

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:54:37.310  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558

Uranus 2033-11-23T09:54:37 K13.46 G15.54 PgtRgt

ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s

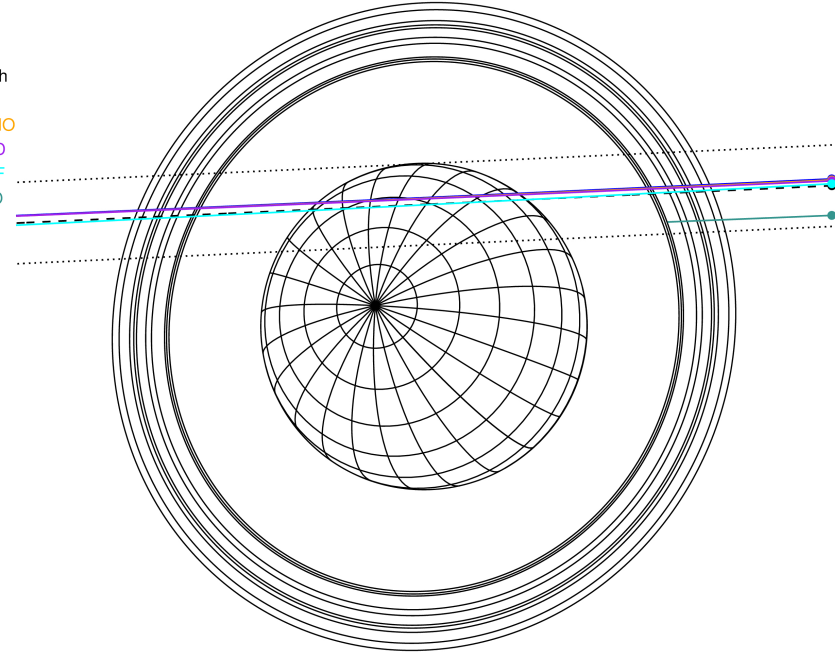
RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 160.63  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79

#	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



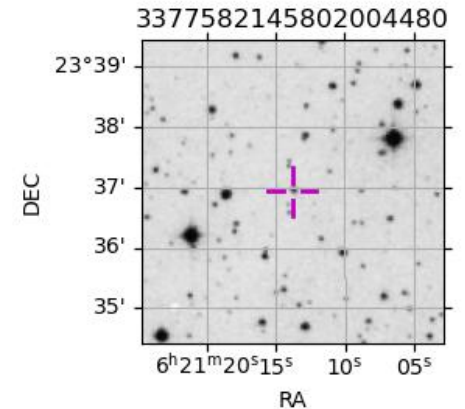
2033-11-23T09:54:37.3100 α: 06 21 13.7808 α: +23 36 55.511 C/A 1.461° PA 182.62 deg v\_sky -18.34 km/s D 18.13 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PAL  
 KPNO  
 MCD  
 IRTF  
 ESO

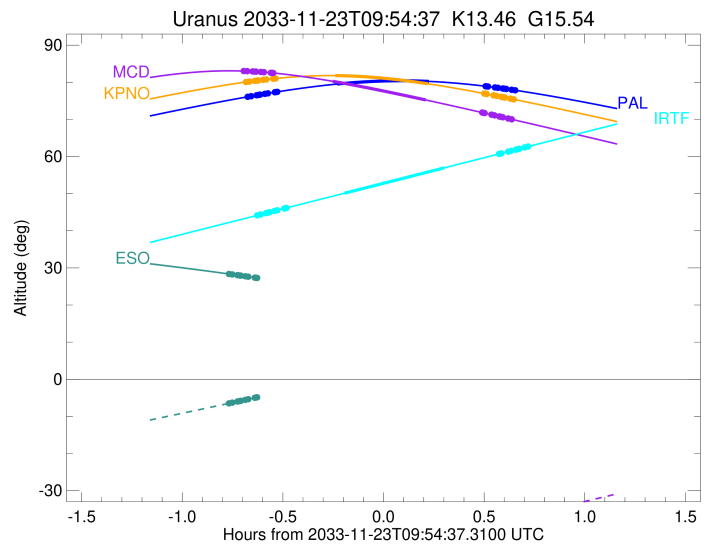
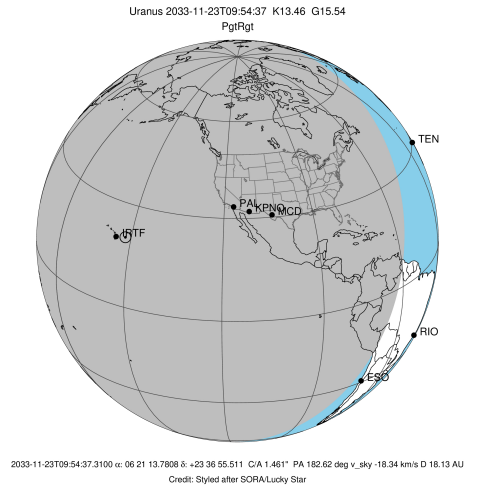


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++	+ +	+++++	NOV 23 09:14 - NOV 23 10:34	PieRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	NOV 23 09:14 - NOV 23 10:33	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	NOV 23 09:13 - NOV 23 10:33	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	NOV 23 09:17 - NOV 23 10:38	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	+++++			NOV 23 09:08 - NOV 23 09:14	PnnRin
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

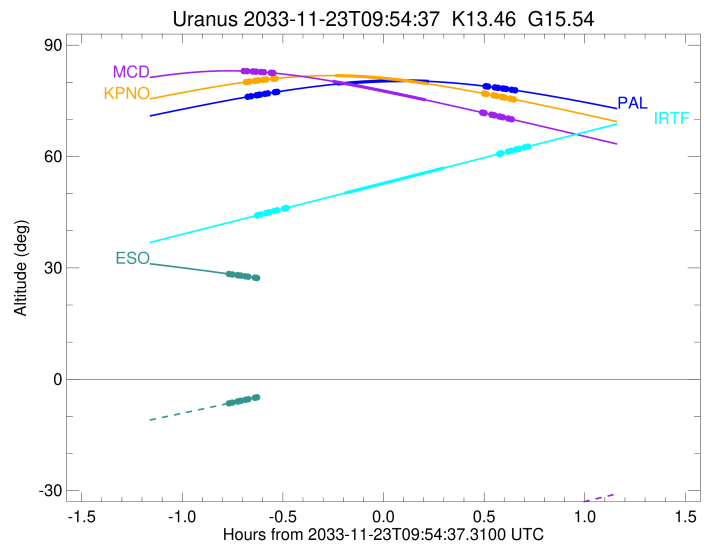
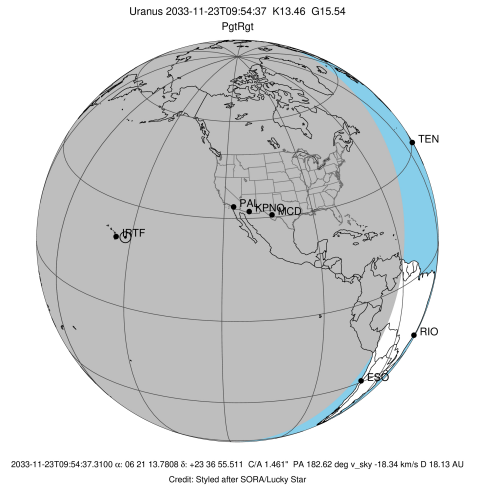


target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:54:45.840  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558  
 ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 160.94  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.533  
 C/A sky separation (km) : 20156.8  
 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	2033-11-23T09:14:30.159		76.15	-64.29	50746.02	-17.95		
lambda	I	2033-11-23T09:15:10.307		76.26	-64.16	50026.71	-17.89		
delta	I	2033-11-23T09:16:47.141		76.51	-63.85	48300.35	-17.76		
gamma	I	2033-11-23T09:17:25.401		76.61	-63.72	47621.82	-17.71		
eta	I	2033-11-23T09:17:50.598		76.67	-63.64	47176.12	-17.67		
beta	I	2033-11-23T09:19:15.698		76.89	-63.37	45677.37	-17.53		
alpha	I	2033-11-23T09:20:09.003		77.02	-63.19	44747.54	-17.45		
4	I	2033-11-23T09:22:14.671		77.32	-62.79	42568.84	-17.21		
5	I	2033-11-23T09:22:37.347		77.38	-62.71	42171.67	-17.14		
6	I	2033-11-23T09:22:54.445		77.42	-62.66	41879.70	-17.12		
Uranus	I	2033-11-23T09:40:49.083		79.53	-59.11	25535.39		-3.89	-4.08
Uranus	E	2033-11-23T10:08:08.031		80.25	-53.55	25144.41		16.72	17.47
6	E	2033-11-23T10:25:01.646		78.94	-50.06	41816.58	17.13		
5	E	2033-11-23T10:25:25.848		78.89	-49.98	42226.79	17.15		
4	E	2033-11-23T10:25:48.475		78.85	-49.90	42610.60	17.22		
alpha	E	2033-11-23T10:27:49.267		78.62	-49.48	44715.82	17.46		
beta	E	2033-11-23T10:28:42.496		78.51	-49.30	45641.94	17.55		
eta	E	2033-11-23T10:30:09.511		78.33	-49.00	47176.12	17.69		
gamma	E	2033-11-23T10:30:34.968		78.28	-48.91	47626.83	17.72		
delta	E	2033-11-23T10:31:12.910		78.20	-48.78	48300.35	17.78		
lambda	E	2033-11-23T10:32:49.653		77.99	-48.44	50026.71	17.91		
epsilon	E	2033-11-23T10:34:09.225		77.81	-48.17	51455.69	17.97		

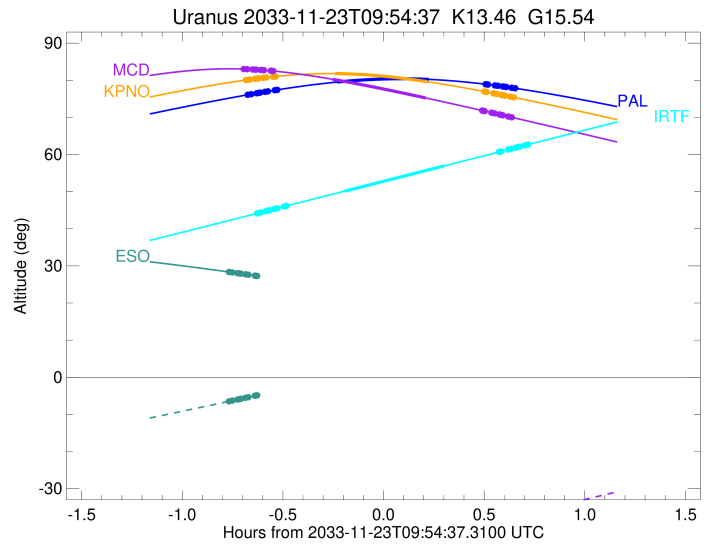
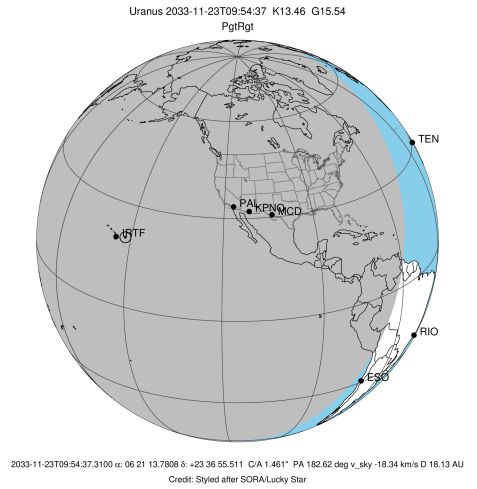
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:54:18.210  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KPNO  
 Location : Kitt Peak Natl Obs  
 Latitude (deg) : 31.96333  
 E. Longitude (deg) : 248.40000  
 Altitude (km) : 2.120  
 Gaia source ID : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558  
 ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 161.00  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.523  
 C/A sky separation (km) : 20032.7  
 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

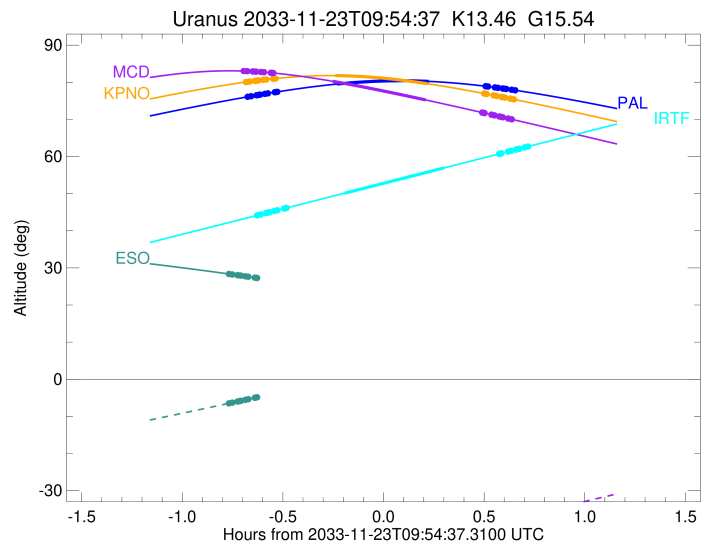
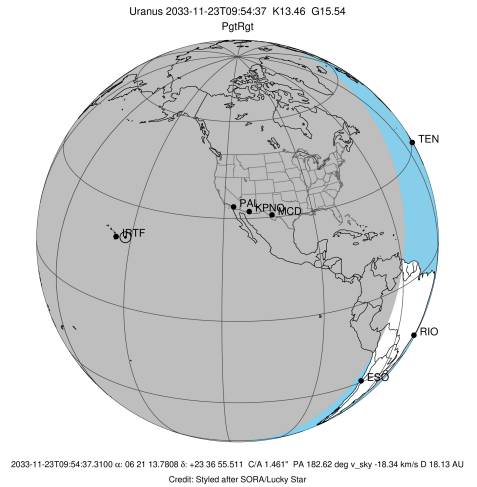
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-11-23T09:14:01.134		80.12	-60.65	50745.87	-17.98		
lambda	I	2033-11-23T09:14:41.201		80.20	-60.51	50026.71	-17.92		
delta	I	2033-11-23T09:16:17.854		80.39	-60.18	48300.35	-17.80		
gamma	I	2033-11-23T09:16:56.039		80.46	-60.05	47621.83	-17.74		
eta	I	2033-11-23T09:17:21.188		80.51	-59.96	47176.12	-17.70		
beta	I	2033-11-23T09:18:46.111		80.66	-59.67	45677.41	-17.57		
alpha	I	2033-11-23T09:19:39.311		80.75	-59.49	44747.47	-17.49		
4	I	2033-11-23T09:21:44.699		80.96	-59.06	42568.65	-17.25		
5	I	2033-11-23T09:22:07.299		80.99	-58.98	42171.88	-17.18		
6	I	2033-11-23T09:22:24.368		81.02	-58.92	41879.70	-17.16		
Uranus	I	2033-11-23T09:40:13.430		81.80	-55.22	25533.48		-4.05	-4.24
Uranus	E	2033-11-23T10:07:48.790		79.60	-49.41	25141.35		16.79	17.54
6	E	2033-11-23T10:24:37.655		76.98	-45.85	41816.48	17.16		
5	E	2033-11-23T10:25:01.829		76.91	-45.76	42227.00	17.18		
4	E	2033-11-23T10:25:24.395		76.84	-45.68	42610.54	17.26		
alpha	E	2033-11-23T10:27:24.980		76.49	-45.25	44715.74	17.49		
beta	E	2033-11-23T10:28:18.129		76.33	-45.07	45641.92	17.57		
eta	E	2033-11-23T10:29:45.018		76.08	-44.76	47176.12	17.71		
gamma	E	2033-11-23T10:30:10.442		76.00	-44.67	47626.84	17.75		
delta	E	2033-11-23T10:30:48.333		75.89	-44.54	48300.35	17.80		
lambda	E	2033-11-23T10:32:24.956		75.60	-44.19	50026.71	17.93		
epsilon	E	2033-11-23T10:33:44.467		75.35	-43.91	51456.21	17.99		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:53:38.150  
 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 : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558  
 ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 161.09  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.518  
 C/A sky separation (km) : 19963.3  
 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\_itr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



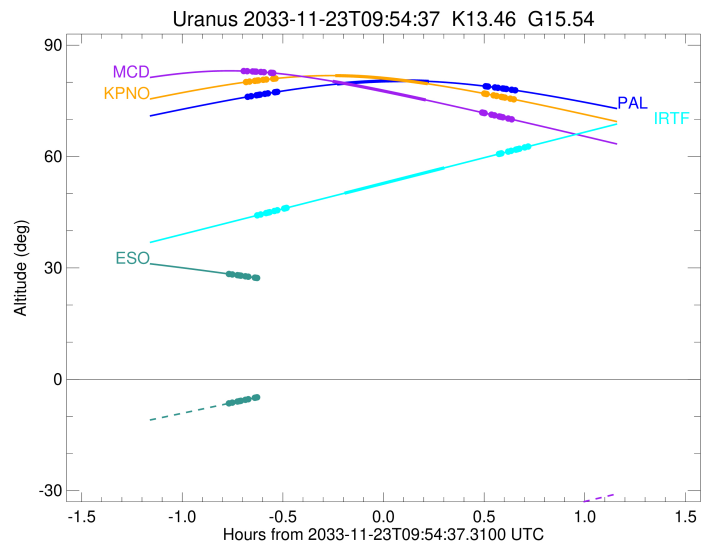
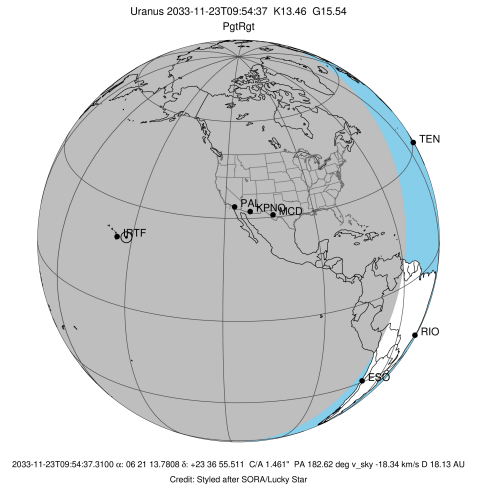
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2033-11-23T09:13:20.101		83.01	-54.68	50745.76	-18.00		
lambda	I	2033-11-23T09:14:00.119		82.99	-54.54	50026.71	-17.94		
delta	I	2033-11-23T09:15:36.667		82.92	-54.20	48300.35	-17.82		
gamma	I	2033-11-23T09:16:14.809		82.89	-54.06	47621.84	-17.76		
eta	I	2033-11-23T09:16:39.929		82.87	-53.97	47176.12	-17.72		
beta	I	2033-11-23T09:18:04.752		82.78	-53.67	45677.45	-17.59		
alpha	I	2033-11-23T09:18:57.893		82.72	-53.48	44747.42	-17.51		
4	I	2033-11-23T09:21:03.125		82.56	-53.03	42568.52	-17.27		
5	I	2033-11-23T09:21:25.678		82.53	-52.95	42172.02	-17.20		
6	I	2033-11-23T09:21:42.734		82.51	-52.89	41879.69	-17.18		
Uranus	I	2033-11-23T09:39:28.760		80.26	-49.08	25532.21		-4.15	-4.34
Uranus	E	2033-11-23T10:07:13.642		75.24	-43.11	25139.95		16.82	17.57
6	E	2033-11-23T10:24:00.328		71.86	-39.50	41816.45	17.17		
5	E	2033-11-23T10:24:24.494		71.77	-39.41	42227.07	17.19		
4	E	2033-11-23T10:24:47.042		71.70	-39.33	42610.52	17.27		
alpha	E	2033-11-23T10:26:47.568		71.28	-38.90	44715.71	17.50		
beta	E	2033-11-23T10:27:40.699		71.10	-38.71	45641.92	17.58		
eta	E	2033-11-23T10:29:07.562		70.80	-38.40	47176.12	17.71		
gamma	E	2033-11-23T10:29:32.979		70.71	-38.31	47626.85	17.75		
delta	E	2033-11-23T10:30:10.861		70.58	-38.17	48300.35	17.81		
lambda	E	2033-11-23T10:31:47.468		70.24	-37.83	50026.71	17.93		
epsilon	E	2033-11-23T10:33:06.978		69.97	-37.54	51456.34	17.99		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:58:08.870  
 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 : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558  
 ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 160.36  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.446  
 C/A sky separation (km) : 19020.0  
 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	2033-11-23T09:17:21.333		44.24	-78.02	50745.25	-18.04		
lambda	I	2033-11-23T09:18:01.218		44.40	-78.17	50026.71	-17.99		
delta	I	2033-11-23T09:19:37.454		44.76	-78.55	48300.35	-17.88		
gamma	I	2033-11-23T09:20:15.446		44.91	-78.70	47621.88	-17.83		
eta	I	2033-11-23T09:20:40.463		45.00	-78.80	47176.12	-17.80		
beta	I	2033-11-23T09:22:04.868		45.33	-79.12	45677.63	-17.68		
alpha	I	2033-11-23T09:22:57.744		45.53	-79.33	44747.13	-17.61		
4	I	2033-11-23T09:25:02.153		46.00	-79.82	42567.72	-17.41		
5	I	2033-11-23T09:25:24.431		46.09	-79.90	42172.93	-17.34		
6	I	2033-11-23T09:25:41.408		46.15	-79.97	41879.64	-17.32		
Uranus	I	2033-11-23T09:42:58.179		50.11	-84.01	25519.63		-5.03	-5.27
Uranus	E	2033-11-23T10:12:45.691		56.96	-88.72	25114.02		17.36	18.13
6	E	2033-11-23T10:29:01.022		60.69	-85.08	41815.24	17.41		
5	E	2033-11-23T10:29:25.083		60.78	-84.99	42229.68	17.43		
4	E	2033-11-23T10:29:47.109		60.87	-84.91	42609.77	17.49		
alpha	E	2033-11-23T10:31:46.153		61.32	-84.44	44714.67	17.70		
beta	E	2033-11-23T10:32:38.732		61.52	-84.24	45641.75	17.78		
eta	E	2033-11-23T10:34:04.671		61.85	-83.91	47176.12	17.90		
gamma	E	2033-11-23T10:34:29.835		61.95	-83.81	47627.00	17.93		
delta	E	2033-11-23T10:35:07.328		62.09	-83.66	48300.35	17.98		
lambda	E	2033-11-23T10:36:43.009		62.46	-83.29	50026.71	18.10		
epsilon	E	2033-11-23T10:38:02.193		62.76	-82.98	51463.52	18.15		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2033-11-23T09:50:49.680  
 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 : 3377582145802004480  
 2Mass ID (if available) : 06211377+2336558  
 ICRS Star Coord at Epoch: 06h 21m 13.78085s +23:36:55.51125s  
 RUWE (>1.4 is poor) : 1.01  
 K magnitude : 13.465  
 G magnitude : 15.540  
 RP magnitude : 14.822  
 BP magnitude : 16.104  
 DUPflag : 0  
 Distance (au) : 18.132  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -18.34  
 Sun-Target sep (deg) : 146.09  
 Sun-Moon sep (deg) : 161.11  
 B (ring opening deg) : 71.07  
 PA of pole (deg) : 66.79  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.129  
 C/A sky separation (km) : 14849.1  
 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	2033-11-23T09:08:54.615		28.32	-6.42	50743.52	-18.67		
lambda	I	2033-11-23T09:09:33.043		28.24	-6.29	50026.71	-18.64		
delta	I	2033-11-23T09:11:05.828		28.04	-5.99	48300.35	-18.57		
gamma	I	2033-11-23T09:11:42.371		27.96	-5.88	47622.22	-18.54		
eta	I	2033-11-23T09:12:06.443		27.91	-5.80	47176.12	-18.52		
beta	I	2033-11-23T09:13:27.385		27.74	-5.54	45678.80	-18.45		
alpha	I	2033-11-23T09:14:18.238		27.63	-5.37	44744.88	-18.41		
4	I	2033-11-23T09:16:17.074		27.37	-4.98x	42562.35	-18.28		
5	I	2033-11-23T09:16:37.625		27.33	-4.92x	42179.50	-18.24		
6	I	2033-11-23T09:16:54.188		27.29	-4.86x	41878.97	-18.23		
Uranus	I	2033-11-23T09:32:21.944		25.20	-1.82x	25434.35	-18.17	-9.00	-9.42
Uranus	E	2033-11-23T10:08:53.283		19.71	5.55x	25053.57	-18.17	18.58	19.39
6	E	2033-11-23T10:23:38.321		17.31	8.59x	41811.73	18.17		
5	E	2033-11-23T10:24:02.005		17.24	8.67x	42237.58	18.17		
4	E	2033-11-23T10:24:22.470		17.19	8.74x	42607.27	18.21		
alpha	E	2033-11-23T10:26:17.097		16.87	9.14x	44711.62	18.33		
beta	E	2033-11-23T10:27:08.059		16.73	9.32x	45641.36	18.37		
eta	E	2033-11-23T10:28:31.356		16.50	9.60x	47176.12	18.44		
gamma	E	2033-11-23T10:28:55.814		16.43	9.69x	47627.44	18.46		
delta	E	2033-11-23T10:29:32.233		16.32	9.82x	48300.35	18.49		
lambda	E	2033-11-23T10:31:05.431		16.06	10.14x	50026.71	18.56		
epsilon	E	2033-11-23T10:32:23.767		15.84	10.41x	51482.26	18.58		