

# About the Occultation

- S95 Rev 237 Saturn rings and atmospheric occultations
  - Telemetry OFF, Ranging OFF, 2-way/3-way mode
  - Covered by Madrid, Goldstone and Canberra

- From Essam Marouf:

The Rev 237 Radio Science observations include an ingress and egress ring occultations and an egress Saturn atmospheric occultation. The latter is the first Saturn atmospheric occultation since April 12, 2013 (Rev 186), and is the first of only two atmospheric occultations captured on the second set of Cassini inclined orbits during the Solstice Mission (on the IN-2 orbits). It probes near-equatorial latitude of  $18.4^{\circ}\text{N}$ , important for characterization of the impact of Saturn's fast equatorial winds on thermal structure of the atmosphere. Comparison with other near-equatorial occultations early in the Cassini mission will help with characterization of any temporal/seasonal variations of the atmosphere. The ring occultations capture the full ring system on the egress side and only the outer part of the system on the ingress side (where most of Ring B and all of Ring C are observed mixed with Saturn's atmosphere). An  $\sim 26^{\circ}$  ring opening angle at the time is close to the largest attainable as seen from Earth ( $\sim 27^{\circ}$ ), and will allow reliable profiling of the structure of ring features of large optical depth. Measurements at three radio wavelengths (0.94, 3.6, and 13 cm; Ka-, X-, and S-bands) will be collected throughout the observation period and will help provide information about physical properties of profiled ring structure.

# DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
16 181	1645	1815	0215	0230	DSS-54	CAS	TP	RSS	DSNMONCAL	6851	0676	1A1
16 181	2230	2330	0200	0215	DSS-63	CAS	RS	237	RI OCC L3	6851	1647	1A1
16 182	0010	0140	1015	1030	DSS-25	CAS	RS	237	RI OCC L3	6851	N748	1A1
16 182	0030	0130	1015	1030	DSS-14	CAS	RS	237	RI OCC L3	6851	2659	1A1
16 182	0425	0555	1110	1125	DSS-35	CAS	RS	237	RI OCC L3	6852	2708	1A1
16 182	0800	0830	1110	1125	DSS-43	CAS	RS	237	OCC DL L3	6852	3633	1A1

- DSS-63 and DSS-14 will provide the uplink
- DSS-54 not included in Level 3 support
  - Not supporting occ, but backup for uplink
- DSS-43 BOTs later than DSS-35 due to scheduling conflicts with JUNO
  - DSS-63, DSS-14 and DSS-43 were all in conflict. Had to slightly modify times of DSS-63. DSS-14 was kept as is

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

# S95 Rev 237 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
63 3-way w/ 54	Elias	rsops2	RSR2	RSR2A -> XRCP RSR2B -> SRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
14 3-1/2-way	Elias	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	rsops3	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)
25 3-way	Elias	rsops2	RSR3	RSR3A -> XRCP RSR3B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
25 1-way	Danny	rsops3	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)
43 3-way	Jay	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	rsops5	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)
35 3-way	Jay	rsops1	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 16, 50, 100 1, 16, 50, 100
35 1-way	Danny	rsops5	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)

# S94 Rev 236 Open-Loop Assignment cont'd

RSSG will be in Ops Room at 3:15 pm on Wednesday, June 29 (181/1530)

- Before DSS-63 BOT, but during DSS-54 track

Aseel – VOCA

Elias - Ops Room Displays

Danny – Check WVSR/VSR availability & RSR/WVSR/VSR disk space

Backup Receivers

- RSR2 at Goldstone
  - Hasn't been very reliable
- VSR at Goldstone
- VSR at Canberra

# Predicts

- Used NAV's OD delivery on June 20 to generate predicts
- DSS-63 and DSS-14 uplink (ETX) predicts were modified by RSS to compensate for Doppler shift due to Saturn's atmosphere
  - Sent to NOAs on June 24
  - Please ensure revised versions are used
- DSS-54 and DSS-25 uplink predicts were also modified as backup
- Elias and Danny completed generation and verification of open-loop downlink predicts
- RSS usually uses three sets of downlink predicts in the open-loop receivers for occultations:
  - #1: Coherent with atmospheric compensation: generated using Nicole's PREDICTs software and SPS nominal (unmodified) ETX
  - #2: 1-way coherent: 1-way predicts generated using PREDICTS and the Doppler file produced by Paul, offset in real-time to coherent downlink frequency
  - #3: 1-way (no offset): For the times when the DST is not in lock on the uplink

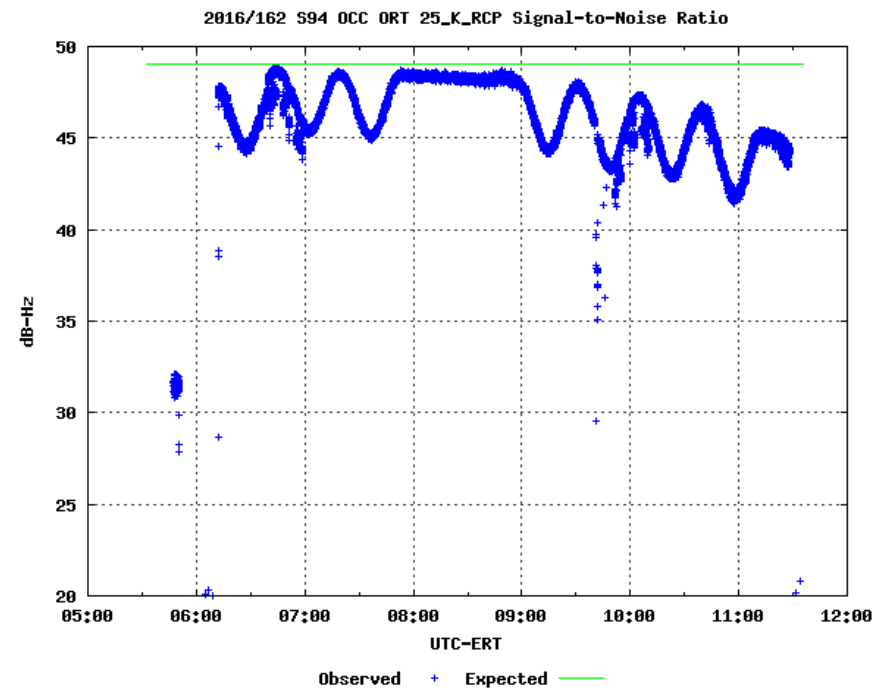
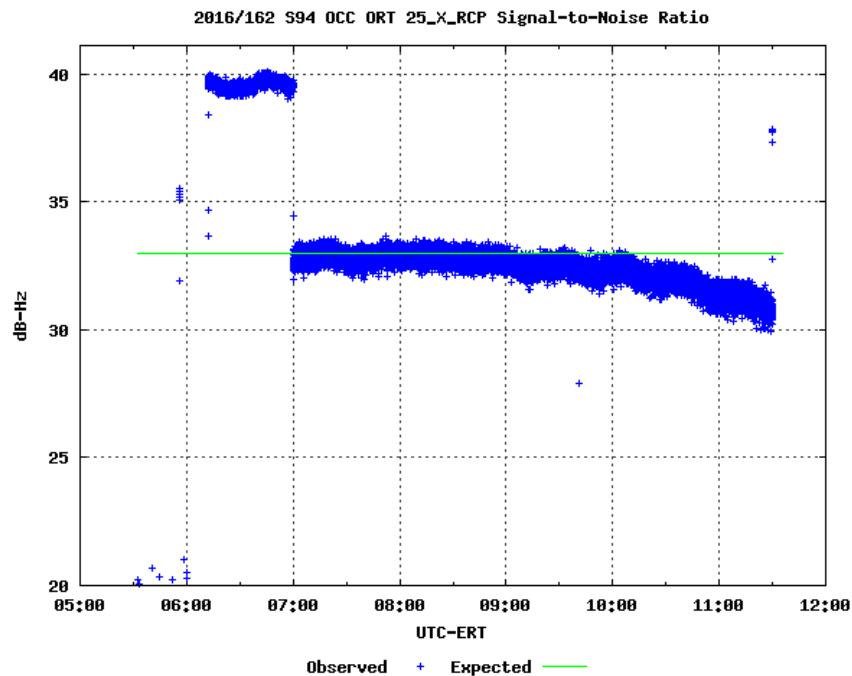
# ORTs

ORT on DOY 162 (June 10) over DSS-25, X- and Ka-band

Completed

16 162 0530 0700 1130 1145 DSS-25 CAS TP RSS ORT MC 6831 N748 1A1

- DSS-25 prime TP
- On-point phase calcs conducted
- Monopulse enabled and worked nominally – Pointing data acquired
- No jump in Ka-band signal power when Monopulse was enabled
- Constant Ka-band tone at 32.023 GHz on RSR1A



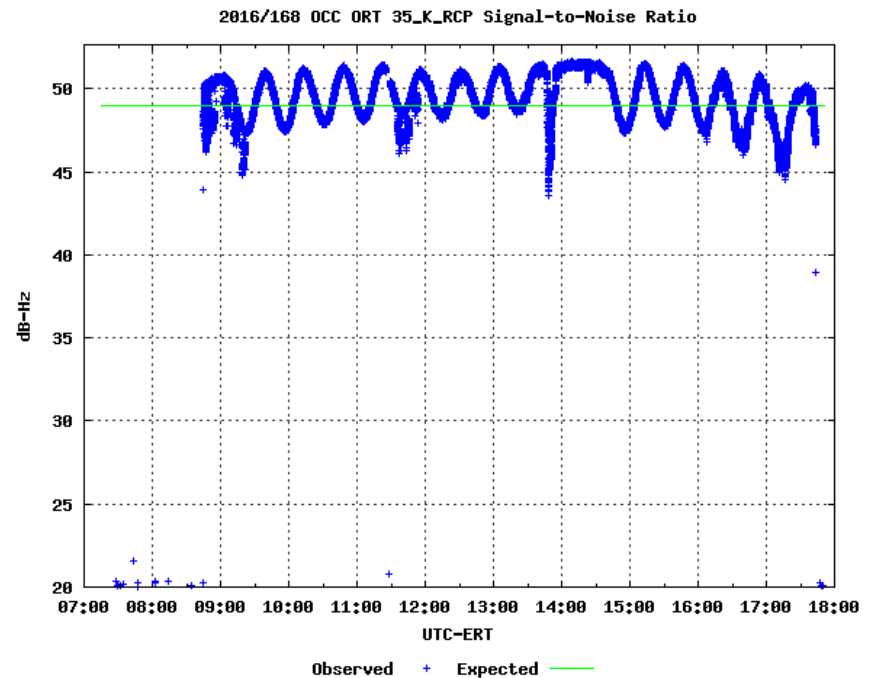
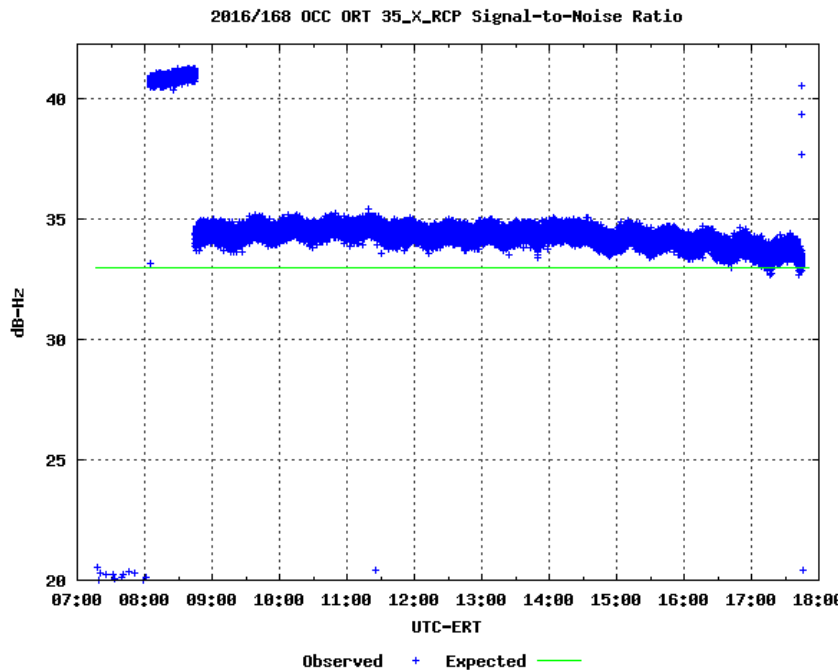
# ORTs cont'd

ORT on DOY 168 (June 16) over DSS-35, X- and Ka-band

Completed

16 168 0715 0845 1745 1800 DSS-35 CAS TP SEQ RSS ORT 6838 N750 1A1

- Also prime TP
- On-point phase calcs conducted
- Monopulse enabled and worked nominally – Pointing data acquired
- No jump in Ka-band signal power when Monopulse was enabled



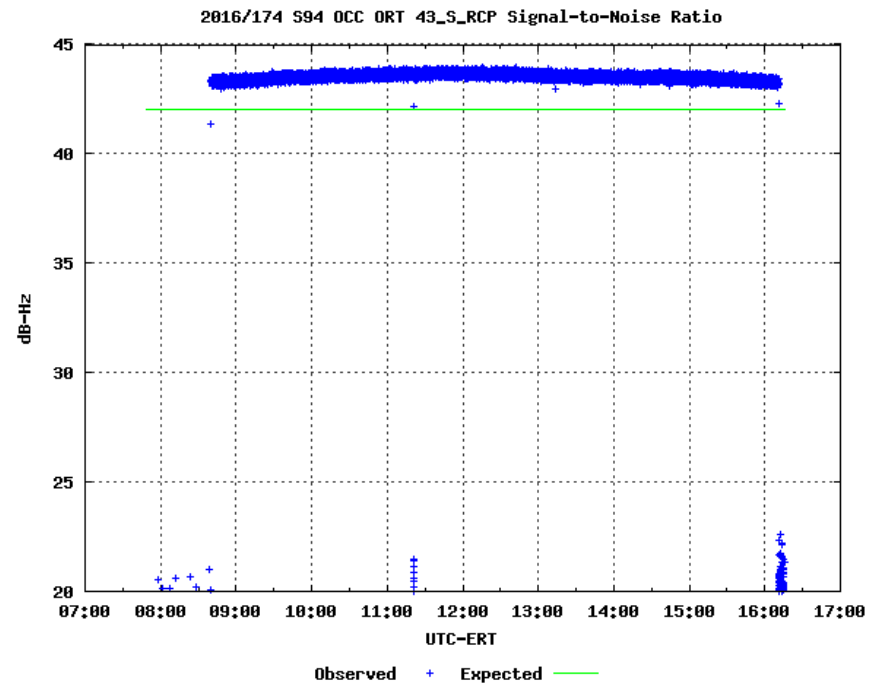
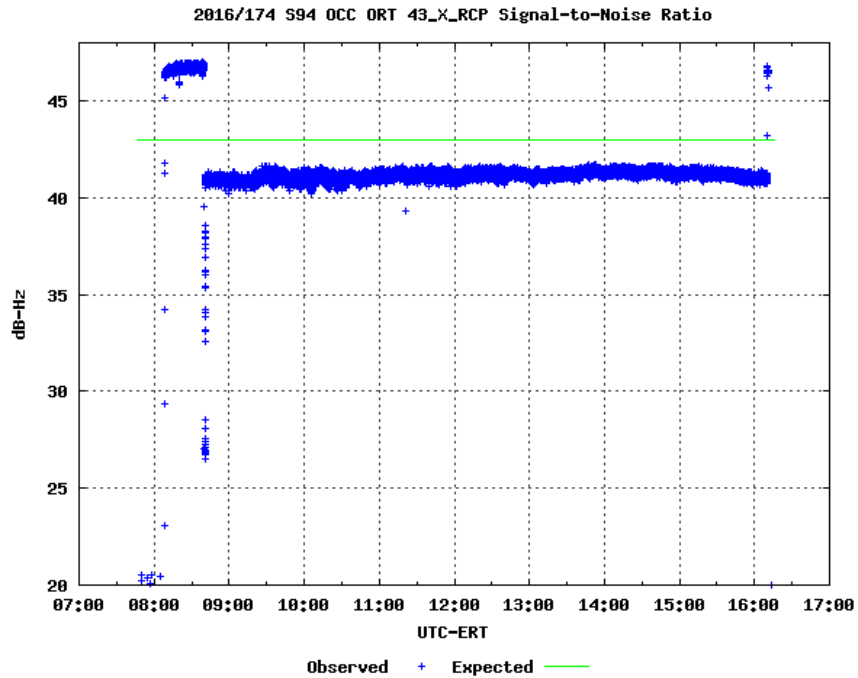
# ORTs cont'd

ORT on DOY 174 (June 22) over DSS-43, X- and S-band

Completed

16 174 0740 0840 1610 1625 DSS-43 CAS TP SEQ RSS ORT 6844 1647 1A1

- Also prime TP
- Verified X- and S-band signals
- Nominal





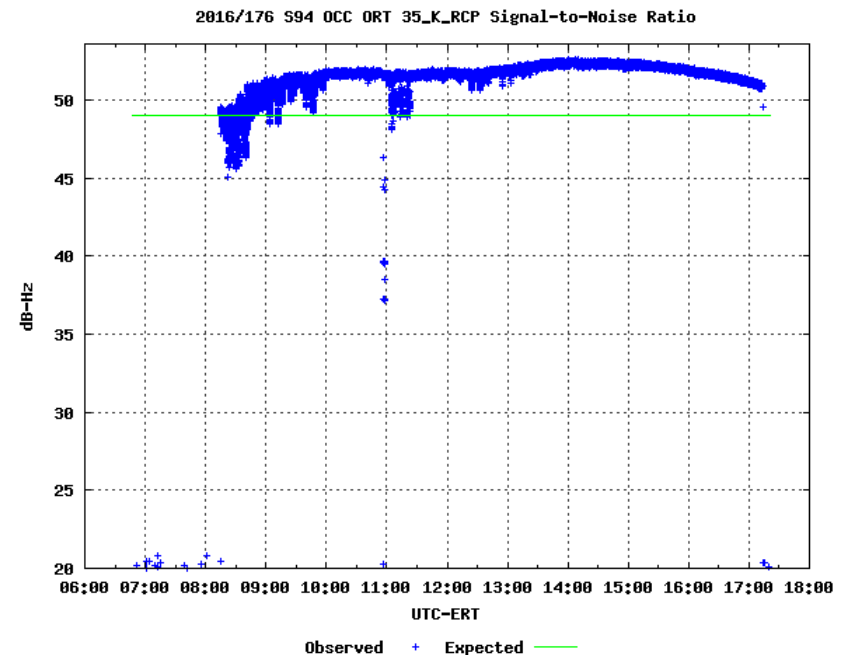
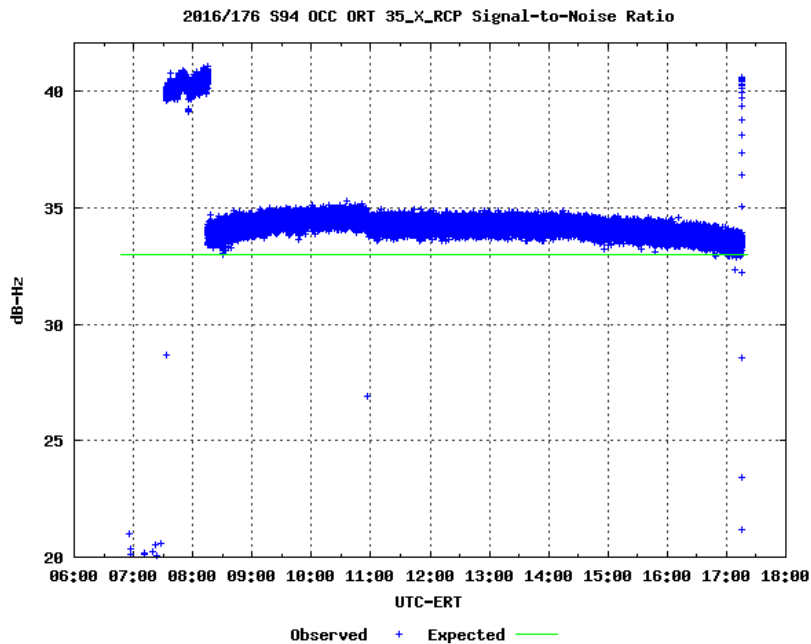
# ORTs cont'd

ORT on DOY 176 (June 24) over DSS-35, X- and Ka-band

Completed

16 176 0645 0815 1715 1730 DSS-35 CAS TP SEQ RSS ORT 6846 0681 1A1

- Also prime TP
- On-point phase calcs conducted
- Monopulse enabled and worked nominally – Pointing data acquired
- No jump in Ka-band signal power when Monopulse was enabled
- Ka-band signal fluctuations – Likely due to weather (overcast with occasional showers)
- Also PIT over DSS-36
  - DSS-36 performance slightly better: X-band  $\sim -0.2$ - $0.4$  dB, Ka-band  $\sim 0.5$  dB



# Misc

## Uplink Strategy

- DSS-63, 18 kW, ramped, sweep
- DSS-14, 18 kW, ramped, no sweep

## Change to DSS-54 uplink

- Don't transfer to DSS-63 at 181/234300
- Instead:
  - 181/234311            DSS-54 transmitter off
  - 181/235400            DSS-63 transmitter on
- RSS will not be in ops room during DSS-54 pre-cal. Can ACE inform DSS-54 of change?

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

## Spurs at DSS-43

- Seem to be back!
- Observed during Rev 236 experiment on June 6

Plan for updating DSS-25 and DSS-35 Cassini Specific 4th Order Pointing Model?

## NOPEs - Equipment Status?

- DSS-35 Xka-HEMT green?
  - Replaced prior to Rev 236 observation