Data Acquisition Systems

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Overview

In 2003, the DAQ group introduced new systems for development of the Tigress detector and the T2K Neutrino group R&D while continuing to support a wide array of experimental groups and tests stations. The DAQ group was involved in defining the next generation Data Acquisition system as a component of the Laboratory for Advanced Detector Development (LADD). The first phase of the development of MIROODAS, an online analysis package for replacement of NOVA, took place.

Table I. Computer systems managed by the DAQ group

Name	Location	Type
isdaq01	ISAC-LE βNMR Trinat	2xPII/450
isdaq02	ISAC-LE, GP2, LTNO	PIII/500
isdaq03	ISAC-HE, Tuda	2xPIII/550
isdaq04	ISAC-HE, Dragon	2xPIII/550
isdaq05	ISAC-LE, Isac users	PIII/1000-256
isdaq06	ISAC-HE Isac users	PIII/1000
isdaq08	ISAC-LE, 8Π	2xPIII/1000
ltno01	LTNO CR DAQ	2xPIII/600
midtis01	Trinat DAQ	2xPIII/550
midtis02	Detector Facility	Celeron 430
midtis03	LTNO platform DAQ	PII/350
midtis04	GP2 DAQ	2xPIII/550
midtis05	8Π cryo	PII/300
midtis06	Neutrino Devel DAQ	AMD/XP/350
midtig01	Tigress Devel DAQ	2xAMD Ath/2000
midmes01	Detector Facility	PIII/500
midmes03	RMC DAQ	2xPIII/550
midmes04	M11 DAQ	PII/300
midmes05	Detector Facility	Celeron/335
midmes06	Neutrino Devel DAQ	PII/400
e614slow	TWIST Slow Control	PII/400
midtwist	Twist DAQ	2xPIII/1000
linm9b	M9B μSR users	AMD Ath/1500
linm15	M15 μSR users	AMD Ath/1500
linm20	M20 μSR users	AMD Ath/1500
midm9b	M9B μSR DAQ	2xPIII/1000
midm15	M15 μSR DAQ	2xPIII/1000
midm20	M20 μSR DAQ	2xPIII/1000
epicsm9b	M9B μSR Epics	PIII/550
epicsm15	M15 μSR Epics	PPro/200
epicsm20	M20 μSR Epics	PPro/200
daqlabpc	DAQ lab machine	PII/232
dasdevpc	DAQ devel, web server	PIV/1700
ladd00	LADD server	2xAMD Opt/1800

The TRIUMF Data Acquisition software package MIDAS is currently deployed over 34 stations managed by the DAQ group around the laboratory. These machines provide also some offline analysis resources and disk storage. (*http://daq.triumf.ca/triumf_nodeinfo/*)

MIDAS and MIROODAS

The core part of the MIDAS software has not changed much during this past year. There were minor changes, some bug fixes and support for new hardware. In particular, MIDAS was deployed and tested on a diskless VMIC/VME processor board. VMIC processors will be used in the future instead of PowerPC running the VxWorks operating system. . Information about MIDAS can be found at *http://midas.triumf.ca*

While Midas is mainly a data acquisition package, it includes a simple framework mechanism to interface to an online data analyzer tool. Currently two different analysis package are routinely in use at TRIUMF: NOVA and PAW (Physics Analysis Workstation). While NOVA is no longer officially supported by the TRIUMF DAQ group anymore, it will remain available as long as no major upgrade of the operating systems would brake it. For the CERN package PAW, the lack of future support and the limitations of the system in some specific area such as the live display, prompted our group to look at the new CERN data analysis package ROOT. By using ROOT (fully OO compliant), TRIUMF will maintain its support capabilities for the next generation of experiments. ROOT is very flexible and incorporates already some of the current simulation tools like GEANT3. By providing a Midas/Root interface, the DAQ group feels that this package will keep Midas in the forefront of DAQ systems.

The status on that software interface at the end of 2003 includes: a mechanism in the MIDAS logger to save raw data in ROOT format (Tree), support for filling ROOT histograms in the standard Midas analyzer program and a simple online live ROOT histogram display GUI.

In parallel to this Midas/Root interface, the DAQ group has defined a new GUI ROOT application which will become a basic tool for online data display in the ROOT environment. This task was initiated with the help of Greg King (summer student) who developed an initial version. This work is also based on some major development done by the 8Π group and their summer student (2002) Brian Eshpeter. Further development will continue in collaboration with TRIUMF Computing Services (Joe Chuma).

At the "2003 Real Time Conference" held in June 2003 in Montreal, Pierre Amaudruz in collaboration with Stefan Ritt (PSI) gave a short course on Midas followed by a short course on ROOT given by its main author Rene Brun (CERN). Discussions on how to structure a MIDAS/ROOT connection took place

between the experts. Rene Brun came to TRIUMF after the conference to give a seminar on ROOT and for further discussions with the DAQ group.

The LADD project

The Laboratory for Advanced Detector Development (LADD) is a CFI funded venture between TRIUMF and the University of Montreal. It provides infrastructure to support radiation imaging research in fields such as high energy and nuclear physics, materials and astrophysical sciences, and medical imaging applications. The LADD infrastructure at TRIUMF supports the development of new types of imaging detectors and systems for gamma rays and charged particles. One of the necessary components for detector development is a data acquisition system.

During 2003, the DAQ group in collaboration with the first users of LADD designed, specified and procured four new DAQ systems. Each consists of a VME crate with VMIC processor and readout modules and some NIM crates and NIM modules. The systems will be rolled out in 2004 for the KOPIO chamber tests, the T2K Neutrino photo detectors tests, the Liquid Zenon prototype tests and a general use station. Since the VMIC processors are diskless, a disk and file server system was also setup (ladd00).

DAQ systems

βNMR and βNQR at ISAC

The second DAQ system used by the βNMR group to acquire data on the second leg of the ISAC I low energy polarized beam line was renamed βNQR. Both systems are similar in nature.

Improvements made this year include the following. The DAQ software was simplified by combining the two experimental modes (integral type and time differential type). This makes the DAQ system simpler for the users, and very much easier to maintain. New features were added to the software, including two new experimental modes: a CAMP magnet scan and mode FAST (TD and I-type combined). Stopping the run automatically on error or after a requested number of cycles were also implemented. The EPICS and CAMP scans were made more reliable by adding code to allow them to reconnect and continue to scan if the connection to EPICS or CAMP is lost. Conversion from Midas format to the μSR group's MUD format while a run is in progress (rather than from a saved file) was implemented.

μSR systems

The TD-μSR system continued to work well, and the new Linux-based Integral μSR DAQ system was installed on all the μSR beamlines (M15,M20,M9B). This system proved successful and as a result all the μSR DAQ VAXes were promptly retired.

The search continued to find a suitable TDC frontend module to support a MULTI type μSR system. In this case, the detector is segmented in 8 sections and the DAQ has to handle the equivalent of 8 parallel experiments. We have chosen to use one of the new deadtimeless TDCs on the market. A first attempt at using a VME module developed in Japan around the Atlas AMT chip proved unsuccessful due to bottlenecks in the readout part of the module. ON the second attempt, we used a CAEN TDC built around the CERN HPTDC chip. This TDC used with a VMIC/VME processor appears to be fast enough to support the MULTI detector.

Other experimental stations

One major new system was requested last year by the Tigress group to study their first prototype detector. This required special software development for control of a scanning table. With the help of Dave Morris and his JACQ package, the system can be used to automatically scan the detector response over the full area of the detector. This DAQ is also used as a prototype to develop the full Tigress DAQ.

The newly formed Canadian T2K Neutrino group occupied the former Atlas clean room to start detector development studies. Two standard CAMAC DAQ test stations were deployed. One of the stations will be replaced by a VME LADD system in the near future. This group is using the MIROODAS package for online analysis.

A special version of the Polarimeter DAQ was setup for the McGill group (E920). On the TWIST system, new devices were added to the slow control frontend programs as well as fine tuning of the beam line magnets for better stability. New slow control device servers were added to the LTNO system. Kopio and Dragon continued to use the test systems in the detector facility.

Support for external MIDAS users is still ongoing.