URSI AP-RASC, Sydney, Australia, 17 – 22 August 2025

The Long Baseline Array – Preparing for SKA-VLBI in the Southern Hemisphere

Cormac Reynolds*[(1)], Chris Phillips[(1)], Phil Edwards[(1)], Lucas Hyland[(2)] and Tessa Vernstrom[(1)]
(1) CSIRO, Space & Astronomy, PO Box 1130, Bentley, WA 6151, Australia
(2) School of Natural Sciences, University of Tasmania, Private Bag 37, Hobart, Tasmania, 7001, Australia

1 Extended Abstract

The Long Baseline Array (LBA) is the only astronomical Very Long Baseline Interferometry (VLBI) array operating in the southern hemisphere. As such it will play a critical role in the provision of long baselines for the planned SKA-VLBI array. SKA-VLBI will provide exquisitely sensitive high resolution observations anchored by the phased SKA telescope (both SKA-Low and SKA-Mid) working in concert with compatible remote VLBI telescopes.

To this end, there has been a significant focus in recent years on efforts to increase the sensitivity of the LBA by allowing bandwidths in excess of 1 GHz. There is also interest in providing a multi-beam capability for the more sensitive telescopes in the array. Multi-beam technologies will provide the basis for the next generation of ultra-precise VLBI astrometry enabled by multiview calibration techniques and will be pivotal for the success of SKA-VLBI.

The heterogeneous nature of the LBA provides significant challenges for the coordinated development of new wideband systems, but through a disparate set of activities these goals are now being realised.

This talk will feature updates on the following developments:

1. the Parkes Ultrawideband Low receiver, which has provided continuous frequency coverage from 700 MHz to 4.5 GHz since 2019 is soon to be complemented by the Ultrawideband High receiver operating from 5 to 27 GHz.
2. the CryoPAF system for Parkes which will permit multi-beam observations with the Parkes telescope at a frequency of $\sim$ 1.5 GHz.
3. the BIGCAT correlator upgrade for the 6-element Australia Telescope Compact Array (ATCA) which will provide a significantly enhanced tied array capability with 8 GHz of bandwidth as well as subarraying and multi-beaming capabilities. This is due to come online in the first half of 2025.
4. the deployment of DBBC3 (Digital Baseband Converters) and wideband (3-14 GHz) Callisto feeds on the AuScope antennas.
5. the planned construction of a small array ($\sim$ 5 stations) of low-frequency telescopes at our existing LBA sites capable of co-observing with SKA-Low.
6. the planned tied-array system for ASKAP which will have a multi-beam capability.

Duplication of effort is minimised by sharing hardware and software components between systems where appropriate.