

Fitter test with ToyMC

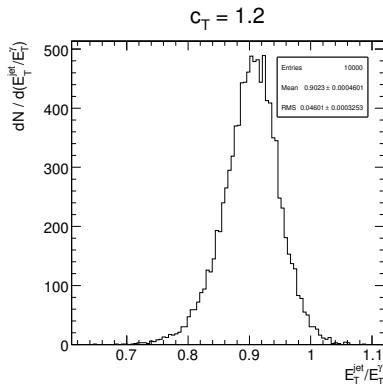
UHH-CMS Jet-Calibration Meeting

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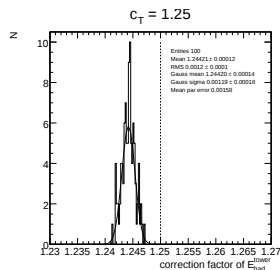
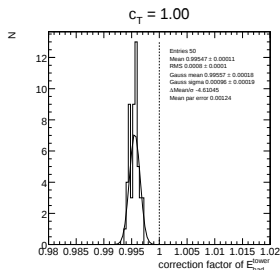
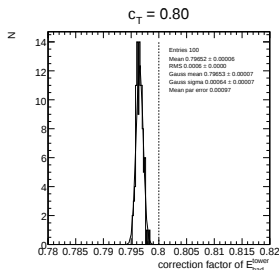
ToyMC γ jet - sample



- $E_{\text{meas}}^{\text{tower}} = \left(\pi^0 + (1 - \pi^0) \left(f_{em} - \frac{1-f_{em}}{c_T} \right) \right) E_{\text{true}}^{\text{tower}}$
- $\pi^0 = 0.25, \bar{f}_{em} = 0.25$: $\langle E_{\text{meas}}^{\text{jet}} / E^\gamma \rangle = \sum \langle E_{\text{meas}}^{\text{tower}} / E_{\text{true}}^{\text{tower}} \rangle = 0.91$

Test setup

- Simplistic parametrization: $E_T^{\text{jet}} = \sum_{\text{tower}} (E_{T,\text{em}}^{\text{tower}} + p_{\text{had}} E_{T,\text{had}}^{\text{tower}})$
- Simplistic calorimeter: same calibration constant for all towers
- Thus one parameter p_{had}



- Generate different ToyMC with same c_T and fit p_{had}
- Width σ of p_{had} -distribution can be compared to parameter error from fit
- $\bar{p}_{\text{had}}$ should equal c_T : about 5σ (0.5%) smaller

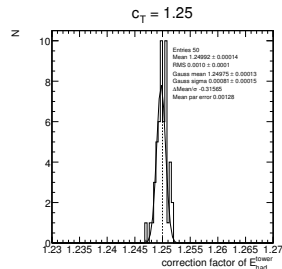
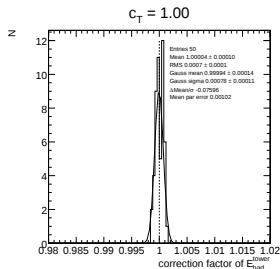
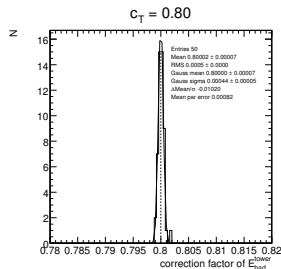
Use 4-vectors

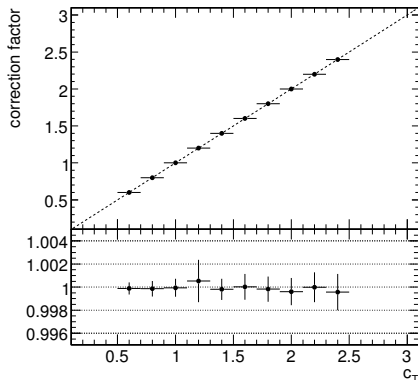
- Jet energy is calculated as scalar sum of the tower E_T :

$$E_T^{\text{jet}} = \sum_{\text{tower}} (E_{T,\text{em}}^{\text{tower}} + p_{\text{had}} E_{T,\text{had}}^{\text{tower}})$$

- Now sum of tower 4-vectors $p^{\text{sum}} = \sum_{\text{tower}} (E^{\text{tower}}, \vec{p}^{\text{tower}})$:

$$E_T^{\text{jet}} = E^{\text{sum}} \cdot \cos \theta^{\text{sum}}$$



c_T -scan

- Improved agreement between c_T and mean fitted parameter
- Deviations well below 0.5σ (0.1%)
- Loss in performance:
 - ▶ Minimization takes ≈ 3 times as long as before (initialization of several `TLorentzVector` objects per χ^2 calculation)
 - ▶ $\chi^2_{\min}$ is 6% larger than before
- Solution: manual summation of $\vec{E}_T$? (also involves trigonometric functions and square roots...)

Backup: performance test

CSA08 γ -jet sample, TStepParametersEnergy, 11 η -bins for tower and jets, symmetric detector (165 parameters), residual scaling 221

Version	Nfcn	time (s)	$\chi^2_{\min}$
TLorentzVector	<u>165</u> , <u>204</u> , 63	1301	150588.763
scalar E_T sum	<u>187</u> , <u>11</u> , 77	415	141701.934