

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-08-20T12:08:20.550
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3413060048838566016
 2Mass ID (if available) : 04481889+2222134

ICRS Star Coord at Epoch: 04h 48m 18.90319s +22:22:13.11916s

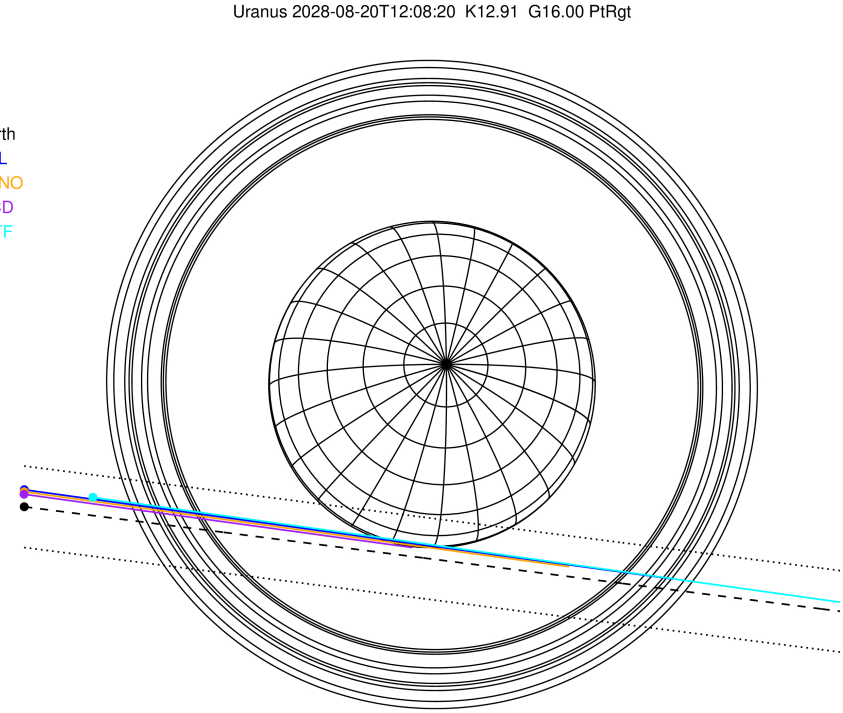
RUWE (>1.4 is poor) : 1.01
 K magnitude : 12.907
 G magnitude : 16.000
 RP magnitude : 15.068
 BP magnitude : 16.908
 DUPflag : 0
 Distance (au) : 19.566
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.47
 Sun-Target sep (deg) : 74.13
 Sun-Moon sep (deg) : 74.98
 B (ring opening deg) : 81.27
 PA of pole (deg) : -35.43

#	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



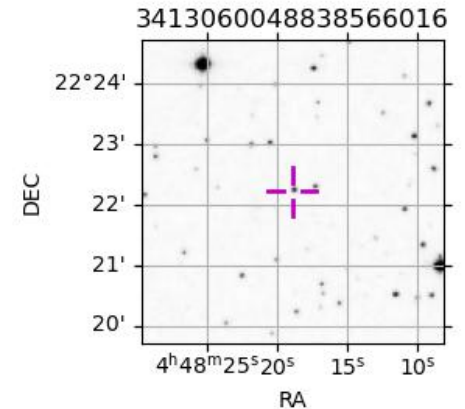
2028-08-20T12:08:20.5500 ex: 04 48 18.9032 s: +22 22 13.119 C/A 1.907 PA 352.70 deg v_sky +14.47 km/s D 19.57 AU
 Credit: Styled after SORA/Lucky Star

Earth
 PAL
 KPNO
 MCD
 IRTF



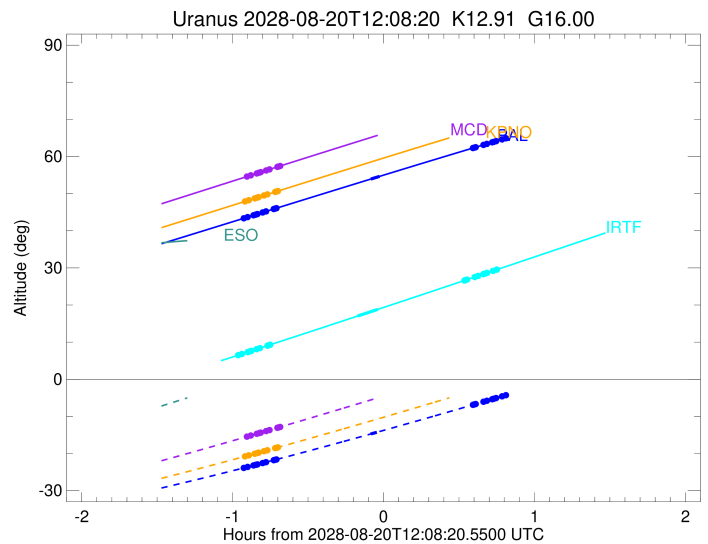
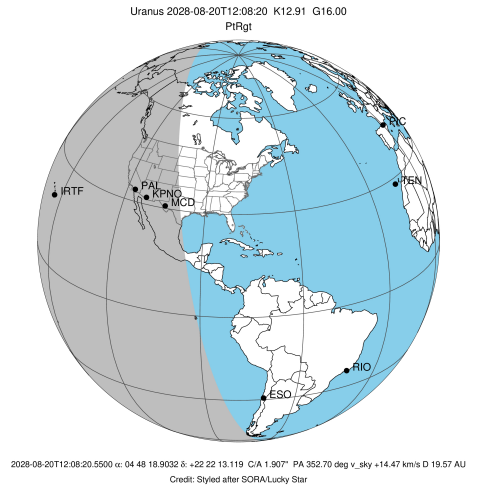
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	+++++	+ +	+++++	AUG 20 11:13 - AUG 20 12:53	PieRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++			AUG 20 11:13 - AUG 20 11:26	PnnRin
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++			AUG 20 11:14 - AUG 20 11:27	PnnRin
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	AUG 20 11:10 - AUG 20 12:53	PieRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European Southern Obs	-29.3	289.3					PnnRnn
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



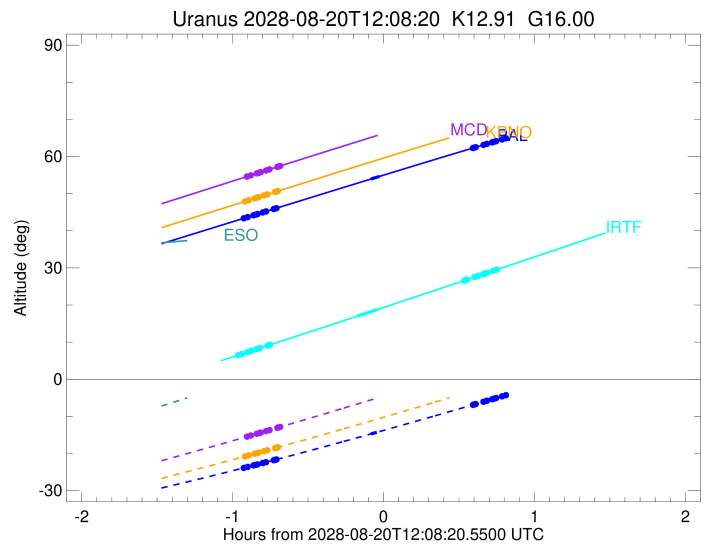
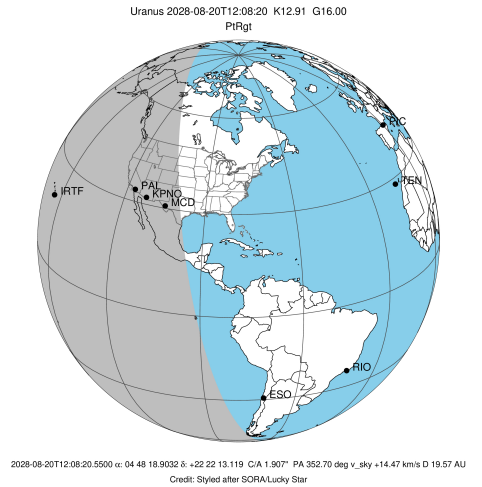
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2028-08-20T12:04:29.120
Event type          : PtRgt
: Uranus occs: topocentric, not geocentric
: 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      : 3413060048838566016
2Mass ID (if available) : 04481889+2222134
ICRS Star Coord at Epoch: 04h 48m 18.90319s +22:22:13.11916s
RUWE (>1.4 is poor) : 1.01
K magnitude         : 12.907
G magnitude         : 16.000
RP magnitude        : 15.068
BP magnitude        : 16.908
DUPflag            : 0
Distance (au)       : 19.566
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : 14.47
Sun-Target sep (deg) : 74.13
Sun-Moon sep (deg)  : 75.91
B (ring opening deg) : 81.27
PA of pole (deg)    : -35.43
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.766
C/A sky separation (km) : 25067.7
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall11.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-08-20T11:13:01.050		43.41	-23.84	51005.79	-12.36		
lambda	I	2028-08-20T11:14:20.185		43.68	-23.61	50026.71	-12.33		
delta	I	2028-08-20T11:16:41.083		44.18	-23.20	48300.35	-12.17		
gamma	I	2028-08-20T11:17:36.668		44.37	-23.04	47625.65	-12.10		
eta	I	2028-08-20T11:18:13.878		44.50	-22.94	47176.12	-12.06		
beta	I	2028-08-20T11:20:22.002		44.95	-22.56	45641.92	-11.89		
alpha	I	2028-08-20T11:21:37.782		45.21	-22.34	44747.02	-11.77		
4	I	2028-08-20T11:24:41.621		45.86	-21.80	42603.62	-11.48		
5	I	2028-08-20T11:25:10.522		45.96	-21.71	42274.22	-11.42		
6	I	2028-08-20T11:25:49.183		46.09	-21.60	41837.24	-11.36		
Uranus	I	2028-08-20T12:03:17.635		53.93	-14.73	25088.19		-7.89	-8.26
Uranus	E	2028-08-20T12:06:47.247		54.66	-14.07	25144.09		-7.39	-7.74
6	E	2028-08-20T12:43:49.400		62.27	-6.91	41796.26	11.27		
5	E	2028-08-20T12:44:21.146		62.38	-6.80	42156.90	11.32		
4	E	2028-08-20T12:44:54.242		62.49	-6.69	42531.48	11.38		
alpha	E	2028-08-20T12:48:01.640		63.12	-6.07	44691.16	11.67		
beta	E	2028-08-20T12:49:24.548		63.40	-5.80	45663.13	11.78		
eta	E	2028-08-20T12:51:32.097		63.82	-5.38	47176.12	11.94		
gamma	E	2028-08-20T12:52:09.349		63.95	-5.26	47621.79	11.99		
delta	E	2028-08-20T12:53:05.810		64.14	-5.07	48300.35	12.05		
lambda	E	2028-08-20T12:55:28.160		64.61	-4.60x	50026.71	12.20		
epsilon	E	2028-08-20T12:56:38.745		64.84	-4.36x	50890.45	12.23		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-08-20T12:04:51.900
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3413060048838566016
 2Mass ID (if available) : 04481889+2222134
 ICRS Star Coord at Epoch: 04h 48m 18.90319s +22:22:13.11916s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 12.907
 G magnitude : 16.000
 RP magnitude : 15.068
 BP magnitude : 16.908
 DUPflag : 0
 Distance (au) : 19.566
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.47
 Sun-Target sep (deg) : 74.13
 Sun-Moon sep (deg) : 75.94
 B (ring opening deg) : 81.27
 PA of pole (deg) : -35.43
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.788
 C/A sky separation (km) : 25368.9
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk

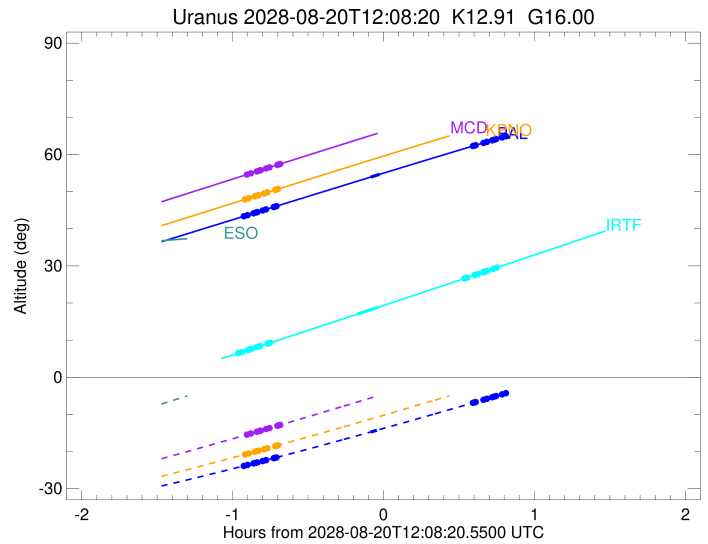
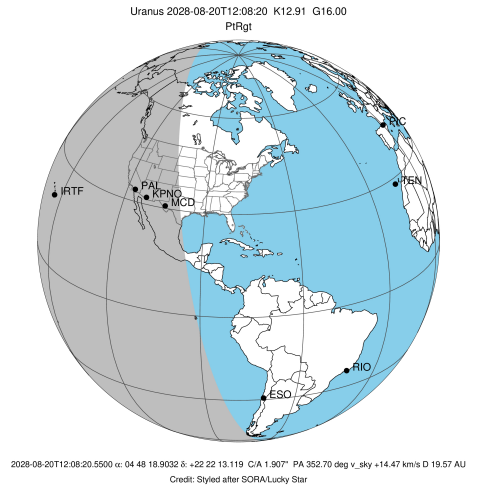


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-08-20T11:13:29.748		47.96	-20.74	51003.06	-12.28		
lambda	I	2028-08-20T11:14:49.171		48.24	-20.49	50026.71	-12.25		
delta	I	2028-08-20T11:17:11.021		48.74	-20.05	48300.35	-12.09		
gamma	I	2028-08-20T11:18:07.001		48.94	-19.88	47625.61	-12.02		
eta	I	2028-08-20T11:18:44.476		49.07	-19.77	47176.12	-11.97		
beta	I	2028-08-20T11:20:53.565		49.53	-19.37	45641.88	-11.79		
alpha	I	2028-08-20T11:22:09.956		49.80	-19.13	44746.87	-11.68		
4	I	2028-08-20T11:25:15.368		50.46	-18.55	42603.33	-11.37		
5	I	2028-08-20T11:25:44.570		50.56	-18.46	42273.57	-11.31		
6	I	2028-08-20T11:26:23.559		50.70	-18.34	41836.84	-11.25		

No planet occultations

6	E	2028-08-20T12:44:00.304		66.96	-3.07x	41796.17	11.17		
5	E	2028-08-20T12:44:32.339		67.07	-2.96x	42157.06	11.23		
4	E	2028-08-20T12:45:05.722		67.18	-2.85x	42531.66	11.29		
alpha	E	2028-08-20T12:48:14.595		67.82	-2.20x	44691.32	11.58		
beta	E	2028-08-20T12:49:38.076		68.09	-1.92x	45662.98	11.69		
eta	E	2028-08-20T12:51:46.504		68.52	-1.48x	47176.12	11.86		
gamma	E	2028-08-20T12:52:23.996		68.65	-1.35x	47621.77	11.91		
delta	E	2028-08-20T12:53:20.816		68.84	-1.16x	48300.35	11.98		
lambda	E	2028-08-20T12:55:44.019		69.31	-0.67x	50026.71	12.13		
epsilon	E	2028-08-20T12:56:54.843		69.54	-0.43x	50888.48	12.16		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-08-20T12:05:32.260
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3413060048838566016
 2Mass ID (if available) : 04481889+2222134
 ICRS Star Coord at Epoch: 04h 48m 18.90319s +22:22:13.11916s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 12.907
 G magnitude : 16.000
 RP magnitude : 15.068
 BP magnitude : 16.908
 DUPflag : 0
 Distance (au) : 19.566
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.47
 Sun-Target sep (deg) : 74.13
 Sun-Moon sep (deg) : 75.97
 B (ring opening deg) : 81.27
 PA of pole (deg) : -35.43
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.812
 C/A sky separation (km) : 25718.5
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



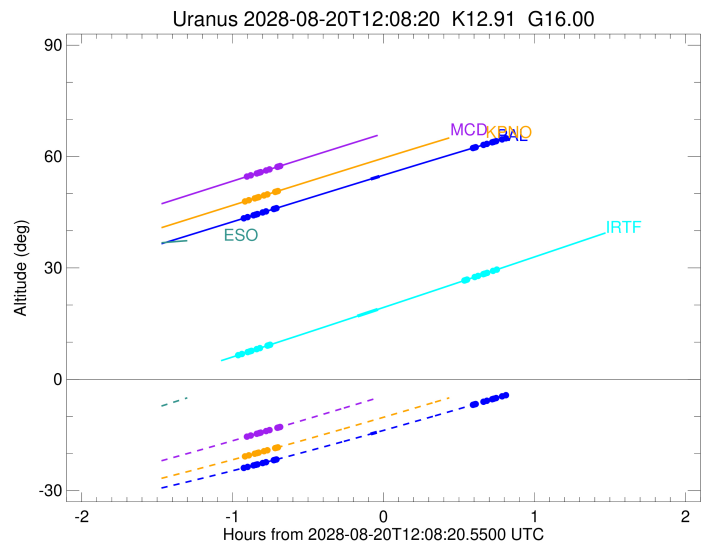
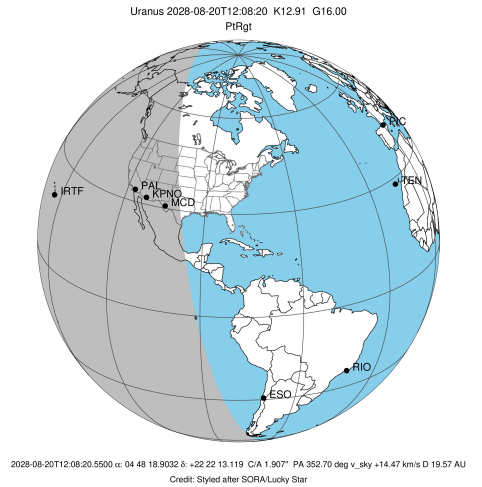
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-08-20T11:14:16.658		54.66	-15.41	50999.75	-12.19		
lambda	I	2028-08-20T11:15:36.439		54.94	-15.15	50026.71	-12.15		
delta	I	2028-08-20T11:17:59.461		55.46	-14.68	48300.35	-11.99		
gamma	I	2028-08-20T11:18:55.929		55.66	-14.50	47625.56	-11.91		
eta	I	2028-08-20T11:19:33.729		55.79	-14.37	47176.12	-11.87		
beta	I	2028-08-20T11:21:44.005		56.26	-13.95	45641.82	-11.68		
alpha	I	2028-08-20T11:23:01.145		56.54	-13.69	44746.67	-11.57		
4	I	2028-08-20T11:26:08.488		57.21	-13.07	42602.97	-11.25		
5	I	2028-08-20T11:26:38.059		57.32	-12.98	42272.77	-11.19		
6	I	2028-08-20T11:27:17.449		57.46	-12.84	41836.35	-11.12		

No planet occultations

6	E	2028-08-20T12:44:26.485		73.55	2.99x	41796.06	11.05		
5	E	2028-08-20T12:44:58.862		73.65	3.10x	42157.25	11.12		
4	E	2028-08-20T12:45:32.588		73.76	3.22x	42531.87	11.18		
alpha	E	2028-08-20T12:48:43.206		74.37	3.89x	44691.49	11.48		
beta	E	2028-08-20T12:50:07.365		74.64	4.18x	45662.81	11.60		
eta	E	2028-08-20T12:52:16.826		75.05	4.64x	47176.12	11.77		
gamma	E	2028-08-20T12:52:54.600		75.17	4.77x	47621.74	11.82		
delta	E	2028-08-20T12:53:51.839		75.35	4.97x	48300.35	11.89		
lambda	E	2028-08-20T12:56:16.040		75.79	5.48x	50026.71	12.05		
epsilon	E	2028-08-20T12:57:27.149		76.01	5.73x	50886.30	12.08		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-08-20T12:01:29.830
 Event type : PtRgt
 : Uranus occs: topocentric, not geocentric
 : 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 : 3413060048838566016
 2Mass ID (if available) : 04481889+2222134
 ICRS Star Coord at Epoch: 04h 48m 18.90319s +22:22:13.11916s
 RUWE (>1.4 is poor) : 1.01
 K magnitude : 12.907
 G magnitude : 16.000
 RP magnitude : 15.068
 BP magnitude : 16.908
 DUPflag : 0
 Distance (au) : 19.566
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.47
 Sun-Target sep (deg) : 74.13
 Sun-Moon sep (deg) : 75.54
 B (ring opening deg) : 81.27
 PA of pole (deg) : -35.43
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.753
 C/A sky separation (km) : 24871.8
 NAIF SPICE kernels : RAJobs_U111+rgf15.spk
 URKALLvl.spk
 ura111.bsp
 IAU_URANUS_for_RINGFIT.tpc
 vgr2.ura111.bsp
 ura161.bsp
 vgr2.ura161.bsp
 peph.ura160.bsp
 earthstns_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-08-20T11:10:46.035		6.54	-56.20	51008.24	-12.62		
lambda	I	2028-08-20T11:12:03.746		6.82	-56.09	50026.71	-12.59		
delta	I	2028-08-20T11:14:21.745		7.33	-55.90	48300.35	-12.43		
gamma	I	2028-08-20T11:15:16.175		7.53	-55.82	47625.69	-12.36		
eta	I	2028-08-20T11:15:52.615		7.66	-55.76	47176.12	-12.31		
beta	I	2028-08-20T11:17:58.054		8.12	-55.57	45641.97	-12.14		
alpha	I	2028-08-20T11:19:12.225		8.39	-55.46	44747.16	-12.03		
4	I	2028-08-20T11:22:12.116		9.05	-55.17	42603.87	-11.73		
5	I	2028-08-20T11:22:40.358		9.16	-55.12	42274.78	-11.67		
6	I	2028-08-20T11:23:18.201		9.30	-55.06	41837.58	-11.61		
Uranus	I	2028-08-20T11:58:00.142		17.02	-50.78	25054.83		-8.18	-8.56
Uranus	E	2028-08-20T12:06:04.427		18.83	-49.59	25184.46		-7.01	-7.34
6	E	2028-08-20T12:40:25.242		26.59	-43.92	41796.29	11.47		
5	E	2028-08-20T12:40:56.412		26.71	-43.83	42156.86	11.53		
4	E	2028-08-20T12:41:28.913		26.83	-43.73	42531.43	11.59		
alpha	E	2028-08-20T12:44:33.049		27.53	-43.18	44691.12	11.87		
beta	E	2028-08-20T12:45:54.562		27.83	-42.93	45663.16	11.98		
eta	E	2028-08-20T12:48:00.000		28.31	-42.55	47176.12	12.14		
gamma	E	2028-08-20T12:48:36.647		28.45	-42.44	47621.79	12.18		
delta	E	2028-08-20T12:49:32.198		28.66	-42.27	48300.35	12.25		
lambda	E	2028-08-20T12:51:52.297		29.19	-41.85	50026.71	12.40		
epsilon	E	2028-08-20T12:53:01.806		29.45	-41.63	50890.70	12.42		