A VME based Data Acquisition system for Pulse Shape Recording of γ- ray detector

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The VME based multicrate data aquisition system has been installed at University of Delhi with a embedded Single Board Computer (SBC). The latest version of GSI Multi-Branch System has been installed which works on real time LynxOS environment.

1. Introduction

Data AcQuisition system (DAQ) is an integral part of signal processing unit used in nuclear and particle physics experiments. The conventional acquisition system (CAMAC) uses the analog based signal processing technique. It involves the data readout in a serial fashion which greatly enhances the overall system dead time.The next generation of gammaray detectors will be employed with VME or PCI bus wih fast digital signal processors. The PCI interface based DAQ is not a well established technology. On the other hand the VME is versatile, time tested and well established DAQ system. The future VME based DAQ will handle high density fast digitizers which will directly operate on the detector preamplifier signal.The output data will provide the energy, timing and position information.

A VME based data acquisition system has been installed at the Physics Department, University of Delhi. Different VME based modules were configured under real time LynxOS enviornment.

2. Description of VME based Data Acquisition System

The standard VME (Versa Module Europa Model No. UEV-6021) has been installed at the University Department. It has a standard IEEE defined 6U size with 430 CERN backplane. It has standard 3U size rear transition module option. The rear transition slots can be used to implement auxillary bus parallel to VME bus. The backplane of VME has J1, JAUX and J2 options with J1 and J2 having DIN-96 pins having 3 rows each with 32 pins whereas JAUX having 3-row type DIN-30 pins.The JAUX connection can be used for geographical addressing to find the module location in the VME slot. It has total 21 slots.

VME is a master slave architecture with master that communicates with the slaves through several IEEE defined standard protocols via VME bus. It has standard read and write cycles which are used during on-line data acquisition in parallel fashion. In the present set-up a maxiumun of 64 bit wide addressing mode can be assigned to a single word of data. There are different data transfer options that are available in VME. In the present set-up the block mode data transfer has been implemented in a parallel fashion. However the multi block mode and chain block mode transfer options are also available.

A modified version (v5.0) of GSI Multi-Branch System (MBS) [2], a dedicated software for data readout of VME based modules has been installed in the department. The software is written in C language. It works on real time LynxOS operative system on a VME based PowerPC Platform from CES[3]. In the present set-up we have used a VME Power embedded SBC (RIO4) computer which is based on Motorola processor running on real time LynxOs environment. The RIO4 is connected

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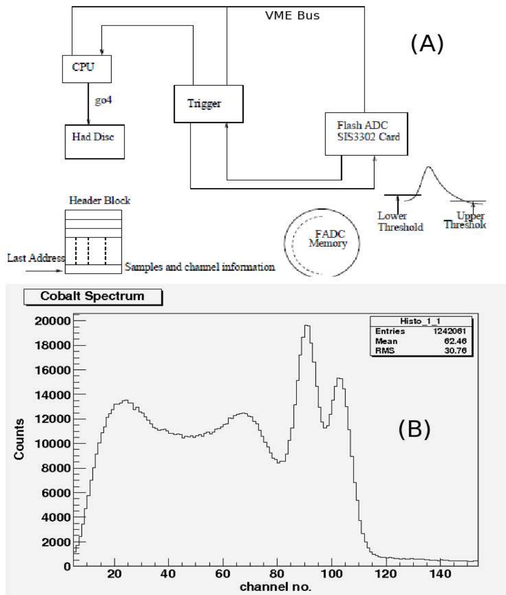

FIG. 1: Simplified block diagram of data transfer using VME Bus (A) and Co-60 spectrum from SIS3302 digitizer(B).

to a intel based quad core CPU operated under 2.5GHz speed on fedora 14 platform (i686) via linux tftp and nfs utilities. The are two ethernet cards (eth0, eth1) present in the system. The first card eth0 is a standard network interface. The other eth1 card is interfaced with RIO4 with freeze ip addresses. Different VME based modules such as CEAN peak sensing ADC and 16 bit eight channel SIS3302 digitizer from struck [1] have been configured with MBS based readout code. In future, individual gate CEAN QDC module will be configured with MBS based readout code.

3. SIS3302 Module and Software development

SIS3302 module can be used for storing preamplifier traces, trapezoid energy traces and energy histograms. It can be operated with a maximum sampling frequency of 100MHz and can sample the input signal with maximum decay time upto 2622μs. The individual and common timestamp of the channels can be obtained by external trigger and external gate options. All the SIS3302 parameters can be controlled by GUI programme written in LabView. The standard Go4 [5] based Object Oriented analysis software has been developed. The Go4 analysis framework is based on ROOT package of CERN [6]. The software defines the single event processing class for the input events. The TGo4Parameter class has been implemented to load the parameters during Online-Offline analysis.

4. Testing of Data Acquisition

The DAQ and SIS3302 digitizer was tested with a standartd NaI(Tl) detector in the University. The conventional NIM based modules have been used to generate the raw trigger from the timing signal of NaI(Tl) scintillators. The decay time of the digitizer was set to be 10 μ sec. The acquisition was triggered by the accepted trigger delivered by standard GSI based TRIVA5 module whose width was adjusted to 4μ sec to accomodate the energy pulses. The average data transfer rate using MBS was observed to be 9 MB/sec. The MBS based readout code was used to extract both the preamplifier traces and energy histograms of SIS3302 module. They are visualized by Go4 based software[5]. Fig 1. shows the energy spectrum of the ^{60}Co source obtained from SIS3302 digitizer.

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