ASKAP Commissioning Update, June 2019

In this issue, we report on the public release of data from the first science test field observed with the full ASKAP array. We also discuss the planning process for pilot surveys and the criteria for determining when they will begin.

GAMA 23 test field data release

The Galaxy And Mass Assembly (GAMA) fields have been identified as high-value targets by many of the ASKAP survey science teams. They were originally selected to contain a rich number of extra-galactic sources and have already been observed in several wavelength bands. The GAMA fields also tend to be free of extended radio emission from nearby sources.

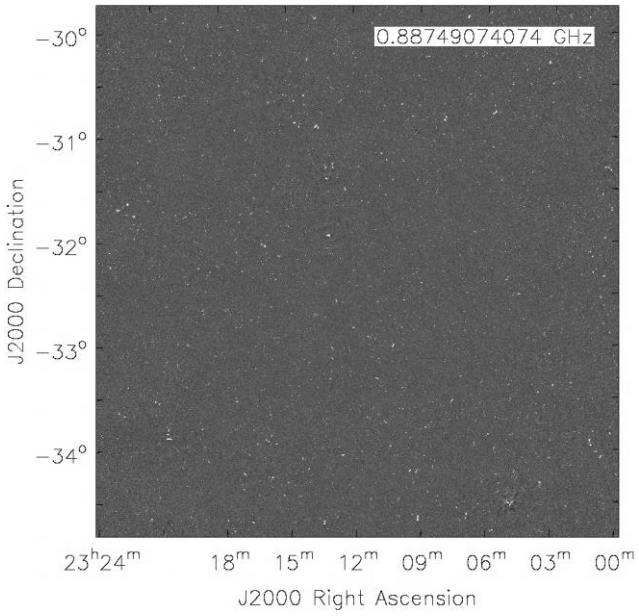
Our first multi-beam observation with the full ASKAP array was of the GAMA23 field in continuum mode with frequency resolution averaged to 1 MHz at the time of data capture. We are also planning spectral line test observations to search for neutral hydrogen in the future.

Observing and data processing

Most of the GAMA23 field fits neatly within two side-by-side ASKAP footprints. We observed these two tiles with the square_6x6 beam footprint over two consecutive nights, for 9 and 10 hours. The observations used a centre frequency of 888 MHz with 288 MHz of bandwidth.

Since these were the first wide-field observations with the full array, it took roughly three months to refine the imaging parameters through iterative processing. We have determined a new optimal image and cell size for the individual beams prior to mosaicking and tuned job distribution across the supercomputer to make more efficient use of each processing node, within memory constraints. We also experimented with various calibration options, settling on a strategy with two loops of phase-only self-calibration like the strategy developed for early science data. These parameters have become the new defaults for continuum observations.

The resulting images have a typical noise background of 37 uJy RMS, which is very close to the thermal noise for robust -0.5 weighting with a small number of antennas flagged due to system faults. Both fields contain roughly 20,000 sources as detected by the Selavy source-finding software package. With the spatial resolution of the full array we now have 215 million pixels over both tiles, making the image difficult to display all at once! To assist with visualisation, we have created an interactive HiPS version that can be viewed online.



Main region of the first GAMA23 field with an intensity scale covering 99.5% of the total range.

Close-up of the second tile, showing a giant radio galaxy in the bottom-right and many others scattered throughout the field.

Quality control and known issues

During the lead-up to pilot surveys, we must manage the conflicting goals of perfecting the instrument and releasing data to the science teams promptly. The CSIRO ASKAP Science Data Archive (CASDA) has three data validation levels, “good”, “bad” and “uncertain”. The GAMA23 data have been released in the uncertain category due to some known issues described below. We feel that it is important to include the wider astronomical community in the process of testing the telescope as soon as possible. The data release is available from CASDA by searching for scheduling block IDs 8132 and 8137.

The first known issue is the presence of imaging artefacts. These typically appear as residuals around strong sources at roughly 1% of the peak flux of the source itself. These are not a major problem in the GAMA23 field due to the lack of bright sources. Artefacts at the 1% level appear in all test observations made so far and are the main factor limiting ASKAP’s dynamic range. They are particularly noticeable in equatorial fields due to the extended PSF.

The second known issue is that the spectral indices quoted in the source catalogue do not match expectations for a field such as GAMA23. The average spectral index derived from the Taylor term images is too negative. This is likely related to how primary beam correction is applied to the higher-order Taylor terms. We have included spectral cubes with 1 MHz resolution in the CASDA data package, so it is possible to compute spectral indices using these as a cross-check.

Pilot survey planning

ASKAP’s pilot survey plan is designed to test the telescope’s readiness to embark on multi-year survey projects. The first step is to ensure that all required operating modes have been implemented and that data can be processed and archived in a timely manner.

Prerequisite test observations

The main requirement for commencement of a pilot survey is successful demonstration of the required observing mode, from data capture through to public availability. For most of the science teams, data processing will be handled by the observatory operations team, so the task is to define an appropriate set of processing parameters for ASKAPsoft and ensure that all required outputs are made available on CASDA.

Test observations are currently underway, with the release of GAMA23 marking the first complete trial for the EMU science team. Spectral line data is proving more challenging to process due to disk space limitations and the need to tune additional parameters. We hope to make the WALLABY Eridanus test field data available in the next few weeks.

Call for pilot survey information

Now that the first test observations are being released, the ASKAP operations team would like to begin planning for pilot survey observations. A request for information has been sent to the science teams and we will be gathering the requested parameters in a new section of the science team confluence page.

Gathering this information now will provide plenty of time for the operations team to assess the feasibility of the requested observing strategies.

ASKAPsoft pipeline developments

The Science Data Processing (SDP) team are actively improving ASKAP’s data processing pipeline. Recent features include a pre-flagging stage that ensures all data flagged by the control system are excluded from both calibration and imaging. Additional work is required to improve the speed and reliability of the mosaicking code and to improve the flagging of bad data in RM synthesis outputs. We are also designing a new validation framework/API that will make quality control more efficient and allow wider access to commonly used image metrics. Suggestions for other improvements should be directed to survey science team ACES representatives.

Science observation guide updates

The ASKAP science observation guide (the user’s manual for astronomers) has been evolving rapidly as the ACES team conduct further tests. The latest version includes updated information on survey speed, field of view estimates, spectral ripple, polarisation calibration and many other topics. This new version should be released within a few days and can be downloaded from the science team confluence pages.

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

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