

# An Update on Measuring $B(\pi^0 \rightarrow e^+e^-\gamma)$ using $K_L \rightarrow 3\pi^0$

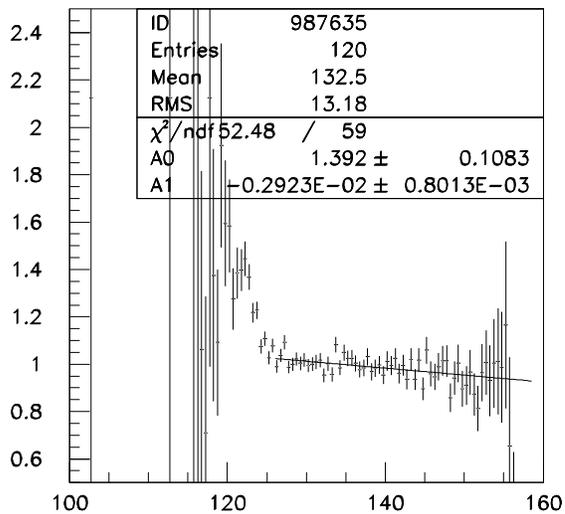
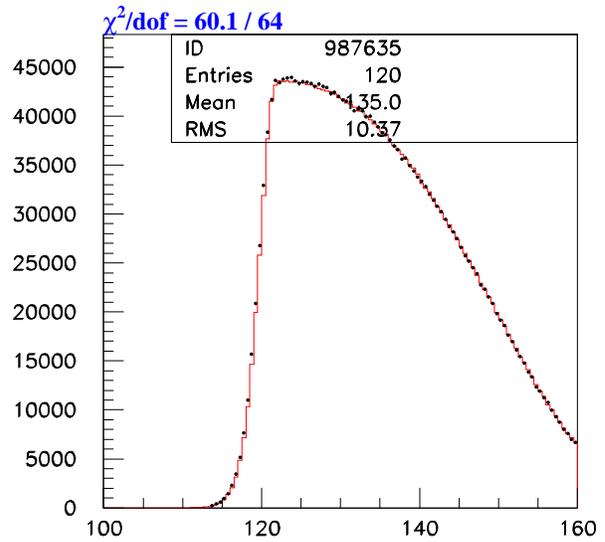
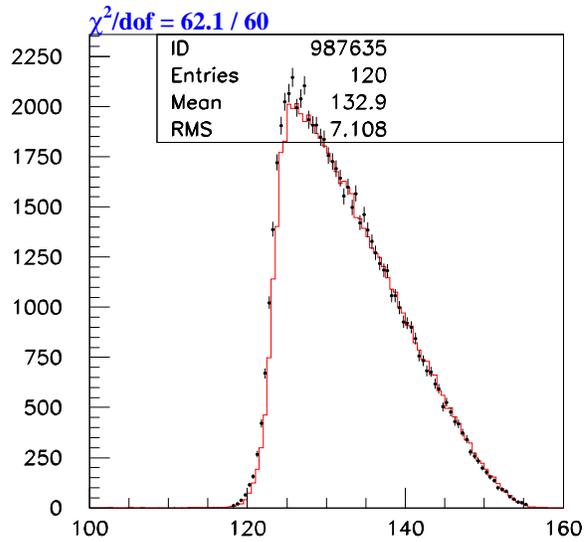
Z-Slope

Tracking Inefficiency

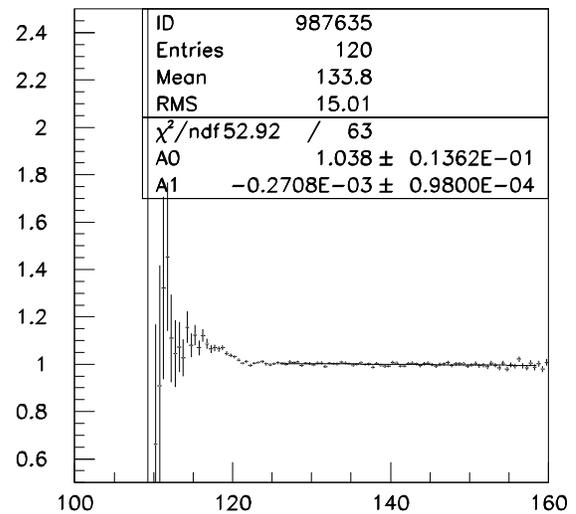
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University of Chicago  
6 October 2006

Recall - **problem with z-slope**, especially in dalitz mode

Kaon Z



dalitz



3pi0

2 known items contributing to problem - trk z cut, energy scale

**Energy Scale** Used reg edge to determine necessary energy scale to apply to data (0.9985).

**Vertex cut based on tracks** Removed.

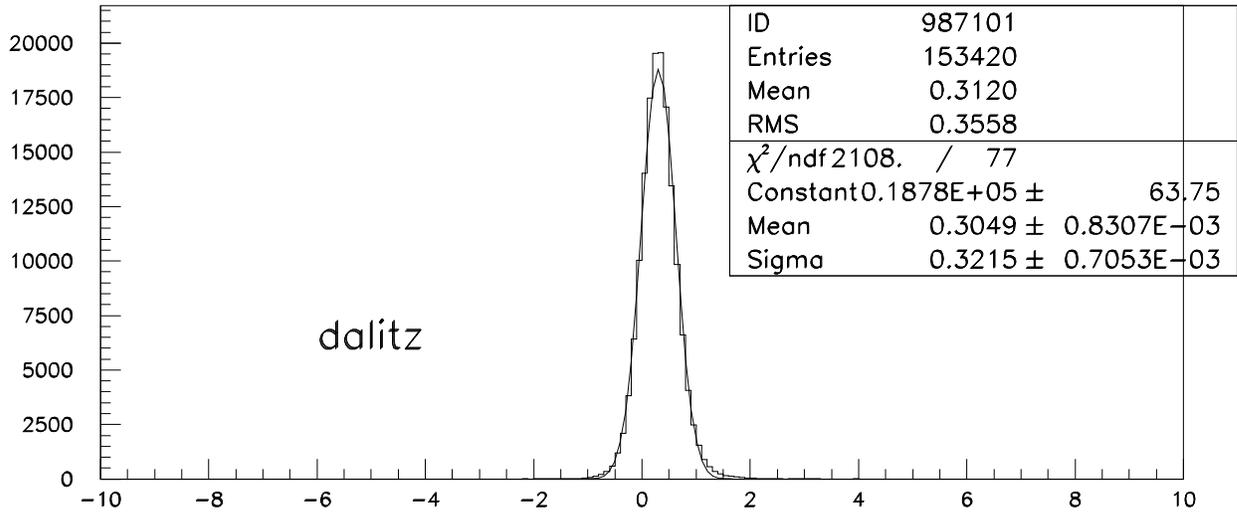
**Still not a great z-slope.**

Found a problem. The dalitz z position was being reconstructed (using ktpairs with the five neutral clusters) too close to the calorimeter in monte carlo.

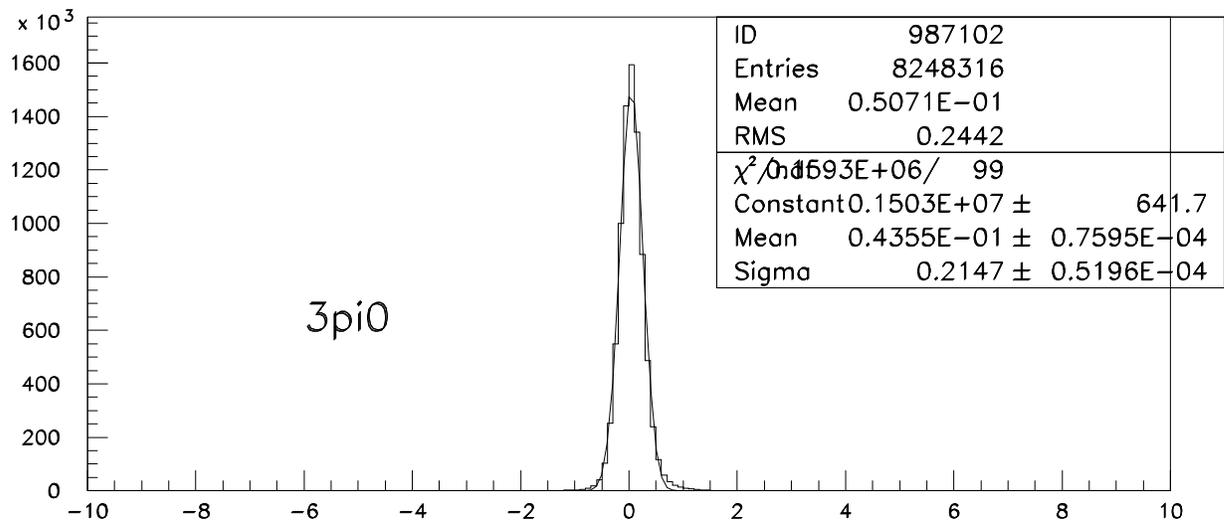
Reconstructed z based on tracks was not biased.

# The $\sim 30$ cm Problem

## MONTE CARLO



vtxz neut-gen all cuts VAC



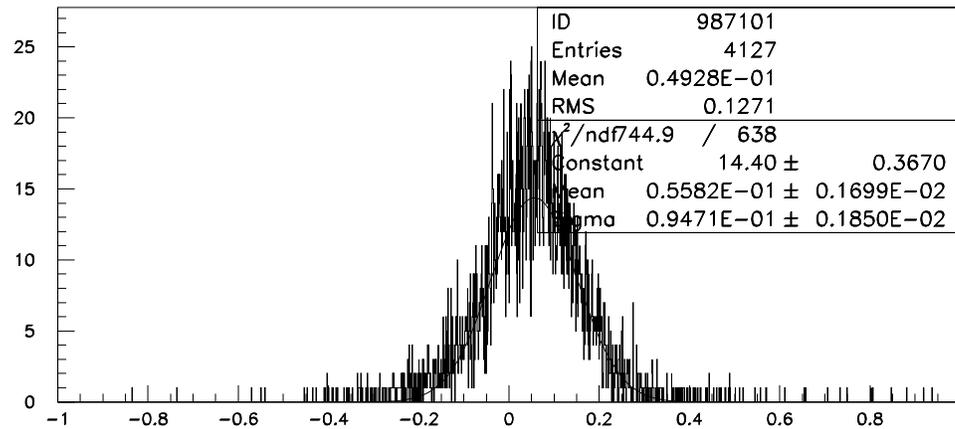
vtxz neut-gen all cuts VAC

What is causing this bias, and why is it only happening in dalitz monte carlo?

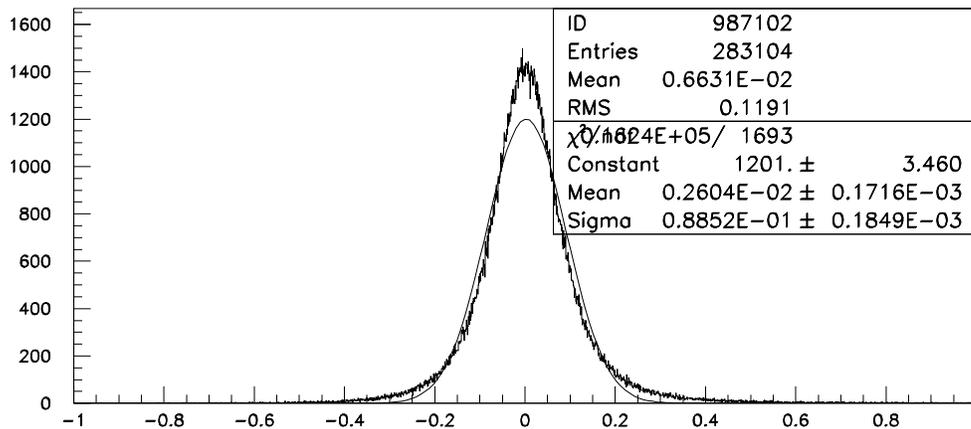
Since  $Z_{rec}$  (dist. from CSI)  $\propto E_{clusters,rec}$ , a too-small  $Z$  could be the result of too-small cluster  $E$ s.

Generated energies are higher than reconstructed by  $\sim 50$  MeV for neutral clusters in dalitz mode.

Dal Cluster E, gen-rec

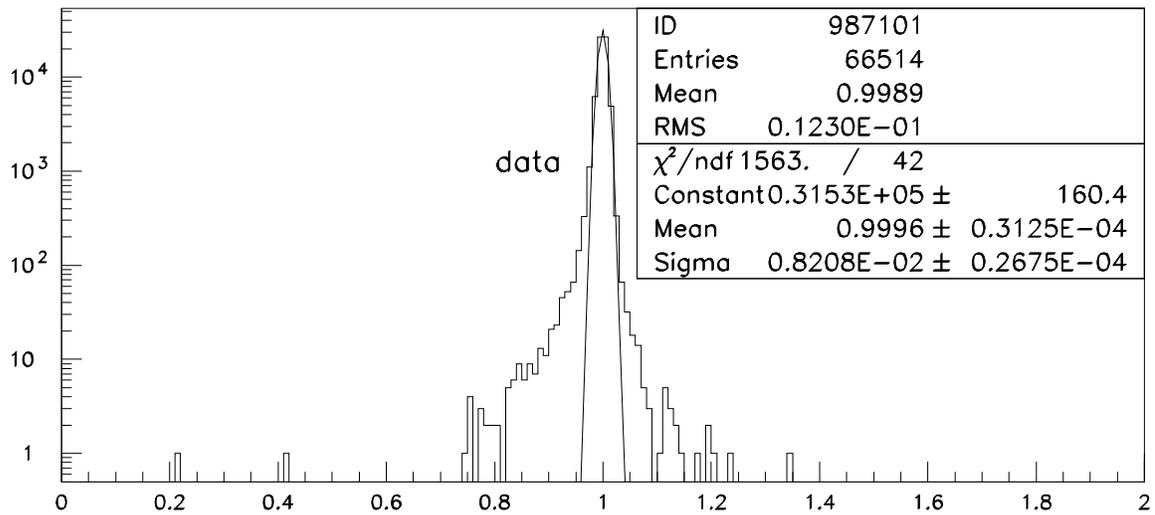


$3\pi^0$  Cluster E, gen-rec

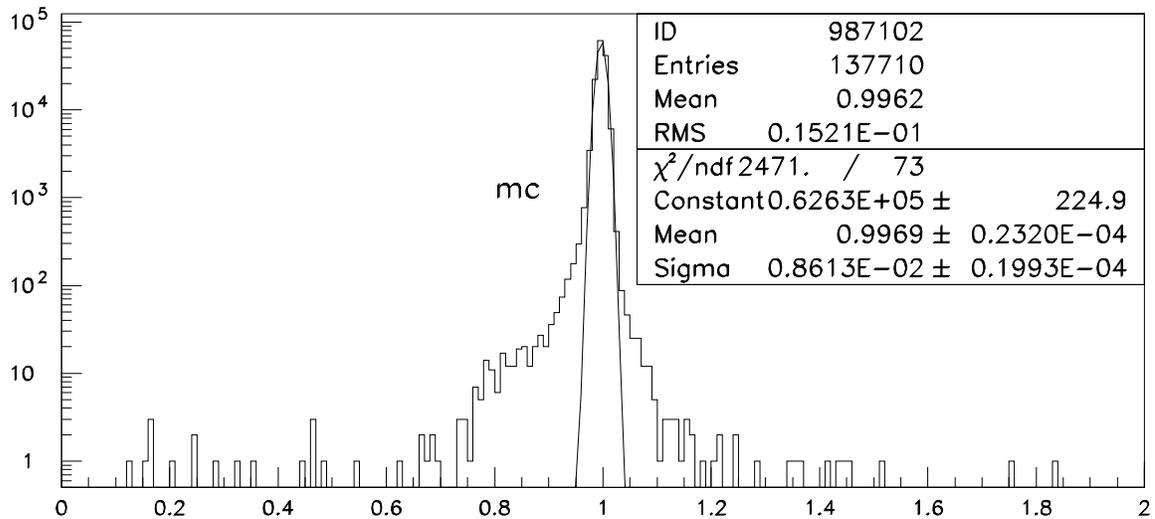


Charged cluster energies are low in mc also.

Track 1 eop with fit



trk 1(hi) eop all cuts but VAC



trk 1(hi) eop all cuts but VAC

Great, but why are the cluster energies being reconstructed too low, and why only in the dalitz mode, only in monte carlo?

**Answer:** The monte carlo is using the wrong slice mask for trigger 14, so it cuts off the last bit of energy (0.5% to 1%) for some of the clusters.

99 data, trigger 14 → 6 slices

99 mc, trigger 14 → NOT 6 slices

The slice mask is not in the database; it is hard-wired in ktevmc.

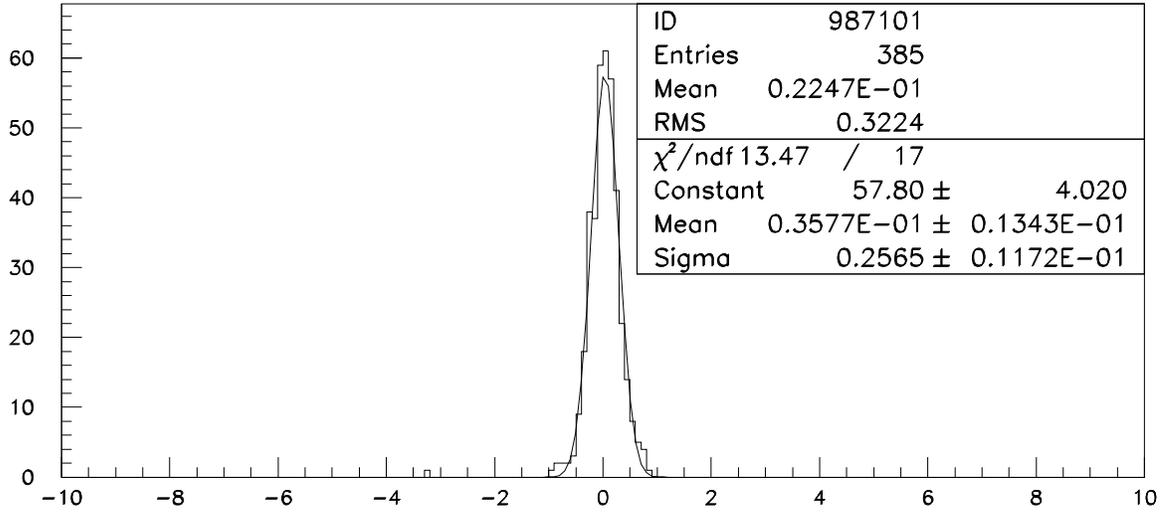
We changed it so that now:

**if inyear=99, ISPRSCOD(14)=6**

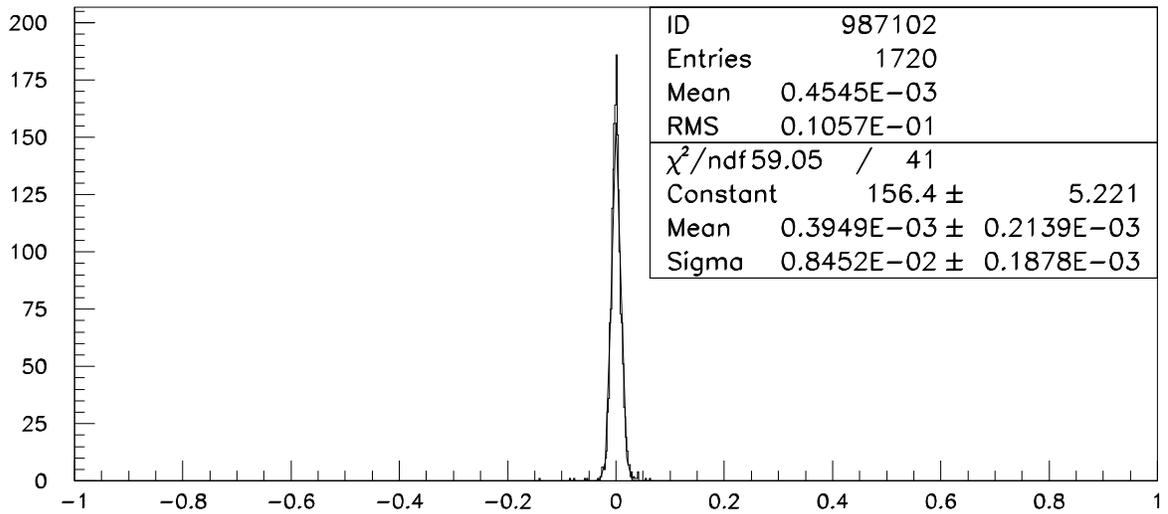
# FIXED!! (Monte Carlo)

25 Sept 06  
MC

## Dalitz Neutral Z – Gen Z

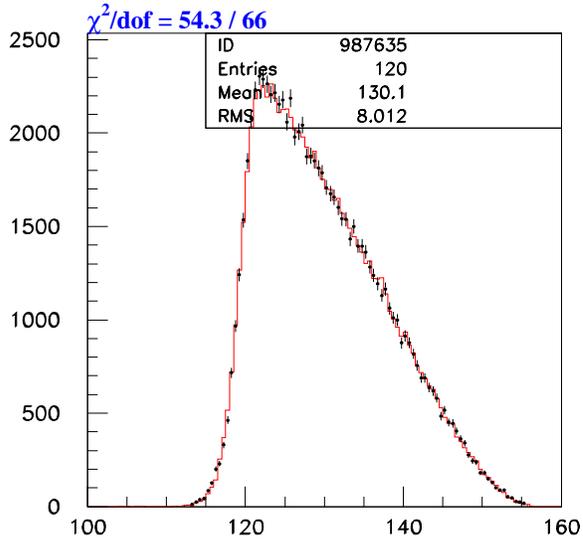


## Dalitz Cluster Energies (Gen – Rec)/Gen

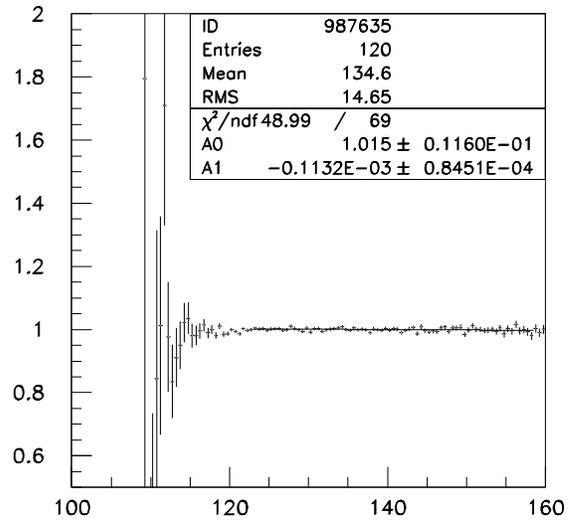
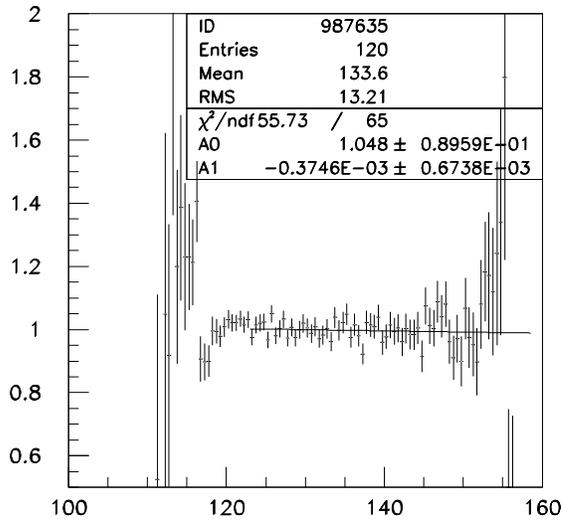
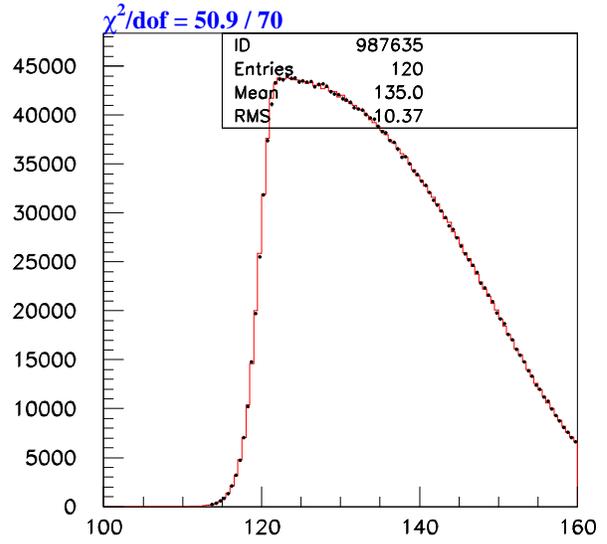


Z overlays look very good now.

Dalitz



3pi0



## Tracking inefficiency systematic for DPF

Redo tracking studies from Vus, using 99 data, using  $\pi^+\pi^-\pi^0$ s from trigger 4.

- **Single-track inefficiency** - one track is fully reconstructed and matches a hadron cluster, and the other hadron cluster is used to determine the missing pion trajectory
- **Two-track loss** - the rate of events with no reconstructed tracks due to correlated hit losses within a chamber

## Pions versus Electrons

- Generated dalitz decays with **no bremsstrahlung**
- Sasha G: **most track loss in 99 is due to accidentals**; that part should be the same for pions and electrons.