ASKAP Commissioning Update, November 2019

In this issue, we report on pilot survey progress, the OzSKA meeting, commissioning of the new Pawsey storage buffer and the latest system improvements.

ASKAP pilot survey progress

Pilot surveys continued this month, including the second epoch of an ongoing survey for the Variables And Slow Transients (VAST) team. The VAST pilot is being conducted in a similar mode to the Rapid ASKAP Continuum Survey (RACS) with 12-minute observations of selected fields covering 1/8 of the RACS area. The same area will be re-observed over several epochs to search for sources that change on timescales of months.

With the new disk array at Pawsey, we have also resumed spectral line pilot projects and hope to make more progress on these over the next few weeks. New data for WALLABY (the Hydra field) and FLASH have already been obtained and will be processed after the GASKAP test observation of the Large Magellanic Cloud.

New LIGO follow-up epoch

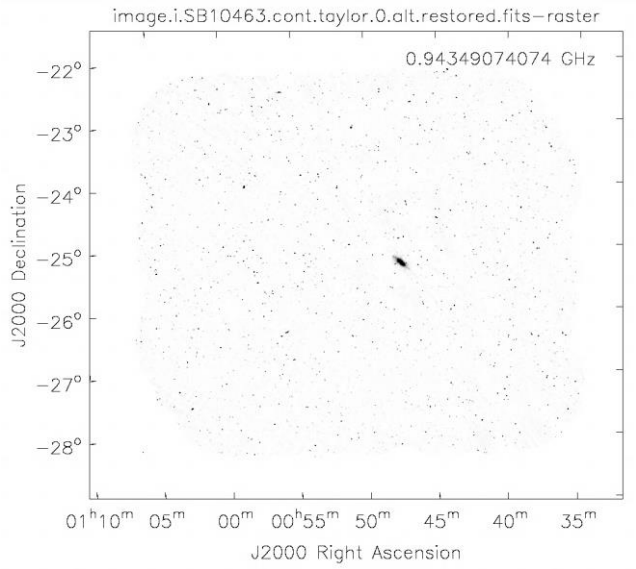
Two months ago, we reported on ASKAP follow-up of the LIGO event S190814bv. Detected in the LIGO O3 campaign, this gravitational wave signal is highly likely to have been caused by the merger of a black hole and a neutron star. Initial ASKAP observations detected a few variable radio sources inside the uncertainty region that have since been classified as active galactic nuclei, most likely not associated with the merger event.

Models for radio emission from such a merger include the possibility of a rise in flux months after the event itself, so we have continued to observe the field. The most recent observation was completed on the 7th of November and is awaiting validation prior to release. All available epochs can be found by searching the CSIRO ASKAP Science Data Archive (CASDA) for project code AS111.

RACS busy week and preparation for release

The third processing pass on data from the first epoch and frequency band of the Rapid ASKAP Continuum Survey (RACS) is nearing completion. Changes to the calibration and imaging parameters have improved image quality in the Galactic plane where there is a large amount of bright, extended emission. We have also observed several replacement fields to fill gaps caused by the Sun and Moon, as well as excessive flagging of bright A-class sources in the original observations.

The team working on RACS data analysis and quality control met in Canberra last week at the Australian National University to discuss progress and plans for the first survey data release. Initially, we intend to post the images of each RACS field to CASDA as level 6 observatory data products. This will be followed by re-mosaicked images of each field that use surrounding data to ensure near-uniform sensitivity and finally a combined source catalogue from the entire survey. We hope to have at least a few of the first images released by the end of the year, with additional data products rolling out in 2020.



ASKAP image of the most recent observation searching for counterparts to LIGO event S190814bv. This is a 10-hour integration at a centre frequency of 944 MHz with a bandwidth of 288 MHz. The field contains NGC 253, visible as a bright extended source slightly to the right of centre

eROSITA collaboration observations

Last month we reported plans to observe the GAMA-09 field in conjunction with eROSITA performance verification (AS112: SWAG-X). The first low-band pass has now been completed at a centre frequency of 888 MHz, with a total of six tiles covering the region. These data were recorded at 18.5 kHz resolution in spectral line mode

and will join the processing queue behind existing pilot survey observations. The resulting data will be made available as soon as possible via public release.

ASKAP at OzSKA

Many of ASKAP's survey science teams reported on results from the early science program and progress on pilot surveys at the OzSKA meeting in Canberra last week. This 2-day event is designed to keep the Australian community informed on the progress of the Square Kilometre Array project. It was extremely encouraging to see the precursor projects producing a wide range of exciting results along with feedback on the commissioning and early science phase, which will hopefully be considered when planning the transition from construction to operations for SKA phase 1. The community has derived a great deal of valuable experience from ASKAP early science, starting back in 2014 with the 6-antenna BETA prototype.

ASKAP-X monthly update

Although much time and effort from the ASKAP-X teams was devoted to commissioning the new Pawsey disk buffer this month, progress was also made on several of the outstanding issues under investigation.

We identified a few specific issues that can cause beam-former weights updates to fail when using the on-dish calibration (ODC) system. These include narrow-band changes that may be related to cross-coupling of the reference signal into other inputs and occasional corruption of the calibration correlator data download. We also found that some of the digital receiver outputs occasionally contain a strong oscillation visible in the coarse filter-bank spectrum.

Although unrelated to the ODC system (the period of the oscillation is much shorter than the effect of the standing wave between the antenna vertex and the feed, which is also present sometimes), the rapid oscillation changes the statistics of the signal and causes the weight update process to fail. The problem seems to occur rarely upon initialisation of the digital receiver and is fixed with a restart, so we will continue to investigate the cause while using the restart work-around to improve operational efficiency in the short term.

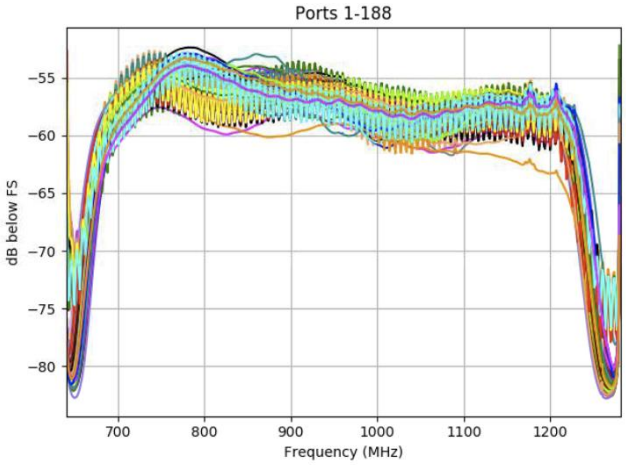


Figure showing the coarse filter-bank spectrum of all 188 active phased array feed ports prior to beam-forming on a single antenna. In rare cases, initialisation of the digital receiver creates an oscillation that corrupts the signal from a few ports

New disk storage buffer operational

Last month we reported that the new ASKAP disk buffer procured by the Pawsey centre had come online. During the following weeks we ran extensive tests to commission observing modes and simultaneous data processing using the new disk array.

The storage system was split into two halves in order to insulate the data capture process from the irregular input/output load that can be created by data processing tasks. Early tests revealed that this partitioning could be overwritten by the act of copying data, due to unintended behaviour of the copy tool. A few of the first data sets were mixed across both partitions and processing these caused observations to fail. The problem was identified with help from Pawsey staff and we have updated procedures to prevent the problem reoccurring.

Tests of simultaneous observing and processing concluded successfully earlier this week and we have therefore resumed spectral line observing to take full advantage of the increased processing space. It will still be necessary to carefully manage resources, but the extra space will allow several data sets to be worked on simultaneously, increasing operational efficiency.

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