ASKAP Commissioning Update #5
September-October 2013

Welcome to the fifth edition of the ASKAP Commissioning Update. This is a regular informal e-mail report on the progress of ASKAP commissioning including new results and challenges, bugs, releases of new software and availability of test data.

If this edition has been forwarded to you, please sign up to the exploder by sending an e-mail to 'askap-commissioning-request@atnf.csiro.au' with the message text: 'subscribe'. We hope you enjoy receiving this regular update on the progress of ASKAP commissioning. Do not hesitate to contact us if you have any questions about the project.

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BETA Commissioning

As reported in the previous *ASKAP Commissioning Update*, we now have all six BETA antennas fitted with Mk I phased array feeds.

To expedite system commissioning tests the correlator is currently configured in a (3+3) mode where data from either (or both) of two groups of three antennas can be correlated. This allows firmware and engineering commissioning teams to work on the system at the same time. For most of the time, both groups are using the two sub-arrays for their observing and debugging activities from the Science Operations Centre.

Much of the work this month has focused on testing the system end-to-end using on-sky measurements of astronomical sources.

The team monitored the shape of the phased array feed boresight power primary beam and conducting long integrations on well-characterised astronomical sources to help debug transient correlator features. The team is also integrating new hardware into the system, which includes testing the hardware fringe rotator for the first time.

On Wednesday 16th October, the team obtained the first HI autocorrelation spectra.

Figure 1 shows quotient spectra for antennas 1, 3, 6 (green, red, blue) formed from a 20 second integration (4 correlator integration cycles) on source IAU S9, divided by a 20 second integration off source (-2hr in right ascension). The on and off-source integrations are separated by a minute or so. The average Tsys on S9 appears to be about 2 times higher than on the off-source position (Galactic continuum).

The difference in on-off flux ratio between antenna 6 (blue) and the others is due to the fact that these signals are measured from a single uncalibrated PAF port.

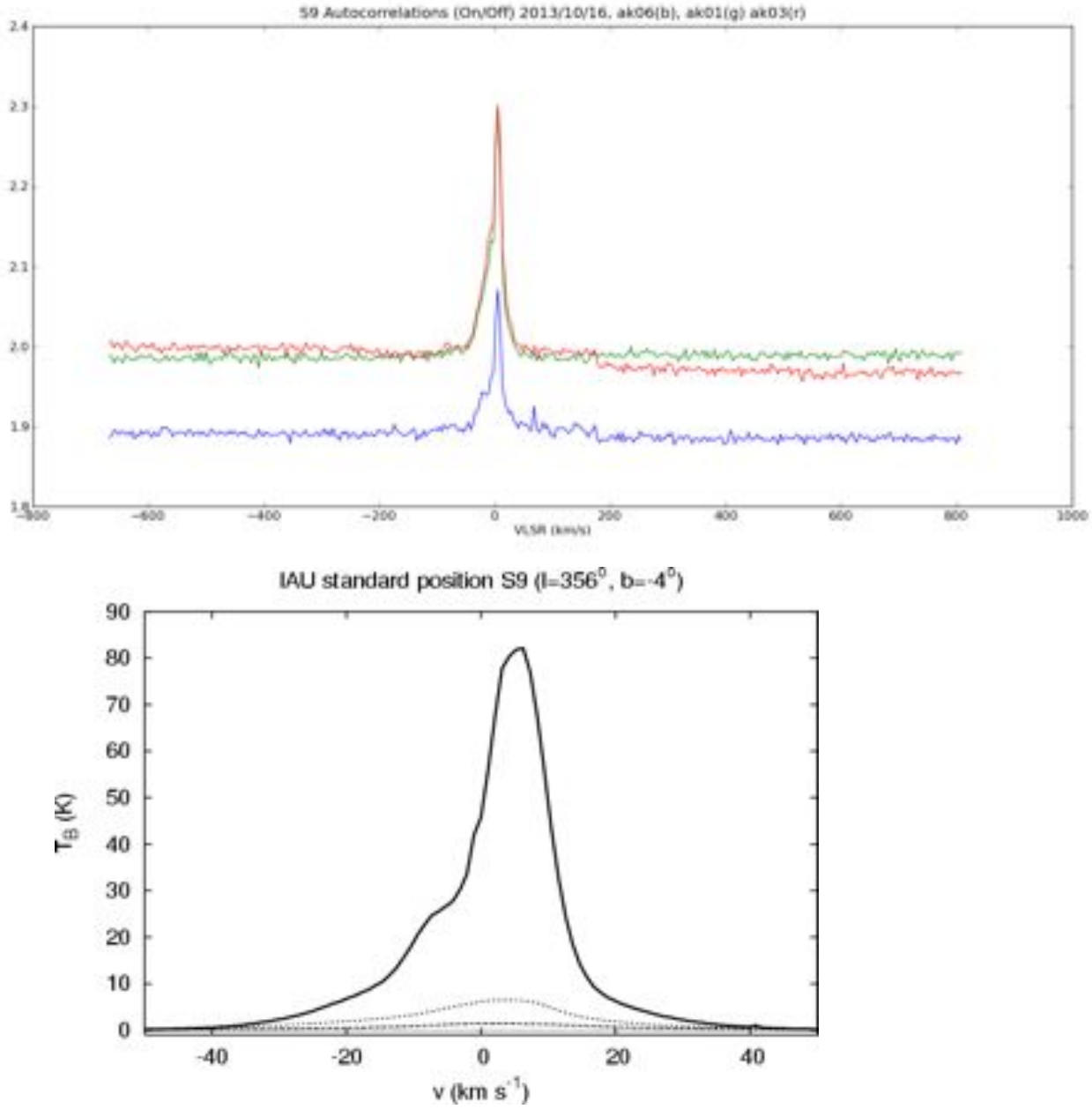

Figure 1 (Top): Autocorrelation spectra from observations of a Galactic region of neutral hydrogen IAU S9 using ASKAP antennas 1,3 and 6 (green, red, blue). The x-scale is velocity relative to the local standard of rest and the y-scale is the ratio between on-source and off-source Tsys. Bottom: Reference spectrum from Bajaja et al. (2005) showing the line profile.

The ASKAP firmware and commissioning teams are now working together on fixes for the various features that have been identified through these activities.

ASKAP Design Enhancements Program

The last component to be tested has now passed its “field tests” and so the design of Mk II phased array feeds is finalised. Several parallel integration and measurement campaigns are currently underway to inform the product readiness reviews (PRRs) for the ASKAP Mk II phased array feeds, which have been running over the last few months, with a few more left to be scheduled.

The PAF electromagnetics group conducted a measurement campaign at Parkes to analyse the relationship between the thickness of spacing materials on 5x4 Mk II PAF prototype variants and the Tsys across the band. In some cases the team measured a remarkable difference in Tsys with only a millimeter variation in material thickness, which confirms the EM modelling. They were able to determine the ‘sweet spot’ for the final Mk II PAF design, which will allow close to theoretical performance across the full ASKAP frequency range from 700-1800 MHz.

Meanwhile, Mk II PAF prototype assembly tests are progressing well at the Marsfield labs. As the PAF is assembled, the various optical (RF over fibre) signal paths are tested in a controlled environment.

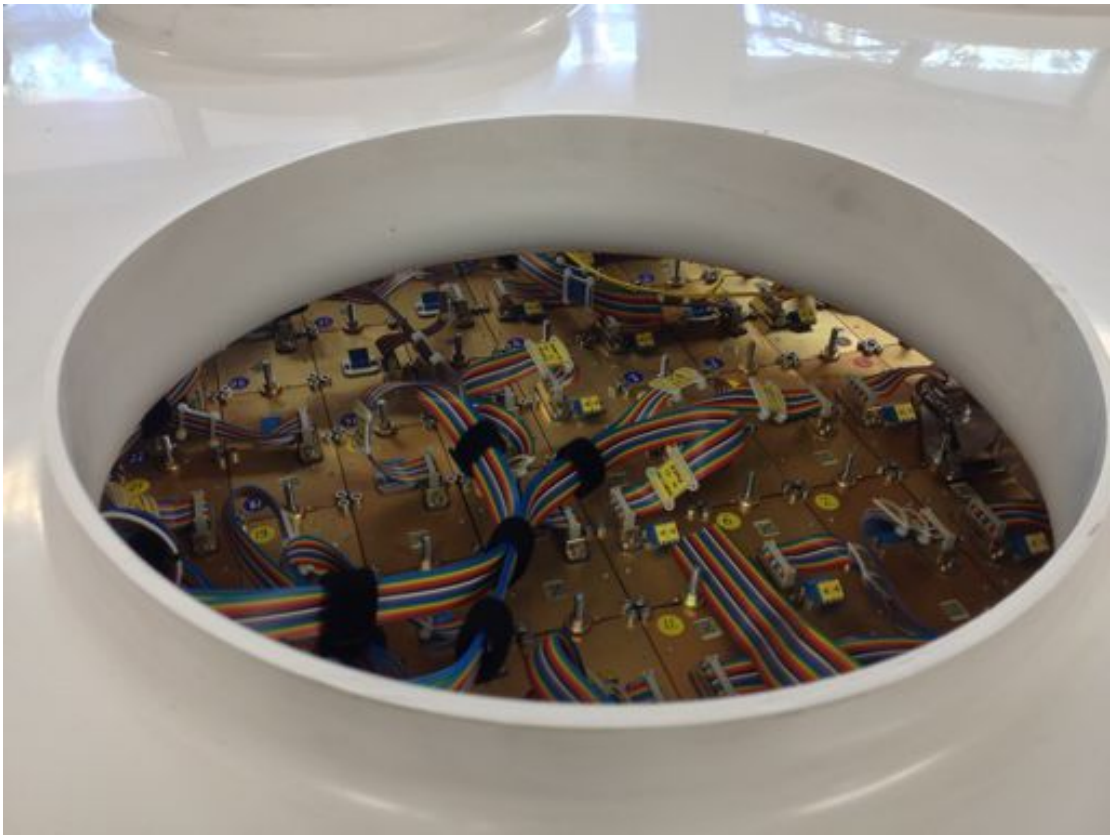

Figure 2: Prototype Mk II phased array feed undergoing integration tests at the Marsfield labs.

ASKAP Early Science Planning

ASKAP Early Science is a program of scientific observations that will be conducted with the first twelve ASKAP antennas fitted with Mk II phased array feeds.

Following the outcomes of the ASKAP early science workshop (reported in last month's *ASKAP Commissioning Update*) a team of CASS astronomers is carrying out a technical assessment of ASKAP-12 (the early science platform). This includes a review of software, calibration, systematic and instrumental factors that may limit the quality of images, spectra and other early science data products.

You can follow the progress of this technical assessment via the ASKAP WG1 (simulations) meetings. Please contact the ASKAP project scientist (lisa.harvey-smith@csiro.au) if you would like to join this working group.

RFI Mitigation with Phased Array Feeds

Professor Brian Jeffs from Brigham Young University is on a 12 month sabbatical at CASS. The aim of Brian's visit is to develop methods to implement active RFI mitigation using some of the remarkable agility of phased array feeds.

Brian is a Professor in the Department of Electrical and Computer Engineering at Brigham Young University. He lectures in the areas of digital signal processing, probability theory and circuits

Brian and Mike Kesteven spent a week this month at Parkes completing the first stage of the campaign to investigate and demonstrate RFI mitigation techniques, eventually for application at the MRO – a reference antenna will be used to drive the PAF weights on the 12 m antenna to reduce visible sources of RFI.

1. The 4.5m reference antenna (previously used in holography) was converted to the ASKAP band, and re-pointed towards BEIDOU-G4, a geostationary satellite.

2. The satellite signal was piped to the 12m antenna where is it is connected to an auxiliary port in the PAF system.

This setup will be used to conduct a number of experiments over the coming months. It is anticipated that stage 2 of the project will have a steerable reference antenna to allow moving beam tests and stage 3 will take the machinery to the Murchison Radio-astronomy Observatory.

ASKAP Commissioning Working Group invites new members

Members of the ASKAP science teams are invited to join the ASKAP Working Group on BETA and Commissioning (WG4b), which provides a monthly update on the latest commissioning results. As data starts to flow from BETA over the coming months, we anticipate that this group will be the forum by which we distribute new test data sets to science teams and for representatives of SSTs to share their results and feedback. Meetings are held via videoconference. Please contact the ASKAP Project Scientist (lisa.harvey-smith@csiro.au) for more information or to sign up.