A HIGH SPEED DISTRIBUTED DATA ACQUISITION SYSTEM

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Electronics and Data Acquisition Systems capable of handling event rates of several kilobytes and two to three hundred signals per event are required for Large Gamma Detector Arrays. Processing of them require a Timing Filter Amplifier, Constant Fraction Discriminator, Shaping Amplifier, Time to digital converter, Analog to Digital Converter and the Compton suppression logic circuits. A valid event is decided by the coincidence of two or more detectors or by some other logic, dictated by the experiment. On detecting a valid event the Energy and Timing signals are digitized and stored. Implementation can be done by using commercially available NIM and CAMAC modules and make the interconnection using cables. A better method is to implement the circuits required for one detector on a single board. Such a board with a proper computer interface will form the basis for a simple and efficient data acquisition system for Gamma Arrays.

The existing data acquisition system at NSC /1/ uses CAMAC interface for transferring data to the computer. NIM modules do the analog processing of the signals, and their output is fed to the ADCs and TDCs inside the CAMAC Crate. A list processor module is used for local buffering and the Crate is connected to a PC. In this system all the parameters representing the event has to be digitized in the same Crate, since the List Processor can only read from the same Crate. This has been tested for data rates up to 400 kilobytes/sec and operational for the past several years. It is based on a client server model where the online analysis and user interface are provided by the client while the server collects data from CAMAC. We have redesigned the server part to have multiple Crates connected over a fast network, which can handle data rates of few megabytes per second.

The distributed System

In the new system, signals generated by an event can be distributed across multiple crates and processed in parallel. Different computers connected over a fast network collect fragments of the event and the event is reconstructed before it is stored and analyzed. With the KSC3922 Crate controller and KSC2927 PC interface card, the observed data transfer rate from one Crate is about 500 KB/sec. Event identification is important when data from a single event is collected across multiple crates. The event assembling software should make sure the fragments belong to the same event. This is done by transmitting the event identification number to all the crates so that it becomes a part of each fragment. The event assembling software uses this information to guarantee synchronization of events.

Results & Conclusion

We have tested a system with two CAMAC crates and obtained an overall data transfer rate of 900 KB/sec, with all the overheads like network transfer, event reconstruction and storage to hard disk. The system can be used for GDA experiments using standard NIM and CAMAC modules. We are also working on a module that can handle the signals from a single Ge detector.

The design of the system is scalable and can be implemented starting from just one Crate and a computer. More Crates and computers can be added to handle up to hundreds of signals, without any change in the software or configuration. It is based on Commercial Off–The–Shelf products like PCs and Ethernet, which are very cost effective, widely available, easy to maintain and upgrade and will not have any vendor dependency. Considerable amount of CAMAC hardware and the expertise to develop it exists in the country, which can be well exploited by this system.

References

1. The Linux based data Acquisition system at NSC, Ajith Kumar B.P. Et al, SANAI–97 held at BARC on 5–feb–97.