**Blue**

Far-infrared Limb Composition Integration (FIRLMBINT)

 Far-infrared Limb Aerosol Scan (FIRLMBAER)

 Far-infrared Limb Temperature Sounding (FIRLMBT)

RED

 Far-infrared Nadir Temperature Maps (FIRNADMAP)

Green

 Far-infrared Nadir Composition Integrations (FIRNADCMP)

Purple

 Mid-infrared Limb Composition Integration (MIRLMBINT)

 Mid-infrared Nadir Temperature Maps (MIDIRTMAP)

**CIRS Titan Prime Observation Notes**

**Sequence 50 CIRS Titan Primes:**

Reconstructed December 2017

**T54**

**CIRS\_110TI\_MIDIRTMAP001\_PRIME:** A full-disk map at a scan rate of 13 microrad/sec.

**CIRS\_110TI\_MIRLMBMAP001\_PRIME:** Latitudes covered range from 30N to 20S. The subspacecraft latitude is 56N, which compresses the range of latitudes present against the limb.

**CIRS\_110TI\_FIRNADMAP001\_PRIME:** This scan covers the full disk of Titan, offset from the subspacecraft point in order to overfly the North Pole. The scan rate is 10 microrad/sec.

**CIRS\_110TI\_EUVFUV001\_UVIS --PRIME**

**CIRS\_110TI\_FIRLMBINT001\_PRIME:** The target latitude is 20N.

**CIRS\_110TI\_FIRLMBAER001\_PRIME:** The target latitude is 30N, and the scan rate is 40 microrad/sec.

**CIRS\_110TI\_FIRLMBT001\_PRIME:** Two scans, at 10N and 5N. The scan rates are 50 microrad.sec, beginning at 0 km altitude and scanning through 24 mrad.

**CIRS\_110TI\_HIRES001\_PRIME:** This is a long stare pointing the ISS NAC to Titan center.

**CIRS\_110TI\_FIRNADCMP001\_PRIME:** The target is 70S 190W.

**CIRS\_111TI\_MIDIRTMAP001\_PRIME:** This is a short-duration MIDIRTMAP with long turns to and from the recommended RBOT-safe secondary pointing, so it consists of a single scan over the North Pole. The scan general follows 110W and 290W at a scan rate of 6 microrad/sec.

**CIRS\_111TI\_FIRNADMAP002\_PRIME:** A full-disk transect, offset from the subspacecraft point in order to provide coverage of the South Pole. The scan rate is 10 microrad/sec.

**CIRS\_111TI\_MIRLMPAIR002\_PRIME:** The target is 25S, and FP3 is pointed to an altitude of 125 km.

**CIRS\_111TI\_FIRNADCMP002\_PRIME:** The target is 25S 5W.

**CIRS\_111TI\_MIDIRTMAP002\_PRIME:** A full-disk map at a scan rate of 6 microrad/sec.

**CIRS\_112TI\_FIRNADCMP001\_PRIME:** The target is 50N 60W.

**CIRS\_112TI\_FIRNADCMP002\_PRIME:** The target is 60S 255W.

**Sequence 51 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_113TI\_FIRNADCMP001\_PRIME:** The target is 15N 75W.

**T57**

**CIRS\_113TI\_FIRLMBINT001\_PRIME:** Four pointings, two each at altitudes of 125 and 225 km; dwell durations are 12 minutes 40 seconds. The target latitude is 10S.

**CIRS\_113TI\_MIDIRTMAP002\_PRIME:** A full-disk map at a scan rate of 5 microrad/sec.

**CIRS\_114TI\_FIRNADMAP002\_PRIME:** This is a north-to-south scan at a rate of 20 microrad/sec, offset eastward from the subspacecraft point to cover longitude 300W.

**CIRS\_114TI\_FIRNADCMP001\_PRIME:** The target is 70S 340W.

**Sequence 52 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_115TI\_MIDIRTMAP001\_PRIME:** A full-disk scan at a rate of 14 microrad/sec.

**CIRS\_115TI\_FIRNADCMP001\_PRIME:** The target is 50N 100W.

**CIRS\_115TI\_MIRLMBMAP001\_PRIME:** Latitude coverage for this observation ranges from 0N to 60N, the furthest north latitude targetable against the limb.

**T59**

**CIRS\_115TI\_FIRLMBT002\_PRIME:** This observation contains two scans, one at 50S and one at 55S. The scan rate for both is 48 microrad/sec.

**CIRS\_115TI\_FIRLMBAER002\_PRIME:** A single scan targeted to 60S, at a scan rate of 33 microrad/sec.

**CIRS\_115TI\_FIRLMBINT002\_PRIME:** Four dwells, two each at 125 and 225 km targeting latitude 60S. Dwells are 11 minutes 40 seconds in duration.

**CIRS\_115TI\_FIRNADMAP002\_PRIME:** This scan crosses the disk from about 55N 0W to 60S 230W, both on the limb. The scan midpoint is the subspacecraft point, 23S 326W. Scan rate is 12 microrad/sec.

**CIRS\_115TI\_MIRLMBINT002\_PRIME:** The target latitude is 67N. All dwells have a 20-degree rotation from the nominal Z perpendicular to limb pointing, due to RBOT.

**CIRS\_116TI\_FIRNADCMP001\_PRIME:** The target is 30S 145W.

**Sequence 53 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_117TI\_MIRLMBINT001\_PRIME:** This observation period is compromised by the nearness of NEG Y to Sun, requiring a long stare at dark sky waiting for the geometry to be favorable at the target latitude of 70S. Due to the reduced targeting time we only have two dwells on the limb, each about 52 minutes in duration. The first dwell is at an altitude of 500 km, with the second stepped down in altitude toward the limb by 2.5 mrad about X.

**Sequence 54 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_119TI\_MIDIRTMAP001\_PRIME:** This is a partial-disk map, limited by the high phase angle of the observation; about a third of the disk of Titan is within 15 degrees of the Sun, so we avoid that region. The scan rate is 7 microrad/sec.

**CIRS\_119TI\_FIRNADCMP001\_PRIME:** The target is 25S 105W.

**T62**

**CIRS\_119TI\_FIRLMBT001\_PRIME:** This observation is on thrusters, so the deadband is higher and the scan pointing may be less precise than when the spacecraft is on wheels. Two scans, both aimed at 75S on the limb, at scan rates of 51 microrad/sec.

**CIRS\_119TI\_FIRLMBAER002\_PRIME:** The spacecraft is on thrusters, so less precise pointing may be expected than when using wheels for turn control. A single scan at a rate of 23 microrad/sec, targeting 70S.

**CIRS\_119TI\_FIRLMBINT002\_PRIME:** The spacecraft is on thrusters, so pointing stability will be less than when using wheels due to the higher deadband associated with RCS. The target is 75S and we have four dwells, two each at 123 and 225 km altitude, each dwell lasting about 12 minutes.

**CIRS\_119TI\_FIRNADCMP002\_PRIME:** The aimpoint is 0N 20W.

**Sequence 55 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_122TI\_FIRNADCMP001\_PRIME:** The target is 40N 0W.

**CIRS\_122TI\_MIRLMBMAP001\_PRIME:** Latitude coverage ranges from 85N to 0N; dwell times are 4 minutes at each altitude, two altitudes per latitude step.

**CIRS\_122TI\_FIRNADMAP002\_PRIME:** This observation is a two-part scan. The first leg begins near 5N 240W and runs to 70S 200W (near the southernmost limb), and the second picks up there and ends at 0N 150W. The scan rate for the first leg is 42 microrad/sec, and for the second 49 microrad/sec.

**CIRS\_122TI\_MIDIRTMAP002\_PRIME:** This is a full-disk scan at a rate of 8 microrad/sec.

**CIRS\_122TI\_COMPMAP002\_PRIME:** This MAP was carved out from the preceding MIDIRTMAP, which had an unusually long duration. The COMPMAP steps FPB across the disk of Titan from the northeast to the southwest, with significant coverage off-disk at both start and end. There are nine footprints total, and each dwell is 25 minutes long.

**Sequence 56 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_123TI\_MIDIRTMAP001\_PRIME:** A full-disk map at 13 microrad/sec.

**CIRS\_123TI\_MIRLMPAIR001\_PRIME:** FP3 is aimed at 75N at an altitude of 225 km; the long axis of the focal plane is parallel to the surface of Titan at that latitude.

**CIRS\_123TI\_FIRNADMAP001\_PRIME:** This is a full transect of the visible disk from south to north, at a scan rate of 10 microrad/sec. The midpoint of the scan is at the subspacecraft point, 4N 21W.

**T64**

**CIRS\_123TI\_FIRLMBINT001\_PRIME:** Targeting 45N, we have two pointings each at altitudes of 125 and 225 km. Each dwell is 10 minutes in duration.

**CIRS\_123TI\_FIRLMBAER001\_PRIME:** This observation had been intended to be a FIRLMBCON, but the latitude range visible against the limb did not meet the science objectives for a condensate scan and it was retitled during integration. This design is a single scan at a rate of 28 microrad/sec, at 50N latitude.

**CIRS\_123TI\_MIRLMBINT002\_PRIME:** Four dwells, two each at 125 and 225 km altitude, each with a duration of about 48 minutes. The target latitude is 75N.

**CIRS\_123TI\_FIRNADCMP002\_PRIME:** The target is 45S 190W.

**CIRS\_123TI\_COMPMAP001\_PRIME:** Three FPB footprints covering the disk from north to south, with significant off-disk coverage at the poles. Dwells are two hours per pointing.

**CIRS\_124TI\_MIRLMBINT001\_PRIME:** The dwells are about 48 minutes each, and the aimpoint is 75S.

**CIRS\_124TI\_FIRNADMAP001\_PRIME:** This is an unusual FIRNADMAP: two scan legs, the first from 0N 90W to 70N 10W and the second from that point to 0N 315W. Scan rates are about 15 microrad/sec.

**CIRS\_124TI\_FIRNADMAP002\_PRIME:** This is a two-leg FIRNADMAP, with the first scan from 20S 280W to 65S 190W, and the second from that point to the limb near 30S 130W. The scan rates are 8 microrad/sec for the first scan and 7 microrad/sec for the second.

**CIRS\_124TI\_MIRLMBMAP002\_PRIME:** This is a good quadrant map, with targeted latitudes ranging from 0N to 85S.

**CIRS\_124TI\_FIRNADCMP002\_PRIME:** The aimpoint is 0N 170W.

**CIRS\_124TI\_MIDIRTMAP002\_PRIME:** This is a full-disk map at a scan rate of 6 microrad/sec.

**CIRS\_124TI\_COMPMAP002\_PRIME:** This COMPMAP has two pointings, targeting FPB to 48N and 48S, with dwells of about 1 hour 41 minutes at each pointing. This puts FPB wholly on the disk of Titan but the north and south polar regions are just sampled. We use an RBOT-safe secondary, so the FP3 and 4 arrays are not oriented exactly north-south.

**Sequence 57 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_125TI\_FIRNADCMP001\_PRIME:** The target is 40N 40W.

**T66**

**CIRS\_125TI\_FIRLMBINT001\_PRIME:** We target 30N on the limb, with four dwells of 12 minutes each. FP1 points to altitudes of 125 and 225 km, twice at each altitude.

**CIRS\_125TI\_FIRLMBAER001\_PRIME:** This FIRLMBAER incorporates an agreed-upon VIMS occultation of a star by the limb of Titan, so the scan rate is a higher-than-optimal 45 microrad/sec. The targeted limb latitude is 20N.

**CIRS\_125TI\_FIRLMBT001\_PRIME:** Two scans, one each at 28N and 23N. The scan rates are both 50 microrad/sec.

**CIRS\_125TI\_FIRNADCMP002\_PRIME:** The target is 45S 225W.

**Sequence 58 CIRS Titan Prime:**

Reconstructed December 2017

**CIRS\_128TI\_COMPMAP001\_PRIME:** Three FPB footprints along the equator, spanning the disk. The subspacecraft point is 0N 64W.

**Sequence 59 CIRS Titan Primes:**

**CIRS\_129TI\_FIRNADCMP001\_PRIME:**

- 20 minute deep space time at the start.

- The aimpoint is 45S, 110W.

**CIRS\_129TI\_MIRLMBINT001\_PRIME:**

- 30 minutes deep space at the start.

- Aimpoint on the limb is 70N, LHS, 350 km altitude, stepping down

1.8 mrad toward the limb.

- Dwell is 47:45 at each of 4 iterations.

**CIRS\_129TI\_FIRNADMAP001\_PRIME:**

- An RBOT secondary pointing was used, so sequence lead and rider

approval will be needed.

- There's a spurious 7POLY\_VEC command well after the end of the

observation.

- The path selected aims to track less-well covered surface areas.

- About 30 minutes deep space at end of observation.

- Scan rate is 5 µrad/sec in X, 11 in Z.

**CIRS\_129TI\_FIRLMBCON001\_PRIME:**

- The aimpoint is 70N, LHS, at altitudes of 100/150/200 km.

- Dwells are about 16:30 at each altitude.

**CIRS\_129TI\_FIRLMBAER001\_PRIME:**

- The aimpoint is 70N, LHS, altitude 600 km scanning to -100 km.

- Single scan at 22 µrad/sec.

**CIRS\_129TI\_FIRLMBT001\_PRIME:**

- Aimpoints are 70N/65N, LHS, 0 km altitude.

- Scan rates are 51 µrad/sec.

**CIRS\_129TI\_FIRNADMAP002\_PRIME:**

- Again, use of the RBOT secondary means we need approval of riders

and sequence leads.

- Aiming at relatively less covered terrain.

- Scan rate is 26 µrad/sec in X, 13 µrad/sec in Z.

**Sequence 60 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_131TI\_MIDIRTMAP001\_PRIME:** A full-disk map at a scan rate of 6 microrad/sec.

**CIRS\_131TI\_FIRNADCMP001\_PRIME:** The target is 30S 30W.

**CIRS\_131TI\_FIRNADCMP002\_PRIME:** The target is 20S 230W.

**CIRS\_131TI\_MIDIRTMAP002\_PRIME:** A full-disk map at a scan rate of 10 microrad/sec.

**CIRS\_131TI\_COMPMAP001\_PRIME:** Four footprints covering the visible disk from north to south, with dwells of 1 hour 45 minutes. The central meridian is 230W and subspacecraft latitude is 5N.

**CIRS\_132TI\_MIRLMBMAP001\_PRIME:** A full quadrant of limb latitudes is mapped, from 85S to the equator.

**CIRS\_132TI\_FIRNADCMP002\_PRIME:** The target is 50N 195W.

**CIRS\_133TI\_FIRNADCMP001\_PRIME:** The target is 50S 0W.

**CIRS\_133TI\_MIRLMBMAP001\_PRIME:** This is a northern hemisphere map, to counterpoint the southern quadrant mapped in rev 132/T69. Latitudes range from 5N to 85N.

**CIRS\_133TI\_FIRNADMAP001\_PRIME:** This is a partial-disk map over regions showing high thermal emissivity, with a midpoint near 0N 10W. The scan rate is about 6 microrad/sec.

**CIRS\_133TI\_FIRLMBINT001\_PRIME:** We target 55N, two dwells at each of two altitudes. Dwells are just under 12 minutes each.

**Sequence 61 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_134TI\_FIRNADCMP001\_PRIME:** The aimpoint is 10S 60W.

**CIRS\_134TI\_MIRLMBINT001\_PRIME:** The target is 80S, with two dwells each at altitudes of 350 km and then offset by 1.8 mrad to higher altitudes. The duration of each dwell is about 36 minutes.

**CIRS\_134TI\_COMPMAP001\_PRIME:** Three footprints allow FPB to cover Titan from north to south, extending off the limb at both poles. The central meridian is 230W and the subspacecraft latitude is nearly equatorial.

**Sequence 63 CIRS Titan Primes:**

Reconstructed December 2017

**CIRS\_138TI\_FIRNADCMP001\_PRIME:** The target is 30S 40W.

**CIRS\_138TI\_MIRLMPAIR001\_PRIME:** The FP3 and FP4 arrays are parallel to the limb, FP4 targeting 225 km altitude, FP3 higher. The latitude targeted is 76N.

**CIRS\_138TI\_FIRNADMAP001\_PRIME:** This is a partial scan across Titan at about 10 microrad/sec, from 33N 54W to about 30S 45W.

**CIRS\_138TI\_FIRLMBINT001\_PRIME:** The aimpoint is 87S. Four dwells, two each targeting FPB to 125 and 225 km altitude, and the dwells are 8 minutes 15 seconds each.

**CIRS\_138TI\_FIRLMBAER001\_PRIME:** We scan from +100 to +600 km altitude at a latitude of 87S; the scan rate is 25 microrad/sec.

**CIRS\_138TI\_FIRLMBT001\_PRIME:** We perform two scans, one each targeting 87S and 82S latitude. The scan rate is 50 microrad/sec through 28 mrad.

**Sequence 64 CIRS Titan Primes:**

**CIRS\_139TI\_COMPMAP001\_PRIME:** Duration 13:30, with two footprints centered on 80S and 30N. Each footprint dwells for 5:53; the design has 30 minute dark sky exposures at beginning, middle and end. (Post-RBOT, this appears to target only 80S.)

**CIRS\_140TI\_MIDIRTMAP001\_PRIME:** Duration is 3:23, with 3:12 tracking time. Scan rate is 12 µrad/sec, and there’s no dark sky time due to the short duration.

**CIRS\_140TI\_FIRNADCMP001\_PRIME:** Duration 4:00 with 3:51 tracking time. The aimpoint is 10N 45W. There’s 45 minutes of dark sky time at the beginning.

**CIRS\_140TI\_MIRLMBMAP001\_PRIME:** Duration is 4:00. Latitude range is from 10S to 89S with two dwells at each 5 degree increment; the dwells are 4 minutes 30 seconds each. CIRS heats with a maximum delta T of 0.277K.

**CIRS\_140TI\_FIRNADMAP001\_PRIME:** Duration is 2:45 with 2:38 tracking time. The ground track of the scan is approximately 45N 5W to 14S 27W, to cover brightness temperature variations as plotted in the radar paper (Janssen et al., Icarus 200 (2009) 222-239). Scan rate is approximately 14 µrad/sec through 57 mrad. One hour dark sky at beginning.

Three consecutive FIR limb observations just after close approach:

**CIRS\_140TI\_FIRLMBT002\_PRIME:** Duration 1:10, much of which is positioning Cassini safely through close approach; tracking time is 26 minutes after close approach. Aimpoint is 38N (for all three of these limb observations). Two scans, 28 mrad each at 40 µrad/sec. CIRS heats a maximum of 0.048K. We handoff to the following observation at the limb to save turn time.

**CIRS\_140TI\_FIRLMBAER002\_PRIME:** Duration is 0:30, with 0:27 tracking time. One scan, at a rate of 25 µrad/sec through 40 mrad. CIRS heats 0.008K. Again, handoff to the following observation is at the limb.

**CIRS\_140TI\_FIRLMBINT002\_PRIME:** Duration 1 hour. Four pointings at 38N, two each at 125 and 225 km, with dwells of 8 minutes 30 seconds per dwell. No heating.

**Sequence 68 Titan Primes:**

**CIRS\_148TI\_FIRNADCMP001\_PRIME:** Target is 10S 115W in Xanadu, per Valeria’s area of interest. Duration is about 4:12 with 20 minutes dark sky at the beginning.

**CIRS\_148TI\_MIRLMBMAP001\_PRIME:** A full quadrant scan from the equator to 85N in 5 degree increments. Individual dwells are about 4 minutes 10 seconds in duration; observation duration is 4:00.

**CIRS\_148TI\_FIRNADMAP001\_PRIME:** A north-south transect crossing the equator off-nadir at 120W, at a scan rate of 10 µrad/sec. 10 minutes of dark sky time at the beginning. Duration is 2:45.

**CIRS\_148TI\_FIRLMBINT001\_PRIME:** Targets 50N, dwells are 13 minutes 40 seconds each at 125 and 225 km altitude.

**CIRS\_148TI\_FIRLMBAER001\_PRIME:** Extended from 30 to 45 minutes duration. Scan from -120 to +480 km altitude at 14 µrad/sec, targeting 50N.

**CIRS\_148TI\_FIRLMBT001\_PRIME:** Two scans at 56 µrad/sec through 28 mrad, targeting 55N and 60N.

**CIRS\_148TI\_MIDIRTMAP002\_PRIME:** Two maps done, the first at 6 µrad/sec and the second at 15 µrad/sec. ISS\_NAC stares at Titan center at beginning and end of the observation period as well as between the two maps, all 30 minute dwells. 30 minutes dark sky at beginning; duration is 8:13.

**CIRS\_149TI\_FIRNADMAP002\_PRIME:** A north-south transect crossing the equator at 217W (again not nadir). 10 minutes dark sky at the beginning; duration is 2:30.

**CIRS\_149TI\_MIRLMBMAP002\_PRIME:** Full quadrant coverage, from 0N to 85S. Dwells are again 4 minutes 10 seconds at each pointing, two pointings per latitude, and overall duration is 4:00.

**CIRS\_149TI\_MIDIRTMAP002\_PRIME:** Two maps, again interspersed with ISS stares at Titan center. First map scan rate is 6 µrad/sec, second is 10 µrad/sec. Duration is 9:45. 30 minutes dark sky at the beginning.

**CIRS\_149TI\_TEA001\_PRIME:** 2x2 NAC mosaics at beginning and end with dwells of 6 minutes, per ISS request. 30 minutes dark sky at the beginning; duration is 7:30.

**CIRS\_149TI\_TEA002\_PRIME:** FPB stare at Titan, duration 21:00. 30 minutes dark sky at beginning and end.

**CIRS\_149TI\_TEA003\_PRIME:** FPB stare at Titan, duration 15:00, with 30 minutes of dark sky at beginning and end.

**CIRS\_149TI\_TEA004\_PRIME:** FPB stare at Titan. Two 30 minute dark sky pointings; duration is 37:29 (1 day 13 hours 29 minutes).

**Sequence 70 CIRS Titan Primes:**

**CIRS\_153TI\_MIDIRTMAP001\_PRIME:** Full disk coverage at a scan rate of 6 µrad/sec. Twenty minutes of dark sky time at the beginning. This is our first use of a template.

**CIRS\_153TI\_FIRNADCMP001\_PRIME:** Targeted at 10N, 110 W, with 25 minutes dark sky at the beginning. The targeted lat/lon is within Valeria’s region of interest.

**CIRS\_153TI\_MIRLMBINT001\_PRIME:** This was changed from a planned MIRLMBMAP to more evenly distribute our mid-IR limb observation types. The target latitude is 85S, with 20 minutes of dark sky at the beginning. CIRS heats a maximum of 0.14K.

**CIRS\_153TI\_FIRNADMAP001\_PRIME:** This is a north-south transect at 9 µrad/sec, crossing the equator at 118W, passing through areas of contrasting surface brightness temperature. No dark sky.

**CIRS\_153TI\_FIRLMBINT001\_PRIME:** Limb stares at 125 and 225 km altitude, targeted at 72.5 south.

**CIRS\_153TI\_FIRLMBAER001\_PRIME:** A single scan from -120 to +480 km altitude; scan rate is 22 µrad/sec. The target latitude is 72.5S.

**CIRS\_154TI\_COMPMAP001\_PRIME:** FPB is placed over the lit portion of Titan. Six hour duration with 30 minutes of dark sky at the beginning.

Titan Explorations at Apoapse (TEAs): These are all at ranges between 1.4 – 2.3 million km, and thus do not require ISS mosaics. All are long FPB stares with two (or three, for CIRS\_156TI\_TEA005\_PRIME) dark sky stares.

**CIRS\_155TI\_TEA003\_PRIME:** FPB north-south over the lit face of Titan.

**CIRS\_155TI\_TEA004\_PRIME:** FPB east-west over the lit face of Titan.

**CIRS\_155TI\_TEA005\_PRIME:** FPB east-west over the lit face of Titan.

**CIRS\_156TI\_TEA003\_PRIME:** FPB east-west over the lit face of Titan.

**CIRS\_156TI\_TEA004\_PRIME:** FPB north-south over the lit face of Titan.

**CIRS\_156TI\_TEA005\_PRIME:** FPB north-south over the lit face of Titan.

**CIRS\_156TI\_TEA006\_PRIME:** FPB north-south over the lit face of Titan.

**Sequence 71 CIRS Titan Primes:**

**CIRS\_157TI\_COMPMAP001\_PRIME:** Three stop positions in a north-south track over the poles. Thirty minutes of dark sky time at the beginning and end of the observation. Duration is 15:34.

**CIRS\_158TI\_MIDIRTMAP002\_PRIME:** A short MAP (duration 2:28), so this observation looks only at the northern hemisphere at a slew rate of 10 µrad/sec. No dark sky time.

**CIRS\_158TI\_TEA001\_PRIME:** Long-range Titan observation (>1.3 million km). Since Titan fits in the 6 mrad ISS\_NAC field of view, there’s no mosaic. Thirty minutes of dark sky at the beginning and end, plus 20 minutes of NAC to Titan at the beginning when Titan is near the edge of the NAC’s field of view. The remaining time, CIRS\_FPB is pointed at Titan center. Duration is 15 hours.

**CIRS\_159TI\_FIRNADCMP001\_PRIME:** Very good geometry for Valeria’s region of interest. Aimpoint is 40S 150W. 30 minutes dark sky at beginning and end.

**CIRS\_159TI\_MIRLMBMAP001\_PRIME:** Captures the limb between 75N and 10S, right-hand side. 75N is a limit imposed by our viewing angle.

**CIRS\_159TI\_FIRNADMAP001\_PRIME:** Targets an oblique track not passing through the subspacecraft point, so as to fill in less sampled terrain and pass over an area of contrasting brightness temperature as measured by radar. Midpoint of the track is approximately 25S 138W.

Note: The T79 replan deleted APS prime observations and substituted ORS observations, including:

**CIRS\_158TI\_FIRNADCMP501\_PRIME:** Aimpoint is 30S 330W.

**CIRS\_158TI\_MIRLMBINT501\_PRIME:** Aimpoint is 80N, and each dwell is 45 minutes.

**CIRS\_158TI\_FIRNADMAP501\_PRIME:** An equatorial scan at 9 microrad/sec, constrained by the proximity of the Sun to Titan's northern hemisphere.

**CIRS\_158TI\_FIRLMBINT501\_PRIME:** Four tracking periods of 10 minutes 40 seconds each, with an aimpoint of 57S on the limb.

**CIRS\_158TI\_FIRLMBAER501\_PRIME:** A single scan from -120 to +480 km altitude, at a latitude of 57S.

**CIRS\_158TI\_FIRLMBT501\_PRIME:** A single scan at 28 microrad/sec at a target latitude of 37S. The observation is compromised and shortened by turns necessary to keep the Sun off the CIRS/VIMS radiators.

**Sequence 72 CIRS Titan Primes:**

**CIRS\_160TI\_FIRNADCMP001\_PRIME:** Poor geometry for Xanadu region; target is 40S, 330W. 30 minutes dark sky time at the beginning.

**CIRS\_160TI\_FIRNADCMP002\_PRIME:**  Aimpoint is 0N, 240W, a relatively unpopulated target for past FIRNADCMPs. 30 minutes dark sky at the end.

**CIRS\_160TI\_TEA002\_PRIME:** Very long duration, 31:30:00, with three dark sky pointings of 30 minutes each. This and all the other TEAs in S72 are distant enough from Titan not to require associated ISS\_NAC mosaics. FP3/4 parallel with Titan’s equator.

**CIRS\_160TI\_TEA003\_PRIME:** Fifteen hour duration, two dark sky pointings. FP3/4 aligned north-south.

**CIRS\_160TI\_TEA004\_PRIME:** Duration is 20:45:00, with three dark sky pointings. FP3/4 are aligned north-south.

**CIRS\_160TI\_TEA005\_PRIME:** Duration is 11:10:00; two dark sky pointings. FP3/4 parallel to Titan’s equator.

**CIRS\_161TI\_TEA001\_PRIME:** Duration 11:10:00 again, with two dark sky pointings. FP3/4 parallel with Titan’s equator.

**CIRS\_161TI\_MIDIRTMAP001\_PRIME:** Full disk scan at a scan rate of 10 µrad/sec; no dark sky time. ISS\_NAC to Titan for 20 minutes at the beginning and the end of the tracking period.

**CIRS\_161TI\_FIRNADCMP001\_PRIME:** Good geometry for Valeria’s Xanadu region of interest, so the target is 10N 150W. This is also unsampled territory. No dark sky.

**CIRS\_161TI\_MIRLMBINT001\_PRIME:** Two altitudes at 45S. Twenty minutes dark sky at the beginning and end of tracking.

**CIRS\_161TI\_FIRNADMAP001\_PRIME:** A nearly north-south scan, offset slightly by the use of an RBOT-safe secondary. The scan midpoint is at 0N, 145W, and the scan rate is 9 microrad/sec. No dark sky.

**CIRS\_161TI\_FIRLMBINT001\_PRIME:** The target latitude is 75N, with two altitude samples (125 and 225 km), each observed twice.

**CIRS\_161TI\_FIRLMBAER001\_PRIME:** A single scan at latitude 75N. The scan rate is 19 µrad/sec through 31 mrad, from an altitude of -120 to +480 km. This is a slightly slower scan than in the S70/T78 FIRLMBAER (which was at 22 µrad/sec).

**CIRS\_161TI\_FIRLMBT001\_PRIME:** Much of this observation block (45 minutes immediately preceding close approach) is taken up with an initial turn to a southern latitude, then a turn off Titan to a safe RA/Dec for handoff. The Sun passes within 12 degrees of Titan center during this time, and the limb cannot be tracked at close approach. We have a single scan targeted at 56s, with a scan rate of 50 µrad/sec through 22 mrad, starting at the limb.

**CIRS\_161TI\_FIRLMBT002\_PRIME:** Two scans, one at 56S and one at 51S. Both scans are through 28 mrad at a rate of 38 µrad/sec.

**CIRS\_161TI\_FIRLMBAER002\_PRIME:** Parameters similar to FIRLMBT001, targeted at 56S. Rate is still 19 µrad/sec.

**CIRS\_161TI\_FIRLMBINT002\_PRIME:** The latitude target is 56S, with one stare each at 125 and 225 km. Typically each altitude is sampled twice (as in FIRLMBINT001 above) but a long turn back to waypoint at the end makes this impossible.

**CIRS\_161TI\_FIRNADMAP002\_PRIME:**  This begins with a stare for VIMS at Senkyo (0N, 330W) for 15 minutes, per an agreement in CIMS. Following that, we scan at 9 µrad/sec through the VIMS area of interest.

**CIRS\_161TI\_MIRLMBMAP002\_PRIME:** This observation samples latitudes from 0N – 80S. No dark sky time.

**CIRS\_161TI\_FIRNADCMP002\_PRIME:**  Xanadu is not in a good viewing position, so we point at 15S, 290W, another recently unsampled location (since T24). Thirty minutes of dark sky time at the end.

**Sequence 73 CIRS Titan Primes:**

**CIRS\_166TI\_MIRLMBINT001\_PRIME:** Collaborative with VIMS, in order to look at northern lakes. For 15 minutes at the end of the observation, we point VIMS\_IR to 30N in order to cover the northern hemisphere region of interest. The MIRLMBINT latitude is equatorial, in part also to facilitate VIMS’s view of the northern hemisphere; dwell times are 51 minutes at each of four pointings. Twenty minutes of dark sky time at the beginning.

**CIRS\_166TI\_FIRNADMAP001\_PRIME:** Collaborative with VIMS for the same purpose as the MIRLMBINT. Again, for the last 15 minutes, VIMS\_IR is pointed toward the northern lakes, this time centered at 45N. The scan is centered on 5N 23 W, running NW to SE at about 11 µrad/sec.

**CIRS\_166TI\_FIRNADCMP001\_PRIME:** The Xanadu region is not in view during this FIRNADCMP; we target 15S 170W. Thirty minutes dark sky time at the end.

**CIRS\_167TI\_MIDIRTMAP001\_PRIME:** A short MIDIRTMAP (2:43), so coverage is only of the northern hemisphere at a scan rate of 9 µrad/sec. No dark sky or ISS stares.

**CIRS\_167TI\_MIRLMBINT001\_PRIME:** Aimpoint is 45N; we have not covered mid-northern latitudes with a MIRLMBINT recently. Twenty minutes dark sky time at the beginning.

**CIRS\_167TI\_FIRNADMAP001\_PRIME:** A NE-SW scan centered on about 22N 18W, at a slew rate of 10 µrad/sec. No dark sky stares.

**CIRS\_167TI\_FIRNADCMP002\_PRIME:** The viewing geometry is very similar to the T83 FIRNADCMP, hence no view of Xanadu again. We target 45S 255W and capture 30 minutes of dark sky at the end.

**CIRS\_167TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS for WAC central stares at the beginning and end of the observation. The scan rate is 6 µrad/sec. Thirty minutes dark sky time at the beginning.

**Sequence 74 CIRS Titan Primes:**

**CIRS\_169TI\_MIDIRTMAP001\_PRIME:** A duration of 9:30 allows time for a single full-disk scan at 4 µrad/sec plus an additional scan at the same rate revisiting the north polar region. We have three quick NAC/WAC stares at Titan center at the beginning and end as well as between the two maps. Twenty minutes dark sky at the beginning.

**CIRS\_169TI\_FIRNADCMP001\_PRIME:** The FP1 target is 10S, 345W, which is unsampled by previous composition stares. Again, 20 minutes of dark sky time at the beginning.

**CIRS\_169TI\_FIRLMBINT001\_PRIME:** Our latitude target is 37.4N for this limb stare at two altitudes (125 and 225 km). Total integration time at each altitude is approximately 26 minutes. By prior agreement, we are pointing VIMS\_IR to 87N, 121W for 10 minutes to observe specular reflection on the northern lakes.

**CIRS\_169TI\_FIRLMBAER001\_PRIME:** One scan at 37.4N at a rate of 20 µrad/sec.

**CIRS\_169TI\_FIRLMBT001\_PRIME:** Two scans, one at 37.4N and one at 32.4N. Both are at a rate of 35 µrad/sec through 28 mrad. These are slower scans than usual for a FIRLMBT, as we had a few extra minutes available.

**CIRS\_169TI\_FIRNADMAP002\_PRIME:** A south-north transect through nadir along the 205W meridian. This is territory that was well-sampled in the prime mission but has not been an FIR map target in years. Scan rate is a relatively slow 10 µrad/sec.

**CIRS\_169TI\_MIRLMBMAP002\_PRIME:** A full quadrant is sampled, between 15S and 65N (the northernmost latitude visible on the limb from our vantage point.)

**Sequence 75 CIRS Titan Primes:**

**CIRS\_172TI\_FIRNADCMP001\_PRIME:** A target lat/lon of 45N 315W, with 20 minutes dark sky at the beginning. VIMS is a collaborative rider, in order to look at northern specular reflection at 81.6N 126W. This point is in the VIM\_IR field of view for the entire time we are pointed at our target.

**CIRS\_172TI\_FIRLMBINT001\_PRIME:** Aimed at the limb stationary point at 50N; dwells are 11:35 each at 125 and 225 km altitude, with each altitude sampled twice.

**CIRS\_172TI\_FIRLMBAER001\_PRIME:** A single scan from -120 to +480 km altitude, latitude 50N. The scan rate is 23 µrad/sec.

**CIRS\_172TI\_FIRLMBT001\_PRIME:**  Two scans, at 50N and 45N, through 28 mrad at a rate of 50 µrad/sec. This observation is on thrusters.

**CIRS\_172TI\_FIRLMBAER002\_PRIME:** A single scan at latitude 49N, covering the altitude range from -120 to +480 km. The scan rate is a relatively slow 17 µrad/sec. This observation is also on thrusters.

**CIRS\_172TI\_FIRLMBINT002\_PRIME:** This observation is almost entirely consumed by a very long turn to waypoint at the end of the custom period. A single stare at 49N, 125 km altitude, with a duration of 4:50.

**CIRS\_172TI\_FIRNADCMP002\_PRIME:**  The target is 70S 240W, with 20 minutes of dark sky at the end.

**CIRS\_172TI\_MIDIRTMAP002\_PRIME:**  An unusually long duration of 14:45 allows two full disk mosaics. The first scan is at 4 µrad/sec, the second at 3 µrad/sec. This is a collaborative design with ISS in order to collect WAC images at the beginning and end of the observation, plus between mosaics. Twenty minutes dark sky near the end.

**Sequence 76 CIRS Titan Primes:**

**CIRS\_174TI\_MIDIRTMAP001\_PRIME:** A moderately slow scan (6 µrad/sec) of the full disk, and ISS stares at Titan at the beginning and the end of the observation. Thirty minutes dark sky time. Predominantly northern hemisphere.

**CIRS\_174TI\_FIRNADCMP002\_PRIME:** Targeted at 72S 185W, in the vicinity of Ontario Lacus. Thirty minutes of dark sky time at the end.

**CIRS\_174TI\_MIDIRTMAP002\_PRIME:** The scan rate is again 6 µrad/sec, with ISS stares at Titan center and the beginning and end. The scan of the entire disk mostly covers the southern hemisphere.

**CIRS\_175TI\_FIRNADCMP001\_PRIME:** Targeted at 15N 60W. Thirty minutes of dark sky time at the beginning.

**CIRS\_175TI\_MIRLMBMAP001\_PRIME:** The subspacecraft latitude is 34N, so high northern and southern latitudes are not visible on the limb. Latitudes sampled range from 50S to 30N.

**CIRS\_175TI\_FIRNADMAP001\_PRIME:** The scan rate is 10 µrad/sec, which at the end is barely greater than the apparently motion of Titan’s limb. Kraken Mare is covered near the end of the scan.

**CIRS\_175TI\_FIRLMBINT001\_PRIME:** Aimpoint is 2S; we sample at two altitudes, 125 and 225 km.

**CIRS\_175TI\_FIRLMBAER001\_PRIME:** A single scan from -120 to +480 km at latitude 2S, at a scan rate of 21 µrad/sec. This is the slowest scan rate possible in the given time, and is close to the desired rate of 17 µrad/sec.

**CIRS\_175TI\_FIRLMBT001\_PRIME:** Two scans, at 2S and 7S. Both scans are at 42 µrad/sec through 28 mrad, beginning at 0 km altitude. We handoff to VIMS with their IR field of view covering the north pole.

**CIRS\_175TI\_FIRNADCMP002\_PRIME:** This is a collaborative design with ISS; we begin and end with ISS stares at Titan center. There is also a 30 minute dark sky stare before the final NAC/WAC pointing. The aimpoint for FP1 is 60S 165W.

**CIRS\_175TI\_MIDIRTMAP002\_PRIME:** Long duration observation, with two complete full-disk maps and ISS stares at Titan center at the beginning and end of the observation as well as in between the maps. The scan rate for the first map is 4 µrad/sec, and for the second it’s 5 µrad/sec. Thirty minutes dark sky time is included.

**Sequence 77 CIRS Titan Primes:**

**CIRS\_181TI\_MIDIRTMAP001\_PRIME:** This is a partial disk scan, covering the north polar region and allowing VIMS to observe the northern lakes for the duration of the observation. Scan rate is 5 µrad/sec.

**CIRS\_181TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS. A full disk mosaic at a scan rate of 6 µrad/sec, with 15-minute ISS central stares at Titan center at the beginning and end.

**CIRS\_181TI\_TEA001\_PRIME:** Collaborative with ISS. We do a 2x2 NAC mosaic of Titan at the beginning of the observation, 5 minutes per dwell, and repeat that in the middle of the block (duration is just shy of 26 hours). At the end, when Titan fits in the NAC field of view, there’s another 8 minute ISS stare. We point FPB to cover the south pole for the remainder of the observation. The secondary axis is shifted about 20˚ from the requested pointing to avoid pointing problems with Saturn and the Rings in the SRU field of view.

**CIRS\_181TI\_TEA002\_PRIME:** Collaborative with ISS. NAC stares at Titan at the beginning, middle and end. We again target FPB at the south pole.

**CIRS\_182TI\_TEA001\_PRIME:** This observation places FP1 on Titan, which is just smaller than the nominal FP1 footprint. Since ISS is not riding, the entire observing period is devoted to FP1.

**CIRS\_182TI\_TEA002\_PRIME:** Collaborative with ISS. We are distant enough during this observation that the NAC covers all of Titan at our desired pointing of FPB to 50S. FPB is oriented east-west, unlike the rev 181 TEAs.

**Sequence 78 CIRS Titan Primes:**

S78 encompasses T90 and T91, as well as some long-range apoapse observations. A couple notes: the SRU referenced below is the Stellar Reference Unit, an attitude control component that is sensitive to bright objects (including Saturn and the Rings) in its field of view. And collaborative observations are those of enough importance to one or more of the riders that they must be coordinated to include the rider’s requirements in the prime design. But you probably already knew this.

**CIRS\_185TI\_MIDIRTMAP001\_PRIME:** At 2:47, a short-duration map. This is a north polar region mosaic at a scan rate of 4 µrad/sec with no dark sky time and no ISS dwells.

**CIRS\_185TI\_FIRNADCMP001\_PRIME:** The target is 15N 70W, at the NE corner of the Xanadu region of interest. Thirty minutes dark sky time at the beginning.

**CIRS\_185TI\_MIRLMBINT001\_PRIME:** Our most recently planned MIR limb maps have targeted high northern/southern latitudes. In this case, since we are out of the equatorial orbits and the subspacecraft latitude is 42N, the range of latitudes visible against the limb is limited. The target is 25N, constrained in part by impingement of the Rings and Saturn on the SRU field of view.

**CIRS\_185TI\_FIRNADMAP001\_PRIME:** Scans from south to north at 10 µrad/sec along the 50W longitude line. Fifteen minutes dark sky time at the end.

**CIRS\_185TI\_FIRLMBINT001\_PRIME:** The target latitude is 14N. Each of the four dwells (twice each at altitudes of 125 and 225 km) is 0:13:40.

**CIRS\_185TI\_FIRLMBAER001\_PRIME:** This is a scan from -125 km to +480 km at a scan rate of 21 µrad/sec, at latitude 14N.

**CIRS\_185TI\_FIRLMBT001\_PRIME:** Two scans, both at 14N (there was insufficient time to target a second latitude due to an unusually long turn to the following pointing). The scan rate is 50 µrad/sec through 28 mrad.

**CIRS\_185TI\_FIRNADCMP002\_PRIME:** Very good southern hemisphere coverage; the target is 89S 245W. Twenty-five minutes of dark sky time at the end, immediately before the following MIDIRTMAP.

**CIRS\_185TI\_MIDIRTMAP002\_PRIME:** A full-disk map at 6 µrad/sec, with ISS stares at Titan center at beginning and end. No dark sky time.

**CIRS\_185TI\_TEA001\_PRIME:** Collaborative with ISS. We stare at Titan’s S Pole, with ISS central stares at the beginning and end. Thirty minutes dark sky time before and after the CIRS stare. This observation had to be rotated 600 mrad about Y for SRU FOV violations.

**CIRS\_186TI\_TEA001\_PRIME:** Collaborative with ISS. This time, CIRS\_FPB is targeted at Titan center. We are again shifted by 150 mrad about Y for Rings and Saturn in the SRU FOV. The ISS stares at the beginning and end of the observation can observe all of Titan in the NAC. Thirty minutes of dark sky time before and after the central CIRS stare.

**CIRS\_186TI\_TEA002\_PRIME:** Collaborative with ISS. No offset from the SPASS targeting. We have ISS stares at the beginning and end, as well as 30 minutes of dark sky time before and after the CIRS stare.

**CIRS\_190TI\_MIDIRTMAP001\_PRIME:** Another brief (1:52) map centered on the North Pole. We point ISS to Titan center for 10 minutes at the beginning. The scan rate is 6 µrad/sec; no dark sky time.

**CIRS\_190TI\_FIRNADCMP001\_PRIME:** Collaborative with VIMS. The target is 0N 50W, where we have no nearby samples since T71. Thirty minutes dark sky at the end. The VIMS requirement is for 3 VIMS\_IR stares at northern latitudes; since that field of view encompasses the North Pole for about the first half of the observation, we only explicitly target VIMS to the north once, before the dark sky time.

**CIRS\_190TI\_MIRLMBMAP001\_PRIME:** Collaborative with VIMS. We sample latitudes between 35N and 15S. Our flyby orientation again limits the range of latitudes visible against the limb. The VIMS requirement is for northern stares at the beginning and end; our targeting puts the VIMS\_IR FOV over the northern regions of interest without specific targeting at the beginning, but we need to retarget at the end (which eliminated one latitude pointing). No dark sky time.

**CIRS\_190TI\_FIRNADCMP002\_PRIME:** Our pointing is to 45S 300W and we have 30 minutes of dark sky time at the end.

**CIRS\_190TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS. We get ISS central stares at Titan at the beginning and end of a relatively long-duration (8:03) full-disk scan at a rate of 4 µrad/sec. This low rate should allow ISS to take further images during the MAP if they choose.

**Sequence 79 CIRS Titan Primes:**

S79 contains T92 and T93. We have five primes, none of them inside +/- 2 hours of close approach (typically FIRLMBxxx observations). We also have no distant observations (TEAs or COMPMAPs) and will not likely see any of these until S81.

**CIRS\_194TI\_FIRNADCMP001\_PRIME:** The targeted latitude/longitude is 30N 90W, relatively unsampled terrain. Twenty minutes of dark sky at the beginning.

**CIRS\_194TI\_MIRLMBINT001\_PRIME:** The aimpoint is 20S at 350 km altitude, stepping in toward Titan’s surface by a 1.8 mrad offset about X. Dwells (two at each altitude) are about 0:43:00 in duration. No dark sky time.

**CIRS\_195TI\_MIDIRTMAP001\_PRIME:** A long-duration map, with ISS stares at Titan at beginning and end. The scan rate is 4 µrad/sec. Twenty minutes of dark sky time.

**CIRS\_195TI\_FIRNADCMP001\_PRIME:** Here we’re targeting 20N 15W, with 20 minutes of dark sky time at the beginning.

**CIRS\_195TI\_MIRLMBMAP002\_PRIME:** A somewhat unusual limb map, in that our position (subspacecraft latitude 62S) limits the distinct latitudes available to sample against the limb. We stare at five latitudes between 15N and 15S, each at two altitudes, beginning at 160 km and then stepping out by 2.4 mrad away from the limb. Dwells are a little longer than typical at 0:17:30 per pointing (two at each of seven latitudes sampled). No dark sky time.

**Sequence 80 CIRS Titan Primes:**

S80 contains **T94** and **T95**. We have nine primes, two of which are close-in limb observations within 2 hours of closest approach. We have no distant observations (TEAs or COMPMAPs).

**CIRS\_197TI\_MIDIRTMAP001\_PRIME**: The observation is bookended by ISS stares at Titan center. Very good coverage of the north polar region. The scan rate is 4 µrad/sec, our target rate. 40 minutes of dark sky time at the beginning.

**CIRS\_197TI\_FIRNADCMP001\_PRIME**: Poor geometry for looking at Xanadu; we target 60N, 110W. Twenty minutes of dark sky at the beginning.

**CIRS\_197TI\_FIRLMBAER002\_PRIME**: CIRS scans from -120 km to +480 km at an unusually slow scan rate of 16 µrad/sec. The aimpoint is 19N. Since we are over high southern latitudes, only a limited range of near-equatorial latitudes present on the limb. During this observation as well as the following FIRLMBINT, our pointing results in Saturn and Rings within the SRU field of view. This is due to constraints imposed by the preceding VIMS observation. The SRU violations were identified during integration in TOST and will require a waiver.

**CIRS\_197TI\_FIRLMBINT002\_PRIME**: The aimpoint for this observation is 18N. Dwells at the four pointings (two each at altitudes of 125 and 225 km) are 8 minutes 30 seconds each, a little shorter than usual due to a long turn back to the waypoint at the end.

**CIRS\_198TI\_MIDIRTMAP001\_PRIME**: Another scan of the northern hemisphere, similar in geometry to the rev 197 MAP. The scan rate is 4 µrad/sec. This is a collaborative observation with ISS and we point the NAC to Titan center for 10 minutes at the beginning and the end. No dark sky time (in order to accommodate the low scan rate).

**CIRS\_198TI\_FIRNADCMP001\_PRIME**: Our aimpoint is 60N, 30W. We have 20 minutes of dark sky time at the beginning.

**CIRS\_198TI\_MIRLMPAIR001\_PRIME**: Our first MIRLMPAIR since rev 138/T72. The pointing is FP4 to the limb, 10N latitude, at an altitude of 125 km, with FP3 at higher altitude. This observation has persistent SRU violations for Saturn and Rings in the field of view. No dark sky time.

**CIRS\_198TI\_MIRLMBINT001\_PRIME**: Targeted at 2S (to keep the radiators safe from the Sun), with two dwells each at two altitudes. Dwells are about 43 minutes each. No dark sky time.

**CIRS\_198TI\_FIRNADCMP002\_PRIME**: An unusual opportunity to target southern latitudes; we point to 70S, 100W. Thirty minutes dark sky time.

**Sequence 81 CIRS Titan Primes:**

S81 contains **T96**. We have six primes, two of which are close-in limb observations within 2 hours of closest approach. We have no distant observations (TEAs or COMPMAPs).

**CIRS\_199TI\_MIDIRTMAP001\_PRIME**: Very good north polar coverage. The scan rate is 7 µrad/sec, and we have ISS stares at the beginning and end of the observation. We get 25 minutes of dark sky time.

**CIRS\_199TI\_FIRNADCMP001\_PRIME**: Again, a good opportunity for targeting the North Pole, as it was during T95 inbound on the last sequence. This time we put FPB on the North Pole while FP1 samples latitudes between 65N – 75N. Twenty minutes of dark sky time. This observation is marked as collaborative with ISS in CIMS but that was meant for the preceding MIDIRTMAP.

**CIRS\_199TI\_FIRLMBAER002\_PRIME**: The target latitude is 10S; geometry dictates that only near-equatorial latitudes intersect the limb. Scan rate is an unusually slow 15 µrad/sec.

**CIRS\_199TI\_FIRLMBINT002\_PRIME**: The target is again 10S at 125 and 225 km altitude, each altitude sampled twice. Dwells are 12 minutes.

**CIRS\_199TI\_FIRNADMAP002\_PRIME**: The scan begins at 60S 183W, passes over the South Pole and Ontario Lacus, and ends at approximately 60S. The scan rate is 4 µrad/sec, and we get 15 minutes of dark sky at the end.

**CIRS\_199TI\_MIRLMBINT002\_PRIME**: This is targeted at 12N, in order to corroborate the rev 198/T95 MIRLMPAIR (planned at 10N but changed after port 1 to 16N, which is inaccessible to us here). No dark sky time.

**S82 CIRS Titan Primes:**

S82 contains three Titan flybys, T97, 98 and 99. The sequence runs from 2013-362 through 2014-072. Orbital inclination decreases from about 52 to 45 degrees. This is a full sequence for CIRS Titan prime observations, with 15 in total, including 3 distant TEAs.

**CIRS\_200TI\_MIDIRTMAP001\_PRIME:** Northern hemisphere aspect, with a full-disk map at a slew rate of 7 µrad/sec. The ISS NAC is pointed at Titan for ten minutes at beginning and end, and there’s 20 minutes of dark sky time.

**CIRS\_200TI\_FIRNADCMP001\_PRIME:** The first of four FIRNADCMPs in this sequence; the geometry for the two each inbound and outbound observations is very similar and covers mostly well-sampled terrain. This COMP looks at 50N, 165W, and we get 20 minutes of dark sky time at the beginning.

**CIRS\_200TI\_FIRLMBAER002\_PRIME:** The aimpoint for this FIR limb period is 24S. The slew rate is an unusually slow 14 µrad/sec and covers and altitude range of -120 to +480 km at the limb.

**CIRS\_200TI\_FIRLMBINT002\_PRIME:** Aimed at 24S, like the preceding FIRLMBAER. We have four dwells, two each at altitudes of 125 and 225 km; each dwell is 8 minutes long. This is shorter than normal due to a very long turn to waypoint at the end of the observation.

**CIRS\_200TI\_FIRNADCMP002\_PRIME:** An outbound COMP aimed at 60S, 45W. Twenty minutes of dark sky time at the end.

**CIRS\_200TI\_MIDIRTMAP002\_PRIME:** Fairly short duration (3:23), so we have a partial disk scan of the south polar region at 4 µrad/sec. There’s a 10-minute ISS NAC stare at Titan at the beginning, and 20 minutes of dark sky time at the end.

**CIRS\_201TI\_MIDIRTMAP001\_PRIME:** A full disk map covering most of the northern hemisphere at a scan rate of 9 µrad/sec. Ten minutes for ISS at the beginning and about 17 minutes dark sky time at the end.

**CIRS\_201TI\_FIRNADCMP001\_PRIME:** Targeted at 20N, 135W, with 20 minutes of dark sky time at the beginning.

**CIRS\_201TI\_MIRLMBMAP002\_PRIME:** Our vantage point for this observation is over the high southern latitudes, so the range of latitudes intersecting the limb is narrow. We step through latitudes between 25N on the right side, through a maximum of 28.8N, then down to 20N on the left side, with a “notch” about midway through where PDT cannot target unambiguously. Dwells are 12 minutes per latitude at two altitudes. No dark sky time.

**CIRS\_201TI\_FIRNADCMP002\_PRIME:** The target is 40S, 20W, which has been sampled before but not since T72 in 2010. Twenty minutes of dark sky at the end.

**CIRS\_201TI\_MIDIRTMAP002\_PRIME:** A full-disk scan at a rate of 6 µrad/sec; no ISS stares, per the TOST template for this observation (we’re looking at the night side of Titan). Seventeen minutes of dark sky time at the end.

**CIRS\_202TI\_TEA001\_PRIME:** This TEA points FP1 at Titan, where it covers the full disk plus the lower atmosphere, for calibration of Herschel data. Dark sky time at the beginning and end.

**CIRS\_202TI\_TEA002\_PRIME:** FPB is targeted to Titan and spans the visible northern latitudes. Twenty minutes of dark sky at the beginning and end.

**CIRS\_202TI\_TEA003\_PRIME:** FPB points to the North Pole for this TEA. Dark sky time at the beginning and end.

**CIRS\_202TI\_MIDIRTMAP002\_PRIME:** A full-disk MAP mainly covering the southern hemisphere, at a scan rate of 6 µrad/sec. The observation opens with a 10 minute ISS stare at Titan center and ends with another ISS stare plus 20 minutes of dark sky time.

**Sequence 83 CIRS Titan Primes:**

S83 Contains the targeted Titan flybys T100 and T101. CIRS has 12 prime observations, 5 of which are marked collaborative with other ORS instruments. No distant Titan observations (TEAs) were integrated.

**CIRS\_203TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS. Despite a somewhat short duration (3 hours), this observation was planned with 15-minute dedicated ISS stares at Titan at the beginning and end. Consequently there was not time for a full disk scan, even at the highest desired scan rate of 14 µrad/sec. The subspacecraft point is in mid-northern latitudes, so CIRS covers the northern hemisphere and about 90% of the visible disk overall. No dark sky time.

**CIRS\_203TI\_FIRNADCMP001\_PRIME:** The targeted FP1 location is 75N, 90W. Twenty minutes of dark sky time at the beginning.

**CIRS\_203TI\_FIRLMBWTR001\_PRIME:**  This is a new type design, essentially a FIRLMBINT but staring at a single altitude only (FPB to 175 km). The targeted latitude is 22S.

**CIRS\_203TI\_FIRLMBAER002\_PRIME:** The scan is targeted at 40S latitude, and scan rate is an exceptionally slow 10 µrad/sec, significantly less than we have been able to achieve in the past. This is possible as a result of an unusually long duration of 1:06. Unfortunately the spacecraft is on thrusters, using a larger pointing deadband than when on wheels, and this may make the scan more difficult to interpret.

**CIRS\_203TI\_FIRLMBINT002\_PRIME:** Immediately follows the transition from thrusters to wheels after the above FIRLMBAER. The transition takes time away from this observation, so instead of a pair of observations at two different altitudes, the altitudes (125 and 225 km) are only sampled once each. The target latitude is 40S.

**CIRS\_203TI\_FIRNADCMP002\_PRIME:** The surface target is 0N, 0W, relatively unsampled terrain. Twenty minutes dark sky time at the end.

**CIRS\_203TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS. We point ISS to Titan center for 15 minutes at the beginning and end of the observation. The CIRS full-disk scan is at a rate of 5 µrad/sec, and we get an hour of dark sky time at the end (not enough time to allow a slower scan rate). The duration is 8:23.

**CIRS\_204TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS; however, the template for this MIDIRTMAP does not include any dedicated ISS time. CIRS gets a full-disk scan at 6 µrad/sec, with 23 minutes of dark sky time at the beginning.

**CIRS\_204TI\_FIRNADMAP002\_PRIME:** Collaborative with VIMS. However, this was not designated as collaborative by TOST, nor does CIMS contain information about what VIMS’s interest in the FIRNADMAP might be. The geometry on northern lakes, specifically Ligeia Mare (roughly 75-80N, 230-270W), is good here. FP1 scans across Ligeia Mare (bracketed with a good amount of scan over non-lake terrain) at 8 µrad/sec, crossing the northern limb, to an altitude of about 400 km. A second scan begins at that point and passes over what is visible of Kraken Mare, though at high emission angle. This way, we get coverage of the northern lake region as well as two limb crossings at a low slew rate. No dark sky time.

**CIRS\_204TI\_MIRLMBINT002\_PRIME:** T101 flyby geometry is such that we see a wider range of latitudes against the limb than in much of IN-1 so far; the latitude target here is 35S. Four dwells at two altitudes (350 km, then stepping in toward the limb by 1.8 mrad), with each dwell lasting 49 minutes. Twenty minutes of dark sky time at the beginning.

**CIRS\_204TI\_FIRNADCMP002\_PRIME:** FP1 is targeted to 0N, 210W; this is near the center of the largest area on Titan left unsampled by earlier FIRNADCMPs. Twenty minutes of dark sky time at the end.

**CIRS\_204TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS, though again the specific template called out is CIRS only. A full-disk scan at 14 µrad/sec, with a scant 5 minute dark sky stare at the end. Duration is 2:54.

**Sequence 84 CIRS Titan Primes:**

S84 includes targeted Titan flybys T102 and T103. In addition, we have three distant TEA observations in this sequence. In all, there are 16 CIRS Titan primes in S84, two of which (the MIDIRTMAPs) are collaborative with ISS.

**CIRS\_205TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS, so we point ISS to Titan center at the beginning and end of the observation. This is a full disk scan at 5 µrad/sec, a relatively slow rate. Fifteen minutes of dark sky time before the scan.

**CIRS\_205TI\_FIRNADCMP001\_PRIME:** Thirty minutes of dark sky time, then a stare at 45S 300W. This is terrain we have not sampled in over 20 Titan flybys. We hand off directly to the following MIRLMBINT.

**CIRS\_205TI\_MIRLMBINT001\_PRIME:** The target latitude is 10N; dwells are 1 hour each. No dark sky time.

**CIRS\_205TI\_FIRNADMAP002\_PRIME:** A single scan across Ligeia Mare, Kraken Mare (at high emission angle), and non-lake terrain. The scan rate is 15 µrad/sec. Twenty minutes of dark sky time at the end.

**CIRS\_205TI\_MIRLMBMAP002\_PRIME:** The latitude range for this map is 40N to 13S. This is better than recent MIRLMBMAPs as the subspacecraft latitude is not high, and more latitudes are visible against the limb.

**CIRS\_205TI\_FIRNADCMP002\_PRIME:** We target 30N 180W, well-sampled terrain but not since T37. Twenty-five minutes of dark sky time at the end.

**CIRS\_206TI\_TEAFP1001\_PRIME:** This distant observation centers the FP1 footprint on Titan, to calibrate Herschel data. This is a roughly 12-hour stare with 30 minutes of dark sky at the beginning and end.

**CIRS\_206TI\_TEA002\_PRIME:** A long FPB stare at Titan covering the north polar region. Thirty minutes of dark sky time at the beginning and end.

**CIRS\_206TI\_TEA003\_PRIME:** A series of pointings keep FPB over the north polar region as the subspacecraft latitude gradually moves south. This is a very long observation (37 hours) with 30 minutes of dark sky time at the beginning and end.

**CIRS\_206TI\_MIDIRTMAP001\_PRIME:** Another full disk map at a slew rate of 5 µrad/sec, the same as the rev 205 MIDIRTMAP. This is collaborative with ISS and we point the NAC to Titan at the beginning and end of the observation. Twenty minutes dark sky time.

**CIRS\_206TI\_FIRNADCMP001\_PRIME:** The target here is 50S 330W, fairly close to the rev 205 inbound FIRNADCMP, with very similar viewing geometry. Twenty-five minutes dark sky time at the beginning.

**CIRS\_206TI\_FIRLMBINT005\_PRIME:** The target latitude is 3.5N, with two dwells each at altitudes of 125 and 225 km. Dwells are 11.5 minutes each.

**CIRS\_206TI\_FIRLMBAER001\_PRIME:** Targeted again at 3.5N. FP1 scans from -120 km to approximately +480 km altitude at a slew rate of 30 µrad/sec. This is a necessarily high rate as the turn back to waypoint at the end of the observation is unusually long.

**CIRS\_206TI\_FIRNADMAP002\_PRIME:** Rather than a single scan, this FIRNADMAP is built as a mosaic of seven short scans centered on Ligeia Mare. Scans are offset by 1.5 mrad, and the scan rate is 20 µrad/sec.

**CIRS\_206TI\_MIRLMBINT002\_PRIME:** The target latitude is 30N; dwells are 49 minutes long at each of two sampled altitudes, repeated (so four dwells total). Twenty minutes dark sky at the end.

**CIRS\_206TI\_FIRNADCMP002\_PRIME:** The target is 30N 240W, with 25 minutes of dark sky time at the end.

**Sequence 85 CIRS Titan Primes:**

S85 includes the targeted flybys T104 and T105, on 2014-233 and-265, respectively. We have 13 prime observations during the two flybys, with no distant observations (TEAs or COMPs). We’re attempting to take data within the southern polar region where possible in this sequence.

**CIRS\_207TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS; we point the camera to Titan for 10 minutes at the beginning of the observation. This is a full-disk southern aspect map at a slew rate of 5 µrad/sec. Thirteen minutes of dark sky time after the ISS offset at the beginning.

**CIRS\_207TI\_FIRNADCMP001\_PRIME:** The southern hemisphere FIRNADCMPs in this sequence are targeted near the pole in order to help characterize the collar feature. Targeting for this observation is 70S 110W. Twenty minutes of dark sky time at the beginning.

**CIRS\_207TI\_FIRNADCMP002\_PRIME:** The pointing is 80N 150W, with 20 minutes of dark sky time at the end.

**CIRS\_207TI\_MIDIRTMAP002\_PRIME:** This is a short map (duration 2:17) targeted at the north polar region. The scan rate is 5 µrad/sec. We target ISS to Titan for 10 minutes, and there is no dark sky time.

**CIRS\_208TI\_MIDIRTMAP001\_PRIME:** Another ISS collaborative observation; we point the NAC to Titan for 10 minutes at the beginning of the observation and 15 minutes at the end, with 25 minutes of dark sky time after the first ISS stare. This is a full-disk southern hemisphere map at a slew rate of 6 µrad/sec.

**CIRS\_208TI\_FIRNADCMP001\_PRIME:** This is the second FIRNADCMP targeted near the south pole in S85; the pointing is to 80S 300W. Twenty minutes of dark sky time at the beginning of the observation.

**CIRS\_208TI\_MIRLMBINT001\_PRIME:** This is a MIRLMBINT in name only; it is designed as a partial-disk high spatial resolution MIDIRTMAP looking at the south pole, specifically the region below 50S. The slew rate is 16 µrad/sec and we have 11 minutes of dark sky time at the beginning.

**CIRS\_208TI\_FIRLMBAER001\_PRIME:** We obtain a relatively slow slew rate of 16 µrad/sec at a target latitude of 28N. Despite the “001” suffix, this observation takes place after close approach.

**CIRS\_208TI\_FIRLMBINT002\_PRIME:** Four pointings, two each at 125 and 225 km altitude, all at 28N.

**CIRS\_208TI\_FIRNADMAP002\_PRIME:** This observation is collaborative with VIMS, in order to observe specular reflection on Kraken Mare. We stare at Kraken (56N 310W, per VIMS’s request) for 10 minutes at the start, then offset for a scan from NW to SE, passing over Kraken again. The slew rate is 6 µrad/sec. Fourteen minutes of dark sky time at the end.

**CIRS\_208TI\_MIRLMBMAP002\_PRIME:** Most MIRLMBMAPs have a duration of 3 to 4 hours, but this is only 2 hours. Limb coverage is from 40N to 15N, less than our desired quadrant of limb soundings.

**CIRS\_208TI\_FIRNADCMP002\_PRIME:** The target is 60N 270W, last targeted during T39. Fifteen minutes of dark sky time at the beginning.

**CIRS\_208TI\_MIDIRTMAP002\_PRIME:** This map is also short duration (2:44) and looks at the north pole region. The scan rate is 4 µrad/sec, and we point the NAC at Titan center for 10 minutes at the beginning. No dark sky time.

**Sequence 86 CIRS Titan Primes:**

S86 includes the targeted flybys T106 and T107. We have nine prime observations in all, no distant observations (TEAs) and no close-in limb observations.

**CIRS\_209TI\_MIDIRTMAP001\_PRIME:** This observation is collaborative with ISS, so before and after the scan portion, the NAC is centered on Titan for 15 minutes. The scan itself covers the full disk at a rate of 7 µrad/sec. We get 22 minutes of dark sky time at the end.

**CIRS\_209TI\_FIRNADCMP001\_PRIME:** Since the two preceding southern-aspect FIRNADCMPs were targeted at 70S and 80S, the target here is 35S 320W. Twenty-five minutes of dark sky time at the beginning.

**CIRS\_209TI\_MIRLMBINT001\_PRIME:** This is the first MIRLMBINT since T103, since the T105 design was repurposed into a South Pole scan. The target latitude is 45S, with no dark sky time (this immediately follows the FIRNADCMP, which does include dark sky).

**CIRS\_209TI\_FIRNADCMP002\_PRIME:** While not collaborative with VIMS, we agreed during this observation to put the VIMS\_IR field of view over the northern lakes area to observe specular reflection for about 5 minutes at or near C/A plus 10 hours. We target 50N 255W, which is close to terrain sampled on T96 and T103, but which puts the northern lakes within VIMS’s coverage throughout the observation. (Even without considering the VIMS request, the coverage possible with our viewing geometry was all relatively well-sampled in the recent past). Twenty-five minutes of dark sky time at the end.

**CIRS\_209TI\_MIDIRTMAP002\_PRIME:** This is collaborative with ISS but the actual template specified by TOST does not include an ISS stare, and ISS agreed during implementation that no stare is needed. This is a partial-disk scan over the North Pole region at a scan rate of 4 µrad/sec. At the end, we get 23 minutes of dark sky time.

**CIRS\_210TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS; we point the NAC to Titan for 10 minute at the beginning of the observation. Our scan rate is 9 µrad/sec for a full-disk scan. Fifteen minutes of dark sky time is included.

**CIRS\_210TI\_FIRNADCMP001\_PRIME:** The target here is 70S 0W. Twenty minutes dark sky time at the beginning.

**CIRS\_210TI\_FIRNADCMP002\_PRIME:** The target is 20S 195W. Twenty minutes of dark sky time at the end.

**CIRS\_210TI\_MIDIRTMAP002\_PRIME:** This is a full-disk scan at 8 µrad/sec, with 13 minutes of dark sky time at the end. No ISS stares.

**Sequence 87 CIRS Titan Primes:**

S87 contains the targeted flybys T108 and T109. We have 9 prime observations in this sequence, including two close-in limb observations and no distant TEAs. None of these were collaborative with other instrument teams.

**CIRS\_211TI\_FIRNADCMP001\_PRIME:** The target is 20N 20W, with 20 minutes of dark sky time at the beginning.

**CIRS\_211TI\_MIRLMBMAP001\_PRIME:** Good coverage of south polar latitudes for this map. We scan between 30S on the right-hand limb, through the south pole (highest southern latitude against the limb is 68S), to 55S on the left-hand side. No dark sky time. Dwells are 6 minutes in duration, with two dwells at each latitude.

**CIRS\_211TI\_MIRLMBINT002\_PRIME:** Poor south polar coverage but good geometry for the north: the limb target is 70N. The last look this far north for a MIRLMBINT was an aimpoint of 80N during T79, on 2011-347. No dark sky time.

**CIRS\_211TI\_FIRNADCMP002\_PRIME:** The target is 40N 160W; 20 minutes dark sky time at the beginning.

**CIRS\_211TI\_MIDIRTMAP001\_PRIME:** This is a full-disk scan at a rate of 6 µrad/sec, with 30 minutes of dark sky time and an 11 minute ISS stare at the end. The time allotted to the observation does not allow a slower scan rate, even without the ISS and dark sky stares.

**CIRS\_212TI\_FIRLMBAER001\_PRIME:** We target the limb at 47N. This is an extremely slow scan, at 14 µrad/sec, but unfortunately we are on thrusters, which means we have a larger deadband than a RWA flyby impacts the quality of the pointing.

**CIRS\_212TI\_FIRLMBINT002\_PRIME:** The same target as the above observation, 47N, but we’re on wheels now with the transition occurring between the two. The transition shortened the time available for this observation so we have two dwells at 47N, one at an altitude of 125 km and one at 225 km, instead of two at each.

**CIRS\_212TI\_FIRNADCMP002\_PRIME:** The target is 40S 200W, with 20 minutes of dark sky at the beginning.

**CIRS\_212TI\_MIDIRTMAP002\_PRIME:** Another full-disk scan at a rate of 4 µrad/sec. We point the NAC at Titan for 11 minutes at the end, followed by 22 minutes of dark sky time.

**Sequence 88 CIRS Titan Primes:**

S88 contains only one CIRS observing period, during targeted flyby T110, with 9 prime observations. Two are close-in limb observations, during which time we are constraining our secondary pointing in order to minimize the NEG\_Z to Earth angle in support of an RSS LGA gravity pass. This has no significant impact on our science.

None of these are collaborative observations.

**CIRS\_213TI\_MIDIRTMAP001\_PRIME:** This is a short MAP, with a duration of about 3:40, so we are getting a partial map centered on the nadir point. The secondary orientation allows us to get coverage (barely) of both the North and South Poles. The scan rate is 9 µrad/sec, and we will have 15 minutes of dark sky time. There’s a brief NAC stare at Titan at the beginning.

**CIRS\_213TI\_FIRNADCMP001\_PRIME:** The observation leads off with 20 minutes of dark sky time, then we target 30S 345W for a long stare.

**CIRS\_213TI\_MIRLMBMAP001\_PRIME:** A good southern hemisphere map with unusually high southern latitudes visible against the limb. We target from 80S on the left-hand side, through 85S, then up to 30S on the right. No dark sky time.

**CIRS\_213TI\_FIRLMBAER002\_PRIME:** An extremely slow scan aimed at 48.7N; the scan rate is 12 µrad/sec. This period uses RWA, not RCS, so the stability should be good. The secondary was chosen to allow RSS to conduct a gravity pass without unduly compromising CIRS pointing requirements.

**CIRS\_213TI\_FIRLMBINT002\_PRIME:** A stare at 48.7N, with two 13-minute dwells at each of two altitudes, 125 and 225 km. Again, the secondary pointing was chosen to work both for CIRS and RSS.

**CIRS\_213TI\_FIRNADMAP002\_PRIME:** Geometry allows for a relatively slow scan from the South Pole to the North, at a rate of 17 µrad/sec. We get 18 minutes of dark sky time at the end. This design heats CIRS by about 0.9K.

**CIRS\_213TI\_MIRLMBINT002\_PRIME:** The target is 80S, taking advantage of our near-equatorial subspacecraft point to get a good look at far southern latitudes. No dark sky time.

**CIRS\_213TI\_FIRNADCMP002\_PRIME:** Twenty minutes of dark sky time (this observation immediately follows the MIRLMBINT), then a stare at 25N 205W.

**CIRS\_213TI\_MIDIRTMAP002\_PRIME:** A long time period allows us to get a full-disk map at a scan rate of 4 µrad/sec, plus 20 minutes of dark sky time and a 9-minute ISS stare at the end.

**Sequence 89 CIRS Titan Primes:**

S89 contains the targeted flybys T111 and T112, including 20 CIRS prime observations. CIRS has an outbound close-approach limb series (FIRLMBT, FIRLMAER, and FIRLMBINT), targeted at 60S. CIRS on T113 owns the entire period from C/A–2:15 through +2:15, giving us six consecutive inbound and outbound limb observations. Inbound MIDIRTMAPs are collaborative with ISS. Both flybys are on RWA.

**CIRS\_215TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS, so we begin and end with 10-minute stares pointing the NAC to Titan center via offsets. The scan rate for the full-disk mosaic is 8 µrad/sec. Fifteen minutes of dark sky time.

**CIRS\_215TI\_FIRNADCMP001\_PRIME:** The target is 50S 140W. Twenty-five minutes of dark sky time included.

**CIRS\_215TI\_FIRLMBT002\_PRIME:** The inbound limb aimpoint is 60S, the furthest southern limb pointing for our atmosphere scans in years (T82, in early 2012, looked at 56S). A second scan targets 55S; the scan rate for both is 50 µrad/sec.

**CIRS\_215TI\_FIRLMBAER003\_PRIME:** The aimpoint is again 60S, and the scan rate is 17 µrad/sec beginning at -120 km altitude and ending near an estimated +480 km.

**CIRS\_215TI\_FIRLMBINT002\_PRIME:** Two dwells at each of two altitudes (125 and 225 km), all aimed at 60S. Dwells are 11 minutes each.

**CIRS\_215TI\_FIRNADMAP002\_PRIME:** A south-to-north scan over both polar regions, at a relatively slow 14 µrad/sec. Twenty-eight minutes of dark sky time at the end.

**CIRS\_215TI\_MIRLMBMAP002\_PRIME:** The preceding two planned MIRLMBMAPs were in the southern hemisphere, so this targets latitudes between 80N (left-hand side) and 35N (right-hand side), covering the furthest northern latitudes visible against the limb. Each dwell (two per latitude) lasts 00:05:30.

**CIRS\_215TI\_FIRNADCMP002\_PRIME:** The aimpoint is 30S 310W, and we get 24 minutes of dark sky time at the end.

**CIRS\_215TI\_MIDIRTMAP002\_PRIME:** No ISS stares and no dark sky time, but we get an unusually slow scan rate of 6 µrad/sec over the full disk.

**CIRS\_218TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS. NAC-to-Titan pointing at the beginning and end, and 23 minutes of dark sky time. The scan rate is a slow 5 µrad/sec.

**CIRS\_218TI\_FIRNADCMP001\_PRIME:** The target is 20S 40W, and we get 25 minutes of dark sky time at the beginning.

**CIRS\_218TI\_FIRLMBINT001\_PRIME:** The inbound portion of this limb series targets 80N. Only one dwell per altitude due to a long initial turn; each dwell is 18:30.

**CIRS\_218TI\_FIRLMBAER001\_PRIME:** A single scan at 80N at a rate of 18 µrad/sec.

**CIRS\_218TI\_FIRLMBT001\_PRIME:** Two scans, at 80N and 70N, both at a rate of 33 µrad/sec.

**CIRS\_218TI\_FIRLMBT002\_PRIME:** The first outbound observation of T112, with two scans, targeted at 65S and 75S. The scan rates are 26 µrad/sec.

**CIRS\_218TI\_FIRLMBAER002\_PRIME:** A single scan at 79S, at a scan rate of 16 µrad/sec.

**CIRS\_218TI\_FIRLMBINT002\_PRIME:** Two dwells of 13:30 at each of two altitudes, targeted at 79S.

**CIRS\_218TI\_FIRNADMAP002\_PRIME:** A north-to-south scan covering the poles, complementing the outbound FIRNADMAP on T111. The scan rate is 13 µrad/sec and we get 20 minutes of dark sky time at the end.

**CIRS\_218TI\_FIRNADCMP002\_PRIME:** 40S 250W is the target, and there’s a 25 minute dark sky stare at the end.

**CIRS\_218TI\_MIDIRTMAP002\_PRIME:** A full-disk mosaic at 10 µrad/sec. Although not collaborative with ISS, they are interested in a stare and we end with 13 minutes of NAC to Titan.

**Sequence 90 CIRS Titan Primes:**

S90 is a sequence with no targeted Titan flybys. We have only two primes, both distant observations (TEAs).

**CIRS\_219TI\_TEA001\_PRIME:** This observation provides calibration against Herschel data by pointing FP1 to Titan center for the duration of the request. We get 20 minutes of dark sky time at the beginning and end of the observation (duration 13:20). No ISS stares, since ISS was not a rider.

**CIRS\_219TI\_TEA002\_PRIME:** FP3 is aimed at 30N for 6 hours, then 35S for 6 hours. Twenty-four minutes of dark sky time in between. Again, no ISS stares since ISS did not ride.

**Sequence 91 CIRS Titan Primes:**

S91 contains the targeted Titan flybys T113 and T114, with 12 CIRS prime observations. Thirteen observations were initially planned but a FIRLMBT on T114 was deleted (merged with a FIRLMBAER) because Saturn is in the background of Titan’s southern limb for about 15 minutes, making atmospheric measurements invalid.

Targeting for limb observations is biased toward the south pole, where possible, in order to get more data on the evolving atmospheric temperature profile.

The sequence contains no distant Titan observations (TEAs or COMPs).

**CIRS\_222TI\_FIRNADCMP001\_PRIME:** The targeted point is 30N 110W, with 20 minutes of dark sky time at the beginning.

**CIRS\_222TI\_MIRLMBMAP001\_PRIME:** Good coverage of the southern hemisphere (since the subspacecraft latitude on Titan is approximately equatorial) allows us to map latitudes between 20S and 85S. Each dwell time is 5:45, with two dwells per latitude step. No dark sky time.

**CIRS\_222TI\_FIRNADMAP001\_PRIME:** A north-to-south scan over both poles at 11 µrad/sec, with highest spatial resolution at the southern end of the scan. The scan follows the 150W meridian. Twenty-five minutes of dark sky time at the beginning.

**CIRS\_222TI\_FIRLMBINT002\_PRIME:** Targeted at 36S, with two dwells at each of two altitudes (125 and 225 km). This is the only FIR limb observation during T113.

**CIRS\_222TI\_FIRNADMAP002\_PRIME:** A south-to-north scan along 340W longitude, again with higher resolution at the South Pole. Twenty-five minutes of dark sky time at the end.

**CIRS\_222TI\_MIRLMBINT002\_PRIME:** The aimpoint is 85S. Dwells are 45 minutes each (2 dwells each at two altitudes). Twenty minutes of dark sky time at the end.

**CIRS\_222TI\_FIRNADCMP002\_PRIME:** FP1 is aimed at 0N 310W, with 25 minutes of dark sky at the end.

**CIRS\_222TI\_MIDIRTMAP002\_PRIME:** This is a full-disk map at a scan rate of 7 µrad/sec. Since it is a night-side map, there are no ISS stares. Thirty-four minutes of dark sky time at the end.

**CIRS\_225TI\_MIDIRTMAP001\_PRIME:** A full-disk map, collaborative with ISS, with stares at Titan center for ISS at the beginning and the end. Twenty-five minutes of dark sky time. The scan rate is 3 µrad/sec, very slow compared to our target rate of 6 µrad/sec. This is an unusually long MIDIRTMAP (duration 8:52).

**CIRS\_225TI\_MIRLMBMAP001\_PRIME:** This is a northern limb map, between 75N and 5N. No dark sky time.

**CIRS\_225TI\_FIRLMBT002\_PRIME:** Deleted, since Saturn is in the field of view. The time goes to the following FIRLMBAER (which incorporates a FIRMLMBT scan).

**CIRS\_225TI\_FIRLMBAER002\_PRIME:** This observation was modified to avoid the time when Saturn is in the field of view against the limb, and a 20-minute inertial pointing was added as a hedge against RBOT or wheel-rate interference problems. There are two scans, a FIRLMBT-type scan at 50 µrad/sec through 28 mrad at latitude 80S, and a FIRLMBAER scan at 17 µrad/sec from -120 km to +480 km altitude, aimed at 85S. The 20 minutes of quiescent time points FP1 to an RA/Dec of 107/-2. For the scans, a secondary pointing of Pos X to the limb is used to reduce turn times to and from (+/- Z to the limb is our normal secondary pointing for aerosol scans).

**CIRS\_225TI\_FIRLMBINT002\_PRIME:** Targeted at 85S, with dwells of 11:05 at each stop (two dwells each at 125 and 225 km altitude).

**Sequence 92 CIRS Titan Primes:**

S92 contains the targeted flybys T115 and T116. During T115, CIRS owns the entire closest-approach period between C/A –2:15 and +9:00. All told we have 15 prime observations in S92. One is collaborative: CIRS\_230TI\_FIRNADMAP002\_PRIME is of interest to VIMS, who wish to look at specular reflection on a northern lake at T115 C/A +4:50. CIRS\_230TI\_MIRLMBMAP002\_PRIME is identified by the sequence leads as collaborative but not marked as such in the SPASS, nor are there any CIMS entries marked collaborative, so that’s apparently an error.

I have added dark sky stares of at least 20 minutes where possible in S92, partly as a preventive measure against post-Port 1 changes due to RBOT or wheel rate problems. The close-in limb observations are the most difficult to find time for an inertial stare, and none of the S92 FIRLMB observations have stares. If we want to start including dwells on the close-in observations, that will require either sacrificing an observation or rethinking how the close-in time is allocated.

**CIRS\_230TI\_FIRNADCMP001\_PRIME:** The target point is 15S 345W, fairly well-sampled terrain. Twenty-five minutes of dark sky time at the beginning.

**CIRS\_230TI\_FIRLMBINT001\_PRIME:** In consultation with Mike, Conor, and Carrie, the inbound portion of T115 looks at latitude 65S, and outbound at 74S. The northern limb stationary point is too close to the Sun to permit off-limb scans. This FIRLMBINT has four dwells of 7:40 duration each, two at 125 km altitude and two at 225 km.

**CIRS\_230TI\_FIRLMBAER004\_PRIME:** Targeted at 65S, a single scan at 20 µrad/sec from -120 km altitude to +480 km.

**CIRS\_230TI\_FIRLMBT001\_PRIME:** Two scans, at 60S and 70S. We scan through 38 mrad at a lower than normal rate, 26 µrad/sec. This is due to the longer duration of this FIRLMBT (45 minutes rather than the usual 30).

**CIRS\_230TI\_FIRLMBT002\_PRIME:** Two scans, at 70S and 75S. The same scan rate was used as in the inbound FIRLMBT, 26 µrad/sec.

**CIRS\_230TI\_FIRLMBAER005\_PRIME:** One scan, at 75S, at a rate of 15 µrad/sec.

**CIRS\_230TI\_FIRLMBINT002\_PRIME:** Points at 75S with four dwells, each 8 minutes long.

**CIRS\_230TI\_FIRNADMAP002\_PRIME:** Collaborative with VIMS. A South to North Pole transect at a scan rate of 14 µrad/sec followed by a 13-minute dwell for VIMS near the north pole. Thirty-four minutes of dark sky time at the end (longer than normal due to the requirement for the VIMS stare).

**CIRS\_230TI\_MIRLMBMAP002\_PRIME:** A southern hemisphere map, between 85S and 25S. Two altitudes per latitude, with a duration of 5:45 each dwell. Fifteen minutes of dark sky time at the end.

**CIRS\_231TI\_FIRNADCMP001\_PRIME:** Targeting 15N 345W, with almost exactly the same aspect as the T115 inbound FIRNADCMP. Twenty-five minutes of dark sky time at the beginning.

**CIRS\_231TI\_MIRLMBINT001\_PRIME:** Targets 85S. Forty-five minute dwells, with 20 minutes of dark sky time at the beginning.

**CIRS\_231TI\_FIRNADMAP001\_PRIME:** A South to North transect again, but nearly 180 degrees of longitude away from the T115 FIRNADMAP. The scan rate is 13 µrad/sec. Twenty-five minutes of dark sky time at the beginning.

**CIRS\_231TI\_FIRLMBINT001\_PRIME:** Four stares, two each at two altitudes, all targeting 57S. Unusually short turns and a longer than normal duration allow dwell times of 13:15 each.

**CIRS\_231TI\_MIRLMBMAP002\_PRIME:** This is a northern hemisphere map, ranging from 80N to 20N. Each altitude dwell duration is 5:45. Fifteen minute of dark sky time at the end.

**CIRS\_231TI\_FIRNADCMP002\_PRIME:** Targets 0N 260W, with 25 minutes of dark sky time at the end.

**Sequence 93 CIRS Titan Primes:**

S93 contains two targeted flybys, T117 and T118, with a single close-in limb observation (during T118 outbound), as well as a distant TEA observation. We have 10 observations in this sequence with a single collaborative prime, CIRS\_234TI\_MIDIRTMAP001\_PRIME, with ISS.

Where possible, these observations have 20-minute quiescent periods built in (targeting an RA/Dec pointing), doubling as dark sky calibration time. These periods are intended to mitigate against loss of data in the event of either an RBOT problem or reaction control wheel rates that cause predicted interference with data collection. These quiescent periods will be included in designs for the remainder of the mission, as observation duration and collection requirements allow.

**CIRS\_232TI\_FIRNADCMP001\_PRIME:** The targeted latitude/longitude is 50S 20W. Twenty minutes of dark sky time at the beginning.

**CIRS\_232TI\_MIRLMBINT001\_PRIME:** The target is 80S, the southernmost latitude visible against the limb. Dwells are 44 minutes each; there are four dwells total, all at 80S, at two altitudes to give continuous FP3 coverage from the surface. Turns to and from the waypoint are unusually long (90 degrees, about 20 minutes each). Twenty minutes of dark sky time at the beginning.

**CIRS\_232TI\_FIRNADMAP002\_PRIME:** This is a North to South transect with good spatial resolution at the North Pole, scanning at a rate of 14 µrad/sec. There’s 23 minutes of dark sky time at the end.

**CIRS\_232TI\_MIRLMBMAP002\_PRIME:** Limb latitude coverage from 75N to 10N; dwells are 5:45 per altitude stop, two altitudes per latitude. Latitude intervals are 5 degrees. No dark sky time.

**CIRS\_232TI\_FIRNADCMP002\_PRIME:** Point and stare at 20S 240W. Twenty minutes of dark sky time at the end.

**CIRS\_232TI\_MIDIRTMAP002\_PRIME:** This is an unusually close-range MIDIRTMAP, and a full-disk map would require 8 scan legs versus the usual 6 or 7 scans. Instead, we do a 4-scan partial map of the center of the disk, with full north-south coverage, at a scan rate of 8 µrad/sec. Ten-minute ISS stares are included at the beginning and end, and there’s a 16-minute dark sky pointing (via an offset).

**CIRS\_233TI\_TEA001\_PRIME:** Two FPB pointings, spanning from the equator to 60N and then 45N to the North Pole. Each dwell is 3:40:00. There’s a 20-minute quiescent/dark sky pointing between the Titan observing periods.

**CIRS\_234TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS; there are ISS pointings/stares at beginning and end. This is a full-disk MAP at a scan rate of 3 µrad/sec, exceptionally slow. Nineteen minutes of dark sky time via an offset.

**CIRS\_234TI\_FIRNADCMP001\_PRIME:** The targeted point is 20N 0W; 20 minutes of dark sky time at the beginning of the observation.

**CIRS\_234TI\_FIRLMBCON002\_PRIME:** Our first FIRLMBCON since T67. This is a design that points FP1 to altitudes of 100, 150, and 200 km above the limb in the flyby time block normally assigned to the similar FIRLMBINT. We would prefer to align FP3/4 perpendicular to the limb, but in this case turn times dictated that we use the handoff secondary pointing, which leaves FP3/4 nearly parallel to the surface. Each dwell is 18:45. Target is 66S.

**Sequence 94 CIRS Titan Primes:**

S94 includes the targeted flybys T119 and T120. Both of these are performed on thrusters; all of our T119 FIR limb observations are during the RCS period, but only the T120 FIRLMBAER observation is done on thrusters. We have 18 observations total, with no distant COMPs or TEAs.

(Repeated from S93) Where possible, these observations have 20-minute quiescent periods built in (targeting an RA/Dec pointing), doubling as dark sky calibration time. These periods are intended to mitigate against loss of data in the event of either an RBOT problem or reaction control wheel rates that cause predicted interference with data collection. These quiescent periods will be included in designs for the remainder of the mission, as observation duration and collection requirements allow.

**CIRS\_235TI\_MIDIRTMAP001\_PRIME:** A full-disk map at a slew rate of 5 µrad/sec, with 20 minutes of dark sky time at the beginning. NAC stares included at the beginning and end (collaborative with ISS).

**CIRS\_235TI\_FIRNADCMP001\_PRIME:** This observation targets 60S 320W. We stare at an RA/Dec for 20 minutes at the end both for dark sky time and as a hedge against RBOT or RWA noise concerns.

**CIRS\_235TI\_MIRLMBMAP001\_PRIME:** Orbital geometry prevents us seeing either of the polar regions against the limb, so this map ranges from 50S to 15N in latitude. No dark sky time.

**CIRS\_235TI\_FIRNADMAP001\_PRIME:** This is a south-to-north transect that passes near the South Pole, at a rate of 13 µrad/sec. There’s a 20-minute quiescent/dark sky period at the end.

**CIRS\_235TI\_FIRLMBINT001\_PRIME:** Our target latitude for the T119 limb observations is 54S, and we are using a secondary pointing of NEG\_Z to Earth for MIMI. Four dwells of 14 minutes each, at altitudes of 125 and 225 km. Thrusters.

**CIRS\_235TI\_FIRLMBAER001\_PRIME:** The target latitude is 54S. Scan rate is 27 µrad/sec, but since we’re traversing our usual altitude range of -120 to +480 km in our typical tracking time, the slew in km/sec should be close to that in other FIRLMBAER scans. In this case, we’re unusually close to Titan. Thrusters.

**CIRS\_235TI\_FIRLMBT001\_PRIME:** Two scans at 54S latitude. The second scan is truncated due to a slightly longer than usual turn to our handoff pointing. The turn to the handoff incurs CIRS heating, as does the following INMS observation. Thrusters.

**CIRS\_235TI\_FIRNADCMP002\_PRIME:** Our target is 15N 255W, and we get 25 minutes of dark sky time at the end.

**CIRS\_235TI\_MIDIRTMAP002\_PRIME:** This is a full-disk scan at 13 µrad/sec, with 20 minute of dark sky time at the end and brief NAC pointings to Titan at the beginning and end. Not collaborative.

**CIRS\_236TI\_FIRNADCMP001\_PRIME:** Targeted at 70S 10W. No dark sky time, as this is a brief observation (1:32).

**CIRS\_236TI\_MIRLMBINT001\_PRIME:** We’re targeting 50S, with four dwells of 52 minutes each. No dark sky time.

**CIRS\_236TI\_FIRNADMAP001\_PRIME:** Another south-to-north track, this time directly over the South Pole. The scan rate is 11 µrad/sec. We have a 20-minute quiescent period/dark sky time at the end.

**CIRS\_236TI\_FIRLMBINT001\_PRIME:** The target latitude is 51S, with two dwells at each of two altitudes. This observation is on RWA.

**CIRS\_236TI\_FIRLMBAER002\_PRIME:** Targeted at 51S. The scan rate is 20 µrad/sec. Thrusters.

**CIRS\_236TI\_FIRNADMAP002\_PRIME:** A north-to-south ground track that passes over the North Pole, at a scan rate of 11 µrad/sec. The observation begins with 20 minutes of quiescent pointing at an RA/Dec.

**CIRS\_236TI\_MIRLMBMAP002\_PRIME:** The targeted latitude range is 50N – 15S, again limited by geometry such that the polar latitudes do not intersect the limb. No dark sky time.

**CIRS\_236TI\_FIRNADCMP002\_PRIME:** The target is 60N 220W. Twenty minutes of dark sky time at the end.

**CIRS\_236TI\_MIDIRTMAP002\_PRIME:** A full-disk map at a scan rate of 11 µrad/sec. We get 20 minutes of dark sky time at the end, and there are brief NAC stares at Titan at the beginning and end. Not collaborative.

**Sequence 95 CIRS Titan Primes:**

S95 contains the T121 and T122 targeted flybys; T121 is dedicated to Radar near closest approach, and T122 is entirely an RSS gravity pass. We have only five CIRS prime observations, none of them close limb scans or stares. There is a single long TEA distant observation.

20-minute quiescent period have been added where practical, as noted in the individual observation descriptions.

**CIRS\_238TI\_MIRLMBINT002\_PRIME:** The targeted latitude is 0N; latitudes visible against the limb range from about 40S to 40N. We get four dwells of approximately 1 hour each, two each at 350 km altitude and the other two offset toward the limb. There’s a 20-minute dark sky/quiescent pointing at the beginning (2017-207T00:19:13 – 00:39:13).

**CIRS\_238TI\_FIRNADMAP001\_PRIME:** This is a north-to-south scan at 10 µrad/sec, crossing over the South Pole (which is not on the limb). There’s a 20-minute dark sky/quiescent period at the end (2016-207T07:19:54 – 07:39:54).

**CIRS\_238TI\_FIRNADCMP002\_PRIME:** This observation targets 15N 260W with FP1, and there’s dark sky/quiescent time from 2016-207T19:01:23 to 19:21:23.

**CIRS\_238TI\_MIDIRTMAP002\_PRIME:** A full-disk map at a scan rate of 8 µrad/sec; the coverage includes the North Pole and extends as far south as about 40S. Again, we have 20 minutes of dark sky and quiescent pointing time toward the end, from 2016-208T03:10:04 to 03:30:04. We also accommodate ISS by aiming the NAC to Titan center during two dwells at the beginning and end of the observing period, for 12 minutes each.

**CIRS\_241TI\_TEA002\_PRIME:** A long-range observation (1.1M km) with a duration of 35 hours. The first half of the tracking period points FP3 to Titan’s North Pole; then we shift to FP4 to the same pointing. The focal plane footprints fall almost entirely on Titan, extending very slightly outside the limb at the end. There are four 20-minute dark sky periods distributed across the observation; while these aren’t targeted to an RA/Dec, the range to Titan is great enough that the pointings are essentially inertial.

**Sequence 96 CIRS Titan Primes:**

S96 includes the T123 and T124 targeted flybys, and CIRS has ten prime observations in this sequence. This is the last sequence contained entirely within IN2, and the F Ring orbits will begin with the T125 flyby in S97. After that, the Cassini Solstice Mission contains only one further targeted flyby, T126 in S99, which marks the start of the Proximal orbits.

We have one close-in limb series in S96, during the outbound portion of T123, and no distant observations (TEAs or COMPs).

These observations include 20-minute quiescent periods where practical, to allow for mitigation of RWA-induced noise, should it be a problem.

**CIRS\_243TI\_MIDIRTMAP001\_PRIME:** Collaborative with ISS. We start off with 20 minutes quiescent/dark sky time, then a central Titan stare for ISS. The mosaic covers the full disk of Titan at a scan rate of 10 µrad/sec.

**CIRS\_243TI\_FIRLMBT002\_PRIME:** Two scans, at 40N and 50N, with scan rates of 50 µrad/sec. The scan at 40N is through 28 mrad, our nominal range normal to the limb, but the 50N scan is time-constrained to only 21 mrad due to the initial turn being somewhat long (from the preceding VIMS observation at closest approach).

**CIRS\_243TI\_FIRLMBAER002\_PRIME:** A single scan from -120 km altitude to +480 km at a scan rate of 16 µrad/sec. This is a very good rate and the observation is on RWA, not thrusters, so this should provide good altitude resolution. We target 50N latitude.

**CIRS\_243TI\_FIRLMBWTR001\_PRIME:** A single stare with FP1 at an altitude of 175 km for the duration of the observation. Again, the target latitude is 50N.

**CIRS\_248TI\_MIDIRTMAP001\_PRIME:** Fairly short duration for a MIDIRTMAP (about 2:30) with both an ISS stare and a 20-minute inertial quiescent period, so we are doing a partial-disk map of the South Polar region below 60S. The scan rate is 6 µrad/sec.

**CIRS\_248TI\_FIRNADCMP001\_PRIME:** Twenty minutes of dark sky/quiescent pointing time at the beginning, then a stare at 89S 50W.

**CIRS\_248TI\_FIRNADMAP002\_PRIME:** This is not a collaborative observation with VIMS, as the following MIRLMBMAP is, but they would like to observe the northern lake region where possible. This observation begins with another 20-minute quiescent period, then we scan from the South to the North Poles at a rate of 13 µrad/sec. After about 2016-319T04:10, the specular reflection point of interest to VIMS should be in the VIMS\_IR field of view.

**CIRS\_248TI\_MIRLMBMAP002\_PRIME:** Collaborative with VIMS, for a dwell on the specular reflection point. We have no quiescent period here, as time is at a premium and the two bordering CIRS primes both contain dwells. The limb scan covers latitudes from 10S to 50N; this is very close to the last MIRLMBMAP during T120, but in part this is constrained by similar flyby geometry, and the T120 example was compromised by post-close approach heating. After the limb map, we point VIMS\_IR to 60N 325W for 20 minutes, as requested. For most of the duration of the map, the VIMS\_IR field will include the specular reflection point, so they will be able to sample the region over more than three hours during our roughly 5.5-minute dwells on the limb.

**CIRS\_248TI\_FIRNADCMP002\_PRIME:** We target 30N 280W for this FP1 stare. The observation begins with 20 minutes quiescent on dark sky.

**CIRS\_248TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS. Another full-disk map, this one at a scan rate of 7 µrad/sec. We begin with 20 minutes of dark sky time at a quiescent pointing, then point the NAC to Titan center for 15 minutes. The observation ends with another NAC dwell on Titan.

**Sequence 97 CIRS Titan Primes:**

S97 includes T125, with our last close-in limb observations of the mission, followed immediately by the beginning of the F-Ring Orbits.

CIRS has 19 prime observations of Titan in S97, including one PIE (Pre-Integrated Event). The first seven observations are during the T125 flyby. These include an outbound FIRLMBT, FIRLMBAER, and FIRLMBWTR, all targeted at latitude 10S. After that, we will execute COMPMAPs, MIDIRTMAPs, and a MIRLMBMAP on more distant flybys.

We have a large number of MIDIRTMAPs in this sequence – seven in all – and it’s worth noting that the scan rates are all slower than we can usually attain, in the range of 5 to 8 µrad/sec.

These observations include 20-minute quiescent periods where practical, to allow for mitigation of RWA-induced noise, should it be a problem.

**CIRS\_250TI\_FIRLMBT002\_PRIME:** A single scan at latitude 10S. The scan parameters are unique to this FIRLMBT: the scan rate is 30 µrad/sec, beginning at -150 km altitude and ending at +400 km. The initial turn from VIMS just after close approach is too long to permit two scans in the allotted 30-minute observation duration.

**CIRS\_250TI\_FIRLMBAER002\_PRIME:** Targeting 10S, FP1 scans from -120 km altitude to +480 km at an unusually slow rate of 14 rad/sec.

**CIRS\_250TI\_FIRLMBWTR001\_PRIME:** A single stare at an altitude of +175 km for about 52 minutes, at 10S latitude. This takes the place of a FIRLMBINT, which would normally be the most distant of the three close-in FIR limb observations.

**CIRS\_250TI\_FIRNADMAP002\_PRIME:** This is collaborative with VIMS, who want to look for specular reflection on the smaller northern lakes toward the end of the observation. We have a single South-to-North transect at a scan rate of 11 µrad/sec, covering the North Pole. We then offset to put VIMS\_IR over 57N 320W and the northwest quadrant of the visible disk.

Twenty minutes of dark sky/quiescent pointing at the beginning.

**CIRS\_250TI\_MIRLMBINT002\_PRIME:** This is targeted at 50N, the first northern hemisphere targeting for a limb integration design in more than a year and a half (the southern limb is largely out of view). We have a pair of 48-minute dwells at each of two altitudes.

Twenty minutes dark sky/quiescent pointing at the end.

**CIRS\_250TI\_FIRNADCMP002\_PRIME:** A long stare at 20S 260W. Twenty minutes of dark sky/quiescent time at the end.

**CIRS\_250TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS, so we point the NAC to Titan for 10 minutes at the beginning and 11 minutes at the end of the observation. This is a full-disk scan at a rate of 5 µrad/sec.

No dark sky or quiescent pointing, since this immediately follows the FIRNADCMP quiescent dwell. Also, adding a quiescent period would necessitate raising the scan rate.

**CIRS\_252TI\_COMPMAP001\_PRIME:** This observation is collaborative with ISS. We offset to point the NAC at Titan’s center for 10 minutes at the beginning and end. In between, CIRS FPB points to 75N, with the arrays spanning from 60N to 90N.

Twenty minutes of dark sky time toward the end.

**CIRS\_253TI\_MIDIRTMAP001\_PRIME:** A full-disk scan at 5 µrad/sec. ISS is not riding on this observation (or any of the rev 253 MIDIRTMAPs, for some reason), so we don’t offset for any NAC stares.

We do have 20 minutes of dark sky/quiescent pointing at the beginning, and another 27 minutes of dark sky at the end. The second stare doesn’t take away from the scan, since scan rates are quantized in 1 µrad/sec increments and there’s insufficient time for a 4 µrad/sec scan.

**CIRS\_253TI\_COMPMAP001\_PRIME:** FPB points to 80N, with the arrays spanning 70N – 90N. We have 20 minutes of quiescent/dark sky time at the beginning.

**CIRS\_253TI\_MIDIRTMAP002\_PRIME:** This is a full-disk map at a scan rate of 8 µrad/sec. There’s a 20-minute quiescent/dark sky stare at the beginning and another 23-minute dark sky stare at the end.

**CIRS\_253TI\_COMPMAP002\_PRIME:** The target is again 80N, with FPB covering from 70N to 90N. No dark sky or quiescent pointing since this is a short COMPMAP (1:30) with long turns to and from the waypoint.

**CIRS\_253TI\_MIDIRTMAP003\_PRIME:** This is a short-duration MIDIRTMAP (1:30) with excellent coverage of the North Pole, so we have a partial map covering the Pole and everything down to at least 60N. The scan rate is 7 µrad/sec.

**CIRS\_253TI\_MIDIRTMAP004\_PRIME:** This is a map of half the visible disk, including the North Pole. Time is insufficient for a full-disk scan at acceptable slew rates (duration is 2:12). The scan rate is 7 µrad/sec and we have a 20-minute quiescent/dark sky period at the beginning.

**CIRS\_259TI\_MIDIRTMAP001\_PRIME:** Another partial map, covering about 2/3 of the visible disk including the South Pole and all visible terrain south of 30S. We offset to point the NAC to Titan’s center at the beginning and end, and we also include 20 minutes of dark sky/quiescent pointing near the beginning. The scan rate for the map is 7 µrad/sec.

**CIRS\_259TI\_COMPMAP001\_PIE:** The FPB boresight is pointed to 80S, spanning from 70S to 90S, for a long stare. There are 20-minute dark sky pointings at the beginning and end of the observation, the first one also an inertial pointing.

**CIRS\_259TI\_MIRLMBMAP002\_PRIME:** This is about an hour longer than a typical MIRLMBMAP and consequently we cover more latitudes against the limb than usual. The range of latitudes observed is from 60S to 15N, with two altitudes sampled at each latitude step. We have a 20-minute dark sky/quiescent pointing at the end.

**CIRS\_259TI\_MIDIRTMAP002\_PRIME:** A long-duration (7 hours) MIDIRTMAP, covering the full disk at a rate of 5 µrad/sec. We offset to put the NAC on Titan for 10 minutes at the beginning, then point to an RA/Dec for 20 minutes of dark sky/quiescent time.

**CIRS\_259TI\_COMPMAP002\_PRIME:** A long stare at 45S, with the FP3/4 arrays spanning from 20S – 90S. There’s 20 minutes of dark sky/quiescent pointing at the end.

**Sequence 98 CIRS Titan Primes:**

S98 occurs entirely within the F Ring orbits, and we have no Titan close flybys. Our prime observation set consists of two distant COMPMAPs and three observations at a range on the order of 200,000 km. These three, a MIDIRTMAP, MIRLMBMAP, and a MIRLMBINT, are similar to those we’ve acquired during targeted flybys.

**CIRS\_261TI\_MIDIRTMAP001\_PRIME:** This is a partial-disk mosaic of the visible portion of the northern hemisphere, at a scan rate of 8 µrad/sec. The observation is collaborative with ISS, and we have included three 10-minute dwells pointing the NAC to Titan center at the beginning, middle, and end of the observation. We also include an 18.5-minute quiescent/dark sky pointing.

**CIRS\_261TI\_MIRLMBMAP001\_PRIME:** The latitude dwells range from 15N to 35S. Our subspacecraft latitude is about 40N, so the South Pole is out of sight and the North Pole is not near the limb. The observation includes 20 minutes of dark sky/quiescent pointing time.

**CIRS\_261TI\_MIRLMBINT001\_PRIME:** This observation is also constrained to low latitudes on the limb, since the subspacecraft latitude is about 60N. We are targeting 10S, and a 20-minute quiescent stare at dark sky is included.

**CIRS\_268TI\_COMPMAP001\_PIE:** With a duration of 5:47, this is a stare at 60S; the FP3/4 arrays span 40S to 90S. Twenty minutes of dark sky/quiescent pointing at the beginning.

**CIRS\_268TI\_COMPMAP002\_PIE:** Similar to COMPMAP001, here we point to 50S to capture latitudes between 30S – 90S with FP3 and FP4. Duration is 5:16 and again there’s a 20-minute quiescent pointing at the beginning.

**Sequence 99 CIRS Titan Primes:**

Our Titan primes in S99 begin during the T126 flyby, which marks the boundary between the F Ring and Proximal orbits. We have two MIDIRTMAPs and a FIRNADCMP during T126; the remainder of S99 contains MIDIRTMAPs, a distant COMPMAP, a FIRNADMAP, and a pair of MIR limb observations. We have no more close-in FIR limb observations in the mission.

**CIRS\_270TI\_MIDIRTMAP001\_PRIME:** Due to its duration of only 2:43, this is a partial-disk map of the South Polar Region up to about 40S. The scan rate is 4 µrad/sec. We get 20 minutes of dark sky time at the end; this is effectively a quiescent period as well, for purposes of RBOT mitigation.

**CIRS\_270TI\_FIRNADCMP001\_PRIME:** Targeted at 75S 55W, this is a 3-hour observation that includes the South Pole within the nominal FP1 footprint. We have 20 minutes of dark sky/quiescent time at the end.

**CIRS\_270TI\_MIDIRTMAP002\_PRIME:** Collaborative with ISS, so we point the NAC to Titan at the beginning and end. The scan rate for the unusually long-duration MAP (9 hours 52 minutes) is 4 µrad/sec, which is slow enough to allow the NAC to image at any time during slew with minimal smear. We also have roughly 20-minute dark sky/quiescent dwells before and after the MAP.

**CIRS\_271TI\_COMPMAP001\_PRIME:** Three dwells, with the Z-axis to the pole, spanning Titan from north to south. Each dwell is 3 hours 20 minutes long. The observation also contains three 20-minute dark sky/quiescent periods.

**CIRS\_273TI\_MIDIRTMAP001\_PRIME:** Unusually distant for a MIDIRTMAP (about 500,000 km), this is a full-disk MAP at 5 µrad/sec. ISS\_NAC is on Titan center at the beginning and end, and we have 24 minutes of dark sky time (not quiescent) before the scan.

**CIRS\_275TI\_MIRLMBINT001\_PRIME:** We target 50S on the limb, nearly the southernmost latitude visible against the limb. Before and after the limb pointings, we have 20-minute dark sky/quiescent dwells.

**CIRS\_275TI\_FIRNADMAP002\_PRIME:** A single composite scan (scanning simultaneously about X and Z) from south to north, passing over the South Pole. Scan rate is 5 µrad/sec. At the end, we are quiescent on dark sky for 34 minutes.

**CIRS\_275TI\_MIRLMBMAP002\_PRIME:** This is a very good southern hemisphere quadrant; we sample latitudes from 80S to 20S. Dwells at each of two altitudes at each latitude are 6 minutes 15 seconds each, except for the final latitude pointing at 20S; this is a single 3-minute dwell at one altitude only, due to timing requirements. We have a single 10-minute dark sky/quiescent dwell at the beginning.

**CIRS\_275TI\_MIDIRTMAP002\_PRIME:** This is a full-disk scan at 10 µrad/sec; we’re fairly close for this type of observation and thus the scan covers a greater angular area. We are nearly equatorial during this observation, so both poles are on or near the limb. We have a 21-minute dark sky dwell at the end (not a quiescent pointing).

**Sequence 100 CIRS Titan Primes:**

S100 includes a nice symmetrical set of six MIDIRTMAPs surrounded by a pair of COMPMAPs. None of these are collaborative. The MIDIRTMAPs are interleaved with ISS prime observations, so we have a series of six observations, each with a duration of two to three hours, separated by one-hour ISS primes. Three hours is insufficient for a full-disk map at anywhere near our desired slew rate of 4 µrad/sec, so each one is a partial map that contributes to a full-disk survey with a lot of revisit. In particular, the North Pole region is sampled in five of the six MIDIRTMAPs.

**CIRS\_278TI\_COMPMAP001\_PRIME:** This observation points first FP3 and then FP4 at 89N, effectively the North Pole, for the duration of the three-hour request. No dark sky or quiescent pointing.

**CIRS\_278TI\_MIDIRTMAP001\_PRIME:** This and the following five MIDIRTMAPs occur over a span of 22 hours, alternating with ISS-prime TI\_CLOUDs, each of which is one hour long. Each of the MIDIRTMAPs scans at a rate of 4 µrad/sec. MIDIRTMAP001 has a duration of 3:00, and is a partial-disk map, covering the North Pole down to latitude 35N. No dark sky/quiescent pointing.

**CIRS\_278TI\_MIDIRTMAP002\_PRIME:** Another partial-disk map without dark sky time. Coverage is from 90N to 12N, and the duration is 3:00.

**CIRS\_278TI\_MIDIRTMAP003\_PRIME:** The duration is 2:00, so this is a single scan across Titan at 4 µrad/sec plus 35 minutes of dark sky/quiescent pointing at the beginning. The scan midpoint is the subspacecraft latitude/longitude of 54N 33W, and latitudes covered range from 68N to 23S (on the limb).

**CIRS\_278TI\_MIDIRTMAP004\_PRIME:** A partial-disk map, duration 3:00, over the North Pole and covering all visible terrain above 40N. No dark sky time.

**CIRS\_278TI\_MIDIRTMAP005\_PRIME:** About a half-disk map including the North Pole. Duration is 3:00 and there’s no dark sky pointing.

**CIRS\_278TI\_MIDIRTMAP006\_PRIME:** Coverage of about three-quarters of the visible disk, at the greatest range/lowest spatial resolution of the series of six MIDIRTMAPs. The duration is 2:54 and there’s no dark sky time.

**CIRS\_280TI\_COMPMAP001\_PIE:** CIRS FPB is targeted at 70S, allowing coverage from the South Pole to about 60S. The duration is 4:24, so we include 20 minutes of dark sky time at the end. This also functions as a quiescent period for RBOT or star tracker purposes, and subsequent observations are anticipated to require this to accommodate SID Suspend issues (bright objects in the star tracker field of view).

**Sequence 101 CIRS Titan Primes:**

We have 20 prime observations in S101, six of them designated as pre-integrated events (PIEs). Four are collaborative with ISS. Most of our primes are COMPMAPs and MIDIRTMAPs and are usually interleaved with ISS primes of one-hour duration. Many of the MIDIRTMAPs are from closer range to Titan than was usually the case during targeted flybys, and coupled with shorter-duration observations, all but one of them are partial-disk maps.

The sequence also includes a single MIRLMBMAP and an unusual FIRNADMAP, which concentrates on the northern lakes. There are no close-in limb observations.

The quiescent pointings in some of these observations are 20-minute (or more) RA/Dec stares that allow mitigation for RBOT or CIRS-specific noise associated with reaction wheel spin rates.

**CIRS\_283TI\_COMPMAP001\_PRIME:** This observation points FP3 and then FP4 at the North Pole, splitting the available dwell time. No dark sky/quiescent time.

**CIRS\_283TI\_MIDIRTMAP001\_PRIME:** This is a partial-disk map covering mid-northern latitudes up to 50N, south to the lowest latitudes visible against the limb (about 30S). The map contains three scan legs. We have 22 minutes of dark sky/quiescent time at the end of the observation. The scan rate for this and all of the MIDIRTMAPs in S101 is 4 µrad/sec.

**CIRS\_283TI\_MIDIRTMAP002\_PRIME:** This mosaic contains three strips and covers the North Pole (all of Titan above 70N) as well as terrain down to the limb. We get 22 minutes of dark sky/quiescent pointing.

**CIRS\_283TI\_MIDIRTMAP003\_PRIME:** This is a 4-strip mosaic which again includes the North Pole and all of the central portion of the visible disk. The observation is collaborative with ISS, and we point the NAC to the northern lakes (73N 300W) for 10 minutes. No dark sky/quiescent time.

**CIRS\_283TI\_COMPMAP002\_PRIME:** We split the observing time here between FP3 and FP4 pointed to the North Pole, along with a 10-minute ISS NAC stare at 73N 300W (this observation is collaborative with ISS). No dark sky/quiescent time.

**CIRS\_283TI\_COMPMAP003\_PRIME:** As with the first two COMPMAPs in this rev, FP3 and FP4 split the dwell time pointed to the North Pole. No dark sky or quiescent time.

**CIRS\_285TI\_COMPMAP001\_PRIME:** A single pointing targeting FPB to 60S, spanning 40S to the South Pole. No dark sky or quiescent time.

**CIRS\_287TI\_MIDIRTMAP001\_PRIME:** This is a four-strip mosaic, with a subspacecraft latitude of 25 degrees, much lower than the earlier MIDIRTMAPs in this sequence. We cover about half of Titan’s disk, including all visible terrain above 33N. Twenty minutes of dark sky/quiescent pointing at the end.

**CIRS\_287TI\_COMPMAP001\_PIE:** FP1 is pointed to the North Pole. We have 20 minutes of dark sky/quiescent time at the end of the observation.

**CIRS\_288TI\_COMPMAP001\_PIE:** Again, FP1 is targeted to the North Pole, and we get 20 minutes of dark sky/quiescent pointing time. This observation is collaborative with ISS, whose wish is to point the NAC to 82N 260W for ten minutes to collect imagery of Ligeia Mare.

**CIRS\_288TI\_COMPMAP002\_PIE:** We point FPB to the North Pole, and we have 20 minutes of dark sky/quiescent time at the end of the observation.

**CIRS\_288TI\_COMPMAP003\_PIE:** Another observation in which we point FPB to the North Pole, and we have a 20-minute dark sky/quiescent pointing toward the end.

**CIRS\_290TI\_COMPMAP001\_PIE:** We target FPB to 48S, at the subspacecraft latitude, so that the FP3/4 arrays span from 25S to 90S. Twenty minutes of dark sky/quiescent pointing at the beginning of the observation.

**CIRS\_292TI\_MIDIRTMAP001\_PRIME:** This MAP covers the southernmost latitudes visible on Titan, below 70S, and captures the atmosphere off the south limb. The mosaic includes three strips and extends north to the equator. No dark sky/quiescent time.

**CIRS\_292TI\_MIRLMBMAP001\_PIE:** Latitude coverage is from 70N (the northernmost latitude visible against the limb) to 5S, covering two altitudes at each latitude step. The observation is collaborative with ISS, who want a 10-minute WAC stare in the middle of the observation; we accommodate this by pausing at one of the limb latitude dwells (at 30N).

**CIRS\_292TI\_FIRNADMAP001\_PRIME:** This is an unusual FIRNADMAP, which instead of a single scan across Titan consists of a four-strip FP1 mosaic over the northern lake region. The slew rate is 7 µrad/sec, and we cover all terrain north of 70N. We have a 20-minute dark sky/quiescent pointing at the end.

**CIRS\_292TI\_COMPMAP001\_PRIME:** This COMPMAP also targets FPB to the North Pole; no dark sky/quiescent pointing.

**CIRS\_292TI\_MIDIRTMAP002\_PRIME:** This is a four-strip mosaic and captures all terrain above 38N (including the North Pole) as well as partial coverage down to the equator. Twenty minutes of dark sky/quiescent pointing at the end.

**CIRS\_293TI\_MIDIRTMAP003\_PRIME:** This is a full-disk MAP, five scans, at a rate of 4 µrad/sec and a range of about 360,000 km. No dark sky/quiescent pointing.

**CIRS\_293TI\_COMPMAP002\_PRIME:** FPB is targeted at 78N, in order to put the FPB footprint over the North Pole without extending off Titan’s limb. A longitude offset also keeps FP1 over Titan. No dark sky or quiescent pointing.