

ASKAP Update

Progress and Plans for 2012

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Presentation Outline

- The path towards an “astronomy ready” BETA in 2012
 - Description of staged BETA deployment process
 - Ongoing phased array feed characterisation at Parkes test facility
- Current BETA project status
 - Hardware – readiness of subsystems for MRO deployment
 - Firmware – update on present capability and planned updates
 - Software – control system capabilities and auxiliary correlator
- Summary of upcoming commissioning activities
 - Installation of 2nd and 3rd PAFs at MRO in May/June
 - System verification and reliability testing in June
 - On-sky testing and first measurement sets in July
- ASKAP Design Enhancements

BETA Deployment Stages



MATES / Marsfield Workshop (Pre-deployment phase)

- Component assembly and initial testing, fine tuning of rack fit-out procedures
- Laboratory testing and development of software / firmware for beamformers & correlator



BETA-3 BETA-Box (Stage 1 deployment, antennas 1, 3 & 6)

- First three Mk I PAFs, with beamformers in temporary container, + SPF reference
- Continued use of Parkes firmware for ease of commissioning and testing
- Software correlation for initial fringe finding, basic imaging, first measurement sets



BETA-3 Central Site (Stage 2 deployment, antennas 8, 9 & 15)

- Installation of next three Mk I PAFs and pedestal electronics, with beamformers in the central building
- Testing of full-bandwidth firmware correlator (if not already installed in BETA box)
- Shift towards remote operation for commissioning activities



BETA

- Relocation of BETA box hardware to central building, connection of antennas 1, 3 & 6 to fibre trunk
- Integration of all 6 BETA antennas as a unified array, development of operating procedures
- Testing of image pipeline, science commissioning observations, formation of data archive

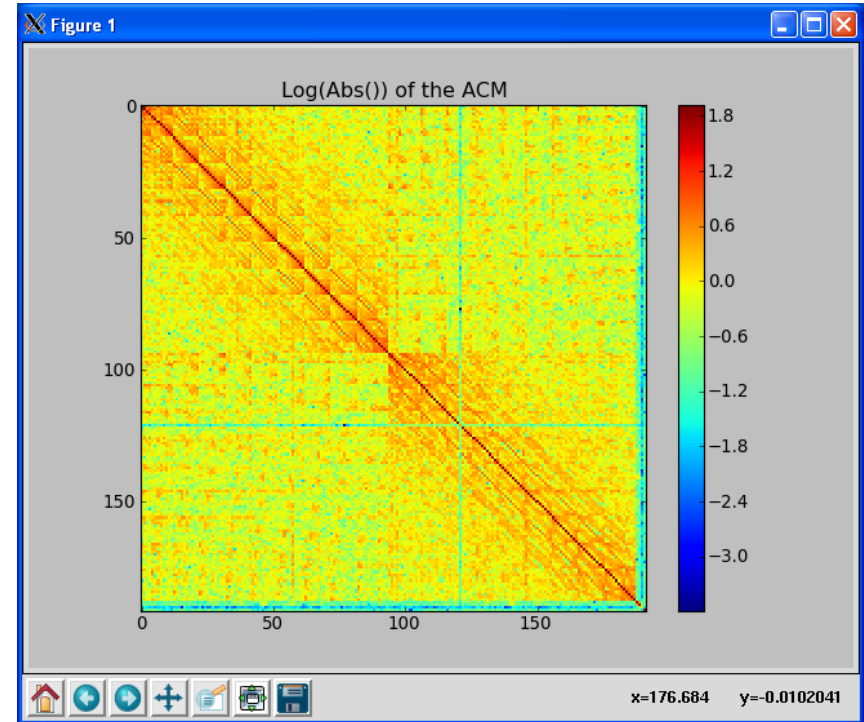
Parkes Test Facility

Characterising the ASKAP Phased Array Feed

- Ongoing effort to use 12m PAF + 64m SPF to measure key properties of our PAFs and gain beam-forming experience
- Full 12m system from PAF to beamformer present at Parkes
 - Only processing 64 x 1 MHz channels (“Parkes Firmware”)
- 64m treated as another PAF element, with delay tracking
 - Connected to PAF conversion system by RF over fibre link (ADE)
- Testing beam shapes, weight algorithms, weight stability, etc.
 - High S/N provided by correlation with 64m is very helpful
- Working primarily with Array Covariance Matrix data
 - Provides all information about performance of PAF
 - Overkill for beamforming, but essential for system verification

Array Covariance Matrices

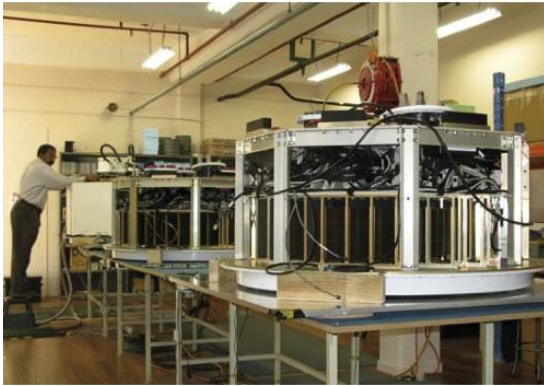
- Parkes firmware in beamformer calculates correlation of every PAF element with all others
- FITS-based storage method
- Python library for analysis
- 1-sec time resolution
- One ACM per frequency channel
- High information content
 - Y-factor measurements
 - Time-series extraction
 - Formation of beams
 - Element stability analysis
 - Hardware diagnostics



BETA System Status Report

BETA Hardware

- Next two PAFs undergoing final assembly in Marsfield
 - All LNAs, gain cards and monitoring electronics have been tested and verified
 - Enclosures will undergo final pressure testing this week
 - PAFs and equipment should arrive at MRO by the end of May
- Minor upgrades to existing pedestal systems underway
 - Operating antennas 1, 3 & 6 has provided valuable experience
- RF cables installed in Antennas 8 & 9, partially complete in 15
 - Pedestal racks and electronics will be delivered later, equipment still being tested and used for firmware development in Marsfield
- BETA box beamformers and compute cluster fully operational
- Hardware correlator may be ready mid-year
 - Planned for installation in central site rather than BETA box

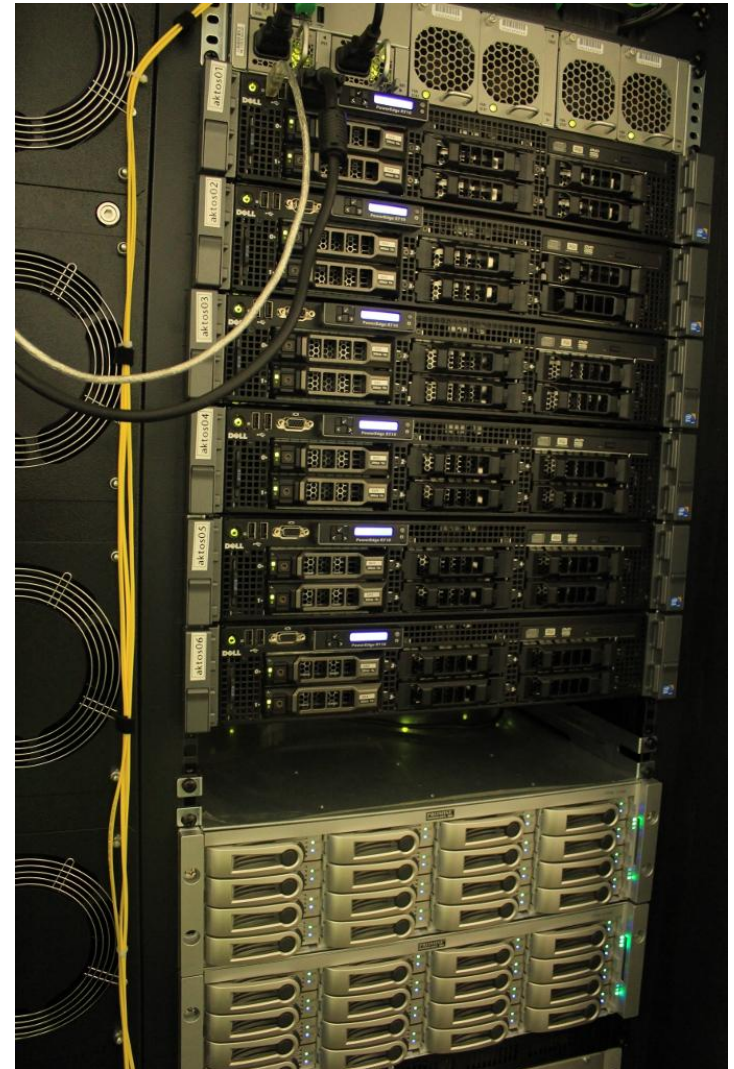


BETA Firmware

- Presently using “Parkes” firmware in BETA beamformers
 - Only 64 of 300 individual 1 MHz channels are beamformed
- Full-band beamformer firmware has been difficult to fit into the FPGA resources on ASKAP Mk I DSP boards
 - Up to 4/5 of the total bandwidth has been achieved in the laboratory, new ACM logic seems to have solved most of the problems
 - Aiming for stage 2 deployment (central site) but may be ready sooner
- High-speed data packet transfer between beamformer and correlator now tested and verified in laboratory
- Work still required to ensure synchronisation of data streams reaching the correlator inputs

BETA Software

- Telescope Operating System
 - Remote control and monitoring crucial for safe extended operation
 - Rapid progress, testing new alarm handler and unified engineering GUI suite this week
- Software Correlator
 - Using raw data capture directly from beamformer cards
 - Allows early interferometry, can be used to verify full correlator
 - Duty cycle limited by data transfer rates over “slow” network link
 - Only 16 MHz, at most 18 beams



MRO Infrastructure

- 1 Gbit fibre link to MRO is now active
 - Expecting to progress towards a model of remote commissioning, monitoring and operation over the next few months
- Infrastructure works largely complete (roads, cables, etc.)
 - Power station still some way off, intermittent interruptions until then
- All antennas on site, 19 complete, 15 partial, 2 still in crates
- Central building undergoing final testing
 - BETA box hardware will remain until the central site array is operational

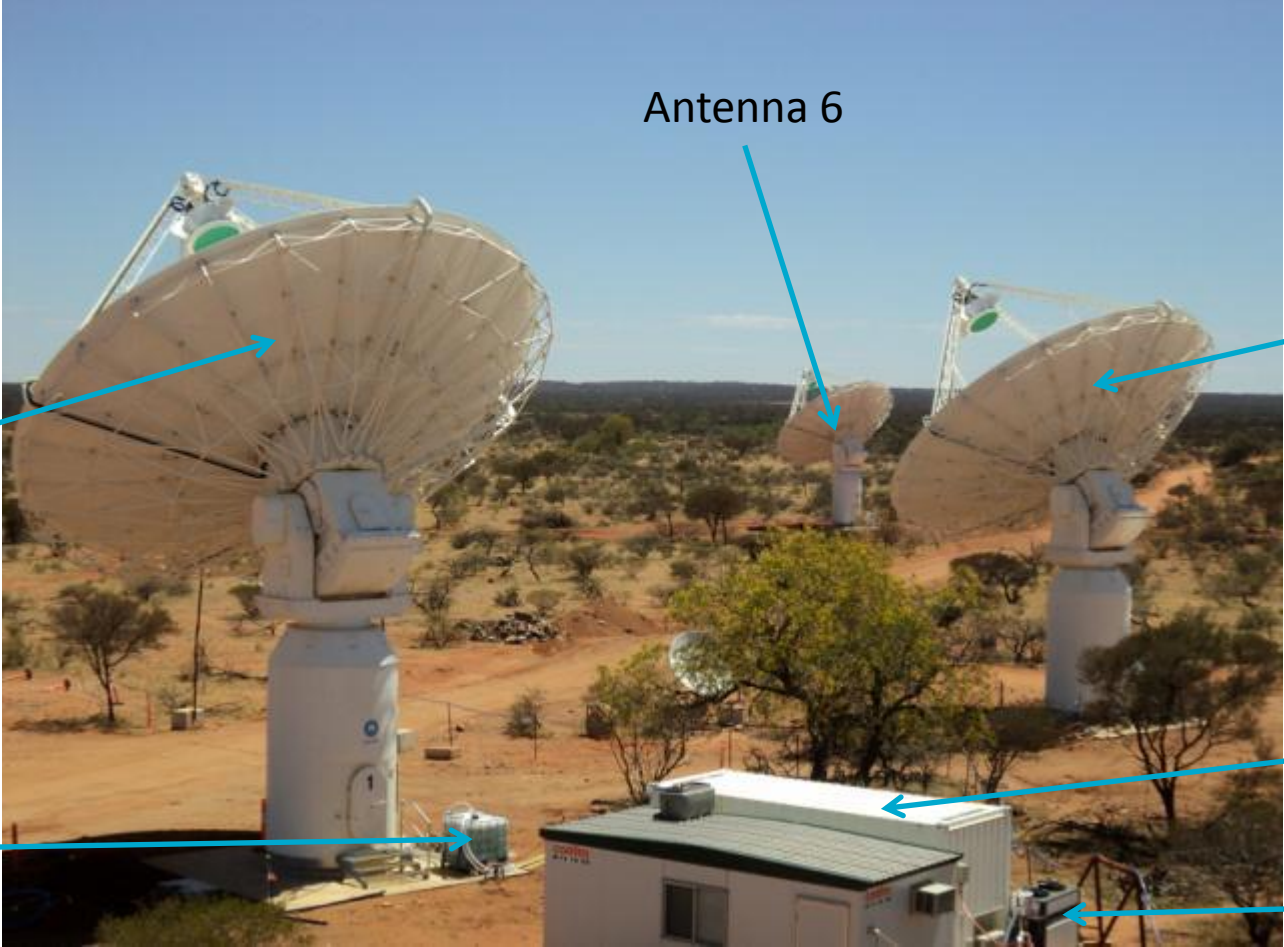


2012 Commissioning Plan

The Role of BETA

- BETA is primarily an Engineering Test instrument
 - Focus on understanding how to make the best images with an array of PAFs
 - Likely to be an iterative process of refinement
 - Manual investigation of beamforming techniques will eventually give rise to automated procedures for use on a larger array
- Some early science may be possible once operational procedures have been established
- Staged deployment of BETA allows for refinement of acceptance and commissioning test strategies
- Detailed commissioning plan is being formulated

Stage 1 Deployment - BETA Box



Antenna 1

Antenna 6

Antenna 3

Cold Water

BETA Box

Chiller



Verification of Installed Components

- Commissioning activities overlap with the final stages of hardware subsystem installation
 - Comprehensive system tests require use of full control system software
- Logged testing of all key hardware components using a combination of manual and scripted measurements
 - Confirm that all systems are operational
- Extended “burn-in” phase to establish system reliability
- Characterisation of required maintenance tasks
- Development of fault-finding procedures
- Identification of any deficiencies that only arise in the field

On-Sky Tests, Towards Science Readiness

- Long-term tracking of sources with sky-mount antenna
- Phase closure with three phased array feeds, bore-sight beams
- Baseline vector verification, delay tracking tests
- First astronomical imaging with software correlator
 - Cascading levels of complexity, starting with point source and single beam, leading up to ATCA reference fields with multiple beams
- Provision of simple measurement sets for pipeline testing
- Analysis of beam shapes and stability, weighting schemes

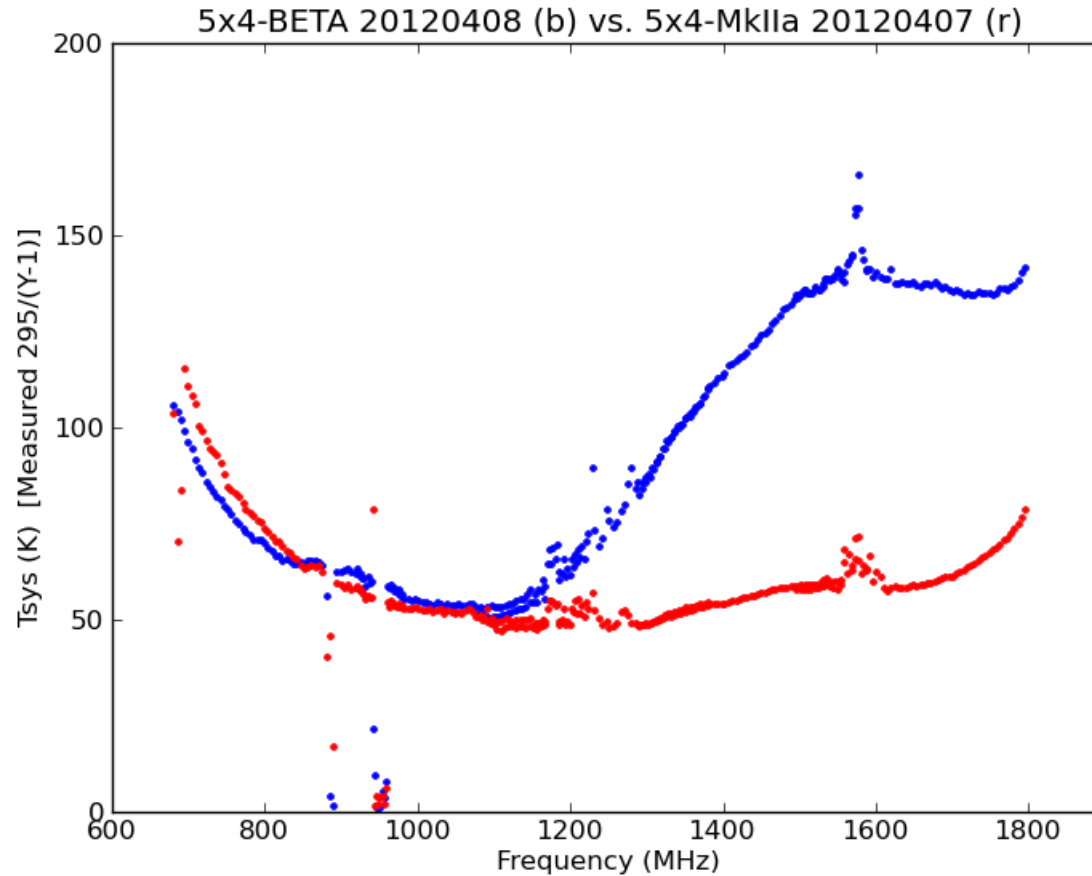
- SCOM-2 involvement likely to begin during this phase (September)

ASKAP Design Enhancements

Latest Developments

- Further \$4 million funding secured for 6 more ADE systems
 - Brings the total to 6 Mk I and 12 ADE systems
- Ongoing discussion about configuration of the 12 ADE antennas
 - Conflicting baseline distribution preferences among SSTs
- ADE Critical Design Review (CDR) scheduled for late June
- Expect first demonstration ADE systems in August
 - RF over fibre direct from PAF to central site building (no pedestal racks)
 - PAF cooled by heat-pipe / Peltier combination (no antenna water chiller)
 - DSP systems based on latest generation FPGAs, less reliant on 3rd party telecommunications backplanes
- Updated PAF element design with improved Tsys in high band
- Deployment of first ADE system to MRO in 2013

Mk II PAF Surface Design



Thank you

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