Workflow for Spectroheliograph Stacking

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I briefly describe here what I do for stacking full-disk spectroheliograph (SHG) images. If you are doing partial disks, there may be other issues to consider.

I generally target acquiring 20 scans (10 back and forth scans). I am normally scanning at around 13-14x sidereal rate at 720mm focal length so the time for each scan is around 14 secs. Generally, I would recommend having at least 6 or 7 good images to stack. But more than 20 is probably not worth it.

Using our **software version 3.5** (https://github.com/thelondonsmiths/Solex_ser_recon_EN), I use the "**Crop square**" and "**Save clahe.png only**" choices. For stacking, all images need to be the same dimensions and "crop square" will do that (as long as the original image is wider than it is tall).

I use the "**Transversalium correction**" features but use a lower setting than I would for a single frame. The process of stacking itself will remove some transversalium and the way that the transversalium filtering works does introduce some artefacts (typically shadows in rows with very bright areas).

I find it useful to look at a "standard" solar image (like GONG) in order to get the orientation correct. I then chose the appropriate rotation amount with "**Rotate PNG images**" (e.g., 90 degrees, 180 degrees). Assuming that half the images are scanned in one direction and half in the other, then half will need to use the "**Mirror X**" function. It's therefore good to figure out first what the correction orientation is. I take care to have alternating scans so I can quickly choose half to process in "non-mirrored" mode, and the other half "mirrored", in two batch processes.

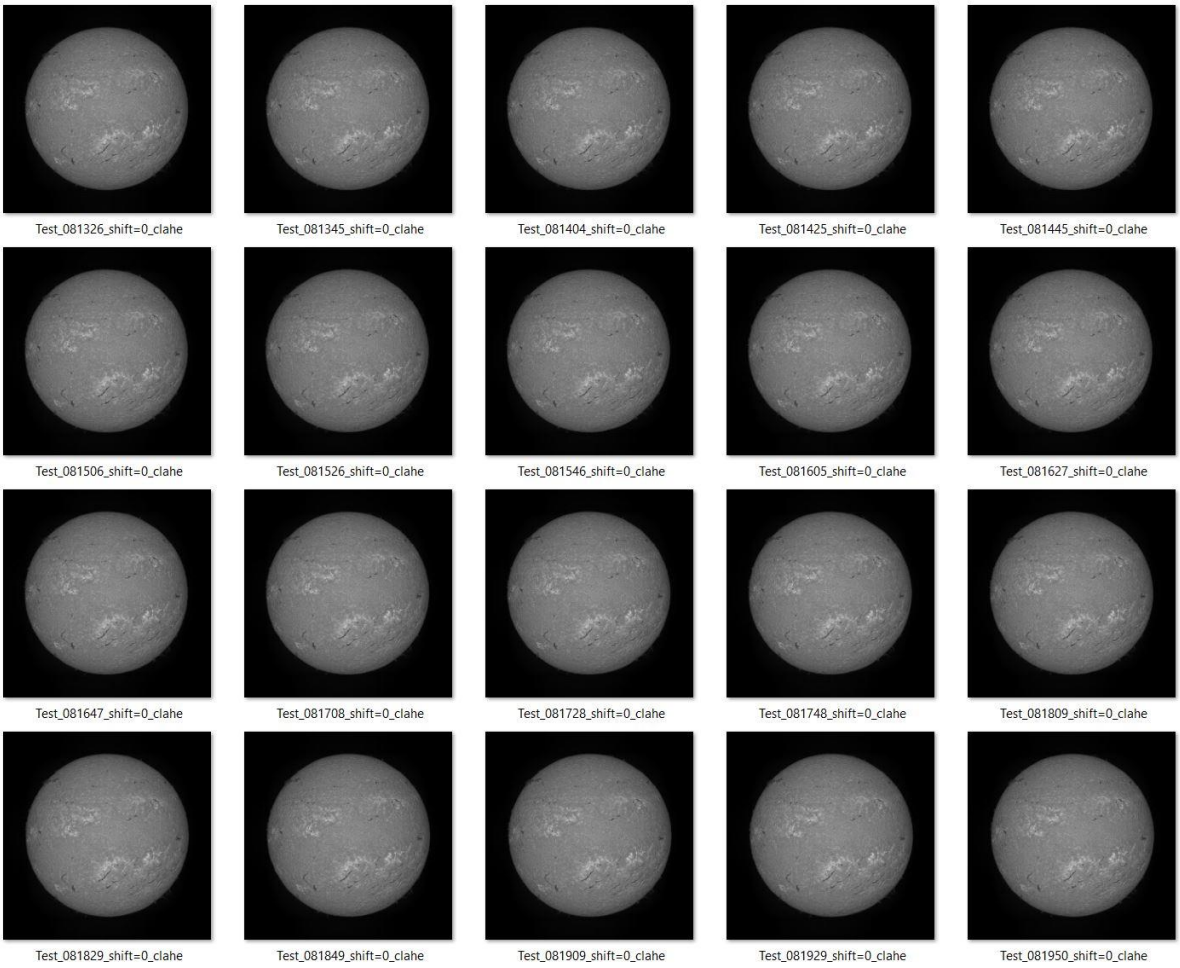
I put all these reconstructed PNG files in a separate folder for stacking. I look at them all and delete ones which have some acquisition defects or are of obviously poor quality. In my case, out of 20 scans, I might eliminate 2 to 4 at this stage (sometimes none, as shown below).

I then drag all the remaining PNG files into the "open" button of **AutoStakkert!** 3.1.4. I won't go into too much detail on using this as it is its own whole topic. Generally, I chose the cut-off at 50% in the "**Quality Graph**". Using the green vertical bar there, you can figure out how many frames this corresponds to. I then chose this number to stack in the "**Number of frames to stack**" box. I use PNG as the output but the choice is not that important.

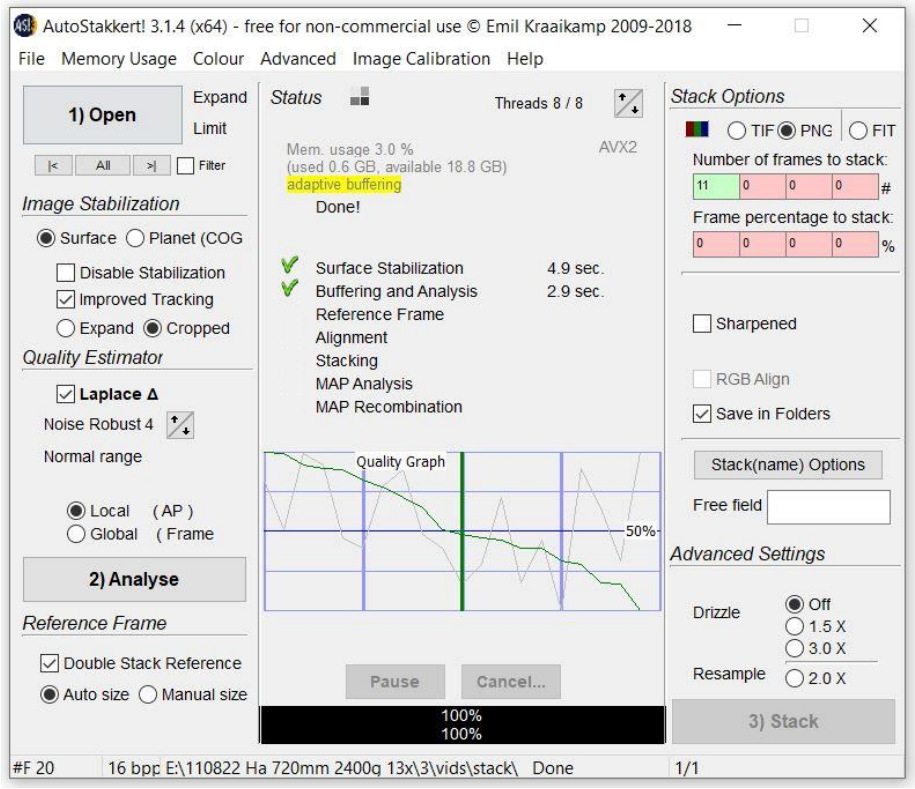
Next, I drop the AS! output into the program **ImPPG** (Image Post-Processor) to do some sharpening. I find it best not to over sharpen so I typically use the **Sigma** settings of 1.5 to 2.0 for both the L-C convolution and the Unsharp masking. I then use the slider for the "**Amount**" of unsharp masking to get something that looks nice but is not over sharpened. I don't use the "**Tone curve**" feature but it is quite a powerful function. For output, I chose TIFF 16-bit.

I then drop the TIFF file into Photoshop Elements for some final cropping, contrast/brightness/levels adjustment, and some additional sharpening (if required). From there I save an 8-bit JPEG file of the appropriate size and quality.

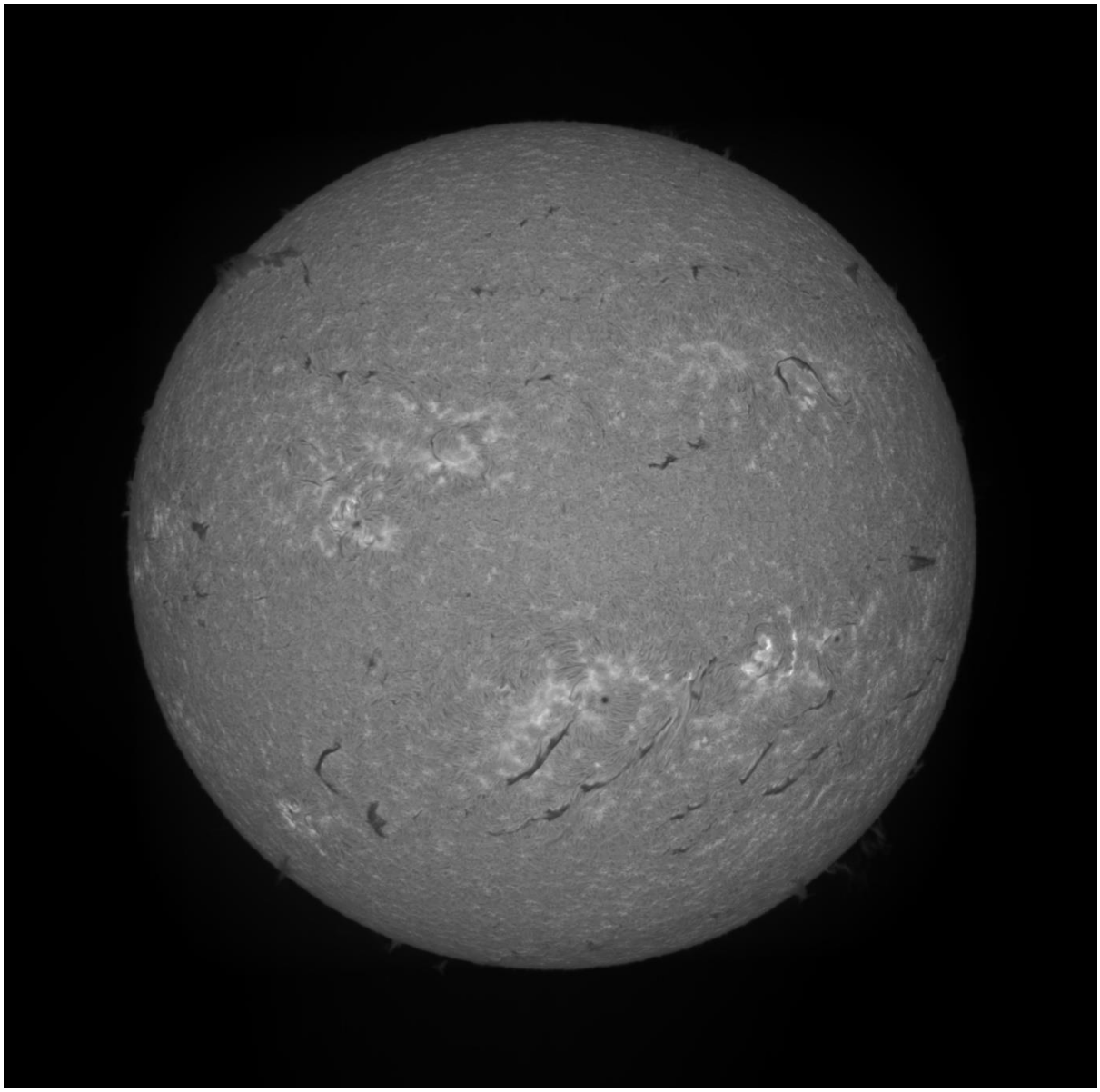
Here is a screen shot of the 20 reconstructed PNG files outputted as 2 batches from our v3.5 software. Total time to process is only a few minutes.



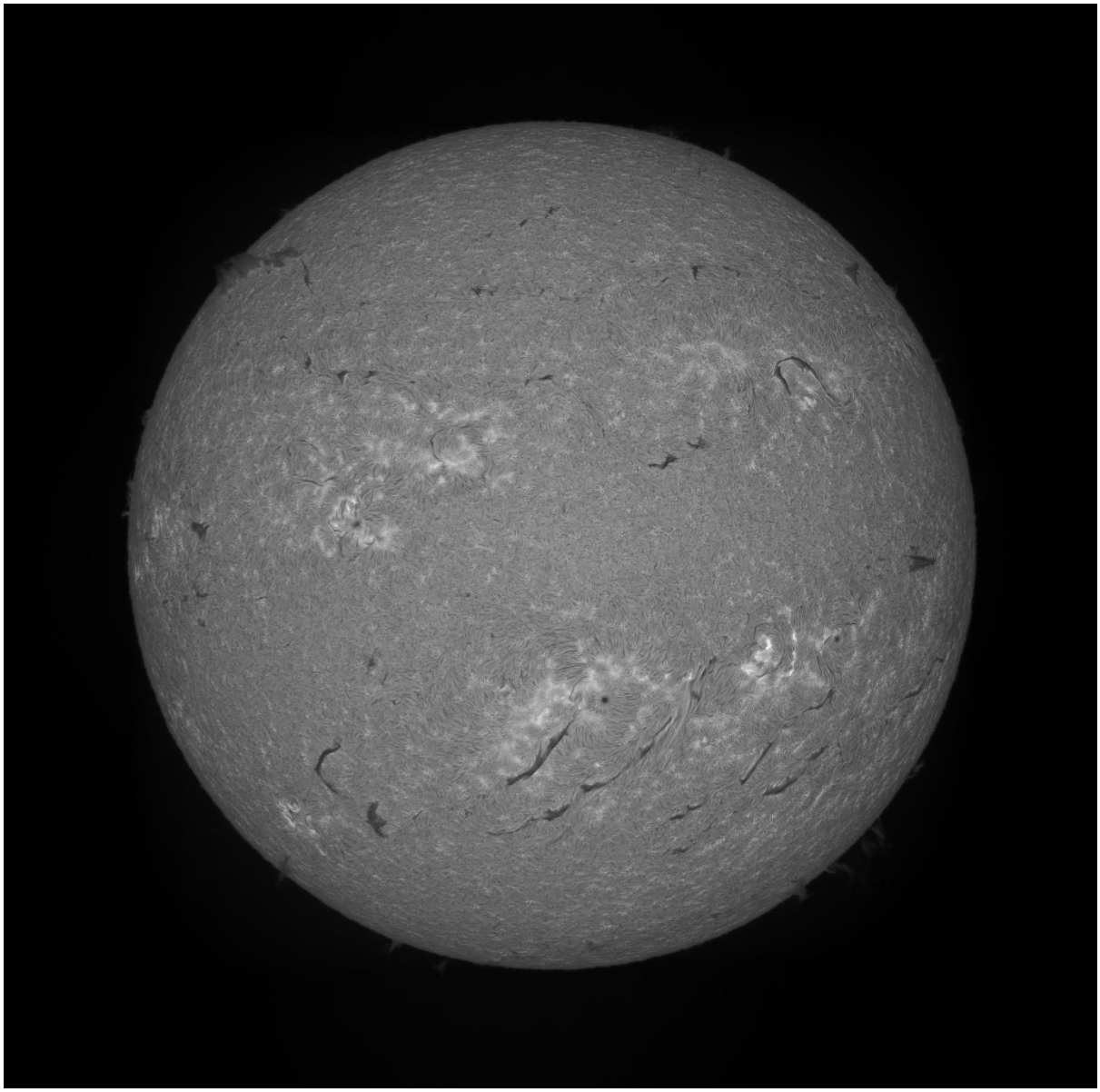
The **AutoStakkert** setting screen. I am not really an expert in using this program so other settings may work better than the ones I chose.



The **AutoStakkert** output file:



The **ImPPG** output file:



The final outputted **JPEG** image: