Contribution ID: **11** Type: **Plenary**

The Track finder algorithm for the Trigger System of the Mu2e experiment at Fermilab

Monday, 20 April 2020 19:00 (25 minutes)

The Mu2e experiment at Fermilab searches for the charged-lepton flavor violating conversion of a negative μ into an e^- in the field of an Al nucleus. The Mu2e goal is to improve by four orders of magnitude the current best limit on the search sensitivity. The main detector consists of a 3.2 m long straw-tube tracker and a crystal calorimeter housed in a 1 T superconducting solenoid.

Even if the topology of the signal from the μ-conversion, which is represented by a $\sim$ 105 MeV/c e^-, is extremely clean and efficient reconstruction and identification of these e^- tracks is difficult due to the presence of spurious hits, low-energy delta e^- and other lower momenta e^- tracks ($p \in [40, 60]$ MeV/c) generated in μ Decay-In-Orbit processes, $N + \mu^- \rightarrow N + e^- + \nu_\mu + \bar{\nu}_e$, happening in all the parts of the apparatus where μ^- get stopped.

The data acquisition (DAQ) system consists of continuous streaming of the data from the readout controller boards to the DAQ server, where we perform the online reconstruction. The trigger system is required to provide:

- signal efficiency larger than 90%;
- trigger rate of a few kHz - equivalent to $\sim$ 7 Pb/year;
- processing time of no more than 4 ms/event.

We present the "heart" of the Trigger system that is based on a multi-staged online track reconstruction algorithm. We use two different pattern recognition algorithms, followed by a χ^2-based track fit performed through the hit positions w/o resolving the left-right ambiguity, nor applying any energy loss correction (no Kalman filter). We perform the event selection by applying a series of filters at each stage of the track reconstruction.

Preliminary studies show that the online track reconstruction will deliver a trigger rate of a few hundreds of Hz with a rate of fake tracks below $\sim$ 10 Hz while keeping the signal efficiency larger than 96\%. We also discuss the expected timing performance that has been measured using a prototype of our DAQ system at the Fermi National Laboratory.

Consider for young scientist forum (Student or postdoc speaker)

Yes

Second most appropriate track (if necessary)

Advanced usage of tracks

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