LRGB Module Use

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Purpose:

- To allow the loading of separate files representing, for example, Luminance and Red, Green and Blue colour channels.

Description:

The LRGB module is used to load and combine multiple files into a single image. Either standard luminance, Red, Green and Blue data or a combination of narrow-band data using different filters.
It can also be used to extract the Red, Green or Blue channel from a colour image..

When to use:

- At the start of processing if you need to load files representing different channels - either traditional LRGB or other combinations such as Hubble Pallette (SII, Ha, OIII)

Workflow:

See the Quick Start Tutorial for a quick generic workflow.

Full Workflow Example:

AutoDev-{Band/Lens}-Bin-Crop-Wipe-AutoDev (or Develop)-{Decon/Sharp/Contrast/HDR/Flux/Life}-Color-{Filter}-Denoise-{Layer/Magic/Heal/Repair/Synth}
Key: {...} optional modules

Method:

1. Preparation:
   - All the image files must be aligned (registered). When stacking, use one image as a reference for the others.
   - If a luminance file has been loaded, any Red, Green or Blue file subsequently loaded must be either exactly the same size or exactly half the size of the luminance file. This allows luminance channels to be 1x1 binned while R,G and B files can be 2x2 binned. In all other cases all loaded files must be the same dimensions.
2. The LRGB module can be set to interpolate any missing channels. Just set Channel Interpolation on and load what channels you have.
3. If you have any luminance data, load that first.
4. Load any Red, Green and Blue data you have, making sure each file has completed loading before loading the next.
5. If there is a difference in exposure time between Red, Green and Blue data set the Ratio settings accordingly.
6. If you have problems loading data because of the error: 'The dimension of the bitmap you're trying to load differ from the previously loaded file bitmap(s). ...' then check the dimensions of individual data files by loading them in StarTools individually. The dimensions are listed to the right of the file name at the top of the screen.
7. If there is a luminance channel present you can reduce the noise in the colour information by adjusting the smoothing of the colour channels using the 'RGB Blur' control.

What results to look for:

- Make sure all the channels are properly aligned. In rare cases it is possible for the registration to be out.
- Ensure that all the colour channels appear. If any colour is missing try reloading it and make sure it finishes loading before continuing.

After Use:

Continue with your preferred workflow.

Loading Narrow Band data using the Hubble Palette

1. You might first want to create a weighted synthetic luminance (B&W) frame first. See the description: weighted synthetic luminance for Hubble palette.
2. Load the SII data into the Red channel.
3. Load the Ha data into the Green channel.
4. Load the OIII data into the Blue channel.

See also the description: LRGB & Hubble palette

Splitting colour image into L,R,G,B files

This is one way if you want to process L and RGB separately.

1. Launch the LRGB module.
2. Load the colour image in the LRGB module using the Luminance button, keep the result.
3. Save the result as the luminance file.
4. Repeat using the Red, Green and Blue buttons, creating a separate file each time.
5. Channel Interpolation should be on so you will end up with a black and white representation of the selected channel. See the Description of Controls section in the notes.

Re-centering blue back onto stars

To recentre a smeared blue channel back to align with the red and green channels try the following as described in Fringe killer filter add blue back to central star.
This can help reduce chromatic aberration (CA).

1. Optionally Bin the image - then save it.
2. In the LRGB module click Blue and navigate to the file just saved. This will load only the Blue channel of the saved image. The other channels will be automatically set due to 'Channel Interpolation'. You end up with a black & white representation of the blue channel
3. Process this image so that you reduce the bloating of the stars in the blue channel.
    - Do AutoDev or Develop - this allows us to see what we are doing.
    - You could then use the Decon module - set to 'De-ring Mask Gaps, Show Result', set Iterations to 1, set Radius to 3.2 (as appropriate).
4. 'Keep' the result.
5. Use Restore selecting 'Linear, Wiped, Deconvolved' option - this reverts to an image which is Linear but which retains the deconvolution you did.
6. Save the image.
7. Use the LRGB module to load the Red and Green channels (binned the same amount) and load the saved image into the Blue channel.
8. You should now have an image with a better focused blue channel. Process as normal.
9. When using the Color module, the Scientific mode may have problems with the star cores as they have artefacts in the blue channel due to the deconvolution. Either:
    - Reduce Bright Saturation right down and set Saturation Amount to 100% or lower. This will avoid recovering colour in the highlights, or
    - Use a star mask to mask out the stars - they then won't be involved in setting the colour balance, or
    - Use Artistic mode.
10. Keep the results.

To separate out the CIE L*a*b 'L' component

To get a file with the CIE L*a*b 'L' component.
See also the description in IC342 - second image in StarTools.

1. Load the colour image.
2. Launch the Color Module,
3. Set Saturation to 0%, keep and save the image.

Combining luminance and RGB Images using the LRGB module

This is one way of combining luminance and RGB image data.
There is an alternative way of combining luminance and RGB images described in Layer Module Use under the heading 'Combining Luminance and RGB images'.

1. Launch the LRGB module.
2. Load the synthetic luminance data.
3. Load Red channel with RGB data.
4. Load Green channel with RGB data.
5. Load Blue channel with RGB data.
6. Increase RGB Blur to reduce colour noise.
7. Keep.

Processing Ha,R,G,B using a synthetic luminance frame

This shows one method of processing Ha, R, G, and B files by processing the luminance and RGB separately.
See also the description:Ha,R,G,B ->synthetic luminance

1. Create the weighted average synthetic luminance frame as described in the Layer module Layer Module Use.
2. Process the synthetic luminance frame for maximum detail as you would normally - for example:
    - Load the luminance data if necessary - indicate it is Linear - this turns Tracking on. If already loaded, make sure Tracking is on - turn Track on if necessary.
    - AutoDev to see what we have.
    - Crop. Record the settings used for later use with the RGB data.
    - Wipe.
    - AutoDev.
      Try to get maximum detail...
    - Decon.
    - HDR.
    - Sharp.
    - Life - Isolate Preset.
    - Contrast.
    - Tracking off - Denoise.
    - Save this file.
3. Process the RGB channels (but not the Ha).
    - Load LRGB module.
        - Load Red channel data.
        - Load Green channel data.
        - Load Blue channel data.
        - Keep
    - Crop - exactly the same as for the luminance - the files must be exactly the same size as the luminance.
    - AutoDev.
    - Wipe.
    - AutoDev.
    - Save this RGB data File.
4. Combine the synthetic luminance and RGB image data as described in the 'Combining luminance and RGB Images' section above.
5. Load the Color module to do colour balancing
    - Increase saturation - so that we can see changes easily.
    - Adjust RGB Bias sliders.
    - Max RGB.
    - Cap Green if needed.
    - Keep.
6. Wipe - to confirm the colour balance (optional).
7. Use the Sharp module with a star mask to sharpen the image.
8. Life - Isolate preset (optional).
9. Save

Luminance button
Allows you to navigate to and load the luminance file.

- Make sure the file has finished loading before continuing.
- If loading a colour (RGB) image - converts the image to greyscale.

Red Button
Allows you to navigate to and load the Red channel file.

- If a luminance file has been loaded then any Red, Green or Blue file subsequently loaded can be either the same pixel size or exactly a quarter of the resolution of the luminance file. This allows luminance channels to be 1x1 binned while R,G and B files can be 2x2 binned. In all other cases all loaded files must be the same pixel dimensions.
- Make sure the file has finished loading before continuing.
- If loading a colour (RGB) image - extracts the Red channel.

Green Button
Allows you to navigate to and load the Green channel file.

- If loading a colour (RGB) image - extracts the Green channel.

Blue Button
Allows you to navigate to and load the Blue channel file.

- If loading a colour (RGB) image - extracts the Blue channel.

Channel Interpolation
The LRGB module can be set to interpolate any missing channels.

- Just set Channel Interpolation On and load what channels you have. This feature can be used to:
    - Generate a missing green channel in the case of an Ha/Hb composite.
    - Generate a greyscale from a single channel (e.g. Ha, Hb, OIII or SII frame) which may later be turned into a false colour image using the Color module.
    - Generate separate R, G and B data from colour images by just loading the colour image into one channel and saving the result. Repeat for R, G and B.
- Default is On

Luminance File
Shows the path of any file loaded in the luminance channel.

- Default is None.

Red File
Shows the path of any file loaded in the Red channel.

- Default is None.

Green File
Shows the path of any file loaded in the Green channel.

- Default is None.

Blue File
Shows the path of any file loaded in the Blue channel.

- Default is None.

RGB Blur
Allows you to reduce the noise in the colour information by adjusting the smoothing of the colour channels using the 'RGB Blur' control.

- Set so that the blur is virtually undetectable.
- The reduction in noise can be significant because the eye is much less sensitive to the colour information than the luminance.
- Default is 1.0 pixel. Range is 1.0 to 5.0 pixels.
- Only works if there is a Luminance channel present.

Cap Green
Removes any green colour information from the image.

- Very few objects in space are green - so often green elements are due to noise and so can be removed.
- Default is No.

Red Ratio
Allows you to compensate for differences between the exposure times of Red, Green and Blue channels.

- Set to the amount the channel should be multiplied by to attain the same exposure duration as the other channels.
- For example, If Red is a 30 minute exposure and Green and Blue were 45 minute exposures then set the Red Ratio to 1.5 to compensate.
- Default is 1.00. Range is 1.00 to 10.00.

Green Ratio
Allows you to compensate for differences between the exposure times of Red, Green and Blue channels.

- Set to the amount the channel should be multiplied by to attain the same exposure duration as the other channels.
- Default is 1.00. Range is 1.00 to 10.00.

Blue Ratio

- Allows you to compensate for differences between the exposure times of Red, Green and Blue channels.
- Set to the amount the channel should be multiplied by to attain the same exposure duration as the other channels.
- Default is 1.00. Range is 1.00 to 10.00.

Processing luminance and colour data separately for better results

In many cases in post-processing the process is best applied to the luminance and not the chrominance (colour):

- By applying some of the processes to the colour data as well as the luminance it is possible that you end up enhancing the noise. See the PixInsight article Why Separate Luminance and Chrominance?.
- In addition, our eyes are much more sensitive to the luminance than the colour of an image.
- StarTools splits luminance and colour to reduce the negative impact of some of the processes on the colour of the image.
- By separating the luminance and colour data it is possible to process the luminance to get the maximum detail without the trade-off of increasing the noise in the colour. In addition it is possible to apply more aggressive denoise in the colour to further reduce the colour noise without noticeable effect.
- With Narrow-band imaging it is quite common to capture L,R,G and B data with more L data than R,G and B. The R,G and B is combined and processed as one frame. The luminance (L) data is processed separately and recombined with the RGB towards the end of Post-Processing.
- It is possible to do the same with OSC and DSLR colour frames by separating out the L and RGB components.
- See the Special Techniques sections both here and in the Layer Module Use.
  - LRGB Module - 'Processing Ha,R,G,B using a synthetic luminance frame'
  - LRGB Module - 'Combining luminance and RGB Images using the LRGB Module'
  - Layer Module - 'Creating a synthetic luminance frame'
  - Layer Module - 'Splitting a colour image into luminance and RGB before Processing'
  - Layer Module - 'Combining luminance and RGB images using the Layer Module'

Aligning LRGB images using Deep Sky Stacker (DSS)

To make sure the L, R, G, B images are all aligned the same. We need to select a single reference frame for all images.

- In DSS all files to be stacked must have the same dimensions, number of colours, number of channels, only one master dark, offset and flat.
- This technique works when stacking multiple frames or with a single frame plus reference.
- Make sure you use the 'Standard Mode' setting in the 'Result' Tab of the Stacking Parameters in DSS.
- If the reference sub-frame appears to be ignored if not included in the stack - try registering all the files again.
- Load the reference (luminosity) sub-frame into DSS.

1. Right-click on it and select 'Use as reference frame'.
2. Load relevant Lights, Darks, Flats etc. into DSS.
3. Stack as normal and save the image.
4. Repeat for Luminosity, Red, Green and Blue data using the same reference frame.
5. The result should be 4 files all aligned exactly the same.

Making multiple images the same size, resolution and alignment

Images loaded in LRGB must be the same pixel size and alignment.

In some cases you might be trying to combine images that are not aligned or not the same pixel size. For example if taken with different cameras, on different nights or with different filters.

There are a number of ways to do this depending on what the differences are:

- Images are the same physical size and resolution but different alignments. Either:
  - Use Regim to align frames as described here - using a single frame or stacking multiple frames. The result will be a frame of the same alignment as the reference frame. or...
  - Use Deep Sky Stacker (DSS) to align frames as described here - using a single frame or stacking multiple frames. The result will be a frame of the same alignment as the reference frame.
- Images are the same physical size and alignment but different resolutions. Either:
  - Use Regim to align frames using the lowest resolution frame as a reference. The result is a frame of the same resolution as the reference. or
  - Use the Bin Module in StarTools to reduce the resolution of the higher resolution frames to that of the lowest resolution frame. Save the image as a TIFF file to be loaded in the relevant channel later.
- Images that are different physical sizes and possibly alignment:
  - Use Regim to align the frames using the lowest resolution frame as a reference. The result will be a frame of the same resolution as the reference
  - Some cropping will be needed after combination to remove any borders.

Aligning LRGB images using Regim

To make sure the L, R, G, B images are all aligned the same. we need to select a single reference frame for all images.

- In Regim images can have different dimensions. The output file dimensions will be that of the reference file.
- This technique works when stacking multiple frames or with a single frame plus reference.

1. Under the Preprocessing menu select the Preprocessing option.
2. Set the standard Calibration, Register and Combination settings under the relevant tabs.
3. Under the 'Files' tab select the luminosity reference light frame first.
4. Select all other relevant lights, darks, flats etc.
5. Select only the 'do calibration' and 'do register' checkboxes in the preprocessing dialog.
6. Press OK to do the registration.
7. All files registered to the reference frame will be .fit files and have the prefix “Reg_”. The reference file will not have one.
8. Open the preprocessing dialog again and select all the "Reg_*.fit" files you want to combine and Add to images - exclude the reference frame if you want.
9. Select only the 'do combination' checkbox.
10. Press OK to do the combination.
11. Save the image.
12. Repeat for Luminosity, Red, Green and Blue data using the same reference frame.
13. The result should be 4 files all aligned exactly the same.

Colours and Filters

Eyes Response to Light

The generally accepted range of visible light is from 400nm-700nm although this varies from person to person and with different light levels. or more information see Eye spectral response.

- Photopic: 50% 510nm-610nm, 5% 450nm-660nm
- Scotopic: 50% 455nm-550nm, 5% 410nm-600nm

RGB Filters

The RGB filters commonly used have a spectral response as follows:

- R: 600-700nm
- G: 500-600nm
- B: 425-500nm

Narrow-band imaging

Using different narrow-band filters to create three data sets and combining them using LRGB channels can have advantages:

- Allows imaging through a lot of light pollution (other than LED broad spectrum light pollution).
- Nebulosity appears more detailed.
- Stars seem less bloated.
- Colours are artificial - so can be chosen to highlight features - e.g. Hubble Palette better differentiates SII and Ha.
- Common narrow band data collected is:
  - SII - Red - 671.9 nm and 673.0 nm
  - Ha - Red - 656.3 nm
  - NII - Red - 654.8 nm and 658.3 nm
  - OIII - Cyan - 495.9 nm and 500.7 nm
  - Hb - Blue - 486.1 nm
  - OII - Near U-V - 372.6 nm and 372.9 nm
- Three colour narrow-band images:
  Common combinations for assigning the three bands to the R,G and B channels are:
  - SII : Ha : OIII (R:G:B) - Hubble palette.
  - Ha : OIII : SII (R:G:B) - Canadian-France-Hawaii Telescope palette.
- Bi-colour narrow-band images:
  Bi-colour images sometimes have advantages over tri-colour images:
  - Reduced imaging time needed over 3-colour images such as Hubble Palette - see the external article Narrowband Bicolor Palette Combinations.

  Many possible bi-colour combinations of assigning the two sets of narrow-band data to the R,G and B channels - common ones are (R:G:B):
  - Ha : OIII : OIII
  - Ha : HaxOIIIx1.5 : OIII - Steve Cannistra's technique - see description in Special Techniques section of Layer Module Use.
  - Ha : Hax0.4 + OIIIx0.6 : OIII
  - SIIx0.5+ Hax0.5 : Hax0.4 + OIIIx0.6 : OIII
- Synthetic H-beta
  Wherever Ha appears there is often also Hb. You can capture the Hb with a filter but you can also easily create a synthetic Hb.
  See Synthetic RGB from [SII], Halpha and [OIII] Emission Line Data and Narrowband imaging with only H-alpha and OIII filters
  - The ratio of Ha:Hb emission is normally about 3:1 for emission nebulae and 6:1 for planetary nebulae.
  - The shorter wavelength Hb has a higher extinction so the perceived amount of Hb is lower.
  - Common to combine OIII and Synthetic Hb into the blue chanel as follows: OIII x 0.85 + Ha x 0.1.5 for an emission nebula with variation depending on the source.
- For a list of targets see the CN list of advanced narrow band imaging targets.

Thanks

Many thanks to Ivo for his feedback and tireless support. Thanks also to others who have contributed.

