

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-02T17:05:38.670  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3404410981135593728  
 2Mass ID (if available) : 05395366+2330305

ICRS Star Coord at Epoch: 05h 39m 53.66010s +23:30:30.38576s

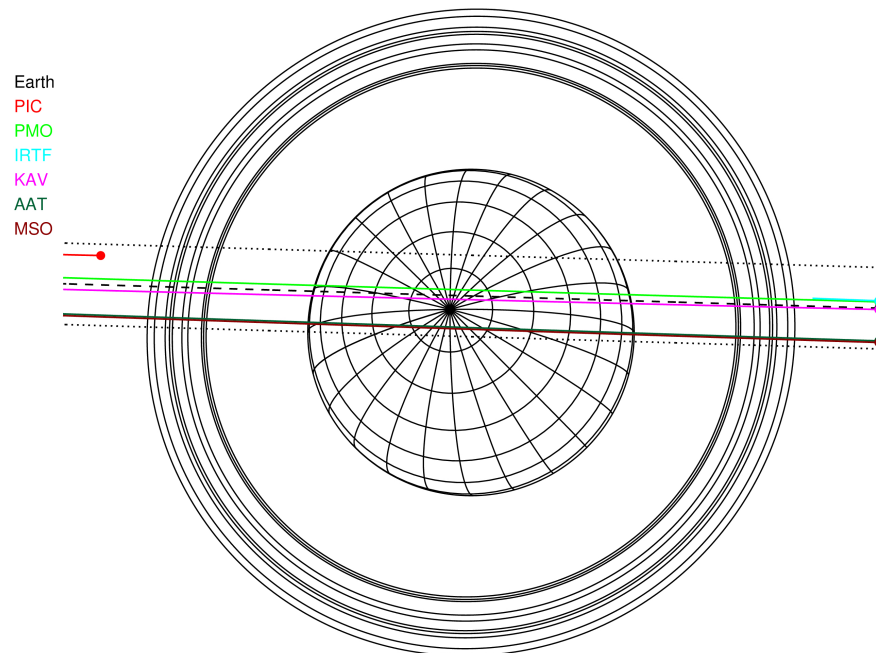
RUWE (>1.4 is poor) : 0.90  
 K magnitude : 14.943  
 G magnitude : 18.816  
 RP magnitude : 17.712  
 BP magnitude : 20.055  
 DUPflag : 0  
 Distance (au) : 18.138  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.34  
 Sun-Target sep (deg) : 164.47  
 Sun-Moon sep (deg) : 26.58  
 B (ring opening deg) : 78.97  
 PA of pole (deg) : 42.29

#	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



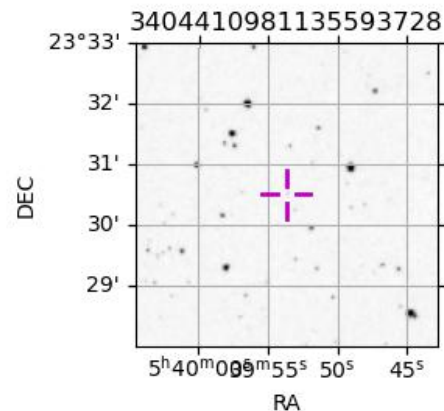
2031-12-02T17:05:38.6700 ex: 05 39 53.66010 s: +23 30 30.386 C/A 0.4411 PA 178.29 deg v\_sky -22.34 km/s D 18.14 AU  
 Credit: Styled after SORA/Lucky Star

Uranus 2031-12-02T17:05:38 K14.94 G18.82 PgtRgt

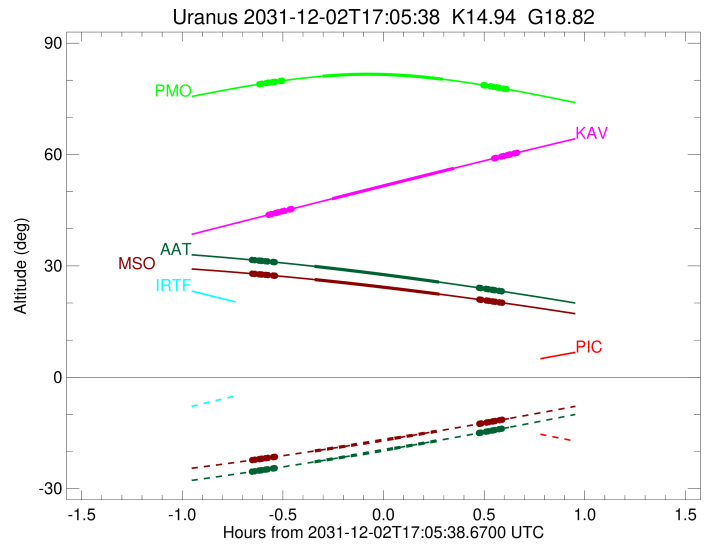
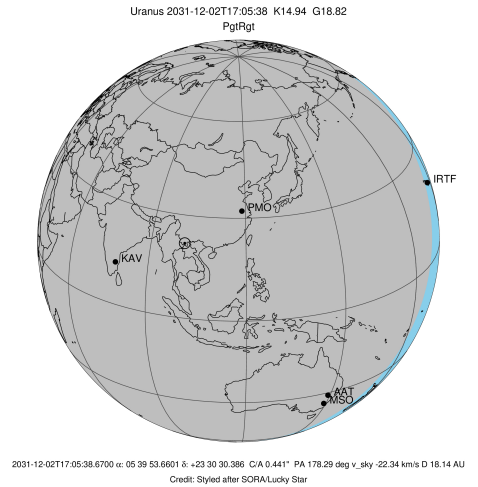


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	+++++	+ +	+++++	DEC 02 16:28 - DEC 02 17:42	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	+++++	+ +	+++++	DEC 02 16:31 - DEC 02 17:45	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	+++++	+ +	+++++	DEC 02 16:26 - DEC 02 17:40	PieRie
SAAO	So. Afr. Astro. Obs.	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Observato	-35.3	149.0	+++++	+ +	+++++	DEC 02 16:26 - DEC 02 17:40	PieRie



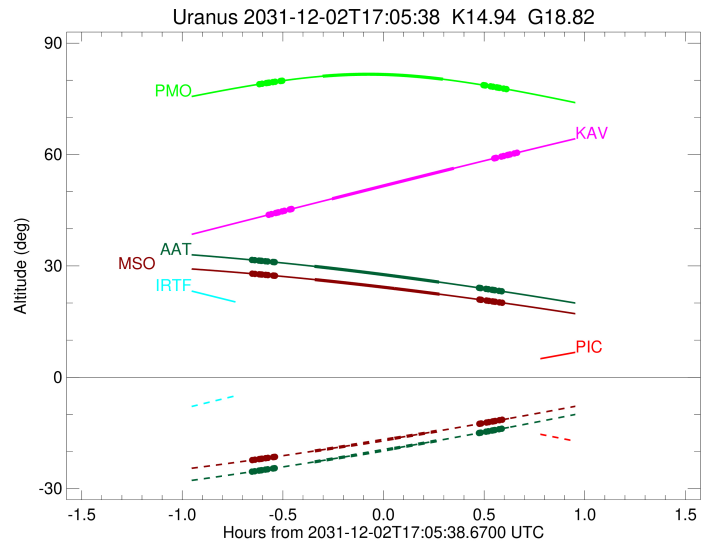
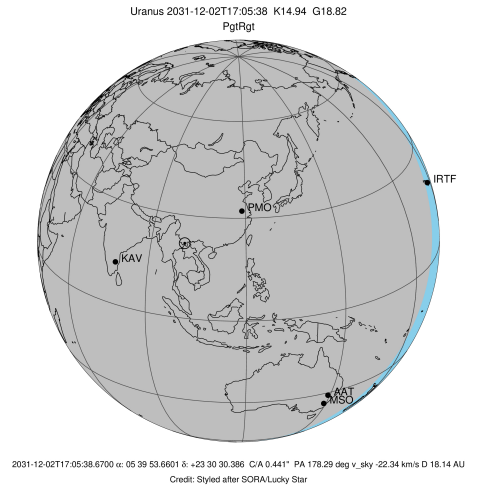
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-02T17:05:33.020  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PMO  
 Location : Purple Mtn Obs. Nanking  
 Latitude (deg) : 32.06667  
 E. Longitude (deg) : 118.82089  
 Altitude (km) : 0.364  
 Gaia source ID : 3404410981135593728  
 2Mass ID (if available) : 05395366+2330305  
 ICRS Star Coord at Epoch: 05h 39m 53.66010s +23:30:30.38576s  
 RUWE (>1.4 is poor) : 0.90  
 K magnitude : 14.943  
 G magnitude : 18.816  
 RP magnitude : 17.712  
 BP magnitude : 20.055  
 DUPflag : 0  
 Distance (au) : 18.138  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.34  
 Sun-Target sep (deg) : 164.47  
 Sun-Moon sep (deg) : 26.99  
 B (ring opening deg) : 78.97  
 PA of pole (deg) : 42.29  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.505  
 C/A sky separation (km) : 6641.7  
 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



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

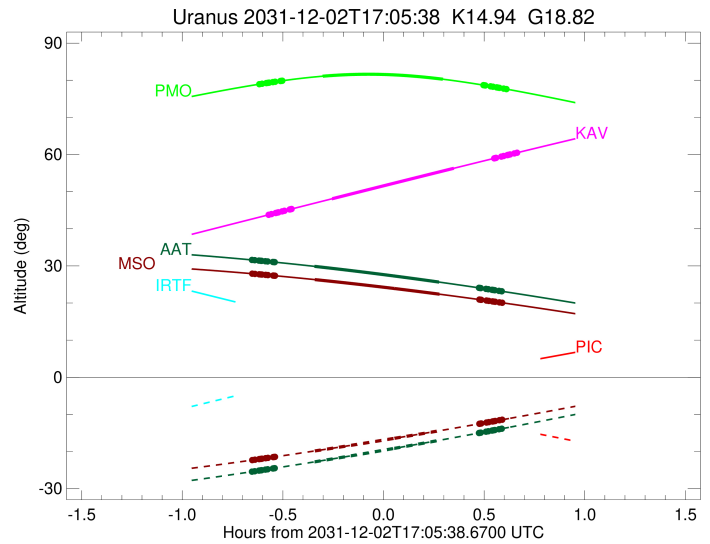
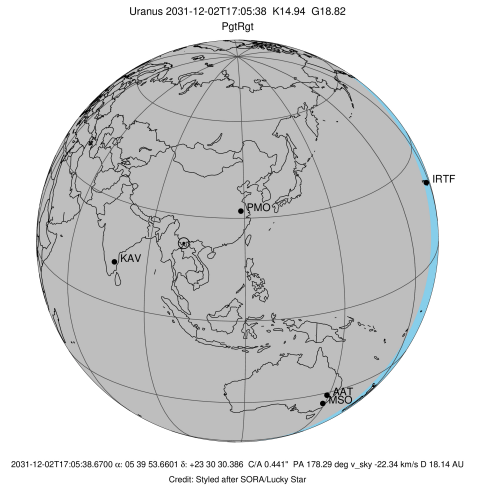
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-02T16:28:33.182		78.94	-77.47	51257.18	-22.71		
lambda	I	2031-12-02T16:29:27.320		79.07	-77.35	50026.71	-22.72		
delta	I	2031-12-02T16:30:43.317		79.25	-77.17	48300.35	-22.71		
gamma	I	2031-12-02T16:31:12.844		79.32	-77.10	47629.93	-22.70		
eta	I	2031-12-02T16:31:32.836		79.36	-77.06	47176.12	-22.70		
beta	I	2031-12-02T16:32:38.943		79.51	-76.90	45675.68	-22.68		
alpha	I	2031-12-02T16:33:21.093		79.61	-76.80	44720.01	-22.67		
4	I	2031-12-02T16:34:54.240		79.81	-76.56	42607.15	-22.64		
5	I	2031-12-02T16:35:12.192		79.84	-76.52	42207.92	-22.65		
6	I	2031-12-02T16:35:30.278		79.88	-76.47	41795.29	-22.63		
Uranus	I	2031-12-02T16:47:33.657		81.10	-74.53	25424.43		-5.29	-5.54
Uranus	E	2031-12-02T17:23:19.251		80.29	-67.85	25138.01		9.47	9.91
6	E	2031-12-02T17:35:28.221		78.69	-65.42	41874.84	22.64		
5	E	2031-12-02T17:35:46.013		78.65	-65.36	42284.43	22.65		
4	E	2031-12-02T17:35:57.989		78.62	-65.32	42545.78	22.65		
alpha	E	2031-12-02T17:37:33.235		78.38	-64.99	44706.92	22.67		
beta	E	2031-12-02T17:38:14.493		78.27	-64.85	45643.17	22.69		
eta	E	2031-12-02T17:39:22.011		78.09	-64.62	47176.12	22.70		
gamma	E	2031-12-02T17:39:41.729		78.04	-64.56	47623.84	22.71		
delta	E	2031-12-02T17:40:11.516		77.96	-64.46	48300.35	22.72		
lambda	E	2031-12-02T17:41:27.490		77.76	-64.20	50026.71	22.73		
epsilon	E	2031-12-02T17:42:07.560		77.65	-64.06	50937.66	22.72		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-02T17:08:32.770  
 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 : 3404410981135593728  
 2Mass ID (if available) : 05395366+2330305  
 ICRS Star Coord at Epoch: 05h 39m 53.66010s +23:30:30.38576s  
 RUWE (>1.4 is poor) : 0.90  
 K magnitude : 14.943  
 G magnitude : 18.816  
 RP magnitude : 17.712  
 BP magnitude : 20.055  
 DUPflag : 0  
 Distance (au) : 18.138  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.34  
 Sun-Target sep (deg) : 164.47  
 Sun-Moon sep (deg) : 27.38  
 B (ring opening deg) : 78.97  
 PA of pole (deg) : 42.29  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.390  
 C/A sky separation (km) : 5129.4  
 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



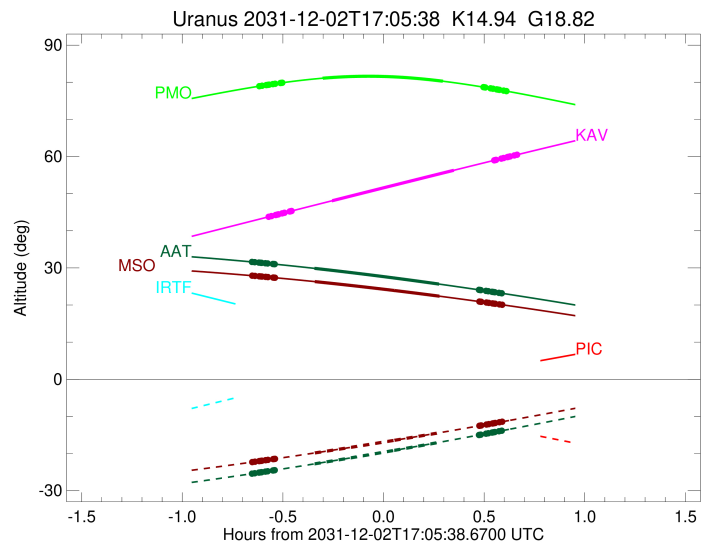
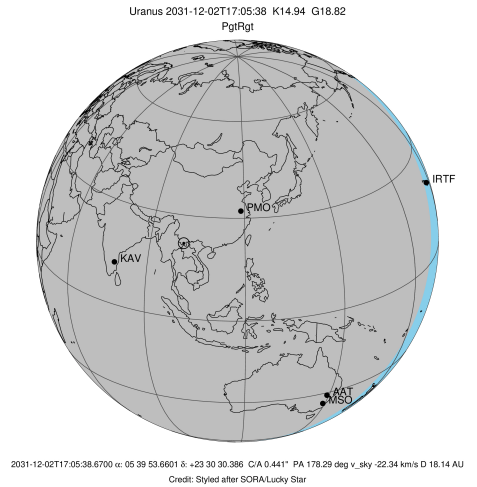
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-02T16:31:19.533		43.75	-59.27	51267.00	-22.71		
lambda	I	2031-12-02T16:32:14.118		43.96	-59.48	50026.71	-22.72		
delta	I	2031-12-02T16:33:30.116		44.25	-59.77	48300.35	-22.71		
gamma	I	2031-12-02T16:33:59.640		44.36	-59.88	47629.82	-22.71		
eta	I	2031-12-02T16:34:19.620		44.43	-59.95	47176.12	-22.71		
beta	I	2031-12-02T16:35:25.672		44.69	-60.20	45676.08	-22.70		
alpha	I	2031-12-02T16:36:07.756		44.85	-60.36	44721.01	-22.69		
4	I	2031-12-02T16:37:40.868		45.20	-60.71	42606.27	-22.68		
5	I	2031-12-02T16:37:58.872		45.27	-60.77	42205.54	-22.68		
6	I	2031-12-02T16:38:16.797		45.34	-60.84	41795.52	-22.67		
Uranus	I	2031-12-02T16:50:16.333		48.08	-63.52	25396.42		-5.82	-6.10
Uranus	E	2031-12-02T17:26:37.930		56.30	-71.34	25171.93		9.07	9.49
6	E	2031-12-02T17:38:40.638		58.98	-73.74	41875.64	22.75		
5	E	2031-12-02T17:38:58.209		59.05	-73.79	42281.77	22.77		
4	E	2031-12-02T17:39:10.166		59.09	-73.83	42544.26	22.76		
alpha	E	2031-12-02T17:40:45.083		59.44	-74.14	44708.19	22.78		
beta	E	2031-12-02T17:41:26.121		59.59	-74.27	45643.54	22.79		
eta	E	2031-12-02T17:42:33.335		59.84	-74.48	47176.12	22.80		
gamma	E	2031-12-02T17:42:52.964		59.91	-74.54	47623.67	22.80		
delta	E	2031-12-02T17:43:22.637		60.02	-74.63	48300.35	22.81		
lambda	E	2031-12-02T17:44:38.314		60.30	-74.87	50026.71	22.82		
epsilon	E	2031-12-02T17:45:18.771		60.45	-74.99	50949.94	22.81		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-02T17:03:39.090  
 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 : 3404410981135593728  
 2Mass ID (if available) : 05395366+2330305  
 ICRS Star Coord at Epoch: 05h 39m 53.66010s +23:30:30.38576s  
 RUWE (>1.4 is poor) : 0.90  
 K magnitude : 14.943  
 G magnitude : 18.816  
 RP magnitude : 17.712  
 BP magnitude : 20.055  
 DUPflag : 0  
 Distance (au) : 18.138  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.34  
 Sun-Target sep (deg) : 164.47  
 Sun-Moon sep (deg) : 26.32  
 B (ring opening deg) : 78.97  
 PA of pole (deg) : 42.29  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.057  
 C/A sky separation (km) : 755.4  
 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	2031-12-02T16:26:19.692		31.61	-25.44	51303.32	-22.91		
lambda	I	2031-12-02T16:27:15.417		31.53	-25.32	50026.71	-22.91		
delta	I	2031-12-02T16:28:30.778		31.43	-25.14	48300.35	-22.91		
gamma	I	2031-12-02T16:29:00.068		31.38	-25.08	47629.40	-22.91		
eta	I	2031-12-02T16:29:19.856		31.36	-25.03	47176.12	-22.91		
beta	I	2031-12-02T16:30:25.263		31.26	-24.88	45677.41	-22.90		
alpha	I	2031-12-02T16:31:06.857		31.20	-24.78	44724.62	-22.90		
4	I	2031-12-02T16:32:39.388		31.06	-24.57	42602.82	-22.90		
5	I	2031-12-02T16:32:57.473		31.03	-24.53	42197.30	-22.91		
6	I	2031-12-02T16:33:14.755		31.01	-24.49	41796.72	-22.90		
Uranus	I	2031-12-02T16:45:04.815		29.88	-22.79	25297.15		-7.42	-7.77
Uranus	E	2031-12-02T17:22:12.563		25.64	-17.00	25263.14		7.90	8.27
6	E	2031-12-02T17:34:07.573		24.09	-15.01	41877.23	22.85		
5	E	2031-12-02T17:34:24.762		24.05	-14.97	42275.27	22.86		
4	E	2031-12-02T17:34:36.777		24.02	-14.93	42540.91	22.85		
alpha	E	2031-12-02T17:36:11.625		23.81	-14.66	44711.15	22.85		
beta	E	2031-12-02T17:36:52.456		23.72	-14.55	45644.46	22.85		
eta	E	2031-12-02T17:37:59.453		23.56	-14.36	47176.12	22.85		
gamma	E	2031-12-02T17:38:19.020		23.52	-14.30	47623.28	22.85		
delta	E	2031-12-02T17:38:48.646		23.45	-14.22	48300.35	22.85		
lambda	E	2031-12-02T17:40:04.188		23.28	-14.00	50026.71	22.85		
epsilon	E	2031-12-02T17:40:45.822		23.18	-13.88	50978.15	22.85		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-02T17:03:45.200  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MSO  
 Location : Mt. Stromlo Observatory  
 Latitude (deg) : -35.32000  
 E. Longitude (deg) : 149.00833  
 Altitude (km) : 0.770  
 Gaia source ID : 3404410981135593728  
 2Mass ID (if available) : 05395366+2330305  
 ICRS Star Coord at Epoch: 05h 39m 53.66010s +23:30:30.38576s  
 RUWE (>1.4 is poor) : 0.90  
 K magnitude : 14.943  
 G magnitude : 18.816  
 RP magnitude : 17.712  
 BP magnitude : 20.055  
 DUPflag : 0  
 Distance (au) : 18.138  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.34  
 Sun-Target sep (deg) : 164.47  
 Sun-Moon sep (deg) : 26.31  
 B (ring opening deg) : 78.97  
 PA of pole (deg) : 42.29  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.038  
 C/A sky separation (km) : 499.5  
 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



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	2031-12-02T16:26:24.201		27.91	-22.33	51305.17	-22.89		
lambda	I	2031-12-02T16:27:20.045		27.84	-22.21	50026.71	-22.89		
delta	I	2031-12-02T16:28:35.456		27.74	-22.05	48300.35	-22.89		
gamma	I	2031-12-02T16:29:04.766		27.70	-21.99	47629.37	-22.89		
eta	I	2031-12-02T16:29:24.567		27.67	-21.94	47176.12	-22.89		
beta	I	2031-12-02T16:30:30.014		27.58	-21.80	45677.47	-22.89		
alpha	I	2031-12-02T16:31:11.629		27.53	-21.71	44724.81	-22.89		
4	I	2031-12-02T16:32:44.237		27.40	-21.51	42602.62	-22.89		
5	I	2031-12-02T16:33:02.345		27.37	-21.47	42196.88	-22.89		
6	I	2031-12-02T16:33:19.614		27.35	-21.43	41796.80	-22.89		
Uranus	I	2031-12-02T16:45:10.124		26.31	-19.85	25291.52		-7.50	-7.85
Uranus	E	2031-12-02T17:22:19.961		22.38	-14.40	25268.94		7.82	8.18
6	E	2031-12-02T17:34:15.279		20.93	-12.53	41877.32	22.84		
5	E	2031-12-02T17:34:32.456		20.89	-12.48	42274.83	22.85		
4	E	2031-12-02T17:34:44.486		20.87	-12.45	42540.70	22.84		
alpha	E	2031-12-02T17:36:19.403		20.67	-12.20	44711.35	22.84		
beta	E	2031-12-02T17:37:00.251		20.58	-12.09	45644.53	22.84		
eta	E	2031-12-02T17:38:07.281		20.44	-11.91	47176.12	22.84		
gamma	E	2031-12-02T17:38:26.858		20.40	-11.86	47623.26	22.84		
delta	E	2031-12-02T17:38:56.501		20.34	-11.78	48300.35	22.84		
lambda	E	2031-12-02T17:40:12.085		20.17	-11.57	50026.71	22.84		
epsilon	E	2031-12-02T17:40:53.826		20.09	-11.46	50980.07	22.84		