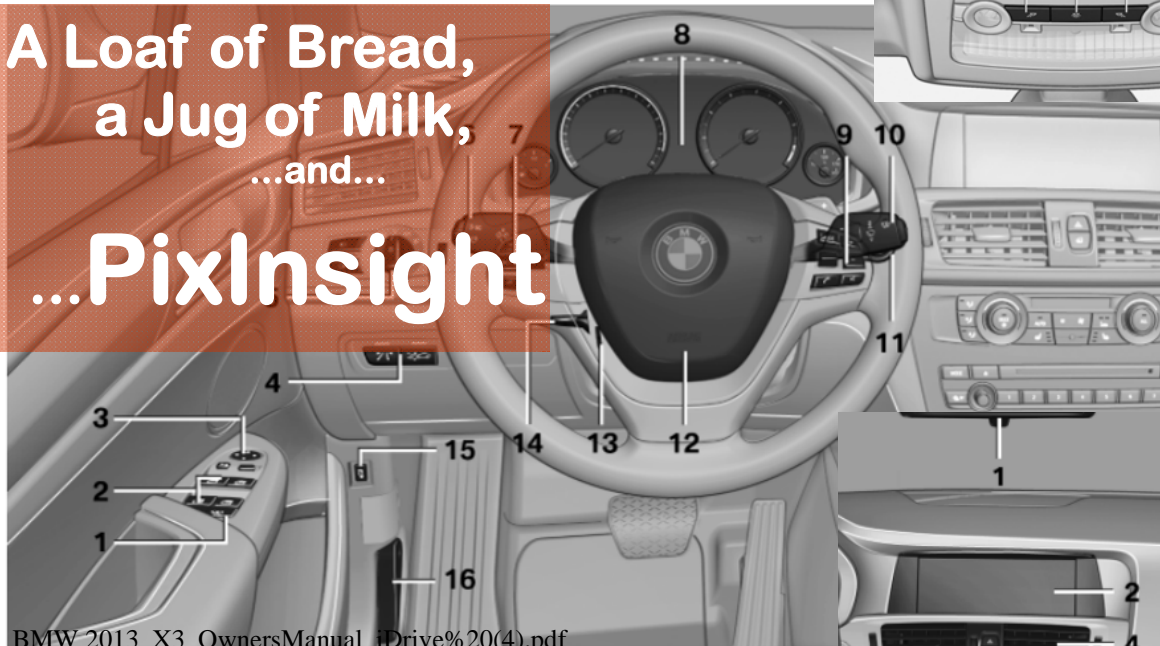


A Loaf of Bread, a Jug of Milk, ...and... ...PixInsight



BMW 2013_X3_OwnersManual_iDrive%20(4).pdf

"Hey, Honey." It was a simple request from my lovely wife. "Why don't you jump in that new car of yours, and run down to the market and get us some bread and milk?"

She did not sense the terror that leapt in my chest.

I had just barely opened the owners manual, and there they were, page after page of pictures and instructions about which button did what, when to use it, when not to use it, how to get the most fuel efficiency out of which turbo mode, how to implement traction assist, and when, and how to change the engine torque and shift points by moving the transmission lever (item #12 in the third illustration on the fourth page of illustrations). One hundred forty pages, and that does not count separate manuals for the radio, clock, and GPS!!!

I would never figure out how to drive this car properly. Shift points? Turbo boost? My gosh, there are 25 warning light indicators on the instrument cluster. They glow in different colors to indicate different disasters. How could I ever learn?

All I wanted to do is drive to the store for some bread and milk!!!!

That was seven years and 51,820 miles ago. I learned. I survived. I even flourished.

But that same fear rushed back when first I opened PixInsight.

...All I wanted was a picture!!!

Not long ago a budding young astroimager asked me to help him get started in PixInsight. During that session, I realized that quite a bit could be done in PI without knowing a lot about it. Within a few hours, this young fellow left my house with an image of M31 far better than he had produced with any other processing software—and he had been at it for several years. I resolved to put together a tutorial of what we did that day. My assumptions were:

- Use Pixinsight just as it comes from the download site.
- Use the processes with the biggest bang for the buck
- Use the processes that could most easily be explained to a newby.
- Use defaults wherever possible.

In other words, use what was in Pixinsight that could produce a photo almost automatically, without knowing much more than what processes to use.

These assumptions do not make for the best image. They do make for a pretty good one, though. I believe a good picture is *easier* to produce under these assumptions in Pixinsight than in the Deep Sky Stacker/Photoshop combination.

For this tutorial, I chose to use and explain things that were easy to explain. For instance, one can start a process many ways: The Process Explorer, the menu bar (which can be approached in several ways), the tool bar, action icons, and I don't know how many others. This tutorial always approaches from "menu bar: Process/All Processes/...(process name)." But the other approaches are actually more convenient!

I leave out many things you will eventually need to know. (See the last page here to see what this costs in quality.) You do not need them for your first image—but you will need them eventually. I have left these things out because they get in the way more than help at this stage. You will come back to them soon enough.

There are some very important processes (like star masks, morphological transform. Atrous Sharpening) that really are cool and improve the image. But they were harder to explain than we needed at this point. Once you have a handle on the system, you will learn them quick enough.

I made some assumptions that the reader of this tutorial knows how to get around in Windows, how to select a file, how to close a window, and so forth.

This tutorial is targeted at a select audience: Those who just want to get an image for the first time. They want to drive to the store, and get a jug of milk and a loaf of bread.

If you find this tutorial too elementary for you, it is. Do not waste your time on it. If you find it helpful, enjoy it.

Before We Start

Hopefully you have a set of data that you can use in this tutorial.

This tutorial is based on One-Shot-Color imaging. If you took your data with a DSLR, or with a OSC CCD camera, it will work fine. If this tutorial works well, I may write a similar one for those with LRGB filters on mono cameras.

You should take enough light frames so that when all is said and done, and you have discarded the streaked, fogged, trailed, and so forth, you still have a dozen or so good Lights. (If you don't, go ahead and use what you have. Try to have eight or nine at least. But use what you have.) You should also take at least a dozen flats, darks, and biases. It is most convenient if you have stored them in a common folder on your hard drive, but as long as you know how to find them when you need them, you will be all right.

This tutorial assumes the defaults that are in PI when you first download and install the system. If you want to get back to that fresh install, simply press the Control button as you click to start Pixinsight. You will get a warning that you are tossing out any re-configuring you have done to your existing copy.

Do not assume that after you produced your first photo you know PixInsight. (Again, see the last page here to see much better proper processing is from what I describe in this tutorial.) You will be led down a very safe path, with a guide all the way. You will not take the exciting side paths that would make this a much more rewarding adventure. But, you will safely make it through. I strongly encourage you, after you have completed your journey once, to go back and explore all those other little twists and turns. That is when you will really learn the power of PixInsight.

Alex McConahay

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On Sunday night, October 11, 2015, I walked through this tutorial with the viewers of The Astro Imaging Channel. You can see a youtube version of that at:

<https://www.youtube.com/watch?v=hsVv2bDmGzA>

Tutorial Ver 1.01 October 29, 2015 Copyright, Alex McConahay alexmccconahay@gmail.com

This tutorial uses PixInsight 01.08.04.1171

The Lights used here of M33 were acquired at the Oregon Star Party in August, 2015, with a TeleVue 85 with a Hotech flattener, on a Losmandy GM 8, using Backyard Eos and PhD2 Guiding. The camera was an unmodified Canon 6D. Exposures were two minutes at ISO 1600.

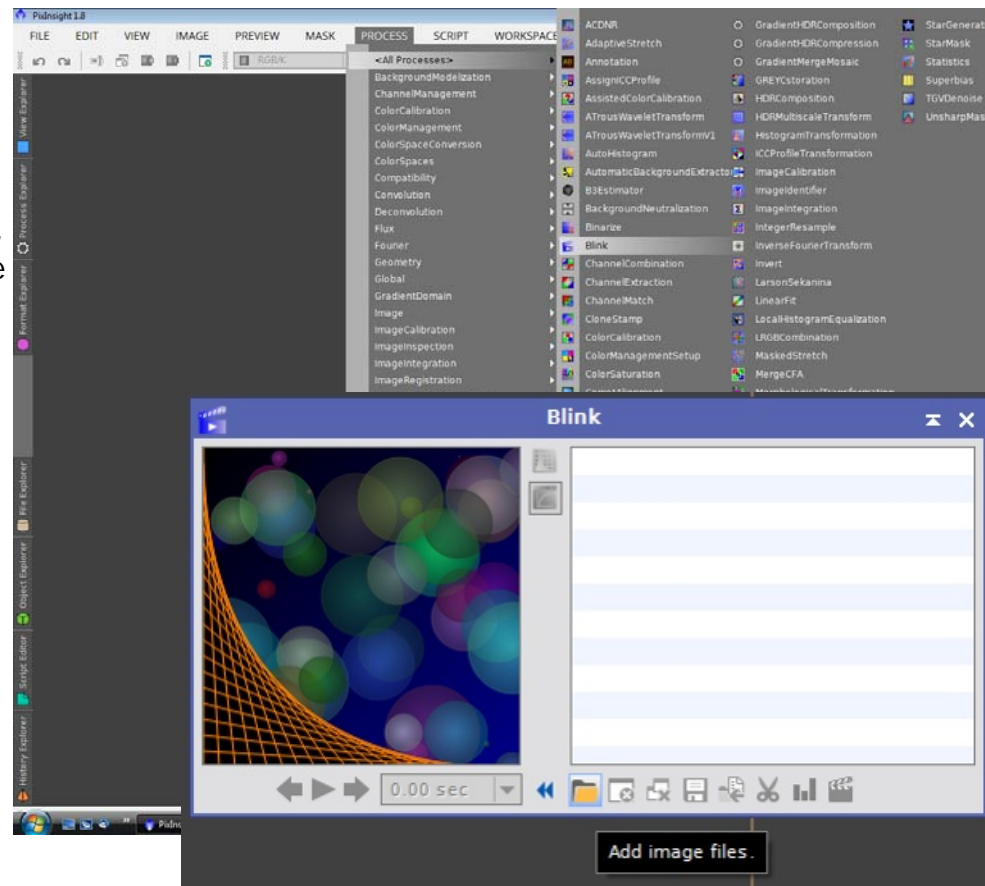
I. Select the Good Shots—the Blink Process

In the course of the night, some subexposures will be good. Others will be out of focus, stuck in clouds, trailed, and such. The first step is to look at each of the subexposures, marking the good, and discarding the bad. To do that, we will use the “Blink” process.

Open the Blink Process by clicking on the main menu bar:

- Process/
 - All Processes/
 - Blink

You will see the Blink Process window.

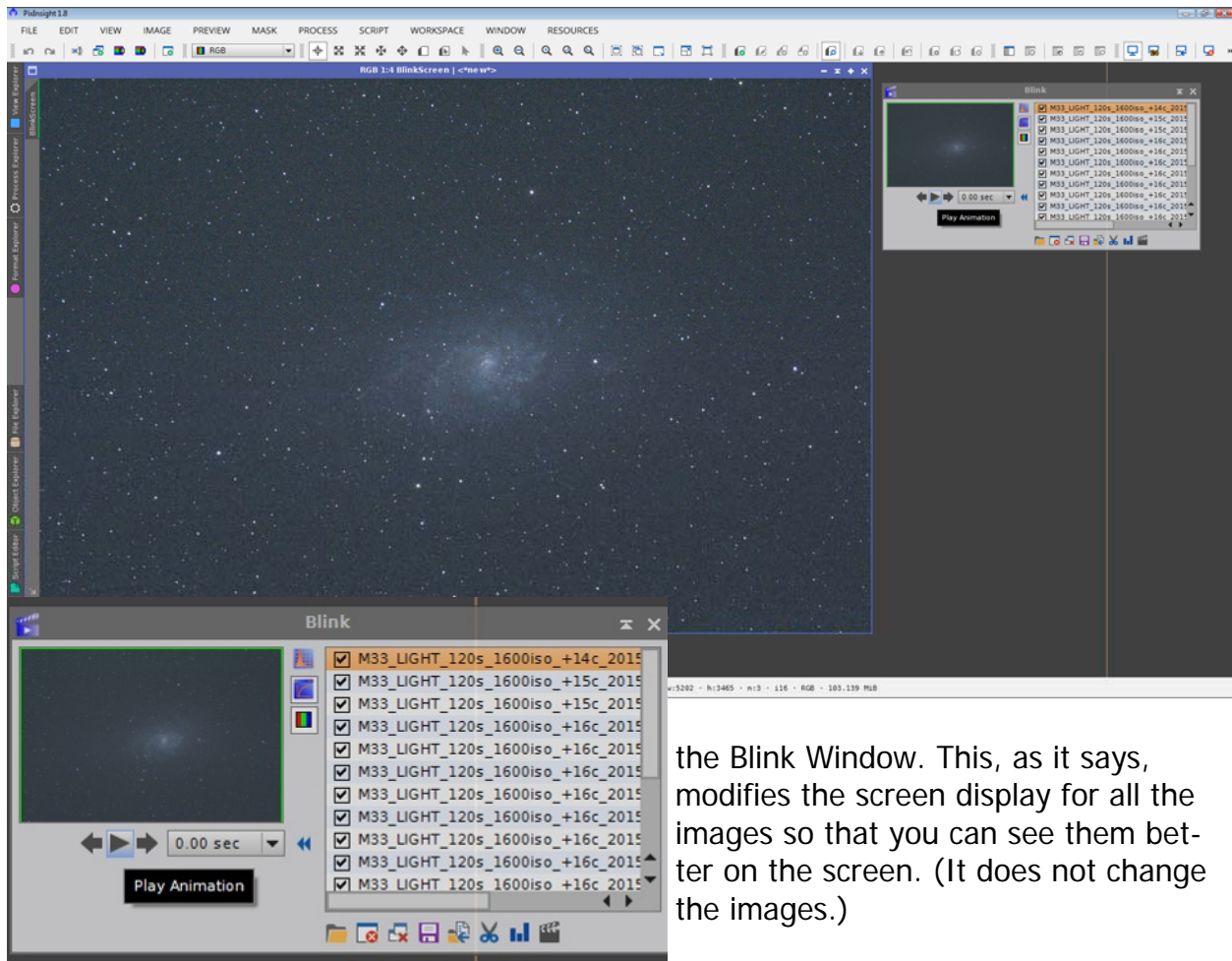


The Blink window has a set of icons at the bottom. The first we will use is the “Add Image Files” icon. It looks like a file folder, and is first on the left at the bottom.

Click on the file folder icon to add image files to the Blink window. Navigate to the folder containing your LIGHT subexposures, and select them all. (Select them as you would any windows file manager files....click on the first, scroll down to the last, and SHIFT-Click on the last. Click the “Open” button in the lower right corner of the file selection window.)

Depending on the number of files, and the size and type of files, this operation could take a minute or more. When it is finished you will see one image in the main window, a smaller image in the Blink window, and a list of all your files.

Click on the “Apply Histogram to All Files” icon. It is the orange on blue histogram at the top of the column between the small image and the list of files on



the Blink Window. This, as it says, modifies the screen display for all the images so that you can see them better on the screen. (It does not change the images.)

Now, click on each image in the list. If the image looks pretty good to your eyeballs, go on to the next image. If it does not look good (trailing, too fat stars, some other weirdness), click on the "Close Selected Image" icon. It is the second from the left on the bottom row, and has a white X on a red circle.



When you have been through your list, all your bad images are gone from your list. All your good images remain. Click through the list again to make sure you did a good job. If you find any bad shots remaining, close them.

Now, you want to move all the good images from where they were to a new folder on your hard drive. To do so, select all the images (again, click on the first, and shift-click on the last). All your files should now be highlighted in orange. This means they are "Selected."



Then click on the "Move Selected Files" icon. It is the fifth icon from the left, a blue arrow pointing to a yellow folder.

When you click the Move Files Icon, you open a standard Windows file folder screen.

Navigate to where you want to save your files.

Create a "New Folder" and rename it "Selected" to hold your good files.

Click on your new folder, and choose the "Select Folder" button in the lower right corner.

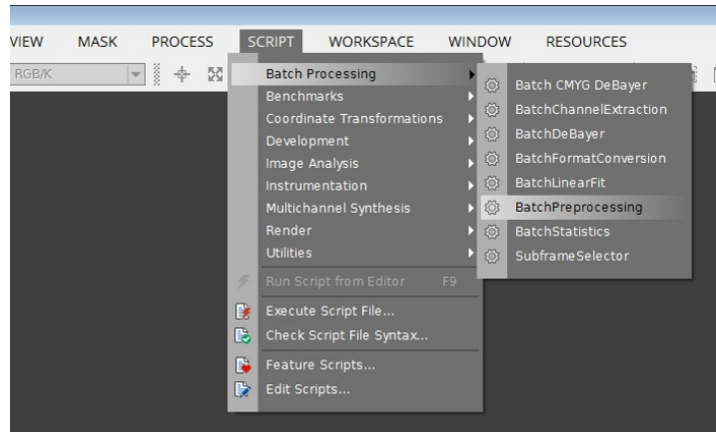
Your good files will be moved to your new folder. Your bad subs will be left behind.

II. Calibration and Pre-Processing

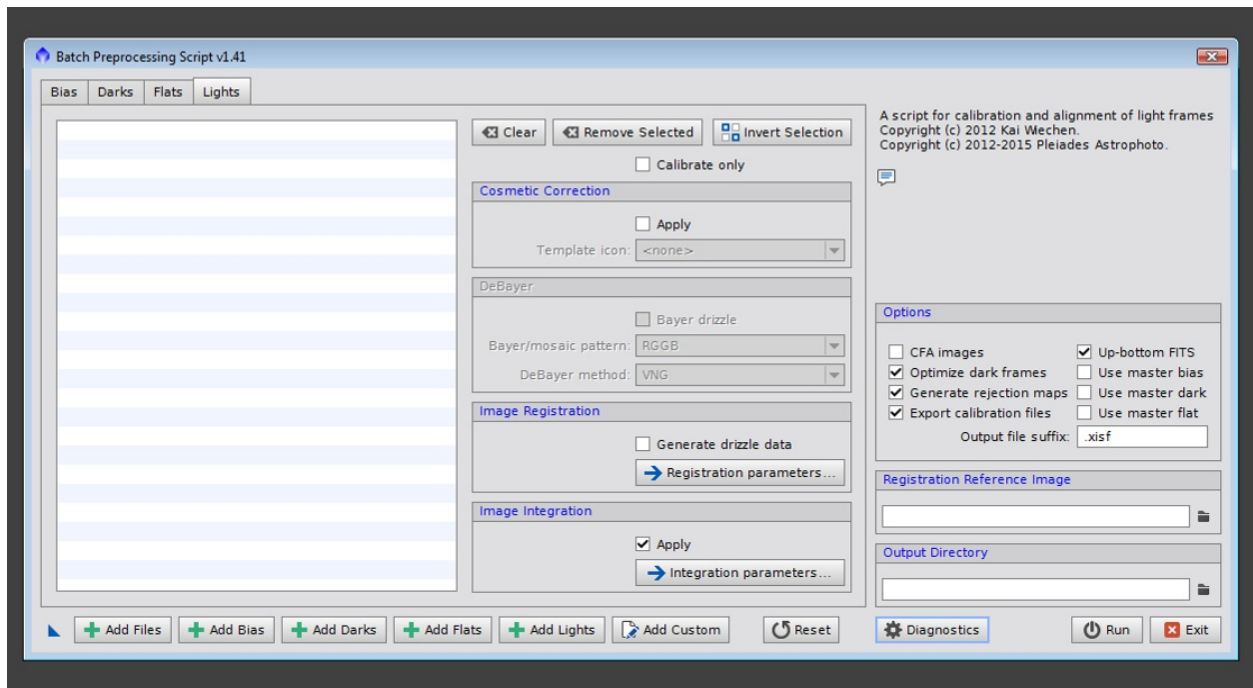
The next job is to calibrate the light frames and combine them into one master image. This is done with the Batch Pre-Processing Script.

Open the Batch Pre-Processing Script by clicking on the main menu bar:

Script/
Batch Processing/
Batch Pre-Processing



And up pops the BPP window:



Start using this tool by populating the file windows. Notice the buttons across the bottom row. Our first (fifth from the left) is "Add Lights." Click on it, navigate to the folder holding your good subexposures. (You labeled this folder "Selected" in the Blink section of this tutorial.) Select them all, and press "Open" in the lower right corner of the folder window.

Continue the same procedure using the Flats, Darks, and Bias buttons.

Click through the tabs at the top of the file lists (Bias, Darks, Flats, Lights) and see


that the files you expect to be there are in fact there.

Now turn your attention to the “Options” panel at the right of the BPP Window.

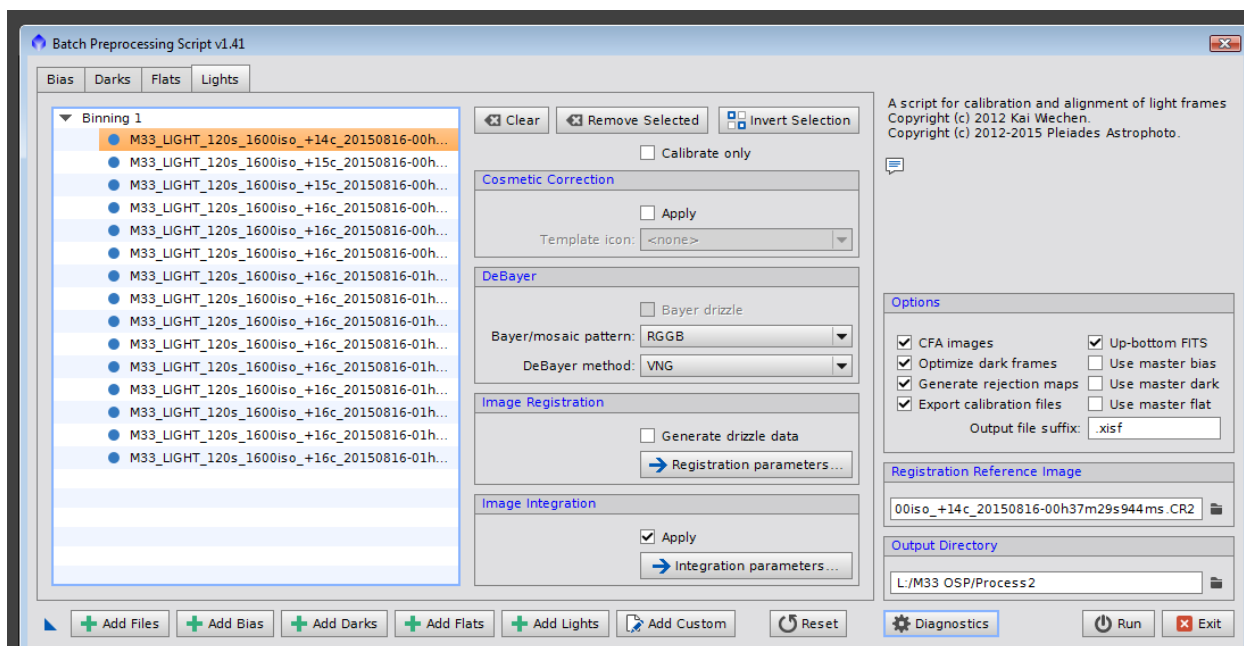
Check the box for CFA Images. This means that you are using One Shot Color images (those that use a **C**olor **F**ilter **A**rray, with a pattern of colored filters in front of a mono sensor). Notice that when you click, the “DeBayer” panel in the middle of the window becomes active. You must provide one piece of information there: The Bayer/demosaic pattern. The default RRGB works for most OSC cameras, including most DSLRs (all Canons and most Nikons). If you know your camera uses a different Bayer pattern, provide it by selecting the proper pattern from the pull down menu. If you do not know your pattern, try the default. If your colors come out very strange, then you need to do some research about your camera’s CFA or Bayer pattern.

Below the Options panel, you will find an entry for Registration Reference Image. The easiest way to complete this information is to double click on one of the “Lights” displayed in the File List.

And below that, is the “Output Directory” input area. This is the name of the file folder where you want to store the files that the script develops, including your calibrated images, your master darks, flats, biases, and important integrated light files.

 To select an output directory, click on the Output Directory file icon (at the end of the entry window) , navigate to where you want to store the files. Create a New Folder called “Processed.” Click on the “Processed” folder, and choose “Select Folder” from the lower right corner of the window.

Your BPP Window will look like this (but with different file names):



Review your window and compare it to the one at the bottom of the previous page. Do you have the same boxes checked, and the same boxes empty?

Click on the "Diagnostics" button at the bottom, three from the right.

The script will analyze your request and the file lists, and may give you a "Diagnostics OK" message. If it does, tell it OK, and tell the script to "Run" by pressing the second icon from the right along the bottom of the window. Then skip to the next page of the tutorial, omitting the next section (about the diagnostic report having problems).

OR.....

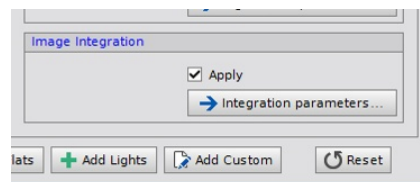
Your Diagnostics report may say you have a problem. You will not have a problem if you did everything this tutorial said to do *and had a sufficient number of files in each category*.

Let's look at some of the problems the diagnostic report could have.

You may have forgotten to identify the Registration Reference Image. Or the Output Directory. Go back and do so. These are easy to correct.

You may not have bias or flat frames. You will get a warning in the diagnostic report. You should collect these calibration frames eventually. However, you can go ahead and run the script even with these shortcomings. Your images will suffer.

Or, you may have insufficient images. This tutorial assumes you have at least a dozen of each type of image (12 lights, 12 darks, etc.). The default integration algorithm, Windsorized Sigma Clipping, needs eight subs to get reliable results. If you have fewer the script suggests you use a different rejection algorithm. To do so, you need to change the Rejection Algorithm in the Image Registration panel (bottom of middle column in the main BPP window). Click on Integration Parameters. Choose the rejection algorithm they recommend (usually Percentile Clipping).



Sometimes you have a Rejection Algorithm mismatch on one type of sub (say lights), but not other types (say bias, or flats). If this happens you can click on the tab for that type of sub having the problem. Steer to the center column, and choose (under Rejection Algorithm) the suggested type.

The script requires that you have at least three frames before it will integrate.

You must resolve any diagnostic errors regarding not having three lights, an output folder, or registration image. Others may be ignored this time. Go ahead and push

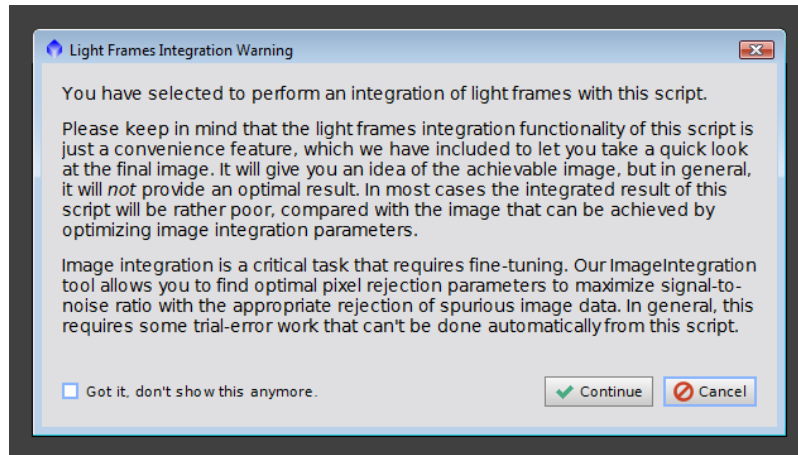
“Run.”

When you press “Run,” you will get a nasty message saying you are a lazy butt. And there is a good reason it is there: you are being a lazy butt. And the results you get from this exercise will not be as good as they should be (and as good as they *will be* once you learn how to use the tools available in Pixinsight). But that mean old message did not know you are a sensitive newbie and trying the hardest you can just to get something. Forget about its cruel tone, its air of superiority, its condescension, and just continue. You are still a worthwhile human being.

Probably.

Tell it to “Continue” and go do something else for a while (an hour sometimes!!!!).

When you get back, if BPP is finished, the Process Console will have disappeared and you will see the BPP screen staring at you. Exit the process, and confirm the exit.



III. Cleaning the Data

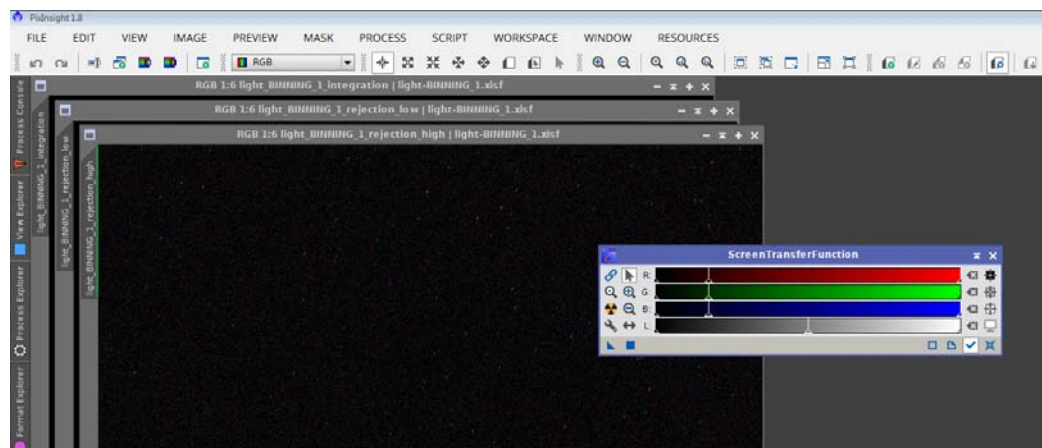
The BPP process created several new files on your computer. We are interested in the Master Light. It contains the image you will work on for the rest of the tutorial.

A: Reviewing the Master Light

On the main Menu, click File/Open, and navigate to the "Process" folder you created in the BPP section. You will notice the program has created three folders: Calibrated, Master, and Registered.

Go to the Master Folder, and you will see four files: Bias..., Flat..., Dark..., and Light.... (The ellipses contain information related to your original file names.)

Double-Click on the "Light..." file, and it will open with three images. All three look black or very dark. To make them visible, you will use one of the most



powerful of Pixinsights tricks, the Screen Transfer Function. This tool applies a temporary transformation to your data so that you can see your image.

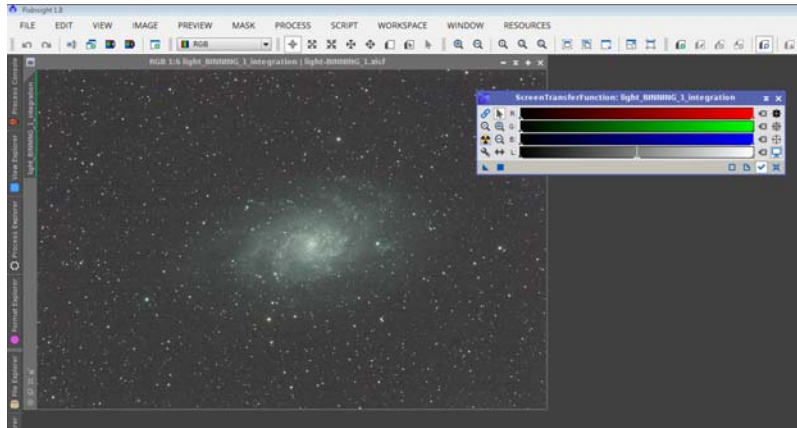
To open the Screen Transfer function. Click on:

- Process/
- All Processes/
- Screen Transfer Function

What you really need for now from the STF window is the "Auto Stretch" icon, the radioactive sign. Click on one of the images (Rejection High should be on top), and then click on the Auto Stretch icon. Look at the "rejections" if you like. Note how the rejected pixels stand out. (Rejection images are unnecessary for this tutorial, but you can learn lots from them when you start processing for real.) Then close the image by clicking the "x" in the upper right hand corner. Inspect the "Rejection Low" image with an Autostretch if you like. There is usually less to see here. Close the file.



Now, the big “reveal.” You should be looking at the master “Light” file. It will probably be very dark until you click the Auto Stretch Icon. PixInsight puts a temporary screen stretch on the image (without changing the underlying data) so you can see what it might look like when properly stretched.



In my M33, the galaxy is off center. There is not much contrast. The background is a little red. And it is noisier than I would like. All that needs to be fixed in processing. But it has promise.

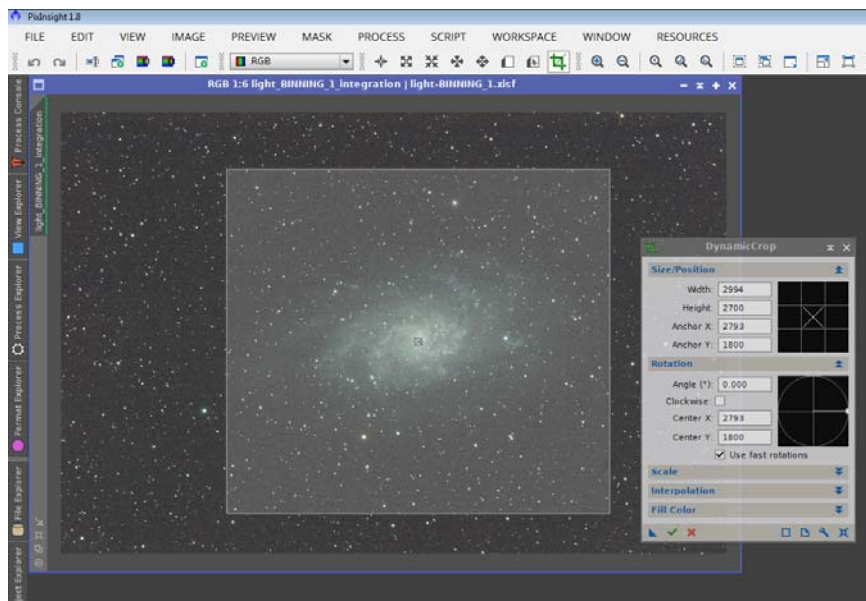
By the way, keep your STF window open for the next few steps.

B: Dynamic Crop

The first thing you want to do is adjust the composition of your picture. If you had a bad gradient, or bad vignetting, annoying optical aberrations in the corners, or some distracting bright star off to one side, you might want to cut them out of the picture.

To open the Dynamic Crop function. Click on:

Process/
All Processes/
Dynamic Crop



You see the Dynamic Crop Window. Click-drag on your image to draw a box around the subject of your picture. Or, place a cursor on the edge of the image, dragging the edges in. Check around the edges. If you have dithered, or your images have otherwise shifted through the night on acquisition, you will find the registration process has left ragged edges. Crop them out. See how the shaded area marks the area that will be retained.



You can click drag the edges inward. You can move the whole box around by click dragging. Beware, the drawing in the tool is a little finicky. You may have to restart the tool several times before you get what you want. Experiment as needed. If you want to reset the tool, use the “Reset” icon in the lower right corner (the blue X on a blue box) or close the process and restart it.



When you are satisfied, click the “Execute” icon (the green checkmark, second from left on the bottom). This will crop your picture.

Re-apply your STF by using the radioactive icon on the STF window. You need to do this because cropping the image has changed the data STF used to compute the best histogram.

C: Removing Gradients: Automatic Background Extraction

Many astroimages suffer from gradients in one or several parts of the image. These are areas that are lighter or darker than they should be. They can come from vignetting (in which the corners are darker and the center brighter), incorrect flat fielding, light pollution, moonglow, and other causes.

Inspect your image (while it is stretched using the radioactive Auto-Stretch of STF), looking for brighter areas and darker areas that should not be there. If you find none, skip this section, and move on.

If, however, you have brighter and darker areas, you need to flatten out the background. Use the Automatic Background Extractor. To get there, click on:

Process/

All Processes/

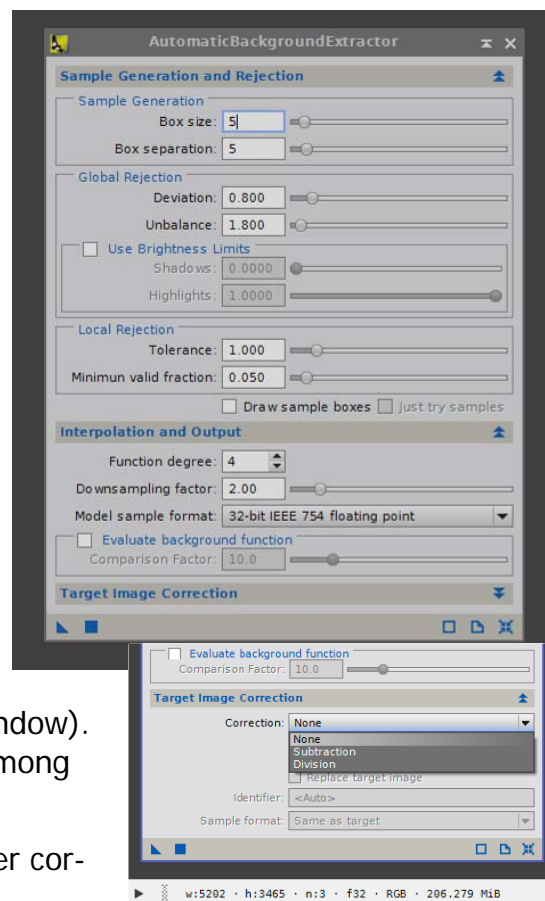
Automatic Background Extractor

So far in this tutorial we have been using defaults. But for ABE, the default for correction is “None.” To change that, open a subwindow of the ABE window. To do so, click on the double down carats next to the “Target Image Correction” panel (at the bottom of the ABE window).



This opens a pane where you can choose among None, Subtraction, or Division.

.....If you can see vignetting in your image (darker cor-



ners, abnormally brighter in the middle), choose Division.

.....If you have any other gradient problem, choose Subtraction.

While you are in the Image Correction Panel, click the "Normalize" box.



Click the "Apply" box (the blue square, second in from the left at the bottom).

After some whirring and clanging the Process Console will disappear, and you will have two new images (in addition to your original).

The first is the Background. It looks black, probably, but click on it, and then click on the Autostretch (radioactive) icon on STF. Is the pattern smooth (showing large, smooth gradations)? Does the pattern you see reflect the distortion of the background in your original? If so, you probably got a good extraction. If you see splotches, small areas of change, you probably did not.

The second new picture, says it is the "ABE" version of your original. Click on it to make it active, and Autostretch it with the STF. Is that background flat like it should be? Have the unnaturally brighter areas been brought down?

If your original was better than your new ABE version, you may want to experiment a little. Simply click on the original image, change the "division/subtraction" parameter, and try again by clicking on the "apply" square. Sometimes it helps to apply the process to the original, and then to the resulting ABE replacement. (Doing the process twice).

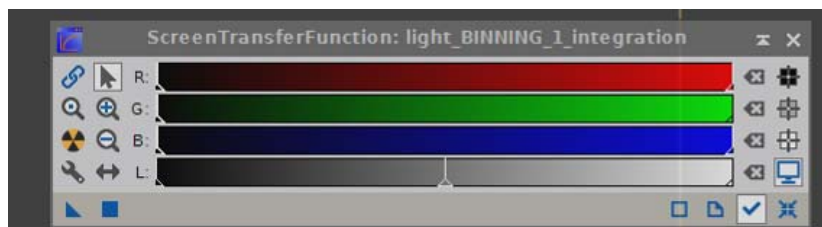
Use the STF to check on your results as you go.

When you are happy with the background flattening, remember to use the best resulting image (the ABE if it was better, or the original, or whatever else you got) as your image in subsequent steps.

D: Background Neutralization

Images sometimes get color casts. The background sky should be pretty much equal in the Red, Green, and Blue channels. But say red is stronger relative to the others, the whole picture will take on a reddish cast. PixInsight has a simple tool to take care of these problems.

Before we look at Back-



ground Neutralization, let us look at a tool that has been hiding in plain sight on the Screen Transfer Function window. You are familiar with the Autostretch (radioactive) icon. Two icons above it, is the “Link Channels” icon. It is a couple of blue chain links. Click on the links, and then on the Autostretch icon. Click again on the links, and again on the Autostretch. Flip back and forth from linked to unlinked, autostretching in each transition. Notice how your image changes general color cast. If it does not, you can skip Background Neutralization. If it substantially changes the general color, click on:



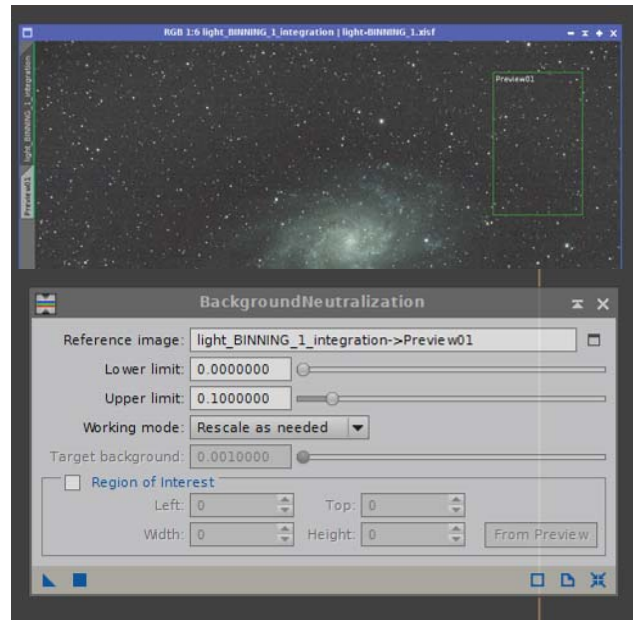
Process/
All Processes/
Background Neutralization.

The tool uses a reference image that shows the typical background sky. It computes the relative weights of the channels, and then mathematically corrects those values, so the typical background sky is neutral—all three colors at about the same strength.

You don’t absolutely need to define the background sky for the image. You can consider the whole image as the reference by taking the default “Target Image.”

But you should create a preview if you have a good bit of of nebulosity, and relatively little background sky. It is easy to define a reference image, and a skill you should learn. (You will need it in the next step!!!)

Creating a Preview Image: With your target image displayed, press Alt-N (hold the “Alt” key down while you press “N” once). On the image, click-drag to create a box covering a good sample of background sky. Try not to include any nebulosity, and relatively few stars if possible. Release the mouse button, and you have your first preview. (If you mess up, and get too small a sample, or cover too much nebulosity, just try again. You can delete any bad previews by right-clicking their tab on the side, and using the “delete” option.)



Now, look to the Background Neutralization window. Under “Reference Image” either take the default “Target Image,” or, preferably “...Preview01.” Choose by clicking the file icon at the end of the reference image window.



Leave the other inputs at their defaults for now. Apply the process by clicking on the

blue “Apply” square on the bottom left.

When the process finishes, run that experiment with STF autostretch again, linking and unlinking the channels as you autostretch your images. Hopefully, this time, you should not observe large color shifts.

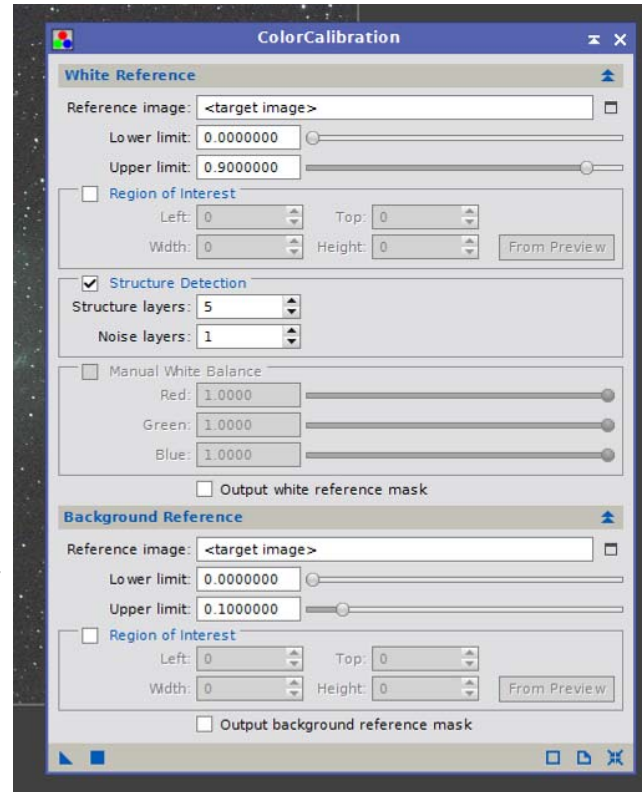
E: Color Calibration

So, the background has been neutralized, and with it the other objects of interest. But are they the right colors? PixInsight provide the Color Calibration Process. To call it up, click on:

Process/
All Processes/
Color Calibration

You can re-use the background reference preview you created for Background Neutralization. Under “Background Reference” In the bottom third of the window, click on the icon at the end of “Reference Image” and choose that preview.

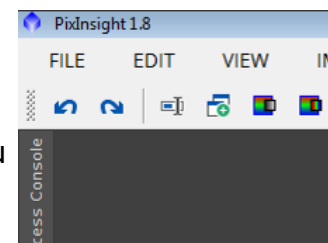
Make sure Structure Detection is checked, and the 5 and 1 are entered in layers under “Structure Detection” as shown at right.



Accept all the other defaults and apply the process by clicking on the blue “apply” box at the bottom like you have done with other processes.

Do-Overs and Take Backs

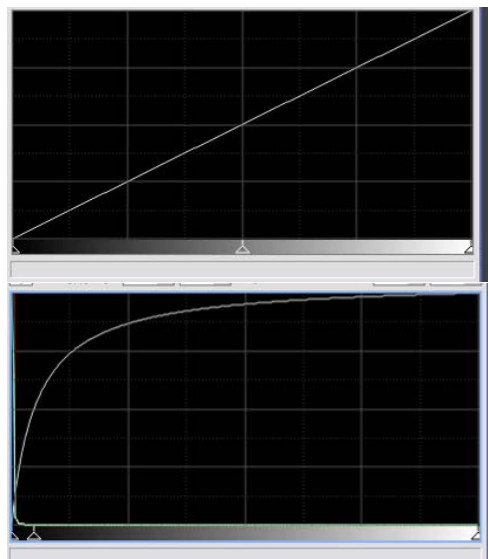
Ever wish you could go back and re-do something? Fix some of the big mistakes you have made in your life? All these processes are reversible. In the upper left hand corner of the PI screen, you will find two curvy arrows. Click on the Undo arrow, and you can undo what you just did. Click again on that arrow, and it takes you further back. Click on the Re-Do arrow, and you come forward again. These arrows are nice if you want to undo something you did. They are also useful to show the effect of a process. Do the process. Undo it. Redo it, Undo it, Redo it, etc. while looking at the effects it has on the image.



IV. Stretching the Data

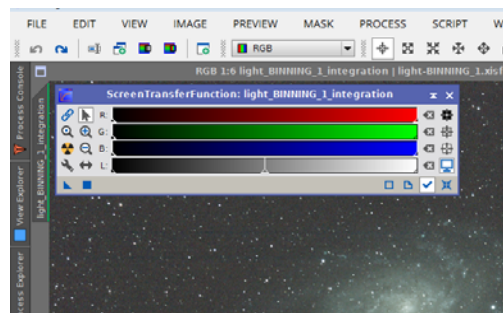
So far we have combined the data, removed the gradients, neutralized the background, and generally color corrected the image. We have been watching the progress by using an artificial Automatic Screen Stretch.

The data, however, is still “Linear.” This means that every value in the data has a direct correspondence, 1:1 (or some other number, depending on the gain of your chip), between the number of photons that struck the pixel on the chip, and the number reported in data file. This correspondence looks like the graph at right. For every increase in input, there is a corresponding increase in output.



We need to change that ratio so that dim things are brightened quite a bit, while bright things are not. The curve of input to output would then look more like the lower graph. One sees lots of change between the dim levels, but not so much in the brighter ranges.

We should look at the image without the STF autostretch. To do so, use the “Reset” button (the blue “X”) in the lower right corner of the STF window. Click on it, and the image goes to black. Or perhaps black with the brightest of stars shining through. Nebulosity is lost.



All this time, the Autostretch function has been brightening the dimmest data while keeping the brightest data close to its original values. This brings out the dim stuff, while preventing any blown out bright spots.

We must now “stretch” the data so that the Autostretch becomes permanent.

The simplest way to do this is to use the STF Autostretch function as our guide to a Histogram Transformation.

The Screen Transfer Function should already be open. To open the Histogram Transformation Process click on:

- Process/
- All Processes/
- Histogram Transformation

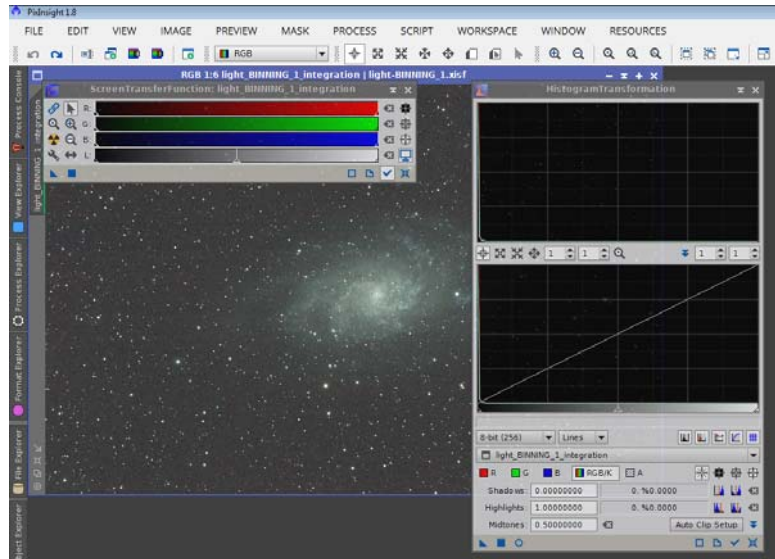
Here you see our old friend, the Screen Transfer Function window, and our new acquaintance, the Histogram Transformation Window.

Start the transformation by computing a good curve. Do this by “autostretching” the image as you have so many times before—press the “Autostretch” radioactive icon in STF.

Now meet a new icon that has been hiding in the background:

The “New Instance” icon. It is a little blue triangle in the lower left corner.

It has been on nearly every one of our process screens. With it, you can copy the process you are working on so that it can be used over and over again. In this case, that little triangle is holding all the information and parameters that the Screen Transfer Function has computed for the image autostretch. We want to transfer all of that to the Histogram Transformation window. Do that by click-dragging the blue triangle from the Screen Transfer Window to the bottom line of the Histogram Transformation window. Make it land between the open circle and the open square, right in the middle there. (X marks the spot!)



Now, apply the HT process by clicking on the “Apply” blue square icon near the lower left corner of the HT window.

After the Process Console does its thing, the image turns white!!!! Or so. Not to worry. The image data has changed, but the Screen Transfer Function is still applying its Autostretch based on what it thought the data was. On the Screen Transfer Function, “Reset,” (blue X in lower right corner of STF). Your image returns to actual data.

Click Autostretch again, and there may be a slight appearance change. Reset, and the change will reverse. Earlier when you tried the same thing, the image shifted from mostly black (Linear) to pleasant brightness (artificially Stretched) and back again. Now, it is shifting ever so slightly, perhaps, but staying generally “Stretched.” Your underlying data is now “stretched,” and no longer “linear.”

It has taken us some fifteen pages to describe how to get to this point. But, it is easier to do than to explain. And your photo is probably already as good or better than any other photo you have done in other processing programs. And you are doing it the lazy butt way. Wait until you learn to do it the right way!!!!

IV. Finishing Touches

With the data stretched, there are a few things that yet could be done. These include noise reduction, curves, saturation, and sharpening.

A: Noise Reduction: Atrous Wavelet Transform

To start Noise Reduction, click on:
Process/
All Processes/
Atrous Wavelet Transform

Up comes a blank (parameter-less) version of the screen at right. This window is blank because it can be used for many things besides noise reduction, depending on how the parameters are set.

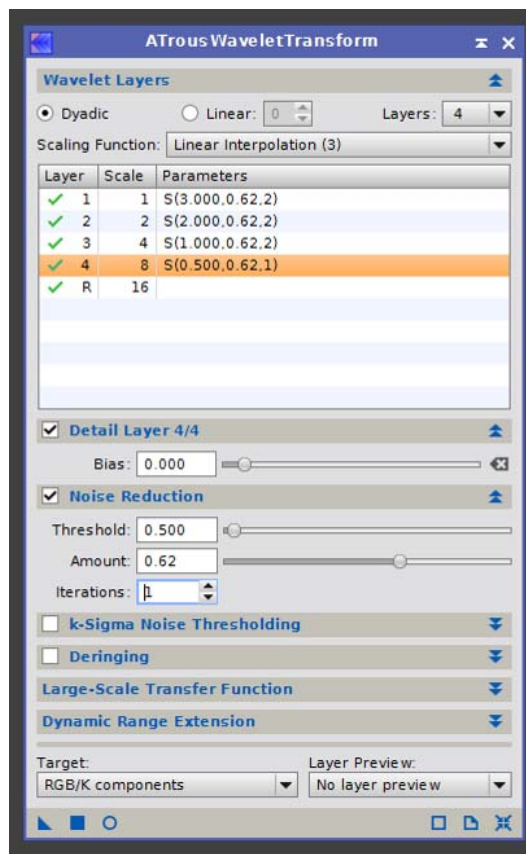
The parameters you see here are from Warren Keller. I must have a shout out here to Warren, whose tutorial series has taught me nearly everything I know about PixInsight. Warren includes, for those who use his tutorials, a set of “Action Icons.” They include a good guess at all the parameters you may need. Until you get better at setting parameters, these are a great way to produce very good images (not great yet—you have to learn to fine tune everything eventually). Using the “chronological” version of Warren’s actions dramatically eased my transition to PixInsight. You can find out more about his series from <http://www.ip4ap.com/>.

The ATWT window already assumes (along the top lines), Dyadic, 4 layers, and Linear Interpolation (3). Click on one of the Layers (Layer 4 is selected above, in orange). Then, below, make sure “Detail Layer” is checked, and showing 0.000. Check “Noise Reduction,” and move sliders (or type in the input box) to match the parameters to those set in the window above. Repeat for layers 1 to 4, until the window matches the one above. (The rest of the parameters can take their defaults.)

Apply by pressing the blue “Apply” square in the lower left corner.

Your image should have much smoother backgrounds, with less noise overall.

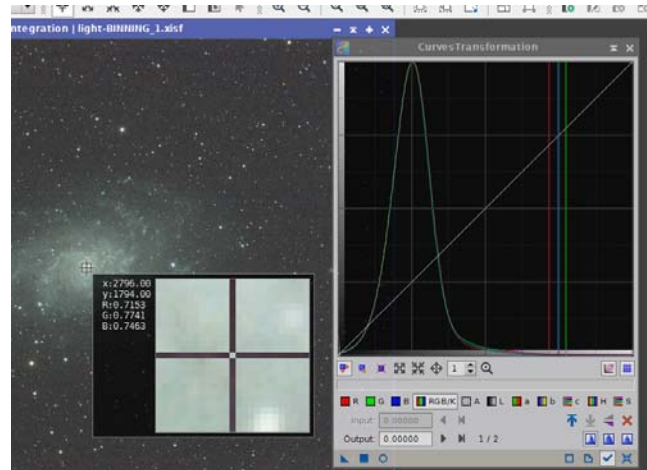
(Note that some imagers prefer to use this process BEFORE stretching.)



B: Curves

To call up the Curves Process, click on:
Process/
All Processes/
Curves

This process should be quite familiar to anybody who has used Curves in Photoshop or other image processing programs. Remember in the discussion of Histogram Transformation, we saw how changing the shape of the input-output curve enabled us to brighten dark areas while not blowing out light areas. This was a “curves” function that changed the Histogram.



Above right is a sample curves window. I have clicked on the center of the galaxy. This put a cross hair on where I had my cursor, and brought up an information window, saying the bull's-eye was on a point at 2796 in x coordinate, 1794 in y, and the color values for that pixel. It also illustrated (with the vertical colored lines in the curve graph) just where that point fell along my input-output curve.

The autostretch function you applied in Histogram Transformation already took its best shot at assigning the proper curve. This is not the place for an extended discussion of how to use curves. But if you are familiar with them in the first place, you can use them to tweak the curves assigned in the Histogram Transformation.

Start by telling the process that you want to “Track View.” The Track View icon is the little blue checkmark, second from the right at the bottom of the window. When you are tracking the view, the window will provide you a histogram of the data.



Then, start a “Real Time Preview” of your image. The Real Time Preview icon is the blue open circle, third in from the left end at the bottom. Up pops a duplicate of your image. As you change the curves, it will reflect your changes (but your changes will not change the original image until you apply the changes).



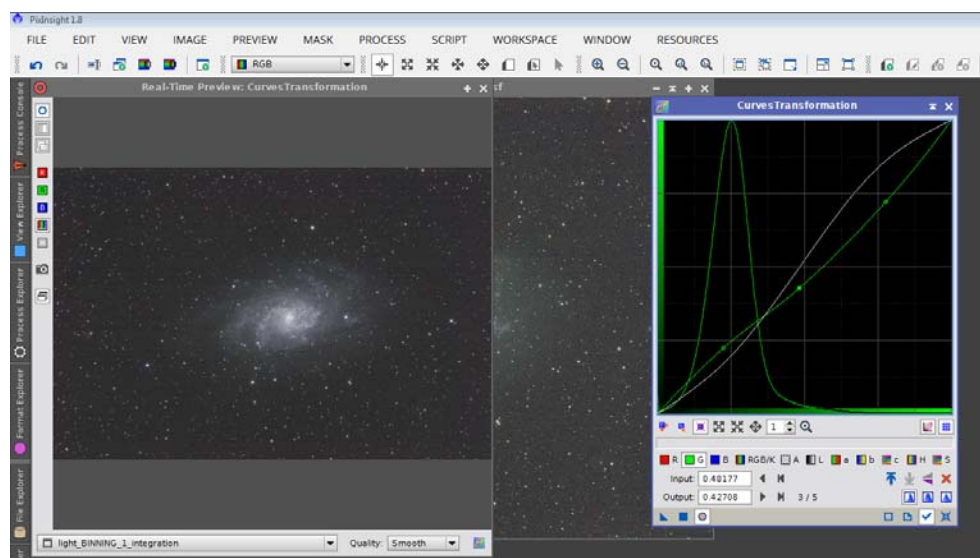
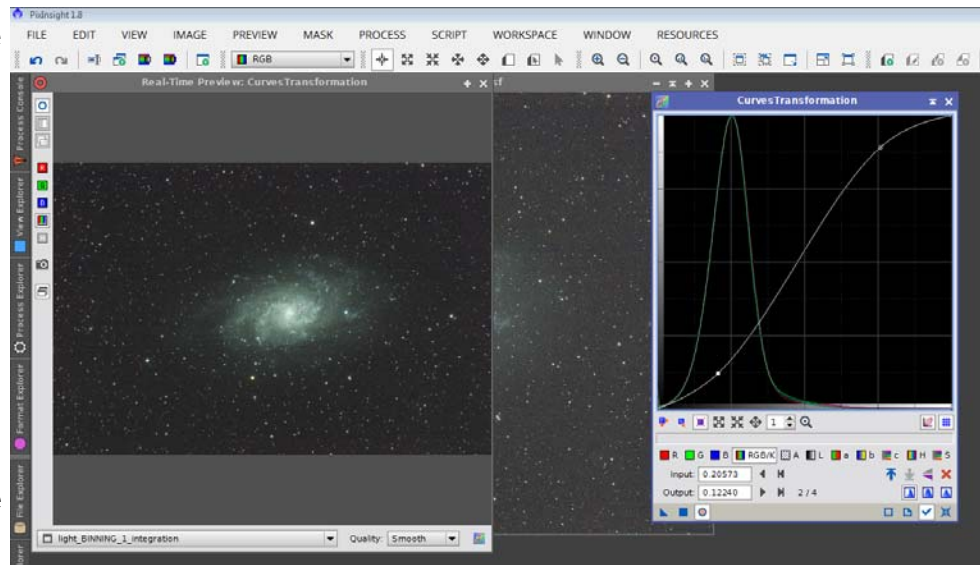
Now, experiment. Decide which area you want darkened, or lightened in relation to the rest of the image. Click on the line where that pixel is and drag downward to darken, and upward to lighten. To determine the brightness level of a pixel or area, click on it. The vertical lines will tell you the brightness level of that target.

A simple “S” curve (the brights pulled up, and the darks pulled down) produces more contrast in this image, for instance. Compare the Real Time Preview with the original underneath.

Let’s say you have one color dominating the rest, (like my green above) and you want to tame it down. Click on that color’s control box (just below the curve graph).



Here I have pulled bright greens down a bit compared to the other colors.



You can reset to start over by clicking the “Reset” blue X in the far right at the bottom.

When you are finished, click the “Apply” blue square at the left bottom. Note that your Real Time Preview will stay active, and since it is applying the new curve to the new data, it will be doubly done—and probably ugly. To reset the Real Time Preview, reset the curves function (with the reset blue X in the lower right hand corner of the Curves Transformation window). If you are happy with the real image below the Real Time Preview, cancel out of the real time preview (by the X in the upper right). Once you are satisfied with the curves operation, you do not need the Real Time Preview.

C: Saturation

Increasing saturation deepens the colors in an image. This can be overdone. But when it is needed, it does help the image.

To call up the Color Saturation process, click on:

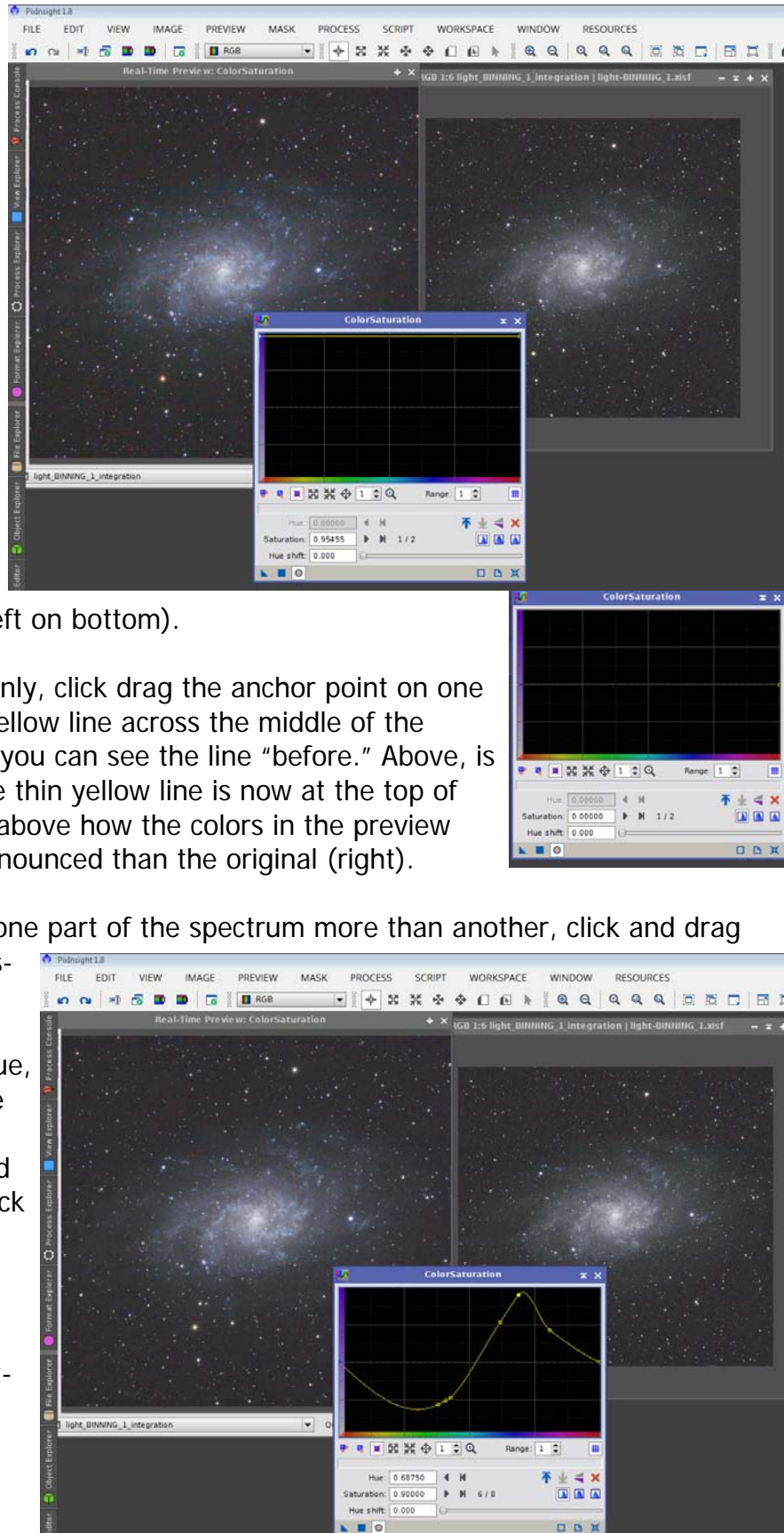
Process/
All Processes/
Color Saturation

Start a real time preview (open circle, third from left on bottom).

To saturate all colors evenly, click drag the anchor point on one end or the other of the yellow line across the middle of the graph upwards. At right, you can see the line "before." Above, is "after" the drag. Note the thin yellow line is now at the top of the graph window. Note above how the colors in the preview (left) are much more pronounced than the original (right).

To increase or decrease one part of the spectrum more than another, click and drag above the color in the display at the bottom of the graph. To de-emphasize green, and emphasize blue, drag the line down above the green and up above the blues, as at right. Add control points (click or click-drag on the line) in various places to aid alterations.

Click the blue "apply" button to make your saturation changes permanent.



V. Save and Close

Now that you have a final picture, you will want to save it off to your hard drive. Generally, click on File/Save As/, navigate to where you want to store the image, and give it a new name. (Do not save under the original name. That file contains the original data, and the rejection maps. You may want to return to them some day when you learn what you are doing.)

Save as an XISF file, taking the defaults all the way. This gives you your highest fidelity.

Then File/Save As again. This time, save as a TIFF, and when the parameter window comes up, tell it 16 bit unsigned integer. This file can be used in other image processing programs that cannot use the XISF data.

You will get warnings that a TIFF file does not do all that PixInsight's own XISF file format wants you to do. That's okay. For your purposes, having that additional TIFF file may be an advantage.

Final Words

If your data was at all decent, you should have something that will wow your significant other, amaze your boy scout troop, and put you in line for a promotion from your boss (Until she saw that galaxy photo, she really did not realize you had a talent!). (And on a phone display, it will look even better than on a computer monitor!!!)

Of course, you will not stand a chance with the dudes on AstroBin or Cloudy Night CCD Forum. But, hey——you are a proud beginner.

Seriously, amateur astroimagers will be able to pixel-peep your image to death. Do not worry about that.

Think instead about what you have learned by doing:

- Processes and Scripts
- Inputting parameters,
- Real Time Preview screen,
- Preview,
- Common icons to apply, reset, or undo a process used throughout PixInsight,
- New instance icons...,

The list goes on.

You have no idea how much you do not know:

- How to use the Process Explorer (Nobody goes to “Processes/All Processes/?????” to start a process.....it was just the easiest way to explain how to start a process.)
- How to determine proper parameters for various functions (Using Preview and Real Time Preview to experiment with changes, among other things.)
- How to optimize the calibration routines, integration parameters, and a whole lot more to get the most out of your data.
- How to sharpen, to shrink stars, to increase contrast in the nebulae.
- The icons in the toolbar. My gosh—so many things are up there that you do not know about yet!!!!

I won’t go on. But look to the last page here to see the difference between this nearly automatic processing and thoughtful work done by a proficient PI user.

The point is, what was once an impenetrable mass of buttons, switches, dials, and gobble-de-gook has produced a pretty darn good picture.

You have justified its purchase price.



Above, M33 processed by the author according to this tutorial—almost all automatic. Below, the same data processed by David Ault using the full power of PixInsight.

