

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:42:41.030  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Gaia source ID : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371

Saturn 2047-08-01T02:42:41 K9.19 G14.83 PgtRgt

ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s

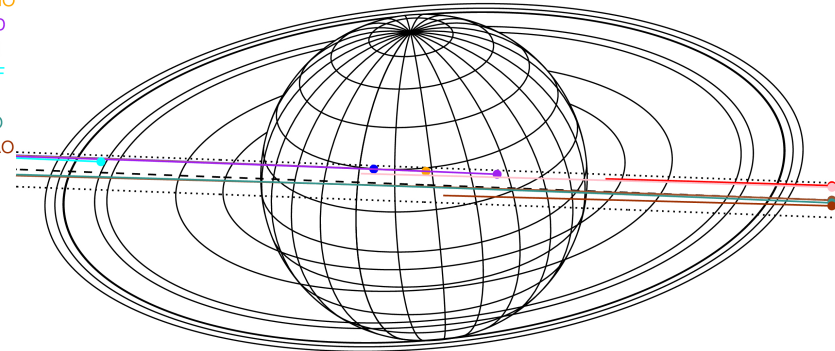
RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.30  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35

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



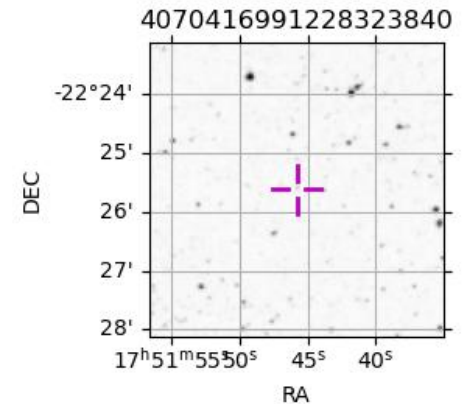
2047-08-01T02:42:41.0300 at: 17 51 45.9396 s: -22 25 37.640 C/A 0.404° PA 357.84 deg v\_sky -13.21 km/s D 09.25 AU  
 Credit: Styled after SORA/Lucky Star

Earth  
 PIC  
 PAL  
 KPNO  
 MCD  
 TEN  
 IRTF  
 RIO  
 ESO  
 SAAO

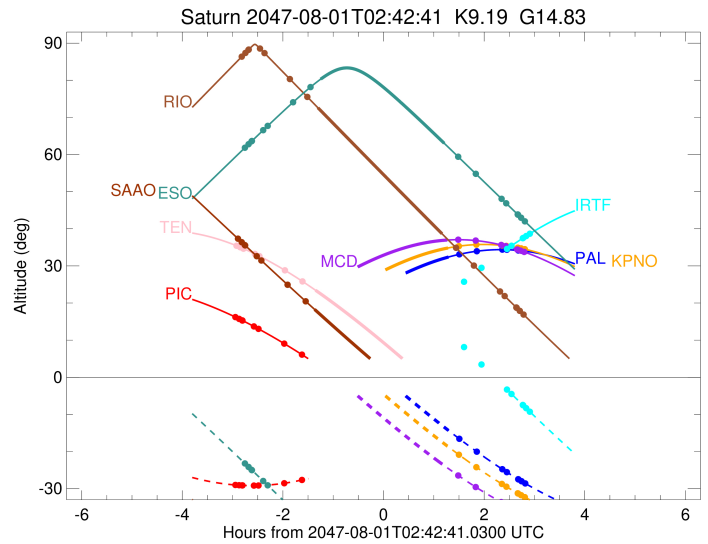
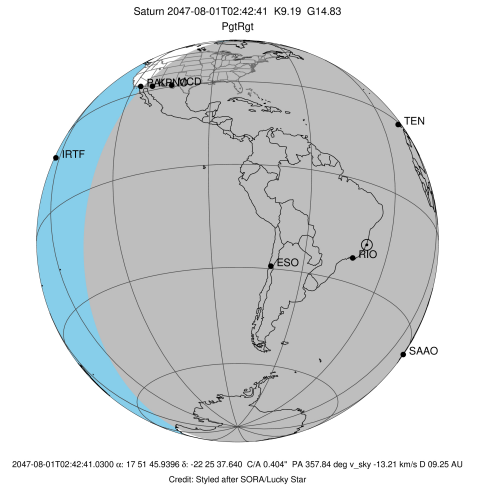


Observable events with sun below -5 deg and altitude above 5 deg unblocked by planet

| Obs  | Location       | lat   | Elon  | Rings I | Planet | Rings E | Observed Events Interval    | OEcode |
|------|----------------|-------|-------|---------|--------|---------|-----------------------------|--------|
| PIC  | Pic du Midi    | 42.9  | 0.1   | +       | +      | +       | JUL 31 23:46 - AUG 01 01:05 | PnnRin |
| PAL  | Palomar Mt (20 | 33.4  | 243.1 |         | +      | +       | AUG 01 04:00 - AUG 01 05:31 | PneRne |
| PMO  | Purple Mtn Obs | 32.1  | 118.8 |         |        |         |                             | PnnRnn |
| KPNO | Kitt Peak Natl | 32.0  | 248.4 |         | +      | +       | AUG 01 03:59 - AUG 01 05:31 | PneRne |
| MCD  | McDonald Obs.  | 30.7  | 256.0 |         | +      | +       | AUG 01 03:58 - AUG 01 05:30 | PneRne |
| TEN  | Teide Obs./Ten | 28.3  | 343.5 | +       | +      |         | JUL 31 23:47 - AUG 01 01:21 | PinRin |
| IRTF | Mauna Kea/IRTF | 19.8  | 204.5 |         |        | +       | AUG 01 05:28 - AUG 01 05:37 | PnnRne |
| KAV  | Kavalur Observ | 12.6  | 78.8  |         |        |         |                             | PnnRnn |
| RIO  | Rio de Janeiro | -22.9 | 316.8 | +       | +      | +       | JUL 31 23:53 - AUG 01 05:29 | PieRie |
| ESO  | European South | -29.3 | 289.3 | +       | +      | +       | JUL 31 23:57 - AUG 01 05:31 | PieRie |
| AAT  | Siding Spring  | -31.3 | 149.1 |         |        |         |                             | PnnRnn |
| SAAO | So. Afr. Astro | -32.4 | 20.8  | +       | +      |         | JUL 31 23:49 - AUG 01 01:20 | PinRin |
| MSO  | Mt. Stromlo Ob | -35.3 | 149.0 |         |        |         |                             | PnnRnn |

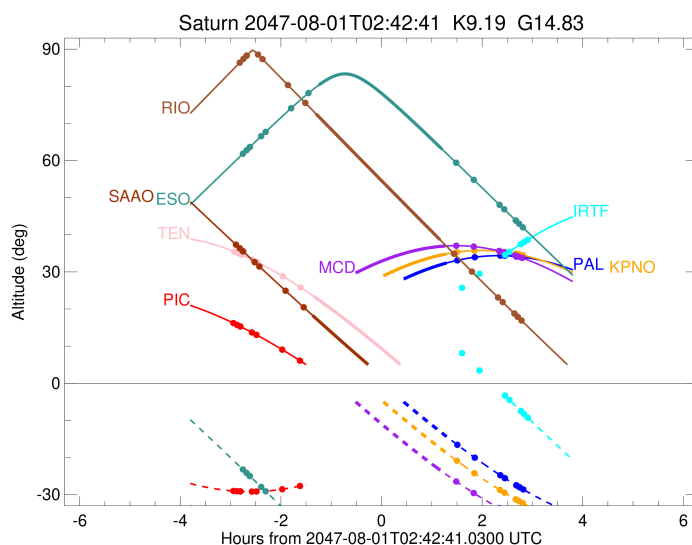
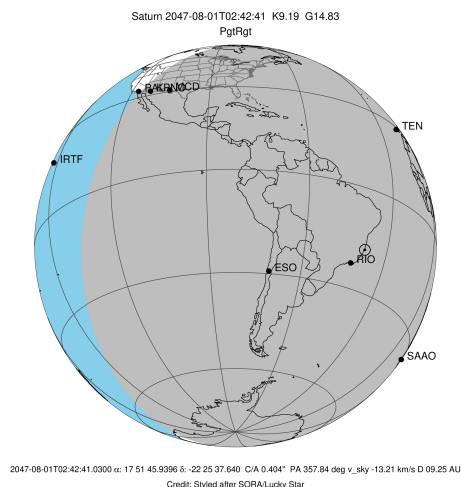


target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:36:39.290  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : PIC  
 Location : Pic du Midi  
 Latitude (deg) : 42.93656  
 E. Longitude (deg) : 0.14231  
 Altitude (km) : 2.890  
 Gaia source ID : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 22.01  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.208  
 C/A sky separation (km) : 1392.8  
 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



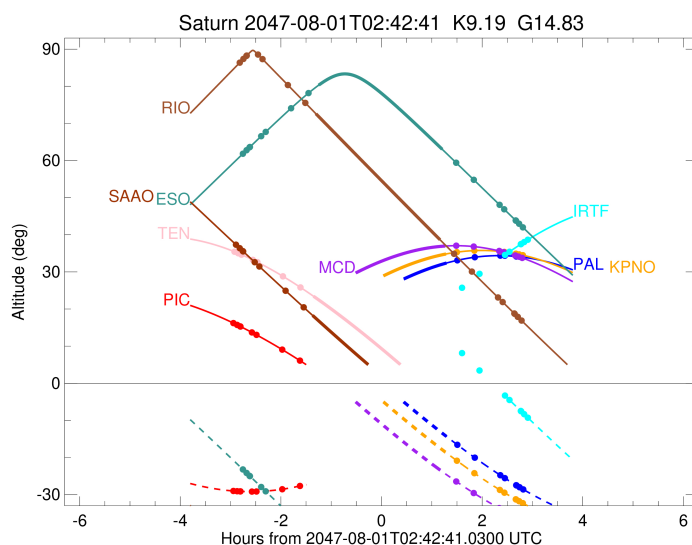
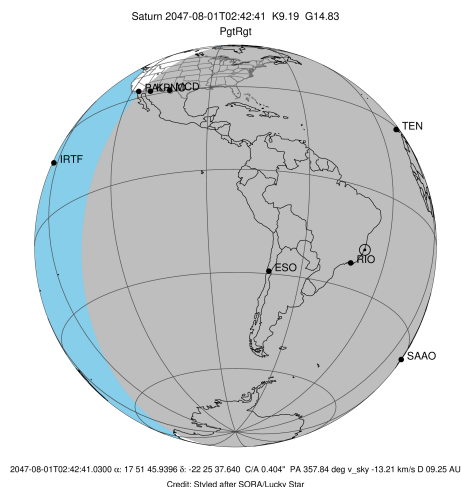
| Ring        | I/E | UTC                     | b? | alt     | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|---------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2047-07-31T23:46:06.087 |    | 16.21   | -29.01  | 140461.00 | -13.91 |         |              |
| A (OER)     | I   | 2047-07-31T23:50:31.152 |    | 15.72   | -29.08  | 136774.40 | -13.91 |         |              |
| Encke (OEG) | I   | 2047-07-31T23:54:09.063 |    | 15.32   | -29.12  | 133744.89 | -13.90 |         |              |
| Encke (IEG) | I   | 2047-07-31T23:54:32.199 |    | 15.28   | -29.13  | 133423.31 | -13.90 |         |              |
| A (IER)     | I   | 2047-08-01T00:08:11.040 |    | 13.69   | -29.18  | 122050.38 | -13.88 |         |              |
| B (OER)     | I   | 2047-08-01T00:13:33.878 |    | 13.04   | -29.16  | 117571.16 | -13.87 |         |              |
| B (IER)     | I   | 2047-08-01T00:44:21.939 |    | 9.05    | -28.55  | 91984.69  | -13.82 |         |              |
| C (IER)     | I   | 2047-08-01T01:05:29.714 |    | 6.09    | -27.66  | 74490.58  | -13.78 |         |              |
| Saturn      | I   | 2047-08-01T01:21:18.282 |    | 3.76x   | -26.76  | 60256.72  |        | -5.01   | -6.15        |
| Saturn      | E   | 2047-08-01T03:52:42.933 |    | -21.70x | -9.96   | 60243.74  |        | 7.36    | 9.02         |
| C (IER)     | E   | 2047-08-01T04:07:18.295 |    | -24.35x | -7.76   | 74490.58  | 13.47  |         |              |
| B (IER)     | E   | 2047-08-01T04:28:58.674 |    | -28.31x | -4.37x  | 91984.69  | 13.44  |         |              |
| B (OER)     | E   | 2047-08-01T05:00:45.701 |    | -34.15x | 0.83x   | 117571.16 | 13.40  |         |              |
| A (IER)     | E   | 2047-08-01T05:06:20.181 |    | -35.18x | 1.77x   | 122050.38 | 13.39  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:20:30.275 |    | -37.78x | 4.18x   | 133423.31 | 13.37  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:20:54.329 |    | -37.86x | 4.25x   | 133744.89 | 13.37  |         |              |
| A (OER)     | E   | 2047-08-01T05:24:40.983 |    | -38.55x | 4.90x   | 136774.40 | 13.36  |         |              |
| F ring      | E   | 2047-08-01T05:29:16.908 |    | -39.39x | 5.69x   | 140461.00 | 13.36  |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:46:11.610  
 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 : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.17  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.347  
 C/A sky separation (km) : 2326.2  
 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



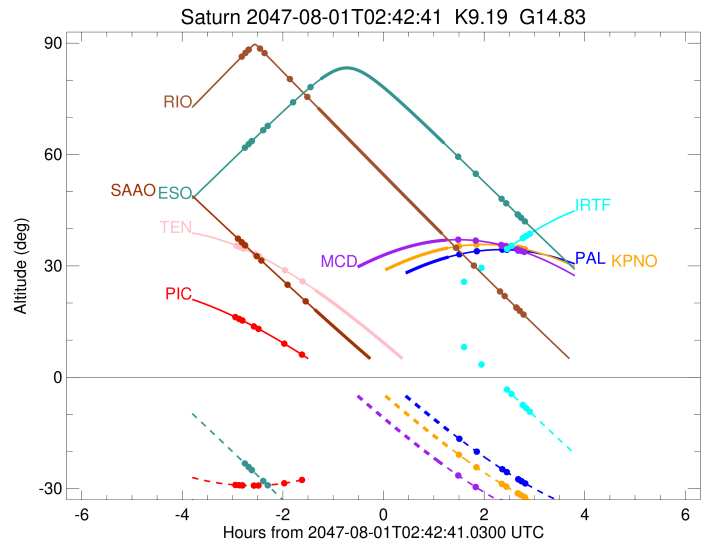
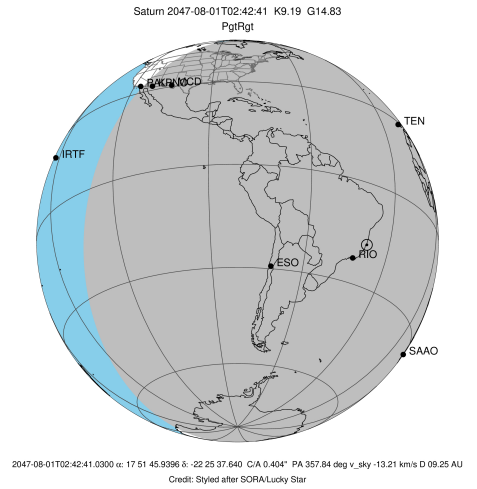
| Ring        | I/E | UTC                     | b?     | alt    | alt-sun   | radius | r-dot | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|--------|--------|-----------|--------|-------|---------|--------------|
| F ring      | I   | 2047-07-31T23:57:01.740 | -1.78x | 33.91x | 140461.00 | -13.84 |       |         |              |
| A (OER)     | I   | 2047-08-01T00:01:28.031 | -0.94x | 32.98x | 136774.40 | -13.85 |       |         |              |
| Encke (OEG) | I   | 2047-08-01T00:05:06.783 | -0.26x | 32.22x | 133744.89 | -13.85 |       |         |              |
| Encke (IEG) | I   | 2047-08-01T00:05:29.999 | -0.19x | 32.13x | 133423.31 | -13.85 |       |         |              |
| A (IER)     | I   | 2047-08-01T00:19:10.580 | 2.35x  | 29.27x | 122050.38 | -13.87 |       |         |              |
| B (OER)     | I   | 2047-08-01T00:24:33.520 | 3.33x  | 28.15x | 117571.16 | -13.87 |       |         |              |
| B (IER)     | I   | 2047-08-01T00:55:15.955 | 8.80   | 21.76x | 91984.69  | -13.90 |       |         |              |
| C (IER)     | I   | 2047-08-01T01:16:14.043 | 12.36  | 17.43x | 74490.58  | -13.91 |       |         |              |
| Saturn      | I   | 2047-08-01T01:31:51.443 | 14.92  | 14.22x | 60256.56  | -5.05  |       | -6.19   |              |
| Saturn      | E   | 2047-08-01T04:00:12.916 | 32.39  | -14.34 | 60233.16  | 8.84   |       | 10.81   |              |
| C (IER)     | E   | 2047-08-01T04:13:04.539 | 33.12  | -16.56 | 74490.58  | 13.99  |       |         |              |
| B (IER)     | E   | 2047-08-01T04:33:55.025 | 33.95  | -20.04 | 91984.69  | 13.99  |       |         |              |
| B (OER)     | E   | 2047-08-01T05:04:23.729 | 34.38  | -24.77 | 117571.16 | 13.99  |       |         |              |
| A (IER)     | E   | 2047-08-01T05:09:43.967 | 34.36  | -25.55 | 122050.38 | 13.99  |       |         |              |
| Encke (IEG) | E   | 2047-08-01T05:23:17.318 | 34.17  | -27.46 | 133423.31 | 13.98  |       |         |              |
| Encke (OEG) | E   | 2047-08-01T05:23:40.322 | 34.16  | -27.51 | 133744.89 | 13.98  |       |         |              |
| A (OER)     | E   | 2047-08-01T05:27:17.056 | 34.08  | -28.00 | 136774.40 | 13.98  |       |         |              |
| F ring      | E   | 2047-08-01T05:31:40.846 | 33.96  | -28.59 | 140461.00 | 13.97  |       |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:45:44.000  
 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 : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.24  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.345  
 C/A sky separation (km) : 2314.3  
 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



| Ring        | I/E | UTC                     | b? | alt   | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2047-07-31T23:56:55.220 |    | 2.78x | 29.44x  | 140461.00 | -13.88 |         |              |
| A (OER)     | I   | 2047-08-01T00:01:20.836 |    | 3.61x | 28.50x  | 136774.40 | -13.88 |         |              |
| Encke (OEG) | I   | 2047-08-01T00:04:59.037 |    | 4.28x | 27.73x  | 133744.89 | -13.89 |         |              |
| Encke (IEG) | I   | 2047-08-01T00:05:22.195 |    | 4.35x | 27.65x  | 133423.31 | -13.89 |         |              |
| A (IER)     | I   | 2047-08-01T00:19:00.747 |    | 6.85  | 24.76x  | 122050.38 | -13.90 |         |              |
| B (OER)     | I   | 2047-08-01T00:24:22.903 |    | 7.82  | 23.63x  | 117571.16 | -13.91 |         |              |
| B (IER)     | I   | 2047-08-01T00:55:01.051 |    | 13.17 | 17.20x  | 91984.69  | -13.93 |         |              |
| C (IER)     | I   | 2047-08-01T01:15:56.413 |    | 16.63 | 12.85x  | 74490.58  | -13.94 |         |              |
| Saturn      | I   | 2047-08-01T01:31:32.784 |    | 19.10 | 9.64x   | 60256.69  |        | -5.02   | -6.16        |
| Saturn      | E   | 2047-08-01T03:59:39.316 |    | 34.83 | -18.68  | 60233.60  |        | 8.78    | 10.74        |
| C (IER)     | E   | 2047-08-01T04:12:33.542 |    | 35.31 | -20.86  | 74490.58  | 13.99  |         |              |
| B (IER)     | E   | 2047-08-01T04:33:23.682 |    | 35.73 | -24.22  | 91984.69  | 13.99  |         |              |
| B (OER)     | E   | 2047-08-01T05:03:52.414 |    | 35.52 | -28.73  | 117571.16 | 13.99  |         |              |
| A (IER)     | E   | 2047-08-01T05:09:12.723 |    | 35.38 | -29.47  | 122050.38 | 13.98  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:22:46.338 |    | 34.90 | -31.26  | 133423.31 | 13.97  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:23:09.352 |    | 34.88 | -31.30  | 133744.89 | 13.97  |         |              |
| A (OER)     | E   | 2047-08-01T05:26:46.179 |    | 34.72 | -31.76  | 136774.40 | 13.97  |         |              |
| F ring      | E   | 2047-08-01T05:31:10.093 |    | 34.50 | -32.30  | 140461.00 | 13.97  |         |              |

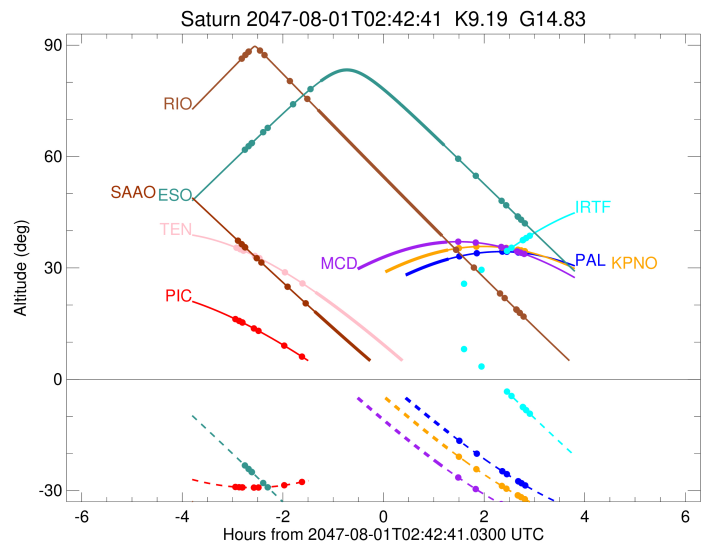
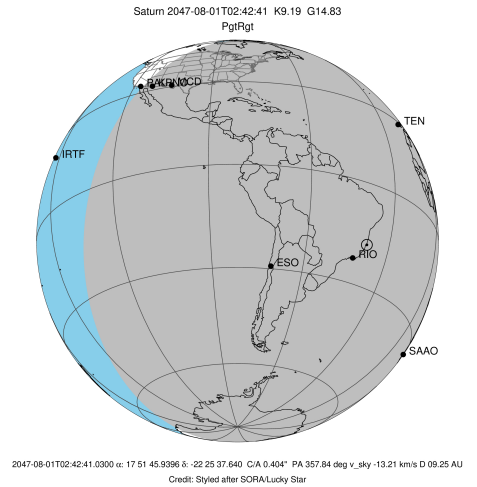
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:44:58.540  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : MCD  
 Location : McDonald Obs. 2.7m  
 Latitude (deg) : 30.67158  
 E. Longitude (deg) : 255.97844  
 Altitude (km) : 2.075  
 Gaia source ID : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.35  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.345  
 C/A sky separation (km) : 2316.3  
 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



| Ring        | I/E | UTC                     | b? | alt   | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2047-07-31T23:56:34.909 |    | 8.95  | 22.93x  | 140461.00 | -13.92 |         |              |
| A (OER)     | I   | 2047-08-01T00:00:59.637 |    | 9.75  | 21.99x  | 136774.40 | -13.93 |         |              |
| Encke (OEG) | I   | 2047-08-01T00:04:37.115 |    | 10.40 | 21.22x  | 133744.89 | -13.93 |         |              |
| Encke (IEG) | I   | 2047-08-01T00:05:00.197 |    | 10.47 | 21.13x  | 133423.31 | -13.93 |         |              |
| A (IER)     | I   | 2047-08-01T00:18:36.106 |    | 12.88 | 18.25x  | 122050.38 | -13.95 |         |              |
| B (OER)     | I   | 2047-08-01T00:23:57.251 |    | 13.81 | 17.11x  | 117571.16 | -13.95 |         |              |
| B (IER)     | I   | 2047-08-01T00:54:29.982 |    | 18.90 | 10.70x  | 91984.69  | -13.97 |         |              |
| C (IER)     | I   | 2047-08-01T01:15:22.015 |    | 22.14 | 6.38x   | 74490.58  | -13.97 |         |              |
| Saturn      | I   | 2047-08-01T01:30:58.128 |    | 24.43 | 3.18x   | 60256.97  |        | -4.96   | -6.08        |
| Saturn      | E   | 2047-08-01T03:58:47.788 |    | 36.97 | -24.39  | 60234.14  |        | 8.71    | 10.66        |
| C (IER)     | E   | 2047-08-01T04:11:45.673 |    | 37.06 | -26.45  | 74490.58  | 13.99  |         |              |
| B (IER)     | E   | 2047-08-01T04:32:36.164 |    | 36.82 | -29.56  | 91984.69  | 13.99  |         |              |
| B (OER)     | E   | 2047-08-01T05:03:06.161 |    | 35.64 | -33.63  | 117571.16 | 13.97  |         |              |
| A (IER)     | E   | 2047-08-01T05:08:26.782 |    | 35.33 | -34.27  | 122050.38 | 13.97  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:22:01.313 |    | 34.43 | -35.80  | 133423.31 | 13.96  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:22:24.354 |    | 34.40 | -35.84  | 133744.89 | 13.96  |         |              |
| A (OER)     | E   | 2047-08-01T05:26:01.455 |    | 34.12 | -36.23  | 136774.40 | 13.95  |         |              |
| F ring      | E   | 2047-08-01T05:30:25.719 |    | 33.78 | -36.67  | 140461.00 | 13.95  |         |              |

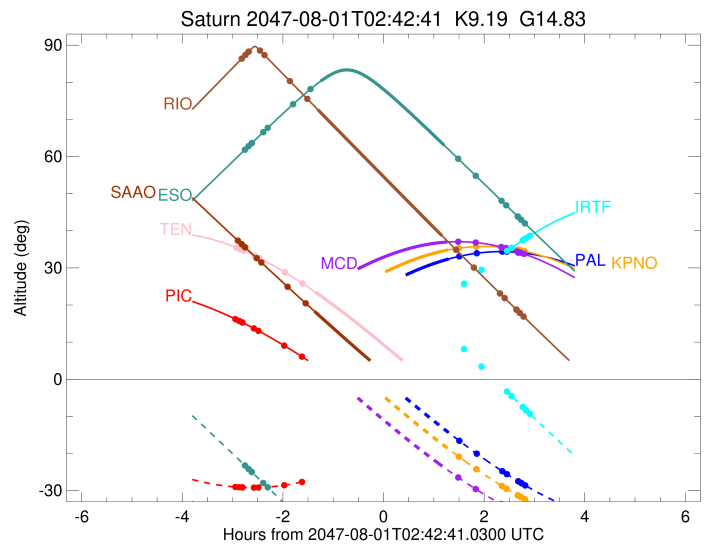
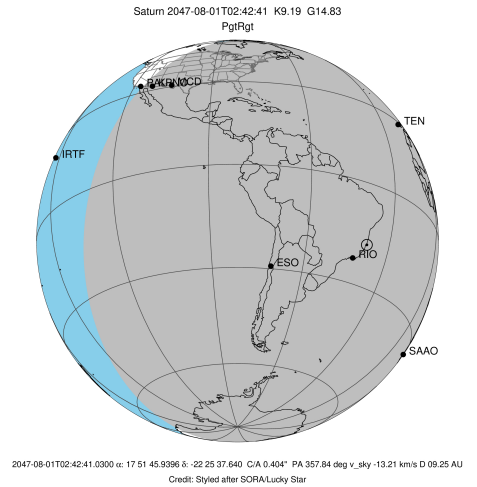


target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:36:08.860  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : TEN  
 Location : Teide Obs./Tenerife  
 Latitude (deg) : 28.30050  
 E. Longitude (deg) : 343.48909  
 Altitude (km) : 2.395  
 Gaia source ID : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 22.18  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.121  
 C/A sky separation (km) : 812.7  
 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\_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



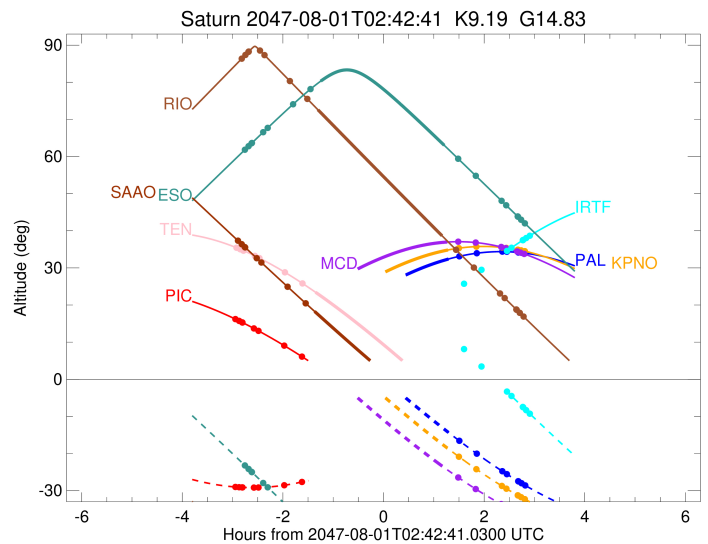
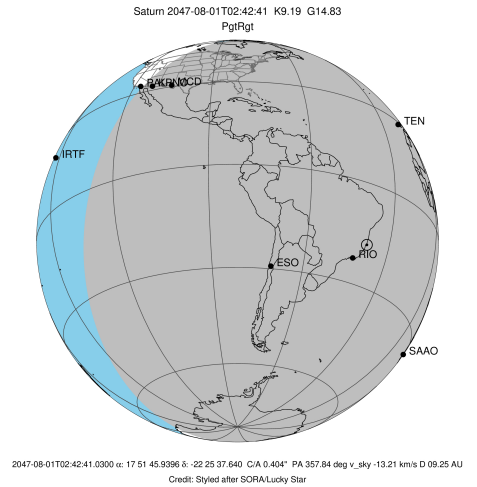
| Ring        | I/E | UTC                     | b? | alt     | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|---------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2047-07-31T23:47:27.881 |    | 35.43   | -39.44  | 140461.00 | -14.04 |         |              |
| A (OER)     | I   | 2047-07-31T23:51:50.555 |    | 35.02   | -39.86  | 136774.40 | -14.03 |         |              |
| Encke (OEG) | I   | 2047-07-31T23:55:26.489 |    | 34.68   | -40.19  | 133744.89 | -14.03 |         |              |
| Encke (IEG) | I   | 2047-07-31T23:55:49.414 |    | 34.64   | -40.23  | 133423.31 | -14.03 |         |              |
| A (IER)     | I   | 2047-08-01T00:09:20.720 |    | 33.23   | -41.35  | 122050.38 | -14.01 |         |              |
| B (OER)     | I   | 2047-08-01T00:14:40.548 |    | 32.63   | -41.74  | 117571.16 | -14.00 |         |              |
| B (IER)     | I   | 2047-08-01T00:45:10.997 |    | 28.80   | -43.34  | 91984.69  | -13.95 |         |              |
| C (IER)     | I   | 2047-08-01T01:06:06.339 |    | 25.82   | -43.78  | 74490.58  | -13.92 |         |              |
| Saturn      | I   | 2047-08-01T01:21:29.994 |    | 23.46   | -43.76  | 60254.56  |        | -5.47   | -6.72        |
| Saturn      | E   | 2047-08-01T03:51:33.187 |    | -4.18x  | -29.88  | 60247.40  |        | 6.78    | 8.31         |
| C (IER)     | E   | 2047-08-01T04:06:27.940 |    | -7.23x  | -27.52  | 74490.58  | 13.57  |         |              |
| B (IER)     | E   | 2047-08-01T04:27:59.473 |    | -11.69x | -23.90  | 91984.69  | 13.52  |         |              |
| B (OER)     | E   | 2047-08-01T04:59:35.513 |    | -18.34x | -18.25  | 117571.16 | 13.46  |         |              |
| A (IER)     | E   | 2047-08-01T05:05:08.311 |    | -19.52x | -17.22  | 122050.38 | 13.45  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:19:14.465 |    | -22.53x | -14.56  | 133423.31 | 13.43  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:19:38.414 |    | -22.62x | -14.48  | 133744.89 | 13.43  |         |              |
| A (OER)     | E   | 2047-08-01T05:23:24.104 |    | -23.43x | -13.76  | 136774.40 | 13.42  |         |              |
| F ring      | E   | 2047-08-01T05:27:58.903 |    | -24.41x | -12.88  | 140461.00 | 13.41  |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:49:44.240  
 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 : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 20.60  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.035  
 C/A sky separation (km) : 236.1  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itr93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 naif0012.tls  
 earth\_flat\_IAU.spk



| Ring        | I/E | UTC                     | b?      | alt    | alt-sun   | radius | r-dot | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|---------|--------|-----------|--------|-------|---------|--------------|
| F ring      | I   | 2047-07-31T23:59:06.600 | -29.58x | 68.46x | 140461.00 | -13.58 |       |         |              |
| A (OER)     | I   | 2047-08-01T00:03:37.978 | -28.55x | 67.39x | 136774.40 | -13.59 |       |         |              |
| Encke (OEG) | I   | 2047-08-01T00:07:20.871 | -27.71x | 66.52x | 133744.89 | -13.59 |       |         |              |
| Encke (IEG) | I   | 2047-08-01T00:07:44.525 | -27.62x | 66.43x | 133423.31 | -13.60 |       |         |              |
| A (IER)     | I   | 2047-08-01T00:21:40.311 | -24.46x | 63.15x | 122050.38 | -13.62 |       |         |              |
| B (OER)     | I   | 2047-08-01T00:27:09.083 | -23.22x | 61.86x | 117571.16 | -13.63 |       |         |              |
| B (IER)     | I   | 2047-08-01T00:58:22.803 | -16.19x | 54.51x | 91984.69  | -13.68 |       |         |              |
| C (IER)     | I   | 2047-08-01T01:19:39.790 | -11.45x | 49.52x | 74490.58  | -13.72 |       |         |              |
| Saturn      | I   | 2047-08-01T01:34:10.342 | -8.24x  | 46.12x | 60245.41  | -7.10  |       | -8.71   |              |
| Saturn      | E   | 2047-08-01T04:04:38.058 | 23.09   | 11.32x | 60243.41  | 7.41   |       | 9.08    |              |
| C (IER)     | E   | 2047-08-01T04:18:40.399 | 25.72   | 8.14x  | 74490.58  | 13.97  |       |         |              |
| B (IER)     | E   | 2047-08-01T04:39:31.229 | 29.48   | 3.45x  | 91984.69  | 14.00  |       |         |              |
| B (OER)     | E   | 2047-08-01T05:09:57.687 | 34.58   | -3.32x | 117571.16 | 14.02  |       |         |              |
| A (IER)     | E   | 2047-08-01T05:15:17.139 | 35.42   | -4.49x | 122050.38 | 14.02  |       |         |              |
| Encke (IEG) | E   | 2047-08-01T05:28:47.929 | 37.46   | -7.45  | 133423.31 | 14.03  |       |         |              |
| Encke (OEG) | E   | 2047-08-01T05:29:10.849 | 37.51   | -7.53  | 133744.89 | 14.03  |       |         |              |
| A (OER)     | E   | 2047-08-01T05:32:46.757 | 38.03   | -8.32  | 136774.40 | 14.03  |       |         |              |
| F ring      | E   | 2047-08-01T05:37:09.461 | 38.65   | -9.27  | 140461.00 | 14.03  |       |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:38:10.860  
 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 : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 22.10  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.500  
 C/A sky separation (km) : 3352.0  
 NAIF SPICE kernels : RAJobs\_U111+rgf15.spk  
 URKALLvl.spk  
 Saturn\_ring\_plane.tf  
 sat378.bsp  
 sat286.bsp  
 vgr1.sat286.bsp  
 vgr2.sat286.bsp  
 HST1081HSPephemUTC.bsp  
 pfb10000r.bsp  
 cassini.bsp  
 earthstns\_itrf93\_040916.bsp  
 earth\_200101\_990628\_predict.bpc  
 earth\_720101\_070426.bpc  
 cpck28Mar2008.tpc  
 pck.sat440.tpc  
 IAU\_SATURN\_for\_RINGFIT.tpc  
 naif0012.tls  
 earth\_flat\_IAU.spk

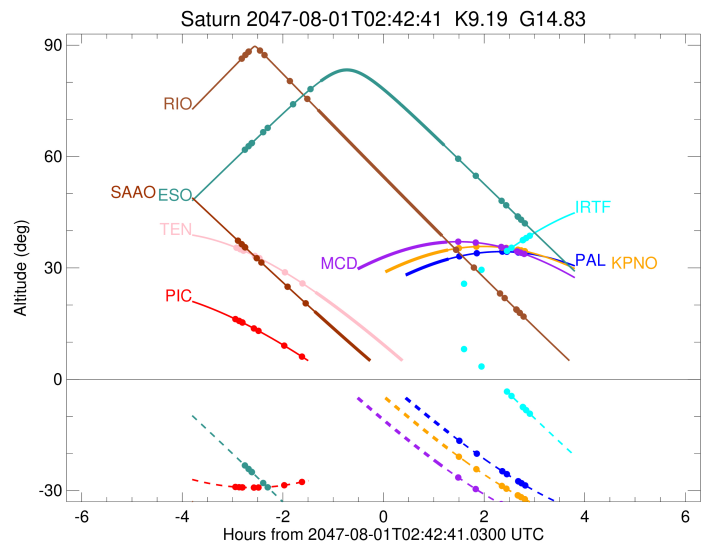
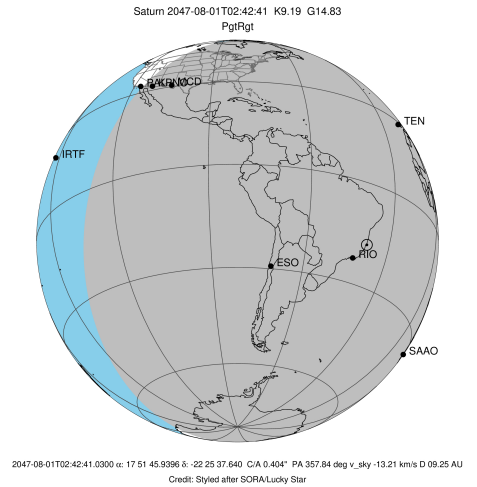


b: ring blocked by planet x: target alt < 5.0 deg or sun > -5.0 deg

| Ring        | I/E | UTC                     | b? | alt   | alt-sun | radius    | r-dot  | lat-geo | lat-geodetic |
|-------------|-----|-------------------------|----|-------|---------|-----------|--------|---------|--------------|
| F ring      | I   | 2047-07-31T23:53:41.695 |    | 86.38 | -46.45  | 140461.00 | -14.11 |         |              |
| A (OER)     | I   | 2047-07-31T23:58:03.053 |    | 87.38 | -47.45  | 136774.40 | -14.10 |         |              |
| Encke (OEG) | I   | 2047-08-01T00:01:37.875 |    | 88.20 | -48.28  | 133744.89 | -14.10 |         |              |
| Encke (IEG) | I   | 2047-08-01T00:02:00.680 |    | 88.29 | -48.36  | 133423.31 | -14.10 |         |              |
| A (IER)     | I   | 2047-08-01T00:15:27.575 |    | 88.53 | -51.46  | 122050.38 | -14.09 |         |              |
| B (OER)     | I   | 2047-08-01T00:20:45.579 |    | 87.32 | -52.68  | 117571.16 | -14.08 |         |              |
| B (IER)     | I   | 2047-08-01T00:51:05.059 |    | 80.32 | -59.67  | 91984.69  | -14.04 |         |              |
| C (IER)     | I   | 2047-08-01T01:11:53.102 |    | 75.51 | -64.45  | 74490.58  | -13.99 |         |              |
| Saturn      | I   | 2047-08-01T01:24:26.401 |    | 72.61 | -67.33  | 60230.47  |        | -9.17   | -11.22       |
| Saturn      | E   | 2047-08-01T03:52:31.055 |    | 38.65 | -76.66  | 60262.97  |        | 3.34    | 4.11         |
| C (IER)     | E   | 2047-08-01T04:09:09.212 |    | 34.89 | -72.96  | 74490.58  | 13.70  |         |              |
| B (IER)     | E   | 2047-08-01T04:30:26.703 |    | 30.09 | -68.13  | 91984.69  | 13.68  |         |              |
| B (OER)     | E   | 2047-08-01T05:01:39.829 |    | 23.11 | -60.97  | 117571.16 | 13.63  |         |              |
| A (IER)     | E   | 2047-08-01T05:07:08.473 |    | 21.89 | -59.71  | 122050.38 | 13.62  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:21:04.004 |    | 18.80 | -56.51  | 133423.31 | 13.60  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:21:27.653 |    | 18.72 | -56.41  | 133744.89 | 13.60  |         |              |
| A (OER)     | E   | 2047-08-01T05:25:10.505 |    | 17.90 | -55.56  | 136774.40 | 13.59  |         |              |
| F ring      | E   | 2047-08-01T05:29:41.850 |    | 16.90 | -54.52  | 140461.00 | 13.58  |         |              |



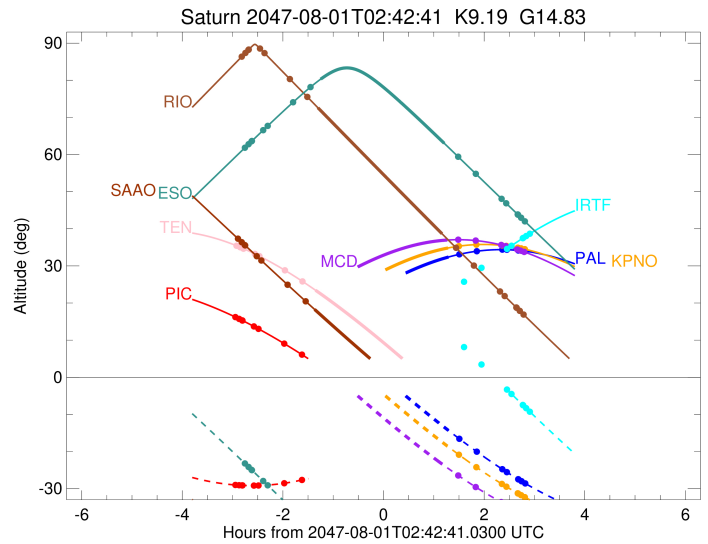
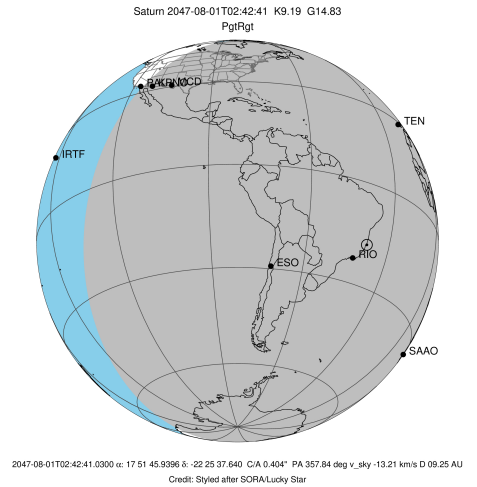
target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:41:24.890  
 Event type : PgtRgt  
 : Saturn occs: geocentric, topocentric  
 : Ring occs: geocentric, topocentric  
 Observer code : ESO  
 Location : European Southern Obs. (3.6m)  
 Latitude (deg) : -29.26097  
 E. Longitude (deg) : 289.26831  
 Altitude (km) : 2.400  
 Gaia source ID : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.79  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.525  
 C/A sky separation (km) : 3523.4  
 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   | 2047-07-31T23:57:26.675 |    | 61.84 | -23.23  | 140461.00 | -14.06 |         |              |
| A (OER)     | I   | 2047-08-01T00:01:48.819 |    | 62.79 | -24.17  | 136774.40 | -14.06 |         |              |
| Encke (OEG) | I   | 2047-08-01T00:05:24.236 |    | 63.57 | -24.95  | 133744.89 | -14.06 |         |              |
| Encke (IEG) | I   | 2047-08-01T00:05:47.102 |    | 63.66 | -25.03  | 133423.31 | -14.06 |         |              |
| A (IER)     | I   | 2047-08-01T00:19:15.815 |    | 66.57 | -27.95  | 122050.38 | -14.06 |         |              |
| B (OER)     | I   | 2047-08-01T00:24:34.361 |    | 67.71 | -29.11  | 117571.16 | -14.06 |         |              |
| B (IER)     | I   | 2047-08-01T00:54:55.077 |    | 74.09 | -35.72  | 91984.69  | -14.04 |         |              |
| C (IER)     | I   | 2047-08-01T01:15:42.197 |    | 78.18 | -40.26  | 74490.58  | -14.01 |         |              |
| Saturn      | I   | 2047-08-01T01:27:51.191 |    | 80.32 | -42.91  | 60227.03  |        | -9.59   | -11.72       |
| Saturn      | E   | 2047-08-01T03:55:14.998 |    | 63.00 | -73.43  | 60262.70  |        | 3.43    | 4.22         |
| C (IER)     | E   | 2047-08-01T04:11:40.802 |    | 59.42 | -75.99  | 74490.58  | 13.85  |         |              |
| B (IER)     | E   | 2047-08-01T04:32:43.786 |    | 54.81 | -78.30  | 91984.69  | 13.85  |         |              |
| B (OER)     | E   | 2047-08-01T05:03:33.541 |    | 48.06 | -78.45  | 117571.16 | 13.81  |         |              |
| A (IER)     | E   | 2047-08-01T05:08:57.864 |    | 46.88 | -78.04  | 122050.38 | 13.81  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:22:42.152 |    | 43.87 | -76.54  | 133423.31 | 13.79  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:23:05.477 |    | 43.79 | -76.49  | 133744.89 | 13.79  |         |              |
| A (OER)     | E   | 2047-08-01T05:26:45.269 |    | 42.99 | -75.99  | 136774.40 | 13.78  |         |              |
| F ring      | E   | 2047-08-01T05:31:12.858 |    | 42.01 | -75.35  | 140461.00 | 13.77  |         |              |

target : Saturn  
 target radius (km) : 60268.00  
 C/A epoch : 2047-08-01T02:36:06.460  
 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 : 4070416991228323840  
 2Mass ID (if available) : 17514594-2225371  
 ICRS Star Coord at Epoch: 17h 51m 45.93955s -22:25:37.64032s  
 RUWE (>1.4 is poor) : 0.97  
 K magnitude : 9.193  
 G magnitude : 14.830  
 RP magnitude : 13.385  
 BP magnitude : 17.092  
 DUPflag : 0  
 Distance (au) : 9.248  
 f0 (km) : 0.000  
 g0 (km) : 0.000  
 skyplane vel. (km/s) : -13.21  
 Sun-Target sep (deg) : 139.92  
 Sun-Moon sep (deg) : 21.97  
 B (ring opening deg) : 26.74  
 PA of pole (deg) : 5.35  
 Pole direction: RA (deg): 40.60000  
 Dec (deg): 83.50000  
 C/A sky separation (") : 0.962  
 C/A sky separation (km) : 6455.0  
 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



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   | 2047-07-31T23:49:11.658 |    | 37.32   | -69.48  | 140461.00 | -13.76 |         |              |
| A (OER)     | I   | 2047-07-31T23:53:39.790 |    | 36.37   | -68.74  | 136774.40 | -13.74 |         |              |
| Encke (OEG) | I   | 2047-07-31T23:57:20.314 |    | 35.60   | -68.11  | 133744.89 | -13.73 |         |              |
| Encke (IEG) | I   | 2047-07-31T23:57:43.732 |    | 35.51   | -68.04  | 133423.31 | -13.73 |         |              |
| A (IER)     | I   | 2047-08-01T00:11:33.227 |    | 32.60   | -65.58  | 122050.38 | -13.69 |         |              |
| B (OER)     | I   | 2047-08-01T00:17:00.647 |    | 31.46   | -64.57  | 117571.16 | -13.67 |         |              |
| B (IER)     | I   | 2047-08-01T00:48:20.326 |    | 24.91   | -58.49  | 91984.69  | -13.55 |         |              |
| C (IER)     | I   | 2047-08-01T01:09:57.675 |    | 20.44   | -54.11  | 74490.58  | -13.41 |         |              |
| Saturn      | I   | 2047-08-01T01:20:32.480 |    | 18.27   | -51.93  | 60208.49  |        | -11.58  | -14.13       |
| Saturn      | E   | 2047-08-01T03:52:35.142 |    | -10.83x | -19.93  | 60267.80  |        | 0.67    | 0.82         |
| C (IER)     | E   | 2047-08-01T04:10:40.938 |    | -13.90x | -16.17  | 74490.58  | 13.09  |         |              |
| B (IER)     | E   | 2047-08-01T04:32:54.476 |    | -17.50x | -11.58  | 91984.69  | 13.14  |         |              |
| B (OER)     | E   | 2047-08-01T05:05:19.631 |    | -22.34x | -4.99x  | 117571.16 | 13.16  |         |              |
| A (IER)     | E   | 2047-08-01T05:10:59.963 |    | -23.14x | -3.85x  | 122050.38 | 13.16  |         |              |
| Encke (IEG) | E   | 2047-08-01T05:25:24.083 |    | -25.06x | -0.98x  | 133423.31 | 13.16  |         |              |
| Encke (OEG) | E   | 2047-08-01T05:25:48.518 |    | -25.11x | -0.90x  | 133744.89 | 13.16  |         |              |
| A (OER)     | E   | 2047-08-01T05:29:38.718 |    | -25.61x | -0.15x  | 136774.40 | 13.16  |         |              |
| F ring      | E   | 2047-08-01T05:34:18.863 |    | -26.19x | 0.77x   | 140461.00 | 13.16  |         |              |