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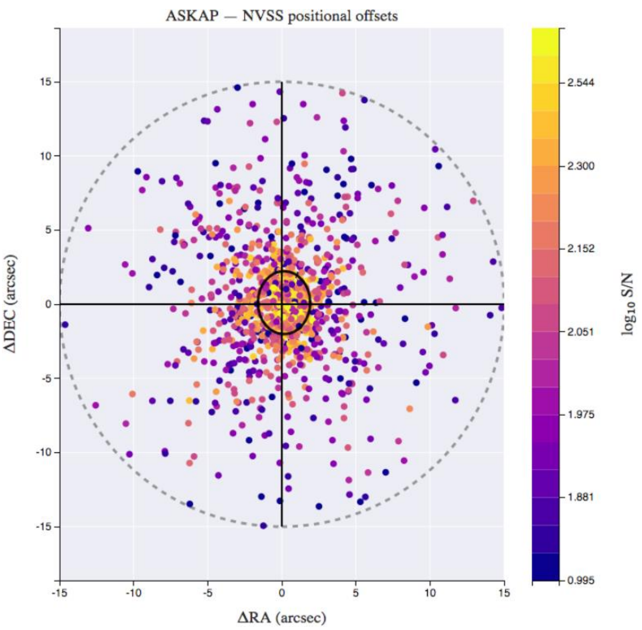
ASKAP Commissioning Update, February 2018

In this issue, we confirm that source positions are now consistent with existing catalogues, give a progress report on fringe rotator testing, announce commencement of an EMU pilot survey and describe a new storm monitoring system for the MRO

Position offset solution confirmed

As we reported in ASKAP news, we now have confirmation that images made after last year's changes to the delay tracking system (described in detail in the previous issue) are consistent with existing source catalogues (see figure below). This gives us much more confidence in the system as we continue to develop the fringe rotation module.



Plot of source position offsets with respect to NVSS from a recent ASKAP image after delay tracking improvements

Fringe rotator system commissioning

As we described in the previous issue, one of the primary goals right now is the completion and integration of our final fringe tracking system. This should remove a major performance bottleneck in the ingest pipeline and reduce the number of visibilities that need to be flagged.

Testing of the new CALC-based delay prediction system is well underway on a partial hardware platform in the Marsfield workshop. Low-level tests of the accuracy of the delay tracking firmware have been completed, revealing some problems in the existing software interface that are being addressed before the commencement of tests on the full system using astronomical sources.

We have held two major workshop sessions across several engineering teams to discuss the timing of the fringe rotator parameter uploads in detail. It is important to ensure that these occur on correlator cycle boundaries to avoid the need for flagging. This discussion also identified a possible improvement in the way that timed events are distributed throughout the digital system. This might reduce the amount of low-level jitter and help improve the dynamic range of the system in the long term.

Observatory tests of the fringe rotator module

Until now we have been busy testing in the Marsfield electronics workshop. However, within the next few weeks we will be moving the system out to the observatory and testing it on astronomical sources.

Initial tests will verify that we can correctly track the delay, phase and rate of a calibrator source on a single baseline with a single beam. More advanced tests will then check whether we are correctly tracking the phase centre of each individual beam and whether the metadata from the new control system are being correctly merged into the visibility data and the final measurement set.

Once all these low-level tests are complete, we will make new images of several early science target fields and use the image quality validation pipeline to verify that the new system is performing within specification.

EMU pilot cosmology survey

Earlier this year we completed observations of WALLABY's deep spectral line survey as described in the ASKAP early science plan. This involved roughly 170 hours on each of 4 target fields using all 36 beams at a frequency of 1.4 GHz.

However, the continuum early science survey component has been awaiting successful validation of continuum images from smaller pilot fields. Default imaging pipeline parameters have struggled with broad-band data, but refinements over time and the increased UV coverage of 16 antennas in the main array have improved the situation. While there is still much work to be done in primary beam correction and calibration, there is also a need to scale up the array with additional antennas once their electronics are installed towards the middle of the year. Meeting the release schedule for an 18 -antenna array means that we will not be able to keep raw visibility data from all our observations for much longer.

Running a pilot survey prior to this transition is important to test various aspects of the system, including our ability to mosaic larger areas. It is also a very useful test of our operational procedures and scheduling system.

EMU and the ACES team therefore decided to begin a reduced-scope continuum pilot survey using only one 240 MHz-wide band, focusing on ASKAP's low-frequency 864 MHz mode. With integrations of 200 minutes, such a survey will be deep enough for cosmological studies and the field of interest was designed to overlap with the Dark Energy Survey. Covering a rectangular area in equatorial coordinates, this field occupies roughly 2000 square degrees between RA 20:30 and 05:30 and Dec -60 to -45.

Planning a wide-area pilot survey

One of the first challenges was in deciding how to cover this area with uniform sensitivity given the standard square_6x6 beam footprint. Existing software is designed to wrap these footprints around great circles on the sky, so we initially produced a plan for a much larger area and then cut out the footprints that fell within the specified region. This created a set of 68 individual pointing centres (see image below). At 864 MHz, it is thought that we will not need to interleave the beam footprints because there is enough overlap within ASKAP's field of view to provide near uniform sensitivity from a single observation.

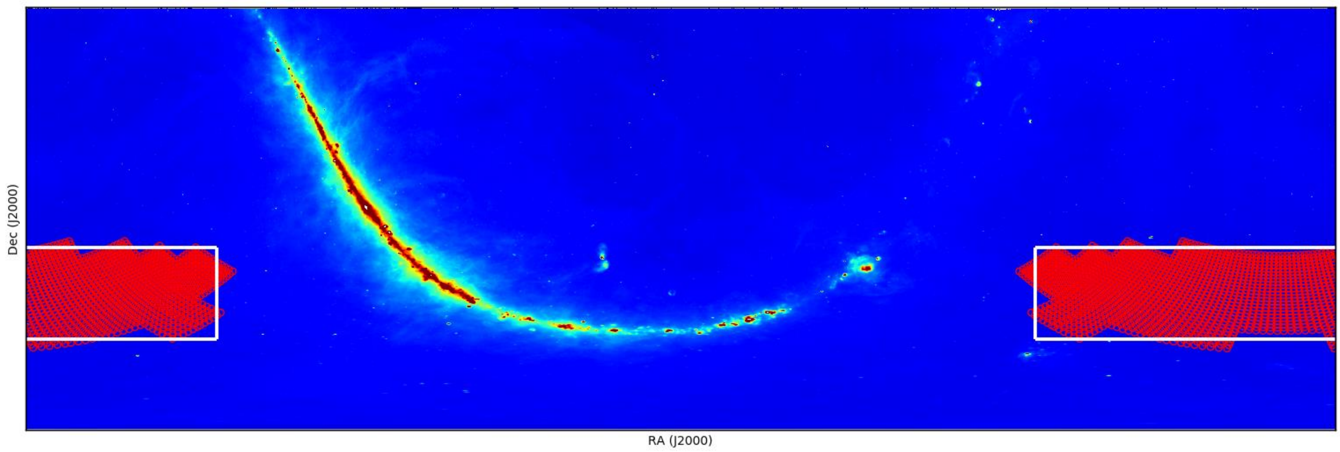
Several of these positions have now been observed and are currently being imaged by members of the EMU team. We look forward to seeing the result!

Storm monitoring at the MRO

Since ASKAP is expected to be a remotely-operated instrument, it is important to ensure that its control system has good situational awareness – particularly with respect to severe thunderstorms which can develop rapidly.

While we have had wind speed monitoring for some time, the MRO covers a large area, where individual anemometer measurements do not provide adequate surveillance. Passing severe weather can trigger microbursts and strong wind gusts that develop more quickly than the antennas can be stowed. Anemometers alone are therefore not good enough to ensure the safety of the telescope.

CSIRO staff member Balthasar Indermühle recently developed a severe weather protection system based on quasi-real-time satellite data capable of detecting severe convective cells and using other meteorological metrics to accurately predict and observe the approach of potentially harmful conditions. This will help to ensure the safety of both hardware and personnel.



EMU cosmology survey region (white box) shown against a background of the Milky Way using CHIPASS data. Red circles indicate the position of each ASKAP beam for the planned survey.

CONTACT US
t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

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FOR FURTHER INFORMATION
CSIRO Astronomy and Space Science
Aidan Hotan
t +61 8 6436 8543
e aidan.hotan@csiro.au
w www.csiro.au/askap