

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:17:19.440  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592

Saturn 2047-06-24T06:17:19 K9.02 G13.63 PgtRgt

ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s

RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 168.86  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56

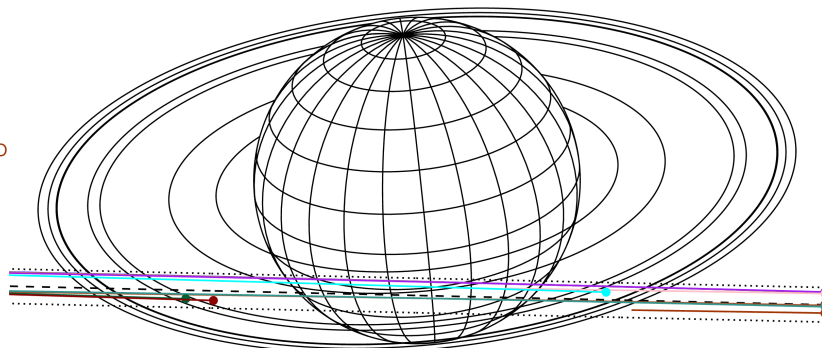
# a(km) ring

- 1 74490.6 C (IER)
- 2 91984.7 B (IER)
- 3 117571.2 B (OER)
- 4 122050.4 A (IER)
- 5 133423.3 Encke (IEG)
- 6 133744.9 Encke (OEG)
- 7 136774.4 A (OER)
- 8 140461.0 F ring



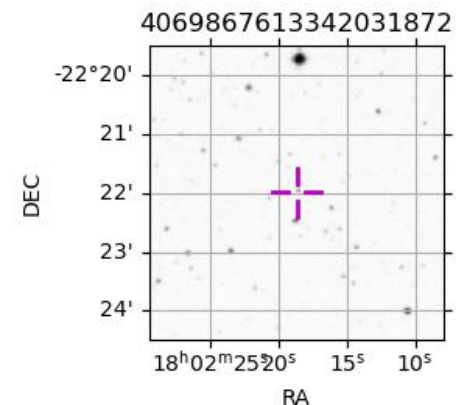
2047-06-24T06:17:19.4400 at: 18 02 18.6910 5: -22 21 59.340 C/A 6.482° PA 358.70 deg v\_sky -20.18 km/s D 09.03 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO  
 AAT  
 SAAO  
 MSO

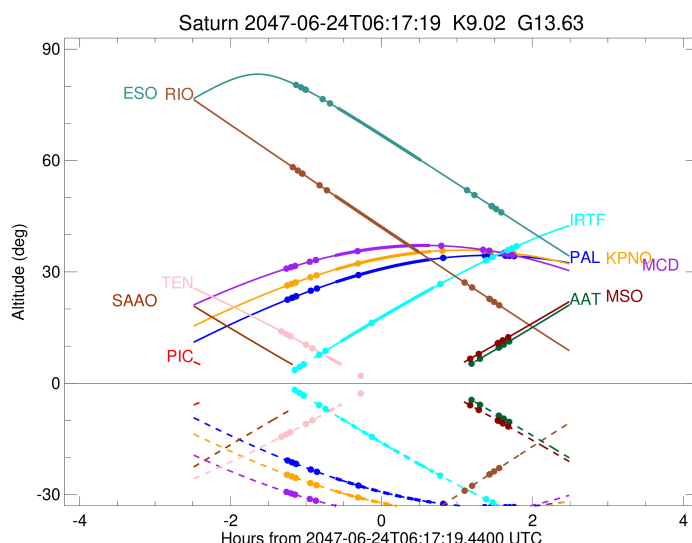
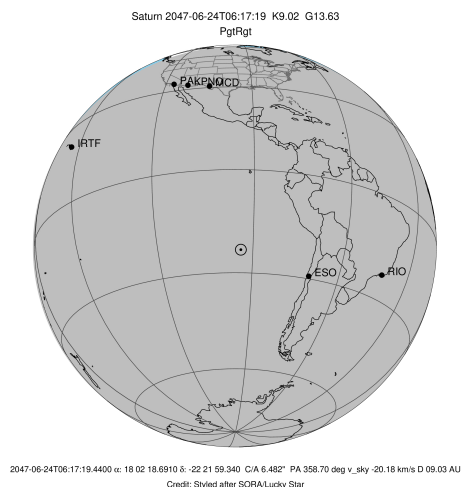


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

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 (20	33.4	243.1	+	+	+	JUN 24 05:02 - JUN 24 08:02	PieRie
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4	+	+	+	JUN 24 05:02 - JUN 24 08:02	PieRie
MCD	McDonald Obs.	30.7	256.0	+	+	+	JUN 24 05:01 - JUN 24 08:01	PieRie
TEN	Teide Obs./Ten	28.3	343.5	+	+	+	JUN 24 04:57 - JUN 24 05:35	PinRin
IRTF	Mauna Kea/IRTF	19.8	204.5	+	+	+	JUN 24 05:27 - JUN 24 08:04	PieRie
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+	+	+	JUN 24 05:06 - JUN 24 07:51	PieRie
ESO	European South	-29.3	289.3	+	+	+	JUN 24 05:09 - JUN 24 07:52	PieRie
AAT	Siding Spring	-31.3	149.1			+	JUN 24 07:35 - JUN 24 07:58	PnnRne
SAAO	So. Afr. Astro	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Ob	-35.3	149.0			+	JUN 24 07:28 - JUN 24 07:58	PnnRne



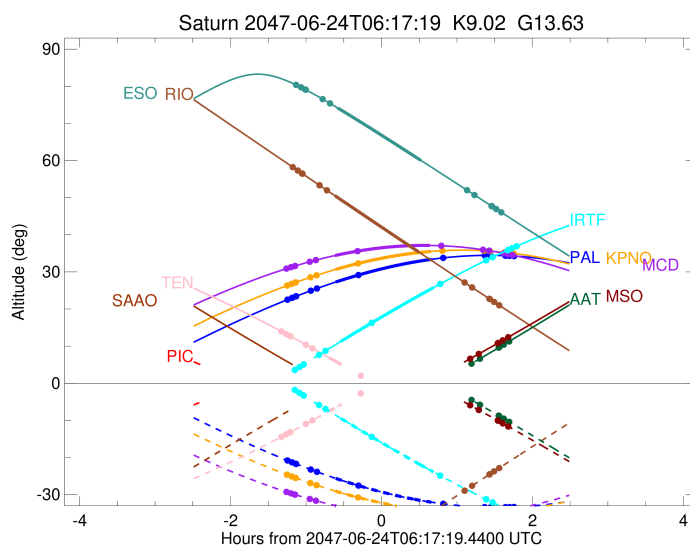
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:18:51.320  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 169.29  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.692  
 C/A sky separation (km) : 37279.6  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:02:35.519		22.52	-20.80	140461.00	-17.23		
A (OER)	I	2047-06-24T05:06:10.979		23.00	-21.29	136774.40	-16.99		
Encke (OEG)	I	2047-06-24T05:09:10.404		23.40	-21.69	133744.89	-16.78		
Encke (IEG)	I	2047-06-24T05:09:29.586		23.44	-21.74	133423.31	-16.75		
A (IER)	I	2047-06-24T05:21:08.246		24.93	-23.25	122050.38	-15.76		
B (OER)	I	2047-06-24T05:25:56.965		25.52	-23.85	117571.16	-15.26		
B (IER)	I	2047-06-24T05:59:04.337	b	29.16	-27.57	91984.69	-9.82		
Saturn	I	2047-06-24T05:41:01.712		27.28	-25.63	59686.48		-39.81	-45.42
Saturn	E	2047-06-24T06:56:55.140		33.38	-32.03	59954.76		-27.92	-32.94
B (IER)	E	2047-06-24T07:06:27.498		33.78	-32.48	91984.69	9.87		
B (OER)	E	2047-06-24T07:39:28.086		34.45	-33.36	117571.16	15.30		
A (IER)	E	2047-06-24T07:44:16.133		34.46	-33.40	122050.38	15.79		
Encke (IEG)	E	2047-06-24T07:55:53.218		34.37	-33.40	133423.31	16.79		
Encke (OEG)	E	2047-06-24T07:56:12.356		34.37	-33.40	133744.89	16.81		
A (OER)	E	2047-06-24T07:59:11.376		34.32	-33.37	136774.40	17.03		
F ring	E	2047-06-24T08:02:46.346		34.26	-33.33	140461.00	17.27		

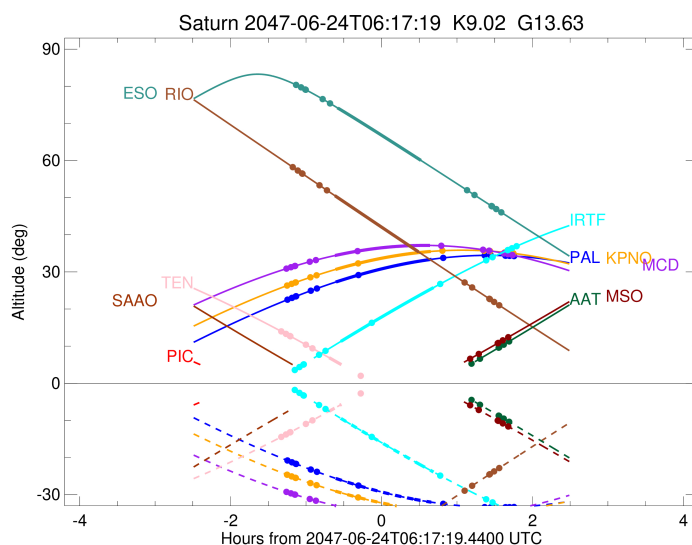
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:18:28.770  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KPNO  
 Location : Kitt Peak Natl Obs  
 Latitude (deg) : 31.96333  
 E. Longitude (deg) : 248.40000  
 Altitude (km) : 2.120  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 169.24  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.699  
 C/A sky separation (km) : 37322.9  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:02:18.041		26.32	-24.64	140461.00	-17.23		
A (OER)	I	2047-06-24T05:05:53.418		26.77	-25.09	136774.40	-17.00		
Encke (OEG)	I	2047-06-24T05:08:52.789		27.14	-25.46	133744.89	-16.78		
Encke (IEG)	I	2047-06-24T05:09:11.965		27.18	-25.50	133423.31	-16.76		
A (IER)	I	2047-06-24T05:20:50.572		28.55	-26.90	122050.38	-15.76		
B (OER)	I	2047-06-24T05:25:39.356		29.08	-27.45	117571.16	-15.26		
B (IER)	I	2047-06-24T05:58:50.257	b	32.29	-30.76	91984.69	-9.78		
Saturn	I	2047-06-24T05:40:43.042		30.65	-29.06	59686.08		-39.83	-45.44
Saturn	E	2047-06-24T06:56:29.236		35.50	-34.27	59953.16		-28.00	-33.03
B (IER)	E	2047-06-24T07:05:50.233		35.71	-34.53	91984.69	9.82		
B (OER)	E	2047-06-24T07:38:55.873		35.69	-34.75	117571.17	15.28		
A (IER)	E	2047-06-24T07:43:44.293		35.60	-34.69	122050.38	15.78		
Encke (IEG)	E	2047-06-24T07:55:22.156		35.26	-34.44	133423.31	16.77		
Encke (OEG)	E	2047-06-24T07:55:41.314		35.24	-34.43	133744.89	16.80		
A (OER)	E	2047-06-24T07:58:40.514		35.13	-34.35	136774.40	17.01		
F ring	E	2047-06-24T08:02:15.691		34.99	-34.23	140461.00	17.25		

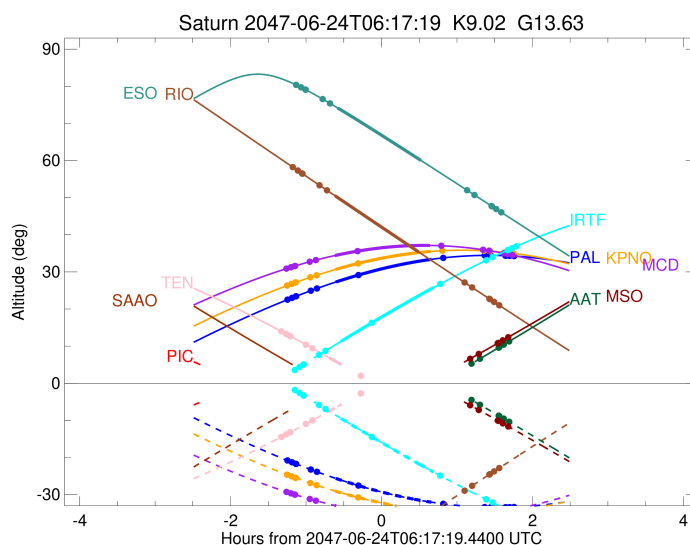
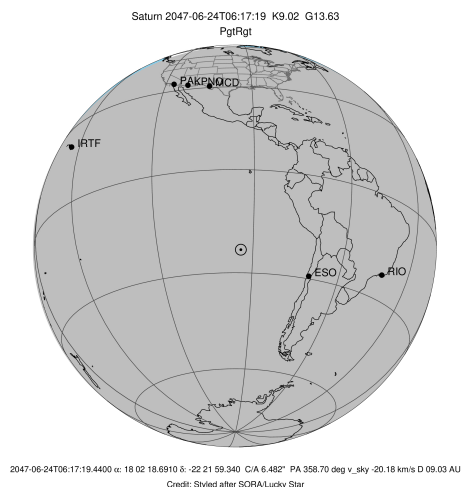
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:17:53.620  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 169.15  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.706  
 C/A sky separation (km) : 37370.4  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:01:46.435		30.88	-29.26	140461.00	-17.24		
A (OER)	I	2047-06-24T05:05:21.740		31.26	-29.66	136774.40	-17.00		
Encke (OEG)	I	2047-06-24T05:08:21.070		31.57	-29.97	133744.89	-16.78		
Encke (IEG)	I	2047-06-24T05:08:40.243		31.61	-30.01	133423.31	-16.76		
A (IER)	I	2047-06-24T05:20:18.894		32.74	-31.18	122050.38	-15.75		
B (OER)	I	2047-06-24T05:25:07.806		33.18	-31.63	117571.16	-15.25		
B (IER)	I	2047-06-24T05:58:23.371	b	35.60	-34.20	91984.69	-9.72		
Saturn	I	2047-06-24T05:40:11.957		34.40	-32.92	59685.96		-39.83	-45.44
Saturn	E	2047-06-24T06:55:50.825		37.13	-36.09	59951.15		-28.10	-33.13
B (IER)	E	2047-06-24T07:04:57.272		37.04	-36.07	91984.69	9.76		
B (OER)	E	2047-06-24T07:38:09.846		35.96	-35.26	117571.16	15.24		
A (IER)	E	2047-06-24T07:42:58.852		35.71	-35.05	122050.38	15.74		
Encke (IEG)	E	2047-06-24T07:54:37.994		35.01	-34.44	133423.31	16.74		
Encke (OEG)	E	2047-06-24T07:54:57.185		34.99	-34.42	133744.89	16.77		
A (OER)	E	2047-06-24T07:57:56.691		34.78	-34.24	136774.40	16.98		
F ring	E	2047-06-24T08:01:32.229		34.53	-34.01	140461.00	17.22		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:12:27.930  
 Event type : PgtRgt  
 : Saturn 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 : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 168.12  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 6.011  
 C/A sky separation (km) : 39369.0  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 naif0012.tls  
 earth\_flat\_IAU.spk

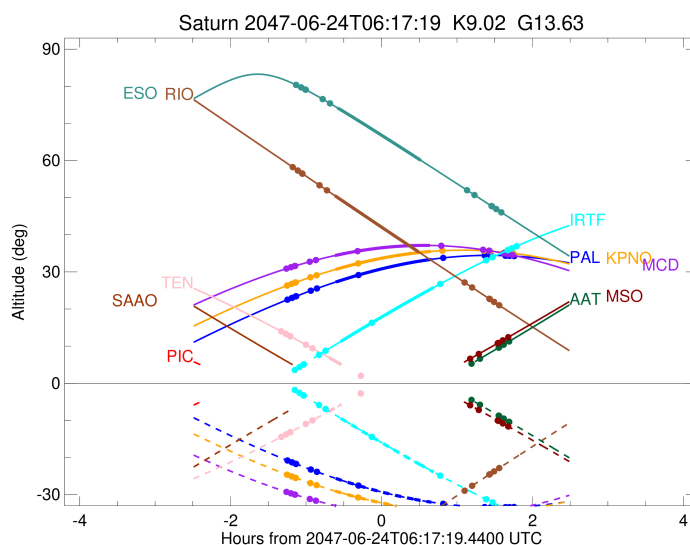


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2047-06-24T04:57:39.599		13.97	-14.45	140461.00	-16.50		
A (OER)	I	2047-06-24T05:01:24.897		13.29	-13.79	136774.40	-16.22		
Encke (OEG)	I	2047-06-24T05:04:33.121		12.72	-13.23	133744.89	-15.97		
Encke (IEG)	I	2047-06-24T05:04:53.278		12.66	-13.17	133423.31	-15.94		
A (IER)	I	2047-06-24T05:17:13.030		10.38	-10.95	122050.38	-14.76		
B (OER)	I	2047-06-24T05:22:22.681		9.42	-10.01	117571.16	-14.16		
B (IER)	I	2047-06-24T06:00:54.506	b	1.98x	-2.72x	91984.69	-7.14		
Saturn	I	2047-06-24T05:35:40.092		6.89	-7.54	59646.11		-41.48	-47.10
Saturn	E	2047-06-24T06:49:39.499		-7.87x	6.97x	59897.25		-30.65	-35.90
B (IER)	E	2047-06-24T06:51:56.532		-8.34x	7.43x	91984.69	7.15		
B (OER)	E	2047-06-24T07:30:41.496		-16.44x	15.42x	117571.16	14.01		
A (IER)	E	2047-06-24T07:35:54.816		-17.55x	16.52x	122050.38	14.58		
Encke (IEG)	E	2047-06-24T07:48:24.776		-20.21x	19.14x	133423.31	15.70		
Encke (OEG)	E	2047-06-24T07:48:45.239		-20.28x	19.22x	133744.89	15.73		
A (OER)	E	2047-06-24T07:51:56.379		-20.96x	19.89x	136774.40	15.97		
F ring	E	2047-06-24T07:55:45.326		-21.78x	20.70x	140461.00	16.23		

```

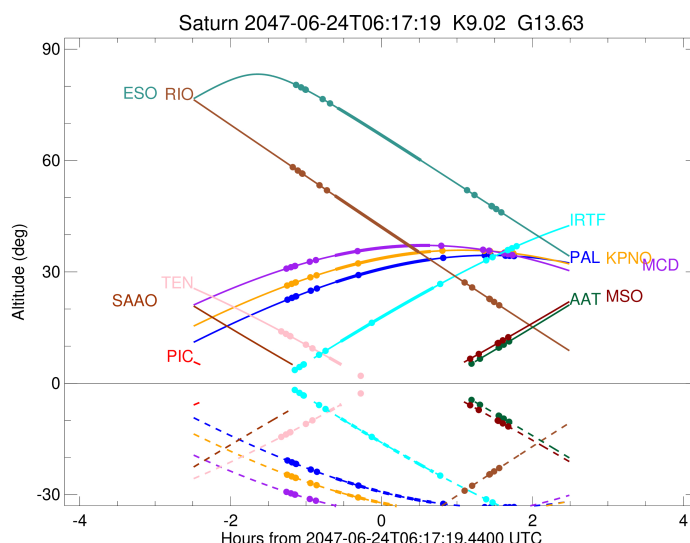
target                : Saturn
target radius (km)   : 60268.00
C/A epoch            : 2047-06-24T06:21:43.040
Event type           : PgtRgt
: Ring occs: geocentric, topocentric
Observer code        : IRTF
Location              : Mauna Kea/IRTF
Latitude (deg)       : 19.82622
E. Longitude (deg)   : 204.52800
Altitude (km)        : 4.168
Gaia source ID       : 4069867613342031872
2Mass ID (if available) : 18021868-2221592
ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s
RUWE (>1.4 is poor) : 1.45
K magnitude           : 9.016
G magnitude           : 13.627
RP magnitude          : 12.448
BP magnitude          : 15.113
DUPflag              : 0
Distance (au)        : 9.030
f0 (km)              : 0.000
g0 (km)              : 0.000
skyplane vel. (km/s) : -20.18
Sun-Target sep (deg) : 178.15
Sun-Moon sep (deg)   : 169.70
B (ring opening deg) : 26.45
PA of pole (deg)     : 5.56
Pole direction: RA (deg): 40.60000
Dec (deg): 83.50000
C/A sky separation (") : 5.976
C/A sky separation (km) : 39142.0
NAIF SPICE kernels   : RAJobs_U111+rgf15.spk
URKALLvl.spk
Saturn_ring_plane.tf
sat378.bsp
sat286.bsp
vgr1.sat286.bsp
vgr2.sat286.bsp
HST1081HSPephemUTC.bsp
pfb10000r.bsp
cassini.bsp
earthstns_itrf93_040916.bsp
earth_200101_990628_predict.bpc
earth_720101_070426.bpc
cpck28Mar2008.tpc
pck.sat440.tpc
IAU_SATURN_for_RINGFIT.tpc
naif0012.tls
earth_flat_IAU.spk
    
```



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2047-06-24T05:08:24.147		3.58x	-1.81x	140461.00	-16.65		
A (OER)	I	2047-06-24T05:12:07.316		4.37x	-2.60x	136774.40	-16.39		
Encke (OEG)	I	2047-06-24T05:15:13.527		5.03	-3.25x	133744.89	-16.15		
Encke (IEG)	I	2047-06-24T05:15:33.455		5.10	-3.32x	133423.31	-16.12		
A (IER)	I	2047-06-24T05:27:42.852		7.67	-5.87	122050.38	-15.01		
B (OER)	I	2047-06-24T05:32:46.858		8.73	-6.93	117571.16	-14.45		
B (IER)	I	2047-06-24T06:09:40.994	b	16.30	-14.46	91984.69	-7.86		
Saturn	I	2047-06-24T05:44:55.659		11.25	-9.44	59635.37		-41.93	-47.54
Saturn	E	2047-06-24T06:58:42.152		25.78	-23.91	59917.58		-29.71	-34.88
B (IER)	E	2047-06-24T07:04:06.836		26.78	-24.90	91984.69	7.93		
B (OER)	E	2047-06-24T07:40:40.386		33.14	-31.28	117571.16	14.59		
A (IER)	E	2047-06-24T07:45:41.283		33.96	-32.10	122050.38	15.17		
Encke (IEG)	E	2047-06-24T07:57:42.613		35.86	-34.01	133423.31	16.31		
Encke (OEG)	E	2047-06-24T07:58:02.308		35.91	-34.06	133744.89	16.34		
A (OER)	E	2047-06-24T08:01:06.302		36.38	-34.54	136774.40	16.59		
F ring	E	2047-06-24T08:04:46.729		36.93	-35.10	140461.00	16.86		



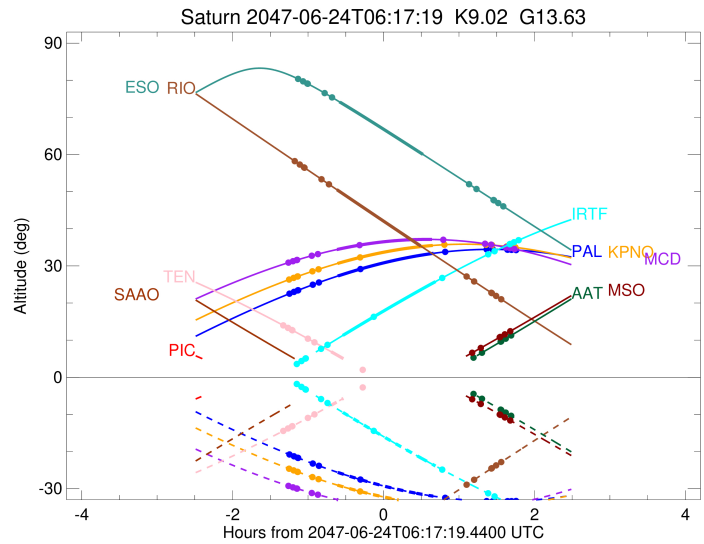
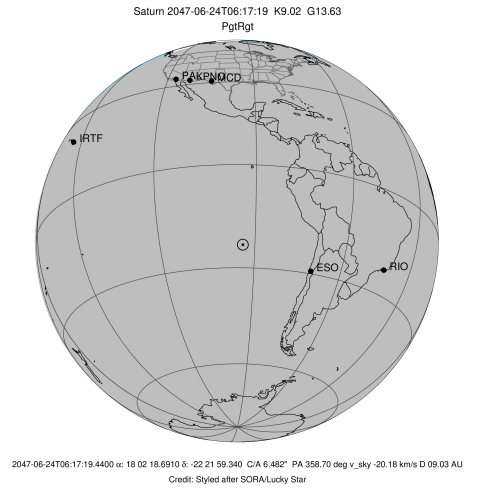
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:13:19.580  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 168.31  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 6.635  
 C/A sky separation (km) : 43456.4  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:06:46.148		58.22	-59.81	140461.00	-15.51		
A (OER)	I	2047-06-24T05:10:46.645		57.30	-58.90	136774.40	-15.14		
Encke (OEG)	I	2047-06-24T05:14:08.934		56.52	-58.13	133744.89	-14.81		
Encke (IEG)	I	2047-06-24T05:14:30.680		56.44	-58.04	133423.31	-14.77		
A (IER)	I	2047-06-24T05:28:02.784		53.33	-54.96	122050.38	-13.17		
B (OER)	I	2047-06-24T05:33:53.802		51.99	-53.63	117571.16	-12.34		
Saturn	I	2047-06-24T05:40:11.746		50.55	-52.19	59538.32		-45.93	-51.46
Saturn	E	2047-06-24T06:46:50.502		35.38	-37.12	59793.08		-35.30	-40.81
B (OER)	E	2047-06-24T07:23:34.198		27.11	-28.90	117571.16	12.24		
A (IER)	E	2047-06-24T07:29:28.332		25.79	-27.59	122050.38	13.04		
Encke (IEG)	E	2047-06-24T07:43:09.481		22.74	-24.56	133423.31	14.59		
Encke (OEG)	E	2047-06-24T07:43:31.502		22.65	-24.48	133744.89	14.62		
A (OER)	E	2047-06-24T07:46:56.427		21.89	-23.72	136774.40	14.94		
F ring	E	2047-06-24T07:51:00.236		20.99	-22.82	140461.00	15.30		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:15:20.010  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : 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 : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 168.68  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 6.634  
 C/A sky separation (km) : 43446.9  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 naif0012.tls  
 earth\_flat\_IAU.spk

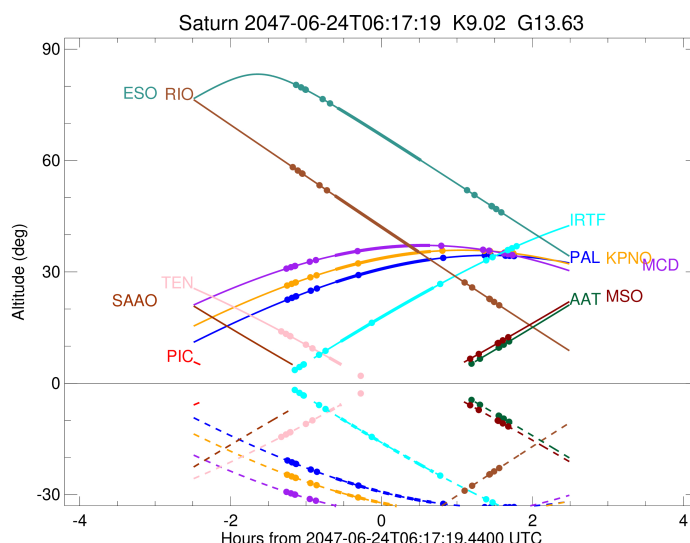


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2047-06-24T05:09:25.059		80.37	-82.15	140461.00	-15.60		
A (OER)	I	2047-06-24T05:13:24.142		79.71	-81.51	136774.40	-15.23		
Encke (OEG)	I	2047-06-24T05:16:45.186		79.13	-80.94	133744.89	-14.90		
Encke (IEG)	I	2047-06-24T05:17:06.794		79.06	-80.88	133423.31	-14.86		
A (IER)	I	2047-06-24T05:30:33.267		76.55	-78.37	122050.38	-13.27		
B (OER)	I	2047-06-24T05:36:21.485		75.40	-77.22	117571.16	-12.44		
Saturn	I	2047-06-24T05:42:20.976		74.19	-76.01	59535.17		-46.06	-51.59
Saturn	E	2047-06-24T06:48:40.061		60.03	-61.84	59796.56		-35.15	-40.65
B (OER)	E	2047-06-24T07:25:31.196		51.97	-53.80	117571.17	12.39		
A (IER)	E	2047-06-24T07:31:21.170		50.69	-52.53	122050.38	13.20		
Encke (IEG)	E	2047-06-24T07:44:53.022		47.73	-49.58	133423.31	14.75		
Encke (OEG)	E	2047-06-24T07:45:14.797		47.65	-49.50	133744.89	14.79		
A (OER)	E	2047-06-24T07:48:37.447		46.91	-48.76	136774.40	15.11		
F ring	E	2047-06-24T07:52:38.561		46.03	-47.88	140461.00	15.47		



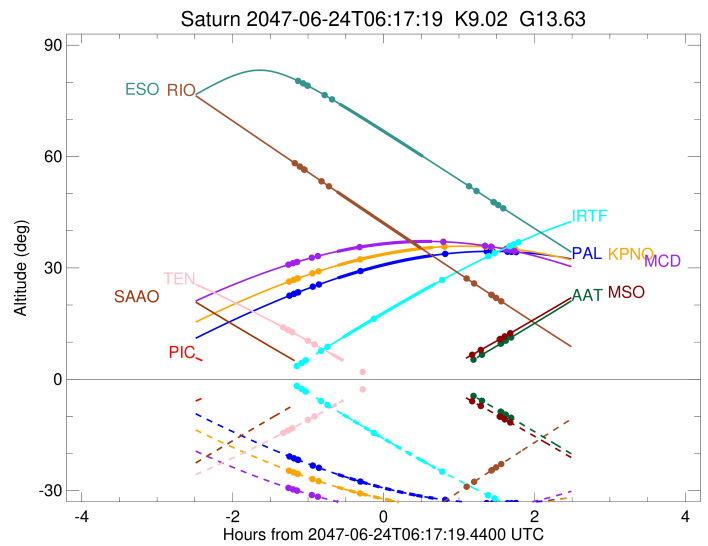
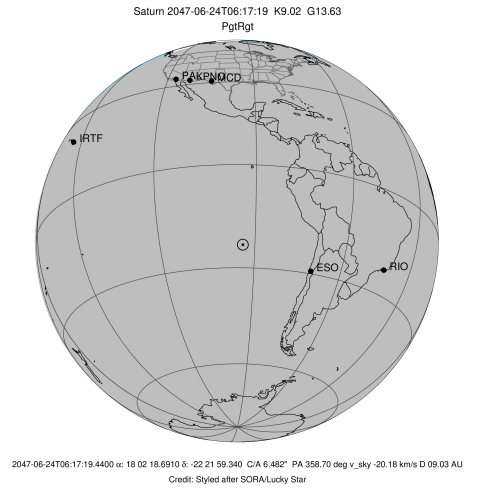
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:21:47.300  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : AAT  
 Location : Siding Spring (AAT)  
 Latitude (deg) : -31.27703  
 E. Longitude (deg) : 149.06608  
 Altitude (km) : 1.164  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 169.46  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 7.056  
 C/A sky separation (km) : 46215.1  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itr93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:20:50.065		-18.01x	18.27x	140461.00	-14.31		
A (OER)	I	2047-06-24T05:25:11.360		-17.31x	17.59x	136774.40	-13.90		
Encke (OEG)	I	2047-06-24T05:28:52.305		-16.71x	17.01x	133744.89	-13.52		
Encke (IEG)	I	2047-06-24T05:29:16.127		-16.64x	16.94x	133423.31	-13.48		
A (IER)	I	2047-06-24T05:44:19.348		-14.12x	14.50x	122050.38	-11.62		
B (OER)	I	2047-06-24T05:51:01.795	b	-12.97x	13.38x	117571.16	-10.62		
Saturn	I	2047-06-24T05:50:36.332		-13.05x	13.45x	59450.18		-49.60	-54.97
Saturn	E	2047-06-24T06:53:15.615		-1.64x	2.31x	59729.42		-38.01	-43.60
B (OER)	E	2047-06-24T07:29:06.252		5.32	-4.53x	117571.16	10.75		
A (IER)	E	2047-06-24T07:35:43.904		6.64	-5.82	122050.38	11.76		
Encke (IEG)	E	2047-06-24T07:50:35.299		9.61	-8.75	133423.31	13.67		
Encke (OEG)	E	2047-06-24T07:50:58.786		9.69	-8.82	133744.89	13.71		
A (OER)	E	2047-06-24T07:54:36.567		10.42	-9.55	136774.40	14.10		
F ring	E	2047-06-24T07:58:53.974		11.29	-10.40	140461.00	14.53		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-24T06:21:35.760  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MSO  
 Location : Mt. Stromlo Observatory  
 Latitude (deg) : -35.32000  
 E. Longitude (deg) : 149.00833  
 Altitude (km) : 0.770  
 Gaia source ID : 4069867613342031872  
 2Mass ID (if available) : 18021868-2221592  
 ICRS Star Coord at Epoch: 18h 02m 18.69103s -22:21:59.33978s  
 RUWE (>1.4 is poor) : 1.45  
 K magnitude : 9.016  
 G magnitude : 13.627  
 RP magnitude : 12.448  
 BP magnitude : 15.113  
 DUPflag : 0  
 Distance (au) : 9.030  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -20.18  
 Sun-Target sep (deg) : 178.15  
 Sun-Moon sep (deg) : 169.42  
 B (ring opening deg) : 26.45  
 PA of pole (deg) : 5.56  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 7.105  
 C/A sky separation (km) : 46532.2  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 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
F ring	I	2047-06-24T05:21:20.199		-15.27x	15.43x	140461.00	-14.21		
A (OER)	I	2047-06-24T05:25:43.444		-14.60x	14.79x	136774.40	-13.79		
Encke (OEG)	I	2047-06-24T05:29:26.242		-14.03x	14.23x	133744.89	-13.40		
Encke (IEG)	I	2047-06-24T05:29:50.276		-13.97x	14.17x	133423.31	-13.36		
A (IER)	I	2047-06-24T05:45:03.954		-11.56x	11.84x	122050.38	-11.45		
B (OER)	I	2047-06-24T05:51:53.265	b	-10.45x	10.76x	117571.16	-10.42		
Saturn	I	2047-06-24T05:50:45.989		-10.64x	10.94x	59441.91		-49.95	-55.29
Saturn	E	2047-06-24T06:52:43.298		0.08x	0.47x	59719.35		-38.43	-44.03
B (OER)	E	2047-06-24T07:28:02.406		6.64	-5.96	117571.16	10.53		
A (IER)	E	2047-06-24T07:34:47.053		7.92	-7.22	122050.38	11.59		
Encke (IEG)	E	2047-06-24T07:49:49.321		10.80	-10.06	133423.31	13.54		
Encke (OEG)	E	2047-06-24T07:50:13.033		10.87	-10.13	133744.89	13.58		
A (OER)	E	2047-06-24T07:53:52.792		11.58	-10.83	136774.40	13.98		
F ring	E	2047-06-24T07:58:12.307		12.42	-11.65	140461.00	14.42		