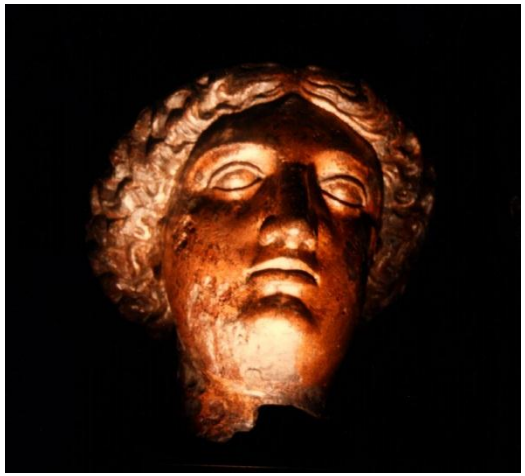
MINERvA's Run Plan



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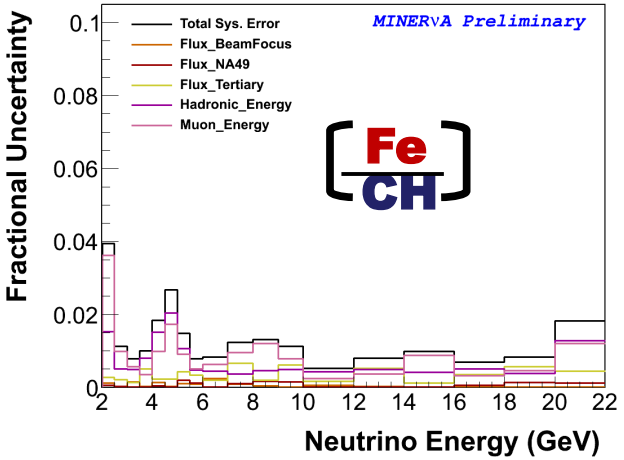
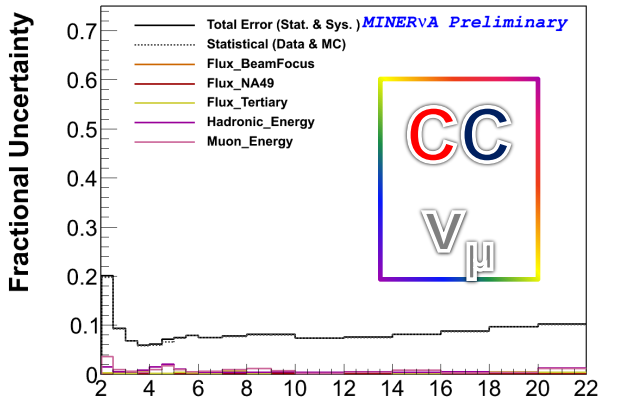
What “Run Plan” means

- Neutrino versus Antineutrino running in default Medium Energy configuration
- Schedule for changing from neutrino to antineutrino
- Plan for special runs to understand Flux
- Plan for Horn Current scans

Neutrino vs Antineutrino

- MINERvA Physics Program in ME beam focuses on DIS events and inclusive measurements over different nuclear targets
- Best physics output comes from healthy exposures in both RHC and FHC
- Example from nuclear target analysis in LE beam:
  - Statistical error at 7-9% with 1E20
  - Systematic error on ratio at 1.5%
  - Expect 5% statistical error in LE run with 4E20 POT
  - Expect ~x3 increase in evts/POT for ME tune
  - Expect /2 decrease in antineutrino
  - Statistics dominated still at 8E20
- MINERvA Request: at least 12E20 POT in each medium energy mode





Response time for switching horn polarity

- MINERvA has a He-filled cryogenic target
- Filling the target costs 20k and ~3-4 weeks
- Emptying the target takes ~1 week
- MINERvA needs empty target data for every long term configuration
- Medium energy estimate: 20-25% of total POT should be in empty target configuration
- If plan is to run neutrinos for 4-6E20POT and then antineutrinos we would start with the target empty, but then we'd need to take empty target data at the end of the antineutrino run
- Plan of 4E20 or 6E20 POT needs to be established by 20%-1 month of estimated switch date

2 Extreme Examples

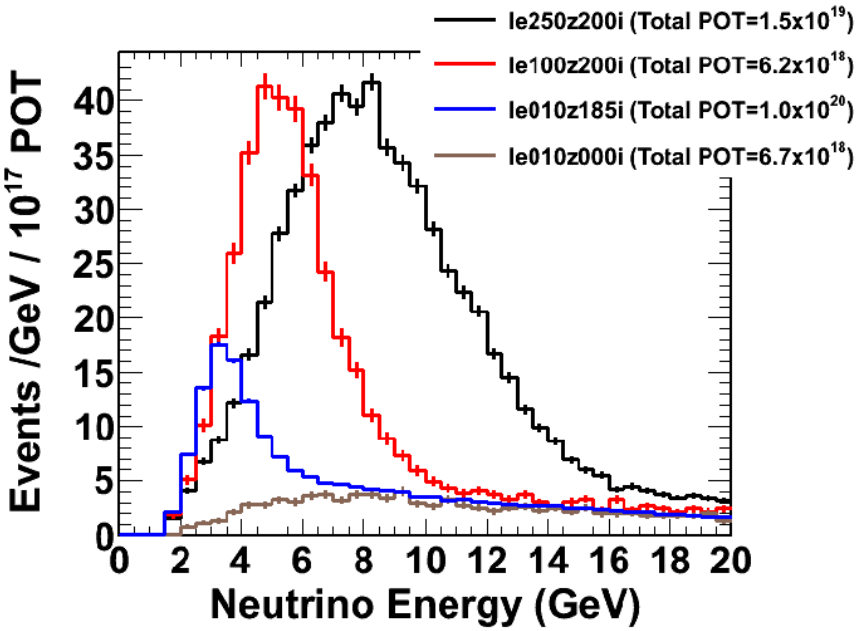
- NOvA says it will run for 6E20POT in neutrino mode before switching and taking 6E20POT in anti-neutrino mode
  - MINERvA takes 1.2E20POT empty target data
  - then fills cryostat (losing 3 weeks of He data)
  - takes another ~4.8E20 POT full target data
  - then keeps target full and takes antineutrino data
  - then empties roughly 1.2E20POT before switchback time (or later if NOvA increases nubar run time)
- NOvA says it will run for 6E20POT and then changes its mind after 3E20: then we only have 1.8E20POT full target data and 1.2E20POT empty target data

Water Target fill plan

- Water target is currently empty
- Target held in by kevlar, which has been creeping a small amount and may touch scintillator planes, don't want to fill it before beam arrives
- Takes 4 hours to fill (but do we have to take roof off?)
- Will fill target once beam power is near 200kW
- Will want neutrino and antineutrino data on target

Special Runs for MINERvA

- Took several special runs in various target positions and horn currents
- Would like to take similar data sets in medium energy beam
- What is feasibility of taking data with target moved back 250cm from target (instead of 100cm from target)?
- Low Energy studies: 7E18POT per special run
- Some special runs we took twice, and have been useful cross checks
- ~36 hours to change target positions in LE beam, doesn't make sense to take special run data for <3 days, scheduling is also important
- Would be good to take some of the higher energy beam when protons per spill is lower to minimize intensity dependent effects



Special run request:
7E18POT in horn off mode
7E18POT in "high energy" beam

Special Runs with LE target ME horn separation

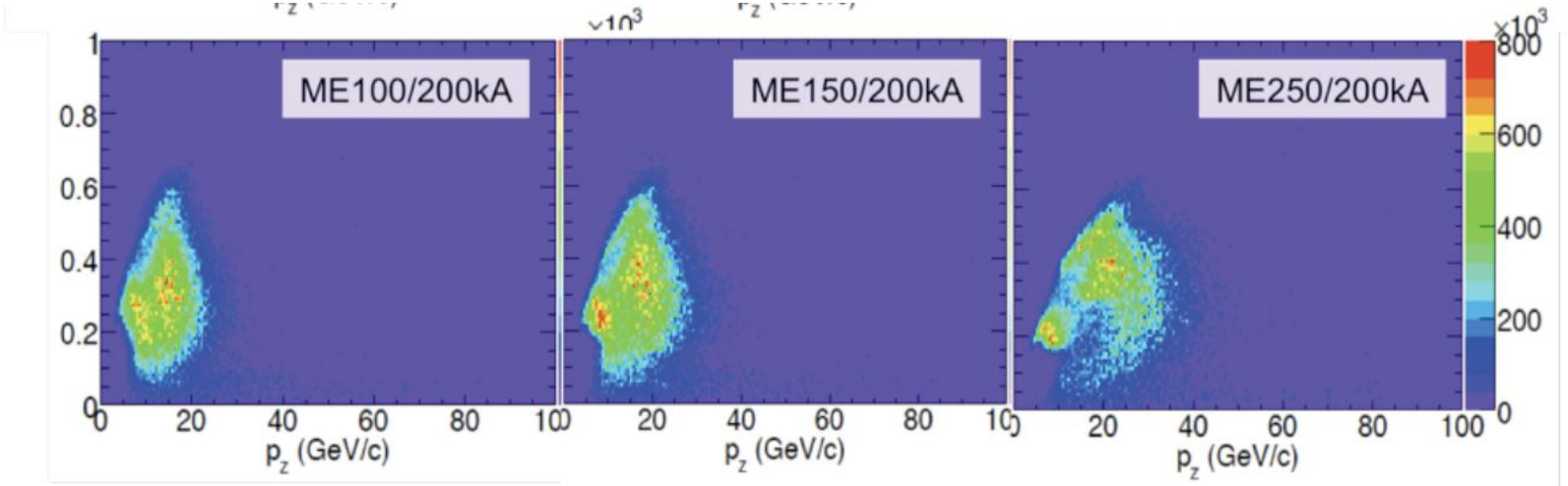
- MINERvA docdb 1820, November 2009
- Want to run with LE target for 45E18
  - To better constrain the LE beam in the first place
  - To make sure we are simulating the two different targets

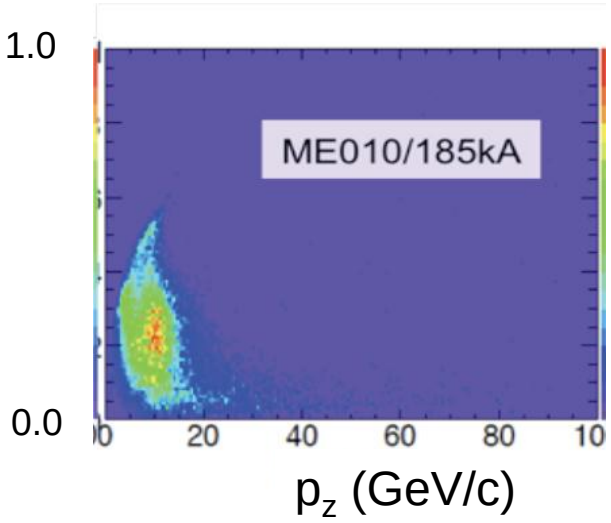
Table I: Proposed Running Requests for the MINERvA Experiment (all of which require use of the LE target design with motion capability)

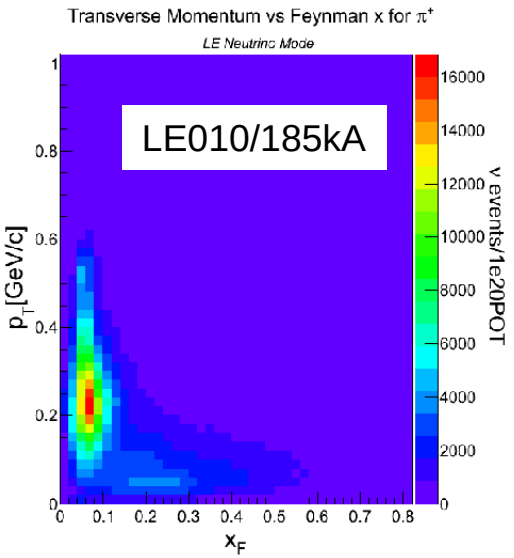
Before LE-to-ME Shutdown		After LE-to-ME Shutdown	
Exposure (10^{20} POT)	**Beam Configuraton**	*Exposure (10^{20} POT)*	**Beam Configuraton**
4.0	LE010cm/185kA	0.005	ME Beam Based Alignment [9]
0.15	LE010cm/150kA	0. 15	ME010cm/200kA
0. 15	LE010cm/200kA	0. 15	ME100cm/100kA
0. 15	LE010cm/000kA	0. 15	ME100cm/150kA
0. 15	LE100cm/200kA	0. 15	ME100cm/200kA
0. 15	LE150cm/200kA	0. 15	ME150cm/200kA
0. 15	LE250cm/200kA	0. 15 [(a)]	ME250cm/200kA
0.005	LE Beam Based Alignment [9]		Switch to ME target design

[(a)]MINERvA would like a longer exposure at this ME250cm/200kA setting if NOvA is delayed.

Comparing Pions across different special run settings





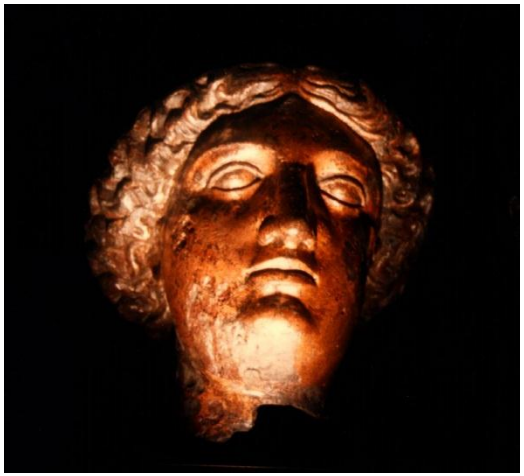


New information in ME010/185kA setting
This beam also provides ν's

Horn Current Scans

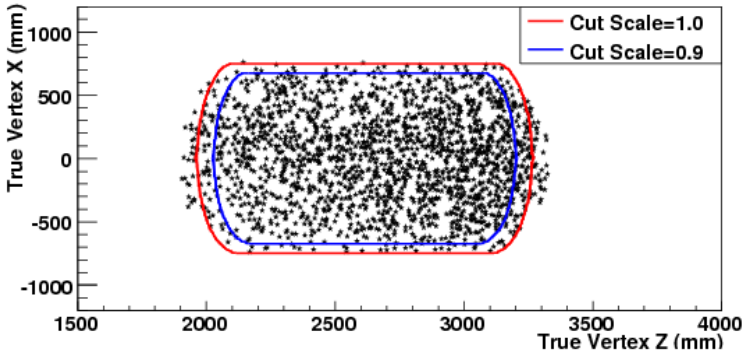
- Horn Current scans took only 90 minutes during LE beam era
- Expect same thing in ME era
- Will want horn current scan
  - every time we move the target
  - every time we change a target
  - any time we switch horn polarity
  - After every 2E20POT for target condition measurement
- Alcove 4 is currently being instrumented, if it is commissioned after beam starts, will need to do another horn scan with that alcove

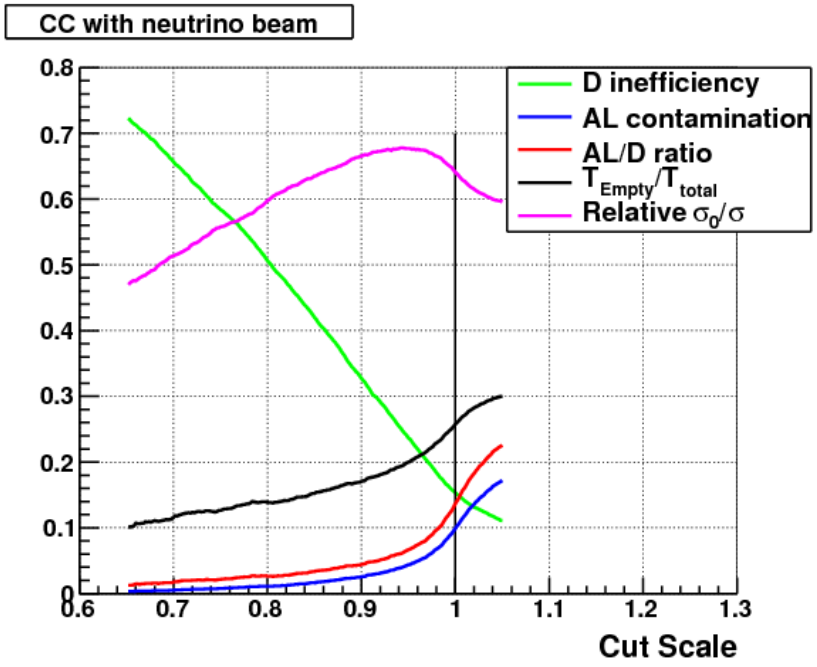
Backups

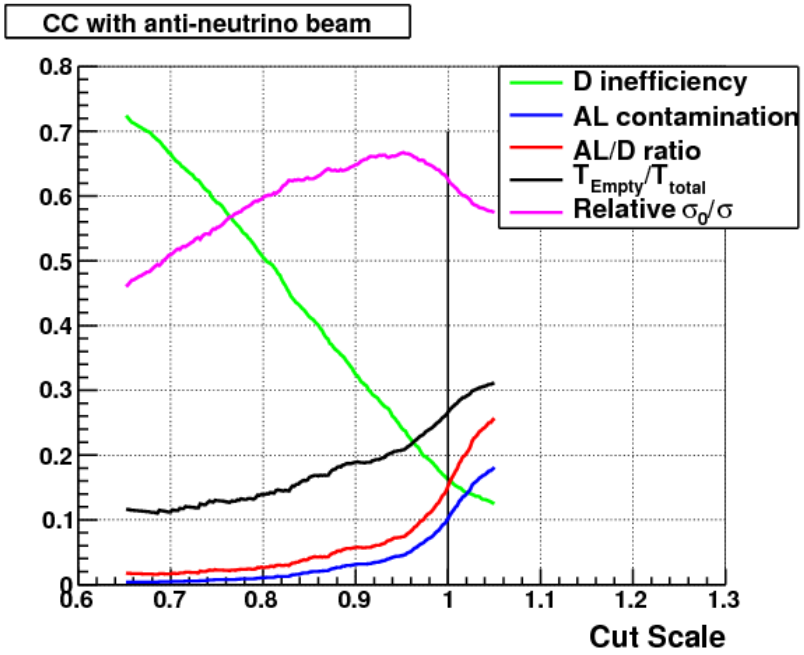


Determining the Empty/Full Running time

- Study was done looking at hit-level simulation for reconstruction of events in D2 target (docdb 6376, PAC presentation)







Horn Current Scans

- Alcove 4 threshold:

Muon Monitor 1: $E_{\mu,\pi} > 4.2$ GeV & $E_{\nu} > 1.8$ GeV

Muon Monitor 2: $E_{\mu,\pi} > 11$ GeV & $E_{\nu} > 4.7$ GeV

Muon Monitor 3: $E_{\mu,\pi} > 21$ GeV & $E_{\nu} > 9.0$ GeV