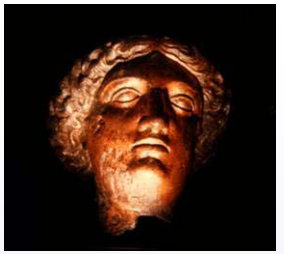
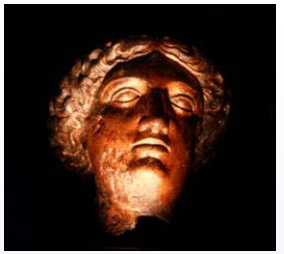
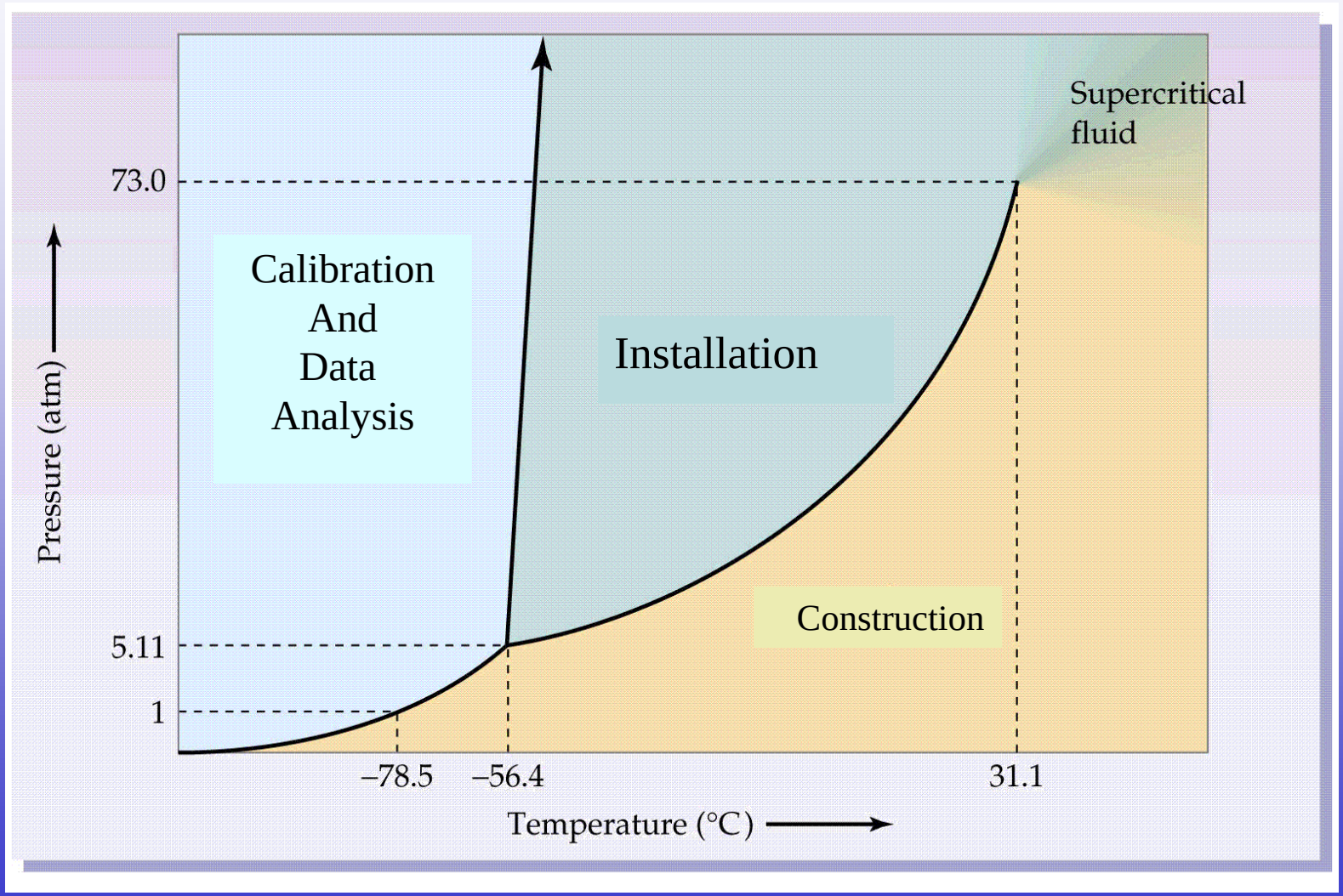


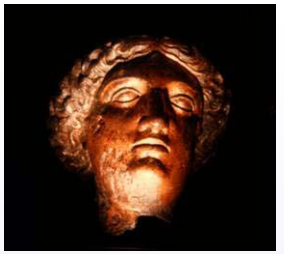
MINERνA at the Triple Point: Three Phases at once

Deborah Harris AEM August 31, 2009

Reminder: Phase Diagram







Construction Status

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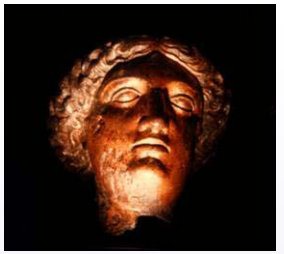
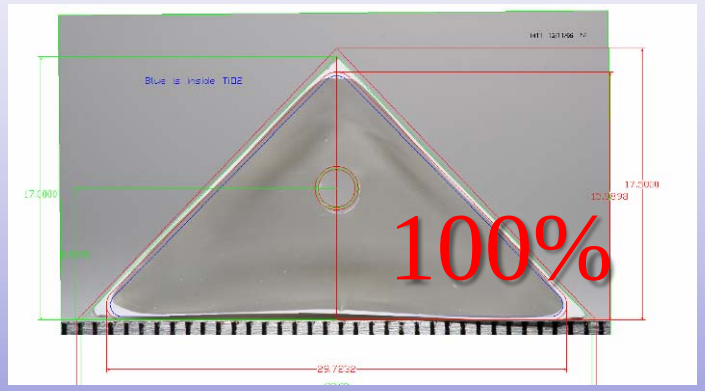
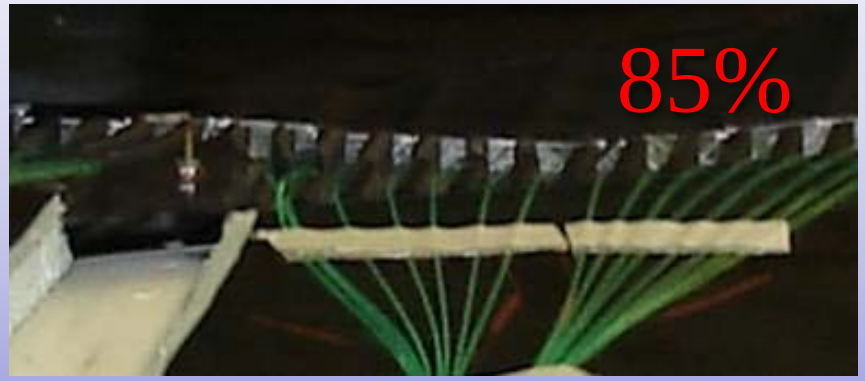
Optical System

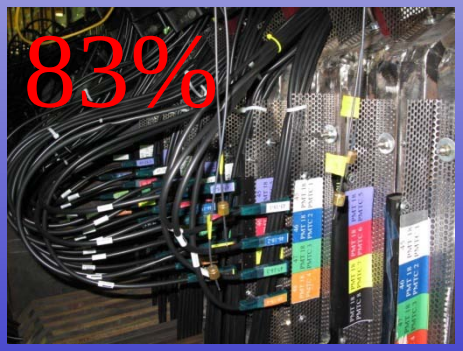


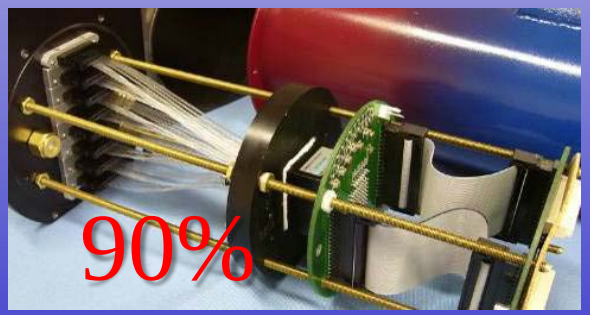
- Blue-emitting extruded plastic scintillator with a hole for a WLS fiber:
- Wavelength Shifting (WLS) fiber mirrored, then glued into scintillator





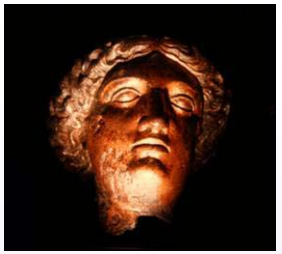
- Clear fiber in light-tight optical cables takes light to PMT box





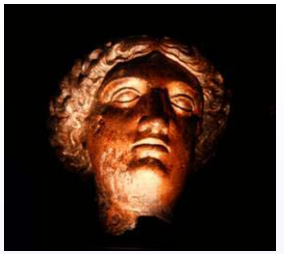
- "ODU" (Optical Decoder Unit) takes light from optical cable to PMT

Electronics and Data Acquisition

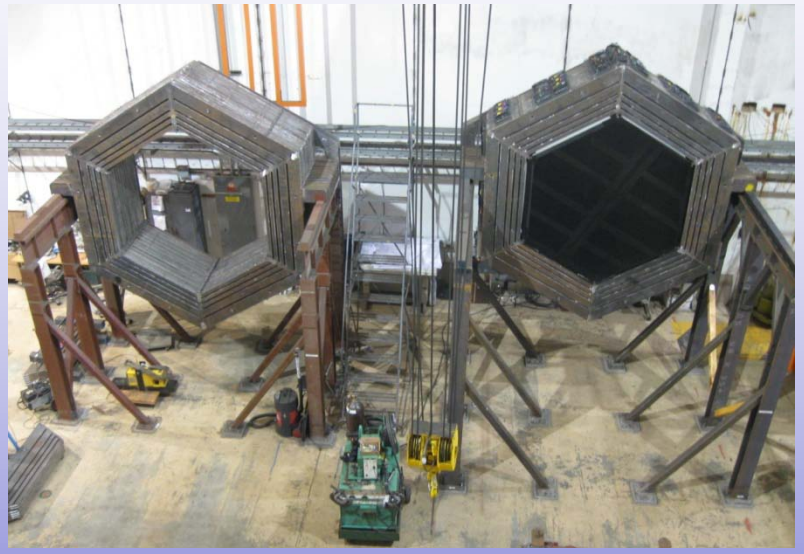


- **PMT Bases**
  - All ~550 have been assembled, tested, calibrated, put into PMT Boxes
- **Front End Boards**
  - All 600 have been assembled
  - 450/600 have been tested and calibrated (Pittsburgh)
- **Chain Read-Out Boards, Interface Modules**
  - 12/14 CROC's produced and tested
  - Interface modules (timing) done
- **DAQ**
  - Windows DAQ ready for commissioning full detector
  - Working on faster Linux DAQ for final data taking
- **Light Injection System**
  - Ready to flash!

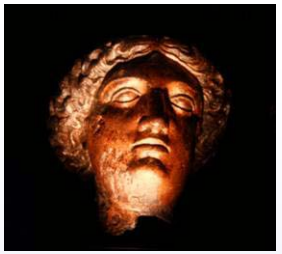
From Scintillator to Detector Modules



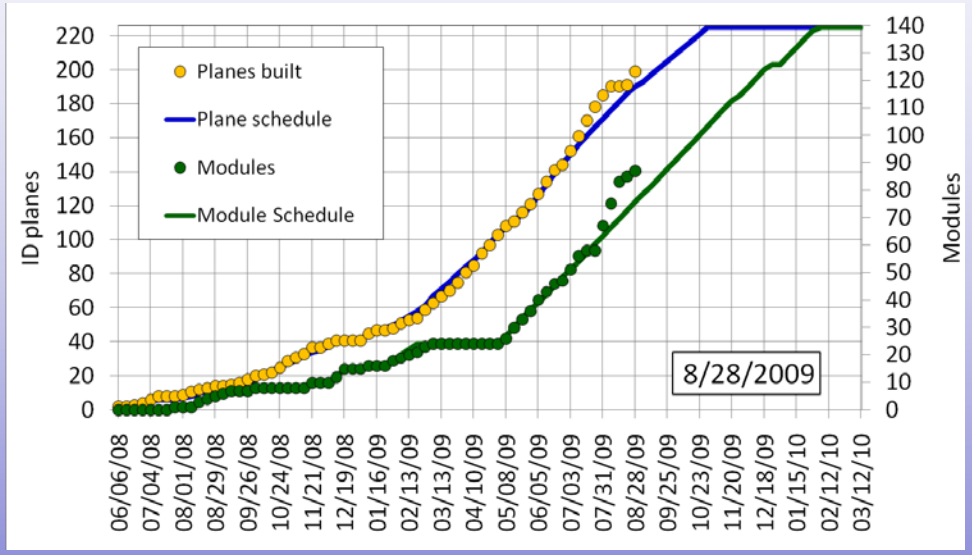
- Scintillator Plane is surrounded by (scintillator-filled) steel frames
- Total of 116 frames (~93 built)
- 80 fully active tracking modules (33 built)
  - 2 scintillator planes @ 17 mm each
- 10 ECAL modules (10 built)
  - 2 lead sheets @ 2 mm each
  - 2 scintillator planes @ 17 mm each
- 20 HCAL modules (20 built)
  - 1 steel sheet @ 25 mm
  - 1 scintillator plane @ 17 mm
- 5+1 Nuclear Target modules: Pb, Fe, C (all targets here, some assembly required)



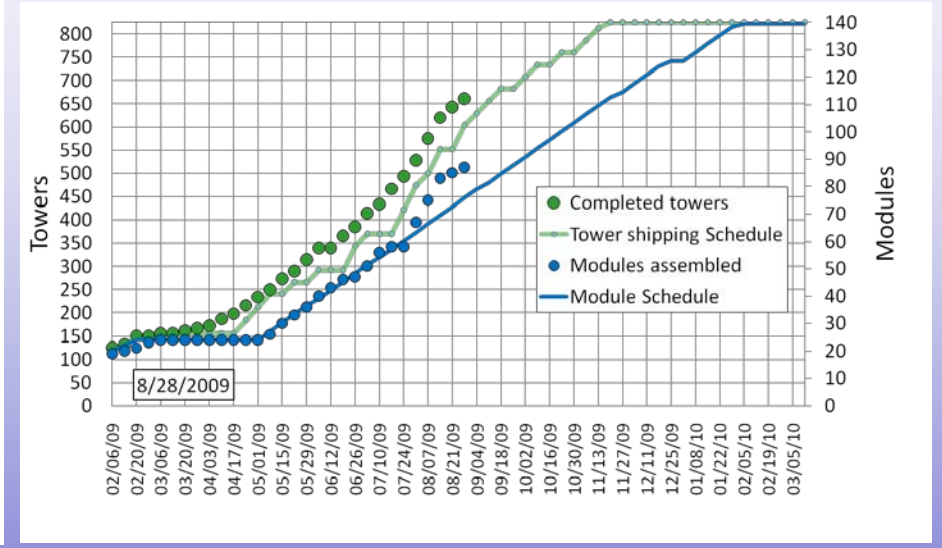
Critical Path for Completion

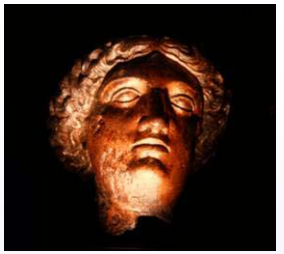


Scintillator Planes



Outer Detector Towers

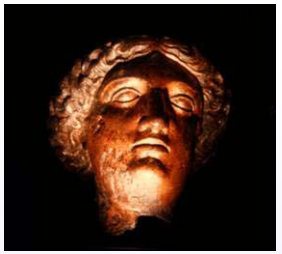




Installation Status

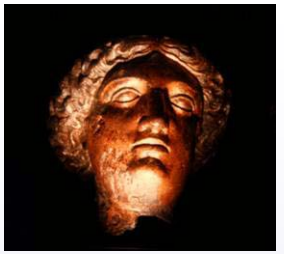
Deborah Harris AEM August 31, 2009

Installation since last AEM…

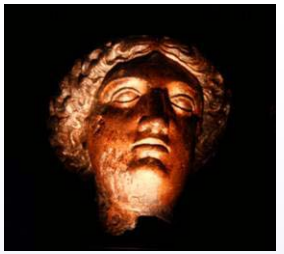


- Gabe Perdue showed our first neutrinos 4/6/09
- Tracking Prototype (24 module) Data-taking: 4/15/09 to 6/15/09
- Repair TP modules and move to side stand: 7/15-8/17
- Move “half the detector” on beam stand: 8/17-late October
- Move rest of detector: January – March 2010

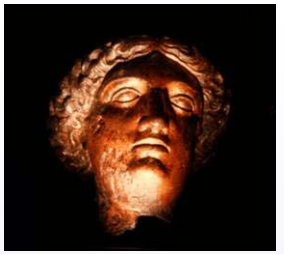
Taking Neutrino Data



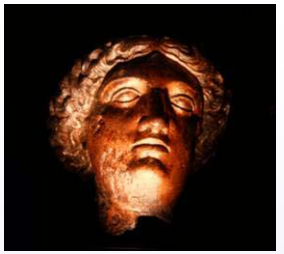
July 13, ready for repairs



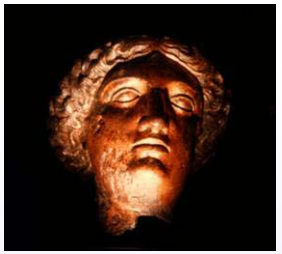
August 17, starting to reinstall



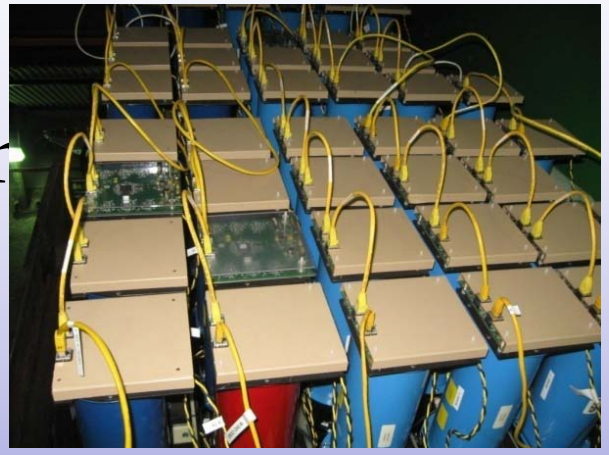
Today, installing



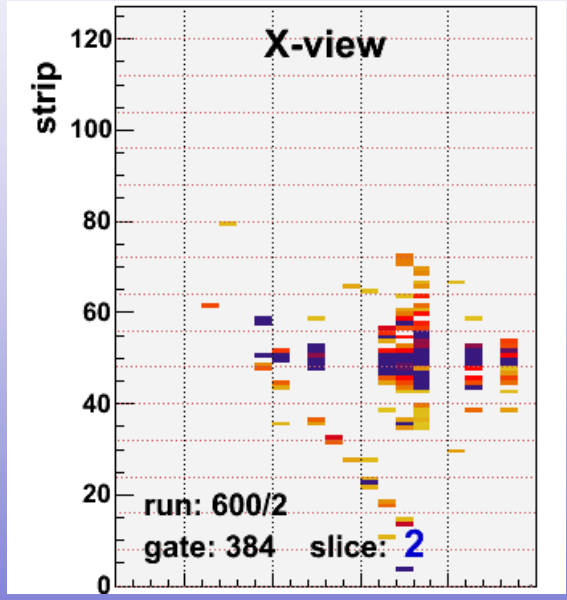
Lessons Learned from TP run (the dirty laundry slide)

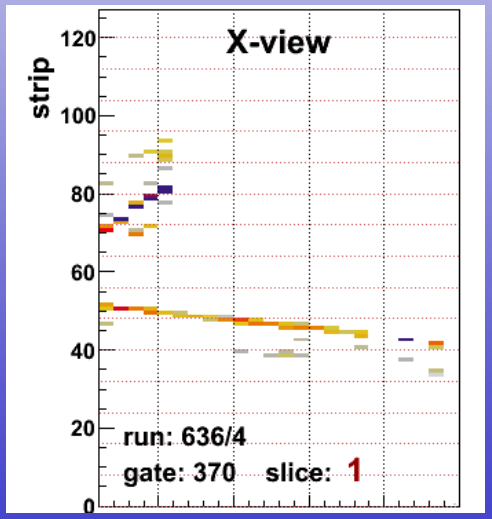


- Be prepared for adverse weather conditions

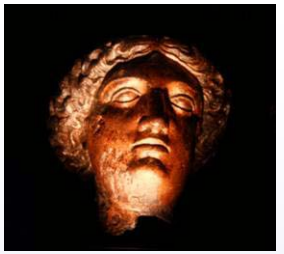


- Be prepared to write out every buffer, no more no less





- Beware of cross-talk from wayward cookies

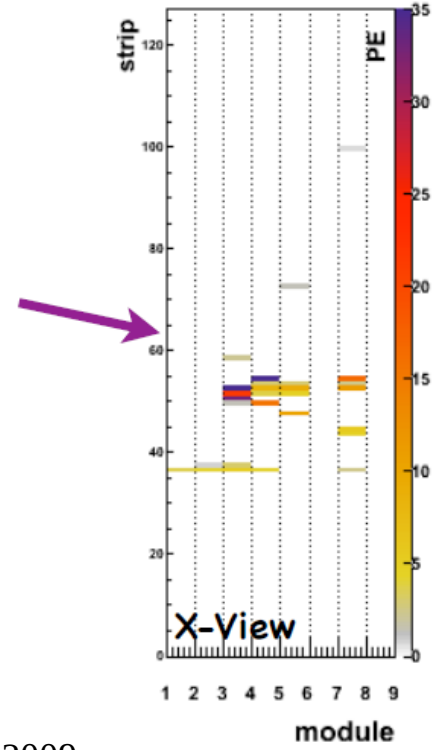


Calibration/Analysis Status

Remember:
April 6
AEM

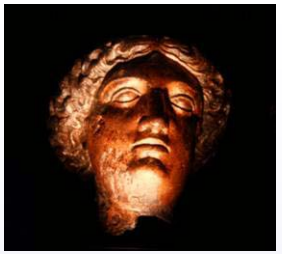
Our cluster of advanced (coffee-drinking) neural nets has even identified some probable neutrino interactions!

This is MINERvA's *first* neutrino interaction!

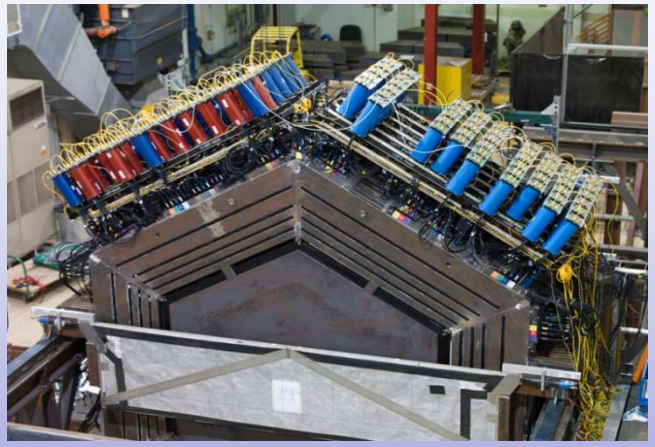


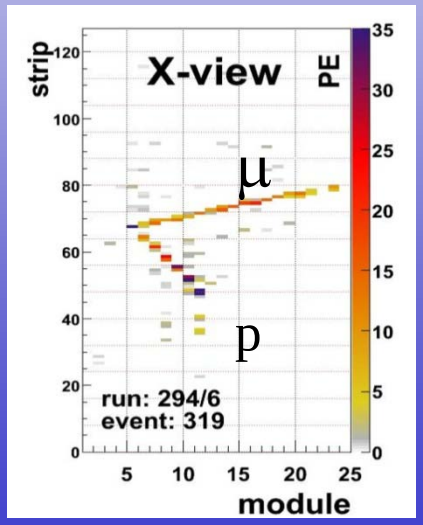
Deborah Harris AEM August 31, 2009

MINERvA Sees!

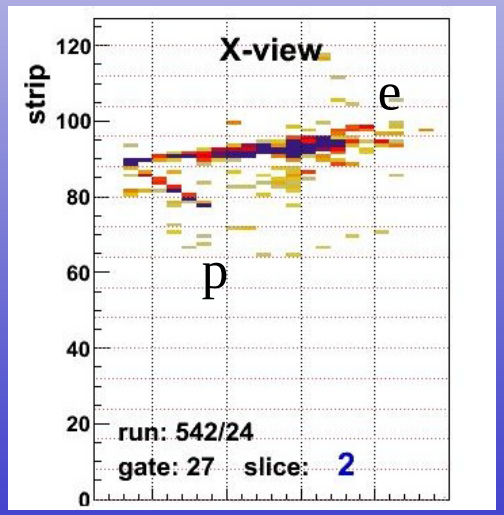


- Took ~4 x10^{19} POT April 15-June 15
- 15k events, publishable physics there
- Exclusive Channel reconstruction
- Following are real data events…
- Candidate reaction given below

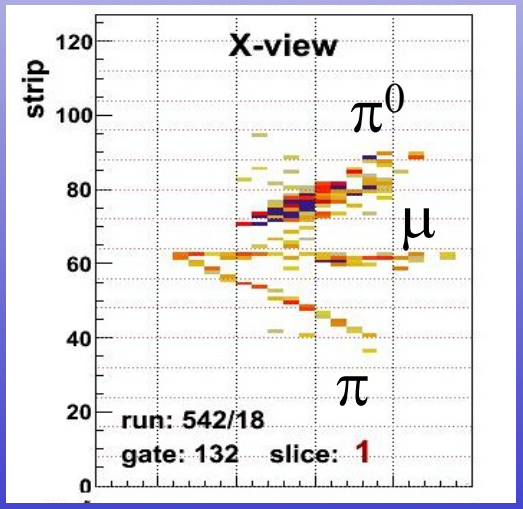




$\nu_\mu + n \rightarrow \mu^- + p$

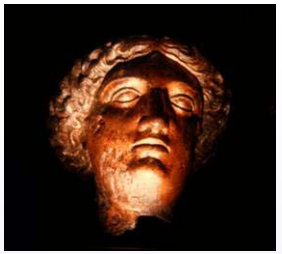


$\nu_e + n \rightarrow e^- + p$



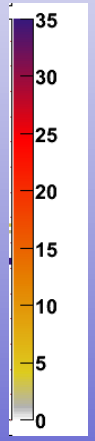
$\nu_\mu + n \rightarrow \mu^- + \pi^0 + \pi^+$

More interesting events…

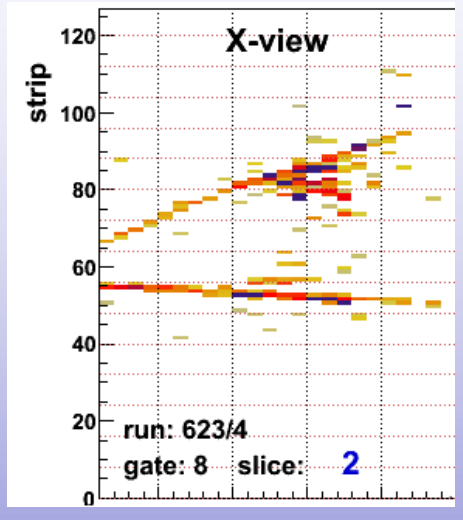


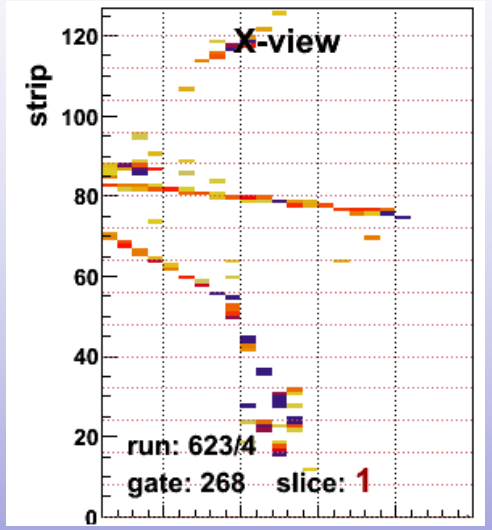
- Events from steel target located 10” upstream of tracker modules

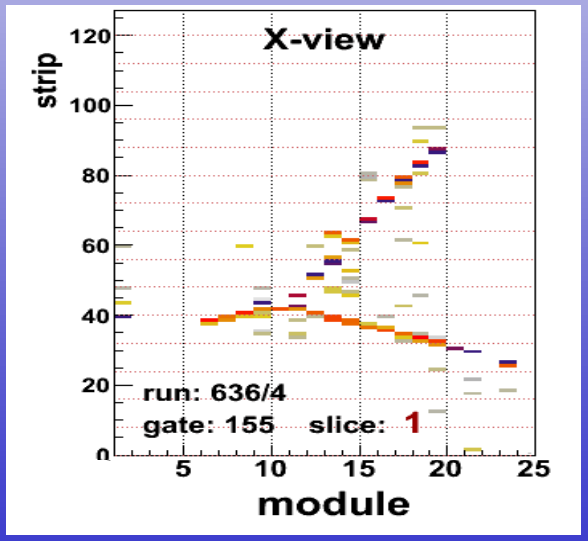
Photo-electron Scale:

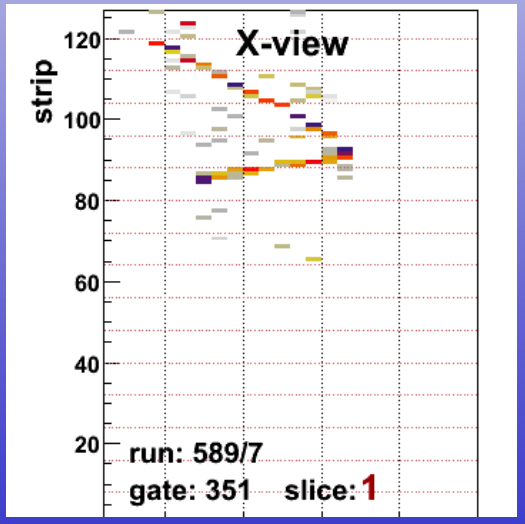


Notice “slice”!



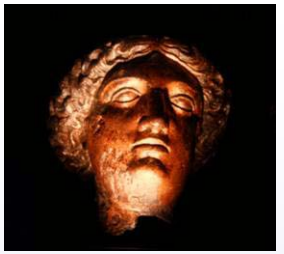




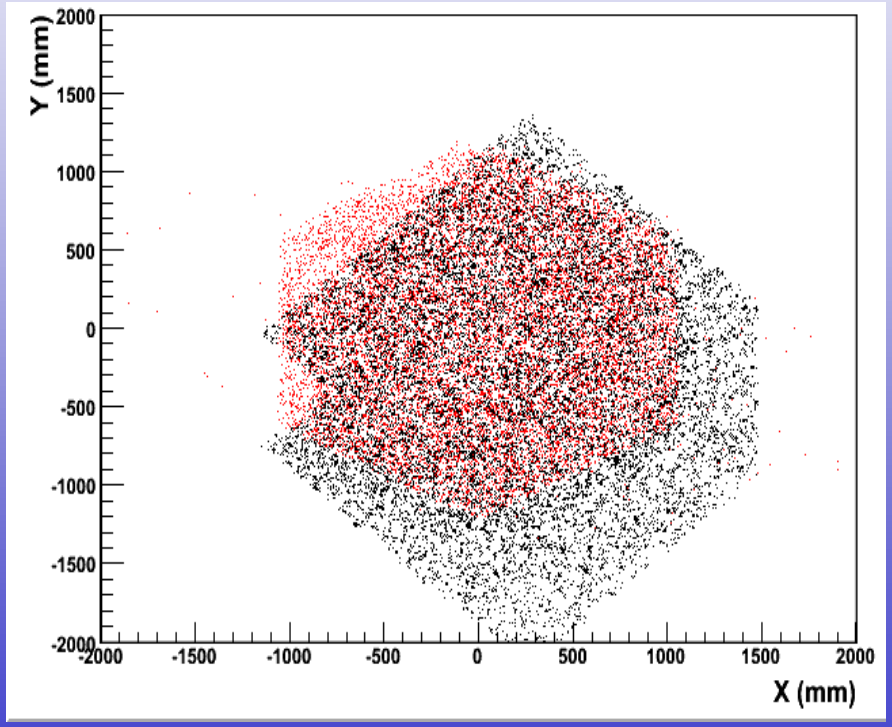


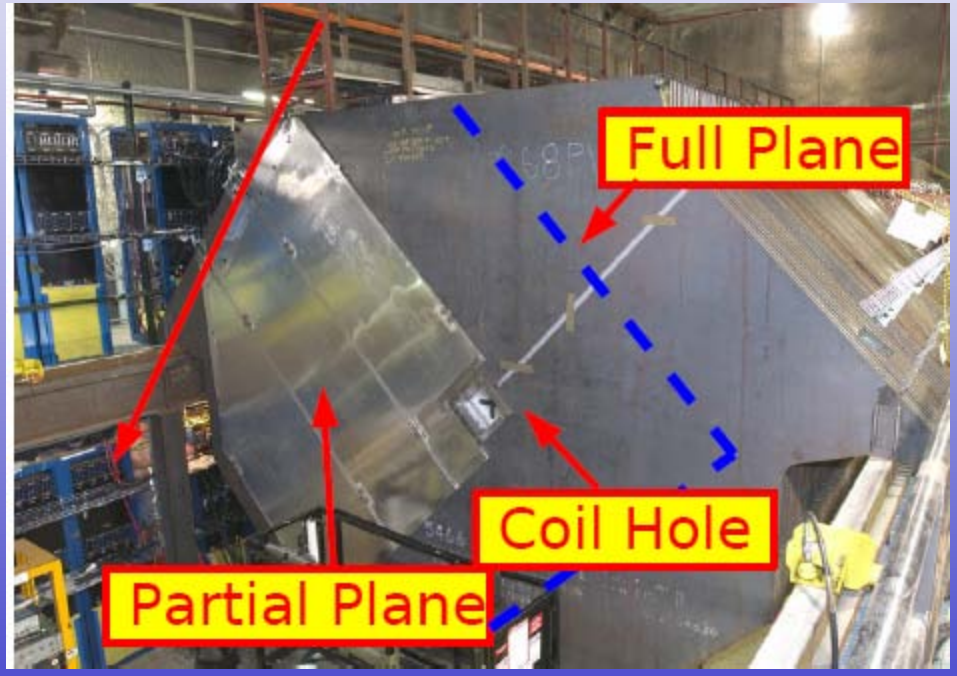
- Neutral and charged current events on Lead

Muon Spectrometer Performance



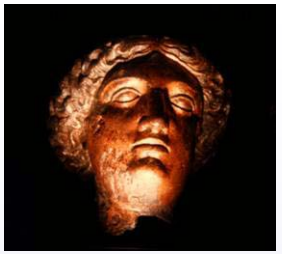
- Otherwise known as MINOS Near Detector
- Commissioning with beam since 2005…

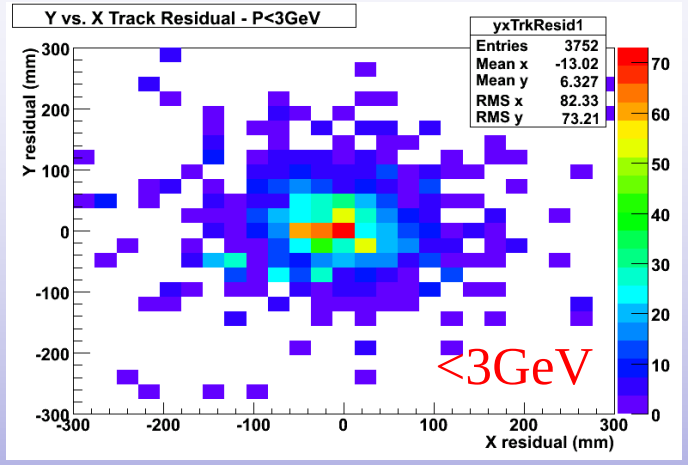


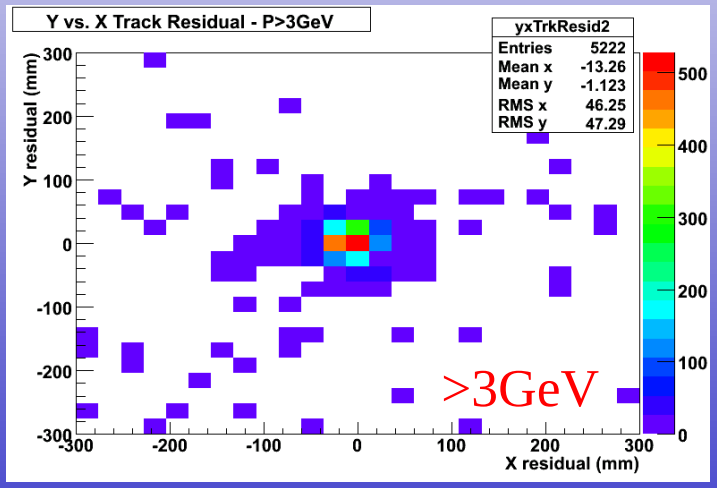


All tracks in MINERvA (red) and MINOS (black),
in MINERvA coordinate system and MINERvA Data Summary Tape

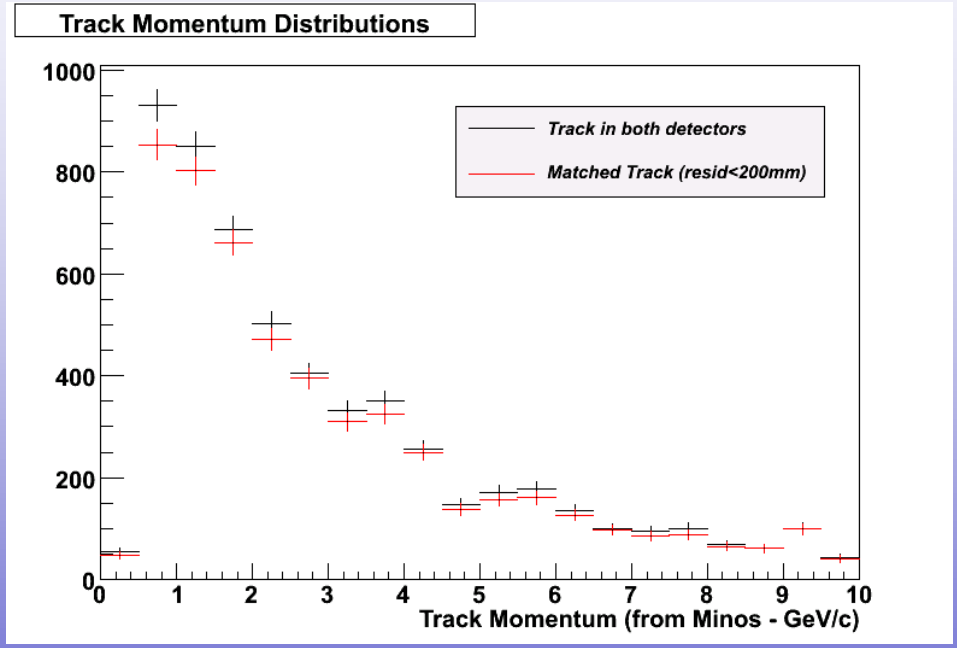
Track Matching between MINERνA and MINOS





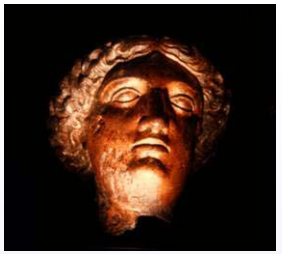


Residuals (MINERνA-MINOS) of Track Projections to front face of MINOS Near Detector

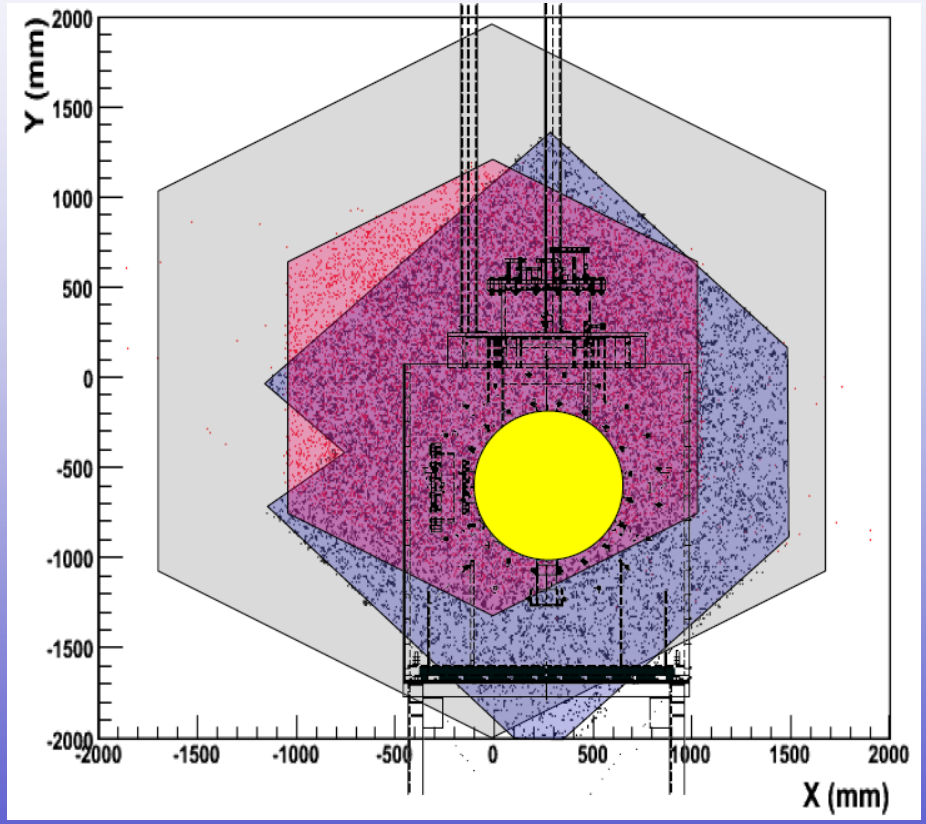


Black: momentum of events with tracks in MINOS and MINERνA
Red: momentum of tracks with residuals <20cm

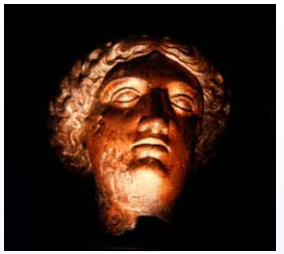
Argoneut Effect on Momentum



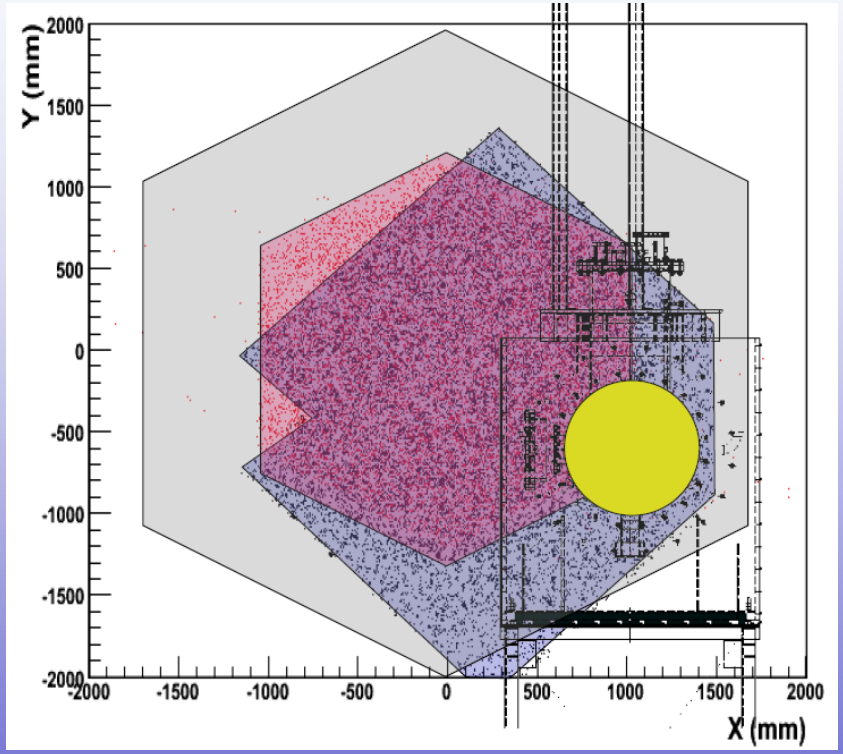
- Argoneut currently sits between MINERνA and MINOS, intersecting ~50% of the muons in our dataset
- 2100 kg over $3m^2$, very complicated geometry
- Average energy loss through Argoneut: 108 MeV, RMS of 200MeV
- Hard to measure muon momentum for half our ν_μ charged current events because of this during Spring '09 run
- Working to find solution for next run



Possible Solutions

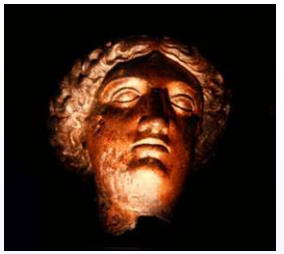


- Do nothing
  - Compromise 50% of muon momenta measurements
- Move Argoneut 2.5’ to the side
  - Small loss in Argoneut Acceptance
  - Compromise 15% of muon momenta
  - 3 days of mechanical technician crew
  - 2 weeks of cryo technician



- Move Argoneut upstream of MINERνA
  - Space upstream of MINERνA for cryogenic target
  - MINERνA provides tracking data to Argoneut
  - Liquid He target not here till Fall of 2010

Will soon enter the 4th Phase



- Data-taking with ~half the detector (11/09 - 2/10)
- Construction forecast to end 1/10
- Data-taking with full detector starting 3/10
- On schedule and budget, thanks to your support!