The Murchison Widefield Array: A Progress Report

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ON BEHALF OF THE MWA COLLABORATION

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The Murchison Widefield Array (MWA) is one of the new-technology radio arrays which exploits the recent advances in capabilities and affordability of high-speed computational and digital signal processing hardware to meet the challenging needs of low frequency radio astronomy. The MWA is currently under construction in the remote and hence radio-quiet, Murchison Radioastronomy Observatory in the Western Australian outback. The MWA ultimately will comprise 8,192 dual polarization dipoles optimized for the 80-300 MHz band. These dipoles are arranged in 4 x 4 grids on a 5 m x 5 m groundscreen to form a *tile*. The 512 tiles will be deployed over a region spanning 3 km. The MWA design is optimized for high fidelity monochromatic snapshot imaging over a wide field of view with good sensitivity. These characteristics make it particularly suitable for Solar, Heliospheric and Ionospheric applications, which are amongst the key science objectives of the MWA. The MWA is a collaborative effort of many different institutions in Australia, India and the USA (Lonsdale et al., 2009).

A 32 element engineering prototype (32T) has been constructed on the site to validate the system design under field operating conditions. 32T has been serving as a test-bed for system integration and end-to-end performance evaluation of the entire signal chain. At the front-end, the dipoles sample the incident electromagnetic radiation and the signal induced in the 16 dipoles on a tile are combined in an analog beamformer. The beamformer output is brought to the receiver nodes, which filter and select the part of the band for further processing and pass it on to the hardware back-end, the correlator. The correlator produces the required cross-correlation products which are either passed to a real-time imaging system or written out to disc using a data capture system. In addition to the engineering performance evaluation, the 32T has been providing observational data to inform and guide the development calibration and imaging algorithms, and some very interesting early science opportunities.

A comprehensive testing and verification effort covering key aspects of the system design and performance has been the focus of the project for the past 18 months. Early science is expected to gain favor as more and more of the critical engineering requirements are met. This paper will present some results from the testing and verification process, along with some of the early science results obtained from the 32T array including some solar observations.

References

[1] Lonsdale, C. J. et al., Proc. IEEE, **97**, 1497-1506 (2009)