

target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-21T07:44:27.840  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3415723757491506688  
 2Mass ID (if available) : 05114691+2304234

Uranus 2031-01-21T07:44:27 K13.31 G16.22 PgtRgt

ICRS Star Coord at Epoch: 05h 11m 46.91636s +23:04:23.50038s

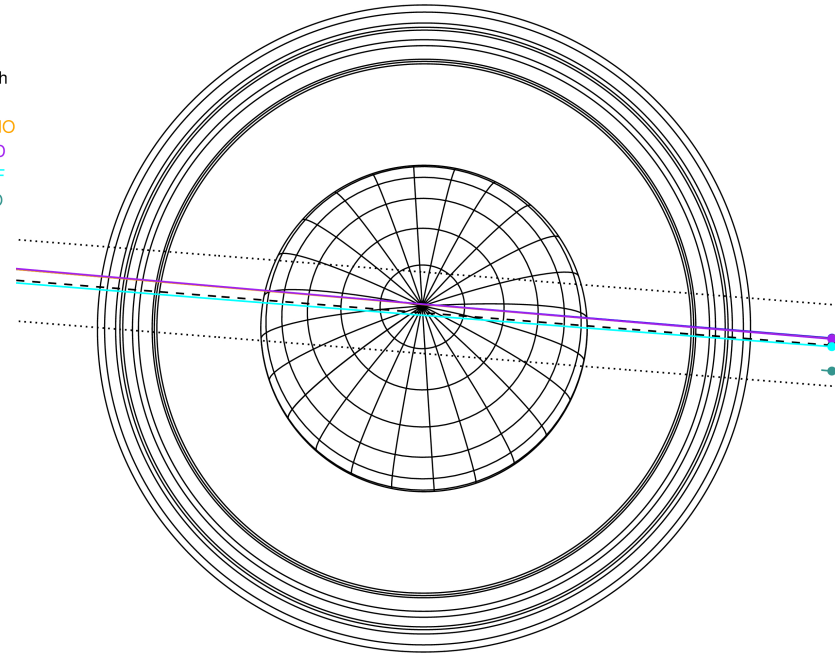
RUWE (>1.4 is poor) : 1.09  
 K magnitude : 13.313  
 G magnitude : 16.219  
 RP magnitude : 15.351  
 BP magnitude : 16.993  
 DUPflag : 0  
 Distance (au) : 18.402  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.92  
 Sun-Target sep (deg) : 138.30  
 Sun-Moon sep (deg) : 164.24  
 B (ring opening deg) : 82.08  
 PA of pole (deg) : 4.45

Uranus 2031-01-21T07:44:27 K13.31 G16.22  
 PgtRgt



2031-01-21T07:44:27.8400 ex: 05 11 46.9164 s: +23 04 23.500 C/A 0.189° PA 175.44 deg v\_sky -15.92 km/s D 18.40 AU  
 Credit: Styled after SORA/Lucky Star

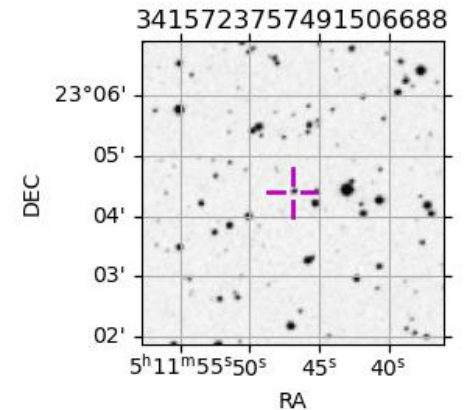
Earth  
 PAL  
 KPNO  
 MCD  
 IRTF  
 ESO



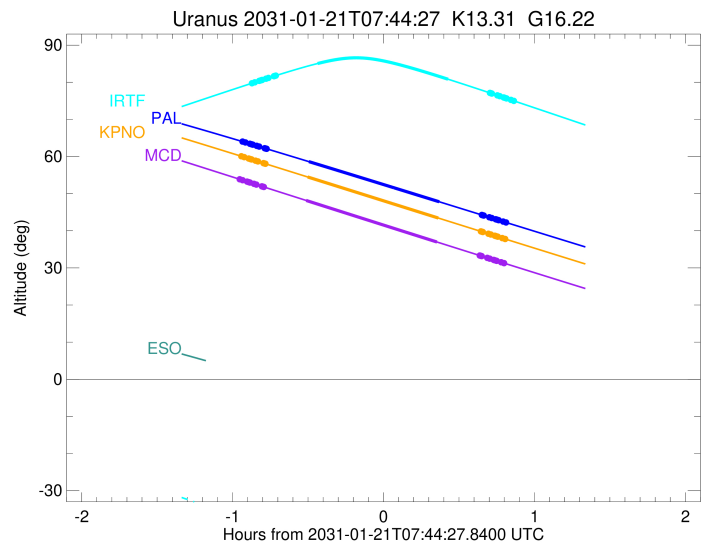
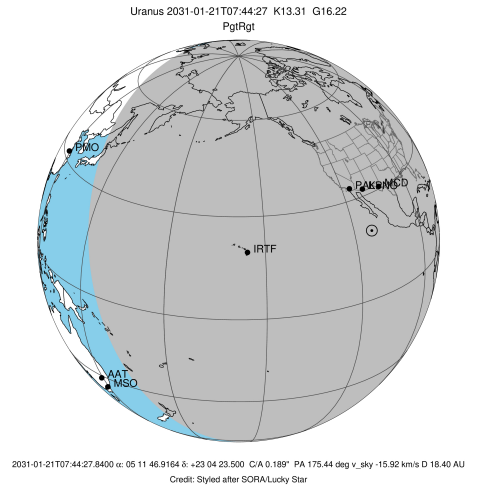
#	a(km)	ring
1	41837.2	6
2	42235.0	5
3	42571.2	4
4	44718.5	alpha
5	45661.1	beta
6	47176.1	eta
7	47626.3	gamma
8	48300.3	delta
9	50026.7	lambda
10	51149.4	epsilon

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					PnnRnn
PAL	Palomar Mt (200")	33.4	243.1	+++++	+ +	+++++	JAN 21 06:48 - JAN 21 08:33	PieRie
PMO	Purple Mtn Obs. Nanki	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl Obs	32.0	248.4	+++++	+ +	+++++	JAN 21 06:48 - JAN 21 08:33	PieRie
MCD	McDonald Obs. 2.7m	30.7	256.0	+++++	+ +	+++++	JAN 21 06:47 - JAN 21 08:32	PieRie
TEN	Teide Obs./Tenerife	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+++++	+ +	+++++	JAN 21 06:52 - JAN 21 08:36	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



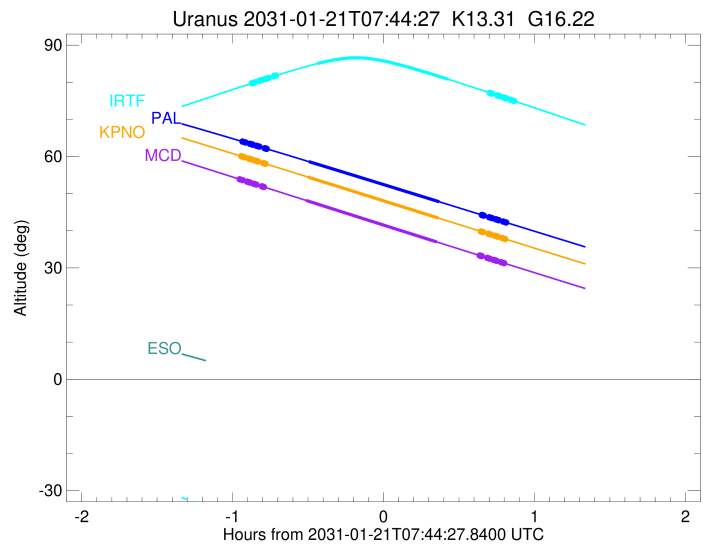
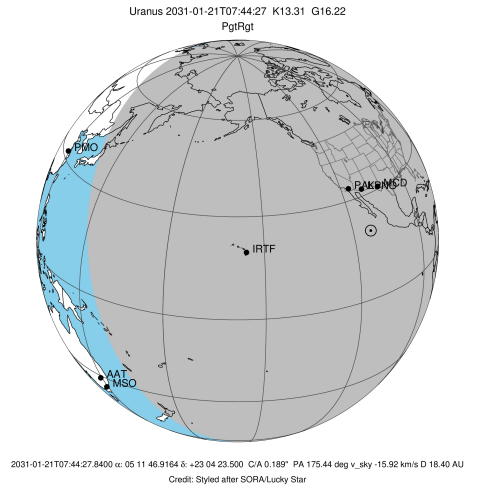
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-21T07:40:42.600  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 3415723757491506688  
 2Mass ID (if available) : 05114691+2304234  
 ICRS Star Coord at Epoch: 05h 11m 46.91636s +23:04:23.50038s  
 RUWE (>1.4 is poor) : 1.09  
 K magnitude : 13.313  
 G magnitude : 16.219  
 RP magnitude : 15.351  
 BP magnitude : 16.993  
 DUPflag : 0  
 Distance (au) : 18.402  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.92  
 Sun-Target sep (deg) : 138.30  
 Sun-Moon sep (deg) : 163.95  
 B (ring opening deg) : 82.08  
 PA of pole (deg) : 4.45  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.284  
 C/A sky separation (km) : 3787.7  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2031-01-21T06:48:45.920		63.96	-69.57	50834.16	-16.24		
lambda	I	2031-01-21T06:49:35.640		63.79	-69.71	50026.71	-16.24		
delta	I	2031-01-21T06:51:21.970		63.43	-70.01	48300.35	-16.23		
gamma	I	2031-01-21T06:52:03.756		63.29	-70.12	47622.08	-16.23		
eta	I	2031-01-21T06:52:31.233		63.20	-70.20	47176.12	-16.23		
beta	I	2031-01-21T06:54:03.646		62.88	-70.45	45676.57	-16.22		
alpha	I	2031-01-21T06:55:01.440		62.69	-70.61	44739.08	-16.22		
4	I	2031-01-21T06:57:13.635		62.24	-70.96	42595.47	-16.21		
5	I	2031-01-21T06:57:30.964		62.18	-71.01	42314.33	-16.21		
6	I	2031-01-21T06:57:58.454		62.09	-71.08	41868.65	-16.21		
Uranus	I	2031-01-21T07:14:46.576		58.63	-73.54	25558.90		-0.10	-0.10
Uranus	E	2031-01-21T08:06:38.394		47.81	-76.61	25503.35		2.42	2.53
6	E	2031-01-21T08:23:30.597		44.27	-75.62	41811.68	16.10		
5	E	2031-01-21T08:23:51.919		44.20	-75.59	42154.87	16.10		
4	E	2031-01-21T08:24:15.794		44.11	-75.56	42540.36	16.10		
alpha	E	2031-01-21T08:26:29.546		43.64	-75.35	44693.55	16.10		
beta	E	2031-01-21T08:27:28.835		43.44	-75.26	45648.14	16.10		
eta	E	2031-01-21T08:29:03.713		43.11	-75.10	47176.12	16.10		
gamma	E	2031-01-21T08:29:31.888		43.01	-75.05	47629.87	16.10		
delta	E	2031-01-21T08:30:13.520		42.86	-74.98	48300.35	16.11		
lambda	E	2031-01-21T08:32:00.708		42.49	-74.79	50026.71	16.11		
epsilon	E	2031-01-21T08:33:27.122		42.19	-74.63	51418.57	16.10		

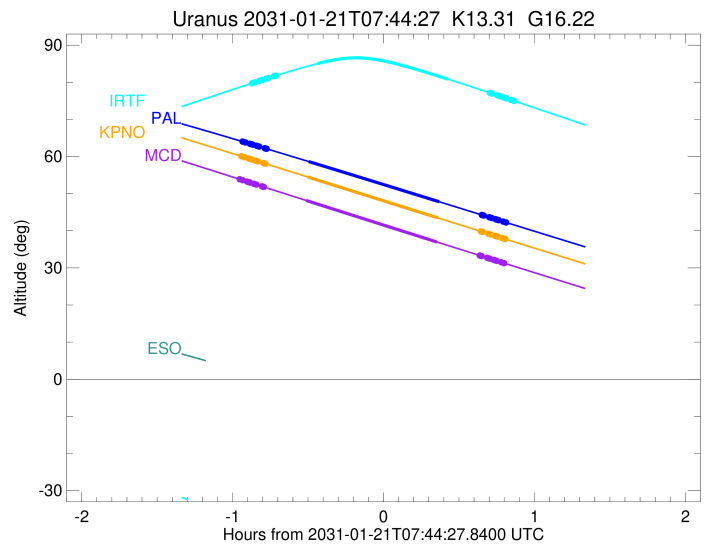
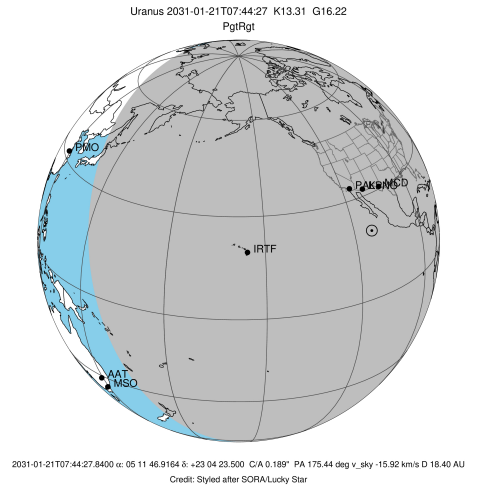
```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-01-21T07:40:16.750
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      : 3415723757491506688
2Mass ID (if available) : 05114691+2304234
ICRS Star Coord at Epoch: 05h 11m 46.91636s +23:04:23.50038s
RUWE (>1.4 is poor) : 1.09
K magnitude          : 13.313
G magnitude          : 16.219
RP magnitude         : 15.351
BP magnitude         : 16.993
DUPflag             : 0
Distance (au)       : 18.402
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : -15.92
Sun-Target sep (deg) : 138.30
Sun-Moon sep (deg)  : 163.87
B (ring opening deg) : 82.08
PA of pole (deg)    : 4.45
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.280
C/A sky separation (km) : 3742.3
NAIF SPICE kernels  : RAJobs_U111+rgf15.spk
URKALLvl.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.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	2031-01-21T06:48:16.999		60.01	-73.79	50834.60	-16.23		
lambda	I	2031-01-21T06:49:06.777		59.83	-73.91	50026.71	-16.23		
delta	I	2031-01-21T06:50:53.173		59.46	-74.18	48300.35	-16.22		
gamma	I	2031-01-21T06:51:34.985		59.31	-74.28	47622.08	-16.22		
eta	I	2031-01-21T06:52:02.481		59.21	-74.35	47176.12	-16.22		
beta	I	2031-01-21T06:53:34.954		58.89	-74.57	45676.54	-16.21		
alpha	I	2031-01-21T06:54:32.781		58.68	-74.71	44739.13	-16.21		
4	I	2031-01-21T06:56:45.061		58.22	-75.02	42595.54	-16.20		
5	I	2031-01-21T06:57:02.404		58.16	-75.06	42314.35	-16.20		
6	I	2031-01-21T06:57:29.917		58.06	-75.12	41868.59	-16.20		
Uranus	I	2031-01-21T07:14:18.717		54.49	-77.04	25558.86		-0.12	-0.13
Uranus	E	2031-01-21T08:06:14.933		43.43	-76.49	25503.69		2.41	2.53
6	E	2031-01-21T08:23:08.388		39.84	-74.33	41811.67	16.08		
5	E	2031-01-21T08:23:29.741		39.77	-74.28	42154.87	16.08		
4	E	2031-01-21T08:23:53.650		39.68	-74.22	42540.37	16.08		
alpha	E	2031-01-21T08:26:07.589		39.21	-73.89	44693.55	16.08		
beta	E	2031-01-21T08:27:06.962		39.00	-73.74	45648.14	16.08		
eta	E	2031-01-21T08:28:41.976		38.66	-73.49	47176.12	16.08		
gamma	E	2031-01-21T08:29:10.192		38.56	-73.42	47629.87	16.08		
delta	E	2031-01-21T08:29:51.884		38.42	-73.31	48300.35	16.08		
lambda	E	2031-01-21T08:31:39.229		38.04	-73.03	50026.71	16.08		
epsilon	E	2031-01-21T08:33:05.774		37.73	-72.79	51418.61	16.08		

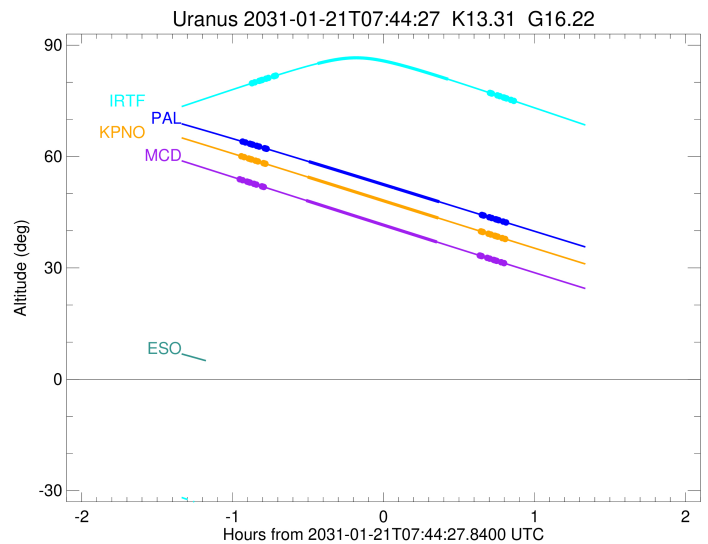
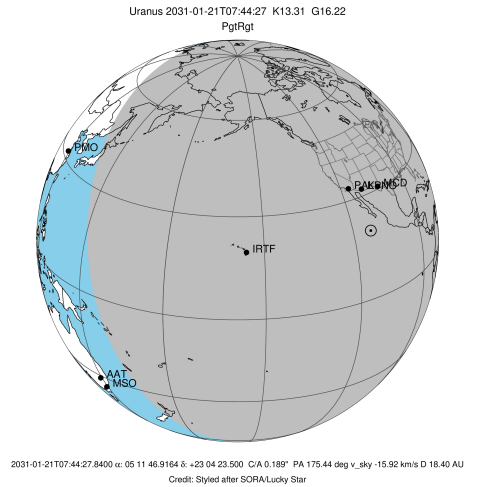
target : Uranus  
 target radius (km) : 25559.00  
 C/A epoch : 2031-01-21T07:39:43.650  
 Event type : PgtRgt  
 : Uranus occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 3415723757491506688  
 2Mass ID (if available) : 05114691+2304234  
 ICRS Star Coord at Epoch: 05h 11m 46.91636s +23:04:23.50038s  
 RUWE (>1.4 is poor) : 1.09  
 K magnitude : 13.313  
 G magnitude : 16.219  
 RP magnitude : 15.351  
 BP magnitude : 16.993  
 DUPflag : 0  
 Distance (au) : 18.402  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -15.92  
 Sun-Target sep (deg) : 138.30  
 Sun-Moon sep (deg) : 163.77  
 B (ring opening deg) : 82.08  
 PA of pole (deg) : 4.45  
 Pole direction: RA (deg): 257.31100  
 Dec (deg): -15.17500  
 C/A sky separation (") : 0.283  
 C/A sky separation (km) : 3781.5  
 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	2031-01-21T06:47:38.410		53.80	-78.54	50834.70	-16.20		
lambda	I	2031-01-21T06:48:28.272		53.62	-78.61	50026.71	-16.20		
delta	I	2031-01-21T06:50:14.836		53.24	-78.75	48300.35	-16.20		
gamma	I	2031-01-21T06:50:56.716		53.09	-78.80	47622.08	-16.19		
eta	I	2031-01-21T06:51:24.255		52.99	-78.83	47176.12	-16.19		
beta	I	2031-01-21T06:52:56.879		52.66	-78.94	45676.54	-16.19		
alpha	I	2031-01-21T06:53:54.801		52.45	-79.00	44739.14	-16.18		
4	I	2031-01-21T06:56:07.301		51.97	-79.13	42595.55	-16.17		
5	I	2031-01-21T06:56:24.674		51.91	-79.14	42314.35	-16.17		
6	I	2031-01-21T06:56:52.234		51.81	-79.17	41868.59	-16.17		
Uranus	I	2031-01-21T07:13:42.908		48.17	-79.32	25558.87		-0.12	-0.12
Uranus	E	2031-01-21T08:05:44.918		36.97	-73.08	25502.79		2.43	2.55
6	E	2031-01-21T08:22:41.051		33.35	-69.97	41811.74	16.03		
5	E	2031-01-21T08:23:02.456		33.27	-69.90	42154.87	16.03		
4	E	2031-01-21T08:23:26.422		33.19	-69.82	42540.31	16.03		
alpha	E	2031-01-21T08:25:40.717		32.71	-69.39	44693.51	16.04		
beta	E	2031-01-21T08:26:40.251		32.50	-69.20	45648.16	16.04		
eta	E	2031-01-21T08:28:15.516		32.16	-68.89	47176.12	16.04		
gamma	E	2031-01-21T08:28:43.807		32.06	-68.80	47629.86	16.04		
delta	E	2031-01-21T08:29:25.610		31.91	-68.66	48300.35	16.04		
lambda	E	2031-01-21T08:31:13.242		31.53	-68.31	50026.71	16.04		
epsilon	E	2031-01-21T08:32:39.985		31.22	-68.03	51418.06	16.03		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2031-01-21T07:44:12.440
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       : 3415723757491506688
2Mass ID (if available) : 05114691+2304234
ICRS Star Coord at Epoch: 05h 11m 46.91636s +23:04:23.50038s
RUWE (>1.4 is poor) : 1.09
K magnitude          : 13.313
G magnitude           : 16.219
RP magnitude          : 15.351
BP magnitude          : 16.993
DUPflag              : 0
Distance (au)        : 18.402
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -15.92
Sun-Target sep (deg) : 138.30
Sun-Moon sep (deg)   : 164.46
B (ring opening deg) : 82.08
PA of pole (deg)     : 4.45
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.153
C/A sky separation (km) : 2046.0
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl1.spk
urall1.bsp
IAU_URANUS_for_RINGFIT.tpc
vgr2.urall1.bsp
ural61.bsp
vgr2.ural61.bsp
peph.ural60.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	2031-01-21T06:52:29.323		79.82	-38.38	50841.46	-16.35		
lambda	I	2031-01-21T06:53:19.156		80.00	-38.57	50026.71	-16.35		
delta	I	2031-01-21T06:55:04.753		80.38	-38.98	48300.35	-16.35		
gamma	I	2031-01-21T06:55:46.237		80.53	-39.14	47622.18	-16.35		
eta	I	2031-01-21T06:56:13.524		80.63	-39.24	47176.12	-16.35		
beta	I	2031-01-21T06:57:45.283		80.96	-39.60	45676.14	-16.35		
alpha	I	2031-01-21T06:58:42.561		81.17	-39.82	44739.96	-16.34		
4	I	2031-01-21T07:00:53.692		81.64	-40.32	42596.80	-16.34		
5	I	2031-01-21T07:01:10.930		81.70	-40.39	42314.71	-16.34		
6	I	2031-01-21T07:01:38.281		81.80	-40.50	41867.60	-16.34		
Uranus	I	2031-01-21T07:18:15.694		85.06	-44.35	25555.67		-0.59	-0.62
Uranus	E	2031-01-21T08:10:08.084		80.83	-56.45	25526.42		1.85	1.94
6	E	2031-01-21T08:26:44.185		77.15	-60.33	41810.08	16.32		
5	E	2031-01-21T08:27:05.308		77.07	-60.41	42154.83	16.32		
4	E	2031-01-21T08:27:28.978		76.98	-60.51	42541.97	16.32		
alpha	E	2031-01-21T08:29:40.894		76.49	-61.02	44694.62	16.32		
beta	E	2031-01-21T08:30:39.284		76.27	-61.25	45647.47	16.32		
eta	E	2031-01-21T08:32:12.944		75.92	-61.61	47176.12	16.32		
gamma	E	2031-01-21T08:32:40.756		75.81	-61.72	47630.03	16.32		
delta	E	2031-01-21T08:33:21.827		75.66	-61.88	48300.35	16.32		
lambda	E	2031-01-21T08:35:07.602		75.26	-62.30	50026.71	16.32		
epsilon	E	2031-01-21T08:36:33.620		74.93	-62.63	51430.63	16.32		