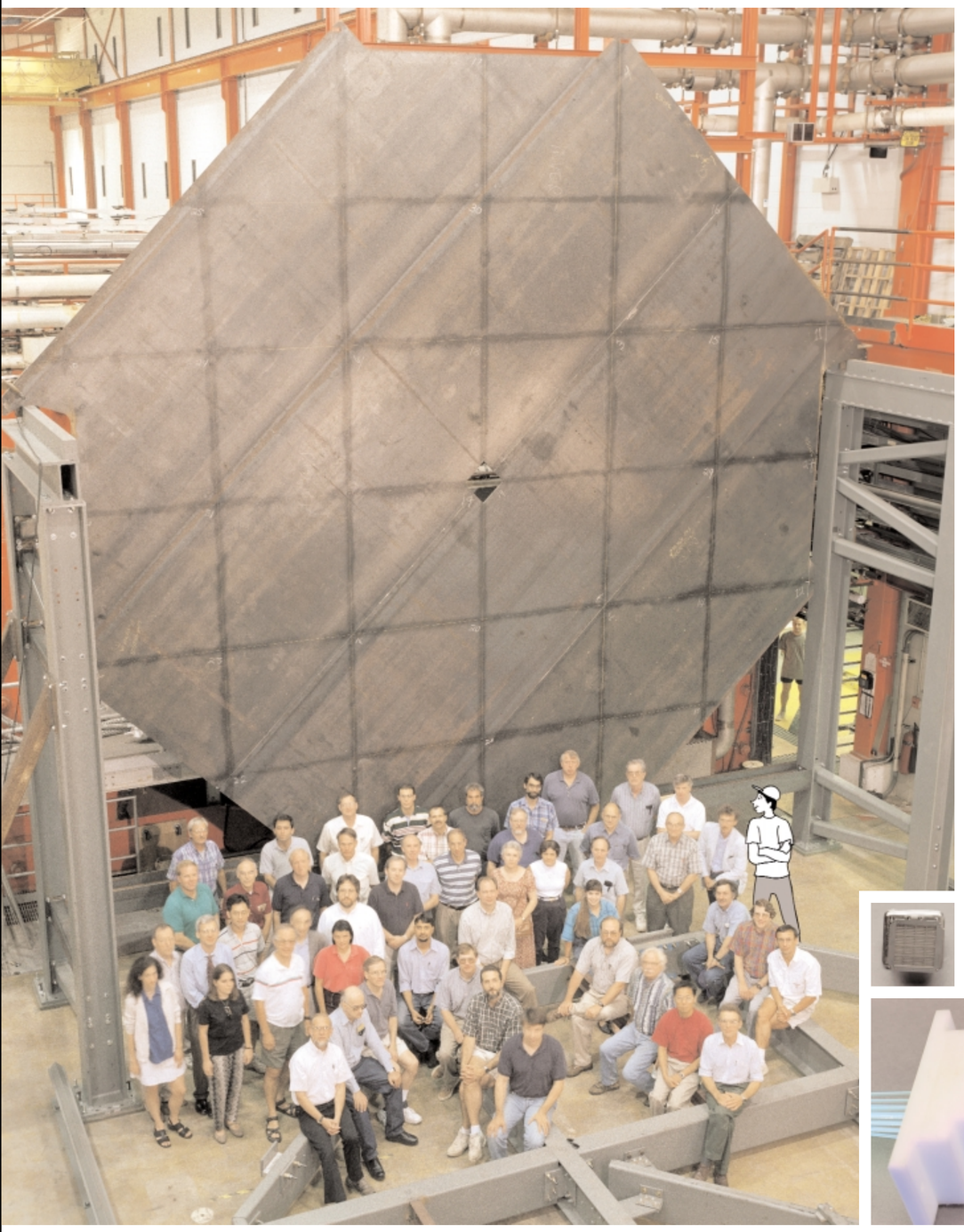
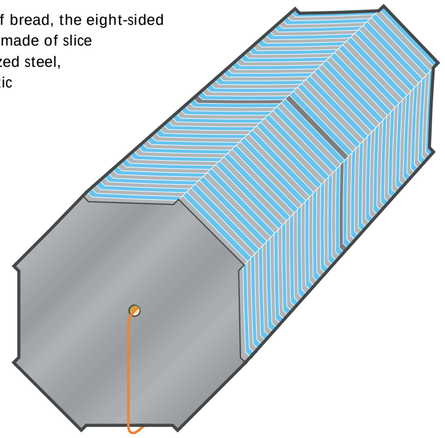
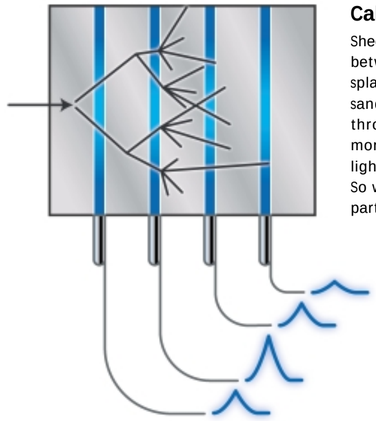
How to DETECT a Neutrino



The MINOS collaboration poses for a photo in front of a steel plane of the MINOS detector. Eventually the detector will be 90 feet long and 24 feet in diameter, made of 486 layers of these eight-sided steel plates. Even with 5,000 tons of steel, only a few in 10 billion neutrinos coming from Fermilab will interact in the MINOS detector.

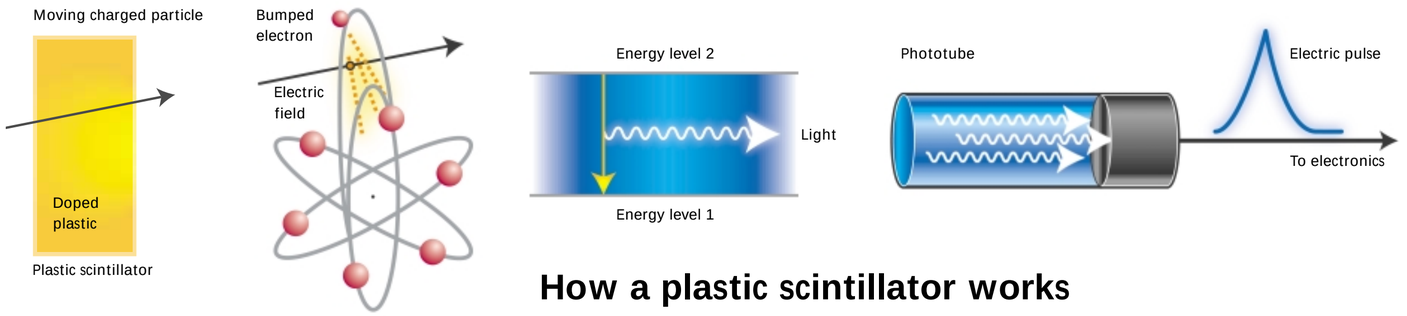
Like a 5000-ton loaf of bread, the eight-sided MINOS far detector is made of slice after slice of magnetized steel, sandwiched with plastic scintillator. When a neutrino collides with an iron nucleus, it produces a splash of particles. Charged particles passing through the scintillator produce light, which is then converted to an electronic signal for the watching experimenters.



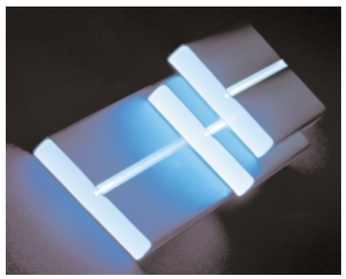


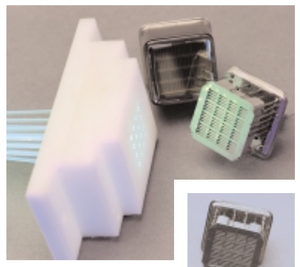
Calorimeter Sandwich Detector

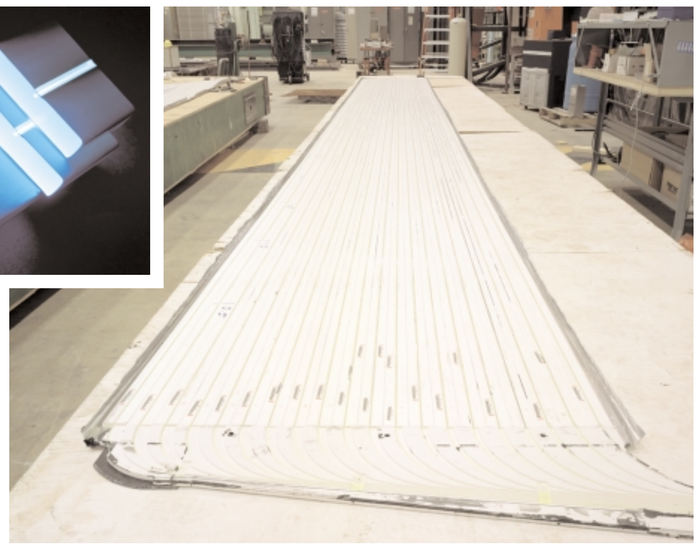
Sheets of plastic scintillator are placed between the steel plates. The particle splash is quickly absorbed in the calorimeter sandwich. Each charged particle passing through the scintillator creates light. The more particles, the more light. The more light the bigger the electronic signal. So we can measure the energy of the particles by adding up the electronic signals.



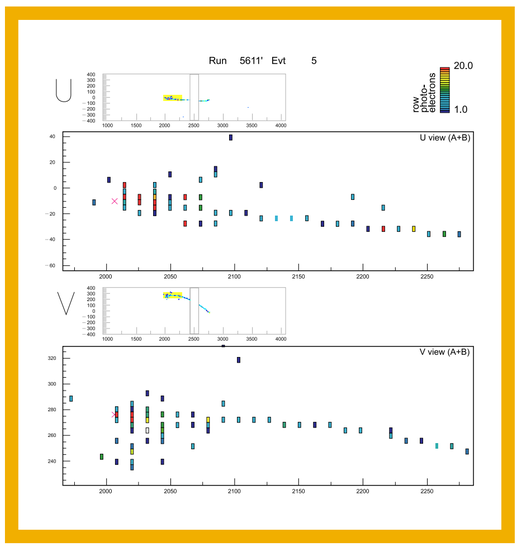
How a plastic scintillator works







Plastic scintillator strips 24 feet long and about 1-5/8″ by 3/8″ are assembled into modules of 20 or 28 strips wide. Eight modules are assembled to make one plane of 192 strips, which is sandwiched between the steel plates. Each strip has a light fiber glued along its center to bring the light to a phototube. Each phototube receives the light from 128 fibers.



A picture of a typical interaction of a muon-flavor neutrino. The muon produced in the interaction (the long track in the picture) is gradually losing energy as it goes through the steel plates. The magnetic field present in the steel causes the muon to bend. The amount of bending gives a measurement of the muon energy.

Neutrinos @ FERMILAB

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