

About the T34 Titan Bistatic Experiment

- S32 Rev48 T34 Titan Bistatic Experiment
 - Telemetry OFF, 1-way mode
 - Last Titan bistatic experiment in Cassini prime mission
 - First stand-alone Titan bistatic experiment (no occultation)
 - Covered by Goldstone and Canberra
 - Canberra's first Cassini bistatic experiment
 - DSS-43 supported several MEX & VEX RS bistatic experiments

- About the science – from Essam Marouf

The observation is [conducted on the inbound approach to Titan](#), roughly from -77 to -12 minutes relative to closest approach (C/A) time. During that period, the Cassini HGA boresight is continuously maneuvered to point to the region on Titan's surface where mirror-like (specular) reflection, if detectable, can be observed at the NASA DSN ground receiving stations at Goldstone and Canberra. Cassini transmits [X-, S-, Ka-band](#) nearly pure sinusoidal right circularly polarized sinusoidal signals. Potential left and right circularly polarized (LCP and RCP) surface echo components are recorded at the DSN stations. The T34 experiment enjoys the [unique advantage of an observation geometry near the Brewster angle of likely surface compositions throughout the 65 minutes observation period](#). This special geometry allows unambiguous determination of the surface dielectric constant, hence it's physical state and properties, from simultaneous measurement of the RCP and LCP echo components, if detectable. [The surface region probed extends from about -12 to -7 degrees South latitude and about 217 to 225 degrees West longitude \(~25 degrees west of the Huygens landing site\)](#). Potential detectability of a weak echo strongly depends on potential presence of relatively flat (liquid or solid) Titan terrain within the HGA footprint over the surface region probed (the ground track). The T34 observation [geometry also enjoys the advantage of extending in time till near C/A where a smaller distance to the surface enhances the measurement signal-to-noise ratio](#), hence enhances potential detectability of any weak surface echo.

DSN Antennas Supporting T34

Station	Pre-cal	BOT	EOT	Post-Cal
DSS-14	199/2045	199/2345	200/0330	200/0430
DSS-25	199/2100	200/0000	200/0330	200/0430
DSS-26	199/2100	200/0000	200/0330	200/0430
DSS-43	199/2100	200/0000	200/0330	200/0430
DSS-34	199/2110	200/0010	200/0330	200/0430

Equipment scheduled:

- 2 closed-loop receivers per antenna
- All RSRs and VSRs and one WVSR at Goldstone and Canberra
 - Total: 18 open-loop receivers
- Open-loop data are prime. Closed-loop data are backup (though don't expect the stations to be in-lock except for the short baseline)

Antennas Capabilities

Simultaneous Band and Polarization

DSS-14

X-RCP
X-LCP

S-RCP
S-LCP

DSS-25

X-RCP
X-LCP

K-RCP

DSS-26

X-RCP
X-LCP

K-RCP
K-LCP

Either KLCP or monopulse

DSS-43

X-RCP
X-LCP

S-RCP
S-LCP

DSS-34

X-RCP

K-RCP

Either XRCP or XLCP

All-Band Dependent Polarizations

Ambient Load or Cold Sky changes will impact both polarizations/both bands

Same-Band Dependent Polarizations

Ambient Load or Cold Sky changes will impact both polarizations/same band

Independent Polarizations

Ambient Load or Cold Sky changes will only impact polarization being changed

RSR/VSR/WVSR Assignment

Aseel: VOCA

Roberto: Displays

DSS	Operator	Station	Open-Loop Receiver	RSR Assignment
14	Elias	rsops1	RSR2 and RSR3	RSR2A -> XRCP
				RSR2B -> XLCP
				RSR3A -> SRCP
				RSR3B -> SLCP
26	Don	rsops3	VSR1 and WVSR2	WVSR2A -> XRCP
				WVSR2B -> XLCP
				VSR1A -> KRCP
				VSR1B -> KLCP
25	Danny	PC through rsops2	RSR1	RSR1A -> XRCP
				RSR1B -> KRCP
43	Kamal	rsops2	RSR1 and RSR2	RSR1A -> XRCP
				RSR1B -> XLCP
				RSR2A -> SRCP
				RSR2B -> SLCP
34	Danny	PC through rsops3	VSR1 and WVSR1*	VSR1A -> XRCP
				VSR1B -> KRCP

* WVSR1 available if needed. But it may be WVSR2 instead.

RSSG will be in RS Ops Room at 1 pm on Wed 7/18 (199/2000)

Bistatic Calibrations

- Calibrations will be performed during
 - Pre-cal (antennas at stow)
 - 3-hr pre-cal periods were scheduled
 - Observation (mini-cals)
 - Pre-determined and carefully selected times (during turns or while in occultation)
 - More from Essam
 - SNT Measurement
 - Just before and after observation
 - Post-Cal (antennas at stow)
 - 1-hr post-cal periods were scheduled
- Pre-cal Calibrations are the longest of the three

T34 ORTs – All Completed

ORT #1: DOY 186 (Thu, July 5) over DSS-25 and DSS-34, X- and Ka-band:

07 186 1600 1800 0300 0500 DSS-25 CAS RSR47-BISTATORT1 3560 N748 1A1

07 186 2230 0100 0300 0500 DSS-34 CAS RSR47-BISTATORT1 3561 N750 1A1

- Practiced bistatic calibrations at both stations, mini-cal and SNT measurements
- Collected pointing data (monopulse) to update the 4th-order blind pointing model
- Comments/Issues:
 - DSS-34 can either support XRCP or XLCP. Have only one X-band downconverter. Cannot support both simultaneously.
 - DSS-34 stow position at 90.07 degrees, but due to limitations, can only go to 89.9 degrees.
 - DSS-25 operator not sure he had X-band in the ambient load

ORT #2: DOY 191 (Tue, July 10) over DSS-14 and DSS-43, X- and S-band:

07 191 1645 1745 0245 0445 DSS-14 CAS TP SEQ RS-BIORT2 3565 1639 1A1

07 191 2100 0000 0245 0445 DSS-43 CAS RSR48-BISTATORT2 3566 1639 1A1

- Practiced bistatic calibrations at both stations, mini-cal and SNT measurements
- Verified RCP and LCP signals
- Comments/Issues:
 - DSS-14 Maser red. Put SRCP on HEMT. No SLCP.

ORT #3: DOY 192 (Wed, July 11) over DSS-26, X- and Ka-band:

07 192 1500 1630 0230 0430 DSS-26 CAS RSR48-BISTATORT3 3566 N750 1A1

07 192 1630 1730 0230 0245 DSS-14 CAS TKG PASS SEQ 3566 N003 1A1

- Practiced bistatic calibrations at both stations, mini-cal and SNT measurements
- Collected pointing data (monopulse) to update the 4th-order blind pointing model

ORT #4: DOY 194 (Fri, July 13) over DSS-34 and DSS-26, X- and Ka-band:

07 194 1630 1730 0230 0245 DSS-14 CAS TKG PASS SEQ 3568 N003 1A1

07 194 2105 0005 0230 0430 DSS-34 CAS RSR48-BISTATORT3 3569 N750 1A1

07 194 2110 2310 0230 0430 DSS-26 CAS RSR48-BISTATORT3 3568 N750 1A1

- Practiced bistatic calibrations at both stations, mini-cal and SNT measurements
- Collected pointing data (monopulse) to update the 4th-order blind pointing model
- Comments/Issues:
 - Perfect ORT!

T34 ORTs – General Comments

- Overall, stations followed procedures very well
- Mini-cals and SNT measurements completed within allocated time
 - 8 minutes or less for Mini-cals
 - 6 minutes for SNT measurements
- Sometimes stations unclear about how to get Ambient Load Temperatures?
- Sometimes diodes are enable or disabled when they shouldn't be
 - Most likely error during cals

To Discuss ...

- DSS-14 Maser
- SNT
- Goldstone XM Radio Interference
 - None observed during DSS-14 ORT
- Naming of 4th-order pointing models: cas25.sem, cas26.sem, 34cas.sem
- Q to David: Any issues with monopulse data collected during ORTs?