

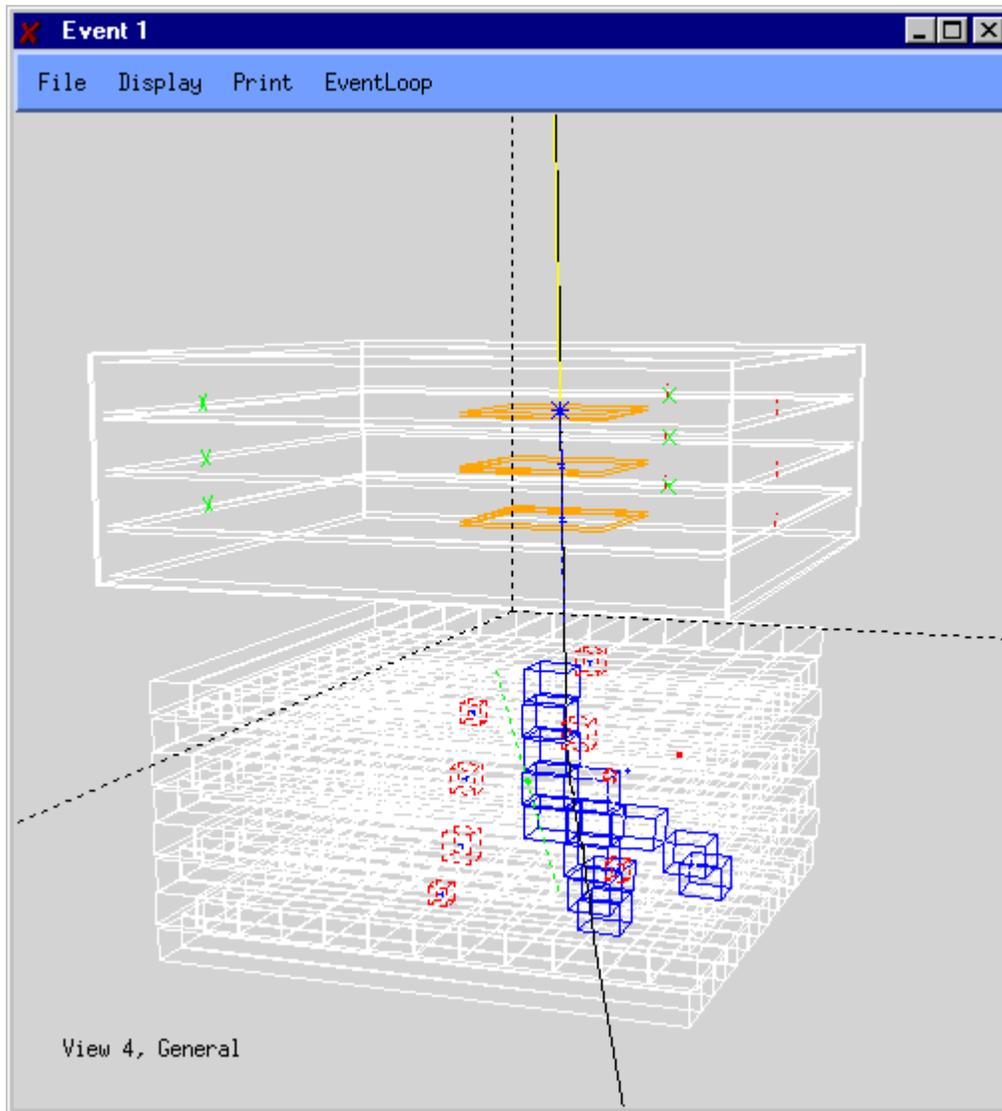
# EM

## Energy Spectrum

### from 17.6 MeV photons

Eduardo do Couto e Silva and Xin Chen  
Feb 13 , 2002

# Event display of a muon passing through EM

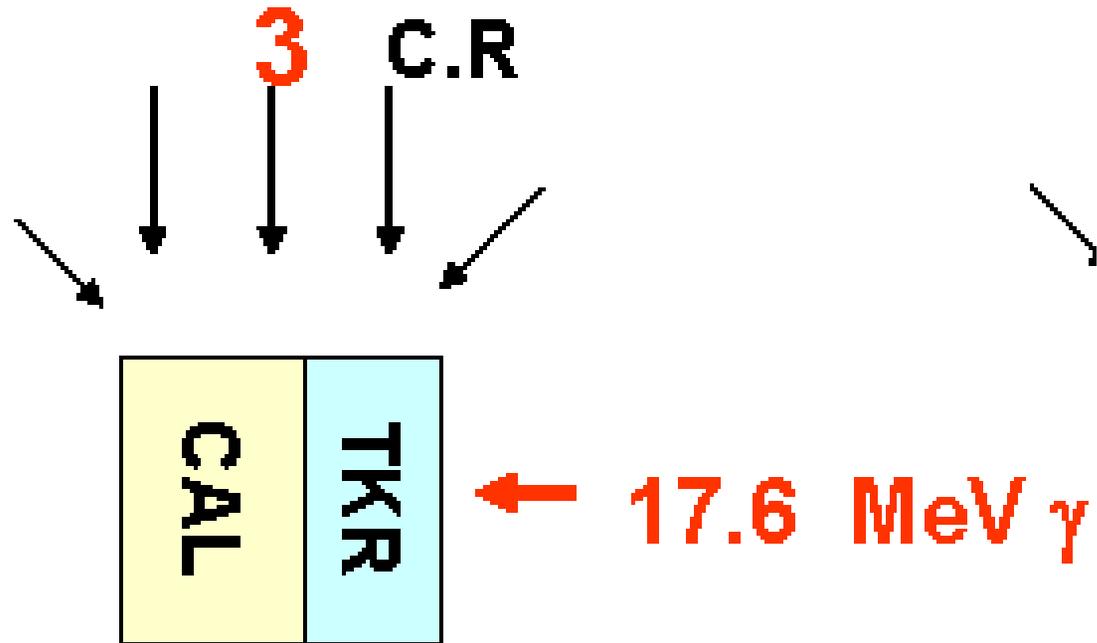


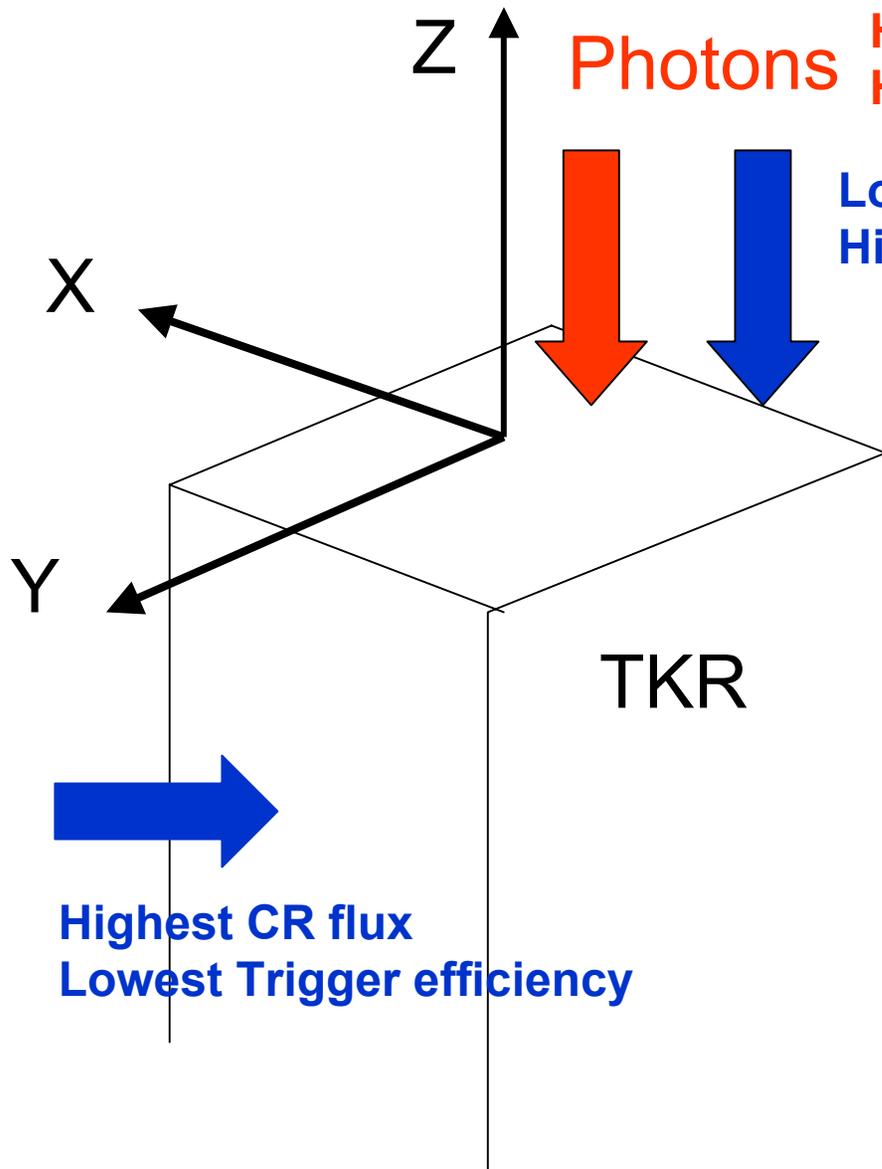
Using GLEAM V3  
**the official version for EM**

Mechanical support  
structure is not simulated !

# Data Taking Configurations

Photon Run – TKR trigger





**Photons** Highest CR flux  
Highest Trigger efficiency

Lowest CR flux  
Highest Trigger efficiency

Highest CR flux  
Lowest Trigger efficiency

For cosmic rays

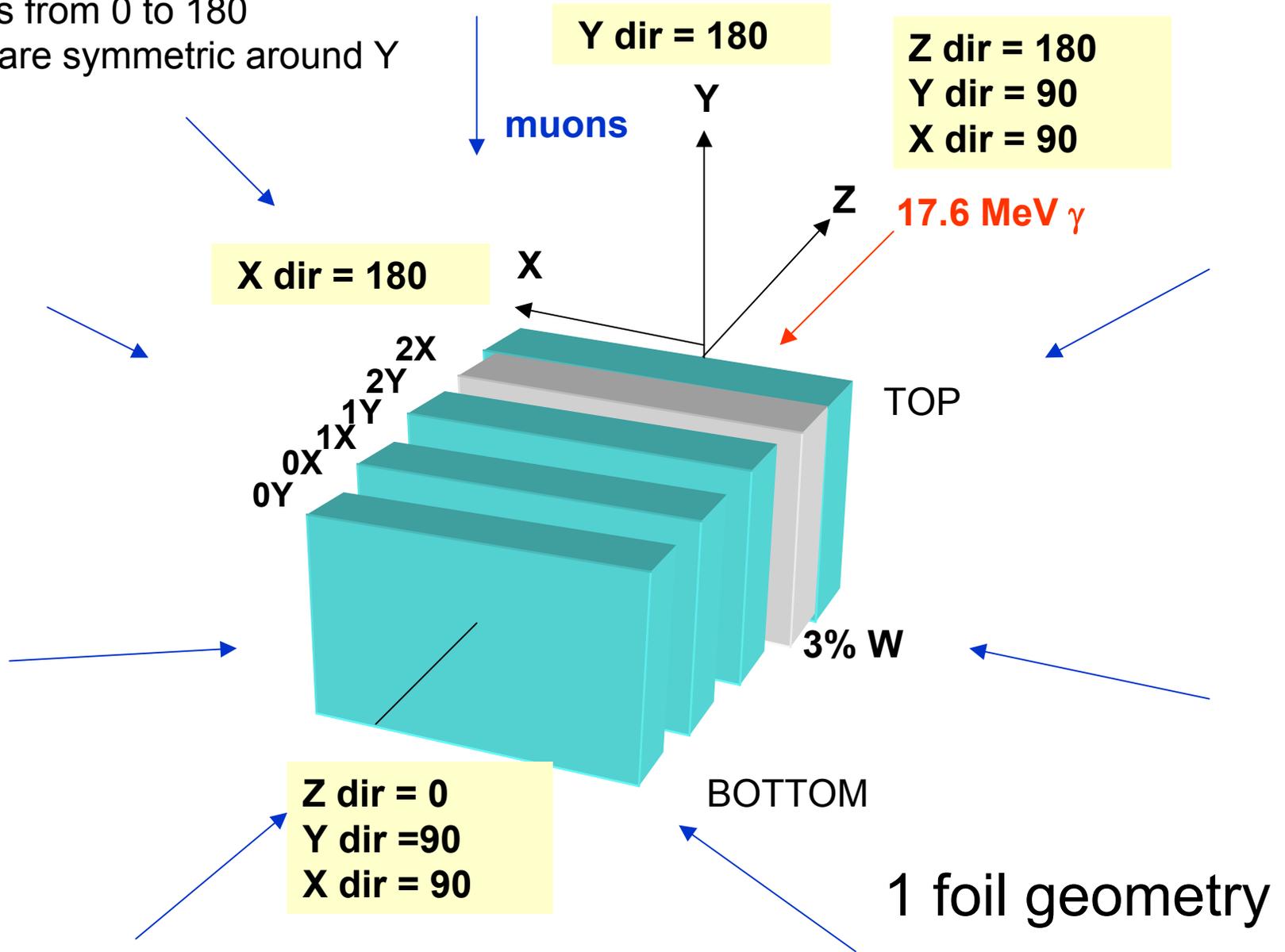
YZ Plane:

Trade off between Flux and Trigger efficiency

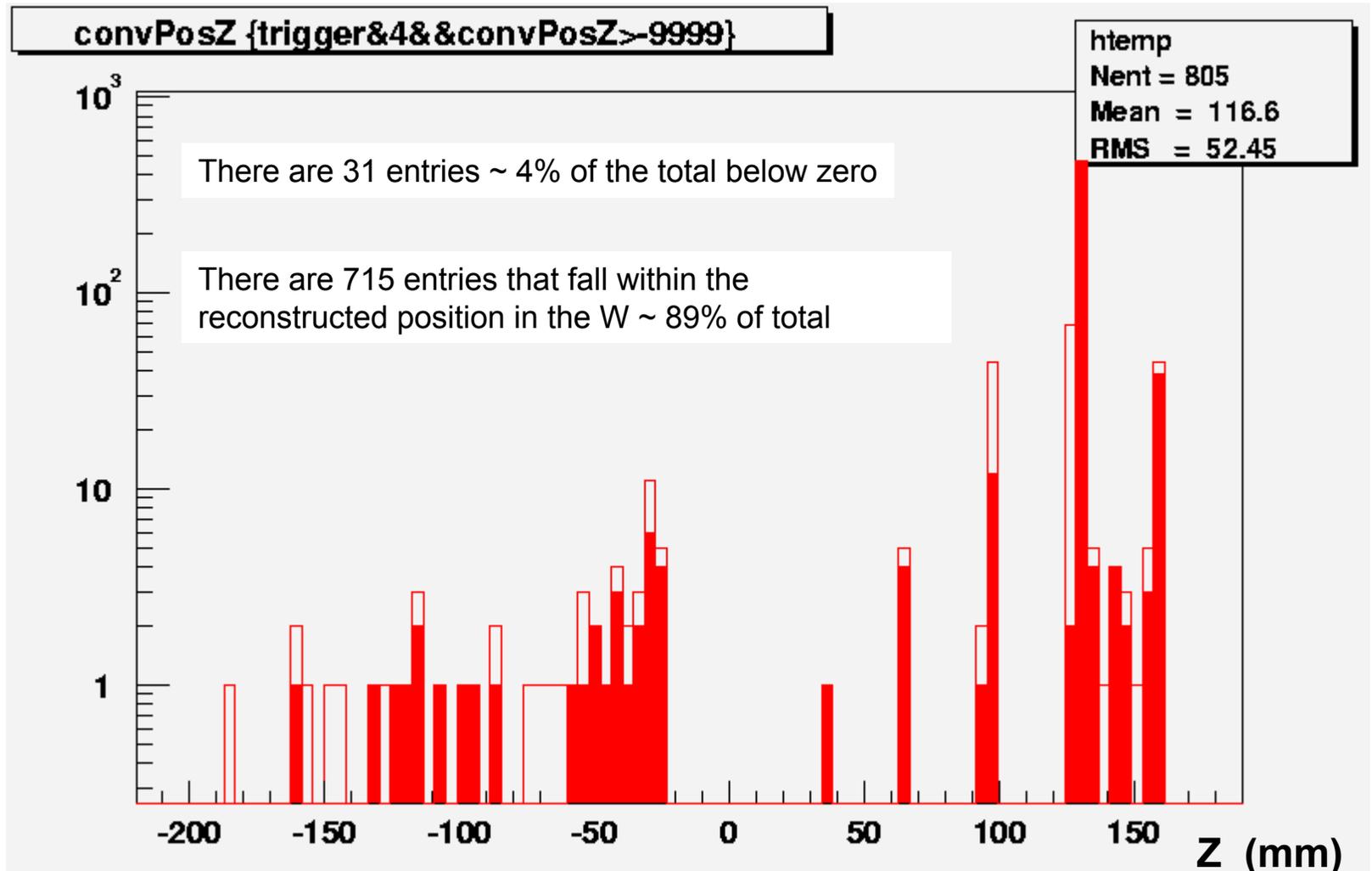
XZ Plane:

No Trade off between Flux and Trigger efficiency rate is dominated by trigger efficiency

Dir goes from 0 to 180  
Muons are symmetric around Y

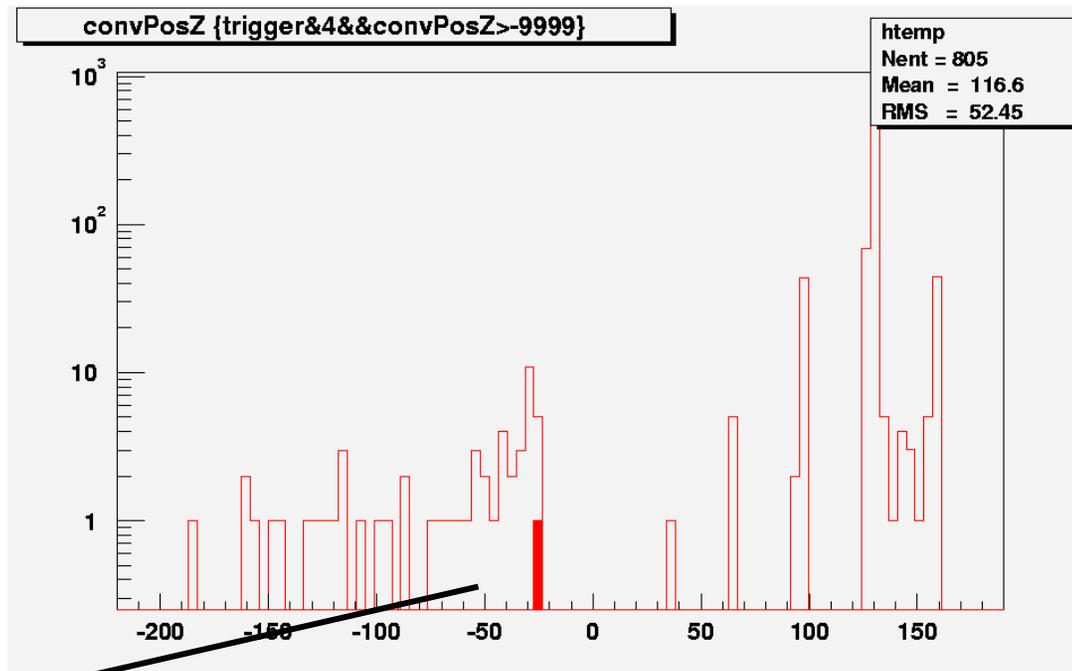
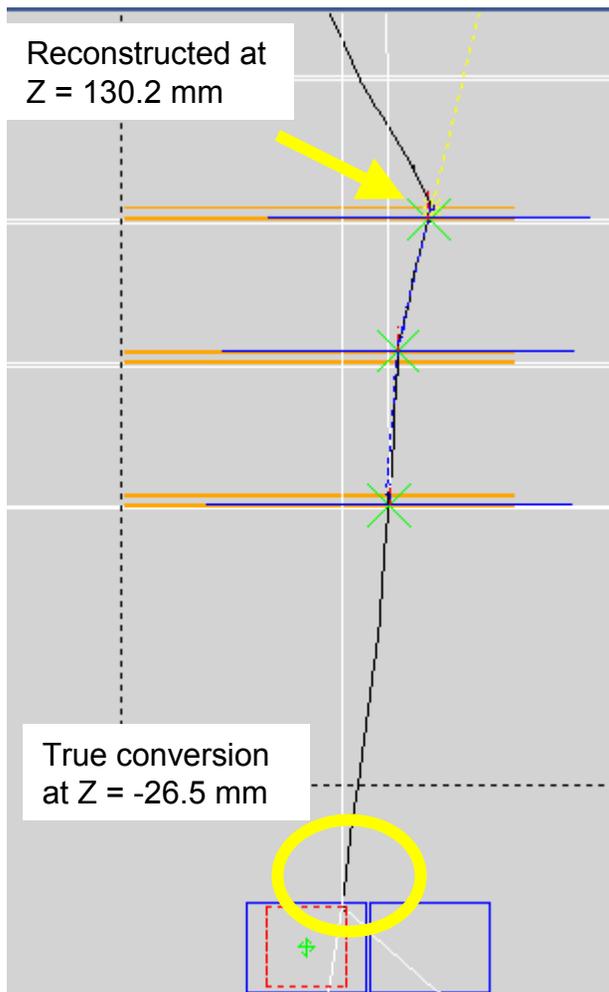


# MC G4 “True” Photon Conversions



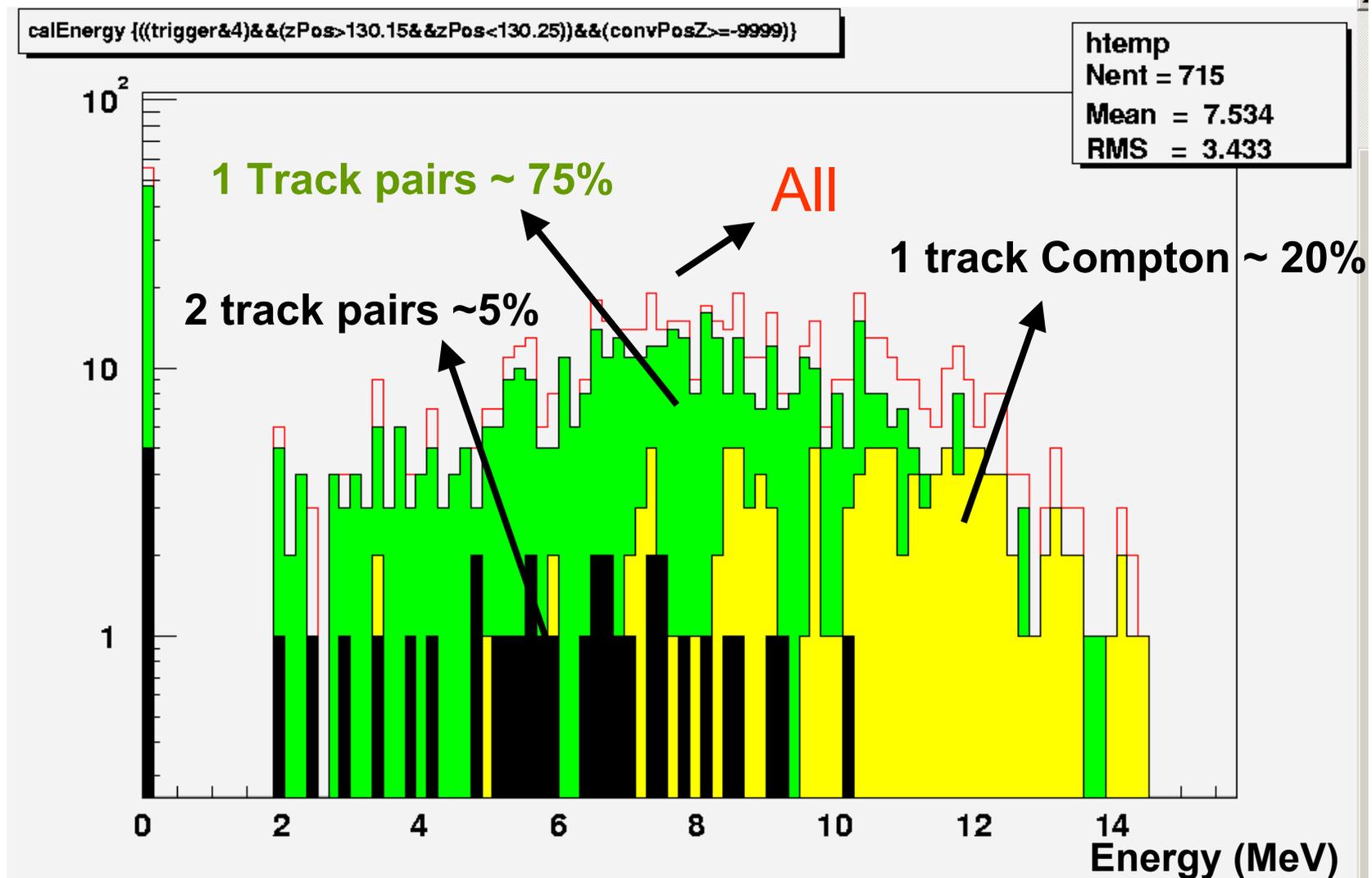
Solid histograms correspond to events in which the reconstructed position of the converted photons lies within the W thickness (130.15 to 130.25 mm). 20% are compton and 80% pairs.

# MC G4 Negative Photon Conversions



# Energy Spectrum in the Calorimeter (signal)

for 3-in-row reconstructed events that Converted inside the W foil (130.15 to 130.25 mm)



# Background Rate Calculation

Muon rate from PDG =  $1 \text{ /cm}^2\text{/min} = 1.67 \text{ /cm}^2\text{/s}$

Expect 1000 Hz from 3 GeV muons (assuming sphere around EM =  $60000 \text{ cm}^2$ )

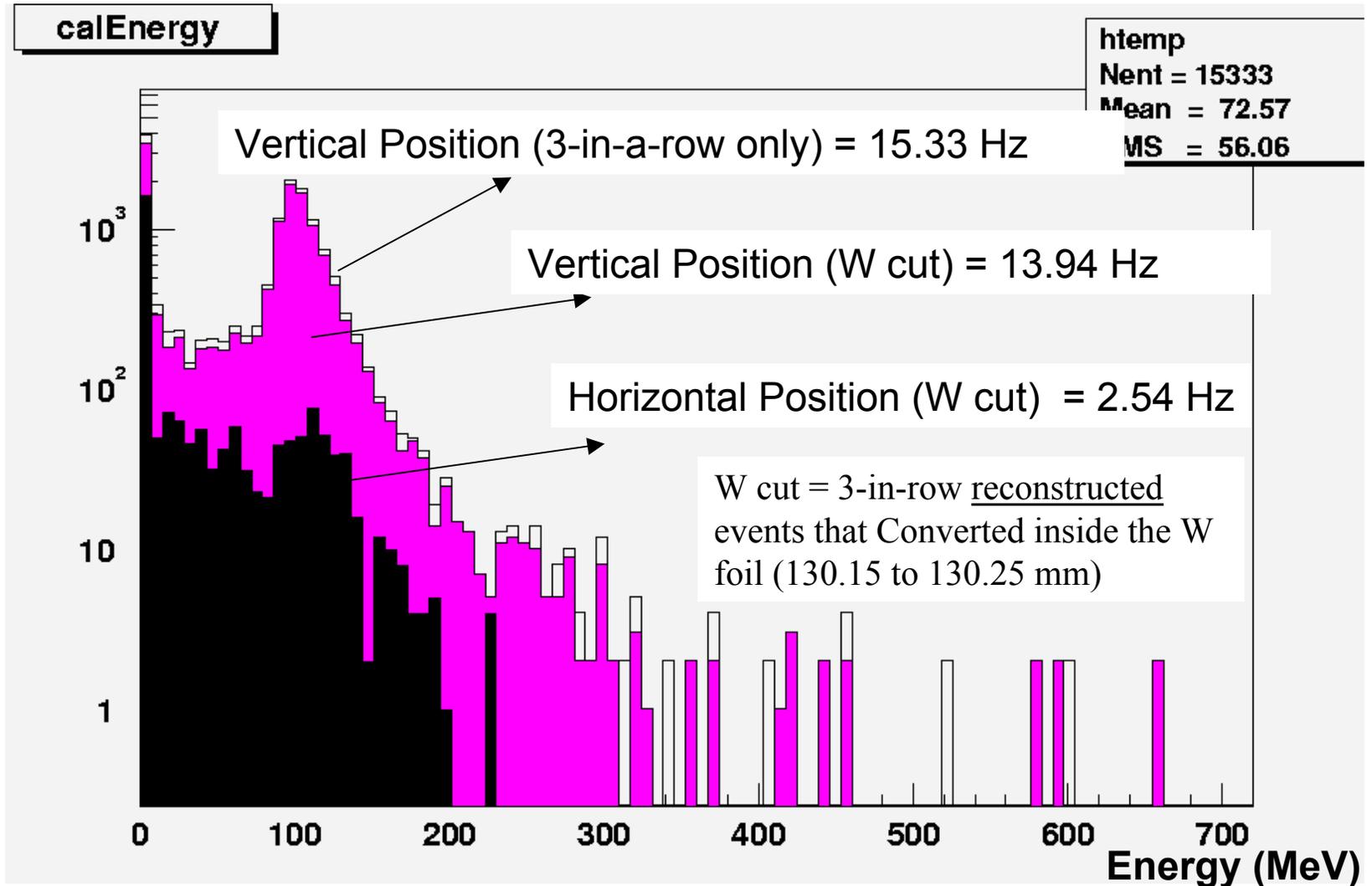
Expect 10 Hz from 100 MeV muons (assuming sphere around EM =  $60000 \text{ cm}^2$ )

Area of TKR =  $35.8 \times 35.8 = 1282 \text{ cm}^2$

**Trigger rate = # of triggered events x  $60000 \text{ cm}^2$  x  $1.67 \text{ /cm}^2\text{/s}$  /  $1,000,000$  events**

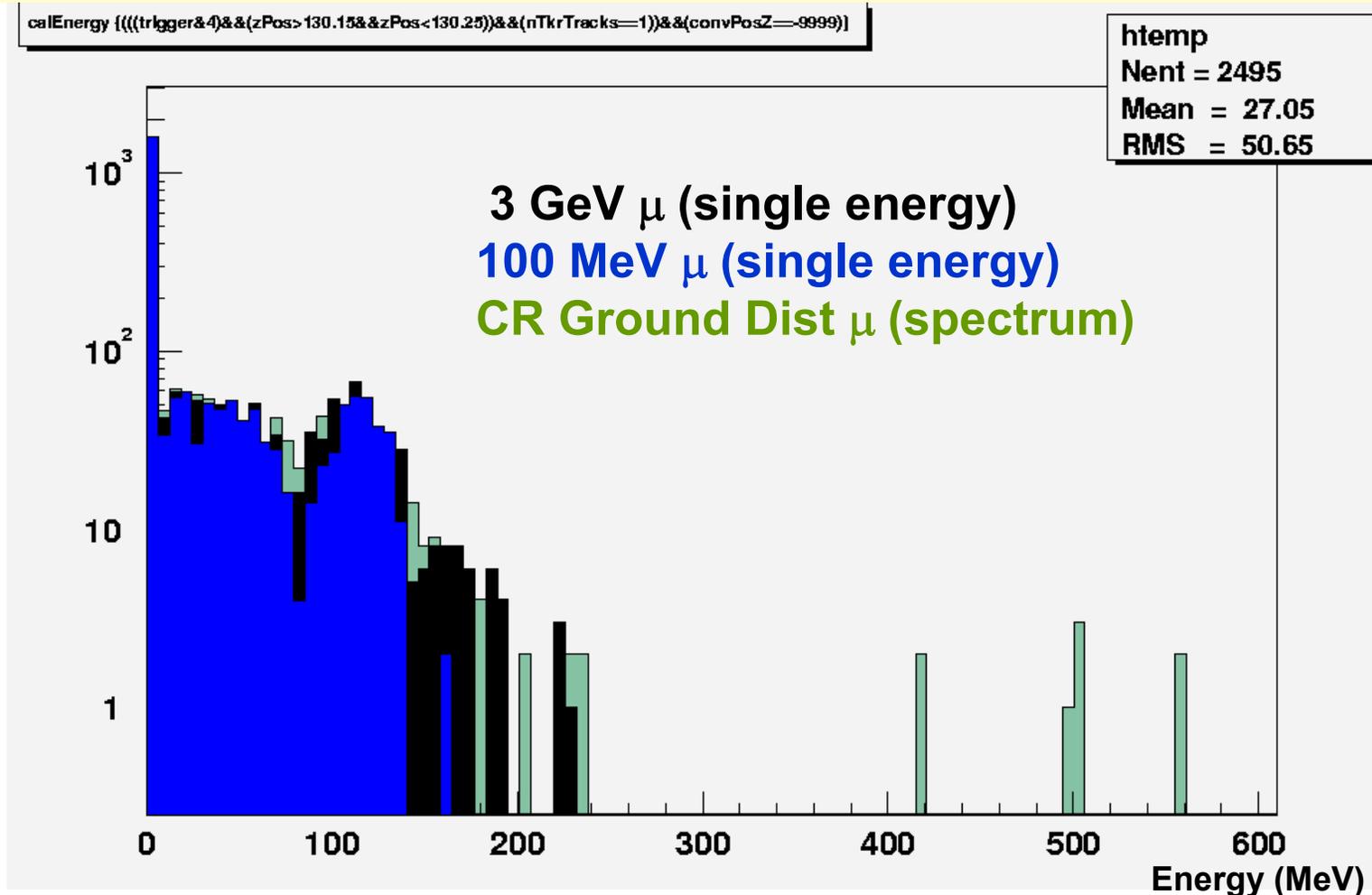
# Background Rate Vertical vs Horizontal

Trigger rate = # of triggered events x 60000 cm<sup>2</sup> x 1.67 /cm<sup>2</sup>/s / 1,000,000 generated events



# Energy Spectrum in the Calorimeter (bkgd)

for 3-in-row reconstructed events that have first hit inside the W foil (130.15 to 130.25 mm)



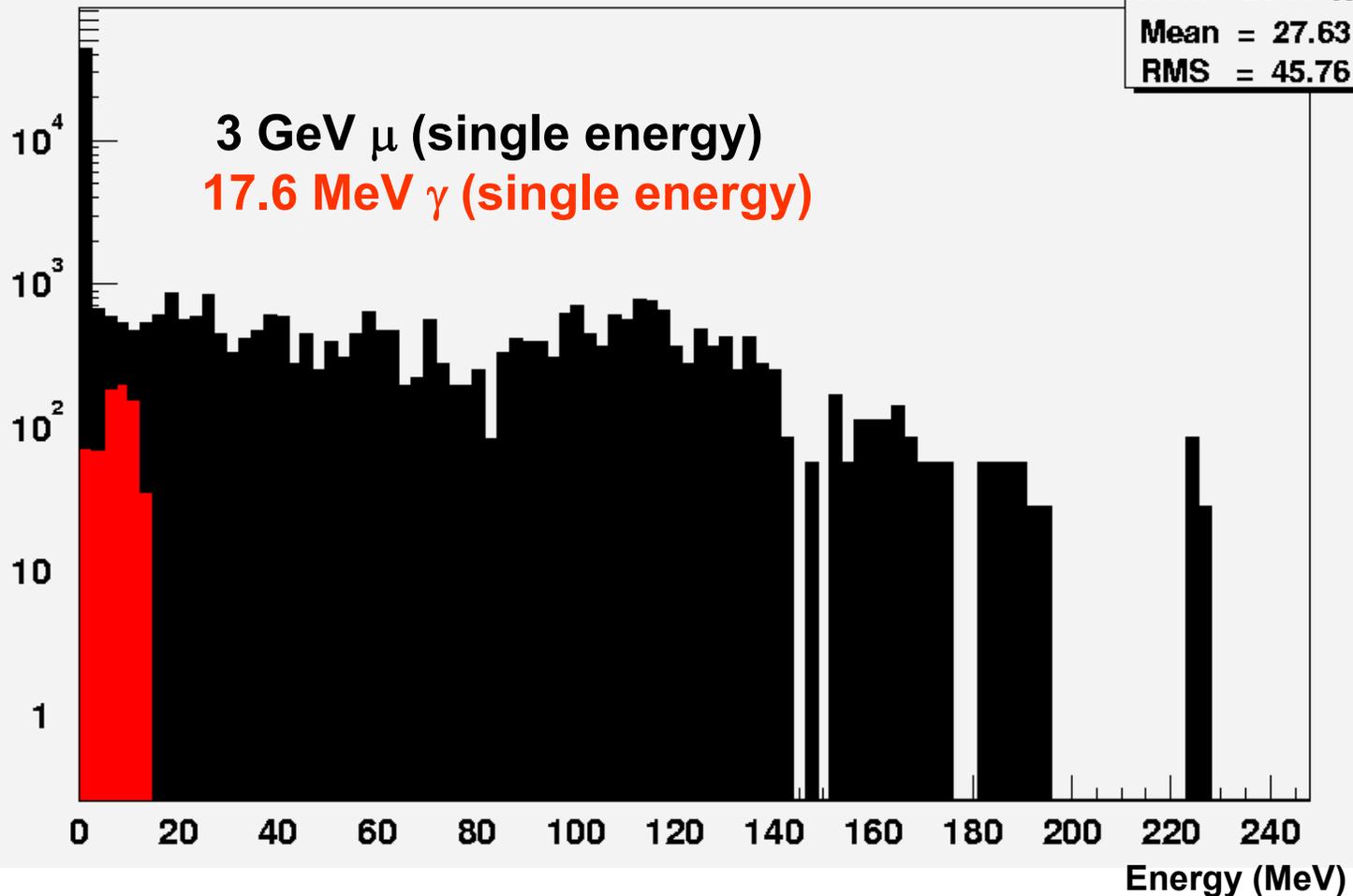
2500 events correspond to 2.5 % of the 1000000 events generated corresponds to **0.5 hours** of data taking. So this must be scaled by a factor of 28 to be normalized with the photon spectrum

# Energy Spectrum in the Calorimeter

normalized to 14 hours of data taking

calEnergy {(trigger&4)&&(zPos>130.15&&zPos<130.25)}

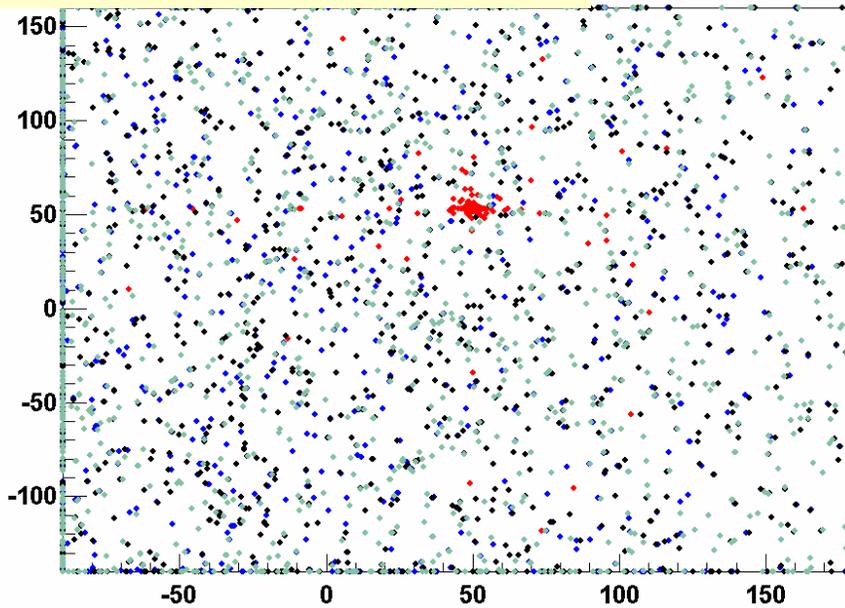
htemp  
Nent = 2541 x 28  
Mean = 27.63  
RMS = 45.76



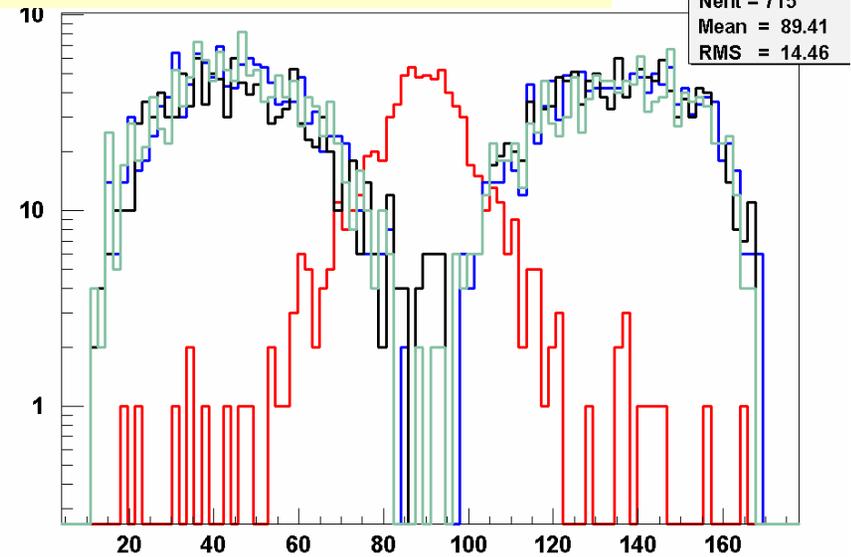
Caveat: Simple scaling applied, ot get a better understanding of the background we need to generate more MC events

# Background rejection variables

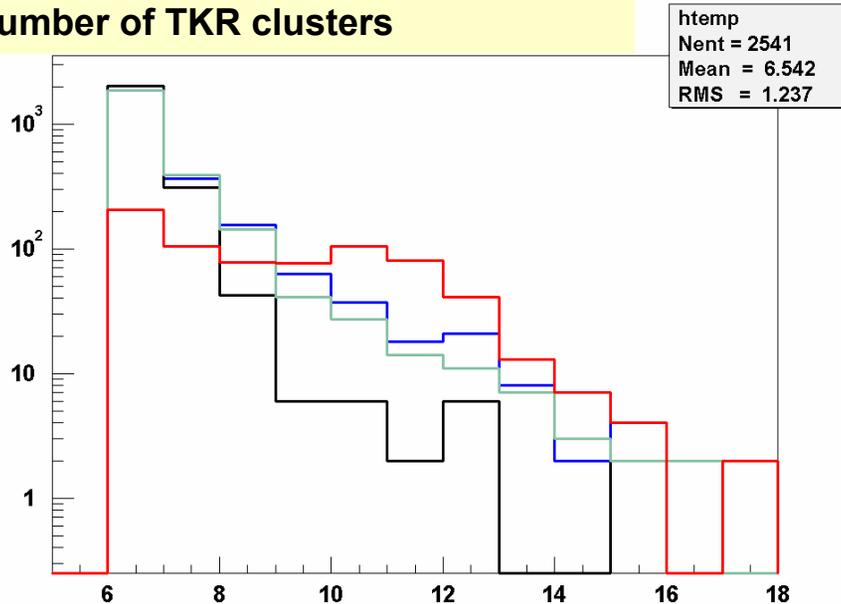
## X and Y position of first hits (mm)



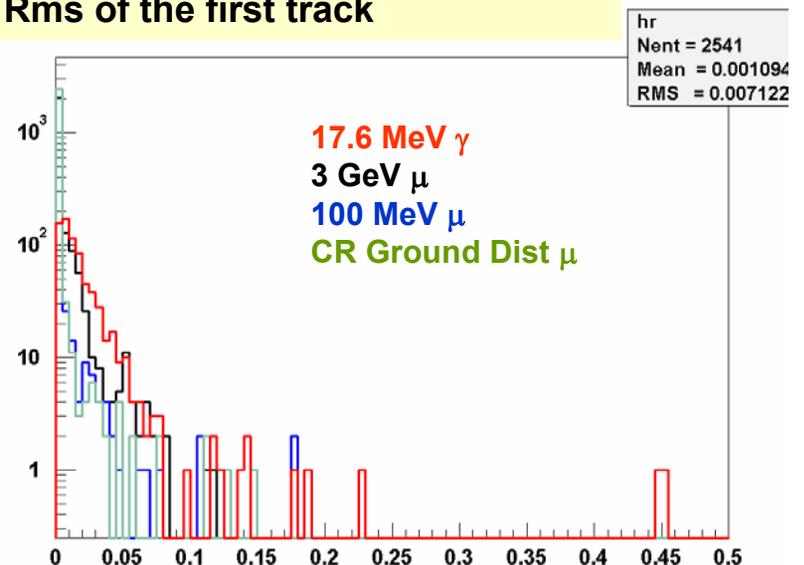
## Reconstructed Y direction (deg)



## Number of TKR clusters



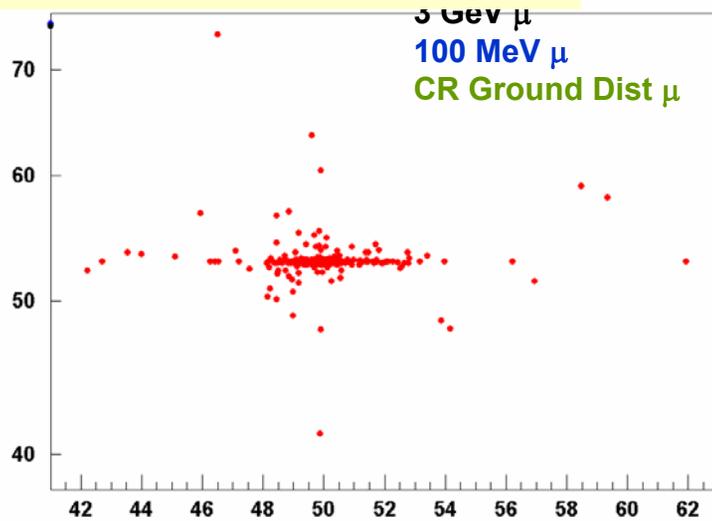
## Rms of the first track



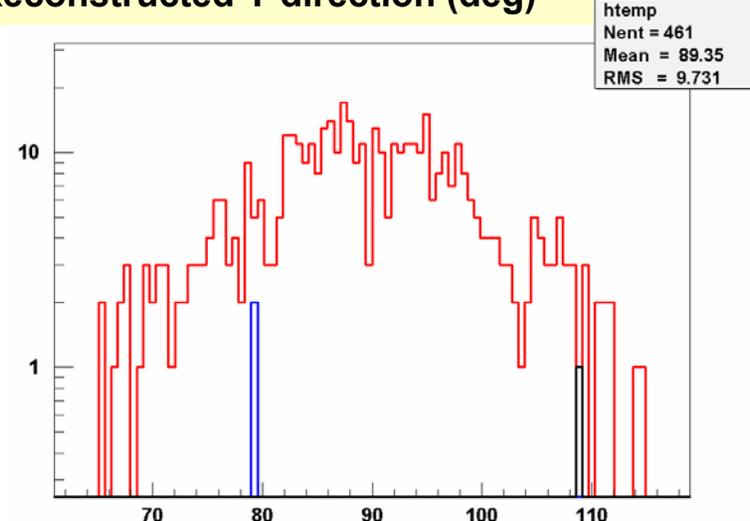
# Background rejection – before the last cut

**Caveat: Limited statistics for background run**

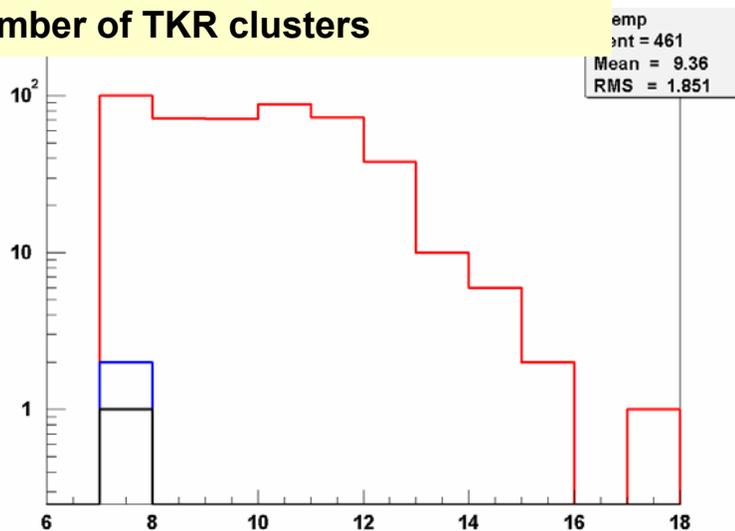
## X and Y position of first hits (mm)



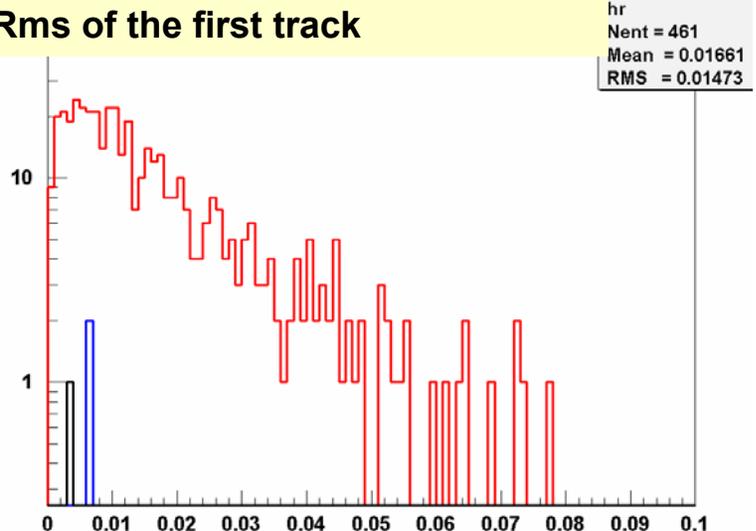
## Reconstructed Y direction (deg)



## Number of TKR clusters



## Rms of the first track

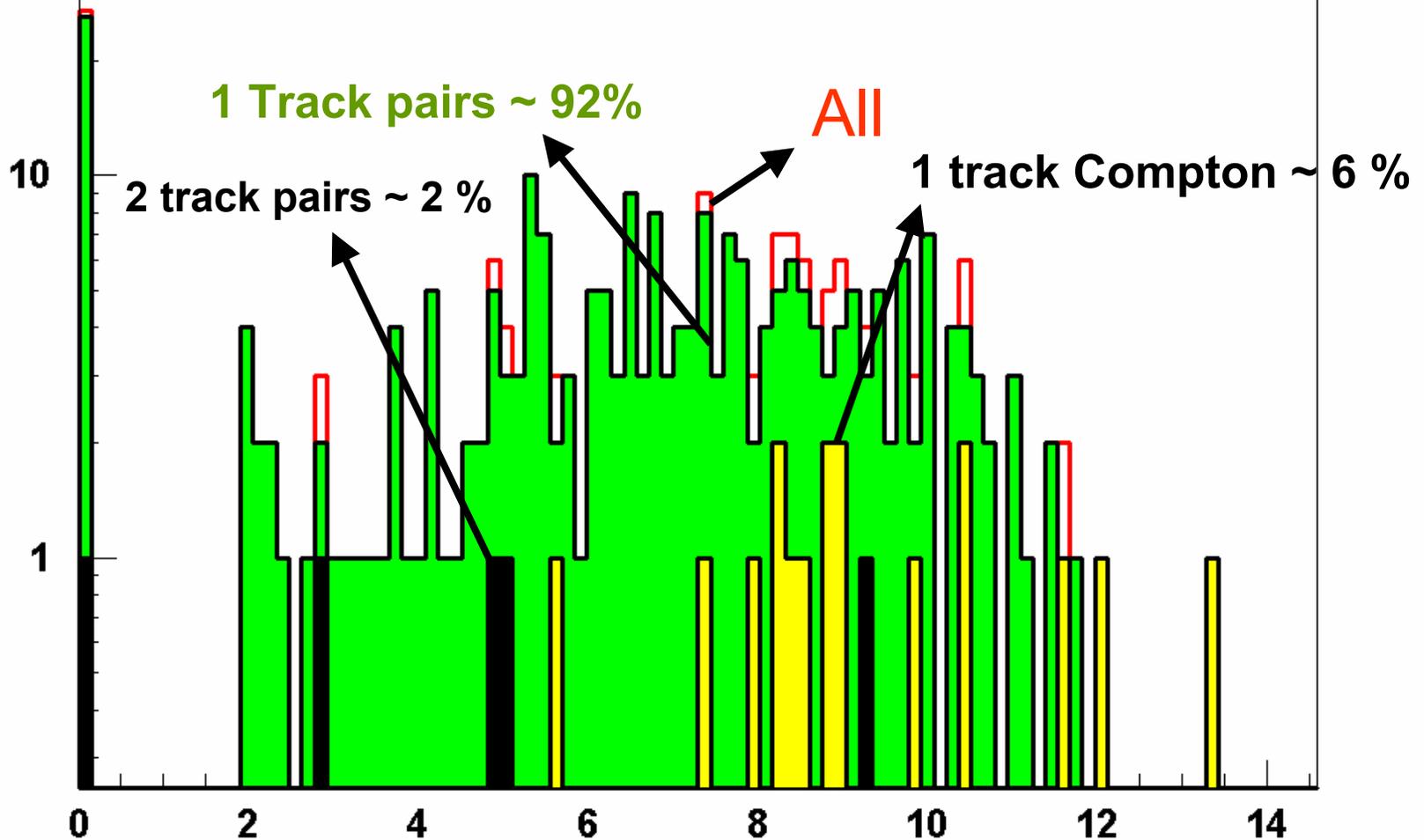


# Energy Spectrum in the Calorimeter

normalized to 14 hours of data taking – background free

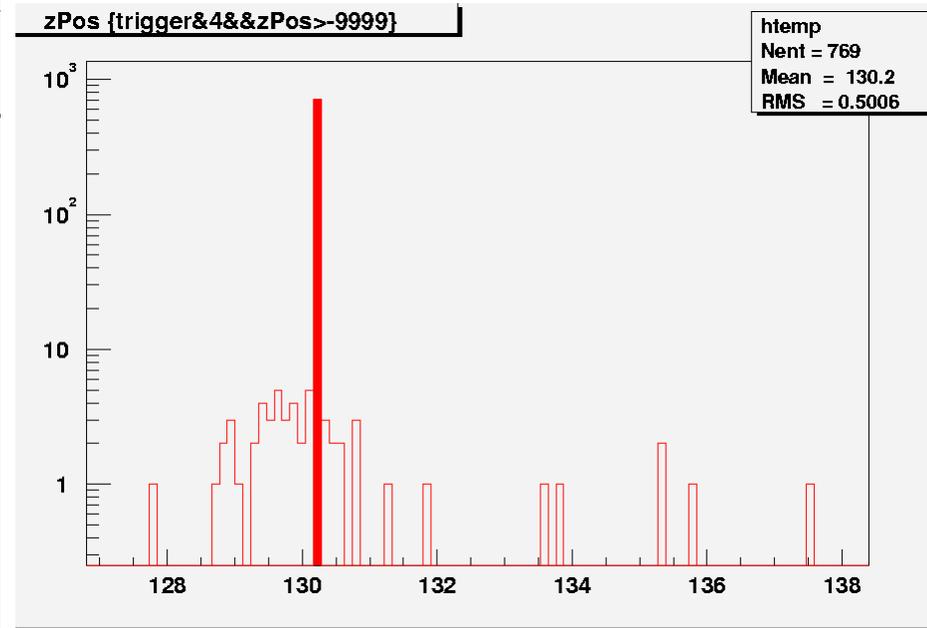
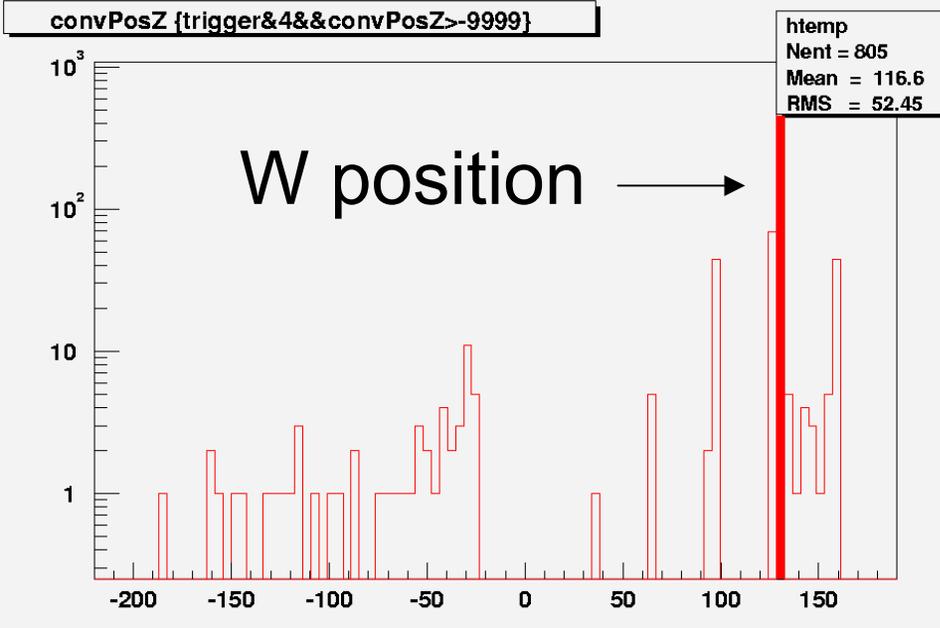
Nent = 268  
Mean = 6.504  
RMS = 3.125

Caveat: Limited statistics for background run



# Backup slides

# Photon Conversions



From MC GEANT4 information we find that

0.83% of source events are pairs that convert inside W

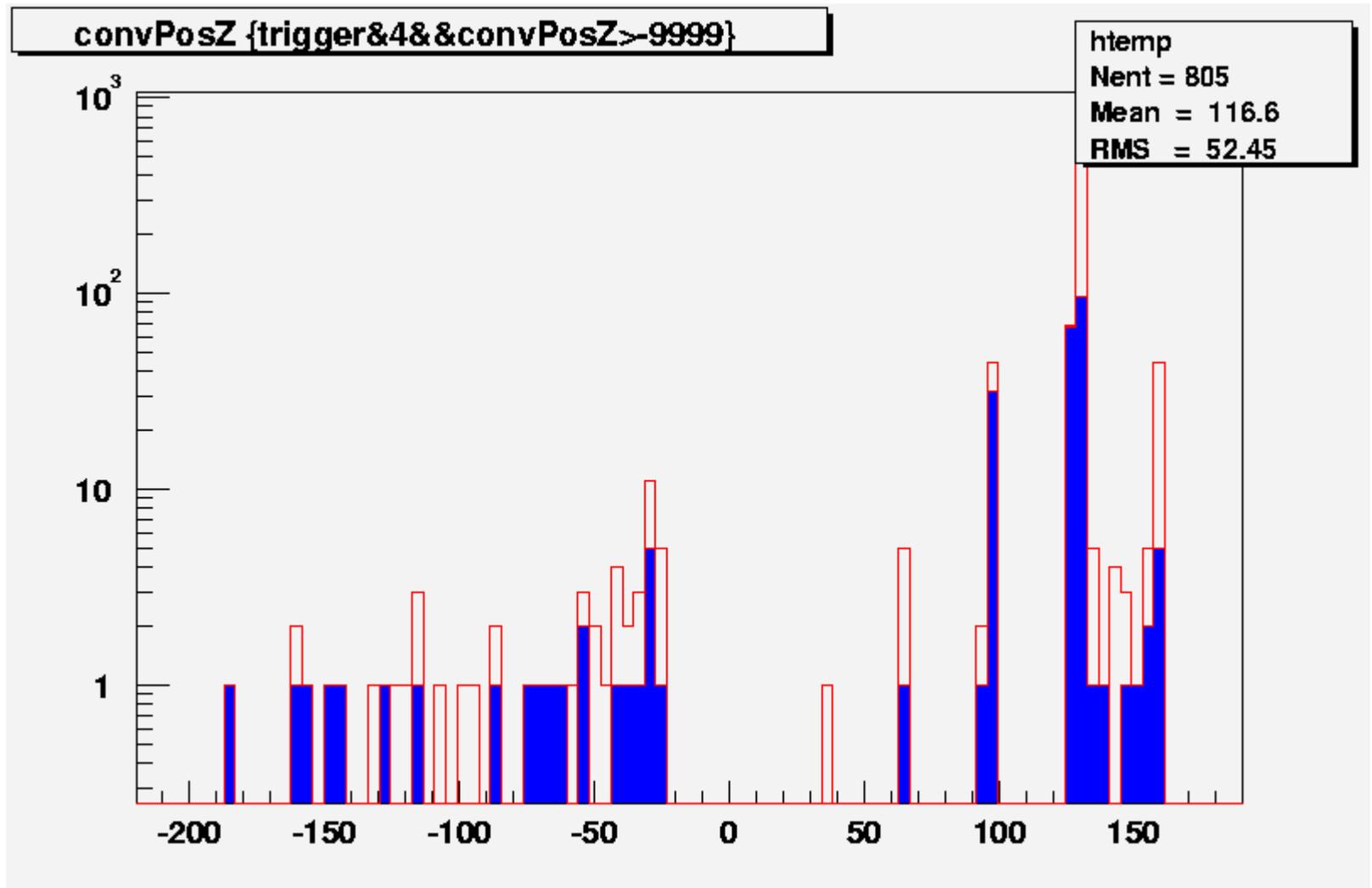
0.43% of source events are pairs that convert outside W

0.23% of source events are Compton

Estimated numbers

- Probability of conversions ~ 3%
- Cross section for Pairs ~ 79%
- Cross section for Compton ~ 21 % ( Theory ~ 17%)
- Trigger efficiency for on axis 17.6 MeV ~ 62%
- Recon efficiency for pairs ~ 82%
- Recon efficiency for recon ~ 67 %

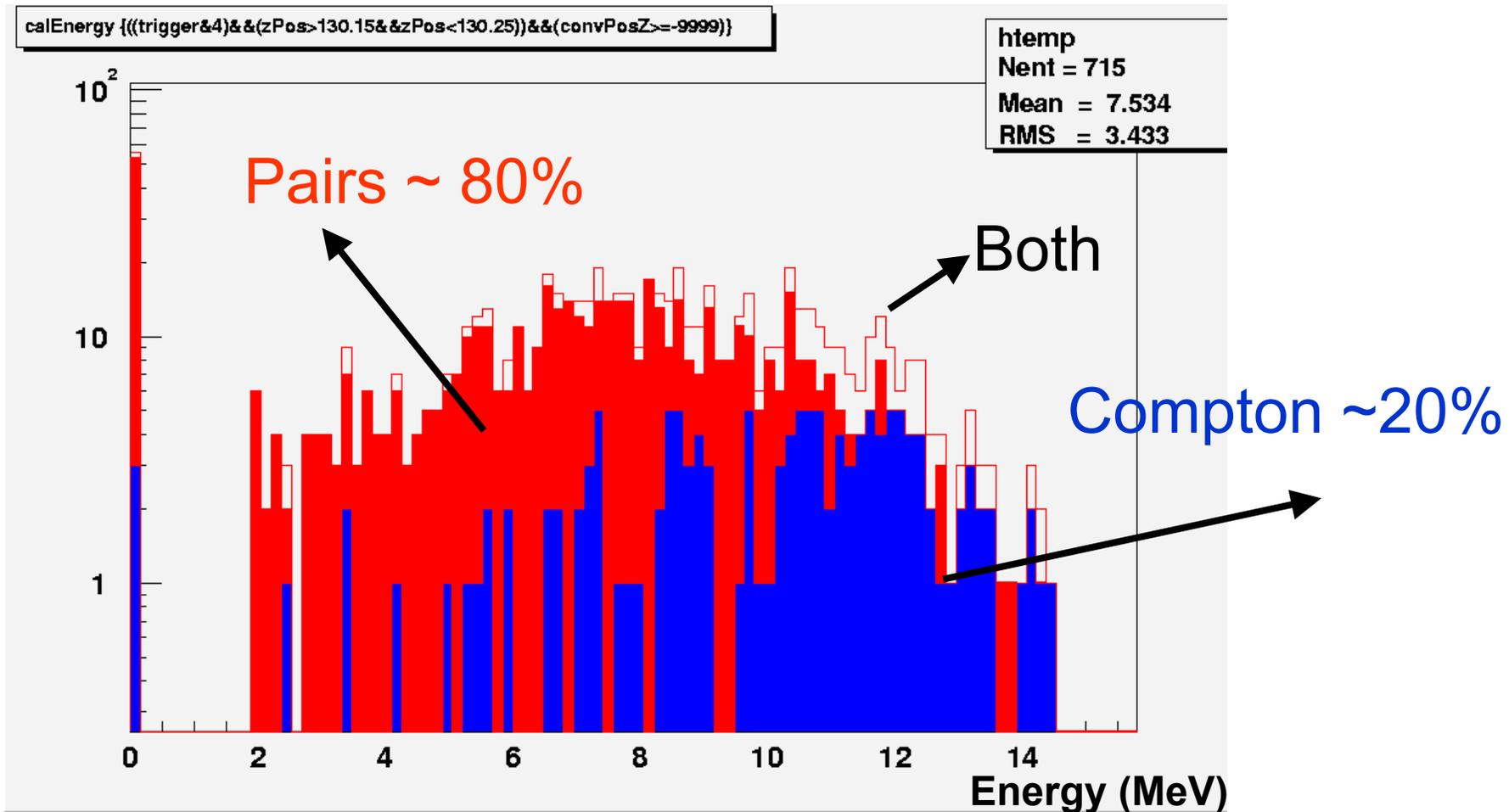
# MC G4 Photon Conversions



Solid bars are the events in which the reconstructed position of the converted photons lied **outside** the W thickness (130.15 to 130.25 mm)

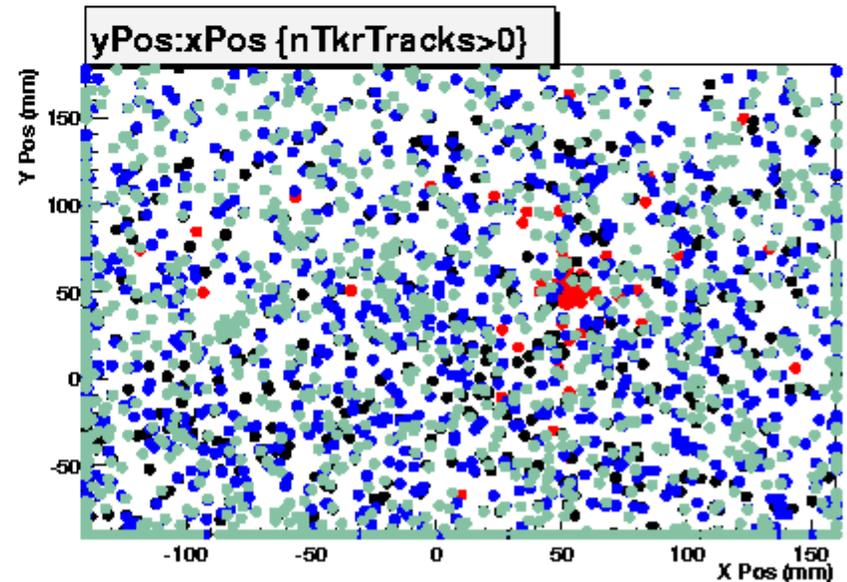
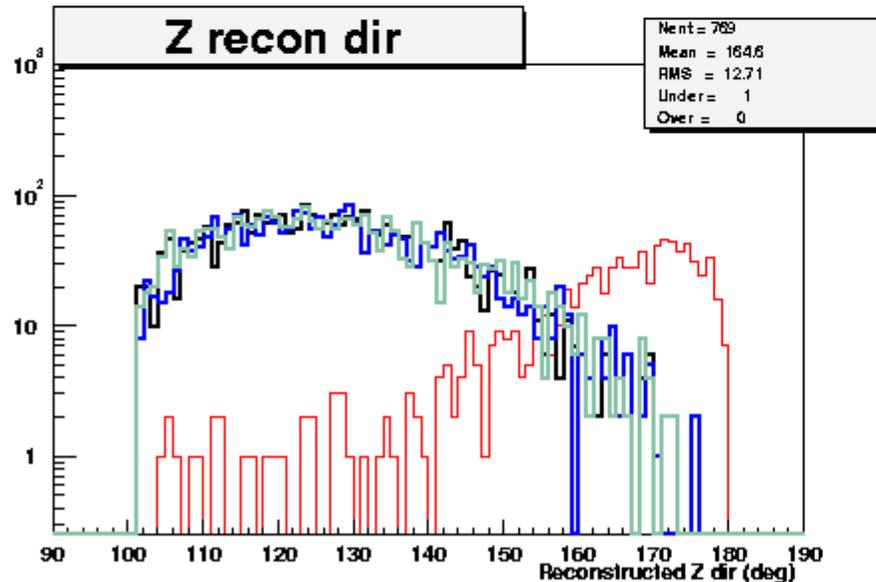
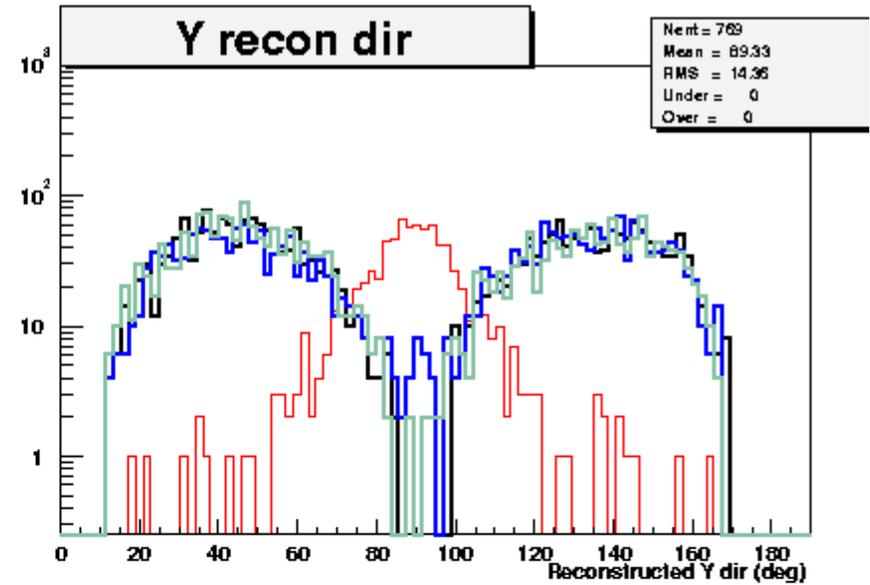
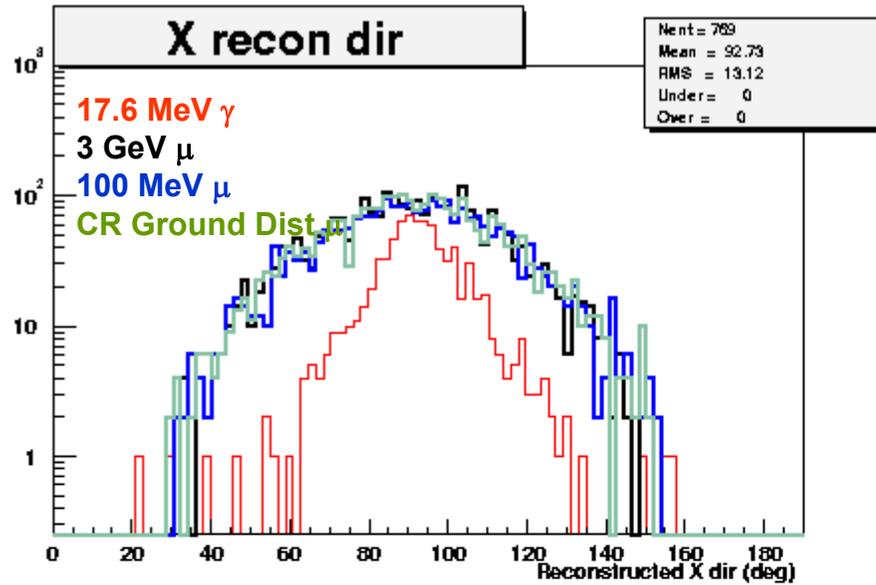
# Energy Spectrum in the Calorimeter (signal)

3-in-row reconstructed events that Converted inside the W foil (130.15 to 130.25 mm)



715 events correspond to 1.4% of the 50000 events generated. Only 1017 triggered the 3-in-a-row. With a rate of 1 Hz from the source this corresponds to **14 hours of data taking**

# MC Reconstructed directions in degrees



# Energy Spectrum in the Calorimeter

normalized to 14 hours of data taking – background free

htemp  
Nent = 364  
Mean = 7.416  
RMS = 3.404

Caveat: Limited statistics for background run

