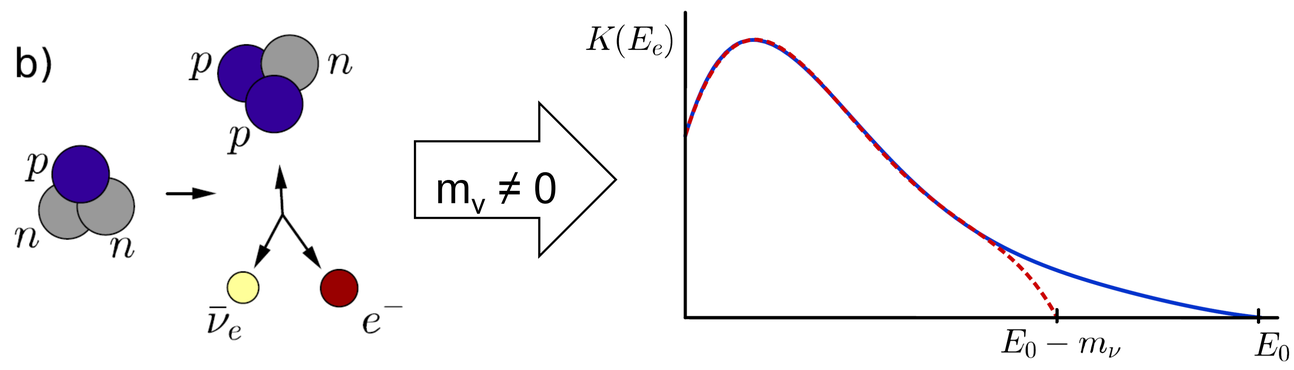
Neutrino Properties

X. Y. KIT, Juan Pablo Yanez, DESY

Neutrino masses and KATRIN

- $m_\nu \neq 0$ lead to a distortion on the e^- spectrum of β decay



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massive neutrinos are a requirement for another striking phenomenon

Measurement of neutrino oscillations with IceCube DeepCore

ν unique properties

Very **small mass** scale
$m_1, m_2 << m_e$

+

Small mass differences
$\sigma_m^2 > m_1^2 - m_2^2$

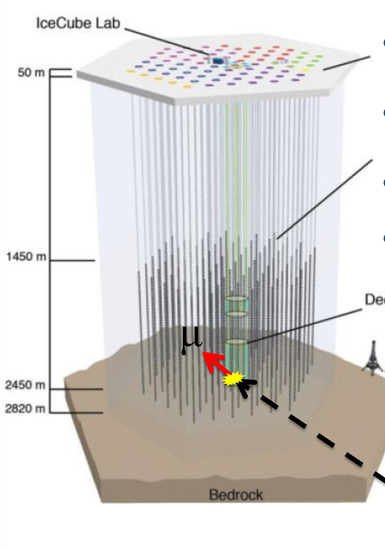
=

Oscillations
Effect depends on energy and distance traveled

$$P(\nu_\alpha \rightarrow \nu_\beta) = \sin^2(2\theta)\sin^2(1.27\Delta m^2 L/E)$$

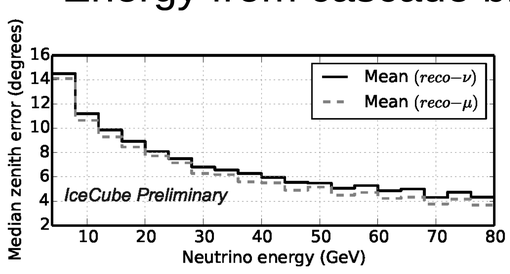
- Oscillation parameters θ_{23} and Δm^2_{23} (in eV^2)
- Variables L_ν (distance traveled in km) and E_ν (energy in GeV) measurable in atmospheric neutrinos using very large detectors

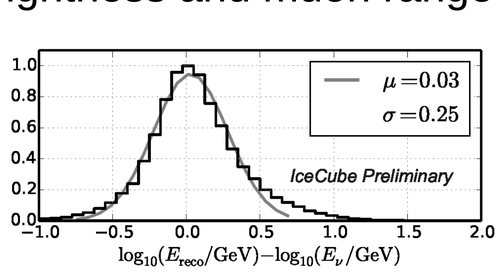
Method



- Focus on CC ν_μ
- Reconstruct outcoming μ
- Use "prompt" Cherenkov γ
- Look at different *L/E* values

- Resolutions achieved for final sample
  - Direction from prompth light hyperbola from muon
  - Energy from cascade brightness and muon range

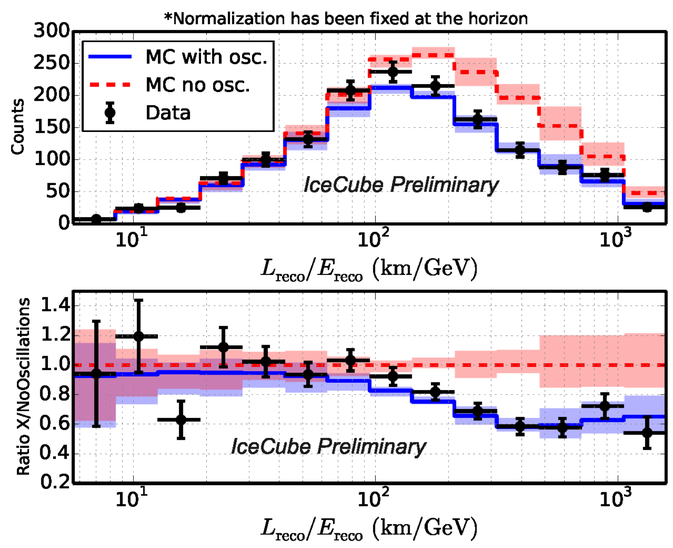


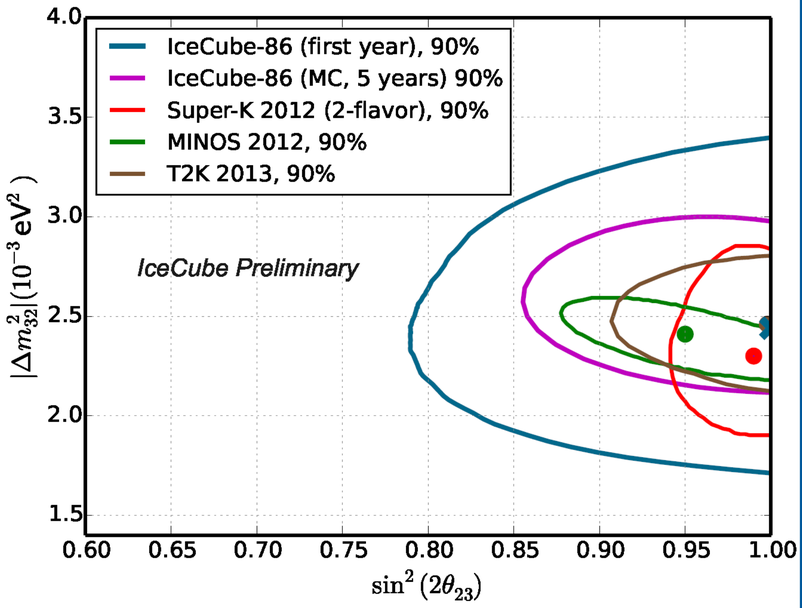


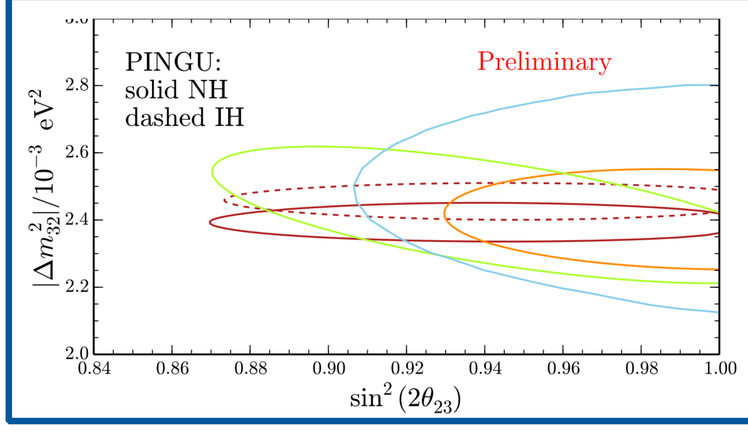
  - About 6 degrees resolution in zenith angle
  - Energy resolution of ~ 40 %

Results

- 1487 events found in first year (~500 disappeared due to osc.)
- Best fit: $|\Delta m^2_{32}| = 2.4 \pm 0.4 \cdot 10^{-3}$ eV^2
  $\sin^2(2\theta_{23}) = 1$ (> 0.93)







The Future: PINGU

- Denser array inside DeepCore
- More light per interaction
- Increase in precission

PINGU (1 year)
DeepCore (6 years)
MINOS 2013
T2K prel.

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KATRIN

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Matter and the Universe

Measurement of Neutrino Oscillations with IceCube DeepCore

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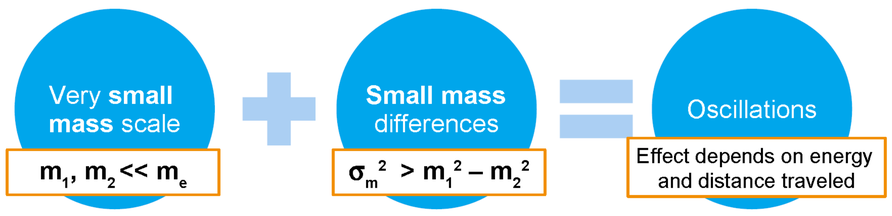

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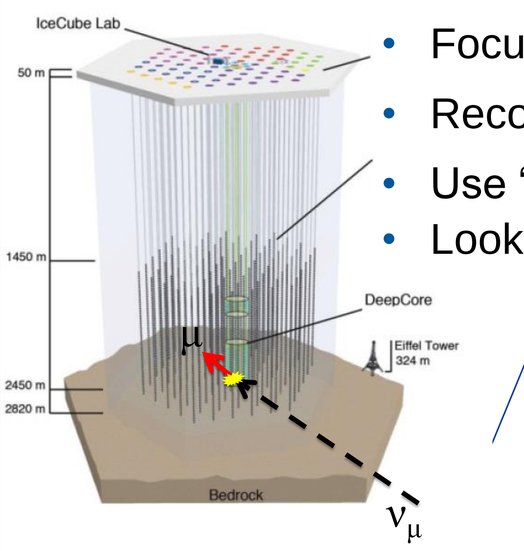

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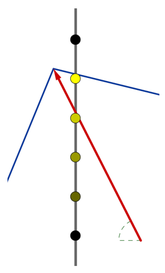

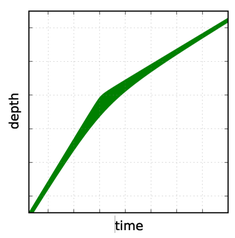

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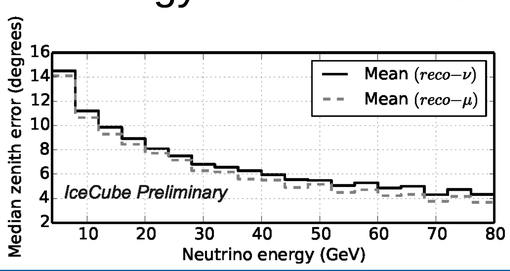

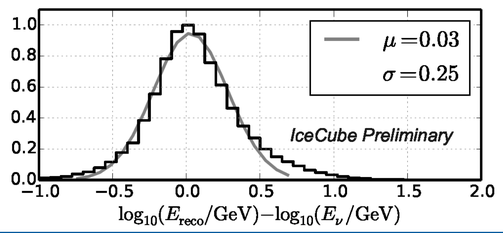

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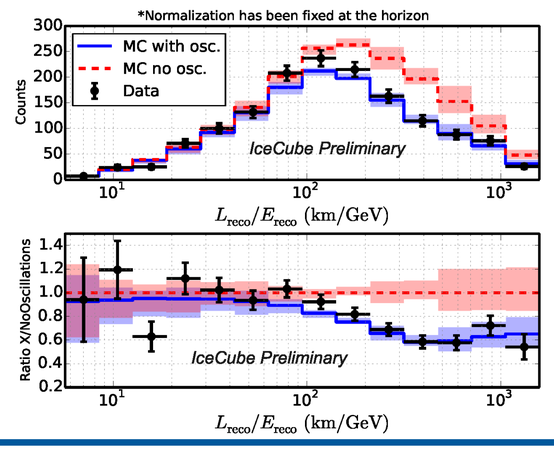

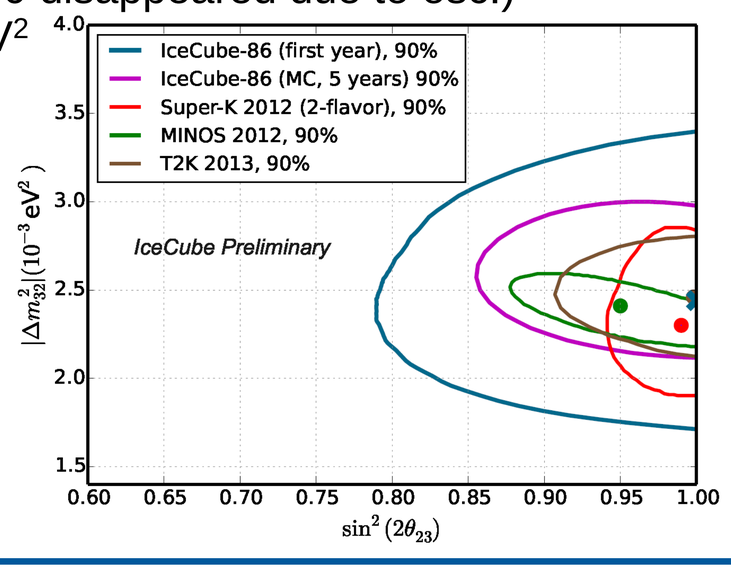

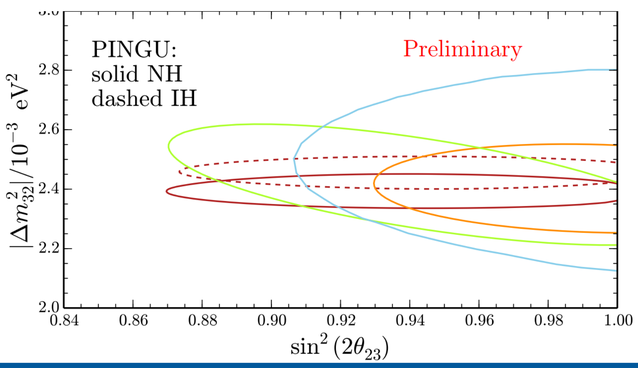

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