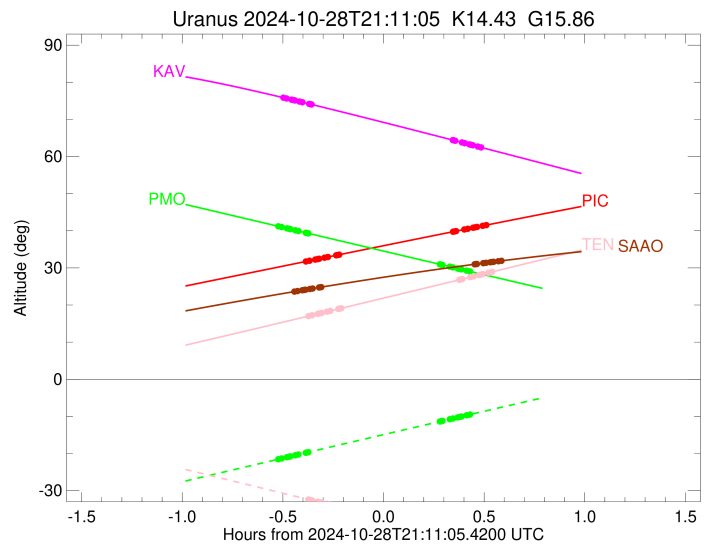
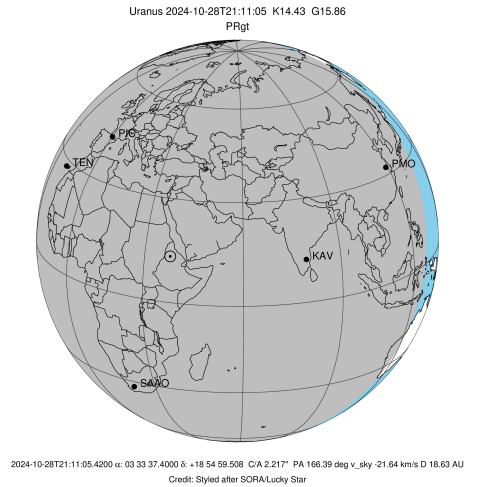




target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-10-28T21:13:37.170  
 Event type : PRgt  
 : Uranus occs: not geocentric or topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 56824070890660864  
 2Mass ID (if available) : 03333741+1854596  
 ICRS Star Coord at Epoch: 03h 33m 37.40000s +18:54:59.50812s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 14.431  
 G magnitude : 15.859  
 RP magnitude : 15.332  
 BP magnitude : 16.212  
 DUPflag : 0  
 Distance (au) : 18.628  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.64  
 Sun-Target sep (deg) : 159.93  
 Sun-Moon sep (deg) : 120.64  
 B (ring opening deg) : 66.86  
 PA of pole (deg) : -84.39  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.518  
 C/A sky separation (km) : 34025.1  
 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\_itrfr93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

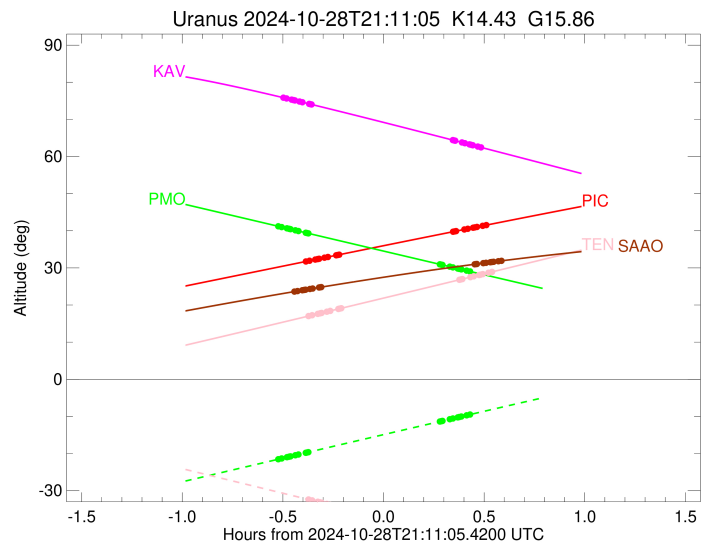
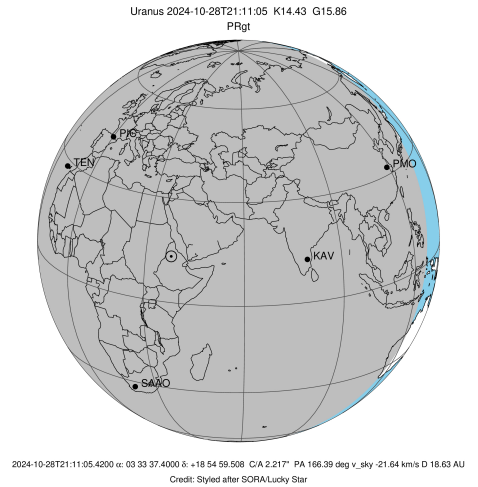


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2024-10-28T20:47:40.295		31.68	-42.32	51454.91	-17.40		
lambda	I	2024-10-28T20:49:02.942		31.93	-42.55	50026.71	-17.07		
delta	I	2024-10-28T20:50:45.713		32.25	-42.83	48300.35	-16.51		
gamma	I	2024-10-28T20:51:27.117		32.38	-42.95	47621.63	-16.27		
eta	I	2024-10-28T20:51:54.639		32.46	-43.02	47176.12	-16.10		
beta	I	2024-10-28T20:53:29.694		32.75	-43.29	45672.75	-15.49		
alpha	I	2024-10-28T20:54:30.138		32.94	-43.45	44747.70	-15.05		
4	I	2024-10-28T20:57:00.629		33.40	-43.87	42562.02	-13.90		
5	I	2024-10-28T20:57:18.336		33.45	-43.92	42311.73	-13.72		
6	I	2024-10-28T20:57:56.431		33.57	-44.02	41795.09	-13.39		

No planet occultations

6	E	2024-10-28T21:31:47.642		39.74	-49.33	41817.42	13.42		
5	E	2024-10-28T21:32:18.259		39.83	-49.41	42237.11	13.75		
4	E	2024-10-28T21:32:45.379		39.91	-49.48	42610.83	13.94		
alpha	E	2024-10-28T21:35:09.824		40.35	-49.83	44706.72	15.10		
beta	E	2024-10-28T21:36:13.235		40.54	-49.99	45678.90	15.54		
eta	E	2024-10-28T21:37:47.715		40.82	-50.21	47176.12	16.15		
gamma	E	2024-10-28T21:38:15.583		40.91	-50.28	47628.66	16.32		
delta	E	2024-10-28T21:38:56.425		41.03	-50.38	48300.35	16.57		
lambda	E	2024-10-28T21:40:38.856		41.33	-50.63	50026.71	17.13		
epsilon	E	2024-10-28T21:41:26.750		41.48	-50.74	50853.14	17.46		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-10-28T21:07:07.130  
 Event type : PRgt  
 : Uranus occs: not geocentric or 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 : 56824070890660864  
 2Mass ID (if available) : 03333741+1854596  
 ICRS Star Coord at Epoch: 03h 33m 37.40000s +18:54:59.50812s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 14.431  
 G magnitude : 15.859  
 RP magnitude : 15.332  
 BP magnitude : 16.212  
 DUPflag : 0  
 Distance (au) : 18.628  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.64  
 Sun-Target sep (deg) : 159.93  
 Sun-Moon sep (deg) : 121.21  
 B (ring opening deg) : 66.86  
 PA of pole (deg) : -84.39  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.299  
 C/A sky separation (km) : 31062.1  
 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



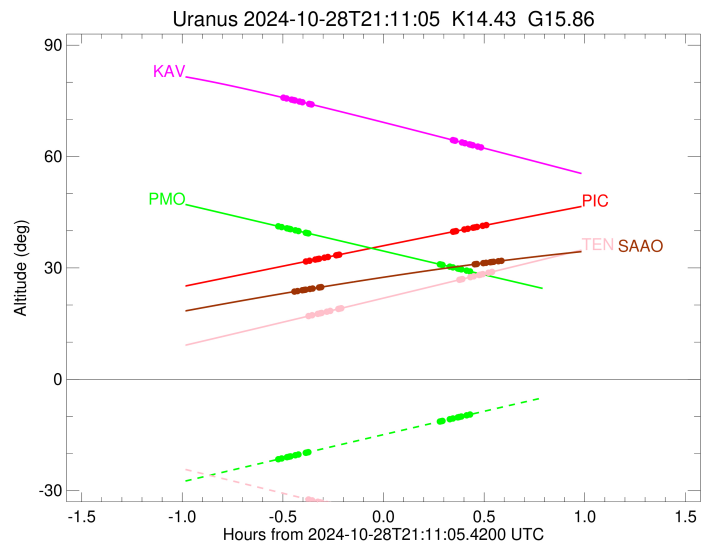
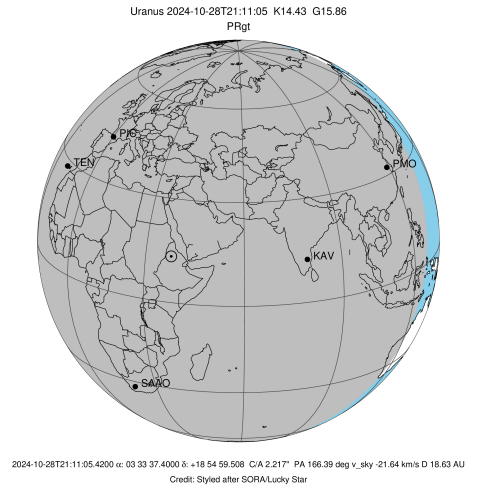
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2024-10-28T20:39:26.502		41.27	-21.60	51476.20	-18.66		
lambda	I	2024-10-28T20:40:44.589		40.99	-21.33	50026.71	-18.40		
delta	I	2024-10-28T20:42:19.549		40.66	-20.99	48300.35	-17.96		
gamma	I	2024-10-28T20:42:57.559		40.52	-20.86	47621.40	-17.77		
eta	I	2024-10-28T20:43:22.713		40.43	-20.77	47176.12	-17.64		
beta	I	2024-10-28T20:44:49.107		40.13	-20.46	45671.03	-17.17		
alpha	I	2024-10-28T20:45:43.191		39.93	-20.27	44749.37	-16.83		
4	I	2024-10-28T20:47:56.498		39.46	-19.80	42556.87	-15.97		
5	I	2024-10-28T20:48:11.397		39.41	-19.75	42313.99	-15.84		
6	I	2024-10-28T20:48:44.250		39.29	-19.63	41796.08	-15.59		

No planet occultations

6	E	2024-10-28T21:27:51.973		30.97	-11.39	41821.54	15.56		
5	E	2024-10-28T21:28:17.615		30.88	-11.30	42228.81	15.81		
4	E	2024-10-28T21:28:41.933		30.79	-11.21	42612.86	15.94		
alpha	E	2024-10-28T21:30:49.853		30.34	-10.77	44703.93	16.79		
beta	E	2024-10-28T21:31:47.224		30.14	-10.57	45678.04	17.12		
eta	E	2024-10-28T21:33:13.544		29.83	-10.27	47176.12	17.59		
gamma	E	2024-10-28T21:33:39.202		29.74	-10.18	47629.02	17.72		
delta	E	2024-10-28T21:34:16.895		29.61	-10.05	48300.35	17.90		
lambda	E	2024-10-28T21:35:52.151		29.27	-9.71	50026.71	18.34		
epsilon	E	2024-10-28T21:36:36.016		29.12	-9.56	50835.15	18.60		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-10-28T21:14:53.720  
 Event type : PRgt  
 : Uranus occs: not geocentric or topocentric  
 : 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 : 56824070890660864  
 2Mass ID (if available) : 03333741+1854596  
 ICRS Star Coord at Epoch: 03h 33m 37.40000s +18:54:59.50812s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 14.431  
 G magnitude : 15.859  
 RP magnitude : 15.332  
 BP magnitude : 16.212  
 DUPflag : 0  
 Distance (au) : 18.628  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.64  
 Sun-Target sep (deg) : 159.93  
 Sun-Moon sep (deg) : 120.36  
 B (ring opening deg) : 66.86  
 PA of pole (deg) : -84.39  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.476  
 C/A sky separation (km) : 33452.5  
 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\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk

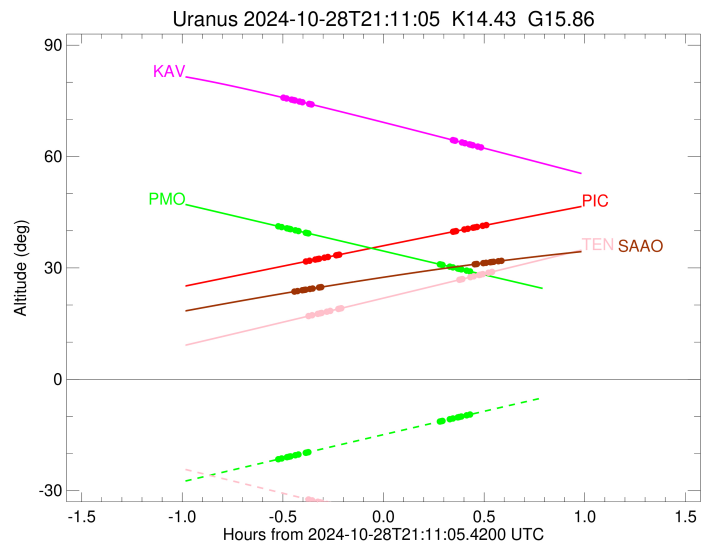
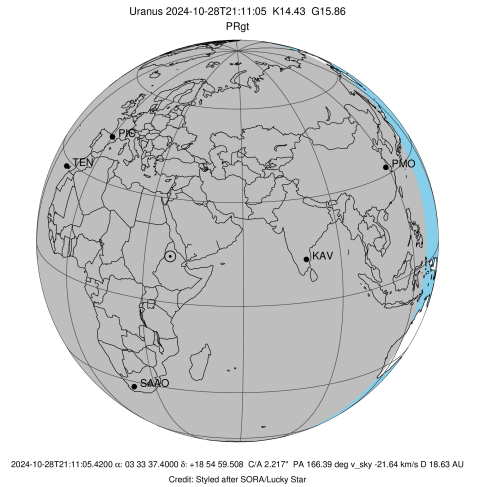


Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2024-10-28T20:48:27.523		16.96	-32.33	51458.75	-17.56		
lambda	I	2024-10-28T20:49:49.580		17.26	-32.63	50026.71	-17.25		
delta	I	2024-10-28T20:51:31.165		17.62	-33.00	48300.35	-16.72		
gamma	I	2024-10-28T20:52:12.029		17.77	-33.15	47621.58	-16.50		
eta	I	2024-10-28T20:52:39.164		17.87	-33.25	47176.12	-16.34		
beta	I	2024-10-28T20:54:12.751		18.20	-33.60	45672.45	-15.76		
alpha	I	2024-10-28T20:55:12.056		18.42	-33.81	44748.03	-15.35		
4	I	2024-10-28T20:57:39.286		18.95	-34.35	42561.05	-14.27		
5	I	2024-10-28T20:57:56.420		19.01	-34.42	42312.24	-14.10		
6	I	2024-10-28T20:58:33.459		19.14	-34.55	41795.23	-13.79		

No planet occultations

6	E	2024-10-28T21:33:40.924		26.79	-42.27	41818.35	13.84		
5	E	2024-10-28T21:34:10.431		26.90	-42.38	42235.20	14.15		
4	E	2024-10-28T21:34:36.989		26.99	-42.47	42611.33	14.32		
alpha	E	2024-10-28T21:36:58.024		27.51	-42.99	44706.06	15.40		
beta	E	2024-10-28T21:38:00.252		27.73	-43.21	45678.71	15.82		
eta	E	2024-10-28T21:39:33.172		28.07	-43.55	47176.12	16.40		
gamma	E	2024-10-28T21:40:00.628		28.17	-43.65	47628.75	16.57		
delta	E	2024-10-28T21:40:40.887		28.32	-43.80	48300.35	16.80		
lambda	E	2024-10-28T21:42:22.024		28.69	-44.17	50026.71	17.33		
epsilon	E	2024-10-28T21:43:09.131		28.86	-44.34	50848.74	17.65		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-10-28T21:09:38.350  
 Event type : PRgt  
 : Uranus occs: not geocentric or 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 : 56824070890660864  
 2Mass ID (if available) : 03333741+1854596  
 ICRS Star Coord at Epoch: 03h 33m 37.40000s +18:54:59.50812s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 14.431  
 G magnitude : 15.859  
 RP magnitude : 15.332  
 BP magnitude : 16.212  
 DUPflag : 0  
 Distance (au) : 18.628  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.64  
 Sun-Target sep (deg) : 159.93  
 Sun-Moon sep (deg) : 121.27  
 B (ring opening deg) : 66.86  
 PA of pole (deg) : -84.39  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 2.135  
 C/A sky separation (km) : 28840.2  
 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\_itrf93\_040916.bsp  
 earth\_720101\_070426.bpc  
 earth\_200101\_990628\_predict.bpc  
 pg3f0000r.bsp  
 pg490000r.bsp  
 naif0012.tls  
 earth\_flat\_IAU.spk



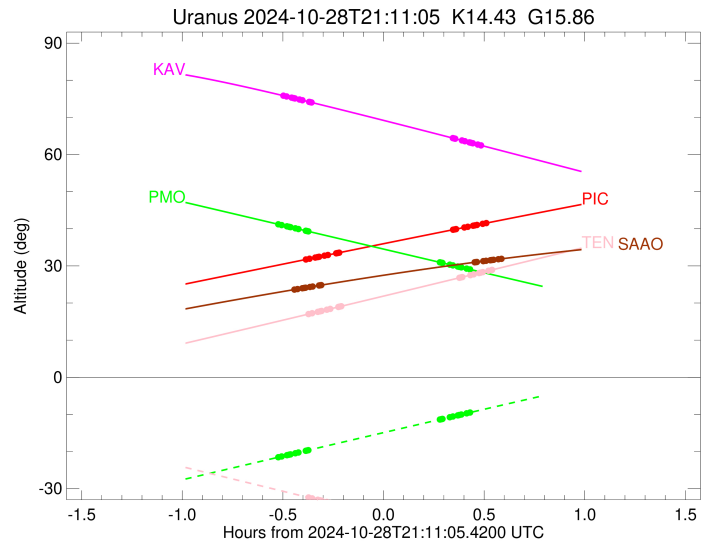
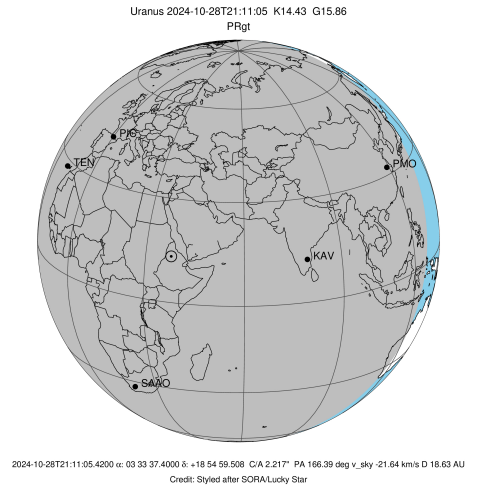
b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2024-10-28T20:40:57.916		75.91	-57.72	51487.75	-19.58		
lambda	I	2024-10-28T20:42:12.821		75.65	-57.41	50026.71	-19.37		
delta	I	2024-10-28T20:43:42.798		75.32	-57.05	48300.35	-19.00		
gamma	I	2024-10-28T20:44:18.683		75.19	-56.90	47621.29	-18.85		
eta	I	2024-10-28T20:44:42.372		75.11	-56.81	47176.12	-18.74		
beta	I	2024-10-28T20:46:03.501		74.81	-56.48	45669.95	-18.35		
alpha	I	2024-10-28T20:46:53.858		74.63	-56.28	44750.20	-18.08		
4	I	2024-10-28T20:48:57.428		74.18	-55.78	42553.89	-17.38		
5	I	2024-10-28T20:49:10.884		74.13	-55.72	42314.80	-17.28		
6	I	2024-10-28T20:49:40.893		74.02	-55.60	41796.96	-17.08		

No planet occultations

6	E	2024-10-28T21:31:44.118		64.43	-45.40	41824.85	17.06		
5	E	2024-10-28T21:32:06.916		64.35	-45.30	42222.39	17.26		
4	E	2024-10-28T21:32:29.648		64.26	-45.21	42614.15	17.37		
alpha	E	2024-10-28T21:34:27.632		63.80	-44.74	44701.74	18.06		
beta	E	2024-10-28T21:35:21.138		63.59	-44.52	45677.23	18.34		
eta	E	2024-10-28T21:36:42.031		63.28	-44.19	47176.12	18.72		
gamma	E	2024-10-28T21:37:06.170		63.18	-44.09	47629.31	18.83		
delta	E	2024-10-28T21:37:41.664		63.05	-43.95	48300.35	18.98		
lambda	E	2024-10-28T21:39:11.735		62.69	-43.59	50026.71	19.34		
epsilon	E	2024-10-28T21:39:52.609		62.54	-43.42	50820.55	19.56		

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2024-10-28T21:14:28.040  
 Event type : PRgt  
 : Uranus occs: not geocentric or topocentric  
 : 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 : 56824070890660864  
 2Mass ID (if available) : 03333741+1854596  
 ICRS Star Coord at Epoch: 03h 33m 37.40000s +18:54:59.50812s  
 RUWE (>1.4 is poor) : 0.95  
 K magnitude : 14.431  
 G magnitude : 15.859  
 RP magnitude : 15.332  
 BP magnitude : 16.212  
 DUPflag : 0  
 Distance (au) : 18.628  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -21.64  
 Sun-Target sep (deg) : 159.93  
 Sun-Moon sep (deg) : 120.45  
 B (ring opening deg) : 66.86  
 PA of pole (deg) : -84.39  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 1.938  
 C/A sky separation (km) : 26181.4  
 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\_itrfr93\_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	2024-10-28T20:44:14.994		23.58	-38.82	51500.33	-20.22		
lambda	I	2024-10-28T20:45:28.090		23.76	-38.95	50026.71	-20.05		
delta	I	2024-10-28T20:46:54.791		23.98	-39.11	48300.35	-19.77		
gamma	I	2024-10-28T20:47:29.253		24.07	-39.17	47621.18	-19.65		
eta	I	2024-10-28T20:47:51.953		24.13	-39.21	47176.12	-19.56		
beta	I	2024-10-28T20:49:09.510		24.32	-39.34	45668.66	-19.27		
alpha	I	2024-10-28T20:49:57.257		24.44	-39.42	44750.99	-19.06		
4	I	2024-10-28T20:51:54.092		24.73	-39.62	42550.63	-18.53		
5	I	2024-10-28T20:52:06.510		24.76	-39.64	42315.22	-18.45		
6	I	2024-10-28T20:52:34.467		24.83	-39.69	41798.21	-18.29		

No planet occultations

6	E	2024-10-28T21:38:15.424		30.97	-43.18	41828.56	18.34		
5	E	2024-10-28T21:38:36.028		31.02	-43.20	42215.43	18.50		
4	E	2024-10-28T21:38:57.690		31.06	-43.22	42615.26	18.58		
alpha	E	2024-10-28T21:40:48.444		31.28	-43.31	44699.41	19.11		
beta	E	2024-10-28T21:41:39.160		31.38	-43.35	45676.24	19.33		
eta	E	2024-10-28T21:42:56.164		31.52	-43.41	47176.12	19.63		
gamma	E	2024-10-28T21:43:19.222		31.57	-43.43	47629.62	19.71		
delta	E	2024-10-28T21:43:53.144		31.63	-43.45	48300.35	19.83		
lambda	E	2024-10-28T21:45:19.558		31.80	-43.52	50026.71	20.12		
epsilon	E	2024-10-28T21:45:58.147		31.87	-43.54	50805.37	20.29		