Contribution ID: **64** Type: **Poster**

The prototype of the MICE Electron Muon Ranger: design, construction and test

Wednesday 3 September 2008 15:10 (20 minutes)

MICE (Muon Ionization Cooling Experiment) and its goal to demonstrate the feasibility of ionization cooling represent the first step towards a neutrino factory. Muons in MICE are produced by pions which derive from the interaction of protons with a target. Being muons short lived particles, a special cooling procedure has to be developed, able to reduce quickly the emittance. MICE intends to measure the emittance value with a 0.1% accuracy before and after the cooling element; thus a detector able to reconstruct and identify individual particles is required. The presence of electrons due to the muons decay introduces a systematic error on the emittance and cooling measurements. For this reason a particle identification system is being developed based on a totally active scintillator tracker/calorimeter (EMR, Electron Muon Ranger). The detector consists of 50 planes of extruded scintillator bars 1m long and with a section of 1.5x1.9 cmˆ2; the bars are readout with 0.8mm WLS fibers coupled to multinanode photomultipliers. The readout segmentation will be chosen accordingly to the rate (600 of good muons per 1ms spill every 1s). This paper describes the design, construction and test with cosmic rays of the first small size prototype of the EMR with full analog readout, consisting of 4x and 4y layers with 10 bars each with the final section and a length of 19cm.

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Session Classification: Poster Session 2 - PPE & Nuclear

Track Classification: Applications in Particle Physics