

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-02T09:34:15.280
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3404410809336902656
 2Mass ID (if available) : 05395699+2330317

ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s

RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.128
 G magnitude : 18.843
 RP magnitude : 17.621
 BP magnitude : 20.380
 DUPflag : 0
 Distance (au) : 18.139
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.30
 Sun-Target sep (deg) : 164.14
 Sun-Moon sep (deg) : 22.87
 B (ring opening deg) : 78.96
 PA of pole (deg) : 42.34

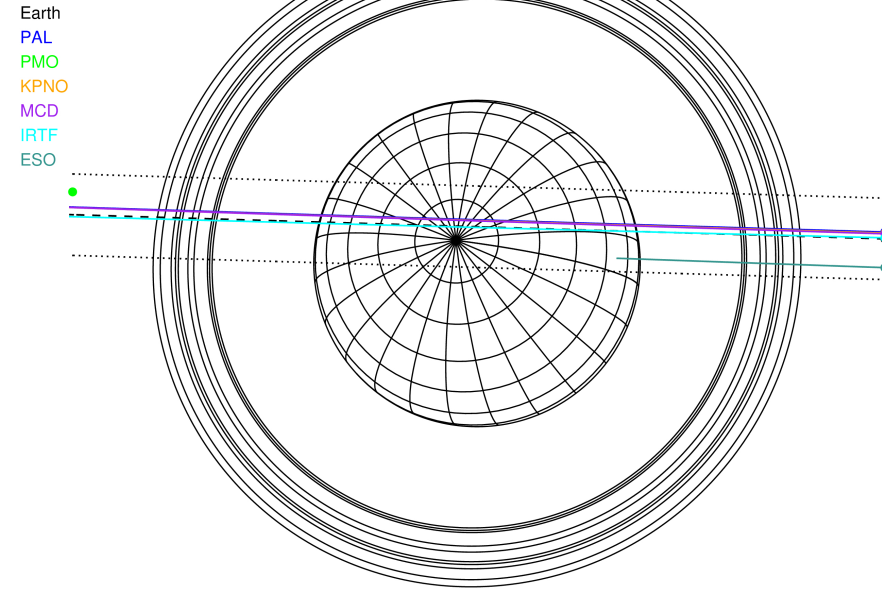
a(km) ring

- 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



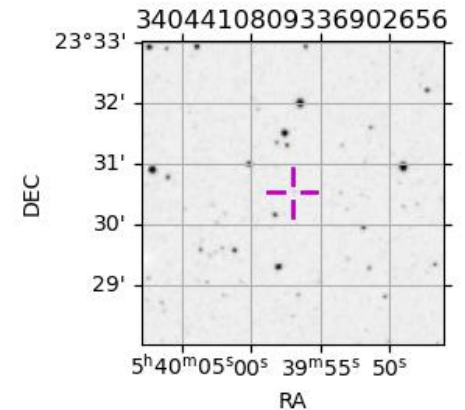
2031-12-02T09:34:15.2800 ra: 05 39 56.9991 s: +23 30 31.760 C/A 0.444 PA 178.29 deg v_sky -22.30 km/s D 18.14 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2031-12-02T09:34:15 K14.13 G18.84 PgtRgt

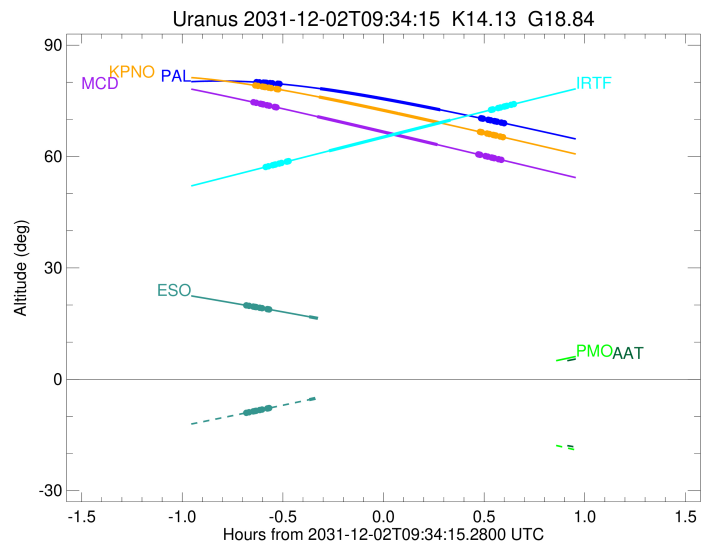
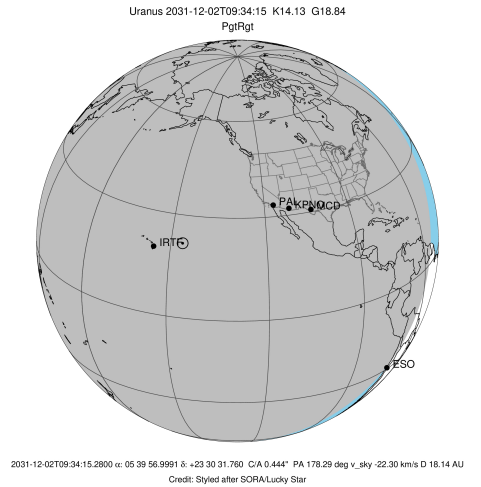


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++	+ +	+++++	DEC 02 08:56 - DEC 02 10:10	PieRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	DEC 02 08:55 - DEC 02 10:09	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	DEC 02 08:55 - DEC 02 10:09	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	DEC 02 08:59 - DEC 02 10:12	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	+++++	+		DEC 02 08:53 - DEC 02 09:12	PinRin
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

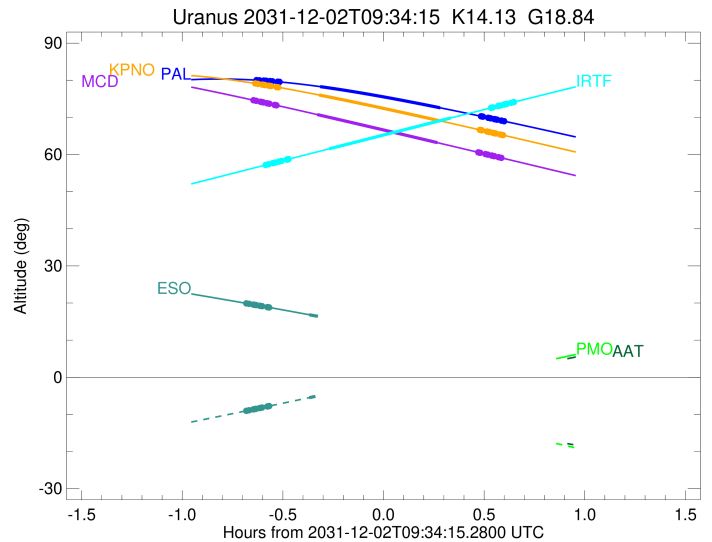
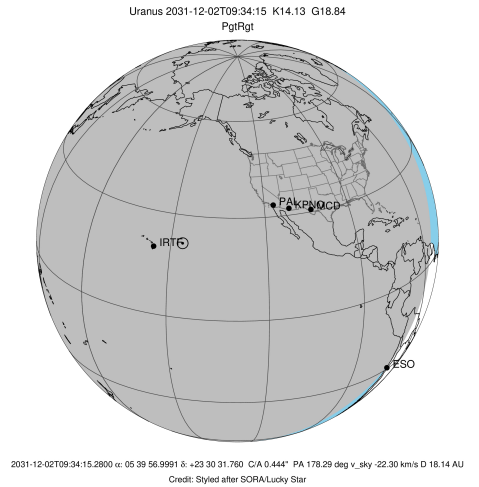


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-02T09:33:23.710
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 3404410809336902656
 2Mass ID (if available) : 05395699+2330317
 ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.128
 G magnitude : 18.843
 RP magnitude : 17.621
 BP magnitude : 20.380
 DUPflag : 0
 Distance (au) : 18.139
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.30
 Sun-Target sep (deg) : 164.14
 Sun-Moon sep (deg) : 23.10
 B (ring opening deg) : 78.96
 PA of pole (deg) : 42.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.520
 C/A sky separation (km) : 6839.7
 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



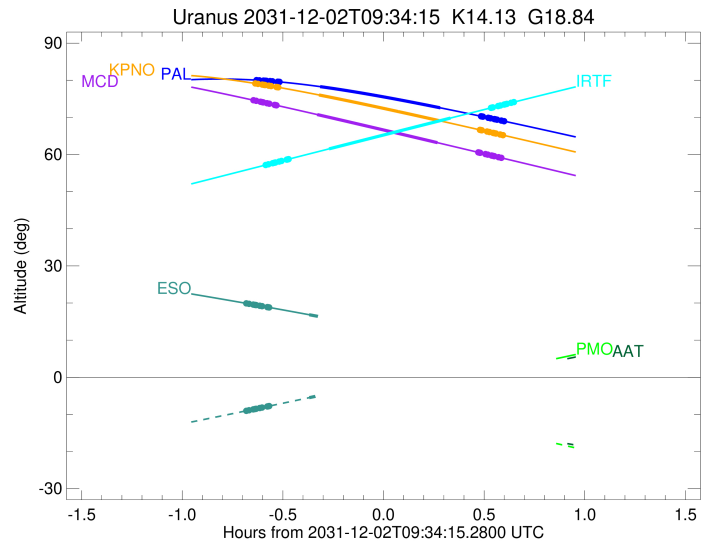
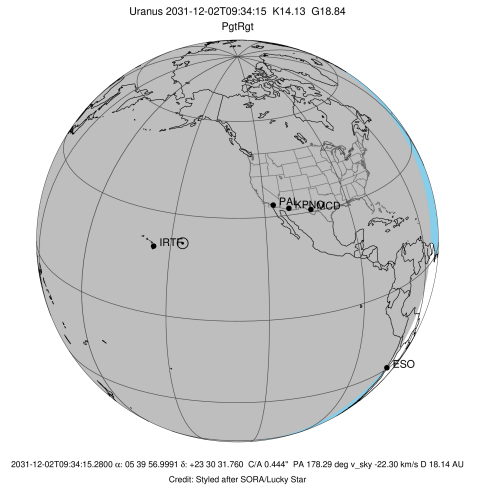
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-02T08:56:19.878		80.04	-69.14	51253.20	-22.65		
lambda	I	2031-12-02T08:57:13.982		79.99	-68.97	50026.71	-22.66		
delta	I	2031-12-02T08:58:30.181		79.92	-68.73	48300.35	-22.65		
gamma	I	2031-12-02T08:58:59.786		79.88	-68.64	47629.97	-22.64		
eta	I	2031-12-02T08:59:19.834		79.86	-68.58	47176.12	-22.64		
beta	I	2031-12-02T09:00:26.134		79.78	-68.37	45675.48	-22.62		
alpha	I	2031-12-02T09:01:08.415		79.73	-68.24	44719.49	-22.60		
4	I	2031-12-02T09:02:41.787		79.61	-67.94	42607.64	-22.58		
5	I	2031-12-02T09:02:59.752		79.59	-67.89	42209.29	-22.58		
6	I	2031-12-02T09:03:17.955		79.56	-67.83	41795.17	-22.57		
Uranus	I	2031-12-02T09:15:23.901		78.29	-65.50	25427.31		-5.24	-5.48
Uranus	E	2031-12-02T09:51:10.245		72.59	-58.32	25133.03		9.53	9.98
6	E	2031-12-02T10:03:22.355		70.30	-55.82	41875.02	22.55		
5	E	2031-12-02T10:03:40.175		70.25	-55.76	42283.89	22.57		
4	E	2031-12-02T10:03:52.208		70.21	-55.72	42545.47	22.56		
alpha	E	2031-12-02T10:05:27.837		69.90	-55.39	44707.12	22.59		
beta	E	2031-12-02T10:06:09.241		69.77	-55.24	45643.23	22.60		
eta	E	2031-12-02T10:07:17.007		69.55	-55.01	47176.12	22.62		
gamma	E	2031-12-02T10:07:36.797		69.49	-54.94	47623.82	22.63		
delta	E	2031-12-02T10:08:06.694		69.39	-54.84	48300.35	22.63		
lambda	E	2031-12-02T10:09:22.947		69.15	-54.58	50026.71	22.65		
epsilon	E	2031-12-02T10:10:03.197		69.01	-54.44	50938.44	22.63		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-02T09:33:01.660
 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 : 3404410809336902656
 2Mass ID (if available) : 05395699+2330317
 ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.128
 G magnitude : 18.843
 RP magnitude : 17.621
 BP magnitude : 20.380
 DUPflag : 0
 Distance (au) : 18.139
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.30
 Sun-Target sep (deg) : 164.14
 Sun-Moon sep (deg) : 23.02
 B (ring opening deg) : 78.96
 PA of pole (deg) : 42.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.511
 C/A sky separation (km) : 6724.4
 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	2031-12-02T08:55:57.224		79.16	-65.64	51254.35	-22.66		
lambda	I	2031-12-02T08:56:51.353		79.03	-65.45	50026.71	-22.67		
delta	I	2031-12-02T08:58:07.517		78.84	-65.20	48300.35	-22.66		
gamma	I	2031-12-02T08:58:37.108		78.77	-65.10	47629.96	-22.65		
eta	I	2031-12-02T08:58:57.146		78.72	-65.03	47176.12	-22.65		
beta	I	2031-12-02T09:00:03.409		78.55	-64.80	45675.53	-22.63		
alpha	I	2031-12-02T09:00:45.666		78.44	-64.66	44719.60	-22.62		
4	I	2031-12-02T09:02:18.996		78.20	-64.34	42607.54	-22.59		
5	I	2031-12-02T09:02:36.960		78.15	-64.28	42209.04	-22.59		
6	I	2031-12-02T09:02:55.139		78.10	-64.22	41795.19	-22.58		
Uranus	I	2031-12-02T09:15:00.492		76.05	-61.73	25424.74		-5.29	-5.54
Uranus	E	2031-12-02T09:50:49.898		69.14	-54.23	25135.04		9.51	9.95
6	E	2031-12-02T10:03:01.618		66.64	-51.65	41875.06	22.56		
5	E	2031-12-02T10:03:19.429		66.58	-51.59	42283.75	22.57		
4	E	2031-12-02T10:03:31.462		66.54	-51.55	42545.40	22.57		
alpha	E	2031-12-02T10:05:07.087		66.21	-51.21	44707.18	22.59		
beta	E	2031-12-02T10:05:48.486		66.07	-51.06	45643.24	22.60		
eta	E	2031-12-02T10:06:56.249		65.83	-50.82	47176.12	22.62		
gamma	E	2031-12-02T10:07:16.038		65.76	-50.75	47623.81	22.63		
delta	E	2031-12-02T10:07:45.935		65.66	-50.65	48300.35	22.63		
lambda	E	2031-12-02T10:09:02.189		65.40	-50.38	50026.71	22.65		
epsilon	E	2031-12-02T10:09:42.466		65.26	-50.24	50939.02	22.63		

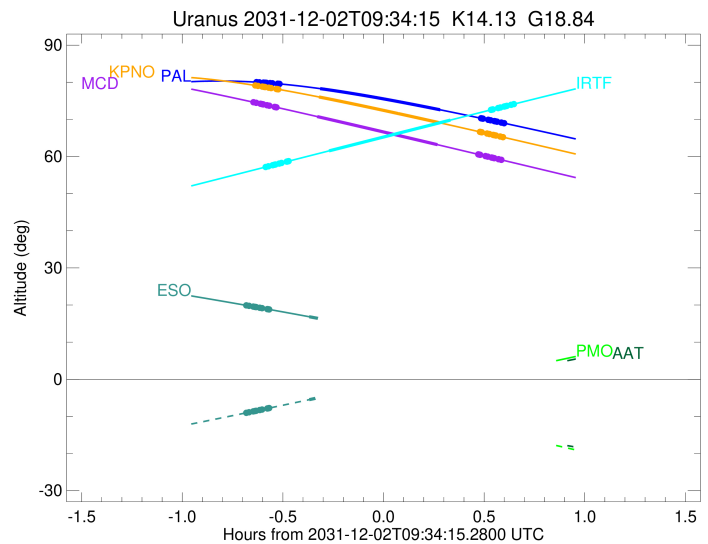
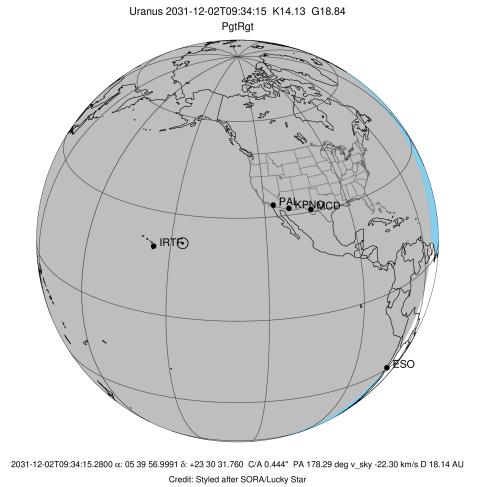
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-02T09:32:30.570
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : MCD
 Location : McDonald Obs. 2.7m
 Latitude (deg) : 30.67158
 E. Longitude (deg) : 255.97844
 Altitude (km) : 2.075
 Gaia source ID : 3404410809336902656
 2Mass ID (if available) : 05395699+2330317
 ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.128
 G magnitude : 18.843
 RP magnitude : 17.621
 BP magnitude : 20.380
 DUPflag : 0
 Distance (au) : 18.139
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.30
 Sun-Target sep (deg) : 164.14
 Sun-Moon sep (deg) : 22.92
 B (ring opening deg) : 78.96
 PA of pole (deg) : 42.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.507
 C/A sky separation (km) : 6667.5
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-02T08:55:24.989		74.65	-59.72	51255.15	-22.66		
lambda	I	2031-12-02T08:56:19.155		74.47	-59.52	50026.71	-22.67		
delta	I	2031-12-02T08:57:35.321		74.21	-59.25	48300.35	-22.66		
gamma	I	2031-12-02T08:58:04.914		74.12	-59.15	47629.95	-22.65		
eta	I	2031-12-02T08:58:24.952		74.05	-59.08	47176.12	-22.65		
beta	I	2031-12-02T08:59:31.217		73.83	-58.84	45675.56	-22.63		
alpha	I	2031-12-02T09:00:13.473		73.69	-58.69	44719.68	-22.62		
4	I	2031-12-02T09:01:46.813		73.37	-58.36	42607.48	-22.59		
5	I	2031-12-02T09:02:04.783		73.31	-58.30	42208.86	-22.59		
6	I	2031-12-02T09:02:22.953		73.25	-58.23	41795.20	-22.58		
Uranus	I	2031-12-02T09:14:28.270		70.77	-55.64	25423.18		-5.32	-5.57
Uranus	E	2031-12-02T09:50:20.243		63.20	-47.93	25135.74		9.50	9.94
6	E	2031-12-02T10:02:32.251		60.58	-45.31	41875.07	22.54		
5	E	2031-12-02T10:02:50.071		60.52	-45.24	42283.72	22.56		
4	E	2031-12-02T10:03:02.113		60.47	-45.20	42545.38	22.55		
alpha	E	2031-12-02T10:04:37.801		60.13	-44.86	44707.20	22.58		
beta	E	2031-12-02T10:05:19.227		59.98	-44.71	45643.25	22.59		
eta	E	2031-12-02T10:06:27.036		59.74	-44.46	47176.12	22.61		
gamma	E	2031-12-02T10:06:46.839		59.67	-44.39	47623.81	22.61		
delta	E	2031-12-02T10:07:16.758		59.56	-44.29	48300.35	22.62		
lambda	E	2031-12-02T10:08:33.067		59.29	-44.01	50026.71	22.63		
epsilon	E	2031-12-02T10:09:13.379		59.14	-43.87	50939.11	22.62		

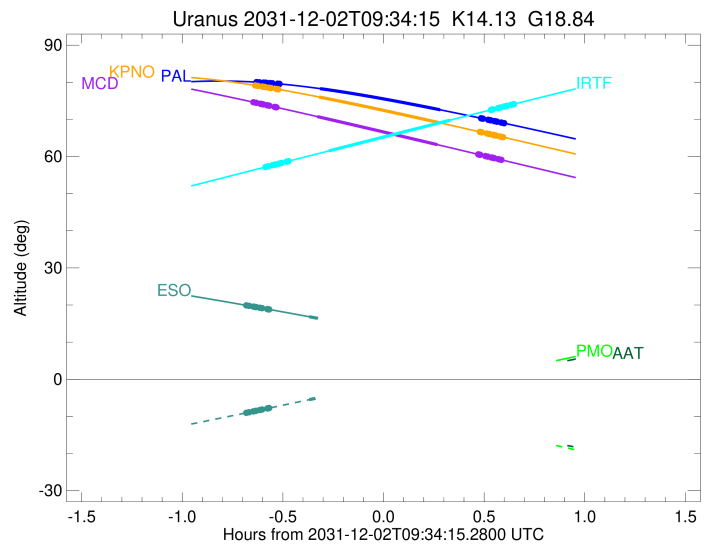
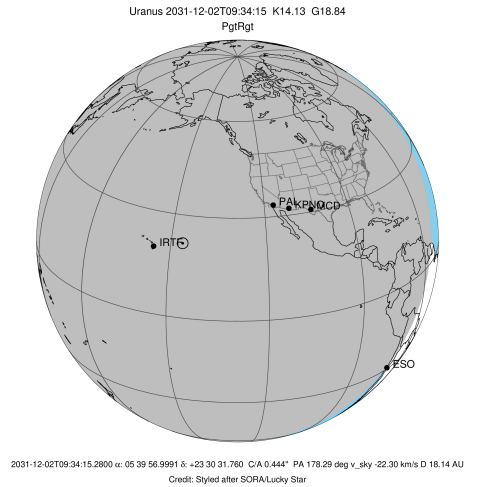
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-12-02T09:36:13.860
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       : 3404410809336902656
2Mass ID (if available) : 05395699+2330317
ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s
RUWE (>1.4 is poor) : 1.02
K magnitude           : 14.128
G magnitude           : 18.843
RP magnitude          : 17.621
BP magnitude          : 20.380
DUPflag              : 0
Distance (au)         : 18.139
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -22.30
Sun-Target sep (deg) : 164.14
Sun-Moon sep (deg)   : 23.54
B (ring opening deg) : 78.96
PA of pole (deg)     : 42.34
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.429
C/A sky separation (km) : 5637.5
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_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	2031-12-02T08:59:02.827		57.17	-73.02	51260.71	-22.69		
lambda	I	2031-12-02T08:59:57.180		57.37	-73.23	50026.71	-22.70		
delta	I	2031-12-02T09:01:13.247		57.66	-73.52	48300.35	-22.69		
gamma	I	2031-12-02T09:01:42.797		57.78	-73.64	47629.89	-22.69		
eta	I	2031-12-02T09:02:02.801		57.85	-73.71	47176.12	-22.68		
beta	I	2031-12-02T09:03:08.937		58.11	-73.97	45675.79	-22.67		
alpha	I	2031-12-02T09:03:51.091		58.27	-74.13	44720.26	-22.66		
4	I	2031-12-02T09:05:24.260		58.63	-74.49	42606.97	-22.65		
5	I	2031-12-02T09:05:42.232		58.70	-74.56	42207.45	-22.65		
6	I	2031-12-02T09:06:00.277		58.76	-74.63	41795.33	-22.64		
Uranus	I	2031-12-02T09:18:01.614		61.53	-77.39	25405.67		-5.66	-5.92
Uranus	E	2031-12-02T09:54:14.169		69.83	-85.46	25160.04		9.22	9.65
6	E	2031-12-02T10:06:19.443		72.58	-87.49	41875.66	22.70		
5	E	2031-12-02T10:06:37.042		72.65	-87.52	42281.71	22.71		
4	E	2031-12-02T10:06:49.033		72.69	-87.54	42544.24	22.71		
alpha	E	2031-12-02T10:08:24.175		73.05	-87.67	44708.15	22.73		
beta	E	2031-12-02T10:09:05.306		73.21	-87.71	45643.52	22.74		
eta	E	2031-12-02T10:10:12.670		73.46	-87.75	47176.12	22.75		
gamma	E	2031-12-02T10:10:32.342		73.53	-87.75	47623.68	22.75		
delta	E	2031-12-02T10:11:02.079		73.65	-87.76	48300.35	22.76		
lambda	E	2031-12-02T10:12:17.917		73.93	-87.74	50026.71	22.77		
epsilon	E	2031-12-02T10:12:58.393		74.09	-87.72	50948.46	22.76		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-12-02T09:30:48.890
 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 : 3404410809336902656
 2Mass ID (if available) : 05395699+2330317
 ICRS Star Coord at Epoch: 05h 39m 56.99915s +23:30:31.76049s
 RUWE (>1.4 is poor) : 1.02
 K magnitude : 14.128
 G magnitude : 18.843
 RP magnitude : 17.621
 BP magnitude : 20.380
 DUPflag : 0
 Distance (au) : 18.139
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.30
 Sun-Target sep (deg) : 164.14
 Sun-Moon sep (deg) : 22.25
 B (ring opening deg) : 78.96
 PA of pole (deg) : 42.34
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.121
 C/A sky separation (km) : 1594.8
 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_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	2031-12-02T08:53:14.648		19.92	-9.06	51295.27	-22.75		
lambda	I	2031-12-02T08:54:10.393		19.78	-8.88	50026.71	-22.76		
delta	I	2031-12-02T08:55:26.264		19.57	-8.65	48300.35	-22.75		
gamma	I	2031-12-02T08:55:55.749		19.50	-8.56	47629.50	-22.75		
eta	I	2031-12-02T08:56:15.677		19.44	-8.49	47176.12	-22.75		
beta	I	2031-12-02T08:57:21.548		19.27	-8.29	45677.08	-22.75		
alpha	I	2031-12-02T08:58:03.458		19.15	-8.16	44723.68	-22.75		
4	I	2031-12-02T08:59:36.553		18.90	-7.87	42603.83	-22.74		
5	I	2031-12-02T08:59:54.702		18.85	-7.81	42199.59	-22.75		
6	I	2031-12-02T09:00:12.229		18.81	-7.75	41796.32	-22.74		
Uranus	I	2031-12-02T09:12:07.560		16.84	-5.49	25313.85		-7.18	-7.52
Uranus	E	2031-12-02T09:49:28.331		10.33	1.81x	25242.59		8.18	8.56
6	E	2031-12-02T10:01:29.923		8.14	4.22x	41877.12	22.66		
5	E	2031-12-02T10:01:47.276		8.09	4.27x	42275.81	22.66		
4	E	2031-12-02T10:01:59.393		8.05	4.31x	42541.18	22.65		
alpha	E	2031-12-02T10:03:35.049		7.75	4.64x	44710.84	22.65		
beta	E	2031-12-02T10:04:16.244		7.63	4.77x	45644.35	22.65		
eta	E	2031-12-02T10:05:23.834		7.42	5.00x	47176.12	22.65		
gamma	E	2031-12-02T10:05:43.574		7.36	5.07x	47623.33	22.65		
delta	E	2031-12-02T10:06:13.458		7.26	5.17x	48300.35	22.65		
lambda	E	2031-12-02T10:07:29.663		7.03	5.43x	50026.71	22.65		
epsilon	E	2031-12-02T10:08:11.475		6.90	5.57x	50973.91	22.65		