

Design and optimization of a MPGD-based HCAL for a future experiment at Muon Collider

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In the context of the European strategy for particle physics, a multi-Tev muon collider has been proposed as a powerful tool to investigate the Standard Model with unprecedented precision, after the full exploitation of the High-Luminosity LHC. Being muons not stable particles, the main foreseen challenge is to distinguish collisions from the background radiation induced by decaying muons in the beam. High granularity, excellent energy resolution and precise timing are therefore the fundamental aspects of a detector at a muon collider. In this context, an innovative hadronic calorimeter (HCAL), based on Micro Pattern Gas Detectors (MPGD) as active layers, has been designed. MPGDs represent the ideal technology, featuring high rate capability (up to 10 MHz/cm²), spatial and good time resolution, good response uniformity (30%). In particular resistive MPGDs, such as resistive Micromegas and microRWELL, demonstrate excellent results for spatial resolution, operational stability (discharge quenching) and detector uniformity, which make them ideally suited for calorimetry. Moreover, gaseous detectors have the advantage of being radiation hard and allow for high granularity (1x1 cm² cell size).

Being the first time that such calorimeter design is proposed, dedicated studies are needed to assess and optimize the performance, as well as the development of medium scale prototypes for performance measurements. In particular, the response of HCAL to the incoming particles is studied and presented in this contribution with Monte Carlo simulations performed using GEANT4. Preliminary test on small detector prototypes with minimum ionizing particles at CERN SPS in order to measure the efficiency, cluster size, hit multiplicity and spatial resolution are also shown, as well as preliminary results of a hcal cell prototype made of 8 layers (~ 1 \times) of alternating stainless steel and MPGD detectors tested with pions beam of energy ranging between 2 to 11 GeV.

Collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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