The Correlator System for the Giant Metrewave Radio Telescope

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The Correlator System of the Giant Metrewave Radio Telescope (GMRT) employs the 'FX' scheme for providing the cross power-spectra of signals from all antenna pairs. It handles a total of 120 analog signals (4 from each antenna) with a bandwidth of 16 MHz, which are digitised at 32 MHz, compensated for path-length differences between antennas, and routed to the FX system. The FX system consists of a set of 120 FFT engines – each sustaining the continuous input samples at 32 MHz, followed by a multiplier-accumulator (MAC) system. The MAC performs self and cross-correlations for each spectral channel (maximum of 256) resulting from the FFT engines. It provides an equivalent of a total of 238080 complex channels, with a typical time-resolution of 64 ms which could be enhanced to 8 ms for specific high time-resolution observations. The MAC section is followed by a long-term-accumulator (LTA) which reads the 238080 Complex numbers every 64 ms and provides user-selectable integration options before recording the data on 8 mm (Exabyte) tape recorders. A control system consisting of a set of microprocessors and special hardware circuitry provides synchronisation between various subsections of the correlator system. Provision also exists for self-test and diagnostic capabilities, as well as online monitoring of selected visibility channels.

The delay system performs the operations relevant to Walsh switching and online system-temperature calibration using noise reference sources injected at the front-end. The FFT system performs the operations necessary for phasing of the antennas and also provides additional inputs to the GMRT Array combiner (part of the Pulsar Machine which is being built in collaboration with Raman Research Institute). It is also planned to provide support to VLBI using the S2-recorders.

The correlator control and the functions related to online monitoring of visibilities will be performed using a SPARC-based single-board-computer (Sun1e) which is networked to the online file-server.

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