

LEPP REU 2008

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 - Subject: J/ψ meson decays

J/ψ Decay

- The particular decay that I will be looking at is:

$$e^+e^- \rightarrow \psi(2S)$$

$$\rightarrow \pi^+\pi^- J/\psi$$

$$\rightarrow \gamma \pi^+\pi^-\pi^+\pi^-$$

- I want to measure how often this particular result occurs from a J/ψ decay
- Using data from CLEO

Motivation

- One reason this is interesting involves some intermediate states of the decay
- $c, \bar{c} \rightarrow \text{gluon}, \text{gluon}, \gamma$
 - J/ψ is made of a charm and an anticharm quark
 - Gluon is carrier of strong force
- This is a possible way to study gluons

Motivation

- Plotting frequency (of this particular decay occurring) versus the 4-pion mass
- If there is a peak at the mass of the 'glueball' (particle made of 2 gluons), that would be interesting

Method

- Using a C++ program, we can identify J/ψ decay events which resulted in four pions and a photon
- Histograms and Ntuples hold the information generated from the data by the program

Method

- 'Good' events are those:
 - with the appropriate numbers of charged particles (6) and photons (1)
 - which conserve charge and momentum
- CLEO measures both charged and neutral particles
 - A charged particle leaves a curved 'track' due to the B-field in the detector
 - Uncharged particles leave 'showers' by interacting with crystals in the detector

Obstacles

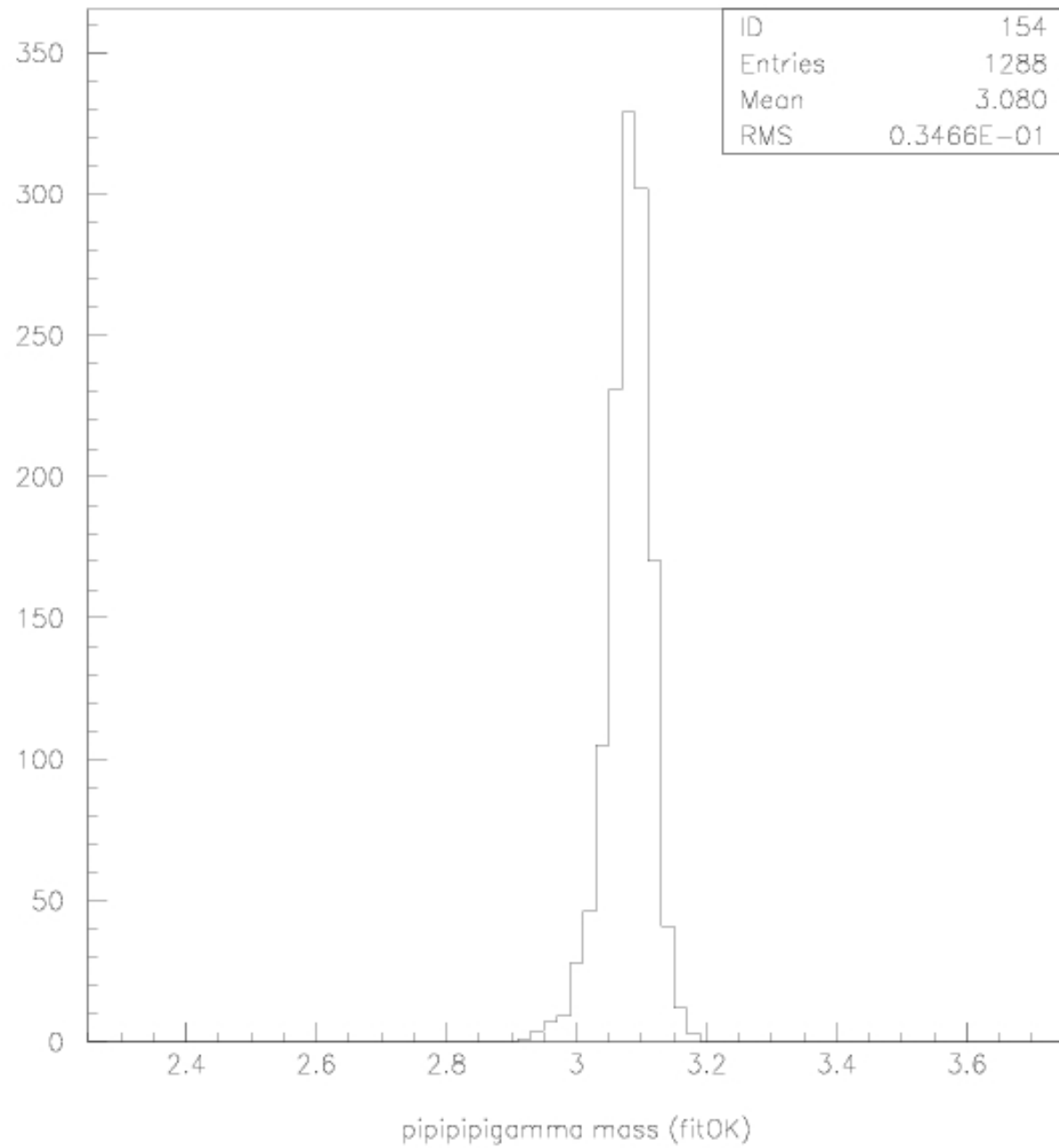
- 6 particles = 6 tracks?
 - Sometimes there are extra or missing tracks
 - A good event could have five, seven, etc. tracks
 - Keeping only 6-track events may exclude other good events
 - This would tamper with the results
 - Trying to keep the good events which have an extra or missing track can skew the results in the opposite direction, giving the reverse effect
- Need to modify program to account for both these problems

Obstacles

- 1 photon, 1 shower...
- Similarly, difficulties can arise from extra and missing showers
- Need to account for these issues as well

So Far

- I have begun to set up the program needed in order to analyze this decay
- Compiles successfully
- Has been running successfully
- Histograms, Ntuples



The Plan

- Set the program up to analyze the data and output the needed info and histograms
- Determine whether possible problems have been dealt with properly
- Once the program is working properly, see what looks interesting
- If time allows, investigate other decay modes