

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:56:44.680  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452

ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s

RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 54.69  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40

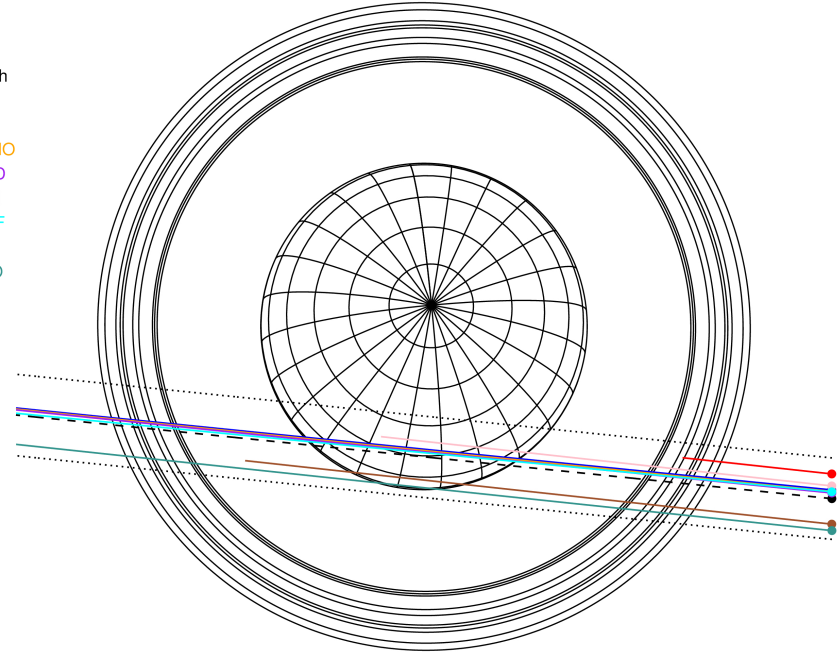
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon



2029-12-15T06:56:44.6800 ra: 04 58 18.3607 s: +22 42 45.310 C/A 1.529° PA 354.15 deg v\_sky -23.21 km/s D 18.25 AU  
 Credit: Styled after SORA/Lucky Star

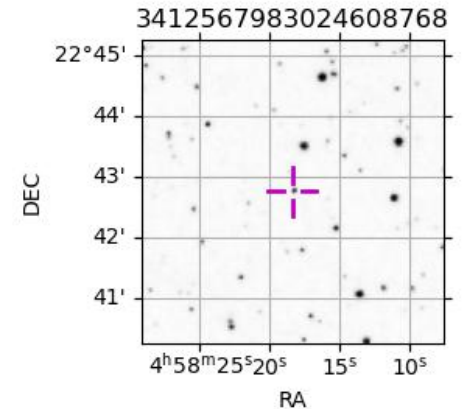
Uranus 2029-12-15T06:56:44 K14.35 G16.35 PgtRgt

Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO



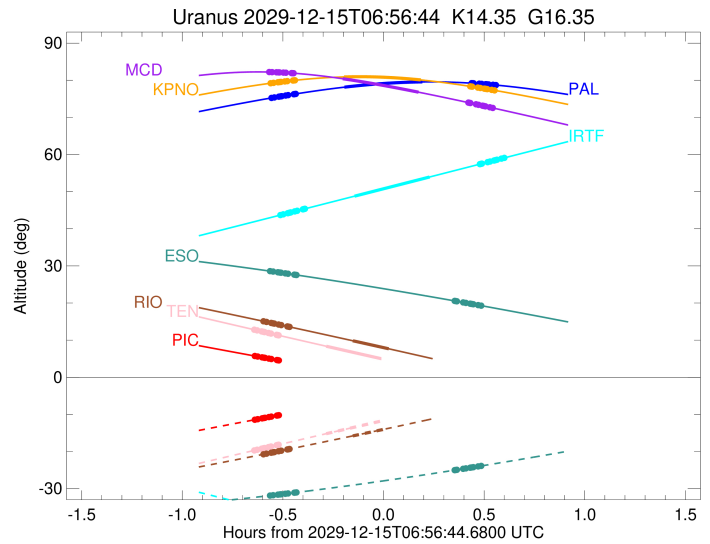
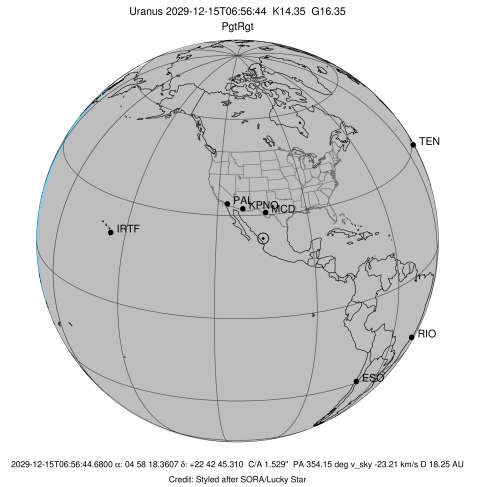
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++			DEC 15 06:18 - DEC 15 06:22	PnnRin
PAL	Palomar Mt (200")	33.4	243.1	+++++	+ +	+++++	DEC 15 06:23 - DEC 15 07:29	PieRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	DEC 15 06:22 - DEC 15 07:29	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	DEC 15 06:22 - DEC 15 07:29	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5	+++++	+		DEC 15 06:18 - DEC 15 06:39	PinRin
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	DEC 15 06:25 - DEC 15 07:32	PieRie
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++	+ +		DEC 15 06:20 - DEC 15 06:58	PieRin
ESO	European Southern Obs	-29.3	289.3	+++++		+++++	DEC 15 06:22 - DEC 15 07:25	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



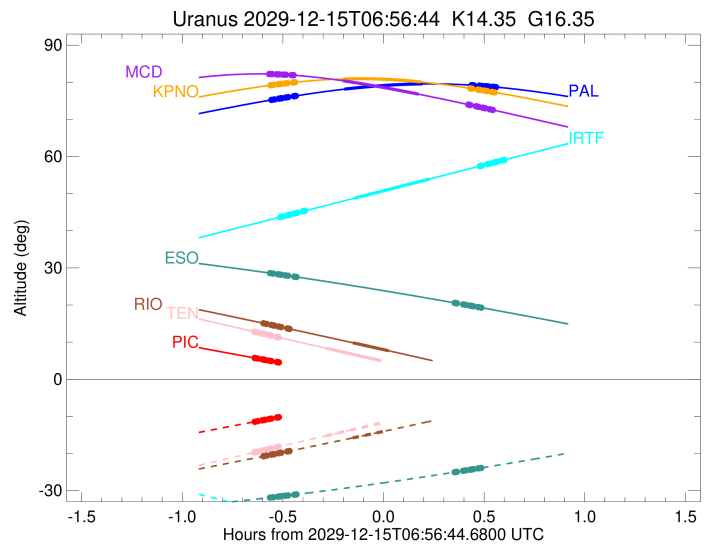
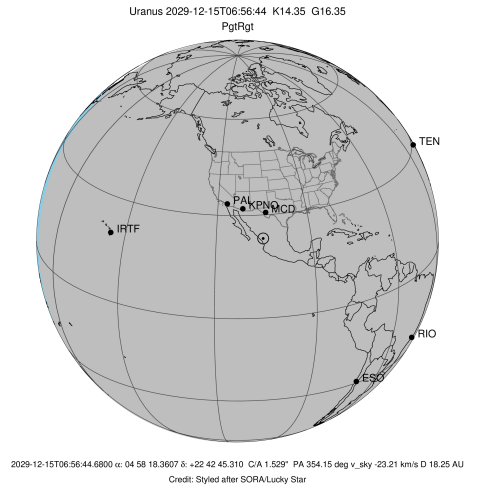
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-12-15T06:53:23.620
Event type           : PgtRgt
: Uranus occs: geocentric, topocentric
: 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       : 3412567983024608768
2Mass ID (if available) : 04581836+2242452
ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 14.353
G magnitude           : 16.353
RP magnitude          : 15.679
BP magnitude          : 16.848
DUPflag              : 0
Distance (au)        : 18.247
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -23.21
Sun-Target sep (deg) : 172.63
Sun-Moon sep (deg)   : 55.03
B (ring opening deg) : 82.03
PA of pole (deg)     : -19.40
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.214
C/A sky separation (km) : 16070.1
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.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
  
```



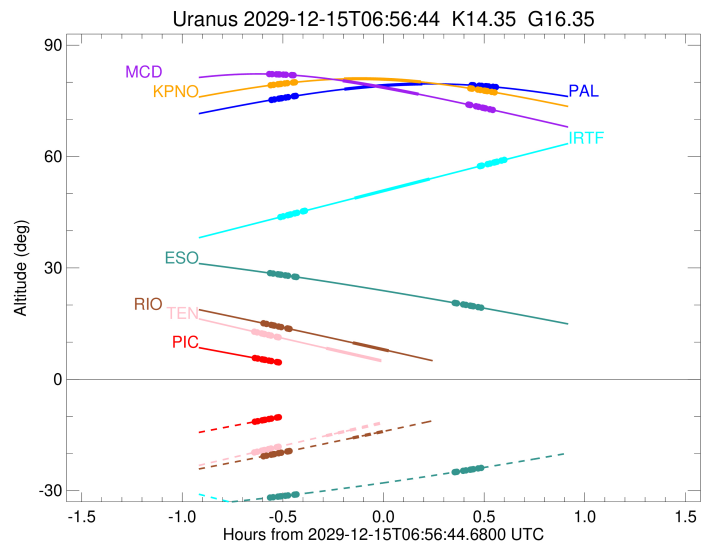
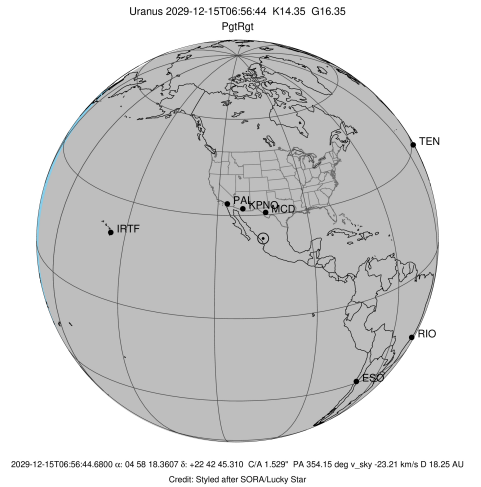
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-15T06:18:12.722		5.75	-11.47	51385.68	-21.91		
lambda	I	2029-12-15T06:19:14.698		5.58	-11.29	50026.71	-21.89		
delta	I	2029-12-15T06:20:33.726		5.37	-11.07	48300.35	-21.80		
gamma	I	2029-12-15T06:21:04.730		5.28	-10.98	47625.20	-21.76		
eta	I	2029-12-15T06:21:25.386		5.22	-10.92	47176.12	-21.73		
beta	I	2029-12-15T06:22:34.472		5.03	-10.73	45678.38	-21.63		
alpha	I	2029-12-15T06:23:20.489		4.91x	-10.59	44684.74	-21.56		
4	I	2029-12-15T06:24:56.807		4.64x	-10.32	42616.36	-21.39		
5	I	2029-12-15T06:25:11.217		4.60x	-10.28	42307.65	-21.36		
6	I	2029-12-15T06:25:31.778		4.55x	-10.22	41869.74	-21.32		
Uranus	I	2029-12-15T06:39:09.459		2.34x	-7.93	25445.89		-3.48	-3.64
Uranus	E	2029-12-15T07:07:24.148		-2.09x	-3.30x	25189.39		-6.34	-6.64
6	E	2029-12-15T07:21:08.681		-4.15x	-1.12x	41794.94	21.24		
5	E	2029-12-15T07:21:25.922		-4.19x	-1.08x	42159.63	21.28		
4	E	2029-12-15T07:21:43.545		-4.24x	-1.03x	42536.12	21.31		
alpha	E	2029-12-15T07:23:26.643		-4.49x	-0.76x	44741.48	21.48		
beta	E	2029-12-15T07:24:09.132		-4.60x	-0.65x	45655.07	21.55		
eta	E	2029-12-15T07:25:19.585		-4.77x	-0.47x	47176.12	21.64		
gamma	E	2029-12-15T07:25:40.563		-4.82x	-0.41x	47630.41	21.67		
delta	E	2029-12-15T07:26:11.452		-4.89x	-0.33x	48300.35	21.71		
lambda	E	2029-12-15T07:27:30.807		-5.09x	-0.13x	50026.71	21.80		
epsilon	E	2029-12-15T07:28:04.465		-5.17x	-0.04x	50761.08	21.82		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:56:51.880  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : 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 : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452  
 ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 55.39  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.445  
 C/A sky separation (km) : 19122.7  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 ural11.bsp  
 IAU\_URANUS\_for\_RINGFIT.tpc  
 vgr2.ural11.bsp  
 ural61.bsp  
 vgr2.ural61.bsp  
 peph.ural60.bsp  
 earthstns\_itrfr93\_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	2029-12-15T06:23:11.431		75.22	-69.95	51366.83	-21.80		
lambda	I	2029-12-15T06:24:12.882		75.38	-70.15	50026.71	-21.76		
delta	I	2029-12-15T06:25:32.473		75.59	-70.40	48300.35	-21.62		
gamma	I	2029-12-15T06:26:03.729		75.67	-70.50	47625.53	-21.56		
eta	I	2029-12-15T06:26:24.592		75.72	-70.56	47176.12	-21.52		
beta	I	2029-12-15T06:27:34.387		75.89	-70.78	45679.02	-21.38		
alpha	I	2029-12-15T06:28:21.022		76.01	-70.93	44684.62	-21.27		
4	I	2029-12-15T06:29:58.833		76.25	-71.23	42615.93	-21.02		
5	I	2029-12-15T06:30:13.585		76.28	-71.28	42305.00	-20.98		
6	I	2029-12-15T06:30:34.525		76.33	-71.34	41867.65	-20.92		
Uranus	I	2029-12-15T06:45:05.449		78.15	-73.95	25363.09		-4.59	-4.81
Uranus	E	2029-12-15T07:08:20.991		79.56	-77.56	25097.38		-7.11	-7.45
6	E	2029-12-15T07:22:58.201		79.23	-79.20	41795.46	20.92		
5	E	2029-12-15T07:23:15.843		79.21	-79.23	42162.32	20.98		
4	E	2029-12-15T07:23:33.681		79.19	-79.25	42538.74	21.03		
alpha	E	2029-12-15T07:25:17.740		79.09	-79.39	44739.35	21.28		
beta	E	2029-12-15T07:26:00.769		79.04	-79.45	45656.63	21.38		
eta	E	2029-12-15T07:27:11.612		78.95	-79.54	47176.12	21.53		
gamma	E	2029-12-15T07:27:32.707		78.93	-79.56	47630.65	21.59		
delta	E	2029-12-15T07:28:03.716		78.89	-79.60	48300.35	21.63		
lambda	E	2029-12-15T07:29:23.284		78.78	-79.68	50026.71	21.77		
epsilon	E	2029-12-15T07:29:56.640		78.74	-79.72	50753.62	21.80		

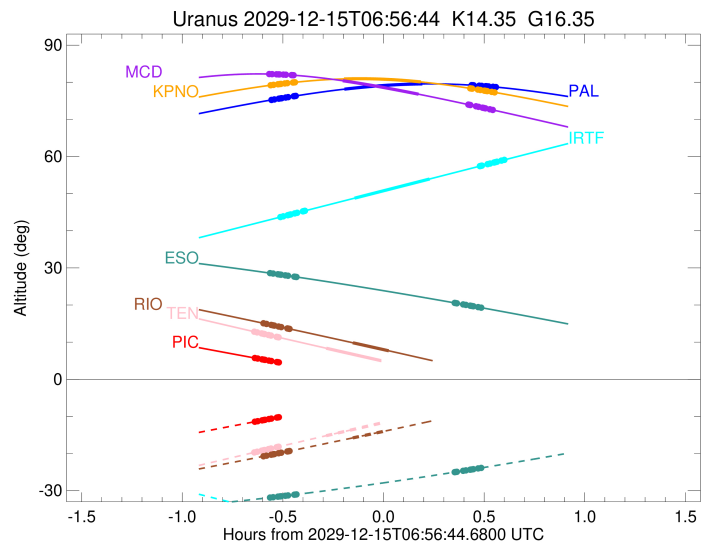
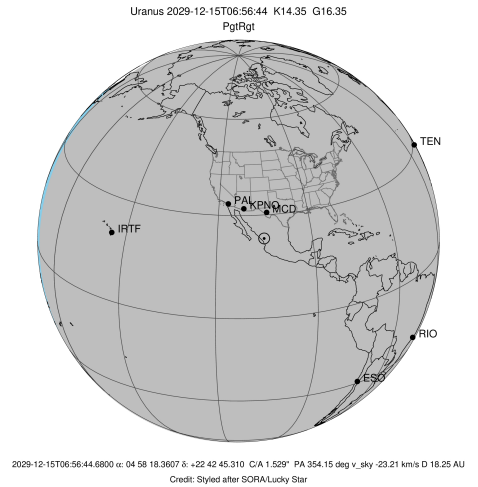
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:56:32.190  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KPNO  
 Location : Kitt Peak Natl Obs  
 Latitude (deg) : 31.96333  
 E. Longitude (deg) : 248.40000  
 Altitude (km) : 2.120  
 Gaia source ID : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452  
 ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 55.43  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.460  
 C/A sky separation (km) : 19324.8  
 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\_itrff93\_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	2029-12-15T06:22:56.189		79.19	-74.49	51365.17	-21.77		
lambda	I	2029-12-15T06:23:57.641		79.31	-74.68	50026.71	-21.73		
delta	I	2029-12-15T06:25:17.345		79.47	-74.92	48300.35	-21.59		
gamma	I	2029-12-15T06:25:48.648		79.53	-75.02	47625.55	-21.53		
eta	I	2029-12-15T06:26:09.545		79.57	-75.08	47176.12	-21.49		
beta	I	2029-12-15T06:27:19.459		79.69	-75.29	45679.07	-21.34		
alpha	I	2029-12-15T06:28:06.183		79.78	-75.43	44684.62	-21.23		
4	I	2029-12-15T06:29:44.202		79.94	-75.72	42615.89	-20.98		
5	I	2029-12-15T06:29:58.994		79.96	-75.77	42304.76	-20.93		
6	I	2029-12-15T06:30:19.983		80.00	-75.83	41867.47	-20.87		
Uranus	I	2029-12-15T06:44:56.444		80.91	-78.25	25355.89		-4.68	-4.90
Uranus	E	2029-12-15T07:07:50.535		80.10	-80.96	25091.90		-7.16	-7.49
6	E	2029-12-15T07:22:33.576		78.37	-81.49	41795.50	20.87		
5	E	2029-12-15T07:22:51.275		78.33	-81.49	42162.49	20.93		
4	E	2029-12-15T07:23:09.158		78.29	-81.48	42538.89	20.97		
alpha	E	2029-12-15T07:24:53.459		78.04	-81.46	44739.23	21.23		
beta	E	2029-12-15T07:25:36.595		77.93	-81.44	45656.72	21.34		
eta	E	2029-12-15T07:26:47.582		77.76	-81.41	47176.12	21.48		
gamma	E	2029-12-15T07:27:08.720		77.70	-81.40	47630.67	21.53		
delta	E	2029-12-15T07:27:39.789		77.63	-81.38	48300.35	21.58		
lambda	E	2029-12-15T07:28:59.501		77.42	-81.33	50026.71	21.73		
epsilon	E	2029-12-15T07:29:32.899		77.34	-81.31	50753.28	21.77		

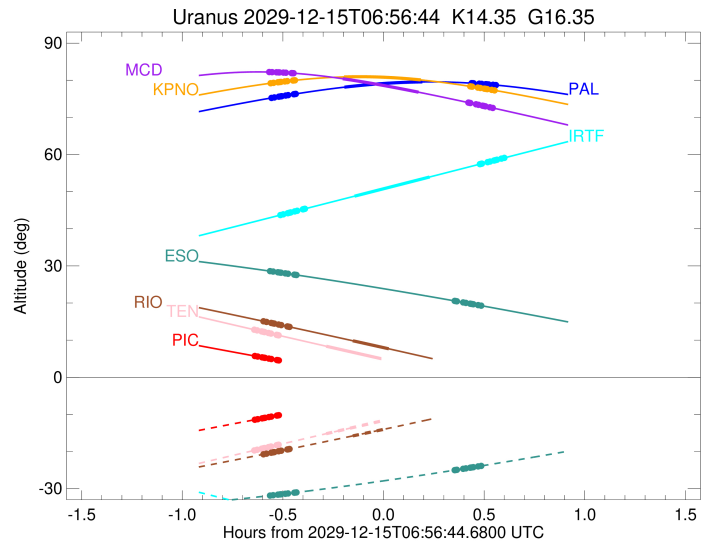
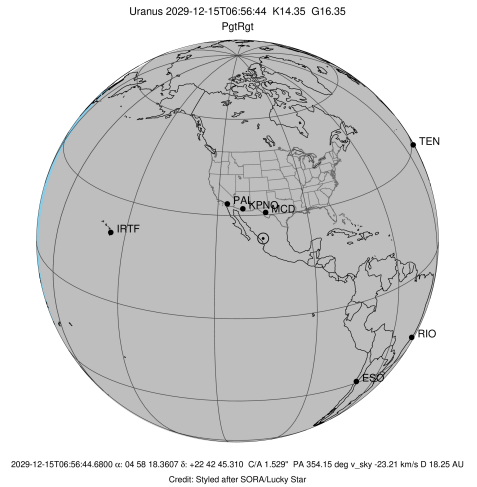
```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2029-12-15T06:56:02.800
Event type            : PgtRgt
: Uranus occs: geocentric, topocentric
: 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        : 3412567983024608768
2Mass ID (if available) : 04581836+2242452
ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s
RUWE (>1.4 is poor)  : 0.98
K magnitude           : 14.353
G magnitude           : 16.353
RP magnitude          : 15.679
BP magnitude          : 16.848
DUPflag              : 0
Distance (au)         : 18.247
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s)  : -23.21
Sun-Target sep (deg)  : 172.63
Sun-Moon sep (deg)    : 55.49
B (ring opening deg)  : 82.03
PA of pole (deg)      : -19.40
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.474
C/A sky separation (km) : 19510.1
NAIF SPICE kernels    : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ural11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ural11.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itrff93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
  
```



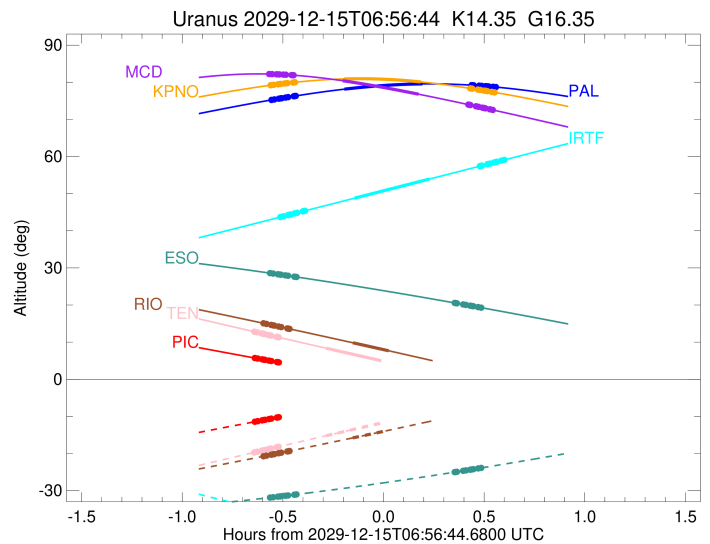
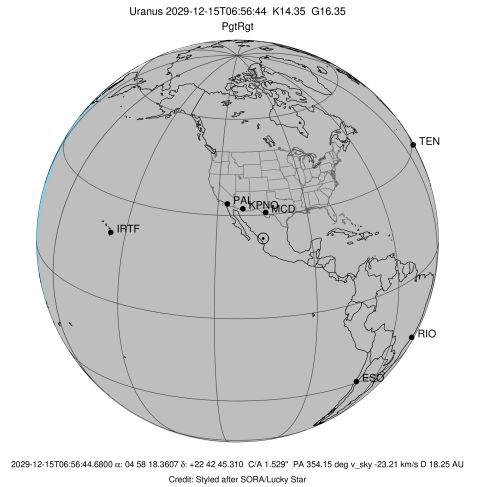
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-15T06:22:30.627	82.22	-80.35	51363.51	-21.74			
lambda	I	2029-12-15T06:23:32.082	82.20	-80.50	50026.71	-21.70			
delta	I	2029-12-15T06:24:51.898	82.16	-80.69	48300.35	-21.55			
gamma	I	2029-12-15T06:25:23.247	82.14	-80.76	47625.58	-21.49			
eta	I	2029-12-15T06:25:44.180	82.13	-80.81	47176.12	-21.45			
beta	I	2029-12-15T06:26:54.209	82.07	-80.97	45679.11	-21.30			
alpha	I	2029-12-15T06:27:41.023	82.04	-81.07	44684.61	-21.19			
4	I	2029-12-15T06:29:19.246	81.94	-81.28	42615.84	-20.93			
5	I	2029-12-15T06:29:34.079	81.93	-81.31	42304.53	-20.88			
6	I	2029-12-15T06:29:55.116	81.90	-81.36	41867.29	-20.82			
Uranus	I	2029-12-15T06:44:36.971	80.42	-82.63	25348.94			-4.76	-4.98
Uranus	E	2029-12-15T07:07:11.188	76.80	-81.95	25087.04			-7.20	-7.53
6	E	2029-12-15T07:22:00.000	74.00	-80.05	41795.54	20.81			
5	E	2029-12-15T07:22:17.755	73.94	-80.00	42162.63	20.87			
4	E	2029-12-15T07:22:35.686	73.88	-79.96	42539.02	20.92			
alpha	E	2029-12-15T07:24:20.247	73.54	-79.69	44739.12	21.17			
beta	E	2029-12-15T07:25:03.494	73.40	-79.57	45656.79	21.29			
eta	E	2029-12-15T07:26:14.639	73.16	-79.38	47176.12	21.44			
gamma	E	2029-12-15T07:26:35.823	73.09	-79.32	47630.68	21.48			
delta	E	2029-12-15T07:27:06.957	72.99	-79.24	48300.35	21.54			
lambda	E	2029-12-15T07:28:26.831	72.73	-79.01	50026.71	21.69			
epsilon	E	2029-12-15T07:29:00.280	72.61	-78.92	50753.01	21.73			

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:52:37.430  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : 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 : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452  
 ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 55.20  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.351  
 C/A sky separation (km) : 17879.9  
 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\_itrff93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



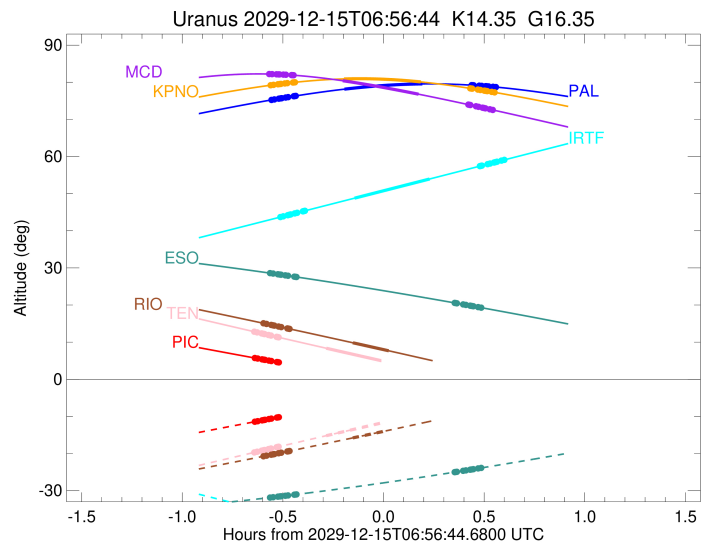
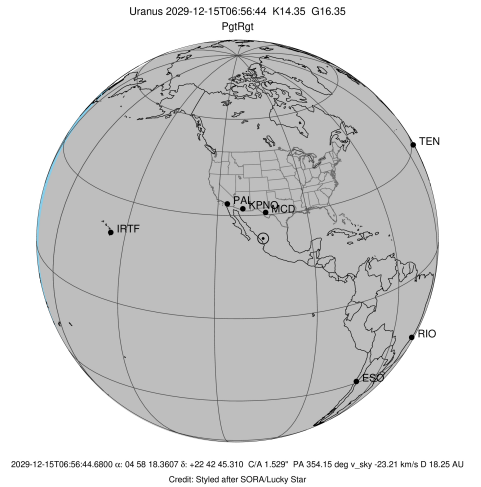
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-15T06:18:03.532		12.84	-19.74	51372.64	-21.71		
lambda	I	2029-12-15T06:19:05.489		12.63	-19.52	50026.71	-21.68		
delta	I	2029-12-15T06:20:25.337		12.35	-19.24	48300.35	-21.56		
gamma	I	2029-12-15T06:20:56.680		12.24	-19.13	47625.42	-21.51		
eta	I	2029-12-15T06:21:17.588		12.17	-19.06	47176.12	-21.47		
beta	I	2029-12-15T06:22:27.517		11.93	-18.81	45678.82	-21.35		
alpha	I	2029-12-15T06:23:14.188		11.76	-18.65	44684.64	-21.26		
4	I	2029-12-15T06:24:51.980		11.42	-18.30	42616.10	-21.04		
5	I	2029-12-15T06:25:06.687		11.37	-18.25	42305.91	-21.00		
6	I	2029-12-15T06:25:27.598		11.30	-18.18	41868.36	-20.95		
Uranus	I	2029-12-15T06:39:39.685		8.36	-15.20	25397.31		-4.17	-4.36
Uranus	E	2029-12-15T07:05:20.092		3.13x	-9.88	25137.54		-6.79	-7.11
6	E	2029-12-15T07:19:40.467		0.26x	-6.95	41795.17	20.86		
5	E	2029-12-15T07:19:58.091		0.20x	-6.89	42160.97	20.91		
4	E	2029-12-15T07:20:16.008		0.14x	-6.83	42537.46	20.95		
alpha	E	2029-12-15T07:22:00.653		-0.21x	-6.48	44740.39	21.16		
beta	E	2029-12-15T07:22:43.852		-0.35x	-6.33	45655.88	21.25		
eta	E	2029-12-15T07:23:55.216		-0.59x	-6.09	47176.12	21.37		
gamma	E	2029-12-15T07:24:16.466		-0.66x	-6.02	47630.54	21.40		
delta	E	2029-12-15T07:24:47.727		-0.76x	-5.91	48300.35	21.45		
lambda	E	2029-12-15T07:26:07.986		-1.02x	-5.64	50026.71	21.57		
epsilon	E	2029-12-15T07:26:41.813		-1.13x	-5.53	50757.00	21.60		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:59:28.820  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : 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 : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452  
 ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 54.93  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.487  
 C/A sky separation (km) : 19673.3  
 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	2029-12-15T06:25:50.632		43.66	-36.45	51364.15	-21.59		
lambda	I	2029-12-15T06:26:52.540		43.90	-36.68	50026.71	-21.55		
delta	I	2029-12-15T06:28:12.910		44.20	-36.99	48300.35	-21.41		
gamma	I	2029-12-15T06:28:44.478		44.32	-37.11	47625.57	-21.35		
eta	I	2029-12-15T06:29:05.557		44.41	-37.19	47176.12	-21.30		
beta	I	2029-12-15T06:30:16.080		44.68	-37.46	45679.10	-21.15		
alpha	I	2029-12-15T06:31:03.226		44.86	-37.63	44684.62	-21.04		
4	I	2029-12-15T06:32:42.157		45.24	-38.01	42615.85	-20.78		
5	I	2029-12-15T06:32:57.097		45.29	-38.07	42304.56	-20.73		
6	I	2029-12-15T06:33:18.289		45.37	-38.15	41867.32	-20.67		
Uranus	I	2029-12-15T06:48:09.098		48.79	-41.53	25346.25		-4.79	-5.01
Uranus	E	2029-12-15T07:10:30.032		53.95	-46.64	25080.03		-7.25	-7.59
6	E	2029-12-15T07:25:25.975		57.40	-50.06	41795.62	20.72		
5	E	2029-12-15T07:25:43.819		57.47	-50.13	42162.98	20.79		
4	E	2029-12-15T07:26:01.814		57.54	-50.20	42539.34	20.84		
alpha	E	2029-12-15T07:27:46.730		57.94	-50.60	44738.86	21.10		
beta	E	2029-12-15T07:28:30.147		58.11	-50.76	45656.98	21.22		
eta	E	2029-12-15T07:29:41.511		58.39	-51.03	47176.12	21.37		
gamma	E	2029-12-15T07:30:02.761		58.47	-51.12	47630.71	21.41		
delta	E	2029-12-15T07:30:33.987		58.59	-51.23	48300.35	21.48		
lambda	E	2029-12-15T07:31:54.086		58.90	-51.54	50026.71	21.63		
epsilon	E	2029-12-15T07:32:27.589		59.03	-51.67	50752.23	21.67		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2029-12-15T06:53:08.210  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : 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 : 3412567983024608768  
 2Mass ID (if available) : 04581836+2242452  
 ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s  
 RUWE (>1.4 is poor) : 0.98  
 K magnitude : 14.353  
 G magnitude : 16.353  
 RP magnitude : 15.679  
 BP magnitude : 16.848  
 DUPflag : 0  
 Distance (au) : 18.247  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.21  
 Sun-Target sep (deg) : 172.63  
 Sun-Moon sep (deg) : 55.24  
 B (ring opening deg) : 82.03  
 PA of pole (deg) : -19.40  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.807  
 C/A sky separation (km) : 23914.1  
 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\_itrff93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

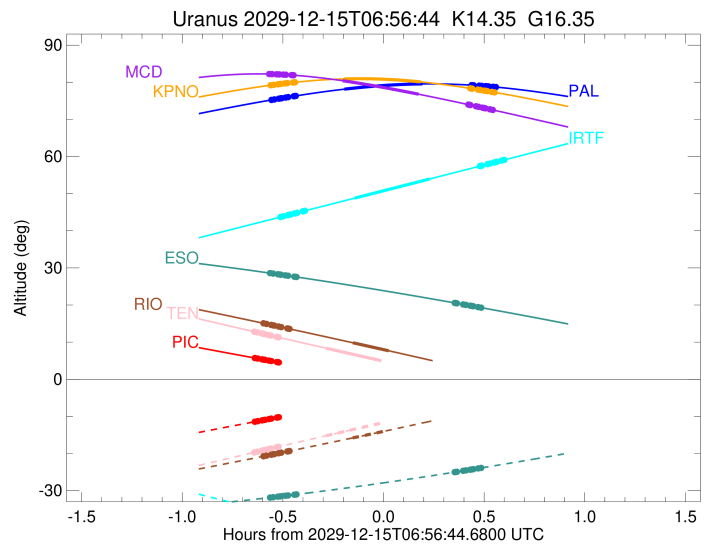
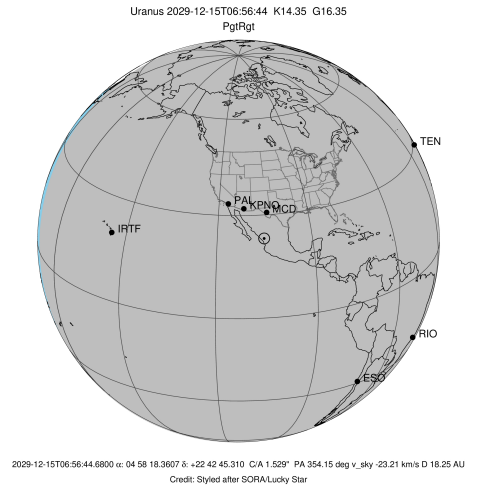


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-12-15T06:20:49.291		15.11	-20.77	51326.80	-20.60		
lambda	I	2029-12-15T06:21:52.407		14.90	-20.58	50026.71	-20.52		
delta	I	2029-12-15T06:23:17.010		14.63	-20.32	48300.35	-20.29		
gamma	I	2029-12-15T06:23:50.319		14.52	-20.22	47626.17	-20.19		
eta	I	2029-12-15T06:24:12.647		14.45	-20.16	47176.12	-20.12		
beta	I	2029-12-15T06:25:27.431		14.21	-19.93	45680.04	-19.88		
alpha	I	2029-12-15T06:26:17.712		14.04	-19.77	44684.83	-19.71		
4	I	2029-12-15T06:28:03.875		13.70	-19.45	42614.43	-19.29		
5	I	2029-12-15T06:28:20.161		13.65	-19.40	42298.74	-19.21		
6	I	2029-12-15T06:28:43.028		13.57	-19.33	41863.08	-19.11		
Uranus	I	2029-12-15T06:47:37.246		9.83	-15.79	25134.19		-6.81	-7.14
Uranus	E	2029-12-15T06:58:18.172		7.67	-13.74	24986.64		-7.95	-8.32
6	E	2029-12-15T07:17:23.551		3.76x	-10.00	41796.80	19.04		
5	E	2029-12-15T07:17:43.172		3.70x	-9.93	42167.16	19.14		
4	E	2029-12-15T07:18:02.629		3.63x	-9.87	42542.92	19.22		
alpha	E	2029-12-15T07:19:55.575		3.24x	-9.49	44736.10	19.63		
beta	E	2029-12-15T07:20:42.412		3.08x	-9.34	45658.86	19.80		
eta	E	2029-12-15T07:21:58.608		2.81x	-9.09	47176.12	20.04		
gamma	E	2029-12-15T07:22:21.270		2.73x	-9.01	47630.95	20.10		
delta	E	2029-12-15T07:22:54.489		2.62x	-8.90	48300.35	20.20		
lambda	E	2029-12-15T07:24:19.479		2.33x	-8.62	50026.71	20.42		
epsilon	E	2029-12-15T07:24:54.661		2.20x	-8.50	50746.76	20.50		



```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-12-15T06:54:27.060
Event type           : PgtRgt
: Uranus occs: geocentric, topocentric
: 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       : 3412567983024608768
2Mass ID (if available) : 04581836+2242452
ICRS Star Coord at Epoch: 04h 58m 18.36074s +22:42:45.30971s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 14.353
G magnitude           : 16.353
RP magnitude          : 15.679
BP magnitude          : 16.848
DUPflag              : 0
Distance (au)         : 18.247
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -23.21
Sun-Target sep (deg) : 172.63
Sun-Moon sep (deg)   : 55.29
B (ring opening deg) : 82.03
PA of pole (deg)     : -19.40
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.898
C/A sky separation (km) : 25111.5
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ural11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ural11.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itrff93_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	2029-12-15T06:22:47.419		28.61	-31.88	51317.93	-20.39		
lambda	I	2029-12-15T06:23:50.744		28.47	-31.77	50026.71	-20.30		
delta	I	2029-12-15T06:25:16.314		28.29	-31.62	48300.35	-20.04		
gamma	I	2029-12-15T06:25:50.034		28.21	-31.56	47626.31	-19.93		
eta	I	2029-12-15T06:26:12.662		28.16	-31.52	47176.12	-19.86		
beta	I	2029-12-15T06:27:28.500		28.00	-31.39	45680.23	-19.59		
alpha	I	2029-12-15T06:28:19.577		27.88	-31.29	44684.96	-19.39		
4	I	2029-12-15T06:30:07.685		27.64	-31.10	42613.97	-18.92		
5	I	2029-12-15T06:30:24.344		27.61	-31.07	42297.13	-18.83		
6	I	2029-12-15T06:30:47.677		27.55	-31.02	41861.95	-18.72		

No planet occultations

6	E	2029-12-15T07:17:55.117		20.58	-25.03	41797.33	18.67		
5	E	2029-12-15T07:18:15.205		20.52	-24.98	42168.83	18.78		
4	E	2029-12-15T07:18:34.994		20.47	-24.94	42544.26	18.87		
alpha	E	2029-12-15T07:20:29.698		20.16	-24.66	44735.07	19.34		
beta	E	2029-12-15T07:21:17.295		20.04	-24.55	45659.55	19.54		
eta	E	2029-12-15T07:22:34.426		19.83	-24.36	47176.12	19.80		
gamma	E	2029-12-15T07:22:57.355		19.76	-24.31	47631.03	19.88		
delta	E	2029-12-15T07:23:30.936		19.67	-24.23	48300.35	19.99		
lambda	E	2029-12-15T07:24:56.761		19.44	-24.02	50026.71	20.24		
epsilon	E	2029-12-15T07:25:32.184		19.34	-23.93	50745.41	20.33		