

SWARM: A compact high resolution correlator and wideband VLBI phased array upgrade for SMA

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Abstract— A new digital back end (DBE) is being commissioned on Mauna Kea. The “SMA Wideband Astronomical ROACH2 Machine”, or SWARM, processes a 4 GHz usable band in single polarization mode and is flexibly reconfigurable for 2 GHz full Stokes dual polarization. The hardware is based on the open source Reconfigurable Open Architecture Computing Hardware 2 (ROACH2) platform from the Collaboration for Astronomy Signal Processing and Electronics Research (CASPER). A 5 GSps quad-core analog-to-digital converter board uses a commercial chip from e2v installed on a CASPER-standard printed circuit board designed by Homin Jiang’s group at ASIAA. Two ADC channels are provided per ROACH2, each sampling a 2.3 GHz Nyquist band generated by a custom wideband block downconverter (BDC). The ROACH2 logic includes 16k-channel Polyphase Filterbank (F-engine) per input

followed by a 10 GbE switch based corner-turn which feeds into correlator-accumulator logic (X-engines) co-located with the F-engines. This arrangement makes very effective use of a small amount of digital hardware (just 8 ROACH2s in 1U rack mount enclosures). The first quadrant of SWARM was deployed for science at SMA in November 2014.

The primary challenge now is to meet timing at full speed for a large and very complex FPGA bit code. Design of the VLBI phased sum and recorder interface logic is also in process. Our poster will describe the instrument design, with the focus on the particular challenges of ultra wideband signal processing. Early connected commissioning and science verification data will be presented.