

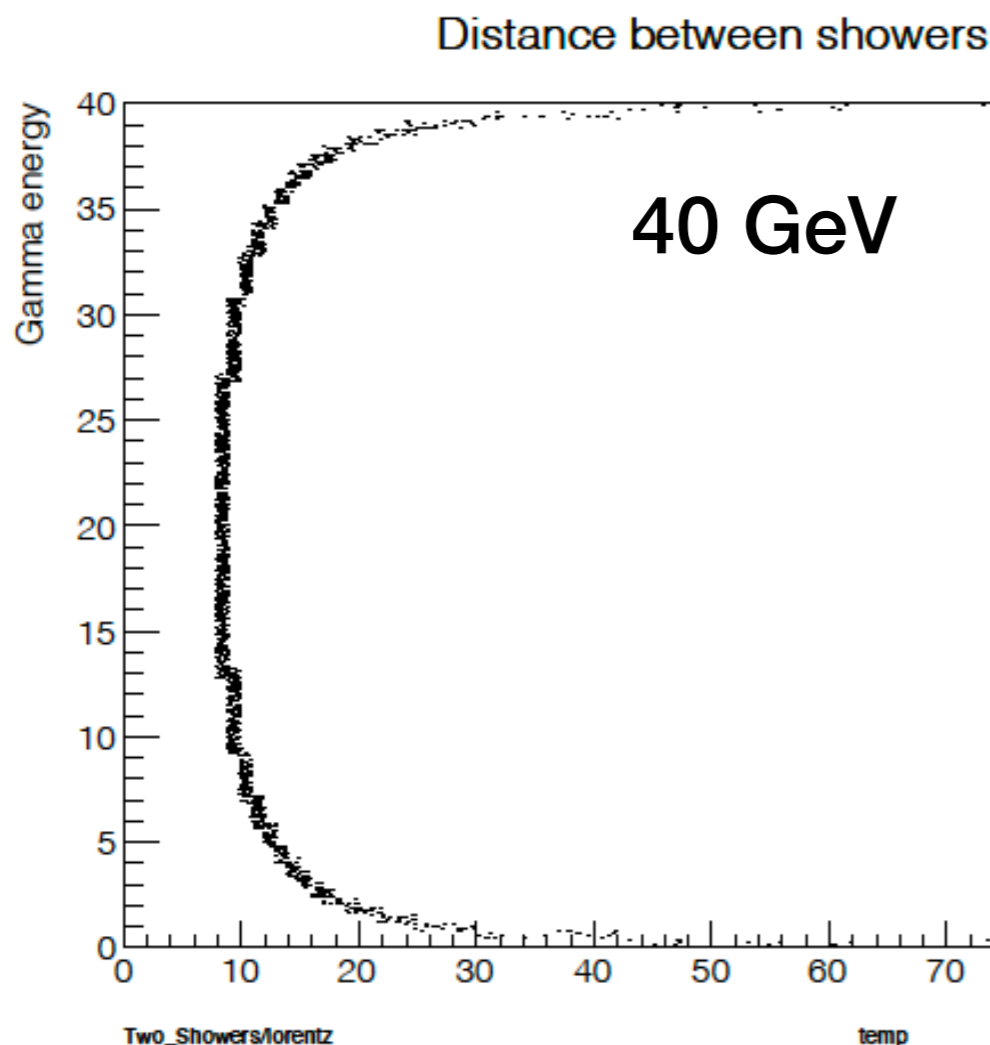


September 9, 2021

π^0 & K^0 Reconstruction
in the
SiD MAPS Digital ECal

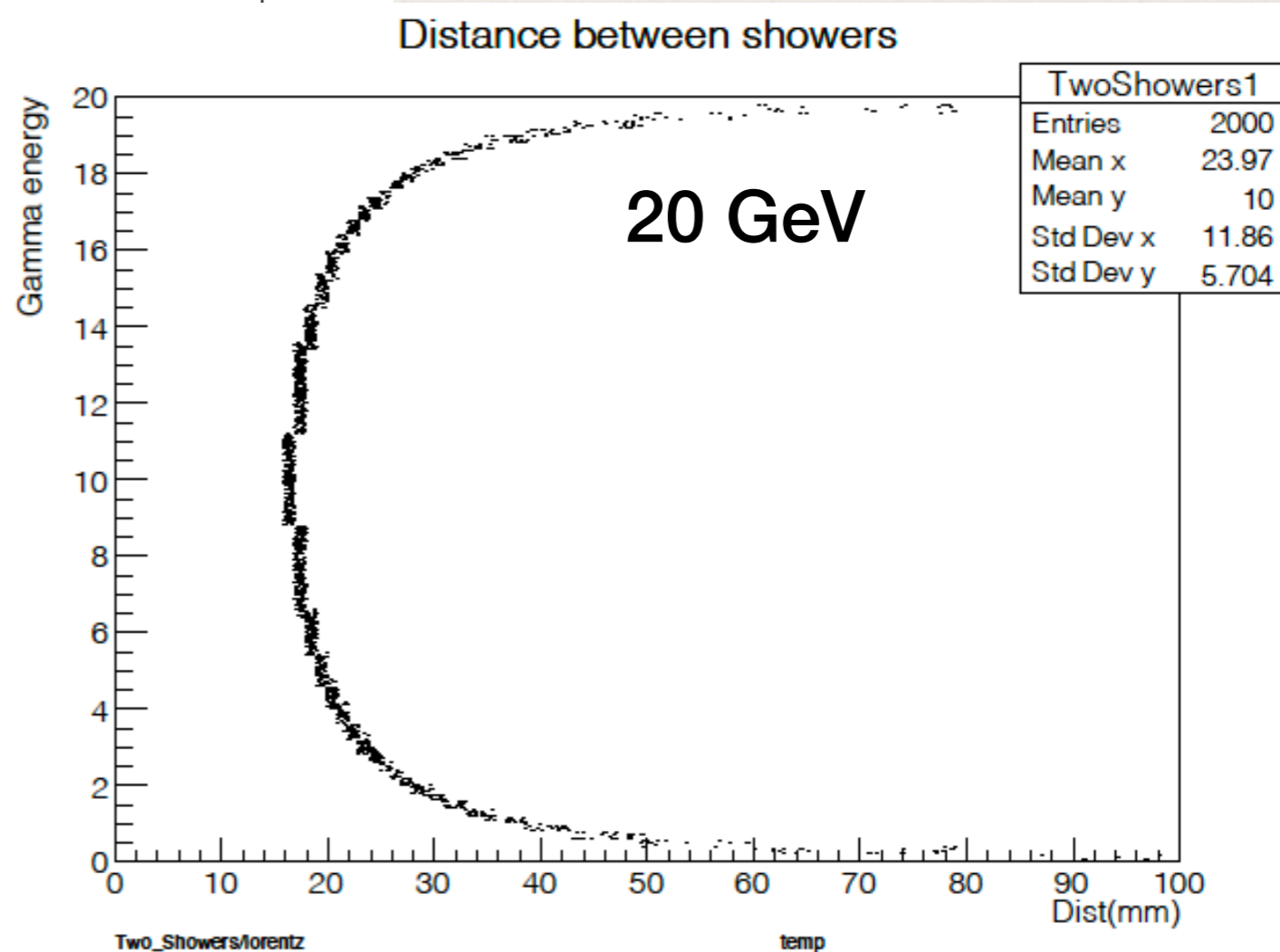
Jim Brau
University of Oregon

π^0 s in the SiD ECal at 90 degrees



TwoShowers3	
Entries	2000
Mean x	12.45
Mean y	20
Std Dev x	7.607
Std Dev y	11.55

γ separations (mm)
for γ energies

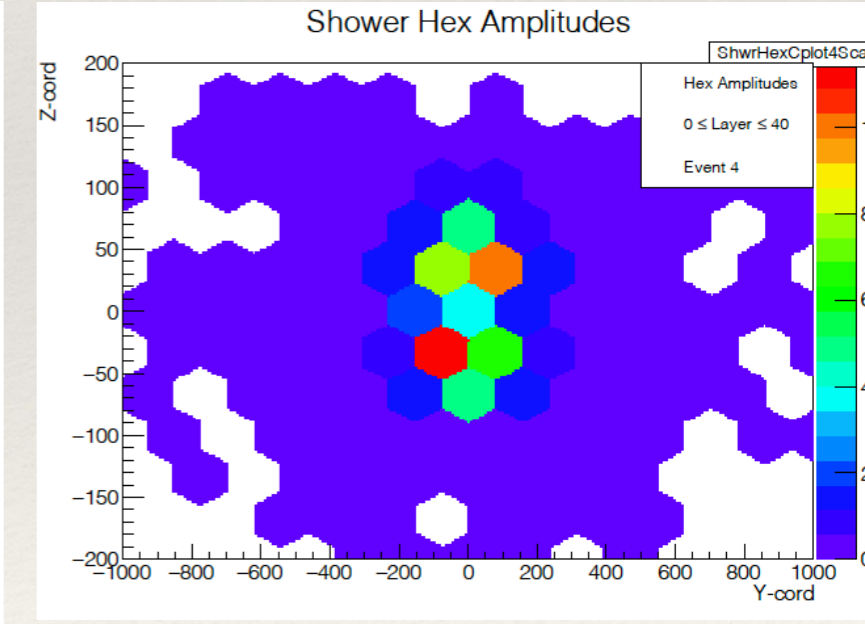
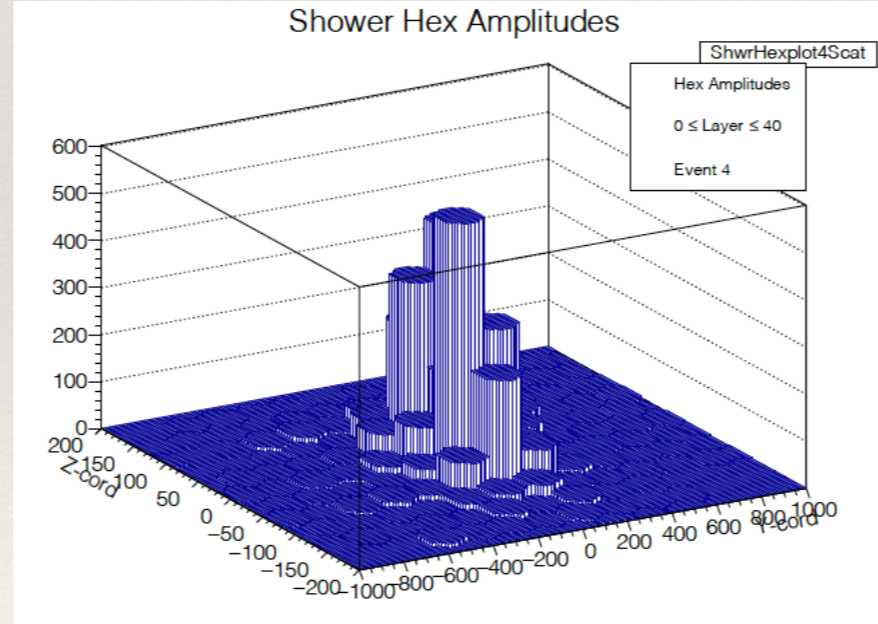
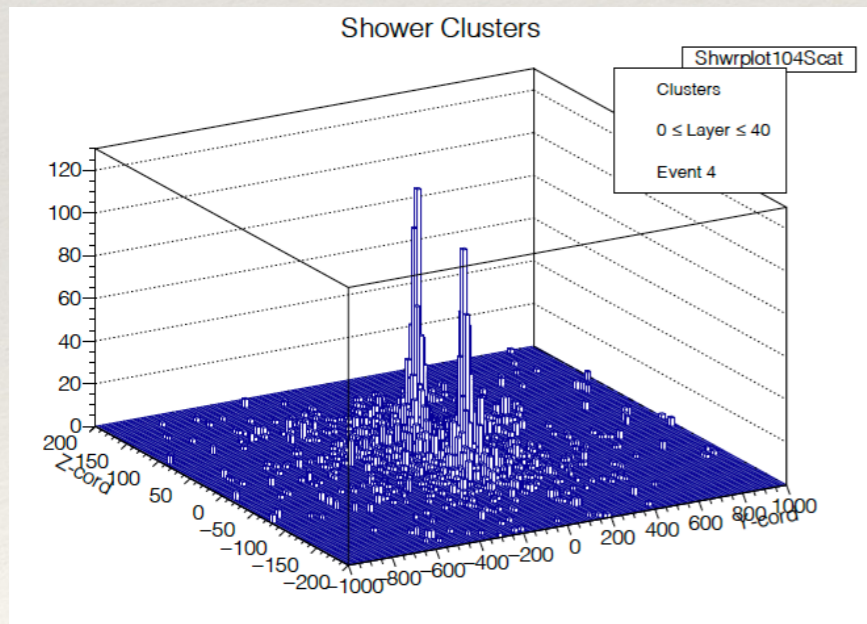
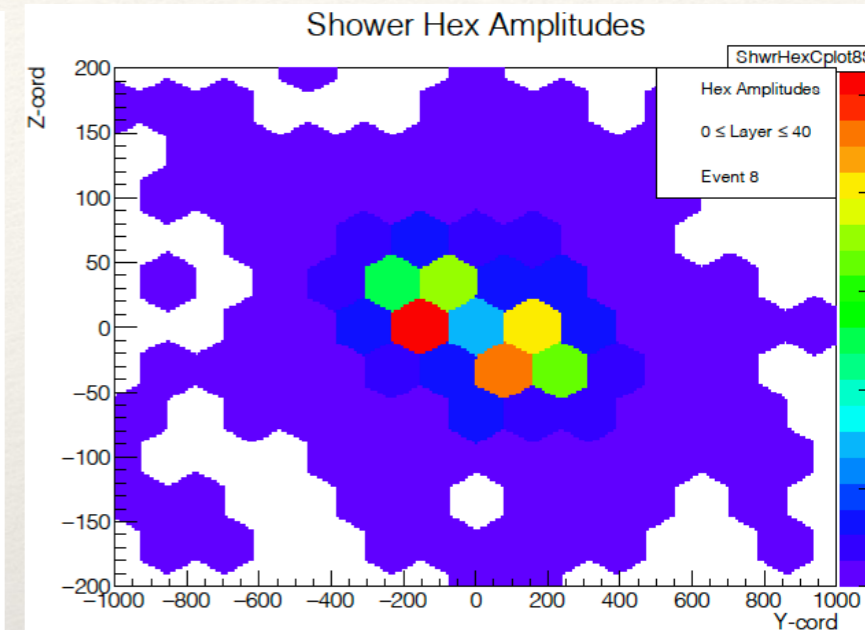
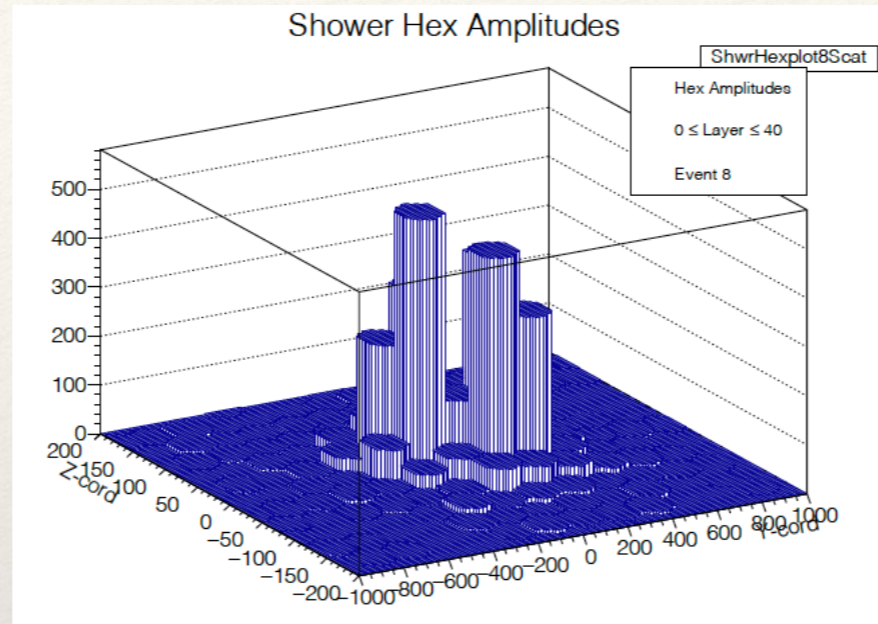
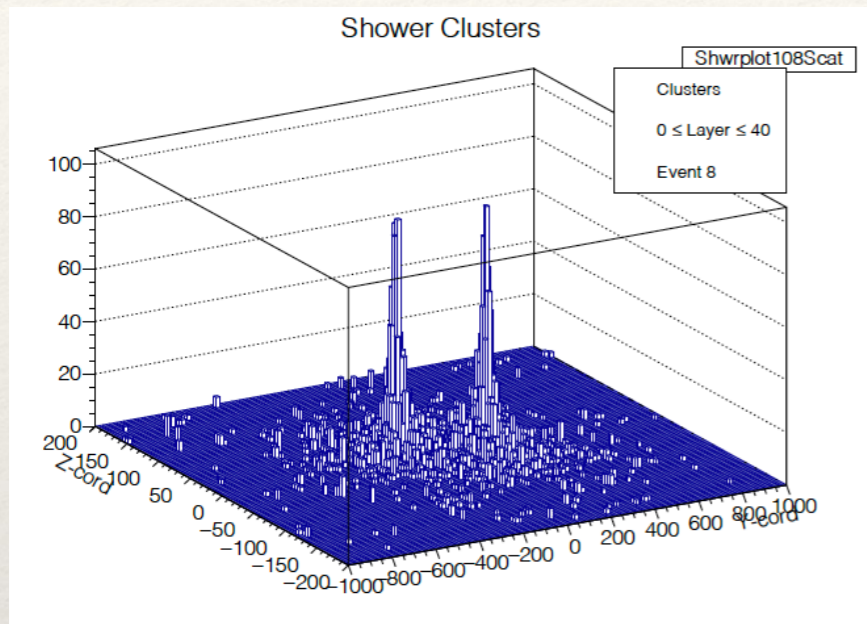


TwoShowers1	
Entries	2000
Mean x	23.97
Mean y	10
Std Dev x	11.86
Std Dev y	5.704

$$40 \text{ GeV } \pi^0 \rightarrow 20 \text{ GeV } \gamma + 20 \text{ GeV } \gamma$$



SiD MAPS Digital ECal J. Brau - 9 September 2021



SiD MAPS Digital ECal

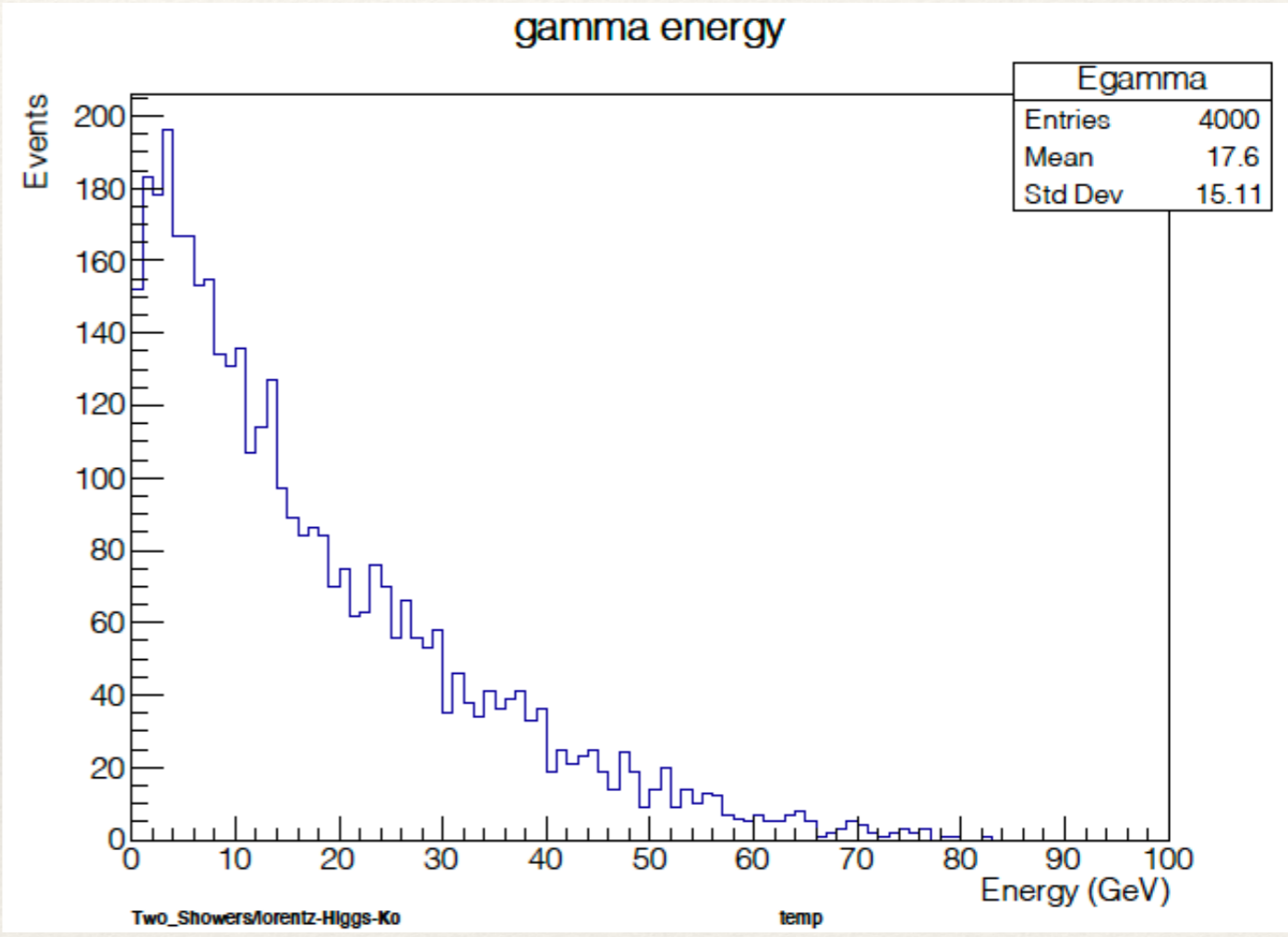
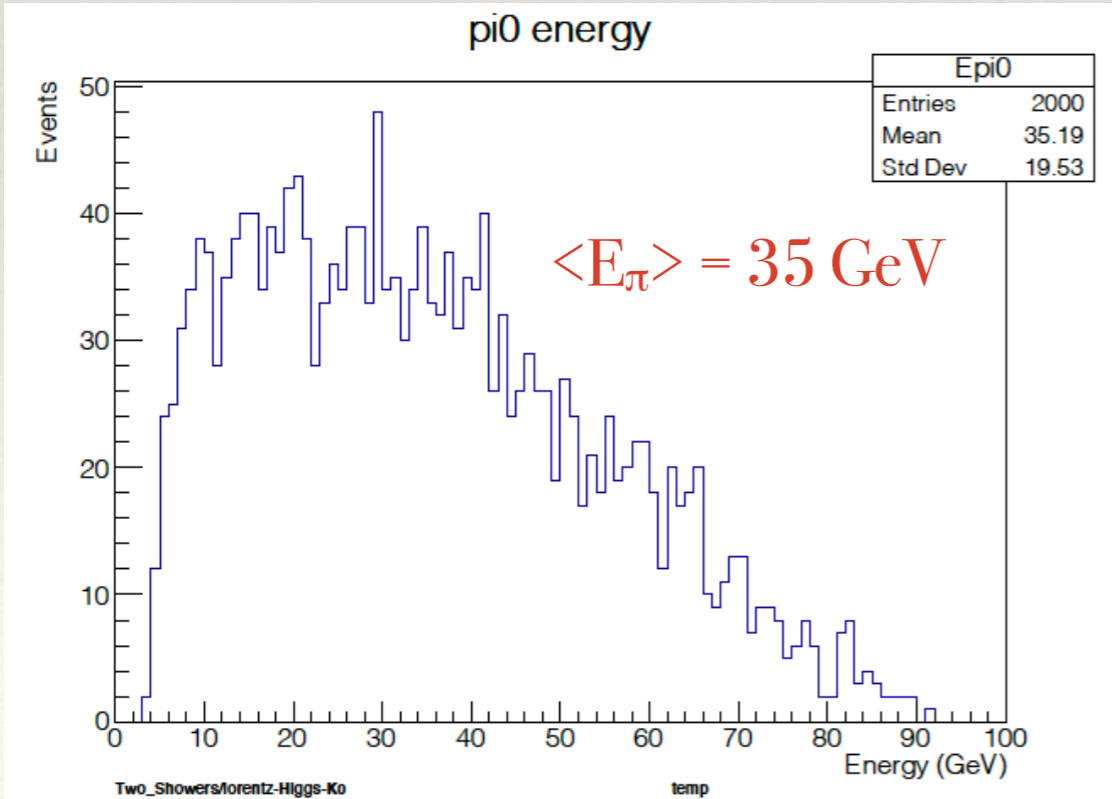
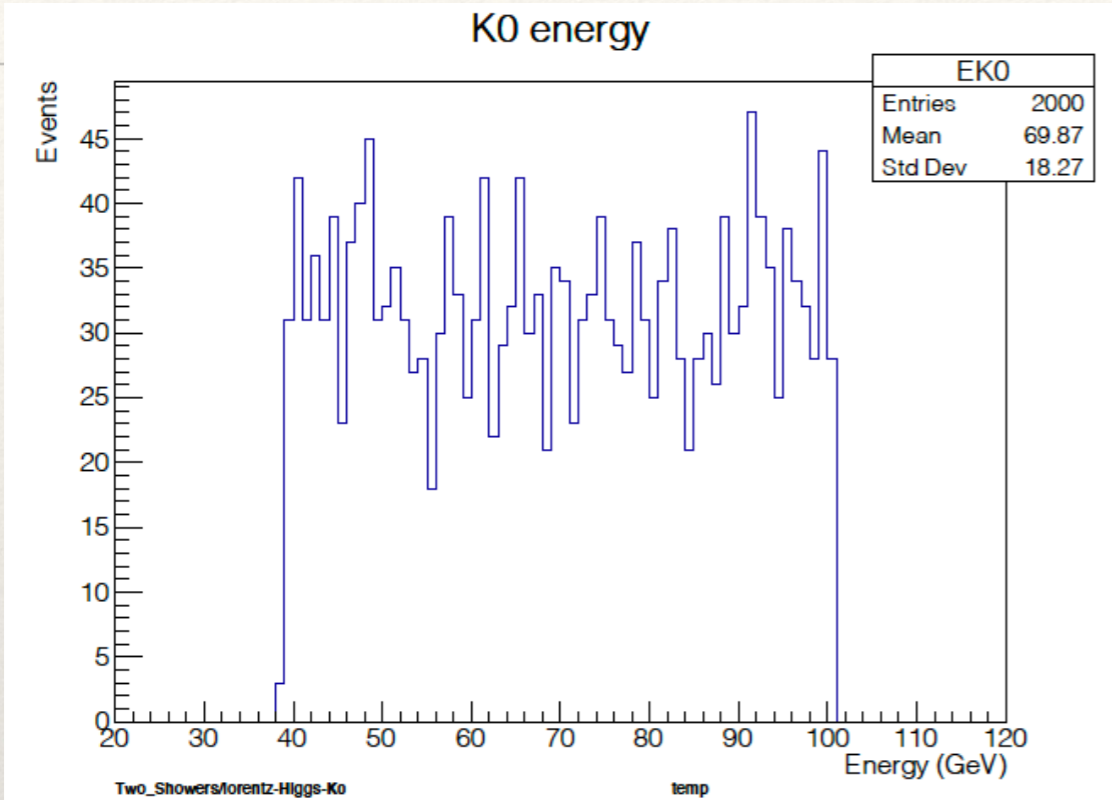
SiD TDR ECal

SiD TDR ECal

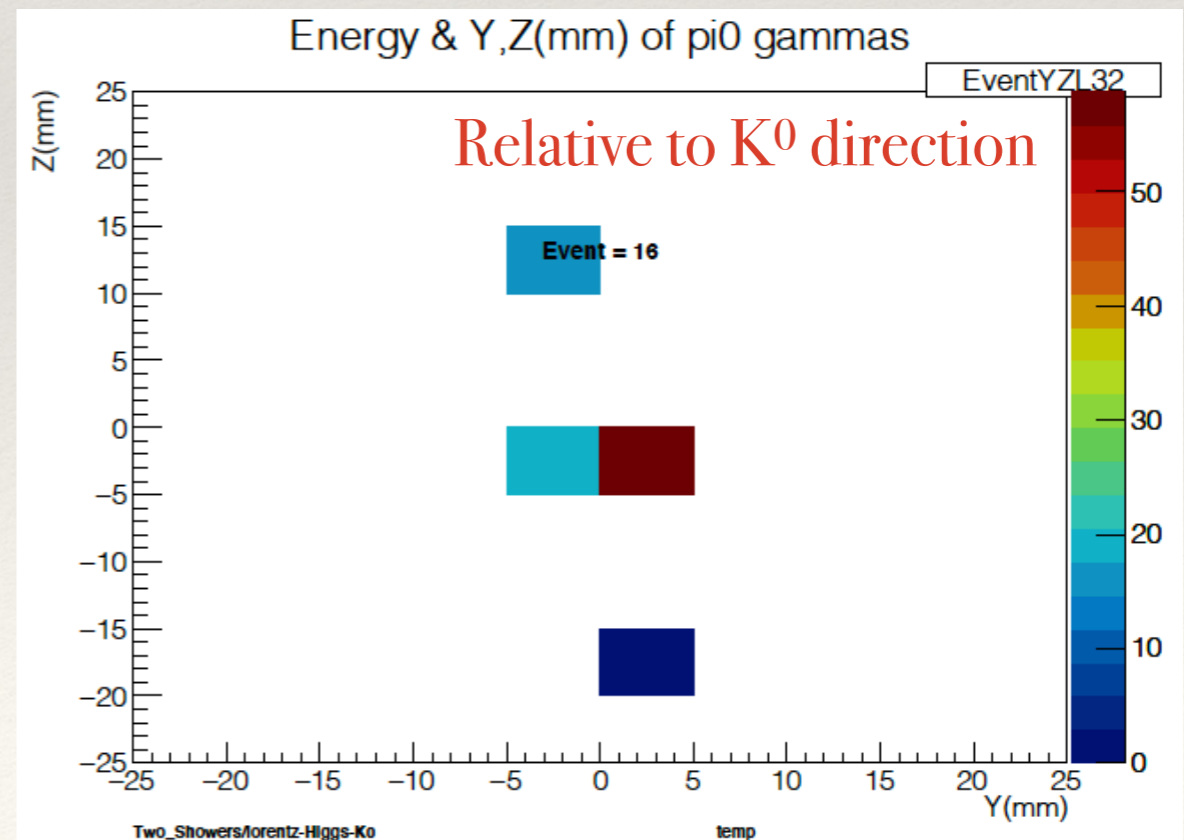
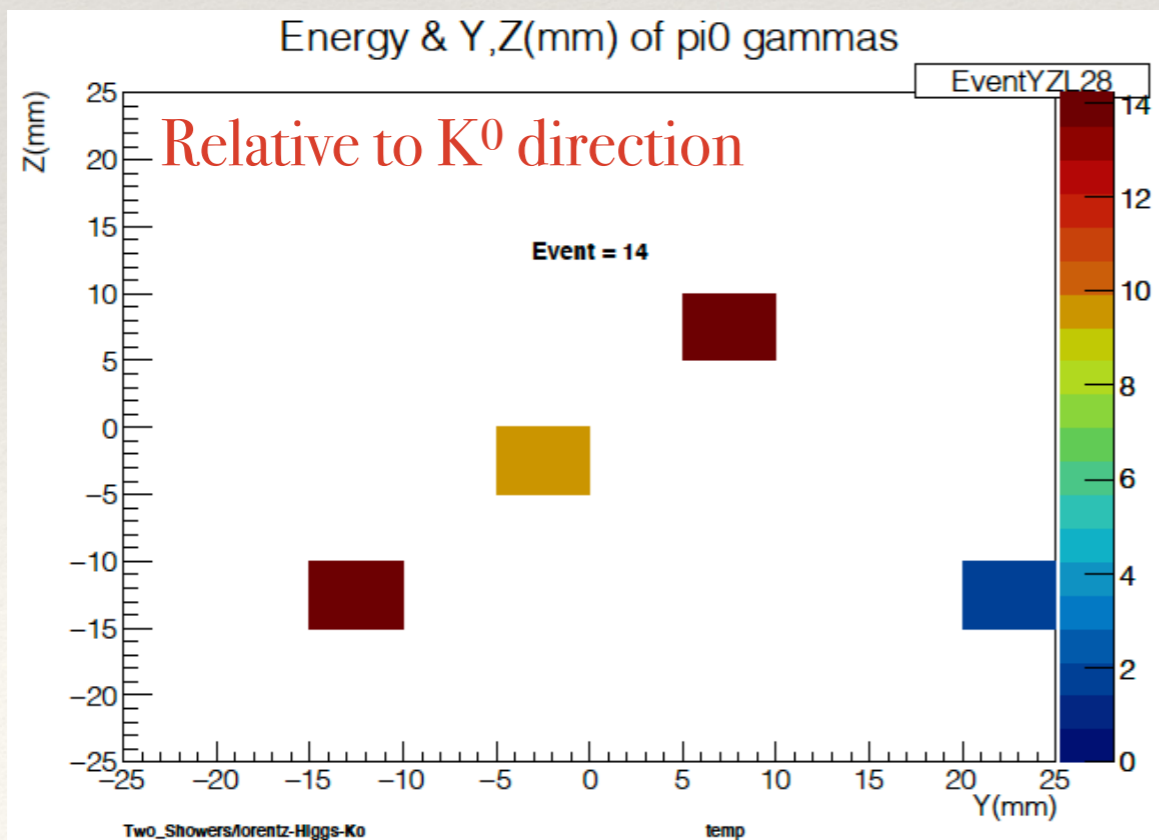
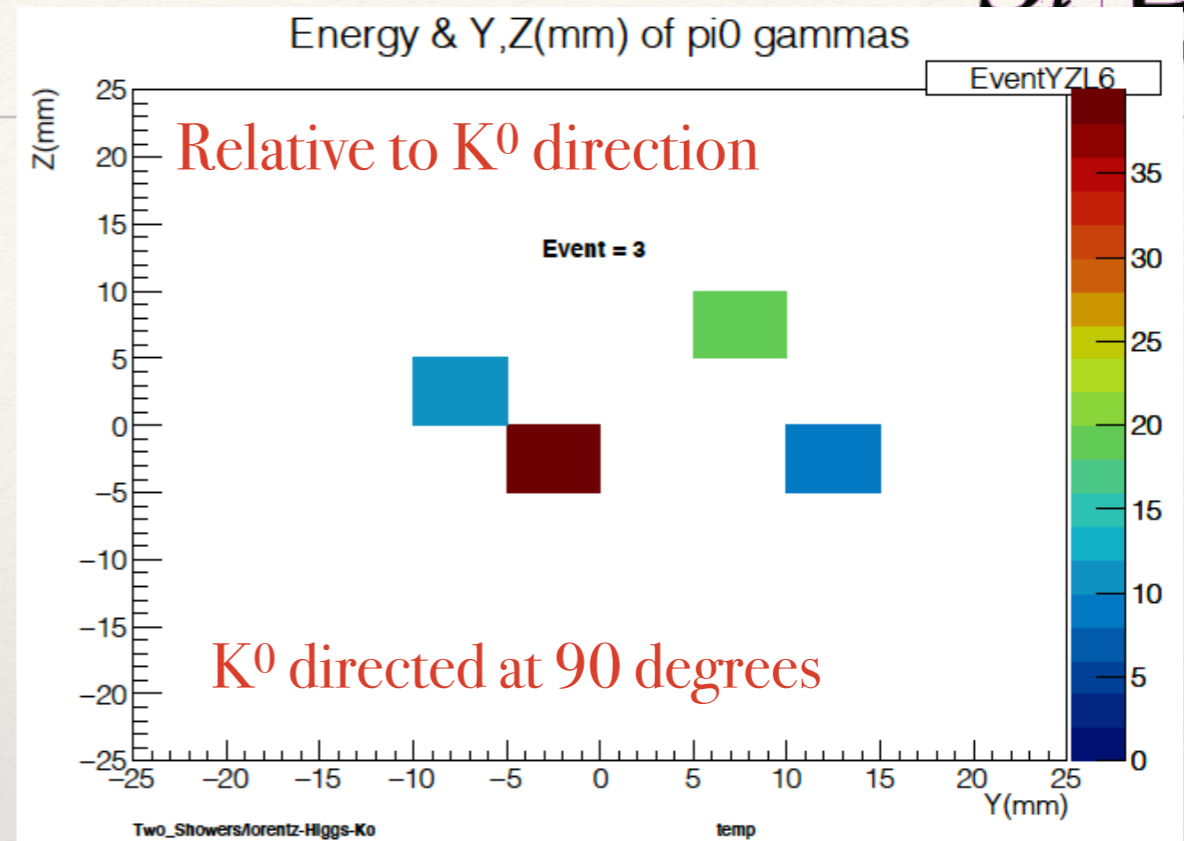
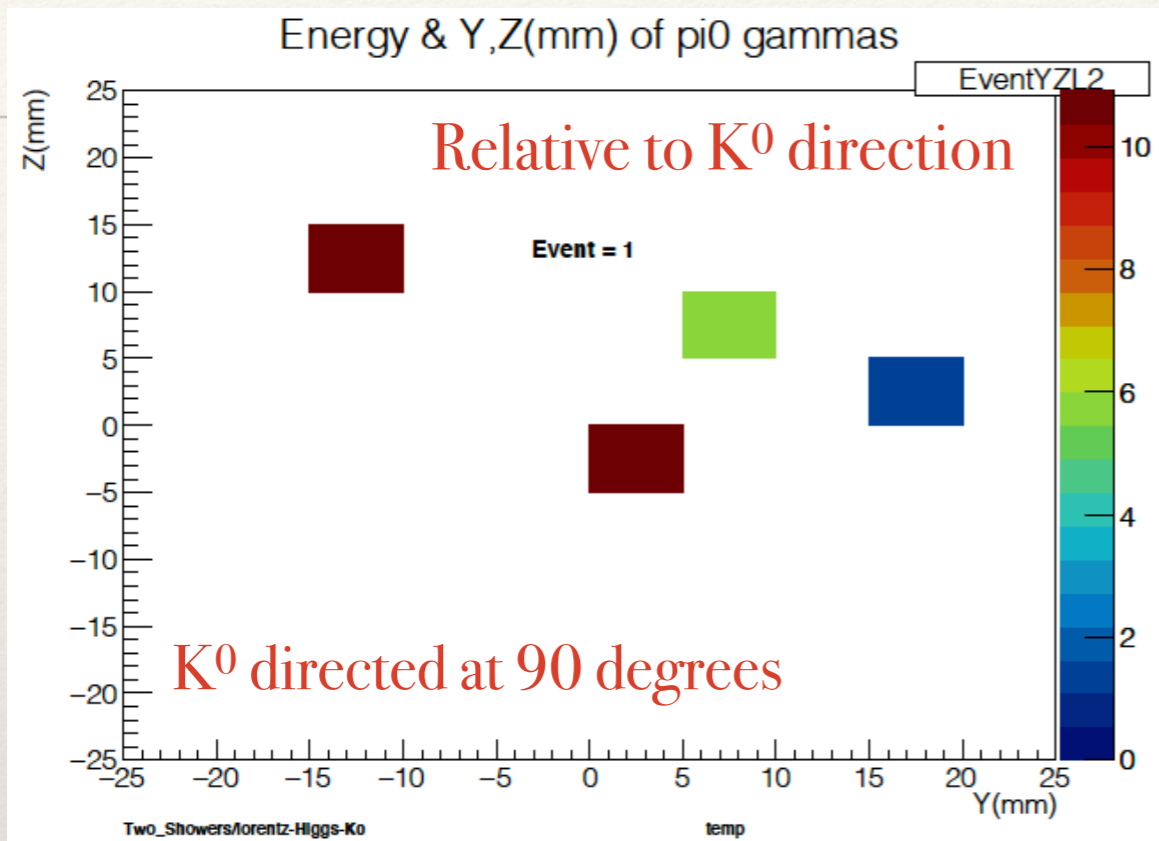
Energy distributions



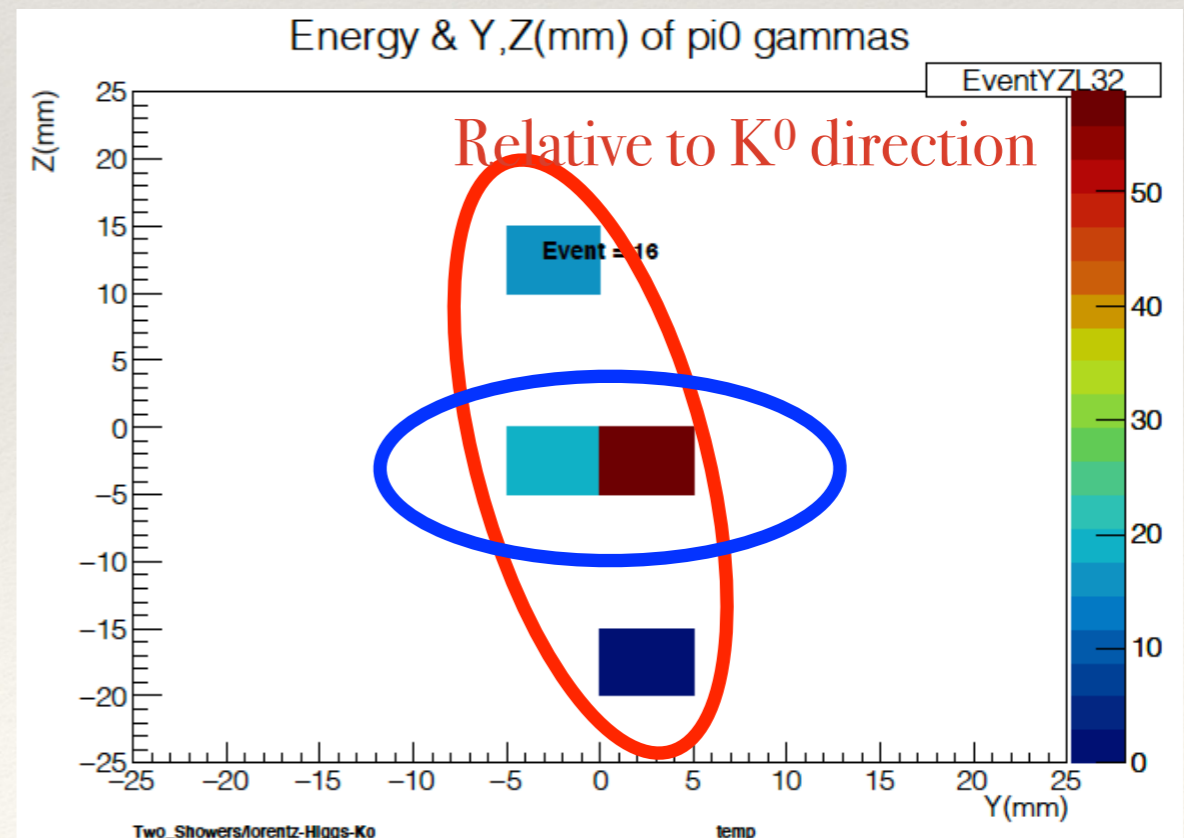
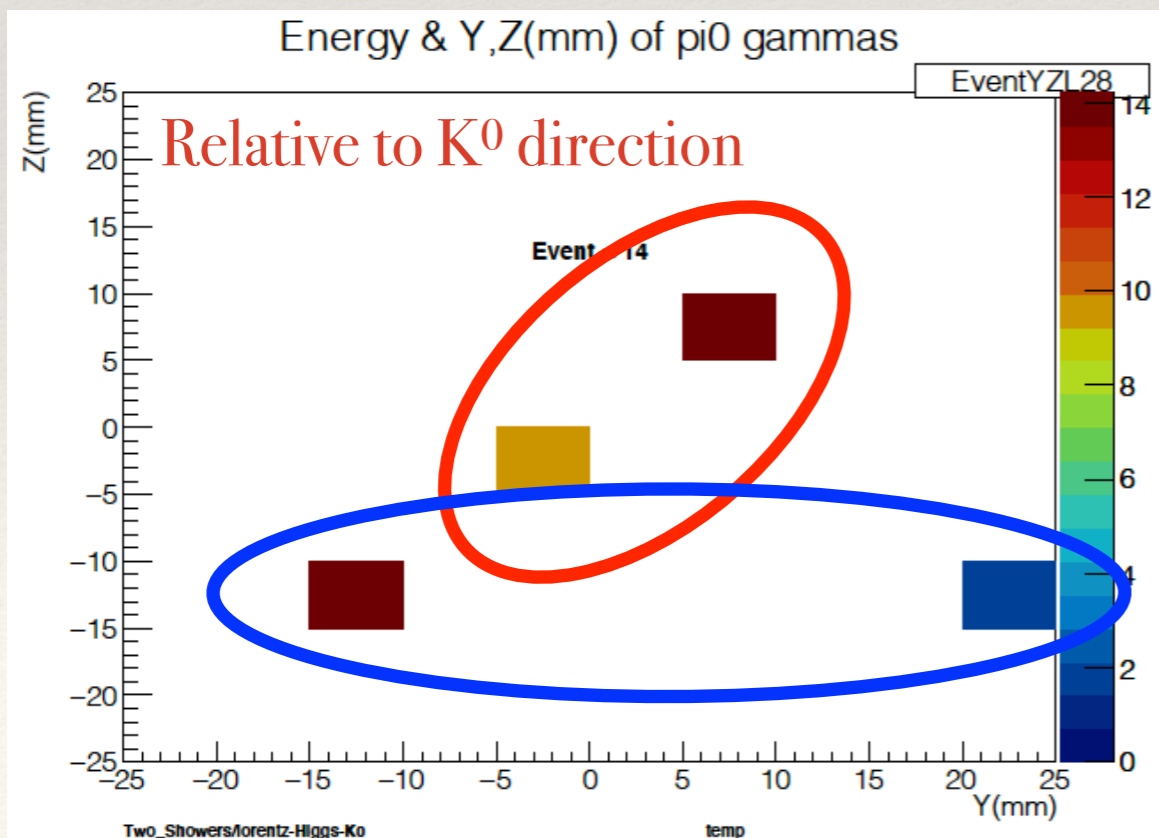
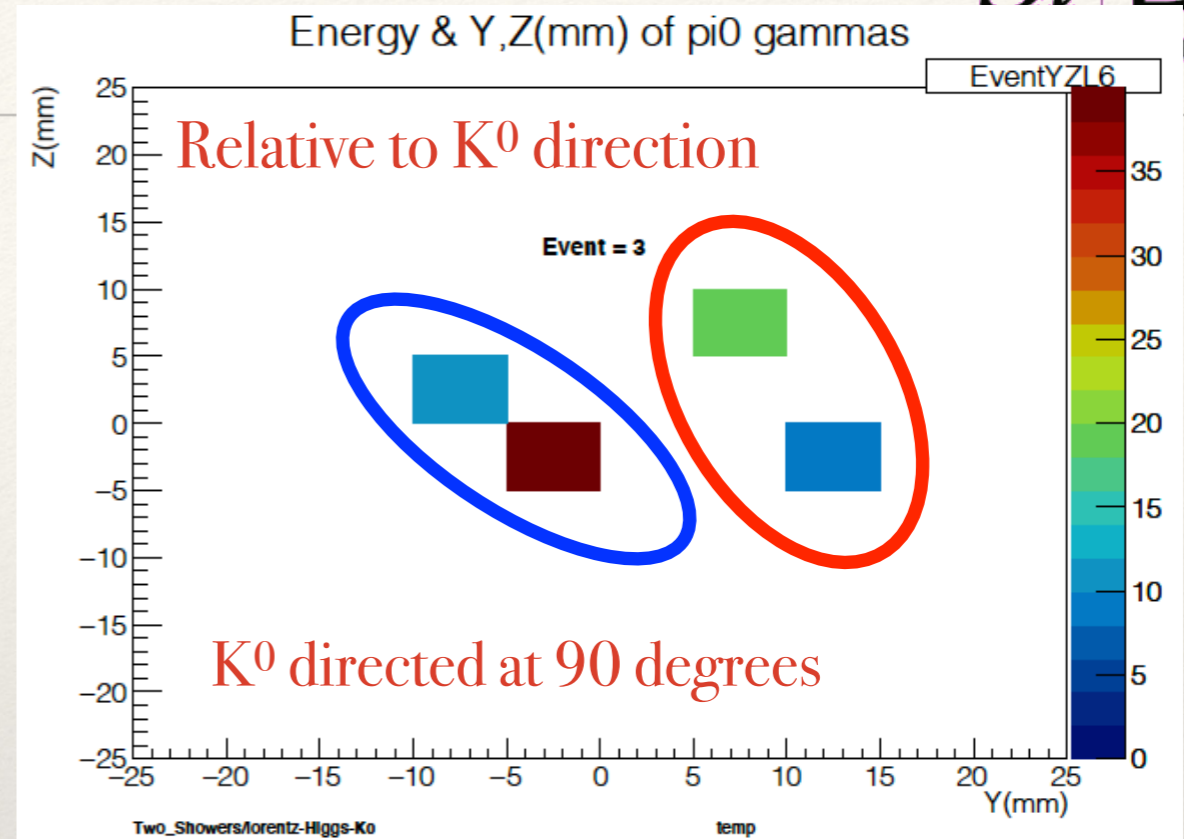
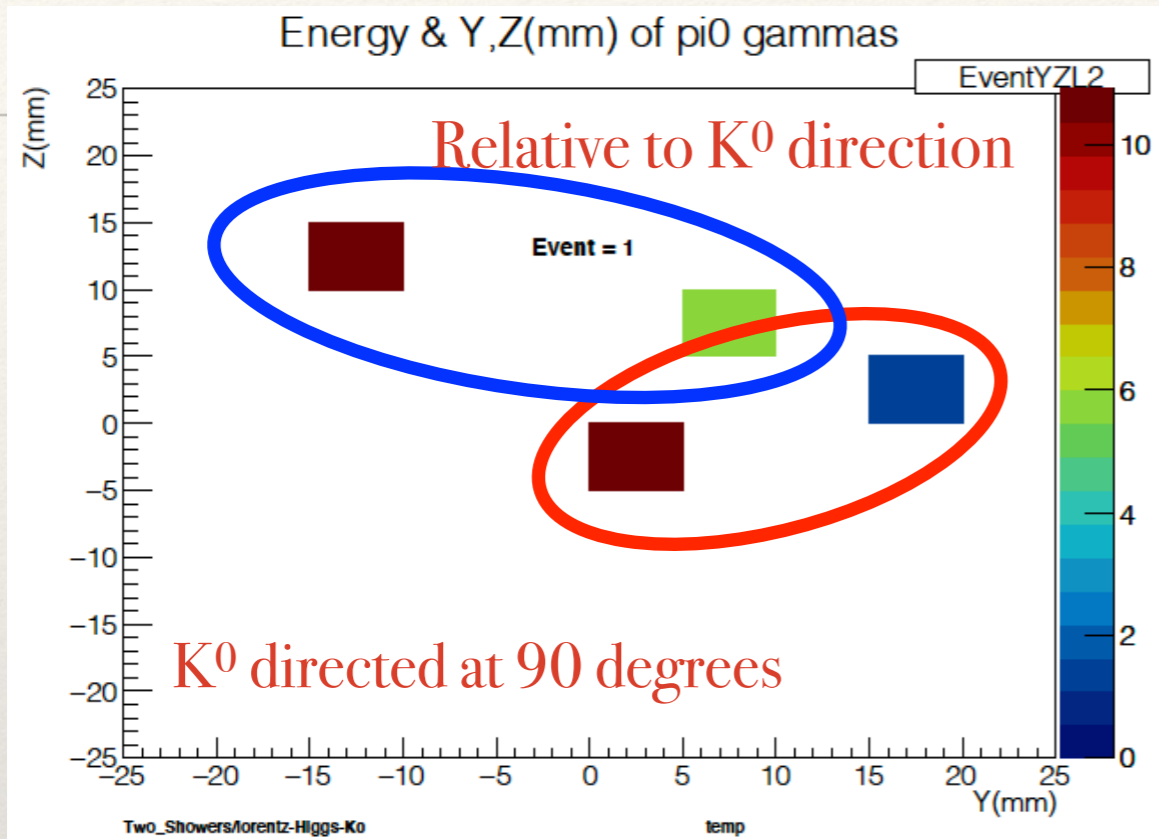
at 250 GeV



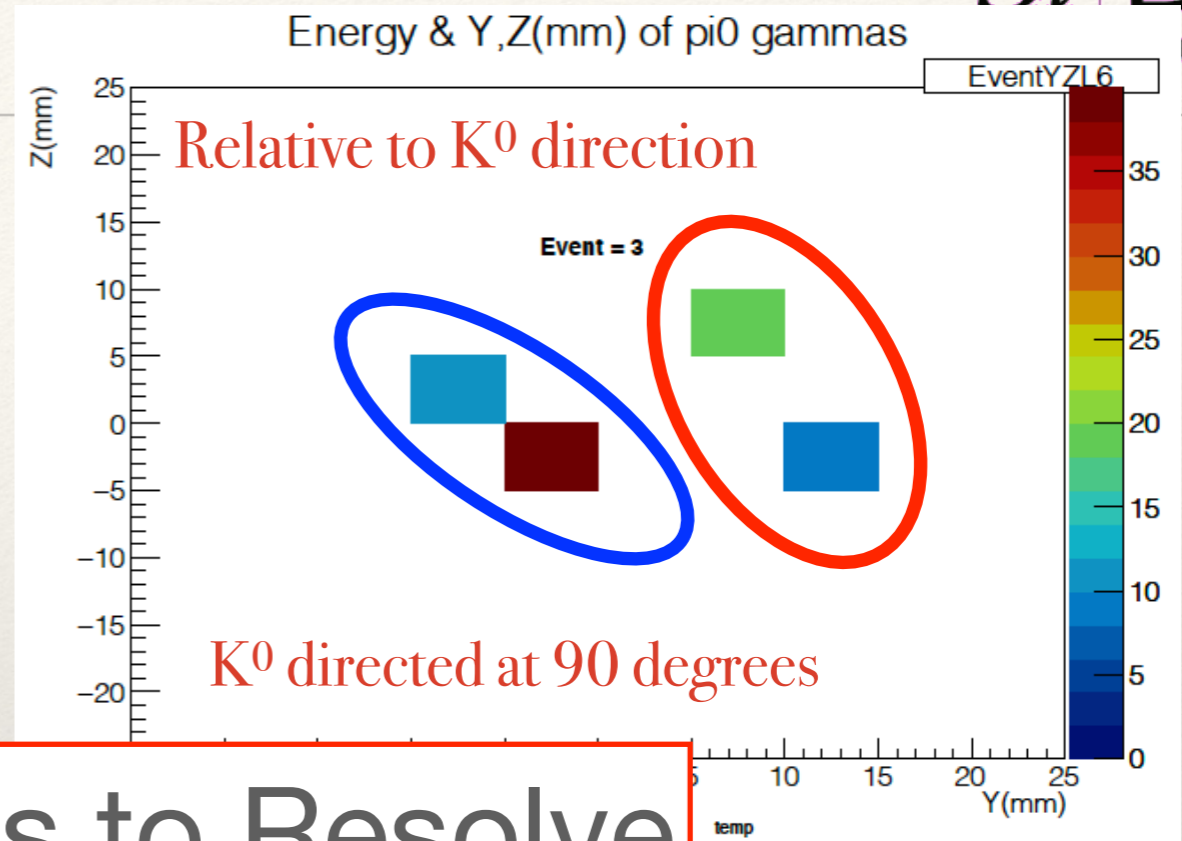
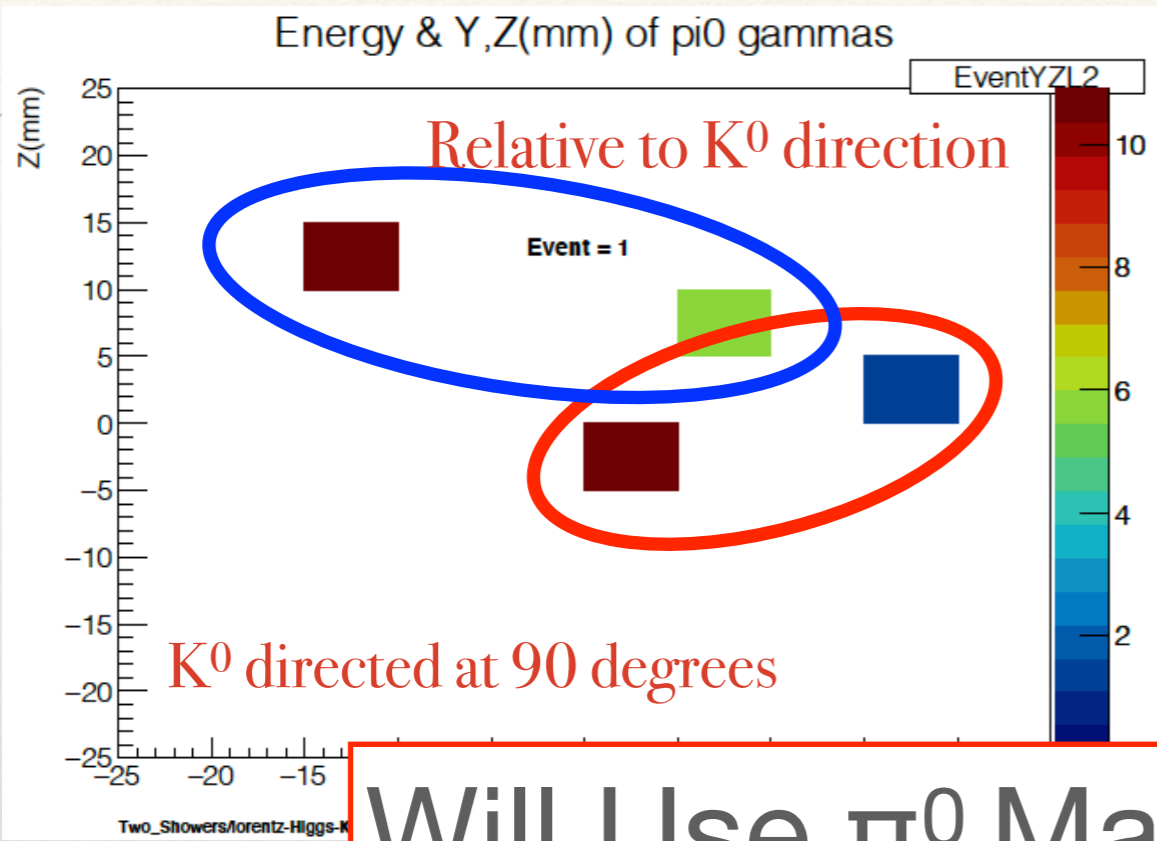
Y,Z (mm) of γ s with Energy (color)



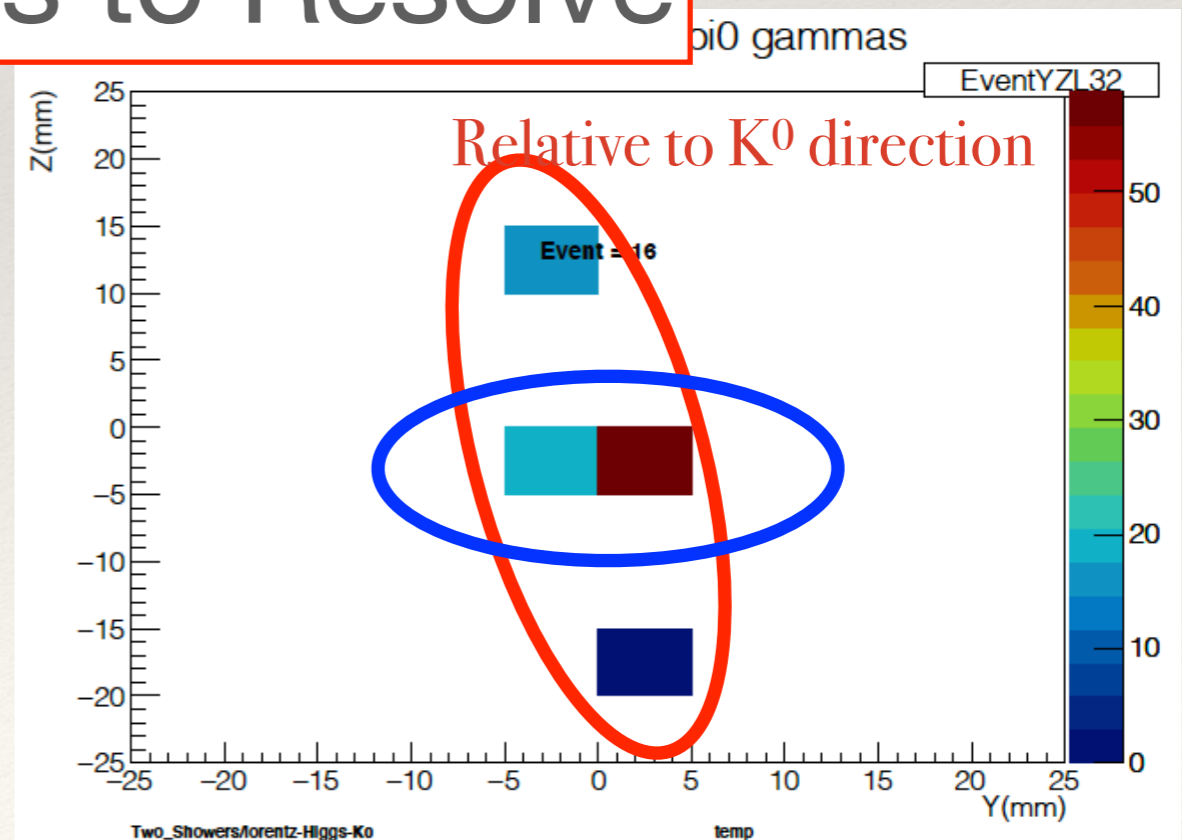
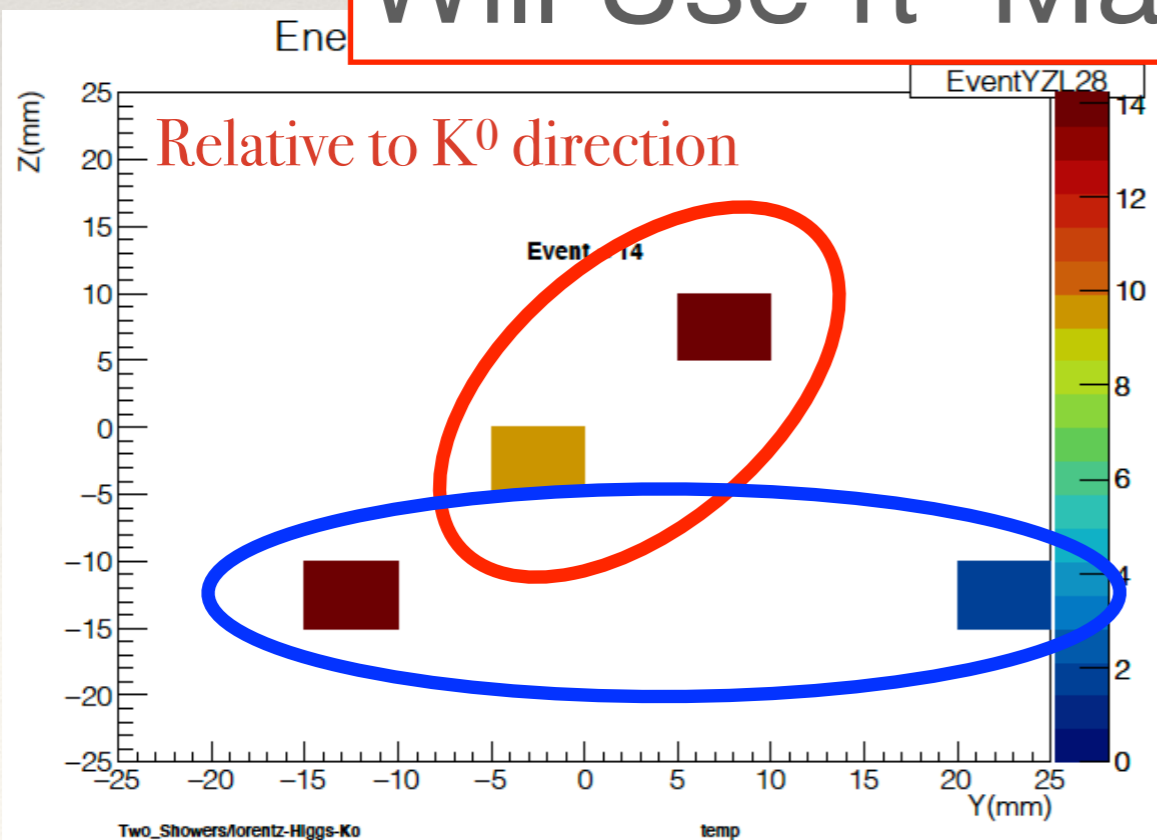
Y,Z (mm) of γ s with Energy (color)



Y,Z (mm) of γ s with Energy (color)

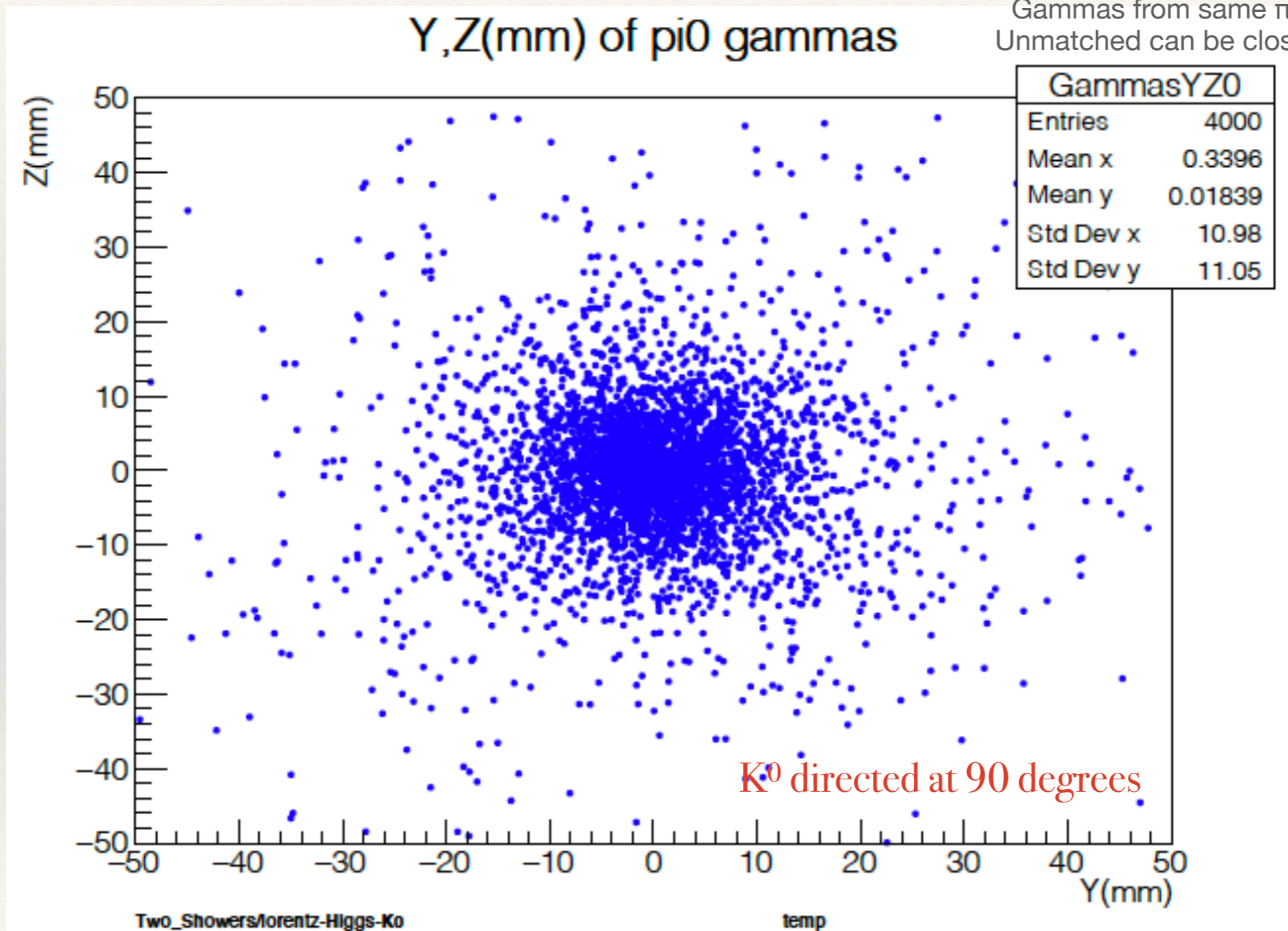


Will Use π^0 Mass to Resolve



Y,Z of γ s

Gammas from same π^0
Unmatched can be closer

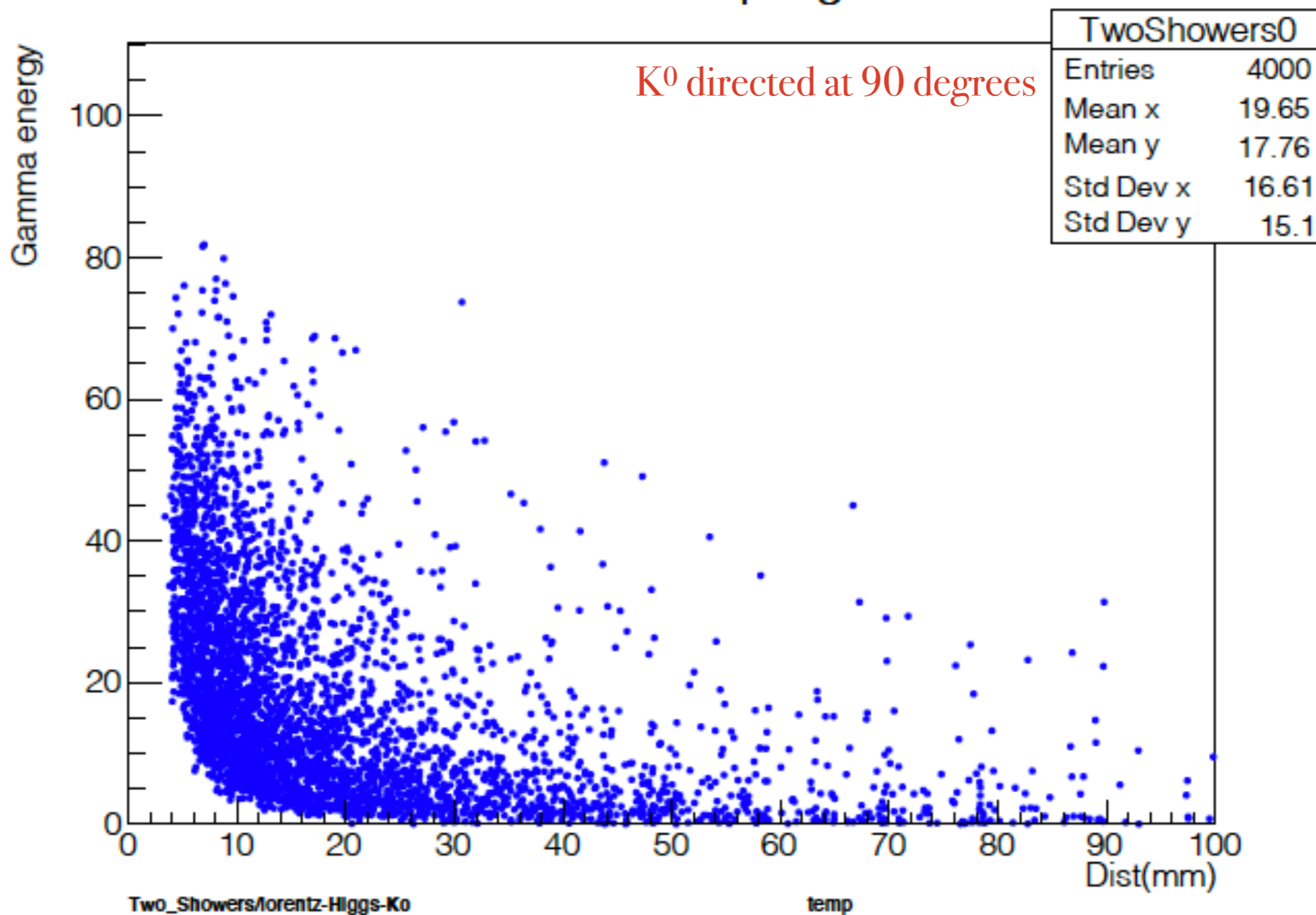


Relative to K^0 direction

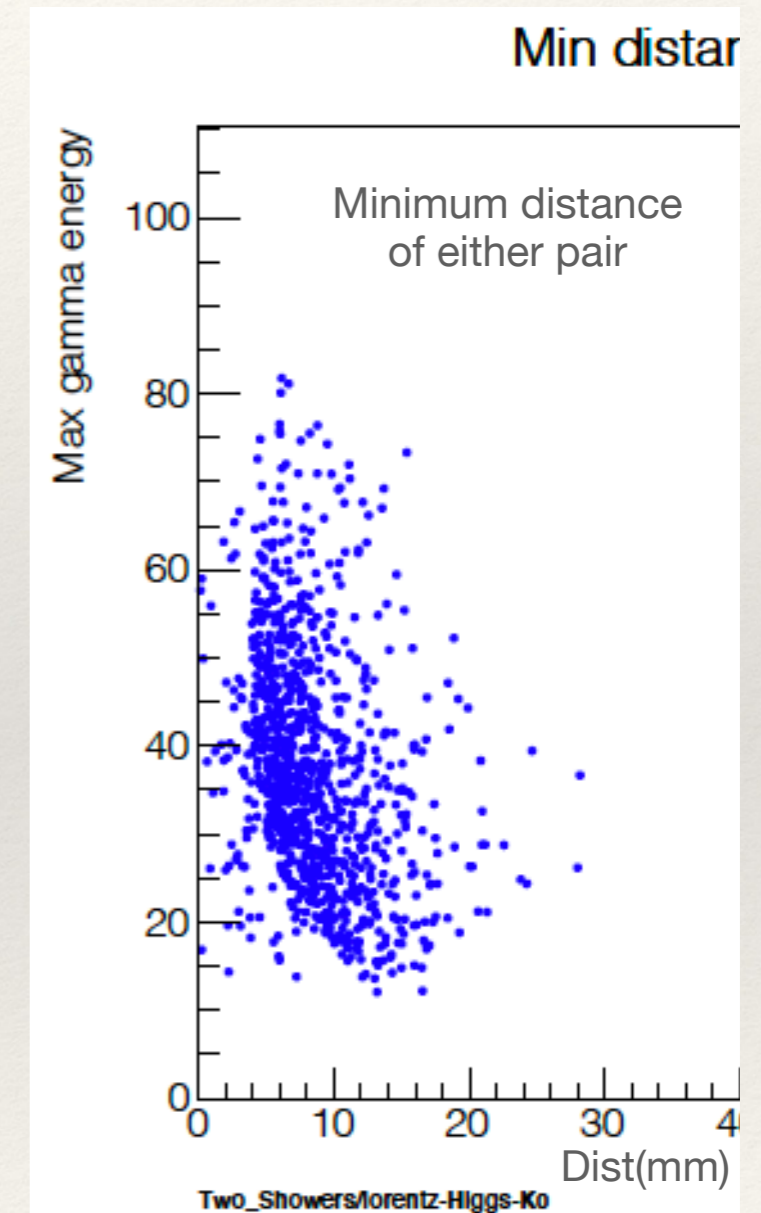
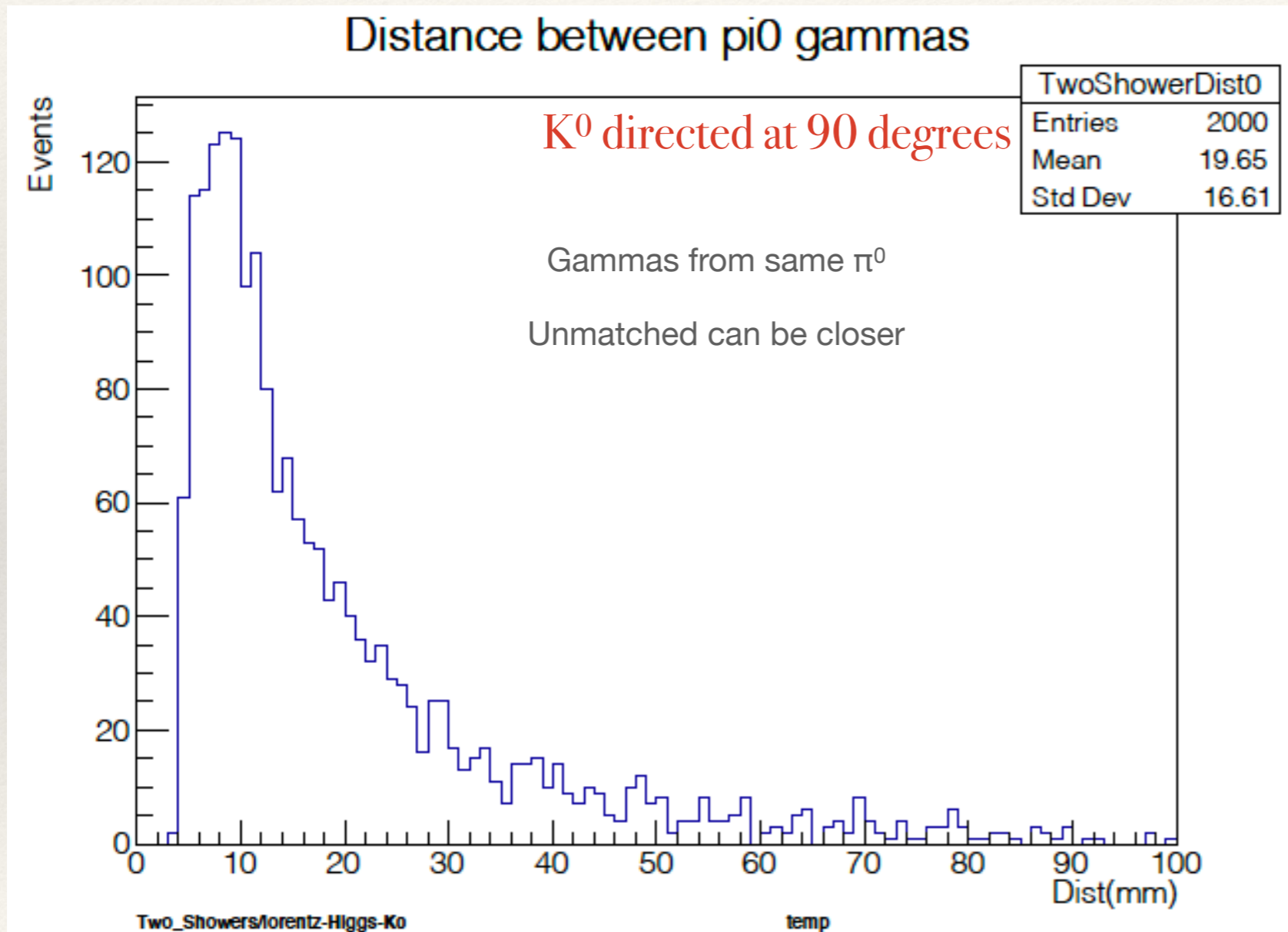
Distance between γ s



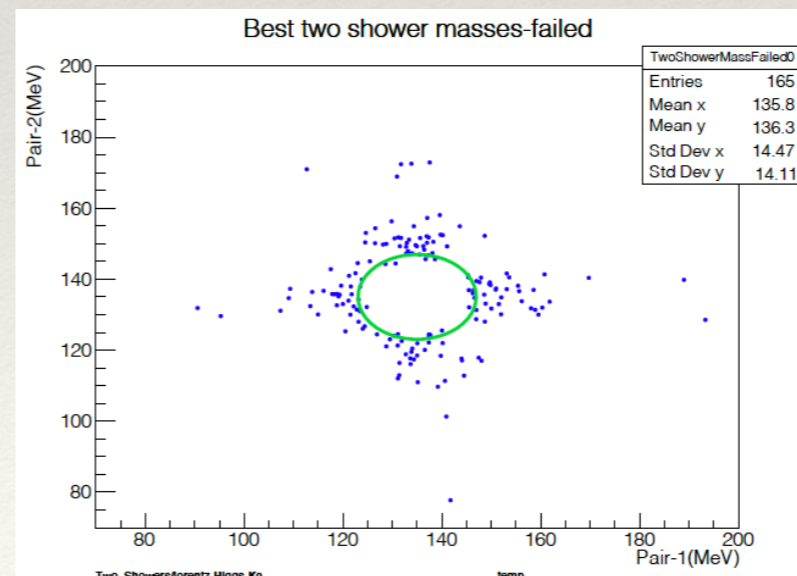
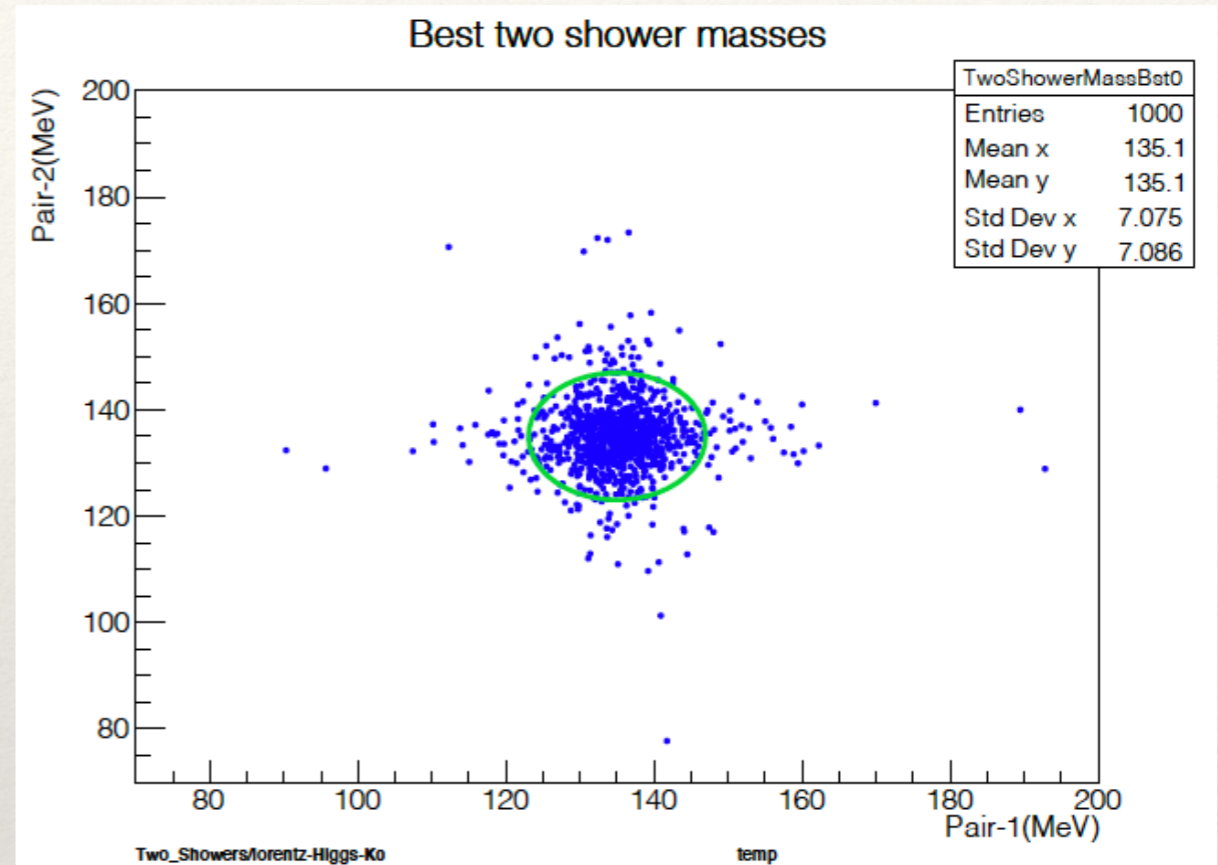
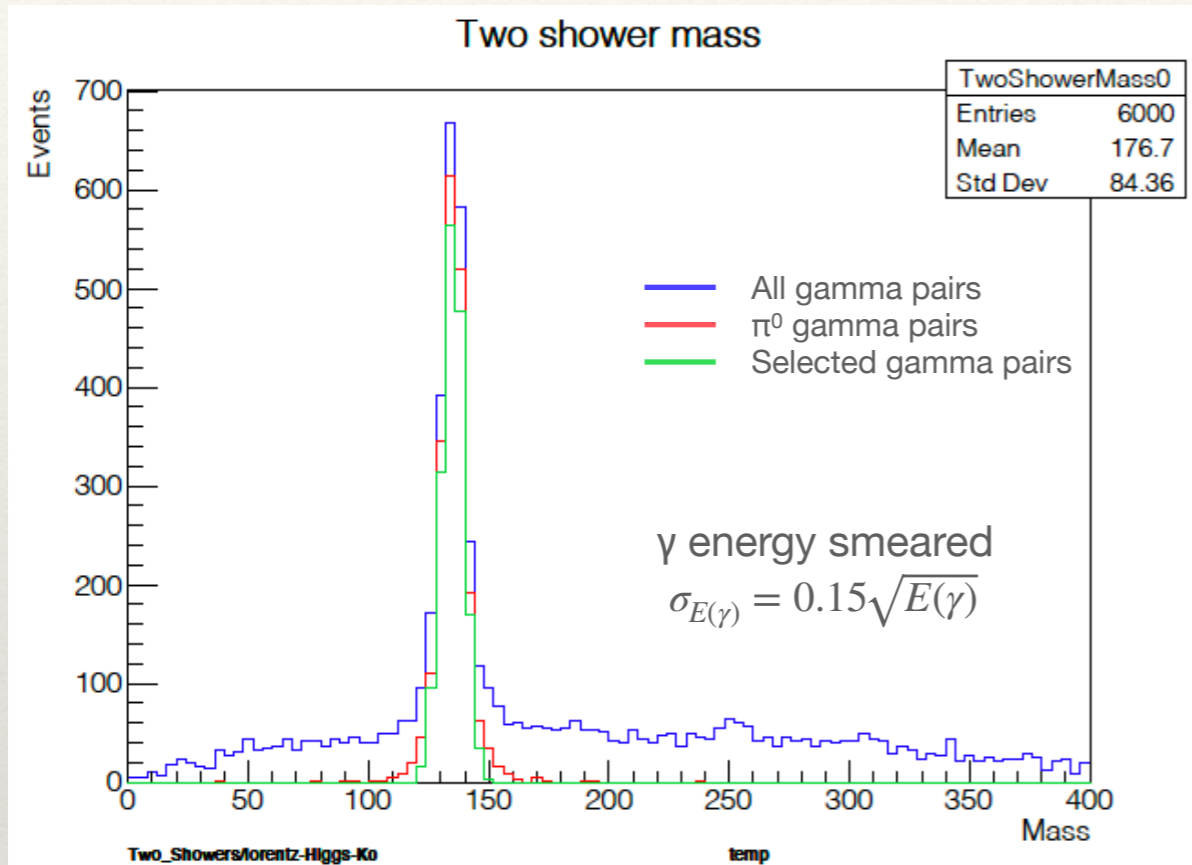
Distance between pi0 gammas



Distance between γ s



π^0 reconstruction

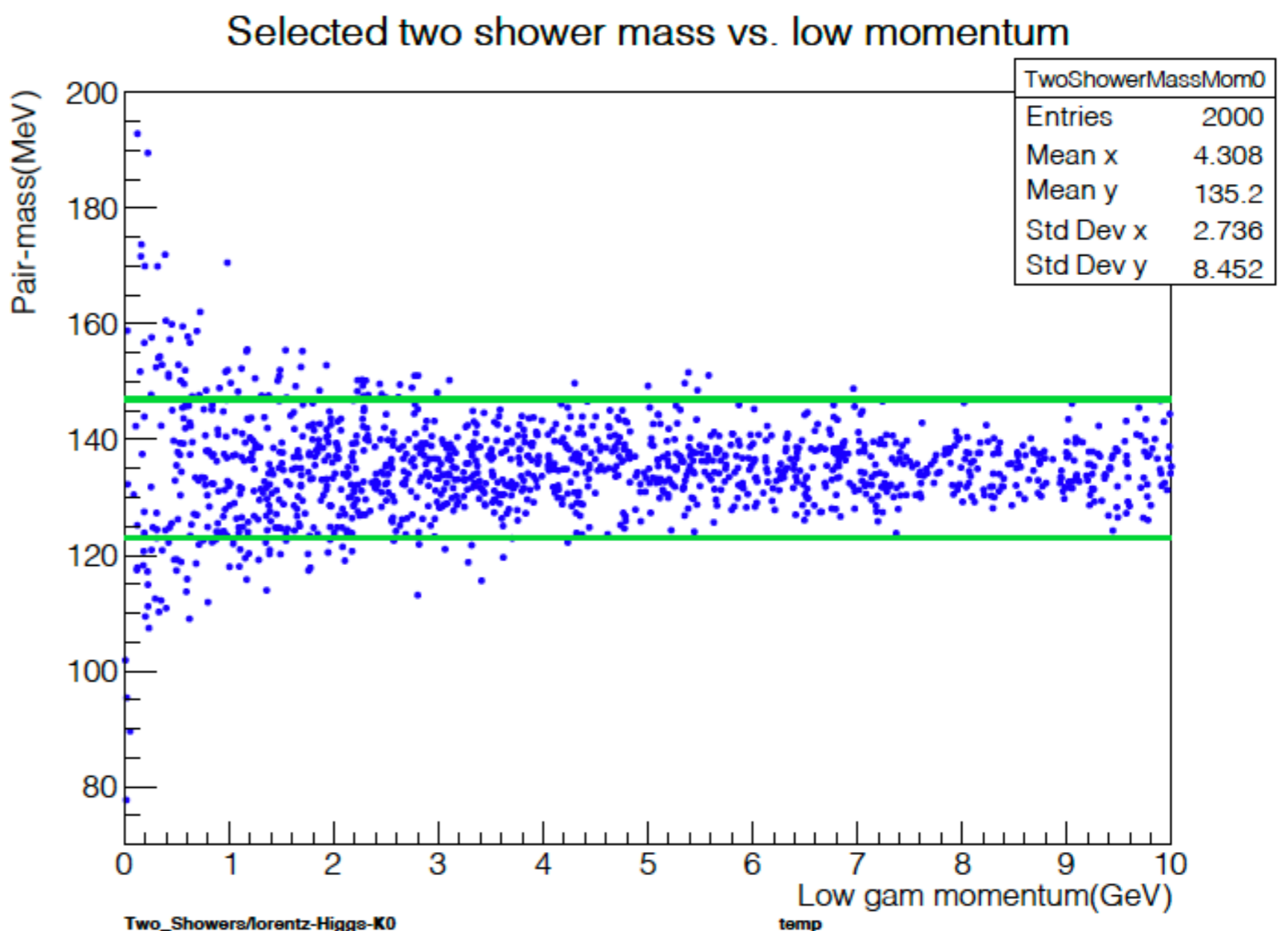
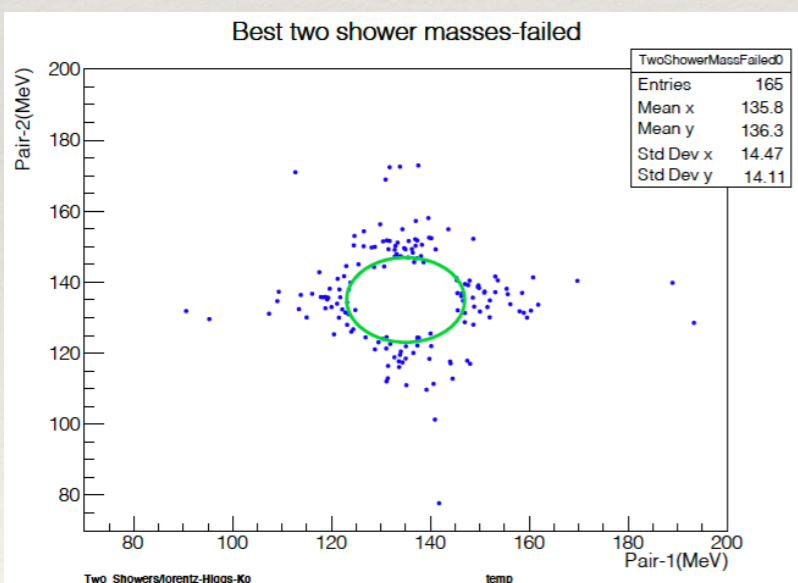


- ❖ Gamma selection:
 - ❖ $\text{Min } (m_{1\gamma\gamma}-135)^2 + (m_{2\gamma\gamma}-135)^2$
 - ❖ MeV units
 - ❖ $< 10,000 / E_{K0} \text{ (GeV)}$

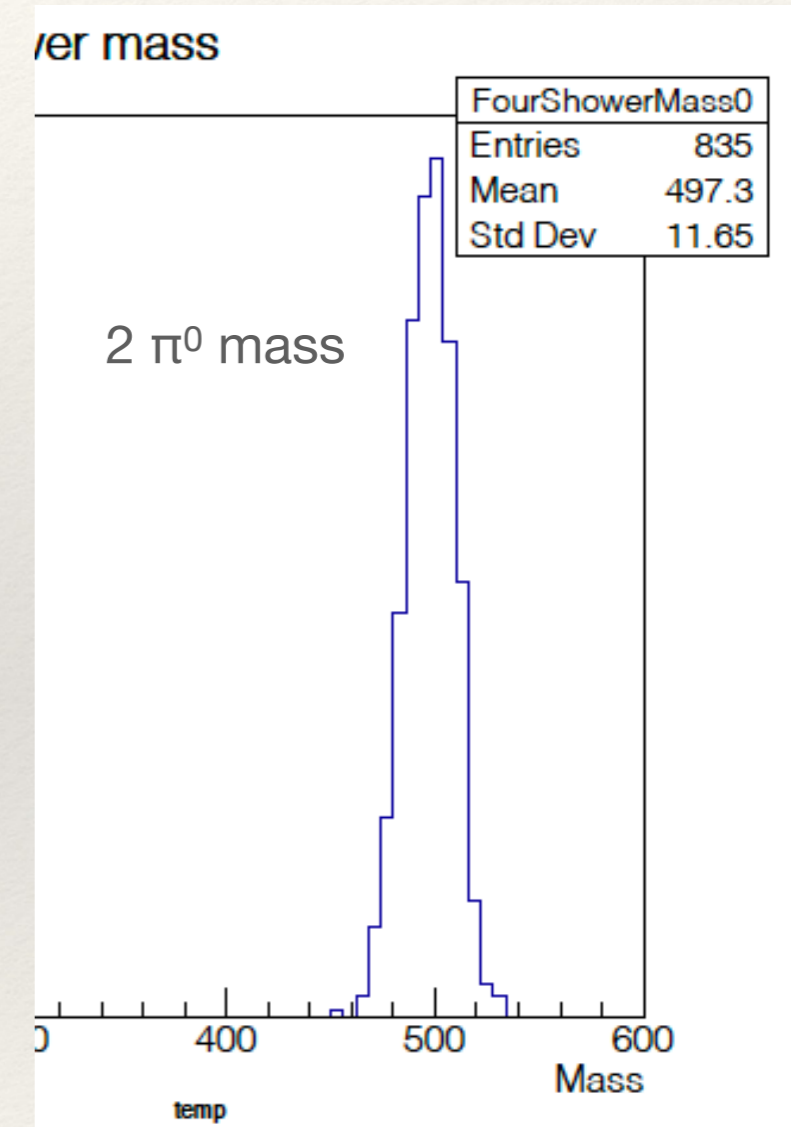
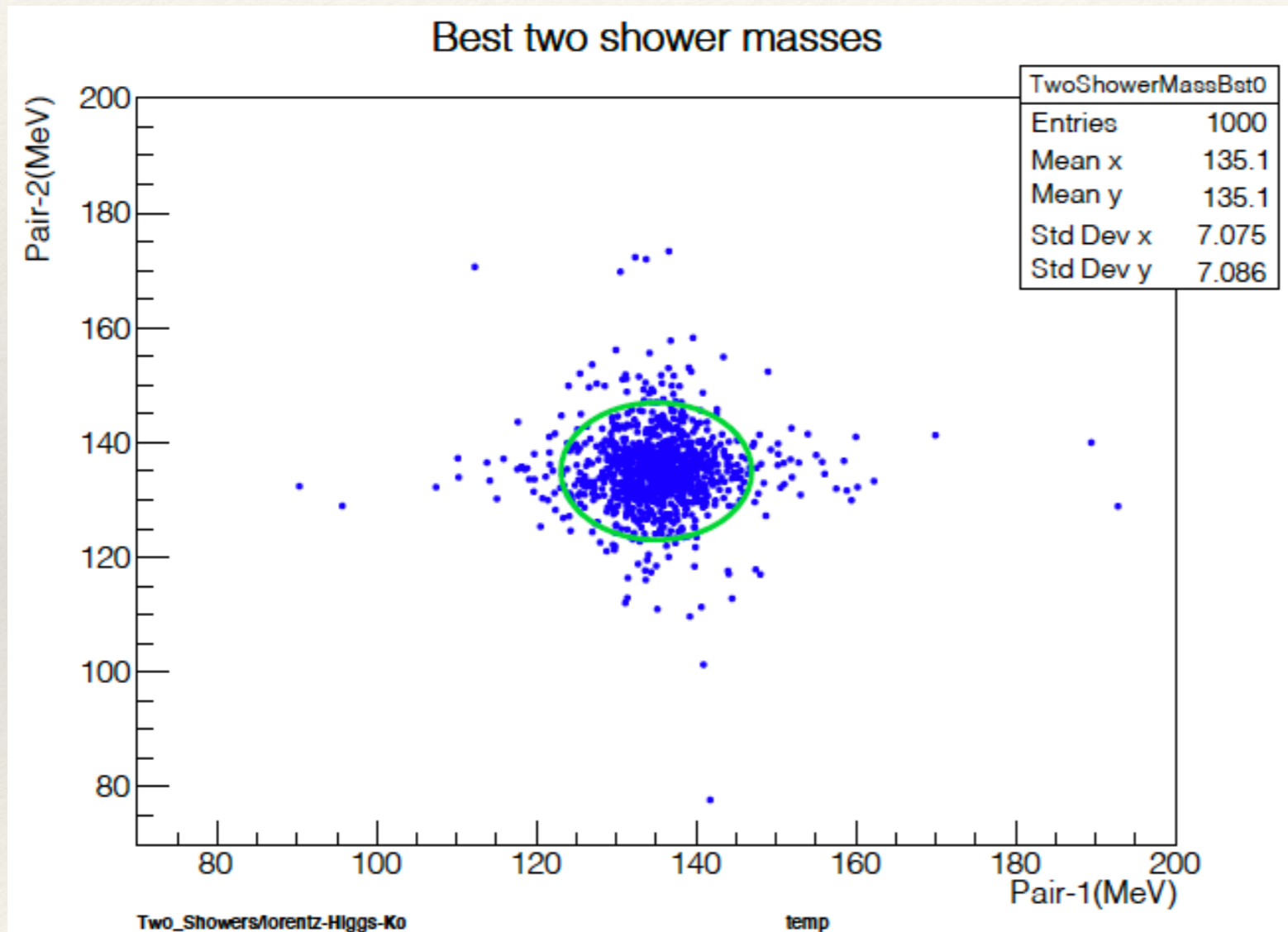
K^0 directed at 90 degrees

Failed γ pairs

- ❖ Gamma selection:
 - ❖ $\text{Min } (m_{1\gamma\gamma} - 135 \text{ MeV})^2 + (m_{2\gamma\gamma} - 135 \text{ MeV})^2$
 - ❖ $< 10,000 / E_{K0} \text{ (GeV)}$



K⁰ reconstruction



Conclusions



- ❖ SiD MAPS Digital ECal provides excellent reconstruction at 250 GeV of $e^+e^- \rightarrow Z^0$ Higgs
 - $\backslash \text{----} \rightarrow K^0 \quad K^0\text{bar}$
 - $\quad \quad \quad \backslash \text{----} \rightarrow \pi^0 \quad \pi^0$
- ❖ 84% K^0 efficiency with mass resolution of 12 MeV or 2.3%
 - ❖ No treatment of inner detector material interactions,
 - ❖ and separations all done at 90 degrees.
- ❖ To come - geant4 simulation of shower reconstruction, and full event treatment.
- ❖ Note - this is a simplified analysis in many ways, but shows potential for measurement.