

DAQ & Development section – DAQ related and other development

Introduction

The Variable Energy Cyclotron Centre offers the facility for various nuclear physics experiments with the cyclotron beam. The Data Acquisition Section of VECC provides the state of the art hardware and software resources for the nuclear physics experiments. The front end electronics involve in-house hardware development along with the procurement of industry standard hardware. Some hardware are procured as standard NIM, CAMAC or VME modules/crates, while requirement specific hardware are developed in-house. The software as such is not commercially available for such a niche community. It is traditionally being developed by the section. The team members are also involved in research activity for their academic pursuit.

Software Development

The design of the DAQ software is determined by the experimental necessity. Thus, all the algorithms and processing techniques have been developed in collaboration with the Nuclear Physicists of the centre and other Institutes. Earlier DAQ software was developed for *PDP15* and *NorskData* super-mini computer with proprietary operating system. From 1995, we have shifted to *Personal Computer* based system with Windows and Linux operating system. The basic readout system has been CAMAC since 1985 with the addition of VME readout since 2001. Now we are moving towards the embedded systems. The basic software structure of a DAQ application is depicted in the attached figure. Apart from the acquisition some development took place for experiment control also. The various versions of the currently available DAQ software is given in the attached table. The device driver development is also a major area of work. The ISA or PCI based hardware interface cards are designed and developed in-house. The device drivers for Linux are developed by the section for these interfacing cards.

Hardware Development

The hardware development was primarily focused towards DAQ related digital hardware and at an early stage various CAMAC modules e.g. crate controller with ISA interface, 4-ch multiplexed ADC, NIM ADC interfaces etc were developed using discrete ICs. In recent years the hardware design facility has been upgraded to cater to CPLD/FPGA based design with procurement of EDA tools like *FPGA Advantage* design-entry, *ModelSim (PE)* simulator, *Leonardo Spectrum Level2* synthesis tool, *Xilinx ISE* place & route and *CADSTAR* PCB design tool. The hardware development team has gained expertise in designing with VHDL and designed and implemented various FPGA based modules e.g. CAMAC trigger module, programmable pulser, CAMAC scaler, statistical pulser. Apart from DAQ related hardware various micro-controller based devices e.g. Ethernet to RS-232 converter, ADC-DAC interface have been fabricated. The figures display two of the products developed. The facility is also equipped with the state of the art soldering station and has the necessary technical skill of soldering surface mount devices of various form factors.

Research Activity

Published research work in the field of Pattern Recognition and Neural Network demonstrated the use of soft-computing techniques in data analysis of physics and other problems. The present focus on Parallel and Distributed computing technique aims to harness more powerful computing clusters and multi-processor workstations for the scientific computing. The application domain concerns DAQ application as well as different scientific simulations, which typically demands ever expanding requirement for more power and bandwidth.

DAQ Software			
CAMAC		VME	
Windows		Linux	
WIN16	OS: Windows3.1/95/98 Controller: Hytec 1331 with ISA List Proc. : Hytec LP1341 Device driver: None ESONE library: In-house		I. OS: Linux upto 2.4.x Controller: Wiener No support for BLT
WIN32	<p style="text-align: center;">I.</p> OS: WINNT Controller: Hytec 1386 with PCI List Proc.: Hytec LP 1341 Device driver: Vendor ESONE library: Vendor <p style="text-align: center;">II.</p> OS: WIN XP/2003 Controller: Hytec 5331 with PCI List Proc.: Hytec LP 1341 Device driver: Vendor ESONE Library: Vendor <p style="text-align: center;">Variants:</p> a) Message based (same as WIN-16) b) Multithreaded c) Multithreaded, readout without LP	<p style="text-align: center;">I.</p> OS: Upto 2.4.x Controller: 1331 with ISA List Proc.: LP 1341 Device driver: In-house ESONE library: In-house <p style="text-align: center;">II.</p> OS: Upto 2.4.x Controller: 5331 with PCI List Proc.: LP 1341 Device driver: In-house ESONE library: In-house	<p style="text-align: center;">II.</p> OS: Linux upto 2.6.x Controller: SIS3100 BLT, CBLT Read Out VME64x support <p style="text-align: center;">III.</p> OS: RTOS Controller: CES RIO3 BLT, CBLT VME64x multi-crate (under progress)

Slow Channel Software		
CAMAC (WIN Only)	VME	
Multi-ch HVPS & Spec Amp	Windows	Linux
		Multi-ch HVPS



