ASKAP update for May 2021

In this issue we report on factors impacting the time scale of Pilot Surveys Phase II, the latest improvements to ASKAPsoft, continuum image quality and CASDA commensality.

Fire suppression recharge and upgrade

On the 23rd of April, the MRO central building fire alarm system detected smoke in one of the cabinets in the correlator room. For the second time in the history of the building, the fire suppression system shut off mains power to the cabinets and deployed FM200 gas into the room. We have been running in low-power mode since this time, with observations suspended. Inspection showed that there was a real fire risk, so the system acted correctly.

Subsequent investigation by contractors responsible for the fire system shows that improvements could be made to stage the alarm response so that low-level events trigger gas discharge in the most suitable zone (cabinets, floor space, etc). Installation of additional sensors and an upgrade to the control system commenced alongside recharge of the FM200 cannisters. This work has now concluded, and operations resumed on the 14th of May.

Dedicated correlator investigation

The CASS digital electronics group has been using weekly test time to investigate occasional loss of spectral line channels from the correlator output data stream. Although some progress has been made, the team has reached a point where dedicated access to the array is required to proceed. Although the timing conflicts with the start of Pilot Surveys Phase II, we have agreed to pause observations for an initial period of two weeks (starting May 17th) for a final attempt at solving these ongoing issues. If successful, the flagging percentage of all ASKAP data will be reduced.

Correlator channel dropouts are present in most ASKAP observations to some degree, but there may be several causes at work and the severity of the issue varies with every firmware build. This makes future changes to ASKAP's firmware a risky prospect. Dedicated access to the entire array should provide the statistics needed to localise and identify some of the failure modes.

After the initial two weeks, we will assess progress and determine whether another two weeks is required to implement any changes arising from the investigation.

ASKAPsoft version 1.2

Quality control and scientific analysis of Pilot Surveys Phase I data has been a rigorous test of ASKAPsoft and the science processing workflow. We recently deployed version 1.1 of ASKAPsoft, which brought the deployed version up to date with many recent developments including new code repositories and a new build system to incorporate updated third-party packages.

This update saw improvements to the speed of several processing tasks (notably continuum imaging and the mosaicking), using multi-threading and improved memory management. We have also found that the overall memory footprint of the spectral imaging has increased. This required us to redistribute the imaging work to utilise fewer cores on the compute nodes.

Further processing software developments will be made available in coming weeks, and the pipeline scripts continue to be improved. A notable component of version 1.2 of the pipeline is the ability to use holography results to improve the primary-beam correction applied at the mosaicking stage. This will be tested with technical test observations in the lead up to Pilot Surveys Phase II.

The most recent pipeline update corrects a bug that has been in place since early March (version 1.0.18.2) that led to flags derived from examination of the bandpass solutions not being applied.

One of the challenges with ASKAPsoft development is balancing the need for a stable and highly-available operational system with the continuous development required to improve data quality and provide all the necessary science products. Full-scale testing is computationally expensive, but we have a cut-down end-to-end test system that exercises all the core pipeline functionality, on a subset of ASKAP's 36 beams. We plan to expand this system to cover more of the pipeline's many options, and provide automated verification of release candidate builds, which should help identify issues before they impact live data.

Image quality investigation

Feedback from Pilot Survey Phase I WALLABY data shows that our standard processing parameters were leaving significant residual structure in continuum images, especially around extended sources. Comparison with other tools and exploration of parameter space shows that with correct flagging, the main factor is the number of self-calibration and cleaning stages allowed (Figure 1).

While it is possible to improve the image quality with more cycles, this will come at the expense of processing time, which may impact ASKAP's observing efficiency. Efforts to find the best compromise strategy will continue with Phase II quality gates.

Commensal observations in CASDA

With Pilot Surveys Phase II including our first set of fully commensal observations, we have been taking stock of CASDA's capability to archive commensal data products.

CASDA (the CSIRO ASKAP Science Data Archive) was designed around the concept that each individual data product (corresponding to a single file) is assigned a primary project code that is responsible for validation of that product. In practice, we found that interdependence between products makes it difficult to fully assess quality in isolation. For example, spectral baseline quality depends on the continuum image that was subtracted, which may fall under the responsibility of a different project code. Visibility data are another example, since they are the foundation of all science outputs, but not used directly.

For Phase II, we will give key team members permission to view pre-release data by making them members of several projects for the purposes of quality control.

We have also realised that enabling discovery of archived commensal data requires tagging a CASDA deposit with secondary project codes, in addition to the primary code associated with validation responsibility. Although this requires development, the change should be relatively minor and will be implemented as soon as possible.

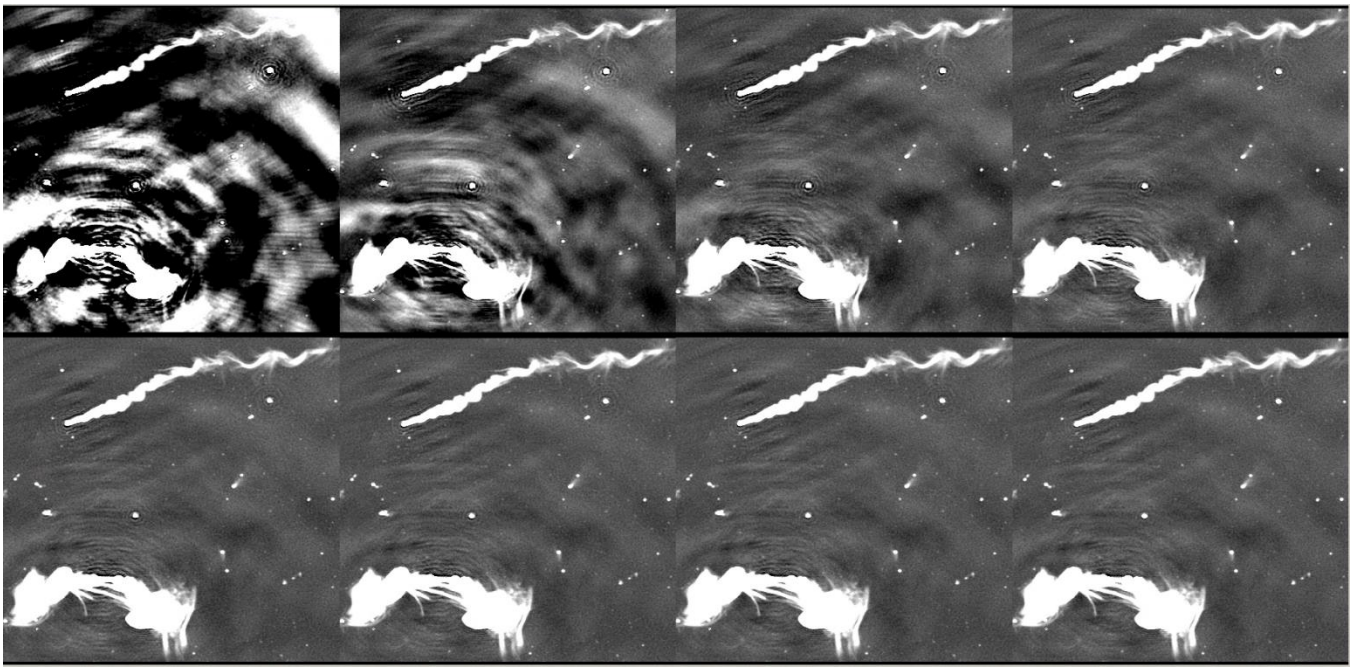

Figure 1: Evolution of image quality with successive cycles of self-calibration and cleaning around an extended source (with uniform colour scale). The upper left panel has only bandpass calibration applied, the next two panels apply phase-only self-calibration and the final 5 show successive iterations with amplitude and phase self-calibration. The current processing strategy stops at the second panel, but at least another two iterations may be justified despite the computational penalty. Image credit: Mark Wieringa

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