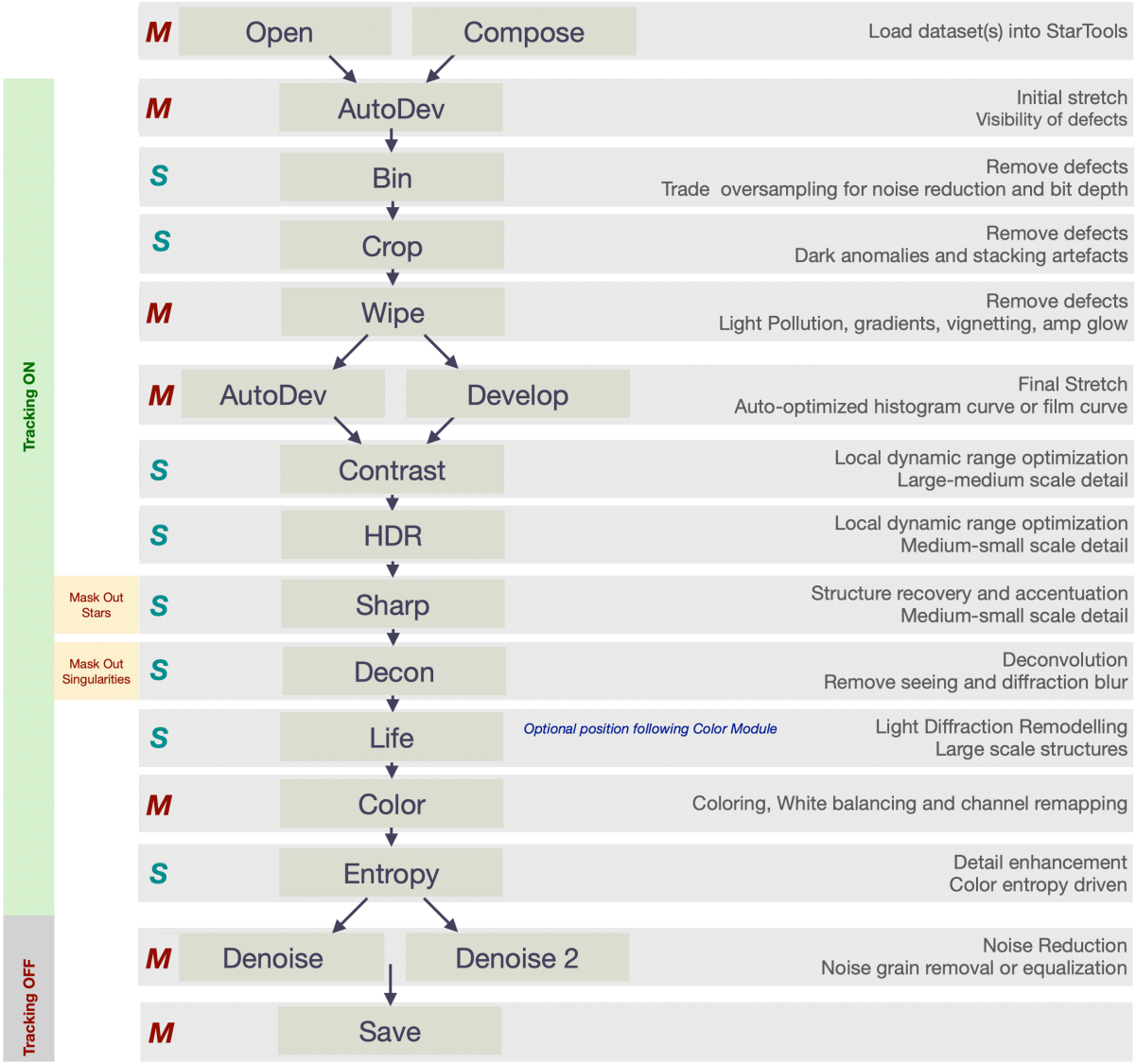
Core Workflow Step by Step



Basic workflow with mandatory ***(M)*** and suggested ***(S)*** modules.

- StarTools workflow allows some flexibility. The diagram is not meant to show a fixed flow but to help beginners putting the moduls in a meaningful order.
- Within 'Tracking On' block, StarTools allows the execution of steps in a different order
- Loading, stretching and noise reduction steps offer two options each.
- Mandatory masks are shown. Sharp will require an inverse star mask. Decon module requires masking out singularities only.
- The below step-by-step tutorial will be explaining the StarTools worksteps. It is intended to provide suggestions to yield good results and learn the frequently used parameters quickly.
- More detailed Instructions, Explanations and Background information may be found in 'User Notes' and 'Modules'.
- *Below instructions are based on Guy's User notes in a slightly condensed version.*

1) Loading Your Data into StarTools: Open or Compose

Choosing the Module

- Open is used to open single monochrome or colour images
- Used to merge multiple files such as those representing Luminance and Red, Green, and Blue channels, or those representing the Hubble palette.

Open

- After loading you are prompted about the image source. This will affect how you open the image in StarTools:
- A stacked RAW image of OSC or DSLR - select 'Linear'
- A stacked RAW colour image that is not white balanced - select 'Linear, from OSC/DLSR with Bayer Matrix and not white balanced'. The data will be loaded using the Compose mode.
- A JPEG or video source use 'Non-Linear sRGB source'.

Compose

1. If you have any Luminance data, load that first. If you don't you must specify a Synthetic Luminance option in 'Luminance, Colour' setting otherwise the 'Compose' mode will not be enabled.
2. Load any Red, Green and Blue data you have.
3. If there is a difference in exposure time between Red, Green and Blue data set the Ratio settings accordingly.

2) Preliminary Stretch: AutoDev

- The preliminary Strech will make objekt and all imaging issues visible so these may be tackled.

AutoDev

1. Load AutoDev module. By default, it will make the whole dynamic range visible.
2. A 'bad' result will usually show up, because all imaging defects will be highlighted:

- Stacking Artefacts - remove later with the Crop module.
- Colour bias (remove this later with the Wipe module)
    - red or yellow/brown cast - skyglow that has been white balanced.
    - teal, blue or green cast - skyglow that has not been white balanced.
    - bright blue-green cast - skyglow filtered using a light pollution filter.
    - missing yellow (e.g. no yellow stars) - indicates use of light pollution filter.
- Vignetting - darkening towards the corners, Amp Glow - remove later with the Wipe module.
- Dust specks - remember to mask out when using the Wipe module.
- Noise.
- Banding - use the Band module next - but don't 'Keep' the AutoDev result.
- Debayering Problems - checkerboard pattern. See the description here.
- Coma - fix later with the Lens module.

3. 'Keep' the result.

3) Remove defects: Band, Lens, Bin, Crop, Wipe

- Any defects in the data will need to be addressed prior actual post processing.

Band & Lens

- These modules are only required in special scenarios. Those will be covered in 'User Notes'.

Bin

1. Load the module - this automatically Bins the image by 50%.
2. Zoom in on the image to see if the image is still oversampled. Small stars would occupy more than 3x3 Pixel when oversampled.
3. Try different levels of binning until the smallest features occupy only a couple of pixels on their minor axis. Leave a bit of oversampling for the Decon module later.
4. 'Keep' when finished.

Crop

1. Remove the stacking artefacts or crop the image to taste.
2. You may adjust the area to be kept using 'click and drag' or the sliders.
3. 'Keep' when done.

Wipe

1. After using the Crop module to remove any stacking artefacts, load the Wipe module.
2. Set the mask to exclude the target, dust specks and other dark anomalies as described below: Mask - Clear - Lasso around Dark Anomalies and Target as needed - Invert - Keep.
3. Adjust the Dark Anomaly Filter to mask the effect of small Dark Anomalies (see below). Increase the value until no further improvement may be seen.
4. Choose a preset which best describes what you are trying to achieve (see below). If there are multiple issues choose the most aggressive (i.e. Vignetting > Gradient > AmpGlow>NrwBand).
5. Default values often work fine. Press 'Do'.
6. Adjust the 'Corner Aggressiveness' and 'Drop Off Point' only when there is Vignetting.
7. Use 'Before' to compare original.
8. 'Keep' the result when you are happy with it.

4) Final Stretch: AutoDev oder Develop

Choosing the Module

- After removing the gradients using Wipe, the stretch should be redone to use the freed up dynamic range.
- AutoDev will optimize global stretch for the visual content to show the most detail in each dynamic range. Usually it is the best choice for most images.
- Develop mimics a film tone curve to provide a classical yet non-optimized look.
- Develop will be used if You may not get statisfying results using AutoDev because:
    - there is no region of interest with sufficient detail for AutoDev to use.
    - There is a lot of noise which disrupts AutoDev operation.
- Develop is also used for adding back an artificial skyglow at the end of processing.

AutoDev

1. Select Region of Interest (ROI):
    - Highlight the subject, or a part of it, to select the range of levels that AutoDev should allocate dynamic range to.
    - Sometimes highlighting an area within the subject gives the optimum dynamic range. Try various selections.
3. Set 'Ignore Fine Detail' - to ensure AutoDev ignores noise, dust specks and other dark anomalies. Increase the value until background and noise will not darken any further.
4. If you make a mistake, the 'Reset' button discards all the changes since you started using the module.
5. 'Keep' the result when you are happy with it.

Develop

- Increase Digital Development to set the black point of the global stretch - The 'Home In' button usually finds a good value.
- Increase Dark Anomaly filter so the noise and other dark anomalies are ignored - usually when the background stops darkening.
- Usually all other parameters work best with their default settings - but try changing them as described below if you want.
- If you make a mistake, the 'Reset' button discards all the changes since you started using the module.
- 'Keep' the result when you are happy with it - unless you plan to use the Band module next.

5) Local Dynamic Optimization: Contrast, HDR

Contrast

- To optimise medium-to-large local contrast (dynamic range) by doing local stretching.

6. Contrast will takes over AutoDev's Dark Anomaly Filter to remove small Anomalies.
7. For larger anomalies it is necessary to use the Heal or Crop modules first. There is no equivalent to the mask in the Wipe module. Using the Heal module must be done with Tracking off which may cause complications and so limit this as an option.
8. Press 'Do'. Default Settings yield good results in many scenarios
9. 'Keep' the result when you are happy with it.

HDR

- To optimise an images medium-to-small local contrast.

10. Select the appropriate preset: Optimise, Equalize, Tame, Reveal
11. Adjust the 'Detail Size Range' to target the size of detail you want.
12. Use 'PreTweak button to compare between current and previous setting.
13. Use 'Before/After' button to compare between original and processed version.
14. 'Keep' the result when you are happy with it.

6) Structure Recovery and Accentuation: Sharp

- To enhance small to medium scale structures.

1. Select the Structure Size you want to sharpen - and press Next
2. Create an inverse star mask. Mask-Auto-Stars-(Shrink-Grow)-Invert.
3. Select a suitable preset according for your object:
    - DSO (deep sky object)
    - DSO Dark
    - DSO Light
    - Planetary
4. Adjust the 'Amount' control to bring out the structures as much as possible without increasing the noise at all scales.
5. Within the selected Structure Size are 5 different layers of different scale sizes. If necessary, reduce the individual Scale setting to reduce the effect at that scale.
6. Toggle top 'Pre Tweak/Post Tweak' button to see the effect of last adjustment if needed.
7. Use Before/After button to compare between original and processed version.
8. 'Keep' the result when you are happy with it.

7) Deconvolution: Decon

1. Select 'Generate mask automatically' or 'Generate conservative mask' to create an inverse star mask in order to avoid ringing artifacts.
2. 'Click and drag' to select a preview area rectangle to speed up analysis.
3. Select Image Type - Deep Space or Lunar/Planetary.
4. Set 'Enhanced Deringing' to 0% for Lunar/Planetary/Solar targets.
5. Leave all other parameters at default settings for now.
6. Increase 'Primary Radius' until small stars start to show first signs of ringing artifacts.
7. Select 'Primary PSF' model 'Moffat Beta=4.765 (Trujillo)'.
8. Select a 'Secondary PSF' / 'Star Sample Small x Primary' and click on a small star without overexposure on dark background.
9. Zoom in and out so you can see effect in the detail as a whole.
10. Increase the 'Iterations' setting to see if it gets better results.
11. Change 'Tracking Propagation' to 'During Regularization (Quality)'
12. Toggle top 'Pre Tweak/Post Tweak' button to see effect of last adjustment if needed.
13. When done, select 'All' to apply this to the whole image - this may take some time.
14. Press 'Keep'.

8) Light Diffraction Remodelling: Life

- Life will remodel the large scale brightness distribution using uniform diffraction.

Isolate preset - to push back noise/starfield.

1. Select Isolate preset - this sets most of the controls to their optimum.
2. Set Strength - to adjust the impact of the Life module. Normally somewhere between 30-100% - use your judgement.
3. Set Saturation - Change this to adjust the amount of ‚glow‘

Other Presets - to add 'life' - increased glow and a more 3-dimensional effect.

1. Select Heavy, Medium or Less=More preset depending on the type and amount of effect needed.
2. Set strength - to adjust the impact of the Life module. Normally somewhere between 50-100% but can be less - use your judgement.
3. Set Saturation - Change this to adjust the amount of 'glow'.
4. When you are finished 'Keep' the result.

9) Coloring: Color

1. At startup, if there is a full mask set, the module auto-calibrates the white point in the image.
2. Select Style 'Scientific, Detail Aware' for accurate color reproduction, or 'Artistic, Not Detail Aware' for a more classical look.
3. Leave default 'LRGB Method Emulation' option 'Straight CIELab Luminance Retention'.
4. If there are problems:
   - Use MaxRGB to look for issues (like unexpected green-dominant areas) - adjust the Red, Green and Blue bias to get a better balance.
   - Use Cap Green control to eliminate any unwanted remaining green.
   - If there are colour problems around stars or other highlights - use Highlight Repair (v1.6)
5. If you make a mistake, the 'Reset' button discards all the changes since you started using the module.
6. 'Keep' the result when you are finished.

10) Detail Enhancement: Entropy

- To enhance local detail based on color information

7. Press 'Do' to generate the entropy map and get initial results.
8. Try different settings of Strength, Dark/Light Enhance.
9. Press 'Do' to update to see the results of the changed settings.
10. Press 'Keep' when you have the results you prefer.

11) Noise Reduction: Denoise or Denoise 2

Choosing the Module

- Use the classic Denoise module where you would prefer a result where noise is smoothed or removed.
- Use the Denoise 2 module where you would prefer a more film-like result where there is a uniform yet invisible grain in the background.

Denoise

1. Switch off tracking clicking the 'Track' button on Main Screen.
2. Select Filter Type - try 'Gaussian Noise Diffusion' if the image is noisy - otherwise use the default.
3. Select 'Grain Size' so the noise grain and clumps can no longer be seen - do not take note of the actual image content in this view.
4. Click 'Next' - StarTools will do its initial attempt using that grain size with other settings at their default values. When complete screen 2 is shown.
5. Select a sample area to speed up the processing while you adjust the parameters.
6. Adjust the 'Smoothness' - this sets how much structures that have been identified as detail can be smoothed to reduce noise.
7. If further adjustment is needed then experiment with the following controls:

    - Adjust 'Brightness Detail Loss' and 'Color Detail Loss' - to balance detail loss or color detail loss and noise reduction.
    - If there is any remaining mottled appearance in the dark background, try adjusting 'Read Noise Compensation' to remove it.
8. Press 'Full' to apply the effect to the full Image.
9. If you make a mistake, the 'Reset' button discards all the changes since you started using the module.
10. Press 'Keep' to exit, keeping the results.

Denoise 2

1. Switch off tracking clicking the 'Track' button on Main Screen.
2. In the Dialog, select 'Grain Equalization' to launch Denoise 2 module.
3. Select 'Grain Size' so the noise grain and clumps can no longer be seen - do not take note of the actual image content in this view.
4. Click 'Next' - StarTools will do its initial attempt using that grain size with other settings at their default values. When complete screen 2 is shown.
5. Select an area to sample to speed up the processing while you adjust the parameters.
6. Adjust the 'Grain Removal' parameter - increase to remove more noise grain.
7. In many cases the remaining parameters can be left at their default values.
8. However, if further adjustment is needed then try adjusting 'Grain Limit Detail and Grain Limit Color - to balance detail loss and noise reduction.
9. Toggle top 'Support' button (PV only) to see the effect on the gain map.
10. Toggle top 'Pre Tweak/Post Tweak' button to see effect of last adjustment if needed
11. Press 'Full' to apply the effect to the full Image.
12. If you make a mistake, the 'Reset' button discards all the changes since you started using the module.
13. Press Keep to exit, keeping the results.

11) Save Your Result: Save

1. Save the current view using the 'Save' Button
2. Choose one of the supported formats:

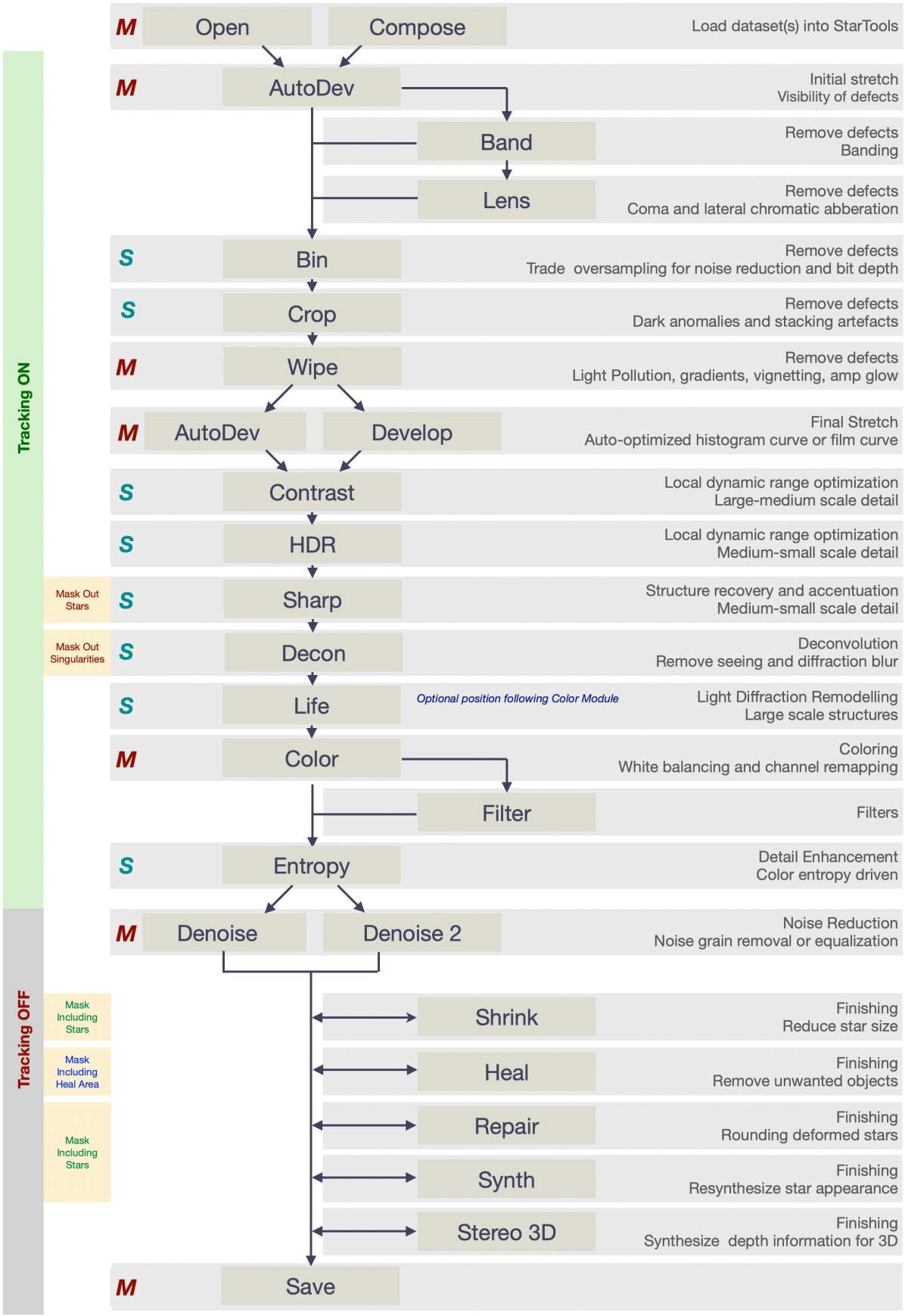
- To save as a 16-bit TIFF file use the extension .tiff or .tif
- To save as a JPEG file use the extension .jpg
- To save as a 8-bit PNG file use the extension .png (StarTools v1.5+ only)

12) Additional Modules

You'll find an introduction to all tools in 'Modules', for further methods and instructions, refer to 'User Notes'. Star Tools provides even more special purpose modules, see 'Advanced Worflow'. These modules are designed to:

- Band: Remove banding
- Lens: Remove coma and lateral CA
- Shrink: Scale down stars and improve star color
- Repair: Bring deformed stars back into shape
- Synth: Synthesize and remodel stars
- Heal: Remove unwanted objects
- Layer: Tools for Layer Manipulation and Pixel Math
- Flux: Detail Manipulation
- 3D: Synthesize Depth information and create 3D formats

Advanced Workflow Diagram



Advanced workflow with mandatory ***(M)*** and suggested ***(S)*** modules to the left and optional modules to the right.

- StarTools workflow allows some flexibility. The diagram is meant to provide a starting point for the use of optional modules
- Please check the 'Special Techniques' sections in the 'User Notes' chapter to find more hints to explore the versatile use of modules in different slots
- Within 'Tracking On' and 'Tracking Off' blocks, StarTools allows the execution of steps in a different order
- Loading, stretching and noise reduction steps offer two options each
- Mandatory masks are shown. Sharp and Flux will require an inverse star mask. Decon module requires masking out singularities only. Shrink, Repair and Synth work on a mask including stars only
- Masks may be used optionally in some other modules including Wipe, Life, Color, Filter, Layer, Heal
- Layer and Flux modules are not shown. These may be used in many different locations depending on purpose. Please refer to 'User Notes'.