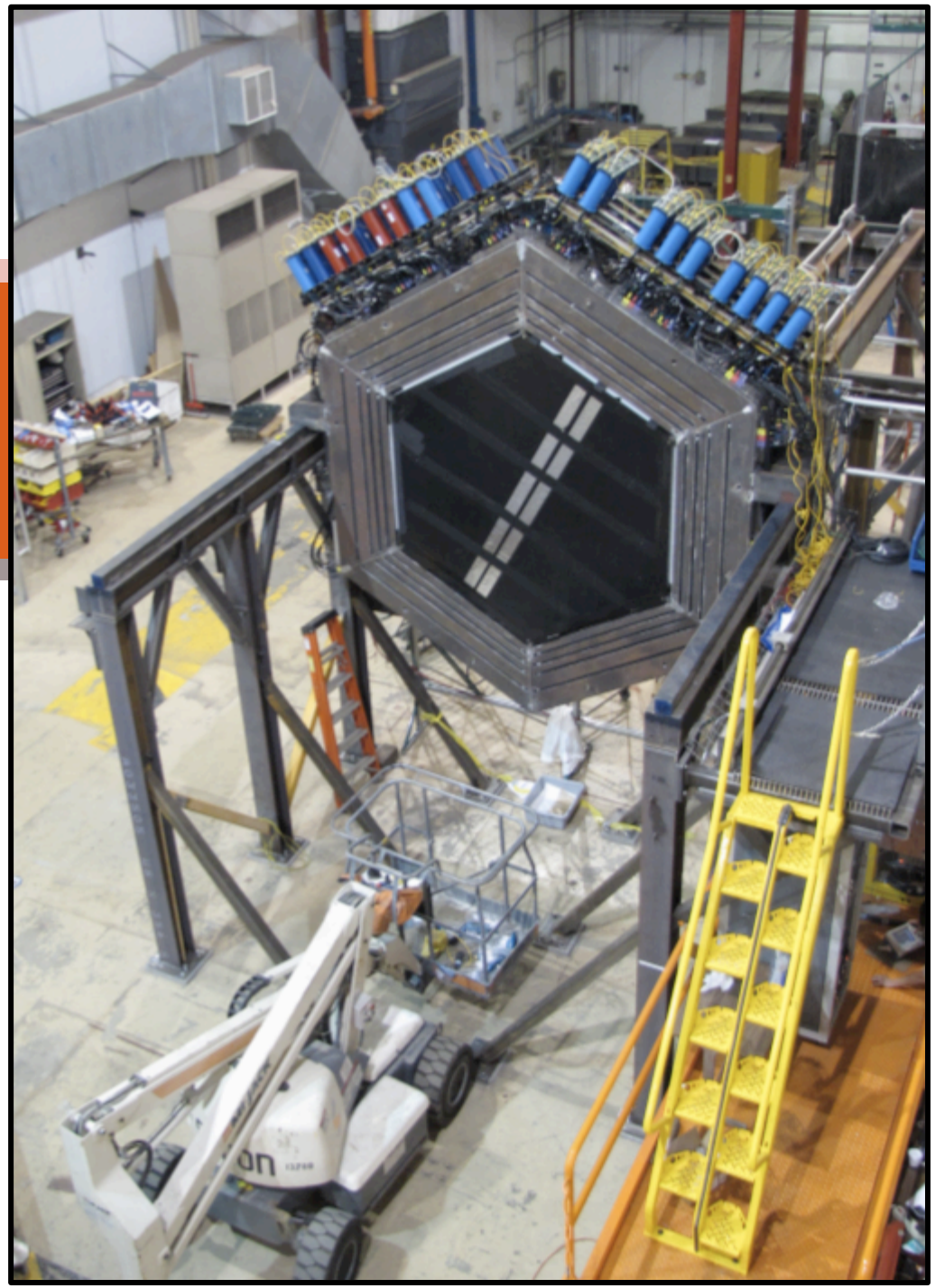
MINERνA

Tracking Prototype Commissioning

Fermilab All Experimenters' Meeting

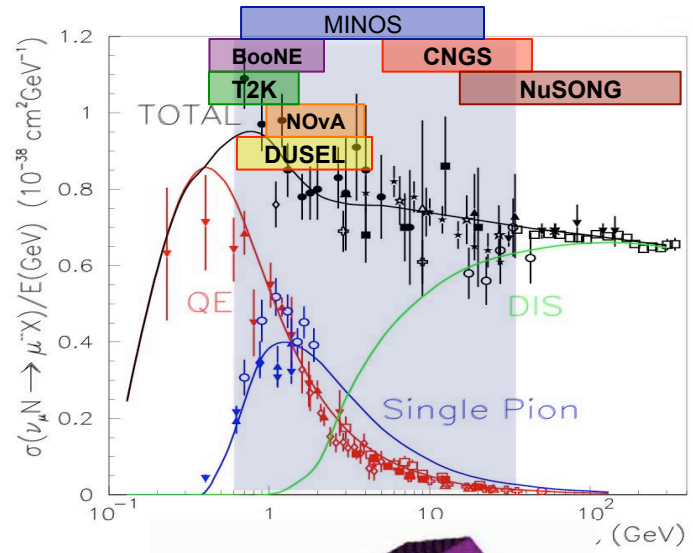
December 22, 2008

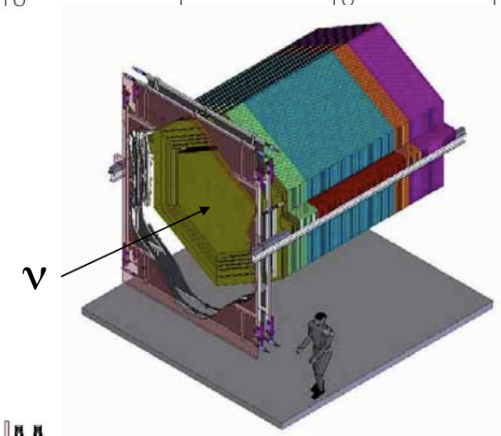
Dave Schmitz

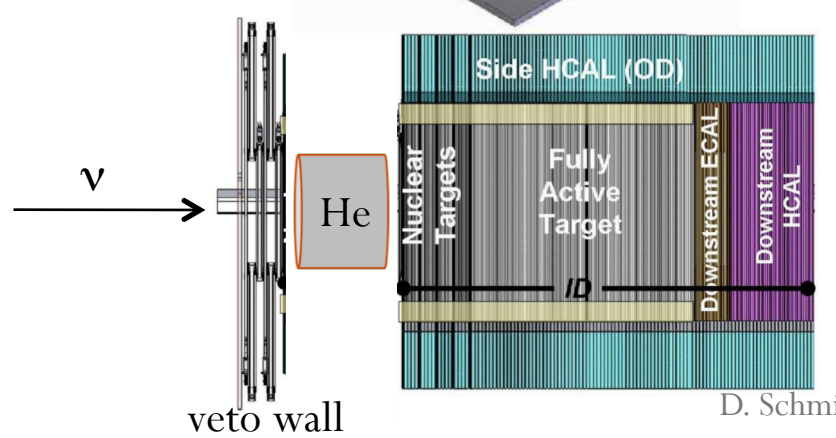


MINERvA Overview

- a finely segmented, fully active detector for study of **neutrino-nucleus** interactions in the GeV energy range
- provide crucial information for current and future **oscillation experiments**
- make use of existing intense NuMI beam and MINOS near detector for muon spectrometer
- range of nuclear targets for study of **nuclear effects** in neutrino interactions (He, C, Fe, Pb)

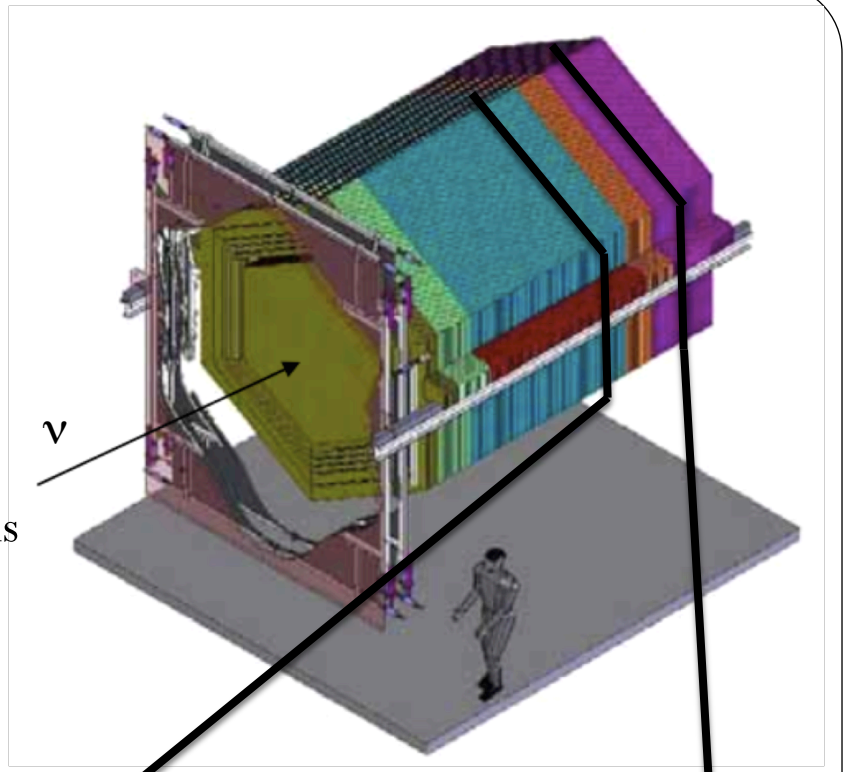


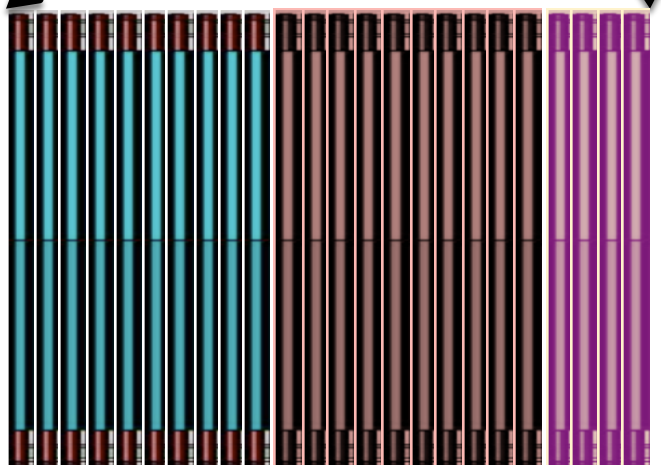




Tracking Prototype

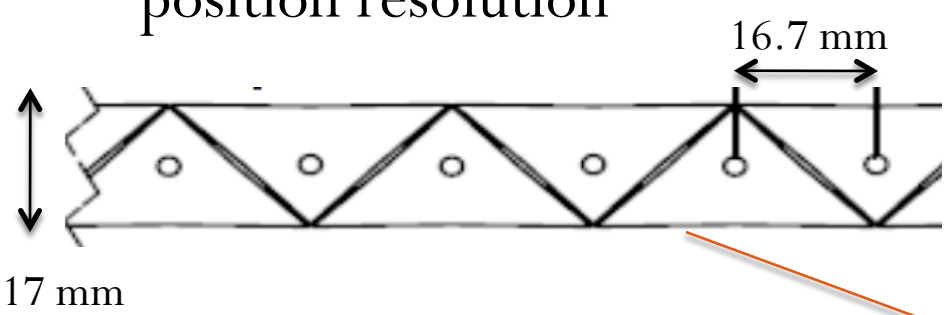
- comprehensive test of :
  - detector design
  - component production
  - detector assembly
  - calibration techniques and implementations
  - event reconstruction
- 10 fully active tracking modules
  - 2 scintillator planes @ 17 mm each
- 10 ECAL modules
  - 2 lead sheets @ 2 mm each
  - 2 scintillator planes @ 17 mm each
- 4 HCAL modules
  - 1 steel sheet @ 25 mm
  - 1 scintillator plane @ 17 mm

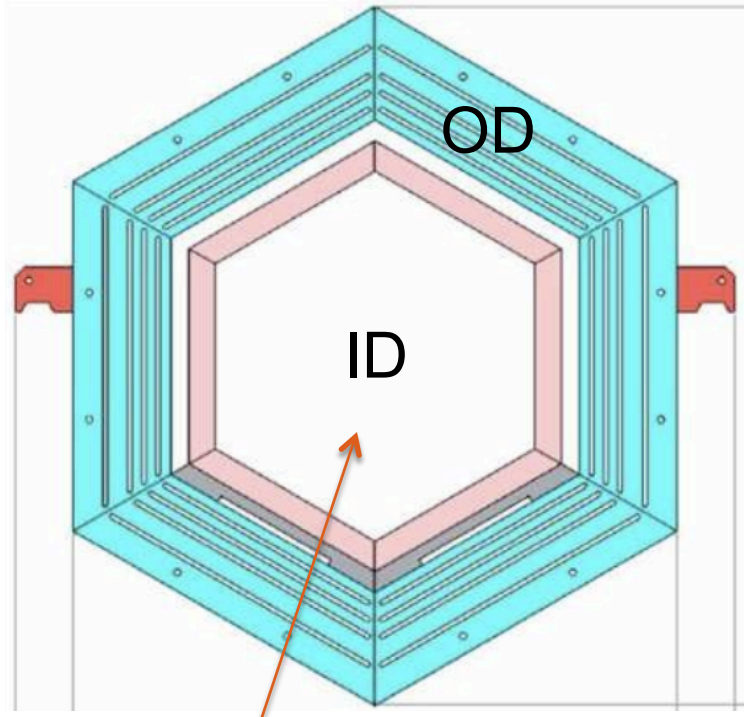


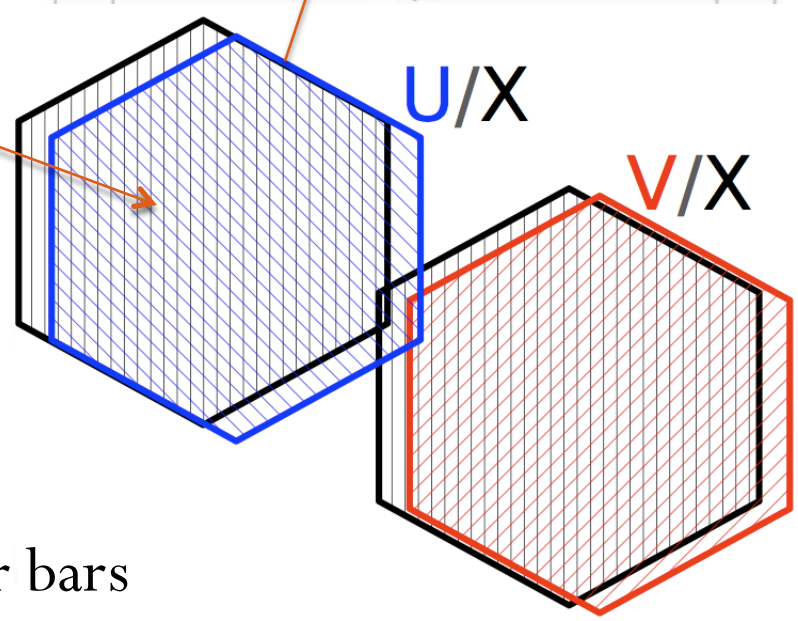


Modules

- fully active scintillator planes
- triangular geometry allows charge sharing for better position resolution



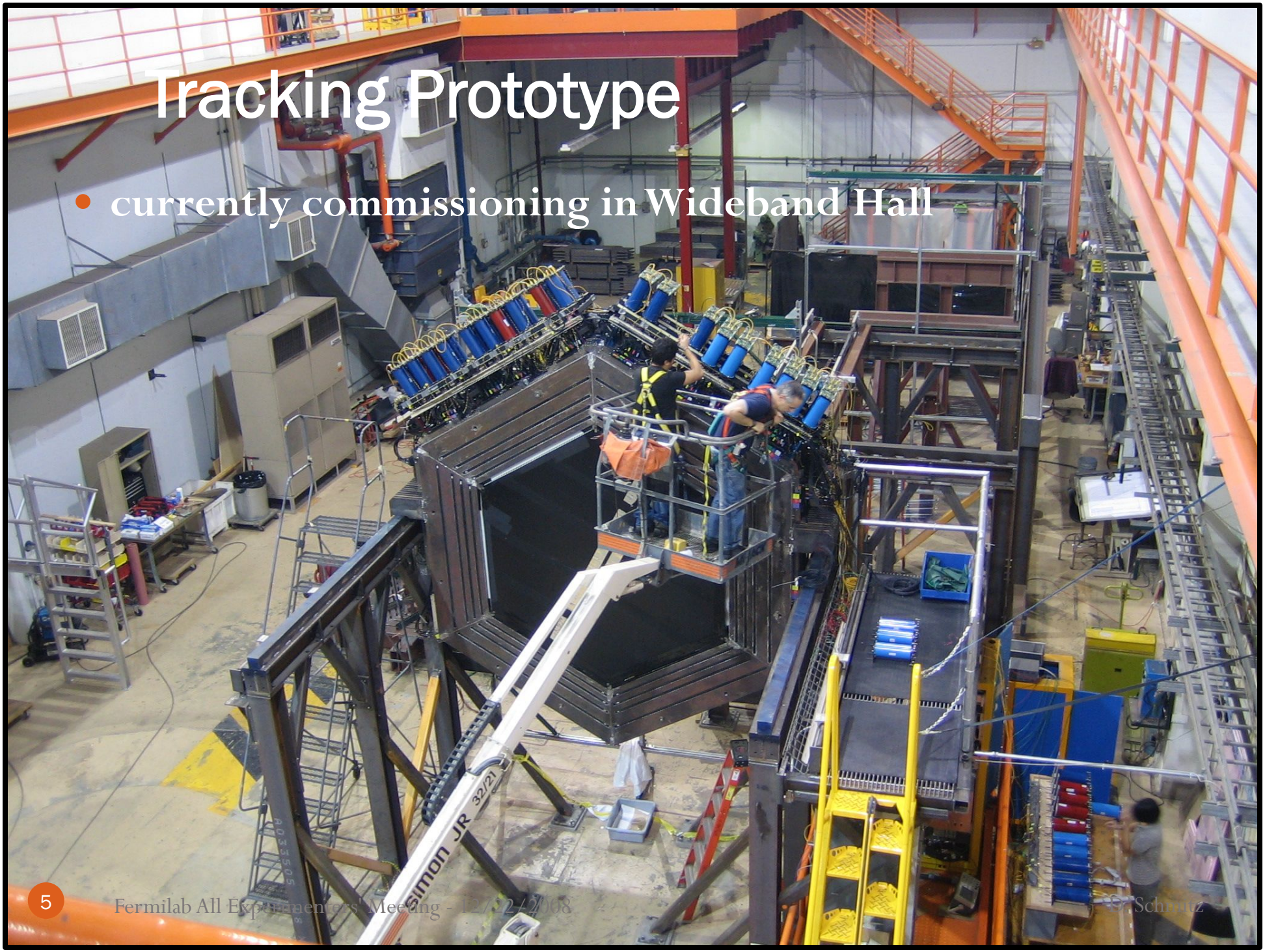




- Tracking/ECAL modules alternate U/X V/X ID views
- HCAL modules only one Inner Detector (ID) view (Fe 1" thick)
- Outer Detector (OD) scintillator bars

Tracking Prototype

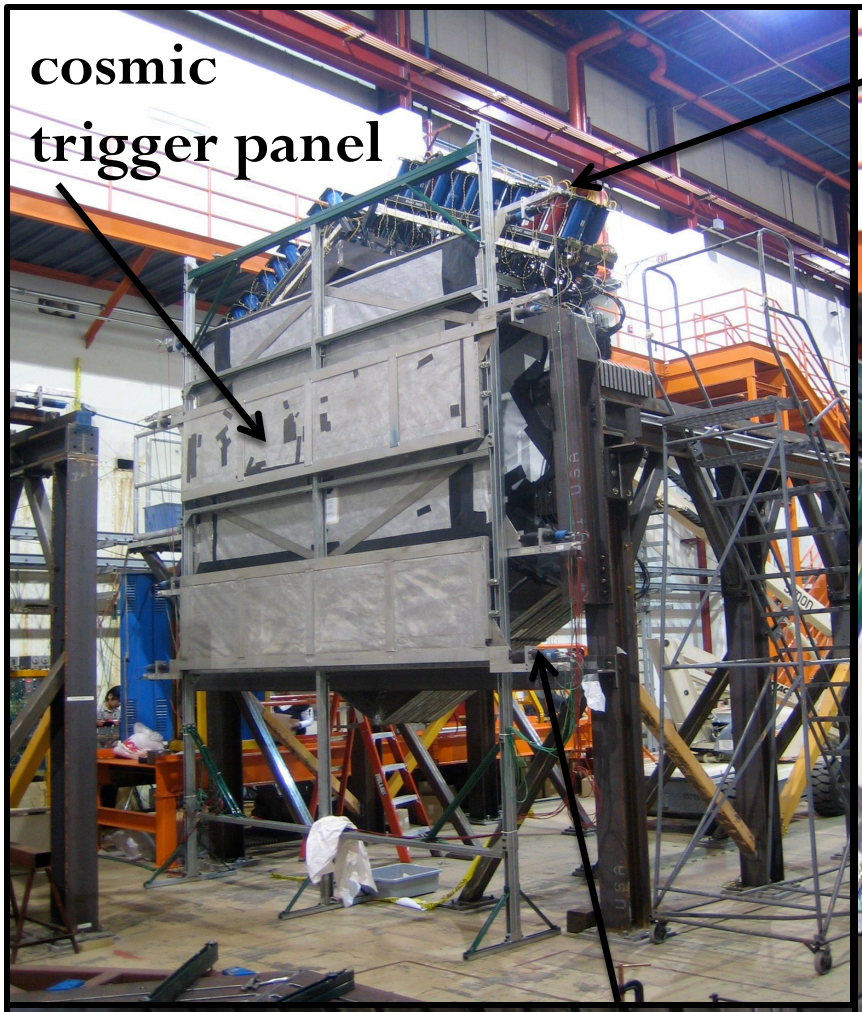
- currently commissioning in Wideband Hall



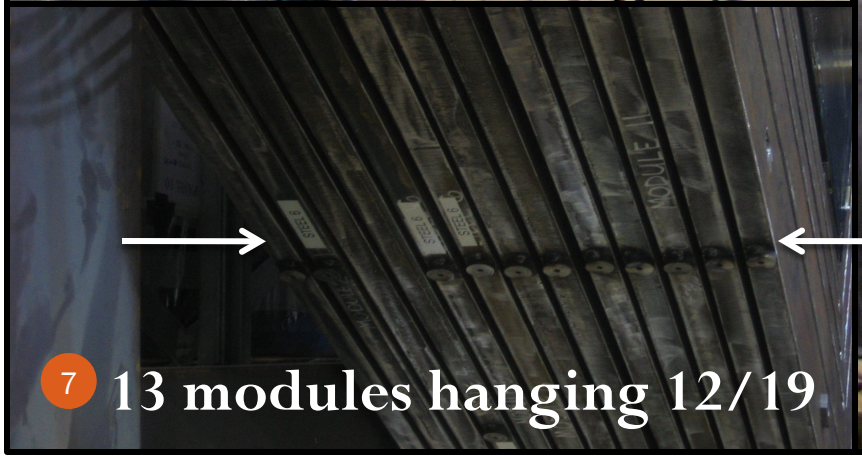
Status of TP Construction

- 13 (of 24) modules hanging in Wideband Hall with 12 instrumented as of last Friday
- 14th mapped and ready to hang with 2 more frames welded
- on track to finish commissioning in Feb 09
- excellent collaboration between Universities and the lab
  - many components assembled here (Labs 6,7,G) and at Universities, final full assembly in Wideband
  - lots of effort by student collaborators from US and Latin American institutions

	required for TP	**produced and @ FNAL**
extruded scintillator bars	5588(ID) + 1152(OD)	all
wavelength shifting fiber	~18 km	all
ID scintillator planes	44	40
OD scintillator assemblies	144	104
steel frame pieces	144	144
2 mm lead sheets ECAL	20	20
25 mm steel sheets HCAL	4	4
PMTs and boxes	105	105
FEBs	105	105


cosmic
trigger panel

10 Tracking + 2 ECAL instrumented
12/19


13 modules hanging 12/19

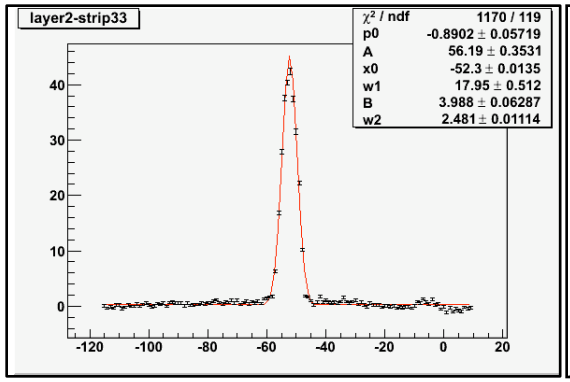
First ECAL Modules – 2 mm Pb sheets

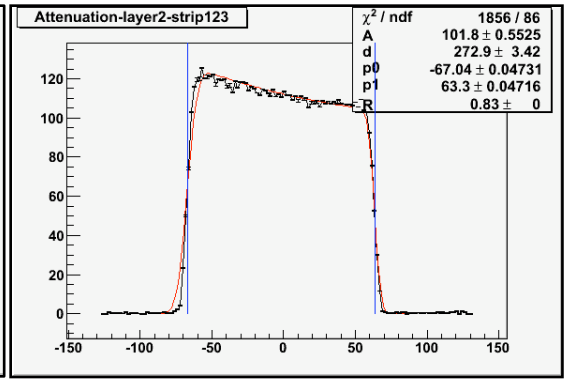
(Hengbao Zeng, Dan Ruggiero, U. of Rochester

Module and PMT Calibration

- All modules are source mapped in Wideband before being hung

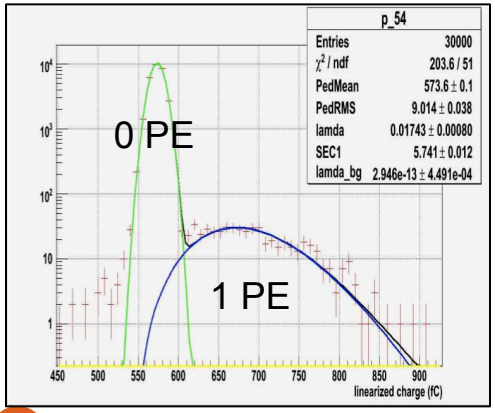
  strip position, relative strip response, attenuation along strips

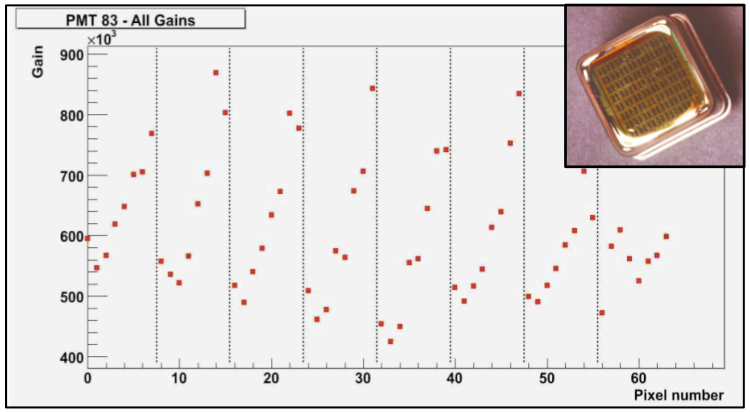




(Jaewon Park, Melanie Day, Bob Bradford, U. of Rochester)

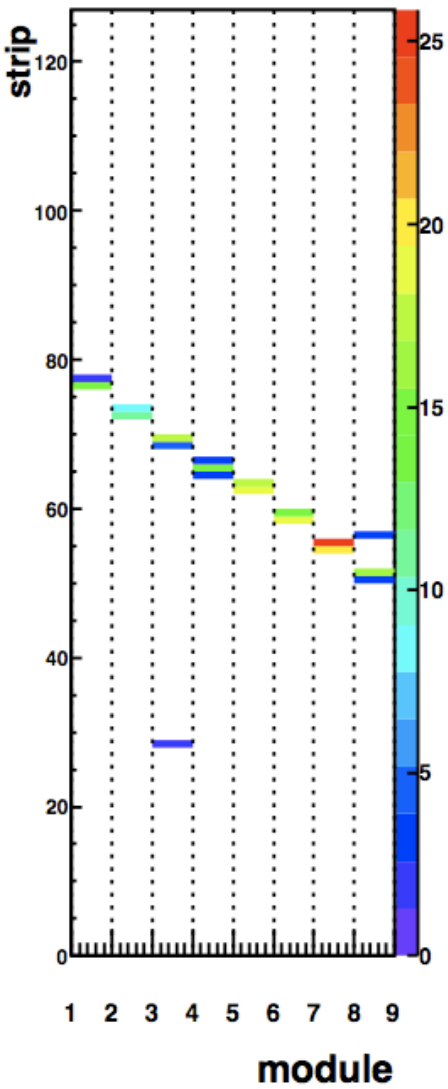
- Light injection system installed for PMT gain calibration

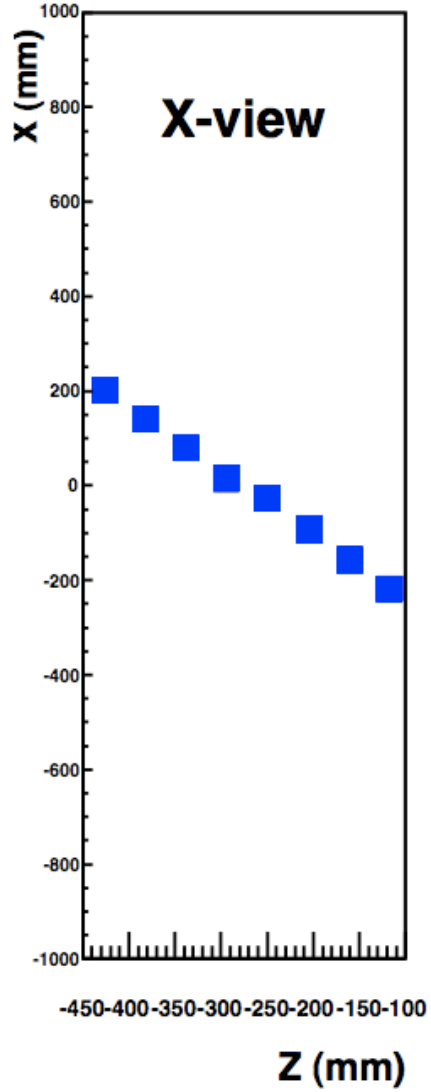


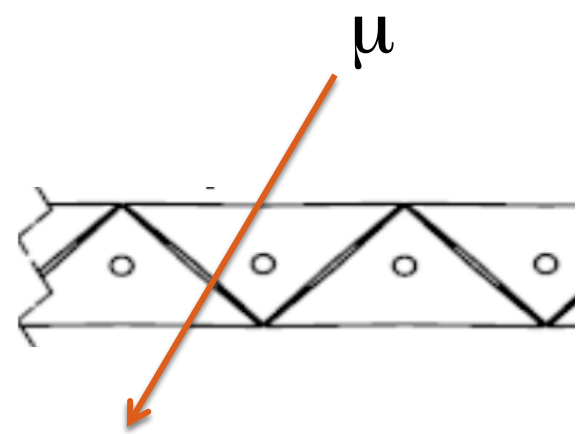


(Brandon Eberly, U. of Pittsburgh)

Cosmic muons in TP

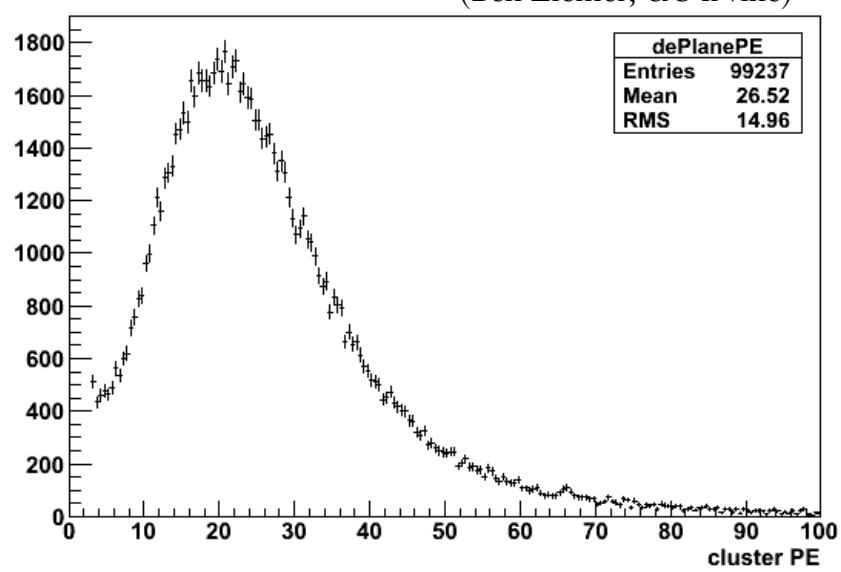


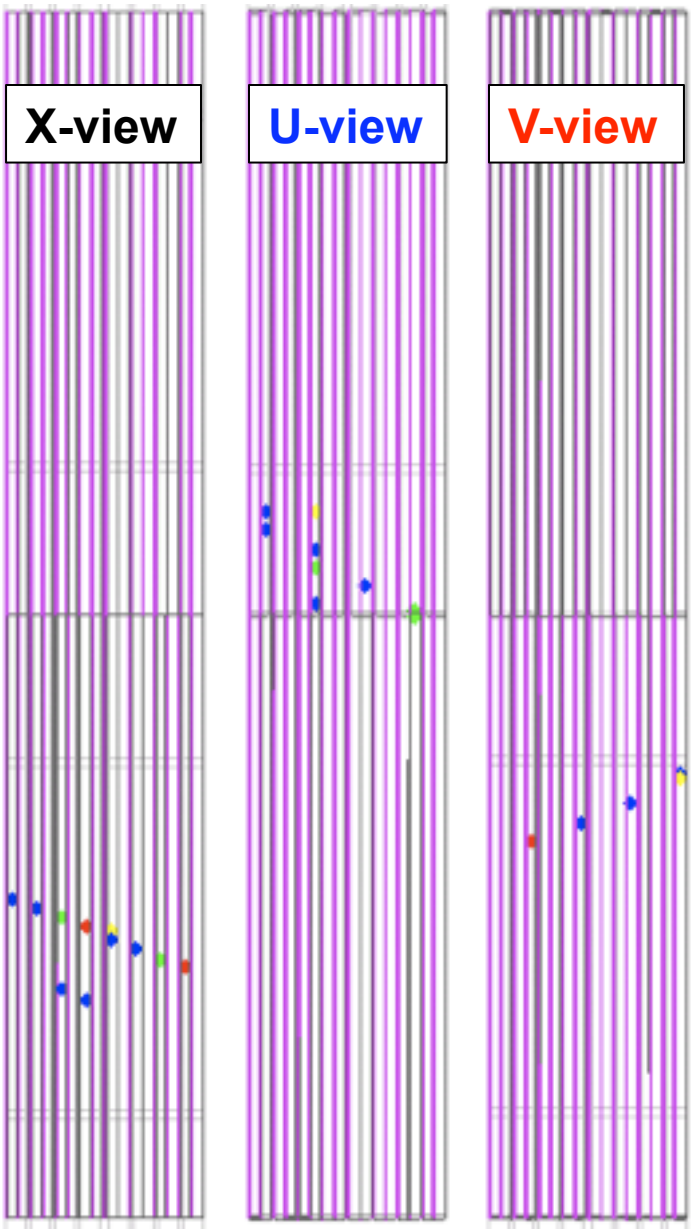


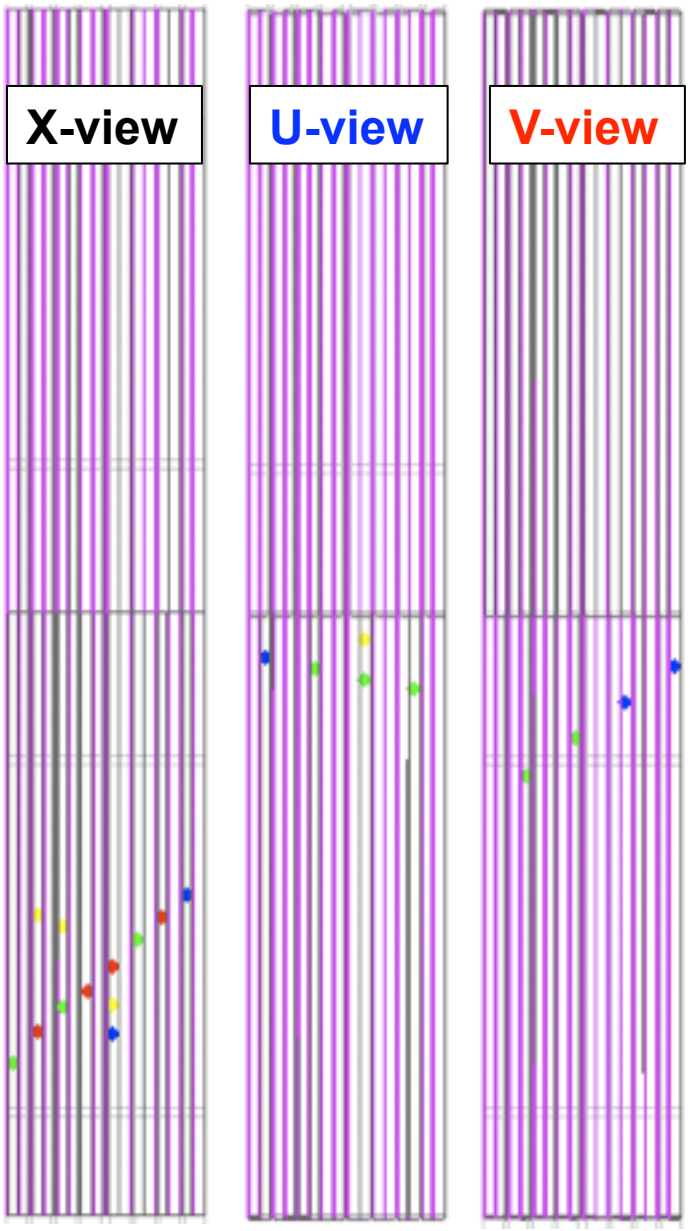


- hit doublets
- clustering, tracking algorithms
- PEs per cluster

(Ben Ziemer, UC Irvine)



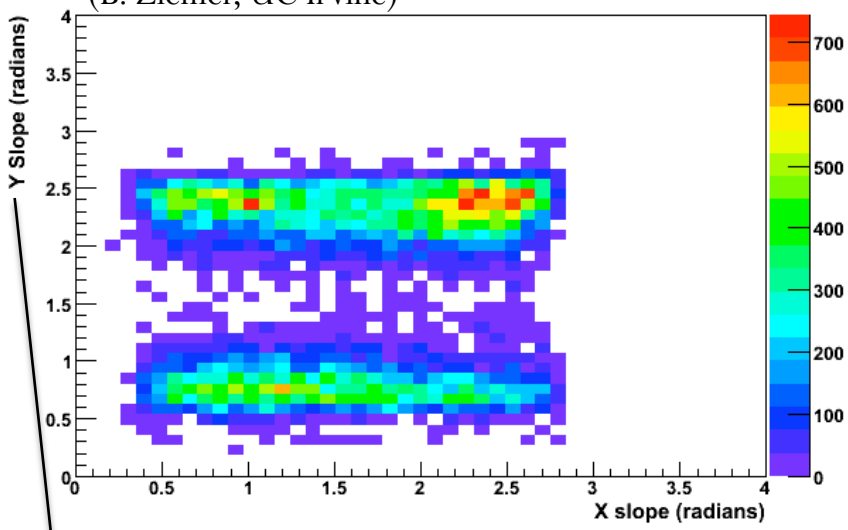


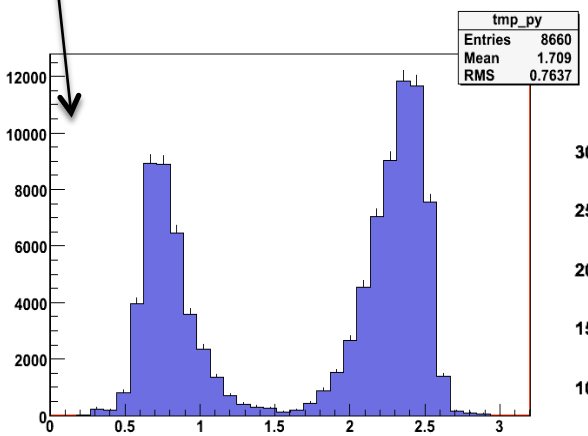


(B. Ziemer, UC Irvine)

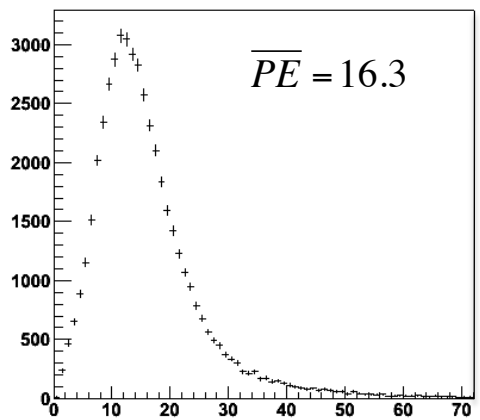
Reconstructing muons

(B. Ziemer, UC Irvine)

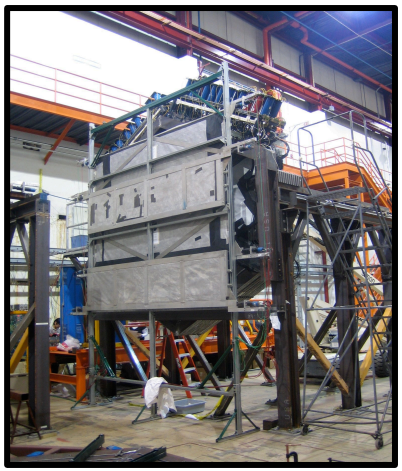


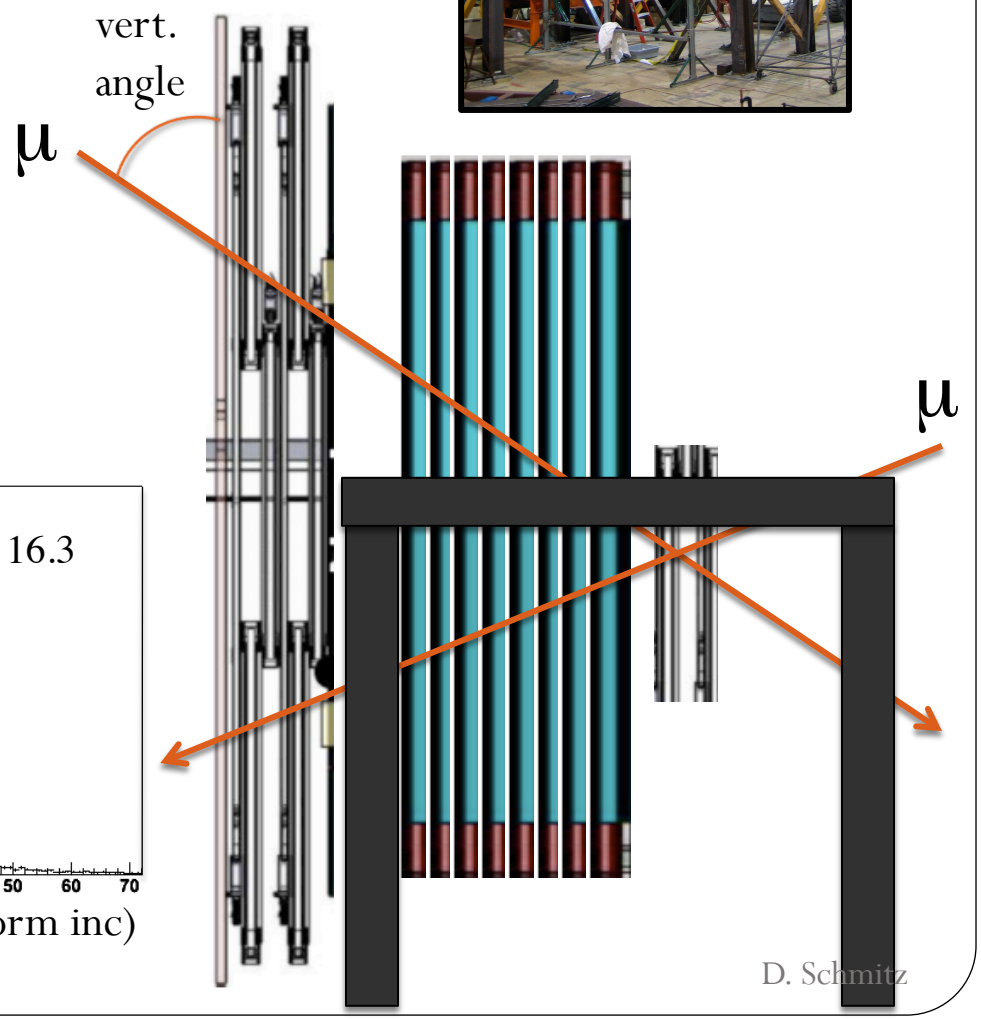


vertical angle (radians)



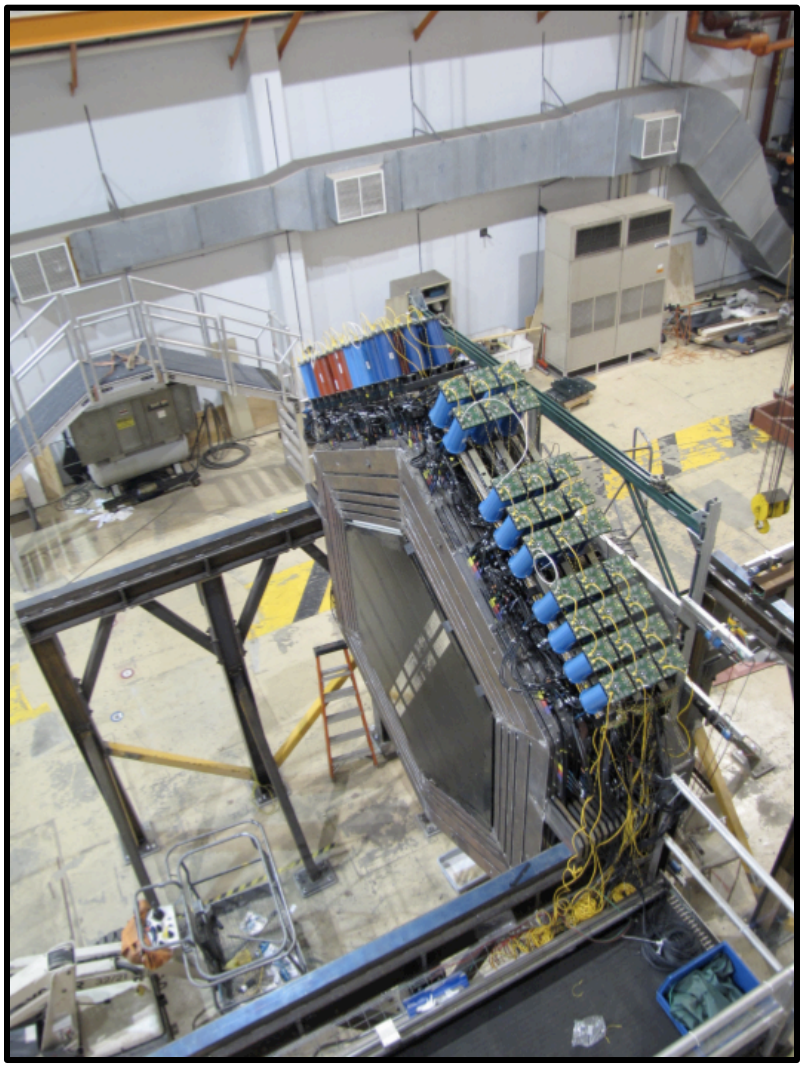
cluster PE (norm inc)





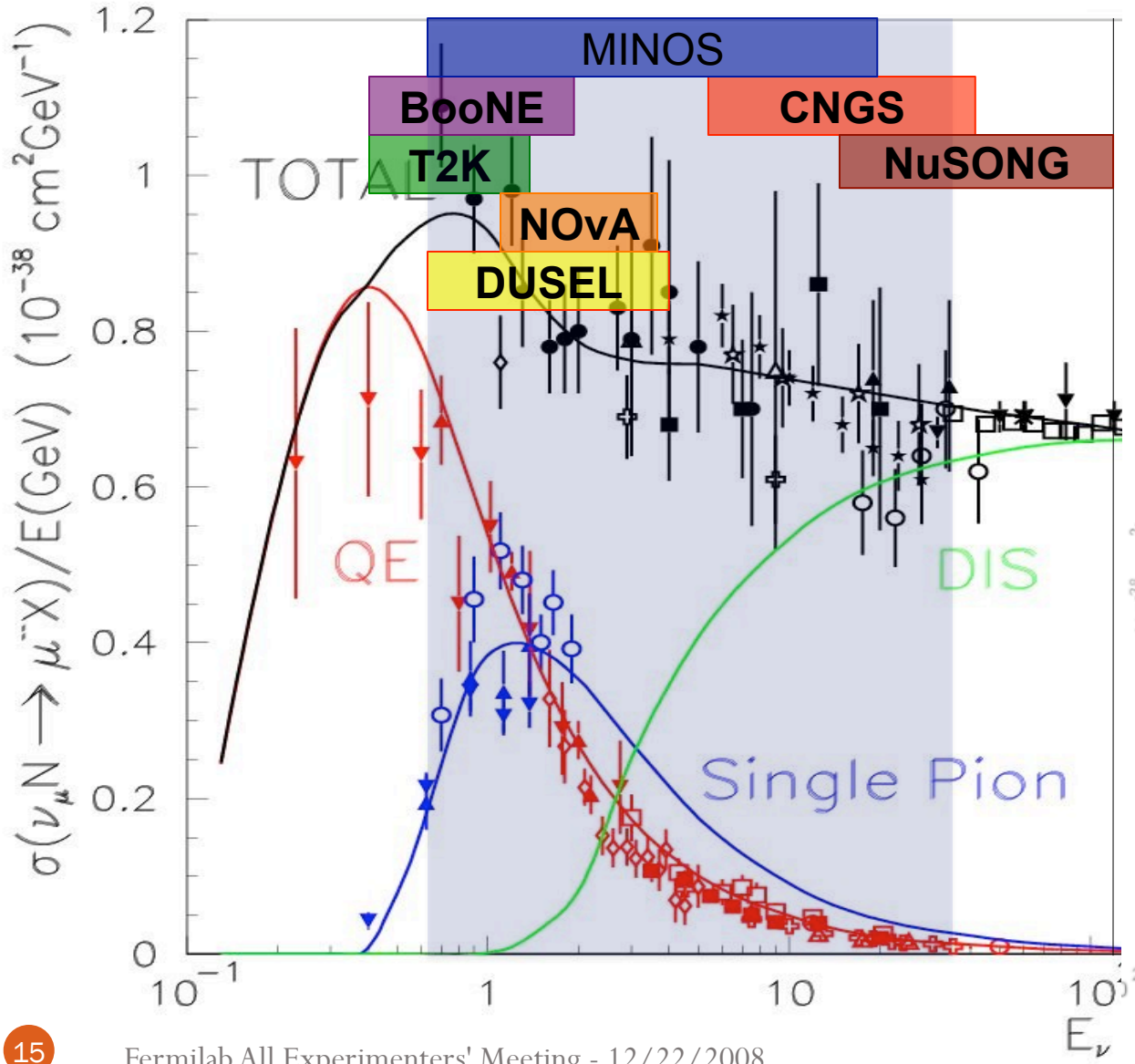
Summary

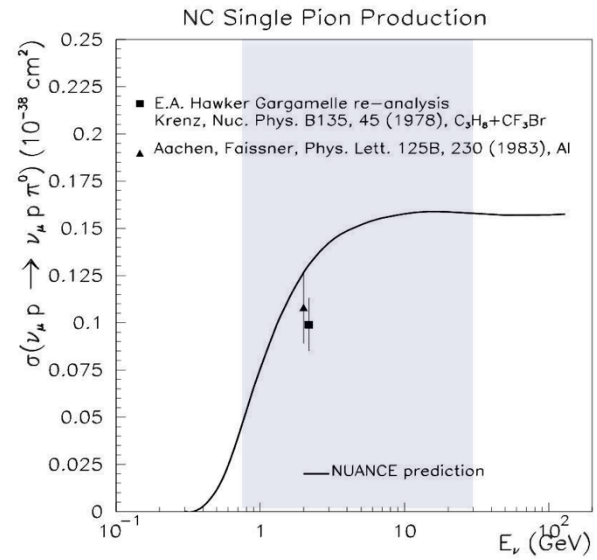
- **MINERvA Tracking Prototype detector** construction more than half complete in Wideband Hall
- Expected completion in Feb '09
- Very successful commissioning so far:
  - construction, mapping, and instrumenting of tracking and ECAL modules
  - DAQ and Light Injection systems
  - first round of calibrations
  - reconstruction software
  - cosmic rays
- Once TP construction complete, next step to move TP underground upstream of the MINOS detector and test response to a neutrino beam

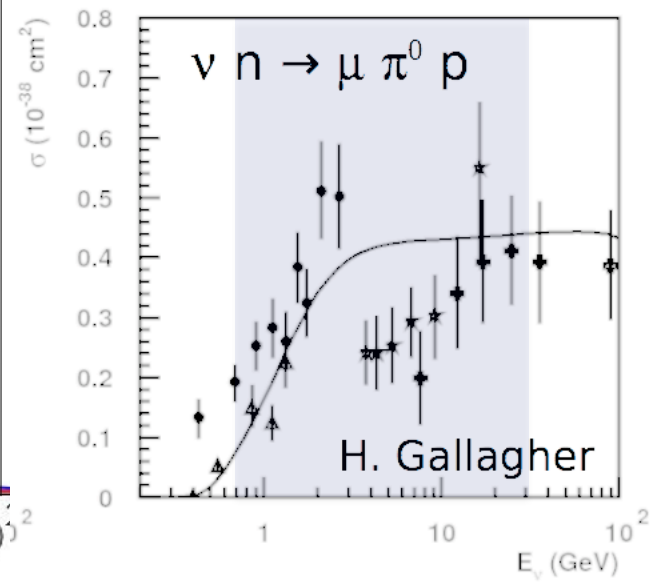


Backups

MINERvA Energy Range

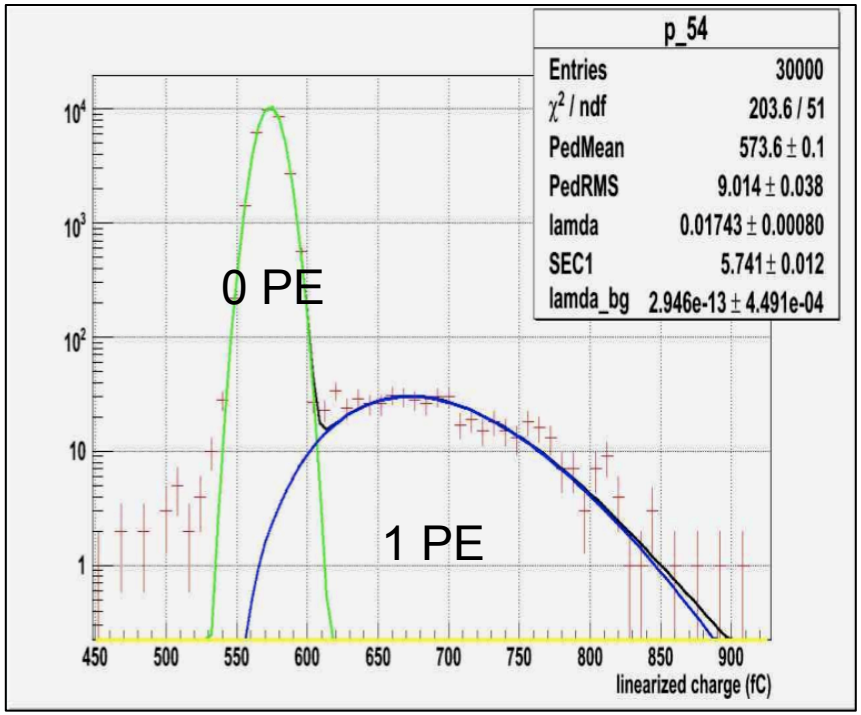




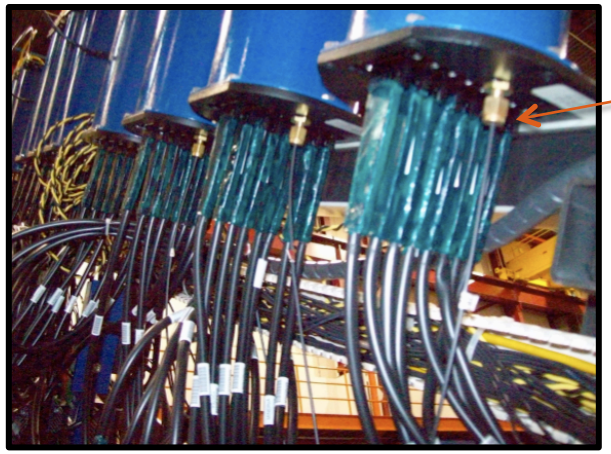


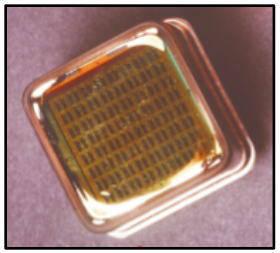
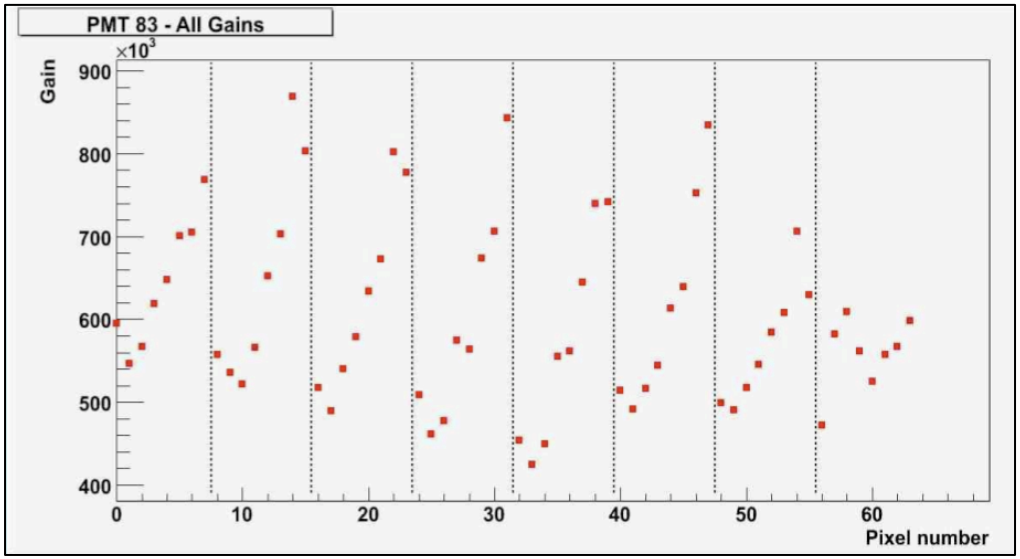
PMT calibration

- Light injection system included in TP commissioning for PMT gain calibration



(Brandon Eberly, U. of Pitt.)





M64 PMTs