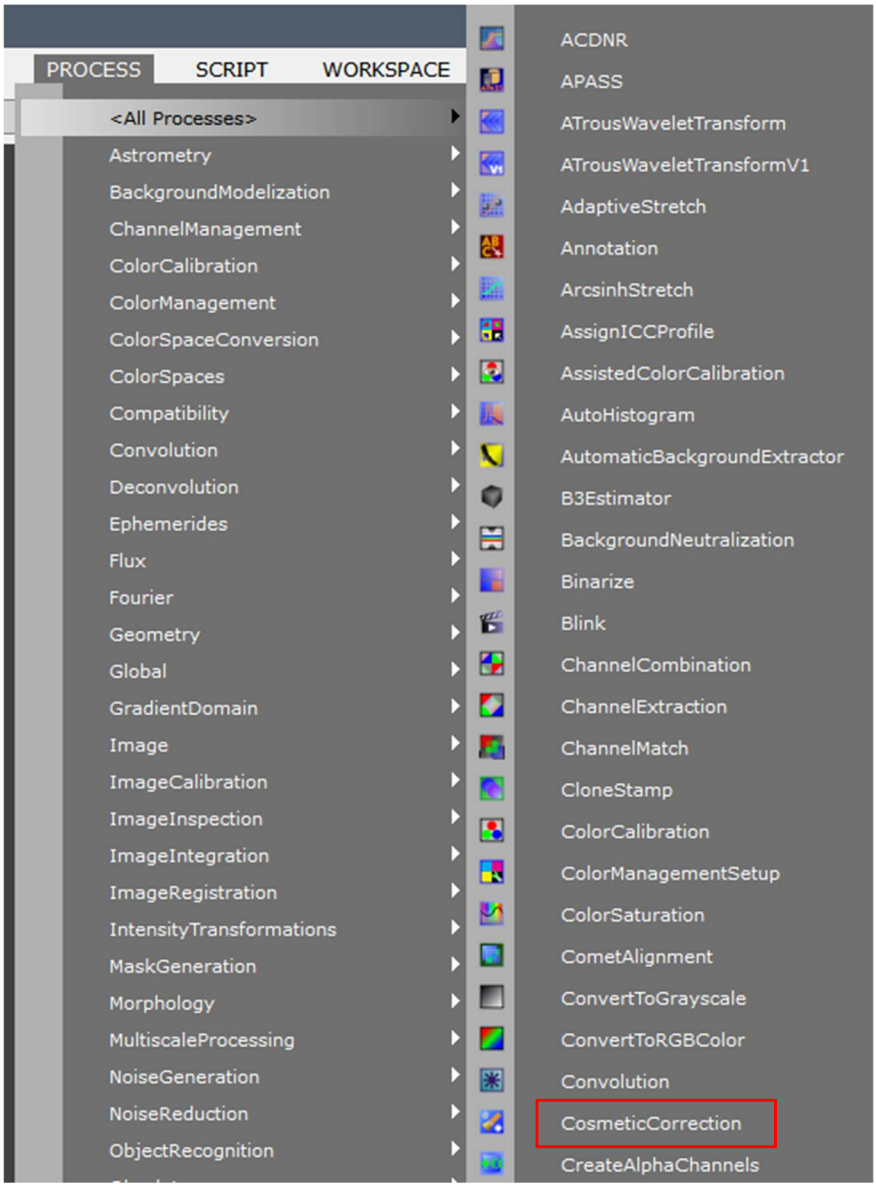
Stacking with PixInsight (version 1.8)

Despite different series of shots from one region, from different nights and possibly not quite at the same angle, the PixInsight program can process and stack these images.

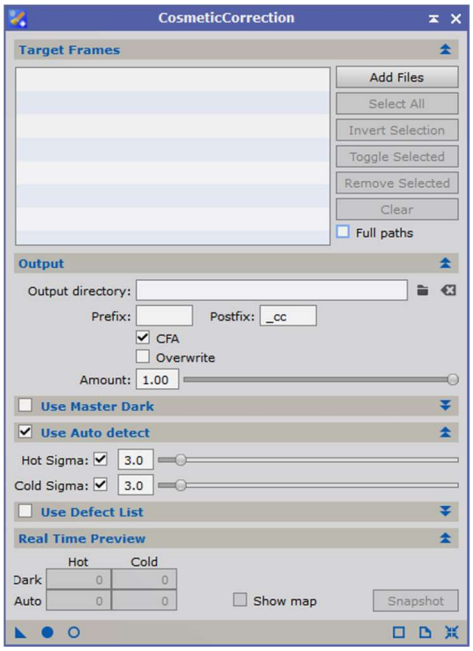
In PixInsight there is a weighted stacking (version 2.2.0), where good images are weighted more than the weaker ones.

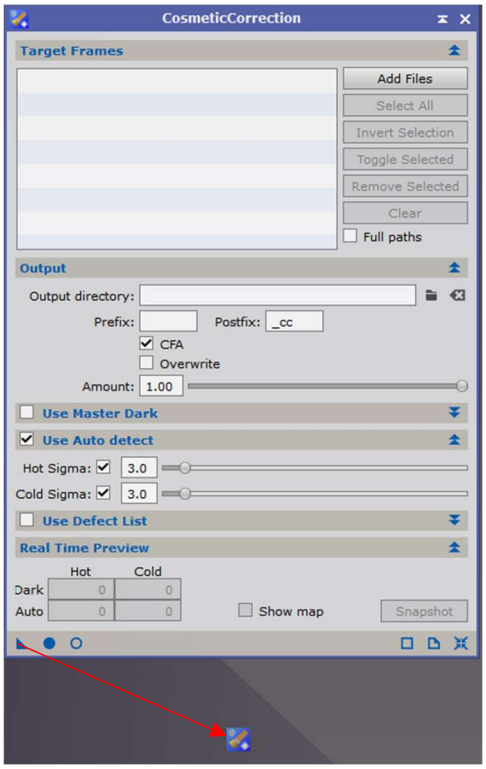
In this script (Weighted Stacking) the 'Process' 'Cosmetic Correction' is applied to the lights. With this process, so-called hot and cold pixels can be detected and eliminated.

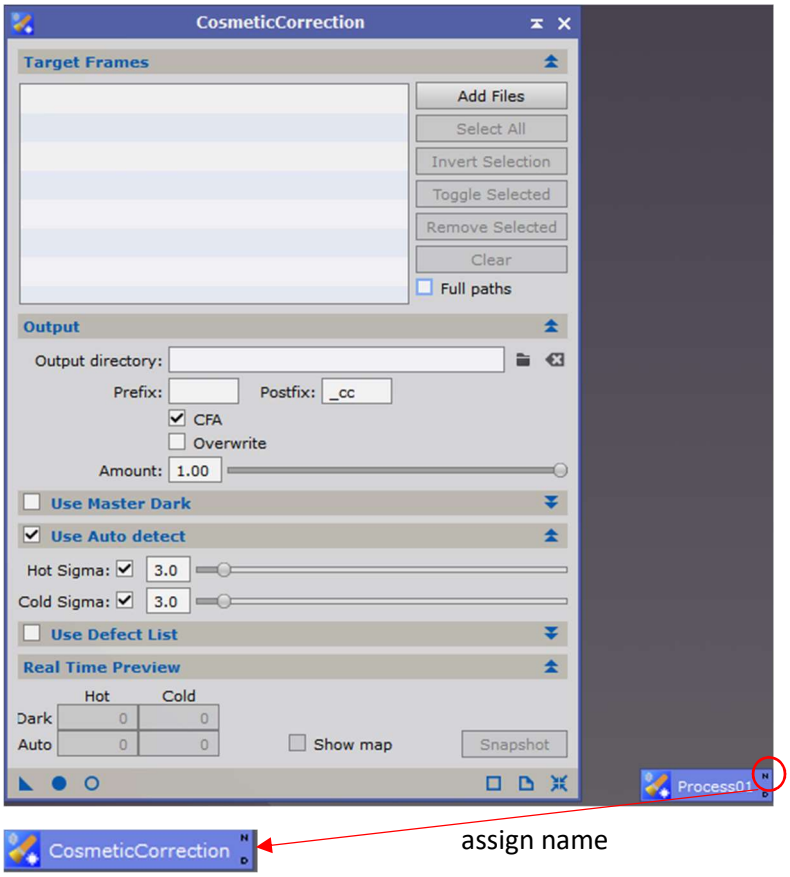
In order for this process to be selected in the script, it must be started beforehand and dragged onto the workspace using the blue triangle with the selected settings.



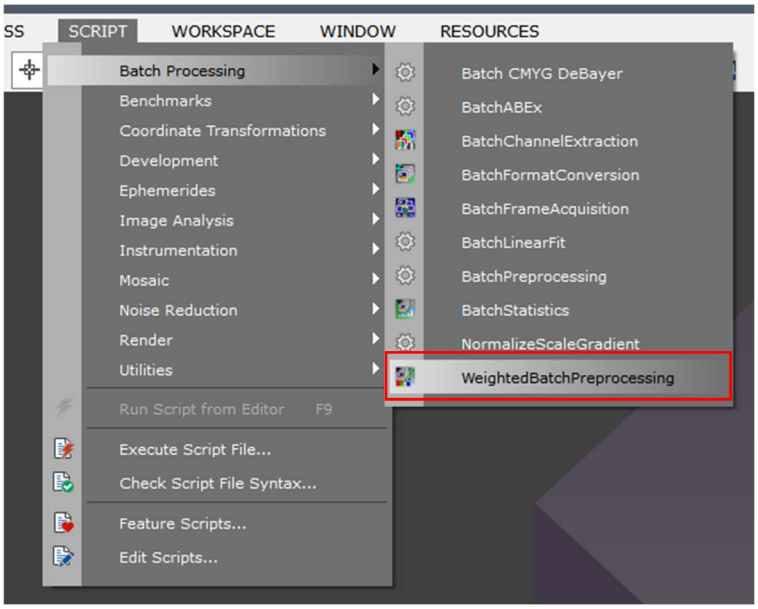
The initial values can be retained:

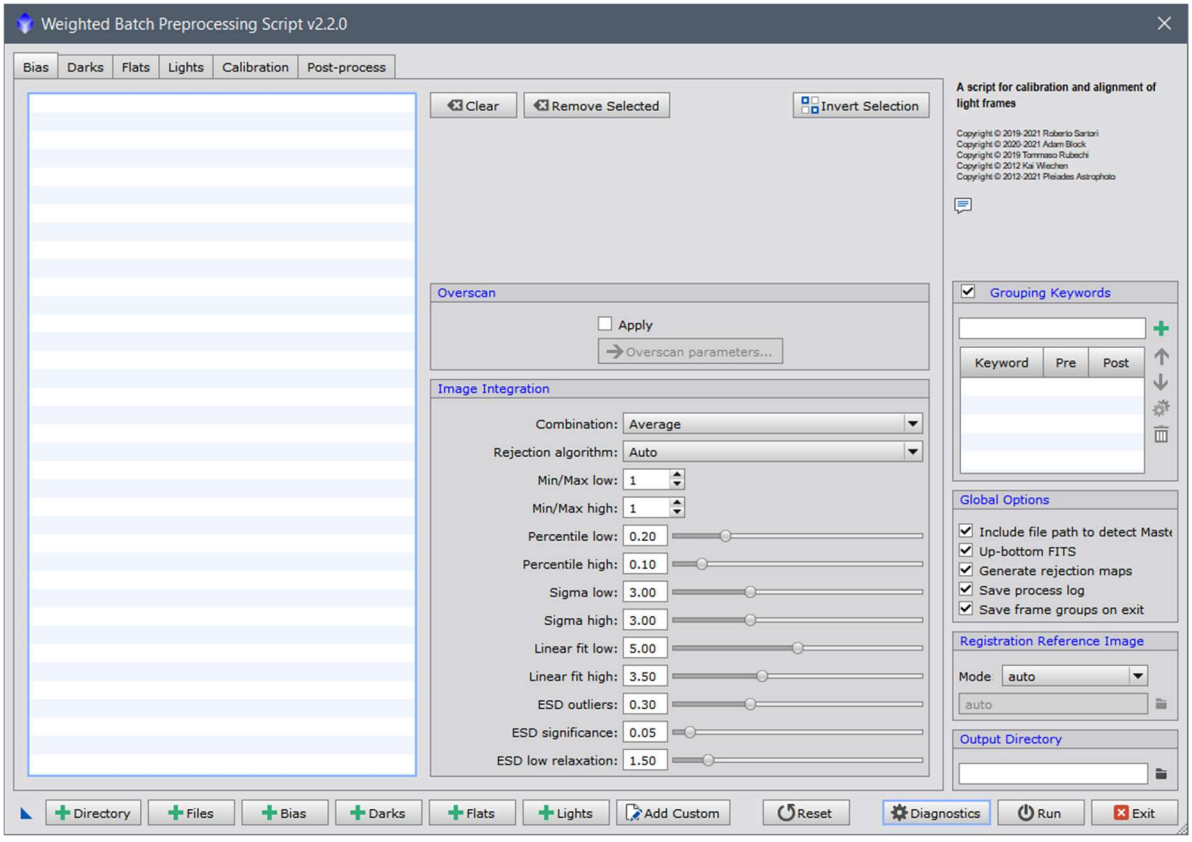






The window can now be closed and the following script will be opened for the stacking process.



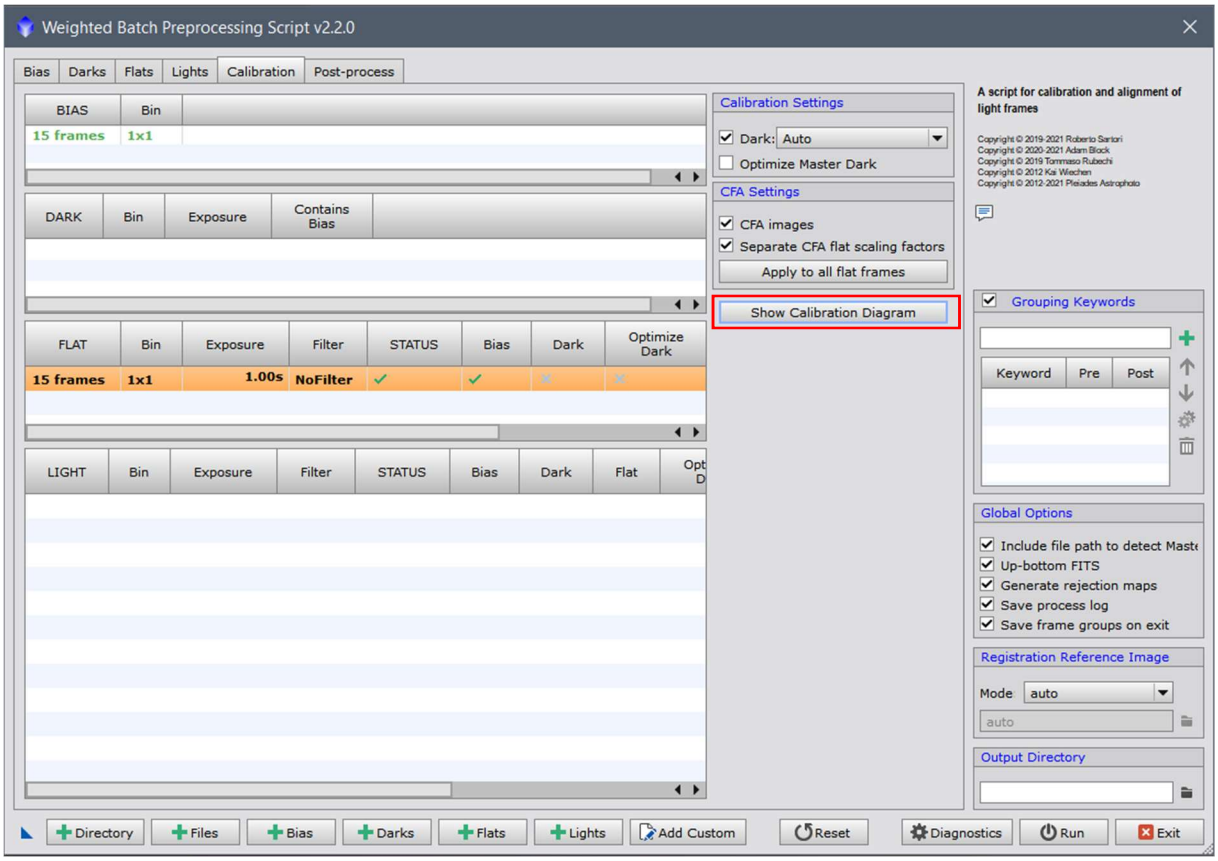


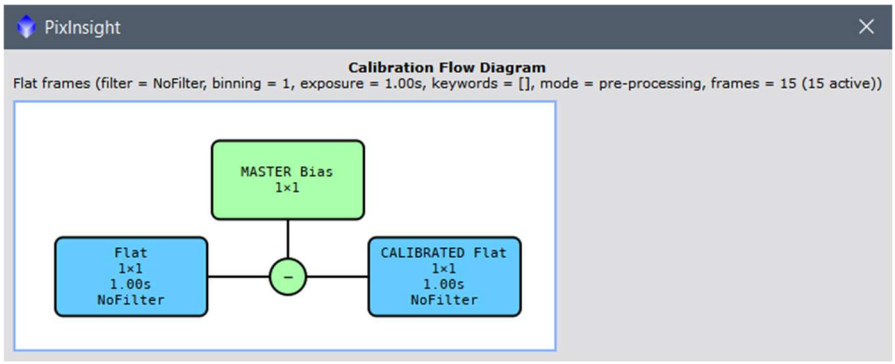
If all images (flat-, darkflat-, dark-, bias- and light-frames (darkflat-frames are handled separately)) are in one folder, this folder can be accessed via the Directory button, and PixInsight automatically assigns the images to the image types. The prerequisite here is that the image names contain specific designations for them, which are usually already generated in many capture programs. However, any data type can also be uploaded as usual via the buttons in the corresponding tab.

If, as in this example, there are different light-frames (due to different exposure times) and correspondingly different dark- and flat-frames, the 'Add Custom' button is used.

Handling darkflat-frames:

If bias-frames were created, they are used to calibrate the flat-frames. This process can be displayed in the 'Calibration' tab.





Bias- and darkflat-frames perform the same function. They are used to calibrate the flat-frames and are subtracted from them. If flat-frames are exposed for a very short time, it is sufficient to calibrate them with bias-frames. Sometimes, however, a flat-frame has to be exposed for a longer time (e.g. when using narrowband filters) and thus has a certain amount of dark current. Darkflat-frames have the same exposure time as the flat-frames and in this case would remove the offset error and the dark current.

But there is no Darkflat-frames tab in PixInsight's batch process. So where are these placed?

The darkflat-frames are stored in the 'Darks' tab. As the exposure times of the dark-frames usually differ considerably from those of the darkflat-frames, PixInsight can assign them precisely via the exposure time. The darkflat-frames are assigned to the flat-frames and the dark-frames to the corresponding light-frames.

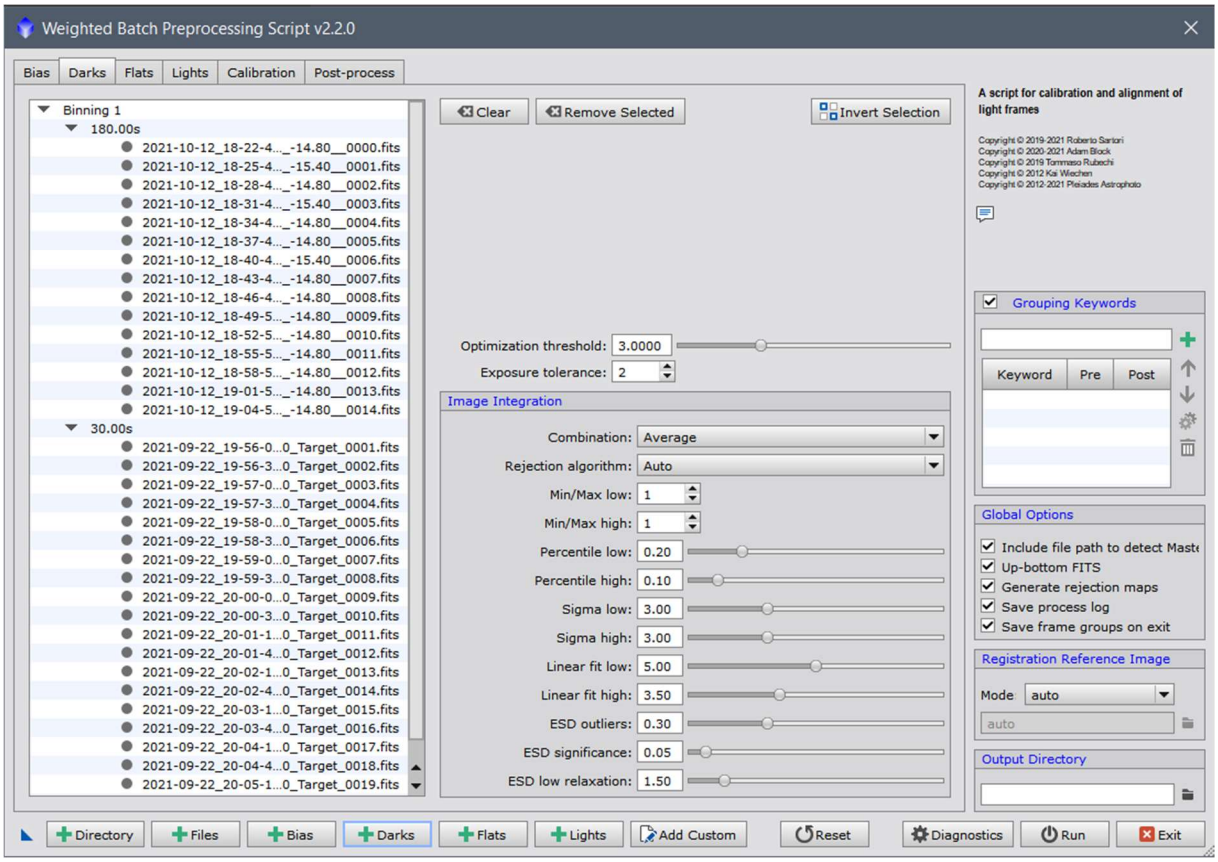
Bias-frames are no longer needed when using darkflat-frames.

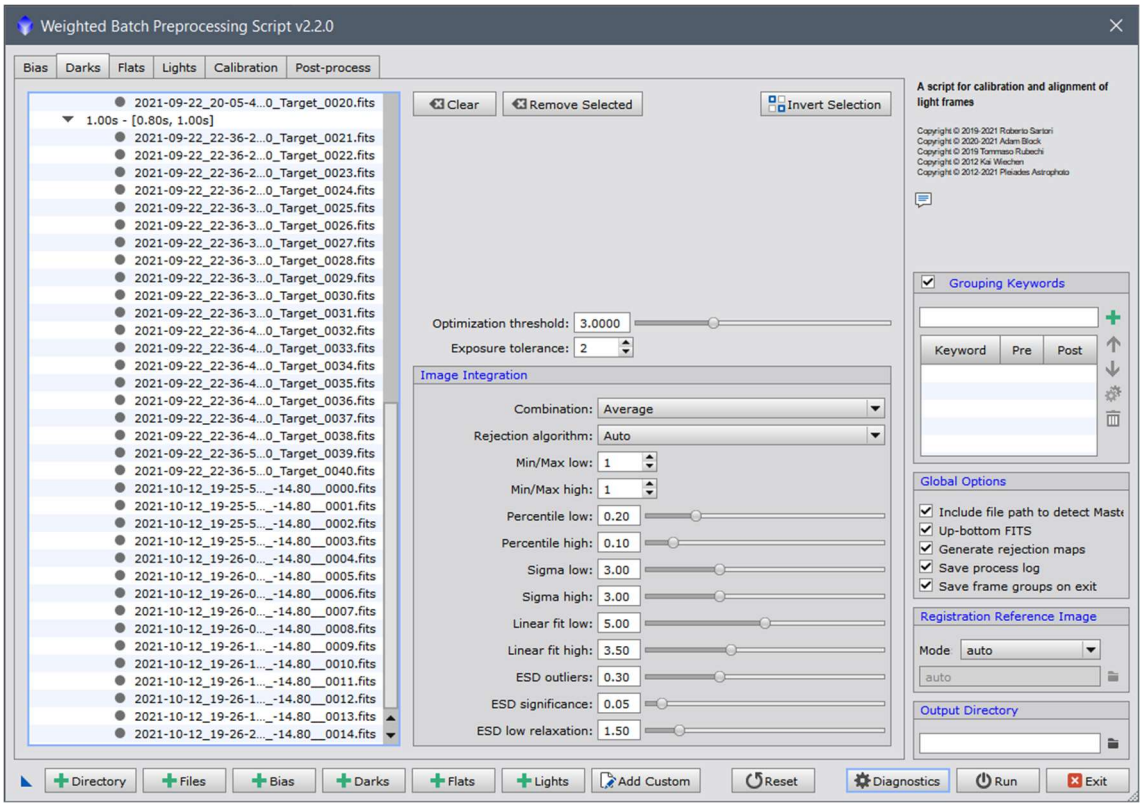
The upper tabs:

1) Bias: are not used because of darkflat-frames in this example → remains empty

2) Darks:

Here all dark-frames and darkflat-frames are uploaded via the button '+Darks'. PixInsight detects the exposure time and groups them automatically into subfolders.



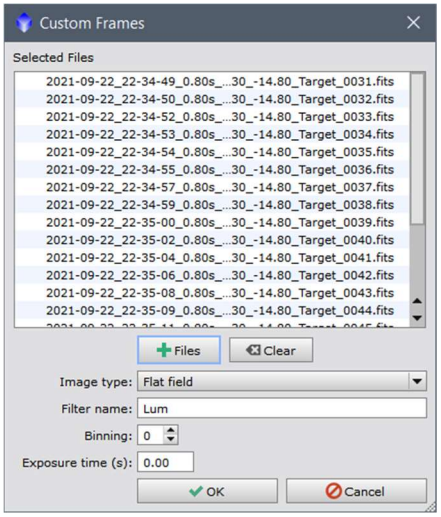


The exposure times of the darkflat-frames for the wideband and narrowband images are so close to each other that PixInsight does not distinguish them separately.

The settings on the right can remain on 'Auto' for the moment. PixInsight will then independently select the most suitable calculation algorithm for the frames.

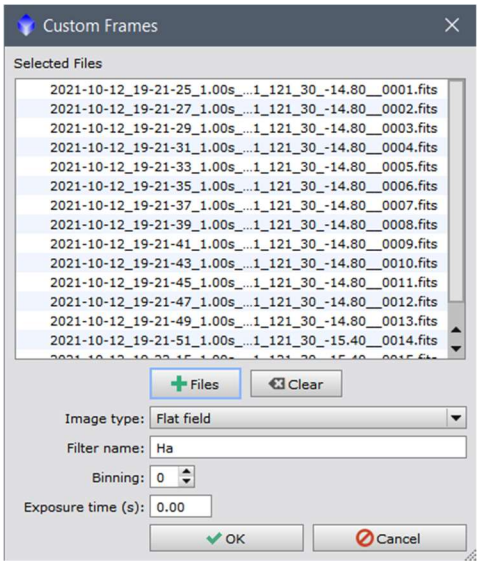
3) Flats:

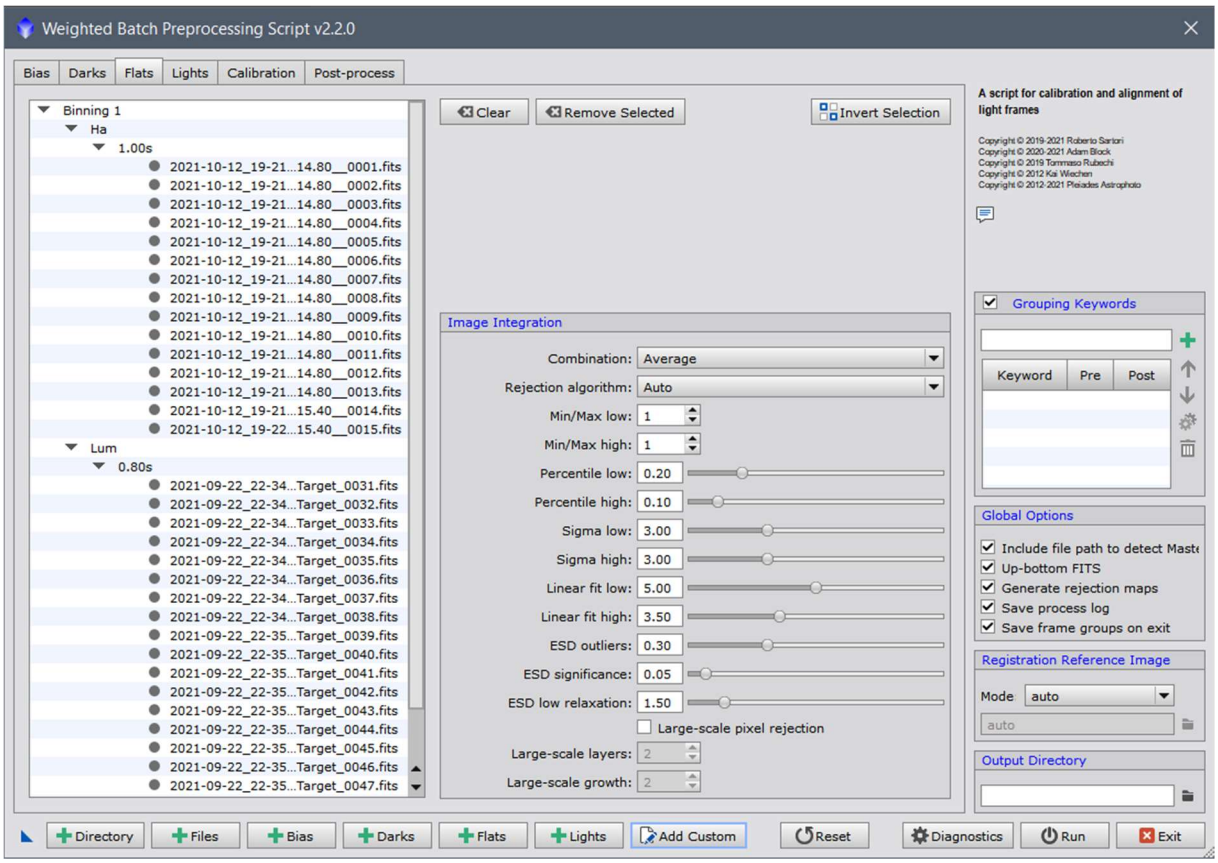
The flat-frames must later be assigned to the corresponding light-frames (broadband, narrowband, or ...). Therefore click on the button 'Add Costum', select the image type and assign a name (here 'Lum' for luminance or broadband).



'Binning' and 'Exposure time' can be left at 0 for automatic detection.

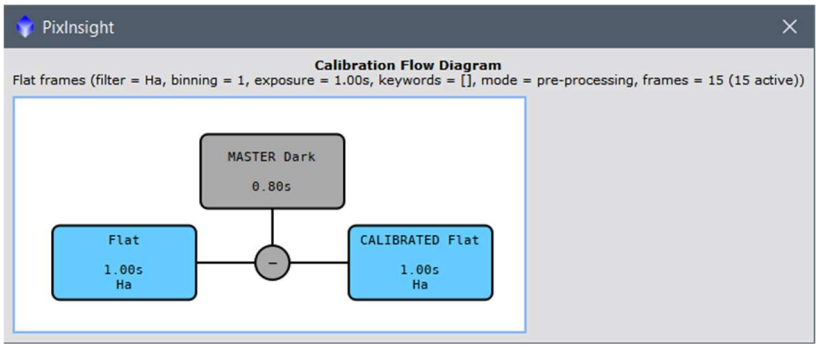
The same is repeated for the narrowband images. **Note: Since this is a color camera, a CLS filter was used here symbolically as Ha. A pure Ha filter would not make sense for color cameras due to the Bayer matrix.**

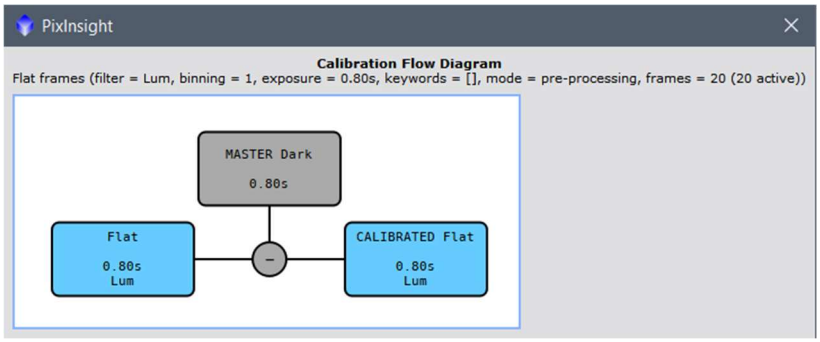




The settings of the right sides can remain set to 'Auto' again.

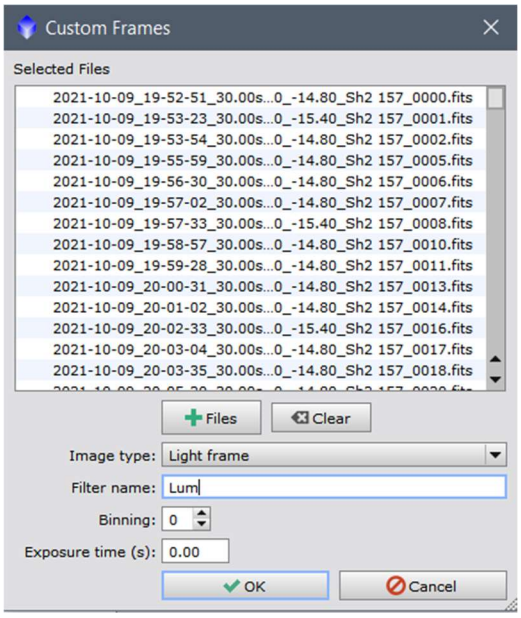
A visualization in the 'Calibration' tab here shows that darkflat-frames and no bias-frames are used, and that all darkflat-frames (0.8 s and 1 s) have been combined into one group (0.8 s).

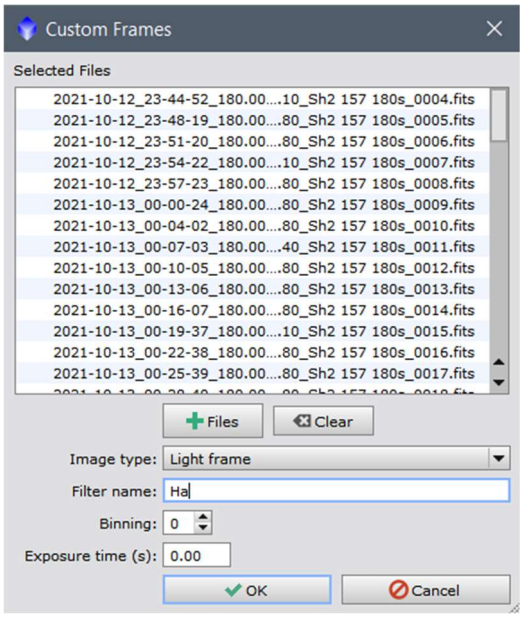


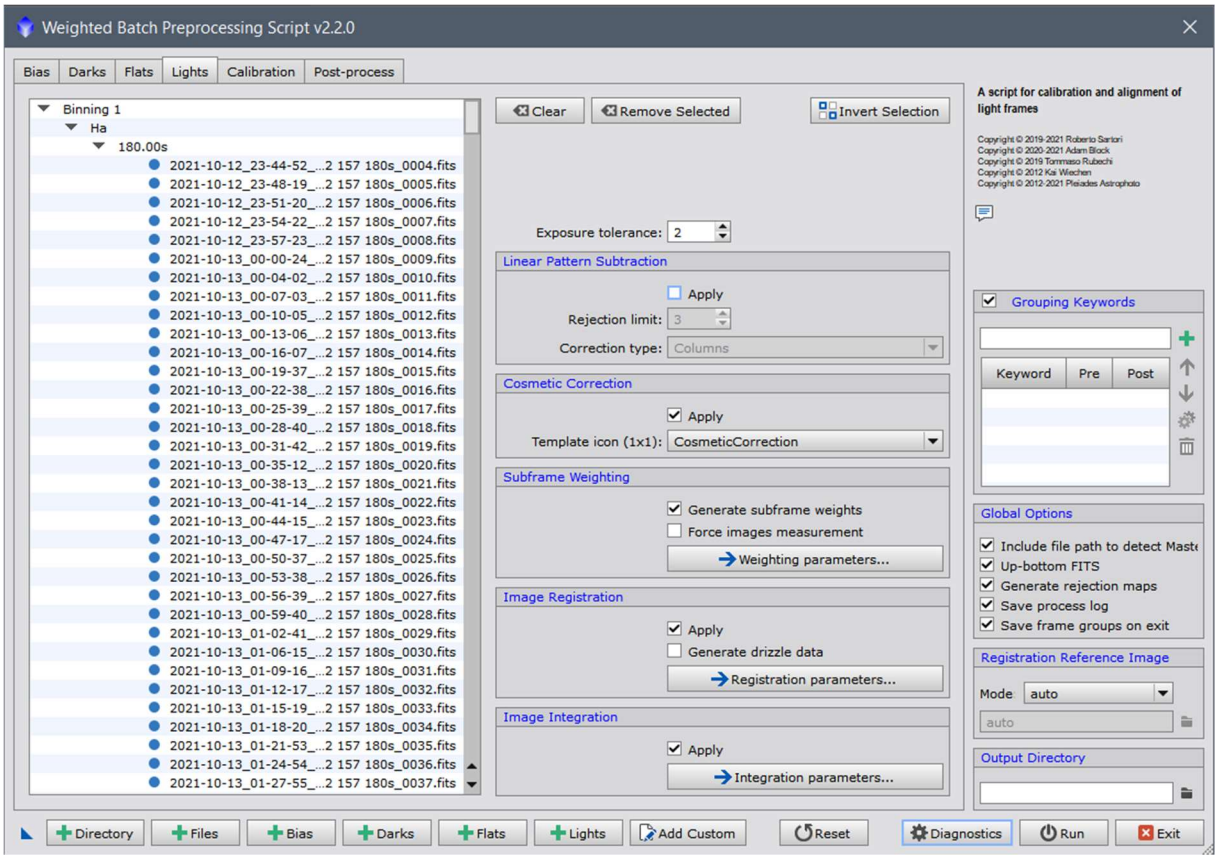


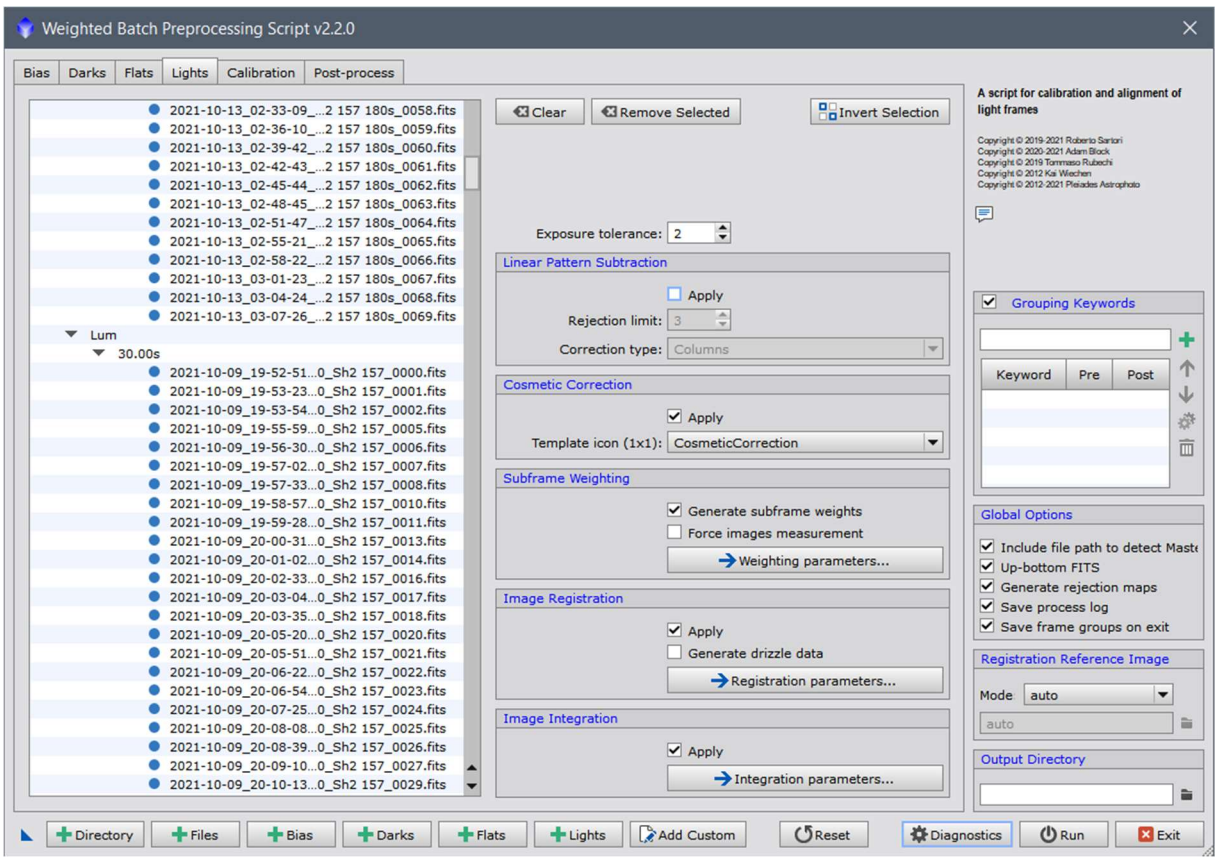
4) Lights:

The light-frames now have to be added via 'Add Custum' like the flat-frames and need the same grouping name as the flat-frames, so PixInsight can link them together.






Weighted Batch Preprocessing Script v2.2.0
Bias
Darks
Flats
Lights
Calibration
Post-process
Binning 1
Ha
180.00s
2021-10-12_23-44-52_...2 157 180s_0004.fits
2021-10-12_23-48-19_...2 157 180s_0005.fits
2021-10-12_23-51-20_...2 157 180s_0006.fits
2021-10-12_23-54-22_...2 157 180s_0007.fits
2021-10-12_23-57-23_...2 157 180s_0008.fits
2021-10-13_00-00-24_...2 157 180s_0009.fits
2021-10-13_00-04-02_...2 157 180s_0010.fits
2021-10-13_00-07-03_...2 157 180s_0011.fits
2021-10-13_00-10-05_...2 157 180s_0012.fits
2021-10-13_00-13-06_...2 157 180s_0013.fits
2021-10-13_00-16-07_...2 157 180s_0014.fits
2021-10-13_00-19-37_...2 157 180s_0015.fits
2021-10-13_00-22-38_...2 157 180s_0016.fits
2021-10-13_00-25-39_...2 157 180s_0017.fits
2021-10-13_00-28-40_...2 157 180s_0018.fits
2021-10-13_00-31-42_...2 157 180s_0019.fits
2021-10-13_00-35-12_...2 157 180s_0020.fits
2021-10-13_00-38-13_...2 157 180s_0021.fits
2021-10-13_00-41-14_...2 157 180s_0022.fits
2021-10-13_00-44-15_...2 157 180s_0023.fits
2021-10-13_00-47-17_...2 157 180s_0024.fits
2021-10-13_00-50-37_...2 157 180s_0025.fits
2021-10-13_00-53-38_...2 157 180s_0026.fits
2021-10-13_00-56-39_...2 157 180s_0027.fits
2021-10-13_00-59-40_...2 157 180s_0028.fits
2021-10-13_01-02-41_...2 157 180s_0029.fits
2021-10-13_01-06-15_...2 157 180s_0030.fits
2021-10-13_01-09-16_...2 157 180s_0031.fits
2021-10-13_01-12-17_...2 157 180s_0032.fits
2021-10-13_01-15-19_...2 157 180s_0033.fits
2021-10-13_01-18-20_...2 157 180s_0034.fits
2021-10-13_01-21-53_...2 157 180s_0035.fits
2021-10-13_01-24-54_...2 157 180s_0036.fits
2021-10-13_01-27-55_...2 157 180s_0037.fits
Clear
Remove Selected
Invert Selection
A script for calibration and alignment of light frames
Copyright © 2019-2021 Roberto Sartori
Copyright © 2020-2021 Adam Block
Copyright © 2019 Tommaso Rubechi
Copyright © 2012 Kai Wiechen
Copyright © 2012-2021 Pleiades Astrophoto
Exposure tolerance: 2
Linear Pattern Subtraction
Apply
Rejection limit: 3
Correction type: Columns
Cosmetic Correction
Apply
Template icon (1x1): CosmeticCorrection
Subframe Weighting
Generate subframe weights
Force images measurement
Weighting parameters...
Image Registration
Apply
Generate drizzle data
Registration parameters...
Image Integration
Apply
Integration parameters...
Grouping Keywords
Keyword
Pre
Post
Global Options
Include file path to detect Maste
Up-bottom FITS
Generate rejection maps
Save process log
Save frame groups on exit
Registration Reference Image
Mode auto
auto
Output Directory
Directory
Files
Bias
Darks
Flats
Lights
Add Custom
Reset
Diagnostics
Run
Exit


Weighted Batch Preprocessing Script v2.2.0
Bias
Darks
Flats
Lights
Calibration
Post-process
2021-10-13_02-33-09_...2 157 180s_0058.fits
2021-10-13_02-36-10_...2 157 180s_0059.fits
2021-10-13_02-39-42_...2 157 180s_0060.fits
2021-10-13_02-42-43_...2 157 180s_0061.fits
2021-10-13_02-45-44_...2 157 180s_0062.fits
2021-10-13_02-48-45_...2 157 180s_0063.fits
2021-10-13_02-51-47_...2 157 180s_0064.fits
2021-10-13_02-55-21_...2 157 180s_0065.fits
2021-10-13_02-58-22_...2 157 180s_0066.fits
2021-10-13_03-01-23_...2 157 180s_0067.fits
2021-10-13_03-04-24_...2 157 180s_0068.fits
2021-10-13_03-07-26_...2 157 180s_0069.fits
Lum
30.00s
2021-10-09_19-52-51...0_Sh2 157_0000.fits
2021-10-09_19-53-23...0_Sh2 157_0001.fits
2021-10-09_19-53-54...0_Sh2 157_0002.fits
2021-10-09_19-55-59...0_Sh2 157_0005.fits
2021-10-09_19-56-30...0_Sh2 157_0006.fits
2021-10-09_19-57-02...0_Sh2 157_0007.fits
2021-10-09_19-57-33...0_Sh2 157_0008.fits
2021-10-09_19-58-57...0_Sh2 157_0010.fits
2021-10-09_19-59-28...0_Sh2 157_0011.fits
2021-10-09_20-00-31...0_Sh2 157_0013.fits
2021-10-09_20-01-02...0_Sh2 157_0014.fits
2021-10-09_20-02-33...0_Sh2 157_0016.fits
2021-10-09_20-03-04...0_Sh2 157_0017.fits
2021-10-09_20-03-35...0_Sh2 157_0018.fits
2021-10-09_20-05-20...0_Sh2 157_0020.fits
2021-10-09_20-05-51...0_Sh2 157_0021.fits
2021-10-09_20-06-22...0_Sh2 157_0022.fits
2021-10-09_20-06-54...0_Sh2 157_0023.fits
2021-10-09_20-07-25...0_Sh2 157_0024.fits
2021-10-09_20-08-08...0_Sh2 157_0025.fits
2021-10-09_20-08-39...0_Sh2 157_0026.fits
2021-10-09_20-09-10...0_Sh2 157_0027.fits
2021-10-09_20-10-13...0_Sh2 157_0029.fits
Clear
Remove Selected
Invert Selection
A script for calibration and alignment of light frames
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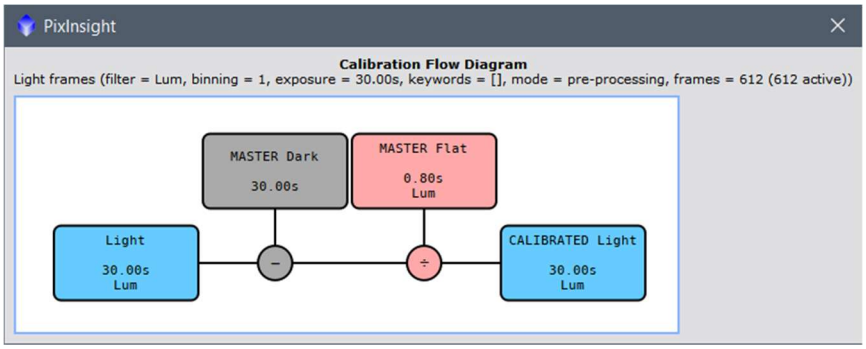
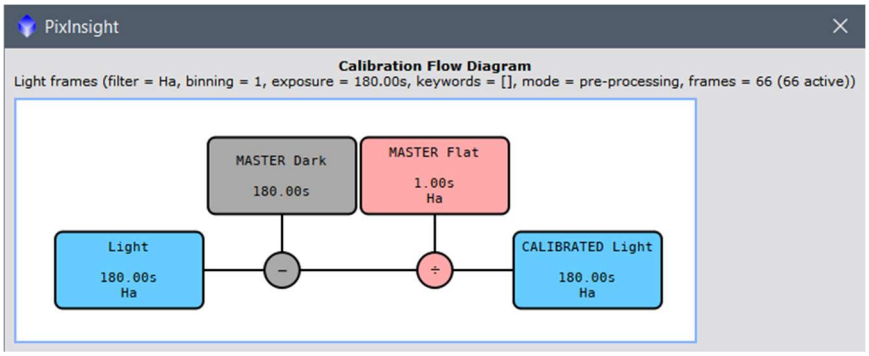
Copyright © 2020-2021 Adam Block
Copyright © 2019 Tommaso Rubechi
Copyright © 2012 Kai Wiechen
Copyright © 2012-2021 Pleiades Astrophoto
Exposure tolerance: 2
Linear Pattern Subtraction
Apply
Rejection limit: 3
Correction type: Columns
Cosmetic Correction
Apply
Template icon (1x1): CosmeticCorrection
Subframe Weighting
Generate subframe weights
Force images measurement
Weighting parameters...
Image Registration
Apply
Generate drizzle data
Registration parameters...
Image Integration
Apply
Integration parameters...
Grouping Keywords
Keyword
Pre
Post
Global Options
Include file path to detect Maste
Up-bottom FITS
Generate rejection maps
Save process log
Save frame groups on exit
Registration Reference Image
Mode auto
auto
Output Directory
Directory
Files
Bias
Darks
Flats
Lights
Add Custom
Reset
Diagnostics
Run
Exit

Again, the 'Calibration' tab shows how the light-frames are calibrated.





Settings of the right menu points

Linear Pattern Substraction

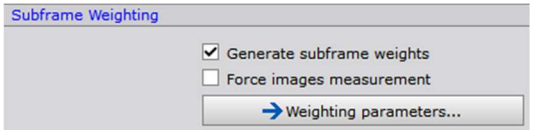
Here row or column errors of a CCD chip are calculated out. Since a CMOS chip was used here, no check mark is set. *(https://pixinsight.com/tutorials/LDD-LPS/)*

Cosmetic Correction

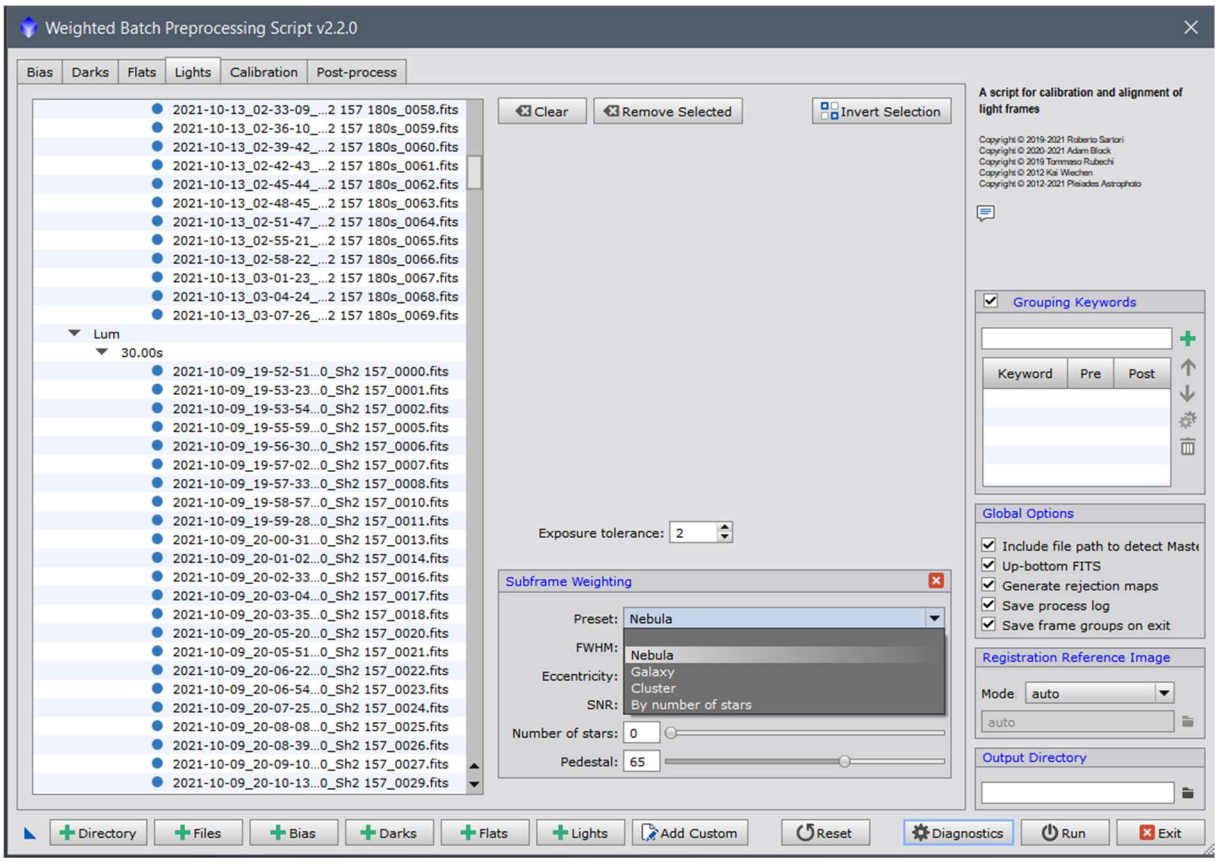
This process detects hot and dead pixels (cold pixels). Here the check mark is set and the name created at the beginning is selected.

Subframe Weighting

Here you define the criteria according to which the lights are to be weighted. Images with a good signal-to-noise ratio get a stronger weighting. Since this is the main purpose of the script, this item is activated.



The signal-to-noise ratio differs depending on the object type. The object type is therefore still defined here under 'Weighting Parameters'.



If some images are too bright (e.g. due to the moon, or it was not yet dark enough), these will produce a high signal-to-noise ratio. But bad images should not be weighted so much. For this, however, the Number of Stars slider can be shifted, since fewer stars are visible in the bright images.

In this example, a nebula is processed. When capturing, it was relatively dark and no moon in the sky.

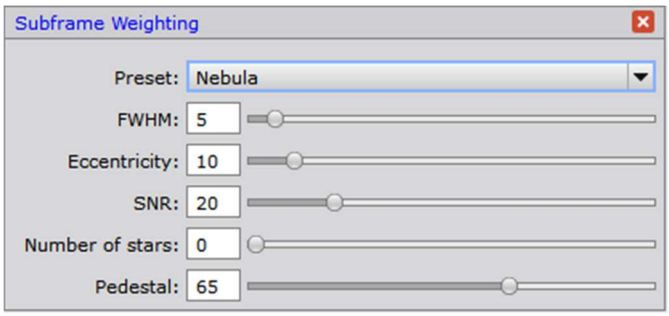
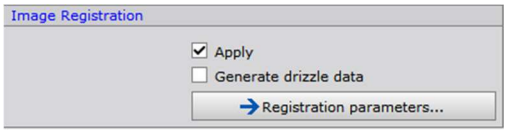


Image Registration

During this process, the images are aligned with each other and aligned to a common reference.
(https://pixinsight.com/doc/tools/StarAlignment/StarAlignment.html)

A check mark is therefore set.

If images are undersampled by large pixels or if the image is to be enlarged later, a check mark can be set for 'Generate Drizzle data'. Drizzle is not necessary for this example.



The default settings for the 'Image Registration' parameters can be used:

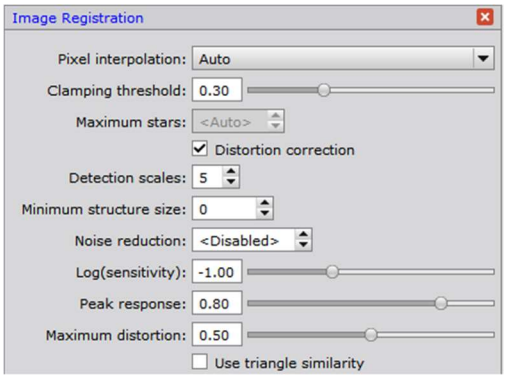
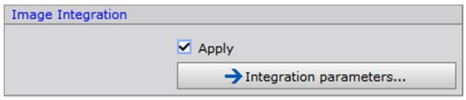


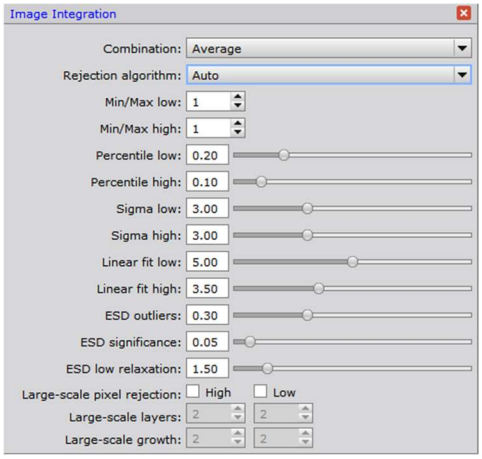
Image Integration

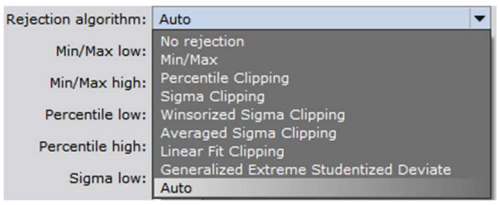
This process combines the prepared images to improve the signal-to-noise ratio and suppress interfering image structures pixel by pixel.
(https://pixinsight.com/doc/tools/ImageIntegration/ImageIntegration.html)

A check mark is set here as well.

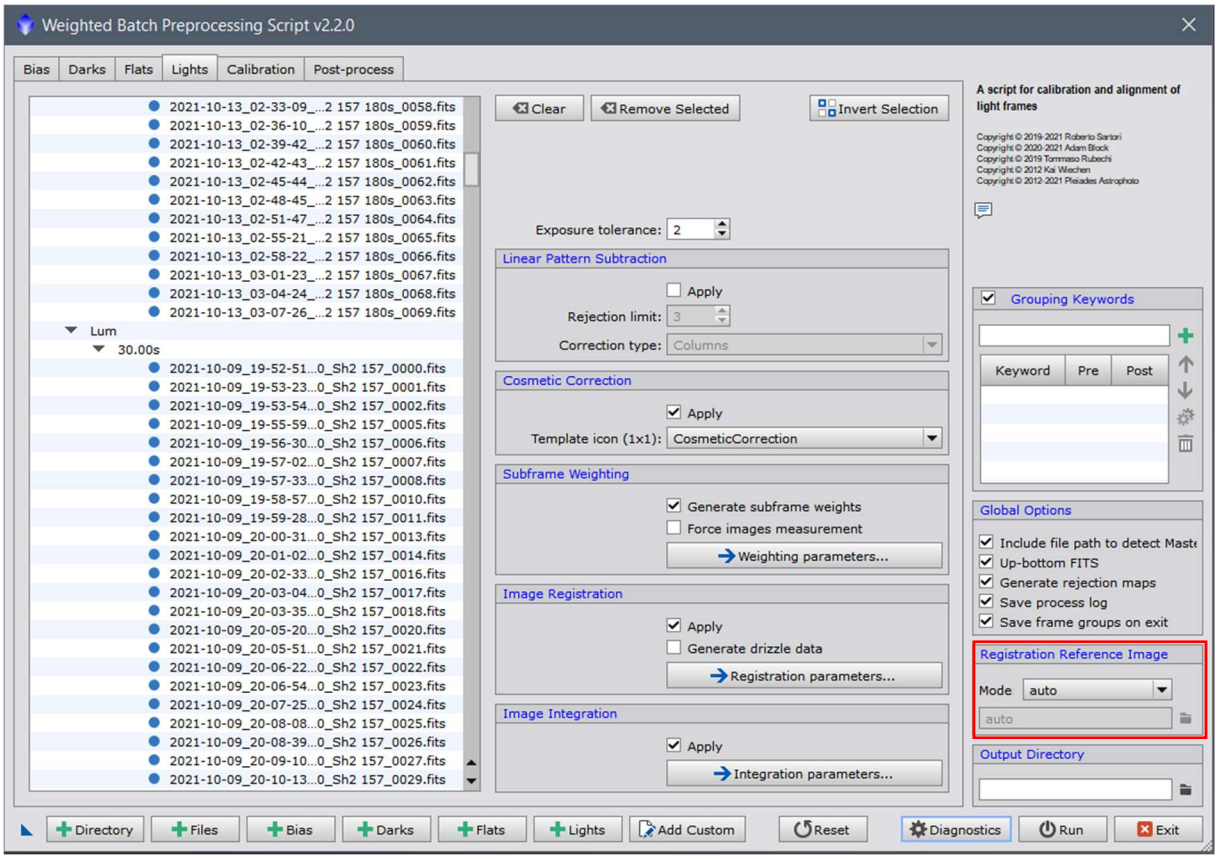


The parameters can be accepted again, or a desired algorithm can be selected by hand. With 'Auto' an algorithm corresponding to the images is selected.



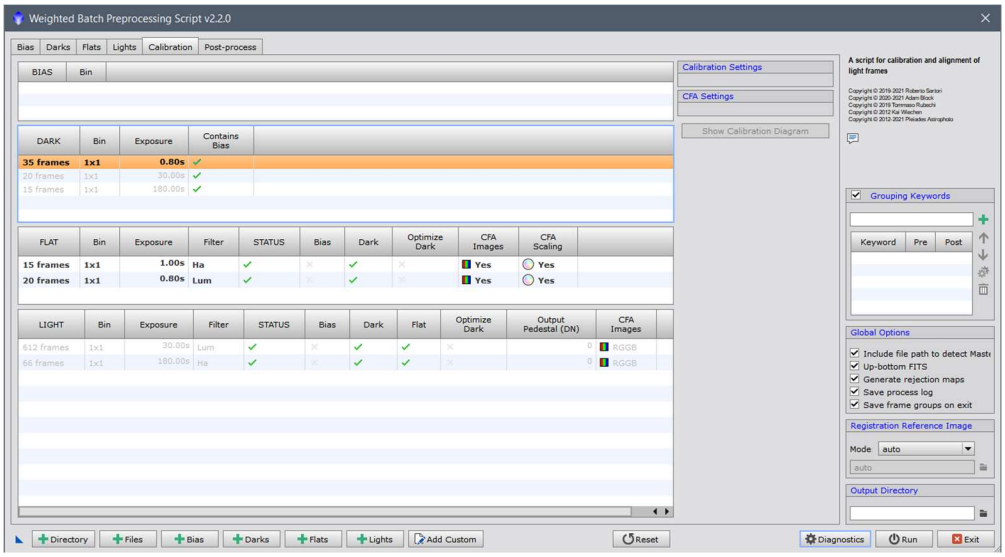


On the right side of the main window, a reference image can still be specified, or via the 'Auto' mode, the image with the best signal-to-noise ratio is determined automatically.



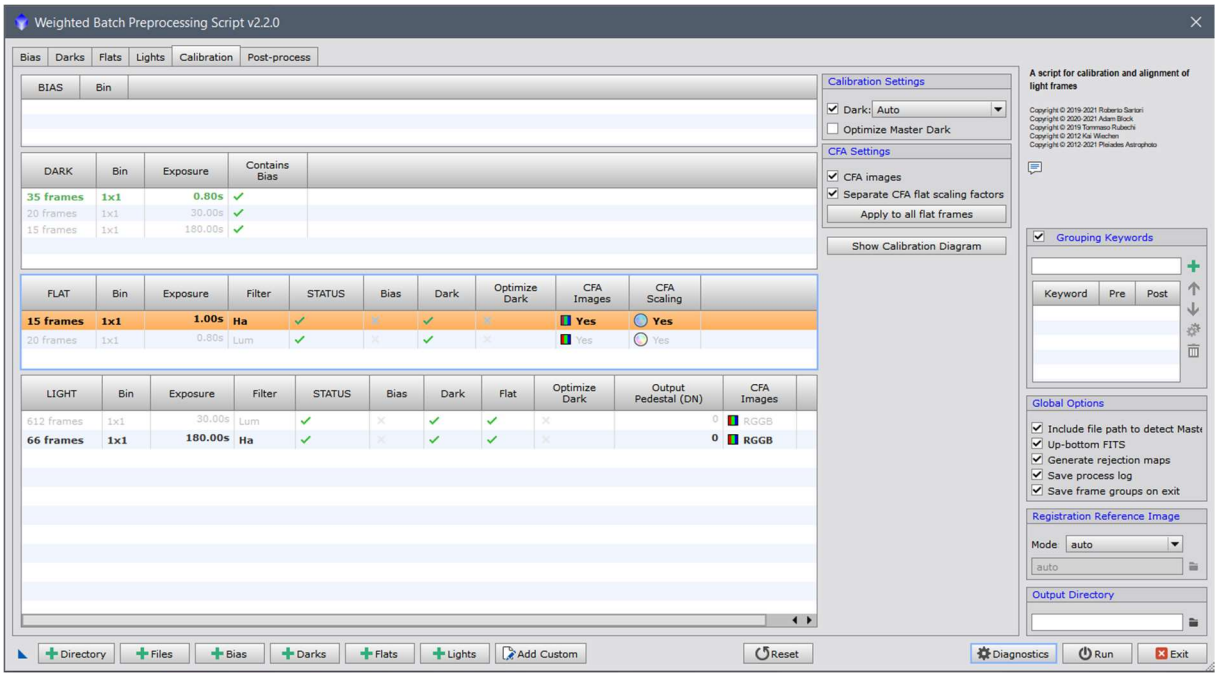
5) Calibration

Here the settings are summarized once again and changes to settings can still be made.



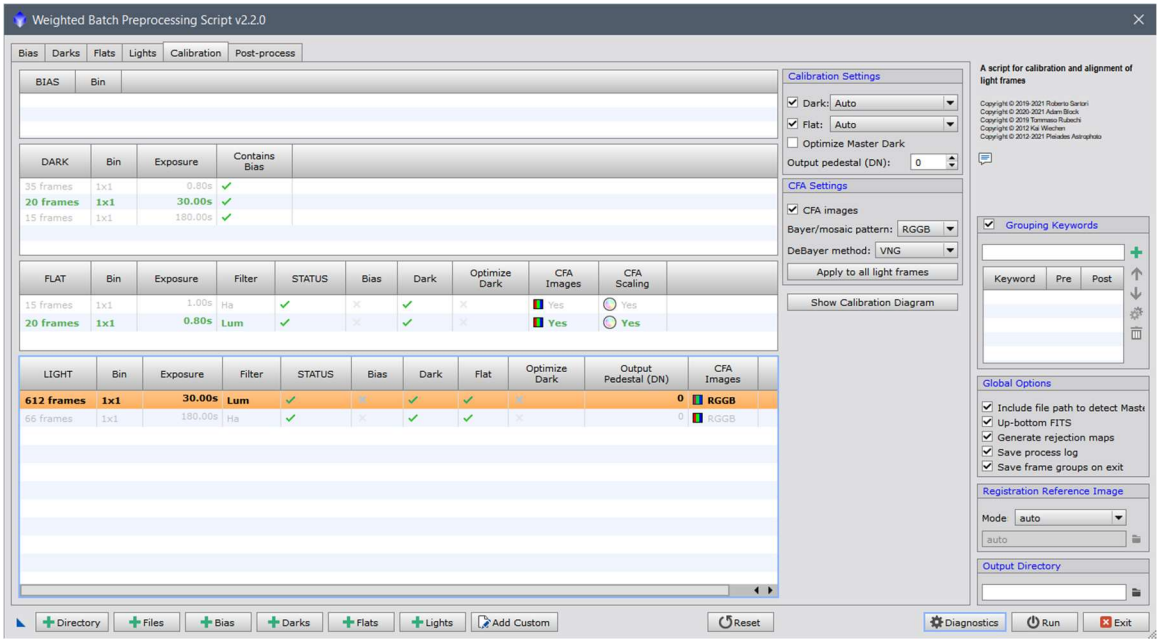
The bias-folder is empty, and nothing else can be set for the dark-frames.

Darkflat-frames can now be assigned to the flat-frames, or this is done automatically. Optimize Master Dark', is only used if the exposure times of the darkflat-frames do not match the flat-frames. Then the dark currents of the darkflat-frames are scaled via an iterative algorithm. But here it is better to use bias-frames or to create matching darkflat-frames.



When using a color camera, a check mark is set at 'CFA Images' and the 'Separate CFA flat scaling factor' can be activated.

Also with the light-frames the dark-frames, and this time also the flat-frames could be assigned manually. But PixInsight does this automatically.



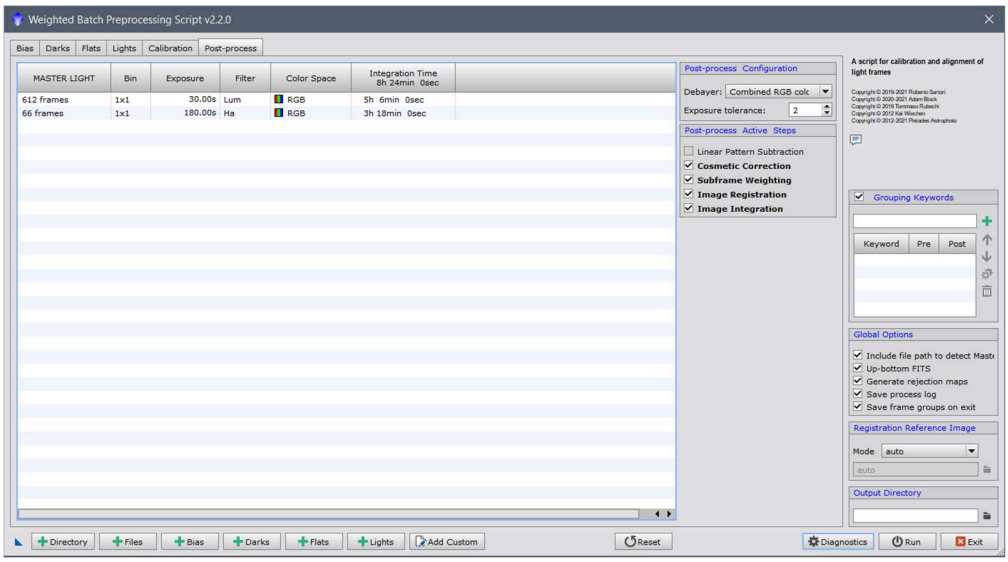
In the section for 'CFA Settings', a check mark must again be set for 'CFA images', and if the Bayer matrix of the camera is known, it can be set here.

Check 'Optimize Master Dark' only if dark-frames and light-frames have different exposure times. (Then an iterative algorithm is used in the background to determine a value that corrects the dark current difference). For this step, bias-frames are needed to remove the noise floor of the dark frames.

At the item 'Output pedestal' a numerical value for the pixels can be set. If narrowband images were created that are only exposed for a very short time (and thus little signal height is available), and subtracts a dark-frame, the pixel value would be negative, and thus set to zero. A value between 100 and 400 can be helpful here. For background-limited capturing, this initial value already grows due to the glow of the sky, which here gives information to each pixel. With very narrowband capturing, this start value is usually omitted by the sky.

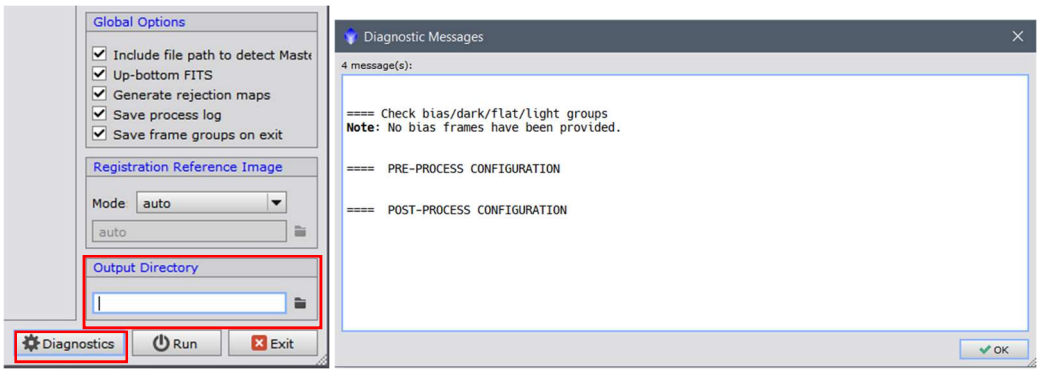
6) Post-process

This window shows what will be saved as output.



In this case, a wideband image and a narrowband image are stored.

Finally, an output folder is created and the 'Diagnostic' button can be used to check for errors:



It is only pointed out that no bias-frames are used, but this was intended by the use of the darkflat-frames. Clicking Run starts the process.