EXTRACTING OPTIMUM LIGHT CURVES FROM VIDEO

NAVIGATING THE OPTIONS IN TANGRA TTSO19 – 12 MAY 2025

DISCLAIMER!!!

- I'm not pretending to know everything about video image processing I will probably get bits wrong
- People in the room or online are free to add their own advice and to discuss things
- This talk is about image processing in Tangra
- Tangra does not have HELP information on these settings as most of them are not occultation/Tangra specific
- I will probably learn as much in this session as you will I certainly did in making this slide pack.

WHAT MAKES AN OCCULTATION OBSERVATION?

- We are not taking pretty pictures!
- Traditionally, we are looking to identify the TIMES of events.
- Increasingly needing some accuracy in photometry to discern double stars from double asteroids
- Massive impact on camera settings selection.
 - Need a light curve that makes the identification of the D and R times unambiguous
 - Balanced against frame rate to maximise time resolution
 - Saturation matters and take care with gamma setting
 - ... but that's another talk
- Don't expect software to fully compensate for a poorly captured video ...

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Measurement Type	act	2 sec f	
 Tracked Asteroidal Occultation 			
Tracked Mutual Satellite Event			
Tracked Variable Star or Transit Event			
Tracked Lunar Occultation			
O Untracked Measurement			
Tracking			
Faster O More Accurate			
Good for less-optimal conditions: faint or large stars, flickering, wind field rotation.			
🔽 Full Disappearance 🗌 Drift Through 🗌 Stop on lost tracki	ing		

OPENING THE VIDEO IN TANGRA

This is the default setting ... and will work well in 99% of cases.

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'MORE OPTIONS'

Allows you to specify how the photometry is done ... but nothing that can't be revisited with a 'Quick Reprocess' later ... so I don't bother. Get it done and create the LC file to tweak the photometry later.



SELECTING TARGET AND COMPARISON STARS

I always choose 'Fixed – Relative to Guiding Stars'. Maybe not if event is short, background is dark, long focal lengths used or seeing or wind shake is really bad.

If the event is reasonably long (e.g. more than 5 frames) suggest selecting brighter guide stars to ensure the measuring aperture stays put.

If the event is short (e.g. 3 or fewer frames) suggest selecting stars of comparable brightness to target, and more stars are better and process the maximum amount of video to build noise statistics for AOTA.

If there are multiple event (double asteroid or double star), suggest a range of brightness guide stars including fainter ones.



RUN THE PHOTOMETRY

Allow the photometry to run and produce a light curve.

Save the .LC file for more processing - it is the same as the video file but only has the interesting bits!

Aperture Photometry	~	4.1 🜲 15	÷ 5.4 ÷ 11 ÷
Digital filter:			
No Filter	~	4.12 px = 1.4 FWHM	5.37 px = 1.5 FWHM
Background from:		5.4 🜲 11	€ 1.0 € 11 €
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GET THE APERTURE RIGHT

Do a 'Quick Reprocess'

Slim Down the measurement aperture to contain only the peak. This applies irrespective of which Reduction method is used.

Load the Chandra example.

TANGRA PHOTOMETRY MAP



APERTURE PHOTOMETRY

- Pixel values within a measurement circle (usually) summed.
- See the backgrounds selected



PSF (POINT SPREAD FUNCTION) PHOTOMETRY

- Fits a curve to the pixel values within the aperture and assumes a Gaussian spread.
- Works best in crowded fields where star images overlap ... if you can't avoid that.
- Can have application if trying to detect a small drop in a saturated image – prone to failure so don't go there is you can avoid it.
- Quaoar example ... and why PSF is not always necessary.





OPTIMAL EXTRACTION PHOTOMETRY

- A relatively new technique specifically aimed at optimum extraction of faint stars.
- Assumes that there are no other influences on the signal other than "photon statistics"
- I don't have a working knowledge of how it works ... I have had good results ... in some cases.
- Chandra example. Aletta example if there is time.

FILTER SELECTION

- No Filter good if your background is quite dark and noise free.
- Low Pass Filter removes small scale (pixel to pixel) noise – effectively a blurring process.
- Low Pass Difference Filter I don't actually know how this differs from the above Low Pass Filter ... suspect it might be noise from frame to frame as compared to pixel to pixel in a given frame????
- If the star is substantially brighter than background then a filter adds little value.
- Consider a filter when using low gamma videos (i.e. noise is amplified) and faint stars.
- Aletta example

BACKGROUND SELECTION

- Many options several are basic statistical treatments of the background zone around the measurement aperture.
- Some are specific to PSF Full Analytical Quadrature ... there is no background aperture and so calculation is applied differently.
- Have seen that some of the PSF related background selections can produce wild outlier measures ... much like PSF itself can do by incorporating noise into the PSF when the star is faint.

TIME TO PLAY

- Very much encourage you to try different settings ... you can't break things.
- If you only do one thing SHRINK THE APERTURES!
- Once you have got a set of settings that work well, you can save a new copy of the .LC file.
- Questions?