

Oscillation Calculation Assumptions

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The following are the assumptions that have been used in the GLoBES-based calculation of long-baseline neutrino oscillation sensitivities for both NuMI and LBNE-based options. More information can also be found here [1]. GLoBES input files can be found here [2].

I. OSCILLATION PARAMETERS

- $\theta_{12} = 0.593 \pm 0.018$ [3]
- $\theta_{13} = 0.154 \pm 0.005$ ($\sin^2 2\theta_{13} = 0.092 \pm 0.005$) [4]
- $\theta_{23} = 0.705 \pm 0.078$ [3]
- $\Delta m_{21}^2 = (7.58 \pm 0.23) \times 10^{-5}$ eV² [3]
- $\Delta m_{31}^2 = (2.35 \pm 0.12) \times 10^{-3}$ eV² [3] (> 0 for NH, < 0 for IH)
- matter density: constant 2.8 g/cm³ with a 2% uncertainty [5]

II. BEAM PARAMETERS

- NOvA: 700 kW at 6×10^{20} POT/year (pre-2020)
- LBNE and NOvA-phase-II: 700 kW at 6.5×10^{20} POT/year (post-2020)
- T2K: 150kW (2012-2013), 300 kW (2013-2020)

III. DETECTOR PARAMETERS: LAR

We assume standard LBNE assumptions for LAr detector performance [6].

- appearance:
 - ↪ signal: 80% CC ν_e efficiency for both ν_e and $\bar{\nu}_e$ ($\sigma/E = 15\%/\sqrt{E}$ energy resolution)
 - ↪ backgrounds:
 - ★ 1% NC ν_μ (NC energy smearing from WC simulation)
 - ★ 1% CC ν_μ ($\sigma/E = 15\%/\sqrt{E}$ energy resolution)
 - ★ 80% intrinsic CC ν_e ($\sigma/E = 15\%/\sqrt{E}$ energy resolution)
 - ★ wrong-sign backgrounds are taken into account for antineutrino mode running
 - ↪ 1% uncertainty on signal normalization
 - ↪ 5% uncertainty on background normalization
- disappearance:
 - ↪ signal: 85% CC ν_μ efficiency for both ν_μ and $\bar{\nu}_\mu$ ($\sigma/E = 20\%/\sqrt{E}$ energy resolution)
 - ↪ backgrounds: 0.5% NC ν_μ ($\sigma/E = 20\%/\sqrt{E}$ energy resolution)
 - ↪ 5% uncertainty on signal normalization
 - ↪ 10% uncertainty on background normalization
 - ↪ 2% energy scale uncertainty on both signal and background

IV. DETECTOR PARAMETERS: NOVA (FROM GLOBES)

- 15 kton fiducial mass
- input files from P. Huber [7]

V. DETECTOR PARAMETERS: T2K (FROM GLOBES)

- 22.5 kton fiducial mass
- input files from P. Huber [8]

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- [1] <https://cdcvns.fnal.gov/redmine/projects/lbne-lblpwgtools>
- [2] <http://lbne2-docdb.fnal.gov:8080/cgi-bin/ShowDocument?docid=5823>
- [3] G.L. Fogli *et al.*, Phys. Rev. D84, 053007 (2011), arXiv:1106.6028 [hep-ph].
- [4] we use the Daya Bay central value and systematic uncertainty assuming that statistics will improve over time; F.P. An *et al.* [Daya Bay collaboration], arXiv:1203.1669 [hep-ex].
- [5] A.M. Dziewonski and D.L. Anderson, Phys. Earth Planet Interiors 25, 297356 (1981); F.D. Stacey, Phys. of the Earth, 2nd edition, Wiley (1977).
- [6] T. Akiri *et al.* [LBNE collaboration], arXiv:1110.6249 [hep-ex], appendix A.
- [7] <http://www.mpi-hd.mpg.de/personalhomes/globes/glb/0709-nova.html>
- [8] <http://www.mpi-hd.mpg.de/personalhomes/globes/glb/0709-t2k.html>