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The MICE Online Systems

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The Muon Ionization Cooling Experiment (MICE) is designed to test transverse cooling of a muon beam, demonstrating an important step along the path toward creating future high intensity muon beam facilities. Protons in the ISIS synchrotron impact a titanium target, producing pions which decay into muons that propagate through the beam line to the MICE cooling channel. Along the beam line, particle identification (PID) detectors, scintillating fiber tracking detectors, and beam diagnostic tools identify and measure individual muons moving through the cooling channel.

The MICE Online Systems encompass all tools; including hardware, software, and documentation, within the MLCR (MICE Local Control Room) that allow the experiment to efficiently record high quality data. Controls and Monitoring (C&M), Data Acquisition (DAQ), Online Monitoring and Reconstruction, Data Transfer, and Networking all fall under the Online Systems umbrella.

C&M controls all MICE systems including the target, conventional and superconducting magnets, detectors, and cooling channel components. Monitoring of environment and equipment function during data-taking is provided by the Alarm Handler, and the Archiver saves a record of all run conditions. C&M also provides an interface with the Configuration Database to retrieve pre-selected run configurations and to save new configurations.

The DAQ controls the taking and recording of all data in MICE, and must allow the collection of data for up to 600 muons in MICE during a 3 ms data acquisition gate. Equipment readout, event building, and the DAQ user interface software has been developed from the DATE package, originally from the ALICE experiment. Within the DAQ, the trigger system initiates the digitization of detector signals and controls the timing of the subsequent readout and local storage of data.

Online Monitoring provides an immediate, low-level diagnostic monitoring capability for all DAQ hardware. It displays DAQ performance and allows for individual channel-by-channel assessment of detector component behavior. Online Reconstruction and Data Quality provide real-time physics information during data-taking, immediate feedback to experimenters, and a first look at analysis quantities. It includes histograms filled during data-taking for checks of data quality, beam dynamics, and detector function and necessarily interfaces with the MICE DAQ and offline software. After each period of MICE running, all data and related histograms are transferred to remote storage on the GRID for later analysis.

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