

Capturing and Processing an Image of Jupiter

USING SHARPCAP, AUTOSTAKKERT AND REGISTAX

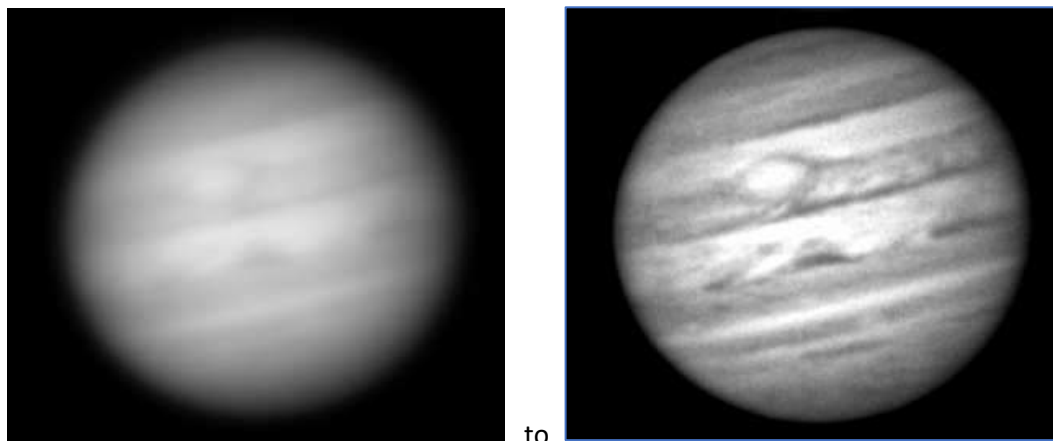
David Richards

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1 Introduction

This document is for anyone who is interested in getting from



The steps described below were taken to:

- Capture a video of Jupiter using SharpCap.
- Stack the resulting video using Autostakkert to produce a single TIF image.
- Process the TIF image with Registax to bring out planetary detail.

The video in this example was captured under clear-sky with a 99% waxing moon. The capture took place around midnight of 10th May 2017, when Jupiter was due south in the North West of the UK.

The following equipment was used:

- Celestron C8 SCT telescope.
- Celestron CG5 Advanced GT equatorial mount.
- Altair GPCAM MONO v1 camera.
- Altair 685nm IR blocking filter (optional).
- Celestron 2x Barlow lens.

The following laptop was used for the video capture:

- Lenovo T400
- 2.4GHz Core 2 Duo processor
- 8Gb memory
- 120Gb SSD drive

The following software was used:

- [SharpCap 3.0.3881](#) – to capture the video in SER format.
- [SER Player](#) – to inspect the completed SER video.
- [Autostakkert v2.6.8](#) – to stack the video frames to produce a single TIF image.
- [Registax v6.1](#) – to process the TIF image to enhance detail.

The process described below has resulted in image consistency by systematically following a basic procedure. The next steps to improve the resultant images would be to look at achieving higher frame rates during the capture.

2 Getting Started

These are the important points to consider in SharpCap when attempting to capture a reasonable video of Jupiter:

- Set the *Gain* to 60 – 70%. (70% if using a Barlow).
- Start the *Histogram* ensure the Logarithmic checkbox is selected.
- Adjust the *Exposure* until the right-hand side of the histogram is at 80%.

The following need to be considered when trying to balance gain, exposure and frames per second (fps).

- Using a filter *may* require more gain (or longer exposures) to increase brightness levels.
- Using a Barlow *will* require more gain (or longer exposures) to increase brightness levels.
- Higher gain adds noise but this can be averaged out in stacking.
- Blurring caused by atmospheric seeing fluctuations cannot be cured hence a high frame rate is desirable to improve image quality.
- Exposures of less than 30ms have a chance to 'freeze' the seeing thus try to capture at 30 fps or better.

The calculation is:

$$\text{fps} = (1 \text{ second})/(\text{exposure})$$

$$\text{fps} = (1000)/(\text{exposure}) \quad [\text{with units in milliseconds (ms)}]$$

As an example, an exposure of 250ms would give:

$$1000/250 = 4 \text{ fps}$$

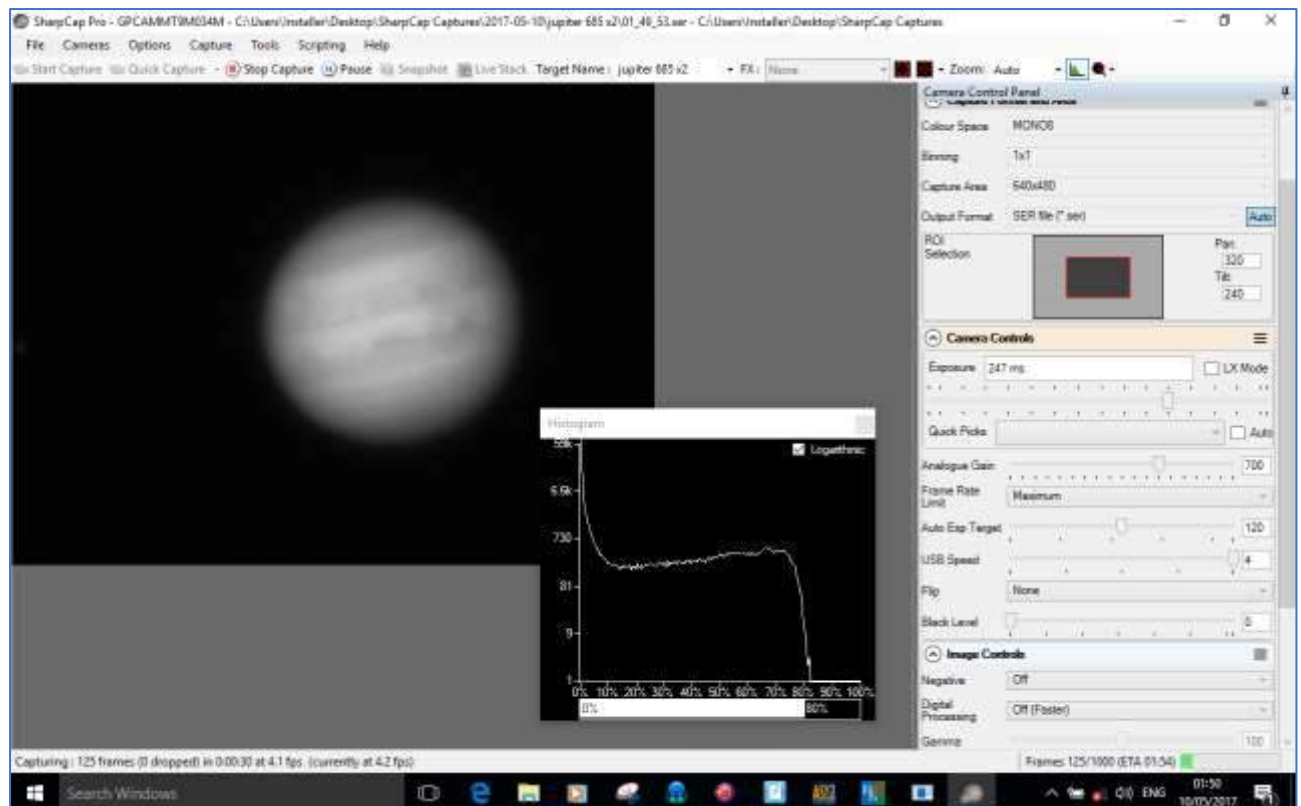
As an example, an exposure of 30ms would give:

$$1000/30 = 33\text{fps}$$

All this will vary depending on factors such as atmospheric conditions, proximity of the moon and equipment. As a general guideline:

lower exposure => higher frame rate => better image

For this scenario, a large planetary disk, the shape of the histogram (with a logarithmic vertical scale) should be a 'whale'. See <http://docs.sharpcap.co.uk/2.9/#The%20Histogram> for further information and background reading. In the picture below, SharpCap is shown ready to capture with the histogram undocked.

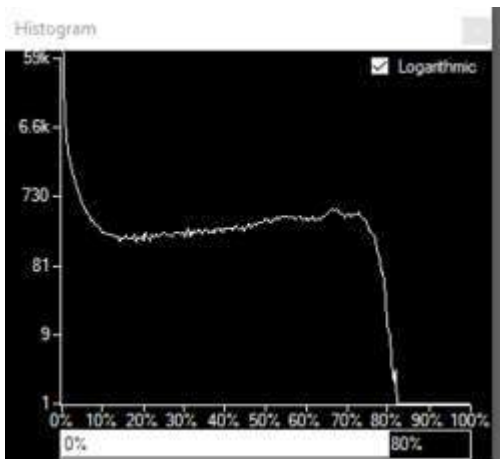
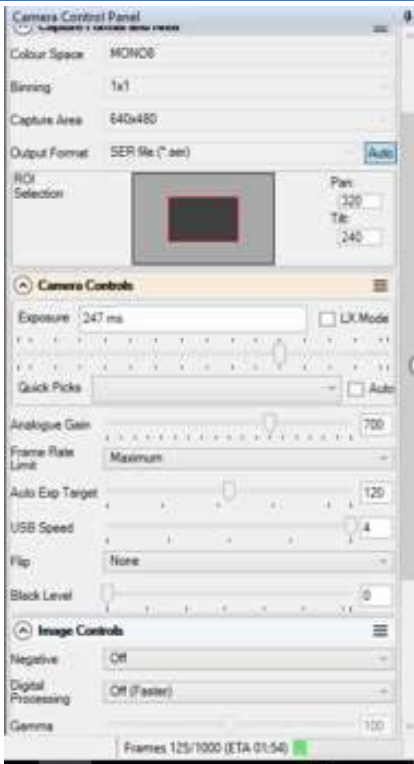


3 Capturing the Image

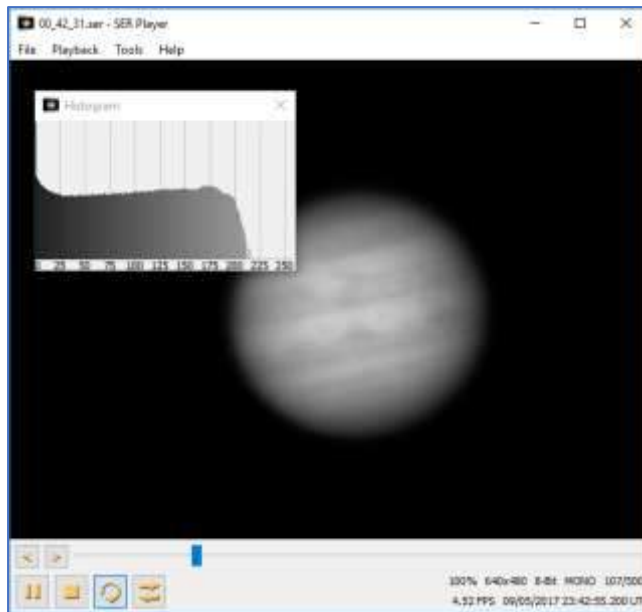
These were the steps to configure SharpCap, steps 1 – 4 being settings in the *Camera Control Panel*.

1. The *Colour Space* was set to *MONO8* (*MONO12* could be selected but would have reduced the frame rate).
2. The *Capture Area* was set to *640 x 480* (no point having lots of background unless hunting for moons). A smaller *Capture Area* helps achieve higher frames per second.
3. The *Output Format* was set to *SER*.
4. The *Analogue Gain* was set to *700* (*700/1000* is 70%).
5. A suitable *Target Name* was defined in the tool bar. In this case '*Jupiter 685 x2*' was set to indicate the equipment used. This became the name of the capture folder.
6. SharpCap's *Histogram* was started via the tool bar and the *Logarithmic* checkbox selected.
7. The *Exposure* was adjusted until the right-hand side of the histogram was around 80%.
8. A 500-frame image was obtained via the *Quick Capture* button on the tool bar.

Only *Analogue Gain* and *Exposure* were adjusted, no other *Camera Controls* or *Image Controls* were adjusted.

	
SharpCap histogram classic 'whale' shape for large disk (logarithmic vertical scale)	SharpCap's Camera Control Panel for the Altair GPCAM MONO V1

The completed image file was inspected using the *SER Player* from the *PIP* website at <https://sites.google.com/site/astropipp/ser-player>. From the *SER Player* menu, *Tools > Histogram* was selected to enable the histogram in the player. The shape of the histogram was reasonable for a large disk, giving high confidence that the data captured was suitable for processing.



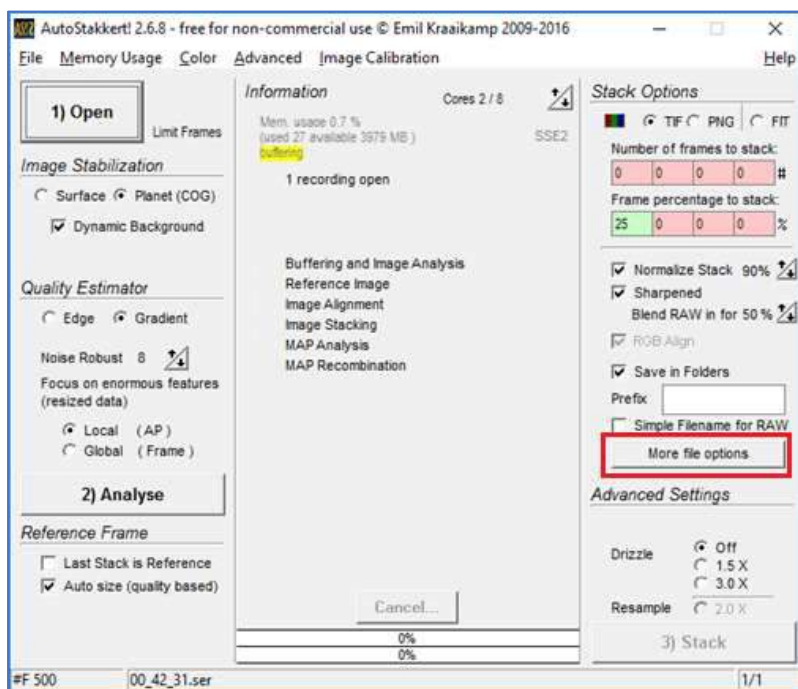
These are the contents of the *Camerasettings.txt* file generated during the capture process:

```
[GPCAMMT9M034M]
Output Format=SER file (*.ser)
Capture Area=640x480
Binning=1x1
Pan=320
Tilt=240
Colour Space=MONO8
Black Level=0
Flip=None
USB Speed=4
Auto Exp Target=120
Frame Rate Limit=Maximum
Analogue Gain=700
Exposure=221.307
Timestamp Frames=Off
Contrast=10
Gamma=100
Extra Controls=On (Slower)
Negative=Off
Apply Flat=None
Subtract Dark=None
Display Brightness=1
Display Contrast=1
Display Gamma=1
```

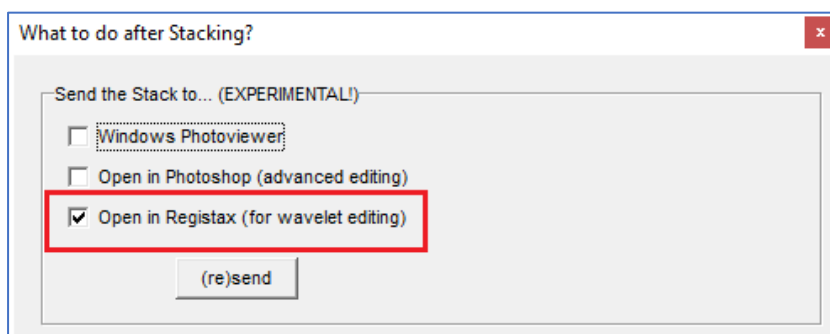
4 Linking Autostakkert and Registax

Autostakkert and Registax are generally used together, so some simple configuration can make the post processing operation seamless. If Autostakkert is configured correctly and if both programs are started before stacking with Autostakkert commences, the resultant stacked image will be automatically loaded directly into Registax.

1. Start Autostakkert and load any video file. The *More file options* button becomes active.



2. Click *More file options* and select *Open in Registax* (for wavelet editing).

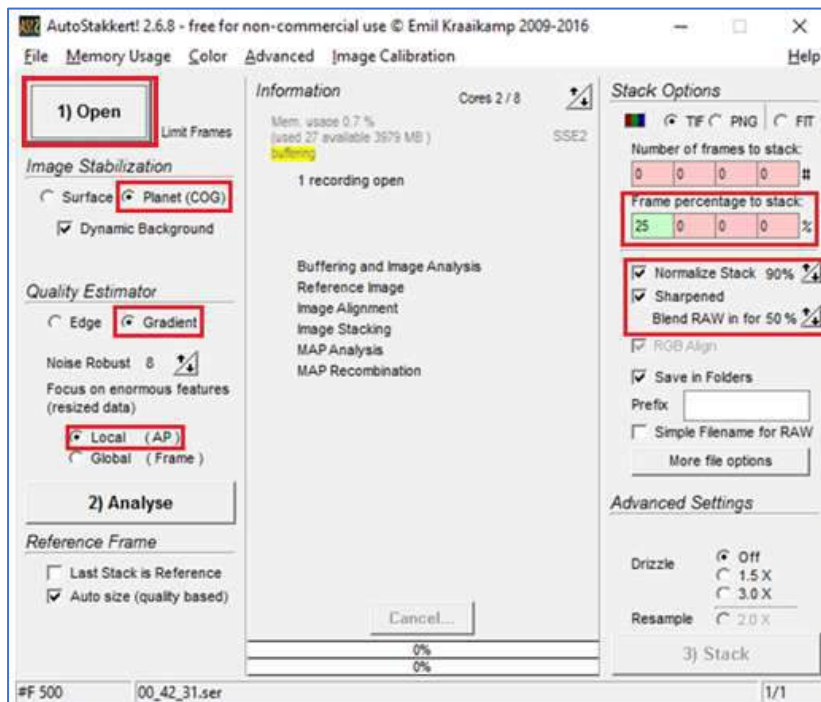


3. For subsequent processing, start both Autostakkert and Registax. Completed stacked images will be loaded directly into Registax.

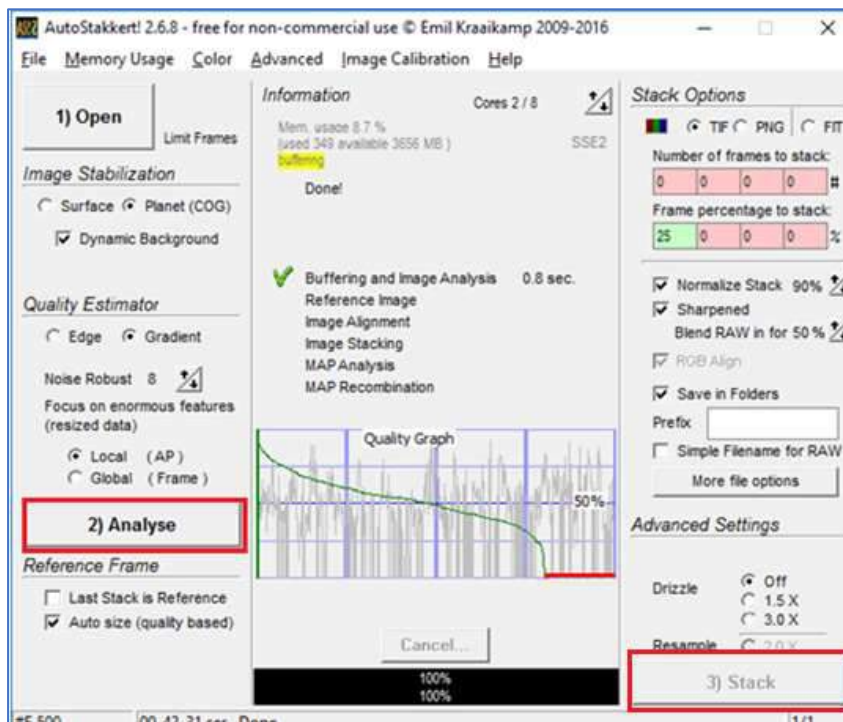
5 Processing with Autostakkert

This section describes how to process a video file to stack the frames and create a single TIF file.

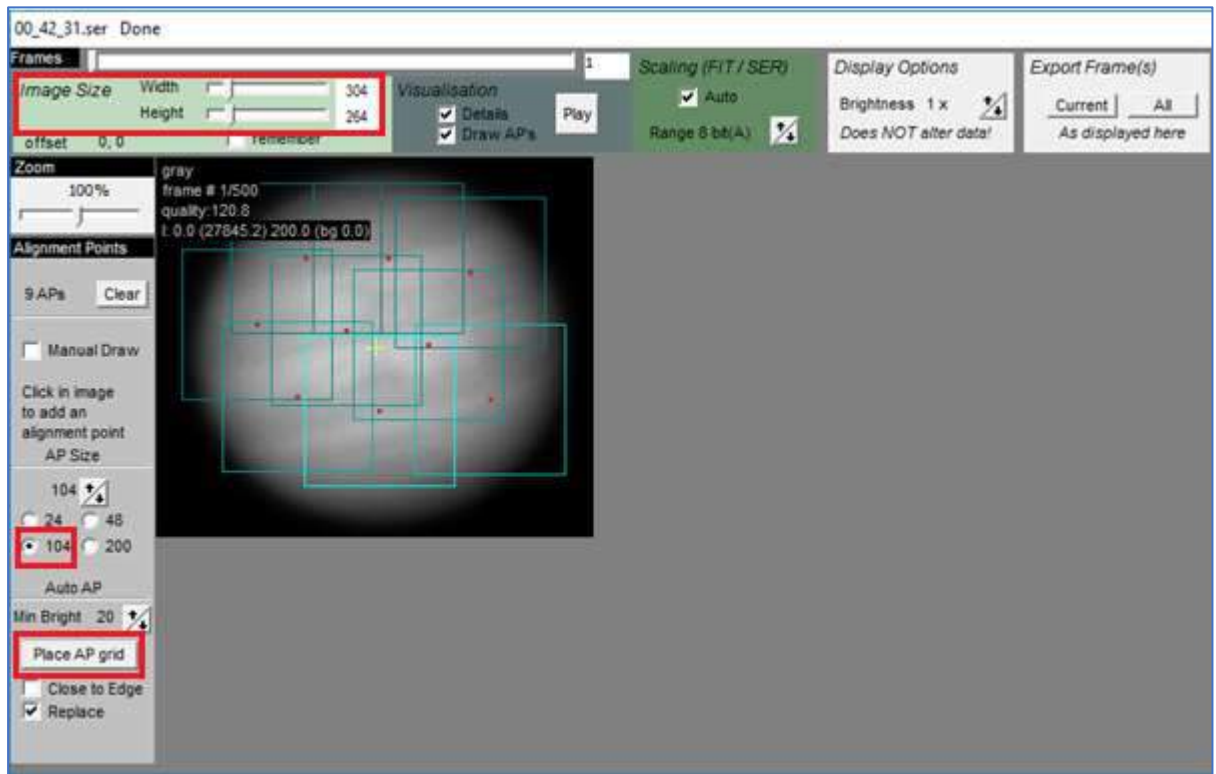
1. Start Autostakkert, drag and drop a suitable video capture file (AVI or SER format) onto the *Open* button and check the settings are suitable. The *Frame percentage to stack* depends on the quality of the video but 25% is a good starting point.



2. Click the *Analyse* button and wait for processing to complete.



3. In the other Autostakkert window, crop the *Image Size* (unless trying to include moons). Select a larger *Alignment point (AP)* size (104 in this example) and click *Place AP grid*. Any APs (red dots) at the edge of the image can be removed with a mouse right-click.



4. Click the *Stack* button in 2 above. Upon completion of processing, two TIF images will be created in the folder *AS_p25* (the stacked image and the sharpened stacked image after stacking the best 25% of the frames).

6 Processing with Registax

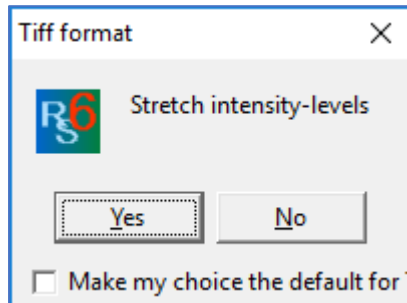
Further useful information can be found on Christophe Pellier's website at <http://www.planetary-astronomy-and-imaging.com/en/finalising-processing-registax6/> - many thanks to the author for creating the tutorial material. Here is an outline of the steps taken (the order with the Layers is important):

1. Move the *Layer 2 slider* over to the right (100%).
2. Increment the *Sharpen filter* for *Layer 2*, doing this will bring out detail but also add noise.
3. Increment the *Denoise filter* for *Layer 2*, until the noise is just removed.
4. Move the *Layer 1 slider* over to the right (100%).
5. Increment the *Sharpen filter* for *Layer 1*, doing this will bring out detail but also add noise.
6. Increment the *Denoise filter* for *Layer 1*, until the noise is just removed.
7. Partially move the *Layer 3 slider* over to the right until satisfactory detail is brought out.
8. Increment the *Sharpen filter* for *Layer 3*, doing this will bring out detail but also add noise.
9. Increment the *Denoise filter* for *Layer 3*, until the noise is just removed.
10. Do not adjust *Layers 4, 5, 6*.

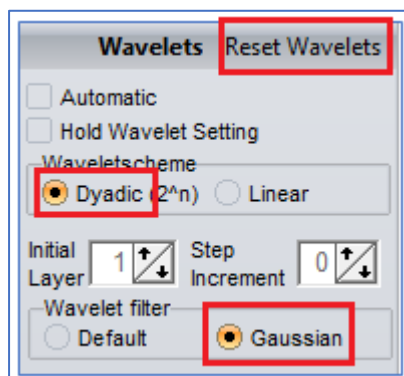
[Note: *Layer 3* can be omitted if the image has enough detail after processing *Layer 2* and *Layer 1*.]

There are no hard and fast rules, Registax final output is very much down to user preference. The settings given below are guidelines – learn by experience and experimentation.

1. Start Registax and load the TIF file stacked image called *x.tif* (not *x_conv.tif*). Answer *Yes* to the *Stretch intensity-levels* window if it appears.



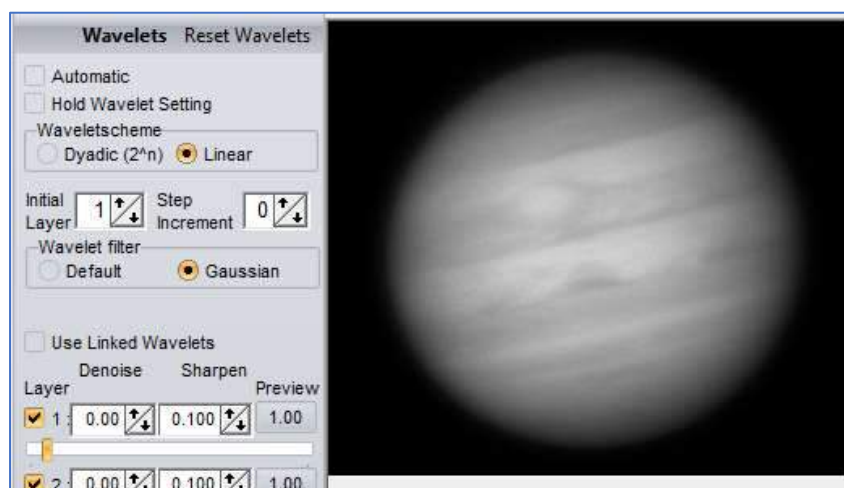
2. Select *Dyadic Wavelets* and *Gaussian filters* as shown below.



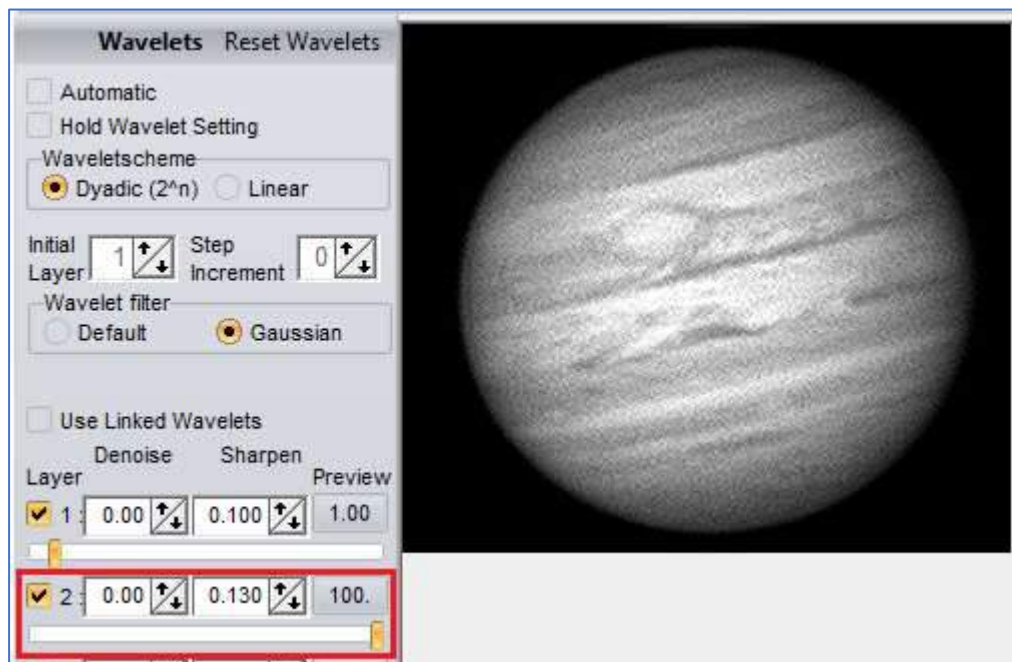
The steps below show how to adjust the *Layer sliders* plus the *Sharpen and Denoise settings* to bring out the detail in the image. The layers *must* be adjusted in the order given. The images for each layer adjustment have been kept on the same page, to allow the reader to see and compare the effects of the adjustments.

[Note: if it all goes wrong use the *Reset Wavelets* button to reset back to the initial loaded image.]

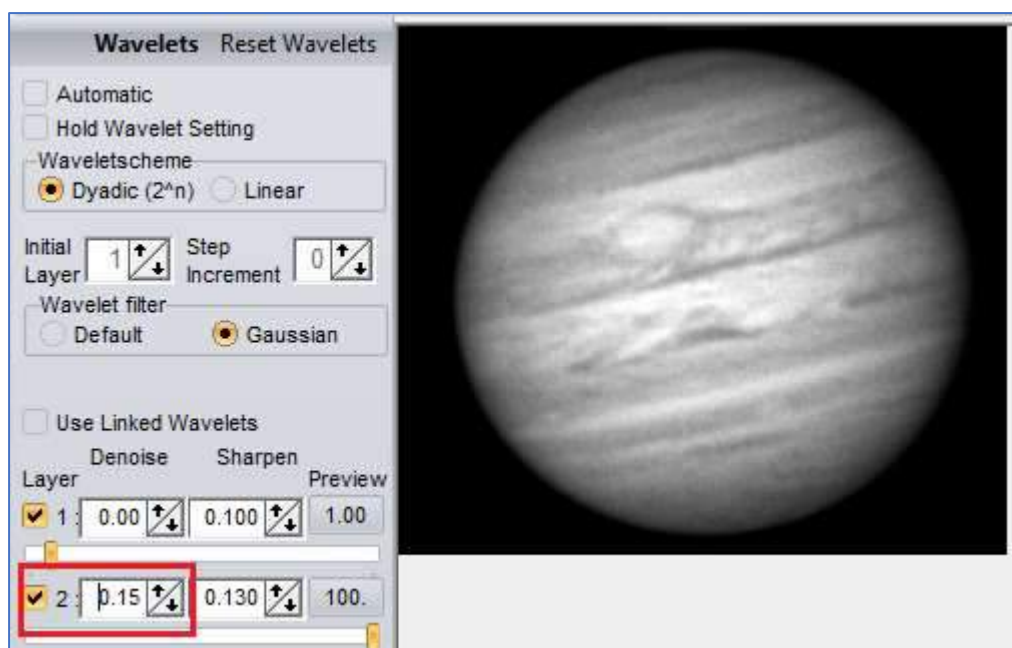
This is the stacked TIF image when first loaded into Registax.



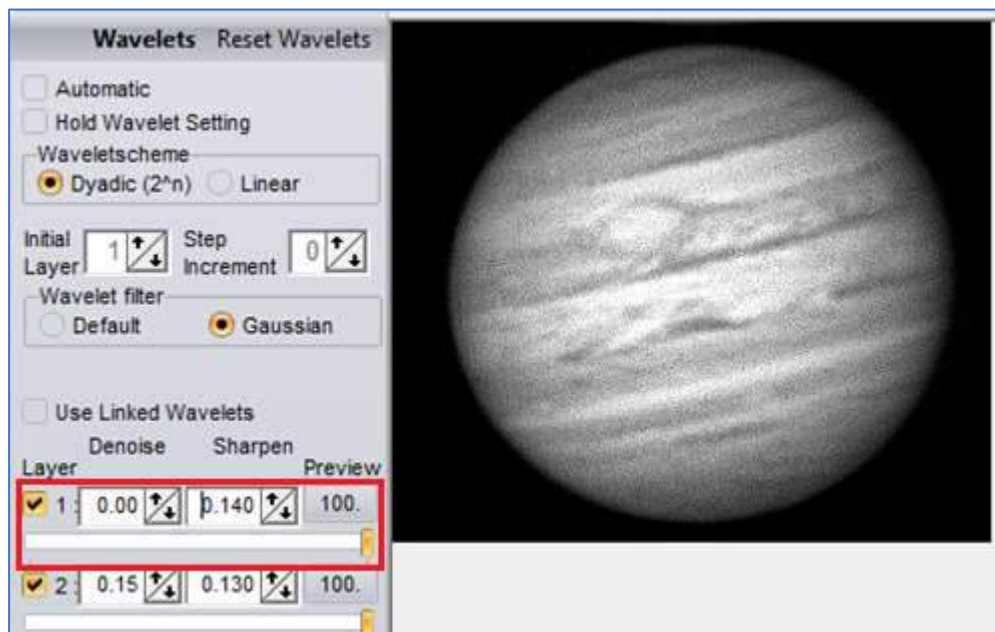
1. For *Layer 2*, move the slider to 100% (less if 100% destroys the image). Increment the *Sharpen* filter (0.130 in the example) to bring out detail (this will also increase noise).



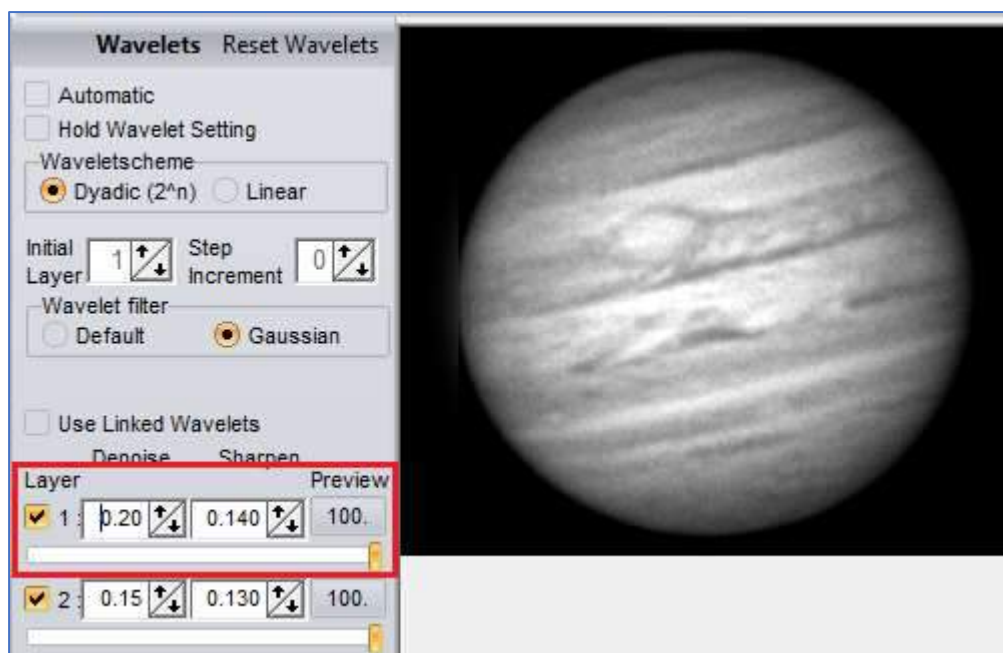
2. For *Layer 2*, increment the *Denoise* filter (0.15 in the example) until the noise just disappears.



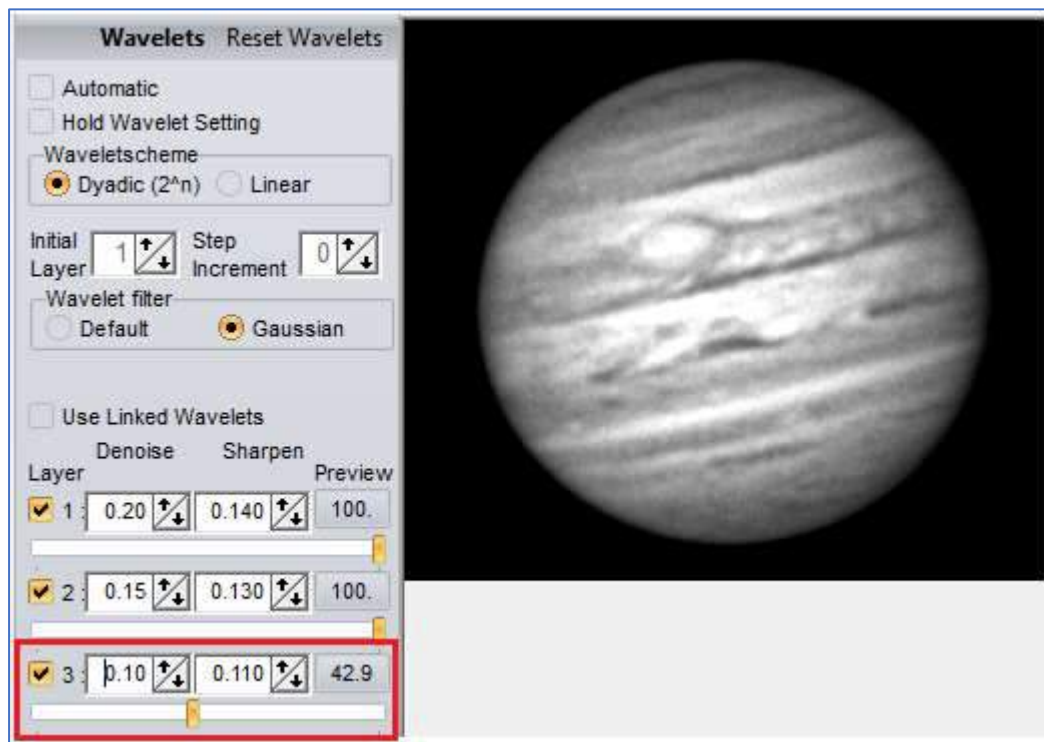
- For *Layer 1*, move the slider to 100% (less if 100% destroys the image). Increment the *Sharpen* filter (0.140 in the example) to bring out detail (this will also increase noise).



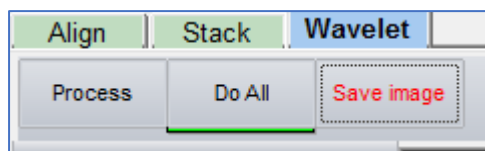
- For *Layer 1*, increment the *Denoise* filter (0.20 in the example) until the noise just disappears.



- For *Layer 3*, move the slider to around 50% (less if 50% destroys the image). Increment the *Sharpen* filter (0.110 in the example) to bring out detail (this will also increase noise). Then, increment the *Denoise* filter (0.10 in the example) until the noise just disappears.

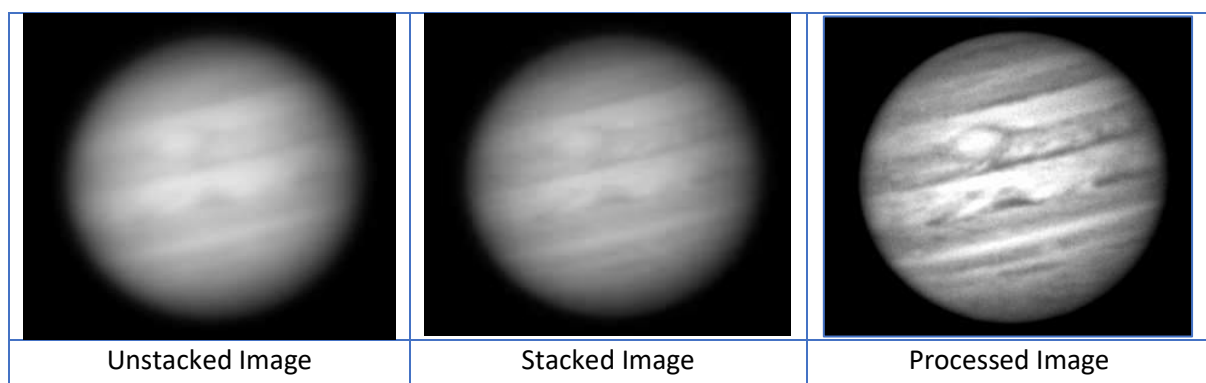


- To finish, click the *Do All* and *Save image* buttons.



- The processed image will be saved in the *AS_p25* folder. The image could be further processed using graphics editing software, examples of which are Gimp and Photoshop.

The resultant image is shown below on the right (with the initial unstacked image on the left).



7 Further Reading

The manual for SharpCap can be found at <http://docs.sharpcap.co.uk/2.9/> .

A detailed explanation of all the settings and functionality in Autostakkert can be found on the Autostakkert website at http://www.astrokraai.nl/software/manual/as2_planet.html . This reference material was written by Jerry Lodriguss, author of the book A Guide to DSLR Planetary Imaging, together with some usage tips from the author of the software.

A step by step example of the use of Linear Wavelets (as opposed to Dyadic Wavelets) can be found on the Registax website at <http://www.astronomie.be/registax/linkedwavelets1.html> .