

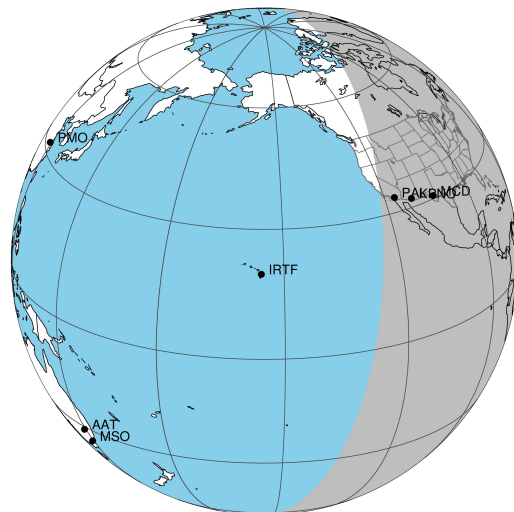
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2033-04-20T02:34:59.760  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 3425270542078711040  
 2Mass ID (if available) : 06081823+2246092

Saturn 2033-04-20T02:34:59 K9.57 G10.31 PgtRgt

ICRS Star Coord at Epoch: 06h 08m 18.24076s +22:46:09.05056s

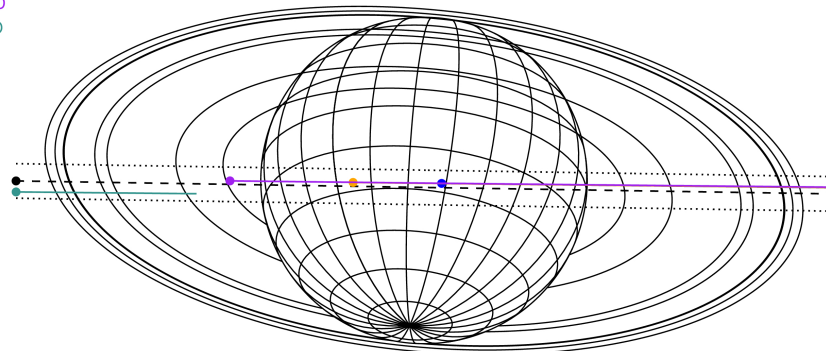
RUWE (>1.4 is poor) : 1.19  
 K magnitude : 9.572  
 G magnitude : 10.309  
 RP magnitude : 9.973  
 BP magnitude : 10.494  
 DUPflag : 0  
 Distance (au) : 9.444  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 23.61  
 Sun-Target sep (deg) : 62.04  
 Sun-Moon sep (deg) : 175.45  
 B (ring opening deg) : -26.71  
 PA of pole (deg) : -5.69

Saturn 2033-04-20T02:34:59 K9.57 G10.31  
 PgtRgt



2033-04-20T02:34:59.7600 ex: 06 08 18.2408 s: +22 46 09.051 C/A 0.374° PA 359.10 deg v\_sky +23.61 km/s D 09.44 AU  
 Credit: Styled after SORA/Lucky Star

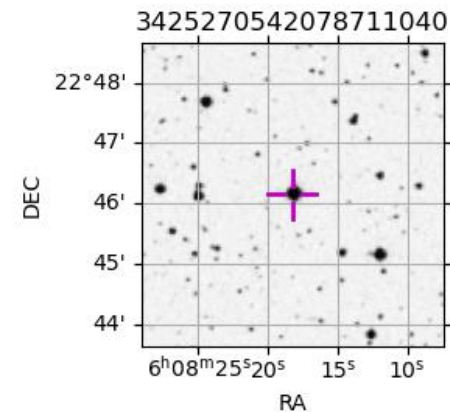
Earth  
 PAL  
 KPNO  
 MCD  
 ESO



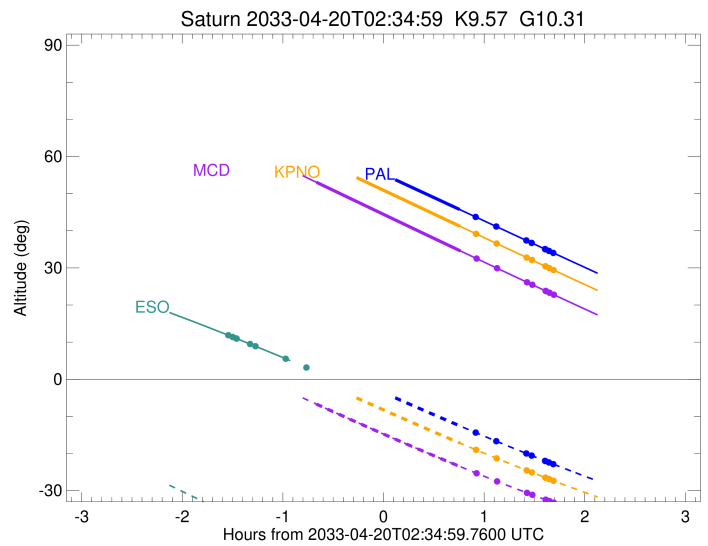
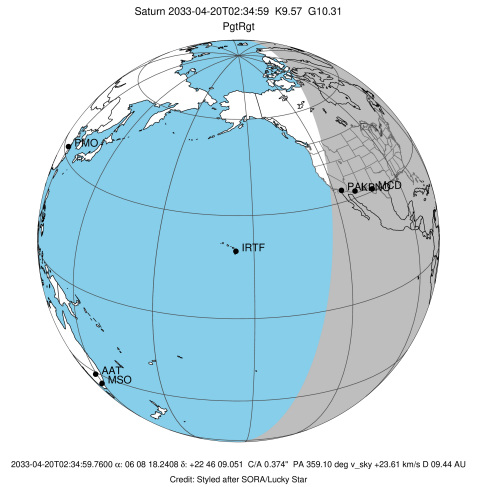
#	a(km)	ring
1	74490.6	C (IER)
2	91984.7	B (IER)
3	117571.2	B (OER)
4	122050.4	A (IER)
5	133423.3	Encke (IEG)
6	133744.9	Encke (OEG)
7	136774.4	A (OER)
8	140461.0	F ring

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	OEncode
PIC	Pic du Midi	42.9	0.1					PnnRnn
PAL	Palomar Mt (20	33.4	243.1		+	+	APR 20 03:20 - APR 20 04:16	PneRne
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4		+	+	APR 20 03:20 - APR 20 04:16	PneRne
MCD	McDonald Obs.	30.7	256.0		+	+	APR 20 01:54 - APR 20 04:16	PieRne
TEN	Teide Obs./Ten	28.3	343.5					PnnRnn
IRTF	Mauna Kea/IRTF	19.8	204.5					PnnRnn
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8					PnnRnn
ESO	European South	-29.3	289.3	+			APR 20 01:02 - APR 20 01:36	PnnRin
AAT	Siding Spring	-31.3	149.1					PnnRnn
SAAO	So. Afr. Astro	-32.4	20.8					PnnRnn
MSO	Mt. Stromlo Ob	-35.3	149.0					PnnRnn



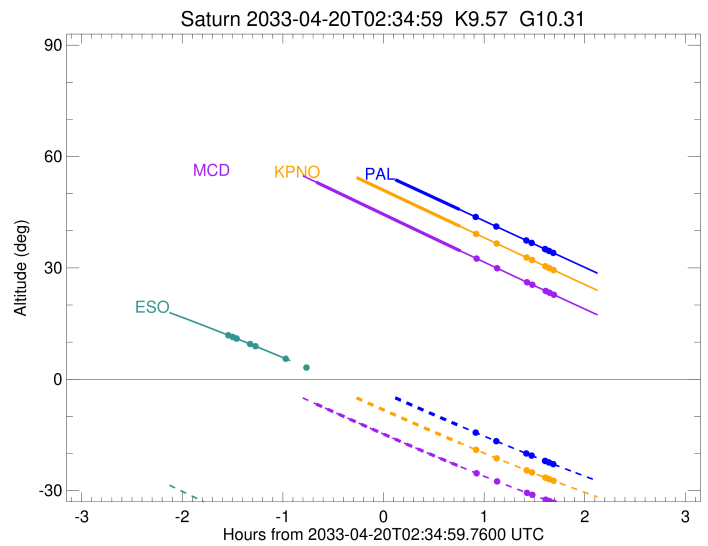
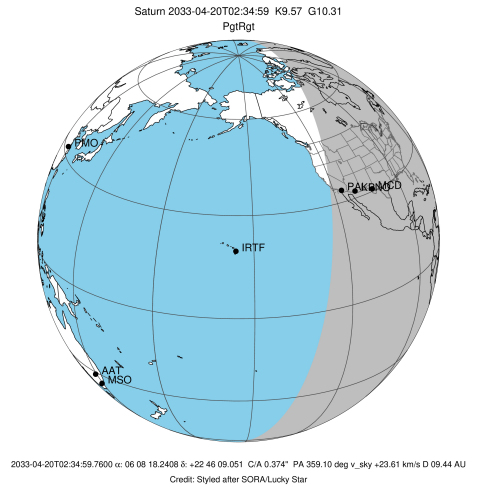
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2033-04-20T02:37:21.110  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PAL  
 Location : Palomar Mt (200")  
 Latitude (deg) : 33.35622  
 E. Longitude (deg) : 243.13601  
 Altitude (km) : 1.706  
 Gaia source ID : 3425270542078711040  
 2Mass ID (if available) : 06081823+2246092  
 ICRS Star Coord at Epoch: 06h 08m 18.24076s +22:46:09.05056s  
 RUWE (>1.4 is poor) : 1.19  
 K magnitude : 9.572  
 G magnitude : 10.309  
 RP magnitude : 9.973  
 BP magnitude : 10.494  
 DUPflag : 0  
 Distance (au) : 9.444  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 23.61  
 Sun-Target sep (deg) : 62.04  
 Sun-Moon sep (deg) : 175.87  
 B (ring opening deg) : -26.71  
 PA of pole (deg) : -5.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.146  
 C/A sky separation (km) : 999.8  
 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\_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

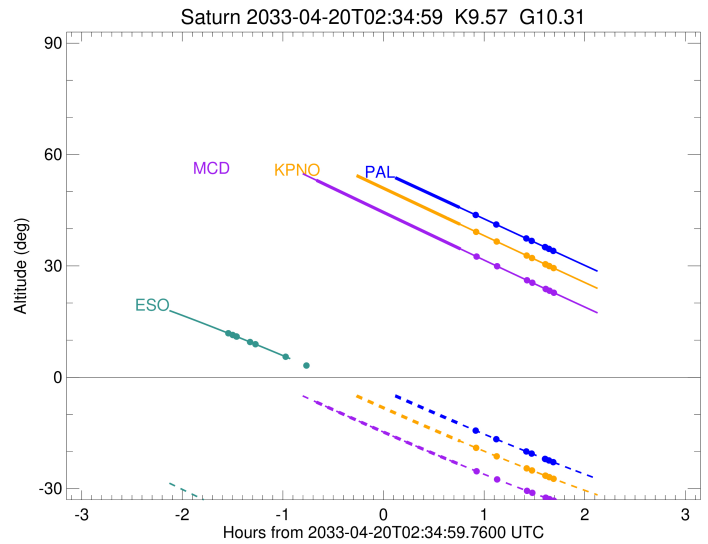
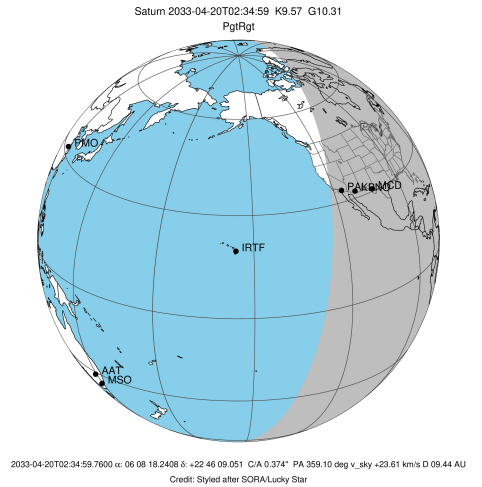
Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2033-04-20T00:58:20.048		74.13	16.28x	140461.00	-23.52		
A (OER)	I	2033-04-20T01:00:56.800		73.69	15.74x	136774.40	-23.52		
Encke (OEG)	I	2033-04-20T01:03:05.602		73.33	15.29x	133744.89	-23.52		
Encke (IEG)	I	2033-04-20T01:03:19.274		73.29	15.24x	133423.31	-23.52		
A (IER)	I	2033-04-20T01:11:22.712		71.87	13.56x	122050.38	-23.53		
B (OER)	I	2033-04-20T01:14:33.076		71.29	12.90x	117571.17	-23.53		
B (IER)	I	2033-04-20T01:32:40.074		67.87	9.14x	91984.69	-23.55		
C (IER)	I	2033-04-20T01:45:02.924		65.44	6.58x	74490.58	-23.55		
Saturn	I	2033-04-20T01:54:12.531		63.60	4.69x	60255.60		-5.26	-6.46
Saturn	E	2033-04-20T03:20:23.464		45.73	-12.53	60262.14		3.62	4.44
C (IER)	E	2033-04-20T03:29:56.462		43.73	-14.36	74490.58	23.72		
B (IER)	E	2033-04-20T03:42:13.607		41.15	-16.68	91984.69	23.75		
B (OER)	E	2033-04-20T04:00:10.176		37.40	-19.99	117571.17	23.79		
A (IER)	E	2033-04-20T04:03:18.462		36.74	-20.56	122050.38	23.79		
Encke (IEG)	E	2033-04-20T04:11:16.294		35.08	-21.99	133423.31	23.81		
Encke (OEG)	E	2033-04-20T04:11:29.800		35.03	-22.03	133744.89	23.81		
A (OER)	E	2033-04-20T04:13:37.026		34.59	-22.40	136774.40	23.81		
F ring	E	2033-04-20T04:16:11.814		34.05	-22.86	140461.00	23.82		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2033-04-20T02:37:39.450  
 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 : 3425270542078711040  
 2Mass ID (if available) : 06081823+2246092  
 ICRS Star Coord at Epoch: 06h 08m 18.24076s +22:46:09.05056s  
 RUWE (>1.4 is poor) : 1.19  
 K magnitude : 9.572  
 G magnitude : 10.309  
 RP magnitude : 9.973  
 BP magnitude : 10.494  
 DUPflag : 0  
 Distance (au) : 9.444  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 23.61  
 Sun-Target sep (deg) : 62.04  
 Sun-Moon sep (deg) : 175.88  
 B (ring opening deg) : -26.71  
 PA of pole (deg) : -5.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.149  
 C/A sky separation (km) : 1022.2  
 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\_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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2033-04-20T00:58:43.058		70.93	11.66x	140461.00	-23.53		
A (OER)	I	2033-04-20T01:01:19.748		70.42	11.11x	136774.40	-23.53		
Encke (OEG)	I	2033-04-20T01:03:28.498		70.00	10.66x	133744.89	-23.53		
Encke (IEG)	I	2033-04-20T01:03:42.164		69.95	10.61x	133423.31	-23.53		
A (IER)	I	2033-04-20T01:11:45.387		68.34	8.91x	122050.38	-23.54		
B (OER)	I	2033-04-20T01:14:55.659		67.70	8.25x	117571.16	-23.54		
B (IER)	I	2033-04-20T01:33:02.057		63.99	4.46x	91984.69	-23.56		
C (IER)	I	2033-04-20T01:45:24.427		61.41	1.88x	74490.58	-23.57		
Saturn	I	2033-04-20T01:54:32.712		59.50	-0.01x	60255.38		-5.31	-6.51
Saturn	E	2033-04-20T03:20:39.329		41.20	-17.20	60262.11		3.62	4.45
C (IER)	E	2033-04-20T03:30:11.538		39.18	-19.00	74490.58	23.75		
B (IER)	E	2033-04-20T03:42:27.746		36.57	-21.29	91984.69	23.78		
B (OER)	E	2033-04-20T04:00:22.878		32.79	-24.54	117571.17	23.82		
A (IER)	E	2033-04-20T04:03:30.905		32.13	-25.10	122050.38	23.83		
Encke (IEG)	E	2033-04-20T04:11:28.072		30.45	-26.49	133423.31	23.84		
Encke (OEG)	E	2033-04-20T04:11:41.560		30.40	-26.53	133744.89	23.84		
A (OER)	E	2033-04-20T04:13:48.606		29.96	-26.90	136774.40	23.85		
F ring	E	2033-04-20T04:16:23.175		29.42	-27.34	140461.00	23.85		

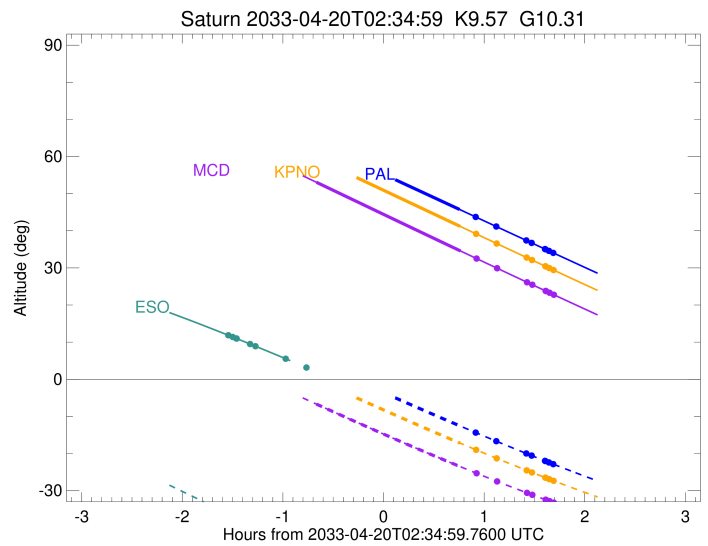
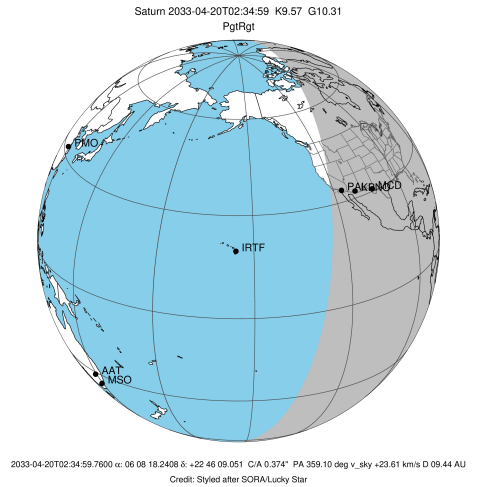
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2033-04-20T02:38:02.690  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 3425270542078711040  
 2Mass ID (if available) : 06081823+2246092  
 ICRS Star Coord at Epoch: 06h 08m 18.24076s +22:46:09.05056s  
 RUWE (>1.4 is poor) : 1.19  
 K magnitude : 9.572  
 G magnitude : 10.309  
 RP magnitude : 9.973  
 BP magnitude : 10.494  
 DUPflag : 0  
 Distance (au) : 9.444  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 23.61  
 Sun-Target sep (deg) : 62.04  
 Sun-Moon sep (deg) : 175.90  
 B (ring opening deg) : -26.71  
 PA of pole (deg) : -5.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.139  
 C/A sky separation (km) : 953.3  
 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\_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	2033-04-20T00:59:13.526		65.02	4.95x	140461.00	-23.55		
A (OER)	I	2033-04-20T01:01:50.060		64.47	4.40x	136774.40	-23.55		
Encke (OEG)	I	2033-04-20T01:03:58.679		64.01	3.94x	133744.89	-23.56		
Encke (IEG)	I	2033-04-20T01:04:12.331		63.96	3.90x	133423.31	-23.56		
A (IER)	I	2033-04-20T01:12:15.038		62.25	2.20x	122050.38	-23.57		
B (OER)	I	2033-04-20T01:15:25.096		61.57	1.53x	117571.16	-23.57		
B (IER)	I	2033-04-20T01:33:30.166		57.70	-2.25x	91984.69	-23.59		
C (IER)	I	2033-04-20T01:45:51.517		55.04	-4.81x	74490.58	-23.60		
Saturn	I	2033-04-20T01:54:59.420		53.07	-6.69	60255.48		-5.29	-6.49
Saturn	E	2033-04-20T03:20:58.284		34.55	-23.57	60261.82		3.71	4.56
C (IER)	E	2033-04-20T03:30:28.045		32.52	-25.31	74490.58	23.80		
B (IER)	E	2033-04-20T03:42:42.693		29.92	-27.51	91984.69	23.83		
B (OER)	E	2033-04-20T04:00:35.507		26.13	-30.60	117571.16	23.87		
A (IER)	E	2033-04-20T04:03:43.123		25.47	-31.13	122050.38	23.88		
Encke (IEG)	E	2033-04-20T04:11:39.242		23.80	-32.44	133423.31	23.90		
Encke (OEG)	E	2033-04-20T04:11:52.699		23.75	-32.47	133744.89	23.90		
A (OER)	E	2033-04-20T04:13:59.465		23.31	-32.82	136774.40	23.90		
F ring	E	2033-04-20T04:16:33.691		22.77	-33.23	140461.00	23.91		

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2033-04-20T02:38:54.790  
 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 : 3425270542078711040  
 2Mass ID (if available) : 06081823+2246092  
 ICRS Star Coord at Epoch: 06h 08m 18.24076s +22:46:09.05056s  
 RUWE (>1.4 is poor) : 1.19  
 K magnitude : 9.572  
 G magnitude : 10.309  
 RP magnitude : 9.973  
 BP magnitude : 10.494  
 DUPflag : 0  
 Distance (au) : 9.444  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : 23.61  
 Sun-Target sep (deg) : 62.04  
 Sun-Moon sep (deg) : 175.20  
 B (ring opening deg) : -26.71  
 PA of pole (deg) : -5.69  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.829  
 C/A sky separation (km) : 5676.0  
 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\_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



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2033-04-20T01:02:29.686		11.85	-36.19	140461.00	-23.64		
A (OER)	I	2033-04-20T01:05:05.612		11.38	-36.76	136774.40	-23.64		
Encke (OEG)	I	2033-04-20T01:07:13.746		11.00	-37.22	133744.89	-23.64		
Encke (IEG)	I	2033-04-20T01:07:27.348		10.96	-37.27	133423.31	-23.64		
A (IER)	I	2033-04-20T01:15:28.413		9.49	-39.00	122050.38	-23.64		
B (OER)	I	2033-04-20T01:18:37.915		8.91	-39.68	117571.17	-23.63		
B (IER)	I	2033-04-20T01:36:41.399		5.52	-43.56	91984.69	-23.58		
C (IER)	I	2033-04-20T01:49:04.453		3.15x	-46.19	74490.58	-23.49		
Saturn	I	2033-04-20T01:56:26.180		1.73x	-47.75	60228.72		-9.40	-11.49
Saturn	E	2033-04-20T03:21:15.550		-15.42x	-64.34	60267.97		-0.24	-0.30
C (IER)	E	2033-04-20T03:31:15.819		-17.52x	-65.99	74490.58	23.71		
B (IER)	E	2033-04-20T03:43:31.248		-20.09x	-67.85	91984.69	23.85		
B (OER)	E	2033-04-20T04:01:20.833		-23.87x	-70.13	117571.16	23.98		
A (IER)	E	2033-04-20T04:04:27.569		-24.53x	-70.47	122050.38	24.00		
Encke (IEG)	E	2033-04-20T04:12:21.166		-26.22x	-71.22	133423.31	24.03		
Encke (OEG)	E	2033-04-20T04:12:34.547		-26.26x	-71.23	133744.89	24.03		
A (OER)	E	2033-04-20T04:14:40.581		-26.71x	-71.41	136774.40	24.04		
F ring	E	2033-04-20T04:17:13.890		-27.26x	-71.60	140461.00	24.05		