

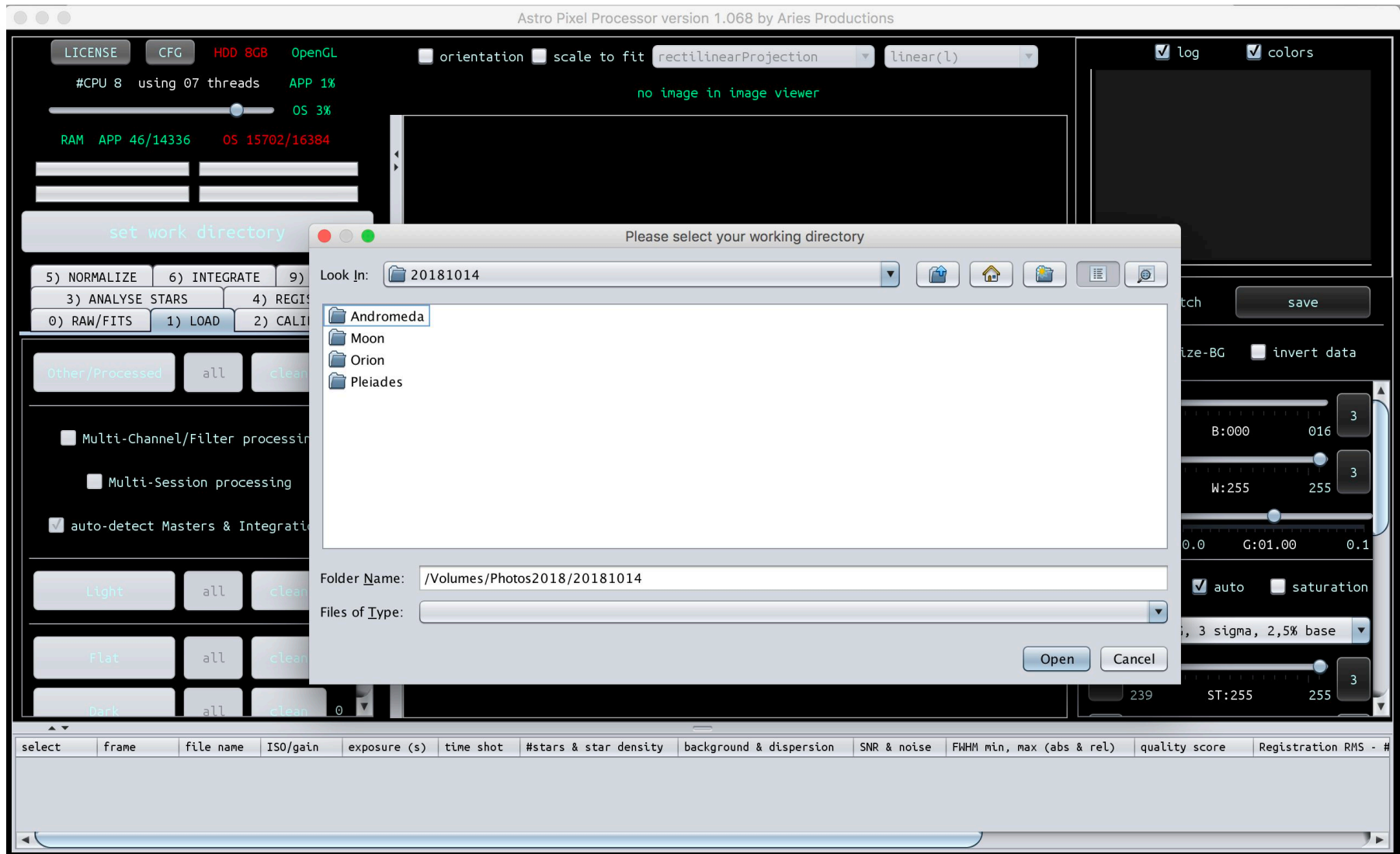
ASTRO PIXEL PROCESSOR : A SIMPLE STEP-BY-STEP TUTORIAL

PART 0 : LAUNCHING AND CONFIGURING APP

1

When you open the software, it asks for a Work Folder

Choose a folder with enough space for all your temporary processing

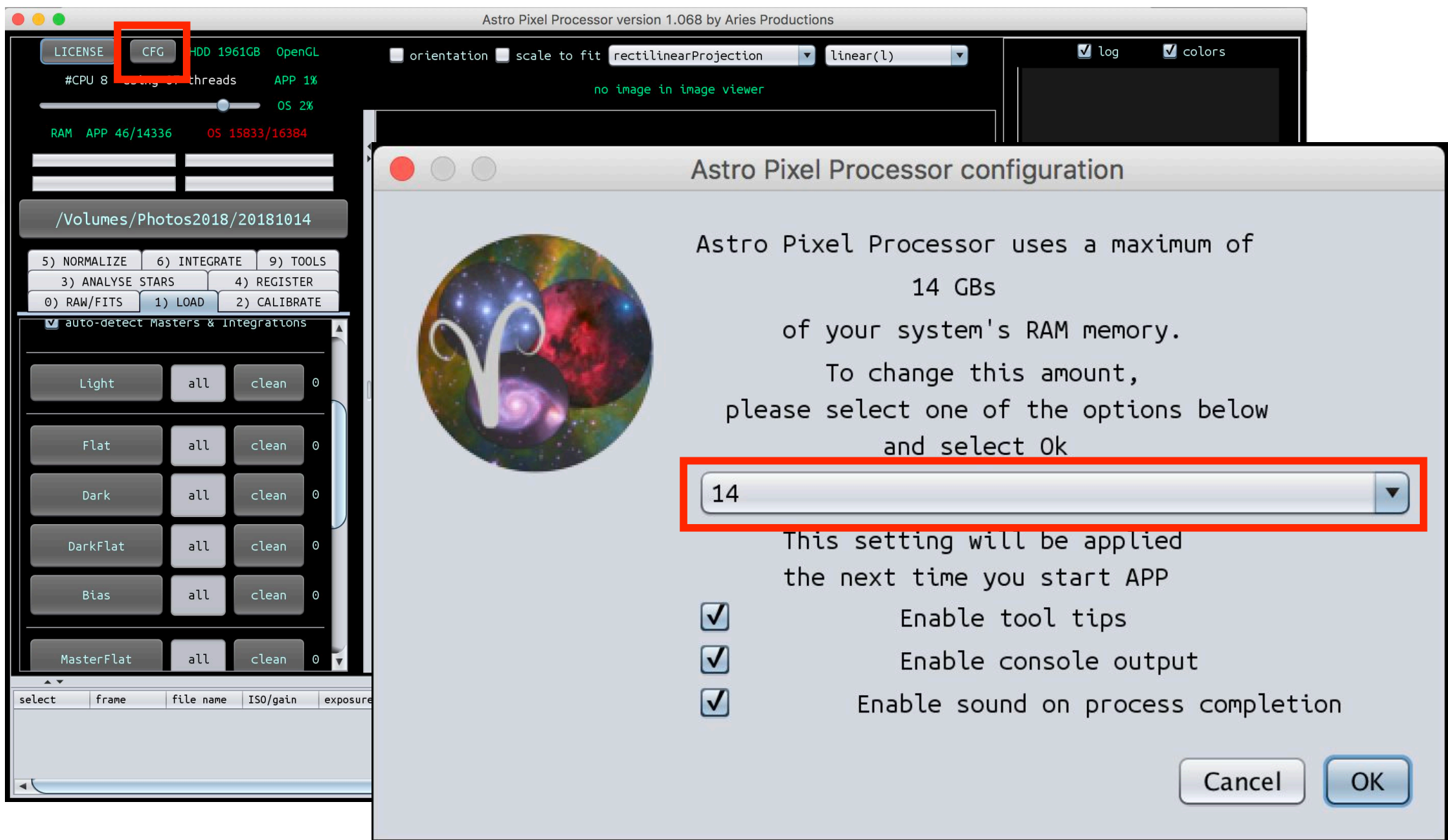


Tip: Use an external drive if you're working on a laptop without a lot of space

Hit the CFG button, and increase the memory size to something appropriate, hit OK and relaunch APP

Tip: 8Gb is good enough for stacking ~100 subs of 20MPixel color images

2

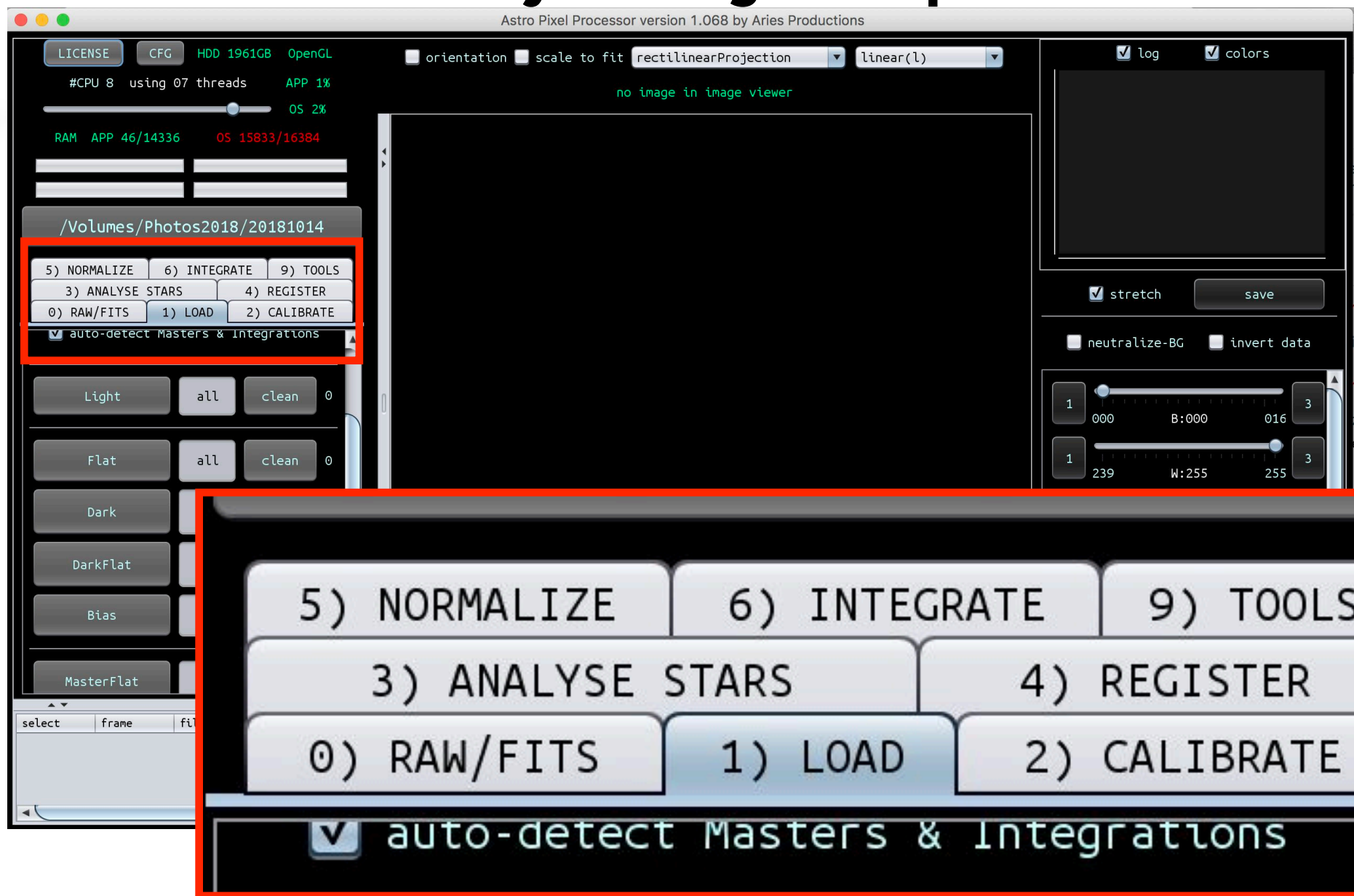


...on to loading images !

PART 1 : LOADING THE LIGHT AND CALIBRATION IMAGES

1

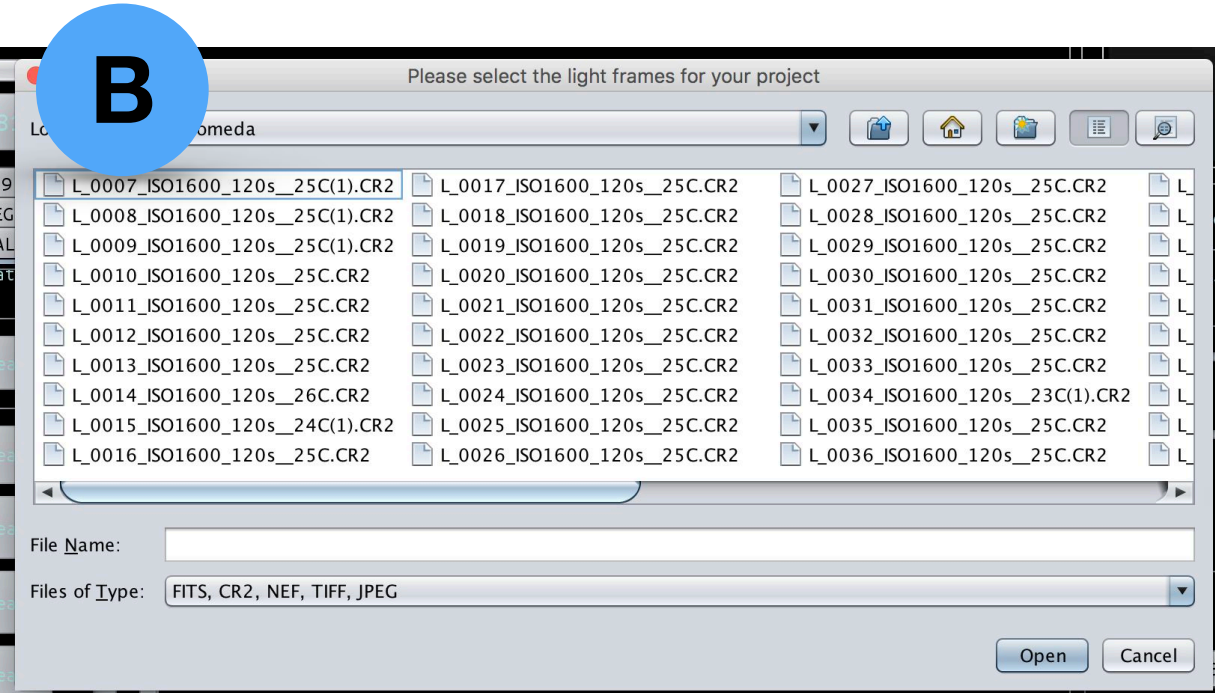
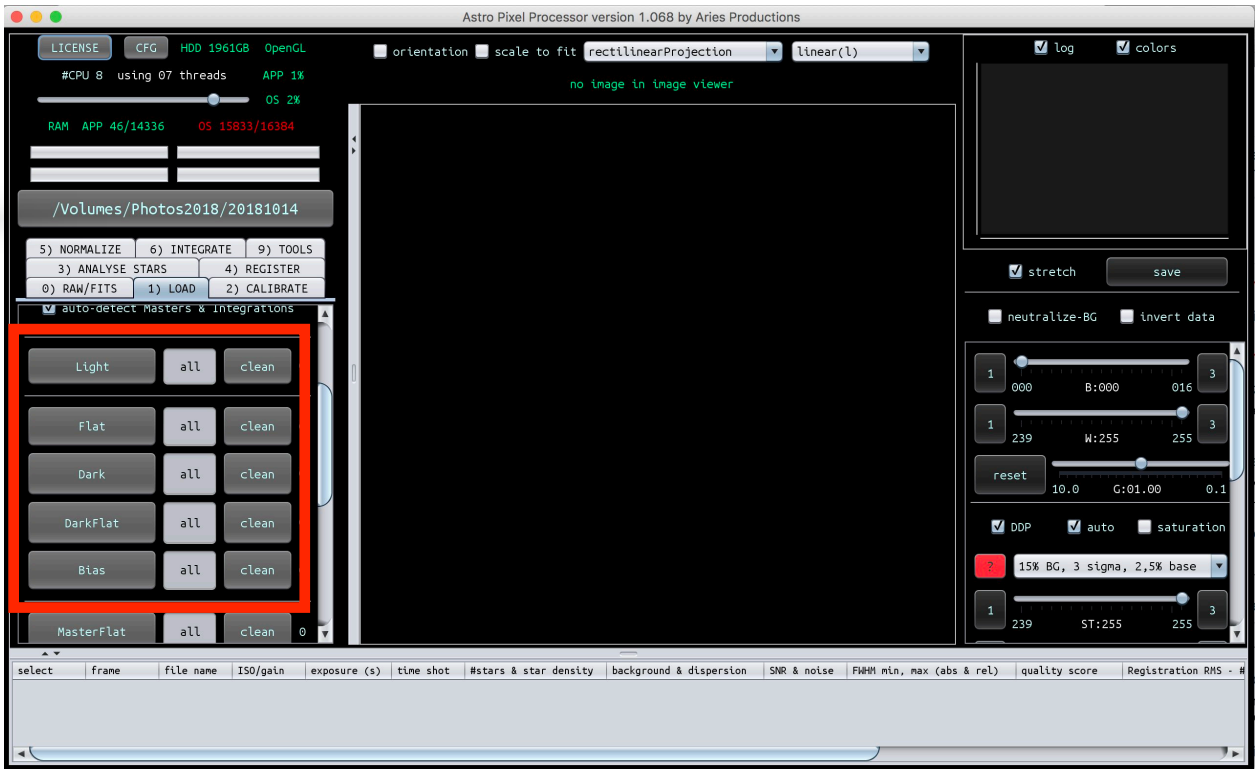
Let's start by loading some pictures



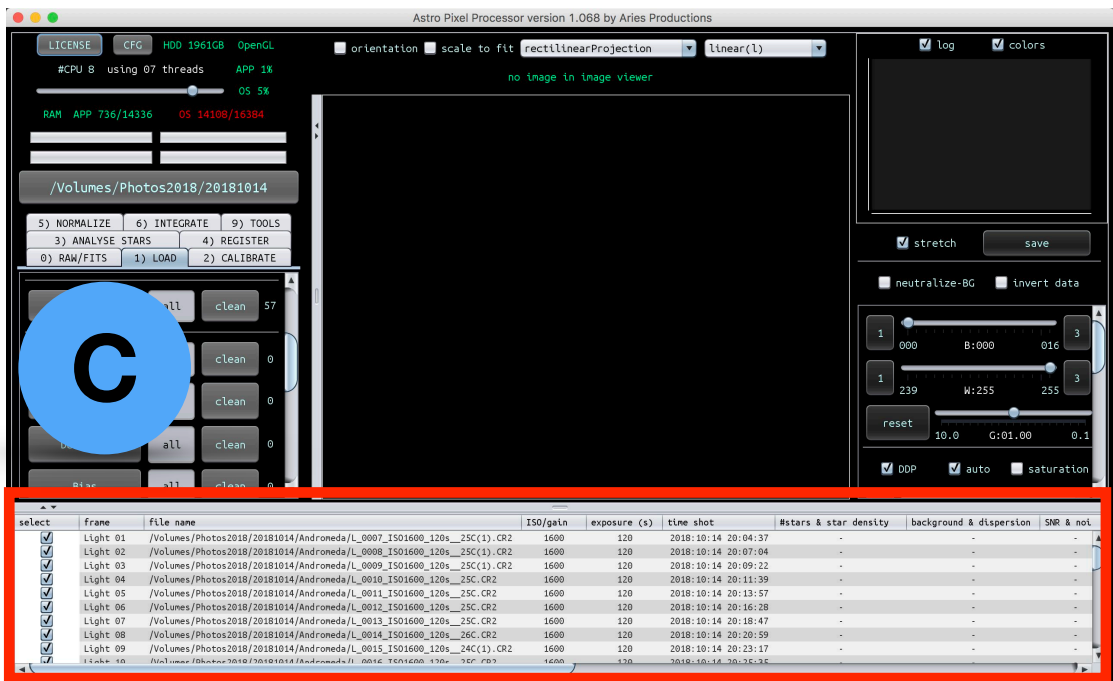
Make sure Load Tab is selected

LOAD IMAGES : Start with Lights then continue with Calibration files

2



Tip : Ctrl+A selects all files in a folder

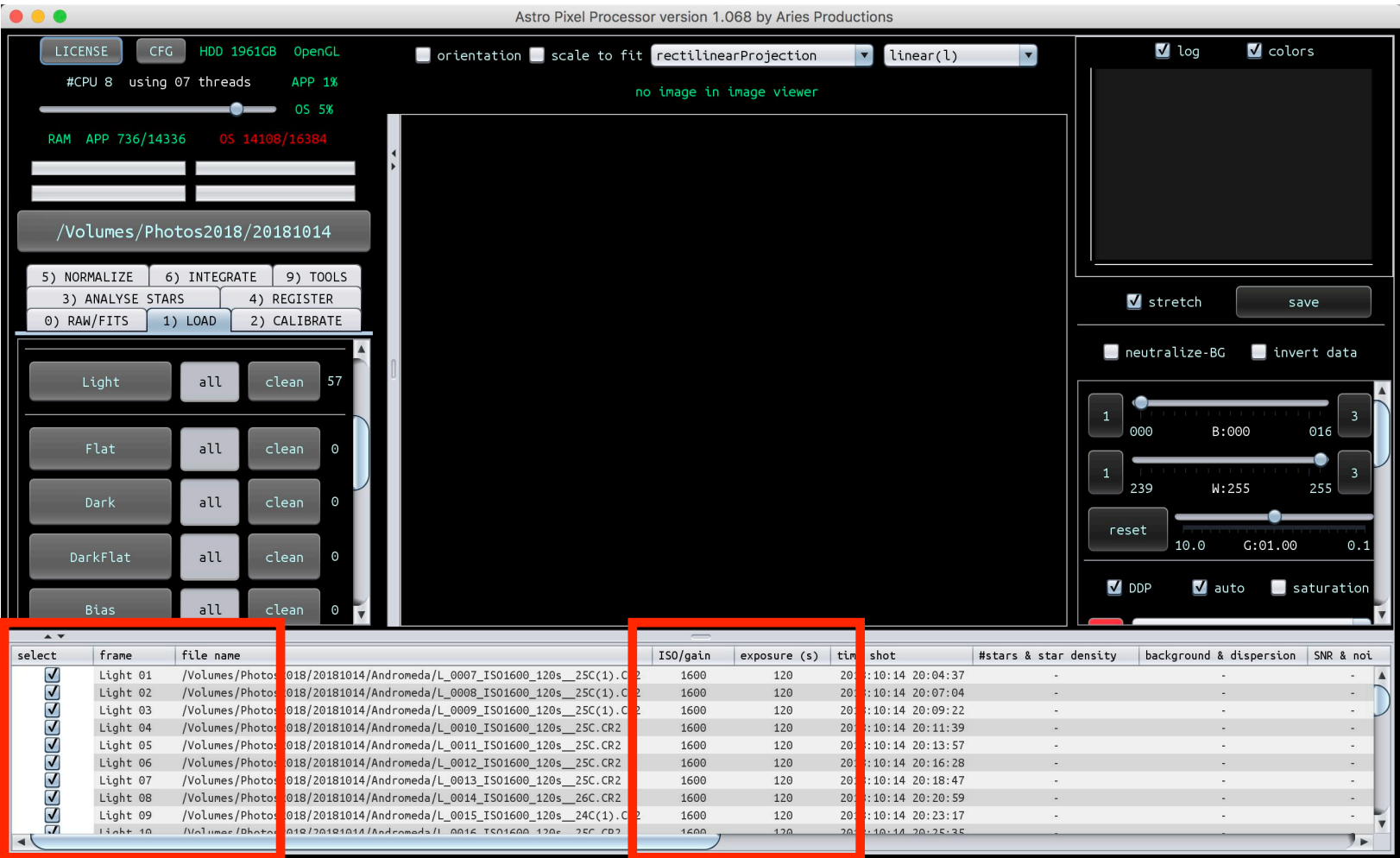


Loaded Images appear Here

You can double click on the the list to view an image (it takes some time)

The Image List on the bottom provides plenty of details about the images you loaded

3



The type of each loaded image is displayed in the Frame column

Check that Iso and Exposure match on Lights and Darks

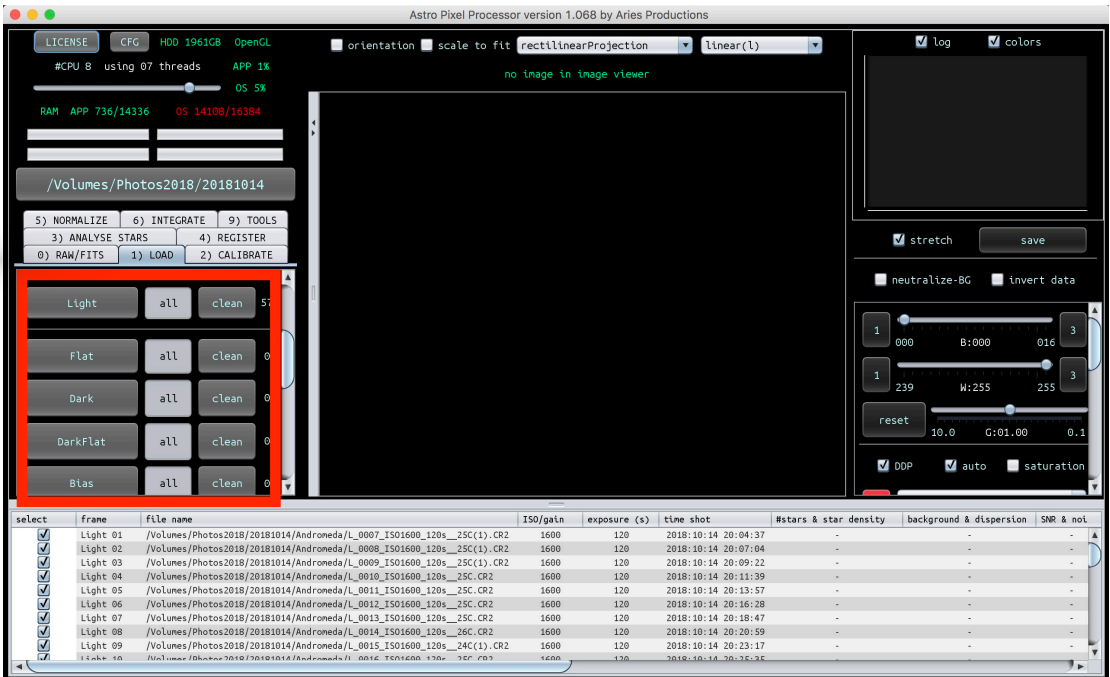
select	frame	file name
<input checked="" type="checkbox"/>	Light 53	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Light 54	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Light 55	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Light 56	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Light 57	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Dark 02	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Dark 04	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Dark 06	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Dark 08	/Volumes/Photos2018/
<input checked="" type="checkbox"/>	Dark 10	/Volumes/Photos2018/

4

ISO/gain	exposure (s)	time shot
1600	120	2018:10:14
1600	120	2018:10:14
1600	120	2018:10:14
1600	120	2018:10:14
1600	120	2018:10:14
1600	120	2018:10:13
1600	120	2018:10:13
1600	120	2018:10:13
1600	120	2018:10:13
1600	120	2018:10:13

This tallies up how many images we have for each Type

5



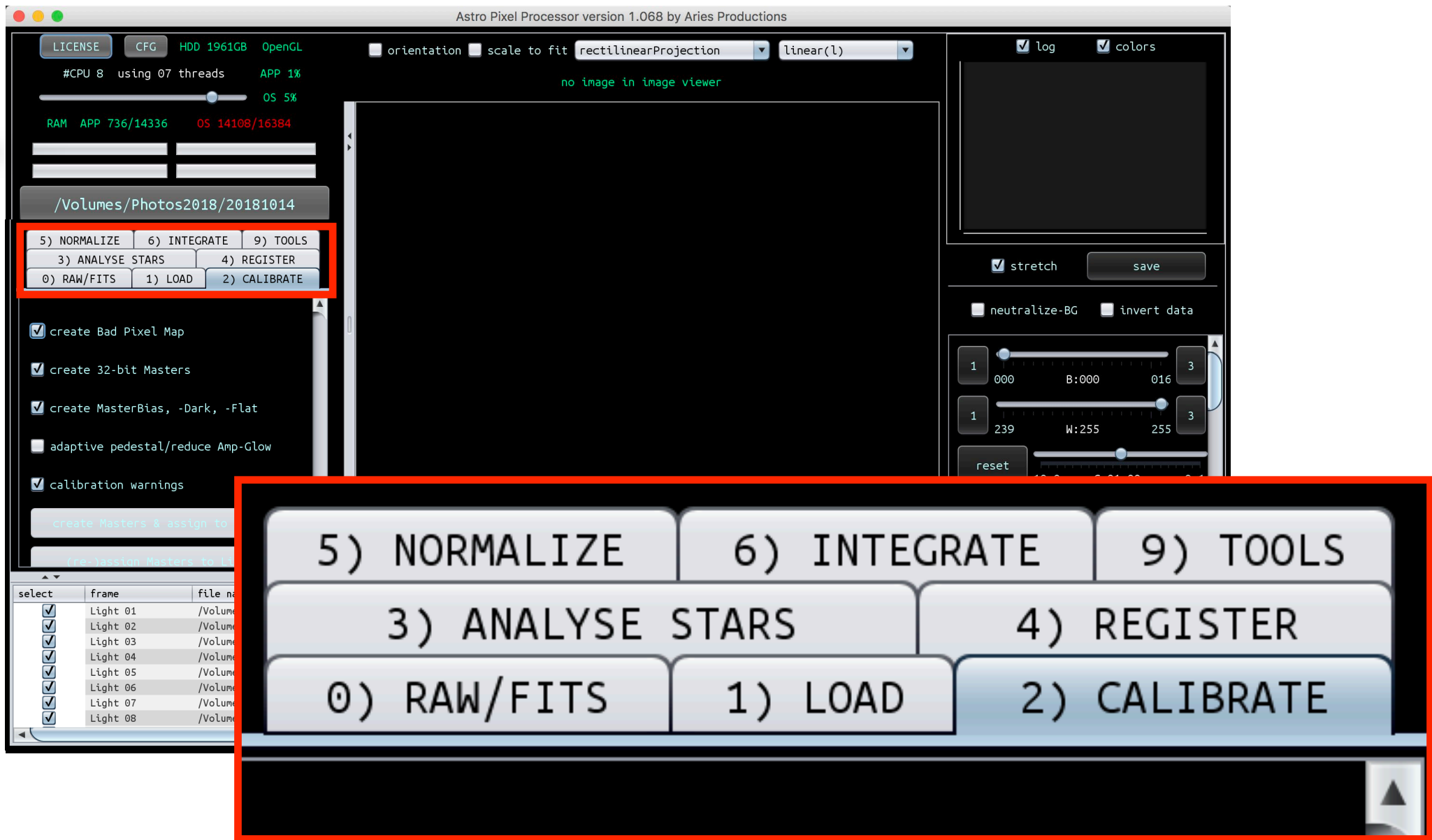
Light	all	clean	57
Flat	all	clean	77
Dark	all	clean	71
DarkFlat	all	clean	0
Bias	all	clean	137

...on to calibration !

PART 2 : CREATING CALIBRATION FILES (MASTERS)

Select the Calibrate Tab

1



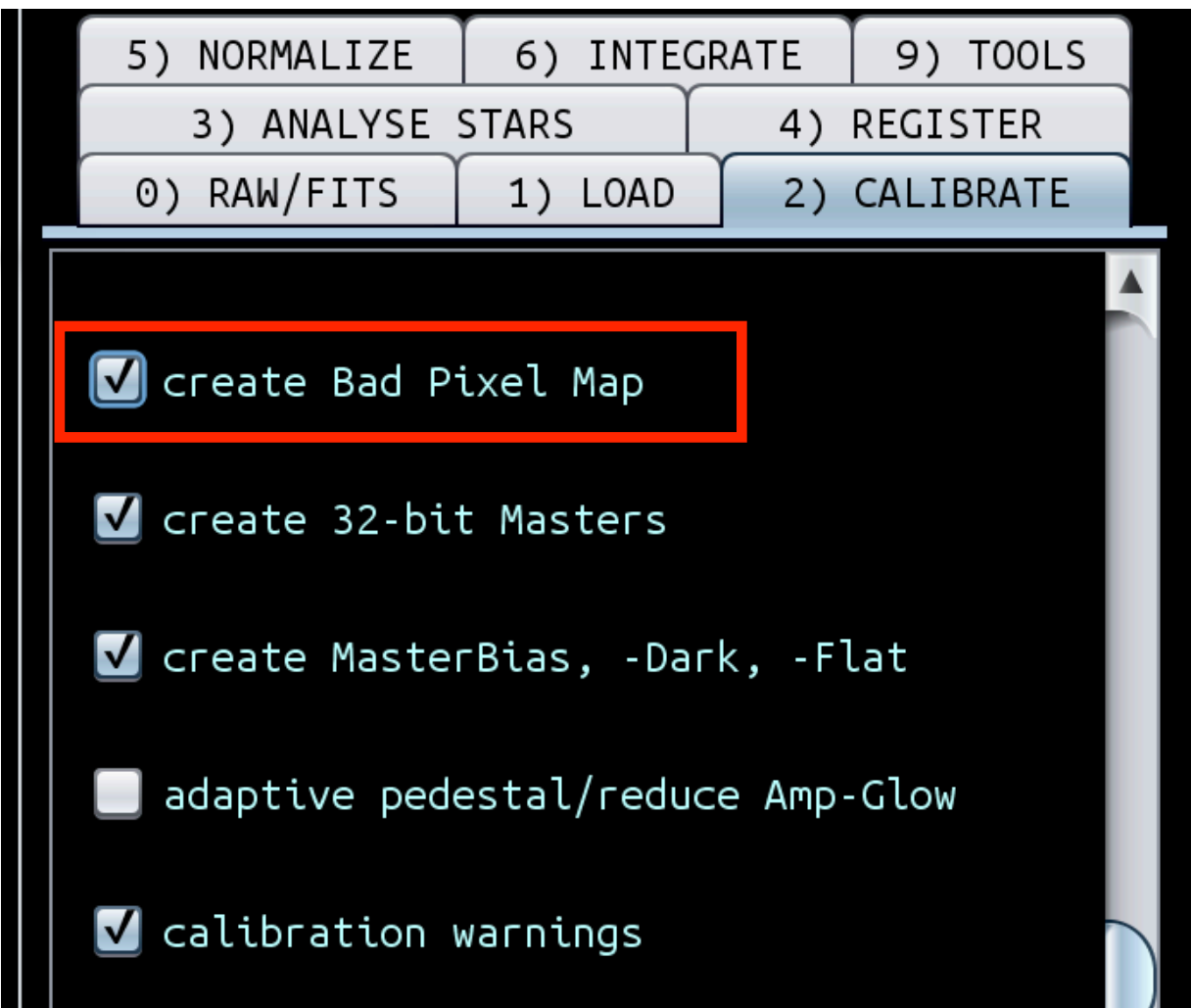
All default values are already OK, but scroll down...

2

Tip : In case something goes awry, just put everything in:
Average | No Rejection | Kappa=3.0 | Iterations 1

...and check "Create Bad Pixel Map"

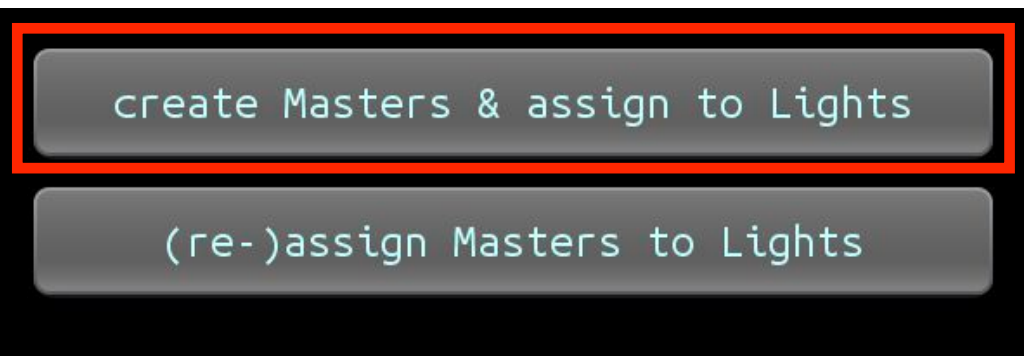
3



Tip : Create Bad Pixel Map
only works if you have both
Flat and Dark files

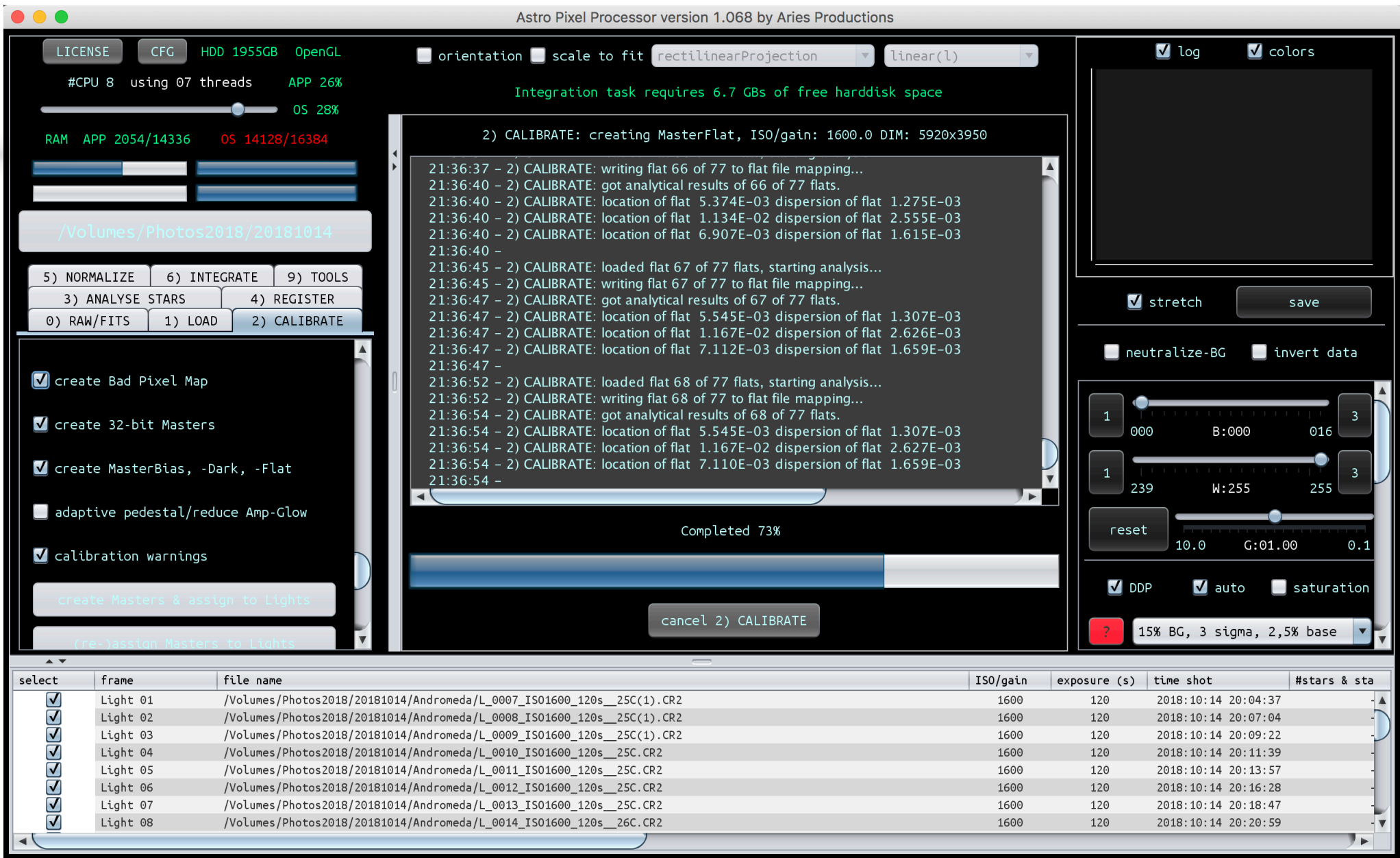
Now hit "Create Masters & Assign to Lights"

4



Let it compute for a while, depending on how many pictures you have it can take a while

5



Scroll to the bottom of the list and you should see 3 master files

6



Scroll back to the top and you should see MB-1 MD-1 MF-1 CA

select	frame	file name			
<input checked="" type="checkbox"/>	Light 01	MB-1	MD-1	MF-1	CA
<input checked="" type="checkbox"/>	Light 02	MB-1	MD-1	MF-1	CA
<input checked="" type="checkbox"/>	Light 03	MB-1	MD-1	MF-1	CA
<input checked="" type="checkbox"/>	Light 04	MB-1	MD-1	MF-1	CA

Tip : If you are combining multiple stacks of pictures you might have multiple Master Calibration Frames (MD-1, MD-2, ...)

If you go back to the LOAD tab and scroll down you will see the masters appear there too

7



Tip: Next time you open APP you can load the Master Files instead of recomputing the calibration files. Just push any of the Master buttons and load all the Master Calibration files, APP will automatically sort them out

...on to star alignment !

PART 3 : FINDING STARS IN THE IMAGES (ANALYSE STARS)

Select the Analyse Stars tab, scroll down to the bottom and hit the Analyse Stars button

1

Astro Pixel Processor version 1.068 by Aries Productions

LICENSE

CFG

HDD 1961GB

OpenGL

#CPU 8

using 07 threads

APP 1%

OS 5%

RAM APP 736/14336

OS 14108/16384

orientation

scale to fit

rectilinearProjection

linear(1)

no image in image viewer

0) RAW/FITS

1) LOAD

2) CALIBRATE

5) NORMALIZE

6) INTEGRATE

9) TOOLS

3) ANALYSE STARS

4) REGISTER

star detection

minimum star size area

6

clip star profile

0.1

☐ filter star profile

☐ out of focus? FWHM > 12 pixels?

☒ automatic minimum #stars target:

select

frame

file name

ISO/gain

exposure (s)

time shot

#stars & star density

background

Light 01

/Volumes/Photos2018/20181014/Andromeda/L_0007_ISO1600_120s_25C(1).CR2

1600

120

2018:10:14 20:04:37

-

Light 02

/Volumes/Photos2018/20181014/Andromeda/L_0008_ISO1600_120s_25C(1).CR2

1600

120

2018:10:14 20:07:04

-

Light 03

/Volumes/Photos2018/20181014/Andromeda/L_0009_ISO1600_120s_25C(1).CR2

1600

120

2018:10:14 20:09:22

-

Light 04

/Volumes/Photos2018/20181014/Andromeda/L_0010_ISO1600_120s_25C.CR2

1600

120

2018:10:14 20:11:39

-

Light 05

/Volumes/Photos2018/20181014/Andromeda/L_0011_ISO1600_120s_25C.CR2

1600

120

2018:10:14 20:13:57

-

Light 06

/Volumes/Photos2018/20181014/Andromeda/L_0012_ISO1600_120s_25C.CR2

1600

120

2018:10:14 20:16:28

-

Light 07

/Volumes/Photos2018/20181014/Andromeda/L_0013_ISO1600_120s_25C.CR2

1600

120

2018:10:14 20:18:47

-

Light 08

/Volumes/Photos2018/20181014/Andromeda/L_0014_ISO1600_120s_26C.CR2

1600

120

2018:10:14 20:20:59

-

Light 09

/Volumes/Photos2018/20181014/Andromeda/L_0015_ISO1600_120s_24C(1).CR2

1600

120

2018:10:14 20:23:17

-

Light 10

/Volumes/Photos2018/20181014/Andromeda/L_0016_ISO1600_120s_26C.CR2

1600

120

2018:10:14 20:25:36

-

0) RAW/FITS

1) LOAD

2) CALIBRATE

5) NORMALIZE

6) INTEGRATE

9) TOOLS

3) ANALYSE STARS

4) REGISTER

stretch

neutralize

1

0.00

1

239

reset

10.0

☒ DDP

00500

detect above noise level:

kappa

038

☒ automatic maximum #stars target:

01000

analyse stars

Tip: with very dark images (e.g. 0.5 sec subs) you'll have to bring Kappa down to something like 010

The default settings should work, (if they dont APP will kindly tell you) and STAR should appear next to the Light images

2

select

frame

file name

☒

Light 01

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 02

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 03

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 04

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 05

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 06

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 07

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

☒

Light 08

MB-1

MD-1

MF-1

CA

STAR

/Volumes/Ph

time shot

#stars & star density

backgrou..

2018:10:14 20:04:37

751 751

-

2018:10:14 20:07:04

811 811

-

2018:10:14 20:09:22

767 767

-

2018:10:14 20:11:39

798 798

-

2018:10:14 20:13:57

704 704

-

2018:10:14 20:16:28

748 748

-

2018:10:14 20:18:47

744 744

-

2018:10:14 20:20:59

730 730

-

Scrolling the Image List to the right, will show the number of stars that have been detected, having 200+ stars should be enough to get a good registration

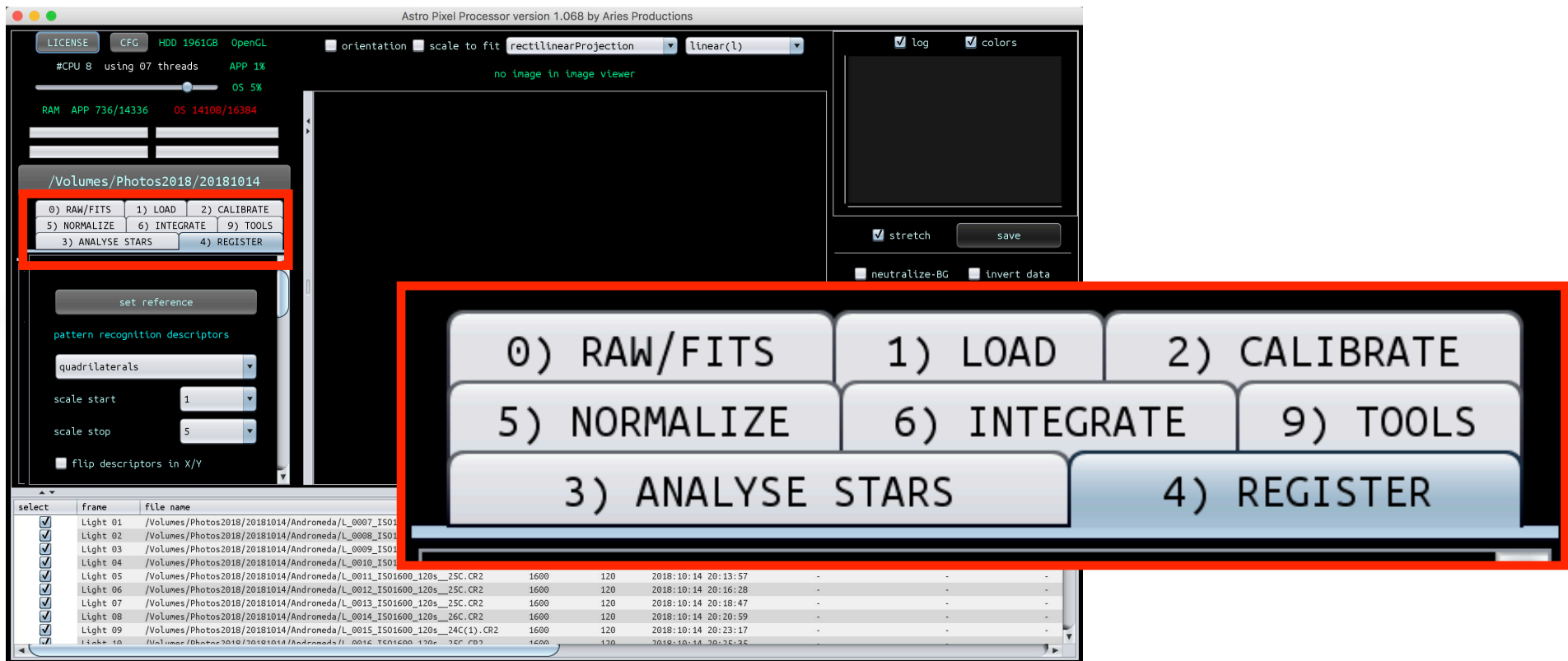
Tip: If your pictures move around a lot between subs, you'll need more stars, as many stars detected on one image will be in parts that dont overlap with any of the other images

...on to registration !

PART 4 : ALIGNING IMAGES TOGETHER (REGISTRATION)

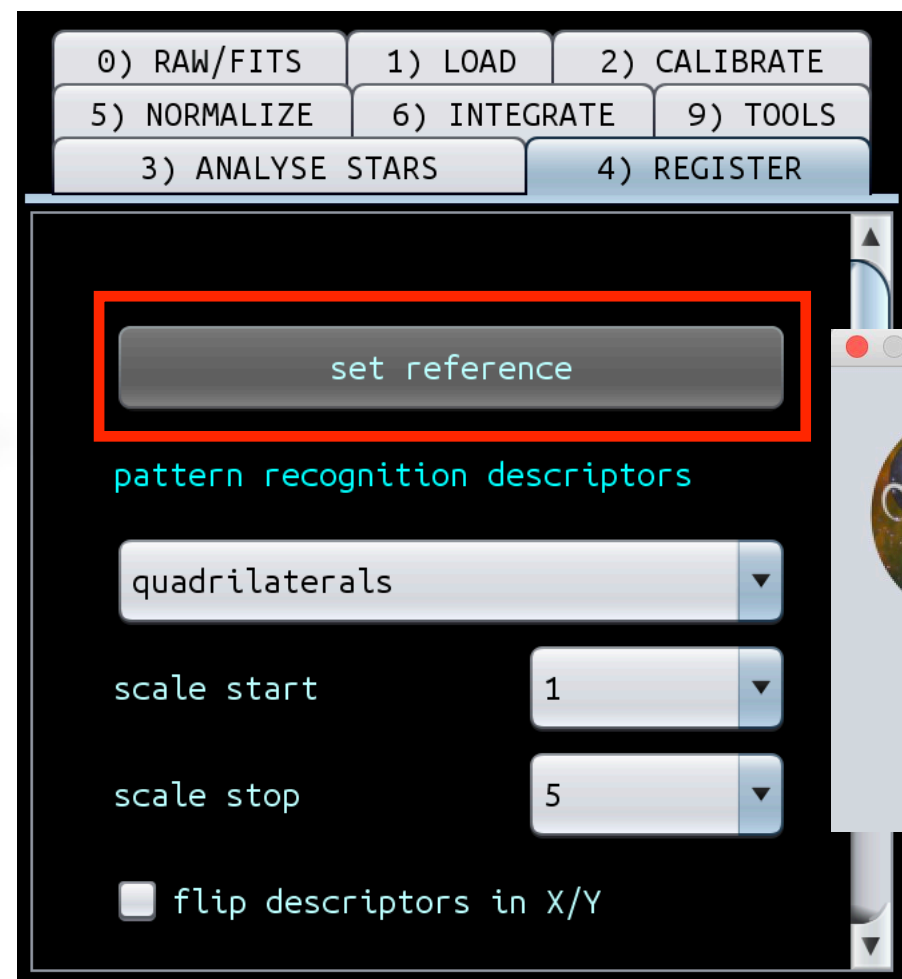
Select the Register tab

1

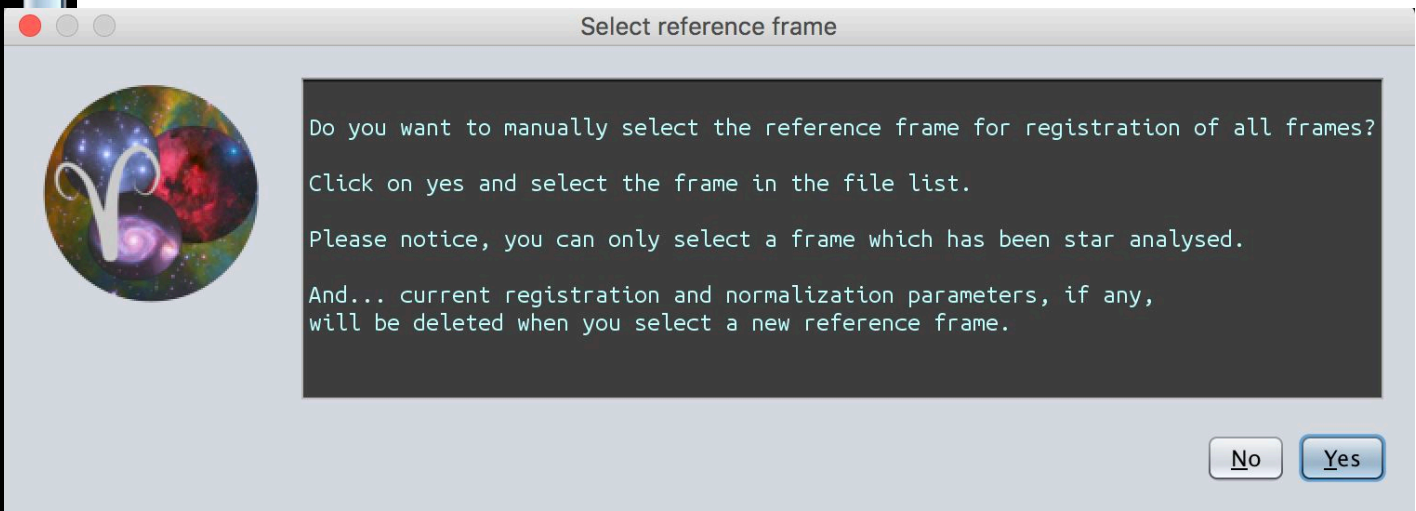


Click on Set Reference, then Yes, then click on an image in the Image List

2



Tip: You can skip this step, but it will let us choose the frame we stack everything on later during the Integrate process



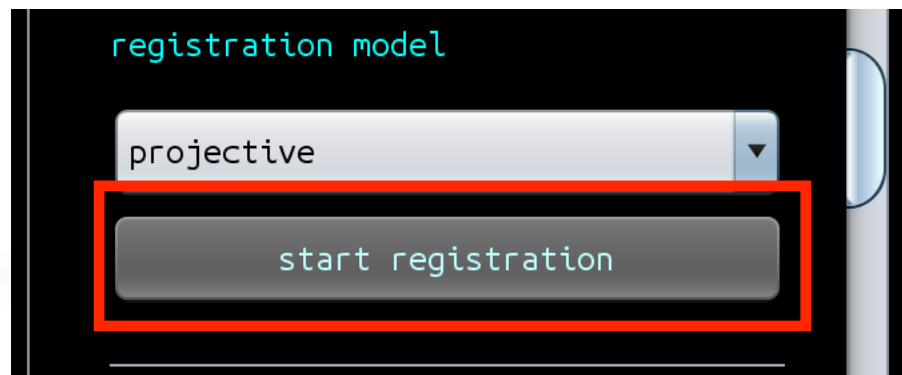
You'll know it worked if the image you selected is now highlighted dark blue and says "REF"

3

select	frame	file name	WHM min, max (abs & rel)	quality score
<input checked="" type="checkbox"/>	Light 24 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0007_ISO1	3.58 3.68 -- 3.58 3.68	467.88 INTEGRATE
<input checked="" type="checkbox"/>	Light 25 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0008_ISO1	3.32 3.49 -- 3.32 3.49	545.90 INTEGRATE
<input checked="" type="checkbox"/>	Light 26 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0009_ISO1	3.44 3.52 -- 3.44 3.52	526.00 INTEGRATE REF
<input checked="" type="checkbox"/>	Light 27 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0010_ISO1	3.41 3.56 -- 3.41 3.56	515.61 INTEGRATE
<input checked="" type="checkbox"/>	Light 28 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0011_ISO1600_120s_25C_CR2	3.56 3.65 -- 3.56 3.65	485.25 INTEGRATE
<input checked="" type="checkbox"/>	Light 29 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0013_ISO1600_120s_25C_CR2	3.57 3.76 -- 3.57 3.76	463.75 INTEGRATE
<input checked="" type="checkbox"/>	Light 30 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0014_ISO1600_120s_26C_CR2	3.82 3.99 -- 3.82 3.99	499.71 INTEGRATE
<input checked="" type="checkbox"/>	Light 31 MB-1 MD-1 MF-1 CA STAR	/Volumes/Photos2018/20181014/Andromeda/L_0015_ISO1600_120s_24C(1)_CR2	3.70 3.73 -- 3.70 3.73	600.59 INTEGRATE

Scroll down and hit Start Registration (this should be quick)

4



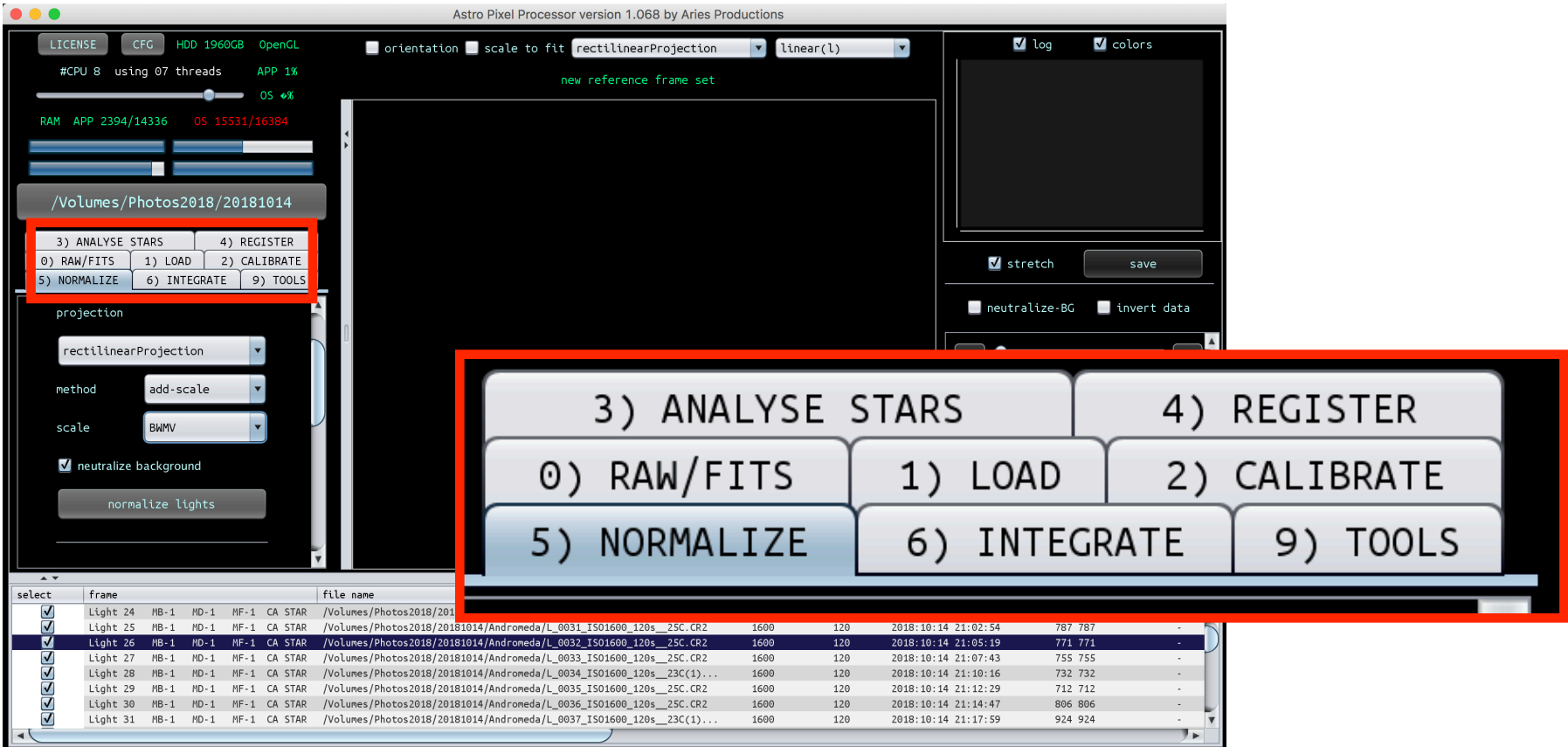
Tip: This step can fail if you dont have enough overlapping stars. APP lets you know which images failed registration in the image list by changing their color

...on to normalisation !

PART 5 : NORMALISING THE LUMINOSITY OF IMAGES

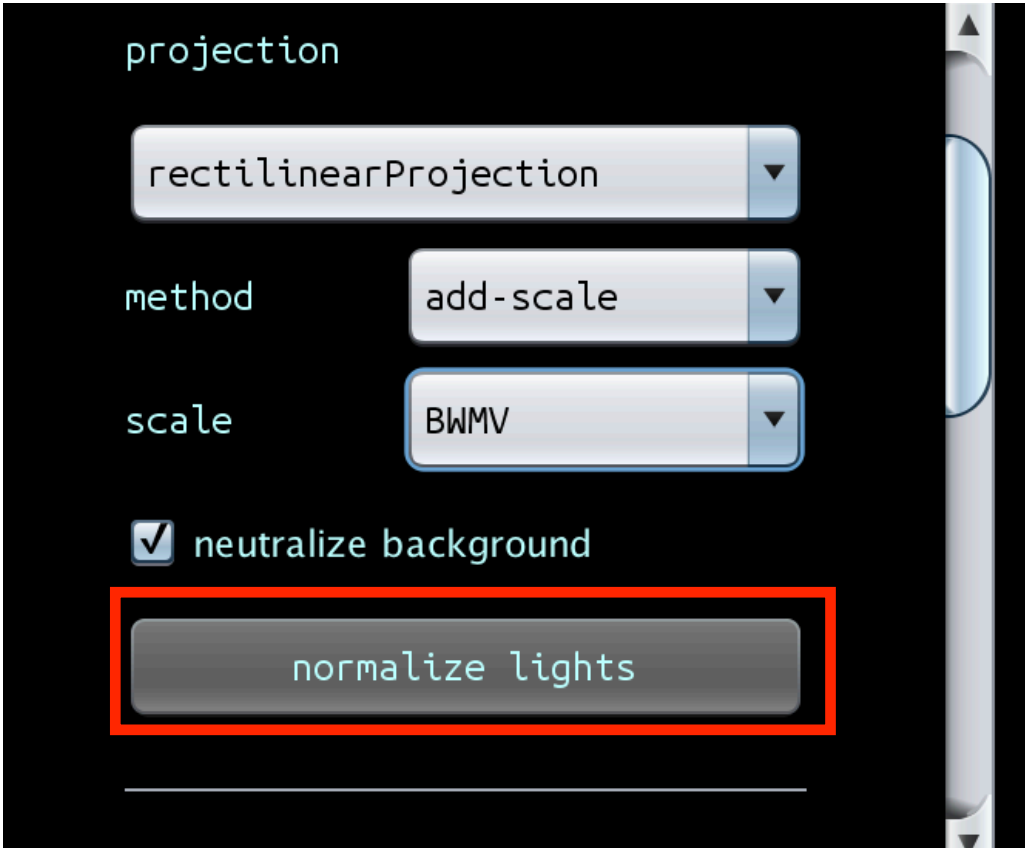
Select the Normalize tab

1



Leave everything as is, scroll down a bit and hit Normalise Lights

2



This will take a while, you deserve a coffee break. You know it will have worked if NORM appears on the image list

3

select	frame	file name
<input checked="" type="checkbox"/>	Light 24 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0031_ISO1600_120s_25C.CR2
<input checked="" type="checkbox"/>	Light 25 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0032_ISO1600_120s_25C.CR2
<input checked="" type="checkbox"/>	Light 26 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0033_ISO1600_120s_25C(1)...
<input checked="" type="checkbox"/>	Light 27 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0034_ISO1600_120s_25C(1)...
<input checked="" type="checkbox"/>	Light 28 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0035_ISO1600_120s_25C.CR2
<input checked="" type="checkbox"/>	Light 29 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0036_ISO1600_120s_25C.CR2
<input checked="" type="checkbox"/>	Light 30 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0037_ISO1600_120s_25C(1)...
<input checked="" type="checkbox"/>	Light 31 MB-1 MD-1 MF-1 CA STAR REC	/Volumes/Photos2018/20181014/Andromeda/L_0037_ISO1600_120s_25C(1)...

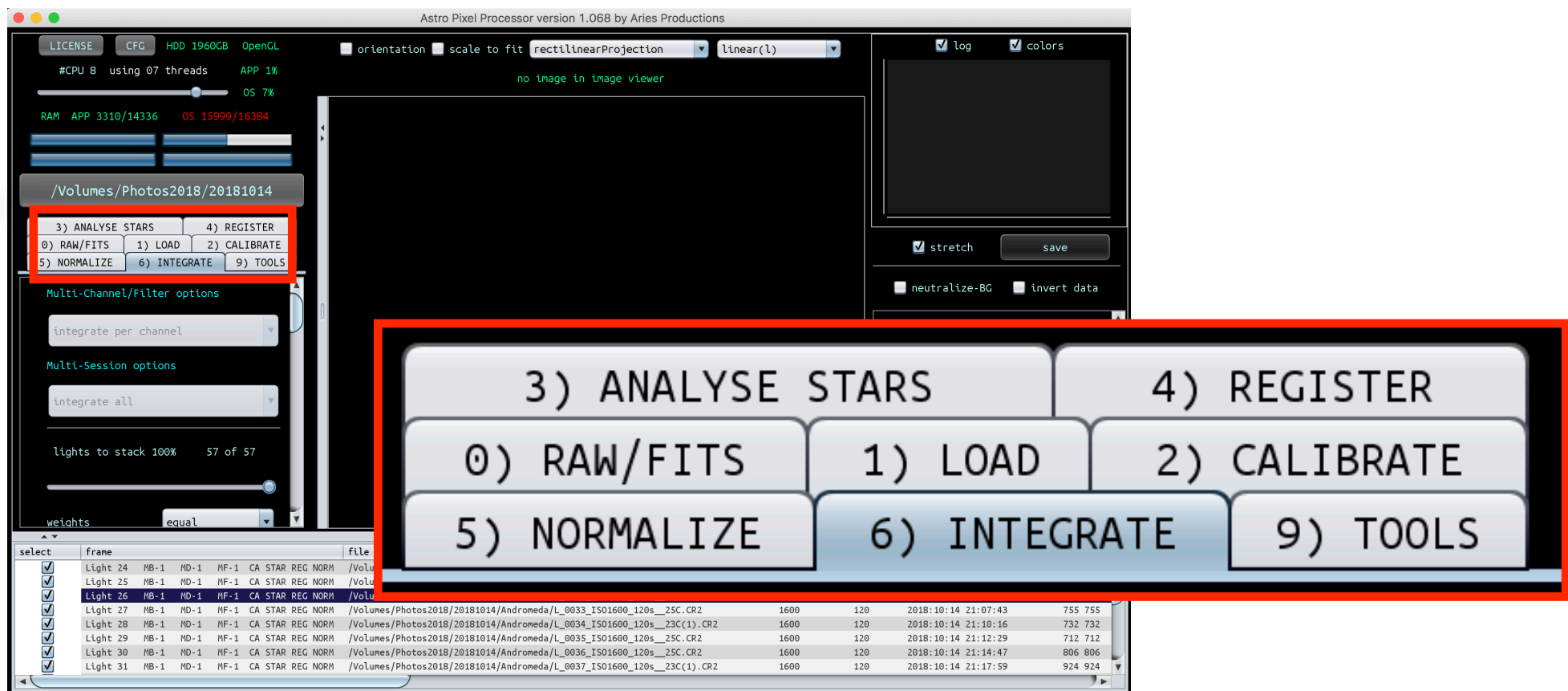
We're now ready for the final step of Pre-Processing

...on to integration !

PART 6 : STACKING THE IMAGES (INTEGRATION)

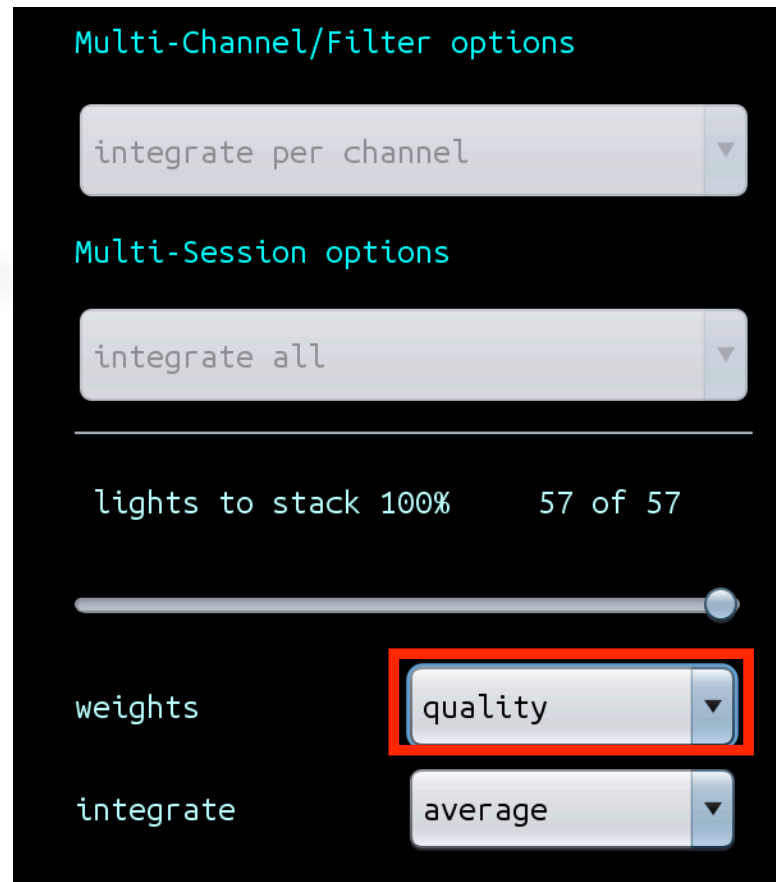
Select the Integrate tab and let's configure the Integration step

1



Let's start with Weights: set it to Quality

2



Tip: Hover on the parameters to have a very detailed description of each value

Set the weight of the frames for stacking.

This setting can have clear impact on the integration result, so you will need to choose the weights that best match what you are trying to accomplish.

equal – this will give you a result which will be suboptimal in SNR, and suboptimal in sharpness, because all frames are weighted equally. Bad frames will have a big impact on the integration result.

exposure – this setting can be chosen if you combine exposures of different exposure times. The frames with longest exposures will have higher weights which scale as the square root of the exposure. This setting will then give more weight to the frames with higher SNR usually, resulting in an integration with a better SNR, but also less sharp in most cases.

quality – this will use the quality score shown in the **quality score** column in the bottom frame list panel. The quality parameter is based on noise, star density, star size and star shape. This usually gives the best integration result for noise and sharpness combined.

SNR – the weights are now based on the Signal to Noise Ratio of the frames. This is a really dangerous method. Any deviating gradients between the frames will make the SNR metric totally unreliable. From all the settings, this is the least attractive one so it's not recommended. Bad frames with guiding errors, or which are out of focus, or have some clouds, or shot with bad transparency, could give higher SNR values, strongly reducing the integration result.

noise – use this if you aim for the lowest noise in the end result. The weights calculated by APP are based on the noise values after having applied normalization to the frames, so these are normalized noise values. This is important, because normalization for scale/dispersion will impact the initial noise values of the frames.

star shape – use this if you want to have the smallest and roundest stars in your integration result. It will give weights to the frames based on the star shape of the stars in the frame (star shape means both roundness and size). Frames that have stars that are not round are punished a lot, so these frames will have little weight. This is a very nice integration setting if you have some frames without perfect guiding but still want those frames to help reduce the noise in the data without impacting the star shapes in the integration.

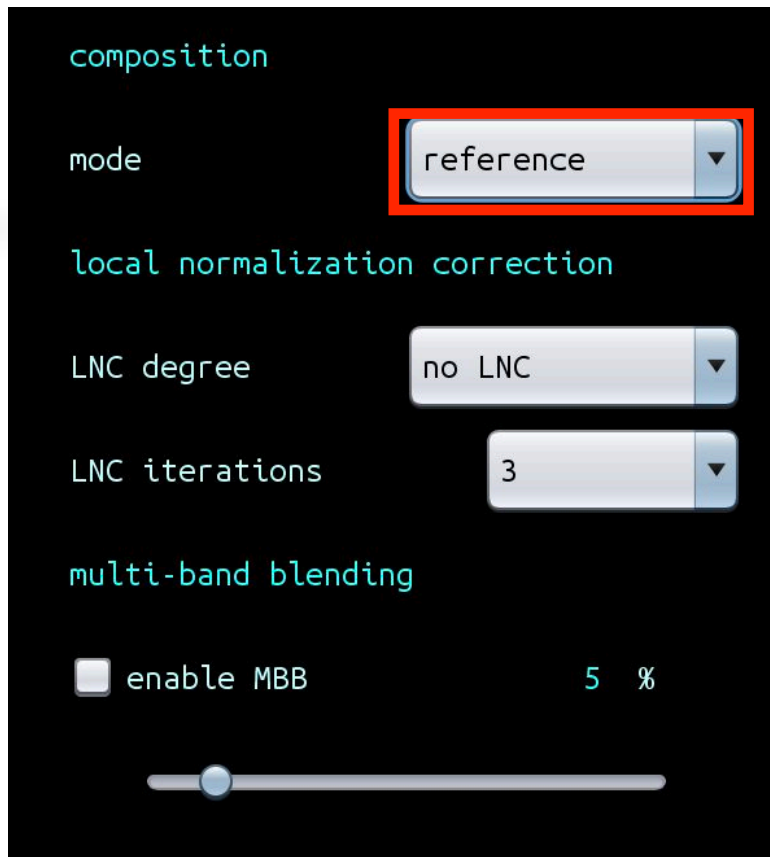
Scale Independent quality parameters.

APP has the parameters star density & relative FWHM which are very helpful if you combine data of different scales. APP calculates the star size/shape and star density relative to the scale differences between the frames. The scale differences are calculated using the homographies (projective transformations) between the frames.

If you have few images (less than 20) set Integrate to Median

Set Composition Mode to Reference (leave it to Full if you want the maximum surface to be stacked and you will crop the image later)

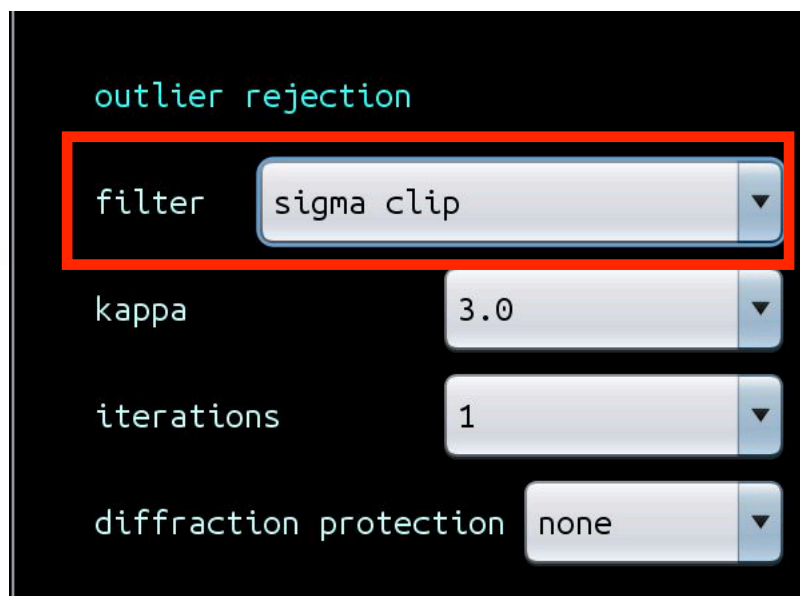
3



Tip: Setting Reference (or Crop) can help avoid Out of Memory errors when stacking a lot of images or using Drizzle and will speed up the process

Scroll down to Outlier Rejection and select Sigma Clip

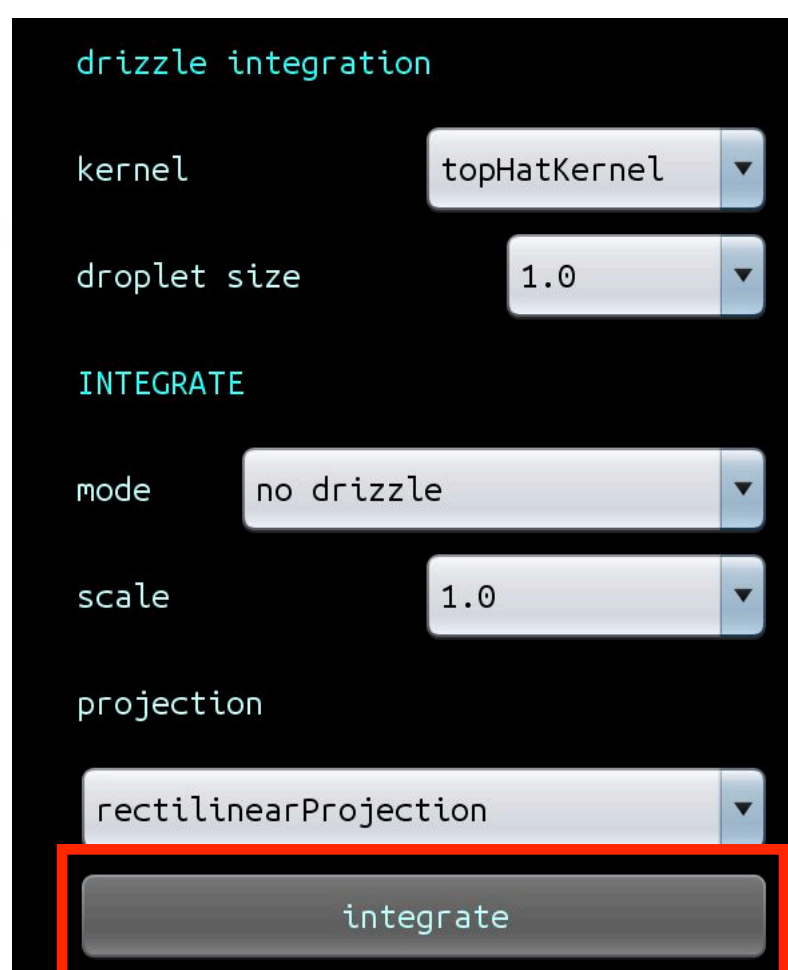
4



Tip: This will remove airplane trails, satellites as well as bad pixels if you took your images with dithering

Ignore Drizzle settings for now, hit Integrate and go wash that coffee cup

5

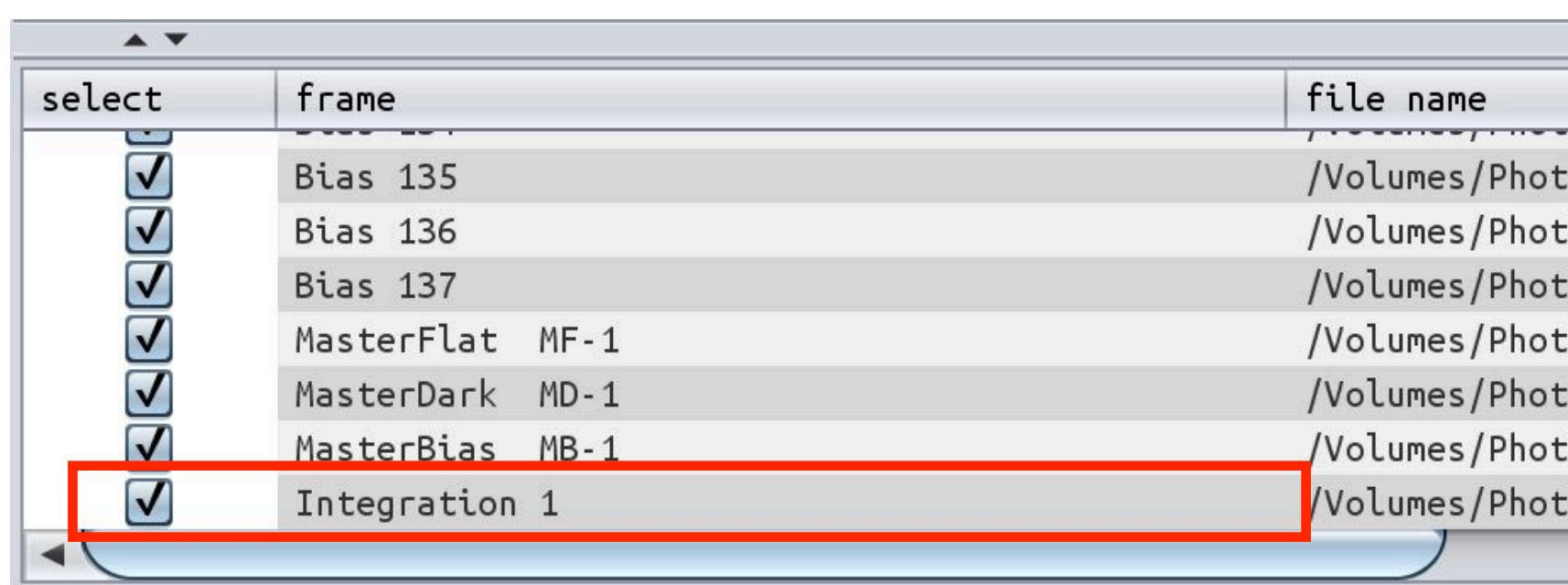


Tip: With a lot of images, Drizzle increases the resolution and makes stars sharper, at the cost of less noise reduction

Oh, and it eats A LOT OF MEMORY

Once it's done, the bell will toll and you'll have a new image at the bottom of your Image List. Double click on it!

6

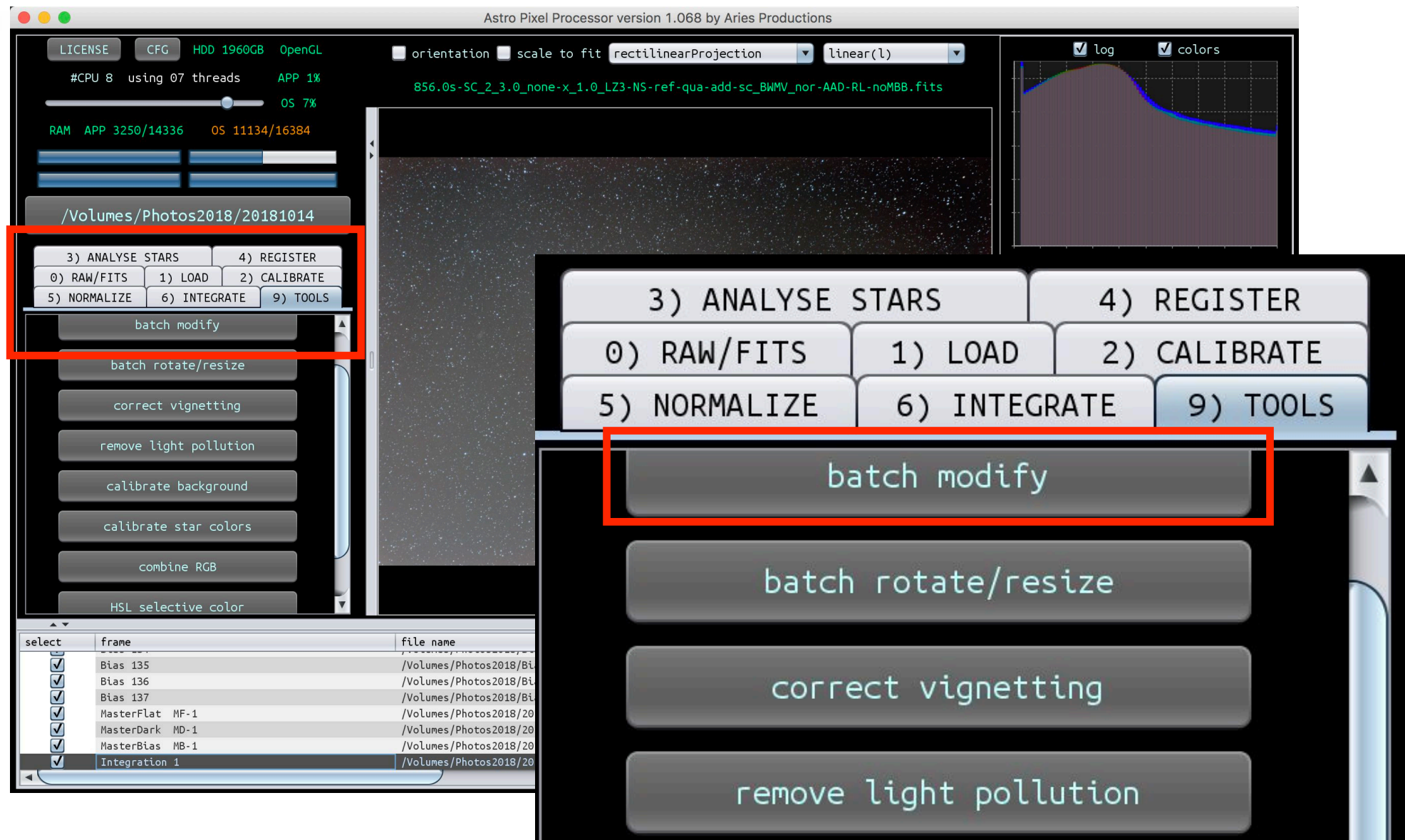


...on to processing !

PART 7 : CROPPING THE IMAGE

1

To crop the image, select the Tools tab
and click on Batch Modify



Click Yes and you'll be sent to a different pane. Draw a rectangle in the area of the image you want to keep, scroll down and hit "crop OK"



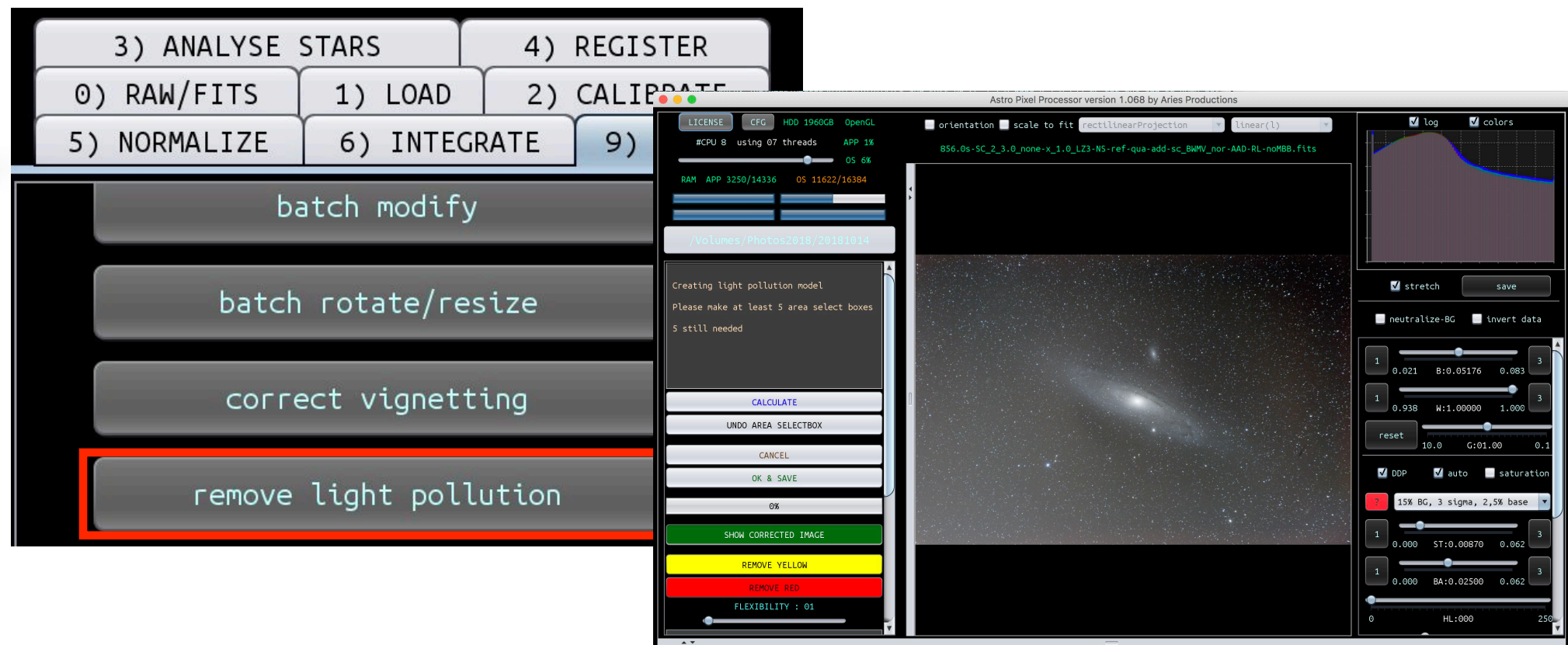
Click ok to save the cropped image

Tip: The cropped image will appear at the bottom
of the Image List as "Other/Processed X"

PART 8 : LIGHT POLLUTION REMOVAL

Hit Remove Light Pollution and the left pane will change again

1



The goal here is to draw a couple of regions that contain empty space (no Deep Space Objects) and regions where the light pollution gradient changes

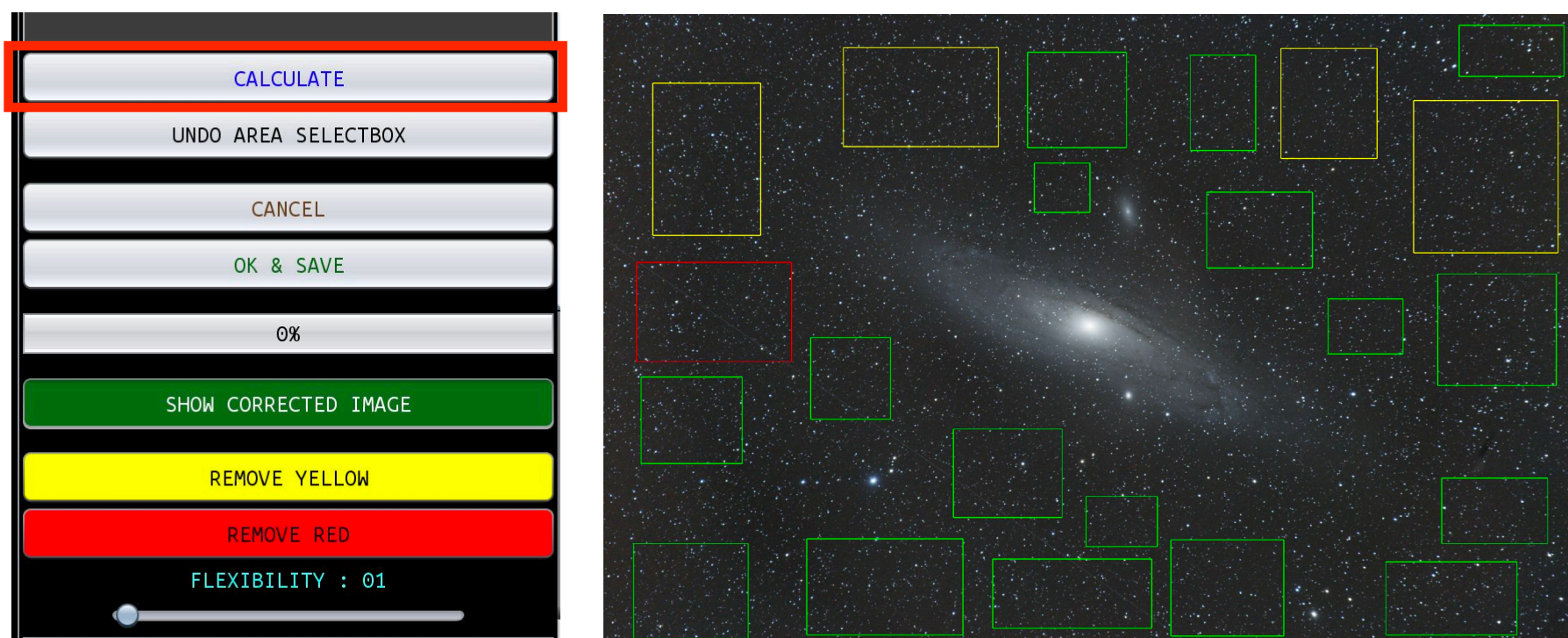
2



Tip: a single Left Click will zoom in, Right Click will zoom out.
Careful clicking too fast as it will start lagging considerably

Hit Calculate to see the current result, adjust your samples and when you're satisfied click OK & Save

3



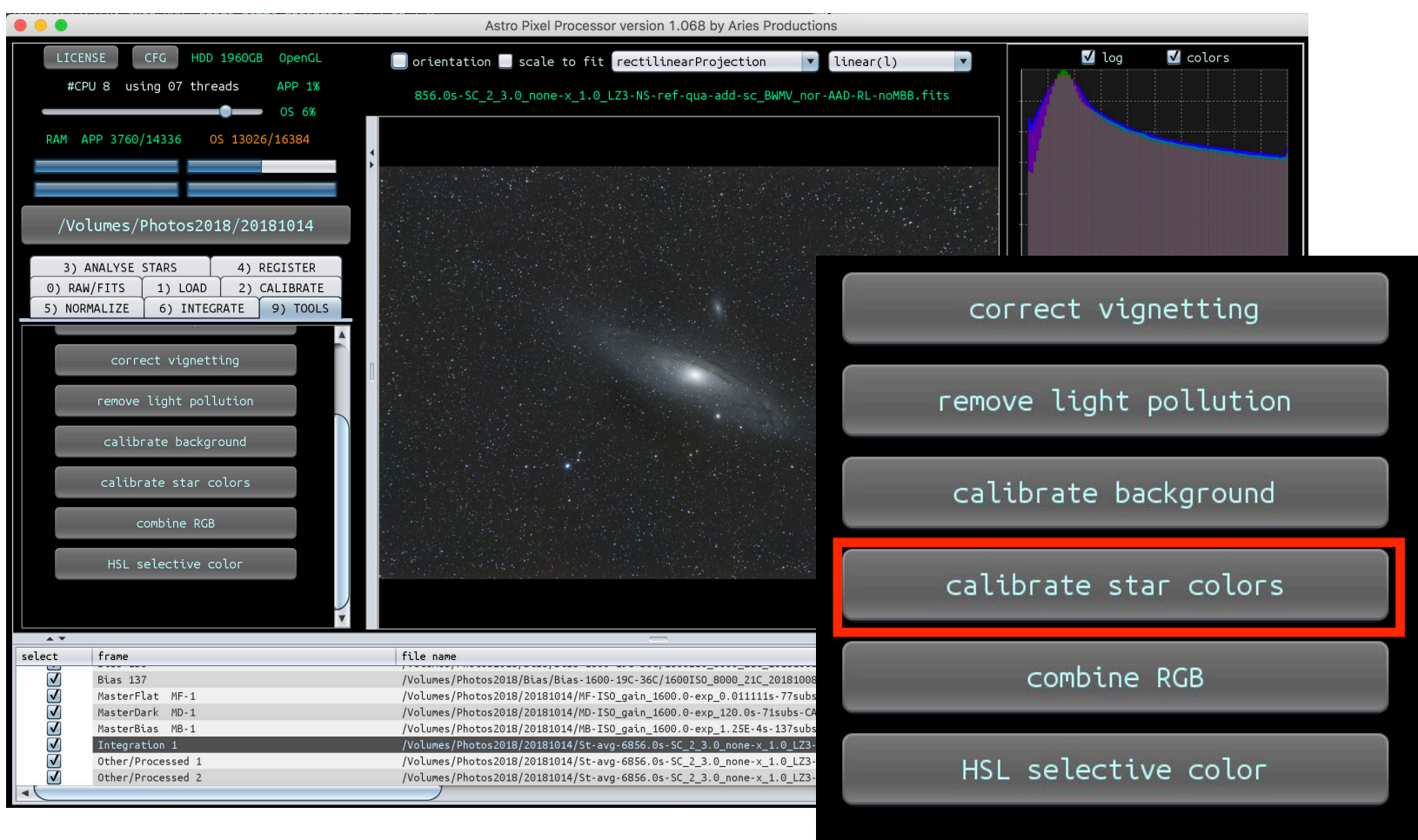
Tip 1: red and yellow selections do not match the gradient model, you can delete them and re-select regions in the same area

Tip 2: Click on Show Corrected Image to display the correction gradient (and see if you are mistakenly removing some of the DSO)

PART 9 : STAR COLOR CORRECTION

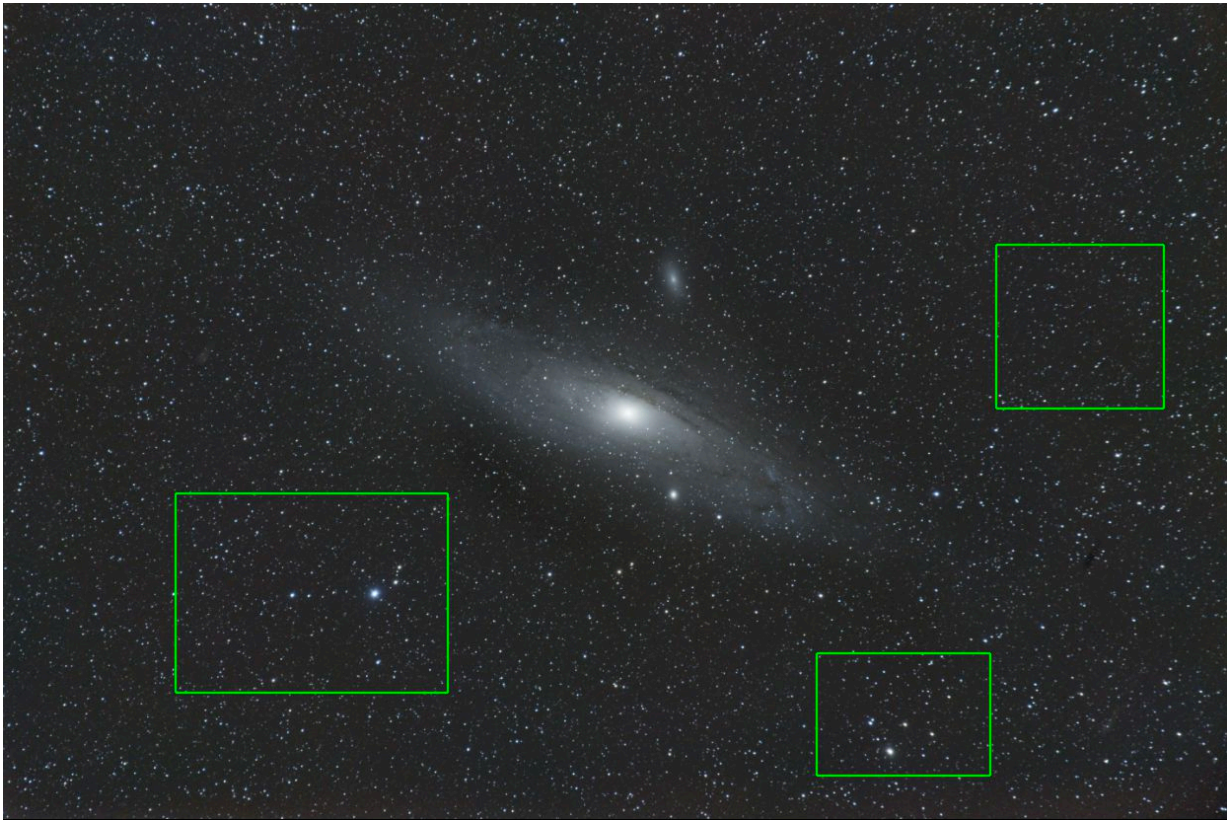
Hit Calibrate Star Colors to open up the corresponding panel

1



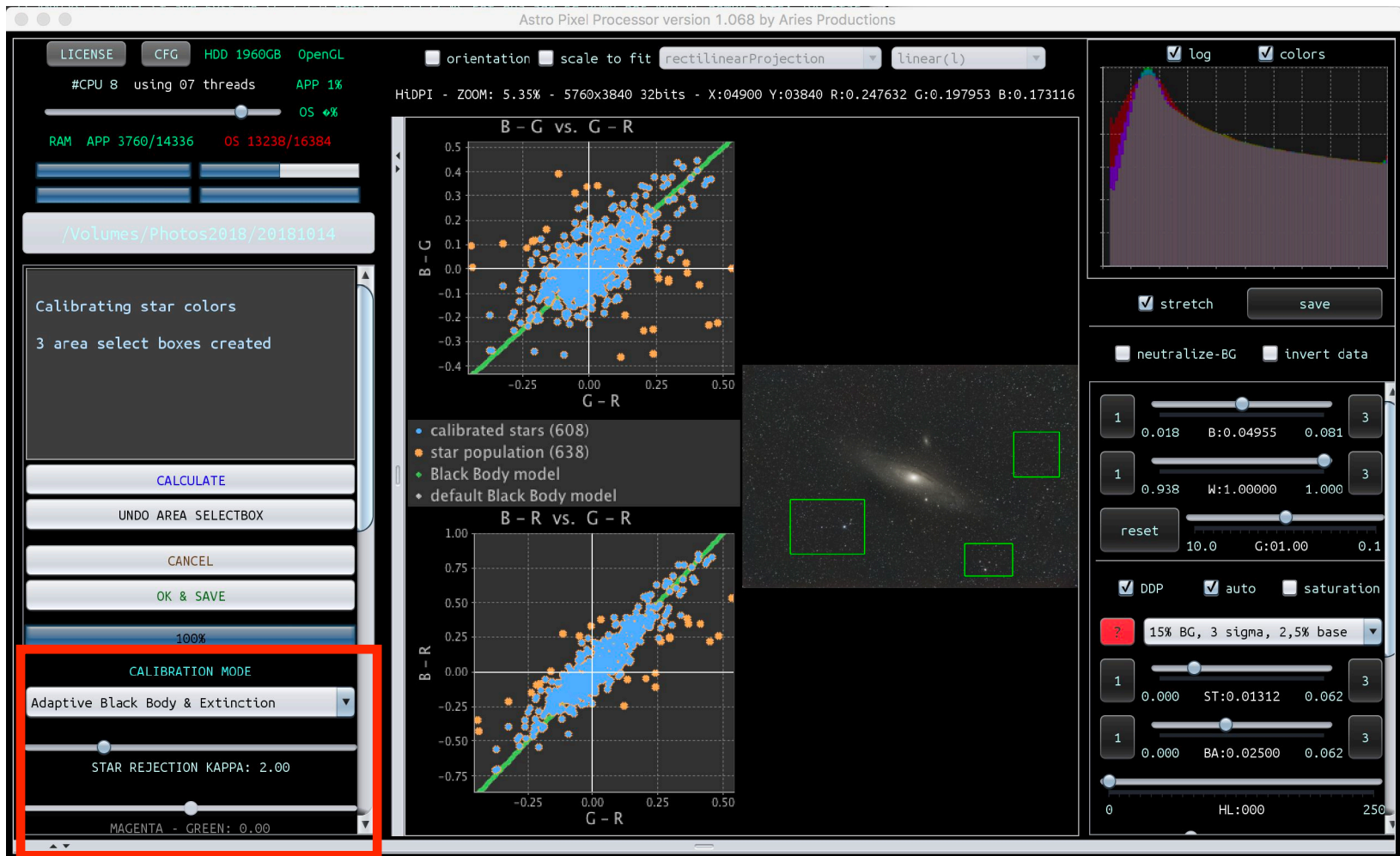
Make some selections of brightish stars on a dark background (no DSOs), and hit Calculate

2



Adjust the "temperature" of the stars using the controls on the left

3

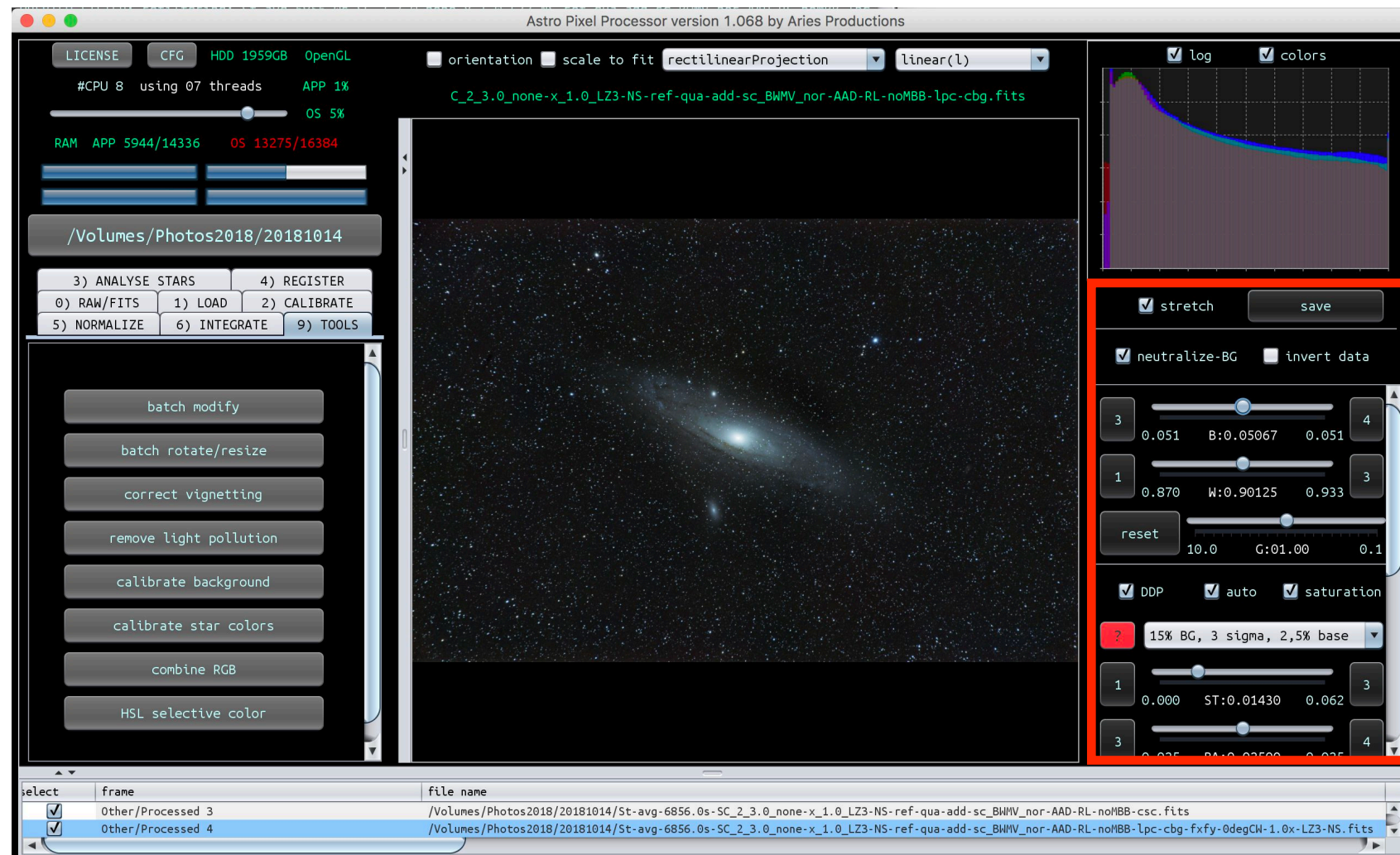


Hit OK & Save when satisfied to save the changes

PART 10 : FURTHER PROCESSING AND EXPORTING

Play around with the Right-Hand pane and its options

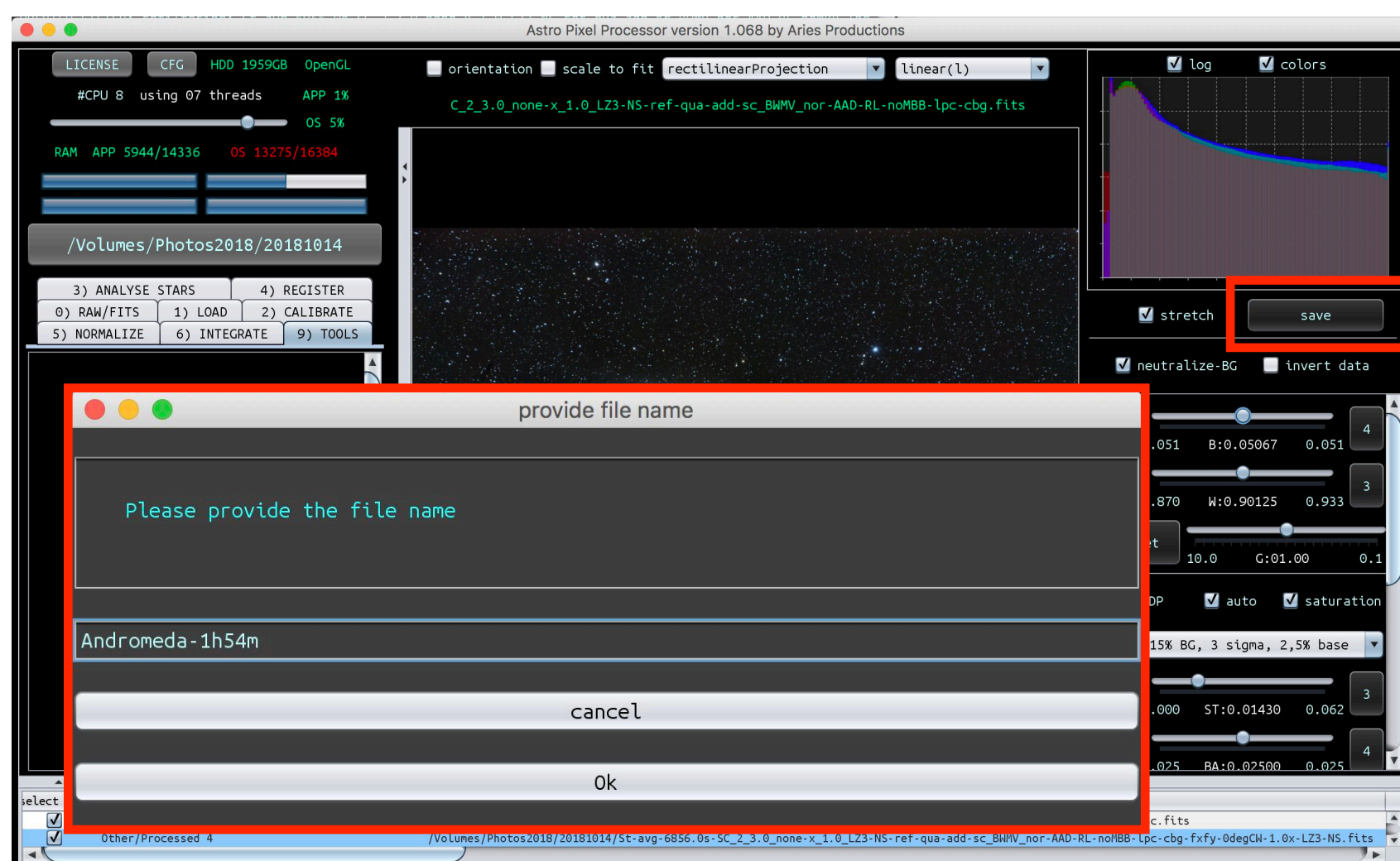
1



Tip: The red "?" button provides visual examples of the parameter options. Play around with the parameters but be careful with the sliders as they can be finicky

Save the File by clicking on Save and providing a name

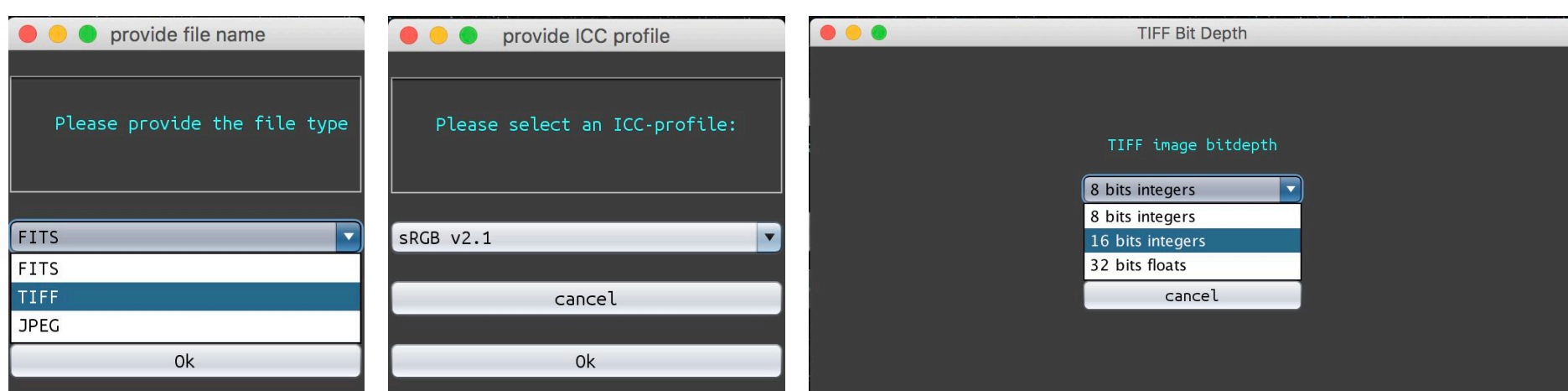
2



Tip: All steps of the process are saved in FITS format, and you dont need to save them again

Select the format, OK OK OK and edit away on your favourite software

3



Tip: Careful with your mouse, the interface tends to lag a bit and you can mis-click on buttons if the combobox disappears at the wrong moment

PART 11 : TIPS AND TRICKS

1

If you Load the images and go directly to the "Integrate" tab, all the other steps will be performed automatically, without having to go step by step

Tip: You will not be able to set a reference though, so you better do:

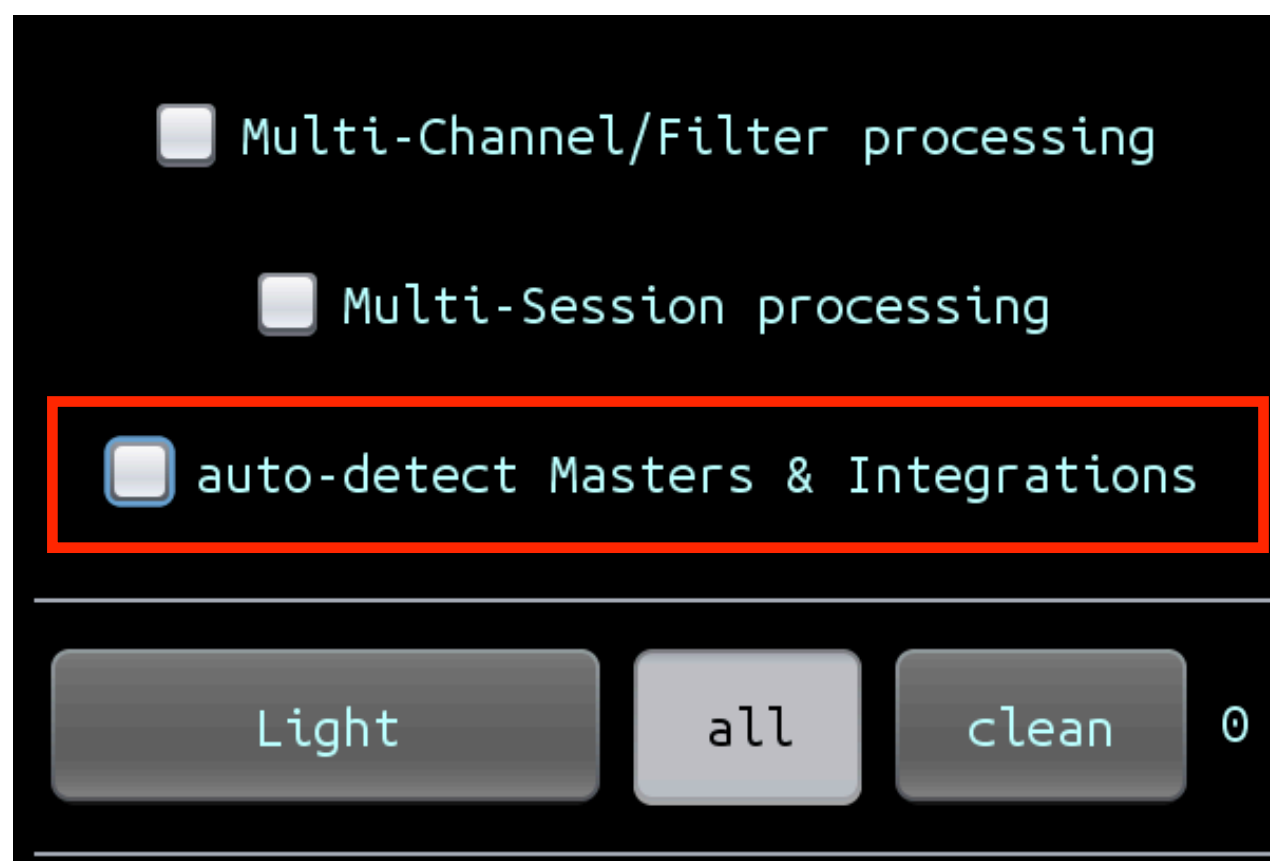
1 - "Analyse Stars"

2 - "Set Reference Image"

3 - Jump all the way to "Integrate" and launch the rest of the process

2

If you're running out of memory, split your subs into 2 groups, stack them together, then RELOAD the two stacked images as Lights and re-stack them



Make sure you DISABLE Auto-Detect Masters first otherwise you won't be able to reload the Integrations as Lights

Tip: When you split into groups don't pick images sequentially (beginning of the night in group 1, second half of the night in group two) but divide them evenly in time. This will improve the quality of each individual stack and make their combination closer to the result you'd obtain if stacking everything in one shot. An easy way to split the images uniformly is to display them in Icon view, resize the explorer/finder window to have two column of images, and select one entire column of images

3

APP automatically recognises master calibration files, so if you have already created them, you can simply load everything at the same time alongside the Lights

Tip: If you have imaged multiple objects, with the same settings make multiple copies of the Master Calibration files once you have them and put them in each folder of your Lights. You can now load everything with a simple Ctrl + A from the Load Light button