

Status of the Mu2e calorimeter readout electronic

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The Mu2e experiment at Fermilab will search for the charged-lepton flavour violating conversion of negative muons into electrons in the coulomb field of an Al nucleus, planning to reach a single event sensitivity of about 3×10^{-17} , four orders of magnitude beyond the current best limit. The conversion electron has a monoenergetic signature at ≈ 105 MeV and will be identified by a high-resolution straw tracker and an electromagnetic calorimeter (EMC) done with pure CsI crystals and custom SiPMs.

The readout electronic consists of a custom front-end board, located near the SiPMs and a digitizer and data transmission board hosted in crates surrounding the calorimeter disks, inside the detector solenoid cryostat. Each front-end board handles the signal from a SiPM and provides amplification, shaping and low noise regulation of the bias voltage. To limit the noise two front-end boards are boxed in a copper faraday cage and the output signal is converted to differential.

The digitizer board (DIRAC) receives up to 20 analog signals from front-end through a mezzanine board and convert to digital. Monte Carlo simulations have shown that a conversion rate of 200 MHz–12 bits is optimal to achieve the required energy (10%) and time resolution (500 ps). Digitized data are stored in a memory and are transmitted to the upper levels of DAQ through an optical fiber that also carries clock and slow control in the same link. The readout of the full calorimeter is handled by 140 DIRAC boards plus mezzanines and 2696 front-end boards.

The electronic will be operated in an harsh environment and has been extensively qualified to be used in high magnetic field, vacuum and high levels of ionizing and non- ionizing radiation. Front-end boards are already installed in the calorimeter and DIRAC boards are ongoing.

Collaboration

Role of Submitter

I am the presenter

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