

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-16T20:29:23.310  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3425564558359475072  
 2Mass ID (if available) : 06171640+2339023

ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s

RUWE (>1.4 is poor) : 0.91  
 K magnitude : 12.890  
 G magnitude : 14.674  
 RP magnitude : 14.039  
 BP magnitude : 15.134  
 DUPflag : 0  
 Distance (au) : 17.983  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.02  
 Sun-Target sep (deg) : 170.77  
 Sun-Moon sep (deg) : 115.42  
 B (ring opening deg) : 71.88  
 PA of pole (deg) : 65.20  
 # 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

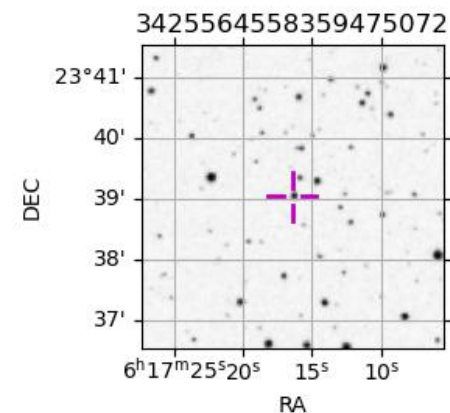
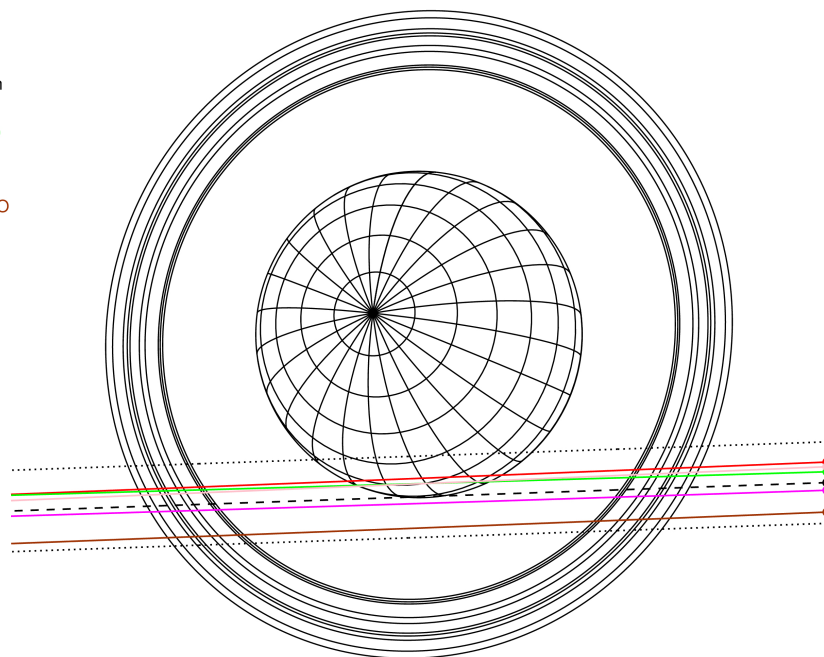
Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++	+ +	+++++	DEC 16 20:01 - DEC 16 21:04	PieRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++	+ +	+++++	DEC 16 19:55 - DEC 16 20:58	PieRie
KPNO	Kitt Peak Natl Obs	32.0	248.4					PnnRnn
MCD	McDonald Obs. 2.7m	30.7	256.0					PnnRnn
TEN	Teide Obs./Tenerife	28.3	343.5	+++++	+ +	+++++	DEC 16 20:02 - DEC 16 21:05	PieRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 16 19:59 - DEC 16 20:58	PnnRie
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	+++++		+++++	DEC 16 20:04 - DEC 16 21:01	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



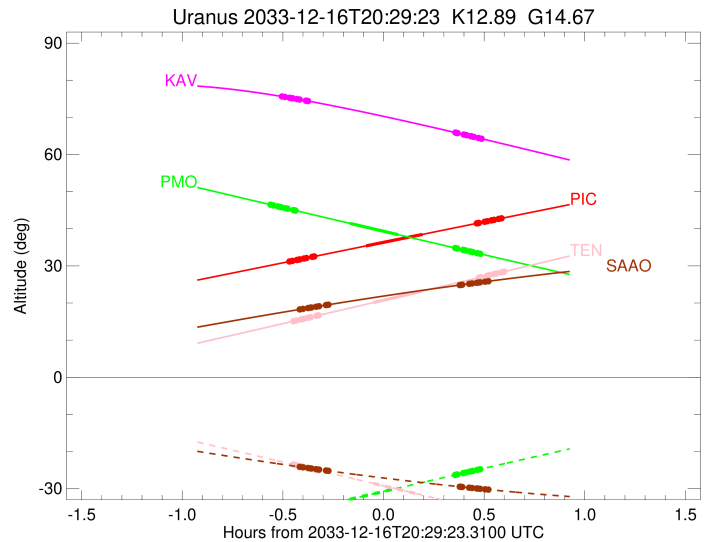
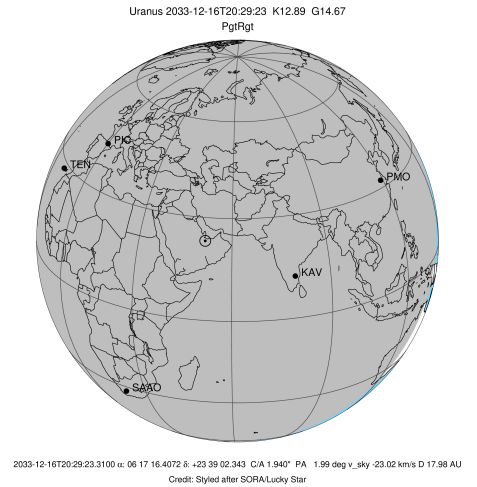
2033-12-16T20:29:23.3100 a: 06 17 16.4072 & +23 39 02.343 C/A 1.940" PA 1.99 deg v\_sky -23.02 km/s D 17.98 AU  
 Credit: Styled after SORA/Lucky Star

Uranus 2033-12-16T20:29:23 K12.89 G14.67 PgtRgt

Earth  
 PIC  
 PMO  
 TEN  
 KAV  
 SAAO

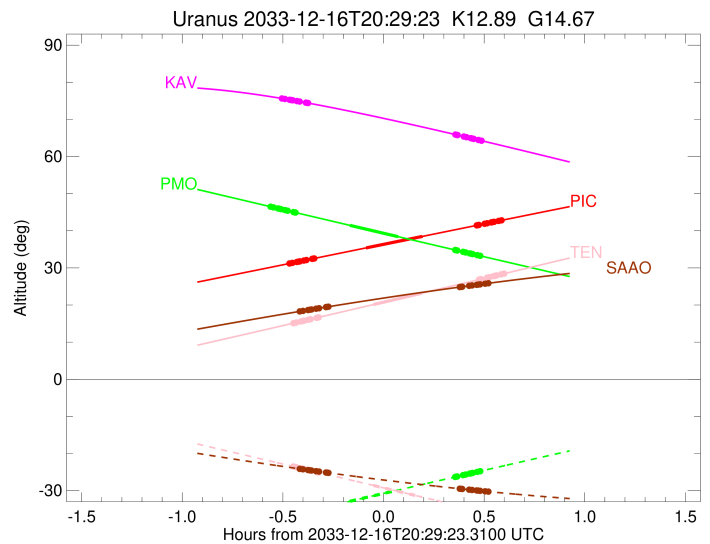
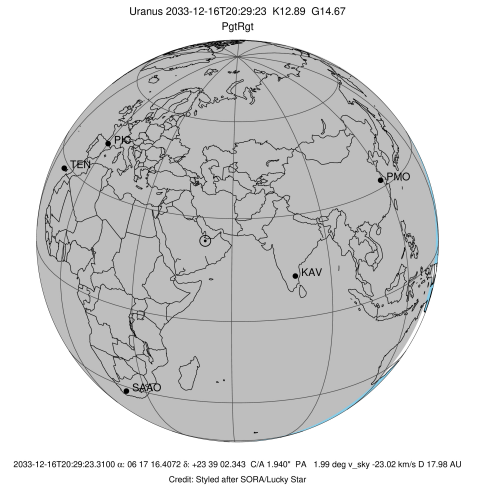


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-16T20:32:20.930  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 3425564558359475072  
 2Mass ID (if available) : 06171640+2339023  
 ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s  
 RUWE (>1.4 is poor) : 0.91  
 K magnitude : 12.890  
 G magnitude : 14.674  
 RP magnitude : 14.039  
 BP magnitude : 15.134  
 DUPflag : 0  
 Distance (au) : 17.983  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.02  
 Sun-Target sep (deg) : 170.77  
 Sun-Moon sep (deg) : 115.65  
 B (ring opening deg) : 71.88  
 PA of pole (deg) : 65.20  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.726  
 C/A sky separation (km) : 22515.2  
 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



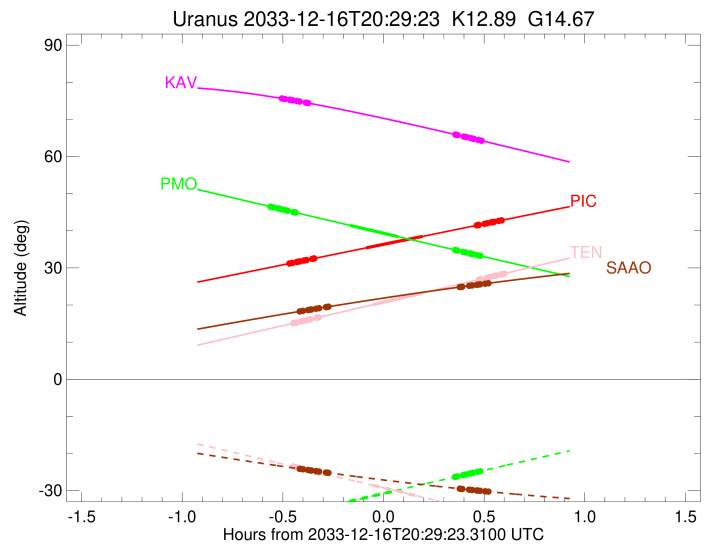
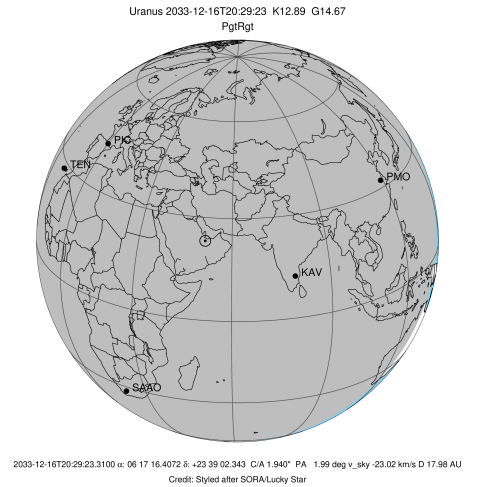
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-16T20:01:26.568		31.21	-38.44	51045.58	-21.66		
lambda	I	2033-12-16T20:02:13.916		31.35	-38.58	50026.71	-21.46		
delta	I	2033-12-16T20:03:34.725		31.60	-38.83	48300.35	-21.26		
gamma	I	2033-12-16T20:04:06.341		31.70	-38.93	47629.53	-21.18		
eta	I	2033-12-16T20:04:27.785		31.76	-38.99	47176.12	-21.11		
beta	I	2033-12-16T20:05:39.479		31.98	-39.21	45668.73	-20.89		
alpha	I	2033-12-16T20:06:26.555		32.12	-39.35	44692.54	-20.74		
4	I	2033-12-16T20:08:11.410		32.45	-39.67	42534.01	-20.38		
5	I	2033-12-16T20:08:21.754		32.48	-39.71	42311.26	-20.33		
6	I	2033-12-16T20:08:46.523		32.55	-39.78	41810.31	-20.21		
Uranus	I	2033-12-16T20:24:11.634		35.39	-42.60	25210.81		-14.54	-15.19
Uranus	E	2033-12-16T20:41:02.489		38.49	-45.66	25558.77		0.37	0.38
6	E	2033-12-16T20:57:11.245		41.46	-48.56	41818.23	20.27		
5	E	2033-12-16T20:57:31.198		41.52	-48.62	42225.31	20.39		
4	E	2033-12-16T20:57:49.631		41.58	-48.67	42610.59	20.44		
alpha	E	2033-12-16T20:59:31.686		41.89	-48.98	44711.97	20.81		
beta	E	2033-12-16T21:00:16.151		42.02	-49.11	45641.26	20.96		
eta	E	2033-12-16T21:01:28.972		42.25	-49.33	47176.12	21.19		
gamma	E	2033-12-16T21:01:50.272		42.31	-49.39	47627.99	21.25		
delta	E	2033-12-16T21:02:21.852		42.41	-49.48	48300.35	21.33		
lambda	E	2033-12-16T21:03:42.375		42.65	-49.72	50026.71	21.54		
epsilon	E	2033-12-16T21:04:51.547		42.86	-49.92	51522.44	21.74		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-16T20:26:17.020  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PMO  
 Location : Purple Mtn Obs. Nanking  
 Latitude (deg) : 32.06667  
 E. Longitude (deg) : 118.82089  
 Altitude (km) : 0.364  
 Gaia source ID : 3425564558359475072  
 2Mass ID (if available) : 06171640+2339023  
 ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s  
 RUWE (>1.4 is poor) : 0.91  
 K magnitude : 12.890  
 G magnitude : 14.674  
 RP magnitude : 14.039  
 BP magnitude : 15.134  
 DUPflag : 0  
 Distance (au) : 17.983  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.02  
 Sun-Target sep (deg) : 170.77  
 Sun-Moon sep (deg) : 116.22  
 B (ring opening deg) : 71.88  
 PA of pole (deg) : 65.20  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.790  
 C/A sky separation (km) : 23349.0  
 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



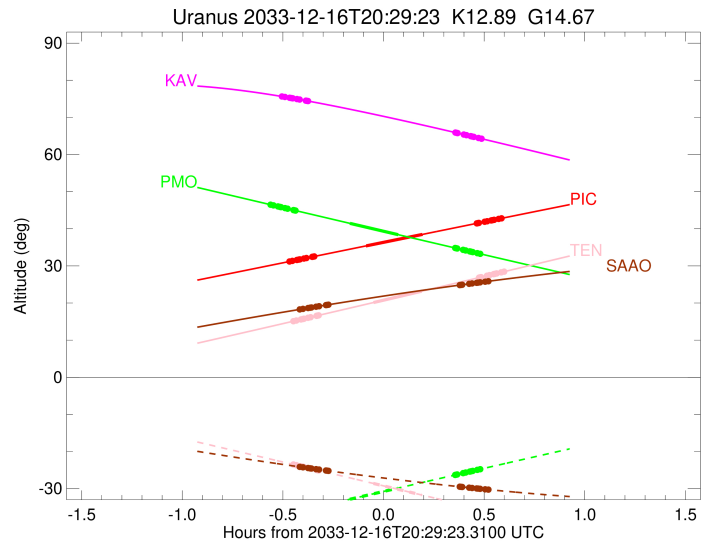
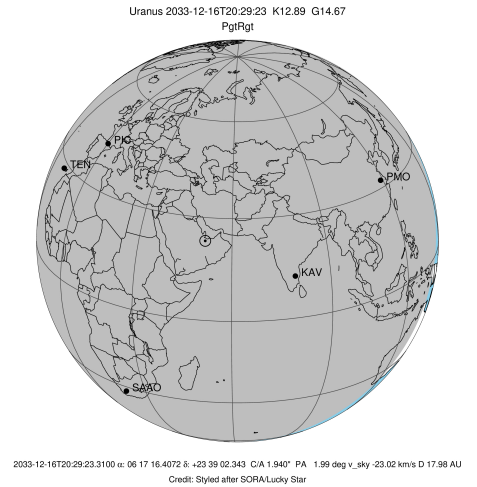
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-16T19:55:47.881		46.47	-37.82	51056.84	-21.59		
lambda	I	2033-12-16T19:56:35.932		46.30	-37.65	50026.71	-21.38		
delta	I	2033-12-16T19:57:57.115		46.01	-37.36	48300.35	-21.15		
gamma	I	2033-12-16T19:58:28.896		45.90	-37.25	47629.66	-21.06		
eta	I	2033-12-16T19:58:50.470		45.82	-37.18	47176.12	-20.99		
beta	I	2033-12-16T20:00:02.662		45.57	-36.92	45668.14	-20.75		
alpha	I	2033-12-16T20:00:50.103		45.40	-36.75	44691.85	-20.58		
4	I	2033-12-16T20:02:35.813		45.03	-36.38	42534.90	-20.17		
5	I	2033-12-16T20:02:46.294		44.99	-36.35	42312.06	-20.12		
6	I	2033-12-16T20:03:11.431		44.90	-36.26	41809.20	-19.99		
Uranus	I	2033-12-16T20:19:22.744		41.46	-32.86	25255.09		-13.54	-14.16
Uranus	E	2033-12-16T20:33:44.580		38.42	-29.85	25558.01		-0.76	-0.80
6	E	2033-12-16T20:50:43.975		34.83	-26.32	41817.71	19.93		
5	E	2033-12-16T20:51:04.337		34.76	-26.25	42226.37	20.06		
4	E	2033-12-16T20:51:23.011		34.69	-26.18	42610.29	20.12		
alpha	E	2033-12-16T20:53:06.593		34.33	-25.83	44711.59	20.51		
beta	E	2033-12-16T20:53:51.691		34.17	-25.67	45641.23	20.68		
eta	E	2033-12-16T20:55:05.468		33.91	-25.42	47176.12	20.92		
gamma	E	2033-12-16T20:55:27.036		33.84	-25.34	47628.04	20.99		
delta	E	2033-12-16T20:55:59.000		33.72	-25.23	48300.35	21.08		
lambda	E	2033-12-16T20:57:20.462		33.44	-24.95	50026.71	21.30		
epsilon	E	2033-12-16T20:58:30.451		33.19	-24.71	51523.66	21.51		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-16T20:33:18.210  
 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 : 3425564558359475072  
 2Mass ID (if available) : 06171640+2339023  
 ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s  
 RUWE (>1.4 is poor) : 0.91  
 K magnitude : 12.890  
 G magnitude : 14.674  
 RP magnitude : 14.039  
 BP magnitude : 15.134  
 DUPflag : 0  
 Distance (au) : 17.983  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.02  
 Sun-Target sep (deg) : 170.77  
 Sun-Moon sep (deg) : 115.38  
 B (ring opening deg) : 71.88  
 PA of pole (deg) : 65.20  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.791  
 C/A sky separation (km) : 23360.4  
 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\_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	2033-12-16T20:02:36.689		15.12	-23.52	51052.24	-21.37		
lambda	I	2033-12-16T20:03:24.998		15.29	-23.69	50026.71	-21.17		
delta	I	2033-12-16T20:04:46.970		15.58	-23.98	48300.35	-20.95		
gamma	I	2033-12-16T20:05:19.059		15.69	-24.09	47629.61	-20.86		
eta	I	2033-12-16T20:05:40.838		15.76	-24.17	47176.12	-20.79		
beta	I	2033-12-16T20:06:53.703		16.02	-24.43	45668.35	-20.55		
alpha	I	2033-12-16T20:07:41.587		16.19	-24.60	44692.10	-20.39		
4	I	2033-12-16T20:09:28.307		16.56	-24.98	42534.59	-19.99		
5	I	2033-12-16T20:09:38.871		16.60	-25.02	42311.80	-19.93		
6	I	2033-12-16T20:10:04.204		16.68	-25.11	41809.57	-19.81		
Uranus	I	2033-12-16T20:26:23.523		20.13	-28.61	25249.35		-13.68	-14.30
Uranus	E	2033-12-16T20:40:46.579		23.18	-31.71	25557.25		-1.01	-1.06
6	E	2033-12-16T20:57:50.888		26.83	-35.40	41817.23	19.88		
5	E	2033-12-16T20:58:11.377		26.91	-35.48	42227.39	20.01		
4	E	2033-12-16T20:58:30.043		26.97	-35.55	42610.00	20.07		
alpha	E	2033-12-16T21:00:13.856		27.35	-35.92	44711.16	20.47		
beta	E	2033-12-16T21:00:59.066		27.51	-36.09	45641.20	20.64		
eta	E	2033-12-16T21:02:12.987		27.77	-36.35	47176.12	20.88		
gamma	E	2033-12-16T21:02:34.597		27.85	-36.43	47628.11	20.95		
delta	E	2033-12-16T21:03:06.614		27.96	-36.55	48300.35	21.04		
lambda	E	2033-12-16T21:04:28.205		28.26	-36.84	50026.71	21.27		
epsilon	E	2033-12-16T21:05:38.383		28.51	-37.10	51525.65	21.48		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-12-16T20:28:06.590  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 3425564558359475072  
 2Mass ID (if available) : 06171640+2339023  
 ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s  
 RUWE (>1.4 is poor) : 0.91  
 K magnitude : 12.890  
 G magnitude : 14.674  
 RP magnitude : 14.039  
 BP magnitude : 15.134  
 DUPflag : 0  
 Distance (au) : 17.983  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -23.02  
 Sun-Target sep (deg) : 170.77  
 Sun-Moon sep (deg) : 116.30  
 B (ring opening deg) : 71.88  
 PA of pole (deg) : 65.20  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.029  
 C/A sky separation (km) : 26458.2  
 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



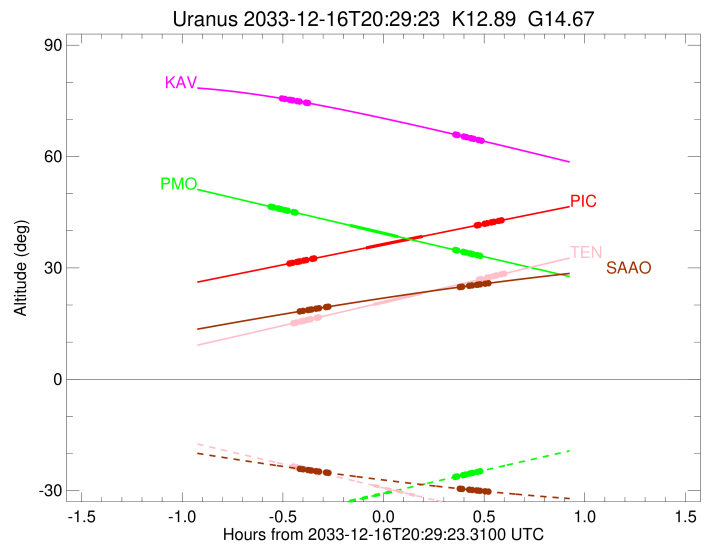
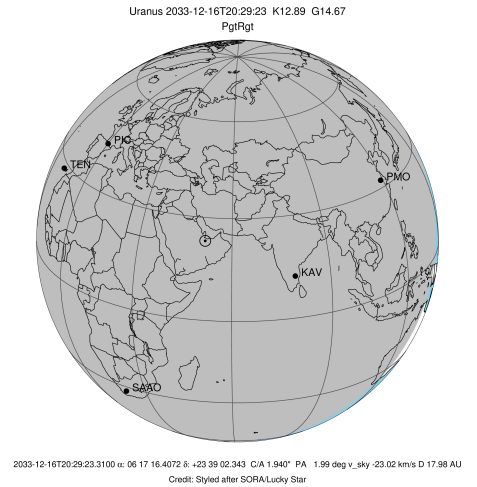
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-16T19:59:09.932		75.63	-68.42	51083.59	-20.92		
lambda	I	2033-12-16T20:00:00.899		75.50	-68.24	50026.71	-20.65		
delta	I	2033-12-16T20:01:25.101		75.29	-67.95	48300.35	-20.35		
gamma	I	2033-12-16T20:01:58.150		75.20	-67.84	47629.96	-20.22		
eta	I	2033-12-16T20:02:20.645		75.14	-67.76	47176.12	-20.13		
beta	I	2033-12-16T20:03:36.167		74.94	-67.50	45666.62	-19.80		
alpha	I	2033-12-16T20:04:25.971		74.81	-67.33	44690.23	-19.57		
4	I	2033-12-16T20:06:17.347		74.51	-66.94	42537.44	-19.01		
5	I	2033-12-16T20:06:28.595		74.47	-66.90	42313.76	-18.94		
6	I	2033-12-16T20:06:55.588		74.40	-66.81	41806.41	-18.76		

No planet occultations

6	E	2033-12-16T20:50:47.723		65.92	-57.27	41814.15	18.75		
5	E	2033-12-16T20:51:09.949		65.85	-57.19	42234.00	18.92		
4	E	2033-12-16T20:51:29.303		65.78	-57.12	42607.96	19.00		
alpha	E	2033-12-16T20:53:18.410		65.39	-56.71	44708.70	19.55		
beta	E	2033-12-16T20:54:05.775		65.23	-56.53	45641.08	19.78		
eta	E	2033-12-16T20:55:22.732		64.95	-56.25	47176.12	20.11		
gamma	E	2033-12-16T20:55:45.176		64.87	-56.16	47628.44	20.20		
delta	E	2033-12-16T20:56:18.338		64.76	-56.04	48300.35	20.33		
lambda	E	2033-12-16T20:57:42.639		64.46	-55.72	50026.71	20.63		
epsilon	E	2033-12-16T20:58:55.299		64.20	-55.45	51534.13	20.89		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-16T20:31:41.700
Event type          : PgtRgt
: Uranus occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code       : SAAO
Location            : So. Afr. Astro. Obs. (Sutherland)
Latitude (deg)      : -32.37953
E. Longitude (deg)  : 20.81070
Altitude (km)       : 1.768
Gaia source ID      : 3425564558359475072
2Mass ID (if available) : 06171640+2339023
ICRS Star Coord at Epoch: 06h 17m 16.40719s +23:39:02.34320s
RUWE (>1.4 is poor) : 0.91
K magnitude         : 12.890
G magnitude         : 14.674
RP magnitude        : 14.039
BP magnitude        : 15.134
DUPflag            : 0
Distance (au)       : 17.983
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -23.02
Sun-Target sep (deg) : 170.77
Sun-Moon sep (deg)  : 115.51
B (ring opening deg) : 71.88
PA of pole (deg)    : 65.20
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 2.323
C/A sky separation (km) : 30294.2
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	2033-12-16T20:04:27.268		18.29	-24.14	51117.81	-19.53		
lambda	I	2033-12-16T20:05:23.805		18.43	-24.26	50026.71	-19.18		
delta	I	2033-12-16T20:06:54.808		18.65	-24.45	48300.35	-18.76		
gamma	I	2033-12-16T20:07:30.702		18.74	-24.53	47630.30	-18.58		
eta	I	2033-12-16T20:07:55.234		18.80	-24.58	47176.12	-18.45		
beta	I	2033-12-16T20:09:18.097		19.01	-24.75	45664.60	-17.99		
alpha	I	2033-12-16T20:10:13.095		19.14	-24.87	44688.39	-17.66		
4	I	2033-12-16T20:12:17.200		19.45	-25.12	42541.20	-16.86		
5	I	2033-12-16T20:12:30.178		19.48	-25.15	42315.03	-16.74		
6	I	2033-12-16T20:13:01.086		19.55	-25.21	41803.08	-16.50		

No planet occultations

6	E	2033-12-16T20:52:05.210		24.83	-29.48	41809.57	16.53		
5	E	2033-12-16T20:52:31.278		24.88	-29.52	42244.57	16.78		
4	E	2033-12-16T20:52:52.366		24.92	-29.55	42604.19	16.89		
alpha	E	2033-12-16T20:54:53.849		25.17	-29.74	44704.88	17.70		
beta	E	2033-12-16T20:55:46.194		25.28	-29.82	45641.10	18.03		
eta	E	2033-12-16T20:57:10.230		25.45	-29.95	47176.12	18.50		
gamma	E	2033-12-16T20:57:34.628		25.50	-29.99	47628.95	18.63		
delta	E	2033-12-16T20:58:10.503		25.57	-30.04	48300.35	18.80		
lambda	E	2033-12-16T20:59:41.264		25.75	-30.18	50026.71	19.23		
epsilon	E	2033-12-16T21:00:59.529		25.90	-30.29	51544.94	19.59		