

S95 T122 Titan Gravity Observation

- S95 Rev239 T122 Titan Gravity Experiment
 - Last Titan gravity observation in the Cassini mission!
 - C/A 223/0951 ERT, Altitude 1700 km
 - Telemetry ON, Coherent mode (2-way and 3-way)
 - Covered by all complexes
 - Madrid -> Goldstone -> Canberra -> Madrid
 - Includes the first Cassini ESA ORT over New Norcia

T122 Science Highlights

- From Luciano Iess

Since its arrival at Saturn in 2004, Cassini performed eight flybys devoted to the determination of Titan's gravity field and its tidal variations. Another flyby (T110, March 2015) was carried out with the low gain antenna as an opportunity radio science pass. This flyby was particularly valuable because closest approach occurred at high latitude (75°N), over an area not previously sampled. T122 is the last Titan gravity flyby of the mission.

Published gravity results (Iess et al., 2012) indicated that Titan is subject to large eccentricity tides in response to Saturn's time varying forcing field. The magnitude of the response quadrupole field, controlled by the Love number k_2 , was used to infer the existence of an internal ocean. The new gravity field determination will provide a better estimate of k_2 , to a level of a few percent. An estimate with such uncertainties constrains the density of the ocean. In addition to a full 3×3 field, the new solution includes also higher degree and order harmonic coefficients (such as J_4) and offers an improved map of gravity anomalies. The updated geoid and its associated uncertainty could be used to refine the gravity-altimetry correlative analysis and for improved interpretation of radar altimetric data.

DSN Antennas

- DSN Coverage

	Pre	BOT	EOT	Post								
16 222	1600	1730	2330	2345	DSS-55 CAS	TP	RSS	GSE	6892	N750	1A1	GSE/Grav
16 222	2110	2240	0730	0745	DSS-25 CAS	RSS	TI122	GRAV	6892	N748	1A1	Grav
16 223	0140	0310	1545	1600	DSS-35 CAS	RSS	TI122	GRAV	6893	N750	1A1	Grav
16 223	0730	0830	1130	1145	DSS-74 CAS	RSS	TI122	GRAV	6894	0142	1A1	ORT/Grav
16 223	1355	1525	2230	2245	DSS-55 CAS	RSS	TI122	GRAV	6893	N750	1A1	Grav
16 224	0315	0445	1345	1400	DSS-35 CAS	RSS	TI	KADOWN	6894	N750	1A1	GSE
16 224	0345	0445	1345	1400	DSS-43 CAS	TKG	PASS		6894	N003	1A1	GSE

Prime gravity passes are DSN Level 3 activity

Inbound GSE is also Level 3 because it starts the uplink for the prime gravity observation

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

S95 T122 Open-Loop Assignments

DSS	Operator	Station	Open-loop Receiver	Channels	Subchannels	Bandwidths KHz
55	Danny/Elias	rsops1	RSR1	RSR1A -> XRCP RSR1B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50
25	Elias/Aseel	rsops1	RSR1	RSR1A -> XRCP RSR1B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50
35	Elias/Aseel/ Danny	rsops1	RSR2	RSR2A -> XRCP RSR2B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50
55	Danny/Jay	rsops1	RSR1	RSR1A -> XRCP RSR1B -> KRCP	1, 2, 3, 4 1, 2, 3, 4	1, 8, 16, 50 1, 8, 16, 50

RSSG will be in Ops Room at 9:00 am on Tue 8/9 (222/1600)

Outbound GSE will be partially supported

RSSG shifts:

Danny	Tue 8/9	9:00 am – 2:30 pm
Elias	Tue 8/9	2:00 pm - 11:30 pm
Aseel	Tue 8/9	11:00 pm - 5:00 am
Danny	Wed 8/10	4:45 am – 12:30 pm
Jay	Wed 8/10	12:00 pm – 4 pm
Aseel	Wed 8/10	8:15 pm – 1 am (outbound GSE)

ORTs

- All completed
- Was unable to schedule ORTs over DSS-55
 - Last DSS-55 Ka-band support was DOY 152 (May 31)

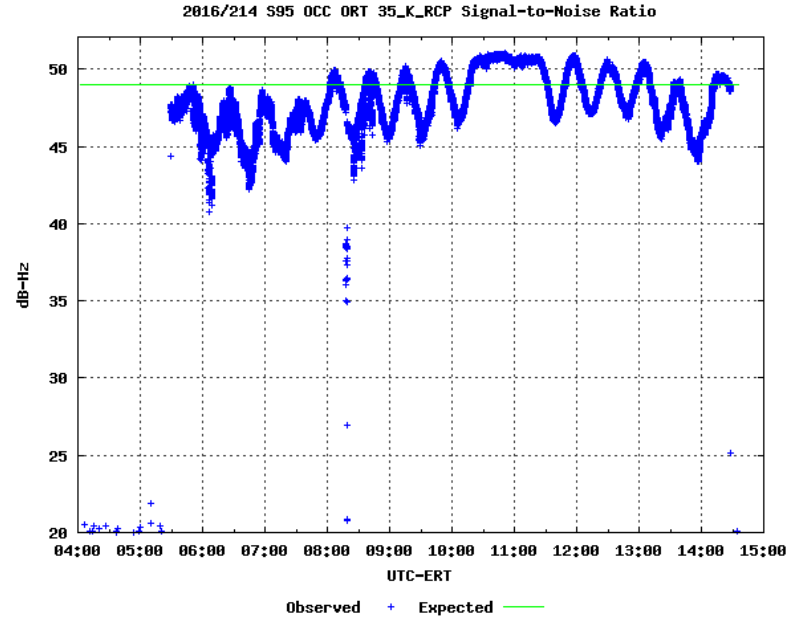
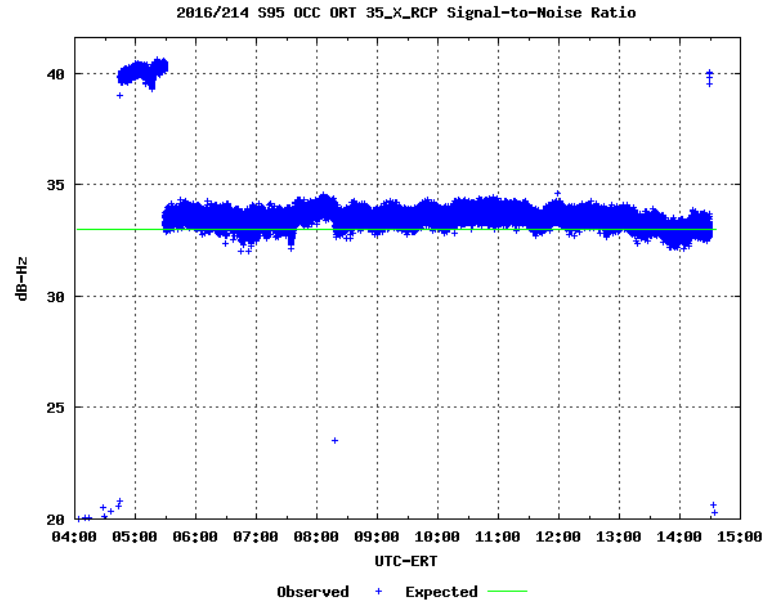
ORT on DOY 214 (Aug 1) over DSS-35 and DSS-25, X- and Ka-band

16 214 0400 0530 1430 1445 DSS-35 CAS TP RS OCCORT MC 6884 N750 1A1

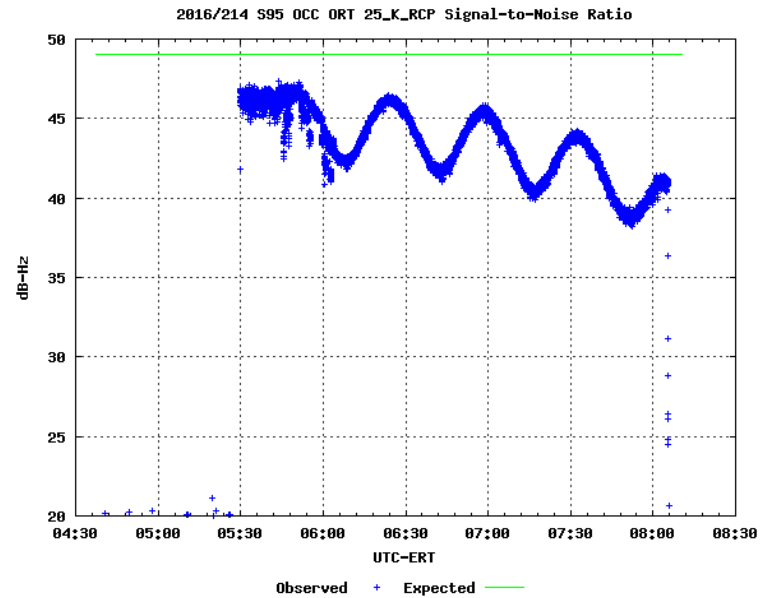
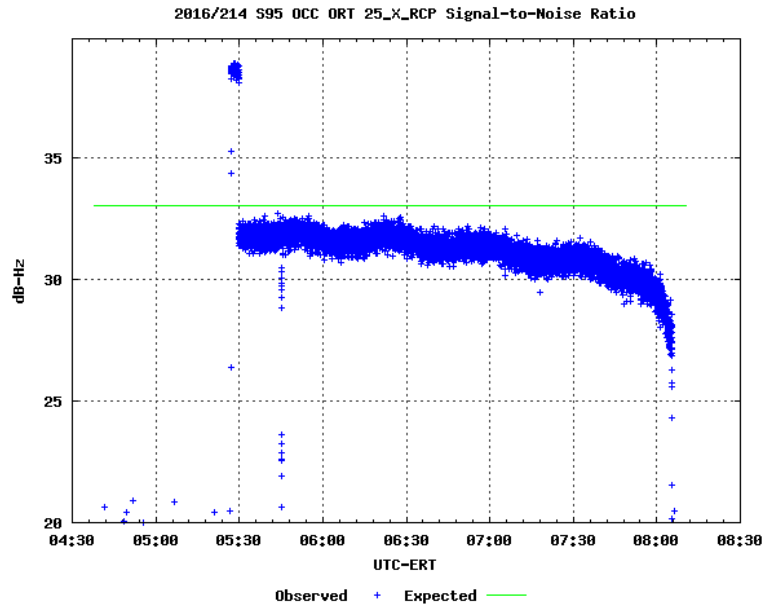
16 214 0435 0605 0805 0820 DSS-25 CAS RS OCCORT MC 6883 N748 1A1

- DSS-35 also prime tracking pass
- Verified Monopulse, acquired pointing data
- DSS-35 subreflector problem that was encountered during Rev238 occultation on 7/23 was fixed prior to this support
- Rain and overcast skies at Canberra likely reason for Ka-band signal degradation

DSS-35



DSS-25



ORTs Cont'd

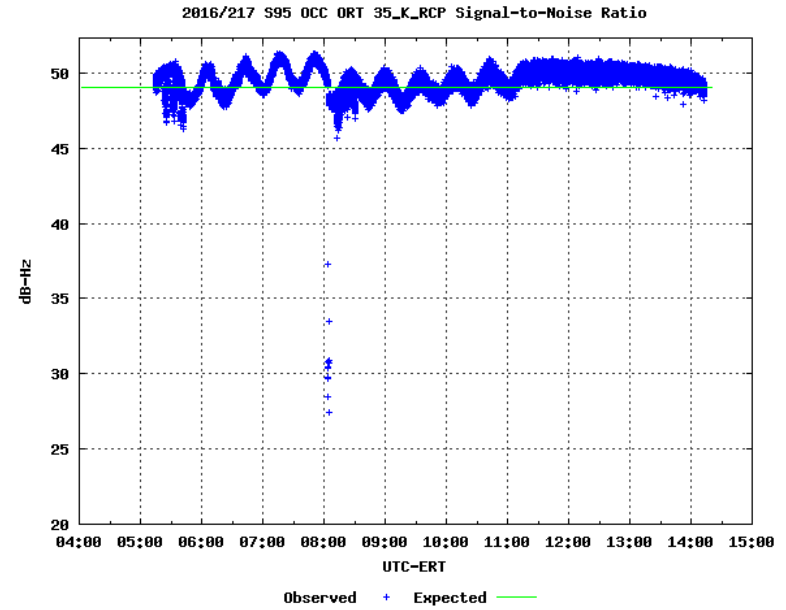
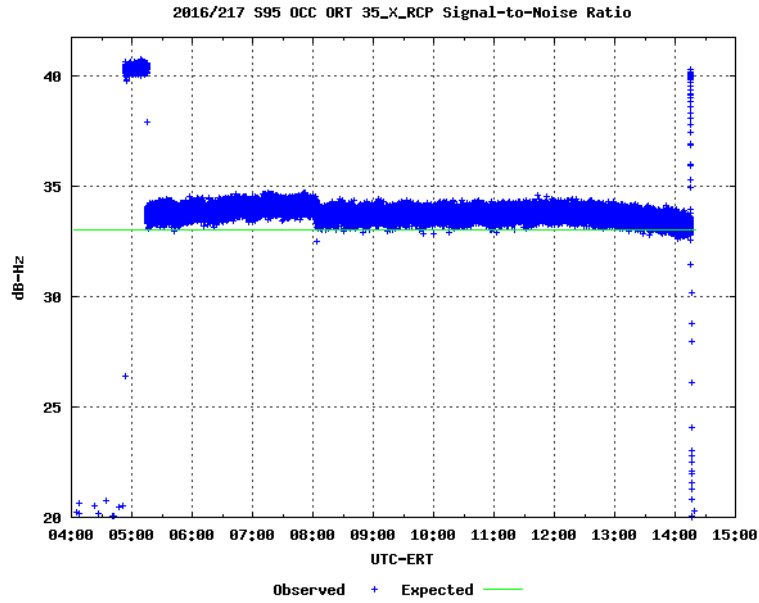
ORT on DOY 217 (Aug 4) over DSS-35 and DSS-25, X- and Ka-band

16 217 0345 0515 0750 0805 DSS-25 CAS RS OCCORT MC 6886 N748 1A1

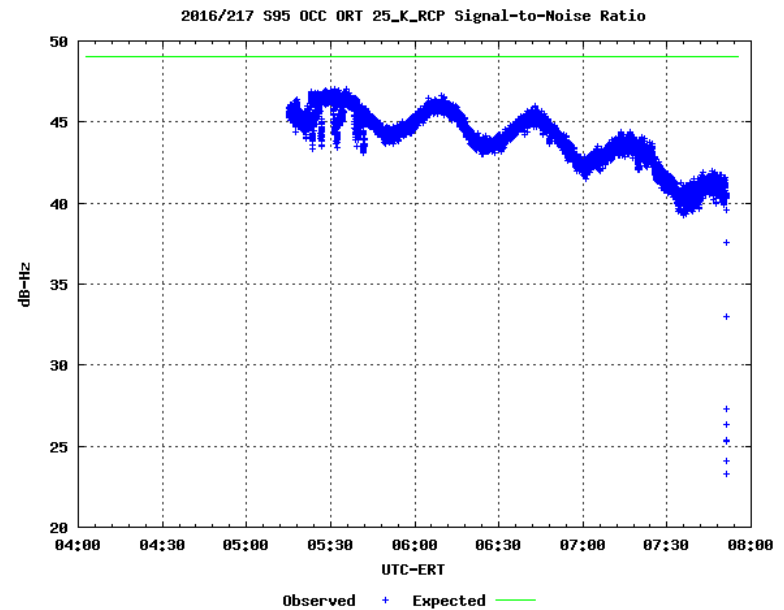
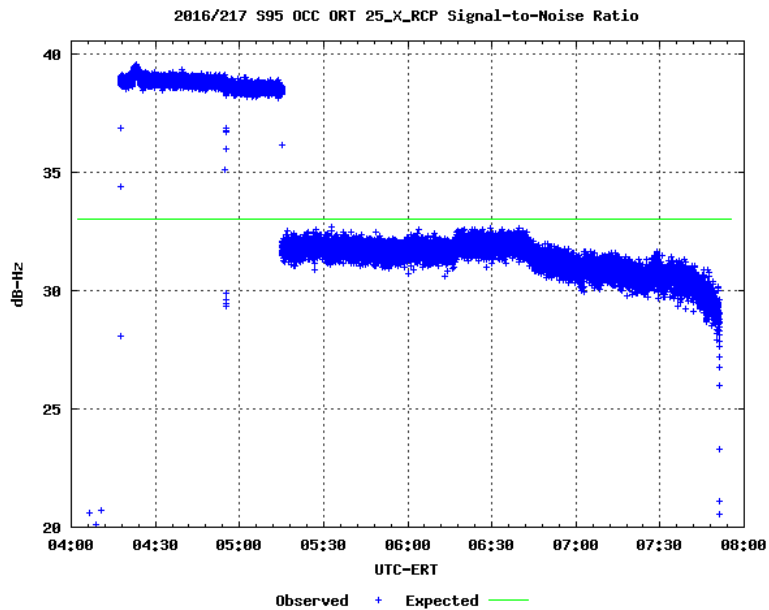
16 217 0345 0515 1415 1430 DSS-35 CAS TP RS OCCORT MC 6887 N750 1A1

- DSS-35 also prime tracking pass
- Verified Monopulse, acquired pointing data
- Jay – Any problems encountered?

DSS-35



DSS-25



Predicts Generation

- NAV will deliver SPK on Saturday
- RSS will use SPS generated predicts
- ESA predicts generation:
 - Entire DSS-74 support will be 3-way with DSS-35
 - They only requested Orbit Ephemeris Message (OEM) file and BLF
 - Appears that they use 1-way with offset
 - NAV will deliver OEM on Saturday along with SPK file
 - We will generate coherent DSS-74 and send to them for comparison

Misc

Uplink Plan

- Ramped uplink predicts throughout
 - Based on Sandy's analysis, unramped uplink predicts not possible
- Per SOE/DKF
- Gap due to transmitter limits during Canberra-Madrid overlap (no uplink transfer)
 - DSS-35 transmitter OFF 223/152530
 - DSS-55 transmitter ON 223/155500
 - Coherent gap RTLTL later is 223/180530 to 223/183510

Pointing Plan

- Enable monopulse throughout observation. If problematic, stay with blind pointing
 - Need good models in case monopulse is problematic
- Disable 2-3 minutes before 1-way to Coherent mode changes
- Stations to wait for RSSG to request monopulse enable/disable during T122
 - Can follow timeline during GSEs
- Watch for monopulse enables at low Elevation angles. Wait till ~10 degrees

Equipment status?

- NOPEs? (DSS-25, DSS-35, DSS-55)

SNT

- Enable at all throughout

Closed-loop Receivers during closest approach

- High signal dynamics. Widen carrier loop bandwidth?