WIDE-BANDWIDTH IMAGING : CHALLENGES AND PROSPECTS FOR THE EVLA AND BEYOND

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Multi frequency synthesis (MFS) imaging involves gridding visibilities from different frequency channels separately to eliminate bandwidth smearing, and augmenting the deconvolution process to take into account flux variations across the observing band. The goal is to obtain a high dynamic range continuum image with minimal deconvolution errors due to spectral flux variation, while using the entire data set for increased sensitivity.

MFS imaging algorithms have so far been designed primarily from the point of view of enhanced UV coverage provided by multi channel data from relatively sparse arrays. These algorithms are reported to produce images with dynamic ranges of about 1000 to 1 and negligible deconvolution errors (within the rms noise) up to bandwidths of 25%. In addition, the Conway/Sault algorithm (currently the most advanced) assumes a relative power law spectrum between image pixels which translates into a constant spectral index across the band.

The planned EVLA bandwidths (50%) with $>$10000 observing channels, are much larger than before, and have been chosen to allow the production of wide-band continuum images with increased sensitivity, and dynamic ranges of over 10000 to 1. With these large bandwidth ratios, the assumption of a pure power-law spectrum often breaks, and it is not clear how well the existing algorithms will perform in terms of achievable dynamic ranges and deconvolution errors due to approximately estimated spectral flux variation.

We present an analysis and comparison of the existing algorithms along with some hybrids, from the point of view of wide-band imaging requirements of $\sim 1\mu$Jy rms noise and $>$10000:1 dynamic range from an 8 hour (E)VLA observation over a 1GHz band at L Band.

Abstract Submission Form

2006 National Radio Science Meeting

Abstract: raovenkata2775

Date Received: September 16, 2005

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5. No special instructions