

Data flow: from front-end boards to data processing

Online update

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on behalf of the Online group

Overview

- DAQ
- Trigger system
- Online monitoring
- Spares

DAQ Software: Description

Readout and data recording:

- The software has been written in the framework of the “DATE” package provided by the CERN-ALICE experiment;
- The DAQ system records binary data in a format defined partially by the DATE software and also by the Front-end Electronics hardware.

Unpacking of the binary data:

- The binary data format - allows for great compression, but difficult for interpretation.
- The data has to be unpacked before it can be used for analysis.
- A dedicated standalone C++ library was developed for this purpose.

DAQ update

- 7 new readout servers have been installed in MLCR. The whole DAQ system has been migrated from SL 5.7 to SL 6.4. A new version of the DATE package has been installed.
- The new version of DATE package introduced significant changes in the structure of the binary data.
- We have to maintain two separate versions of the unpacking library. One for Step I and another one for Step IV data.

Two mock-data runs and two weekend beam-data runs were used to:

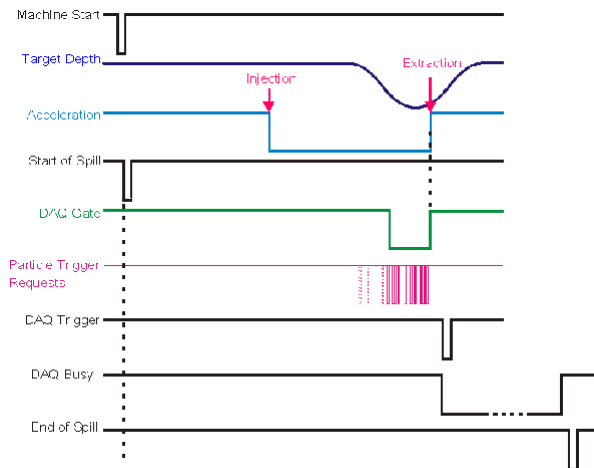
- Test the system after the upgrade and modifications. No issues found.
- Begin the work of integrating the tracker readout into the main DAQ system.
- Validate the new trigger system.

Trigger system: Description

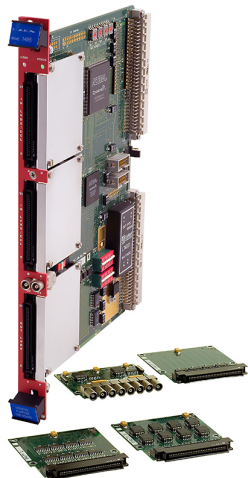
- In MICE the spill is defined as the period when the target crosses the ISIS proton beam.
- The overall principle of the MICE DAQ is that the readout is performed only at the end of the spill.
- The digital information accumulated during the Spill is buffered in the Front-End Electronics.
- The Trigger System produces and distributes both the signal triggering the digitization of the analog signals from the detectors and the signal triggering the readout of the digitized data at the end of the Spill.

Trigger system: Description

In a normal operation mode the DAQ cycle is started by the so called "Machine Start" signal, received from the ISIS Control room.



Trigger system: Update



- New trigger system for MICE based on CAEN V1495. This is a General Purpose VME Board, whose management is handled by two field-programmable gate arrays (FPGA). The board can be directly customized by the User.
- The new trigger system inherits all the functionalities of the old, NIM-based, system but is more flexible, easier to maintain and adds more control and monitoring capability.

Advantages of the new Trigger system

1. DAQ cycle generator

- All parameter are controlled by the user. Possible to enable/disable all type of events.

2. Particle trigger generator

- The programmable FPGA logic of the trigger allows for a great variety of trigger conditions, controlled by the user;
- Trigger condition masks controlled by the user;
- Various options for pulser triggers.

3. Data recording

- Trigger pattern and time recorded in a FIFO;
- Readout of the recorded data through the VME bus.

Test if the integration with the time-of-flight detectors

- The new trigger system is integrated with the TOF detectors and is being validated systematically. This validation is very important because the TOF measurement depends strongly on the trigger.
- A dedicated run on the weekend of the 28th March 2015 was used to collect data for a new TOF calibration using the new trigger. No difference in the performance of the TOF detectors was found when using the new trigger compared to what was obtained using the old trigger.

Online monitoring: Description and update

- The Online Monitoring verifies the quality of the data-taking process by performing simple checks over the online data stream.
- It has to be able to identify any problems in the functioning of the different electronics modules of the DAQ system and also to detect problems in the readout synchronization or event-building processes so that corrupt data is not recorded.

The major issue with the current implementation of the Online Monitoring is that it requires persistent attention from those on shift.

There is now an ongoing effort to automate the checking process and to make an interface between the Online Monitoring system and EPICS.

Spares

- All DAQ computers are relatively new and still under warranty.
- All the computers are interchangeable with some minor configuration changes. Spare computers are available.
- The only missing DAQ FEE spare is a single CAEN V1290 time-to-digital conversion (TDC) module.

Conclusion

The online group is in good shape.

- The upgrade of the DAQ system (hardware and software) is completed. All the modifications are test with beam data. No issues found.
- The new Trigger System is validated and will be used as a default system in Step IV.
- The integration of the two trackers in the MLCR DAQ system is in progress.
- All key components of the DAQ system are secured with spares.