BNL colaboration in MINOS

- M. Diwan is co-convener of the $\nu_\mu \to \nu_e$ analysis group in MINOS.

  This will be one of the key measurements from the experiment.

- B. Viren is in charge of the event display package as well as the software for online beam monitoring.

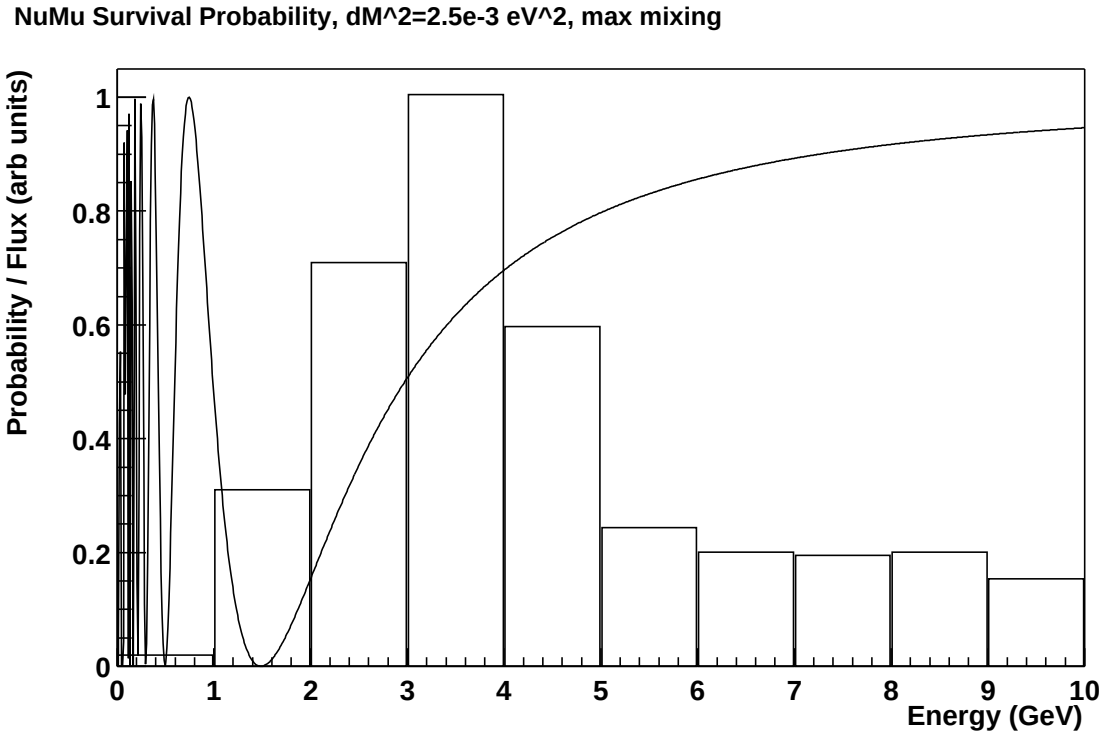
- B. Viren has made key contributions to the OO software development.

- Developed beam monitoring detectors in collaboration with FNAL, Pittsburgh, Wisconsin.

  Publication: J. McDonald et al., NIM **A 496** (2003) 293-304.

- We are studying possible beam upgrades for NuMI to create a better tuned beam when the oscillation parameters are better known.

NUMI beam tuning



Oscillation probability and NUMI flux in bins.

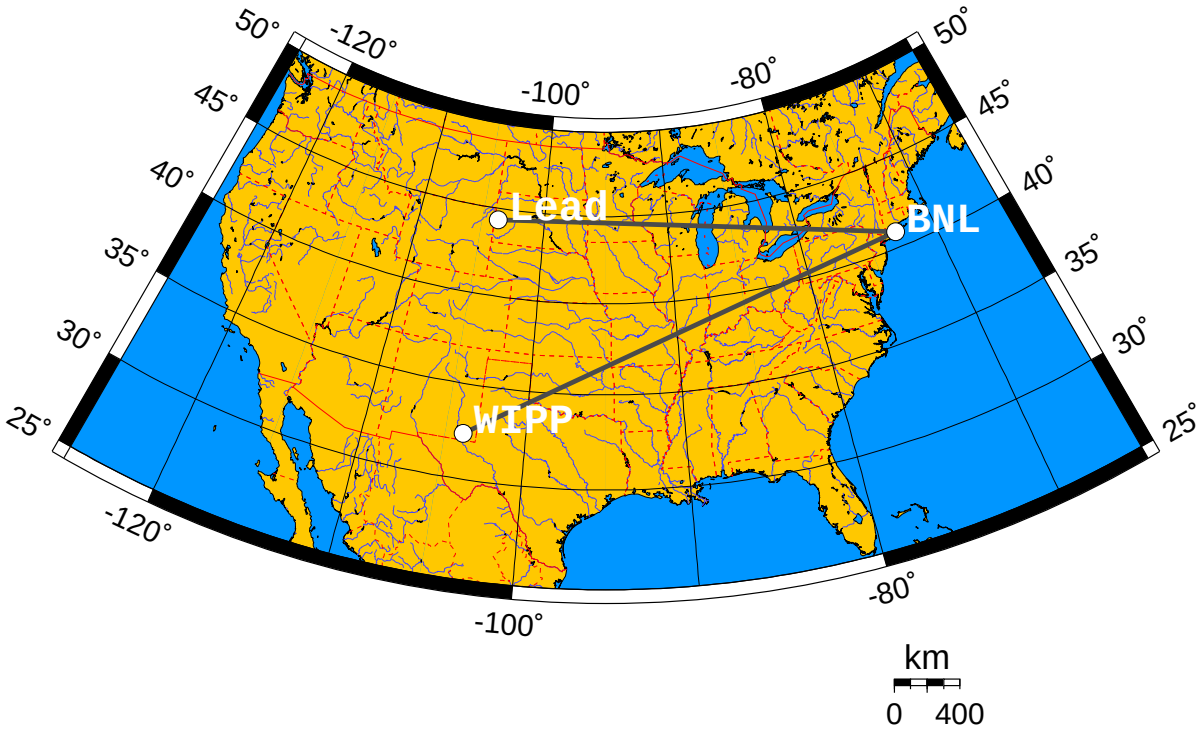
- Currently the first minimum is expected to be at 1.5 GeV for MINOS.
- It is unclear if MINOS can see the "Spectrum Dip". Also not optimized for $\nu_\mu \to \nu_e$.
- Goal for optimization:
  Eliminate flux above 6 GeV.
  Increase flux below 1.5 GeV.

Our view of future goals in ν-Osc physics.

BNL neutrino working group

- Precise determination of Δm^2_{32} and definitive observation of oscillatory behavior.
- Detection of $\nu_\mu \to \nu_e$ in the appearance mode. If $\Delta m^2_{\nu_\mu \to \nu_e} = \Delta m^2_{32}$ then $|U_{e3}|^2$ $(= \sin^2 \theta_{13})$ is non-zero.
- Detection of the matter enhancement effect in $\nu_\mu \to \nu_e$. Sign of Δm^2_{32}; i.e. which neutrino is heavier.
- Detection of CP violation in neutrino physics. Phase of $|U_{e3}|$ is CP violating and causes asymmetry in the rates $\nu_\mu \to \nu_e$ versus $\bar{\nu}_\mu \to \bar{\nu}_e$.

Experimental Approach



Send beam over a very long distance ($\sim 2500 km$) so that many oscillation nodes can be covered.

- Can address all 4 goals. See T. Kirk's talk for more details.
- Needs a very large detector. 500 kT
- Need an intense new beam. 1 MW
- Excellent match for the proposed NUSL laboratory with a very large detector.

Some Documents

"BNL neutrino working group report," M. Diwan, W. Marciano, W. Weng et al., BNL-69395, Oct 18, 2002. hep-ex/0211001.

W. J. Marciano, hep-ph/0108181.

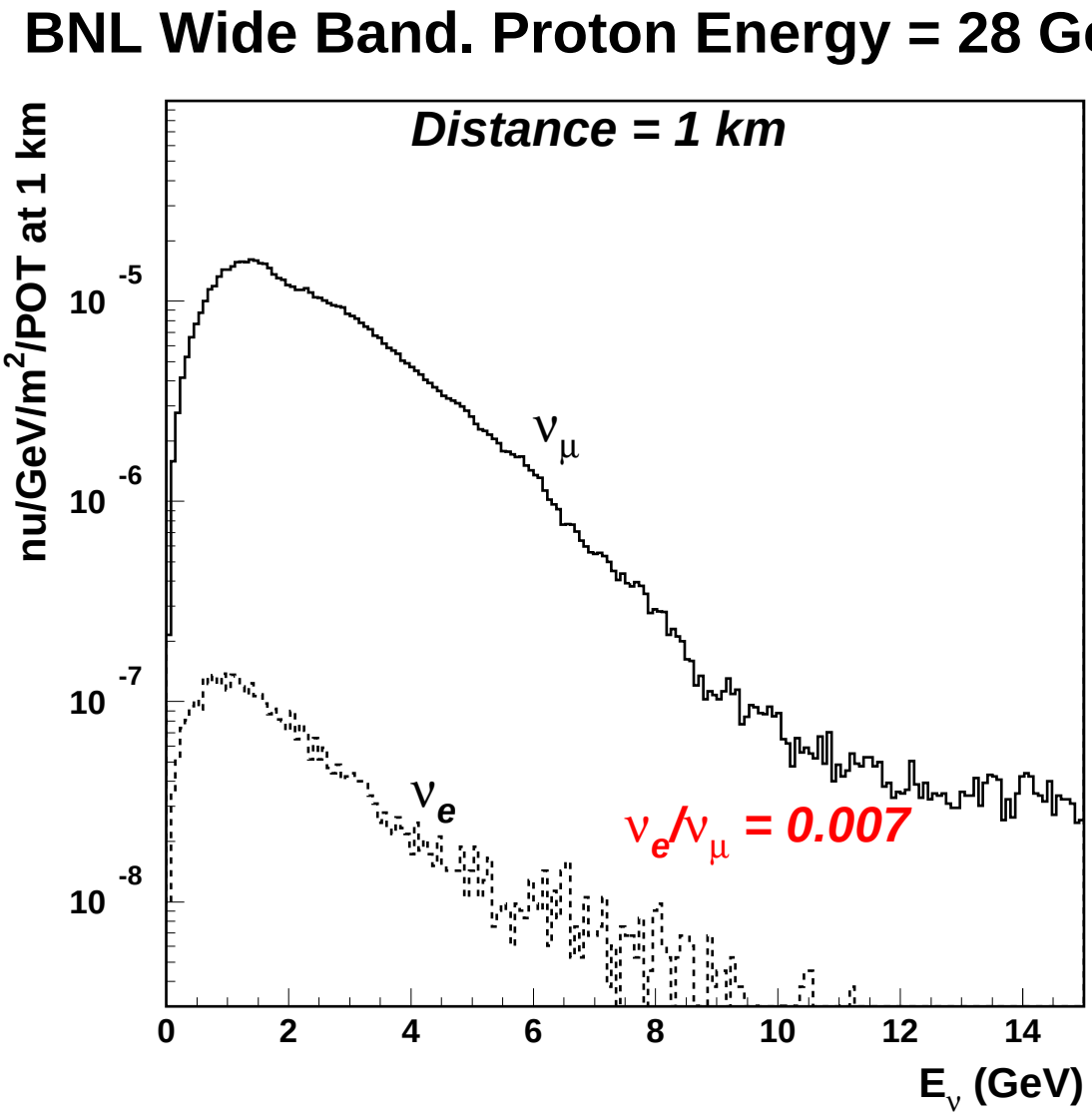
"Very Long Baseline Neutrino Oscillation Experiments for Precise Measurements of Mixing Parameters and CP Violating Effects," M. Diwan et al., hep-ph/0303081. Submitted for Publication.

Look at

http://nwg.phy.bnl.gov/

for all materials.

BNL Wideband Beam



Decay Tunnel length = 200 m.

Things to do

Partial list of things to be worked on

- Requirements for near and far detectors.
- Far detector conceptual design.
- Optimum beam to enhance signal/background.
- Backgrounds for disappearance.
- backgrounds for appearance.
- Resolution on parameters.
- Anti-neutrino running and events rates.
- Optimum running plan for physics.

Conclusions

- BNL is playing a vital role in MINOS.
  Providing leadership for analysis effort.
  Possible new ideas for beam upgrades.
- The BNL neutrino working group has produced a remarkable new idea for a very long baseline experiment.
- The VLBL approach must be studied completely to understand the feasibility.
  - BNL-SUNY are firmly proceeding towards a stronger collaboration on VLBL and UNO.
  - There will be an intellectual collaboration with the SuperK group for detector simulations.
  - There will also be a collaboration with JHFν on beam/target issues.
- Need at least 2 physicists to perform the detailed studies necessary for VLBL. (will try LDRD route for now.)