

Data Acquisition System for the GRETINA Prototype Module

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We have developed a data acquisition system which will serve as a prototype for the full GRETINA data acquisition system and for carrying out tests of the 3-crystal prototype detector module. This VME-based data acquisition system is based on the simplified Gammaphere data acquisition and is used to read out the 15 8-channel digitizer modules (120 channels) used to instrument the three Ge crystals of the prototype detector module. It also controls an I/O register (Caen V977) used to control the trigger system used for these tests.

The data acquisition system is implemented on a PowerPC based single board computer (Creative Electronics Systems RIO3) employing a single PPC603 processor. The card is equipped with a single Gigabit network interface used to write data to an NFS-mounted disk array. The data acquisition system is implemented in C using the vxWorks real time operating system. With 15 digitizer boards and I/O register, the entire system resides in a single VME crate as shown in figure 1.

The data acquisition program is structured as a set of co-operating tasks or threads. The first task reads out individual digitizer modules when a memory half-full interrupt from the board is generated. To speed transfers and reduce processor loads, DMA transfers are performed. The second task takes the data collected from the first task and writes it to a network-attached disk array (Network Appliance FAS270) over a gigabit Ethernet link using NFS. The stateless nature of NFS allows for interruptions of the data acquisition system without loss of data. Data is partitioned into sets of 2 GB files for easy analysis. This task also sends a fraction of the data over the network using UDP to a histogrammer for online analysis.

User controls for the data acquisition system are implemented though a third task. It also maintains the many configuration parameters of the digitizer boards which are set through a configuration file which can be read at startup of through user commands. The control task interfaces to the other through tasks through a set of semaphores.

The system has been shown to sustain data rates of 8 Mb/s using all 15 digitizer cards which is sufficient for testing the prototype module. The data rate is currently limited by the processing power provided by the single board computer we have employed. The system has been successfully used in a number of source and in-beam tests of the GRETINA detector module and has been shown to be stable and reliable.

Several improvements are planned for the data acquisition system. An EPICS interface is being written to allow networked graphical control of the data acquisition system. Event building will be completed in the acquisition system rather than as a post-processing step. Also a TCP-based data sender that can dispatch data to multiple computers for analysis will be written.

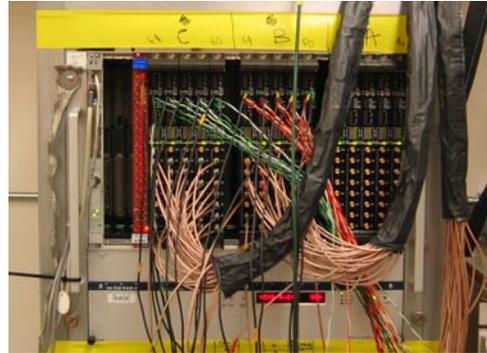


Fig. 1: Photograph showing the GRETINA prototype data acquisition system including the VME-based single board computer (left) and 15 signal processing boards.

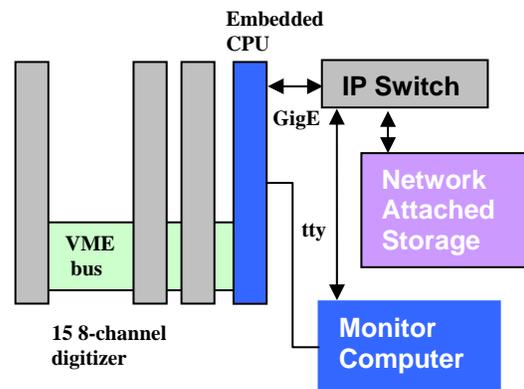


Fig. 2: Data flow diagram of the GRETINA prototype data acquisition system.