

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:20:05.250  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270

ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s

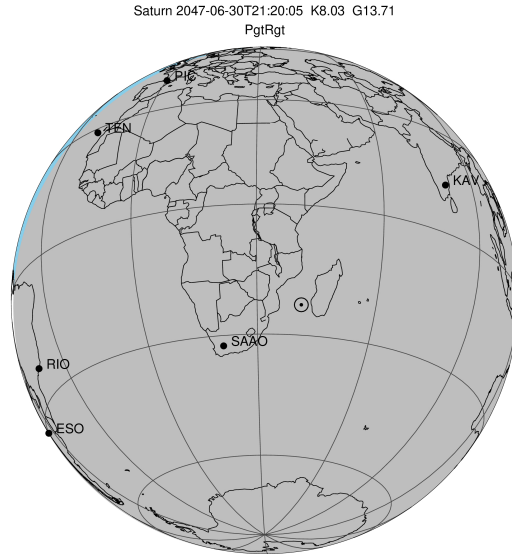
RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.78  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52

# 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

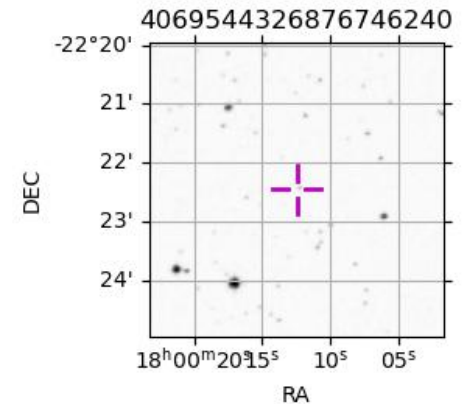
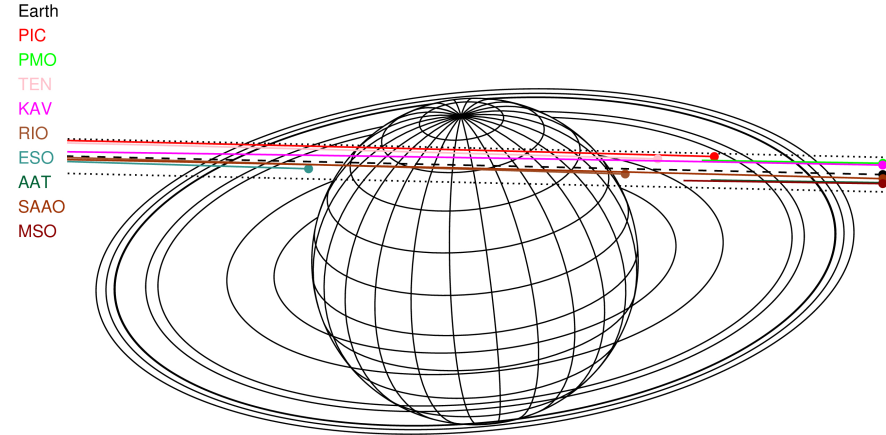
Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEcode
PIC	Pic du Midi	42.9	0.1		++	+++++	JUN 30 20:45 - JUN 30 22:33	PieRne
PAL	Palomar Mt (20	33.4	243.1					PnnRnn
PMO	Purple Mtn Obs	32.1	118.8	+++++			JUN 30 19:30 - JUN 30 19:55	PnnRin
KPNO	Kitt Peak Natl	32.0	248.4					PnnRnn
MCD	McDonald Obs.	30.7	256.0					PnnRnn
TEN	Teide Obs./Ten	28.3	343.5	+	++	+++++	JUN 30 20:43 - JUN 30 22:36	PieRie
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observ	12.6	78.8	+++++	++	+++++	JUN 30 19:32 - JUN 30 22:34	PieRie
RIO	Rio de Janeiro	-22.9	316.8		++	+++++	JUN 30 20:43 - JUN 30 22:47	PieRne
ESO	European South	-29.3	289.3			+++++	JUN 30 22:28 - JUN 30 22:50	PnnRne
AAT	Siding Spring	-31.3	149.1	+++++			JUN 30 19:24 - JUN 30 19:46	PnnRin
SAAO	So. Afr. Astro	-32.4	20.8	+++++	++	+++++	JUN 30 19:32 - JUN 30 22:43	PieRie
MSO	Mt. Stromlo Ob	-35.3	149.0	+++++			JUN 30 19:24 - JUN 30 19:46	PnnRin

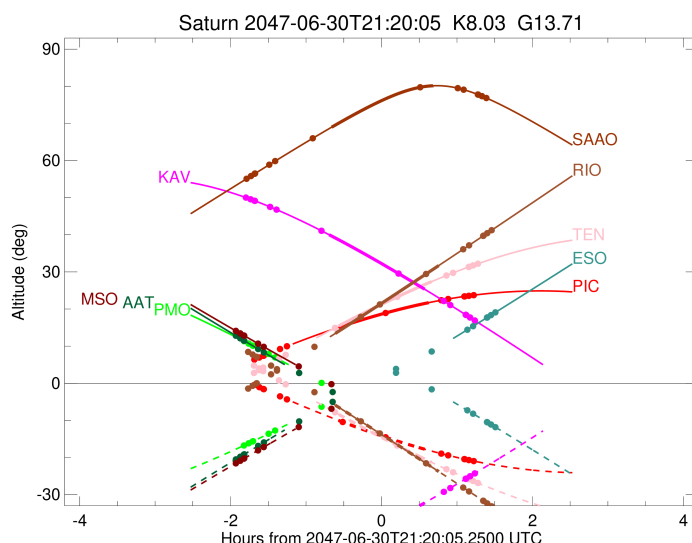
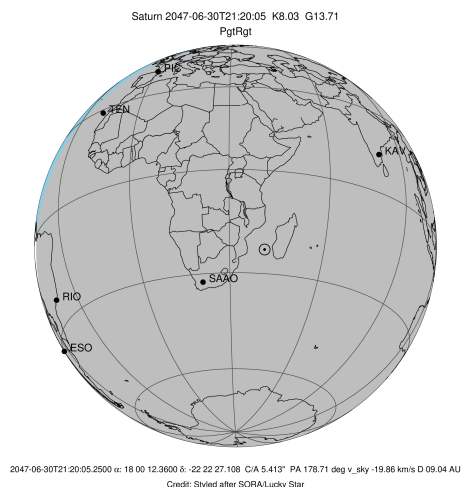


2047-06-30T21:20:05.2500 at: 18 00 12.3600 s: -22 22 27.108 C/A 5.413° PA 178.71 deg v\_sky -19.86 km/s D 09.04 AU  
 Credit: Styled after SORA/Lucky Star

Saturn 2047-06-30T21:20:05 K8.03 G13.71 PgtRgt

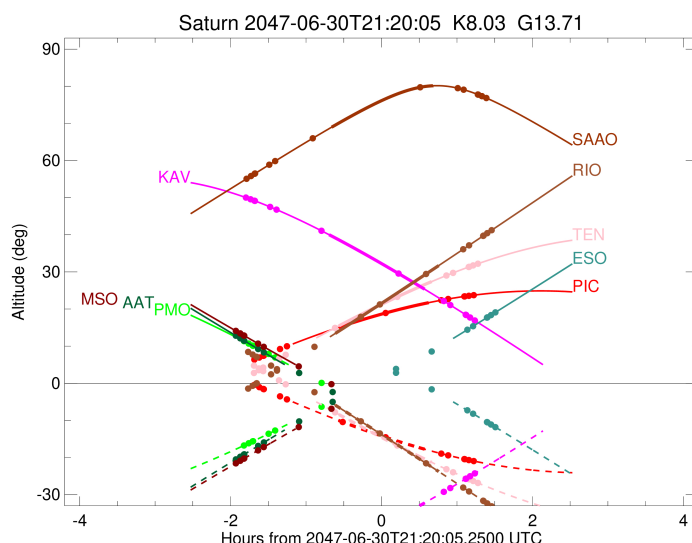
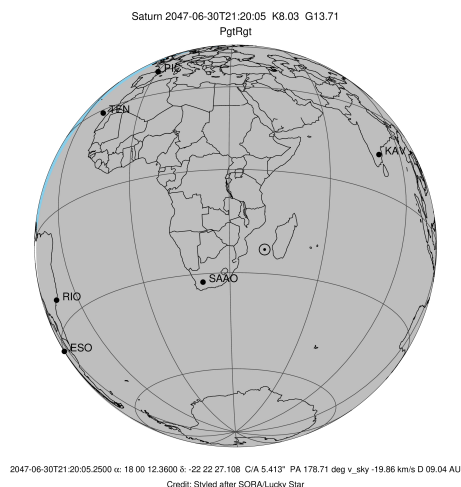


target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:21:53.670  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 80.04  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 6.266  
 C/A sky separation (km) : 41076.4  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2047-06-30T19:38:56.377		6.36	-0.43x	140461.00	-15.91		
A (OER)	I	2047-06-30T19:42:50.294		6.92	-1.03x	136774.40	-15.61		
Encke (OEG)	I	2047-06-30T19:46:06.027		7.38	-1.53x	133744.89	-15.34		
Encke (IEG)	I	2047-06-30T19:46:27.008		7.43	-1.58x	133423.31	-15.31		
A (IER)	I	2047-06-30T19:59:20.225		9.22	-3.52x	122050.38	-14.05		
B (OER)	I	2047-06-30T20:04:46.449		9.95	-4.31x	117571.16	-13.40		
B (IER)	I	2047-06-30T20:49:06.248	b	15.42	-10.42	91984.69	-4.77		
Saturn	I	2047-06-30T20:45:50.391		15.05	-10.00	59864.78		32.04	37.38
Saturn	E	2047-06-30T21:57:35.445		21.71	-18.06	59589.35		43.68	49.27
B (IER)	E	2047-06-30T21:23:14.784	b	18.92	-14.54	91984.69	4.75		
B (OER)	E	2047-06-30T22:07:38.636		22.37	-18.96	117571.16	13.42		
A (IER)	E	2047-06-30T22:13:04.214		22.70	-19.42	122050.38	14.08		
Encke (IEG)	E	2047-06-30T22:25:55.254		23.39	-20.43	133423.31	15.36		
Encke (OEG)	E	2047-06-30T22:26:16.164		23.41	-20.45	133744.89	15.39		
A (OER)	E	2047-06-30T22:29:31.219		23.56	-20.69	136774.40	15.67		
F ring	E	2047-06-30T22:33:24.269		23.73	-20.96	140461.00	15.97		

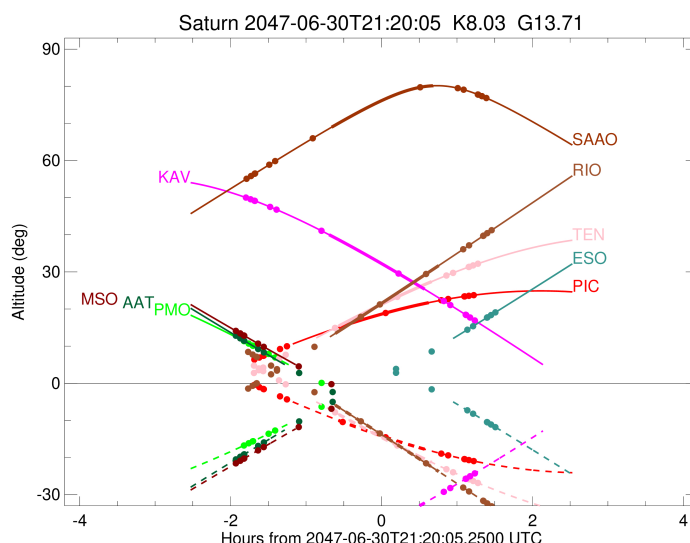
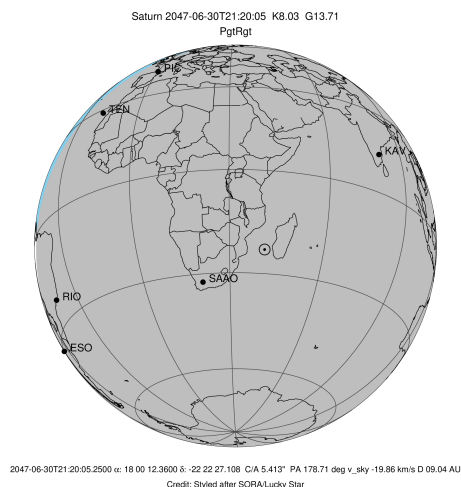
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:15:43.800  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PMO  
 Location : Purple Mtn Obs. Nanking  
 Latitude (deg) : 32.06667  
 E. Longitude (deg) : 118.82089  
 Altitude (km) : 0.364  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.78  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.888  
 C/A sky separation (km) : 38602.2  
 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	2047-06-30T19:30:40.197		11.36	-16.77	140461.00	-16.42		
A (OER)	I	2047-06-30T19:34:26.549		10.70	-16.17	136774.40	-16.15		
Encke (OEG)	I	2047-06-30T19:37:35.429		10.15	-15.67	133744.89	-15.92		
Encke (IEG)	I	2047-06-30T19:37:55.644		10.09	-15.62	133423.31	-15.90		
A (IER)	I	2047-06-30T19:50:15.361		7.90	-13.61	122050.38	-14.81		
B (OER)	I	2047-06-30T19:55:23.432		6.98	-12.75	117571.16	-14.26		
B (IER)	I	2047-06-30T20:32:20.652		0.12x	-6.34	91984.69	-8.07		
Saturn	I	2047-06-30T20:37:23.389		-0.84x	-5.43	59913.09		29.83	35.01
Saturn	E	2047-06-30T21:53:55.491		-16.01x	9.09x	59663.87		40.62	46.24
B (IER)	E	2047-06-30T21:31:41.924	b	-11.51x	4.75x	91984.69	7.99		
B (OER)	E	2047-06-30T22:09:02.576		-19.10x	12.09x	117571.16	14.09		
A (IER)	E	2047-06-30T22:14:14.409		-20.17x	13.13x	122050.38	14.62		
Encke (IEG)	E	2047-06-30T22:26:43.988		-22.76x	15.64x	133423.31	15.67		
Encke (OEG)	E	2047-06-30T22:27:04.489		-22.83x	15.71x	133744.89	15.70		
A (OER)	E	2047-06-30T22:30:16.096		-23.49x	16.36x	136774.40	15.92		
F ring	E	2047-06-30T22:34:05.825		-24.29x	17.13x	140461.00	16.17		

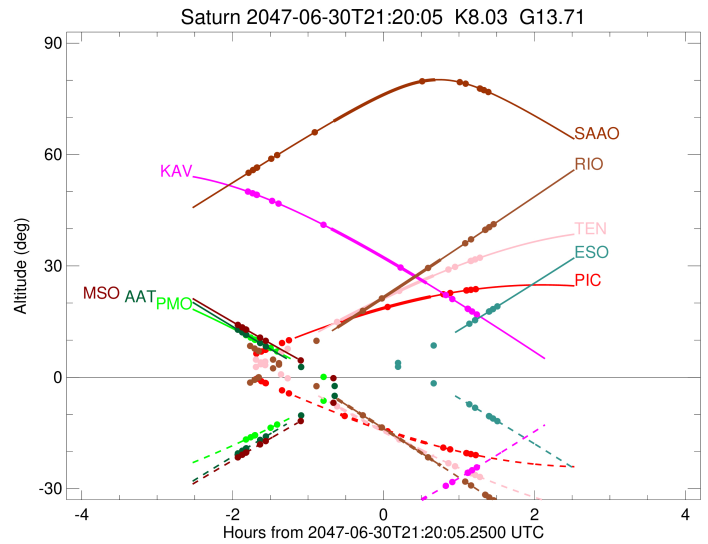
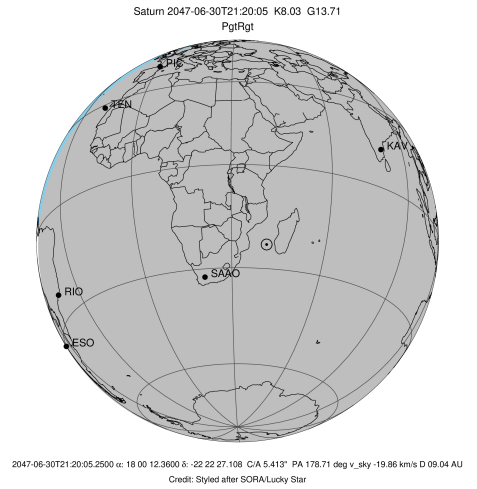
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:23:17.460  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 80.04  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 6.075  
 C/A sky separation (km) : 39828.1  
 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\_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	2047-06-30T19:38:37.771		2.77x	4.77x	140461.00	-16.20		
A (OER)	I	2047-06-30T19:42:27.167		3.52x	4.00x	136774.40	-15.93		
Encke (OEG)	I	2047-06-30T19:45:38.740		4.14x	3.36x	133744.89	-15.69		
Encke (IEG)	I	2047-06-30T19:45:59.252		4.21x	3.29x	133423.31	-15.66		
A (IER)	I	2047-06-30T19:58:31.556		6.63	0.79x	122050.38	-14.52		
B (OER)	I	2047-06-30T20:03:46.234		7.63	-0.25x	117571.16	-13.94		
B (IER)	I	2047-06-30T20:43:01.565		14.89	-7.82	91984.69	-6.91		
Saturn	I	2047-06-30T20:46:12.515		15.46	-8.41	59898.30		30.52	35.75
Saturn	E	2047-06-30T21:59:58.792		27.39	-21.31	59618.78		42.48	48.09
B (IER)	E	2047-06-30T21:32:32.683	b	23.26	-16.75	91984.69	6.90		
B (OER)	E	2047-06-30T22:11:44.940		29.03	-23.16	117571.16	14.01		
A (IER)	E	2047-06-30T22:16:57.874		29.73	-23.96	122050.38	14.61		
Encke (IEG)	E	2047-06-30T22:29:25.117		31.32	-25.81	133423.31	15.78		
Encke (OEG)	E	2047-06-30T22:29:45.475		31.36	-25.86	133744.89	15.81		
A (OER)	E	2047-06-30T22:32:55.570		31.75	-26.32	136774.40	16.06		
F ring	E	2047-06-30T22:36:43.105		32.20	-26.86	140461.00	16.34		

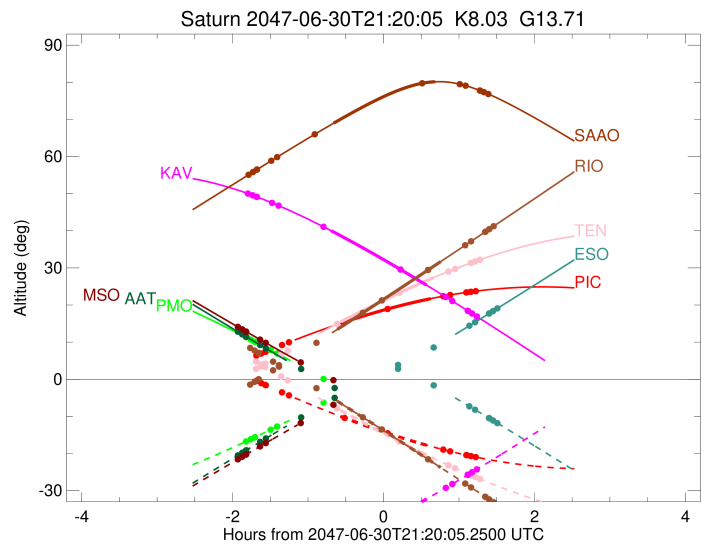
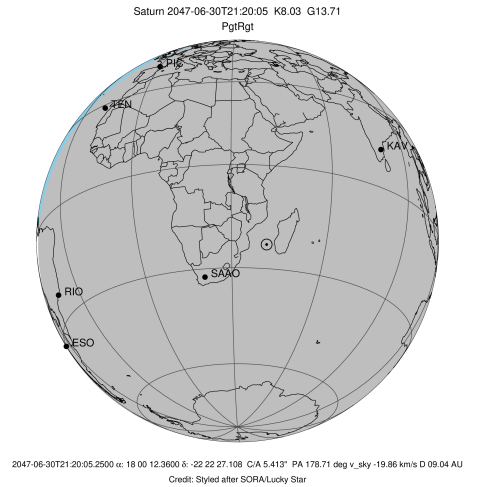
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:16:28.170  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 80.43  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.840  
 C/A sky separation (km) : 38285.9  
 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	2047-06-30T19:32:14.270		50.03	-52.80	140461.00	-16.68		
A (OER)	I	2047-06-30T19:35:56.948		49.57	-52.52	136774.40	-16.43		
Encke (OEG)	I	2047-06-30T19:39:02.668		49.18	-52.28	133744.89	-16.20		
Encke (IEG)	I	2047-06-30T19:39:22.538		49.14	-52.26	133423.31	-16.17		
A (IER)	I	2047-06-30T19:51:28.815		47.51	-51.18	122050.38	-15.10		
B (OER)	I	2047-06-30T19:56:30.689		46.79	-50.67	117571.16	-14.57		
B (IER)	I	2047-06-30T20:32:16.934		41.09	-46.24	91984.69	-8.55		
Saturn	I	2047-06-30T20:38:25.150		40.02	-45.35	59921.92		29.42	34.57
Saturn	E	2047-06-30T21:54:21.291		25.34	-32.23	59671.20		40.32	45.93
B (IER)	E	2047-06-30T21:33:33.347	b	29.58	-36.14	91984.69	8.47		
B (OER)	E	2047-06-30T22:09:40.736		22.15	-29.24	117571.16	14.41		
A (IER)	E	2047-06-30T22:14:45.987		21.07	-28.23	122050.38	14.93		
Encke (IEG)	E	2047-06-30T22:27:01.109		18.47	-25.76	133423.31	15.96		
Encke (OEG)	E	2047-06-30T22:27:21.237		18.39	-25.69	133744.89	15.99		
A (OER)	E	2047-06-30T22:30:29.401		17.72	-25.05	136774.40	16.21		
F ring	E	2047-06-30T22:34:15.107		16.91	-24.28	140461.00	16.45		

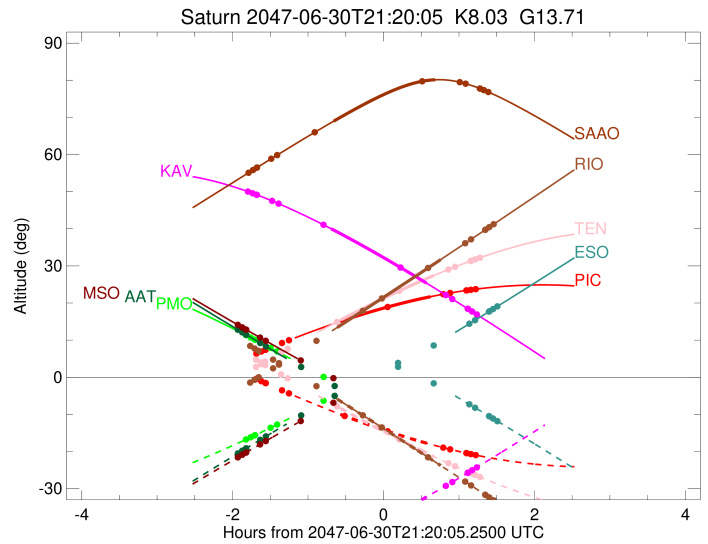
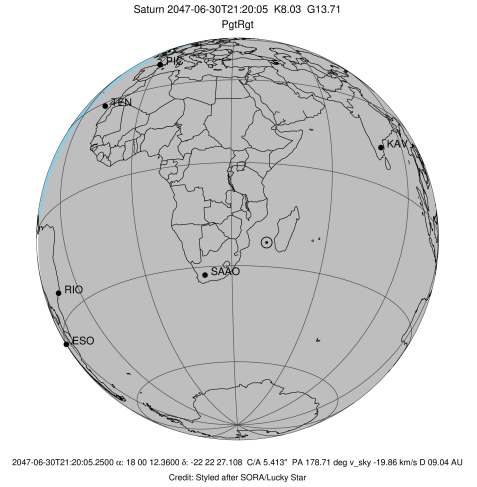
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:24:38.740  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : RIO  
 Location : Rio de Janeiro  
 Latitude (deg) : -22.89506  
 E. Longitude (deg) : 316.77708  
 Altitude (km) : 0.033  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.98  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.184  
 C/A sky separation (km) : 33986.7  
 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	2047-06-30T19:34:02.807	-1.44x	8.45x	140461.00	-17.36			
A (OER)	I	2047-06-30T19:37:36.215	-0.69x	7.74x	136774.40	-17.19			
Encke (OEG)	I	2047-06-30T19:40:33.309	-0.07x	7.14x	133744.89	-17.03			
Encke (IEG)	I	2047-06-30T19:40:52.205	-0.00x	7.08x	133423.31	-17.01			
A (IER)	I	2047-06-30T19:52:14.902	2.40x	4.77x	122050.38	-16.27			
B (OER)	I	2047-06-30T19:56:53.171	3.39x	3.82x	117571.17	-15.91			
B (IER)	I	2047-06-30T20:26:43.326	9.80	-2.39x	91984.69	-12.21			
C (IER)	I	2047-06-30T21:03:43.907	b	17.90	-10.27	74490.58	-2.50		
Saturn	I	2047-06-30T20:43:17.849		13.41	-5.89	60026.41		24.19	28.81
Saturn	E	2047-06-30T22:05:34.639		31.70	-23.78	59758.15		36.68	42.24
C (IER)	E	2047-06-30T21:18:24.102	b	21.15	-13.44	74490.58	2.49		
B (IER)	E	2047-06-30T21:55:27.878	b	29.43	-21.55	91984.69	12.26		
B (OER)	E	2047-06-30T22:25:04.538		36.11	-28.11	117571.16	16.08		
A (IER)	E	2047-06-30T22:29:39.754		37.15	-29.13	122050.38	16.46		
Encke (IEG)	E	2047-06-30T22:40:54.069		39.69	-31.64	133423.31	17.24		
Encke (OEG)	E	2047-06-30T22:41:12.716		39.76	-31.71	133744.89	17.25		
A (OER)	E	2047-06-30T22:44:07.430		40.43	-32.36	136774.40	17.42		
F ring	E	2047-06-30T22:47:37.865		41.22	-33.15	140461.00	17.61		

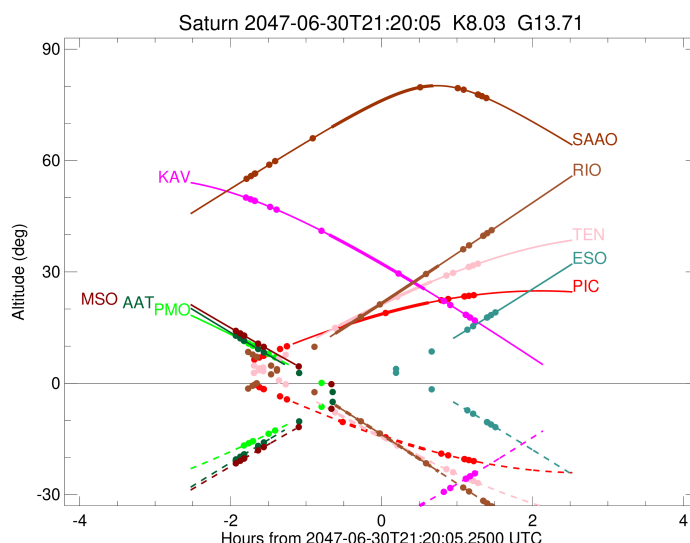
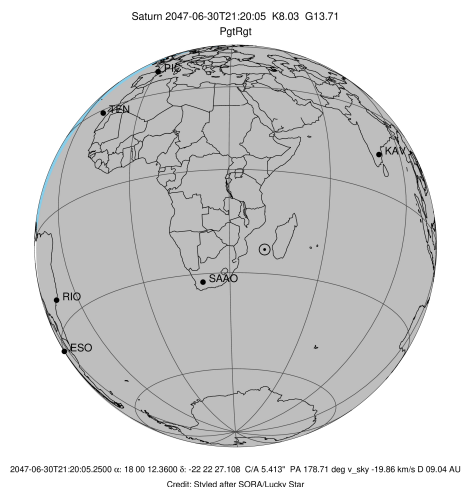
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:24:31.960  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : ESO  
 Location : European Southern Obs. (3.6m)  
 Latitude (deg) : -29.26097  
 E. Longitude (deg) : 289.26831  
 Altitude (km) : 2.400  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.63  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.935  
 C/A sky separation (km) : 32354.5  
 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	2047-06-30T19:31:51.270		-19.34x	24.37x	140461.00	-17.52		
A (OER)	I	2047-06-30T19:35:22.653		-18.76x	23.85x	136774.40	-17.36		
Encke (OEG)	I	2047-06-30T19:38:17.852		-18.27x	23.42x	133744.89	-17.22		
Encke (IEG)	I	2047-06-30T19:38:36.533		-18.22x	23.37x	133423.31	-17.21		
A (IER)	I	2047-06-30T19:49:49.562		-16.31x	21.67x	122050.38	-16.56		
B (OER)	I	2047-06-30T19:54:22.593		-15.52x	20.96x	117571.16	-16.24		
B (IER)	I	2047-06-30T20:23:04.031		-10.38x	16.27x	91984.69	-13.09		
C (IER)	I	2047-06-30T20:51:35.248	b	-5.03x	11.29x	74490.58	-6.67		
Saturn	I	2047-06-30T20:41:50.130		-6.88x	13.02x	60056.16		22.56	26.96
Saturn	E	2047-06-30T22:06:49.010		9.96	-2.98x	59794.88		35.11	40.62
C (IER)	E	2047-06-30T21:31:25.991	b	2.78x	3.90x	74490.58	6.64		
B (IER)	E	2047-06-30T21:59:56.322	b	8.55	-1.62x	91984.69	13.16		
B (OER)	E	2047-06-30T22:28:22.584		14.42	-7.29	117571.16	16.44		
A (IER)	E	2047-06-30T22:32:52.324		15.36	-8.20	122050.38	16.77		
Encke (IEG)	E	2047-06-30T22:43:56.360		17.68	-10.45	133423.31	17.45		
Encke (OEG)	E	2047-06-30T22:44:14.775		17.75	-10.51	133744.89	17.47		
A (OER)	E	2047-06-30T22:47:07.427		18.35	-11.10	136774.40	17.62		
F ring	E	2047-06-30T22:50:35.634		19.09	-11.81	140461.00	17.79		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:16:14.940  
 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 : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.74  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.789  
 C/A sky separation (km) : 31393.2  
 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

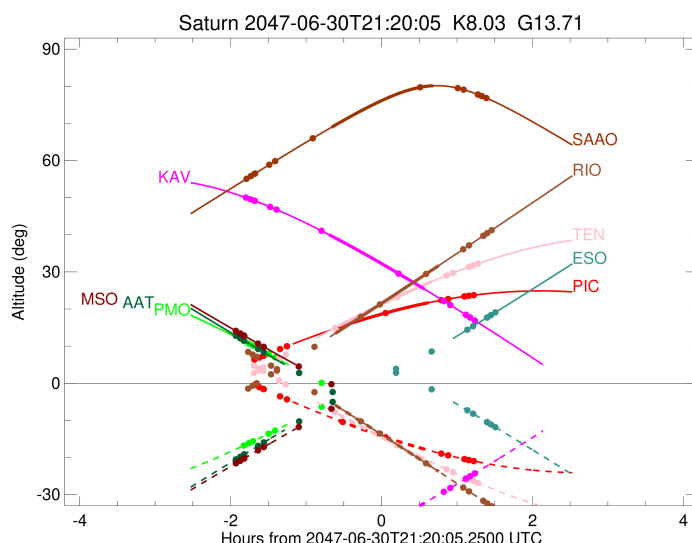
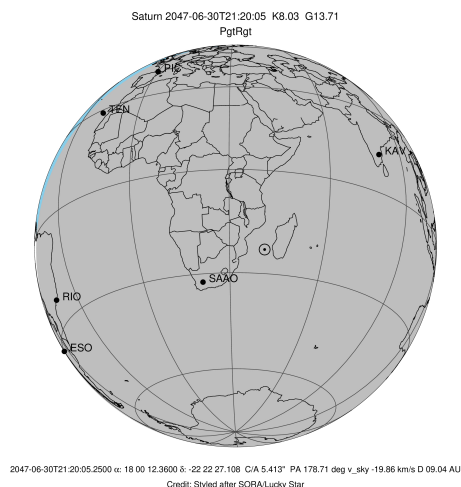


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2047-06-30T19:24:16.657		12.81	-20.52	140461.00	-17.77		
A (OER)	I	2047-06-30T19:27:45.055		12.11	-19.80	136774.40	-17.61		
Encke (OEG)	I	2047-06-30T19:30:37.772		11.53	-19.21	133744.89	-17.47		
Encke (IEG)	I	2047-06-30T19:30:56.188		11.46	-19.14	133423.31	-17.45		
A (IER)	I	2047-06-30T19:41:59.443		9.23	-16.88	122050.38	-16.81		
B (OER)	I	2047-06-30T19:46:28.301		8.33	-15.96	117571.16	-16.50		
B (IER)	I	2047-06-30T20:14:34.328		2.78x	-10.29	91984.69	-13.49		
C (IER)	I	2047-06-30T20:41:13.434	b	-2.35x	-5.01	74490.58	-7.80		
Saturn	I	2047-06-30T20:32:58.545		-0.78x	-6.63	60059.99		22.34	26.72
Saturn	E	2047-06-30T21:59:26.739		-16.31x	9.59x	59831.95		33.50	38.93
C (IER)	E	2047-06-30T21:28:33.103	b	-11.03x	4.00x	74490.58	7.72		
B (IER)	E	2047-06-30T21:55:27.594	b	-15.65x	8.89x	91984.69	13.37		
B (OER)	E	2047-06-30T22:23:50.670		-20.20x	13.79x	117571.16	16.31		
A (IER)	E	2047-06-30T22:28:22.696		-20.90x	14.55x	122050.38	16.61		
Encke (IEG)	E	2047-06-30T22:39:34.389		-22.57x	16.39x	133423.31	17.22		
Encke (OEG)	E	2047-06-30T22:39:53.053		-22.61x	16.44x	133744.89	17.24		
A (OER)	E	2047-06-30T22:42:48.121		-23.04x	16.91x	136774.40	17.37		
F ring	E	2047-06-30T22:46:19.439		-23.54x	17.47x	140461.00	17.52		



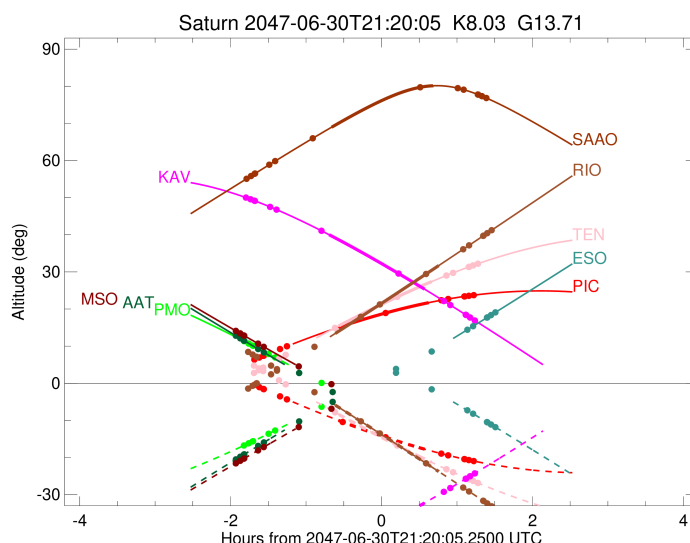
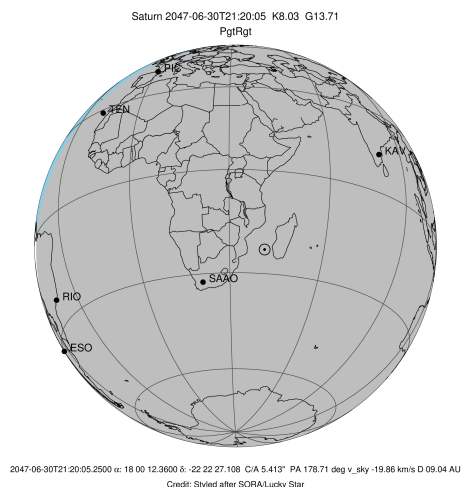
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:20:56.310  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : SAAO  
 Location : So. Afr. Astro. Obs. (Sutherland)  
 Latitude (deg) : -32.37953  
 E. Longitude (deg) : 20.81070  
 Altitude (km) : 1.768  
 Gaia source ID : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 80.70  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 5.246  
 C/A sky separation (km) : 34393.4  
 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	2047-06-30T19:32:46.699		55.08	-47.80	140461.00	-17.54		
A (OER)	I	2047-06-30T19:36:18.010		55.82	-48.54	136774.40	-17.35		
Encke (OEG)	I	2047-06-30T19:39:13.471		56.43	-49.16	133744.89	-17.18		
Encke (IEG)	I	2047-06-30T19:39:32.199		56.50	-49.23	133423.31	-17.16		
A (IER)	I	2047-06-30T19:50:49.720		58.87	-51.61	122050.38	-16.38		
B (OER)	I	2047-06-30T19:55:26.470		59.83	-52.59	117571.16	-15.99		
B (IER)	I	2047-06-30T20:25:22.100		65.98	-58.88	91984.69	-12.02		
Saturn	I	2047-06-30T20:40:25.378		68.98	-62.02	60012.46		24.93	29.63
Saturn	E	2047-06-30T22:01:10.597		80.15	-77.43	59756.86		36.74	42.30
B (IER)	E	2047-06-30T21:50:47.387	b	79.73	-75.75	91984.69	11.99		
B (OER)	E	2047-06-30T22:20:45.393		79.49	-79.92	117571.16	15.98		
A (IER)	E	2047-06-30T22:25:22.231		79.09	-80.32	122050.38	16.37		
Encke (IEG)	E	2047-06-30T22:36:39.839		77.79	-80.88	133423.31	17.16		
Encke (OEG)	E	2047-06-30T22:36:58.568		77.75	-80.88	133744.89	17.18		
A (OER)	E	2047-06-30T22:39:54.028		77.35	-80.92	136774.40	17.35		
F ring	E	2047-06-30T22:43:25.329		76.85	-80.89	140461.00	17.54		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-06-30T21:16:25.890  
 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 : 4069544326876746240  
 2Mass ID (if available) : 18001236-2222270  
 ICRS Star Coord at Epoch: 18h 00m 12.35998s -22:22:27.10840s  
 RUWE (>1.4 is poor) : 1.04  
 K magnitude : 8.026  
 G magnitude : 13.706  
 RP magnitude : 12.362  
 BP magnitude : 15.866  
 DUPflag : 0  
 Distance (au) : 9.039  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -19.86  
 Sun-Target sep (deg) : 171.61  
 Sun-Moon sep (deg) : 79.78  
 B (ring opening deg) : 26.50  
 PA of pole (deg) : 5.52  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.743  
 C/A sky separation (km) : 31094.8  
 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	2047-06-30T19:24:16.267		14.12	-21.58	140461.00	-17.82		
A (OER)	I	2047-06-30T19:27:43.991		13.44	-20.89	136774.40	-17.67		
Encke (OEG)	I	2047-06-30T19:30:36.110		12.88	-20.32	133744.89	-17.53		
Encke (IEG)	I	2047-06-30T19:30:54.461		12.82	-20.26	133423.31	-17.52		
A (IER)	I	2047-06-30T19:41:55.020		10.69	-18.09	122050.38	-16.89		
B (OER)	I	2047-06-30T19:46:22.570		9.83	-17.22	117571.16	-16.59		
B (IER)	I	2047-06-30T20:14:15.243		4.55x	-11.81	91984.69	-13.66		
C (IER)	I	2047-06-30T20:40:14.271	b	-0.24x	-6.87	74490.58	-8.22		
Saturn	I	2047-06-30T20:33:00.817		1.08x	-8.23	60065.42		22.03	26.36
Saturn	E	2047-06-30T21:59:46.133		-13.72x	7.31x	59838.14		33.23	38.64
C (IER)	E	2047-06-30T21:30:04.935	b	-8.93x	2.20x	74490.58	8.13		
B (IER)	E	2047-06-30T21:56:18.513	b	-13.18x	6.72x	91984.69	13.54		
B (OER)	E	2047-06-30T22:24:27.476		-17.43x	11.33x	117571.16	16.41		
A (IER)	E	2047-06-30T22:28:58.055		-18.08x	12.04x	122050.38	16.70		
Encke (IEG)	E	2047-06-30T22:40:06.680		-19.63x	13.77x	133423.31	17.29		
Encke (OEG)	E	2047-06-30T22:40:25.266		-19.67x	13.82x	133744.89	17.31		
A (OER)	E	2047-06-30T22:43:19.634		-20.07x	14.26x	136774.40	17.44		
F ring	E	2047-06-30T22:46:50.149		-20.54x	14.78x	140461.00	17.58		