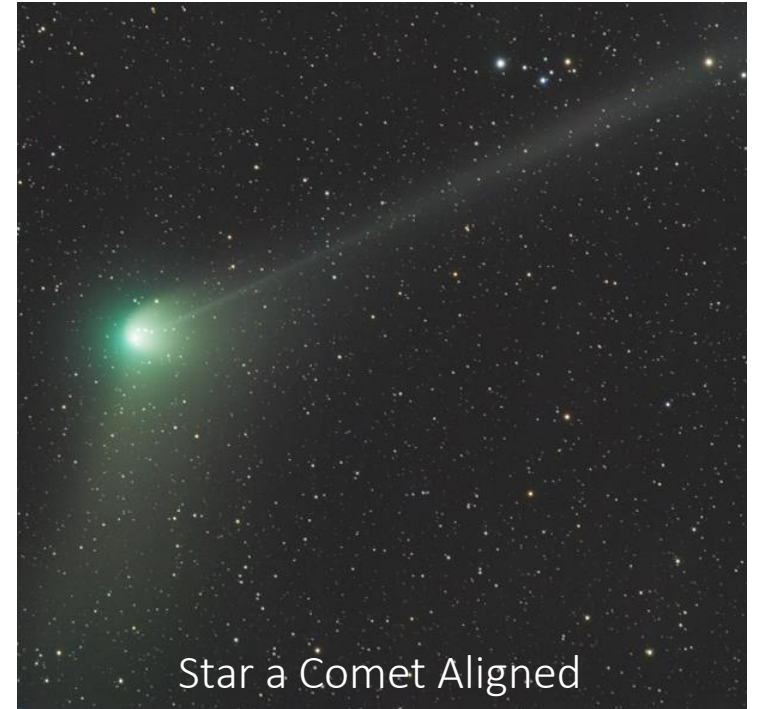
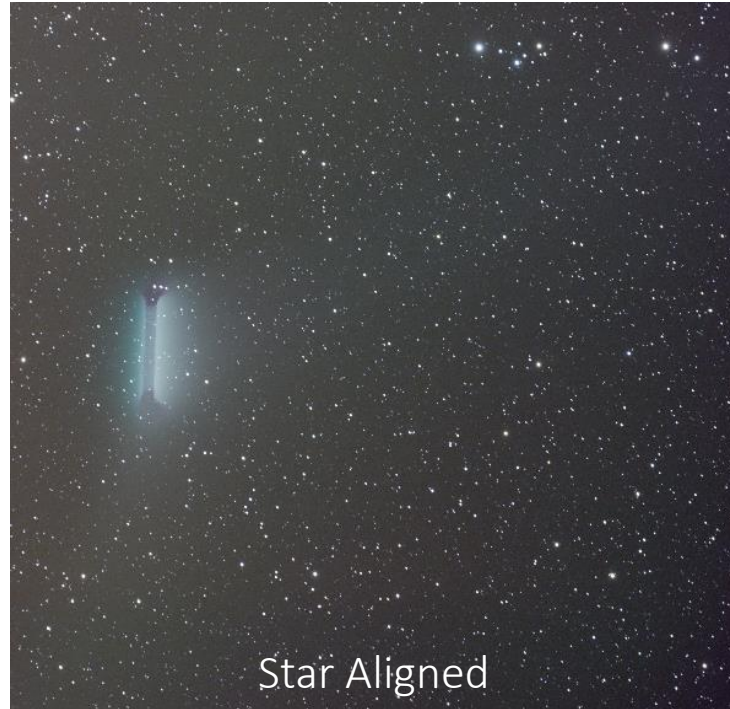




Processing van kometen in PixInsight

Bert Moyaers

Alignment – Different types



Opnamegegevens

- Object: komeet C/2022 E3 (ZTF)
- 28 - 29 jan 2023
- Maan: Eerste kwartier (58%)
- 102 opnames van 90 seconden (23u44 - 02u17)
- 82 opnames gestackt

Equipment

Imaging Telescopes Or Lenses Askar ACL200

Imaging Cameras ZWO ASI533MC Pro

Mounts Explore Scientific EXOS2-GT PMC-Eight

Filters SVBony UV/IR Cut 2"

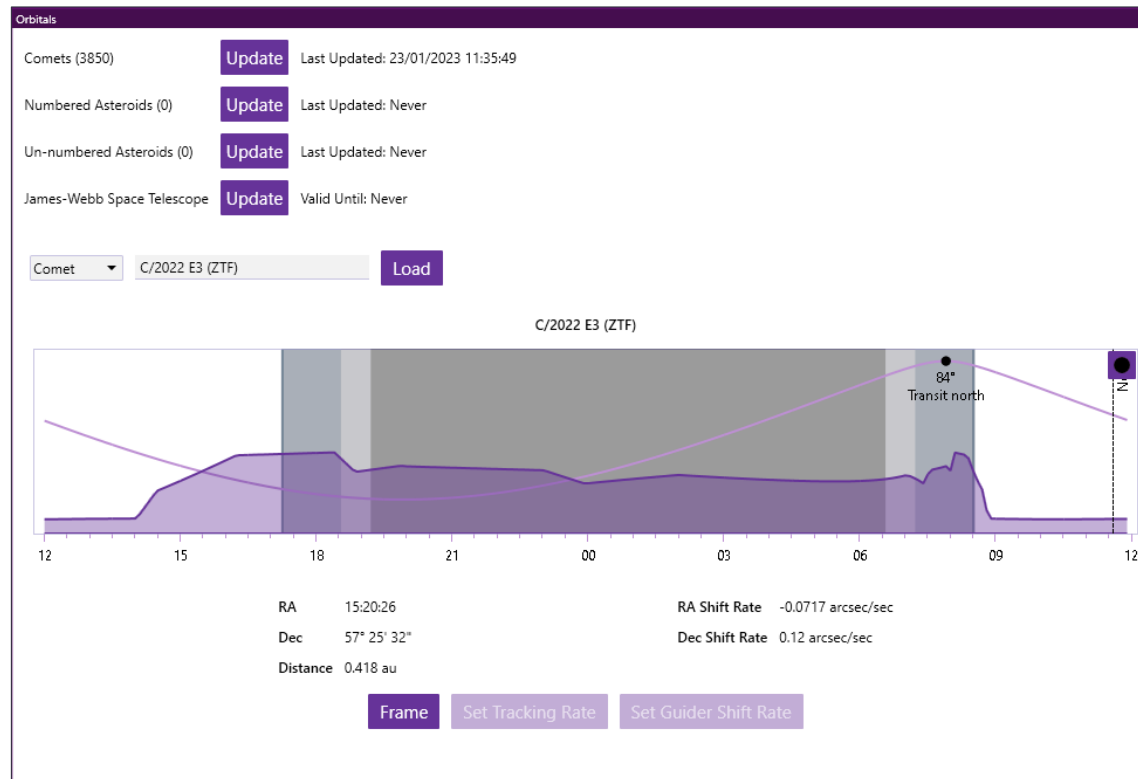
Accessories ZWO EAF

Software GNU Image Manipulation Program (GIMP) · Open PHD Guiding Project PHD2 · Pleiades Astrophoto PixInsight · Russell Croman Astrophotography NoiseXTerminator · Stefan Berg Nighttime Imaging 'N' Astronomy (N.I.N.A. / NINA)

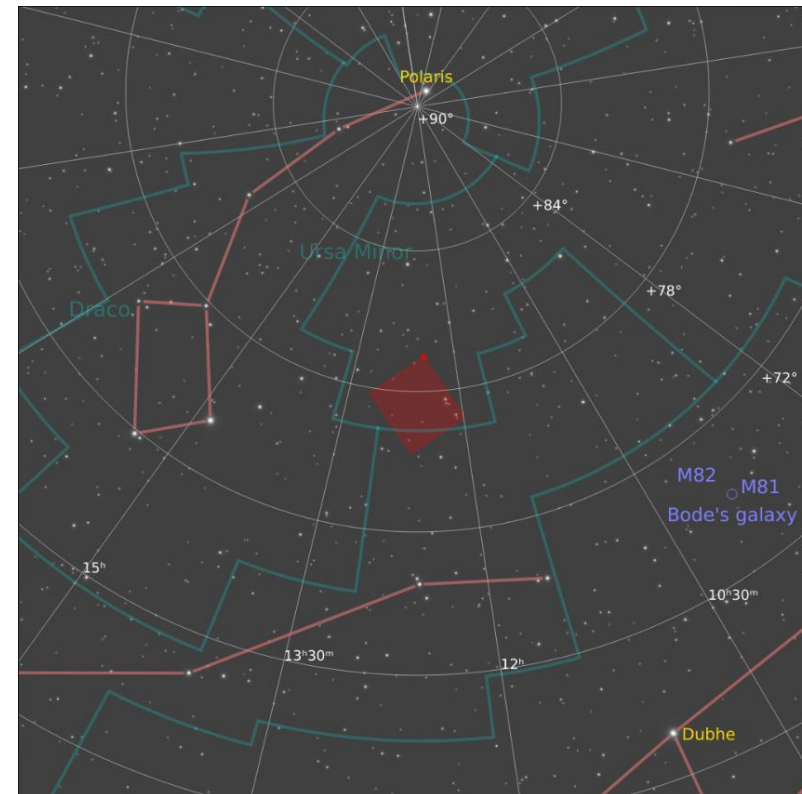


Opnamegegevens

N.I.N.A. - Orbitals plugin



Komeet in sterrenbeeld Giraf

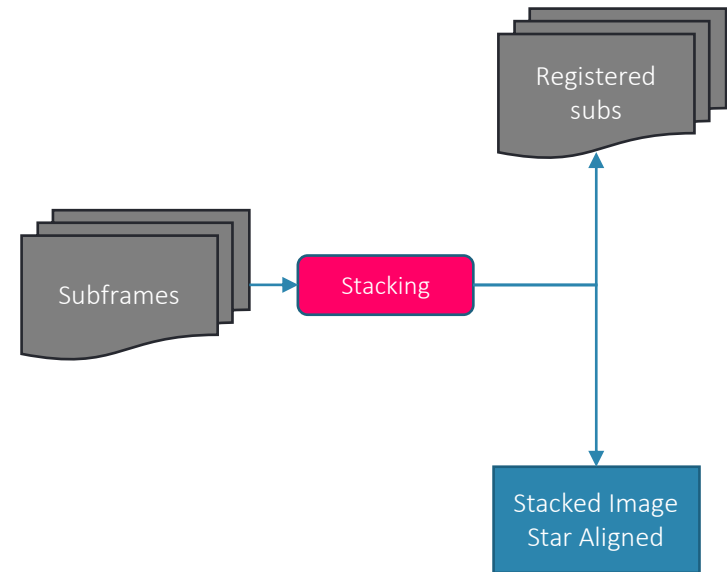




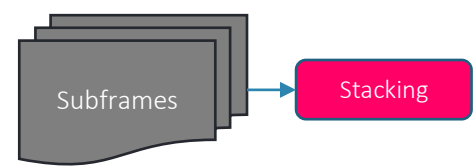
Calibration

- Stacking
- Register frames

Workflow



Stacking – Frames Registration



Weighted Batch Preprocessing Script v2.5.9

Bias Darks Flats Lights Calibration Post-Calibration Pipeline

Light frames

- ▼ Binning 1 (3008x3008)
 - ▼ None
 - ▼ 90.00s
 - ▼ EXPOSURE: 90.0, FILTER: None (102 frames)
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-44-32_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-46-03_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-47-34_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-49-05_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-50-36_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-52-06_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-53-37_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-55-08_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-56-39_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-58-10_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-59-41_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-01-12_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-02-43_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-04-14_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-05-45_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-07-16_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-08-47_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-10-18_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-11-49_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-13-20_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-14-51_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-16-22_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-17-52_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-19-23_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-20-54_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-22-25_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-23-56_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-25-27_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-26-58_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-28-29_stars
 - LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-30-00_stars

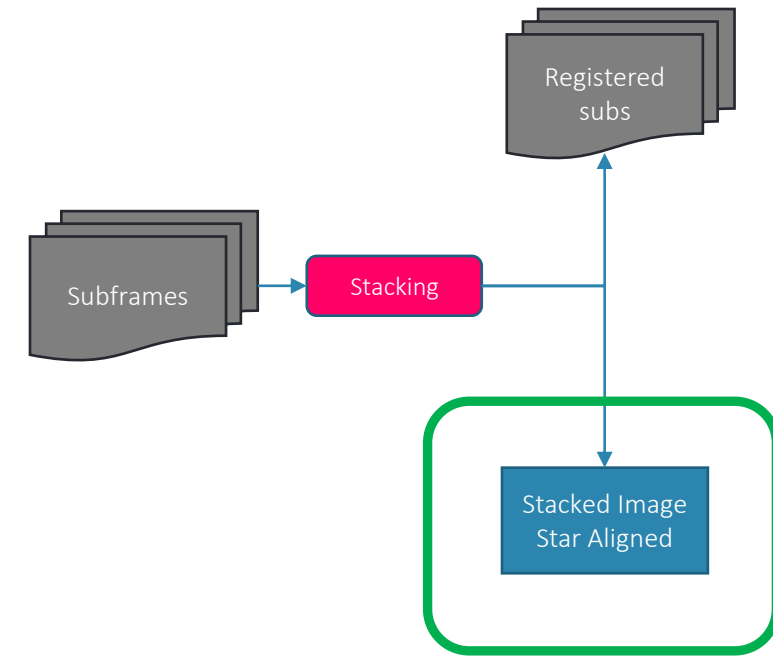
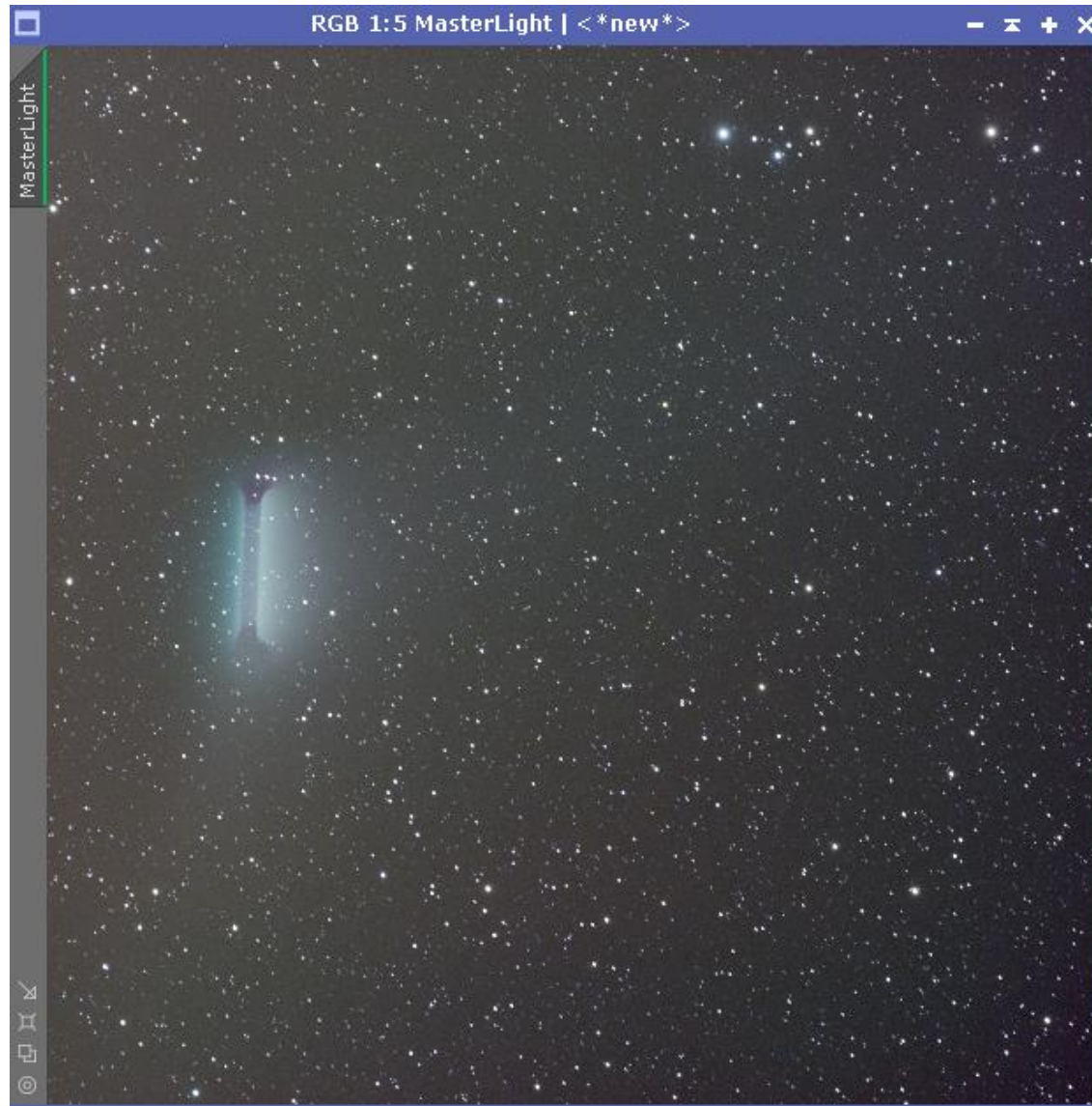
Clear Remove Selected Hide Astrometry Invert Selection

Calibration exposure tolerance: 2

- Linear Defects Correction
- Subframe Weighting
- Image Registration
- Astrometric Solution
- Local Normalization
- Image Integration

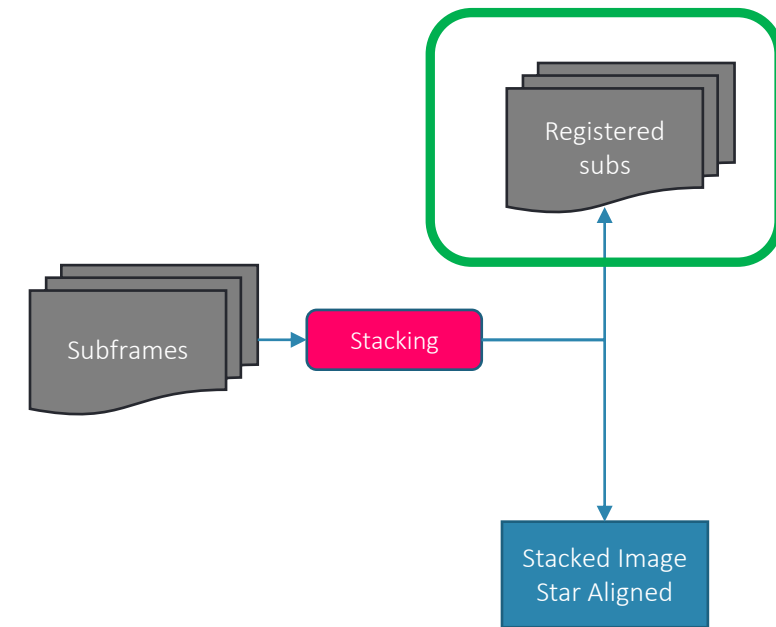
Add actions: + Directory + Files Reset Diagnostics Run Exit

Stacked image



Registered sub-frames

Naam	Gewijzigd op	Type	Grootte
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-43-03_stars 897_HFR 2.17_RMS 0.00_c_d_r.xisf	29/01/2023 10:35	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-44-34_stars 869_HFR 2.15_RMS 0.00_c_d_r.xisf	29/01/2023 10:35	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-46-05_stars 874_HFR 2.15_RMS 0.00_c_d_r.xisf	29/01/2023 10:35	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-47-36_stars 849_HFR 2.14_RMS 0.00_c_d_r.xisf	29/01/2023 10:35	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-49-07_stars 842_HFR 2.13_RMS 0.00_c_d_r.xisf	29/01/2023 10:37	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-50-38_stars 828_HFR 2.17_RMS 0.00_c_d_r.xisf	29/01/2023 10:37	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-52-09_stars 850_HFR 2.18_RMS 0.00_c_d_r.xisf	29/01/2023 10:37	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-53-40_stars 885_HFR 2.16_RMS 0.00_c_d_r.xisf	29/01/2023 10:37	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-55-11_stars 878_HFR 2.15_RMS 0.00_c_d_r.xisf	29/01/2023 10:39	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-56-42_stars 864_HFR 2.20_RMS 0.00_c_d_r.xisf	29/01/2023 10:39	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-58-13_stars 896_HFR 2.14_RMS 0.00_c_d_r.xisf	29/01/2023 10:39	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T02-59-44_stars 859_HFR 2.14_RMS 0.00_c_d_r.xisf	29/01/2023 10:39	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-01-15_stars 888_HFR 2.14_RMS 0.00_c_d_r.xisf	29/01/2023 10:41	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-02-46_stars 892_HFR 2.15_RMS 0.00_c_d_r.xisf	29/01/2023 10:41	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-04-17_stars 884_HFR 2.13_RMS 0.00_c_d_r.xisf	29/01/2023 10:41	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-05-48_stars 882_HFR 2.12_RMS 0.00_c_d_r.xisf	29/01/2023 10:41	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-07-19_stars 912_HFR 2.12_RMS 0.00_c_d_r.xisf	29/01/2023 10:43	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-08-50_stars 904_HFR 2.12_RMS 0.00_c_d_r.xisf	29/01/2023 10:43	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-10-21_stars 886_HFR 2.14_RMS 0.00_c_d_r.xisf	29/01/2023 10:43	Extensible Image ...	106.074 kB
◆ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-11-52_stars 885_HFR 2.09_RMS 0.00_c_d_r.xisf	29/01/2023 10:43	Extensible Image ...	106.074 kB
▲ LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T03-13-24_stars 866_HFR 2.07_RMS 0.00_c_d_r.xisf	29/01/2023 10:45	Extensible Image ...	106.074 kB

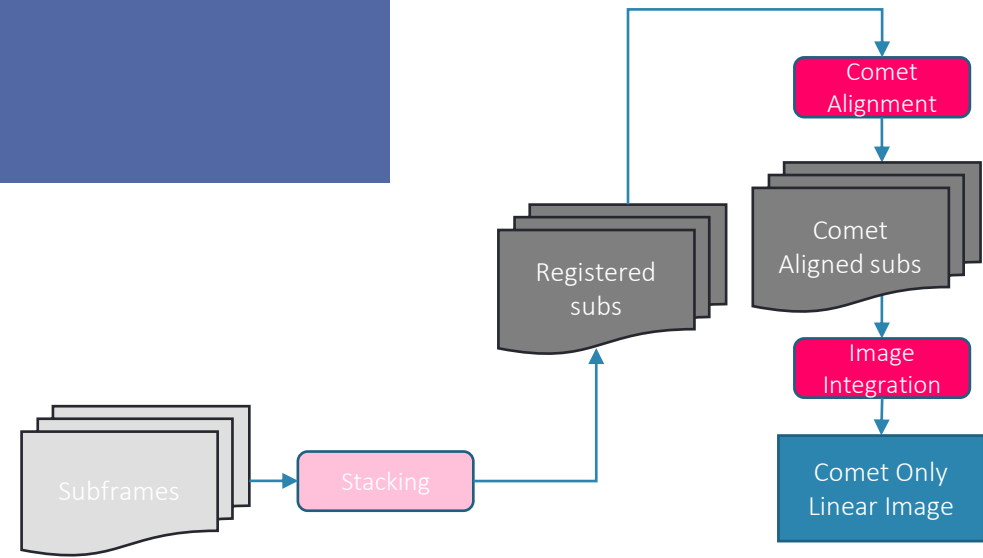




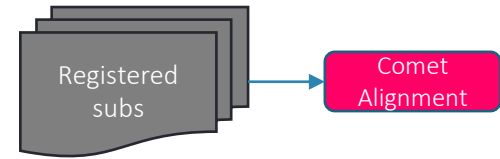
Comet-only image

- Comet Alignment
- Image Integration -> Comet Only image

Workflow



Comet Alignment



CometAlignment

Target Frames

#	?	F	File
47	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
48	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
49	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
50	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
51	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
52	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
53	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
54	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...
55	✓		LIGHT_C-2022 E3 (ZTF)_D2023-01-29_...

Format Hints

Output

Output directory: ocess/23_01_29 C2022 E3 ZTF close to Earth/CometAligned

Prefix: Postfix: _ca Overwrite

Generate comet path mask

Parameters

X₀: 571.09 Y₀: 1709.38 **Show First Image**

X₁: 588.04 Y₁: 1253.27 **Show Last Image**

X: 8.27 Y: -222.56 **Reset Positions**

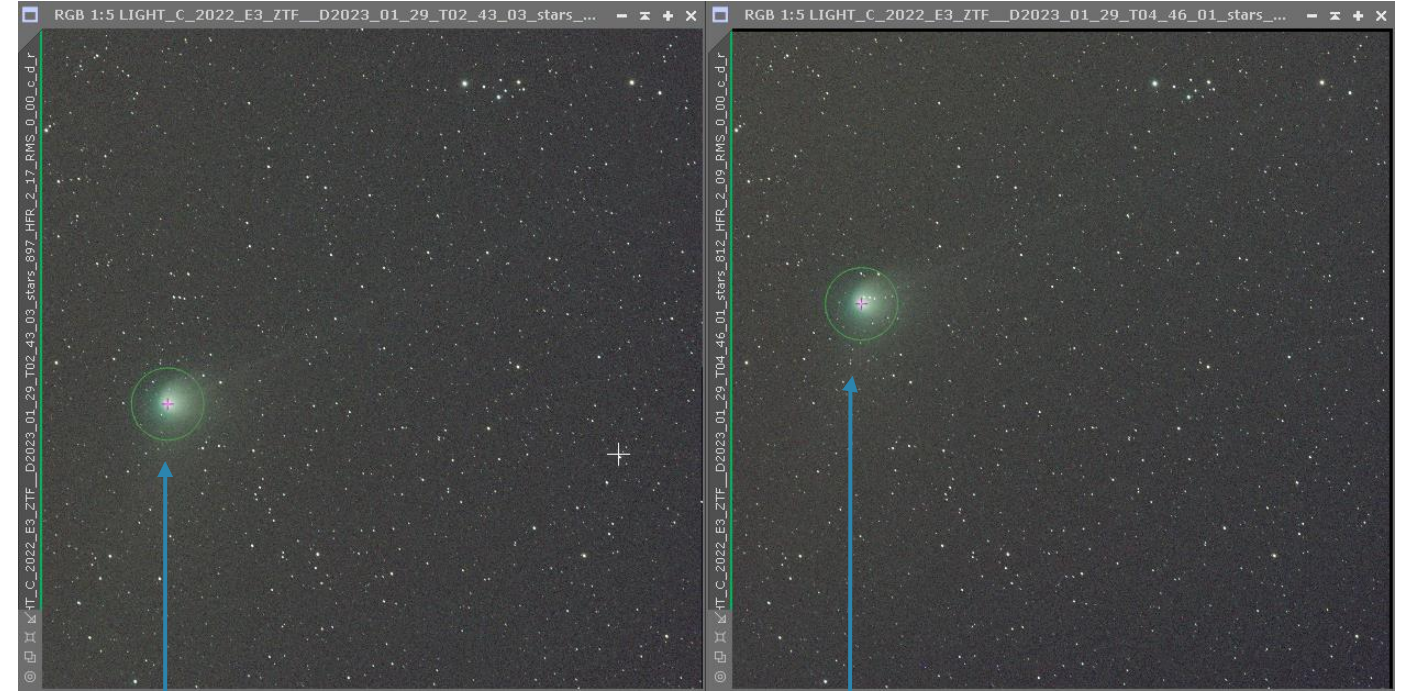
Compute PSF fits

Subtract

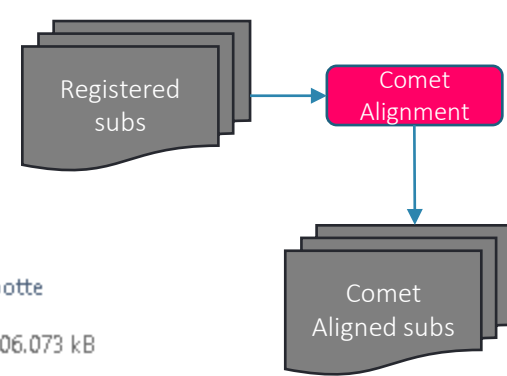
Interpolation

Pixel interpolation: Lanczos-4

Clamping threshold: 0.30



Comet Alignment



Naam	Gewijzigd op	Type	Grootte
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-44-32_stars 848_HFR 2.13_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-46-03_stars 821_HFR 2.13_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-47-34_stars 875_HFR 2.09_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-49-05_stars 902_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-50-36_stars 874_HFR 2.09_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-52-06_stars 827_HFR 2.09_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-53-37_stars 857_HFR 2.09_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-55-08_stars 847_HFR 2.12_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:51	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-56-39_stars 875_HFR 2.10_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-58-10_stars 859_HFR 2.10_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-28_T23-59-41_stars 880_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-01-12_stars 876_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-02-43_stars 852_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-04-14_stars 853_HFR 2.13_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-05-45_stars 915_HFR 2.13_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-07-16_stars 907_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-08-47_stars 885_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-10-18_stars 893_HFR 2.12_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-11-49_stars 896_HFR 2.09_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:52	Extensible Image ...	106.073 kB
LIGHT_C-2022 E3 (ZTF)_D2023-01-29_T00-13-20_stars 906_HFR 2.11_RMS 0.00_c_d_r_ca.xisf	29/01/2023 13:53	Extensible Image ...	106.073 kB

Comet Alignment

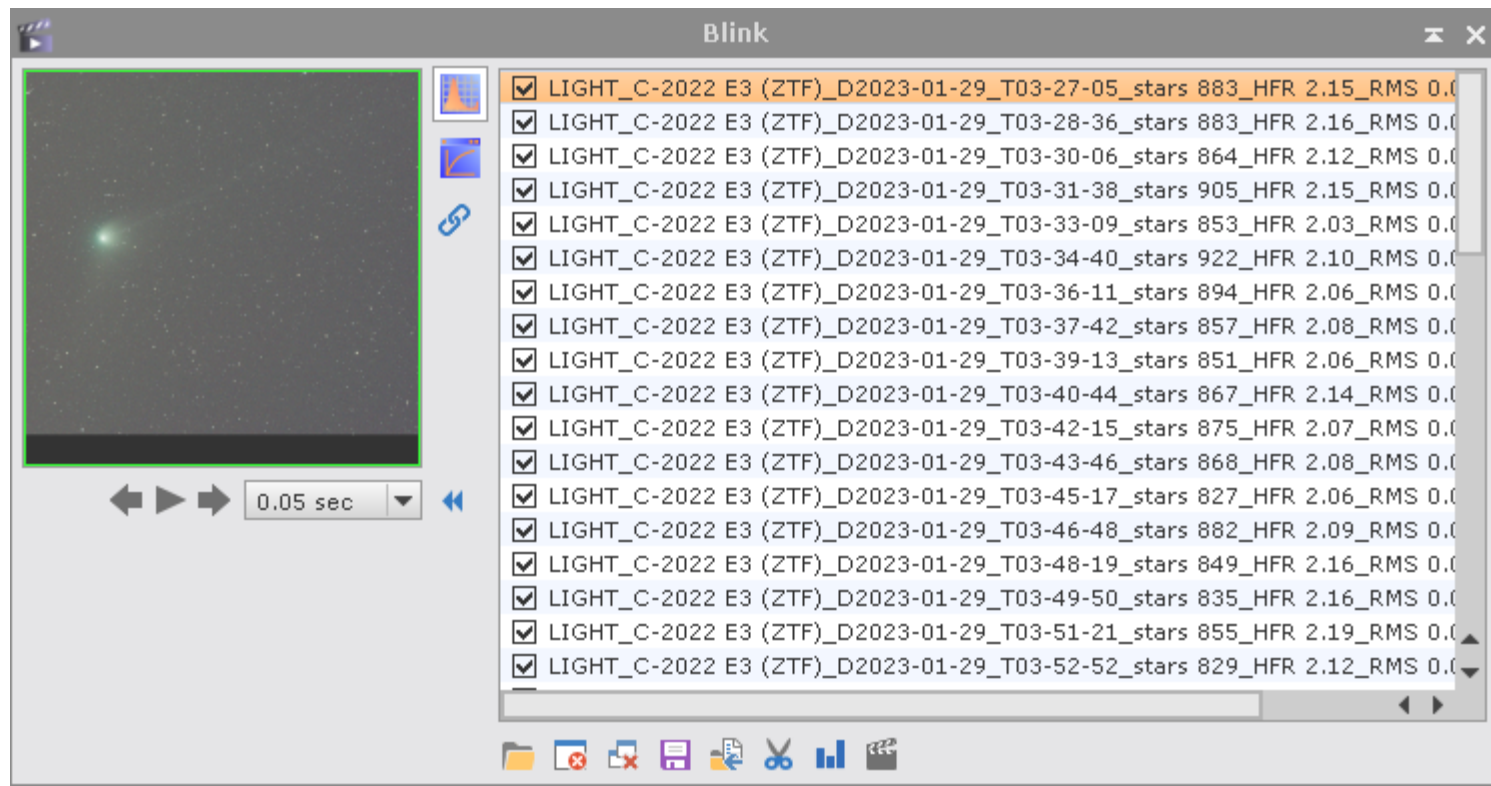
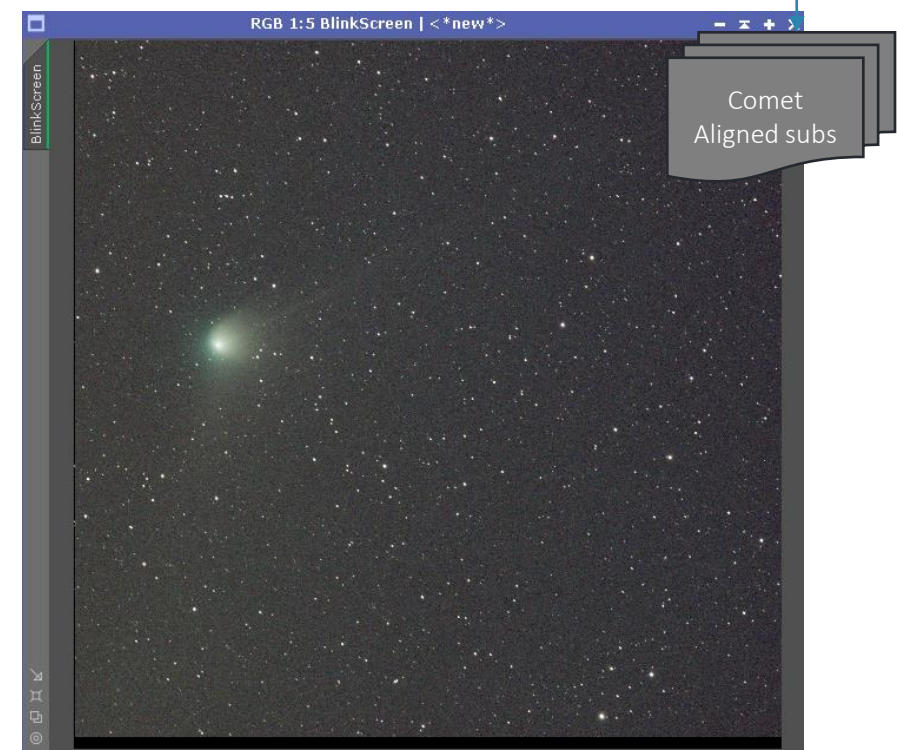
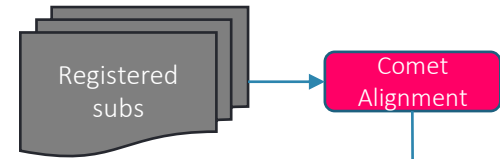
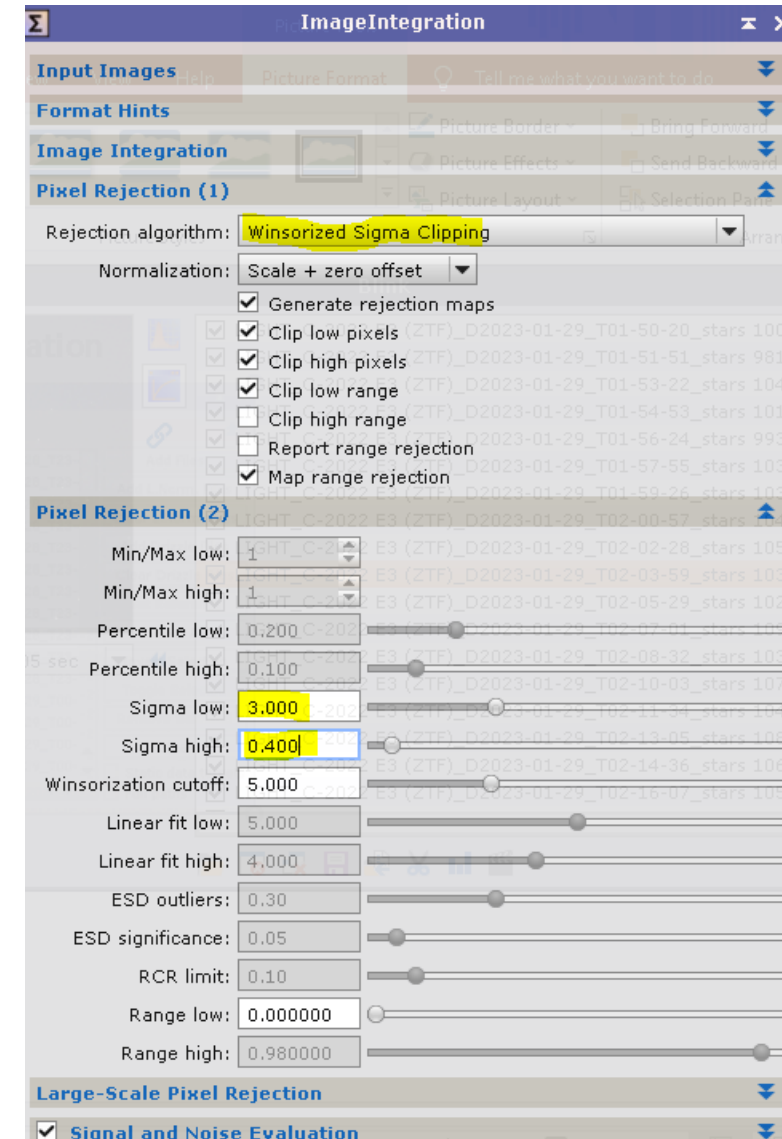
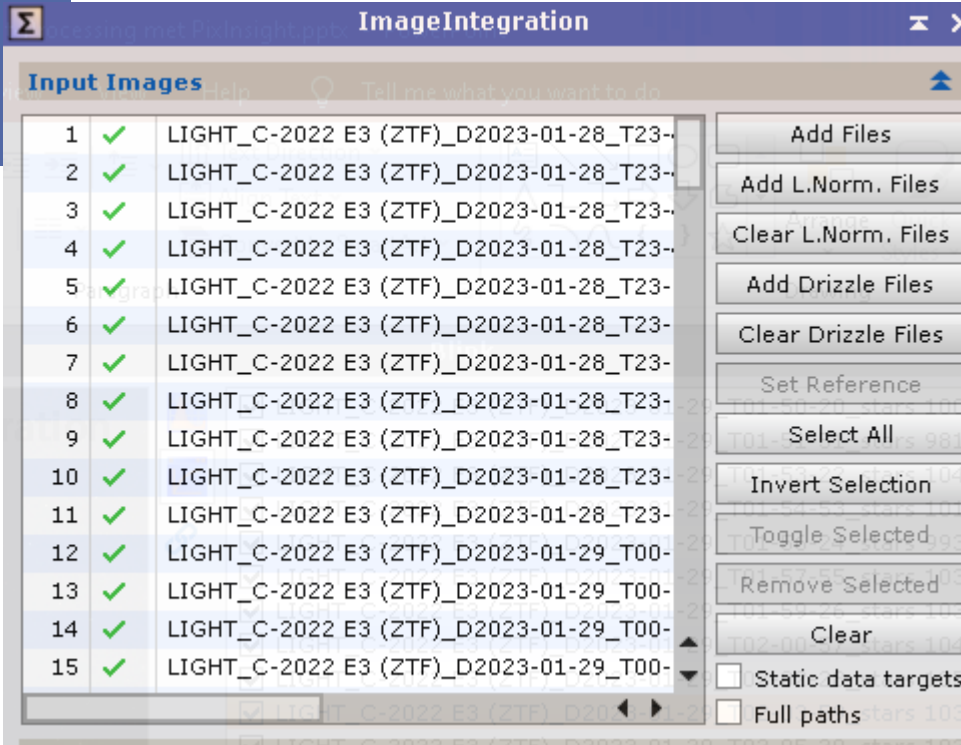
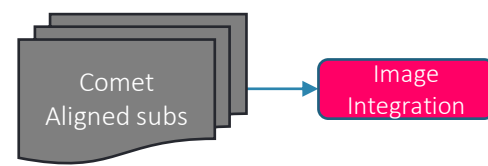


Image Integration of Comet Aligned subs



Rejection Algorithm

> 10 subs.: Winsorized Sigma Clipping

< 10 subs: Percentile Clipping

To improve rejection:

- Increase Sigma low
- Decrease Sigma High

Image Integration without Pixel rejection

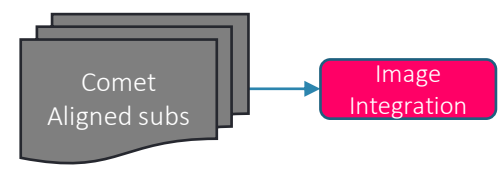
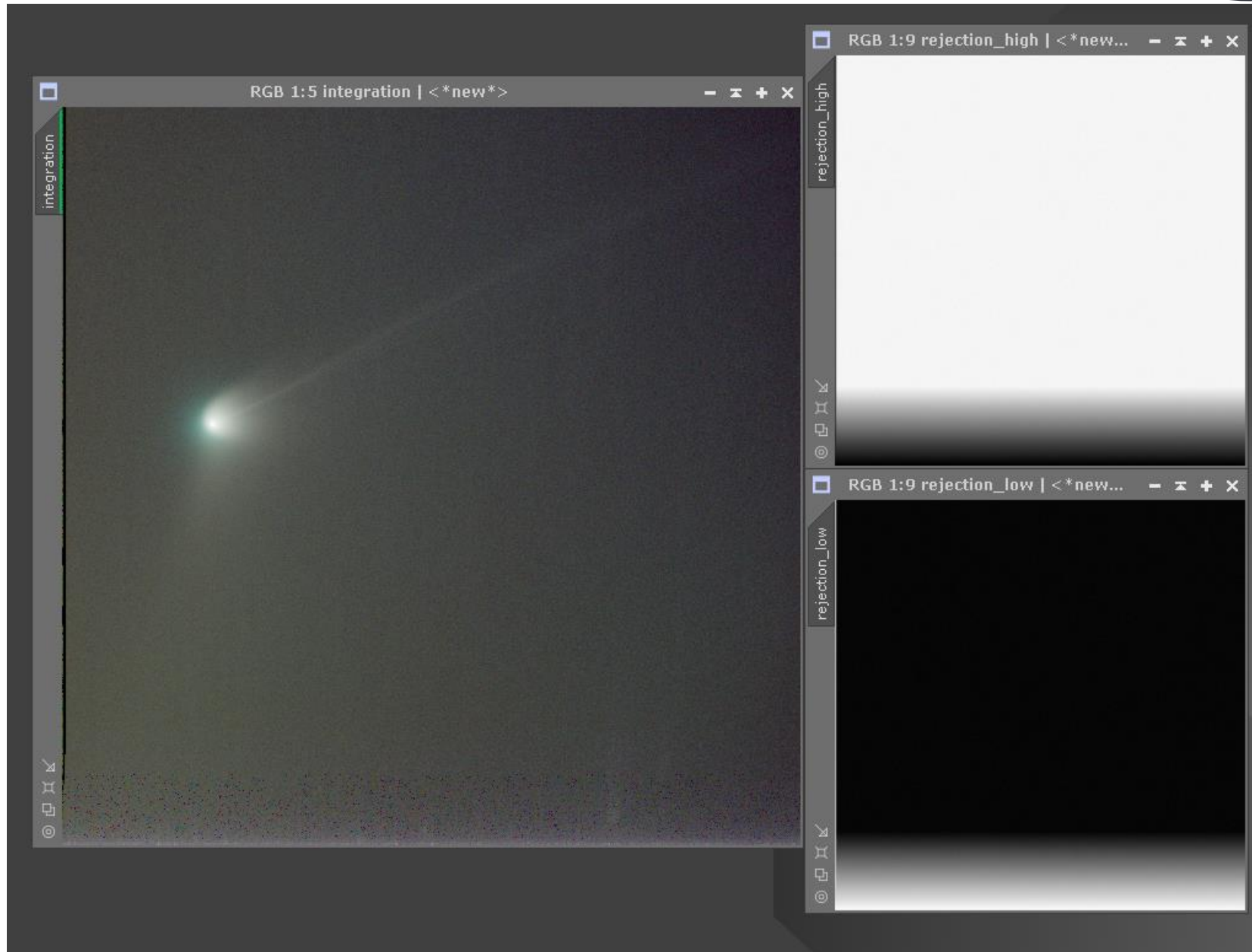
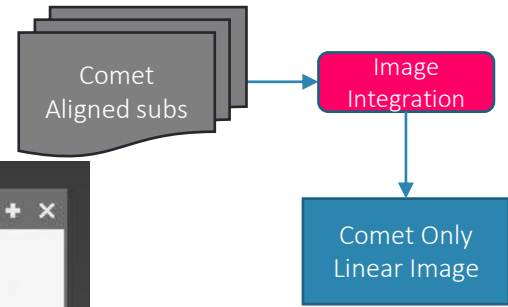


Image Integration with Pixel rejection

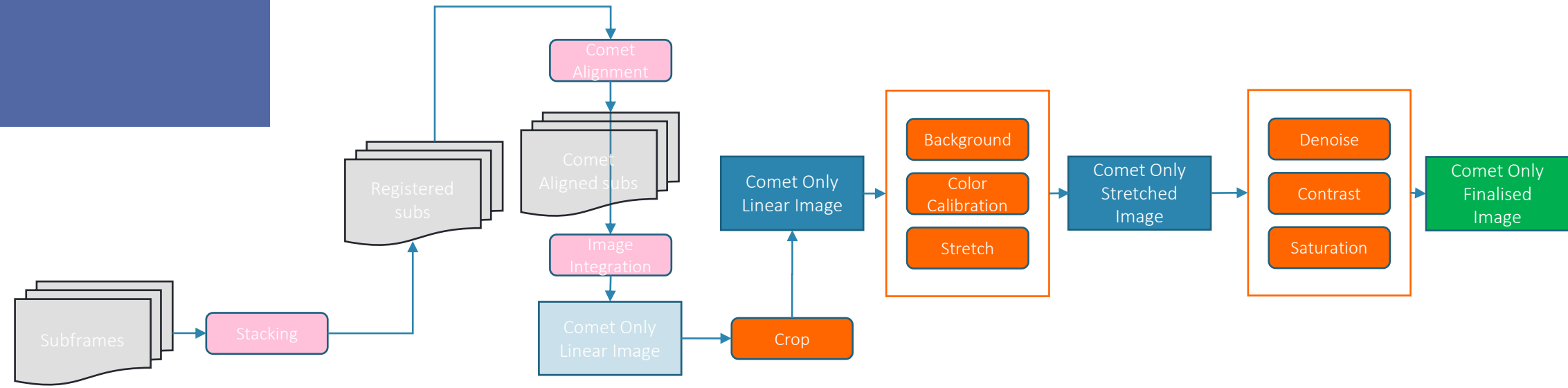




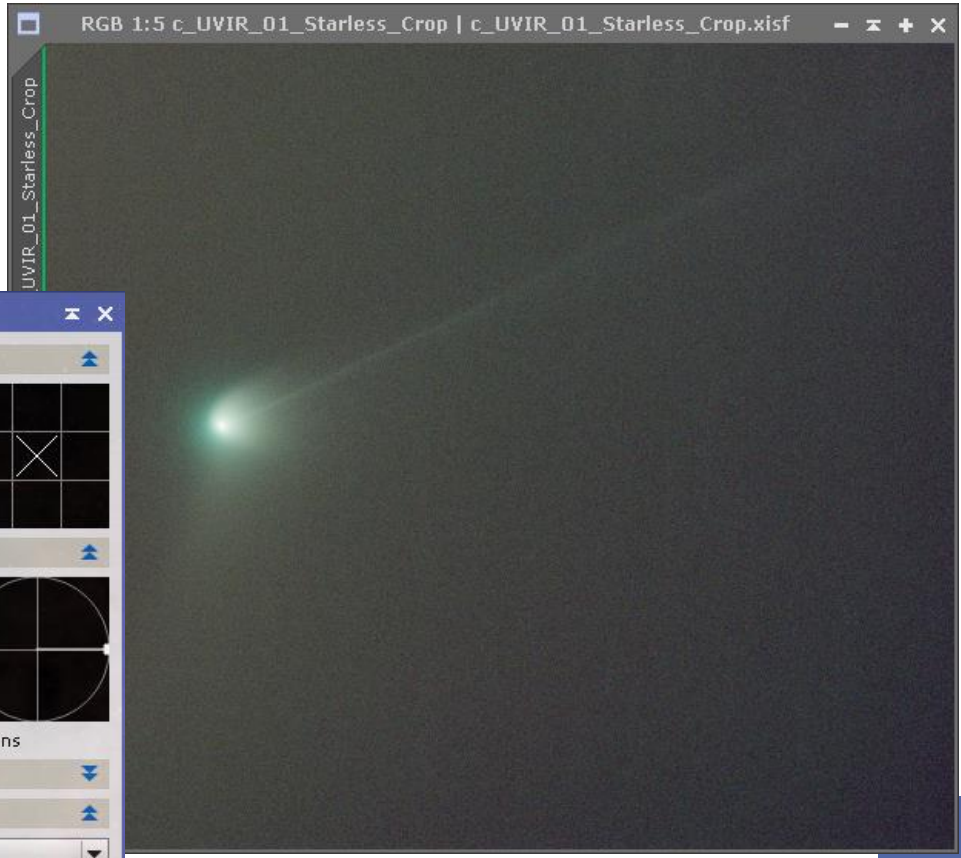
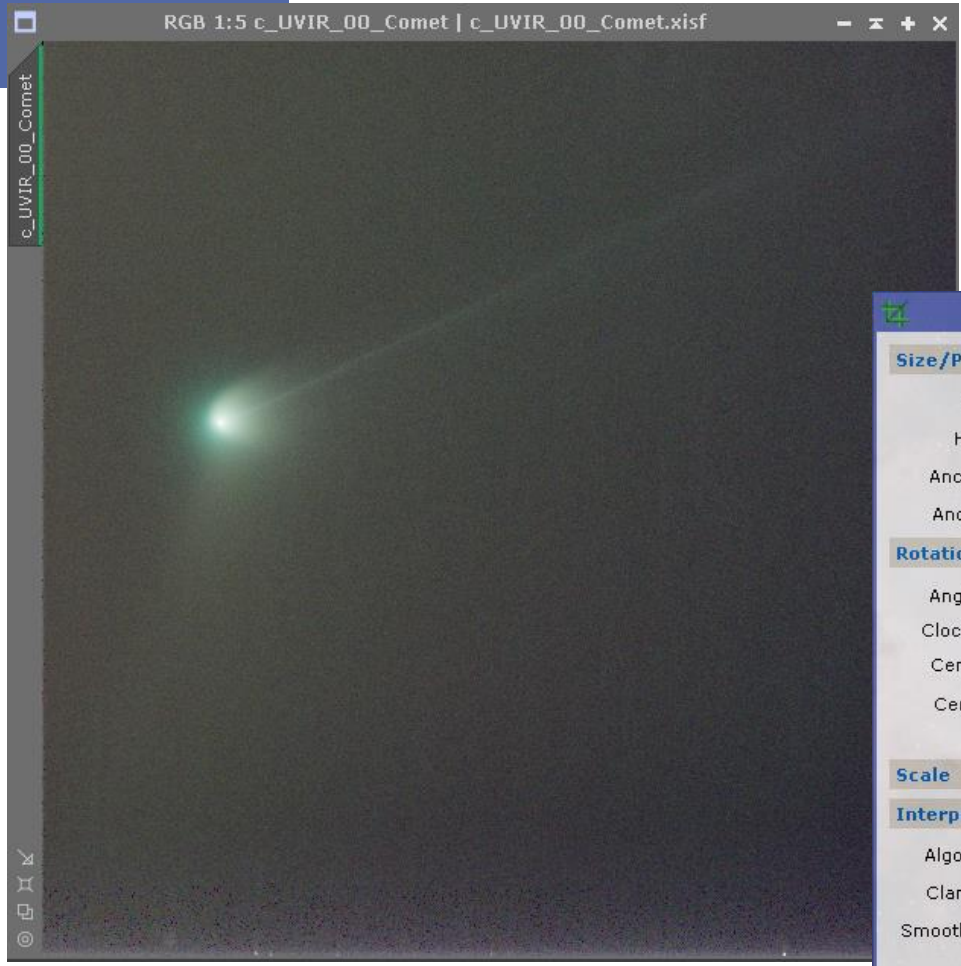
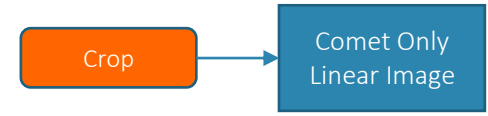
Post-Processing - Comet

- Crop
- Background Extraction
- Color Calibration
- Stretch
- Denoise
- Curves
- Saturation

Workflow



Crop



DynamicCrop

Size/Position

Width: 2955.00
Height: 2620.00
Anchor X: 1492.51
Anchor Y: 1320.00

Rotation

Angle (°): 0.00000
Clockwise:
Center X: 1492.51
Center Y: 1320.00
 Use fast rotations

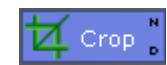
Scale

Interpolation

Algorithm: Auto
Clamping: 0.30
Smoothness: 1.50
 Gamma correction

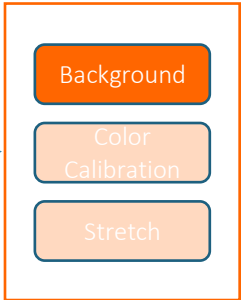
Resolution

Fill Color



Dynamic Background Extraction (DBE)

Comet Only
Linear Image



DynamicBackgroundExtraction

Selected Sample: 1 of 74

Model Parameters (1)

Tolerance: 10.00

Shadows relaxation: 3.000

Smoothing factor: 0.250 Unweighted

Model Parameters (2)

Sample Generation

Default sample radius: 31

Samples per row: 10

Minimum sample weight: 0.750

Sample color: [Color Picker]

Selected sample color: [Green]

Bad sample color: [Red]

Model Image

Target Image Correction

Correction: Subtraction

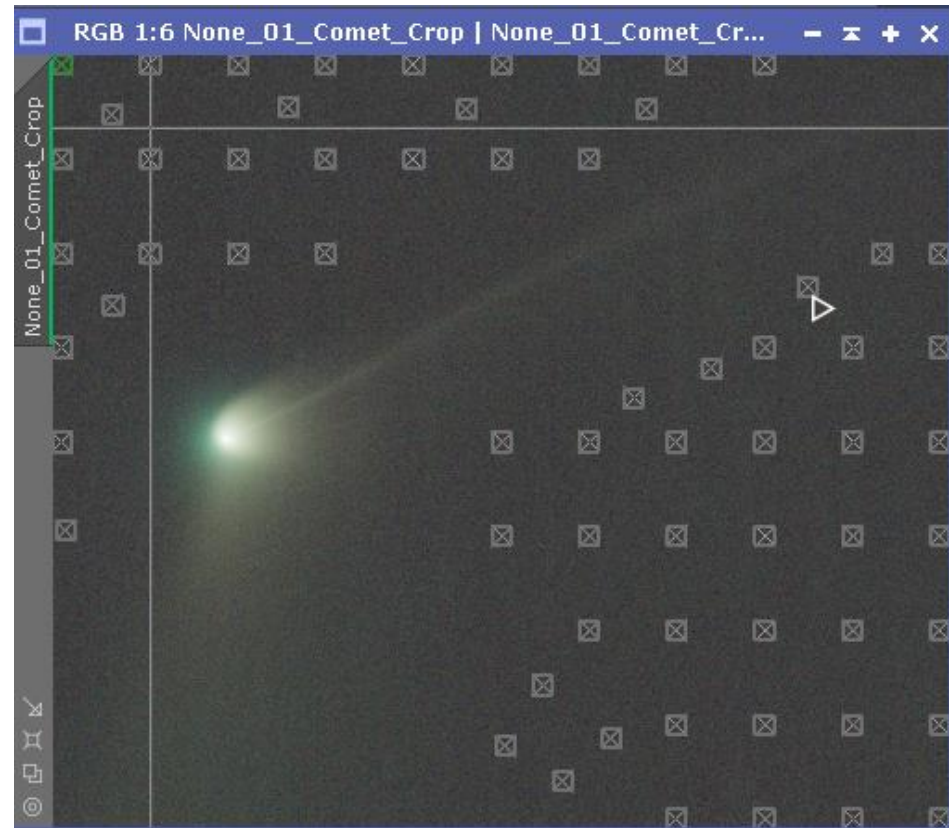
Normalize

Discard background model

Replace target image

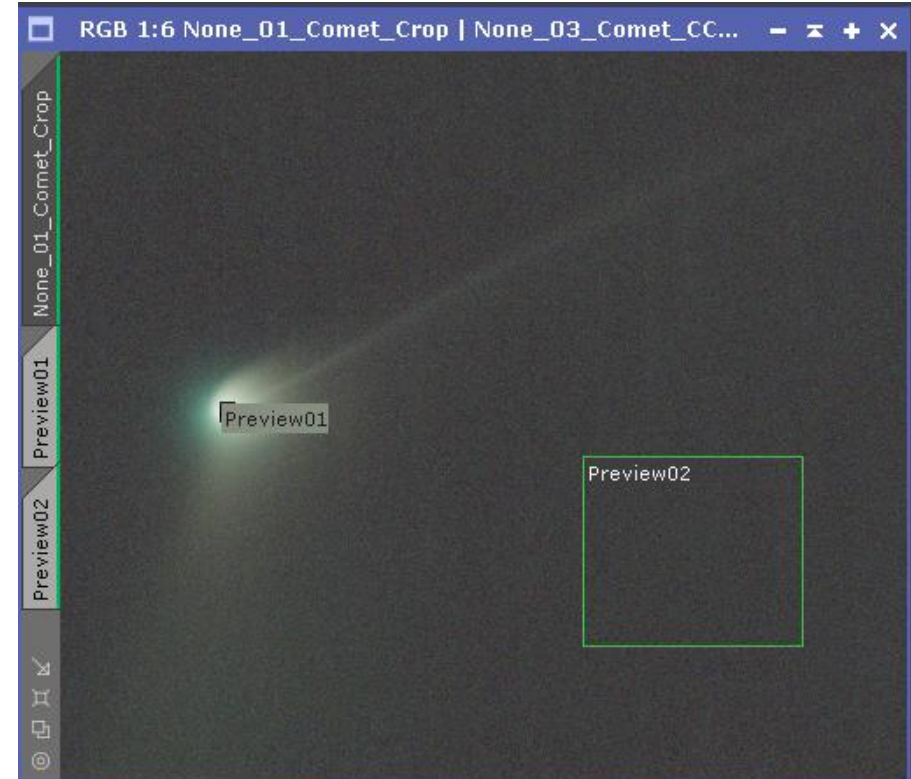
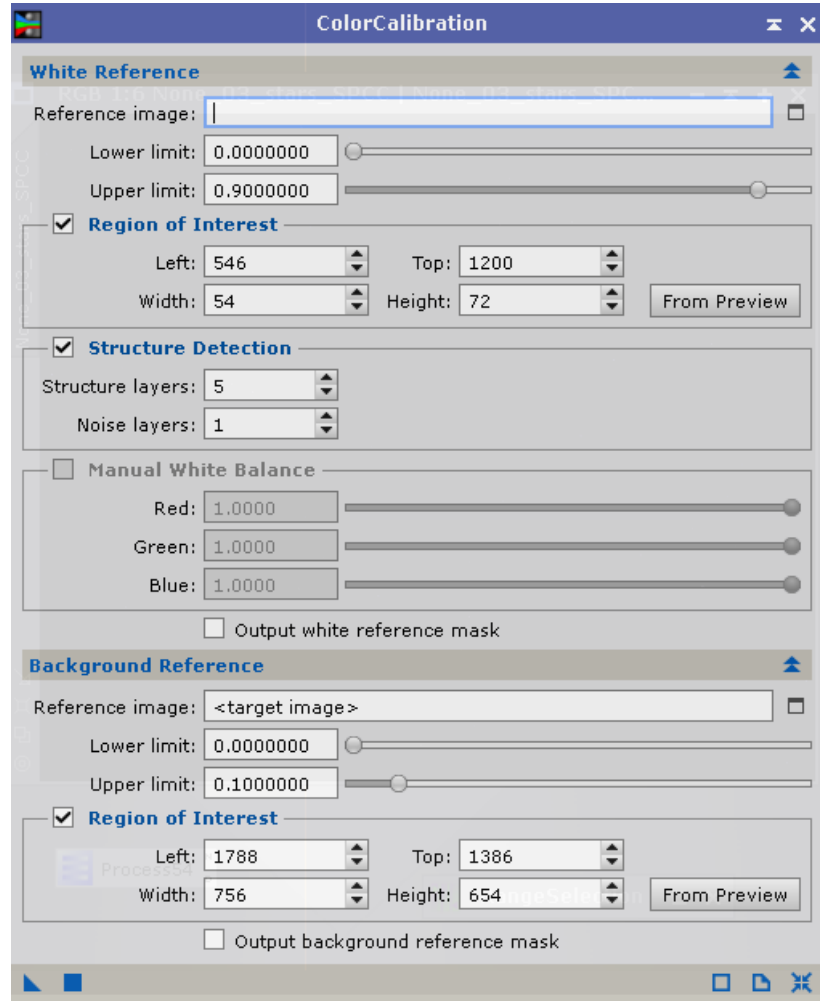
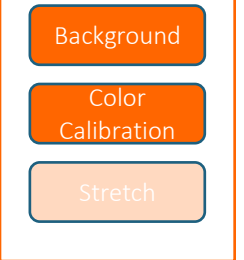
Identifier: <Auto>

Sample format: Same as target

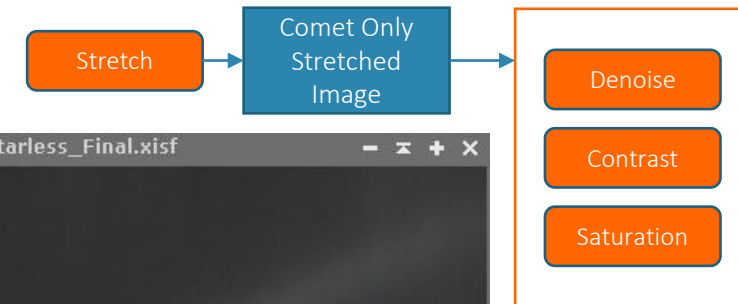


Color Calibration

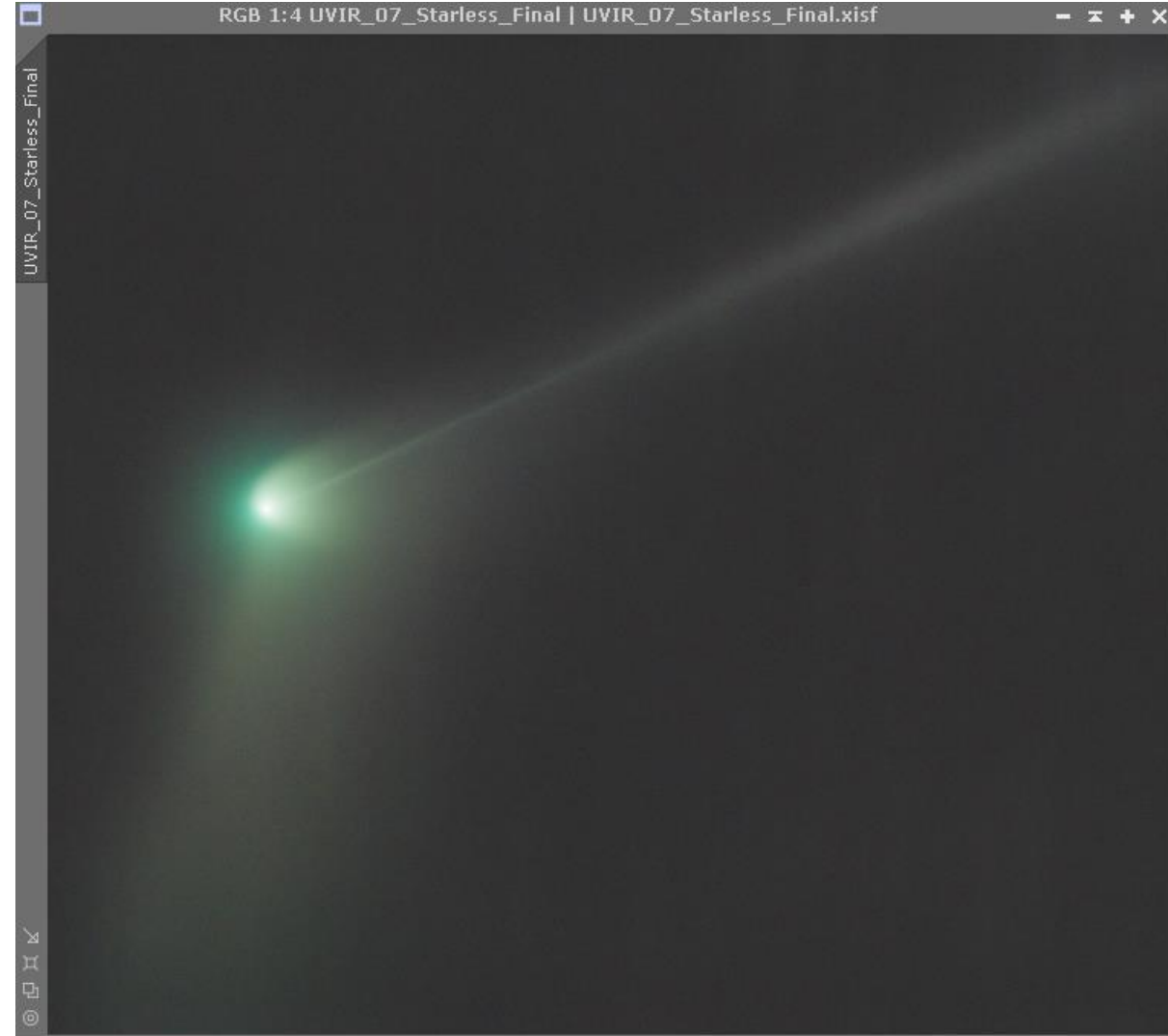
Comet Only
Linear Image



Stretch – Denoise - Curves



History Explorer			
	#	Process	Mask
▼ →	0	<Initial State>	
	0.1	ImageIntegration	
	0.2	DynamicCrop	
	0.3	DynamicBackgroundExtraction	
	0.4	DynamicBackgroundExtraction	
	0.5	ColorCalibration	
	0.6	HistogramTransformation	
	0.7	ImageIdentifier	
	0.8	NoiseXTerminator	
	0.9	CurvesTransformation	range_mask4
	0.10	CurvesTransformation	~range_mask4
	0.11	CurvesTransformation	Comet_unl_gm
	0.12	CurvesTransformation	range_mask3
	0.13	CurvesTransformation	~range_mask3
	0.14	CurvesTransformation	~range_mask3

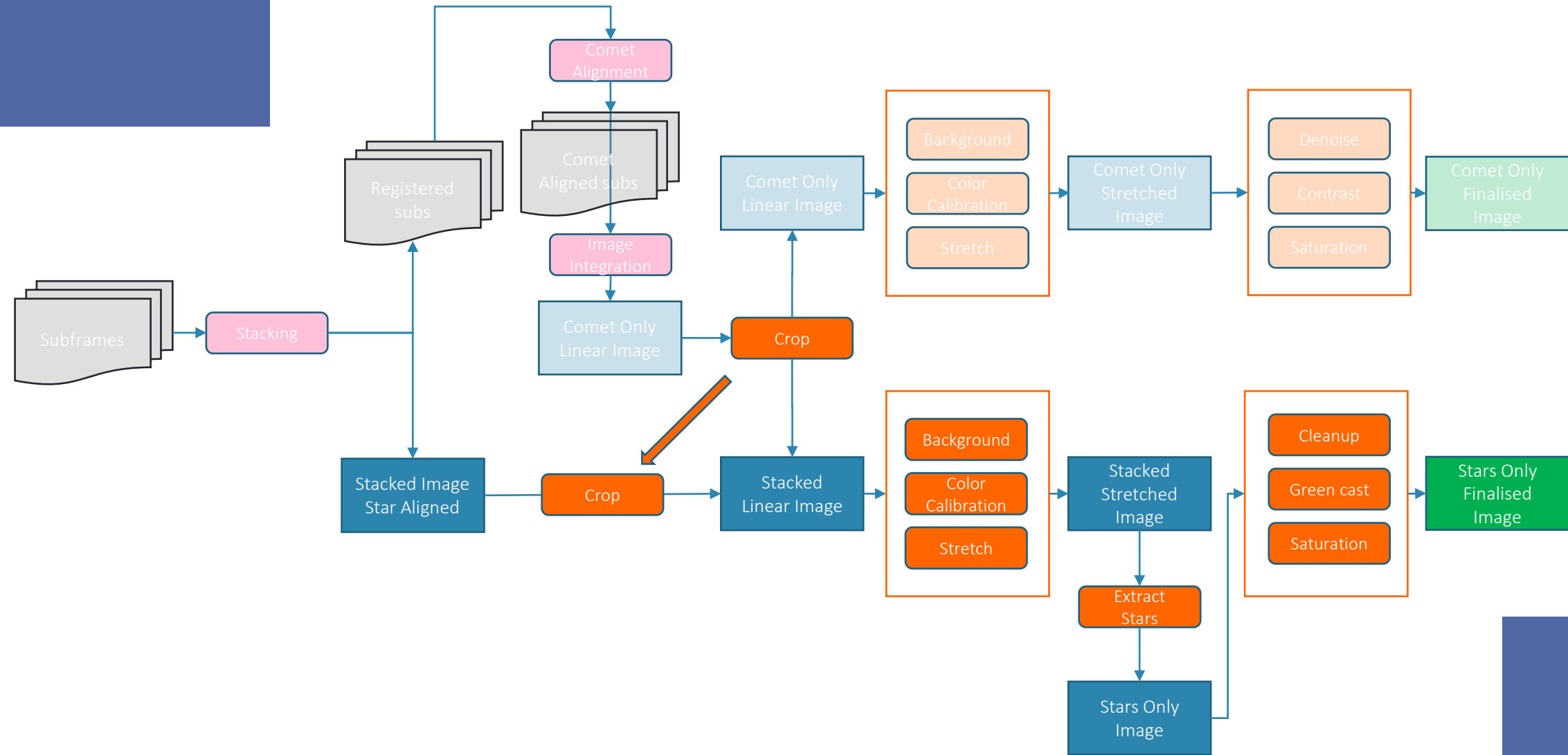




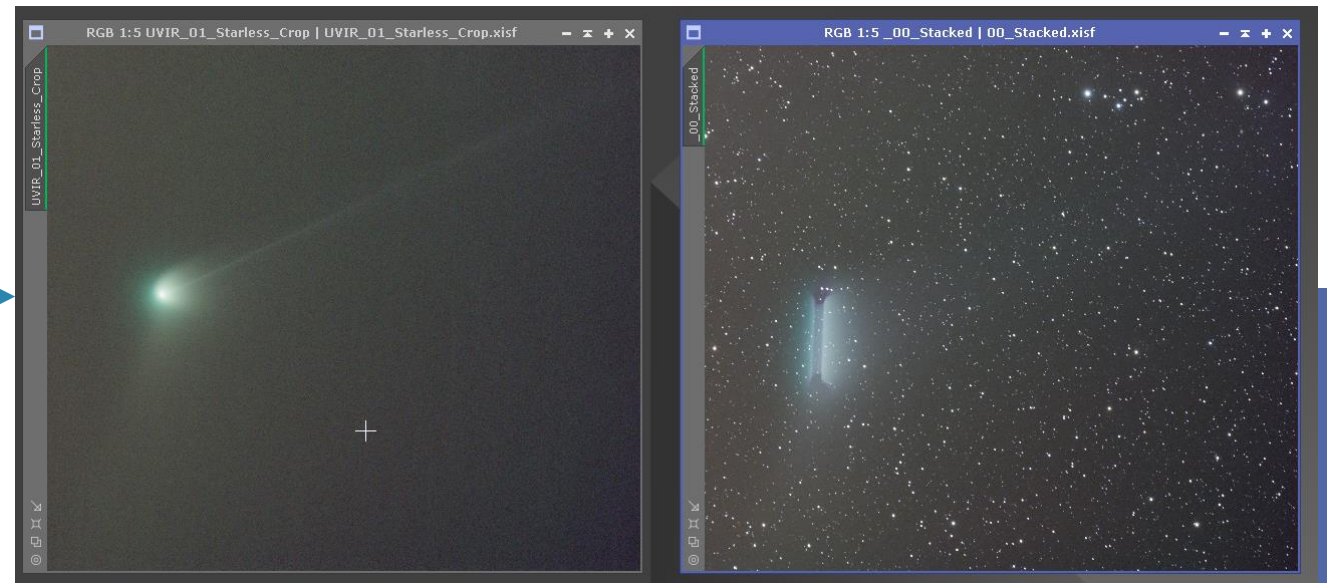
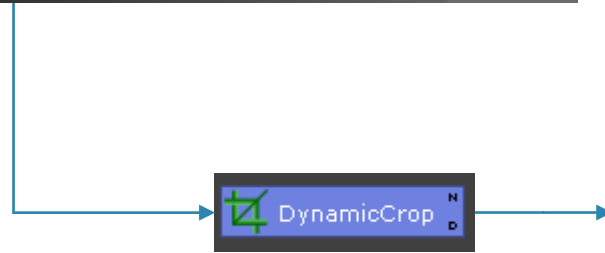
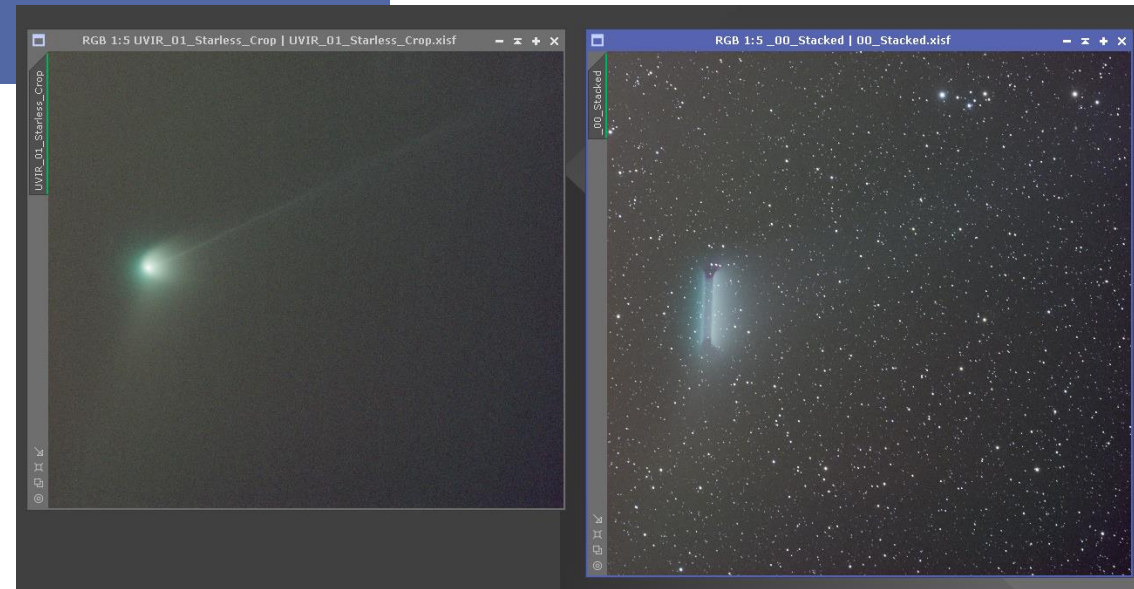
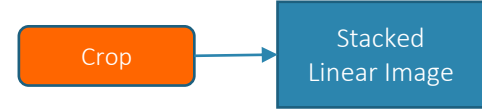
Processing - Stars

- Background Extraction
- Color Calibrate
- Stretch
- Extract Stars

Workflow



Stars – Crop



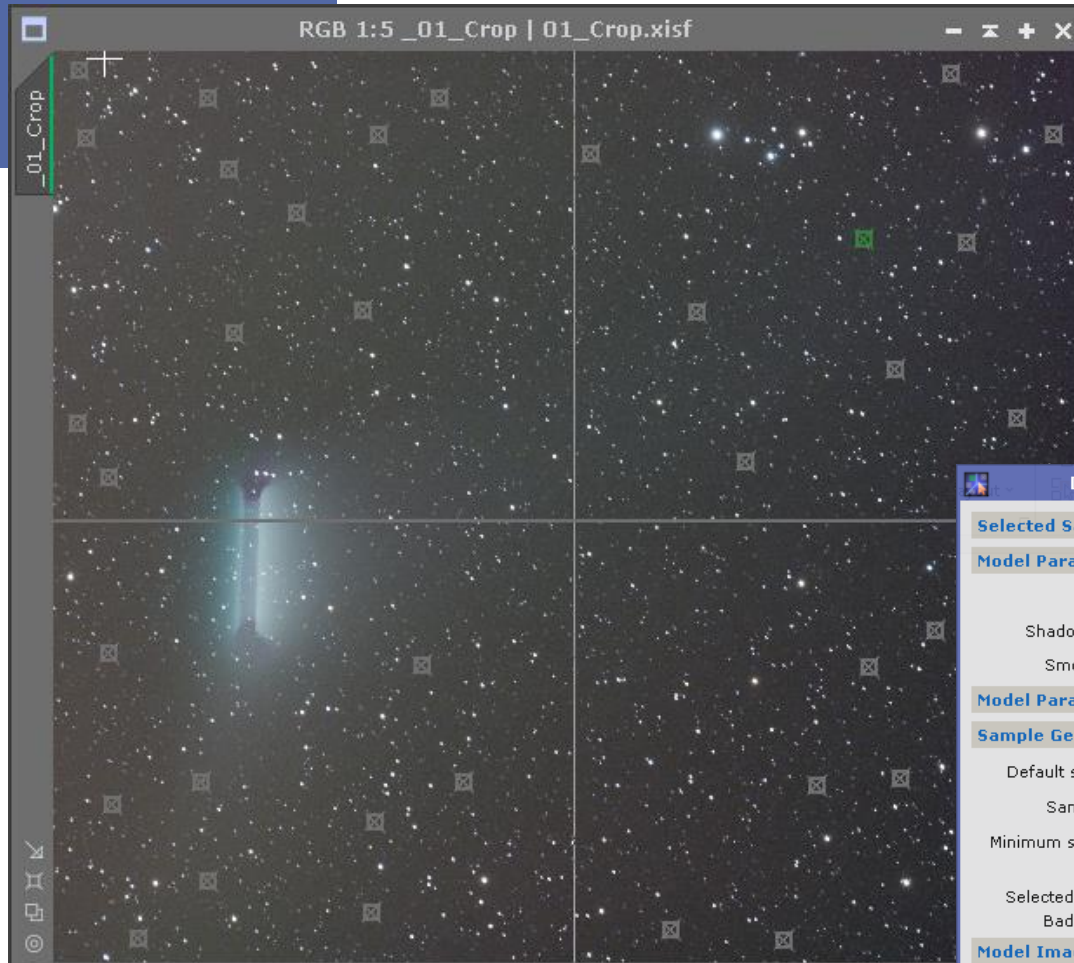
Stars – Background Extraction

Stacked
Linear Image

Background

Color
Calibration

Stretch



DynamicBackgroundExtraction

Selected Sample: 10 of 10

Model Parameters (1)

Tolerance: 10.00

Shadows relaxation: 3.000

Smoothing factor: 0.600 Unweighted

Model Parameters (2)

Sample Generation

Default sample radius: 22

Samples per row: 10

Minimum sample weight: 0.750

Sample color:

Selected sample color:

Bad sample color:

Model Image

Target Image Correction

Correction: Subtraction

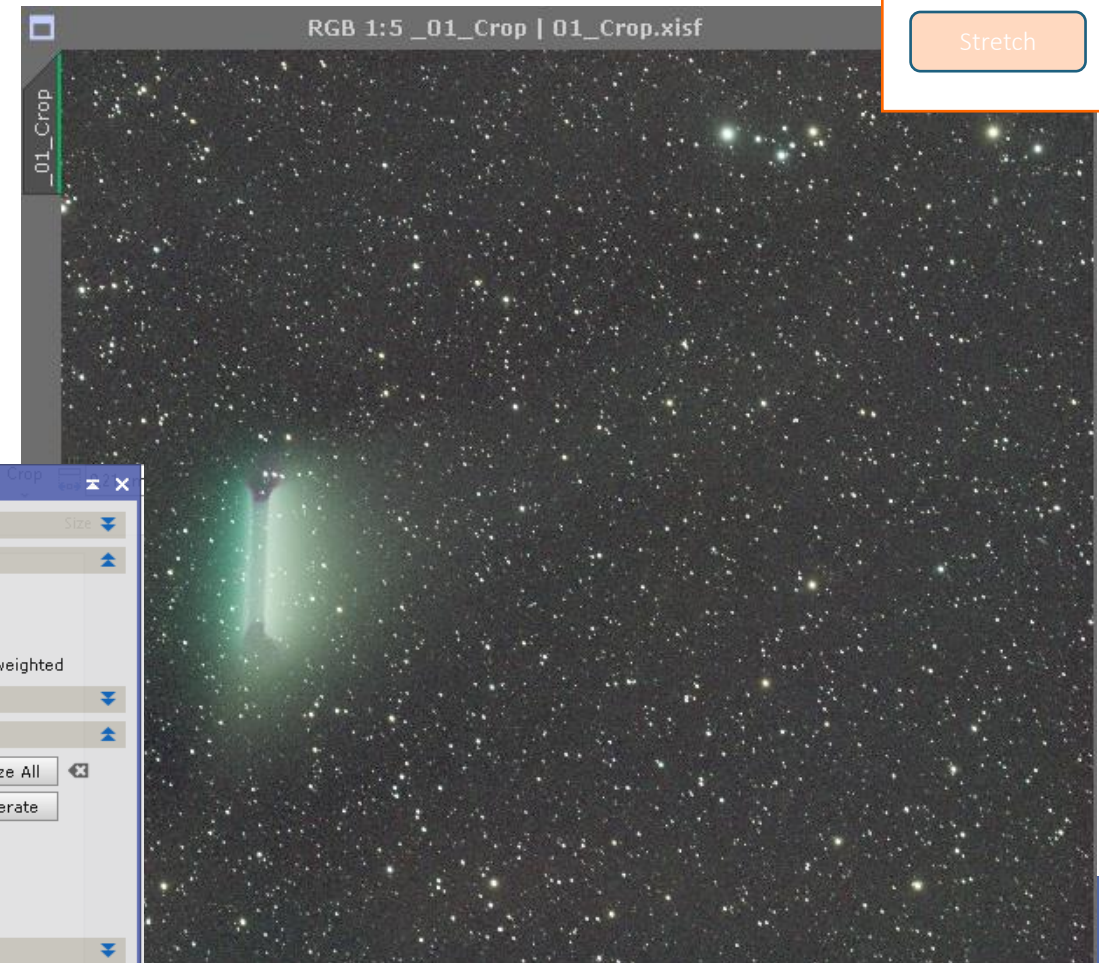
Normalize

Discard background model

Replace target image

Identifier: <Auto>

Sample format: Same as target



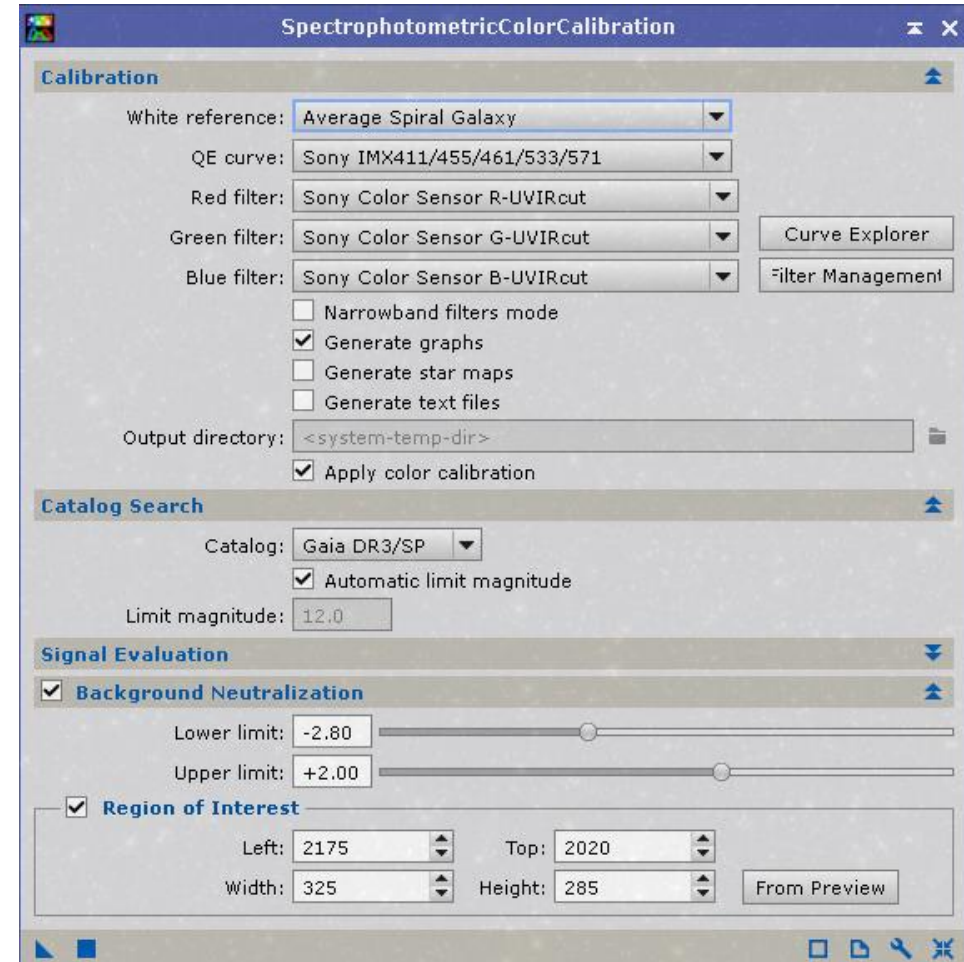
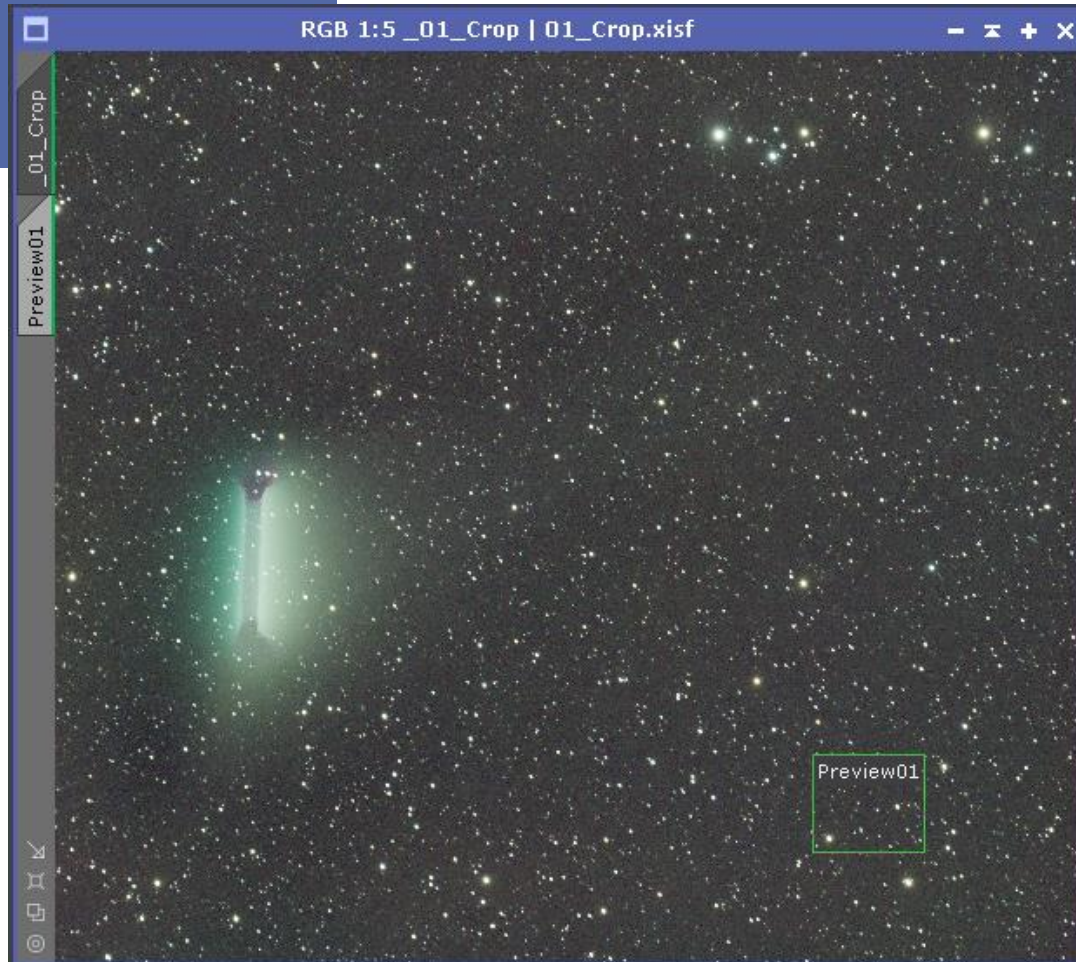
Stars - Color Calibrate

Stacked
Linear Image

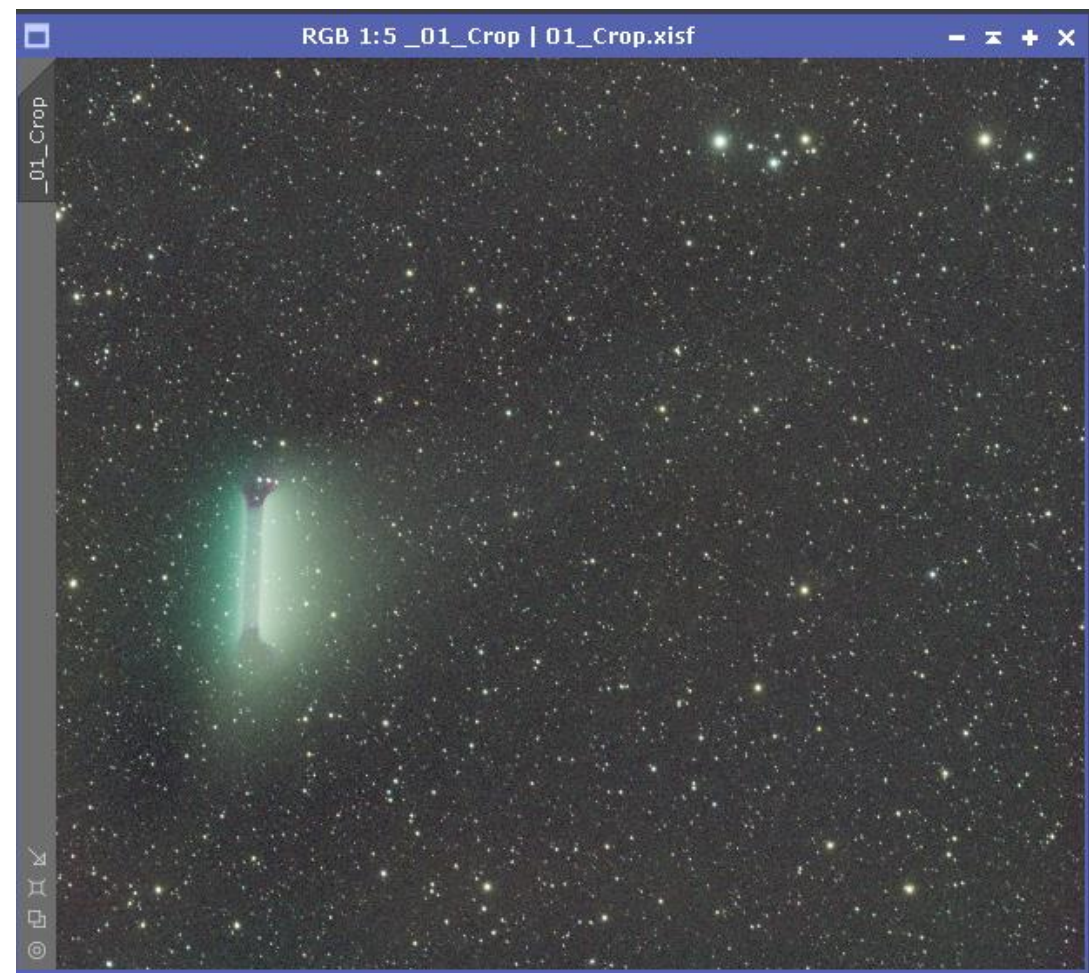
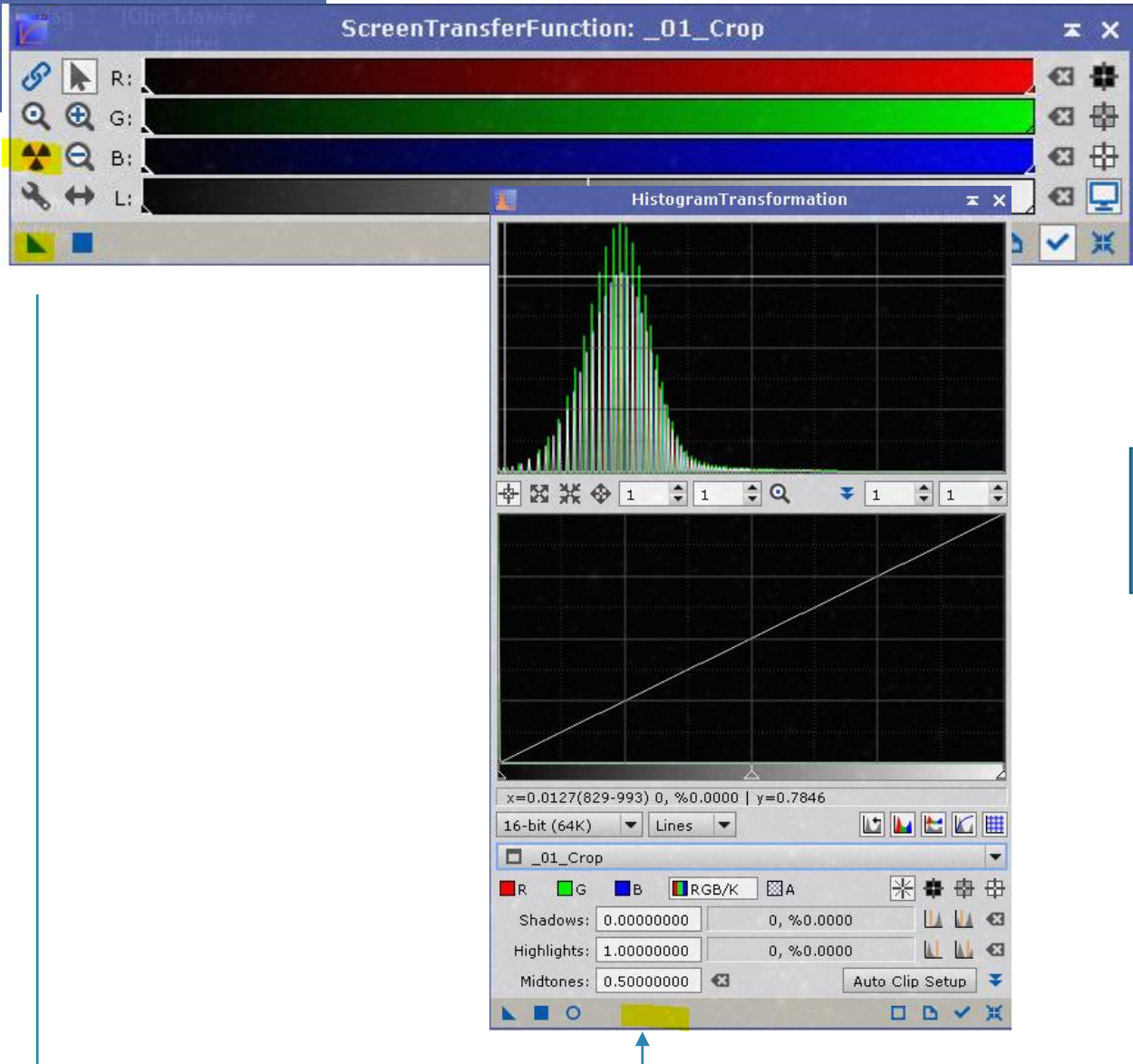
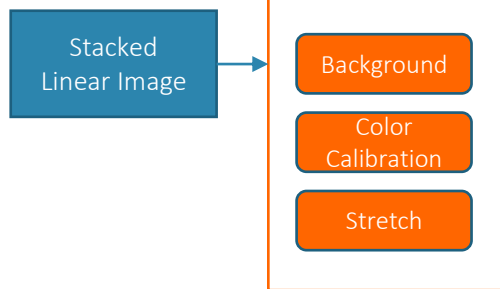
Background

Color
Calibration

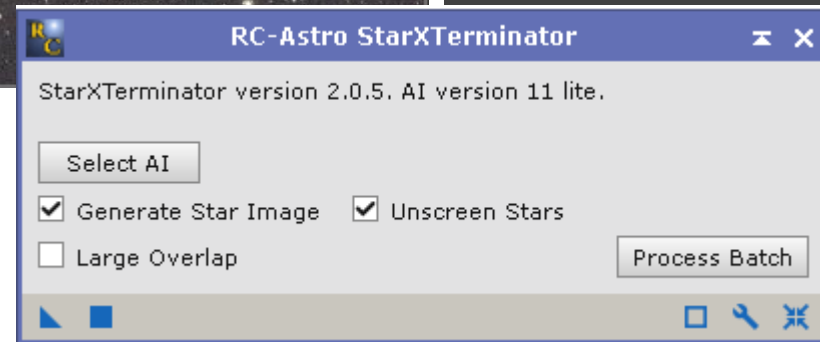
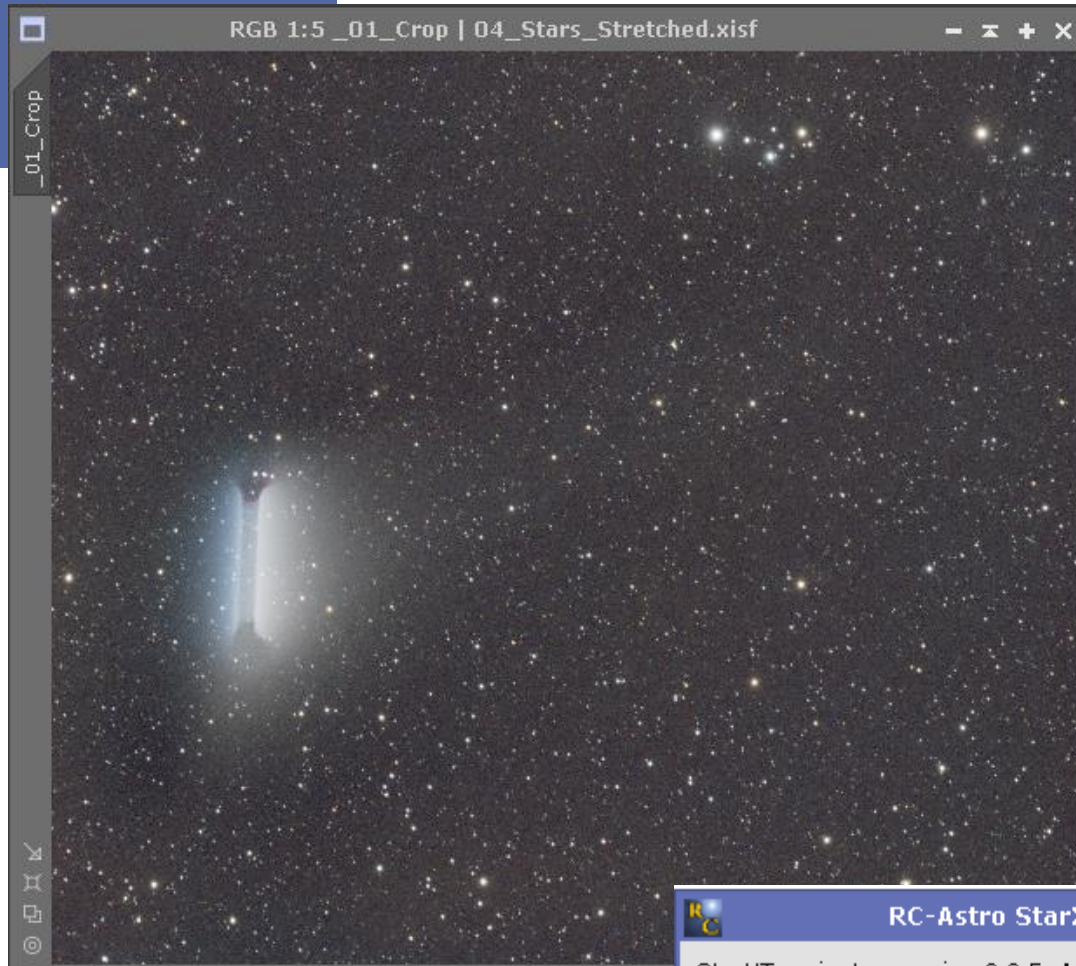
Stretch



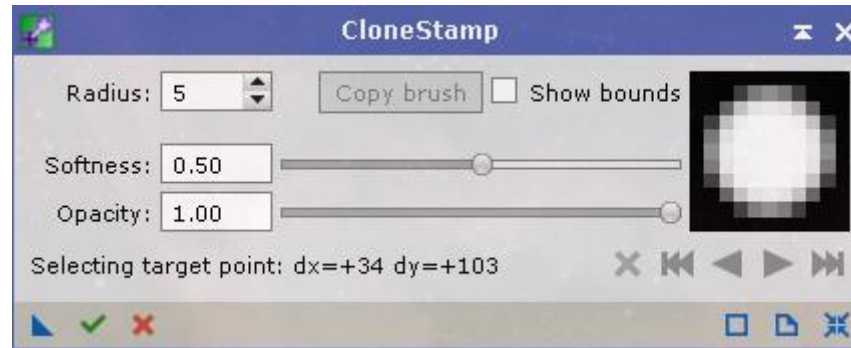
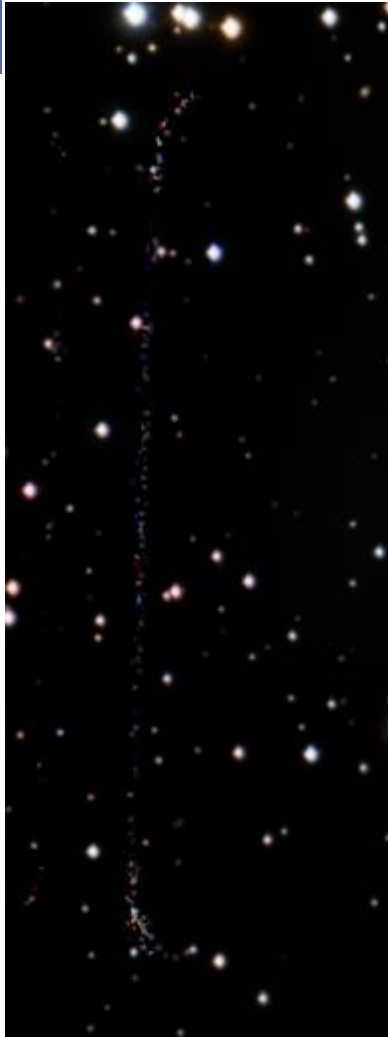
Stars -Stretch



Stars –Extract Stars



Stars –Cleanup



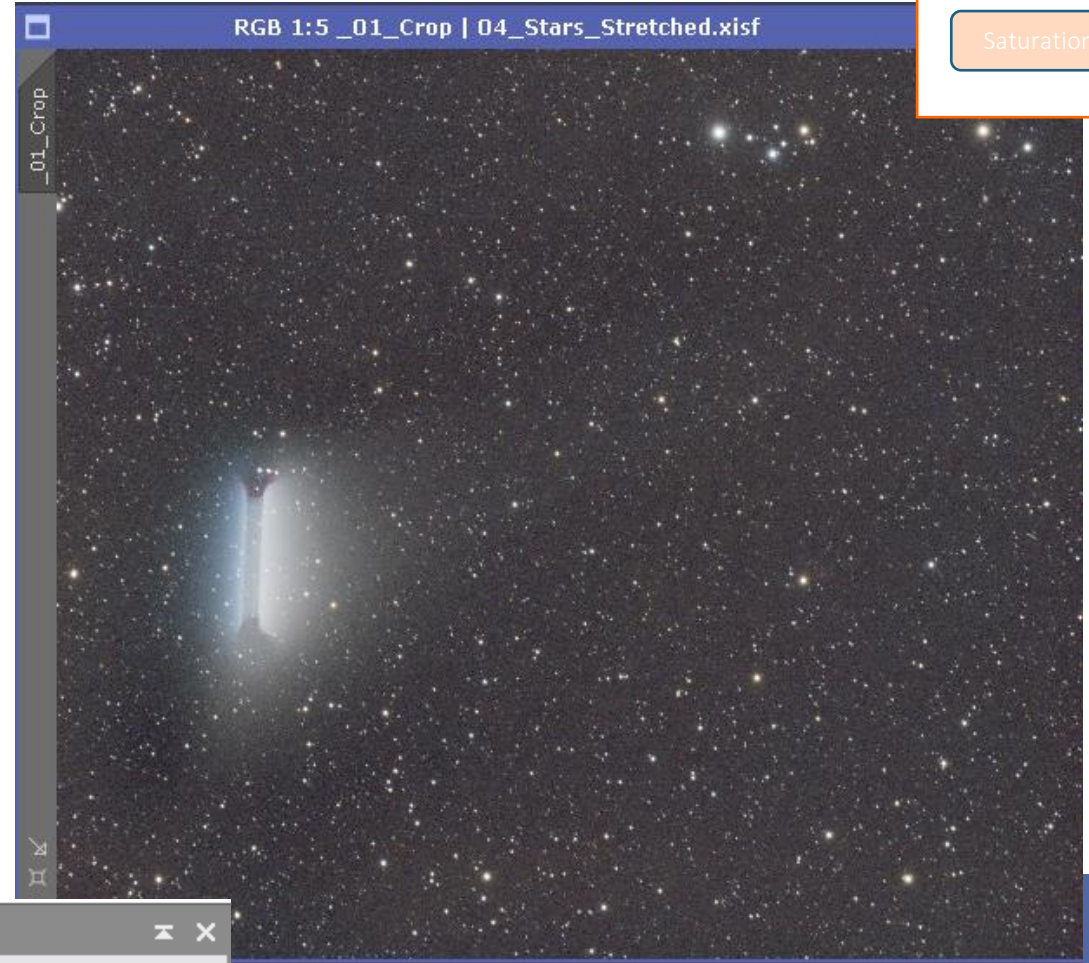
Stars Only Image

- Cleanup
- Green cast
- Saturation

Stars –Remove green cast

Stars Only Image

- Cleanup
- Green cast
- Saturation



SCNR

Color to remove: Green

Protection method: Average Neutral

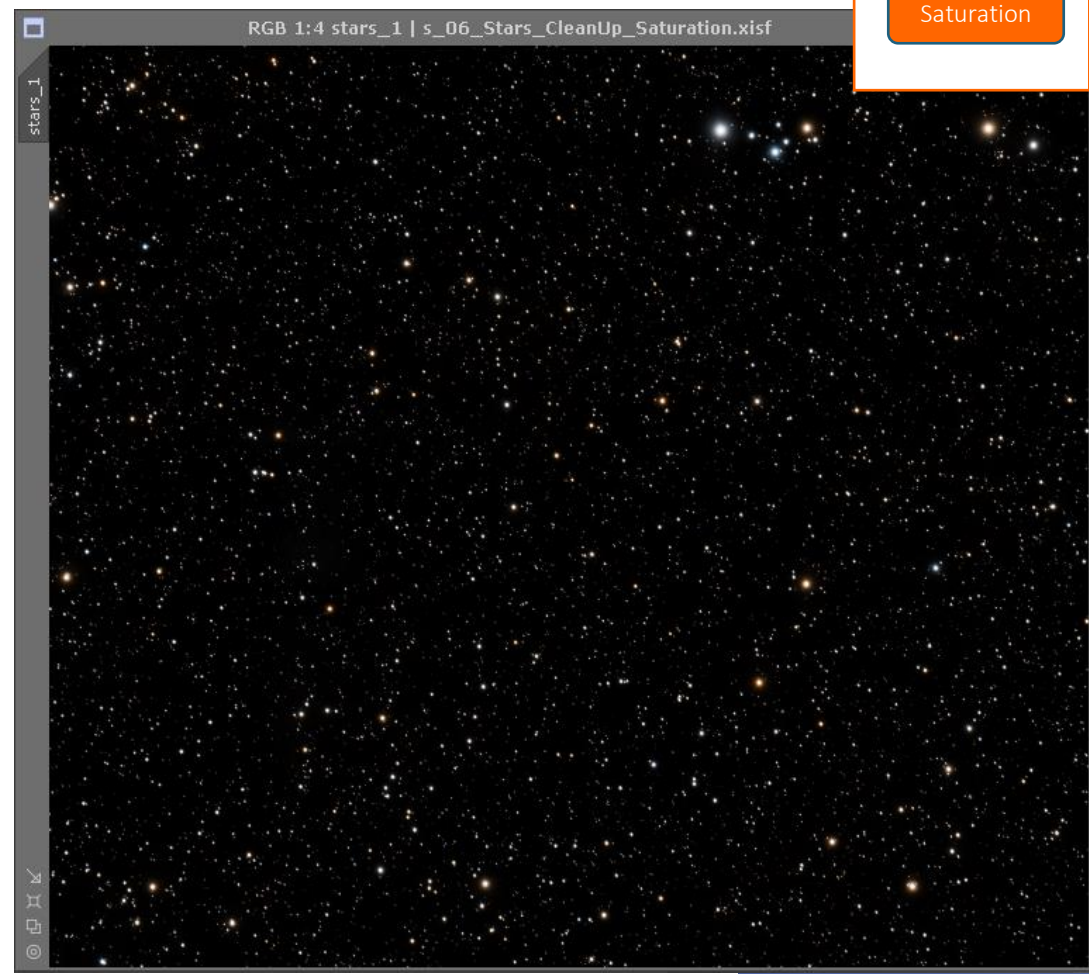
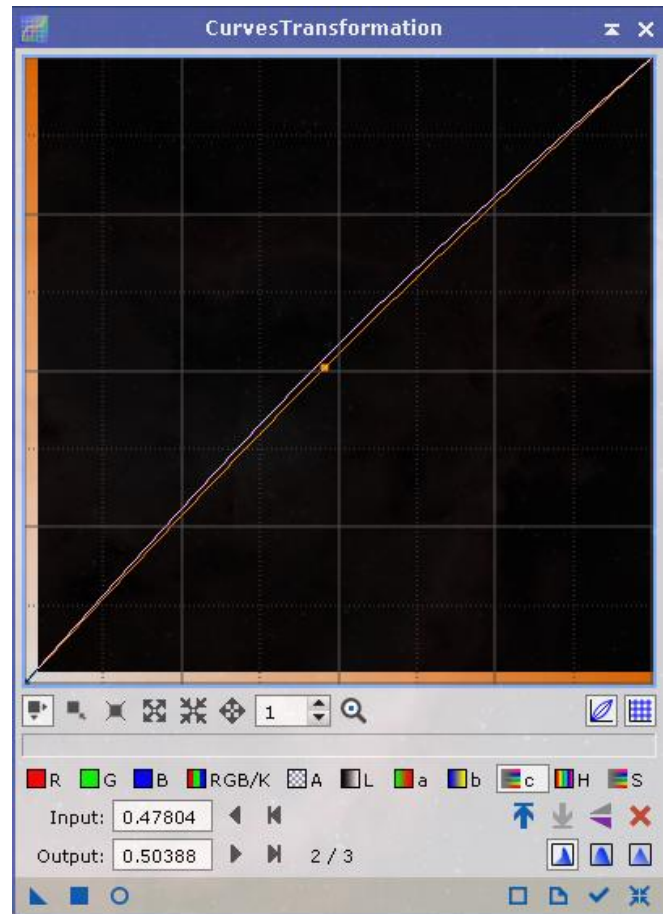
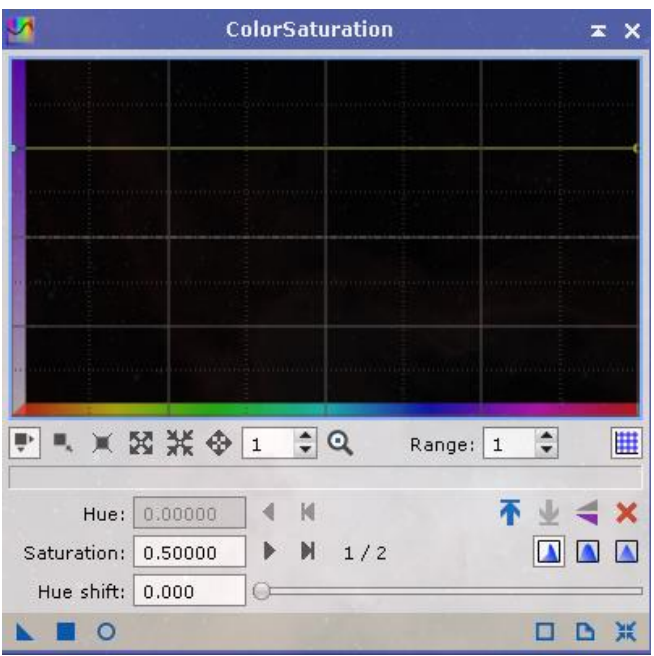
Amount: 1.00

Preserve lightness

Saturation

Stars Only Image

- Cleanup
- Green cast
- Saturation

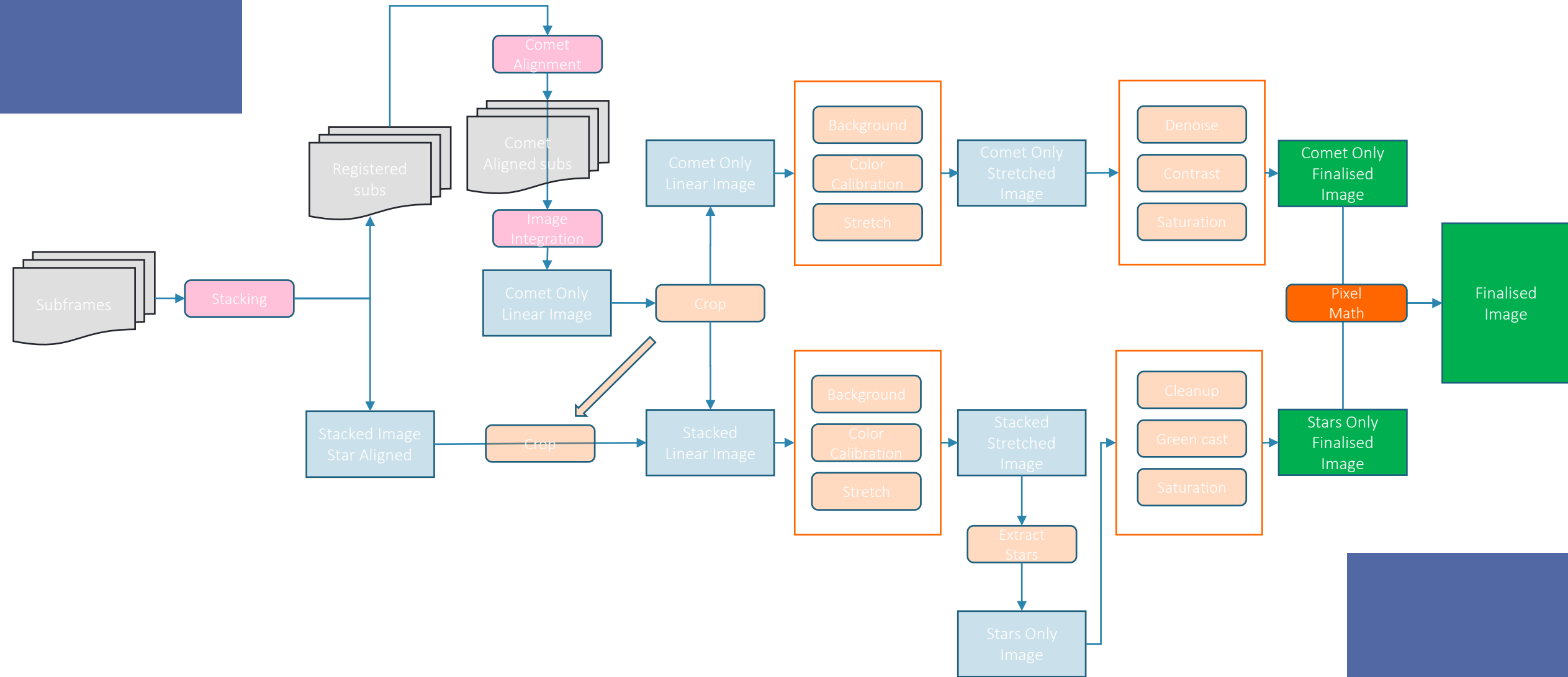




Integration

- PixelMath

Workflow

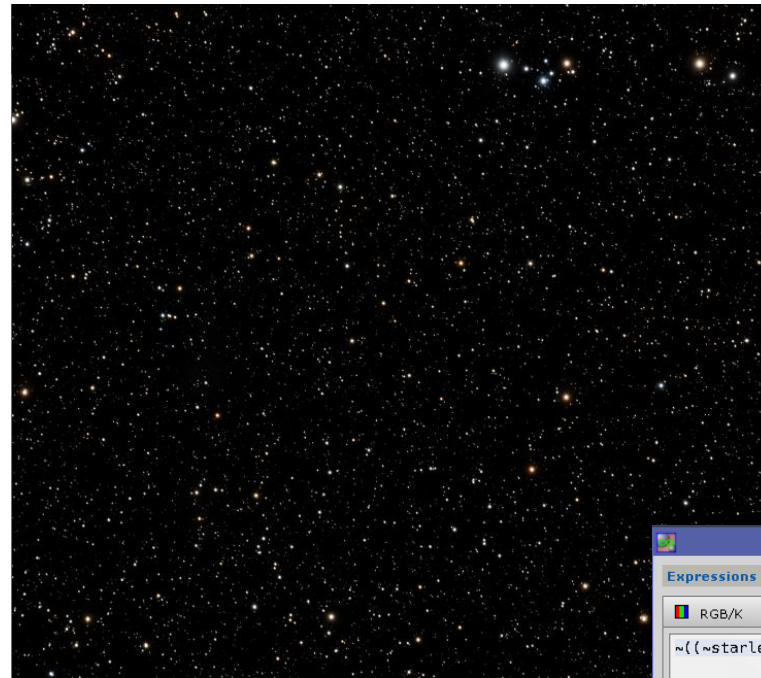


Integration

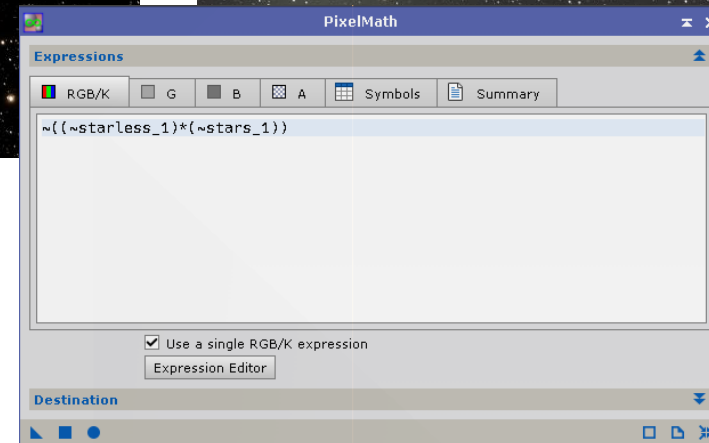
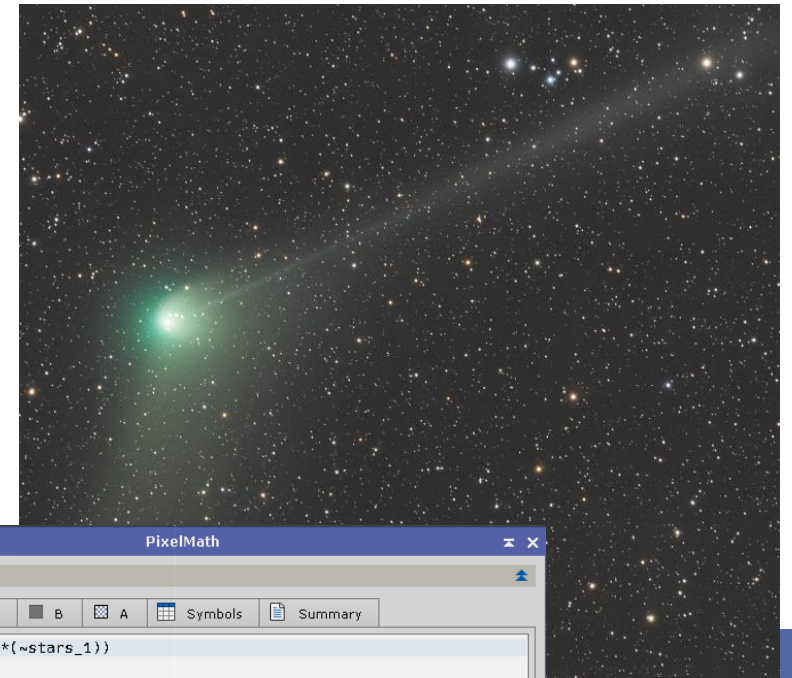


$\sim((\sim\text{starless}))$

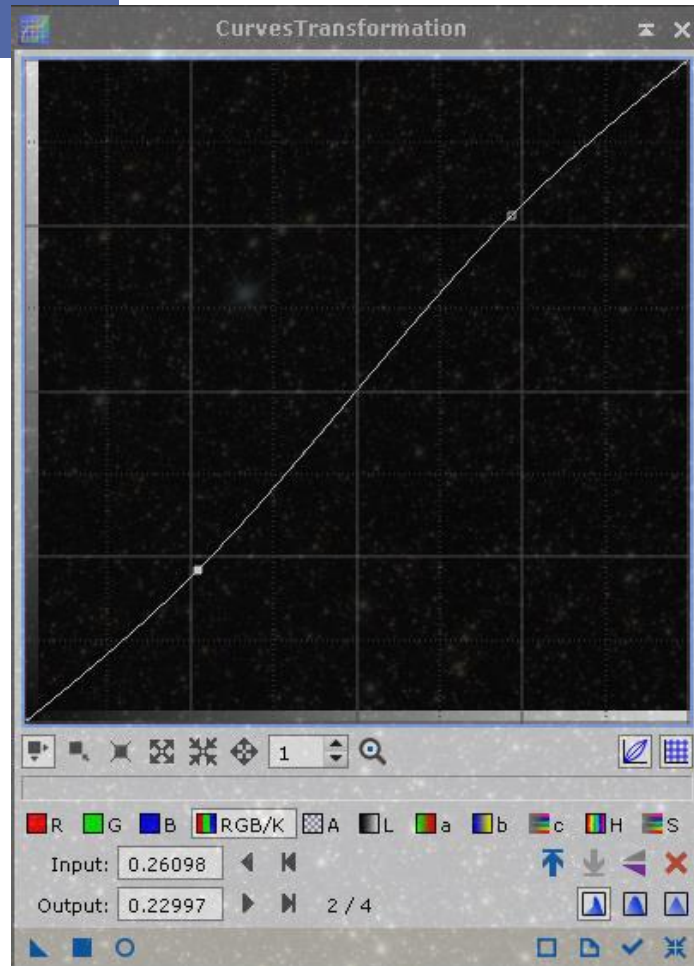
*



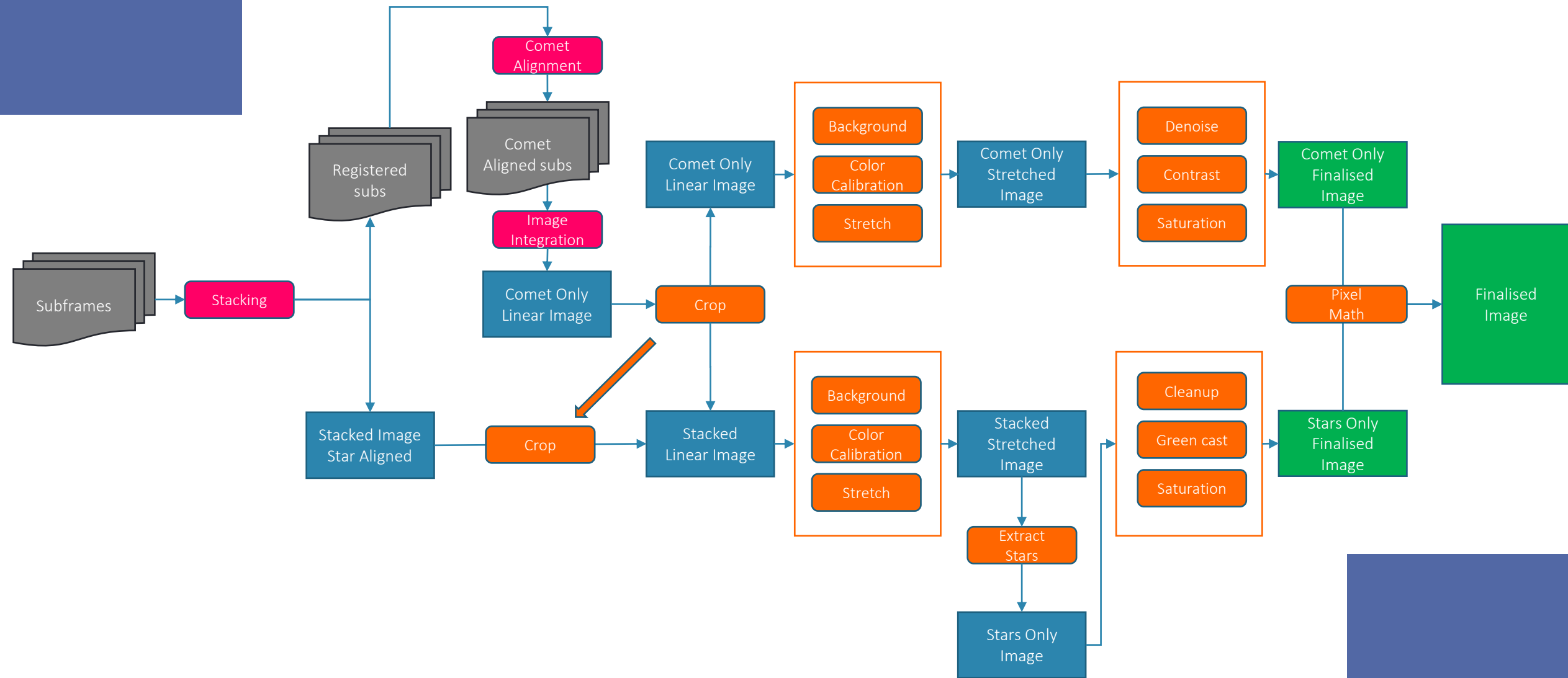
$(\sim\text{stars})$



Finishing Touch



Workflow



Bedank voor jullie aandacht



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