High Energy Calibration of Super-Kamiokande

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Super-Kamiokande

- Located under Mt. Ikenoyama in Gifu prefecture, Japan
- Worlds largest Water Cherenkov Detector
- Under ~2,700 m.w.e. of rock, it is shielded from all but the highest energy cosmic rays.
- 41.4 m tall and 39.3 m in diameter, it holds 50 KT of water.
- Used for atmospheric and solar neutrino studies as well as proton decay searches. It also servers as the far detector for the Long Baseline Neutrino Oscillation experiment T2K.
Super-Kamiokande
Motivation

- A good energy scale calibration is needed for all most all physics experiments.
- With Super-Kamiokande being used as the far detector of the T2K experiment, this is even more important.
- To reach the desired sensitivity levels for T2K, we need the systematic error on energy reconstruction to be at the ± 1% with our hopes of reducing it to ± 0.5% by the time final results are published.
Energy Calibration at SuperK

- The energy scale calibration at SuperK is maintained by two primary groups: Low Energy and High Energy.
- The Low Energy groups primary purpose is to calibrate the detector for neutrino energies below 20 MeV and keep it prepared for supernova observations.
- The High Energy group does calibrations for all other energy regions. These higher neutrino energies will be the focus of the rest of this talk.
Energy Calibration

The four methods we use to calibrate Super-Kamiokande and the energy regions they correspond to.
The current systematic errors for Super-Kamiokande as of 2010
Future Work

- Continue to add data and increase statistics as much as possible, particularly for sub-GeV stopping muon and \( \pi^0 \) mass study.
- Tune all PMT gains by a constant amount to center the total energy scale around 0%.
- Tune MC to include water quality as a function of depth.