

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:05:50.230  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548

ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s

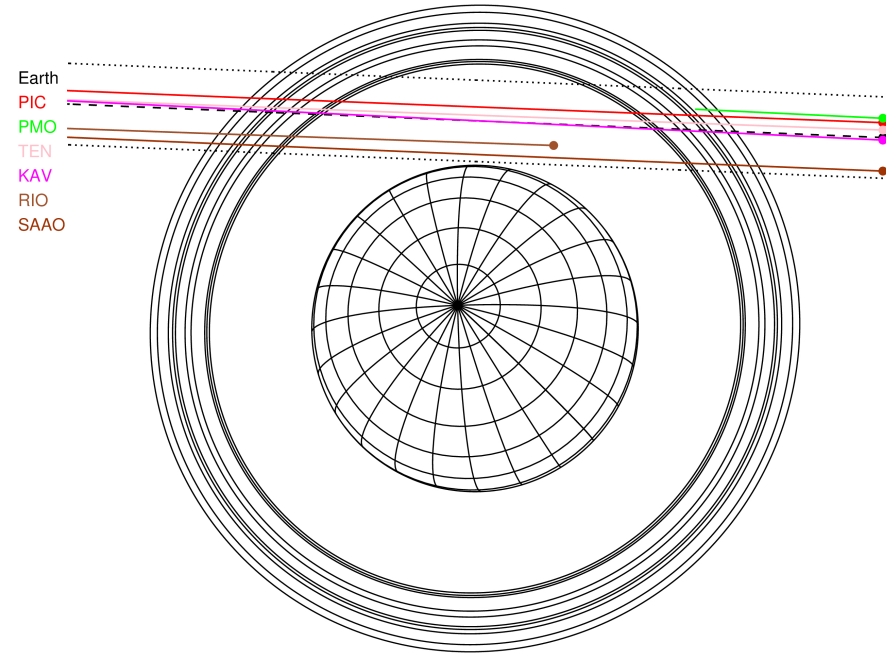
RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 50.38  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84

#	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



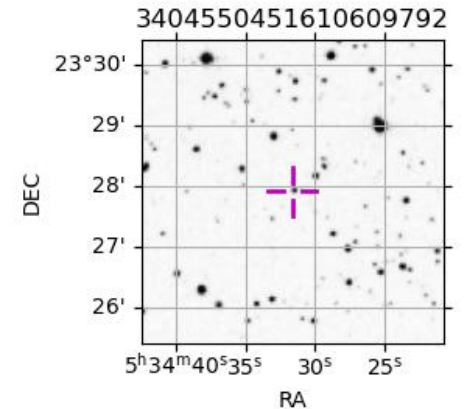
2031-12-31T22:05:50.2300 ra: 05 34 31.60022 s: +23 27 54.584 C/A 2.478° PA 177.65 deg v\_sky -22.36 km/s D 18.13 AU  
 Credit: Styled after SORA/Lucky Star

Uranus 2031-12-31T22:05:50 K13.69 G15.81 XRgt

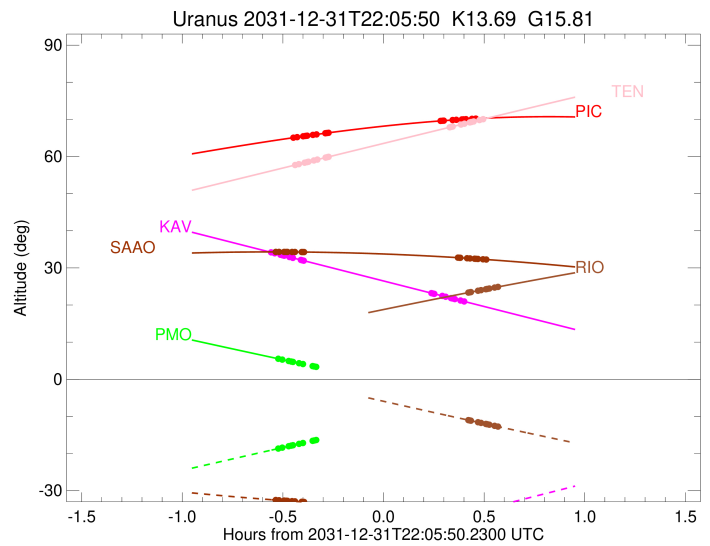
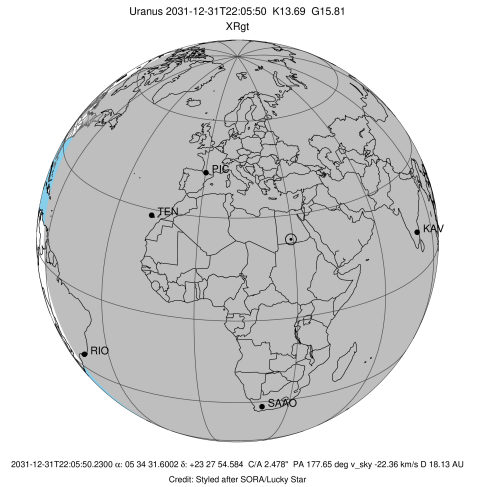


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++		+++++	DEC 31 21:38 - DEC 31 22:32	PnnRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8	++			DEC 31 21:34 - DEC 31 21:35	PnnRin
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 31 21:39 - DEC 31 22:35	PnnRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++		+++++	DEC 31 21:32 - DEC 31 22:29	PnnRie
RIO	Rio de Janeiro	-22.9	316.8			+++++	DEC 31 22:31 - DEC 31 22:39	PnnRne
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 31 21:33 - DEC 31 22:36	PnnRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:06:33.600  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 51.13  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.637  
 C/A sky separation (km) : 34681.2  
 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

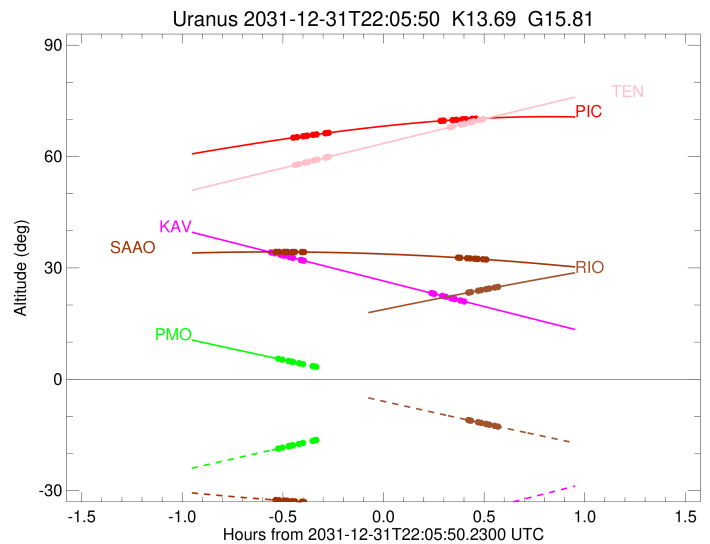
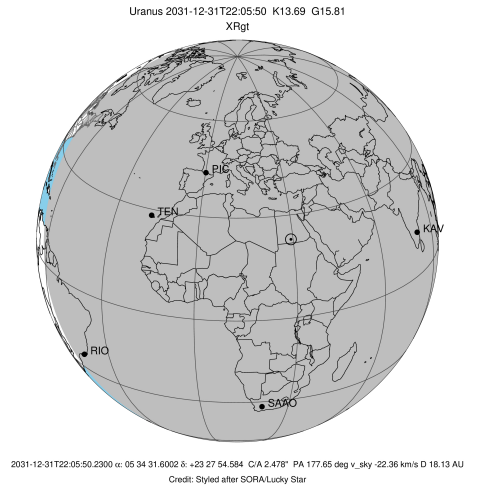


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T21:38:50.055		65.06	-54.40	51286.38	-16.56		
lambda	I	2031-12-31T21:40:06.426		65.23	-54.62	50026.71	-16.30		
delta	I	2031-12-31T21:41:54.200		65.46	-54.92	48300.35	-15.72		
gamma	I	2031-12-31T21:42:37.235		65.55	-55.04	47629.05	-15.47		
eta	I	2031-12-31T21:43:06.673		65.61	-55.13	47176.12	-15.30		
beta	I	2031-12-31T21:44:46.586		65.82	-55.41	45679.22	-14.65		
alpha	I	2031-12-31T21:45:52.185		65.96	-55.59	44732.04	-14.19		
4	I	2031-12-31T21:48:29.646		66.28	-56.03	42588.74	-13.01		
5	I	2031-12-31T21:49:02.164		66.35	-56.12	42172.89	-12.74		
6	I	2031-12-31T21:49:31.095		66.40	-56.20	41805.75	-12.45		

No planet occultations

6	E	2031-12-31T22:22:46.990		69.59	-61.47	41798.37	12.46		
5	E	2031-12-31T22:23:23.220		69.64	-61.56	42258.39	12.74		
4	E	2031-12-31T22:23:51.846		69.67	-61.63	42616.54	13.01		
alpha	E	2031-12-31T22:26:23.968		69.83	-62.01	44691.35	14.20		
beta	E	2031-12-31T22:27:30.853		69.90	-62.17	45655.73	14.66		
eta	E	2031-12-31T22:29:12.272		69.99	-62.41	47176.12	15.30		
gamma	E	2031-12-31T22:29:41.822		70.02	-62.48	47631.01	15.48		
delta	E	2031-12-31T22:30:24.708		70.06	-62.59	48300.35	15.73		
lambda	E	2031-12-31T22:32:12.422		70.15	-62.84	50026.71	16.31		
epsilon	E	2031-12-31T22:32:57.116		70.19	-62.95	50760.85	16.57		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:01:39.600  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 49.93  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.734  
 C/A sky separation (km) : 35958.5  
 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

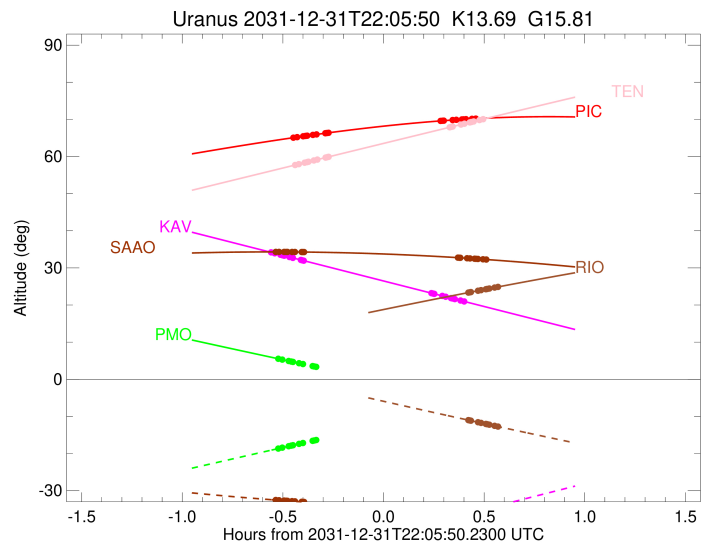
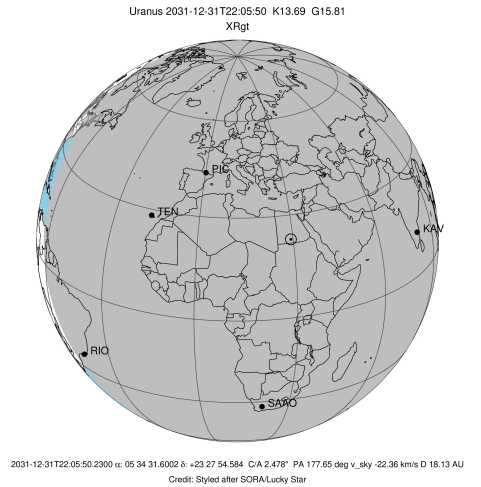


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T21:34:20.830		5.55	-18.69	51276.41	-15.74		
lambda	I	2031-12-31T21:35:40.667		5.29	-18.42	50026.71	-15.44		
delta	I	2031-12-31T21:37:34.770		4.92x	-18.03	48300.35	-14.80		
gamma	I	2031-12-31T21:38:20.533		4.77x	-17.88	47629.19	-14.53		
eta	I	2031-12-31T21:38:51.933		4.67x	-17.77	47176.12	-14.33		
beta	I	2031-12-31T21:40:39.041		4.33x	-17.41	45678.89	-13.61		
alpha	I	2031-12-31T21:41:49.952		4.10x	-17.17	44730.82	-13.09		
4	I	2031-12-31T21:44:42.103		3.55x	-16.59	42590.65	-11.74		
5	I	2031-12-31T21:45:18.227		3.43x	-16.46	42175.40	-11.43		
6	I	2031-12-31T21:45:50.881		3.33x	-16.35	41804.36	-11.10		

No planet occultations

6	E	2031-12-31T22:16:37.546		-2.47x	-10.18	41797.30	11.07		
5	E	2031-12-31T22:17:17.749		-2.59x	-10.05	42253.32	11.40		
4	E	2031-12-31T22:17:50.089		-2.69x	-9.94	42616.55	11.71		
alpha	E	2031-12-31T22:20:37.310		-3.21x	-9.39	44692.53	13.05		
beta	E	2031-12-31T22:21:49.808		-3.43x	-9.15	45656.77	13.57		
eta	E	2031-12-31T22:23:38.869		-3.76x	-8.79	47176.12	14.28		
gamma	E	2031-12-31T22:24:10.518		-3.86x	-8.69	47631.12	14.47		
delta	E	2031-12-31T22:24:56.321		-4.00x	-8.54	48300.35	14.75		
lambda	E	2031-12-31T22:26:50.880		-4.35x	-8.16	50026.71	15.38		
epsilon	E	2031-12-31T22:27:38.582		-4.49x	-8.01	50766.32	15.67		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:07:54.780  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 51.25  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.539  
 C/A sky separation (km) : 33390.5  
 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

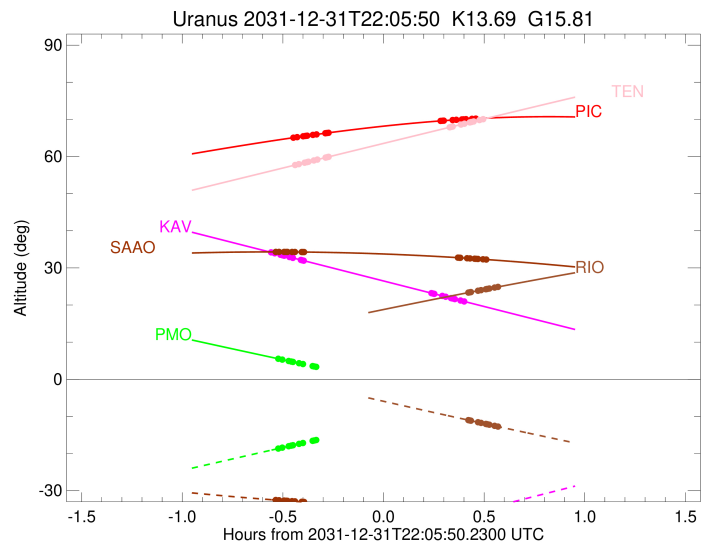
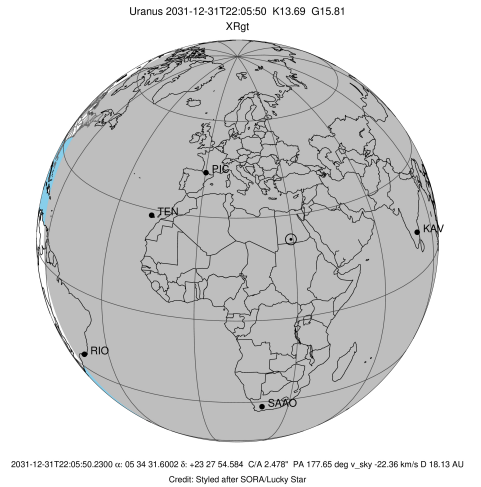


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T21:39:21.263		57.68	-42.81	51298.63	-17.10		
lambda	I	2031-12-31T21:40:35.888		57.96	-43.08	50026.71	-16.87		
delta	I	2031-12-31T21:42:19.778		58.34	-43.46	48300.35	-16.35		
gamma	I	2031-12-31T21:43:01.117		58.49	-43.61	47628.88	-16.13		
eta	I	2031-12-31T21:43:29.321		58.60	-43.71	47176.12	-15.97		
beta	I	2031-12-31T21:45:04.669		58.95	-44.06	45679.56	-15.41		
alpha	I	2031-12-31T21:46:06.850		59.18	-44.29	44733.37	-15.00		
4	I	2031-12-31T21:48:34.966		59.72	-44.83	42586.65	-13.97		
5	I	2031-12-31T21:49:05.176		59.83	-44.94	42170.39	-13.73		
6	I	2031-12-31T21:49:31.680		59.93	-45.04	41807.29	-13.49		

No planet occultations

6	E	2031-12-31T22:25:30.236		67.87	-52.95	41799.41	13.51		
5	E	2031-12-31T22:26:04.005		67.99	-53.07	42262.59	13.75		
4	E	2031-12-31T22:26:30.262		68.09	-53.17	42616.38	13.99		
alpha	E	2031-12-31T22:28:52.922		68.61	-53.69	44690.41	15.02		
beta	E	2031-12-31T22:29:56.318		68.84	-53.93	45654.86	15.43		
eta	E	2031-12-31T22:31:33.065		69.19	-54.28	47176.12	16.00		
gamma	E	2031-12-31T22:32:01.347		69.30	-54.38	47630.90	16.16		
delta	E	2031-12-31T22:32:42.489		69.45	-54.54	48300.35	16.38		
lambda	E	2031-12-31T22:34:26.190		69.82	-54.92	50026.71	16.90		
epsilon	E	2031-12-31T22:35:09.125		69.98	-55.07	50756.81	17.14		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:01:27.120  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 50.18  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.472  
 C/A sky separation (km) : 32514.5  
 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

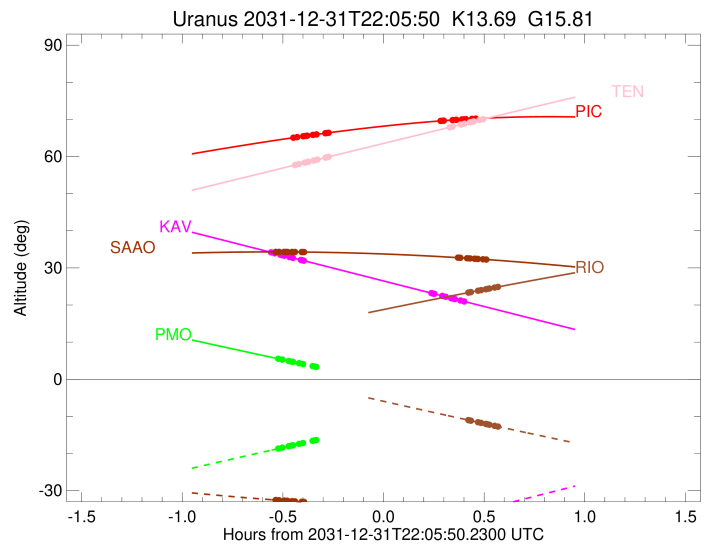
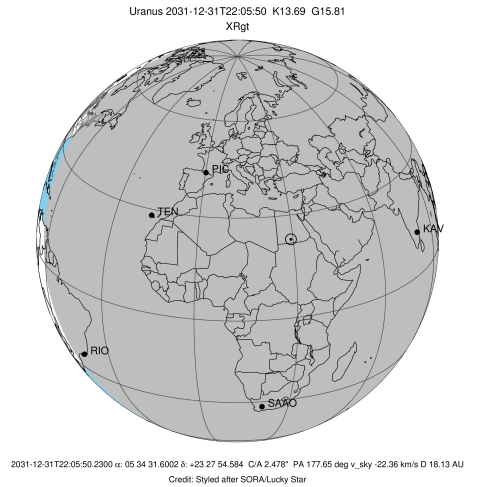


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T21:32:10.940		34.22	-49.60	51311.42	-17.39		
lambda	I	2031-12-31T21:33:25.052		33.94	-49.32	50026.71	-17.17		
delta	I	2031-12-31T21:35:06.990		33.54	-48.93	48300.35	-16.69		
gamma	I	2031-12-31T21:35:47.480		33.39	-48.78	47628.70	-16.49		
eta	I	2031-12-31T21:36:15.057		33.28	-48.67	47176.12	-16.34		
beta	I	2031-12-31T21:37:48.095		32.93	-48.32	45679.86	-15.81		
alpha	I	2031-12-31T21:38:48.534		32.70	-48.09	44734.60	-15.44		
4	I	2031-12-31T21:41:12.061		32.15	-47.54	42584.74	-14.50		
5	I	2031-12-31T21:41:41.115		32.03	-47.43	42168.31	-14.28		
6	I	2031-12-31T21:42:06.347		31.94	-47.34	41808.71	-14.07		

No planet occultations

6	E	2031-12-31T22:20:03.354		23.22	-38.64	41799.89	14.02		
5	E	2031-12-31T22:20:36.036		23.09	-38.51	42264.36	14.24		
4	E	2031-12-31T22:21:01.287		23.00	-38.42	42616.28	14.45		
alpha	E	2031-12-31T22:23:19.993		22.47	-37.88	44690.05	15.38		
beta	E	2031-12-31T22:24:21.998		22.23	-37.65	45654.52	15.75		
eta	E	2031-12-31T22:25:56.979		21.87	-37.28	47176.12	16.27		
gamma	E	2031-12-31T22:26:24.804		21.76	-37.18	47630.86	16.42		
delta	E	2031-12-31T22:27:05.338		21.61	-37.02	48300.35	16.62		
lambda	E	2031-12-31T22:28:47.739		21.22	-36.63	50026.71	17.09		
epsilon	E	2031-12-31T22:29:30.153		21.05	-36.47	50755.57	17.30		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:09:39.480  
 Event type : XRgt  
 : No Uranus occs  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 51.01  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.210  
 C/A sky separation (km) : 29073.1  
 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

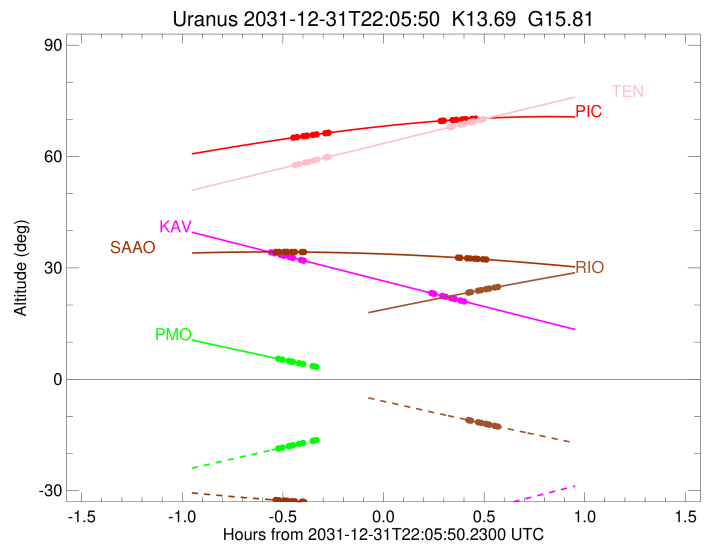
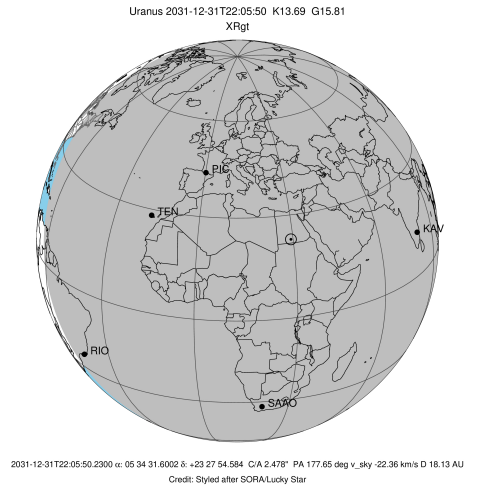


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-12-31T21:38:27.038		13.59	-0.29x	51337.86	-18.53		
lambda	I	2031-12-31T21:39:37.909		13.82	-0.53x	50026.71	-18.38		
delta	I	2031-12-31T21:41:12.738		14.13	-0.86x	48300.35	-18.02		
gamma	I	2031-12-31T21:41:50.176		14.25	-0.99x	47628.30	-17.88		
eta	I	2031-12-31T21:42:15.548		14.33	-1.08x	47176.12	-17.77		
beta	I	2031-12-31T21:43:40.607		14.60	-1.37x	45680.45	-17.39		
alpha	I	2031-12-31T21:44:35.235		14.78	-1.56x	44737.35	-17.12		
4	I	2031-12-31T21:46:43.672		15.19	-2.01x	42580.08	-16.46		
5	I	2031-12-31T21:47:09.124		15.27	-2.10x	42163.88	-16.31		
6	I	2031-12-31T21:47:30.726		15.34	-2.17x	41812.38	-16.15		

No planet occultations

6	E	2031-12-31T22:31:05.184		23.34	-11.00	41803.03	16.20		
5	E	2031-12-31T22:31:34.055		23.42	-11.09	42274.15	16.36		
4	E	2031-12-31T22:31:55.399		23.49	-11.16	42615.21	16.51		
alpha	E	2031-12-31T22:33:58.217		23.84	-11.56	44688.03	17.18		
beta	E	2031-12-31T22:34:53.973		24.00	-11.75	45652.35	17.45		
eta	E	2031-12-31T22:36:20.312		24.25	-12.03	47176.12	17.83		
gamma	E	2031-12-31T22:36:45.719		24.33	-12.11	47630.55	17.94		
delta	E	2031-12-31T22:37:22.898		24.43	-12.23	48300.35	18.09		
lambda	E	2031-12-31T22:38:57.373		24.71	-12.54	50026.71	18.45		
epsilon	E	2031-12-31T22:39:36.311		24.82	-12.67	50747.79	18.60		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-12-31T22:05:24.350  
 Event type : XRgt  
 : No Uranus occs  
 : 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 : 3404550451610609792  
 2Mass ID (if available) : 05343160+2327548  
 ICRS Star Coord at Epoch: 05h 34m 31.60022s +23:27:54.58382s  
 RUWE (>1.4 is poor) : 1.06  
 K magnitude : 13.693  
 G magnitude : 15.806  
 RP magnitude : 15.118  
 BP magnitude : 16.333  
 DUPflag : 0  
 Distance (au) : 18.134  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -22.36  
 Sun-Target sep (deg) : 164.58  
 Sun-Moon sep (deg) : 50.67  
 B (ring opening deg) : 79.79  
 PA of pole (deg) : 36.84  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.071  
 C/A sky separation (km) : 27233.6  
 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	2031-12-31T21:33:33.012		34.31	-32.52	51355.79	-19.26		
lambda	I	2031-12-31T21:34:42.086		34.31	-32.59	50026.71	-19.13		
delta	I	2031-12-31T21:36:13.019		34.31	-32.69	48300.35	-18.83		
gamma	I	2031-12-31T21:36:48.846		34.30	-32.73	47628.03	-18.70		
eta	I	2031-12-31T21:37:13.070		34.30	-32.75	47176.12	-18.61		
beta	I	2031-12-31T21:38:34.112		34.29	-32.84	45680.74	-18.29		
alpha	I	2031-12-31T21:39:25.922		34.29	-32.89	44739.02	-18.06		
4	I	2031-12-31T21:41:27.498		34.27	-33.01	42577.17	-17.50		
5	I	2031-12-31T21:41:51.358		34.27	-33.03	42161.59	-17.37		
6	I	2031-12-31T21:42:11.388		34.27	-33.05	41814.76	-17.24		

No planet occultations

6	E	2031-12-31T22:27:59.239		32.76	-34.67	41804.43	17.23		
5	E	2031-12-31T22:28:26.577		32.74	-34.68	42277.78	17.36		
4	E	2031-12-31T22:28:46.444		32.72	-34.68	42614.58	17.49		
alpha	E	2031-12-31T22:30:42.888		32.61	-34.70	44687.37	18.04		
beta	E	2031-12-31T22:31:36.040		32.56	-34.71	45651.54	18.27		
eta	E	2031-12-31T22:32:58.703		32.47	-34.72	47176.12	18.60		
gamma	E	2031-12-31T22:33:23.072		32.45	-34.72	47630.41	18.69		
delta	E	2031-12-31T22:33:58.799		32.41	-34.73	48300.35	18.82		
lambda	E	2031-12-31T22:35:29.806		32.32	-34.73	50026.71	19.12		
epsilon	E	2031-12-31T22:36:07.308		32.28	-34.74	50745.90	19.25		