

VLBI2010 Project for Geodesy and Astrometry: Proof-of-Concept Demo

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and

The Broadband Development Team

Broadband Delay Team

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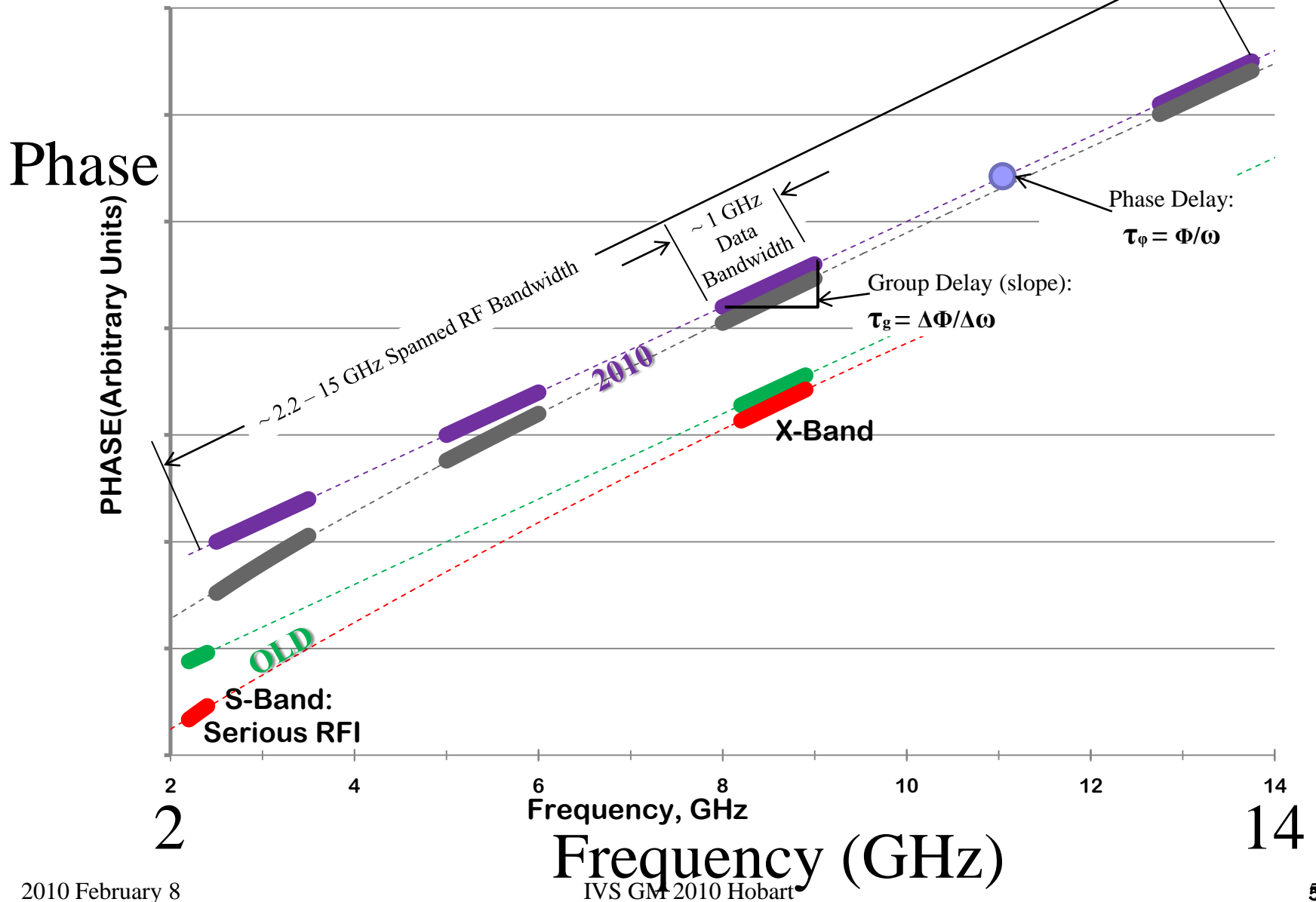
Approach – What is Needed

- Measurement delay precision ~ 4 psec per observation
- Fast antenna motion: any point in the sky in ~ 30 seconds
- Sensitivity to observe several hundred radio sources
- \rightarrow small antenna, large bandwidth, high data record rate

Proof-of-Concept Development

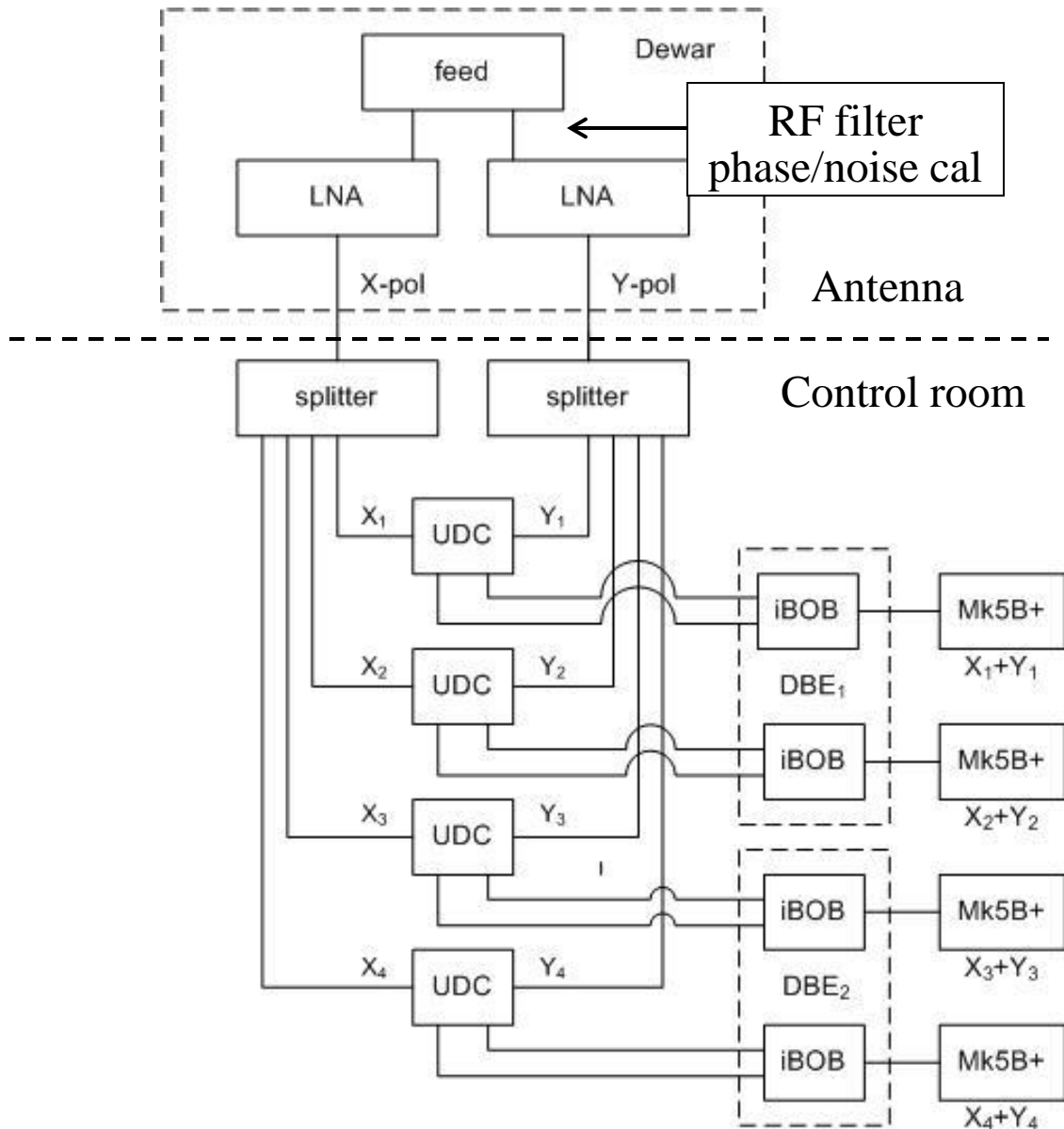
- Develop the instrumentation to implement the broadband delay system as recommended by the V2C
- Mount the equipment on two existing antennas
 - Westford 18m antenna, Massachusetts
 - MV-3 5m antenna, Washington, D.C.
- Make observations to demonstrate that broadband delay can be effectively used

Observing Frequency Bands



Proof of Concept System

- New equipment
 - Commercial broadband feed and LNAs
 - Cover entire frequency range in one feed
 - Flexible frequency converter (UDC)
 - Choose best frequencies
 - Avoid RFI
 - New phase cal generator
 - Digital back end (DBE)
 - High data rate recorder



Feed and LNAs
cooled to ~20K

Both senses of linear
polarization used

Odd channels from each
pol'n for one band output to
each Mk5B+.

2 gigabits/sec recorded on
each Mk5B+.

Total data rate: 8 gbps

Impact on geodetic VLBI

- Dual linear polarization
 - Intrinsic to broadband feed
- Very high data record rate
 - Per polarization in each band: 1 Gbps
 - Per band: 2 Gbps
 - Total data rate : 8 Gbps

MV-3 5M Antenna @ GGAO

Broad Band LNAs
& Feed in Dewar



Broadband Back-End Hardware

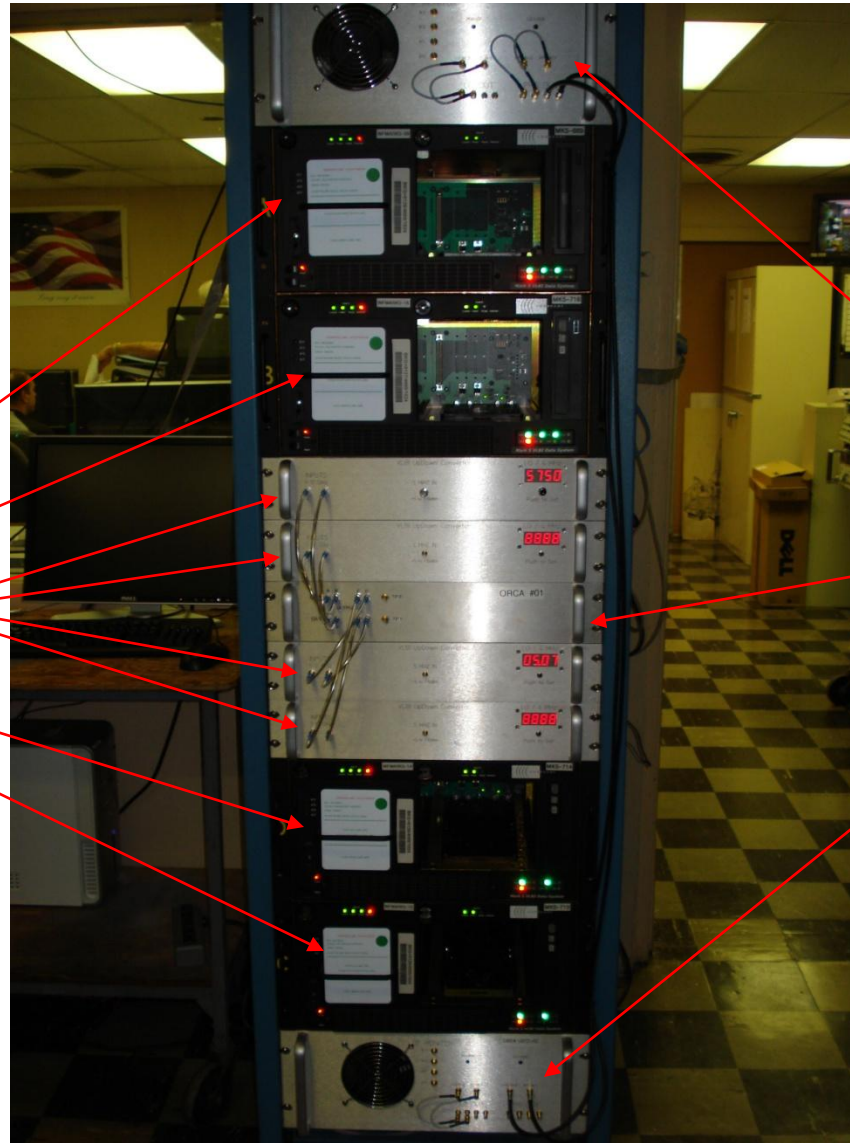
8 gigabit/sec
LOs and
back end

Mark5B+

UDCs

ORCA
Box

DBEs

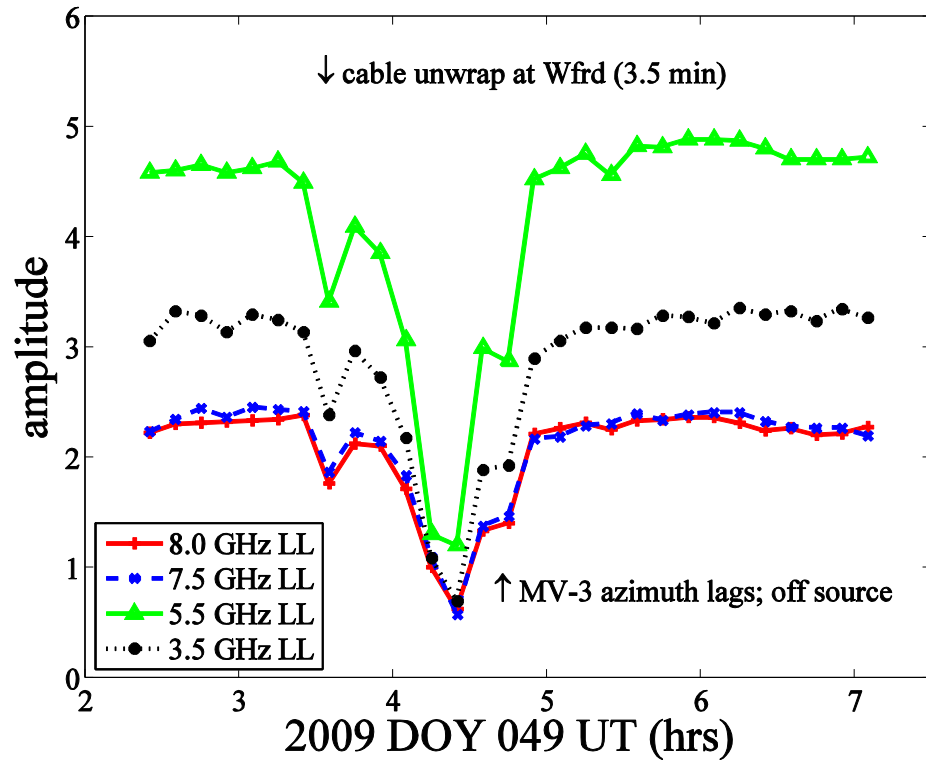


Recent Results

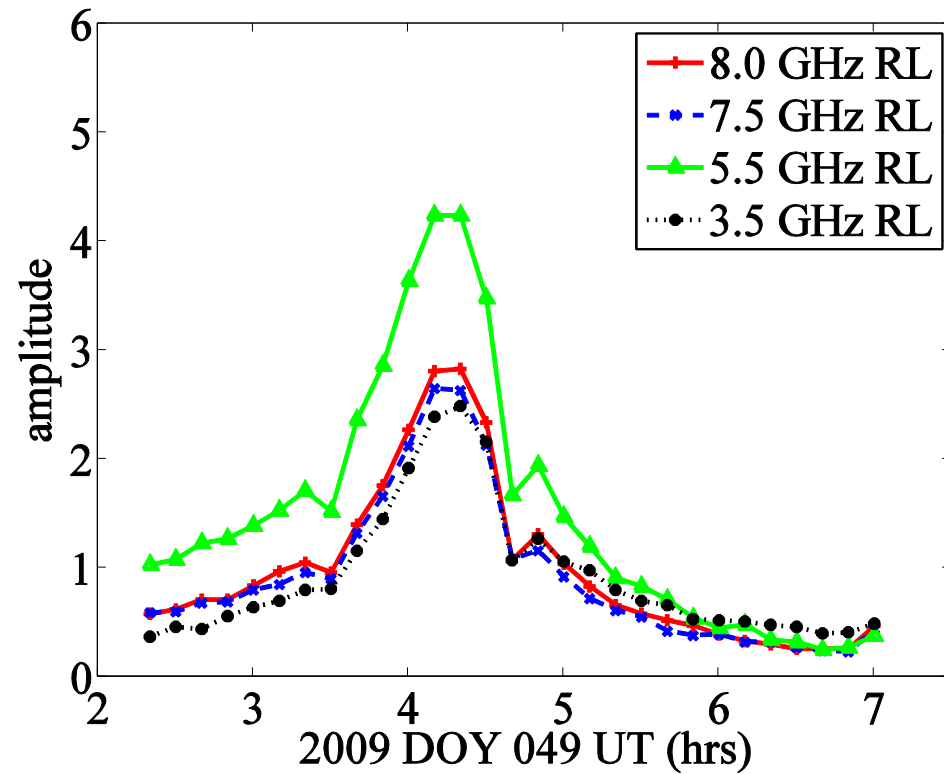
- Polarization track
- Band configurations – 512 MHz bands
 - All four bands identical frequencies
 - Four bands contiguous for 2 GHz total
 - Four bands spread to cover 3.5 GHz to 11.5 GHz
- Source survey
 - Four bands spread to cover 3.5 GHz to 11.5 GHz

Polarization test

4C39.25 Wfrd-MV3

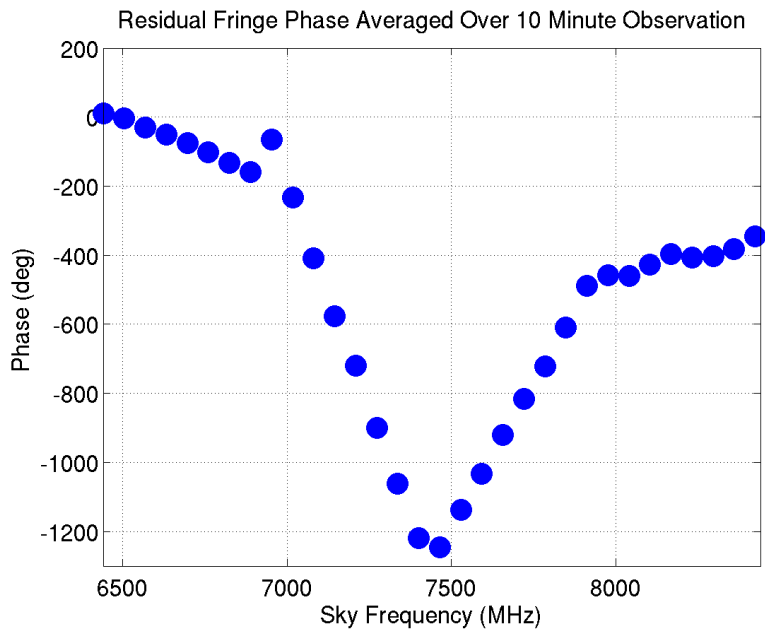


4C39.25 Wfrd-MV3

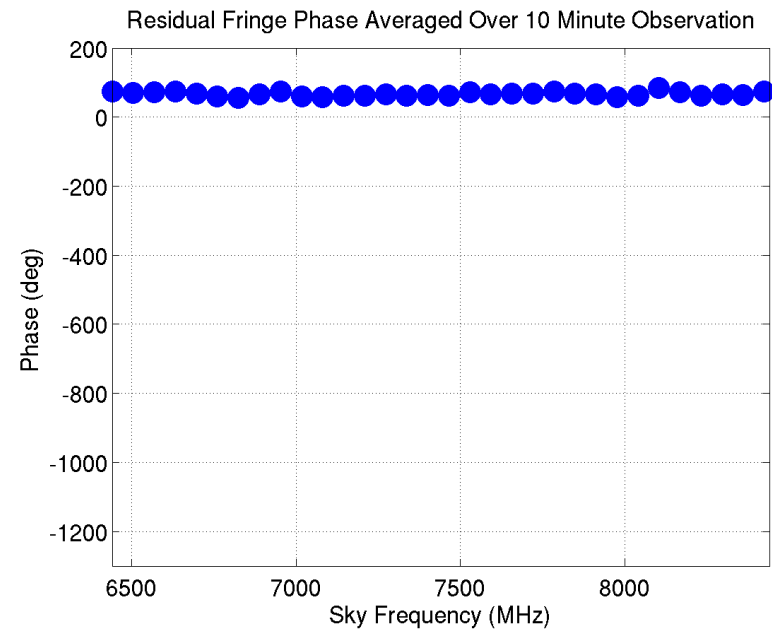


Contiguous bands 6.4 GHz – 8.4 GHz

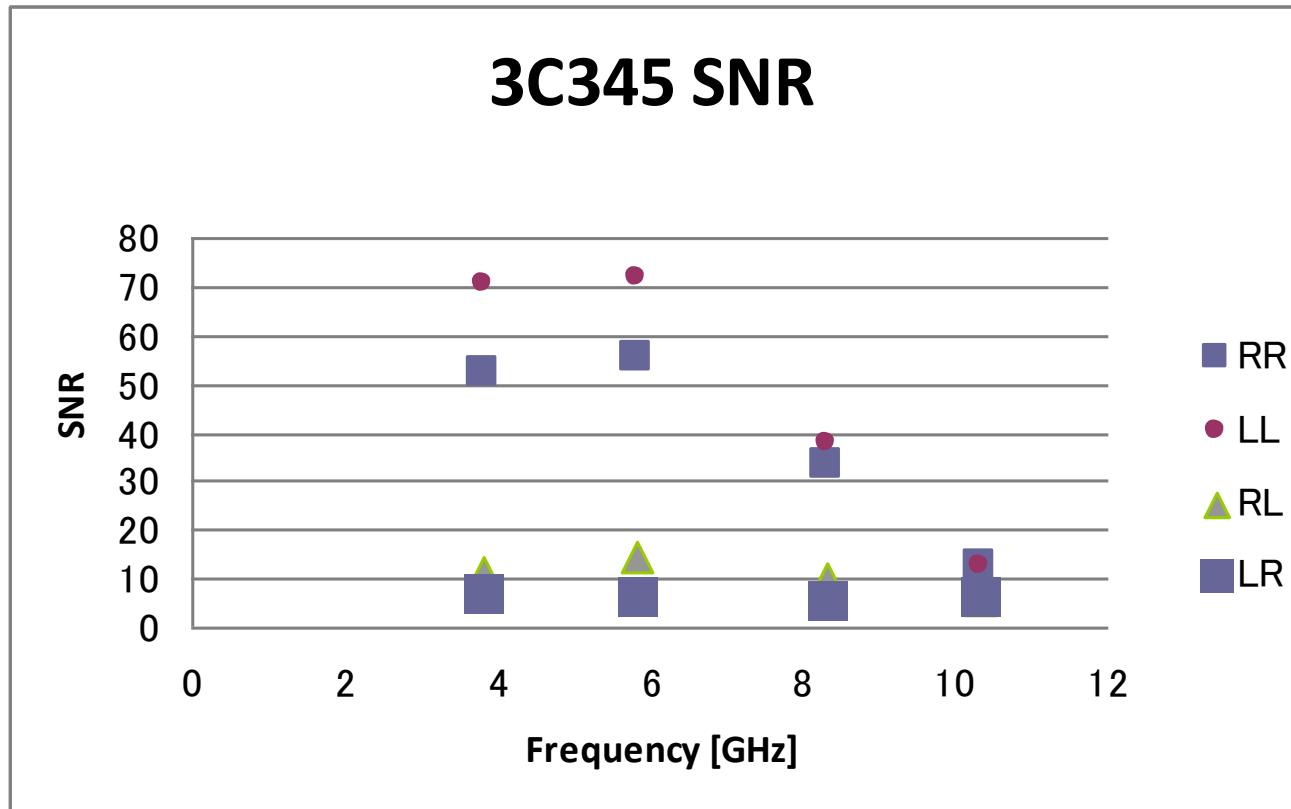
No phase cal



With phase cal



Source survey



Next - 1

■ Analysis

- Combining multiple bands, polarizations, pcal, and ionosphere estimation in *fourfit*

■ Hardware

- Implement EMI and thermal control in phasecal
- Complete Eleven feed development
- Complete RDBE/Mk5C development
- Add Monitor/Control infrastructure

Next - 2

- 12m antenna - Patriot
 - Antenna at GGAO in containers
 - Awaiting permission to clear trees and pour pad
 - Install feed support cone with Dewar, feed, phase and noise calibration
 - Install VLBI2010 signal chain
 - Feed: Eleven or Lindgren
 - Signal chain: DBE1/Mk5B+ or RDBE/Mk5C

Proof of Concept System Status

	<u>Current</u>	<u>Next</u>
■ Feed	Lindgren	Eleven
■ RF filter	>3.1 GHz	\geq 2.2 GHz
■ DBE	DBE1(iBOB)	DBE2(ROACH)
■ Recorder	Mk5B+	Mk5C
■ Correlator	Mk4 (hardware)	Software (DiFX)



The End