

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-03-16T00:24:12.230
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 145002974996928128
 2Mass ID (if available) : 04340017+2157177

ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s

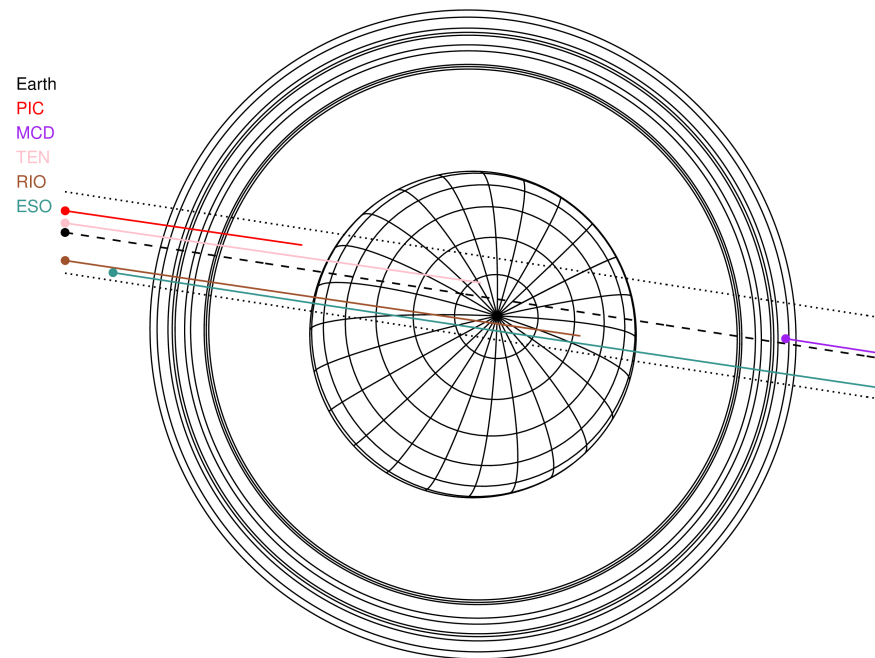
RUWE (>1.4 is poor) : 0.93
 K magnitude : 14.483
 G magnitude : 18.798
 RP magnitude : 17.501
 BP magnitude : 20.667
 DUPflag : 0
 Distance (au) : 19.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.12
 Sun-Target sep (deg) : 74.83
 Sun-Moon sep (deg) : 65.80
 B (ring opening deg) : 79.25
 PA of pole (deg) : -52.41

#	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



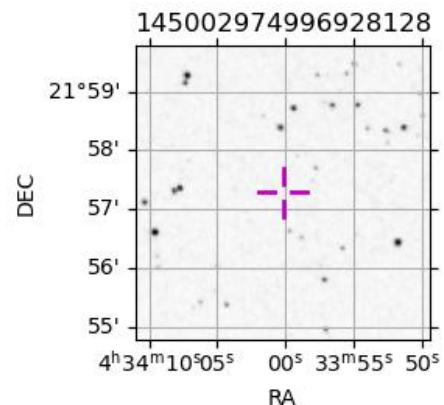
2029-03-16T00:24:12.2300 ex: 04 34 00.2210 s: +21 57 17.248 C/A 0.431" PA 171.22 deg v_sky +14.12 km/s D 19.51 AU
 Credit: Styled after SORA/Lucky Star

Uranus 2029-03-16T00:24:12 K14.48 G18.80 PgtRgt

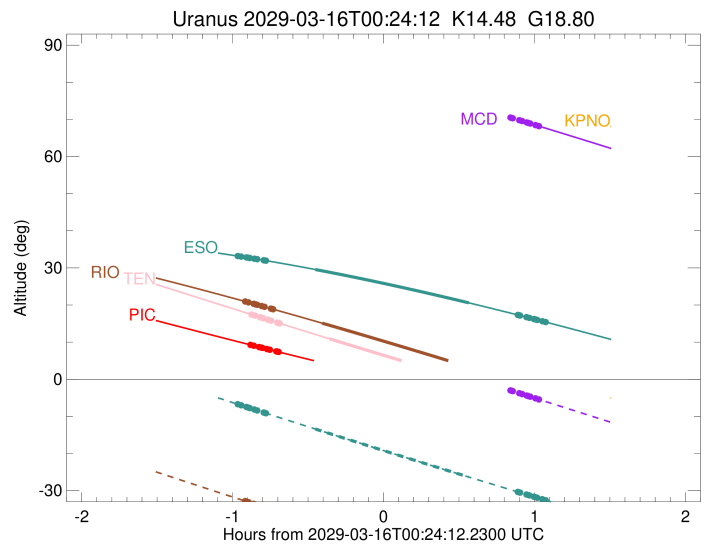
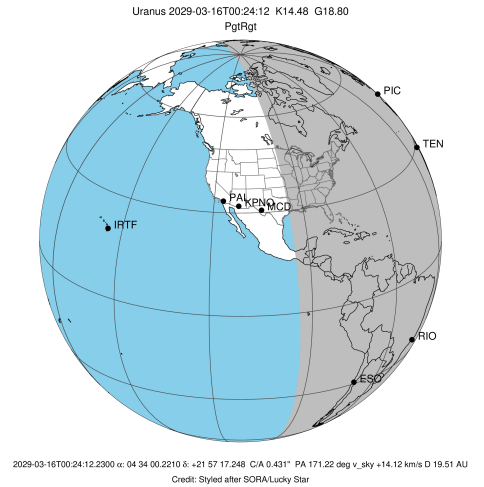


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1	+++++			MAR 15 23:31 - MAR 15 23:42	PnnRin
PAL	Palomar Mt (200")	33.4	243.1					PnnRnn
PMP	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			++	MAR 16 01:24 - MAR 16 01:26	PnnRne
TEN	Teide Obs./Tenerife	28.3	343.5	+++++	+		MAR 15 23:32 - MAR 16 00:02	PinRin
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observatory	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+++++	+		MAR 15 23:29 - MAR 15 23:59	PinRin
ESO	European Southern Obs	-29.3	289.3	+++++	+	+++++	MAR 15 23:26 - MAR 16 01:29	PieRie
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

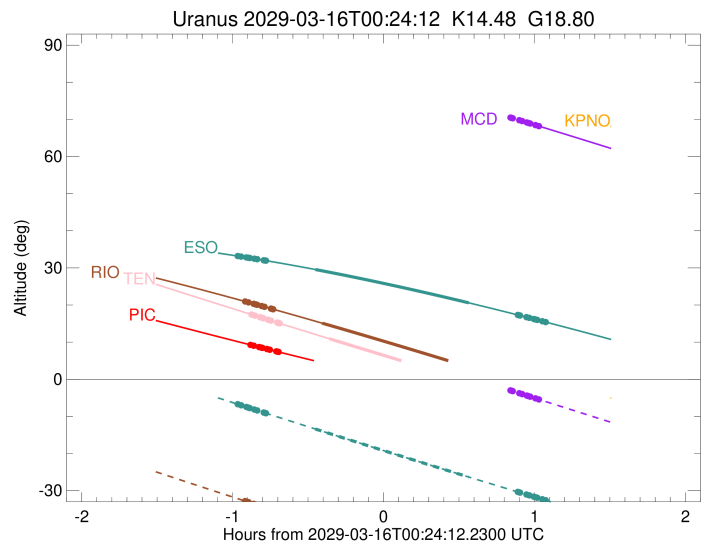
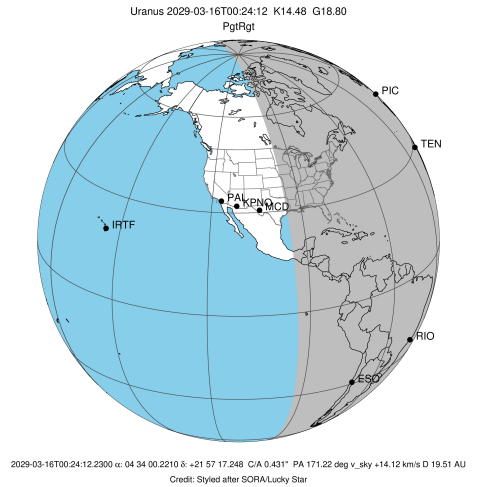


target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-03-16T00:29:57.610
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 145002974996928128
 2Mass ID (if available) : 04340017+2157177
 ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s
 RUWE (>1.4 is poor) : 0.93
 K magnitude : 14.483
 G magnitude : 18.798
 RP magnitude : 17.501
 BP magnitude : 20.667
 DUPflag : 0
 Distance (au) : 19.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.12
 Sun-Target sep (deg) : 74.83
 Sun-Moon sep (deg) : 66.07
 B (ring opening deg) : 79.25
 PA of pole (deg) : -52.41
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.709
 C/A sky separation (km) : 10030.2
 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



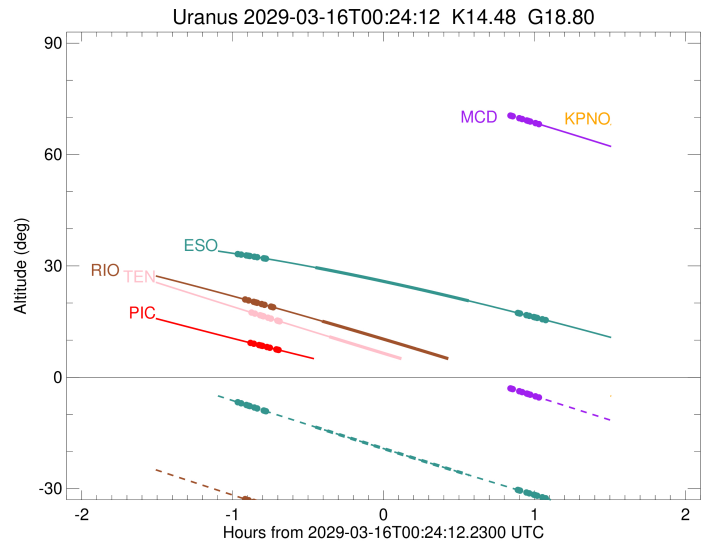
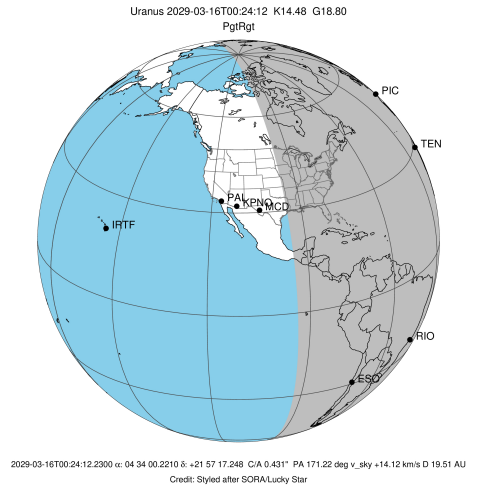
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-03-15T23:31:45.183		9.19	-48.18	50807.59	-13.97		
lambda	I	2029-03-15T23:32:41.132		9.03	-48.22	50026.71	-13.95		
delta	I	2029-03-15T23:34:44.938		8.68	-48.30	48300.35	-13.93		
gamma	I	2029-03-15T23:35:33.079		8.54	-48.33	47629.69	-13.93		
eta	I	2029-03-15T23:36:05.653		8.45	-48.35	47176.12	-13.92		
beta	I	2029-03-15T23:37:53.734		8.14	-48.42	45672.32	-13.90		
alpha	I	2029-03-15T23:39:03.171		7.94	-48.46	44708.45	-13.89		
4	I	2029-03-15T23:41:40.502		7.50	-48.55	42526.04	-13.85		
5	I	2029-03-15T23:42:07.465		7.42	-48.56	42154.96	-13.85		
6	I	2029-03-15T23:42:33.043		7.35	-48.58	41795.02	-13.84		
Uranus	I	2029-03-16T00:02:28.624	4.03x	-48.95	25484.18			-3.83	-4.02
Uranus	E	2029-03-16T00:56:49.673	-4.53x	-47.53	25072.28			9.94	10.41
6	E	2029-03-16T01:16:46.489	-7.44x	-46.17	41872.31	14.00			
5	E	2029-03-16T01:17:17.322	-7.51x	-46.13	42308.20	14.01			
4	E	2029-03-16T01:17:39.043	-7.56x	-46.10	42612.85	14.02			
alpha	E	2029-03-16T01:20:08.830	-7.92x	-45.90	44713.33	14.06			
beta	E	2029-03-16T01:21:16.064	-8.07x	-45.81	45658.22	14.08			
eta	E	2029-03-16T01:23:03.758	-8.33x	-45.66	47176.12	14.10			
gamma	E	2029-03-16T01:23:35.567	-8.40x	-45.61	47624.83	14.11			
delta	E	2029-03-16T01:24:23.424	-8.51x	-45.54	48300.35	14.12			
lambda	E	2029-03-16T01:26:25.570	-8.79x	-45.37	50026.71	14.15			
epsilon	E	2029-03-16T01:28:13.089	-9.04x	-45.21	51548.81	14.17			

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-03-16T00:25:12.240
 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 : 145002974996928128
 2Mass ID (if available) : 04340017+2157177
 ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s
 RUWE (>1.4 is poor) : 0.93
 K magnitude : 14.483
 G magnitude : 18.798
 RP magnitude : 17.501
 BP magnitude : 20.667
 DUPflag : 0
 Distance (au) : 19.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.12
 Sun-Target sep (deg) : 74.83
 Sun-Moon sep (deg) : 66.65
 B (ring opening deg) : 79.25
 PA of pole (deg) : -52.41
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.487
 C/A sky separation (km) : 6889.4
 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



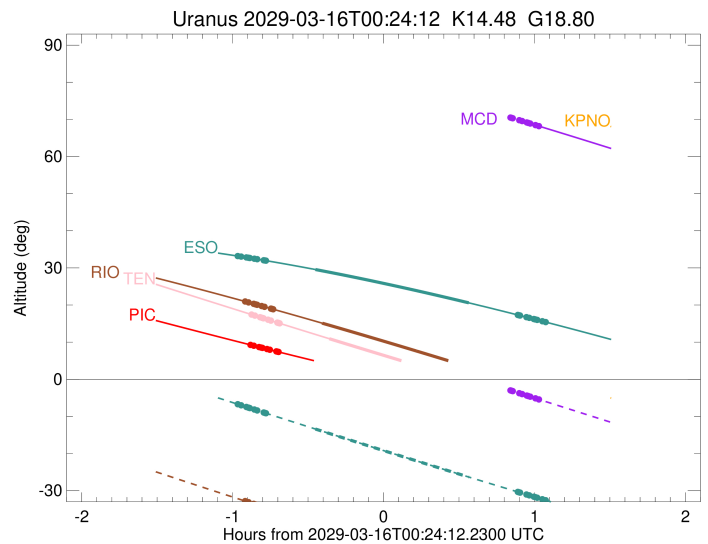
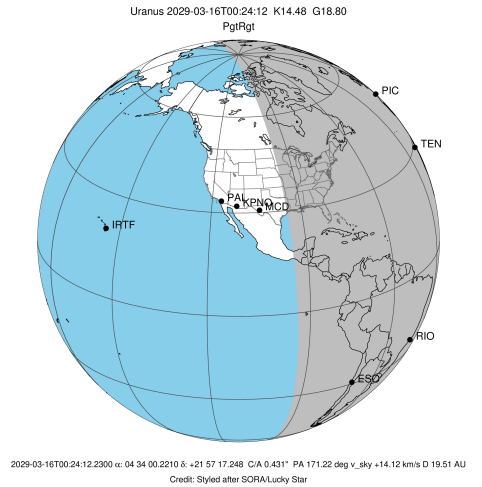
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
epsilon	I	2029-03-15T23:24:26.256		78.89	20.48x	50797.26	-13.70		
lambda	I	2029-03-15T23:25:22.546		79.03	20.28x	50026.71	-13.69		
delta	I	2029-03-15T23:27:28.722		79.32	19.84x	48300.35	-13.68		
gamma	I	2029-03-15T23:28:17.782		79.43	19.67x	47629.47	-13.67		
eta	I	2029-03-15T23:28:50.942		79.50	19.56x	47176.12	-13.67		
beta	I	2029-03-15T23:30:41.046		79.74	19.17x	45671.35	-13.66		
alpha	I	2029-03-15T23:31:51.491		79.89	18.93x	44710.36	-13.65		
4	I	2029-03-15T23:34:31.607		80.20	18.37x	42525.93	-13.63		
5	I	2029-03-15T23:34:58.994		80.25	18.27x	42154.82	-13.63		
6	I	2029-03-15T23:35:24.920		80.30	18.18x	41795.42	-13.63		
Uranus	I	2029-03-15T23:55:27.587		81.51	13.96x	25433.51		-4.98	-5.21
Uranus	E	2029-03-16T00:54:32.611		74.43	1.33x	25136.37		9.24	9.67
6	E	2029-03-16T01:14:42.343		70.49	-3.00x	41874.30	13.67		
5	E	2029-03-16T01:15:13.896		70.38	-3.12x	42310.80	13.68		
4	E	2029-03-16T01:15:36.110		70.31	-3.20x	42614.26	13.68		
alpha	E	2029-03-16T01:18:09.735		69.79	-3.75x	44716.13	13.70		
beta	E	2029-03-16T01:19:18.422		69.56	-4.00x	45656.60	13.71		
eta	E	2029-03-16T01:21:09.162		69.18	-4.39x	47176.12	13.72		
gamma	E	2029-03-16T01:21:41.826		69.07	-4.51x	47624.43	13.73		
delta	E	2029-03-16T01:22:31.058		68.90	-4.69x	48300.35	13.73		
lambda	E	2029-03-16T01:24:36.722		68.47	-5.14	50026.71	13.74		
epsilon	E	2029-03-16T01:26:26.963		68.09	-5.53	51542.40	13.76		

target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-03-16T00:31:09.170
 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 : 145002974996928128
 2Mass ID (if available) : 04340017+2157177
 ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s
 RUWE (>1.4 is poor) : 0.93
 K magnitude : 14.483
 G magnitude : 18.798
 RP magnitude : 17.501
 BP magnitude : 20.667
 DUPflag : 0
 Distance (au) : 19.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.12
 Sun-Target sep (deg) : 74.83
 Sun-Moon sep (deg) : 66.22
 B (ring opening deg) : 79.25
 PA of pole (deg) : -52.41
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.579
 C/A sky separation (km) : 8192.8
 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	2029-03-15T23:32:10.833		17.34	-53.99	50799.52	-13.96		
lambda	I	2029-03-15T23:33:06.251		17.15	-54.14	50026.71	-13.94		
delta	I	2029-03-15T23:35:10.110		16.71	-54.47	48300.35	-13.93		
gamma	I	2029-03-15T23:35:58.265		16.54	-54.60	47629.52	-13.93		
eta	I	2029-03-15T23:36:30.821		16.42	-54.69	47176.12	-13.93		
beta	I	2029-03-15T23:38:18.891		16.04	-54.97	45671.60	-13.91		
alpha	I	2029-03-15T23:39:28.102		15.80	-55.15	44709.87	-13.90		
4	I	2029-03-15T23:42:05.272		15.24	-55.55	42525.94	-13.89		
5	I	2029-03-15T23:42:32.168		15.15	-55.62	42154.83	-13.88		
6	I	2029-03-15T23:42:57.640		15.06	-55.69	41795.29	-13.88		
Uranus	I	2029-03-16T00:02:41.624		10.92	-58.48	25451.41		-4.60	-4.82
Uranus	E	2029-03-16T00:59:03.655		-0.60x	-63.30	25104.49		9.60	10.04
6	E	2029-03-16T01:18:45.081		-4.49x	-63.54	41873.33	14.07		
5	E	2029-03-16T01:19:15.741		-4.59x	-63.54	42309.55	14.08		
4	E	2029-03-16T01:19:37.331		-4.66x	-63.53	42613.58	14.09		
alpha	E	2029-03-16T01:22:06.439		-5.15x	-63.50	44714.69	14.12		
beta	E	2029-03-16T01:23:13.247		-5.36x	-63.48	45657.43	14.13		
eta	E	2029-03-16T01:25:00.600		-5.71x	-63.44	47176.12	14.15		
gamma	E	2029-03-16T01:25:32.288		-5.81x	-63.43	47624.63	14.16		
delta	E	2029-03-16T01:26:20.005		-5.97x	-63.41	48300.35	14.16		
lambda	E	2029-03-16T01:28:21.800		-6.36x	-63.35	50026.71	14.18		
epsilon	E	2029-03-16T01:30:08.860		-6.70x	-63.30	51546.05	14.20		

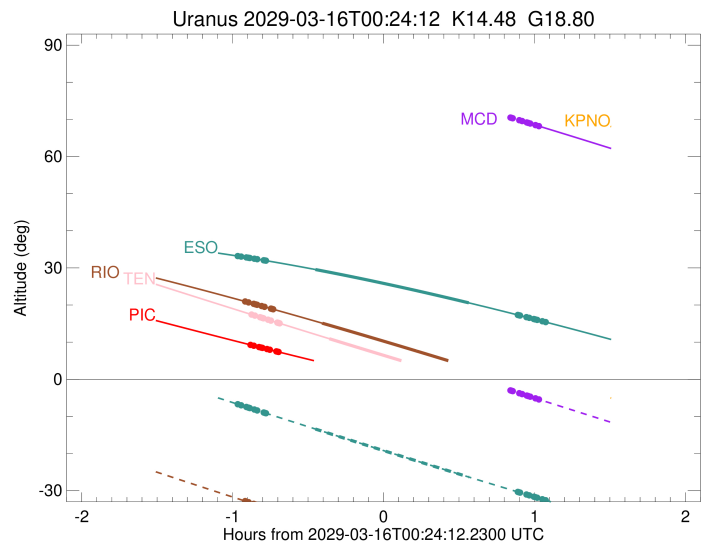
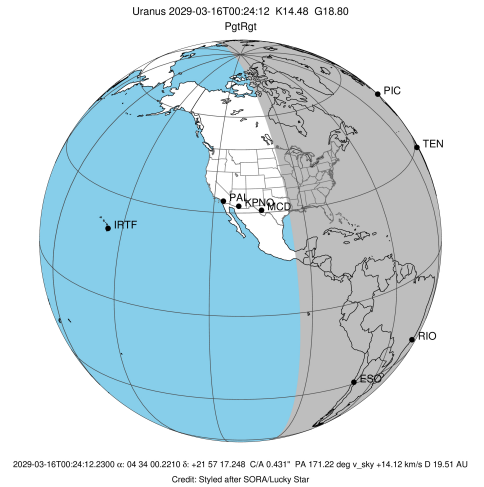
target : Uranus
 target radius (km) : 25559.00
 C/A epoch : 2029-03-16T00:30:03.310
 Event type : PgtRgt
 : Uranus occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : RIO
 Location : Rio de Janeiro
 Latitude (deg) : -22.89506
 E. Longitude (deg) : 316.77708
 Altitude (km) : 0.033
 Gaia source ID : 145002974996928128
 2Mass ID (if available) : 04340017+2157177
 ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s
 RUWE (>1.4 is poor) : 0.93
 K magnitude : 14.483
 G magnitude : 18.798
 RP magnitude : 17.501
 BP magnitude : 20.667
 DUPflag : 0
 Distance (au) : 19.511
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : 14.12
 Sun-Target sep (deg) : 74.83
 Sun-Moon sep (deg) : 66.25
 B (ring opening deg) : 79.25
 PA of pole (deg) : -52.41
 Pole direction: RA (deg): 257.31100
 Dec (deg): -15.17500
 C/A sky separation (") : 0.155
 C/A sky separation (km) : 2191.2
 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	2029-03-15T23:29:40.196		20.87	-32.92	50778.01	-13.94		
lambda	I	2029-03-15T23:30:34.114		20.70	-33.11	50026.71	-13.93		
delta	I	2029-03-15T23:32:37.996		20.31	-33.57	48300.35	-13.94		
gamma	I	2029-03-15T23:33:26.168		20.16	-33.74	47628.97	-13.94		
eta	I	2029-03-15T23:33:58.658		20.06	-33.86	47176.12	-13.94		
beta	I	2029-03-15T23:35:46.736		19.72	-34.25	45669.27	-13.94		
alpha	I	2029-03-15T23:36:55.312		19.51	-34.50	44714.32	-13.94		
4	I	2029-03-15T23:39:32.290		19.02	-35.07	42526.24	-13.94		
5	I	2029-03-15T23:39:59.008		18.93	-35.17	42155.49	-13.95		
6	I	2029-03-15T23:40:24.303		18.85	-35.26	41796.70	-13.94		
Uranus	I	2029-03-15T23:59:50.114		15.11	-39.44	25328.98		-6.77	-7.08
Uranus	E	2029-03-16T01:00:01.474		2.91x	-51.60	25230.72		8.11	8.49
6	E	2029-03-16T01:19:20.824		-1.15x	-55.10	41876.24	14.15		
5	E	2029-03-16T01:19:51.300		-1.26x	-55.19	42313.09	14.15		
4	E	2029-03-16T01:20:12.754		-1.34x	-55.26	42615.47	14.15		
alpha	E	2029-03-16T01:22:41.470		-1.86x	-55.68	44719.36	14.16		
beta	E	2029-03-16T01:23:47.604		-2.10x	-55.87	45654.80	14.16		
eta	E	2029-03-16T01:25:34.978		-2.48x	-56.17	47176.12	14.17		
gamma	E	2029-03-16T01:26:06.590		-2.59x	-56.26	47624.00	14.17		
delta	E	2029-03-16T01:26:54.320		-2.76x	-56.40	48300.35	14.17		
lambda	E	2029-03-16T01:28:56.116		-3.19x	-56.73	50026.71	14.18		
epsilon	E	2029-03-16T01:30:42.332		-3.57x	-57.02	51532.81	14.18		

```

target                : Uranus
target radius (km)   : 25559.00
C/A epoch            : 2029-03-16T00:27:41.500
Event type          : PgtRgt
: Ring occs: geocentric, topocentric
Observer code       : ESO
Location            : European Southern Obs. (3.6m)
Latitude (deg)      : -29.26097
E. Longitude (deg)  : 289.26831
Altitude (km)       : 2.400
Gaia source ID      : 145002974996928128
2Mass ID (if available) : 04340017+2157177
ICRS Star Coord at Epoch: 04h 34m 00.22101s +21:57:17.24790s
RUWE (>1.4 is poor) : 0.93
K magnitude          : 14.483
G magnitude          : 18.798
RP magnitude         : 17.501
BP magnitude         : 20.667
DUPflag             : 0
Distance (au)       : 19.511
f0 (km)             : 0.000
g0 (km)             : 0.000
skyplane vel. (km/s) : 14.12
Sun-Target sep (deg) : 74.83
Sun-Moon sep (deg)  : 66.35
B (ring opening deg) : 79.25
PA of pole (deg)    : -52.41
Pole direction: RA (deg): 257.31100
Dec (deg): -15.17500
C/A sky separation (") : 0.078
C/A sky separation (km) : 1101.1
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	2029-03-15T23:26:43.736		33.14	-6.82	50775.42	-13.84		
lambda	I	2029-03-15T23:27:37.849		33.04	-7.02	50026.71	-13.84		
delta	I	2029-03-15T23:29:42.610		32.82	-7.47	48300.35	-13.84		
gamma	I	2029-03-15T23:30:31.131		32.73	-7.64	47628.89	-13.84		
eta	I	2029-03-15T23:31:03.848		32.67	-7.76	47176.12	-13.84		
beta	I	2029-03-15T23:32:52.726		32.47	-8.16	45668.92	-13.84		
alpha	I	2029-03-15T23:34:01.725		32.34	-8.41	44714.97	-13.84		
4	I	2029-03-15T23:36:39.886		32.05	-8.98	42526.36	-13.84		
5	I	2029-03-15T23:37:06.783		32.00	-9.07	42155.72	-13.84		
6	I	2029-03-15T23:37:32.262		31.95	-9.17	41796.97	-13.84		
Uranus	I	2029-03-15T23:57:06.686		29.56	-13.40	25307.83		-7.08	-7.41
Uranus	E	2029-03-16T00:58:06.903		20.59	-26.34	25257.78		7.76	8.13
6	E	2029-03-16T01:17:37.970		17.32	-30.35	41876.74	13.99		
5	E	2029-03-16T01:18:08.784		17.23	-30.46	42313.62	13.99		
4	E	2029-03-16T01:18:30.480		17.17	-30.53	42615.76	13.99		
alpha	E	2029-03-16T01:21:00.953		16.74	-31.04	44720.36	14.00		
beta	E	2029-03-16T01:22:07.750		16.55	-31.27	45654.26	14.00		
eta	E	2029-03-16T01:23:56.427		16.23	-31.63	47176.12	14.00		
gamma	E	2029-03-16T01:24:28.402		16.14	-31.74	47623.86	14.00		
delta	E	2029-03-16T01:25:16.709		16.00	-31.90	48300.35	14.00		
lambda	E	2029-03-16T01:27:19.960		15.64	-32.32	50026.71	14.01		
epsilon	E	2029-03-16T01:29:07.196		15.33	-32.68	51529.18	14.01		