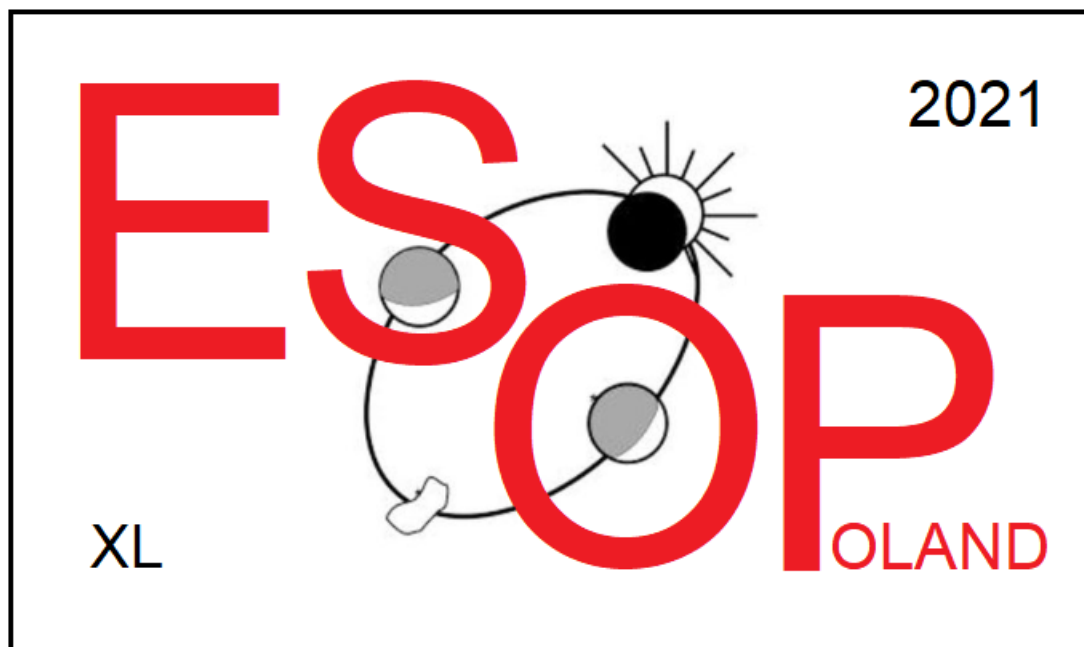


Daylight grazing occultation of Asellus Borealis on Sep 14, 2020



**XL European Symposium on Occultations Projects
Aug 27-31, 2021 – Białystok, Poland**

Wojciech Burzyński - IOTA/ES
Occultation Section of Polish Amateur Astronomers Society

Asellus Borealis = Gamma Cancri = ZC 1308



STAR:

V = 4.66 mag

multiple star

comp. B = 10.2 mag, sep. = 116''

comp. C = 14.1 mag, sep. = 91''

DIAMETER = 0.4 mas

MOON:

ALT. = 41°

PHASE = - 14%

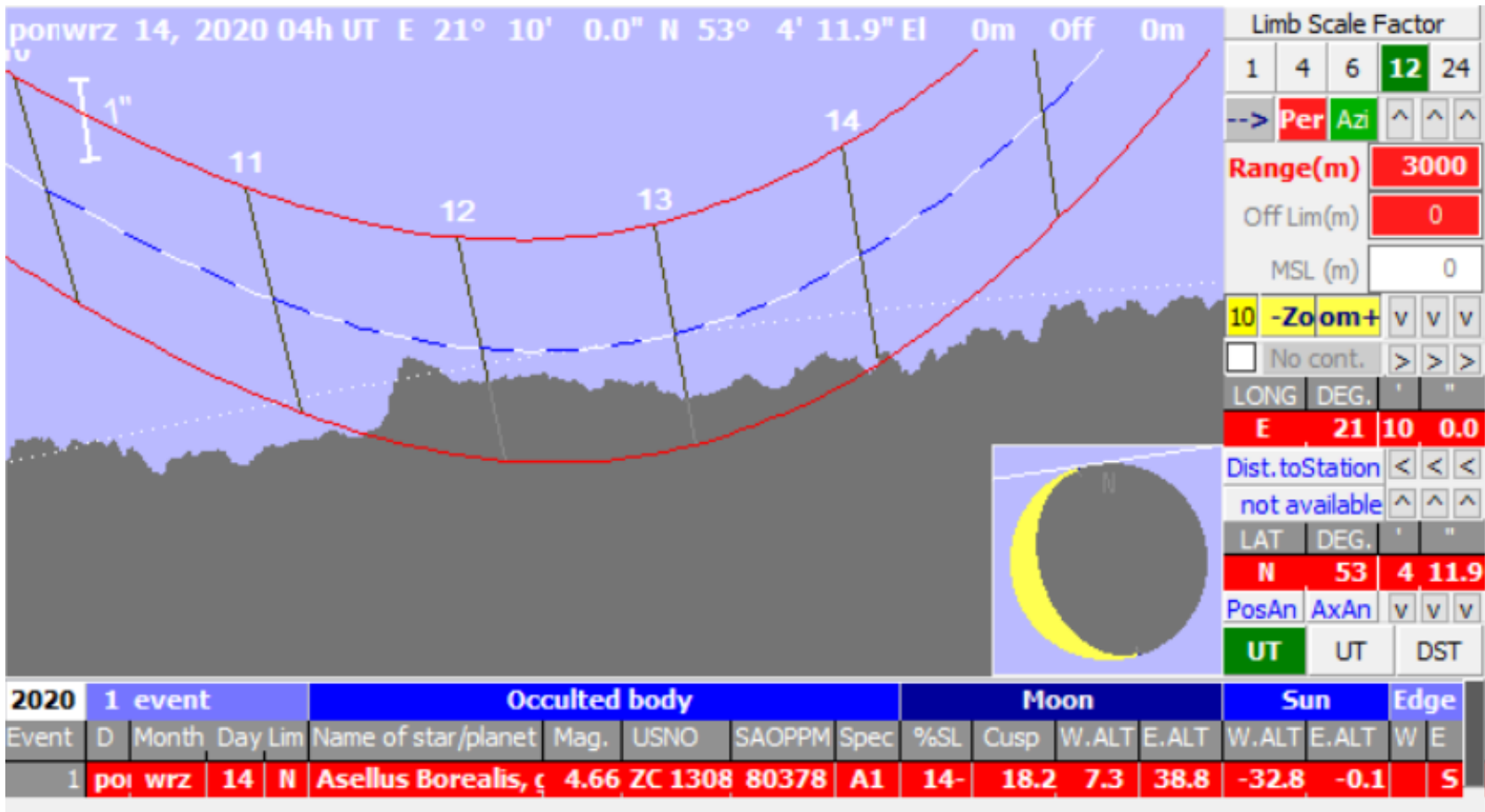
ELONG. = 44°

CUSP ANGLE = 9.5° N

SUN (during the observation):

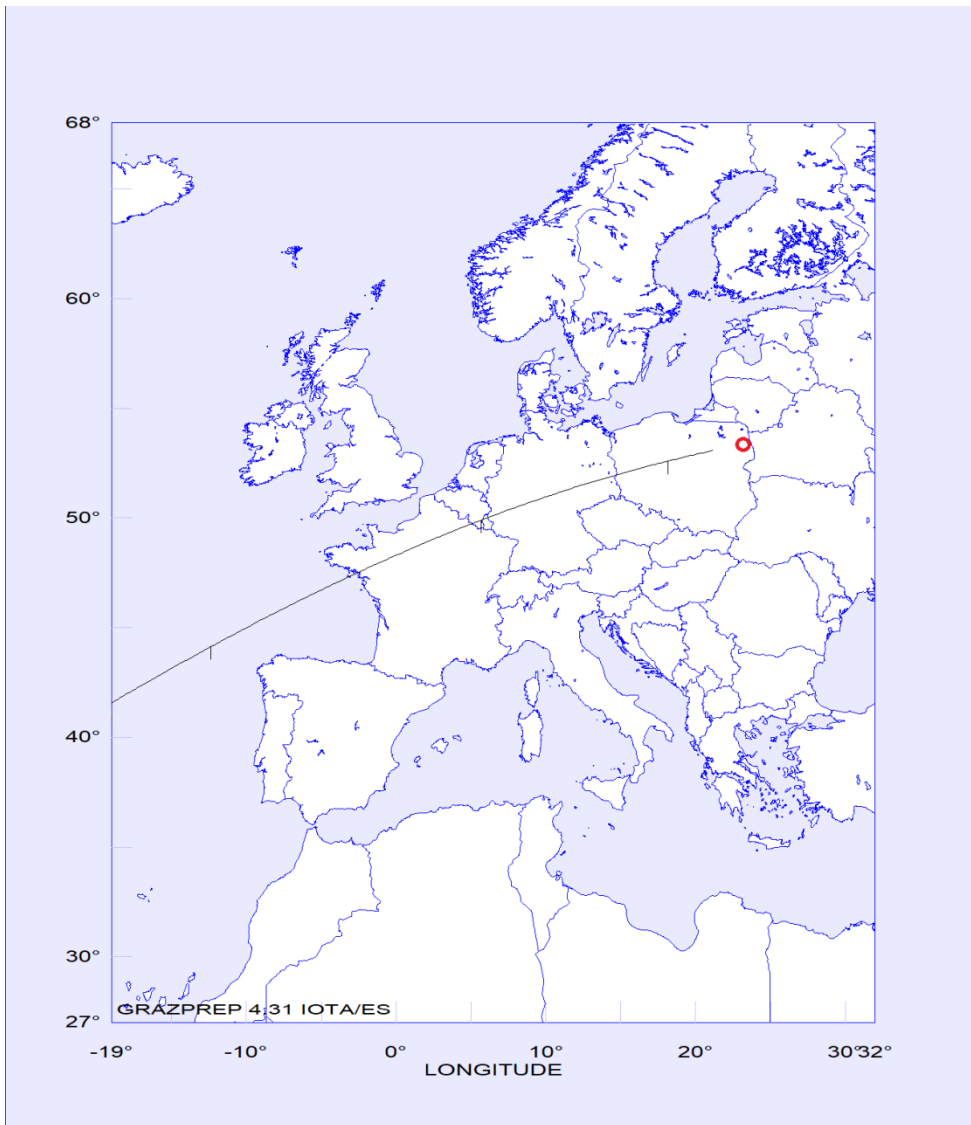
ALT = + 1° 26' to + 2° 07'

Event predictions - GRAZPREP



EAST LONG.			NORTH LAT.			UT				SUN	MOON			x OFF	PATH	POS.ANG.	AXIS	LIBRATION		CUSP	
DEG	'	"	DEG	'	"	D	h	min	sec	ALT.	ALT.	AZI.	TANZ	LIMIT	AZI.	OF GRAZE	ANGLE	LONG.	LAT.	ANGLE	
+	21	100	+	53	4	12	po	4	12	41.5	-0.1	38.8	106.9	1.24	0.64	76.15	8.44	352.16	-6.17	-3.93	9.7 D

Event predictions - GRAZPREP



Unfortunately GRAZPREP events set for Europe did not show the ephemeris for our coordinates.

The last longitude of graze limit in the GRAZPREP was only $21^{\circ}10'$ E, we were at 23° E.

The reason was the high position of the Sun above the horizon at our observation site ...

Event predictions - Occult

Grazing Occultations near CHRABOLY GRAZE

E. Longitude 22 59 38.7, Latitude 53 16 10.9, Alt. 151m; Telescope dia100cm; dMag 0.0

day	Time	P	Star	Sp	Mag	Mag	% Elon	Sun	Moon	Cusp angle	Distance	Azimuth				
y	m	d	h	m	s	No	D	v	r	V	ill	Alt	Alt	o	km	deg
20	Sep	14	4	14	22	Gr	1308SA1	4.7	4.7	14-	44	1	41	**	GRAZE: CA	9.5N; Dist. 6km in az. 348deg

Grazing Occultation of 1308SA1 Magnitude 4.7 [Red = 4.7]

R1308 = Asellus Borealis = Gamma Cancri

Date: 2020 Sep 14 4h 12m, to 2020 Sep 14 4h 16m

Nominal site altitude 151m

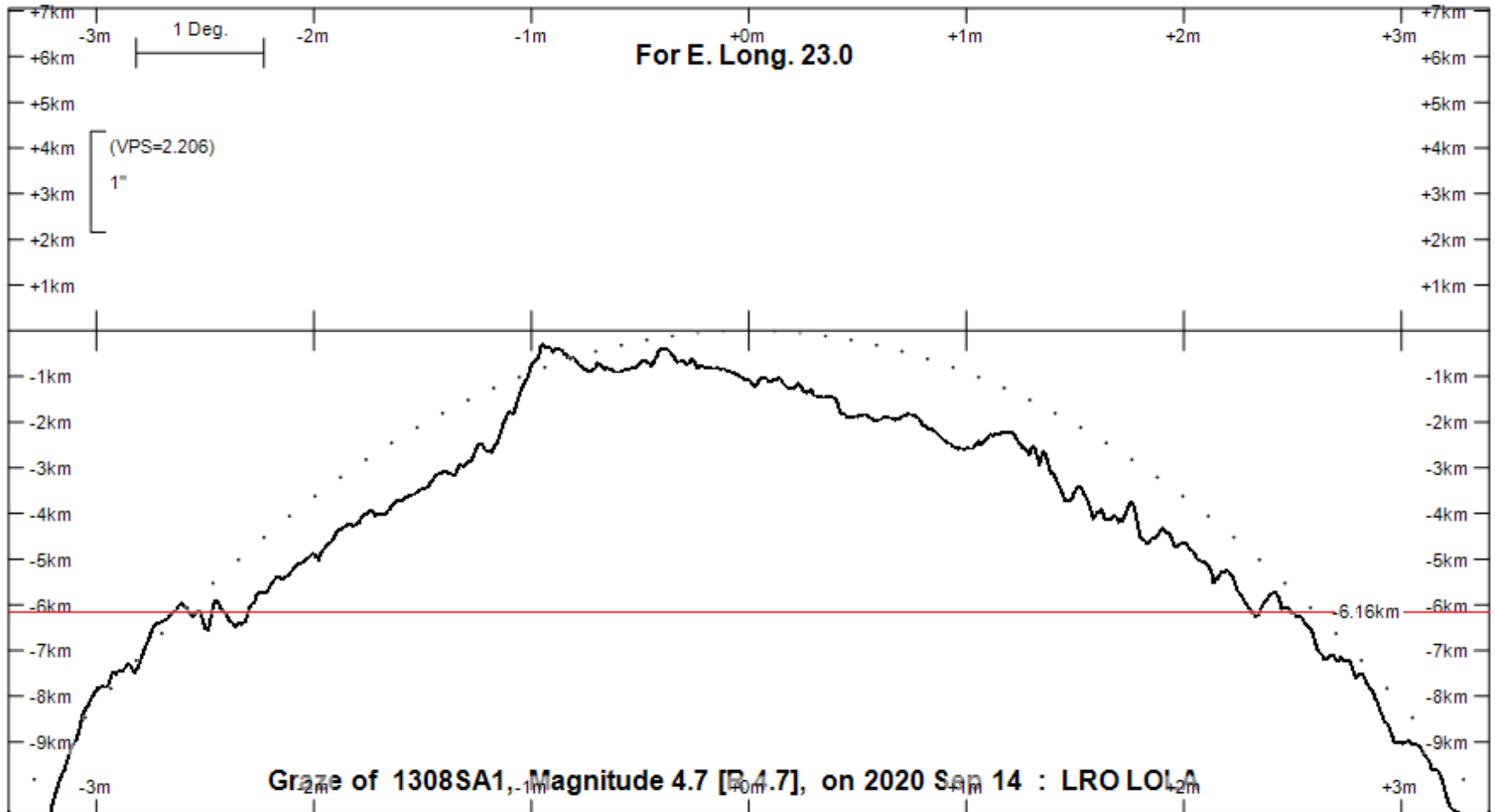
E. Longit.	Latitude	U.T.	Sun	Moon	TanZ	PA	AA	CA
o ' "	o ' "	h m s	Alt	Alt Az		o	o	o
20 0 0	52 53 31.5	4 11 40	-1 38 105	1.28	8.3 351.94	9.95N		
20 15 0	52 55 51.3	4 11 53	-1 38 106	1.27	8.3 351.97	9.91N		
20 30 0	52 58 9.4	4 12 6	-1 38 106	1.26	8.3 352.01	9.87N		
20 45 0	53 0 25.9	4 12 20	0 39 106	1.25	8.4 352.04	9.84N		
21 0 0	53 2 40.6	4 12 33	0 39 107	1.25	8.4 352.08	9.80N		
21 15 0	53 4 53.6	4 12 47	0 39 107	1.24	8.4 352.11	9.77N		
21 30 0	53 7 5.0	4 13 0	0 39 107	1.23	8.5 352.15	9.73N		
21 45 0	53 9 14.6	4 13 14	0 39 108	1.23	8.5 352.19	9.69N		
22 0 0	53 11 22.6	4 13 27	0 39 108	1.22	8.5 352.22	9.66N		
22 15 0	53 13 28.9	4 13 41	1 40 108	1.21	8.6 352.26	9.62N		
22 30 0	53 15 33.4	4 13 55	1 40 108	1.20	8.6 352.30	9.58N		
22 45 0	53 17 36.3	4 14 8	1 40 109	1.20	8.7 352.33	9.55N		
23 0 0	53 19 37.4	4 14 22	1 40 109	1.19	8.7 352.37	9.51N		
23 15 0	53 21 36.9	4 14 36	1 40 109	1.18	8.7 352.41	9.47N		
23 30 0	53 23 34.7	4 14 50	2 40 110	1.18	8.8 352.44	9.44N		
23 45 0	53 25 30.7	4 15 3	2 41 110	1.17	8.8 352.48	9.40N		
24 0 0	53 27 25.1	4 15 17	2 41 110	1.16	8.8 352.52	9.36N		
24 15 0	53 29 17.8	4 15 31	2 41 111	1.16	8.9 352.56	9.32N		
24 30 0	53 31 8.7	4 15 45	2 41 111	1.15	8.9 352.59	9.29N		
24 45 0	53 32 58.0	4 15 59	3 41 111	1.14	8.9 352.63	9.25N		
25 0 0	53 34 45.6	4 16 13	3 41 112	1.14	9.0 352.67	9.21N		

... but Occult generated graze limit line also for places where the Sun was above the horizon.

The data marked in red show the parameters of the event at our observation site near Chraboty village, NE Poland.

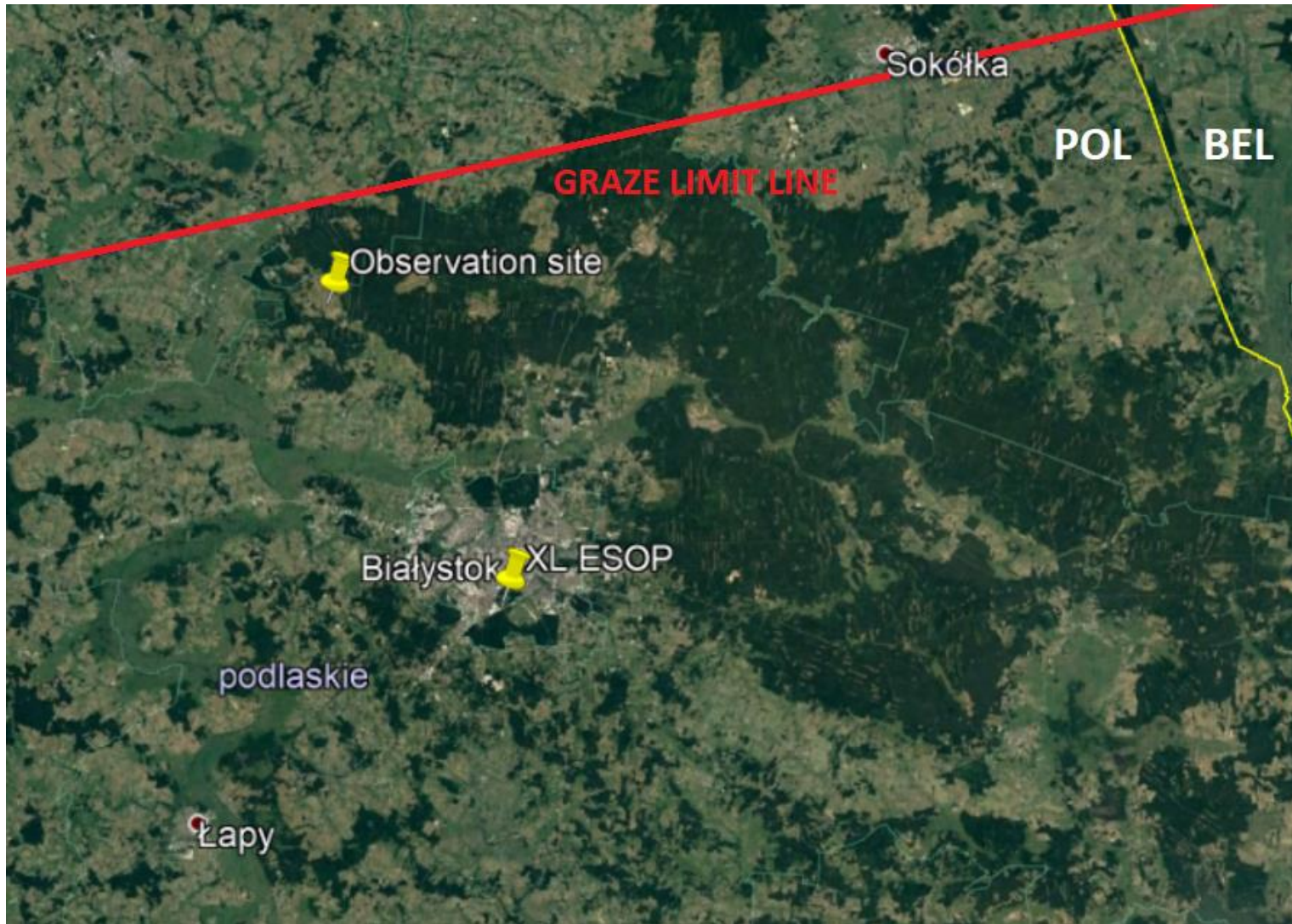
Event predictions - Occult

Occult 4.12.12.0



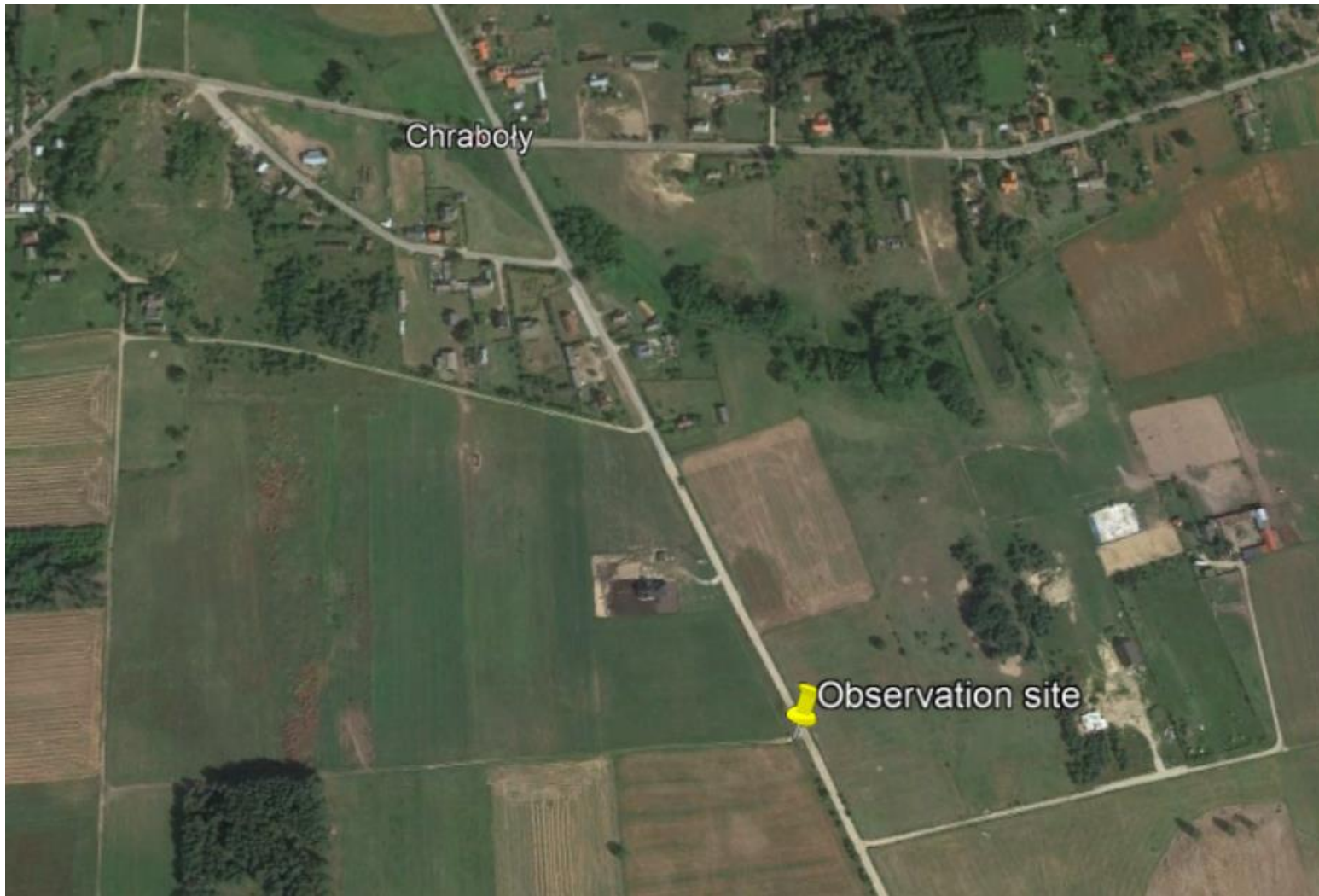
**The most interesting place on the Moon's profile with many contacts has been selected.
8 - 10 events were expected.**

Observation site – Chraboły



The graze limit line was located about 30 km north of Białystok (total occultation in the city).

Observation site – Chrabotý



I have found a proper crossroad at the distance of 6.15 km, near Chrabotý village.

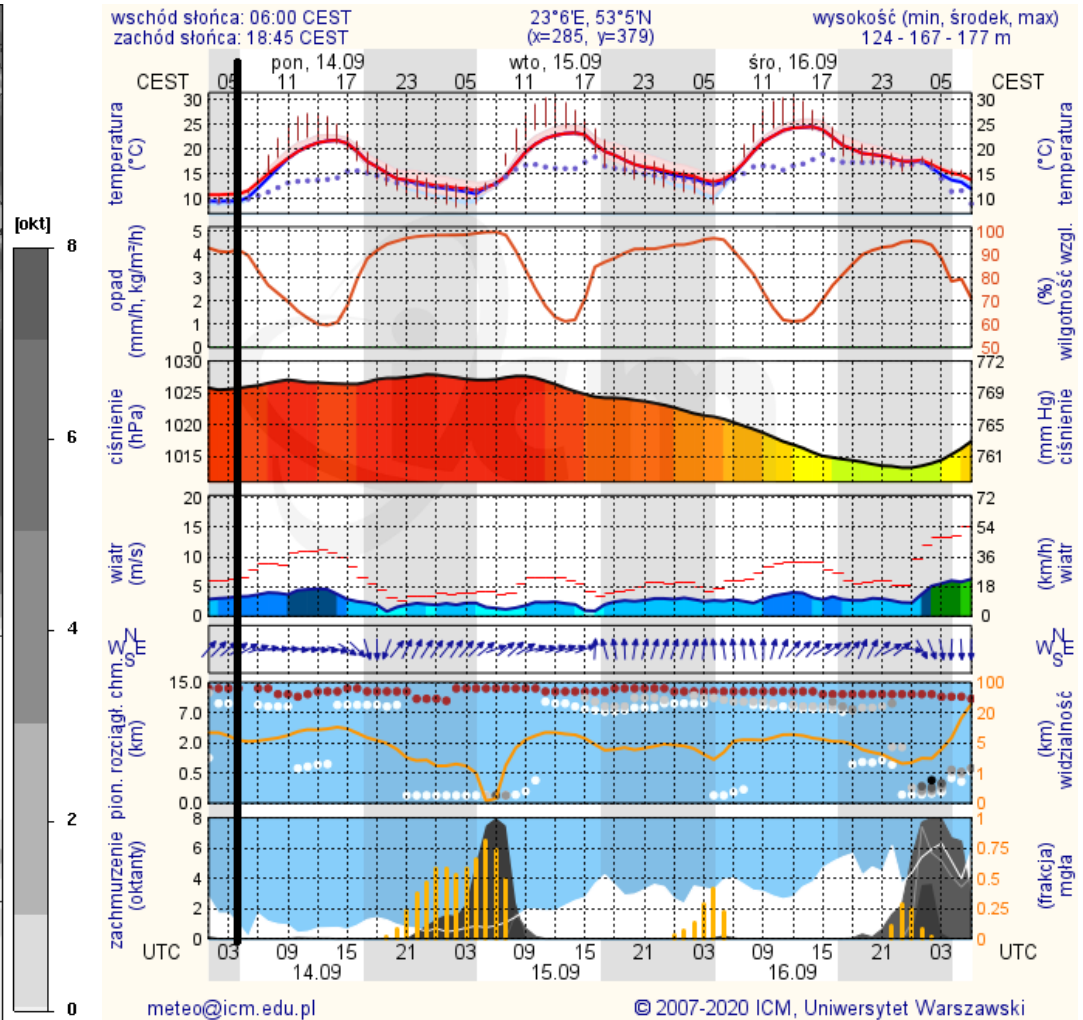
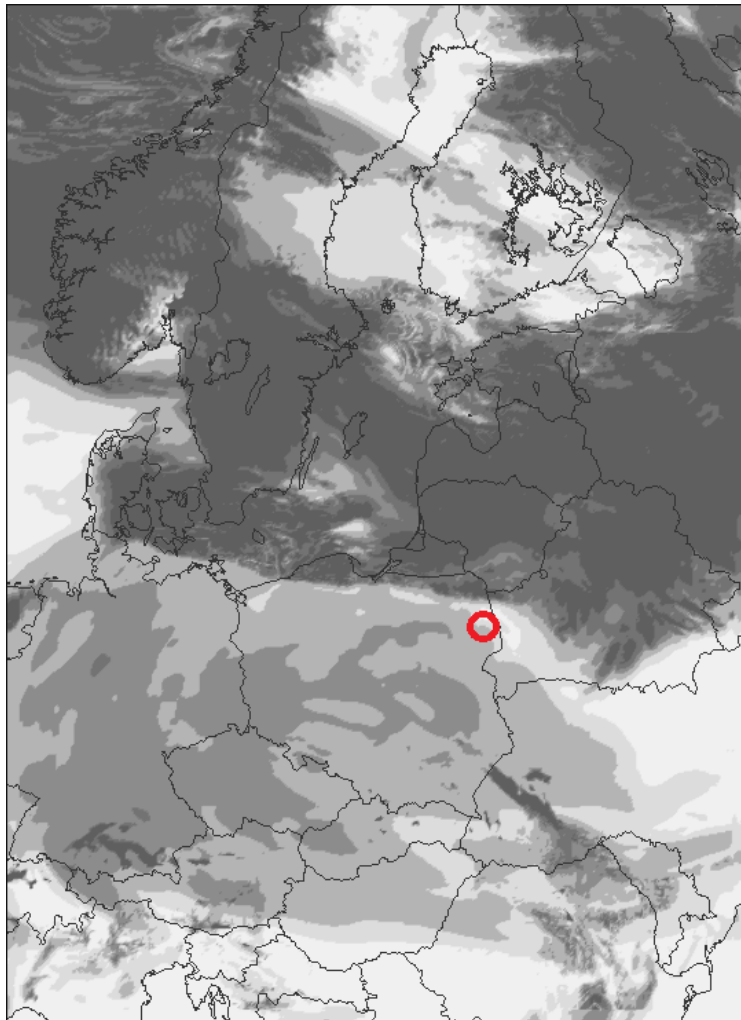
53°16'10.9" N 22°59'38.7" E 151 m

Observation site – Chrabotý



20 mins before the event (03:52 UT), Sun altitude = - 1° 12'

Weather conditions



According to the weather forecasts, we had the best conditions for observation in Poland

Weather conditions on site



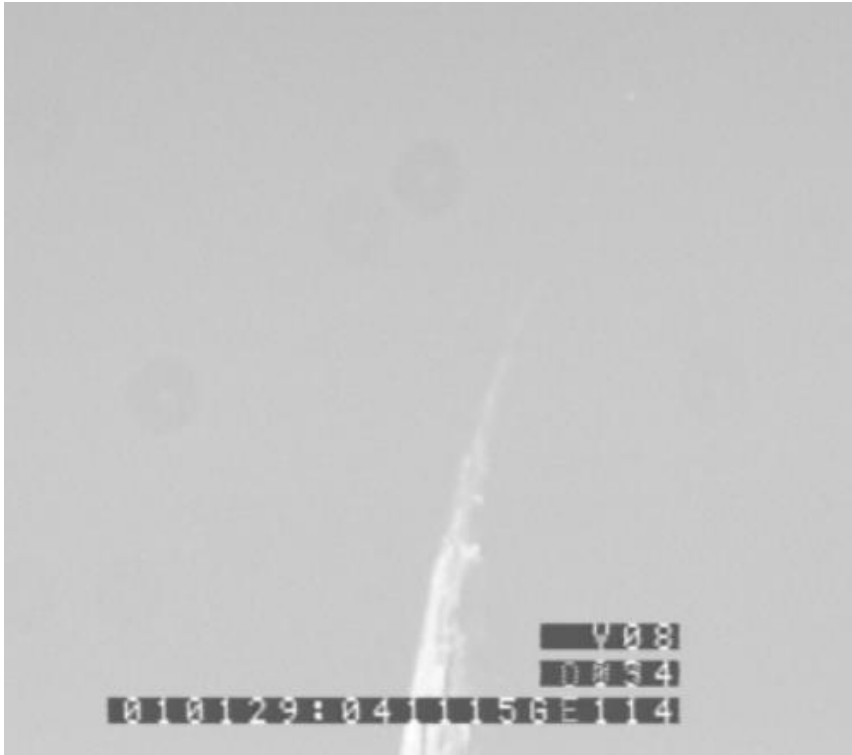
44 mins before the event (03:28 UT), Sun altitude = $-4^{\circ} 46'$, Venus visible below the Moon.

Equimpment

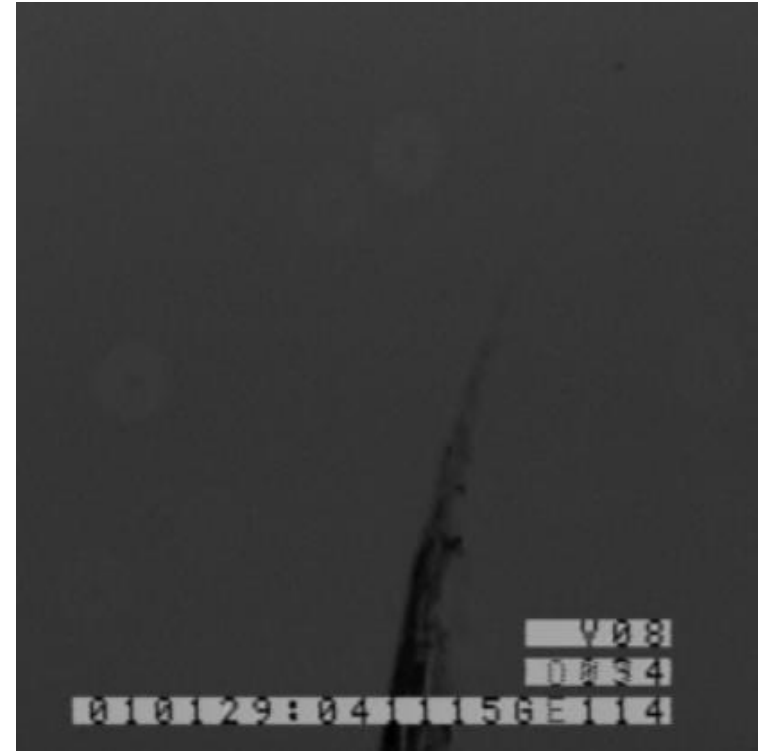


TELESCOPE: Skywatcher Dobson 300/1500 GOTO CAMERA: Watec 910HX/RX
EXPOSURE TIME: 1/1000 s, changed to 1/2000 s at 04:16:36 UT, AGC OFF, SENSUP OFF

Event evaluation in Tangra – Display Mode



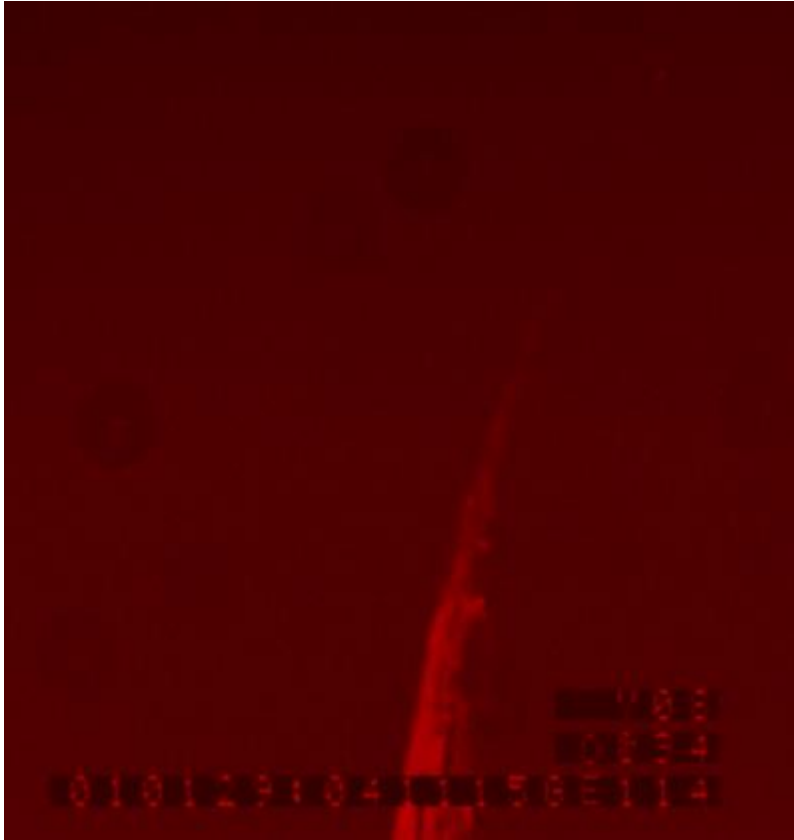
NORMAL, GAMMA OFF



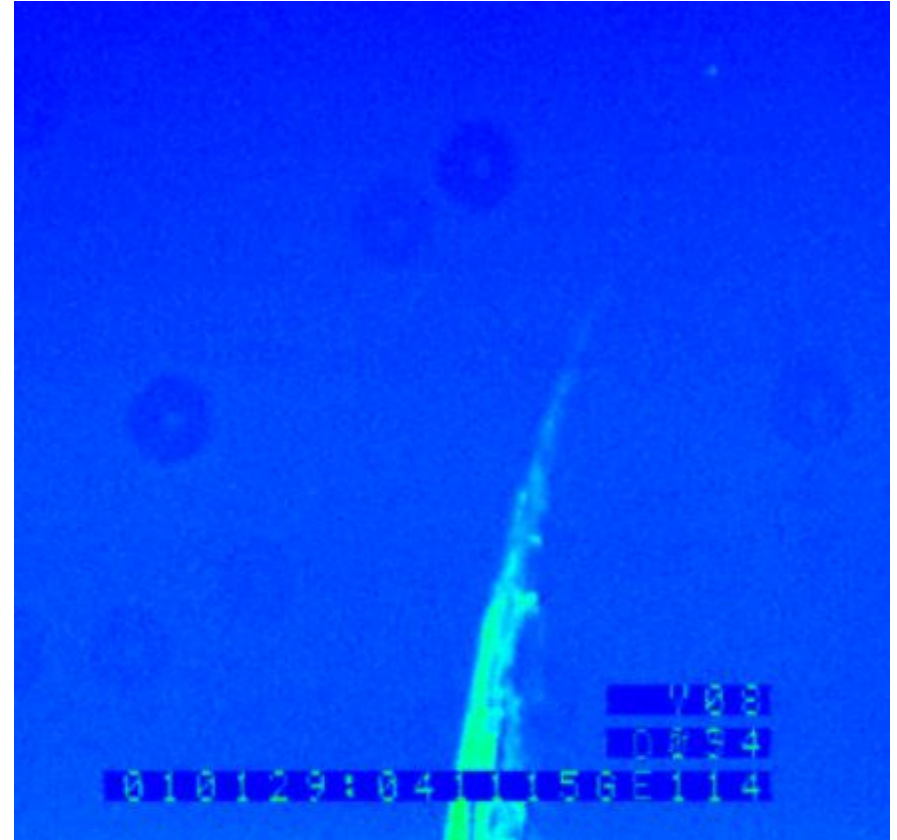
INVERTED, GAMMA OFF

Both NORMAL and INVERTED view were poor to extract event times.

Event evaluation in Tangra – Display Mode



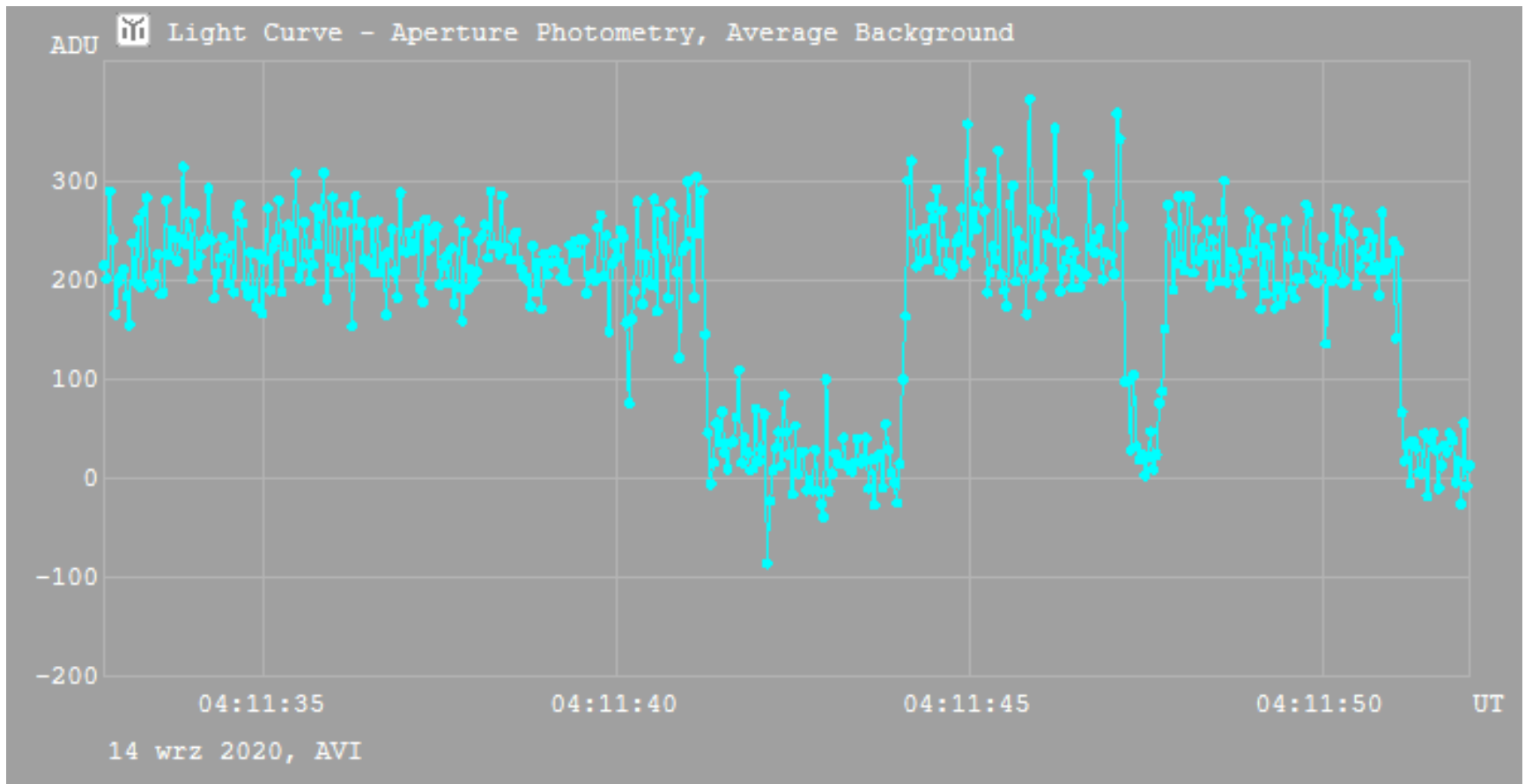
HUE INTENSITY + INVERTED, GAMMA OFF



HUE INTENSITY, GAMMA OFF

**The HUE INTENSITY mode was the best choice for star visibility during recording evaluation.
The dust on camera matrix is also visible.**

Light curve made by Tangra – first 5 events



The fact of multiplicity of the star is not (not clearly) visible in the light curve.

Results – 10 events (5D, 5R)

Ephemeris : DE440 (1550/2650), VSOP87A
Limb basis : LRO Lunar Orbiter Laser Altimeter [LOLA]
O-C basis : limb correction applied

Telescopes:

#	Aperture cm	Longitude o ' "	Latitude o ' "	Alt m
A	30	+ 22 59 38.7	+53 16 10.9	151

ref	Tel	Observer	Star No.	y	m	d	h	m	s	PhGrMrCeDb	O-C mas	O-C sec	limb "	PA o
001	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	41.34	DD G G 1	+28	-0.65	0.08	13.14
002	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	44.10	RD G G 1	+48	1.40	-0.05	13.06
003	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	47.27	DD G G 1	+11	0.19	-0.13	12.97
004	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	47.79	RD G G 1	+28	0.20	-0.16	12.96
005	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	51.18	DD G G 1	-29	0.49	-0.23	12.86
006	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	53.87	RD G G 1	+19	1.54	-0.37	12.79
007	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	54.15	DD G G 1	+12	0.24	-0.37	12.78
008	A	W. Burzynski, M Bork R	1308	2020	9	14	4	11	54.33	RD G G 1	+15	0.21	-0.38	12.77
009	A	W. Burzynski, M Bork R	1308	2020	9	14	4	12	1.19	DD G G 1	+20	-0.28	-0.62	12.58
010	A	W. Burzynski, M Bork R	1308	2020	9	14	4	16	37.00	RD G G 1	+46	1.14	-0.61	4.75
011	A	W. Burzynski, M Bork R	1308	2020	9	14	4	17	40.00	RD G G 1	+2307	46.75	-0.30	2.98

Star positions not from Gaia or Hipparcos2 have a '\$' after the O-C

Mean residual of 10 events involving single stars: +20 mas ±20 mas

Mean residuals are exclusive of:

events after 1900 with a residual > ±0.5"

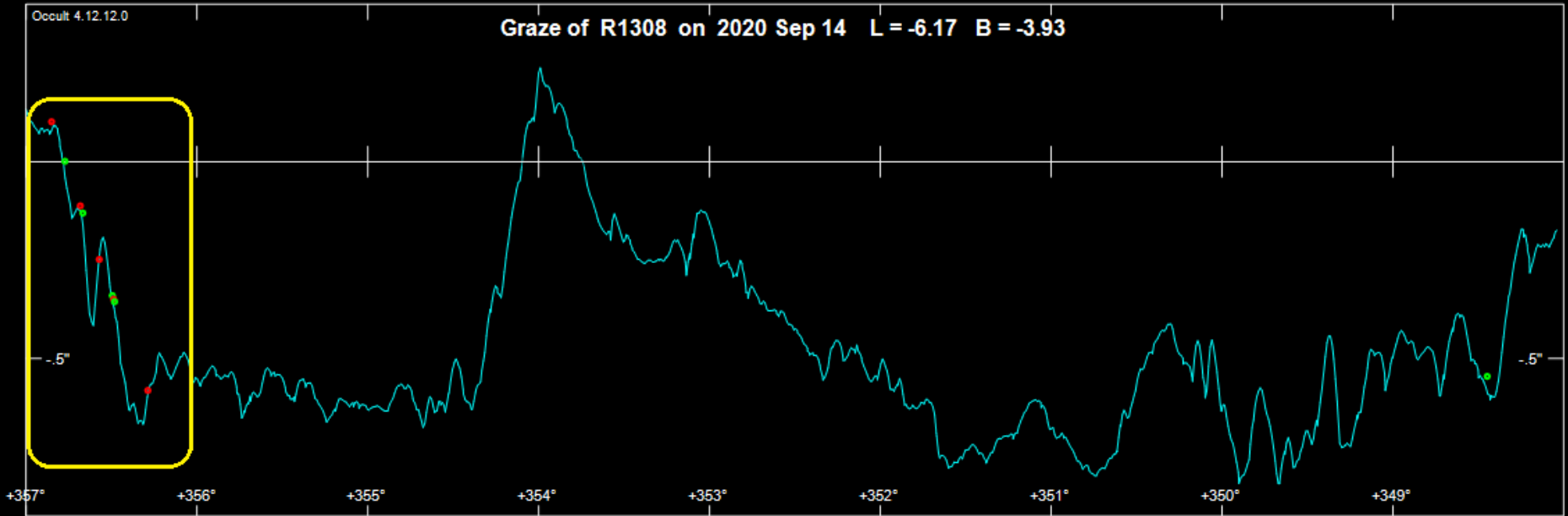
Bright limb events, events that are not 'Certain', and Start, End and Miss events

events involving Planets or Asteroids

Mean clock correction additionally limited to events with a radial motion >0.15"/sec

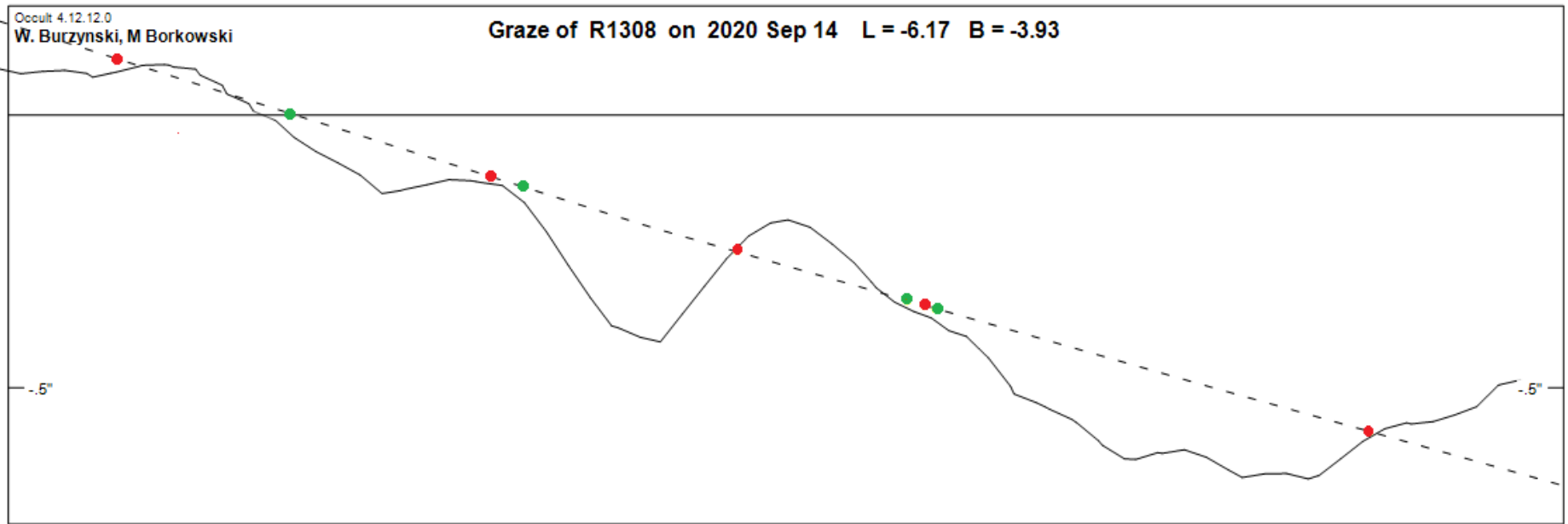
Mean residual of 10 events: + 0.020" (+/- 0.020") – the observation was of good quality.

Overall results – 10 events (5D, 5R)



We successfully registered the first part of the graze occultation, but in its second part **we missed at least 2 events** - it was related to a very bright background of the sky, which required quick experimental changes in the exposure time from 1/1000 s to 1/2000 s, but the main cause was inadequate correction of the telescope's field of view.

Overall results – 10 events (5D, 5R)

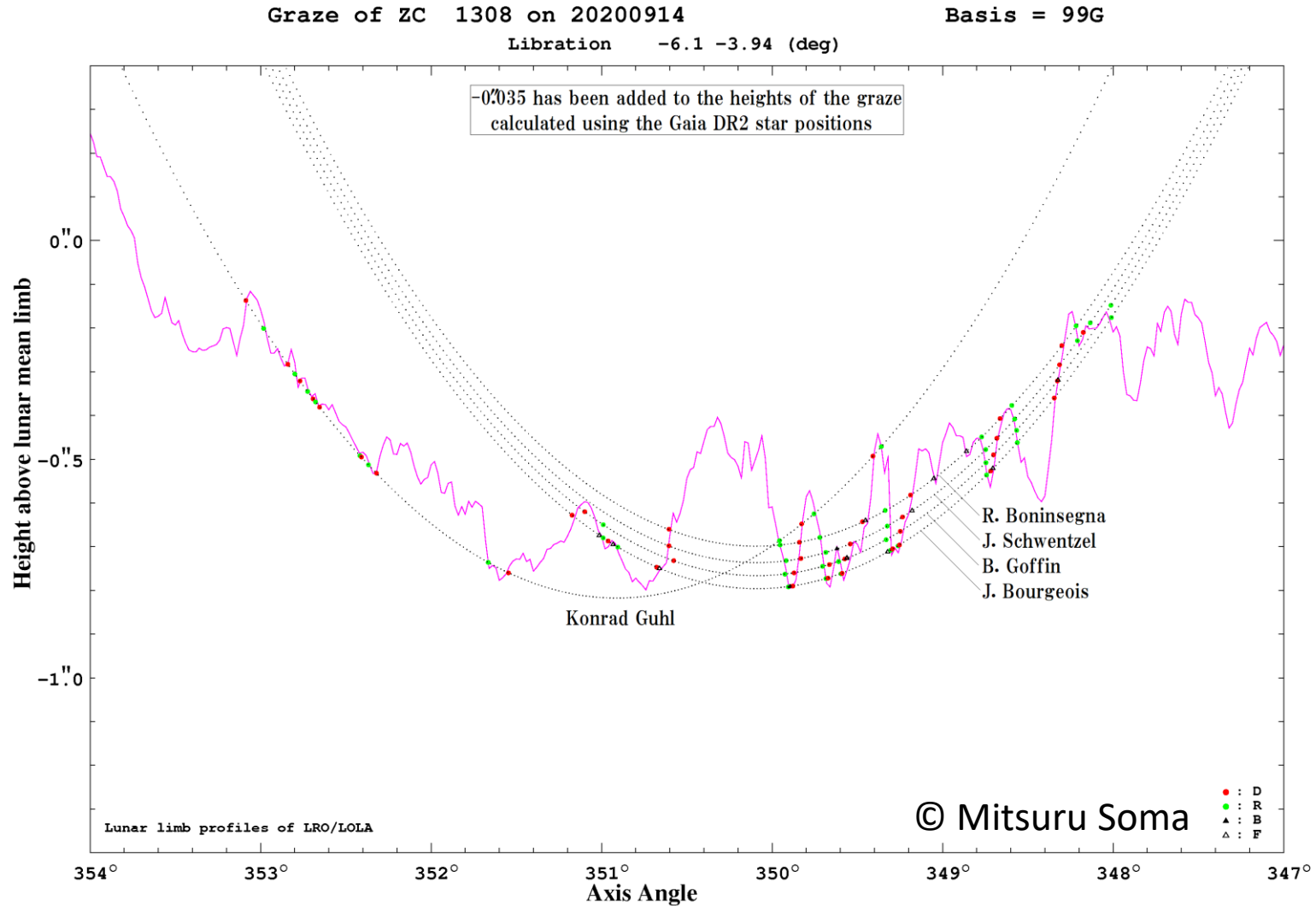


As you can see even in the era of laser measuring of the Moon's surface, we can still improve something during lunar grazing occultations observations.

The last **R**eappearance was recorded when the Sun was **2° 7'** above the horizon.

It was the first positive daytime lunar grazing occultation
observed in Poland 😊

Western Europe – Germany x 2, Belgium



Thank you for your attention !

