ASKAP Update, March 2020

In this issue, we discuss progress on pilot surveys, plans for improved data processing workflows, plans for a coherent fast transient detection system and an extended period of testing to narrow down the cause of low-level correlator data loss.

Pilot survey observations

Most of the past month was dedicated to development and testing rather than astronomical observations. However, this past weekend we managed to complete observations of the third and final WALLABY pilot survey field. These data will be processed over the coming weeks. WALLABY's Hydra field (the first observed) was recently uploaded to CASDA and is awaiting final quality control analysis before public release. At a team-wide busy week, WALLABY members demonstrated the results of running SoFiA (a spectral line source finding software application) on some of the Hydra cubes, showing many new galaxy detections and detailed, resolved structure (see image below).

Pilot survey data workflow

As part of an effort to learn from pilot surveys, we have been holding a series of workshops within the ASKAP-X project. These cover aspects of the system that have led to operational challenges. One of these was dedicated to managing disk space and developing a smooth science data processing workflow.

Pilot surveys have been challenging for the observatory for several reasons – in part due to the large amount of data they generate, but also the desire to engage with all ASKAP's science teams simultaneously. While it is important to make sure all teams have access to pilot data, the need to develop several independent processing strategies in parallel requires significant storage space and divides the attention of the science data processing software development team.

In order to improve processing efficiency, we are intending to focus more on "production line" processing of individual survey projects, once feedback on data quality indicates that the processing strategy is producing science-ready data products. This may slow research into other processing strategies but should allow disks to be cleared of data more quickly.

We are also investigating the inclusion of a tape buffer between the ingest and processing disk partitions, to provide expanding storage of data products not yet ready for processing. This would allow completion of pilot survey observations more quickly, with the benefit of then being able to switch focus to development consolidation, control system improvements, firmware tests and commissioning of new features.

ASKAP system development

Since the last newsletter, we have confirmed that funding for a coherent fast-transient detection upgrade is available this financial year. This upgrade has been identified as having a high potential for scientific impact as it would increase ASKAP's sensitivity to fast radio bursts by a factor of 6. The required changes to existing ASKAP control system software and firmware are modest and the greatest impact on the observatory itself is likely to be the addition of more computing power for searching the coherent output data in real time. Analysis of the required changes is underway and has already led to identification of ways to make the existing firmware more resource-efficient and numerically correct.

System configuration workshop

In addition to the data management workshop, the ASKAP development team also met for a day to discuss telescope configuration management. ASKAP is a very complicated instrument with many configuration parameters and the process of preparing to observe in a specific mode is still rather labour intensive. The first step towards automation is to consolidate the location of key configuration parameters and remove some instances of duplication. Although the telescope design includes a Facility Configuration Manager (FCM) database, some important parameters can still be found in scheduling block templates and user interfaces.

One of the main difficulties with the current system is that antennas can be marked as offline or online in the FCM, but also switched between local and remote mode in the engineering user interface. These two states share similar characteristics, but both must be activated to effectively exclude an antenna from the array for maintenance

without leading to conflicts. This will be solved by moving array composition management entirely into the EPICS control system composite layer.

We identified several other design improvements including the need for a high-level service that merges information from the FCM and a scheduling block before presenting the unified output to other systems. These improvements have been documented as tasks that will appear in future development increments.

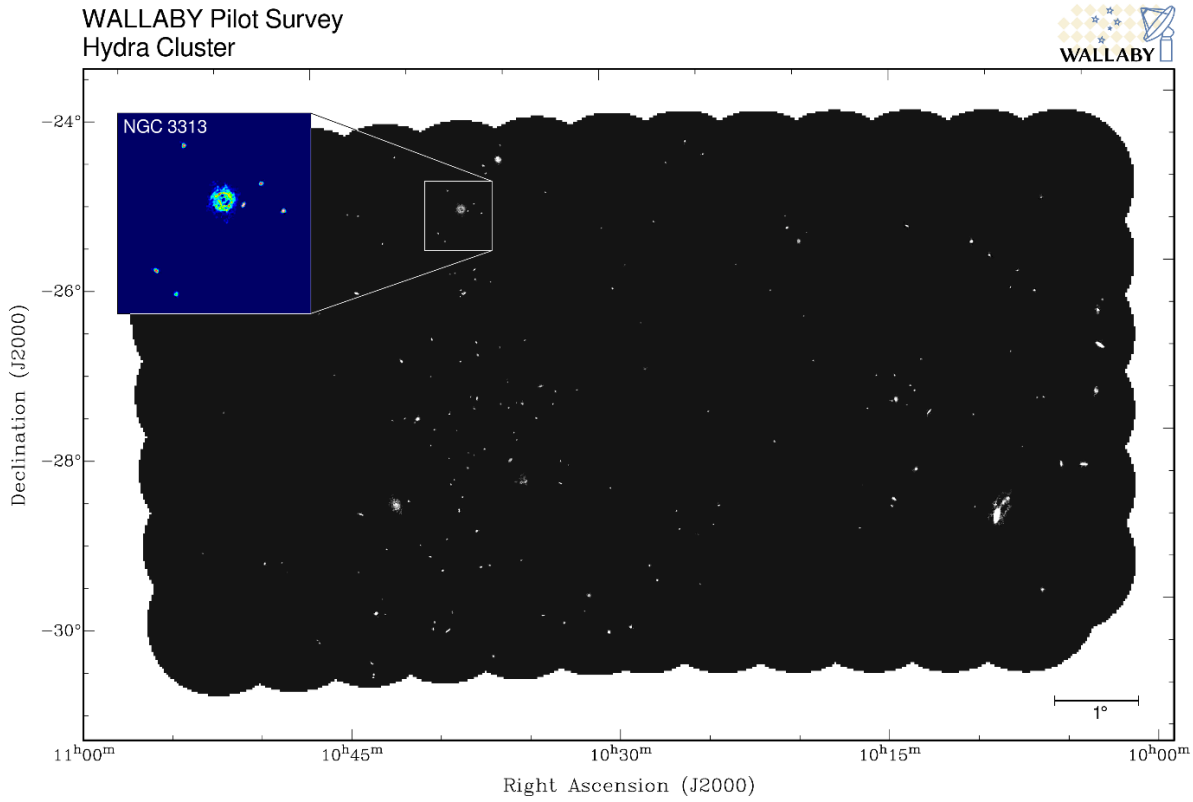
Dedicated digital system testing

The last two weeks of ASKAP time have been dedicated to detailed analysis of outstanding data integrity issues. Several problems still exist, including occasional NaN values appearing in the visibility data stream, occasional de-synchronisation of a small number of fine filter-bank channels and occasional glitches in the time tags associated with individual accumulation cycles. These problems impact a relatively small fraction of the data but understanding their cause would improve our confidence in the overall integrity of the data stream. Analysing these issues in the laboratory or in simulation is very difficult due to the small fraction of data impacted. Often, we only see a significant number of events over periods of days when the full array is in use.

In order to expedite the analysis process, we have been running the telescope using test beamformer and correlator firmware that has additional debugging information exposed to the engineering team. This dedicated time has narrowed the search parameter space and provided information on how to implement the next generation of diagnostic tools.

Training and professional development

Many members of the ASKAP-X teams also participated in SKA-oriented training sessions organised recently in association with the PI planning session in Perth, Western Australia. These included training on various roles and responsibilities in the SAFe project management scheme and use of the TANGO control system library.



SoFiA moment-0 map from the combined Hydra pilot survey field, showing detected HI emission. Image made by T. Westmeier.

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