# *Astroimaging From Somerset*

*BY PETE RICHARDSON*

# *Astroimaging From Somerset*

- *Observatory build.*
- *Equipment used.*
- *Planetary & Lunar imaging.*
- *Deep sky imaging.*

# *The Observatory Build*

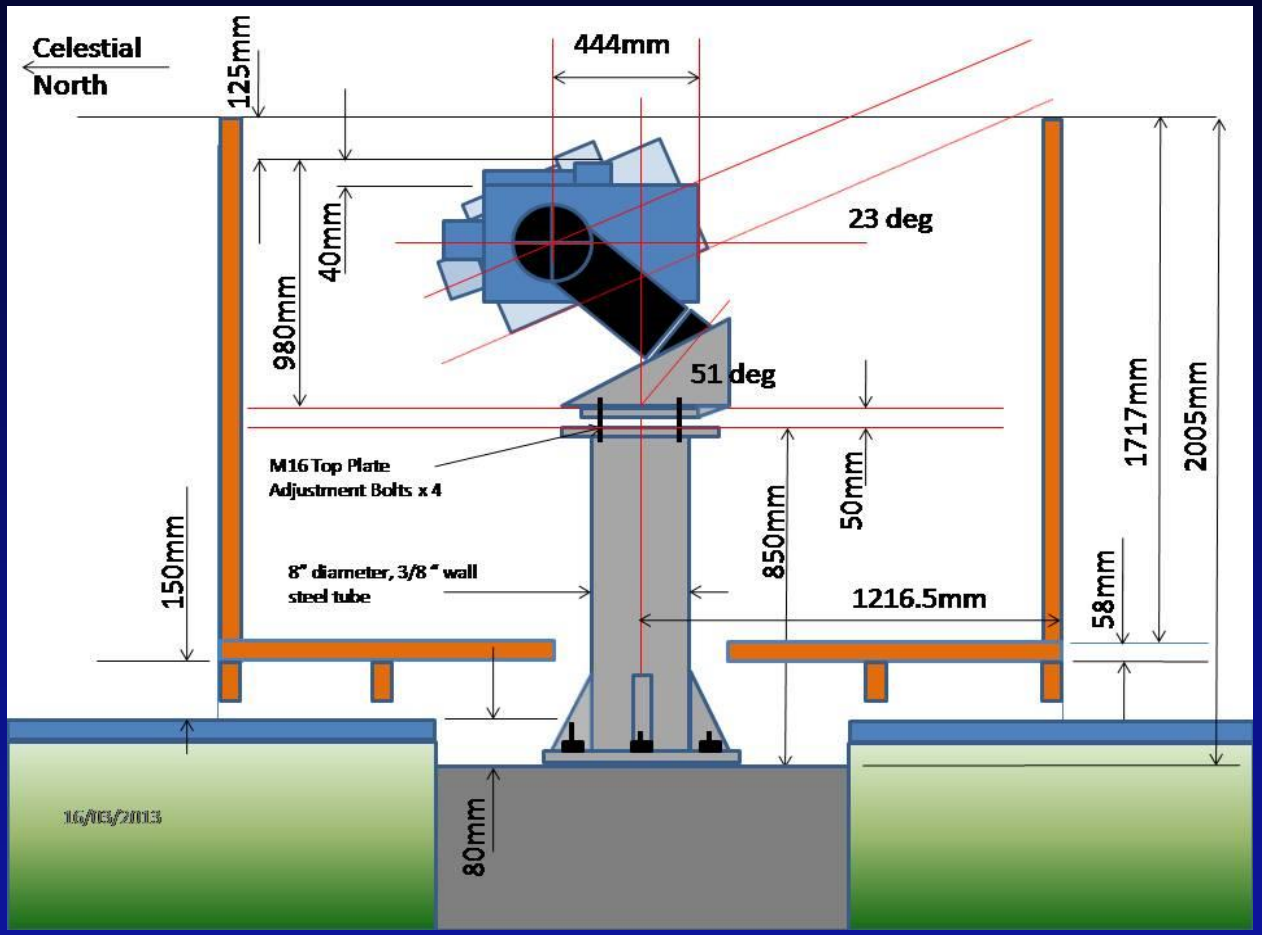
*Why build an observatory?*

*For me the main reasons were:*

- *To increase the opportunities for imaging!!*
- *To have the telescope permanently Polar aligned!!*
- *To maintain thermal stability of the optics!!*

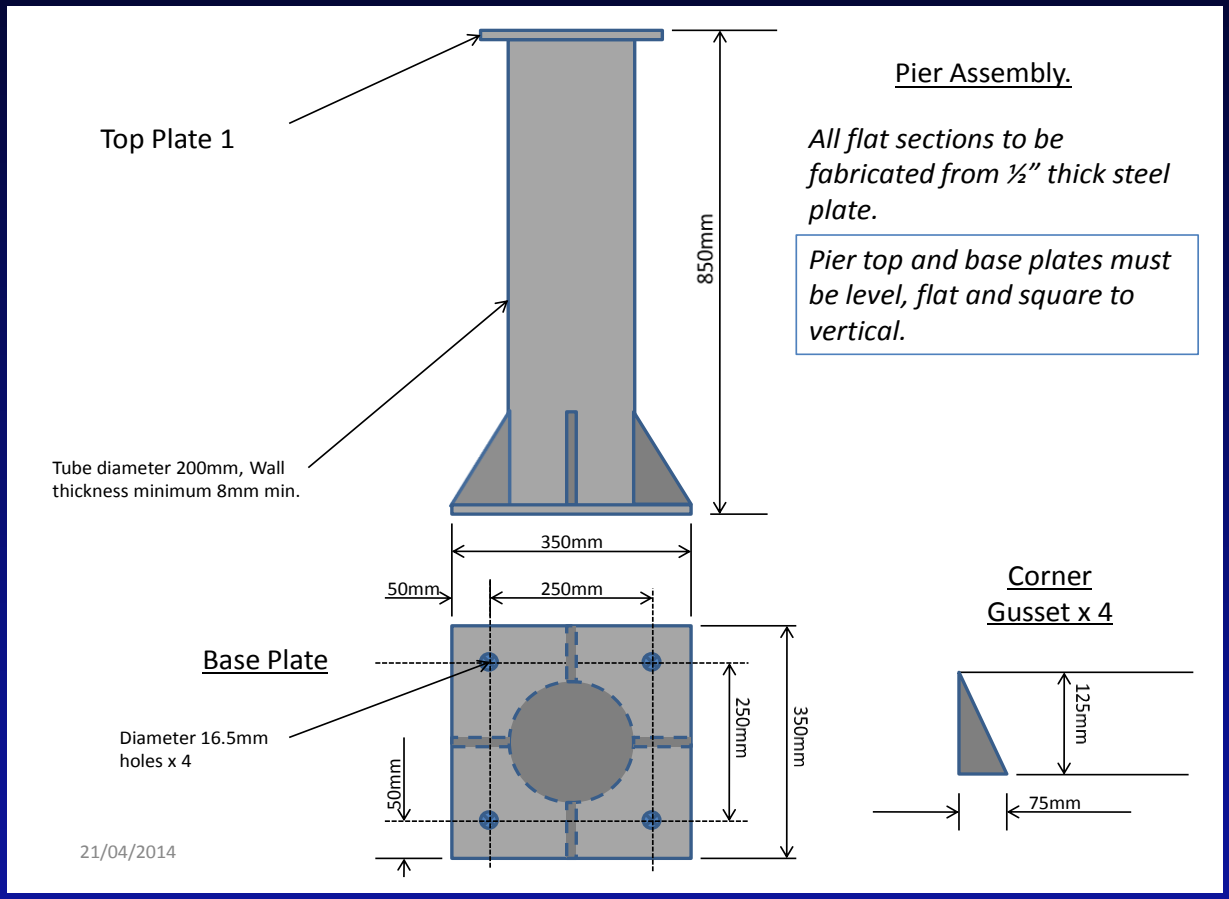
# *The Observatory Build*

*Design & Planning...*



# The Observatory Build

*Design & Planning...*



# *The Observatory Build*

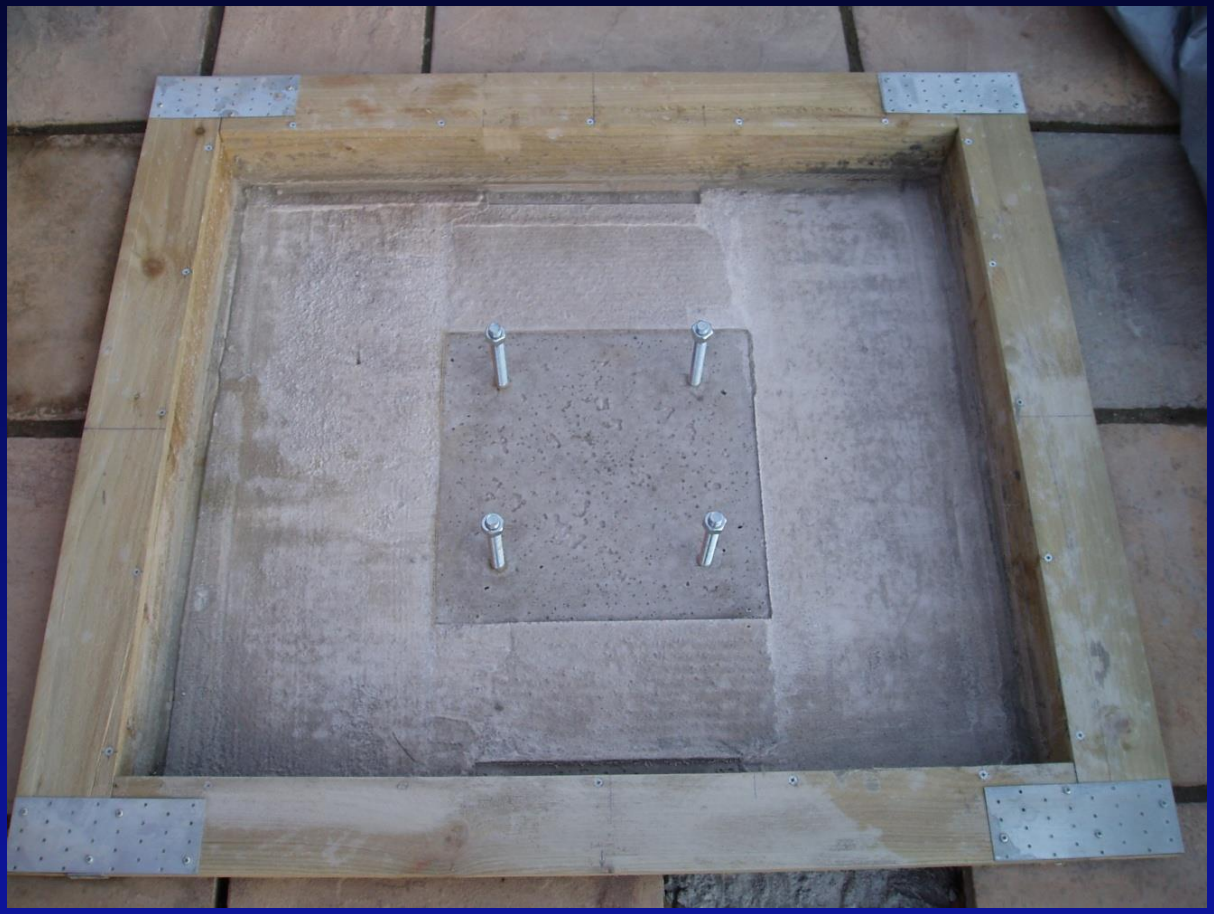
*Laying the Pier Foundation...*

# *The Observatory Build*

*Pouring the concrete...*

# *The Observatory Build*

*The completed foundation...*

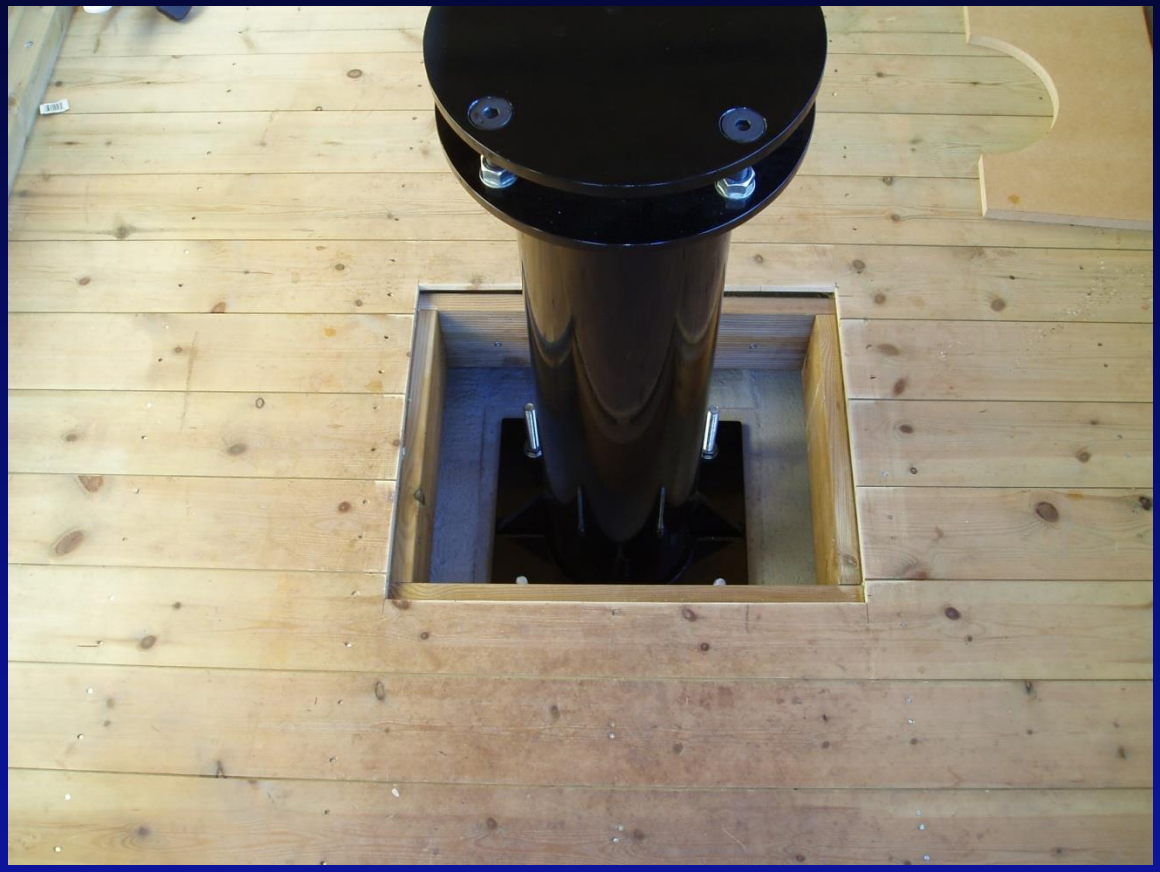


# *The Observatory Build*

*The base framework...*

# *The Observatory Build*

*Installing the Pier...*



# *The Observatory Build*

*Converting the roof...*

# *The Observatory Build*

*Converting the Roof...*

# *The Observatory Build*

*Complete and Ready for First Light!!*

# *Main Equipment – Telescopes*

*Meade 12” LX200ACF.*

*Used for planetary imaging,*

*deep sky imaging and guiding.*

*FL 3040mm, F10.*

*William Optics Zenithstar 80mm Refractor.*

*Used for deep sky imaging and guiding.*

*FL 545mm, F6.8*

# *Main Equipment - Cameras*

*ZW Optical ASI120mm monochromatic high frame rate camera.*

*Used for planetary imaging. This camera has excellent sensitivity & resolution.*

# *Main Equipment - Cameras*

*QSI683wsg*

*CCD camera.*

*Monochrome cooled*

*8 megapixel CCD.*

*Used for deep sky imaging*

*only.*

# *Main Equipment - Cameras*

*Orion Starshoot Autoguider CCD camera.*

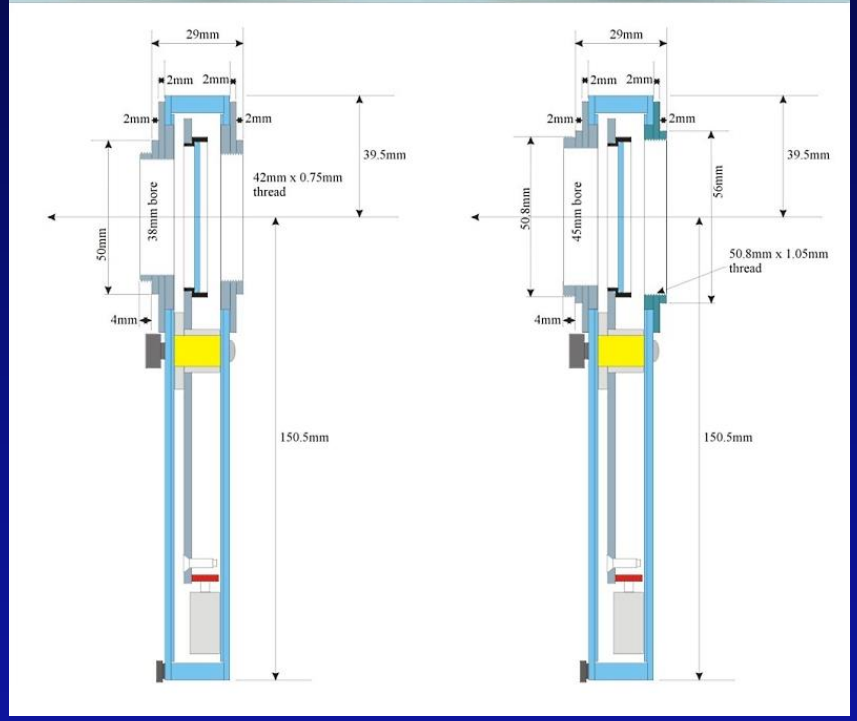
*Used for autoguiding when deep sky imaging.*

# *Main Equipment – Filter Wheel*

*<u>Starlight Express Filter Wheel</u>*

*Used for planetary imaging in conjuction with the mono ASI120mm camera.*

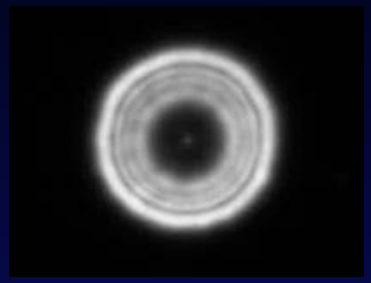
*Full colour images are obtained by imaging through red, green & blue filters.*

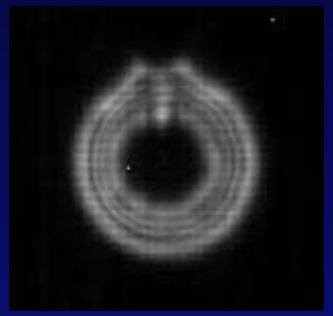



# *Other Equipment &Accessories:*

- *Lakeside electronic focuser*
- *Bader crayford focuser*
- *Lap top computer – core i5 processor, 6Gb RAM.*
- *Barlow lenses, focal reducers/flatteners*
- *Flat frame boxes*
- *Atmospheric Dispersion Corrector.*
- *Kendric Dew Control System (deep sky imaging)*
- *Astronomik LRGB & IR Pass Filters*
- *Various extension tubes, eyepieces, illuminated reticle eyepiece and visual filters.*

# *Capturing the Moon & Planets*



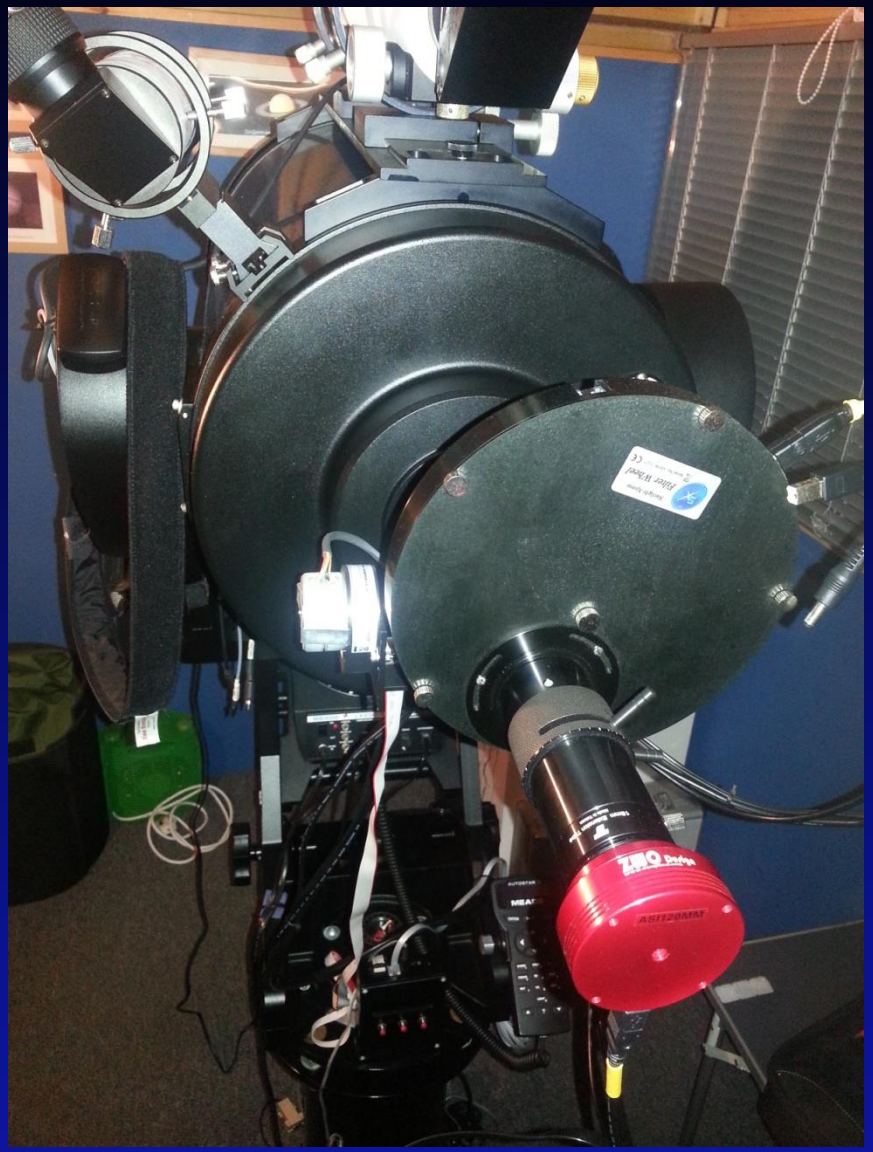


*Critical checklist prior to starting capture:*

- *Ensure accurate collimation of the optics!!*
- *Ensure thermal equalibrium of the optics!!*
- *Try and ensure images are obtained under the best possible seeing conditions for the location!!*

# *Capturing the Moon & Planets*

*Equipment Set-Up:*



# *Capturing the Moon & Planets*

*Image Acquisition Process Summary:*

- *Connect the equipment to laptop PC (camera, filter wheel).*
- *Start the capture software of choice (eg, IC Capture, Firecapture).*
- *Centre the target on camera chip (except for the Moon, this does take some practice!!)*
- *Focus on the target object – critical to spend time here ensuring best focus!! Use features on the subject to gauge the focus point.*
- *Set frame rate and gain settings to achieve the best histogram fill / highest frame rate combination but without introducing too much noise. The histogram should be as close to equal as possible for all filters.*

# *Capturing the Moon & Planets*

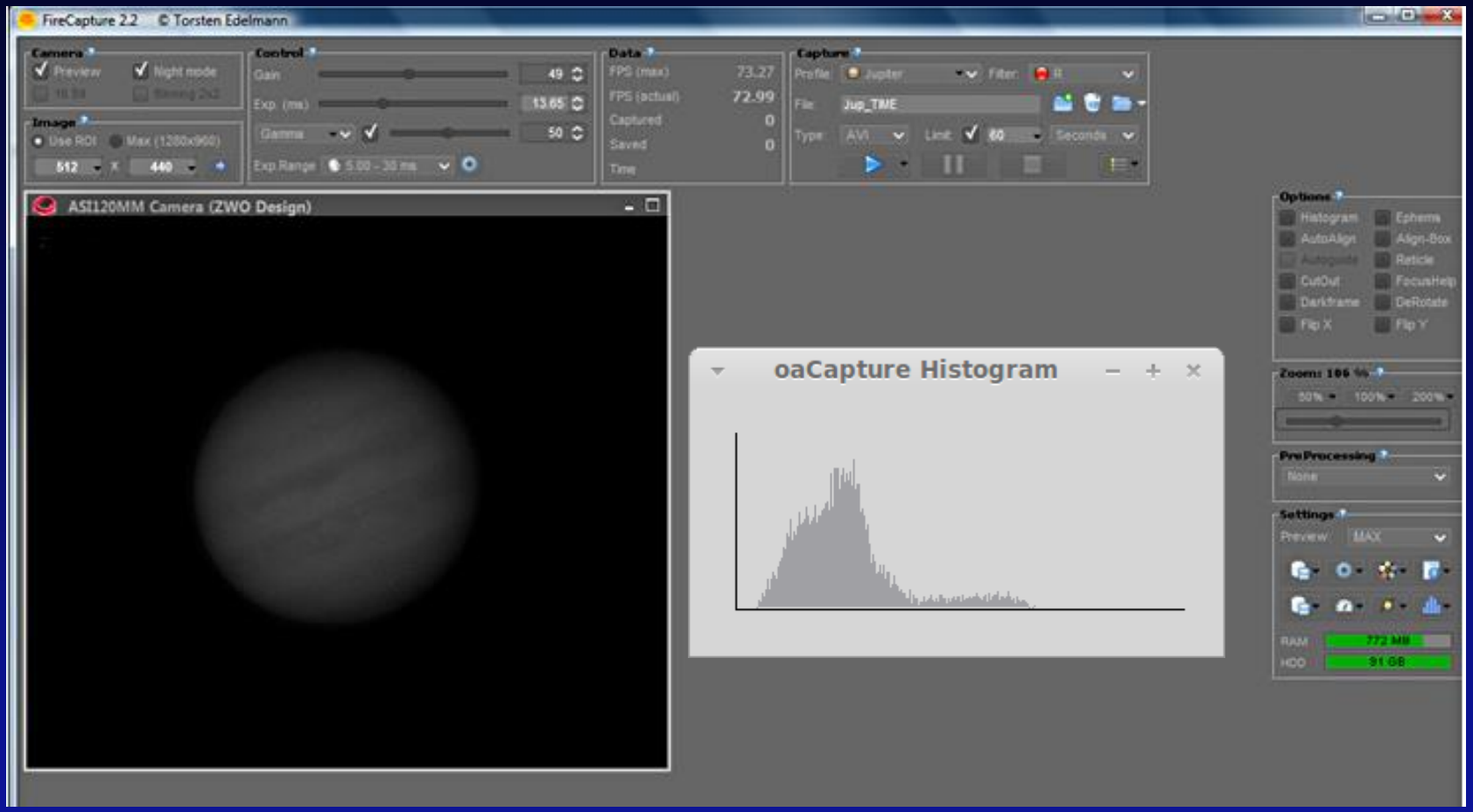
*Image Acquisition Process Summary:*

- *Start the capture – for mono camera's this will involve taking AVI video through the Red, Green & Blue filters (and possibly others, eg Infa Red Pass).*

- *Capture enough video (AVI format) to achieve the maximum number of individual frames. Care must be taken to ensure planetary rotation does not come into effect as this will blur detail (derotation software such as WinJupos can overcome this allowing for longer captures).*

# *Capturing the Moon & Planets*

*Image Acquisition: Firecapture 2.2*



# *Capturing the Moon & Planets*

*Image Processing:*

- *Registration & stacking – Software such as Autostakkert or Registax will sort through the individual frames and select the ones of the best quality by way of a pre selected 'reference frame'.*

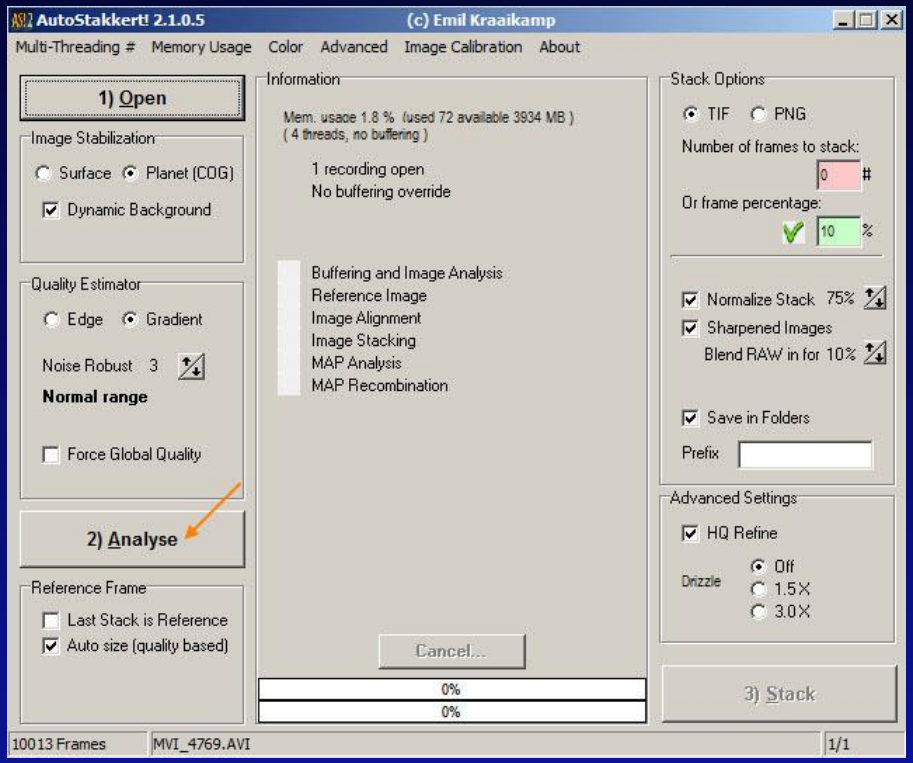
- *These frames are then combined (stacked) into a single image using a series of alignment points. This would be done for each colour channel.*

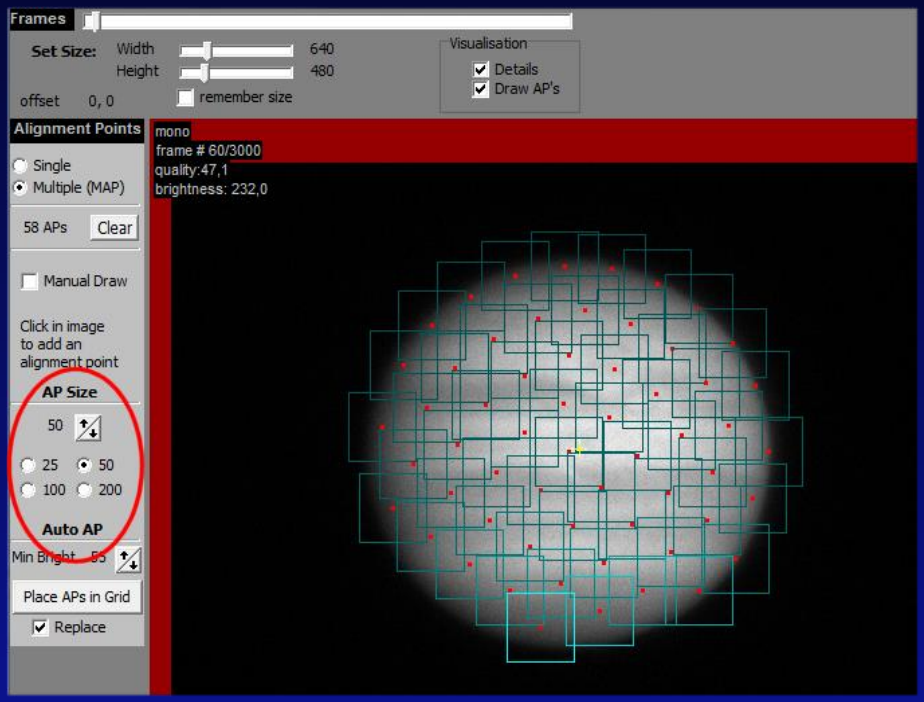
- *Sharpening – Registax allows use of 'Wavelets' to sharpen the image allowing fine detail to be resolved. Again this would be done for each stacked image for each colour channel.*

- *Final procesing – Software such as Adobe Photoshop allows the individual colour channels to be combined into a composite RGB full colour image. Final tweaks such as denoising filters or colour balancing and saturation can be applied.*

# *Capturing the Moon & Planets*

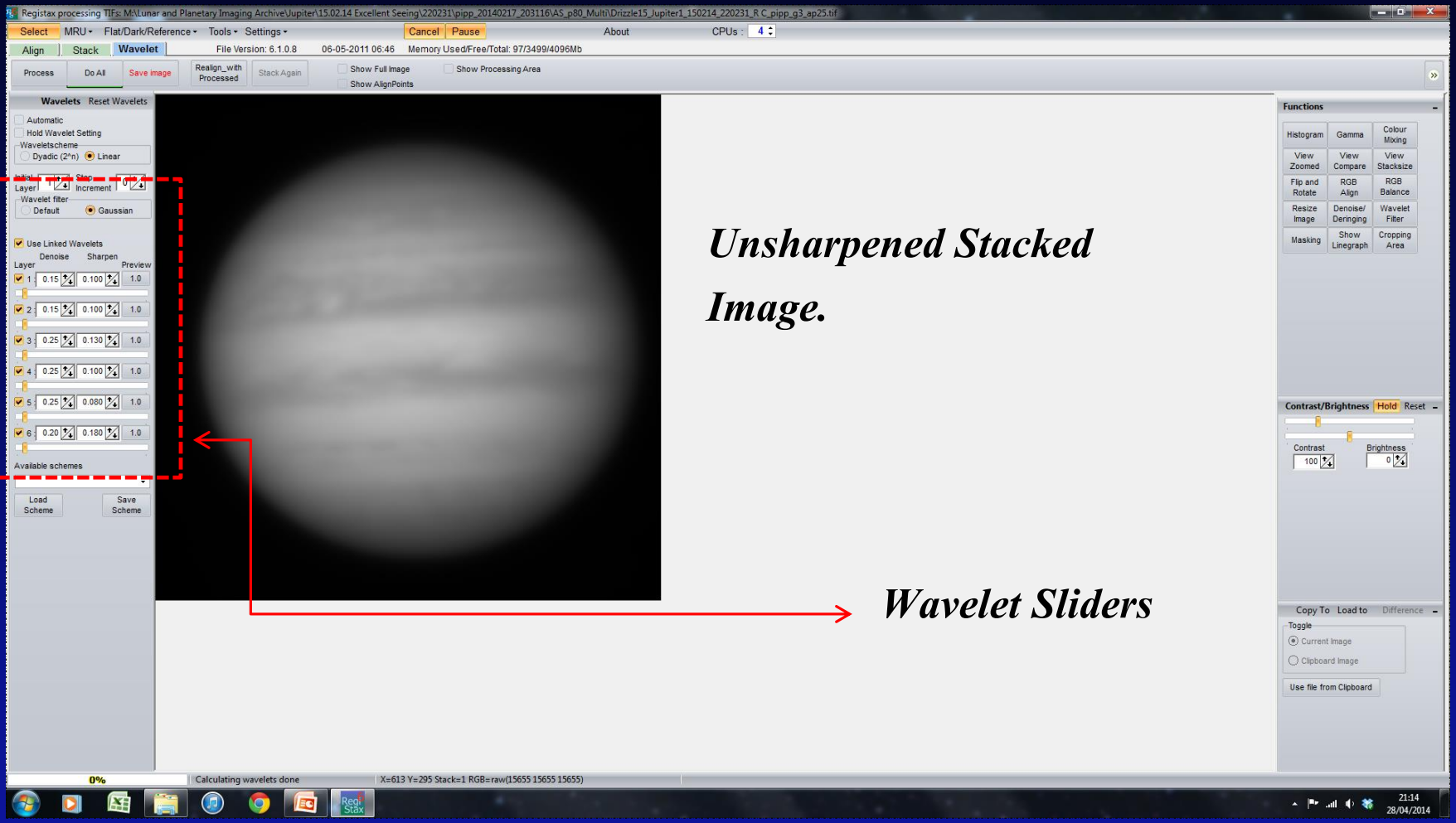
*Image Processing: Registration & Stacking Using Autostakkert*



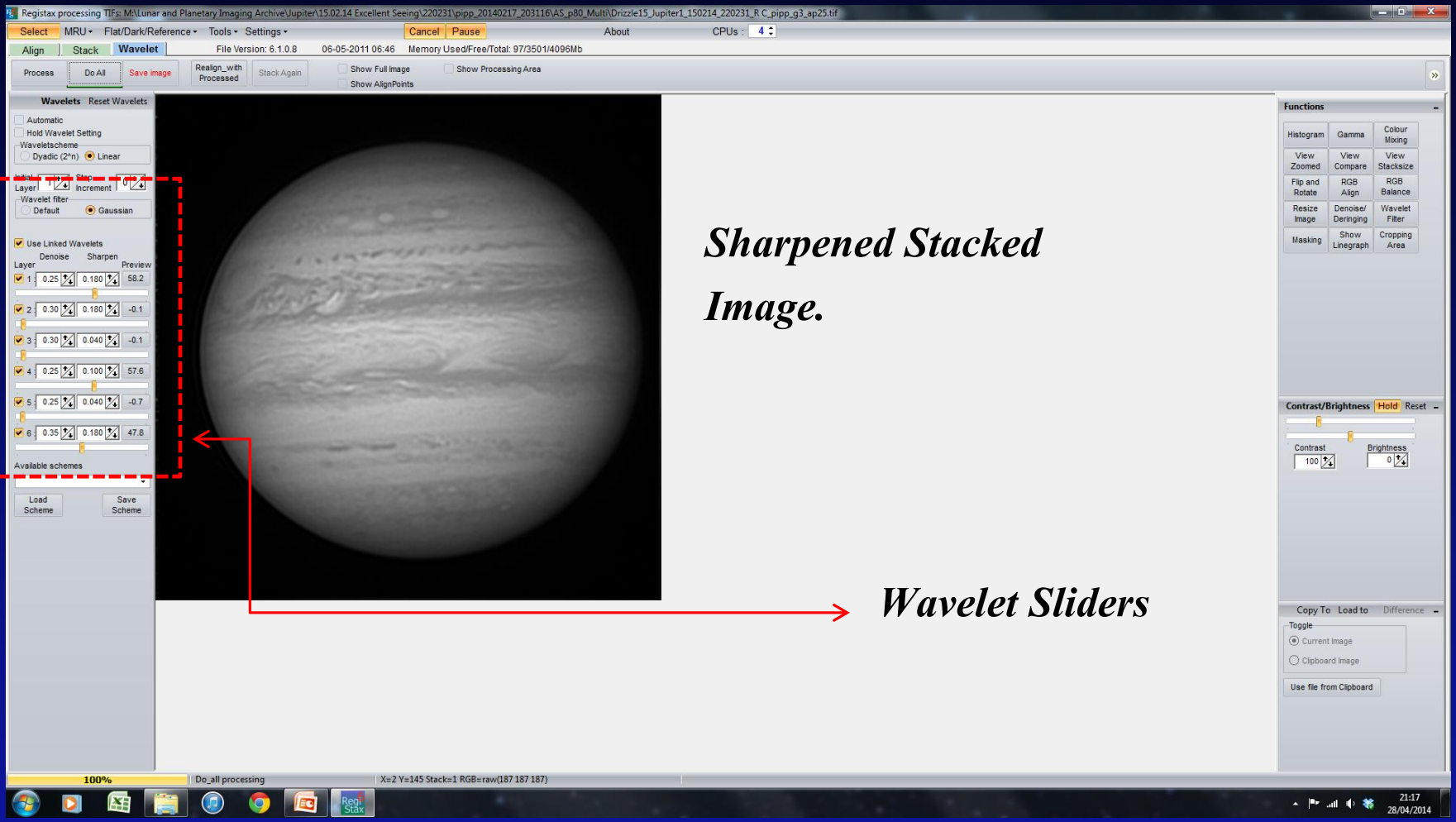
# Capturing the Moon & Planets

*Image Processing: Image Sharpening Using Registax*



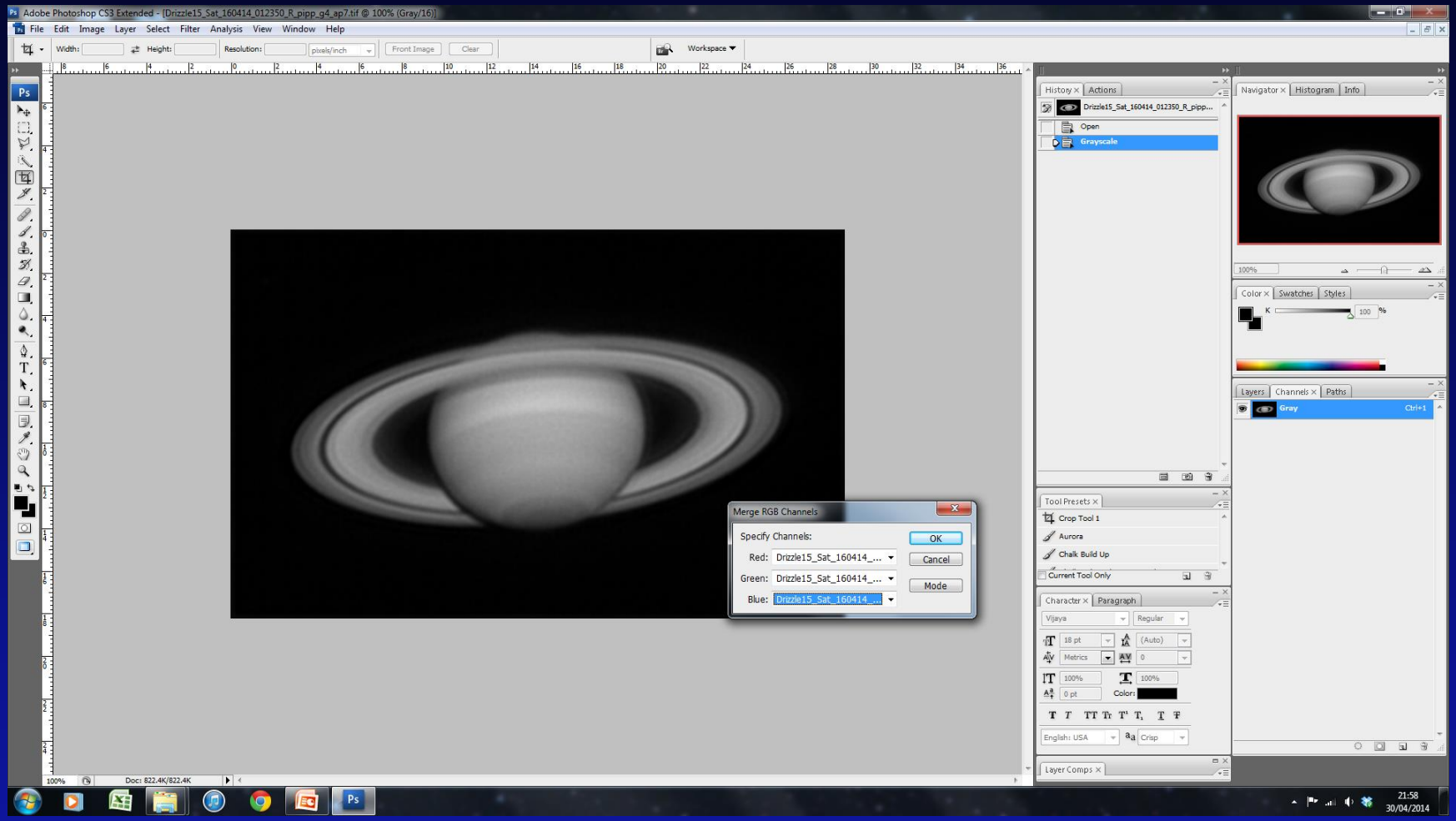
# Capturing the Moon & Planets

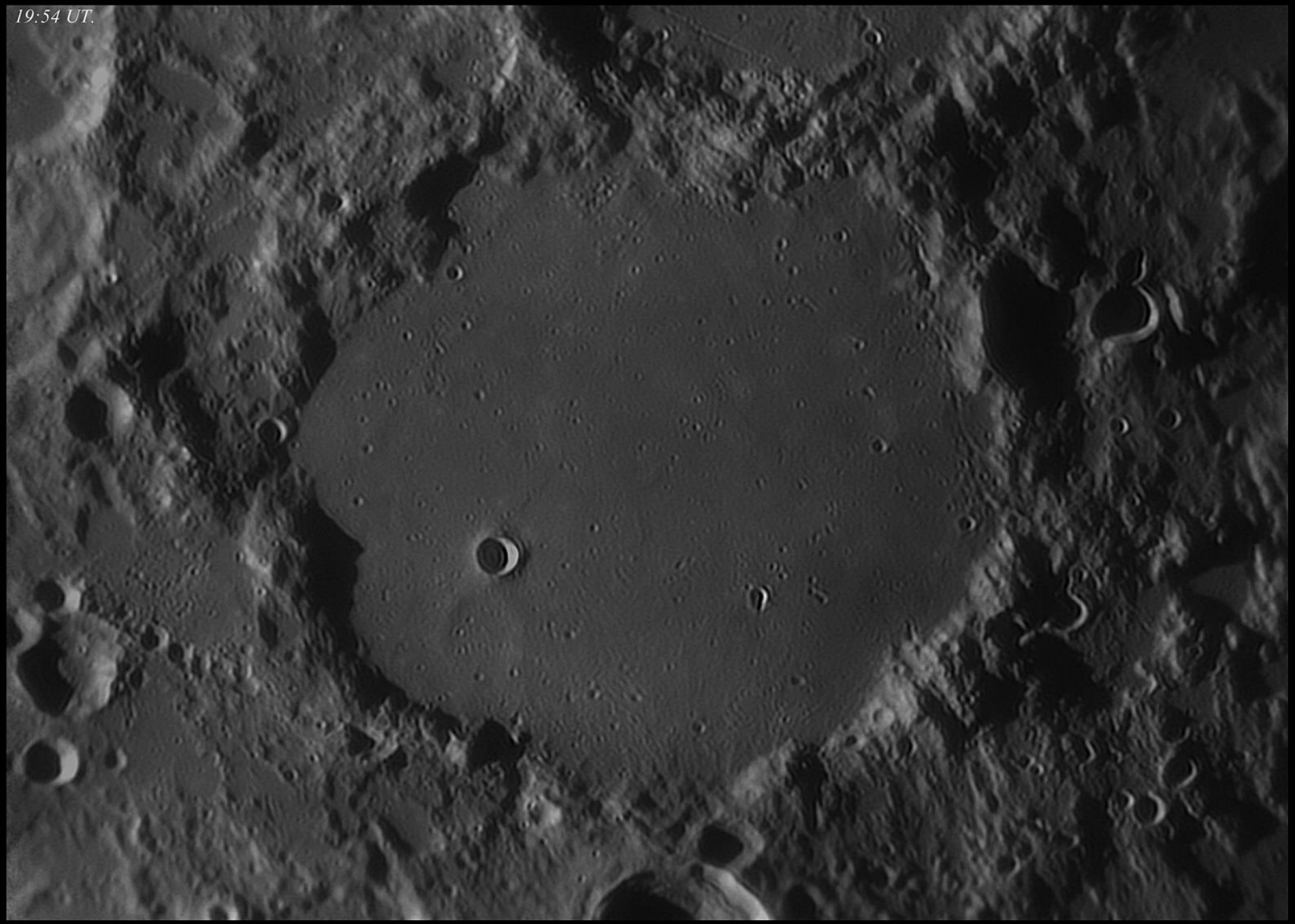
*Image Processing: Image Sharpening Using Registax*



# *Capturing the Moon & Planets*

*Image Processing: Creating an RGB Image In Photoshop*

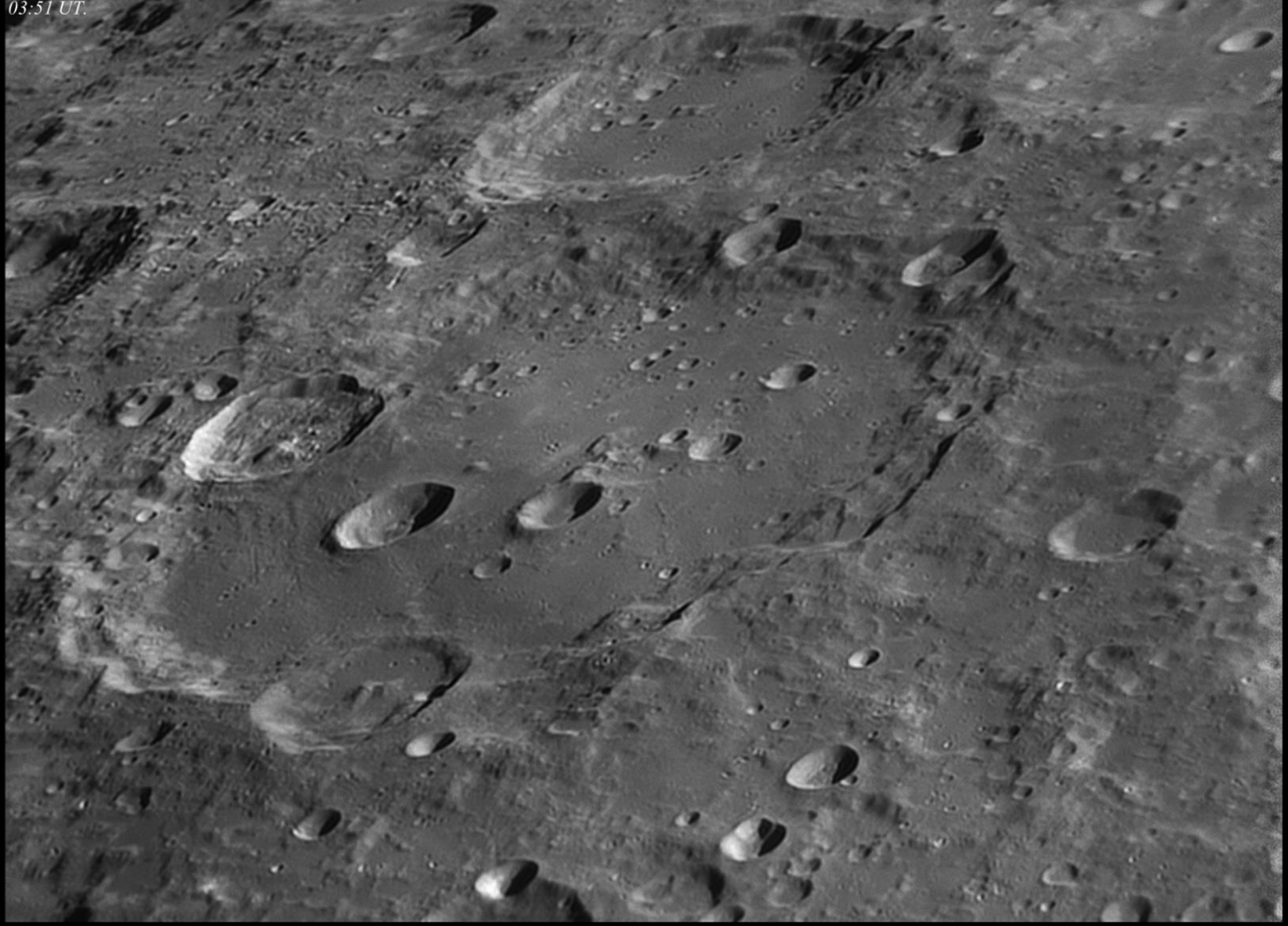





*Lunar Crater Ptolemaeus, 09.03.2014, Somerset UK.*

*LX200ACF 12", ASI120mm Camera.*

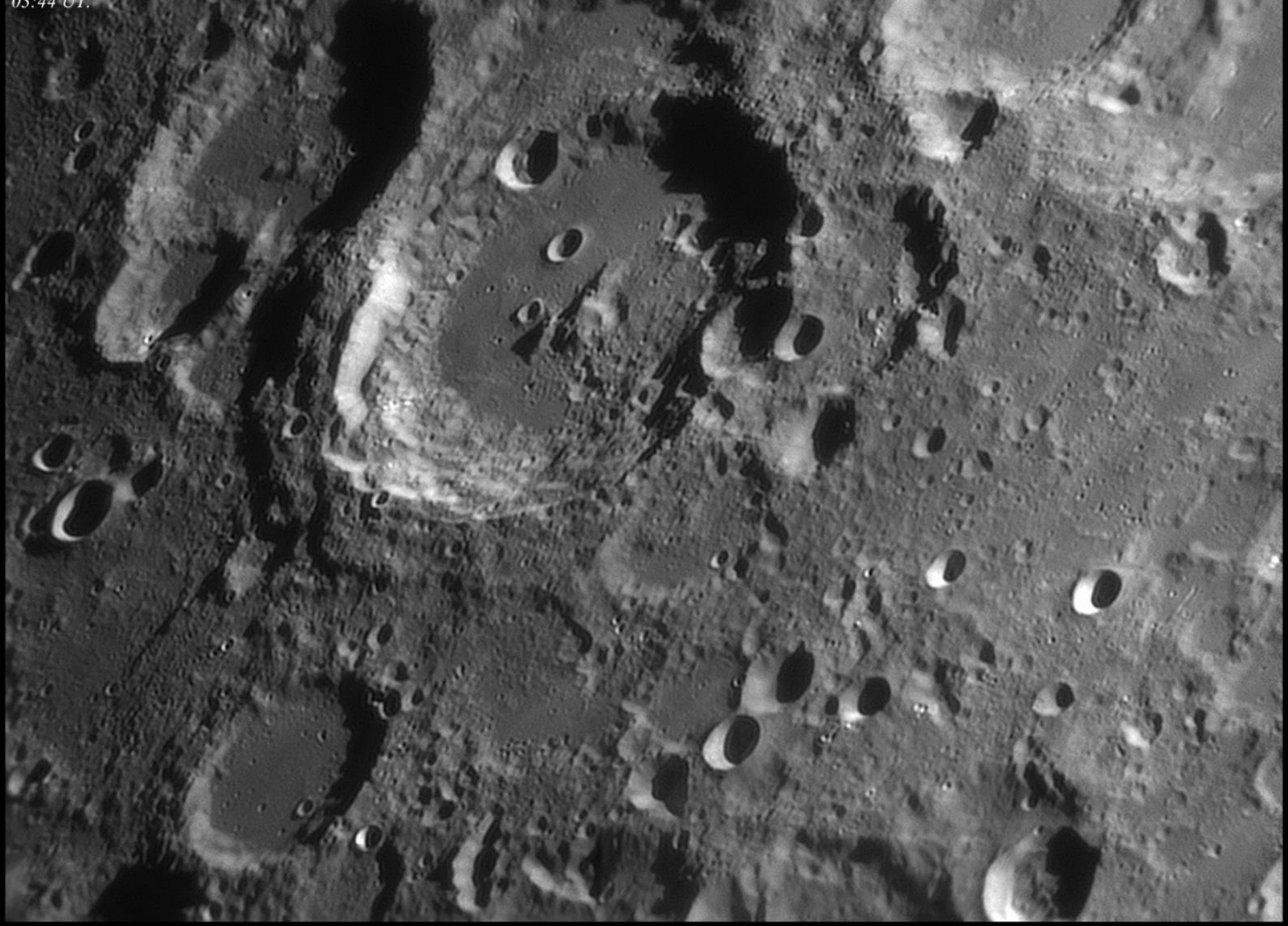
*Pete Richardson.*




*Lunar Craters Clavius & Blancanus, 23.11.13, Somerset UK.*

*LX200ACF 12". ASI120mm Camera.*

*Pete Richardson.*




*Lunar Crater Maurolycus, 23.11.13, Somerset UK.*

*LX200ACF 12". ASI120mm Camera.*

*Pete Richardson.*

*23:14 UT.*

*Jupiter 19.01.2014, Somerset UK.*
*LX200ACF 12", ASI120mm Camera.*

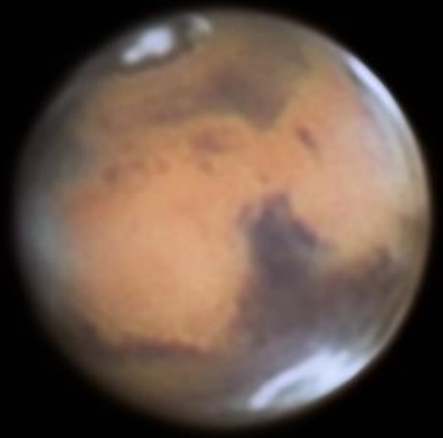
*Pete Richardson.*

*22:14 UT.*

*Saturn 15.05.2014,*
*Combined RGB WinJupos Derotation.*
*Somerset UK.*
*LX200ACF 12", ASI120mm Camera.*

*Pete Richardson.*

*23:08 UT.*



*Mars 23.04.14, Somerset UK.*
*LX200ACF 12", ASI120mm Camera.*

*Pete Richardson.*

# *Capturing Deep Sky Objects*

*Critical checklist prior to starting capture:*

- *Ensure accurate collimation of the optics!!*
- *Ensure correct balance of the optical tube!! A slight weight bias to the east forkarm and the primary mirror end minimises guiding errors.*
- *Ensure thermal equalibrium of the optics!!*
- *Try and ensure images are obtained under the best possible seeing conditions & transparency for the location!!*
- *Select a suitable target!! (ie matched for CCD FOV and imaging location – not too faint!!). A good planetarium software is invaluable here where FOV indicators can be set to mimic individual equipment set-ups.*

# *Capturing Deep Sky Objects*

*Equipment set-up:*

# *Capturing Deep Sky Objects*

*Autoguiding:*

- *This technique is employed to enable long exposures by way of very accurate tracking. This is achieved using a second telescope (the Guidescope) which is fixed to the main imaging telescope. A mag 2.0 to 4.0 star is centred, focused & guiding software (eg Phd guiding) reads the drift of this star away from a target point and sends corrections to the mount to keep the star fixed in position. Only very high end mounts have the ability to track unguided.*

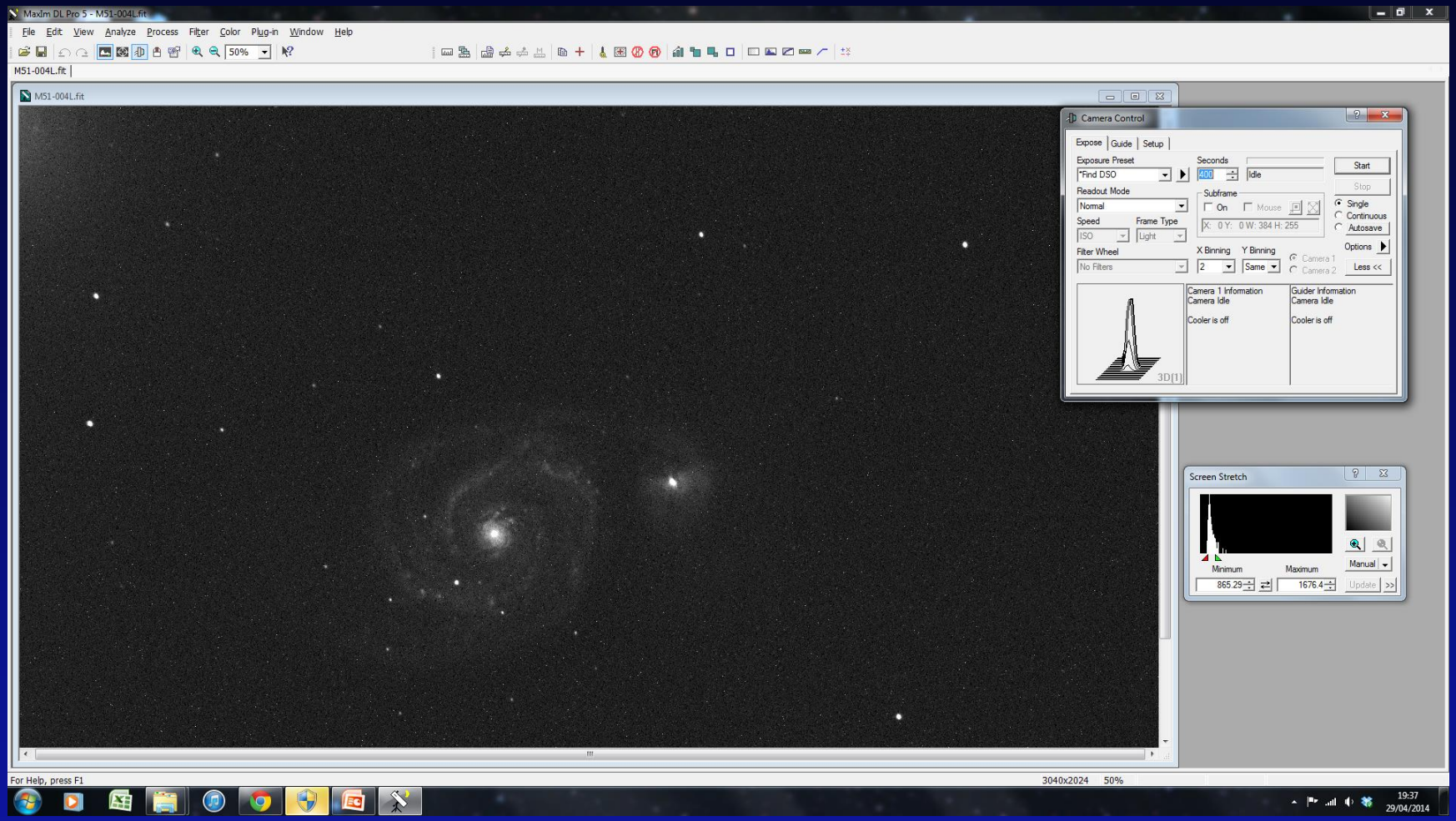
# *Capturing Deep Sky Objects*

## *Image Acquisition Process Summary:*

- *Connect the equipment to laptop PC (imaging camera, guide camera, filter wheel).*
- *Start the capture & guiding software of choice (eg, Maxim DL, Phd Guiding).*
- *Slew to a magnitude 3.0 – 4.0 star near to the main imaging target of choice and centre star on CCD (capture single test exposure (2s) to verify star is centred).*
- *Perform focus routine (Focusmax)*
- *Slew to main target and centre on chip (capture single test exposure (60s) to verify target is centred).*
- *Check and find suitable guide star.*
- *Start autoguiding via Phd (Phd will perform an auto calibration routine first to establish mount Periodic Error)*
- *Perform another test exposure to ensure accurate guiding.*
- *Set number and duration of exposures. Start main capture sequence.*

# Capturing Deep Sky Objects

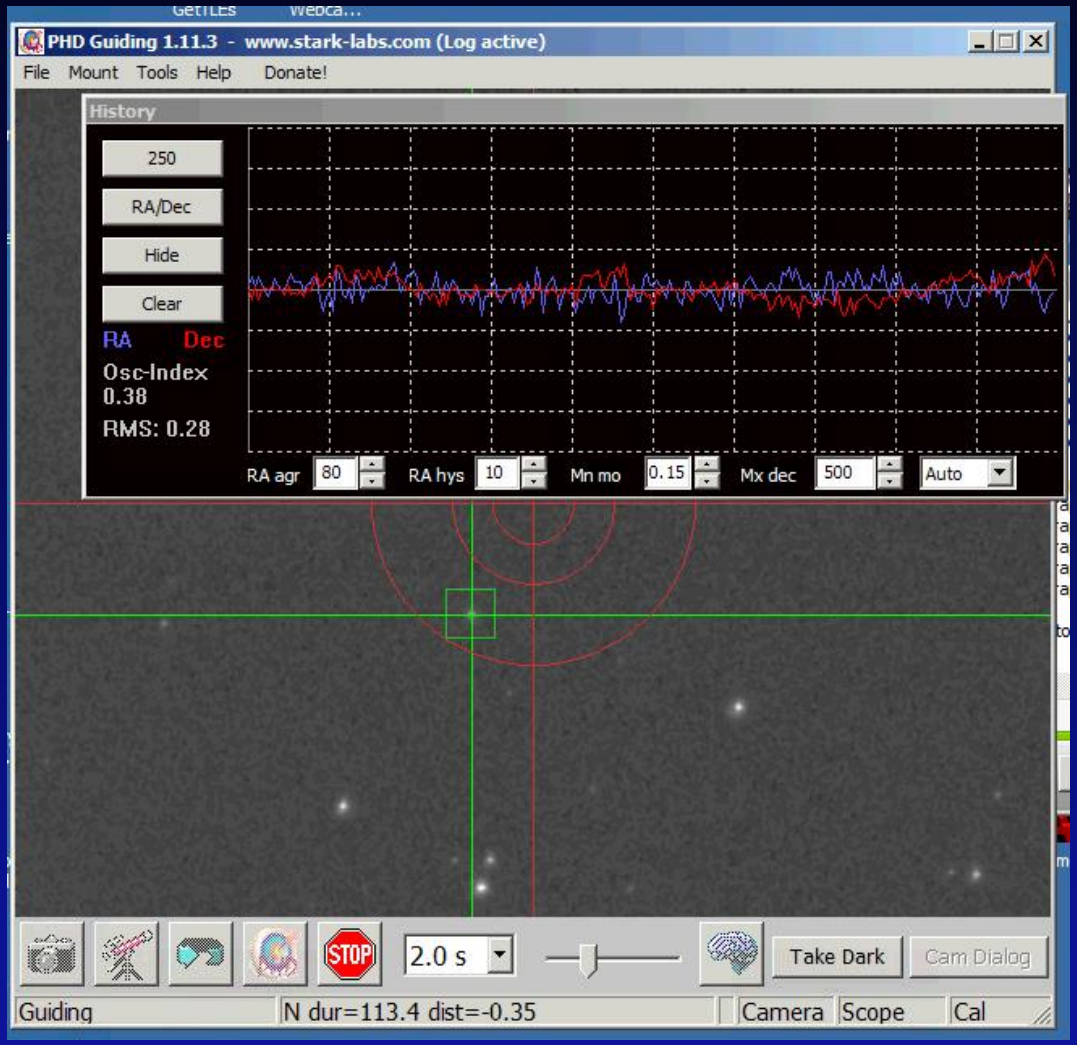
*Image Acquisition: Maxim DL Pro V5*



# *Capturing Deep Sky Objects*

*Image Acquisition:*

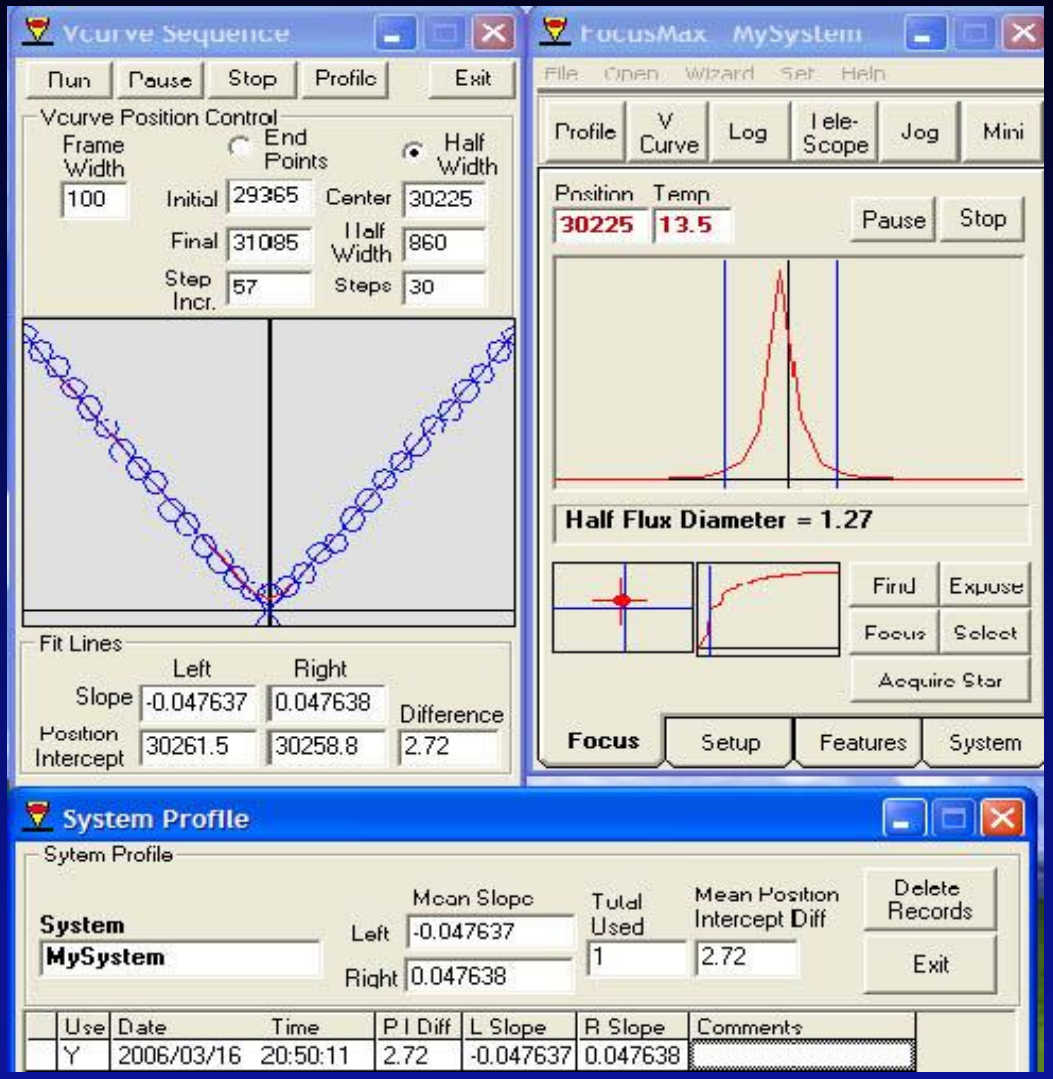
*Phd Guiding*



# *Capturing Deep Sky Objects*

*Image Acquisition:*

*Focusmax.*



# *Capturing Deep Sky Objects*

*Image Processing Summary:*

- *Image Calibration – A series of calibration frames (darks, flats, flat darks and bias frames) are used initially to calibrate the 'light' frames. This process removes noise and other defects such as dust doughnuts in the optical train and any vignetting from the light images.*

- *Colour conversion (for OSC CCD Cameras) – raw images are converted to colour in Maxim DL. For a mono CCD this step would be omitted.*

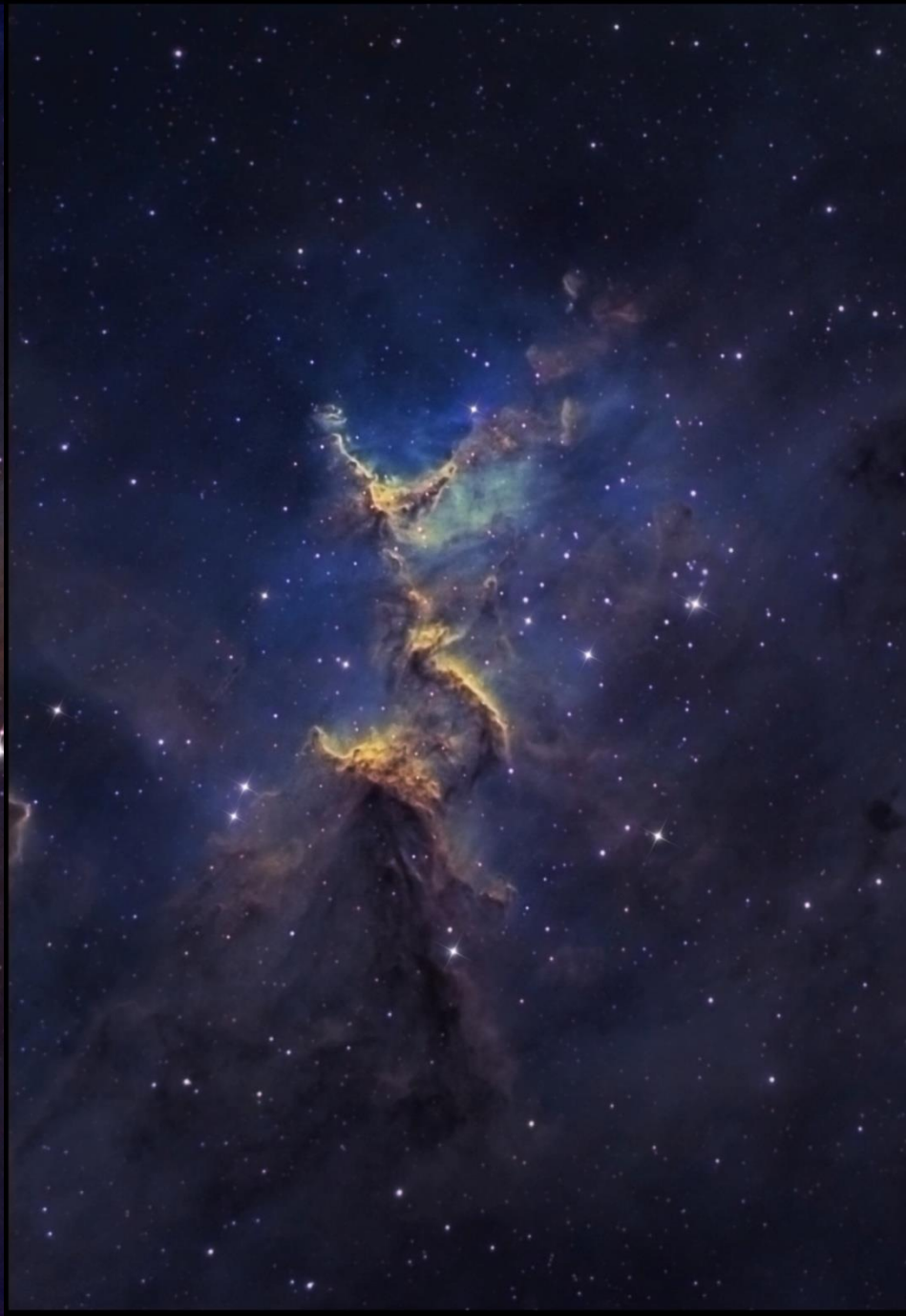
- *Registration – Software such as Maxim DL will sort through the individual frames and will perform a 'best quality 'selction. Manual selection can also be used to remove any bad frames (eg satellite trails)*

- *The individual frames are then combined (stacked) into a single image using an auto -starmatching algorithm. This would be done for each filtered colour channel for a mono CCD.*

- *Final procesing – Software such as Adobe Photoshop allows the individual colour channels to be combined into a composite RGB for a mono CCD full colour image. Final tweaks such as denoising filters, image stretching (curves), levels (histogram) or colour balancing and saturation can be applied to achieve an appealing depp sky image.*

795 In Cassiopeia, Somerset UK.
200ACF 305mm, QS1683WSG Camera.

Pete Richardson



Melotte 15 In IC1805, 23.11.2014, Somerset UK.
Lx200ACF 305mm, QS1683WSG Camera.

*M42, M43 & NGC1977 in Orion, Somerset UK.*

*William Optics 80mm Apo, Orion Starshoot Pro V2 Camera.* *Pete Richardson.*

# *The End.*

*I hope you enjoyed the talk!!*

*For more images see*

*www.peterichardsonastro.com*