Num Methods 4/20/12
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Project Proposal
Envision an experiment designed to measure the lifetime of various leptons. Imagine a random beam of electrons, muons and tau leptons moving close to c, incident upon a scintillator/PMT detector. The detector will give a signal when one of the leptons either a) generated ionization within the detector or b) decays and its daughter particles ionize the detector. Once the scintillator receives a signal (assumed to be from initial ionization, causing the particle to come to rest) it will wait a period of time to see if it receives another signal (assumed to be from daughter ionization), if no second event is received then reset.

Project involves 2 parts:
Design a MCMC program to emulate the following experiment:
The MCMC returns the number of decays that take an amount of time t, N(t). Each incoming particle will be assigned a random flavor and then randomly decay according to its lifetime.

After a data sample has been generated, use the Levenberg-Marquardt method to fit the data and extract the 3 lifetimes, beam fractions, and associated errors.

Extra (if time allows):
What is the minimum fraction of tau leptons needed in the beam to distinguish it as separate from electron & muon background (95% CL).