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Wide-field Imaging with ASKAP: Challenges and Approaches

W. Raja*(1), M. T. Whiting(1), D. Mitchell(1), S. M. Ord(1), M. A. Voronkov(1), M. H. Wieringa(1),
E. Bastholm(2) and J. C. Guzman(2)
(1) CSIRO Astronomy & Space Science, PO Box 76, Epping, NSW 1710, Australia, http://www.atnf.csiro.au
(2) CSIRO Astronomy & Space Science, PO Box 1130, Bentley, WA 6102, Australia

The Australian Square Kilometre Array Pathfinder (ASKAP) is an interferometric array of 36 fully steerable dishes operating at low radio frequencies (700-1800 MHz) with wide instantaneous bandwidths of 300MHz. Located at the radio-quiet Murchison Radio-astronomy Observatory (MRO) in the deserts of Western Australia, ASKAP is unique in several ways. Each of these 12-metre dishes is equipped with an array of 188 Phased Array Feeds (PAFs) at their focal planes. The PAFs provide enormous flexibility in reliably measuring wide regions of the sky. While conventional telescopes observe the sky with a single instantaneous beam, the ASKAP PAFs, with its current hardware, can electronically form up to 36 simultaneous dual-polarised beams on the sky. The "*Roll axis*" allows rotation of the dishes about their optic axes, thus ensuring the multiple beams formed by the ASKAP PAFs remain fixed with respect to the sky throughout the observation duration thereby facilitating high dynamic range imaging. While these make ASKAP a very powerful wide field-of-view instrument (with instantaneous f-o-v $\sim$30 square-degrees at the lower end of its operating frequency band), the resulting high data volumes present new challenges in data processing (calibration, imaging, archiving etc.,) and require the algorithms and the processing pipelines to adopt high performance computing solutions.

In this talk, we highlight some of these unique challenges that ASKAP presents, discuss current practices and new approaches being explored for efficient data reduction in high performance compute environments, and present some wide-field high dynamic range images made using our in-house software package ASKAPsoft that was designed from the start to address these challenging problems.