Contribution ID: **7** Type: **not specified**

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

Tuesday 12 September 2023 16:35 (20 minutes)

In the context of the European strategy for particle physics, a multi-Tev muon collider has been proposed as an interesting alternative to investigate the Standard Model with unprecedented precision, after the full exploitation of the High-Luminosity LHC. Such a collider will indeed allow to accurately measure the Higgs coupling with other Standard Model particles, as well as the trilinear and quadrilinear Higgs self-coupling. 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, superb energy resolution and precise timing are therefore the fundamental aspects of a detector at 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%). Being more specific, 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, spatial and time resolution are also shown.

Primary author: LONGO, Luigi (INFN Bari)

Co-authors: ZAZA, Angela (INFN Bari - University of Bari); COLALEO, Anna (INFN Bari - University of Bari); STAMERRA, Anna (INFN Bari - University of Bari); PELLECCHIA, Antonello (INFN Bari); SIMONE, Federica Maria (INFN Bari - University of Bari); VERWILLIGEN, Piet (INFN Bari); RADOGNA, Raffaella (INFN Bari - University of Bari); VENDITTI, Rosamaria (INFN Bari - University of Bari)

Presenter: LONGO, Luigi (INFN Bari)