

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-13T12:09:08.090
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3427644112804524160
 2Mass ID (if available) : 05452341+2331304

Uranus 2031-09-13T12:09:08 K13.98 G17.34 PgtRgt

ICRS Star Coord at Epoch: 05h 45m 23.43260s +23:31:30.21568s

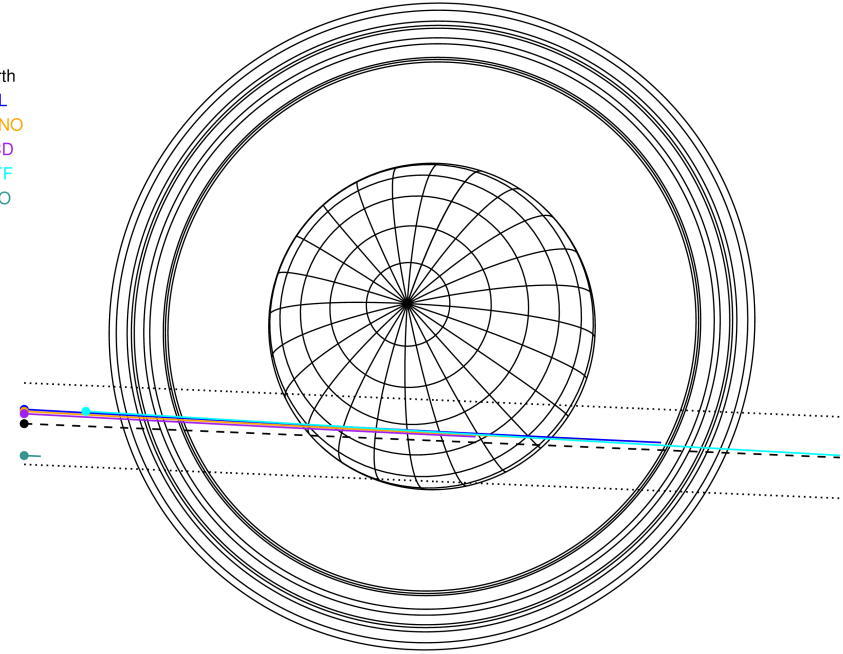
RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.984
 G magnitude : 17.337
 RP magnitude : 16.352
 BP magnitude : 18.384
 DUPflag : 0
 Distance (au) : 19.193
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 9.76
 Sun-Target sep (deg) : 83.43
 Sun-Moon sep (deg) : 46.45
 B (ring opening deg) : 78.07
 PA of pole (deg) : 47.19

#	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



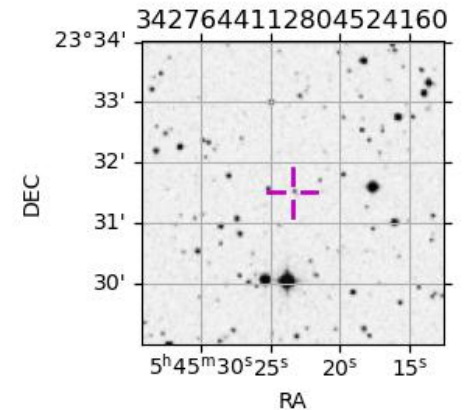
2031-09-13T12:09:08.0900 ra: 05 45 23.4326 s: +23 31 30.216 C/A 1.279° PA 357.62 deg v_sky + 9.76 km/s D 19.19 AU
 Credit: Styled after SORA/Lucky Star

Earth
 PAL
 KPNO
 MCD
 IRTF
 ESO



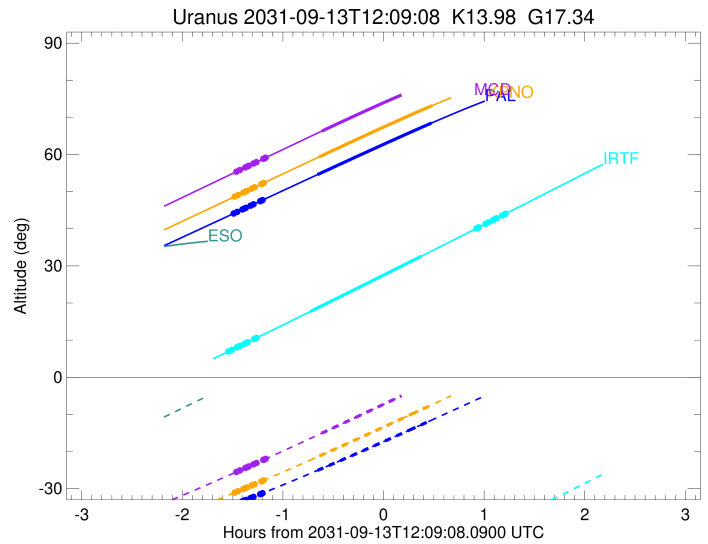
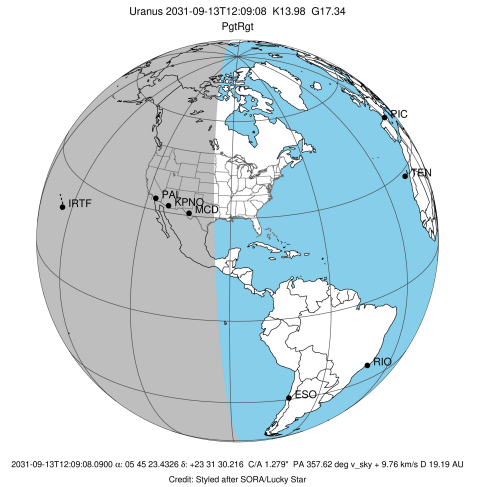
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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	+++++	+ +		SEP 13 10:39 - SEP 13 12:37	PieRin
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +		SEP 13 10:39 - SEP 13 12:38	PieRin
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+		SEP 13 10:40 - SEP 13 11:32	PinRin
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	SEP 13 10:35 - SEP 13 13:21	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					PnnRnn
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



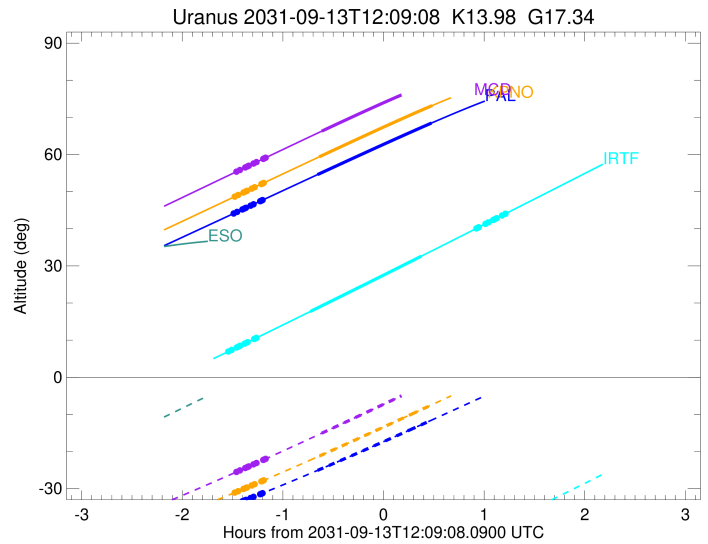
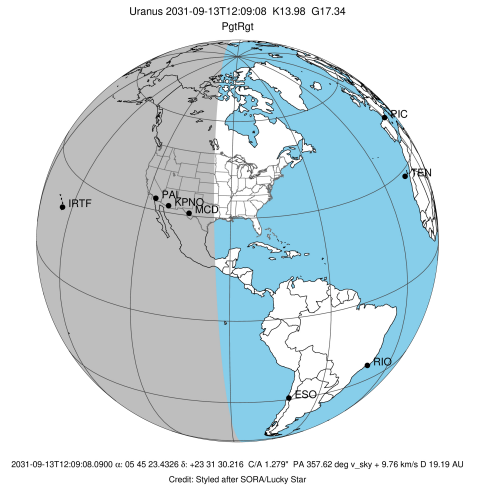
3427644112804524160

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-13T12:04:21.660
 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 : 3427644112804524160
 2Mass ID (if available) : 05452341+2331304
 ICRS Star Coord at Epoch: 05h 45m 23.43260s +23:31:30.21568s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.984
 G magnitude : 17.337
 RP magnitude : 16.352
 BP magnitude : 18.384
 DUPflag : 0
 Distance (au) : 19.193
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 9.76
 Sun-Target sep (deg) : 83.43
 Sun-Moon sep (deg) : 47.30
 B (ring opening deg) : 78.07
 PA of pole (deg) : 47.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.178
 C/A sky separation (km) : 16393.4
 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



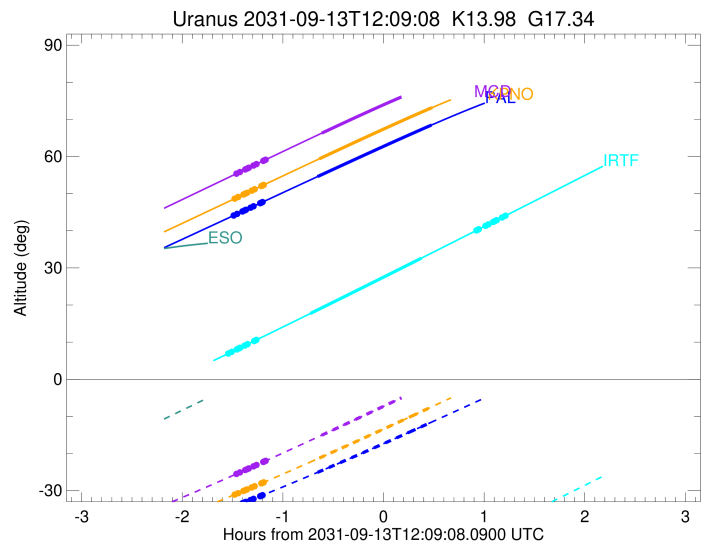
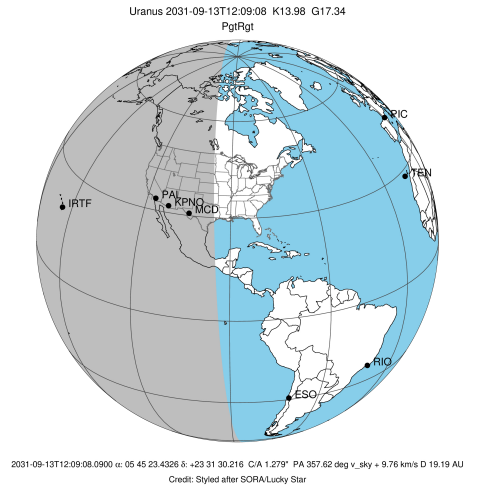
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-09-13T10:39:06.510		43.97	-34.44	51544.97	-9.16		
lambda	I	2031-09-13T10:41:52.506		44.55	-33.96	50026.71	-9.13		
delta	I	2031-09-13T10:45:02.118		45.22	-33.40	48300.35	-9.08		
gamma	I	2031-09-13T10:46:16.279		45.47	-33.18	47627.58	-9.06		
eta	I	2031-09-13T10:47:06.136		45.65	-33.03	47176.12	-9.05		
beta	I	2031-09-13T10:49:52.270		46.23	-32.53	45677.09	-9.00		
alpha	I	2031-09-13T10:51:39.166		46.60	-32.21	44716.14	-8.97		
4	I	2031-09-13T10:55:34.533		47.43	-31.50	42616.51	-8.89		
5	I	2031-09-13T10:56:12.734		47.56	-31.38	42270.99	-8.88		
6	I	2031-09-13T10:57:05.622		47.75	-31.22	41806.99	-8.86		
Uranus	I	2031-09-13T11:29:48.791		54.60	-25.08	25540.70		2.11	2.21
Uranus	E	2031-09-13T12:37:48.179		68.49	-11.55	24998.49		-11.92	-12.47
6	E	2031-09-13T13:11:06.736		74.67	-4.69x	41879.72	8.70		
5	E	2031-09-13T13:11:51.967		74.80	-4.53x	42261.55	8.72		
4	E	2031-09-13T13:12:22.908		74.89	-4.42x	42538.07	8.73		
alpha	E	2031-09-13T13:16:29.359		75.57	-3.57x	44696.96	8.80		
beta	E	2031-09-13T13:18:16.611		75.86	-3.20x	45641.13	8.83		
eta	E	2031-09-13T13:21:10.223		76.32	-2.60x	47176.12	8.87		
gamma	E	2031-09-13T13:22:01.230		76.45	-2.42x	47628.61	8.88		
delta	E	2031-09-13T13:23:16.832		76.64	-2.16x	48300.35	8.89		
lambda	E	2031-09-13T13:26:30.536		77.12	-1.49x	50026.71	8.93		
epsilon	E	2031-09-13T13:27:54.842		77.33	-1.19x	50780.31	8.96		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-13T12:05:04.790
 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 : 3427644112804524160
 2Mass ID (if available) : 05452341+2331304
 ICRS Star Coord at Epoch: 05h 45m 23.43260s +23:31:30.21568s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.984
 G magnitude : 17.337
 RP magnitude : 16.352
 BP magnitude : 18.384
 DUPflag : 0
 Distance (au) : 19.193
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 9.76
 Sun-Target sep (deg) : 83.43
 Sun-Moon sep (deg) : 47.28
 B (ring opening deg) : 78.07
 PA of pole (deg) : 47.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.196
 C/A sky separation (km) : 16651.9
 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



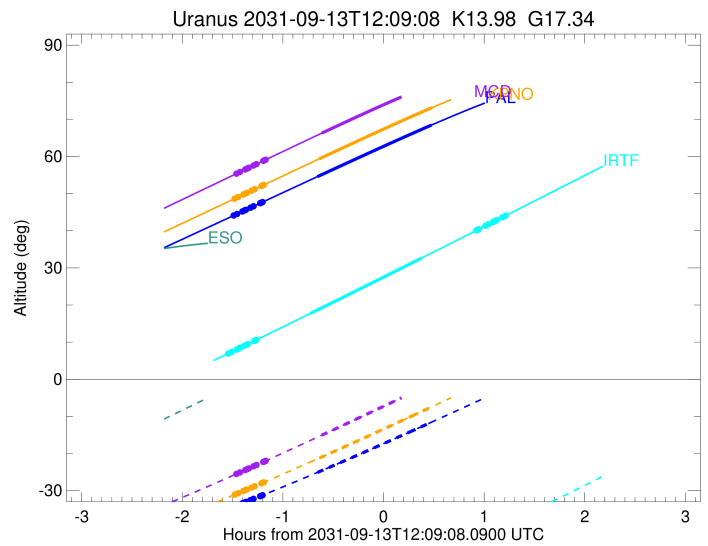
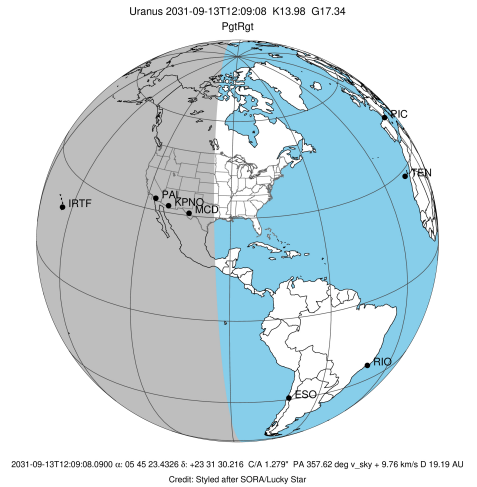
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-09-13T10:39:42.514		48.51	-31.20	51544.39	-9.11		
lambda	I	2031-09-13T10:42:29.347		49.10	-30.68	50026.71	-9.08		
delta	I	2031-09-13T10:45:40.010		49.78	-30.08	48300.35	-9.03		
gamma	I	2031-09-13T10:46:54.586		50.05	-29.84	47627.62	-9.01		
eta	I	2031-09-13T10:47:44.730		50.22	-29.68	47176.12	-9.00		
beta	I	2031-09-13T10:50:31.836		50.82	-29.15	45677.00	-8.95		
alpha	I	2031-09-13T10:52:19.382		51.20	-28.81	44715.90	-8.91		
4	I	2031-09-13T10:56:16.160		52.04	-28.05	42616.50	-8.84		
5	I	2031-09-13T10:56:54.545		52.18	-27.93	42271.54	-8.83		
6	I	2031-09-13T10:57:47.792		52.36	-27.75	41807.22	-8.80		
Uranus	I	2031-09-13T11:30:48.944		59.38	-21.24	25543.48		1.94	2.03
Uranus	E	2031-09-13T12:38:11.759		73.20	-7.36	24998.82		-11.92	-12.47
6	E	2031-09-13T13:11:45.754		79.04	-0.28x	41879.71	8.66		
5	E	2031-09-13T13:12:31.238		79.15	-0.12x	42261.96	8.68		
4	E	2031-09-13T13:13:02.294		79.23	-0.01x	42538.24	8.69		
alpha	E	2031-09-13T13:17:09.748		79.79	0.86x	44696.83	8.76		
beta	E	2031-09-13T13:18:57.442		80.02	1.24x	45641.14	8.79		
eta	E	2031-09-13T13:21:51.708		80.36	1.86x	47176.12	8.83		
gamma	E	2031-09-13T13:22:42.902		80.46	2.04x	47628.63	8.85		
delta	E	2031-09-13T13:23:58.771		80.60	2.31x	48300.35	8.86		
lambda	E	2031-09-13T13:27:13.132		80.92	3.00x	50026.71	8.90		
epsilon	E	2031-09-13T13:28:37.790		81.04	3.30x	50781.01	8.93		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-13T12:06:15.900
 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 : 3427644112804524160
 2Mass ID (if available) : 05452341+2331304
 ICRS Star Coord at Epoch: 05h 45m 23.43260s +23:31:30.21568s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.984
 G magnitude : 17.337
 RP magnitude : 16.352
 BP magnitude : 18.384
 DUPflag : 0
 Distance (au) : 19.193
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 9.76
 Sun-Target sep (deg) : 83.43
 Sun-Moon sep (deg) : 47.24
 B (ring opening deg) : 78.07
 PA of pole (deg) : 47.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.216
 C/A sky separation (km) : 16923.9
 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	2031-09-13T10:40:43.712		55.23	-25.65	51543.69	-9.05		
lambda	I	2031-09-13T10:43:31.565		55.84	-25.08	50026.71	-9.02		
delta	I	2031-09-13T10:46:43.504		56.53	-24.44	48300.35	-8.97		
gamma	I	2031-09-13T10:47:58.581		56.80	-24.19	47627.66	-8.95		
eta	I	2031-09-13T10:48:49.072		56.98	-24.02	47176.12	-8.94		
beta	I	2031-09-13T10:51:37.345		57.58	-23.45	45676.90	-8.89		
alpha	I	2031-09-13T10:53:25.669		57.97	-23.09	44715.62	-8.85		
4	I	2031-09-13T10:57:24.126		58.83	-22.28	42616.47	-8.77		
5	I	2031-09-13T10:58:02.731		58.97	-22.15	42272.17	-8.76		
6	I	2031-09-13T10:58:56.402		59.16	-21.96	41807.49	-8.74		
Uranus	I	2031-09-13T11:32:18.201		66.30	-15.07	25546.31		1.75	1.84
Uranus	E	2031-09-13T12:39:01.486		79.53	-0.90x	24999.33		-11.91	-12.46
6	E	2031-09-13T13:12:51.759		83.03	6.37x	41879.70	8.63		
5	E	2031-09-13T13:13:37.489		83.03	6.54x	42262.34	8.65		
4	E	2031-09-13T13:14:08.660		83.03	6.65x	42538.39	8.65		
alpha	E	2031-09-13T13:18:17.090		82.97	7.54x	44696.71	8.73		
beta	E	2031-09-13T13:20:05.206		82.90	7.93x	45641.15	8.76		
eta	E	2031-09-13T13:23:00.090		82.75	8.56x	47176.12	8.80		
gamma	E	2031-09-13T13:23:51.460		82.70	8.74x	47628.65	8.82		
delta	E	2031-09-13T13:25:07.576		82.61	9.02x	48300.35	8.83		
lambda	E	2031-09-13T13:28:22.542		82.33	9.71x	50026.71	8.88		
epsilon	E	2031-09-13T13:29:47.517		82.20	10.02x	50781.62	8.90		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2031-09-13T11:59:04.370
 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 : 3427644112804524160
 2Mass ID (if available) : 05452341+2331304
 ICRS Star Coord at Epoch: 05h 45m 23.43260s +23:31:30.21568s
 RUWE (>1.4 is poor) : 0.97
 K magnitude : 13.984
 G magnitude : 17.337
 RP magnitude : 16.352
 BP magnitude : 18.384
 DUPflag : 0
 Distance (au) : 19.193
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 9.76
 Sun-Target sep (deg) : 83.43
 Sun-Moon sep (deg) : 47.30
 B (ring opening deg) : 78.07
 PA of pole (deg) : 47.19
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 1.184
 C/A sky separation (km) : 16479.9
 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	2031-09-13T10:35:54.920		6.79	-66.10	51545.36	-9.40		
lambda	I	2031-09-13T10:38:36.661		7.38	-65.97	50026.71	-9.37		
delta	I	2031-09-13T10:41:41.400		8.05	-65.80	48300.35	-9.32		
gamma	I	2031-09-13T10:42:53.668		8.31	-65.73	47627.56	-9.30		
eta	I	2031-09-13T10:43:42.251		8.49	-65.68	47176.12	-9.29		
beta	I	2031-09-13T10:46:24.165		9.08	-65.50	45677.14	-9.23		
alpha	I	2031-09-13T10:48:08.356		9.46	-65.37	44716.29	-9.20		
4	I	2031-09-13T10:51:57.855		10.30	-65.07	42616.52	-9.12		
5	I	2031-09-13T10:52:35.137		10.44	-65.02	42270.69	-9.11		
6	I	2031-09-13T10:53:26.702		10.63	-64.95	41806.87	-9.09		
Uranus	I	2031-09-13T11:25:25.014		17.70	-61.26	25540.13		2.14	2.24
Uranus	E	2031-09-13T12:31:44.585		32.62	-49.61	24998.84		-11.92	-12.47
6	E	2031-09-13T13:04:34.957		40.10	-42.82	41879.70	8.82		
5	E	2031-09-13T13:05:19.694		40.27	-42.66	42262.40	8.84		
4	E	2031-09-13T13:05:50.187		40.39	-42.55	42538.42	8.85		
alpha	E	2031-09-13T13:09:53.393		41.31	-41.68	44696.67	8.91		
beta	E	2031-09-13T13:11:39.336		41.72	-41.30	45641.15	8.94		
eta	E	2031-09-13T13:14:30.805		42.37	-40.69	47176.12	8.98		
gamma	E	2031-09-13T13:15:21.197		42.56	-40.51	47628.67	8.99		
delta	E	2031-09-13T13:16:35.884		42.85	-40.24	48300.35	9.00		
lambda	E	2031-09-13T13:19:47.301		43.58	-39.55	50026.71	9.04		
epsilon	E	2031-09-13T13:21:10.842		43.89	-39.24	50782.21	9.06		