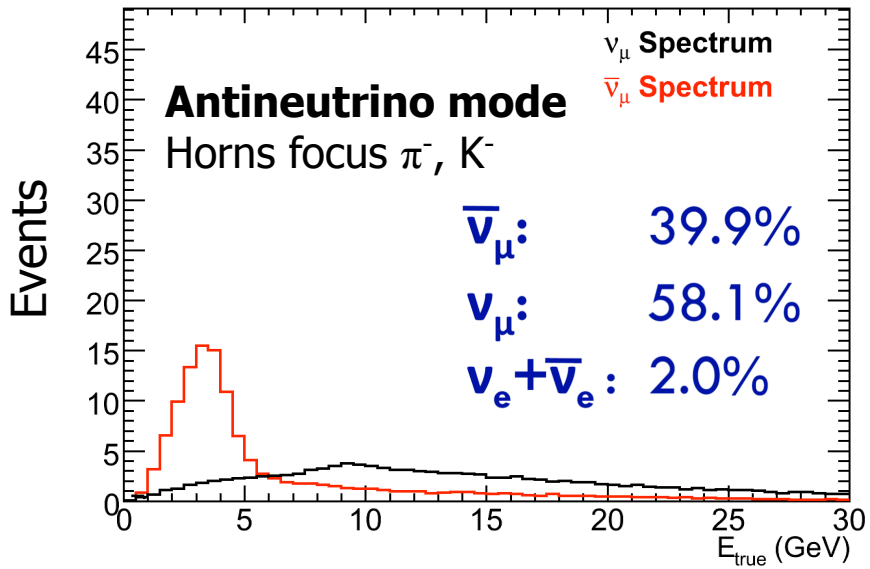
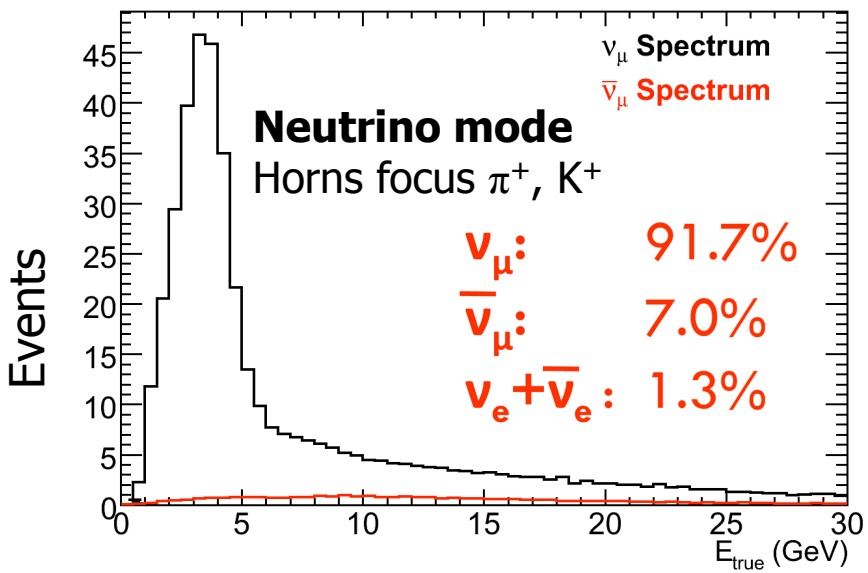
Measuring antineutrino oscillations with the MINOS experiment

Antineutrino running





MINOS has taken six months of data with a dedicated $\bar{\nu}_\mu$ beam

- Allows the first direct precision measurement of the muon antineutrino oscillation parameters

To obtain a pure CC- $\bar{\nu}_\mu$ sample, apply two selection cuts

- Charge of selected muon track
- k-nearest-neighbour-based selection variable to separate out NC events

Final sample purity is 98% below 6 GeV

Results

Expect 156 events with no oscillations

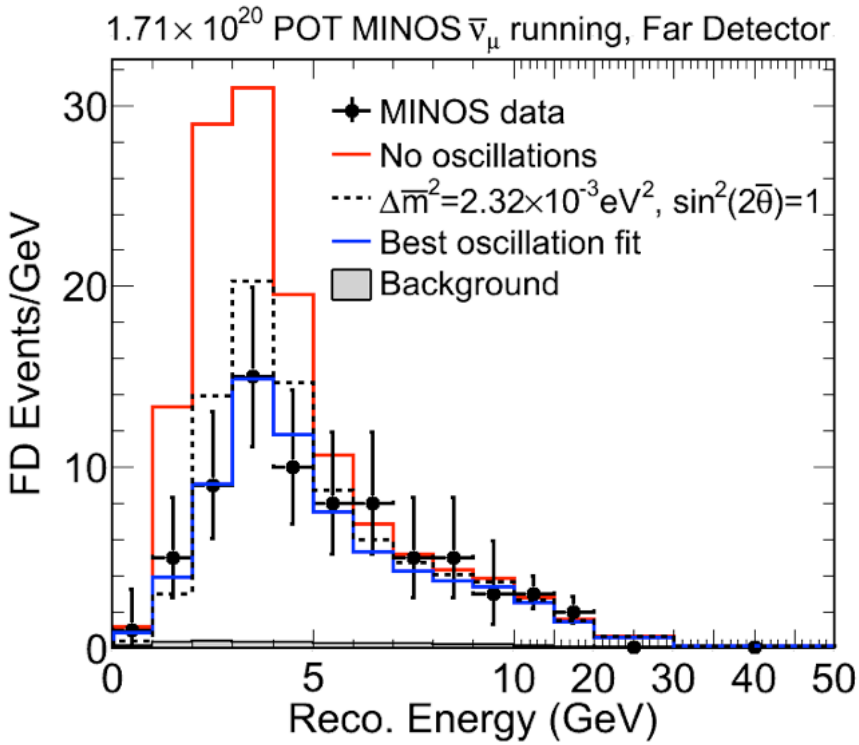
Observe 97 events

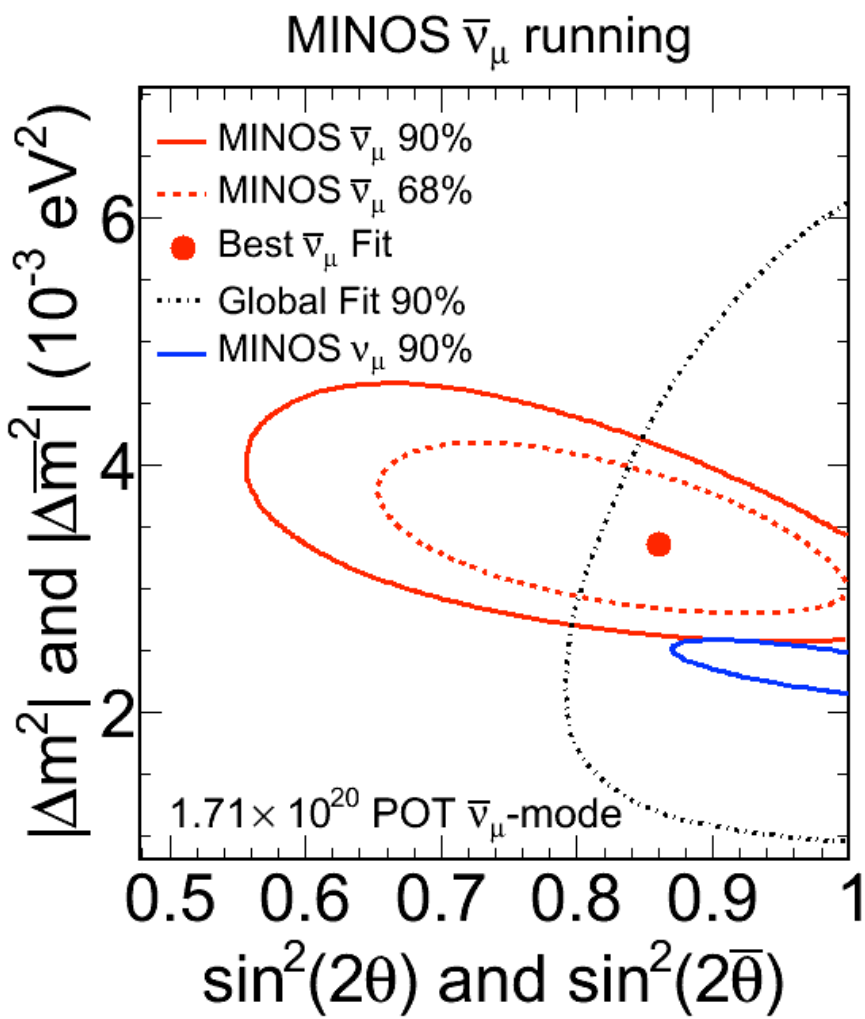
- No oscillations disfavoured at 6.3σ

Best fit to oscillations:

$$|\Delta\overline{m}^2| = (3.36^{+0.46}_{-0.40}(\text{stat.}) \pm 0.06(\text{syst.})) \times 10^{-3}\,\text{eV}^2$$

$$\sin^2(2\overline{\theta}) = 0.86^{+0.11}_{-0.12}(\text{stat.}) \pm 0.01(\text{syst.})$$



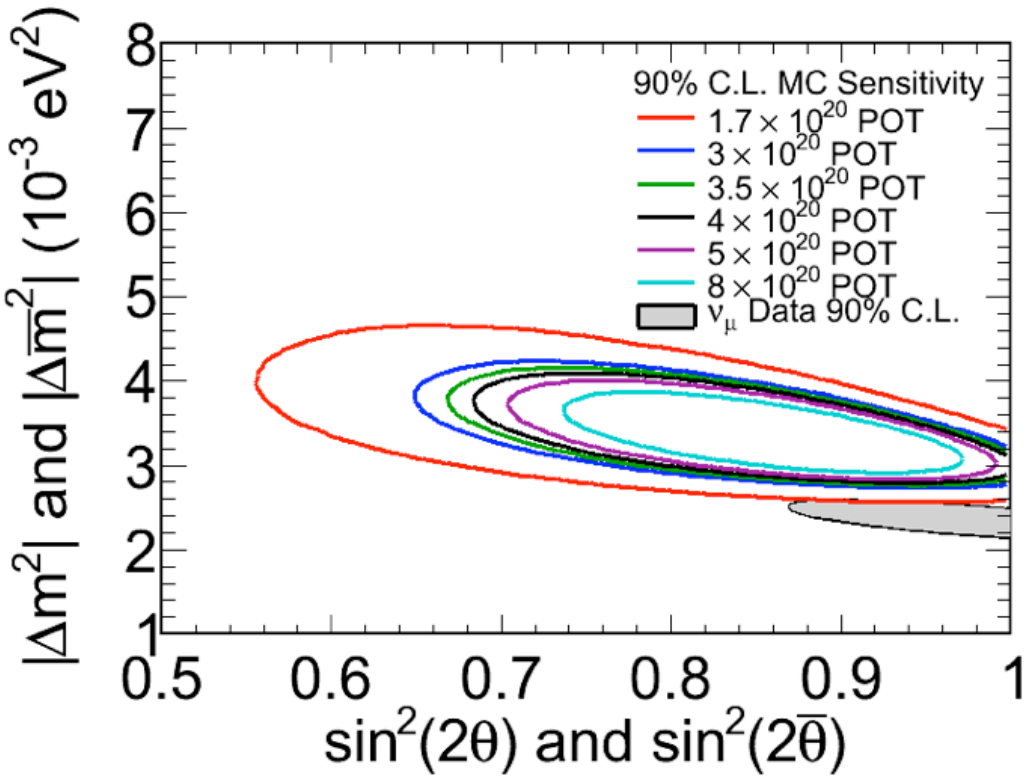


Global fit from Gonzalez-Garcia & Maltoni, *Phys. Rept.* 460 (2008), SK data dominates

The Future

This result was obtained with data corresponding to 1.7×10^{20} protons-on-target

With more antineutrino running, MINOS can quickly make significant improvements to the precision

Our dataset can be doubled in six months

- This would decrease the errors on the oscillation parameters by ~30%