

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:59:22.680  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118

Saturn 2029-12-30T11:59:22 K9.71 G11.50 PgtRgt

ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44964s

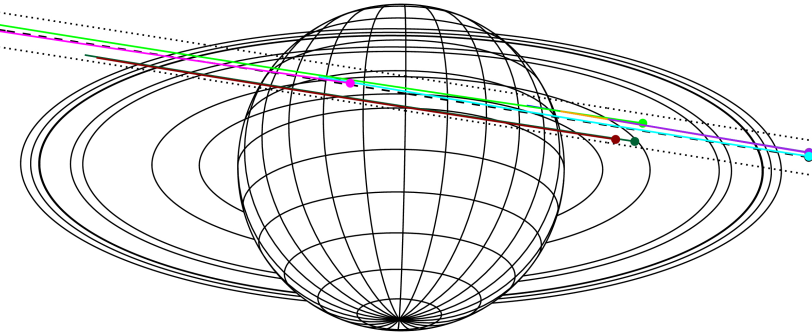
RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 166.61  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69

#	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



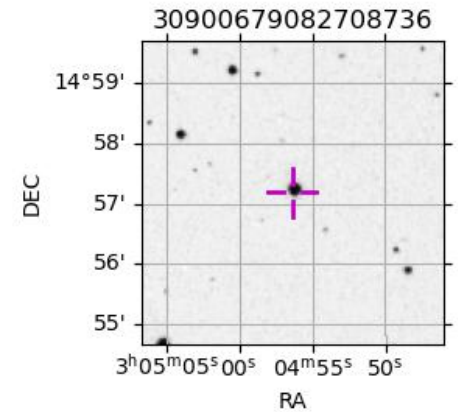
2029-12-30T11:59:22.6800 α: 03 04 56.3377 δ: +14 57 10.450 C/A 4.434° PA 171.04 deg v\_sky - 9.27 km/s D 08.47 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PAL  
 PMO  
 KPNO  
 MCD  
 IRTF  
 KAV  
 AAT  
 MSO

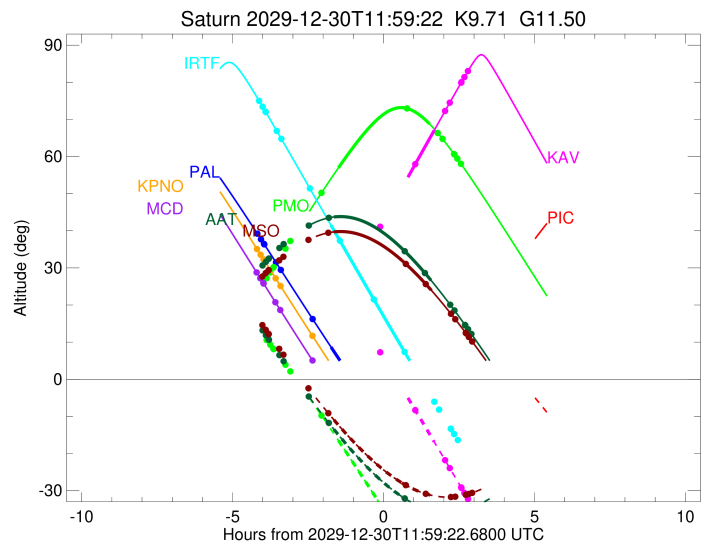
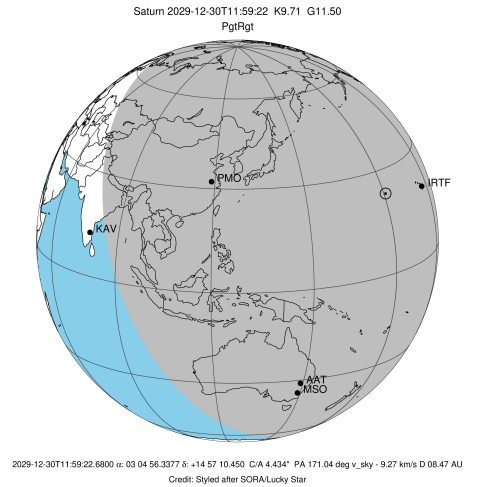


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

Obs	Location	lat	Elon	Rings I	Planet	Rings E	Observed Events Interval	OEncode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (20	33.4	243.1	+ + + + +	+		DEC 30 07:48 - DEC 30 10:15	PinRin
PMO	Purple Mtn Obs	32.1	118.8		+		DEC 30 09:56 - DEC 30 14:33	PieRie
KPNO	Kitt Peak Natl	32.0	248.4	+ + + + +			DEC 30 07:47 - DEC 30 09:38	PnnRin
MCD	McDonald Obs.	30.7	256.0	+ + + + +			DEC 30 07:47 - DEC 30 09:38	PnnRin
TEN	Teide Obs./Ten	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5	+ + + + +	+		DEC 30 07:52 - DEC 30 10:14	PinRin
KAV	Kavalur Observ	12.6	78.8		+		DEC 30 13:39 - DEC 30 14:47	PneRne
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European South	-29.3	289.3					PnnRnn
AAT	Siding Spring	-31.3	149.1		+		DEC 30 10:10 - DEC 30 14:54	PieRie
SAAO	So. Afr. Astro	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Ob	-35.3	149.0		+		DEC 30 10:09 - DEC 30 14:55	PieRie



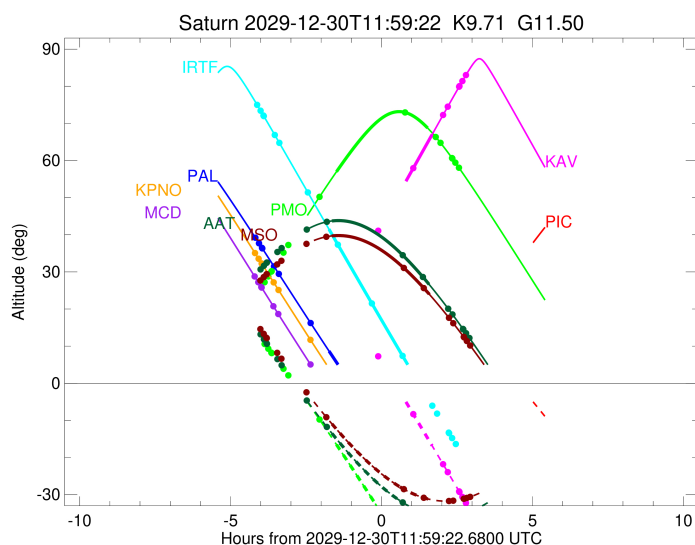
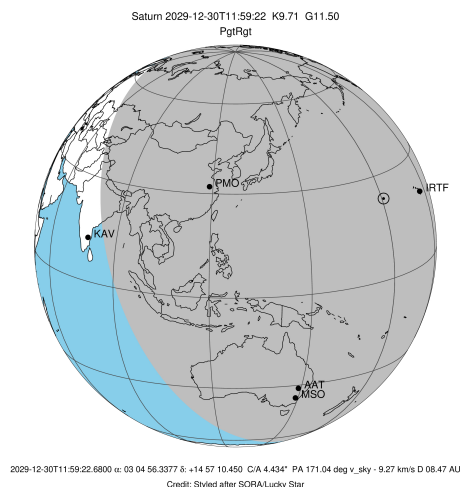
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:48:52.820  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.13  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.942  
 C/A sky separation (km) : 30356.0  
 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

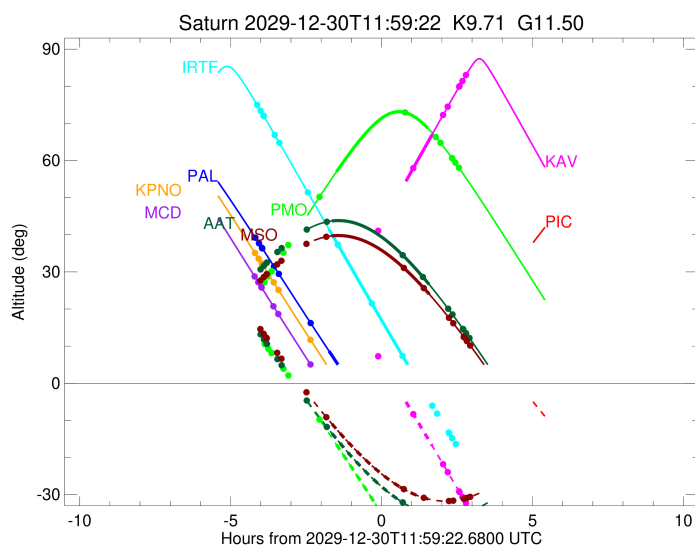
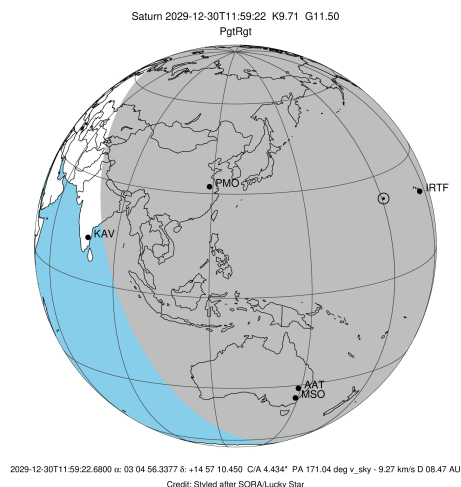
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T07:48:40.561		39.21	-79.95	140461.00	-8.62		
A (OER)	I	2029-12-30T07:55:51.177		37.71	-79.87	136774.40	-8.50		
Encke (OEG)	I	2029-12-30T08:01:49.445		36.47	-79.63	133744.89	-8.41		
Encke (IEG)	I	2029-12-30T08:02:27.725		36.33	-79.59	133423.31	-8.40		
A (IER)	I	2029-12-30T08:25:38.328		31.48	-77.26	122050.38	-7.94		
B (OER)	I	2029-12-30T08:35:10.041		29.48	-75.88	117571.16	-7.72		
B (IER)	I	2029-12-30T09:38:29.195		16.23	-64.17	91984.69	-5.49		
Saturn	I	2029-12-30T10:15:05.309		8.67	-56.68	60166.96		19.80	23.81
Saturn	E	2029-12-30T13:24:04.059		-26.53x	-17.59	59961.88		36.24	41.78
B (IER)	E	2029-12-30T12:25:20.350	b	-16.66x	-29.55	91984.69	5.26		
B (OER)	E	2029-12-30T13:32:06.009		-27.76x	-15.98	117571.16	7.25		
A (IER)	E	2029-12-30T13:42:16.008		-29.26x	-13.96	122050.38	7.43		
Encke (IEG)	E	2029-12-30T14:07:08.056		-32.68x	-9.08	133423.31	7.79		
Encke (OEG)	E	2029-12-30T14:07:49.295		-32.77x	-8.95	133744.89	7.80		
A (OER)	E	2029-12-30T14:14:15.674		-33.58x	-7.70	136774.40	7.88		
F ring	E	2029-12-30T14:22:01.083		-34.52x	-6.21	140461.00	7.96		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T12:00:41.010  
 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 : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44964s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 166.64  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.755  
 C/A sky separation (km) : 29206.8  
 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



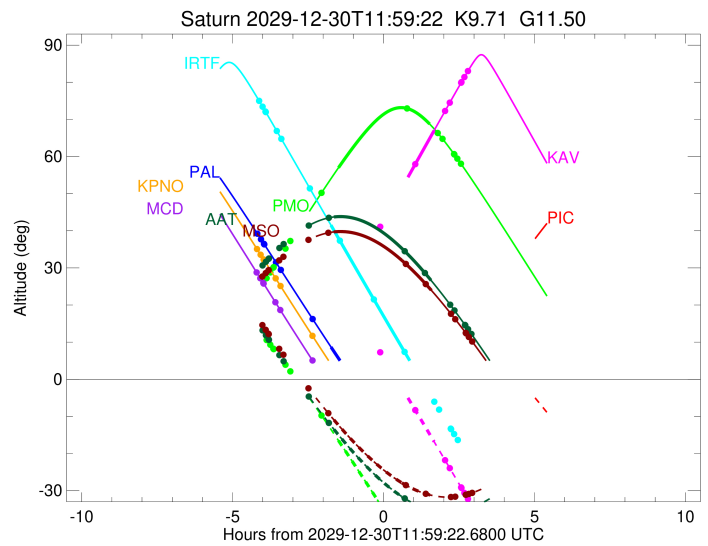
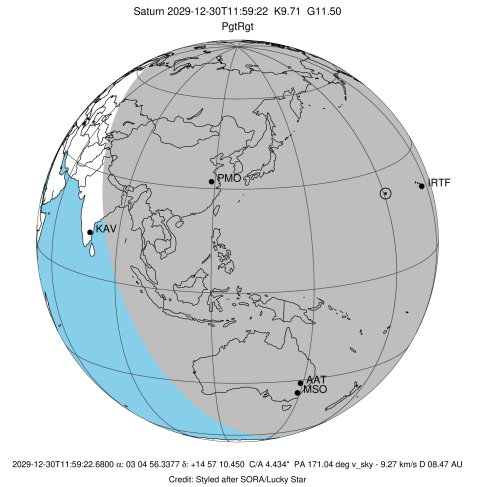
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T08:07:03.418		27.23	10.57x	140461.00	-8.43		
A (OER)	I	2029-12-30T08:14:22.758		28.78	9.30x	136774.40	-8.35		
Encke (OEG)	I	2029-12-30T08:20:27.322		30.08	8.24x	133744.89	-8.27		
Encke (IEG)	I	2029-12-30T08:21:06.222		30.21	8.12x	133423.31	-8.26		
A (IER)	I	2029-12-30T08:44:32.027		35.20	3.91x	122050.38	-7.90		
B (OER)	I	2029-12-30T08:54:05.570		37.23	2.15x	117571.16	-7.72		
B (IER)	I	2029-12-30T09:56:06.854		50.21	-9.76	91984.69	-5.78		
Saturn	I	2029-12-30T10:29:49.583		56.98	-16.51	60167.32		19.76	23.77
Saturn	E	2029-12-30T13:31:08.815		68.75	-54.47	59991.82		34.14	39.60
B (IER)	E	2029-12-30T12:46:19.176	b	72.95	-44.96	91984.69	5.81		
B (OER)	E	2029-12-30T13:47:32.696		66.28	-57.93	117571.16	7.86		
A (IER)	E	2029-12-30T13:56:55.285		64.72	-59.90	122050.38	8.06		
Encke (IEG)	E	2029-12-30T14:19:51.367		60.62	-64.68	133423.31	8.45		
Encke (OEG)	E	2029-12-30T14:20:29.392		60.50	-64.81	133744.89	8.46		
A (OER)	E	2029-12-30T14:26:25.625		59.38	-66.03	136774.40	8.55		
F ring	E	2029-12-30T14:33:34.631		58.01	-67.48	140461.00	8.64		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:49:06.520  
 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 : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.09  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.946  
 C/A sky separation (km) : 30378.6  
 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



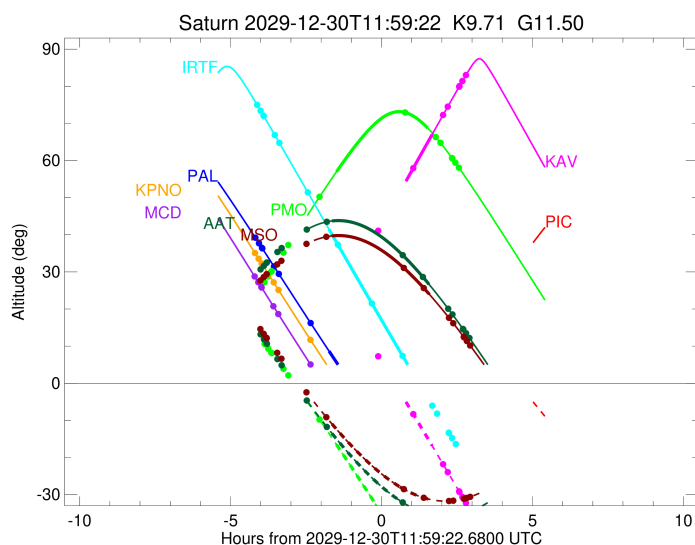
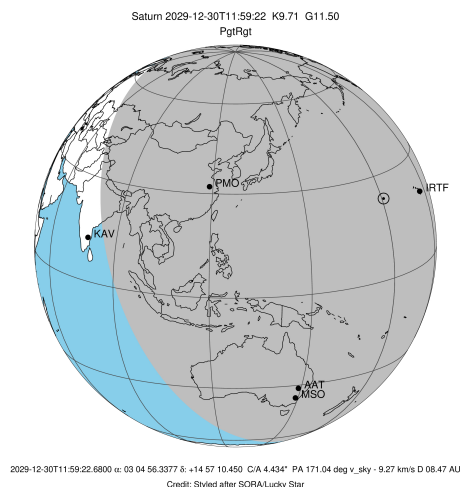
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T07:47:58.538		35.07	-80.37	140461.00	-8.60		
A (OER)	I	2029-12-30T07:55:10.039		33.54	-79.58	136774.40	-8.49		
Encke (OEG)	I	2029-12-30T08:01:09.083		32.26	-78.79	133744.89	-8.39		
Encke (IEG)	I	2029-12-30T08:01:47.449		32.13	-78.70	133423.31	-8.38		
A (IER)	I	2029-12-30T08:25:01.412		27.18	-74.87	122050.38	-7.92		
B (OER)	I	2029-12-30T08:34:34.664		25.14	-73.10	117571.16	-7.70		
B (IER)	I	2029-12-30T09:38:06.674		11.71	-60.20	91984.69	-5.47		
Saturn	I	2029-12-30T10:14:57.756		4.05x	-52.42	60167.02		19.79	23.80
Saturn	E	2029-12-30T13:24:37.961		-30.76x	-12.83	59961.48		36.27	41.81
B (IER)	E	2029-12-30T12:25:29.570	b	-21.17x	-24.89	91984.69	5.23		
B (OER)	E	2029-12-30T13:32:34.441		-31.91x	-11.24	117571.16	7.22		
A (IER)	E	2029-12-30T13:42:47.158		-33.32x	-9.21	122050.38	7.40		
Encke (IEG)	E	2029-12-30T14:07:45.628		-36.46x	-4.33x	133423.31	7.76		
Encke (OEG)	E	2029-12-30T14:08:27.039		-36.54x	-4.20x	133744.89	7.77		
A (OER)	E	2029-12-30T14:14:55.023		-37.27x	-2.96x	136774.40	7.85		
F ring	E	2029-12-30T14:22:42.333		-38.11x	-1.47x	140461.00	7.93		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:49:39.660  
 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 : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.01  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.963  
 C/A sky separation (km) : 30482.1  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T07:47:13.412		28.77	-76.91	140461.00	-8.56		
A (OER)	I	2029-12-30T07:54:27.082		27.21	-75.55	136774.40	-8.44		
Encke (OEG)	I	2029-12-30T08:00:28.014		25.91	-74.38	133744.89	-8.34		
Encke (IEG)	I	2029-12-30T08:01:06.586		25.77	-74.26	133423.31	-8.33		
A (IER)	I	2029-12-30T08:24:28.712		20.74	-69.53	122050.38	-7.87		
B (OER)	I	2029-12-30T08:34:05.734		18.68	-67.52	117571.16	-7.65		
B (IER)	I	2029-12-30T09:38:12.832		5.08	-53.84	91984.69	-5.40		
Saturn	I	2029-12-30T10:15:04.745		-2.55x	-45.91	60166.29		19.87	23.89
Saturn	E	2029-12-30T13:25:33.022		-36.05x	-6.14	59960.12		36.36	41.91
B (IER)	E	2029-12-30T12:25:21.436	b	-27.09x	-18.32	91984.69	5.16		
B (OER)	E	2029-12-30T13:33:07.430		-37.01x	-4.64x	117571.16	7.16		
A (IER)	E	2029-12-30T13:43:24.963		-38.23x	-2.63x	122050.38	7.34		
Encke (IEG)	E	2029-12-30T14:08:34.243		-40.82x	2.20x	133423.31	7.71		
Encke (OEG)	E	2029-12-30T14:09:15.935		-40.88x	2.33x	133744.89	7.72		
A (OER)	E	2029-12-30T14:15:46.507		-41.44x	3.55x	136774.40	7.79		
F ring	E	2029-12-30T14:23:36.832		-42.06x	5.01x	140461.00	7.88		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:48:10.620  
 Event type : PgtRgt  
 : Saturn 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 : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.48  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.557  
 C/A sky separation (km) : 27991.0  
 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

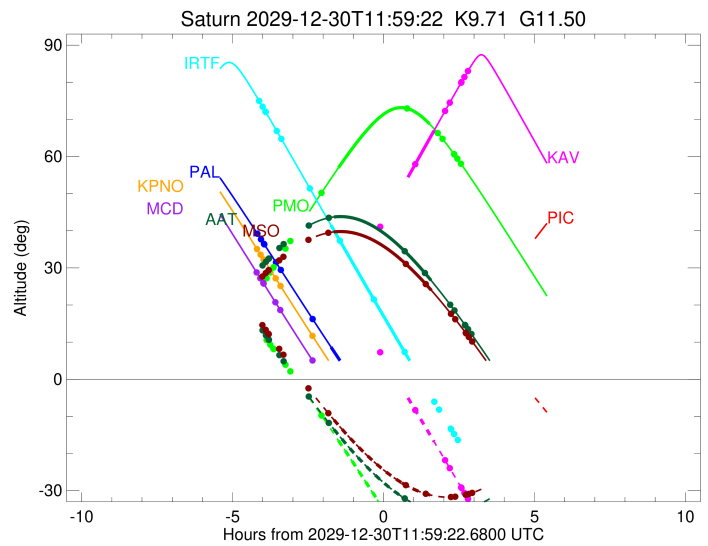
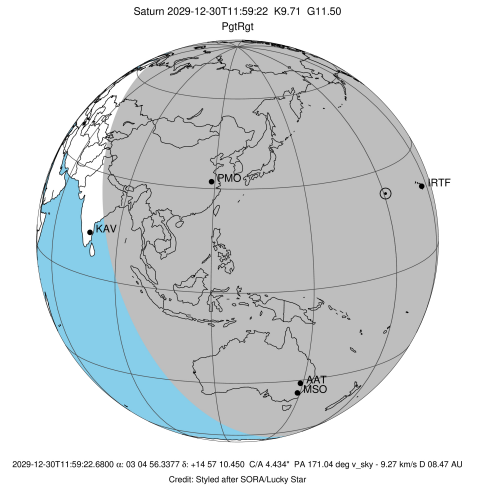


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T07:52:12.824		74.99	-54.51	140461.00	-9.00		
A (OER)	I	2029-12-30T07:59:04.532		73.42	-56.08	136774.40	-8.91		
Encke (OEG)	I	2029-12-30T08:04:46.046		72.11	-57.39	133744.89	-8.83		
Encke (IEG)	I	2029-12-30T08:05:22.479		71.97	-57.53	133423.31	-8.82		
A (IER)	I	2029-12-30T08:27:17.369		66.87	-62.57	122050.38	-8.46		
B (OER)	I	2029-12-30T08:36:12.323		64.79	-64.61	117571.16	-8.28		
B (IER)	I	2029-12-30T09:32:58.446		51.41	-77.54	91984.69	-6.53		
C (IER)	I	2029-12-30T10:32:36.208	b	37.35	-86.09	74490.58	-2.88		
Saturn	I	2029-12-30T10:14:48.716		41.54	-85.90	60186.93		17.66	21.32
Saturn	E	2029-12-30T13:23:07.096		-2.17x	-48.46	59996.07		33.84	39.29
C (IER)	E	2029-12-30T11:39:53.210	b	21.58	-72.14	74490.58	2.82		
B (IER)	E	2029-12-30T12:41:22.192	b	7.35	-58.04	91984.69	6.29		
B (OER)	E	2029-12-30T13:40:43.666		-6.13x	-44.42	117571.16	7.86		
A (IER)	E	2029-12-30T13:50:08.000		-8.23x	-42.27	122050.38	8.01		
Encke (IEG)	E	2029-12-30T14:13:21.249		-13.36x	-36.98	133423.31	8.30		
Encke (OEG)	E	2029-12-30T14:13:59.976		-13.50x	-36.83	133744.89	8.31		
A (OER)	E	2029-12-30T14:20:03.328		-14.83x	-35.45	136774.40	8.37		
F ring	E	2029-12-30T14:27:22.134		-16.42x	-33.79	140461.00	8.43		



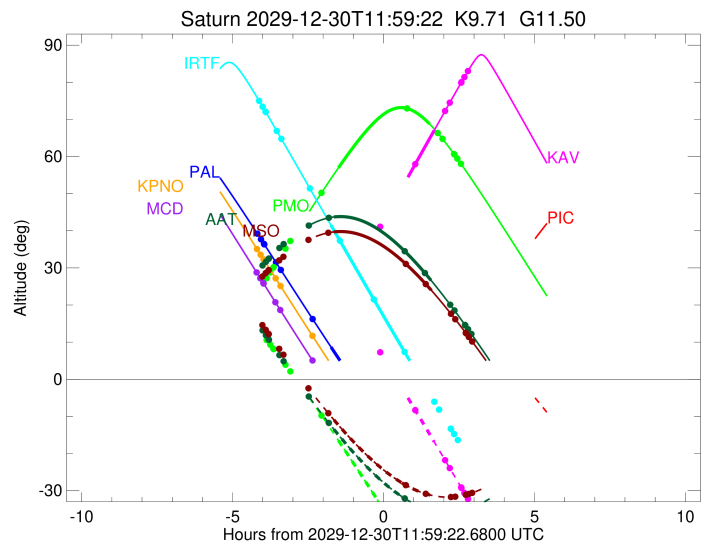
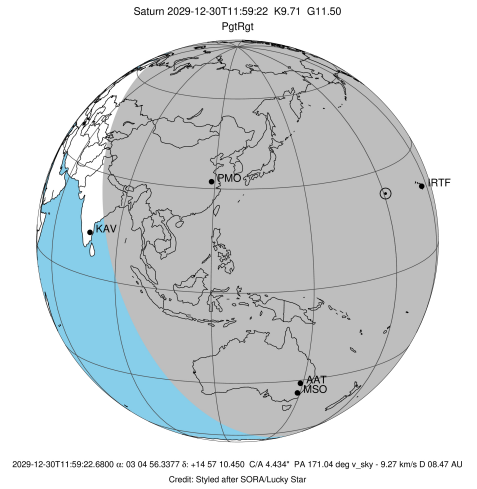
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T12:08:03.530  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : KAV  
 Location : Kavalur Observatory  
 Latitude (deg) : 12.57556  
 E. Longitude (deg) : 78.83167  
 Altitude (km) : 0.722  
 Gaia source ID : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44964s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 166.07  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 4.585  
 C/A sky separation (km) : 28160.3  
 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	2029-12-30T08:07:59.583		-12.46x	49.25x	140461.00	-8.25		
A (OER)	I	2029-12-30T08:15:28.538		-10.72x	48.34x	136774.40	-8.17		
Encke (OEG)	I	2029-12-30T08:21:40.702		-9.28x	47.53x	133744.89	-8.11		
Encke (IEG)	I	2029-12-30T08:22:20.391		-9.13x	47.44x	133423.31	-8.10		
A (IER)	I	2029-12-30T08:46:11.267		-3.54x	43.99x	122050.38	-7.78		
B (OER)	I	2029-12-30T08:55:52.677		-1.26x	42.46x	117571.16	-7.62		
B (IER)	I	2029-12-30T09:57:39.403		13.40	31.36x	91984.69	-5.96		
C (IER)	I	2029-12-30T11:08:40.029	b	30.43	16.83x	74490.58	-1.77		
Saturn	I	2029-12-30T10:34:46.271		22.28	23.93x	60174.94		18.97	22.85
Saturn	E	2029-12-30T13:39:55.725		66.99	-16.81	60011.41		32.74	38.13
C (IER)	E	2029-12-30T11:52:20.771	b	40.97	7.37x	74490.58	1.77		
B (IER)	E	2029-12-30T13:02:38.199	b	57.97	-8.33	91984.69	6.12		
B (OER)	E	2029-12-30T14:02:07.603		72.35	-21.89	117571.16	8.00		
A (IER)	E	2029-12-30T14:11:21.004		74.57	-24.00	122050.38	8.19		
Encke (IEG)	E	2029-12-30T14:33:56.944		79.95	-29.19	133423.31	8.57		
Encke (OEG)	E	2029-12-30T14:34:34.441		80.10	-29.33	133744.89	8.58		
A (OER)	E	2029-12-30T14:40:25.769		81.46	-30.68	136774.40	8.66		
F ring	E	2029-12-30T14:47:28.935		83.08	-32.30	140461.00	8.76		

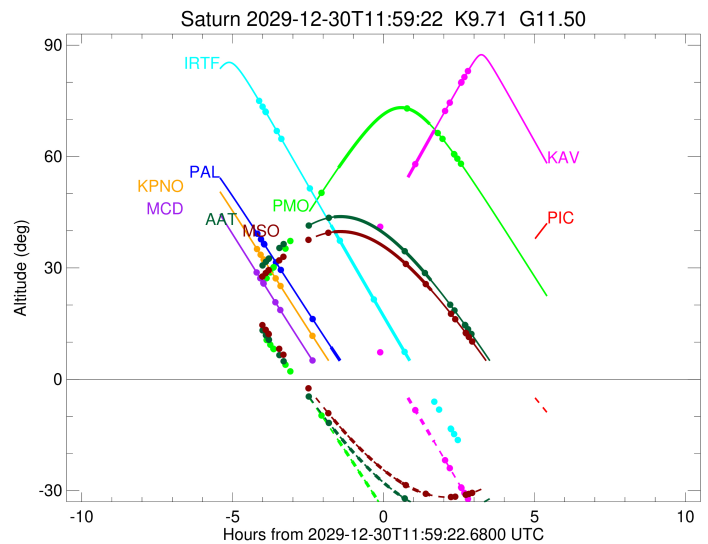
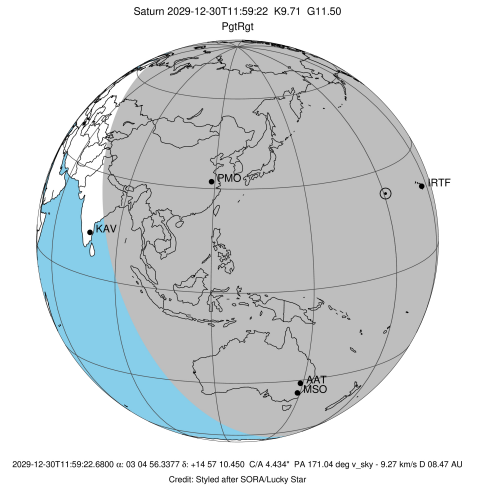
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:57:14.540  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : AAT  
 Location : Siding Spring (AAT)  
 Latitude (deg) : -31.27703  
 E. Longitude (deg) : 149.06608  
 Altitude (km) : 1.164  
 Gaia source ID : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.18  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.663  
 C/A sky separation (km) : 22495.7  
 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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2029-12-30T07:59:00.867		30.67	13.18x	140461.00	-9.30		
A (OER)	I	2029-12-30T08:05:38.310		31.66	11.84x	136774.40	-9.25		
Encke (OEG)	I	2029-12-30T08:11:06.449		32.45	10.74x	133744.89	-9.21		
Encke (IEG)	I	2029-12-30T08:11:41.368		32.54	10.63x	133423.31	-9.21		
A (IER)	I	2029-12-30T08:32:28.980		35.37	6.50x	122050.38	-9.01		
B (OER)	I	2029-12-30T08:40:48.465		36.41	4.87x	117571.16	-8.92		
B (IER)	I	2029-12-30T09:30:53.547		41.41	-4.65x	91984.69	-7.99		
C (IER)	I	2029-12-30T10:10:46.857		43.50	-11.77	74490.58	-6.47		
Saturn	I	2029-12-30T10:21:03.822		43.72	-13.52	60223.83		12.93	15.74
Saturn	E	2029-12-30T13:33:55.922		26.64	-35.22	60074.34		28.00	33.03
C (IER)	E	2029-12-30T12:41:34.580	b	34.50	-32.09	74490.58	6.40		
B (IER)	E	2029-12-30T13:21:47.595	b	28.61	-34.73	91984.69	7.93		
B (OER)	E	2029-12-30T14:12:13.625		20.03	-35.76	117571.16	8.85		
A (IER)	E	2029-12-30T14:20:36.971		18.50	-35.67	122050.38	8.94		
Encke (IEG)	E	2029-12-30T14:41:34.949		14.60	-35.13	133423.31	9.13		
Encke (OEG)	E	2029-12-30T14:42:10.173		14.49	-35.11	133744.89	9.13		
A (OER)	E	2029-12-30T14:47:41.232		13.44	-34.89	136774.40	9.17		
F ring	E	2029-12-30T14:54:22.322		12.15	-34.58	140461.00	9.21		



target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2029-12-30T11:57:28.630  
 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 : 30900679082708736  
 2Mass ID (if available) : 03045634+1457118  
 ICRS Star Coord at Epoch: 03h 04m 56.33770s +14:57:10.44965s  
 RUWE (>1.4 is poor) : 1.07  
 K magnitude : 9.712  
 G magnitude : 11.495  
 RP magnitude : 10.883  
 BP magnitude : 11.929  
 DUPflag : 0  
 Distance (au) : 8.469  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -9.27  
 Sun-Target sep (deg) : 129.33  
 Sun-Moon sep (deg) : 167.16  
 B (ring opening deg) : -21.42  
 PA of pole (deg) : -0.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 3.616  
 C/A sky separation (km) : 22211.0  
 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	2029-12-30T07:58:39.391		27.68	14.59x	140461.00	-9.31		
A (OER)	I	2029-12-30T08:05:16.284		28.60	13.31x	136774.40	-9.27		
Encke (OEG)	I	2029-12-30T08:10:43.927		29.34	12.26x	133744.89	-9.23		
Encke (IEG)	I	2029-12-30T08:11:18.790		29.42	12.14x	133423.31	-9.22		
A (IER)	I	2029-12-30T08:32:04.065		32.03	8.19x	122050.38	-9.03		
B (OER)	I	2029-12-30T08:40:22.370		32.99	6.63x	117571.16	-8.94		
B (IER)	I	2029-12-30T09:30:14.994		37.56	-2.44x	91984.69	-8.04		
C (IER)	I	2029-12-30T10:09:42.625		39.46	-9.14	74490.58	-6.58		
Saturn	I	2029-12-30T10:20:55.143		39.70	-10.95	60225.69		12.65	15.41
Saturn	E	2029-12-30T13:34:31.989		23.96	-31.25	60077.72		27.74	32.73
C (IER)	E	2029-12-30T12:43:45.006	b	31.07	-28.52	74490.58	6.51		
B (IER)	E	2029-12-30T13:23:32.079	b	25.62	-30.85	91984.69	7.99		
B (OER)	E	2029-12-30T14:13:46.265		17.58	-31.72	117571.16	8.87		
A (IER)	E	2029-12-30T14:22:08.574		16.14	-31.63	122050.38	8.96		
Encke (IEG)	E	2029-12-30T14:43:04.605		12.45	-31.11	133423.31	9.14		
Encke (OEG)	E	2029-12-30T14:43:39.786		12.34	-31.09	133744.89	9.14		
A (OER)	E	2029-12-30T14:49:10.459		11.34	-30.88	136774.40	9.18		
F ring	E	2029-12-30T14:55:51.136		10.13	-30.59	140461.00	9.22		