



**ESOP XXXVII**  
**Czech Republic**



# Highlights of occultation observations in Poland 2018

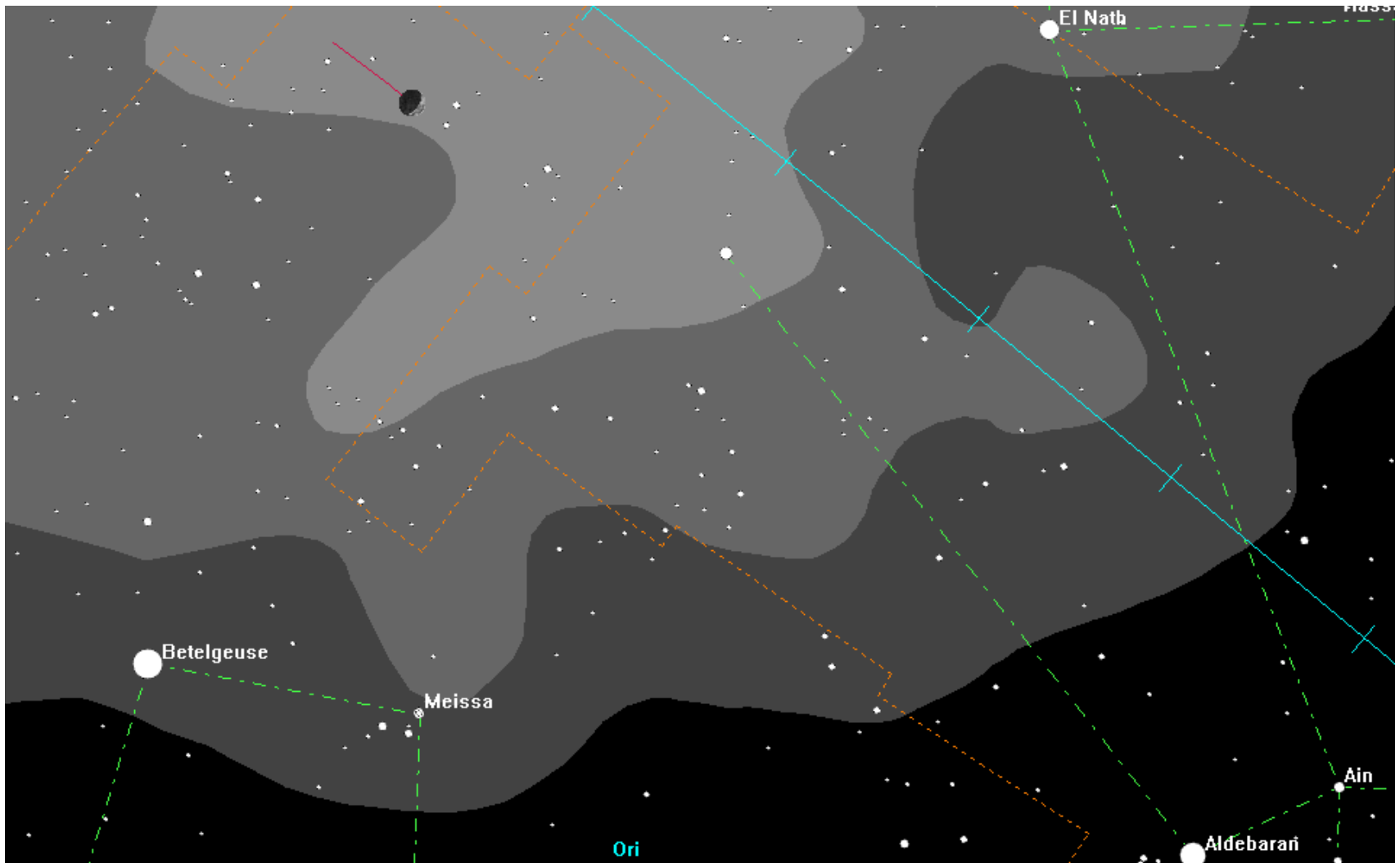
- *faint star total lunar occultations big serie*
- *4 grazing lunar occultations*
- *asteroidal occultation with new double star discovery*
- *occultation of Himalia, the jovian moon*
- *the longest lunar eclipse of the XXI century*

*Wojciech Burzyński, IOTA/ES*

Occultation Section of Polish Amateur Astronomers Society

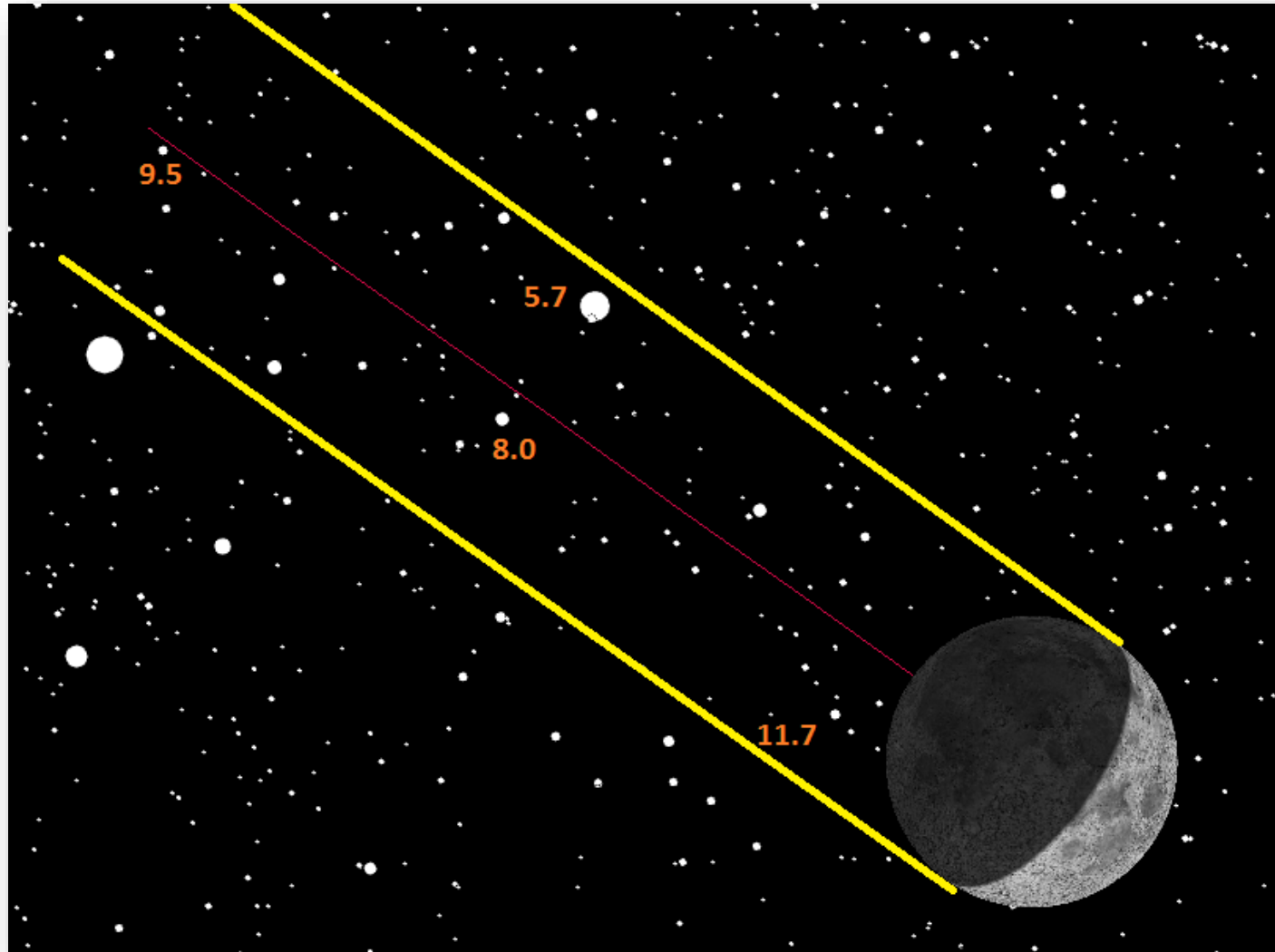
# Faint star occultations

On April 20, 2018, the young 26-28% sunlit Moon passed through the dense star field of Milky Way in the constellation of Orion.



# Faint star occultations

The sky area covered by the Moon lies between two yellow lines (18:30 - 21:50 UT)



It was a good opportunity to test both occultation software and equipment

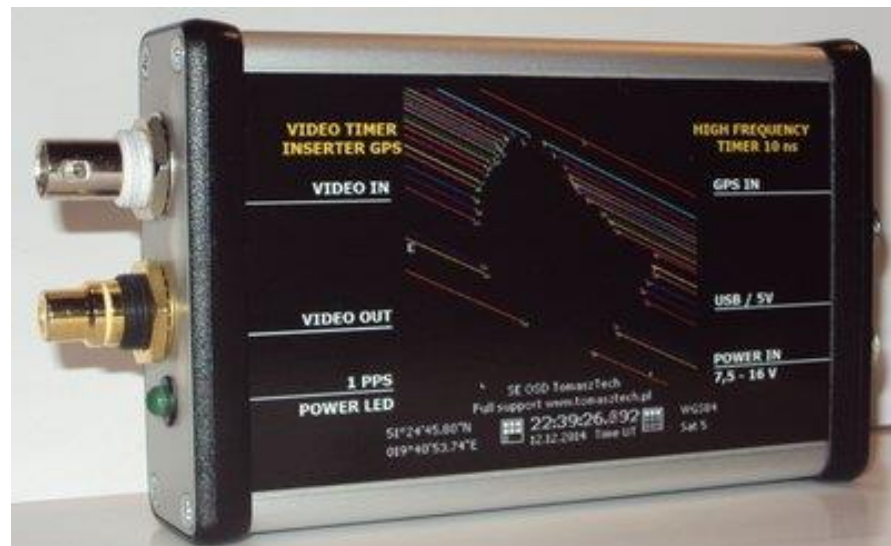
# The equipment – my basic setup for bright events



## Sky-Watcher „Star Discovery”

150/750 mm Newtonian  
on ALT-AZ mount with  
GOTO, only 11 kg!  
**450 EUR**

„TomaszTech” VTI  
based on 1pps GPS  
**185 EUR**



## NOVUS NVC GDN5811C-2

unexpensive (50 EUR)  
secondary market  
integrating camera,  
**0.00002 lx**, as sensitive  
as Watec 120N+



# Test of the „TomaszTech VTI” measurements

8.3 mag

The Tomasz Tech GPS VTI was working continuously for 4 hours (18:10 UT – 22:10 UT)

The coordinates were recorded with every single occultation event  
66 measurements were made in total

**LAT:** minimum: 53° 12' 31.10" N  
maximum: 53° 12' 31.27" N  
average: 53° 12' 31.17" N

**LONG:** minimum: 23° 31' 37.66" E  
maximum: 23° 31' 37.95" E  
average: 23° 31' 37.78" E

max-min: 0.174" => 5.37 m      max-min 0.294" => 5.44 m

Number of satellites between 9 and 13, most of time 10 - 11

53°12.5183' N  
023°31.6278' E



20:48:19.486  
20.04.2018 Time UT



WG584  
Sat 13

No	STAR	MAG	Eph OCC	Eph LOW	Time UT	DIA.	SUN	MOON
1	XZ 83308	10.87	18:31:54.1	18:31:55	18:31:54.24	27	-8	34
2	XZ 83372	10.15	18:33:41.4	18:33:40	18:33:41.49	18	-9	34
3	XZ 83313	11.73	no eph.	18:36:17	18:36:17.2	50	-9	34
4	XZ 83384	10.41	18:39:10.0	18:39:12	18:39:10.0	21	-9	33
5	TYC 1322-951	12.16	no eph.	no eph.	unreadable		-9	33
6	XZ 83470	11.56	no eph.	18:41:10	18:41:12.3	41	-10	33
7	XZ 8399	8.81	18:43:08.8	18:43:09	18:43:08.92	9	-10	33
8	XZ 83475	11.19	18:43:32.2	18:43:32	18:43:31.68	32	-10	33
9	TYC 1321-96	10.67	no eph.	no eph.	18:44:55.2		-10	33
10	XZ 83540	10.26	18:46:49.7	18:46:51	18:46:49.9	19	-10	33
11	XZ 83328	10.92	no eph.	18:47:11	18:47:12.6	30	-10	33
12	XZ 83545	10.86	18:47:22.3	18:47:22	18:47:22.3	26	-10	32
13	XZ 83528	11.28	18:48:41.9	18:48:41	18:48:42.2	34	-11	32
14	XZ 83580	9.77	18:52:03.1	18:52:03	18:52:03.29	14	-11	32
15	TYC 1322-1435	12.36	no eph.	no eph.	18:53:23		-11	32

No	STAR	MAG	Eph OCC	Eph LOW	Time UT	DIA.	SUN	MOON
16	XZ 83633	9.83	18:54:35.1	18:54:35	18:54:35.25	15	-11	31
17	3UC220-047697	10.74	no eph.	no eph.	18:56:25.5		-12	31
18	XZ 83693	10.93	18:58:48.1	18:58:50	18:58:48.1	28	-12	31
19	XZ 83690	10.76	19:00:12.1	19:00:10	19:00:12.29	25	-12	31
20	XZ 8431	9.02	19:01:23.3	19:01:21	19:01:23.7	11	-12	30
21	XZ 83769	11.22	19:04:14.5	19:04:14	19:04:15	33	-12	30
22	XZ 83759	11.62	no eph.	19:04:55	19:04:56	44	-12	30
23	XZ 83750	10.41	19:10:26.6	19:10:26	19:10:26.60	21		29
24	XZ 8464	8.04	19:18:01.1	19:18:02	19:18:01.26	7	LC	28
25	XZ 83914	10.18	19:18:35.4	19:18:35	19:18:35.49	18		28
26	XZ 83943	9.63	19:21:24.8	19:21:23	19:21:25.02	14		28
27	XZ 83832	11.14	no eph.	19:24:32	unreadable	36		28
28	XZ 83997	10.31	19:27:18.4	19:27:18	19:27:18.39	20		28
29	XZ 84040	10.45	19:30:01.8	19:30:05	19:30:01.75	21		27
30	XZ 84047	11.67	no eph.	19:30:39	unreadable	50		26

No	STAR	MAG	Eph OCC	Eph LOW	Time UT	DIA.	SUN	MOON
31	XZ 84060	11.23	19:32:33.4	19:32:34	unreadable	36		26
32	XZ 84076	11.53	no eph.	19:36:30	19:36:31.6	46		25
33	XZ 84112	10.27	19:42:26.9	19:42:29	19:42:26.96	21		25
34	XZ 84173	11.30	no eph.	19:46:53	unreadable	39		24
35	XZ 84175	10.19	19:53:07.7	19:53:10	19:53:07.80	20		23
36	XZ 8528	9.94	19:57:06.7	19:57:06	19:57:06.68	18		22
37	XZ 8553	8.02	20:09:50.1	20:09:50	20:09:50.06	7	LC	20
38	XZ 84453	10.79	20:10:32.6	20:10:34	20:10:32.8	29		20
39	XZ 8549	9.29	20:14:49.1	20:14:49	20:14:49.18	13		20
40	XZ 8557	9.55	20:17:18.0	20:17:18	20:17:18.06	14	LC	19
41	XZ 8550	5.76	20:18:32.1	20:18:33	20:18:32.10	4	LC	19
42	TYC 1322-256	11.74	no eph.	no eph.	20:20:45			19
43	XZ 84591	11.30	no eph.	20:24:45	20:24:43.8	46		18
44	XZ 84605	10.85	20:25 40.6	20:25:42	20:25:40.7	32		18
45	XZ 84596	11.10	no eph.	20:26:32	20:26:33.6	39		18



No	STAR	MAG	Eph OCC	Eph LOW	Time UT	DIA.	SUN	MOON
46	XZ 84642	11.26	no eph.	20:30:38	20:30:39.5	46		17
47	XZ 84652	10.23	20:38:40.6	20:38:40	20:38:40.68	23		16
48	XZ 8583	9.24	20:40:14.1	20:40:17	20:40:14.10	13		16
49	XZ 84773	10.84	no eph.	20:45:25	20:45:25	36		15
50	XZ 84728	9.40	20:46:07.4	20:46:08	20:46:07.80	14	LC	15
51	XZ 84768	9.74	20:46:28.3	20:46:27	20:46:28.56	18	LC	15
52	XZ 8579	8.31	20:48:43.7	20:48:42	20:48:44.10	9	LC	15
53	XZ 84854	10.85	no eph.	20:51:57	20:51:56.5	37		14
54	XZ 8608	9.12	20:58:32.6	20:58:33	20:58:32.64	13	LC	14
55	XZ 8610	8.31	21:00:33.6	21:00:32	21:00:33.86	8	LC	13
56	XZ 8598	7.76	21:02:16.0	21:02:17	21:02:16.09	7	LC	13
57	XZ 84980	9.98	21:05:03.4	21:05:04	21:05:03.5	21		13
58	XZ 85012	10.78	no eph.	21:11:21	21:11:22	45		12
59	TYC 1322-961	11.10	no eph.	no eph.	21:21:27			11
60	XZ 85171	9.55	21:25:14.3	21:25:13	21:25:14.47	18		10

No	STAR	MAG	Eph OCC	Eph LOW	Time UT	DIA.	SUN	MOON
61	XZ 8656	9.01	21:30:02.0	21:30:03	21:30:02.22	14		9.3
62	XZ 8629	8.73	21:33:13.4	21:33:27	21:33:13.56	13		8.7
63	TYC 1322-1333	10.93	no eph.	no eph.	21:36:15			8.5
64	TYC 1322-1413-1	11.37	no eph.	no eph.	21:42:21.2			7.8
65	XZ 8688	8.94	21:48:26.0	21:48:27	21:48:26.13	14		6.9

**65 occultations have been recorded in total in one night by single observer!**

*This is probably a national record 😊*

## RESULTS:

- hard to make light curves for stars fainter than **9.5 mag**
- only 10 LC's clearly readable
- average magnitude of occulted star: 10.0 mag
- **32 timings with 0.02 - 0.04 sec. accuracy (for stars brighter than 10.3 mag)**
- 20 timings with 0.1 - 0.5 sec. accuracy
- 7 timings with 1 sec. accuracy
- 6 timings absolutely unreadable

**It was easy to observe events on LCD screen but much harder to read timings**

# Results and Conclusions

## CAMERA AND TELESCOPE:

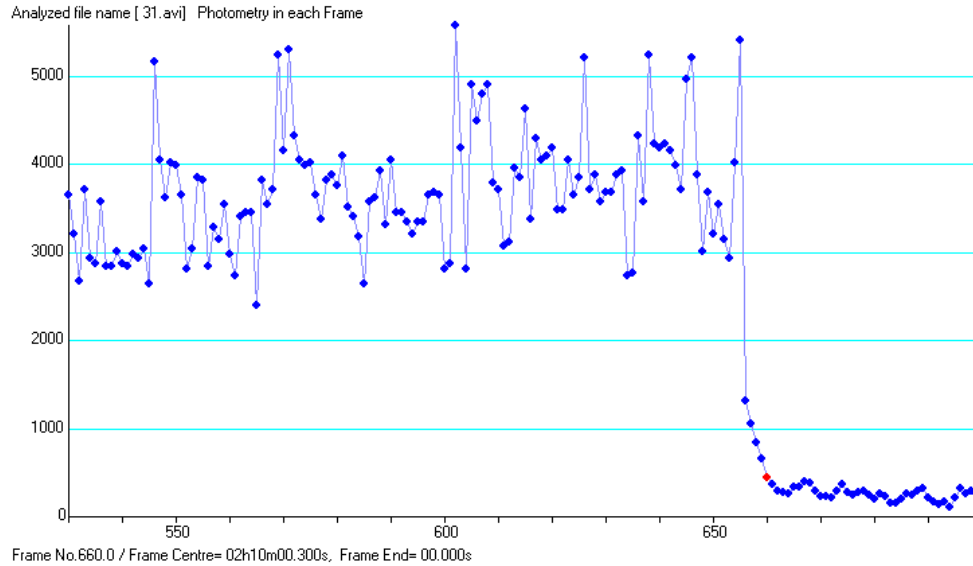
- gain was set as „low” („Auto Gain Control – LOW”) – made possible to record fainter stars but then made more noise,
- this equipment can reach even 12.5 mag stars being occulted by the crescent Moon and permanently visible on LCD display,
- occultation of a 8.94 mag star was observed at low altitude of 6.9°.

## SOFTWARE:

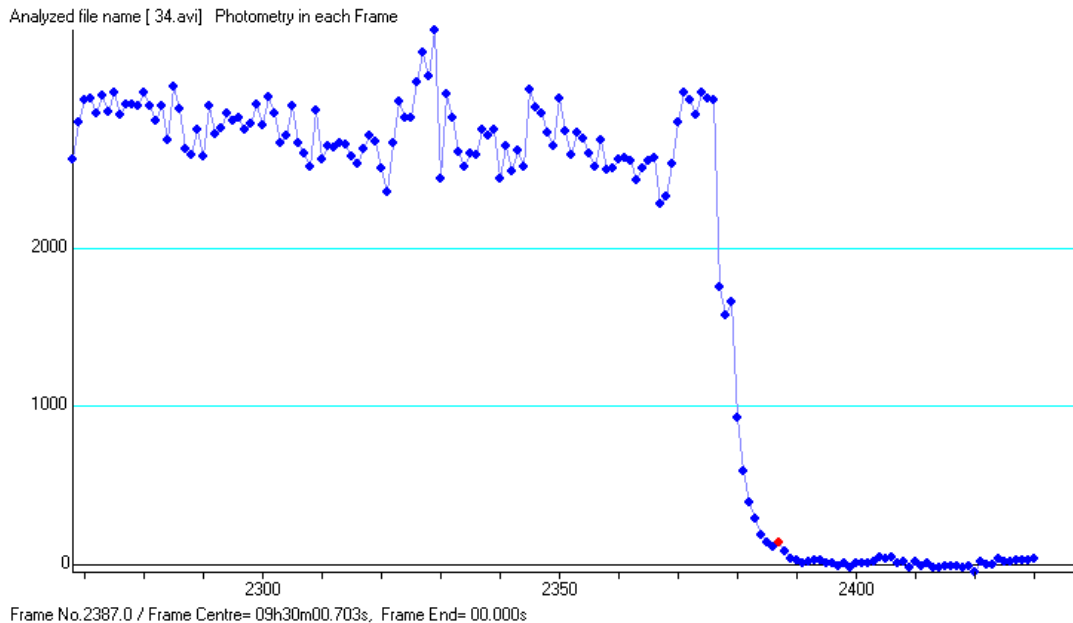
- telescope diameter was set in both LOW and Occult to a max. allowed value
- LOW recommended at least 50-cm telescope for 11.7 mag occultation for visual obs.
- 8 from 65 stars without any ephemeris have been observed (range: 10.74 - 12.36 mag)
- LOW - no ephemeris for 8 of 65 stars
- *Occult - no ephemeris for 22 of 65 stars !*
- *Occult – nearly all ephemeris earlier by 0.1 - 0.3 secs*
- ephemeris difference between LOW and Occult – usually no more than 1-2 secs but...
- *LOW: there is a big strange ephemeris difference for XZ 8629 occultation: +14 secs !*

***Both LOW and Occult should be used together for total and grazing lunar occultations!***

# Light curves of double stars



XZ 8553 (8.02 mag)  
is double, separation 0.1''



XZ 8550 (5.76mag)  
is double, separation 0.1''

# Grazing lunar occultations in Poland 2018

No	Date	Star	Mag	CA	MOON %	ALT	SUN ALT	No of EVENTS	No of OBSERVERS
1	21 III 2018	ZC 508 (5 Tau)	4.14	1.72	+ 20	9.7	- 28	48	4 + 1
2	21 IV 2018	SAO 79097	8.86	- 0.50	+ 37	44	- 7.1	5	1
3	23 V 2018	SAO 119000	7.28	- 1.38	+ 68	33	- 13	3	1
4	08 VIII 2018	ZC 895	5.92	5.70	- 16	15	-12	44	3 + 2 + 1

Despite of a very accurate lunar limb profile made by the Kaguya and LRO probes, we are still trying to observe grazing lunar occultations in Poland.

It is still possible to improve very slightly the profile data but perhaps **the most important are emotional impressions felt by the observer** 😊

**At the moment, 4 lunar grazing observations from Poland and one from Germany (B. Kattentidt - SAO 96697, 7.45 mag, on Apr 21st) were reported worldwide in 2018 to dr M. Soma**

**Grazes in 2017 (18) : Japan - 8, USA - 3, Poland - 3, UK - 2, Austria - 1**

# Grazing occultation of ZC 508, 21 III 2018, Sztabin + Lidzbark Warm.



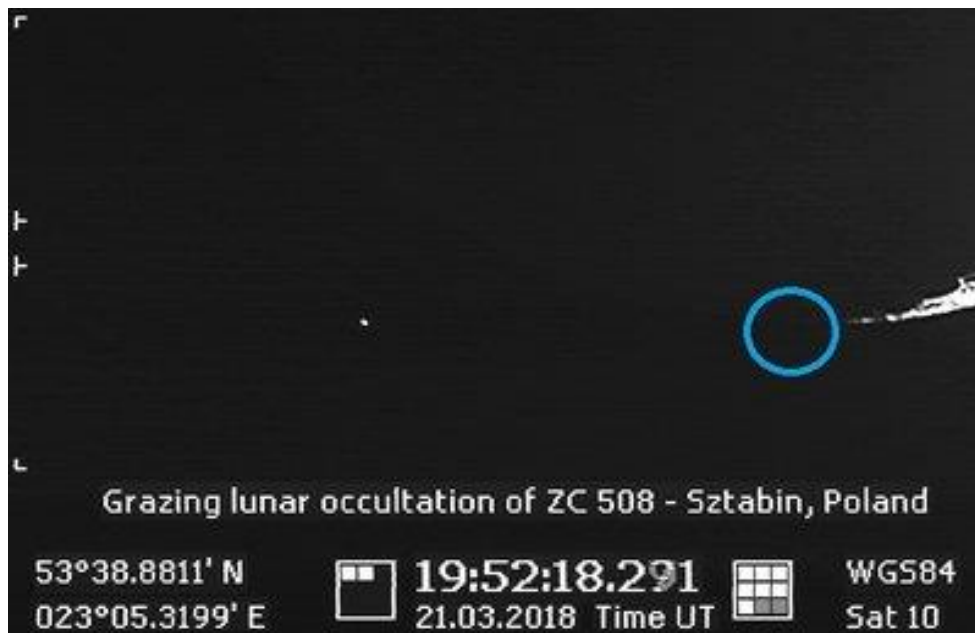
# Grazing occultation of ZC 508, 21 III 2018, Sztabin + Lidzbark Warm.

Observation site of W. Burzyński

Two teams from Łódź and Białystok have met together just 2 hours before the event near Sztabin, NE Poland.



## Grazing occultation of ZC 508, 21 III 2018, Sztabin + Lidzbark Warm.



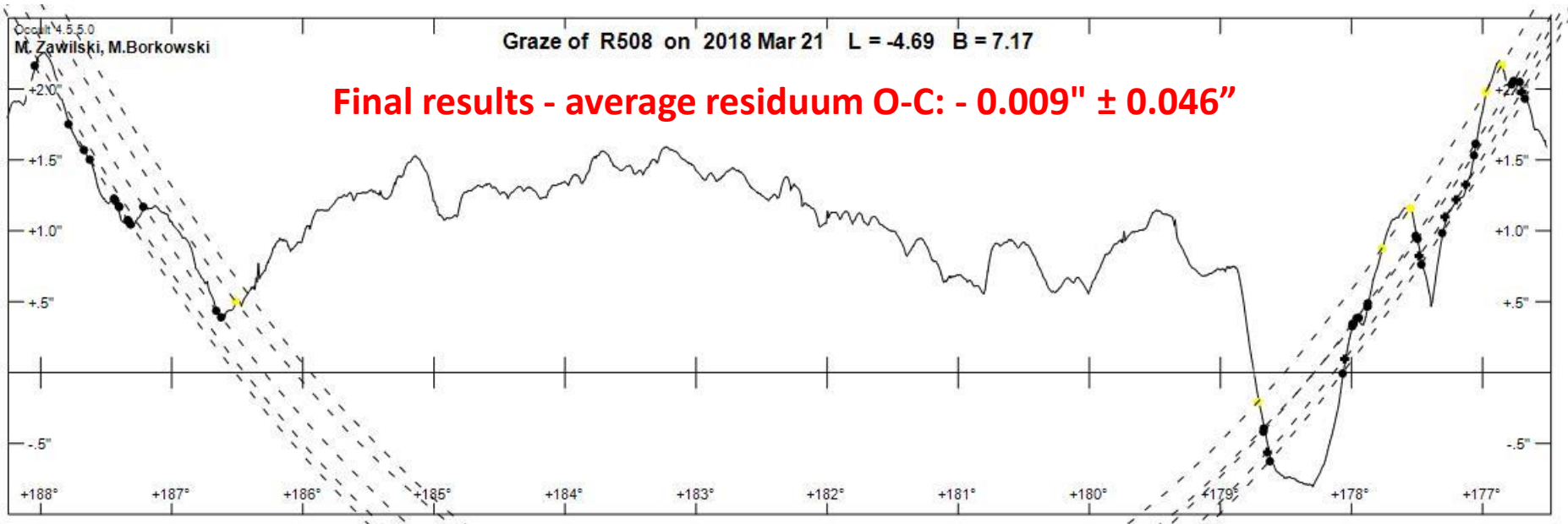
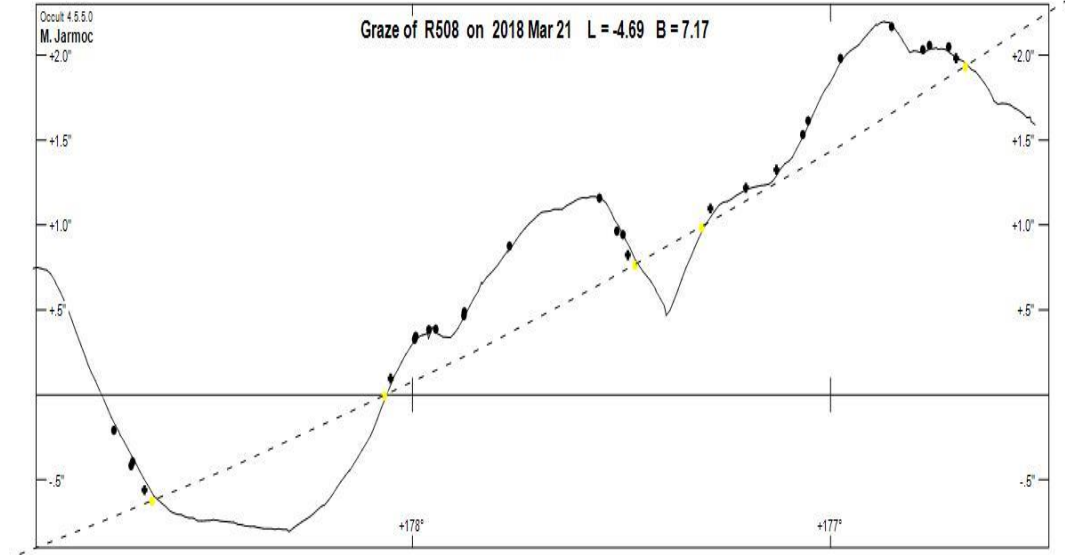
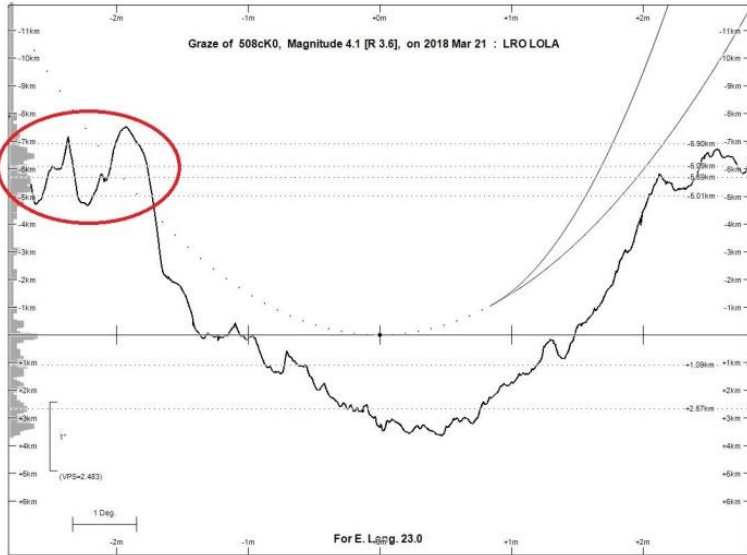
There were another graze occultation just 30 mins. before and 30-km apart from observation sites naer Sztabin – it was faint star of 8.4 mag (inside blue circle).

The ZC 508 with crescent Moon taken by **Jacek Drążkowski** from Lidzbark Warmiński 30 mins. before the graze.

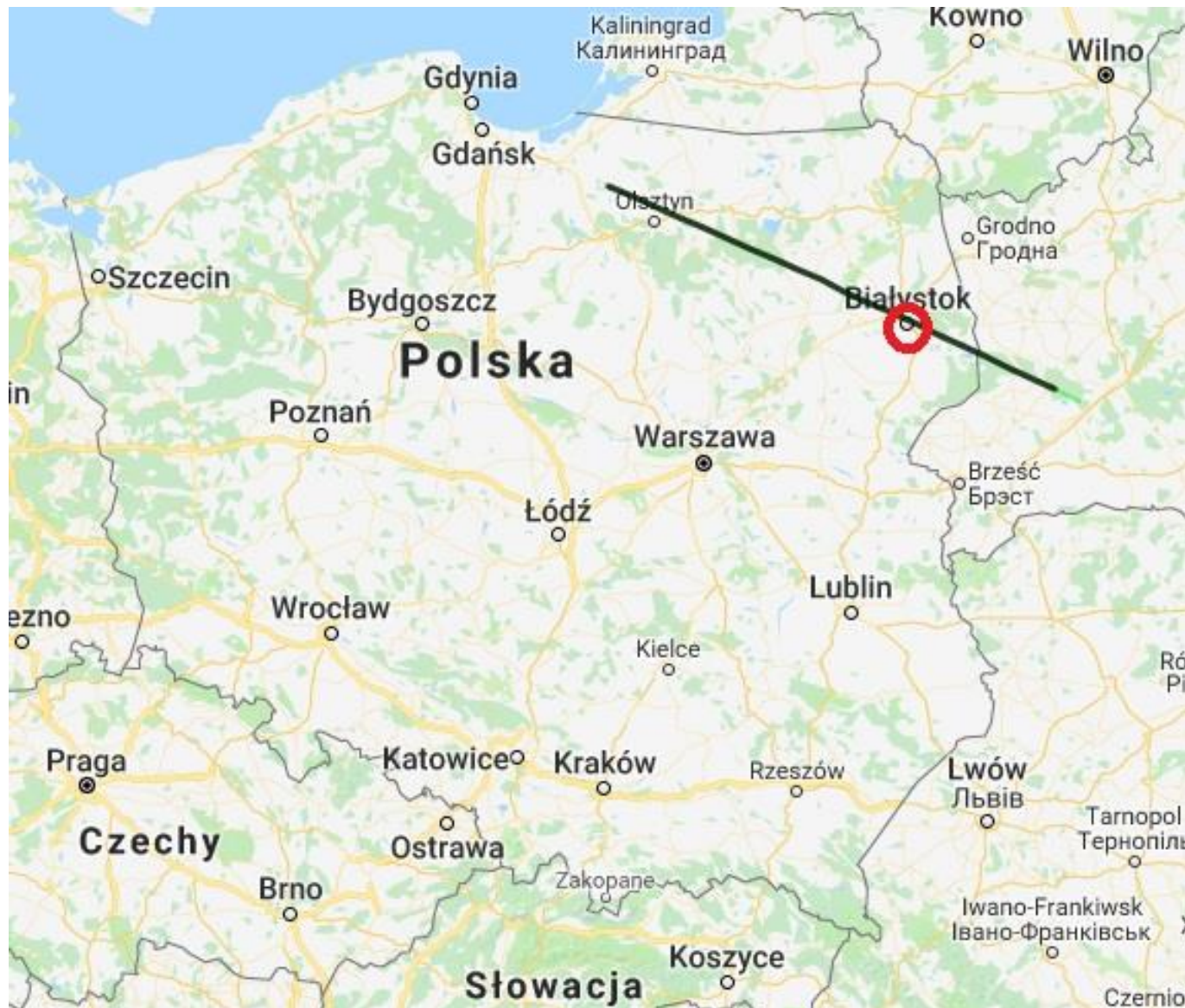




# Grazing occultation of ZC 508, 21 III 2018, Sztabin + Lidzbark Warm.

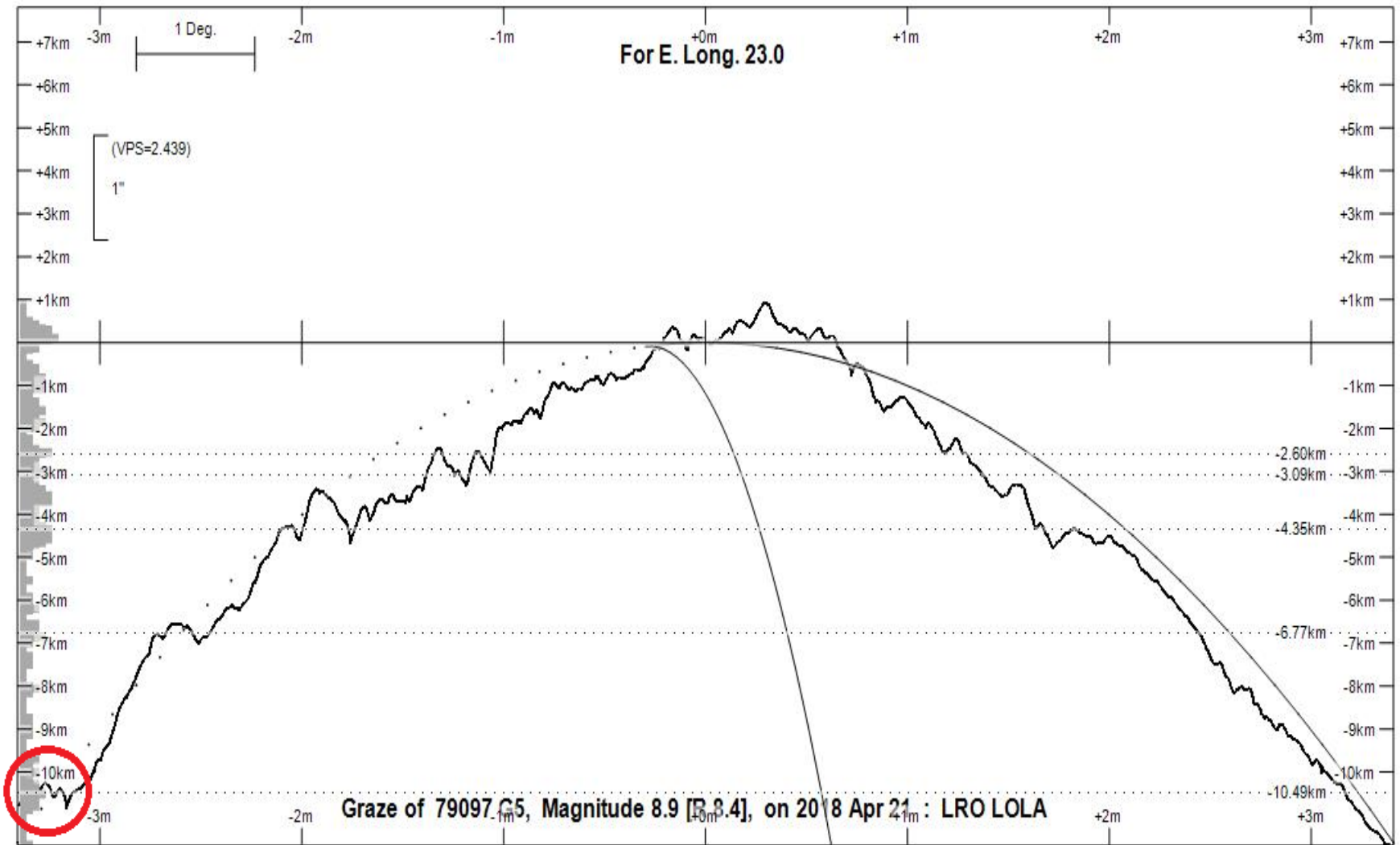


# Grazing occultation of SAO 79079 (8.9 mag!) - 21 IV 2018, Ignatki



# Grazing occultation of SAO 79079 (8.9 mag!) - 21 IV 2018

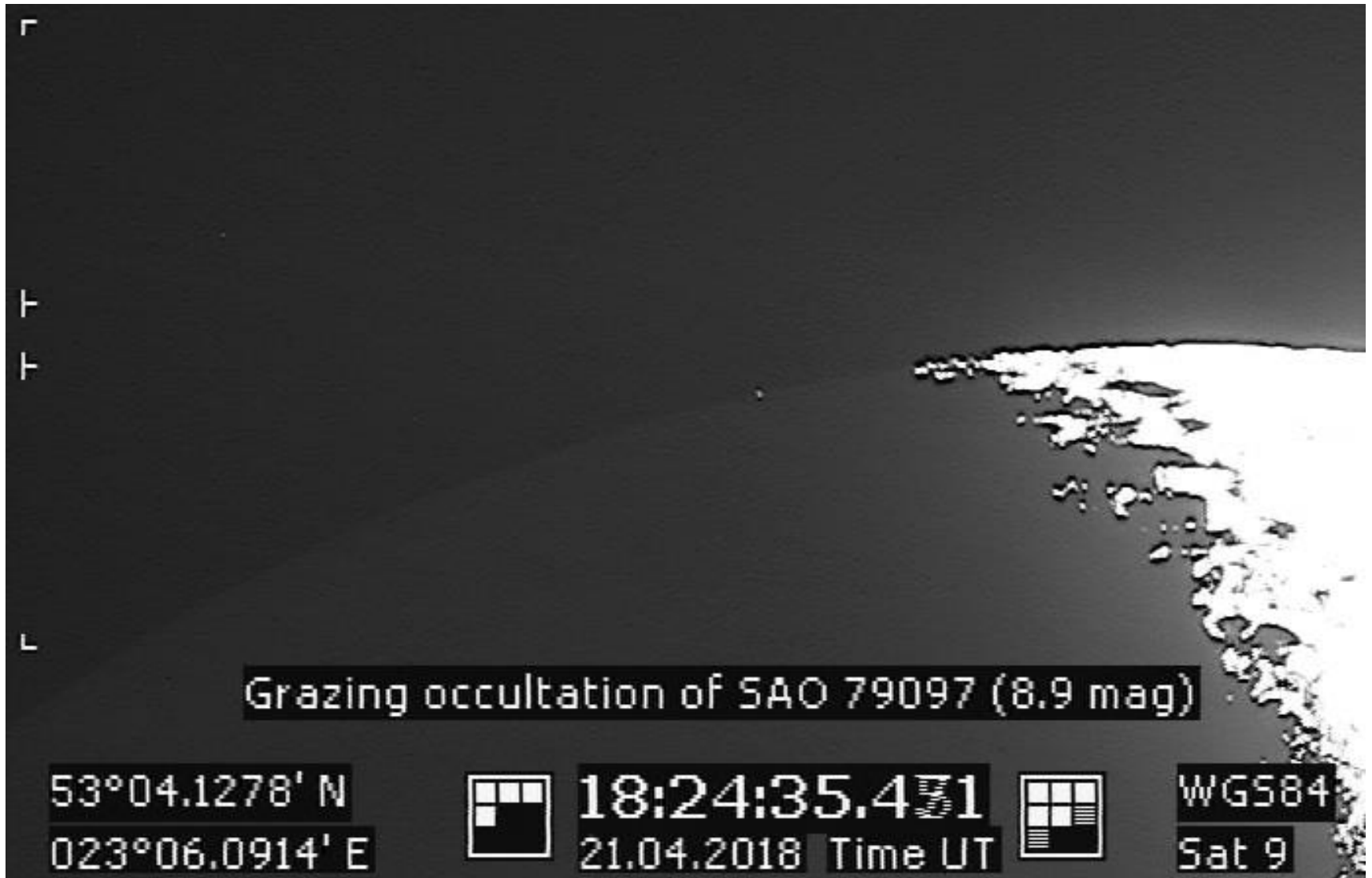
Occult 4.5.5.0



Observation site as far as **10.34 km** from the limit line !

# Grazing occultations in Poland 2018

Grazing occultation of SAO 79079 (8.9 mag!) - 21 IV 2018



# Grazing occultations in Poland 2018

**Grazing occultation of SAO 79079 (8.9 mag!) - 21 IV 2018**



See the event:

<https://www.youtube.com/watch?v=QxlpBvJl8kQ>

**Fainter lunar grazing occultation  
was observed only once in Poland**

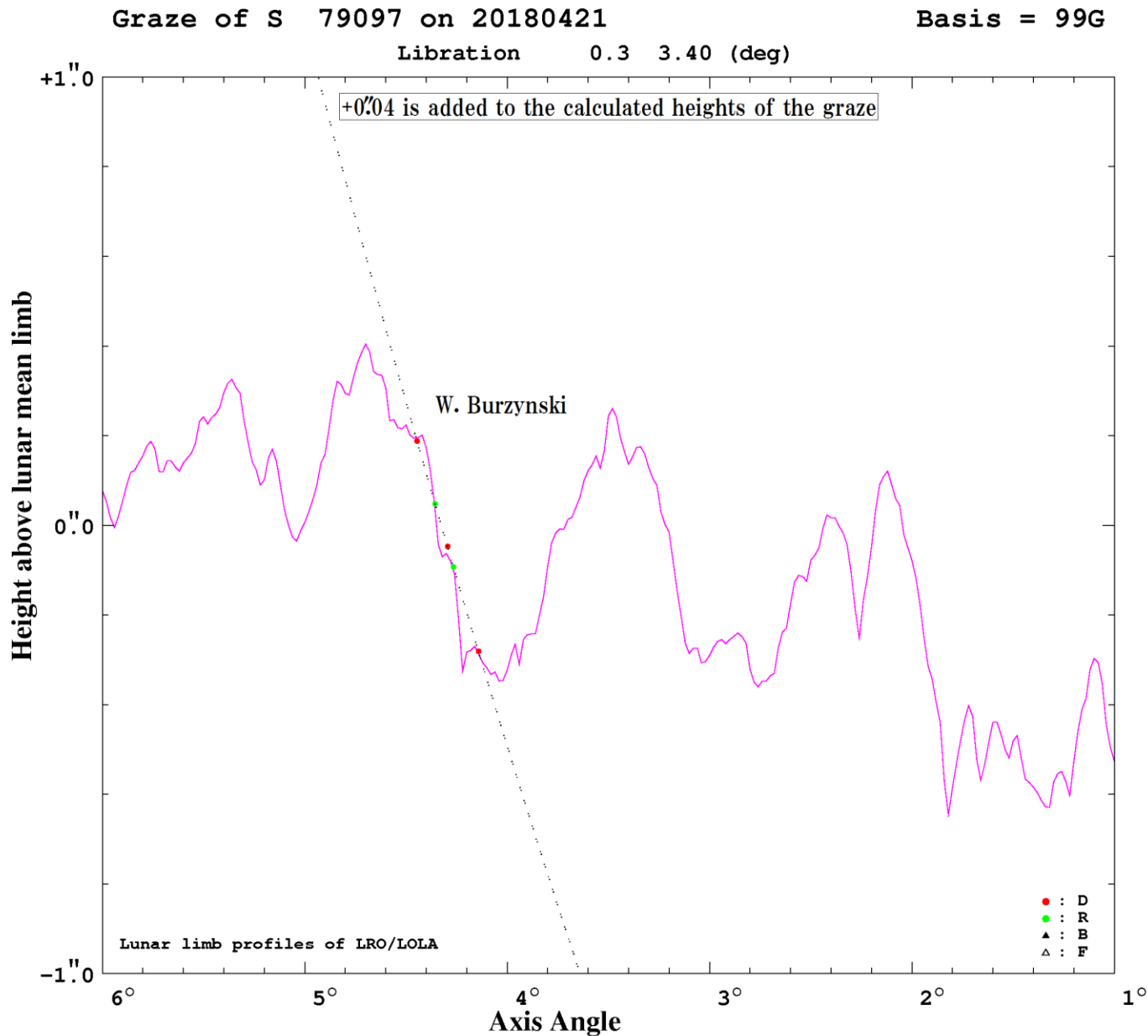
by

**Mirośław Krasnowski and  
Artur Wrembel**

on 2005 May 12th –  
SAO 78974, 9.19 mag

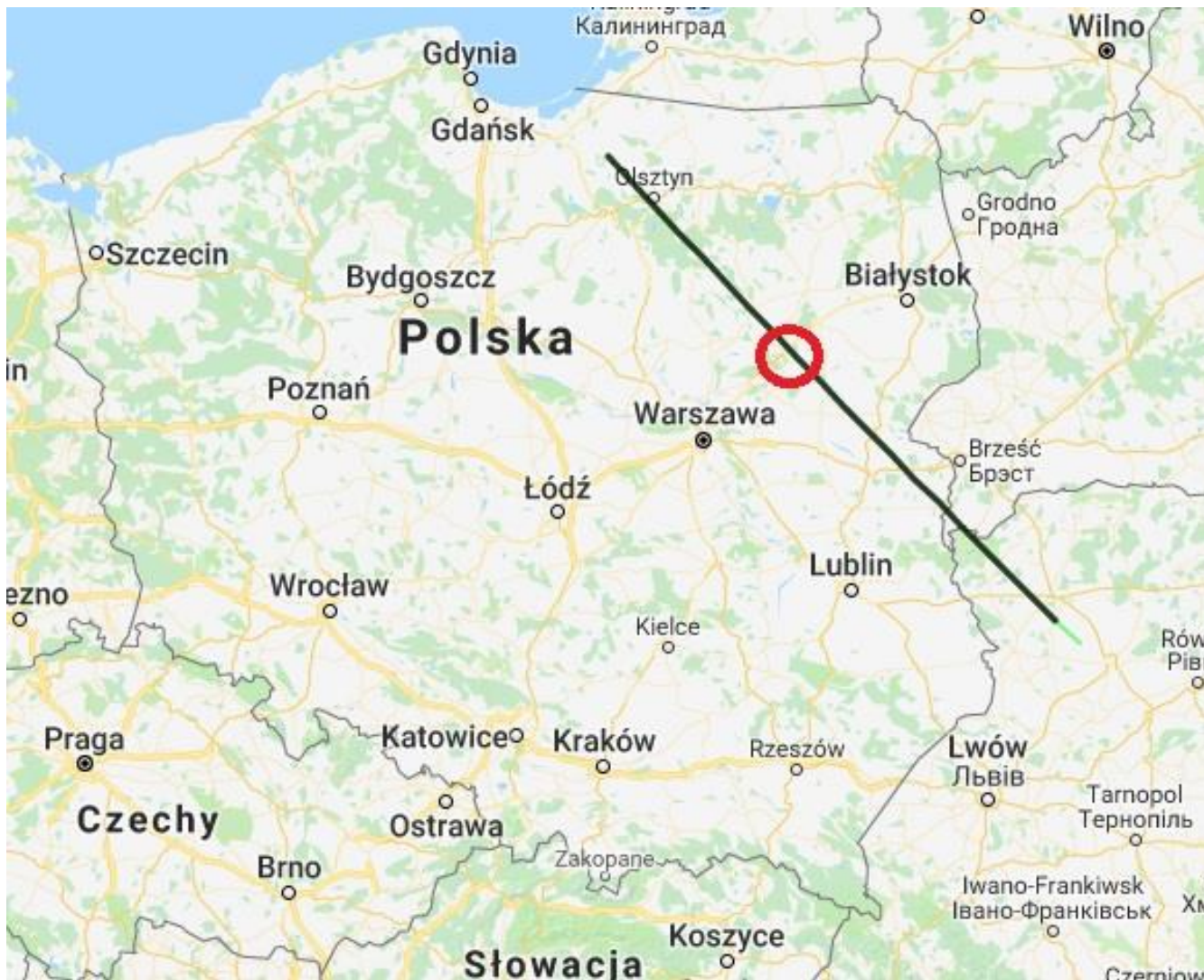
*The world record is probably the  
graze of XZ 179173, 10.50 mag,  
observed by o Kunio Kenmotsu in  
Japan on 2007 Nov 17th with a  
20-cm SCT – not during an eclipse  
but in an urban environment !*

# Grazing occultation of SAO 79079 (8.9 mag!) - 21 IV 2018



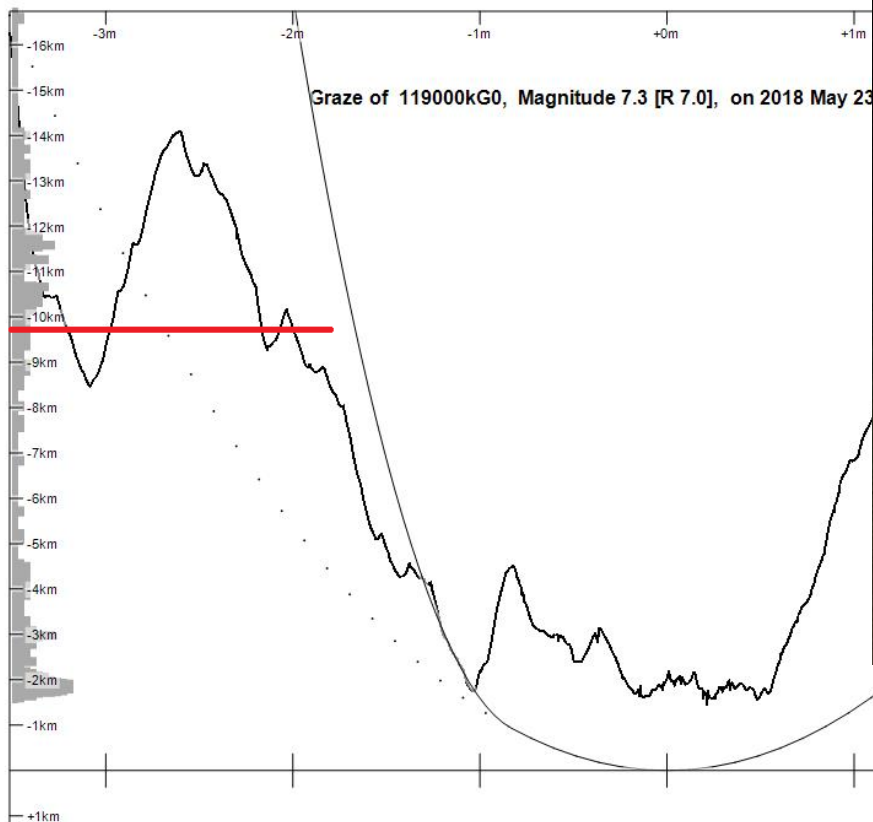
# Grazing occultations in Poland 2018

Grazing occultation of SAO 119000 (7.2 mag), 23 V 2018



# Grazing occultations in Poland 2018

Grazing occultation of SAO 119000 (7.2 mag), 23 V 2018



See the event: <https://www.youtube.com/watch?v=FARPIOiNjSg>



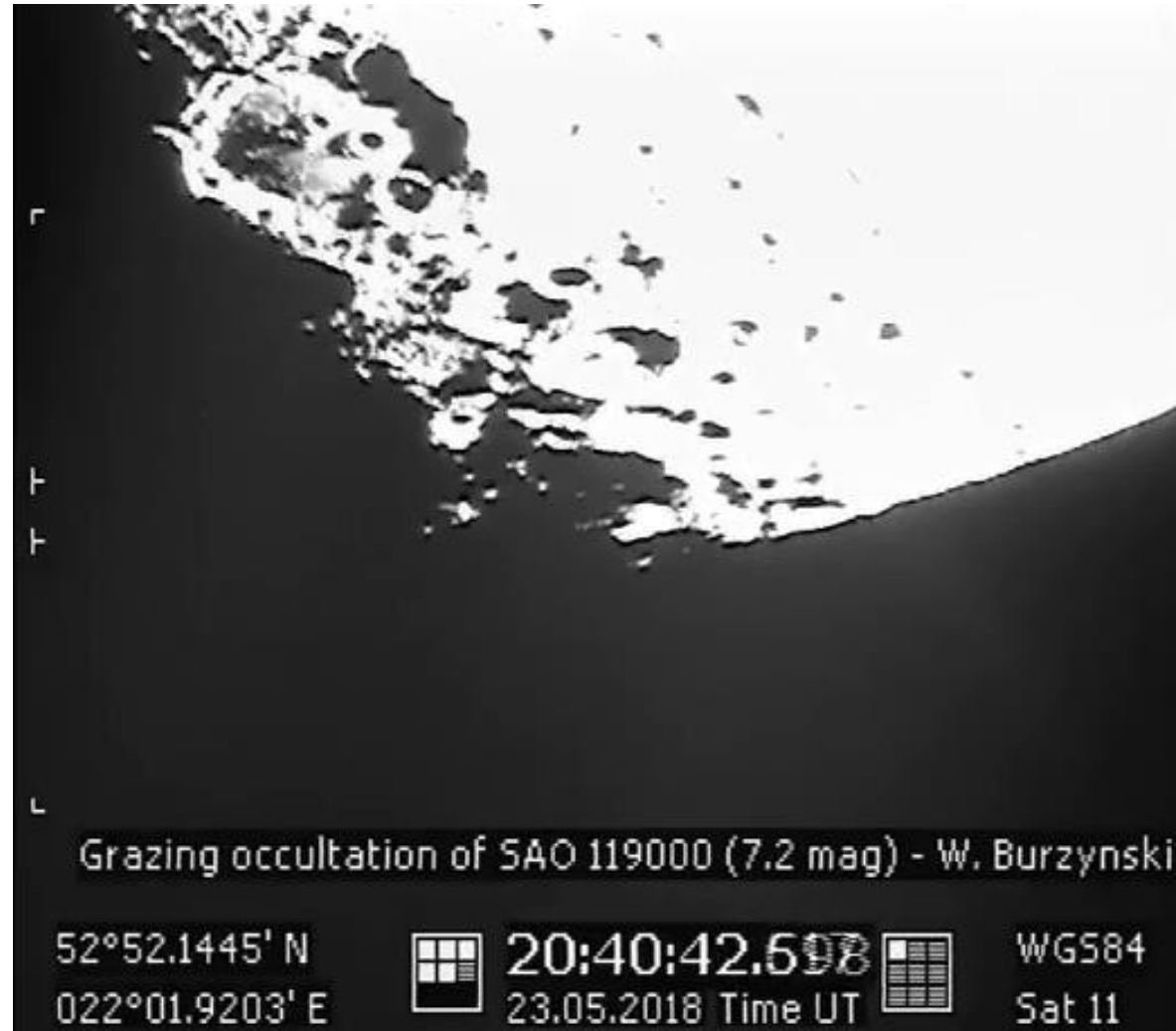
# Grazing occultations in Poland 2018

## Grazing occultation of SAO 119000 (7.2 mag), 23 V 2018

The observation was made  
by 20-cm SCT telescope.

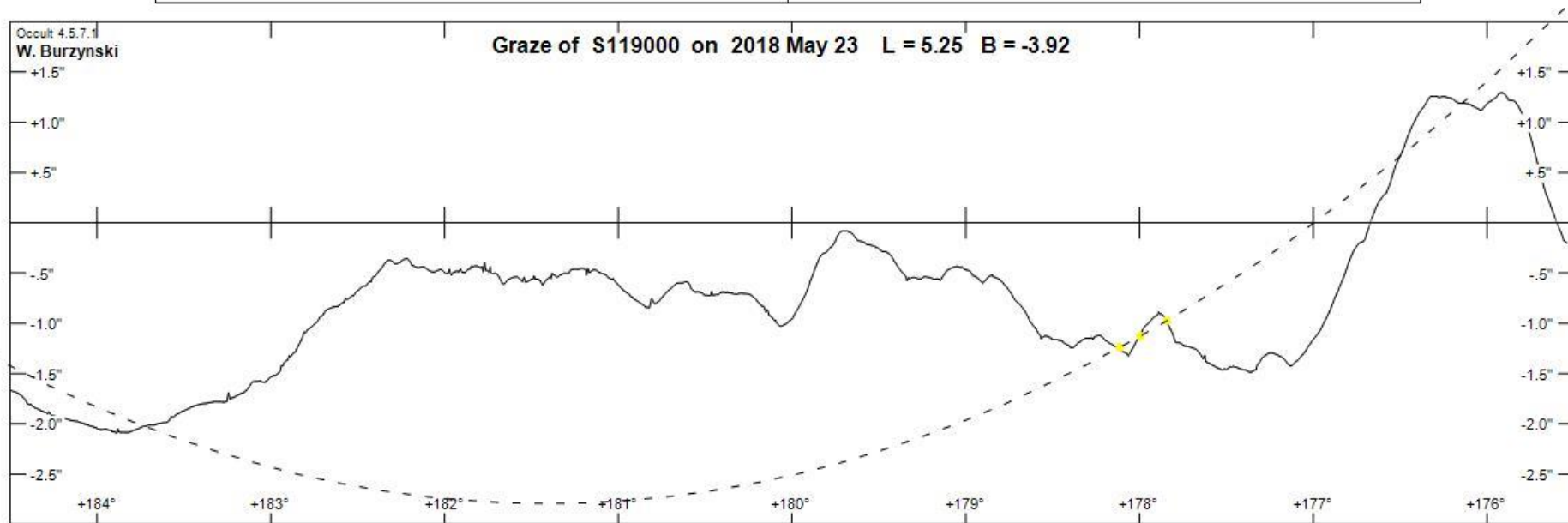
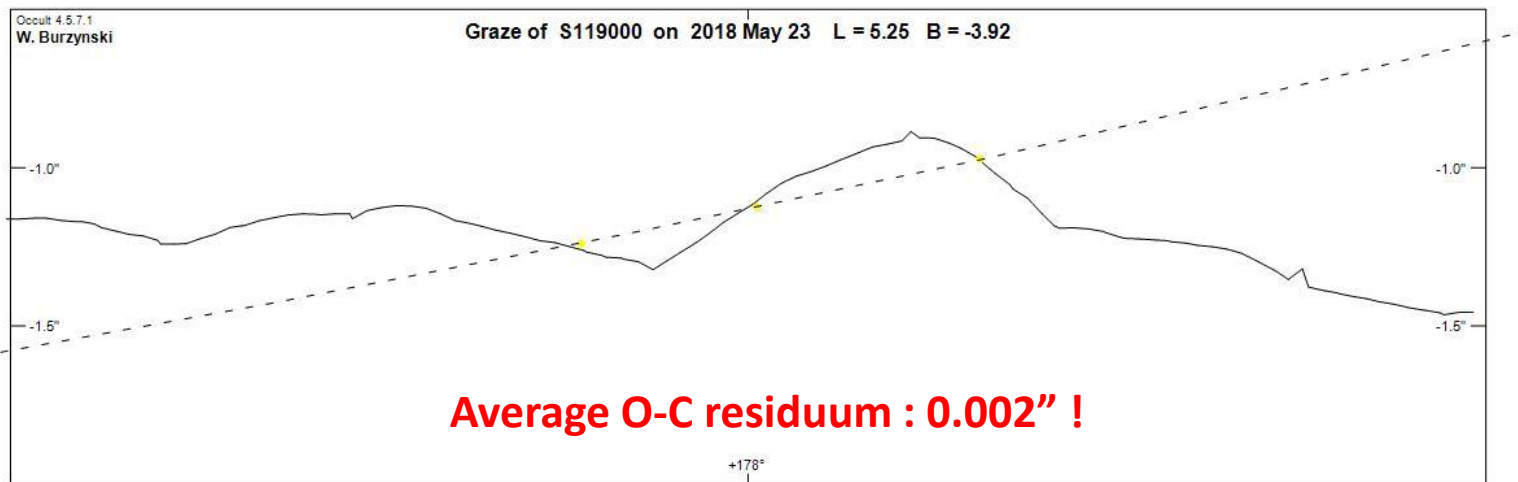
Occult's ephemerides shown  
the **event available for  
minimum 28-cm telescopes  
only.**

Poor CA angle ( $-1.4^\circ$ )  
determined observation site  
**as far as 9.7 km**  
from the graze limit line.



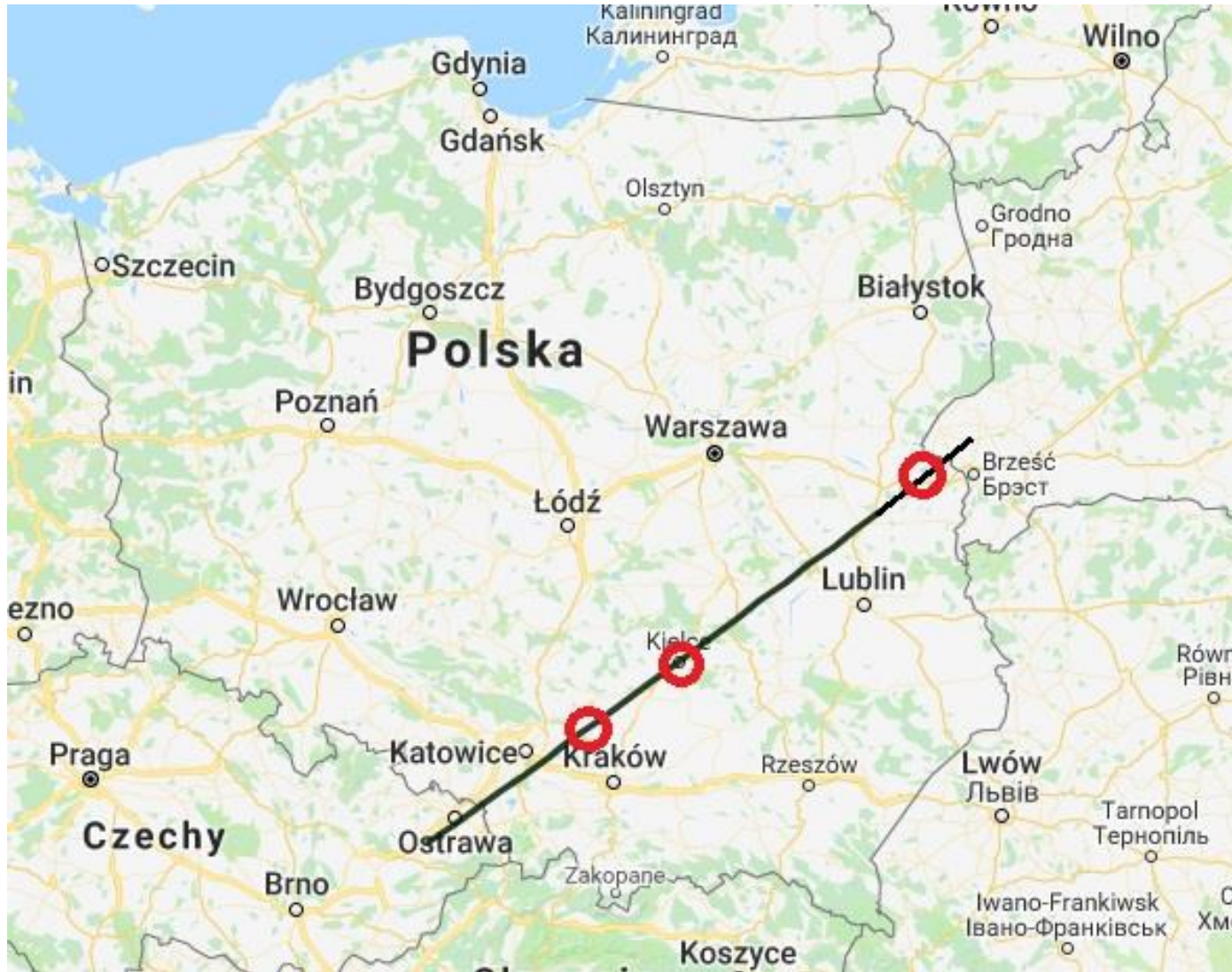
# Grazing occultations in Poland 2018

## Grazing occultation of SAO 119000 (7.2 mag), 23 V 2018



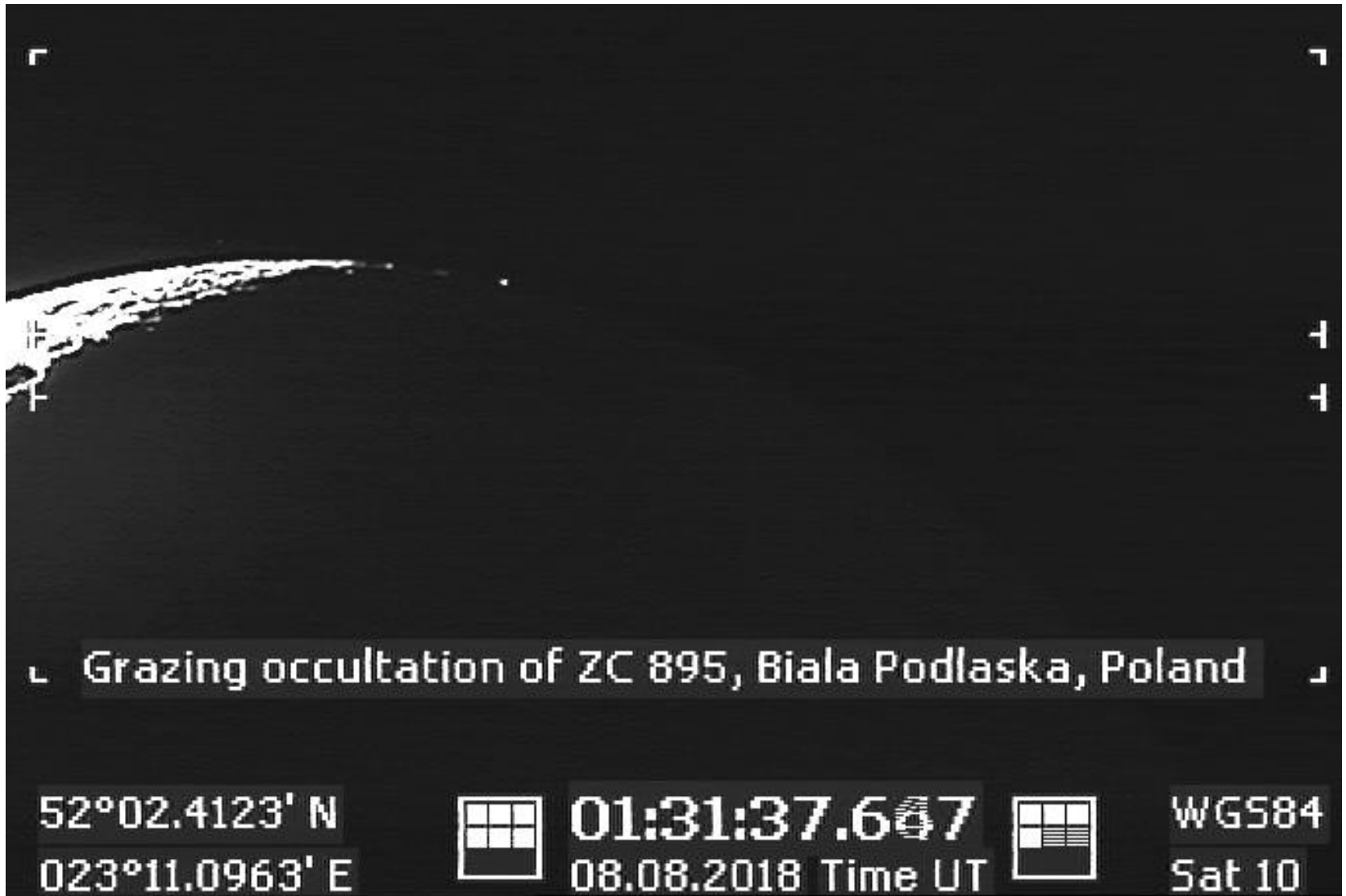
# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018

3 observation sites have been set – Biała Podlaska, Kielce, Wolbrom near Kraków



# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018

W. Burzyński's observation site (Biała Podlaska) – 1 sec. before the event



# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018



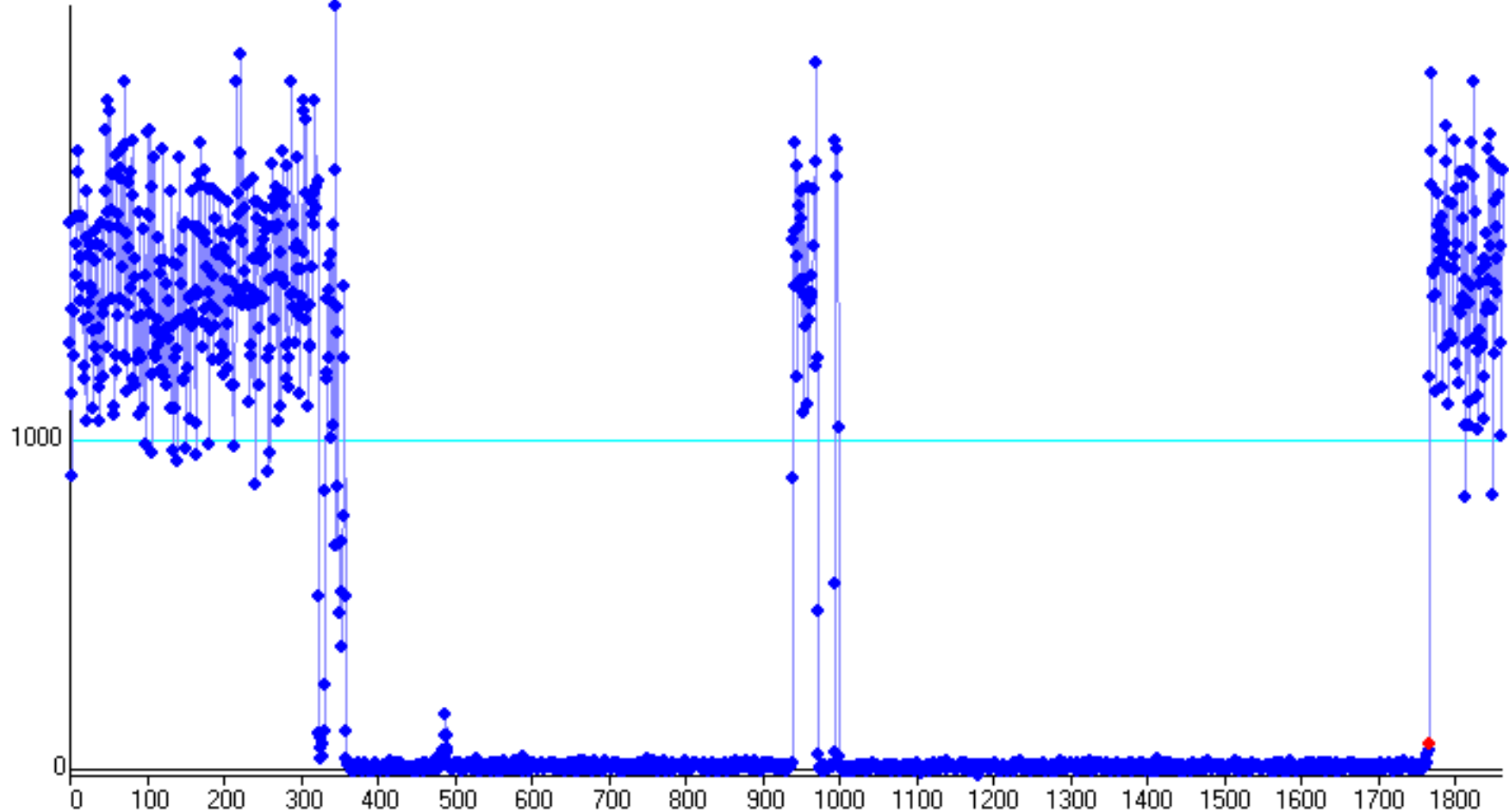
W. Burzyński's observation site  
(Biała Podlaska) – the setup



# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018

W. Burzyński's observation site (Biała Podlaska) – the entire LC

Analyzed file name [ zc895\_crop.avi] Photometry in each Frame

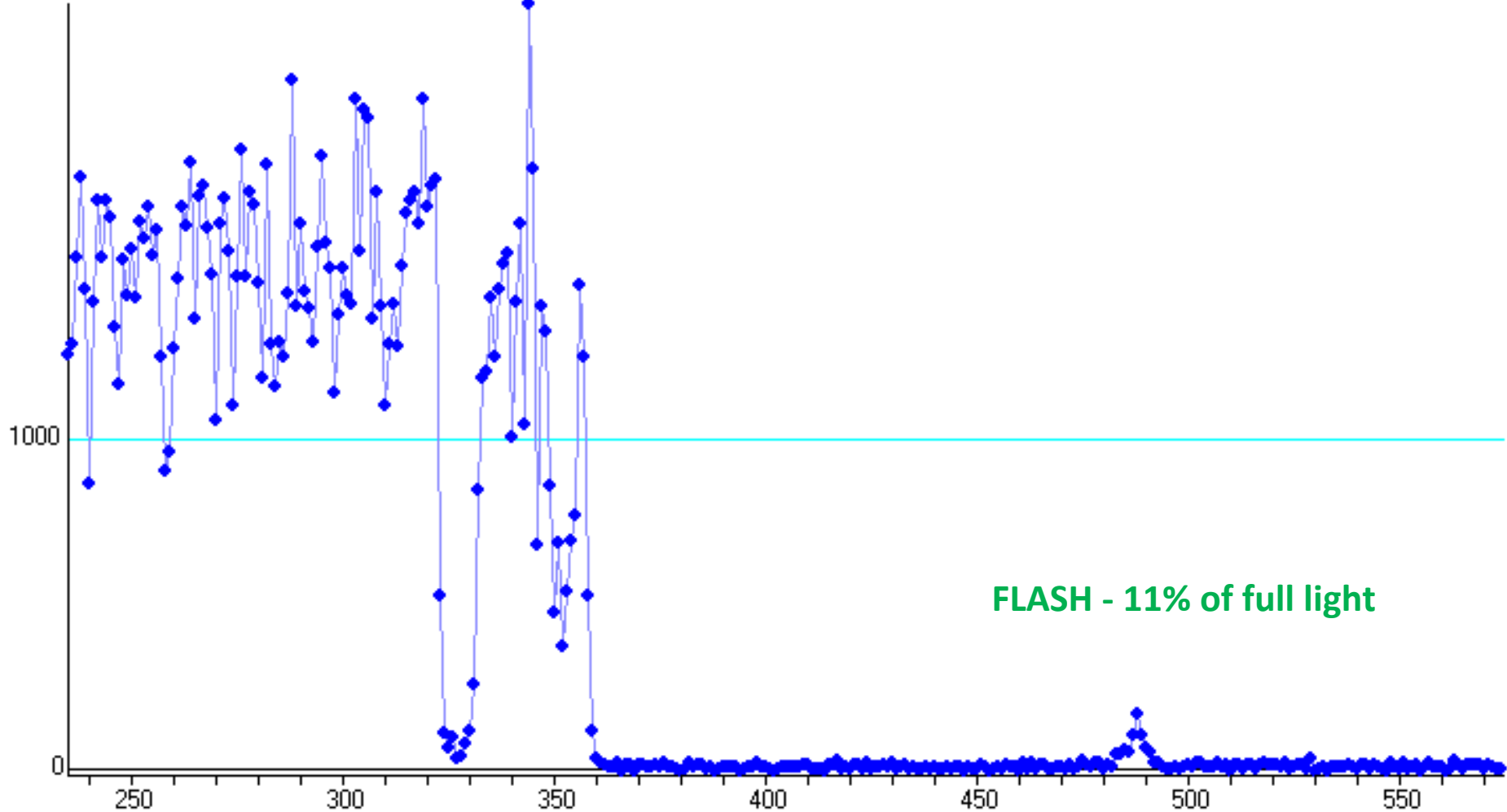


Frame No.1766.0 / Frame Centre= 02h30m00.000s, Frame End= 00.000s

# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018

## W. Burzyński's observation site – the beginning of the graze

Analyzed file name [ zc895\_crop.avi] Photometry in each Frame



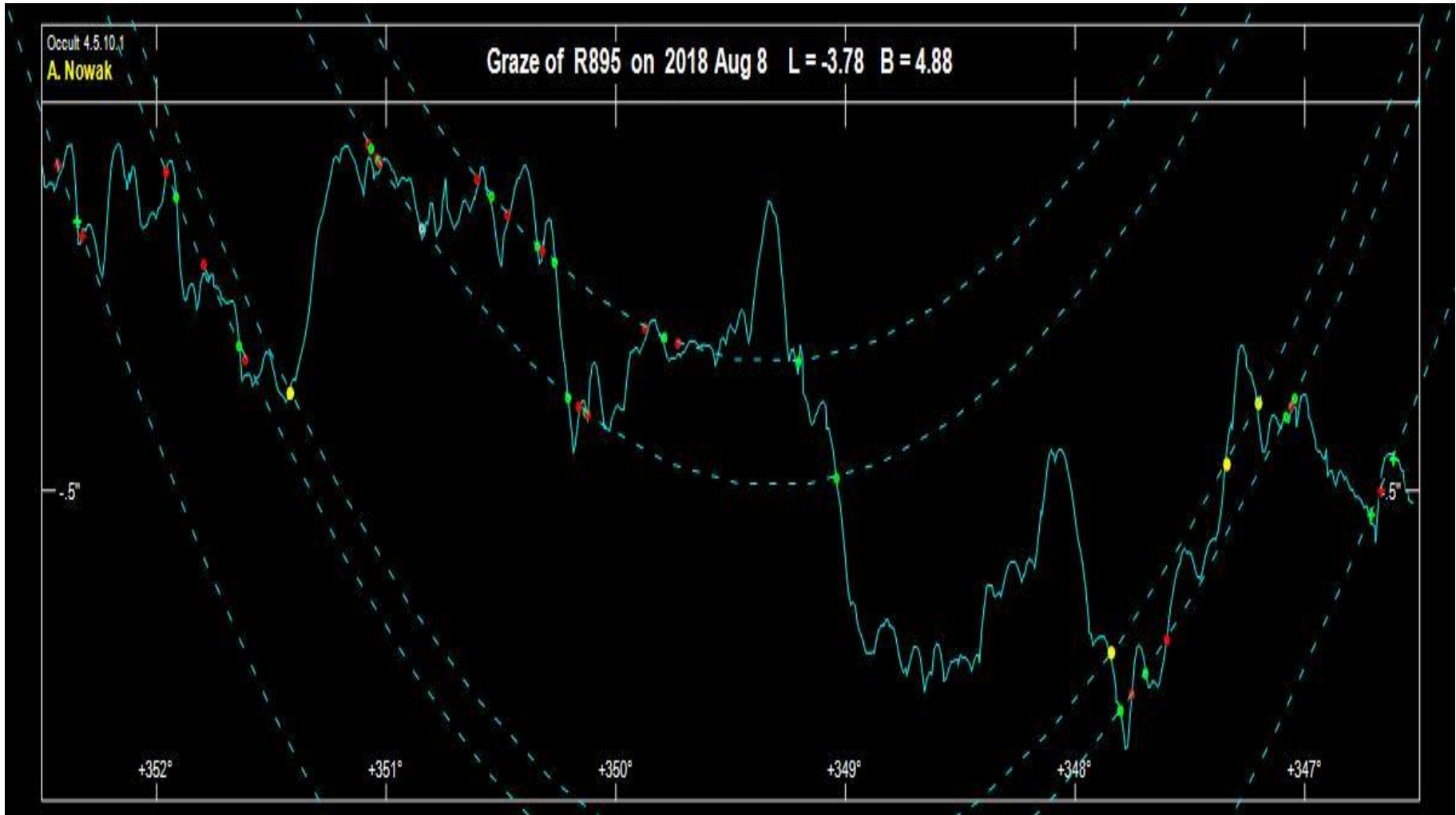
FLASH - 11% of full light

Frame No.1766.0 / Frame Centre= 02h30m00.000s, Frame End= 00.000s

# Grazing occultation of ZC 895 (5.9 mag), 08 VIII 2018

**Final results – 44 events have been recorded**

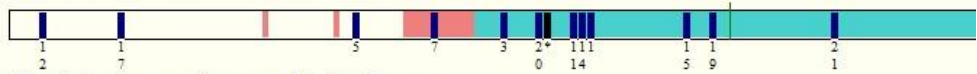
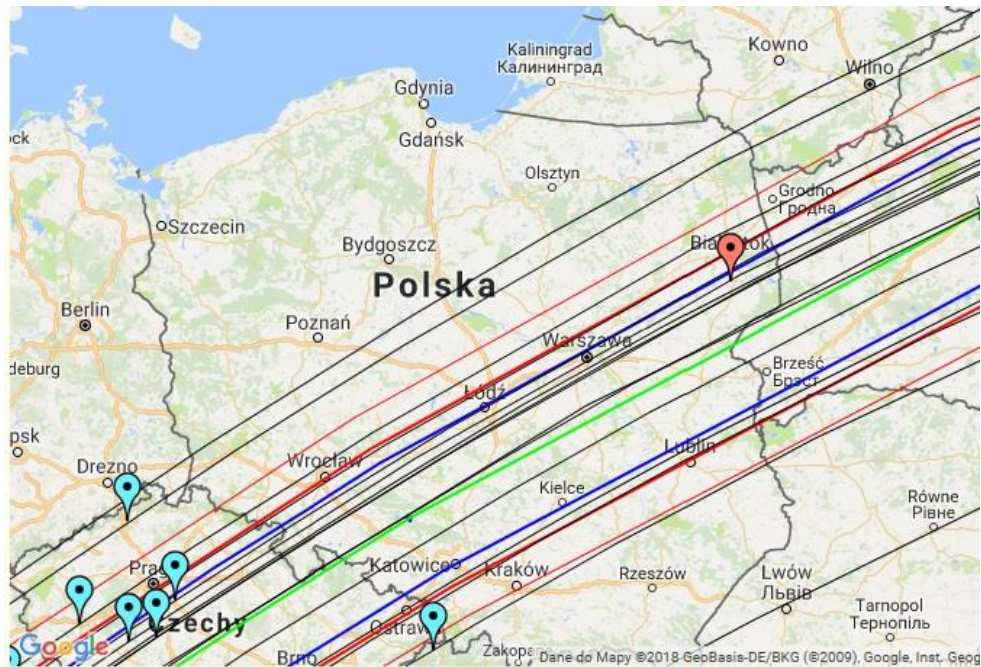
**Mean residual of events:  $0.006'' \pm 0.012''$**



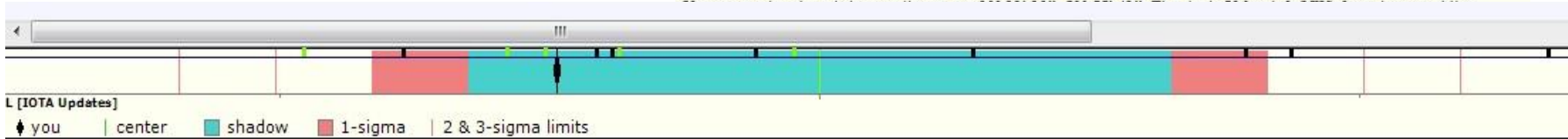


# Asteroidal occultations in Poland 2018

**(129) Antigone occults HIP 22583 (9.8 mag) – 23.02.2018, -15°C**



Observing locations currently announced by other observers:  
 8 = Perelló & Selva; 3 = Mánek J; 15 = sternwarte mirasteillas Falera; 17 = Janik T Meteostation; 18 = Delincak P Home; 5 = Polák J Hon mobile; 13 = Pietro G Home; 12 = JL P Home; 11 = Brabant G Home; 20 = Rottenborn M mobile; 21 = Andrea M Home; 14 = Delgado J I



L [IOTA Updates]

♦ you   
 | center   
 ■ shadow   
 ■ 1-sigma   
 | 2 & 3-sigma limits

**(129) Antigone occults HIP 22583**

Position: In the shadow, 49 km from the central line

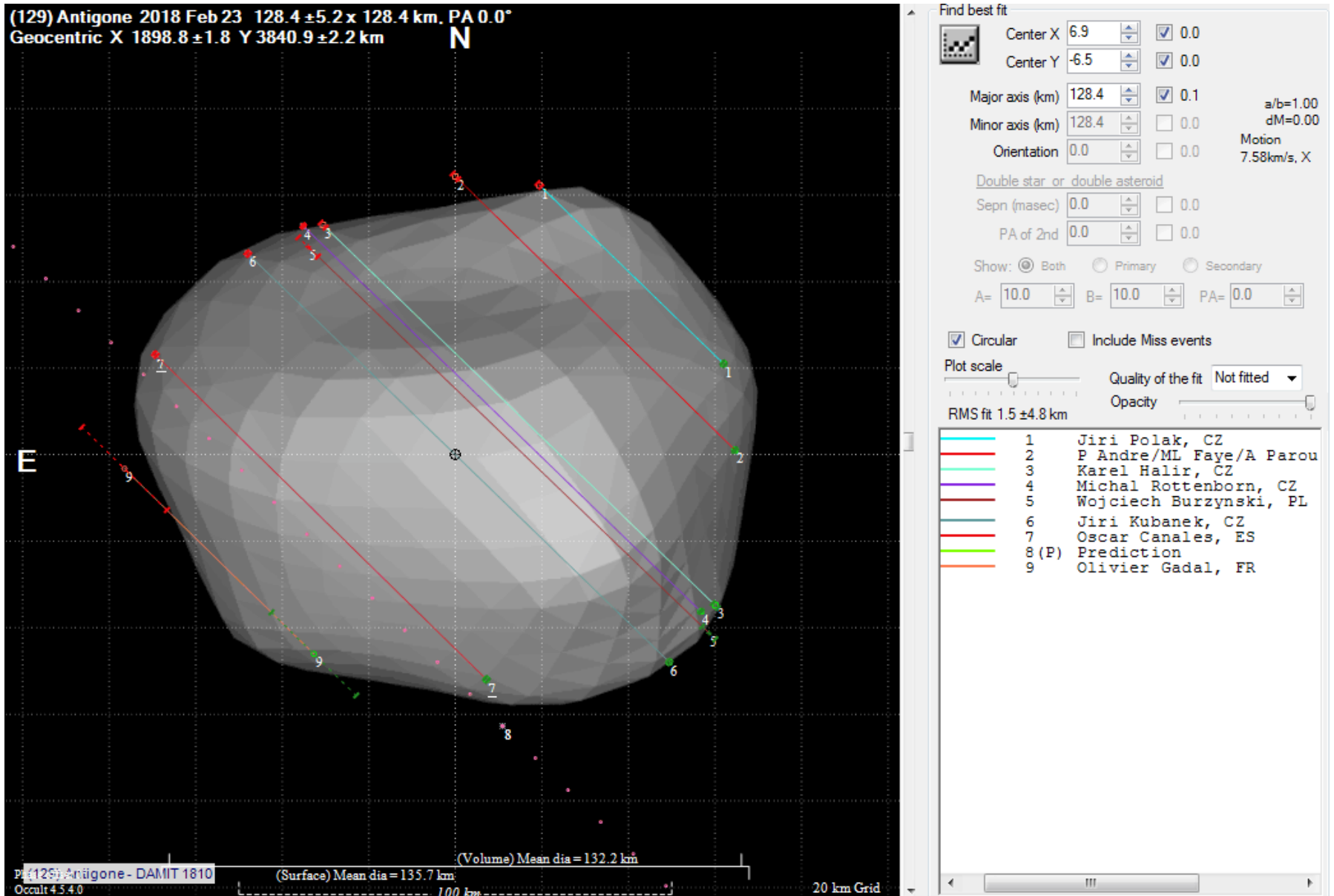
There are currently 16 announced stations for this event.  
 None of them are yours.

Event time: 19:34:01 UT  
 Error in time: 2 sec  
 Max duration: 12.0 sec

Combined magnitude: 9.7 m  
 Star magnitude: 9.8 m  
 Magnitude drop: 3.2 m

Constellation: Orion  
 Star altitude: 41° SW  
 Sun altitude: -33°  
 Moon altitude: 43° SW  
 Moon distance: 5°

# (129) Antigone occults HIP 22583 – 23.02.2018



**On 20-th May 2018, the star UCAC4 371-069226 (10.3 mag) has been occulted by jovian moon Himalia (J-6).**

**Himalia has a diameter of 170 km (the largest irregular satellite of Jupiter) and brightness of 15.0 mag.**

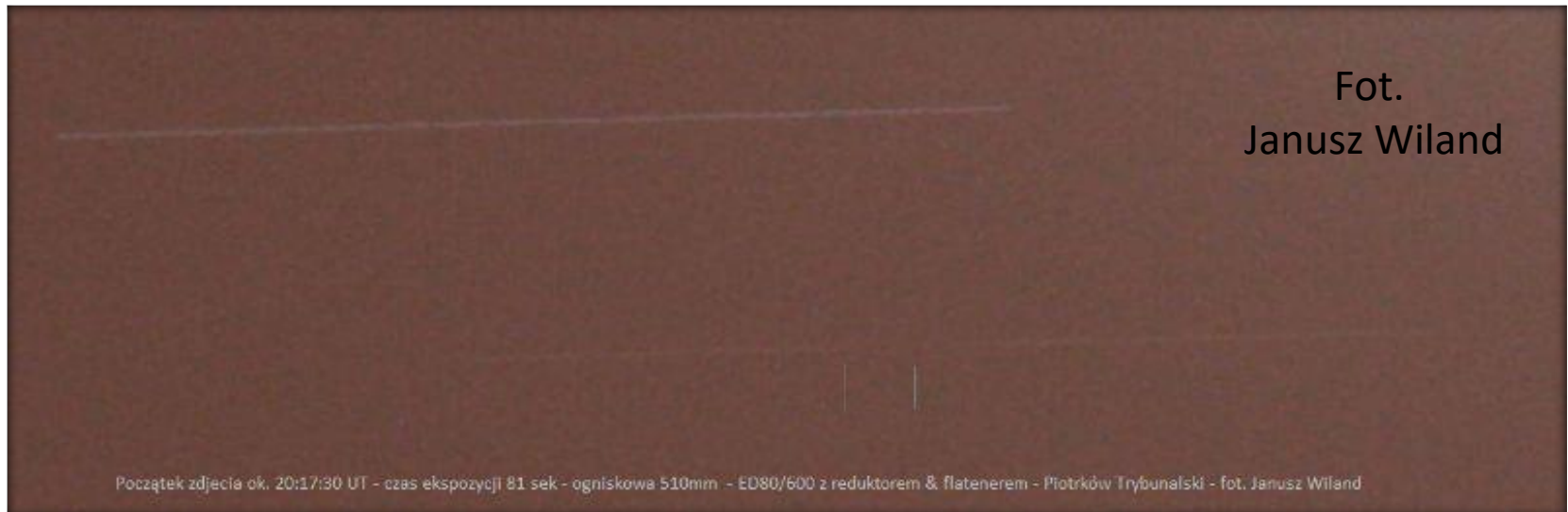
**The predicted path of the Himalia's shadow favored central Europe, mainly Poland.**



# The observational campaign in Poland was promoted by Dr. Eberhard Bredner

## POSITIVE RESULTS:

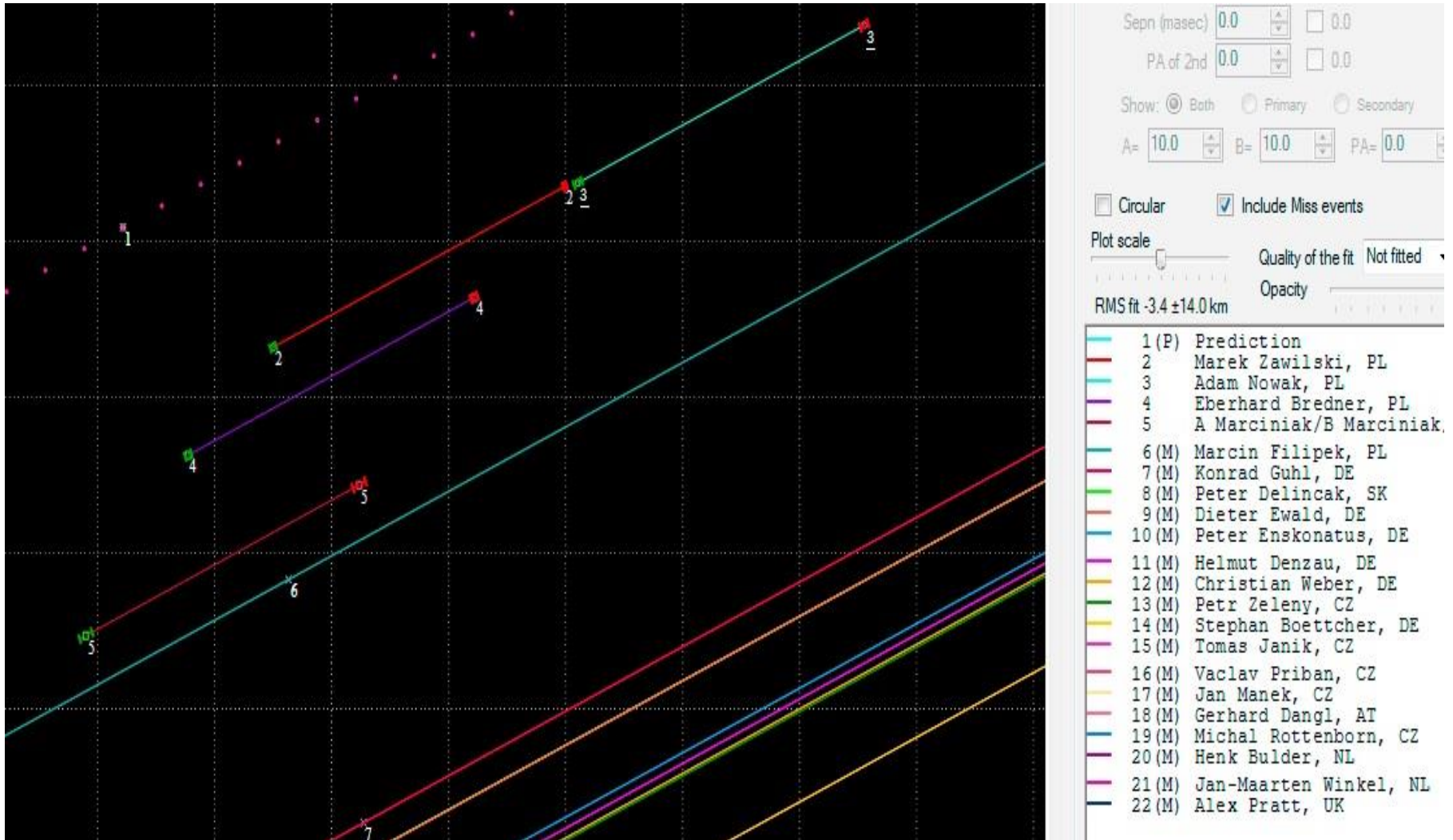
- dr Eberhard Bredner - near Konin – „Max” setup
- dr Anna Marciniak (University of A. Mickiewicz, Poznań)- „Moritz” setup – **7.04 s**
- Roman Hirsh - Observation Station of UAM in Borowciec - short positive, **around 2 s.**
- dr Marek Zawilski - Tobolice near Łódź - **7.51 s**
- Adam Nowak- Bilcza near Kielce - **7.36 s** (newbie, *very poor time keeping*)
- Janusz Wiland - Piotrków Trybunalski (only photographically, without time keeping)
- Mariusz Świącicki - Zręcin near Krosno (*very poor time keeping*)



**NEGATIVE** - Marcin Filipek - Jerzmanowice naer Kraków (visual only)

# At the moment no obvious Himalia's profile can be drawn from the observations received on the Planoccut.

The RIO Team (led by Felipe Braga Ribas) have more data and they are under their own analysis.

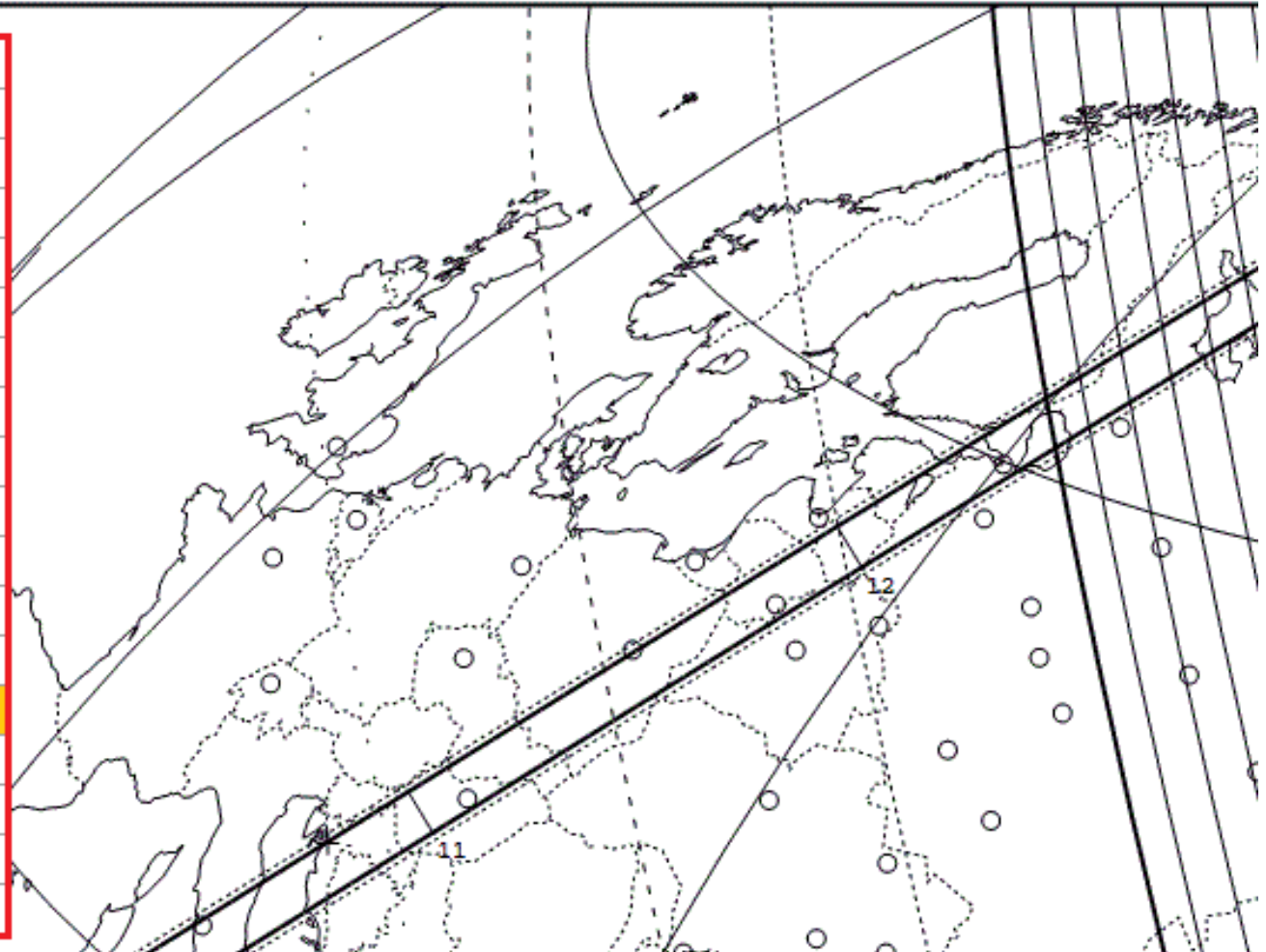


# Asteroidal occultations in Poland 2018

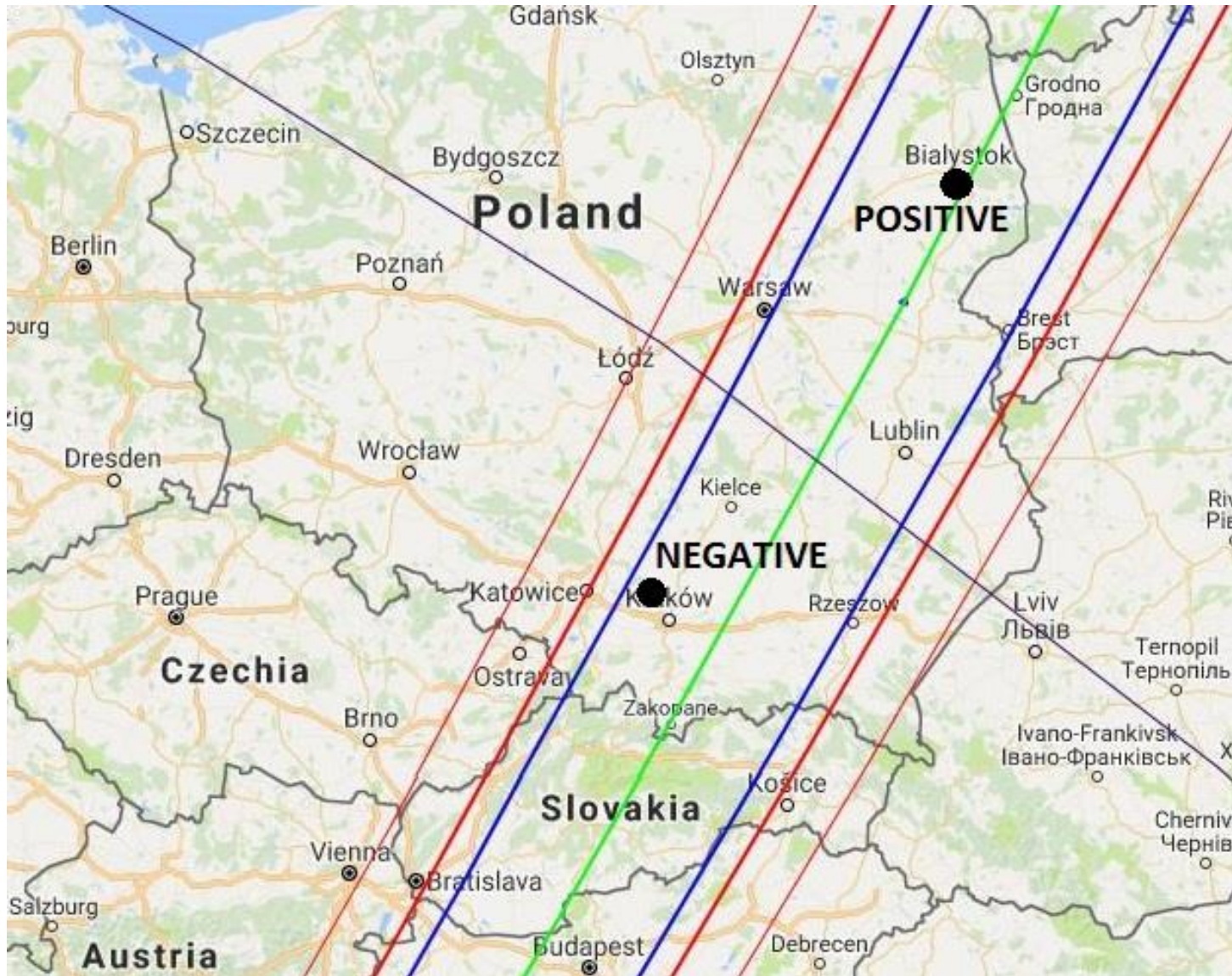
476 Hedwig occults TYC 1769-01181-1 on 2018 Jul 26 from 1h 9m to 1h 16m UT

Star:	Asteroid:	Max Duration = 5.6 secs
Mv = 11.9	Mag = 13.8	Mag Drop = 2.1 (0.0r)
RA = 2 17 53.5701 (J2000)	Dia = 117km,	Sun : Dist = 91 deg
Dec = 25 38 5.861	Parallax = 3.412"	Moon: Dist = 116 deg
[of Date: 2 18 57, 25 43 0]	Hourly dRA = 2.520s	: illum = 97 %
Prediction of 2018 May 15.0	dDec = 20.62"	E 0.014"x 0.009" in PA 76

Rank	100
Magn Drop (mag)	2.07
Magn Drop (R)	8.5
Jasność sumaryczna	11.7
Asteroid Magnitude	13.8
Max Duration (sec)	5.6
Path Width (km)	166
Sigma Width (km)	215
Probability	99.9%
Travel Distance	9 km E
Chord Offset	-6
Star Altitude	44
Star Azimuth	106
Sun Altitude	-10
Moon Altitude	N/A
Sun Distance (deg)	82
Moon Distance (deg)	116
Moon Illumination	97



## (476) Hedwig occults TYC 1769-01181-1 (11.9 mag)

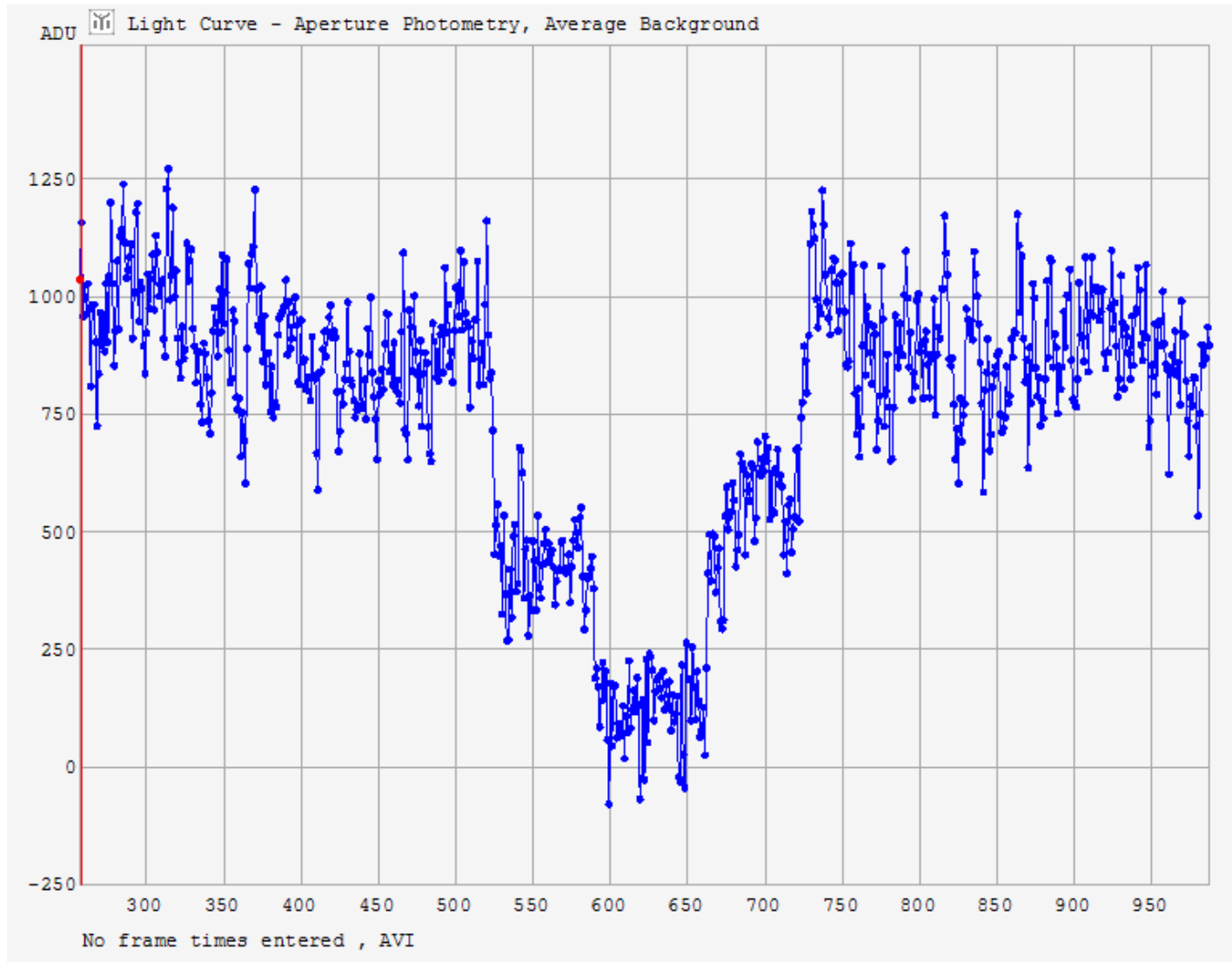


The negative result near Kraków (**Marcin Filipiek**) has been canceled from the **EURASTER** database since his negative visual report was not compatible with the positive observations.

He should have observed at least the occultation of the secondary star, but it was very hard for visual setup – **only 0.3 mag drop**.

# (476) Hedwig occults TYC 1769-01181-1 (11.9 mag)

## NEW DOUBLE STAR DETECTION !



D1 - 01:11:33.06

D2 - 01:11:35.64

R1 - 01:11:38.57

R2 - 01:11:41.09

### Duration:

5.51 s (star 1)

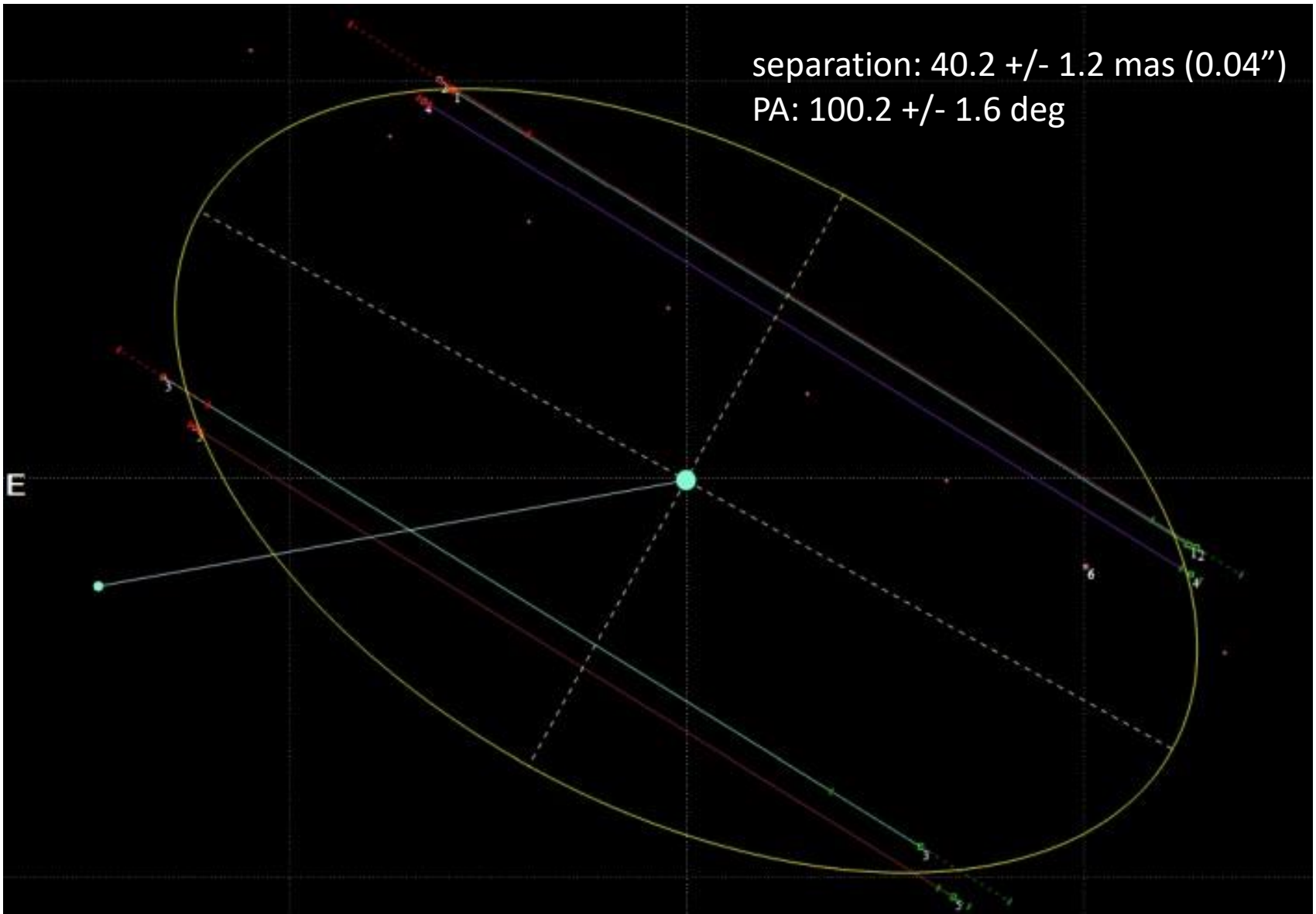
5.45 s (star 2)

Components are  
~57% and ~43%  
of the  
double star flux.

*Results with  
cooperation with  
E. Frappa and  
B. Kattentidt.*



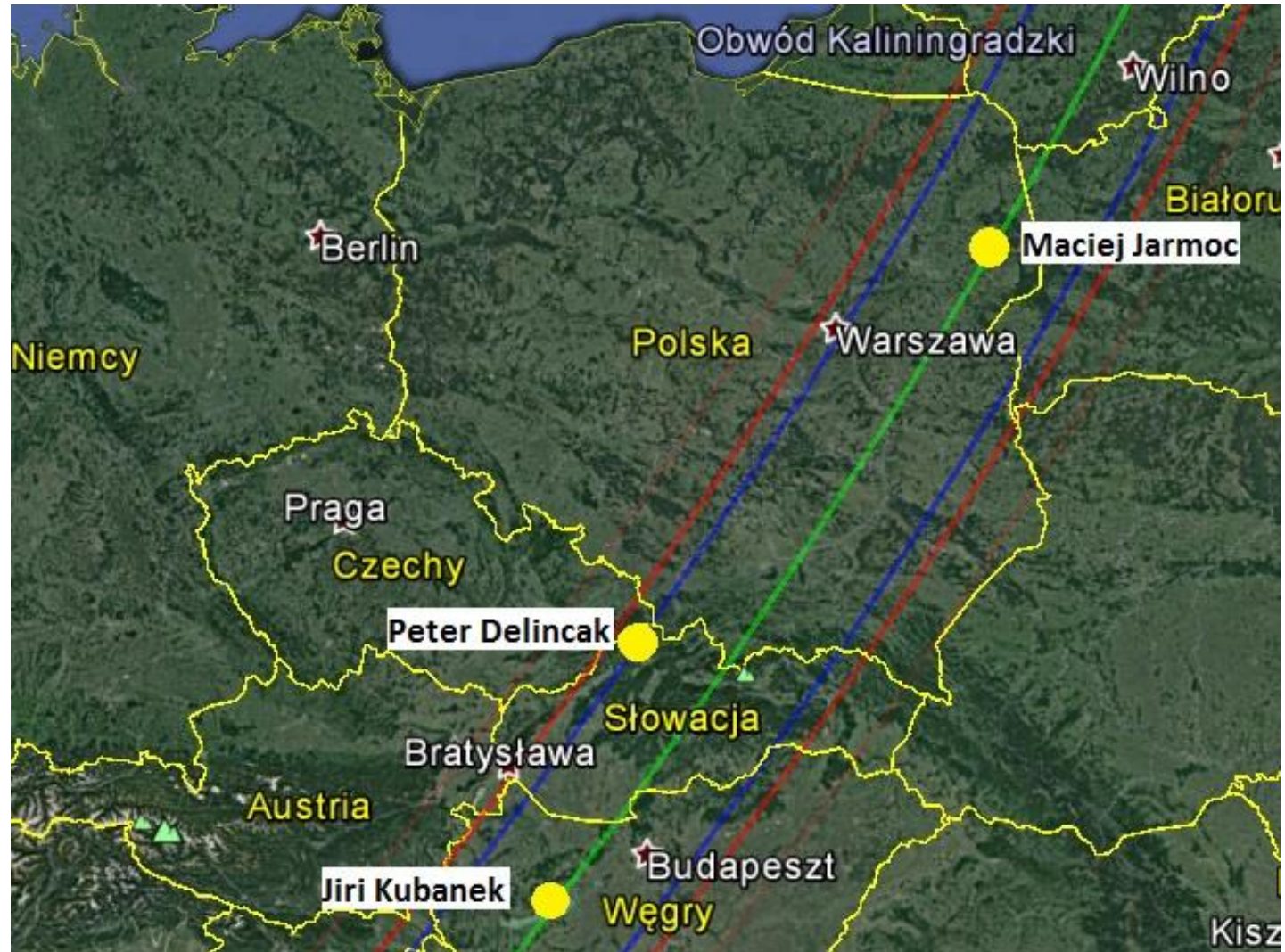
**(476) Hedwig occults TYC 1769-01181-1 (11.9 mag).  
Double star solution**



# (476) Hedwig occults TYC 1769-01181-1 (11.9 mag)

Two more positives  
were recorded  
in Europe:

- **Jiří Kubánek  
(Czech Republic)**  
- from hungarian  
observation site  
near Balaton Lake  
(new double star  
discovery – both  
components  
occulted)
- **Peter Delincak  
(Slovak Republic)**  
- only one  
component  
occulted



# Total lunar eclipse – 27 VII 2018



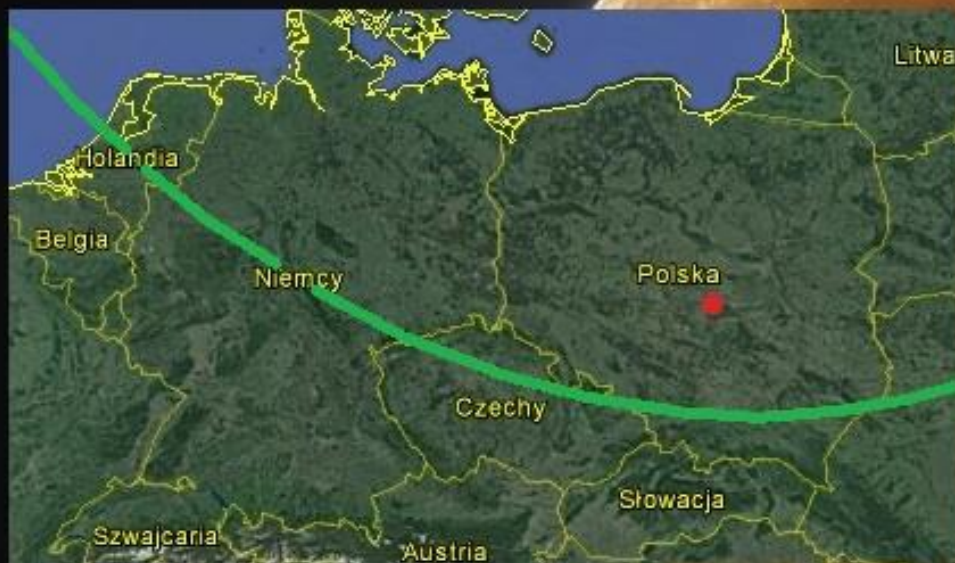
# Total lunar eclipse – 27 VII 2018

9.7 mag - graze 200 km  
from the site



12.0 mag (graze 280 km)

13.0 mag upper



Taken by Gabriel Murawski in central Poland (Tomaszów Mazowiecki).

Canon 300 mm f/4 telelens with ASI 178 MM-c CMOS monochrome camera and RVB filters.

Stack of numerous frames: Moon 75x0.25 secs, stars 30x1 sec for every channel.

# Total lunar eclipse – 27 VII 2018



Taken by **Szczepan Skibicki** near Białystok, NE Poland

# Partial solar eclipse – 11 VIII 2018

*1.45 %, several mins. before maximum phase*



Taken by **Adam Nowak (PL)** in Tallin, Estonia –  
ASI 178 MM-c CMOS monochrome camera with 400 mm f/6 telelens

**Thank you for your attention.  
Any questions ?**

