Jet energy correction using weights on calorimeters readout.

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- **All calculations were carried out with CMSIM120**

Calorimeter geometry:
Barrel: ECAL+HB1+HB2+HB3 + tailcatcher
Endcap: ECAL+HE1+HE2+HE3

Calibration constants for HCAL (determined for E_T=50 GeV pions):
Barrel: 118E5,147E5,147E5,150E5
Endcap: 156E5,220E5,220E5

Energy threshold for ECAL:
Barrel: E_T=30 MeV/crystal
Endcap: E=150 MeV/crystal

♦ CALIBRATION PROCEDURE

➨ $q\bar{q}$ were generated with PY2ENT
(generates partons with exact value of ET)
PYSHOW
(enable initial and final state radiation)
PYROBO
(allow to choose exact direction)

➨ jets were found on generation level with simple cone algorythm (PYCELL)

➨ jets were found in calorimeter with modified window algorithm using default calibration coefficient.

➨ **minimisation of functional:**

$$S = \sqrt{\frac{\sum_{1}^{nevent} \langle E_{jet_i}^{rec} - E_{jet_i}^{gen} \rangle^2}{nevent - 1}}$$

was performed for 20 GeV and 100 GeV partons with η=0. and for cone size=0.5 and 0.6.

$$E_{jet_i}^{rec} = \alpha ECAL + \Sigma\beta_j HB_j + \Sigma\gamma_j HE_j$$

⌘ **Obtained weights (only α, β_1 and β_2 were optimized, all other weightes were taken equal 1 and fixed):**

E_T^{parton}=20 GeV

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cone size=0.6 : **E_T^{jet}=16.31+-3.4 GeV**

α=1.2447,β_1=0.8305, β_2=0.7944

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cone size=0.5: **E_T^{jet}=16.02+-3.66 GeV**

α=1.2618,β_1=0.9819, β_2=0.8467

E_T^{parton}=100 GeV

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cone size=0.6: E_T^{jet}=91.52+10.19GeV

α=1.1692, β_1=0.9607, β_2=0.9617

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cone size=0.5: E_T^{jet}=90.48+10.19GeV

α=1.1661, β_1=1.0432, β_2=0.9694

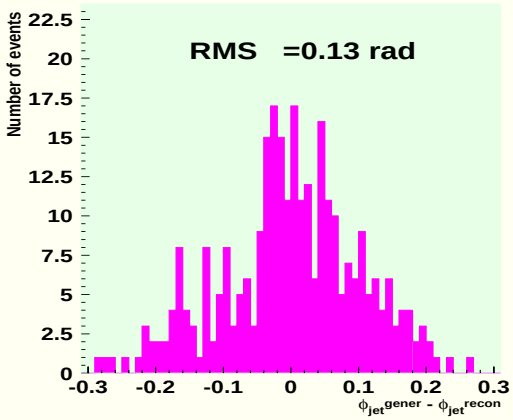
Spatial resolution.
$P_T$parton=20 GeV/c, η=0

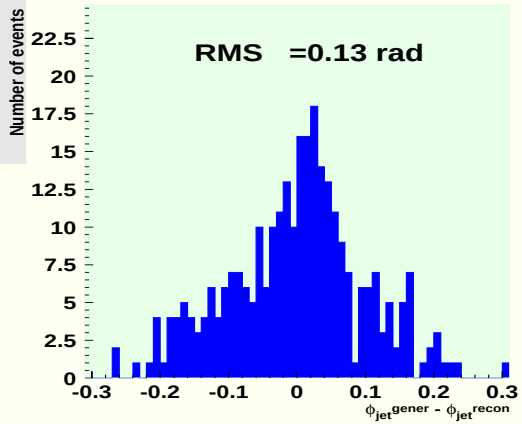
Cone 0.5

Cone 0.6

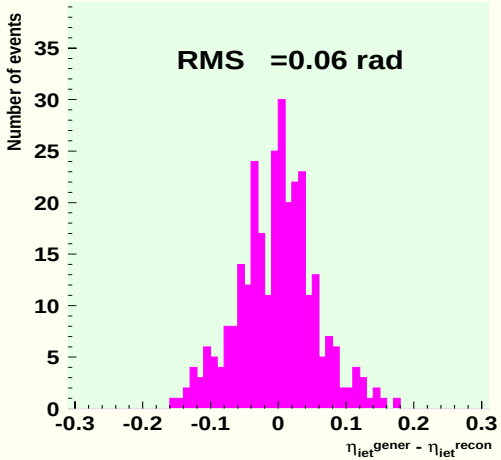
With

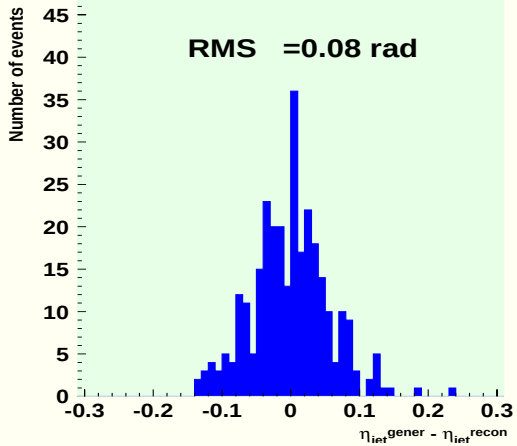
additional weights





$\phi_{jet}^{gen}-\phi_{jet}^{rec}$





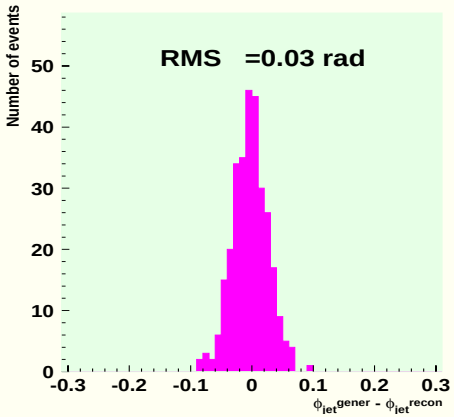
$\eta_{jet}^{gen}-\eta_{jet}^{rec}$

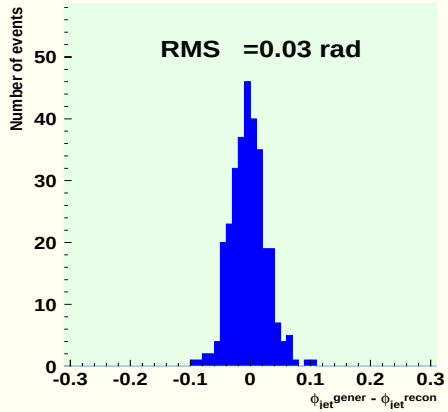
Spatial resolution.
$P_T$parton=100 GeV/c, η=0

Cone 0.5

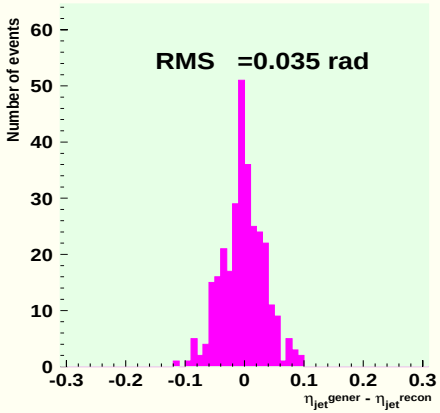
Cone 0.6

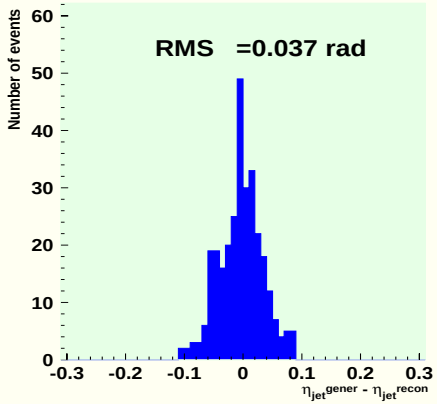
With additional weights





$\phi_{jet}^{gen}-\phi_{jet}^{rec}$





$\eta_{jet}^{gen}-\eta_{jet}^{rec}$

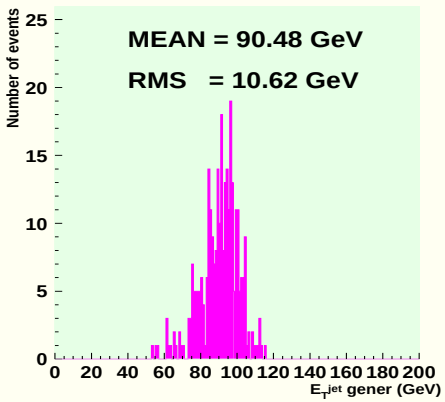
Generated and reconstructed transverse energy of jets.

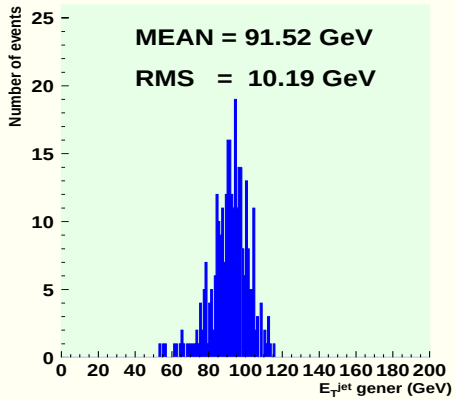
$P_T$parton=100 GeV/c, η=0

Cone 0.5

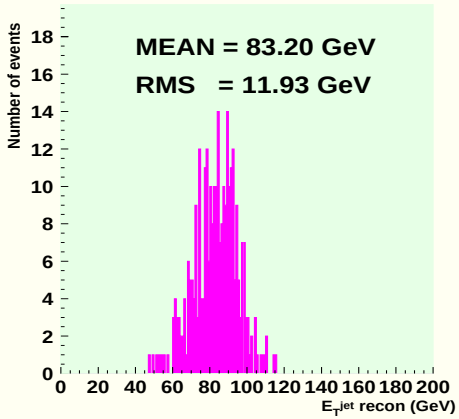
Cone 0.6

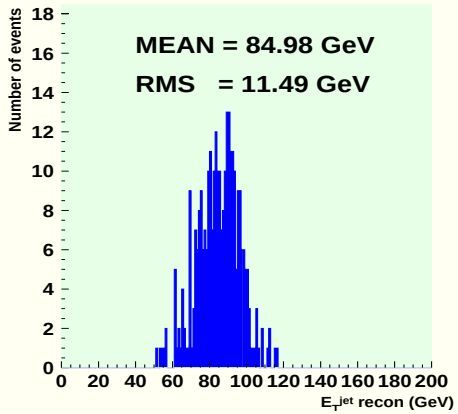
Without additional weights





E_T^{jet}gen





E_T^{jet}rec

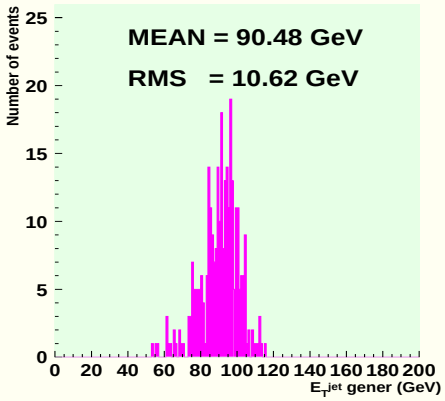
Generated and reconstructed transverse energy of jets.

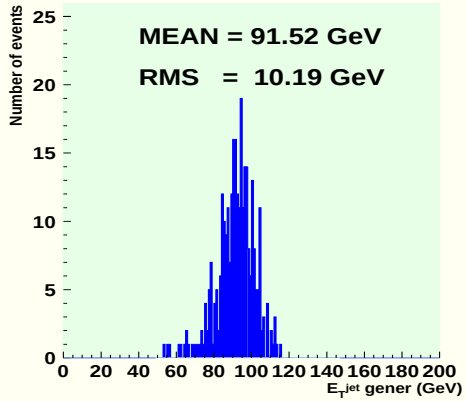
$P_T$parton=100 GeV/c, η=0

Cone 0.5

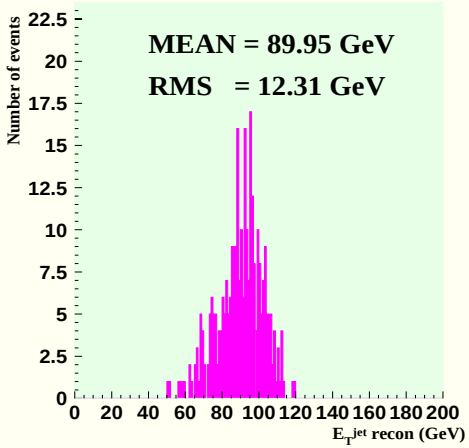
Cone 0.6

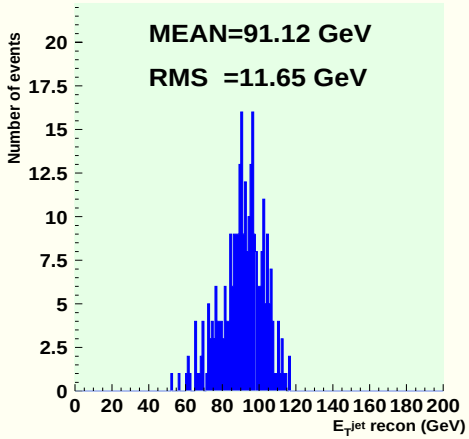
With additional weights





E_T^{jet}gen





E_T^{jet}rec

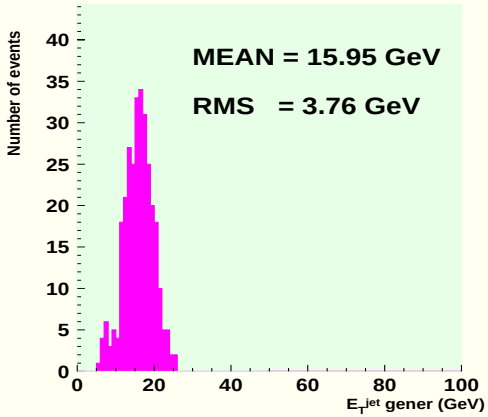
Generated and reconstructed transverse energy of jets.

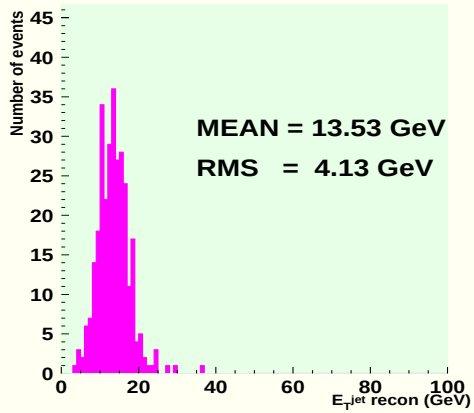
$P_T$parton=20 GeV/c, η=0

Cone 0.5

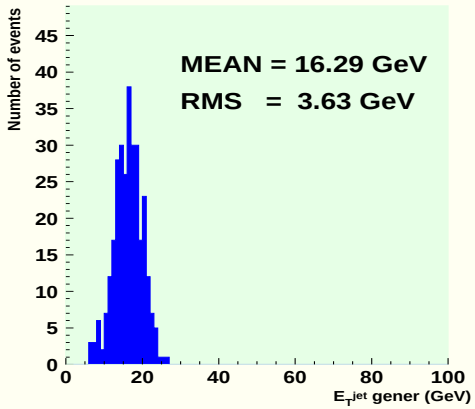
Cone 0.6

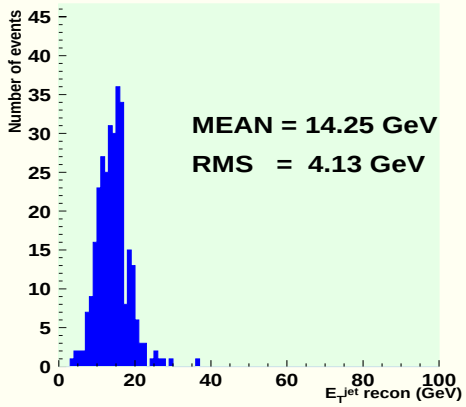
Without additional weights





E_T^{jet}gen





E_T^{jet}rec

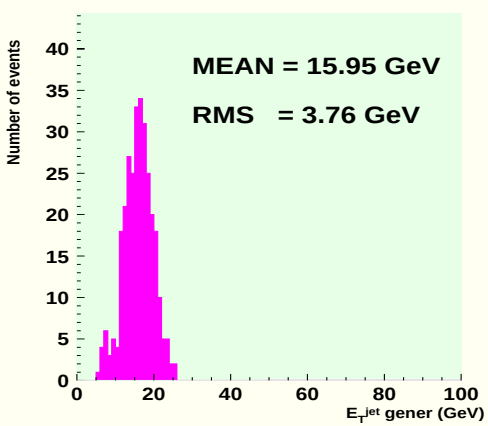
Generated and reconstructed transverse energy of jets.

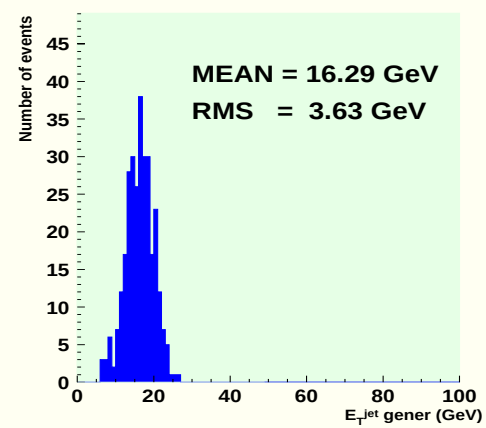
$P_T$parton=20 GeV/c, η=0

Cone 0.5

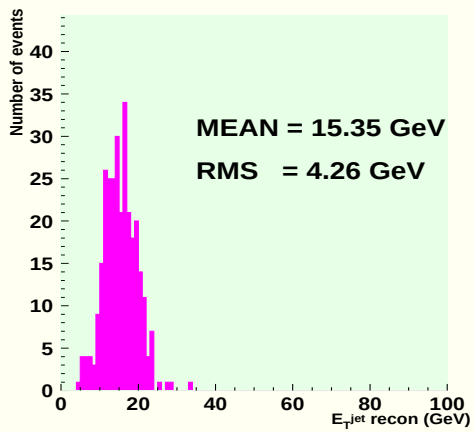
Cone 0.6

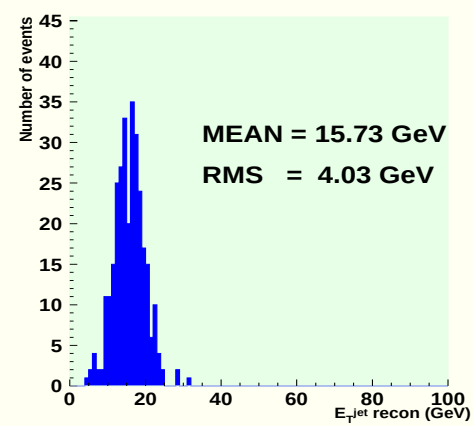
With additional weights





E_T^{jet}gen





E_T^{jet}rec

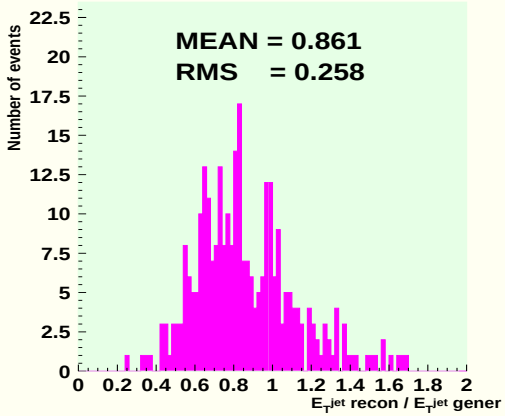
Jet energy resolution .

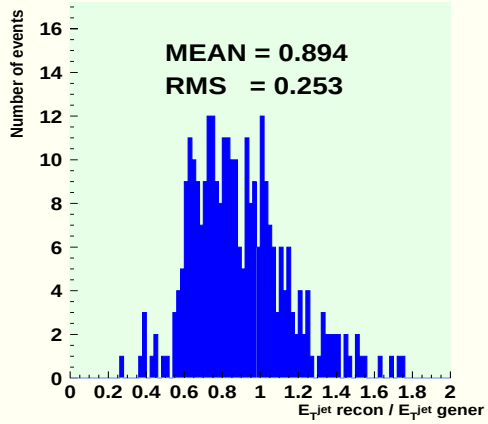
$P_T$parton=20 GeV/c, η=0

Cone 0.5

Cone 0.6

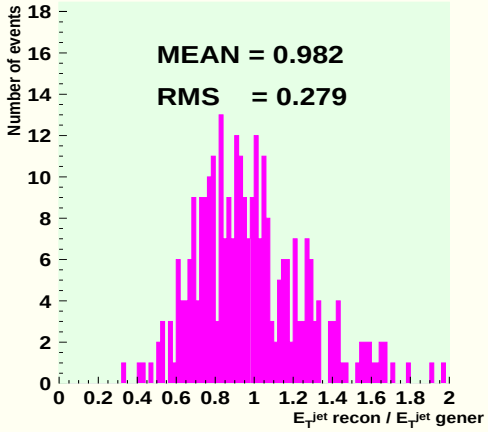
without additional weights

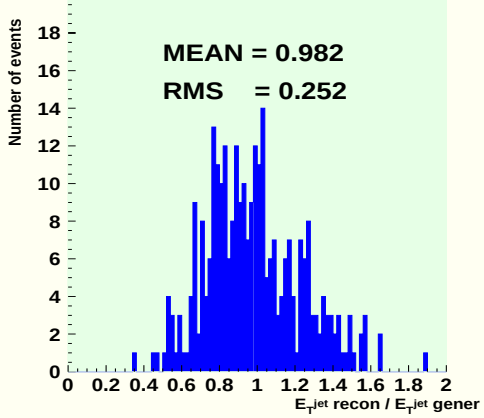




E_T^{jet}recon/E_T^{jet}gen

with additional weight



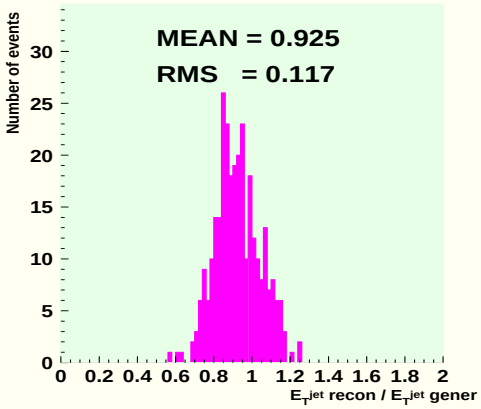


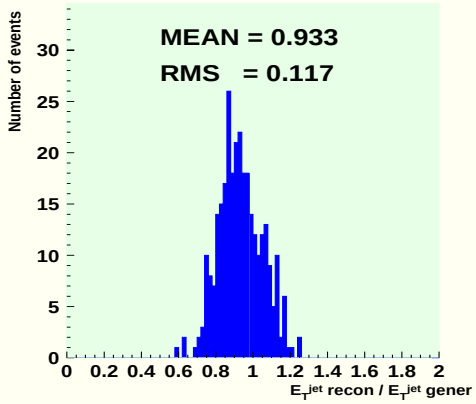
Jet energy resolution.
$P_T$parton=100 GeV/c, η=0

Cone 0.5

Cone 0.6

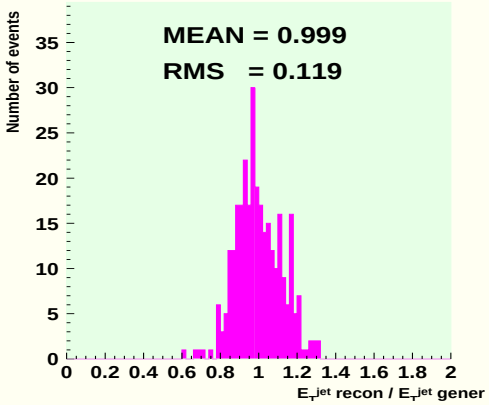
without additional weights

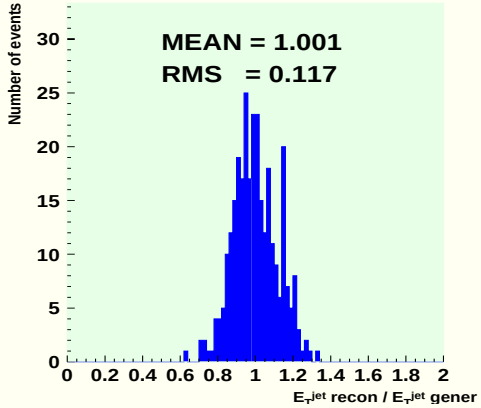




E_T^{jet}recon/E_T^{jet}gen

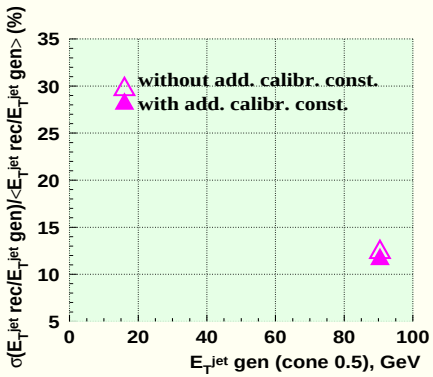
with additional weights

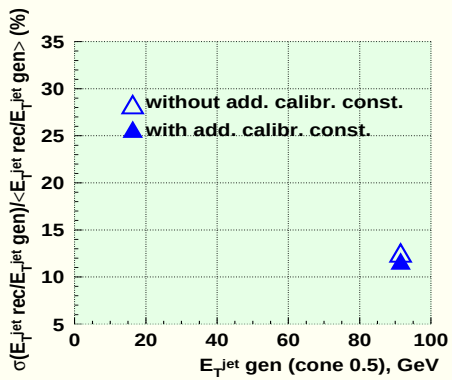




Instead of summary.

Resolution





$$\frac{\sigma(E_{jet}^{rec}/E_{jet}^{gen})}{\langle E_{jet}^{rec}/E_{jet}^{gen}\rangle}(\%)$$

Cone 0.5:

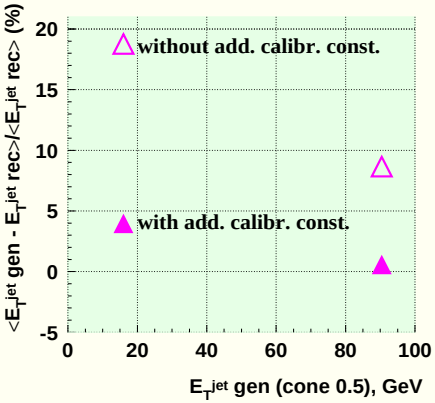
20 GeV: 28.41 (without)

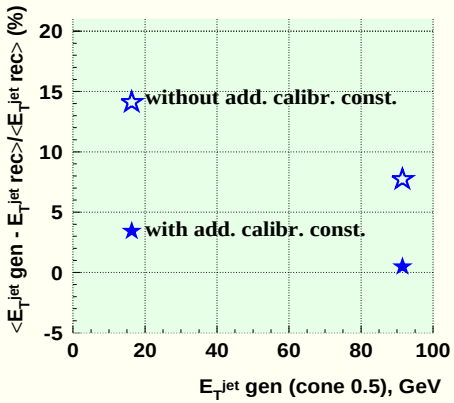
25.8 (with)

100 GeV: 12.65 (without)

11.9 (with)

Relative error





Cone 0.6:

20 GeV: 28.3 (without)

25.7 (with)

100 GeV: 12.54 (without)

11.7 (with)

Jet energy resolution improves on 7%

Difference between mean energy of reconstructed jet and mean energy of generated jet is 4% for 16 GeV jets (instead of 18%) and 0.6% (istead of 8.6%) for 90 GeV jets for cone 0.5.