

## S89 Rev 217 Dione D4 Gravity Observation

- Telemetry ON, Coherent mode (2-way and 3-way)
- Covered by Canberra (uplink) and Madrid (uplink and downlink)
- One 3.5hr segment
- RSS is riding-along (INMS prime)
  - Was originally a candidate for a ride-along on the LGA opportunity
  - Pointing analysis revealed that primary axis pointing by INMS (prime) and CDA (ride-along) was only 2.4 degrees off from HGA pointing to Earth
  - Change was made to accommodate RSS ride-along on the HGA

- Science Highlights (From Paolo Tortora)

The Dione D4 flyby provides a valuable opportunity to improve our knowledge of Dione's gravitational field, internal structure, and the rigidity of its outer ice shell. The goal of gravity science at Dione is the improvement of the determination of the quadrupole field (J<sub>2</sub>, C<sub>22</sub>). Dione's D3 flyby, carried out in late 2011, was the first for this moon with tracking at closest approach. In spite of the small satellite mass, the spacecraft acceleration was clearly detected in Doppler data and allowed a preliminary determination of Dione's quadrupole gravity field, for the first time. The analysis of Doppler data acquired so far suggests that Dione's interior is not compatible with the condition of hydrostatic equilibrium. However, a reliable determination of the quadrupole field requires at least two flybys with suitable geometries. Data from D4 are expected to reduce significantly the current uncertainties.

# DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post							
15 166	0615	0745	1645	1700	DSS-34 CAS	TP RSS DI GSE	6470 N750	1A1	GSE		
15 166	0645	0745	1015	1030	DSS-43 CAS	TKG PASS	6470 N003	1A1	GSE		
15 167	1500	1630	1840	1855	DSS-34 CAS	RSS D4 GRAV L3	6471 N750	1A1	D4 Gravity		
15 167	1645	1815	0015	0030	DSS-55 CAS	RSS D4 GRAV L3	6471 N750	1A1	D4 Gravity		
15 167	1910	1940	2305	2320	DSS-63 CAS	TKG PASS D/L	6471 N008	1A1	D4 Gravity		
15 168	0615	0745	1815	1830	DSS-34 CAS	TP RSS DI GSE	6472 N750	1A1	GSE		
15 168	0715	0745	1000	1015	DSS-43 CAS	TKG PASS D/L	6472 N008	1A1	GSE		
15 168	1710	1810	1945	2000	DSS-63 CAS	TKG PASS	6472 N003	1A1	GSE		

This is a DSN Level 3 activity

- Receivers scheduled

- 2 closed-loop receivers per BWG antenna
- Open-loop receivers
- Closed-loop data are prime. Open-loop data are backup
- LCP not required. Only RCP

# S89 D4 Open-Loop Assignment

DSS Prdx Mode	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
34*	?/ Aseel	rsops1	RSR1	RSR1A -> XRCP RSR1B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50
55	Aseel	rsops1	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50

RSSG will be in Ops Room at 7:30 am on Tuesday, June 16 (167/1445)

\*Uplink only support. Bring up RSRs just in case.

Backup receivers:

RSR1 at Madrid

# ORTs

## Completed

ORT on DOY 150 (May 30 PDT) over DSS-55, X- and Ka-band

15 150 1800 1930 0345 0400 DSS-55 CAS TP RSS GRVORT MC 6454 N750 1A1

- DSS-55 prime
- Verified monopulse, conducted on-point phase cals, and acquired pointing data
- Pointing issues that took about one hour to resolve
  - Station reported tracking errors soon after BOT
  - Conscan at X-band then enable Monopule
  - Issues with first on-point phase cal (not pointing to boresight). Conscan again
- Higher than normal Monopulse corrections
  - In EL at beginning of track. In AZ at end

## Upcoming

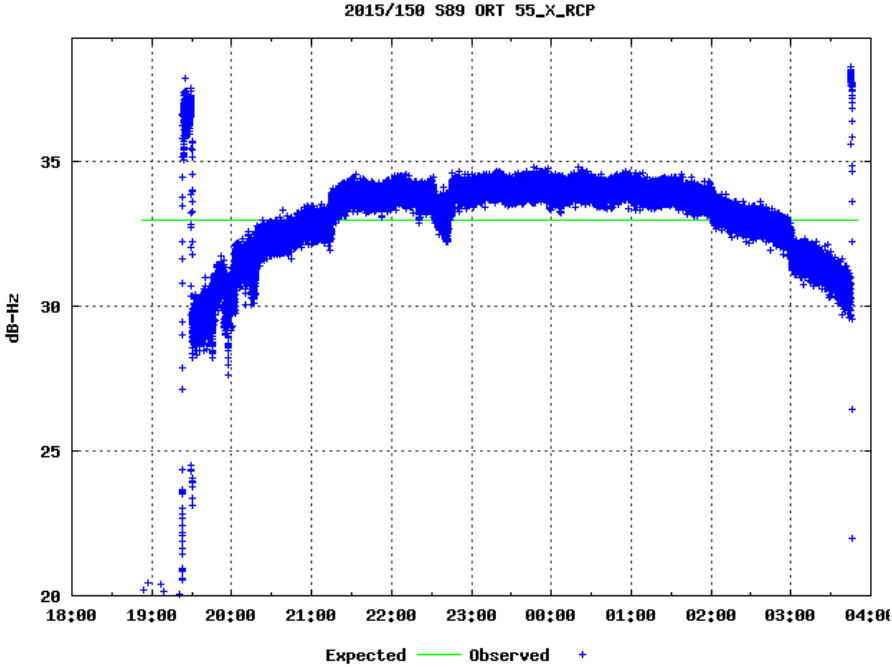
ORT on DOY 163 (June 12 PDT) over 34, X- and Ka-band

15 163 0630 0800 1700 1715 DSS-34 CAS TP RSS GRVORT MC 6467 N750 1A1

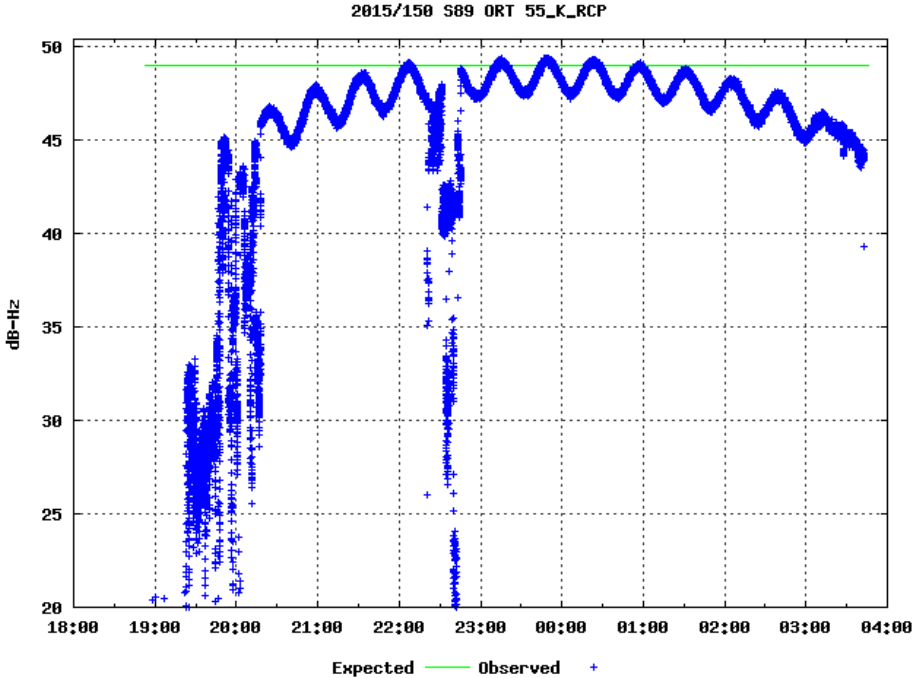
- DSS-34 prime
- Verify uplink

# DOY 150 DSS-55 ORT

## Post-Pass Power Plots



X-band



Ka-band

# Misc

## RS Support schedule:

- GSEs will be partially supported and then scripted
- Prime D4 gravity fully supported

## Downlink Predicts

- Use SPS Predicts
  - RSS will not be generating predicts

## Uplink Plan

- Ramped predicts
  - Based on analysis by NOPEs, unramped predicts not possible
- Per SOE/DKF, except add 5 minutes to transmitter off during prime gravity
- Gap due to transmitter limits during Canberra-Madrid overlap (no uplink transfer)
  - DSS-34 transmitter OFF 167/181730
  - DSS-55 transmitter ON 167/183830
  - Coherent gap RTL later is 167/204809 to 167/210909

## Timeline

- Per SOE/DKF

## Equipment status?

- NOPEs? (DSS-34, DSS-55)

# Misc Cont'd

## Pointing Plan

- Enable monopulse throughout gravity observation. If problematic, stay with blind pointing
  - Are 4<sup>th</sup>-order pointing models good? Need good models in case monopulse is problematic
  - Dustin sent DSS-55 data to David Rochblatt from recent ORT
- DSS-55 elevation is ~19 degrees when Monopulse first enabled
  - No concern about enabling at low elevations angles (lower than 10 degrees)

## Spacecraft biases around D4 (thruster firing)

All while spacecraft not Earth-pointed

- Before Inbound GSE, during DSS-34 pre-cal:  
166/06:15 ERT, 1hr30min
- Between Inbound GSE and prime gravity  
167/10:18 ERT, 27min
- During prime gravity, before turn to Earth-point  
167/17:40 ERT, 27 min

SNT – Enable throughout

## AWVR

- Elias: Schedule AWVR at Madrid