ASKAP update for October 2023

This month we report on survey progress, ingest cluster maintenance, the latest CASDA release and several new science data processing software features.

Survey progress report

Survey operations continued during the past month, though we have yet to resume spectral line observations. Some of the work described in the rest of this newsletter may help reduce the data backlog.

SST	Observed	Awaiting Validation	Released	Rejected
EMU	114	2	97	15
WALLABY	47	2	17	28
POSSUM	161	6	119	36
VAST	1721	50	1635	36
FLASH	58	5	23	30

Table 1: Survey progress as of 09-10-2023

Table 1 (above) shows progress since the beginning of full survey operations. A recently updated real-time ducted RFI metric should improve the quality of FLASH data products in future, and work is planned to include ducting alerts in observation logs (in the meantime, data is being made available to teams via SAURON). We are also working on sky-model calibration and source peeling with the goal of improving astrometry and reducing artefact levels overall. We are still planning to switch WALLABY continuum data validation responsibilities over to EMU in the hope that we can preserve some of the data from rejected fields in future.

The DINGO team have organised independent storage space for spectral line visibilities with which to conduct stacking experiments, reducing the urgency of implementing new file compression technology. We are currently discussing suitable observing constraints for DINGO, which may include a night-only restriction due to the likely severe impact of solar interference on DINGO's capacity to integrate for 100 hours or more.

GASKAP-OH have made a final selection of their preferred velocity correction method and are now seeking new data to cross-check maser polarisation properties against the ATCA. We also have one viable new observation for GASKAP-HI on disk. With these latest developments we are close to getting all 9 of the Survey Science Projects underway.

New data archive features

Version 1.23 of CASDA was released on the 13th of October, including a major upgrade to the user interface, the ability to remotely visualise data cubes with CARTA, and a host of other improvements. Full details can be found on the CASDA web page.

Pawsey data ingest filesystem upgrade

On October 9th, the Pawsey Supercomputing Research Centre began upgrading the software and firmware on the fast storage system attached to the ASKAP ingest cluster. While the total amount of storage has not changed, the new drivers should ensure ongoing compatibility and stability. The work concluded on the 12th of October, and we are currently bringing the telescope back online. Observing and processing were not possible during the upgrade, but we did manage to conduct testing on other parts of the telescope and release new software for the control system and science data processing pipeline.

Processing workflow improvements

As part of a recent internal informal review of the science processing operations workflow, we have identified a few key challenges to address.

Our workflow management software services run on ingest cluster machines that have no visibility of the Setonix supercomputer's /scratch space. We use /scratch to store output from the processing pipeline prior to archiving, since it has much better parallel write performance than /askapbuffer. Although there is a large amount of raw storage space on /scratch, the number of files that can be created is limited, and we reach capacity after about a dozen scheduling blocks. The current

solution is to curate files by hand, deleting completed directories after the data have been archived. We are exploring ways to give our data manager software visibility of /scratch or allow it to issue remote management commands so that processing can continue indefinitely without human intervention.

We are also testing a change to the POSSUM validation workflow that involves packing spectra from individual beams into a single FITS file. The change should greatly reduce the number of files used per scheduling block. The new approach will have no impact on data indexed in CASDA since validation spectra are only stored in an auxiliary .tar file, but we may extend the feature to spectra intended for science use in future.

New processing software features

Alongside survey operations, the science data processing team are working to optimise the core ASKAPsoft tools with the goal of improving data quality and throughput. Some of the latest features will be incorporated into the processing pipeline soon.

Polarisation calibration improvements

After POSSUM reported excessive off-axis leakage in one of the survey's polar cap fields (which are observed with a non-standard roll axis angle) we uncovered two problems with the way holography is applied to Stokes Q, U and V during linear mosaicking. While we have been correctly rotating the Stokes I holography beam maps to match the field orientation, the same rotation was not applied to Q, U and V. This bug has been corrected in askapsoft/1.13.0 and is currently being tested on science data.

While investigating this issue, we uncovered a more subtle problem with the normalisation of Q, U and V holography data, resulting from an incorrect assumption about the normalisation state upon completion of the holography processing pipeline. This may have resulted in double-correction of the on-axis leakage component, contributing to the lack of improvement in Stokes V properties after holography application. Fixing these issues may improve the polarisation characteristics of all future observations, especially those in the polar cap region.

Faster and more efficient w-projection

The existing w-projection scheme that ASKAPsoft uses to correct for wide-field imaging artefacts runs as a serial process, contributing to high memory usage due to repeated caching of the same information. This limits the oversampling and support parameters that can be used on Setonix, which has a high number of cores per node. Standard continuum processing (such as for EMU) has used the best set of parameters that would reliably fit on Setonix, but these are still suboptimal in certain situations (See Figure 1).

We now have an alternative MPI-enabled w-projection scheme that shares common resources over multiple threads. This should reduce resource requirements for the current set of w-projection parameters and provide room to improve the widefield correction without exceeding system resources. We are testing the required pipeline changes with the existing Survey Science Project processing parameters to ensure backwards compatibility. Once initial tests are complete, we will determine a new recommended set of w-projection parameters and update the survey processing strategies in consultation with the Survey Science Teams.

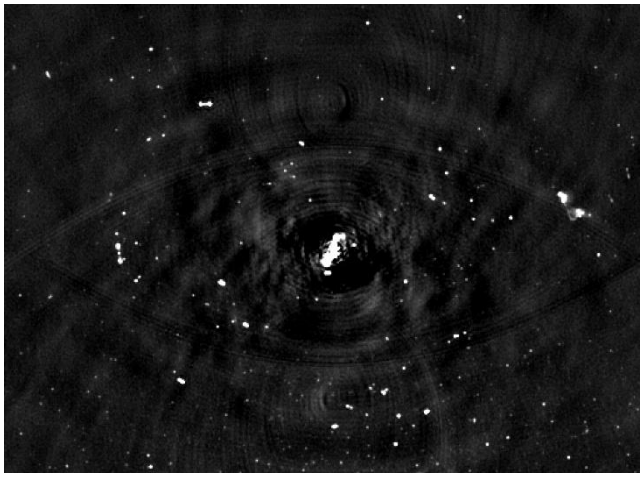

Figure 1: A region extracted from a recent EMU observation scaled to show the presence of curved wide-field artefacts around a bright source. These persist due to insufficient w-term correction. Image made by Emil Lenc.

Guest science project preparation

Successful guest science PIs from the current semester will shortly receive an email describing the steps required to incorporate their observations into the survey pool.

We are also working with the CSIRO Space & Astronomy Space Weather group to test the technical feasibility of using ASKAP to monitor interplanetary scintillation. This may unlock new scientific opportunities for ASKAP.

For further information

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