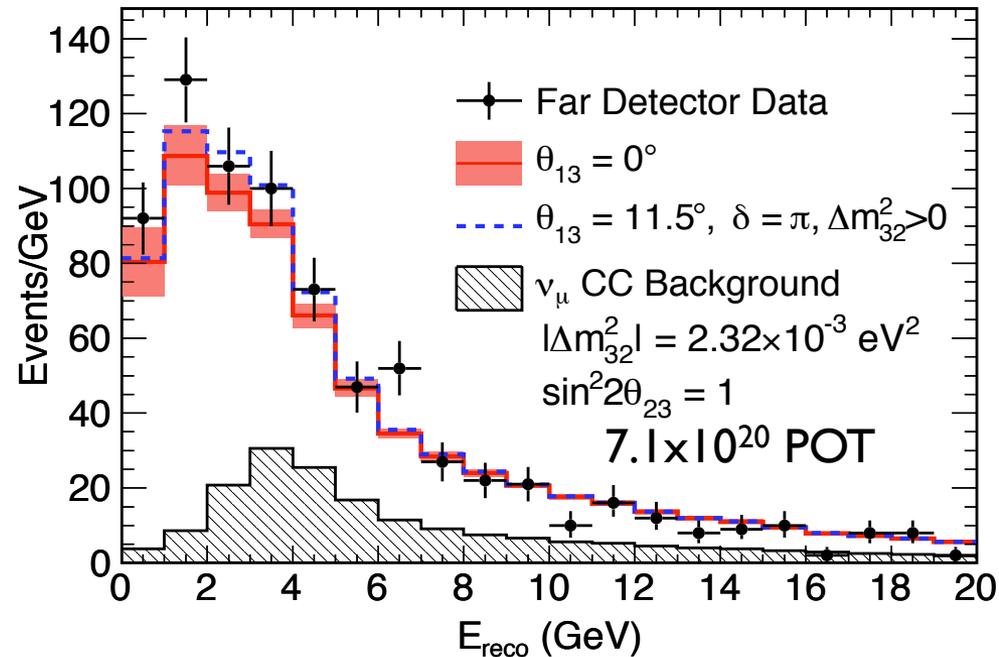




MINOS Search for Active Neutrino Disappearance

- Transitions of active neutrino flavors to sterile neutrinos would result in a deficit of neutral current events observed at the MINOS Far Detector.
- Observed MINOS neutral current spectrum is shown on the right, along with spectra predicted from the Near Detector for oscillations among three active neutrinos with and without ν_e appearance (set at the MINOS 90% CL limit).



- Agreement between the observed and predicted neutral-current spectra is quantified using the statistic R , tabulated on the right for different ranges of the calorimetrically reconstructed energy E_{reco} .

$$R = \frac{N_{\text{Data}} - \sum B_{\text{CC}}}{S_{\text{NC}}}$$

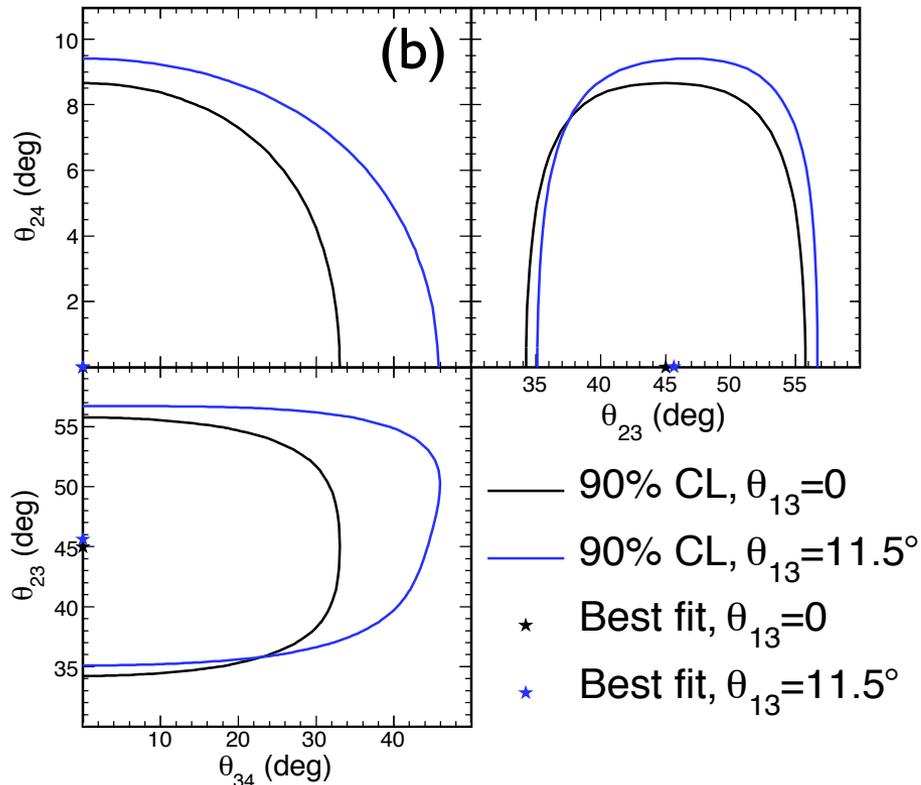
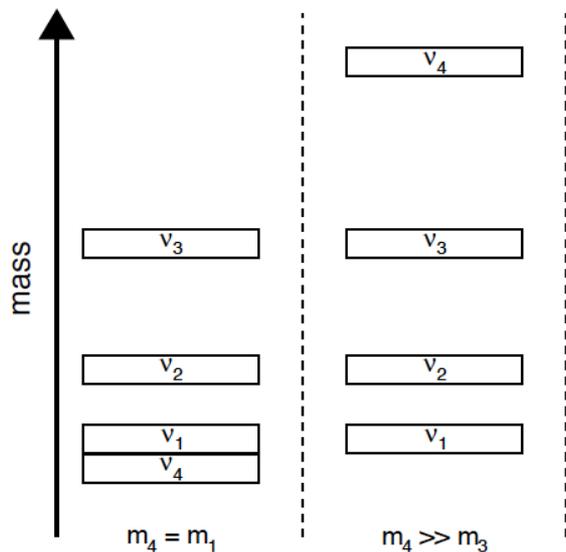
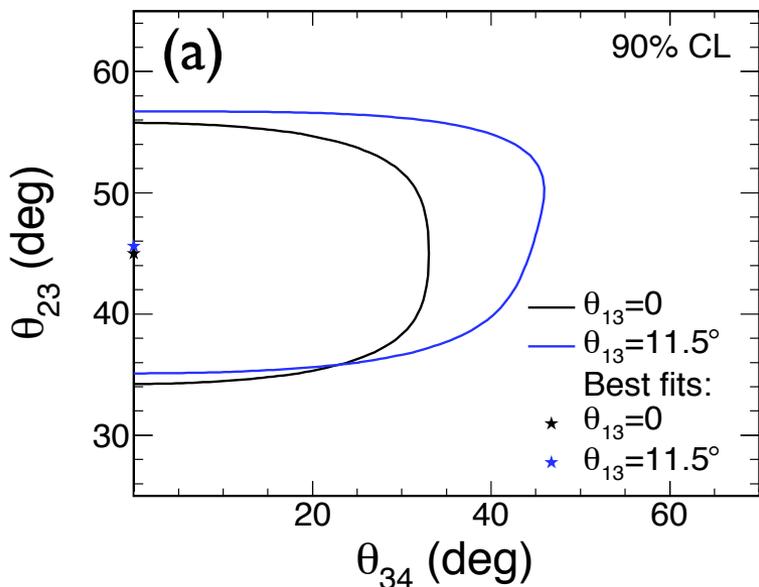
- Fraction of disappearing ν_μ that may convert to sterile neutrinos is limited to **< 0.22 at 90% CL** without ν_e appearance (**< 0.40 at 90% CL** with maximal ν_e appearance allowed by the MINOS 90% C.L. limit).

E_{reco} (GeV)	N_{Data}	S_{NC}	$B_{\text{CC}}^{\nu\mu}$	$B_{\text{CC}}^{\nu\tau}$	$B_{\text{CC}}^{\nu e}$
0 – 3	327	248.4	33.2	3.2	3.1 (21.5)
3 – 120	475	269.6	156.0	9.2	31.2 (53.8)
0 – 3	$R = 1.16 \pm 0.07 \pm 0.08 - 0.08(\nu_e)$				
3 – 120	$R = 1.02 \pm 0.08 \pm 0.06 - 0.08(\nu_e)$				
0 – 120	$R = 1.09 \pm 0.06 \pm 0.05 - 0.08(\nu_e)$				

$$f_s = \frac{P_{\nu_\mu \rightarrow \nu_s}}{1 - P_{\nu_\mu \rightarrow \nu_\mu}} < 0.22 (0.40) \text{ at } 90\% \text{ CL}$$



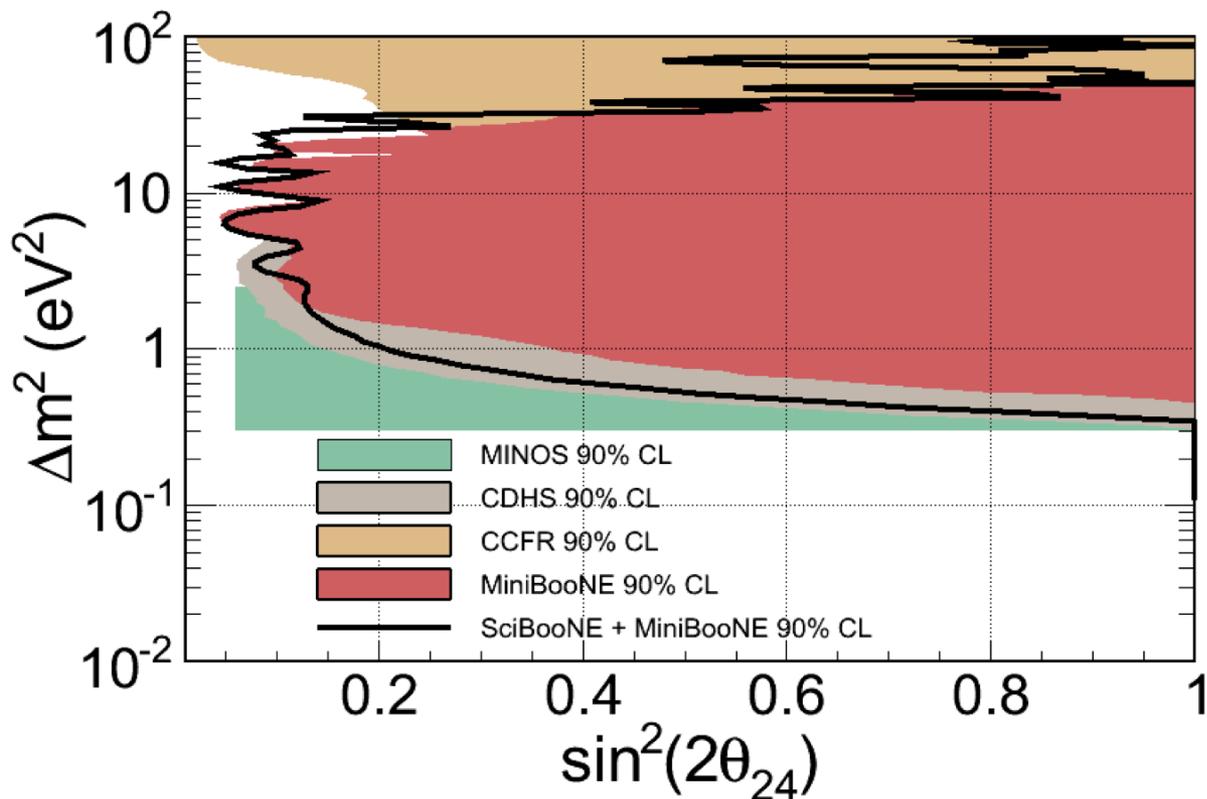
MINOS Search for Active Neutrino Disappearance



- Contours representing 90% CL for the mixing angles of (a) $m_4=m_1$ and (b) $m_4 \gg m_3$ neutrino oscillation models including one sterile neutrino. The black line and best-fit point (black symbol) are obtained for null ν_e appearance, whereas the blue line and corresponding best-fit point (blue symbol) are obtained with ν_e appearance set at the MINOS 90% CL limit.



MINOS Search for Active Neutrino Disappearance



- MINOS exclusion compared to MiniBooNE, CDHS, and CCFR ν_μ disappearance results. MINOS 90% CL excluded region is shown in green. The MiniBooNE, CDHS, and CCFR contours come from Phys. Rev. Lett. 103 (2009) 061802 and show the MiniBooNE disappearance result. The MiniBooNE appearance result is more sensitive than all of these. The Δm^2 value for CDHS, MiniBooNE and CCFR is for mass states m_2 and m_4 . Because $m_4 \gg m_3$, Δm^2_{42} is nearly the same as Δm^2_{43}