The muon campus program at Fermilab includes the Mu2e experiment that will search for a charged-lepton flavor violating process where a negative muon converts into an electron in the field of an aluminum nucleus, improving by four orders of magnitude the search sensitivity reached so far.

The Mu2e apparatus includes three superconducting solenoids: 1. the production solenoid, where an 8 GeV proton pulsed-beam (period ~ 1.7 µs) hits a tungsten target, producing mostly pions; 2. the transport solenoid, which serves as a decay “tunnel” for the pions, and makes also charge and momentum selection, creating a low-momentum µ beam; 3. the detector solenoid, which houses an aluminum Stopping Target, where the muons get stopped and form muonic atoms, and the detector system (a 3.2 m long straw tube tracker and a crystal calorimeter in a 1T solenoidal magnetic field) optimized to detect low-momentum µ.

The Mu2e experiment at Fermilab:

1. Observe Process Variables (PVs) from their production to their transport and use the info of the reconstructed hits.
2. Interact through a web interface that is customizable;
3. Achieve a processing time < 5 ms/event.

The TDAQ and DCS installation in the Mu2e building

A prototype of the TDAQ and the DCS systems has been built and tested over the last three years at Fermilab’s Feynman Computing Center, and now the production system installation is underway.

The installation plans

The Trigger and Data Acquisition system resides in the DAQ room of the Mu2e Detector Hall. The racks, cabling, networking and controls are installed first, followed by the DAG servers. The cables and fibers that connect the TDAQ to the various detector elements will be pulled prior to installing the Detector Train.

Over the last two years, vertical and horizontal slice tests have focused on the following:

- Characterization of synchronization and jitter;
- Testing of DTC-ROC interface;
- Trigger benchmarking.

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The Mu2e apparatus includes three superconducting solenoids:

1. The Mu2e experiment is the window, for experimenters and detector experts, on the status and health of the Mu2e detector. DCS must archive and present graphical user interfaces of both detailed and high-level displays of power supplies, liquid and gas system’s operational data, environmental temperatures and magnetic field strength, and status and run condition information for the data acquisition of every portion of the detector.

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What is now ready in the DAQ room

- General-Purpose Network;
- 12 DTCs nodes;
- 396 DTCs nodes;
- OTDAQ as solution.

A custom front-end interface plug-in communicates with the detector Read Out Controller (ROC) firmware of the tracker, calorimeter and the cosmic ray veto (CRV) through the Data Transfer Controller (DTC). ROCs stream out continuously the data, zero-suppressed, to the DTCs. The data of a given event is then grouped in a single server using a 10 GBytes switch. Then, the online reconstruction of the events starts and make a trigger decision. If an event gets triggered, we pull also the data from CRV and we aggregate them in a single data stream.

For more information, see https://otsdaq.fnal.gov