FULL BEAM IMAGING AT HIGH DYNAMIC RANGES

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Full beam imaging at high dynamic range is required to exploit the increased sensitivity of the next generation interferometric radio telescopes under construction or being planned. At low frequencies (1GHz or less) a large fraction of the field of view will have significant amount of flux. In single pointing observations, to remove the contamination due to sources away from the centre, imaging the full field of view will be required. Similarly for mosaicking at higher frequencies, the effects of time varying Primary Beam pattern needs to be corrected for high dynamic ranges. Existing imaging and calibration algorithms explicitly assume direction independent sources of corruption and errors. At the required sensitivity, the effects of various direction dependent (image plane) effects currently limit the achievable dynamic range. Such effects can be classified as direction dependent effects which can be parameterized by apriori knowledge and effects which cannot be similarly parameterized apriori. Examples of the former kind are the polarization squint of VLA antennas, instrumental polarization across the Primary Beam, the effect of the w-term in imaging with non-coplanar arrays, etc. Effects of antenna pointing errors, non-isoplanatic ionosphere etc. are not known apriori and need to be solved for.

Straight foward inversion of the Measurement Equation (required for imaging and calibration using models of the sky) in the presence of direction dependent effects become impractically expensive. This makes it difficult to correct for such effects during image deconvolution. We have been working on developing efficient methods to correct for such effects during image deconvolution as well as develop solvers to solve for antenna based parameterized Primary Beam pattern. In this talk, I will present the progress so far, work in progress and the future plan of action.

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5. No special instructions