

The CALICE collaboration is developing three prototype calorimeters for the International Linear Collider: an electromagnetic calorimeter (ECAL), a hadronic calorimeter (HCAL) and a tail catcher/muon tracker (TCMT). The detectors have collected several terabytes of data from electron, proton, muon, and pion test beams at Fermilab (2008) and CERN (2006, 2007).



The Northern Illinois Center for Accelerator and Detector Development (NICADD) at NIU is leading the development of the TCMT. The TCMT sits behind the HCAL and contains 320 strips of scintillating material (each 1m by 5 cm) with a total interaction length of 6 λ . The strips are arranged in 16 layers of 20 strips each with alternating vertical and horizontal orientations.

Calibration

The strips of the TCMT were staggered by $\frac{1}{2}$ of a strip width for the experiments conducted at CERN in 2007. Modifications to the analysis software were necessary to account for this staggering. Calibration of the 320 strips using Minimum Ionizing Particles (MIPs) was completed via statistical analysis in ROOT.

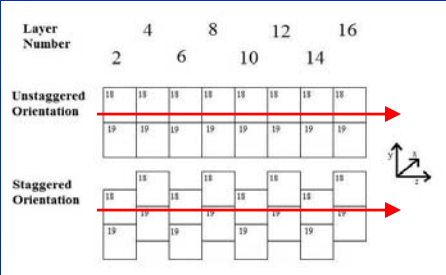
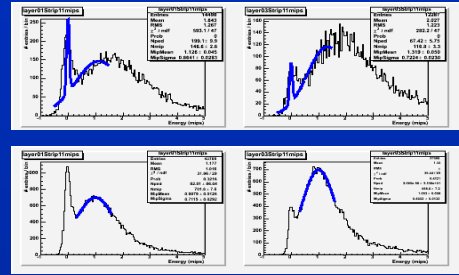


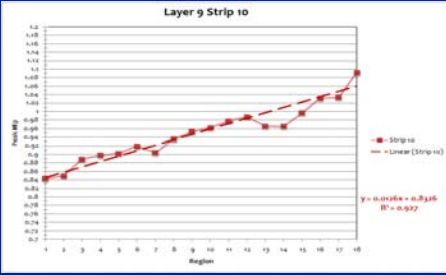
Illustration of the different strip orientations with sample particle paths drawn



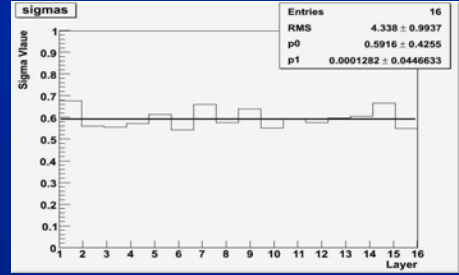
Samples of pre-calibration (top) and post-calibration (bottom) energy distributions

Attenuation

The light generated in the scintillating strips travels through wavelength-shifting optical fibers to silicon photomultipliers (SiPMs), where the signal is read out. The attenuation of the optical signal per 1m of fiber was found to be approximately 10%. The width of the energy distributions as a function of layer was also studied.



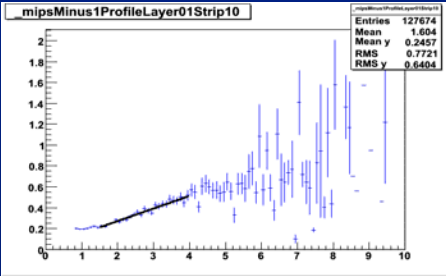
Sample graph of normalized signal strength vs region of strip where signal was measured



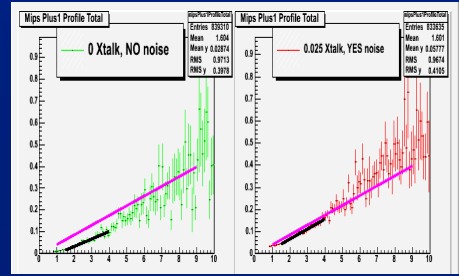
Comparison of the mean width of each strip's energy distribution as a function of layer

Crosstalk

The prevalence of crosstalk between scintillating strips was studied by looking for correlated signals in adjacent strips during muon events. An analysis technique was developed for extracting these correlations with a preliminary result of approximately 4.5%. Comparisons to Monte Carlo (MC) events were performed.



Sample profile plot of normalized signals in adjacent strips for muon events



Two attempts to recreate the observed 4.5% crosstalk effect in 10 GeV MC muon events