THE BASELINE ALMA CORRELATOR

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The status of the baseline correlator being designed by the NRAO for the Atacama Large Millimeter Array (ALMA) radio astronomy observatory is presented here. Also presented is an upgrade path for the correlator under consideration for increasing the spectral performance of the instrument.

The NRAO, in collaboration with other North American and European scientific agencies, is developing the ALMA radio astronomy array, to consist of a main array of 64 12-meter diameter antennas and possibly a compact array of smaller 8-meter antennas. The instrument is to be used for observing astronomical sources at millimeter and submillimeter wavelengths at a 5000 meter elevation site in the Atacama desert of Chile.

The correlator under development will process the outputs of the 64 antennas that are to comprise the main array of the ALMA observatory using a bandwidth of 16 GHz per antenna. The system, designed using a conventional XF architecture, works at a clock rate of 125 MHz. Antenna-based electronics in the correlator include fiber optic receiver cards to recover digitized samples from the remote telescopes, digital FIR filters for bandwidth selection, delay lines, and signal conditioning logic to packetize the output of the high-speed digitizers in order to drive lower-speed correlator circuits.

An application-specific integrated circuit (ASIC) has been designed for use in measuring the cross- and auto-correlation coefficients. Each correlator ASIC has 4096 lags, including 20 bits of integration and 16 bits of secondary storage for the results. Prototype units of this ASIC have been received and tested successfully. Prototype logic cards for both station-based and baseline-based applications in the correlator have been evaluated, including the correlator card with 64 of the 4096-lag ASICs mounted. All cards tested so far have demonstrated acceptable functional and speed characteristics. System testing of a prototype 2-antenna correlator is currently in progress.

A study of implementing an enhanced digital filter card with multiple selectable output bands is in progress. This could increase the spectral resolution at the wider bandwidths and permit operation as a digital hybrid correlator.