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Central Calorimeter γ Detection Efficiency

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In this memo we present some results on the Central Calorimeter γ detection efficiency in the low energy region.

Briefly, the software energy threshold to start a cluster has to be decided on the basis of the detection efficiency because using a too low value increases the amount of spurious clusters and on the other hand a too high threshold tends to reject good clusters.

We used a sample of reconstructed $\pi^o\pi^o$ events at $E_{CM} = 2.985$ GeV with a cluster threshold at 20 MeV and 5 MeV for the central block. For each event we selected the least energetic γ among the fitted values. The energy distribution of the low energy tail is shown in Fig. 1.a.

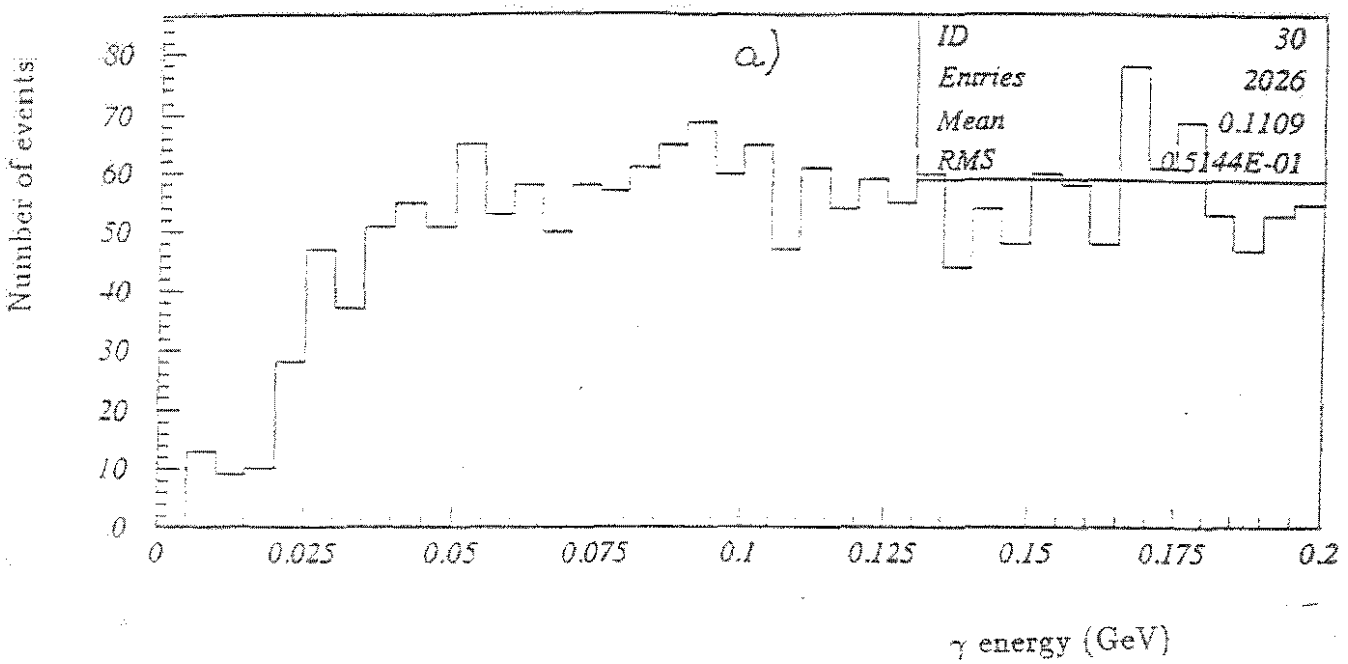
The expected γ energy distribution has been simulated by Monte Carlo. Events $p\bar{p} \rightarrow \pi^o\pi^o$ were generated starting with the experimental center of mass angular distribution. We selected events with 4γ in the Central Calorimeter acceptance and considered the least energetic γ among the four. The generated distribution is shown in Fig. 1.b.

The detection efficiency as a function of E_γ can be computed comparing the experimental softest γ energy distribution to the expected from Monte Carlo.

The normalization can be done in several ways: a) assuming a 100% detection efficiency for γ with energy within 200 and 400 MeV. b) normalizing the total number of reconstructed events.

The two methods gave normalization constants differing by less than 1%. In Fig. 2 we show the detection efficiency plot as a function of the γ energy. The curve is rather sharp and at around 30 MeV the efficiency saturates at 1.

We notice that efficiency is slightly higher than 1., and we explain the anomalous behavior as an indication of a contribution of background events, which tends to be higher with soft γ's.



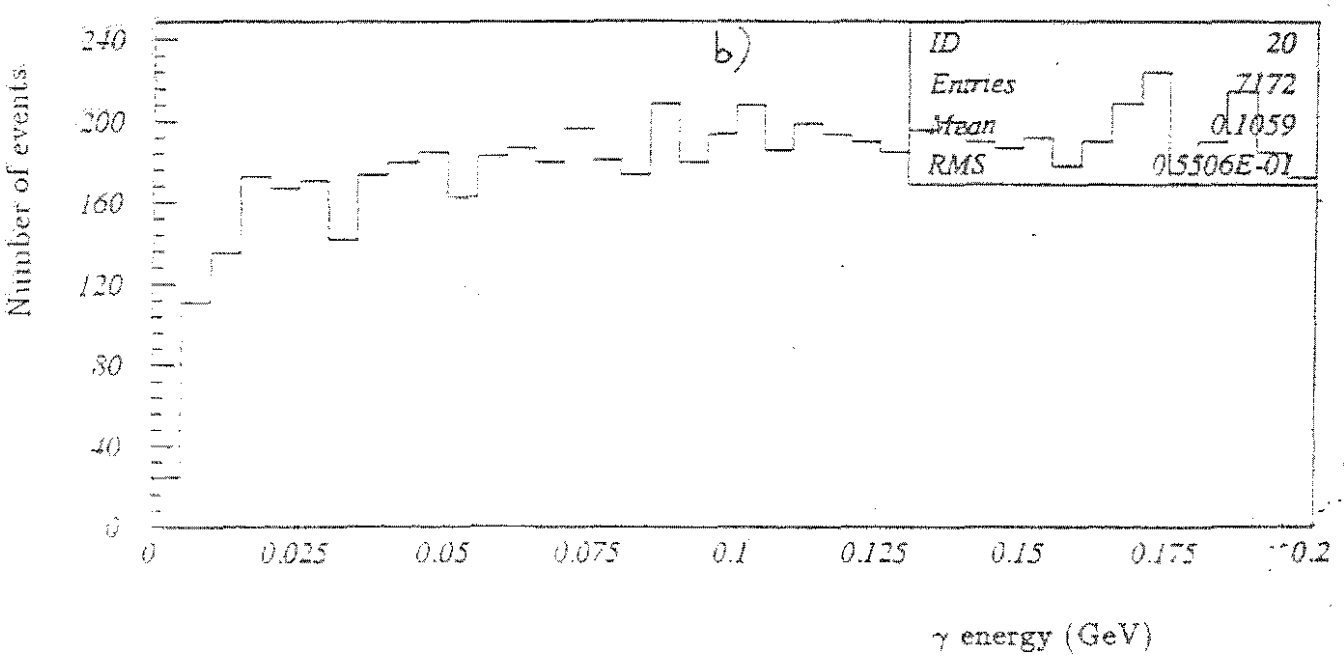


Fig. 1.a Distribution of the least energetic γ from $p\bar{p} \rightarrow \pi^o\pi^o$ reconstructed events. The γ energy is the fitted value.

Fig. 1.b Distribution of the least energetic γ from $p\bar{p} \rightarrow \pi^o\pi^o$ generated events.

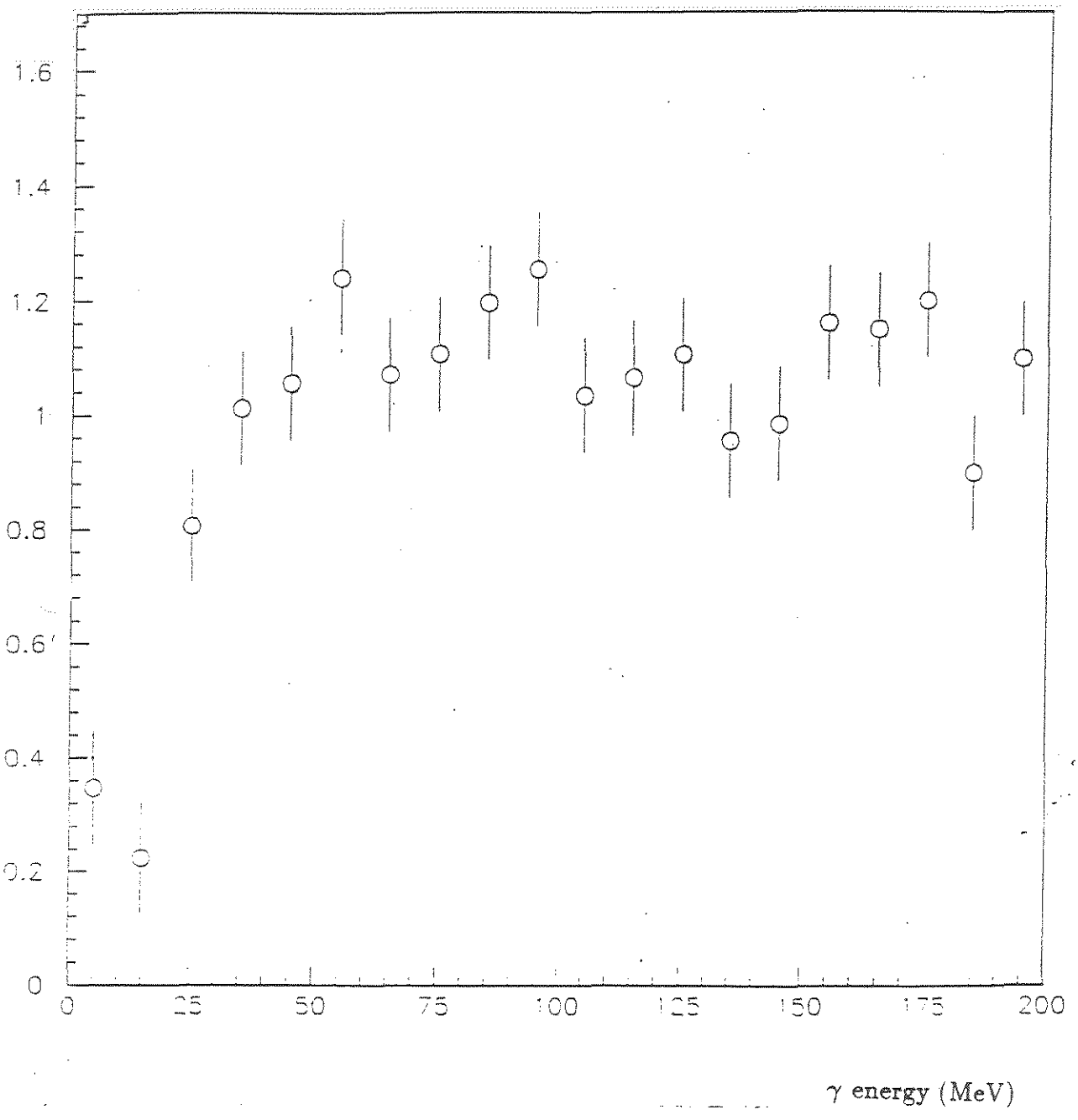


Fig. 2 γ detection efficiency as a function of the γ energy.