

Relative and Absolute Jet Energy Correction at CMS

The 5th Korea CMS Collaboration Meeting

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Motivation and Goal of Jet Energy Correction



Why?

The calorimeter response to particles is not linear



The goal of the jet energy correction is to relate, on average, the jet energy measured in the detector to the energy of the final state particle jet or parton jet.



Scheme of Jet Energy Correction



CMS adopt factorized multi-level jet correction

1. Offset

Required correction for pile-up and electronic noise.

2. Relative(L2)

Required correction for variations **in jet response with pseudorapidity relative to control region.**

3. Absolute(L3)

Required correction to particle level **versus jet pT in the control region.**

4. EMF(L4)

Optional correction for variations in jet response with electromagnetic energy fraction.

5. Flavor(L5)

Optional correction to particle level for different types of jets (light quark, c, b, gluon)

6. Underlying Event

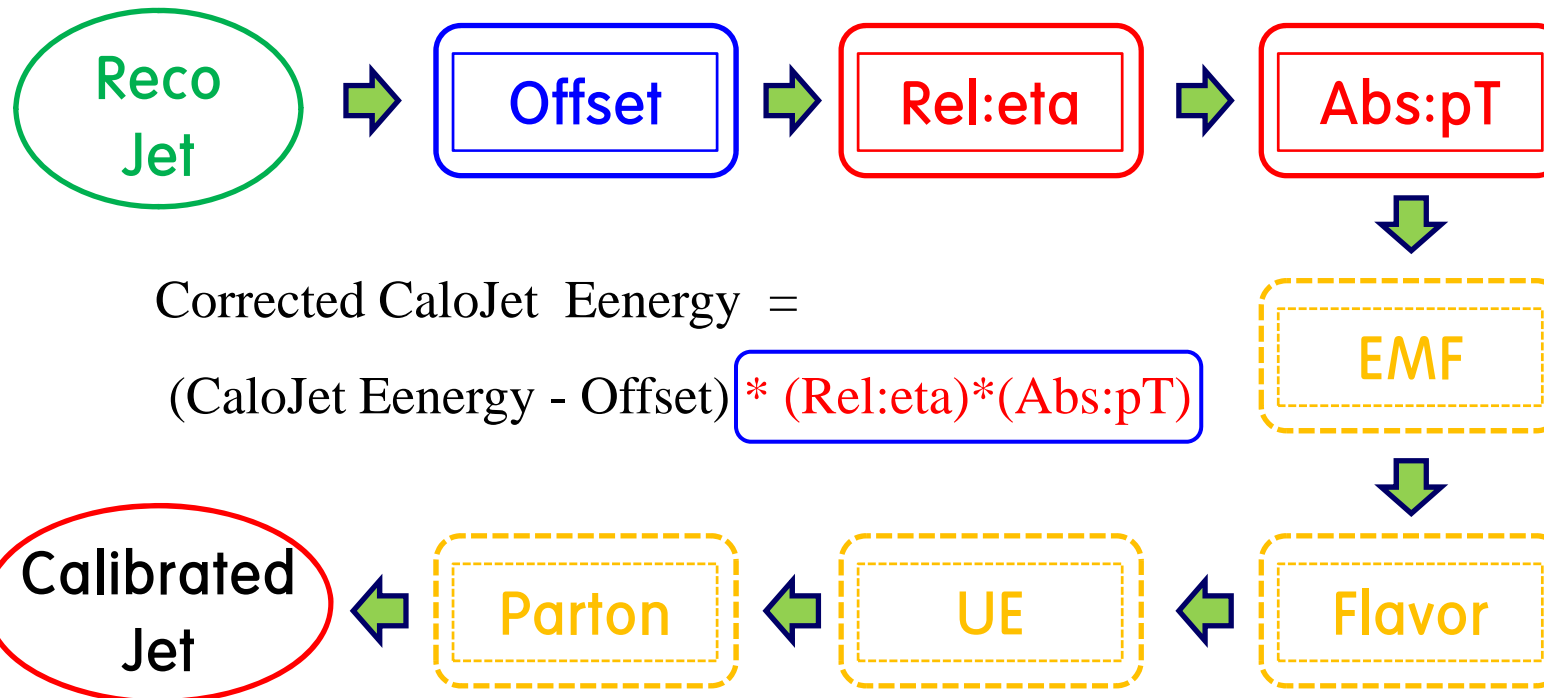
Optional correction for underlying event energy due to soft interaction involving spectator partons.

7. Parton(L7)

Optional correction to parton level.



Schematic picture jet correction at CMS



Corrected CaloJet Eenergy =

$$(\text{CaloJet Eenergy} - \text{Offset}) * (\text{Rel:eta}) * (\text{Abs:pT})$$

$$\text{Corrected CaloJet Eenergy} = (\text{CaloJet Eenergy} - \text{Offset}) * (\text{Rel:eta}) * (\text{Abs:pT}) * (\text{EMF}) * (\text{Flavor}) * (\text{UE}) * (\text{Parton})$$



L2(Relative) & L3(Absolute) correction



L2 (Relative)

Reason

The CMS jet response varies as a function of jet eta for fixed jet pT

Goal

Eta dependence correction is to remove these variations and make the response flat as a function of eta

Method

Correction from MC truth (my job)

→ Correction from QCD dijet events in actual collision data

L3 (Absolute)

Reason

The CMS calorimeter energy response to a particle level jet is smaller than unity and varies as a function of jet pT.

Goal

pT dependent correction is to remove these variations and make the response equal to unity at all pT

Method

Correction from MC truth (my job)

→ correction from photon+jet and Z+jet pT balance in actual collision data



Simple result L2 and L3 correction



- **Configuration**

- **gate.sccc.uos.ac.kr at UOS**
- **CMSSW_3_1_2**
- **<https://twiki.cern.ch/twiki/bin/view/CMS/SWGu>**
- **/store/relval/CMSSW_3_1_2/RelValQCD_FlatPt_15_3000/GEN-SIM-RECO/MC_31X_V3-v1/0007/9E83A122-E978-DE11-9D04-001D09F23C73.root**
- **CVS package**
 - **JetMETAnalysis/JetUtilities**
 - **JetMETAnalysis/JetAnalyzers**
 - **SchieferD/Configuration**
 - **UserCode/SchieferD/Configuration**



Work flow of JetResponseAnalyzer



Input file → /store/relval/CMSSW_3_1_2/RelValQCD_FlatPt_15_3000/GEN-SIM-RECO/MC_31X_V3-v1/0007/9E83A122-E978-DE11-9D04-001D09F23C73.root



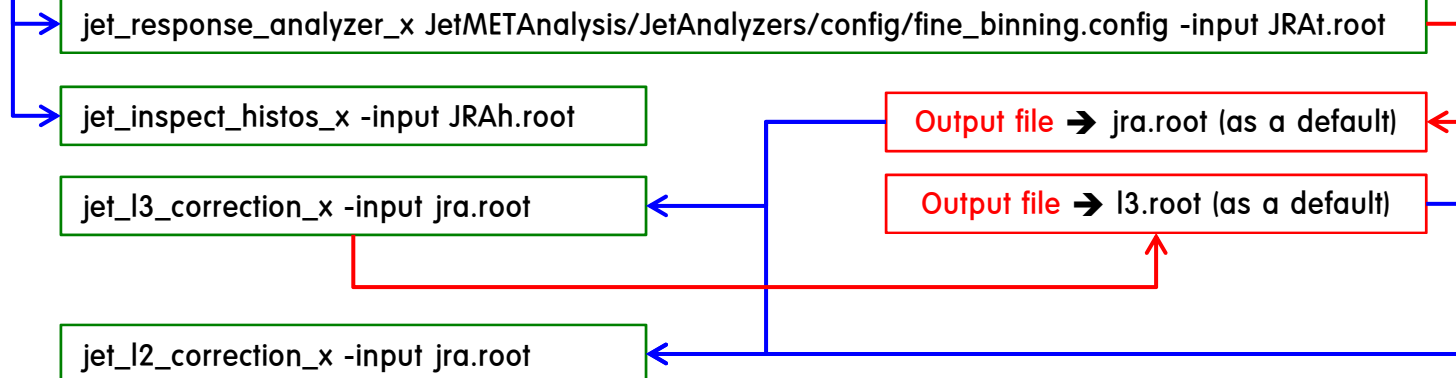
```
cmsRun JetMETAnalysis/JetAnalyzers/test/JRAh_cfg.py
cmsRun JetMETAnalysis/JetAnalyzers/test/JRAt_cfg.py
```

JRAh:JetResponseAnalyzer historam

JRAt:JetResponseAnalyzer tree

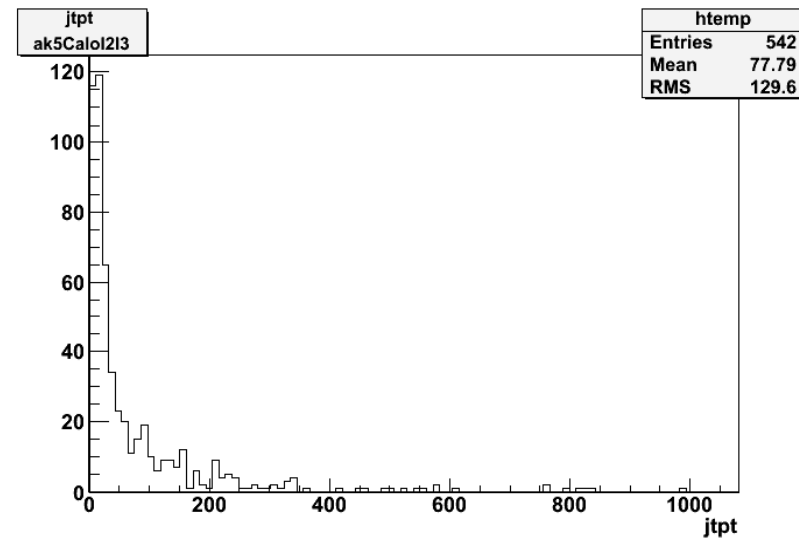
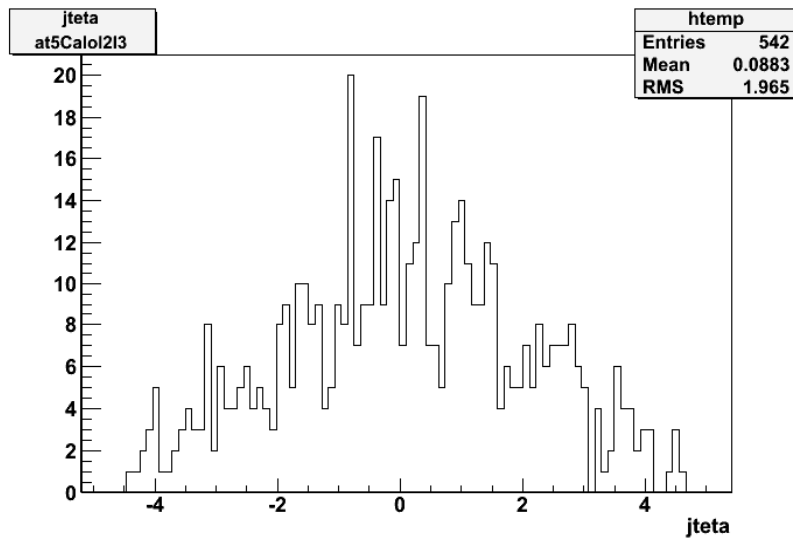
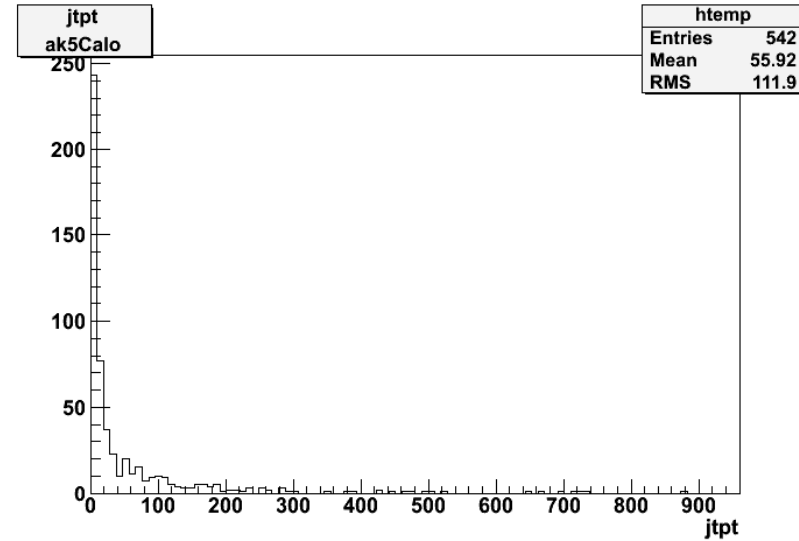
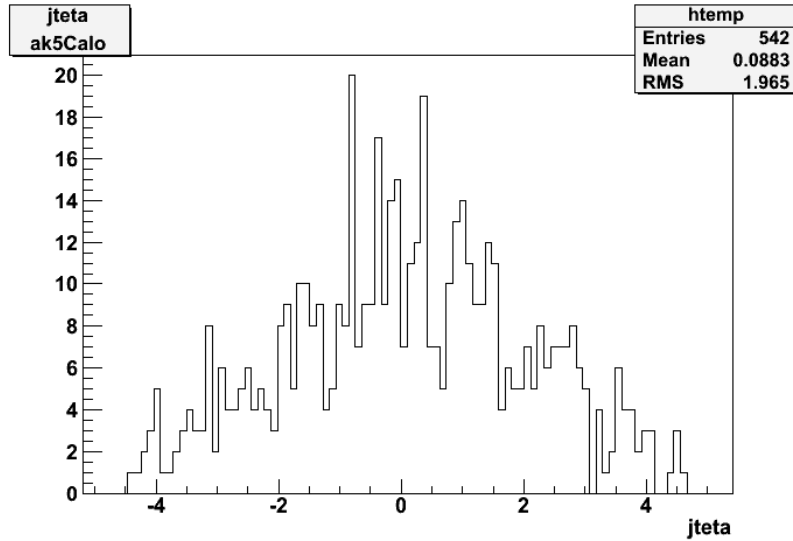


Output file → JRAh.root & JRAt.root
(These file names are default)



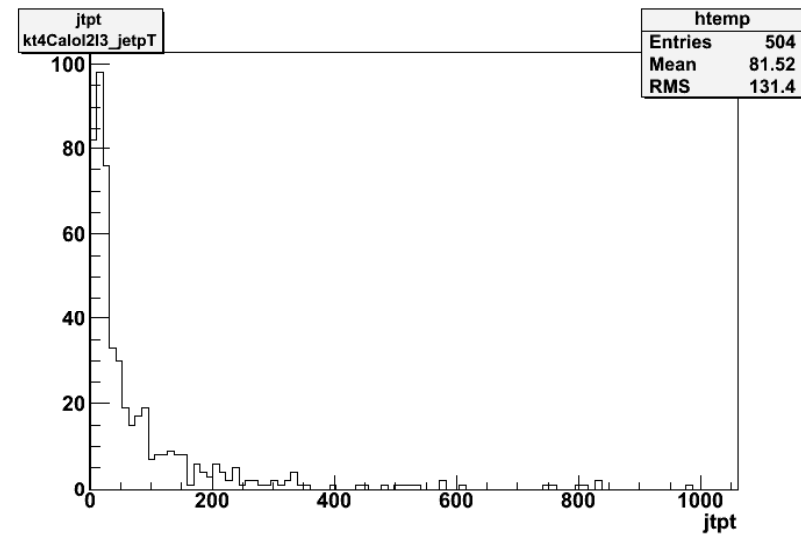
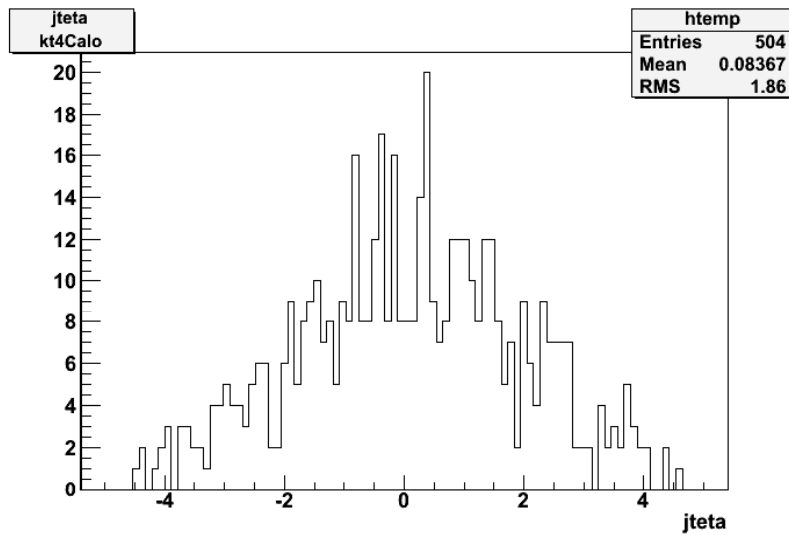
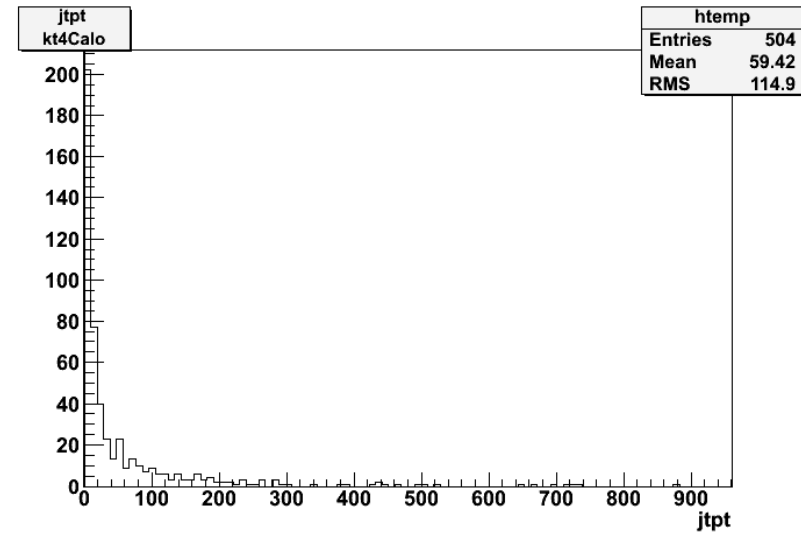
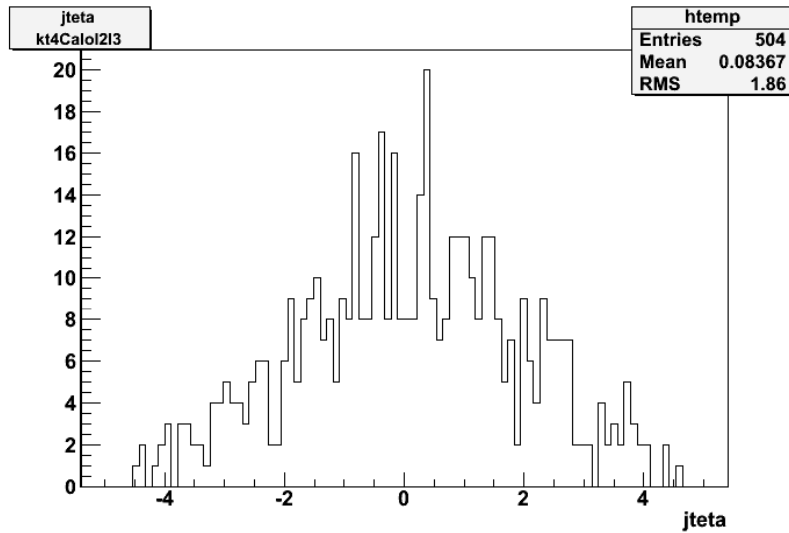


Result for Anti-kt5



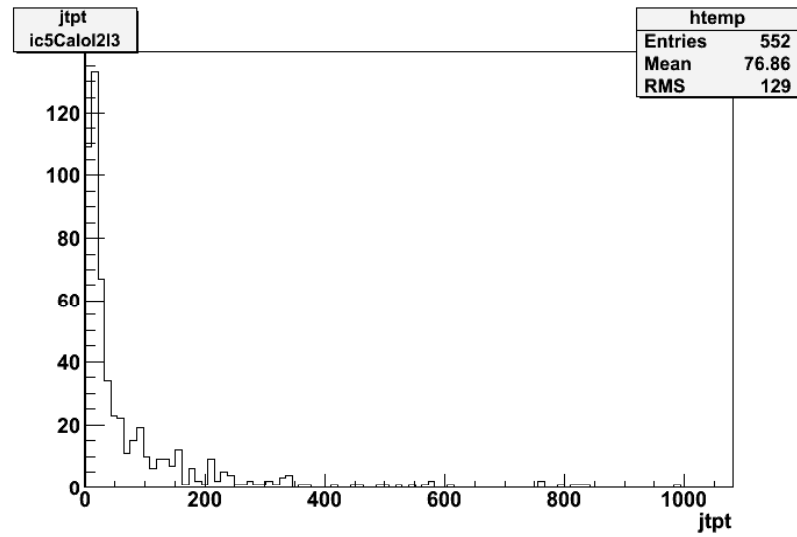
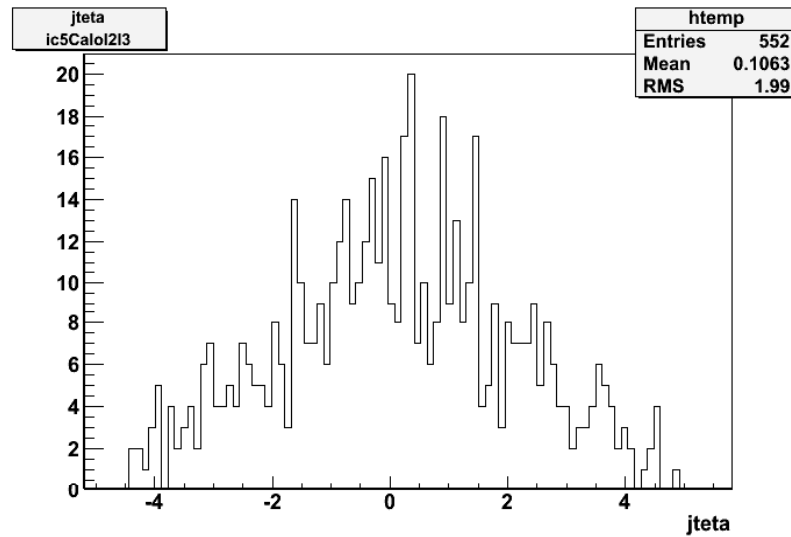
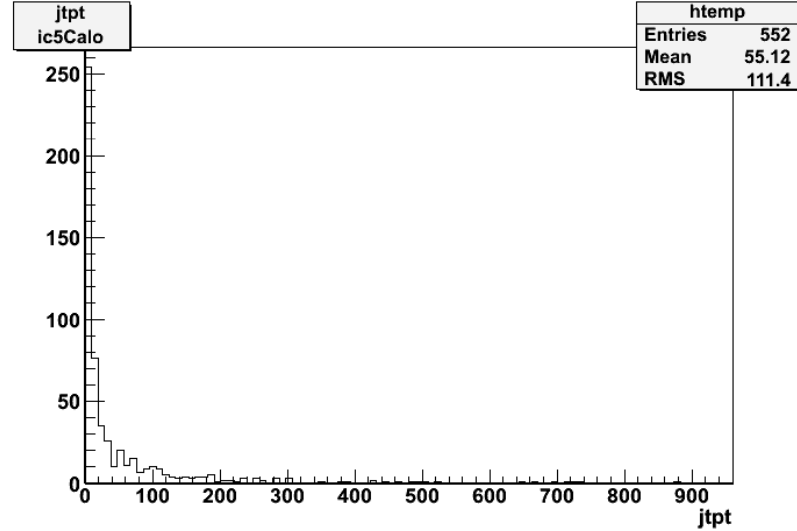
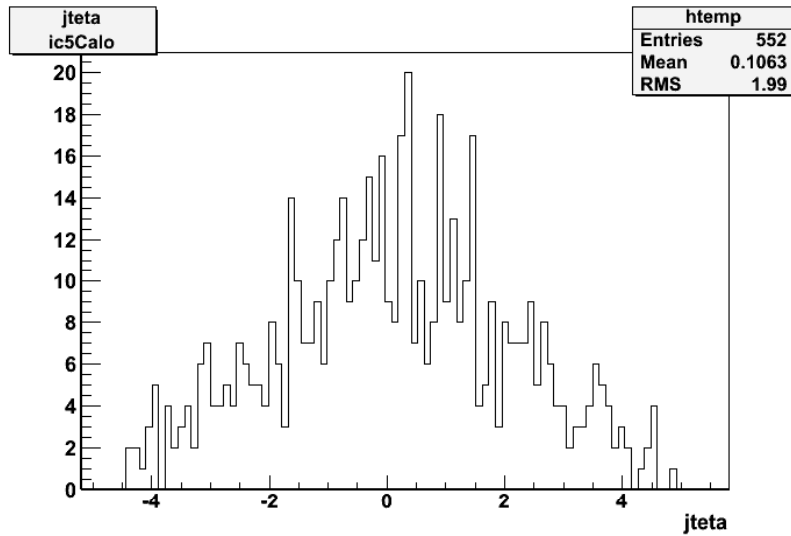


Result for kt4



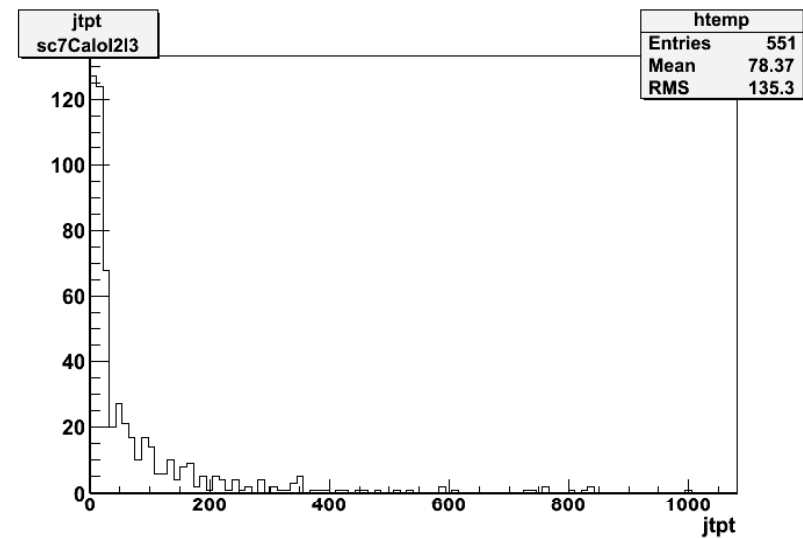
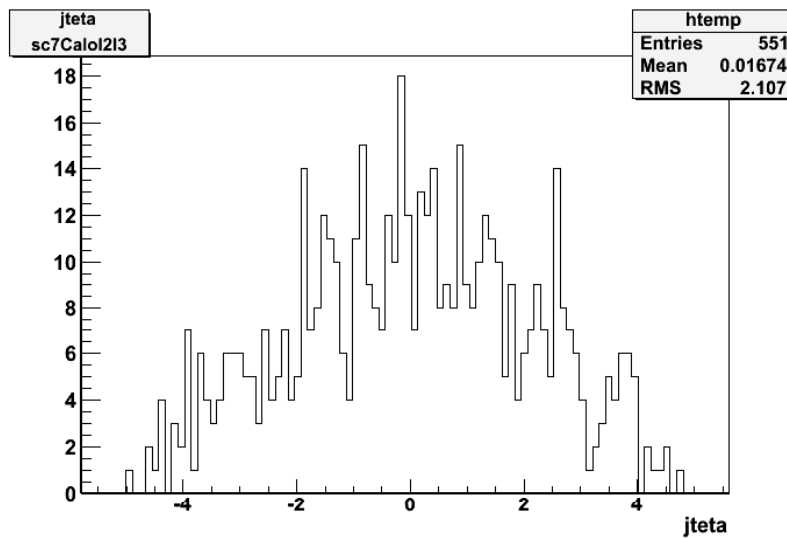
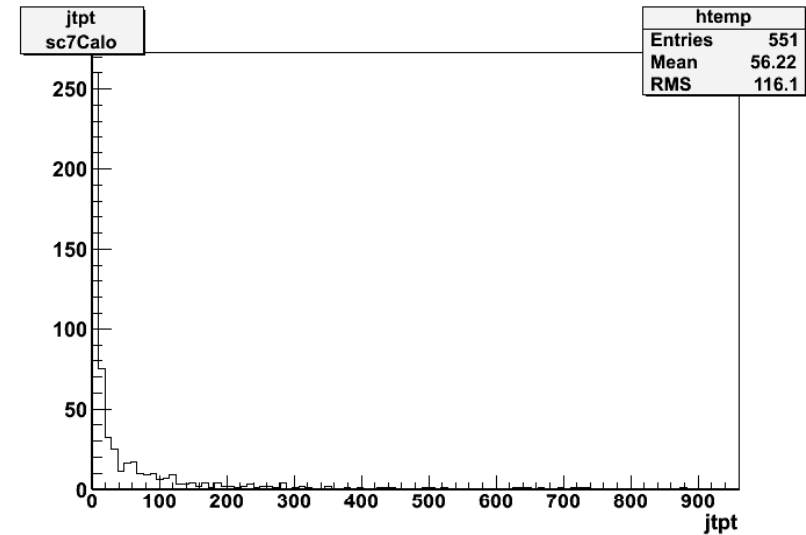
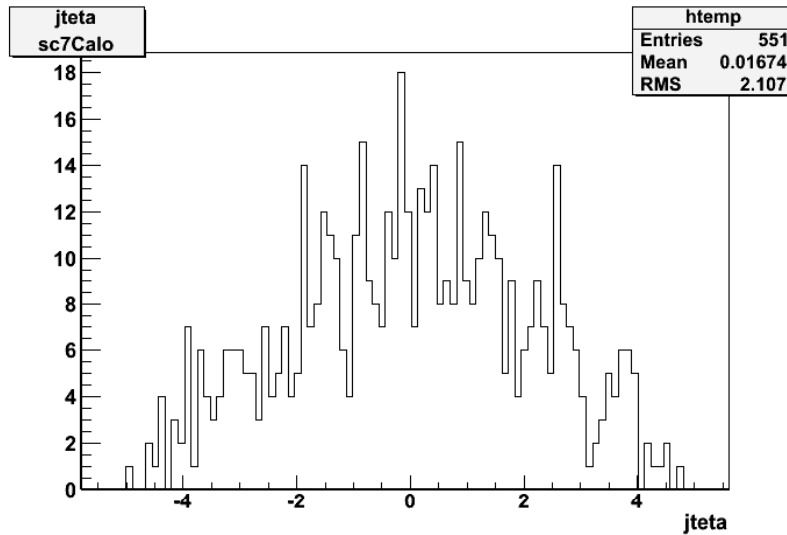


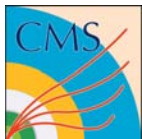
Result for ic5





Result for sc7





Collaboration group



[high_pt] Heavy Ion subgroup meeting

Monday 21 September 2009
from 16:00 to 18:50
Europe/Zurich
at **evo**
chaired by:
Marguerite Tonjes (University of Maryland)

Description: EVO password: cms_hi
High pT/ET: Jets and Photons Heavy Ion Physics subgroup

Material: [Minutes](#)

With Marguerite Tonjes Monday 21 September 2009

Status report of JetResponseAnalyzer

2009-09-21 16:35:00 (CEST)

Seo Kon Kang (Speaker)

[20090921_StausReport\(JetResponseAnalyzer\).pdf](#) [20090921_StausReport\(JetResponseAnalyzer\).ppt](#) [Contribution details](#) [Event details](#)

iC5 Jet Energy Corrections (p+p, Pb+Pb)

2009-08-24 17:20:00 (CEST)

Seo Kon Kang (Speaker)

[20090824_StausReport.pdf](#) [Contribution details](#) [Event details](#)

Status report as a new volunteer

2009-08-10 17:55:00 (CEST)

Seo Kon Kang (Speaker)

[20090810_StausReport.pdf](#) [20090810_StausReport.ppt](#) [Contribution details](#) [Event details](#)



Summary & To do work



- **Summary**

- **Jet energy correction must need for CMS**
- **Focus on L2 & L3 correction**
- **All of HI-MC data is generated by MIT group**
- **We try to All of Jet algorithm which adopted at CMS for jet energy correction**

- **To do work**

- **Try to Heavy Ion data**
- **Increase statistics of data**
- **Study for jet energy correction more**