SODIS

User Meeting 2025 Sep. 25

C. Weber | IOTA/ES, SODIS

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Overview

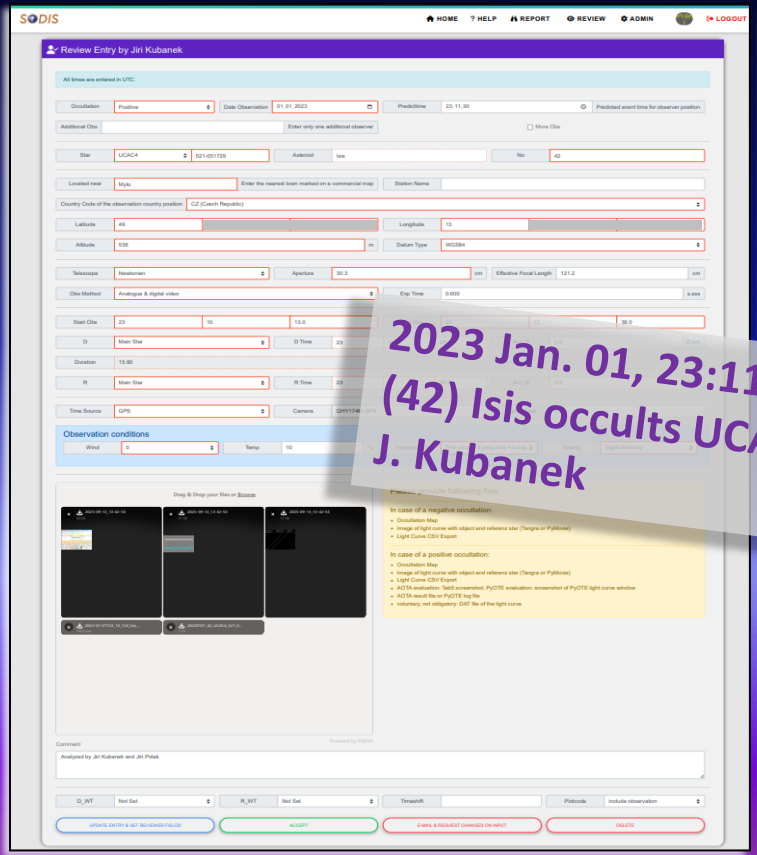
- SODIS current state
- Some SODIS highlights
- **SODIS news and useful tips**
- **Common errors in reporting to SODIS**
- SODIS Team wishes and outlook

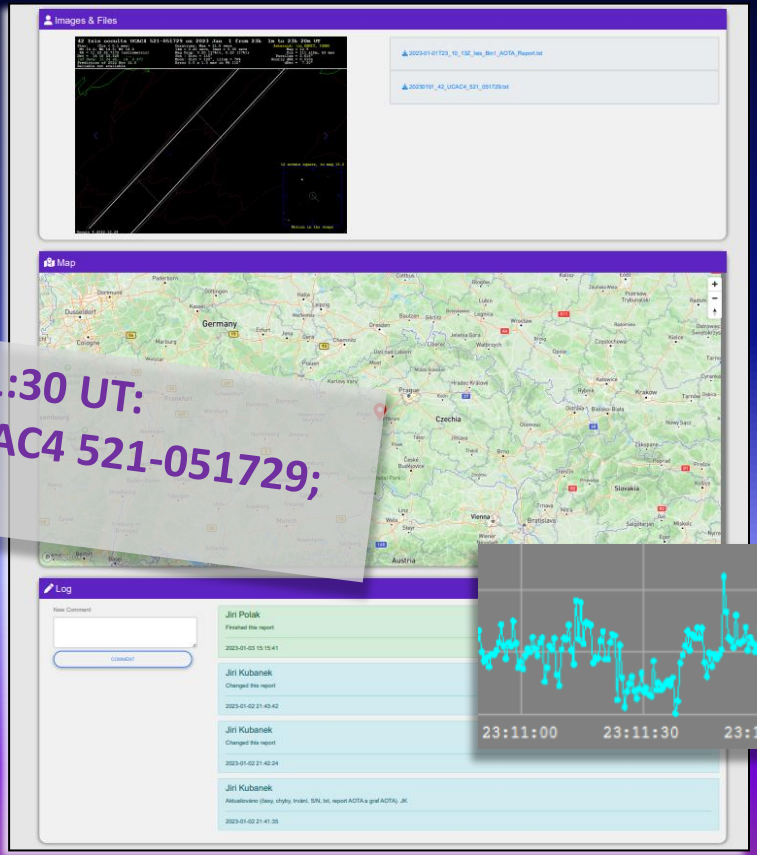
Most of the negative examples of use in the presentation come from real reports - they are largely anonymised. In the case of positive examples the name of the observer is usually given.

SODIS hot start: 2023 Jan. 01

… First positive report to SODIS:

First positive report to SODIS:





2023 Jan. 01, 23:11:30 UT:
(42) Isis occults UCAC4 521-051729;
J. Kubanek

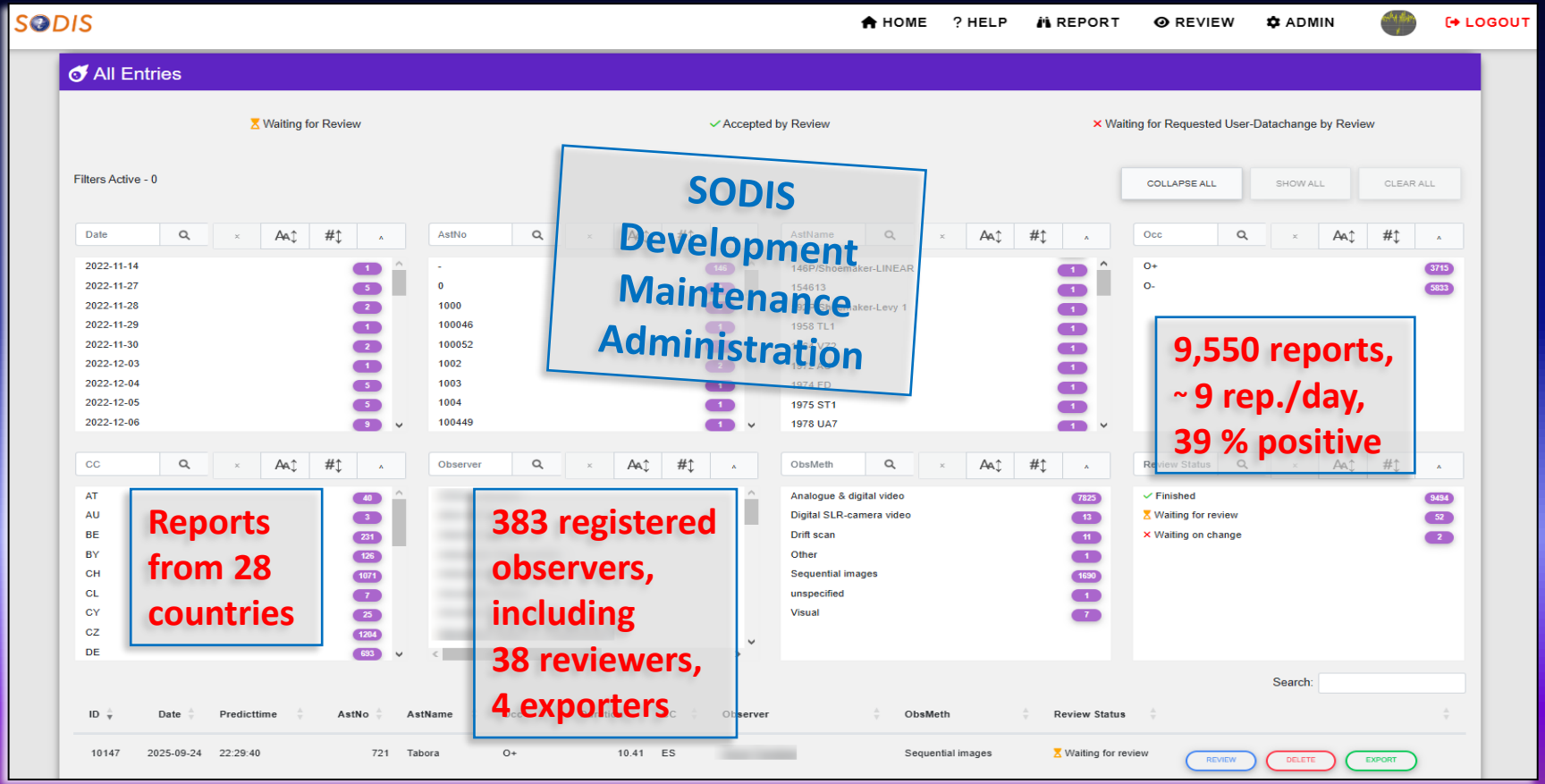
SODIS hot start: 2023 Jan. 01 …

… until today:

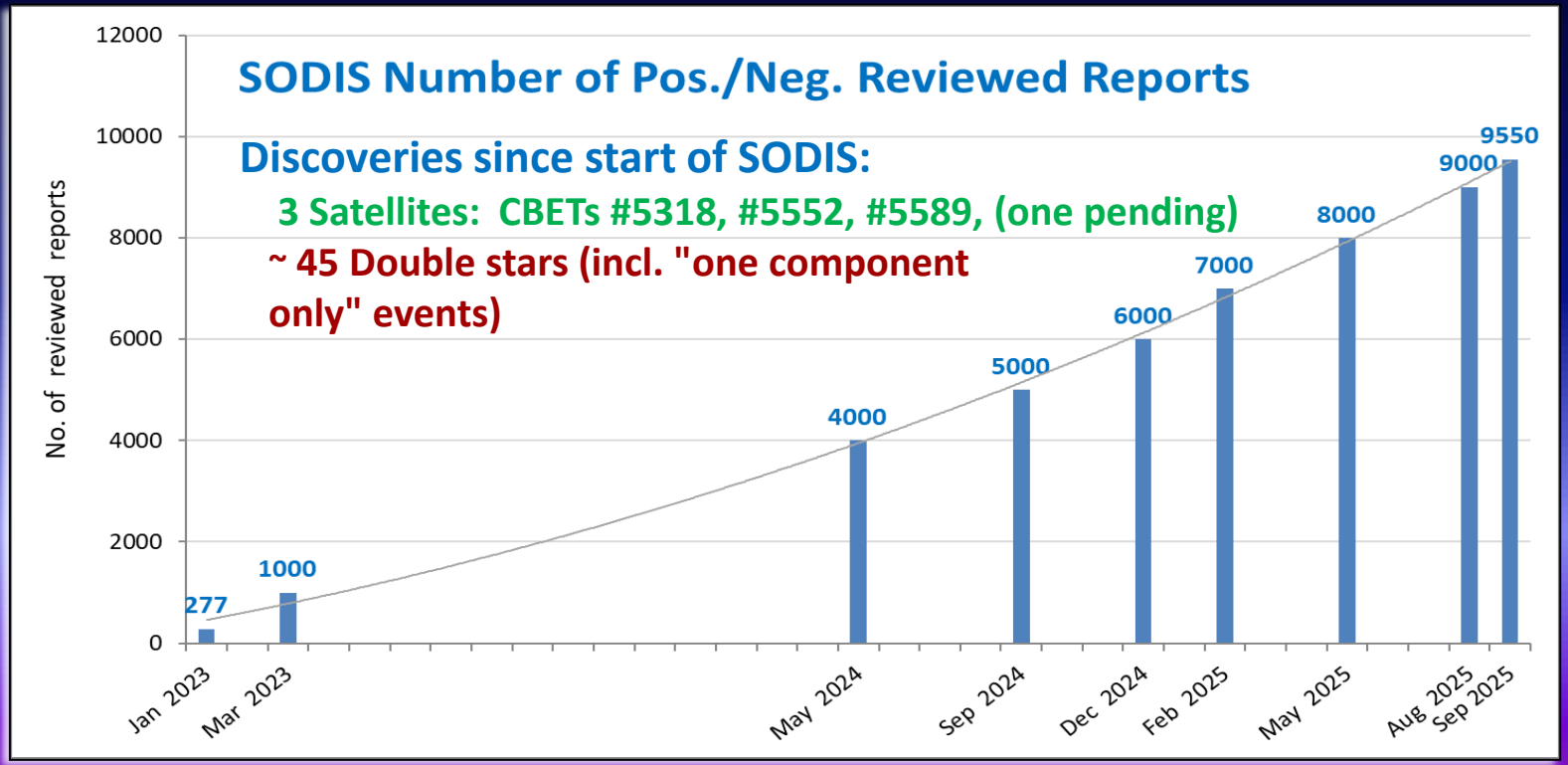
a success story …

SODIS current state

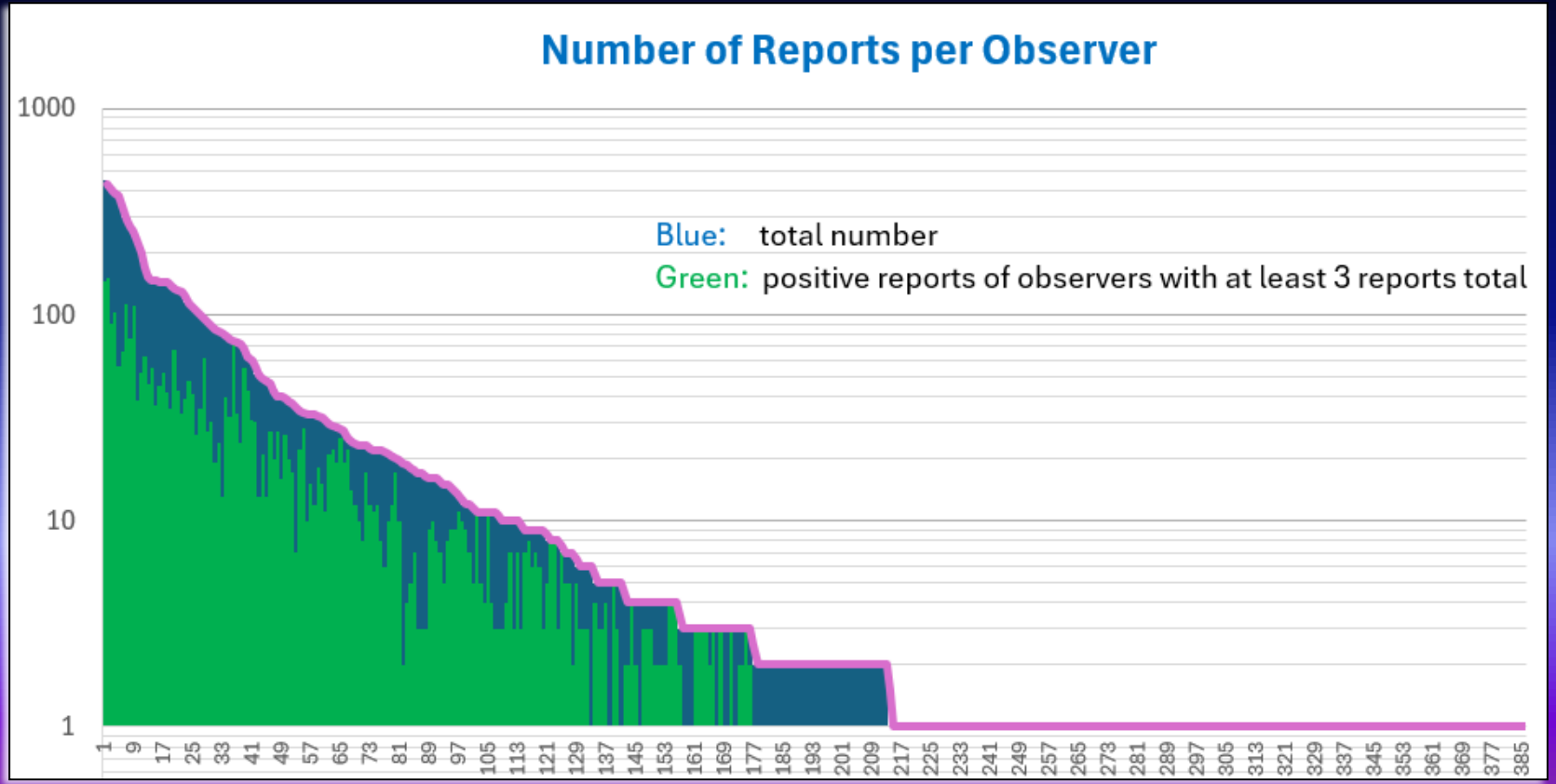
SODIS - 2025 Sep. 25 state



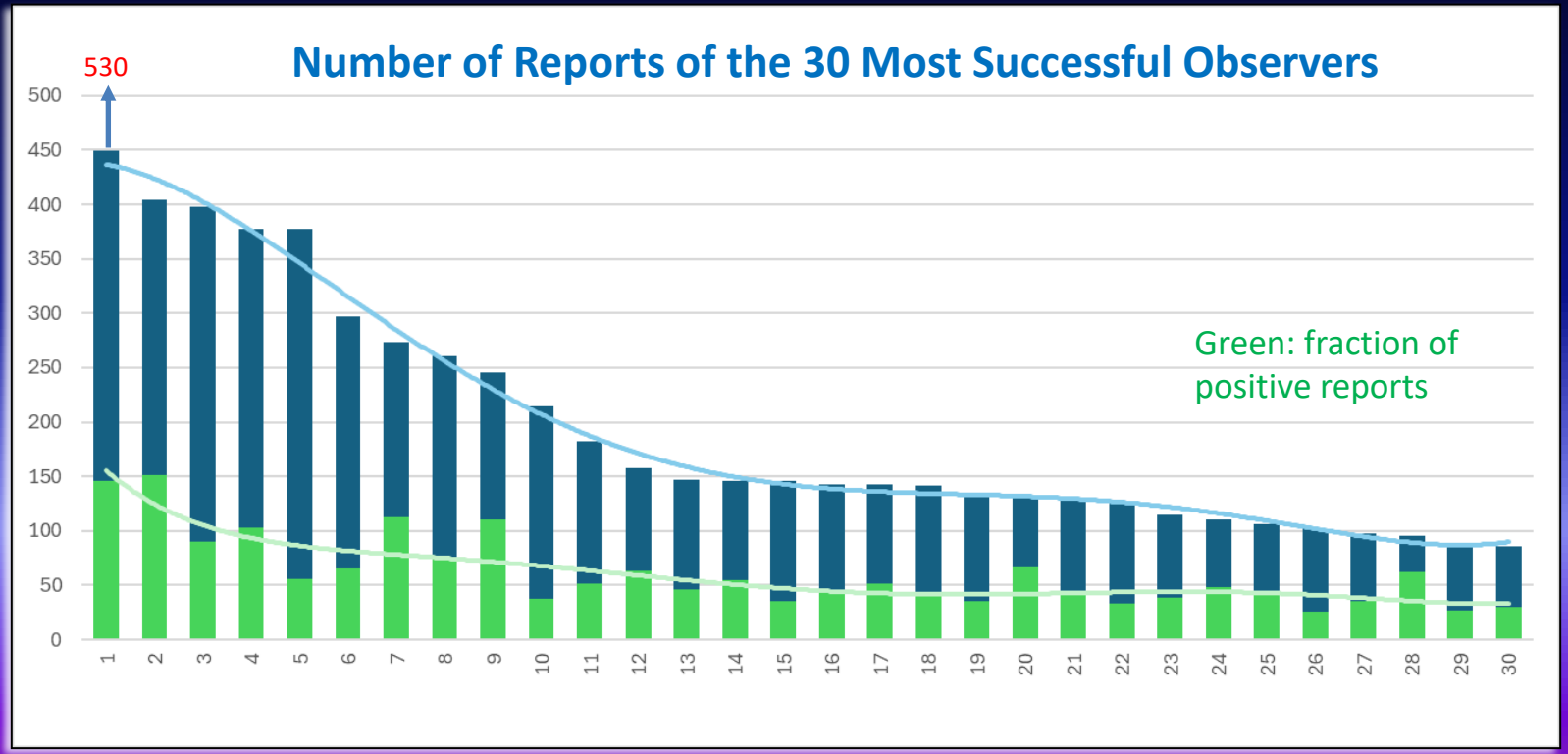
SODIS - 2025 Sep. 25 state



SODIS - 2025 Aug. 15 state

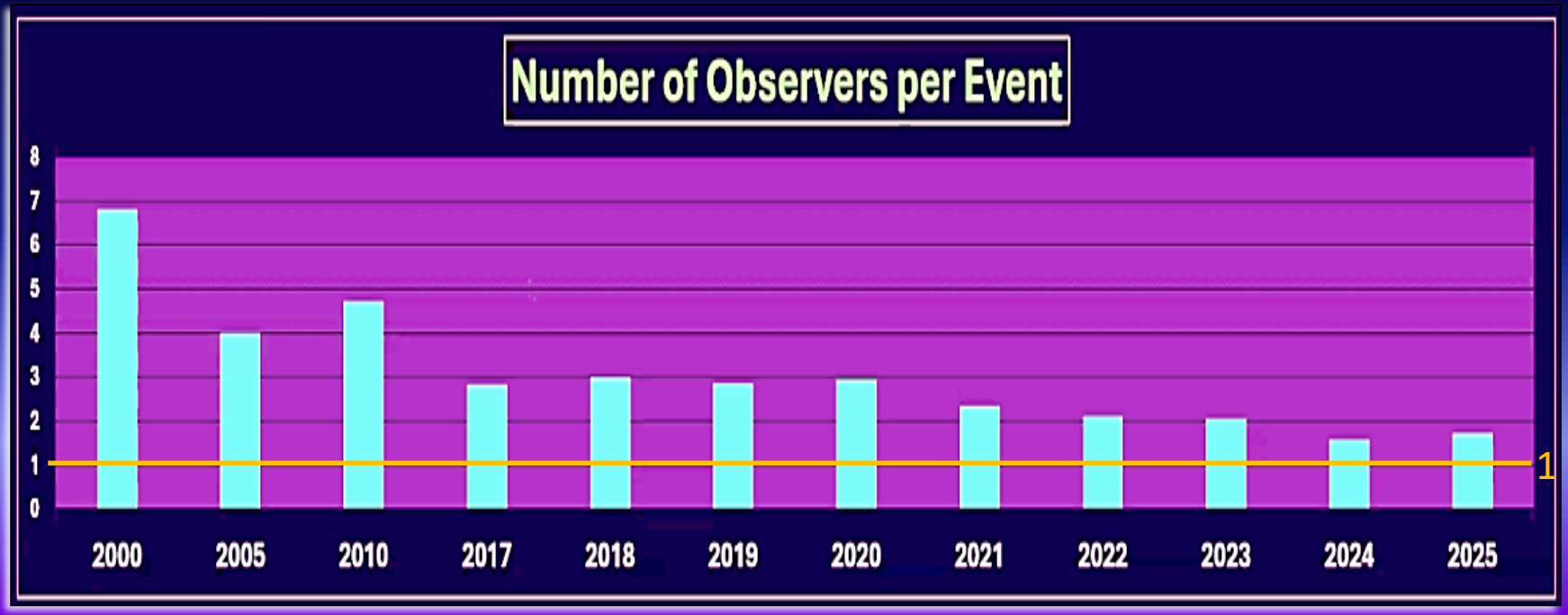


SODIS - 2025 Aug. 15 state

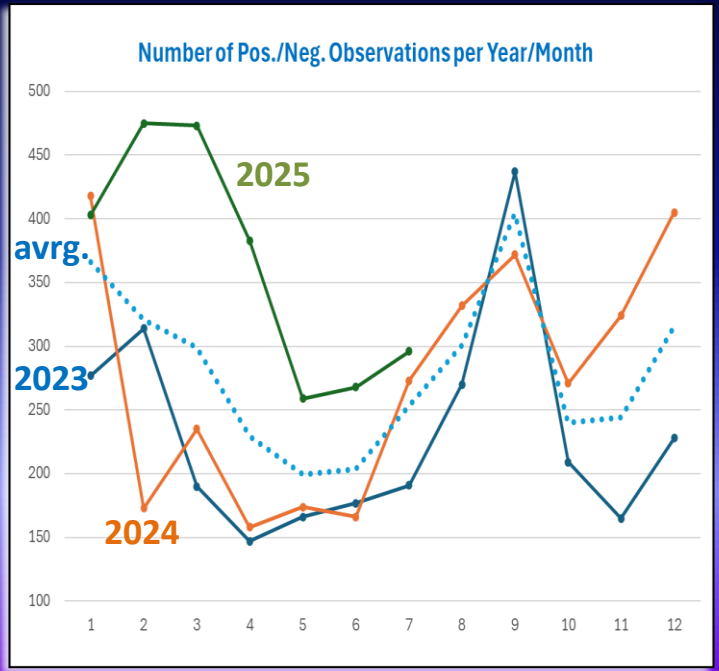


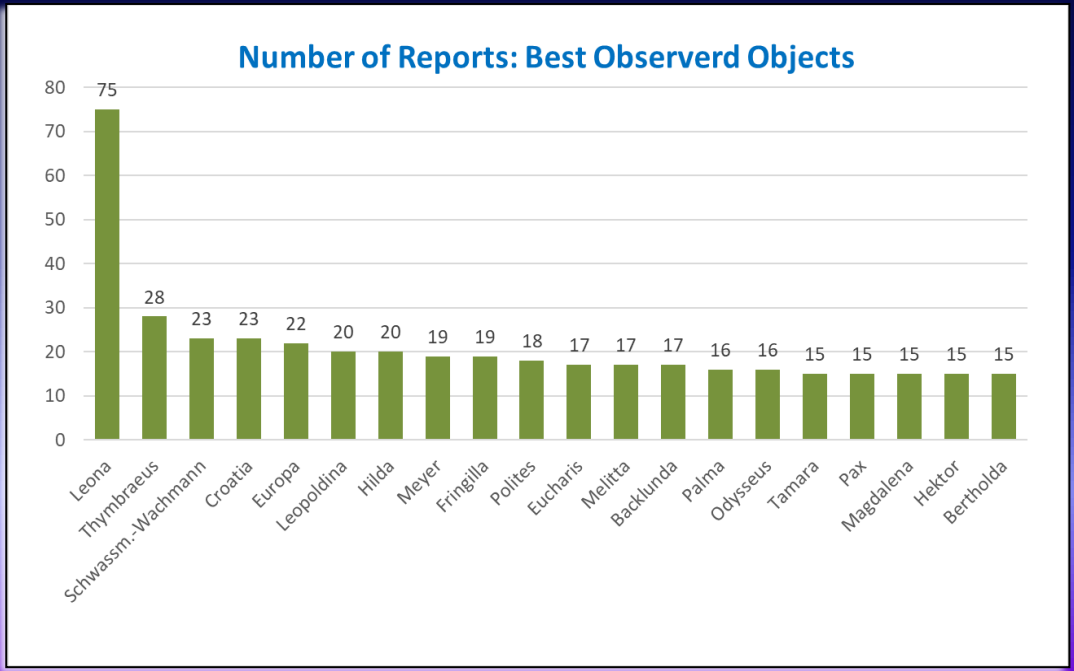
Occult worldwide

Credit: D. Herald



SODIS - 2025 July state



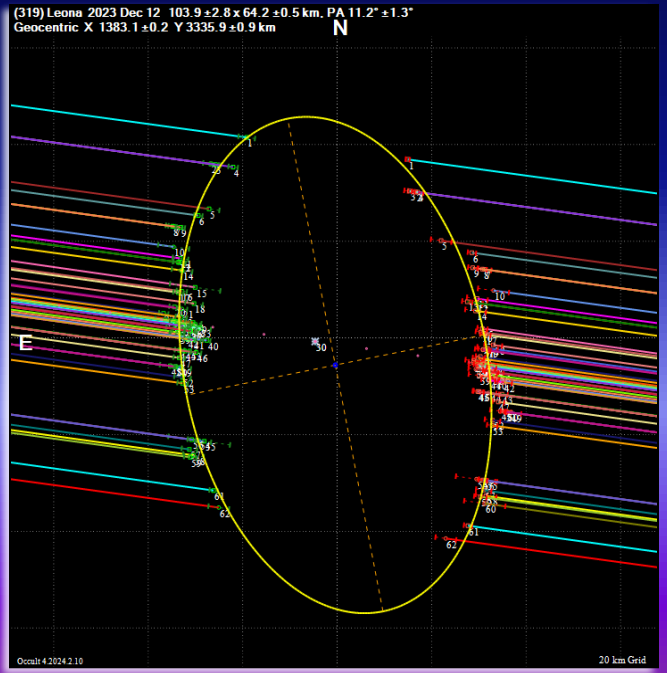


Some SODIS highlights

Highlights

Multi-chord events

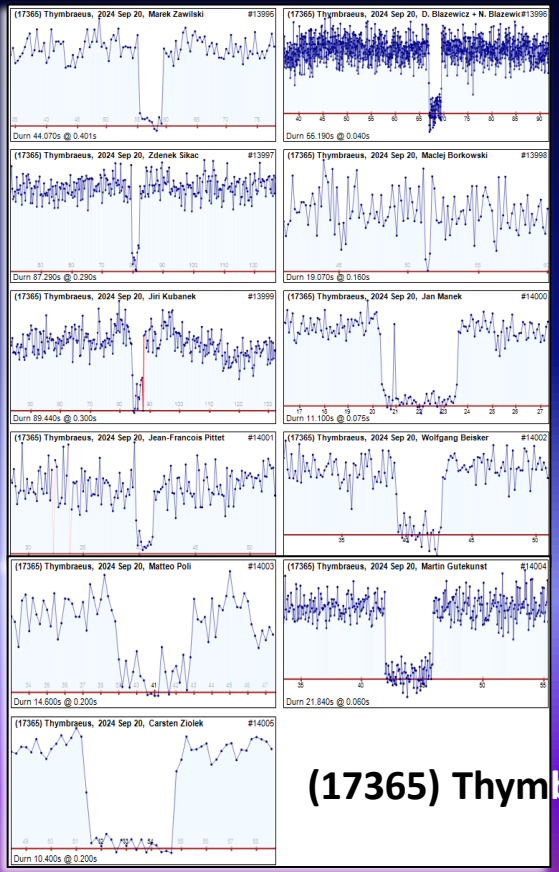
(319) Leona Betelgeuse occultation 2023 Dec. 12

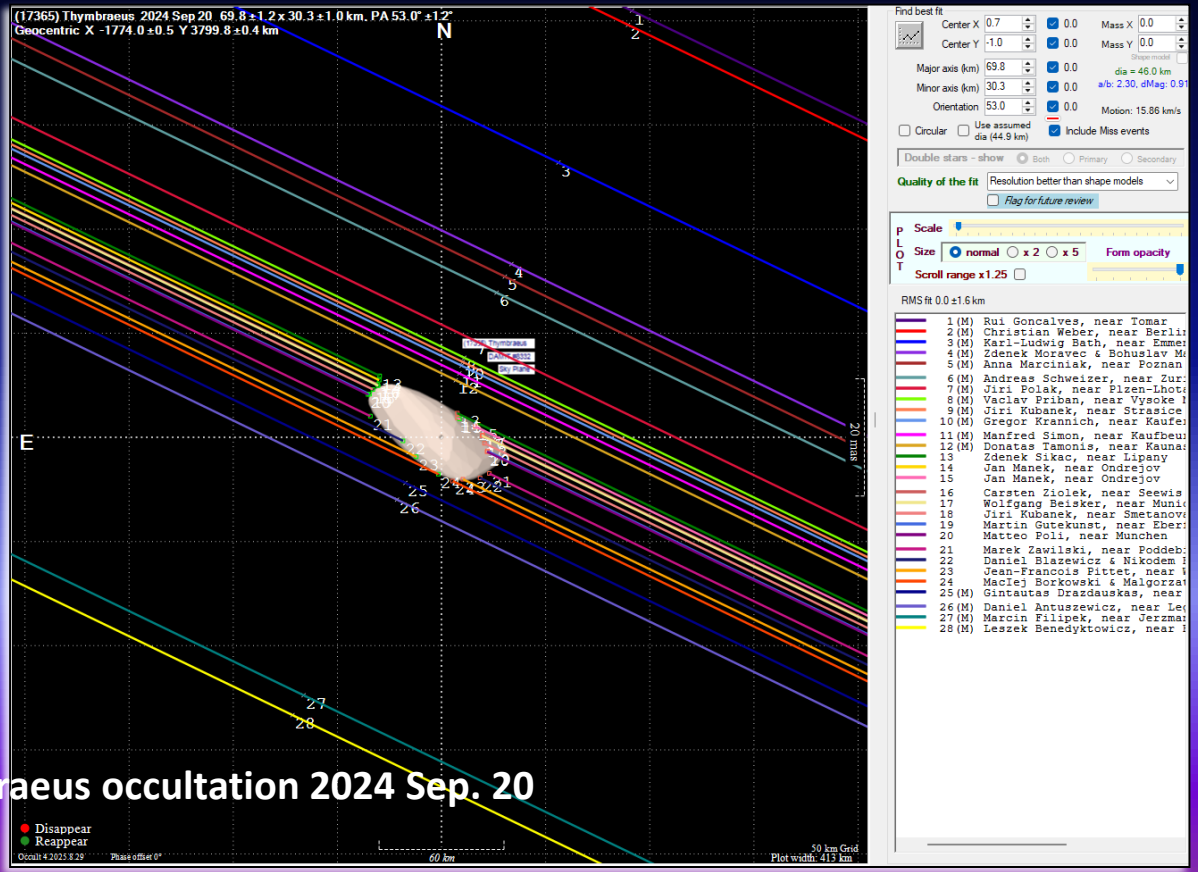


1 Jan Maarten Winkel, near Denia
2 Pascal Andre, Patrick Martinez et al, near Alcoy
3 Pascal Andre, Sebastien Serpaud et al, near Alcoy
4 Pascal Andre, Patrick Martinez et al, near Alcoy
5 Michel Boutet, Michel Llibre et al, near Alicante
6 Tim Haymes & Anne Haymes, near Santa Luzia
7 Simone Falerno, near Plataci
8 Valerio Faiuolo, near Plataci
9 Valerio Faiuolo, near Plataci
10 Javier Prat & Pedro Martorell, near Benidorm
11 Carlos Oliveira, near Odemira
12 Carlos Perello, Carles Schnabel et al, near Culebron
13 Carlos Perello, Carles Schnabel et al, near Culebron
14 Antonio Piras, near Assemini
15 Aleksander Smirnov, near Tomjik
16 Antoni Selva, Josep Masalles et al, near La Romana
17 Stefano Sposetti & Marina Sposetti-Conedera Et Al., near Cagliari
18 Marek Zawilski, near Sibari
19 Michael Dohrmann & Konrad Guhl, near Sibari
20 Takatsuna Otsuki, near Cagliari
21 Anna Marciniak, near Alicante
22 Alban Darnas, near Alicante
23 Claudio Costa, near Schiavonea
24 Oscar Canales, near San Juan De Alicante
25 Antonio Vecchione, near Salice
26 Alfonso Noschese, near Corigliano
27 Alfonso Noschese, near Corigliano
28 Alfonso Noschese, near Corigliano
29 Peter Lindner & Katrin Lindner, near Santa Anna
30(P) Predicted
31 Wojciech Burzynski & Marcin Wierzbicki, near Las Canalosa
32 Petr Zeleny, near Hornachuelos
33 Jan Manek, near Hornachuelos
34 Jiri Kubanek & Lucie Kubankova, near Hornachuelos
35 Jose Maria Oncins Lagranja, near Cieza
36 Harumi Fujita, near Cordoba
37 Masaya Kawaguchi, near Cordoba
38 Francisco J Alvarez Sanchez, near Zalamea La Real
39 Andreas Dill, near Torrelano
40 Ferran Casarramona & Graciela Estraviz, near Alicante
41 Michael Oconnell, near Alicante
42 Alex Pratt, near Alicante
43 Michael Kohl, near Corigliano Scalo
44 Andreas Schweizer, near Corigliano-Rossano
45 Stefan Meister, near Corigliano-Rossano
46 Stefan Meister, near Corigliano-Rossano
47 Paolo Fini & Guido Betti, near Rossano
48 Didier Walliang, near Fortuna
49 Didier Walliang & Joelle Laufer, near Fortuna
50 Isabelle Auvray & Jean-Francois Counilh, near Fortuna
51 Isabelle Auvray, near Fortuna
52 Antonio Catapano, near Calopezzati
53 Jose Antonio De Los Reyes, Sensi Pastor et al, near Arroyo Hurtado
54 Nick Sioulas, D.T. Georgoulas et al, near Ioannina
55 Nick Sioulas, Georgoulas T. D. et al, near Ioannina
56 Periklis Papadopoulos, near Ioannina
57 Apostolos Christou, near Corfu
58 Serge Dramonis, near Kalambaka
59 Juan Ramon Arques Perpinan & Paqui Vicente, near Murcia
60 Giuseppe Bianco, near Cosenza
61 Andrea Di Dato, near Ciro
62 Vincent Hourdin, Leon Bewersdorff et al, near Castillejar

Highlights

Multi-chord events

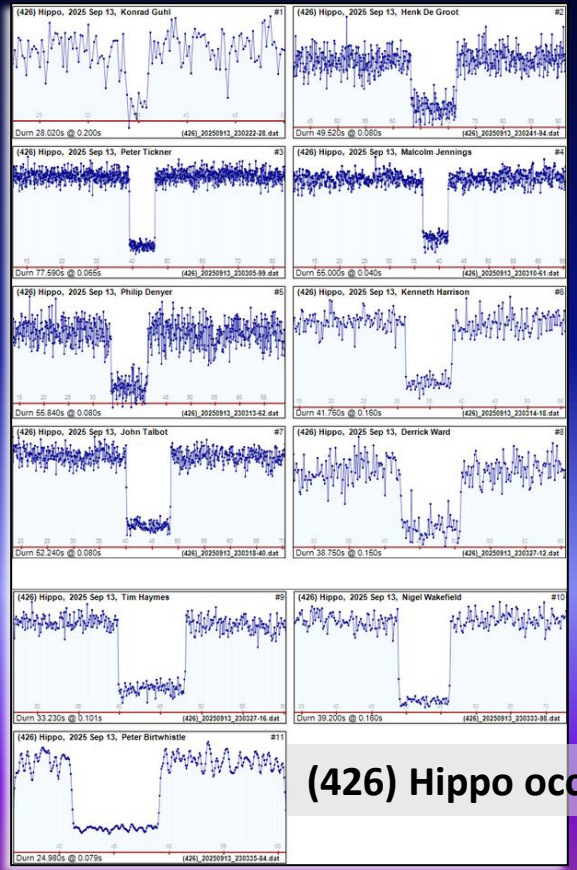


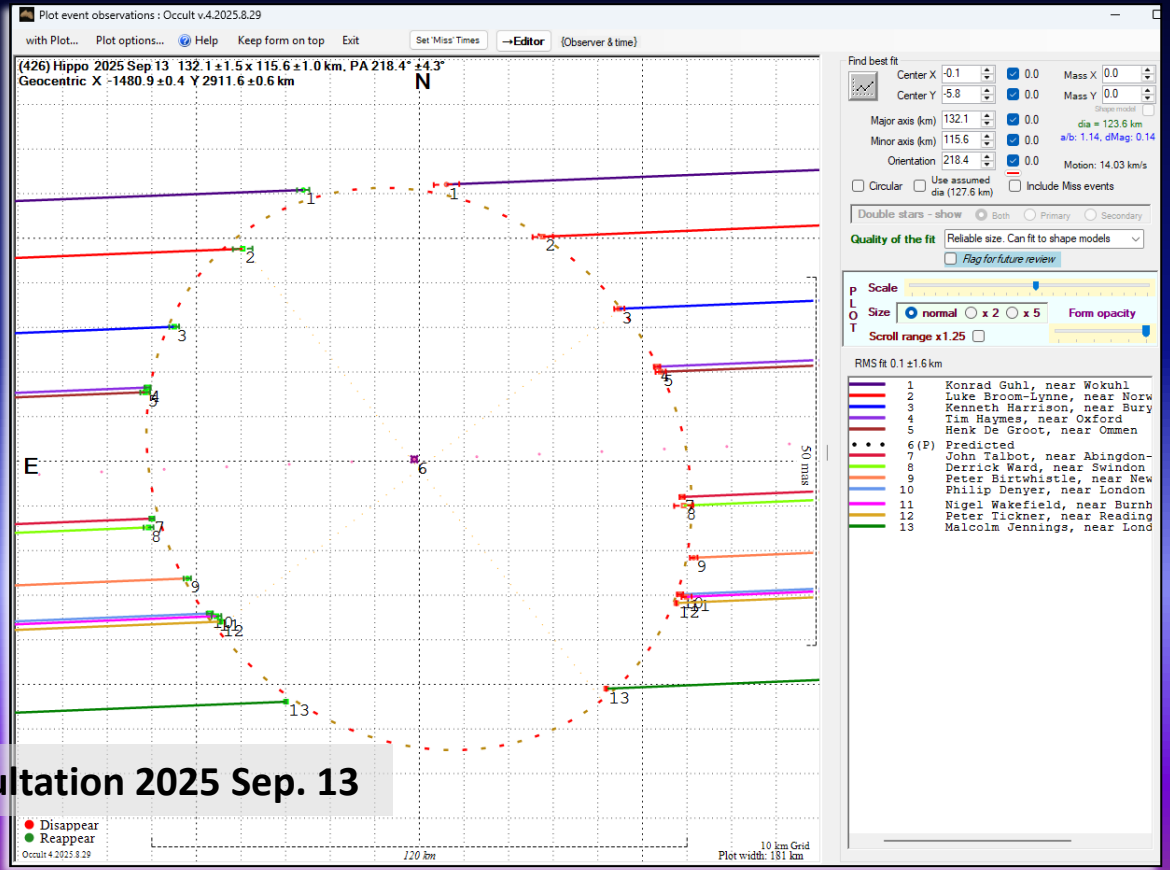


(17365) Thymbraeus occultation 2024 Sep. 20

Highlights

Multi-chord events





(426) Hippo occultation 2025 Sep. 13

Highlights

Double star discoveries 2025 Jan. 13 – Apr. 18

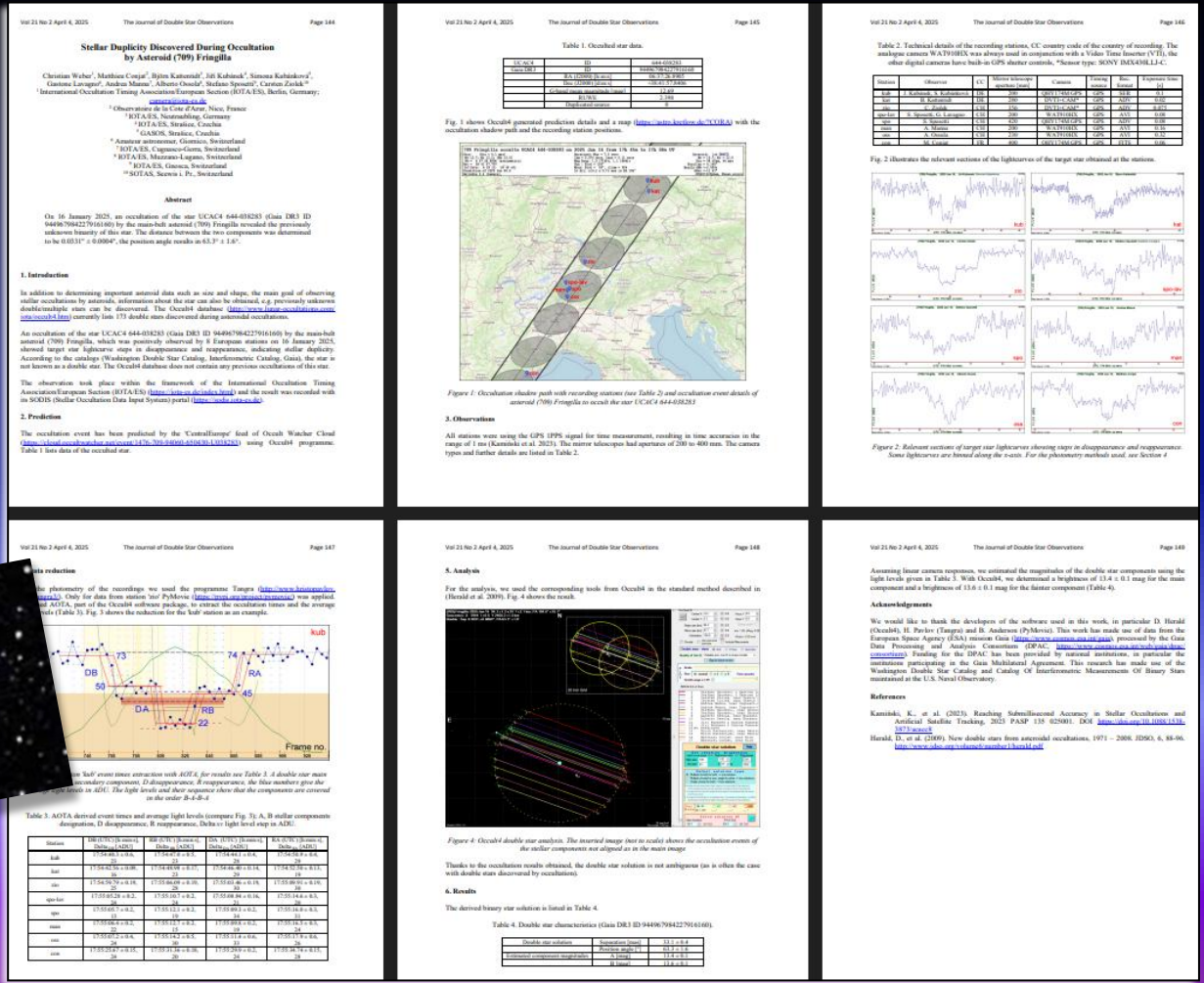
Count	Star number	Mv1	Mv2	Soln	Sep (masec)	P.A.	RUWE	Date	Asteroid
1	UCAC4 379-071051	14.7	12.0	#1	36.9	104	0.95	2025 Apr 18	2392 Jonathan Murray
2	UCAC4 497-056240	13.4	13.4	#1	>0.3	20	1.10	2025 Apr 17	158207 2001 SK55
3	UCAC4 227-074249	13.5	13.8	#1	>7.2	180	1.00	2025 Apr 14	372 Palma
4	UCAC4 498-051917	12.3	12.3	#1	?	?	1.30	2025 Apr 12	13260 Sabadell
5	UCAC4 427-055478	13.8	14.2	#1	>0.9	20	0.95	2025 Apr 12	118042 3204 T-2
6	J173846.80-332029.4	12.6	12.8	#1	1.4 ± 5.3	135	9.35	2025 Apr 11	3630 Lubomir
7	Tycho2 1228-01069-1	10.9	11.1	#1	15.1 ± 0.3	66 ± 3	1.65	2025 Mar 17	31817 1999 RK134
8	UCAC4 537-041385	14.8	14.1	#1	>1.2	30	0.90	2025 Feb 25	48499 1993 BV7
9	UCAC4 510-043997	13.0	13.5	#1	20.1 ± 4.5	161 ± 0	1.10	2025 Feb 23	24362 2000 AR120
10	UCAC4 605-018016	14.1	14.1	#1	>1.9	170	1.00	2025 Feb 18	35572 1998 HW6
11	UCAC4 552-009486	13.8	15.0	#1	>0.3	150	1.00	2025 Feb 11	77721 2001 OB52
12	UCAC4 658-041449	11.7	11.3	#1	>0.1	150	1.00	2025 Feb 7	116917 2004 GZ15
13	UCAC4 536-029244	11.7	11.2	#1	>4.0	10	1.35	2025 Feb 6	3625 Fracastoro
14	UCAC4 334-078310	13.7	14.7	#1	2.2 ± 1.3	84 ±21	1.80	2025 Feb 5	21161 Yamashitaharuo
15	UCAC4 624-042759	14.0	14.2	#1	>4.2	10		2025 Feb 4	2424 Tautenburg
16	UCAC4 515-034351	14.0	15.0	#1	>2.6	20	0.95	2025 Feb 3	57304 2001 QV198
17	HIP 57690	8.4	8.4	#1	>1.0	60	1.10	2025 Feb 2	46909 1998 RF72
18	UCAC4 587-036757	13.8	13.5	#1	>1.0	10	1.05	2025 Jan 27	62452 2000 SO209
19	UCAC4 522-012609	13.2	13.7	#1	13.1 ± 1.3	226 ± 3	1.35	2025 Jan 18	540 Rosamunde
20	Tycho2 1347-00529-1	10.6	10.8	#1	16.4	296	0.85	2025 Jan 16	110008 2001 SY65
21	UCAC4 644-038283	13.4	13.6	#1	33.1 ± 0.4	63 ± 2	2.35	2025 Jan 16	709 Fringilla
22	UCAC4 670-037147	15.7	16.1	#1	>11.2	140	0.95	2025 Jan 13	759 Vinifera

White: world, yellow: SODIS (50%)

Credit: D. Herald

Highlights

Discovery of a formerly unknown double star due to an occultation event by (709) Fringilla, 2025 Jan. 16



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Stellar Duplicity Discovered During Occultation by Asteroid (709) Fringilla

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[2] Observatoire de la Côte d'Azur, Nice, France
[3] IOTA/ES, Neutraubling, Germany
[4] IOTA/ES, Strakice, Czechia
[5] GAMOS, Strakice, Czechia
[6] Amateur astronomer, Giornico, Switzerland
[7] IOTA/ES, Cugnasco-Gerra, Switzerland
[8] IOTA/ES, Muzzano-Lugano, Switzerland
[9] IOTA/ES, Gnosca, Switzerland
[10] SOTAS, Scuola i. Pr., Switzerland

Abstract

On 16 January 2025, an occultation of the star UCAC4 644-038283 (Gaia DR3 ID 9449679842279161601) by the main-belt asteroid (709) Fringilla revealed the previously unknown binarity of this star. The distance between the two components was determined to be 0.033" ± 0.0004", the position angle results in 63.3° ± 1.6°.

1. Introduction

In addition to determining important asteroid data such as size and shape, the main goal of observing stellar occultations by asteroids, information about the star can also be obtained, e.g. previously unknown double/multiple stars can be discovered. The Occult4 database (https://www.lunar-occultations.com/iota/occult4.htm) currently lists 173 double stars discovered during asteroidal occultations.

An occultation of the star UCAC4 644-038283 (Gaia DR3 ID 9449679842279161601) by the main-belt asteroid (709) Fringilla, which was positively observed by 8 European stations on 16 January 2025, showed target star lightcurve steps in disappearance and reappearance, indicating stellar duplicity. According to the catalogs (Washington Double Star Catalog, Interferometric Catalog, Gaia), the star is not known as a double star. The Occult4 database does not contain any previous occultations of this star.

The observation took place within the framework of the International Occultation Timing Association/European Section (IOTA/ES) (https://iota-es.de/index.html) and the result was recorded with its SODIS (Stellar Occultation Data Input System) portal (https://india.iota-es.de).

2. Prediction

The occultation event has been predicted by the 'CentralEurope' feed of Occult Watcher Cloud (https://cloud.occultwatcher.net/event/1476-709-9449-650430-1303283) using Occult4 programme. Table 1 lists data of the occulted star.

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Table 1. Occulted star data.

UCAC4	ID	644-038283
Gaia DR3	ID	9449679842279161601
	RA (J2000) [h m s]	06:37:26.9985
	Dec (J2000) [deg s]	-08:41:57.8406
	G-band mean magnitude [mag]	12.60
	BP/RP	2.388
	Duplicated source	0

Fig. 1 shows Occult4-generated prediction details and a map (https://astro.kwiflow.de/?COR/A) with the occultation shadow path and the recording station positions.

Figure 1: Occultation shadow path with recording stations (see Table 2) and occultation event details of asteroid (709) Fringilla to occult the star UCAC4 644-038283

3. Observations

All stations were using the GPS 1PPS signal for time measurement, resulting in time accuracies in the range of 1 ms (Kamiński et al. 2023). The mirror telescopes had apertures of 200 to 400 mm. The camera types and further details are listed in Table 2.

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Table 2. Technical details of the recording stations, CC country code of the country of recording. The analogue camera WATV01HD was always used in conjunction with a Video Time Inserter (VTI), the other digital cameras have built-in GPS shutter controls. *Sensor type: SONY IMX438LLJ-C.

Station	Observer	Cc	Mirror telescope aperture [mm]	Camera	Timing source	Rec. format	Exposure time [s]
kub	F. Kubánek & Kubánková	CZ	200	ODYSSEY-M GPS	GPS	AVI	0.1
kat	B. Kattenstiff	DE	200	DVTI+C-SMP	GPS	ADV	0.02
ulm	C. Ziegler	DE	350	ZYZ1G-GMP	GPS	ADV	0.072
spo-lav	S. Sposetti, G. Lavagna	CH	200	WATV01HD	GPS	AVI	0.08
spo	S. Sposetti	CH	400	ODYSSEY-M GPS	GPS	ADV	0.08
mun	A. Manna	CH	200	WATV01HD	GPS	AVI	0.16
ass	A. Ossola	CH	200	WATV01HD	GPS	AVI	0.32
zim	M. Conjat	FR	400	ODYSSEY-M GPS	GPS	FITS	0.06

Fig. 2 illustrates the relevant sections of the lightcurves of the target star obtained at the stations.

Figure 2: Relevant sections of target star lightcurves showing steps in disappearance and reappearance. Some lightcurves are binned along the x-axis. For the photometry methods used, see Section 4

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4. Data reduction

For the photometry of the recordings we used the programme Tangra (http://www.hristopavlov.net/Tangra/). Only for data from station 'mir' PyMovie (https://www.occultwatcher.net/) was applied. We used AOTA, part of the Occult4 software package, to extract the occultation times and the average light levels (Table 3). Fig. 3 shows the reduction for the 'kub' station as an example.

Figure 3: Screen shot of 'kub' event times extraction with AOTA, for results see Table 3. A double star main component (secondary component), D-disappearance, R-reappearance, the blue numbers give the average light levels in ADU. The light levels and their sequence show that the components are covered in the order B-A-B-A

Table 3: AOTA derived event times and average light levels (compare Fig. 3); A, B stellar components designation, D disappearance, R reappearance, Delta ev light level step in ADU.

Station	DB (UTC) [h:mm:s], $Delta_{ev}$ [ADU]	RB (UTC) [h:mm:s], $Delta_{ev}$ [ADU]	DA (UTC) [h:mm:s], $Delta_{ev}$ [ADU]	RA (UTC) [h:mm:s], $Delta_{ev}$ [ADU]
kub	17:54:48.3 ± 0.5, 22	17:54:47.0 ± 0.5, 23	17:54:44.1 ± 0.5, 28	17:54:38.9 ± 0.6, 28
kat	17:54:42.56 ± 0.08, 16	17:54:49.08 ± 0.17, 23	17:54:46.40 ± 0.14, 24	17:54:52.98 ± 0.11, 19
ulm	17:54:39.79 ± 0.19, 22	17:55:06.09 ± 0.19, 26	17:55:03.46 ± 0.19, 30	17:55:09.91 ± 0.19, 30
spo-lav	17:55:05.28 ± 0.2, 20	17:55:10.7 ± 0.2, 24	17:55:08.04 ± 0.16, 21	17:55:14.6 ± 0.3, 28
spo	17:55:05.7 ± 0.2, 13	17:55:11.1 ± 0.2, 19	17:55:09.3 ± 0.2, 24	17:55:16.0 ± 0.3, 31
mun	17:55:04.4 ± 0.2, 22	17:55:12.7 ± 0.2, 17	17:55:09.8 ± 0.2, 19	17:55:16.5 ± 0.3, 24
ass	17:55:07.2 ± 0.4, 20	17:55:14.2 ± 0.5, 30	17:55:11.4 ± 0.6, 31	17:55:17.9 ± 0.6, 26
zim	17:55:25.67 ± 0.15, 24	17:55:31.36 ± 0.18, 24	17:55:29.9 ± 0.2, 24	17:55:34.74 ± 0.15, 18

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5. Analysis

For the analysis, we used the corresponding tools from Occult4 in the standard method described in (Herald et al. 2009). Fig. 4 shows the result.

Figure 4: Occult4 double star analysis. The inserted image (not to scale) shows the occultation events of the stellar components not aligned as in the main image

Thanks to the occultation results obtained, the double star solution is not ambiguous (as is often the case with double stars discovered by occultation).

6. Results

The derived binary star solution is listed in Table 4.

Table 4. Double star characteristics (Gaia DR3 ID 9449679842279161601).

Double star solution	Separation [mas]	33.1 ± 0.4
	Position angle [°]	63.3 ± 1.6
Estimated component magnitudes	A [mag]	11.4 ± 0.1
	B [mag]	12.6 ± 0.1

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Assuming linear camera responses, we estimated the magnitudes of the double star components using the light levels given in Table 3. With Occult4, we determined a brightness of 13.4 ± 0.1 mag for the main component and a brightness of 13.6 ± 0.1 mag for the fainter component (Table 4).

Acknowledgments

We would like to thank the developers of the software used in this work, in particular D. Herald (Occult4), H. Pavlov (Tangra) and B. Anderson (PyMovie). This work has made use of data from the European Space Agency (ESA) mission Gaia (https://www.cosmos.esa.int/gaia), processed by the Gaia Data Processing and Analysis Consortium (DPAC, https://www.cosmos.esa.int/web/gaia/dpac-consortium). Funding for the DPAC has been provided by national institutions, in particular the institutions participating in the Gaia Multilateral Agreement. This research has made use of the Washington Double Star Catalog and Catalog Of Interferometric Measurements Of Binary Stars maintained at the U.S. Naval Observatory.

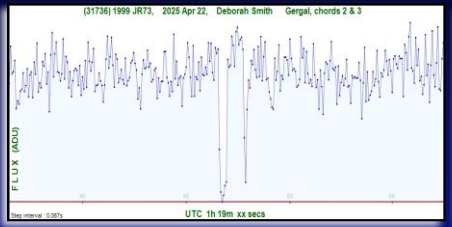
References

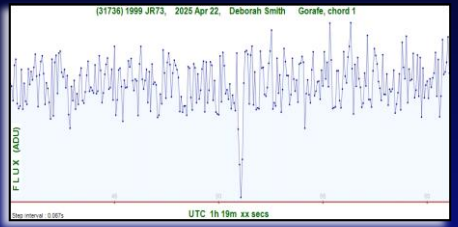
Kamiński, K., et al. (2023). Reaching Submilliasecond Accuracy in Stellar Occultations and Artificial Satellite Tracking. 2023 PASP 135 025001. DOI: https://doi.org/10.1088/1538-3873/acacc8

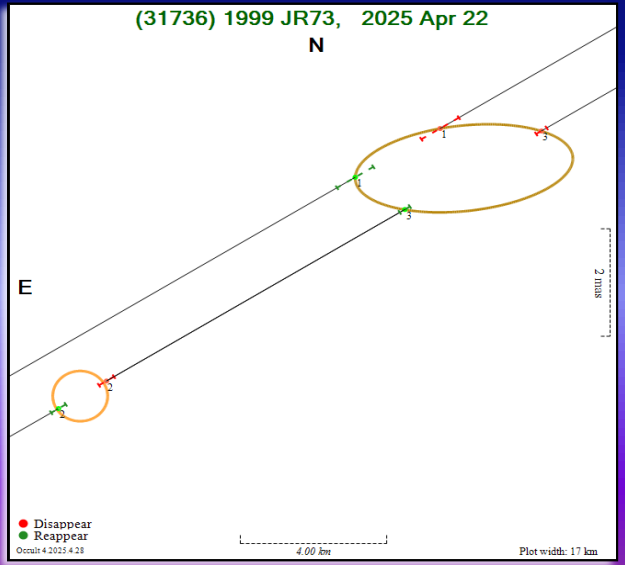
Herald, D., et al. (2009). New double stars from asteroidal occultations, 1971 – 2008. JDSO, 6, 88-96. http://www.jdso.org/volume6/number1/herald.pdf

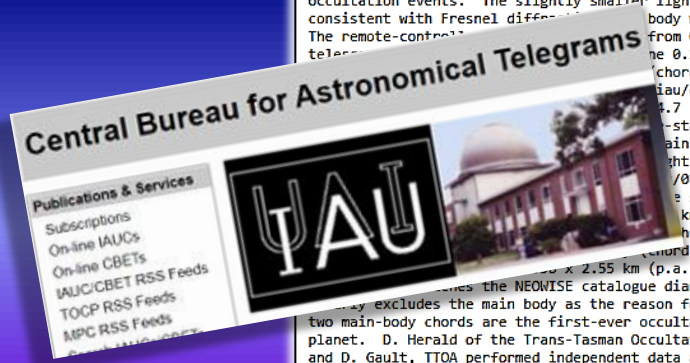
Highlights

Discovery of a satellite of (31736) 1999 JR73, 2025 Apr. 22









Electronic Telegram No. 5552

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e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
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Prepared using the Tamkin Foundation Computer Network

(31736) 1999 JR_73

C. Weber (Berlin, Germany), on behalf of the European Section of the International Occultation Timing Association (IOTA), writes that D. Smith, observing from two sites near Granada, Spain, reports the discovery of an apparent satellite of the minor planet (31736) via the Stellar Occultation Data Input System (SODIS). The detection was achieved through occultation observations of the 12.4-magnitude star UCAC4 401-061053 (Gaia DR3 star number 6316990418098769408) on 2025 Apr. 22.055 UT. The observation revealing the satellite was carried out from Gergal (Spain) using a 20-cm Newtonian telescope (+ ASI462MM camera). The light curve (which is posted at URL http://www.cbat.eps.harvard.edu/iau/cbet/005500/CBET5552_Fig1.png; see CBET 5521 for explanation of the graph) shows two consecutive drops of 0.37 and 0.13 s, with an interval of 0.808 s. The resulting chord lengths are 5.8 km for the first event (chord 3) and 1.51 km for the second (chord 2). Both drops reached a depth greater than the V magnitudes of two faint comparison stars (UCAC4 401-061056, V = 14.0; UCAC4 401-061064, V = 14.7), which rules out the hypothesis of a double star as the reason for the consecutive occultation events. The slightly smaller light drop of the second event is consistent with Fresnel diffr[illegible] body with a diameter of 1.5 km. The remote-contro[illegible] from Gorafe (28-cm Schmidt-Cassegrain tele[illegible] he 0.23-s occultation event, which [illegible] chord 1). The light curve is [illegible] iau/cbet/005500/CBET5552_Fig2.png. [illegible] 4.7 (comparison star UCAC4 [illegible]-star explanation. The position [illegible] ain body is 0".0078 in p.a. 123 [illegible] ght curves of both stations (see [illegible] /005500/CBET5552_Fig3.png). [illegible] e size was set to a circle with [illegible] km. The size of the apparent [illegible] hord 1, but it is not possible [illegible] (chord 3) was fitted elliptically, [illegible] x 2.55 km (p.a. 96.9 degrees for the long [illegible] the NEOWISE catalogue diameter of 5.1 +/- 0.6 km and [illegible] excludes the main body as the reason for the second light drop. The two main-body chords are the first-ever occultation chords for this minor planet. D. Herald of the Trans-Tasman Occultation Alliance (TTOA) and IOTA; and D. Gault, TTOA performed independent data analysis to confirm the results.

NOTE: These 'Central Bureau Electronic Telegrams' are sometimes superseded by text appearing later in the printed IAU Circulars.

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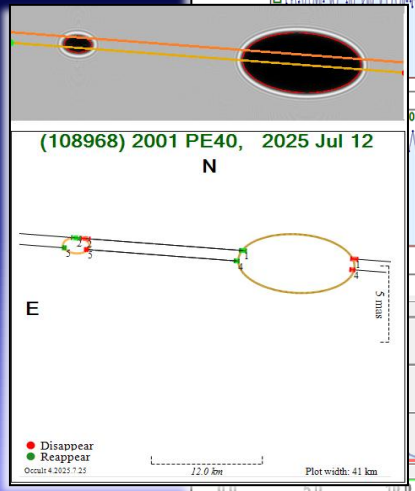
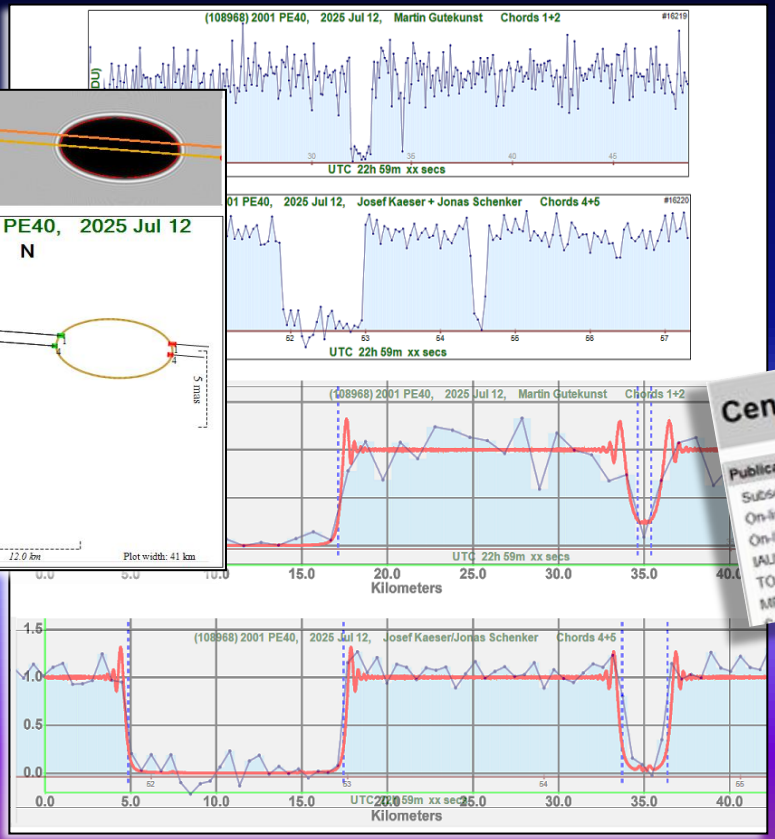
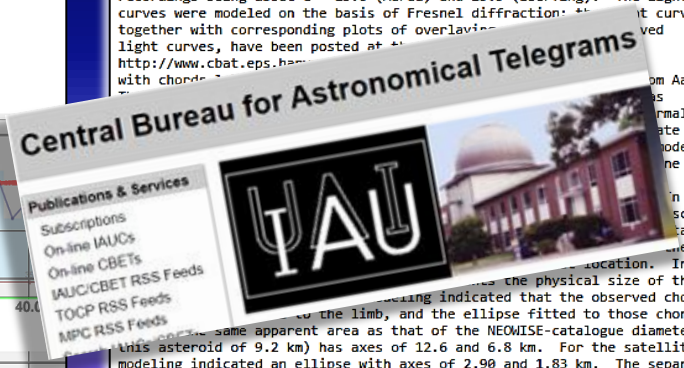
2025 May 1 (CBET 5552) Daniel W. E. Green

Highlights

Discovery of a satellite of (108968) 2001 PE40, 2025 Jul. 12







Electronic Telegram No. 5589

Central Bureau for Astronomical Telegrams
Mailing address: Hoffman Lab 209; Harvard University;
20 Oxford St.; Cambridge, MA 02138; U.S.A.
e-mail: cbatiau@eps.harvard.edu (alternate cbat@iau.org)
URL http://www.cbat.eps.harvard.edu/index.html
Prepared using the Tamkin Foundation Computer Network

(108968) 2001 PE_40

C. Weber, European Section of the International Occultation Timing Association (IOTA), Berlin, reports the discovery of an apparent satellite of the minor planet (108968) based on an occultation of the star UCAC4 427-071562 (which has catalogued magnitudes G = 13.1 and R = 12.0) on 2025 July 12.958 UT. The magnitude then of this main-belt asteroid was 19.5. The observations were made by J. Kaeser and J. Schenker, observing from Schafmatt Observatory in Aarau, Switzerland, using a 45-cm telescope, and M. Gutekunst, observing from Eberfing, Germany, using a 28-cm telescope. All observations were made with Swiss DVTI+CAM video cameras designed for use by occultation observers and utilizing Sony IMX430 CMOS sensors. All of the observers recorded two consecutive light drops, of durations 1.10 and 0.21 s at Aarau, and 1.14 and 0.09 s at Eberfing, with corresponding chord lengths of 12.5 and 2.4 km (Aarau) and 12.1 and 1.0 km (Eberfing). The light drops reached a depth greater than the G magnitudes of two faint comparison stars (UCAC4 427-071537, G = 14.1; UCAC4 427-071545, G = 15.4) with the limiting magnitude of the recordings being about G = 15.8 (Aarau) and 15.5 (Eberfing). The light curves were modeled on the basis of Fresnel diffraction: [illegible] curves, together with corresponding plots of overlaying [illegible] ved light curves, have been posted at [illegible] http://www.cbat.eps.har[illegible] with chords [illegible] om Aarau. [illegible] rmalized [illegible] ate the [illegible] odel that [illegible] ne plot of [illegible] n the [illegible] scale [illegible] tar and [illegible] ne [illegible] location. Inside [illegible] the physical size of the body. [illegible] the limb, and the ellipse fitted to those chords [illegible] same apparent area as that of the NEOWISE-catalogue diameter for this asteroid of 9.2 km) has axes of 12.6 and 6.8 km. For the satellite, the modeling indicated an ellipse with axes of 2.90 and 1.83 km. The separation of the satellite from the main body is 0".0135 in p.a. 85 deg, with a sky-plane separation of 23.9 km. D. Herald, Trans-Tasman Occultation Alliance (TTOA) and IOTA; and D. Gault, TTOA, aided in the analysis, using a Fresnel diffraction modeling tool by Bob Anderson (IOTA).

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2025 August 12 (CBET 5589) Daniel W. E. Green

IOTA Lightcurve Generator

IOTA 2025 Annual Meeting

Bob Anderson – Dave Herald

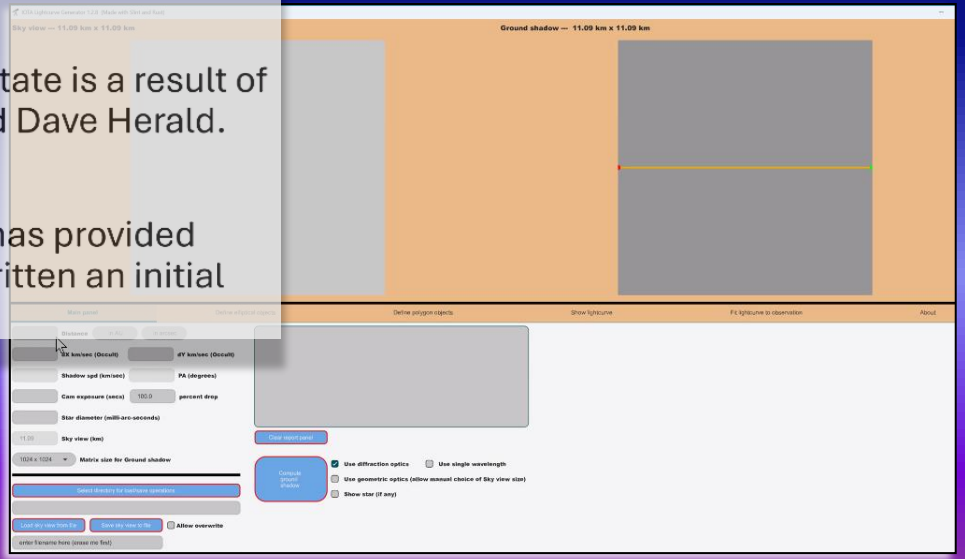
status report: IOTA Lightcurve Generator

New tool !

This is a joint report on a new tool for asteroid/star occultation analysis.

The tool is currently a work in progress. Its current state is a result of a collaboration between myself (Bob Anderson) and Dave Herald.

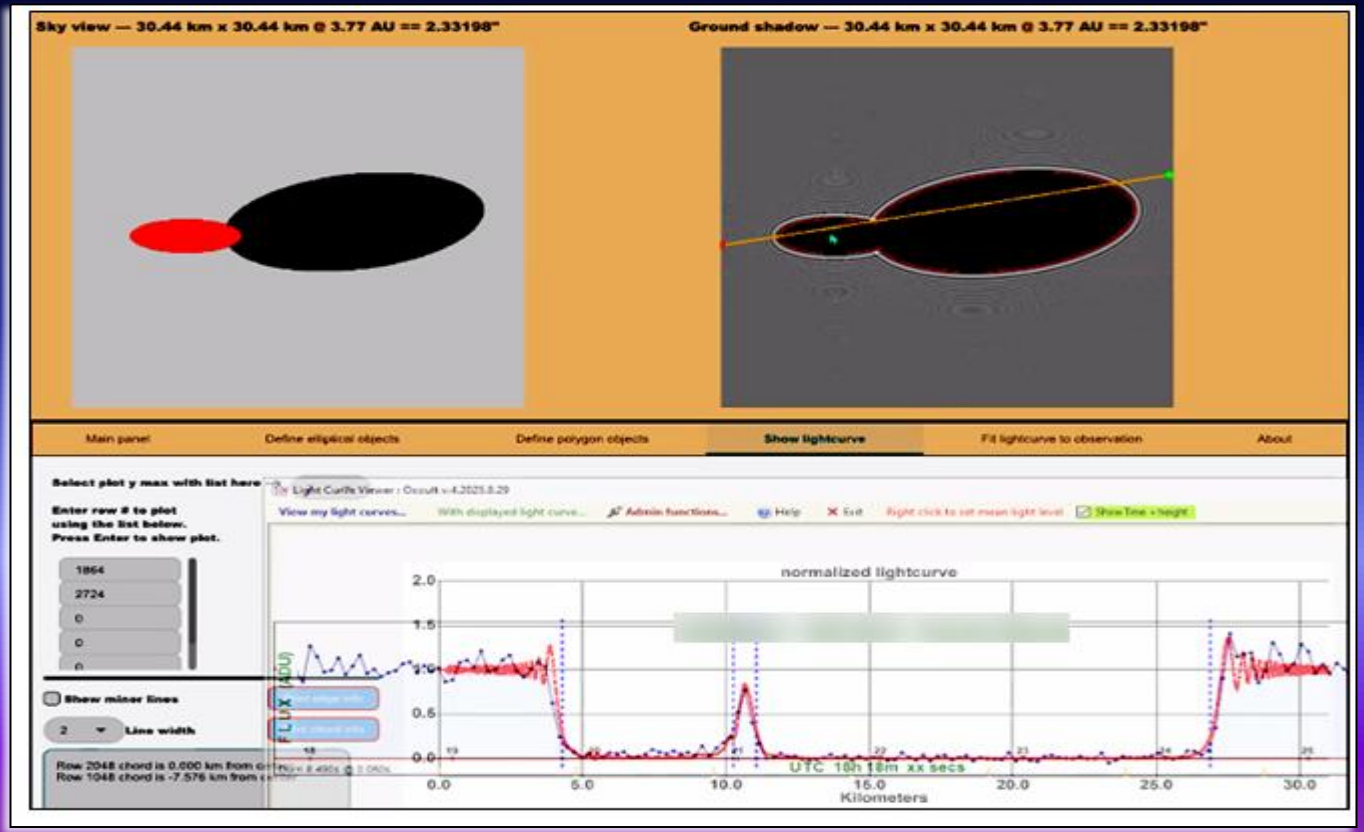
Dave has been the sole Beta tester. In that role, he has provided major architectural guidance. In addition, he has written an initial user guide.



Credit: B. Anderson, D. Herald

IOTA Lightcurve Generator

Credit: B. Anderson, D. Herald



SODIS news and useful tips

SODIS 2.0

SODIS

HOME ? HELP REPORT REVIEW ADMIN LOGOU

Review Entry by Christian Weber

All times are entered in UTC.

Occultation	Positive	Date Observation	27.10.2024	Predicttime	23:30:43
Predicted event time for observer position					
Additional Obs		Enter only one additional observer		More Obs	
Star	UCAC4 515-029293	Asteroid	Biermann	No	73640
Located near	Berlin	Enter the nearest town marked on a commercial map		Station Name	
Country Code of the observation country position	DE (Federal Republic of Germany)				
Latitude	52	Longitude	013		
Altitude	40 m	Datum Type	WGS84		
Telescope	Other	Aperture	20.3 cm	Effective Focal Length	80 cm
Obs Method	Analogue & digital video	Exp Time	0.16 s.sss		
Start Obs	23 29 43.7	End Obs	23 31 32.9		
D	Main Star	D Time	23 30 43.36	Acc_D	0.08 S.sss
Duration	1.84 s.s				
R	Main Star	R Time	23 30 45.20	Acc_R	0.08 S.sss
Time Source	GPS	Camera	WAT910HX-RC	Signal/Noise	12.9

Observation conditions

Wind	0	Temp	8 °C	Transparency	Clear	Seeing	Slight flickering

Drag & Drop your files or Browse

Please provide following files:

In case of a negative occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export

In case of a positive occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export
- AOTA evaluation: Tab5 screenshot; PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

Comment

D_WT	Not Set	R_WT	Not Set	Timeshift		Plotcode	include observation

UPDATE ENTRY & SET REVIEWER FIELDS | ACCEPT | E-MAIL & REQUEST CHANGES ON INPUT | DELETE

Images & Files

044_avi_1.1_folc_Bin4_AOTA_Report.txt

044_avi_1.1_folc__.csv

(73640)_20241027_233027-86.dat

Map

Log

New Comment

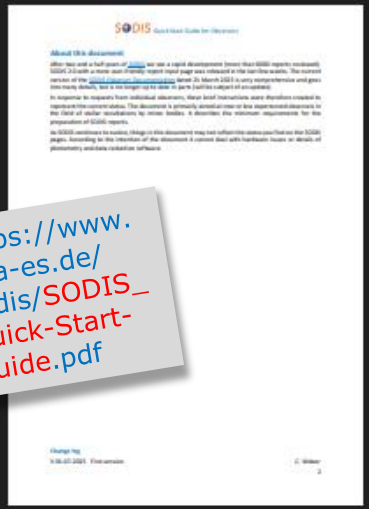
Gregor Krannich

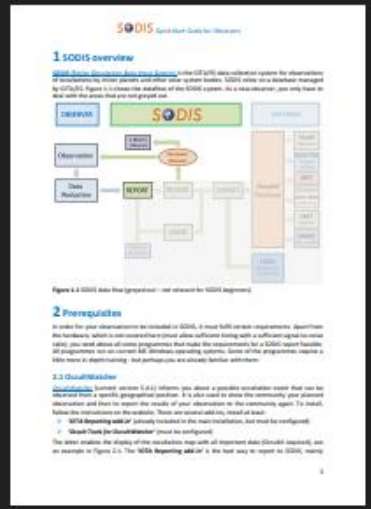
SODIS 2.0

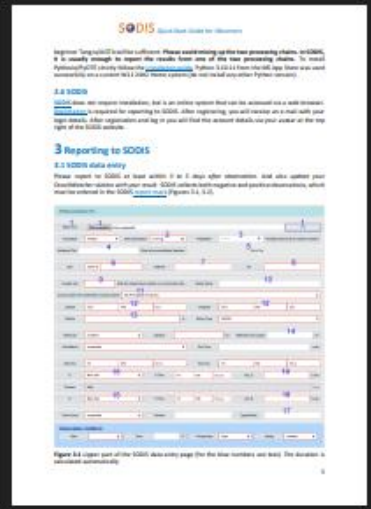
SODIS
Stellar Occultation Data Input System

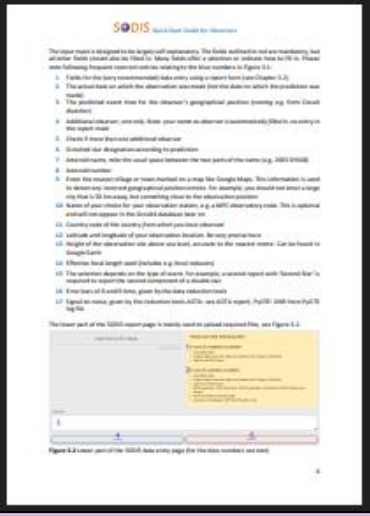
Quick Start Guide
for Observers

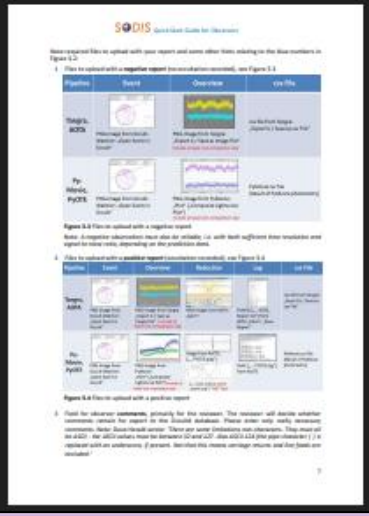
https://www.iota-es.de/sodis/SODIS_Quick-Start-Guide.pdf

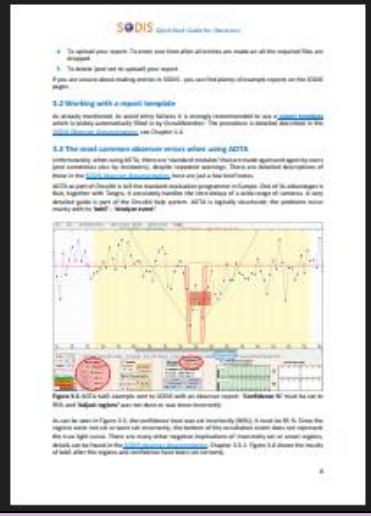


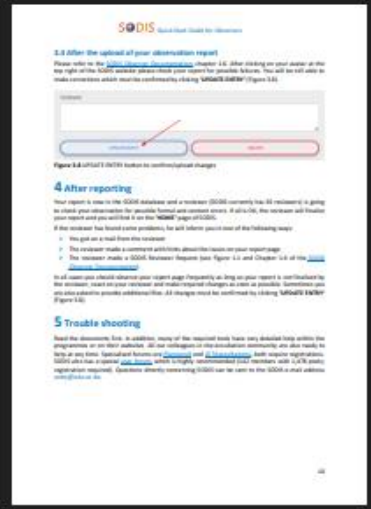




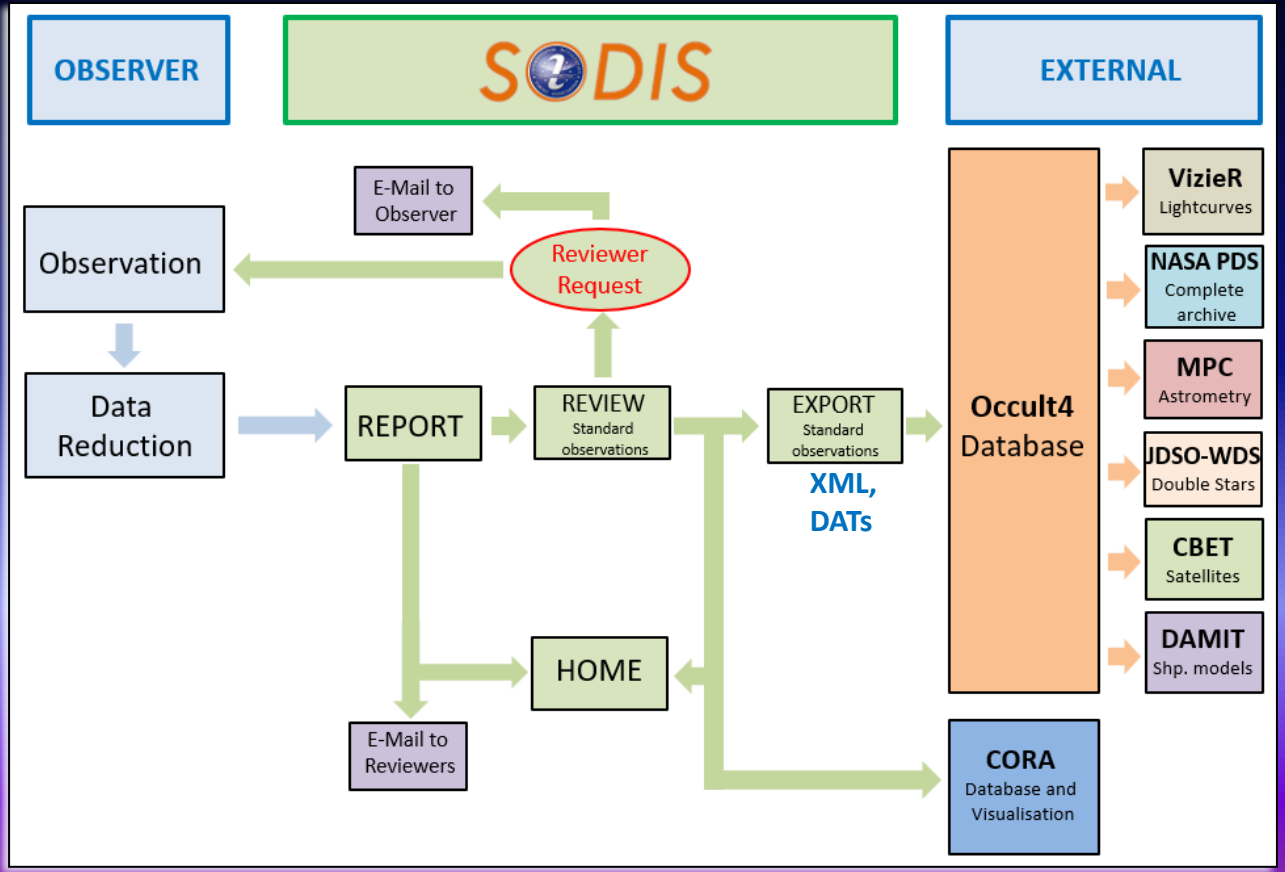




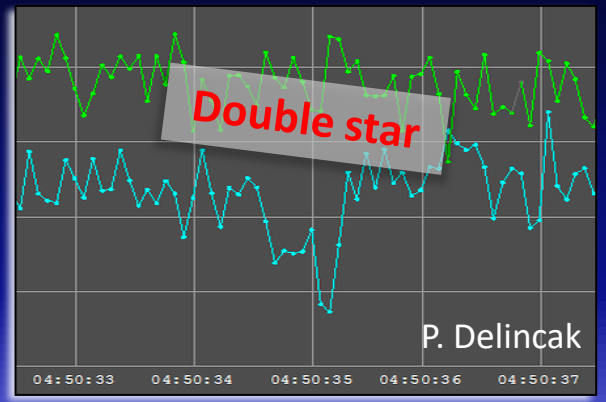


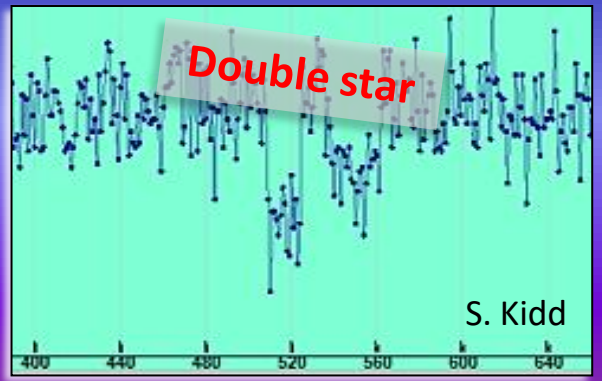


SODIS 2.0 data flow



SODIS: Special events

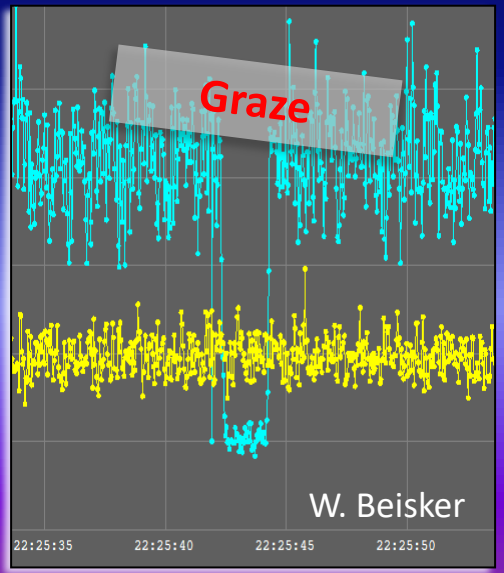


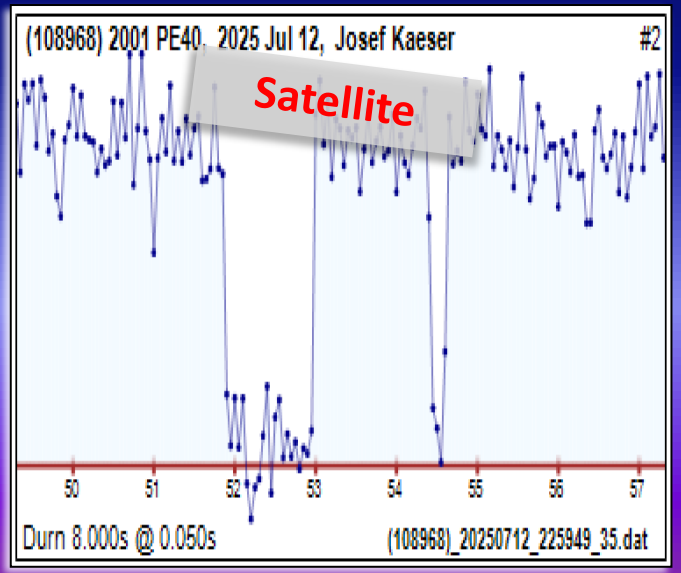


In order to distinguish between different event types, the limiting magnitude of the recording must be known.

> Faint comparison stars are required for this <

https://forum.iota-es.de/showthread.php?tid=371





Special features in lightcurves

a. "Stepped light curve – definite **double star**. If the step is only apparent on one side, the events are assumed to be coincident on the other

b. Separate drops to different levels – definite **double star**

c. Separate drops to the same light level (give or take). Either a **graze, double star or satellite**

c1. For a graze, the observer needs to be close to the north or south of the asteroid profile, and the chord lengths plus separation must be compatible with the known or expected size of the asteroid

c2. Double star. Light drop of one component must be no more than 50% of the expected light drop

c3. Satellite. Light drop of each event is full expected light drop"

Credit: D. Herald; see also https://forum.iotas.de/showthread.php?tid=371

SODIS: Special events > SODIS Hot Cases

SODIS

HOME ? HELP REPORT REVIEW

5147	2024-10-27	23:30:43	73640	Biermann	O+	1.8	DE	Christian Weber	Analogue & digital video	✓
5145	2022-08-25	20:03:31	928	Hildrun	O+	4.0	DE	Sven Andersson	Analogue & digital video	⌛

New !

SODIS Hot Cases

+ New Entry

All times are entered in UTC.

Read Form | Datei auswählen | Keine ausgewählt | READ

Occultation | Positive | Date Observation | tt.mm.jjjj | Predicttime | --:--:-- | Predicted event time for observer position

Additional Obs | Enter only one additional observer

More Obs

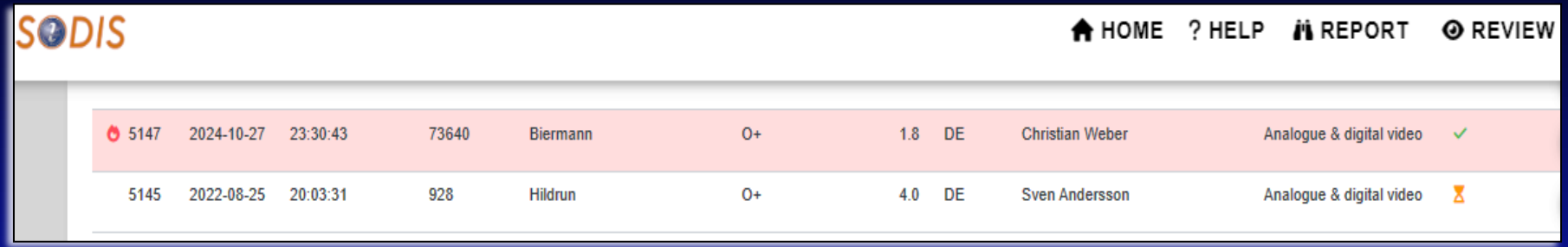
Hot Case

Comment for Hotcase

Double star assumption

Star | UCAC4 | Asteroid | No

SODIS Hot Cases



5147	2024-10-27	23:30:43	73640	Biermann	O+	1.8	DE	Christian Weber	Analogue & digital video	✓
5145	2022-08-25	20:03:31	928	Hildrun	O+	4.0	DE	Sven Andersson	Analogue & digital video	⌛

Hot cases:

Potential satellites, multiple stars, rings

HC flag can be set by:

Observers, reviewers, exporters

But please consider it carefully.

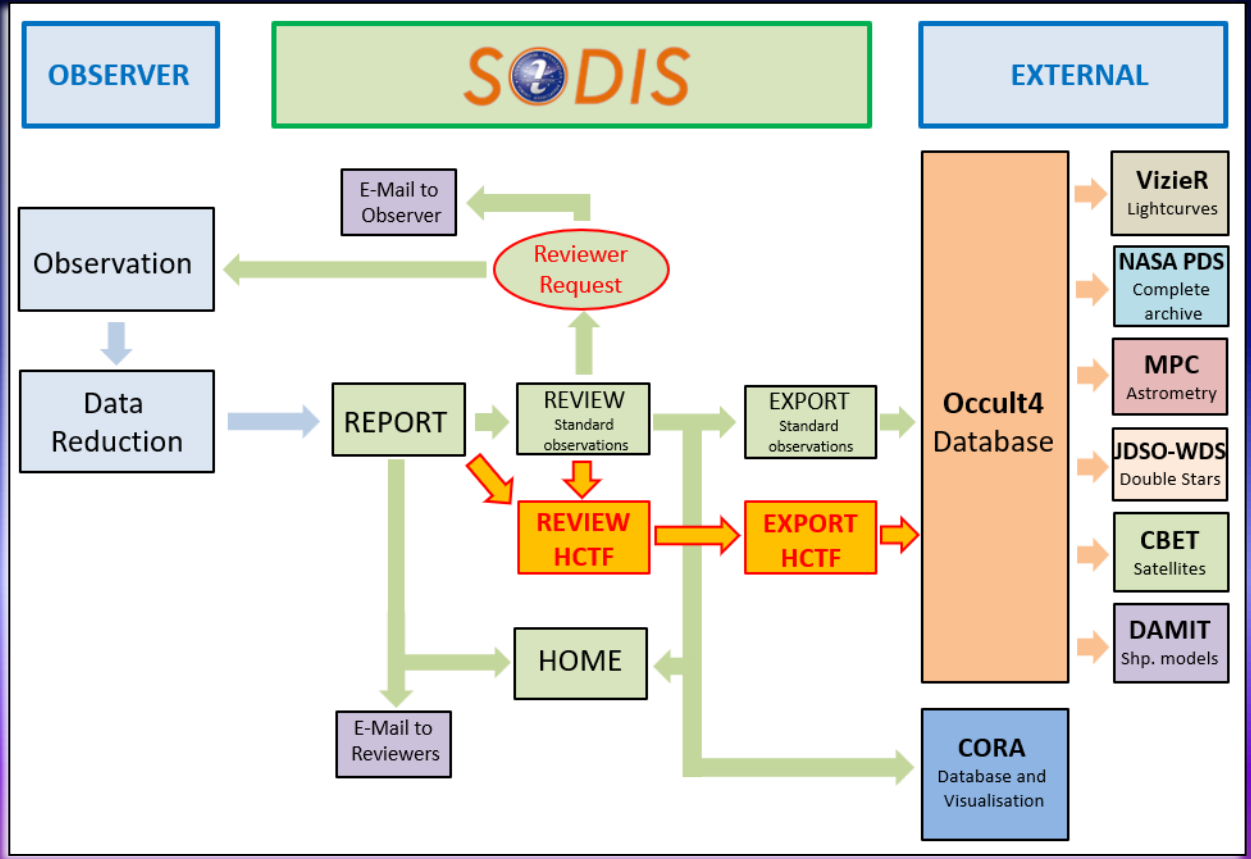
Recognition (Hot Case can be rejected) and processing by :

Hot Case Task Force (HCTF):

L. Curelaru (RO), G. Krannich (DE), S. Sposetti (CH), C. Weber (DE)

!!! New analysts are welcome !!!

SODIS Hot Cases



SODIS Hot Cases

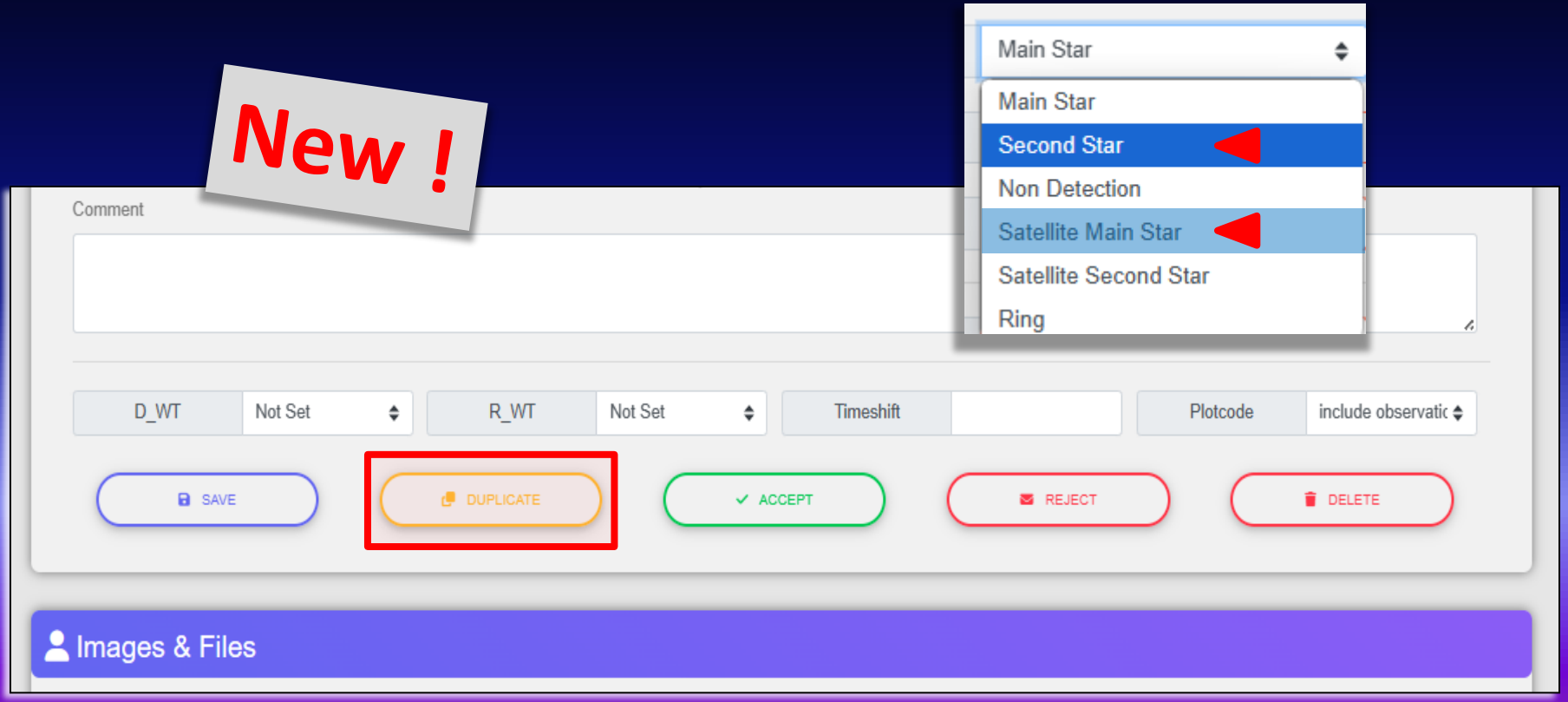
First Hot Cases being processed …

HCTF Hot Cases

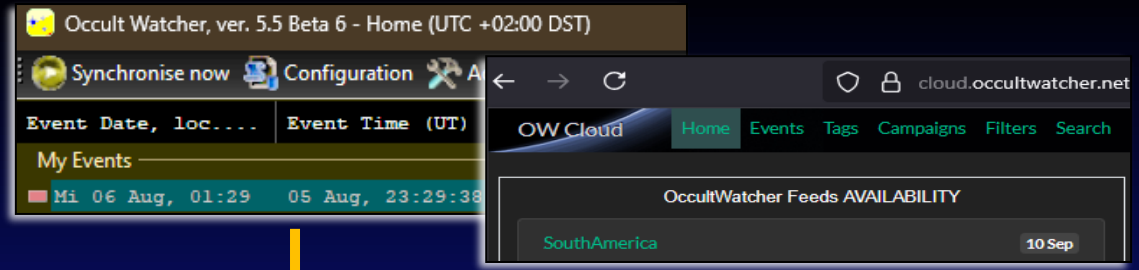
Hot Case ID	SODIS Reports No.	Observers	Type	HCTF Analyst	Remarks	Status
HC-001_2025-03-27_19879_1274 T-1	9644	S. Kidd, GB	Double star ?	CUR	SNR too bad to decide on double star (from Tangra.lc file)	closed, already in Occult4
HC-002_2025-08-26_47139_1999 GN9	9717, 9723	M. Harman, SK; P. Nosal, SK	Double star ?	SPO		
HC-003_2025-08-18_43857_Tanijinzan	9636, 9638, 9640, 4649	J. Kubanek + S. Kubankova, CZ; J. Kubanek, CZ; M. Kohl, DE; M. Rottenborn, CZ	Known dbl. star (WDS)	KRA	1 add. obs. from Japan !, under processing	
HC-004_	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
HC-005_2025-09-06_183_Istria	9871, 9877, 9879, 9887, 9889, 9917	J. Castellani, FR; G. Vaudescal, FR; S. Kidd, GB; M. Jennings, GB	Double star ?	CUR		
HC-006_2025-06-30_8983_Rayakazakova	8977, 9036, 9037	M. Gorko, PL; M. Zawilski, PL	Double star			
HC-007_2024-12-16_937_Bethgea	6373	C. Ziolek, CH	Double star ?			
HC-008_	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
HC-009_2025-09-21_17171_1999 NB38	pending	P. Delincak, SK	Double star		Analyst: contact WEB for add. info	

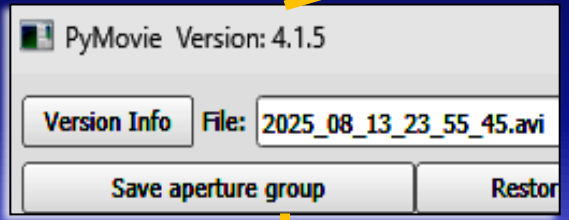
As a rule, the Hot Case analyst will request Tangra.lc files, often also the raw files of the recording.

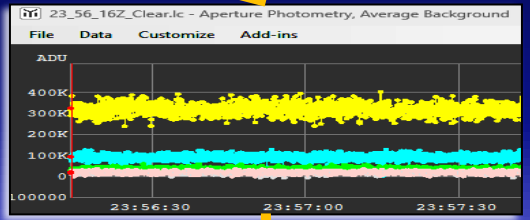
SODIS Hot Cases: Duplicate report

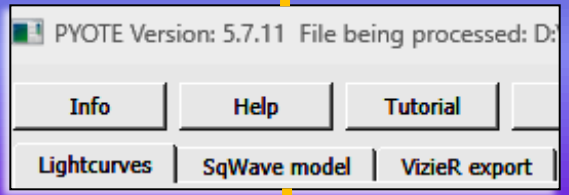


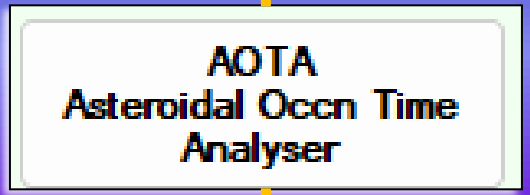
Recommended software

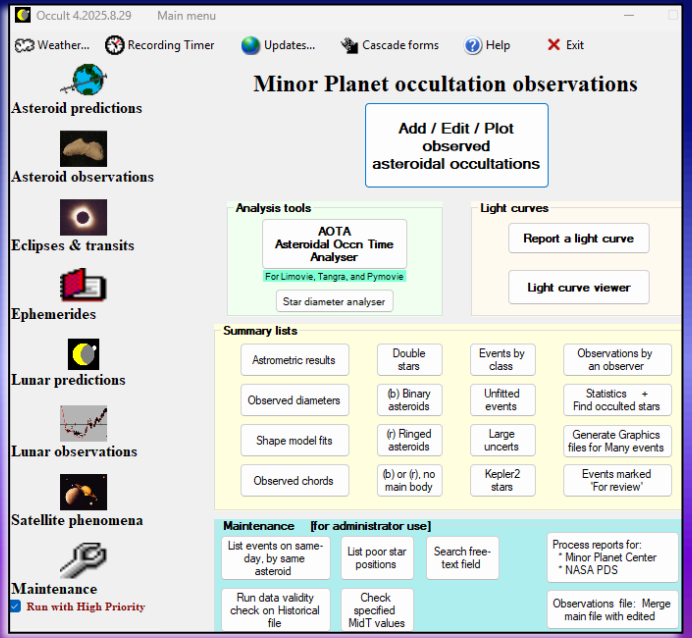






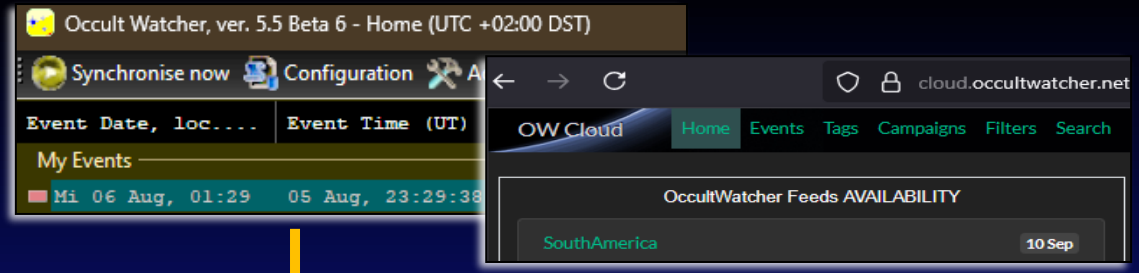


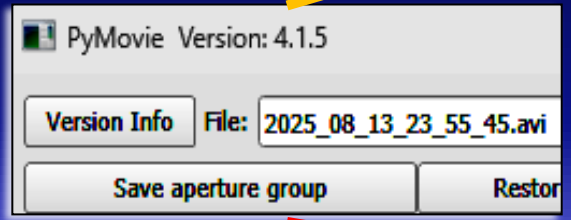


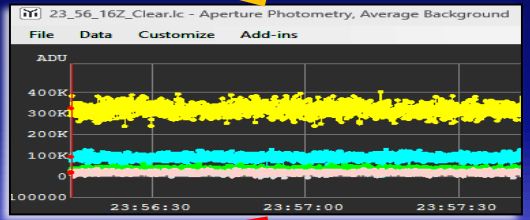


Recommended software

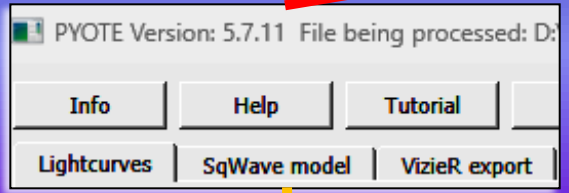
Always use the latest version!



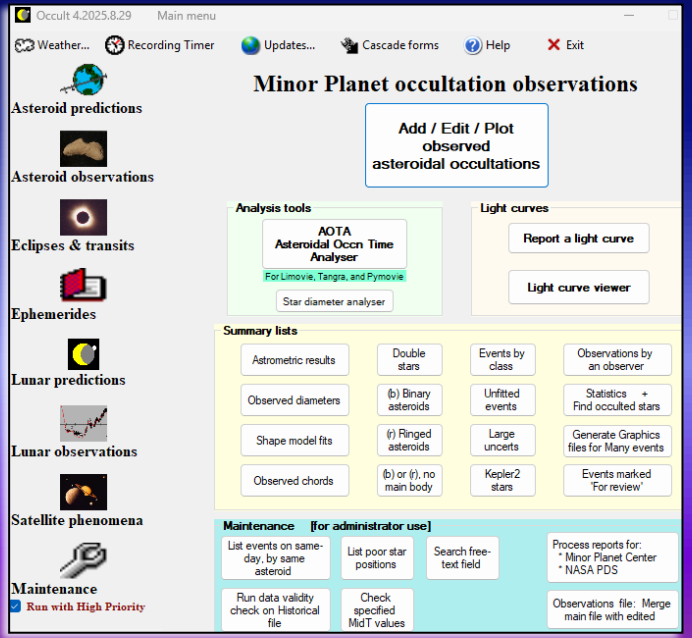




! Don‘t mix up !



AOTA
Asteroidal Occn Time Analyser



Help

E-Mail SODIS <sodis@iota-es.de>
Planoccult <planoccult@ls.vvs.be>
IOTAOccultations <IOTAoccultations@groups.io>

SODIS Forum

SODIS https://forum.iota-es.de/index.php

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Our members have made a total of 1,490 posts in 480 threads.

We currently have 148 members registered.

IOTA/ES

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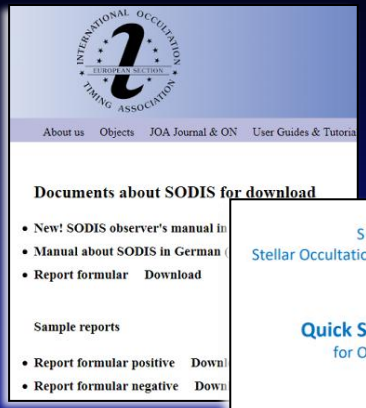
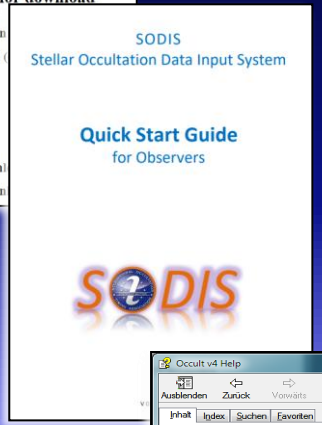
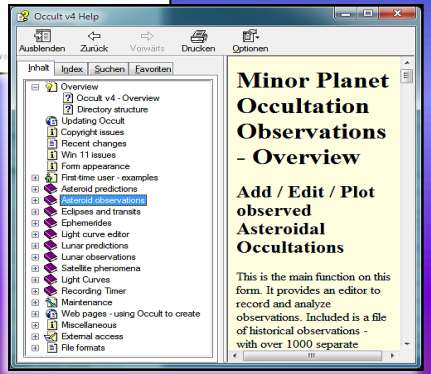
SODIS Documents



https://iota-es.de/sodis/sodis_docu.html



https://www.iota-es.de/sodis/SODIS_Quick-Start-Guide.pdf



Occult4 Help

Common errors in reporting to SODIS

SODIS reviewers and exporters have a difficult and time-consuming task - they often have to process several reports per day !

Please - Make this work as easy as you can for them.

How ?

SODIS reviewers and exporters have a difficult and time-consuming task - they often have to process several reports per day !

Please - Make this work as easy as you can for them.

How ? - By simply following the guidelines for submitting a report.

Where can these guidelines be found ?

On the SODIS report page itself and in the documents.

- By using report templates.

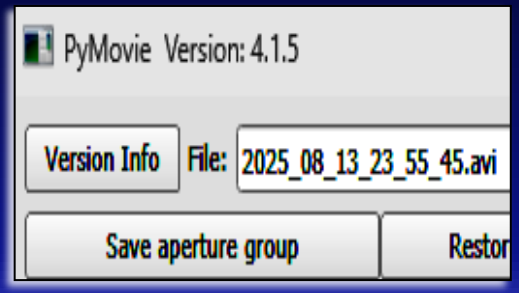
And please, very important:

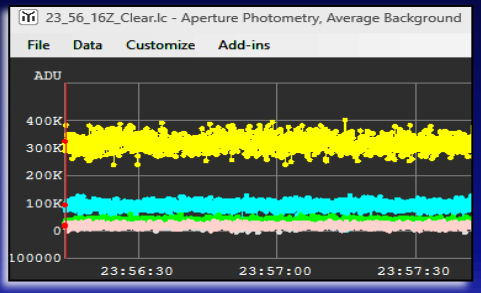
Check your uploaded report again after uploading - sometimes errors will appear …

> … maybe you are not in your observatory, but somewhere at sea ? (check the map)

> … and do the images/files really show what is required ?

It all starts with photometry …

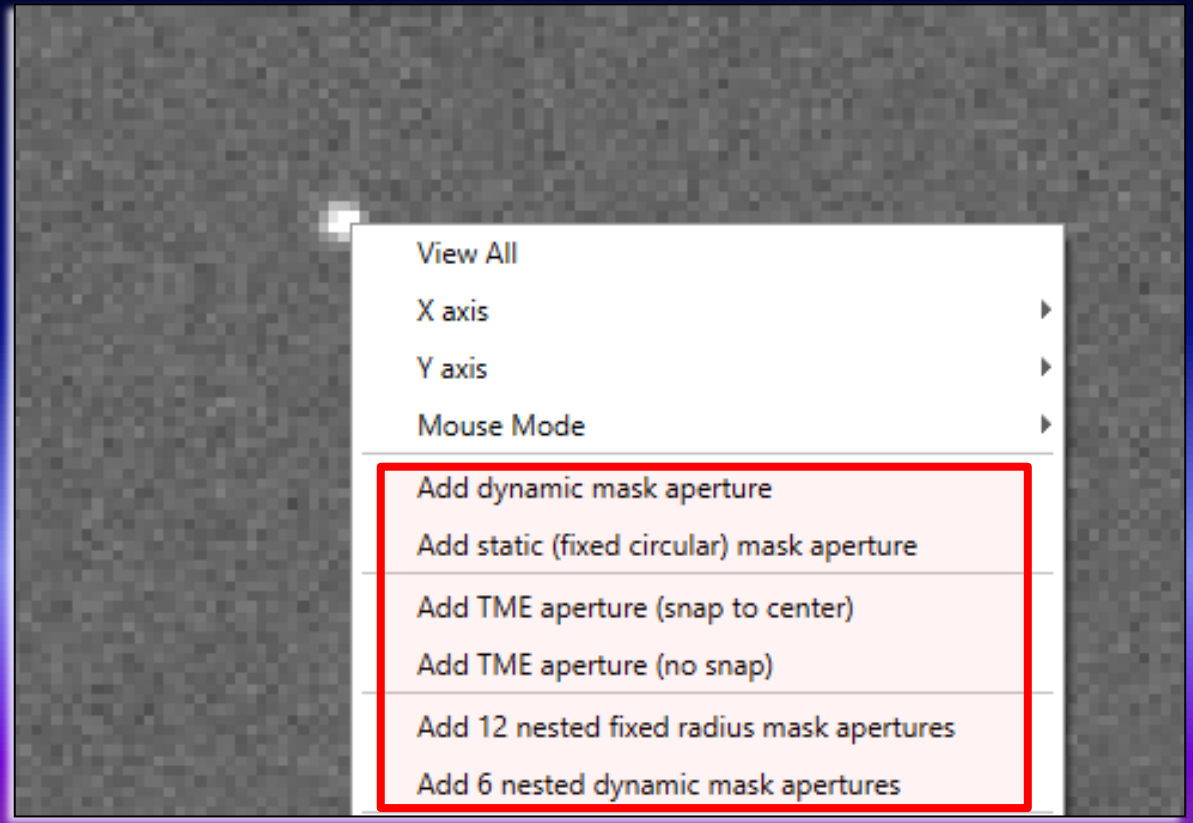




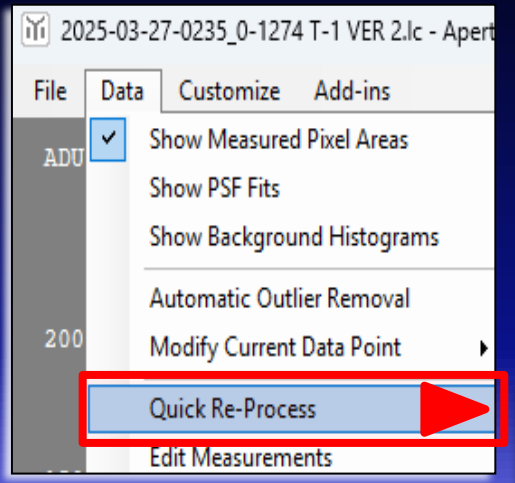
This is not the place for details, just a few hints …

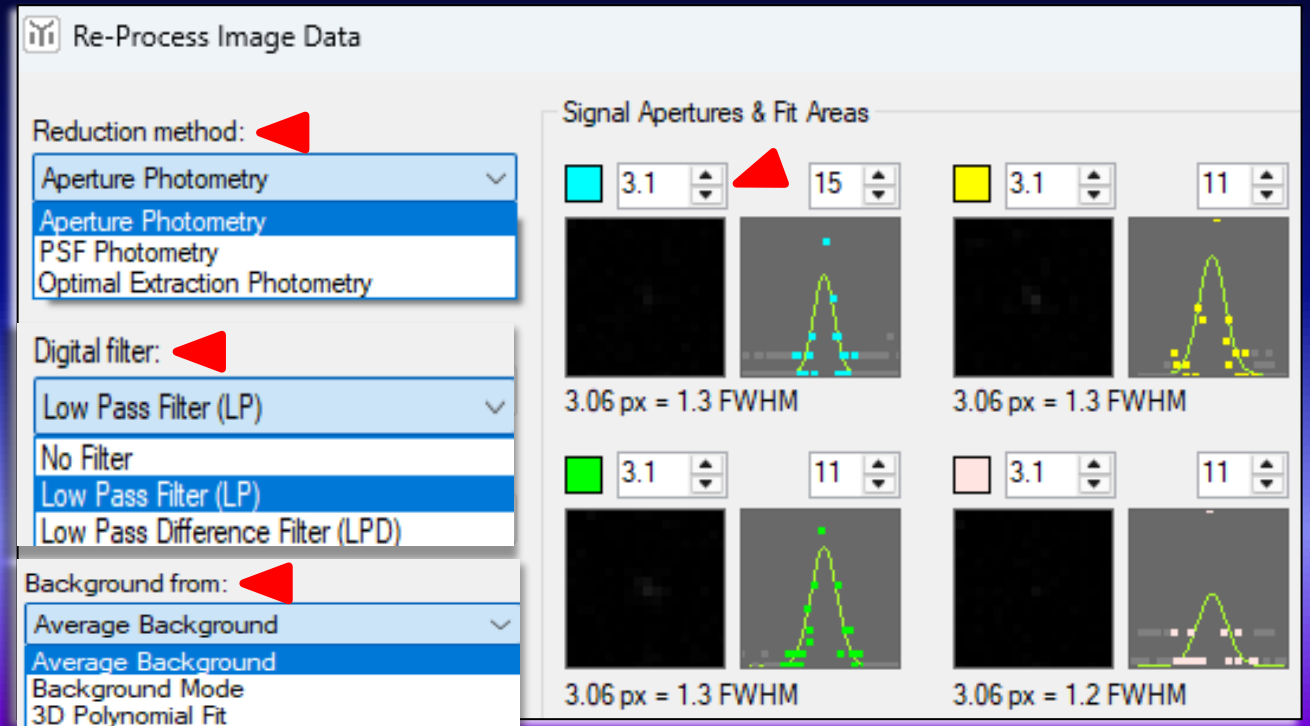
- The default photometry settings are not always the best
- Try to visualise the event as clearly as possible (shape, SNR, …) by varying the photometric methods/parameters

It all starts with photometry … PyMovie



It all starts with photometry … Tangra





Errors - wrong / insufficent files

Files in SODIS reports:

- **> Too few,**
- **> Too many/not required,**
- **> Incorrect/not applicable**

Pipeline	Event	Overview	Reduction	Log	csv File
Tangra, AOTA	PNG-Image from Occult-Watcher: „Open Event in Occult“	PNG-Image from Tangra: „Export lc / Save as Image File“ Include at least one comparison star	PNG- „tab 5		
Py-Movie, PyOTE	PNG-Image from Occult-Watcher: „Open Event in Occult“	PNG-Image from PyMovie: „Plot“ („Composite Lightcurve Plot“) Include at least one comparison star	Image („... P („... noise_induce_event _pyote.png“) "NIE-Test"		

Please provide following files:

SODIS 2.0 reporting mask

In case of a negative occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export

In case of a positive occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export
- AOTA evaluation: Tab5 screenshot; PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

Errors - wrong / insufficent files

Negative report

Pipeline			ile
Tangra, AOTA	PNG Wat Occ		ra: as csv File“
Py-Movie, PyOTE	PNG Wat Occult“	Plot“) Include at least one comparison star	e photometry) AOTA: tab 2b-test for 1 – 3 fr. events PyOTE: Noise induced event test

Please provide following files:

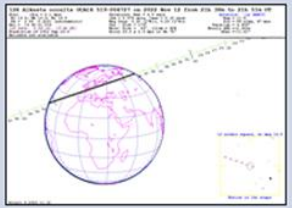
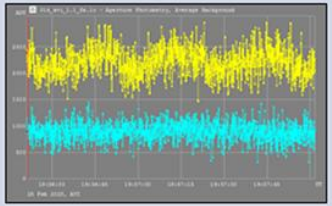
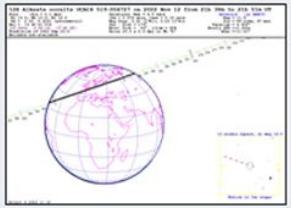
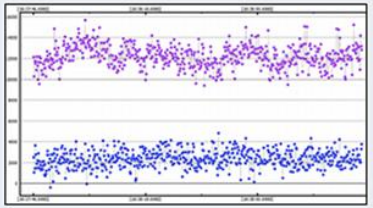
In case of a negative occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export

In case of a positive occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export
- AOTA evaluation: Tab5 screenshot, PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

What to submit ? Negative report

Pipeline	Event	Overview	csv File
Tangra, AOTA	 PNG-Image from Occult-Watcher: „Open Event in Occult“	 PNG-Image from Tangra: „Export lc / Save as Image File“ Include at least one comparison star	csv file from Tangra: „Export lc / Save as csv File“
Py-Movie, PyOTE	 PNG-Image from Occult-Watcher: „Open Event in Occult“	 PNG-Image from PyMovie: „Plot“ („Composite Lightcurve Plot“) Include at least one comparison star	PyMovie csv file (Result of PyMovie photometry)

https://www.iota-es.de/sodis/SODIS_Quick-Start-Guide.pdf

Errors - wrong / insufficent files

Positive report

Pipeline	Eve				csv File
Tangra, AOTA	PNG-Image Occult-Watc „Open Even Occult“				csv file from Tangra: „Export lc / Save as csv File“
Py-Movie, PyOTE	PNG-Image Occult-Watc „Open Even Occult“		least one comparison star	_pyote.png“) "NIE-Test"	PyMovie csv file (Result of PyMovie photometry)

Please provide following files:

In case of a negative occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export

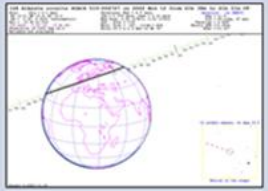
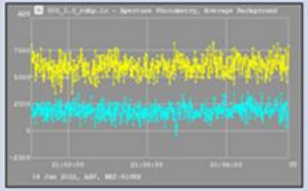
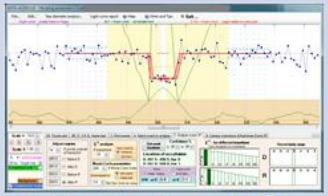
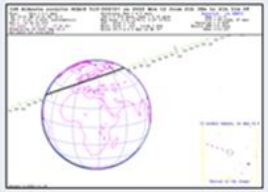
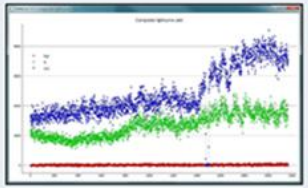
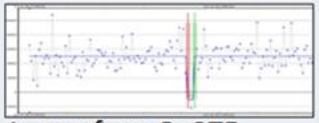
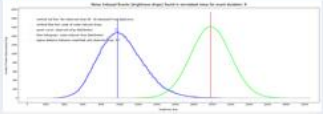
In case of a positive occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export
- AOTA evaluation: Tab5 screenshot; PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

AOTA: tab 2b-test for 1 – 3 fr. events

PyOTE: Noise induced event test

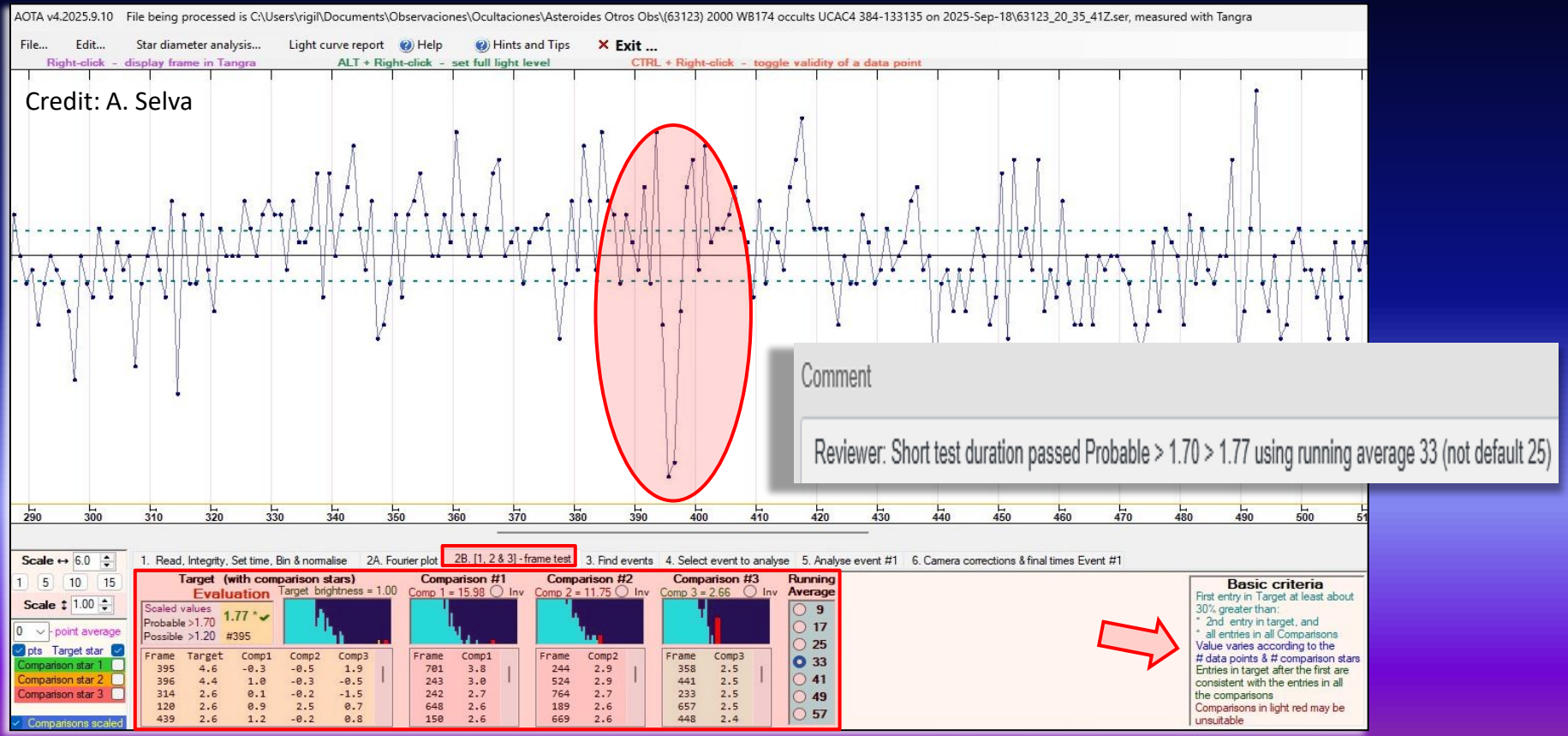
What to submit ? Positive report

Pipeline	Event	Overview	Reduction	Log	csv File
Tangra, AOTA	 PNG-Image from Occult-Watcher: „Open Event in Occult“	 PNG-Image from Tangra: „Export lc / Save as Image File“ Include at least one comparison star	 PNG-Image from AOTA: „tab 5“ AOTA tab 2B-test for 1, 2, 3 – frame events	Textfile („... AOTA_ Report.txt“) from AOTA „tab 6“: „Save Report“	csv file from Tangra: „Export lc / Save as csv File“
Py-Movie, PyOTE	 PNG-Image from Occult-Watcher: „Open Event in Occult“	 PNG-Image from PyMovie: „Plot“ („Composite Lightcurve Plot“) Include at least one comparison star	 Image from PyOTE: („... PYOTE.png“)  („... noise_induce_event _pyote.png“) "NIE-Test"	Textf. („... PYOTE.log“) from PyOTE	PyMovie csv file (Result of PyMovie photometry)

https://www.iota-es.de/sodis/SODIS_Quick-Start-Guide.pdf

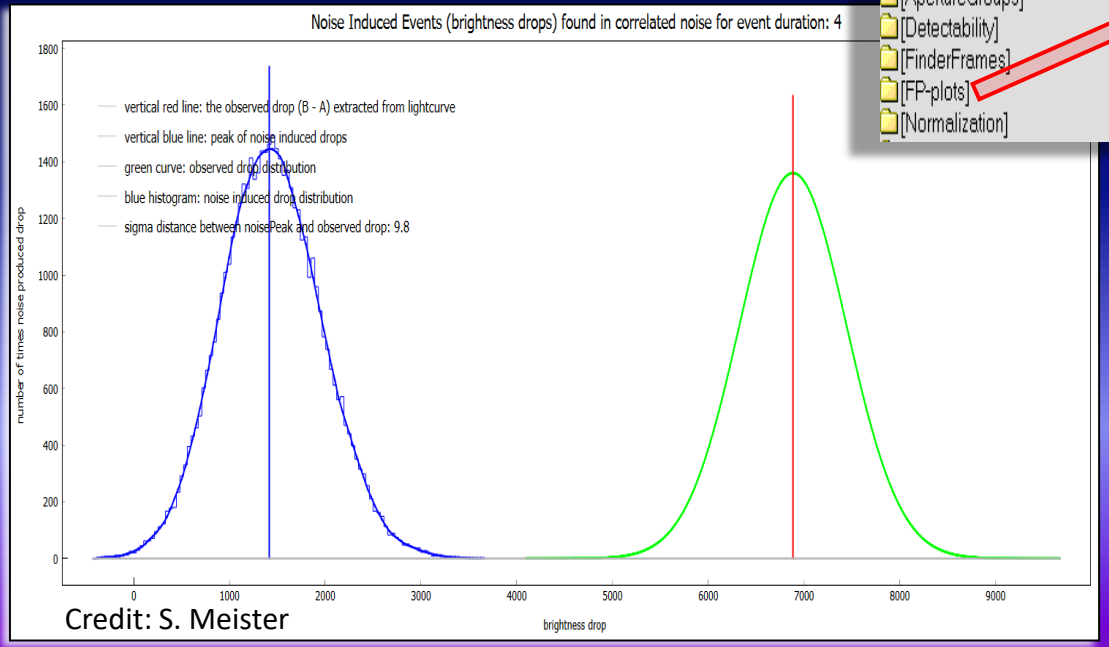
What to submit ?

Positive report – AOTA tab 2B test for 1, 2, 3 – frame events

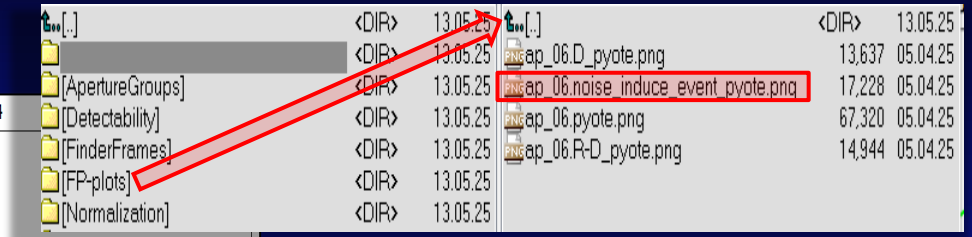


What to submit ?

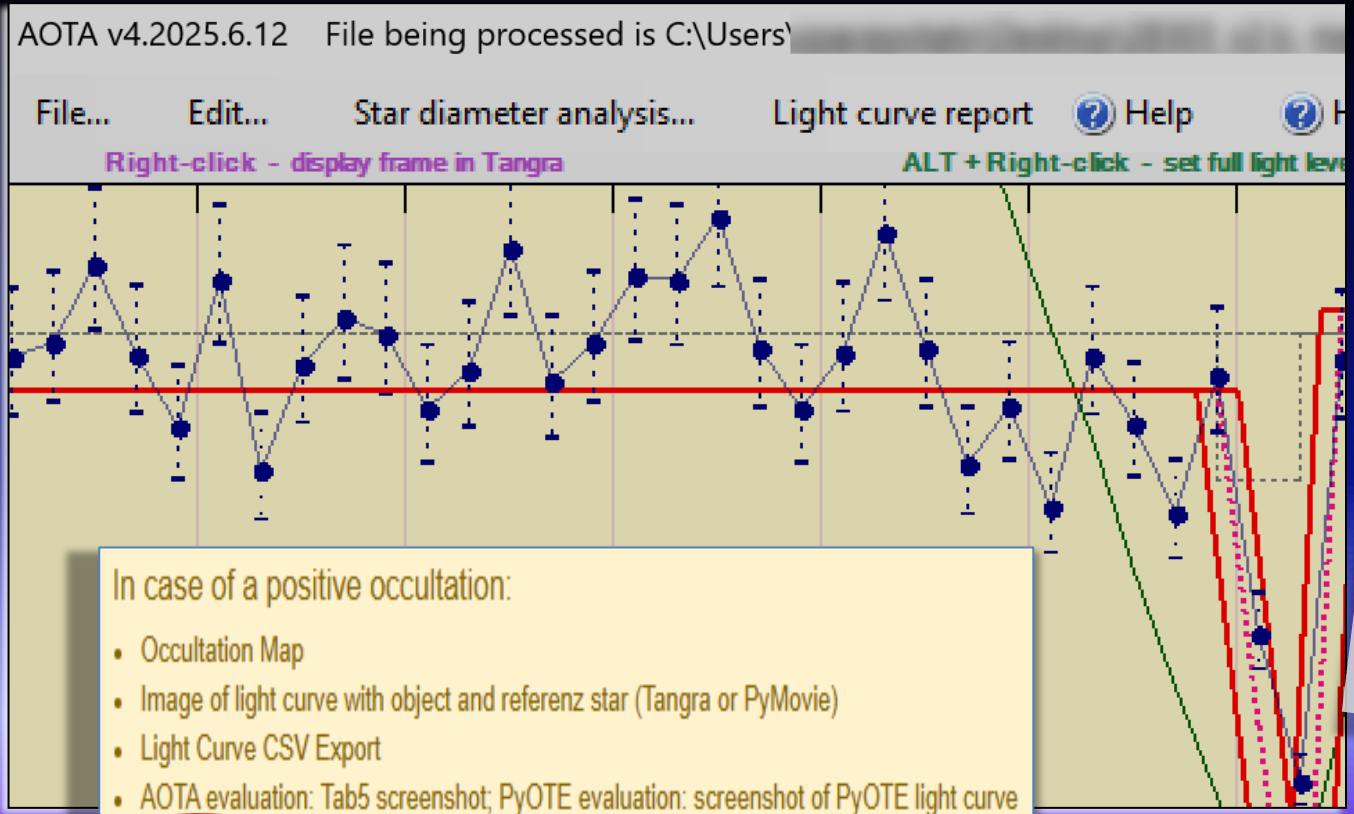
Positive report – PyOTE „Noise Induced Events“ („NIE“) test



Credit: S. Meister



Errors - wrong / insufficent files



In case of a positive occultation:

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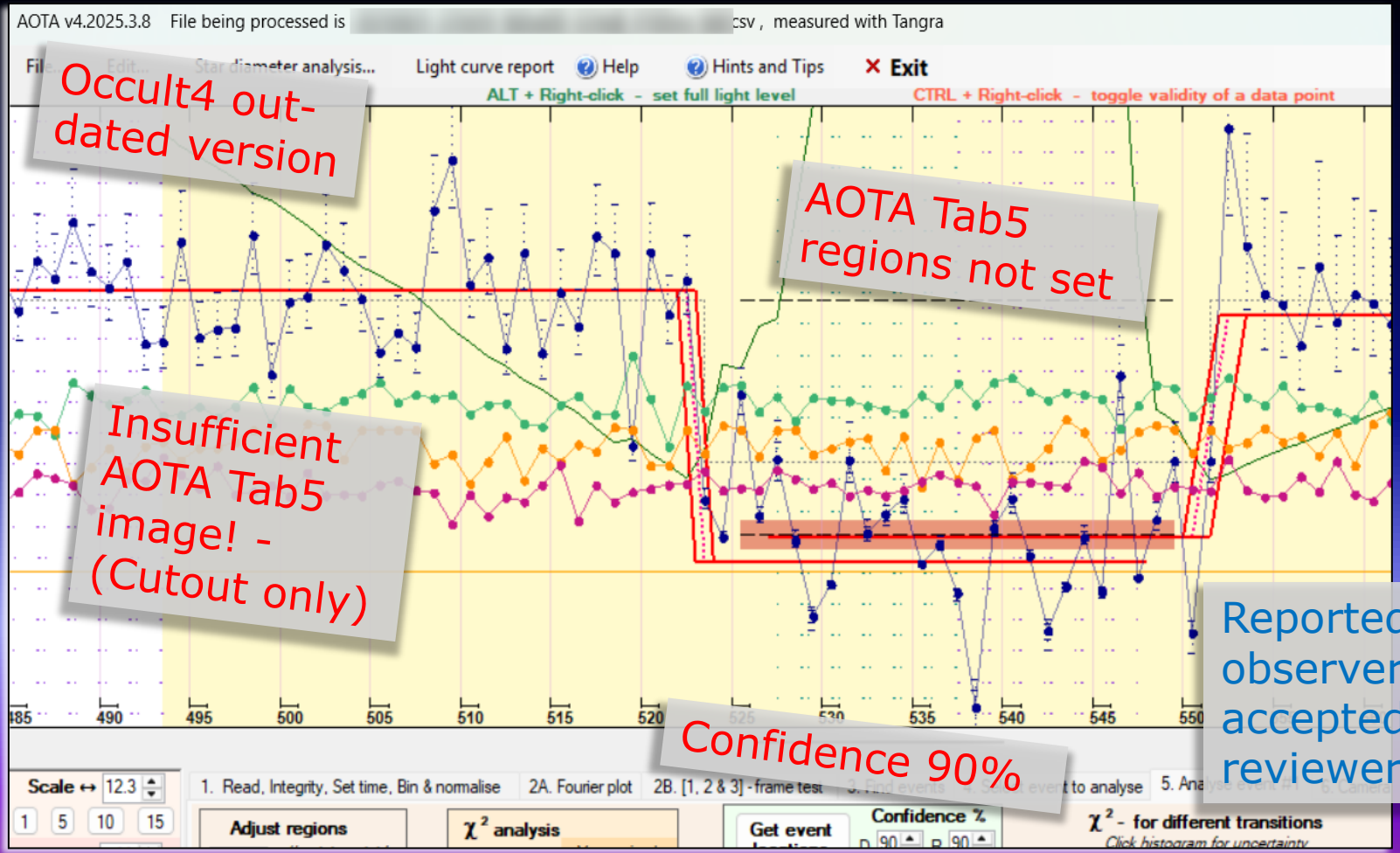
- AOTA evaluation: Tab5 screenshot; PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

This is a totally insufficient AOTA Tab5 image! - Cutout only

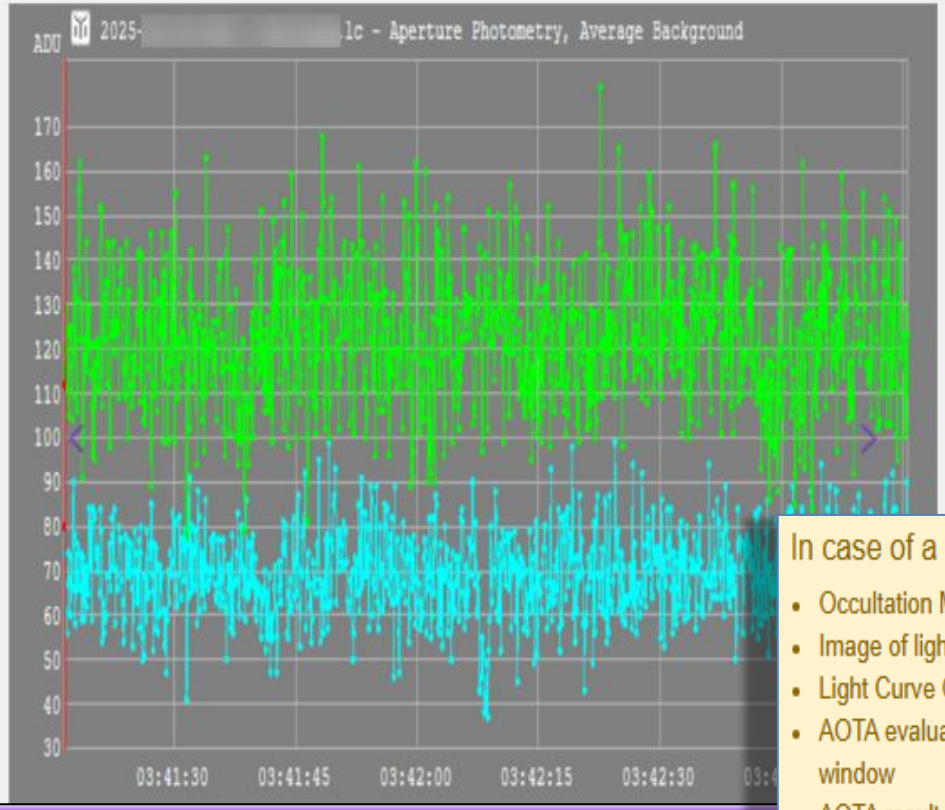
Errors - wrong / insufficent files



Reported by observer, accepted by reviewer ☹

Errors - wrong / insufficent files

Images & Files



dat

.csv

AOTA report missing ...

In case of a positive occultation:

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- Light Curve CSV Export
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- AOTA result file or PyOTE log file
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Errors - wrong / insufficent files

Drag & Drop your files or Browse

Please provide following files:

In case of a negative occultation:

- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export

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- Occultation Map
- Image of light curve with object and referenz star (Tangra or PyMovie)
- Light Curve CSV Export
- AOTA evaluation: Tab5 screenshot; PyOTE evaluation: screenshot of PyOTE light curve window
- AOTA result file or PyOTE log file
- voluntary, not obligatory: DAT file of the light curve

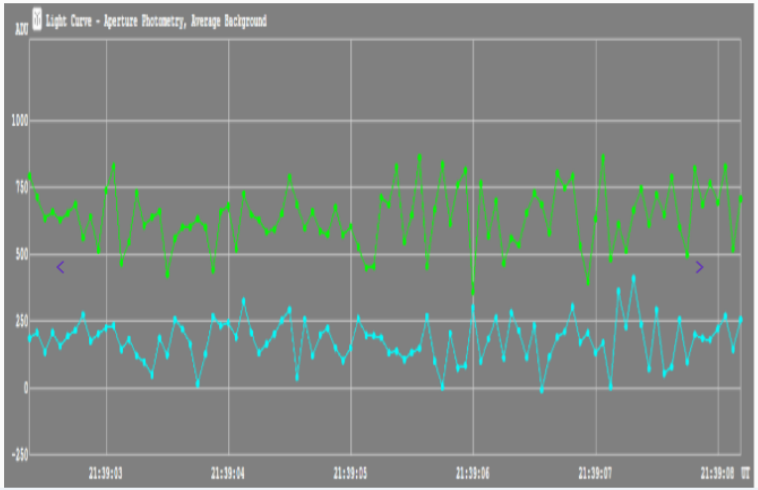
Occultation map missing ...

Comment

D_WT | Not Set | R_WT | Not Set | Timeshift | Plotcode | include observation

UPDATE ENTRY & SET REVIEWER FIELDS | ACCEPT | E-MAIL & REQUEST CHANGES ON INPUT | DELETE

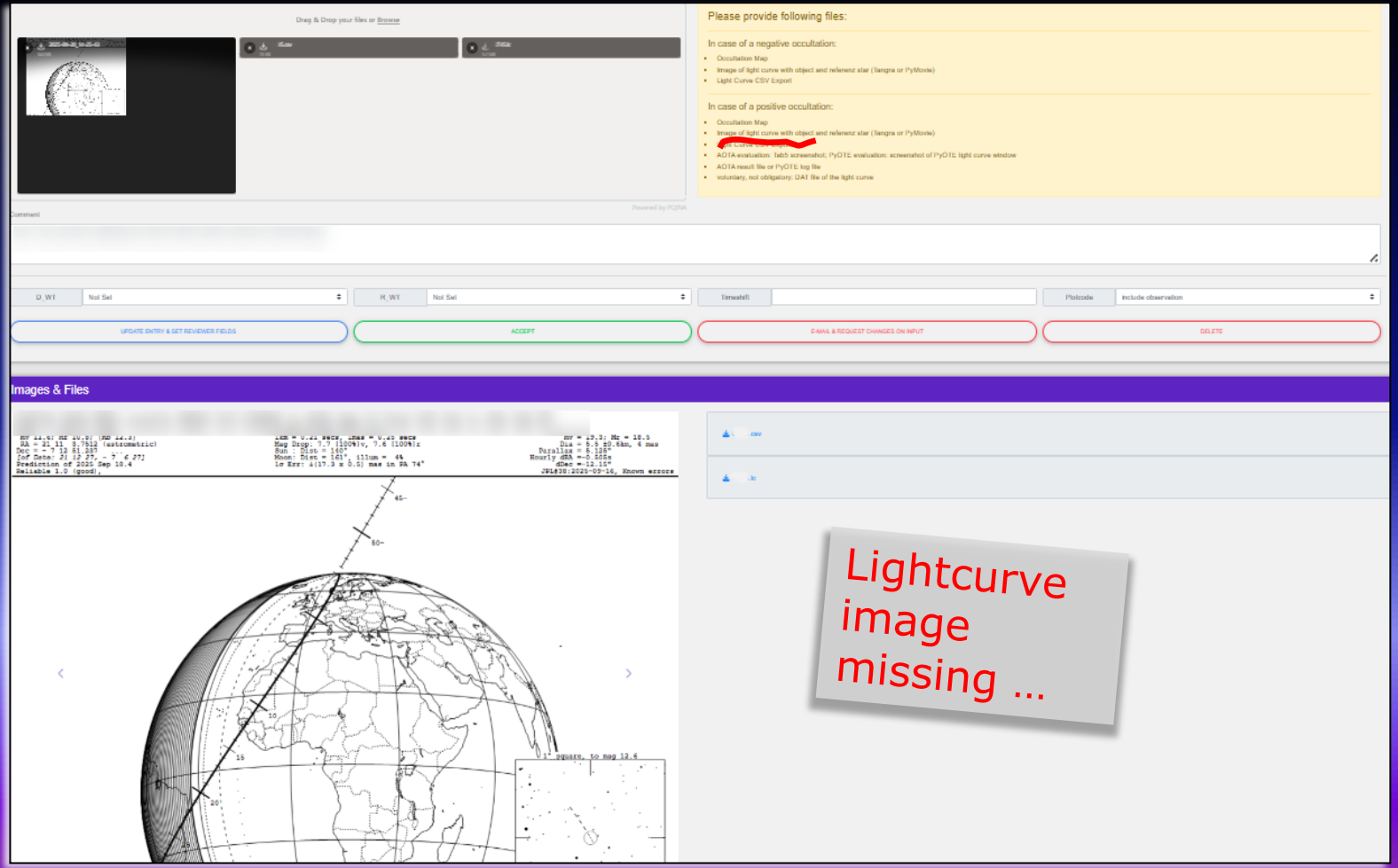
Images & Files



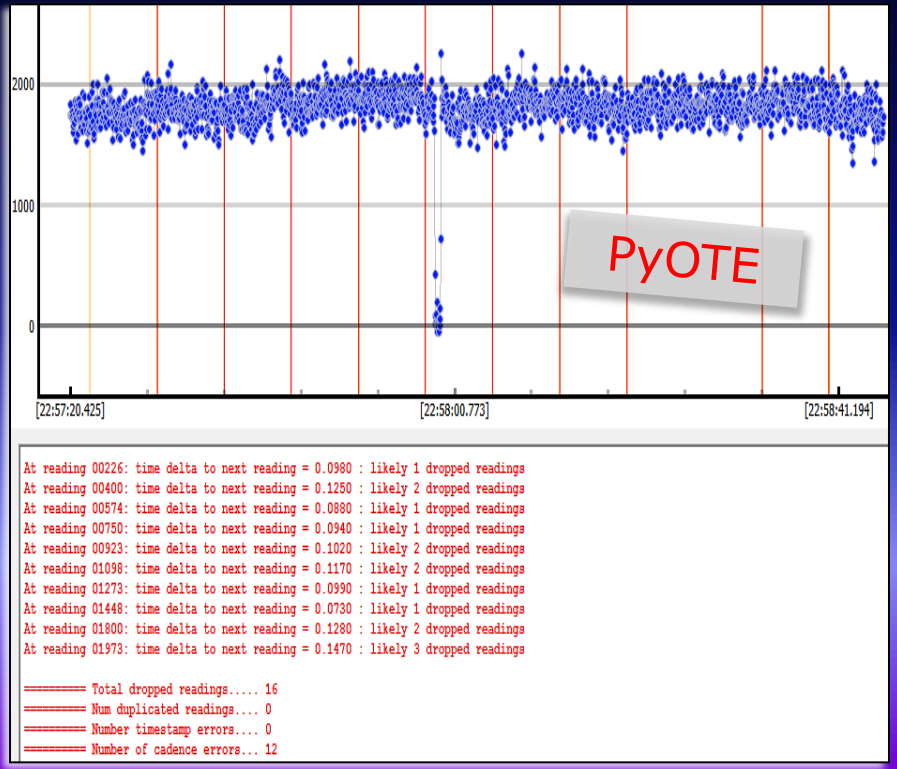
CSV_

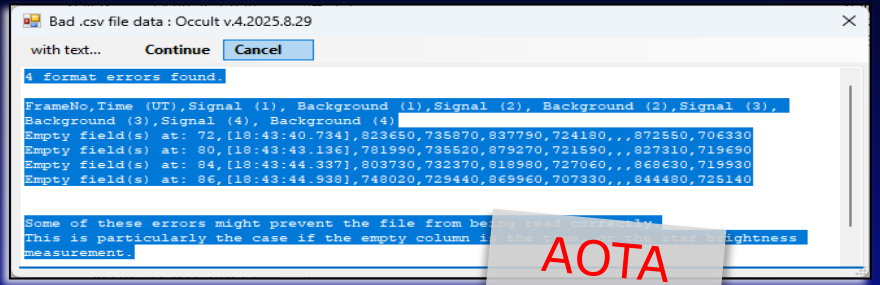
Poor SNR > no reliability, also for a negative observation

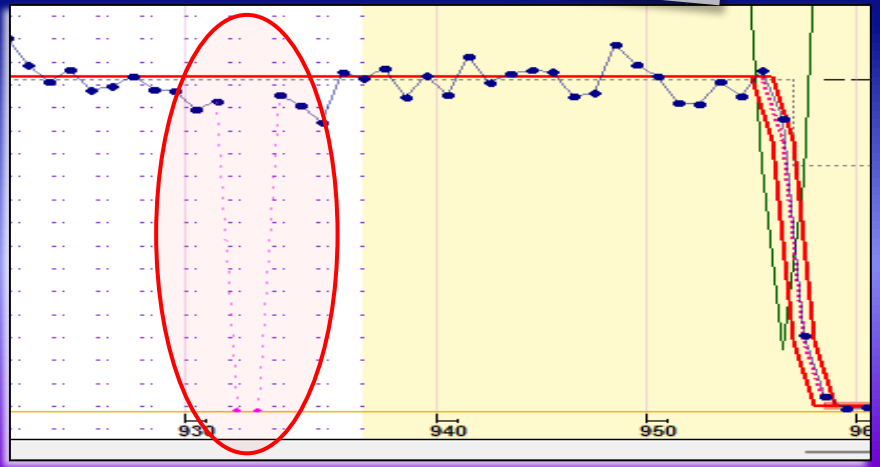
Errors - wrong / insufficent files



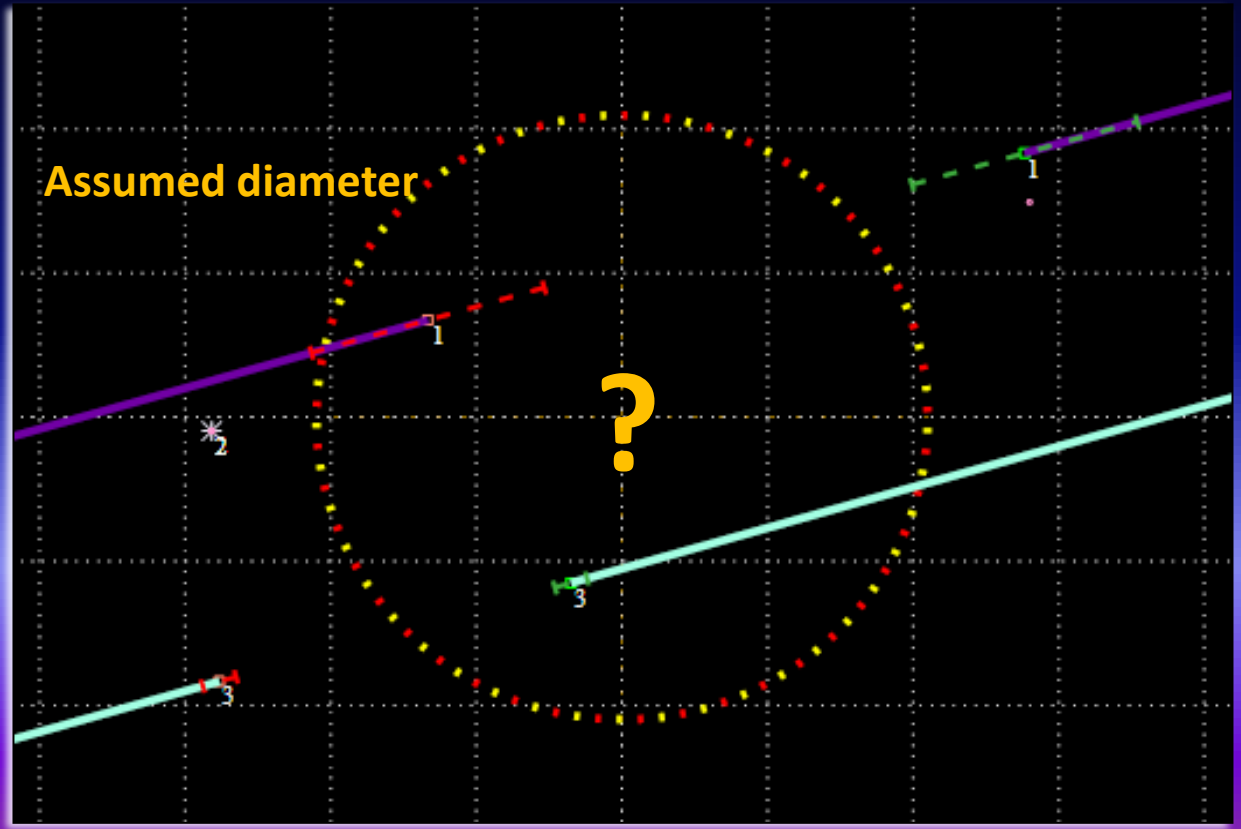
Errors - frame errors



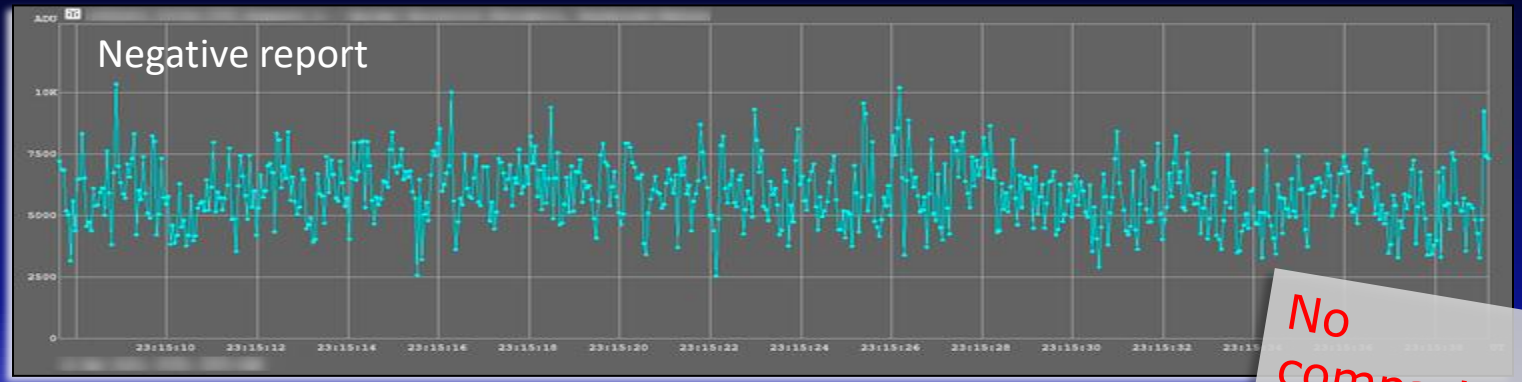


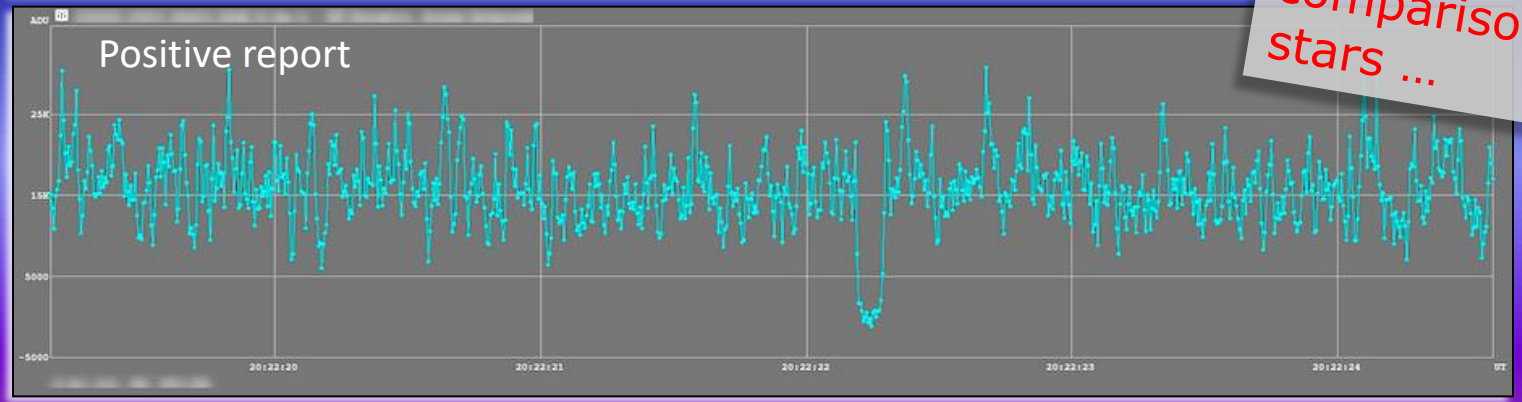


Errors - time base errors ?



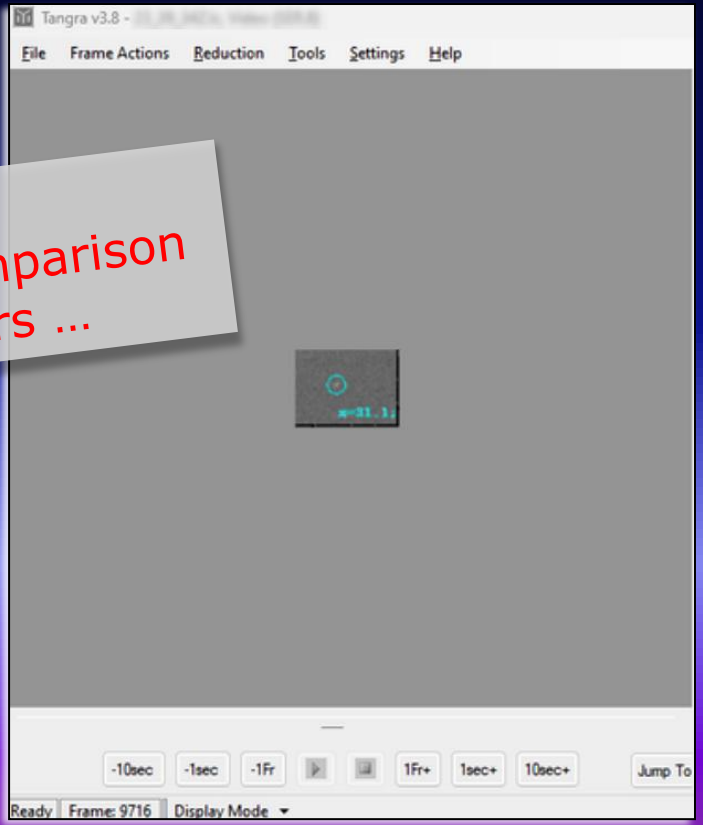
Errors - missing comparison stars



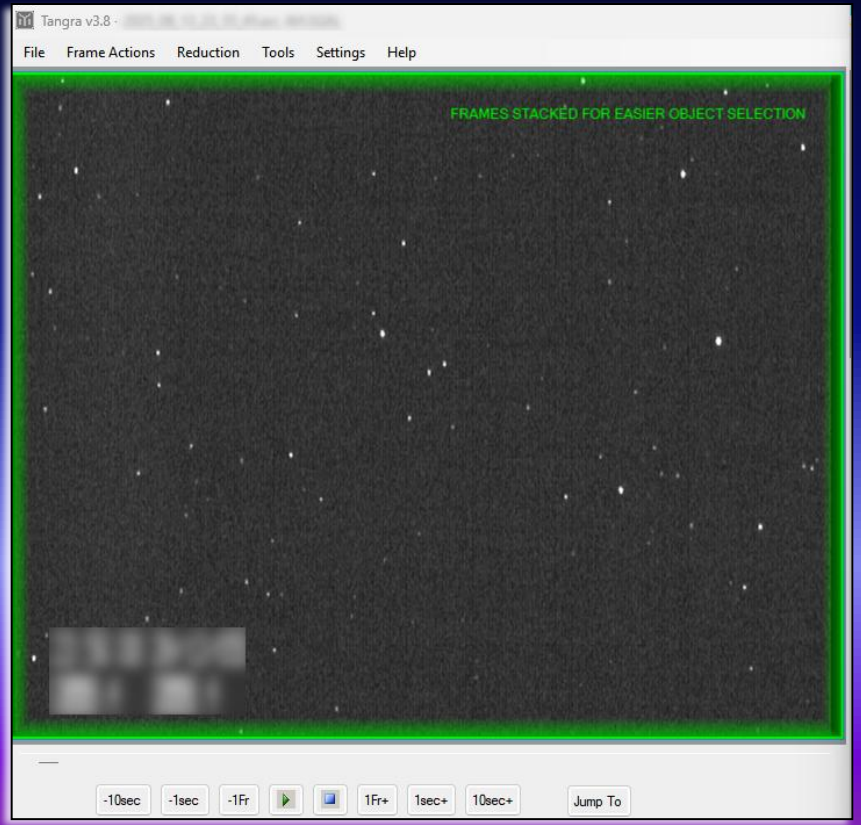


No comparison stars …

Errors - missing comparison stars

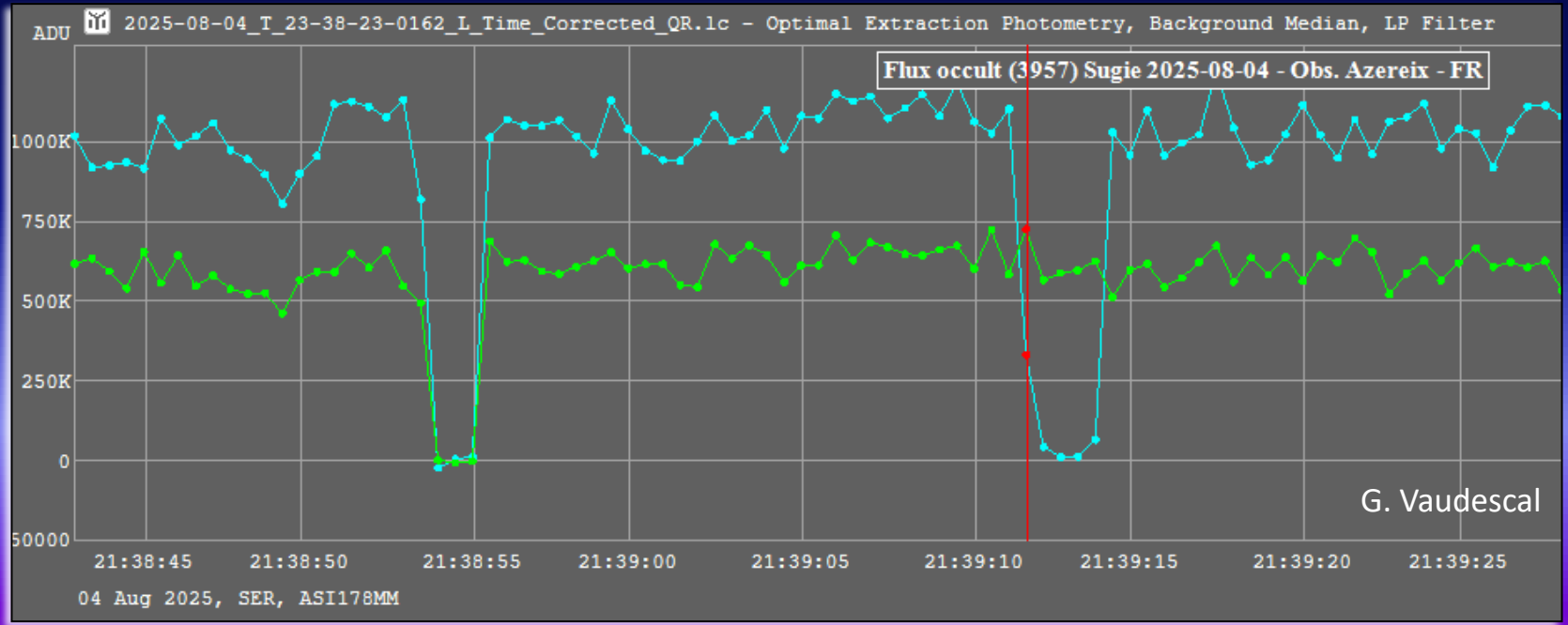


No comparison stars ...



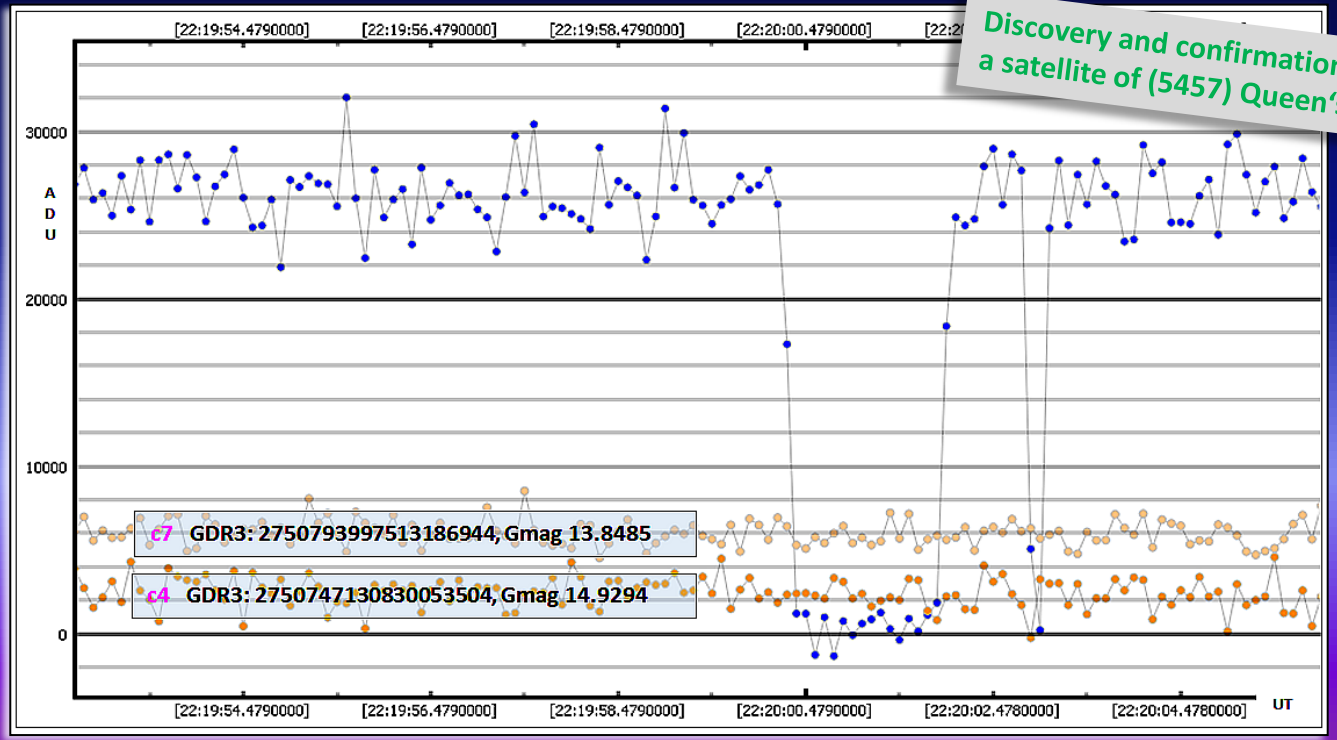
Importance of comparison stars

> To assess the credibility of an event



Importance of comparison stars

> To measure the limiting magnitude



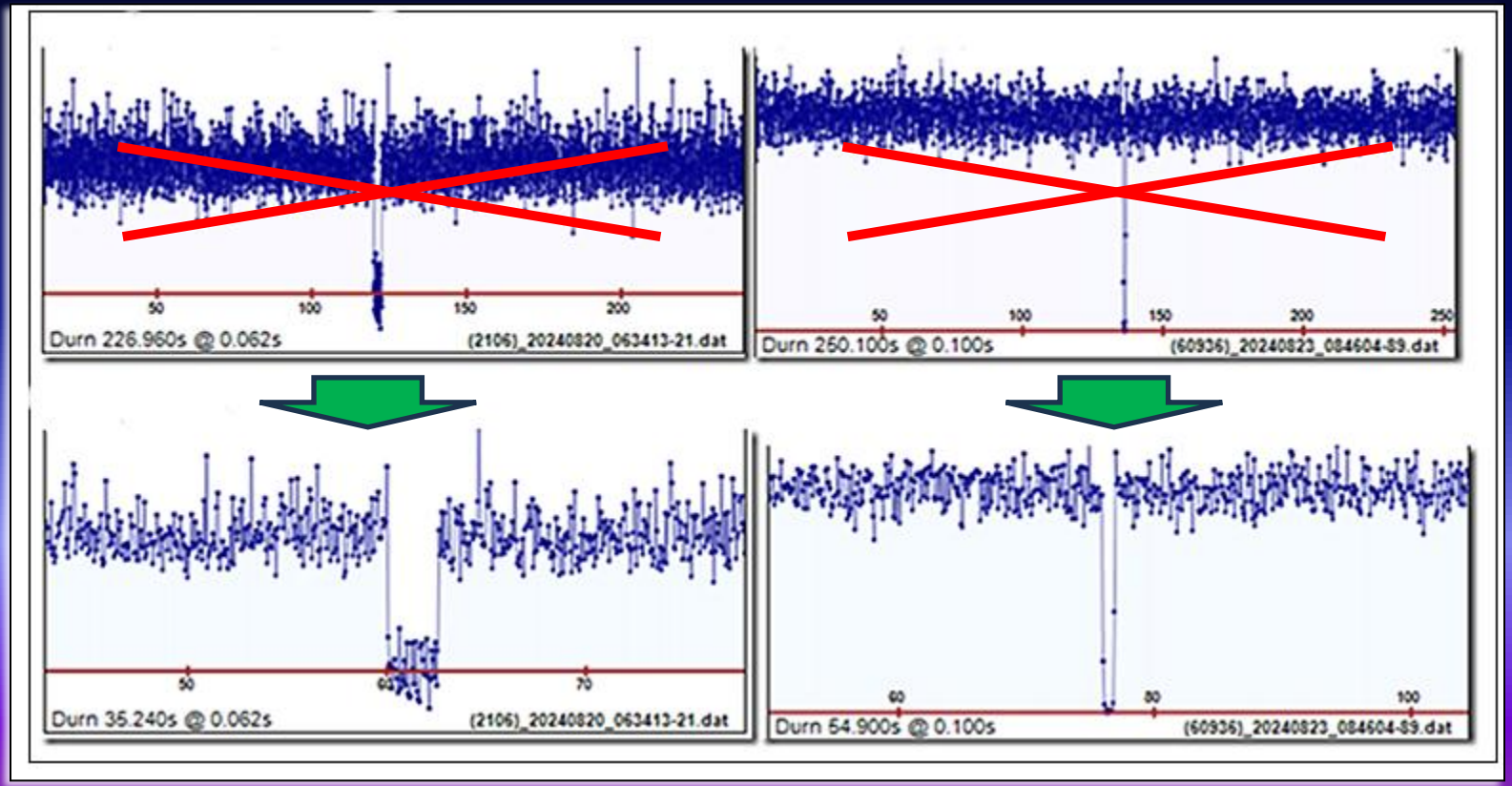
Discovery and confirmation of a satellite of (5457) Queen's

.dat-formatted lightcurves: SODIS handling

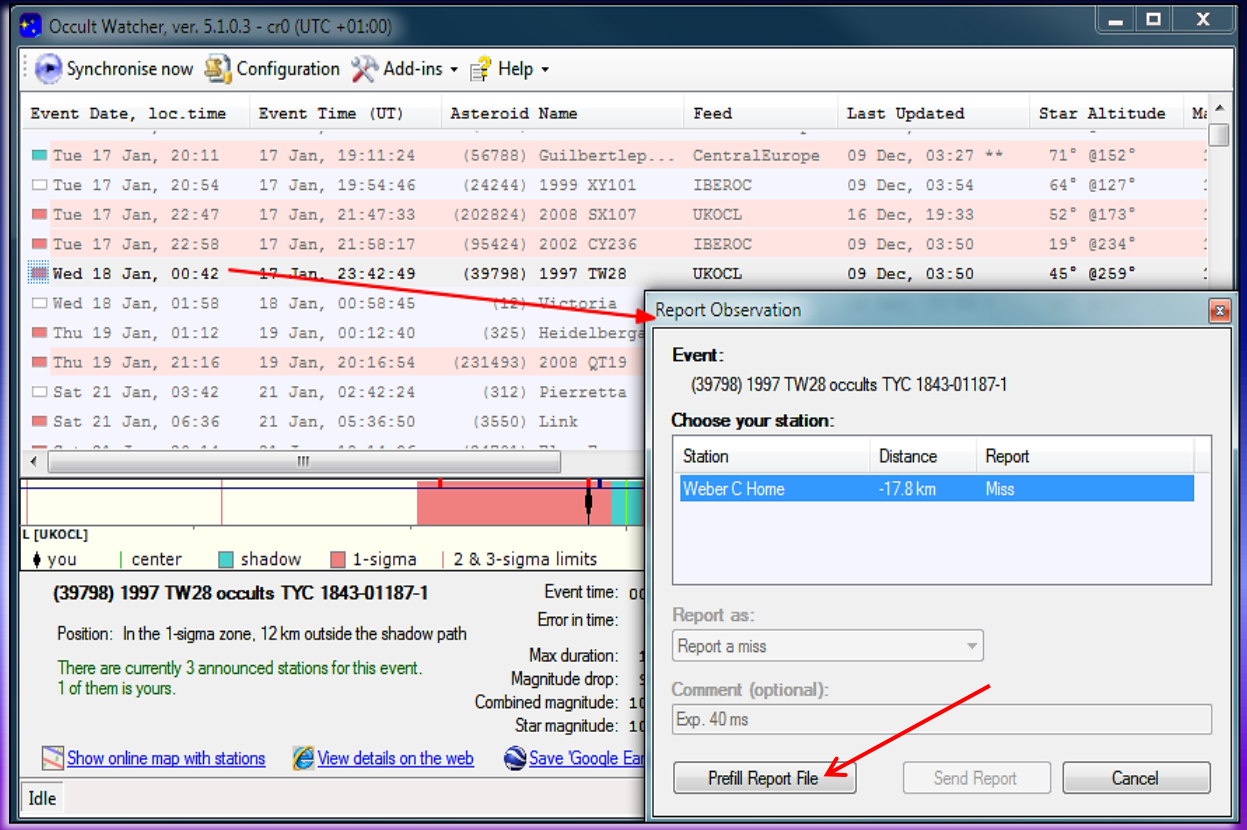
Observer	**.dat already sent to D. H.** Obs. comment in SODIS report	**.dat sent to SODIS**	**–**
Reviewer	**–**	Check .dat .dat remains in SODIS	**Create .dat (from .csv)** Check .dat .dat remains in SODIS
Super Exporter	**–**	.dat export to D. H.	.dat export to D. H.

Errors - DAT lightcurves

Credit: D. Herald



Avoiding data entry errors - the best way



Use report-tem-plates !

Latest: https://forum.iota-es.de/attachment.php?aid=256

Avoiding data entry errors - the best way

Asteroidal Occultation Report Addin, ver 1.9

The reporting add-in will help you maintain a list of templates for your different telescopes, fixed observatories and equipment and will prepopulate the event information (date, star, asteroid, negative/positive and others) when you press "Prefill Report". Then you will have to enter the event times and the rest of the required details.

Template to use

IOTA-ES_report_203

Templates must be text files (extension .txt) saved unc
tokens that the Reporting Addin will replace with real
%ASTEROID% and %ASTEROID-NO%. Leave "xxxx
"POSITIVE". Additoinally more tokens can be used a

The Report Templates directory is:

C:\OccultWatcher\Report Templates

It is recommended that you create one template for ea
of your mobile telescopes. You should fill in section 3
doesn't change. Leave the OBSERVING STATION f
you submit your report. Complete section 2 (OBSERV
information every time.

Prefill Report | Cancel

The reporting add-in will help you maintain a list of templates for your different telescopes, fixed observatories and equipment and will prepopulate the event information (date, star, asteroid, negative/positive and others) when you press "Prefill Report". Then you will have to enter the event times and the rest of the required details.

Template to use

IOTA-ES_report_203__8RC-WAT | Reload | New | Edit | Delete

IOTA-ES_report_203

IOTA-ES_report_203__8RC-WAT

Templates must be text files (extension .txt) saved under the Report Templates directory and containing all compulsory tokens that the Reporting Addin will replace with real data. These tokens are: %EVENT-DATE%, %STAR%, %ASTEROID% and %ASTEROID-NO%. Leave "xxxxTIVE" as it is as it will be also updated with "NEGATIVE" or "POSITIVE". Additoinally more tokens can be used at your descretion. Click here for the full list of available tokens.

Avoiding data entry errors - the best way

```
#IOTA-ES ASTEROIDAL OCCULTATION - REPORT FORM 2.03
#Event
#Occultation: NEGATIVE
#DATE: 17 January 2023
#PREDICTTIME: 17 Jan; 23:42:49 UT
#STAR: TYC 1843_01187_1
#ASTEROID: 1997 TW28
#Nr: 39798
#OBSERVER
#Observer1: (will be automatically filled in by SODIS)
#Observer2: Frank Muller
#moreObs:
#E-mail:
#Address:
#OBSERVING_STATION
#Located near: Xtown
#Countrycode: DE
#Coordinates LAT +/-DD MM SS.S  LON +/-DDD MM SS.S
#Latitude: 42 35 48.0
#Longitude: 023 35 40.4
#Altitude: 470
#Datum _blank=WGS84 N=NAD1927 E=ED1950 T=Tokyo G=GB1936 *=unspecified, or other
#Datum:
#Teleskop _=unstated 1=Refractor 2=Newtonian 3=SCT 4=Dobsonian 5=Binoculars 6=Other
7=None 8=eVscope
#Telescope: 6
#Aperture in cm
#Aperture: 21
#FocalLength in cm
#FocalLength: 90
#ObservingMethod _=unspecified a=Analogue & digital video b=Digital SLR-camera video
c=Photometer d=Sequential images e=Drift scan f=Visual g=Other
#ObservingMethod: a
#Observation
#StartObs:
#D D=Main Star d=second Star G=satellite main star g=satellite 2nd star N=ring M=non detection
+time hh:mm:ss.s
#D:
#Acc_D:
#R R=Main Star r=second Star B=satellite main star b=satellite 2nd star N=ring M=non detection
```

Green: automatically pre-filled

Common data entry errors

Comment

Max duration predicted : 0.7s. Probability : 11%.

Comment

moon distance 9°

Comment

Telescope RC 12"

Unnecessary comments ...

Comment

Telescope type RC. Link OWC https://cloud.occultwatcher.net/event/783-8066-135865-648239-U042534/833428.

Comment

here only really important remarks

Comment

sehr w

Comments must be in English

Comments …

… Can be useful, primarily to tell the reviewer something that is important but not apparent from the report itself e.g.:

“No GPS lock”

“Second drop caused by a bird” :-)

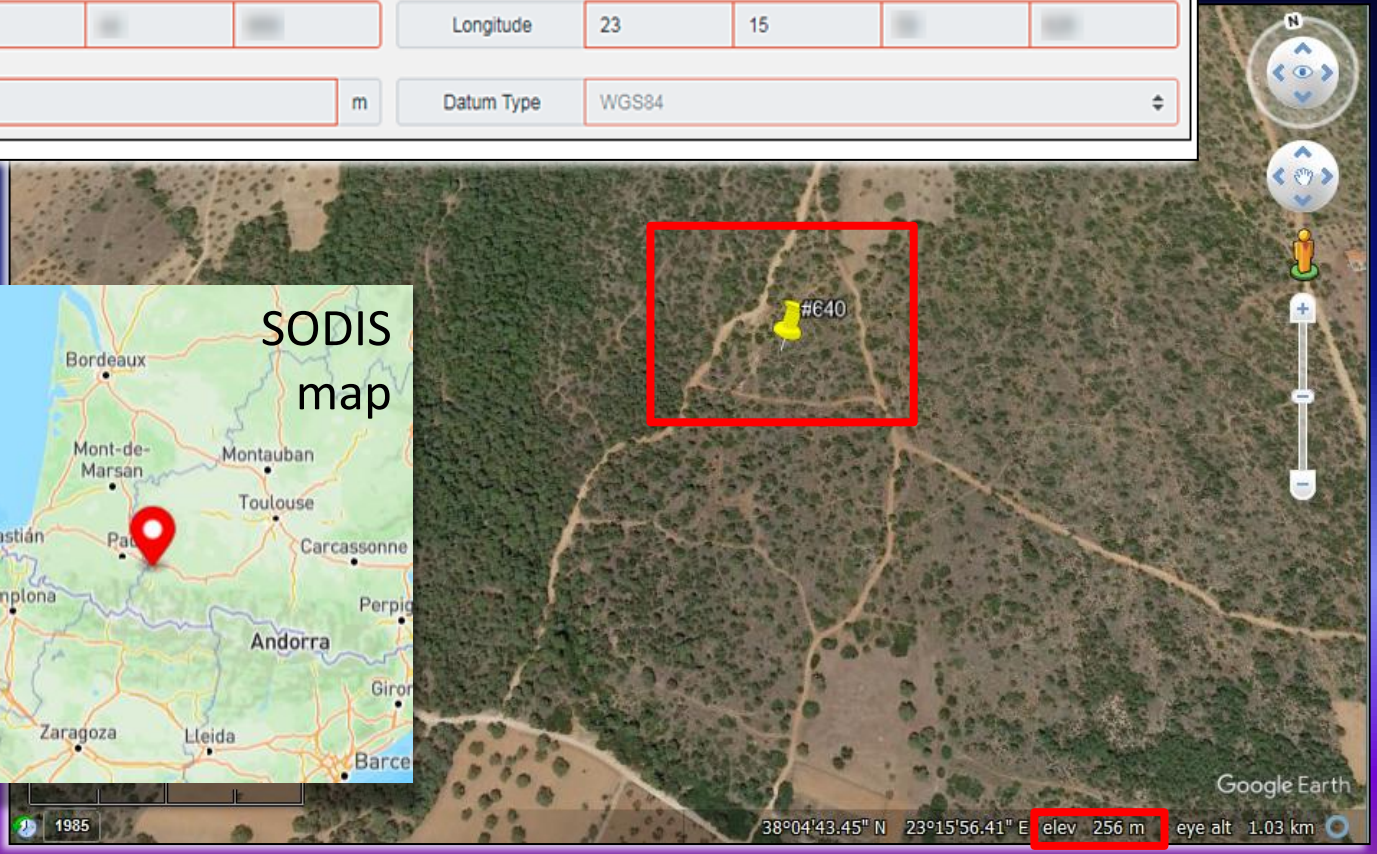
”Rolling shutter, delay is not corrected”

The reviewer decides whether comments are retained and thus included in the XML file to export to D. Herald or removed and kept as reviewer comments.

Common data entry errors

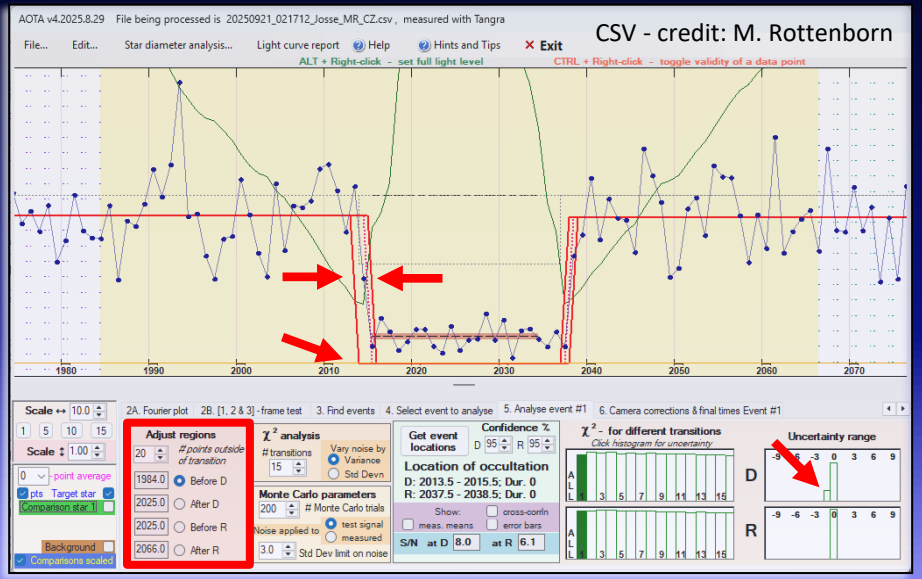
Latitude	38	04			Longitude	23	15	
Altitude	302.3	m			Datum Type	WGS84		

Wrong geogra-phical data



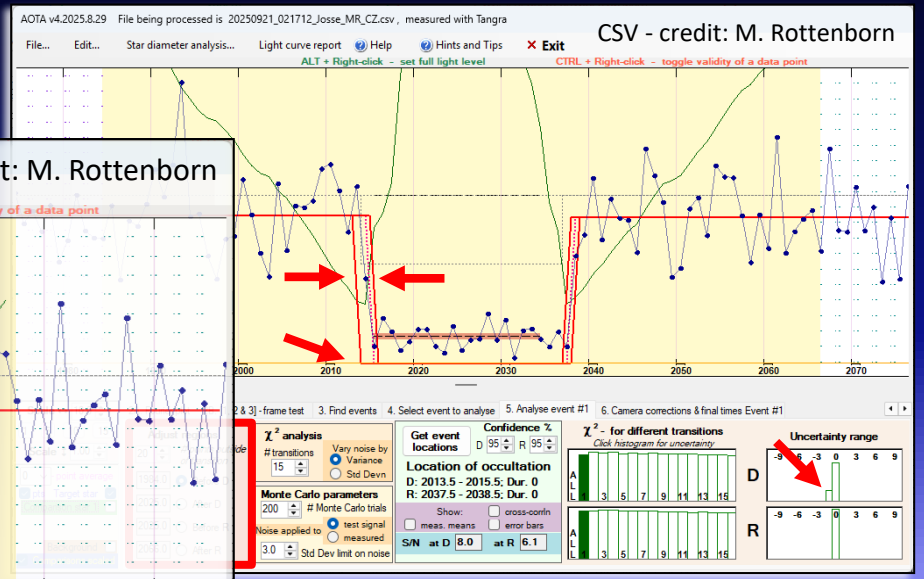
Common data reduction errors

AOTA tab 5
incorrect use
(*very* common)
Demo only, in report OK

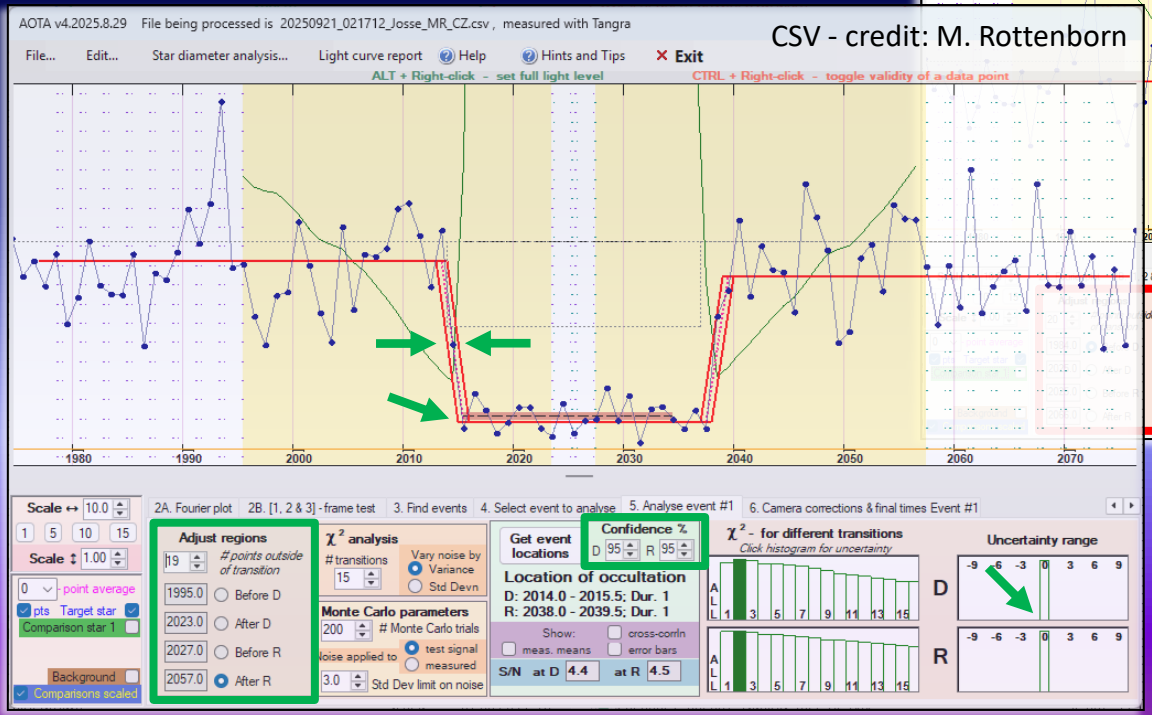


Common data reduction errors

AOTA tab 5 correct use



CSV - credit: M. Rottenborn

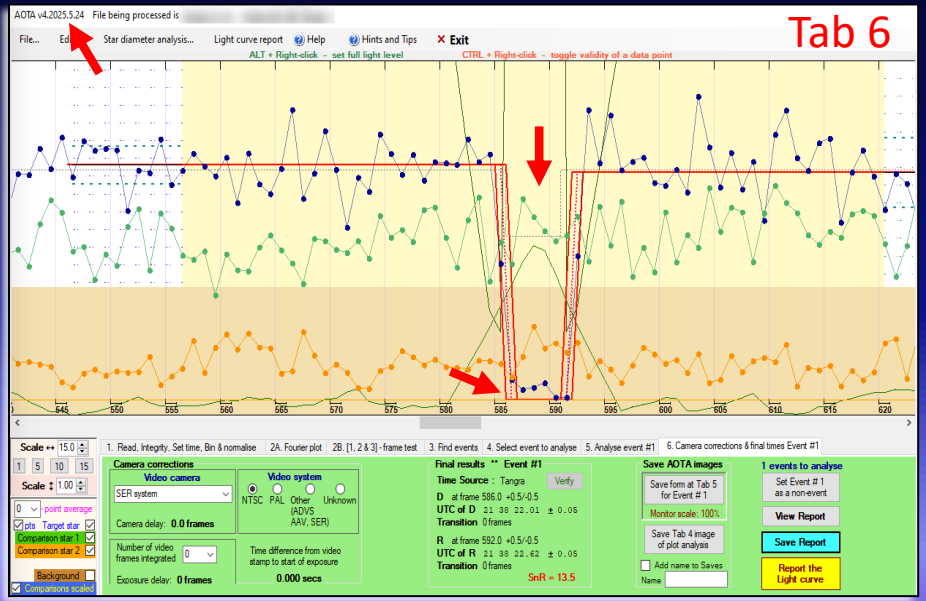


CSV - credit: M. Rottenborn

For details see chapter 3.3.1 here: https://iota-es.de/sodis/SODIS_Observer-Doc_21-03-23.pdf

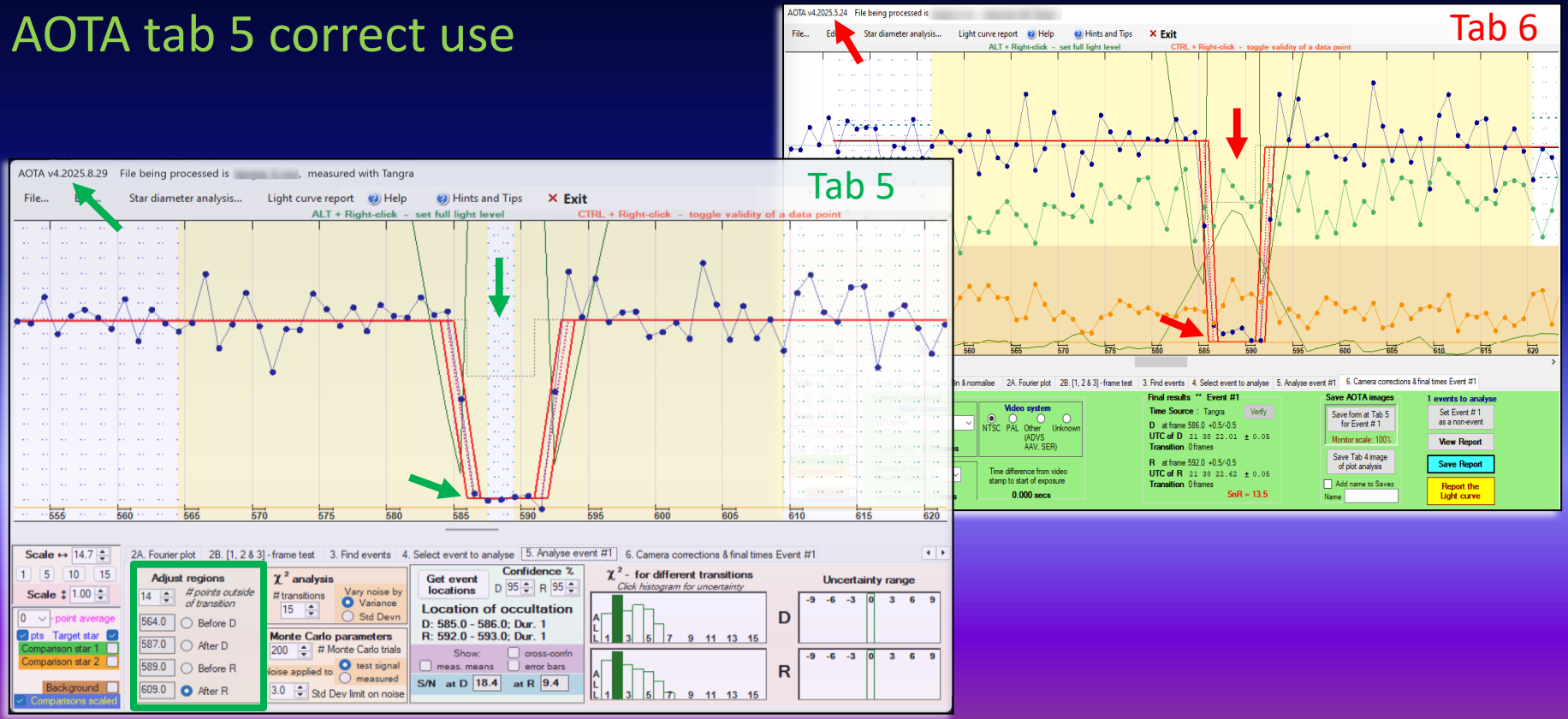
Common data reduction errors

AOTA tab 5
incorrect use
(*very* common)

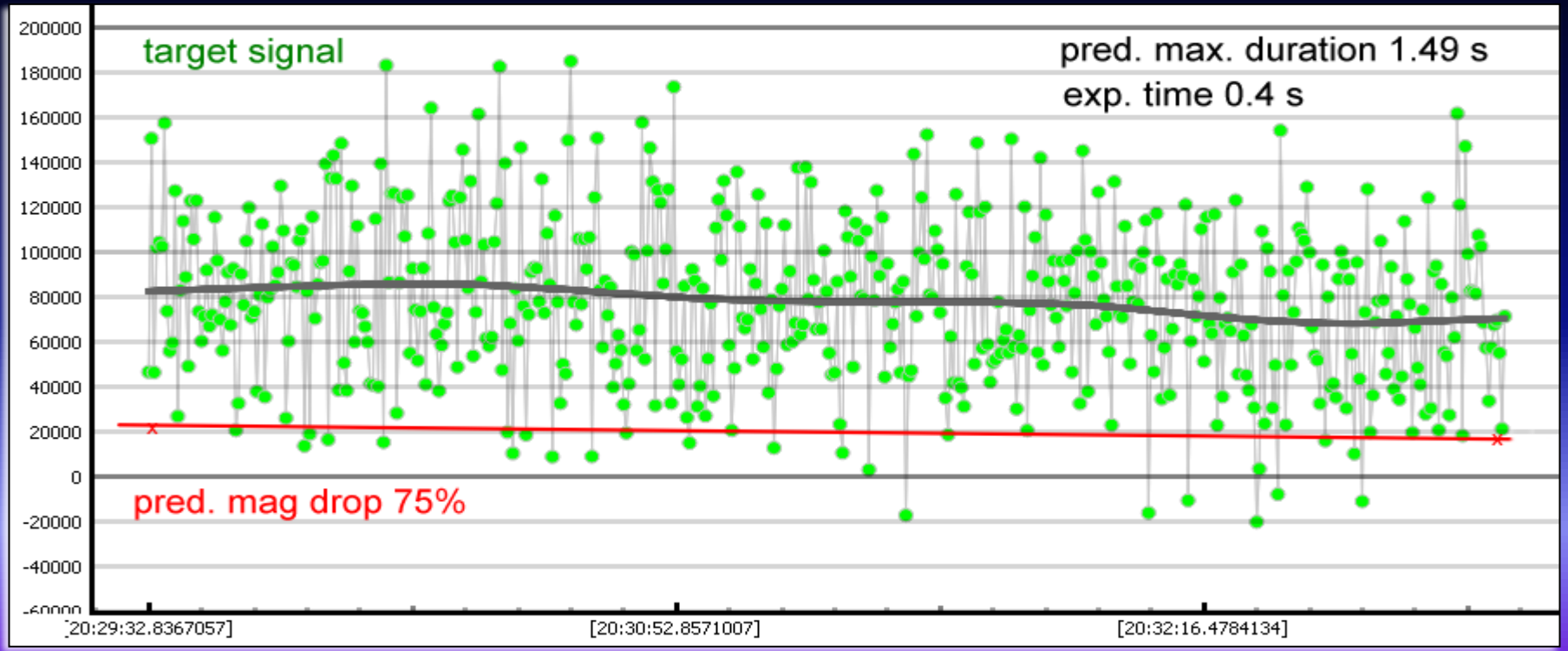


Common data reduction errors

AOTA tab 5 correct use



Common data reduction errors



Unreliable negative = „No observation“ > no report to SODIS

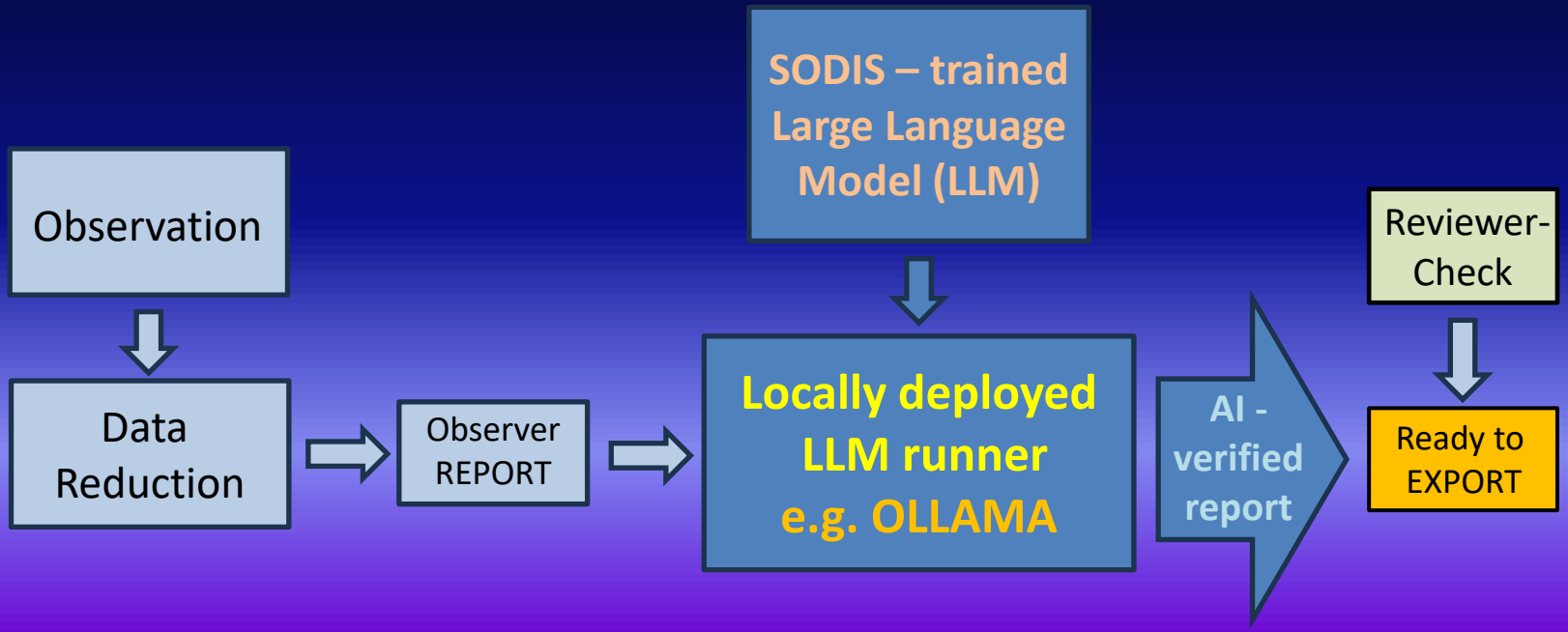
SODIS Team wishes to the observers

- Use/report to OccultWatcher before and *after* the event
- Report to SODIS within 1 week
- Use the OW-template for reporting
- Submit *all* required files (double check)
- After report, check SODIS and emails for possible reviewer requests

What's next ?

- Further qualifying of observers, reviewers and exporters
- HC Task Force: Continue work on an ongoing basis
- **Project: AI support for review** (Suggestion: G. Krannich)

Project: AI support for review Basic layout



Project: AI support for review Example: Ollama

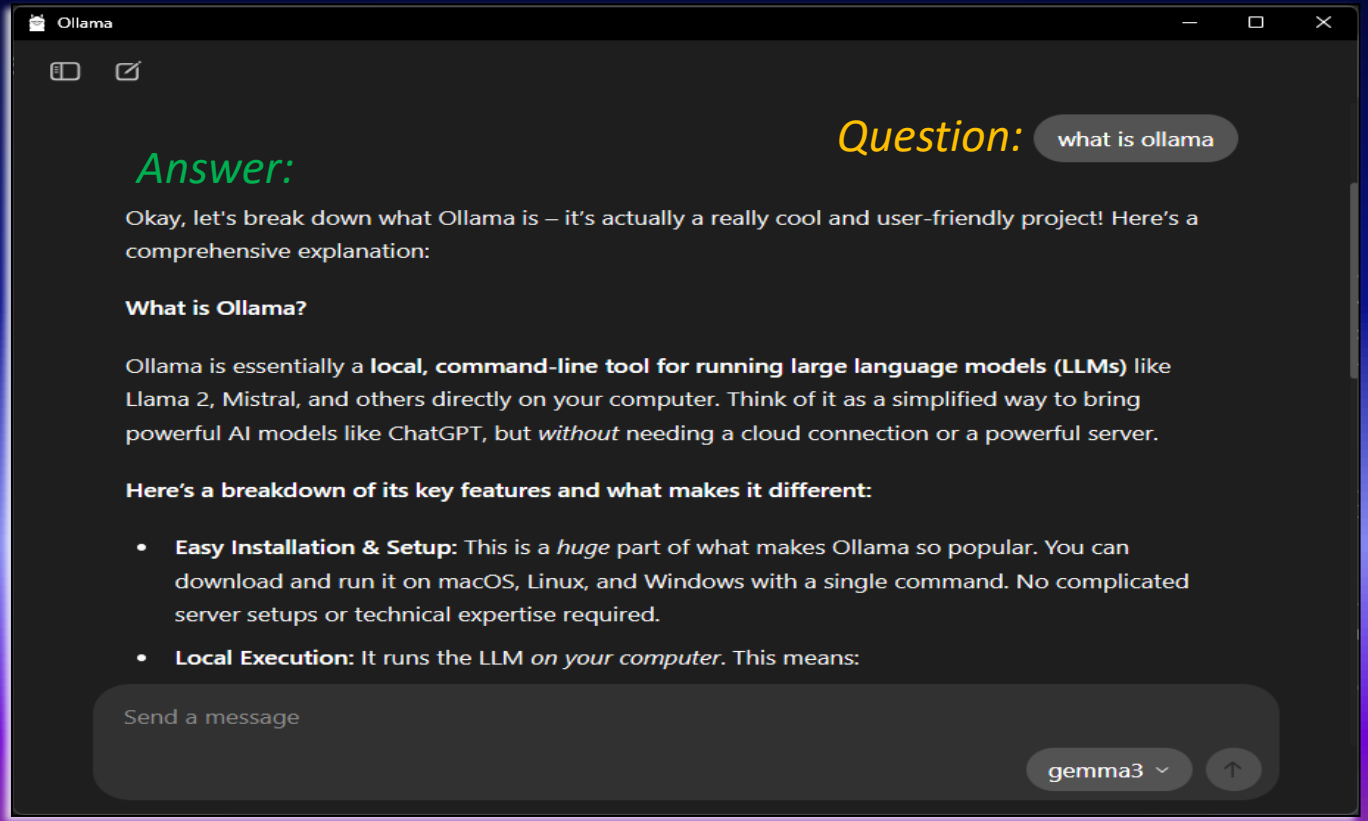
Ollama

(https://ollama.com; /https://github.com/ollama/ollama)

Locally on W11

GUI >

Self-disclosure >



Project: AI support for review

Example 1: Ollama,
LLM: Granite3.2-vision

> Text extraction from image

> Prompt: *"Extract all text from this Image."*

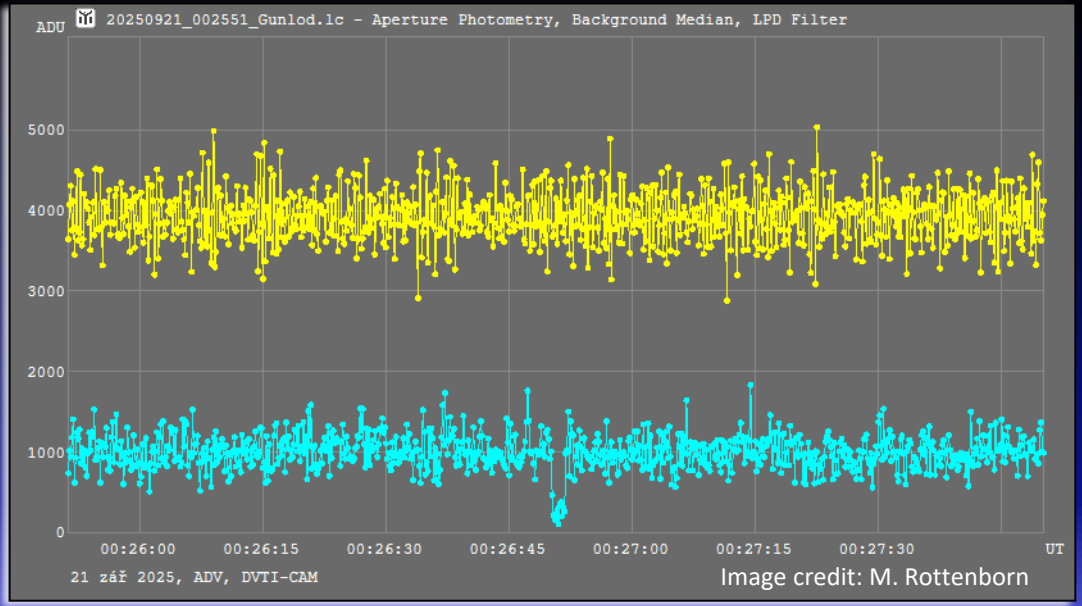


Image credit: M. Rottenborn

file:///C:/Users/[redacted]/ollama-env/granite-vision-output/granite3.2-vision_ta_mr.json

JSON Rohdaten Kopfzeilen

Speichern Kopieren Alle einklappen Alle ausklappen JSON durchsuchen


```
original_image_path:      "input\\ta_mr.png"
extracted_text:           "\n<doc> 20250921_002551 Gunlod.1c - Aperture Photometry, Background Median, IRD Filter \n
                          4000 \n 3000 \n 2000 \n 1000 \n 0 \n 21 z´ar 2025, ADV, DVTI-CAM \n UT \n 00:26:00   00:26:15
                          00:27:00 \n 00:27:15   00:27:30 </doc>"
model_used:               "granite3.2-vision"
processing_time_seconds:  186.76
```

Project: AI support for review

Example 2: Ollama, LLM: Granite3.2-vision; > Recognition of image details

> Prompt: *"How many graphs are in the image and which color has the top graph?"*

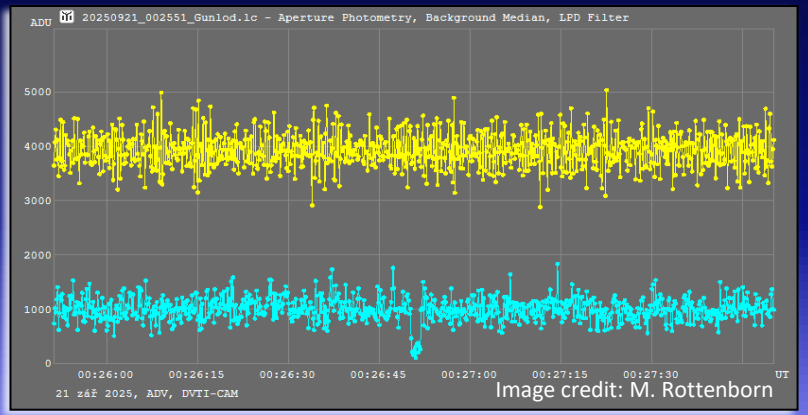
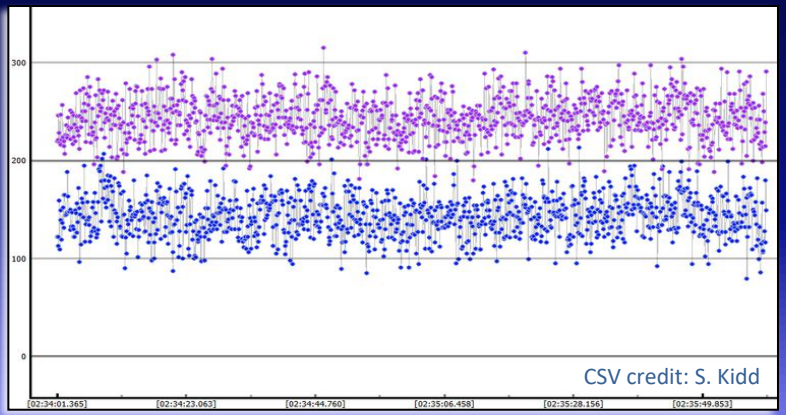


Image credit: M. Rottenborn



CSV credit: S. Kidd

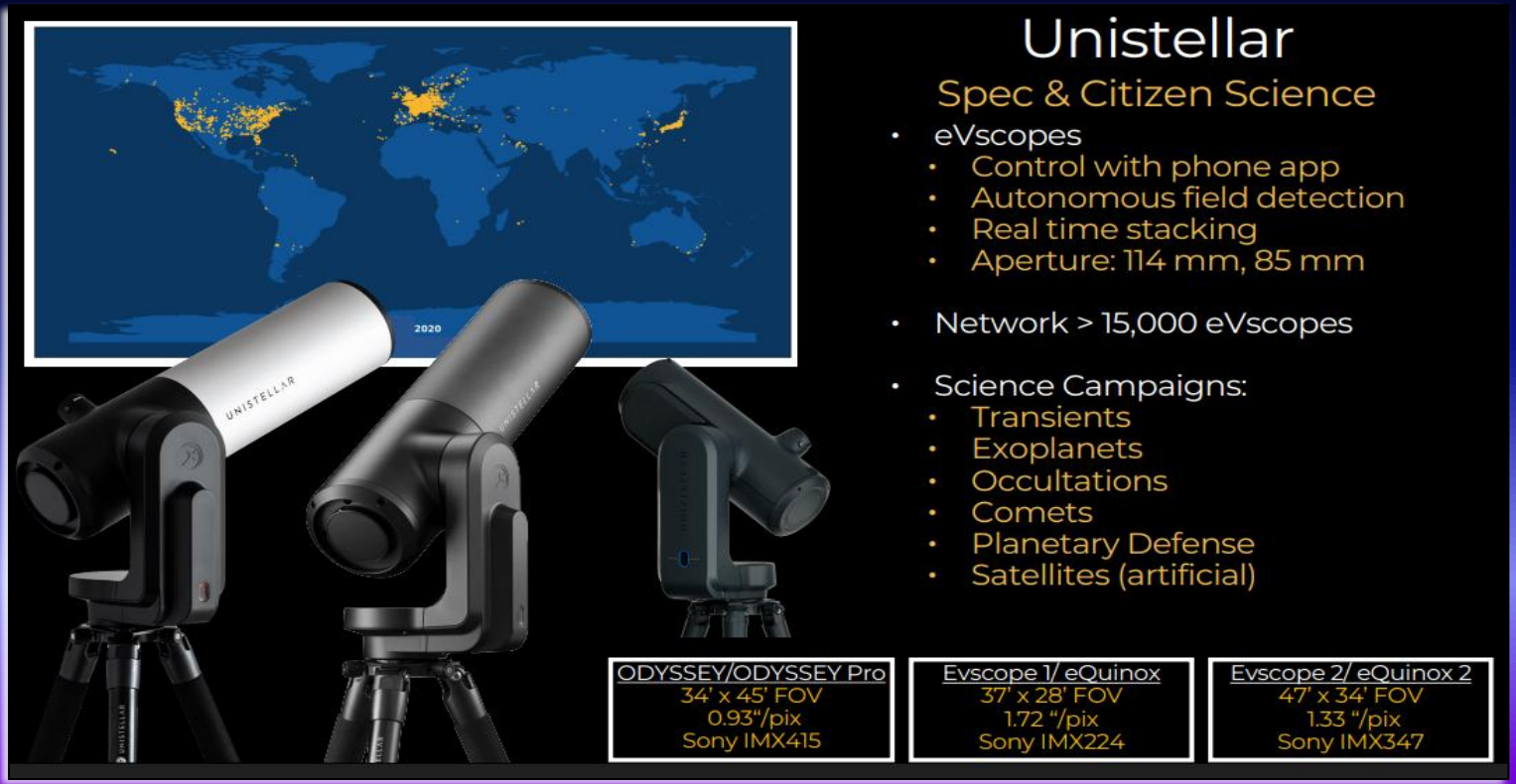
```
original_image_path:      "input\\ta_mr.png"
extracted_text:           "\nThere are two graphs in the image,
                          with the top graph being yellow."
model_used:               "granite3.2-vision"
processing_time_seconds:  142.86
```

```
original_image_path:      "input\\pool\\ver2_3.png"
extracted_text:           "\nThere are two graphs in the image,
                          and the top graph is colored purple."
model_used:               "granite3.2-vision"
processing_time_seconds:  86.31
```

What’s next ?

- Further qualifying of observers, reviewers and exporters
- HC Task Force: Continue work on an ongoing basis
- Project: AI support for review
- Hardware: „Smart“ telescopes > more multi-chord results

„Smart“ telescopes: Unistellar

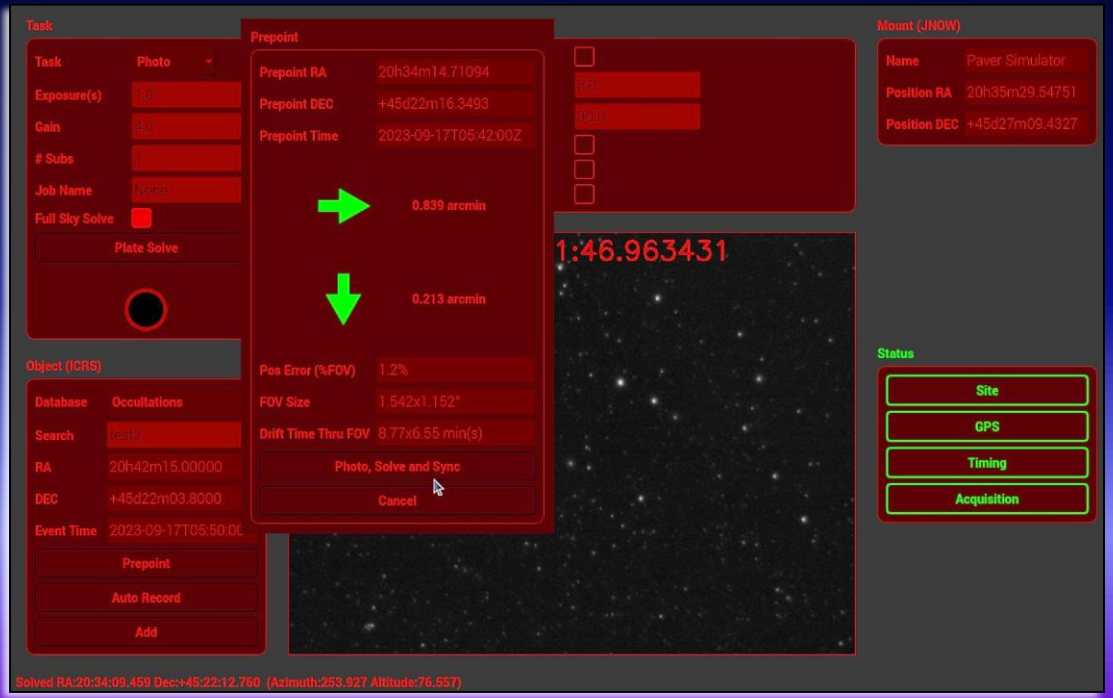


2500 – 3500 EUR

Unistellar: https://shop.eu.unistellar.com

Credit J. Hanus; https://esop44.iota-es.de/wp-content/uploads/2025/08/20_Hanus_ESOP44.pdf

„Smart“ telescopes: ASTRID



$695 USD + shipping + insurance

Credit M. Simpson; https://github.com/ChasinSpin/astrid?tab=readme-ov-file

„Smart“ telescopes: Example ZWO Seestar S50

Credit: ZWO

Product model	Seestar S50
Sensor	IMX462
Resolution	1080 x 1920
Aperture	50mm
Focal ratio	f/5
Focal length	250mm
Optical lens	Apochromatic triplet
Storage	64GB
Transmission Mode	Bluetooth 5.0 Wi-Fi 5G & 2.4G USB Type-C
Working temperature	0-40°C (Recommended)
Mount type	Alt-azimuth
Slew rate	1X-1440X
Zero position	Mechanical
Battery capacity	6000mAh
Connection port	3/8-20 inch
Net weight	2.5kg
Power input	Type-C
Wi-Fi reset button	Supported
Size	142.5 × 130 × 257
Working distance	30m-∞
Wi-Fi range	≤10m
Bluetooth range	≤5m

Credit: ZWO

ZWO
Seestar S50,
650 – 800 EUR

ZWO:
https://www.zwoastro.com/product/seestar-s50

Community project:
https://github.com/smart-underworld/seestar_alp

What’s next ?

- Further qualifying of observers, reviewers and exporters
- HC Task Force: Continue work on an ongoing basis
- Project: AI support for review
- Hardware: „Smart“ telescopes > more multi-chord results
- For all tasks: Further volunteers urgently needed …
- **Your own ideas ?**

THANKS

for your attention