ASKAP update for March 2024

This month we report on the status of CASDA, progress of survey operations and plans for future ASKAP upgrades.

Survey science progress

Survey Science Project observations are proceeding well with 6 of the 9 SSPs in the observing pool. We have deposited the first scheduling blocks into CASDA for the three remaining teams, GASKAP-HI, GASKAP-OH and DINGO (see Table 1), which are awaiting validation before we can activate the remaining survey fields.

Data processing was going smoothly until March 5th, when scheduled maintenance at the Pawsey Supercomputing Research Centre caused some unexpected downtime. An update intended to address issues with the scratch filesystem was rolled out, but this caused performance degradation that had to be investigated and led to the discovery of hardware faults. The system was returned to service on the 12th of March, and we are now working through the backlog that has accumulated.

SST	Deposited	Awaiting Validation	Released	Rejected
EMU	205	13	155	36
WALLABY	52	3	21	28
POSSUM	256	41	155	61
VAST	2918	263	2611	38
FLASH	95	1	49	45
GASKAP-HI	1	1	0	0
GASKAP-OH	1	1	0	0
DINGO	2	2	0	0

Table 1: Survey progress as of 18-03-2024

We have adjusted the calculations used to avoid scheduling observations during periods of ducted Radio Frequency Interference (RFI) and increased the rate at which data are obtained from the on-site RFI monitoring system. The previous alerts were causing most FLASH observations to be interrupted or preventing them from being scheduling at all. Based on the last few months of data, our new thresholds should avoid the majority of ducted RFI while providing larger windows of opportunity for FLASH observations.

The VAST team have also reported issues with incomplete flagging of strong RFI and (independently) flagging of baselines below a specified minimum (u,v) distance. These issues are being investigated and software improvements should be deployed with the next ASKAPsoft release.

CASDA status

CASDA has been performing normally since returning to service after downtime associated with hardware faults on the Acacia storage system. We have now synchronised all data deposited during the period of degraded service and the full collection of ASKAP data should be available.

ASKAP upgrade planning

To keep ASKAP at the forefront of radio astronomy into the next decade, we are actively discussing potential upgrade options with the goal of including an upgrade strategy in community discussions around the next decadal plan for Australian astronomy. One of the possibilities that has already been suggested to the community is an upgrade of the Phased Array Feeds that would include new Low Noise Amplifiers. This would bring the telescope's effective system temperature below the original 50K design goal, with a possible factor of three improvement in sensitivity across the entire ASKAP band.

At a recent online gathering of internal stakeholders, we discussed the feasibility of implementing such an upgrade with varying degrees of scope. There was some interest in attempting a small-scale upgrade by changing only the LNAs, and perhaps only on a few key antennas. However, the proposed LNAs would use about twice as much power as the existing versions, causing additional stress on the PAF power supply and cooling systems. Since power and cooling are already leading causes of PAF faults and antenna downtime, it is likely that upgrading the LNAs on their own would be unsuccessful. The question of how

many antennas to upgrade is also complicated. Achieving a factor of three improvement in sensitivity would require upgrading all the antennas but would position ASKAP to match the survey speed of SKA-mid (with further upgrades to the digital systems). An interim approach might be to upgrade e.g. just the 6 outer antennas, which might benefit some science cases, but would also result in an inhomogeneous array that increases complexity in the control and monitoring system and image processing parameters. Instead of proceeding with an operational upgrade using the small amount of funding that could be made available in the next year or two, we would prefer to invest in the design and construction of a prototype for a new or more thoroughly refurbished PAF that address all the issues mentioned above. This prototype would be tested thoroughly to ensure operational readiness before securing funding for mass production.

ASKAP's PAFs already provide about twice the bandwidth we can process with available supercomputing resources. An upgrade that improved the system temperature and reliability while maintaining the existing frequency coverage would be highly compatible with existing operations, allowing a sequential roll-out that better manages the effort required.

ASKAP's high data rate means that processing capacity needs to be an integral part of any upgrade plan. It is therefore important to consider the timescale for future hardware refreshes at Pawsey (roughly 4 years after the acceptance of Setonix) as well as the need to optimise our processing code and implement additional features to improve data quality. We will need continued software development to complete the existing SSP plans on time.

ASKAP's wide field of view, integrated processing pipeline and autonomous scheduling system will be unique assets well into the SKA era. With RACS-low3 data now awaiting validation in CASDA, we have demonstrated our ability to survey more than 80% of the sky and make the resulting data available within about 3 months. Whether we invest in expanding ASKAP's capability will depend on the community's interest in the science that can be done with a wide-field survey telescope, including innovative uses that may still be emerging.

ASKAP's 60,000th scheduling block

Now that we are operating continuously in full survey mode, ASKAP is consuming scheduling block IDs at the rate of about 10,000 per year. This includes calibration, system checks and other operations-related blocks as well as science observations. On the 13th of March, the 60,000th SBID was assigned to a FLASH observation.

Testing new imager features

At a recent joint session of the continuum, polarisation and spectral line working groups, we discussed the technical details of an upcoming implementation of source peeling that should help reduce artefacts from bright sources outside image boundaries. There is significant community interest in this feature as it may help meet data quality requirements for WALLABY and should be an improvement for all other teams. Determining how to select the sources that are peeled and ensuring that the method is robust across the entire sky will require significant testing. The ASKAP Operations team has already reserved a few example data sets that are likely to benefit significantly from the technique.

We have also implemented the ability to set CLEAN thresholds based on the image RMS, which may help reduce the amount of over-cleaning that happens at the edges of the field or less-sensitive parts of the frequency band. Selecting a suitable threshold will require further testing in consultation with the SSTs.

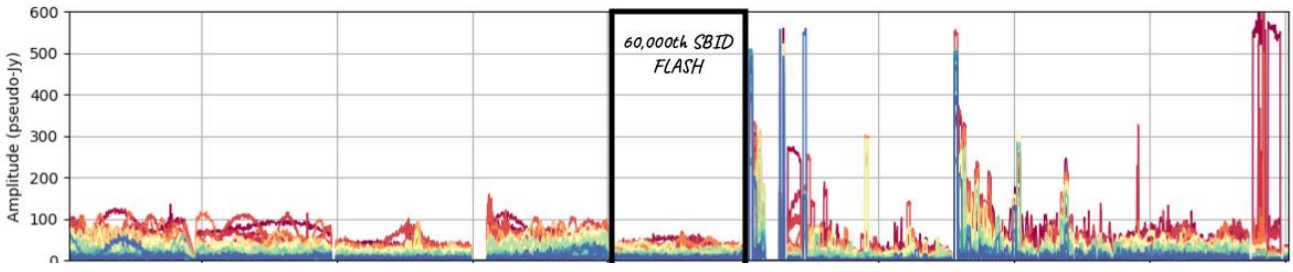

Figure 1: ASKAP visibility amplitudes colour coded by baseline length (red shortest, blue longest) across the time of the 60,000th scheduling block. Image made by Vanessa Moss.

For further information

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