Array Configuration and Total Power Calibration for the Large-Aperture Experiment to Detect the Dark Ages

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The Large-Aperture Experiment to detect the Dark Ages (LEDA) pursues to answer questions related to the early universe about 100 million years after the Big Bang (http://www.ledatelescope.org). In order to achieve the required observational capabilities LEDA is currently developing signal processing instrumentation that comprises a large-N correlator expected to serve 512 dipole antennas with a 32 input prototype deployed at the first station of the Long Wavelength Array (LWA1) colocated with the Very Large Array in New Mexico. The correlator comprises a packetized CASPER architecture and combines FPGAs and GPUs for the F and X stages. The LEDA backend is going to provide a frequency coverage of 28-88 MHz.

Accurate calibration and imaging of the captured data are crucial in order to achieve the science goals of LEDA. The aim of the project is to recover the spectrum from a total power single dipole signal from which a model of the bright foreground sky is subtracted. This requires the construction of additional dipoles augmenting the existing compact LWA1 station, increasing baseline lengths and providing dipoles that do not suffer from mutual coupling. These additional dipoles are equipped with custom made frontend electronics providing three way switching of the signals between the sky, a temperature stabilized noise diode, and an attenuator. Our solutions for the design, construction, and operation of these extensions to LWA1 are going to be presented together with first results from deep integrations and calibration of the captured total power dipole signals.