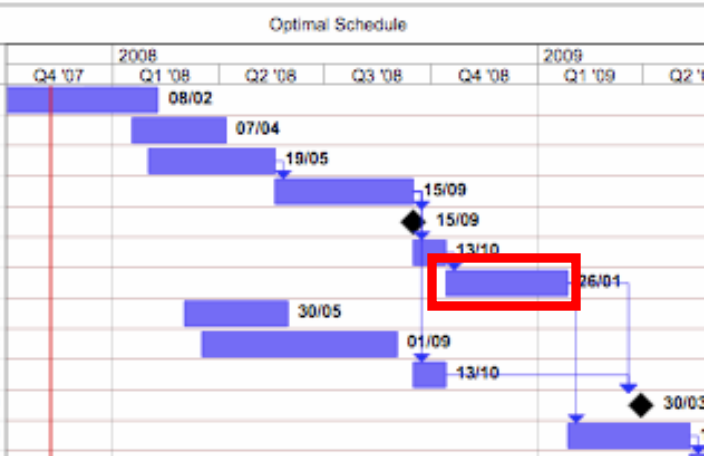
Prototype Correlator Tests on the Critical Path

Michael P. Rupen

The Issue: The Critical Path

Optimal Schedule

ID	Task Name	Start
3	Stage 2 Prototype Redesign, Fabrication, & Assembly (2 PCB)	Mon 28/05/07
6	Stage 2 Prototype Fabrication Acceptance Testing	Fri 18/01/08
7	Stage 2 Accepted; Go-ahead Stage 3 (Fab & Assy - 8 PCB)	Fri 01/02/08
8	Hardware/Software Integration Testing	Tue 20/05/08
9	Critical Design Review	Mon 15/09/08
10	Hardware for OTS Testing Sent to VLA	Tue 16/09/08
11	On-The-Sky Testing	Tue 14/10/08
12	High-Speed Inter-Rack Cables Delivered to and Installed at VLA Site	Mon 03/03/08
13	Racks Delivered to and Installed at VLA Site	Tue 18/03/08
14	Limited Production Hardware Could Be Sent to VLA	Tue 16/09/08
15	Limited (10-Antenna) Observing	Mon 30/03/09
16	Stage 4 Production Hardware	Tue 27/01/09



Why OTS testing?

- To reveal hidden, low-probability, low-level systematic effects that could be devastating were they to find their way into the final system
- Critical tests are intended to reveal possible **hardware** problems
- These are **in addition** to basic tests done at DRAO (basic functionality checks)

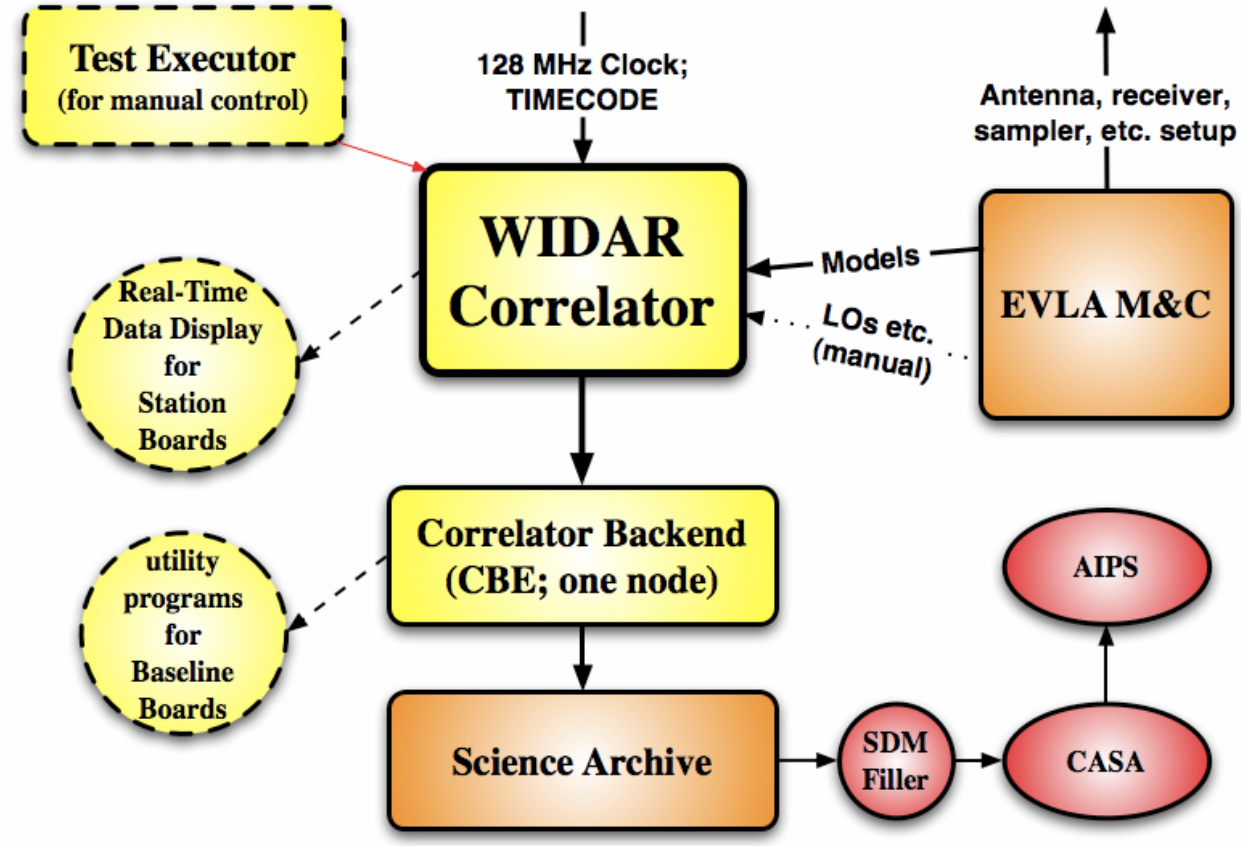
Why OTS testing?

- Proposed by DRAO
- Affirmed by NRAO Dec06 due to "the basic necessity for checking that the most important part of the EVLA actually works, so far as we can reasonably tell, before proceeding with the final huge procurement orders."

The Critical On-the-Sky Tests

- First fringes
- Check of corr'n coeff. (source of known flux density)
- Check for glitches over several hours
- Check closure within each channel
- Check for correlator offsets and other systematics (deep integration)
- Check spectral bandpass stability
- Check spectral dynamic range ("RFI spatter")
- Check sub-band stitching
- Pre-requisites for the above (e.g., delay tracking)

Initial setup at the site



Software Requirements

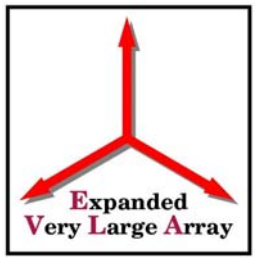
- GUIs for configuration & status
- Real-time delay tracking
- Real-time phase model generation
- Real-time dump control generation
- Real-time data display
- CBE basics & archive retrieval
- Off-line tools
  - Check phase, amp closures
  - Check phase, amp vs. time
  - Spectral & continuum images

Concerns of EVLA Advisory Committee

- Context: **WIDAR schedule is a major risk for the project as a whole**
- Bringing the PTC to the VLA will lead to a host of new problems, obscuring those specific to the correlator, and leading to substantial delays which can't be predicted or easily mitigated
  - Requires a fair amount of software integration
- How can you put these tests on the critical path, when you don't know how long they will take?

Responses

- Remove all OTS tests from the critical path
- Do the most important critical tests up at DRAO
  - Fundamental difference between OTS and DRAO tests is the ability to do long integrations, on realistic data
  - Noise sources and tones would suffice for most of these tests (?)
  - Avoids integration issues (???)
- Pick a hard deadline for the go/no-go decision
  - What do we do if we just haven't managed to check a lot of the Critical Tests? If we go ahead anyhow, were these tests really "critical"?



Questions…

Does OTS Testing at DRAO make sense?

- Can we really do this? Does it buy us anything? Revnell says no gain:
  - expensive in both equipment and people
  - lots of throwaway hardware & software
  - basically just replicating VLA environment up north -- why not just use the already-working environment we have?
  - not convinced critical tests are critical
- N.B. EVLA/eMERLIN are unique in modifying existing arrays (except maybe CARMA? ATNF?)

Which tests are really critical for checking the *hardware*?

- First fringes
- Check of corr'n coeff. (source of known flux density)
- Check for glitches over several hours
- Check closure within each channel
- Check for corr offsets and other systematics (deep integration)
- Check spectral bandpass stability
- Check spectral dynamic range ("RFI spatter")
- Check sub-band stitching
- Pre-requisites for the above (e.g., delay tracking)

Which tests *must* be done at the VLA?

- First fringes
- Check of corr'n coeff. (source of known flux density)
- Check for glitches over several hours
- Check closure within each channel
- Check for corr offsets and other systematics (deep integration)
- Check spectral bandpass stability
- Check spectral dynamic range ("RFI spatter")
- Check sub-band stitching
- Pre-requisites for the above (e.g., delay tracking)

Implications of Critical OTS Testing

- Critical path item
  - "all hands on deck"
  - Argues for absolute priority for WIDAR testing
  - Many items require only 1 or 2 antennas -- argues for ability to run old correlator at the same time (i.e., two subarrays, one with current correlator, one with WIDAR)
- Array configuration not very important
  - Little impact on tests
  - Can always move a few antennas

Which approach do we take?

- No critical tests?
- More tests in Penticton?
- Pick a hard deadline?

WHAT IT TAKES TO RUN DIGITIZERS OUTSIDE OF ANTENNAS

(I THINK)

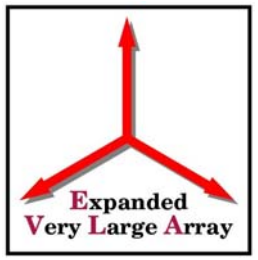
BASIC REQUIREMENTS

- Clocks and timing derived from same reference used by correlator.
- Power and cooling.

DTS COMPONENTS

- Full DTS modules.
- Subrack with cooling.
- 48v power.

OTHER ANTENNA MODULES

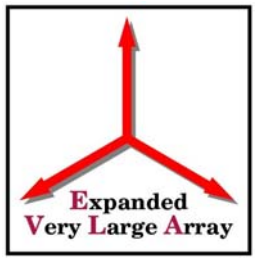


- Power supply.
- L300 for 2048 and 4096 MHz clocks
- L305 for 128MHz and time code, 512 MHz for L300.
- L304 (maybe).

CONTROL BLDG MODULES

- L350 Master reference for correlator timing and clock, reference for L305.
- L353 (maybe).
- Deformatters.

OTHER



- Cables.
- Bins, Rack.
- Noise source(s). Uncorrelated or correlated signals?
- Software.
- Time to identify, configure, test, ship and set up all of this.