

# Systems Integration and Testing

EVLA Advisory Committee Meeting, March 19-20, 2009



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Atacama Large Millimeter/submillimeter Array  
Expanded Very Large Array  
Robert C. Byrd Green Bank Telescope  
Very Long Baseline Array



# Systems Integration

- Module Production Status
- Antenna Outfitting Status
- Round Trip Phase System
- Phase Stability
- Maintenance Tracking

# Module Production Status

- Antenna LO modules meeting project schedule
  - 50% of L302 Synthesizers need minor upgrade
    - Replacement of Direct Digital Synthesizer (DDS) PCB
    - Plan in place for upgrade
  - L352 RTP module behind but now in production
    - Plan in place for catch up
- Antenna IF modules meeting project schedule
  - 50% of T304 Downconverters need upgrades
    - Required to support 2-4 GHz 3-bit digitizer path
    - Plan in place for upgrade

# Module Production Status

- Data Transmission System modules meeting project schedule
  - All D30x DTS modules require upgrade
    - 3-bit digitizer board and improved M&C firmware
    - Plan in place for upgrade
  - D351 De-formatter move to WIDAR station board
- Central LO reference system
  - Critical modules complete and in use
  - Hardware to support redundant LO system in development
- Antenna power supply modules meeting project schedule
  - 48V Bulk supply and DC/DC converter modules

# Module Production Status

- Antenna front end modules meeting project schedule
- Antenna M&C utility modules meeting project schedule
- Special central rack power supply modules in development
  - New design is N+1 redundant
  - Non-Critical development
    - Currently using antenna DC/DC converter design
    - Deployed by summer 2009

# Antenna Outfitting Status

- 20 Antennas converted to EVLA design
  - All currently in regular scientific use
- Some antennas need upgrade at end of project
  - Antennas 13, 14 , 16 & 18
  - These antennas work with VLA & WIDAR Correlators
  - Prototype hardware to be replaced w/ production hardware
  - Plans in place for these updates following:
    - VLA correlator shut-down (13 & 18)
    - Completion of 28<sup>th</sup> EVLA Antenna upgrade (14 & 16)

# Round Trip Phase System

- More difficult to implement than originally thought
- Went through 5 major design iterations of L351/L352 modules
- Now have a design that meets project specifications
- L352 RTP Modules are now in production
  - Will be deployed at an accelerated rate for catch up
- Incurred some additional engineering cost
- No major increase in production cost

# Phase Stability

- Problem with excessive phase change with antenna elevation
  - Noticed several years ago
  - Was difficult to impossible to recreate in the lab
- Has been difficult to track down – multiple sources contributing
- Software change fixed large part of problem
- Remainder was determined to be in LO/IF electronics
  - Timescales and behavior indicate some of this is a thermal issue
- Worst offending antennas tracked down to a defect in one batch of 512 MHz crystal oscillators
  - These have been returned for repair
  - Repaired devices seem much better



# Phase Stability

- Effect still exists but is much diminished
- Next Steps:
  - Need WIDAR to see if any remaining effect is due to use of the recovered DTS data clock in the transition system
    - Any contribution due to this goes away with WIDAR
  - Need to further evaluate the L301 synthesizer & it's references
    - Some remaining effect seems to only effect bands using this synthesizer as a first LO

# Maintenance Tracking

- Maintenance records of Hardware Assets will be tracked using MainSaver
  - Commercial Oracle based database software package
  - Currently used for VLA and VLBA maintenance
  - Historical data on hardware assets not tracked for VLA/VLBA
  - Software has capability to track historical data
  - Process now started for EVLA LO/IF modules as test case
    - Tracked by model & serial numbers
  - Seems to be working
  - Remaining modules & receivers will follow

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## Questions?

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# Phase Stability DTS Explanation

(Aux Slide)

- Recovered clock used to recreate analog signals for VLA correlator
  - Clock is dependent on:
    - 5X Analog multiplier used in DTS module
    - Unknown on-chip VCO's used in 10GB/s SERDES chips
    - DTS fiber - behavior is unmeasured and uncharacterized
      - DTS operates at 1550nm whereas LO fiber is 1310nm
      - Fiber dispersion is zero at 1310nm, non-zero at 1550nm