



ATUC ASKAP Update

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6th June 2017

CSIRO ASTRONOMY AND SPACE SCIENCE

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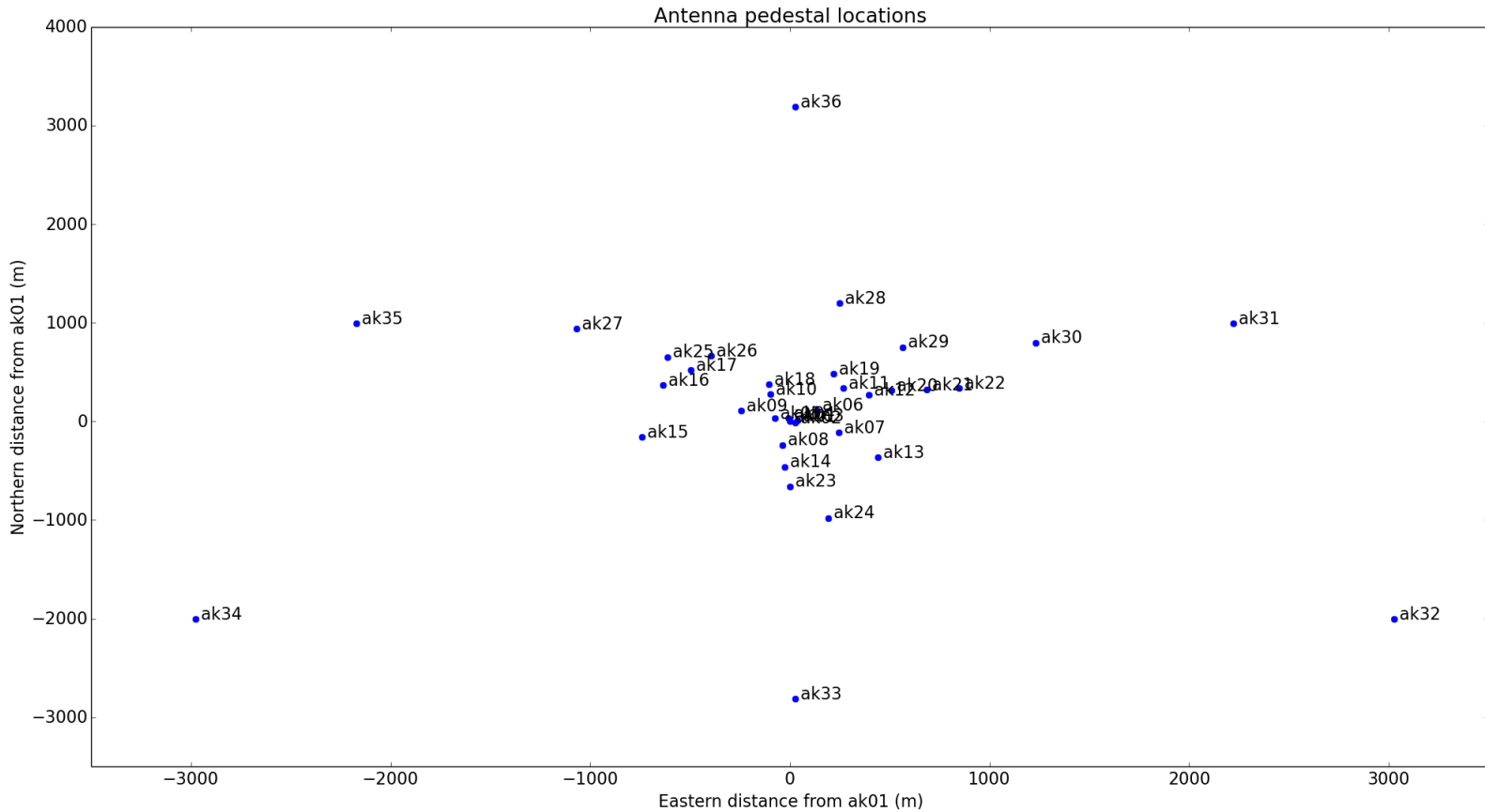
Installation progress

- 30 antennas have PAFs installed (most with ODCs)
 - The remaining 6 are part of the “upgrade project” and are currently under construction in Marsfield, due for installation by the end of September
- 22 antennas have working digital backend systems
 - This includes timing, digitisers and beamformers
 - Some hardware still being assembled, some delivered hardware requires rework, several in-system failures
- 5 correlator blocks installed (48 MHz bandwidth each)
 - One additional block is being used as a test platform in Marsfield
- Horizon Power have commissioned their hybrid station and are now supplying the MRO with electricity

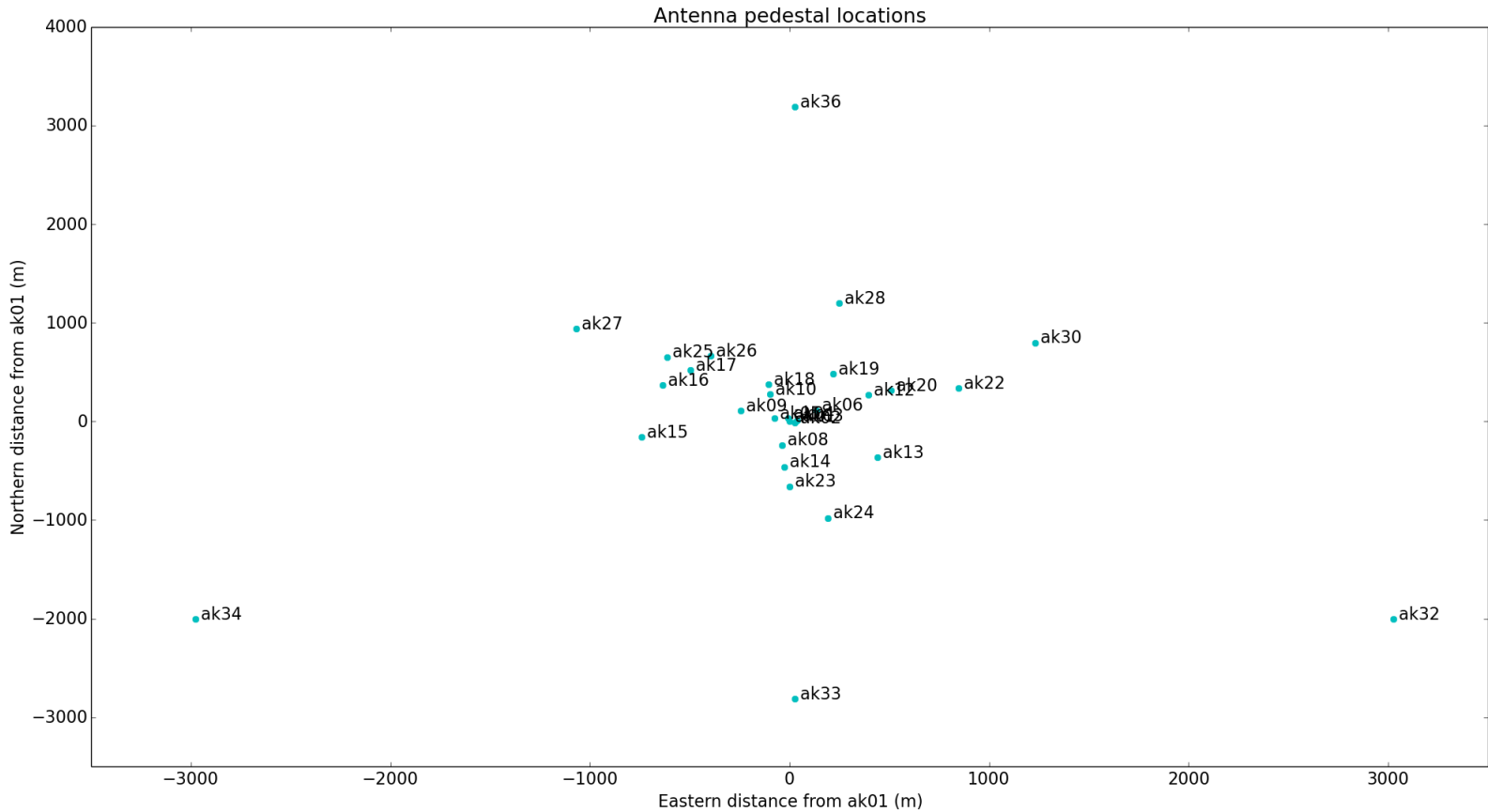
Installation photos



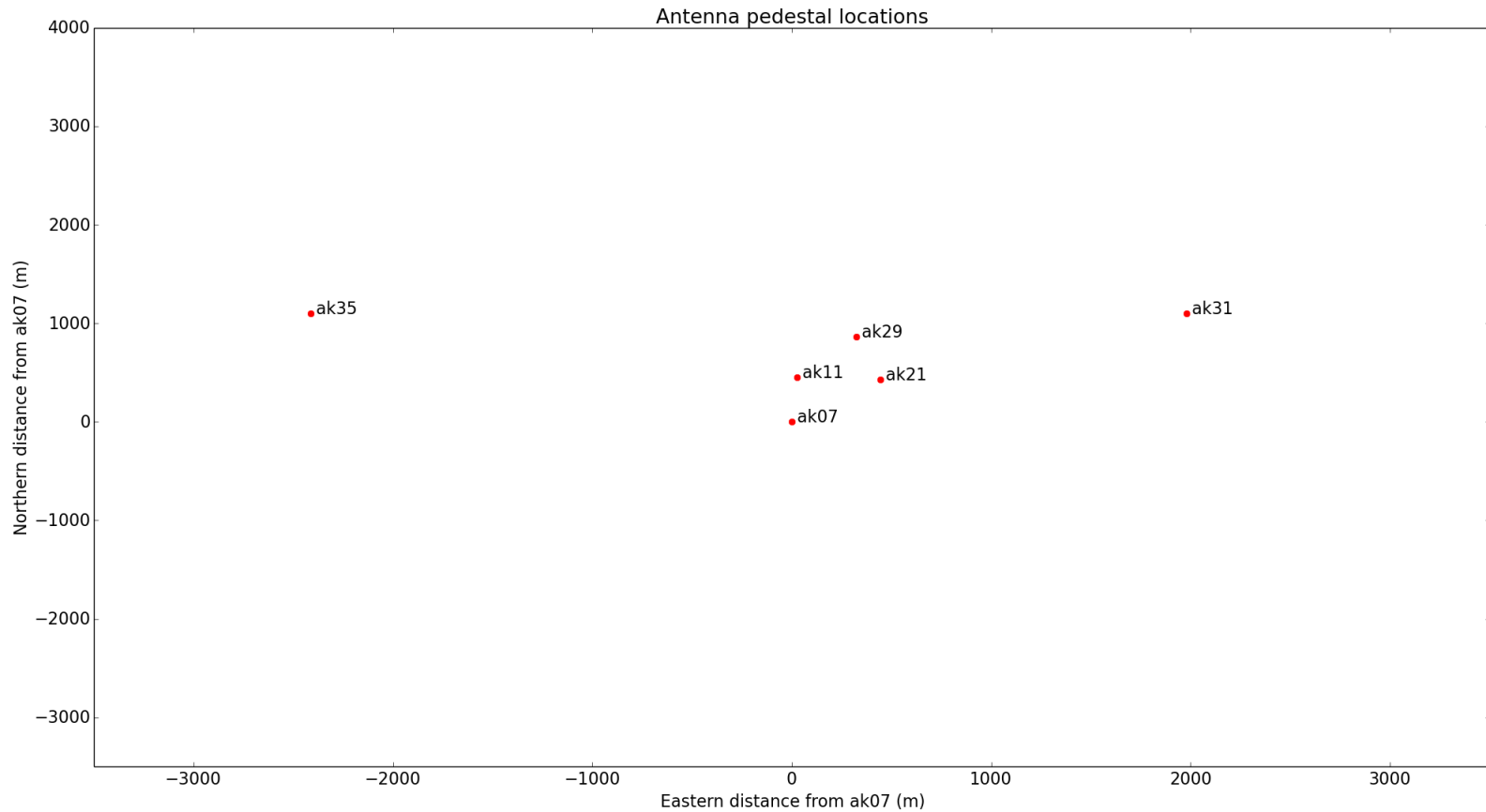
Antenna pedestal locations



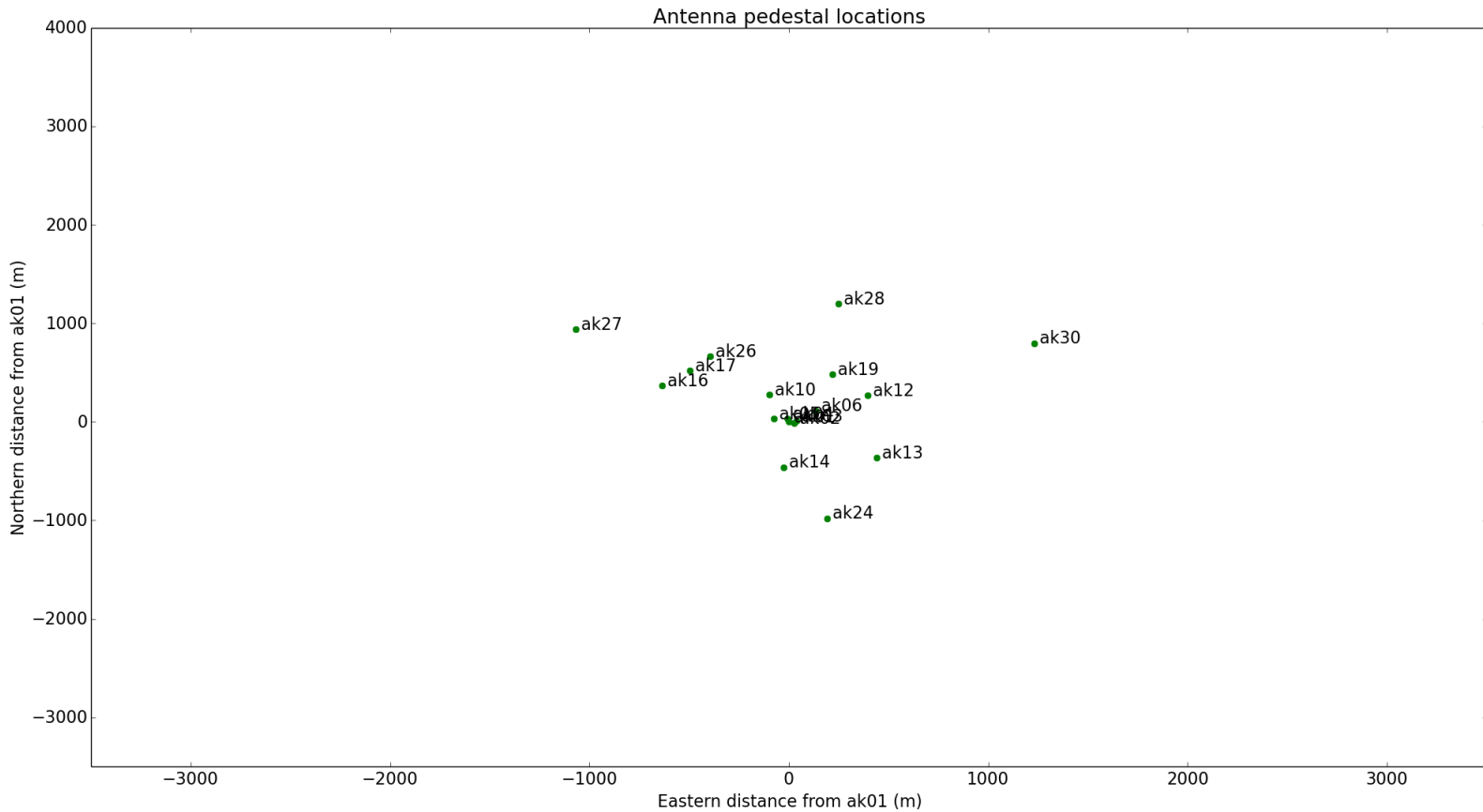
Antennas with PAFs



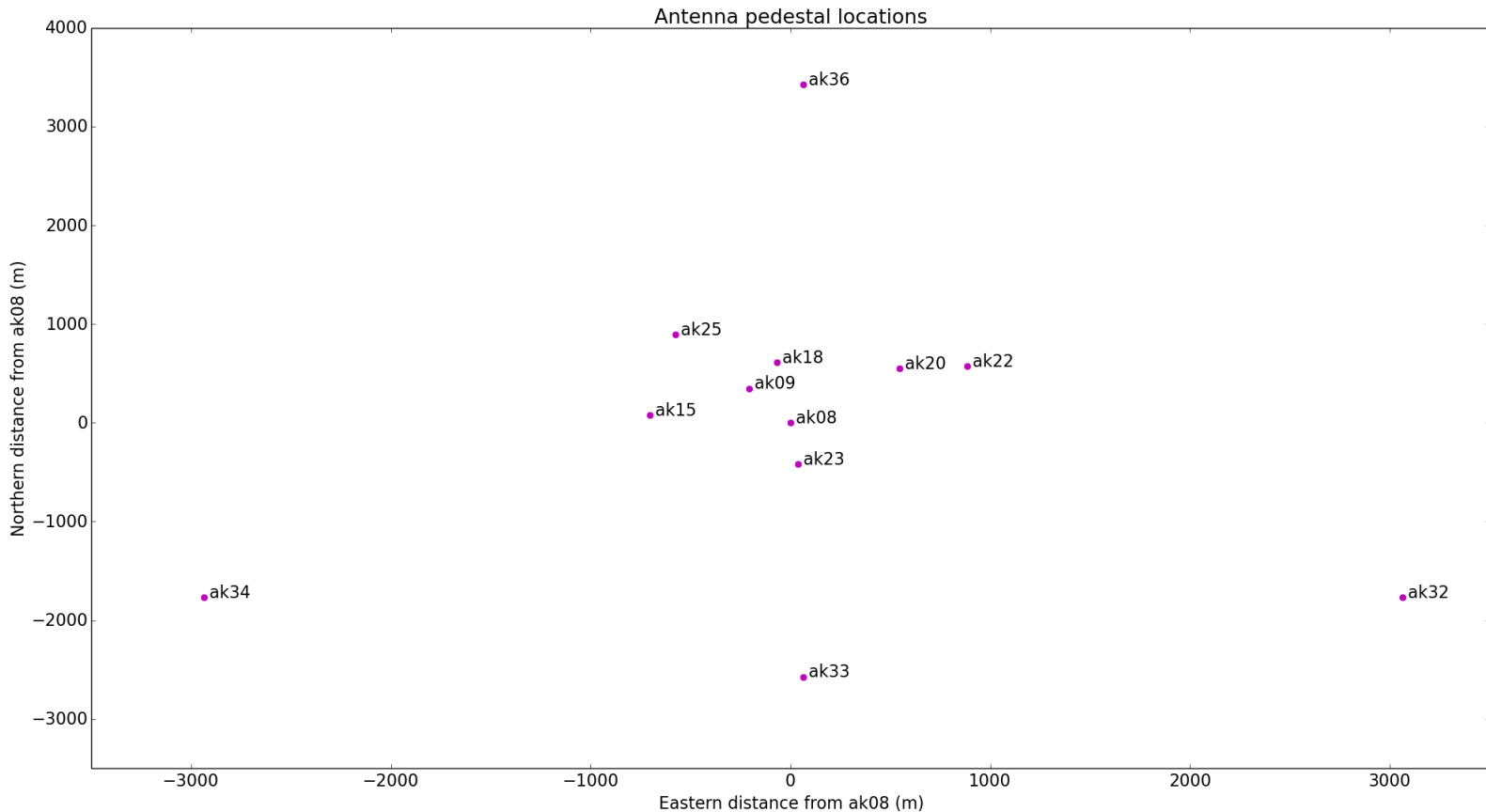
Antennas without PAFs



Antennas in the operational array



Antennas undergoing acceptance tests



Commissioning report

- Acceptance tests of individual antennas are proceeding smoothly
 - All 30 PAFs have been powered up and soak tested
 - Signal integrity and routing checks complete where possible
 - Several PAF power & control system issues identified, now largely understood
- Integration of new antennas into the array is proving more difficult
 - Alignment of signals at correlator input hard to maintain as the array expands
 - Missing output data packets from the correlator
 - Inadequate feedback of error conditions
 - Performance of disk I/O during real-time data ingest at Pawsey
- The current priority is on addressing the above engineering issues

Operations report

- Early science was planned for an array of 12 antennas operating at full bandwidth (300 MHz) with 36 beams
- At the end of 2016 we had a brief window of a few weeks when stable operation on this scale was possible
 - Several data sets were obtained, all at centre frequencies around 1400 MHz with 18.5 kHz channels and footprint interleaving done on successive nights
 - 48 MHz bandwidth 30-beam data on the LMC (AS032)
 - 48 MHz bandwidth 36-beam data on NGC 7232 (AS035)
 - 144-192 MHz bandwidth 36-beam data on the GAMA23 field (AS034)
 - 192 MHz bandwidth 36-beam data on Fornax, Dorado & M83 fields (AS035)
- These data are still being actively investigated by ACES
 - Development of the science data pipeline is progressing well
 - Lack of new data does not (yet) appear to be holding up other work

Operations report

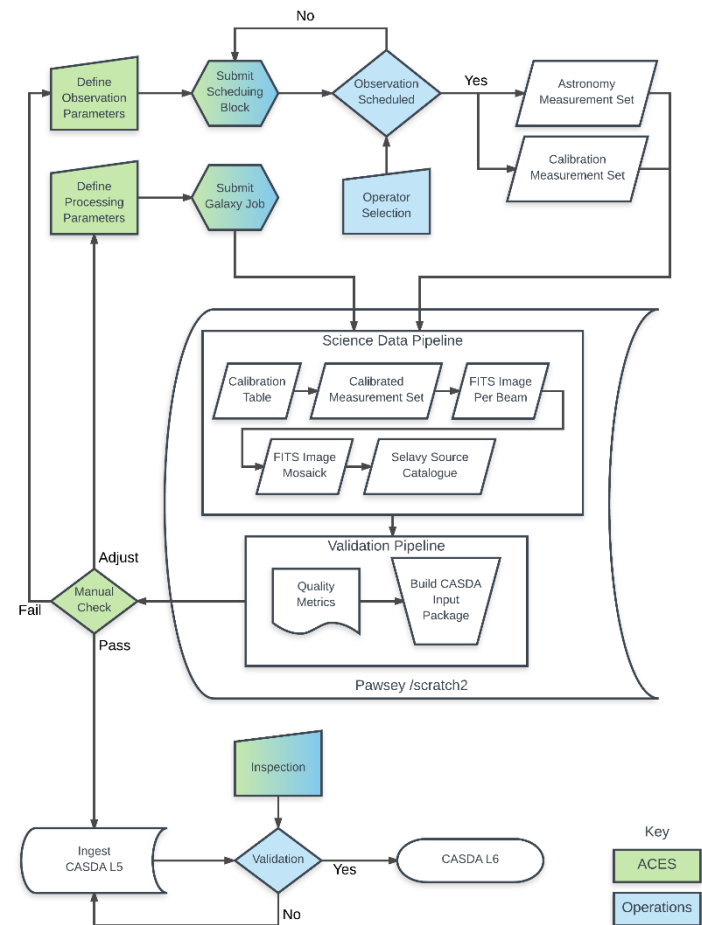
- We also recorded single-beam data on several HI absorption targets in early 2017
 - Single beam operations are less of a strain on I/O rates and disk space
- CRAFT have been able to use an incoherent filterbank mode (without the correlator) to do single-dish fast transient searching
 - At last count, three new FRBs have been detected
- The latest results from ACES / SST processing of early science data will be presented by others this afternoon

Pawsey report

- Quotas on /scratch2 and deletion of archived scheduling blocks seem to have addressed most space-related problems for now
- New /astro filesystem is operational
 - Dedicated to real time data capture (avoiding multi-user load issues)
 - Tests meet vendor write speed specifications, but writing measurement sets is still significantly slower than a single file
 - Pawsey are investigating the creation of a loopback device to trick the filesystem into handling measurement sets like a single file
- Intermediate science data pipeline products are still being written to /scratch2, but this system will be decommissioned by year's end
 - The computing group are formulating a longer-term plan with Pawsey

Early science operations model

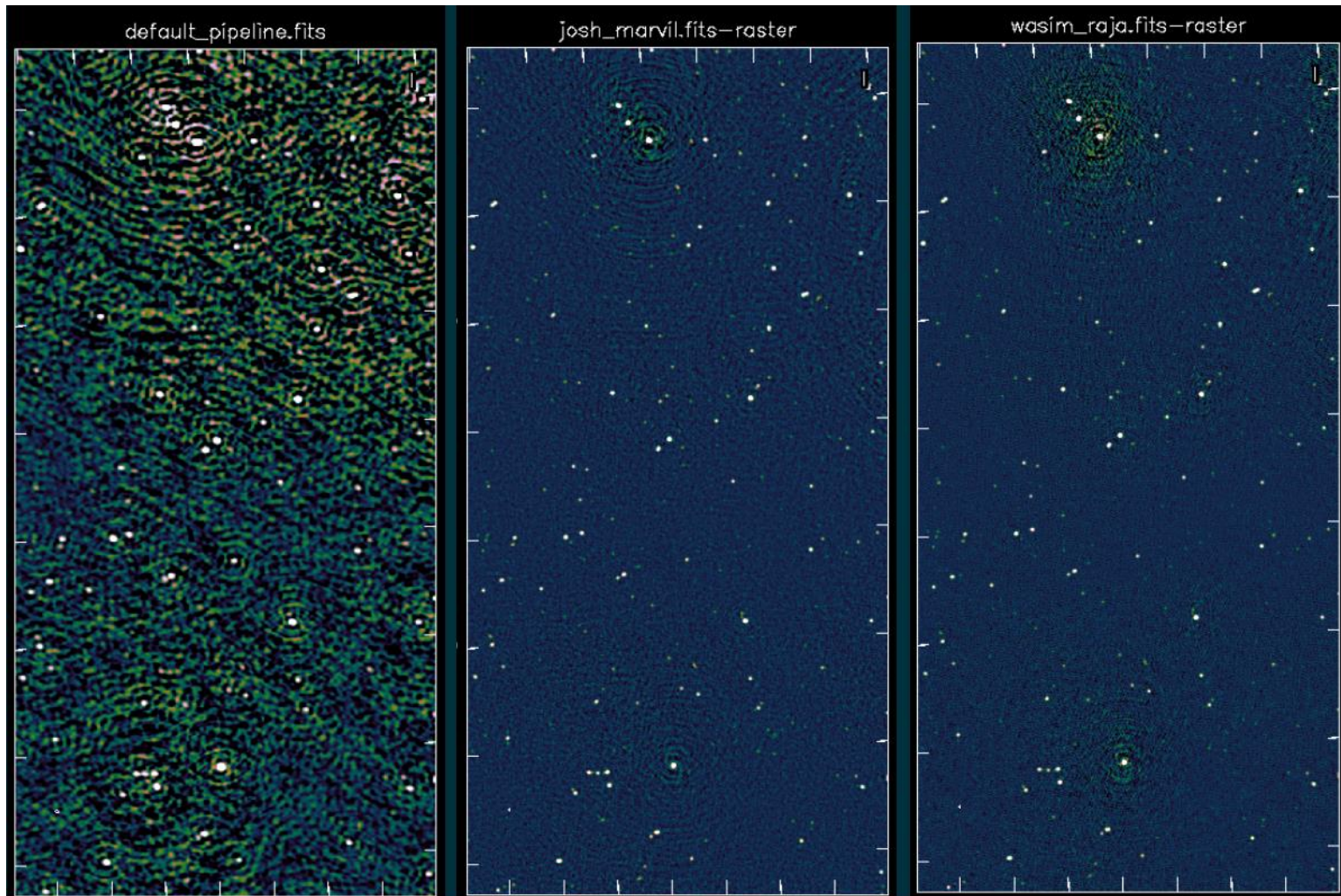
- Early science enables testing of pipeline components
 - Everything from observation scheduling to data archiving
 - Feedback and iteration are crucial
- Several ACES/SST working groups have been established
 - Continuum data processing
 - Spectral line data processing
 - Beam forming and characterisation
 - Polarisation calibration



Science data pipeline development

- Much activity this year has been devoted to improving the ASKAP science data pipeline using the observations that we have in hand
 - This has been a joint effort between ACES, SSTs and CASS computing group
- The goal is to tune the default processing parameters to a point where it is possible to get a high-quality image on the first pass
 - Right now we have the luxury of being able to try multiple processing passes with different parameters (unlike the final real-time pipeline)
- Calibration is still being done using per-beam pointing
 - A bandpass calibrator is observed in every beam in turn rather than using a global sky model to solve for the instrumental parameters

Imaging pipeline parameter tuning



CASDA pilot data release

- ACES have selected specific test data sets to use for pipeline tuning and performance analysis
 - e.g. SB 2338, 12 hrs on NGC7232 with 48 MHz bandwidth and 36 beams
- These well-studied observations will be used as a pilot for public release via CASDA in July
 - Detailed discussions between ACES and the CASDA development team have led to revised quality metric requirements that will be implemented soon
- Data are initially uploaded to CASDA as “level 5” products that must be validated for public release at “level 6”
 - The validation process is currently under discussion and will likely involve input from CASS, ACES and SST members

Beamforming developments

- The unique flexibility of our phased array feeds comes at the cost of increased complexity in operations
- One of the ACES working groups is investigating the properties of our formed beams and helping the computing group to develop a software management framework for beam weights
 - Offering pre-defined “footprints” and ways to build new ones
 - Availability of a standard Max S/N automatic beamforming system
 - Development of additional algorithms with alternative optimisations
 - Association of beam weights with on-dish calibration data for stabilisation
 - Association of beam weight metadata with astronomy archives
 - Automatic reporting of beam quality using various metrics

Scheduling and planning

- Apr 2018: ADE-18 (array release 3)
- Dec 2018: ADE-36 (array release 4)
 - Commencement of full science operations in basic modes
- Jun 2019 - Integration and verification of extended modes
 - Full polarization, 10" postage stamps, transient and zoom mode imaging
- Survey speed likely to be 30-50% slower than original specification
- Commensal observing may pose more challenges than expected
 - Particularly if the observing strategies / configurations vary by project
- Revised allocation of survey time will be planned on a similar timescale to the array releases above

*We acknowledge the Wajarri Yamatji people
as the traditional owners of the Murchison
Radio-astronomy Observatory site*

Thank you

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