Using VXIbus-based DAQs for basic research and unattended monitoring applications

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We are using VXIbus - based system to build data acquisition systems both for basic research and IAEA unattended monitoring systems.
These applicationes demonstrate the power of VXI standard to build effective DAQ in the applications where sensitive electronics, large data production, networking and complicated software have to work together in the real-time.

Key words: networking, parallelization, data acquisition systems

1 Introduction

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2 Gamma-Ray detector for basic research

The first DAQ is the distributed VXIbus system to measure circular polarization of gamma-quanta in the capture of polarized cold neutrons by protons. This project is devoted to the study of the fundamental physics [1].

The choice was VXI was done due to its high bandwidth and the provision of low-noise enviroment. It make us sure to build the compact portable DAQ for use at the reactor hall.

The system inludes essentially 2 full-size VXI crates to work with 2 arms of mosaic BGO gamma-spectrometer. High voltage detector power supply and service things are provided with devices in CAMAC standard. Everything is build around LAN with remote control from the user graphics terminal.

Data acquisition is written under QNX real-time operating system within Photon graphical enviroment. The choice of QNX was done taking account of its high-effective development tools and powerful graphics, which was essential to present multidetector spectra. The whole system includes essentially 4-nodes as follows: 2 VXI crates with embedded controllers, CAMAC under PC control and remote graphics console. Additionally one of the nodes is used for data storage. Data production rate is of 512 kByte per measurement with 1/4 Hz rate.

The work is at stage of the measurements. We process 10^6 gamma-quanta per second with 12-bit energy resolution. The accuracy of 10^-5 in gain stabilizing against magnetic field was demonstrated. The special techique was used to generate narrow peaks into the gamma-ray spectra from LEDs [2].

3 VXIbus-based unattended monitoring system for safeguard apllications

Unattended monitoring system for IAEA tasks is the very specifics field [3]. Unitterupted data acquisition have to be continous for month even with mains power outage and have to restore it automatically. The status of the researh is the design study to work out recommendations for the Member State Support Programs.

We developed the generic VXI module for this task and implement the demo software at the VXI bus master. VXI module specifics is the 8-channel counter 32-bit depth and 100 ms to 1000 s gate time. The architecture of the device includes non-volatile real-time clock and buffer memory, external UPS support, trigger output built around mc68000 processor under the control of monolithic software.

Now we are upgrading the module level with more powerful 68030 processor and OS-9 real-time OS. On-module non-volatile data buffer storage is provided by PC-card.

Software at VXIbus controller is under Windows NT OS. It provides all VXI slot zero functions like resource management plus the specifics like data archiving to the removable media with generating reports about the specifics events. The most critical feature is the system restore after the mains power outage.

The communication between VXIbus controller and the data acquisition modules uses both high-level word-serial and low-level shared memory protocols.

References

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