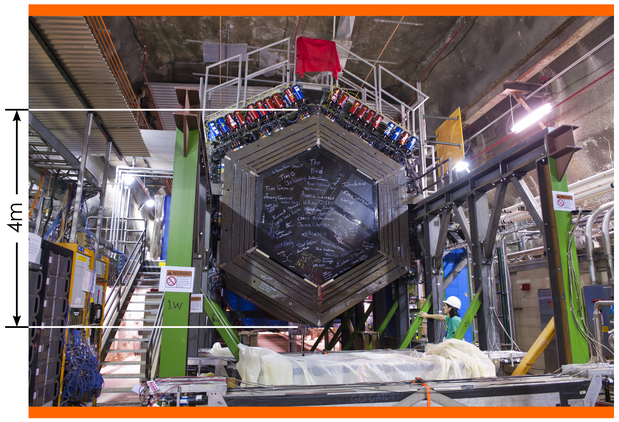
MINERvA Test Beam

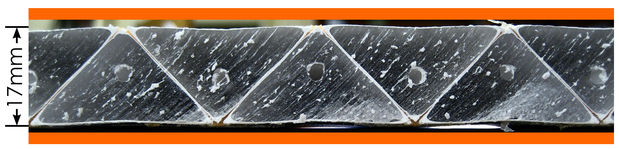
In a new low energy beamline at the Fermilab Test Beam Facility

E938/T977

Josh Devan
June 2011

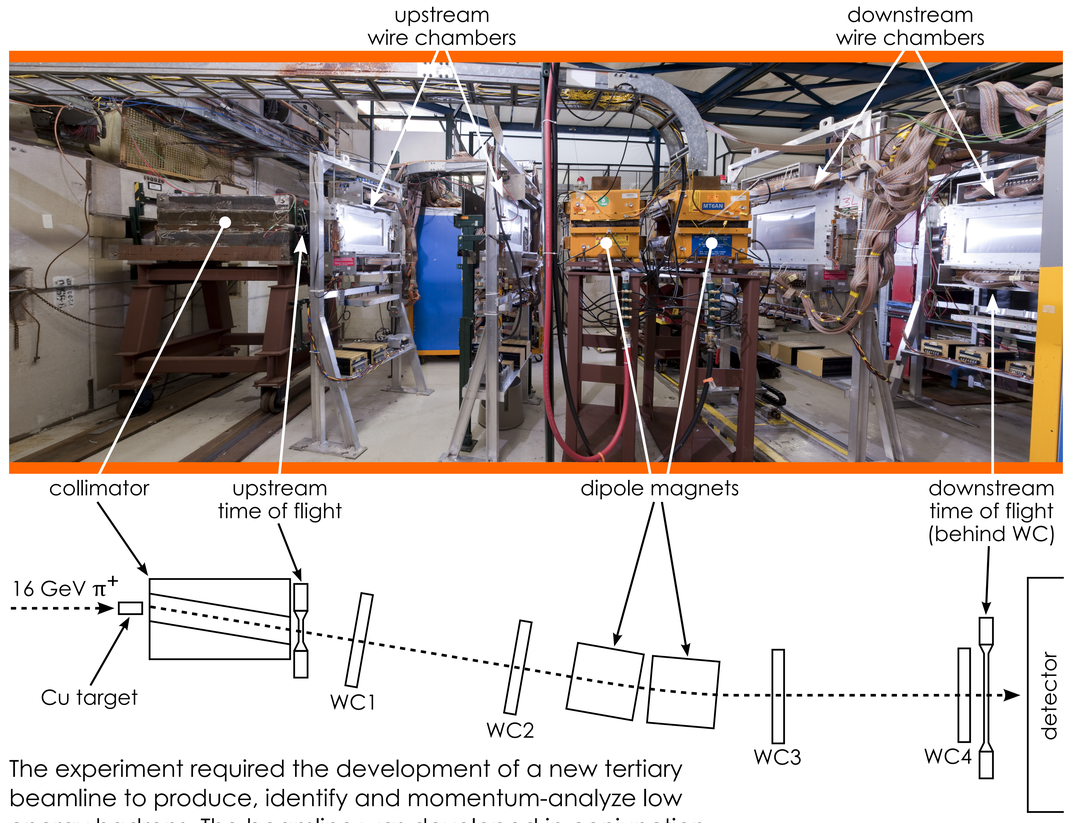


MINERvA is a neutrino scattering experiment in the NuMI beamline at Fermilab, designed to measure neutrino cross-sections, final states and nuclear effects on a variety of targets in the few-GeV region. The MINERvA collaboration consists of scientists from both the nuclear physics and neutrino oscillation communities.

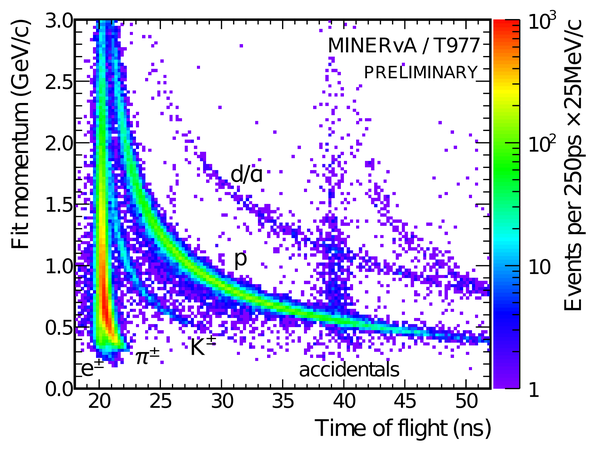


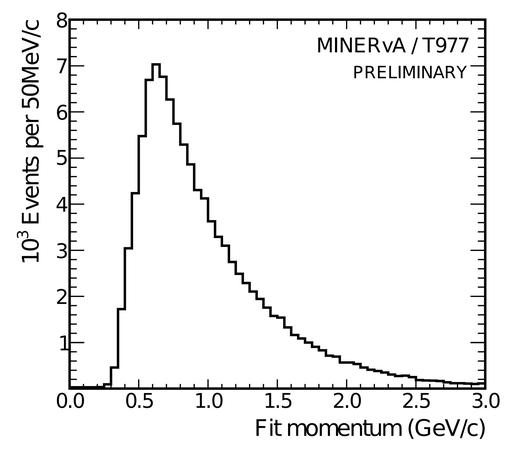
The detector is constructed of planes of triangular, extruded polystyrene scintillator laced with wavelength-shifting optical fiber.

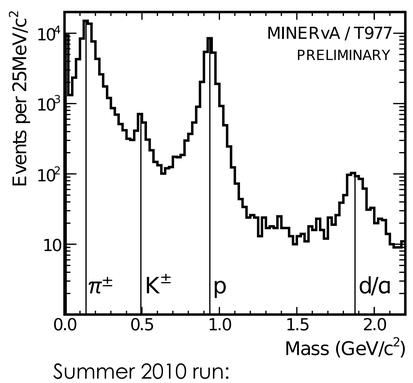
In order to calibrate the absolute energy scale of the detector, a small, reconfigurable version was constructed and exposed to a measured beam of particles. The 40 scintillator planes of ~1m^2 active area can be interleaved with sheets of 2mm lead and 1in steel absorber to emulate the downstream calorimeters of the main detector, or without absorber to emulate the fully-active tracker region.



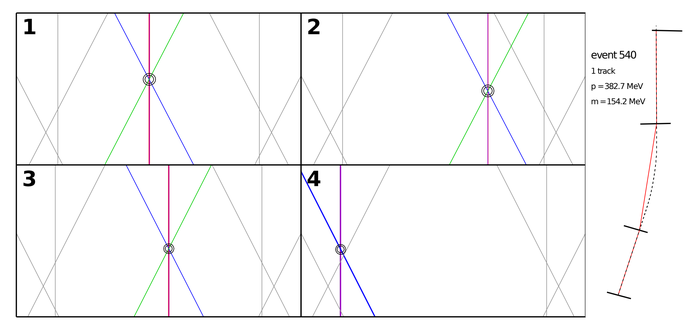
The experiment required the development of a new tertiary beamline to produce, identify and momentum-analyze low energy hadrons. The beamline was developed in conjunction with the Fermilab Test Beam Facility. It is now a permanent asset of the facility, extending the energy reach to sub-GeV, and is available for use by other experiments.



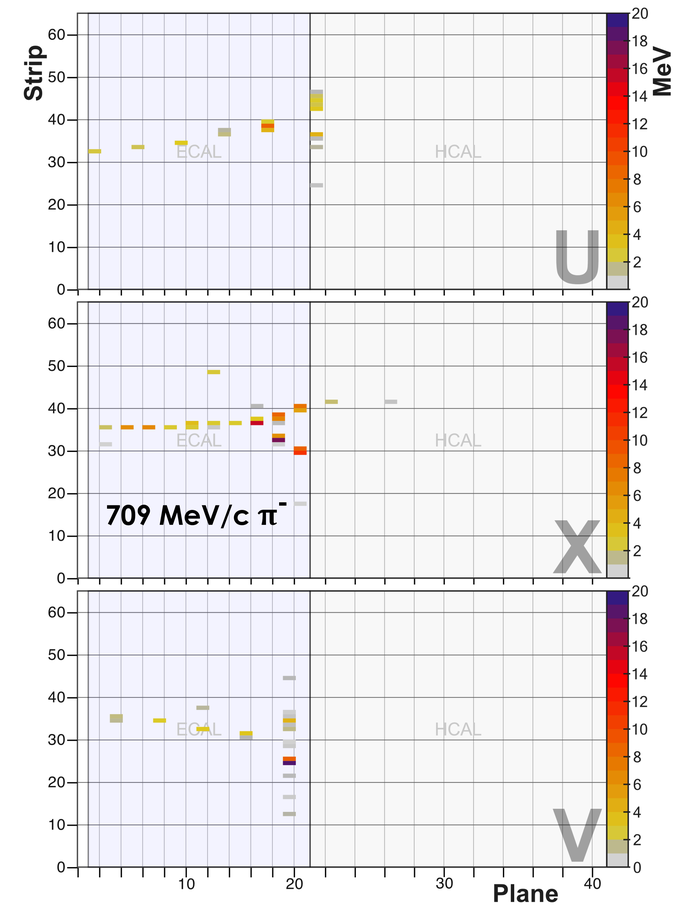




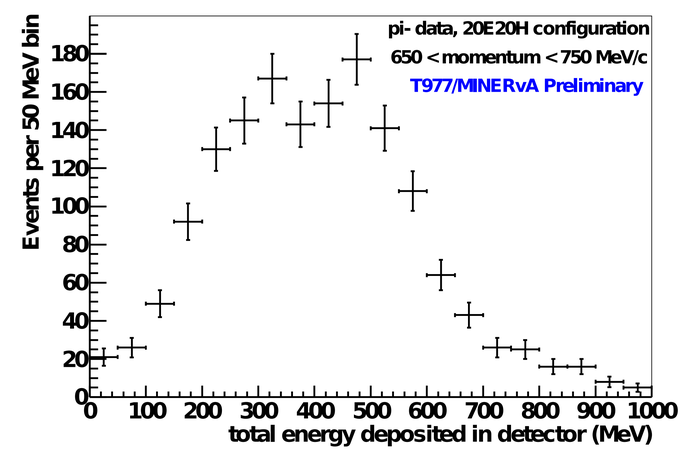
Summer 2010 run:
32 operational days
107k reconstructed events



The display above shows a low energy pion traversing the beamline. For each of the four chambers, wire hits are shown as colored lines; the hit position is marked with a circle. The fitted path is shown dashed on the right.



The three views of the detectors (X,U,V) differ by a 60° rotation of the scintillator strips. The above event display shows an interacting pion in the test beam detector.



A preliminary analysis of the test beam detector in the electromagnetic/hadronic calorimeter configuration, before final calibrations. Total energy deposited is the visible energy weighted by a dE/dx factor to account for the passive lead and steel absorber.