ASKAP Commissioning Update, March 2019

In this issue, we report successful integration of the last 8 antennas into ASKAP. We have now obtained fringes to all 36 antennas and are conducting test observations with the full array before commencing pilot surveys.

Antenna integration complete

After many years of development, construction and commissioning, all 36 of ASKAP's antennas are now fitted with Mk II phased array feeds, digital signal processors and on-dish calibration systems.

On the 22nd of February 2019 we pointed all 36 antennas at an astronomical source and obtained fringes across the entire array, as shown below.

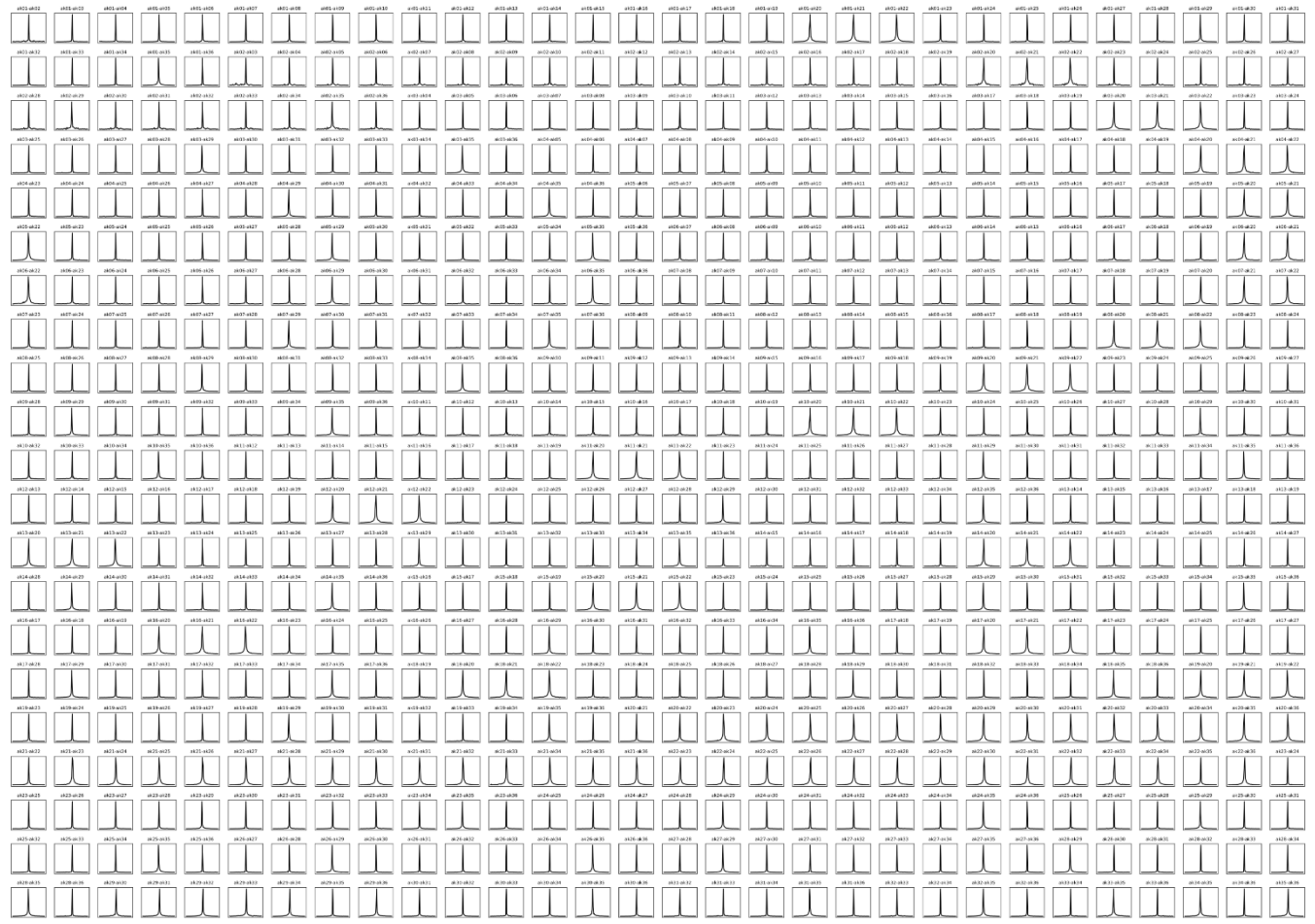
The next 10 days were spent tracking calibrator sources in order to refine the coordinates of the antennas in preparation for imaging observations.

Antenna position measurements were done using a single beam, but towards the end of the commissioning session we began to observe with all 36 beams and antennas.

Some slight changes were made to the ingest pipeline to support the increased data rate from the full array and we now write 6 measurement sets per beam instead of 4, with 48 MHz of bandwidth in each. In this configuration

First fringes between all 36 ASKAP antennas

February 22nd, 2019: Correlated signal from PKS B1934-638 detected on 630 baselines



360-degree panoramic photograph showing all visible antennas tracking the radio galaxy PKS B1934-638 during the first calibration observations made with the full array

we have demonstrated sustained ingest rates at Pawsey of 1.8 GB per second using 10-second correlator cycles.

ASKAP's control system, beam-forming and observing modes will continue to be developed throughout the lifetime of the instrument. However, the essential modes are now fully operational and we are preparing to conduct the first pilot surveys, which will demonstrate the full capability of the telescope.

Test observations and data processing

Before pilot surveys commence, we are observing a number of test fields as requested by the science teams. These observations will be thoroughly analysed to determine whether ASKAP data meets expectations and will be used to tune pilot survey parameters. Test fields include regions such as GAMA23, 12 and 09, and the Eridanus cluster.

Representatives from each survey science team are working with the ASKAP operations team to process these test data, with the goal of publishing results to the science data archive (CASDA) for distribution. It is hoped that once the pipeline processing parameters have been optimised, we can reduce the time between observation and data release to a few days.

Upgrades to ASKAP's processing pipeline

The ASKAP processing pipeline has received a number of major upgrades during the last few development sprints. This includes the addition of parallel processing (by splitting in time) during the initial calibration and flagging stages, as well as continuum subtraction for spectral line mode. This has improved the performance of these previously serial tasks by nearly an order of magnitude.

In the coming weeks we will ensure that the processing pipeline can produce all the necessary data products required by the science teams for pilot surveys, and update our quality control metrics for the increased sensitivity and resolution of the full array.

Continuum imaging tests

Preliminary continuum images from the full array show improvements in sensitivity and UV coverage as expected from the increased number of antennas. There are still some visible artefacts around bright sources (at a similar level to those present in 28-antenna data) and we are investigating whether these can be removed with careful selection of imaging or calibration parameters.

Zoom mode imaging tests

After the detection of the first masers in zoom mode data reported last month, we have been attempting to make image cubes with 1 kHz frequency resolution. This has proven difficult – especially when attempting to create a high-quality continuum image for subtraction. However, the spectra of individual sources match well with observations made using the Australia Telescope Compact Array. Some work is still required in the imager code to allow barycentric velocity corrections over small channel ranges and we are investigating whether ASKAPsoft could also provide LSR correction as a processing option.

We have found small clusters of corrupted channels in zoom mode data that were not detected in the standard 18.5 kHz mode. The origin of these is being investigated.

The Rapid ASKAP Continuum Survey

Alongside observations requested by the survey science teams we have been conducting tests of the survey strategy for RACS. This observatory project will survey the sky to a much reduced depth compared to the multi-year survey projects, but will provide a wealth of early information and a sky-model that can be used to develop advanced calibration methods.

Our observing strategy involves tiling the sky in declination strips, resulting in a total of over 1000 field centres which will be observed for 10 minutes each. One of the first test runs with 36 antennas reached a 1-sigma sensitivity limit of 250 uJy/beam with interleaved fields. Analysis of the test data should reveal whether or not interleaving is necessary to maximise survey speed and also determine the best beam-spacing parameter to use. We hope to begin observing with the optimal strategy within a month or two, covering the entire visible sky within a few weeks. It may take significantly longer to process the observations and produce science-quality images and catalogues, but we expect that the RACS survey will be ASKAP's first large-scale data release.

FOR FURTHER INFORMATION
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