

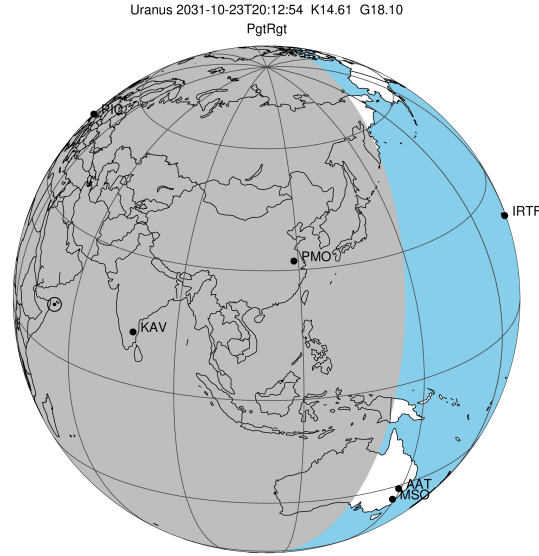
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-23T20:12:54.020
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3427644383385003648
 2Mass ID (if available) : 05451726+2332089

ICRS Star Coord at Epoch: 05h 45m 17.26439s +23:32:08.85623s

RUWE (>1.4 is poor) : 0.94
 K magnitude : 14.614
 G magnitude : 18.103
 RP magnitude : 17.096
 BP magnitude : 19.180
 DUPflag : 0
 Distance (au) : 18.534
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -9.95
 Sun-Target sep (deg) : 123.15
 Sun-Moon sep (deg) : 139.62
 B (ring opening deg) : 78.08
 PA of pole (deg) : 47.06

a(km) ring

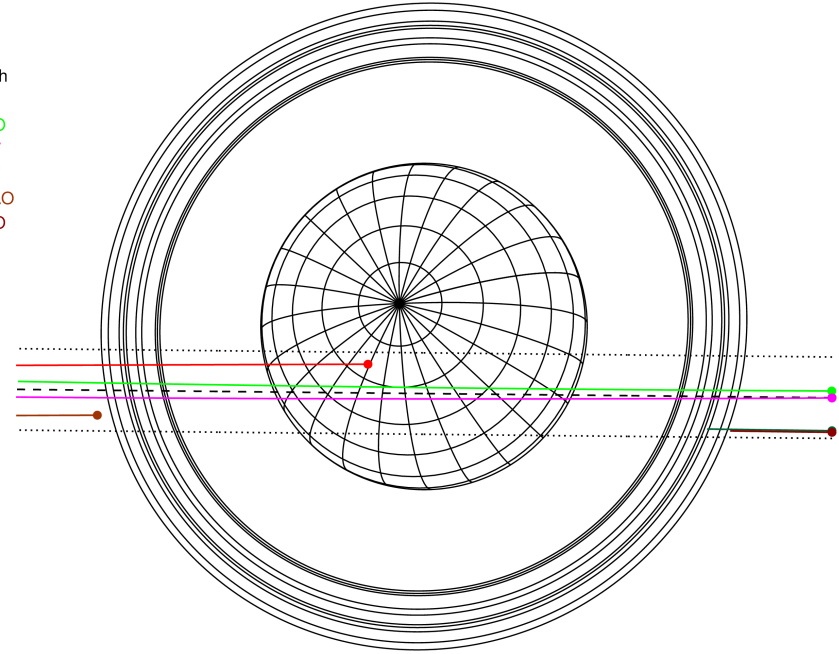
- 1 41837.2 6
- 2 42235.0 5
- 3 42571.2 4
- 4 44718.5 alpha
- 5 45661.1 beta
- 6 47176.1 eta
- 7 47626.3 gamma
- 8 48300.3 delta
- 9 50026.7 lambda
- 10 51149.4 epsilon



2031-10-23T20:12:54.0200 α: 05 45 17.2644 δ: +23 32 08.856 C/A 0.773° PA 359.41 deg v_sky - 9.95 km/s D 18.53 AU
 Credit: Styled after SORA/Lucky Star

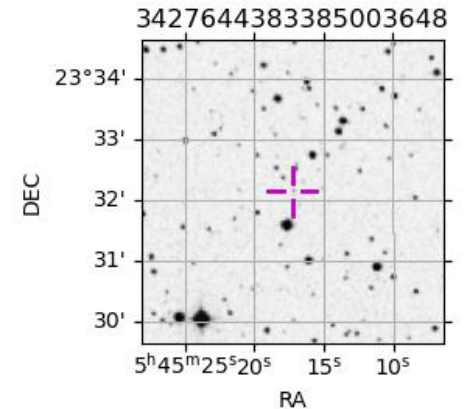
Uranus 2031-10-23T20:12:54 K14.61 G18.10 PgtRgt

Earth
 PIC
 PMO
 KAV
 AAT
 SAAO
 MSO

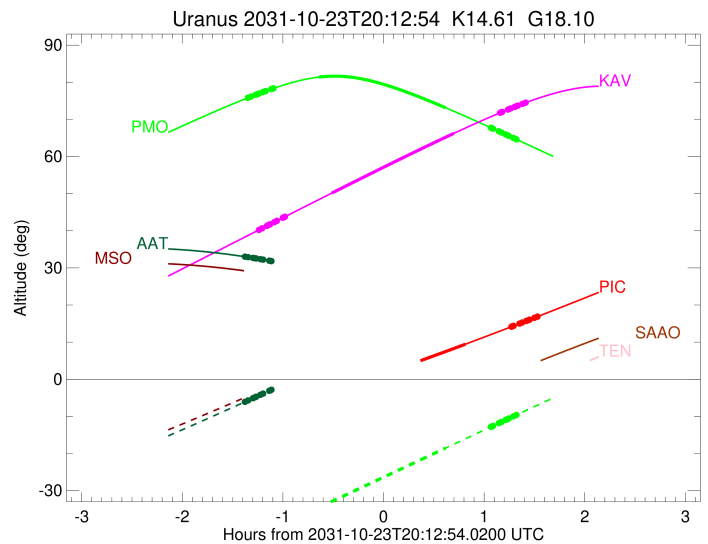
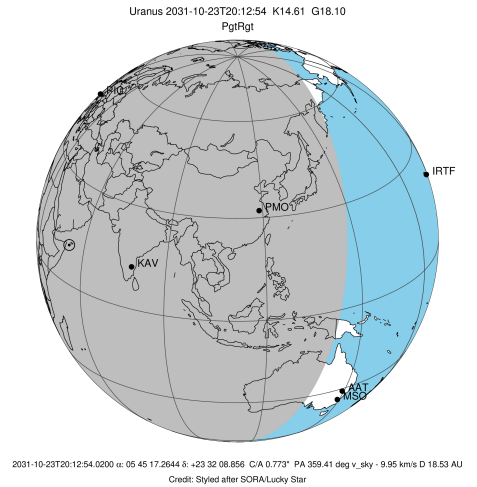


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1		+	+++++	OCT 23 21:01 - OCT 23 21:45	PneRne
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++	+ +	+++++	OCT 23 18:52 - OCT 23 21:32	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					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++	+ +	+++++	OCT 23 18:58 - OCT 23 21:38	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	+++			OCT 23 18:50 - OCT 23 18:55	PnnRin
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn

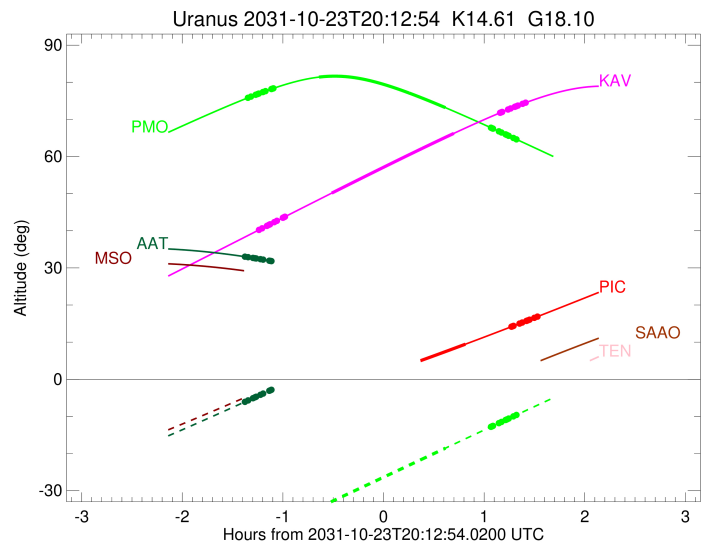
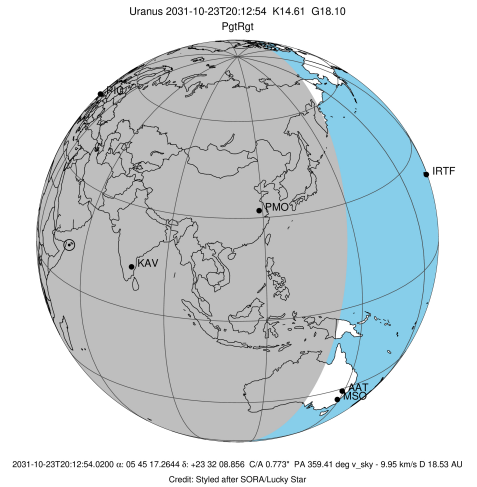


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-23T20:20:06.050
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 3427644383385003648
 2Mass ID (if available) : 05451726+2332089
 ICRS Star Coord at Epoch: 05h 45m 17.26439s +23:32:08.85623s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 14.614
 G magnitude : 18.103
 RP magnitude : 17.096
 BP magnitude : 19.180
 DUPflag : 0
 Distance (au) : 18.534
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -9.95
 Sun-Target sep (deg) : 123.15
 Sun-Moon sep (deg) : 140.22
 B (ring opening deg) : 78.08
 PA of pole (deg) : 47.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.438
 C/A sky separation (km) : 5882.6
 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	2031-10-23T18:55:01.006	-9.77x	-20.85	50971.63	-9.76			
lambda	I	2031-10-23T18:56:37.892	-9.56x	-21.15	50026.71	-9.75			
delta	I	2031-10-23T18:59:34.915	-9.18x	-21.69	48300.35	-9.75			
gamma	I	2031-10-23T19:00:43.505	-9.03x	-21.90	47631.51	-9.75			
eta	I	2031-10-23T19:01:30.208	-8.92x	-22.04	47176.12	-9.75			
beta	I	2031-10-23T19:04:06.316	-8.58x	-22.52	45654.29	-9.75			
alpha	I	2031-10-23T19:05:45.359	-8.36x	-22.82	44686.74	-9.75			
4	I	2031-10-23T19:09:19.850	-7.88x	-23.47	42600.21	-9.74			
5	I	2031-10-23T19:09:49.057	-7.81x	-23.56	42310.84	-9.74			
6	I	2031-10-23T19:10:37.613	-7.70x	-23.71	41833.41	-9.74			
Uranus	I	2031-10-23T19:38:34.708	-3.75x	-28.78	25131.08			-10.35	-10.83
Uranus	E	2031-10-23T21:01:45.961	9.45	-43.10	25384.30			6.54	6.85
6	E	2031-10-23T21:29:10.609	14.16	-47.32	41829.08	9.97			
5	E	2031-10-23T21:29:42.750	14.25	-47.40	42154.94	9.98			
4	E	2031-10-23T21:30:22.497	14.36	-47.50	42552.85	9.98			
alpha	E	2031-10-23T21:34:02.932	15.01	-48.03	44752.29	10.00			
beta	E	2031-10-23T21:35:34.808	15.27	-48.25	45672.59	10.00			
eta	E	2031-10-23T21:38:05.048	15.71	-48.61	47176.12	10.01			
gamma	E	2031-10-23T21:38:49.514	15.84	-48.71	47621.40	10.02			
delta	E	2031-10-23T21:39:57.289	16.04	-48.87	48300.35	10.02			
lambda	E	2031-10-23T21:42:49.493	16.54	-49.27	50026.71	10.03			
epsilon	E	2031-10-23T21:45:06.545	16.95	-49.59	51401.95	10.05			

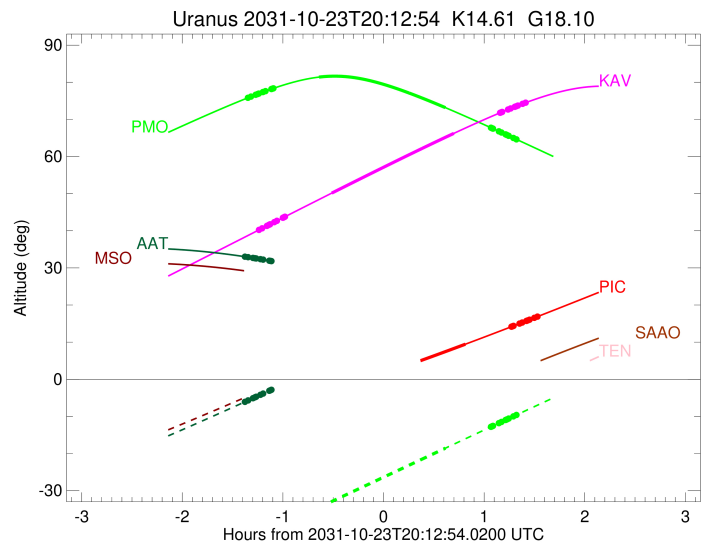
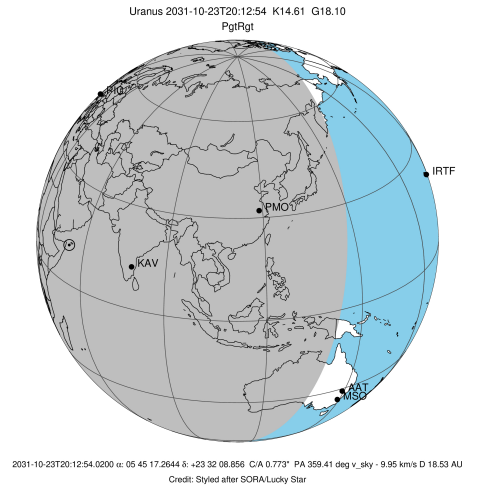
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-23T20:11:48.480
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PMO
 Location : Purple Mtn Obs. Nanking
 Latitude (deg) : 32.06667
 E. Longitude (deg) : 118.82089
 Altitude (km) : 0.364
 Gaia source ID : 3427644383385003648
 2Mass ID (if available) : 05451726+2332089
 ICRS Star Coord at Epoch: 05h 45m 17.26439s +23:32:08.85623s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 14.614
 G magnitude : 18.103
 RP magnitude : 17.096
 BP magnitude : 19.180
 DUPflag : 0
 Distance (au) : 18.534
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -9.95
 Sun-Target sep (deg) : 123.15
 Sun-Moon sep (deg) : 140.18
 B (ring opening deg) : 78.08
 PA of pole (deg) : 47.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.712
 C/A sky separation (km) : 9566.0
 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



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-23T18:52:18.576		75.87	-43.26	51002.95	-10.25		
lambda	I	2031-10-23T18:53:53.943		76.15	-42.94	50026.71	-10.23		
delta	I	2031-10-23T18:56:42.745		76.64	-42.36	48300.35	-10.22		
gamma	I	2031-10-23T18:57:48.197		76.83	-42.14	47631.56	-10.22		
eta	I	2031-10-23T18:58:32.790		76.95	-41.98	47176.12	-10.21		
beta	I	2031-10-23T19:01:01.771		77.37	-41.47	45656.09	-10.20		
alpha	I	2031-10-23T19:02:36.536		77.63	-41.15	44688.01	-10.19		
4	I	2031-10-23T19:06:01.789		78.18	-40.44	42603.55	-10.17		
5	I	2031-10-23T19:06:30.284		78.25	-40.34	42307.81	-10.16		
6	I	2031-10-23T19:07:17.050		78.37	-40.18	41829.12	-10.15		
Uranus	I	2031-10-23T19:34:27.312		81.40	-34.51	25061.29		-11.20	-11.71
Uranus	E	2031-10-23T20:49:49.540		73.17	-18.56	25450.39		5.14	5.39
6	E	2031-10-23T21:16:56.826		67.77	-12.82	41826.02	10.16		
5	E	2031-10-23T21:17:28.649		67.66	-12.71	42154.84	10.17		
4	E	2031-10-23T21:18:07.997		67.52	-12.57	42555.89	10.18		
alpha	E	2031-10-23T21:21:43.702		66.79	-11.81	44752.42	10.20		
beta	E	2031-10-23T21:23:13.797		66.48	-11.50	45673.65	10.21		
eta	E	2031-10-23T21:25:40.795		65.97	-10.98	47176.12	10.23		
gamma	E	2031-10-23T21:26:24.337		65.82	-10.83	47621.54	10.23		
delta	E	2031-10-23T21:27:30.662		65.59	-10.59	48300.35	10.24		
lambda	E	2031-10-23T21:30:19.180		65.01	-10.00	50026.71	10.25		
epsilon	E	2031-10-23T21:32:34.967		64.54	-9.53	51419.33	10.27		

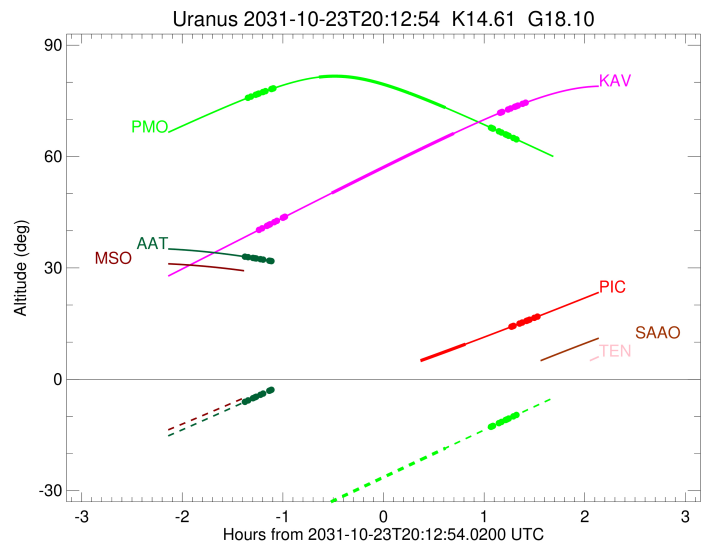
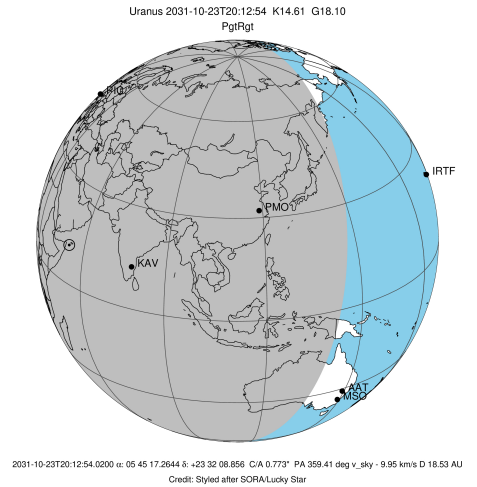
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-23T20:18:09.630
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : KAV
 Location : Kavalur Observatory
 Latitude (deg) : 12.57556
 E. Longitude (deg) : 78.83167
 Altitude (km) : 0.722
 Gaia source ID : 3427644383385003648
 2Mass ID (if available) : 05451726+2332089
 ICRS Star Coord at Epoch: 05h 45m 17.26439s +23:32:08.85623s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 14.614
 G magnitude : 18.103
 RP magnitude : 17.096
 BP magnitude : 19.180
 DUPflag : 0
 Distance (au) : 18.534
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -9.95
 Sun-Target sep (deg) : 123.15
 Sun-Moon sep (deg) : 140.54
 B (ring opening deg) : 78.08
 PA of pole (deg) : 47.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.844
 C/A sky separation (km) : 11339.9
 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_itr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-23T18:58:54.163		40.29	-82.62	51012.54	-10.08		
lambda	I	2031-10-23T19:00:32.163		40.67	-82.22	50026.71	-10.06		
delta	I	2031-10-23T19:03:23.974		41.32	-81.53	48300.35	-10.04		
gamma	I	2031-10-23T19:04:30.606		41.58	-81.26	47631.57	-10.03		
eta	I	2031-10-23T19:05:16.009		41.75	-81.07	47176.12	-10.03		
beta	I	2031-10-23T19:07:47.672		42.33	-80.46	45656.67	-10.01		
alpha	I	2031-10-23T19:09:24.216		42.70	-80.07	44688.48	-10.00		
4	I	2031-10-23T19:12:53.360		43.50	-79.22	42604.58	-9.97		
5	I	2031-10-23T19:13:22.588		43.61	-79.10	42306.65	-9.96		
6	I	2031-10-23T19:14:10.328		43.79	-78.91	41827.71	-9.95		
Uranus	I	2031-10-23T19:42:04.358		50.16	-72.10	25039.71		-11.45	-11.97
Uranus	E	2031-10-23T20:54:53.127		66.25	-54.34	25486.44		4.20	4.40
6	E	2031-10-23T21:22:24.230		71.78	-47.63	41823.79	10.12		
5	E	2031-10-23T21:22:56.453		71.88	-47.50	42155.04	10.13		
4	E	2031-10-23T21:23:36.220		72.00	-47.34	42558.22	10.14		
alpha	E	2031-10-23T21:27:12.367		72.67	-46.46	44752.42	10.18		
beta	E	2031-10-23T21:28:42.748		72.95	-46.09	45674.44	10.20		
eta	E	2031-10-23T21:31:09.876		73.39	-45.50	47176.12	10.22		
gamma	E	2031-10-23T21:31:53.467		73.51	-45.32	47621.67	10.22		
delta	E	2031-10-23T21:32:59.814		73.71	-45.05	48300.35	10.23		
lambda	E	2031-10-23T21:35:48.309		74.19	-44.37	50026.71	10.26		
epsilon	E	2031-10-23T21:38:05.312		74.58	-43.81	51433.14	10.29		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-23T20:07:46.780
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : AAT
 Location : Siding Spring (AAT)
 Latitude (deg) : -31.27703
 E. Longitude (deg) : 149.06608
 Altitude (km) : 1.164
 Gaia source ID : 3427644383385003648
 2Mass ID (if available) : 05451726+2332089
 ICRS Star Coord at Epoch: 05h 45m 17.26439s +23:32:08.85623s
 RUWE (>1.4 is poor) : 0.94
 K magnitude : 14.614
 G magnitude : 18.103
 RP magnitude : 17.096
 BP magnitude : 19.180
 DUPflag : 0
 Distance (au) : 18.535
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -9.95
 Sun-Target sep (deg) : 123.15
 Sun-Moon sep (deg) : 139.43
 B (ring opening deg) : 78.08
 PA of pole (deg) : 47.06
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.138
 C/A sky separation (km) : 15302.1
 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



b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-23T18:50:27.719		33.01	-6.05	51051.00	-9.96		
lambda	I	2031-10-23T18:52:10.927		32.89	-5.69	50026.71	-9.91		
delta	I	2031-10-23T18:55:05.401		32.68	-5.10	48300.35	-9.87		
gamma	I	2031-10-23T18:56:13.182		32.60	-4.87x	47631.57	-9.86		
eta	I	2031-10-23T18:56:59.408		32.54	-4.71x	47176.12	-9.85		
beta	I	2031-10-23T18:59:33.845		32.35	-4.18x	45658.84	-9.81		
alpha	I	2031-10-23T19:01:12.516		32.22	-3.84x	44690.43	-9.78		
4	I	2031-10-23T19:04:46.732		31.94	-3.10x	42607.94	-9.71		
5	I	2031-10-23T19:05:17.429		31.90	-3.00x	42301.89	-9.69		
6	I	2031-10-23T19:06:06.636		31.83	-2.83x	41822.86	-9.68		
Uranus	I	2031-10-23T19:35:42.856		29.03	3.34x	25001.11		-11.88	-12.43
Uranus	E	2031-10-23T20:41:00.650		20.65	17.20x	25536.39		2.34	2.45
6	E	2031-10-23T21:10:46.592		16.04	23.57x	41820.46	9.60		
5	E	2031-10-23T21:11:21.023		15.95	23.69x	42155.81	9.61		
4	E	2031-10-23T21:12:03.264		15.84	23.84x	42561.80	9.63		
alpha	E	2031-10-23T21:15:50.142		15.22	24.65x	44752.25	9.69		
beta	E	2031-10-23T21:17:25.159		14.96	24.99x	45675.52	9.72		
eta	E	2031-10-23T21:19:59.284		14.54	25.54x	47176.12	9.75		
gamma	E	2031-10-23T21:20:44.959		14.41	25.71x	47621.86	9.76		
delta	E	2031-10-23T21:21:54.394		14.22	25.95x	48300.35	9.78		
lambda	E	2031-10-23T21:24:50.612		13.73	26.58x	50026.71	9.81		
epsilon	E	2031-10-23T21:27:15.546		13.33	27.10x	51450.97	9.86		