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A Highly Granular Calorimeter Concept for Long Baseline Near Detectors

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Future long baseline neutrino experiments such as the DUNE experiment under construction at Fermilab will perform precision measurements of neutrino oscillations, including the potential for the discovery of CP violation in the lepton sector. These measurements require an understanding of the unoscillated neutrino beam with unprecedented accuracy. This will be provided by complex near detectors which consist of different subsystems including tracking elements and electromagnetic calorimetry. A high granularity in the calorimeter, provided by scintillator tiles with SiPM readout as used in the CALICE analog hadron calorimeter, provides the capabillity for direction reconstruction of photon showers, which can be used to determine the decay positions of neutral pions. This can enable the association of neutral pions to neutrino interactions in the tracker volume, improving the event reconstruction of the near detector. Beyond photon and electron reconstruction, the calorimeter also provides sensitivity to neutrons. In this presentation, we will discuss a simulation study exploring the potential of high granularity for the electromagnetic calorimeter of the DUNE near detector. Particular emphasis will be placed on the combination with a high pressure TPC as tracking detector, which puts particularly stringent requirements on the calorimeter. The dependence of the projected detector performance on granularity, absorber material and absorber thickness as well as geometric arrangement satisfying the constrants of the TPC are explored.

Secondary topics

Highly granular calorimeters, simulation studies of a new detector concept

Applications

Design concepts for future calorimeter at the intensity frontier

Primary topic

Other

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