

Lunar (and solar) Mosaics – a processing tutorial



In this tutorial I will describe the way I process my lunar (and exactly the same solar) images recorded with a webcam (I my case a DMK21-618) into lunar mosaics. In my experience this way of processing results in the highest sharpness, and I will describe the steps to do this.

Before going into the processing it's important to realise that all images start with the recording. If the input is not good the result will never be good also. Try to obtain the highest sharpness already when recording the movies and don't expect the best results under bad seeing conditions.

Set the proper recording settings (exposure) and do NOT change them anymore during recording of the mosaic. All images must have the same exposure. So make sure you set the exposure on the brightest part of your future mosaic.

Having said this we are ready to start with processing. Before doing this a number of programs has to be obtained to go through the workflow.

Download the following programs:

Avistack 2.0 - <http://www.avistack.de/>

This is a freeware stacking program comparable to for example Registax. In my experience Registrar is better in planetary processing, while avistack is better for lunar and solar processing.

Astra image 3.0 PS (photoshop plugin) - <http://www.phasespace.com.au/>

This program costs \$39,95 or about 30 euros. It's well worth the investment and will give you the opportunity to really get much better results.

Imerge - <http://jaggedplanet.com/iMerge.html>

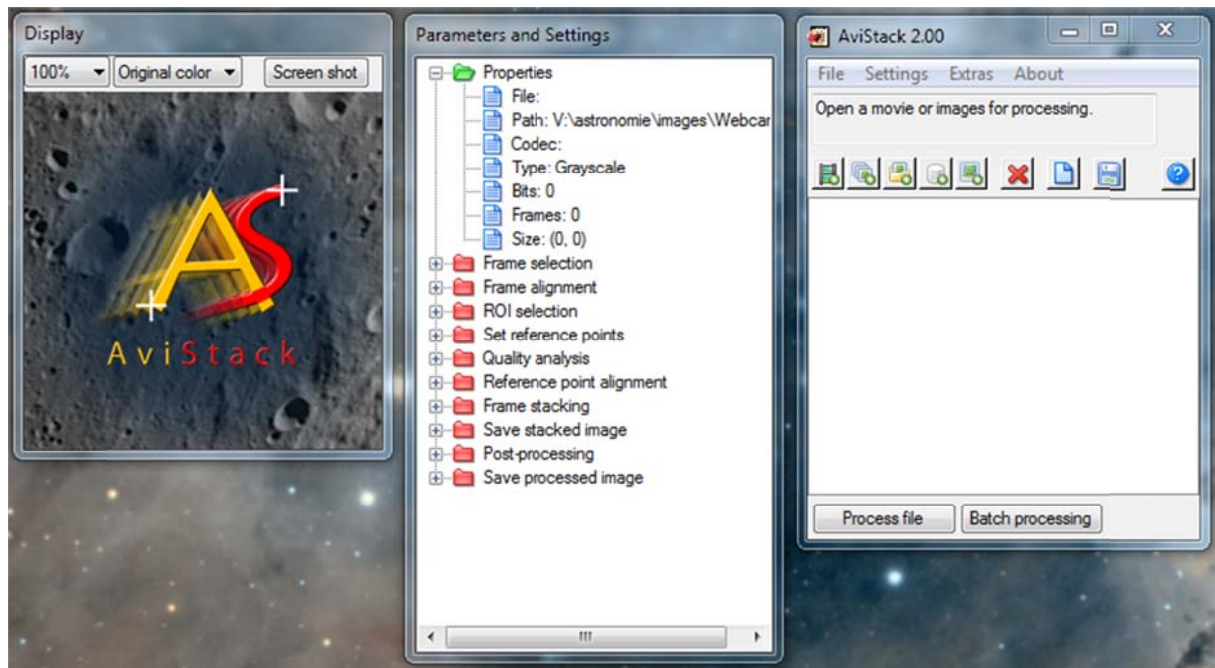
This is freeware program to create mosaics from astro-images, as well stellar as lunar/solar images.


The workflow

1. Avistack

First we start with stacking the movies. Therefore we will use avistack. In green marked I will mark the settings that are changed from the standard settings. In yellow you will see when you go to the next step. Basically you can go along the green and yellow steps to go through the processing fast. I will describe every step to give a feeling of what is happening.

Open avistack and you will see the following three screens:



In the right screen choose for  and open the movie you want to process.

Next choose **process file**, and you will see the following screen:

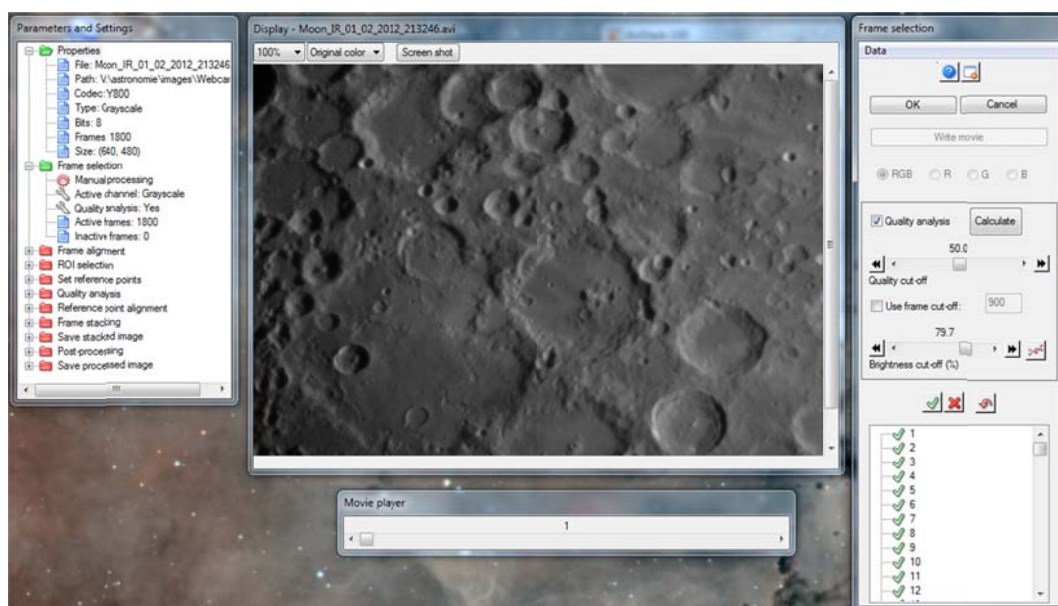


Image selection

The left screen shows the processing steps and the according settings. The center frame shows the movie, the right screen shows the settings for this processing step.

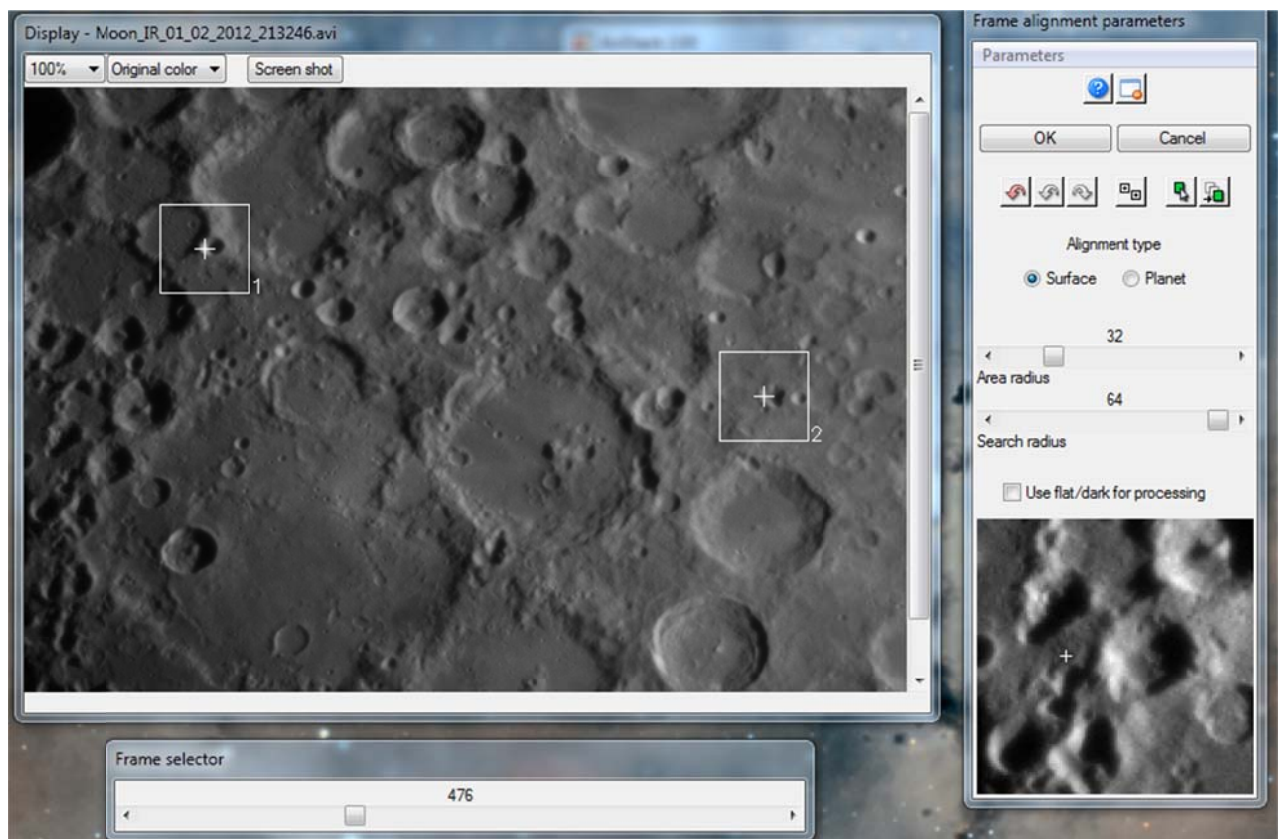
By selecting the **quality analysis checkmark** you can let the program automatically select the best images using sharpness and brightness. With the **quality cut-off** you can set the percentage of the best images used in the processing. When seeing is good, and you have an overall good recording you can put a high percentage here (like 80% or so). When seeing is bad, or you have only a few good images in the movie, then select a lower percentage (20-30%). Remember the more images used, the lower the noise. You can also use a **frame cut-off** to manually select the amount of images used.

Next press **calculate** to have avistack calculate which images are selected. After finishing the calculation the button will change to **apply** and by pressing this you will select the images. If you want to manually add or delete images from the processing this can be done in the bottom half of the box with the green checkmark/red cross.

Next press **OK** to go to the next step.

Image alignment and seeing condition check

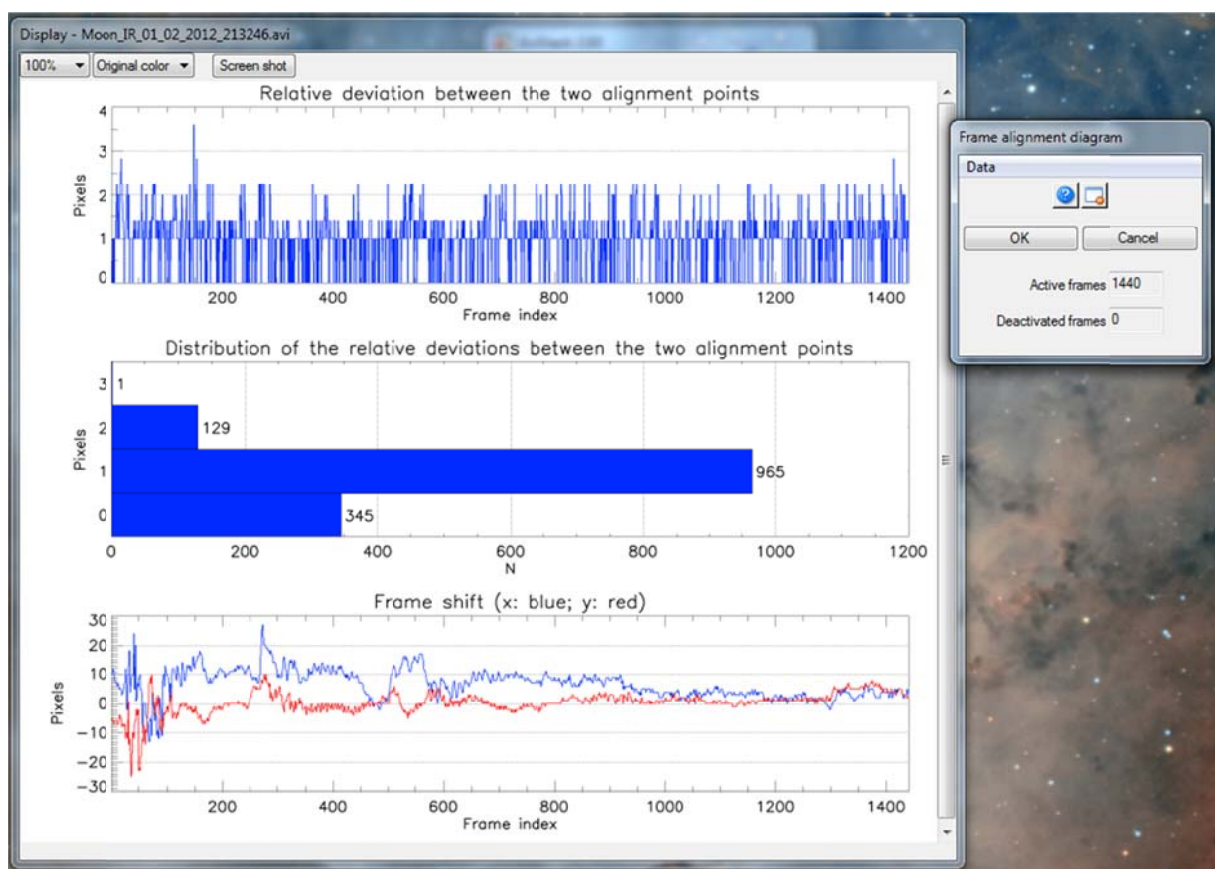
Now you will see the next screen:



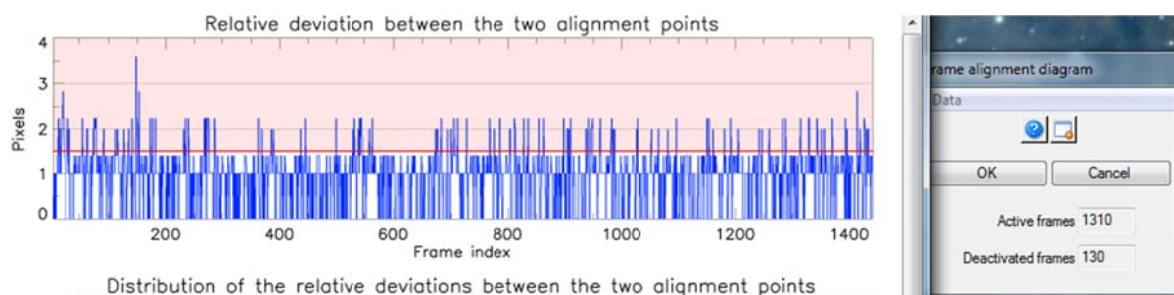
The squares show the chosen alignment points. AviStack will place them automatically in the first frame. If this frame is not suitable (too low quality) you can simply choose a different Frame using the frame selector. The two alignment points are used to determine the drift of the field of view and the seeing conditions. By pressing the left mouse you can set point 1, by using the right mouse button you set point 2.

Make sure the **alignment type** is set to **surface**. The **area radius** sets the size of the squares (I use 32). The **search radius** determines how many pixels from the last detected point is searched for the new point in the next image. I use the **maximum value (64)** here to allow the frames to bump around, for example by wind gusts...

Press **OK** to go to the next step.



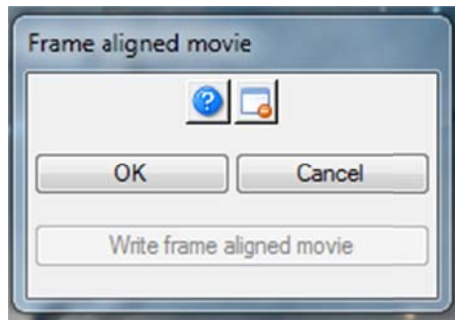
This screen shows the results of the analysis. The upper part shows the deviation between the two pixels in all the images. This should be low when seeing is good.



With the mouse you can drag a square box in the upper screen. This box determines which images you will NOT use in processing. The right box shows the active frames that are left that will be used in processing (in this example 130 images are not used).

I normally try to select all images until about 2 pixels deviation or lower.

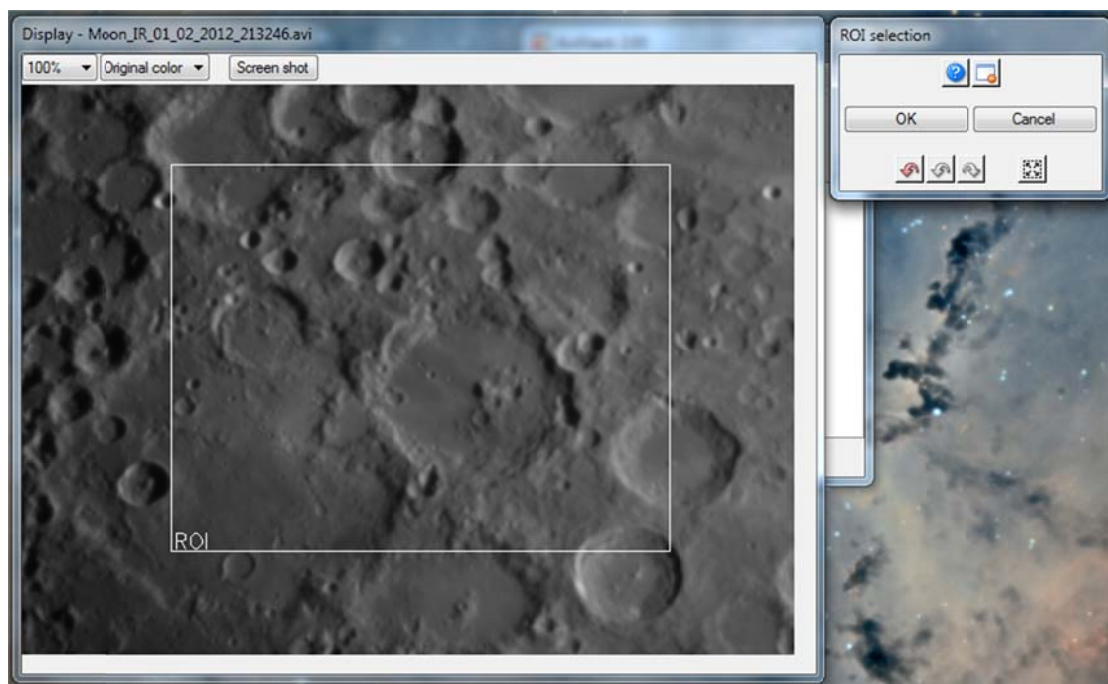
Press **OK** to go to the next step.



You can see the aligned movie now, and with the frame selector you can see through it to see if it aligned properly (the images should not move anymore between frames).

Press **OK** to go to the next step.

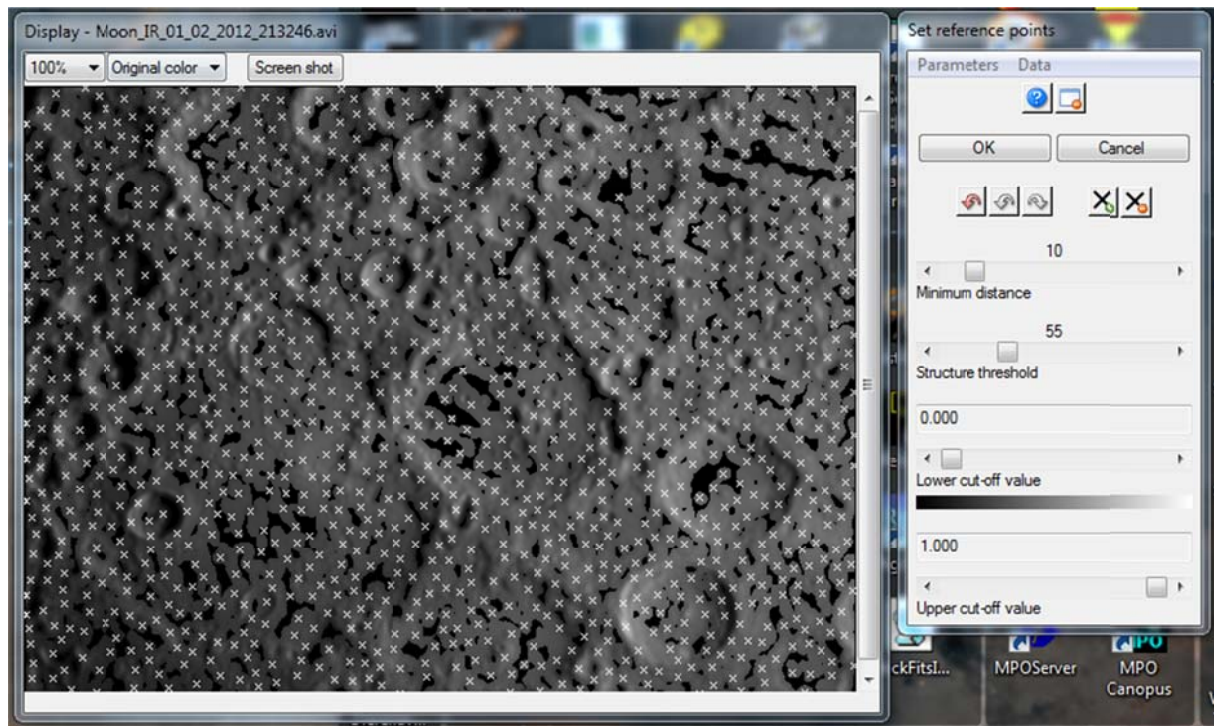
Region of interest selection



In this screen you can select with your mouse a region that you want to process (if you want to only process a smaller part of the image). With the right mouse you can move the rectangle. Doing nothing here just process the whole image.

Press **OK** to go to the next step.

Reference points



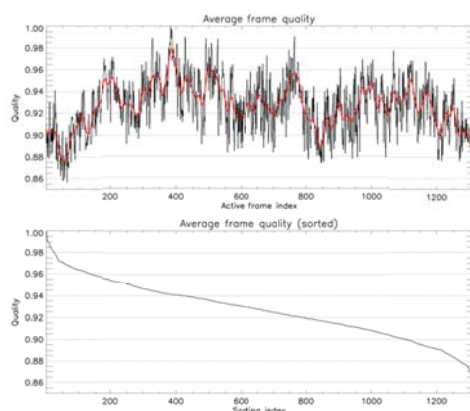
The program will select reference points as shown. With **minimum distance** you can change the amount of generated points.

Press **OK** to go to the next step.

Quality analysis

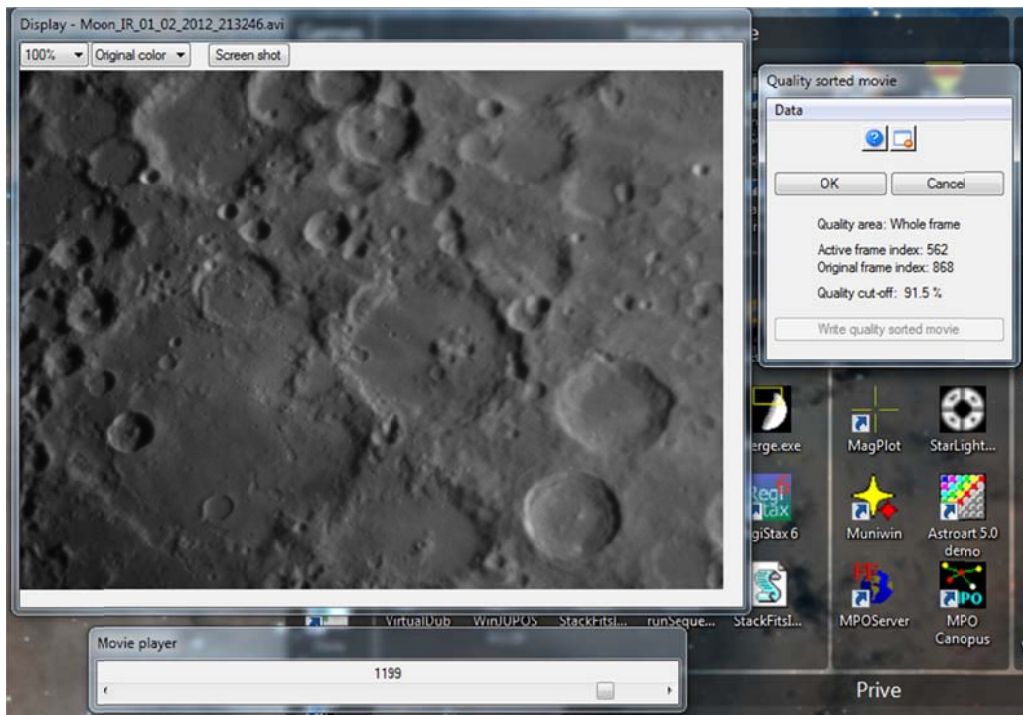
As the image quality varies within a frame due to seeing related distortions, the quality is calculated for small areas of the image, separately. That way only the best parts of an image are later used, even if it is only one small area of a whole frame. The size of these areas is determined by the Quality area size (I use 32). I use **standard quality analysis** here. For **Noise reduction** I use setting 1.

Press **OK** to go to the next step.



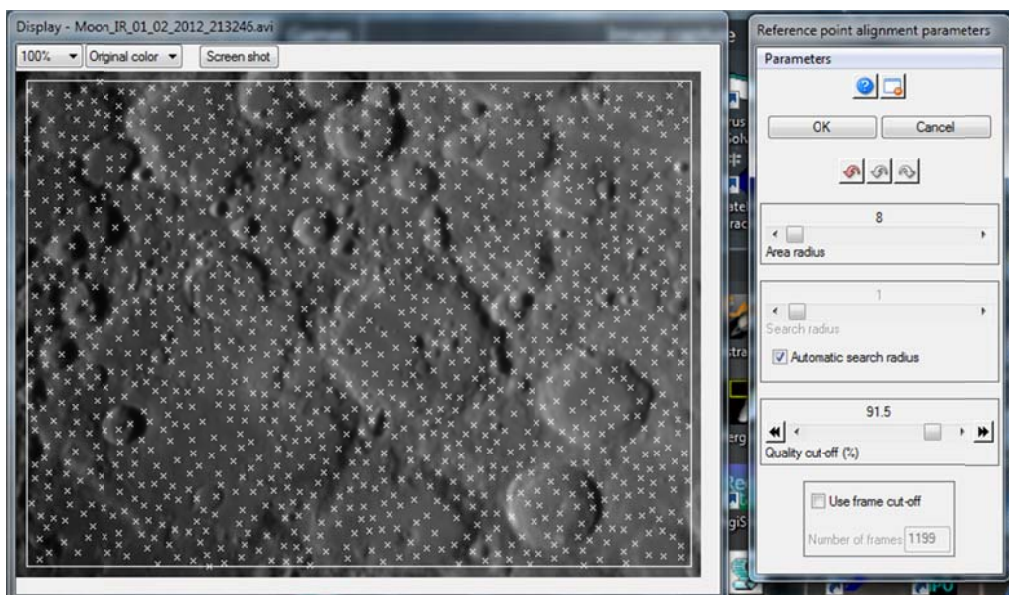
Next you will see an informational view where you can see the seeing during the recording.

Press **OK** to go to the next step.



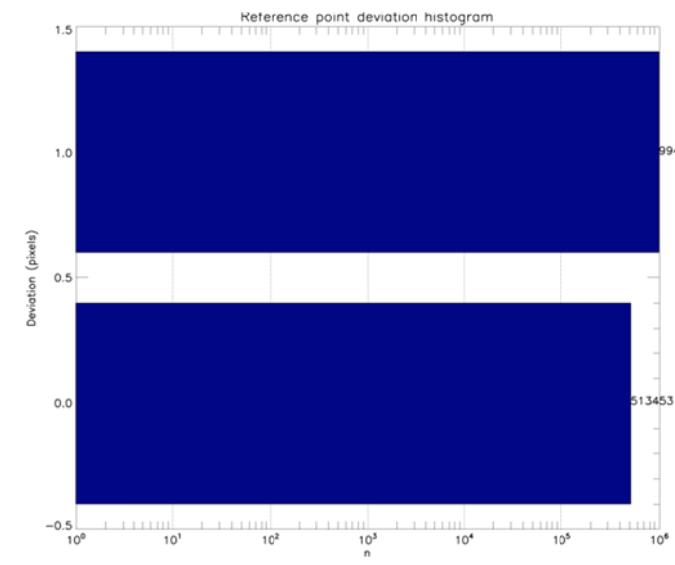
Now you will see a quality sorted movie. You can use the movie player to scroll through the sorted movie. In this way you can look when the quality starts to degrade. In the right pane you can then see which cut-off should be used to use only the images until this point. Remember the number (in this example it's 91,5%).

Press **OK** to go to the next step.



In this screen set the **quality cut-off** to the value of the previous screen. For the rest use the shown values. Press **OK** to go to the next step.

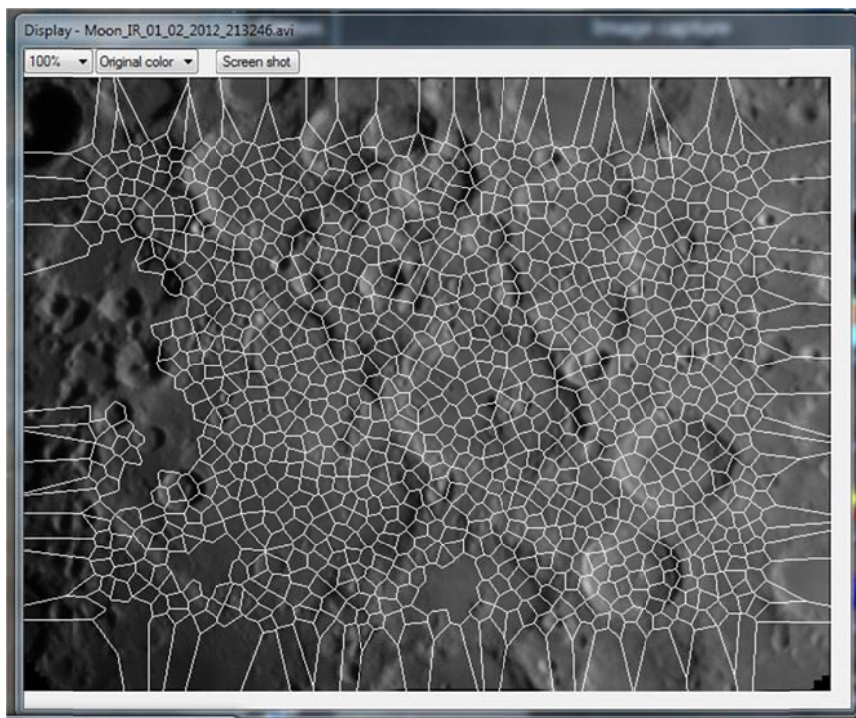
Now you get another informational screen with the distribution of the deviations.



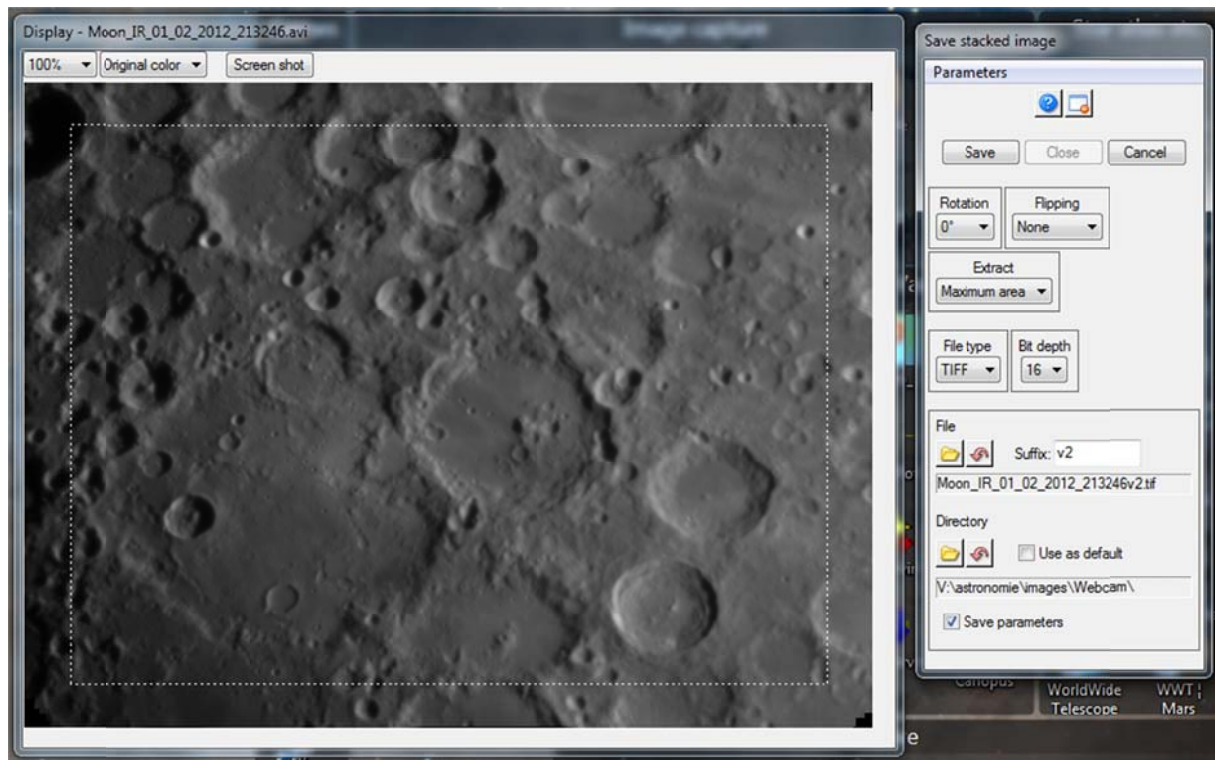
Press **OK** to go to the next step.

Frame stacking

Now you will get into the frame stacking mode. Just press **OK** to start the stacking.



After stacking you will see the next screen.



Set the **extract** to maximum area and **file type** to 16-bit tiff. Select **save** and save your file.

Now you can close the screen and press cancel in the next step.

We're done now with avistack.

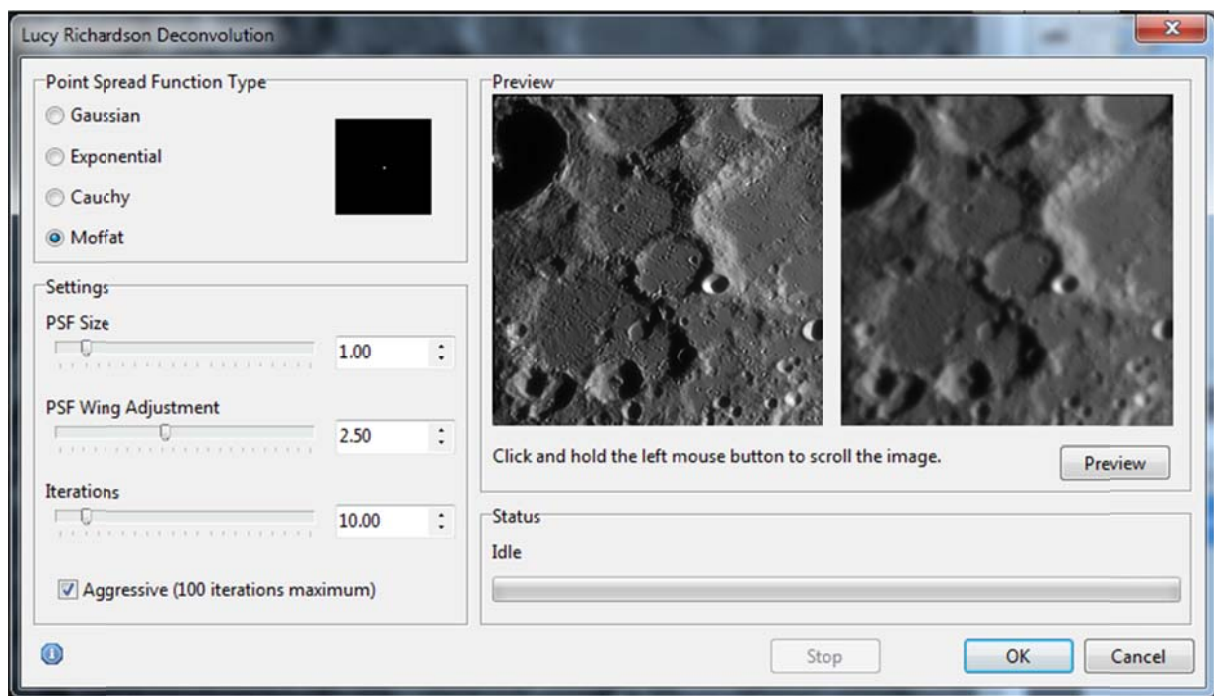
Workflow 2. Astra image

Now you open your image in photoshop and we will use astra image to improve the quality.

The stacked image from the example is shown here:

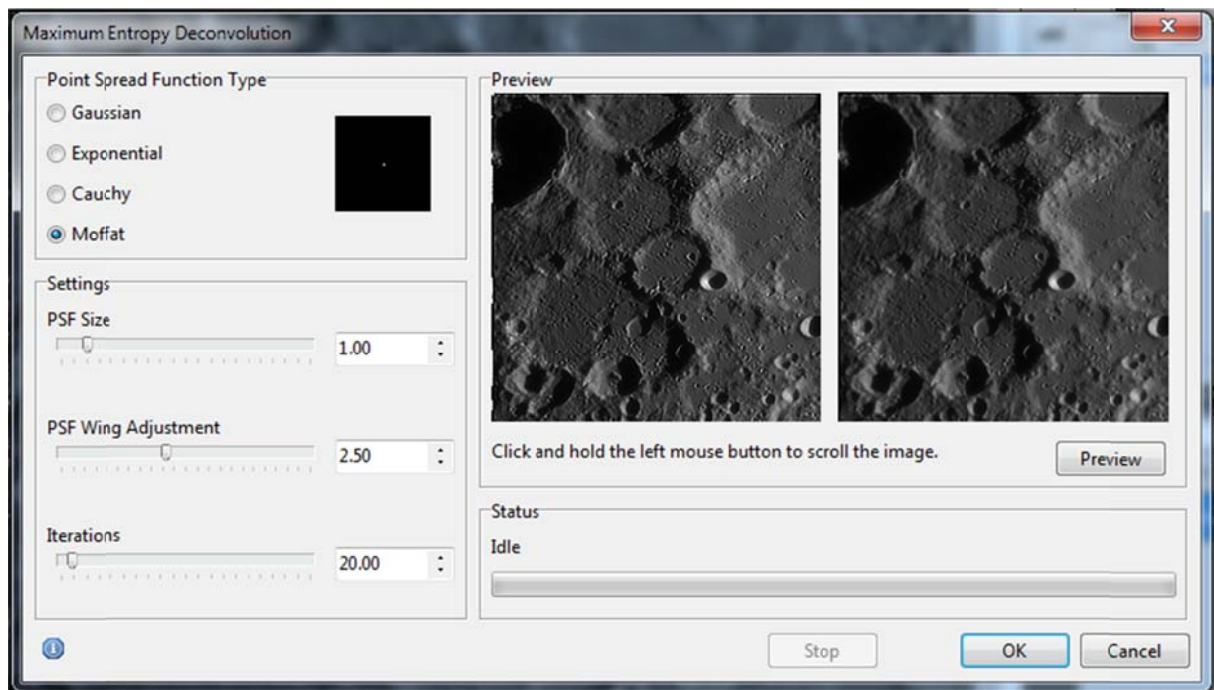


Select from the menu: filter → astra image → Lucy Richardson deconvolution



Set the settings as shown here, and press preview to see what the result will be, then press ok.

Now select from the menu: filter → astra image → maximum entropy deconvolution



Take over the settings (change PSF size to 1.00) and press ok to process.

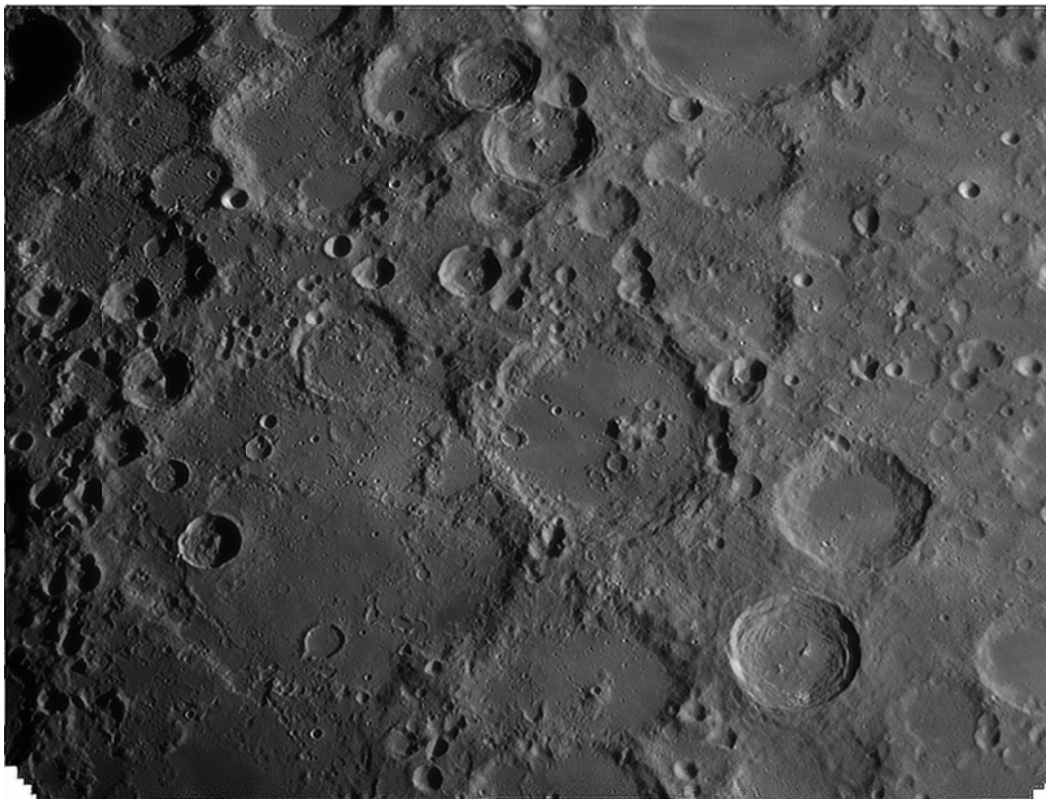
Now you will have your finished image. Save it somewhere with all the other images ready for mosaicking in the next step.

Result:

Before deconvolution:



After deconvolution:



Workflow

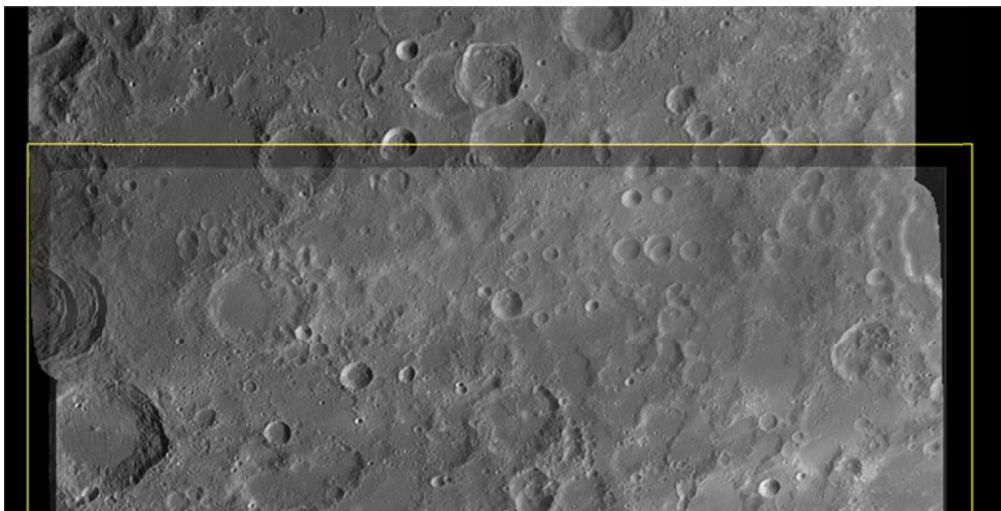
3. mosaicking

For mosaicking I use Imerge. Imerge can not import tif files, so you have to convert them to fits files first. When you have astra image in photoshop it also contains a fits loader/saver. So you can save from photoshop directly to fits format.

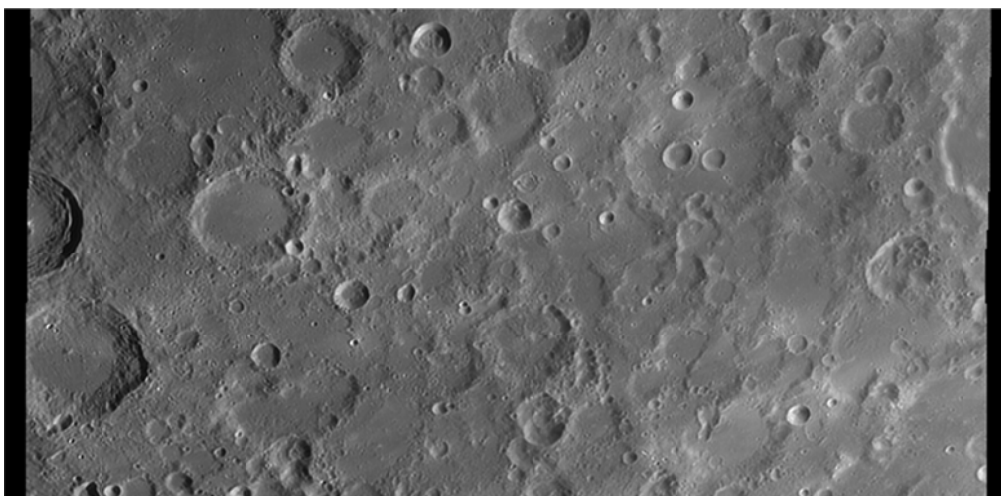
In Imerge you import the first two images which should be mosaicked by choosing file → import image.

Make sure that the autobrighten (view → autobrighten) is turned off! All images already have the same exposure so this is not necessary and can even ruin your attempt...

With the mouse you can move them, and you overlay them in such way that they are very close to fitting properly:



Now you can right click on a clear point (a crater or so) and the images will be automatically aligned:



Now you can import the next image and fit it on the already aligned images. Just go on until all images are mosaicked. That's it. Now you should have a nice mosaic!