

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:12:59.780
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Gaia source ID : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040

Saturn 2031-12-31T04:12:59 K9.83 G13.03 PgtRgt

ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s

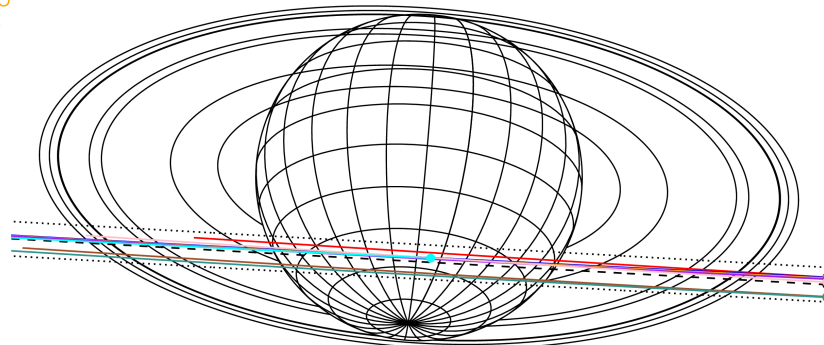
RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 48.00
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27

Saturn 2031-12-31T04:12:59 K9.83 G13.03
 PgtRgt



2031-12-31T04:12:59.7800 ra: 05 06 24.1620 s: +21 19 03.964 C/A 5.284 PA 356.78 deg v_sky -18.06 km/s D 08.10 AU
 Credit: Styled after SORA/Lucky Star

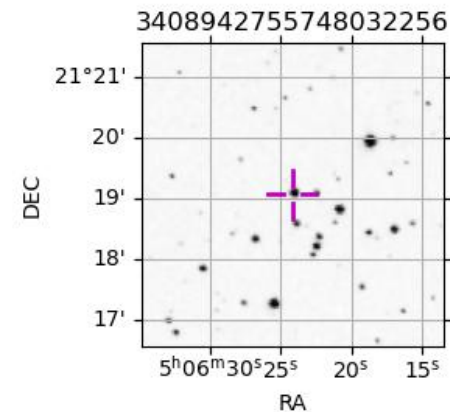
Earth
 PIC
 PAL
 KPNO
 MCD
 TEN
 IRTF
 RIO
 ESO



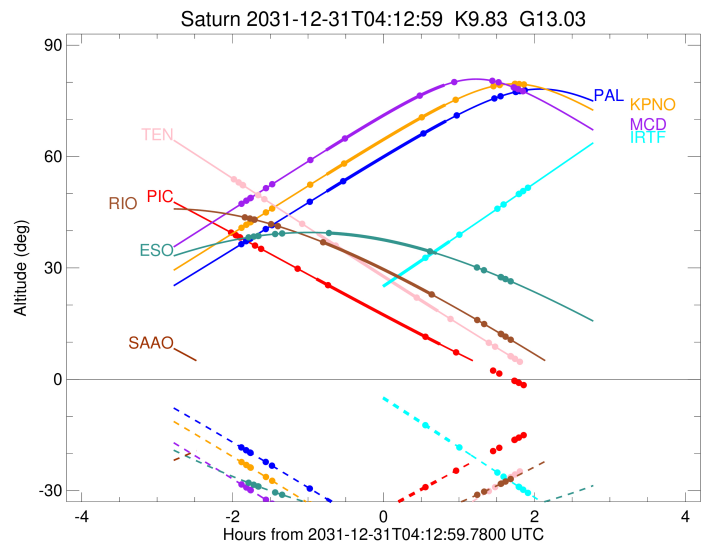
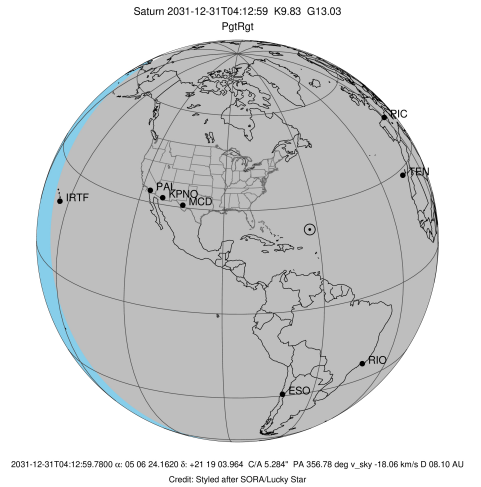
#	a(km)	ring
1	74490.6	C (IER)
2	91984.7	B (IER)
3	117571.2	B (OER)
4	122050.4	A (IER)
5	133423.3	Encke (IEG)
6	133744.9	Encke (OEG)
7	136774.4	A (OER)
8	140461.0	F ring

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	+	+	+	DEC 31 02:11 - DEC 31 05:10	PieRie
PAL	Palomar Mt (20	33.4	243.1	+	+	+	DEC 31 02:19 - DEC 31 06:05	PieRie
PMO	Purple Mtn Obs	32.1	118.8					PnnRnn
KPNO	Kitt Peak Natl	32.0	248.4	+	+	+	DEC 31 02:20 - DEC 31 06:04	PieRie
MCD	McDonald Obs.	30.7	256.0	+	+	+	DEC 31 02:20 - DEC 31 06:03	PieRie
TEN	Teide Obs./Ten	28.3	343.5	+	+	+	DEC 31 02:13 - DEC 31 05:57	PieRie
IRTF	Mauna Kea/IRTF	19.8	204.5		+	+	DEC 31 05:05 - DEC 31 06:07	PneRne
KAV	Kavalur Observ	12.6	78.8					PnnRnn
RIO	Rio de Janeiro	-22.9	316.8	+	+	+	DEC 31 02:22 - DEC 31 05:54	PieRie
ESO	European South	-29.3	289.3	+	+	+	DEC 31 02:25 - DEC 31 05:54	PieRie
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



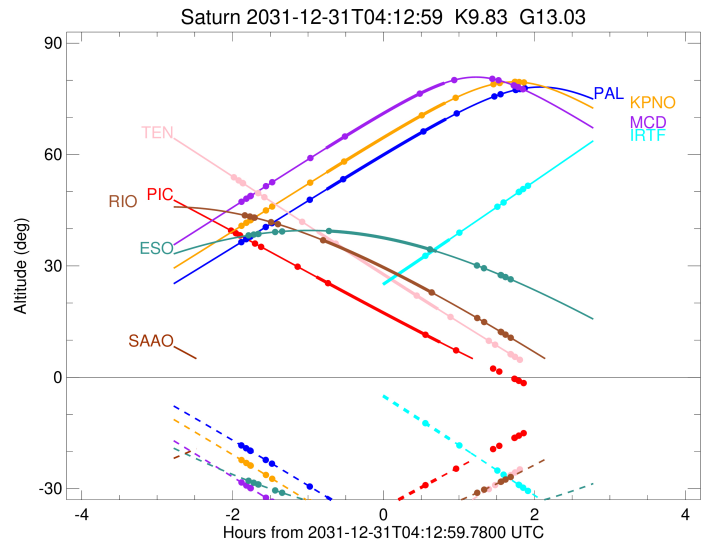
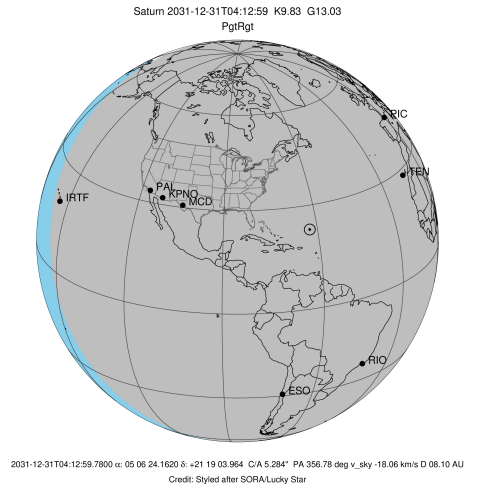
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:08:41.130
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : PIC
 Location : Pic du Midi
 Latitude (deg) : 42.93656
 E. Longitude (deg) : 0.14231
 Altitude (km) : 2.890
 Gaia source ID : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 47.76
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 4.667
 C/A sky separation (km) : 27429.0
 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	2031-12-31T02:11:45.655		39.52	-56.79	140461.00	-16.42		
A (OER)	I	2031-12-31T02:15:30.863		38.83	-56.16	136774.40	-16.31		
Encke (OEG)	I	2031-12-31T02:18:37.125		38.26	-55.65	133744.89	-16.22		
Encke (IEG)	I	2031-12-31T02:18:56.963		38.20	-55.59	133423.31	-16.20		
A (IER)	I	2031-12-31T02:30:48.164		36.03	-53.58	122050.38	-15.76		
B (OER)	I	2031-12-31T02:35:34.313		35.15	-52.75	117571.16	-15.54		
B (IER)	I	2031-12-31T03:04:39.876		29.79	-47.62	91984.69	-13.53		
C (IER)	I	2031-12-31T03:28:51.134	b	25.35	-43.25	74490.58	-10.23		
Saturn	I	2031-12-31T03:19:36.845		27.05	-44.93	60037.70		-23.57	-28.11
Saturn	E	2031-12-31T04:57:56.846		9.44	-26.95	60016.85		-24.69	-29.36
C (IER)	E	2031-12-31T04:46:18.463	b	11.46	-29.07	74490.58	10.16		
B (IER)	E	2031-12-31T05:10:42.426		7.25	-24.63	91984.69	13.39		
B (OER)	E	2031-12-31T05:40:10.595		2.33x	-19.34	117571.16	15.31		
A (IER)	E	2031-12-31T05:45:01.221		1.54x	-18.47	122050.38	15.51		
Encke (IEG)	E	2031-12-31T05:57:04.473		-0.40x	-16.34	133423.31	15.92		
Encke (OEG)	E	2031-12-31T05:57:24.666		-0.45x	-16.28	133744.89	15.93		
A (OER)	E	2031-12-31T06:00:34.309		-0.96x	-15.73	136774.40	16.02		
F ring	E	2031-12-31T06:04:23.724		-1.56x	-15.06	140461.00	16.12		

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:15:17.830
 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 : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 48.85
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 4.990
 C/A sky separation (km) : 29324.6
 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

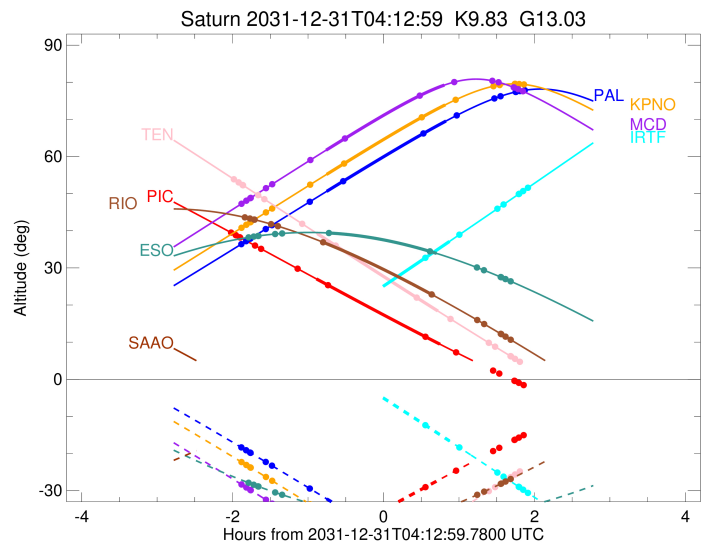
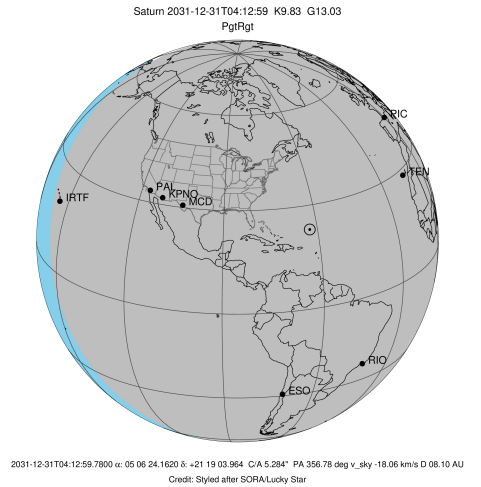


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2031-12-31T02:19:54.853		36.39	-18.34	140461.00	-16.15		
A (OER)	I	2031-12-31T02:23:43.934		37.19	-19.11	136774.40	-16.03		
Encke (OEG)	I	2031-12-31T02:26:53.523		37.85	-19.75	133744.89	-15.93		
Encke (IEG)	I	2031-12-31T02:27:13.724		37.92	-19.81	133423.31	-15.91		
A (IER)	I	2031-12-31T02:39:19.100		40.46	-22.26	122050.38	-15.42		
B (OER)	I	2031-12-31T02:44:11.805		41.48	-23.25	117571.16	-15.18		
B (IER)	I	2031-12-31T03:14:19.629		47.80	-29.43	91984.69	-12.83		
C (IER)	I	2031-12-31T03:40:55.875	b	53.35	-34.93	74490.58	-8.64		
Saturn	I	2031-12-31T03:27:46.741		50.61	-32.20	60015.27		-24.77	-29.45
Saturn	E	2031-12-31T05:02:40.668		69.57	-52.00	59970.70		-27.05	-31.98
C (IER)	E	2031-12-31T04:44:39.938	b	66.20	-48.24	74490.58	8.64		
B (IER)	E	2031-12-31T05:11:12.181		71.08	-53.77	91984.69	12.88		
B (OER)	E	2031-12-31T05:41:10.944		75.65	-59.98	117571.16	15.27		
A (IER)	E	2031-12-31T05:46:01.819		76.24	-60.97	122050.38	15.52		
Encke (IEG)	E	2031-12-31T05:58:02.252		77.39	-63.41	133423.31	16.03		
Encke (OEG)	E	2031-12-31T05:58:22.307		77.42	-63.48	133744.89	16.04		
A (OER)	E	2031-12-31T06:01:30.506		77.64	-64.11	136774.40	16.15		
F ring	E	2031-12-31T06:05:17.858		77.86	-64.87	140461.00	16.28		

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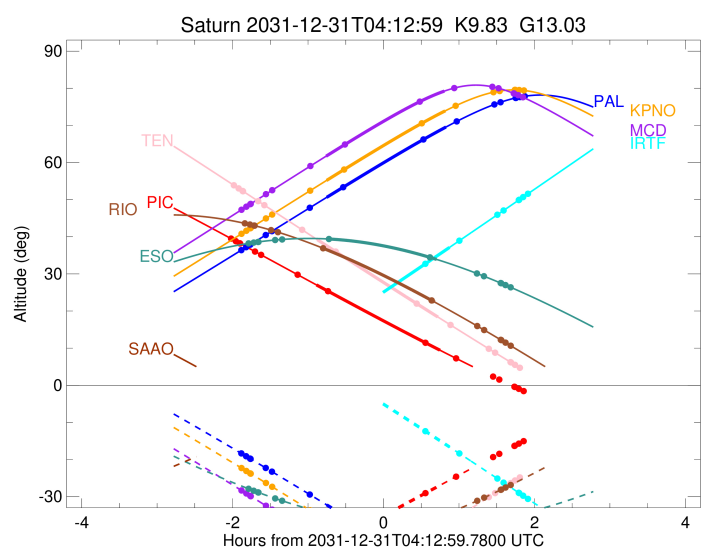
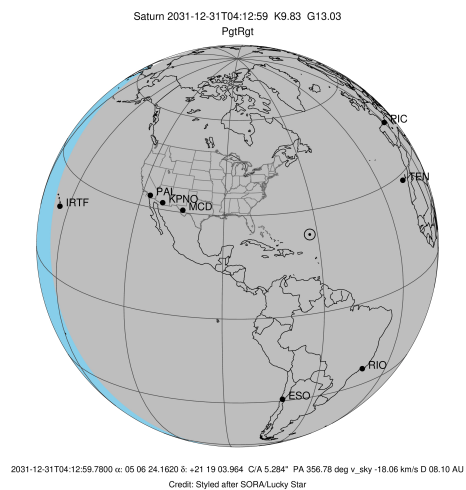
target                : Saturn
target radius (km)   : 60268.00
C/A epoch            : 2031-12-31T04:14:57.750
Event type          : PgtRgt
: Saturn occs: geocentric, topocentric
: Ring occs: geocentric, topocentric
Observer code       : KPNO
Location            : Kitt Peak Natl Obs
Latitude (deg)      : 31.96333
E. Longitude (deg)  : 248.40000
Altitude (km)       : 2.120
Gaia source ID      : 3408942755748032256
2Mass ID (if available) : 05062416+2119040
ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
RUWE (>1.4 is poor) : 1.20
K magnitude         : 9.832
G magnitude         : 13.028
RP magnitude        : 12.098
BP magnitude        : 13.925
DUPflag            : 0
Distance (au)       : 8.103
f0 (km)            : 0.000
g0 (km)            : 0.000
skyplane vel. (km/s) : -18.06
Sun-Target sep (deg) : 158.66
Sun-Moon sep (deg)  : 48.83
B (ring opening deg) : -26.52
PA of pole (deg)    : -4.27
Pole direction: RA (deg): 40.60000
Dec (deg): 83.50000
C/A sky separation (") : 5.033
C/A sky separation (km) : 29576.0
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	2031-12-31T02:20:02.461		40.79	-22.29	140461.00	-16.14		
A (OER)	I	2031-12-31T02:23:51.744		41.61	-23.08	136774.40	-16.02		
Encke (OEG)	I	2031-12-31T02:27:01.534		42.28	-23.73	133744.89	-15.91		
Encke (IEG)	I	2031-12-31T02:27:21.758		42.35	-23.80	133423.31	-15.89		
A (IER)	I	2031-12-31T02:39:28.256		44.93	-26.31	122050.38	-15.39		
B (OER)	I	2031-12-31T02:44:21.599		45.97	-27.33	117571.17	-15.14		
B (IER)	I	2031-12-31T03:14:37.586		52.41	-33.66	91984.69	-12.74		
C (IER)	I	2031-12-31T03:41:38.875	b	58.11	-39.36	74490.58	-8.38		
Saturn	I	2031-12-31T03:27:38.518		55.16	-36.40	60010.22		-25.04	-29.75
Saturn	E	2031-12-31T05:02:09.699		73.94	-56.43	59966.38		-27.26	-32.21
C (IER)	E	2031-12-31T04:43:21.418	b	70.55	-52.45	74490.58	8.38		
B (IER)	E	2031-12-31T05:10:19.685		75.28	-58.16	91984.69	12.77		
B (OER)	E	2031-12-31T05:40:28.298		78.95	-64.46	117571.16	15.22		
A (IER)	E	2031-12-31T05:45:20.145		79.26	-65.47	122050.38	15.47		
Encke (IEG)	E	2031-12-31T05:57:22.600		79.57	-67.93	133423.31	15.99		
Encke (OEG)	E	2031-12-31T05:57:42.704		79.56	-67.99	133744.89	16.00		
A (OER)	E	2031-12-31T06:00:51.357		79.53	-68.63	136774.40	16.11		
F ring	E	2031-12-31T06:04:39.225		79.42	-69.39	140461.00	16.24		

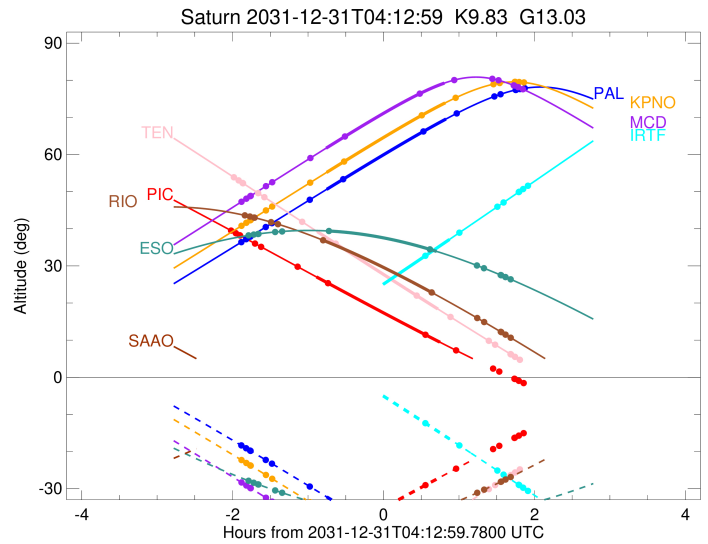
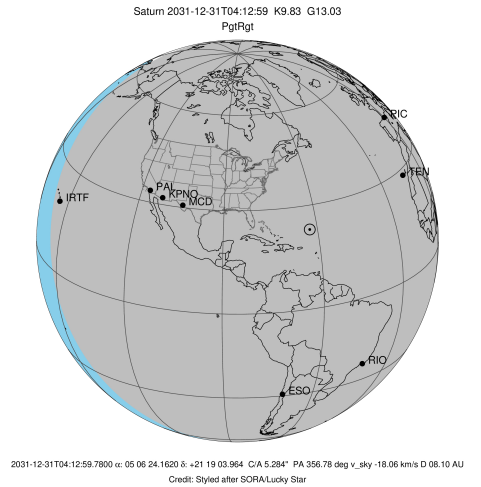
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:14:24.950
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : MCD
 Location : McDonald Obs. 2.7m
 Latitude (deg) : 30.67158
 E. Longitude (deg) : 255.97844
 Altitude (km) : 2.075
 Gaia source ID : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
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 Distance (au) : 8.103
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 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 48.80
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 5.078
 C/A sky separation (km) : 29843.9
 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	2031-12-31T02:20:02.754		47.27	-28.33	140461.00	-16.13		
A (OER)	I	2031-12-31T02:23:52.176		48.09	-29.14	136774.40	-16.01		
Encke (OEG)	I	2031-12-31T02:27:02.120		48.78	-29.80	133744.89	-15.89		
Encke (IEG)	I	2031-12-31T02:27:22.362		48.85	-29.88	133423.31	-15.88		
A (IER)	I	2031-12-31T02:39:29.854		51.47	-32.45	122050.38	-15.36		
B (OER)	I	2031-12-31T02:44:23.810		52.52	-33.49	117571.16	-15.11		
B (IER)	I	2031-12-31T03:14:48.369		59.05	-39.98	91984.69	-12.63		
C (IER)	I	2031-12-31T03:42:18.206	b	64.85	-45.88	74490.58	-8.09		
Saturn	I	2031-12-31T03:27:18.814		61.70	-42.66	60004.50		-25.34	-30.08
Saturn	E	2031-12-31T05:01:25.339		79.25	-62.87	59962.06		-27.47	-32.45
C (IER)	E	2031-12-31T04:41:45.669	b	76.39	-58.67	74490.58	8.09		
B (IER)	E	2031-12-31T05:09:14.001		80.06	-64.53	91984.69	12.65		
B (OER)	E	2031-12-31T05:39:33.864		80.40	-70.87	117571.16	15.16		
A (IER)	E	2031-12-31T05:44:26.855		80.01	-71.86	122050.38	15.41		
Encke (IEG)	E	2031-12-31T05:56:31.737		78.64	-74.28	133423.31	15.94		
Encke (OEG)	E	2031-12-31T05:56:51.902		78.59	-74.34	133744.89	15.95		
A (OER)	E	2031-12-31T06:00:01.111		78.15	-74.96	136774.40	16.07		
F ring	E	2031-12-31T06:03:49.619		77.59	-75.69	140461.00	16.20		

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:08:17.400
 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 : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 47.82
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 4.985
 C/A sky separation (km) : 29294.6
 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

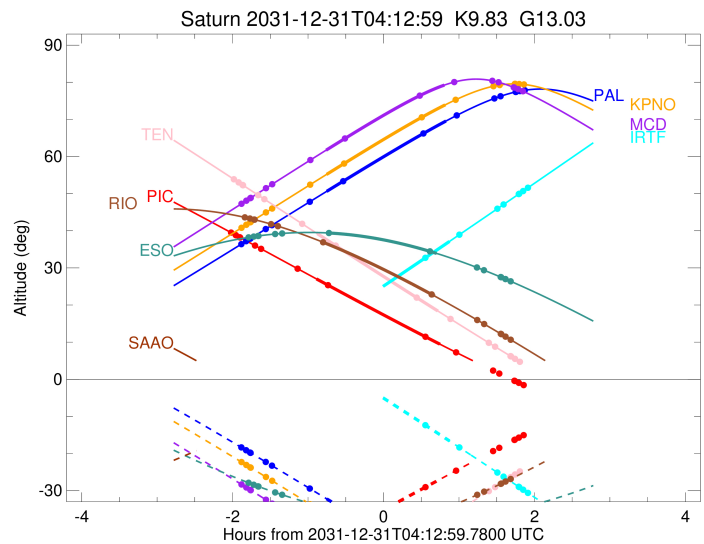
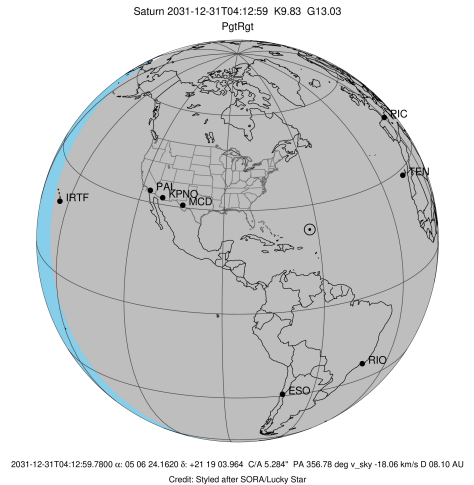


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2031-12-31T02:13:58.121		53.89	-74.46	140461.00	-16.25		
A (OER)	I	2031-12-31T02:17:45.945		53.05	-73.65	136774.40	-16.12		
Encke (OEG)	I	2031-12-31T02:20:54.579		52.35	-72.98	133744.89	-16.00		
Encke (IEG)	I	2031-12-31T02:21:14.682		52.28	-72.91	133423.31	-15.99		
A (IER)	I	2031-12-31T02:33:17.163		49.62	-70.31	122050.38	-15.47		
B (OER)	I	2031-12-31T02:38:09.024		48.54	-69.25	117571.16	-15.22		
B (IER)	I	2031-12-31T03:08:15.804		41.89	-62.65	91984.69	-12.82		
C (IER)	I	2031-12-31T03:34:56.999	b	36.02	-56.77	74490.58	-8.60		
Saturn	I	2031-12-31T03:20:29.687		39.20	-59.96	60004.14		-25.35	-30.10
Saturn	E	2031-12-31T04:56:17.005		18.38	-38.91	59983.08		-26.43	-31.30
C (IER)	E	2031-12-31T04:39:19.603	b	22.01	-42.62	74490.58	8.54		
B (IER)	E	2031-12-31T05:06:14.784		16.25	-36.74	91984.69	12.68		
B (OER)	E	2031-12-31T05:36:46.174		9.81	-30.12	117571.16	14.98		
A (IER)	E	2031-12-31T05:41:42.909		8.78	-29.05	122050.38	15.21		
Encke (IEG)	E	2031-12-31T05:53:58.513		6.24	-26.42	133423.31	15.69		
Encke (OEG)	E	2031-12-31T05:54:19.003		6.17	-26.35	133744.89	15.70		
A (OER)	E	2031-12-31T05:57:31.321		5.51	-25.66	136774.40	15.80		
F ring	E	2031-12-31T06:01:23.728		4.71x	-24.83	140461.00	15.92		

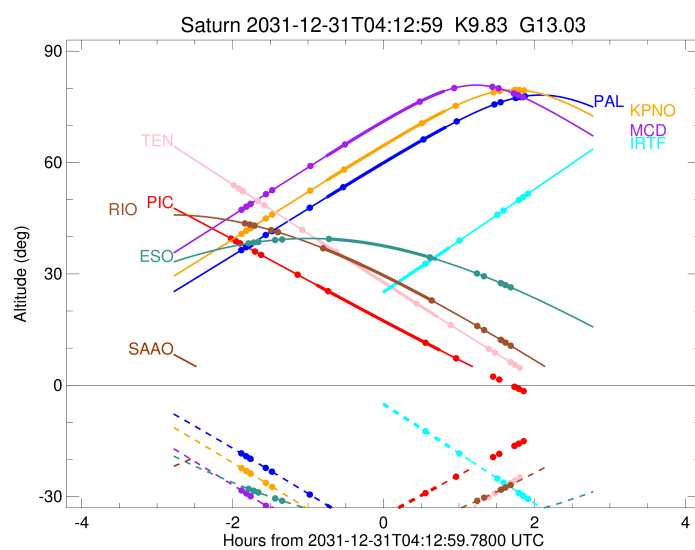
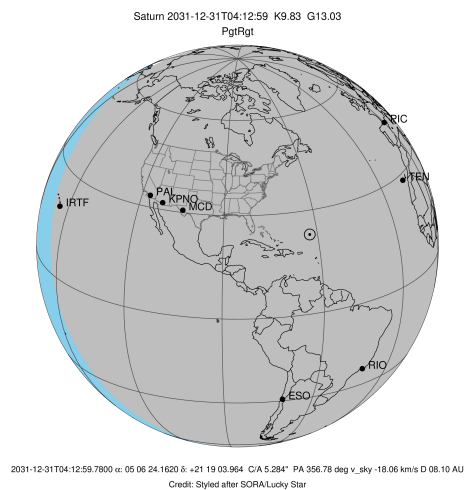
```

target                : Saturn
target radius (km)   : 60268.00
C/A epoch            : 2031-12-31T04:17:51.490
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       : 3408942755748032256
2Mass ID (if available) : 05062416+2119040
ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
RUWE (>1.4 is poor) : 1.20
K magnitude           : 9.832
G magnitude           : 13.028
RP magnitude          : 12.098
BP magnitude          : 13.925
DUPflag              : 0
Distance (au)         : 8.103
f0 (km)               : 0.000
g0 (km)               : 0.000
skyplane vel. (km/s) : -18.06
Sun-Target sep (deg) : 158.66
Sun-Moon sep (deg)   : 48.81
B (ring opening deg) : -26.52
PA of pole (deg)     : -4.27
Pole direction: RA (deg): 40.60000
Dec (deg): 83.50000
C/A sky separation (") : 5.027
C/A sky separation (km) : 29543.2
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
    
```



Ring	I/E	UTC	b?	alt	alt-sun	radius	r-dot	lat-geo	lat-geodetic
F ring	I	2031-12-31T02:21:02.528		0.07x	18.18x	140461.00	-15.92		
A (OER)	I	2031-12-31T02:24:54.995		0.92x	17.42x	136774.40	-15.80		
Encke (OEG)	I	2031-12-31T02:28:07.394		1.62x	16.79x	133744.89	-15.69		
Encke (IEG)	I	2031-12-31T02:28:27.894		1.69x	16.72x	133423.31	-15.68		
A (IER)	I	2031-12-31T02:40:44.134		4.39x	14.28x	122050.38	-15.19		
B (OER)	I	2031-12-31T02:45:41.293		5.48	13.28x	117571.16	-14.95		
B (IER)	I	2031-12-31T03:16:18.924		12.29	6.99x	91984.69	-12.60		
C (IER)	I	2031-12-31T03:43:34.183	b	18.42	1.25x	74490.58	-8.34		
Saturn	I	2031-12-31T03:29:56.667		15.35	4.13x	60014.42		-24.82	-29.50
Saturn	E	2031-12-31T05:05:30.768		37.15	-16.62	59962.30		-27.46	-32.43
C (IER)	E	2031-12-31T04:46:13.291	b	32.70	-12.35	74490.58	8.37		
B (IER)	E	2031-12-31T05:13:17.793		38.94	-18.36	91984.69	12.72		
B (OER)	E	2031-12-31T05:43:33.653		45.95	-25.13	117571.16	15.17		
A (IER)	E	2031-12-31T05:48:26.452		47.08	-26.23	122050.38	15.42		
Encke (IEG)	E	2031-12-31T06:00:30.938		49.88	-28.96	133423.31	15.95		
Encke (OEG)	E	2031-12-31T06:00:51.092		49.96	-29.03	133744.89	15.96		
A (OER)	E	2031-12-31T06:04:00.190		50.69	-29.75	136774.40	16.08		
F ring	E	2031-12-31T06:07:48.550		51.58	-30.61	140461.00	16.21		

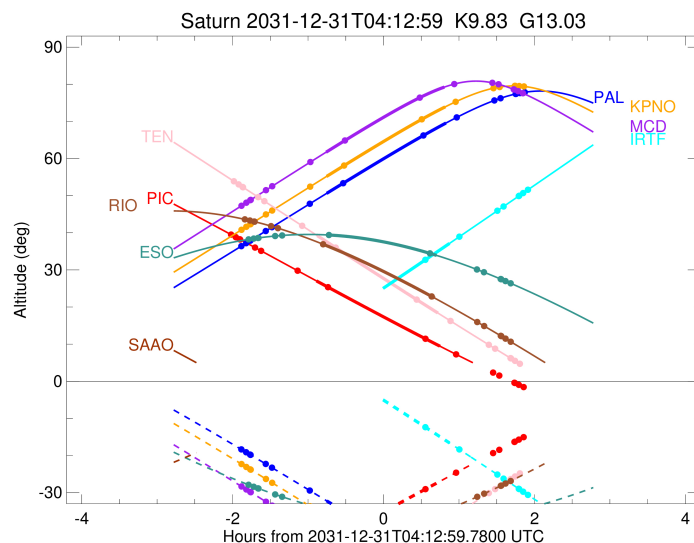
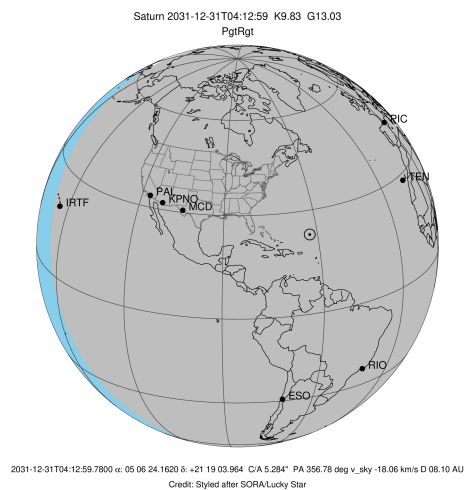
target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:09:44.840
 Event type : PgtRgt
 : Saturn occs: geocentric, topocentric
 : Ring occs: geocentric, topocentric
 Observer code : RIO
 Location : Rio de Janeiro
 Latitude (deg) : -22.89506
 E. Longitude (deg) : 316.77708
 Altitude (km) : 0.033
 Gaia source ID : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 47.96
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 5.980
 C/A sky separation (km) : 35145.0
 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	2031-12-31T02:22:40.897		43.62	-43.44	140461.00	-15.28		
A (OER)	I	2031-12-31T02:26:43.662		43.30	-43.60	136774.40	-15.09		
Encke (OEG)	I	2031-12-31T02:30:05.612		43.03	-43.71	133744.89	-14.91		
Encke (IEG)	I	2031-12-31T02:30:27.189		43.00	-43.73	133423.31	-14.89		
A (IER)	I	2031-12-31T02:43:31.025		41.80	-44.04	122050.38	-14.09		
B (OER)	I	2031-12-31T02:48:53.424		41.26	-44.10	117571.16	-13.69		
B (IER)	I	2031-12-31T03:24:52.709		36.92	-43.58	91984.69	-9.50		
Saturn	I	2031-12-31T03:25:50.480		36.79	-43.55	59887.19		-31.01	-36.28
Saturn	E	2031-12-31T04:53:45.617		22.40	-35.88	59858.48		-32.31	-37.67
B (IER)	E	2031-12-31T04:51:15.884	b	22.86	-36.20	91984.69	9.44		
B (OER)	E	2031-12-31T05:27:33.992		15.95	-31.11	117571.16	13.54		
A (IER)	E	2031-12-31T05:33:00.068		14.88	-30.28	122050.38	13.93		
Encke (IEG)	E	2031-12-31T05:46:13.792		12.24	-28.17	133423.31	14.70		
Encke (OEG)	E	2031-12-31T05:46:35.661		12.17	-28.11	133744.89	14.71		
A (OER)	E	2031-12-31T05:50:00.386		11.48	-27.55	136774.40	14.88		
F ring	E	2031-12-31T05:54:06.604		10.65	-26.87	140461.00	15.06		

target : Saturn
 target radius (km) : 60268.00
 C/A epoch : 2031-12-31T04:11:58.200
 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 : 3408942755748032256
 2Mass ID (if available) : 05062416+2119040
 ICRS Star Coord at Epoch: 05h 06m 24.16199s +21:19:03.96445s
 RUWE (>1.4 is poor) : 1.20
 K magnitude : 9.832
 G magnitude : 13.028
 RP magnitude : 12.098
 BP magnitude : 13.925
 DUPflag : 0
 Distance (au) : 8.103
 f0 (km) : 0.000
 g0 (km) : 0.000
 skyplane vel. (km/s) : -18.06
 Sun-Target sep (deg) : 158.66
 Sun-Moon sep (deg) : 48.28
 B (ring opening deg) : -26.52
 PA of pole (deg) : -4.27
 Pole direction: RA (deg): 40.60000
 Dec (deg): 83.50000
 C/A sky separation (") : 6.119
 C/A sky separation (km) : 35962.8
 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	2031-12-31T02:25:38.623		38.22	-27.87	140461.00	-15.11		
A (OER)	I	2031-12-31T02:29:44.303		38.43	-28.40	136774.40	-14.90		
Encke (OEG)	I	2031-12-31T02:33:08.823		38.60	-28.83	133744.89	-14.72		
Encke (IEG)	I	2031-12-31T02:33:30.683		38.61	-28.88	133423.31	-14.70		
A (IER)	I	2031-12-31T02:46:46.194		39.12	-30.47	122050.38	-13.85		
B (OER)	I	2031-12-31T02:52:14.407		39.28	-31.10	117571.16	-13.43		
B (IER)	I	2031-12-31T03:29:31.374	b	39.40	-34.68	91984.69	-8.89		
Saturn	I	2031-12-31T03:28:44.531		39.41	-34.61	59872.88		-31.66	-36.98
Saturn	E	2031-12-31T04:55:12.624		33.91	-37.75	59835.48		-33.33	-38.74
B (IER)	E	2031-12-31T04:49:54.810	b	34.45	-37.79	91984.69	8.86		
B (OER)	E	2031-12-31T05:27:20.408		30.11	-36.84	117571.16	13.37		
A (IER)	E	2031-12-31T05:32:50.235		29.38	-36.58	122050.38	13.78		
Encke (IEG)	E	2031-12-31T05:46:10.070		27.54	-35.81	133423.31	14.62		
Encke (OEG)	E	2031-12-31T05:46:32.057		27.49	-35.78	133744.89	14.64		
A (OER)	E	2031-12-31T05:49:57.788		26.99	-35.56	136774.40	14.81		
F ring	E	2031-12-31T05:54:04.975		26.39	-35.27	140461.00	15.01		