Photon and neutron production studies in the MIPP Experiment

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MIPP Main Goals:
- Hadronic Fragmentation Scaling Law Test
- NuMI Target Study for the MINOS Experiment
- Anti-proton Physics and ILC Calorimeter studies with upgraded detector

CALORIMETER Goals:
- Photon and Neutron production studies with different targets and beam momenta.

Energy Calibration of Calorimeters:

Method 1: \[ E_0 = \sum c_j E_{\text{EMCal}} + \sum c_k E_{\text{HCal}} \]

Calibration with 90 GeV/c electron beam

Method 2:

See MIPP-Note 61 for details

MIPP is investigating the use of hadrons for EMCal calibration. EMCal and HCal calibrations are fit simultaneously. Hadrons will leave some fraction \( f_{\text{EM}} \) of their energy in the EMCal. The EMCal weights as a function of \( f_{\text{EM}} \) can be extrapolated to \( f_{\text{EM}} = 1 \) to yield the EM calibration. This method may allow to calibrate an EMCal with hadrons!

Search for Neutrons from the elastic proton to neutron charge exchange reaction:
- beam - 35 and 58 GeV/c protons
- target - LH2, Carbon and Beryllium
- veto on forward-going charged tracks based on the wire chambers
- veto on the TPC tracks which match to beam tracks
- calculate the deposited energy into EMCal and HCal

Neutron Production Studies:

EMCal and HCal ADC sums for neutron sample events.

The sum of EMCal distribution on the neutron sample events.

HCal ADC sum for the neutron sample.

The ratio of calorimeter energy to proton beam momentum.

Specifications
EMCAL:
- 64”(x) x 60”(y) x 12”(z)
- 10 Layers of Pb and PWCs
- 10 radiation lengths
- P10+C4F gas mix in PWCs

HCAL:
- 40”(x) x 40”(y) x 96”(z)
- 64 layers of Fe + Scintillator
- 9.6 Interaction lengths

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