JVLA Capabilties for the Aug 1 Deadline (D, DnC, C configurations)

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29 March 2012

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

NRAO

Background

- EVLA construction project ends Dec 2012
- First call for post-construction proposals: 1 Aug 2012
- Call covers D (25 Jan-22 Apr 2013), DnC (26 Apr-13 May 2013), C (24 May-19 Aug 2013) configurations
- Must define the capabilities by May; earlier is better!
- Should:
  - Show the full scientific power of the JVLA
  - Fulfill our promises to the community, and to NSF
  - Be realistic: we are still constructing, commissioning, & learning

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Today's proposal

- Emphasize both basic capabilities & flexibility
- Strive for 90% of the science for 10% of the work
- Be realistic: what we believe we can do, primarily in terms of correlator and software efforts
- Under-promise, over-deliver

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The Proposal

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8 GHz/pol'n for continuum observations

- **POP item**
- First open call using the 3-bit samplers
- Continuum only:
  - 128 MHz subbands
  - Full pol'n products → 2 MHz channels
  - Dual pol'n products → 1 MHz channels
  - Single pol'n products → 0.5 MHz channels
- Flux scale good to ~10%
- Can't mix 3- and 8-bit samplers

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Phased array VLBI

- **POP item**
- 2 x 1-128 MHz/pol'n independently phased and written to Mk5C recorder
- Cannot use multiple subarrays
- Cannot use the rest of the correlator for other work
- Cannot stack Baseline Boards
  - 256 channels per subband pair, spread over pol'n products
- Cannot transfer phase from one subband (or subband bandwidth) to another

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Independent & flexible 8-bit subbands

- Up to 16 subband pairs per baseband pair
- Fully tunable, but cannot cross 128 MHz boundaries (inherent in correlator hardware/firmware)
- Doppler setting *per baseband* (as current OSRO)
- Independent subband bandwidths, 31.25 kHz-128 MHz
- Independent choice of pol'n products (1, 2, 4)
- Independent channelization (next slide)

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Up to 16,384 spectral channels

- Flexibly distributed across pol'n products and subbands
- Up to 2,048 channels per subband pair (dual pol'n)
- Implemented through Baseline Board stacking
- *Not available* when using 3-bits, subarrays, fast dumps, VLBI

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Up to 5 independent 8-bit subarrays

- Completely independent in terms of baseband & subband tuning, bandwidths, channelization, dump times, etc.
- Observer must submit separate SBs for each subarray, explicitly specifying the antennas to be used in each
- Cannot use phased array, 3-bit samplers, Baseline Board stacking (i.e., no more than 256 channels per subband pair, distributed across all pol'n products)
- Some restrictions on number of antennas per subarray (must use <=8 sets of up to 4 antennas each)

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Special fast (sub-second) dump modes

- 8-bit only
- Continuum only: 128 MHz subbands, full pol'n products with 2 MHz spectral channels
- Table of possible modes
- One subarray: possibilities include…
    - 2 GHz → 6 ant @ 10msec, 15 @ 50msec, 28 @ 200msec
    - 1 GHz → 9 ant @ 10msec, 20 @ 50msec, 28 @ 100msec
    - 128 MHz → 28 ant @ 10msec

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Special fast (sub-second) dump modes

- Three subarrays (10, 9, 8 antennas):
    - 256 MHz @ 10msec
    - 1 GHz @ 40msec
    - 2 GHz @ 80msec
- High data rates require special justification
    - 28 ant, 128 MHz, 10msec → 77 MB/s, 270 GB/hr
    - Three subarray modes → 48 MB/s, 170 GB/hr

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Dump rate restrictions

- Retain 3-5sec dump limit for now for standard observations
- Flexibility and channelization options → switch from dump time to dump rate restrictions
- Limit without special justification: 20 MB/s (70 GB/hr, 140 TB/cfg)
- Absolute limit without RSRO: 60 MB/s (with good scientific justification)

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Summary

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Slide 14

Summary

- 8 GHz/pol'n for continuum observations (3-bit)
- Phased-array VLBI
- Up to 16 independent subbands per baseband
  - Flexible tuning, independent subband bandwidths, numbers of channels, and polarization products
- Baseline Board stacking: 16,384 channels spread across all subbands and pol'n products
  - Up to 2048 channels per subband (dual pol'n)
- Up to 5 subarrays for continuum work

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Summary

- Sub-second time resolution for 8-bit continuum work
  - 200msec for 28 antennas, 2 GHz/pol'n
  - 10msec for 28 antennas, 128 MHz/pol'n
- Data rates up to 60 MB/s, with good scientific justification

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What's missing

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Missing bits

- No frequency averaging – may need this for data rates, certainly by the bigger configs
- No recirculation
- No wideband phased array
- No pulsars
- No Doppler tracking, or Doppler setting per subband
- No OTF mosaicking
- No commensal transient detection etc.
- Only 16 sb/bb

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Pipeline processing & NRAO defaults

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Pipeline-able modes

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- NOT the same as "regular observing" (non-RSRO) modes
- Could define set of standard NRAO resources which must be used for a script to be pipeline-able

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NRAO defaults

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- Should ensure they match the data rate restrictions
- Possible avenue for the L-band survey setup Andreas would like (esp. if that require recirculation)

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