Fwd PID effects on EMC

SuperB EMC Session

XVII SuperB Workshop and Kick Off Meeting
La Biodola (Isola d'Elba)

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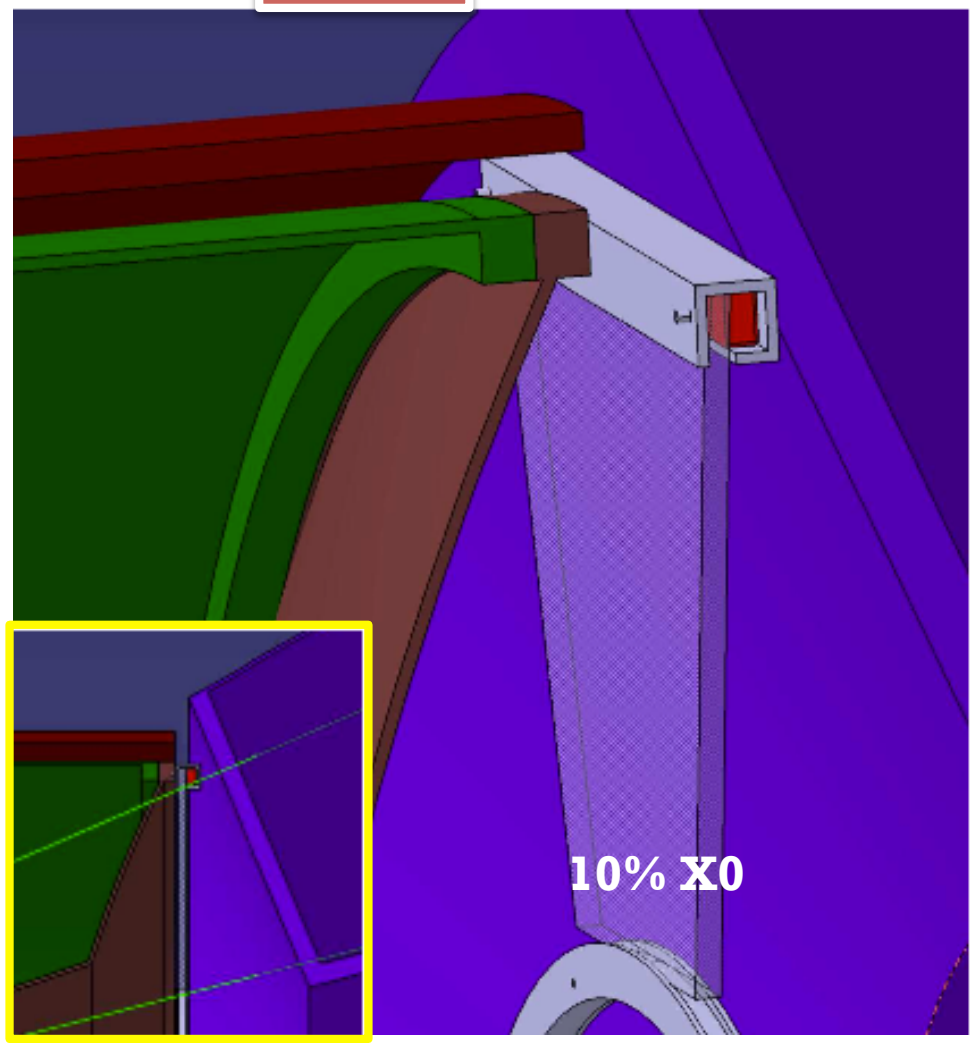
Outline

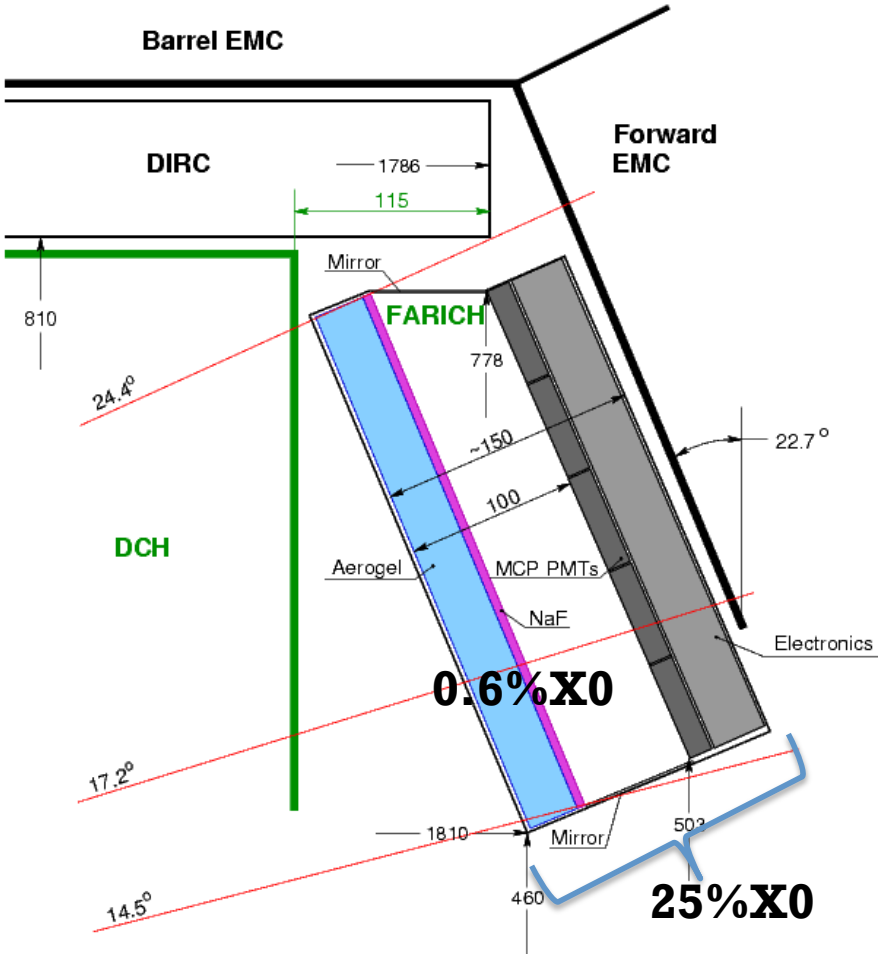
- Study of the impact of the forward PID detector options on the EMC performance
  - Detector options
  - Method description
  - γ energy resolution and efficiency
  - π^0 mass resoltion and efficiency
  - Conclusions

Fwd PID geometry options

fTOF



FARICH

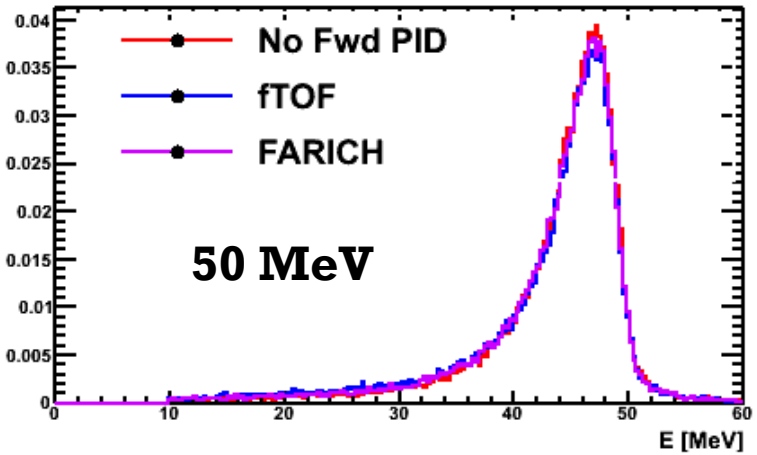


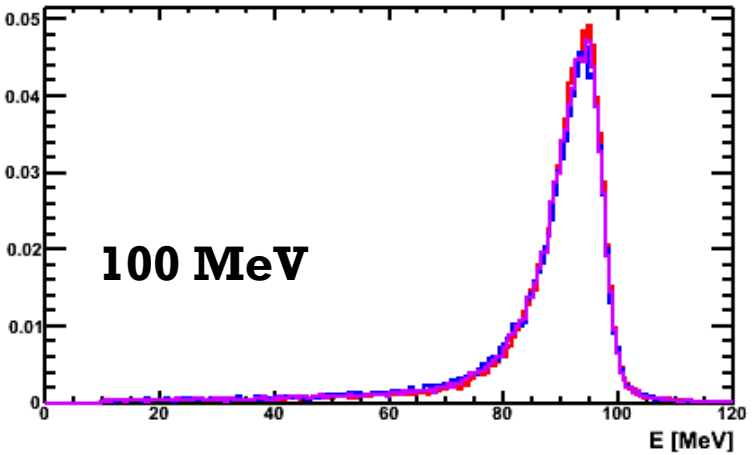
Method description

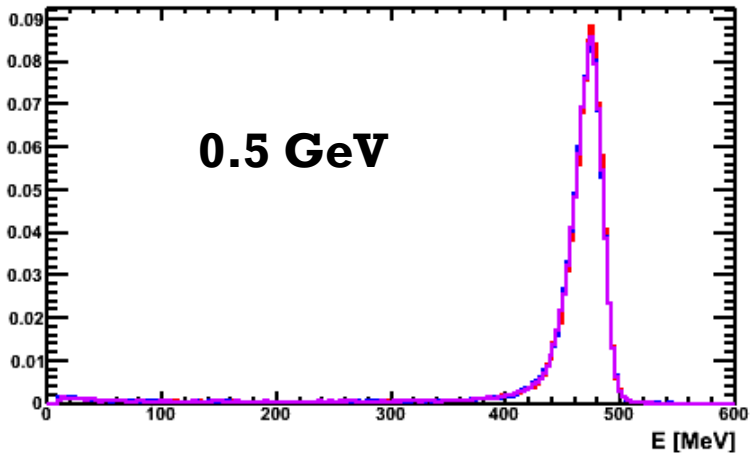
- Simulation:
  - Monochromatic single particle beams @ different energies
  - Machine background (Rad Bhabha
- Digitization
  - Use realistic electronic signal shape and temporal development to overlay the effecto of background and signal particles in the detector
- Reconstruction
  - Perform clustering algorithm
  - Each cluster is considered as a potential γ

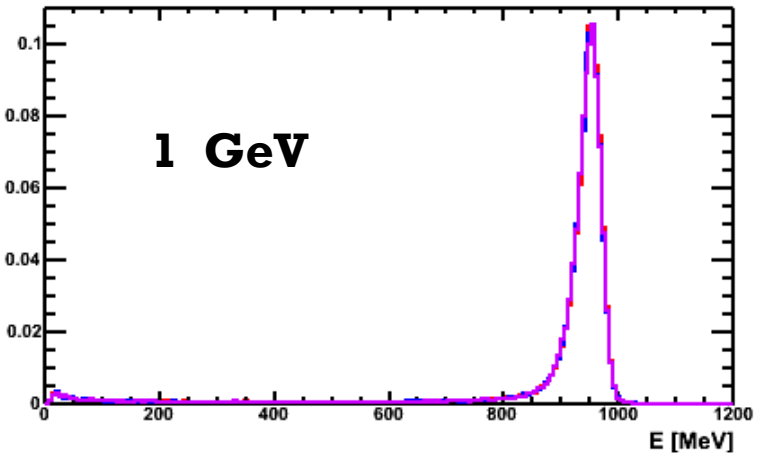
Photon measured energy

Photon selection: cluter with smaller angle wrt MC truth



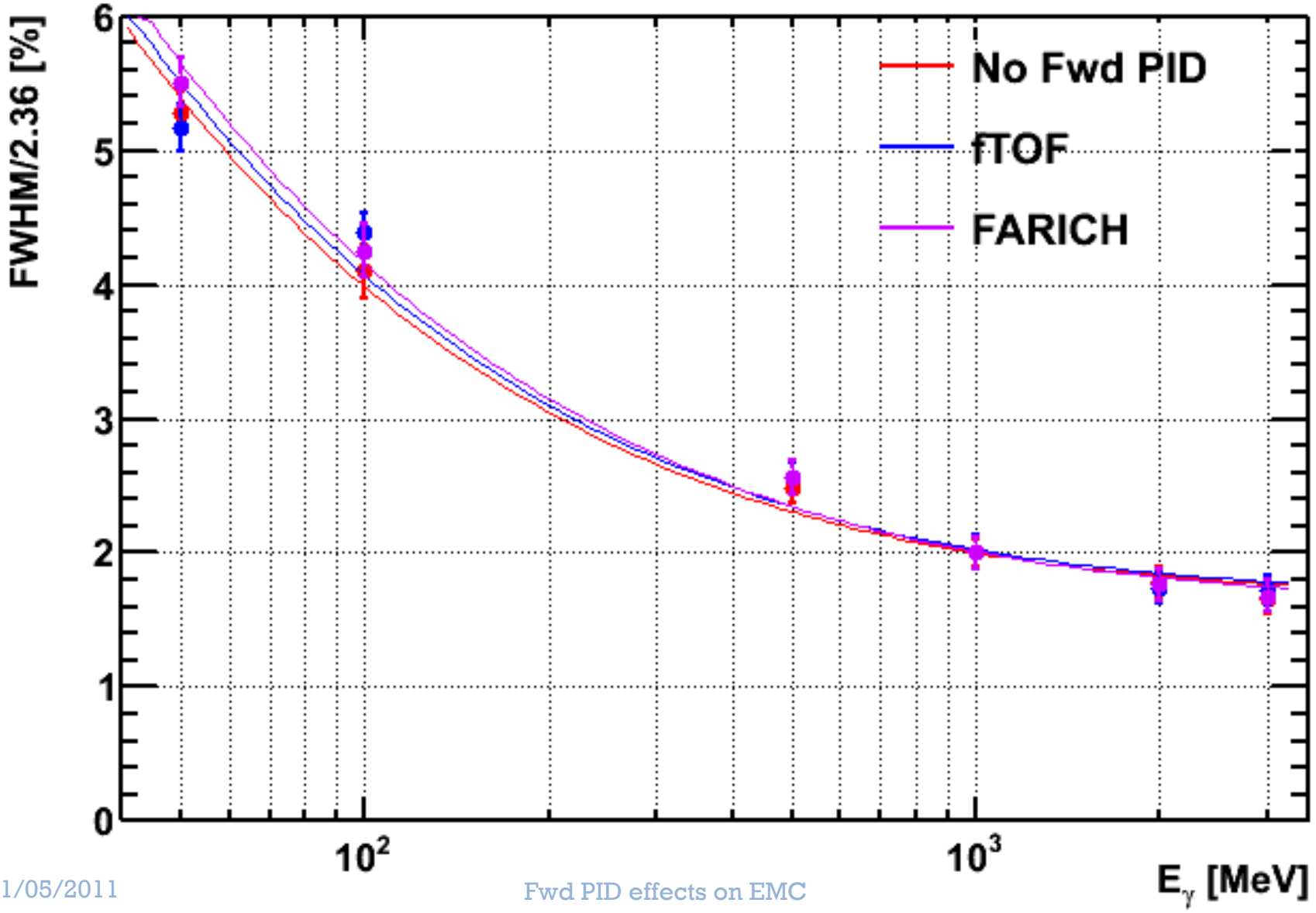






Photn energy resolution

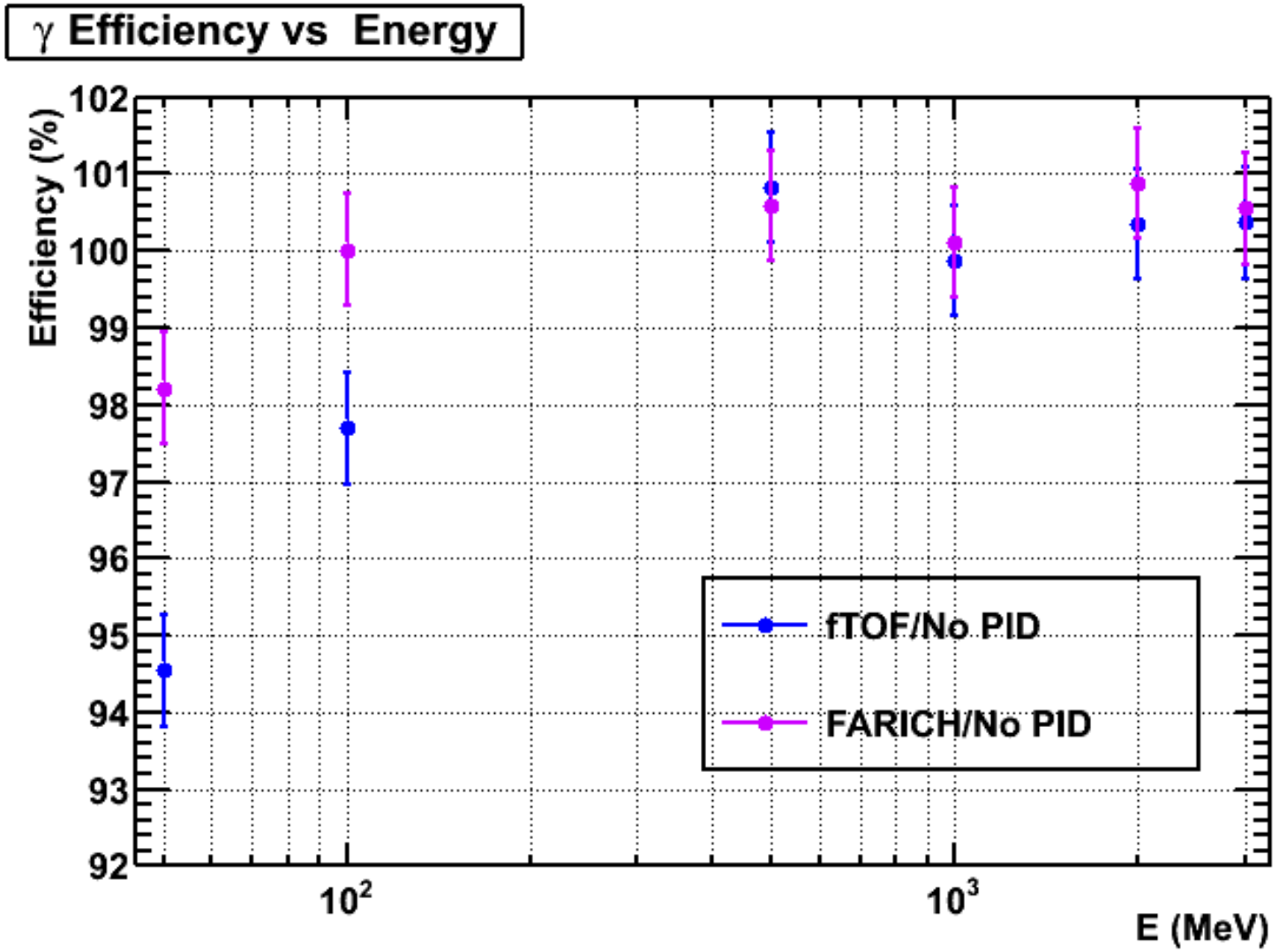
No Significant effect



Photon detection efficiency

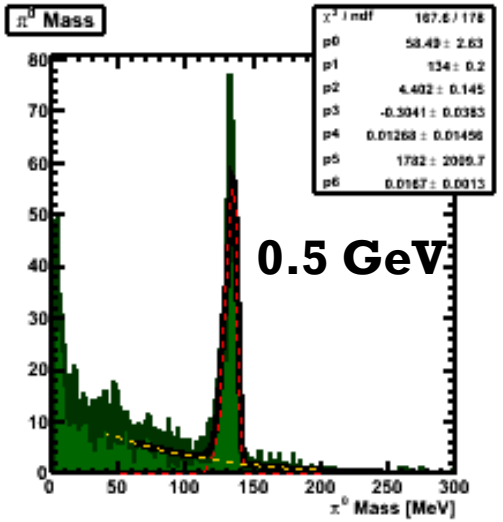
→Small photon efficiency decrease at low energy

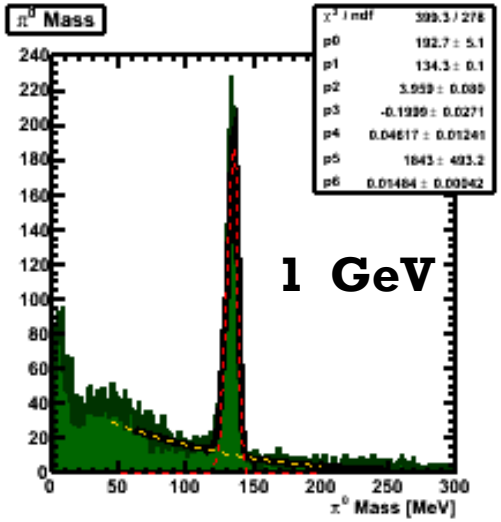
→ fTOF has sligthly larger effect due to the distance from EMC

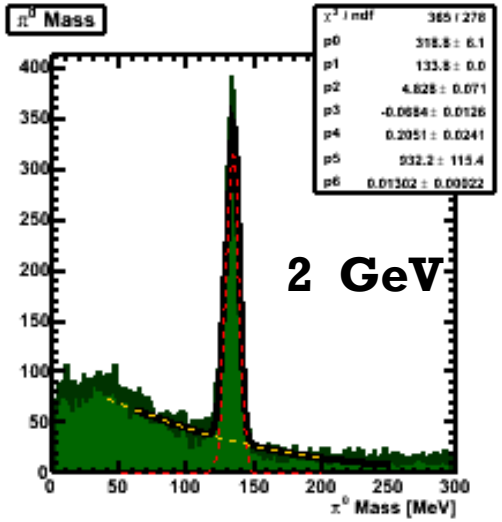


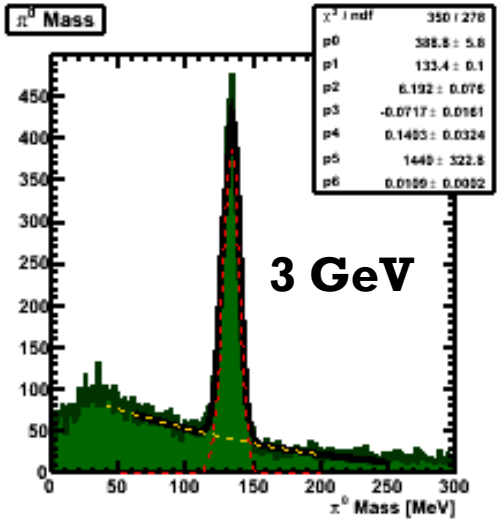
Reconstructed π^0 mass No PID – 2 Fwd γ

→ π^0 mass for 2 γ in the Fwd calorimeter
→Signal fit: Novosibirsk function
→Background:
F(E) = (E+ k1)/(1+exp(E*k2)

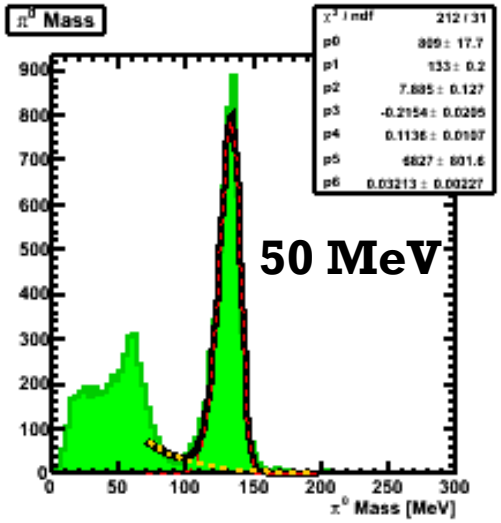


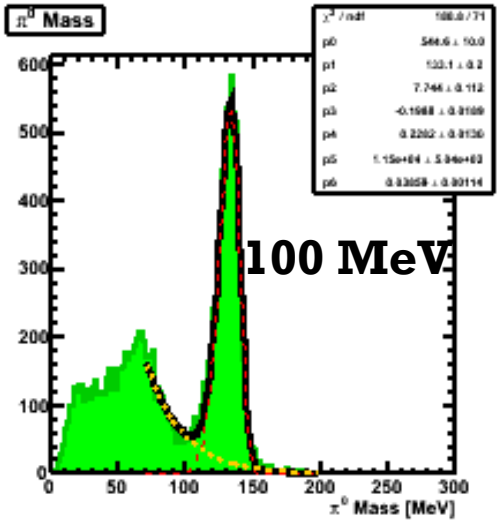


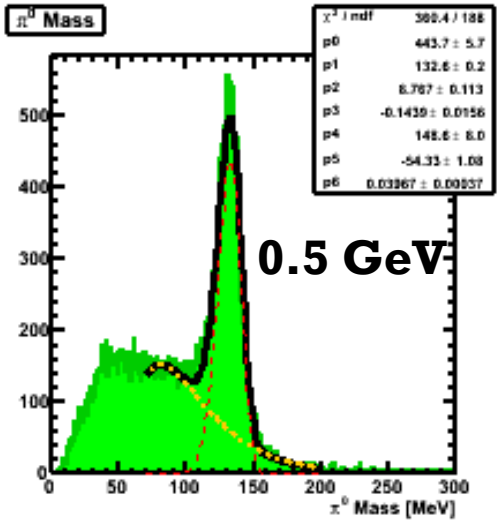


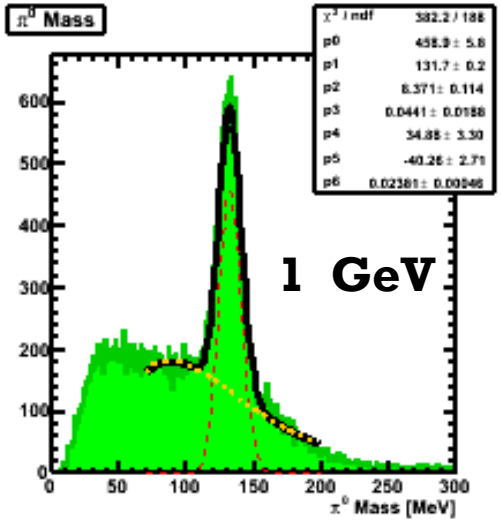


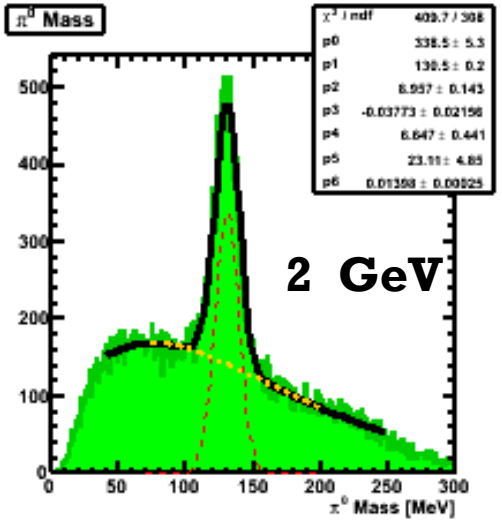
Reconstructed π^0 mass No PID – 1 Fwd γ











→ π^0 mass for 1 γ in the Fwd and 1 γ in the Barrel

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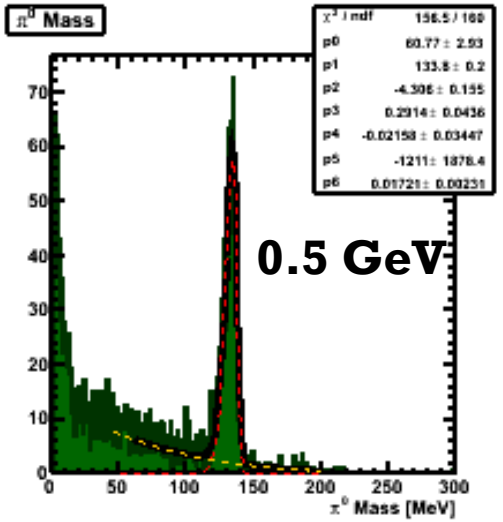

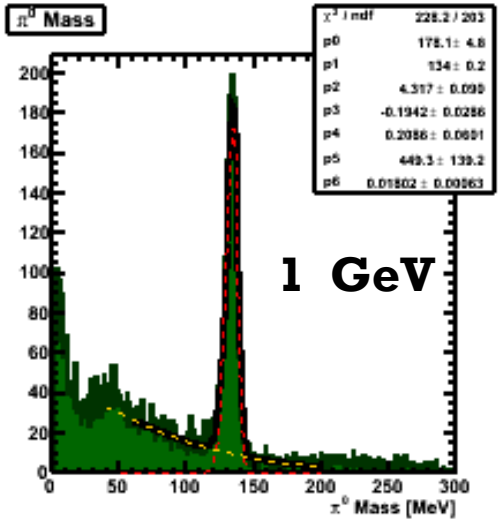

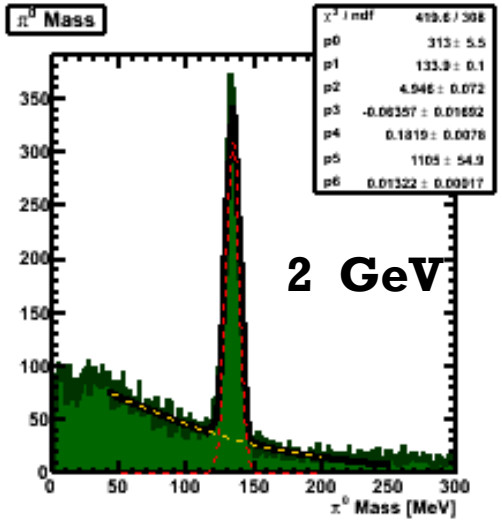

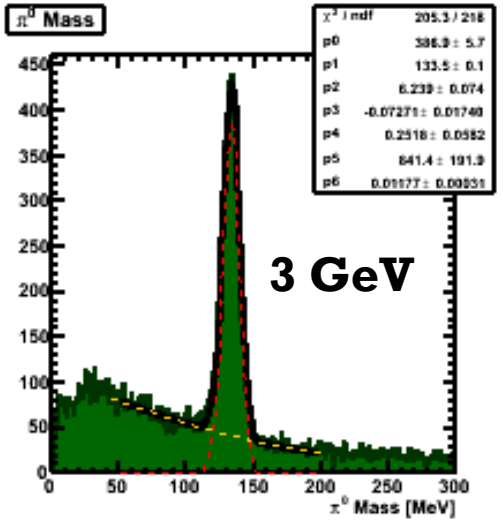

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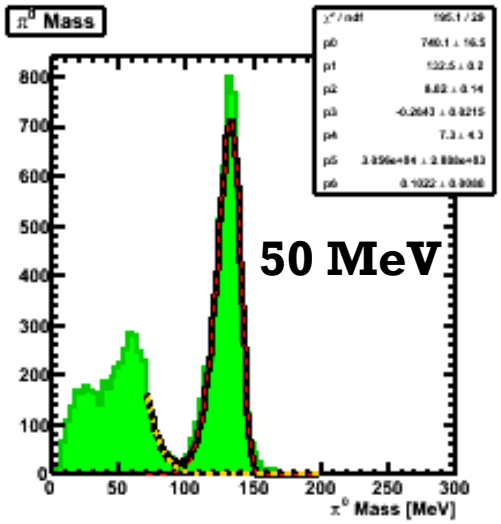

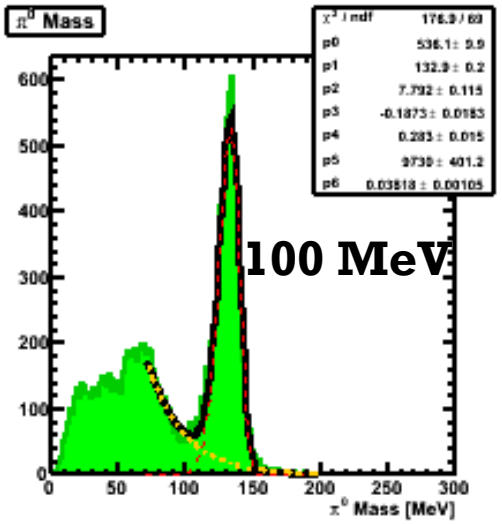

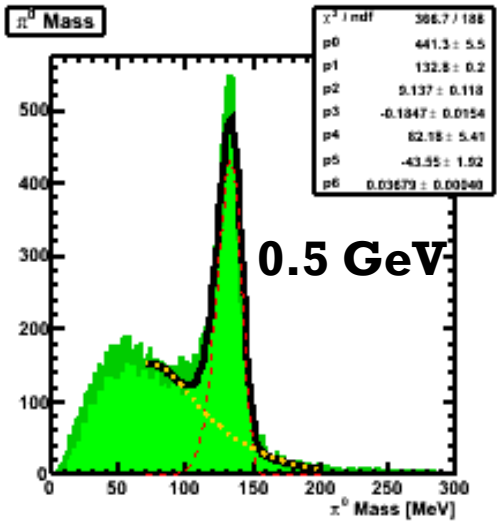

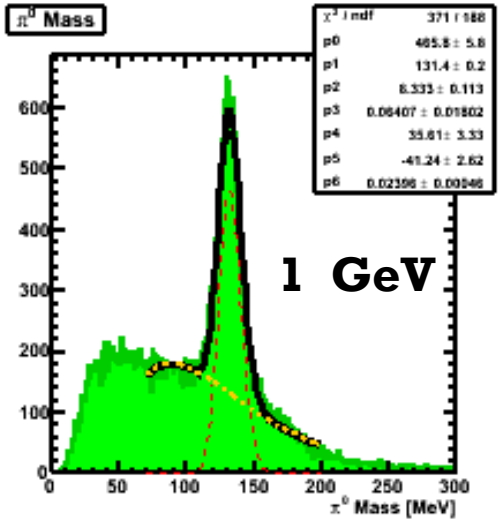

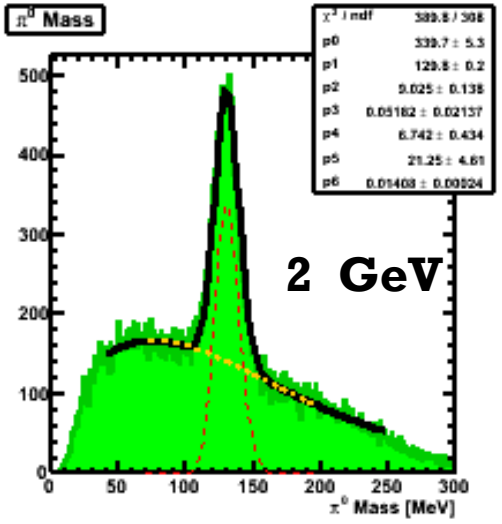

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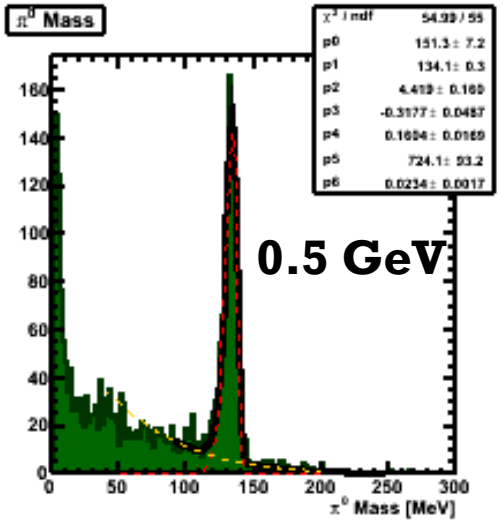
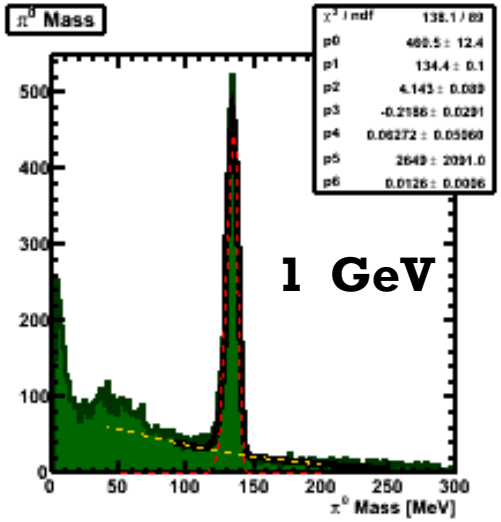
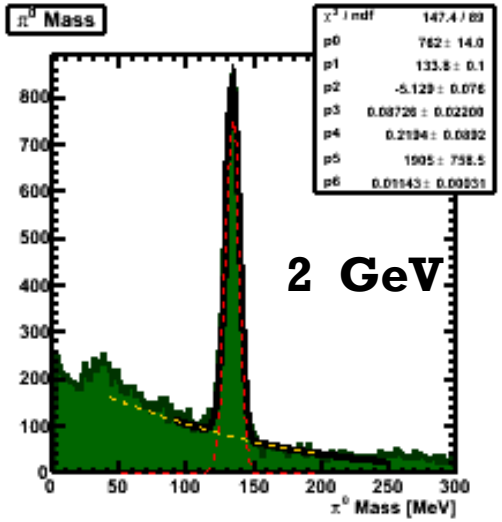
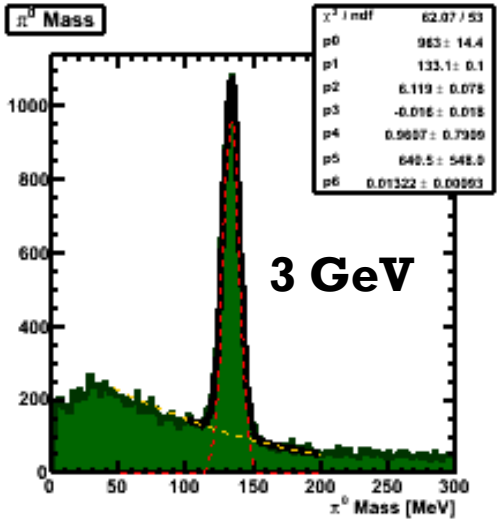
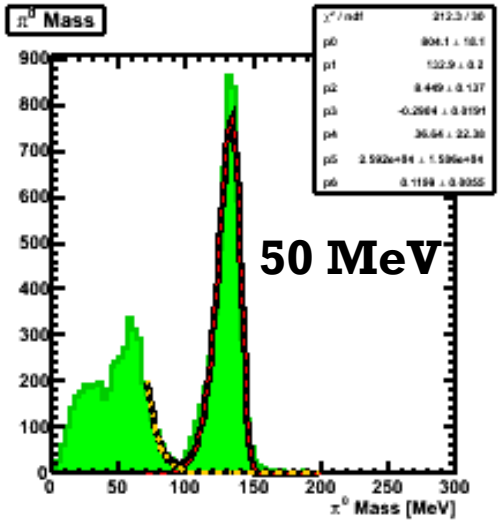


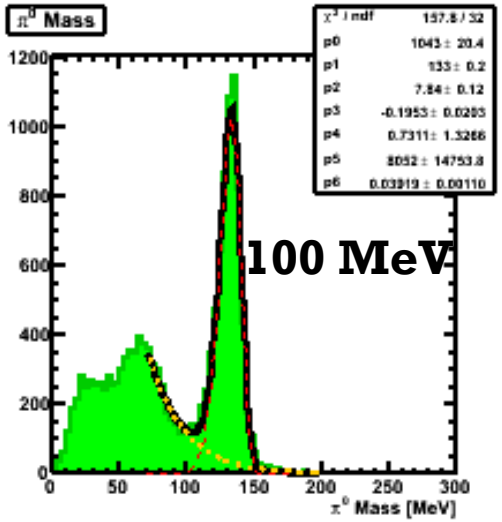


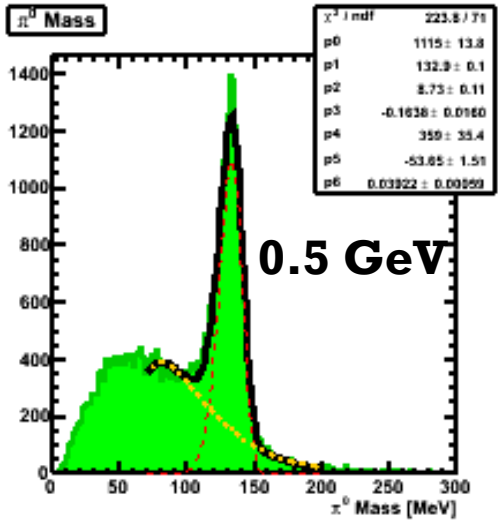


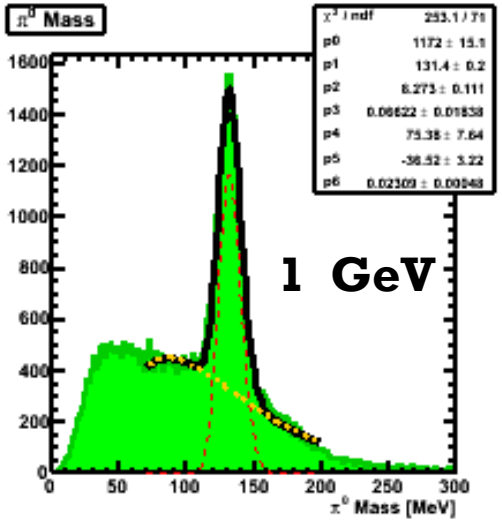


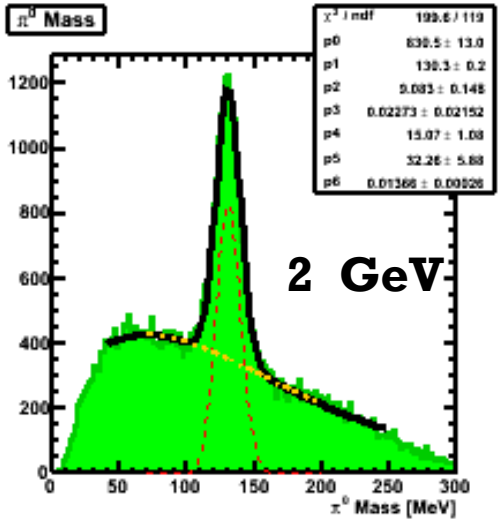
Reconstructed π^0 mass FARICH – 1 Fwd γ











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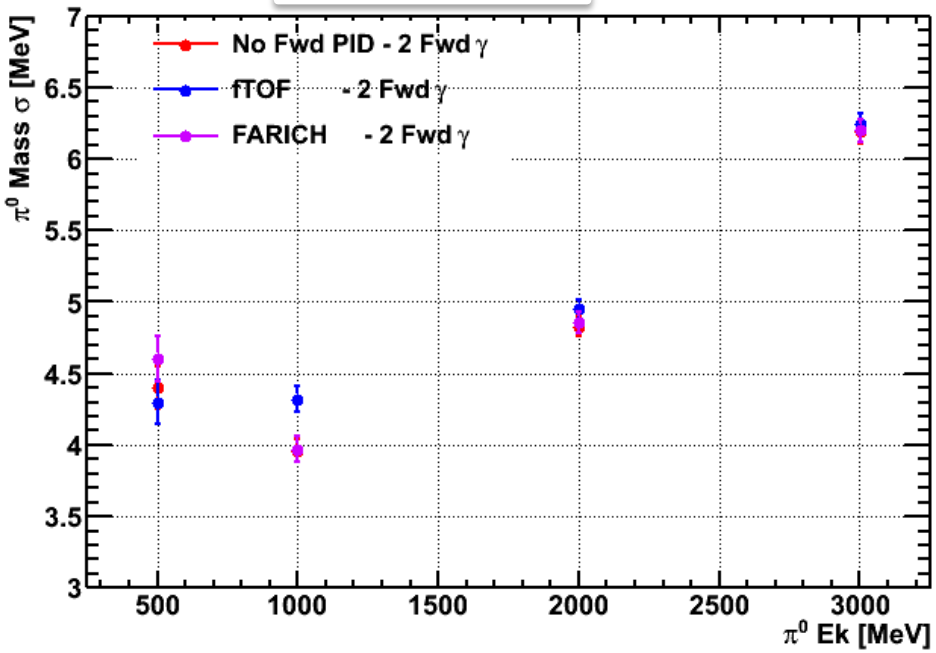
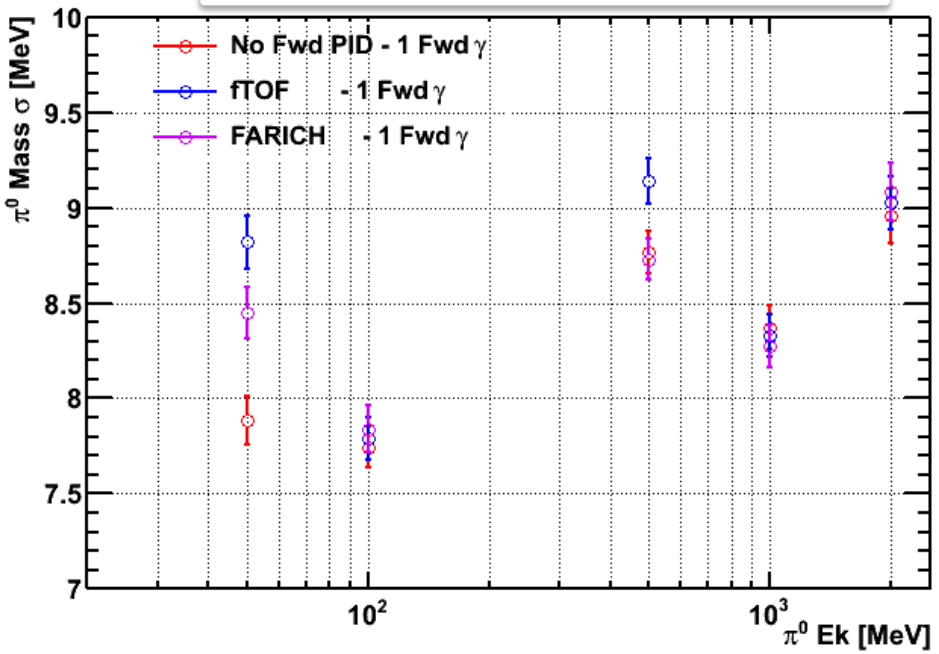
π^0 Mass resolution

Mass resolution from fit: Novosibirsk width

2 γ in Fwd



1 γ in Fwd – 1 γ in Barrel



Background shape for 1 γ in the Fwd is vey hard to fit (large fluctuations)

No significant effect on π^0 mass resolution

π^0 detection efficiency

Fit results are quite unstable:

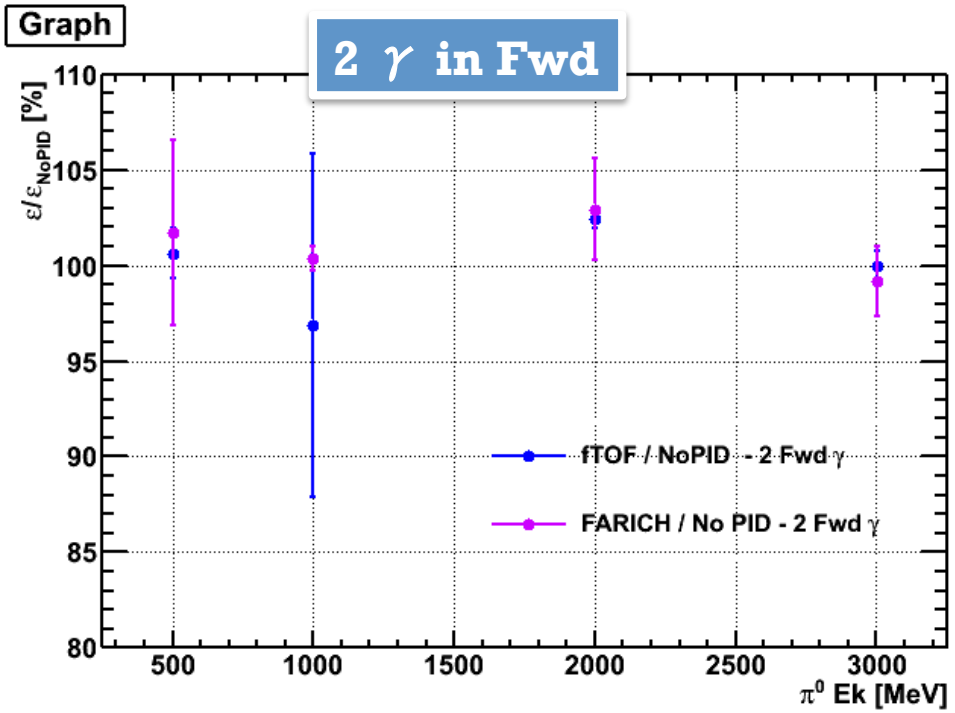
→Developed 2 alternative metods to measure relative efficiency

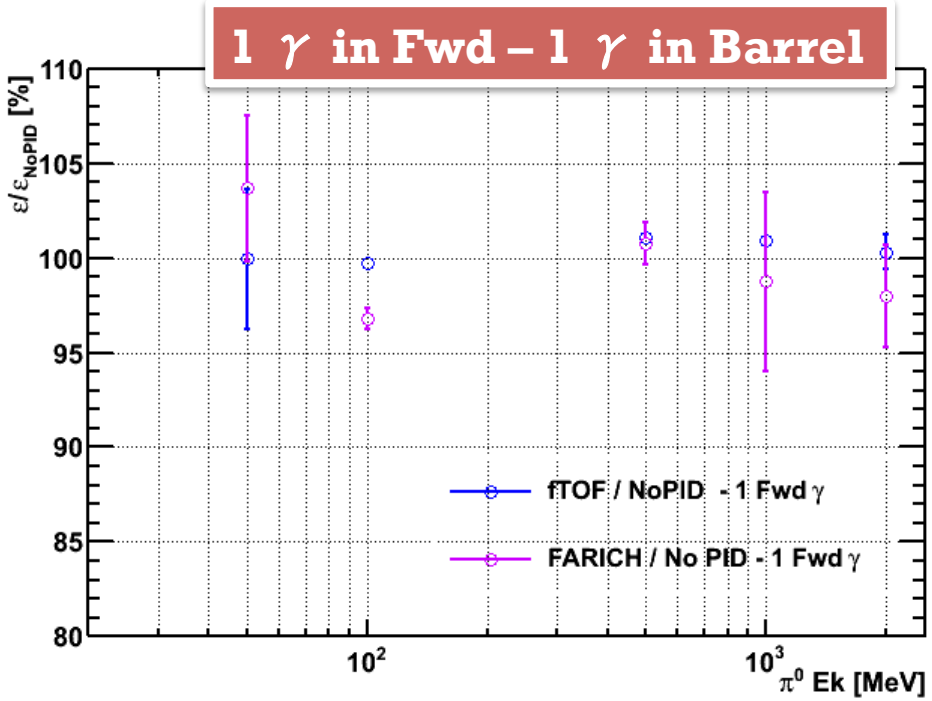
→Reported values are the mean of the 2 methods

→Error is the difference between the 2 method

Method 1) Nπ = Novosibirsk integral

Method 2) Nπ = Histogram integral – Bkg function integral





Large errors and fluctuations

No significant effect

Conclusions

- The different geometry options do not show any significant difference in
  - π0 mass resoltion
  - π0 detection efficiency (large errot due to fit instability)
  - γ energy resolution

- The only sizable effect is a small efficiency loss for low energy photons
  - Distance from EMC seems to have an impact on the efficiency