les rencontres du ciel et de l'espace

1-2-3 Novembre 2012

PixInsight

Philippe Bernhard

PixInsight : Qu’es aquò ?

Réponse rapide :

un logiciel de traitement d’images du ciel profond (et aussi planétaire)

Mais ce n’est pas que ça !

Historique

- Créé par Juan Conejero (Espagne), programmeur professionnel et astrophotographe.
- Prédécesseur: SGBNR (réduction de bruit) en 2001.
- Le projet PixInsight a démarré en 2003.
- PixInsight LE (freeware limited edition) a été réalisé en 2004/2005.
- PixInsight Standard (Edition commerciale, architecture modulaire) a démarré en 2008 et toujours en évolution constante.

Pourquoi PixInsight ?

- Logiciel de traitement puissant
- Algorithmes mathématiques innovants et optimisés
- Contrôle total de tous les processus
- Environnement graphique évolué
- Plateforme de traitement d'image réalisé par des astrophotographes pour des astrophotographes

PixInsight

Inside PixInsight ?

- Architecture modulaire et ouverte
- Développement : PixInsight Class Library
- Portabilité multi OS
- Données 8, 16, 32, 64 bits
- Interface graphique avec visu temps réel
- Gestion multi-processeur et RAM
- Gestion des profils de couleur ICC
- Scripts (Javascript), command line, PCL C++

Portabilité multi OS

- Microsoft Windows XP/Vista/7 : 32 et 64 bits
- Mac OS X 10.6/10.7/10.8 : 32 et 64 bits
- Linux 32 et 64 bits

- Core application based on PCL and Trolltech's Qt framework
- PCL : librairie indépendante de l'OS et du hardware
- Parallel processing : gestion avancée des processeurs multi-coeurs et hyperthreading

Dynamique réelle de 64 bits

- Unsigned Integers : 8-bit, 16-bit, 32-bit
- IEEE 754 Floating Point : 32-bit et 64-bit
- PCL support for complex-valued floating-point images
- Tous les processus peuvent travailler avec tous les types de données sans aucune distinction

12bit =	4 196
14bit =	16 384
16bit =	65 536
32bit =	4 294 967 296
64bit =	18 446 744 073 709 551 616

Formats d'images supportés

- FITS : 8, 16, 32, 64 bits
- TIF : 8, 16, 32, 64 bits
- APN (RAW : librairie DC-RAW)
- formats graphiques 8 bits (BMP, JPEG, PNG, GIF,...)

Principe mathématique

- Traitement multi-échelle (multi-résolution)
  - Décomposition du signal de départ en séparant à chaque niveau de résolution les basses fréquences (approximation) et les hautes fréquences (détails) du signal.
- Traitement par ondelettes (algorithme à trous)
- Transformée de Fourier
- Déconvolution
- Masques
- Opérations linéaires (mathématiques)

Principe mathématique

- Alignement stellaire précis (jusqu'à 20% meilleur que les autres logiciels dédiés)
- Empilement optimisé selon différents algorithmes
- Algorithmes évolués de composition de mosaïques
- Fonction magique : HDR Multiscale Transform

PixInsight

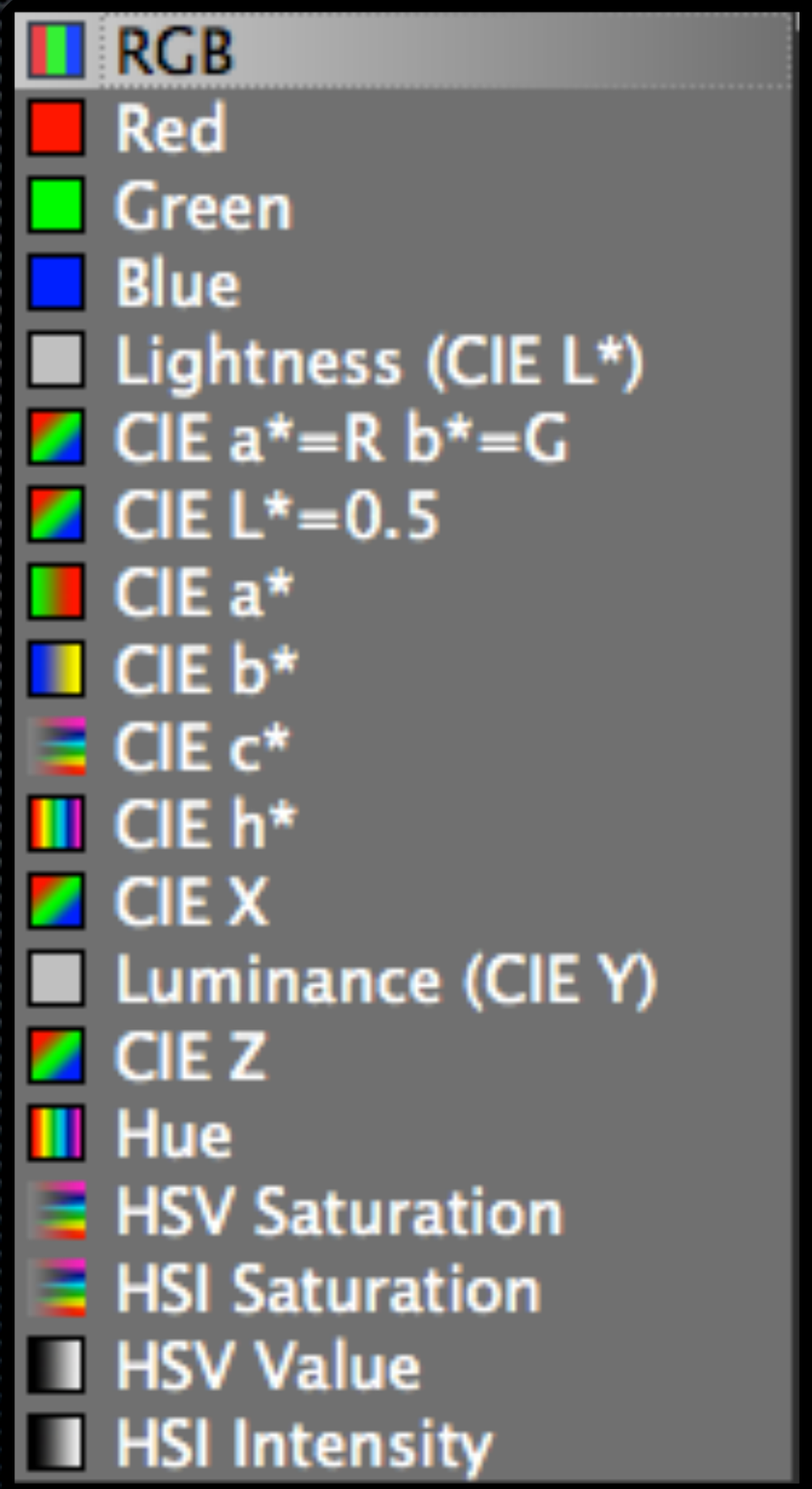
Principe mathématique

- Outils paramétrables (répétables pour plusieurs images)

- Outils dynamiques (uniques à l’image sélectionnée)

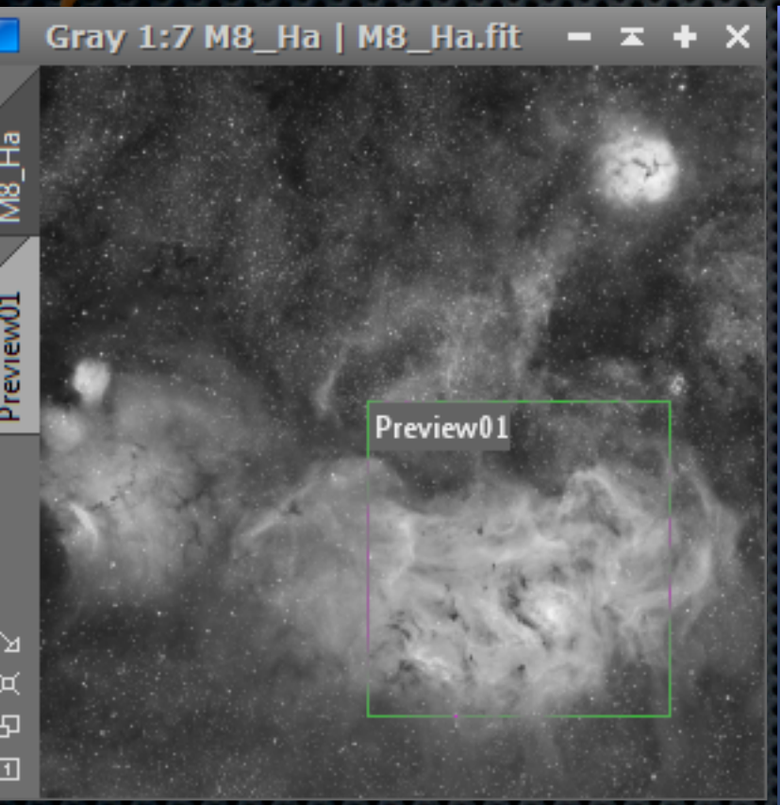
Gestion des couleurs

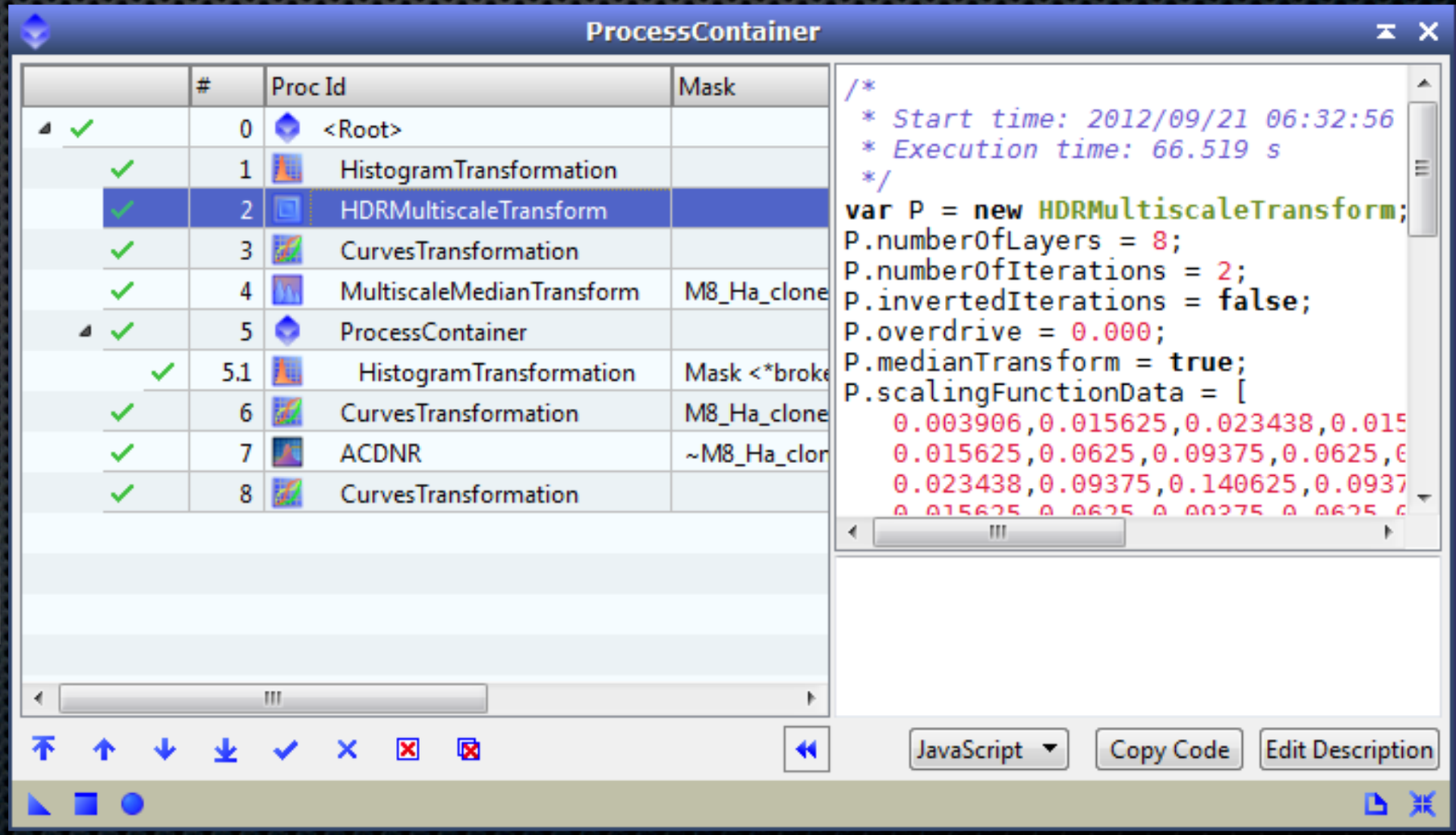
- Affichage
- Profils colorimétriques



Sauvegarde des Process

- Process Icons
- Historique d'un traitement : icône
- Projets (incluant historique de chaque image)





Ce qu’on n’y trouvera pas

- Fonctions artistiques
- Outils «clone» évolués
- Retouches locales
- Et plusieurs petites choses pourtant bien utiles...

Insight

Pixl

L’interface

L'interface...

Process

Console

PixInsight File Edit View Image Preview Mask Process Script Workspace Window Resou

Gray

Process Console

```
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-010bm.fit
Reading FITS: 16-bit integers, 1 channel(s), 2048x2048 pixels: 100%
MRS noise evaluation: done.
Scale factors   :   0.99971
Zero offset     :  +3.051758e-05
Noise estimates :  3.238e-04
Weight          :     1.00000
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-011bm.fit
Reading FITS: 16-bit integers, 1 channel(s), 2048x2048 pixels: 100%
MRS noise evaluation: done.
Scale factors   :   1.00140
Zero offset     :  +3.051758e-05
Noise estimates :  3.238e-04
Weight          :     1.00000

Integration of 11 images:
Pixel combination ......... average
Output normalization ...... none
Pixel rejection ........... Winsorized sigma clipping
Rejection normalization ... none
Rejection clippings ....... low=yes high=yes
Rejection parameters ...... sigma_low=4.000 sigma_high=4.000

* Using 2048 concurrent pixel stack(s) = 544.00 MB
Integrating pixel rows:     0 ->  2047: 100%

Pixel rejection counts:
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-001bm.fit
    1 :      4482   0.107% (     1476 +      3006 =   0.035% +   0.072%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-002bm.fit
    2 :      4541   0.108% (     1659 +      2882 =   0.040% +   0.069%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-003bm.fit
    3 :      4479   0.107% (     1663 +      2816 =   0.040% +   0.067%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-004bm.fit
    4 :      4308   0.103% (     1720 +      2588 =   0.041% +   0.062%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-005bm.fit
    5 :      4201   0.100% (     1697 +      2504 =   0.040% +   0.060%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-006bm.fit
    6 :      4158   0.099% (     1715 +      2443 =   0.041% +   0.058%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-007bm.fit
    7 :      4389   0.105% (     1831 +      2558 =   0.044% +   0.061%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-008bm.fit
    8 :      4279   0.102% (     1824 +      2455 =   0.043% +   0.059%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-009bm.fit
    9 :      4274   0.102% (     1776 +      2498 =   0.042% +   0.060%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-010bm.fit
   10 :      4367   0.104% (     1876 +      2491 =   0.045% +   0.059%)
/Volumes/HD2/AIP/concours 4559/Bias -35C bin 22 11 fichiers bruts/calib_Mar25-011bm.fit
   11 :      4313   0.103% (     1879 +      2434 =   0.045% +   0.058%)

Total :     47791   0.104% (    19116 +     28675 =   0.041% +   0.062%)

MRS noise evaluation: done.
Computing noise scaling factors: done.

Gaussian noise estimates:
σ₅ = 9.939e-05

Reference SNR increments:
Δσ₅₀ = 1.6791

Average SNR increments:
```

Ready

Pause/Abort

Process751

Process Console | View Explorer | Process Explorer | Format Explorer | Script Editor | History Explorer

RGB/K

<Favorites>

ATrousWaveletTransform
BackgroundNeutralization
ColorCalibration
CurvesTransformation
Deconvolution
DynamicBackgroundExtraction
DynamicCrop
FastRotation
HDRMultiscaleTransform
HistogramTransformation
MorphologicalTransformation
MultiscaleMedianTransform
PixelMath
ProcessContainer
RGBWorkingSpace
Resample
SampleFormatConversion
ScreenTransferFunction
StarMask
Statistics

<All Processes>
<Scripts>
BackgroundModelization
ChannelManagement
ColorCalibration
ColorManagement
ColorSpaceConversion
ColorSpaces
Compatibility
Convolution
Deconvolution
Flux
Fourier
Geometry
Global
GradientDomain
Image
ImageCalibration
ImageInspection
ImageIntegration
ImageRegistration
IntensityTransformations

AdaptiveStretch
AutoHistogram
Binarize
ColorSaturation
CurvesTransformation
DigitalDevelopment

Process 10 of 20

PixInsight Reference Documentation — Hist

100%

file:///Applications/PixInsight64.app/Cont

PixInsight Reference Documentation

HistogramTransformation

Implements pixel intensity transformations defined by histogram clipp
expansion points. [more]

Categories: IntensityTransformations

Keywords: histogram, histogram transformation, intensity transform

Contents

Introduction

A histogram is a discrete representation of the distribution of values i
the whole set of data points into a number of intervals and counts the
Histograms are discrete functions usually represented in the form of

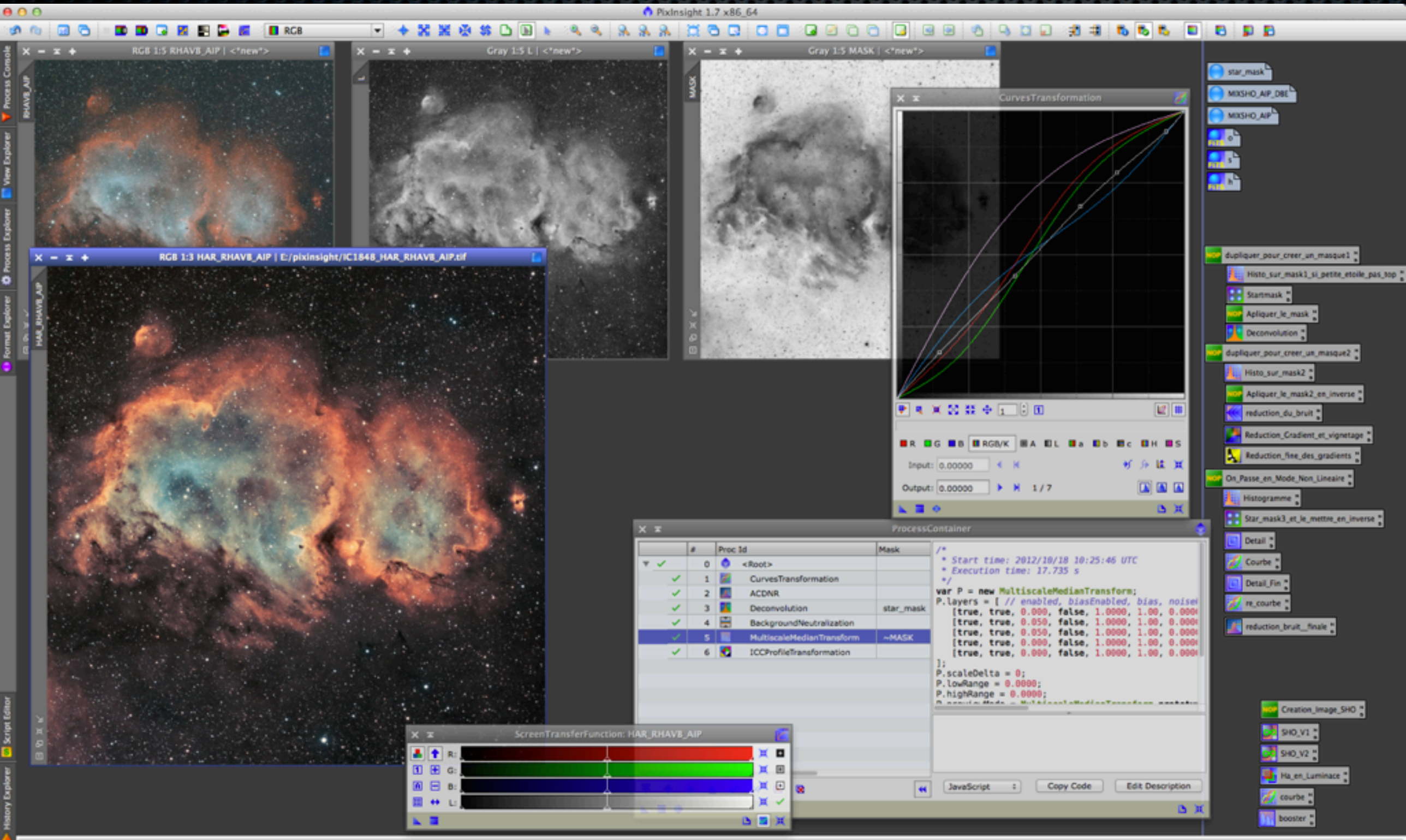
Applied to digital images, histograms are generated by remapping al
range of discrete values, for example 256 values in an 8-bit histogra
counter initialized to zero. Then for each pixel in the image, its value
corresponding counter is incremented by one unit. The result of this
is a list of integers representing the total number of existing pixels fo

A histogram provides a wealth of information about an image and ho
available numeric range. Histograms are powerful tools for statistical image analysis, and the basis for many essential

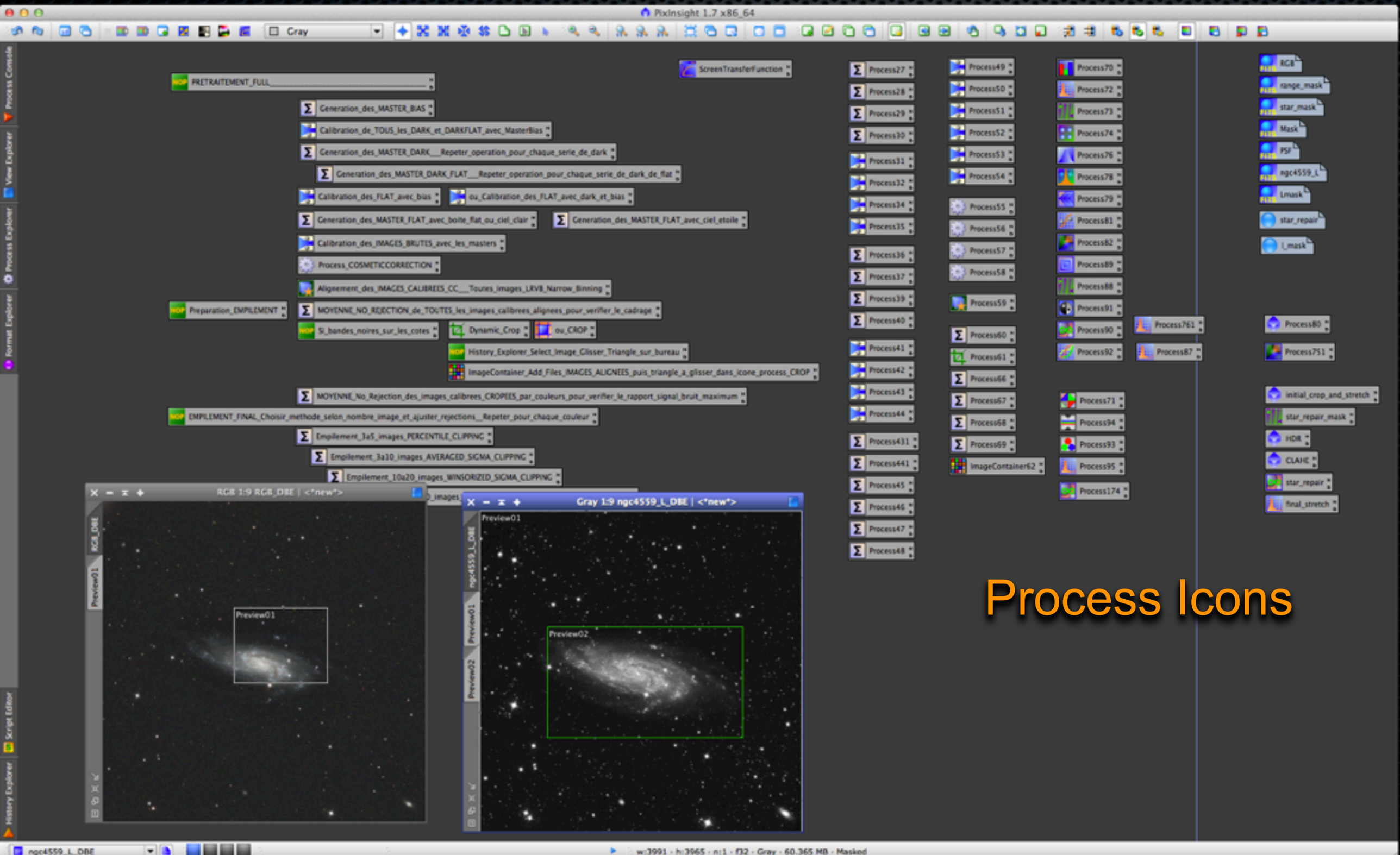
Edit Preferences | Property Browser | Documentation Browser

<No View Available>

L’interface...

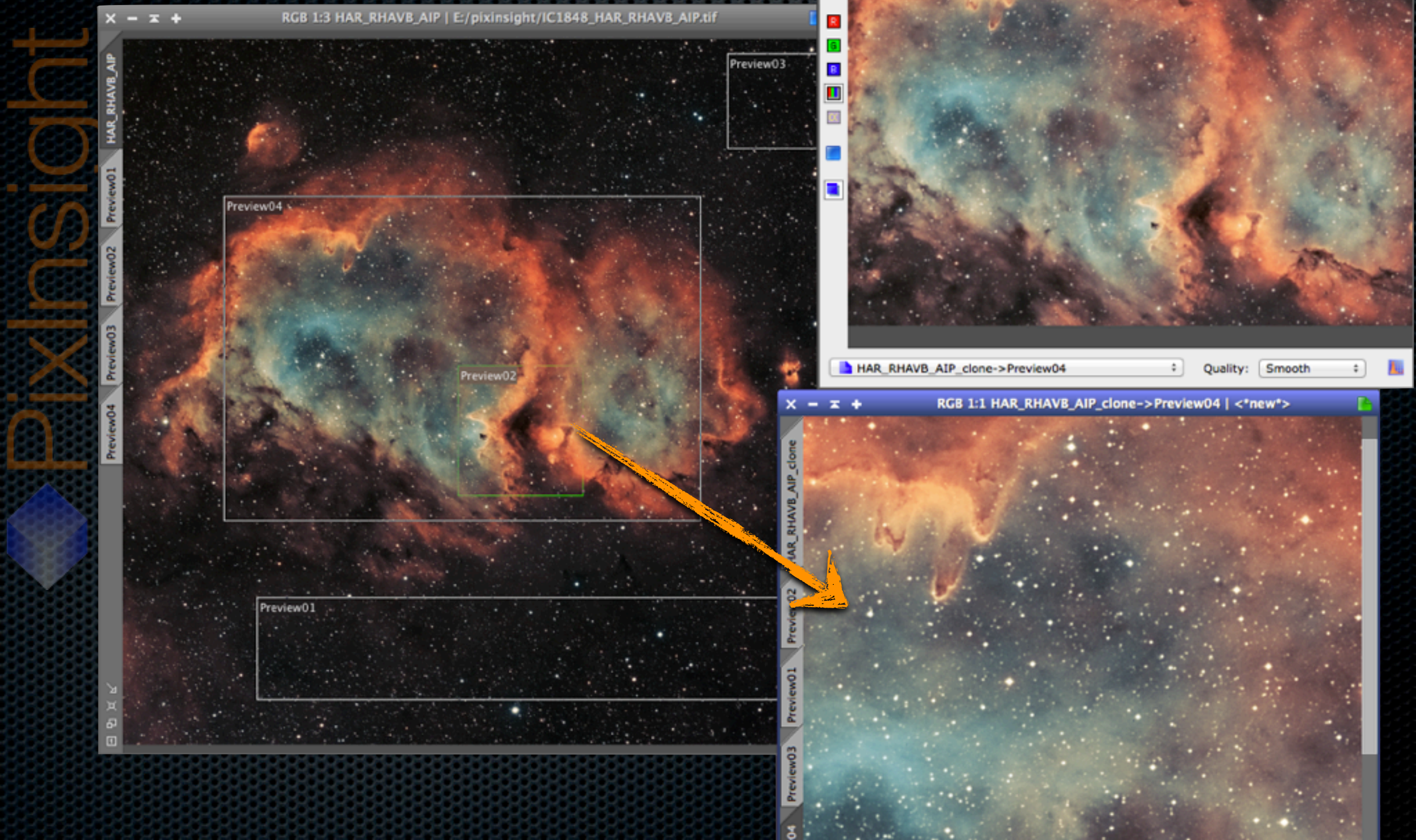

PixInsight 1.7 x86_64
RGB
RGB 1:5 RHAVB_AIP | <*new*>
Gray 1:5 L | <*new*>
Gray 1:5 MASK | <*new*>
RGB 1:3 HAR_RHAVB_AIP | E:/pixinsight/IC1848_HAR_RHAVB_AIP.tif
CurvesTransformation
R G B RGB/K A L a b c H S
Input: 0.00000
Output: 0.00000
1 / 7
star_mask
MIXSHO_AIP_DBE
MIXSHO_AIP
dupliquer_pour_creer_un_masque1
Histo_sur_mask1_si_petite_etoile_pas_top
Starmask
Apliquer_le_mask
Deconvolution
dupliquer_pour_creer_un_masque2
Histo_sur_mask2
Apliquer_le_mask2_en_inverse
reduction_du_bruit
Reduction_Gradient_et_vignetage
Reduction_fine_des_gradients
On_Passe_en_Mode_Non_Lineaire
Histogramme
Star_mask3_et_le_mettre_en_inverse
Detail
Courbe
Detail_Fin
re_courbe
reduction_bruit__finale
ProcessContainer
Proc Id Mask
0 <Root>
1 CurvesTransformation
2 ACDNR
3 Deconvolution star_mask
4 BackgroundNeutralization
5 MultiscaleMedianTransform ~MASK
6 ICCProfileTransformation
/*
* Start time: 2012/10/18 10:25:46 UTC
* Execution time: 17.735 s
*/
var P = new MultiscaleMedianTransform;
P.layers = [// enabled, biasEnabled, bias, noise
[true, true, 0.000, false, 1.0000, 1.00, 0.000
[true, true, 0.050, false, 1.0000, 1.00, 0.000
[true, true, 0.050, false, 1.0000, 1.00, 0.000
[true, true, 0.000, false, 1.0000, 1.00, 0.000
[true, true, 0.000, false, 1.0000, 1.00, 0.000
];
P.scaleDelta = 0;
P.lowRange = 0.0000;
P.highRange = 0.0000;
JavaScript
Copy Code
Edit Description
ScreenTransferFunction: HAR_RHAVB_AIP
R:
G:
B:
L:
Creation_Image_SHO
SHO_V1
SHO_V2
Ha_en_Luminace
courbe
booster
Process Console
View Explorer
Process Explorer
Format Explorer
Script Editor
History Explorer

L’interface...



Process Icons

Preview, Real-Time Preview



Insight

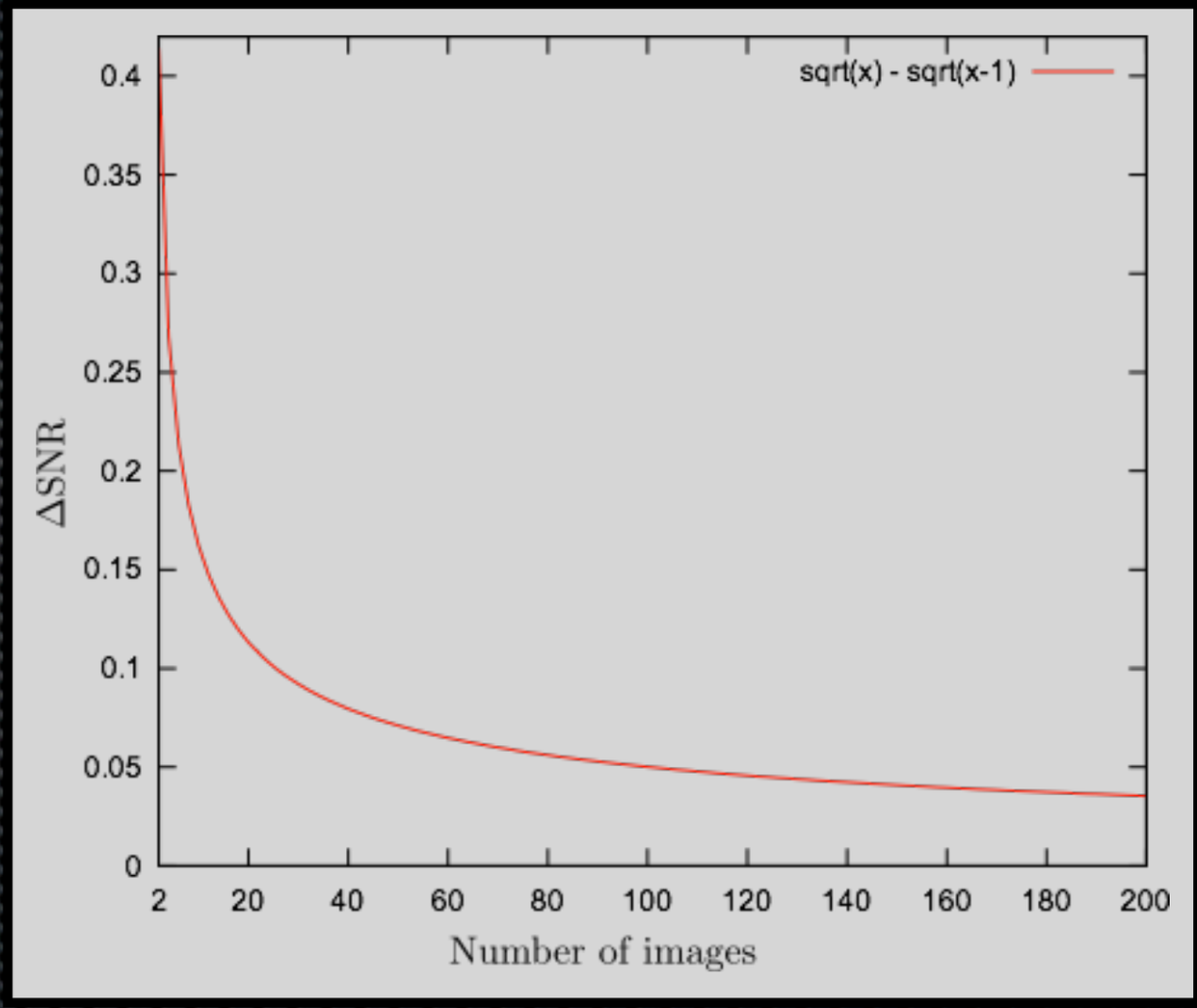
Pixl

Le prétraitement

Optimisation prétraitement
Combien d'images ?

Bias, dark, flat :

- ☐ 10 images ?
- ☐ 25 images ?
- ☐ 50 images ?
- ☐ 100 images ?
- ☐ 200 images ?



$$\Delta\mathrm{SNR}(N) = \sqrt{N} - \sqrt{N-1}$$

Process icons :
Création d'un Prétraitement CCD complet

- Suite d'icônes représentant des fonctions préprogrammées *(création perso)*
- Adapté aux images CCD monochromes L, R, V, B, Ha, OIII, SII, NII..., objets du ciel profond
- Adaptable facilement aux CCD couleurs ou APN (matrice de Bayer)
- Optimisation des paramètres à chaque étape par analyse des cartes de réjection
- Sauvegarde de chaque MASTER ou images en 32bits

PixInsight

Process icons : prétraitement «full»

MasterBIAS optimisé(s)

Calibration des DARK

MasterDARK optimisé(s)

Calibration des FLATS

MasterFLAT optimisé(s)

Calibration des IMAGES avec les MASTERS

Elimination des défauts cosmétiques résiduels

Alignement de toutes les IMAGES

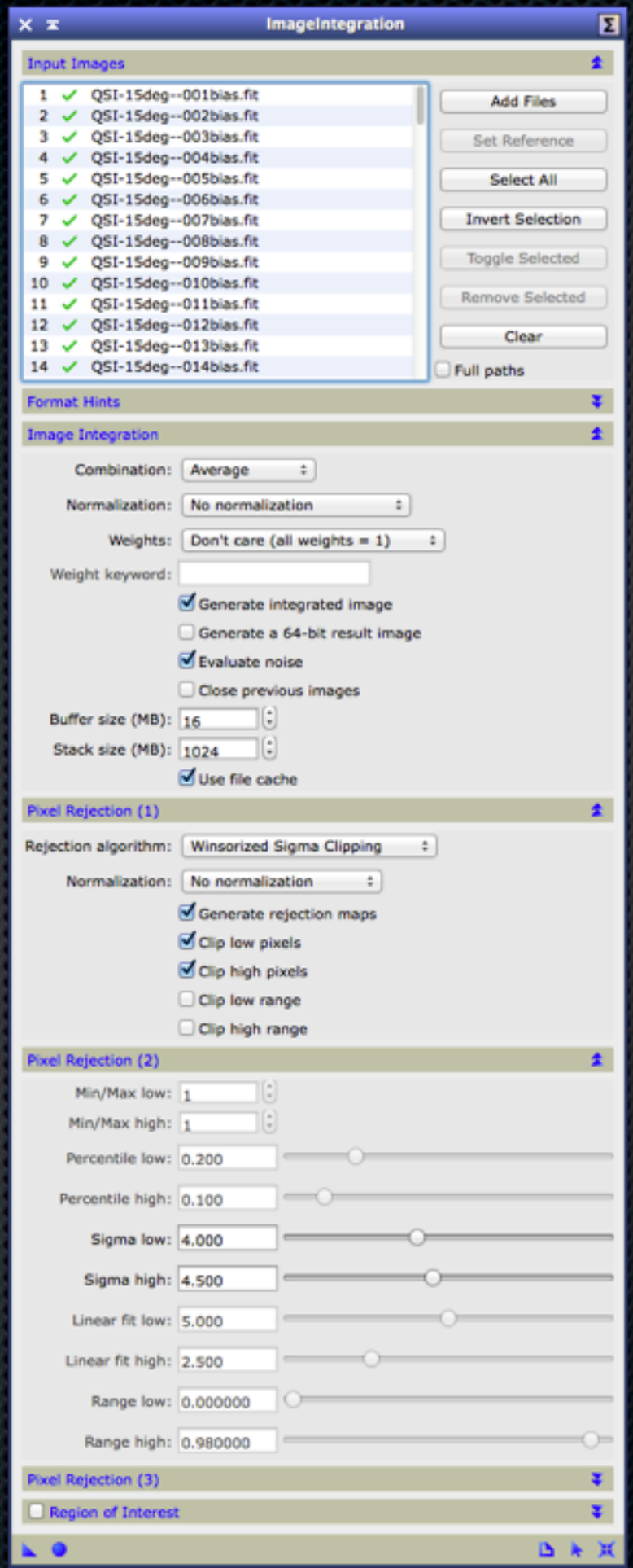
Retrait des bandes noires pour optimisation du calcul du S/B

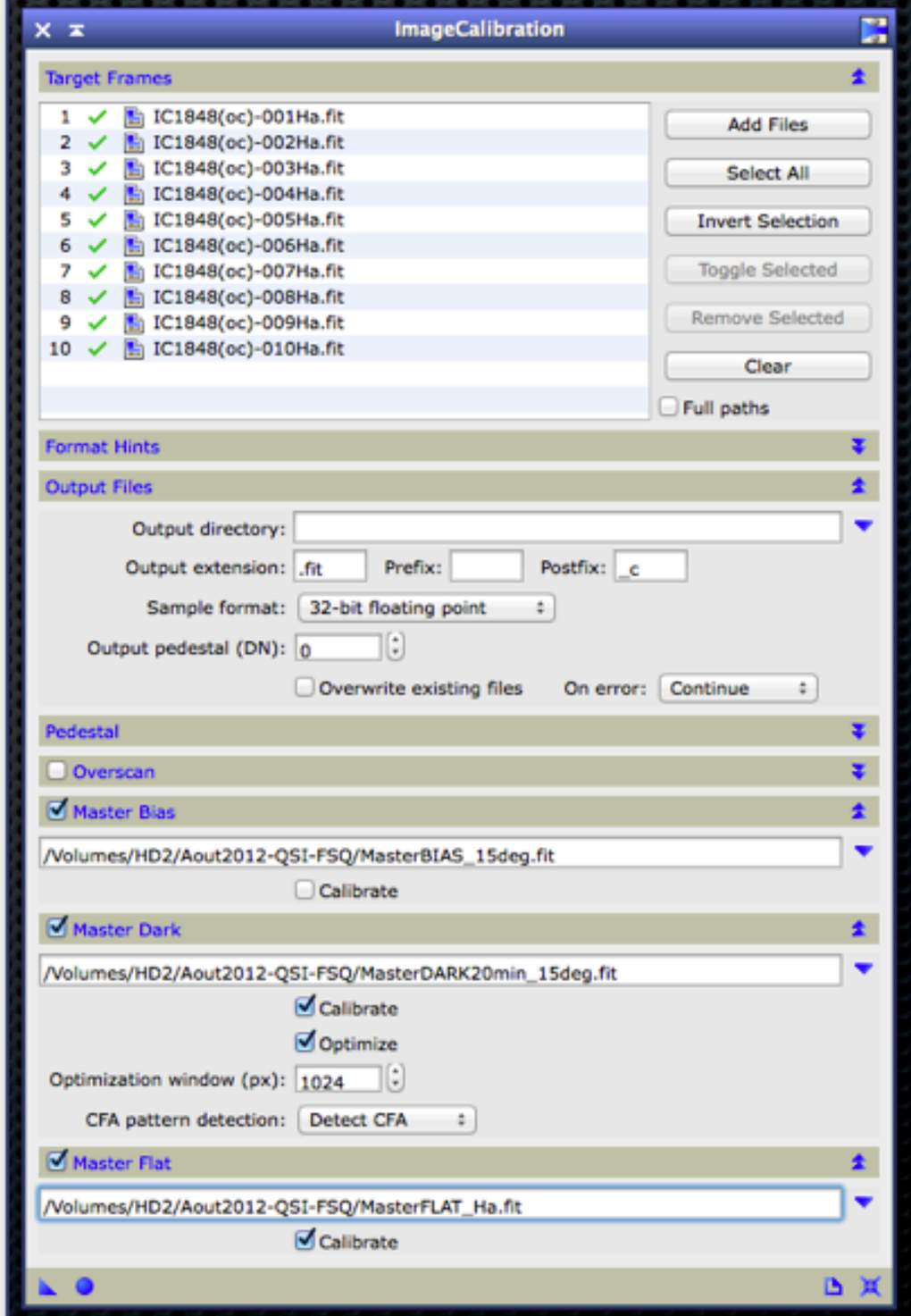
calcul du S/B max

Empilement(s) optimisé(s) des différentes images ou couches couleur

intégration, calibration

PixInsight





cosmetique, alignement...

PixInsight

CosmeticCorrection

Target Frames

1 NGC6888-001Ha_c.fit
2 68cyg-001Ha_c.fit
3 68cyg-002Ha_c.fit
4 68cyg-003Ha_c.fit
5 68cyg-004Ha_c.fit
6 68cyg-005Ha_c.fit
7 68cyg-006Ha_c.fit
8 68cyg-007Ha_c.fit
9 68cyg-008Ha_c.fit
10 68cyg-009Ha_c.fit
11 68cyg-010Ha_c.fit

Add Files | Select All | Invert Selection | Toggle Selected | Remove Selected | Clear | Full paths

Output

CFA | Overwrite | Prefix: | Postfix: _cc

Amount: 1.00

Use Master Dark

Master Dark

umes/HD2/Aout2012-QSI-FSQ/MasterDARK20min_15deg.fit

Hot Pixels Threshold

Enable

Level: 0.1233997121

Sigma: 34.3740

Qty: 385

Real: Qty: 385, Level: 0.1233997121, Sigma: 34.373997

Cold Pixels Threshold

Enable

Level: 0.0000152590

Sigma: 0.02260

Qty: 38

Real: Qty: 9293, Level: 0.0000152590, Sigma: 0.022597

Use Auto detect

Hot Sigma: 3.0

Cold Sigma: 3.0

Use Defect List

Real Time Preview

	Hot	Cold
Dark	0	0
Auto	0	0

Show map | Snapshot

StarAlignment

Reference image: 68_Cyg_002Ha_c_cc | View

Working mode: Register/Match Images

Generate masks

Frame adaptation

Target Images

1 68cyg-001Ha_c_cc.fit
2 68cyg-002Ha_c_cc.fit
3 68cyg-003Ha_c_cc.fit
4 68cyg-004Ha_c_cc.fit
5 68cyg-005Ha_c_cc.fit
6 68cyg-006Ha_c_cc.fit
7 68cyg-007Ha_c_cc.fit
8 68cyg-008Ha_c_cc.fit
9 68cyg-009Ha_c_cc.fit
10 68cyg-010Ha_c_cc.fit
11 68cyg-011Ha_c_cc.fit
12 68cyg-012Ha_c_cc.fit
13 68 Cyg-001Ha_c_cc.fit
14 68 Cyg-002Ha_c_cc.fit

Add Files | Add Views | Select All | Invert Selection | Toggle Selected | Remove Selected | Clear | Full paths

Format Hints

Output Images

Star Detection

Detection scales: 4
Noise scales: 1
Hot pixel removal: 1
Log(sensitivity): -1.00
Peak response: 0.80
Maximum distortion: 0.500
Inverted image

Star Matching

RANSAC tolerance: 2.00
RANSAC iterations: 2000
Maximize inliers: 1.00
Maximize overlapping: 1.00
Maximize regularity: 1.00
Minimize RMS error: 1.00
Maximum stars: <Auto>
Triangles per star: 40
Compute intersections: Mosaic modes only
Restrict to previews
Use brightness relations
Use scale differences
Scale tolerance: 0.010

Interpolation

Registration model: Projective Transformation
Pixel interpolation: Auto
Clamping threshold: 0.30

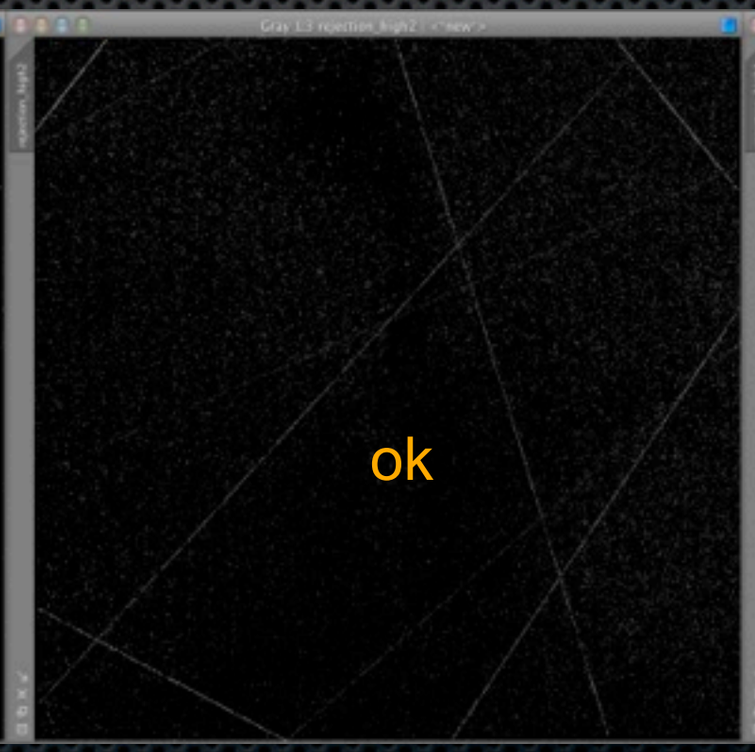
Optimisation de l'intégration : réjection

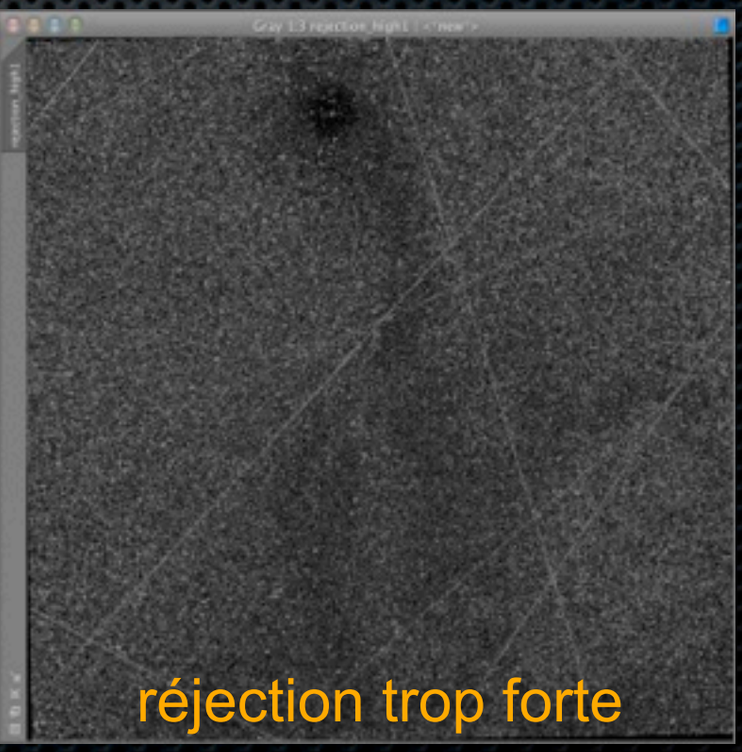
Moyenne simple

```
Integration of 11 images:
Pixel combination ..... average
Output normalization ..... additive
Pixel rejection ..... none
Integrating pixel rows:    0 ->  2047: 100%

MRS noise evaluation: done.

Gaussian noise estimates:
σ₀ = 5.728e-05

Reference SNR increments:
Δσ₀ = 4.6897

Average SNR increments:
Δσ₀ = 3.3180

5.574 s
```

moyenne avec réjection

```
Total :   345387   0.749% (     45 +   345342 =   0.000% +   0.749%)

MRS noise evaluation: done.

Gaussian noise estimates:
σ₀ = 5.813e-05

Reference SNR increments:
Δσ₀ = 4.6185

Average SNR increments:
Δσ₀ = 3.2676
```





Process icons : prétraitement «simplifié»

Process icons : prétraitement «minimum»

BATCH

Batch Preprocessing Script v1.22

Bias | Darks | Flats | Lights

- Binning 1
  - 900.00s
    - Dark-900s-20deg-01…
    - Dark-900s-20deg-02…
    - Dark-900s-20deg-03…
    - Dark-900s-20deg-04…
    - Dark-900s-20deg-05…
    - Dark-900s-20deg-06…
    - Dark-900s-20deg-07…
    - Dark-900s-20deg-08…
    - Dark-900s-20deg-09…
- Binning 2
  - 300.00s
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…
    - Dark2x2-300s-20deg…

Clear | Remove Selected | Invert Selection

Exposure tolerance: 10

Image Integration

Combination: Average

Rejection algorithm: Winsorized Sigma Clipping

Min/Max low: 1

Min/Max high: 1

Percentile low: 0.20

Percentile high: 0.10

Sigma low: 4.00

Sigma high: 3.50

Linear fit low: 5.00

Linear fit high: 3.50

A script for calibration and alignment of light frames
Copyright (c) 2012 Kai Wiechen.
Copyright (c) 2012 Pleiades Astrophoto.

Options

- [ ] CFA images
- [x] Up-bottom FITS
- [x] Optimize dark frames
- [ ] Use master bias
- [x] Generate rejection maps
- [ ] Use master dark
- [x] Export calibration files
- [ ] Use master flat

Registration Reference Image

Output Directory

Add Files | Add Bias | Add Darks | Add Flats | Add Lights | Add Custom | Reset | Diagnostics | Run | Exit

Batch Preprocessing Script v1.22

Bias | Darks | Flats | Lights

- Binning 1
  - Luminance
    - 900.00s
      - Trio-L-02.fit
      - Trio-L-03.fit
      - Trio-L-04.fit
      - Trio-L-05.fit
      - Trio-L-06.fit
      - Trio-L-07.fit
      - Trio-L-08.fit
      - Trio-L-11.fit
      - Trio-L-12.fit
- Binning 2
  - Bleu
    - 300.00s
      - Trio-B-01.fit
      - Trio-B-02.fit
      - Trio-B-03.fit
      - Trio-B-04.fit
      - Trio-B-05.fit
- Binning 2
  - Rouge

Calibrate only

Cosmetic Correction

Apply

Template icon: <none>

DeBayer

Bayer/mosaic pattern: RGGB

DeBayer method: VNG

Image Registration

Pixel interpolation: Auto

Clamping threshold: 0.30

Image Integration

Apply

Integration parameters...

Options

- [ ] CFA images
- [x] Up-bottom FITS
- [x] Optimize dark frames
- [ ] Use master bias
- [x] Generate rejection maps
- [ ] Use master dark
- [x] Export calibration files
- [ ] Use master flat

Registration Reference Image

E:/pixinsight/TRIO/IMAGES/Trio-L-05.fit

Output Directory

E:/pixinsight

Add Files | Add Bias | Add Darks | Add Flats | Add Lights | Add Custom | Reset | Diagnostics | Run | Exit

Pixinsight

Le traitement

Traitement

Avant tout traitement, il faut s'assurer que l'on a utilisé toutes les techniques possibles afin d'optimiser l'image brute d'empilement :

- Utilisation de toutes les techniques permettant d'augmenter le rapport signal sur bruit lors de l'acquisition
- Calibration précise des images brutes
- Intégration optimale des images

Traitement

Le traitement est avant tout une perception personnelle (artistique ou mathématique) de l'image finale tout en essayant de préserver les structures qui la composent.
Il faut avoir à l'esprit que :

- Le traitement n'est pas une chose triviale (cela demande des essais et donc du temps)
- Chaque image est unique : pas de formules universelles (ou de «workflow»)
- Et... une bonne dose de subjectivité

Traitement

PIXINSIGHT offre une panoplie de fonctions pour traiter toute sorte d'images. Beaucoup de fonctions sont inédites et uniques au logiciel. Il ne faut pas hésiter à les utiliser pour optimiser chaque étape du traitement
Citons par exemple :

- Pas moins de 6 fonctions de réduction de bruit.
- Outil mathématique très puissant (PIXELMATH)
- Gestion des masques très précise. Bon nombre de traitements plus ou moins complexes nécessitent un masque optimisé

Insight

Pixl

Images linéaires
Images non-linéaires
Screen Transfer Function

Image linéaire

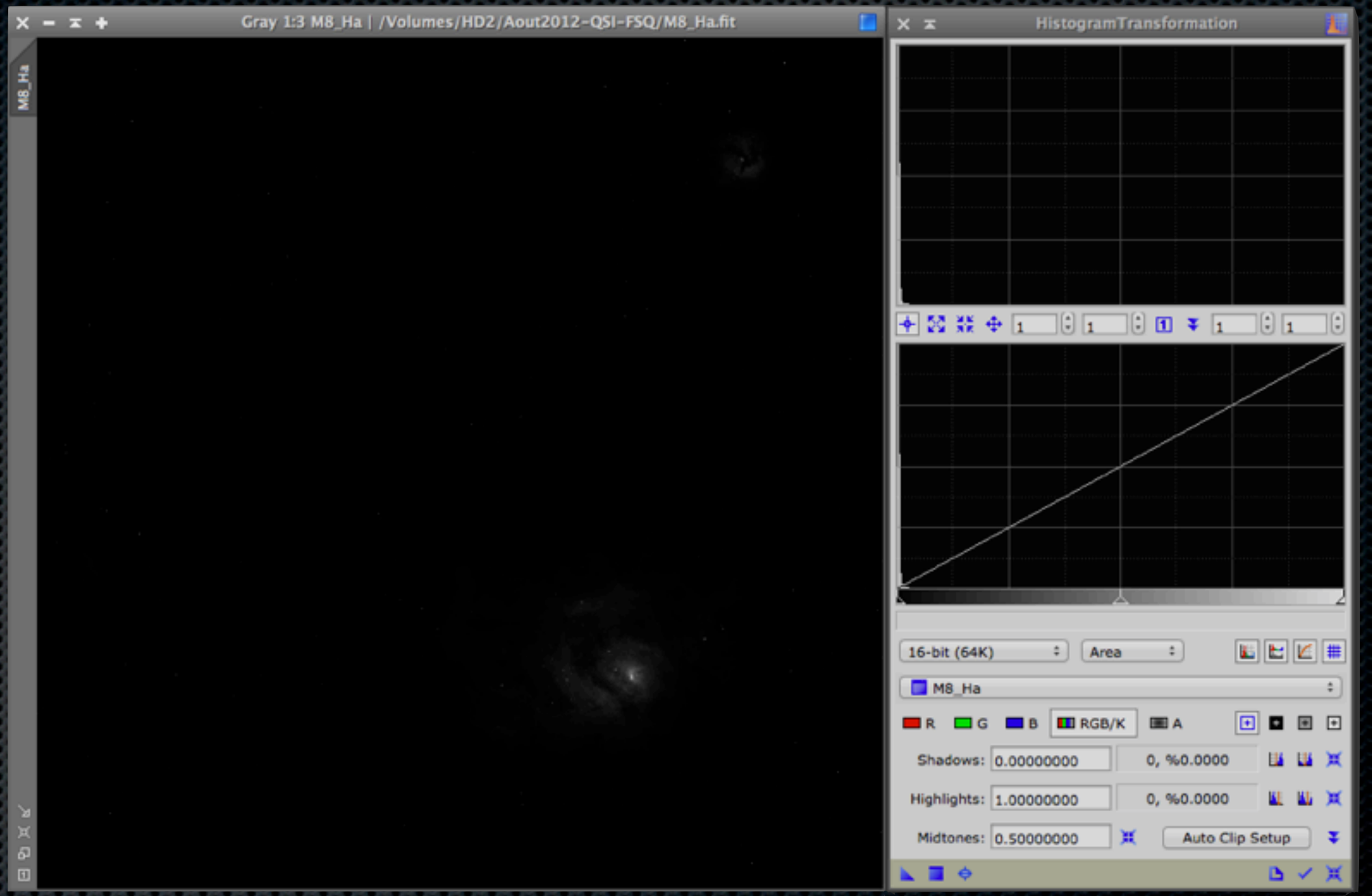
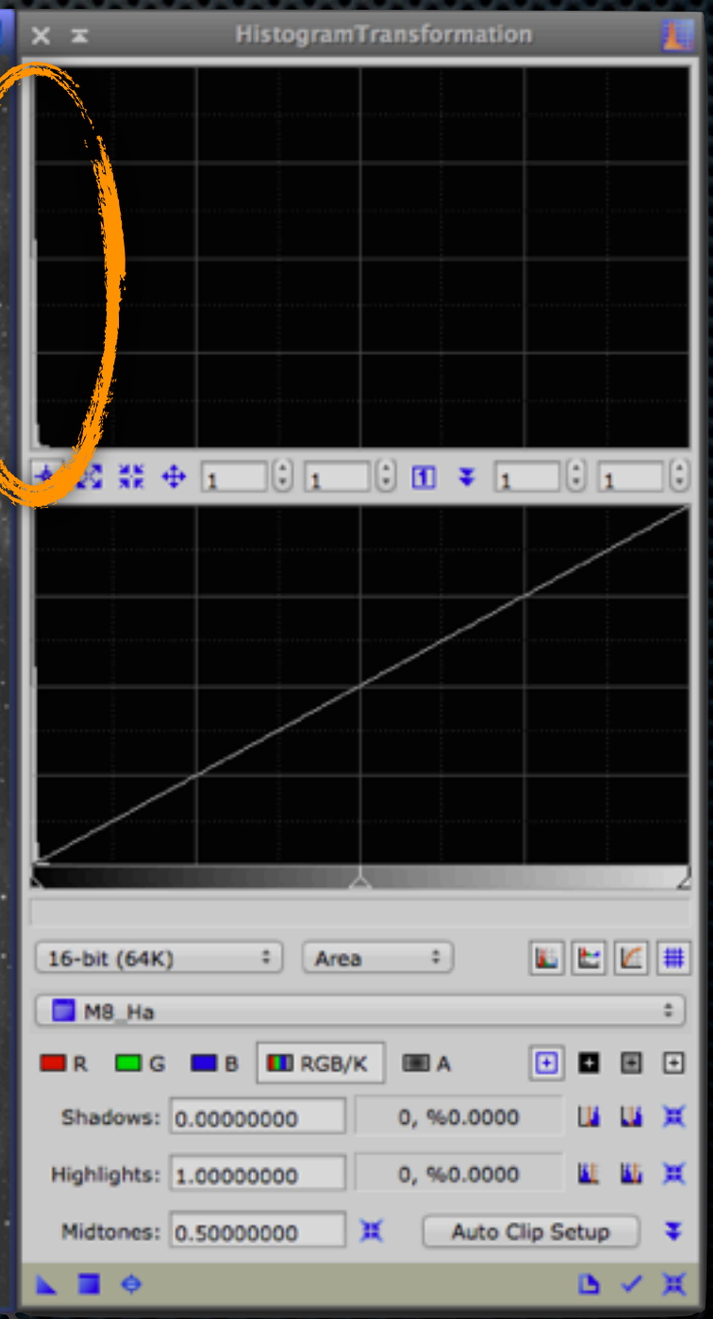


Image linéaire : STF



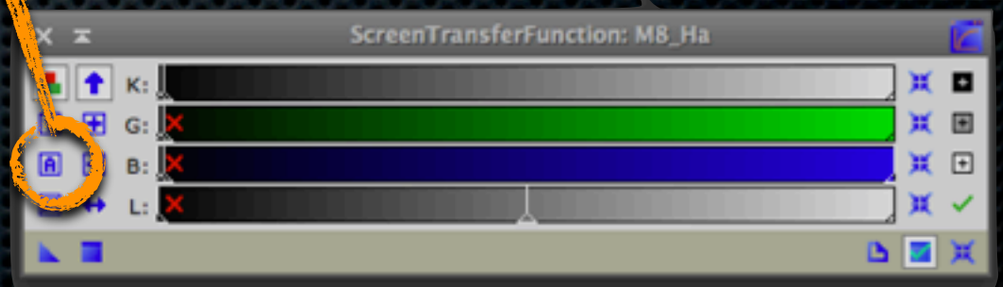


Image linéaire --> non linéaire

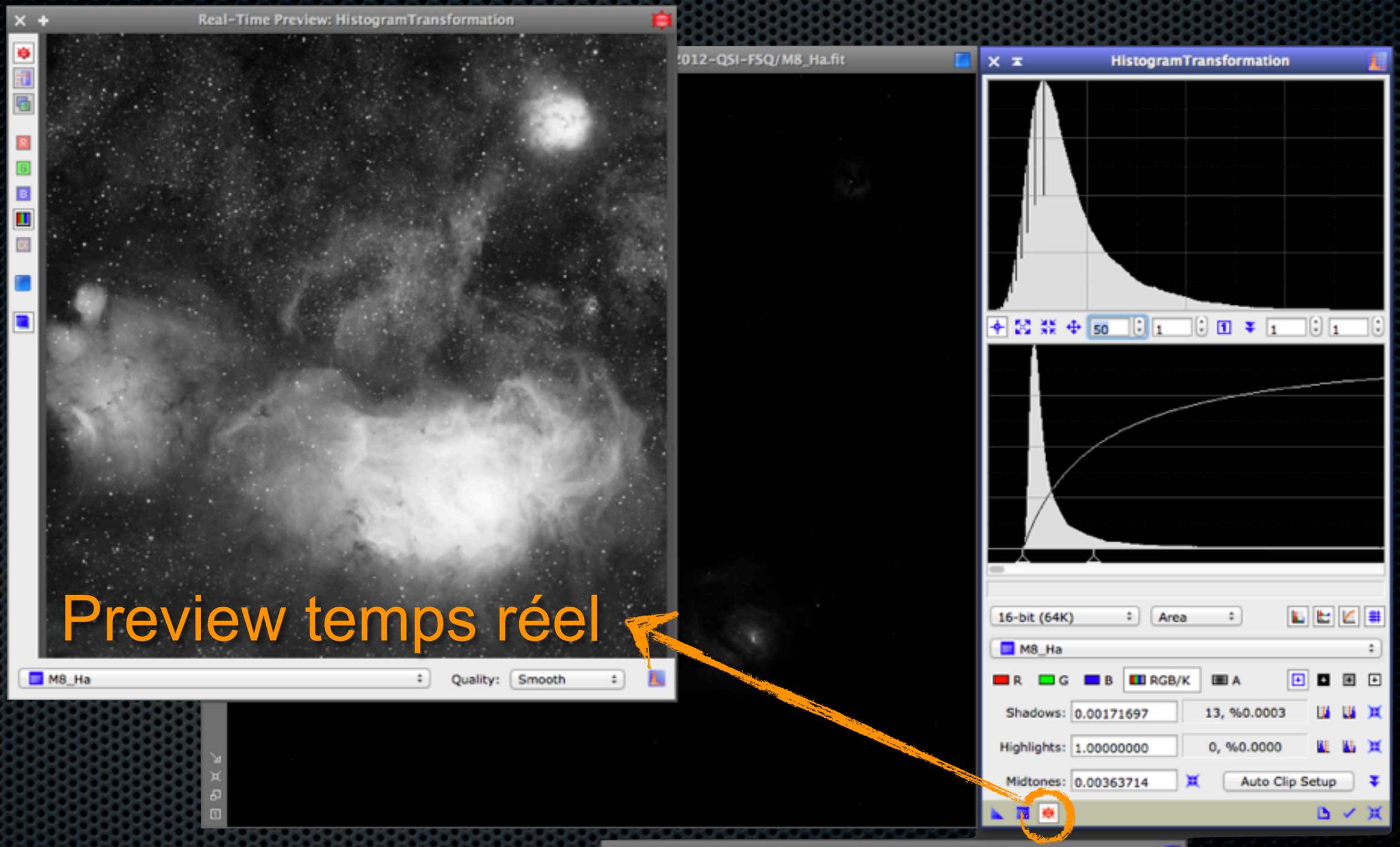
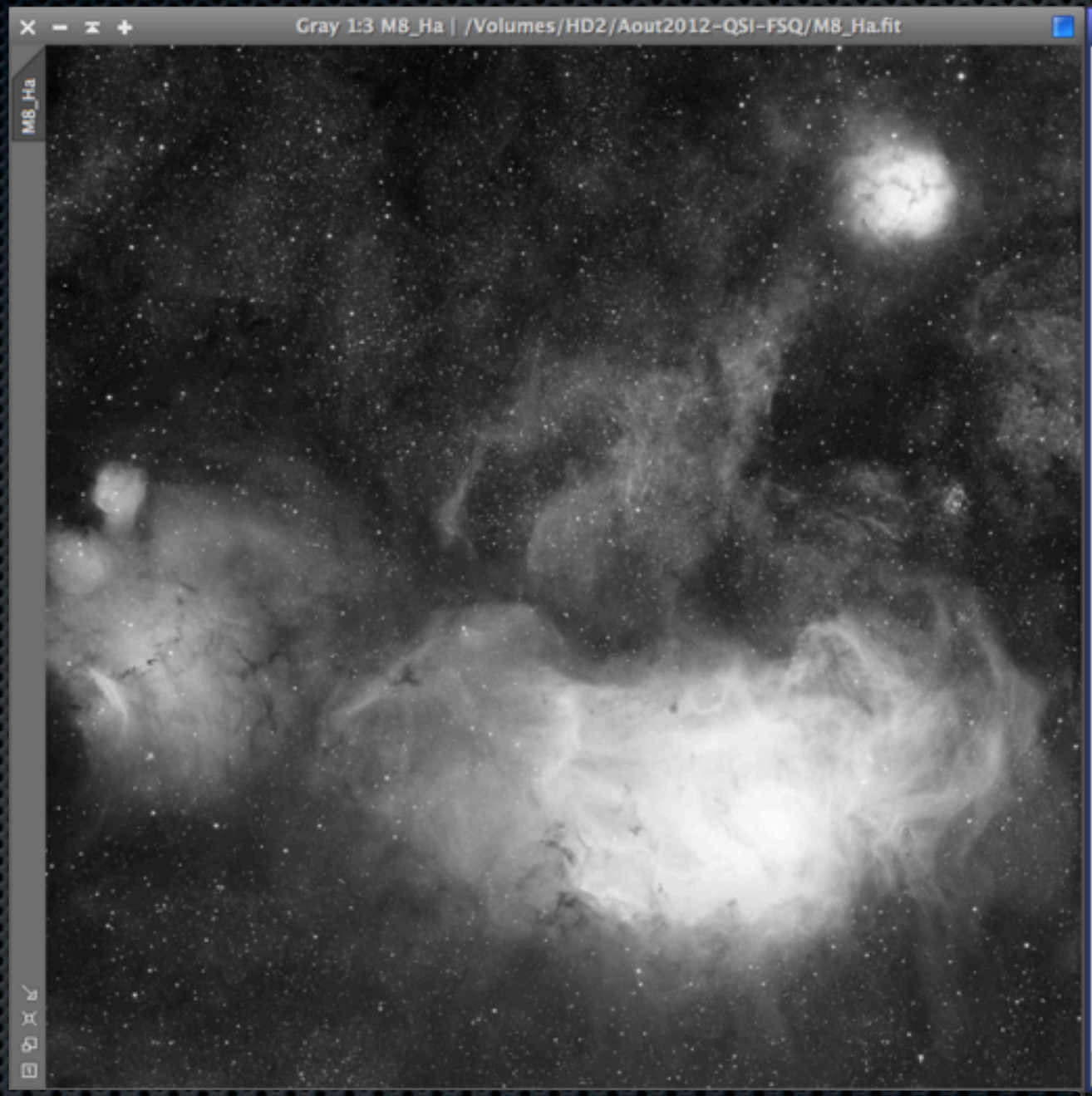
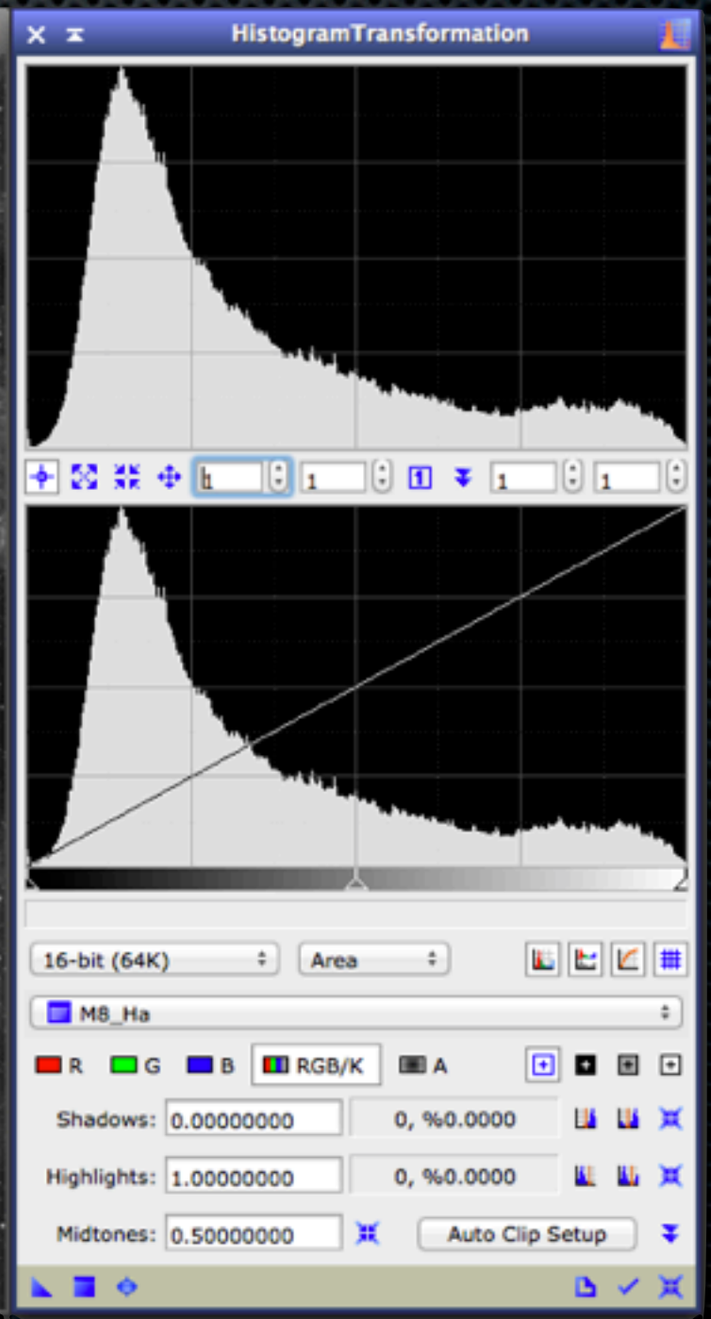
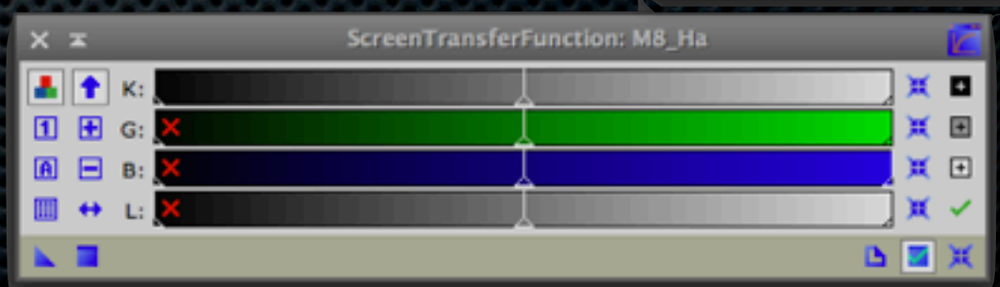


Image non linéaire







Des exemples de processus de traitement

Traitement : image monochrome

image linéaire

RGBWorkingSpace

ScreenTransferFunction

Masque de protection des hautes lumières

ATrousWevletTransform

Réduction du bruit

DynamicBackgroungExtraction

Retrait des gradients

AutomaticBackgroundExtractor

image non linéaire

HistogramTransformation

Compression de la dynamique

HDRMultiscaleTransform

un peu de magie !

CurvesTransformation

Rehaussement des niveaux

ACDNR

2nde réduction du bruit (éventuellement)

ICCProfileTransformation

Profil de couleurs (sRGB ou AdobeRGB ou GREY)

IntegerResample

Réduction format (éventuellement)

Traitement : image monochrome

PixInsight

image
linéaire

RGBWorkingSpace
ScreenTransferFunction
DynamicPSF
StarMask
Deconvolution
ATrousWevletTransform
DynamicBackgroungExtraction
AutomaticBackgroundExtractor
HistogramTransformation

Déconvolution

image
non linéaire

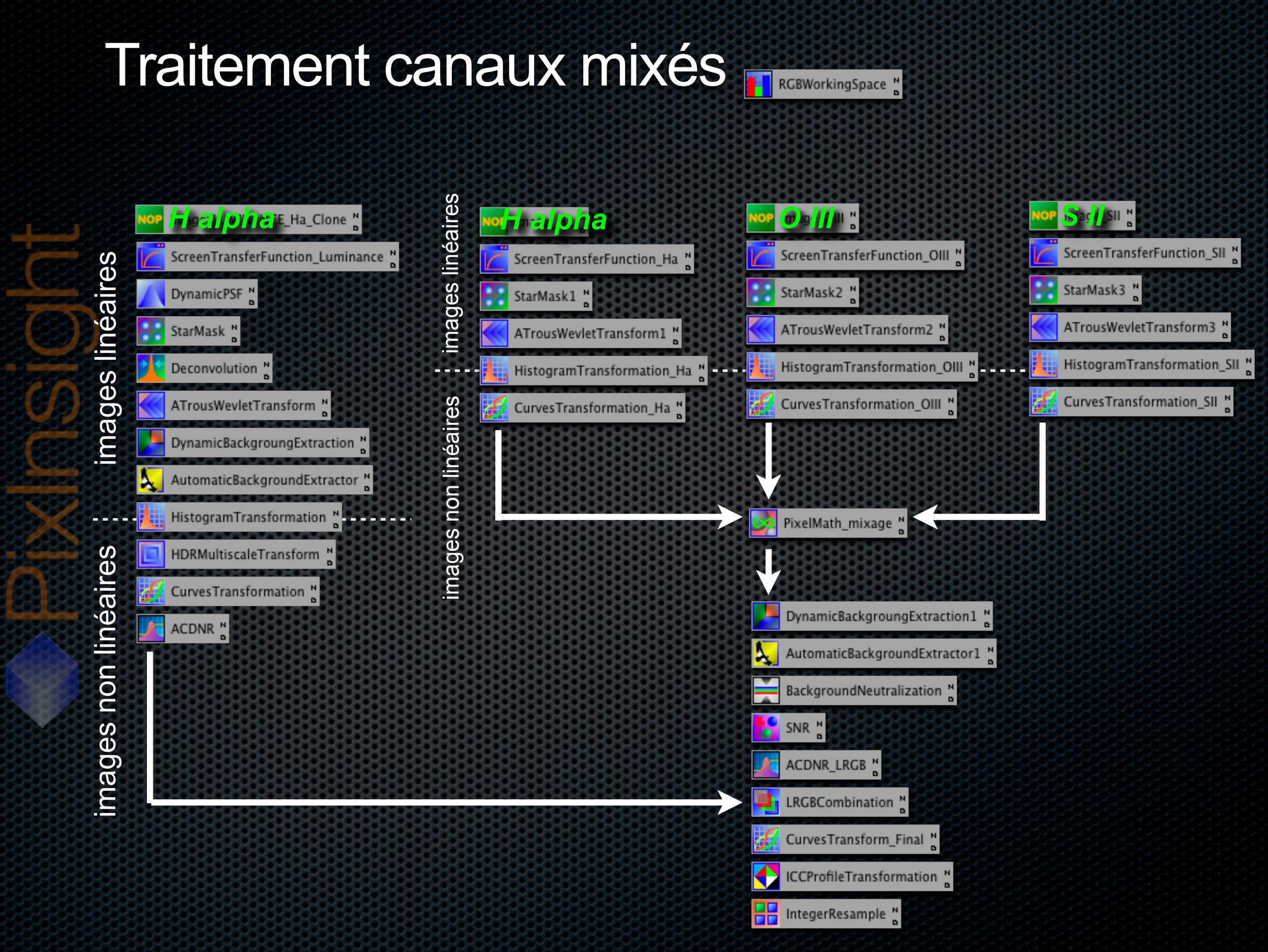
HDRMultiscaleTransform
CurvesTransformation
ACDNR
ICCProfileTransformation
IntegerResample

Traitement LRVB

images
linéaires

images
non linéaires

Traitement canaux mixés

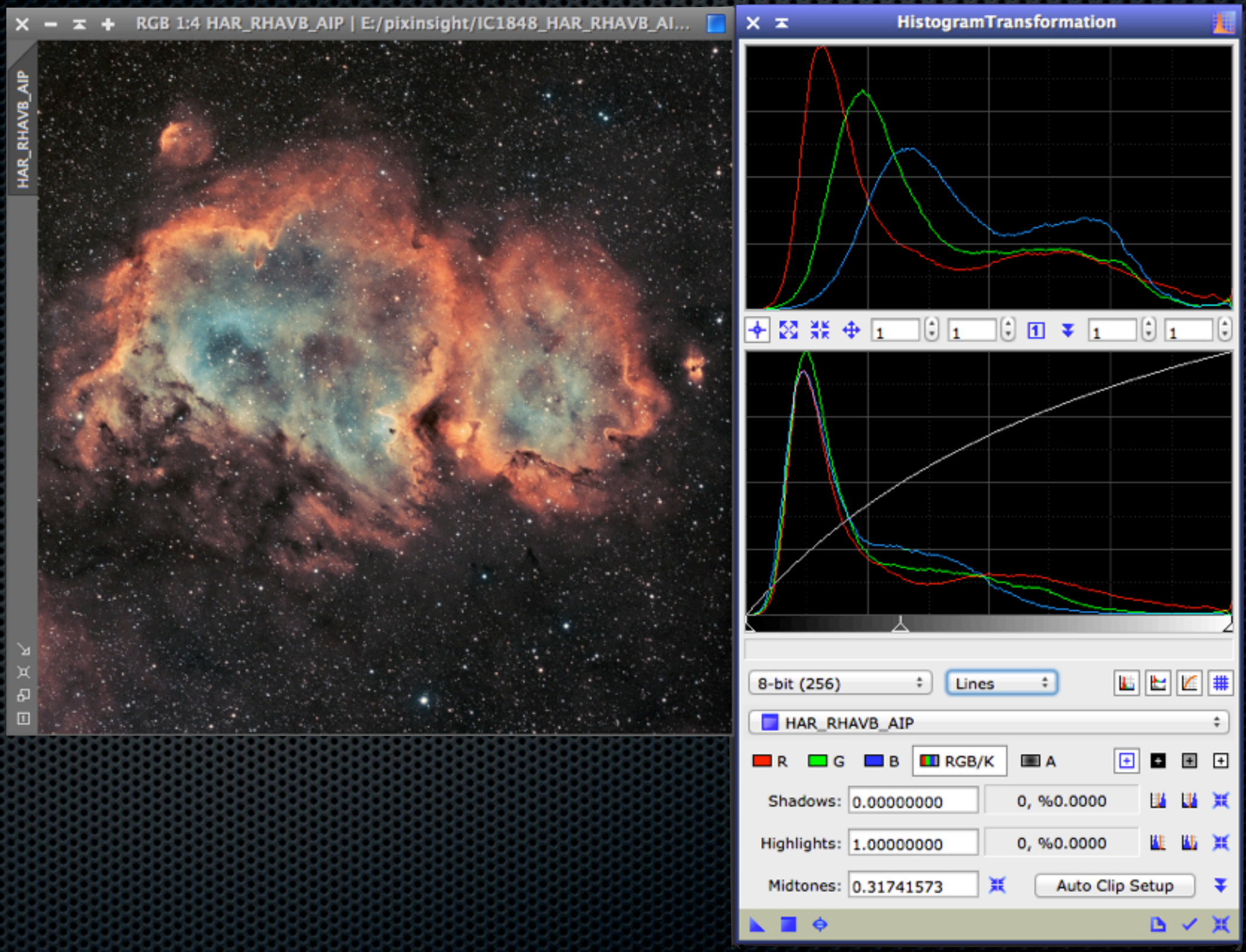


Pixinsight

Des fonctions clés !

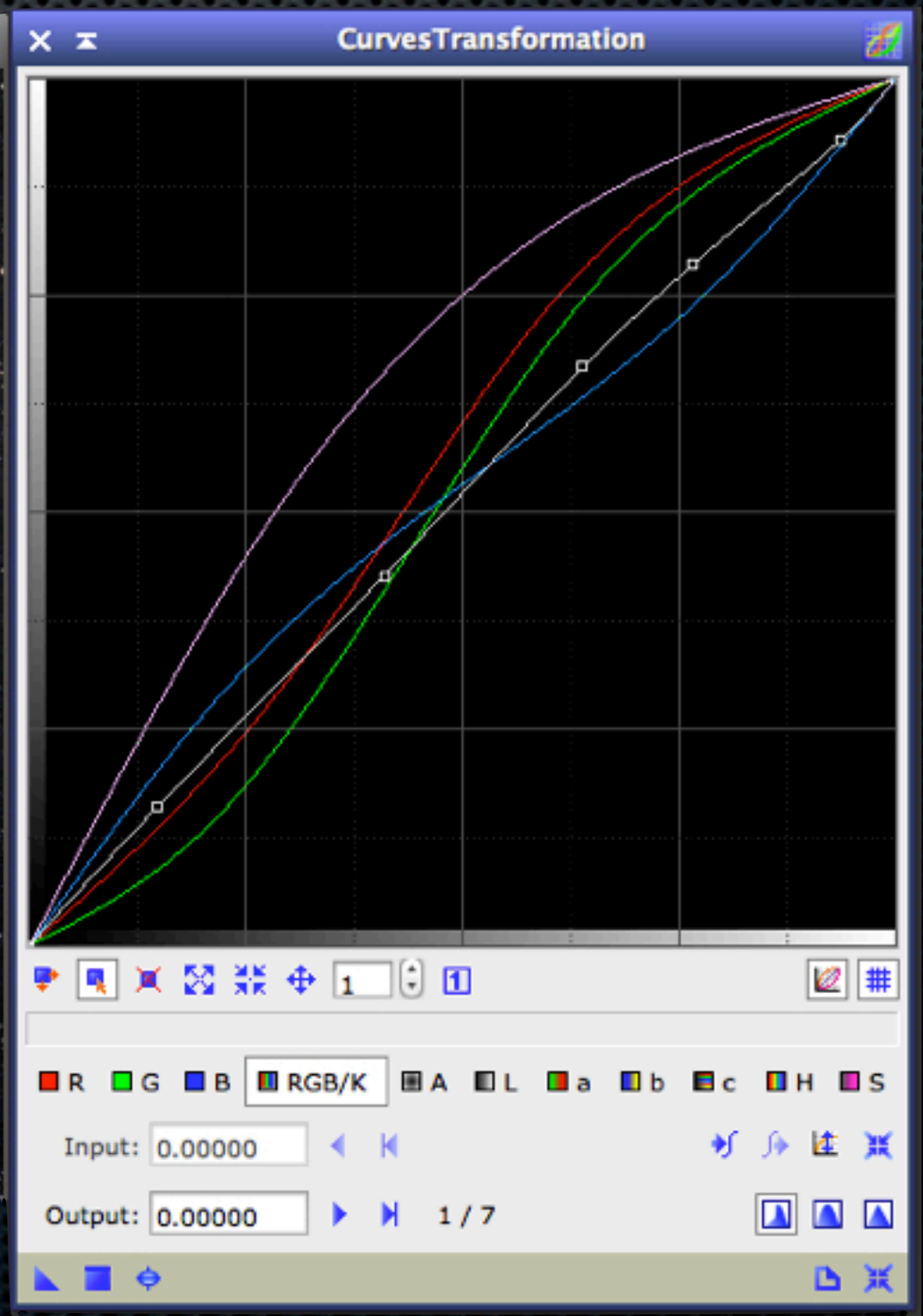
HistogramTransformation

PixInsight



CurvesTransformation

PixInsight



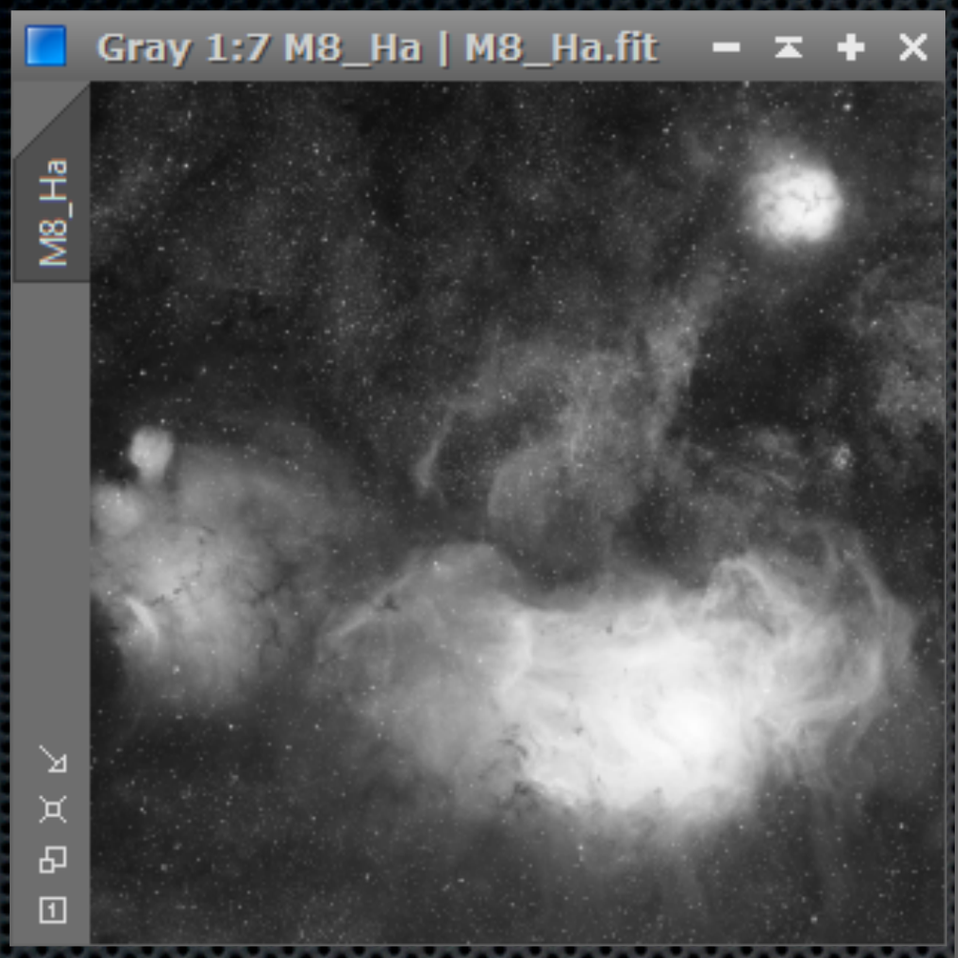
Les masques

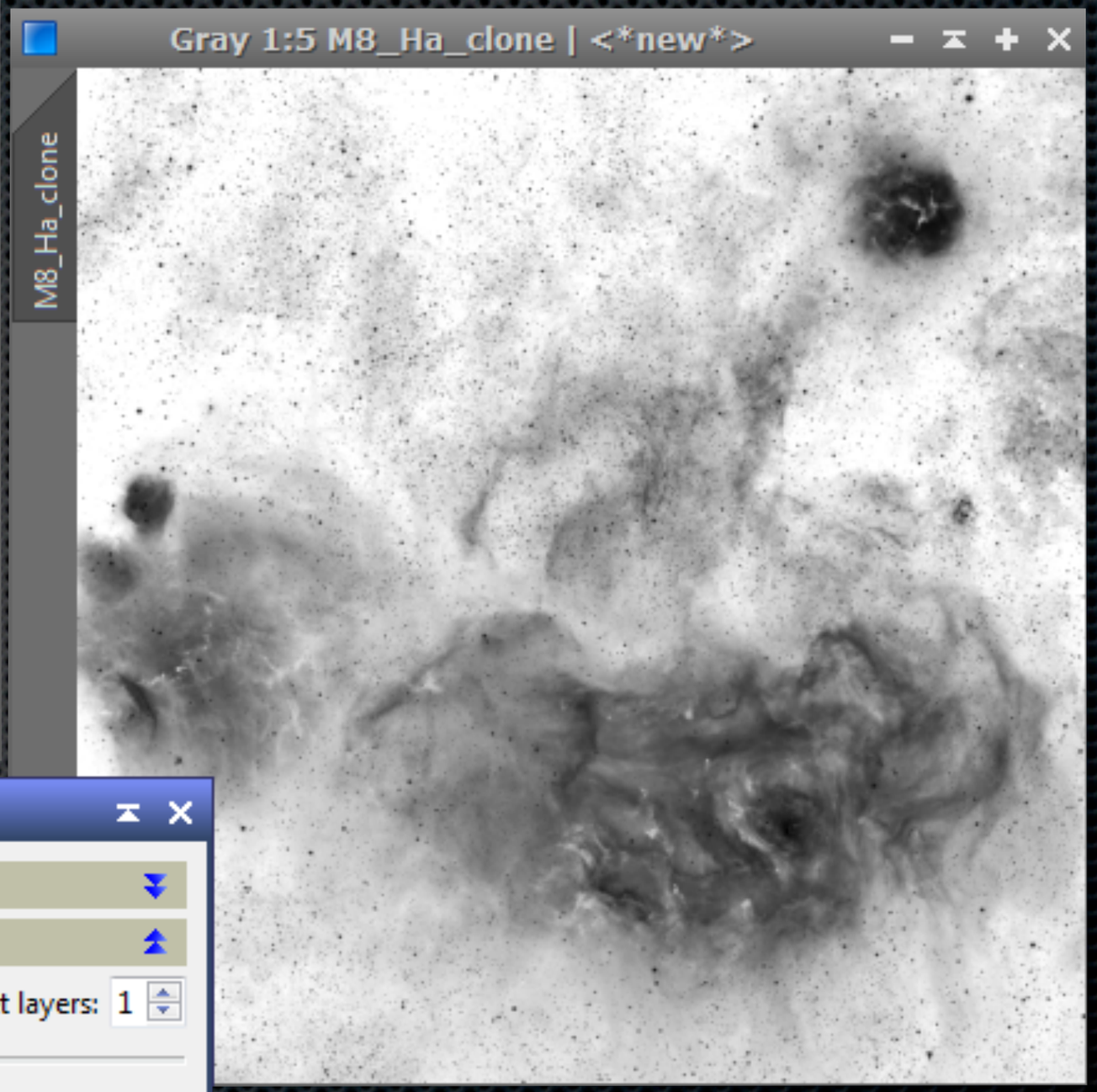
Indispensables à une majorité de fonctions

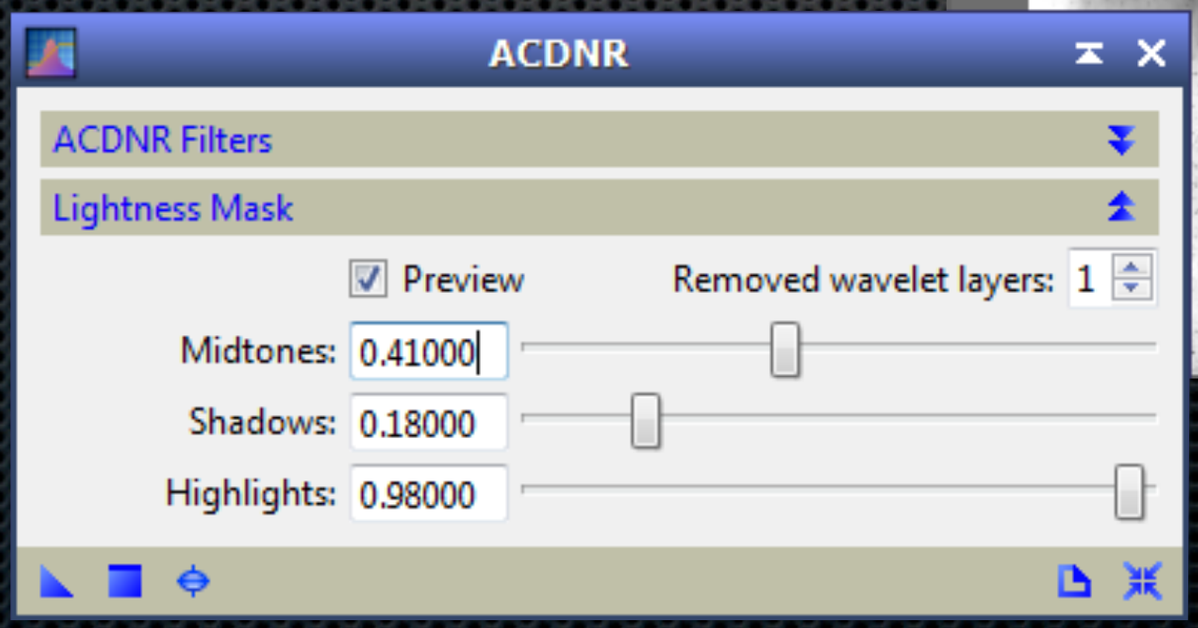
Les processus de traitement utilisent des masques d'intensité pour limiter leur effets sur certaines zones de l'image. Leur choix et leur utilisation est primordiale dans la réussite d'un traitement spécifique

Plusieurs fonctions permettent de créer facilement ces masques.

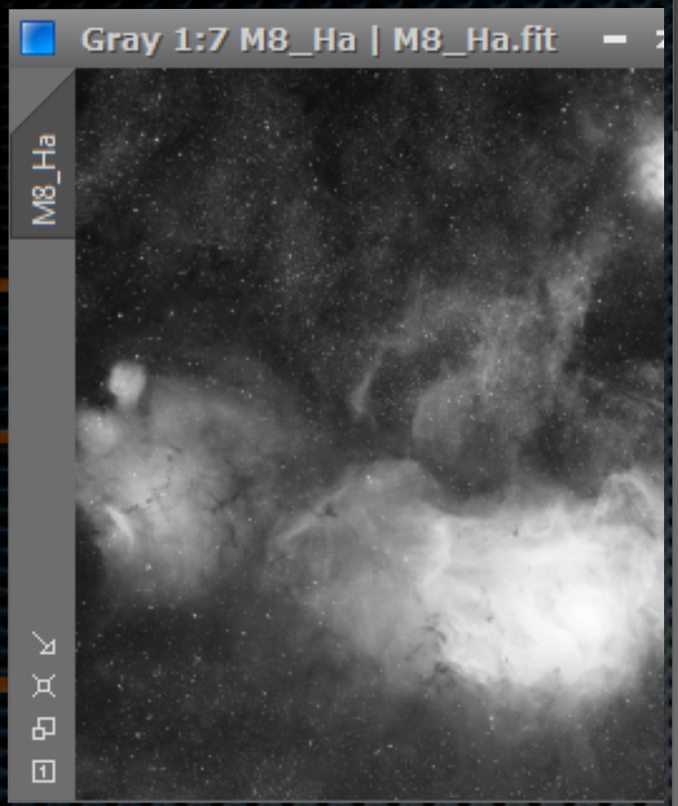
Les masques

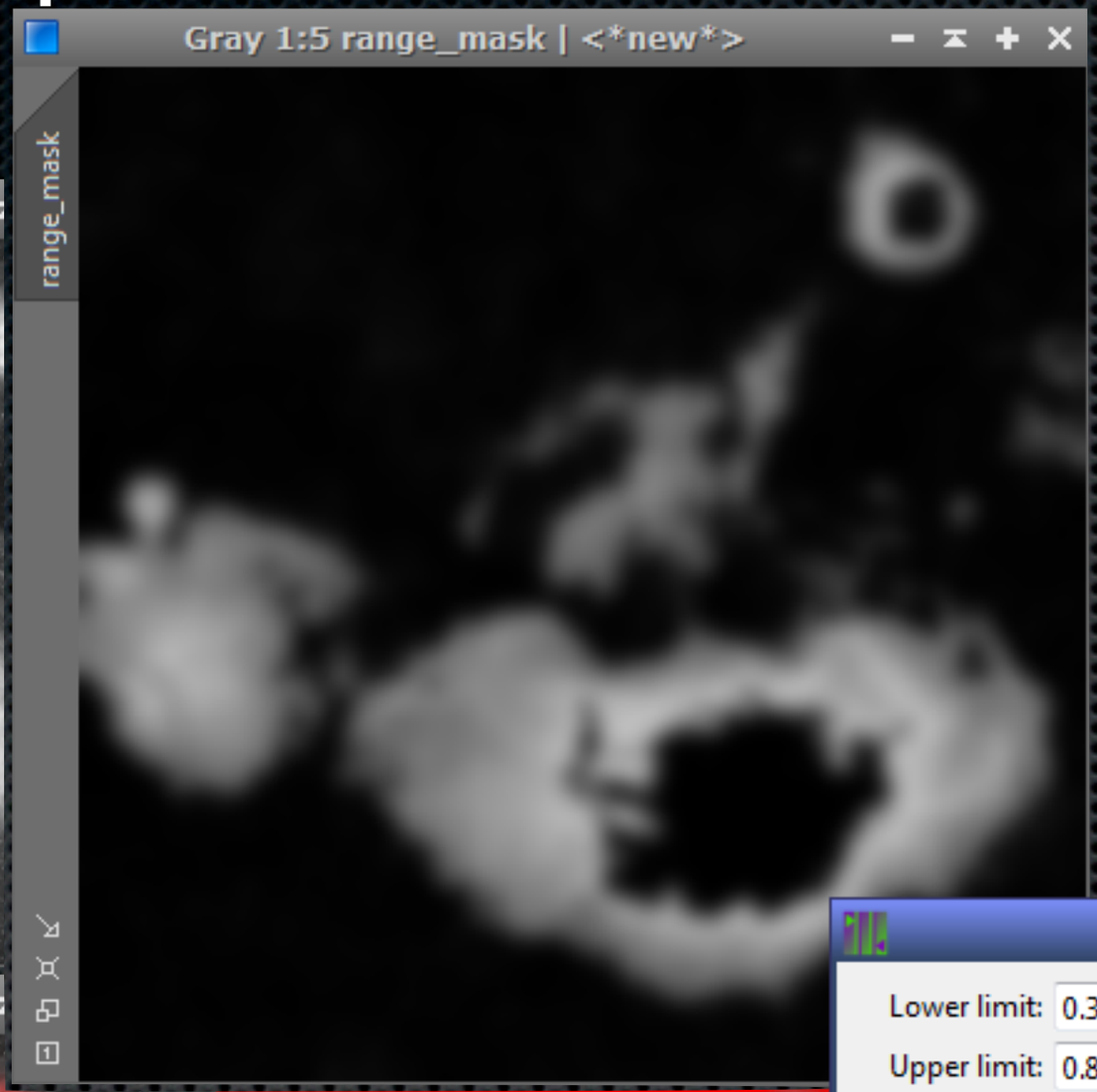

Gray 1:7 M8_Ha | M8_Ha.fit
M8_Ha

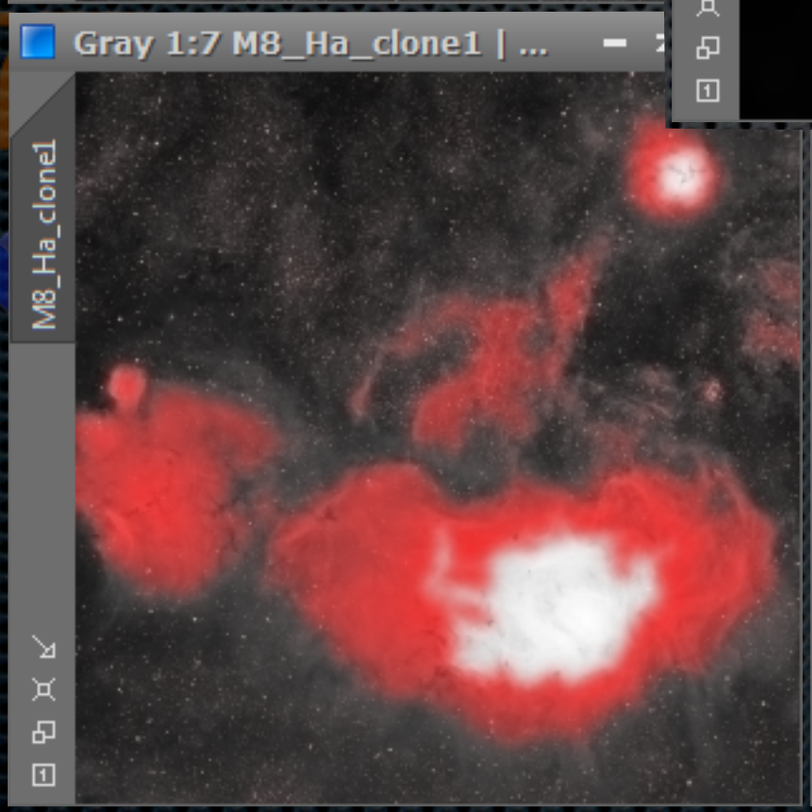

Gray 1:5 M8_Ha_clone | <*new*>
M8_Ha_clone

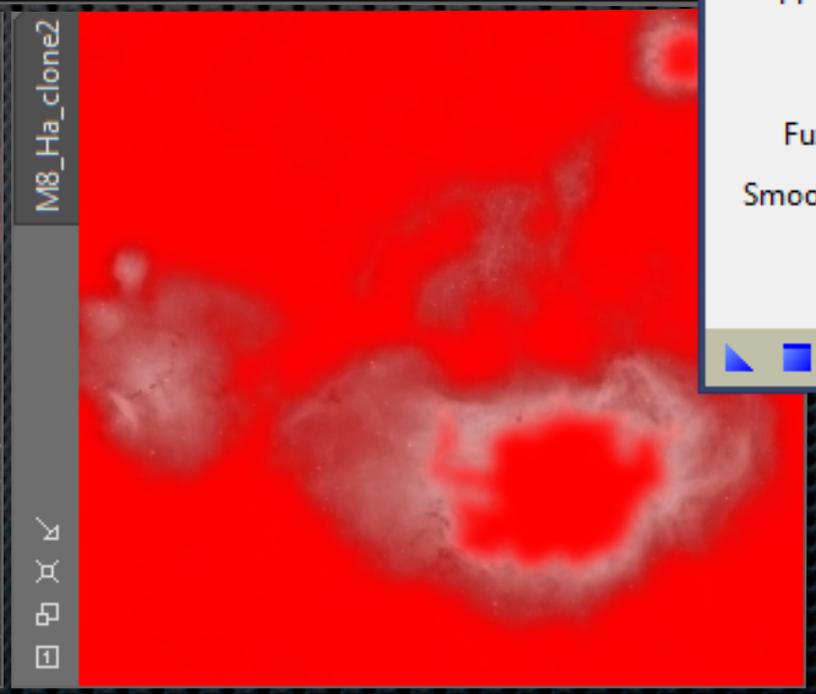

ACDNR
ACDNR Filters
Lightness Mask
Preview
Removed wavelet layers: 1
Midtones: 0.41000
Shadows: 0.18000
Highlights: 0.98000

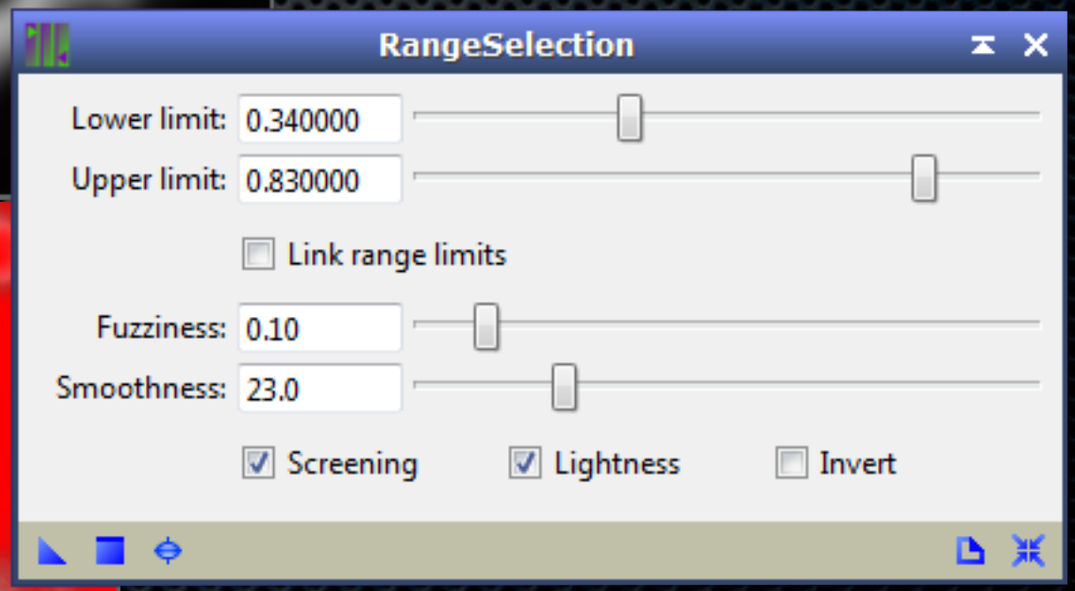
Les masques


Gray 1:7 M8_Ha | M8_Ha.fit
M8_Ha

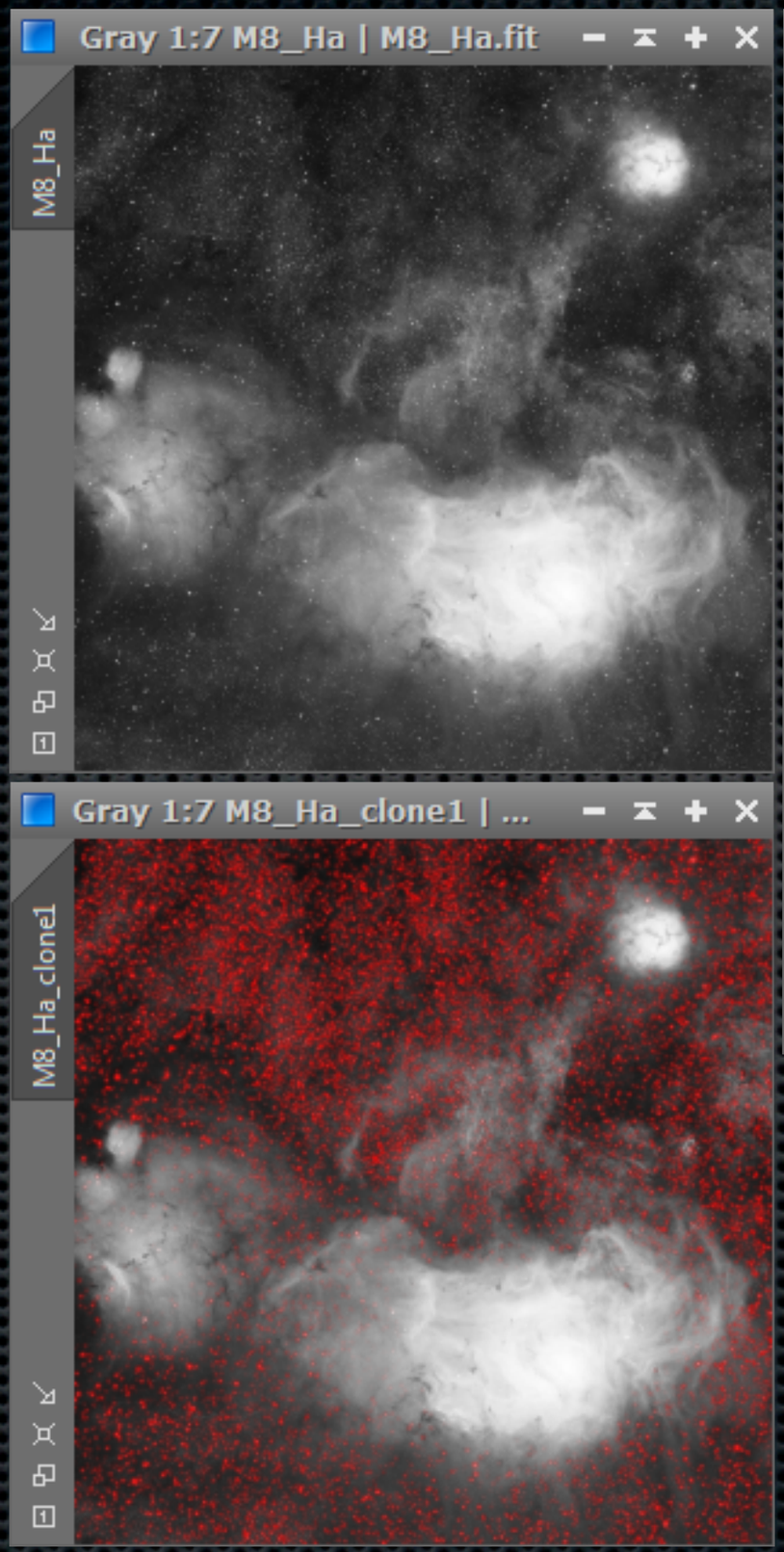

Gray 1:5 range_mask | <*new*>
range_mask

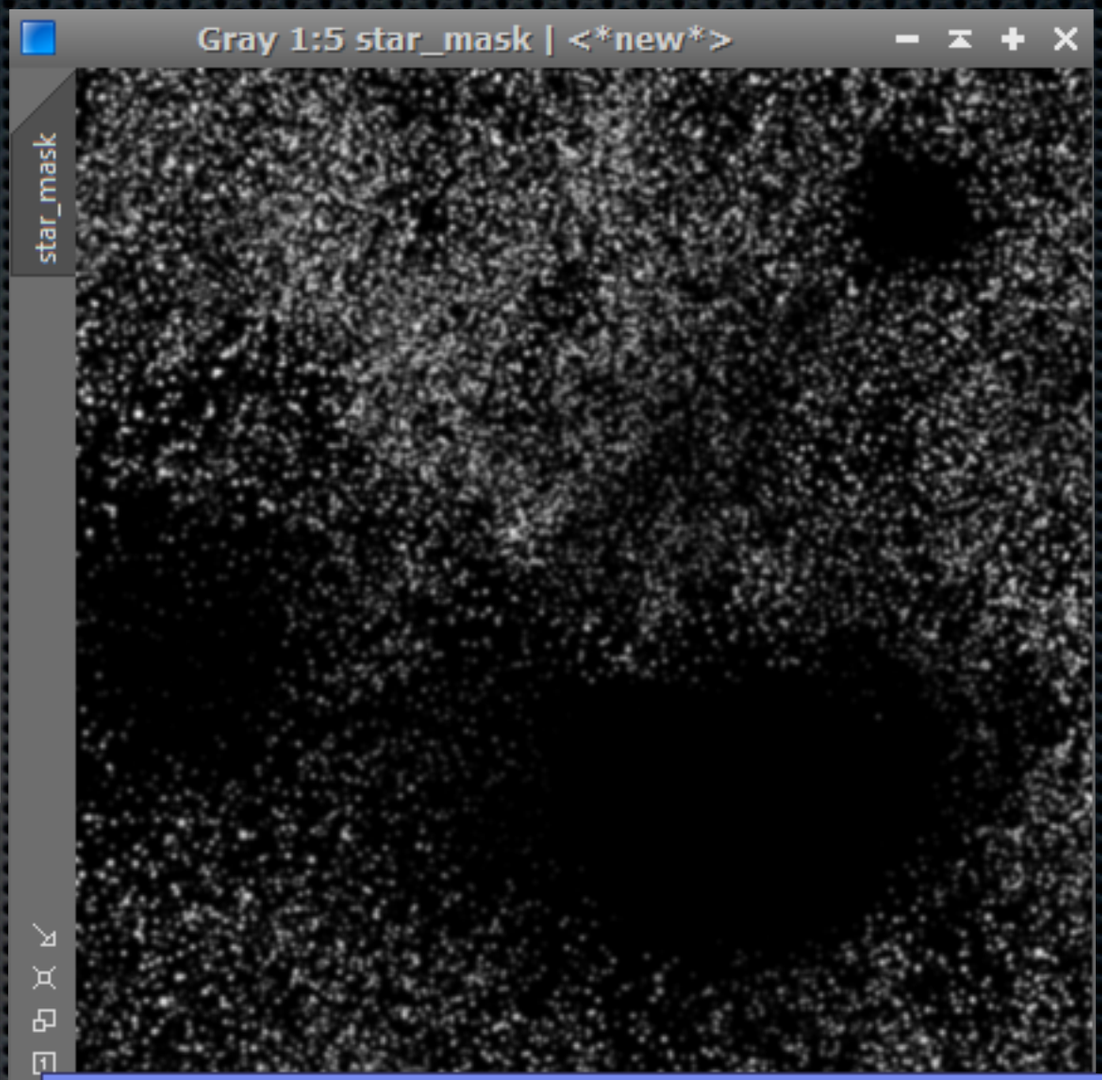

Gray 1:7 M8_Ha_clone1 | ...
M8_Ha_clone1

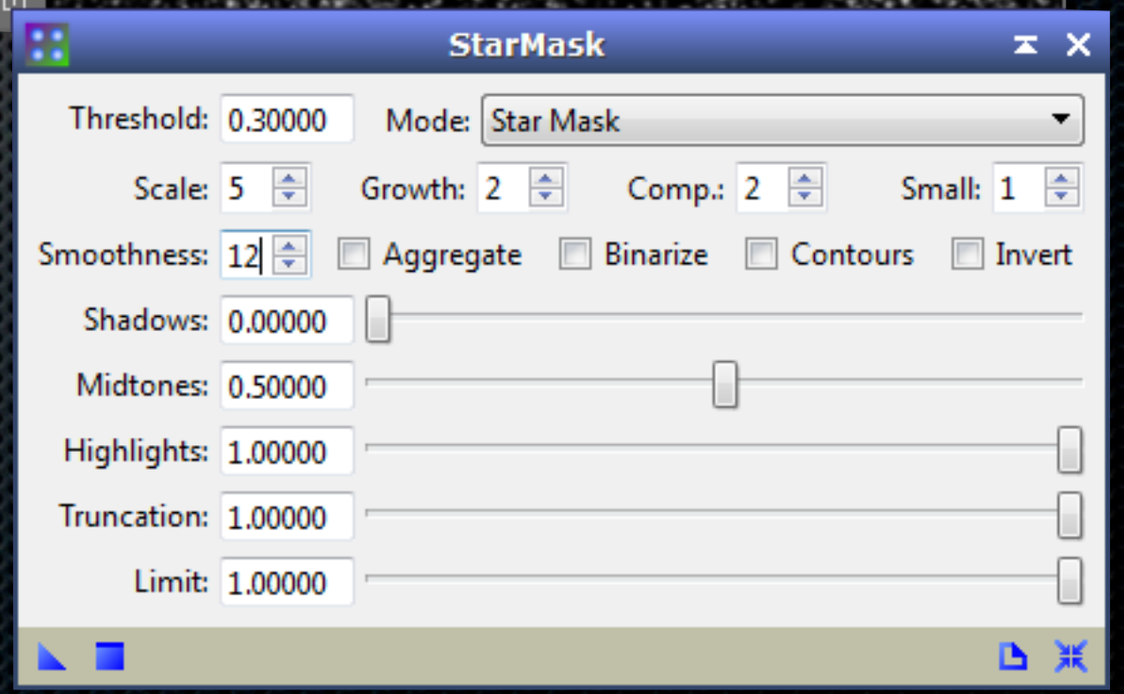

M8_Ha_clone2


RangeSelection
Lower limit: 0.340000
Upper limit: 0.830000
Link range limits
Fuzziness: 0.10
Smoothness: 23.0
Screening
Lightness
Invert

Les masques


Gray 1:7 M8_Ha | M8_Ha.fit
M8_Ha
Gray 1:7 M8_Ha_clone1 | ...
M8_Ha_clone1


Gray 1:5 star_mask | <*new*>
star_mask


StarMask
Threshold: 0.30000
Mode: Star Mask
Scale: 5
Growth: 2
Comp.: 2
Small: 1
Smoothness: 12
Aggregate
Binarize
Contours
Invert
Shadows: 0.00000
Midtones: 0.50000
Highlights: 1.00000
Truncation: 1.00000
Limit: 1.00000

HDRMultiscaleTransform

image Nicolas Outters

HDRMultiscaleTransform

HDRMultiscaleTransform

Number of layers: 7 Number of iterations: 1 Inverted

Overdrive: 0.000

Median transform

Scaling function: Small Scale 32 (3)

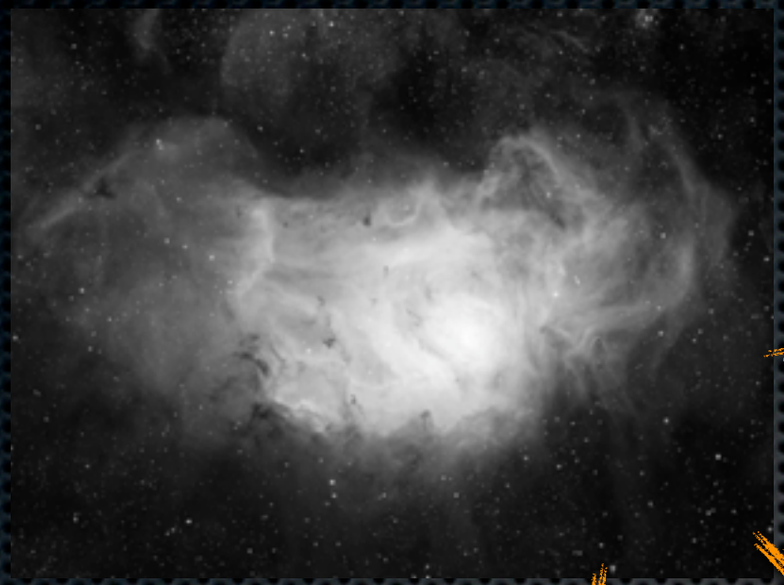
To lightness Preserve hue

Lightness mask

Deringing

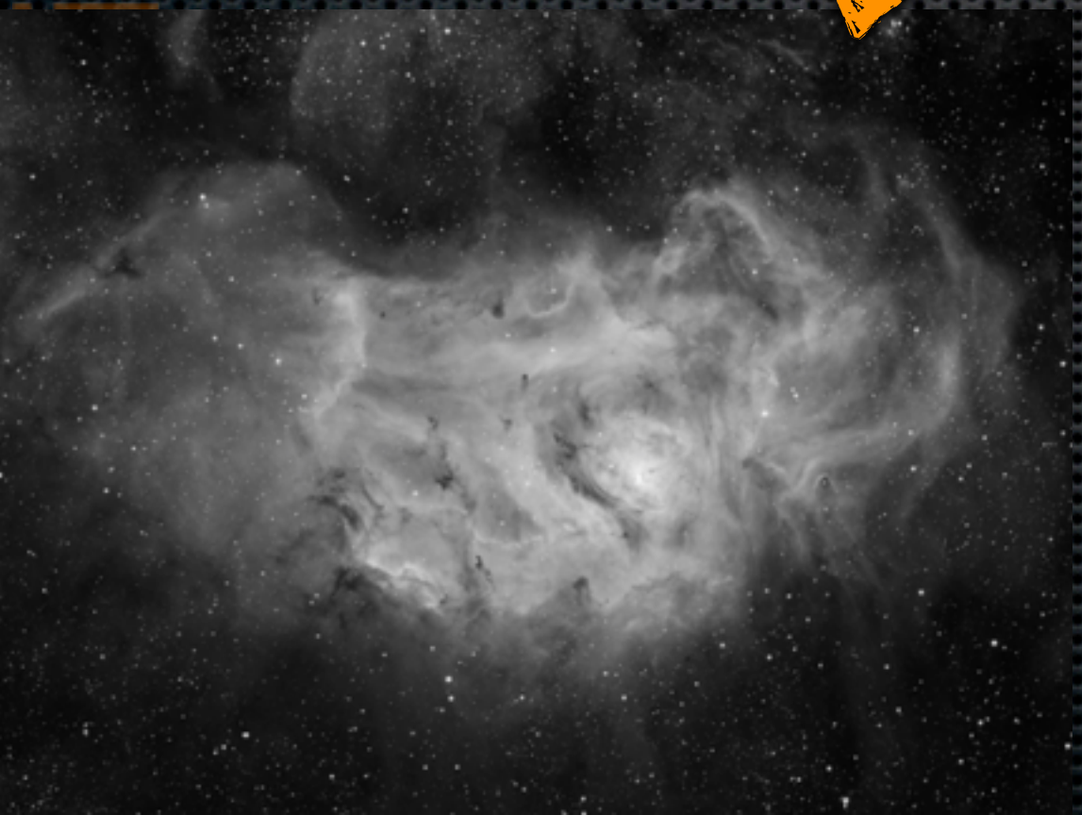
Midtones Balance

HDRMultiscaleTransform

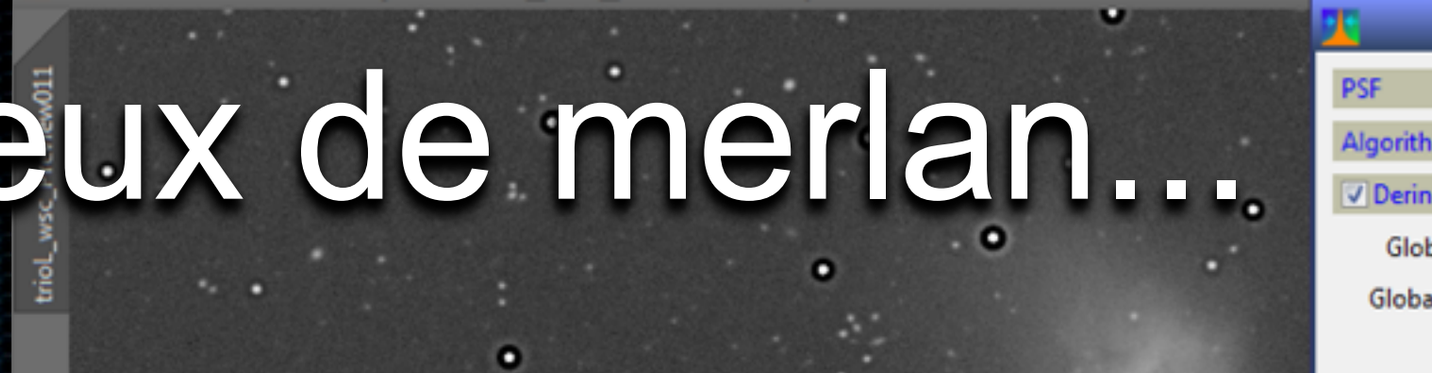


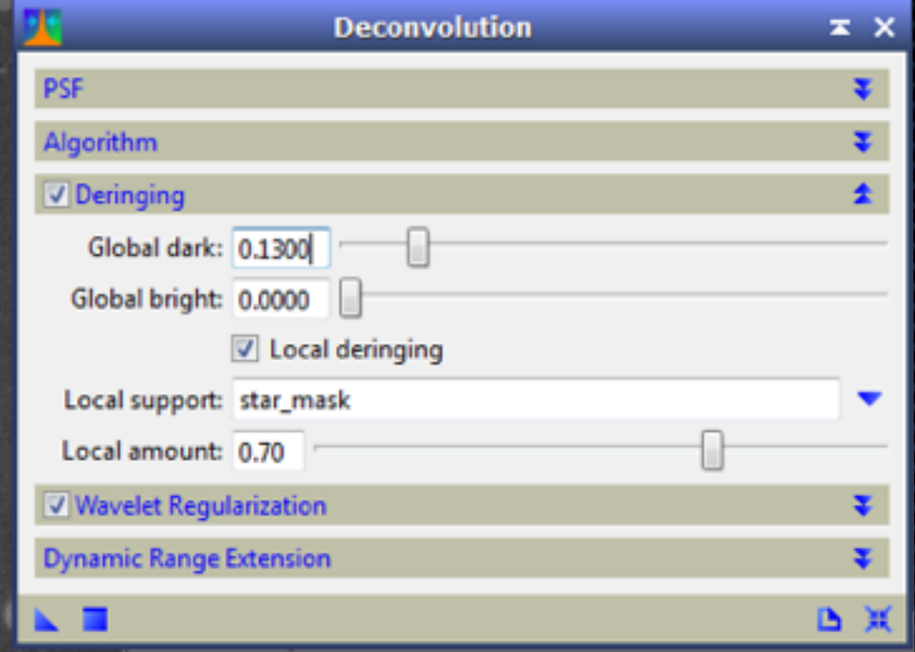
Tout est possible !

Du plus soft au plus hard !



Yeux de merlan...





PixInsight

DERINGING !

Présent sur de nombreuses fonctions

DynamicBackgroundExtraction

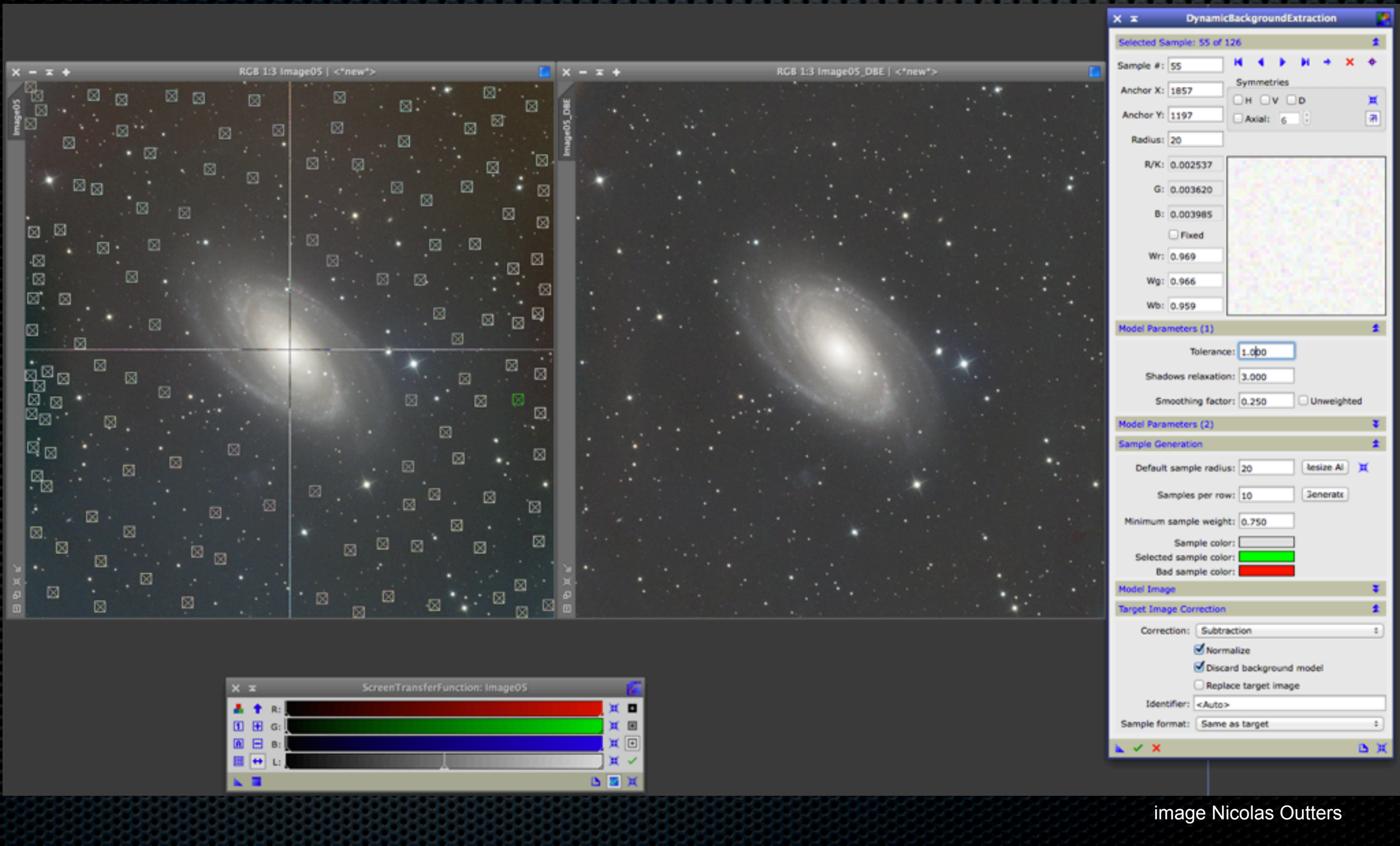
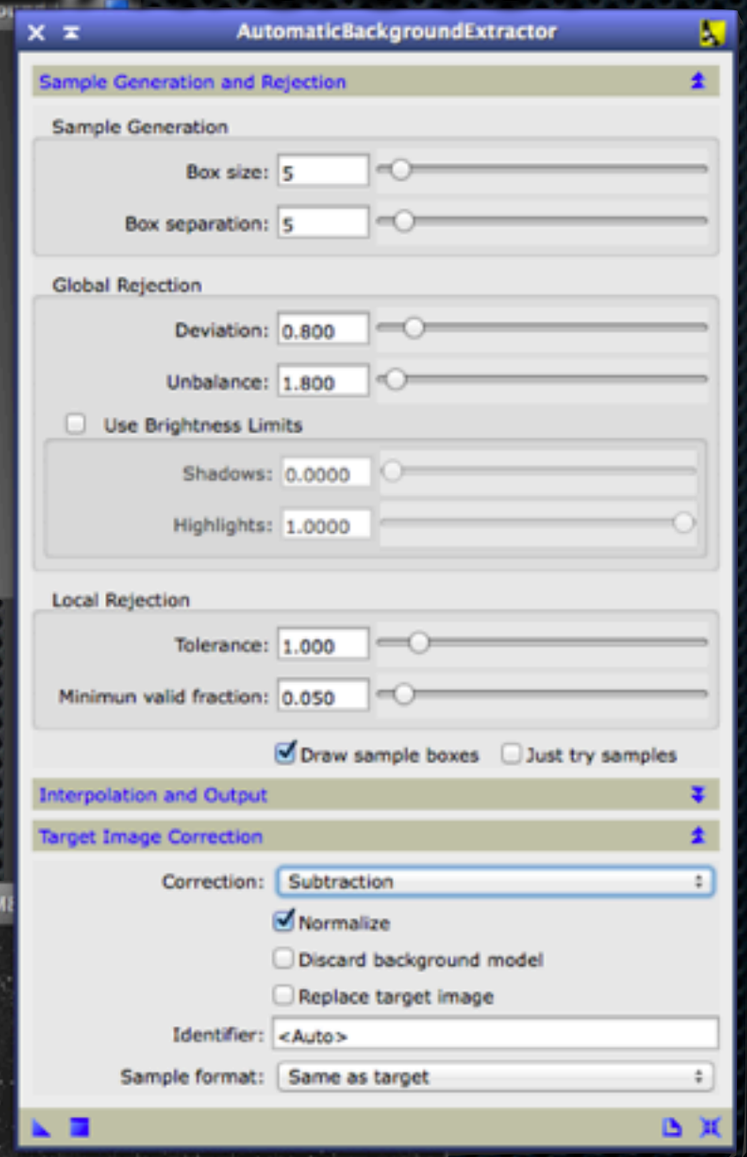
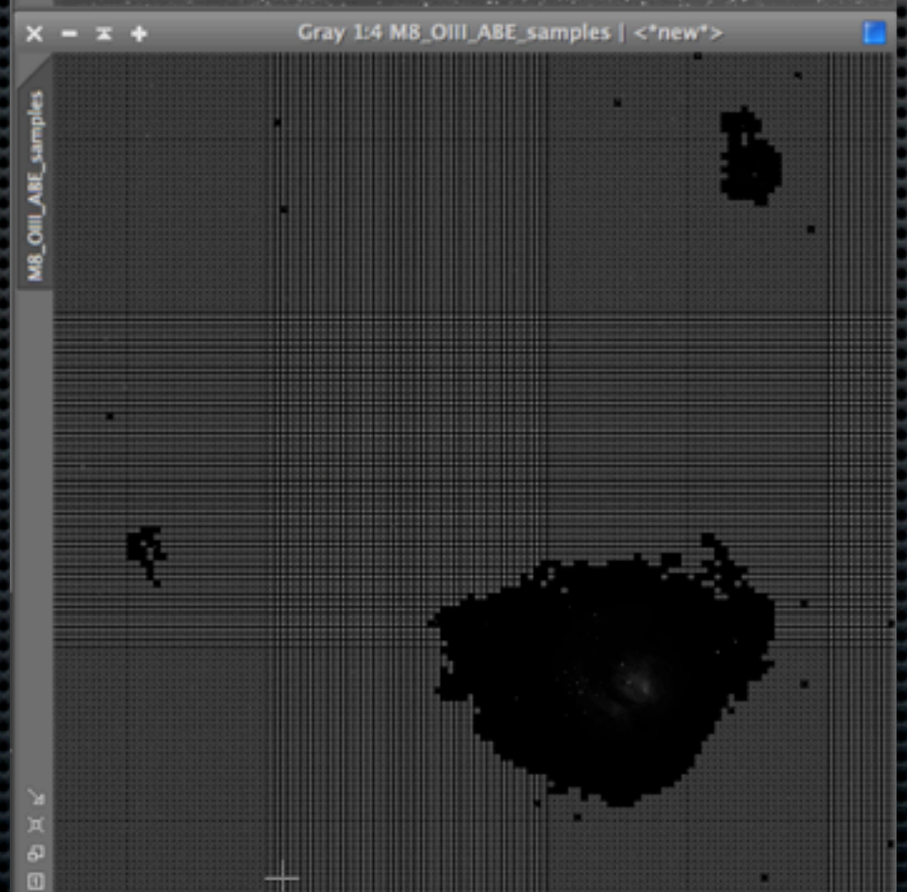


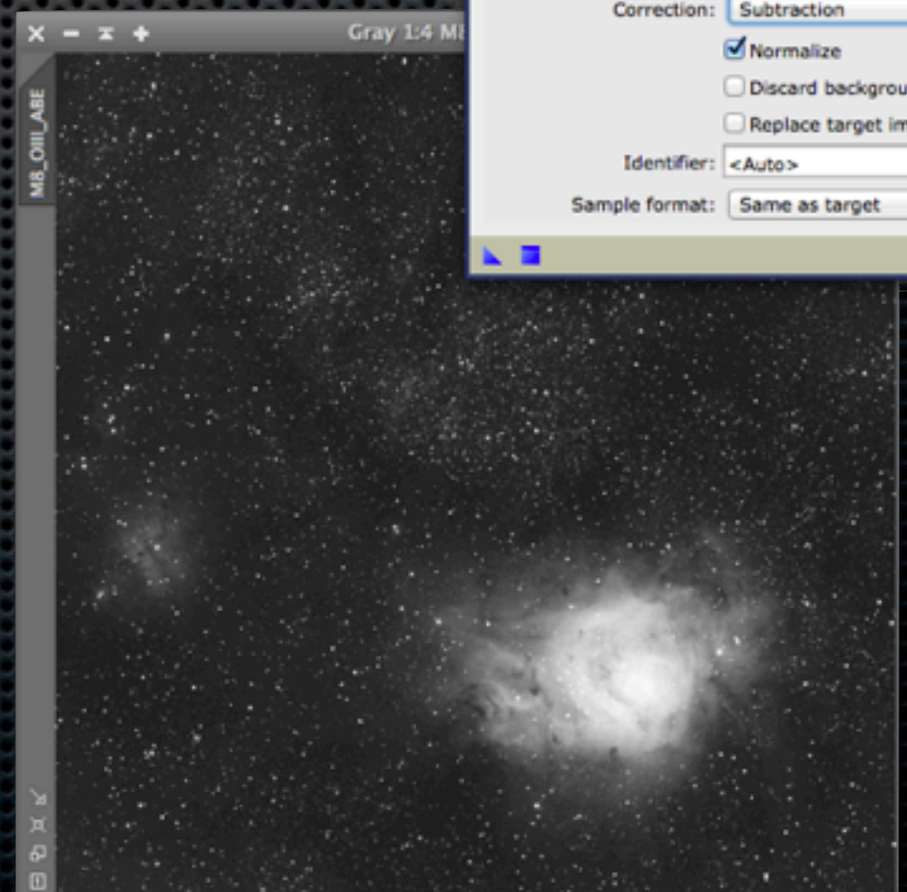
image Nicolas Outters

AutomaticBackgroundExtractor

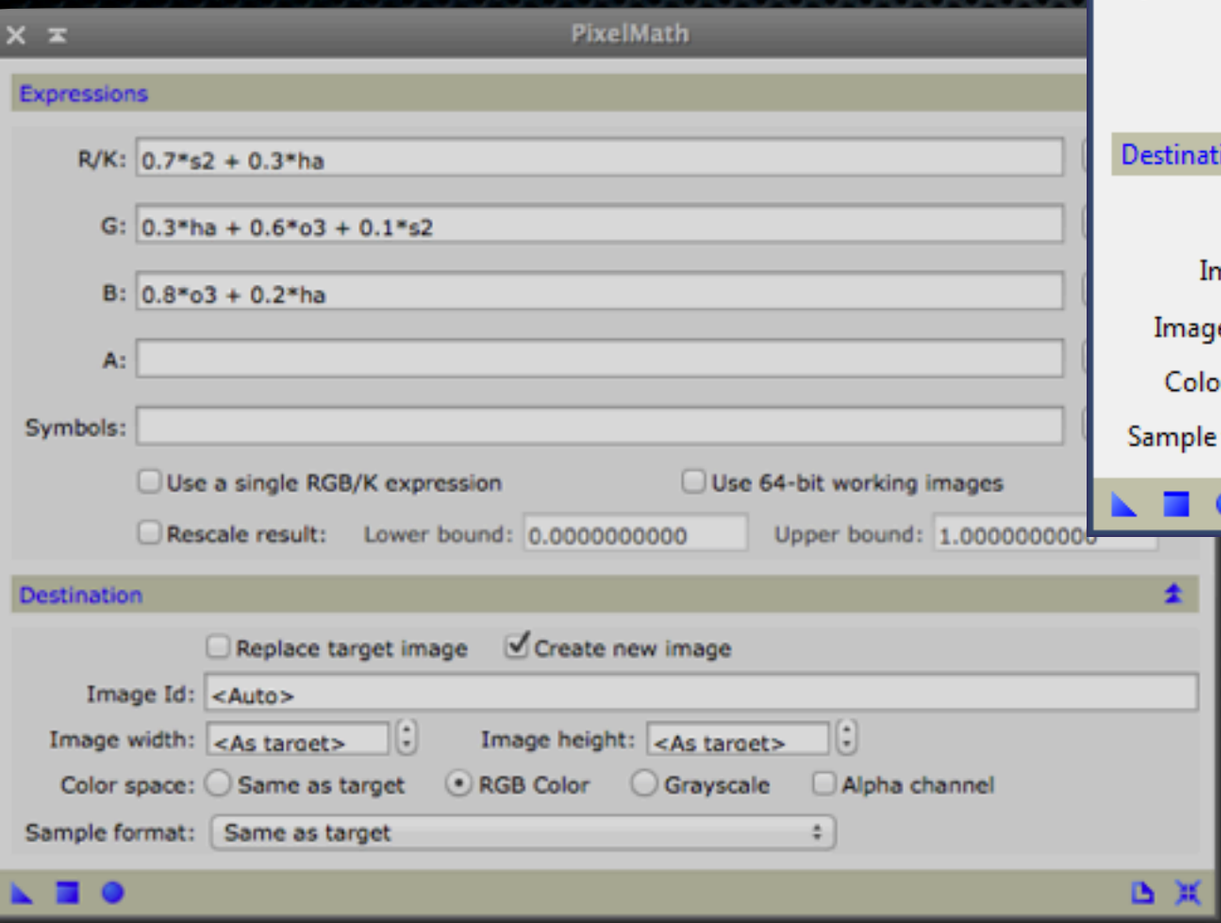
PixInsight

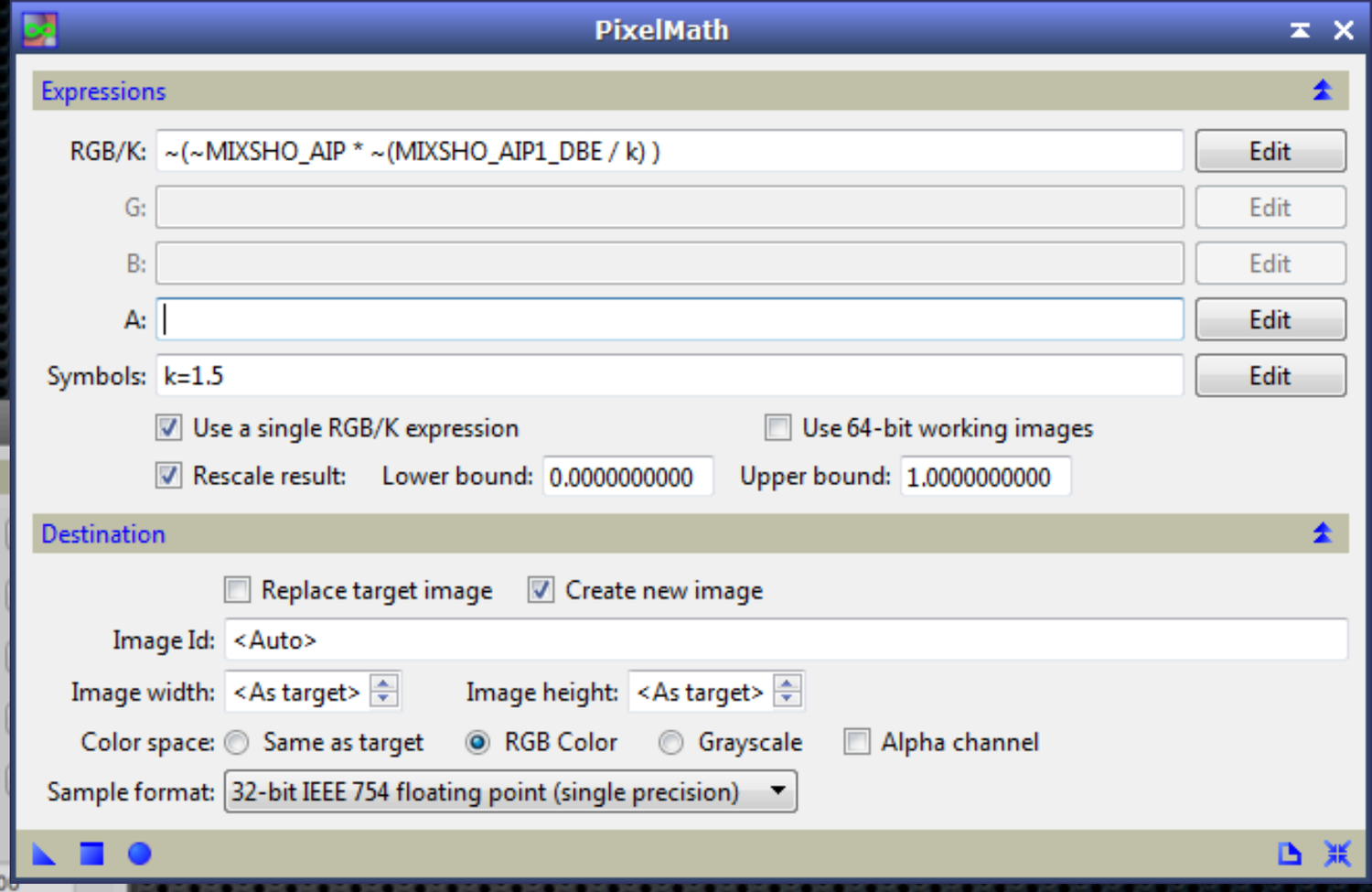


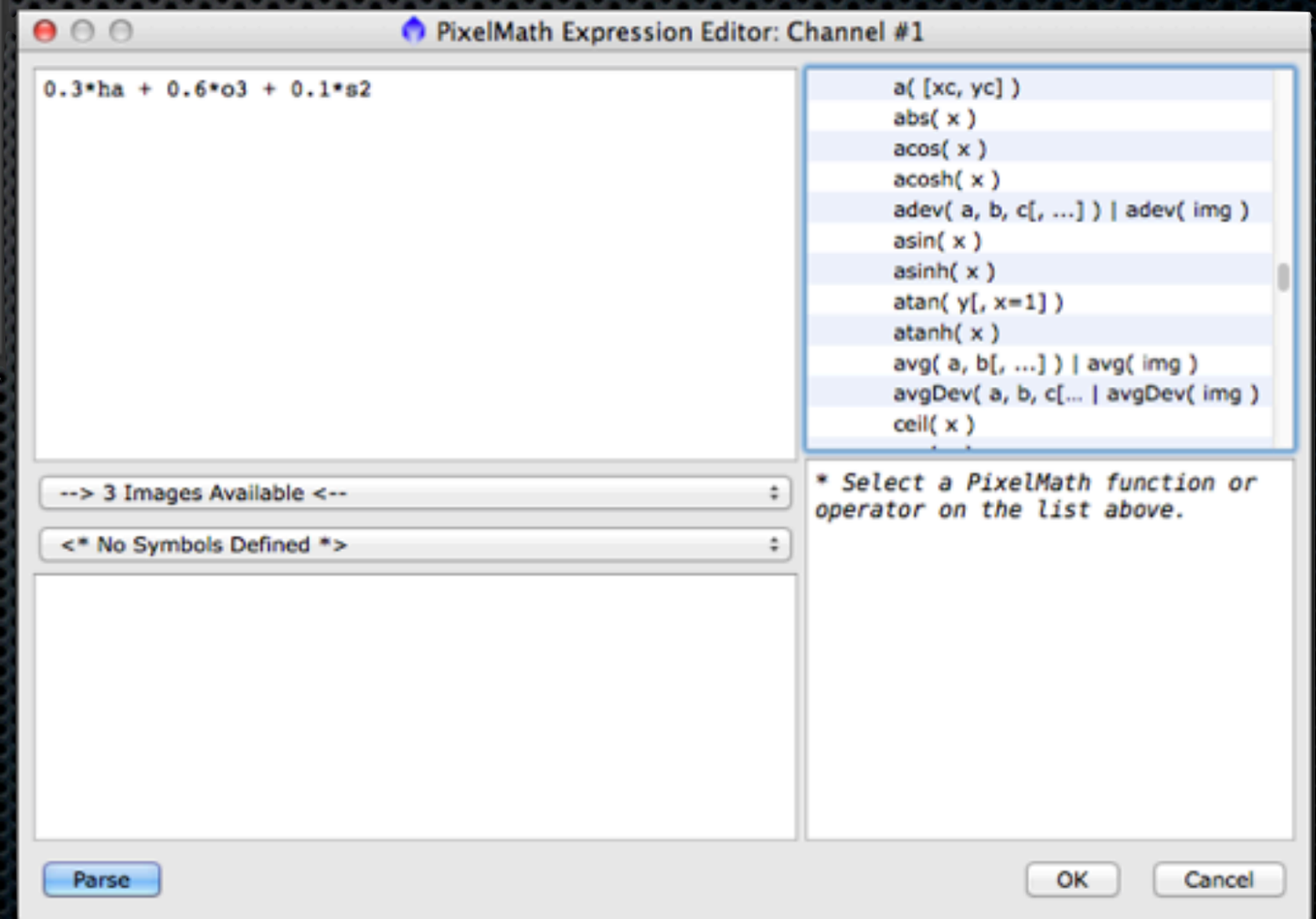




PixelMath

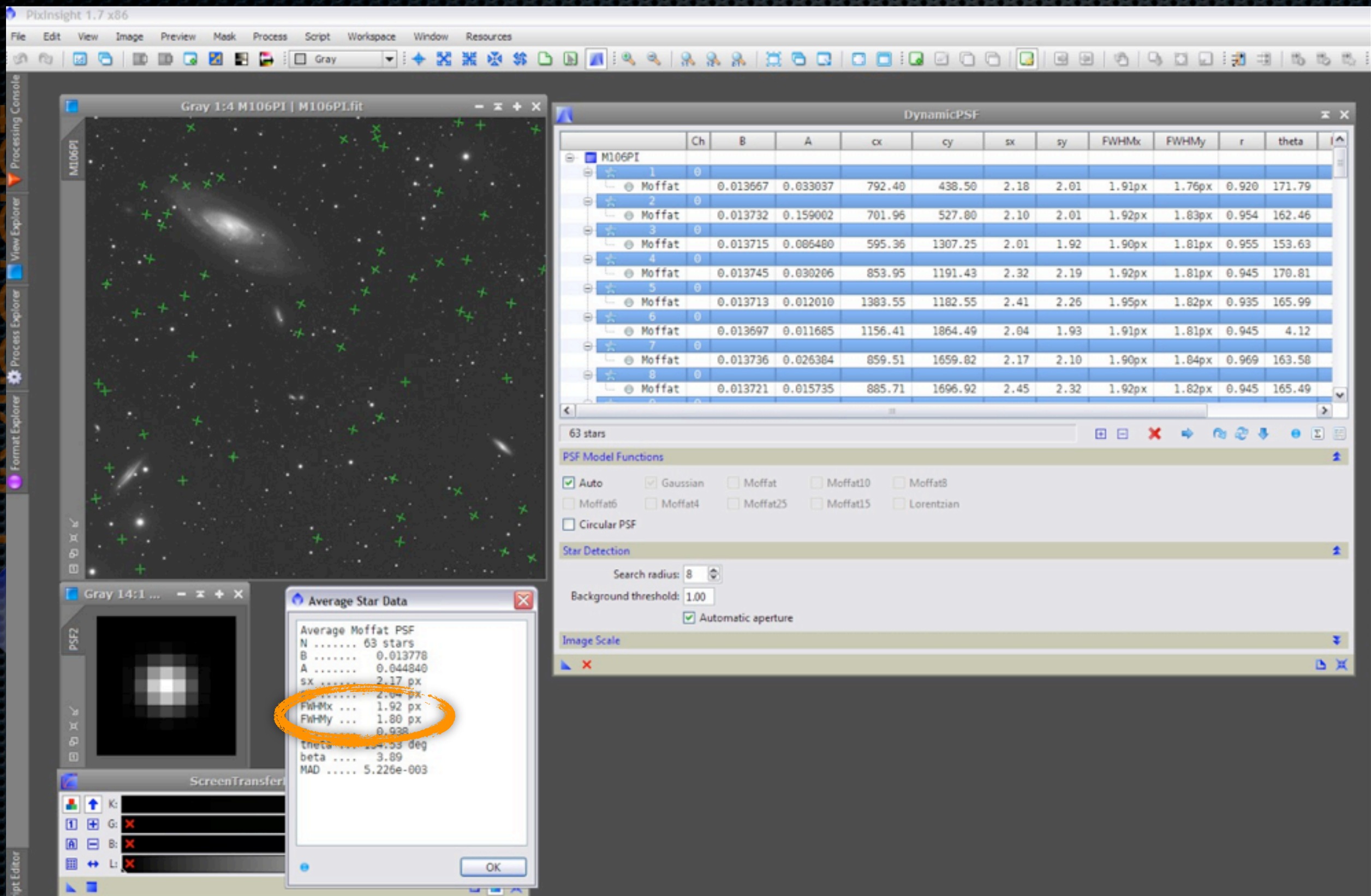




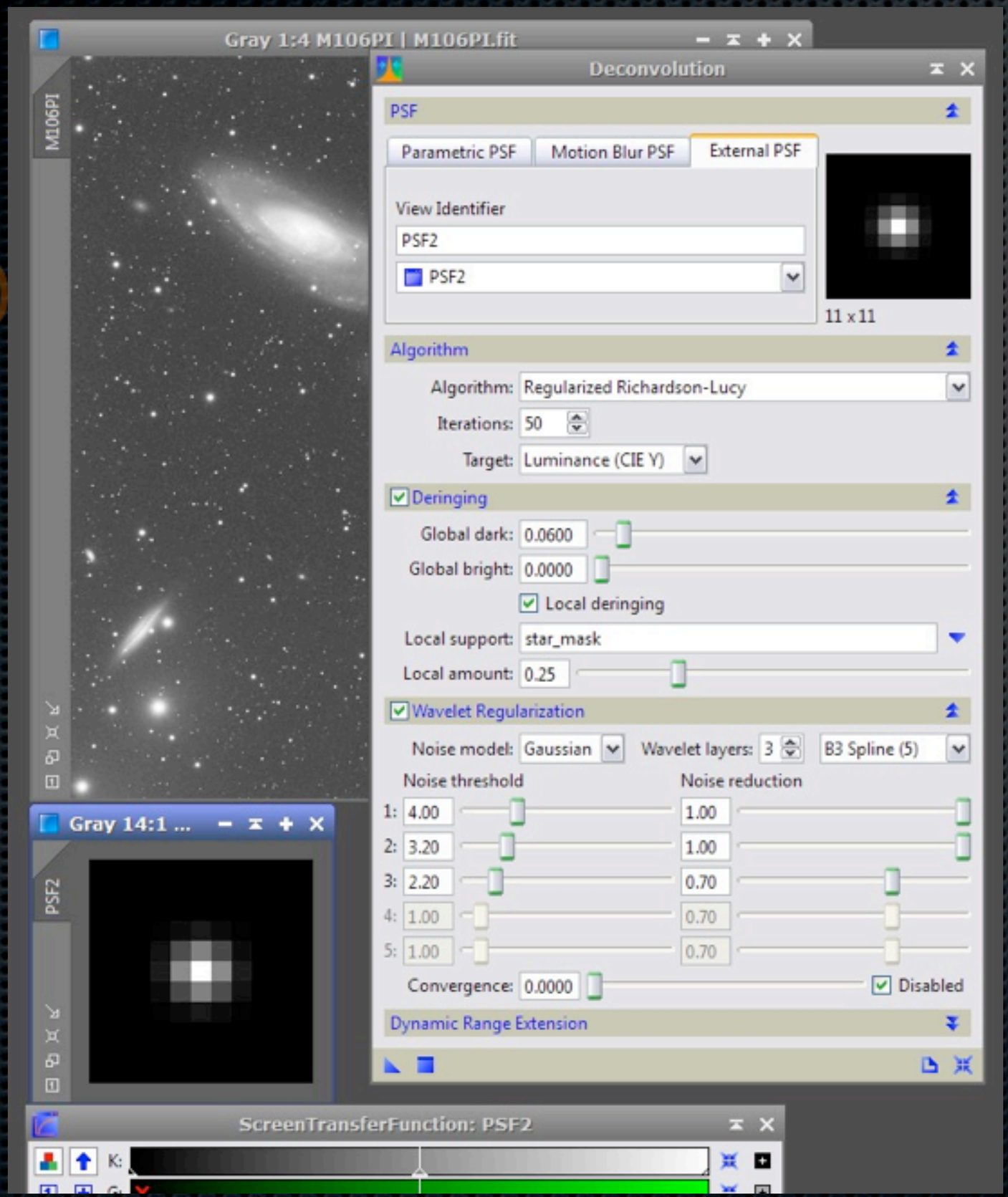


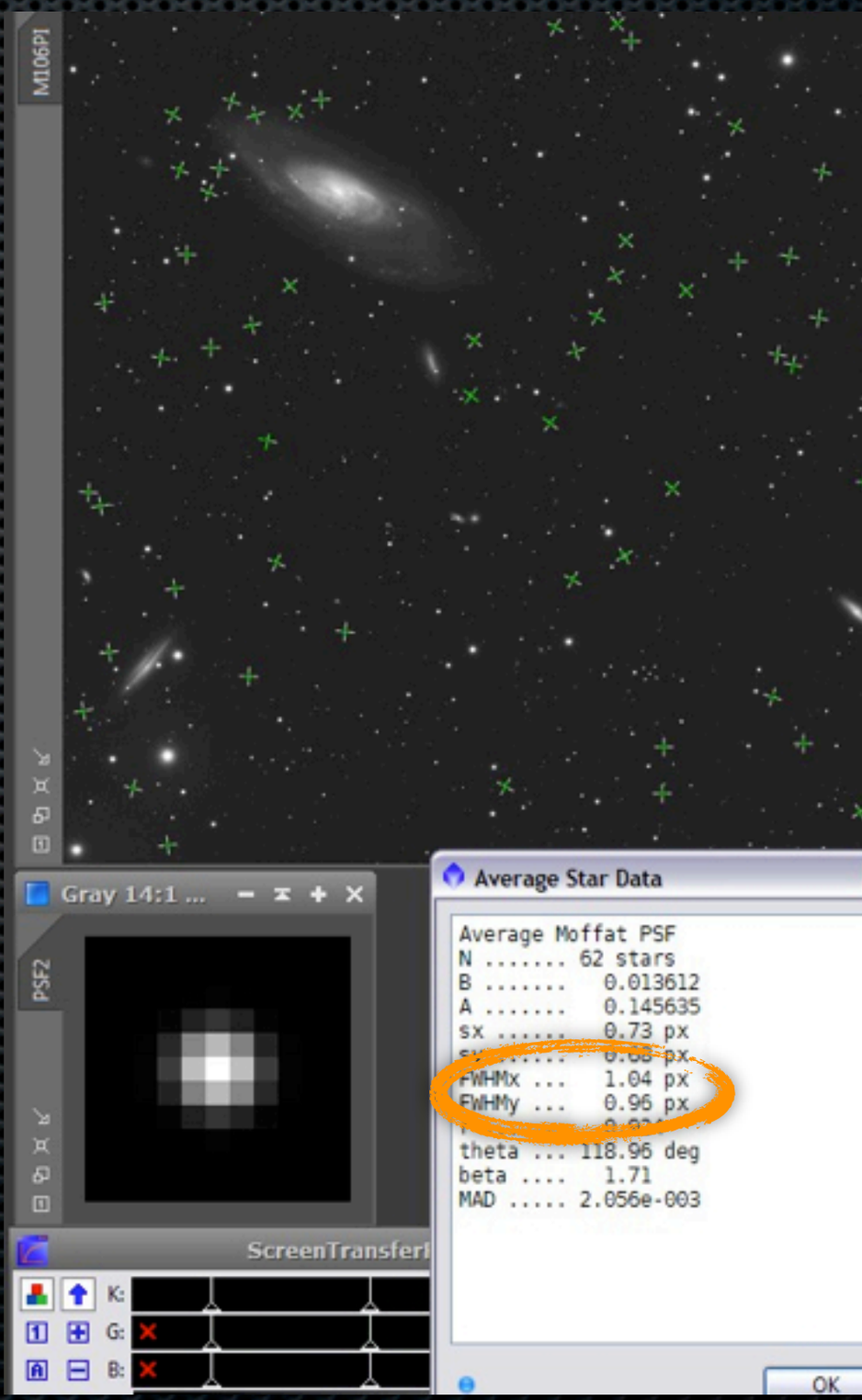
INDISPENSABLE !

La déconvolution : la PSF



La déconvolution

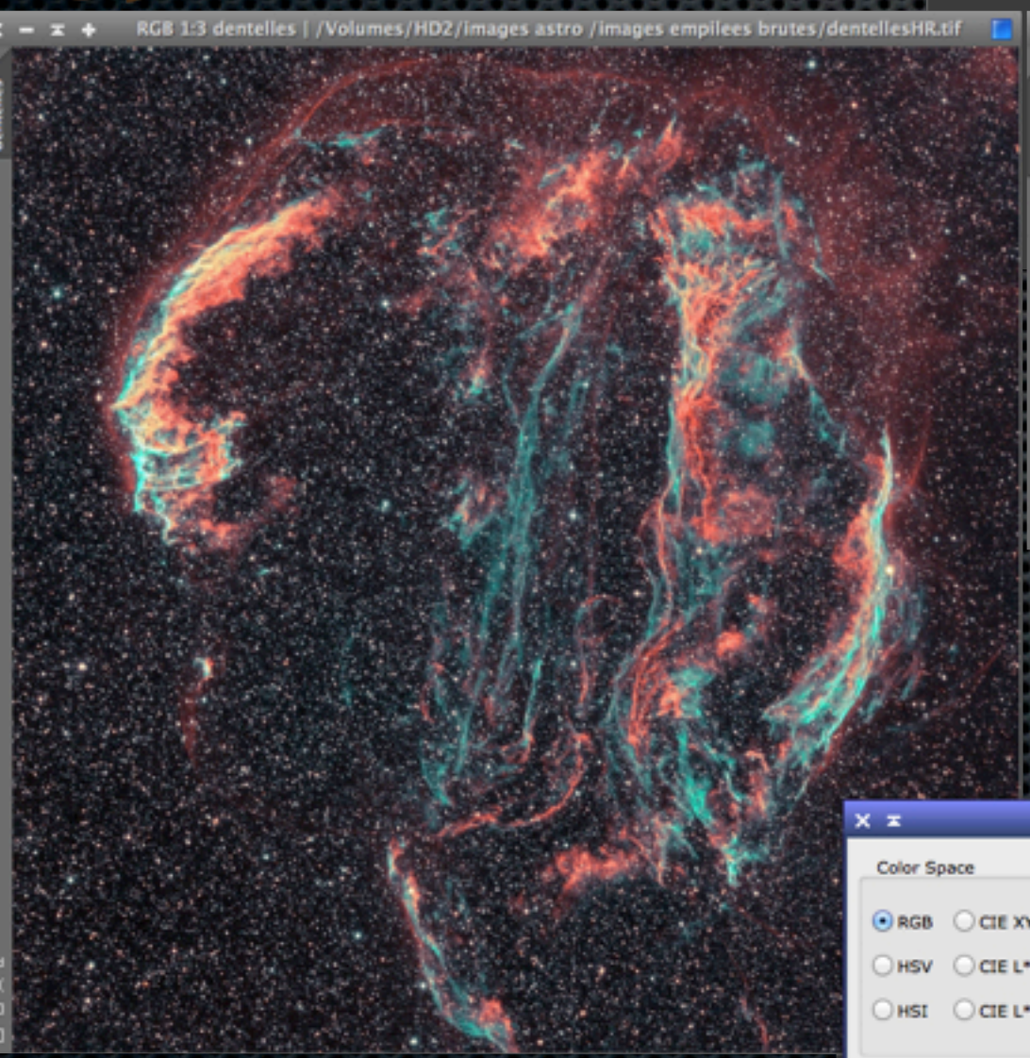


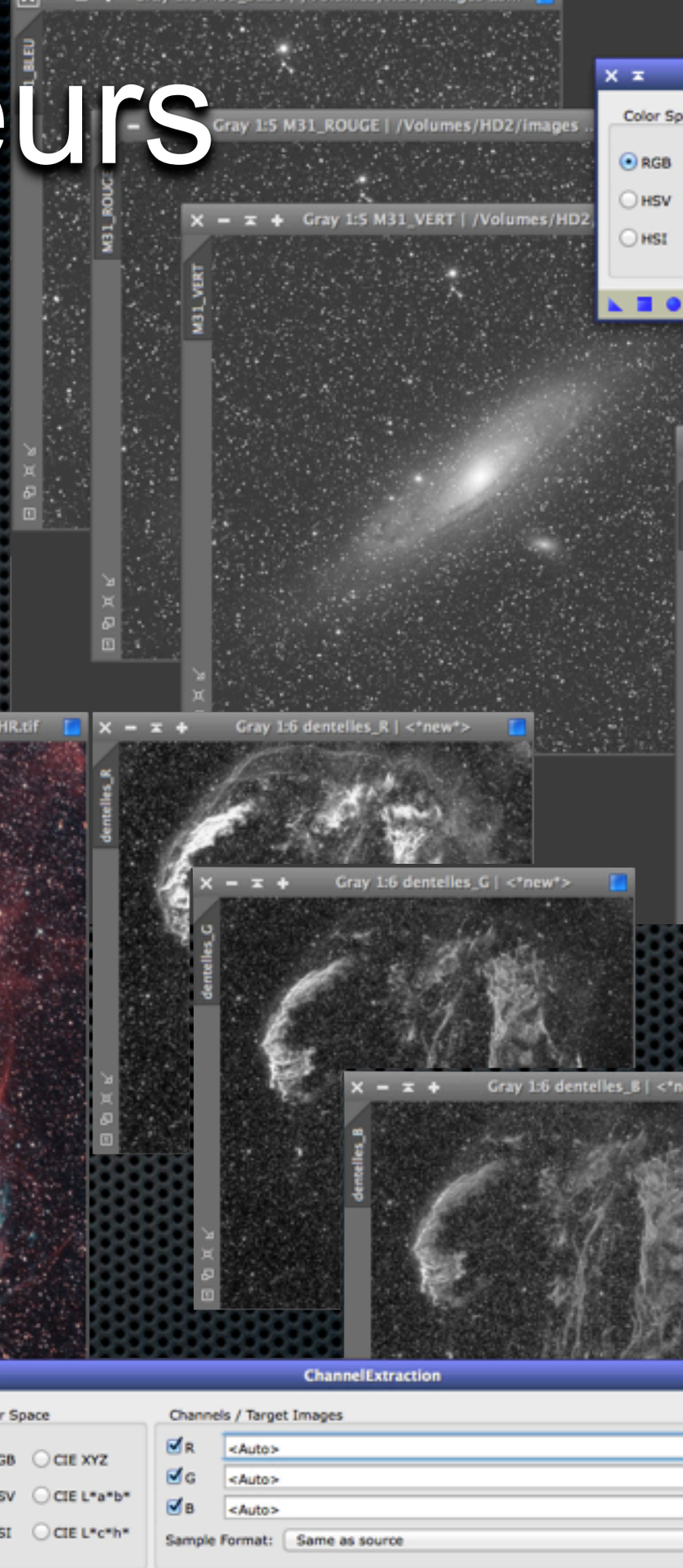


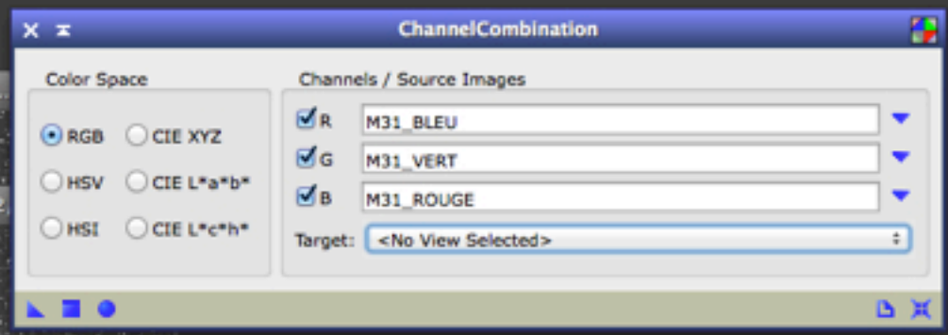
Les couleurs

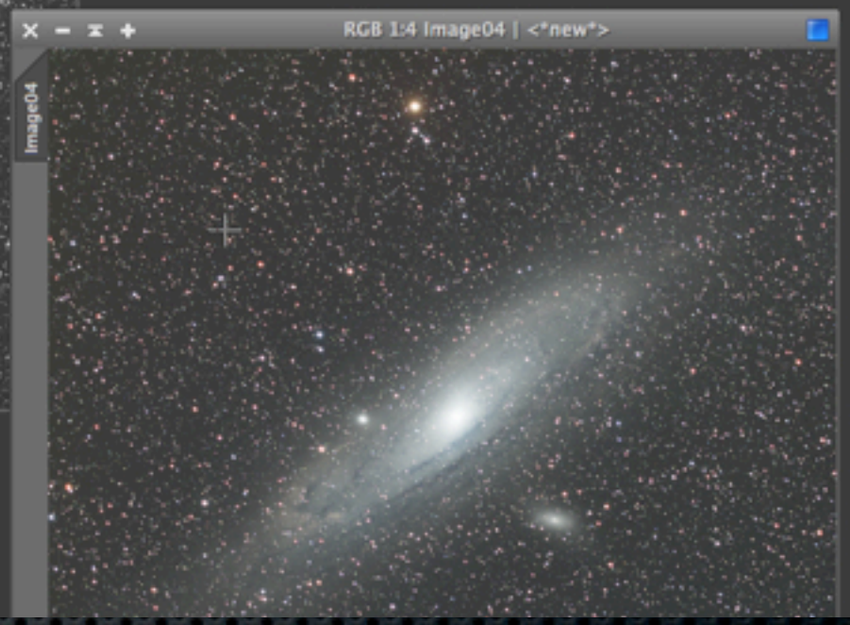
- Combinaison
- Extraction

sight









La calibration des couleurs

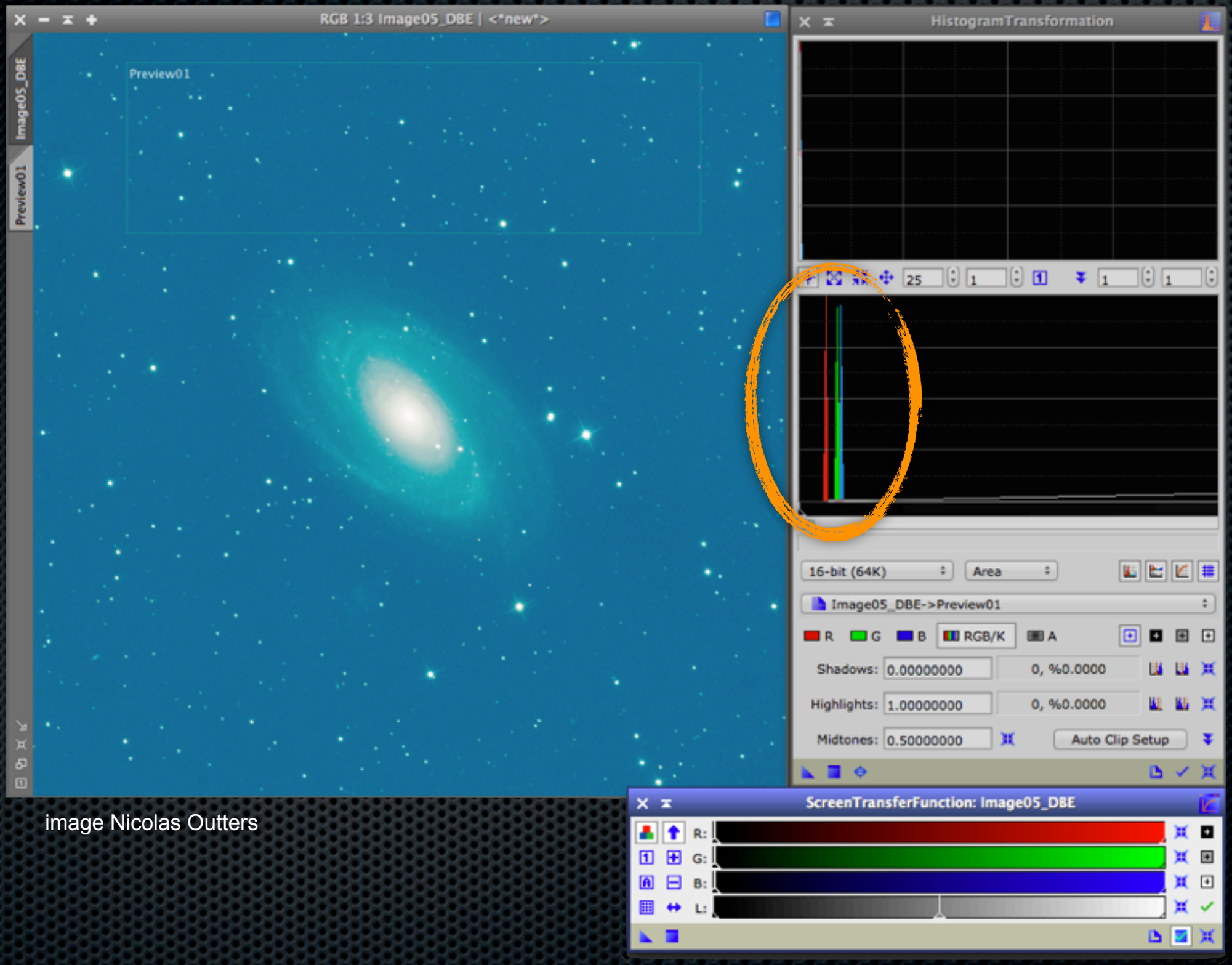
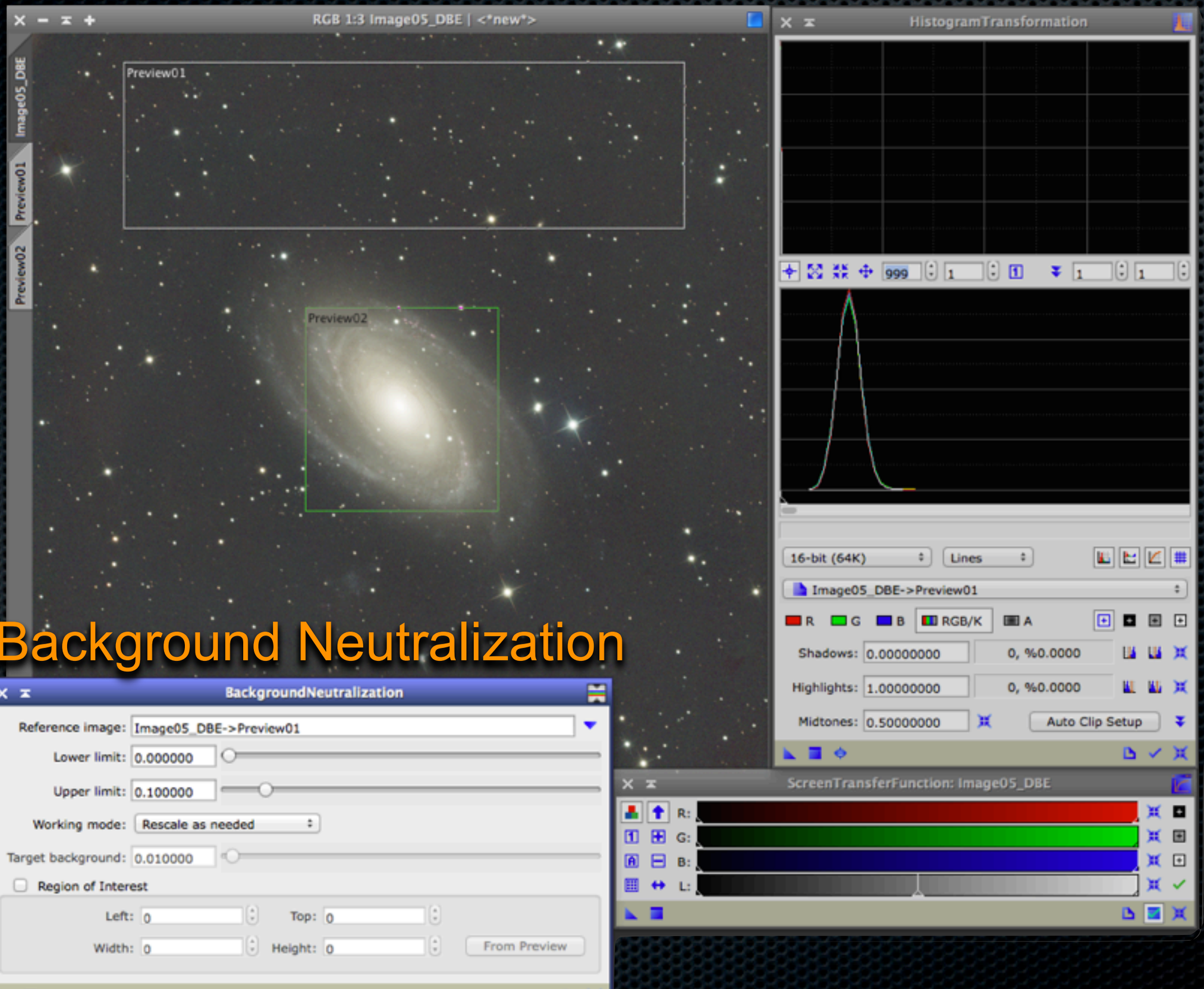


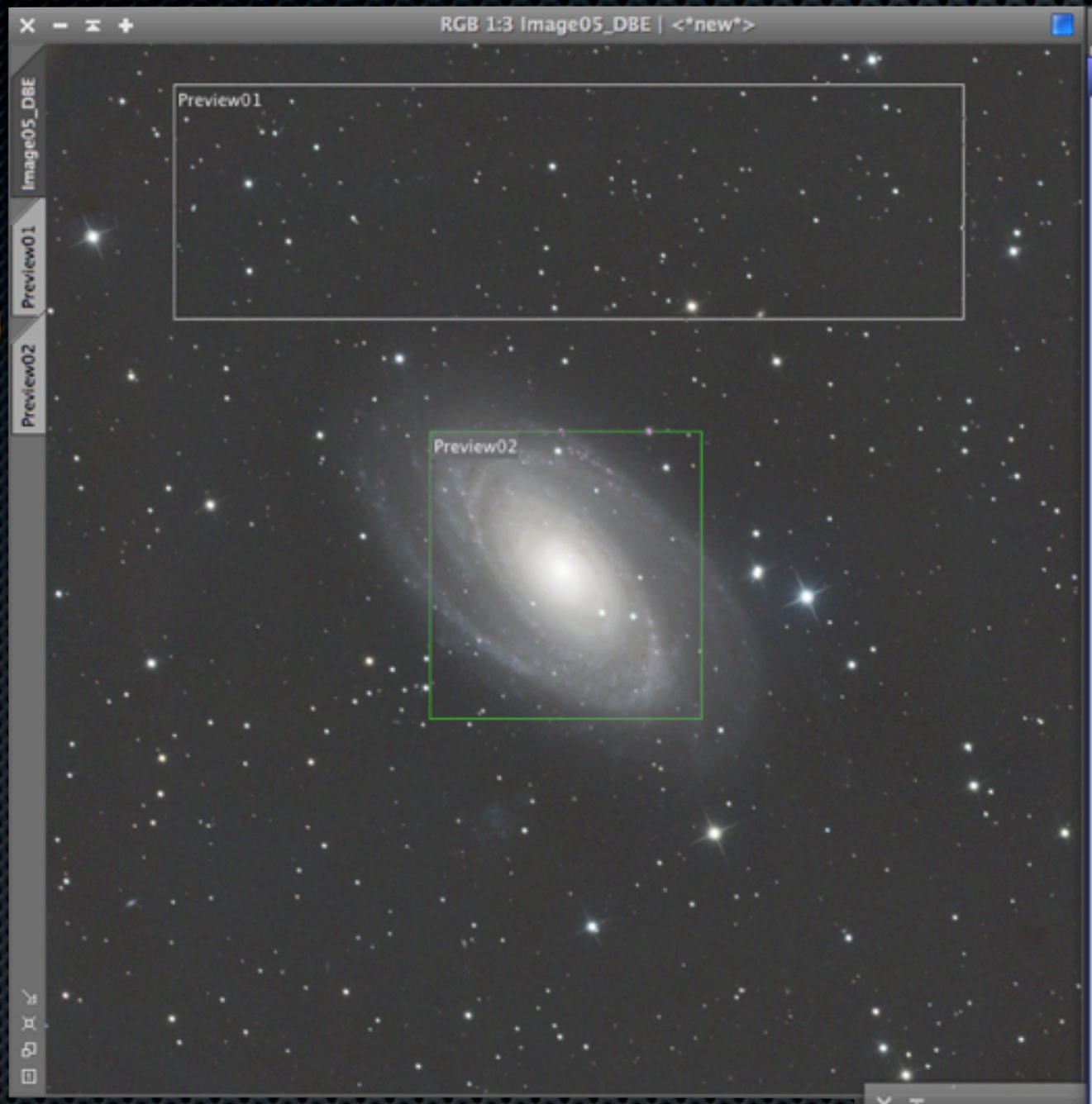
image Nicolas Outters

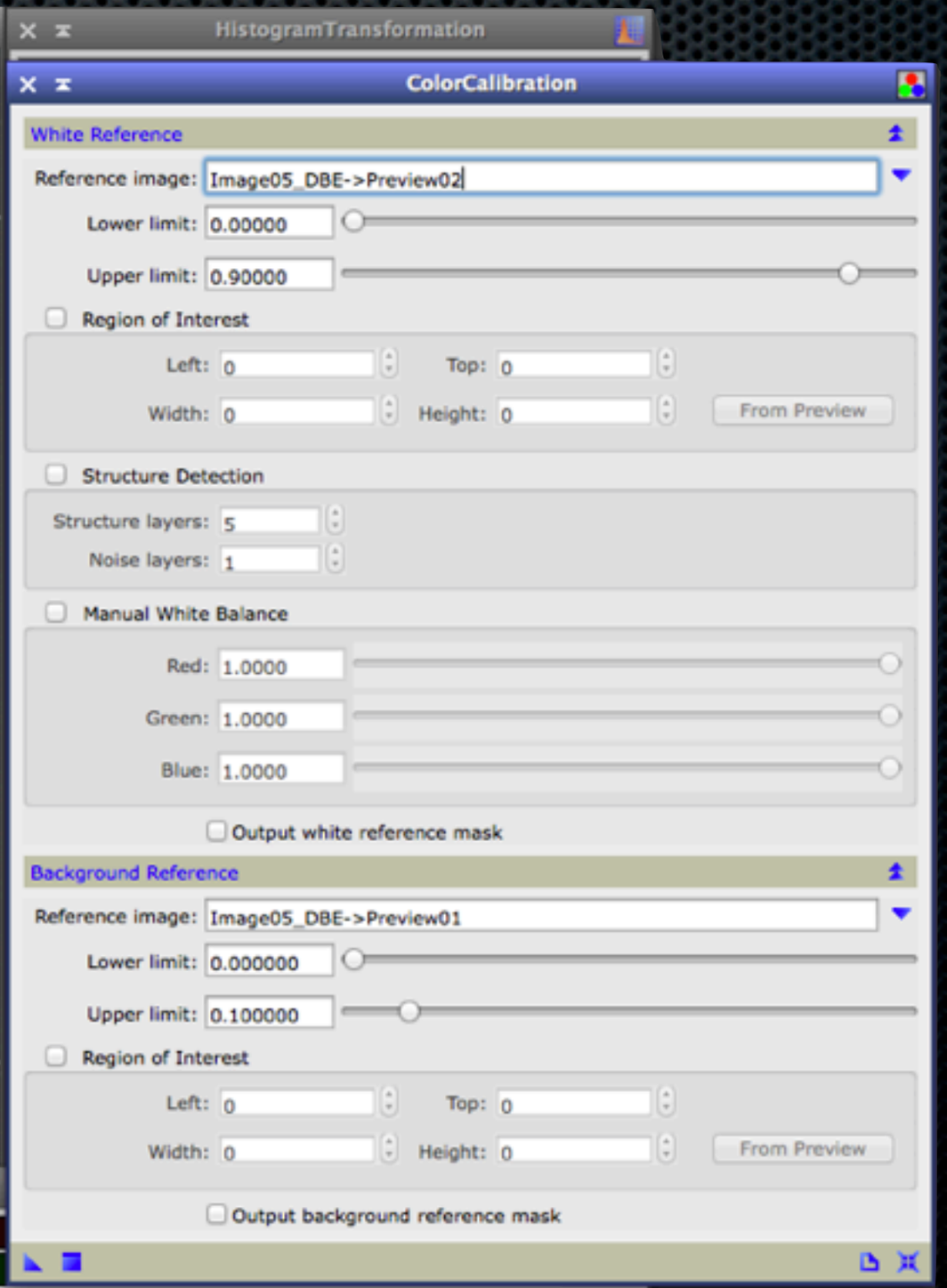
La calibration des couleurs

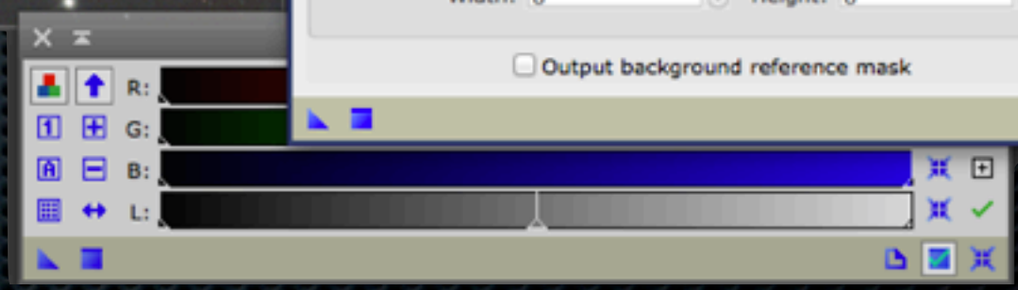
Background Neutralization



La calibration des couleurs

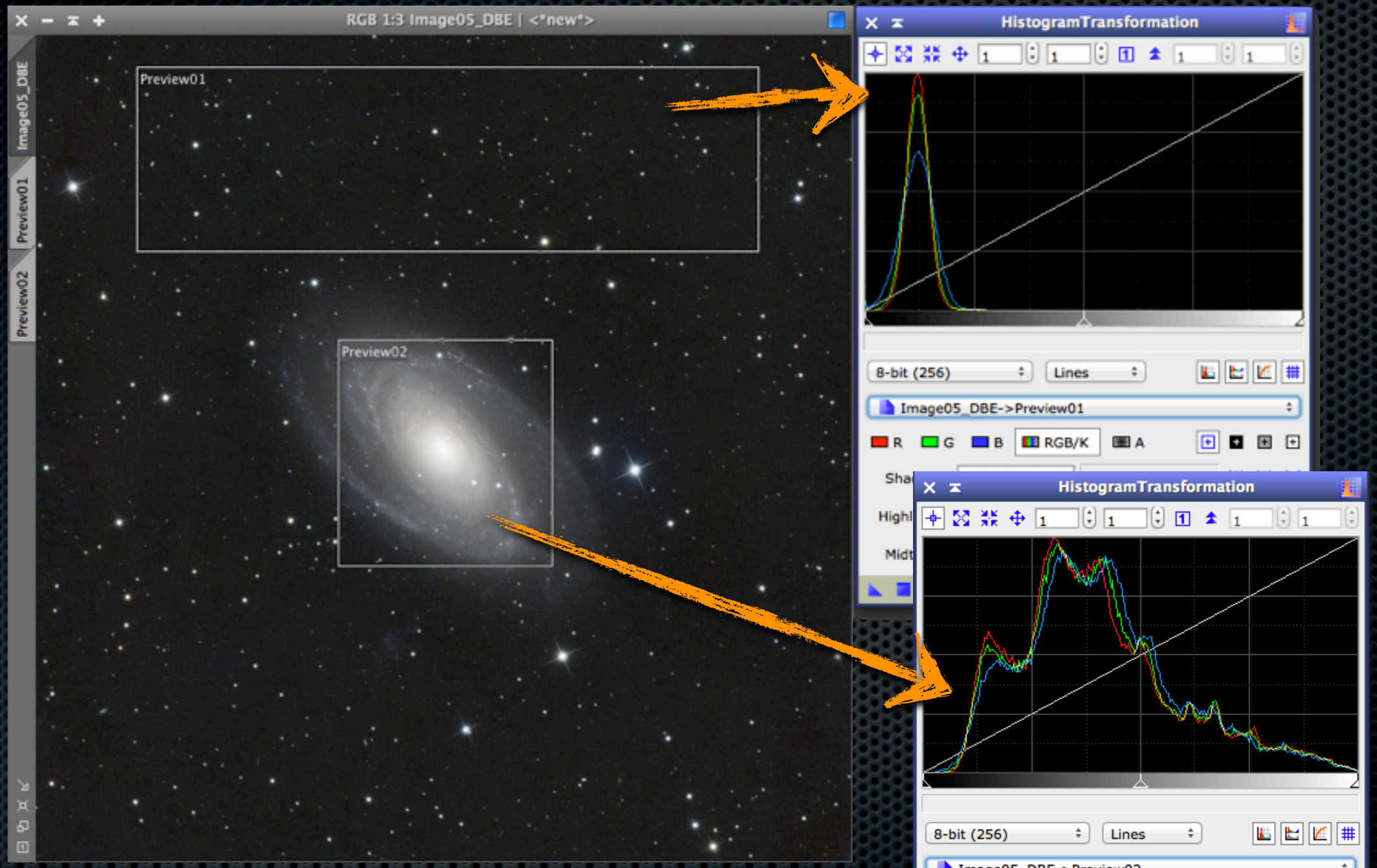






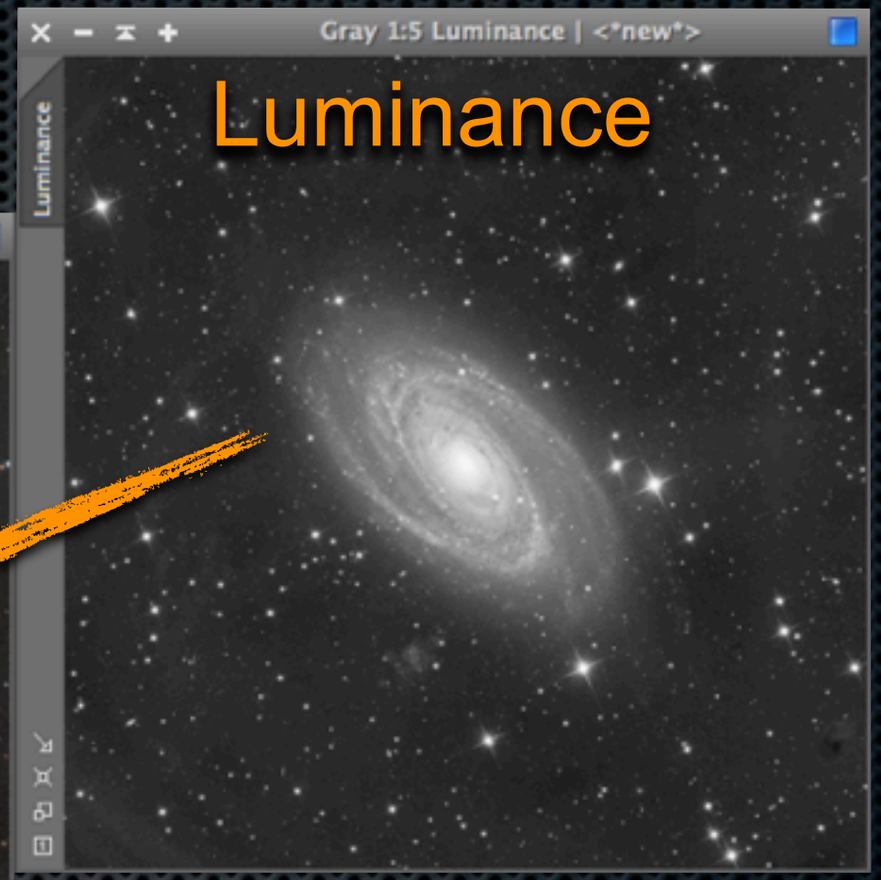
Color Calibration

La calibration des couleurs



LRGB

PixInsight



Luminance

LRGBCombination

Channels / Source Images

L: Luminance
R: <Auto>
G: <Auto>
B: <Auto>
Target: <No View Selected>

Channel Weights

Transfer Functions

Lightness: 0.500
Saturation: 0.200

Chrominance Noise Reduction

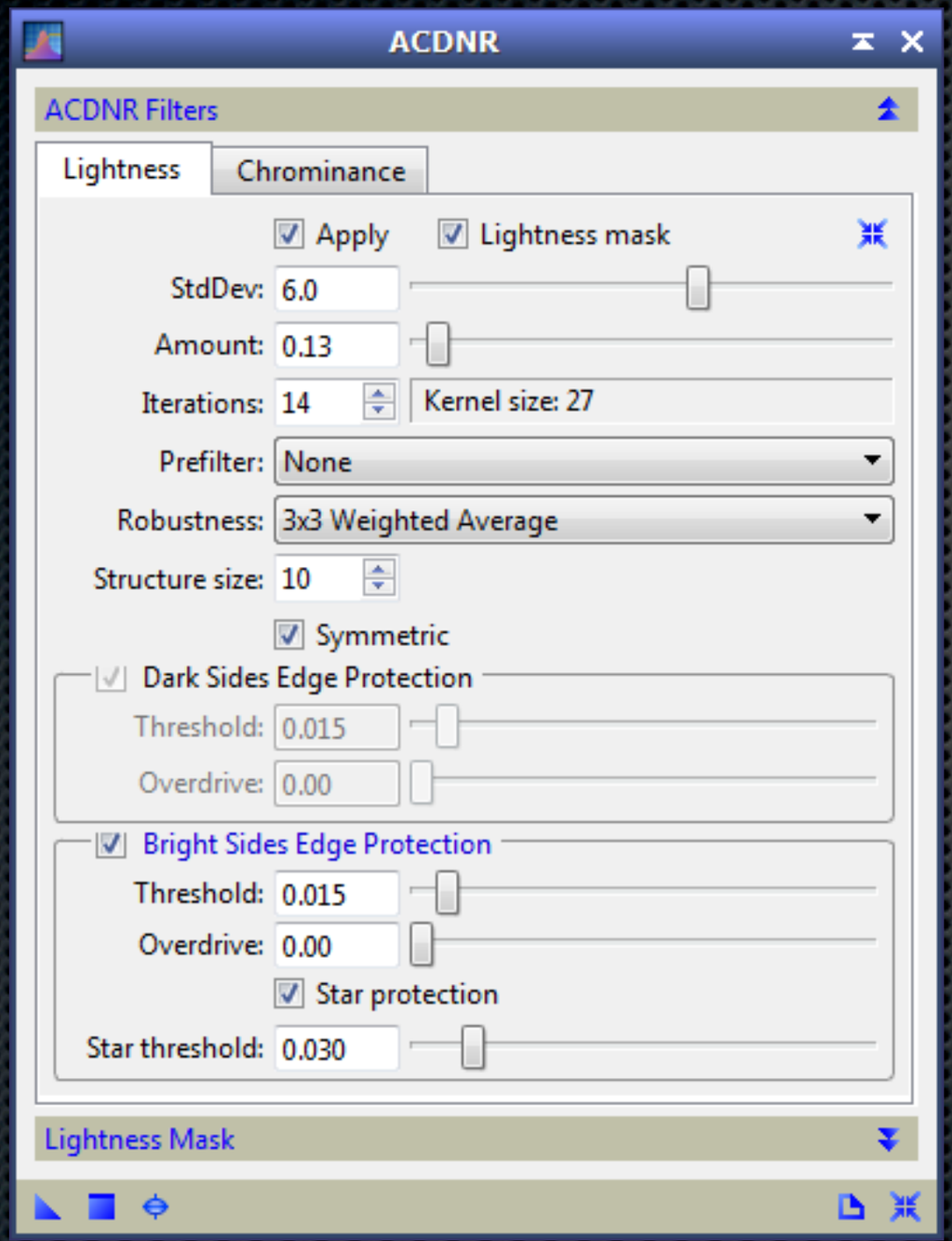
Smoothed wavelet layers: 4
Protected wavelet layers: 2

Le bruit... pas moins de 6 fonctions

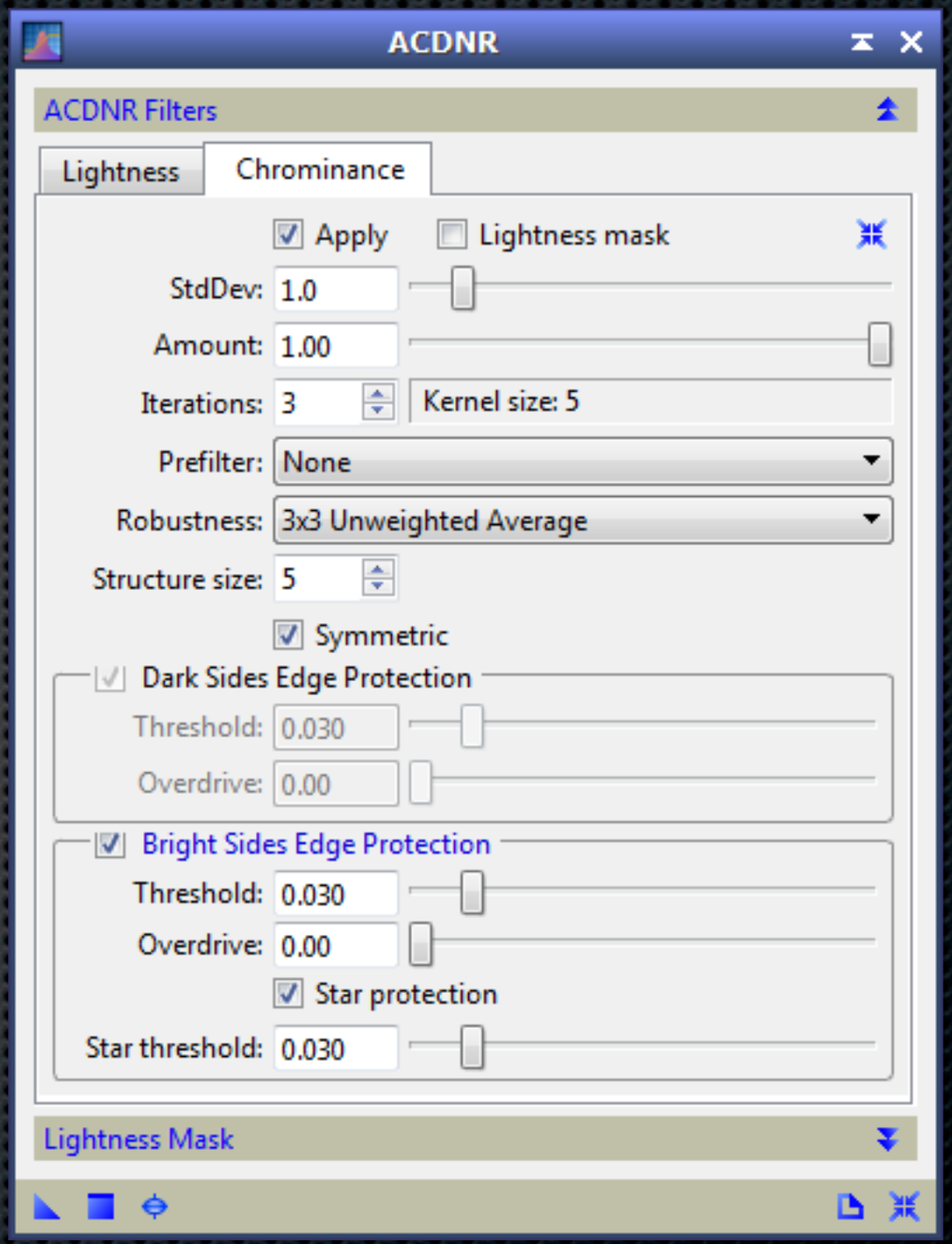
La réduction du bruit est souvent une étape clé du traitement mais c'est aussi une décision puisqu'il y a toujours un risque que l'algorithme détruise des données essentielles en plus du bruit.

- ACDNR *Adaptive contrast-driven noise reduction* (Lum+Chroma / non-linéaire)
- SCNR *Subtractive Chromatic Noise Reduction* (Chroma / non-linéaire)
- GREYCstoration (Lum / non-linéaire)
- ATrouWaveletTransform (Lum+Chroma / linéaire, non-lin.)
- MultiscaleMedianTransform (Lum+Chr / lin., non-lin)
- LRGB Combination (Chroma / non-linéaire)

ACDNR



Luminance

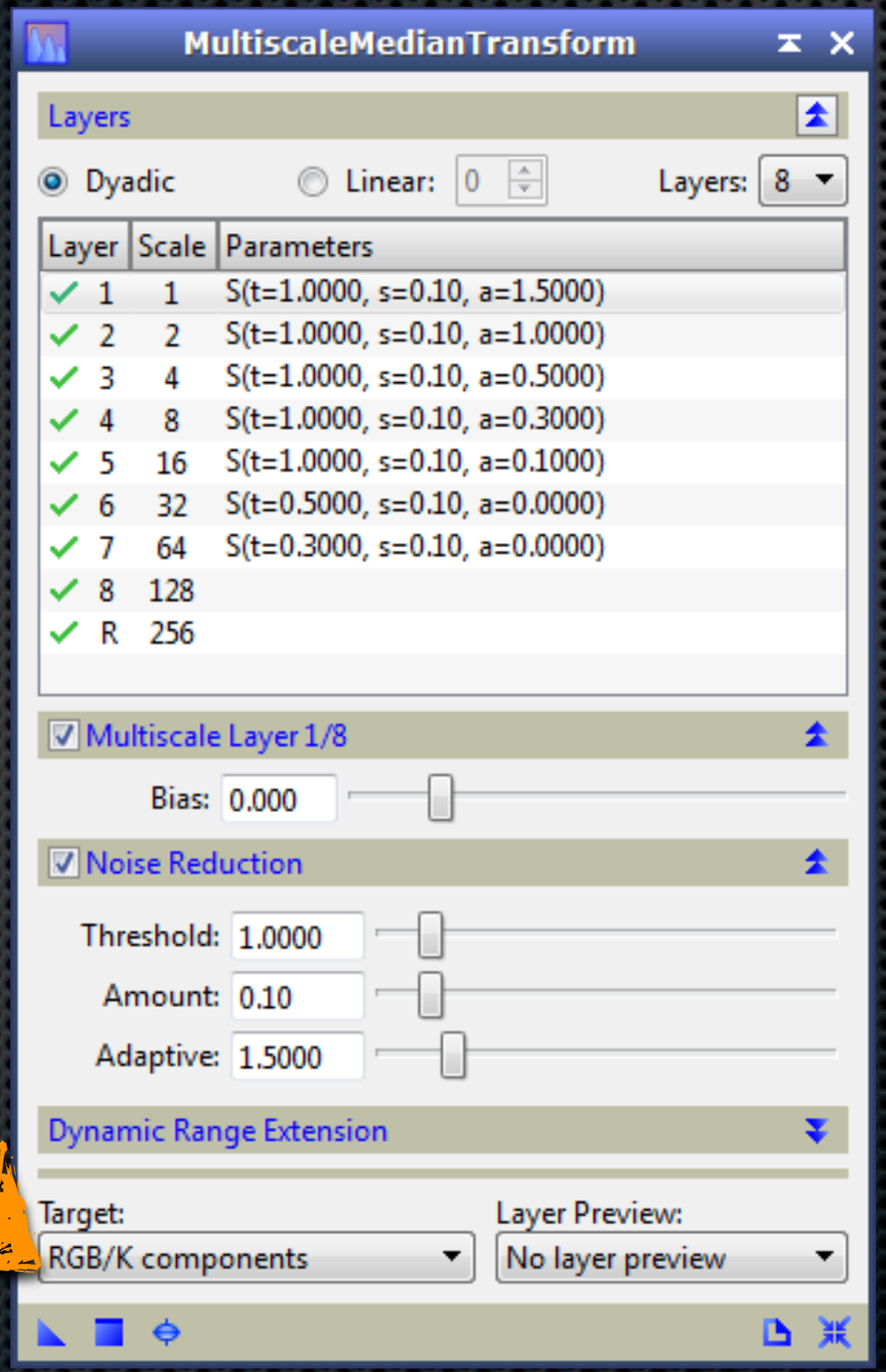


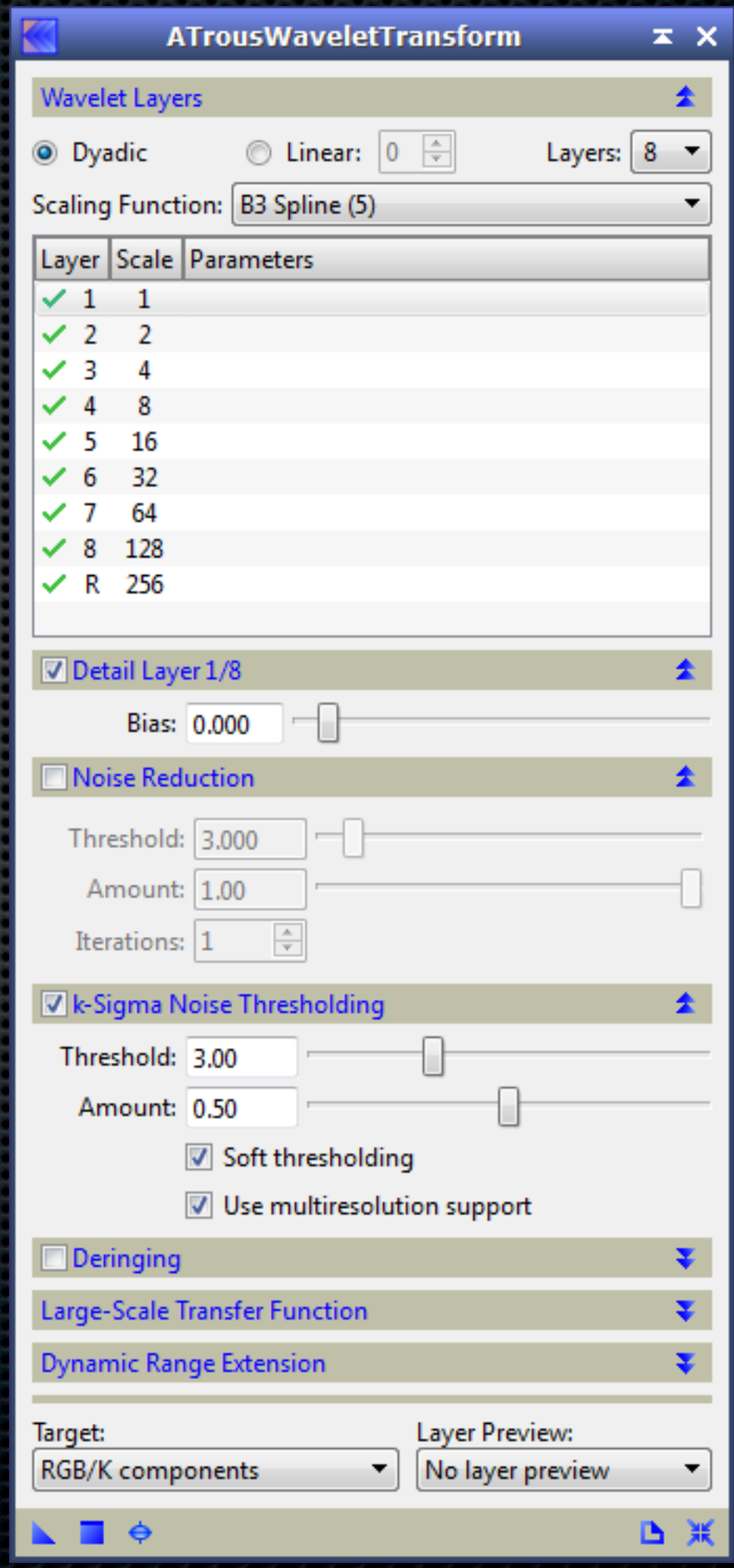
Chroma

MultiscaleMedianTransform
ATrouWaveletTransform

PixInsight

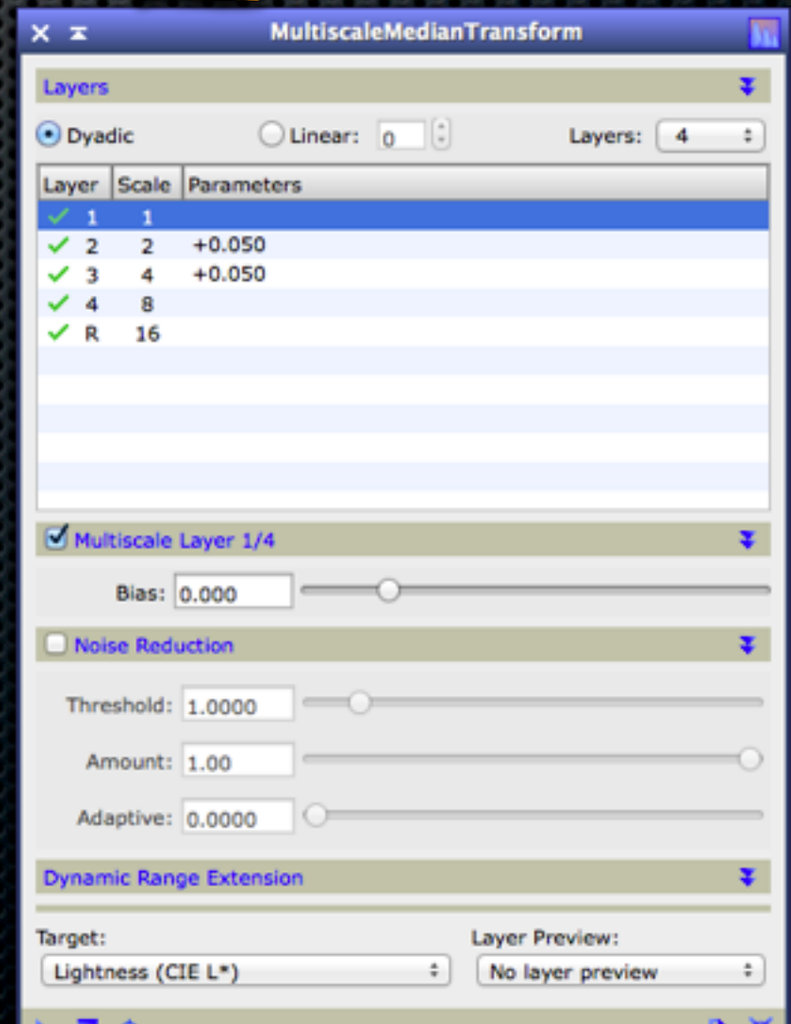
Luminance
et/ou
Chroma





L’accentuation… 5 fonctions

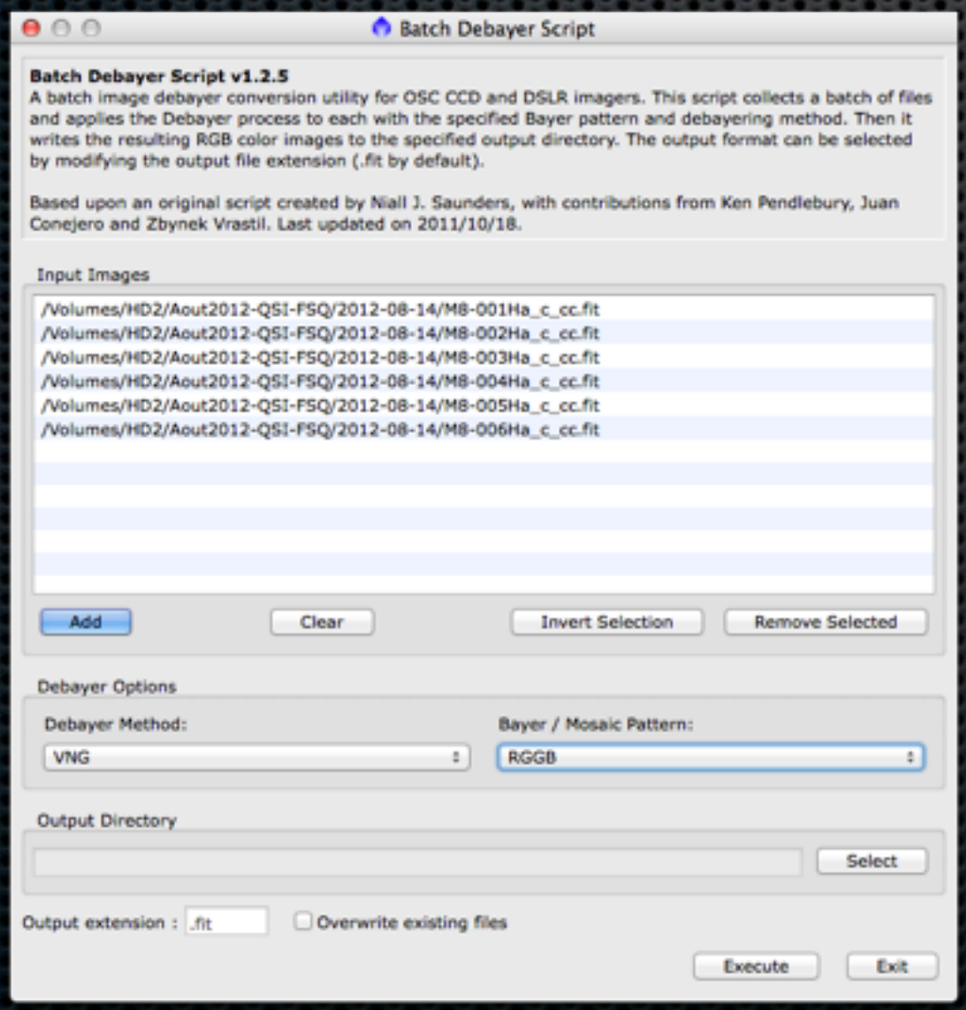
- UnsharpMask
- MultiscaleMedianTransform
- ATrouWaveletTransform
- RestorationFilter
- Deconvolution

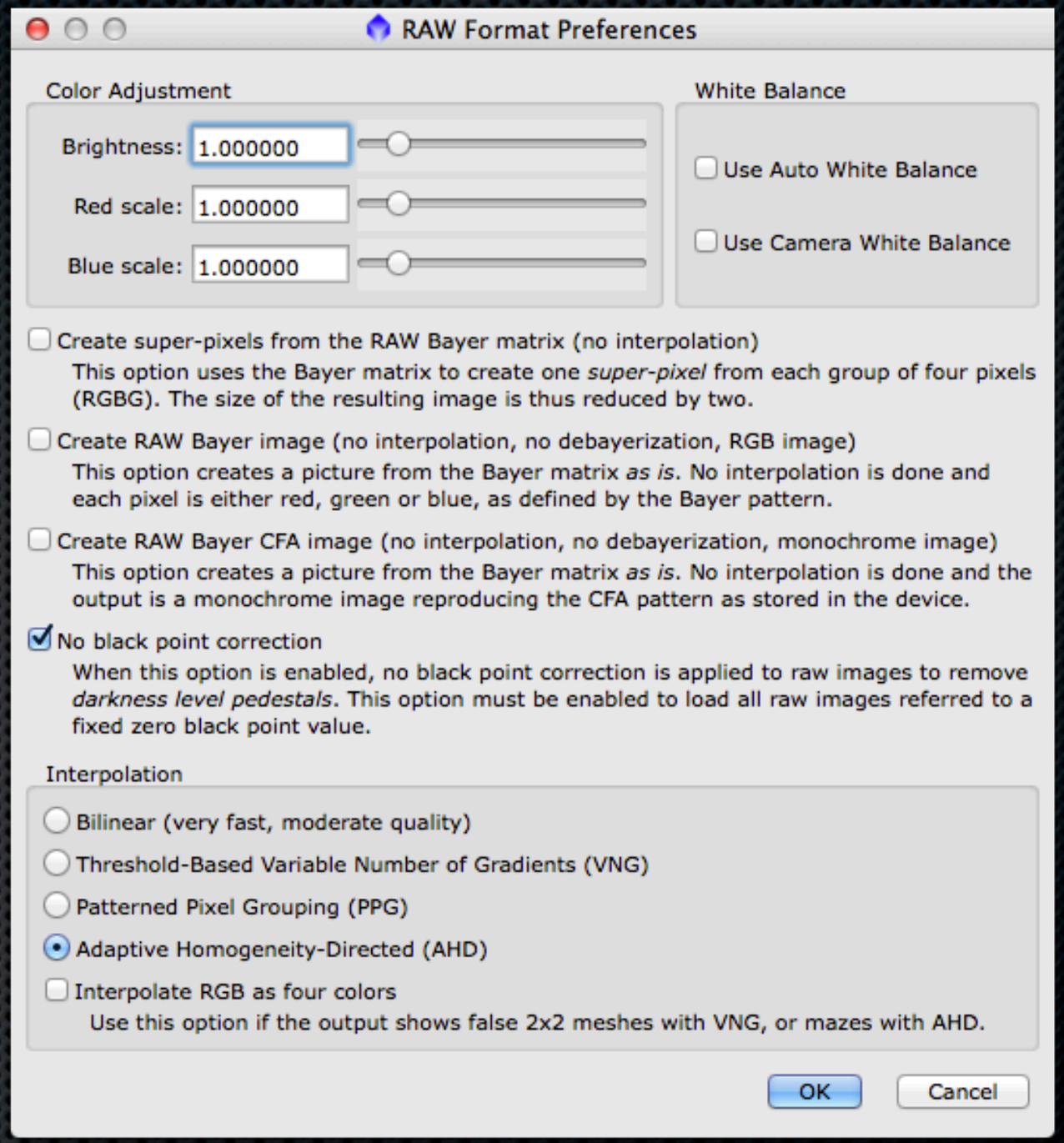


Les APN

- RAW
- Debayer

PixInsight

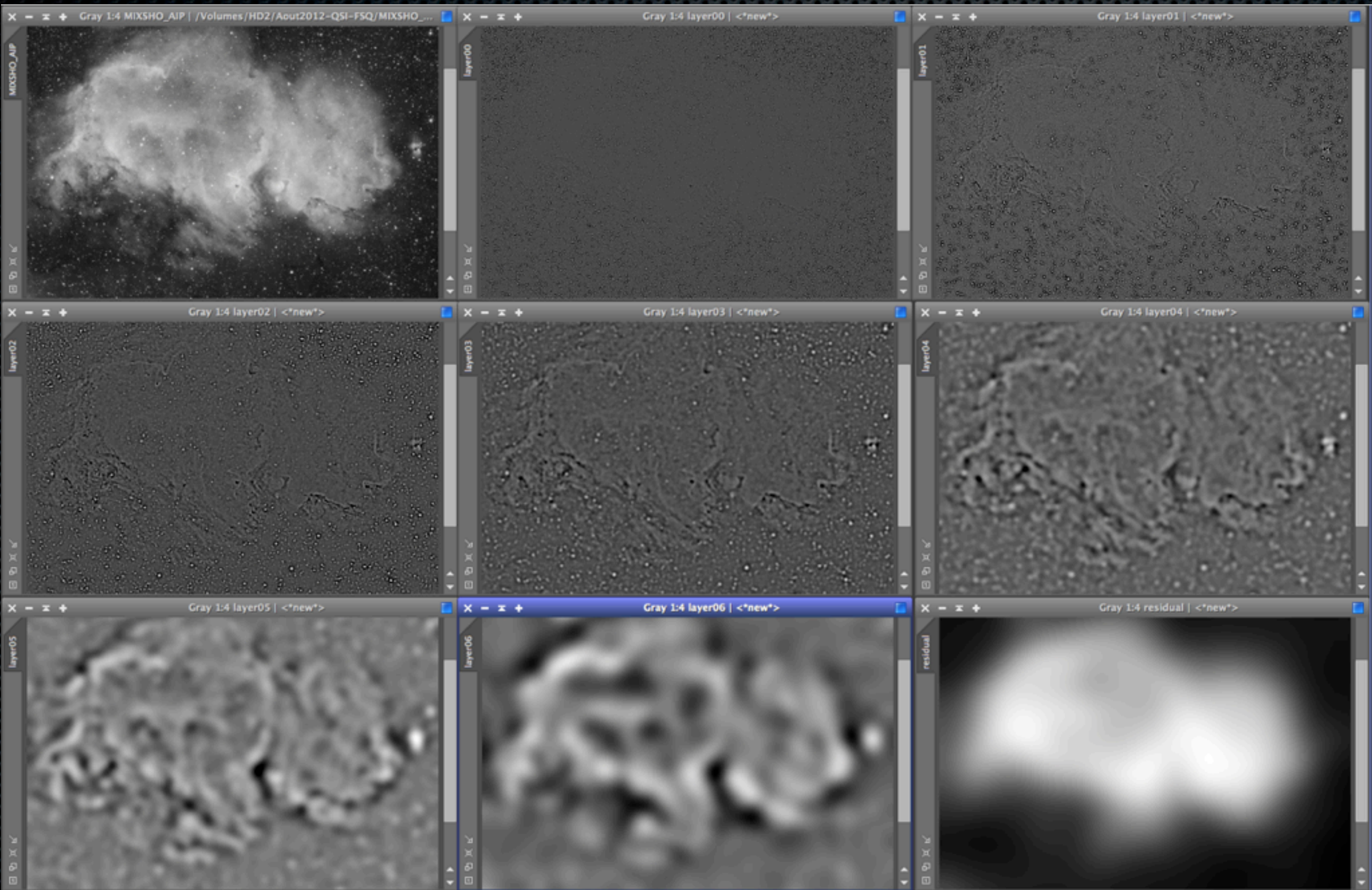




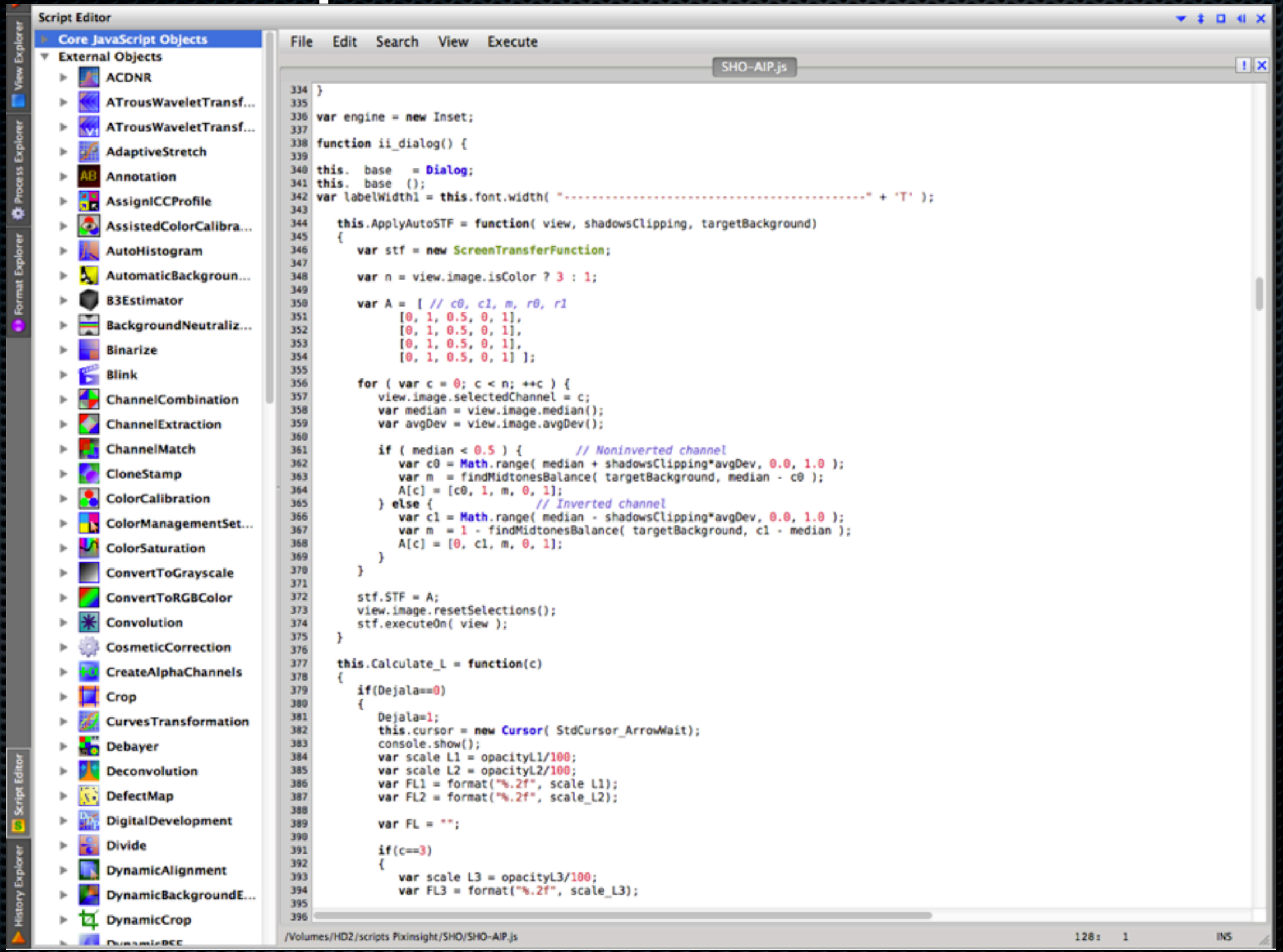
Et les autres...

- Fonctions géométriques
- Fonctions d'interpolation
- Couleurs
- Transformée de Fourier
- HDR sur plusieurs images
- Mosaïques
- *j'en oublie...*

Multiscale : analysez vos images



Les scripts




```
}

var engine = new Inset;

function ii_dialog() {

this.__base__ = Dialog;
this.__base__();
var labelWidth1 = this.font.width( "-----------------------------------------" + 'T' );

   this.ApplyAutoSTF = function( view, shadowsClipping, targetBackground)
   {
      var stf = new ScreenTransferFunction;

      var n = view.image.isColor ? 3 : 1;

      var A = [ // c0, c1, m, r0, r1
            [0, 1, 0.5, 0, 1],
            [0, 1, 0.5, 0, 1],
            [0, 1, 0.5, 0, 1],
            [0, 1, 0.5, 0, 1] ];

      for ( var c = 0; c < n; ++c ) {
         view.image.selectedChannel = c;
         var median = view.image.median();
         var avgDev = view.image.avgDev();

         if ( median < 0.5 ) {        // Noninverted channel
            var c0 = Math.range( median + shadowsClipping*avgDev, 0.0, 1.0 );
            var m  = findMidtonesBalance( targetBackground, median - c0 );
            A[c] = [c0, 1, m, 0, 1];
         } else {                     // Inverted channel
            var c1 = Math.range( median - shadowsClipping*avgDev, 0.0, 1.0 );
            var m  = 1 - findMidtonesBalance( targetBackground, c1 - median );
            A[c] = [0, c1, m, 0, 1];
         }
      }

      stf.STF = A;
      view.image.resetSelections();
      stf.executeOn( view );
   }

   this.Calculate_L = function(c)
   {
      if(Dejala==0)
      {
         Dejala=1;
         this.cursor = new Cursor( StdCursor_ArrowWait);
         console.show();
         var scale_L1 = opacityL1/100;
         var scale_L2 = opacityL2/100;
         var FL1 = format("%.2f", scale_L1);
         var FL2 = format("%.2f", scale_L2);

         var FL = "";

         if(c==3)
         {
            var scale_L3 = opacityL3/100;
            var FL3 = format("%.2f", scale_L3);
```

PixInsight 1.7 x86_64

RGB

RGB 1:2 MIXSHO_AIP | <*new*>

SHO-AIP Script v1.0.2

SHO-AIP v1.0.2 — Creation L et SHO, Mix L avec SHO —L.Bourgon & P. Bernhard

Window Preview Control

Mix (pixelmath) avec Rescall Auto STF

Couche 1: h % 100

Couche 2: s % 50

Couche 3: o % 33

Mix L avec 2 couches

Mode Melange 2C: AVERAGE

Mix L avec 3 couches

Mode Melange 3C : Screen

Mix SHO

Mix L-SHO

Methode AIP Flout It: 1

Nouvelle image

Images Selection:

Image L : L

Image SII : s

Image HA : h

Image OIII : o

Image NII : s

Couche pour Mix SHON

COUCHE Rouge --- % SII : 55

% HA : 45

% OIII : 0

% NII : 0

COUCHE Vert --- % SII : 10

% HA : 20

% OIII : 70

% NII : 0

COUCHE Bleu --- % SII : 0

% HA : 10

% OIII : 90

% NII : 0

OK

Les scripts

Le fun...

- ImageSolver
- AnnotateImage

```
putative star pair matches.
orming RANSAC ...
star pair matches in 130 RANSAC iterations.
ary of model properties:
ers      : 0.762
lapping  : 0.978
larity   : 0.964
ity      : 0.883
 mean square error:
 :  0.345 px
age RMS error deviation:
 :  0.284 px
 errors:
 :  1.381 px
 :  1.236 px
sformation matrix:
 -0.9997     -0.0255  +2064.7347
 +0.0257     -1.0001  +2012.4393
 +0.0000     +0.0000     +1.0000
e    : 0.999
tion :   -181.45°
     :  +2064.73 px
     :  +2012.44 px
3 s

ation 2, delta = 0.197 arcsec (0.1 pixels)
e center ..... RA: 02 55 08.279  Dec: +60 31 01.72
lution ....... 3.93 arcsec/pix

e Plate Solver script version 1.51
rentiation Matrix (Gnomonic projection = Matrix * Coords[x,y]):
    +0.001091148462     -0.000027856936     -1.084835520758
    +0.000028000633     +0.001090779784     -1.140105925929
    +0.000000000000     +0.000000000000     +1.000000000000
lution ....... 3.929 arcsec/pix
tion ......... 178.543 deg
l ............ 388.51 mm
l size ....... 7.40 um
d of view ..... 2d 13' 30.7" x 2d 13' 26.8"
e center ..... RA: 02 55 08.279  Dec: +60 31 01.72
e bounds:
op-left ...... RA: 02 46 37.861  Dec: +59 21 35.76
op-right ..... RA: 03 04 06.317  Dec: +59 24 54.37
ottom-left ... RA: 02 45 33.064  Dec: +61 34 44.36
ottom-right .. RA: 03 04 15.897  Dec: +61 38 16.98

--execute-mode=auto
plications/PixInsight64.app/Contents/src/scripts/ImageSolver+AnnotateImage/ImageSolver.js"

essing script file:
lications/PixInsight64.app/Contents/src/scripts/ImageSolver+AnnotateImage/ImageSolver.js
```

Pause/Abort

Image Plate Solver Script

Image Plate Solver v1.51 — A script for plate-solving astronomical images.
The values are initialized from existing WCS coordinates or the keywords OBJCTRA, OBJCTDEC, FOCALLEN, XPIXSZ and DATE_OBS if present.

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Image parameters

Right Ascension (hms): 2 55 7.747 — Search
Declination (dms): 60 31 1.62 S
Epoch (ymd): 2012 8 20
Image scale: Focal distance (mm): 388.509 / Resolution (arcsec/px): 3.92876
Pixel size (um): 7.4

Model Parameters

Local star catalog: /Users/Macbookpro/Documents/PPMX.bin
VizieR star catalog: PPMXL — CDS (vizier.u-strasbg.fr) Strasbourg, France
Limit magnitude: 12
Star sensitivity: -1.00 — Show stars
Maximum iterations: 4
Update FITS keywords
Add WCS keywords

Reset — OK — Cancel

RGB 1:2 L1LRVBtrgs_Annotated | <*new*>

```
Catalog TYCHO-2 size: 210 objects
```

Image Annotation Script

Image Annotation v1.11 — A script for annotating astronomical images.

This script draws on the image coordinate grids and symbols of objects extracted from different astronomical catalogs.
The script requires the image to have coordinates stored in FITS header keywords following the WCS convention.
The Image Plate Solver script can be used to generate these coordinates and keywords.

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Layers

Layer	Description
Grid	Grid in equatorial coordinates
NamedSt...	HD-DM-GC-HR-HP-Bayer-Flamsteed Cross Index(36
NGC-IC	NGC and IC catalogs (9900 objects)
TYCHO-2	Tycho-2 catalog (2,539,913 stars)
PGC	PGC HYPERLEDA I catalog of galaxies (983,261 galax
PPMXL	PPMXL catalog (910,469,430 objects)
Sharpless	Catalog of HII Regions - Sharpless (313 nebulaes)
VdB	Catalog of Reflection Nebulae - Van den Bergh (159

Grid Parameters
Show markers — Color: Custom (255,255, 0) 255 — Width: 1
Show labels — Font: SansSerif 22 Bold Italic — Color: Custom (255,255, 0) 255
Grid density: 10

General Properties
Output mode: Annotate image — Apply STF before annotation
Epoch (ymd): 2000 1 1
Vizier server: CDS (vizier.u-strasbg.fr) Strasbourg, France
Remove duplicate objects

Reset — OK — Cancel

IC1848 IC1848 Sh2-199

Une communauté active...

- site web : http://pixinsight.com/
- forum actif et riche en informations : http://pixinsight.com/forum/index.php
- AIP organise régulièrement des stages de formation à Pixinsight http://www.astro-images-processing.fr/
- Nombreux scripts et process développés par des utilisateurs
- tutoriels divers sur différents sites web

Merci…