MINOS near detector 3/1/2003

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Items to study in near detector for ν_e

Need to understand backgrounds in far detector to <10%.

- Near versus far spectrum.
  - Need same studies for ν_e background spectrum as ν_μ.
- Systematic error due to near/far multiplexing.
- Systematic error due to QIE electronics, overlapped events.
- Prompt extra energy: neutrons ?
- Any issues regarding different Cosmic ray rate ?
- Energy calibration differences.
- Fiducial volume differences.

Some history of near/far systematics for ν_e

- G. Feldman should tell us about the history from CERN-PS experiment.
- S. Mishra should tell us about NOMAD systematic error.
- BNL-E734
  - $\nu_e/\nu_\mu = 0.73 \pm 0.14 \times 10^{-2}$ or 20% error.
  - Main error due to Monte Carlo modelling of background.
- BNL-E776
  - Error on ν_e/ν_μ 12%
  - Better Monte Carlo technique. Tuned to ν_μ spectrum. Cannot use this technique for MINOS.
  - Overall error of 40% to π^0 background.
  - 100% error to ν_μ charged current component of background.

- If same error assignment as BNL-E776 is used then overall error on background for MINOS will be 30%.
- Must reduce 30% to 10% by using near detector.

Background sources and comments on each

δm^2	signal	ν_e (intrinsic)	ν_μ CC	ν_τ CC	NC (E_ν <10 GeV)	NC (E_ν >10 GeV)
0.002	8	5.6	3.9	2	15.7	11.5
0.003	8.5	5.6	3.9	3	15.7	11.5
0.004	20	5.6	3.9	10	12.0	11.5

At $|U_{e3}|^2 = 0.01$

Baseline LE beam.

10 kton·years.

Comments

- Beam ν_e: can we measure this cleanly in the near detector ?
- ν_μ CC: will be affected by oscillations. How sensitive to Δm^2 ?

  Interesting problem of perception: what if signal is apparent only after the oscillation correction on this background.
- ν_τ CC: depends on Δm^2. What syst error ?
- Neutral current: How does it behave under pattern recognition differences ?