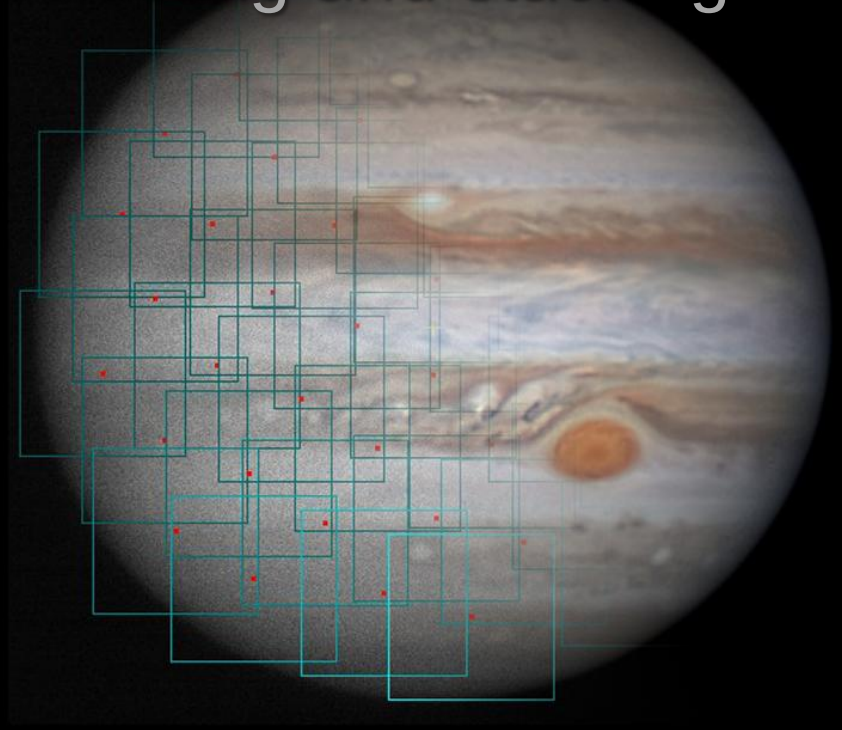
AutoStakkert!

selecting and stacking frames



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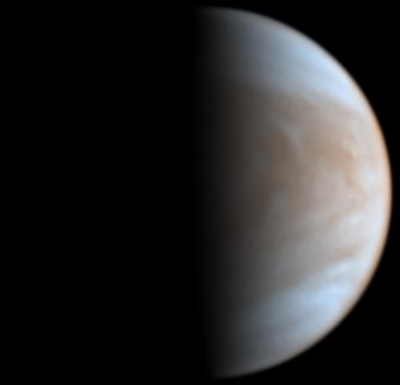


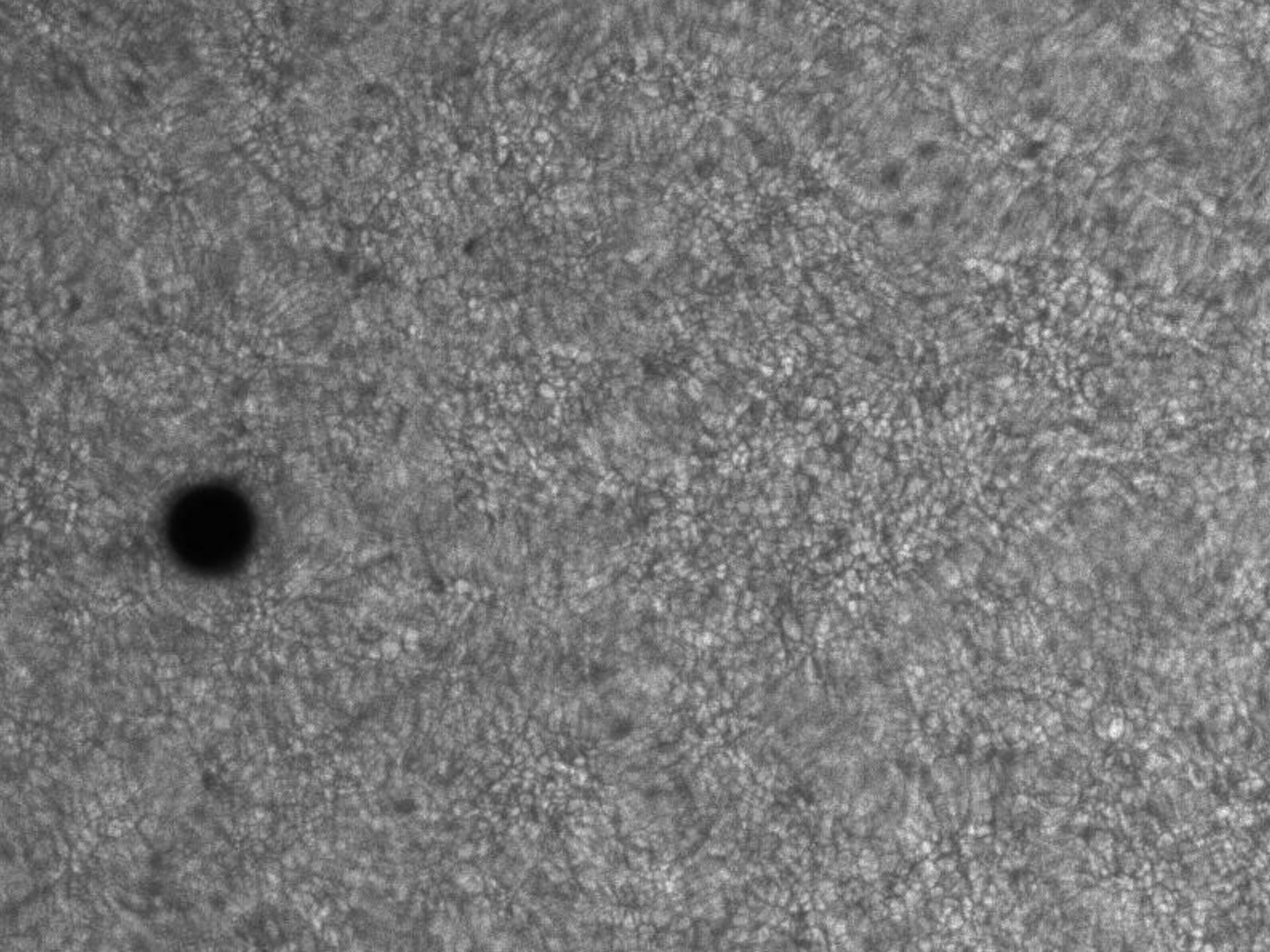
A brief history of AS!2

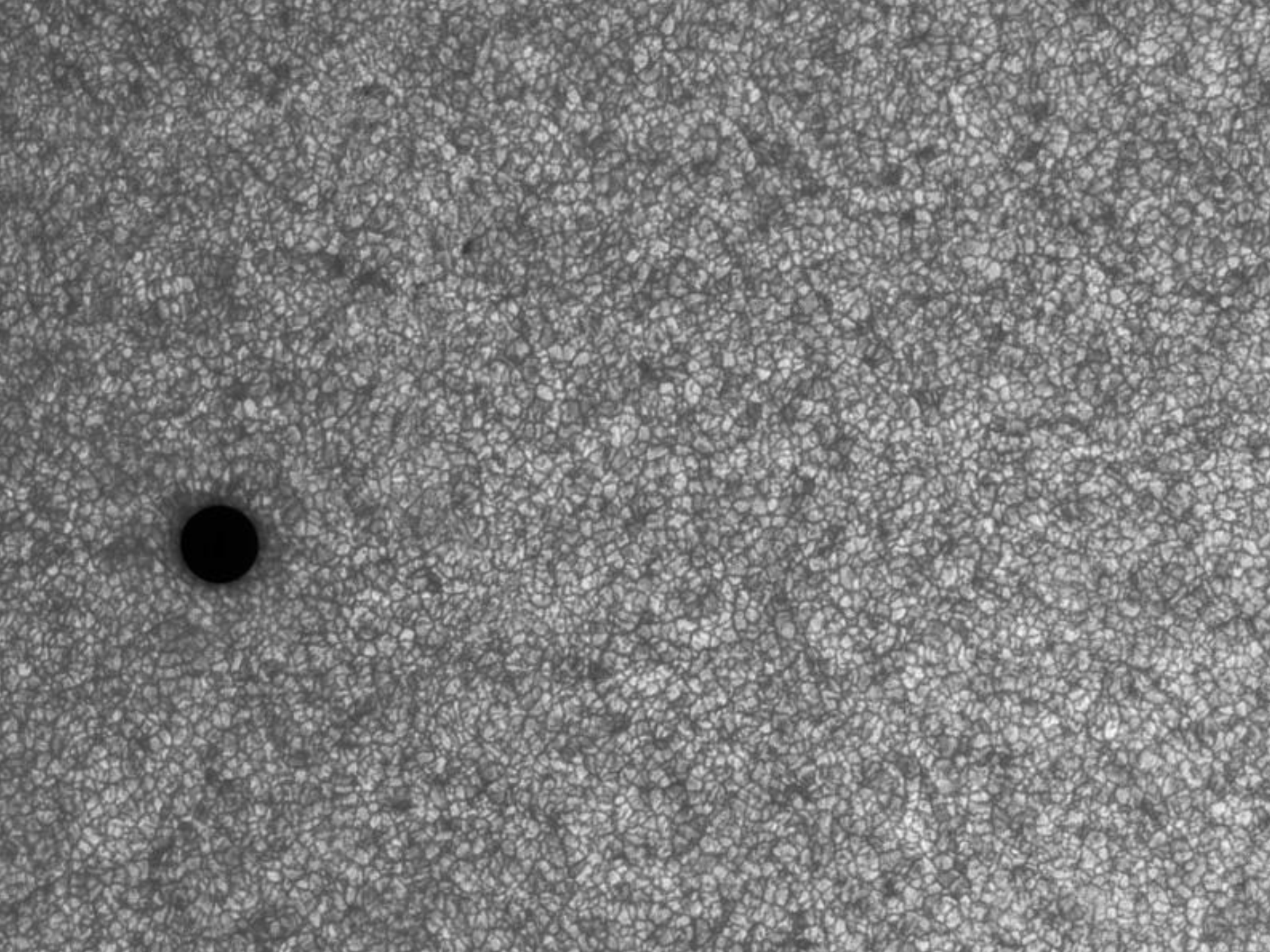
- I'm a lazy astrophotographer ⟶ automation

- AS! (2009) Simple, fast, but used just one alignment point
- AS!2 (2012) Could use multiple alignments, better for larger targets
  - Aim: fast, accurate, and little user interaction

- Now at AS!2.6, ongoing development
  - Tell me about problems

Seeing distortions and AS!2



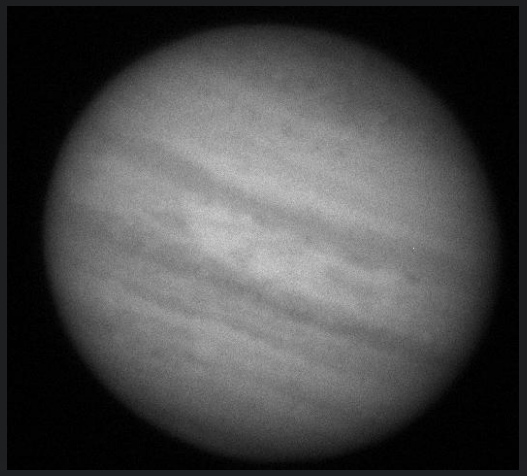


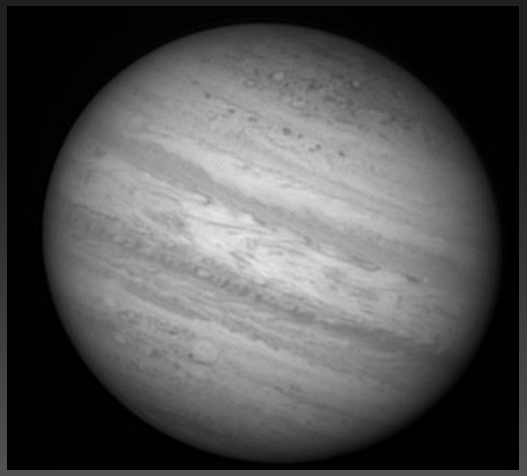
How AS!2 deals with seeing

- Stabilize, get rid of coarse movements
  - Typically tracking inaccuracies
  - COG alignment for planets, alignment ‘anchor’ for lunar/solar
- Analyze the quality of each of the frames
  - Building contrast maps to be used by alignment points (APs)
- Divide frames into smallest segments (APs) that still allows for accurate quality determination and especially accurate alignment
- Align each of these APs onto a reference frame
- ... And, stacks a *reasonable amount* of frames

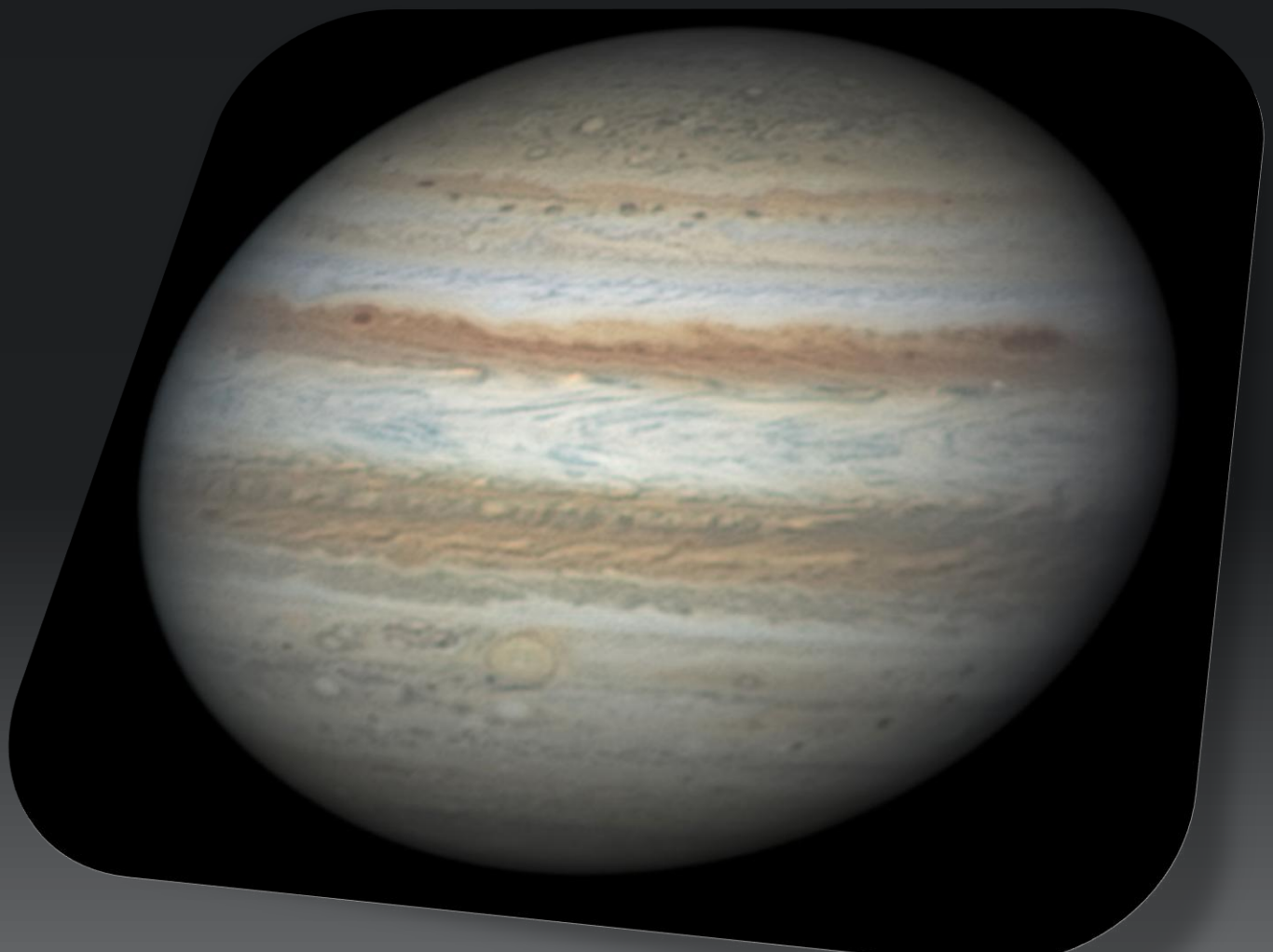
- And finally merge the AP-stacks together, using the best (typically center) parts to create one or more final stacks of the entire image

- Batch processing



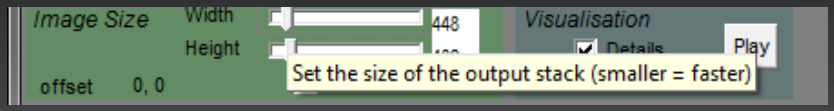


Using AS!2 on Jupiter



Select image size

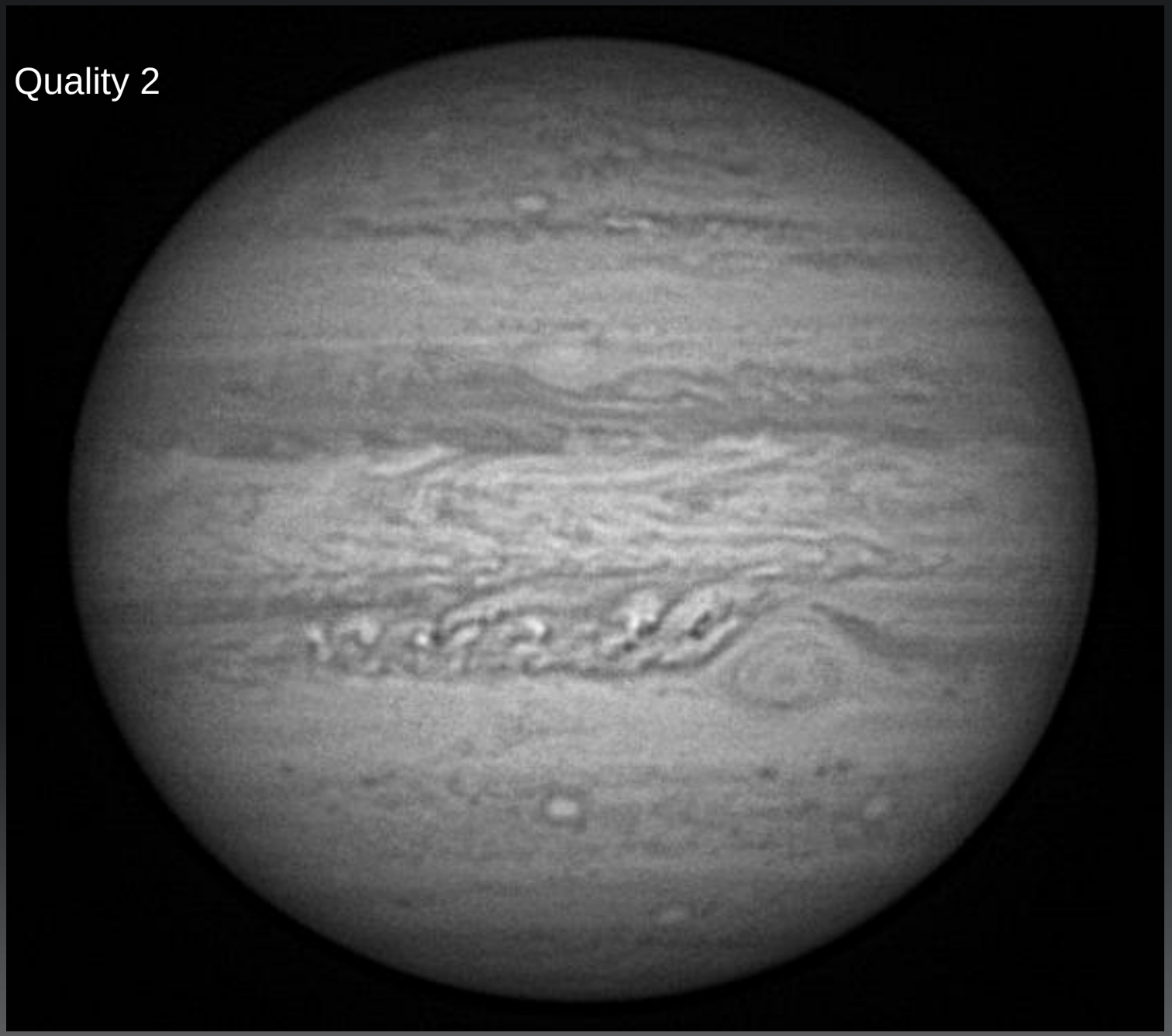
- Crop width and height in frame view to speed up processing
- Can use shift + drag to move planet around
  - To make sure some moons fit in FOV



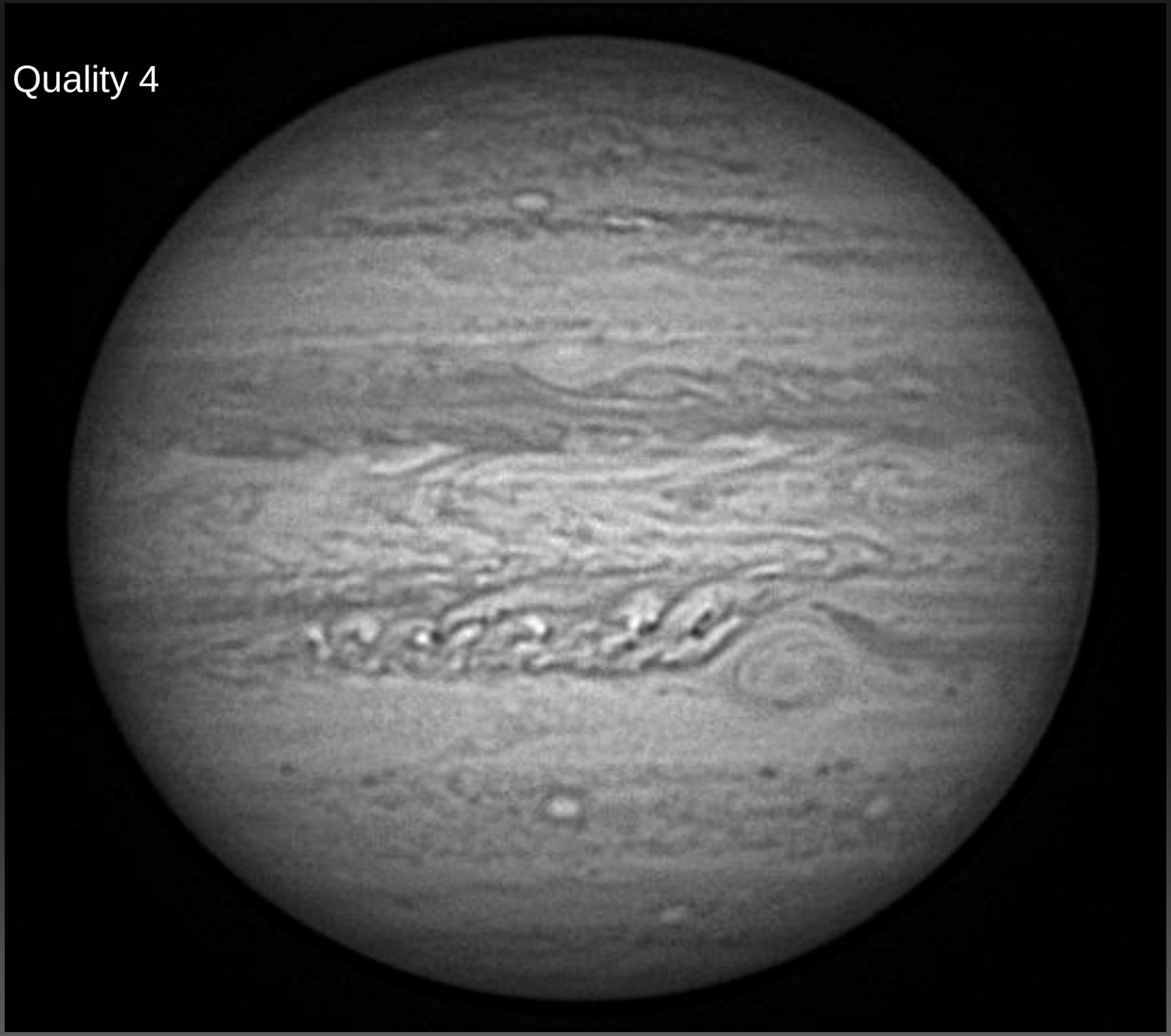
Quality estimator

- Always use ‘Gradient’ for Jupiter – Edge is only for bright small planets, and even then only sometimes (Mercury, Venus, Mars)
  - Local: each AP uses frame based on the alignment quality around that AP
  - Global: each AP uses the same frames for stacking
- Gradient quality sizes
  - 4 is good in 95% of the cases
  - Higher numbers for poor seeing or low contrast (high noise) images
  - The smallest option (2) only for undersampled very high SNR data.

Quality 2

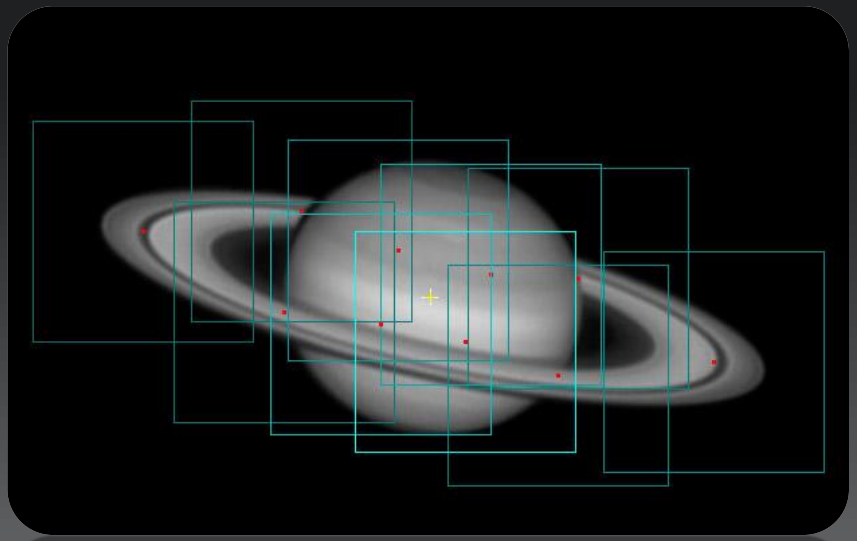


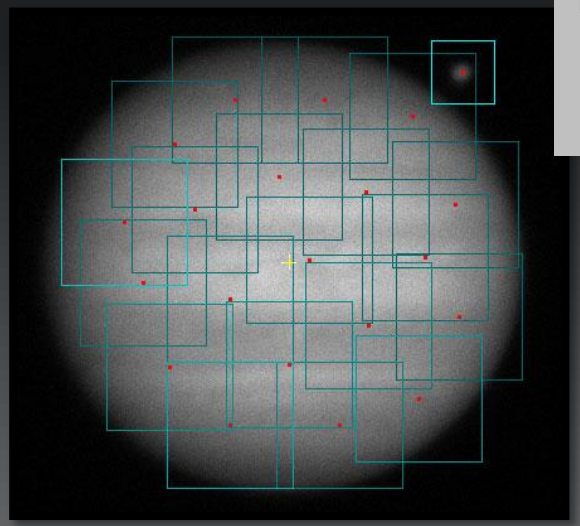
Quality 4

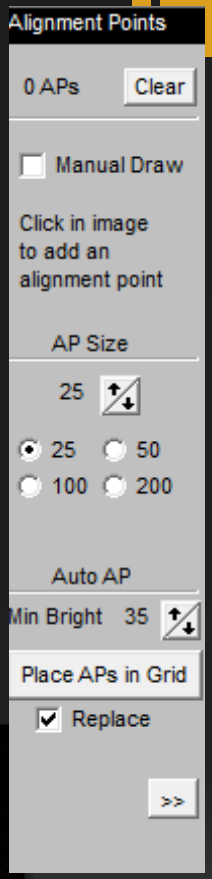


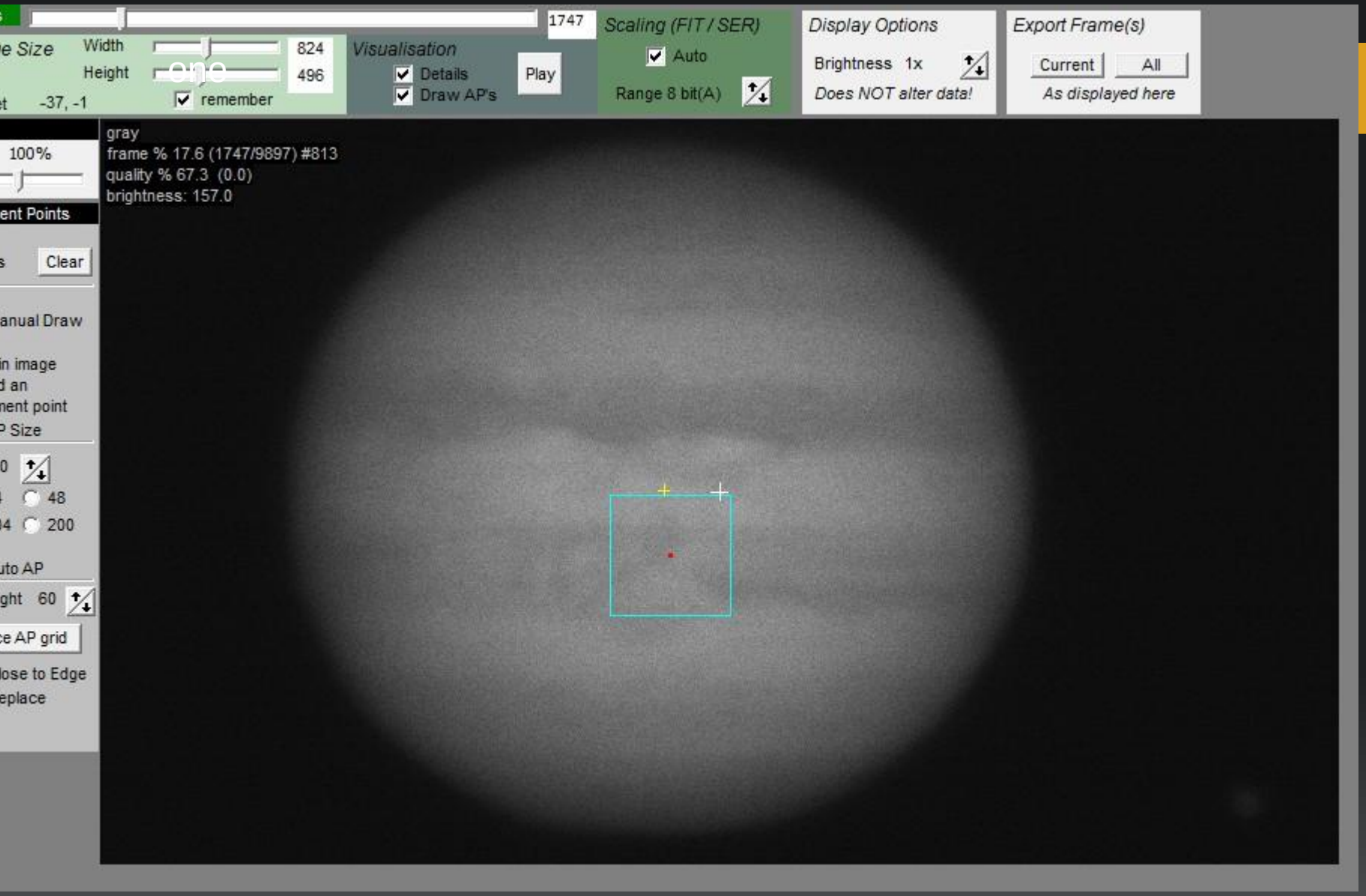
Alignment points

- APs track details
  - Accurate tracking requires contrast in perpendicular directions
- Size and location matters





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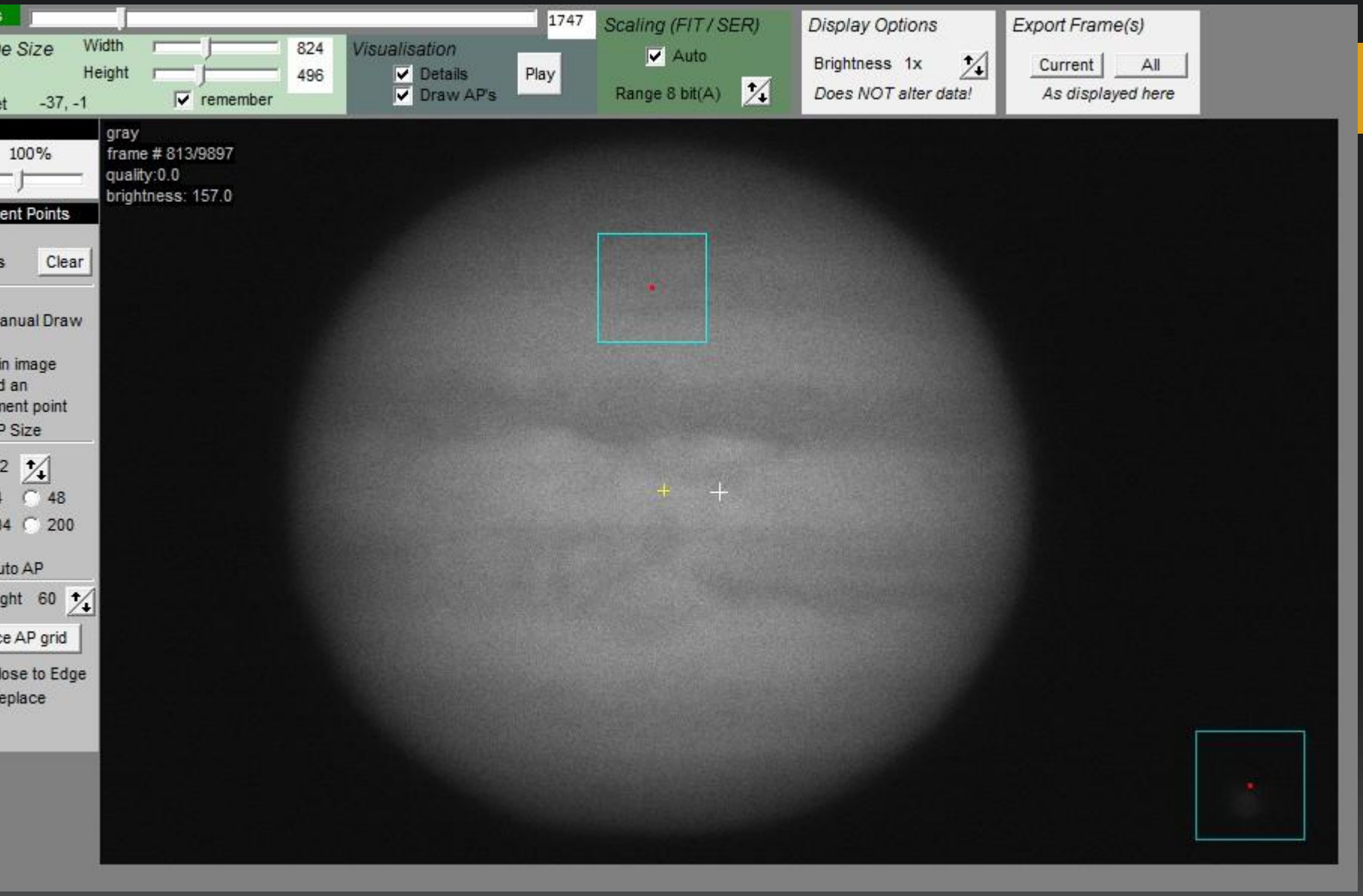
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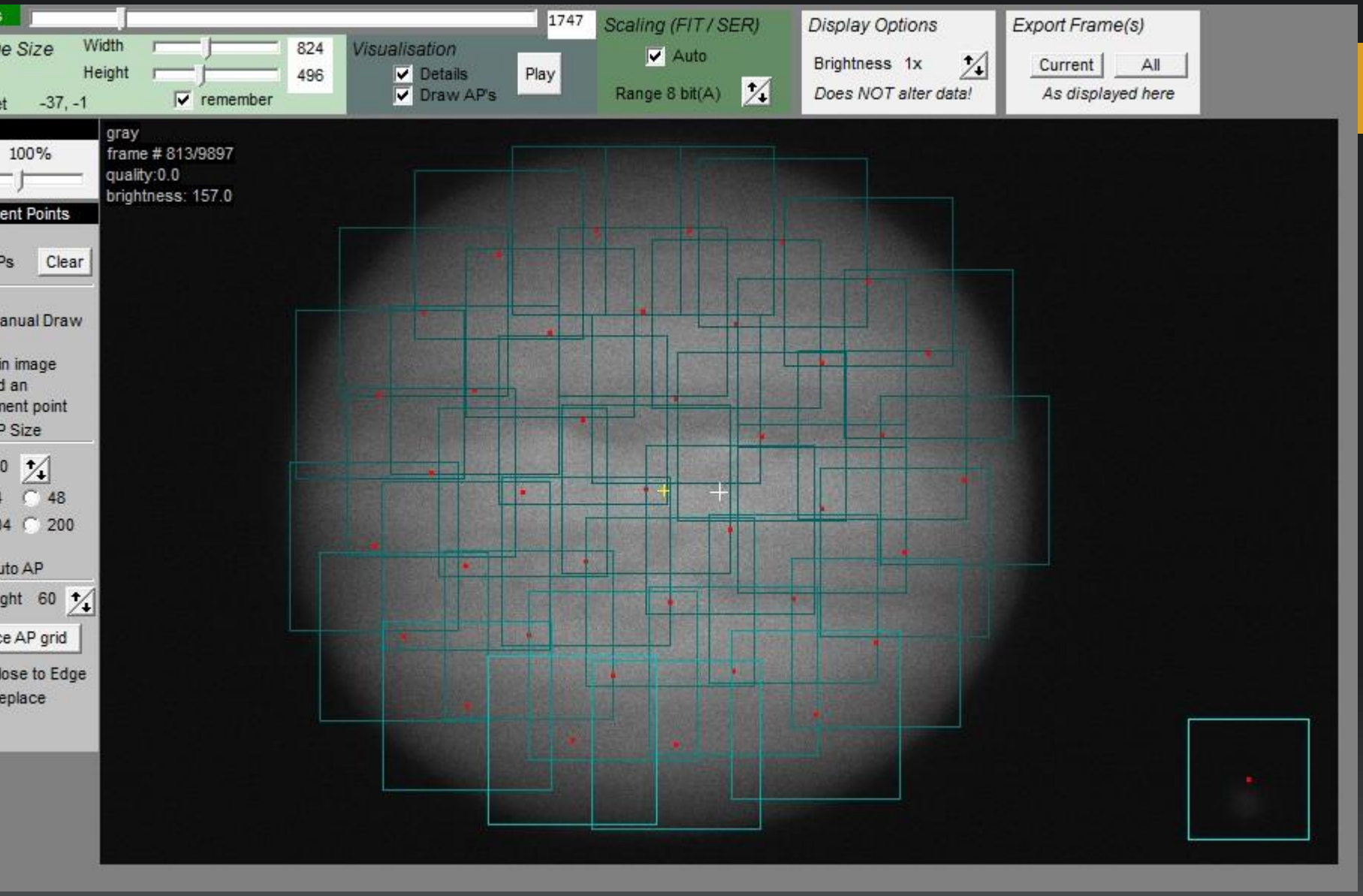
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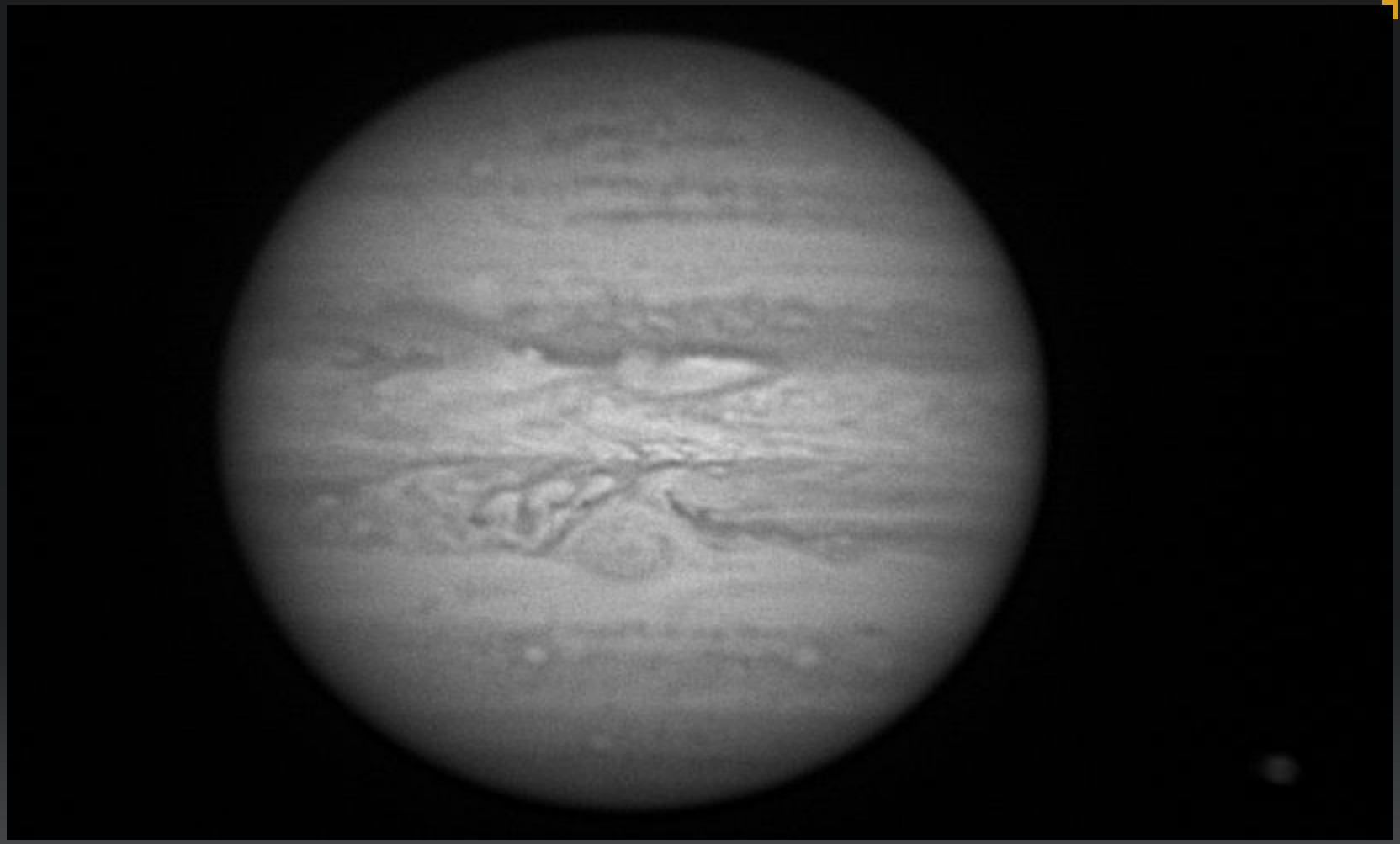
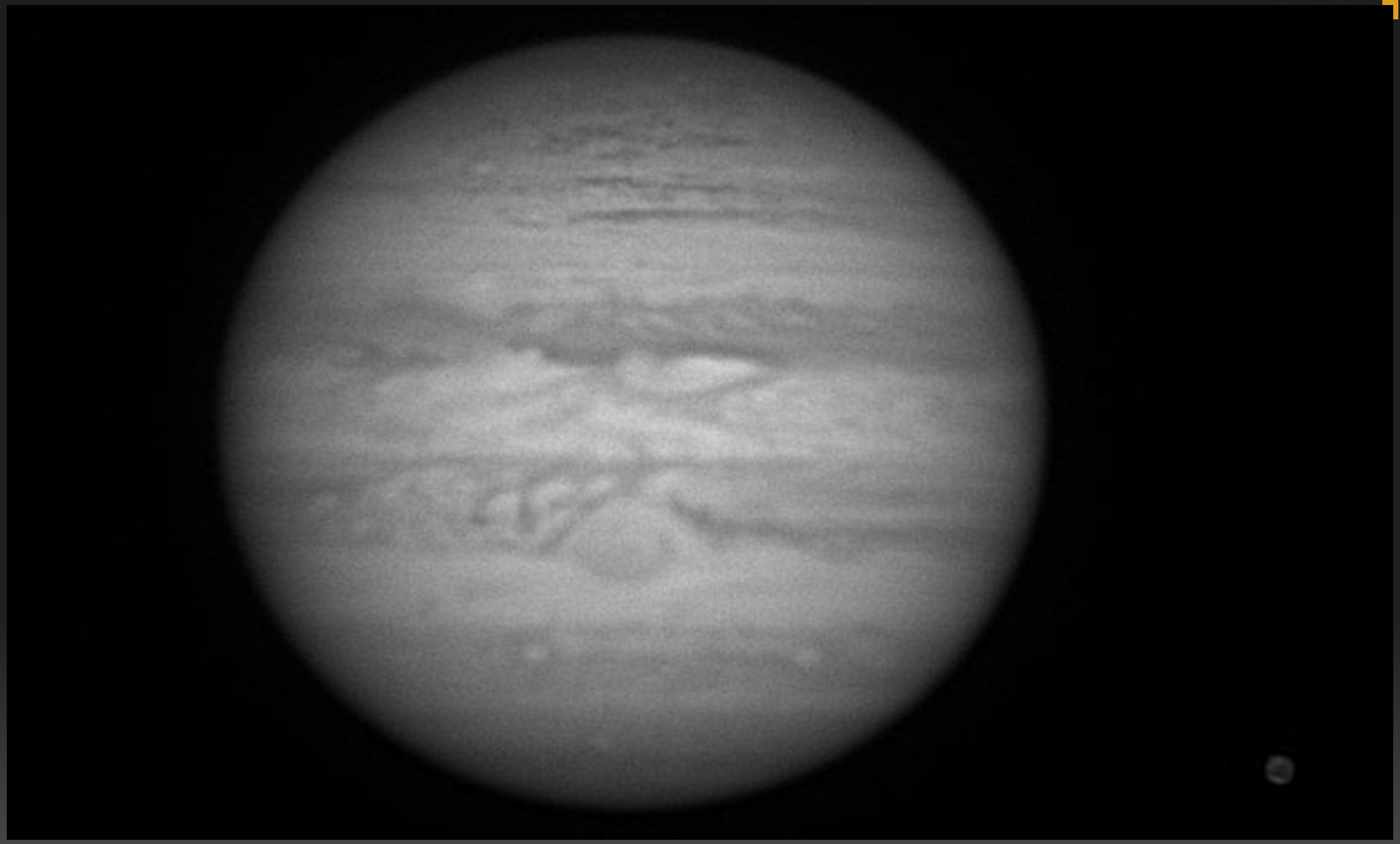
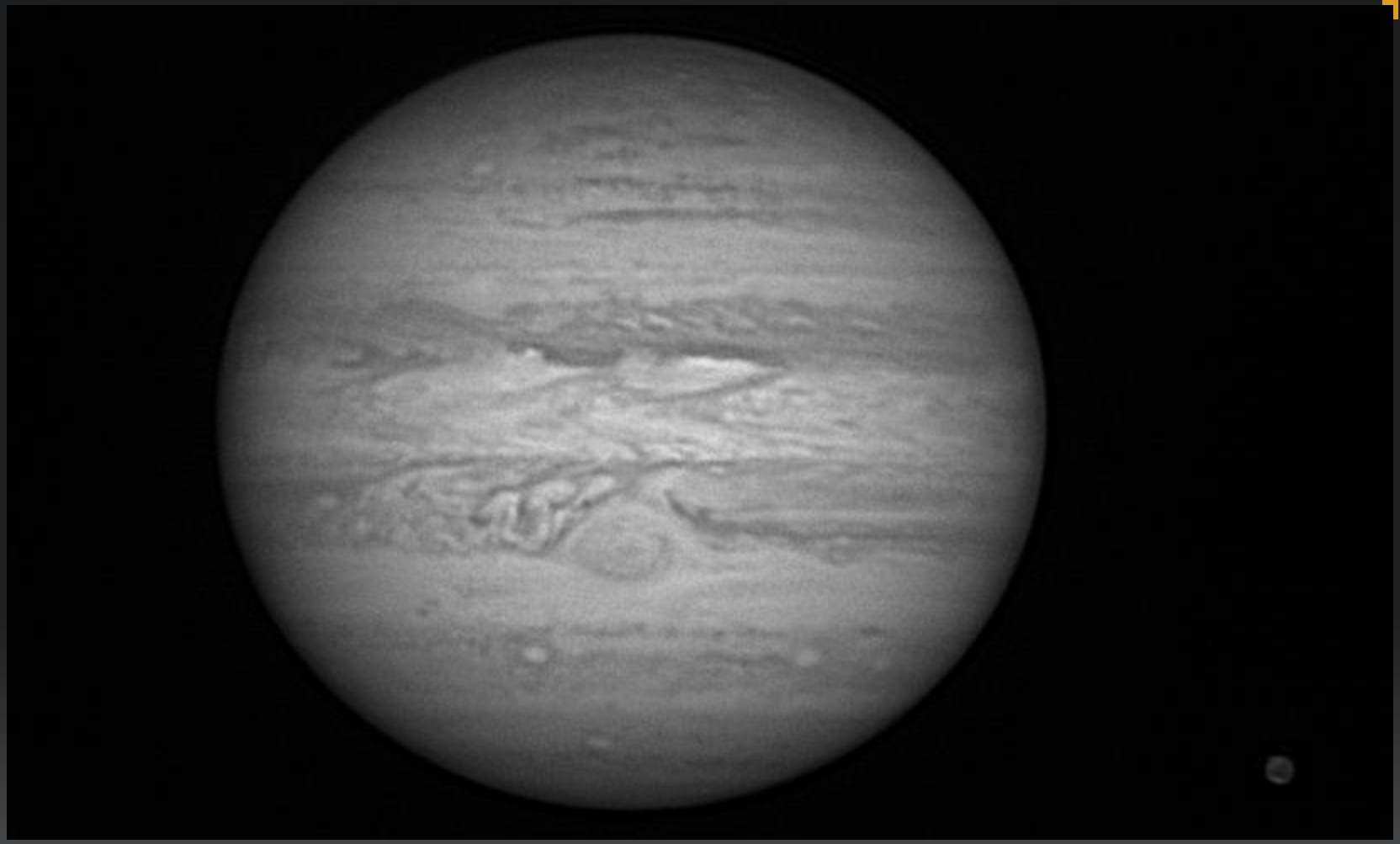
one



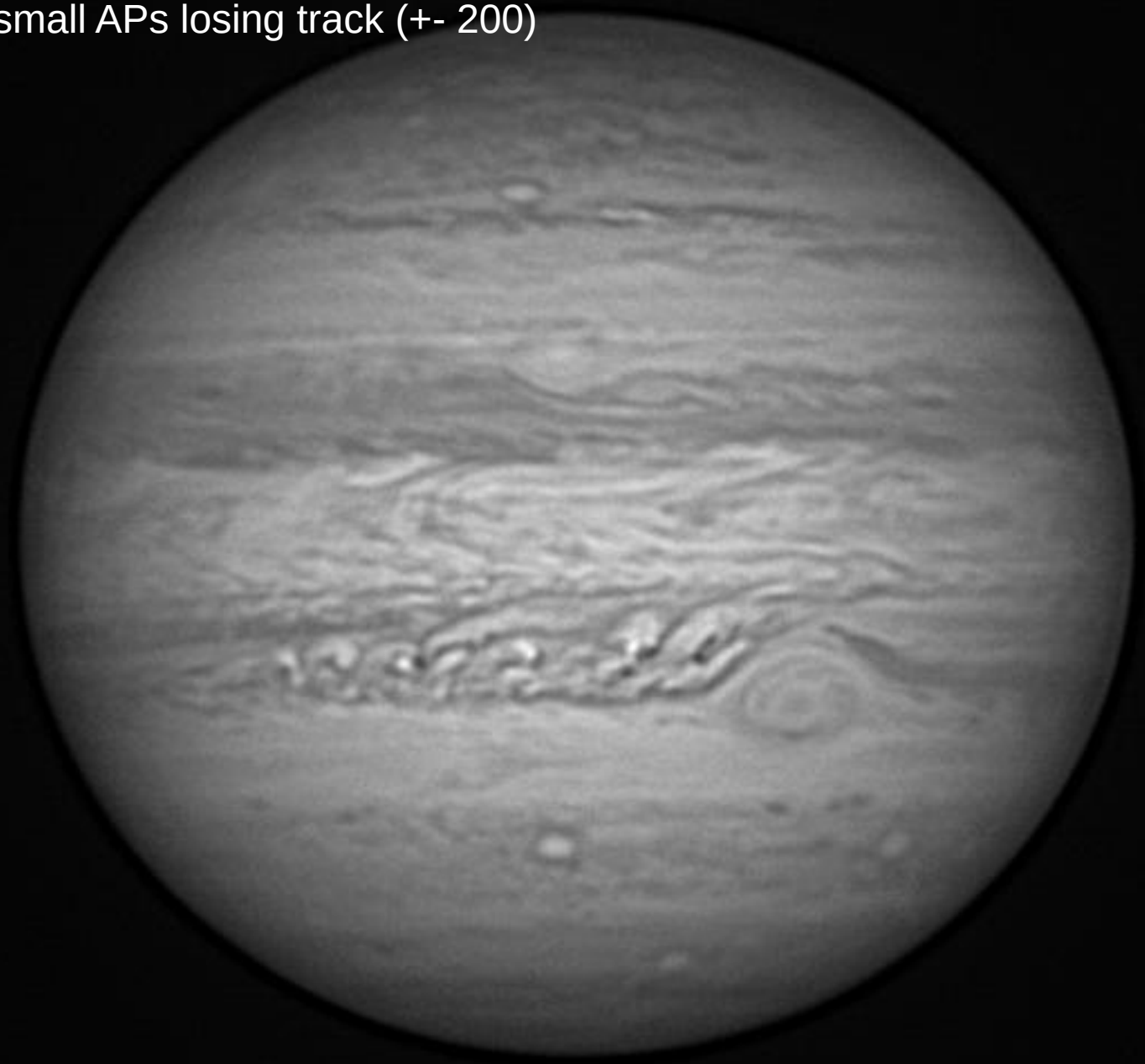
two



many



small APs losing track (+- 200)

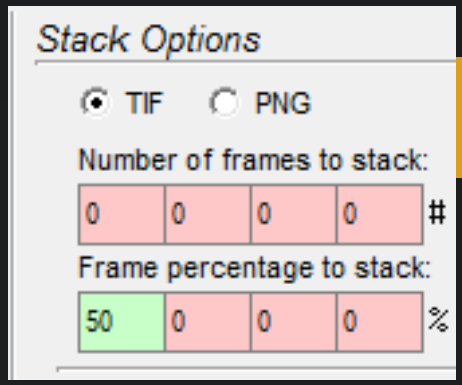


bigger and less works better (+- 30)

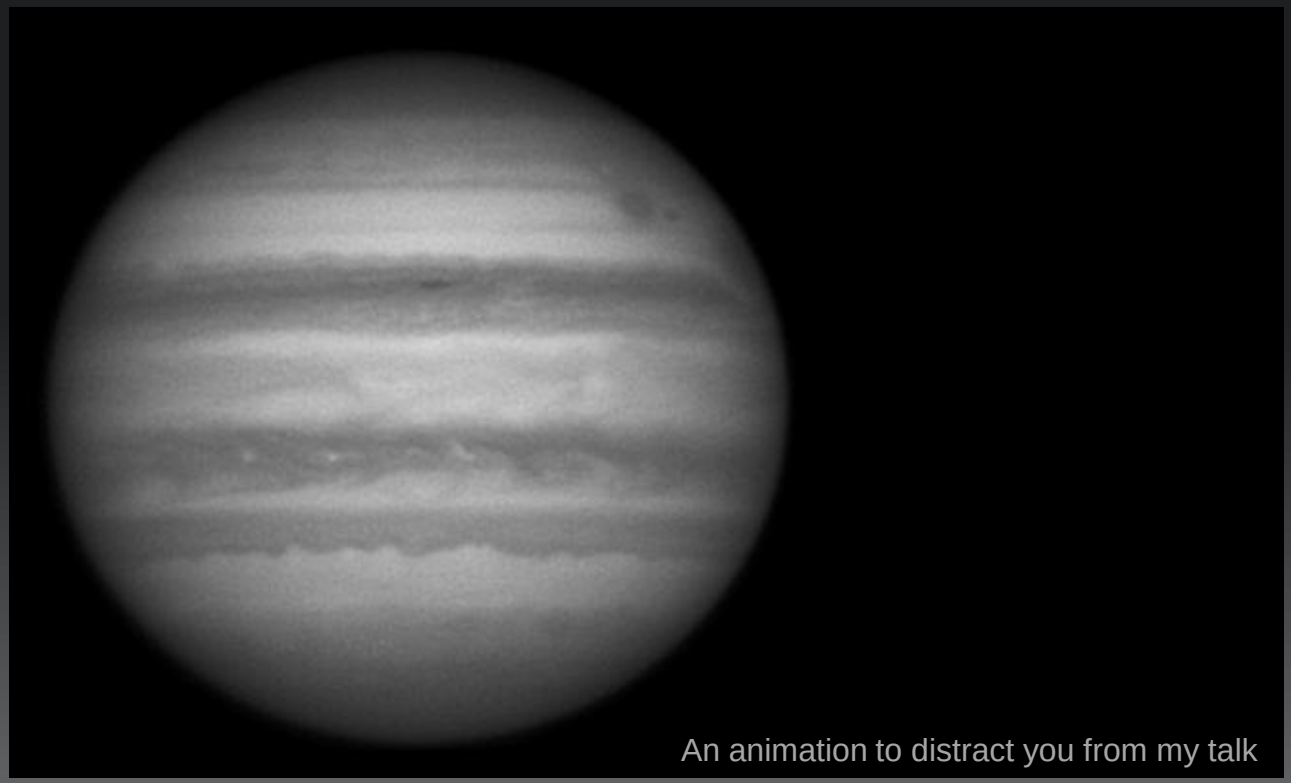
Alignment points tips

- Good placement and sizing important, *especially for sub-optimal seeing*
- Don’t place APS too close to edges
- Aim for around 10-40 on Jupiter
  - More and smaller for good seeing and high SNR frames, less and bigger for poor seeing
- Partially manual placement (left/right click) is advised
  - Place an additional small AP on moons or shadows of moons
  - Have them overlap!
  - Or at least use grid + a high minimal brightness to place them automatically a bit further from the edge
- You can mix and match (grids of) AP sizes
  - But stay reasonable, avoid APs you know are too small
- Batch processing? Anticipate path of moons with some extra APs (they are used for all videos you opened)

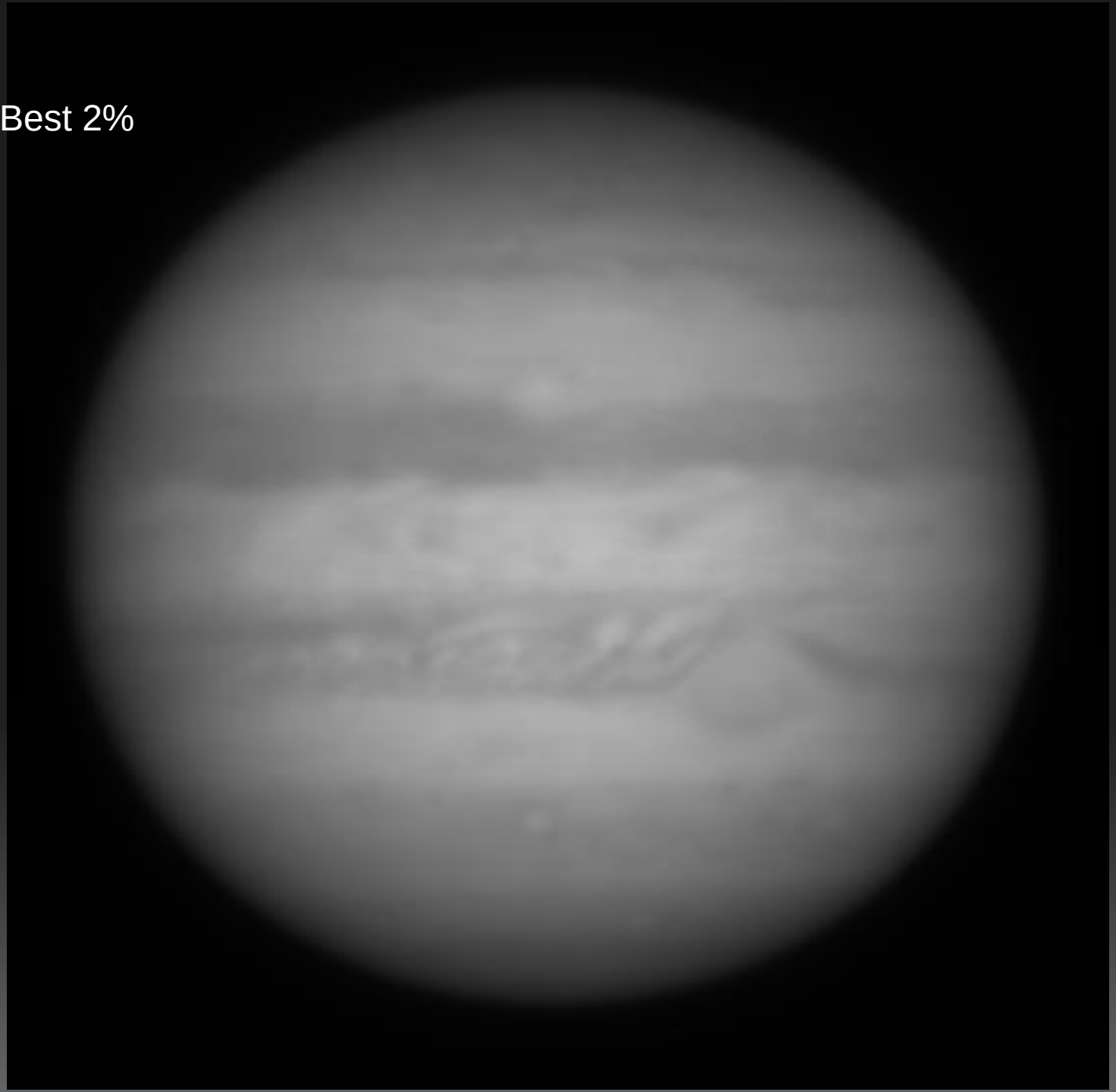
Stack size



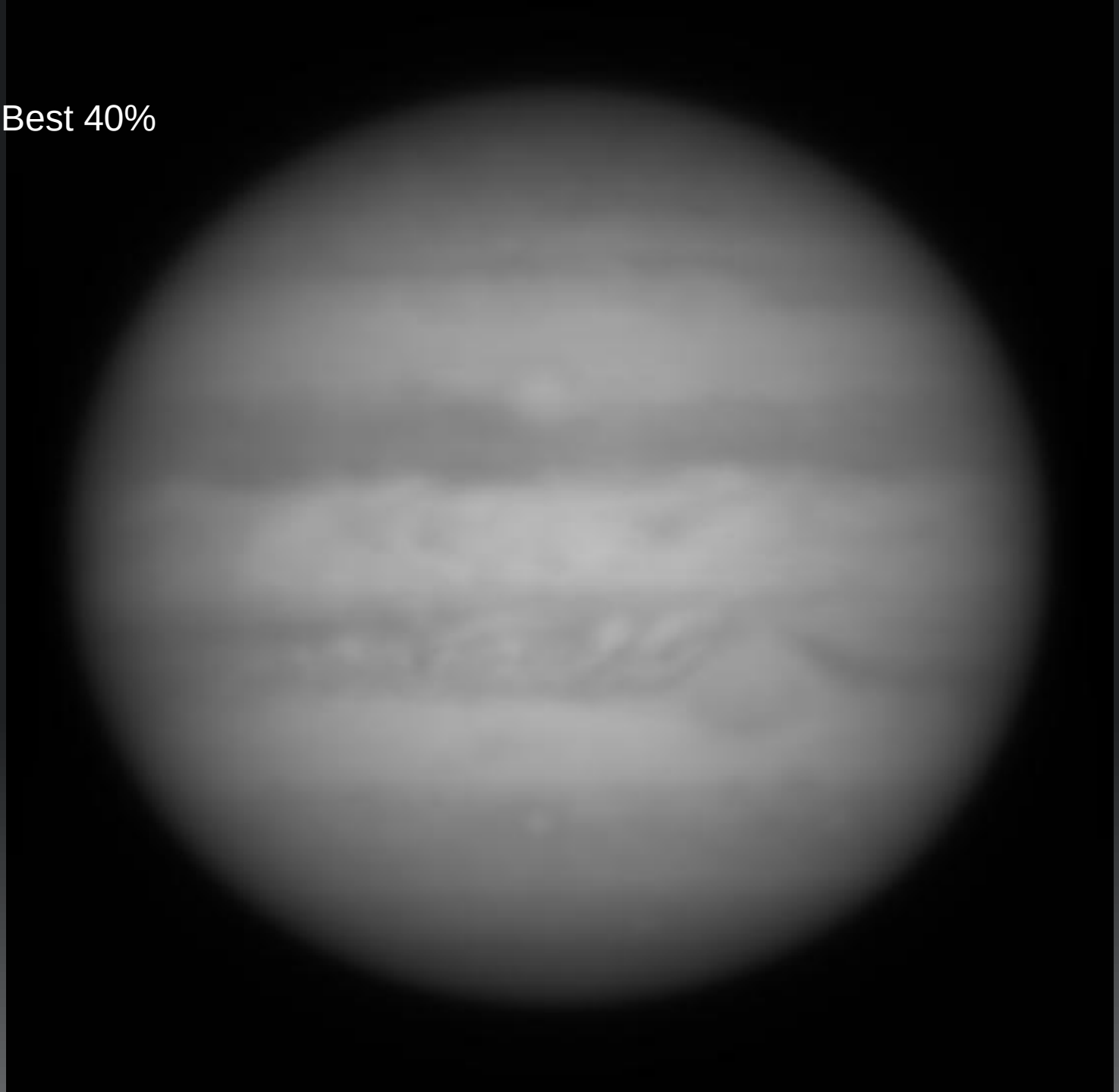
- Stacking few versus many frames
  - Or lucky-imaging vs. image sharpening/deconvolution



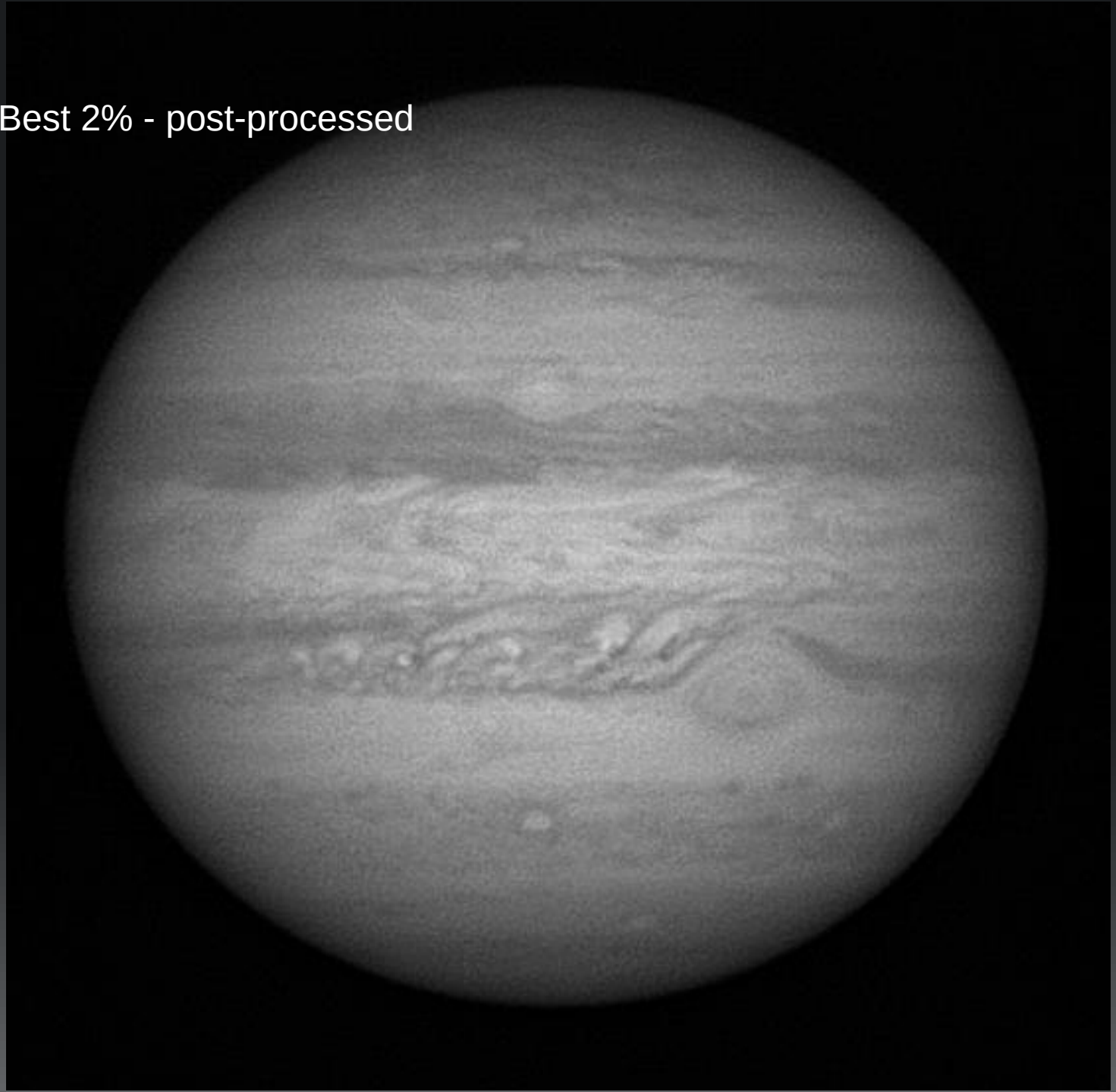
Best 2%



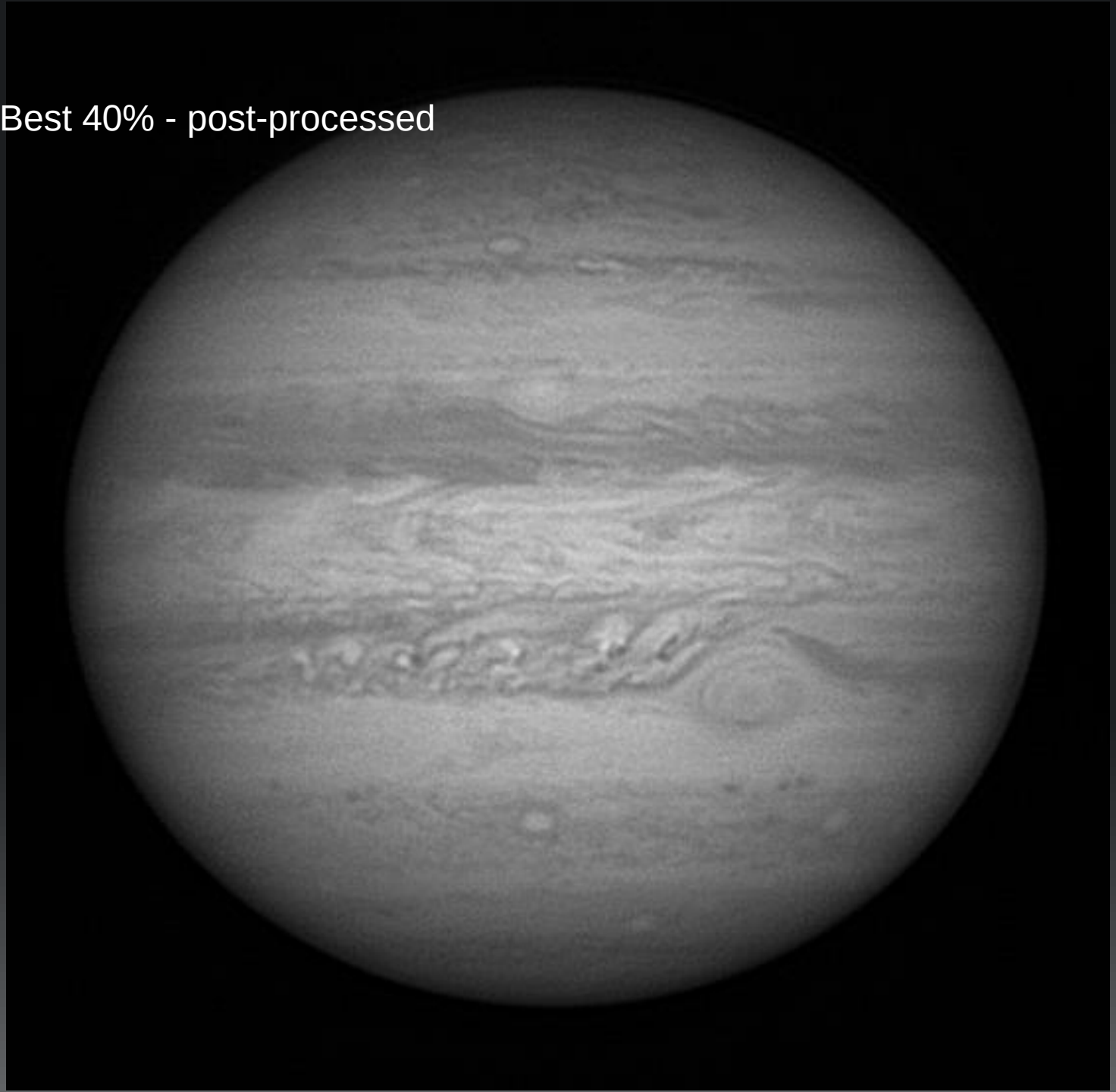
Best 40%

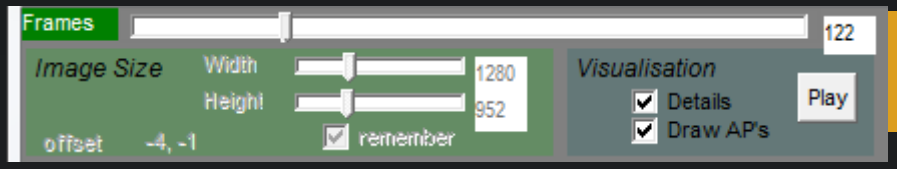


Best 2% - post-processed

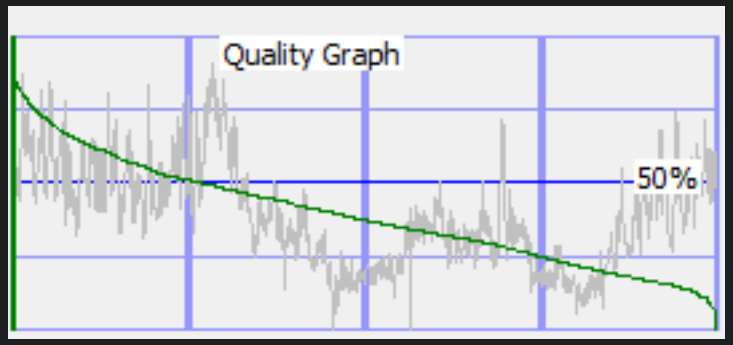


Best 40% - post-processed



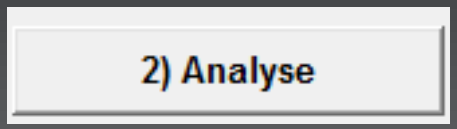


Analyse

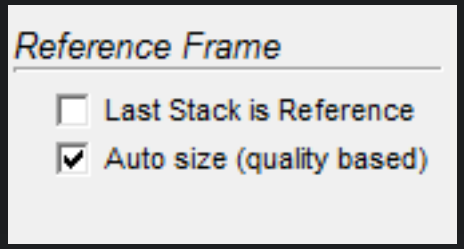


- Calculates quality of the images
  - And disables some frames with missing data “Detect horizontal and vertical artifacts’
  - Quality graph only gives an indication of the average seeing for each frame; don’t trust it blindly

Is automatically applied when stacking as well! So not needed to manually do this for planetary imaging, but can’t hurt to decide how many frames you want to stack for example…



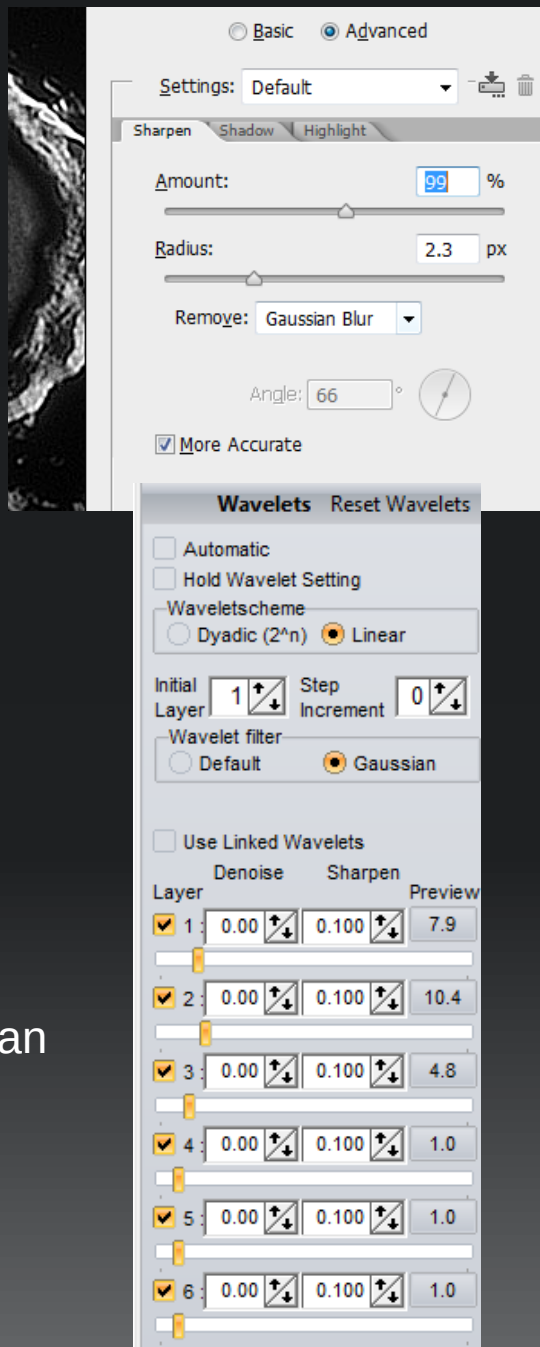
Reference Frame



- Frames need to be aligned onto something
- Single frame is not a good reference frame
  - Seeing distorted, not sharp everywhere
- Does not need to be perfectly sharp, faint blurry contrasts are often good to align onto as well
- AS!2 builds this reference stack automatically
  - (possible to use previous stack as reference, for solar recordings this sometimes gives slightly better results. Not for Jupiter)

Post-processing

- Typically something like sharpening or deconvolution of (gaussian-blurred) image stacks
- Registax/Photoshop/...
- WinJUPOS
- Should be done with great care, and often less is more
  - Practice, there is more to gain when seeing is less than perfect!



Future

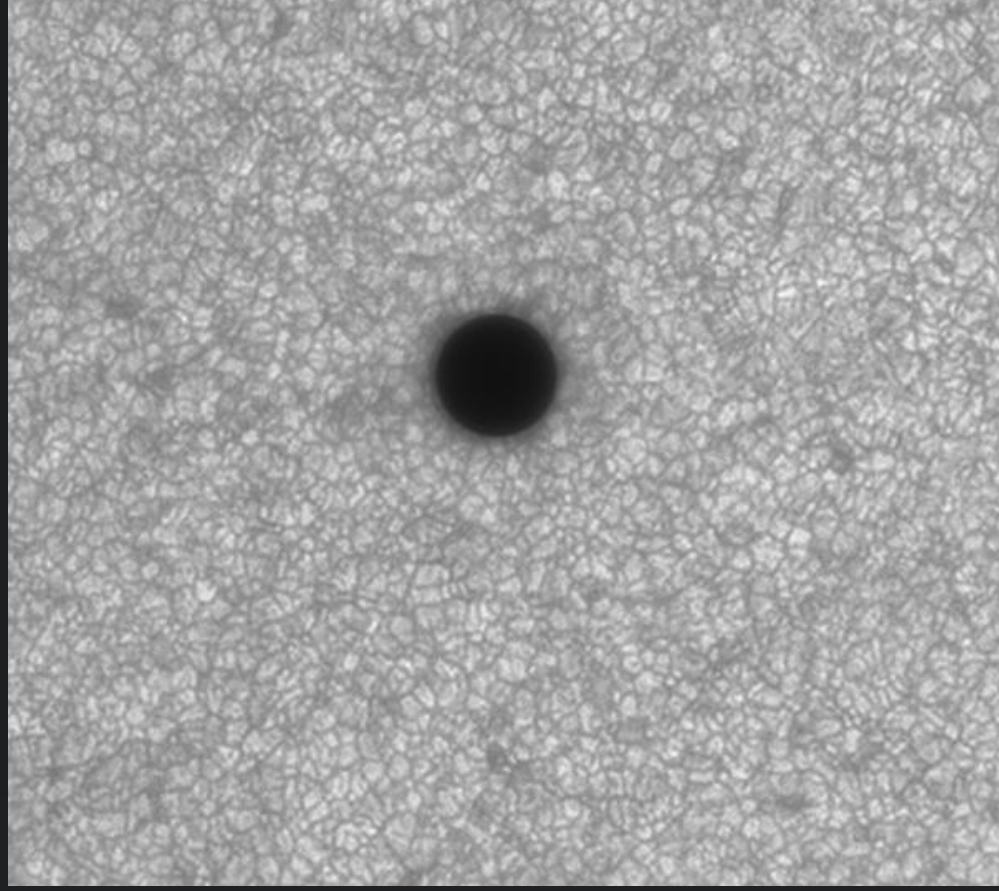
- Use it more myself ...
  - I prefer astrophotography over writing/supporting software
- Make it more stable
  - I love getting bug reports... Please send them!
- Image calibration
  - CMOS horizontal/vertical line noise
- 64-bit version
  - Image sequences are getting larger and larger
- Better AP placement
- Incorporate Impact Detection?
- What would be specifically useful for JUNO?

Final thoughts

- Experiment to find your ‘default’ options that will get you 95% optimal results for most of your recordings
- (Keep) experiment(ing) if you want the last 5%
  - Different camera’s, scopes, targets, seeing, transparency, etc...
  - AS!2 is fast, use it...
- Have fun and keep sharing your results!

Questions?

Links



www.autostakkert.com

www.autostakkert.com/beta
(latest versions; May, 2016)

groups.yahoo.com/group/autostakkert

ekraaikamp@gmail.com

Spares

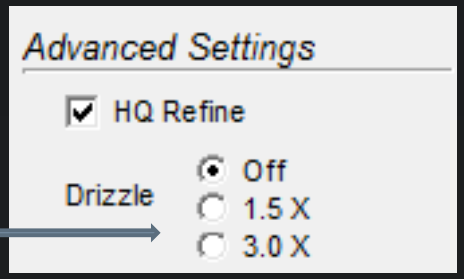
Stack size tips

- More frames often allows you to extract more details
  - Using good sharpening or deconvolution techniques
- With good seeing, less sharpening is needed
  - So you can get away with using less frames for similar results…
- A few blurry frames among hundreds of good frames typically don’t matter much
- Different techniques exist…
  - Some favour stacking just the best 5-10% and light processing
  - I often stack at least 40% and push the stack a bit harder

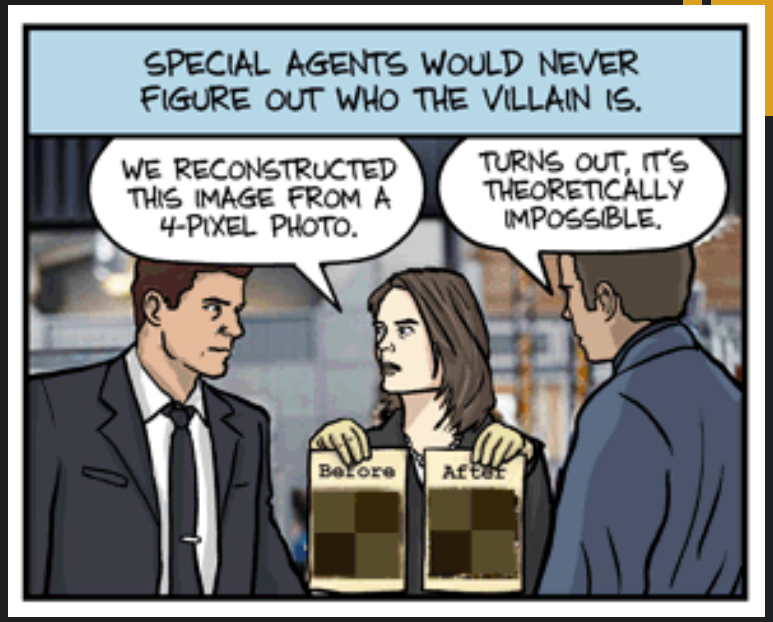
Quality estimator tips

- Global quality can help avoid artifacts related to changes in image brightness
- Variable transparency recovery (menu-option) can help to more accurately estimate the quality of each frame, independent of frame brightness
  - But only use it when transparency is indeed variable

Drizzle

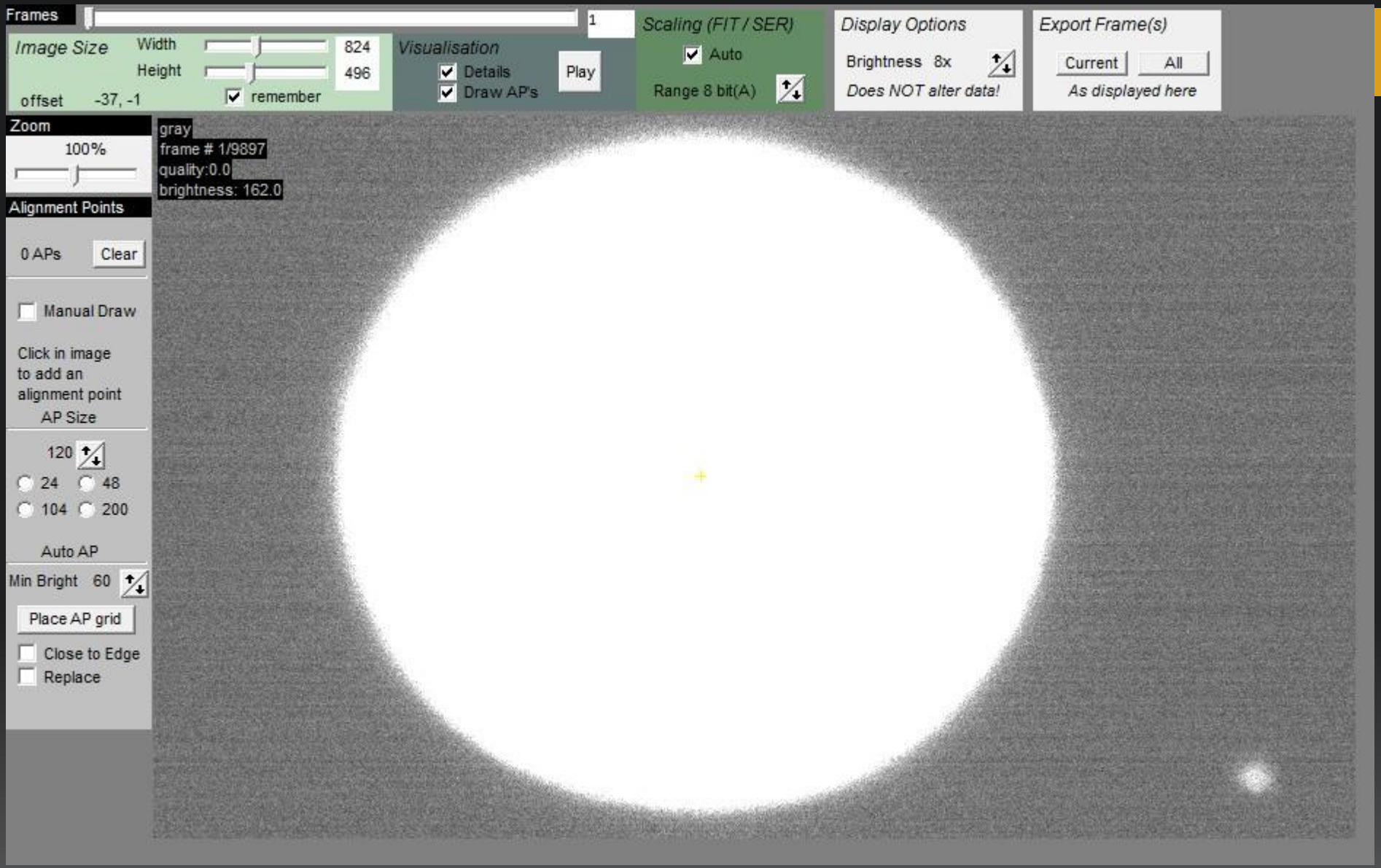


- Works on undersampled recordings
- Slower and asks for different processing



- Combine multiple frames on grid containing finer pixels
- Difference is smaller for astronomical recordings (seeing, and often over-sampling)
  - But it can work, and can result in slightly higher alignment quality even if over-sampled data

- Especially when batch processing recordings it is a good idea to *save* the stacks *in folders*. For each stack size (or quality percentage), a separate folder is created, keeping your output nicely organised.
- For most planetary imaging, *image calibration* isn't nearly as important as for deepsky imaging, but AutoStakkert! does have the option to create and apply both dark and flat fields that are especially useful for calibrating your lunar or solar recordings.
- *Normalize stack* is only available for planetary recordings, and sets the maximum brightness of the image stack to a fixed percentage. It also compensates for brighter than normal backgrounds that you can get when imaging in twilight (or even daylight). Turning this option on greatly simplifies post-processing, especially if you have to process many recordings with (gradually) changing brightness levels or, for example, like to create animations that have a constant brightness.
- When processing raw color recordings, AutoStakkert! does on the fly drizzle debayering. This is a technique that does not perform debayering per frame, but instead relies on (small) movements in the recording to fill in missing colors of the bayer pattern. By keeping the color channels separated, this results in more details in the final image stack.
- For all color recordings, *RGB align* allows your stack to be compensated for atmospheric dispersion effects (with sub-pixel accuracy). This is the next best option to the hardware equivalent: an atmospheric dispersion correction.
- Both *drizzling* and *resampling* are available as techniques to upscale your images. Especially for undersampled data, drizzling can be used to improve the resolution of your final image. It does however significantly increase memory usage, and often requires your images to be processed more carefully. Both drizzling and resampling are performed during stacking, allowing sub-pixel alignment accuracy.
- AutoStakkert! builds a reference frame onto which each AP is aligned. By default, this reference frame is made up of those frames that score better than the 50% frame quality point. You can use the last stack as a reference frame to use a slightly higher quality reference frame. Typically this does very little if anything to improve the final stack quality, but it can have a (small) positive effect for recordings that have some much sharper than average frames (with the bulk of the frames having poorer quality).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brightness: 162.0
Alignment Points
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Clear
Manual Draw
Click in image
to add an
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Place AP grid
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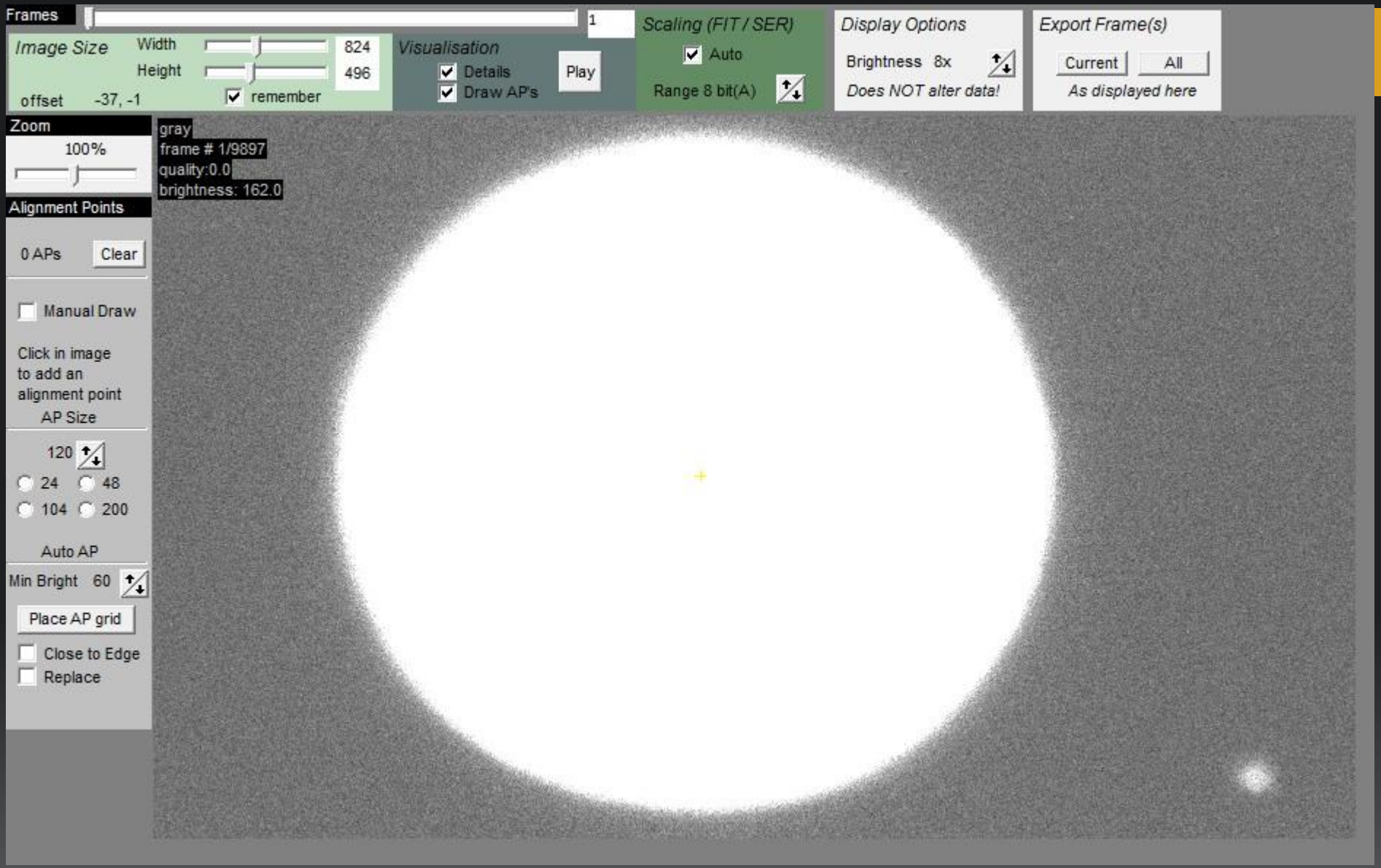
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