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"Development, construction, qualification and assembly of the Mu2e electromagnetic calorimeter mechanical structures"

Proposed Speaker Daniele Pasciuto, for the Mu2e Calorimeter Group

The Mu2e EM calorimeter consists of two identical annular matrices ("disks") of 670 CsI crystals readout by SiPM and fast front-end and digitization electronics. The hostile operational conditions (radiation levels, magnetic field intensity and vacuum) posed tight constraints on the design of the mechanical structures and materials choice. The support structure of the two crystal matrices employs two aluminum hollow rings and parts made of open-cell vacuum-compatible carbon fiber. The SiPM and front-end electronics for each crystal are assembled in a unique mechanical unit inserted in a machined copper holder. The 670 units are supported by a machined plate made of vacuum-compatible plastic material. The plate 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 DAQ is hosted in aluminum custom crates positioned on the lateral surface of the two disks. The crates integrate the electronics cooling system as lines running in parallel to the front-end system. We review the development from the conceptual design to the specifications of all the structural components, including the mechanical and thermal simulations that have determined the materials and technological choices, the status of components production, the components quality assurance tests, the procedures for detector assembly, transportation and installation in the Mu2e experimental area.