

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-20T01:20:52.710
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3427632872872654848
 2Mass ID (if available) : 05453335+2332104

Uranus 2031-10-20T01:20:52 K13.61 G15.47 PgtRgt

ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s

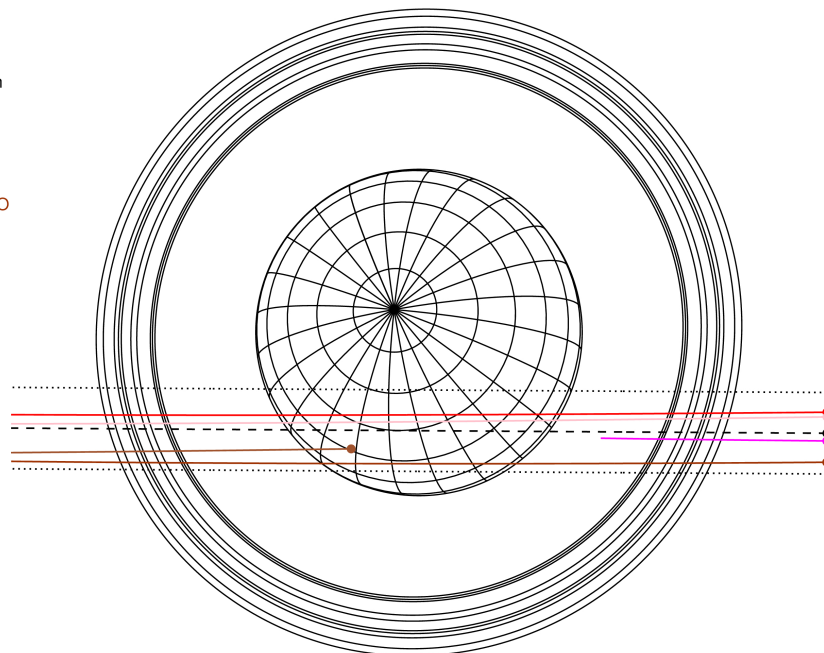
RUWE (>1.4 is poor) : 0.95
 K magnitude : 13.607
 G magnitude : 15.470
 RP magnitude : 14.841
 BP magnitude : 15.920
 DUPflag : 0
 Distance (au) : 18.590
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -8.26
 Sun-Target sep (deg) : 119.33
 Sun-Moon sep (deg) : 166.28
 B (ring opening deg) : 78.04
 PA of pole (deg) : 47.29

Uranus 2031-10-20T01:20:52 K13.61 G15.47
 PgtRgt



2031-10-20T01:20:52.7100 α: 05 45 33.3618 β: +23 32 10.364 C/A 1.132° PA 359.64 deg v_sky - 8.25 km/s D 18.59 AU
 Credit: Styled after SORA/Lucky Star

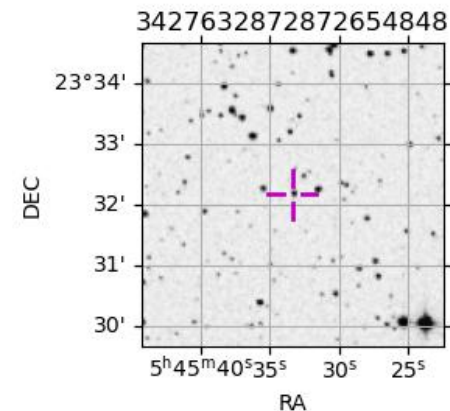
Earth
 PIC
 TEN
 KAV
 RIO
 SAAO



#	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

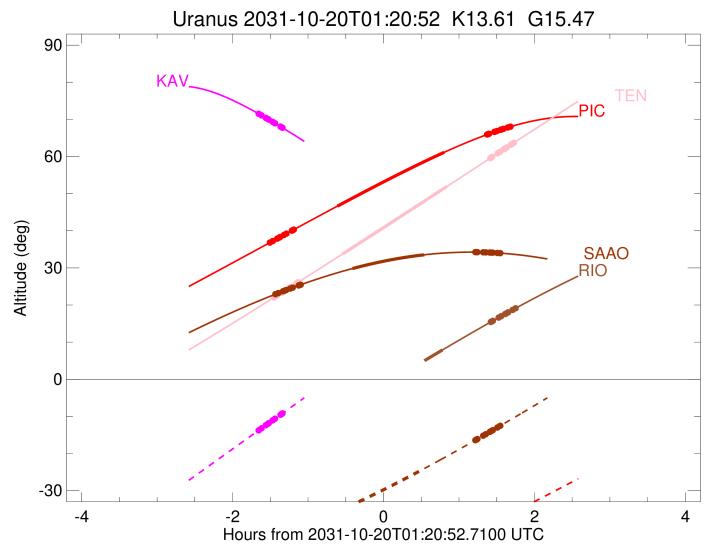
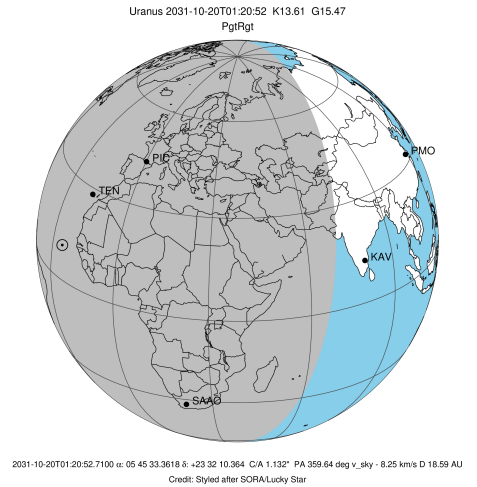
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++	+ +	+++++	OCT 19 23:50 - OCT 20 03:02	PieRie
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
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	+++++	+ +	+++++	OCT 19 23:54 - OCT 20 03:05	PieRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8	+++++			OCT 19 23:41 - OCT 20 00:00	PnnRin
RIO	Rio de Janeiro	-22.9	316.8		+	+++++	OCT 20 02:07 - OCT 20 03:06	PneRne
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	+++++	+ +	+++++	OCT 19 23:55 - OCT 20 02:54	PieRie
MSO	Mt. Stromlo Observato	-35.3	149.0					PnnRnn



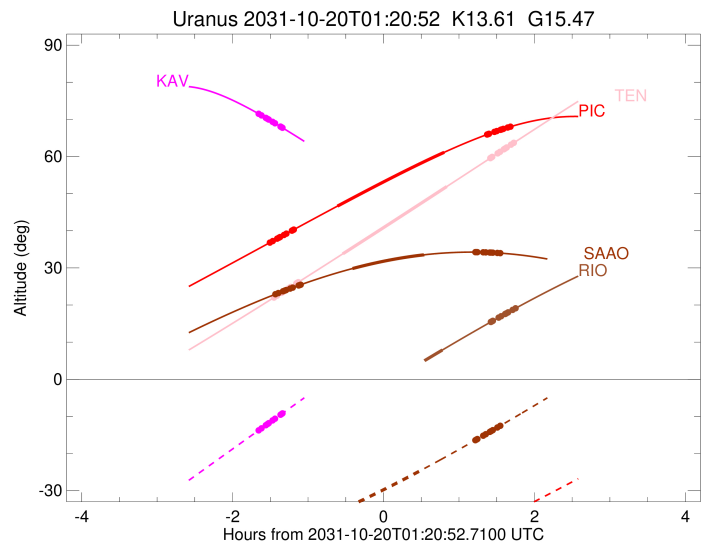
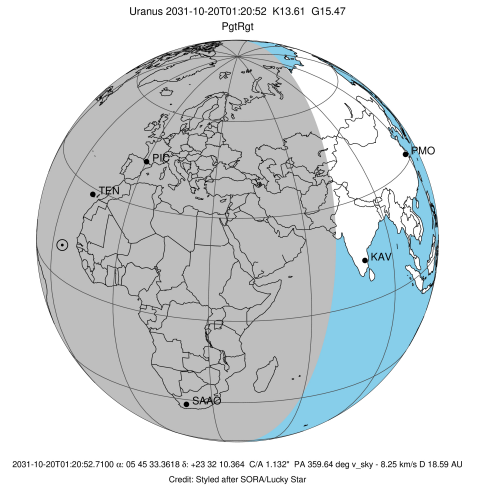
3427632872872654848

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-20T01:26:16.480
 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 : 3427632872872654848
 2Mass ID (if available) : 05453335+2332104
 ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s
 RUWE (>1.4 is poor) : 0.95
 K magnitude : 13.607
 G magnitude : 15.470
 RP magnitude : 14.841
 BP magnitude : 15.920
 DUPflag : 0
 Distance (au) : 18.590
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -8.26
 Sun-Target sep (deg) : 119.33
 Sun-Moon sep (deg) : 166.11
 B (ring opening deg) : 78.04
 PA of pole (deg) : 47.29
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.957
 C/A sky separation (km) : 12902.4
 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



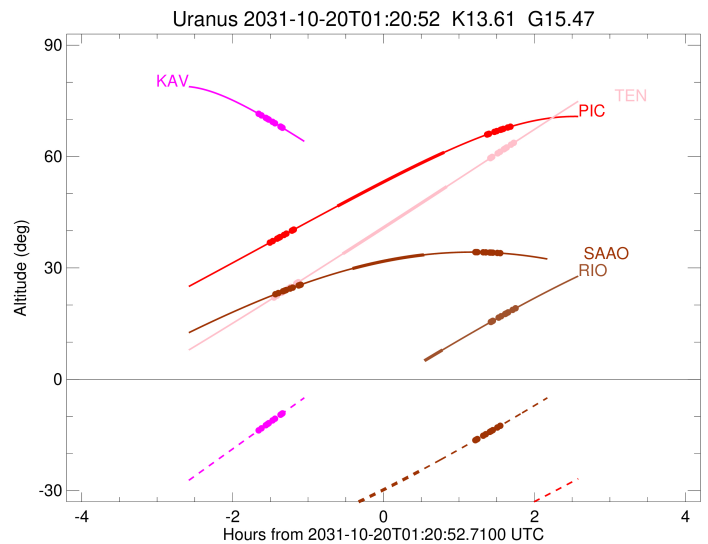
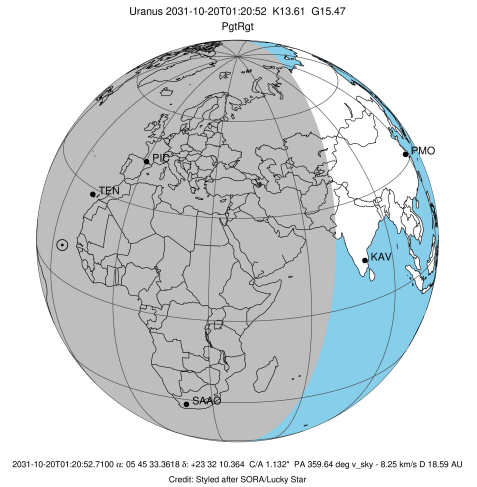
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-19T23:50:53.746		36.88	-57.41	50989.15	-8.22		
lambda	I	2031-10-19T23:52:51.099		37.24	-57.39	50026.71	-8.20		
delta	I	2031-10-19T23:56:21.916		37.89	-57.34	48300.35	-8.18		
gamma	I	2031-10-19T23:57:43.709		38.14	-57.31	47631.53	-8.17		
eta	I	2031-10-19T23:58:39.445		38.31	-57.29	47176.12	-8.17		
beta	I	2031-10-20T00:01:45.959		38.88	-57.22	45654.69	-8.15		
alpha	I	2031-10-20T00:03:44.542		39.24	-57.17	44686.92	-8.14		
4	I	2031-10-20T00:08:02.115		40.03	-57.04	42600.07	-8.11		
5	I	2031-10-20T00:08:36.703		40.14	-57.02	42311.04	-8.10		
6	I	2031-10-20T00:09:35.509		40.32	-56.98	41833.89	-8.09		
Uranus	I	2031-10-20T00:44:13.729		46.64	-54.93	25021.67		-11.70	-12.24
Uranus	E	2031-10-20T02:09:10.888		61.14	-44.71	25510.82		3.43	3.59
6	E	2031-10-20T02:43:11.610		65.93	-39.35	41815.12	8.26		
5	E	2031-10-20T02:43:52.602		66.01	-39.24	42158.24	8.28		
4	E	2031-10-20T02:44:41.933		66.11	-39.10	42567.71	8.29		
alpha	E	2031-10-20T02:49:05.087		66.64	-38.38	44751.67	8.33		
beta	E	2031-10-20T02:50:55.914		66.86	-38.07	45676.84	8.35		
eta	E	2031-10-20T02:53:55.310		67.20	-37.57	47176.12	8.37		
gamma	E	2031-10-20T02:54:48.574		67.30	-37.42	47622.13	8.38		
delta	E	2031-10-20T02:56:09.486		67.45	-37.19	48300.35	8.39		
lambda	E	2031-10-20T02:59:35.005		67.81	-36.62	50026.71	8.41		
epsilon	E	2031-10-20T03:02:26.057		68.10	-36.13	51467.27	8.44		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-20T01:29:27.680
 Event type : PgtRgt
 : Uranus occs: geocentric, 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 : 3427632872872654848
 2Mass ID (if available) : 05453335+2332104
 ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s
 RUWE (>1.4 is poor) : 0.95
 K magnitude : 13.607
 G magnitude : 15.470
 RP magnitude : 14.841
 BP magnitude : 15.920
 DUPflag : 0
 Distance (au) : 18.590
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -8.26
 Sun-Target sep (deg) : 119.33
 Sun-Moon sep (deg) : 165.80
 B (ring opening deg) : 78.04
 PA of pole (deg) : 47.29
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.036
 C/A sky separation (km) : 13973.0
 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_itrfr93_040916.bsp
 earth_720101_070426.bpc
 earth_200101_990628_predict.bpc
 pg3f0000r.bsp
 pg490000r.bsp
 naif0012.tls
 earth_flat_IAU.spk



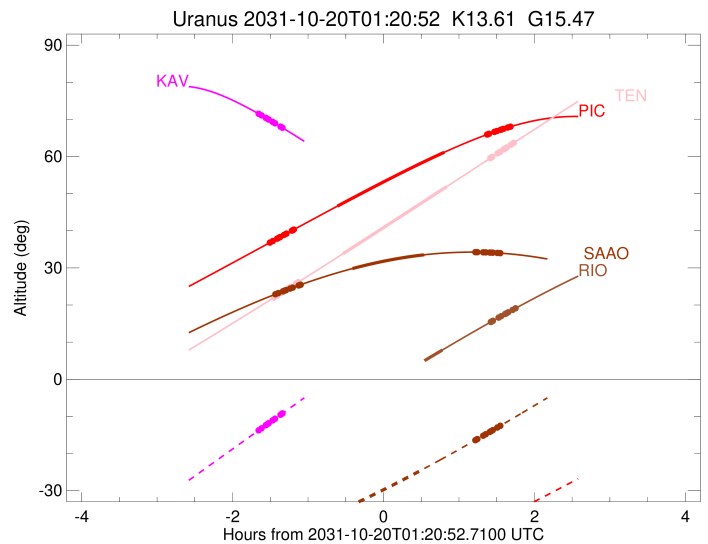
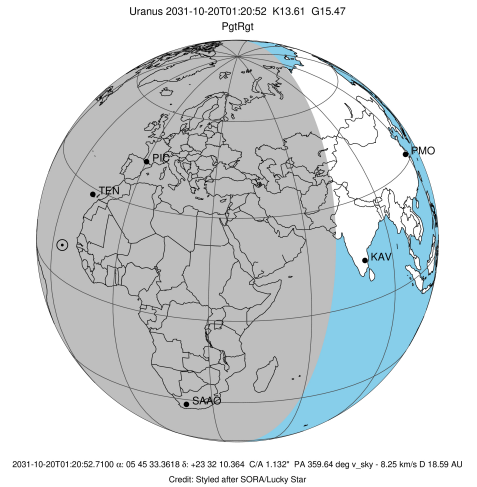
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-10-19T23:54:09.539		22.10	-67.65	50995.35	-8.10		
lambda	I	2031-10-19T23:56:09.380		22.52	-67.93	50026.71	-8.08		
delta	I	2031-10-19T23:59:43.333		23.28	-68.41	48300.35	-8.06		
gamma	I	2031-10-20T00:01:06.359		23.58	-68.59	47631.54	-8.05		
eta	I	2031-10-20T00:02:02.945		23.78	-68.71	47176.12	-8.05		
beta	I	2031-10-20T00:05:12.295		24.45	-69.10	45655.06	-8.03		
alpha	I	2031-10-20T00:07:12.760		24.88	-69.34	44687.17	-8.01		
4	I	2031-10-20T00:11:34.456		25.81	-69.83	42600.81	-7.98		
5	I	2031-10-20T00:12:09.750		25.94	-69.89	42310.47	-7.97		
6	I	2031-10-20T00:13:09.615		26.15	-69.99	41832.96	-7.95		
Uranus	I	2031-10-20T00:48:36.964		33.81	-72.06	25012.73		-11.80	-12.34
Uranus	E	2031-10-20T02:11:10.435		51.91	-64.00	25526.81		2.80	2.94
6	E	2031-10-20T02:45:45.009		59.55	-57.65	41813.94	8.20		
5	E	2031-10-20T02:46:26.564		59.71	-57.52	42159.04	8.21		
4	E	2031-10-20T02:47:16.368		59.89	-57.35	42569.18	8.23		
alpha	E	2031-10-20T02:51:41.015		60.87	-56.49	44751.43	8.28		
beta	E	2031-10-20T02:53:32.556		61.28	-56.12	45677.21	8.30		
eta	E	2031-10-20T02:56:32.820		61.94	-55.52	47176.12	8.33		
gamma	E	2031-10-20T02:57:26.344		62.14	-55.34	47622.23	8.34		
delta	E	2031-10-20T02:58:47.599		62.44	-55.07	48300.35	8.35		
lambda	E	2031-10-20T03:02:13.917		63.20	-54.38	50026.71	8.38		
epsilon	E	2031-10-20T03:05:06.341		63.83	-53.80	51474.12	8.42		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-20T01:13:27.300
 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 : 3427632872872654848
 2Mass ID (if available) : 05453335+2332104
 ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s
 RUWE (>1.4 is poor) : 0.95
 K magnitude : 13.607
 G magnitude : 15.470
 RP magnitude : 14.841
 BP magnitude : 15.920
 DUPflag : 0
 Distance (au) : 18.590
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -8.26
 Sun-Target sep (deg) : 119.33
 Sun-Moon sep (deg) : 167.02
 B (ring opening deg) : 78.04
 PA of pole (deg) : 47.29
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.192
 C/A sky separation (km) : 16069.0
 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_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	2031-10-19T23:41:53.168		71.47	-13.70	51021.84	-8.32		
lambda	I	2031-10-19T23:43:53.199		71.08	-13.21	50026.71	-8.28		
delta	I	2031-10-19T23:47:22.125		70.40	-12.37	48300.35	-8.24		
gamma	I	2031-10-19T23:48:43.318		70.14	-12.04	47631.57	-8.23		
eta	I	2031-10-19T23:49:38.700		69.95	-11.82	47176.12	-8.22		
beta	I	2031-10-19T23:52:44.085		69.34	-11.07	45656.53	-8.18		
alpha	I	2031-10-19T23:54:42.392		68.94	-10.60	44688.25	-8.15		
4	I	2031-10-19T23:58:59.731		68.07	-9.56	42603.46	-8.09		
5	I	2031-10-19T23:59:35.033		67.95	-9.42	42308.03	-8.08		
6	I	2031-10-20T00:00:34.327		67.74	-9.18	41829.56	-8.06		
Uranus	I	2031-10-20T00:36:24.239		60.06	-0.55x	24998.92		-11.96	-12.51
Uranus	E	2031-10-20T01:52:01.374		42.98	17.45x	25543.27		1.96	2.05
6	E	2031-10-20T02:28:12.822		34.67	25.92x	41813.02	7.94		
5	E	2031-10-20T02:28:55.951		34.51	26.09x	42159.72	7.96		
4	E	2031-10-20T02:29:47.455		34.31	26.29x	42570.31	7.97		
alpha	E	2031-10-20T02:34:20.384		33.26	27.34x	44751.25	8.02		
beta	E	2031-10-20T02:36:15.495		32.82	27.78x	45677.46	8.05		
eta	E	2031-10-20T02:39:21.348		32.11	28.50x	47176.12	8.08		
gamma	E	2031-10-20T02:40:16.541		31.90	28.71x	47622.29	8.09		
delta	E	2031-10-20T02:41:40.303		31.58	29.03x	48300.35	8.10		
lambda	E	2031-10-20T02:45:12.989		30.76	29.85x	50026.71	8.13		
epsilon	E	2031-10-20T02:48:11.164		30.08	30.53x	51477.66	8.17		

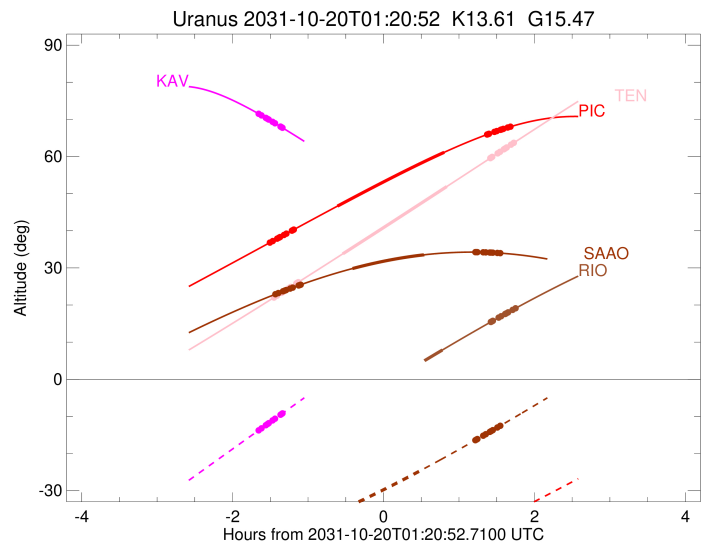
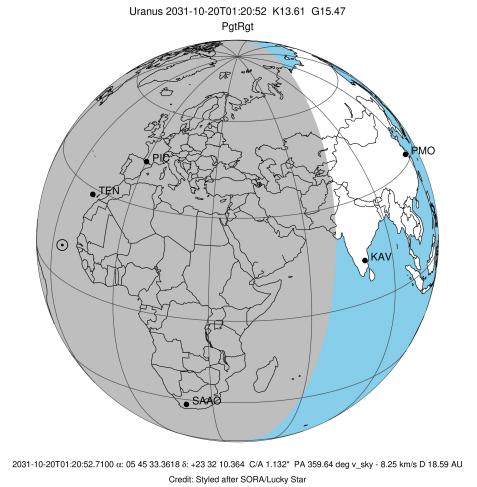
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-10-20T01:31:47.910
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : RIO
 Location : Rio de Janeiro
 Latitude (deg) : -22.89506
 E. Longitude (deg) : 316.77708
 Altitude (km) : 0.033
 Gaia source ID : 3427632872872654848
 2Mass ID (if available) : 05453335+2332104
 ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s
 RUWE (>1.4 is poor) : 0.95
 K magnitude : 13.607
 G magnitude : 15.470
 RP magnitude : 14.841
 BP magnitude : 15.920
 DUPflag : 0
 Distance (au) : 18.590
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -8.26
 Sun-Target sep (deg) : 119.33
 Sun-Moon sep (deg) : 165.34
 B (ring opening deg) : 78.04
 PA of pole (deg) : 47.29
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.341
 C/A sky separation (km) : 18081.4
 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	2031-10-19T23:57:22.334		-19.71x	-38.74	51026.80	-7.71		
lambda	I	2031-10-19T23:59:32.614		-19.24x	-39.15	50026.71	-7.67		
delta	I	2031-10-20T00:03:18.298		-18.41x	-39.85	48300.35	-7.63		
gamma	I	2031-10-20T00:04:46.021		-18.09x	-40.11	47631.58	-7.62		
eta	I	2031-10-20T00:05:45.867		-17.87x	-40.30	47176.12	-7.61		
beta	I	2031-10-20T00:09:06.204		-17.14x	-40.91	45656.89	-7.57		
alpha	I	2031-10-20T00:11:14.149		-16.68x	-41.29	44688.56	-7.54		
4	I	2031-10-20T00:15:52.592		-15.66x	-42.12	42604.16	-7.47		
5	I	2031-10-20T00:16:30.988		-15.52x	-42.23	42307.25	-7.46		
6	I	2031-10-20T00:17:35.280		-15.29x	-42.42	41828.57	-7.44		
Uranus	I	2031-10-20T00:57:08.753		-6.76x	-48.85	24999.75		-11.95	-12.50
Uranus	E	2031-10-20T02:07:44.085		7.89	-56.21	25558.61		0.31	0.32
6	E	2031-10-20T02:46:09.430		15.42	-56.95	41810.05	7.72		
5	E	2031-10-20T02:46:54.555		15.57	-56.94	42162.40	7.74		
4	E	2031-10-20T02:47:47.691		15.73	-56.92	42574.23	7.76		
alpha	E	2031-10-20T02:52:26.634		16.61	-56.82	44750.39	7.85		
beta	E	2031-10-20T02:54:24.460		16.98	-56.76	45678.37	7.89		
eta	E	2031-10-20T02:57:33.762		17.58	-56.66	47176.12	7.94		
gamma	E	2031-10-20T02:58:29.956		17.75	-56.62	47622.58	7.95		
delta	E	2031-10-20T02:59:55.068		18.02	-56.57	48300.35	7.97		
lambda	E	2031-10-20T03:03:30.860		18.68	-56.41	50026.71	8.03		
epsilon	E	2031-10-20T03:06:33.357		19.25	-56.26	51495.03	8.08		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-10-20T01:23:49.740
Event type           : PgtRgt
: Uranus occs: geocentric, 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       : 3427632872872654848
2Mass ID (if available) : 05453335+2332104
ICRS Star Coord at Epoch: 05h 45m 33.36178s +23:32:10.36371s
RUWE (>1.4 is poor) : 0.95
K magnitude          : 13.607
G magnitude          : 15.470
RP magnitude         : 14.841
BP magnitude         : 15.920
DUPflag             : 0
Distance (au)        : 18.590
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -8.26
Sun-Target sep (deg) : 119.33
Sun-Moon sep (deg)   : 166.00
B (ring opening deg) : 78.04
PA of pole (deg)     : 47.29
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 1.524
C/A sky separation (km) : 20550.9
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
ural11.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.ural11.bsp
ural161.bsp
vgr2.ural161.bsp
peph.ural160.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	2031-10-19T23:55:09.707		22.94	-42.08	51051.96	-7.90		
lambda	I	2031-10-19T23:57:20.110		23.23	-41.84	50026.71	-7.85		
delta	I	2031-10-20T00:01:00.870		23.71	-41.41	48300.35	-7.79		
gamma	I	2031-10-20T00:02:26.828		23.90	-41.25	47631.57	-7.77		
eta	I	2031-10-20T00:03:25.518		24.02	-41.13	47176.12	-7.75		
beta	I	2031-10-20T00:06:42.125		24.44	-40.74	45658.32	-7.69		
alpha	I	2031-10-20T00:08:48.105		24.70	-40.48	44689.82	-7.65		
4	I	2031-10-20T00:13:22.918		25.27	-39.90	42606.50	-7.55		
5	I	2031-10-20T00:14:01.523		25.34	-39.82	42304.27	-7.53		
6	I	2031-10-20T00:15:05.398		25.47	-39.68	41825.28	-7.50		
Uranus	I	2031-10-20T00:56:11.116		29.82	-33.79	25023.84		-11.67	-12.21
Uranus	E	2031-10-20T01:53:09.137		33.53	-24.08	25552.39		-1.27	-1.33
6	E	2031-10-20T02:33:48.922		34.24	-16.43	41808.41	7.60		
5	E	2031-10-20T02:34:35.242		34.24	-16.28	42164.21	7.63		
4	E	2031-10-20T02:35:29.249		34.24	-16.11	42576.48	7.65		
alpha	E	2031-10-20T02:40:11.375		34.20	-15.19	44749.83	7.76		
beta	E	2031-10-20T02:42:10.610		34.18	-14.80	45678.81	7.81		
eta	E	2031-10-20T02:45:21.633		34.14	-14.18	47176.12	7.87		
gamma	E	2031-10-20T02:46:18.321		34.12	-14.00	47622.75	7.89		
delta	E	2031-10-20T02:47:44.087		34.10	-13.71	48300.35	7.91		
lambda	E	2031-10-20T02:51:21.379		34.03	-13.00	50026.71	7.98		
epsilon	E	2031-10-20T02:54:25.868		33.96	-12.39	51502.45	8.04		