ASKAP update for February 2025

This month we report on survey progress, release of RACS_low2 data, self-calibration improvements and plans to reduce ASKAP's calibration overheads.

Survey science progress update

During the first full month of observations in 2025 we made significant progress on EMU with 22 fields observed, although only 15 of these met the Survey Science Team's validation criteria. Some of the quality issues relate to a strong RFI ducting event impacting one of the bandpass calibration observations. Due to the nighttime observing constraint, we only observed 6 fields for WALLABY but three of these have been deemed of good quality and the remaining three are still being checked. Given the length of each observation and overheads related to our current calibration scheme, it is not possible to observe both EMU and WALLABY in the same day. Overall, our survey uptime and efficiency were high this month, accounting for some maintenance downtime due to high-voltage power work at the Pawsey Supercomputing Research Centre. The POSSUM Survey Science Project receives commensal data from both EMU and WALLABY.

SST	Deposited	Awaiting Validation	Released	Rejected
EMU	364	1	284	82
WALLABY	96	3	57	40
POSSUM	459	19	308	137
VAST	4860	0	4820	42
FLASH	279	0	157	122
GASKAP-HI	12	11	1	0
GASKAP-OH	1	1	0	0
DINGO	24	2	19	3

Table 1: Survey progress as of 15-01-2025

We also observed a new set of data for GASKAP-OH to test a more compact beam footprint. It is expected that the closer beam spacing will improve the spatial uniformity of the noise background in these image cubes. If confirmed, this may allow GASKAP-OH to soon join the main survey pool.

A new processing feature was activated for EMU from scheduling block 70504 onwards. The self-calibration process now begins with the first iteration consisting of a model derived from RACS observations of the field. This has several benefits in that it helps the process converge more quickly and potentially more accurately, while also aligning the astrometry of the EMU field with RACS. This has the additional benefit of aligning each beam within ASKAP's footprint to a common astrometry reference, so mosaicking of the beams after independent imaging will not introduce any smearing. It also means we should no longer see large astrometry offsets in the science data products. A side-by-side comparison of the new method with the previous processing parameters was done for scheduling block 70504 (see Figure 1) showing a slightly smaller overall RMS and reduced astrometry offset. The RACS-based self-calibration feature is also available for other Survey Science Teams to use if they wish. Please contact the Operations team for more information.

On the 11th of February, we released data products for each individual scheduling block comprising the second epoch of RACS_low, known as RACS_low2. These are now available for general use via CASDA.

ASKAP Key Capabilities

On the 14th of February, we released ASKAPsoft 1.18.0, which includes the ability to subtract bright sources from outside the field of view, along with several other features requested by the Survey Science Teams. This new release is not yet being used for operational processing but will be put through extensive verification tests during the following week. We will bring example data showing the benefits of the new features to upcoming working group meetings for assessment and approval before enabling these features in the operational pipeline.

Our next highest priority is to address the calibration overheads which currently result in long bandpass observations, thus impacting survey progress and efficiency. With several passes of the Rapid ASKAP

Continuum Survey now complete and ready to provide reference data at all typical observing frequencies across the entire visible sky, we are currently developing an improved calibration scheme. The selected approach will replace 2.5-hour observations of PKS B1934-638 with much shorter observations of reference fields, selected from a group of 12. These 12 fields were identified as being the most suitable RACS fields from which to derive a calibration solution, from a combination of their source flux distribution and sky position. At least a few of these reference fields should be observable at any given time, and by comparing a few minutes of data with the associated RACS image, we can derive the complex gain of each antenna.

At first, these reference field observations will be used to update the delay and phase of an initial PKS B1934-638 bandpass which will be taken once whenever new beam weight solutions are made. Eventually, as we gain confidence with the method, we may be able to calibrate amplitude as well. Ultimately, when we have a global sky model that combines all RACS frequency bands, we expect that calibration solutions could be obtained from any science observation by comparing it to the global sky model, with no need for independent calibration observations at all.

Our updated calibration workflow should reduce typical calibration times from 2.5 hours down to several minutes, making it possible to switch bands and conduct two long observations within a day. Expanding the number of calibration fields also removes the LST congestion associated with calibration.

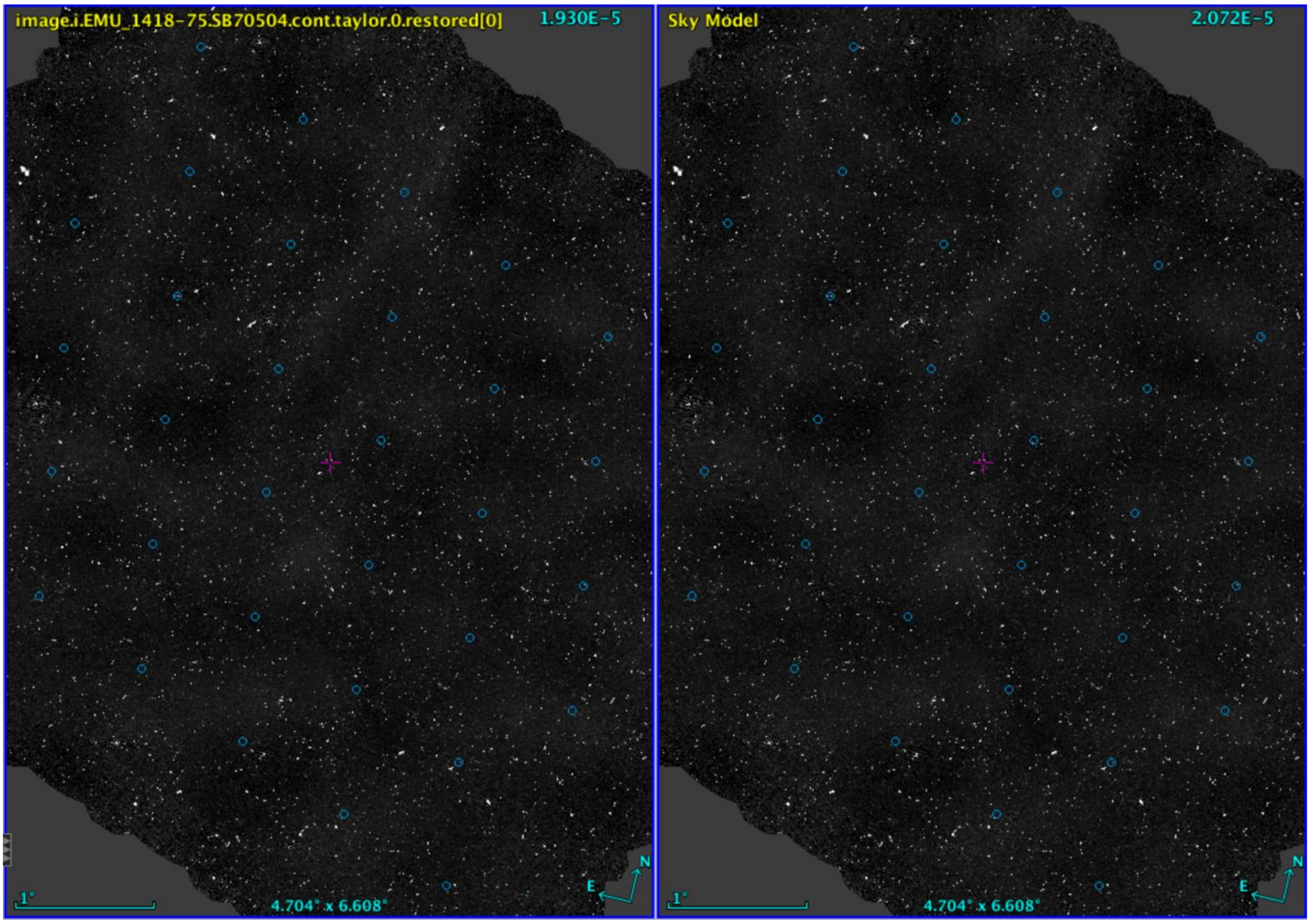

Figure 1: Comparison of two different processing schemes for scheduling block 70504, with the previous EMU processing parameters on the left, and a new method of initialising self-calibration with a RACS-based model on the right. The images appear very similar at first glance. Detailed analysis shows a slight reduction in RMS and a significant reduction in astrometry offsets using the new method. The mean pointing errors were reduced from 0.5~0.6 arcsec in each coordinate in the original image, to < 0.1 arcsec in the RACS-based image, with slightly reduced scatter. All EMU processing from 70504 onwards should benefit from the updated approach. Image provided by Emil Lenc.

For further information

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