Are non co-located linearly polarized antennas advantageous for FARSIDE?. N.Mahesh[1], J.D. Bowman and B. Gehlot[1], [1]Arizona State University, Tempe, AZ-85281. (nivedita.mahesh@asu.edu).

The Farside Array for Radio Science Investigations of the Dark ages and Exoplanets (FARSIDE) is a Probe-class concept to place a low-frequency radio interferometric array on the far side of the Moon. The array will enable detection of radio emission from exoplanets and be a pathfinder for 21~cm cosmology using the redshifted 21 cm signal from neutral hydrogen in the early Universe. The notional architecture of the array consists of 128 dipole antennas spread across a 10~km area. FARSIDE uses two sets of dipoles each designed to be electrically short in their respective frequency range of operation - Low band: 100~kHz to 2 MHz uses 50 m long arms and the High band: 1-40 MHz employs 2.5 m arms. This design maximizes sky coverage while minimizing volume and mass.

To deploy the array, a rover would carry a set of antenna nodes out from a base station, unreeling a tether connecting between nodes that distributes power and provides a data signal path back to the base station for processing. The reference plan is that, the low frequency (LF) dipole will be embedded in the tether while the high frequency (HF) dipole is created from a deployable stacer that must extend from the node at the center of LB antenna after it is deployed by the rover.

This current design is not intended for dual polarization measurements. Circular polarization data can help confirm exoplanet radio emissions and reduce integration time by a factor of 2. But with the present deployment strategy it is not possible to add another polarization to the low band since deployment of a 50m arm with stacer cannot be done. Here we investigate the science impact of an alternate antenna design and array layout that offers easy deployment by eliminating the deployable stacers. We consider a design that embeds two dipoles sequentially in the tether for each antenna. In this scenario, the rover must deploy the tether with 90° bends along its path at each antenna location to ensure that the two embedded dipoles are aligned to orthogonal polarizations. The strategy has the caveat that the two orthogonal polarizations (labeled X and Y) for each antenna will not be co-located. This will cause the sets of XY and YX baselines to fill different regions in visibility space compared to corresponding XX and YY polarizations.

We address the key question of how the Stokes I,Q,U,V images of the sky are affected if the array is deployed such that the two linearly polarized components of each antenna are not co-located. To investigate this, we are using the already available radio interferometer data processing pipeline for LOFAR that we can modify to simulate visibilities for antenna array configurations with non co-located X and Y polarizations. We have begun with a simple dipole beam and the array layout of the AARTFAAC widefield-imager of LOFAR (but with positional shifts applied) to simulate visibilities. These simulated visibilities will be used to produce Stokes I, Q, U, V images of the sky and compared with images produced with a co-located array. I will report the latest results from this effort.