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Commissioning, verification and science output of the SKA-Low prototype EDA2

Randall B. Wayth[(1)]
(1) ICRAR/Curtin University, Perth 6102, Australia, e-mail: r.wayth@curtin.edu.au

The Engineering Development Array #2 (EDA2) is a second-generation prototype station array for the future SKA-Low radio telescope. In addition to testing, commissioning, and sensitivity verification work [1], the array is being used for science applications by taking advantage of its all-sky field of view.

Since achieving first light in 2019, the primary goal of the array has been testing, commissioning and verification. The EDA2, along with companion second-generation prototype station AAVS2, incorporate significant design changes compared to the first generation system AAVS1, including the use of `SMART' signal aggregation and RFoF conversion units, new power and signal distribution, and in the case of AAVS2, a new antenna. Although stations in SKA-Low will primarily work as beamformed phased-arrays as part of the full telescope, the prototype stations EDA2 and AAVS2 have been used as compact imaging interferometers with an all-sky field of view and excellent PSF.

The on-sky sensitivity for both EDA2 and AAVS2 was measured using imaging interferometry [1,2] and proved again the value of prototype systems by uncovering a temperature dependent gain issue that affects system temperature and hence sensitivity.

The arrays have also been used for science investigations by taking advantage of the full-sky imaging capability and compact configuration. Examples include: studying the location, strength and likely origin of radio-frequency interference (RFI) in the FM band [3]; using the very short baselines in the array for potential detection of the global signal from the EoR [4]; detecting radio transients (and satellites etc) using difference imaging [5]; demonstrating the feasibility and utility of calibration using self-holography [6].

Until recently, the station beamformer for the EDA2 was limited to a single 0.926 MHz coarse channel, although it will support up to 100 MHz. With a wider bandwidth and the combination of station sensitivity and potential all-sky field of view, some new opportunities for science and verification with EDA2 become available. Current activities include testing the wide bandwidth station beamformer on pulsars, and testing a system to inject the station beam into the MWA correlator (which is non-trivial due to the different system sample rates and coarse channel widths). This type of EDA-MWA hybrid system has been used before to independently measure the on-sky sensitivity of the station.

Looking forward, the expertise and tools developed over two generations of SKA-Low prototype arrays will serve us well for the future build-out of SKA-Low, starting with AA0.5 in the coming years.

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