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MICE Experiment Data Acquisition system

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The Muon Ionization Cooling Experiment (MICE) is under development at the Rutherford Appleton Laboratory (UK). The goal of the experiment is to build a section of a cooling channel that can demonstrate the principle of ionization cooling and to verify its performance in a muon beam. The final setup of the experiment will be able to measure a 10% reduction in emittance (transverse phase space size) of the beam with a relative precision of 1%.

The Data Acquisition (DAQ) system of the MICE experiment must be able to acquire data for ~600 muons, crossing the experiment during 1 ms long beam spill. To fulfill this requirement, the Front-End Electronics (FEE) must digitize the analog signals in less than 500 ns and store the digitized data in buffer memory. The time before the arrival of the next spill (~1 s) is used to read out the buffers and record the data.

The acquisition of the data coming from the detectors is based on VME FEE interfaced to Linux PC processors. The event building, and the DAQ user interface software has been developed from the DATE package, originally developed for the ALICE experiment. The DAQ system communicates with the Control and Monitoring System of the experiment, using the EPICS (Experimental Physics and Industrial Control System) platform. This communication is used to exchange large number of parameters, describing the run conditions and the status of the data taking process. All these parameters are recorded in a Configuration Data Base.

The Detector DAQ is strongly dependent on the Trigger System, which is divided into two parts. The first part is responsible for the generation of the so called "Particle Trigger", which triggers the digitization of the analog signals received from the detectors. The second part of the Trigger System generates the so called "DAQ Trigger". This signal is generated after the end of the spill and causes the readout and storage of the digital data, corresponding to all the particle triggers received during a spill. A new Trigger System for the MICE experiment, based on programmable FPGA logic is now under development and tests.

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