

# About the Occultation

- S79 Rev 194 Saturn rings occultation on DOY 187 (July 6, July 5-6 PDT)
  - Chord rings occultation
  - Telemetry OFF, Ranging OFF, **2-way/3-way mode**
  - Covered by Goldstone (uplink and partial downlink) and Canberra (downlink)
- From Essam Marouf:

The Rev 194 rings radio occultation is the second of two 'sisters' chord ring occultations that capture full Rings A and B, and partially Ring C. The other sister occultation was completed on Rev 193. In both cases, the ring opening angle is nearly equal ( $B = 17.1$  degrees). The similar chord occultation geometry for the two occultations allow separation and characterization of two distinct types of ring optical depth profile longitudinal asymmetry. The first is 'real' (dynamical) and is primarily due to resonant interactions with Saturn's external and ring-embedded satellites. The second is 'virtual' and is primarily due to the different geometry of observing 'cylindrical-like' structures known to exist across most of Rings A and B (gravitational wakes). The wakes act like a 'venetian-blind' causing signal attenuation that strongly depends on the orientation of the observation line-of sight relative to the orientation of the cylindrical structure, which is different for the ingress and egress segments of the chord. Observed optical depth differences between the Revs 193 and 194 chords will be dominated by the true dynamical asymmetries since Saturn satellites will be at different locations at the two different epochs of the occultations. This facilitates separation of the 'virtual' optical depth profile asymmetry using the differences in the profiles observed over the ingress and egress segments of each chord. Revs 193 and 194 provide one of the rare opportunities in the Cassini tour where measurements over nearly identical longitudes and ring opening angle are captured over full Rings A and B, facilitating the separation above. The two occultations will add to others already completed to help characterize both the macro and micro structure of the rings and the physical properties of such structure. The observations are conducted in the 2-way configuration with the reference X-band uplink signal provided by DSS-14 and the three downlink signals (S/X/Ka-band) observed at DSS-43 and DSS-34, and partially also at DSS-14.

# DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
13	187	0025	0125	0700	0715	DSS-14	CAS	TP	RS194-RIOCC	5758	1647	1A1
13	187	0220	0350	1045	1100	DSS-34	CAS	TP	RS194-RIOCC	5759	N750	1A1
13	187	0230	0330	1045	1100	DSS-43	CAS	TP	RS194-RIOCC	5759	1647	1A1

- DSS-14 will provide uplink throughout for the occultation

- Receivers scheduled

- 2 closed-loop receivers per antenna
- Open-loop receivers (RSRs, WVSRs, VSRs)
- Open-loop data are prime. Closed-loop data are backup
  - Will need ramp info in closed-loop data for processing

- Antennas Band and Polarization Capabilities

### DSS-14

X-RCP  
X-LCP

S-RCP  
S-LCP

### DSS-43

X-RCP  
X-LCP

S-RCP  
S-LCP

### DSS-34\*

X-RCP

K-RCP

- Only RCP will be recorded
  - 2-way/3-way and 1-way modes

\*KLCP capability exists, but cable not connected

# S79 Rev 194 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
14 2-way*	Gregory	rsops2	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
14 1-way	Danny**	rsops4	WVSR1	WVSR1A -> XRCP  WVSR1B -> SRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 16, 50, 100 1, 16, 50, 100 (with offset)
43 3-way/14*	Dustin	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
43 1-way	Danny	rsops4	WVSR1	WVSR1A -> XRCP  WVSR1B -> SRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 16, 50, 100 1, 16, 50, 100 (with offset)
34 3-way/14*	Elias	rsops3	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
34 1-way	Danny	rsops4	WVSR2	WVSR2A -> XRCP  WVSR2B -> KRCP	1, 2, 3, 4 5, 6, 7, 8 1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset) 1, 2, 16, 50 1, 2, 16, 50 (with offset)

\* Start 1-way

\*\* If rsops5 is ready, then maybe Elias

# S79 Rev 194 Open-Loop Assignment Cont'd

- Danny – Check WVSR/VSR availability
- Aseel - VOCA
- Elias - Ops Room Displays
- RSSG will be in Ops Room at 5:00 pm on Friday, July 5 (185/0000)
  - Two shifts:
    - Gregory 5:00 pm – 1 am
    - Aseel, Elias, Danny, Dustin 6:30 pm – 4:30 am

# Predicts

- No need to modify the uplink predicts (ETX) since no atmospheric occultations are included
- NAV's last OD delivery prior to the occultation was on June 7<sup>th</sup>
  - Elias talked with Duane Roth, and he said that the uncertainty at Saturn is less than 0.1 mrad, so unless there's a compelling reason to do so, there are no plans to release a new OD until after this occultation
  - Essam: Not sure how accurate predicted event times based on the June 7 OD will be for an occultation on July 6 since prediction accuracy usually worsen with time
    - Stay with the event times presently listed in the timeline (based on reference trajectory 110818) and adjust the monopulse on/off times according to real-time monitoring and observed shift in times
    - Run EVENTS to check the difference in occultation times between the 110818 reference tour and the June 7<sup>th</sup> OD. If more than 15 seconds, adjust the monopulse on/off times
      - Elias and Danny to do that
- When will SPS provide ETX?
- Elias and Danny will generate of the downlink predicts and do the usual predicts checks and comparisons
  - Hope to start on Monday
- RSS usually uses three sets of downlink predicts in the open-loop receivers:
  - #1: Coherent (no atmospheric compensation this time): generated using Nicole's PREDICTS software and SPS nominal (unmodified) ETX
  - #2: 1-way coherent: 1-way predicts generated using PREDICTS (no Doppler file from Paul this time), offset in real-time to coherent downlink frequency
  - #3: 1-way (no offset): For the times when the DST is no in lock on the uplink
  - Will acquire set #2 as backup

# ORTs

## Upcoming

ORT on DOY 182 (July 1, 6/30-7/1 PDT) over DSS-34, X- and Ka-band

13 182 0345 0515 1415 1430 DSS-34 CAS RS193-OCCORT MC 5754 N750 1A1

- Also prime TP
- Verify X- and Ka-band signals
- Acquire monopulse/pointing data

# Misc

## Uplink Strategy

- DSS-14, 18 kW, ramped, sweep

DKF – Does not have the correct uplink or AOS/LOS times. Use times in RSS timeline

## Plan for DSS-34 Cassini Specific 4th Order Pointing Model?

- During previous occultation support (Rev 193, DOY 175): large offsets were observed. Partly due to weather
  - The pointing model was not updated prior to the occultation, but a -3.00 mdeg elevation offset was applied to the model
- Dustin already sent DOY 175 (Rev 193 occ) monopulse data to David, and will also send data from the upcoming ORT
- Important for DSS-34 to have good pointing model since we can't utilize monopulse throughout

## Need to discuss the monopulse plan with Essam some more

- During previous occultation, the closed-loop receivers lost lock during the sides of ring A while monopulse was enabled

Reminder that DSS-34 has new controller (Monopulse will not be disabled automatically when the receivers go out of lock)

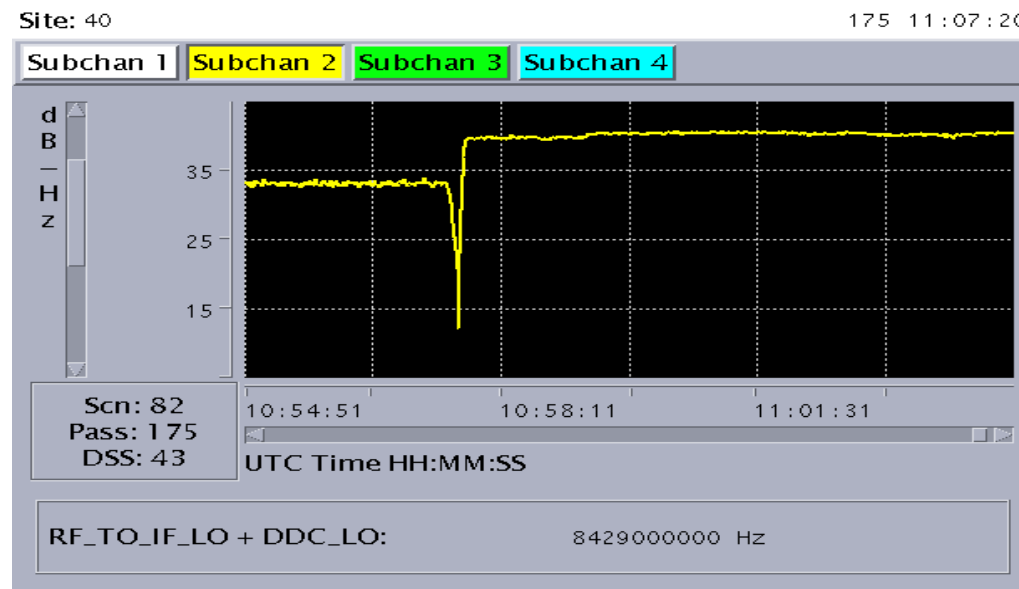
- Pointing/monopulse strategy to take this into consideration

# Misc cont'd

NOPEs - Equipment Status?

DSS-43 Dichroic plate

- Impact of rain/moisture on the mirror: 7 dB jump in X-band power after mirror was retracted at the end of Rev 193!



SNT

- Enable X only at DSS-34 throughout
- Conduct SNT measurements