

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2033-12-17T21:01:43.060
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3425565176834775296
 2Mass ID (if available) : 06170504+2339110

ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s

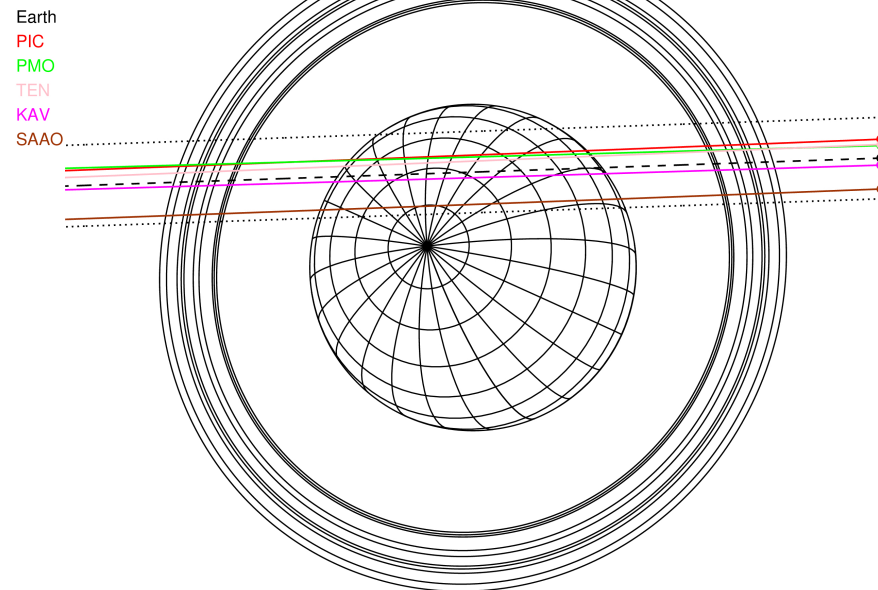
RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.630
 G magnitude : 15.914
 RP magnitude : 15.156
 BP magnitude : 16.537
 DUPflag : 0
 Distance (au) : 17.980
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.11
 Sun-Target sep (deg) : 171.85
 Sun-Moon sep (deg) : 127.56
 B (ring opening deg) : 71.92
 PA of pole (deg) : 65.12

#	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



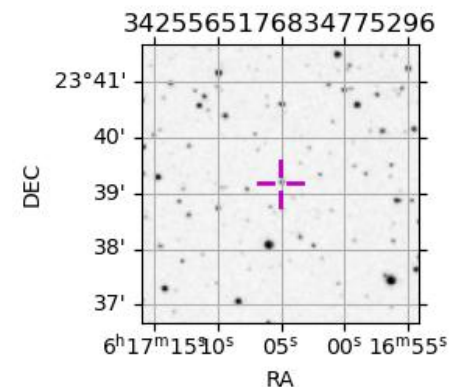
2033-12-17T21:01:43.0600 ra: 06 17 05.0519 s: +23 39 10.826 C/A 1.152° PA 181.97 deg v_sky -23.11 km/s D 17.98 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2033-12-17T21:01:43 K13.63 G15.91 PgtRgt

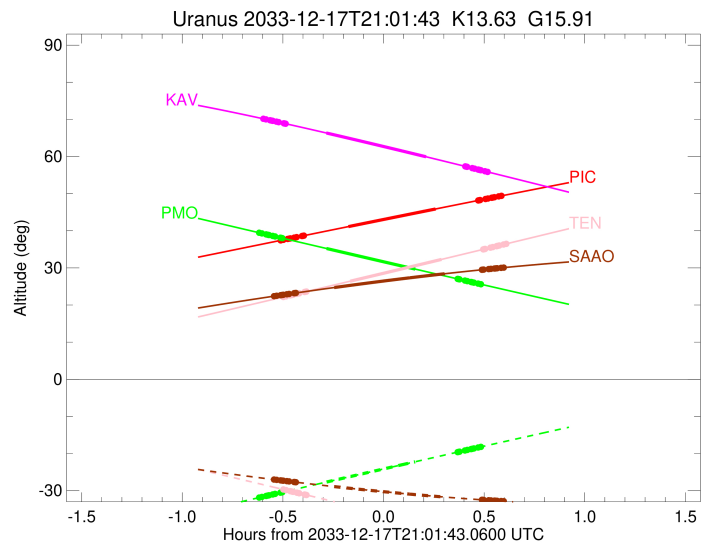
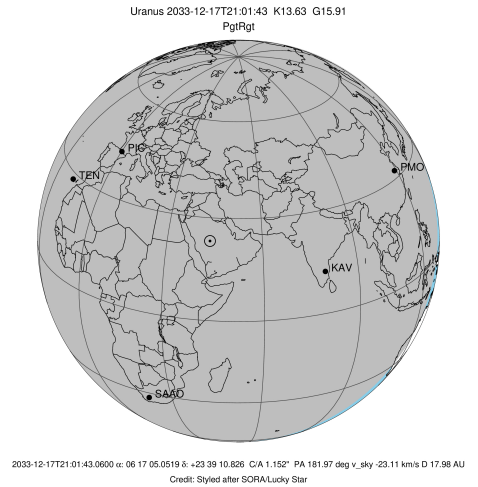


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++	+ +	+++++	DEC 17 20:31 - DEC 17 21:36	PieRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++	+ +	+++++	DEC 17 20:24 - DEC 17 21:30	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 17 20:32 - DEC 17 21:38	PieRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++	+ +	+++++	DEC 17 20:26 - DEC 17 21:32	PieRie
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 17 20:29 - DEC 17 21:37	PieRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn

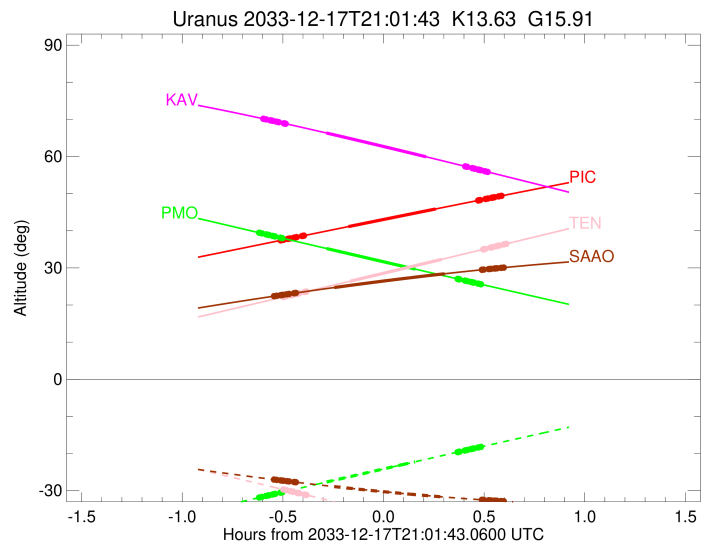
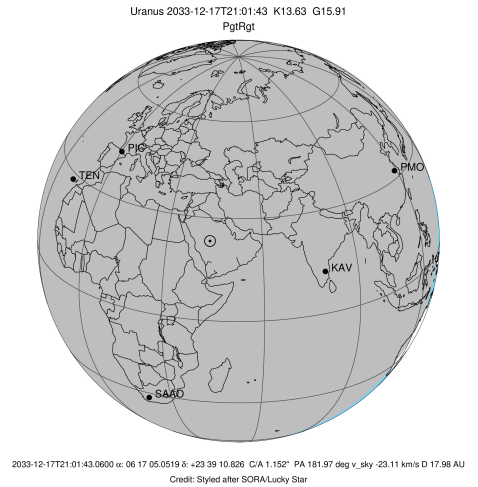


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2033-12-17T21:04:29.720
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 3425565176834775296
 2Mass ID (if available) : 06170504+2339110
 ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.630
 G magnitude : 15.914
 RP magnitude : 15.156
 BP magnitude : 16.537
 DUPflag : 0
 Distance (au) : 17.980
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.11
 Sun-Target sep (deg) : 171.85
 Sun-Moon sep (deg) : 127.74
 B (ring opening deg) : 71.92
 PA of pole (deg) : 65.12
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.349
 C/A sky separation (km) : 17587.8
 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



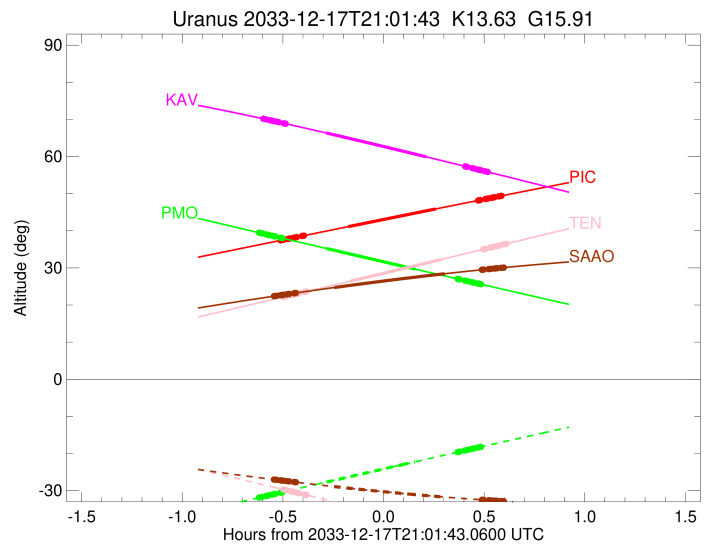
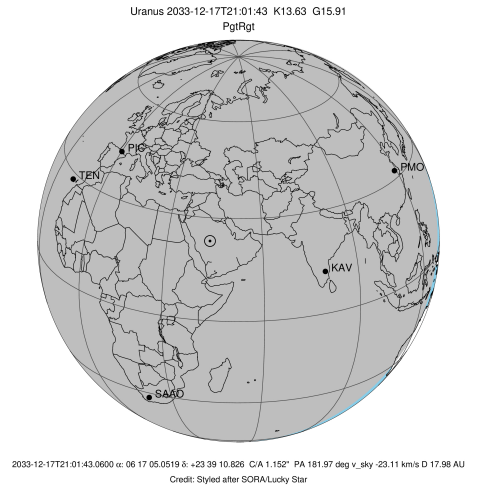
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-17T20:31:19.213		37.46	-43.83	50797.45	-22.67		
lambda	I	2033-12-17T20:31:53.194		37.57	-43.93	50026.71	-22.66		
delta	I	2033-12-17T20:33:09.583		37.80	-44.16	48300.35	-22.54		
gamma	I	2033-12-17T20:33:39.567		37.89	-44.25	47625.29	-22.49		
eta	I	2033-12-17T20:33:59.555		37.95	-44.31	47176.12	-22.45		
beta	I	2033-12-17T20:35:06.339		38.16	-44.51	45680.34	-22.33		
alpha	I	2033-12-17T20:35:49.436		38.29	-44.64	44719.54	-22.25		
4	I	2033-12-17T20:37:28.618		38.59	-44.94	42528.55	-22.03		
5	I	2033-12-17T20:37:40.367		38.63	-44.98	42258.67	-21.97		
6	I	2033-12-17T20:37:58.938		38.69	-45.04	41848.89	-21.95		
Uranus	I	2033-12-17T20:51:17.836		41.13	-47.44	25499.63		-5.89	-6.16
Uranus	E	2033-12-17T21:17:15.814		45.88	-52.04	25076.28		17.22	17.99
6	E	2033-12-17T21:29:58.943		48.17	-54.24	41861.24	22.01		
5	E	2033-12-17T21:30:12.574		48.21	-54.28	42161.09	22.03		
4	E	2033-12-17T21:30:32.280		48.27	-54.34	42610.52	22.09		
alpha	E	2033-12-17T21:32:08.257		48.56	-54.61	44742.56	22.32		
beta	E	2033-12-17T21:32:49.099		48.68	-54.73	45652.03	22.40		
eta	E	2033-12-17T21:33:56.902		48.89	-54.92	47176.12	22.53		
gamma	E	2033-12-17T21:34:16.741		48.95	-54.98	47623.35	22.56		
delta	E	2033-12-17T21:34:46.715		49.03	-55.06	48300.35	22.61		
lambda	E	2033-12-17T21:36:02.854		49.26	-55.28	50026.71	22.73		
epsilon	E	2033-12-17T21:36:57.839		49.43	-55.43	51278.98	22.75		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2033-12-17T20:58:09.100
 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 : 3425565176834775296
 2Mass ID (if available) : 06170504+2339110
 ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.630
 G magnitude : 15.914
 RP magnitude : 15.156
 BP magnitude : 16.537
 DUPflag : 0
 Distance (au) : 17.980
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.11
 Sun-Target sep (deg) : 171.85
 Sun-Moon sep (deg) : 128.38
 B (ring opening deg) : 71.92
 PA of pole (deg) : 65.12
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.326
 C/A sky separation (km) : 17295.3
 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_itrf93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



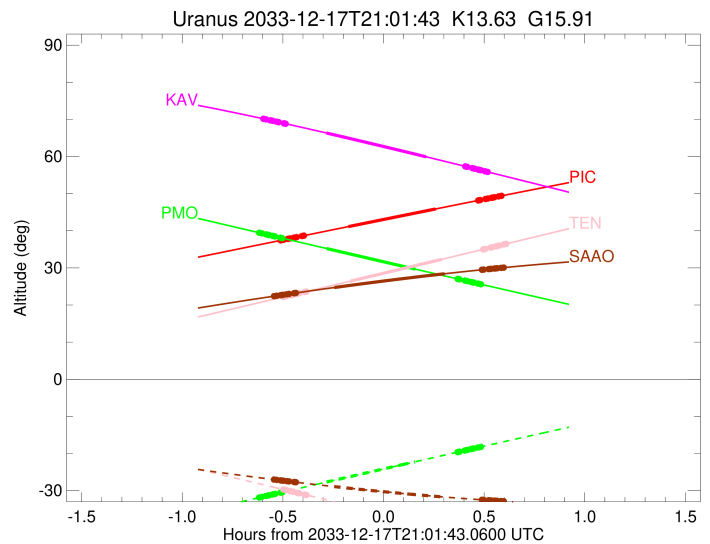
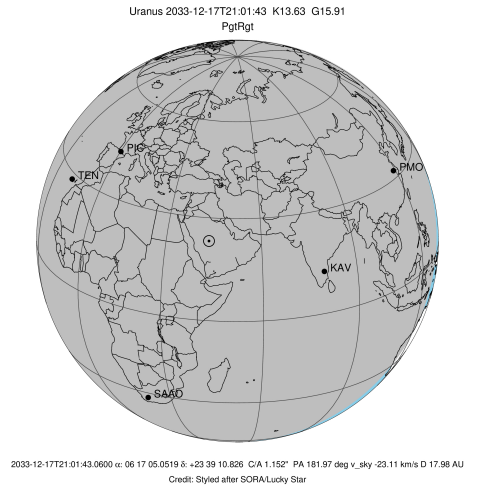
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-12-17T20:24:54.638		39.42	-31.81	50800.86	-22.77		
lambda	I	2033-12-17T20:25:28.623		39.30	-31.70	50026.71	-22.75		
delta	I	2033-12-17T20:26:44.687		39.03	-31.43	48300.35	-22.64		
gamma	I	2033-12-17T20:27:14.537		38.92	-31.33	47625.38	-22.59		
eta	I	2033-12-17T20:27:34.442		38.85	-31.26	47176.12	-22.55		
beta	I	2033-12-17T20:28:40.938		38.62	-31.03	45680.23	-22.43		
alpha	I	2033-12-17T20:29:23.867		38.47	-30.88	44718.94	-22.35		
4	I	2033-12-17T20:31:02.578		38.12	-30.53	42528.28	-22.14		
5	I	2033-12-17T20:31:14.183		38.08	-30.49	42260.06	-22.08		
6	I	2033-12-17T20:31:32.762		38.01	-30.43	41848.15	-22.06		
Uranus	I	2033-12-17T20:44:44.624		35.22	-27.68	25490.51		-6.32	-6.62
Uranus	E	2033-12-17T21:11:09.760		29.68	-22.22	25074.66		17.25	18.02
6	E	2033-12-17T21:23:50.561		27.03	-19.62	41861.32	21.98		
5	E	2033-12-17T21:24:04.206		26.99	-19.58	42161.02	22.00		
4	E	2033-12-17T21:24:23.943		26.92	-19.51	42610.47	22.06		
alpha	E	2033-12-17T21:26:00.105		26.58	-19.18	44742.62	22.27		
beta	E	2033-12-17T21:26:41.039		26.44	-19.04	45652.09	22.35		
eta	E	2033-12-17T21:27:49.014		26.21	-18.81	47176.12	22.46		
gamma	E	2033-12-17T21:28:08.908		26.14	-18.74	47623.34	22.50		
delta	E	2033-12-17T21:28:38.970		26.03	-18.64	48300.35	22.54		
lambda	E	2033-12-17T21:29:55.350		25.77	-18.38	50026.71	22.66		
epsilon	E	2033-12-17T21:30:50.462		25.58	-18.20	51277.50	22.67		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2033-12-17T21:05:36.310
 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 : 3425565176834775296
 2Mass ID (if available) : 06170504+2339110
 ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.630
 G magnitude : 15.914
 RP magnitude : 15.156
 BP magnitude : 16.537
 DUPflag : 0
 Distance (au) : 17.980
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.11
 Sun-Target sep (deg) : 171.85
 Sun-Moon sep (deg) : 127.46
 B (ring opening deg) : 71.92
 PA of pole (deg) : 65.12
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.276
 C/A sky separation (km) : 16643.1
 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_itrf93_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	2033-12-17T20:32:07.194		22.22	-29.75	50801.13	-22.76		
lambda	I	2033-12-17T20:32:41.196		22.34	-29.87	50026.71	-22.75		
delta	I	2033-12-17T20:33:57.238		22.61	-30.14	48300.35	-22.65		
gamma	I	2033-12-17T20:34:27.066		22.71	-30.25	47625.39	-22.60		
eta	I	2033-12-17T20:34:46.954		22.78	-30.32	47176.12	-22.58		
beta	I	2033-12-17T20:35:53.363		23.02	-30.56	45680.21	-22.47		
alpha	I	2033-12-17T20:36:36.219		23.17	-30.71	44718.82	-22.40		
4	I	2033-12-17T20:38:14.678		23.52	-31.07	42528.21	-22.20		
5	I	2033-12-17T20:38:26.225		23.56	-31.11	42260.42	-22.15		
6	I	2033-12-17T20:38:44.767		23.63	-31.17	41847.95	-22.13		
Uranus	I	2033-12-17T20:51:46.518		26.41	-33.99	25482.69		-6.68	-6.99
Uranus	E	2033-12-17T21:19:01.247		32.29	-39.92	25061.84		17.49	18.27
6	E	2033-12-17T21:31:28.253		34.99	-42.64	41860.29	22.22		
5	E	2033-12-17T21:31:41.835		35.04	-42.69	42161.94	22.23		
4	E	2033-12-17T21:32:01.338		35.11	-42.76	42611.11	22.29		
alpha	E	2033-12-17T21:33:36.478		35.46	-43.11	44741.95	22.49		
beta	E	2033-12-17T21:34:17.014		35.60	-43.25	45651.60	22.56		
eta	E	2033-12-17T21:35:24.363		35.85	-43.50	47176.12	22.68		
gamma	E	2033-12-17T21:35:44.077		35.92	-43.57	47623.46	22.71		
delta	E	2033-12-17T21:36:13.855		36.03	-43.68	48300.35	22.75		
lambda	E	2033-12-17T21:37:29.542		36.30	-43.96	50026.71	22.86		
epsilon	E	2033-12-17T21:38:24.592		36.50	-44.16	51287.34	22.88		

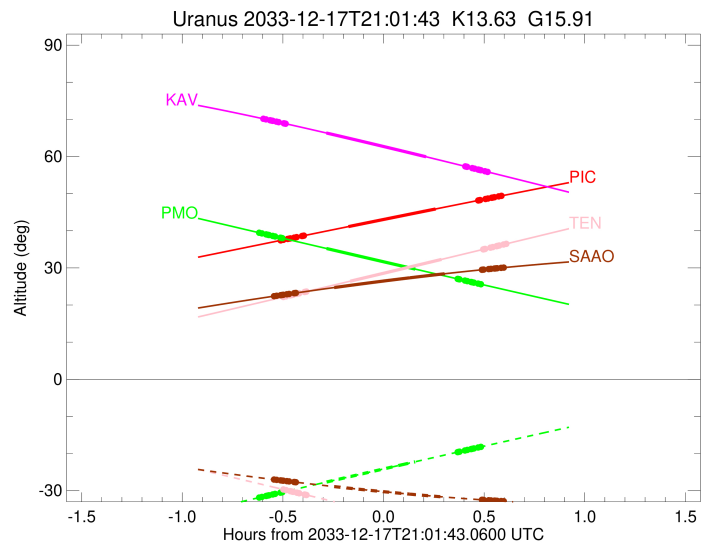
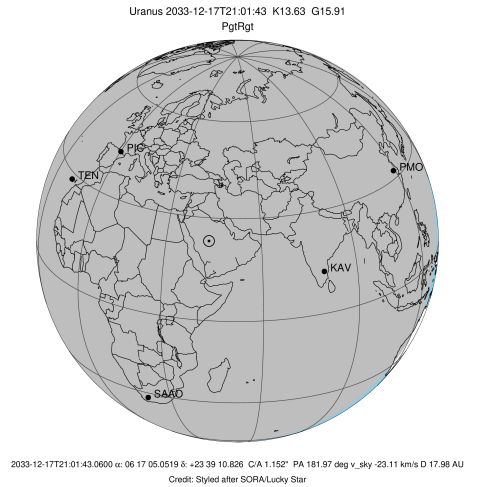
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2033-12-17T20:59:41.900
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : KAV
 Location : Kavalur Observatory
 Latitude (deg) : 12.57556
 E. Longitude (deg) : 78.83167
 Altitude (km) : 0.722
 Gaia source ID : 3425565176834775296
 2Mass ID (if available) : 06170504+2339110
 ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s
 RUWE (>1.4 is poor) : 0.98
 K magnitude : 13.630
 G magnitude : 15.914
 RP magnitude : 15.156
 BP magnitude : 16.537
 DUPflag : 0
 Distance (au) : 17.980
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -23.11
 Sun-Target sep (deg) : 171.85
 Sun-Moon sep (deg) : 128.44
 B (ring opening deg) : 71.92
 PA of pole (deg) : 65.12
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.077
 C/A sky separation (km) : 14048.9
 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_itrf93_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	2033-12-17T20:26:08.095		70.12	-62.80	50815.10	-23.51		
lambda	I	2033-12-17T20:26:41.613		70.01	-62.68	50026.71	-23.51		
delta	I	2033-12-17T20:27:55.175		69.77	-62.41	48300.35	-23.43		
gamma	I	2033-12-17T20:28:23.988		69.67	-62.31	47625.74	-23.40		
eta	I	2033-12-17T20:28:43.215		69.61	-62.24	47176.12	-23.37		
beta	I	2033-12-17T20:29:47.326		69.40	-62.01	45679.72	-23.30		
alpha	I	2033-12-17T20:30:28.731		69.26	-61.86	44716.37	-23.25		
4	I	2033-12-17T20:32:03.402		68.94	-61.51	42527.26	-23.11		
5	I	2033-12-17T20:32:14.153		68.90	-61.47	42266.16	-23.06		
6	I	2033-12-17T20:32:32.347		68.84	-61.41	41844.74	-23.05		
Uranus	I	2033-12-17T20:44:40.952		66.34	-58.73	25425.03		-8.88	-9.29
Uranus	E	2033-12-17T21:14:23.552		59.94	-52.07	25038.84		17.92	18.71
6	E	2033-12-17T21:26:06.604		57.34	-49.42	41858.19	23.01		
5	E	2033-12-17T21:26:19.888		57.30	-49.37	42163.94	23.02		
4	E	2033-12-17T21:26:38.675		57.23	-49.30	42612.26	23.06		
alpha	E	2033-12-17T21:28:10.695		56.88	-48.95	44740.63	23.20		
beta	E	2033-12-17T21:28:50.024		56.74	-48.80	45650.71	23.25		
eta	E	2033-12-17T21:29:55.485		56.49	-48.55	47176.12	23.33		
gamma	E	2033-12-17T21:30:14.664		56.42	-48.48	47623.68	23.35		
delta	E	2033-12-17T21:30:43.628		56.31	-48.37	48300.35	23.38		
lambda	E	2033-12-17T21:31:57.355		56.04	-48.09	50026.71	23.45		
epsilon	E	2033-12-17T21:32:51.758		55.84	-47.88	51303.96	23.45		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2033-12-17T21:03:37.230
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       : 3425565176834775296
2Mass ID (if available) : 06170504+2339110
ICRS Star Coord at Epoch: 06h 17m 05.05189s +23:39:10.82572s
RUWE (>1.4 is poor) : 0.98
K magnitude           : 13.630
G magnitude           : 15.914
RP magnitude          : 15.156
BP magnitude          : 16.537
DUPflag              : 0
Distance (au)        : 17.980
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -23.11
Sun-Target sep (deg) : 171.85
Sun-Moon sep (deg)   : 127.62
B (ring opening deg) : 71.92
PA of pole (deg)     : 65.12
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.757
C/A sky separation (km) : 9866.8
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.bsp
earthstns_itrf93_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	2033-12-17T20:29:18.192		22.41	-27.04	50834.17	-23.88		
lambda	I	2033-12-17T20:29:51.987		22.49	-27.10	50026.71	-23.89		
delta	I	2033-12-17T20:31:04.315		22.65	-27.24	48300.35	-23.85		
gamma	I	2033-12-17T20:31:32.590		22.72	-27.29	47626.20	-23.84		
eta	I	2033-12-17T20:31:51.476		22.76	-27.32	47176.12	-23.83		
beta	I	2033-12-17T20:32:54.345		22.90	-27.44	45678.96	-23.79		
alpha	I	2033-12-17T20:33:34.981		22.99	-27.51	44713.29	-23.77		
4	I	2033-12-17T20:35:07.320		23.19	-27.68	42526.41	-23.70		
5	I	2033-12-17T20:35:17.410		23.21	-27.70	42273.23	-23.67		
6	I	2033-12-17T20:35:35.609		23.25	-27.73	41840.58	-23.67		
Uranus	I	2033-12-17T20:47:01.646		24.71	-28.91	25335.94		-11.52	-12.05
Uranus	E	2033-12-17T21:19:58.103		28.42	-31.73	25032.28		18.04	18.83
6	E	2033-12-17T21:31:04.147		29.50	-32.47	41853.93	23.73		
5	E	2033-12-17T21:31:17.385		29.52	-32.49	42168.49	23.73		
4	E	2033-12-17T21:31:35.476		29.54	-32.51	42614.13	23.76		
alpha	E	2033-12-17T21:33:04.802		29.68	-32.59	44737.82	23.82		
beta	E	2033-12-17T21:33:43.147		29.74	-32.63	45649.00	23.85		
eta	E	2033-12-17T21:34:47.094		29.83	-32.70	47176.12	23.89		
gamma	E	2033-12-17T21:35:05.847		29.86	-32.71	47624.15	23.90		
delta	E	2033-12-17T21:35:34.134		29.90	-32.74	48300.35	23.91		
lambda	E	2033-12-17T21:36:46.272		30.01	-32.81	50026.71	23.95		
epsilon	E	2033-12-17T21:37:40.982		30.09	-32.86	51337.72	23.94		