Jet energy calibration using $e^+e^- \rightarrow \gamma Z$ process at the ILC

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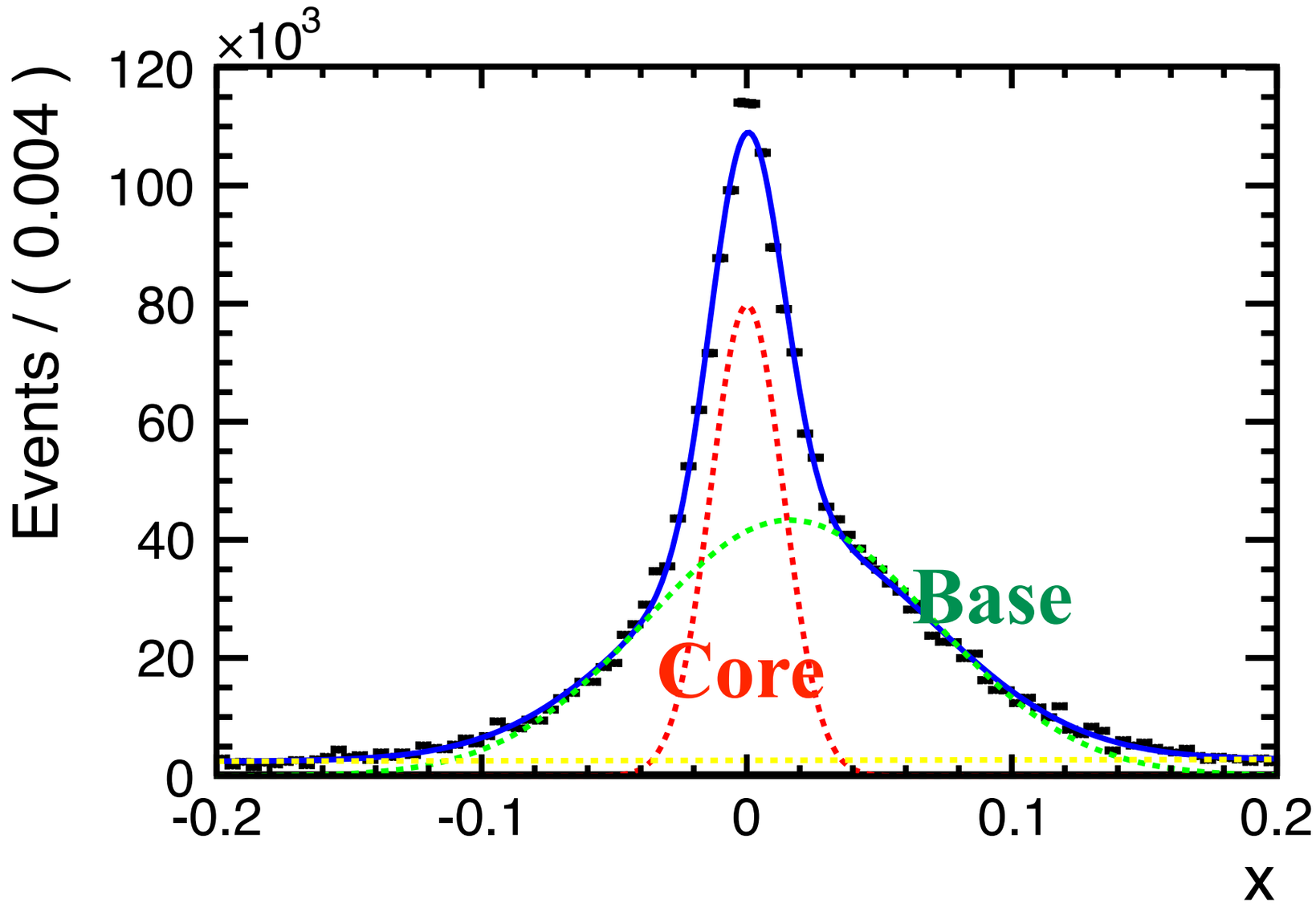
JES Calibration

Fitting the relative difference of reconstructed jet energy with gaus+gaus+exponential

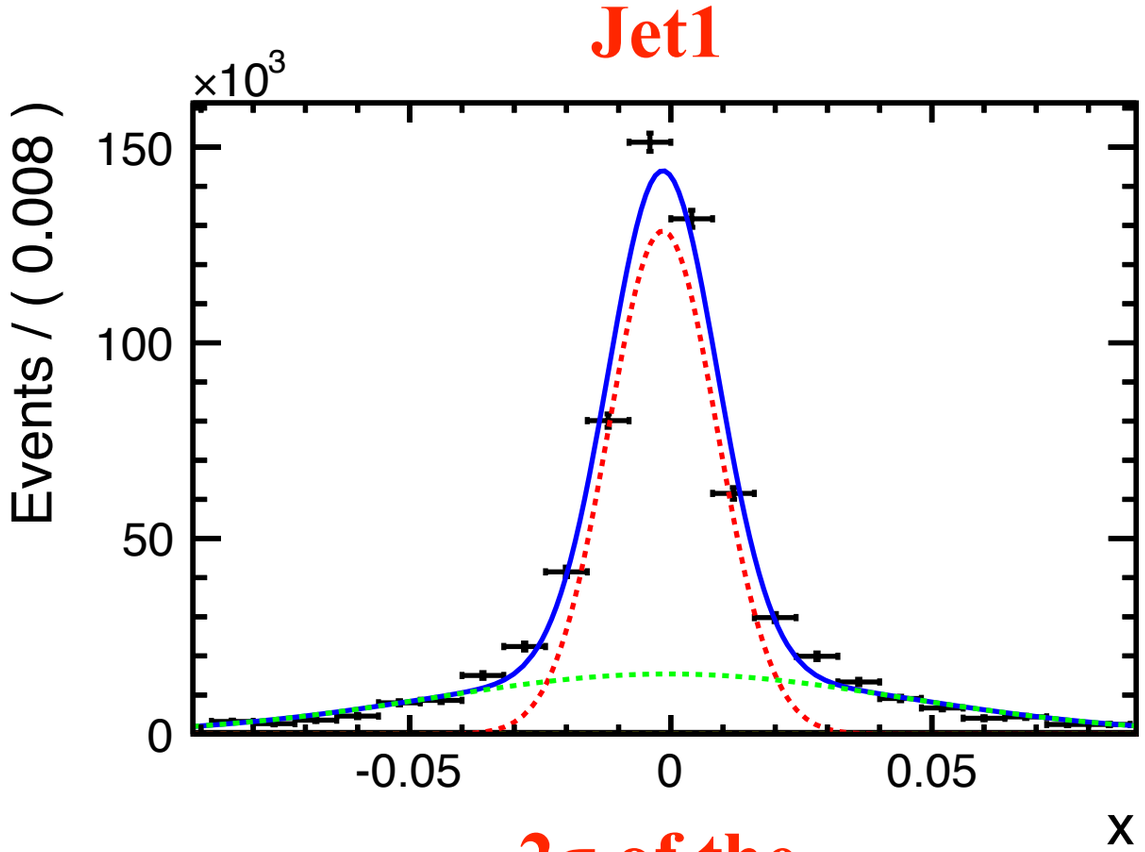


Calibration is based on the mean value of the gaus (Core).

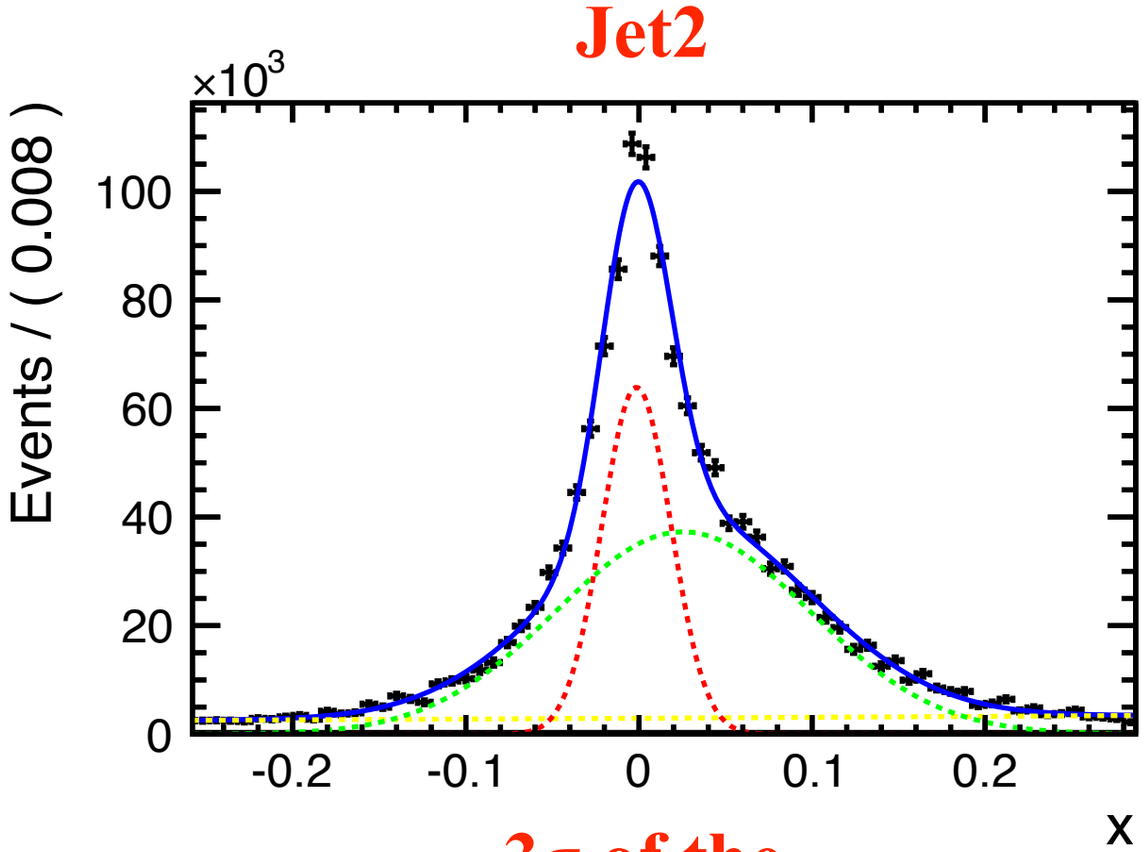
Theta, energy, and flavor dependence were checked.

Recent Progress

- Binning is changed for the energy dependence plot. The energy is not from PFO but from Method3 reconstructed. It is because PFO photon energy can be underestimated.
- Fitting is performed twice and the fitting range is changed.



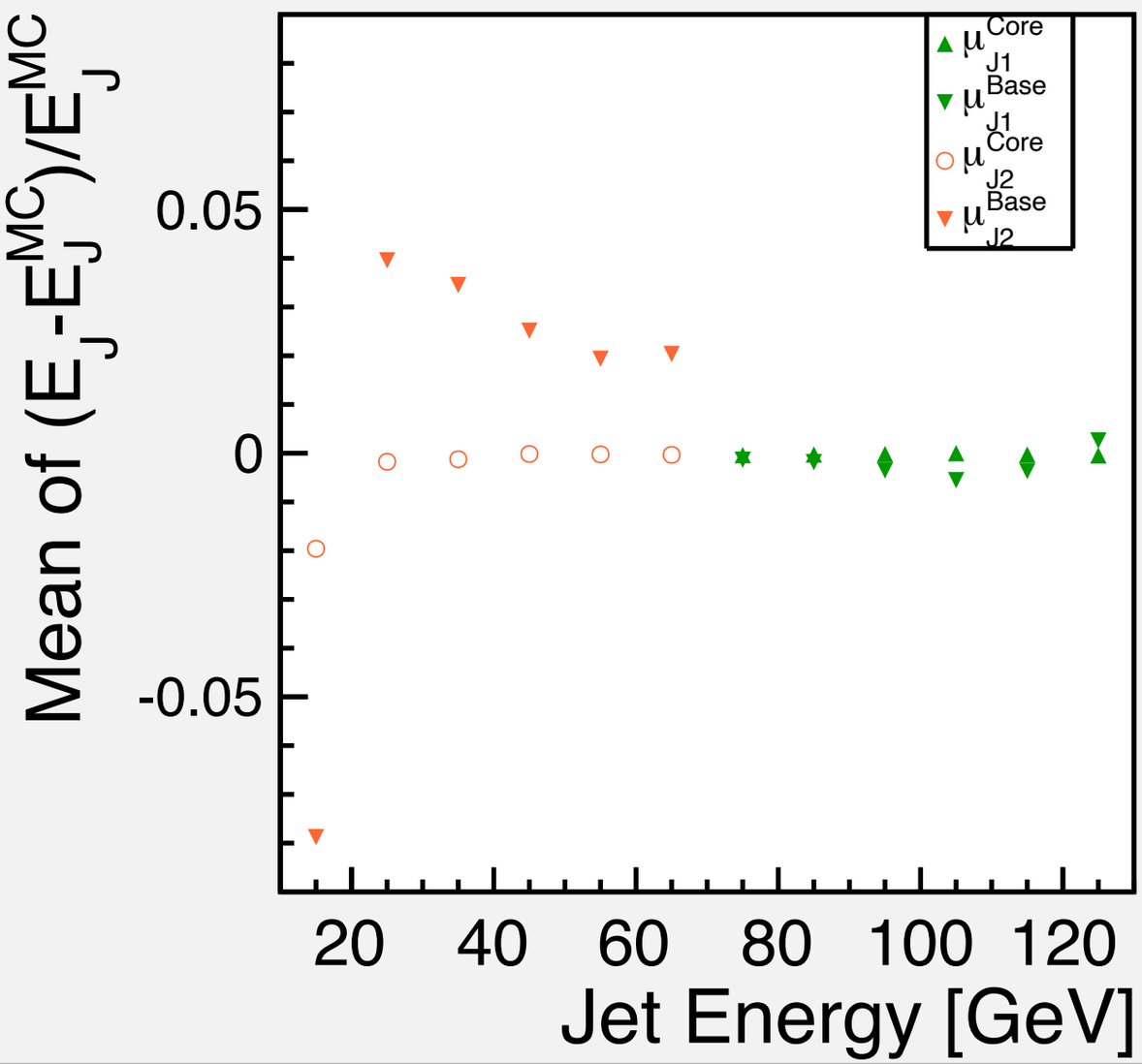
2σ of the base



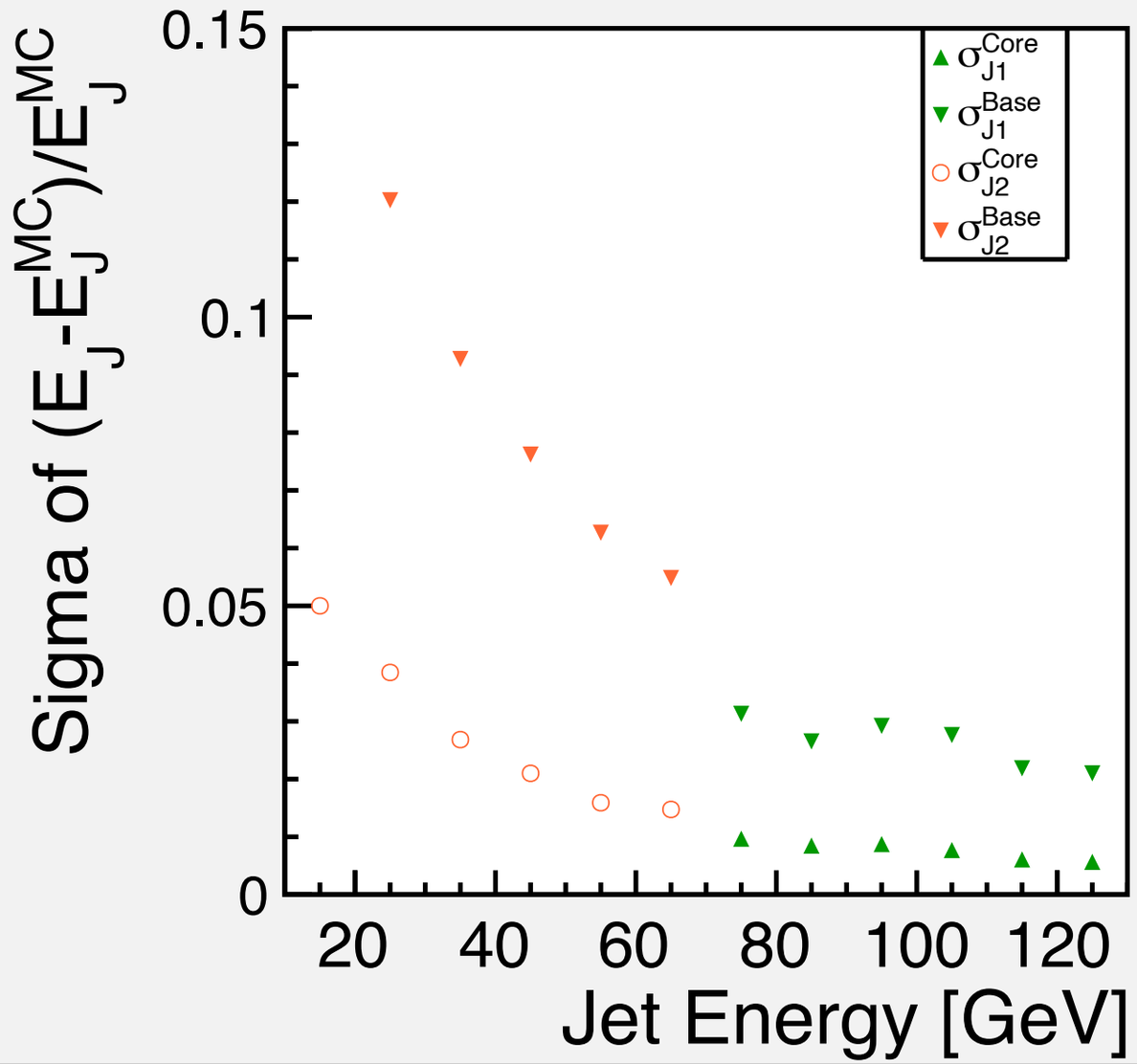
3σ of the base

Energy dependence

Mean of the Fitting Gaussian



Sigma of the Fitting Gaussian

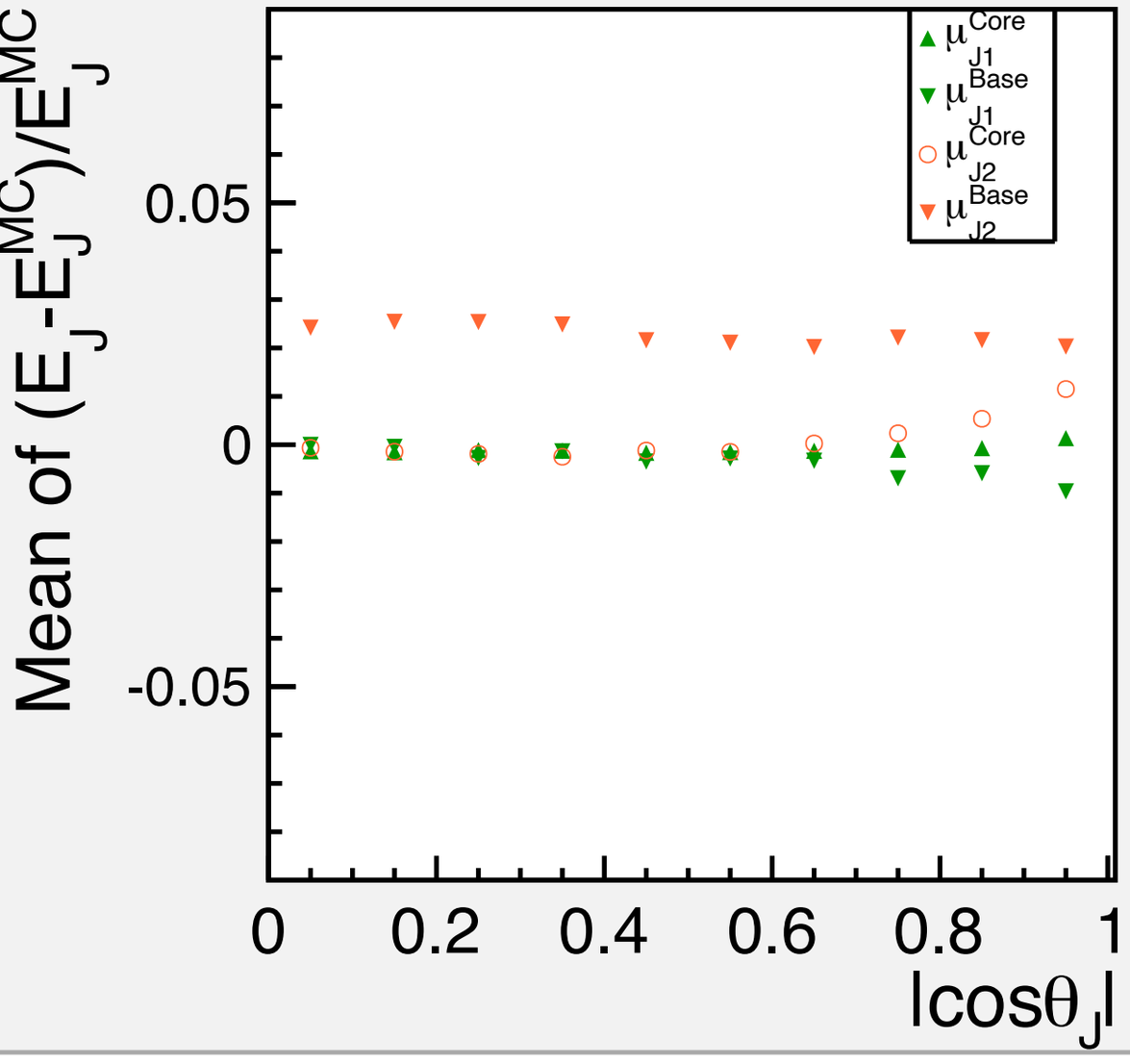


Mean value of the core gaussian is order of 10^{-4} independent on the jet energy.

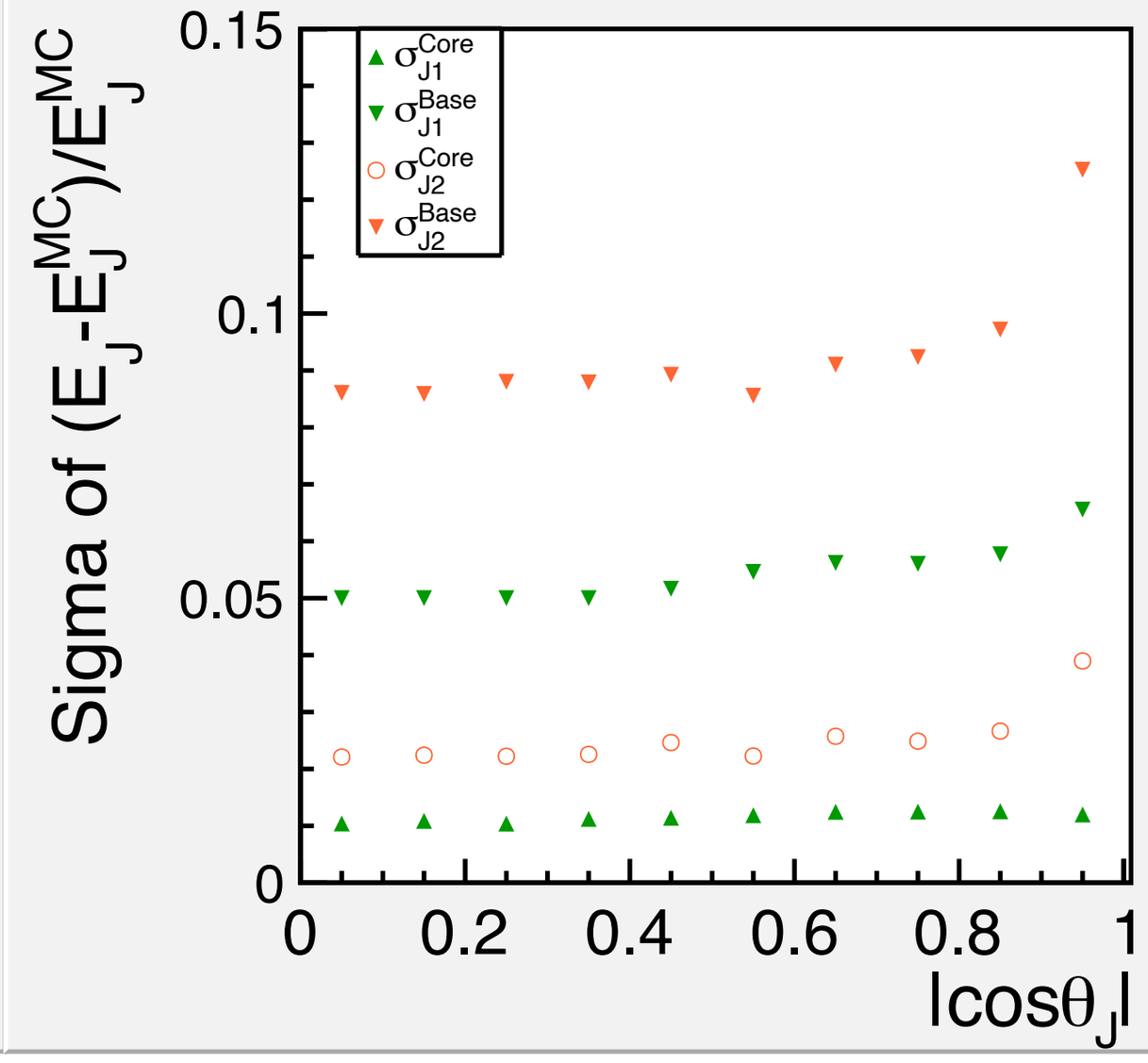
Higher energy jet has negative bias and lower one has positive bias.

Polar angle dependence

Mean of the Fitting Gaussian



Sigma of the Fitting Gaussian

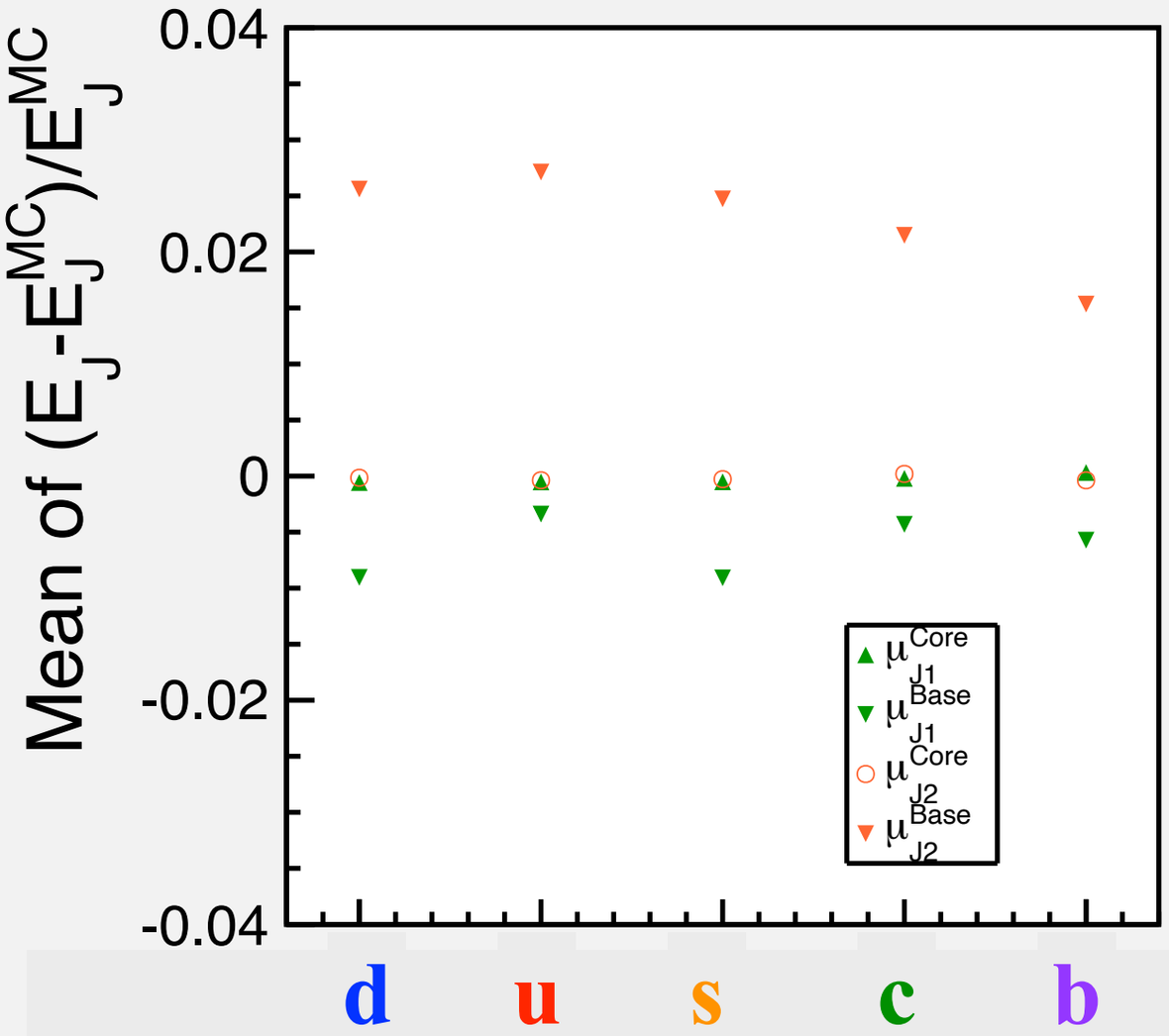


Forward jet makes slight positive bias on the core gaussian and barrel region jet makes slight negative bias on the core gaussian.

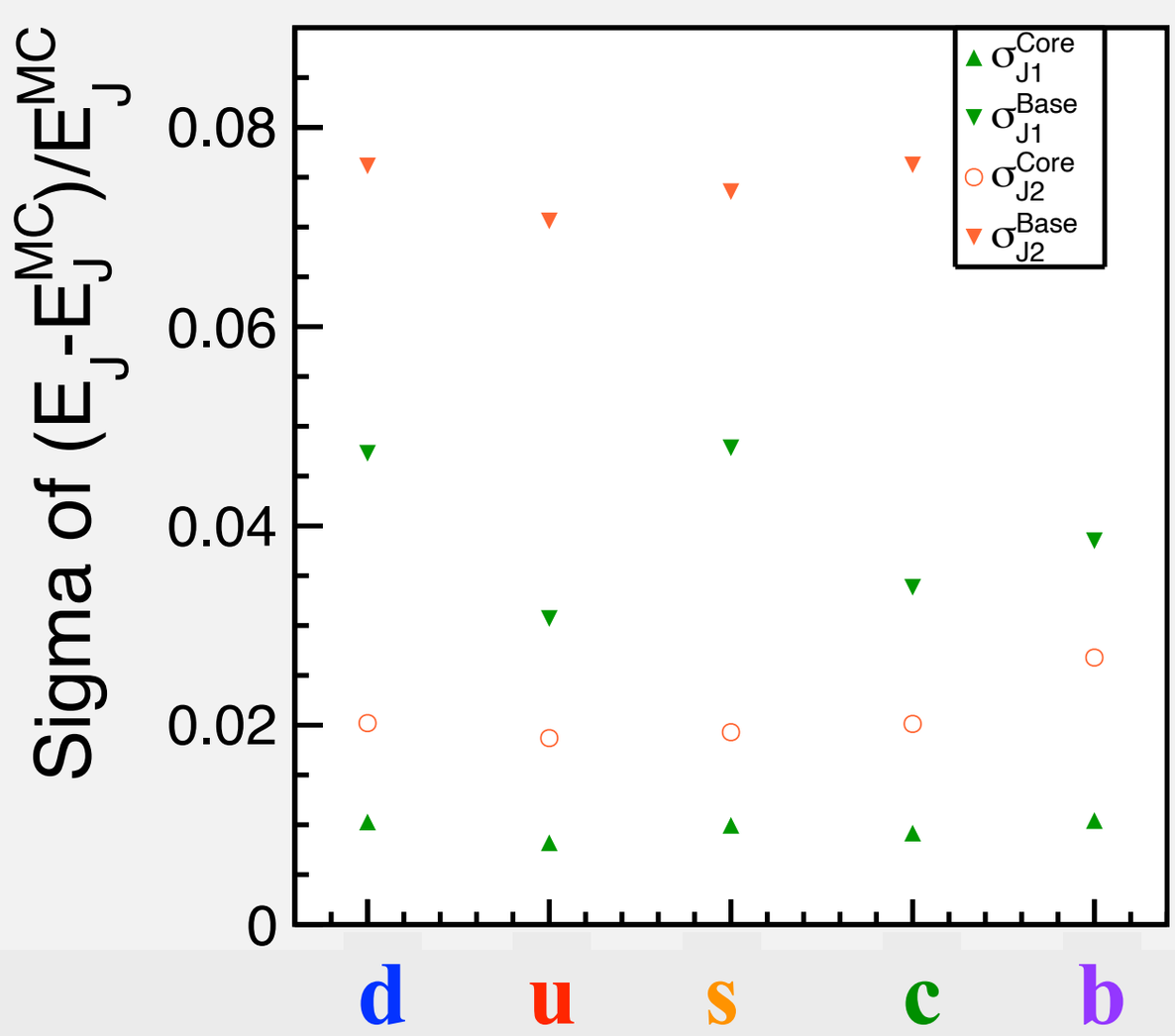
Flavor dependence

Showing dependence on flavor of the seed of the jet

Mean of the Fitting Gaussian



Sigma of the Fitting Gaussian



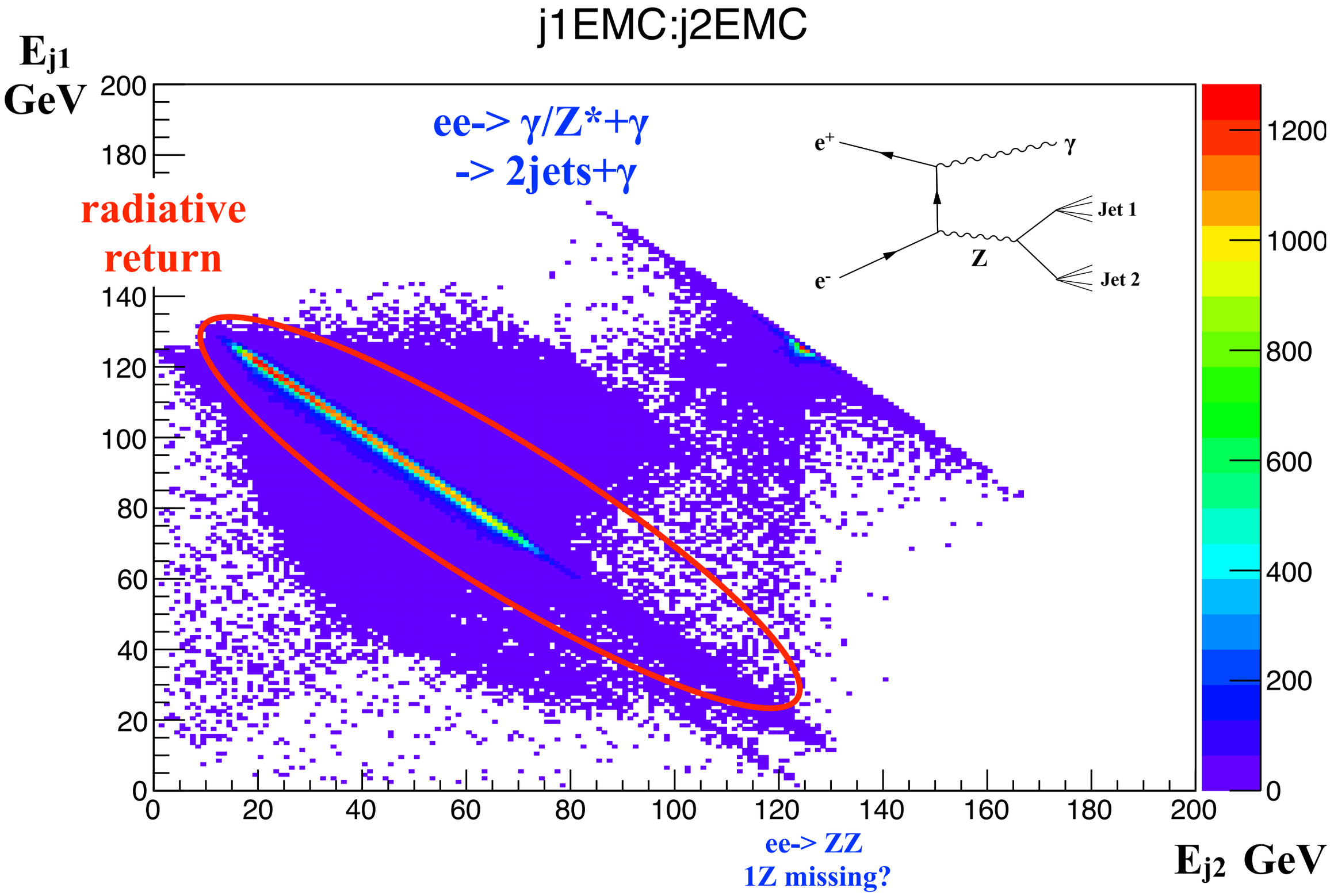
Mean value of the core gaussian is order of 10^{-4} independent on the flavor.

Next step

- Check the effect of the beam energy deviation.
- Integrate jet1 and jet2.

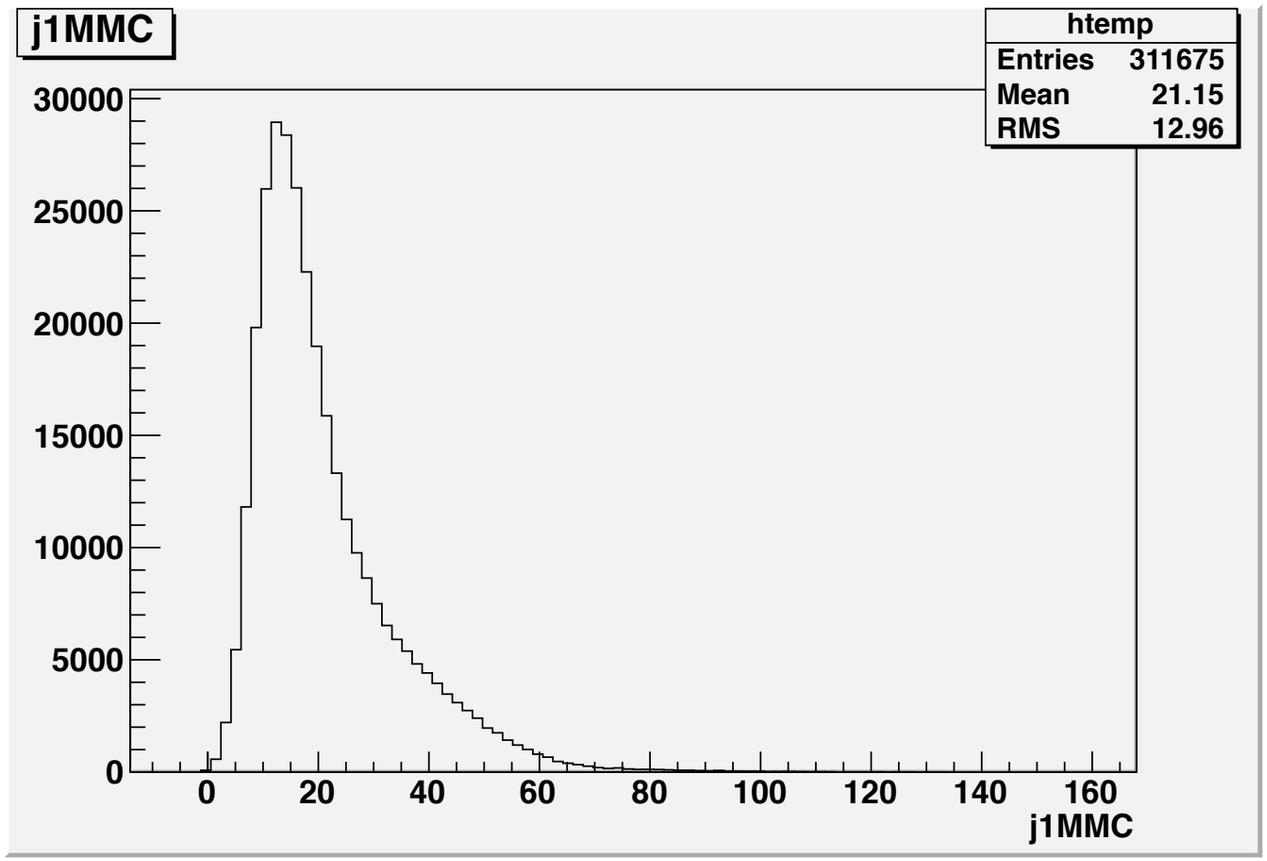
Backup

Jet energy distribution



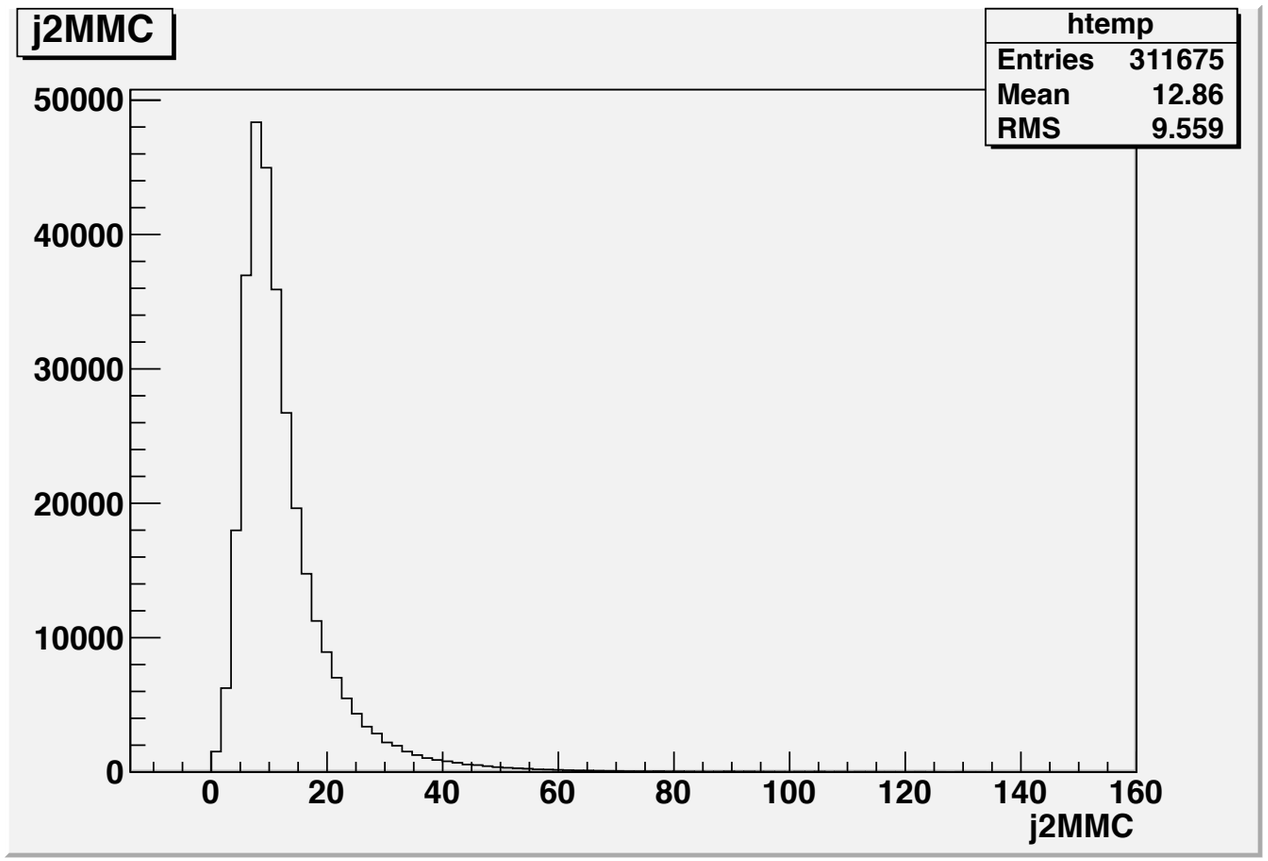
Jet mass distribution

Jet1



M_{Jet1} GeV

Jet2

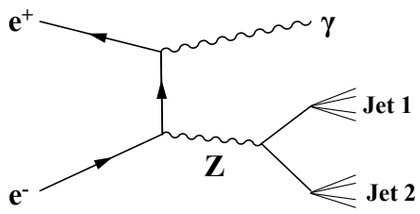


M_{Jet2} GeV

Correct photon selection

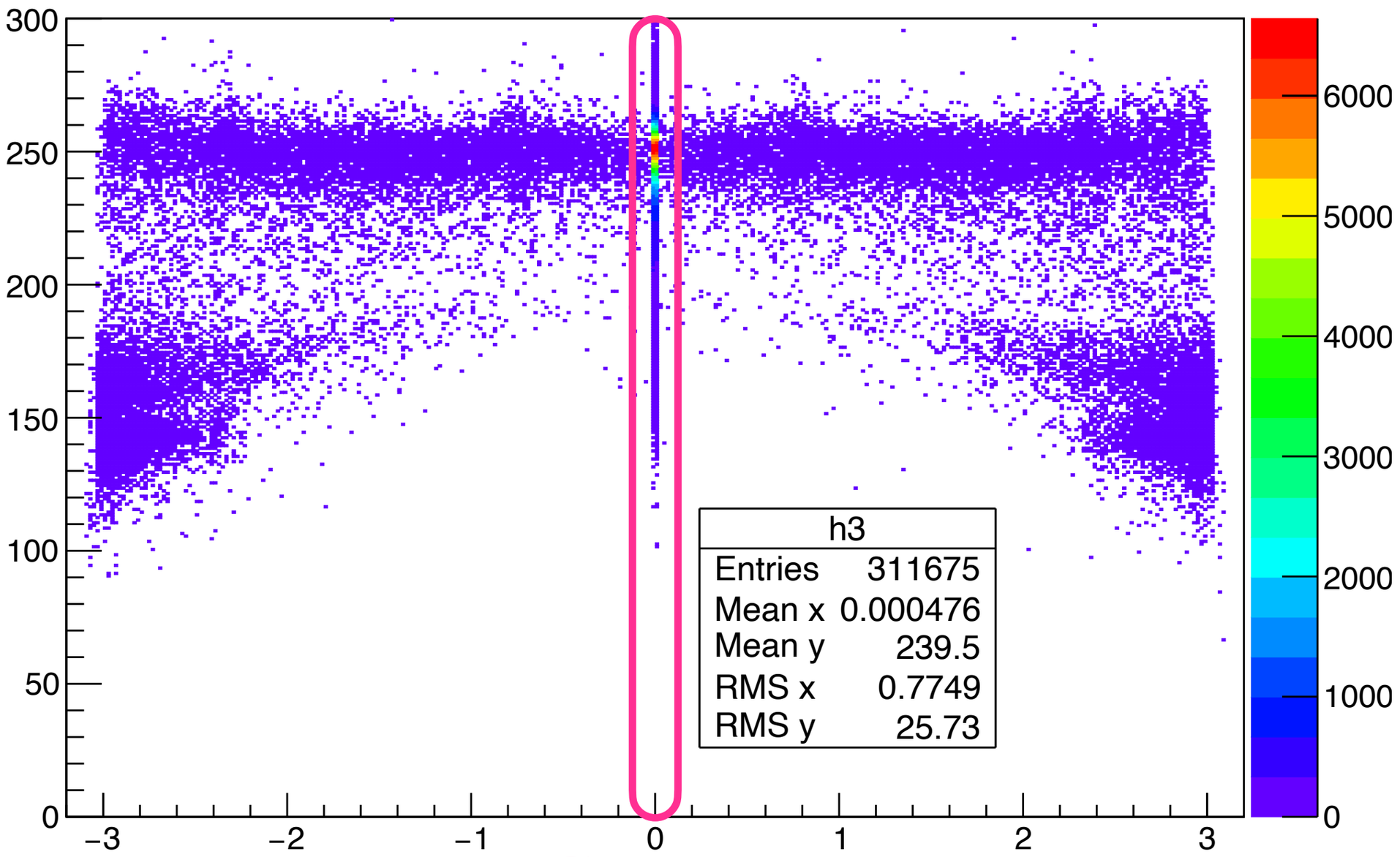
E_{vis} (=E_{j1}+E_{j2}+E_γ) vs. $\Delta\theta_\gamma$ =θ_γ(meas)-θ_γ(MC)

True signal photon: feeble and missing



True signal photon: energetic but missing

Selected photon: from jets



$|\Delta\theta_\gamma|$ <0.01 events: 87.8%

$|\Delta\theta_\gamma|$ >0.01 events: 12.2%

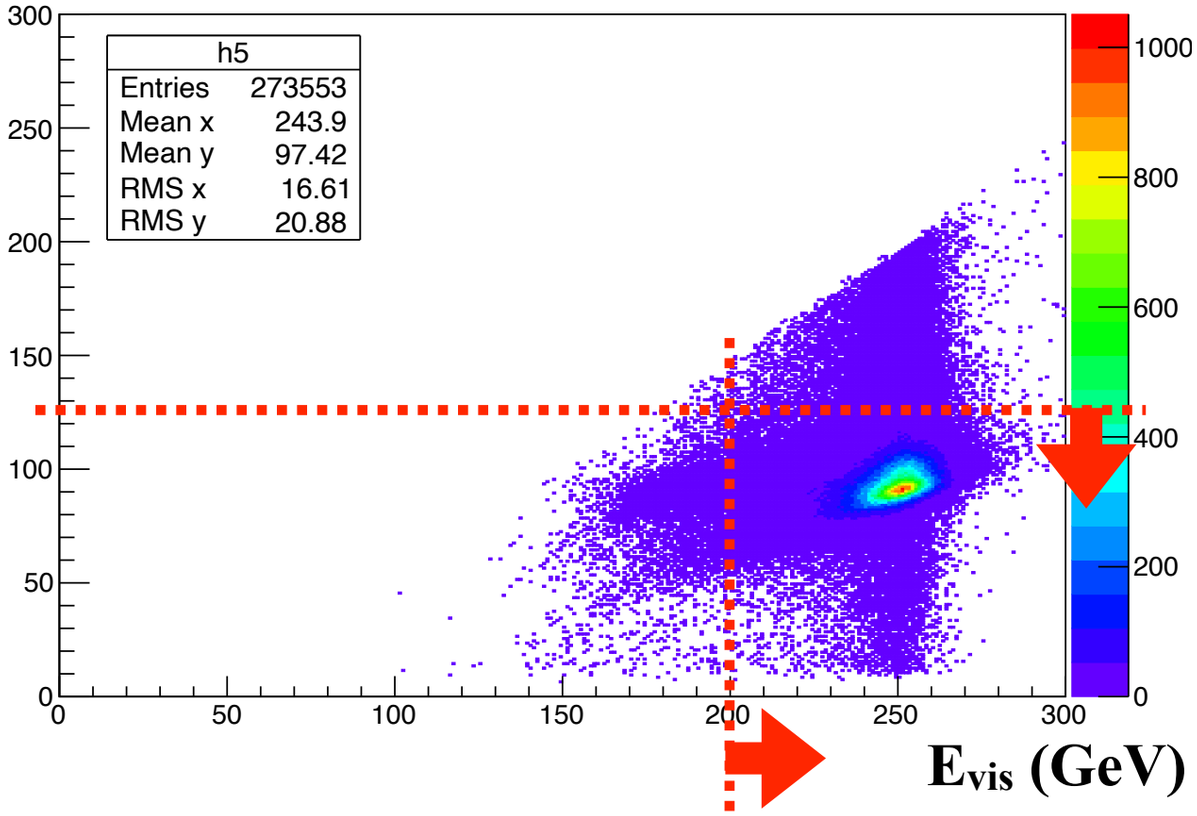
Correct Photon

Correct photon selection cut 1

M_{2j} vs. E_{vis} (=Ej1+Ej2+Eγ)

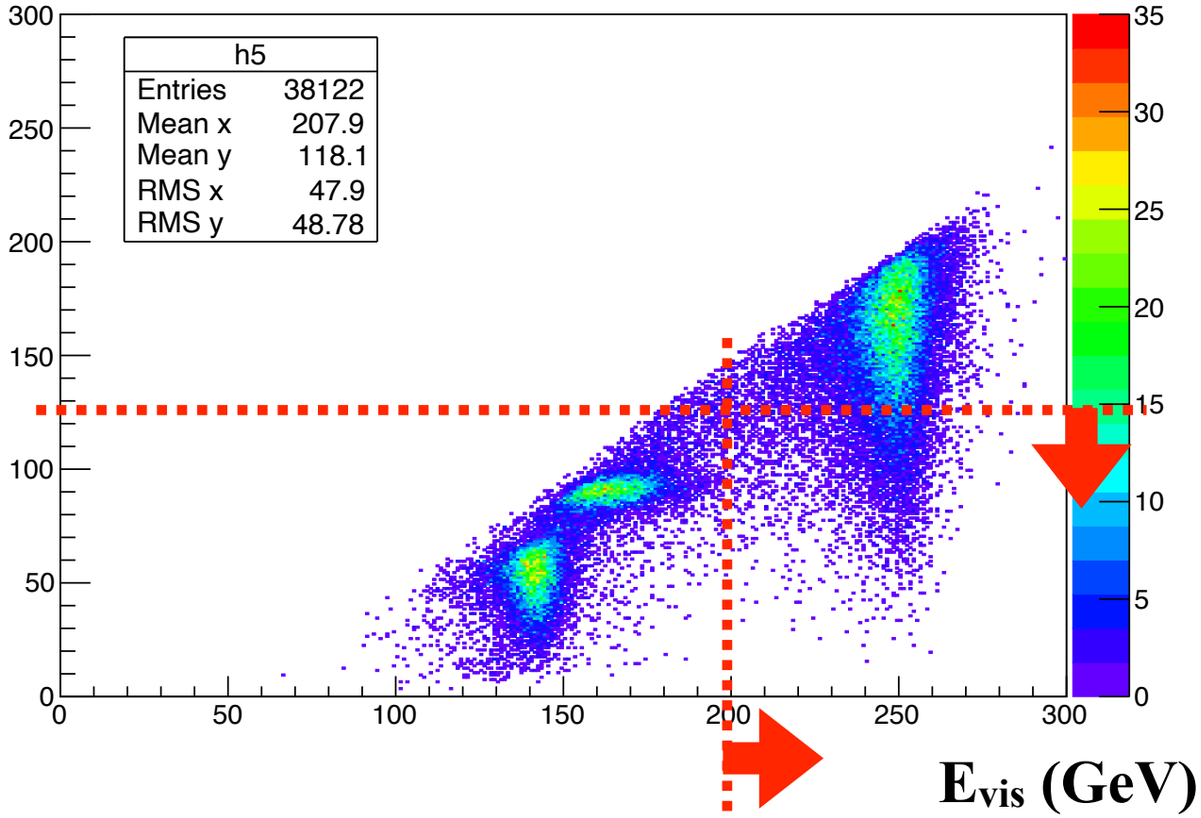
correct photon case

$|\Delta\theta_\gamma| < 0.01$



wrong photon case

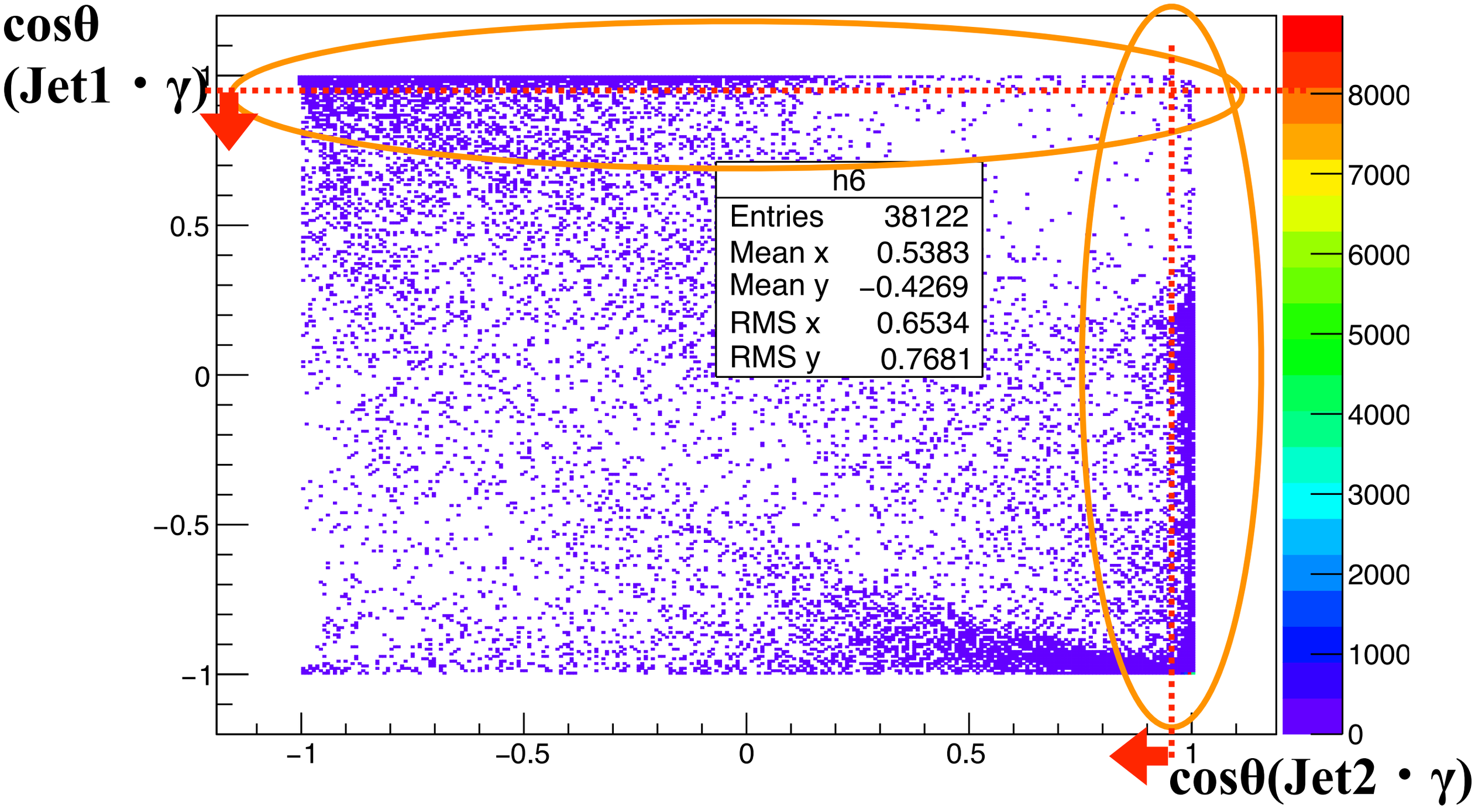
$|\Delta\theta_\gamma| > 0.01$



Cut1: M_{2j} <125 GeV && E_{vis} >200 GeV

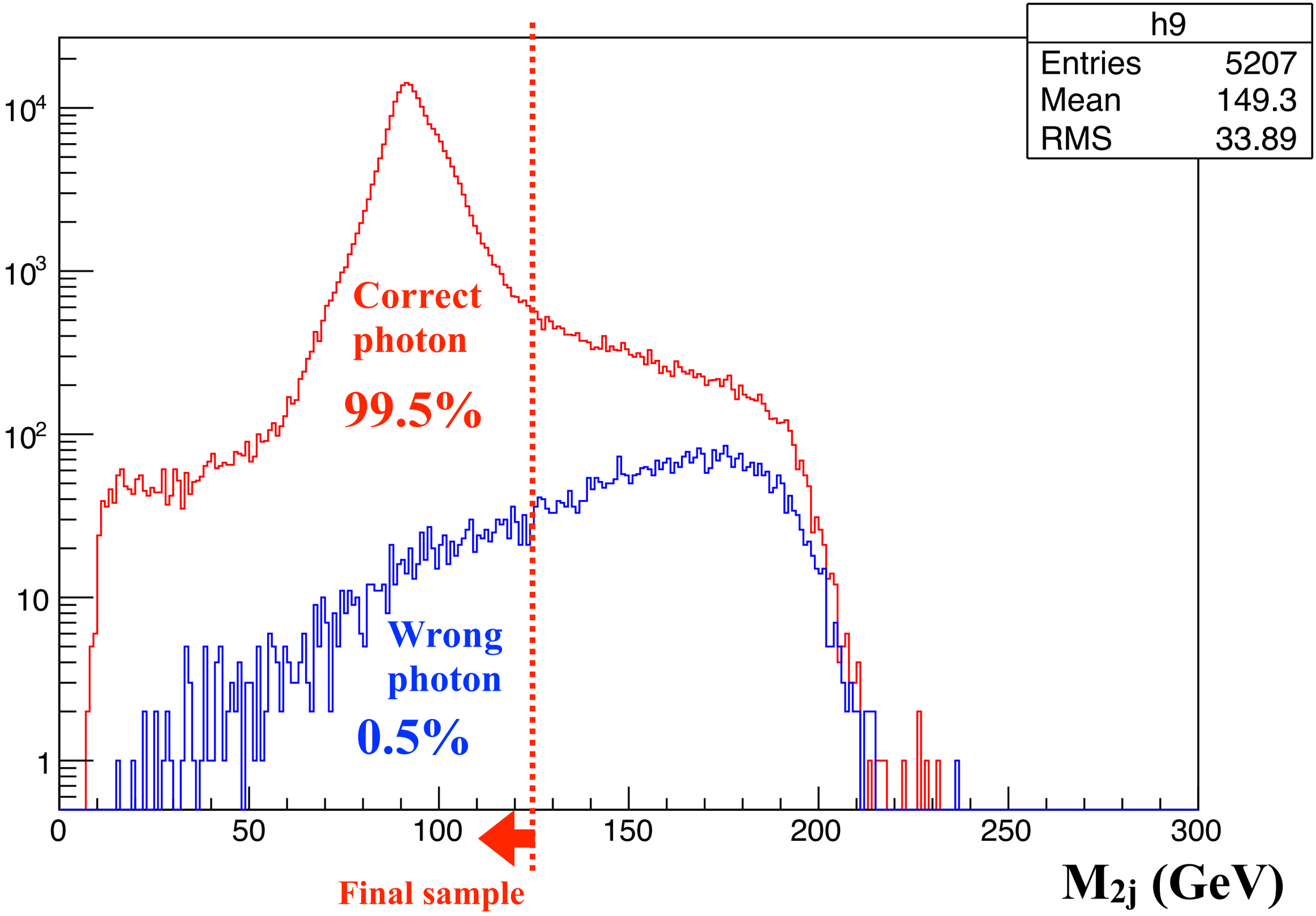
Correct photon selection cut 2

Wrong photons are near jet axes



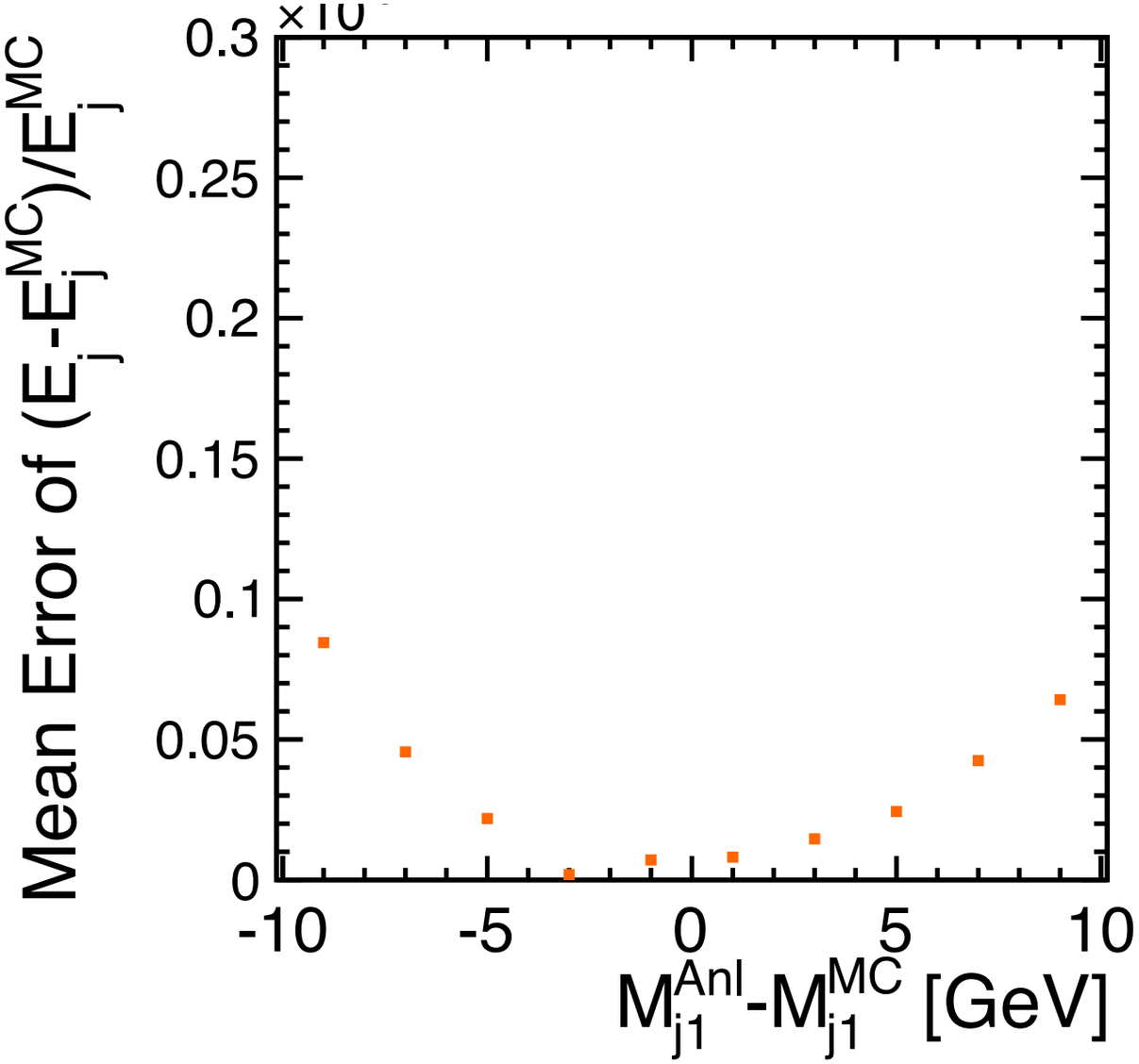
Cut2: cosθ(Jet1 ・ γ)<0.95 && cosθ(Jet2 ・ γ)<0.95

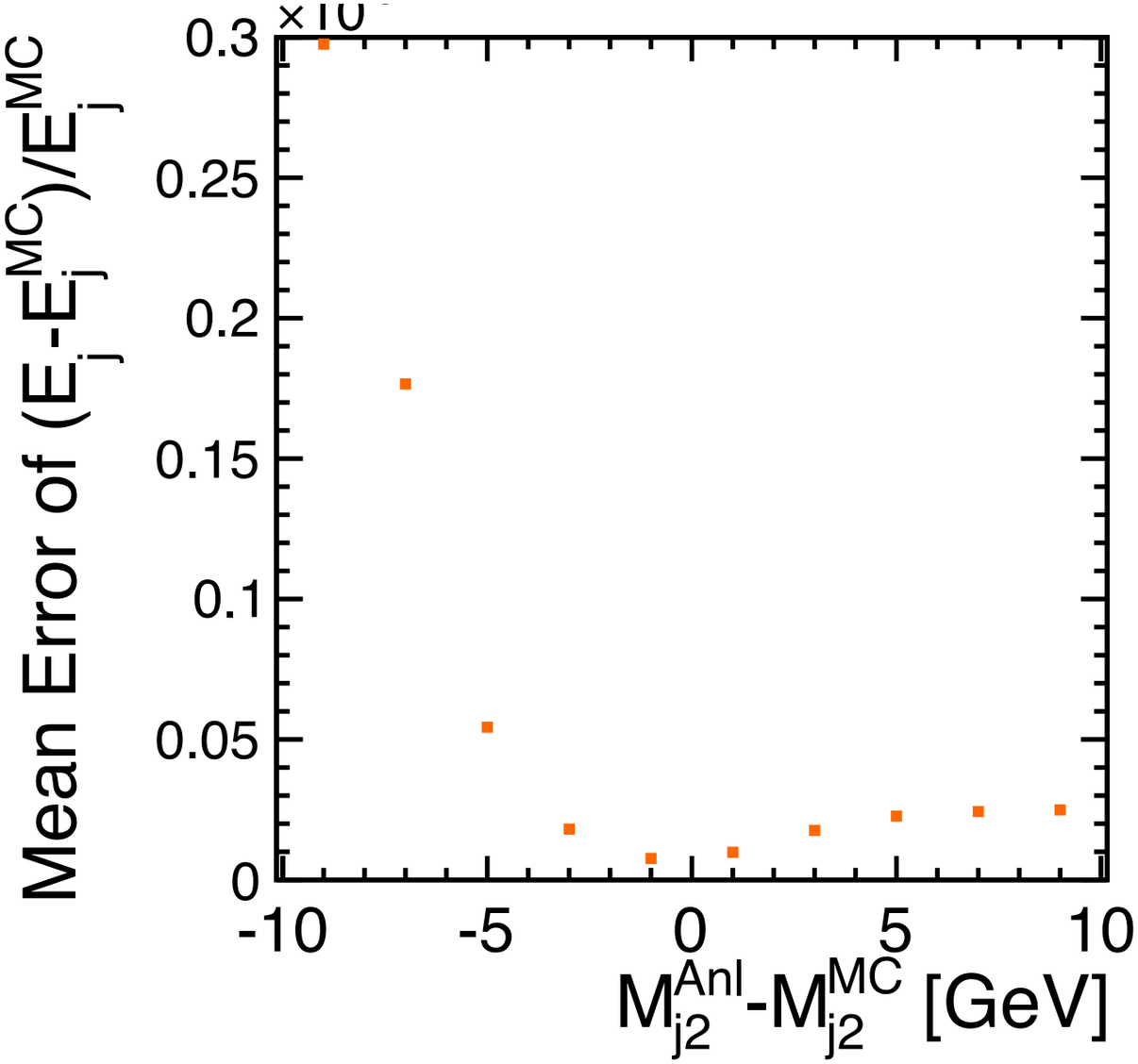
M_{2j} distribution after all but M_{2j} cut



Source (B): Error of the jet mass inputs

Mean value of the fitting function for the Jet 1 $\frac{E_{JRec} - E_{JTrue}}{E_{JTrue}}$ as a function of the input jet mass deviation





Large dependence on both jet 1 mass and jet 2 mass inputs.
If $<8 \times 10^{-4}$ accuracy is necessary, compensation to the reconstructed jet energy should be introduced.