# UNIQUE DESIGN FEATURES THE MWA CORRELATOR AND DIGITAL BACKEND SYSTEMS

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The Mileura Widefield Array Low Frequency Demonstrator (MWA-LFD) is a unique proposed low frequency observatory for Epoch of Reionization, Heliospheric, and Radio Transient observations. The MWA is located in the radio quiet Mileura stie in Western Australia, and features a very large 15–40° FWHM field of view over the 80–300 MHz frequency range. The wide field-of-view gives the array a very high survey speed for cosmology applications and provides unique capabilities for time variable heliospheric and transient observations.

However, the wide field of view produces a number of unique challenges for the correlator, digital processing, and calibration backends. The ionospheric calibration must be performed in real time, with a time constant of a few seconds and different solutions across the field-of-view, and the precision of the calibration is closely related to the instantaneous visibility coverage of the array. Additionally, bright sources must be subtracted with very high precision to allow the sensitive observations of the Epoch of Reionization.

The correlator and backend systems were designed together to optimize the throughput of the digital processing chain and enable high precision and dynamic range observations. In this talk I will detail a number of unique design features of the MWA digital processing system, including the horizon to horizon correlator field of view, “topocentric” visibility coordinates to improve source subtraction, and the data rich computation paradigm. These design features take advantage of the characteristics and features of modern parallel supercomputing, both in the FPGA based correlator and the cluster computer based digital backend, and offer a direction forward for future high throughput radio digital processing systems.

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