

VLBA Plans & Prospects

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for the VLBA project

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Atacama Large Millimeter/submillimeter Array

Expanded Very Large Array

Robert C. Byrd Green Bank Telescope

Very Long Baseline Array



VLBA activities, in context

- Exciting science: Astrometry, H₂O maser cosmology, Movies of jets, Transients...
 - 2006 Senior Review recommended NSF funds 50% (\$ 3M) of VLBA operations, from 2011 on.
 - *Negotiations with potential partners is in progress to make up the difference.*
 - *Partners would provide their own data transport or recording media, mitigating impact on other users.*
 - Meanwhile, operations funds and existing partner- ships are being applied to upgrade the array.
- http://www.nrao.edu/A2010/rfi/RMS_Panel_Response_NRAO_Director.pdf

Current Focus: Modernize the VLBA

- New technology is more capable, flexible.
- 1) Upgrade selected Rx for spectroscopy
 - *K* band new amps. [Done]
 - *G* band new 4-8 GHz Rx. [NSF ~~RF~~ Proposal]
- 2) 4 Gbps with 500 MHz IF/pol. [Ongoing]
 - *N*w 256 *M*ps sustained, 512 occasional.
 - 4*X* improvement in continuum sensitivity.
 - Target 2011 [some 2 Gbps by 2009 end]
 - *DFX* software correlator [by 2009 end]
- <http://www.vlba.nrao.edu/memos/sensi/>

1.) Upgrade K- & C-band Receivers

- K band (*NRAO/MP collaboration*):
 - Replace old *GAFDS* with *EMAP* design.
 - Completed *Jun 2008*.
 - *Ag. zenith SFD = 800 before, 500 after* (420 off water line)
- C-band: *NOF MP proposal submitted*.
 - *EMAP style 4-8 GHz receiver, CM*
 - *Methanol line 6.7 GHz, star forming regions.*
 - *Single wide band allows ionosphere fit for astrometry + deep continuum imaging.*

2.) 4 Gbps Data Path

- Target completion 2011
 - High-priority projects 2 Gbps by end 2009.
 - Sustained ops - need more disks [unfunded]
 - DFXPCUs are $\sim 15\%$ of media cost.
- Three new components:
 - a. Digital Backend, FPGA-based sub-bands.
 - b. MET Recording System.
 - c. DFX Software Correlator.

2. a.) Digital Backend: sub-band processor

- Sample directly 500-1000 MHz IF, 2 poln.
 - *All subsequent oprn's digital.*
- Flexible filter personalities
 - Digital Down-Converter (DDC)
 - 4 independent tunable subbands per IF.
 - BW 0.5 - 256 MHz; output 1 - 8 bits.
 - Polyphase Filter Bank (PFB)
 - 32 or more subbands spanning 500 MHz IF.
- Output: 10G Ethernet - *ELDB* ready
 - Individual sub-band packet streams.
 - Max rate 8 Gps.

2. a.) Digital Backend: hardware platform

- 'ROACH' (formerly iDB)
 - Reconfigurable Open Architecture Computing Hardware.
 - CASPER/KU/NRAO collaborative.
 - Upgrade of WB CASPERs successful iDB
 - Newer Xilinx-Virtex-5 FPGA
 - 10- Ggabit Ethernet output interface.
- Status
 - Boards in production, 6 expected now.
 - FPGA firmware for FFBpath implemented
 - DDC path implemented??

2. b.) Mark 5C Recording System

- Successor to current MK5A/B/B+ Recorders
 - Joint development by HyStack/Conduant/MK5
 - Requirements:
 - Sustained recording at ≥ 2 Gps (Amazon disk array already capable of this rate.)
 - Preserve investment in MK5 drive modules.
 - 10 G Ethernet input interface, sub-band packet streams.
 - Output optimized for direct access software correlator.
- Status: first 3 units (MK5) + 8 units purchased in partnership with CONA.

2. c.) Di FX Software Correlator

- NRAO implementation for production use
 - Software by Pam Deller, Swinburne U (now NICTA)
 - Licencing agreement, code-sharing consortium.
 - Peripheral software to interface to VLBA is mostly complete: operator GUI archive interface etc. in testing.
- CPU cluster procured & installed.
 - 20 Intel Xeon quad-core processors.
 - Now matches throughput of hardware correlator.
 - Current cost of CPUs is 15% of media cost
- Goal: routine service by end 2009.

New Decade:

- Astro 2010 Activity White Paper (JD Romney)
www.nrao.edu/A2010/rfi/VLBA-edited.pdf
- Main Theme: Precision Astrometry
 - Replace 4.5- 5.2 GHz Rx with 4- 8 GHz ELAtype.
 - Methanol, Wideband V/X in one gulp.
 - NSF funding requested; 30% MIT partner, if accepted.
 - Expand to 4 GHz/pol (sustain 32 Gbps) over ~6yrs.
 - Need new I/F system.
 - New data transmission system.
 - Media (disk/flash?).
 - CPU nodes for DFX correlator.
 - Water Vapour Radiometer's.

New Capability: near-field, moving sources

- **Phoenix Mars Lander**, 2008 *May*: demonstration of correlator model & operations procedures for astrometry on satellites (VLBA team)
- **Asteroid Radar** (Michael Busch et al. AAS, Pasadena).
- **Cassini**: Observations to refine Saturn's ephemeris via long-term astrometry on Cassini spacecraft (Dayton Jones et al. AAS, Pasadena)

Phoenix Mrs landing, May 2008

Phoenix

Creator:ESF Ghostscript 81502 (epswrite)
CreationDate:2009/06/10 22:43:00
LanguageLevel:2

Cassini
CreationDate:2009/06/10 22:43:07
LanguageLevel:2