ASKAP data processing

Maxim A. Voronkov* [(1)], Ben Humphreys [(1)], Daniel Mitchell [(1)], and Matthew Whiting [(1)]
(1) CSIRO Astronomy and Space Science, PO Box 76, Epping NSW 1710, Australia
http://www.atnf.csiro.au

Wide instantaneous field of view is a new dimension of parameter space explored by the next generation radio telescopes such as the Australian Square Kilometre Array Pathfinder (ASKAP), an array of 36 antennas equipped with phased array feeds (PAFs) located in the Western Australian outback. Processing data from such an instrument presents new challenges. With the data rate from the correlator to central processor in excess of 2 GB/s and the requirement for non-trivial and poorly scaling algorithms to achieve good quality images, ASKAP is fundamentally a real-time telescope - the processing pipelines have to keep up with observations. We will review the software architecture and hardware design decisions aimed at reducing the cost of processing. In particular, the parallel software design using the master-worker approach, where a single processing rank orchestrates parallel computations and performs parts of the algorithm which are naturally serial, was found grossly inadequate to perform efficiently given the memory constraints of the ASKAP's central processor. A new framework has been suggested which enables a more flexible parallelization and allows us to process different PAF beams in parallel.

We will also discuss the results from one year of full operations of the first stage of ASKAP with 6 first generation PAFs from both engineer and astronomer perspective. Among results of general scientific interest, this first stage of ASKAP demonstrated benefits of the novel 3-axis antenna mount, which allowed us to stabilize beam patterns on the sky and therefore achieve a higher dynamic range without additional computing cost.