# Updates and a Look Towards First Results: Beam and Osc Groups

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on behalf of Osc and Beam Coordinators

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Oscillation Group: The Long Game

- Oscillation analysis: Remake this plot for MicroBooNE

  - Make it in a bunch of different ways

- This plot is a WAYS away: need ~3 years' data to make this...

- **What can we present in the short term to lay the groundwork for a solid nue appearance analysis?**
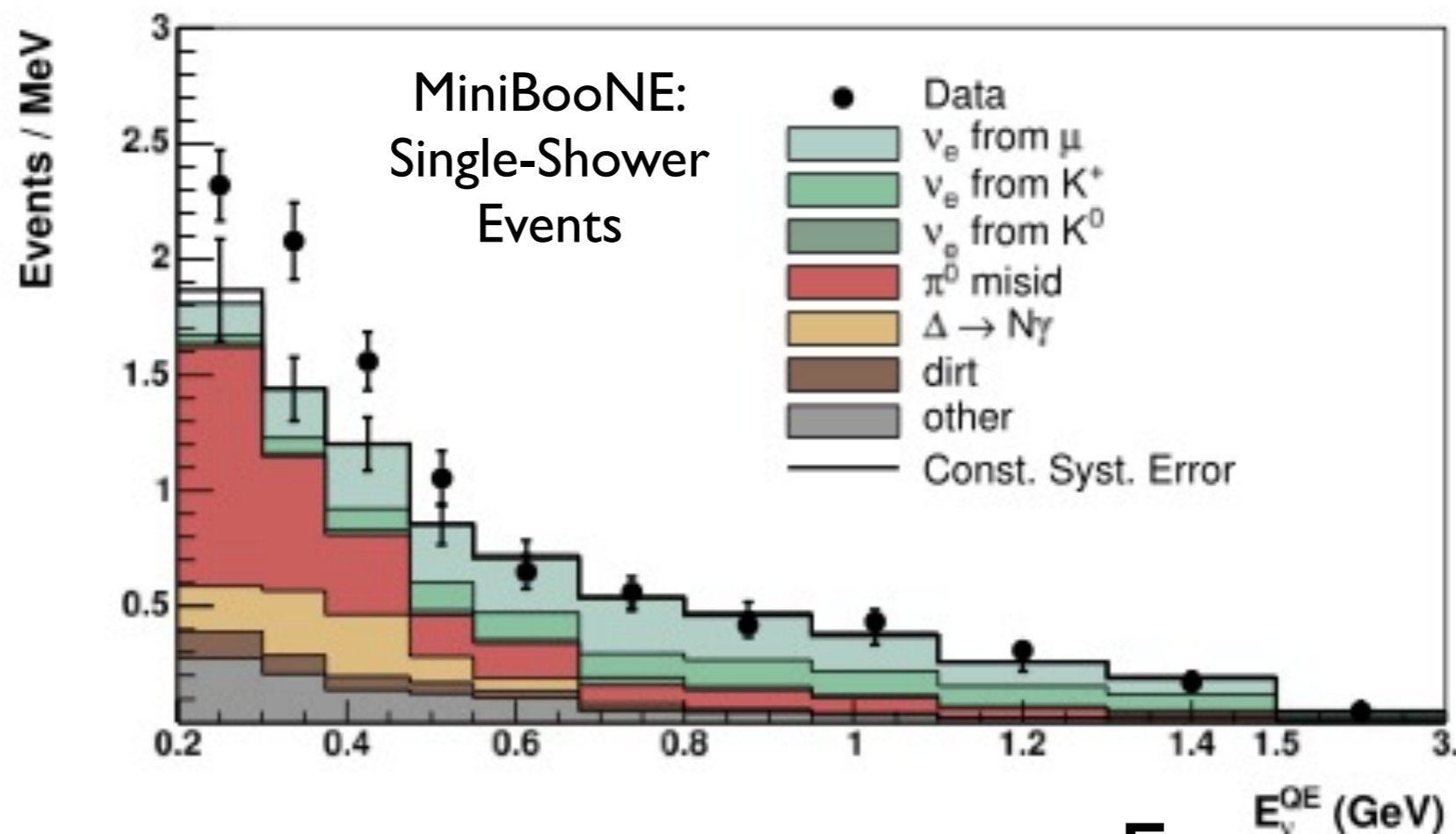
...or $E_{lep+had}$ or E_{lep} or...

The Short Game

- In near term, Osc Group will lead effort to understand showers

  - Develop highly efficient automated shower reconstruction: >90%

  - Determine selection efficiencies (>90%) and mis-id rates (<1% μ, <10% γ)

  - Ensure data and Monte Carlo showers have similar characteristics

  - Demonstrate level of gamma background reduction with data

  - If possible, demonstrate characteristics of e- while staying 'blind' to excess

- We'd like to aim for a paper demonstrating these efforts:

- **"Shower reconstruction in the uBooNE LArTPC"**

  - Prepare for this in the first year of MicroBooNE running

The Short(er) Game

- This work takes for granted some preceding accomplishments:

  - Commissioning

  - Cosmic rejection

  - Charge, drift, and energy calibrations

- See Jonathan's next talk: R&D and Calibrations Groups

- Because of this, osc work is less 'first-plots' type results, and more 'first year' type of results
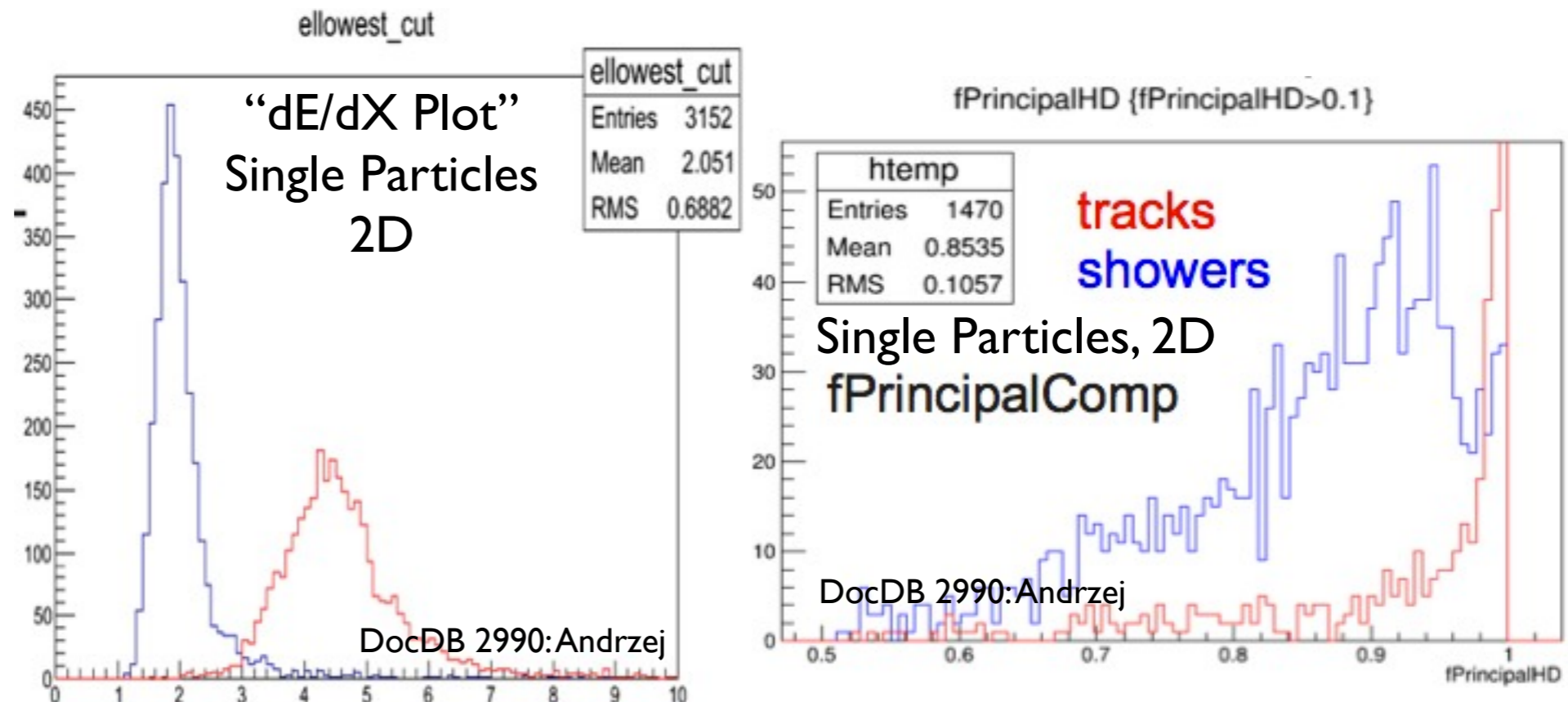
Near-Term Efforts: MC

- **In near term, Osc Group will lead effort to understand showers**
  - Develop efficient automated shower reconstruction: >90%; good ϕ, E res.
  - Determine selection efficiencies (>90%) and mis-id rates (<1% μ, <10% γ)

- These efforts should be attacked in the near term with MC

- A major focus of upcoming Yale workshop

Identify metrics for separating tracks/ showers

Make these plots for showers/tracks in 3D for GENIE events

Plots could appear in shower paper

"dE/dX Plot" Single Particles 2D

ellowest_cut

ellowest_cut	
Entries	3152
Mean	2.051
RMS	0.6882

DocDB 2990: Andrzej

fPrincipalHD {fPrincipalHD>0.1}

htemp	
Entries	1470
Mean	0.8535
RMS	0.1057

tracks
showers

Single Particles, 2D
fPrincipalComp

DocDB 2990: Andrzej

Near-Term Efforts: Data/MC Comparison

- In near term, Osc Group will lead effort to understand showers
  - Ensure data, MC showers have similar shower/track characteristics
  - Necessary for confidence in applying MC selection, mis-id efficiencies to data

- We will have lots of data in short-term, shower- and track-like
  - Compare track-shower discriminating variables for data, MC
  - Data available for use is limited by chosen blinding plan
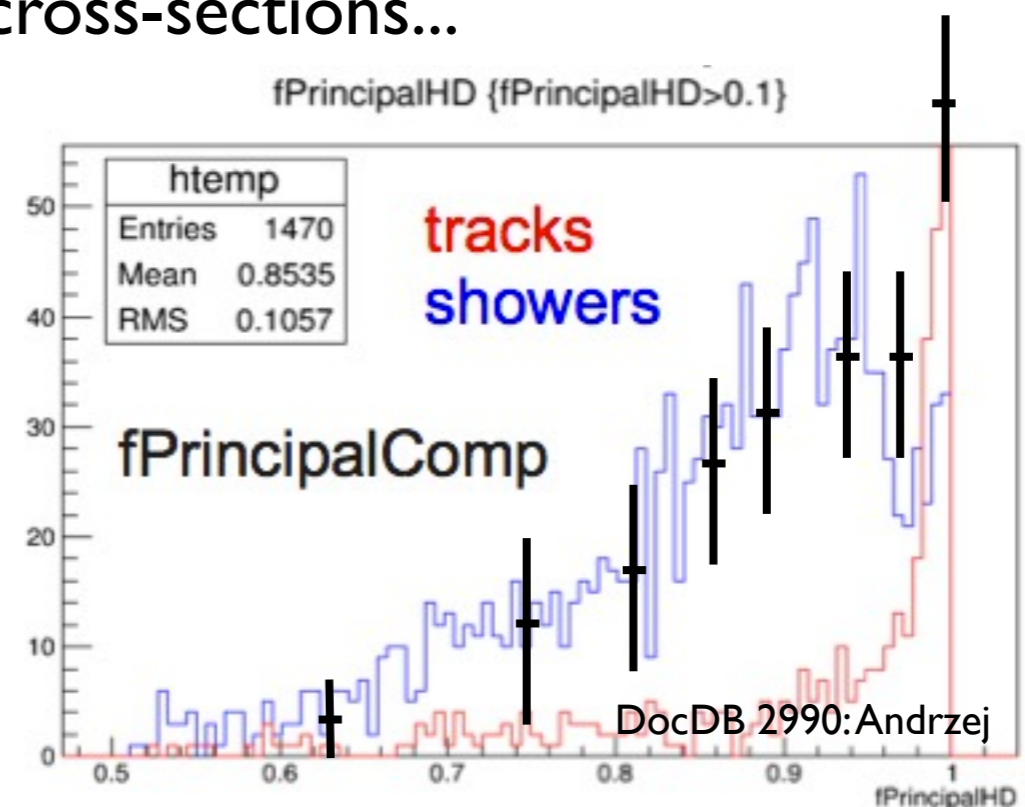 - Distributions somewhat coupled with cross-sections...

BNB, 6.6e20 POT

Process		No. Events
ν_μ *Events (By Final State Topology)*		
CC Inclusive		88,098
CC $\geq 1\pi^0$	$\nu_\mu N \to$ nucleons $+ \geq 1\pi^0$	9,678
NC Inclusive		33,000
NC $\geq 1\pi^0$	$\nu_\mu N \to$ nucleons $+ \geq 1\pi^0$	6,657

Corey, DocDB 2876

Events	BNB	NuMI
Total	145k	60k
ν_μ CCQE	68k	25k
NC π^0	8k	3k
ν_e CCQE	0.4k	1.2k
POT	6×10^{20}	8×20^{20}

Doug, DocDB 3216

fPrincipalHD {fPrincipalHD>0.1}

htemp	
Entries	1470
Mean	0.8535
RMS	0.1057

tracks
showers

fPrincipalComp

DocDB 2990: Andrzej

Assume this plot is for GENIE-based beam and dirt MC

Also do for shower width v. length, off-axis charge, etc.

Near-Term Efforts: Data/MC Comparison

- ## In near term, Osc Group will lead effort to understand showers

  - ### Demonstrate level of gamma background reduction with data

- ## We will have some data to work with here:

  - ### Cleanly separated two-shower events from NCPi0, CCmu+Pi0

  - ### Will have lots of cosmic and beam Michels (applicable to bnb e-?)

  - ### If possible, we can also look at e- events from NUMI beam
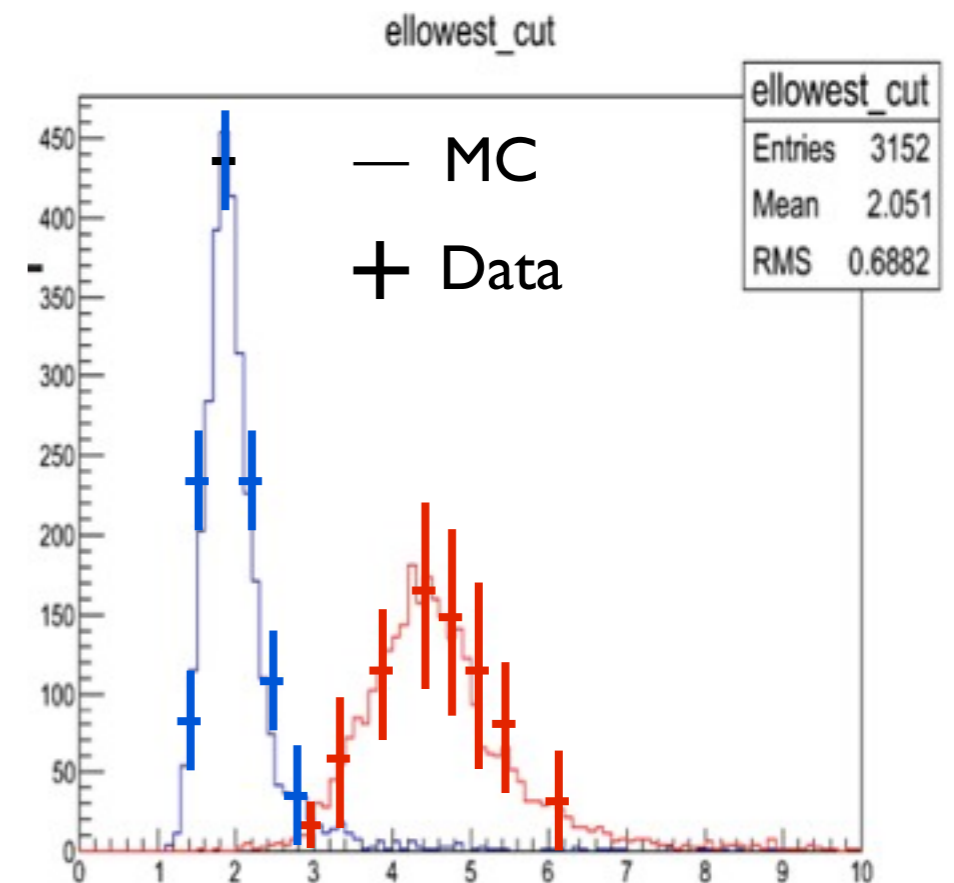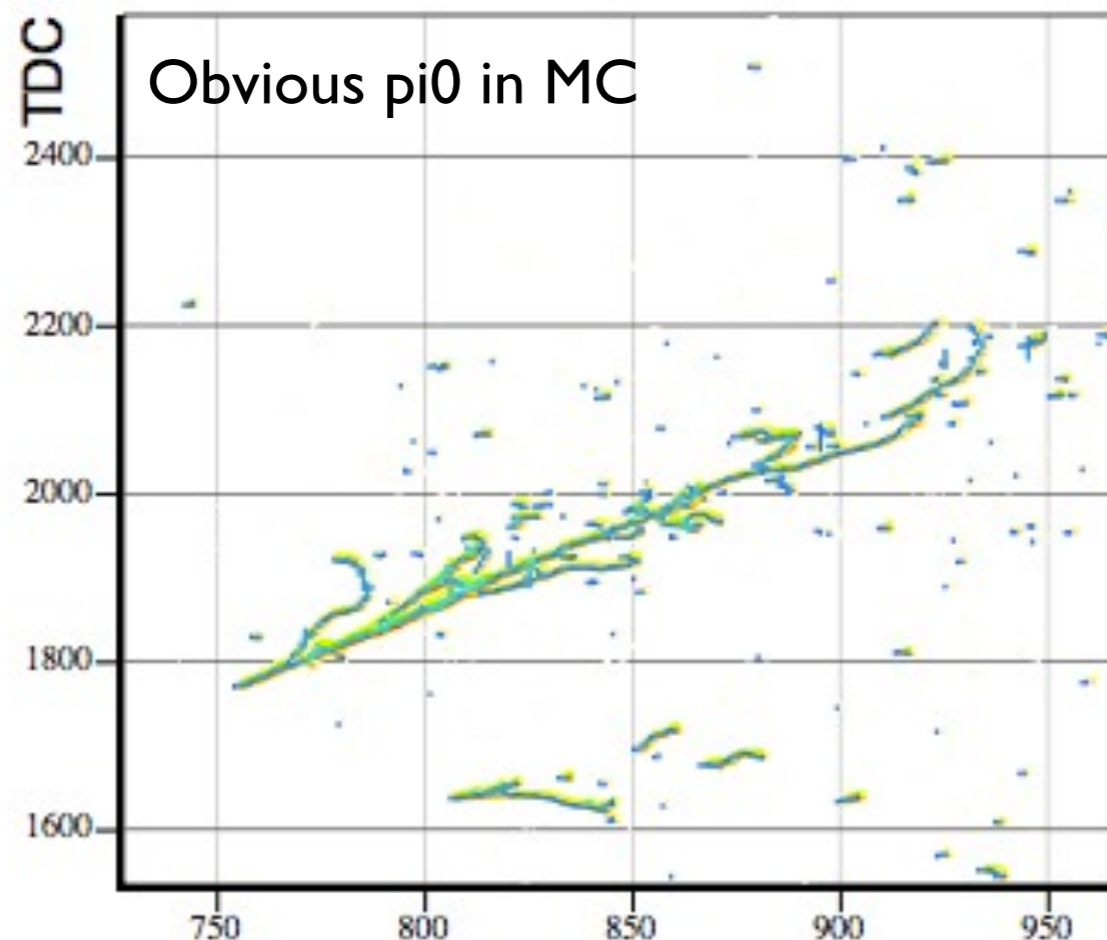
Near-Term Efforts: Energy/Direction

- In near term, Osc Group will lead effort to understand showers
  - Demonstrate shower reconstruction resolution
- Pi0 mass peak?

Shower Paper

- If we include this information in a nearer-term paper, we can present groundwork of nue analysis to the community:

    - "We can automatically reconstruct showers."

    - "Here are our reconstruction efficiencies."

    - "Our MC simulations model actual uB showers very well."

    - "e/γ separation is clearly demonstrated in first data."

    - "Waiting for full 3 year dataset to give final nue result."

- The kind of plots we'd put this paper are demonstrated in previous slides

- No breaking of nue-appearance blinding is necessary to accomplish this demonstration
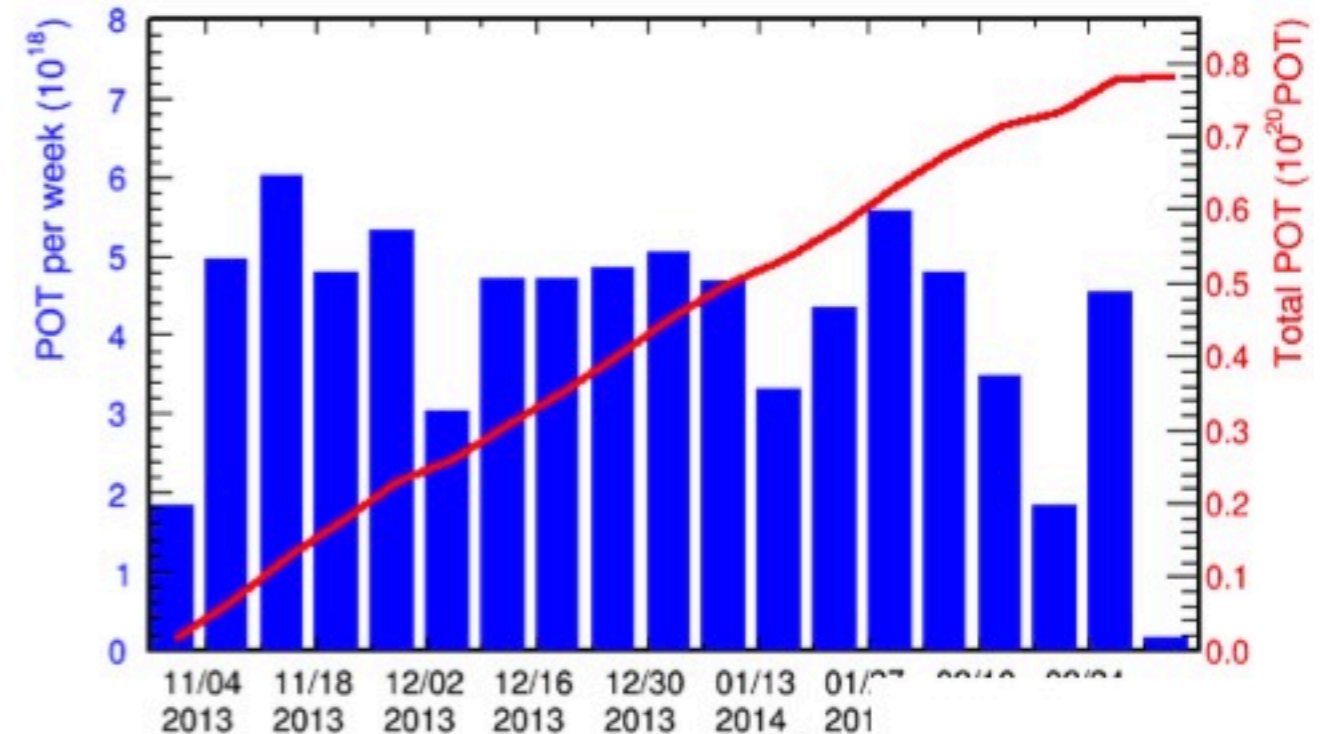
Beam Updates

RWM

- Got 2 AFL300 units from Mike Kucera (convert ttl at MiniBooNE and send it over fibre to LarTF)
- Reserved fibre, need to install

Plots

- POT performance plots updated daily on Beam monitoring page (http://www-microboone.fnal.gov/at_work/beam/beammonitoring.html)

Tia & Zarko

Beam Group MC Goals

Goal	BNB	NUMI
updated CC, NC events and tables		
Dirt: scatter plot of vertex position of particles producing activity in TPC		
z distributions of dirt events appearing as different event types in TPC		
position on gSimple window for ν producing TPC event		

- ❑ **NUMI fluxes from Doug Davis on the way**
- ❑ **New Dirt MC delivery this week**
  - ▪ Create these plots during Yale workshop

Tia & Zarko

Beam Group First Result Goals

✓ # Protons on Target

- accelerator division

☐ uB activity corresponding to beam arrival

- need rough tag of a "neutrino event"
- need precuts to remove cosmics
- these will emerge from Yale workshop

☐ # ν event / # protons on target

- from above two plots

☐ # dirt muons entering detector

Tia & Zarko