PixInsight Workflow Example for OSC Data (derived from Highpoint Scientific Video)

Rev 20230201-2

The workflow outlined in this document was adapted from the PDF file posted in the comments section of the YouTube video linked to below. Even though this workflow has had significant modifications compared to the original, watching at least the first M31 processing example in the video could prove helpful for better understanding some of the processes referenced herein.

https://www.youtube.com/watch?v=V-9MIy0eB6k

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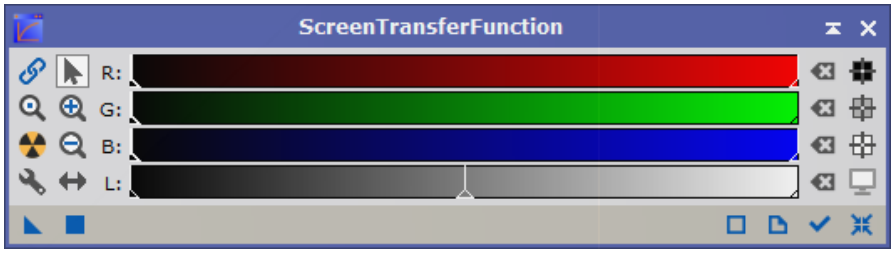
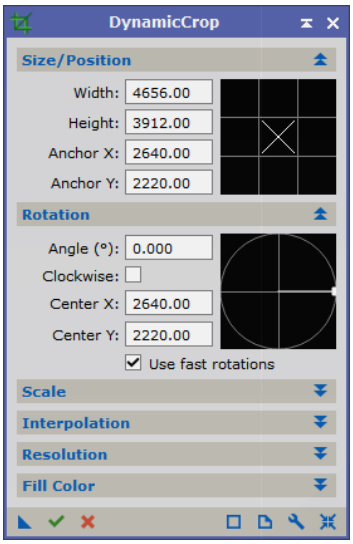
1. Open the saved image. This will usually be a **.fits**, **.tiff**, or **.xisf** file.

2. Apply an auto-stretch to the image (**Ctrl+A** in Windows or **Process > All Processes > ScreenTransferFunction - AutoStretch**) to display a preview of what PixInsight believes to be a good stretch for the image.



Note that the RGB channels are unlinked in this dialog. Some tutorials recommend unlinking them and others don't mention this (including the source Highpoint Scientific tutorial). I've tried it both ways and the results are more neutral in color if the RGB channels are unlinked (…this might depend on the particulars of the file). However, it probably doesn't matter since the color cast is neutralized in steps 4, 5 & 6 below. Regardless, I always unlink the RGB channels since the visual result has been consistently better without a dominant color cast.

3. My recommendation is to use the **AutoCrop** function of the **Weighted Batch Pre-processing (WBPP)** script. If you don't use AutoCrop or have images before that function was available, this step can be used to crop out the edges of the integrated image since not all images will overlap perfectly due to dithering the sub-exposures, misalignment, etc. Cropping can also be used to fix any oblate looking stars in the corners or any other imperfection. **Go to Process > All Processes > DynamicCrop** and crop accordingly.



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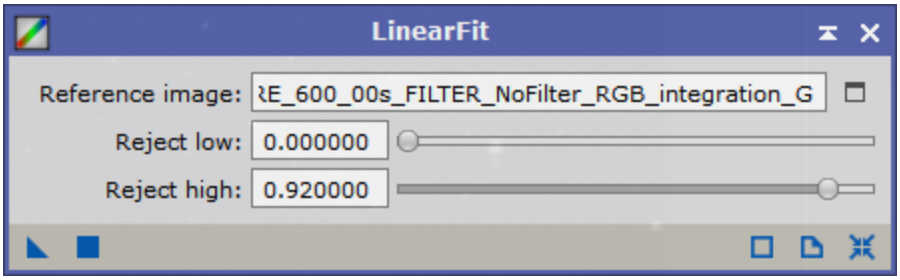
Rev 20230201-2

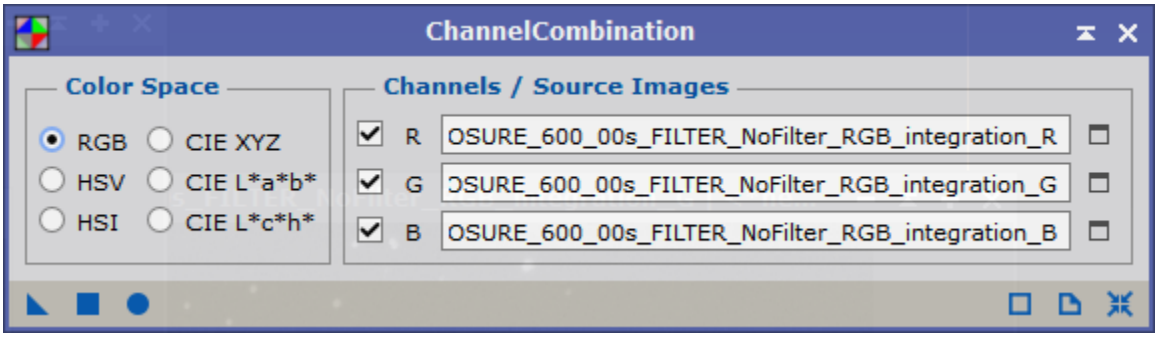
4. Split the RGB channels so that we can get ready to apply a linear fit to fix the green color cast (or some other color cast caused by imbalance of the RGB channels in your One-Shot-Color (OSC) camera). You can find the **Split RGB Channels** tool on the PixInsight application toolbar (usually on the upper-left-hand side).

This is what the icon looks like.

5. Go to **Process > All Processes > LinearFit**. Use the **Green** channel as your reference image, then apply the linear fit to the **Red** and **Blue** channels. From what I've read, **LinearFit** will give you more accurate color in your image compared to offsetting or adjusting the individual R (G or B) channel of the histogram.



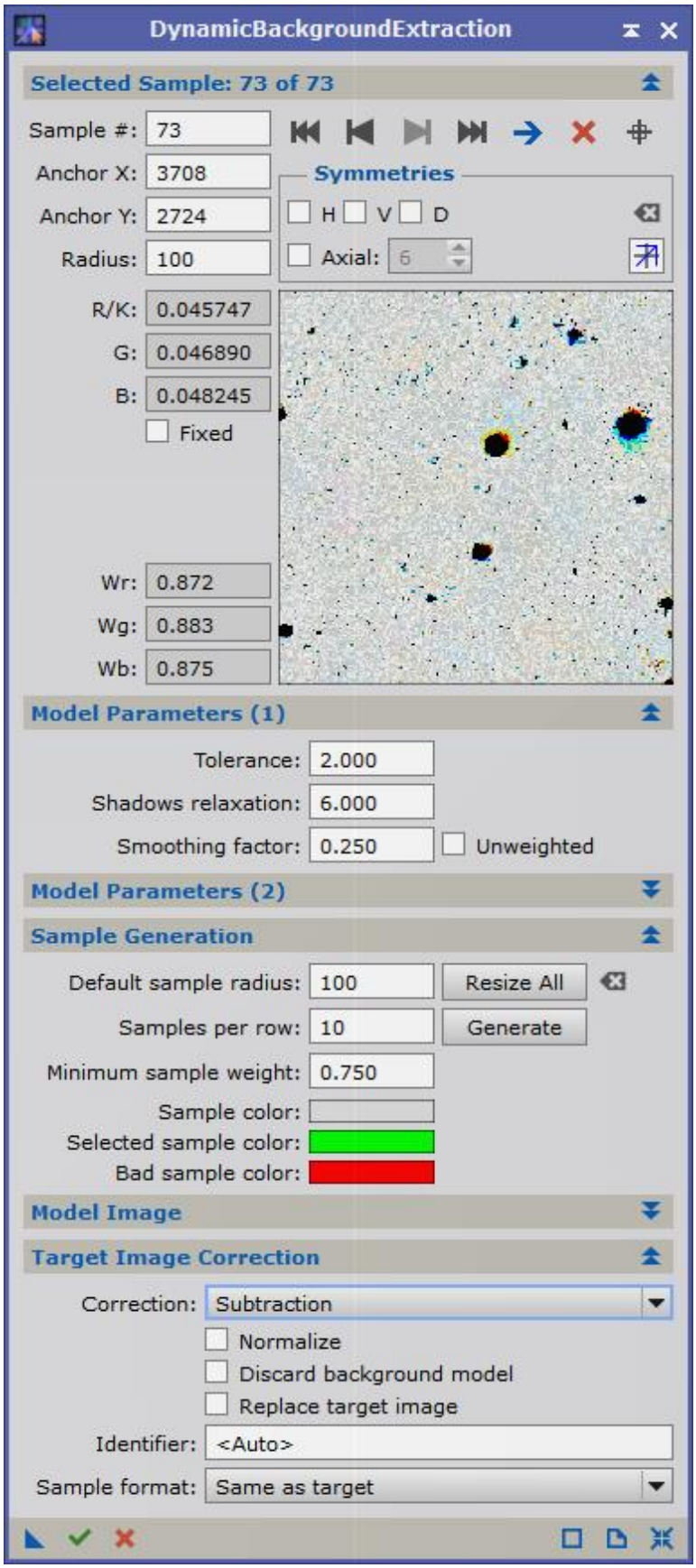
6. Go to **Process > All Processes > ChannelCombination**. Make sure Color Space is set as "**RGB**". Then under Channels / Source Images, apply each of the correct channels that you extracted earlier. Click the circle to "**Apply Global**" or press F6.



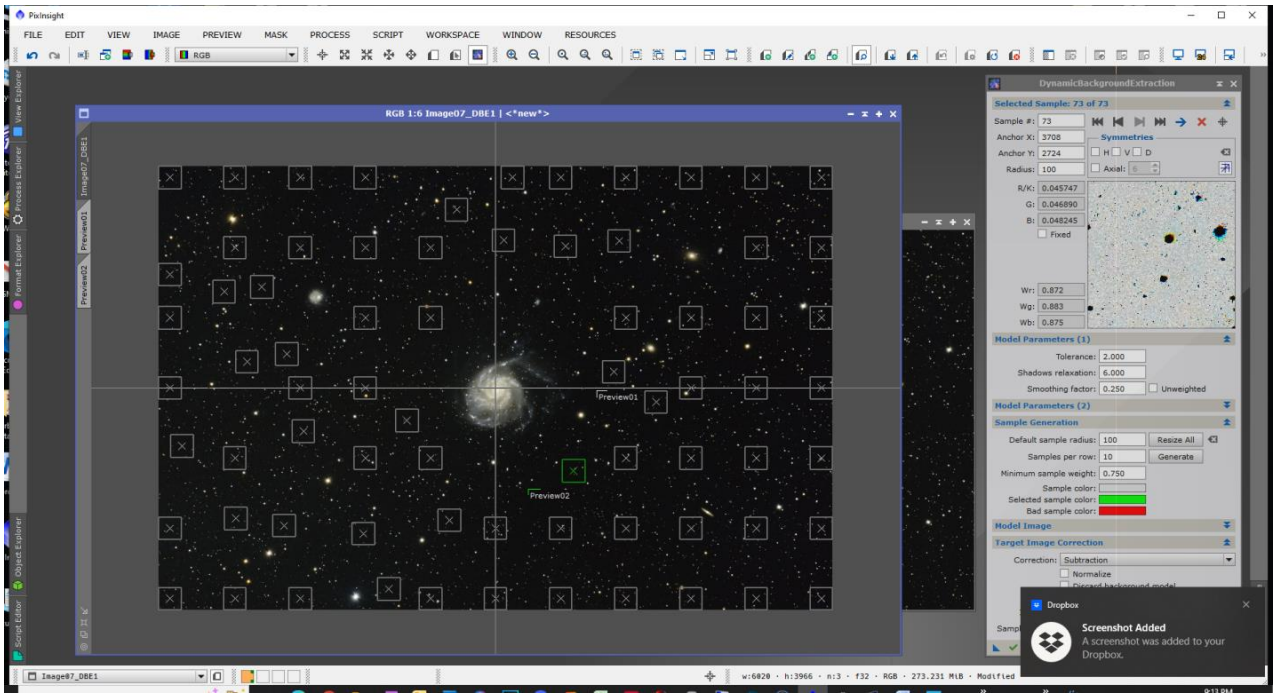
7. Let's get rid of some of the gradients caused by light pollution. Open the **DynamicBackgroundExtraction (DBE)** tool. Under "**Sample Generation**" increase "**Default sample radius**" somewhere around 100 to 150, depending on what size fits better with your image. Add sample points around the image and avoid putting any sample points on any nebulosity, galaxies, or objects of interest. Also, try to avoid having any bright stars contained in any of the sample boxes.

PixInsight Workflow Example for OSC Data (derived from Highpoint Scientific Video)

Rev 20230201-2

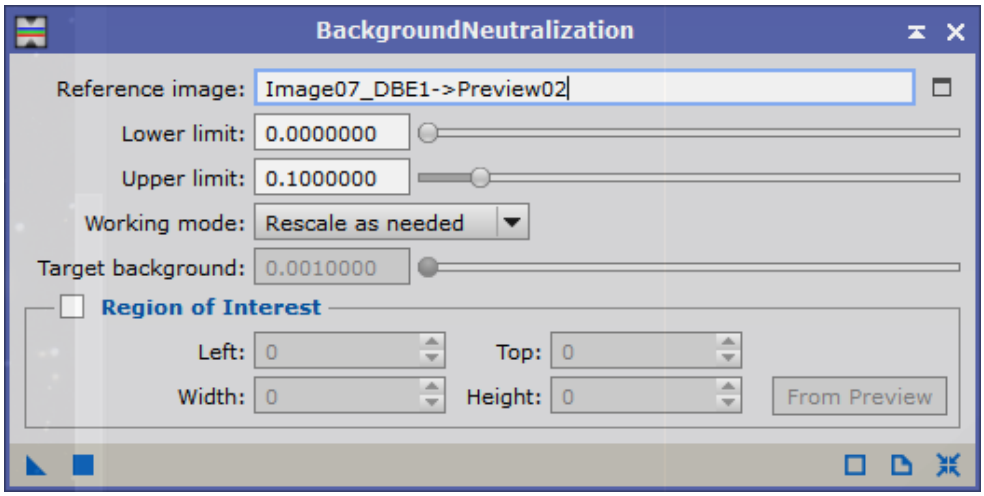


Or, you can generate sample points in an array by pressing "**Generate**" in the **Sample Generation** section.



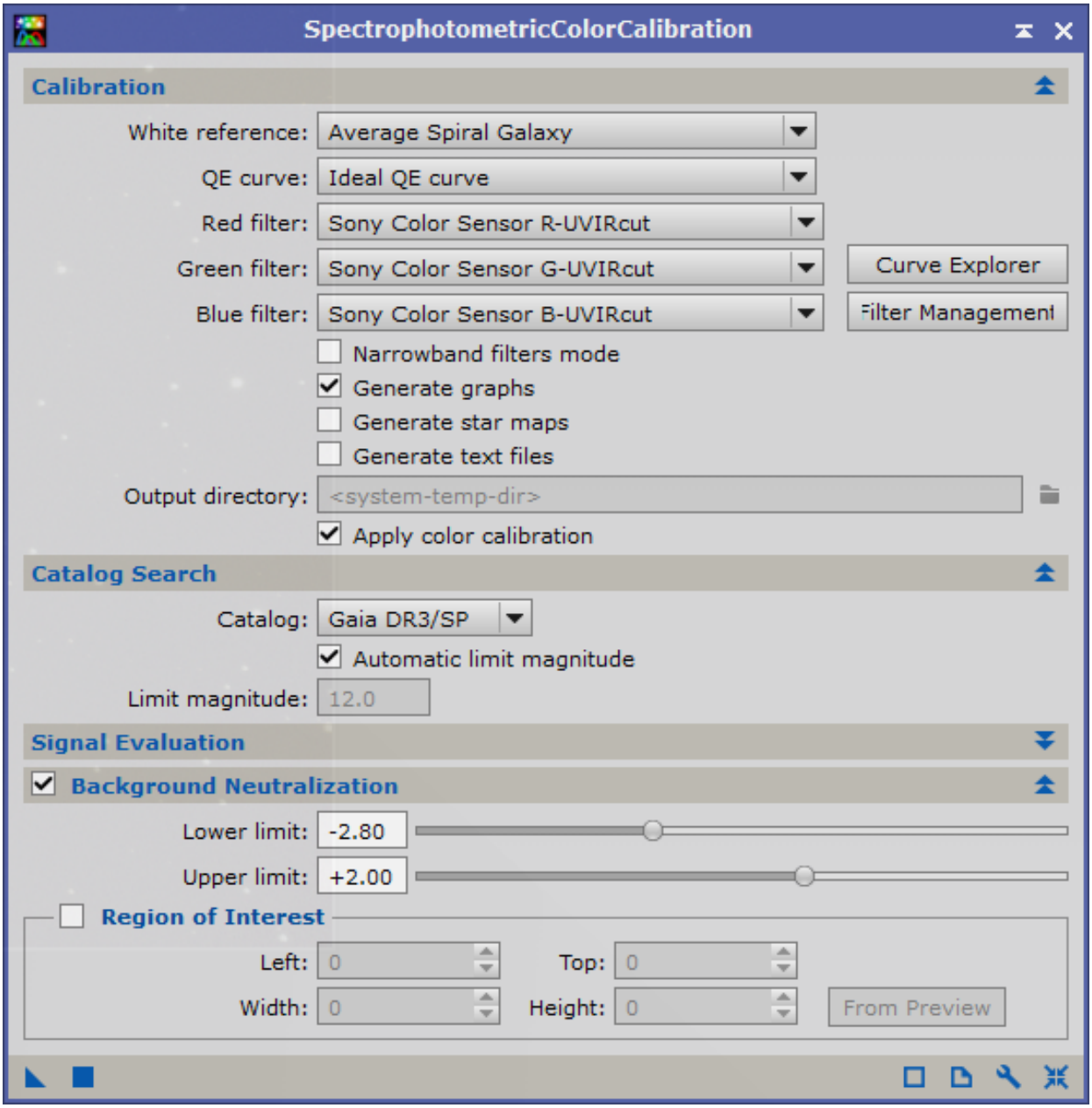
8. In the **DBE** tool, go under "**Target Image Correction**" and change "**Correction**" to "**Subtraction**" assuming your background gradient is caused by typical sources such as light pollution. Click **Execute**. Preview the background gradient & apply an **Autostretch** to the new image to investigate. ***Note:*** *A correction of* ***"Division"*** *would be appropriate for multiplicative gradients such as vignetting.*

9. It might now be beneficial to neutralize the background. This equalizes the red, green, and blue components to yield a neutral gray rendition of the sky background (from PixInsight's manual). Create a new preview (**Alt+N**), find a region of the image with little-to-no-stars, and create a new preview. Select the background preview as the Reference Image and apply the tool to the image. ***Note:*** *I typically do this step but often haven't noticed any difference in how the background looks. This might be a function of how well the DBE process above worked. I might eliminate this step at some point especially since photometric based color calibration is done next.*



10. Now is a good time to perform color calibration on the image. Doing this helps to ensure the colors in your image are more accurately represented.

I've had very good success using the **Spectrophotometric Color Calibration** method introduced into PixInsight recently. Go to **Process > ColorCalibration > SpectrophotometricColorCalibration** to locate this process.



Note: *This method requires that one or more of the Gaia star databases be installed into PixInsight. Information can be found on the web for how to do this. Also, the image must contain the plate solve data for this color calibration process to work. This data should already be included in the file's metadata but might not be if the image was rotated or possibly other geometric transformations done. You can run* ***Script > Image Analysis > ImageSolver*** *on the image to restore the required astrometric data.*

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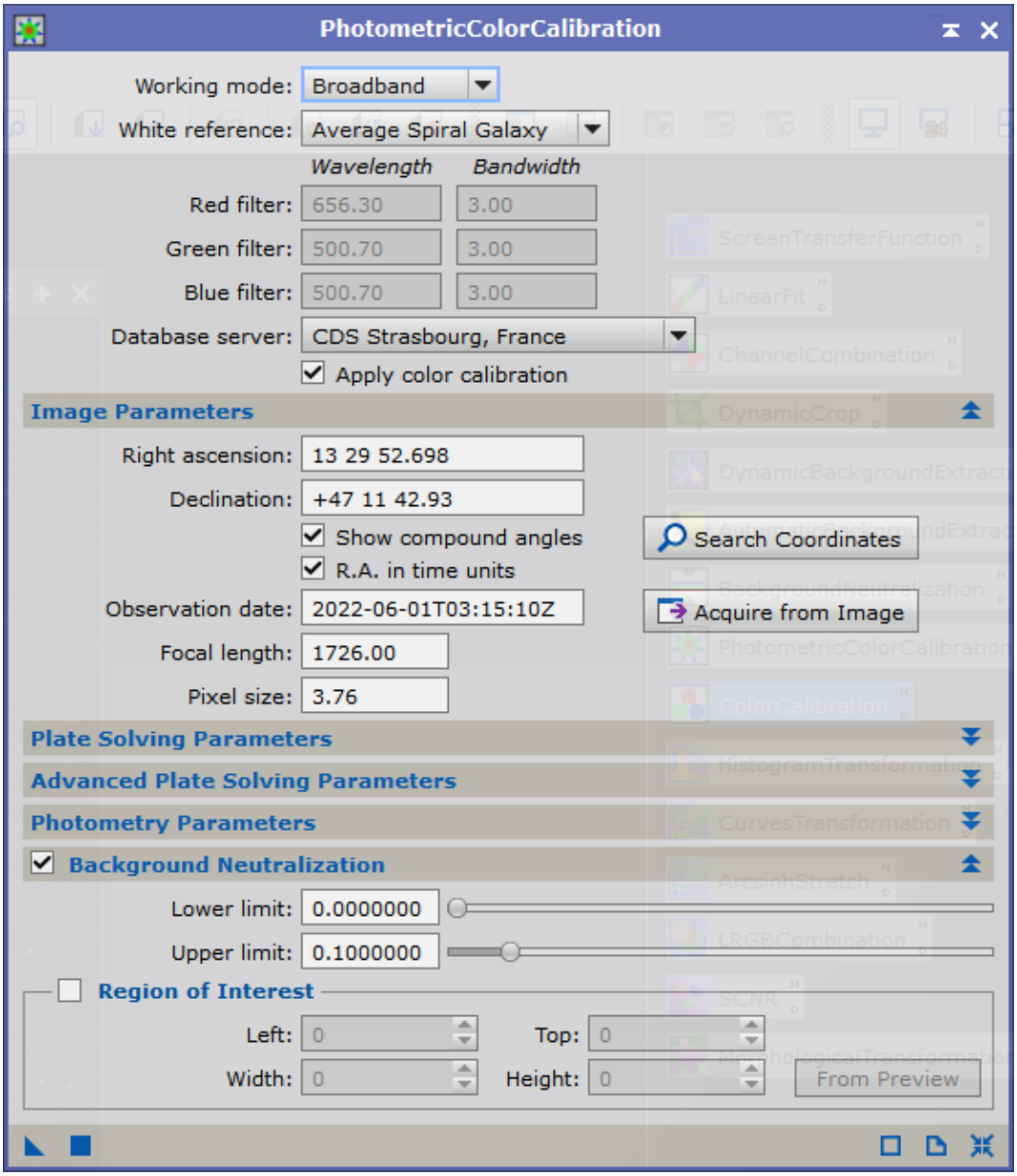
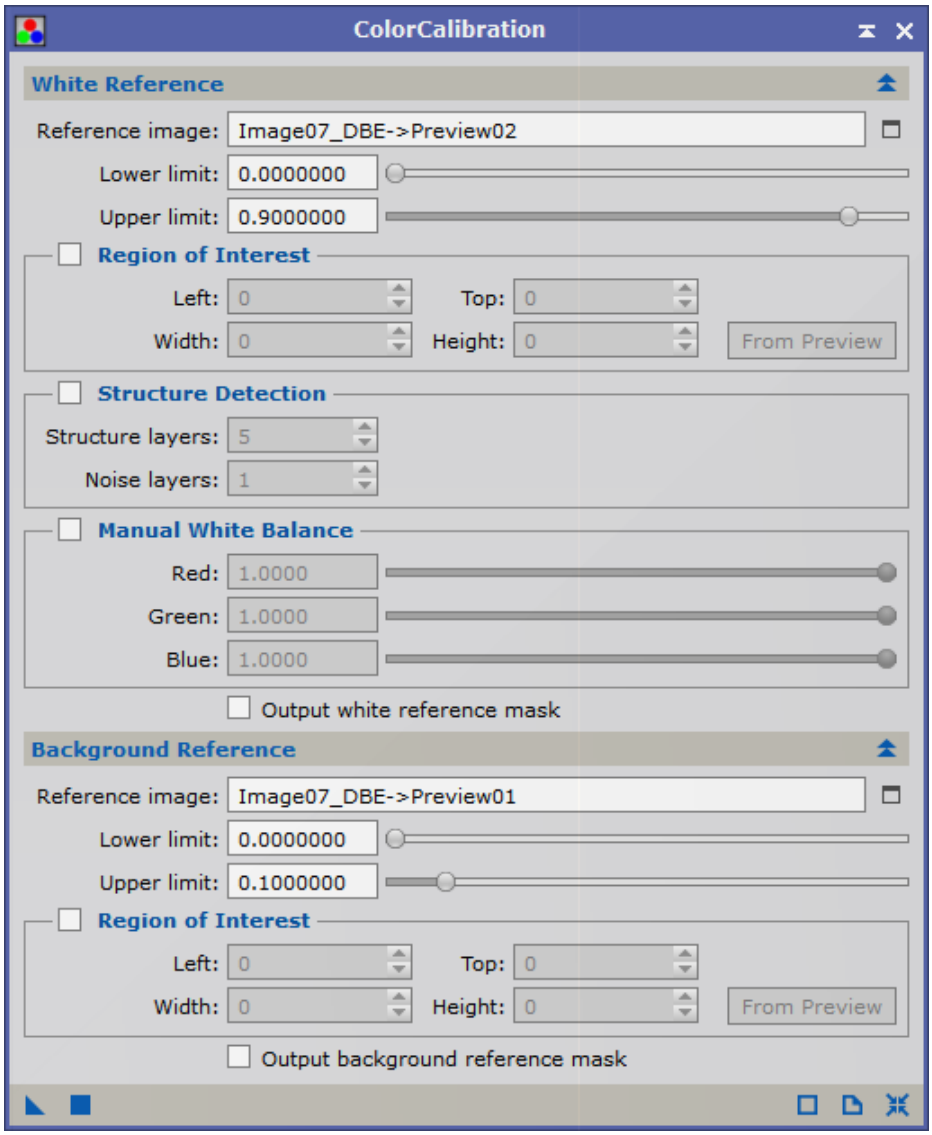
Rev 20230201-2

Another option that worked quite well is the process available before Spectrophotometric Color Calibration was included in PixInsight. Go to **Process > color calibration > PhotometricColorCalibration**.

Note: *This process does not require the Gaia databases or have previous astrometric data included in the image's metadata.*



11. If either **SpectrophotometricColorCalibration** or **PhotometricColorCalibration** aren't viable options for your particular image (e.g. – prominent nebulosity everywhere), color calibration can be done using this alternate method. Go to P**rocess > ColorCalibration > ColorCalibration**. Set the Background reference image to the preview used in the last step, and (optionally) set the white reference as the core of a galaxy or similar white object using another preview. Uncheck **Structure Detection** and apply the tool to the image.



12. Deconvolution can be done at this point now that the data has been calibrated, etc. ***Note:*** *You should always do deconvolution before any noise reduction or stretching is performed on the image.*

    I've been using the **ezDecon** script as part of the **ezProcessingSuite**

    Note: *You can Add the URL below to PixInsight under* ***Resources > Updates > Manage Repositories*** *to install and to keep the EZ Processing Suite Scripts up to date.*

    https://darkarchon.internet-box.ch:8443/

    Note: *The* ***ezProcessingSuite*** *tools (and many other PixInsight functions) require* ***StarNet*** *to be installed. The latest version is* ***StarNet2****, which can be found at the URL below. Pick the appropriate PixInsight Plugin for your OS and follow the installation instructions.*

    https://www.starnetastro.com/download/

13. Now is a good time to reduce noise in the image. I've been using the **ezDenoise** script that's part of the **ezProcessingSuite** referenced in the above step and in the Highpoint Scientific video.

    *Note: The PixInsight processes **TGVDenoise** and **MultiscaleLinearTransformation** can be used to reduce noise instead of or in addition to using **ezDenoise** if desired. I've seen decent results using **TGVDenoise** late in the post-processing operations (i.e. - after stretching) but only have very limited experience with **MultiscaleLinearTransformation** so I cannot comment further on that particular process.*

    ***Note:** The remaining portion of this document deals mostly with non-linear processing and still needs considerable refinement. Therefore, what follows does not have the same level of detail as the earlier content. Part of the reason for this is that the workflow and processes related to non-linear processing are very dependent on the content of the image. In other words, processing a galaxy and processing an image with mostly nebulosity will likely have different workflows.*

14. I now typically do multiple, mild iterations of the **HistogramTransformation** process for the initial image stretch (**Process > IntensityTransformations > HistogramTransformation**).

    ***Hint:** If you're not yet comfortable with doing the **HistogramTransformation** manually, it is very easy to apply the **AutoStretch** parameters determined by the **ScreenTransferFunction** to the **HistogramTransformation** dialog. Go to **Process > IntensityTransformations > ScreenTransferFunction** and **Process > IntensityTransformations > HistogramTransformation**. Select your image in **HistogramTransformation**, then drag the **New Instance** arrow from the **ScreenTransferFunction** dialog over to the bottom bar of the **HistogramTransformation** dialog. This will apply the stretch to your histogram. Then press **Apply** (F5 or the blue square) on the bottom of the **HistogramTransformation** dialog. Turn off the preview, and the image will be now stretched (or non-linear) and ready for further processing.*

    ***Note:** If I'm processing an image that is mostly faint nebulosity, I'll often remove the stars from the image using **StarNet2** and process the starless image with further stretching type transformations at this point. I'll then recombine the stars only and starless image later on using **PixelMath**.*

15. The histogram stretch can then be followed by an iteration or two of the **CurvesTransformation** process (**Process > IntensityTransformations > CurvesTransformation**).

    The **ArcsinhStretch** tool can be used instead of (or in addition to) **CurvesTransformation** depending on the particulars of the image being processed. **ArcsinhStrech** allows you to adjusting the black point and the stretch factor as separate controls. The goal here is to increase the contrast in your image and to have the background less grey. Apply to your image. ***Note:** Selecting the preview function (open circle icon) will allow the tool to estimate the black point. You can also turn on the highlighting of the saturated blacks to help with the final adjustment of the black point.*

16. Now let's increase the saturation. Extract the Luminance channel from the image, then pull up the **LRGBCombinationTool.** Apply the Luminance to the "L" channel only (i.e. – uncheck the R, G, and B channels). Under Transfer Functions, decrease the saturation slider to your preference (maybe in the 0.400 range or so). Apply to your image.

17. The image may now look too green. You can reduce some of that using the **SCNR** tool. Open **SCNR** tool, keep selected "**Color to remove**" as **Green** and protection method "A**verage Neutral**." Change the amount to whatever you desire (…0.8 is a reasonable starting point). Apply to the image.

18. If you want to reduce the star size you can use the **ezStarReduction** tool, select your image, and click "Create Star Mask for reduction". You will need **StarNet++** installed for this step.

I hope this document helps with your PixInsight image processing. Please keep in mind that it is a work in progress so feel free to edit it to your liking based on your needs and personal workflow.