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3 Years Occultation Observation at new K71 Observatory

Experiences and Results

Dr. Björn Kattentidt
Rokycany, 25./26. Aug. 2018

Overview

- K71, pictures, equipment
- Selection criteria for observation planning
- Short movies of POSITIVE observations
Light curves

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Observatory K71



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Equipment



Device	Product	Remark
Telescope Mount	Celestron 11" SC f/10 on CGE-Pro	optimal collimated! reducer f/6,3
Camera	Waterc 910HX/RC (QHY 174 Mono ?)	battery supported!
Video time inserter with GPS	VTI by Sven Andersson Garmin GPS 18x LVC	analogue
Frame grabber	Digitus 70820, (Hauppauge Live 2)	digitizer
Recording	(VirtualDub 1.8.6) SharpCap V3.1	25fps exactly lossless
Hard drive, Interface	Samsung SSD 850 Pro, USB3	fast ! 0 dropped frames
Software, OS	C2A Limovie, (Tangra/AOTA) Windows 10 pro & XP pro	fast processor fast main board
Problematic programs	Occult Watcher Virus scanner Firewall, LAN	no autonomous background run

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Observation planning

The screenshot shows the Occult Watcher software interface with a table of occultation events. The table columns include: Name Asteroid, Datum Ereignis, Wahr., Magn., Magn., Stern N., Max. Dauer, A., Abnahme, Schatt., Stern, G., Distanz Erde, Sonne, P., Parity, Feed, and Di. The highlighted row is for asteroid (45) Eugenia on Tue 02 May 22:10. The highlighted cells in this row are: Magn. (11.7), Magn. (11.3), Stern N. (11.3), Abnahme (2.2), Distanz Erde (232 km NE), Sonne (-15° NW), and Feed (100 IOTA).

Selection criteria highlighted in the diagram:

- brightness** (yellow circle)
- diameter** (dark blue circle)
- probability** (magenta circle)
- drop** (magenta circle)
- distance** (green circle)
- central line** (green circle)
- frames** (yellow circle)
- feed** (dark blue circle)

Central selection criteria: **selection criteria ?** (red circle)

Motivation: Reduction of negative observations !

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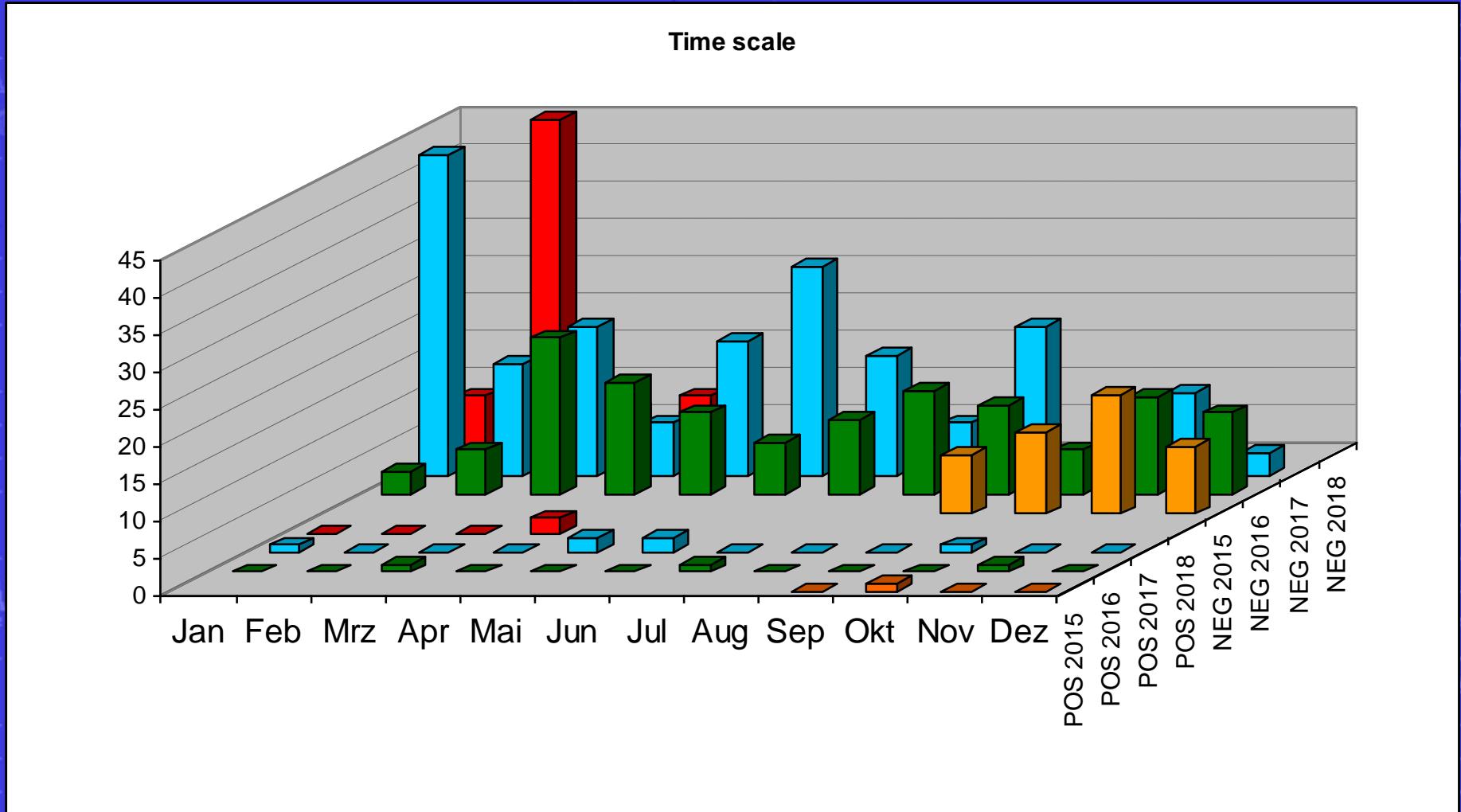
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Observation statistics

440 observations during nearly 3 years, 12 POSITIVE



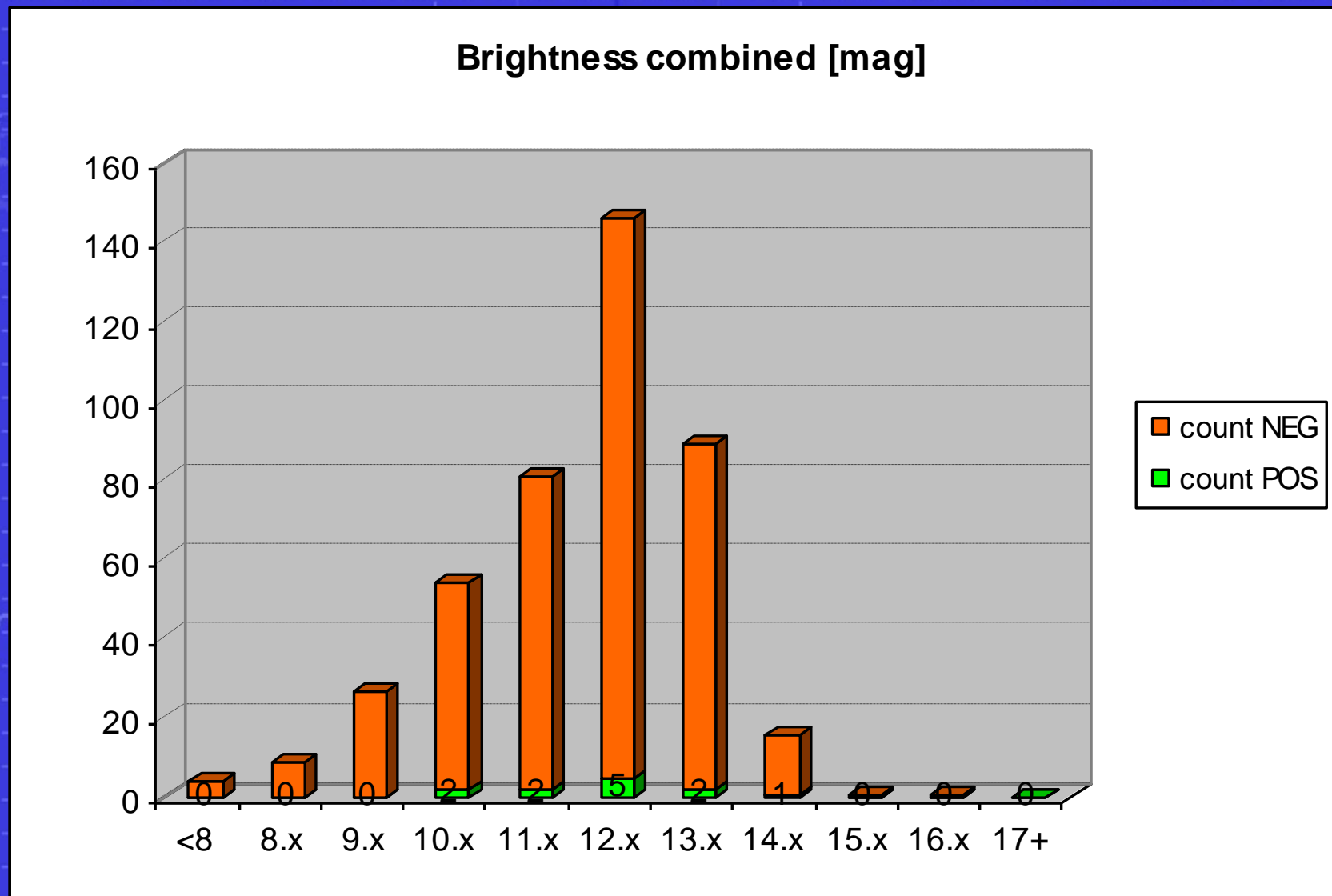
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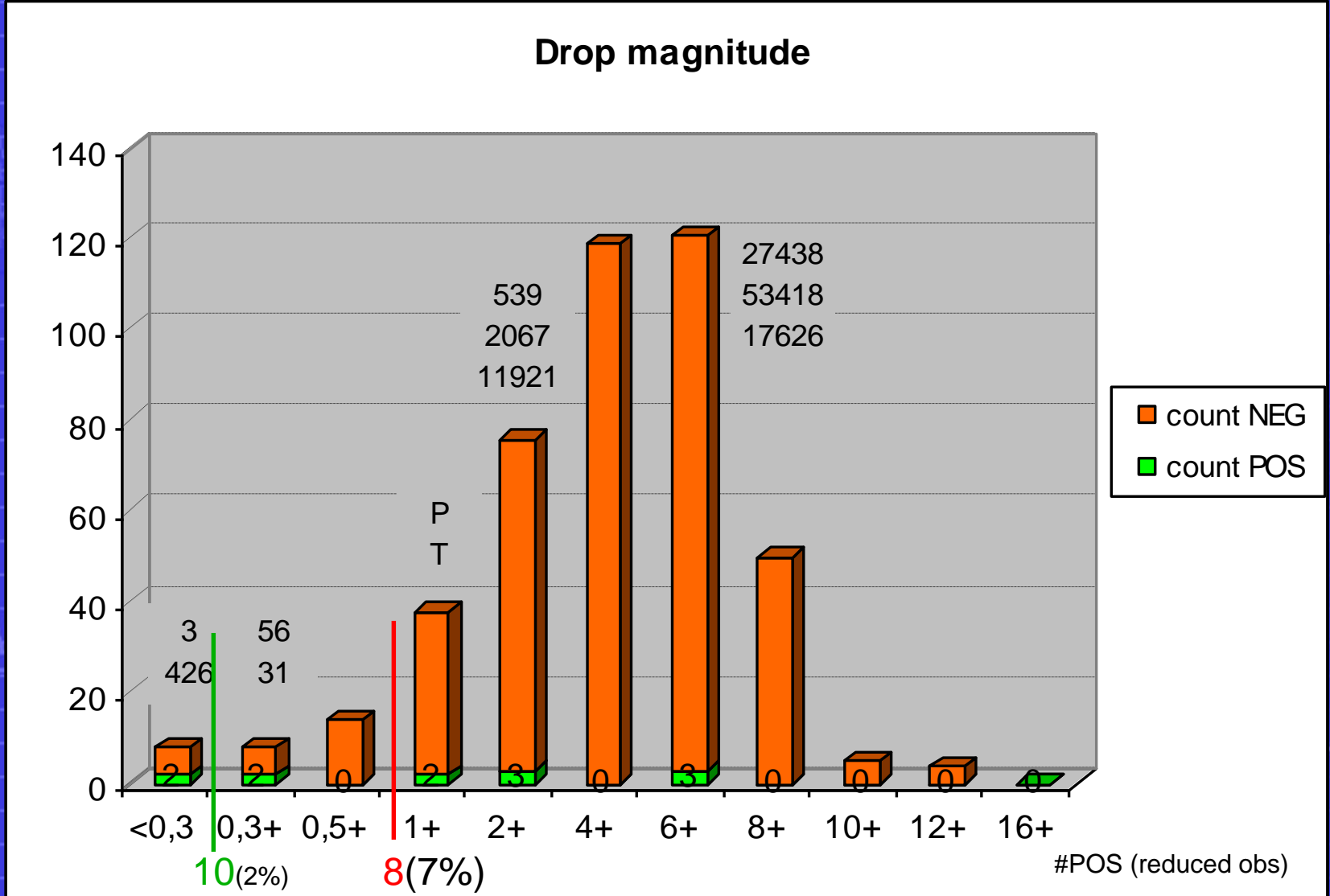
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Brightness ?

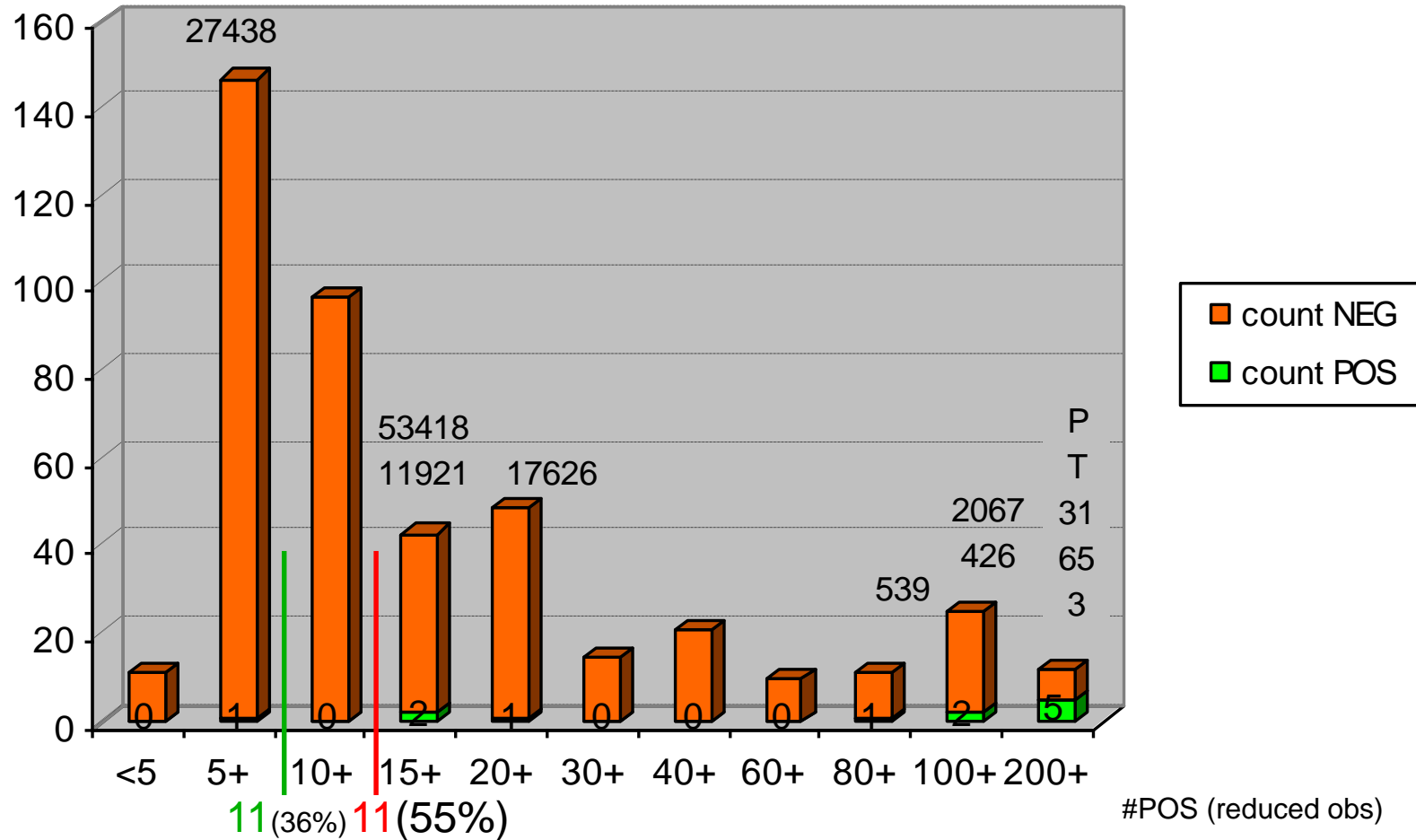


Drop ?



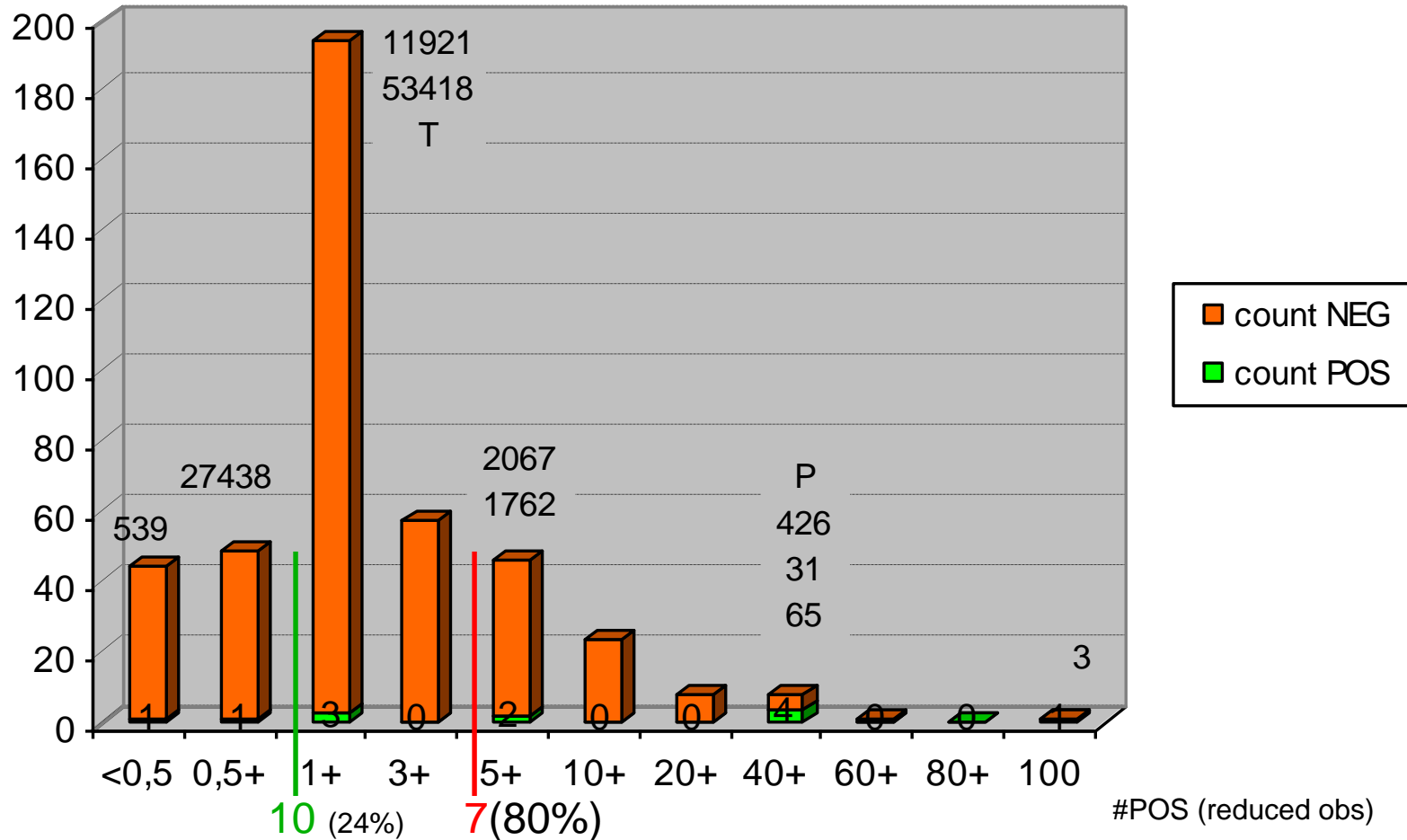
Diameter !

Diameter minor planet [km]

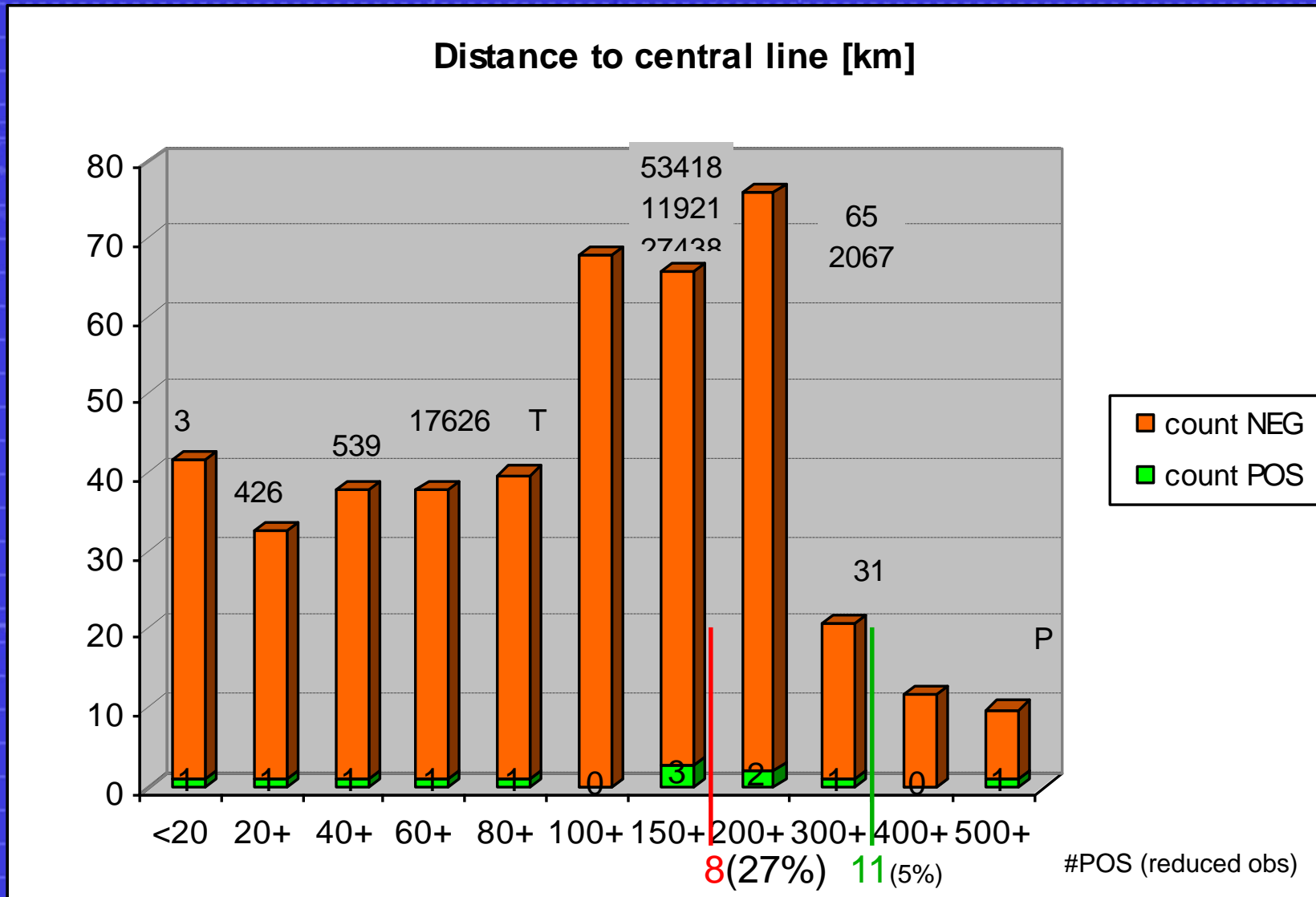


Probability !

Predicted probability @ obs location [%]

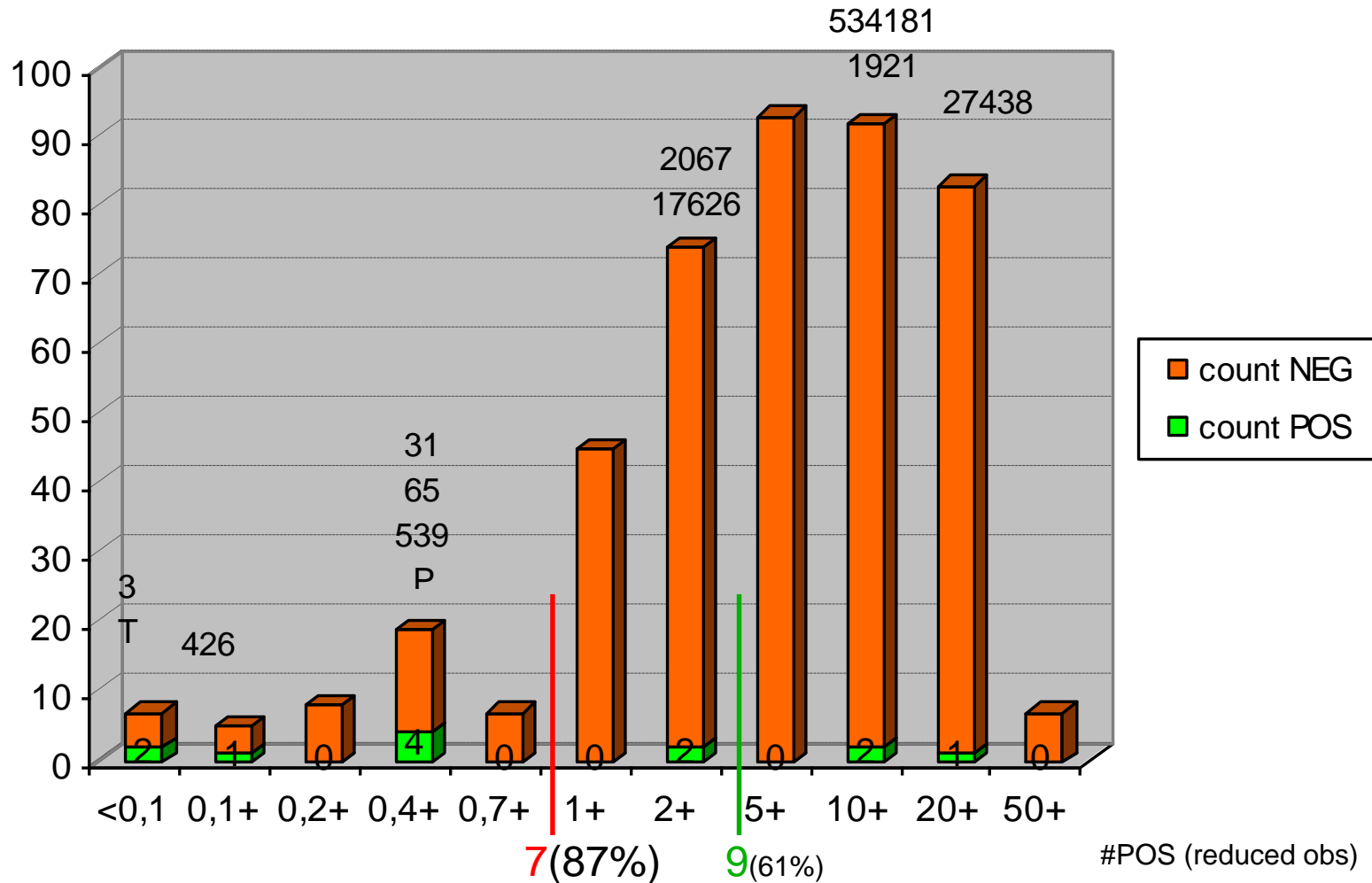


Distance central line ?

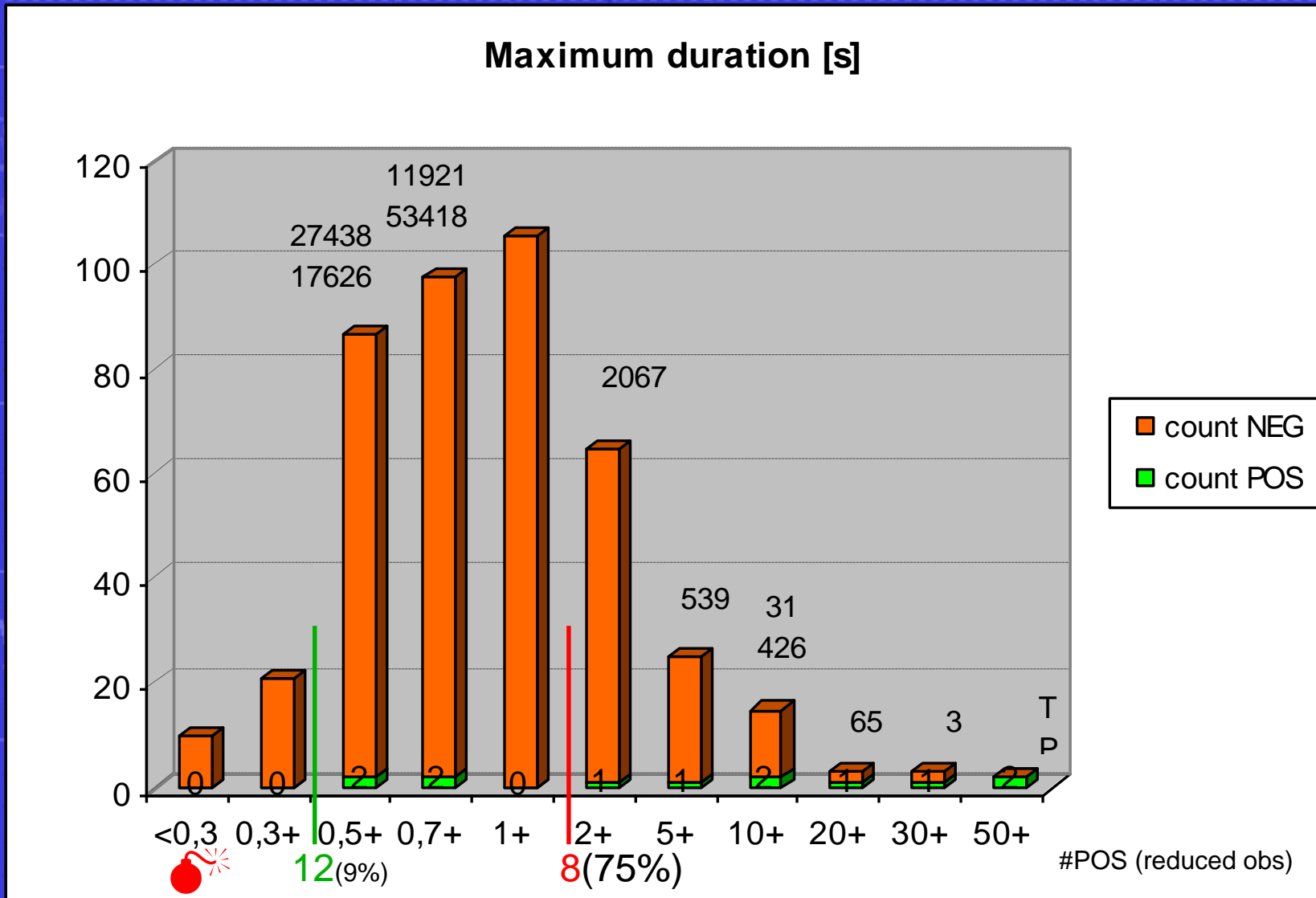


Ratio: distance CL / diameter !

Distance to central line / diameter [part]

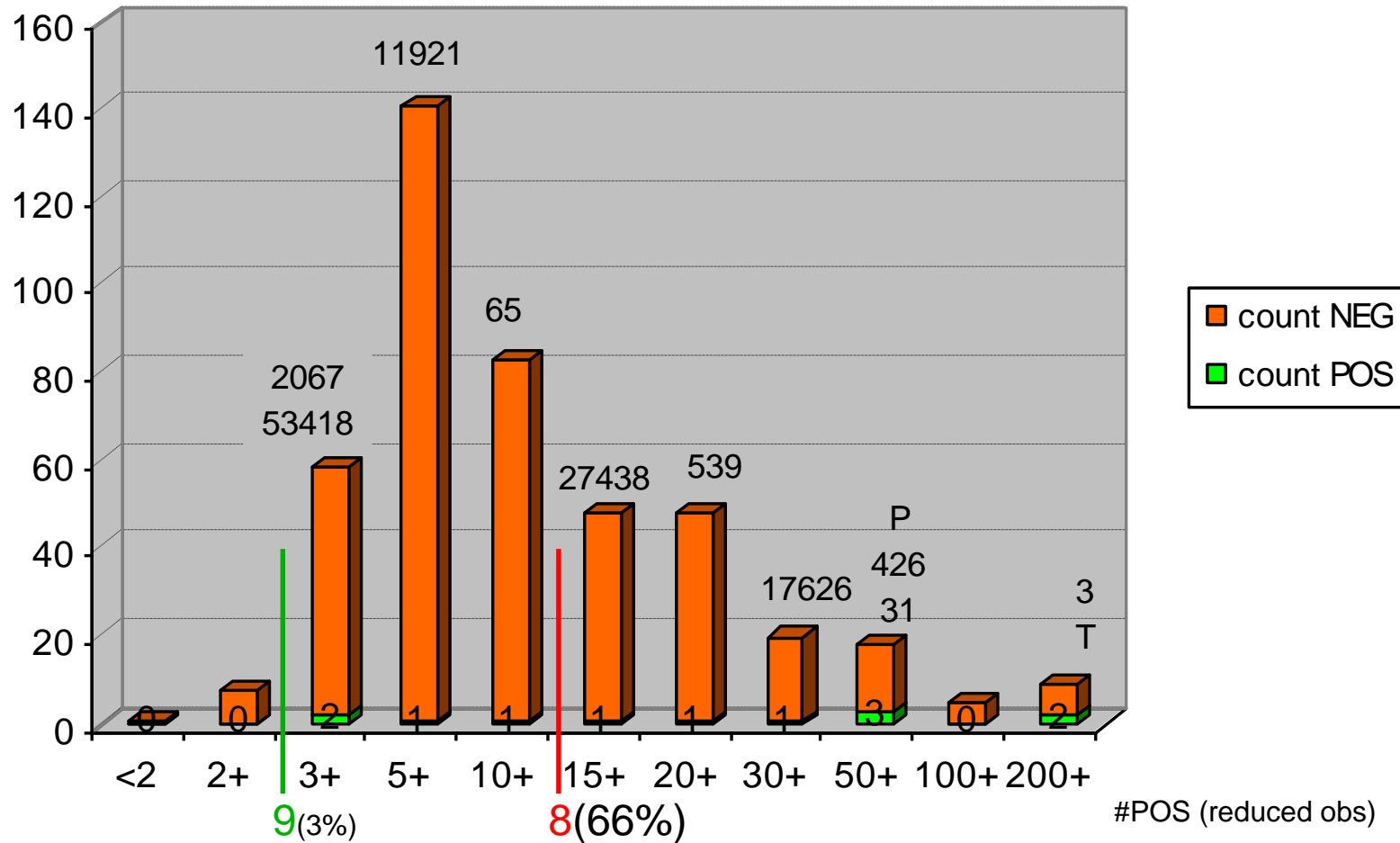


Maximum duration (!)

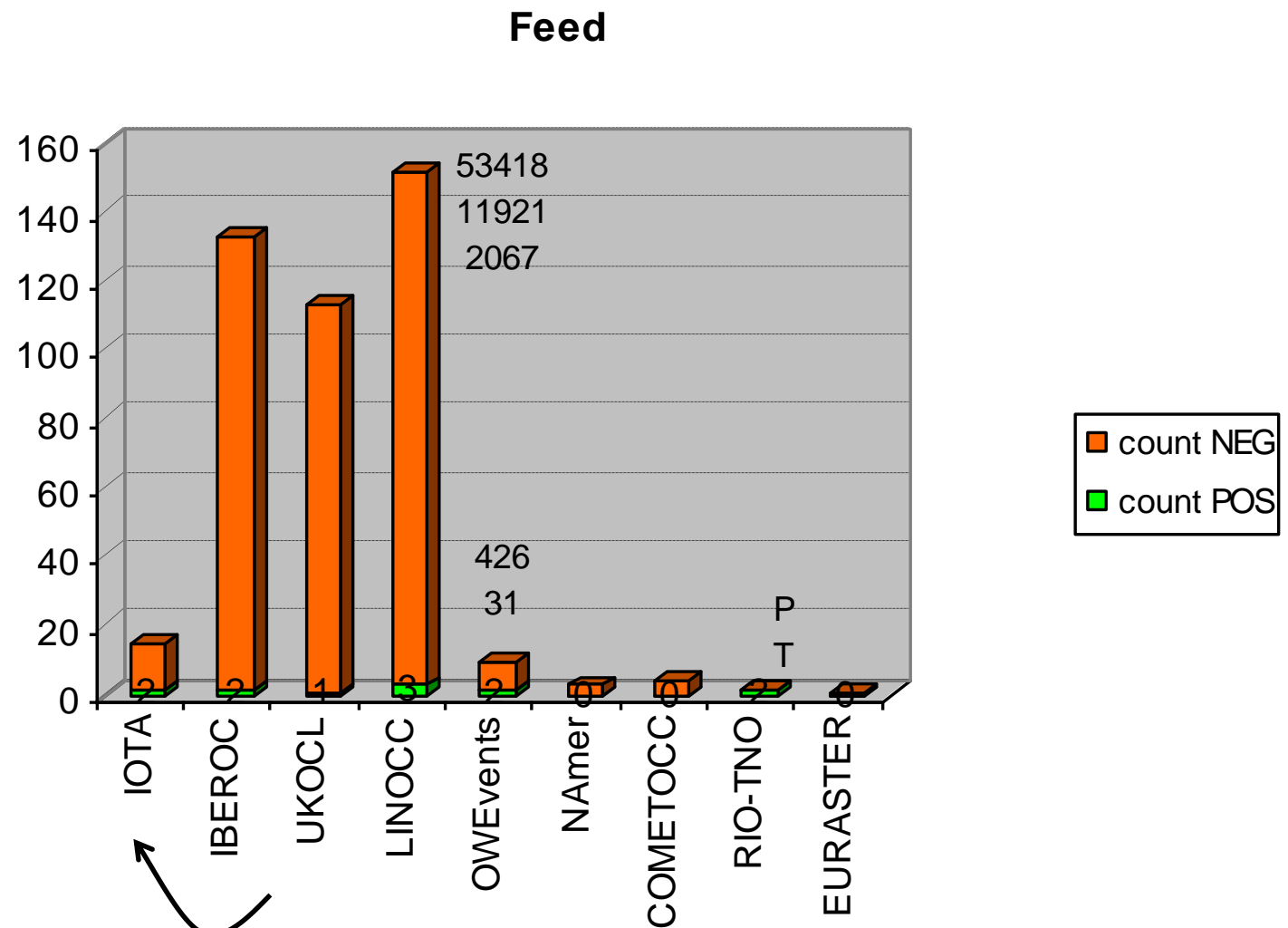


Frames possible ...

Maximum frames possible



Feed



All criteria applied

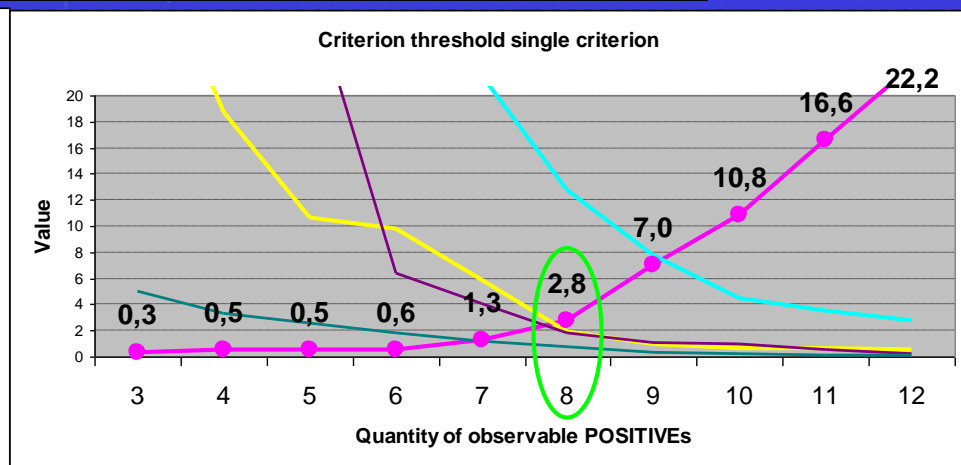
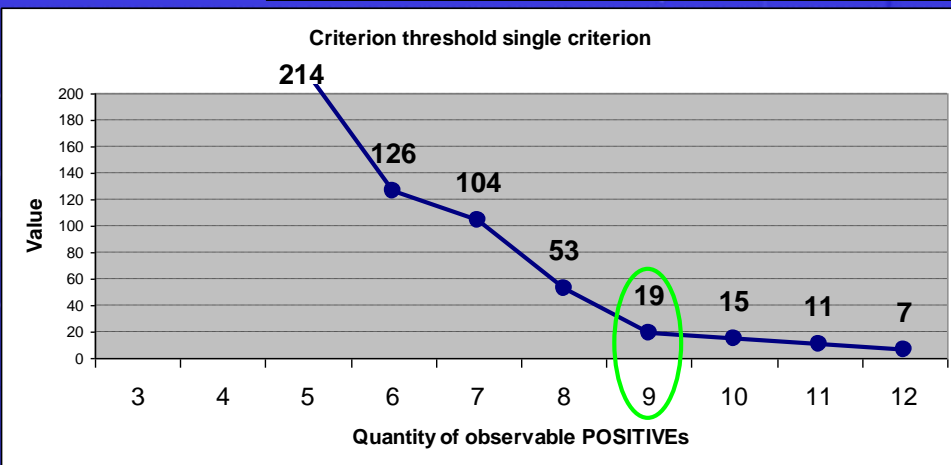
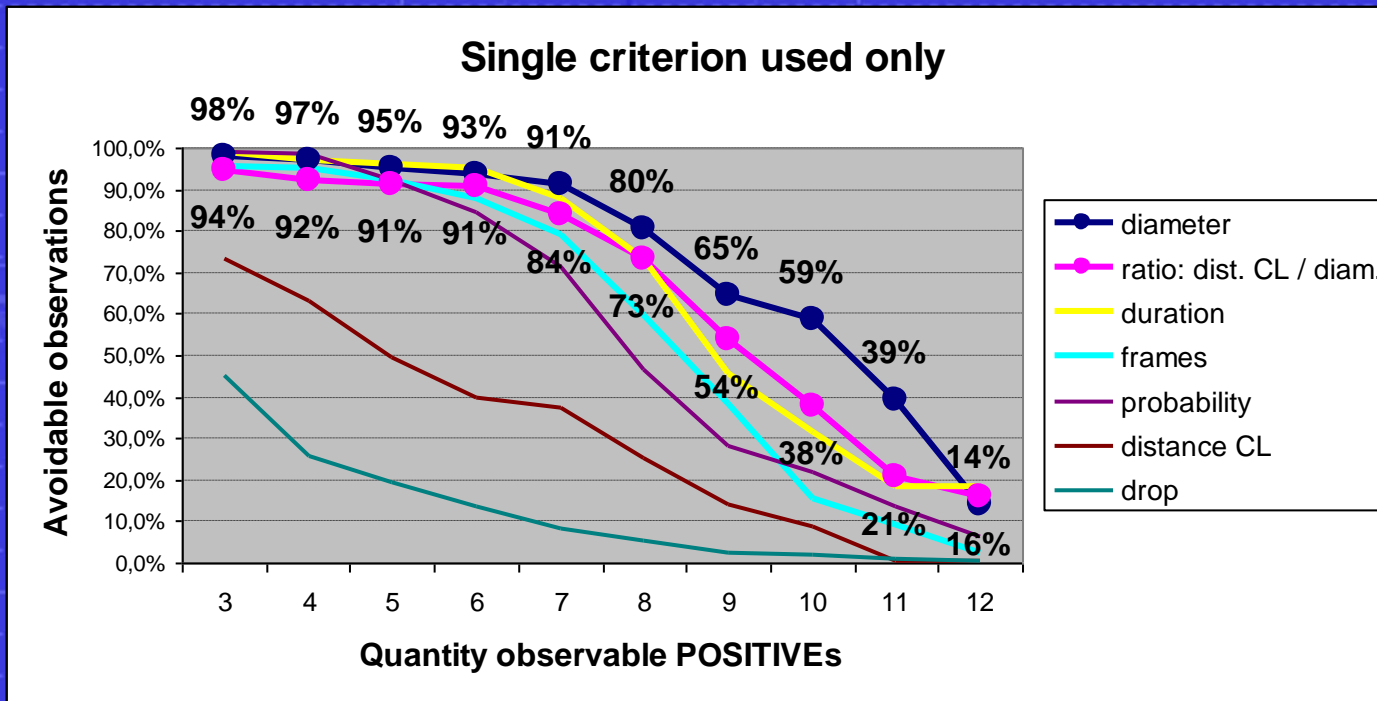
date	minor planet	mobile (red marker)	stationary (green marker)	all
28.10.2015	(65) Cybele	excluded	observation	observation
18.03.2016	(53418) 1999 PY3	excluded	excluded	observation
19.07.2016	Pluto	excluded	excluded	excluded
20.11.2016	(426) Hippo	excluded	excluded	observation
20.01.2017	(27438) Carolynjons	excluded	excluded	observation
05.05.2017	(3) Juno	excluded	excluded	observation
22.05.2017	(539) Pamina	excluded	excluded	observation
08.06.2017	(11921) Mitamasahiro	excluded	excluded	observation
25.06.2017	(2067) Aksnes	excluded	observation	observation
05.10.2017	Triton	excluded	observation	observation
06.04.2018	(17626) 1996 AG2	excluded	observation	observation
09.04.2018	(31) Euphrosyne	excluded	observation	observation
All criteria applied				
Avoided observations using all criteria		98,6%	53%	11%

critierion value			
drop [mag]	1	0,3	0,1
diameter [km]	14	10	5
probability [%]	5	1	0,1
distance CL [km]	500	500	500
distance CL / diameter	1	5	50
duration [s]	2	0,5	0,3
frames	15	3	3

For several criteria only use „weak exclusions“!

or: Exclude only „ineffective“ observations

Summary - optimal single criterion



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Results: Positive observations

- (65) Cybele occults 4UC 371-181908, 28.10.2015 IBEROC
- (53418) 1999 PY3 occults UCAC2 32827518, 18.03.2016 LINOCC
- (134340) Pluto occults 4UC 345-180315, 19.07.2016 RIO TNO
- (426) Hippo occults UCAC4 687-036601, 20.11.2016 OWEvents
- (27438) Carolynjans occults 4U 555-39601, 20.01.2017 IBEROC
- (3) Juno occults 2UCAC 29533817, 06.05.2017 IOTA
- (539) Pamina occults 2UCAC 22329080, 23.05.2017 IOTA
- (11921) Mitamasahiro occults UCAC4 375075312, 08.06.2017 LINOCC
- (2067) Aksnes occults UCAC4 351118281, 25.06.2017 LINOCC
- moon Triton occults 4UC 410-143659, 05.10.2017 RIO TNO
- (17626) 1996 AG2 occults 4U 598-18888, 06.04.2018 UKOCL
- (31) Euphrosyne occults 4UC 699-045897, 09.04.2018 OWEvents

clouds
airplane

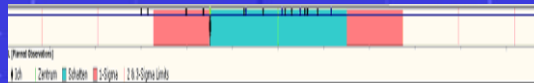
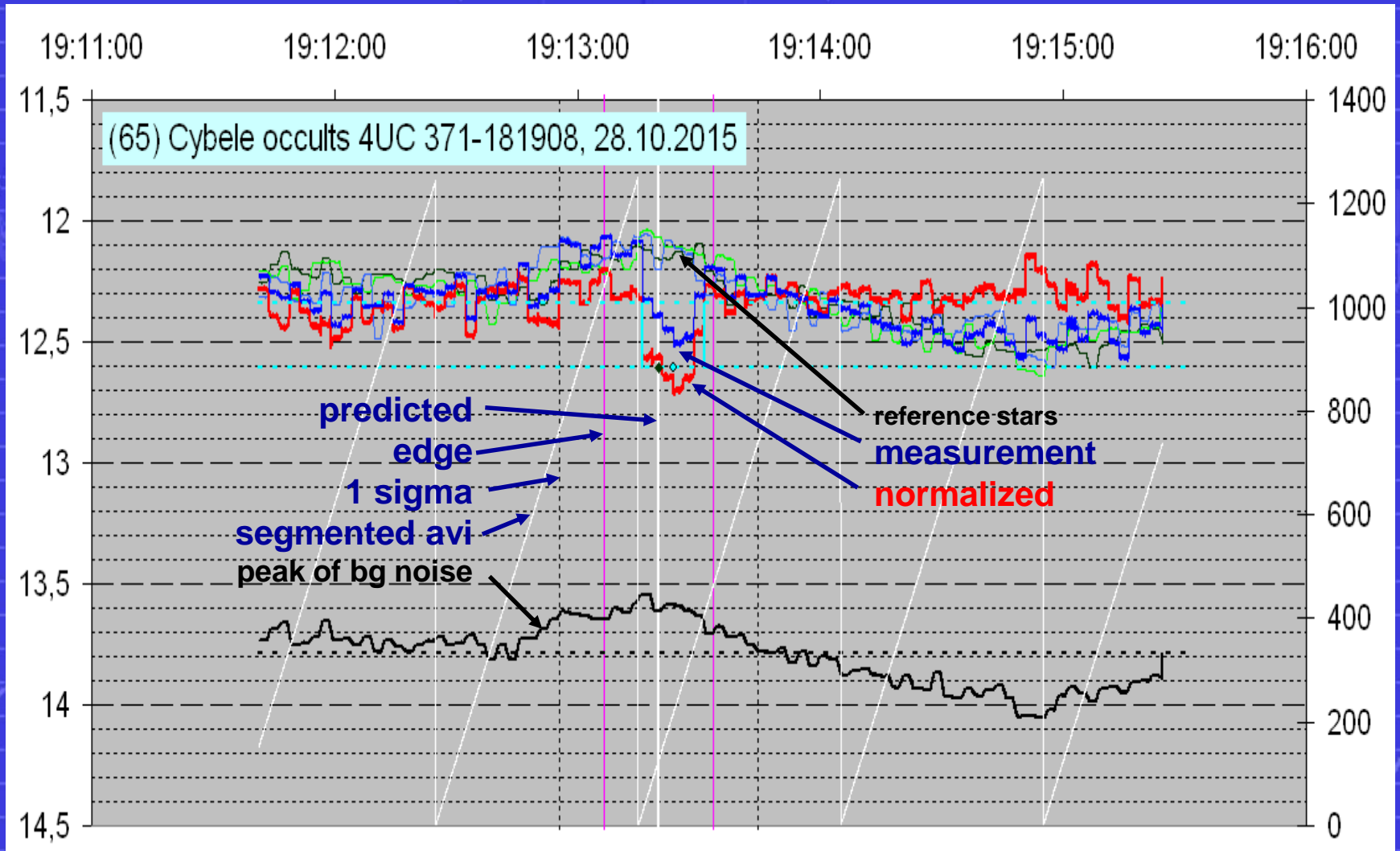
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1. Long integration 2,56 sec., clouds, low drop 0,3m



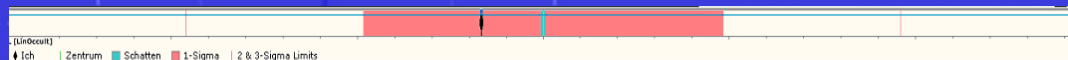
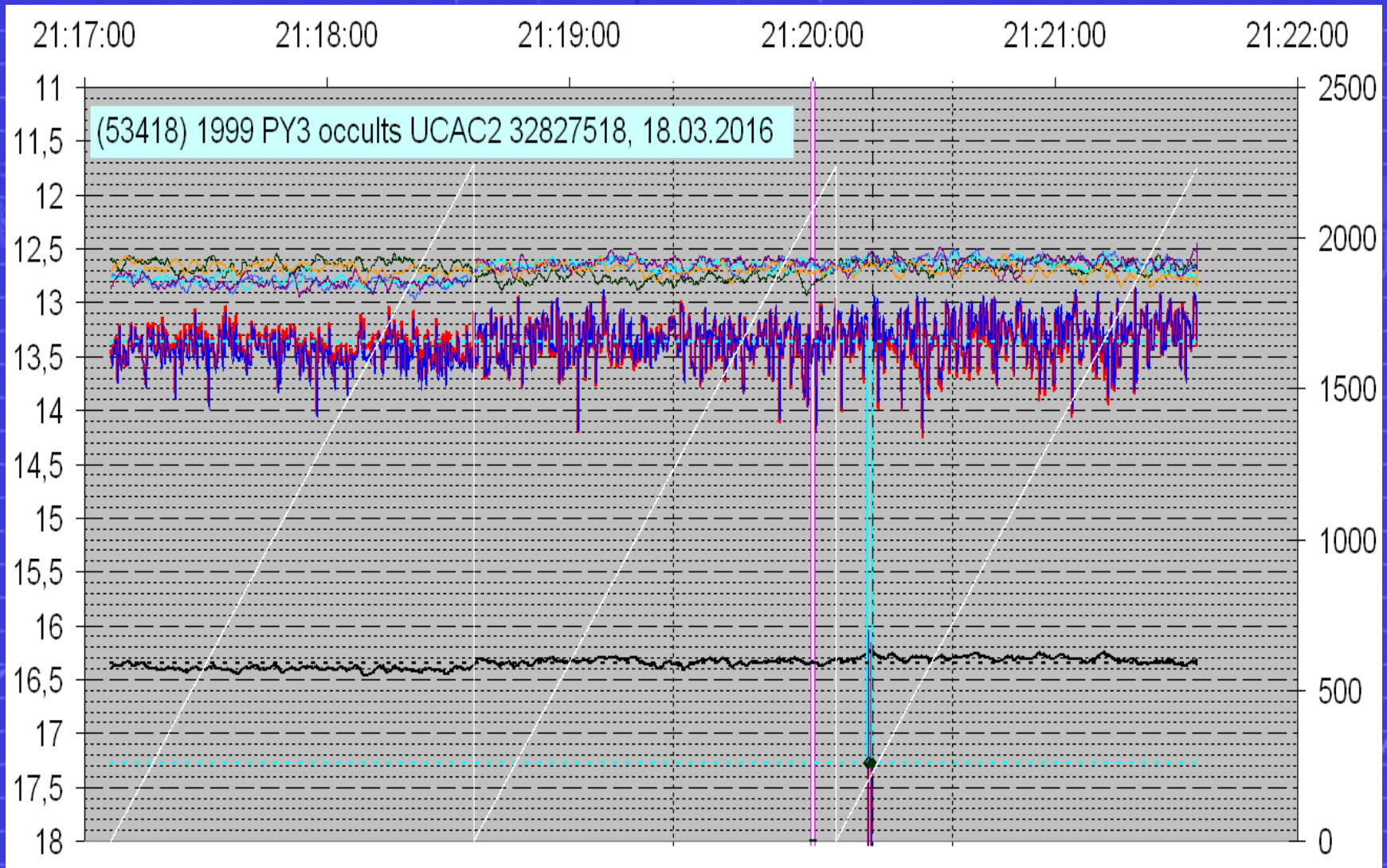
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2. Low probability 1,2%, only 3 frames predicted
1,2 sec. at 4 frames measured



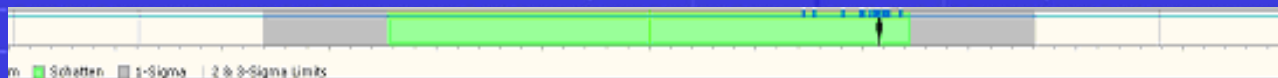
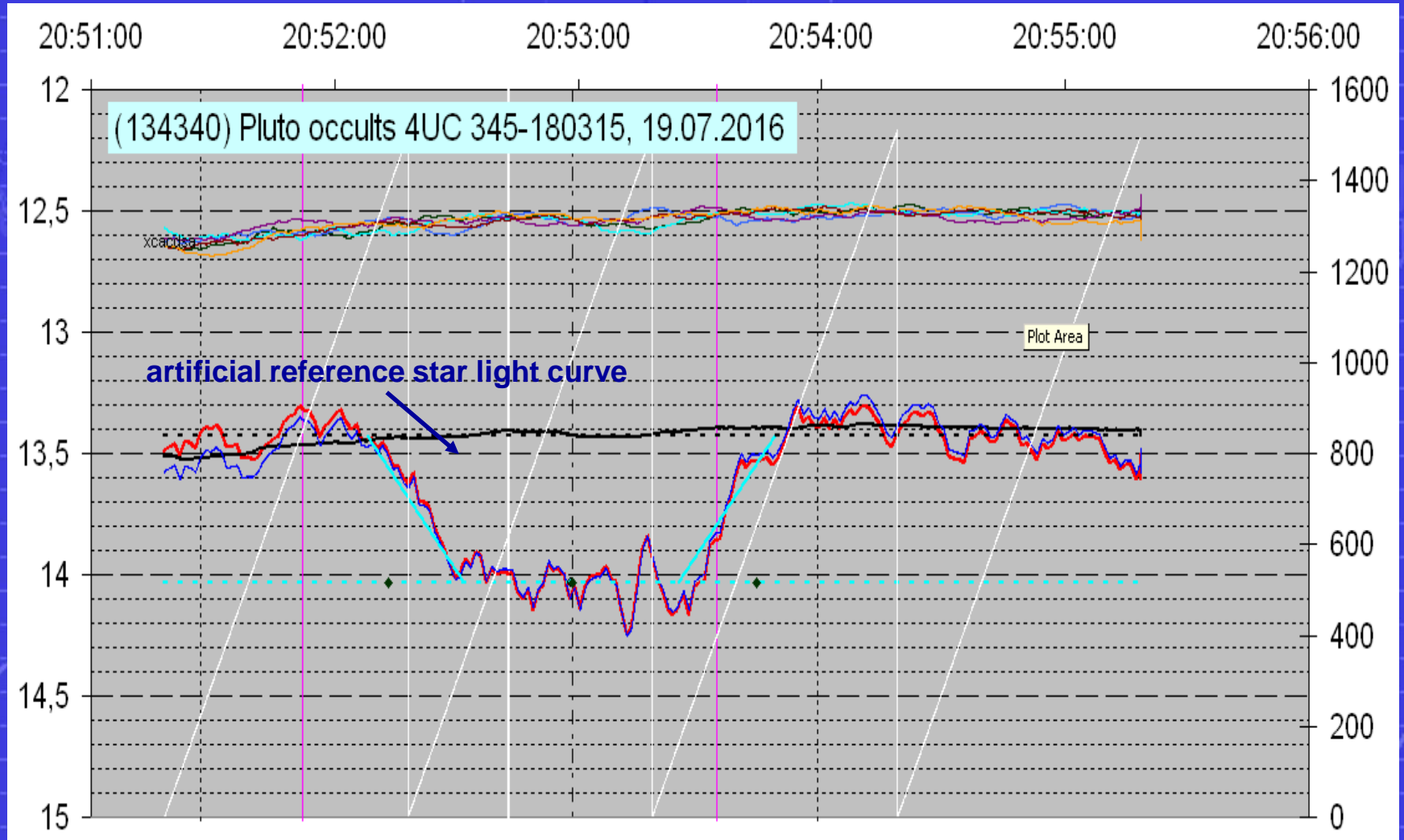
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3. Prominent occultation, atmosphere, 1,1 mag drop predicted problematic circumstances...



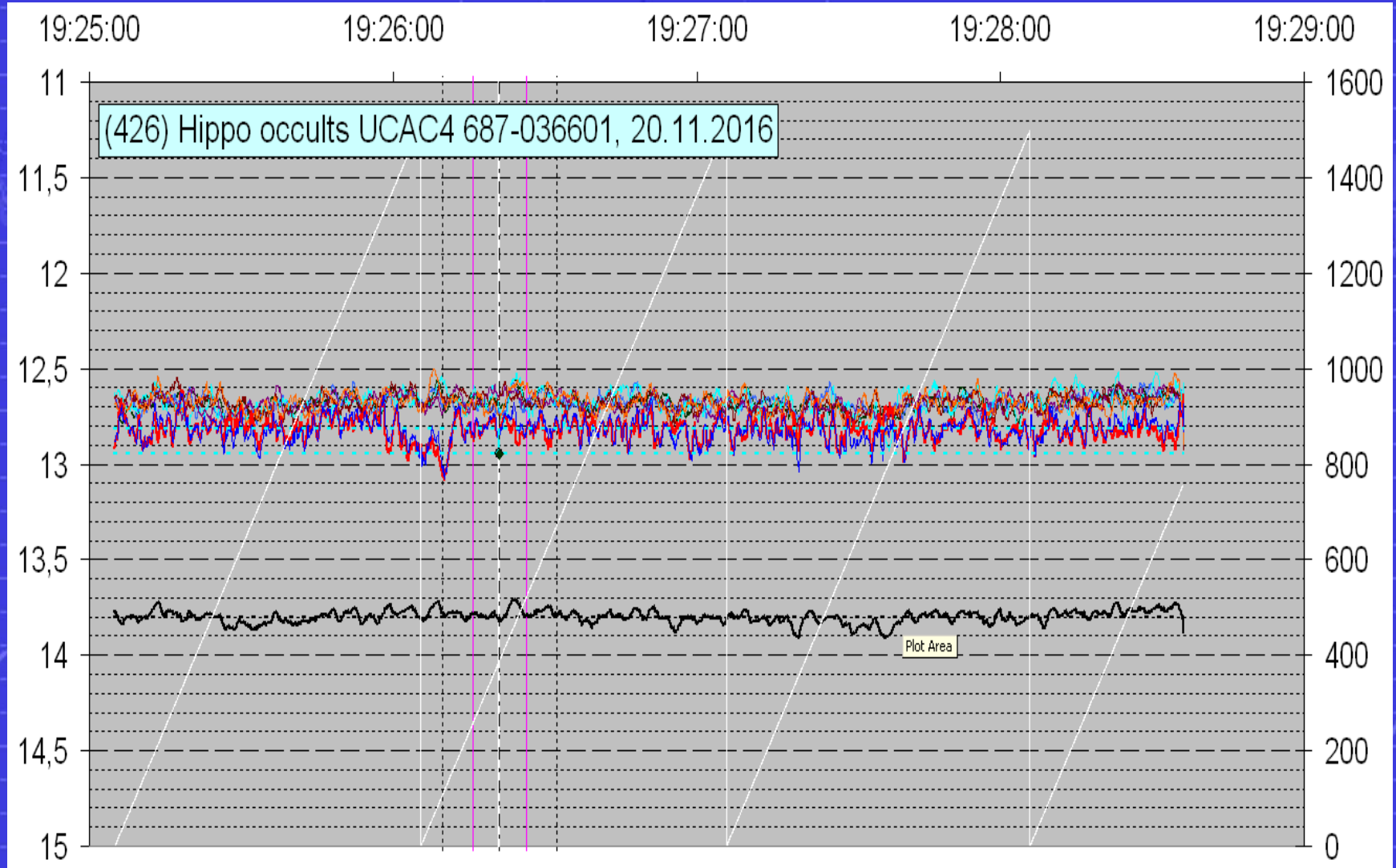
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4. Only 0,1 mag drop, 9,2 sec. duration
... but uncertain due to noise compared to low drop



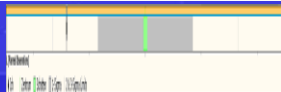
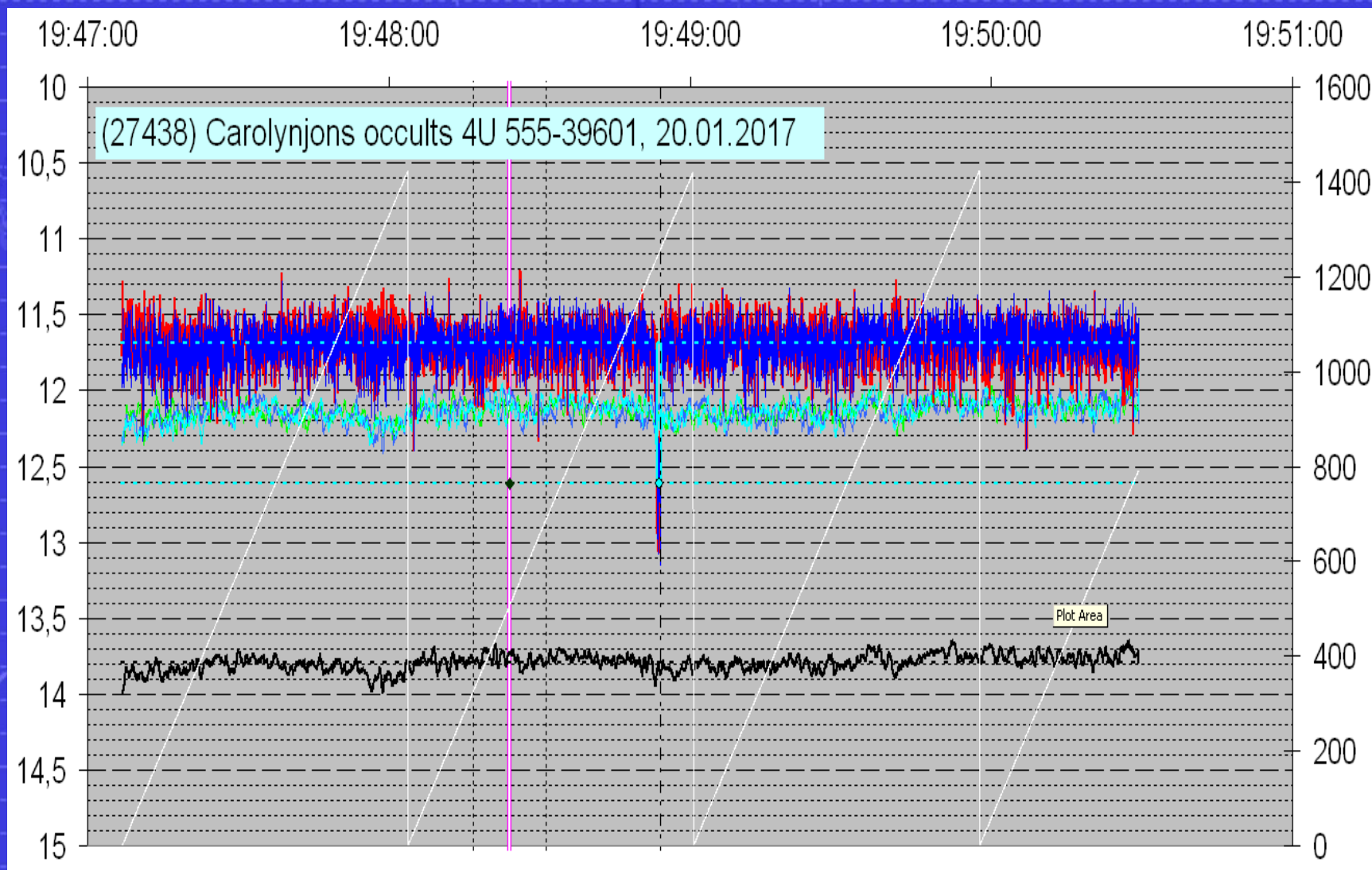
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5. Double star ?!
prediction 6,1mag drop, but only 1 mag observed



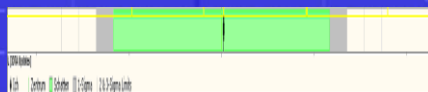
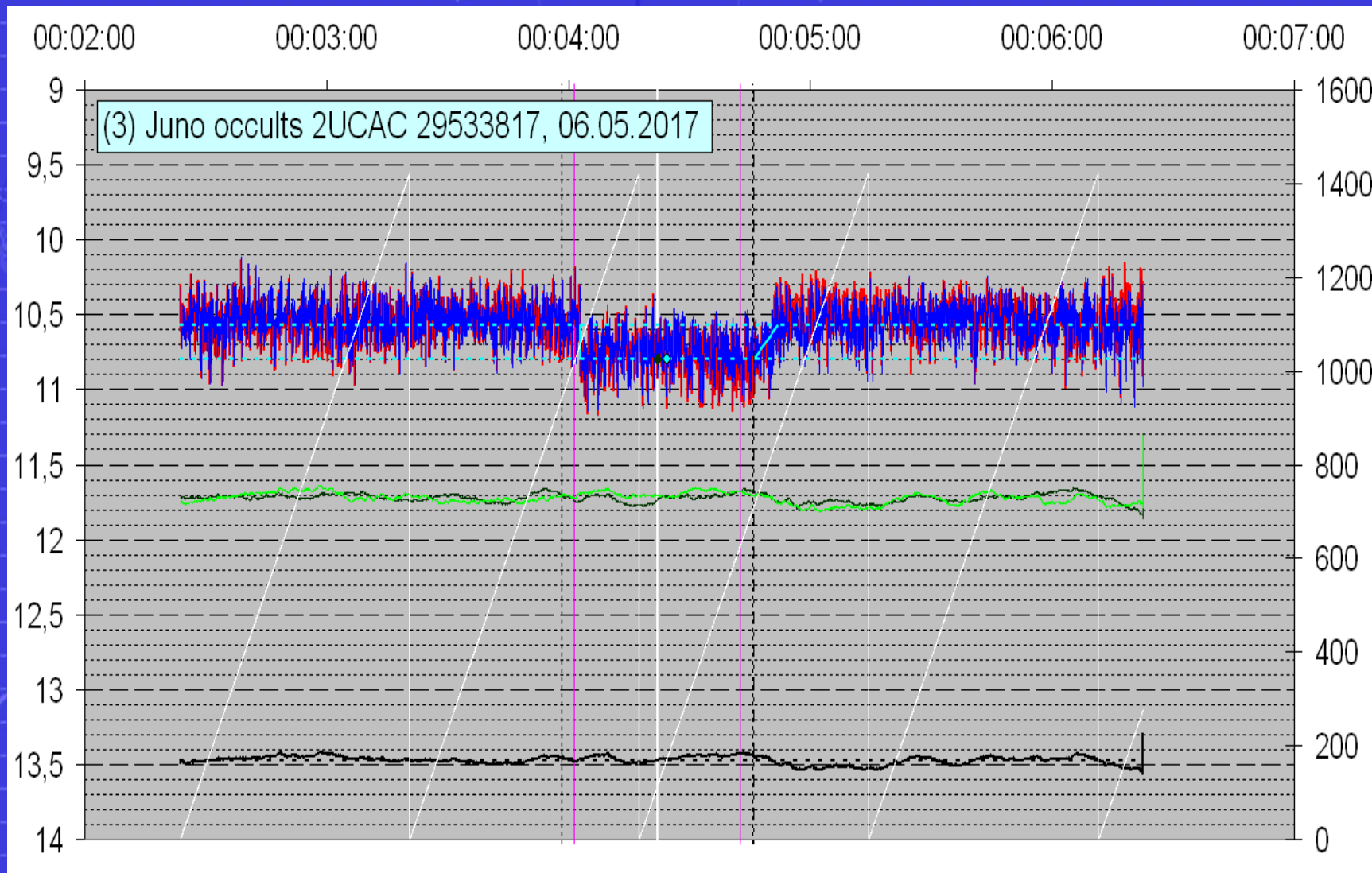
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6. Only 0,2 mag drop but prominent



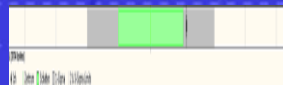
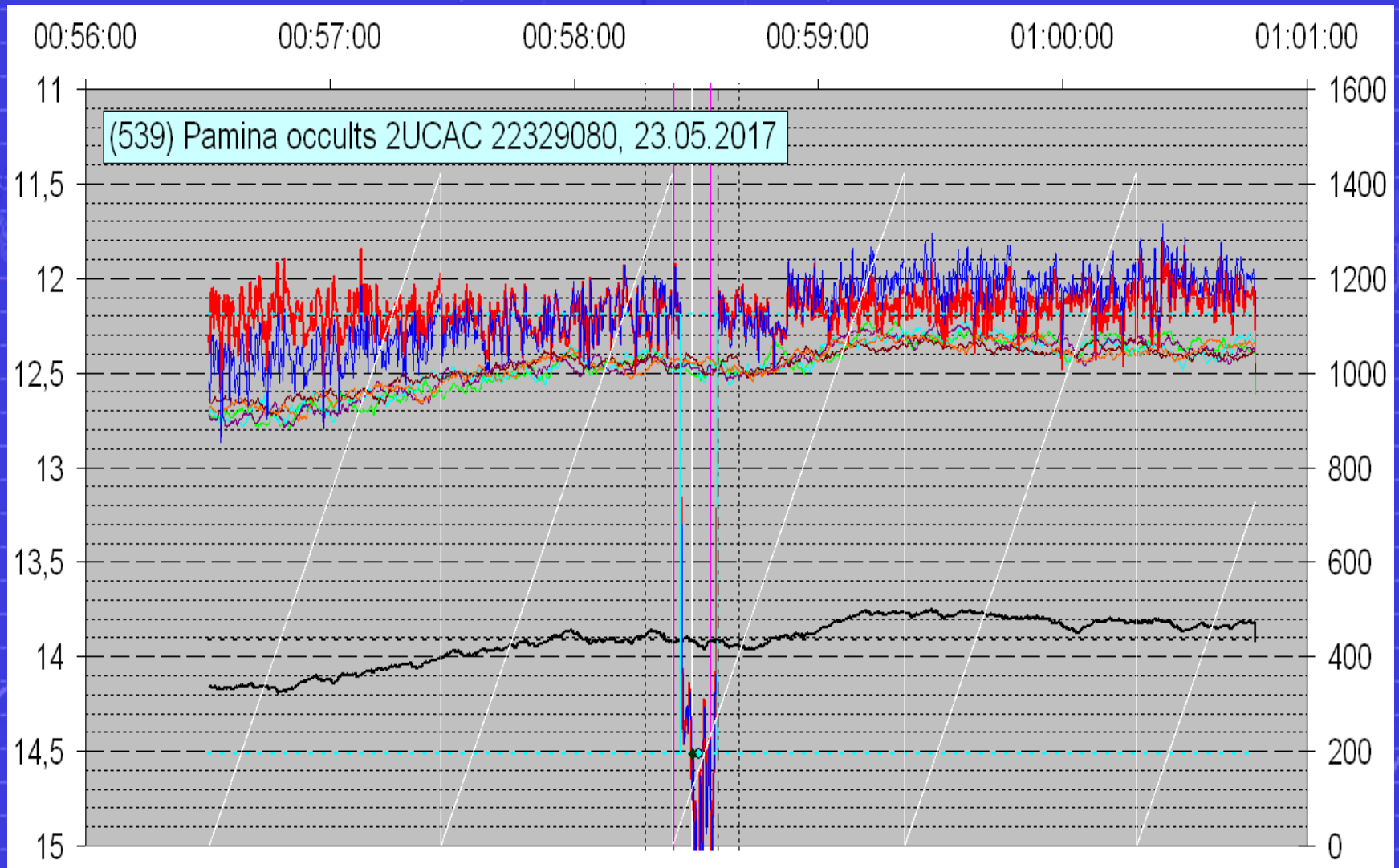
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7. Classical occultation 9 sec. duration with clouds



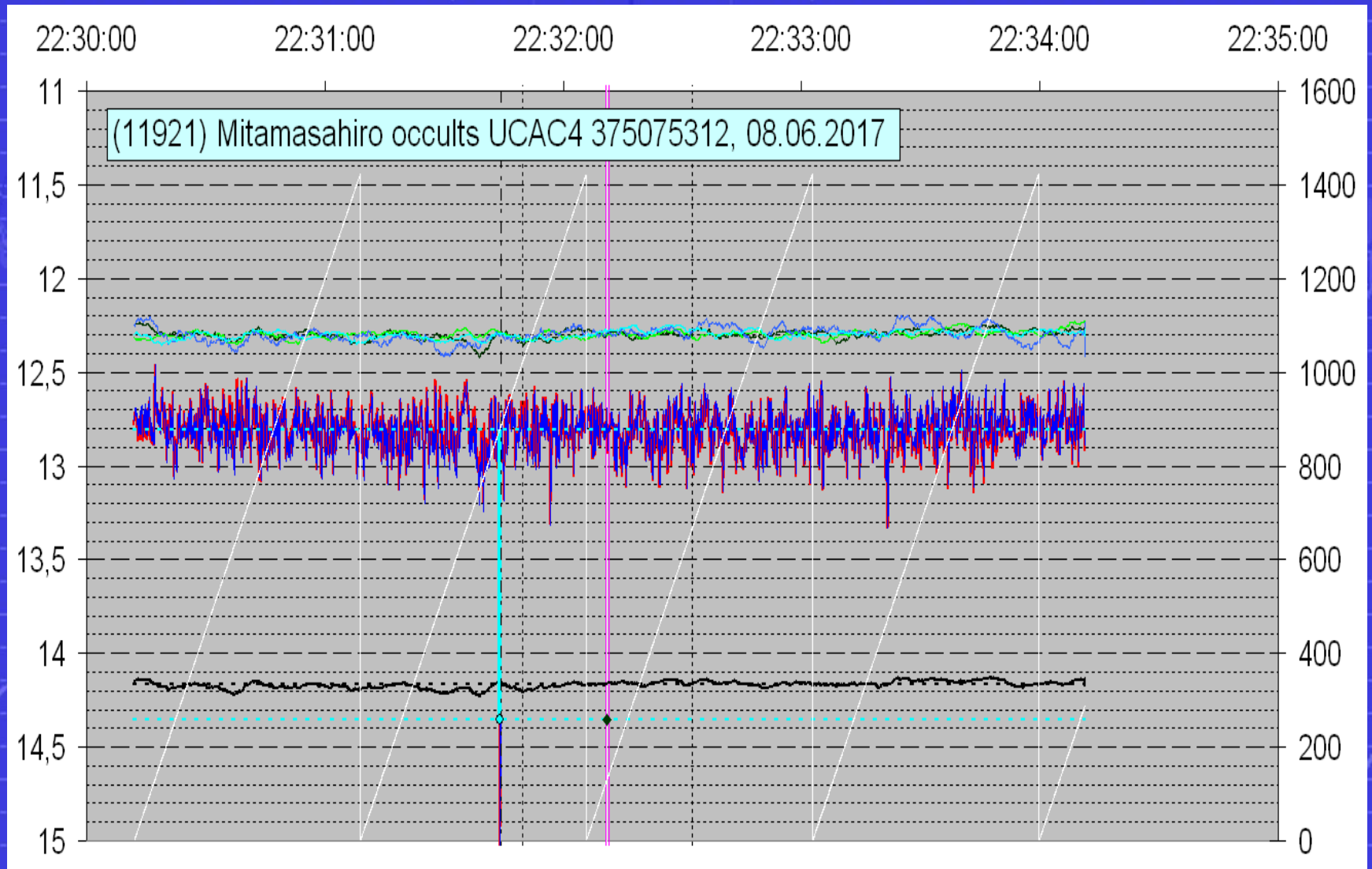
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8. Only 3 of 5 possible frames (0,32 ... 0,48 sec.)



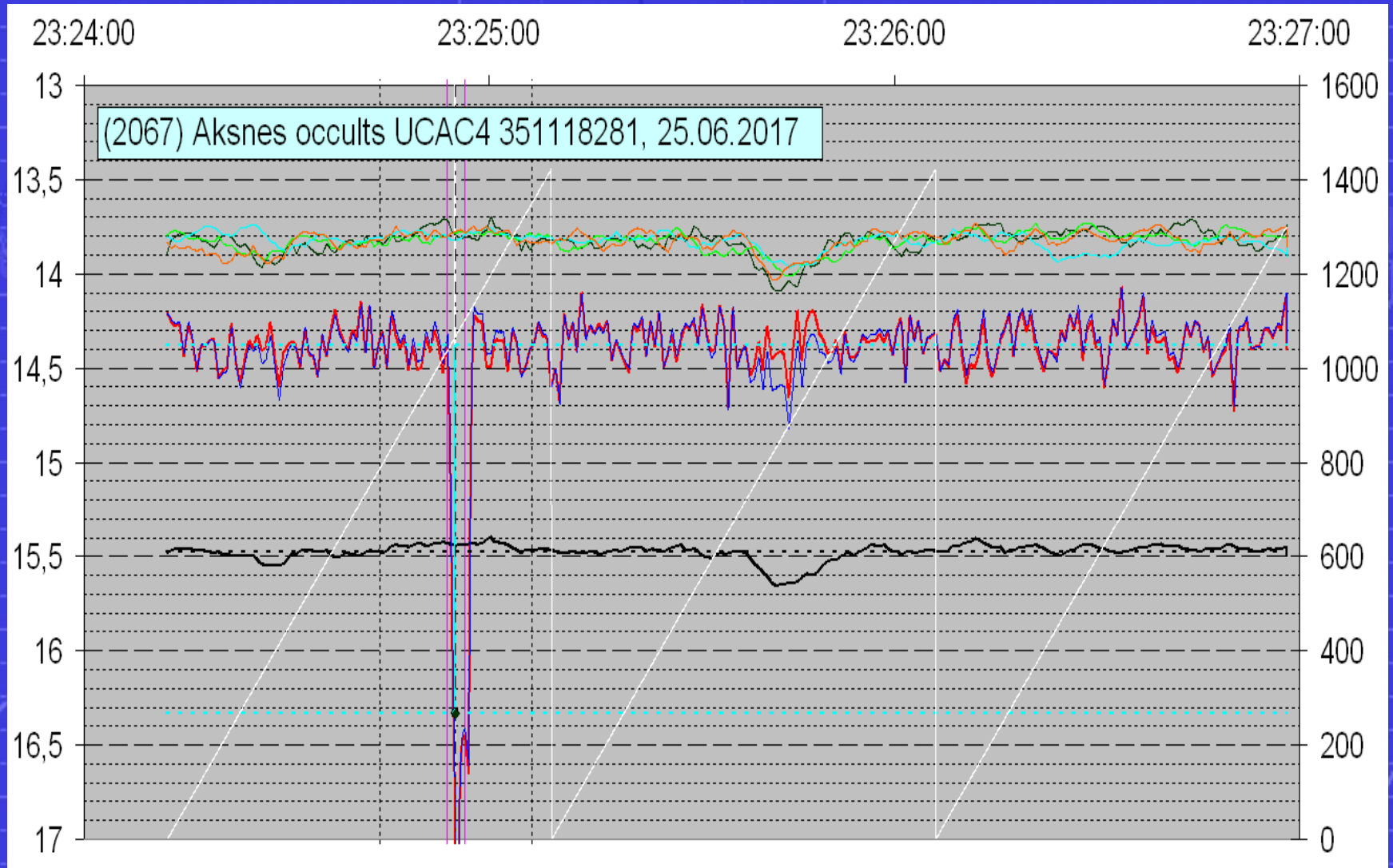
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9. Classical occultation



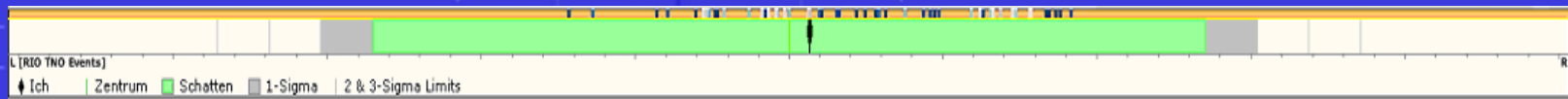
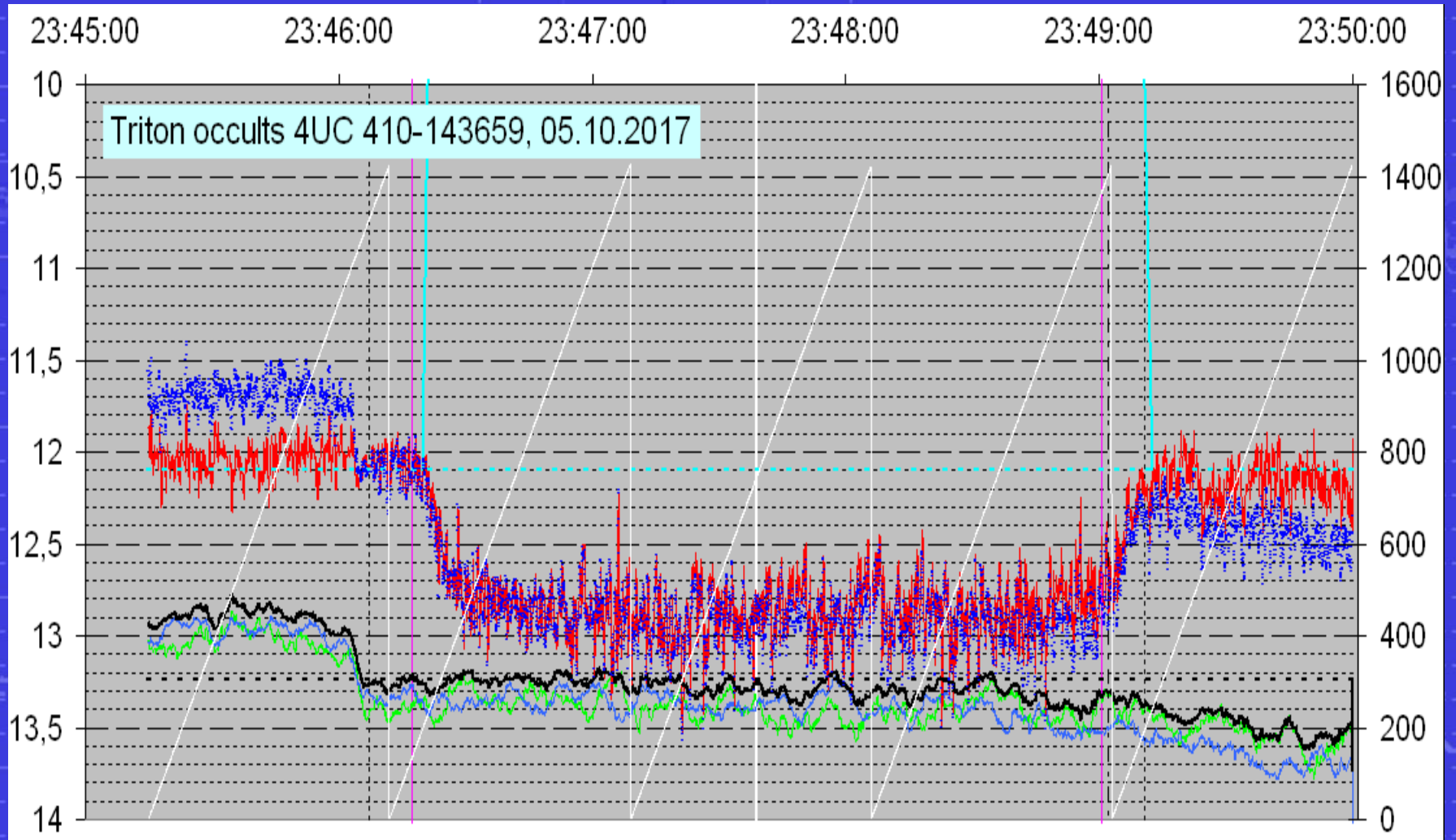
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10. Saturn moon Triton and atmosphere ☺ problematic circumstances...



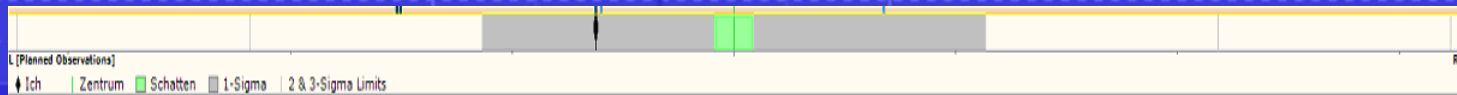
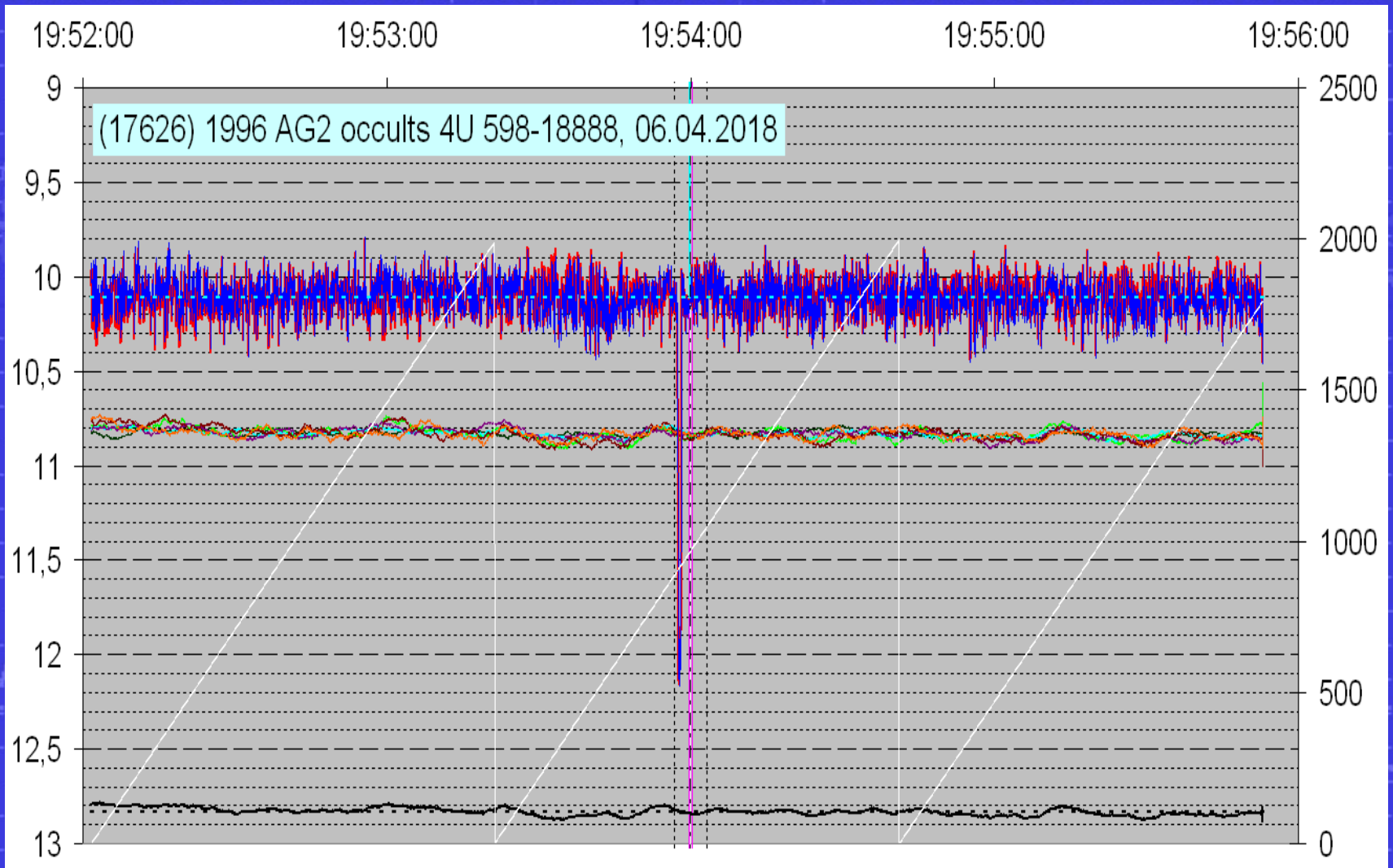
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11. Another double star ?
prediction 7,7 mag drop, but only 1,9 mag observed



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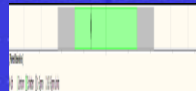
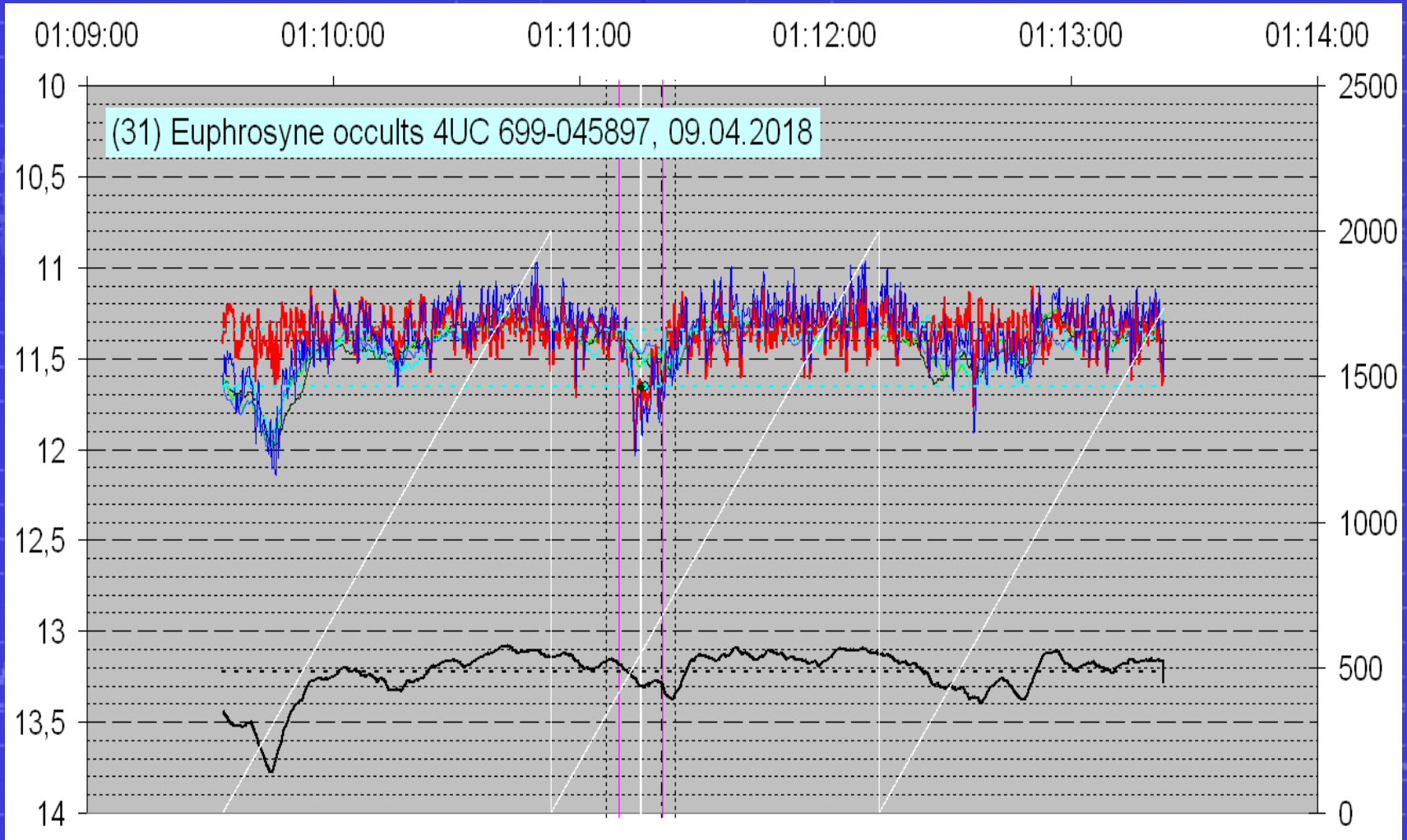
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12. ...confirmed by Tony George

prediction 0,29 mag drop, 0,25 mag observed @ 95% confidence, SNR 1,6



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33° height

www.flightradar24.com

“occultation” ca. 0,2 seconds, max. 0,3 seconds @ biggest airliner
independant from height, distance and flight direction
only ratio „length / velocity“ is relevant for artificial occultation duration



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Thanks!

bjoern@kattentidt-astro.de

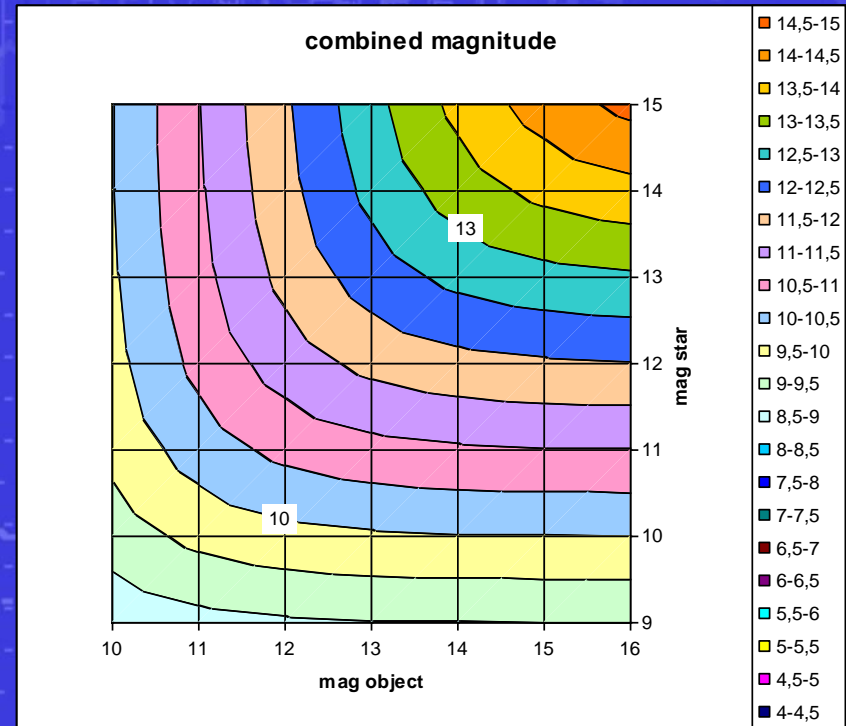
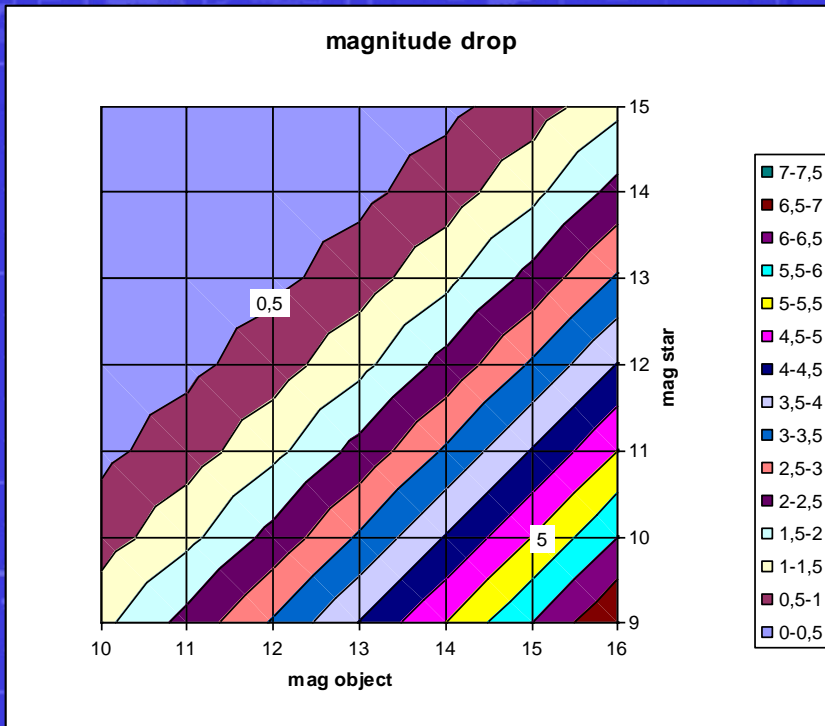
K71

Neutraubling near Regensburg / germany

Magnitude calculation

$$\ln\left(1 + \frac{100^{0,2*(m_{Obj}-m_{Star})}}{\ln(100^{0,2})}\right)$$

$$m_{Obj} - \ln\left(1 + \frac{100^{0,2*(m_{Obj}-m_{Star})}}{\ln(100^{0,2})}\right)$$



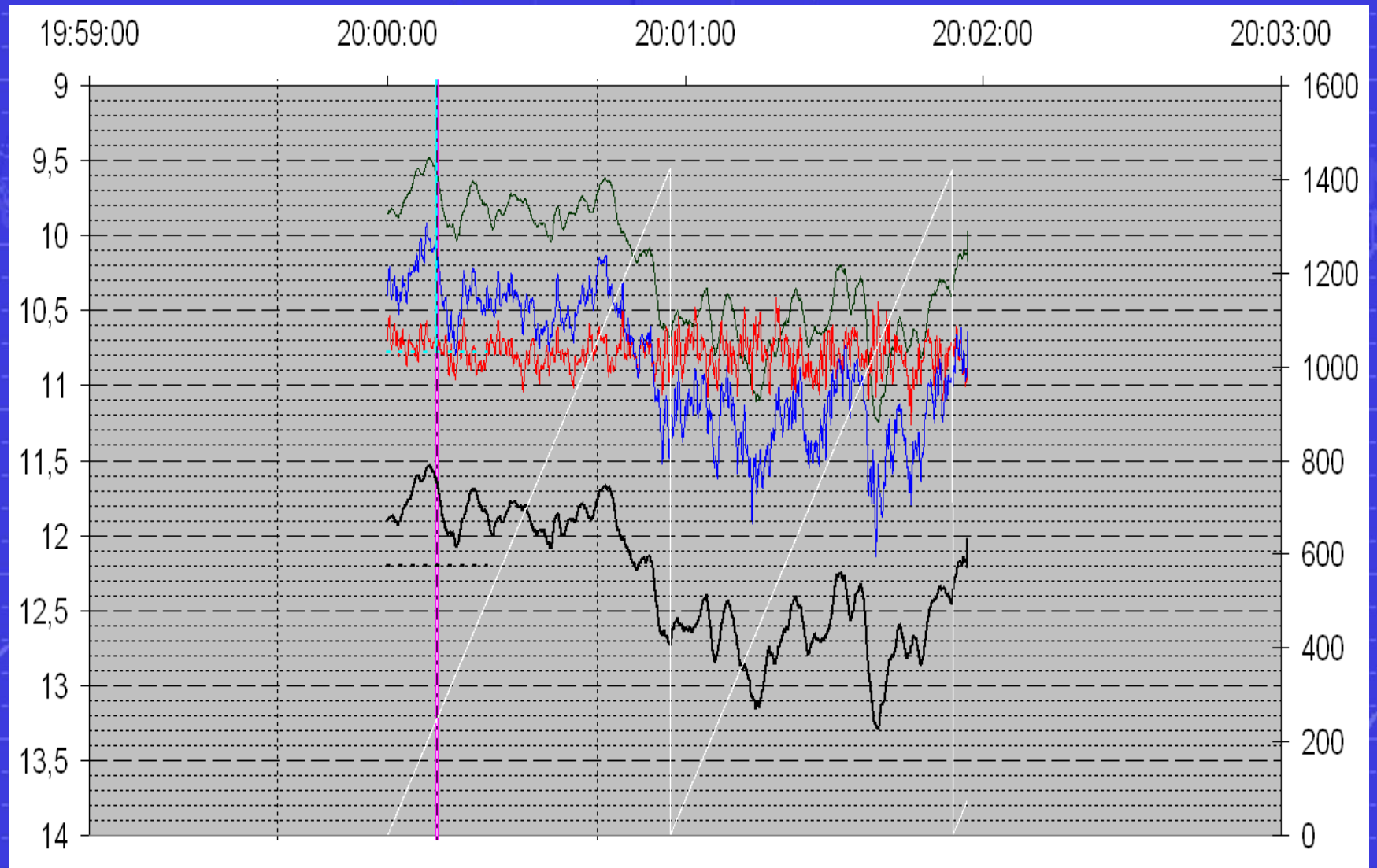
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(66062) 1998 RG1 occults 4U 505-16470, 09.02.2017, Wolken



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(42519) 1994 AU6 occults 4U 549-44626, 09.02.2017, clouds

