

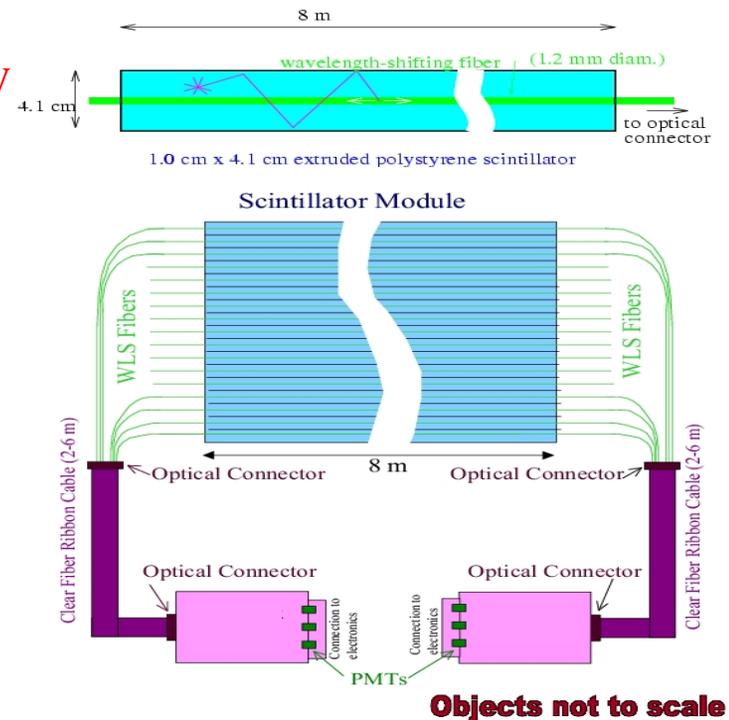
MINOS Detector Status

- Far Detector
- Near Detector



MINOS Detectors

- Detectors:
 - 2.54cm magnetized Fe Planes/1cm Scintillator planes
 - 4.1cm wide scintillator strips read-out by WLS fibers into Multi-Anode PMTs
- Far Detector
 - 5kt, 485 planes
 - Double-ended readout
 - Sample-and-hold electronics
- Near Detector
 - 980 t, 281 planes
 - Single-ended readout
 - QIE-Based electronics – 19ns sampling



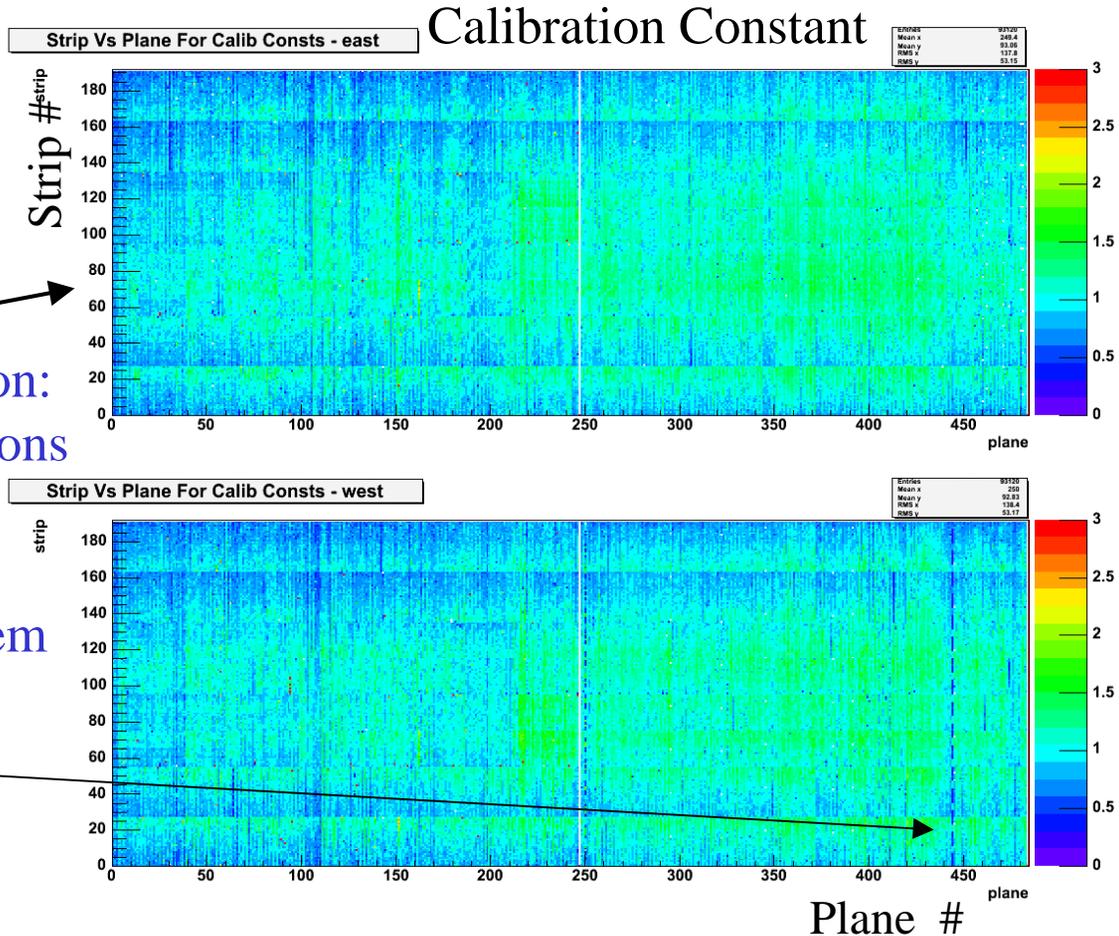
MINOS Far Detector



- Installation completed in summer 2003
- Commissioning and data taking have continued since then:
 - Atmospheric Neutrinos
 - Cosmic Muons

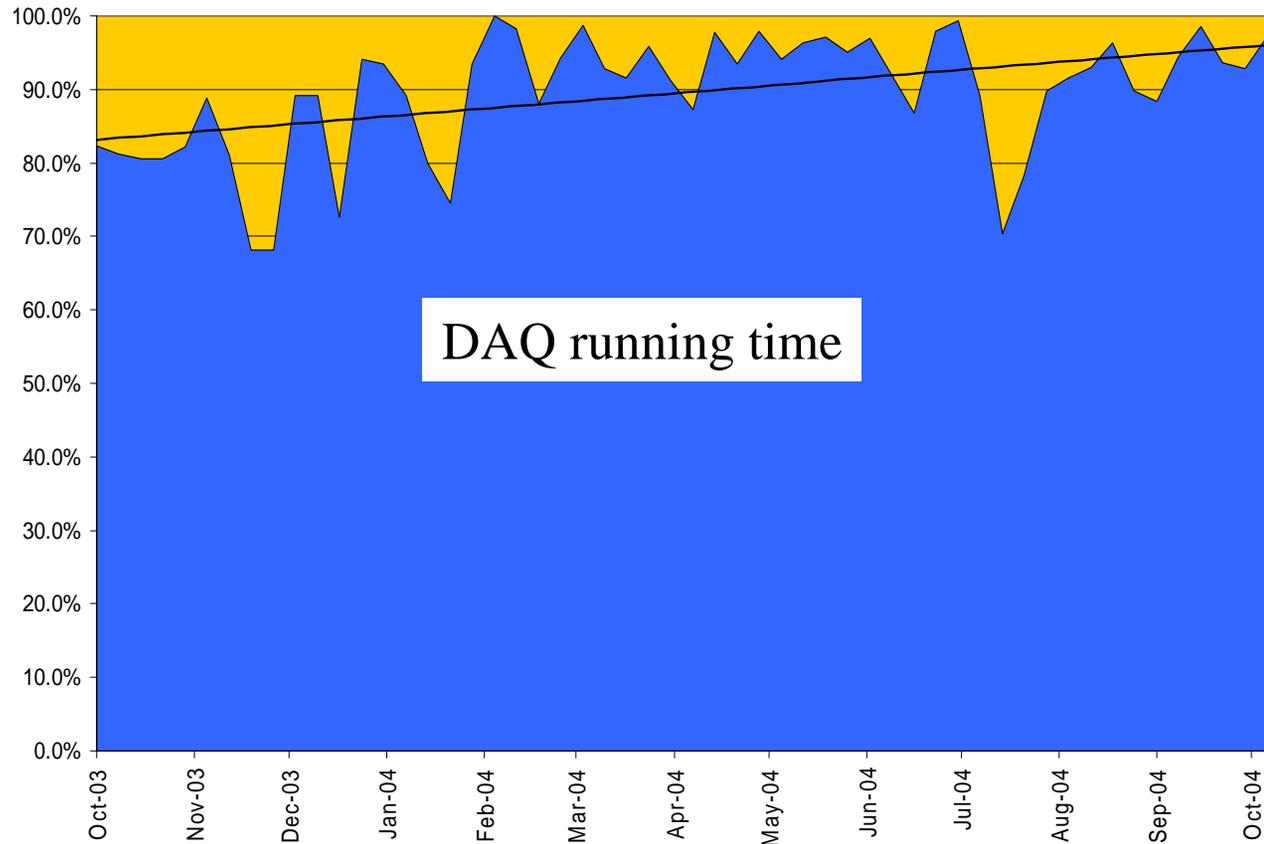
FarDet Commissioning

- Soudan Lab-Crew, working with visiting physicist shifters, have shaken down the detector electronics and readout.
- Strip-to-strip muon calibration: corrects for light output variations and fiber attenuation.
- A small percentage of problem channels.



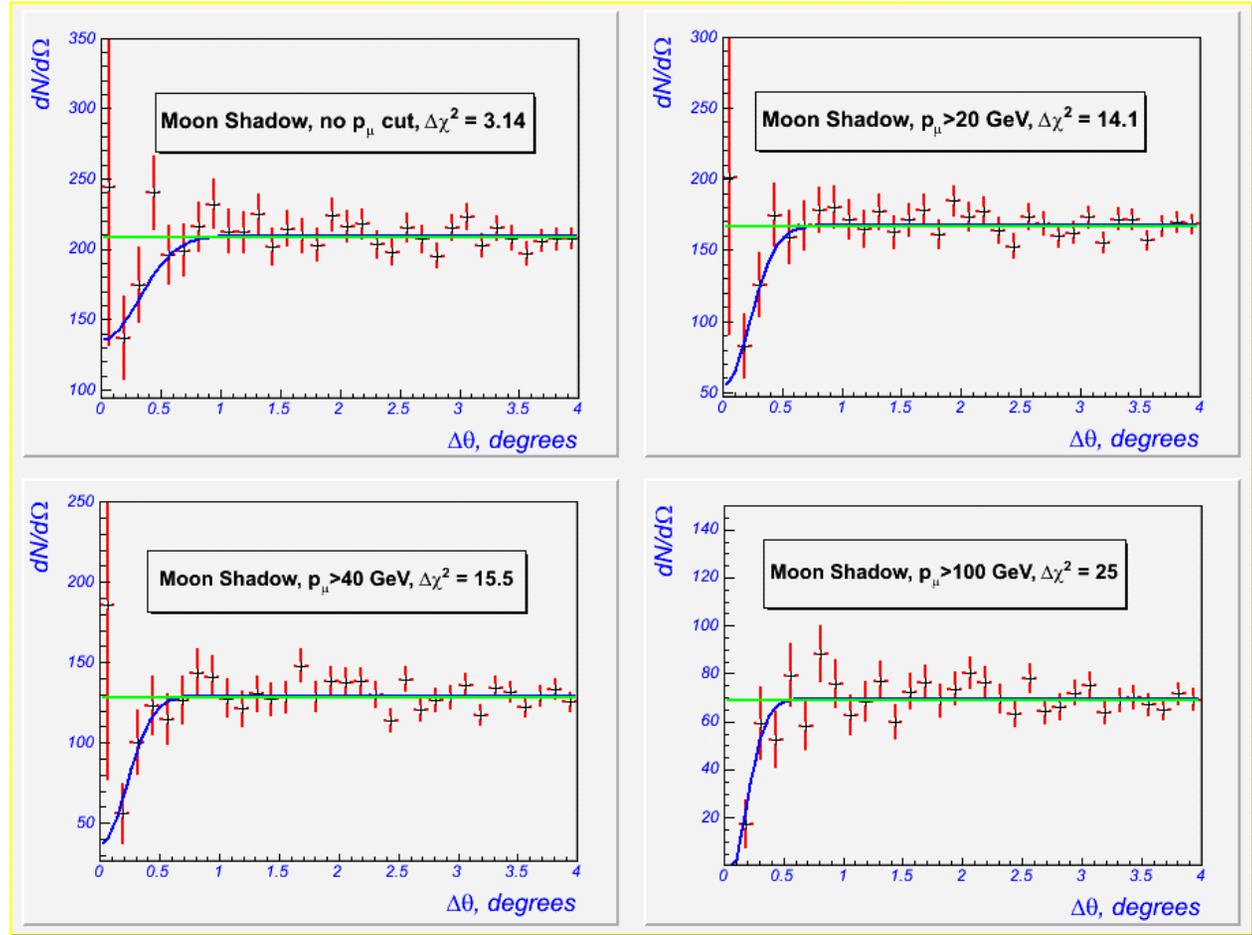
FarDet Uptime

- Recent uptime is typically ~95%, even with debugging work
 - Debugging work is tailing off
 - Any debugging during MI run will take place only during machine downtimes

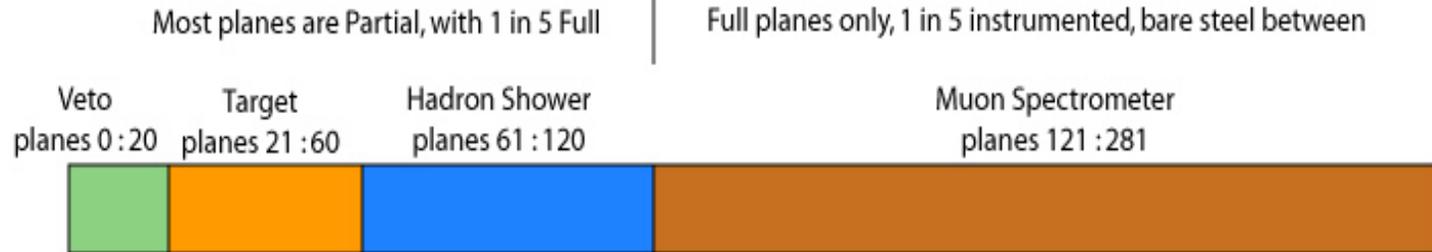


FarDet Data

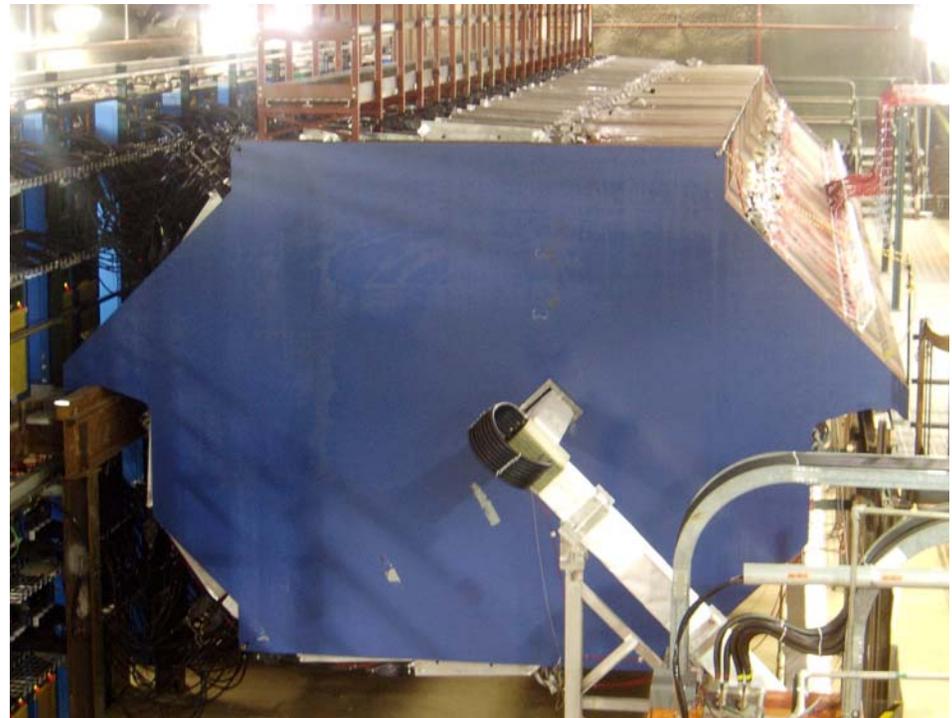
- Cosmic ray Moon Shadow
 - 20 months of data, include 8 months with full detector
 - 15×10^6 cosmics passing cuts



MINOS Near Detector



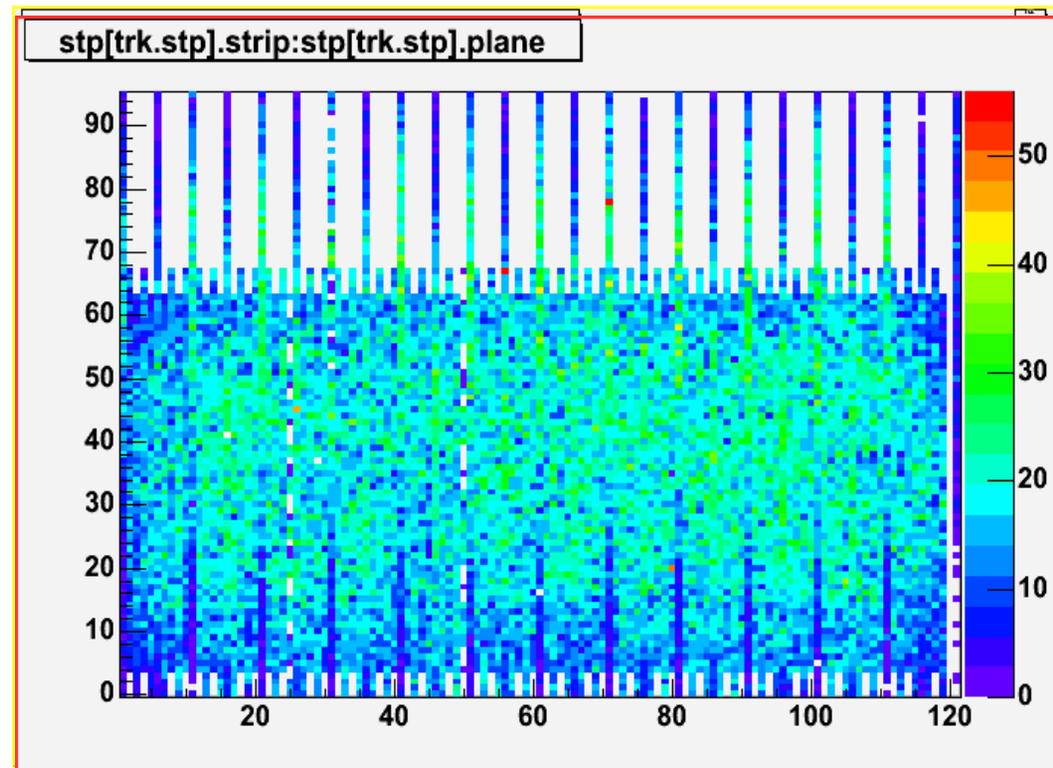
- Plane installation completed in August
 - Collaborators – mostly students and postdocs – were crucial part of effort
 - Plane and electronics checkout and commissioning during installation
 - Magnet coil installed in October



Debugging

- Since installation was completed:
 - Vast majority of readout holes resolved.
 - Holes in LED Light injection fixed.
 - Calibrations and alignments underway with >5 million cosmics.

Calorimeter: hits on tracks early November

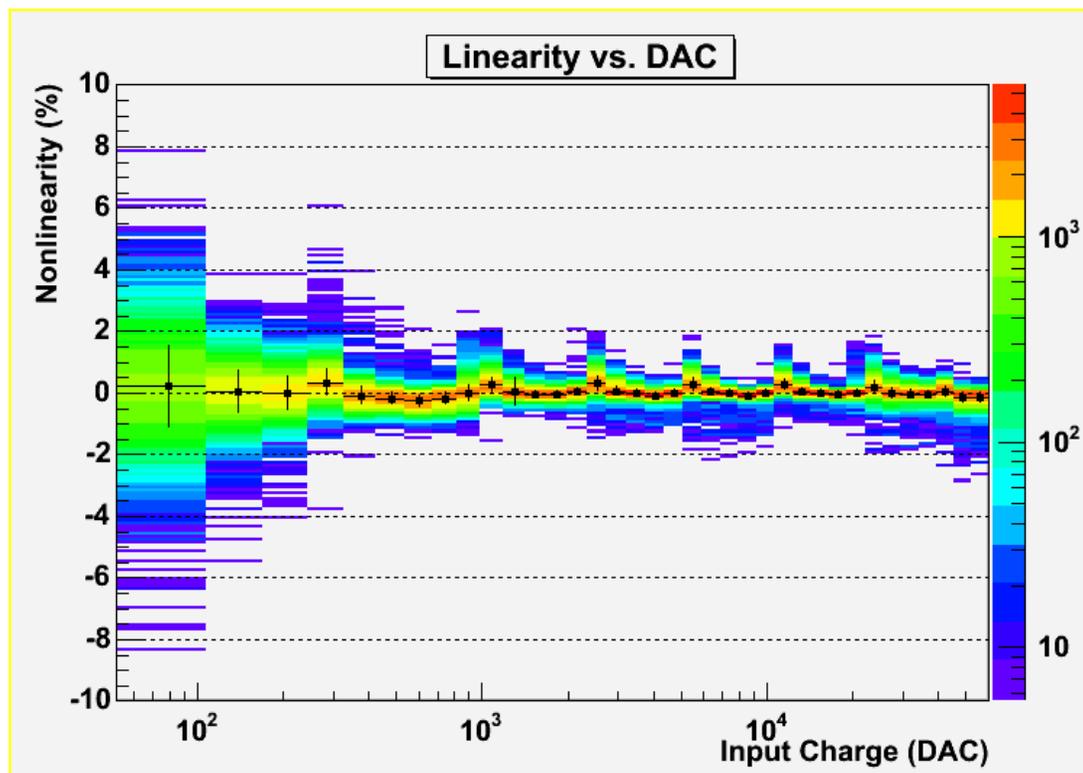


Track Occupancy vs. strip and plane

NearDet Performance

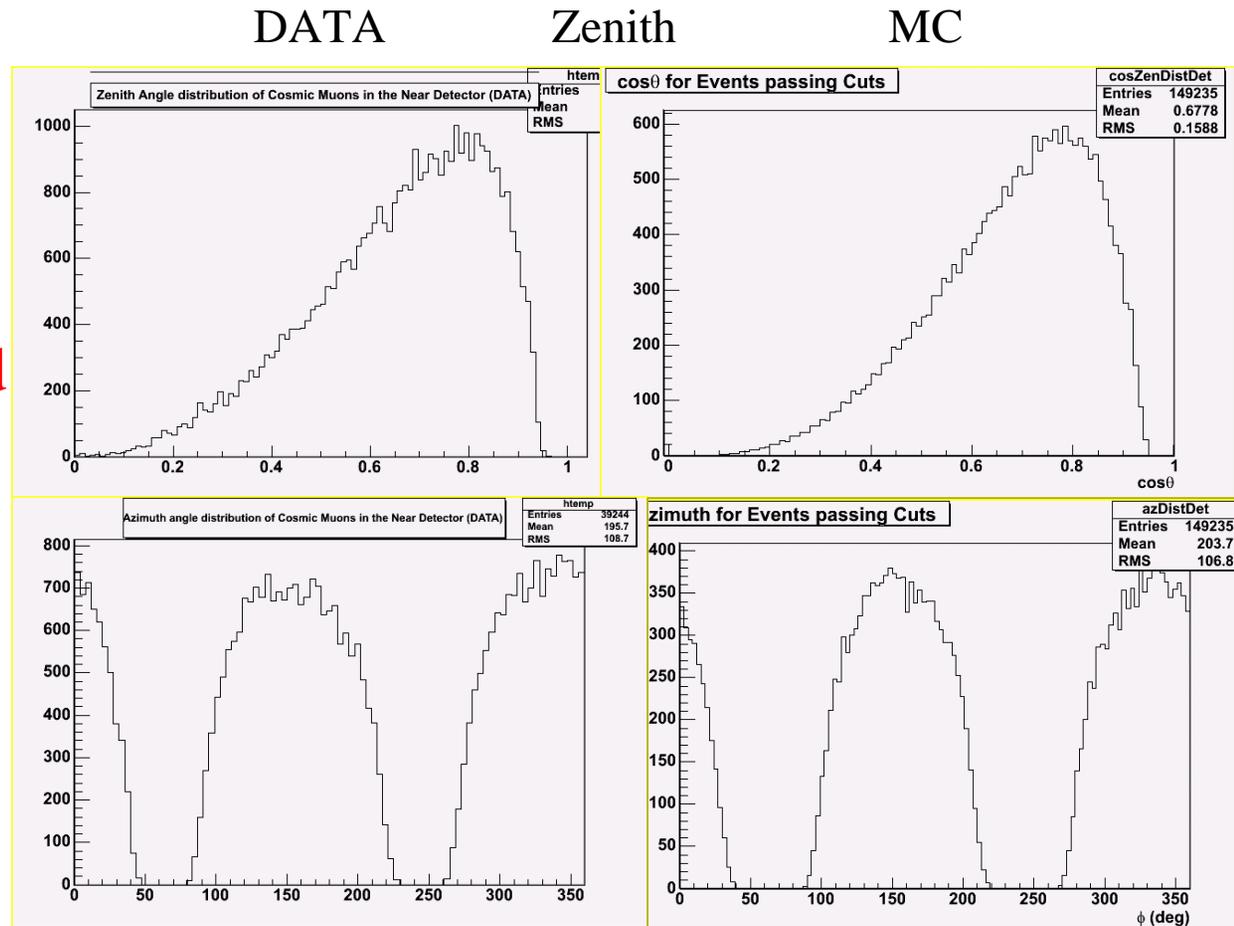
Color scale: 1 entry/channel/non-linearity/Input Charge value
Error points: profile (mean nonlinearity of all channels)

- Electronics Linearity
 - Charge injection calibration
 - 99% of all channels included



NearDet Cosmics

- Cosmic rays
 - Comparison of angular distribution between data and toy Monte Carlo, with no tuning
 - Sanity check of overall system performance



Azimuth

Ongoing work

- Far Detector
 - Continued fine tuning of detector performance
- Near Detector
 - Complete remaining debugging work
 - Fine tune operations parameters as needed:
 - e.g. PMT gains
 - Test beam-spill readout mode
 - Tested at Calibration Detector at CERN
 - Integrate Main Injector signals to Front End timing system
 - Commission magnet coil in next 2 weeks

Summary

- Both Near and Far Detectors could take beam data today:
 - With NearDet triggering on PMT thresholds
 - limited intensity due to $5\mu\text{s}$ deadtime per PMT not present in Beam-Spill readout mode.
 - Lower NearDet statistics due to no Magnetic field
- We will be more ready in December, but we are ready enough today!

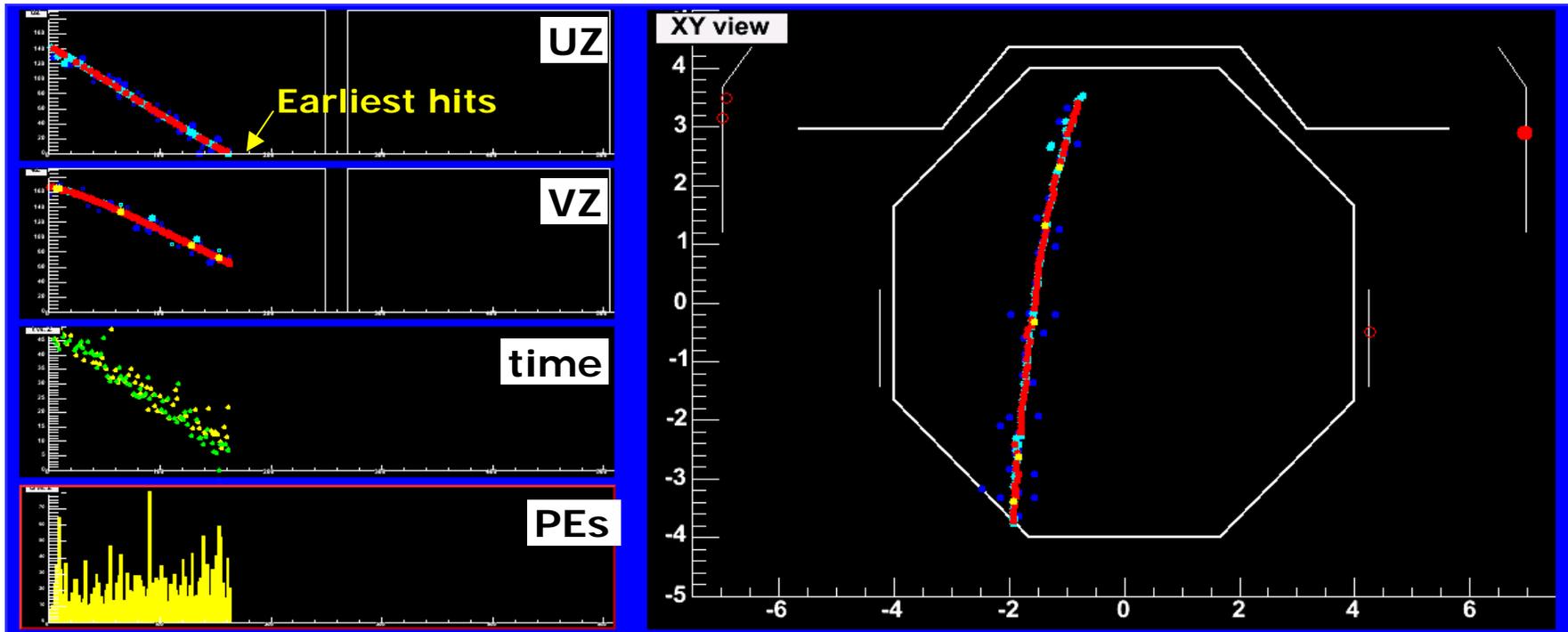
Supplementary Slides

- Atmospheric Neutrino studies
- Presented at Neutrino 2004 (Paris) by Mark Thomson (Cambridge)

ν induced upward μ

- ★ Expect : 1 Event/6 Days
- ★ Identified on basis of timing

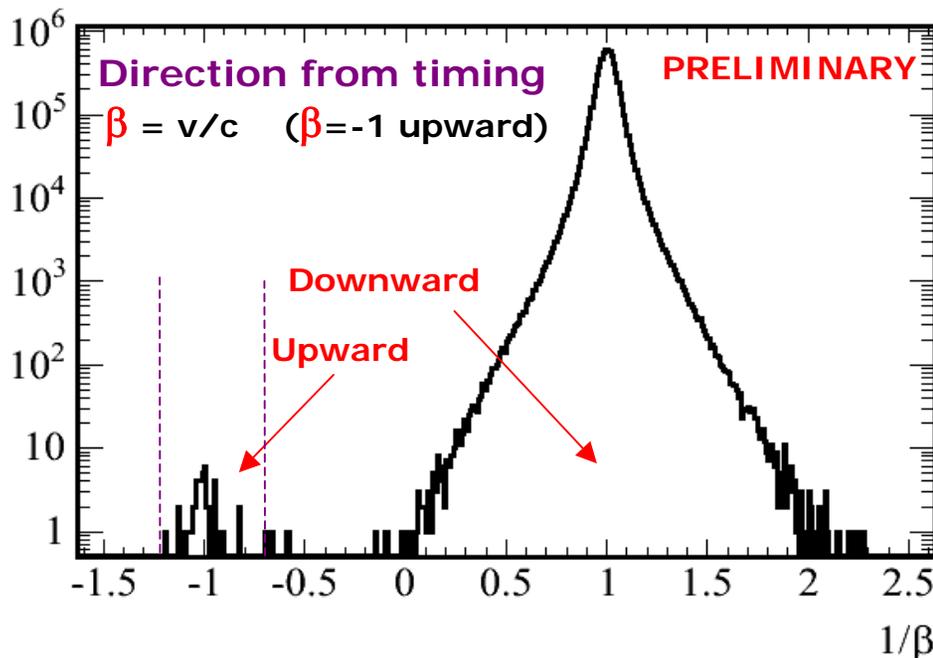
From Mark Thomson (Cambridge) at Neutrino 2004



ν induced upward-going muons

- ★ Look for events coming from below horizon
- ★ Require clear up/down resolution from timing
 - 'Good track' > 2.0 m
 - >20 planes crossed
- ★ Calculate muon velocity from hit times: $\beta = v/c$

From Mark Thomson (Cambridge) at Neutrino 2004



★ Clear separation of up/down going μ s !

$$\sigma_{1/\beta} \sim 0.05$$

★ 48 Upward events

Upward μ Analysis: Data vs. MC

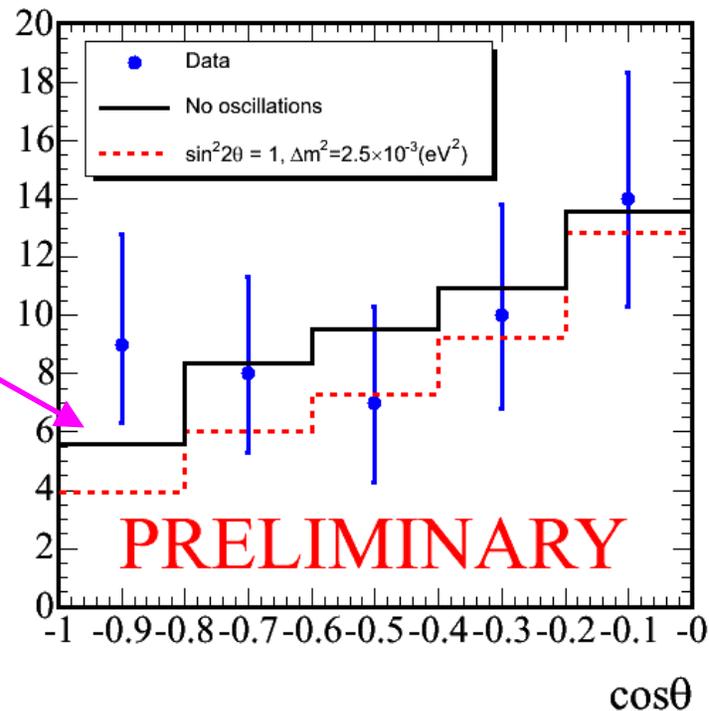
NUANCE generator:

- Bartol '96 flux
- MC normalised to data (assuming no oscillations)

From Mark Thomson (Cambridge) at Neutrino 2004

Charge-tagging:

- Tag $\nu/\bar{\nu}$ using muon charge
- Efficiency depends on:
 - muon momentum
 - track length
 - orientation wrt B-field
- Clean charge ID for approx. 50 % of events



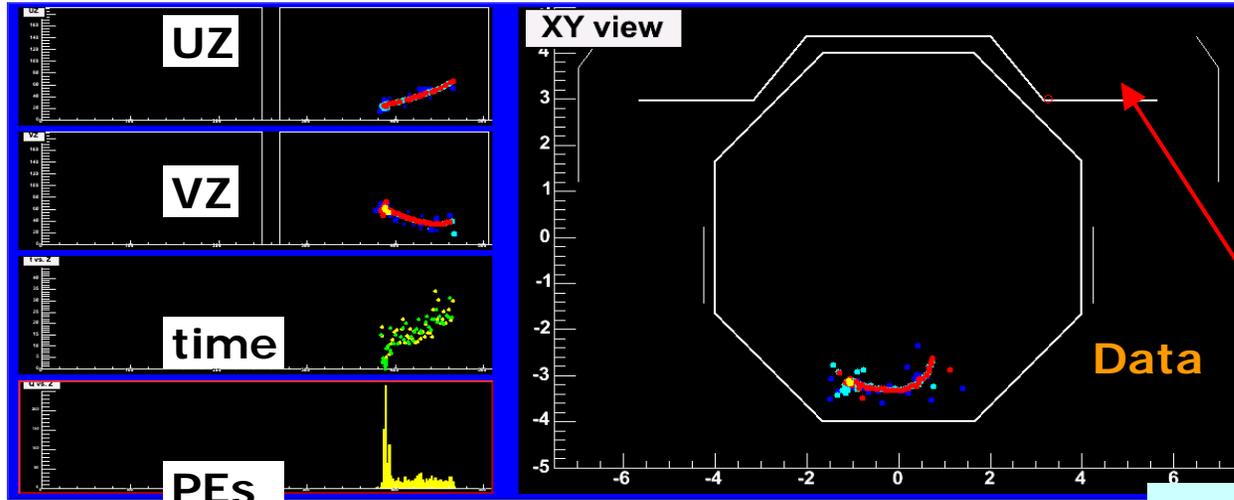
	ν	$\bar{\nu}$	$\nu/\bar{\nu}$?
Events	13	8	27

★ Understanding systematics : Work in progress

Contained Event Selection

CC ν_μ EVENT SELECTION:

- Fiducial Volume: little activity within 50cm of detector edge
- Reconstructed muon track track which crosses 8 planes
- Cosmic muon rejection remove steep events
- Veto Shield no 'in-time' Veto shield hit



MINOS Preliminary

	DATA	MC ν no osc.*	MC Cosmic backgnd.
Before VETO	88	39	63±6
VETOED	51	1	61±6
ν selection	37	38±8	2

Measure cosmic μ bgd. from data using events solely rejected on basis of veto hit

Vetoed background agrees with MC expectation !

ν MC : Battistoni et al

* Does not include acceptance systematic uncertainties – work in progress 17