APPLICATION OF THE ATLAS DAQ AND MONITORING SYSTEM FOR MDT AND RPC COMMISSIONING

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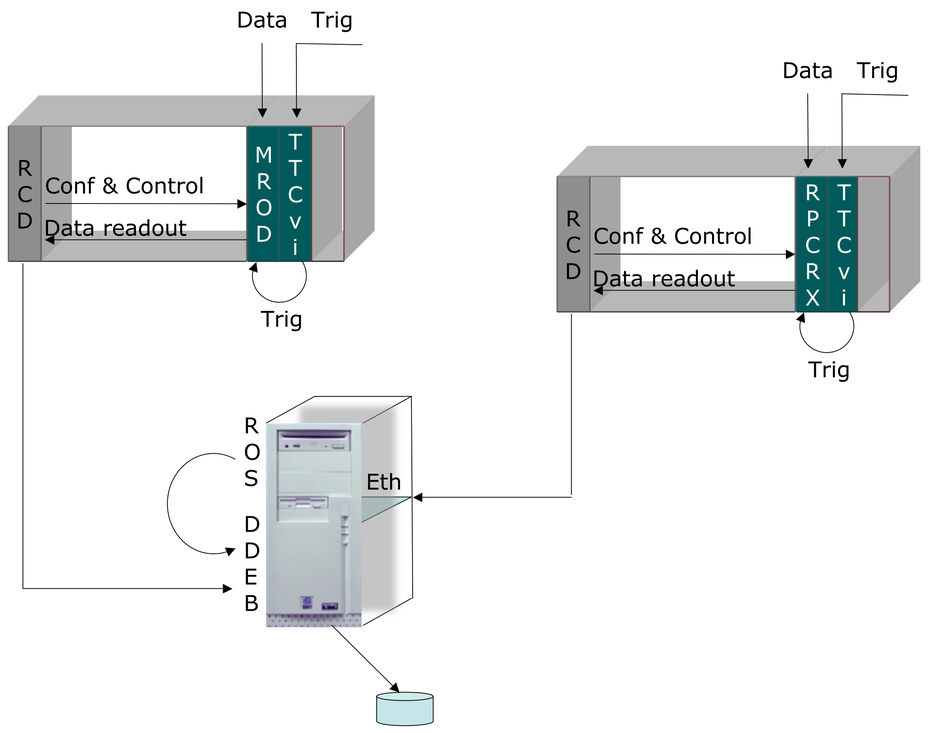
The ATLAS DAQ and monitoring software are currently commonly used to test detectors during the commissioning phase. In this paper, their usage in MDT and RPC commissioning is described, both at the surface pre-commissioning and commissioning stations and in the ATLAS pit. Two main components are heavily used for detector tests. The ROD Crate DAQ software is based on the ATLAS Readout application. Based on the plug-in mechanism, it provides a complete environment to interface any kind of detector or trigger electronics to the ATLAS DAQ system. All the possible flavors of this application are used to test and run the MDT and RPC detectors at the pre-commissioning and commissioning sites. Ad-hoc plug-ins have been developed to implement data readout via VME, both with ROD prototypes and emulating final electronics to read out data with temporary solutions, and to provide trigger distribution and busy management in a multi-crate environment. Data driven event building functionality is also used to combine data from different detector technologies. Monitoring software provides a framework for on-line analysis during detector test. Monitoring applications have been developed for noise and cosmic tests and for pulse runs. The PERSINT event display has been interfaced to the monitoring system to provide an on-line event display for cosmic runs in the ATLAS pit.

Commissioning a sector of the barrel muon detector

An asynchronous system is used for the cosmic run of a sector of the barrel muon detector (sector 13). In this case, the RPC electronics used is the same of the other sites, but the readout of the MDT chambers is performed by the MDT ROD modules (MROD). Both the RPCRX and the MROD have internal memory for data buffering. The trigger propagation to the RCD is not needed, since the trigger can be blocked by the module busy when their memory is going to be filled up.
The two systems can run both in standalone and in combined mode.



The MROD readout does not follow the standard ATLAS path (from the MROD to a ROS via s-link), since we want to take detector commissioning decoupled from DAQ commissioning. Fragments are red out by the RCD via VME. Since data are already formatted as ROD fragments, RCD builds ROS fragments and sends them directly to the DDEB.

Online monitoring and data analysis

The Readout application automatically instantiates an event sampler. A monitoring application, based on the ATLAS low-level monitoring framework GNAM, can get data at any level of the DAQ system. Event fragments are actually sampled at ROD level for single subdetector monitoring and at event builder level for combined monitoring.
During detector commissioning, all events are sampled and data analysis is performed online, producing root histograms and saving them at the end of run. A graphical browser allows to view histograms both online and offline.

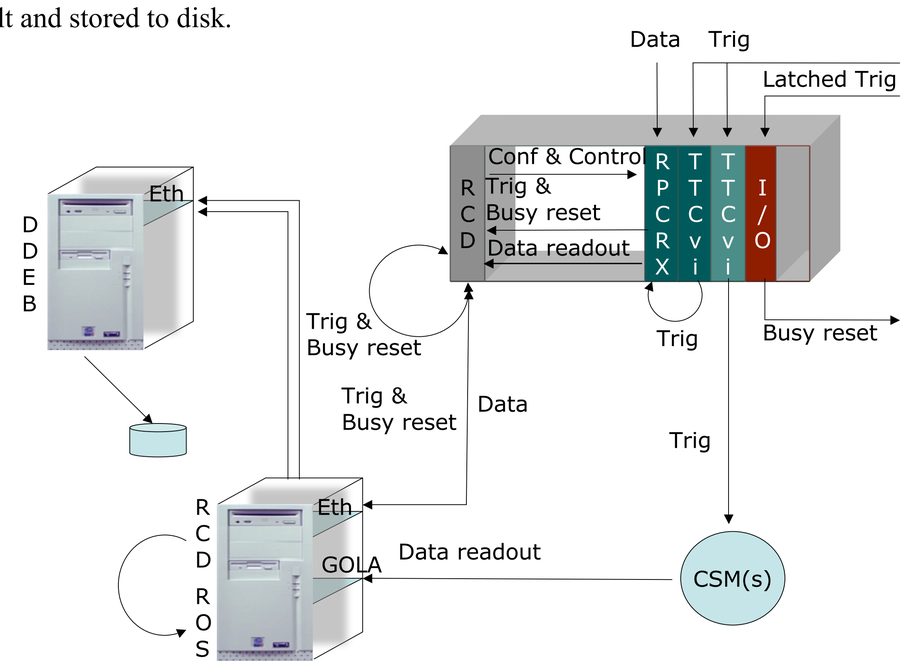
The Readout application

The Readout application is a plug-in based configurable application. It can behave, according to the configuration stored in the online configuration database:

1) As a ROD Crate DAQ (RCD) application, configuring and monitoring modules (in general VME or PCI modules), sampling events from them and acquiring events if required. It can emulate a ROD producing ROD fragments from payload data;
2) As a ROS, receiving ROD fragments via optical links from ROD modules or via TCP connections from ROD emulators, interfacing the system to 2nd level trigger and event building system or encapsulating data in ROS fragments and sending them to a Data Driven Event Builder (DDEB);
3) As a DDEB, receiving ROS fragments and building ATLAS events.

MDT and RPC cosmic and noise test

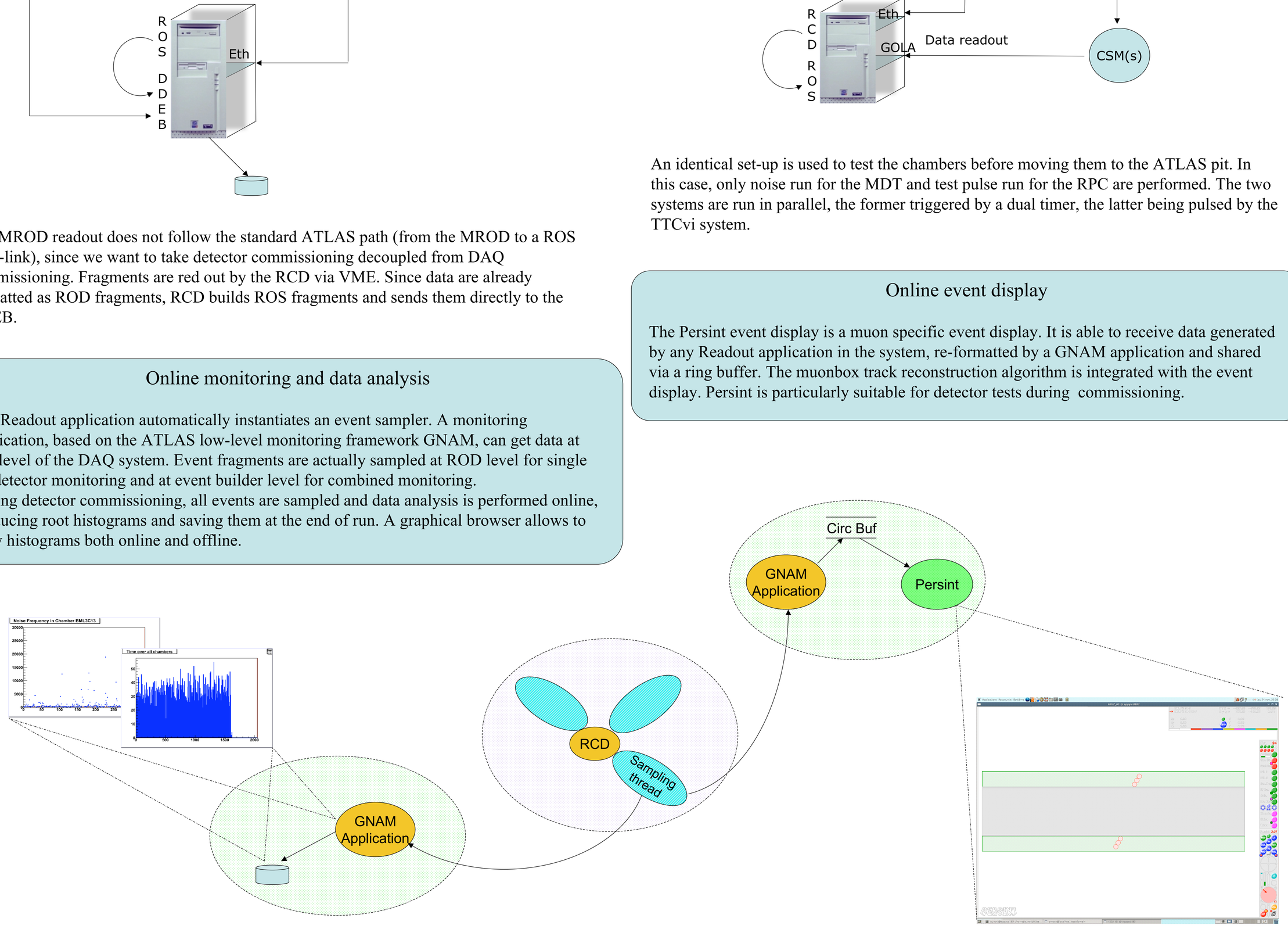
A pre-commissioning test stand is dedicated to test MDT and RPC chambers with cosmic rays. Detectors can run both in standalone and in combined mode. In order to keep the system simple, runs are taken in synchronous mode, i.e., after each trigger the system is in busy state until all the RCD finish their data read out.
The trigger is sent to the detector electronics by TTCvi modules. It is notified in parallel to an instance of the RCD acting as a trigger/busy manager via a VME I/O register and distributed via TCP to the current running subsystems, triggering data readout. The busy is released when all the subsystems issue an enable command via a TCP packet.
Both MDT and RPC use ROD emulation. The RPC RCD reads out data via VME from a data receiver board, the MDT one reads out a four input GOLA pci card. ROD fragments are sent via TCP connections to a ROS for formatting and then to a Data Driven Event Builder to be built and stored to disk.



An identical set-up is used to test the chambers before moving them to the ATLAS pit. In this case, only noise run for the MDT and test pulse run for the RPC are performed. The two systems are run in parallel, the former triggered by a dual timer, the latter being pulsed by the TTCvi system.

Online event display

The Persint event display is a muon specific event display. It is able to receive data generated by any Readout application in the system, re-formatted by a GNAM application and shared via a ring buffer. The muonbox track reconstruction algorithm is integrated with the event display. Persint is particularly suitable for detector tests during commissioning.



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