Instructions for Using DeepSkyStacker

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The use of DeepSkyStacker is applicable to any deep sky object (DSO) for which you have acquired a series of sequential images with at least 15-20 visible stars, sharply focused and limited in overall rotation of the field of view (e.g. <~50 degrees). This is the case for multiple alt-az images taken over a period of about 1-2 hours, or images taken with an equatorial mount over an indefinite period of time. Of course, you can also stack multiple sessions of such sequential images taken over many, many nights as well, provided your field of view is similar in each session.

I provide *very* simple instructions below using an example set of images taken through my LX200R 10 inch Meade on an alt-az mount, generally using multiple 20sec exposures at ISO1600. The quality of my tracking enables me to expose my camera chip up to about 20 seconds per exposure and still maintain sharply focused circular star images (necessary for DeepSkyStacker to work well). I capture *both* JPG and RAW images – RAW for processing but JPG also for viewing convenience whenever I need them. (Note, you can also *just* use JPG images at first, if you want. Sheesh! Ok…don't yell at me…hardcore imagers will of course, tell you this is sacrilege. However, I was able to get very nice images for quite a while until I became good enough at everything else to notice a difference).

The following details a process using a single DSO as an example, assuming only "light frame" images are used (i.e. not darks, flats or bias frames) and also assuming everything is perfect, to give you an idea of how simple things *can* be if all goes well. It is by no means comprehensive and begins from the moment you come back inside from your viewing session:

Transfer your images and load them into DeepSkyStacker

1. Once inside, connect your camera to your computer.
2. Preview the JPG images on the camera card to determine where your first DSO images begin and end.
3. Create a folder on your computer to store the object images. You will eventually come up with a naming convention for your folders and images, so I won't bother detailing mine. Copy the corresponding RAW images to the folder. (I also copy the JPG images as well in case I want to look at them, but delete them soon after).
4. Start up the program "DeepSkyStacker".
5. Select "Open Picture Files" and select ALL the RAW images (referred to as "light frames" in the folder. Verify the images all have the same ISO and exposure and check all of them. You can select "Check All" then deselect if needed (see figure 1).

Select a good image for setting the "star detection threshold"

6. Click once on the first image in the list, and use the top right bar to adjust the contrast until you see sufficient stars. This is for visual use and does not affect any subsequent processing.
7. Move the cursor over the stars and observe their shape in the display box in the top left corner (see figure 2). If the images of the stars are not circular, uncheck that image and move to the next one in the list. Repeat (6) and (7) until you find an image with stars that are circular.

Set parameters for registration and stacking

8. Select "Register checked pictures..." which will cause a window to open as shown in figure 3.
9. Select the "Actions" tab. Check all boxes. The percent number of images to stack is determined by how good your tracking and focus is, and is the percent number of the CHECKED images that is stacked. If tracking and focus is very good, you can set this number high (80-90%). If it is poor, you may need to set it lower. If you hand-select your frames (by checking only the images you want), you can set this to 100% and stack all of the CHECKED images. My 20 second exposure time insures my tracking is usually pretty good for many of my images, and my use of the Bahtinov mask insures me excellent focus, so I typically use 80% for planetary nebula and 90% for everything else.
10. Next click on the "Advanced" tab (see figure 4). Make sure "Reduce the noise by using a median filter" is checked. Alternate between changing the star detection threshold and clicking the "Compute the number of detected stars" button until you get some number of stars between 20 and 60. Problems can occur if:
    a. focus is bad (stars are too bloated)
    b. tracking is bad (stars are all elongated)
    c. your star field does not contain enough visible stars
    d. the star detection is less than 3%
11. See Figure 5 for Result settings.
12. See Figure 6 for Light settings.
13. See Figure 7 for Alignment settings.
14. All other settings can be left alone as defaults.

Begin registration and stacking

15. Clicking OK in any one of the Stacking Parameters boxes gets you back to the Register Settings (see figure 3). Once you click OK in that box, the popup in figure 8 appears. Click OK to begin the processing. Then sit back and relax! Registration and stacking can each take typically anywhere between 5 and 30 minutes for about 100 images, depending on the star detection threshold and the computational power of your computer.

Do some preliminary enhancement

16. Once completed, a window similar to the one shown in figure 12 will appear. I usually set saturation to 18%, and adjust the color histograms to be coincident (on top of each other). I then adjust the luminance to result in the settings shown in figure 13. Click on "Apply" to modify the final image. Don't worry, you can modify the image and click "Apply" as many times as you want until you get the result you want.
17. I save several different versions, and then use a more sophisticated program for final enhancement. To save a version, click on "Save Picture to file…" on the left hand side. The dialog shown in figure 14 will appear. Use the settings shown there and name your image. I usually store the result with my raw images. Iterate steps (16) and (17) until you get a few versions.

Do final post processing using an image processing program

18. Finally, open one of your final images in an image processing program like Photoshop or a free one like GIMP (or any other you are familiar with) and further enhance and crop your image.

And that's all there is to it! Of course, I didn't show you how to trouble shoot any problems, or to create file lists, or discuss the meaning of the settings, or talk about the use of darks, flats, or bias frames, all of which you will eventually figure out. Hopefully, this at least gives you some idea of the overall process. Trust me, the first DSO you process will absolutely stun you. Good luck!

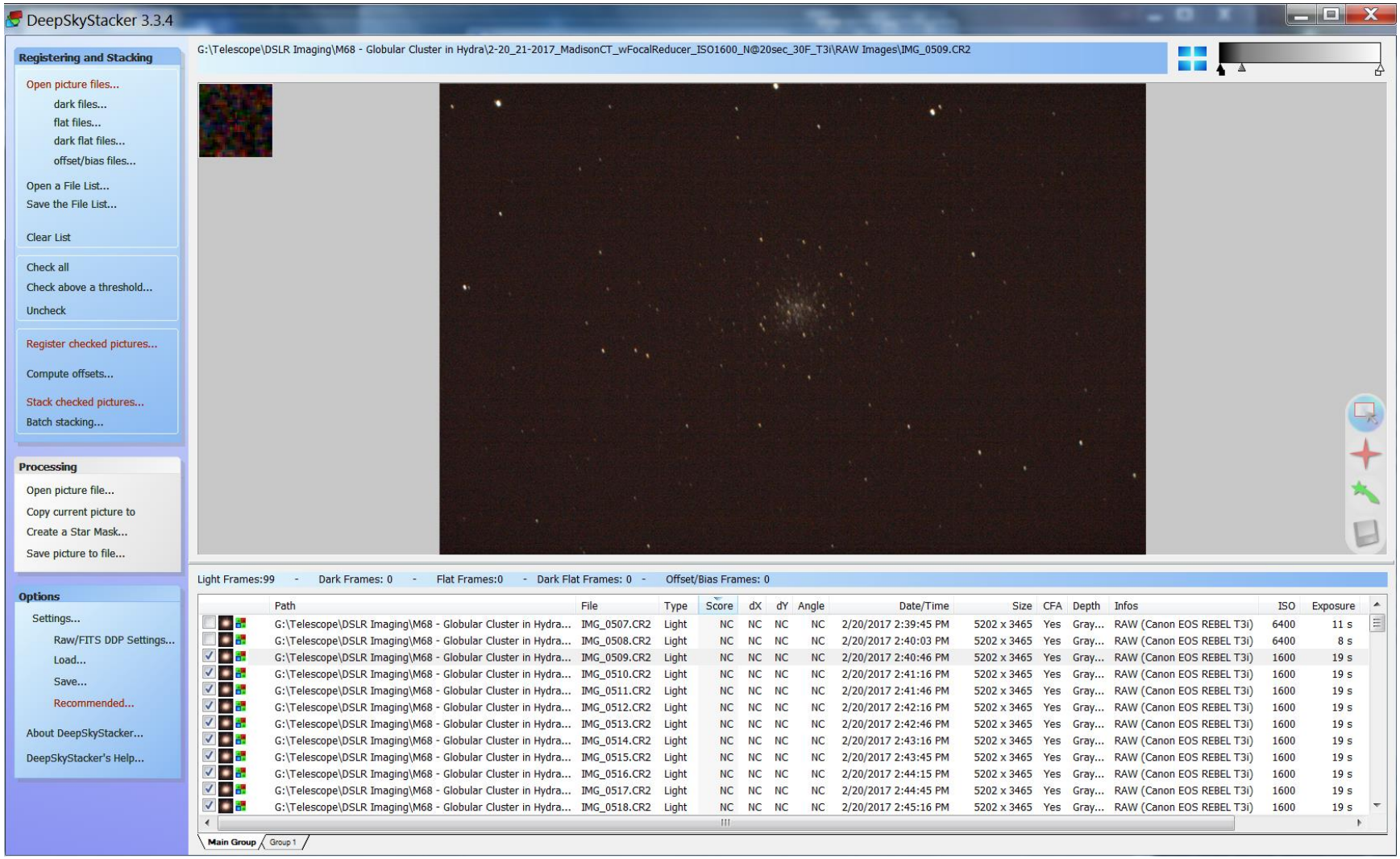

Figure 1: This is the view you should have after selecting “Open picture files…” and loading in all your RAW images, then deselecting images that you don’t want as part of your set. Note, to see any one of your images, you need to click on one in the list. You also may need to adjust the contrast using the control in the upper right (which affects only your view, not any of the processing).

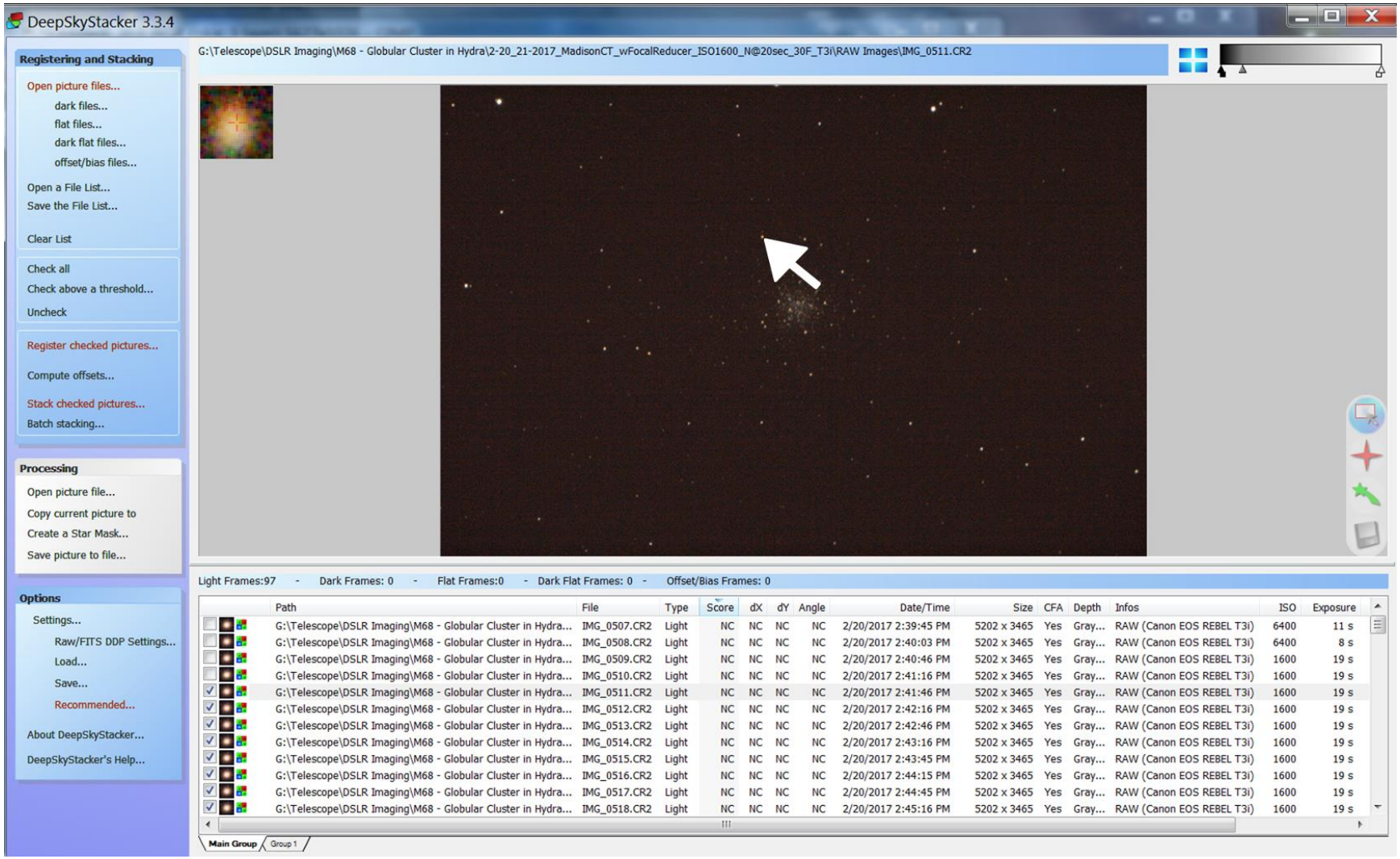

Figure 2: Click once on the first checked image in the list. Move your cursor over the stars and observe their shape in the display box in the top left corner. If the images of the stars are not circular, uncheck that image and move to the next one in the list. Repeat until you find an image with stars that are circular.

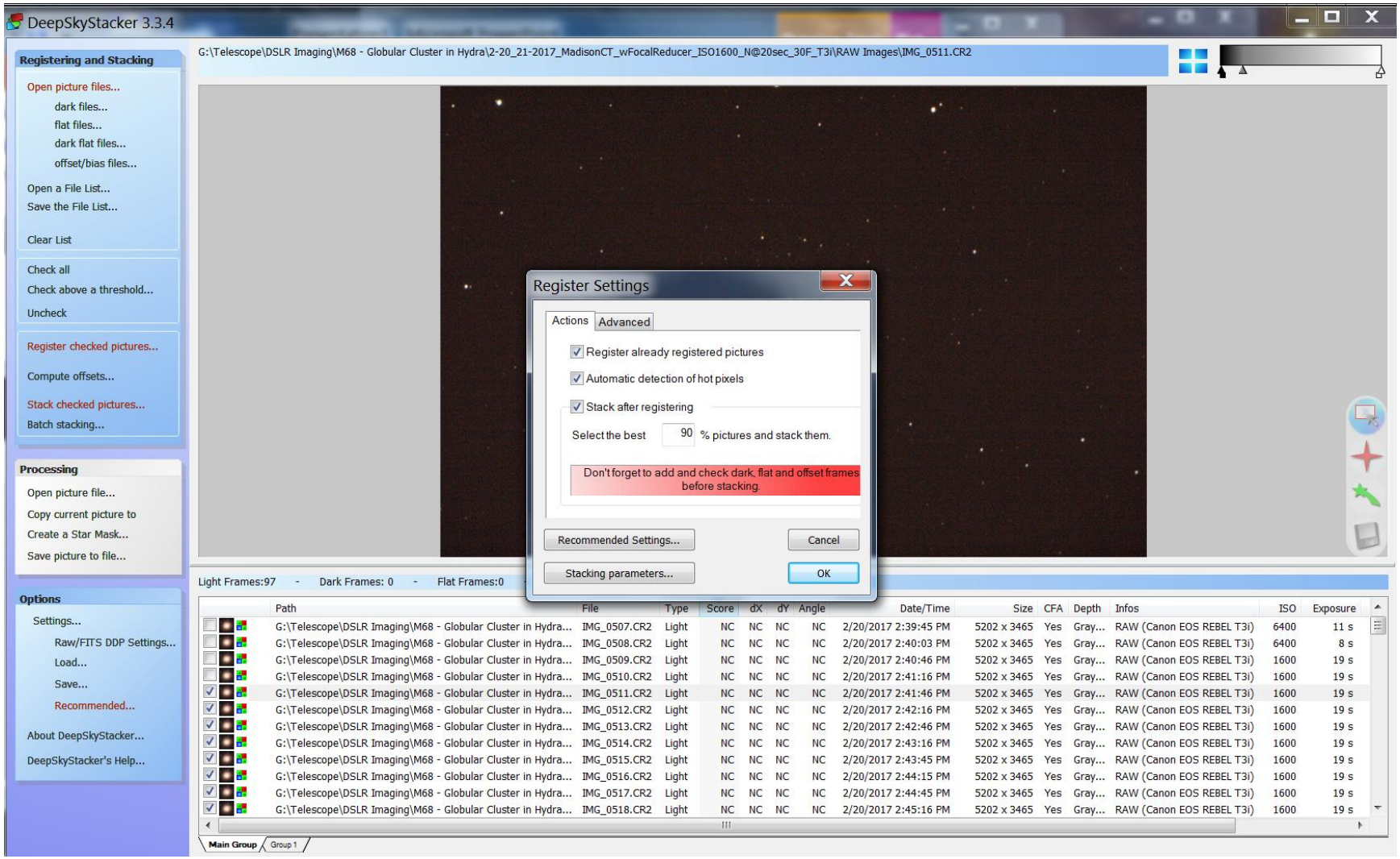

Figure 3: Window popup upon selection of “Register checked pictures…”. It defaults to the “Actions” tab. I usually check all boxes and set the percentage high because my tracking and focus is usually pretty good.

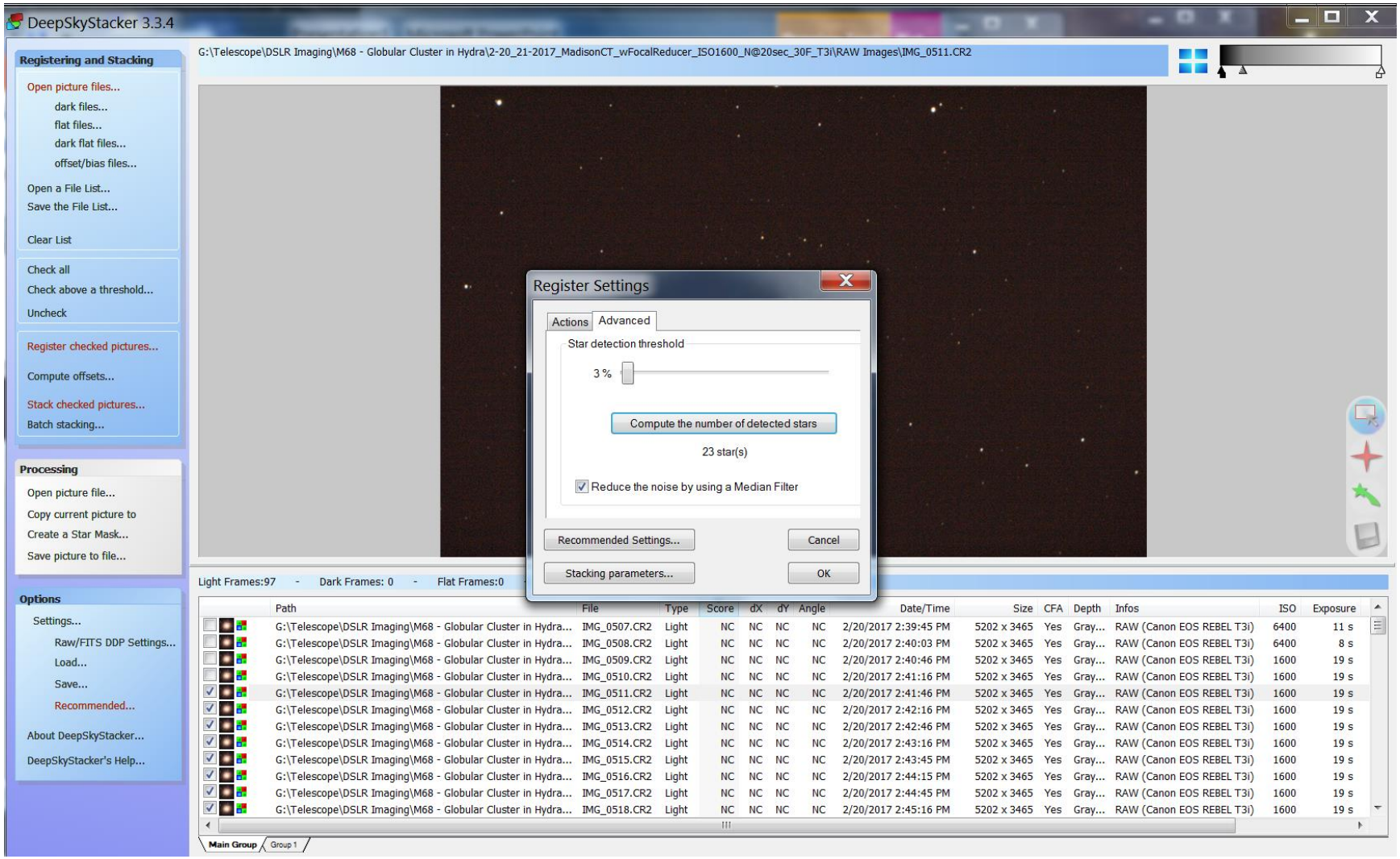

Figure 4: The advanced tab allows you to set the star detection threshold. This is a *very* important iterative process. A good range is between 20 and 60. Fewer than 10 will usually result in failure. More than 100 increases stack time with no improvement in results.

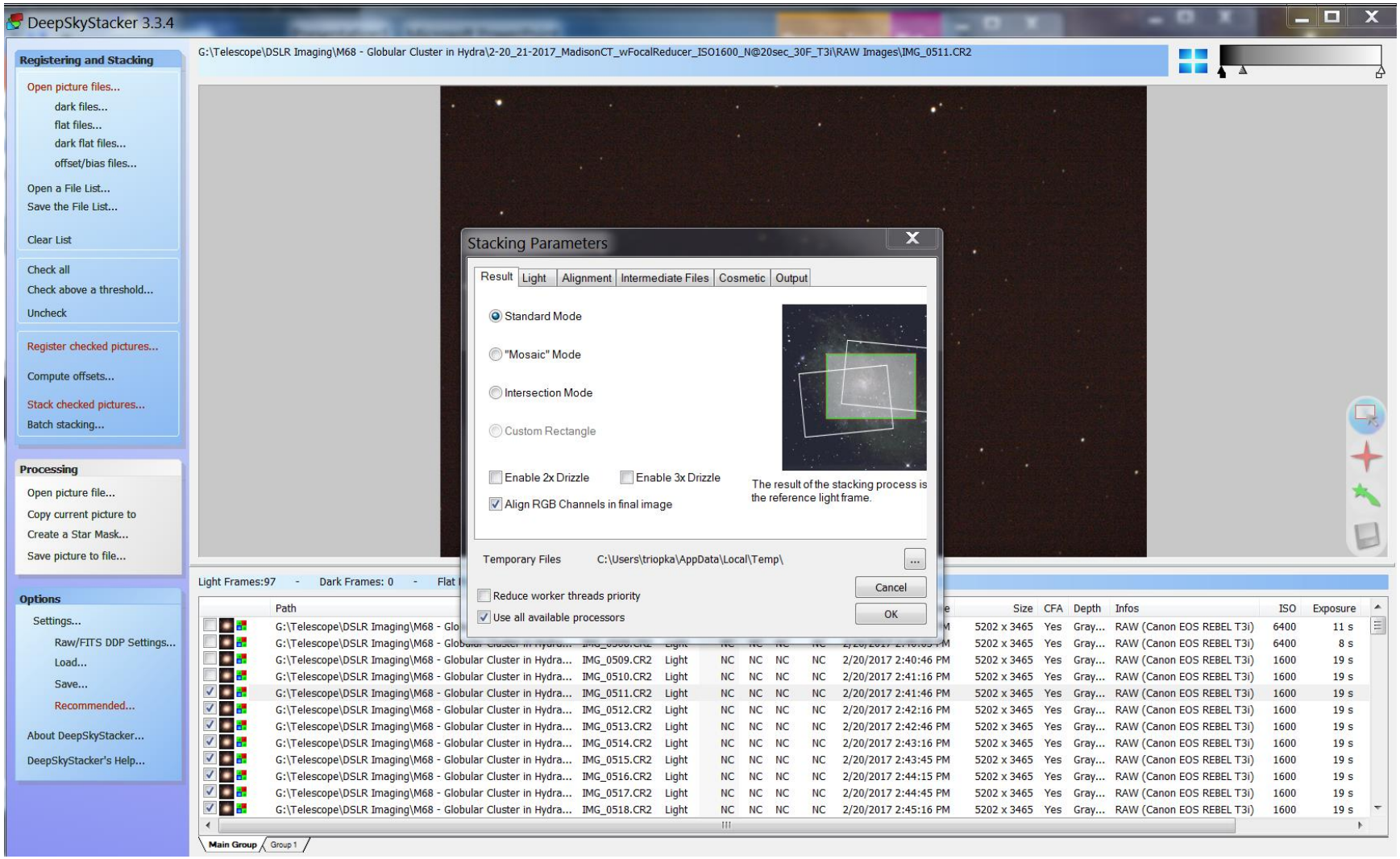

Figure 5: Settings for the Result tab. Most of these are defaults.

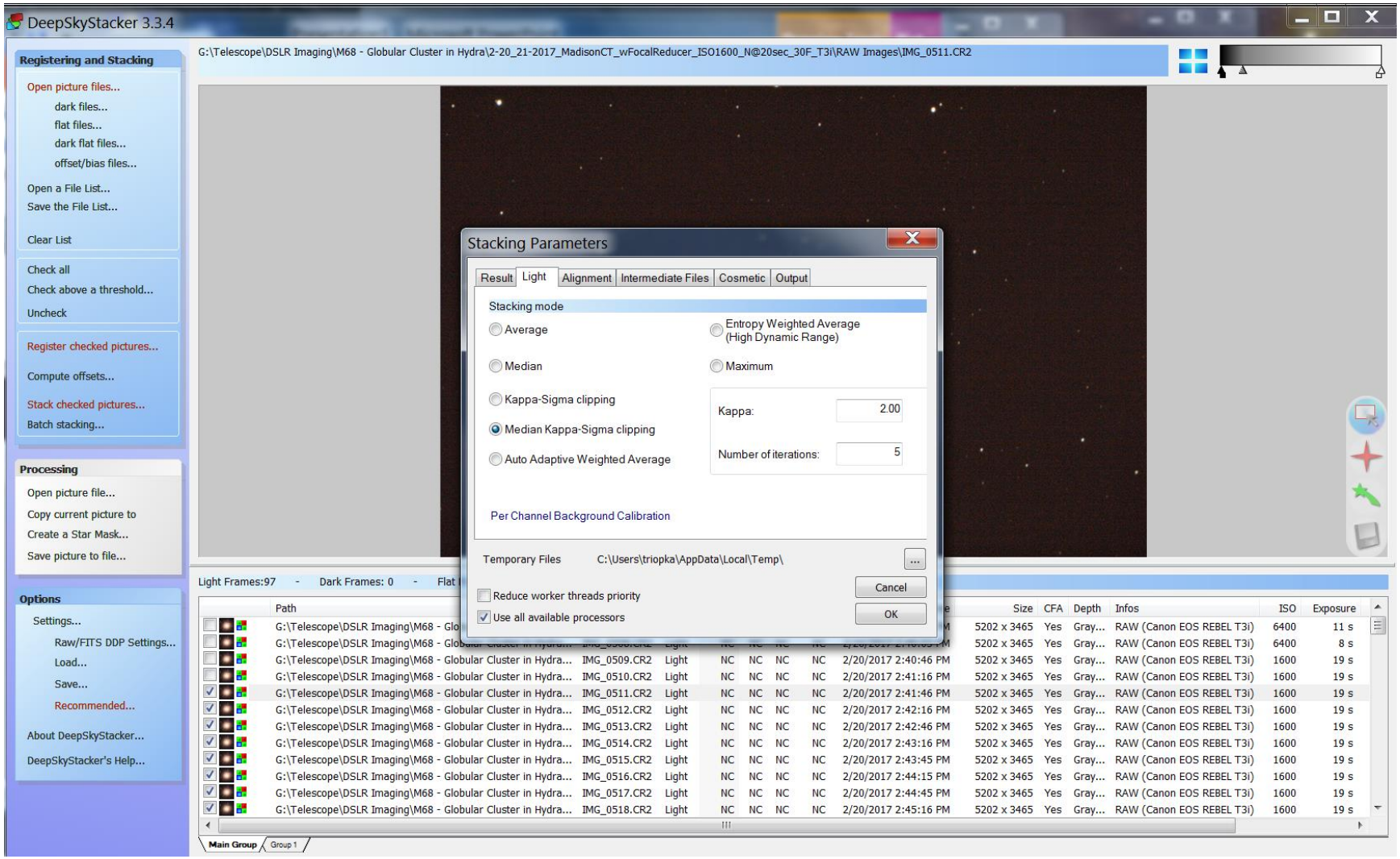

Figure 6: Settings for the Light tab. Most of these are defaults.

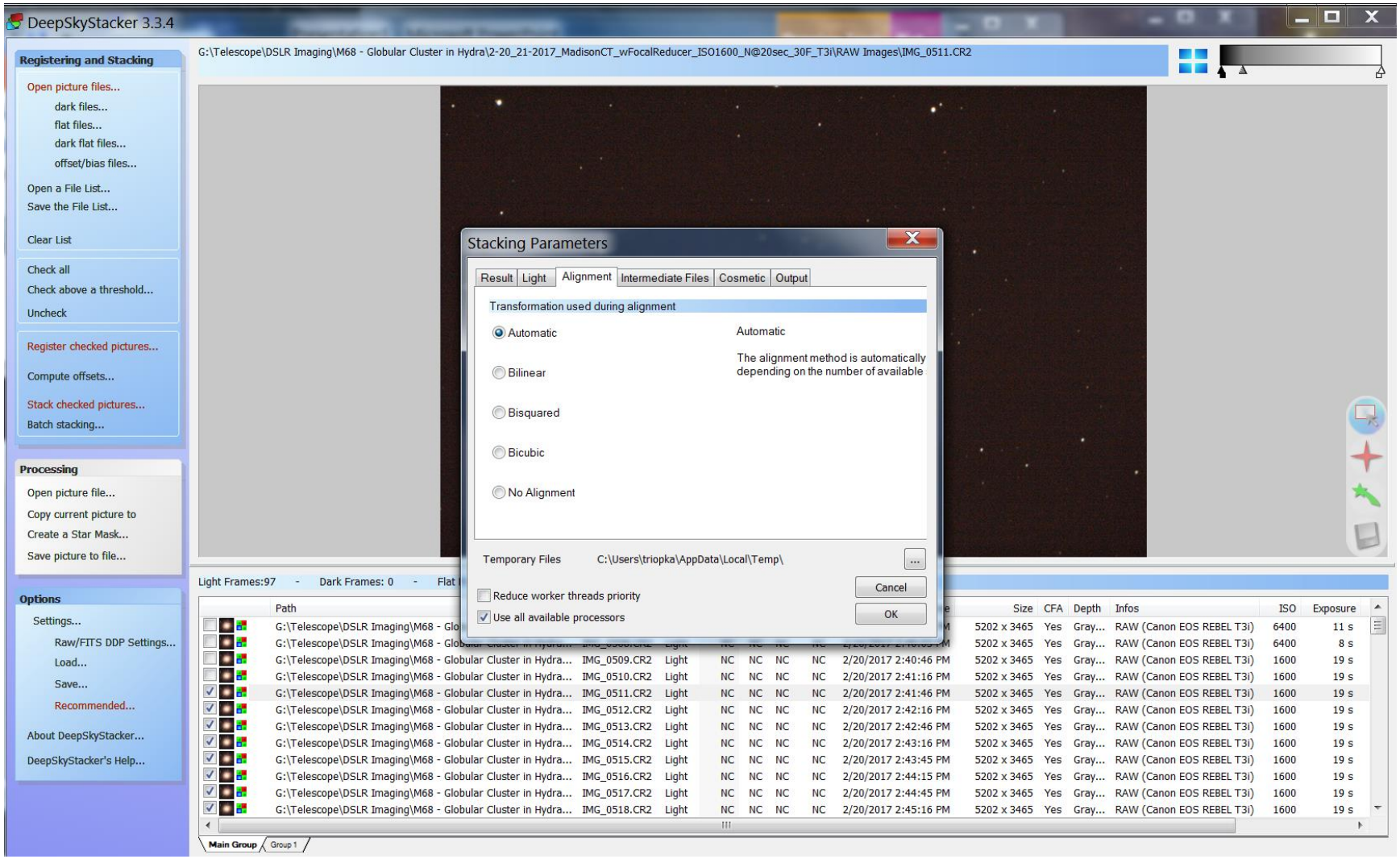

Figure 7: Settings for the Alignment tab. Most of these are defaults. You can go with defaults on all other tabs. Clicking OK in any one of the Stacking Parameters boxes gets you back to Register Settings (figure 3).

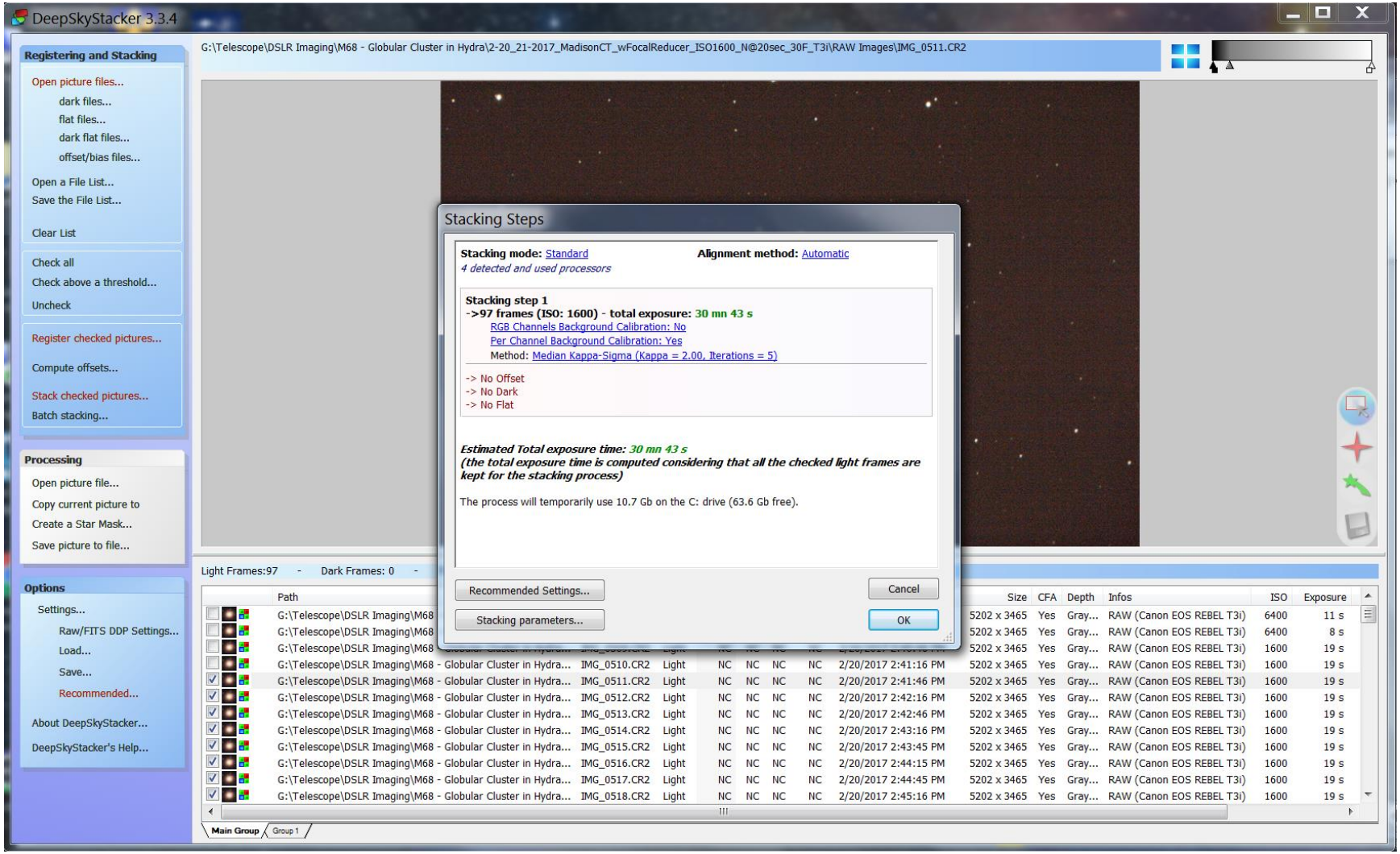

Figure 8: As mentioned in figure 7, clicking OK in any one of the Stacking Parameters boxes gets you back to the Register Settings (see figure 3). Once you click OK in that box, the following popup appears. Click OK to begin the processing. Then sit back and relax!

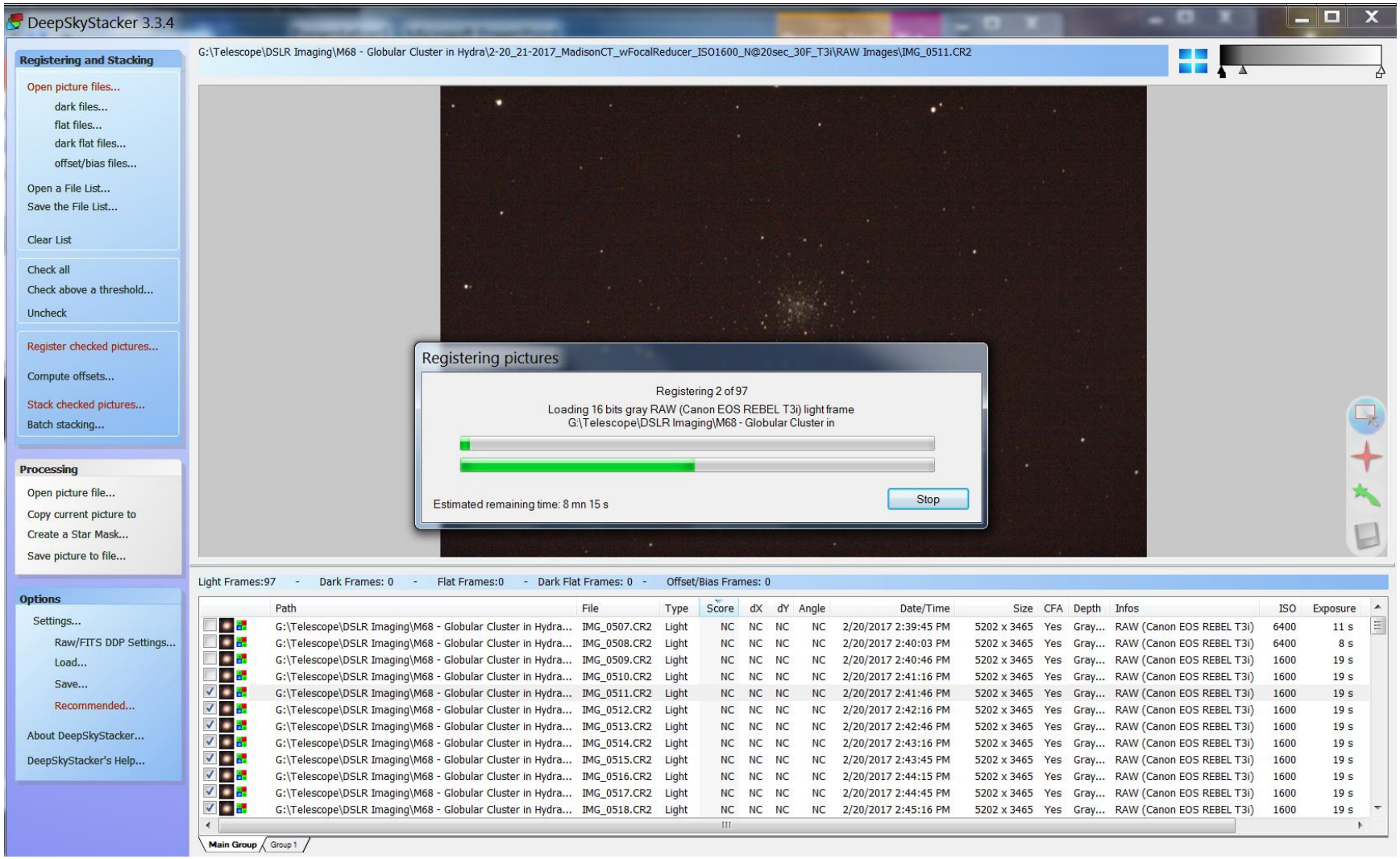

Figure 9: Once you start the processing by clicking OK in figure 8, you are good to go! Let the registration begin! This may take a little while (e.g. 5-30 minutes depending on number of images, star detection threshold and the power of your computer).

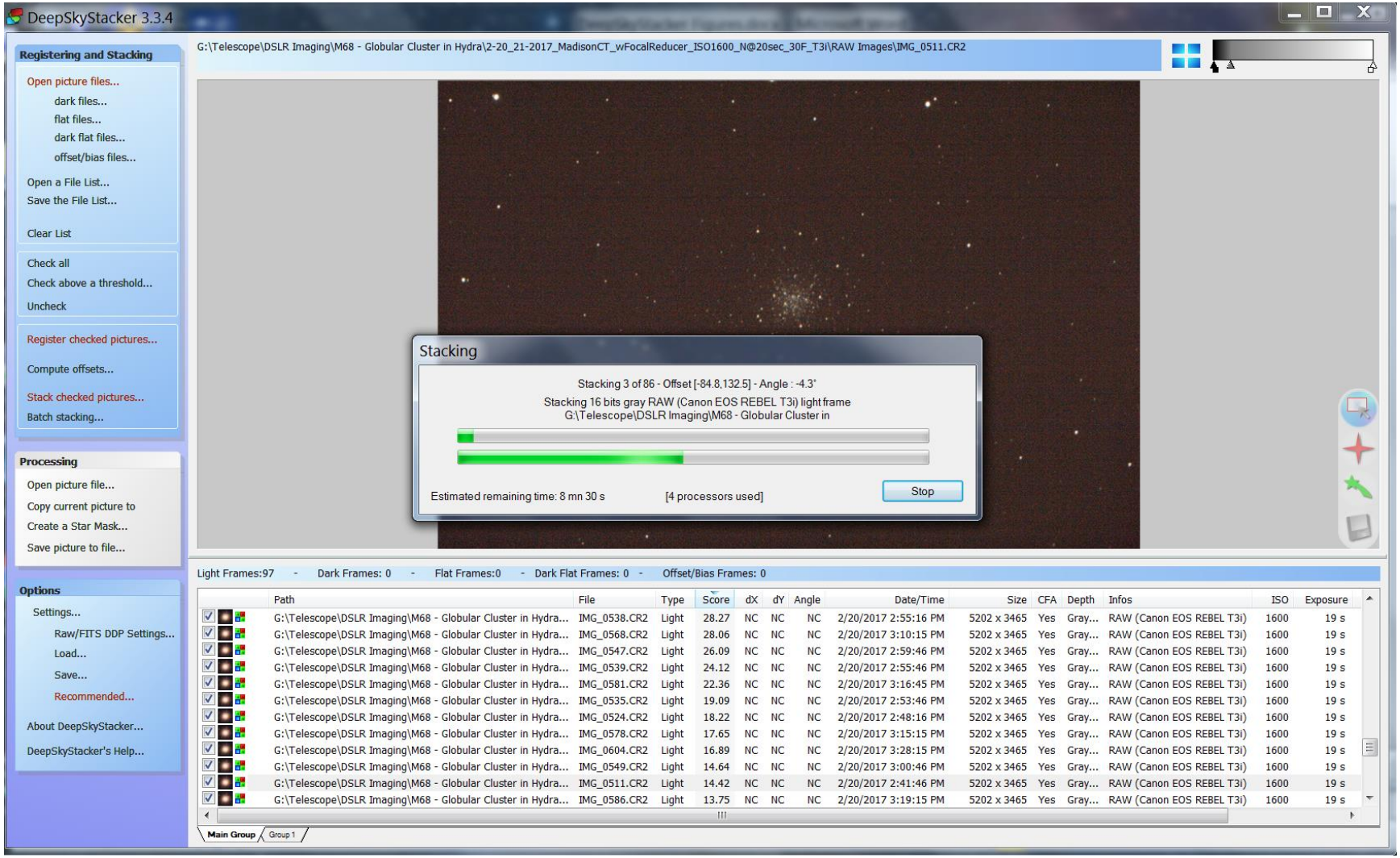

Figure 10: Once the images are registered (i.e. the software determines all the stars common between all the image frames and determines their location), the images are then stacked. This process can also take between 5-30 minutes depending the configuration.

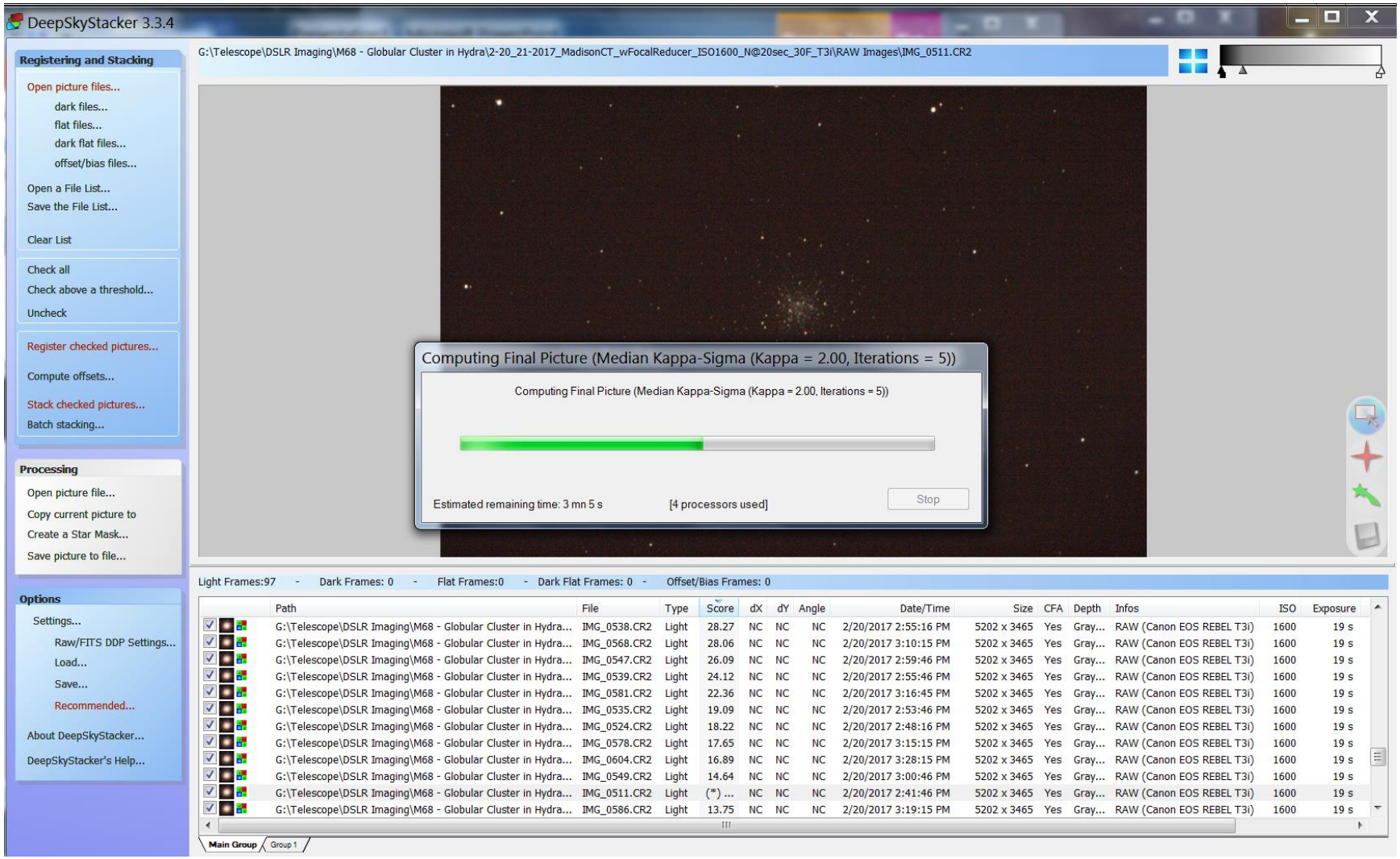

Figure 11: Finally, once the images are registered and stacked, statistics for each pixel are used to determine how to combine the pixels across images.

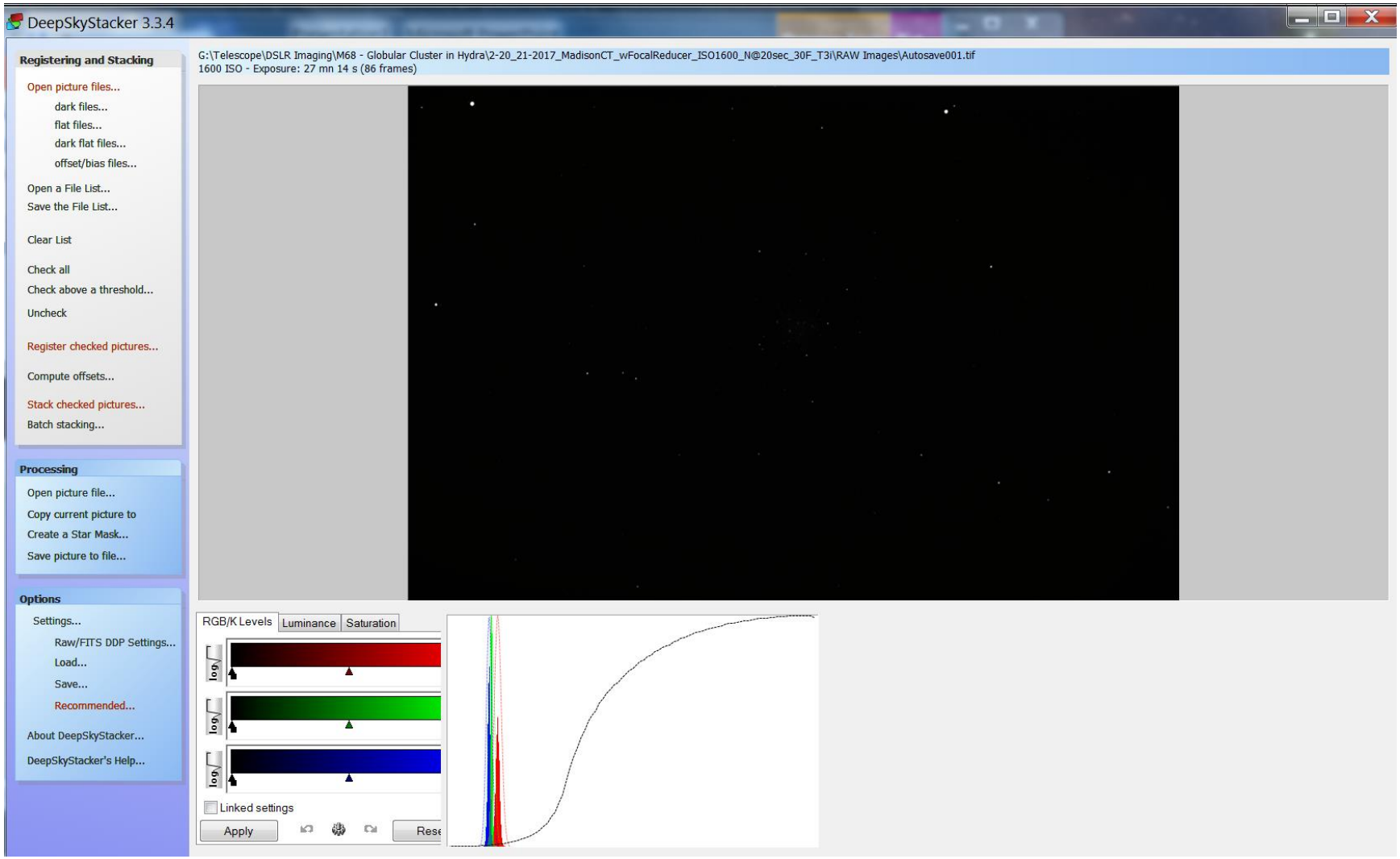

Figure 12: Once the final stacked image is produced, this interface must be used to adjust the distribution of gray values in the image to make sure when this 16-bit image is converted to 8-bits, as much of the necessary detail as possible is retained. In other words, we stretch or compress parts of the gray distribution to either increase or decrease the dynamic range in pertinent areas of the image.

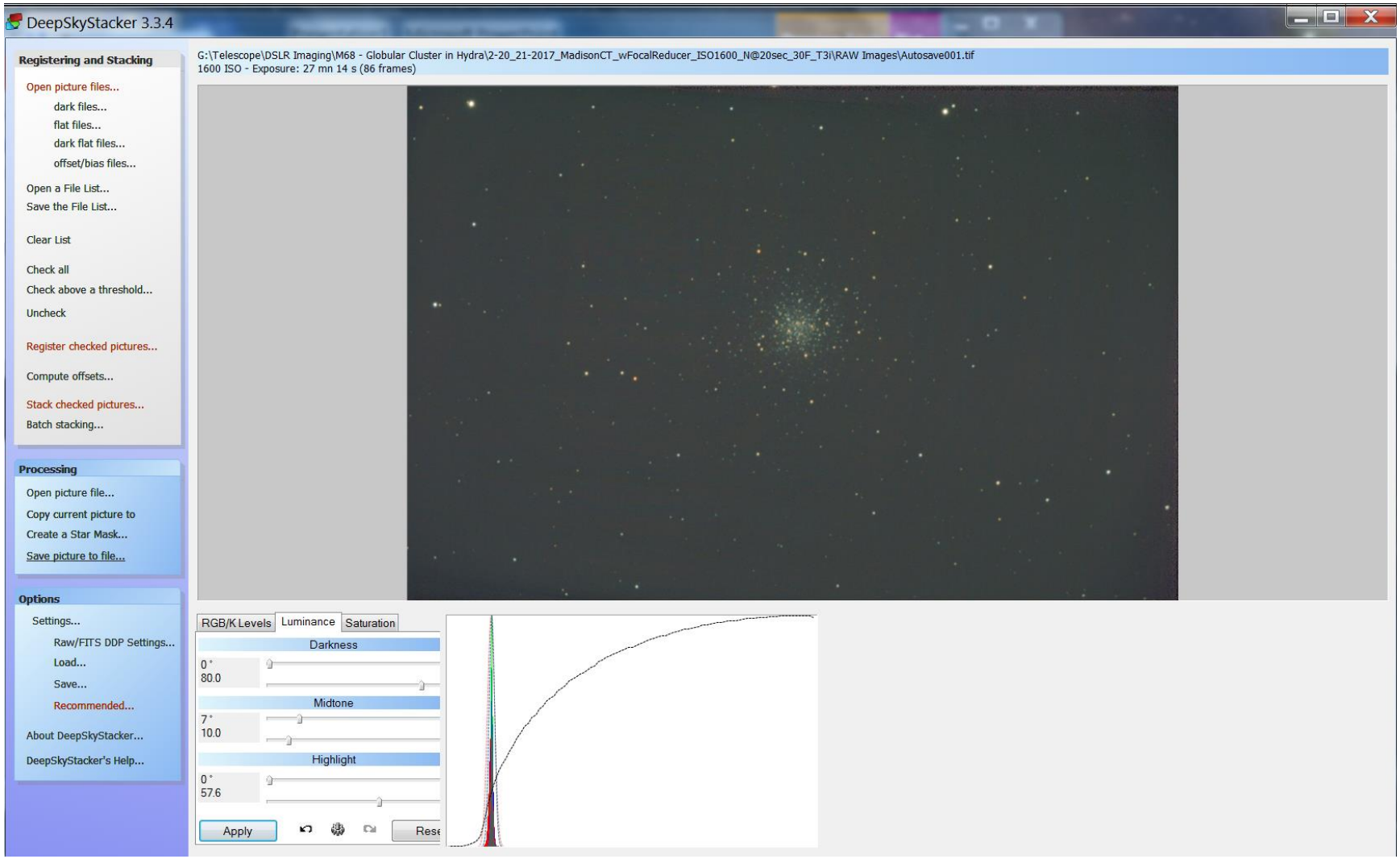

Figure 13: This is the approximate desired appearance of the final curves. All color histograms should roughly coincide with each other. The curve should be steeper where most of the information is (i.e. where the histograms are largest in amplitude) in order to expand the dynamic range where it most counts. As you experiment with the settings, you will develop your own technique and rules of thumb.

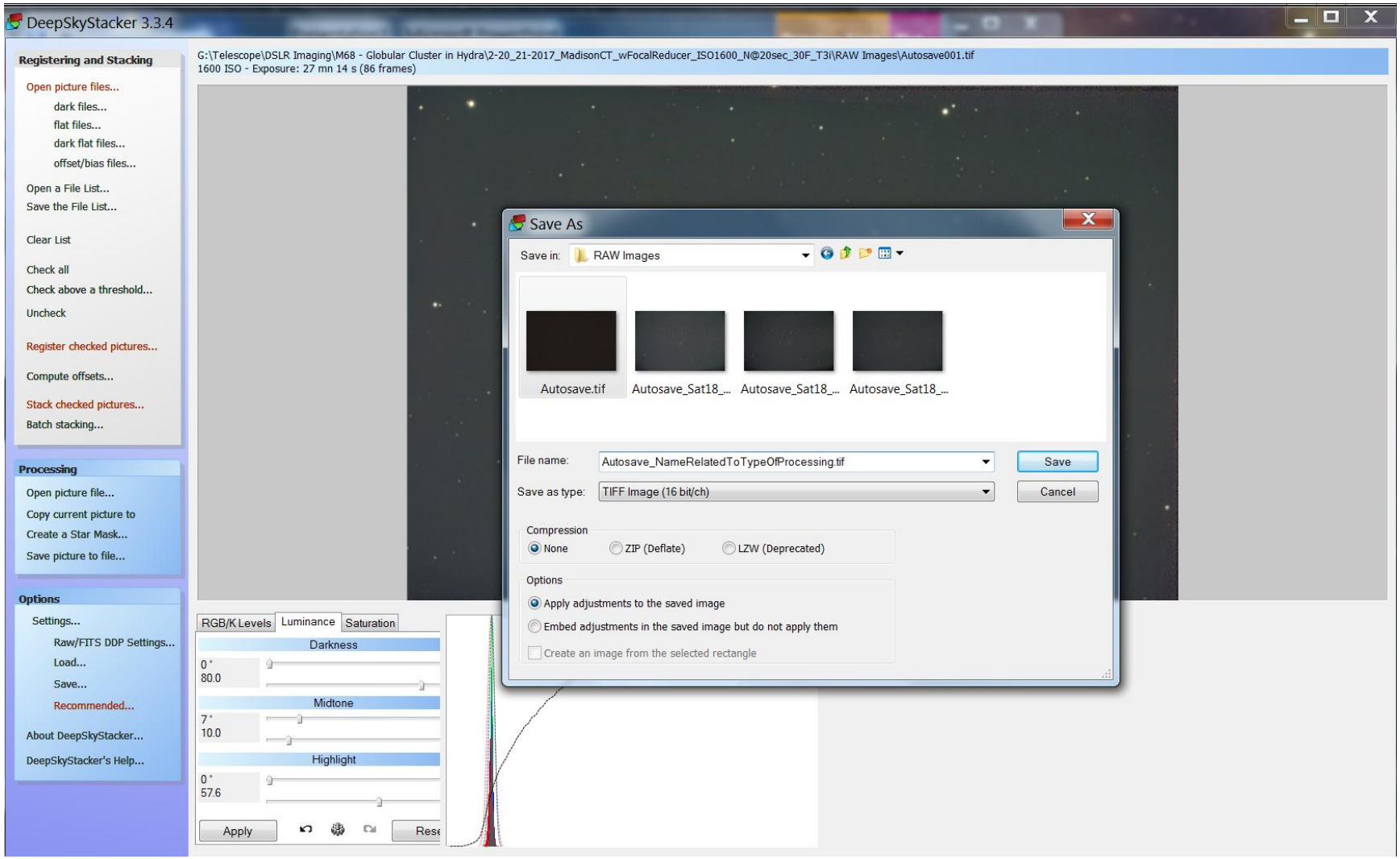

Figure 14: Once an enhancement is completed, click on "Save picture to file…" to open the dialog above. Save the enhanced image using the settings above. Later you can reopen the image in a more advanced image processing environment to further enhance, crop and scale the final image for presentation purposes. Note that each time an image is saved, you can readjust and resave to obtain additional versions for further processing.