

About the Occultation

v1

- S78 Rev 191 Saturn ionospheric & rings occultations
 - Ionospheric ingress and egress, rings egress
 - Telemetry OFF, Ranging OFF, **2-way/3-way mode**
 - Covered by Goldstone (uplink and partial downlink) and Canberra (downlink)
- From Essam Marouf:

At the heart of the Radio Science observations on Cassini Rev 191 is a PIE (Pre-Integrated Event) egress rings occultation that captures the full ring system. Few ring occultations during Cassini Solstice Mission do so. It samples new ring longitudes at ring opening angle of 17.4 degrees, important for profiling micro and macro ring structures and their variability with observation geometry. The occultation is conducted using three frequencies (X-, S-, and Ka-band), important for characterization of ring particle sizes and other physical properties. Two chance ingress and egress grazing occultations of the ionosphere of Saturn are also captured. They will provide information about the electron density profile of the ionosphere and, together with previous occultations, profile variability with latitude. In addition, a chance ingress ring occultation is also captured mixed, however, with the upper troposphere. The relatively shallow penetration of the radio signals in the atmosphere may still allow recovery of useful information about the rings and the upper region of the atmosphere if signal perturbations caused by each medium can be separated when processing the data (a non-trivial task). All occultations will be conducted using the 2-way configuration with the 70-m DSS-14 providing the reference X-band uplink signal during the observations period.

DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
13	151	0310	0410	1025	1040	DSS-14	CAS	TP	RS191-RIOCC	5722	1647	1A1
13	151	0500	0630	1340	1355	DSS-34	CAS	TP	RS191-RIOCC	5723	N750	1A1
13	151	0530	0630	1230	1245	DSS-45	CAS	TP	RS191-RIOCC	5723	0624	1A1
13	151	0735	0805	1205	1220	DSS-43	CAS	RTS	DEMO RS D/L	5723	1953	1A1

- DSS-14 will provide uplink throughout
- DSS-43 RTS demo, downlink only
- DSS-45 end a little earlier due to scheduling conflict with another project

- 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	DSS-45	DSS-34*	DSS-43
X-RCP X-LCP	X-RCP	X-RCP	X-RCP X-LCP
S-RCP S-LCP	S-RCP	K-RCP	S-RCP S-LCP

*KLCP capability exists, but cable not connected

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

S78 Rev 191 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
14 2-way*	Gregory	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
14 1-way (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	rsops2	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
34 1-way (1-way)	Danny	rsops4	WVSR1	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)
45 3-way/14*	Gregory	rsops1	RSR1	RSR1A -> XRCP RSR1B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
45 1-way (1-way)	Danny	rsops4	PRSR1	PRSR1A -> SRCP	1, 2, 3, 4 5, 6, 7, 8	1, 16, 50, 100 1, 16, 50, 100 (with offset)
43 3-way/14*	Elias	rsops2	VSR1	VSR1A -> XRCP VSR1B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
43 1-way (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, 16, 50, 100 1, 16, 50, 100 (with offset)

* Start 1-way

S78 Rev 191 Open-Loop Assignment Cont'd

- Using all open-loop receivers at Canberra!
- Danny – Check WVSR/VSR availability
- Aseel - VOCA
- Elias - Ops Room Displays
- **RSSG will be in Ops Room at 8:00 pm on Thursday, May 30 (151/0300)**
 - Gregory: 8:00 pm – 6:00 am
 - Aseel, Elias, Danny: 10:30 pm – 8:00 am

Predicts

- DSS-14 uplink (ETX) predicts should compensate for Doppler shift due to Saturn's atmosphere on both ingress and egress
- NAV's last OD delivery prior to the occultation is scheduled on Sunday, 5/26, but NAV said they may deliver on Saturday, 5/25 instead
- When can SPS provide ETX
 - Note: Monday is a JPL holiday
- RSS (Paul Schinder) will apply the Doppler shifts to the ETX files, modified file will be sent to the NOPEs less than 2 days after the ETX files are made available to RSS
- Elias and Danny will generate of the downlink predicts and do the usual predicts checks and comparisons starting on Tuesday
- RSS will be using three sets of downlink predicts in the open-loop receivers:
 - Coherent with atmospheric compensation: generated using Nicole's PREDICTs software and SPS nominal (unmodified) ETX
 - 1-way coherent: 1-way predicts generated using PREDICTS and the Doppler file produced by Paul, offset in real-time to coherent downlink frequency
 - 1-way (no offset): For the times when the DST is no in lock on the uplink

ORTs

Upcoming

ORT on DOY 137 (May 29, 28-29 PDT) over DSS-34, X- and Ka-band

13 149 0655 0825 1620 1635 DSS-34 CAS SEQ RS191-ORT 5721 N750 1A1

- Verify X- and Ka-band
- Acquire pointing (monopulse) data

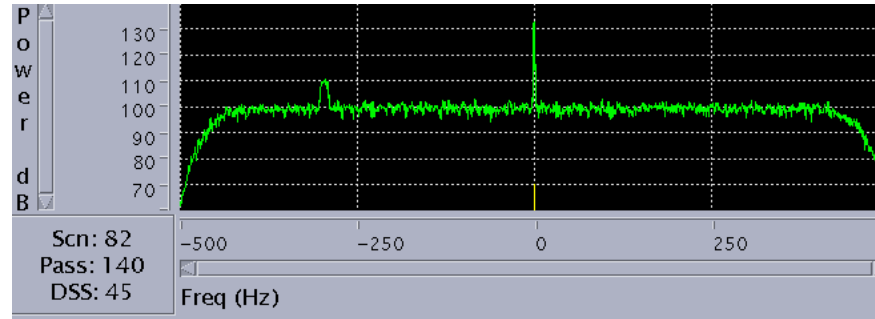
Gregory will send monopulse data to David, also the data from the DSS-34 GSE the day before the experiment:

GSE on DOY 150 (May 30, 29-30 PDT) over DSS-34, X- and Ka-band

13 150 0545 0715 1615 1630 DSS-34 CAS SEQ RS191-GSE 5722 N750 1A1

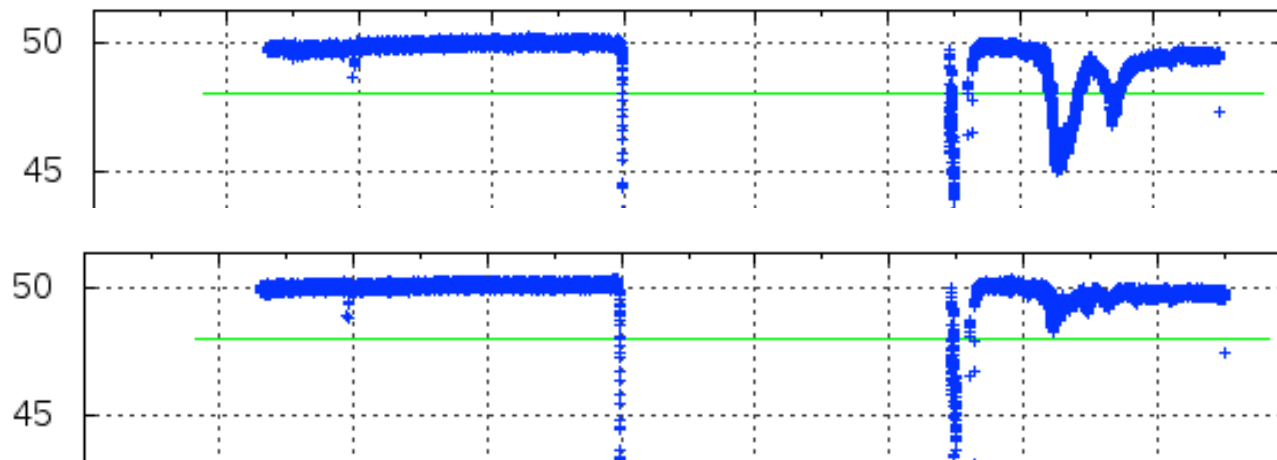
DSS-45 on DOY 140

DSS-45 S-band Downlink Spur



- Above plot is for 1 KHz BW) at the switch to coherent mode
- Ground based (not moving)
- No Cassini S-band track prior to occultation

X-band data at DSS-45 were more degraded than X-band at DSS-34 due to weather



- Do we know why?

Misc

Uplink Strategy

- DSS-14, 18 kW, ramped, sweep
- Transmitter is powered OFF at elevation limit
 - According to view periods file, that time is 151/10:05:22

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?

- Was updated prior to DOY 140 experiment
 - Ka-band looked very good during ingress, but was degraded by weather during egress
- Important for DSS-34 to have good pointing model since we can't utilize monopulse throughout

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

- **Pointing/monopulse strategy to take this into consideration**

NOPEs - Equipment Status?

SNT

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