Primary Beam and Mosaic Imaging

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What are we trying to do?

- **Accurate correction for the primary beam in all Stokes parameters for heterogeneous arrays (ALMA 12m + ACA; e-MERLIN; EVN)**

- **Mosaic imaging over large field of view: critical for ALMA**

- **Wide-band imaging (large $\Delta\nu/\nu$) requires use of frequency-dependent primary beams**

Technical issues

- **Subset of full wide-field, wide-band imaging problem.**
- **w term important for lower frequencies**
- **Closely related to correction of dynamic direction-dependent effects (e.g. ionosphere, pointing), but should be possible to use a priori models.**
- **Intermediate timescales: variation of primary beam with elevation.**
- **Current primary beam models are often crude (circularly symmetric). EM simulations available for ALMA: others?**
- **Use on-sky measurements (holography) to validate.**

Methods and implementations

- **AIPS primary beam model is crude and assumes all antennas identical – must do better**

- **CASA machinery?**

- **Various mosaic imaging algorithms in AIPS, CASA, GILDAS, Miriad, Obit (CLEAN and MEM based)**

- **Use of realistic primary beams for CARMA (Wright, SKA Memo 102)**

- **Related work on optimal single-dish data combination (IRAM, part of ALMA FP6 Enhancement Programme). Will be ported to CASA**

Test Problems and Issues

- **Ample (E)VLA, (e-)MERLIN, CARMA data available; ALMA shortly. Identify test cases.**

- **Want to extend to all Stokes parameters (although this is less urgent, at least for ALMA); possible within the same framework**

- **How does this application relate to the work on LOFAR (and SKA?) planned for task 6.2.4?**

- **Is may be hard to separate the primary beam problem from other aspects of wide-field imaging.**