Part II

OCCULTATIONS BY ASTEROIDS - HIGHLIGHTS FOR EUROPE IN 2023

JIŘÍ KUBÁNEK, EFP ESOP XLI, GRANADA, 10-11 SEPTEMBER 2022

INTERNATIONAL OCCULTATION TIMING ASSOCIATION / EUROPEAN SECTION

CZECH ASTRONOMICAL SOCIETY – OCCULTATION AND TIMING SECTION

Part II

2. Asteroids with satellites

3. Other interesting asteroids

A: Jupiter Trojans

B: Interesting asteroids from past observations

C: Occultations by (319) Leona before the event with Betelgeuse

2. Asteroids with satellites

469 asteroids with companions (453 binary systems, 14 triple systems, 1 quadruple s., 1 sextuple s.), July 2022. Chosen 10 events with good path accuracy for the main body.

(243) IDA AND DACTYL, CREDIT: NASA/JPL

(4492) Debussy, comb. 12,9 mag / 0,79 s / drop 6,2 mag

2023 Jan 02, 03:40 UT

4492 Debussy occults UCAC4 389-058365 on 2023 Jan 2 from 3h 41m to 3h 47m UT

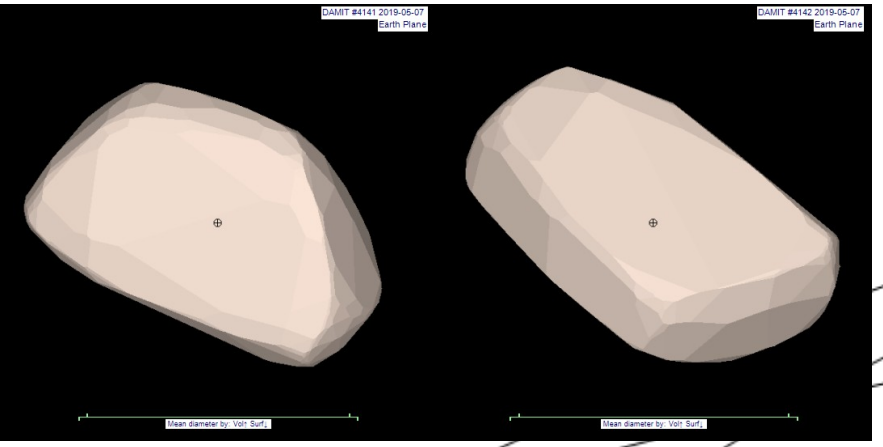
Star: (Dia < 0.1 mas)
Mv 12.9; Mb 13.2; Mr 12.4
RA = 13 32 20.9051 (astrometric)
Dec = -12 18 47.118 ...
[of Date: 13 33 33, -12 25 47]
Prediction of 2022 Jul 15.8
Reliable 1.0 (good),

Durations: Max = 0.79 secs
1km = 0.045 secs, 1mas = 0.11 secs
Mag Drop: 6.2 [100%]v, 6.2 [100%]r
Sun : Dist = 76°
Moon: Dist = 158°, illum = 80%
Error 12.0 x 3.3 mas in PA 118°

Asteroid: (in DAMIT)
Mag = 19.1
Dia = 17 ±1km, 7 mas
Parallax = 2.715"
Hourly dRA = 2.008s
dDec =-16.69"
JPL#79:2022-Jun-07, Known errors

1 moon. {?} 9km at 31km, Period 1.109days

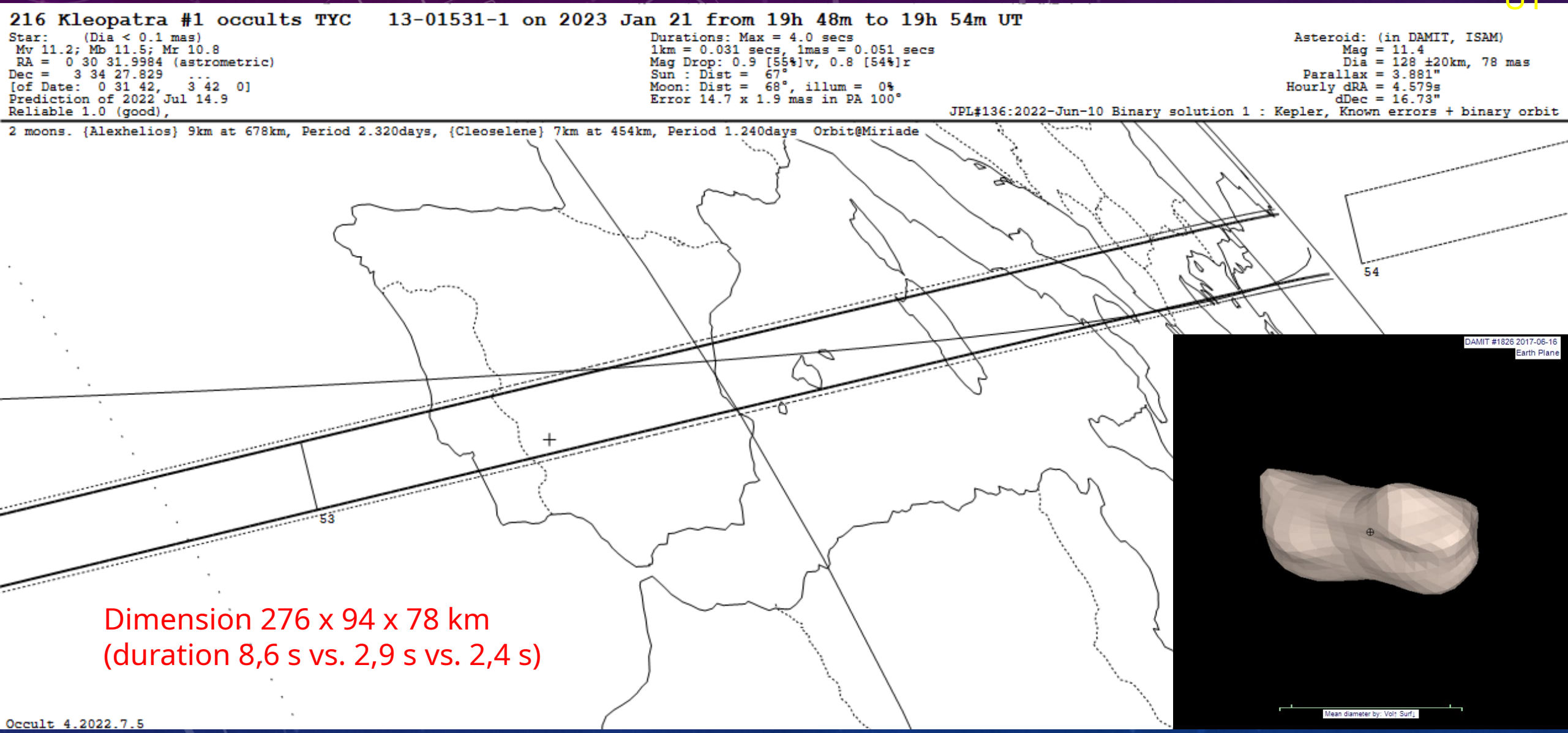
Diameter (primary) 14,6 km – duration 0,66 s
Diameter (secondary) 9,39 km – duration 0,42 s
Semimajor axis 31 km



JIŘÍ KUBÁNEK, IOTA/ES

(216) Kleopatra, comb. 10,5 mag / 4,0 s / drop 0,9 mag

2023 Jan 21, 19:53 UT

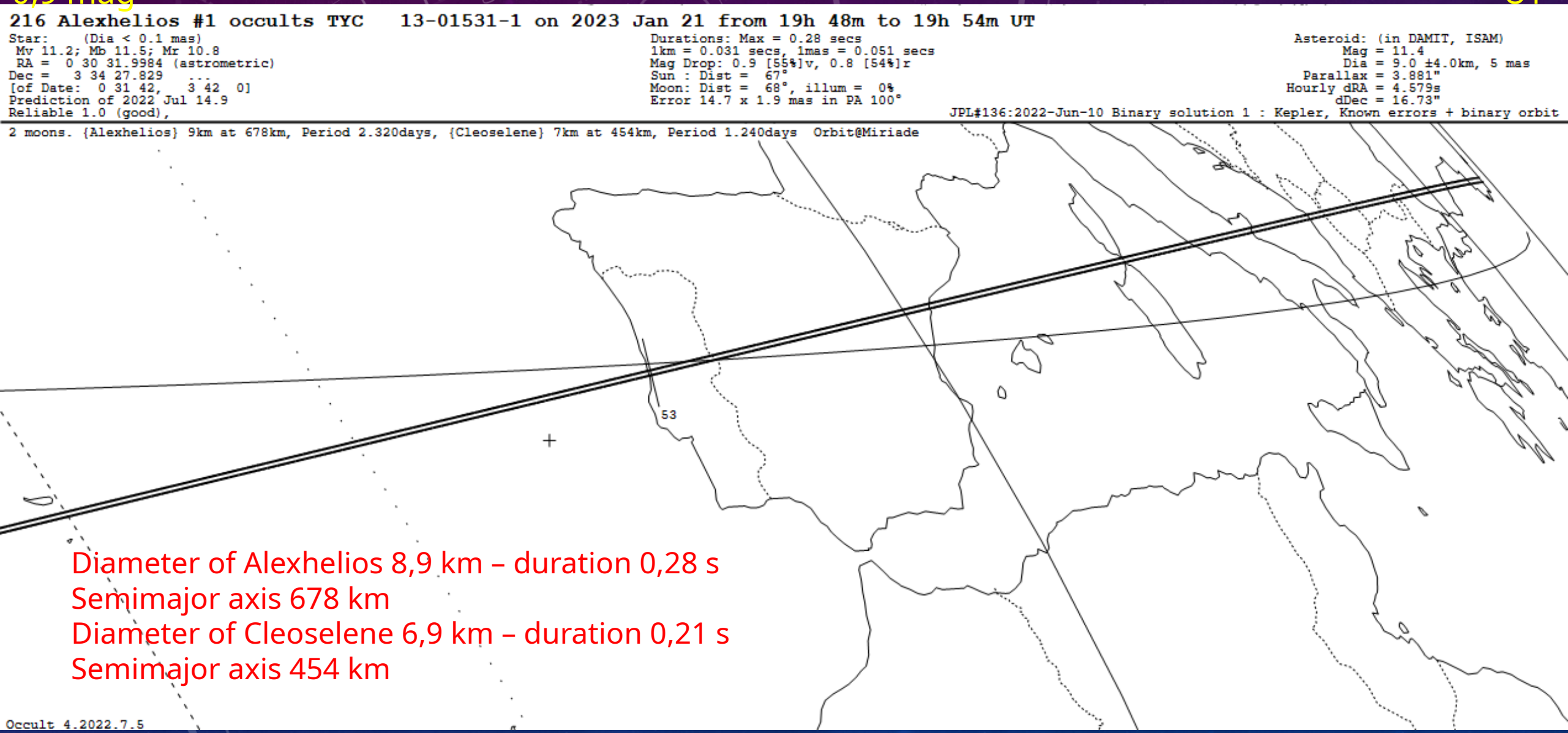


Dimension 276 x 94 x 78 km
(duration 8,6 s vs. 2,9 s vs. 2,4 s)

JIŘÍ KUBÁNEK, IOTA/ES

(216) Kleopatra I = Alexhelios, comb. 10,5 mag / 0,28 s / drop 0,9 mag

2023 Jan 21, 19:52 UT

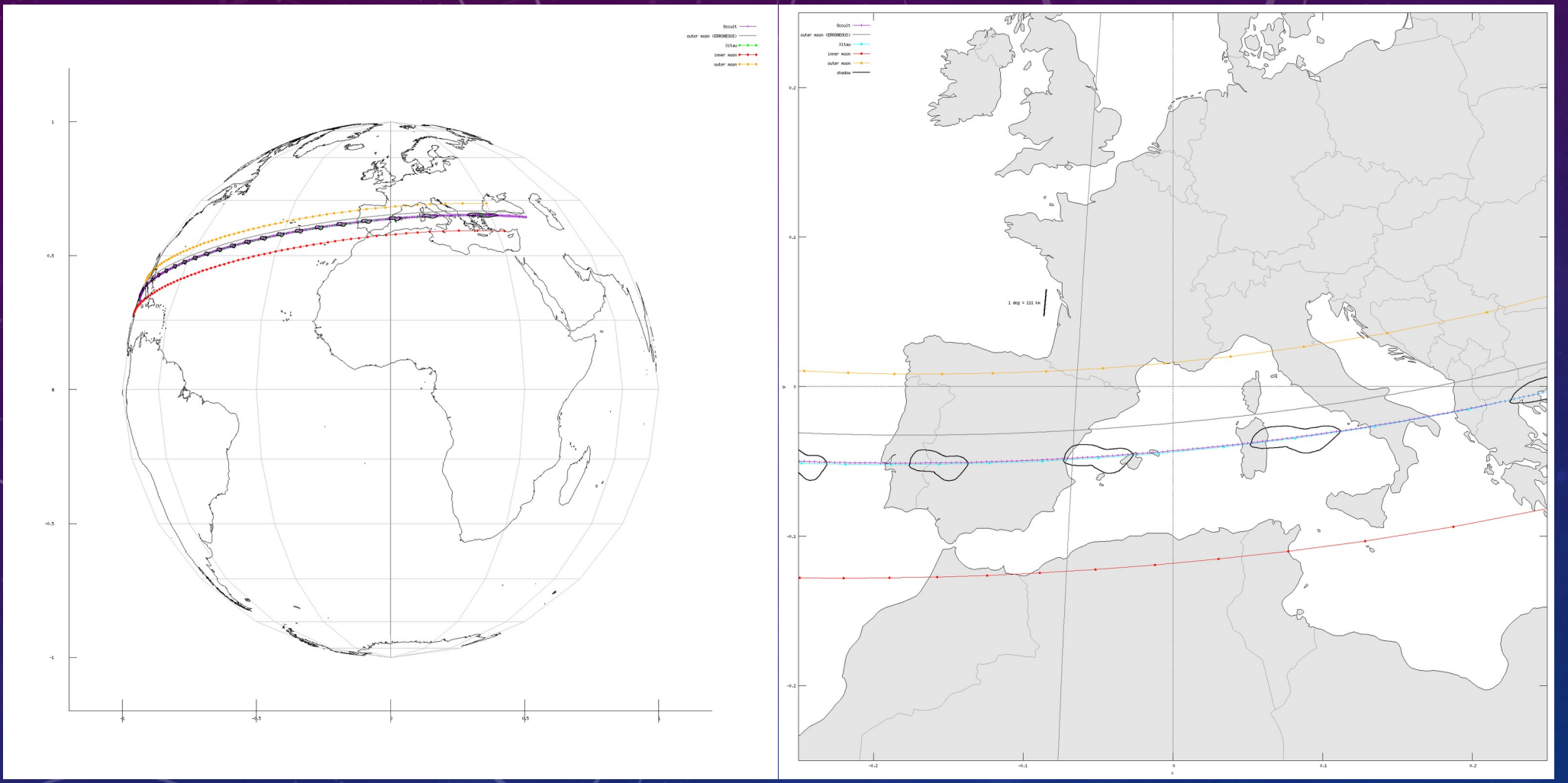


Diameter of Alexhelios 8,9 km – duration 0,28 s
Semimajor axis 678 km
Diameter of Cleoselene 6,9 km – duration 0,21 s
Semimajor axis 454 km

JIŘÍ KUBÁNEK, IOTA/ES

(216) Kleopatra, comb. 10,5 mag / 4,0 s / drop 0,9 mag

2023 Jan 21, 19:53 UT



OCCULTATION COMPUTATION WITH XITAU, CREDIT: MIROSLAV BROŽ, JOSEF HANUŠ; HTTPS://SIRRAH.TROJA.MFF.CUNI.CZ/~MIRA/TMP/KLEOPATRA2/JAN2023.HTML

(216) Kleopatra, comb. 10,5 mag / 4,0 s / drop 0,9 mag

2023 Jan 21, 19:53 UT

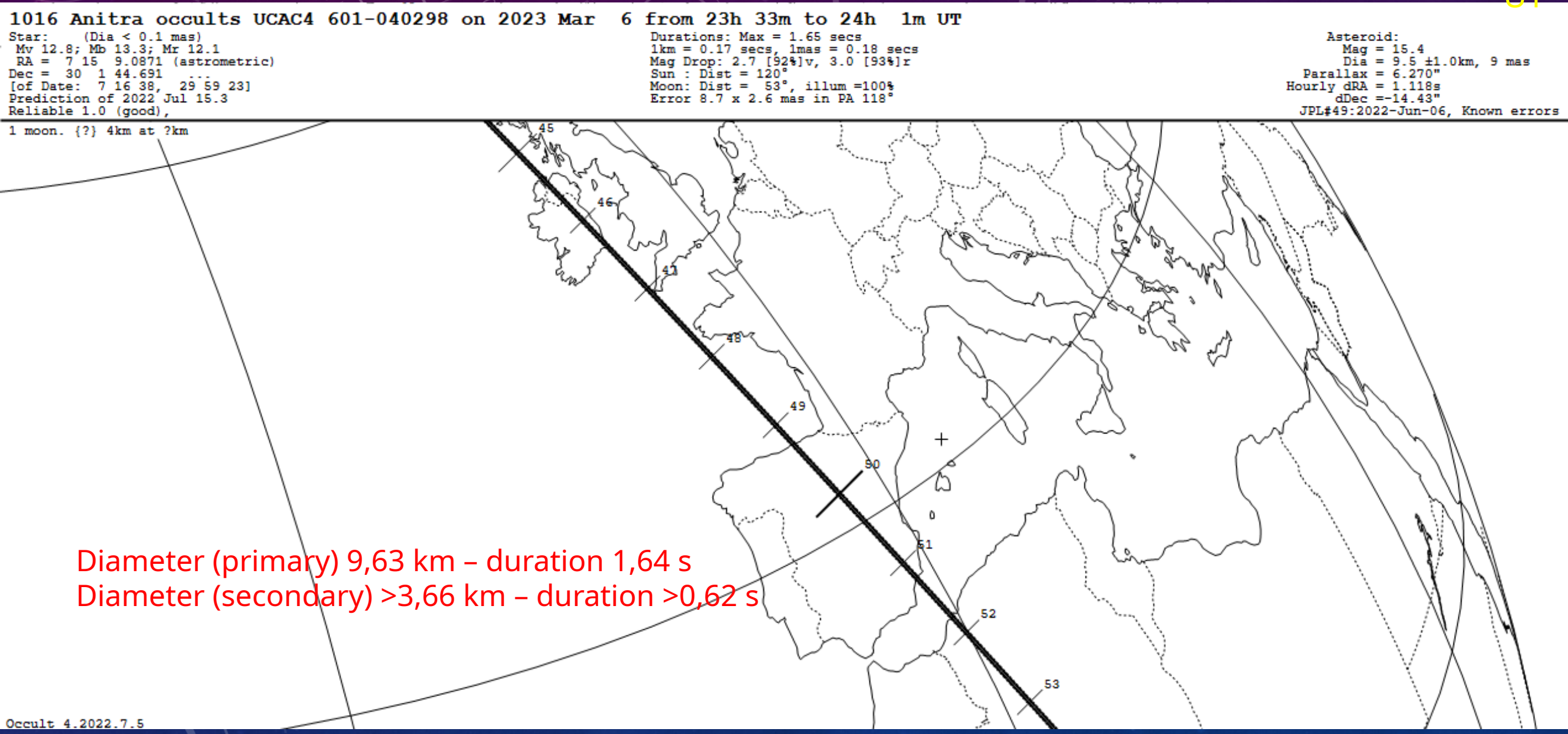
OCCULTATION COMPUTATION WITH XITAU, CREDIT: MIROSLAV BROŽ, JOSEF HANUŠ

ESOP XLI, GRANADA, 2022

JIŘÍ KUBÁNEK, IOTA/ES

(1016) Anitra, comb. 12,7 mag / 1,65 s / drop 2,7 mag

2023 Mar 06, 23:45 UT

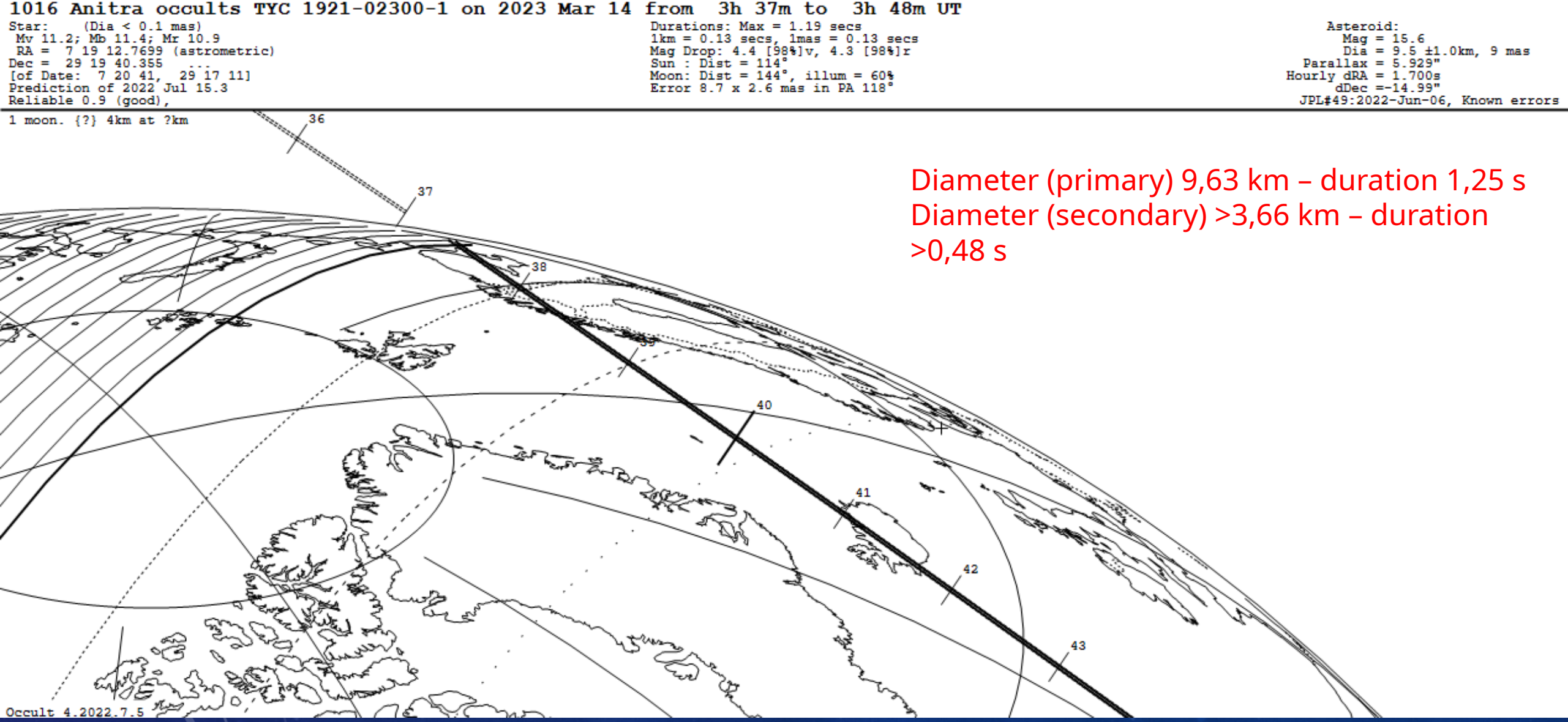


Diameter (primary) 9,63 km – duration 1,64 s
Diameter (secondary) >3,66 km – duration >0,62 s

JIŘÍ KUBÁNEK, IOTA/ES

(1016) Anitra, comb. 11,2 mag / 1,19 s / drop 4,4 mag

2023 Mar 14, 03:38 UT

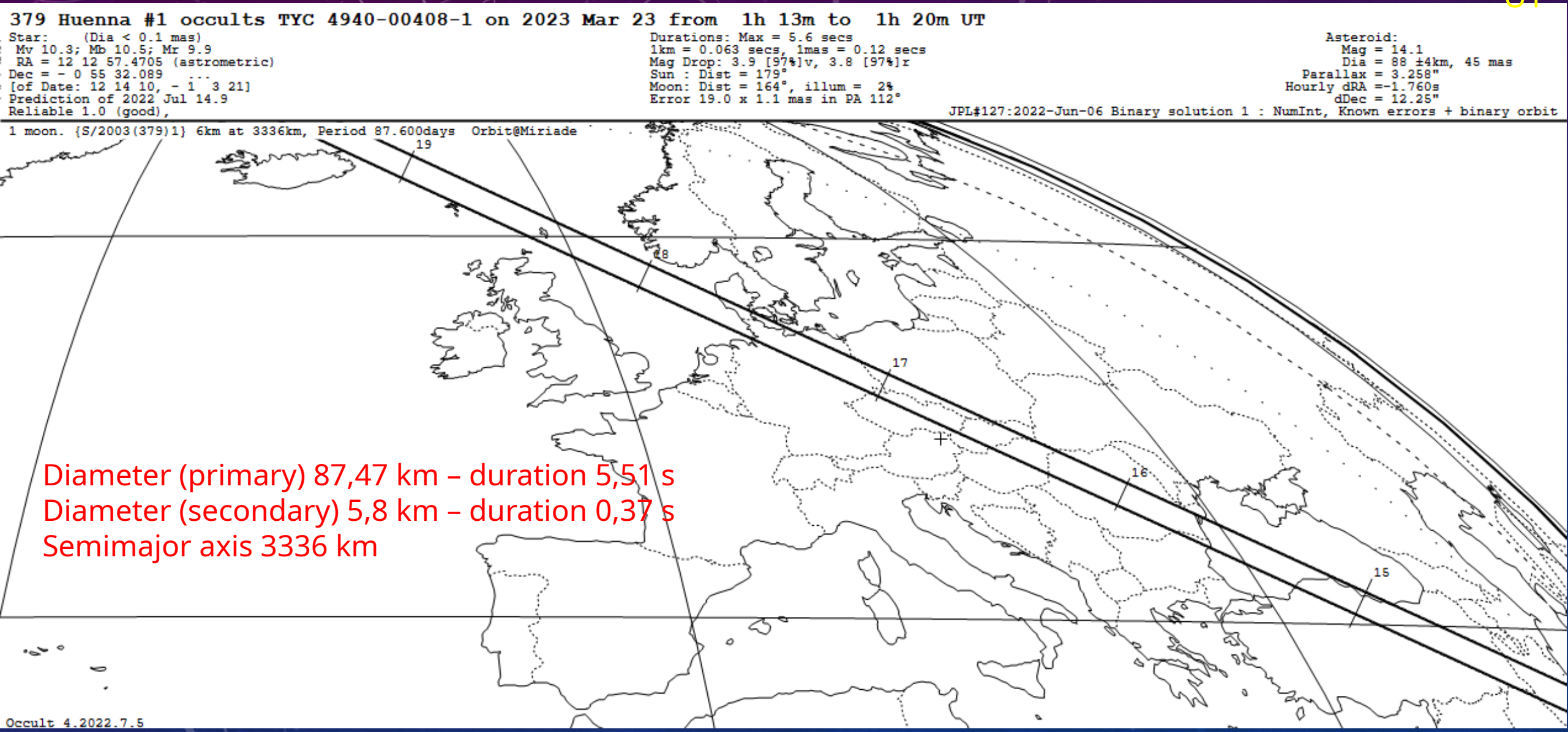


Diameter (primary) 9,63 km – duration 1,25 s
Diameter (secondary) >3,66 km – duration >0,48 s

JIŘÍ KUBÁNEK, IOTA/ES

(379) Huenna, comb. 10,2 mag / 5,6 s / drop 3,9 mag

2023 Mar 23, 01:15 UT

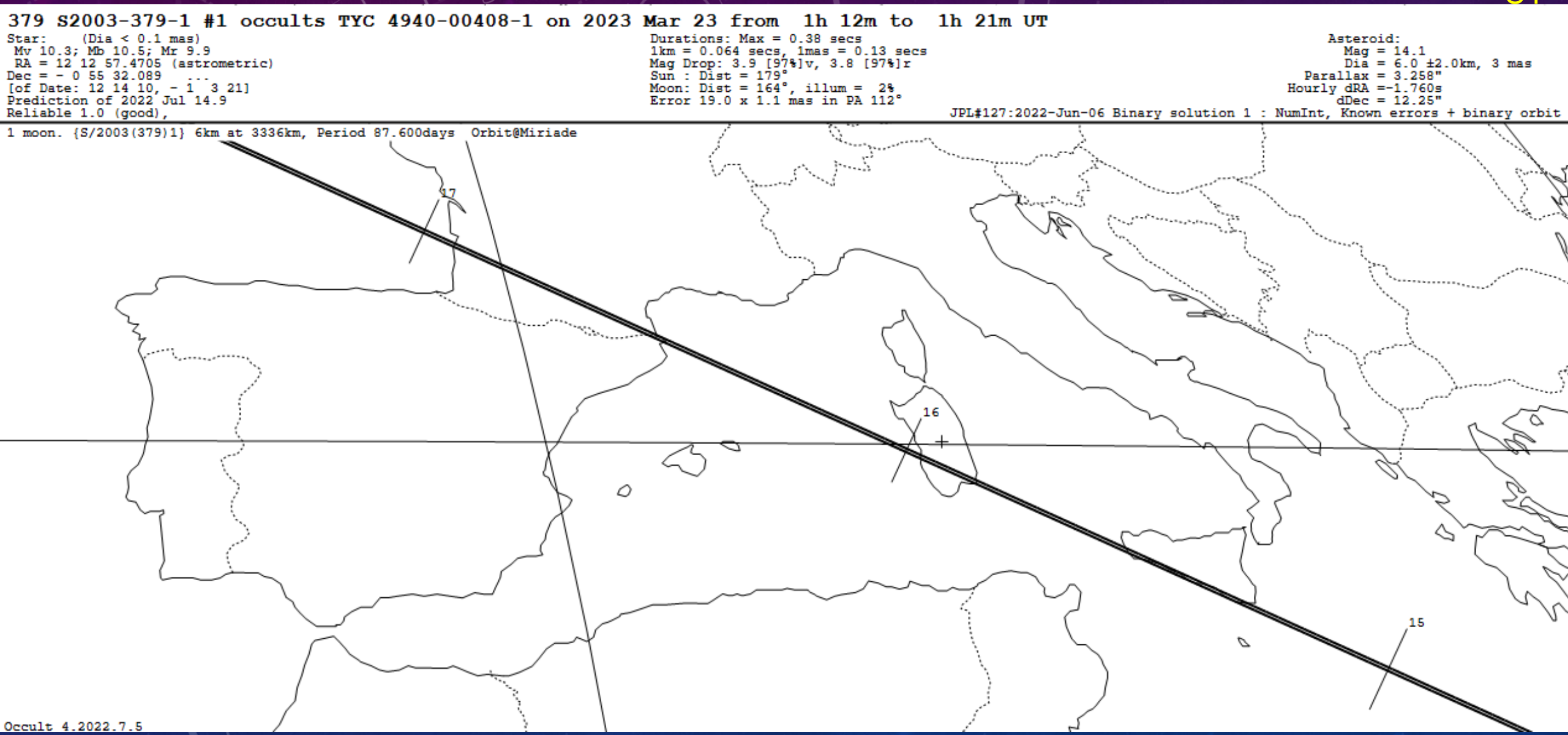


Diameter (primary) 87,47 km – duration 5,51 s
Diameter (secondary) 5,8 km – duration 0,37 s
Semimajor axis 3336 km

JIŘÍ KUBÁNEK, IOTA/ES

S/2003 (379) 1, comb. 10,2 mag / 0,38 s / drop 3,9 mag

2023 Mar 23, 01:15 UT



JIŘÍ KUBÁNEK, IOTA/ES

(121) Hermione, comb. 9,2 mag / 5,7 s / drop 4,7 mag

2023 May 06, 22:46 UT

121 Hermione #1 occults TYC 1887-01582-1 on 2023 May 6 from 22h 43m to 22h 47m UT

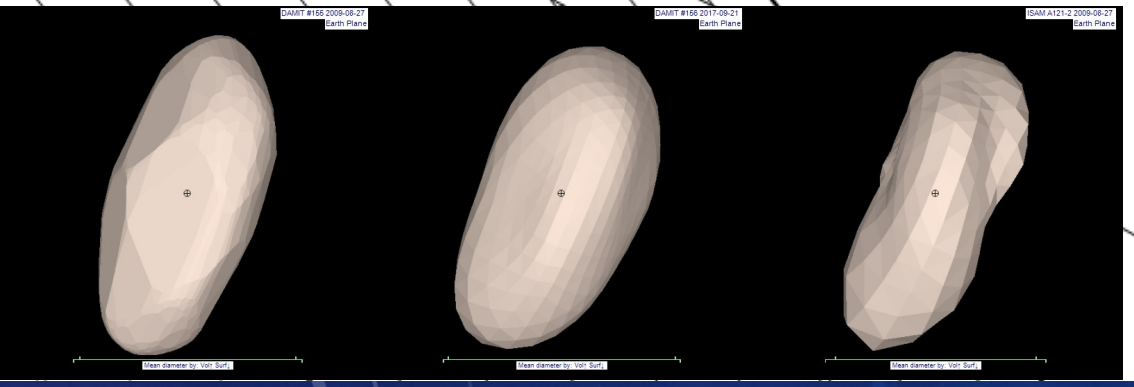
Star: (Dia < 0.1 mas)
Mv 9.2; Mb 9.2; Mr 9.2
RA = 6 28 46.9949 (astrometric)
Dec = 27 10 51.952 ...
[of Date: 6 30 13, 27 10 2]
Prediction of 2022 Jul 14.9
Reliable 2.9 (beware),

Durations: Max = 5.7 secs
1km = 0.029 secs, 1mas = 0.086 secs
Mag Drop: 4.7 [99%]v, 4.3 [98%]r
Sun : Dist = 50°
Moon: Dist = 145°, illum = 98%
Error 16.0 x 9.3 mas in PA 85°

Asteroid: (in DAMIT, ISAM)
Mag = 13.9
Dia = 196 ±15km, 67 mas
Parallax = 2.186"
Hourly dRA = 3.154s
dDec = -1.76"

JPL#125:2022-Jun-06 Binary solution 1 : Kepler, Known errors + binary orbit

1 moon. {S/2002(121)1} 32km at 747km, Period 2.563days Orbit@Miriade

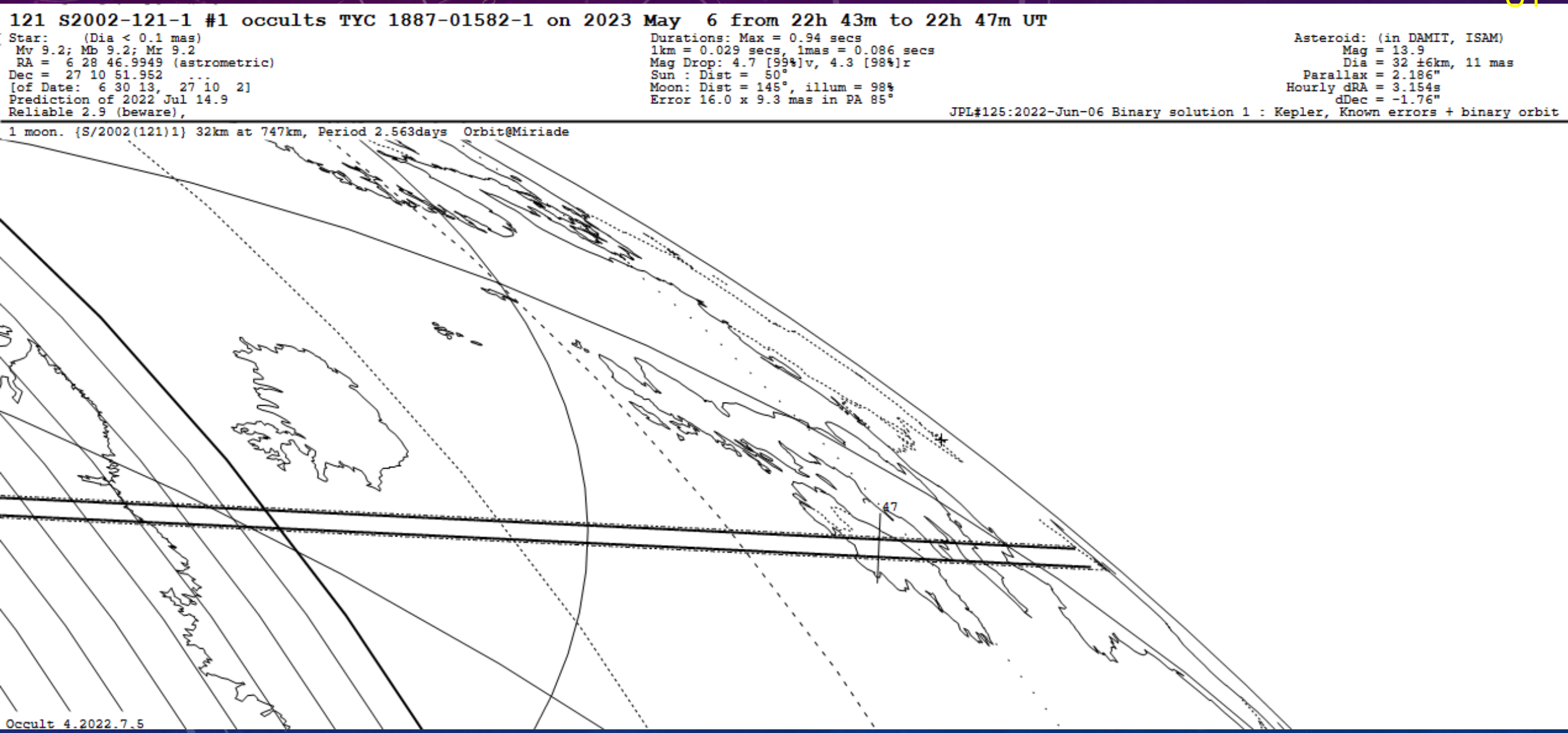


Diameter (primary) 187 km – duration 5,42 s
Diameter (secondary) 32 km – duration 0,93 s
Semimajor axis 747 km

JIŘÍ KUBÁNEK, IOTA/ES

S/2002 (121) 1, comb. 9,2 mag / 0,94 s / drop 4,7 mag

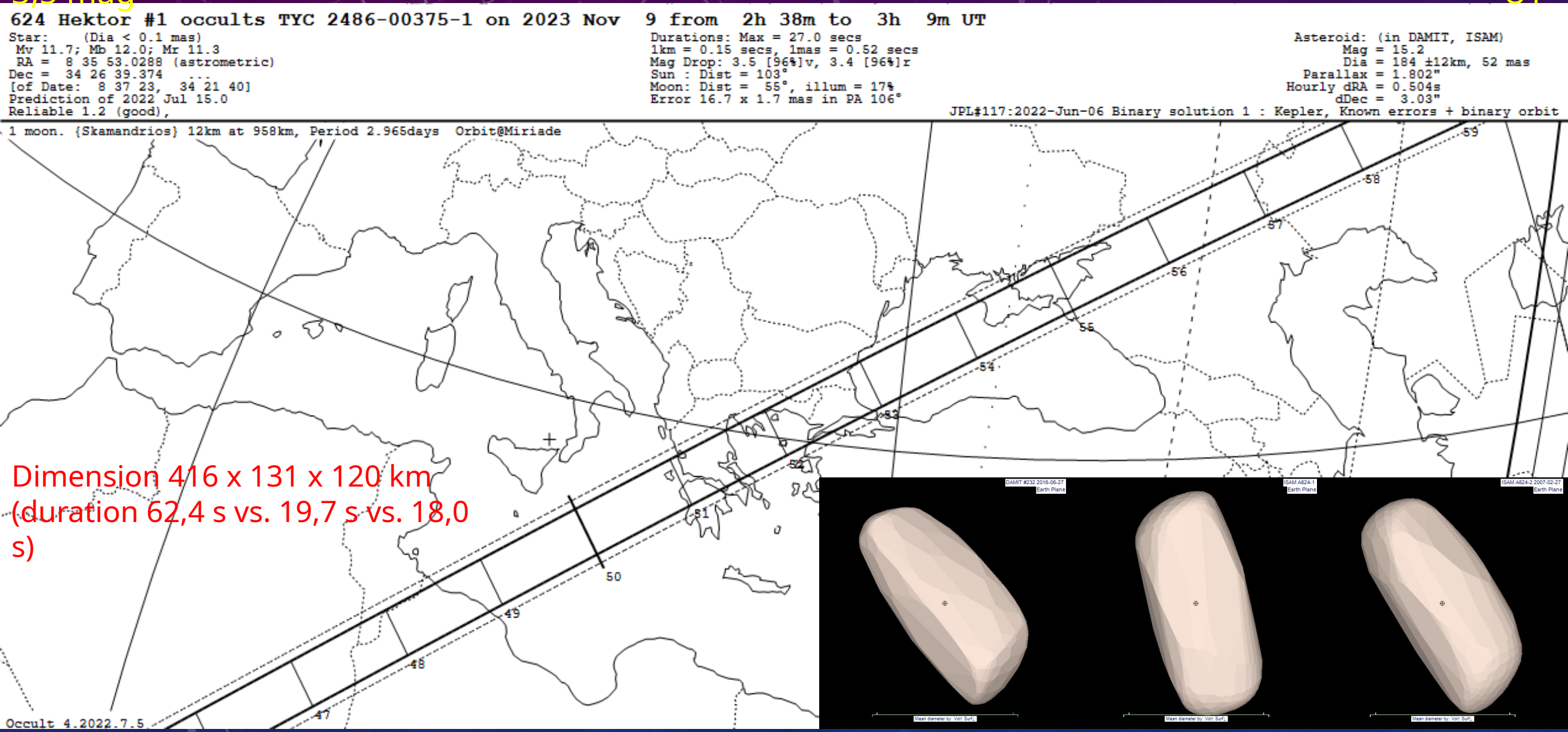
2023 May 06, 22:46 UT



JIŘÍ KUBÁNEK, IOTA/ES

(624) Hektor (Jupiter Trojan, L4), comb. 11,7 mag / 27,0 s / drop 3,5 mag

2023 Nov 09, 02:46 UT

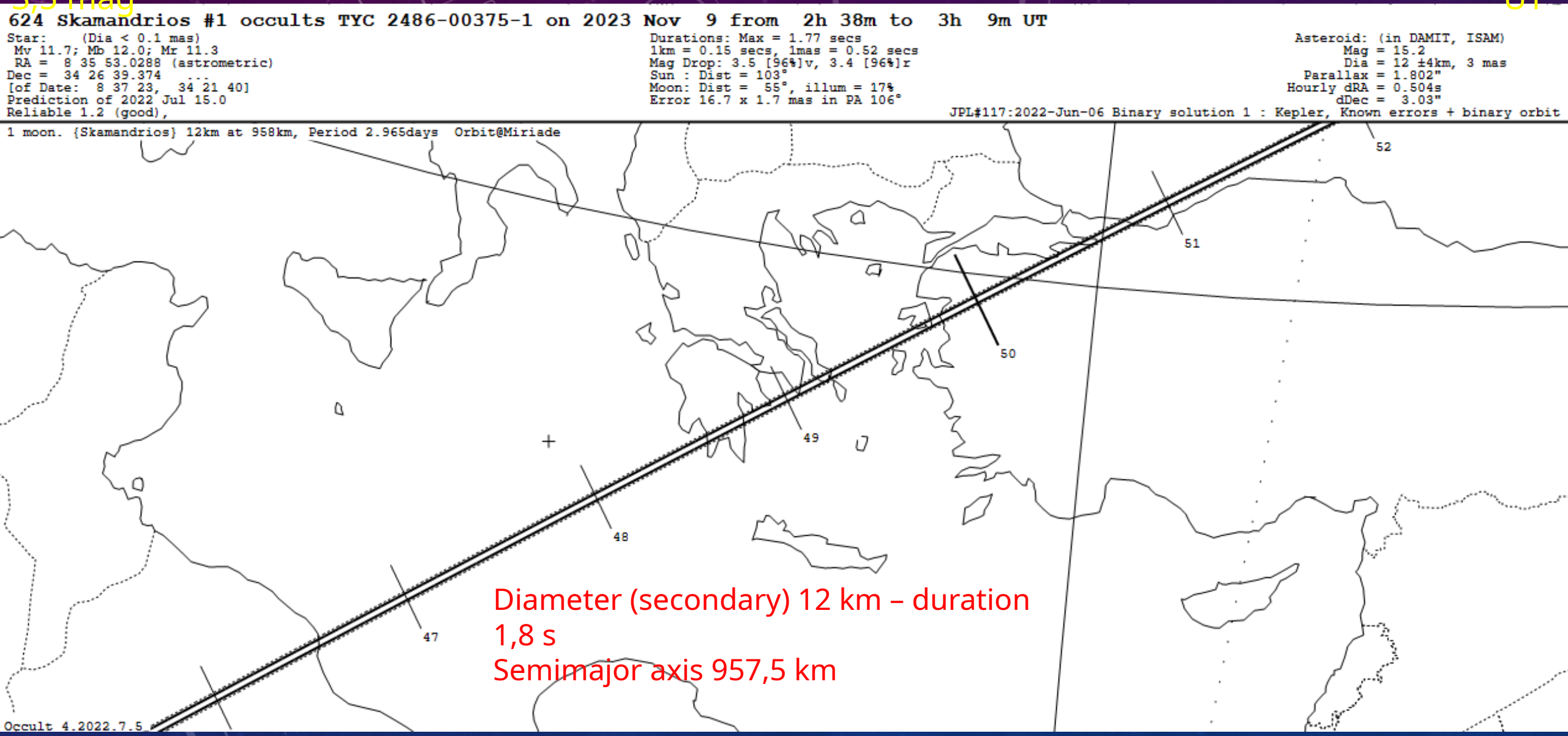


Dimension 416 x 131 x 120 km (duration 62,4 s vs. 19,7 s vs. 18,0 s)

JIŘÍ KUBÁNEK, IOTA/ES

(624) Hektor I = Skamandrios, comb. 11,7 mag / 1,77 s / drop 3,5 mag

2023 Nov 09, 02:46 UT



Diameter (secondary) 12 km – duration 1,8 s

Semimajor axis 957,5 km

JIŘÍ KUBÁNEK, IOTA/ES

(4337) Arecibo, comb. 13,2 mag / 1,46 s / drop 4,6 mag

2023 Nov 22, 18:34 UT

4337 Arecibo occults UCAC4 528-004534 on 2023 Nov 22 from 18h 27m to 18h 40m UT

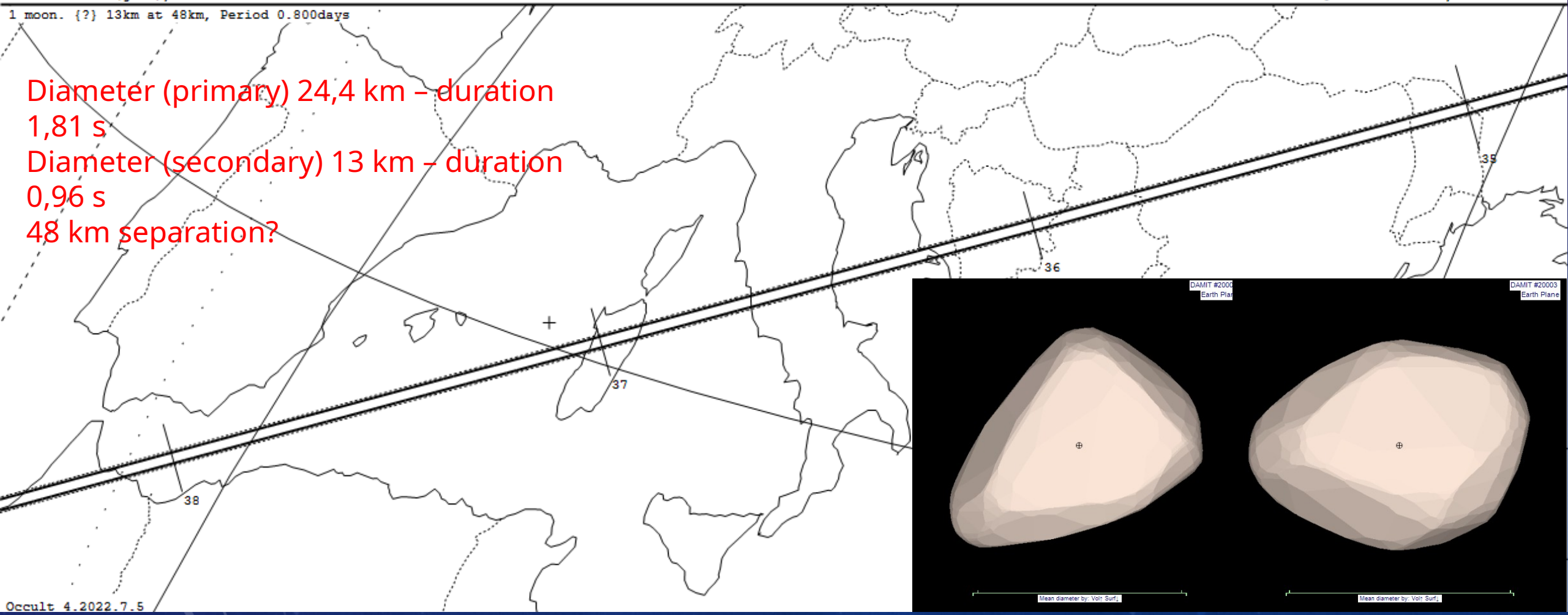
Star: (Dia < 0.1 mas)
Mv 13.2; Mb 13.6; Mr 12.6
RA = 2 35 29.4410 (astrometric)
Dec = 15 30 24.860 ...
[of Date: 2 36 49, 15 36 46]
Prediction of 2022 Jul 15.8
Reliable 1.0 (good),

Durations: Max = 1.46 secs
1km = 0.074 secs, 1mas = 0.14 secs
Mag Drop: 4.6 [99%]v, 4.8 [99%]r
Sun : Dist = 161°
Moon: Dist = 41°, illum = 75%
Error 24.3 x 1.0 mas in PA 71°

Asteroid: (in DAMIT)
Mag = 17.8
Dia = 20 ±2km, 10 mas
Parallax = 3.353"
Hourly dRA =-1.706s
dDec = -6.92"
JPL#45:2022-Jun-07, Known errors

1 moon. {?} 13km at 48km, Period 0.800days

Diameter (primary) 24,4 km – duration 1,81 s
Diameter (secondary) 13 km – duration 0,96 s
48 km separation?



JIŘÍ KUBÁNEK, IOTA/ES

(45) Eugenia, comb. 9,9 mag / 4,7 s / drop 3,3 mag

2023 Nov 26, 17:08 UT

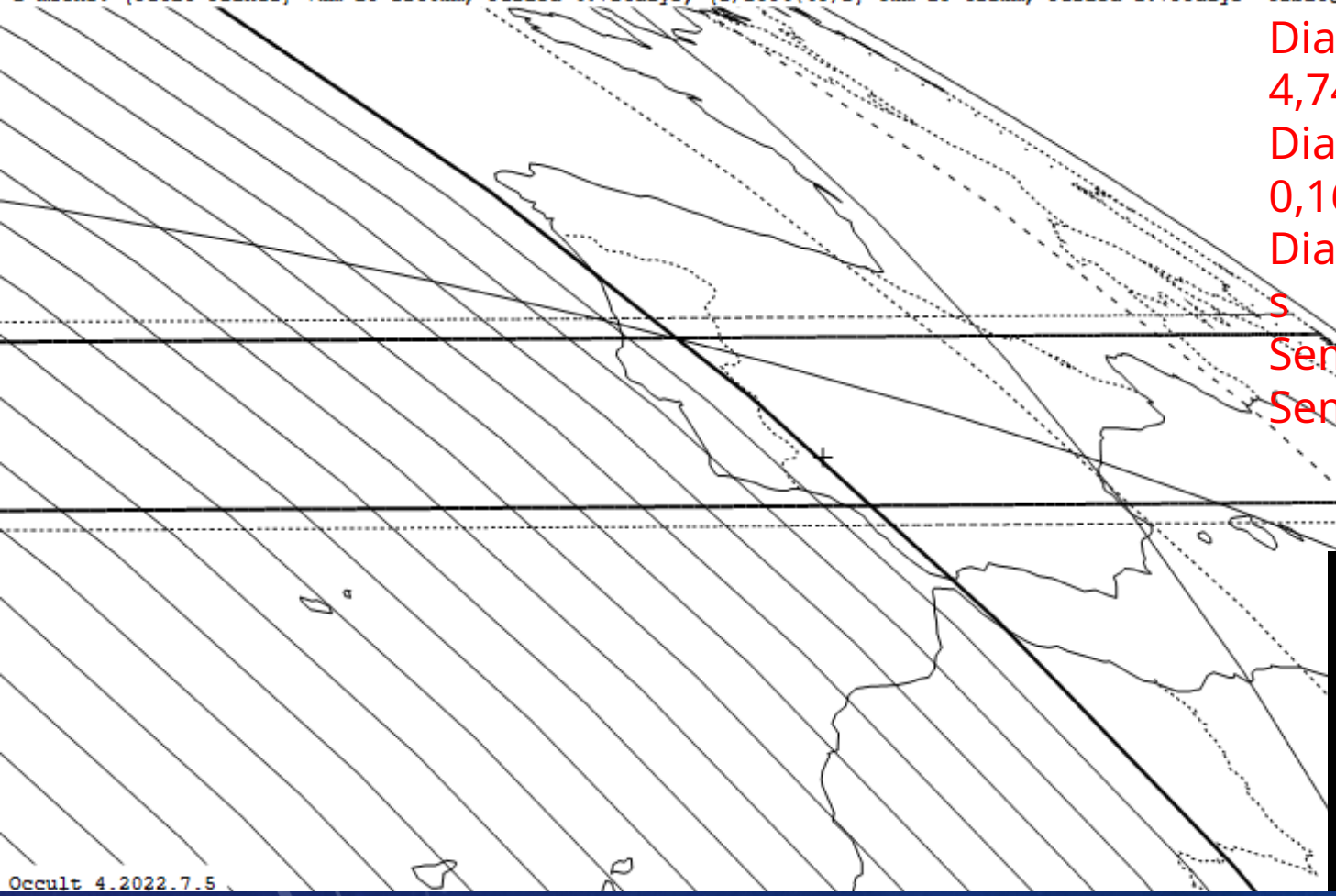
45 Eugenia #1 occults TYC 6274-01613-1 on 2023 Nov 26 from 17h 6m to 17h 9m UT

Star: (Dia = 0.1 mas)
Mv 9.9; Mb 10.6; Mr 9.1
RA = 18 31 34.3011 (astrometric)
Dec = -20 5 47.611 ...
[of Date: 18 32 58, -20 4 49]
Prediction of 2022 Jul 14.8
Reliable 0.9 (good), DupSrc,

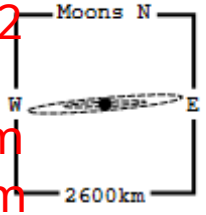
Durations: Max = 4.7 secs
1km = 0.023 secs, 1mas = 0.055 secs
Mag Drop: 3.3 [95%]v, 3.7 [97%]r
Sun : Dist = 33°
Moon: Dist = 138°, illum = 99%
Error 18.7 x 9.7 mas in PA 95°

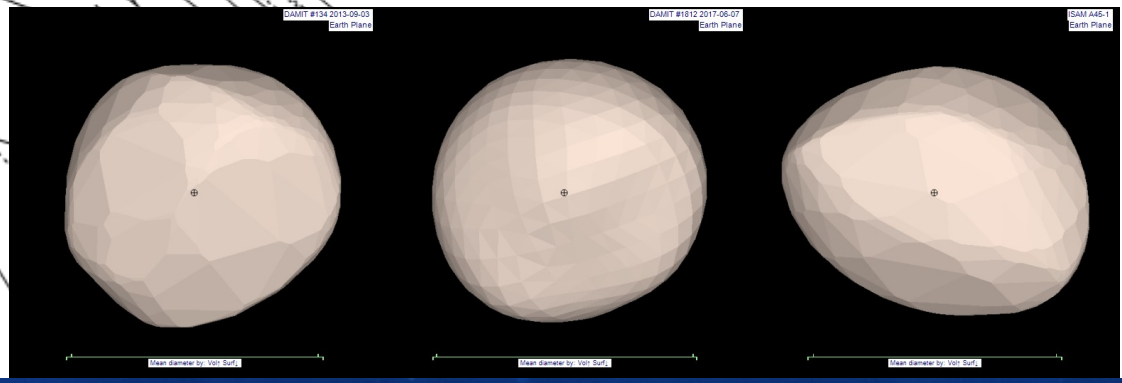
Asteroid: (in DAMIT, ISAM)
Mag = 13.2
Dia = 206 ±6km, 85 mas
Parallax = 2.634"
Hourly dRA = 4.658s
dDec = 0.22"
JPL#124:2022-Jun-06 Binary solution 1 : Kepler, Known errors + binary orbit

2 moons. {Petit-Prince} 7km at 1164km, Period 4.716days, {S/2004(45)1} 5km at 611km, Period 1.793days Orbit@Miriade



Diameter (Eugenia) 206,14 km – duration 4,74 s
Diameter (Petit-Prince) 7 km – duration 0,16 s
Diameter (S/2004 (45) 1) 5 km – durat. 0,12 s
Semimajor axis (Petit-Prince) = 1164,42 km
Semimajor axis (S/2004 (45) 1) = 610,59 km

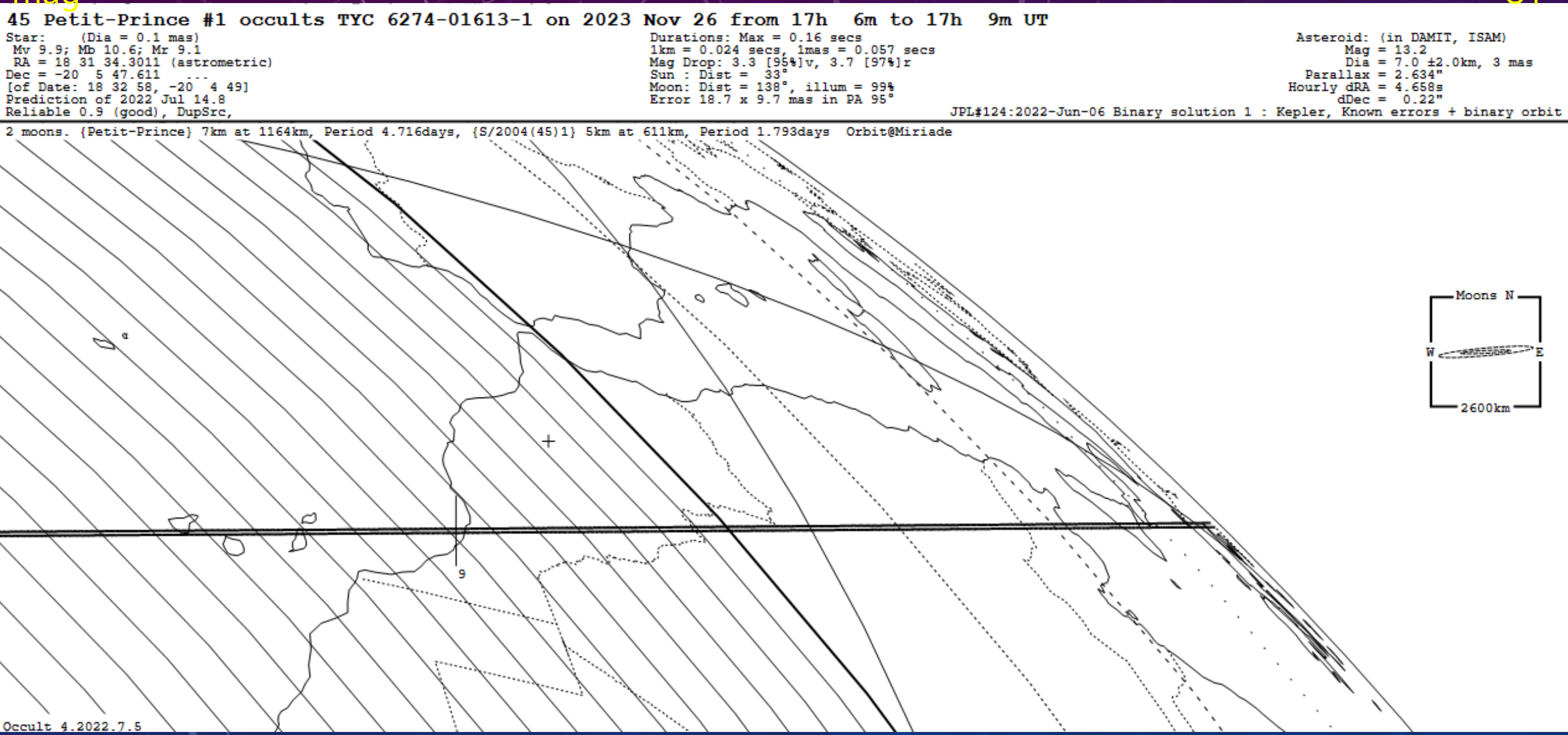




JIŘÍ KUBÁNEK, IOTA/ES

(45) Eugenia I = Petit-Prince, comb. 9,9 mag / 0,16 s / drop 3,3 mag

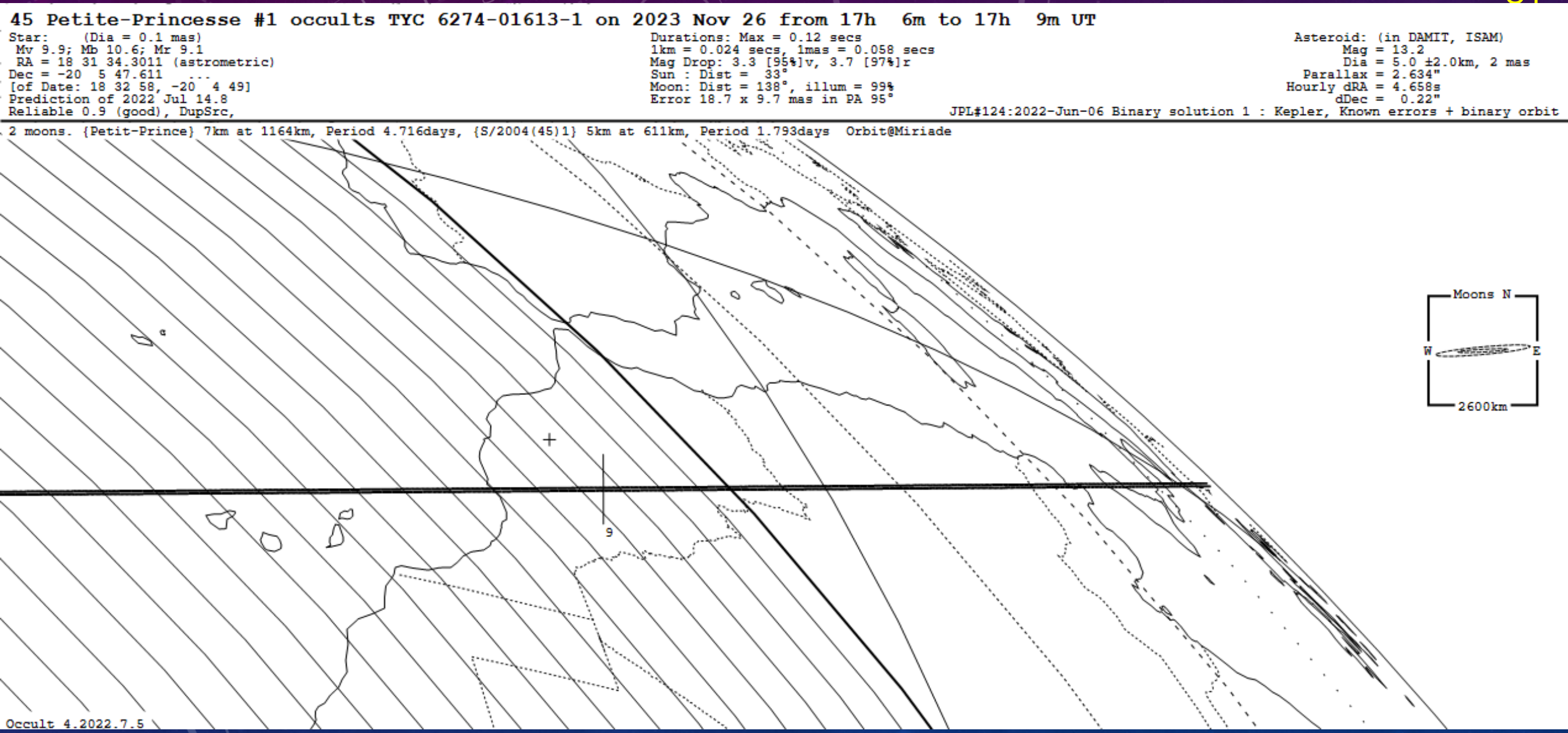
2023 Nov 26, 17:09 UT



JIŘÍ KUBÁNEK, IOTA/ES

S/2004 (45) 1, comb. 9,9 mag / 0,12 s / drop 3,3 mag

2023 Nov 26, 17:09 UT



JIŘÍ KUBÁNEK, IOTA/ES

(317) Roxane, comb. 11,6 mag / 1,76 s / drop 0,8 mag

2023 Dec 05, 03:37 UT

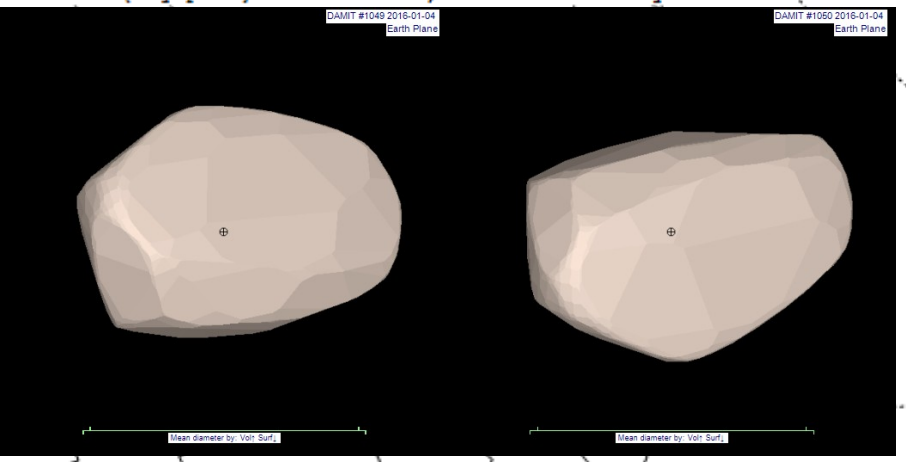
317 Roxane occults UCAC4 547-010590 on 2023 Dec 5 from 3h 37m to 3h 54m UT

Star: (Dia < 0.1 mas)
Mv 12.3; Mb 12.7; Mr 11.7
RA = 4 44 11.4404 (astrometric)
Dec = 19 13 16.917 ...
[of Date: 4 45 36, 19 16 1]
Prediction of 2022 Jul 8.9
Reliable 1.4 (good),

Durations: Max = 1.76 secs
1km = 0.095 secs, 1mas = 0.089 secs
Mag Drop: 0.8 [53%]v, 0.9 [56%]r
Sun : Dist = 177°
Moon: Dist = 89°, illum = 51%
Error 32.7 x 1.9 mas in PA 82°

Asteroid: (in DAMIT, ISAM)
Mag = 12.4
Dia = 19 ±1km, 20 mas
Parallax = 6.773"
Hourly dRA =-2.833s
dDec = -4.48"
JPL#57:2022-Jun-06, Known errors

1 moon. {Olympias} 5km at 247km, Period 11.540days



36
37
38
39
40

Diameter (Roxane) 19,86 km – dur. 1,89 s
Diameter (Olympias) 5,2 km – dur. 0,49 s
Semimajor axis 245 km

Occult 4.2022.7.5

JIŘÍ KUBÁNEK, IOTA/ES

3. Other asteroids

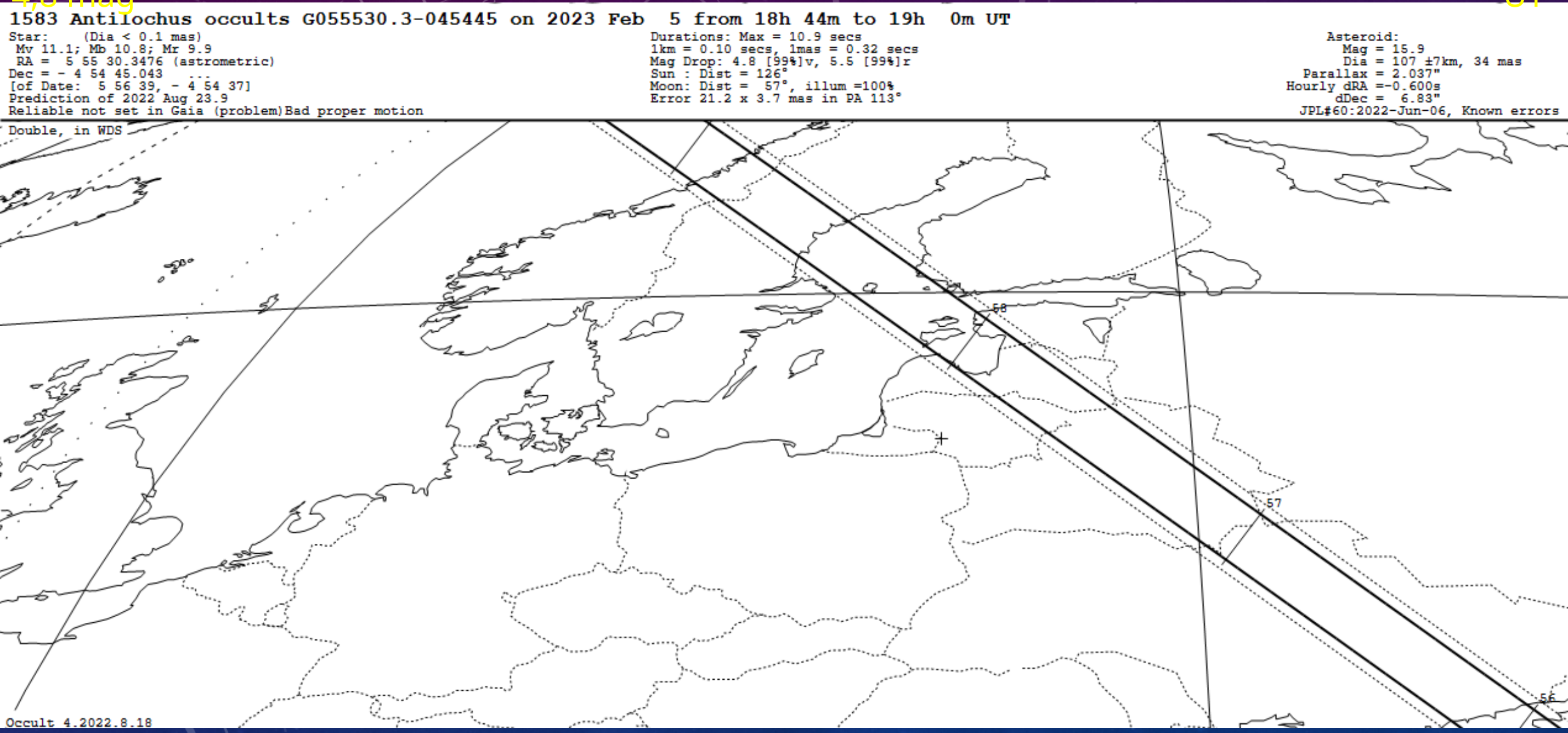
A: Jupiter Trojans

3 events chosen

1 event of (624) Hektor was in part of Asteroids with satellites

(1583) Antilochus (Jupiter Trojan, L4), comb. 11,1 mag / 10,9 s / drop 4,8 mag

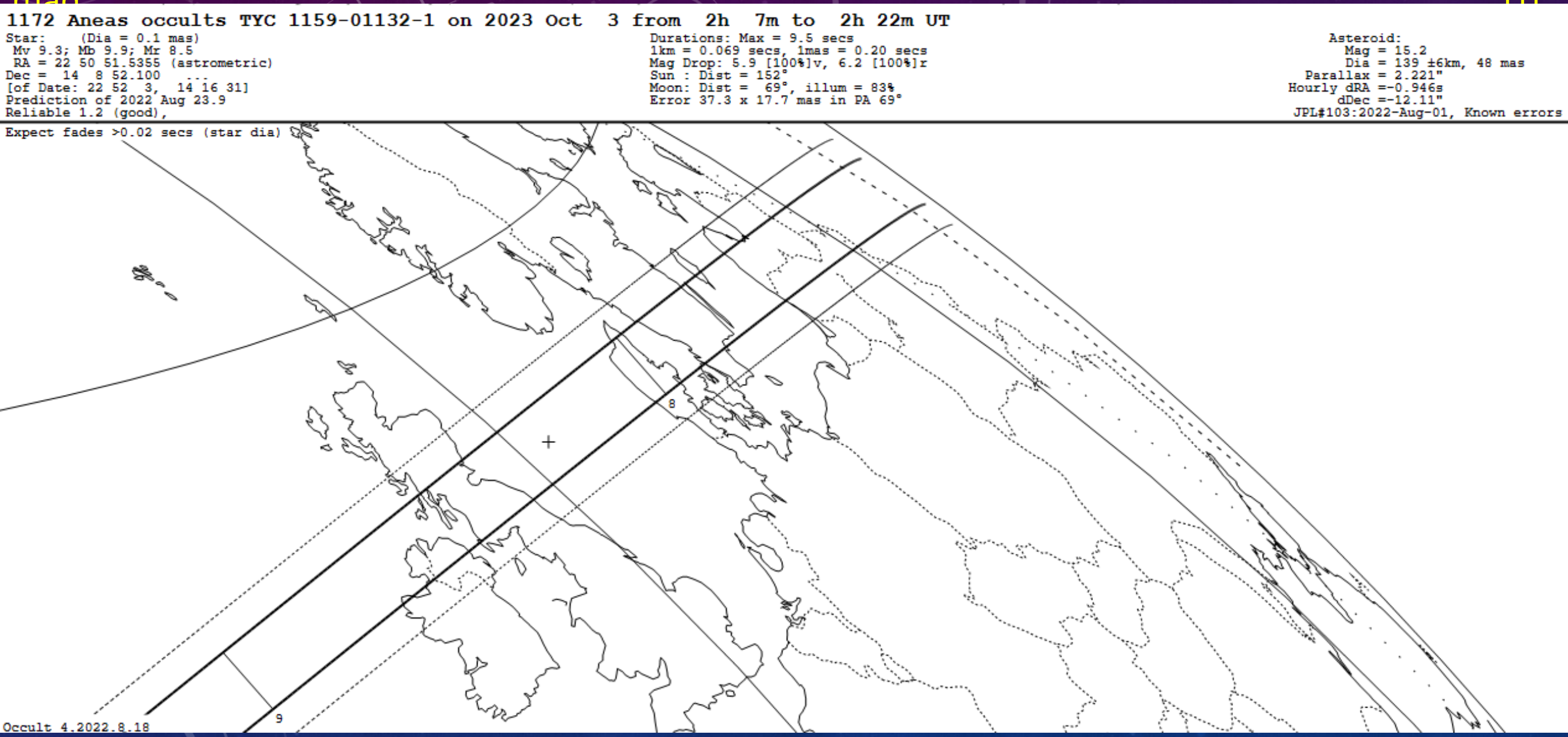
2023 Feb 05, 18:55 UT



JIŘÍ KUBÁNEK, IOTA/ES

(1172) Aneas (Jupiter Trojan, L5), comb. 9,3 mag / 9,5 s / drop 5,9 mag

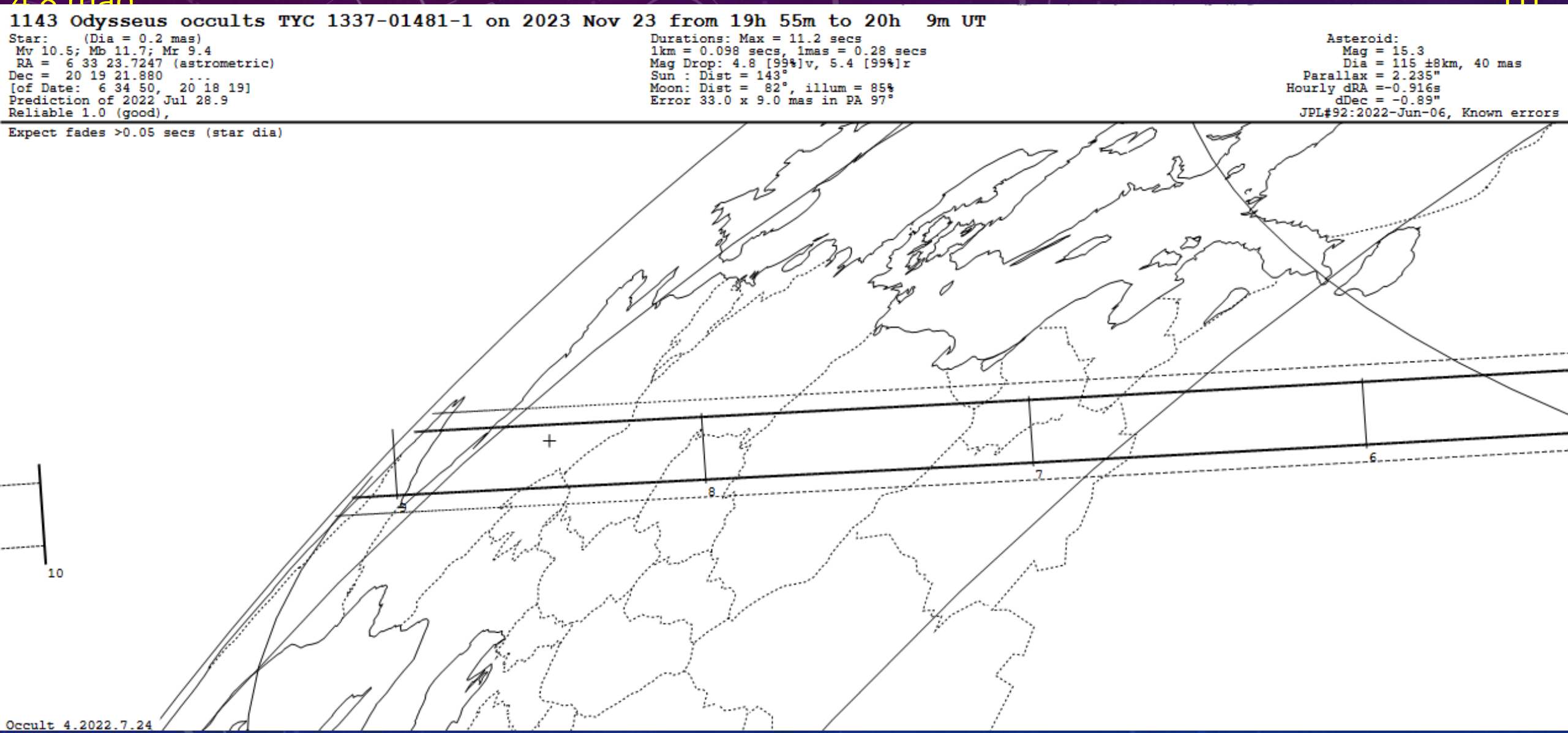
2023 Oct 03, 02:07 UT



JIŘÍ KUBÁNEK, IOTA/ES

(1143) Odysseus (Jupiter Trojan, L4), comb. 10,5 mag / 11,9 s / drop 4,8 mag

2023 Nov 23, 19:06 UT



JIŘÍ KUBÁNEK, IOTA/ES

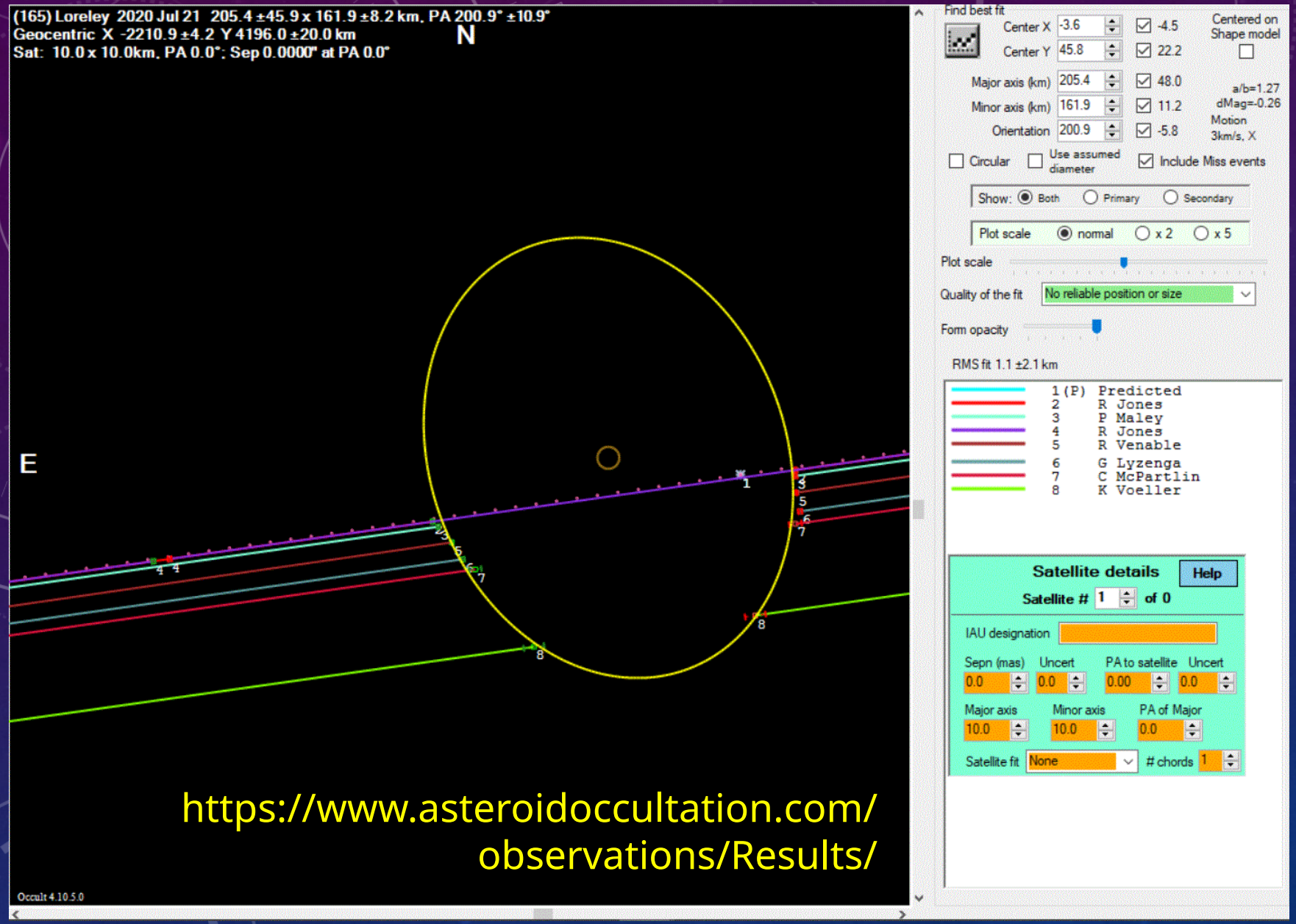
3. Other asteroids

B: Interesting asteroids from past observations

Asteroids from view of an observer of the occultations; suspicion for a satellite, concave shape or other.
7 events chosen and 6 supplementary.

(165) Loreley, comb. 11,3 mag / 19,7 s / drop 0,8 mag

2020 Jul 21, 08:15
UT, North America



https://www.asteroidoccultation.com/observations/Results/

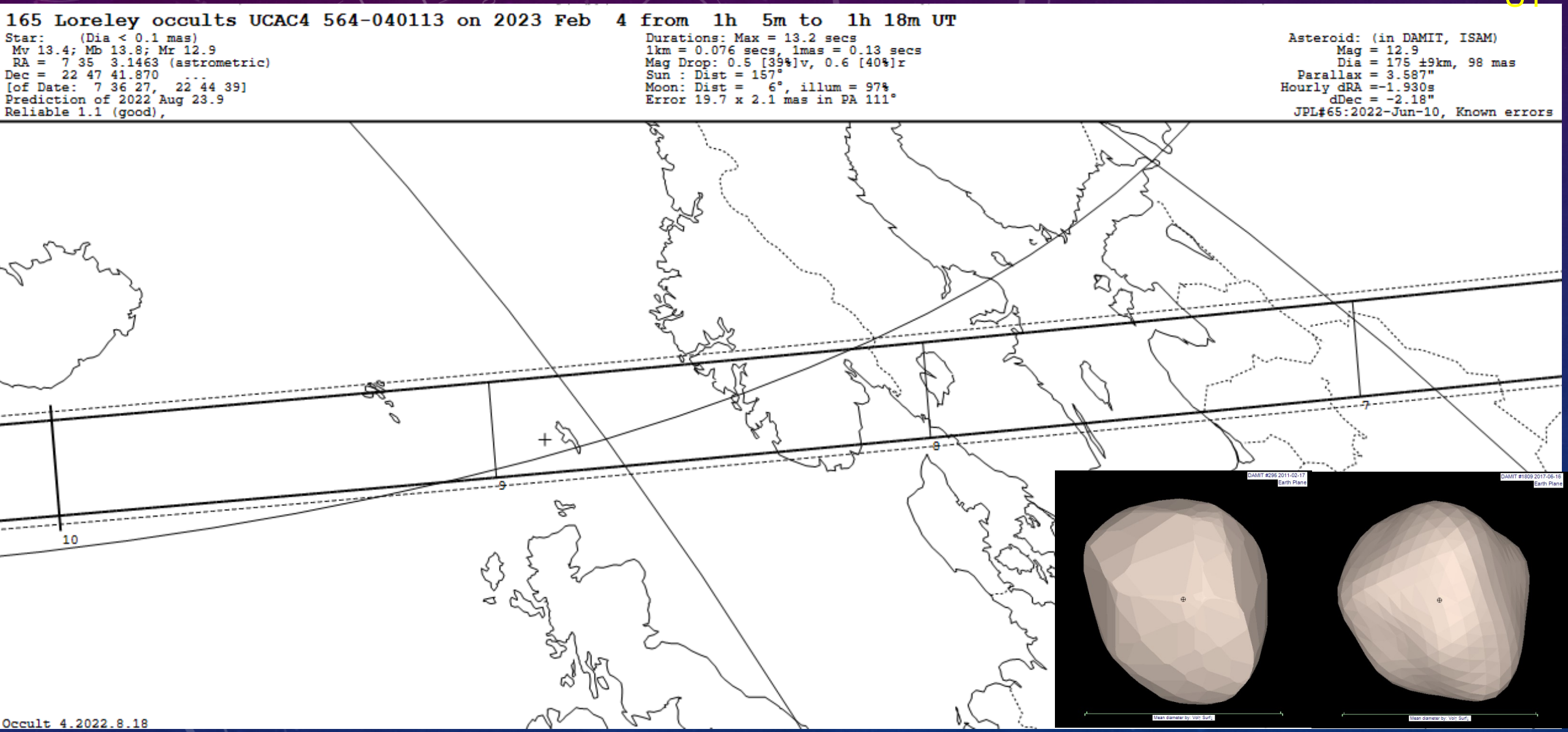
Possible Satelliete

Robert Jones in CA observed a secondary event.

JIŘÍ KUBÁNEK, IOTA/ES

(165) Loreley, comb. 12,4 mag / 13,2 s / drop 0,5 mag

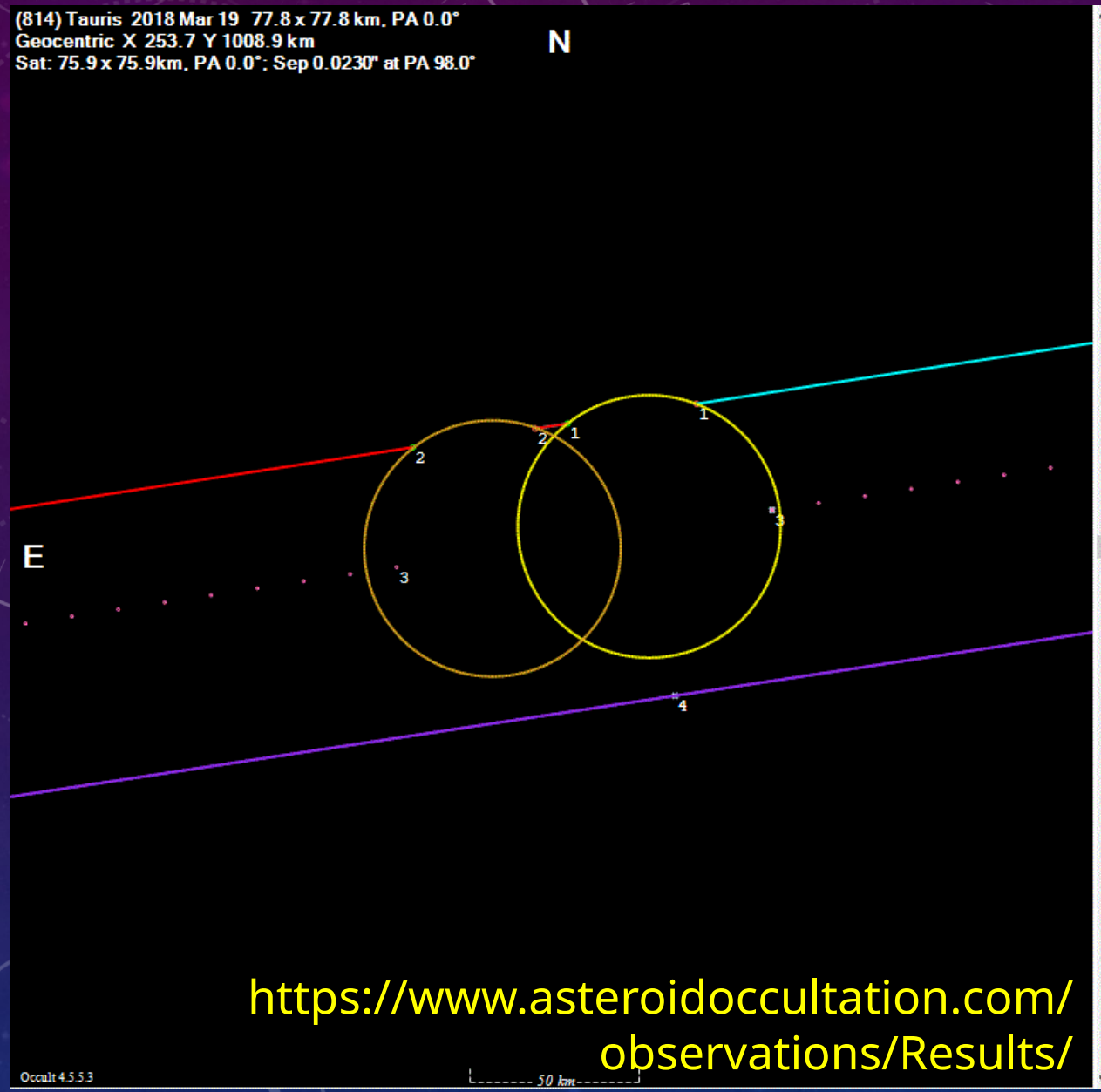
2023 Feb 04, 01:07 UT

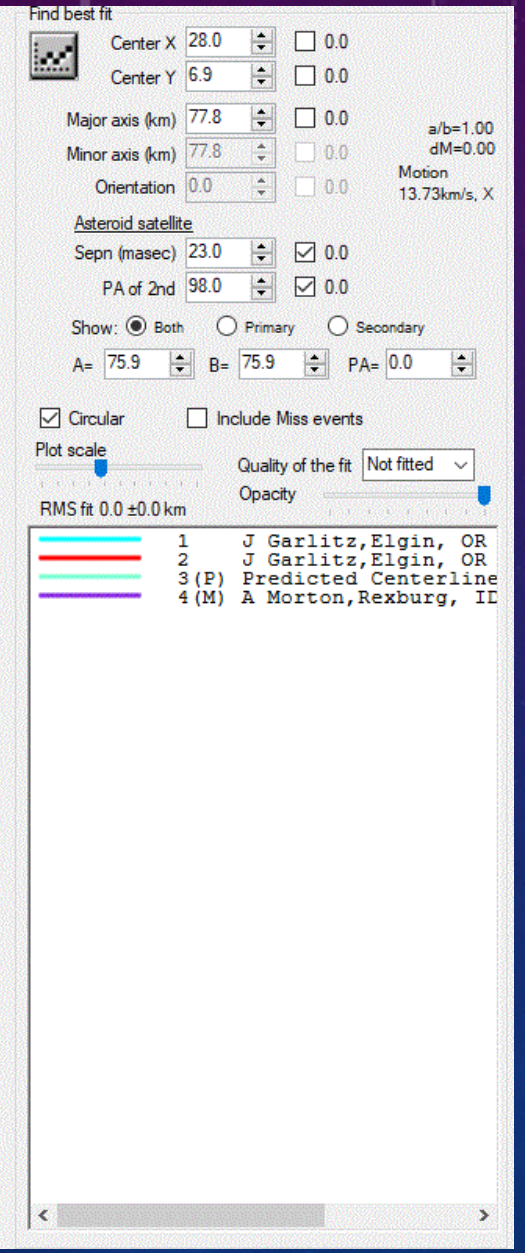


JIŘÍ KUBÁNEK, IOTA/ES

(814) Tauris, comb. 9,1 mag / 8,1 s / drop 5,3 mag

2018 Mar 19, 07:19 UT, North America





„Lobed“ asteroid.

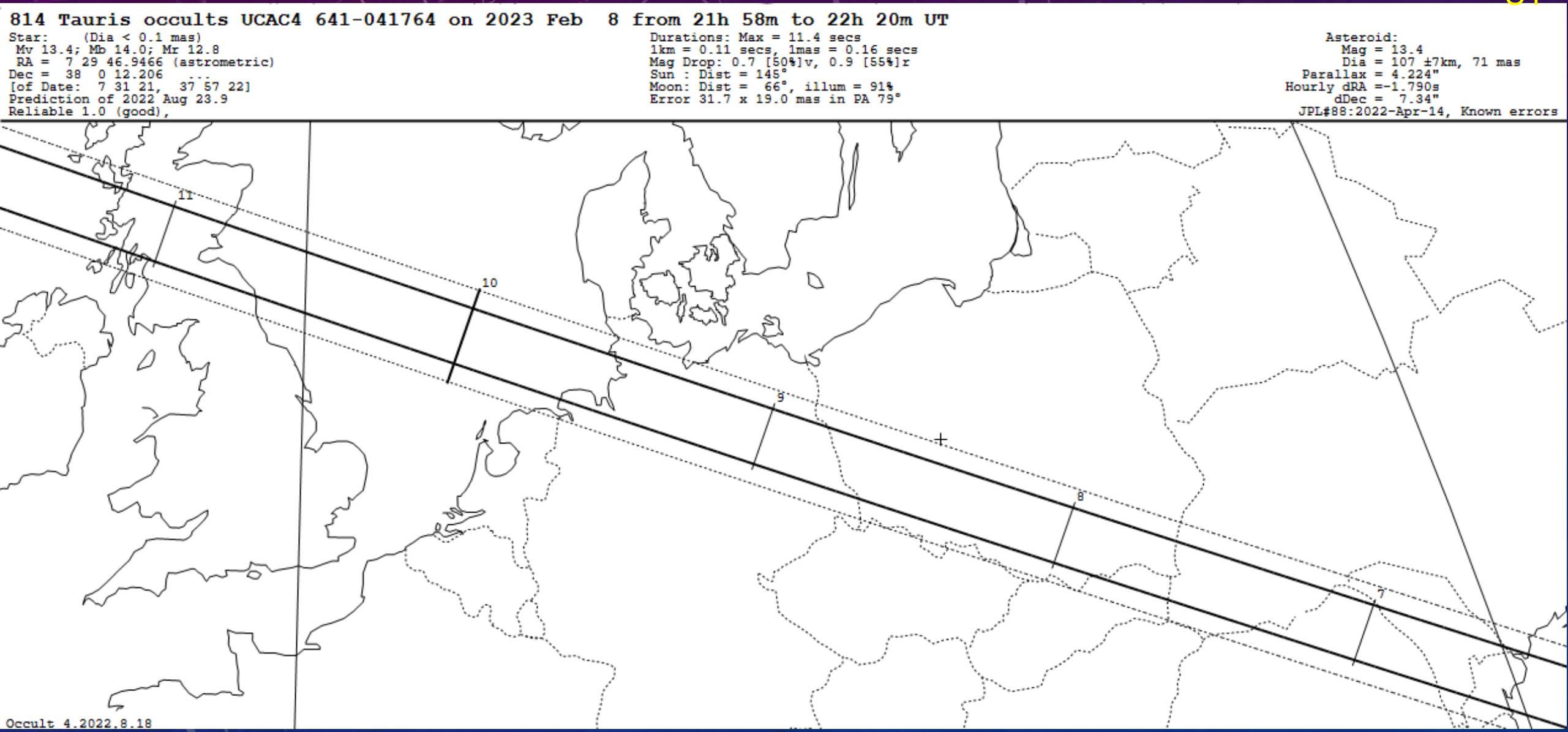
Joe Garlitz in OR observed 2xD and 2xR.

https://www.asteroidoccultation.com/observations/Results/

JIŘÍ KUBÁNEK, IOTA/ES

(814) Tauris, comb. 12,7 mag / 11,4 s / drop 0,7 mag

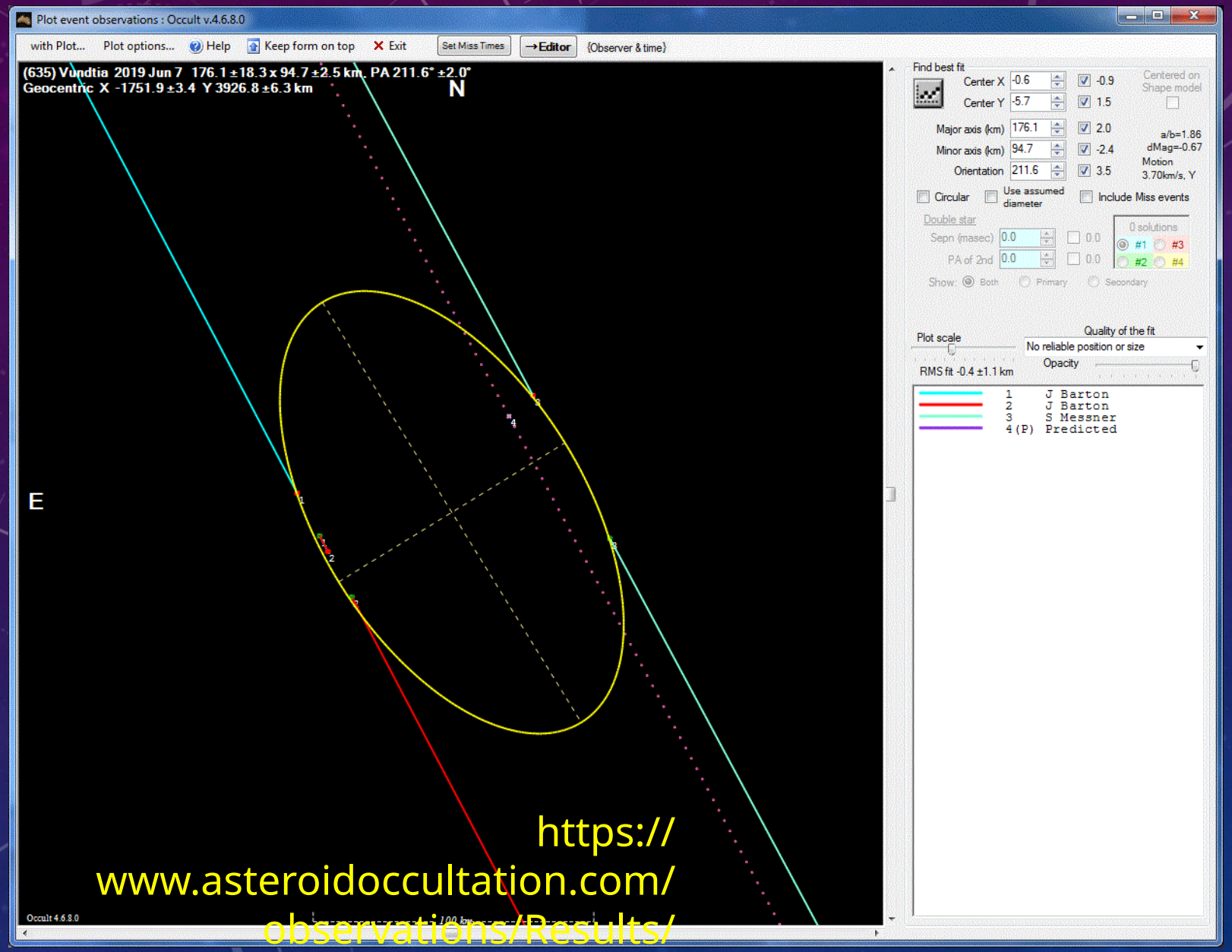
2023 Feb 08, 22:06 UT



JIŘÍ KUBÁNEK, IOTA/ES

(635) Vundtia, comb. 11,7 mag / 23,2 s / drop 2,8 mag

2019 Jun 19, 09:20
UT, North America



https://www.asteroidoccultation.com/observations/Results/

Possible concavity

Johnny Barton in TX observed 2xD and 2xR.

JIŘÍ KUBÁNEK, IOTA/ES

(635) Vundtia, comb. 12,8 mag / 8,3 s / drop 1,5 mag

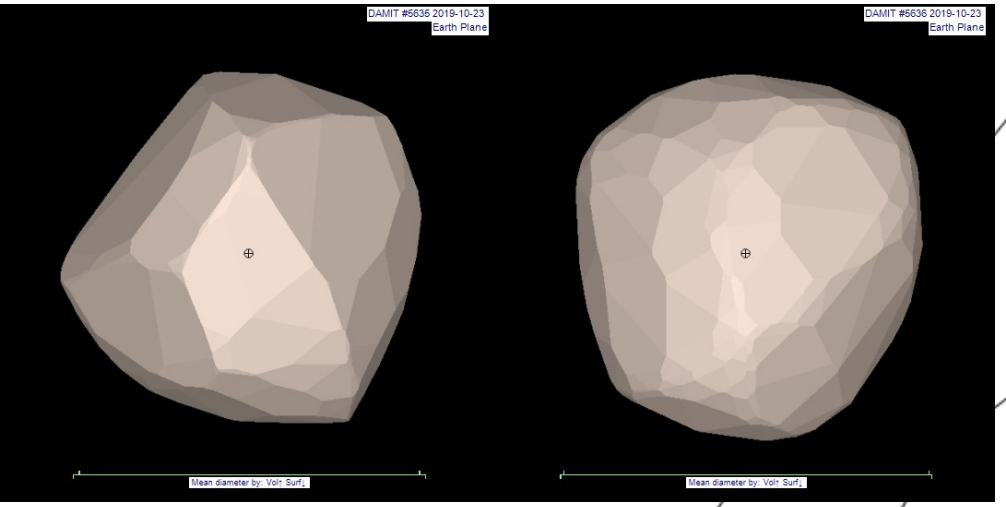
2023 Mar 23, 21:38 UT

635 Vundtia occults UCAC4 418-058484 on 2023 Mar 23 from 21h 22m to 21h 40m UT

Star: (Dia < 0.1 mas)
Mv 13.1; Mb 13.5; Mr 12.6
RA = 13 53 6.3447 (astrometric)
Dec = - 6 28 13.326 ...
[of Date: 13 54 20, - 6 35 10]
Prediction of 2022 Aug 23.9
Reliable 1.0 (good),

Durations: Max = 8.3 secs
1km = 0.083 secs, 1mas = 0.15 secs
Mag Drop: 1.5 [74%]v, 1.5 [75%]r
Sun : Dist = 154°
Moon: Dist = 175°, illum = 6%
Error 23.7 x 2.0 mas in PA 101°

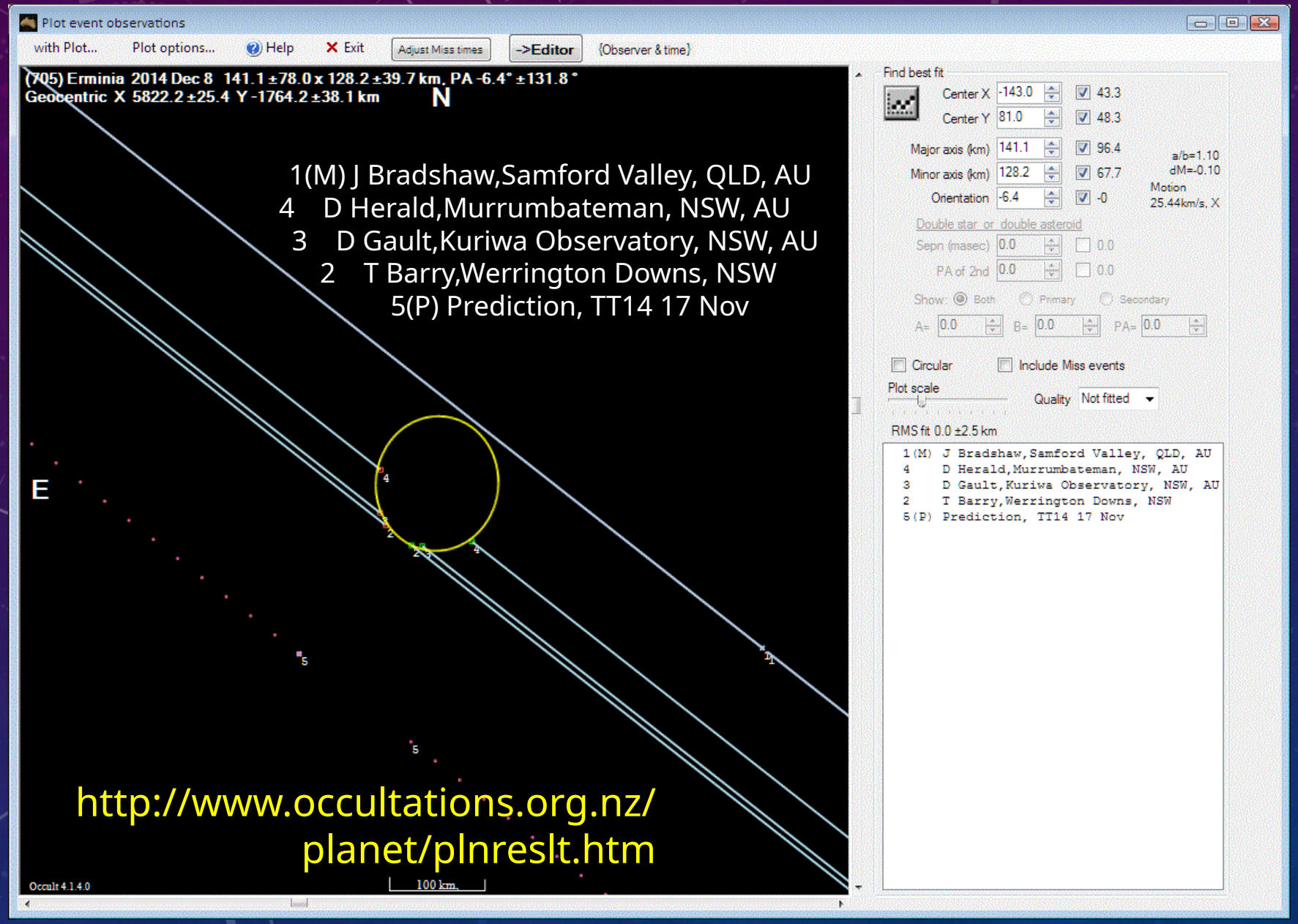
Asteroid: (in DAMIT)
Mag = 14.3
Dia = 100 ±5km, 57 mas
Parallax = 3.619"
Hourly dRA =-1.285s
dDec = 15.44"
JPL#107:2022-Aug-03, Known errors



JIŘÍ KUBÁNEK, IOTA/ES

(705) Erminia, comb. 12,8 mag / 4,6 s / drop 1,5 mag

2014 Dec 08, 11:11
UT, Australia



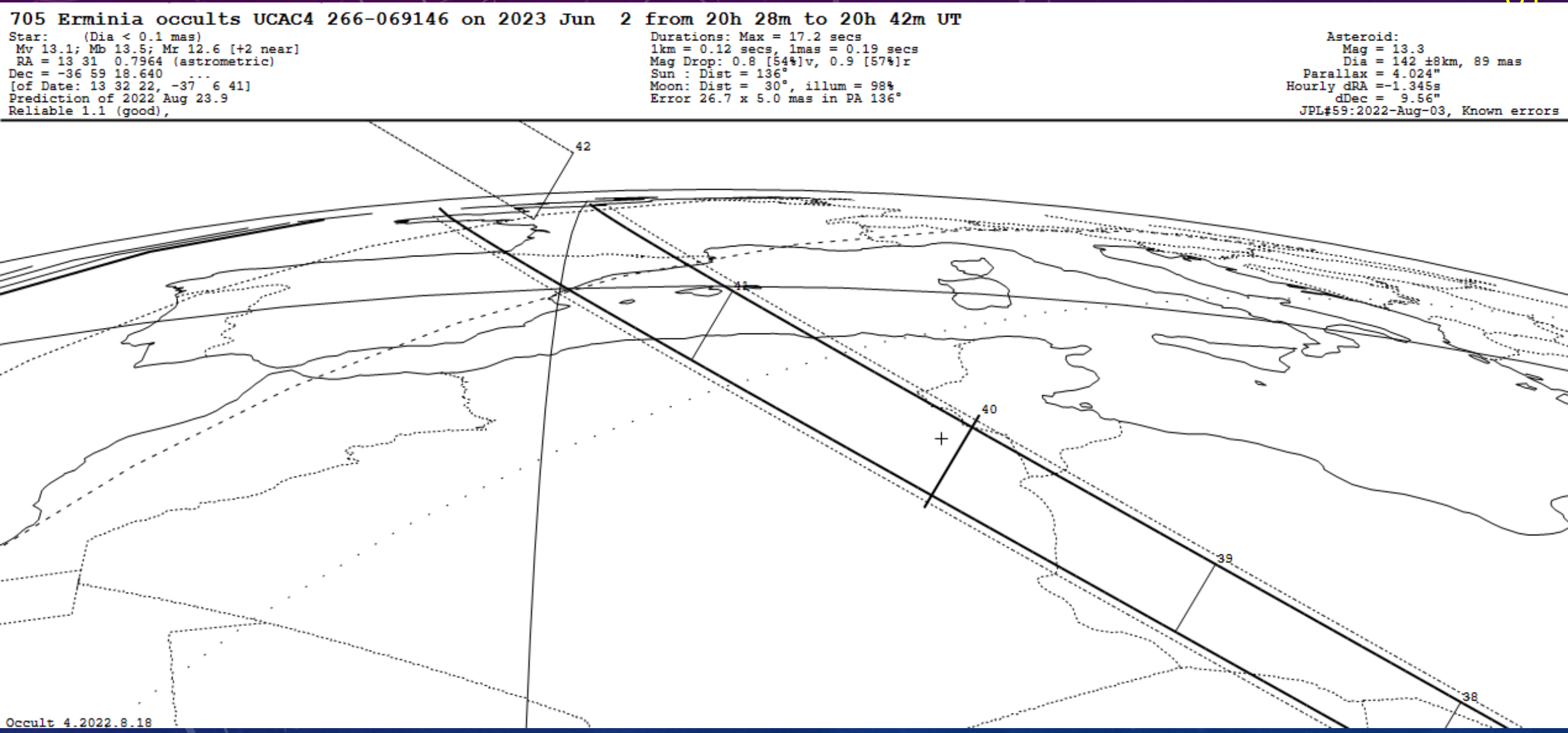
Possible Satellite

Jonathan Bradshaw in QLD observed a positive out of main body.
Minimum size of a possible satellite is about 6 to 10 km.

JIŘÍ KUBÁNEK, IOTA/ES

(705) Erminia, comb. 12,5 mag / 17,2 s / drop 0,8 mag

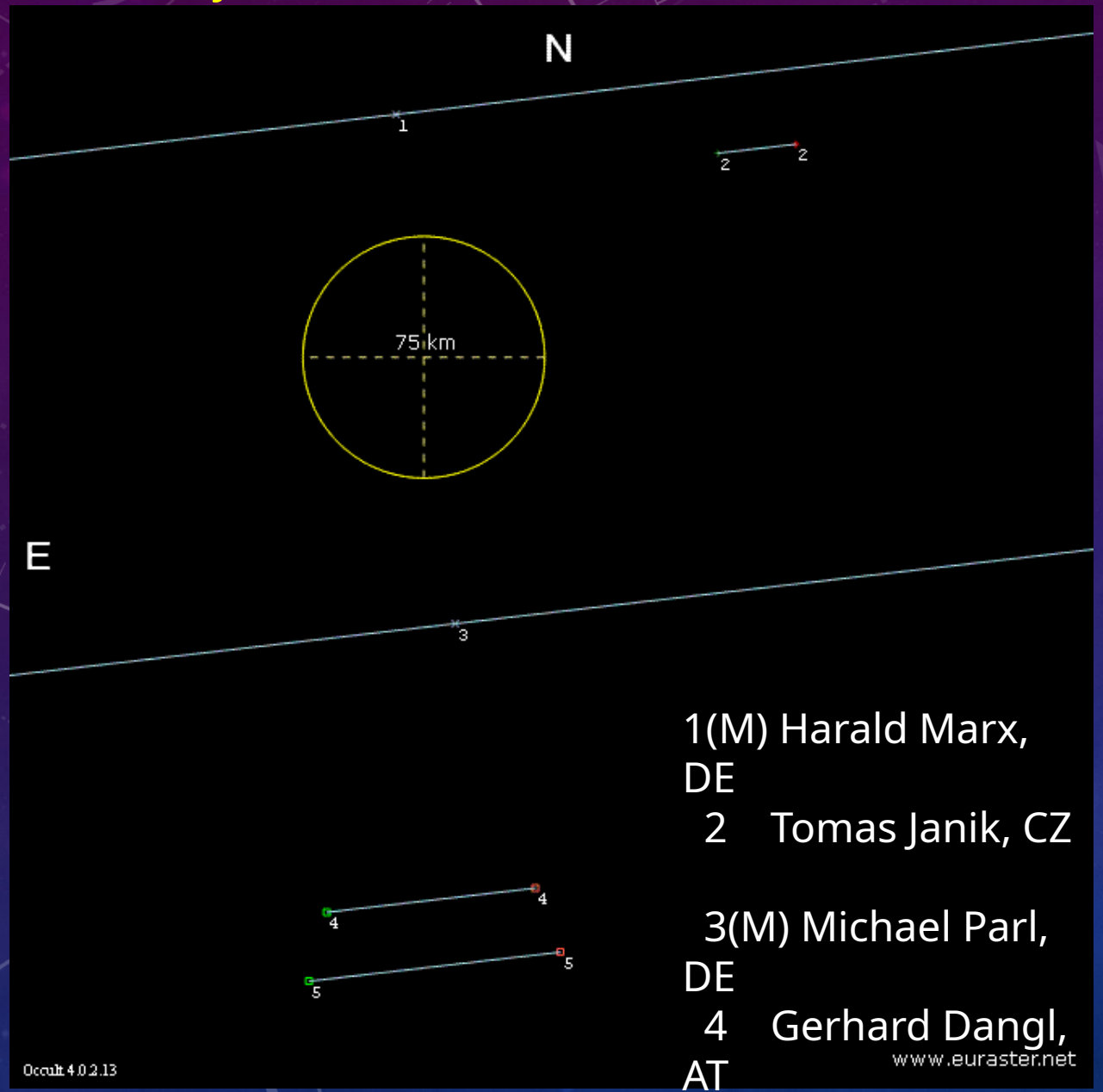
2023 Jun 02, 20:39 UT



JIŘÍ KUBÁNEK, IOTA/ES

(595) Polyxena

2008 Feb 03, 18:58 UT, Europe



1(M) Harald Marx, DE
2 Tomas Janik, CZ

3(M) Michael Parl, DE
4 Gerhard Dangl, AT
5 Herbert Raab,

```
2008/02/03 | 595 | Polyxena | TYC 2989-01266-1
potential stations W, E (O. Kloes)
chords, observer list
asteroid measurement: at least 78 km

O- | Harald Marx          | 18:53:40 | 19:04:43 | M350  | VIS | DE | E  09 11 51.0
O- | Michael Parl         | 18:53:00 | 19:03:00 | M203  | VID | DE | E  11 39 30.5
O? | Tomas Janik          | 18:57:59 | 19:00:49 | M200  | VIS | CZ | E  14 00 09
 1.67 | 18:58:31.97 | 0.2  | 18:58:33.64 | 0.5  | RAD++ | 0.5  | 0.7  | A |
Observer surprised by D in the 3 sigma zone. Technical interruption 18:59:22/32.
Not consistent with the other observations.|;
O+ | Herbert Raab         | 18:56:40 | 19:00:40 | M200  | VID | AT | E  14 13 41.8
 5.40 | 18:58:49.92 | 0.12 | 18:58:55.32 | 0.12 | GPS++ |      |      |   |;
O+ | Gerhard Dangl        | 18:55:04 | 19:02:02 | M254  | VID | AT | E  15 14 07.7
 4.48 | 18:58:44.57 | 0.08 | 18:58:49.05 | 0.08 | GPS++ |      |      |   |;
```

http://www.euraster.net/results/

Possible Satelliete

Tomáš Janík in CZ was a positive out of main body.

JIŘÍ KUBÁNEK, IOTA/ES

(595) Polyxena, comb. 11,8 mag / 11,7 s / drop 1,3 mag

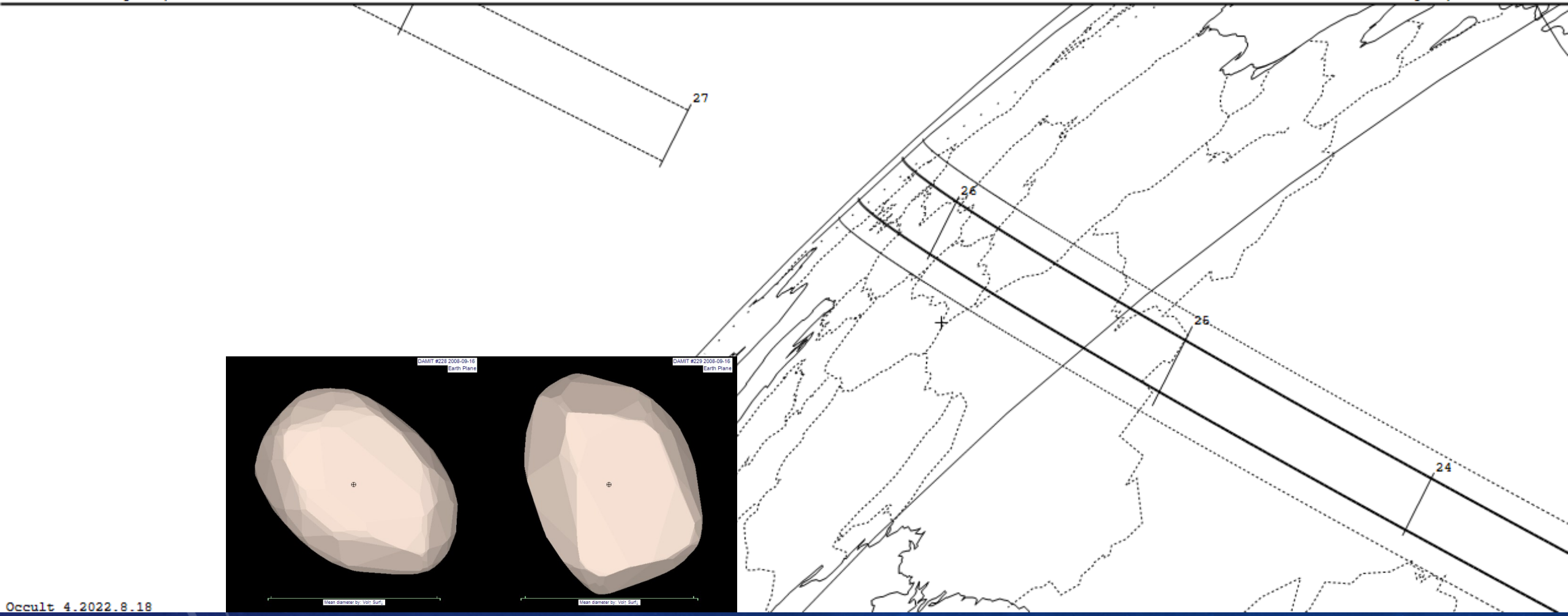
2023 Sep 25, 19:25 UT

595 Polyxena occults UCAC4 553-005449 on 2023 Sep 25 from 19h 4m to 19h 27m UT

Star: (Dia < 0.1 mas)
Mv 12.3; Mb 12.6; Mr 11.7
RA = 2 48 51.4421 (astrometric)
Dec = 20 29 3.700 ...
[of Date: 2 50 13, 20 35 2]
Prediction of 2022 Aug 23.9
Reliable 1.2 (good),

Durations: Max = 11.7 secs
1km = 0.11 secs, 1mas = 0.19 secs
Mag Drop: 1.3 [69%]v, 1.3 [70%]r
Sun : Dist = 136°
Moon: Dist = 95°, illum = 82%
Error 30.3 x 4.7 mas in PA 55°

Asteroid: (in DAMIT, ISAM)
Mag = 13.1
Dia = 104 ±5km, 60 mas
Parallax = 3.667"
Hourly dRA =-1.177s
dDec = 8.35"
JPL#95:2022-Aug-01, Known errors

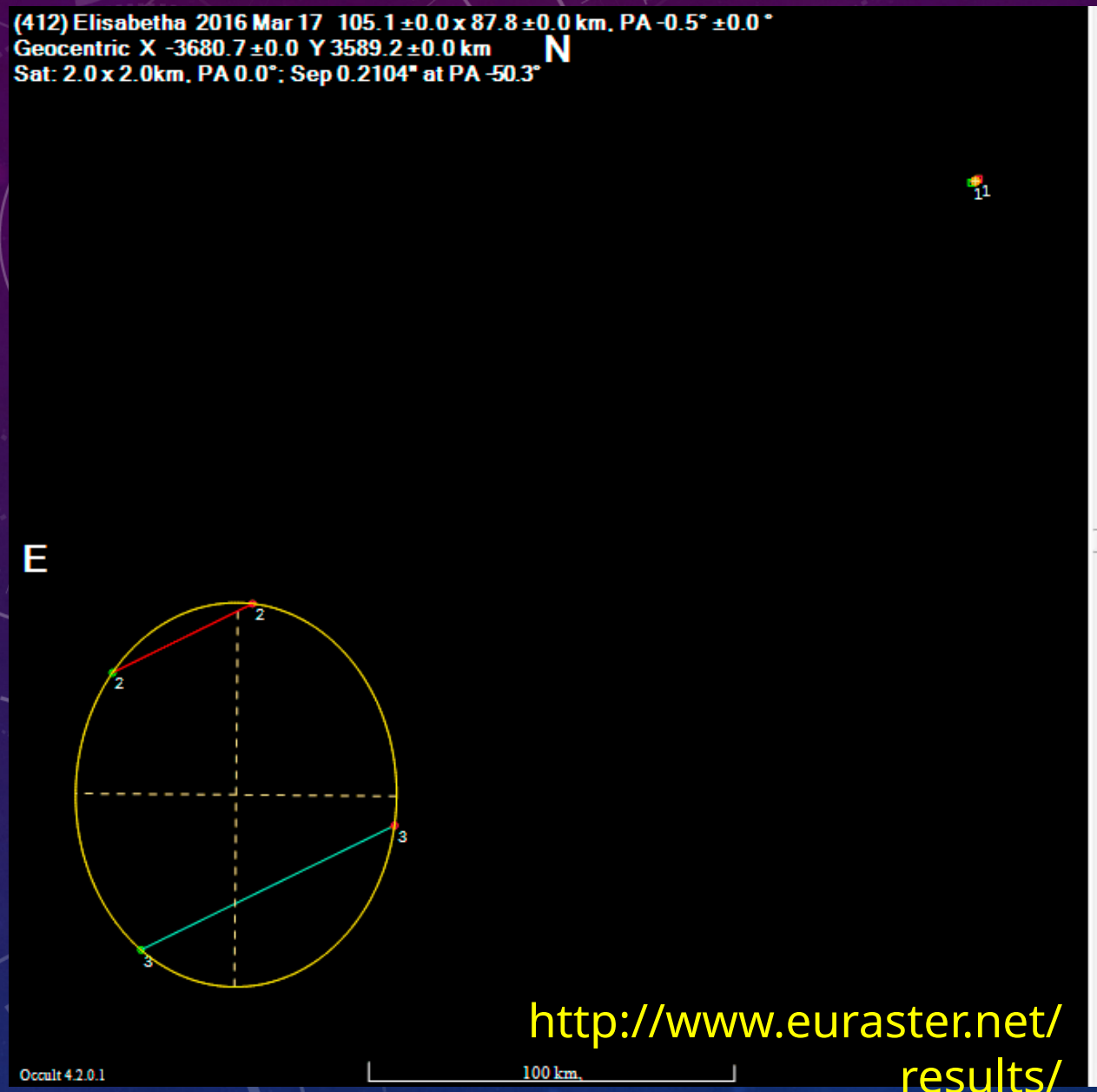


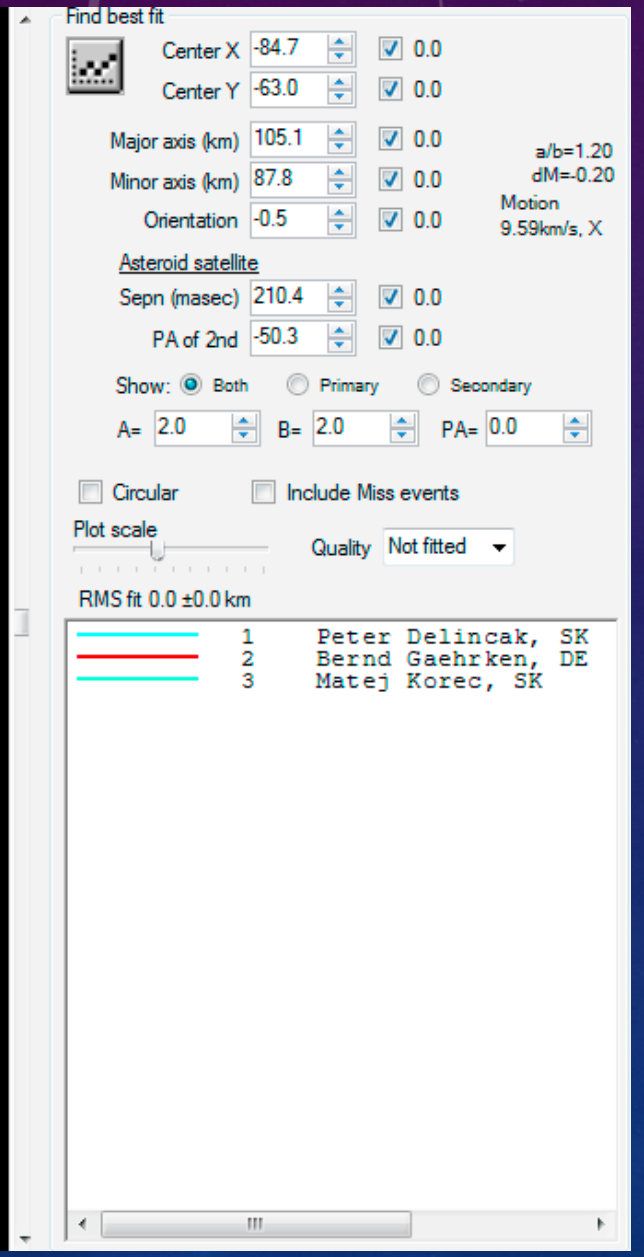
Occult 4.2022.8.18

JIŘÍ KUBÁNEK, IOTA/ES

(412) Elisabetha

2016 Mar 17, 17:46
UT, Europe





Possible Satelliete

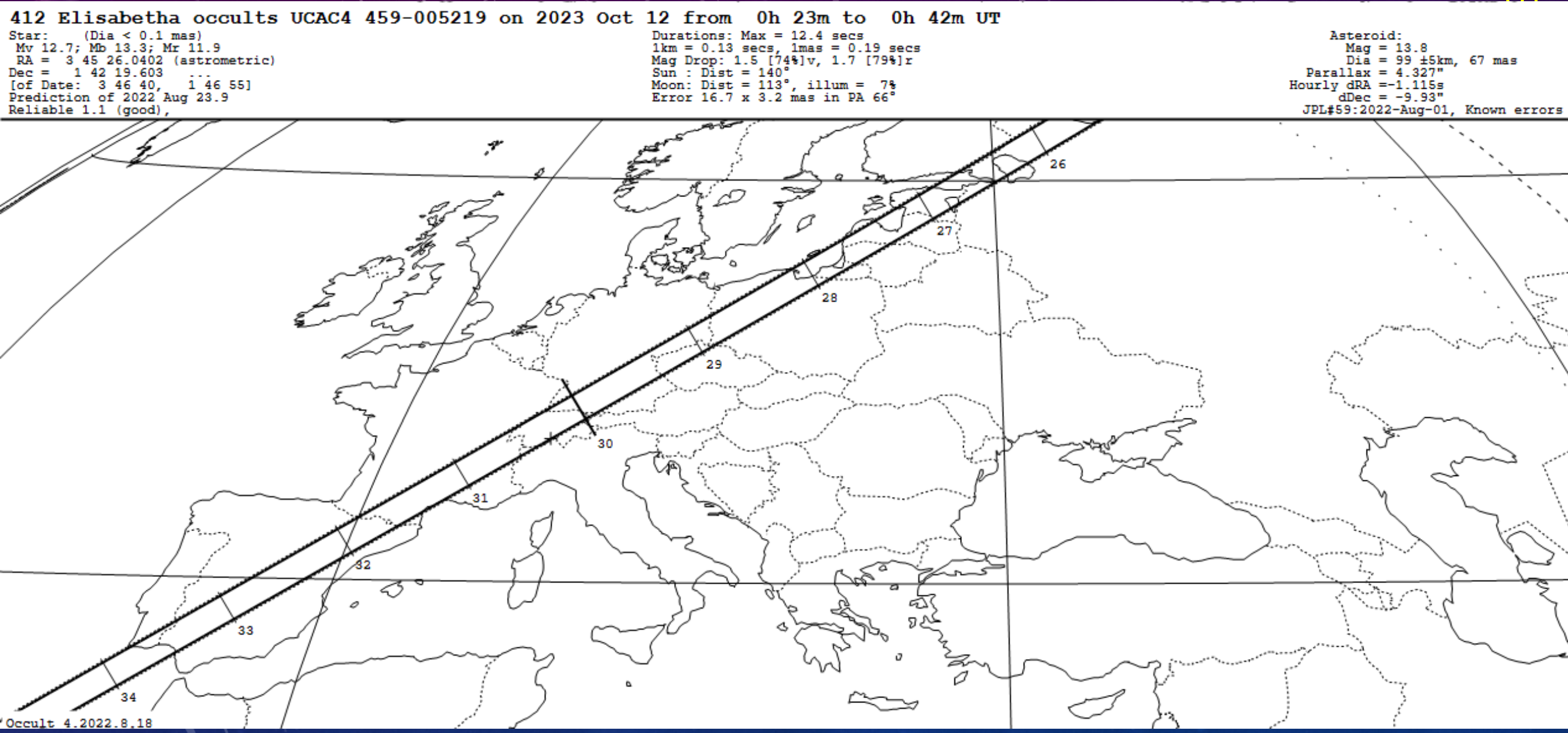
Peter Delinčák in SK was a positive out of main body.

http://www.euraster.net/results/

JIŘÍ KUBÁNEK, IOTA/ES

(412) Elisabetha, comb. 12,3 mag / 12,4 s / drop 1,5 mag

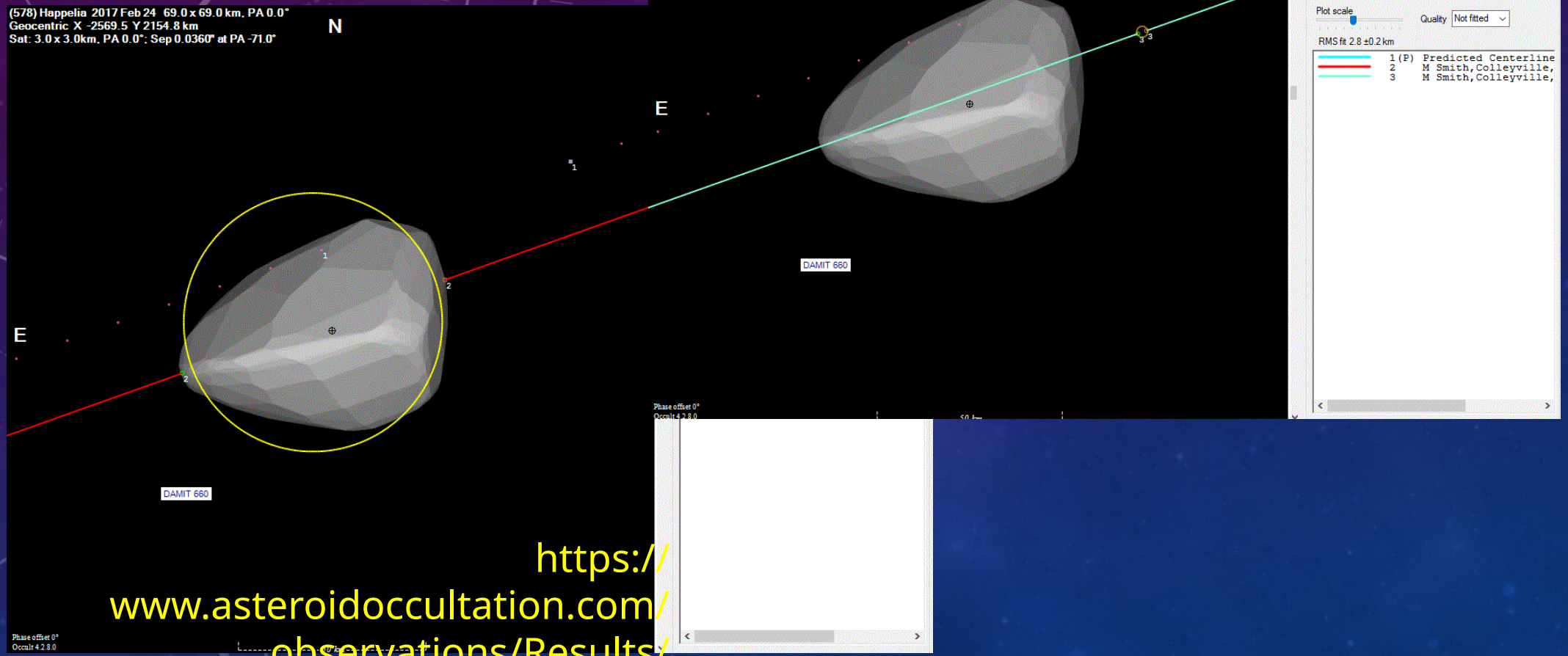
2023 Oct 12, 00:26 UT



JIŘÍ KUBÁNEK, IOTA/ES

(578) Happelia, comb. 11,7 mag / 4,9 s / drop 2,0 mag

2017 Feb 24, 05:10 UT, North America



Possible Satelliete

Mark Smith in TX observed a secondary event.

https://www.asteroidoccultation.com/observations/Results/

JIŘÍ KUBÁNEK, IOTA/ES

(578) Happelia, comb. 12,7 mag / 11,5 s / drop 0,5 mag

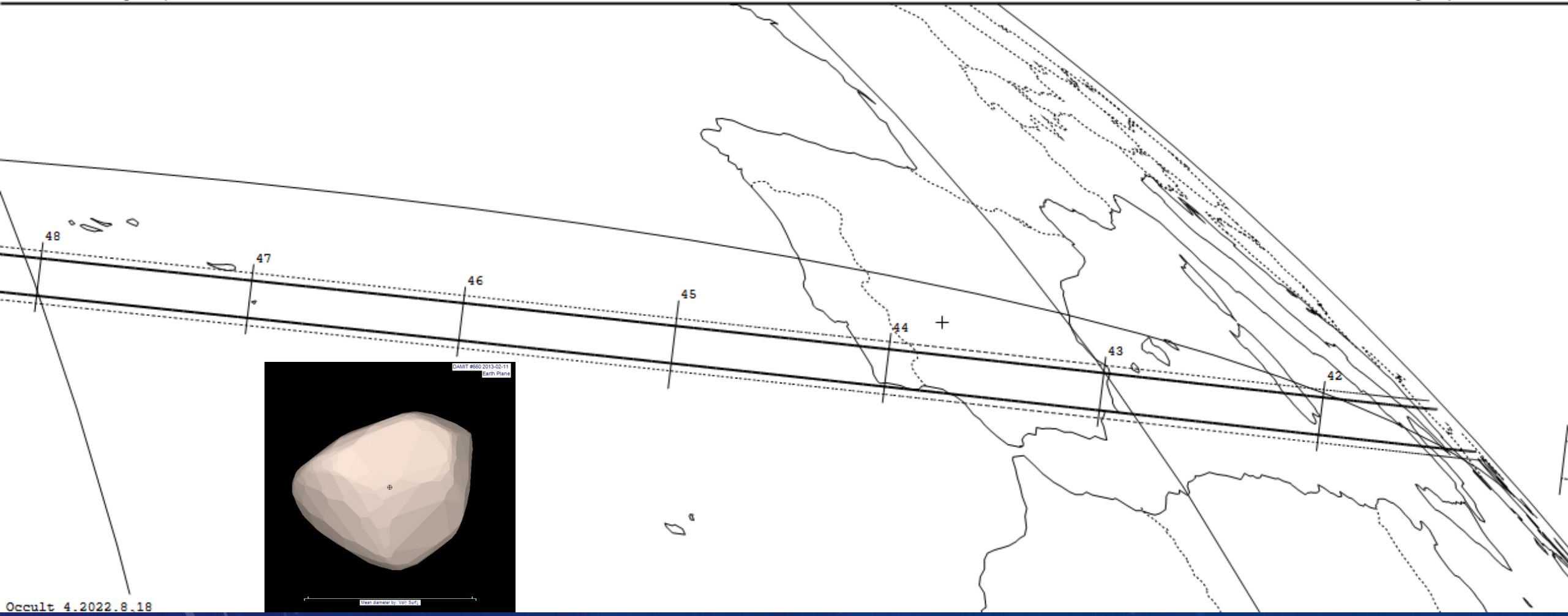
2023 Oct 12, 01:41 UT

578 Happelia occults UCAC4 400-138407 on 2023 Oct 12 from 1h 41m to 2h 5m UT

Star: (Dia < 0.1 mas)
Mv 13.7; Mb 14.1; Mr 13.1
RA = 23 15 45.5101 (astrometric)
Dec = -10 11 37.431 ...
[of Date: 23 17 0, -10 3 48]
Prediction of 2022 Aug 23.9
Reliable 1.0 (good),

Durations: Max = 11.5 secs
1km = 0.17 secs, 1mas = 0.19 secs
Mag Drop: 0.5 [40%]v, 0.6 [42%]r
Sun : Dist = 147°
Moon: Dist = 177°, illum = 7%
Error 23.3 x 1.2 mas in PA 64°

Asteroid: (in DAMIT, ISAM)
Mag = 13.2
Dia = 68 ±4km, 60 mas
Parallax = 5.614"
Hourly dRA =-1.260s
dDec = 2.25"
JPL#128:2022-Aug-01, Known errors



JIŘÍ KUBÁNEK, IOTA/ES

Other events in 2023 of interesting asteroids from past observations

Date	Asteroid	Comb. Mag	Max. dur. (s)	Drop (mag)	Location (path and 1-sigma)	Past observation	Strange
7 January 03:05 UT	(885) Ulrike	14,3	3,5	2,0	DZ, MA, Lanzarote	2020, Pierre Le Cam in FR	Poss. bilobated shape
15 February 20:26 UT	(686) Gersuind	12,6	3,9	2,2	NO, SE, FI	2018, Andrea Manna in CH	Double body?
24 February 21:32 UT	(2494) Inge	14,3	5,1	2,2	PT, ES, DZ, TN	2016, Stefano Sposetti in CH	Close binary or elongated body?
15 March 00:26 UT	(934) Thuringia	13,5	3,5	1,2	La Gomera, Tenerife, Gran Canaria, EH, MR, DZ	2021, K. Halíř, T. Janík in CZ, 22 W. Stewart	Concave topographic features
30 October 20:11 UT	(57291) 2001 QQ172	10,8	0,77	7,7	UK, FR, ES, Madeira, Porto Santo (lower accuracy)	2022 Apr 17, Peter Nosál in SK	Close binary asteroid? Concave topographic feature on elongated body?
21	(776)	11,2	15,6	0,4	UA, MD, PL, SK, CZ,	2011, Peter	Poss. Satellite

3. Other asteroids

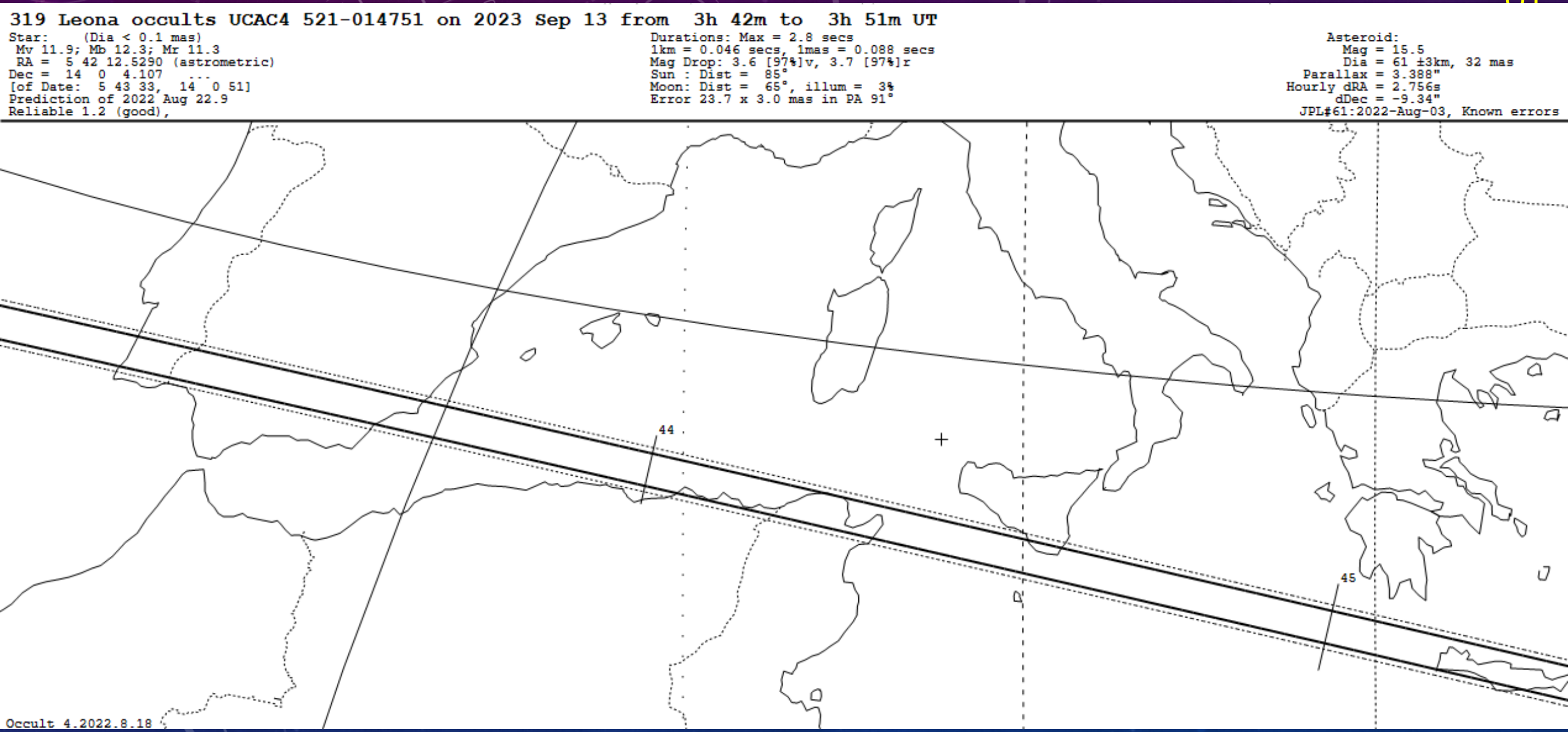
C: Occultations by (319) Leona before the event with Betelgeuse

We can get some profiles.

2 events chosen and 8 supplementary.

(319) Leona, comb. 11,9 mag / 2,8 s / drop 3,6 mag

2023 Sep 13, 03:43 UT



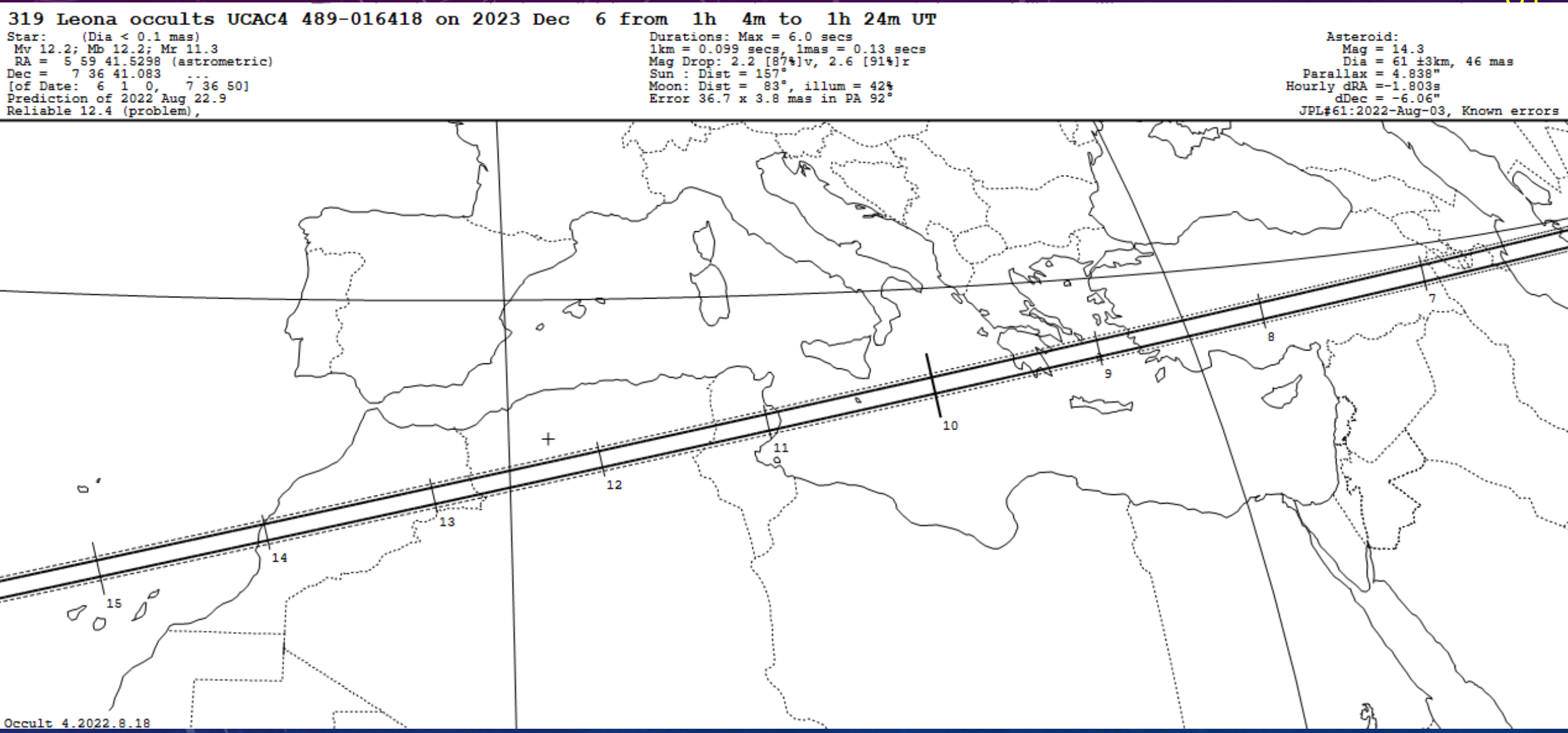
JIŘÍ KUBÁNEK, IOTA/ES

Supplementary events of Leona in 2023 until December 12

Date	Time	Comb. Mag	Max. dur. (s)	Drop (mag)	Location (path and 1-sigma)
28 October 2023	20:33 UT	13,7	10,3	1,2	PL (low altitude)
29 October 2023	00:27 UT	14,1	10,3	0,8	IS, DK, UK, DE, PL, CZ, SK, HU, RO, BG, GR, TR
15 November 2023	05:10 UT	14,25	9,6	0,35	IT, FR, MC, ES, PT
19 November 2023	02:08 UT	14,41	8,6	0,19	IS
19 November 2023	02:08 UT	13,9	8,6	0,7	NO, FI, SE, UK

(319) Leona, comb. 12,1 mag / 6,0 s / drop 2,2 mag

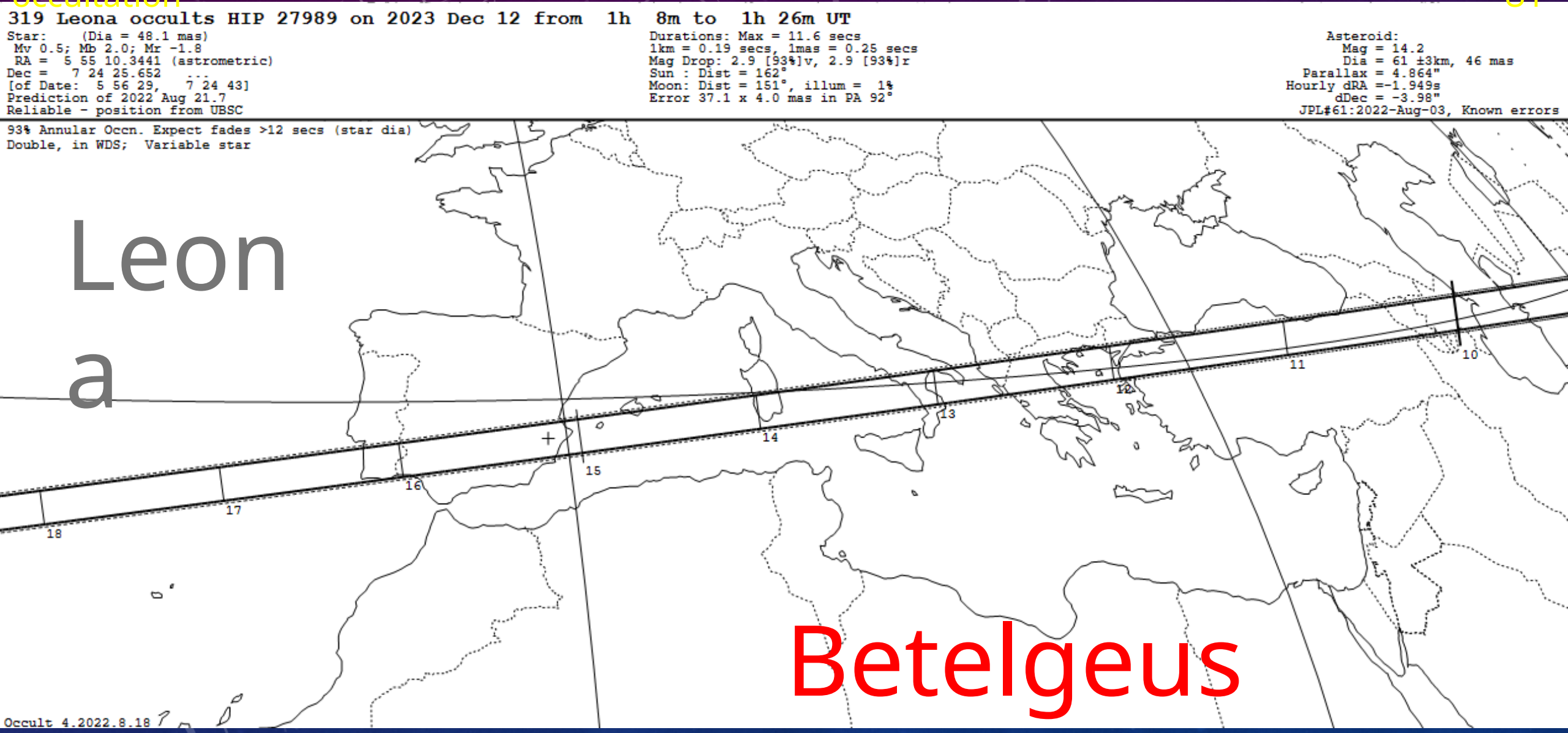
2023 Dec 06, 01:08 UT



JIŘÍ KUBÁNEK, IOTA/ES

(319) Leona, comb. 0,5 mag / 11,6 s / drop 2,9 mag – annular occultation

2023 Dec 12, 01:08 UT



JIŘÍ KUBÁNEK, IOTA/ES

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Thanks for your attention!

OCCULTATIONS BY ASTEROIDS - HIGHLIGHTS FOR EUROPE IN 2023

JIŘÍ KUBÁNEK, EFP ESOP XLI, GRANADA, 10-11 SEPTEMBER 2022

INTERNATIONAL OCCULTATION TIMING ASSOCIATION / EUROPEAN SECTION

CZECH ASTRONOMICAL SOCIETY – OCCULTATION AND TIMING SECTION