

Energy resolution and dijet mass resolution

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PFA meeting

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Motivation

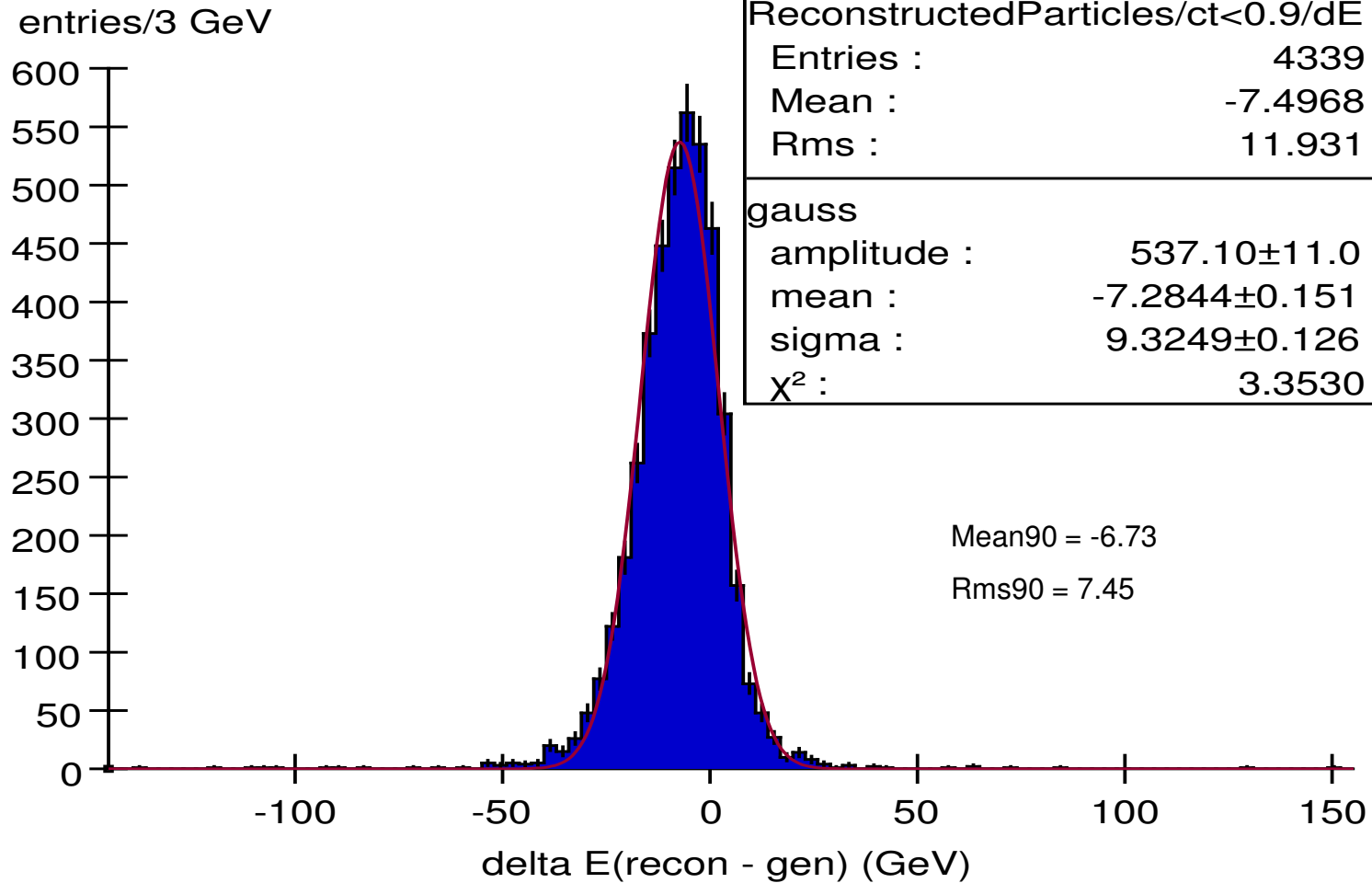
- Jet energy resolution seems to be the “holy grail”.
- Dijet mass resolution is more closely related to physics output.
- Better jet energy resolution => better dijet mass resolution ?? Not always.
- Can we understand this

Event sample

- $ZZ \rightarrow qq\nu\nu$ at 500 GeV E_{cm} .
- Bypass jet finding errors, combinatorics, neutrinos.
- $\langle \text{Generated event energy} \rangle$ (excluding neutrinos) = 221 GeV

- Start with sid02, and reconstruct the events with the LOI PFA.

ZZ->qqnunu: LOI recon: delta E, ct<.9

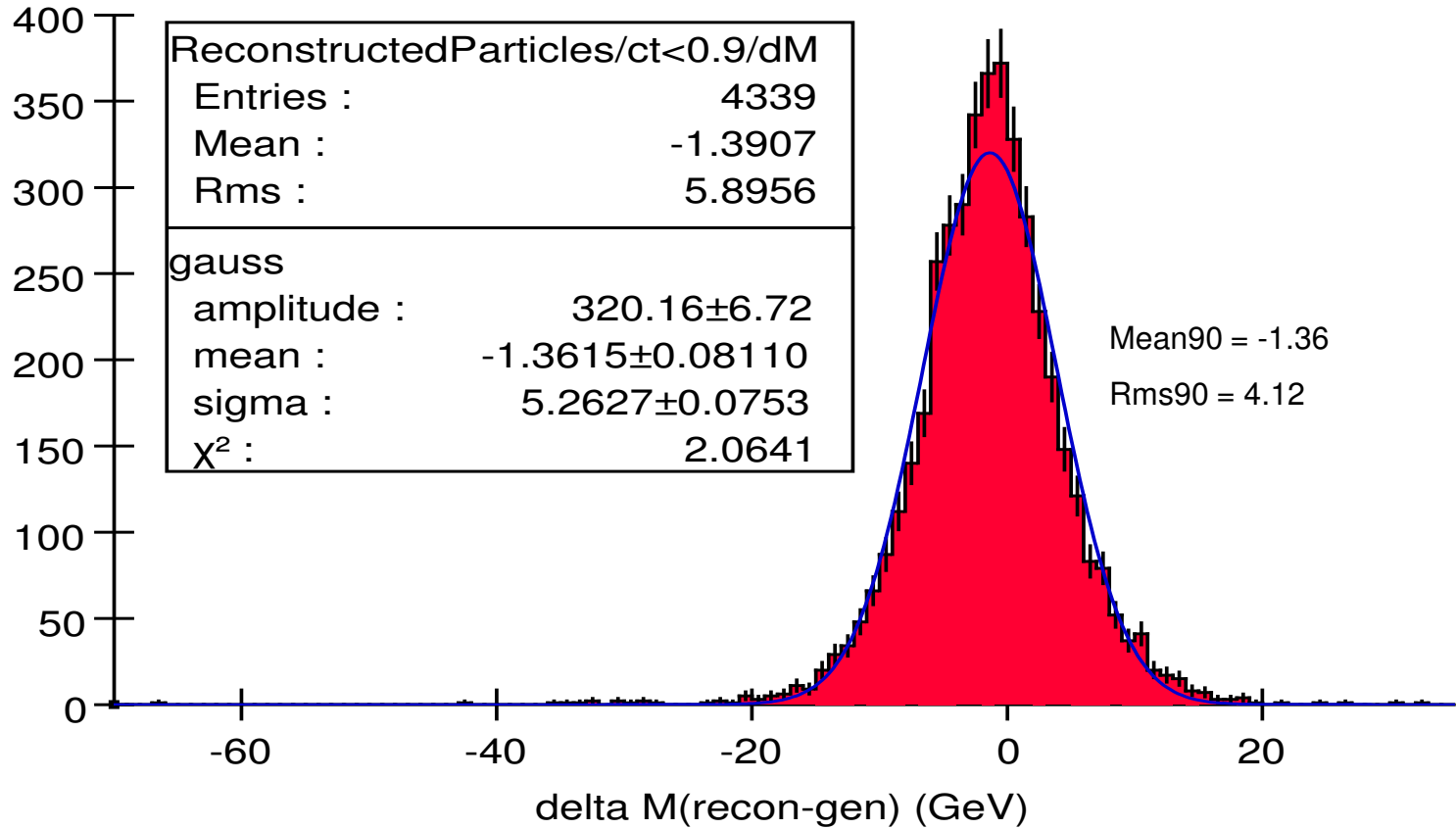


From gaussian fit: $\sigma/E = 4.37\%$

$\sigma_{90}/E = 3.48\%$

ZZ->qqnunu: LOI recon: delta M, ct<.9

entries/1 GeV

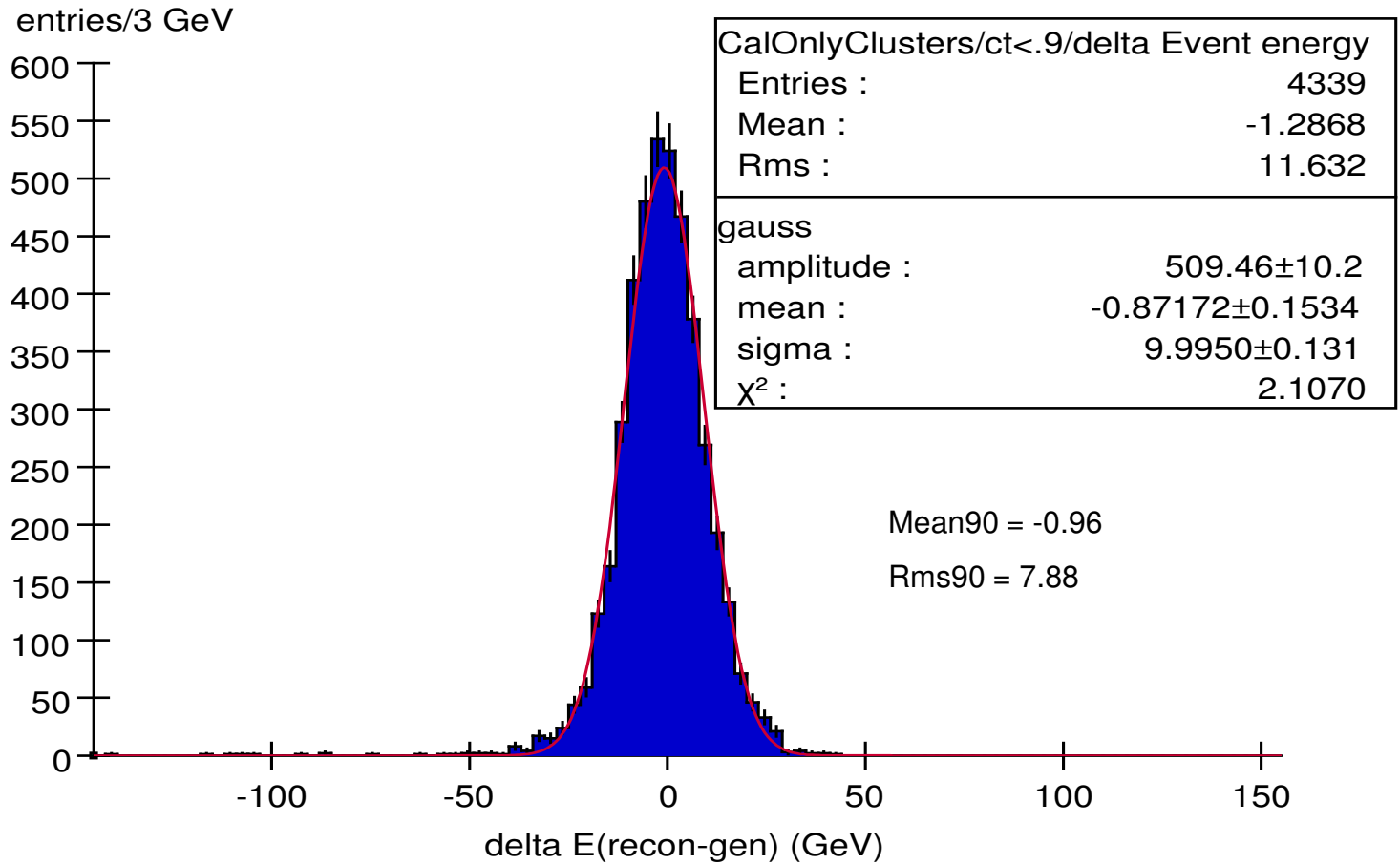


From gaussian fit: $\sigma/M = 5.86\%$

$\sigma_{90}/M = 4.59\%$

- Use the same events, same detector, but do the reconstruction using only the calorimeters
- Cluster ReconstructedParticles: Use DT clusterer, make cores from clusters ≥ 10 hits, add energy of clusters < 10 hits to nearest core, add muon hits to nearest core, make massless particles from cores.

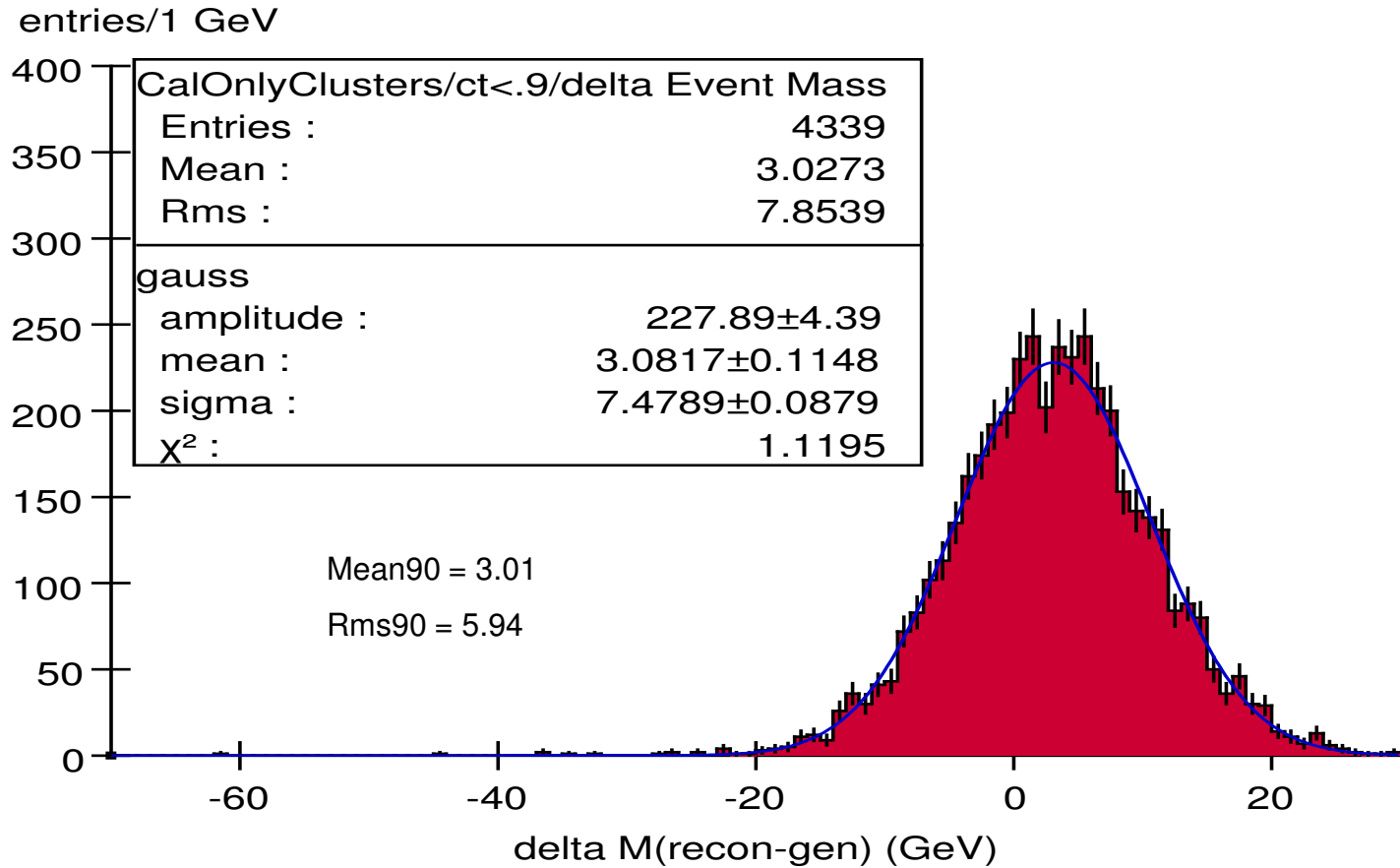
ZZ->qqnunu: Cluster recon: delta E, ct<.9



From gaussian fit: $\sigma/E = 4.56\%$

$\sigma_{90}/E = 3.59\%$

ZZ->qqnunu: Cluster recon: delta M, ct<.9



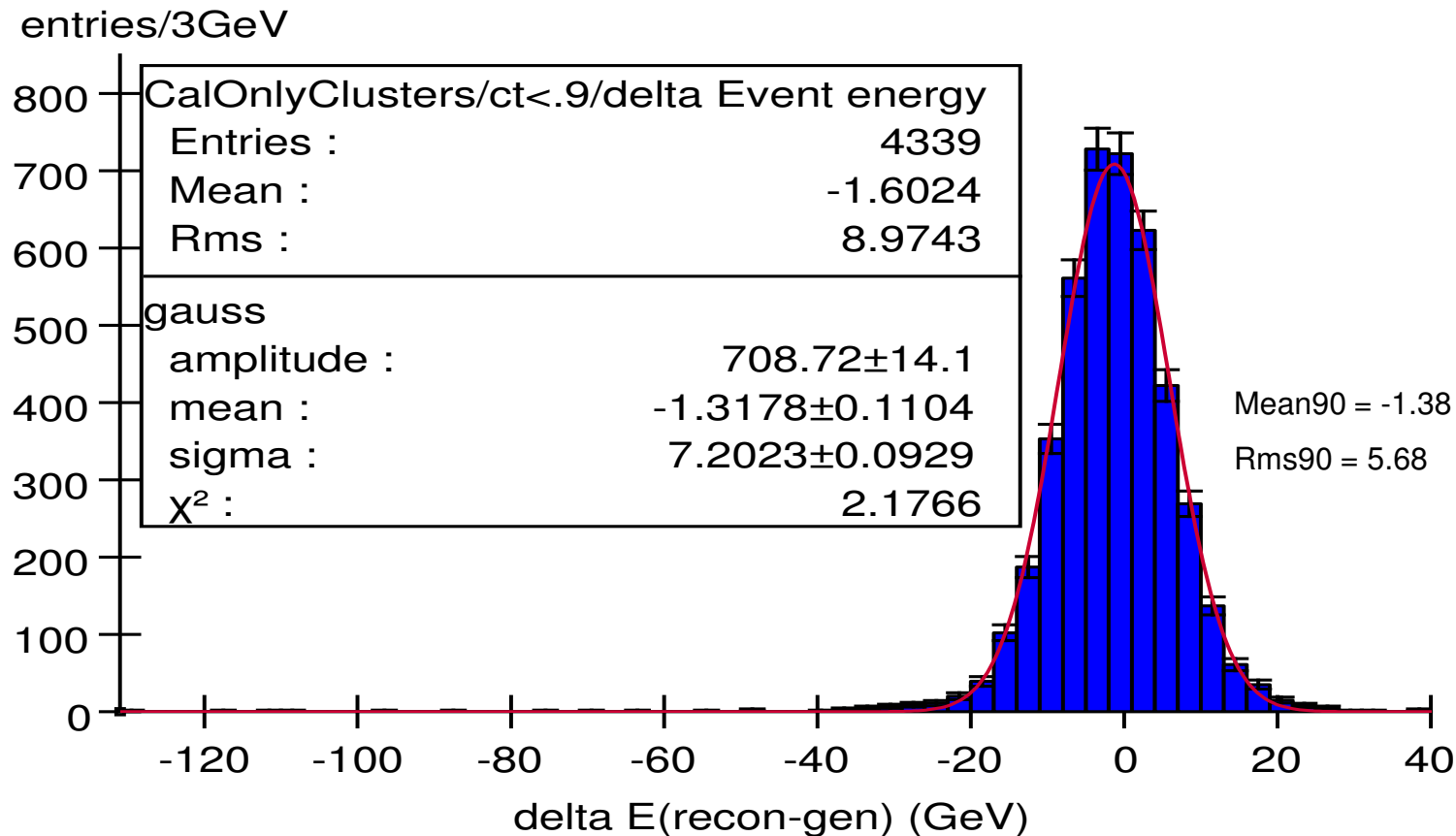
From gaussian fit: $\sigma/M = 7.93\%$

$\sigma_{90}/M = 6.31\%$

sid02_scint

- Don't have PFA results for sid02_scint. Ray?
- From sid01 studies, ~10% better performance with scintillator HCAL
- Do reconstruction with calorimeters only on sid02_scint, same as sid02 only require ≥ 20 hits for a core.

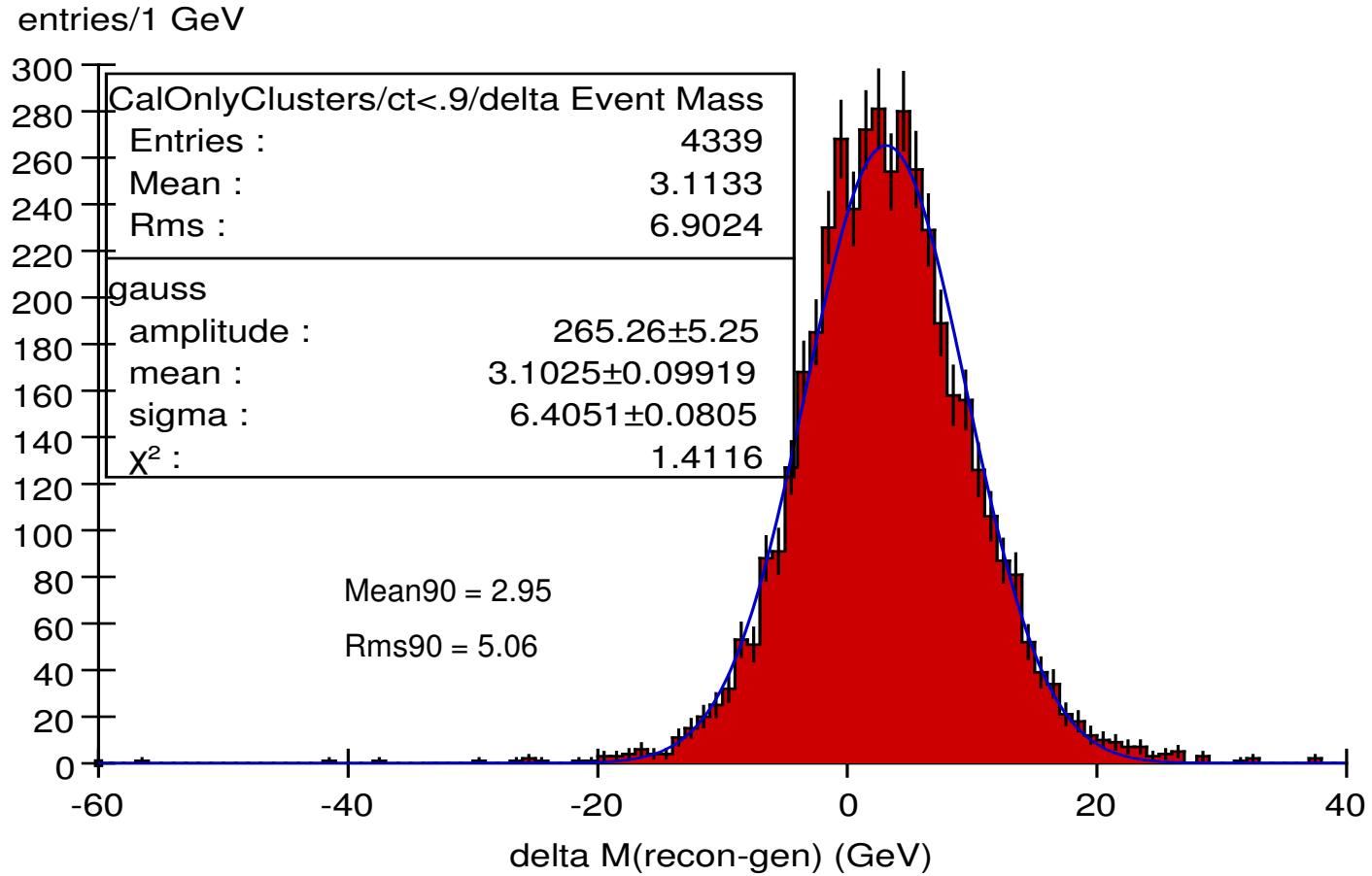
sid02_scint: ZZ->qqnunu: Cluster recon: dE



From gaussian fit: $\sigma/E = 3.28\%$

$\sigma_{90}/E = 2.59\%$

sid02_scint: ZZ->qqnunu: Cluster recon: dM

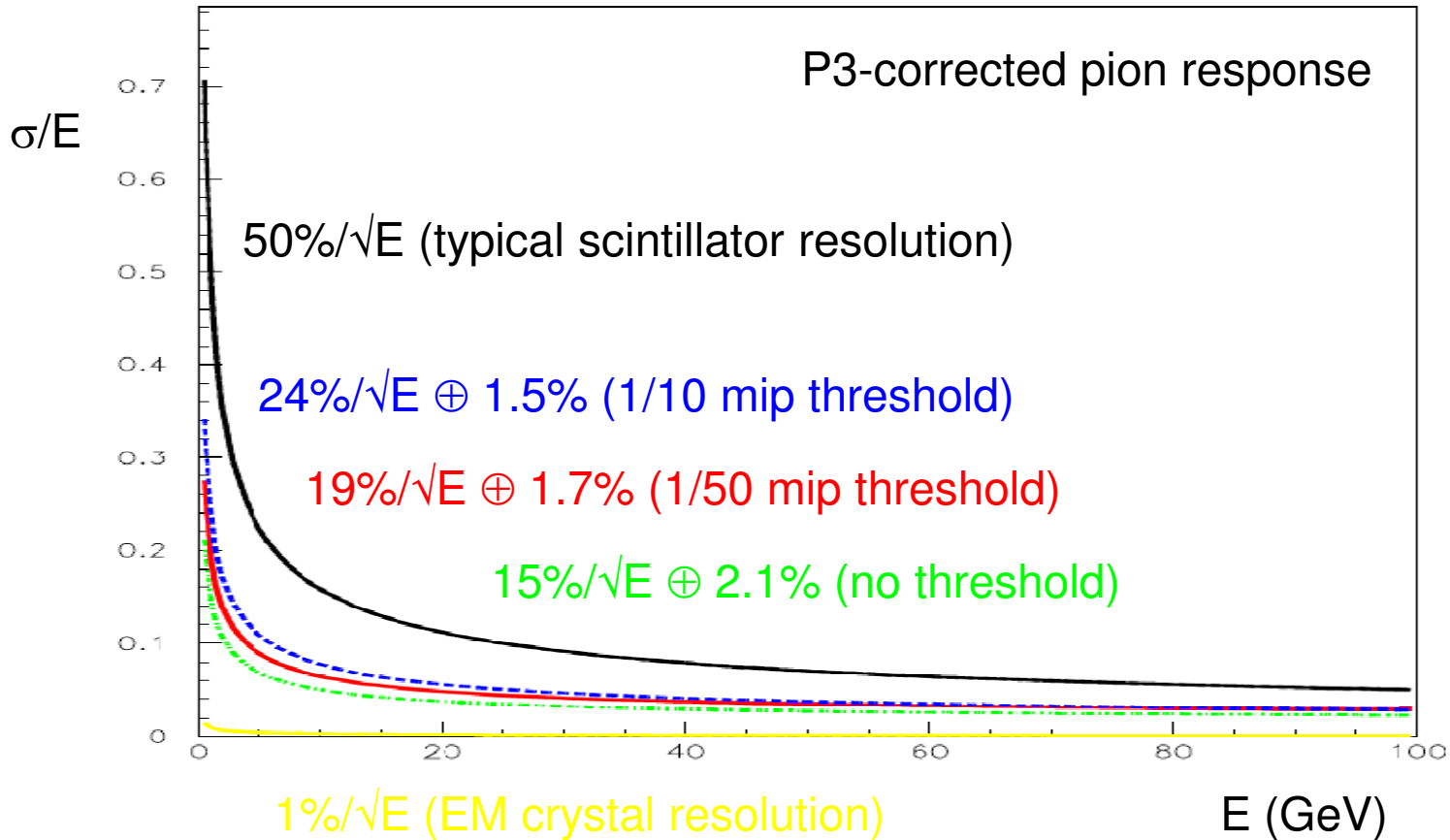


From gaussian fit: $\sigma/M = 6.79\%$

$\sigma_{90}/M = 5.37\%$

- Look at dual readout simulation (from Steve)
- Don't have delta E,M plots. Could try to make some estimates, but should probably wait for the plots.

Resolution fits for single pions



Consistent fits for p1, p2, p3, and p4 corrected pions

Effect of lower thresholds on Particle Flow?

DiJet Mass measurements with C/S, B-field corrections

Cerenkov, Bfield Corrected Dijet Mass

Using MC ΔM

$\sigma/M \sim 0.064$

Ceren Corrected Scin Jet Mass	
Entries :	983
Mean :	84.756
Rms :	11.555
gauss	
amplitude :	122.22
mean :	87.184
sigma :	5.5782
gauss_1	
amplitude :	6.7231
mean :	76.396
sigma :	23.606
sum	
amplitude :	122.22±6.321
mean :	87.184±0.24
sigma :	5.5782±0.2838
amplitude_1 :	6.7231±1.950
mean_1 :	76.396±3.443
sigma_1 :	23.606±4.478
χ^2 :	1.1746

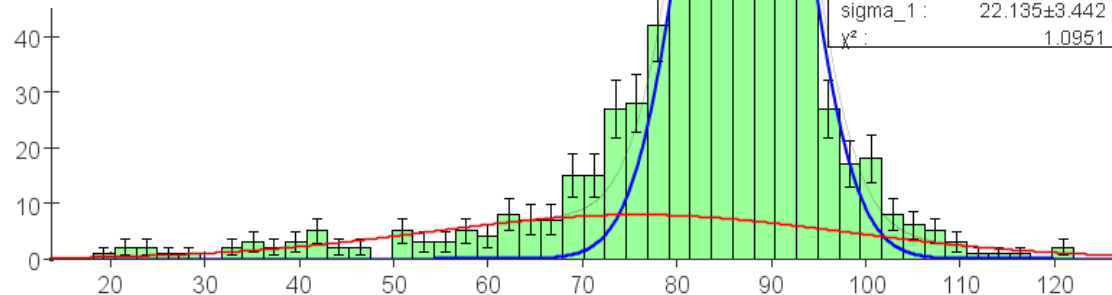
Cerenkov, TrEP Corr Dijet Mass

Using PFA ΔM

$\sigma/M \sim 0.065$

Ceren Corrected Scin Jet Mass	
Entries :	983
Mean :	84.381
Rms :	12.211
NaN :	2
SumOfWeights :	981.00
gauss	
amplitude :	119.87
mean :	87.003
sigma :	5.6835
gauss_1	
amplitude :	7.8957
mean :	75.650
sigma :	22.135
sum	
amplitude :	119.87±6.372
mean :	87.003±0.26
sigma :	5.6835±0.3139
amplitude_1 :	7.8957±2.179
mean_1 :	75.650±3.075
sigma_1 :	22.135±3.442
χ^2 :	1.0951

1/10 mip threshold
 C/S, ΔM (B-field) corrections
 ZZ \rightarrow qq $\nu\nu$ @ 500 GeV



Dual readout

- Delta E plot for these events should blow away sid02.
- Delta M plot will be interesting.

Detector/ Recon	Single gauss $\sigma/\langle E \rangle$	Single gauss $\sigma/\langle M \rangle$	Rms90 $\sigma/\langle E \rangle$	Rms90 $\sigma/\langle M \rangle$
Sid02 LOI PFA	4.37%	5.86%	3.48%	4.59%
Sid02 Cluster	4.56%	7.93%	3.59%	6.31%
Sid02_scint Cluster	3.28%	6.79%	2.59%	5.37%
DR				

Summary

- Would be interesting to understand mass resolution: How much can be recovered from Eflow, field corrections? Why not a more direct correlation with energy resolution?