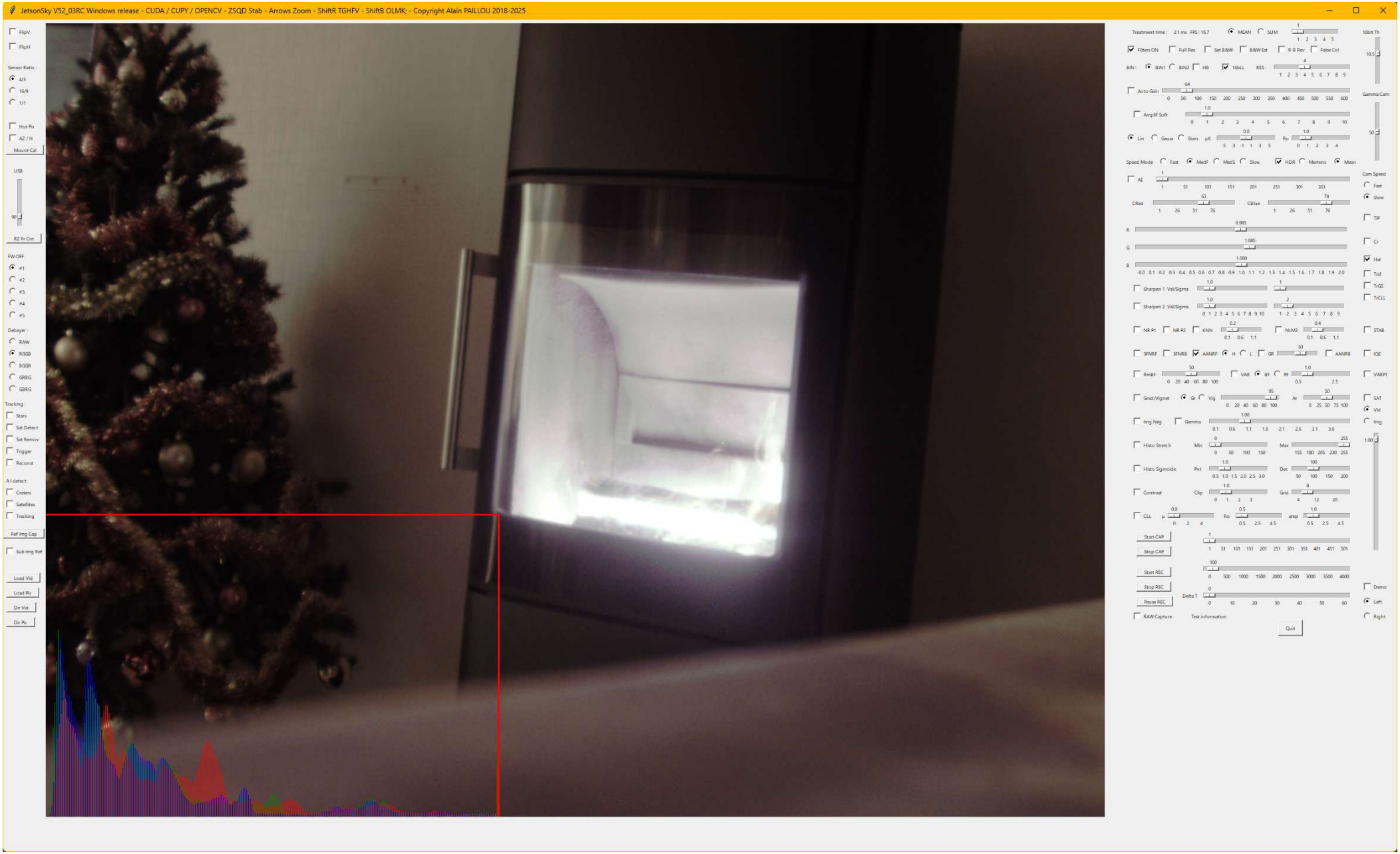

JetsonSky V52_03RC Windows release - CUDA / CUPY / OPENCV - ZSQD Stab - Arrows Zoom - ShiftR TGHFV - ShiftB OLMK: - Copyright Alain PAILLOU 2018-2025

JetsonSky is a Python based program and needs a Nvidia GPU and some Python libraries to work properly.

JetsonSky is mainly dedicated to live videos treatments of the deep sky with small exposure time (smallest as possible) with very high camera gain.

JetsonSky is free of use for personal and non commercial use. This software and part of this software are not free of use for professional and or commercial use.

It can control a ZWO camera but it also works with videos and images (no camera required).

I recommend **Python 3.11** version
Nvidia CUDA SDK required (I recommend SDK V12.1 or V12.3 ; I had some issues with V12.5 and above).

Libraries :
numpy
cupy
opencv (with or without CUDA)
pillow
psutil (optional)
pytorch (optional)
YOLOv8 (optional)
keyboard (Windows system)
pynput (Linux system)

Libraries provided in my Github JetsonSky directory :
Serfile (to manage SER video files)
zwoasi_cupy (if camera control needed, optional)
zwoefw (if filter wheel needed, optional)
synscan (only if you get a Skywatcher AZ-Gti mount, optinal)

IMPORTANT NOTE :

Some functions can be used from keyboard and you will have to choose in the main program which kind of keyboard layout you have. 2 options :

- **AZERTY keyboard**
- **QWERTY keyboard**

Lines 52-23 in JetsonSky :

If you have an AZERTY keyboard, you must have :
keyboard_layout = "AZERTY"
#keyboard_layout = "QWERTY"

If you have a QWERTY keyboard, you must have :
#keyboard_layout = "AZERTY"
keyboard_layout = "QWERTY"

CAMERA CONTROL MODE

Supported ZWO cameras :

ASI120MC, ASI120MM
ASI178MC, ASI178MM, ASI178MM Pro
ASI224MC
ASI290MC, ASI290MM
ASI294MC, ASI294MM, ASI294MC Pro, ASI294MM Pro
ASI385MC
ASI462MC
ASI482MC
ASI485MC, ASI585MC
ASI533MC, ASI533MM, ASI533MC Pro, ASI533MM Pro
ASI662MC
ASI676MC
ASI678MC, ASI678MM
ASI1600MC, ASI1600MM

Supported motorized filter wheel :

ZWO mini filter wheel 5 positions

Supported motorized mount :

SkyWatcher AZ-Gti

Now support 16 bits SER video format for post treatment.

You can download a 16 bits SER file here (this is a RAW file; you will need to debayer it in JetsonSky using RGGB pattern) :

https://drive.google.com/file/d/1qPviaGZvQkVqvf6GS91-7f4pXqau4PD-/view?usp=sharing

Main Window LEFT SIDE controls (up to down) :

Flip V : Flip the image vertically (Camera is performing the flip)

Flip H : Flip the image horizontally (Camera is performing the flip)

Sensor Ratio : select the camera sensor ratio Width / Height (3 possibles ratios : 4/3, 16/9, 1/1)

Hot pix checkbox : select to remove hot pixels

AZ/H checkbox : will display azimutal coordinates of the center of the image (use only if you connected with an AZ-Gti with WIFI)

Mount Cal button : click on the button to calibrate the mount coordinate (use only if you connected with an AZ-Gti with WIFI). You must set the mount to center Polaris star. Then, click on the button to make coordinates calibration

USB slider (from 0 to 100%) : select the USB bandwidth for the USB camera connection. Default value is 95. Try other values to get highest frame rate.

Button **RZ Fr Cnt** : Reset the frame count in the Text In Picture information

FW selection boxes : only for ZWO mini filter wheel 5 positions control. Display **ON** if the filter wheel is detected. If not, display **OFF**

Select the filter wheel position you want (from 1 to 5).

Debayer : those selection boxes allow you to select the bayer matrix of your color sensor. 5 possibilities :
RAW (no debayer)
RGGB
BGGR
GRBG
GBRG

Tracking check boxes :
Stars : detect stars
Sat detect : detect satellites using OpenCV functions
Sat remove : remove the satellites from the video capture

Trigger : allow video capture only if satellites are detected
Reconst : Reconstruct image with theoretical stars and/or satellites (if you select stars and/or satellites detection)

AI detect (artificial intelligence) :
Craters : detect Moon craters (YOLOv8 model)
Satellites : detect satellites (YOLOv8 model)
Tracking : plot the detected objects trajectories

Button **Ref Img Cap** : capture a reference image
Sub Img Ref checkbox : subtract the reference image to the video

Button **Dir Vid** : open dialog box to select Videos directory (for video captures saving)

Button **Dir Pic** : open dialog box to select Pictures directory (for images captures saving)

Main Window RIGHT SIDE controls (up to down) :

Information about treatment time (filters) and FPS

MEAN, SUM and #FS slider : perform the mean (median) or the SUM of 2 to 5 images.

Filters ON : checked : the filters are active. Unchecked : no filtering (even debayering).

Full Res : display the center of the Full resolution image (depending of the resolution set). Useful for telescope fine tuning. You can navigate in the image using **arrows keys** to focus on a specific part of the video.

Set B&W : convert a color image into a monochrome image.

B&W Est : works only with color camera. Calculate the luminance you should have with a monochrome sensor. This allow you to get much more signal with a color sensor, without having to much noise. This is useful to get quite low exposure time.

R-B Rev : only for colr sensor. Reverse red and blue channels.

False col : apply false colors to the video

BIN1 : set the camera sensor in BIN1 mode

BIN2 : set the camera sensor in BIN2 mode

HB : hardware BIN (for supported cameras). Only works in BIN2 mode. Hardware BIN gives you the mean of the 4 neighbors pixels instead of the SUM (lower noise). Software BIN (default choice) performs the sum of the 4 neighbors pixels (higher noise but more signal).

16bLL : allow 16 bit camera capture

16bit Th slider : Allow to choose the significant bits in 16 bits mode capture.
If you choose 14 for example, I will keep bits from 1 to 14 (every bit above will be set to maximum) and the result image will be converted to 8 bits format.
If you choose 11, I will keep bits from 1 to 11 (every bit above will be set to maximum) and the result image will be converted to 8 bits format.

This will allow you to amplify small signals in the video.

This works with gray conversion, B&W estim and BIN2 mode.

RES & slider : select the resolution of the camera within 9 defined resolutions (7 for BIN2 mode).

GAIN : set the camera sensor gain. The max gain depends of the camera characteristics.
Auto : the gain will be adjusted by the camera

Gamma Cam : set the gamma correction of the camera (from 0 to 100). The camera perform the gamma adjustment.

Ampli Soft : software amplification of each pixel with 3 modes
- **Lin** : linear amplification for each pixel value (from 0 to 255)
- **Gauss** : the amplification is set with a Gaussian function you can adjust with 2 parameters (µX and Ro). This allow you to get selective amplification. Activate TrGS to see the Gaussian.
- **Stars** : the same as Gauss but it will only amplify Stars.

Speed Mode : for selecting the exposure time

Fast : from 100µS to 10mS
MedF : from 1 ms to 400ms
MedS : from 1 ms to 1000ms
Slow : from 500ms to 20000ms (20s)

HDR : HDR capture mode (multiple acquisitions with different exposure times) to improve video dynamic.

Note : with 16 bits acquisition, HDR is made with a single image capture. You will also have to set the **16bLL AND 16bit Th slider** value (12 for example). The 12 bits threshold image will be the brighter image and JetsonSky will calculate 3 other images (the darkest image will have a 16 bits threshold image) to create the HDR image result.

HDR based on 8 bits video capture needs several captures with different exposure times to create HDR images.

Mertens (slow) or **Mean** (fast) HDR method.

Exposition & slider : select the exposure time with the slider

AE : Auto exposure. The exposure time will be adjusted by the camera

Cam speed selection boxes : select the camera acquisition mode (can improve the FPS)
Fast : fast acquisition mode
Slow : slow acquisition mode (default)

CRed & slider : select the camera response for Red channel (camera internal setting)
CBlue & slider : select the camera response for Blue channel (camera internal setting)

R, G, B & the 3 sliders : software adjustment and fine tuning for the three channels red green blue

TIP : Text In Picture – Add the date, time, the frame number and the FPS in the upper left corner of the image

Cr : Draw a cross in the center of the image

Hst : Draw the histogram of the image (RGB or Mono histogram)

Trsf : Draw the adjustments applied to the image (modifications applied to the pixels – RGB or Mono) – related to software gamma, histo stretch and histo sigmoïde)

TrGS : Show the amplification applied to each pixel – Related to Ampli Soft with 3 kinds of amplification : Linear, Gaussian and Stars – see on the RIGHT SIDE controls)

TrCLL : Show the transformation applied to each pixel using Contrast Low Light filter– Related to Ampli Soft with 3 kinds of amplification : Linear, Gaussian and Stars – see on the RIGHT SIDE controls)

Sharpen 1 & Val/Sigma sliders : will sharpen the image
Val : amount of sharpening
Sigma : level of sharpening detail (from fine to coarse)

Sharpen 2 & Val/Sigma sliders : the same as Sharpen 1. 2nd pass sharpening.

Note : If Sharpen 1 & 2 are actives, we get the result of the 2 sharpen filters

NR P1 : a personal noise removal filter (Paillou 1). Works on images and videos.
NR P2 : a personal noise removal filter (Paillou 2). Works on images and videos.

Dn KNN & **slider** : KNN noise removal filter. The slider allow to choose noise removal level. Works on images and videos.

Dn NLM2 & **slider** : Fast NLM2 noise removal filter. The slider allow to choose noise removal level. Works on images and videos.

STAB checkbox : Allow video stabilization. You can choose the stabilization zone using **ZSQD (azerty keyboard)** or **QSAD (QWERTY keyboard)** and move the zone. You can increase or decrease the size of the zone using + or – key.

3FNRF checkbox : 3 frames noise reduction filter applied to the RAW capture video (front applying). Personal filter. Only works with video.

3FNRB checkbox : 3 frames noise reduction filter applied to the treated capture video (back applying). Personal filter. Only works with video.

AANRF : Adaptive Absorption Noise Removal filter applied to the RAW capture video (front applying). Personal filter. Only works with video.
You can choose **High dynamic** or **Low dynamic** option :
H : high dynamic
L : low dynamic with **GR** check box & **slider** : Ghost effect reducer – Can reduce the AADF ghost effect mainly for Low dynamic option.

AANRB : Adaptive Absorption Noise Removal filter applied to the treated capture video (back applying). Only high dynamic. Personal filter. Only works with video.

IQE checkbox : Image Quality Estimator. Useful to tune the image focus.

RmBF checkbox & slider : Remove Bad Frame. Can remove the blurry images. The slider allows to choose the quality threshold.

VAR checkbox : Allow to reduce variations between consecutive frames
2 selective boxes :
BF : Best frame; allow amount of variations considering the best frame of the video
PF : Previous frame : allow amount of variations considering the previous frame
The slider : allow a variation inside the % of variation between frame and reference frame (from 0,5 % to 3 %)
This filter is useful to manage atmospheric turbulence.

VARPT checkbox : same as VAR but this filter consider the post treatment image. VAR id Front treatment, VARPT is Back treatment.

Grad/Vignet : remove image gradient or image vignetting (**select in the checkbox the filter you want to apply**)
- **1st slider** : choose the threshold for the gradient/vignetting
- **2nd slider** : choose the attenuation of the gradient/vignetting correction

Img Neg check box : turns the image into a negative image

SAT checkbox : Image Color Saturation enhancement
Vid selectbox : better result with video
Img selectbox : better result with image
Slider from 0 to 40 :
0 : the video will be in gray levels
1 : no color modifications
above 1 : color saturation enhancement

Gamma & slider : modify the image gamma. Activate Trsf (LEFT CONTROL) to see how this filter works.

Histo Stretch & 2 sliders : modify the histogram. Activate Trsf (LEFT CONTROL) to see how this filter works.

Histo Sigmoide & 2 sliders : modify the histogram (sigmoide function). Activate Trsf (LEFT CONTROL) to see how this filter works.

Contrast CLAHE & slider : modify the contrast of the image

CLL : Contrast Low Light. Modify the contrast of the image mainly with low signal (no high signal amplification). 3 sliders µ, Ro and amp. Activate TrCLL checkbox to see how those parameters work.

Start CAP / Stop CAP buttons & slider :
Select the number of images you want to capture
Press Start CAP to start the images capture
Press Stop CAP to stop images capture
Note : don't forget to choose the capture quality you want by checking / unchecking HQ Capture

Start REC / Pause REC / Stop REC buttons & sliders :
Select the number of frames you want to capture with the **slider**.
If you select **0** with the slider, the number of frames will be set to **10000**.
Press Start REC to start the video capture
Press Stop REC to stop video capture
Press Pause REC to pause video capture
Delta T slider : set the number of seconds between 2 frames

HQ Capture : Select (or not) high quality for captures
High Quality : TIF for images and RAW videos
Low Quality : JPG for images and MPEG videos

Demo checkbox :
Left : the left side of the image is the RAW image – the right side of the image is the image with the treatments.
Right : the right side of the image is the RAW image – the left side of the image is the image with the treatments.

Quit button : exit the program

IMPORTANT : Some functions can be used directly from the keyboard

STAB : select the stabilization zone
with AZERTY keyboard :

up : z
down : s
left : q
right : d
increase zone surface : +
decrease zone surface : -

with QWERTY keyboard :
up : w
down : s
left : a
right : d
increase zone surface : +
decrease zone surface : -

Red channel alignment :
with AZERTY keyboard :
red up : t
red down : g
red left : h
red right : f
red reset : v

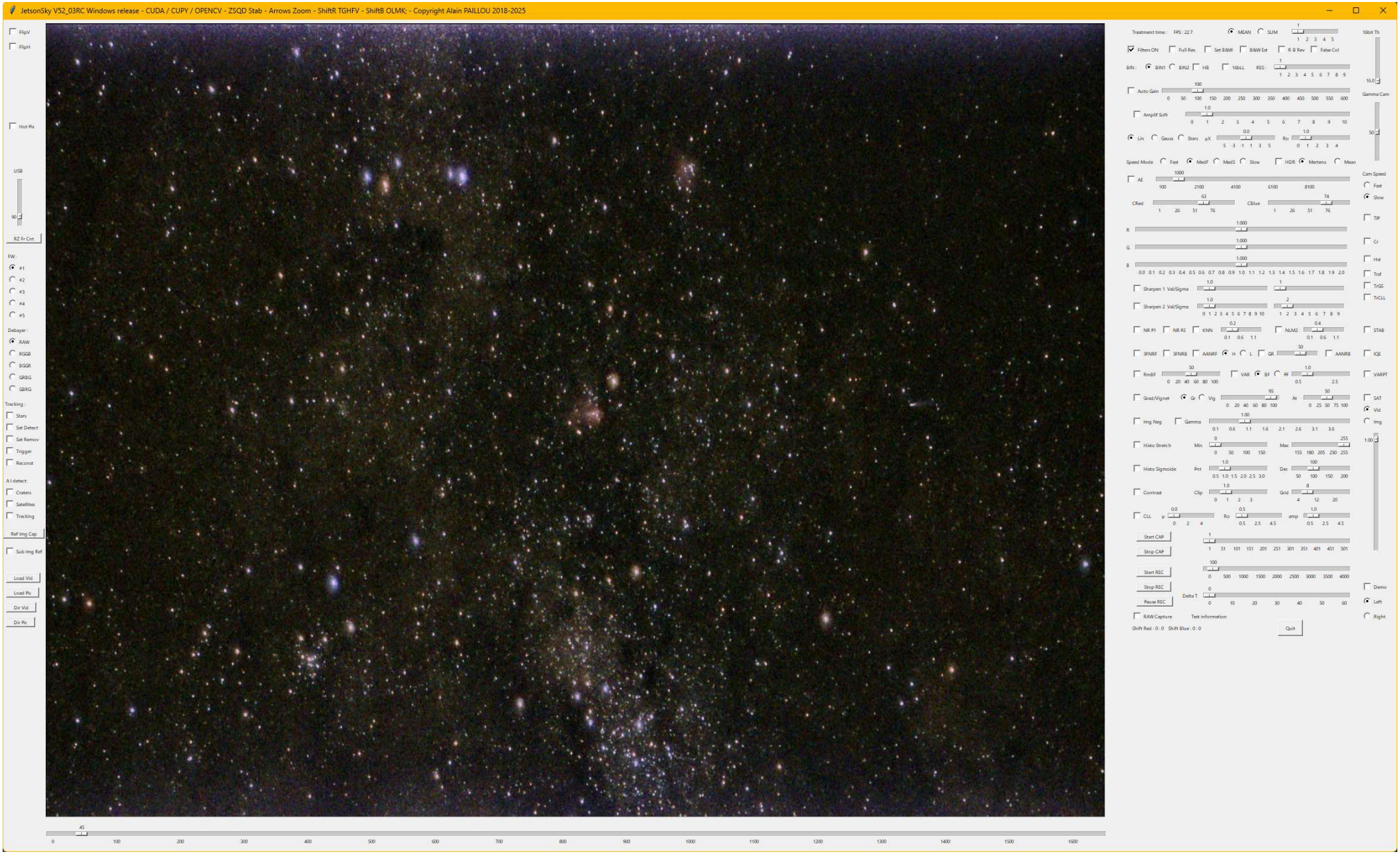
with QUERTY keyboard :
red up : t
red down : g
red left : h
red right : f
red reset : v

Blue channel alignment :
with AZERTY keyboard :
blue up : o
blue down : l
blue left : k
blue right : m
blue reset : ;

with QUERTY keyboard :
blue up : o
blue down : l
blue left : k
blue right : ;
blue reset : ,

Full res zoom – choose the part of the image :
Both AZERTY & QWERTY keyboards :
UP : up arrow
DOWN : down arrow
LEFT : left arrow
RIGHT : right arrow

VIDEO TREATMENT MODE (no camera control, no filter wheel and no mount control)



The camera control functions are not active.

Some small changes :

Debayer :
Select RAW if it is a RGB video

LOAD V/I button : open a dialog box to load the Video

RIGHT SIDE controls :

Information about FPS only.

If you load 16 bits SER video, you will be able to use :

16bit Th slider : Allow to choose the significant bits in 16 bits mode capture.
If you choose 14 for example, I will keep bits from 1 to 14 (every bit above will be set to maximum) and the result image will be converted to 8 bits format.
If you choose 11, I will keep bits from 1 to 11 (every bit above will be set to maximum) and the result image will be converted to 8 bits format.

This will allow you to amplify small signals in the video.

This works with gray conversion, B&W estim and BIN2 mode.

No need to select 16bLL because JetsonSky will consider that we have a 16 bits video.

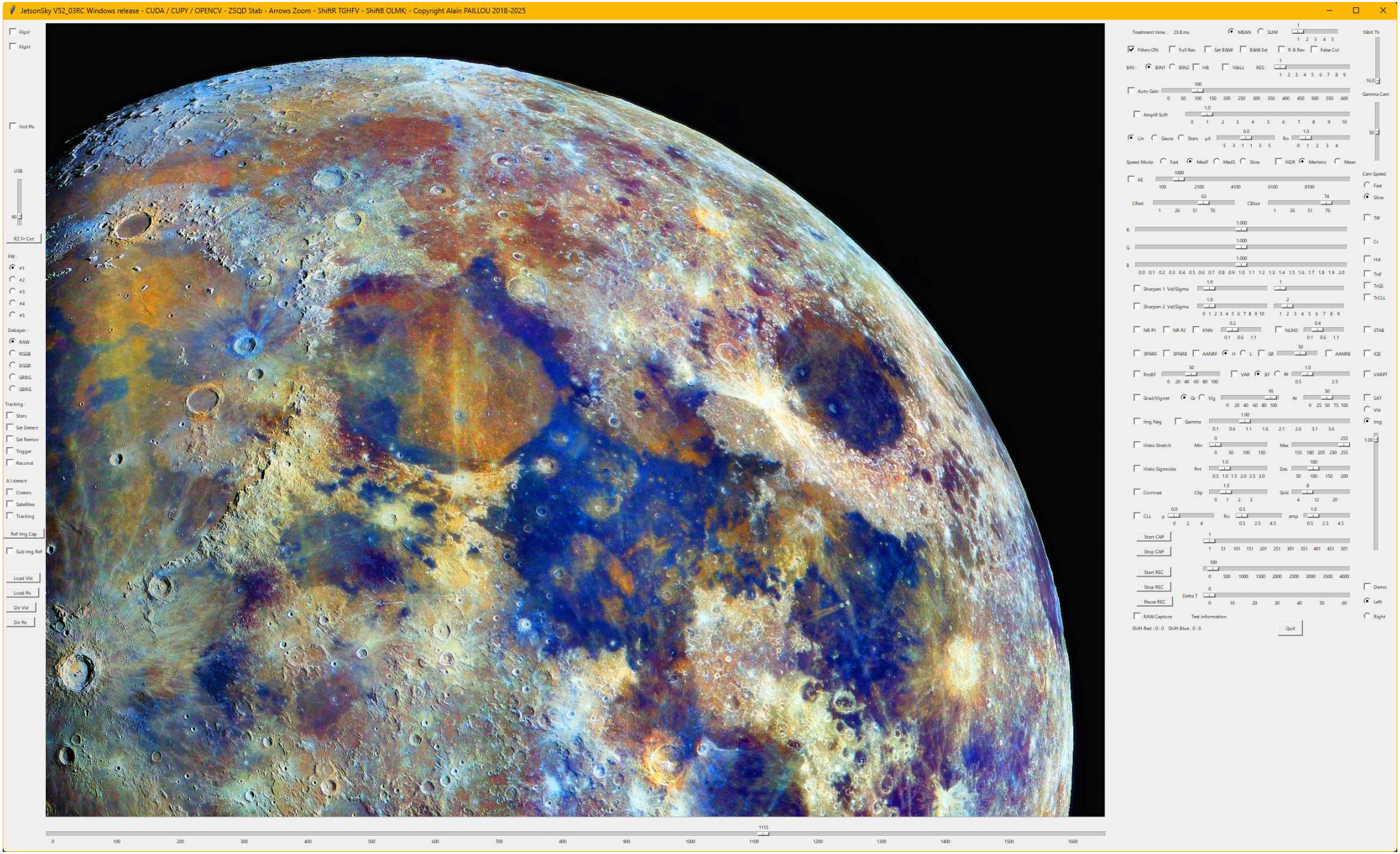
You can load a 8 bits SER file but in that case, 16bit Th slider won't produce any effect.

You can use BIN2 with a video (AVI or SER).

HDR with 16 bits video (SER format) will work just like it does when a camera is plugged.

HDR with 8 bits video (SER or AVI) won't produce any result.

IMAGE TREATMENT MODE (no camera control, no filter wheel and no mount control)



The same as Video mode except it is image treatment mode.

Debayer selection is not active. All images are considered as RGB images.

Some specific filters like 3FNR and AANR won’t be actives.

Only 8 bits RGB or monochrome images can be used.

Monochrome images will be considered as color images (R G B will be the same).