

Design and assembling status of the Mu2e electromagnetic calorimeter mechanical structures

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The “muon-to-electron conversion”(Mu2e) experiment at Fermilab will search for the Charged Lepton Flavour Violating neutrino-less coherent conversion of a muon into an electron in the field of an aluminum nucleus. The observation of this process would be the unambiguous evidence of physics beyond the Standard Model. The detector has been designed as a state-of-the-art crystal calorimeter and employs 1348 pure Cesium Iodide (CsI) crystals readout by UV-extended silicon photosensors and fast front-end and digitization electronics. A design consisting of two identical annular matrices (named “disks”) positioned at the relative distance of 70 cm, downstream the aluminum target along the muon beamline, satisfies the Mu2e physics requirements. The hostile Mu2e operational conditions, in terms of radiation levels (total ionizing dose of 12 krad and a neutron fluence of 5×10^{10} n/cm² @ 1 MeVeq (Si)/y), magnetic field intensity (1 T) and vacuum level (10^{-4} Torr) have posed tight constraints on the design of the detector mechanical structures and materials choice. The support structure of the two 674 crystal matrices employs two aluminum hollow rings and parts made of open-cell vacuum-compatible carbon fiber. The photosensors and service front-end electronics for each crystal are assembled in a unique mechanical unit inserted in a machined copper holder. The 674 units are supported by a machined plate made of vacuum-compatible plastic material. The plate also integrates the cooling system made of a network of copper lines flowing a low temperature radiation-hard fluid and placed in thermal contact with the copper holders. The data acquisition electronics is hosted in aluminum custom crates positioned on the external lateral surface of the two disks. The crates also integrate the electronics cooling system. In this poster we will review the constraints on the calorimeter mechanical structures, the technological choices, and the status of assembling at Fermilab.

Collaboration

Role of Submitter

I am the presenter

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