

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-14T08:00:43.050
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 144879112435214720
 2Mass ID (if available) : 04391584+2206452

Uranus 2028-12-14T08:00:43 K13.78 G15.94 PgtRgt

ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s

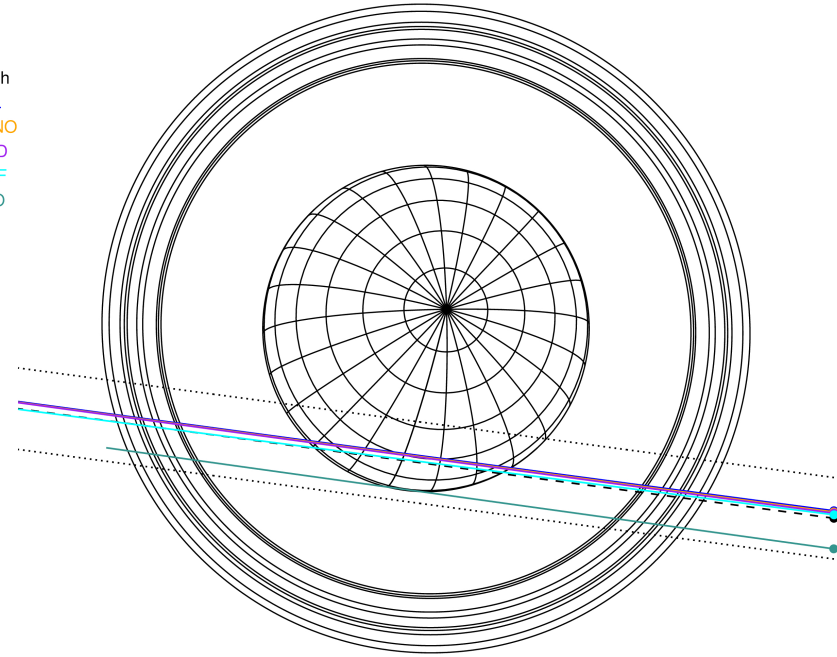
RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.779
 G magnitude : 15.942
 RP magnitude : 15.237
 BP magnitude : 16.489
 DUPflag : 0
 Distance (au) : 18.325
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.92
 Sun-Target sep (deg) : 168.90
 Sun-Moon sep (deg) : 167.99
 B (ring opening deg) : 80.08
 PA of pole (deg) : -46.93

Uranus 2028-12-14T08:00:43 K13.78 G15.94
 PgtRgt



2028-12-14T08:00:43.0500 ra: 04 39 15.8461 s: +22 06 45.168 C/A 1.571'' PA 352.35 deg v_sky -22.92 km/s D 18.33 AU
 Credit: Styled after SORA/Lucky Star

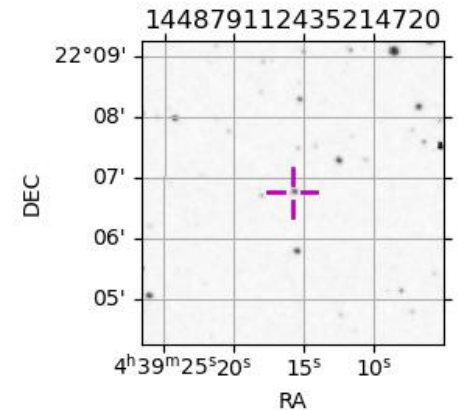
Earth
 PAL
 KPNO
 MCD
 IRTF
 ESO



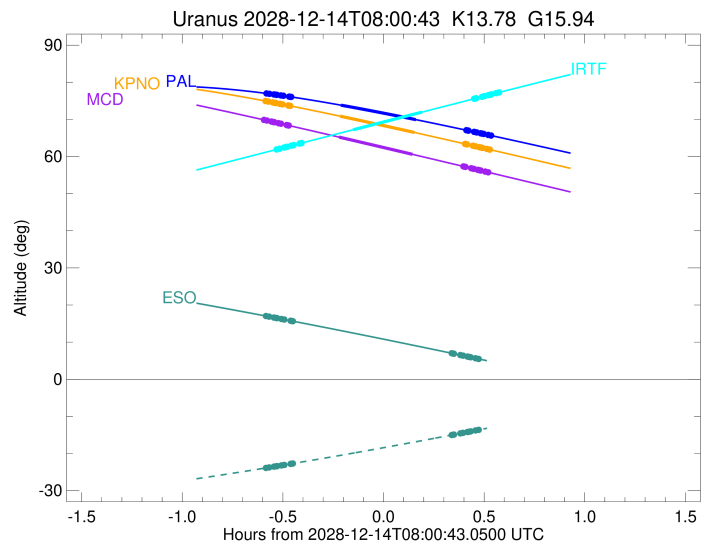
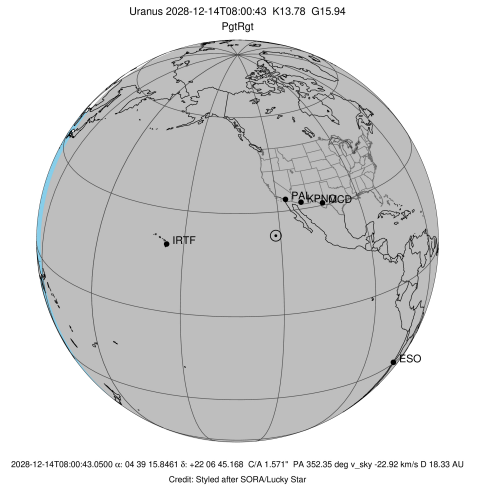
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon

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					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	+++++	+ +	+++++	DEC 14 07:25 - DEC 14 08:32	PieRie
PNO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	DEC 14 07:25 - DEC 14 08:32	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	DEC 14 07:25 - DEC 14 08:32	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	DEC 14 07:28 - DEC 14 08:35	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 14 07:25 - DEC 14 08:29	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



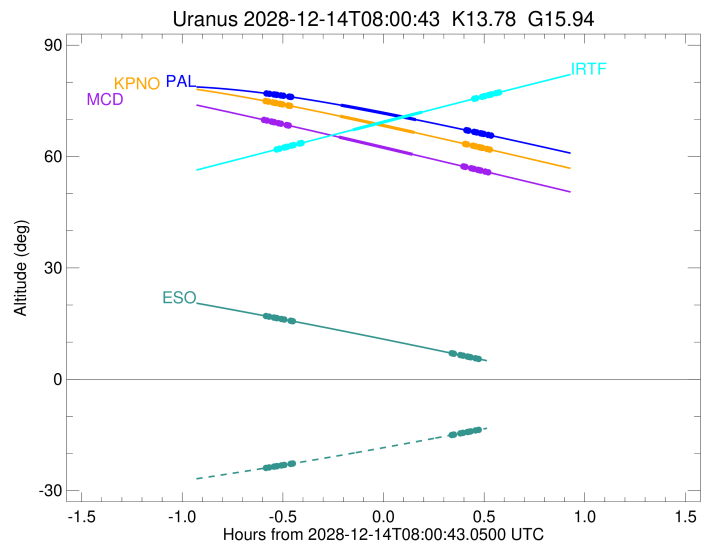
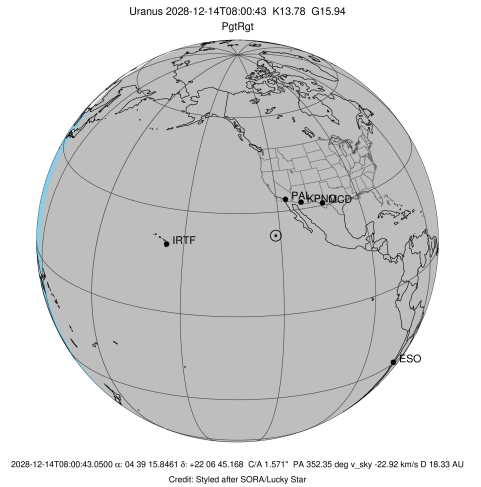
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-14T07:59:30.660
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PAL
 Location : Palomar Mt (200")
 Latitude (deg) : 33.35622
 E. Longitude (deg) : 243.13601
 Altitude (km) : 1.706
 Gaia source ID : 144879112435214720
 2Mass ID (if available) : 04391584+2206452
 ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.779
 G magnitude : 15.942
 RP magnitude : 15.237
 BP magnitude : 16.489
 DUPflag : 0
 Distance (au) : 18.325
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.92
 Sun-Target sep (deg) : 168.90
 Sun-Moon sep (deg) : 168.37
 B (ring opening deg) : 80.08
 PA of pole (deg) : -46.93
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.494
 C/A sky separation (km) : 19858.4
 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	2028-12-14T07:25:47.641		77.00	-79.42	51211.99	-21.64		
lambda	I	2028-12-14T07:26:42.722		76.89	-79.49	50026.71	-21.47		
delta	I	2028-12-14T07:28:03.405		76.73	-79.58	48300.35	-21.32		
gamma	I	2028-12-14T07:28:34.831		76.66	-79.62	47631.32	-21.26		
eta	I	2028-12-14T07:28:56.268		76.62	-79.64	47176.12	-21.21		
beta	I	2028-12-14T07:30:07.330		76.46	-79.71	45674.26	-21.06		
alpha	I	2028-12-14T07:30:53.109		76.37	-79.75	44712.40	-20.94		
4	I	2028-12-14T07:32:37.732		76.13	-79.84	42536.49	-20.66		
5	I	2028-12-14T07:32:54.899		76.10	-79.85	42180.38	-20.60		
6	I	2028-12-14T07:33:12.543		76.06	-79.87	41819.40	-20.55		
Uranus	I	2028-12-14T07:48:01.406		73.84	-79.98	25534.68		-2.01	-2.11
Uranus	E	2028-12-14T08:10:22.301		69.94	-78.30	24991.21		-9.92	-10.38
6	E	2028-12-14T08:25:23.792		67.10	-76.27	41814.46	20.53		
5	E	2028-12-14T08:25:43.949		67.03	-76.22	42215.89	20.57		
4	E	2028-12-14T08:26:00.649		66.98	-76.18	42566.46	20.64		
alpha	E	2028-12-14T08:27:43.103		66.65	-75.92	44695.47	20.91		
beta	E	2028-12-14T08:28:29.272		66.50	-75.80	45665.03	21.03		
eta	E	2028-12-14T08:29:40.885		66.26	-75.61	47176.12	21.19		
gamma	E	2028-12-14T08:30:02.015		66.20	-75.55	47624.24	21.23		
delta	E	2028-12-14T08:30:33.814		66.09	-75.47	48300.35	21.29		
lambda	E	2028-12-14T08:31:54.603		65.83	-75.25	50026.71	21.44		
epsilon	E	2028-12-14T08:32:57.979		65.62	-75.08	51389.07	21.61		

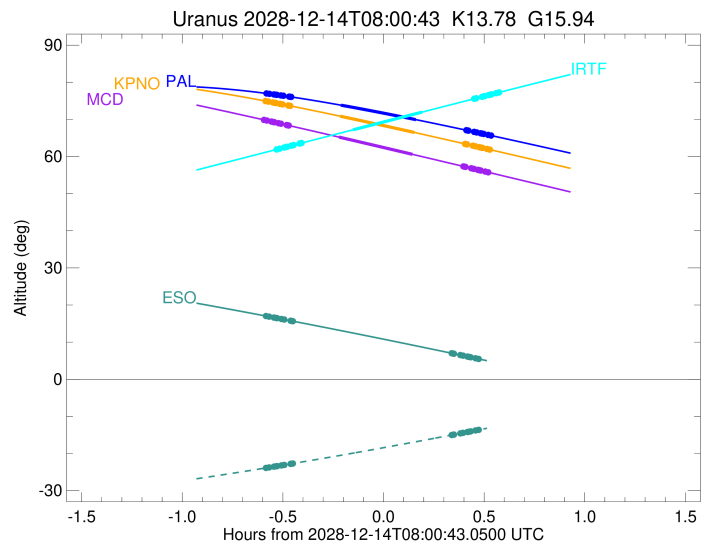
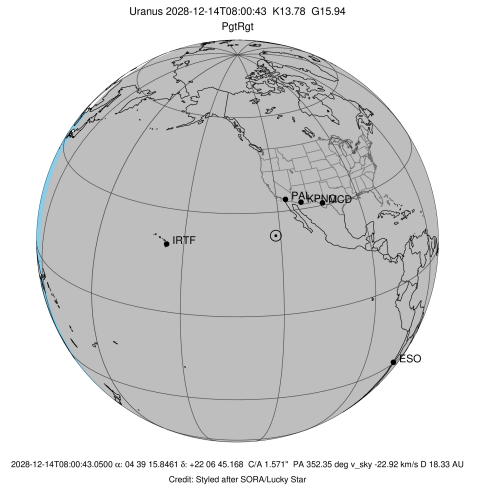
```

target                : Uranus
target radius (km)    : 25559.00
C/A epoch             : 2028-12-14T07:59:10.640
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        : 144879112435214720
2Mass ID (if available) : 04391584+2206452
ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s
RUWE (>1.4 is poor)  : 0.97
K magnitude           : 13.779
G magnitude           : 15.942
RP magnitude          : 15.237
BP magnitude          : 16.489
DUPflag              : 0
Distance (au)         : 18.325
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -22.92
Sun-Target sep (deg) : 168.90
Sun-Moon sep (deg)   : 168.44
B (ring opening deg) : 80.08
PA of pole (deg)     : -46.93
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.506
C/A sky separation (km) : 20011.8
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_itr93_040916.bsp
earth_720101_070426.bpc
earth_200101_990628_predict.bpc
pg3f0000r.bsp
pg490000r.bsp
naif0012.tls
earth_flat_IAU.spk
    
```



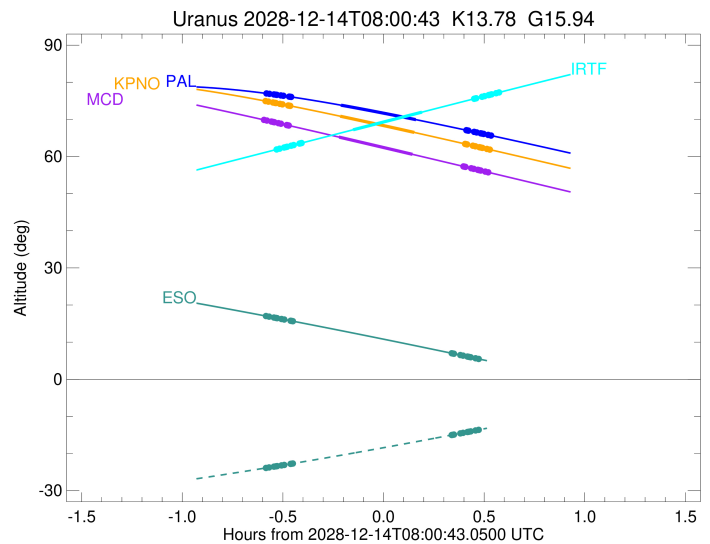
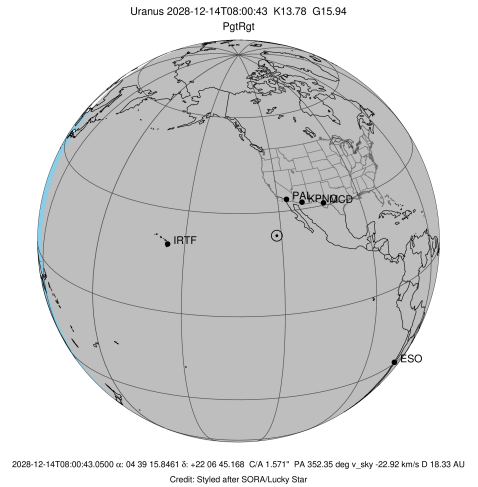
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-14T07:25:30.136		74.95	-81.40	51213.54	-21.61		
lambda	I	2028-12-14T07:26:25.367		74.79	-81.37	50026.71	-21.44		
delta	I	2028-12-14T07:27:46.173		74.56	-81.33	48300.35	-21.29		
gamma	I	2028-12-14T07:28:17.650		74.46	-81.31	47631.33	-21.22		
eta	I	2028-12-14T07:28:39.122		74.40	-81.30	47176.12	-21.18		
beta	I	2028-12-14T07:29:50.307		74.19	-81.24	45674.33	-21.02		
alpha	I	2028-12-14T07:30:36.183		74.06	-81.20	44712.25	-20.90		
4	I	2028-12-14T07:32:21.023		73.75	-81.10	42536.35	-20.61		
5	I	2028-12-14T07:32:38.238		73.69	-81.09	42180.10	-20.55		
6	I	2028-12-14T07:32:55.914		73.64	-81.07	41819.22	-20.51		
Uranus	I	2028-12-14T07:47:49.694		70.86	-79.62	25532.20		-2.11	-2.21
Uranus	E	2028-12-14T08:09:53.719		66.50	-76.25	24991.62		-9.91	-10.37
6	E	2028-12-14T08:25:00.442		63.40	-73.51	41814.33	20.48		
5	E	2028-12-14T08:25:20.646		63.33	-73.44	42215.61	20.52		
4	E	2028-12-14T08:25:37.395		63.28	-73.39	42566.30	20.58		
alpha	E	2028-12-14T08:27:20.102		62.92	-73.07	44695.39	20.86		
beta	E	2028-12-14T08:28:06.383		62.76	-72.92	45665.09	20.99		
eta	E	2028-12-14T08:29:18.148		62.51	-72.69	47176.12	21.14		
gamma	E	2028-12-14T08:29:39.322		62.44	-72.62	47624.25	21.19		
delta	E	2028-12-14T08:30:11.186		62.33	-72.52	48300.35	21.25		
lambda	E	2028-12-14T08:31:32.131		62.05	-72.26	50026.71	21.40		
epsilon	E	2028-12-14T08:32:35.664		61.83	-72.05	51389.95	21.57		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-14T07:58:42.400
 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 : 144879112435214720
 2Mass ID (if available) : 04391584+2206452
 ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.779
 G magnitude : 15.942
 RP magnitude : 15.237
 BP magnitude : 16.489
 DUPflag : 0
 Distance (au) : 18.325
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.92
 Sun-Target sep (deg) : 168.90
 Sun-Moon sep (deg) : 168.53
 B (ring opening deg) : 80.08
 PA of pole (deg) : -46.93
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.514
 C/A sky separation (km) : 20124.1
 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_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



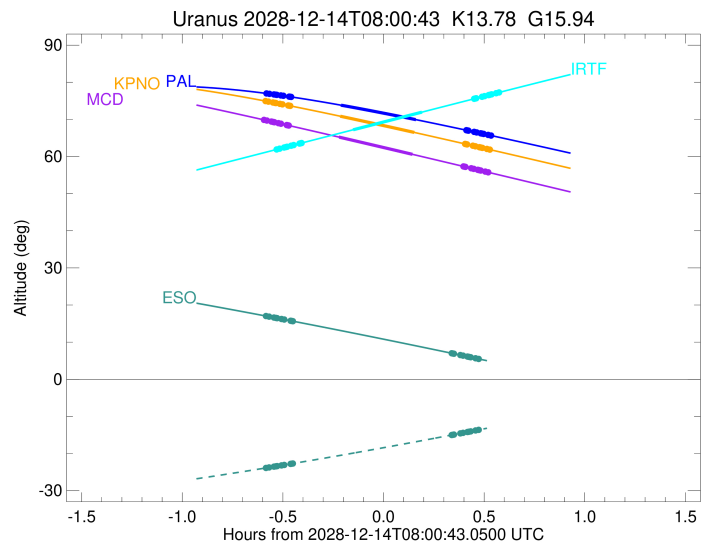
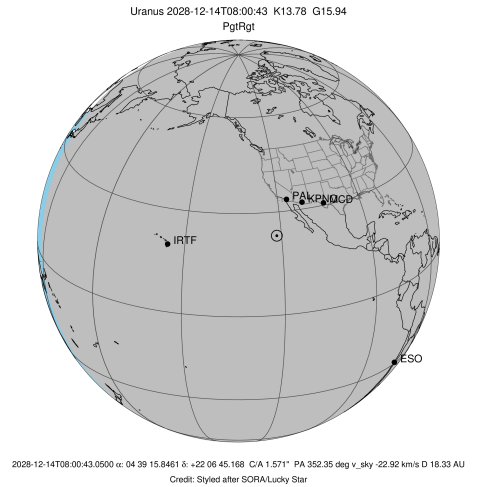
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2028-12-14T07:25:02.884		69.88	-79.49	51214.86	-21.58		
lambda	I	2028-12-14T07:25:58.254		69.69	-79.34	50026.71	-21.41		
delta	I	2028-12-14T07:27:19.180		69.42	-79.12	48300.35	-21.25		
gamma	I	2028-12-14T07:27:50.705		69.31	-79.03	47631.33	-21.19		
eta	I	2028-12-14T07:28:12.213		69.24	-78.97	47176.12	-21.14		
beta	I	2028-12-14T07:29:23.514		68.99	-78.77	45674.38	-20.98		
alpha	I	2028-12-14T07:30:09.481		68.84	-78.64	44712.13	-20.86		
4	I	2028-12-14T07:31:54.522		68.47	-78.33	42536.24	-20.57		
5	I	2028-12-14T07:32:11.779		68.42	-78.28	42179.87	-20.51		
6	I	2028-12-14T07:32:29.487		68.35	-78.23	41819.07	-20.46		
Uranus	I	2028-12-14T07:47:27.339		65.24	-75.47	25530.19		-2.19	-2.29
Uranus	E	2028-12-14T08:09:19.435		60.60	-71.10	24991.95		-9.91	-10.37
6	E	2028-12-14T08:24:30.616		57.35	-67.96	41814.25	20.42		
5	E	2028-12-14T08:24:50.867		57.28	-67.89	42215.44	20.47		
4	E	2028-12-14T08:25:07.664		57.22	-67.83	42566.20	20.53		
alpha	E	2028-12-14T08:26:50.622		56.85	-67.47	44695.34	20.81		
beta	E	2028-12-14T08:27:37.014		56.68	-67.30	45665.12	20.94		
eta	E	2028-12-14T08:28:48.937		56.42	-67.05	47176.12	21.10		
gamma	E	2028-12-14T08:29:10.158		56.35	-66.98	47624.26	21.14		
delta	E	2028-12-14T08:29:42.089		56.23	-66.87	48300.35	21.21		
lambda	E	2028-12-14T08:31:03.202		55.94	-66.58	50026.71	21.36		
epsilon	E	2028-12-14T08:32:06.886		55.71	-66.36	51390.45	21.53		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-14T08:02:15.110
 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 : 144879112435214720
 2Mass ID (if available) : 04391584+2206452
 ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.779
 G magnitude : 15.942
 RP magnitude : 15.237
 BP magnitude : 16.489
 DUPflag : 0
 Distance (au) : 18.325
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.92
 Sun-Target sep (deg) : 168.90
 Sun-Moon sep (deg) : 167.85
 B (ring opening deg) : 80.08
 PA of pole (deg) : -46.93
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.563
 C/A sky separation (km) : 20776.0
 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	2028-12-14T07:28:48.661		61.90	-50.91	51218.11	-21.44		
lambda	I	2028-12-14T07:29:44.558		62.11	-51.13	50026.71	-21.26		
delta	I	2028-12-14T07:31:06.064		62.43	-51.44	48300.35	-21.10		
gamma	I	2028-12-14T07:31:37.827		62.55	-51.56	47631.35	-21.03		
eta	I	2028-12-14T07:31:59.501		62.64	-51.64	47176.12	-20.98		
beta	I	2028-12-14T07:33:11.370		62.91	-51.92	45674.53	-20.81		
alpha	I	2028-12-14T07:33:57.756		63.09	-52.09	44711.77	-20.68		
4	I	2028-12-14T07:35:43.768		63.50	-52.50	42535.90	-20.37		
5	I	2028-12-14T07:36:01.219		63.57	-52.57	42179.17	-20.30		
6	I	2028-12-14T07:36:19.087		63.64	-52.64	41818.60	-20.25		
Uranus	I	2028-12-14T07:51:39.147		67.20	-56.15	25520.04		-2.55	-2.67
Uranus	E	2028-12-14T08:12:11.341		71.96	-60.87	24996.16		-9.87	-10.33
6	E	2028-12-14T08:27:42.912		75.55	-64.43	41813.39	20.29		
5	E	2028-12-14T08:28:03.250		75.63	-64.51	42213.59	20.33		
4	E	2028-12-14T08:28:20.197		75.69	-64.58	42565.14	20.40		
alpha	E	2028-12-14T08:30:03.755		76.09	-64.97	44694.79	20.71		
beta	E	2028-12-14T08:30:50.417		76.27	-65.15	45665.56	20.85		
eta	E	2028-12-14T08:32:02.618		76.55	-65.43	47176.12	21.02		
gamma	E	2028-12-14T08:32:23.922		76.63	-65.51	47624.37	21.07		
delta	E	2028-12-14T08:32:55.958		76.75	-65.63	48300.35	21.14		
lambda	E	2028-12-14T08:34:17.312		77.06	-65.94	50026.71	21.30		
epsilon	E	2028-12-14T08:35:21.452		77.31	-66.19	51396.94	21.48		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2028-12-14T07:57:37.520
 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 : 144879112435214720
 2Mass ID (if available) : 04391584+2206452
 ICRS Star Coord at Epoch: 04h 39m 15.84612s +22:06:45.16823s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.779
 G magnitude : 15.942
 RP magnitude : 15.237
 BP magnitude : 16.489
 DUPflag : 0
 Distance (au) : 18.325
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -22.92
 Sun-Target sep (deg) : 168.90
 Sun-Moon sep (deg) : 168.86
 B (ring opening deg) : 80.08
 PA of pole (deg) : -46.93
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.912
 C/A sky separation (km) : 25418.2
 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	2028-12-14T07:25:35.630		17.05	-23.90	51262.45	-20.26		
lambda	I	2028-12-14T07:26:37.147		16.87	-23.75	50026.71	-20.00		
delta	I	2028-12-14T07:28:04.023		16.62	-23.53	48300.35	-19.74		
gamma	I	2028-12-14T07:28:38.005		16.52	-23.45	47631.50	-19.63		
eta	I	2028-12-14T07:29:01.254		16.46	-23.39	47176.12	-19.55		
beta	I	2028-12-14T07:30:18.518		16.23	-23.20	45676.35	-19.27		
alpha	I	2028-12-14T07:31:09.047		16.09	-23.08	44707.44	-19.06		
4	I	2028-12-14T07:33:04.591		15.75	-22.79	42532.25	-18.56		
5	I	2028-12-14T07:33:24.045		15.69	-22.74	42171.54	-18.46		
6	I	2028-12-14T07:33:43.498		15.64	-22.69	41813.28	-18.37		

No planet occultations

6	E	2028-12-14T08:21:00.686		7.02	-15.03	41809.16	18.32		
5	E	2028-12-14T08:21:22.886		6.95	-14.96	42204.18	18.40		
4	E	2028-12-14T08:21:41.836		6.89	-14.91	42559.69	18.50		
alpha	E	2028-12-14T08:23:35.463		6.53	-14.58	44692.19	18.99		
beta	E	2028-12-14T08:24:26.482		6.37	-14.43	45667.69	19.20		
eta	E	2028-12-14T08:25:44.523		6.12	-14.21	47176.12	19.47		
gamma	E	2028-12-14T08:26:07.525		6.05	-14.14	47624.89	19.55		
delta	E	2028-12-14T08:26:41.980		5.94	-14.04	48300.35	19.66		
lambda	E	2028-12-14T08:28:09.213		5.66	-13.79	50026.71	19.92		
epsilon	E	2028-12-14T08:29:19.122		5.44	-13.59	51425.79	20.17		