.0 fps

Data Rate: 44.8 MB/s

## Control panel buttons



Settings that can generally be left at the default values are: Fall off correction, blending width (100), image type (only affects visual feedback, rotation angle, mapping type (radial), stabilisation (off) and stitching sphere. All of these can be set/changed during the frame exporting stage.

Fall-off correction compensates for the barrel distortion of the lenses, this can improve the grey zones often visible in regions of near constant colour.

"Settings" is where most important image based controls reside, see later.

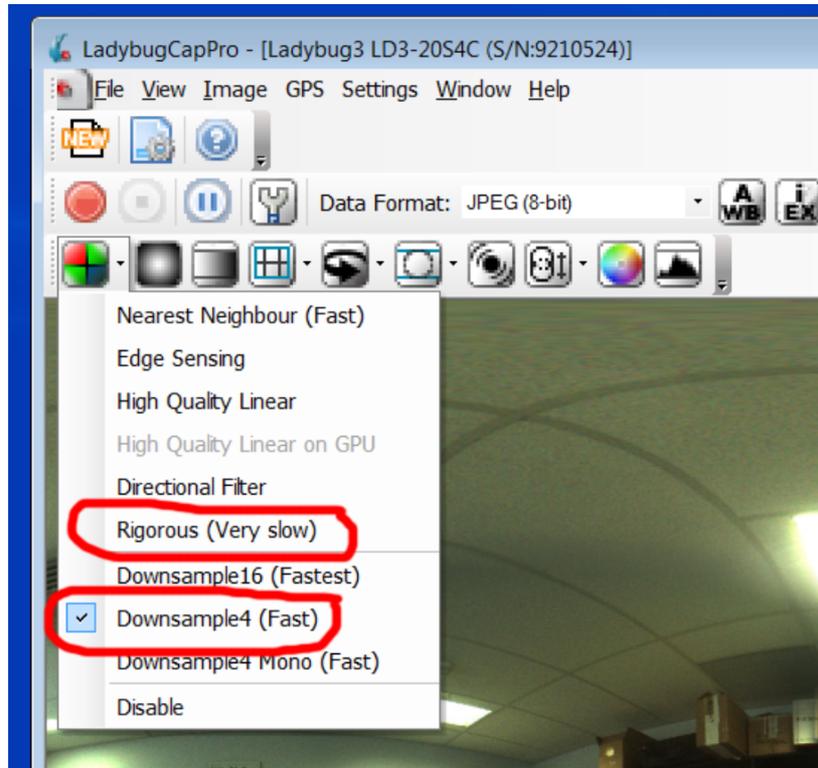
Auto white balance tends to work well, otherwise additional controls are available in the colour correction pane. Good idea to keep an eye on the colour histogram to minimise over saturated (white) areas. Auto white balance is one shot only, so needs to be hit again if the environment changes.

The current version (1.8.X) of the software has problems with some AMD graphics cards, a solution seems to be to toggle the stabilisation option followed by changing the stitching sphere.

The algorithm by which colour is processed is managed by the Bayer colour mode button, see later but essentially a trade off between accuracy and speed.

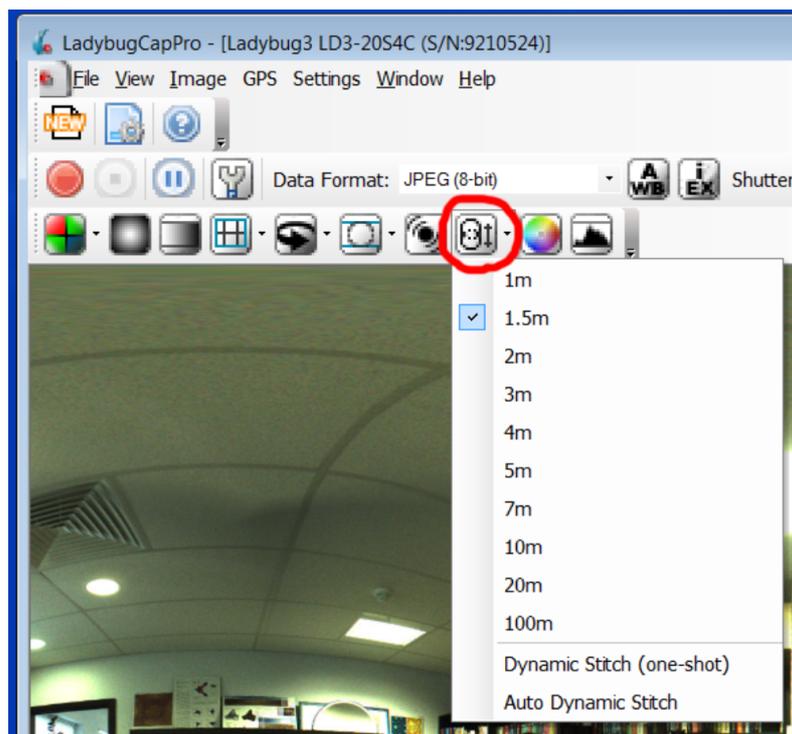
## Bayer colour mode

When recording and using the real-time preview typically use either the nearest neighbour or the  $\frac{1}{4}$  down-sampling for the colour extraction. When exporting frames use either “rigorous” or “high quality linear”.



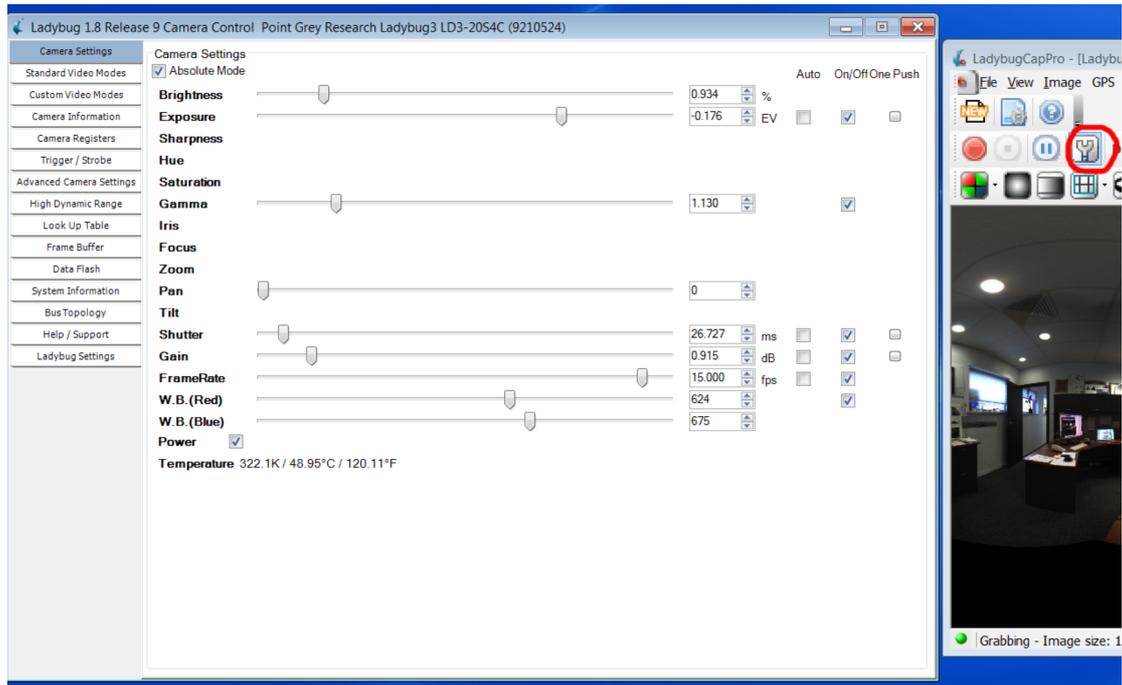
## Blend sphere

Due to fundamental limitations of any multi-camera rig, a perfect blend is impossible for all depths. It can however be achieved for any particular depth. This is selected using the icon as shown below, note this is a post processing option so can be chosen when exporting frames.



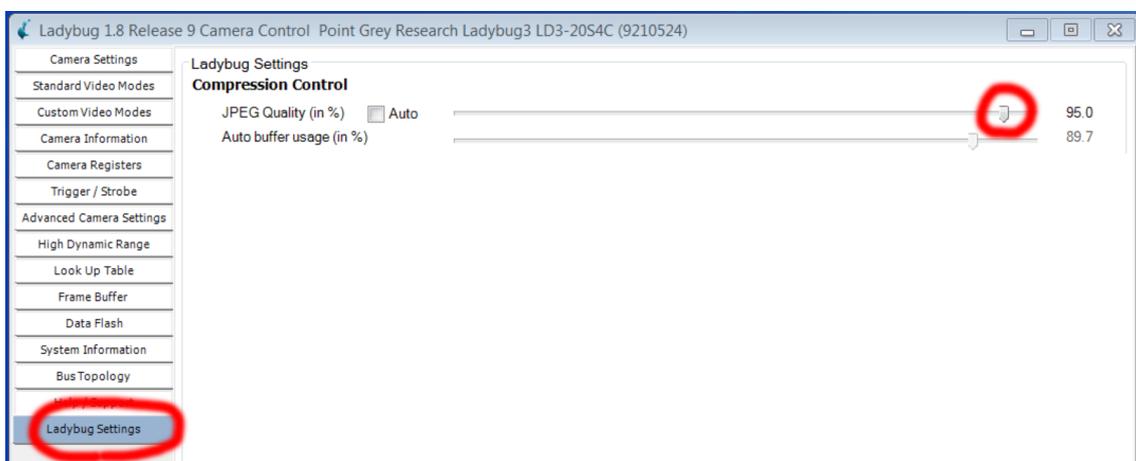
## Camera controls

General camera controls is where the main recording characteristics are found, they are as shown below.



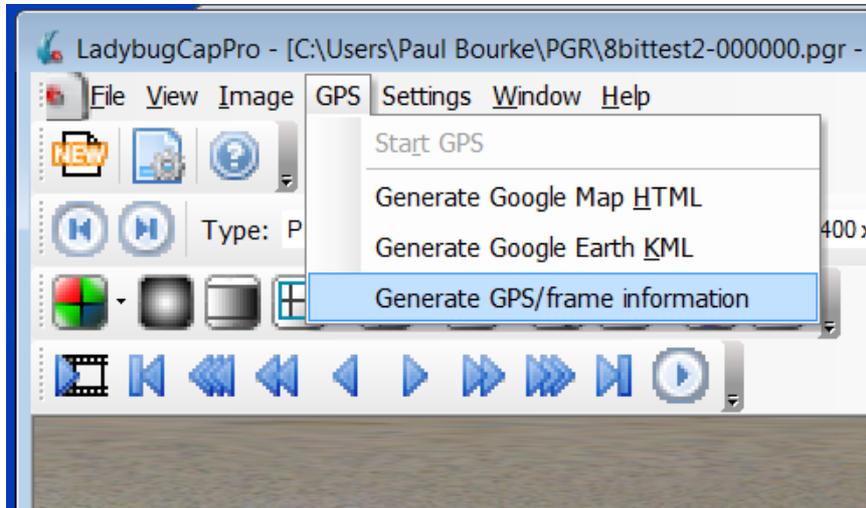
Most of these are self explanatory and are best understood by “playing” and experiencing their effects, some notes follow

- The author generally sets the frame rate to 15fps rather than the maximum 16fps. This allows easier up-scaling to 30fps, a standard for fulldome at least. Note this setting needs to be regularly checked, the software doesn't seem to remember it.
- The automatic settings tend to use a small shutter and thus can be noisy.
- As with most video recordings it is generally better to record dark than too bright, this maximizes scope for colour corrections in post production.
- When recording in 12bit colour (recommended) many of the options are disabled or have no function since the recordings contain all the whole dynamic range of the camera.
- Recommend 95% jpeg compression during recording.

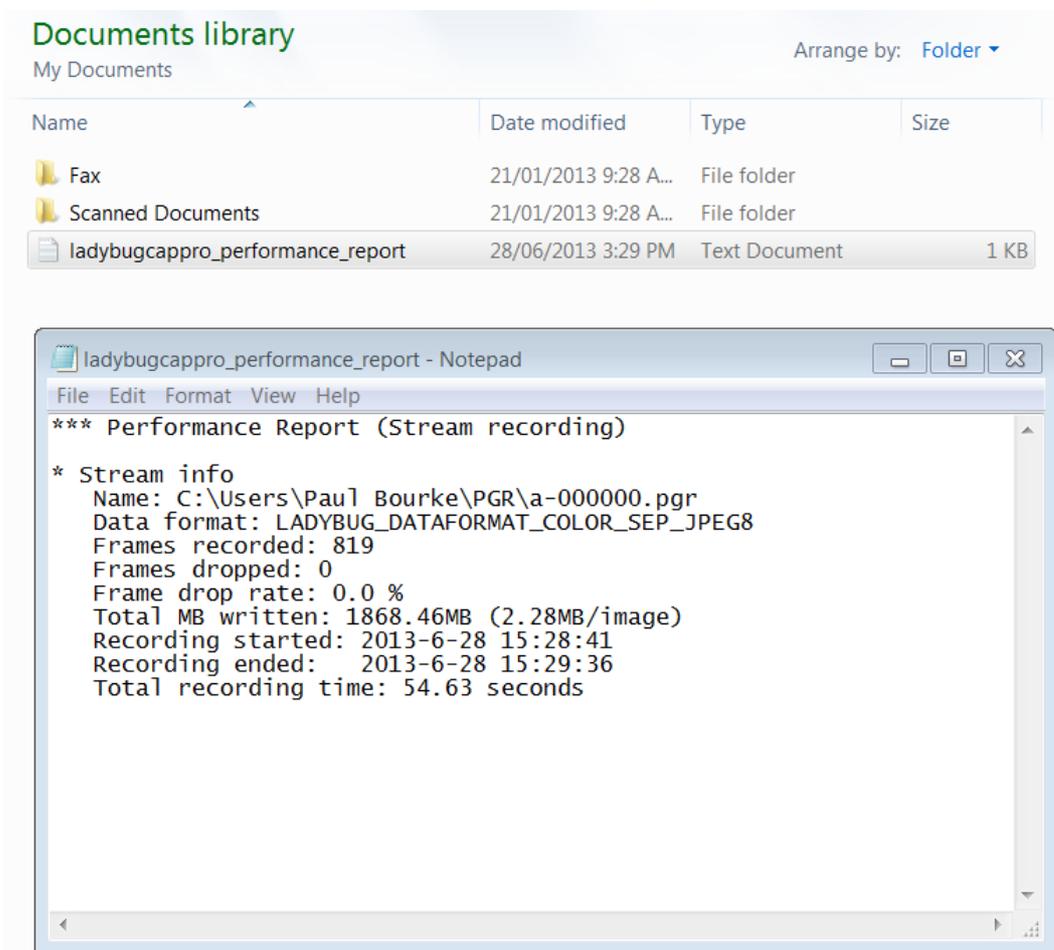


## Testing for dropped frames

To test dropped frames it is possible to generate a report from the GPS menu. This will list each frame, time stamp etc, along with reports of dropped frames. If one is getting dropped frames given a particular quality and frame rate for the recording disk speed, then reducing the quality settings is necessary. For a RAIDED disk pair on a laptop 40-50MB/sec sustained should be safe, this should be a compression ratio of around 95% for 12bit recordings.



A higher level report is created after each recording and saved in a file called "ladybugcappro\_performance\_report" in the documents directory. This is the fastest way to see if a recording had any dropped frames, note the file is added to on each operation with the capture software. The author usually renames this on each day of recording, if forms a good report of filming activity, stream file names, times, etc.



The screenshot shows a Windows Documents library window titled "Documents library" with "My Documents" selected. The "Arrange by" dropdown is set to "Folder". A table lists the contents:

Name	Date modified	Type	Size
Fax	21/01/2013 9:28 A...	File folder	
Scanned Documents	21/01/2013 9:28 A...	File folder	
ladybugcappro_performance_report	28/06/2013 3:29 PM	Text Document	1 KB

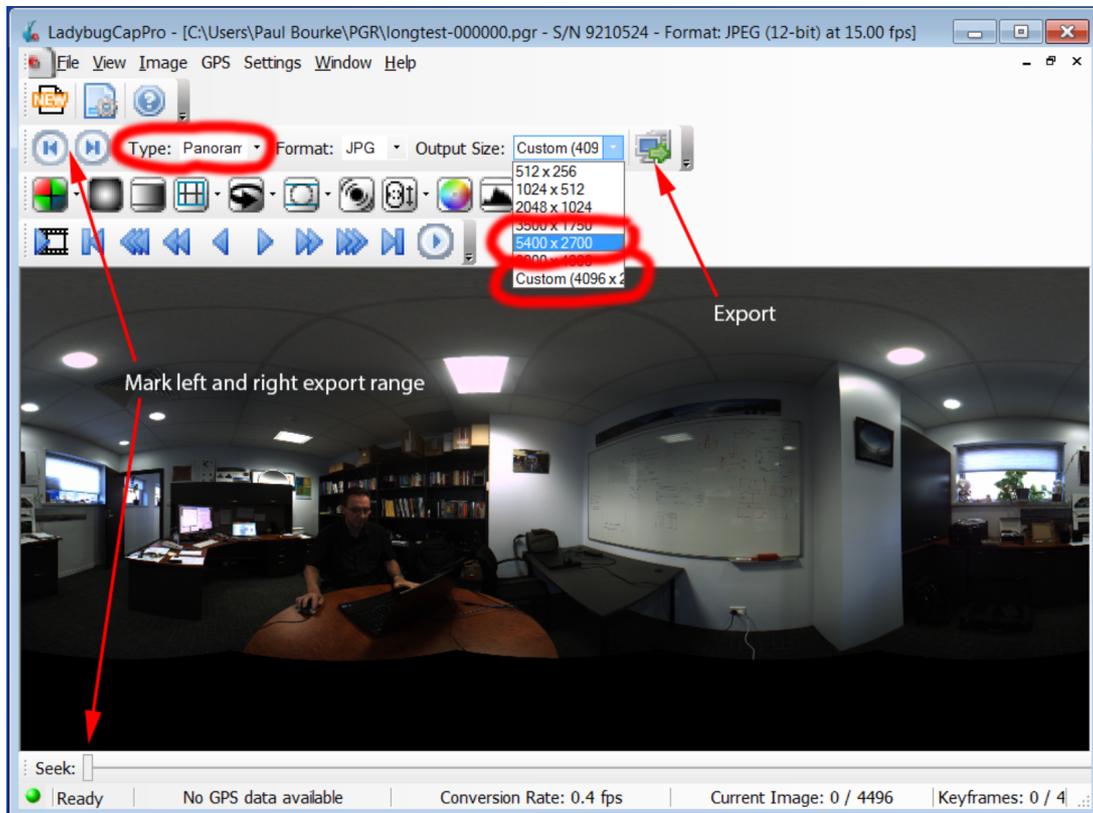
Below the library window is a Notepad window titled "ladybugcappro\_performance\_report - Notepad". The text inside reads:

```
*** Performance Report (Stream recording)

* Stream info
  Name: C:\Users\Paul Bourke\PGR\a-000000.pgr
  Data format: LADYBUG_DATAFORMAT_COLOR_SEP_JPEG8
  Frames recorded: 819
  Frames dropped: 0
  Frame drop rate: 0.0 %
  Total MB written: 1868.46MB (2.28MB/image)
  Recording started: 2013-6-28 15:28:41
  Recording ended: 2013-6-28 15:29:36
  Total recording time: 54.63 seconds
```

## Exporting

Recommended export is "panorama" for a 360x180 degree equirectangular panorama, jpg frames but set the jpg quality to 100% in the preferences. Export as either 5400x2700 pixels for some external down-sampling or directly as 4096x2048 (the usual resolution of iDome playback for example).



The range of frames to export can be selected using the slider at the bottom of the screen along with the in and out marker buttons.

## Shooting considerations

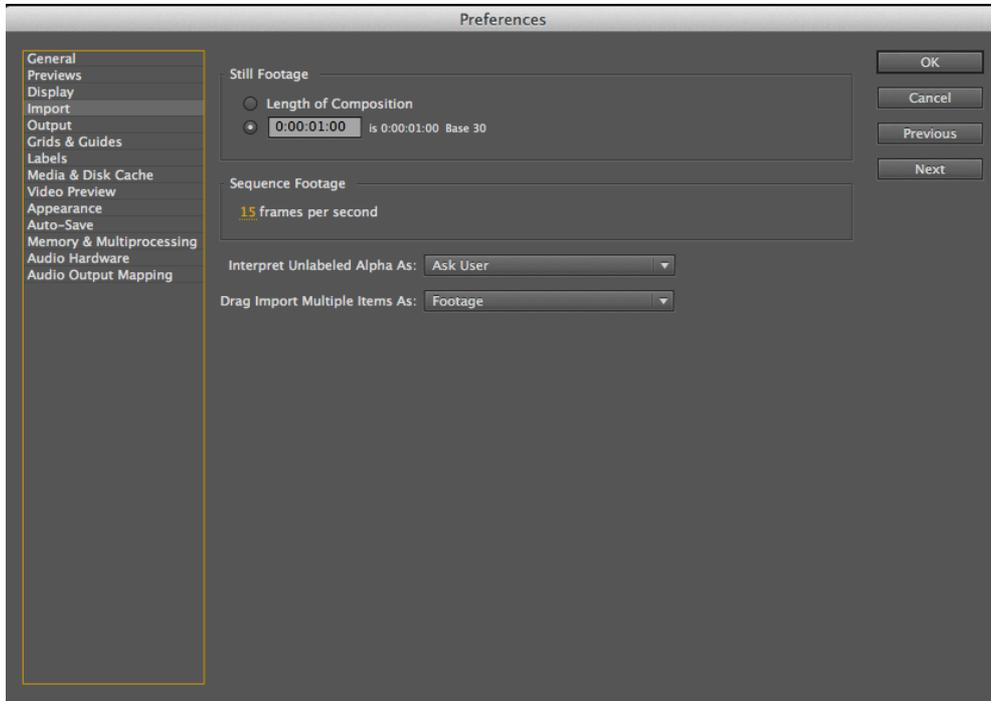
The following are some general considerations relating to filming with the LadyBug-3, they are guidelines only but things to be aware of especially when filming content destined for domes or cylindrical displays.

- Generally the camera would be at the height of the intended viewer in the projection environment, this is especially so for more immersive environments.
- The camera would normally be in a central location recording the scene or activity that is occurring around it. This is a reflection of the reasons for using the camera, if the action was only in one direction why use the LadyBug?
- While the resolution is relatively high, 5400 pixels, those pixels are spread around 360 degrees. As such content is generally best up close, there is not enough resolution to resolve small distant objects.
- The smallest radius for successful blending is 1m, objects coming closer than that should be avoided.
- Where possible important objects should be aligned with a lens and not straddle the region between two lenses, those regions will inevitably be less resolved.
- The region under the camera tripod is normally where recording equipment is located, audio recording gear, and possibly lighting.
- Leave time between starting the recording and the action for the camera operator(s) to vacate the scene.
- It is usual to time warp the footage to 30fps, either with frame blending or flow based warping. Note that the camera can record at 30fps (32fps) if half vertical resolution is used.
- Since the camera does not record audio nor have an audio sync capability, the audio needs to be synced in post production. This will be more challenging if there is any frame dropping. Usual practice is to use a hand clap in shot so the audio can be more readily aligned, perhaps another at the end to detect any drift.
- Lighting can be challenging, avoiding light shining directly into a camera is usually desirable. Having said that, the camera deals reasonably well with the sun in shot but be prepared for interesting lens flares.
- Exposure considerations are no different to most photography and filming except of course for the 360 degree nature so it is more difficult to find a single exposure for the whole scene.
- Choose the post processing software carefully, some packages are not able to deal with the 2:1 aspect ratio or the resolution. Others run very slowly or generally perform poorly at the 5400x2700 pixel resolution. The author typically uses AfterEffects

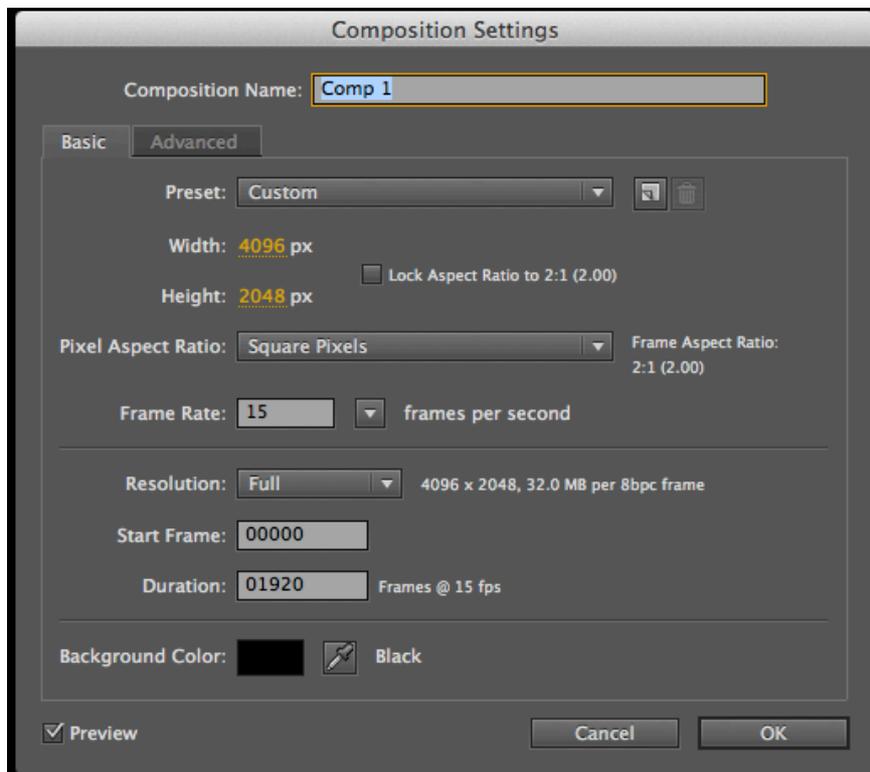
## Post Production

There are obviously a number of packages that can be used to post produce LadyBug frames, the author has found After Effects to be the most suitable. It does not impose aspect ratio constraints, performs well with large frames, supports frame warping for built-in up-sampling to 30fps.

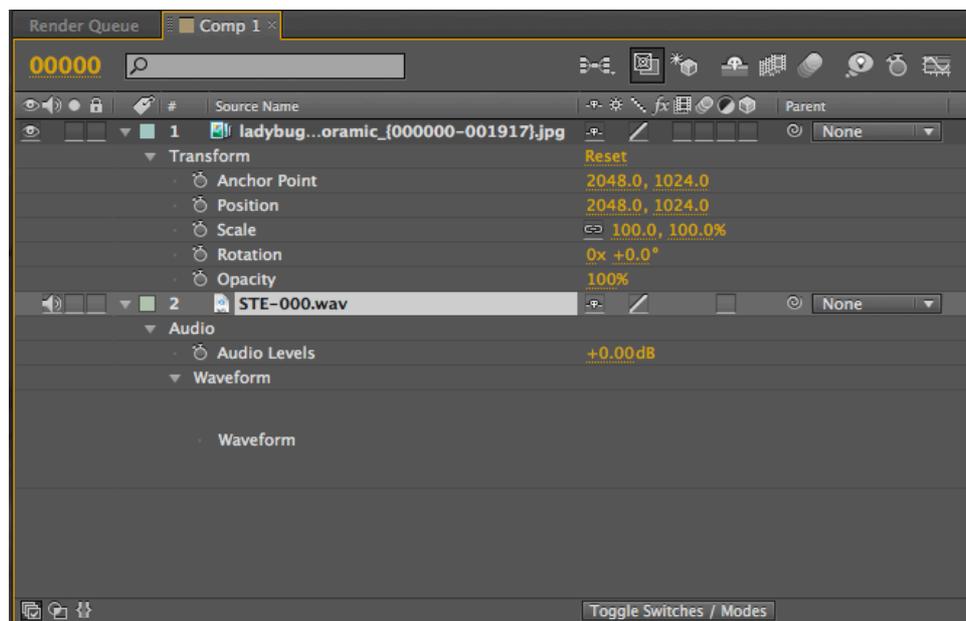
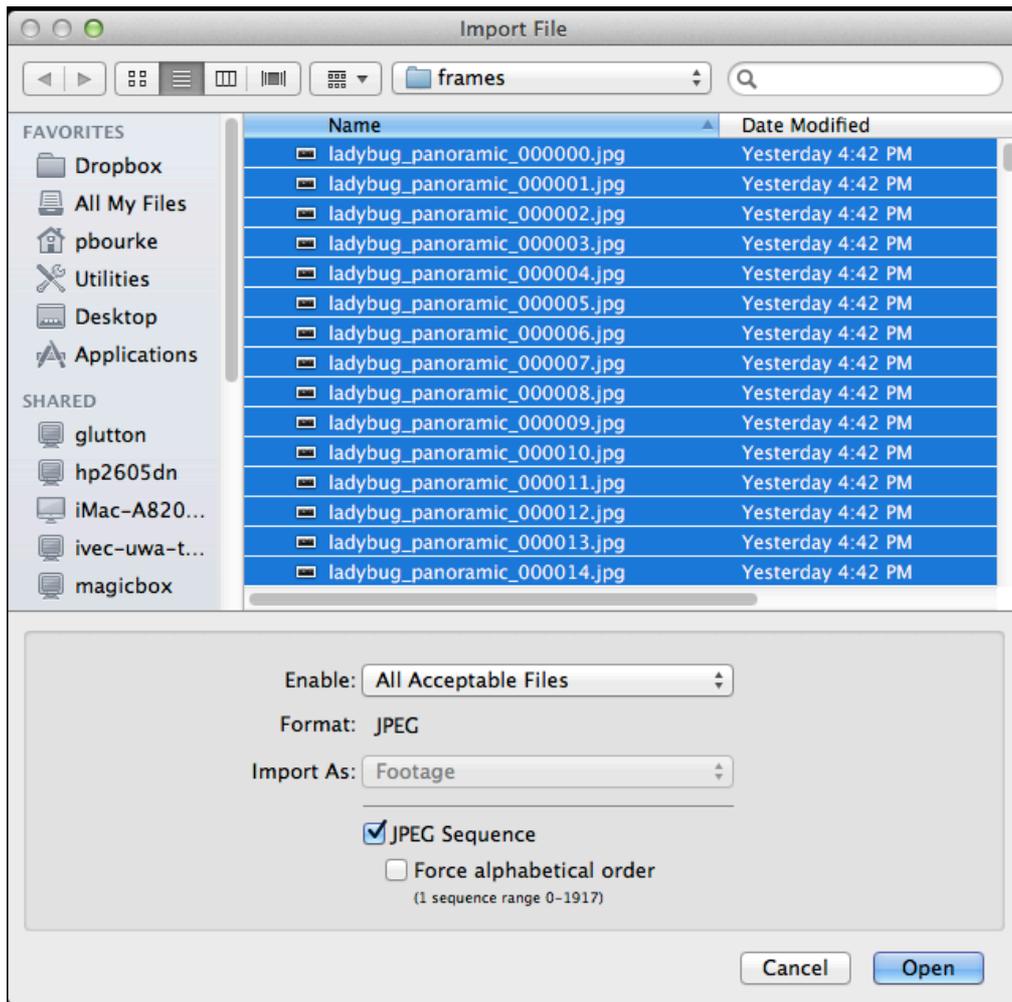
In order for imported frames to be of the duration of a 1/15 second the AE preferences can be set as follows, before frame import.



Composition settings would typically be as follows.



Import frames, be sure to select the "sequence" button. Note a warning will be presented if there are gaps in the sequence.



Most common video controls are perhaps "Highlights-Lowlights", gamma control, and colour vibrance (footage in domes is often over saturated in order to cope with low contrast arising from interreflections).