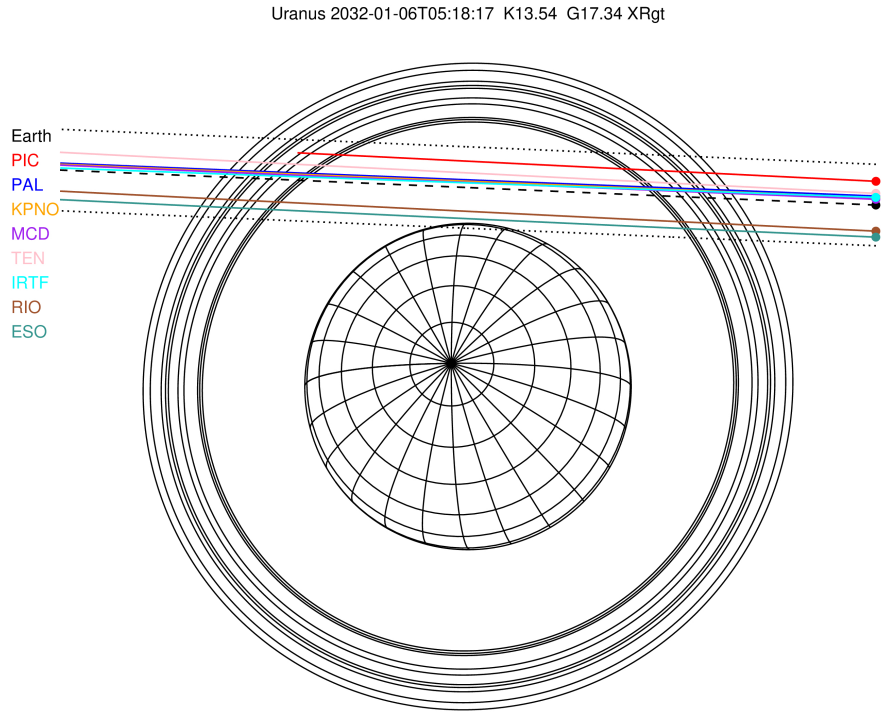
Stellar occultation prediction by rfrench@wellesley.edu Sun Jun 25 00:24:32 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:18:17.370
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232

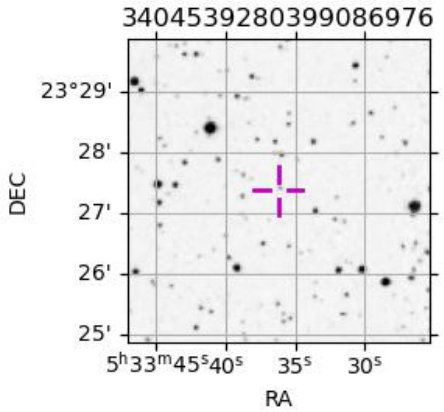
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 114.51
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82

#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon

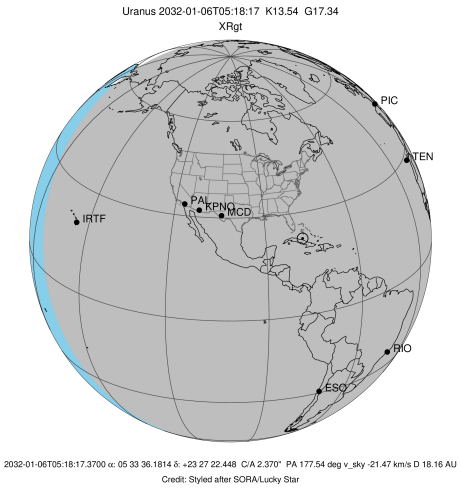


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

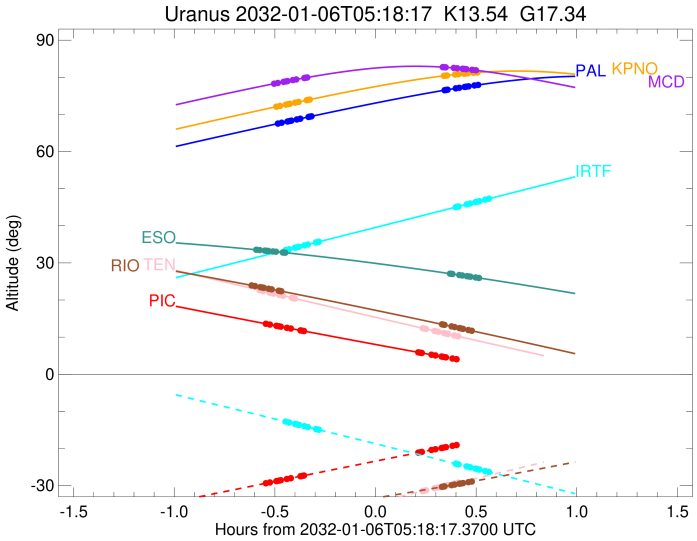
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	++++++++++		+++++	JAN 06 04:45 - JAN 06 05:36	PnnRie
PAL	Palomar Mt (200")	33.4	243.1	++++++++++		++++++++++	JAN 06 04:49 - JAN 06 05:48	PnnRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	++++++++++		++++++++++	JAN 06 04:48 - JAN 06 05:48	PnnRie
MCD	McDonald Obs. 2.7m	30.7	256.0	++++++++++		++++++++++	JAN 06 04:47 - JAN 06 05:47	PnnRie
TEN	Teide Obs./Tenerife	28.3	343.5	++++++++++		++++++++++	JAN 06 04:43 - JAN 06 05:42	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5	++++++++++		++++++++++	JAN 06 04:51 - JAN 06 05:51	PnnRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	++++++++++		++++++++++	JAN 06 04:41 - JAN 06 05:46	PnnRie
ESO	European Southern Obs	-29.3	289.3	++++++++++		++++++++++	JAN 06 04:42 - JAN 06 05:48	PnnRie
AAT	Siding Spring (AAT)	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



Uranus_2032-01-06T05_18_17.3700_PIC.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:15:55 2023



target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:14:24.690
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : PIC
Location : Pic du Midi
Latitude (deg) : 42.93656
E. Longitude (deg) : 0.14231
Altitude (km) : 2.890
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 114.90
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.675
C/A sky separation (km) : 35240.3
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

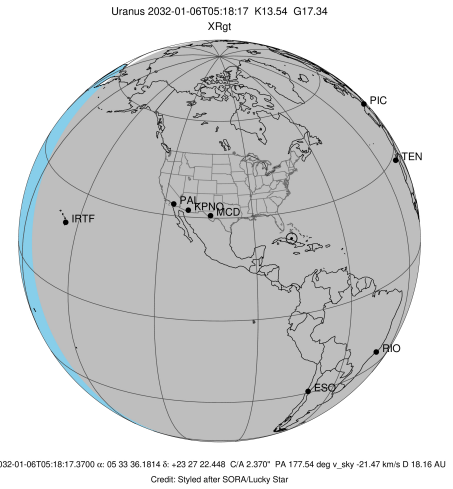
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:45:24.588		13.63	-29.40	51331.47	-15.45		
lambda	I	2032-01-06T04:46:49.506		13.39	-29.14	50026.71	-15.17		
delta	I	2032-01-06T04:48:45.489		13.05	-28.78	48300.35	-14.59		
gamma	I	2032-01-06T04:49:31.944		12.92	-28.64	47628.32	-14.34		
eta	I	2032-01-06T04:50:03.671		12.83	-28.55	47176.12	-14.16		
beta	I	2032-01-06T04:51:51.658		12.52	-28.22	45680.48	-13.52		
alpha	I	2032-01-06T04:53:02.507		12.31	-28.00	44737.68	-13.06		
4	I	2032-01-06T04:55:55.575		11.82	-27.48	42578.97	-11.86		
5	I	2032-01-06T04:56:31.379		11.71	-27.37	42162.95	-11.57		
6	I	2032-01-06T04:57:01.677		11.63	-27.27	41813.40	-11.30		

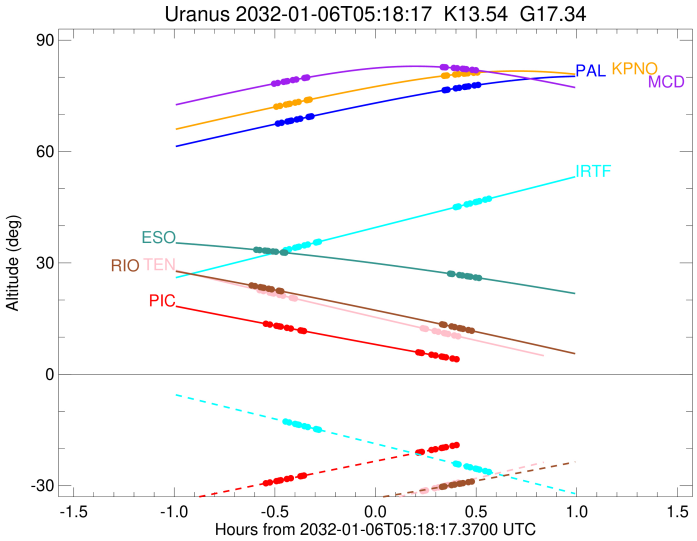
No planet occultations

6	E	2032-01-06T05:30:56.715		5.92	-21.13	41795.09	11.28		
5	E	2032-01-06T05:31:35.264		5.82	-21.01	42236.26	11.54		
4	E	2032-01-06T05:32:08.485		5.73	-20.91	42615.31	11.83		
alpha	E	2032-01-06T05:34:55.573		5.27	-20.41	44696.69	13.02		
beta	E	2032-01-06T05:36:08.369		5.07	-20.19	45659.98	13.48		
eta	E	2032-01-06T05:37:58.208		4.78x	-19.87	47176.12	14.11		
gamma	E	2032-01-06T05:38:30.265		4.69x	-19.77	47631.37	14.29		
delta	E	2032-01-06T05:39:16.683		4.56x	-19.63	48300.35	14.53		
lambda	E	2032-01-06T05:41:13.132		4.25x	-19.29	50026.71	15.11		
epsilon	E	2032-01-06T05:42:02.781		4.11x	-19.14	50782.39	15.38		

Uranus_2032-01-06T05_18_17.3700_PAL.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:18:01 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:19:25.620
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : PAL
Location : Palomar Mt (200")
Latitude (deg) : 33.35622
E. Longitude (deg) : 243.13601
Altitude (km) : 1.706
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 115.22
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.455
C/A sky separation (km) : 32335.1
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk





b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

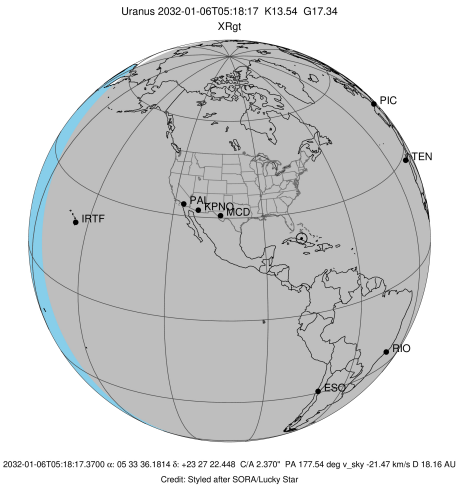
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:48:59.524		67.49	-48.32	51355.60	-16.85		
lambda	I	2032-01-06T04:50:18.662		67.75	-48.60	50026.71	-16.63		
delta	I	2032-01-06T04:52:03.863		68.10	-48.97	48300.35	-16.18		
gamma	I	2032-01-06T04:52:45.675		68.23	-49.11	47627.93	-15.99		
eta	I	2032-01-06T04:53:14.064		68.33	-49.21	47176.12	-15.85		
beta	I	2032-01-06T04:54:49.885		68.64	-49.54	45680.88	-15.35		
alpha	I	2032-01-06T04:55:51.822		68.84	-49.76	44740.18	-15.00		
4	I	2032-01-06T04:58:20.570		69.32	-50.28	42574.20	-14.11		
5	I	2032-01-06T04:58:50.343		69.42	-50.38	42159.54	-13.89		
6	I	2032-01-06T04:59:14.979		69.50	-50.47	41817.50	-13.70		

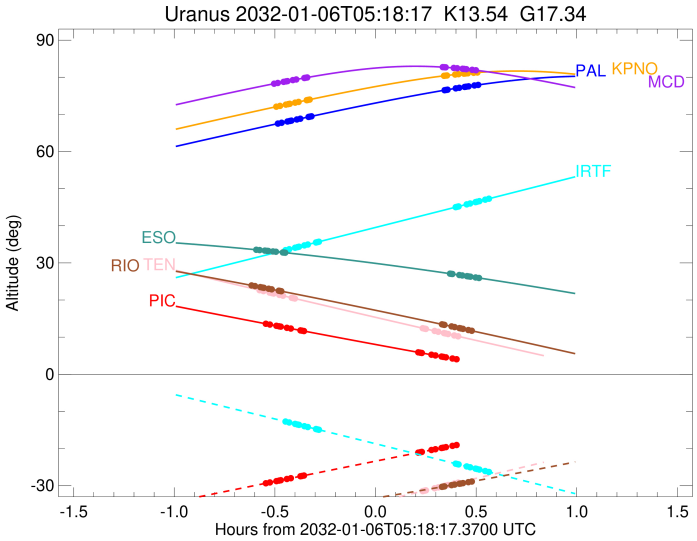
No planet occultations

6	E	2032-01-06T05:38:48.911		76.51	-58.66	41796.15	13.71		
5	E	2032-01-06T05:39:21.525		76.59	-58.78	42246.40	13.90		
4	E	2032-01-06T05:39:48.538		76.66	-58.87	42616.28	14.12		
alpha	E	2032-01-06T05:42:10.872		77.02	-59.35	44693.98	15.01		
beta	E	2032-01-06T05:43:14.422		77.17	-59.57	45657.89	15.37		
eta	E	2032-01-06T05:44:51.616		77.40	-59.90	47176.12	15.86		
gamma	E	2032-01-06T05:45:20.185		77.47	-60.00	47631.20	16.00		
delta	E	2032-01-06T05:46:01.756		77.56	-60.14	48300.35	16.19		
lambda	E	2032-01-06T05:47:46.859		77.80	-60.50	50026.71	16.65		
epsilon	E	2032-01-06T05:48:31.198		77.90	-60.65	50768.93	16.87		

Uranus_2032-01-06T05_18_17.3700_KPNO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:22:19 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:19:03.940
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : KPNO
Location : Kitt Peak Natl Obs
Latitude (deg) : 31.96333
E. Longitude (deg) : 248.40000
Altitude (km) : 2.120
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 115.27
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.439
C/A sky separation (km) : 32122.4
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk





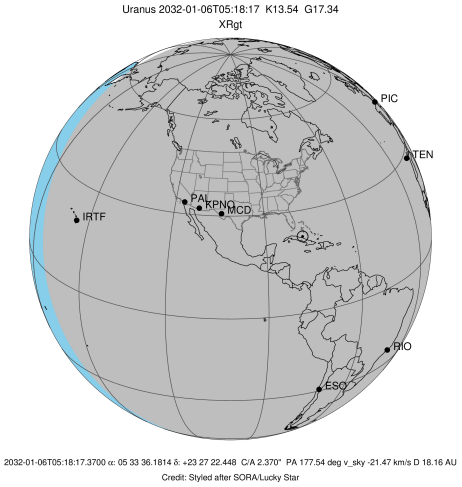
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:48:31.275		72.04	-52.74	51357.70	-16.94		
lambda	I	2032-01-06T04:49:50.101		72.30	-53.02	50026.71	-16.73		
delta	I	2032-01-06T04:51:34.670		72.64	-53.39	48300.35	-16.28		
gamma	I	2032-01-06T04:52:16.214		72.77	-53.53	47627.90	-16.09		
eta	I	2032-01-06T04:52:44.409		72.86	-53.63	47176.12	-15.96		
beta	I	2032-01-06T04:54:19.538		73.17	-53.97	45680.91	-15.47		
alpha	I	2032-01-06T04:55:20.974		73.36	-54.18	44740.37	-15.12		
4	I	2032-01-06T04:57:48.410		73.83	-54.70	42573.82	-14.25		
5	I	2032-01-06T04:58:17.860		73.93	-54.81	42159.31	-14.04		
6	I	2032-01-06T04:58:42.198		74.00	-54.89	41817.83	-13.85		

No planet occultations

6	E	2032-01-06T05:38:38.803		80.39	-63.26	41796.23	13.86		
5	E	2032-01-06T05:39:11.118		80.45	-63.37	42246.99	14.05		
4	E	2032-01-06T05:39:37.820		80.50	-63.47	42616.32	14.26		
alpha	E	2032-01-06T05:41:58.888		80.74	-63.95	44693.83	15.13		
beta	E	2032-01-06T05:43:01.955		80.84	-64.17	45657.76	15.48		
eta	E	2032-01-06T05:44:38.488		80.98	-64.50	47176.12	15.96		
gamma	E	2032-01-06T05:45:06.873		81.02	-64.60	47631.20	16.10		
delta	E	2032-01-06T05:45:48.190		81.08	-64.74	48300.35	16.29		
lambda	E	2032-01-06T05:47:32.701		81.21	-65.09	50026.71	16.74		
epsilon	E	2032-01-06T05:48:16.768		81.26	-65.24	50768.25	16.95		

Uranus_2032-01-06T05_18_17.3700_MCD.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:24:31 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2032-01-06T05:18:30.570
Event type              : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code           : MCD
Location                : McDonald Obs. 2.7m
Latitude (deg)          :  30.67158
E. Longitude (deg)      : 255.97844
Altitude (km)           :   2.075
Gaia source ID          : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor)     :   1.16
K magnitude             : 13.542
G magnitude             : 17.344
RP magnitude            : 16.140
BP magnitude            : 18.871
DUPflag                 : 0
Distance (au)           : 18.162
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -21.46
Sun-Target sep (deg)    :  158.97
Sun-Moon sep (deg)      :  115.33
B (ring opening deg)    :   79.92
PA of pole (deg)        :   35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.423
C/A sky separation (km) :  31920.9
NAIF SPICE kernels      : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
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pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
```
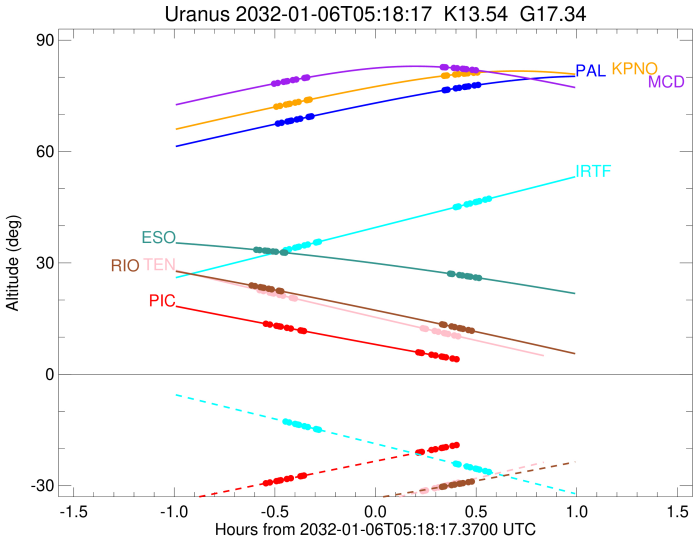



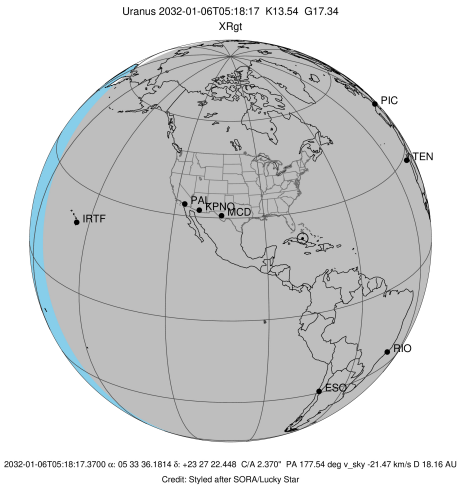
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:47:51.752		78.24	-59.18	51359.81	-17.03		
lambda	I	2032-01-06T04:49:10.291		78.47	-59.46	50026.71	-16.82		
delta	I	2032-01-06T04:50:54.267		78.77	-59.83	48300.35	-16.38		
gamma	I	2032-01-06T04:51:35.560		78.89	-59.97	47627.86	-16.19		
eta	I	2032-01-06T04:52:03.575		78.97	-60.07	47176.12	-16.06		
beta	I	2032-01-06T04:53:38.058		79.24	-60.41	45680.93	-15.58		
alpha	I	2032-01-06T04:54:39.029		79.41	-60.62	44740.57	-15.24		
4	I	2032-01-06T04:57:05.254		79.81	-61.14	42573.45	-14.38		
5	I	2032-01-06T04:57:34.406		79.89	-61.25	42159.09	-14.18		
6	I	2032-01-06T04:57:58.469		79.95	-61.33	41818.16	-13.99		

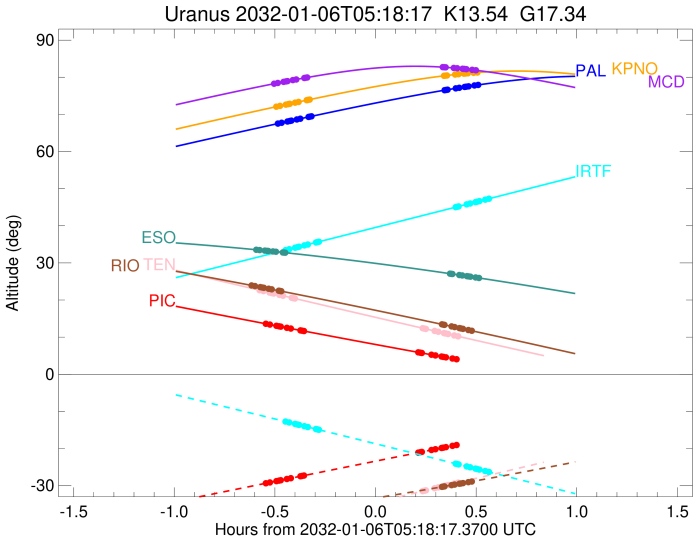
No planet occultations

6	E	2032-01-06T05:38:16.327		82.74	-69.78	41796.31	13.99		
5	E	2032-01-06T05:38:48.372		82.71	-69.89	42247.51	14.18		
4	E	2032-01-06T05:39:14.792		82.68	-69.98	42616.35	14.38		
alpha	E	2032-01-06T05:41:34.717		82.52	-70.45	44693.69	15.24		
beta	E	2032-01-06T05:42:37.348		82.44	-70.66	45657.66	15.58		
eta	E	2032-01-06T05:44:13.283		82.30	-70.99	47176.12	16.06		
gamma	E	2032-01-06T05:44:41.503		82.26	-71.08	47631.18	16.19		
delta	E	2032-01-06T05:45:22.591		82.19	-71.22	48300.35	16.38		
lambda	E	2032-01-06T05:47:06.569		82.02	-71.57	50026.71	16.82		
epsilon	E	2032-01-06T05:47:50.395		81.94	-71.71	50767.65	17.03		

Uranus_2032-01-06T05_18_17.3700_TEN.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:26:40 2023



target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:13:41.190
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : TEN
Location : Teide Obs./Tenerife
Latitude (deg) : 28.30050
E. Longitude (deg) : 343.48909
Altitude (km) : 2.395
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 115.08
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.536
C/A sky separation (km) : 33406.0
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

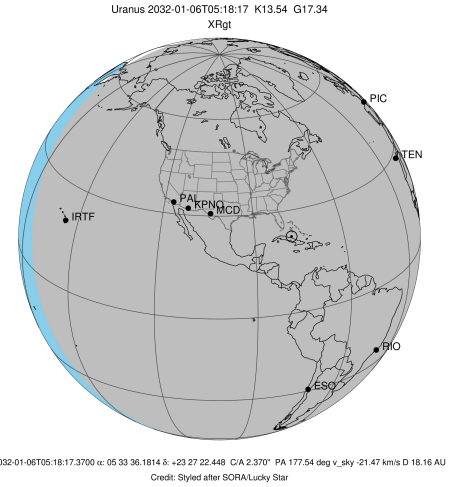
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:43:32.551		22.68	-42.13	51349.49	-16.27		
lambda	I	2032-01-06T04:44:54.209		22.39	-41.83	50026.71	-16.03		
delta	I	2032-01-06T04:46:43.585		22.01	-41.43	48300.35	-15.53		
gamma	I	2032-01-06T04:47:27.171		21.85	-41.27	47628.04	-15.32		
eta	I	2032-01-06T04:47:56.818		21.75	-41.16	47176.12	-15.17		
beta	I	2032-01-06T04:49:37.160		21.39	-40.79	45680.79	-14.63		
alpha	I	2032-01-06T04:50:42.322		21.16	-40.56	44739.50	-14.24		
4	I	2032-01-06T04:53:19.663		20.60	-39.98	42575.56	-13.25		
5	I	2032-01-06T04:53:51.470		20.49	-39.87	42160.42	-13.01		
6	I	2032-01-06T04:54:17.950		20.40	-39.77	41816.30	-12.80		

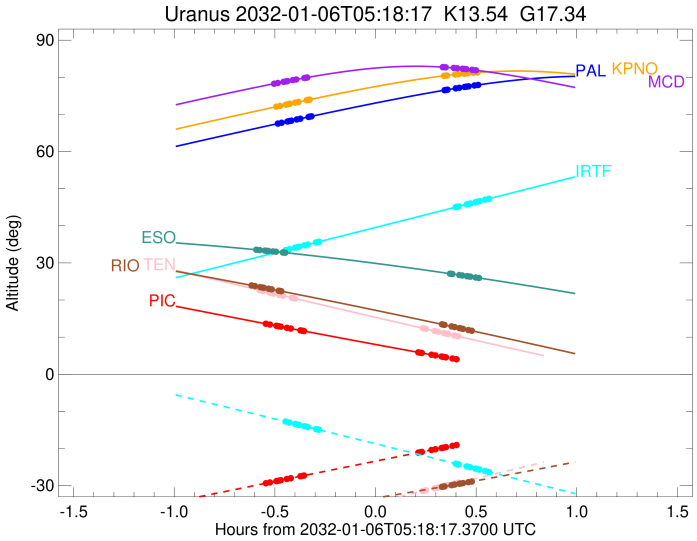
No planet occultations

6	E	2032-01-06T05:32:16.997		12.42	-31.50	41795.64	12.75		
5	E	2032-01-06T05:32:51.688		12.30	-31.37	42242.34	12.97		
4	E	2032-01-06T05:33:20.919		12.20	-31.26	42615.97	13.20		
alpha	E	2032-01-06T05:35:52.408		11.68	-30.72	44695.07	14.18		
beta	E	2032-01-06T05:36:59.545		11.45	-30.48	45658.76	14.56		
eta	E	2032-01-06T05:38:41.796		11.10	-30.11	47176.12	15.10		
gamma	E	2032-01-06T05:39:11.792		10.99	-30.00	47631.28	15.25		
delta	E	2032-01-06T05:39:55.371		10.84	-29.84	48300.35	15.46		
lambda	E	2032-01-06T05:41:45.289		10.47	-29.45	50026.71	15.95		
epsilon	E	2032-01-06T05:42:31.898		10.30	-29.28	50774.46	16.18		

Uranus_2032-01-06T05_18_17.3700_IRTF.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:28:47 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:22:11.240
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : IRTF
Location : Mauna Kea/IRTF
Latitude (deg) : 19.82622
E. Longitude (deg) : 204.52800
Altitude (km) : 4.168
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 114.75
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.419
C/A sky separation (km) : 31866.3
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk





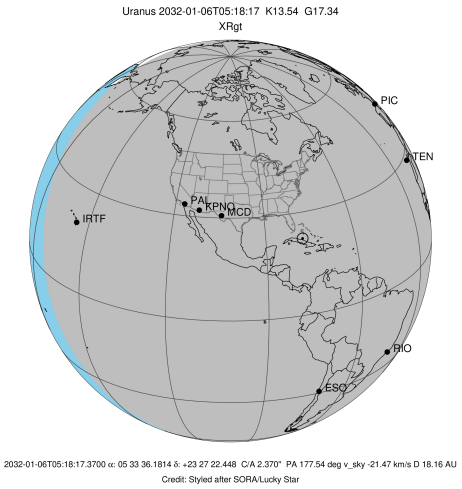
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:51:16.137		33.39	-12.70	51358.31	-16.90		
lambda	I	2032-01-06T04:52:35.198		33.69	-12.99	50026.71	-16.69		
delta	I	2032-01-06T04:54:19.958		34.09	-13.38	48300.35	-16.26		
gamma	I	2032-01-06T04:55:01.553		34.25	-13.53	47627.88	-16.08		
eta	I	2032-01-06T04:55:29.772		34.35	-13.63	47176.12	-15.94		
beta	I	2032-01-06T04:57:04.924		34.71	-13.99	45680.92	-15.47		
alpha	I	2032-01-06T04:58:06.316		34.95	-14.21	44740.47	-15.14		
4	I	2032-01-06T05:00:33.463		35.50	-14.76	42573.61	-14.30		
5	I	2032-01-06T05:01:02.800		35.62	-14.87	42159.19	-14.10		
6	I	2032-01-06T05:01:27.019		35.71	-14.96	41818.02	-13.91		

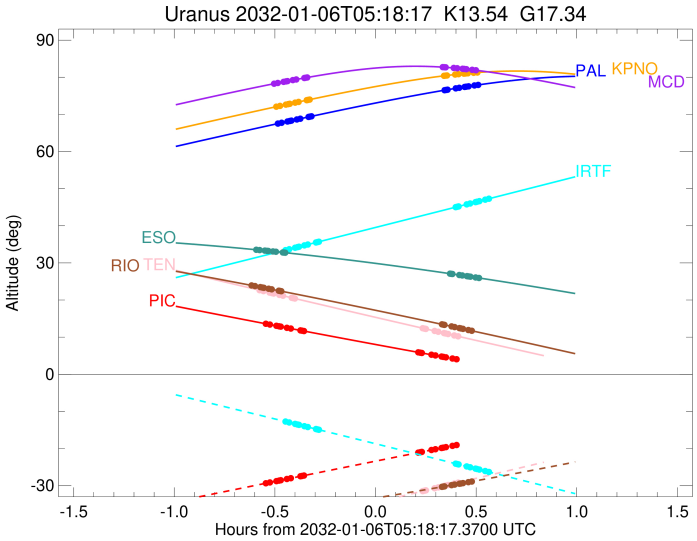
No planet occultations

6	E	2032-01-06T05:42:07.360		45.00	-24.07	41796.40	13.95		
5	E	2032-01-06T05:42:39.549		45.12	-24.19	42248.13	14.13		
4	E	2032-01-06T05:43:06.011		45.22	-24.29	42616.38	14.34		
alpha	E	2032-01-06T05:45:26.400		45.76	-24.82	44693.52	15.19		
beta	E	2032-01-06T05:46:29.258		46.00	-25.05	45657.51	15.53		
eta	E	2032-01-06T05:48:05.552		46.37	-25.41	47176.12	16.00		
gamma	E	2032-01-06T05:48:33.876		46.48	-25.52	47631.17	16.13		
delta	E	2032-01-06T05:49:15.118		46.63	-25.68	48300.35	16.32		
lambda	E	2032-01-06T05:50:59.484		47.03	-26.07	50026.71	16.76		
epsilon	E	2032-01-06T05:51:43.416		47.20	-26.23	50766.67	16.96		

Uranus_2032-01-06T05_18_17.3700_RIO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:32:59 2023




```
target                  : Uranus
target radius (km)      :  25559.00
C/A epoch               : 2032-01-06T05:14:26.870
Event type              : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code           : RIO
Location                : Rio de Janeiro
Latitude (deg)          : -22.89506
E. Longitude (deg)      : 316.77708
Altitude (km)           :   0.033
Gaia source ID          : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor)     :   1.16
K magnitude             : 13.542
G magnitude             : 17.344
RP magnitude            : 16.140
BP magnitude            : 18.871
DUPflag                 : 0
Distance (au)           : 18.162
f0 (km)                 :       0.000
g0 (km)                 :       0.000
skyplane vel. (km/s)    : -21.46
Sun-Target sep (deg)    :  158.97
Sun-Moon sep (deg)      :  115.07
B (ring opening deg)    :   79.92
PA of pole (deg)        :   35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (")  :   2.080
C/A sky separation (km) :  27394.6
NAIF SPICE kernels      : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
```



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

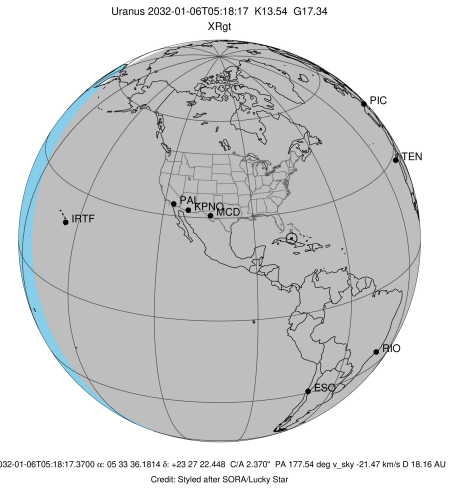
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:41:07.501		23.97	-38.26	51399.22	-18.38		
lambda	I	2032-01-06T04:42:22.310		23.75	-38.11	50026.71	-18.24		
delta	I	2032-01-06T04:43:57.726		23.48	-37.92	48300.35	-17.94		
gamma	I	2032-01-06T04:44:35.377		23.37	-37.85	47627.19	-17.82		
eta	I	2032-01-06T04:45:00.758		23.29	-37.80	47176.12	-17.73		
beta	I	2032-01-06T04:46:25.825		23.04	-37.63	45681.22	-17.41		
alpha	I	2032-01-06T04:47:19.977		22.88	-37.52	44744.07	-17.19		
4	I	2032-01-06T04:49:28.692		22.50	-37.25	42566.26	-16.64		
5	I	2032-01-06T04:49:53.476		22.43	-37.20	42155.93	-16.51		
6	I	2032-01-06T04:50:13.585		22.37	-37.16	41824.64	-16.39		

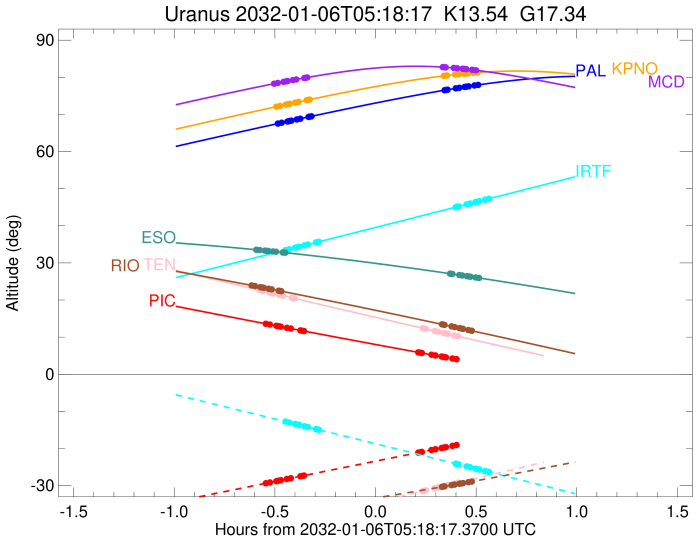
No planet occultations

6	E	2032-01-06T05:38:02.386	13.46	-30.33	41798.48	16.33		
5	E	2032-01-06T05:38:30.592	13.37	-30.26	42259.01	16.45		
4	E	2032-01-06T05:38:52.692	13.30	-30.20	42616.52	16.58		
alpha	E	2032-01-06T05:40:55.576	12.90	-29.88	44690.89	17.12		
beta	E	2032-01-06T05:41:51.631	12.72	-29.73	45655.20	17.34		
eta	E	2032-01-06T05:43:18.538	12.44	-29.49	47176.12	17.65		
gamma	E	2032-01-06T05:43:44.246	12.35	-29.42	47630.92	17.74		
delta	E	2032-01-06T05:44:21.862	12.23	-29.32	48300.35	17.86		
lambda	E	2032-01-06T05:45:57.739	11.92	-29.06	50026.71	18.15		
epsilon	E	2032-01-06T05:46:37.767	11.79	-28.96	50755.44	18.28		

Uranus_2032-01-06T05_18_17.3700_ESO.txt
Occultation predictions computed by rfrench@wellesley.edu Sun Jun 11 11:35:09 2023

target : Uranus
target radius (km) : 25559.00
C/A epoch : 2032-01-06T05:16:13.530
Event type : XRgt
: No Uranus occs
: Ring occs: geocentric, topocentric
Observer code : ESO
Location : European Southern Obs. (3.6m)
Latitude (deg) : -29.26097
E. Longitude (deg) : 289.26831
Altitude (km) : 2.400
Gaia source ID : 3404539280399086976
2Mass ID (if available) : 05333618+2327232
ICRS Star Coord at Epoch: 05h 33m 36.18138s +23:27:22.44787s
RUWE (>1.4 is poor) : 1.16
K magnitude : 13.542
G magnitude : 17.344
RP magnitude : 16.140
BP magnitude : 18.871
DUPflag : 0
Distance (au) : 18.162
f0 (km) : 0.000
g0 (km) : 0.000
skyplane vel. (km/s) : -21.46
Sun-Target sep (deg) : 158.97
Sun-Moon sep (deg) : 115.10
B (ring opening deg) : 79.92
PA of pole (deg) : 35.82
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.993
C/A sky separation (km) : 26252.8
NAIF SPICE kernels : RAJobs_U111+rgf15.spk
URKALLv1.spk
ura111.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ura111.bsp
ura161.bsp
vgr2.ura161.bsp
peph.ura160.bsp
earthstns_itrf93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk





b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2032-01-06T04:42:31.577		33.56	-38.34	51406.62	-18.77		
lambda	I	2032-01-06T04:43:45.212		33.45	-38.35	50026.71	-18.64		
delta	I	2032-01-06T04:45:18.476		33.31	-38.36	48300.35	-18.37		
gamma	I	2032-01-06T04:45:55.233		33.25	-38.36	47627.05	-18.26		
eta	I	2032-01-06T04:46:19.982		33.22	-38.36	47176.12	-18.18		
beta	I	2032-01-06T04:47:42.838		33.09	-38.36	45681.23	-17.90		
alpha	I	2032-01-06T04:48:35.452		33.01	-38.36	44744.70	-17.70		
4	I	2032-01-06T04:50:40.341		32.81	-38.36	42564.83	-17.21		
5	I	2032-01-06T04:51:04.223		32.77	-38.36	42155.54	-17.09		
6	I	2032-01-06T04:51:23.561		32.74	-38.36	41825.98	-16.98		

No planet occultations

6	E	2032-01-06T05:40:26.575		27.11	-36.87	41799.19	16.95		
5	E	2032-01-06T05:40:53.926		27.05	-36.84	42261.94	17.05		
4	E	2032-01-06T05:41:15.060		27.01	-36.82	42616.41	17.17		
alpha	E	2032-01-06T05:43:13.954		26.74	-36.71	44690.22	17.65		
beta	E	2032-01-06T05:44:08.355		26.62	-36.65	45654.55	17.85		
eta	E	2032-01-06T05:45:32.887		26.43	-36.57	47176.12	18.13		
gamma	E	2032-01-06T05:45:57.910		26.37	-36.54	47630.83	18.21		
delta	E	2032-01-06T05:46:34.561		26.29	-36.50	48300.35	18.32		
lambda	E	2032-01-06T05:48:08.090		26.08	-36.40	50026.71	18.59		
epsilon	E	2032-01-06T05:48:47.040		25.99	-36.36	50752.73	18.71		