Jet Energy Scale Calibration using $e^+e^- \rightarrow \gamma Z$ process

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Reconstruction Method

Method 3: Consider ISR and solve the full equation
Using (θ_{J1},θ_{J2},θ_γ,φ_{J1},φ_{J2},φ_γ,m_{J1},m_{J2}) -> Determine (P_{J1},P_{J2},P_γ,P_{ISR})

$$\begin{cases} \sqrt{P_{J1}^2+m_{J1}^2}+\sqrt{P_{J2}^2+m_{J2}^2}+|P_\gamma|+|P_{ISR}| = E_{CM} \quad ① \\ \begin{pmatrix} sin\theta_{J1}cos\phi_{J1} & sin\theta_{J2}cos\phi_{J2} & sin\theta_\gamma cos\phi_\gamma \\ sin\theta_{J1}sin\phi_{J1} & sin\theta_{J2}sin\phi_{J2} & sin\theta_\gamma sin\phi_\gamma \\ cos\theta_{J1} & cos\theta_{J2} & cos\theta_\gamma \end{pmatrix} \begin{pmatrix} P_{J1} \\ P_{J2} \\ P_\gamma \end{pmatrix} = \begin{pmatrix} (E_{CM}-|P_{ISR}|)sin\alpha \\ 0 \\ E_{CM} \pm |P_{ISR}|cos\alpha \end{pmatrix} \end{cases}$$

Matrix A — Inverse

Irrational equation for each sign of the ISR -> 8 possible solutions

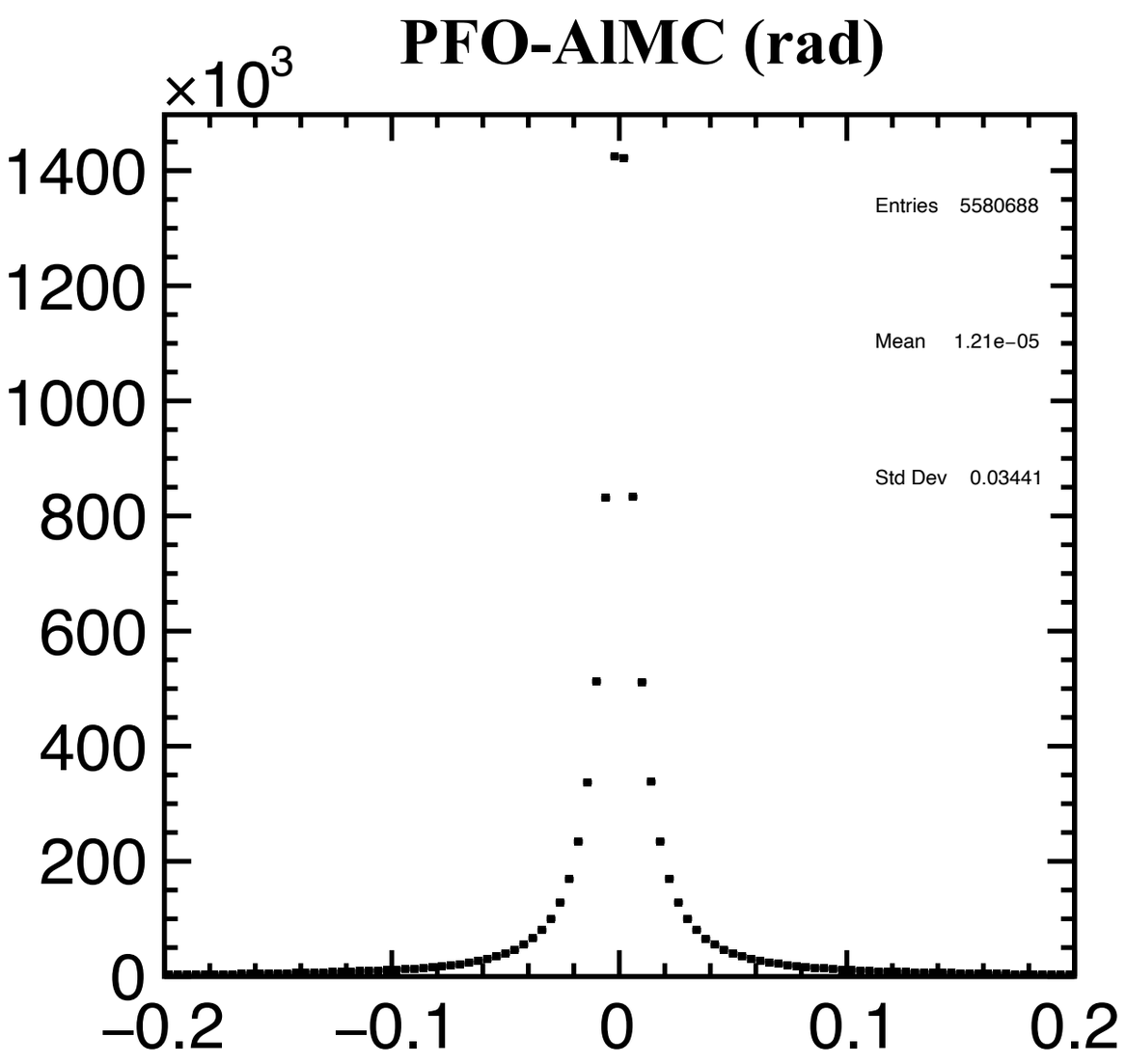
Choose the solution with

(i) Real and positive value with $<E_{CM}/2$
(ii) $\sqrt{P_{J1}^2+m_{J1}^2}>0$ and $\sqrt{P_{J2}^2+m_{J2}^2}>0$
(iii) P_{J1}, P_{J2}, P_γ >0
(iv) solved P_γ closest to the measured P_γ

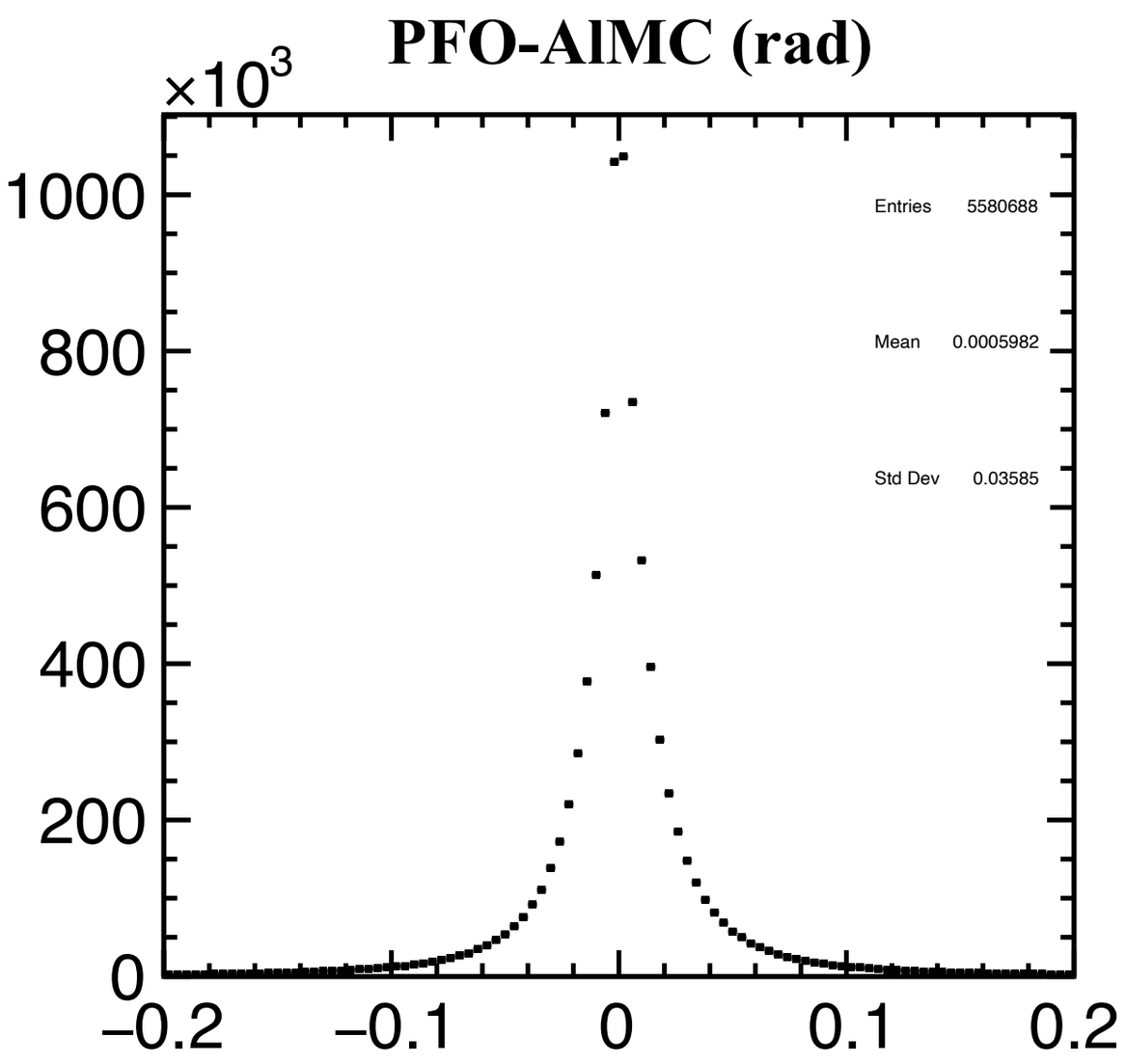
Input variables correctness

eLpR Samples
MC Cut:
Correct photon selection
Method 3 has answer

Theta



Phi

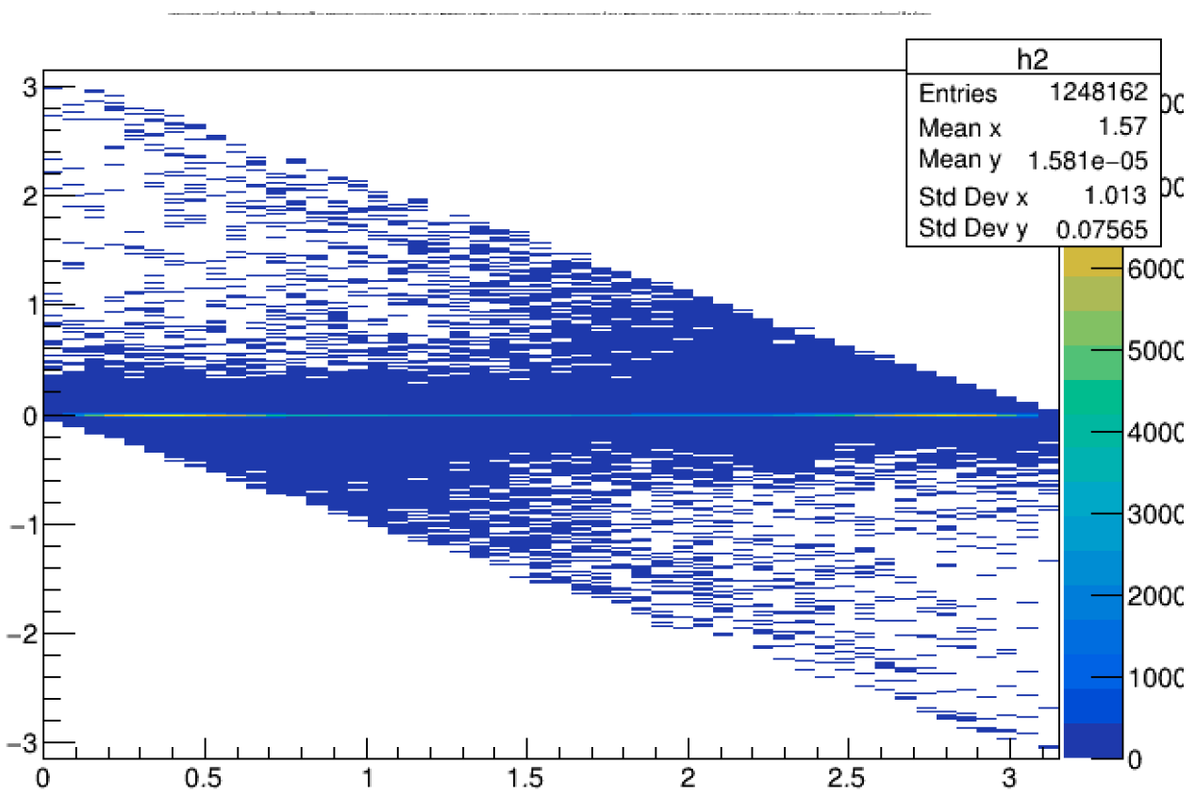


Both have 0.03 or 0.04 rad standard deviation.
RMS90 macro is taking much time (with 100000 bins).

Theta Abs. Difference

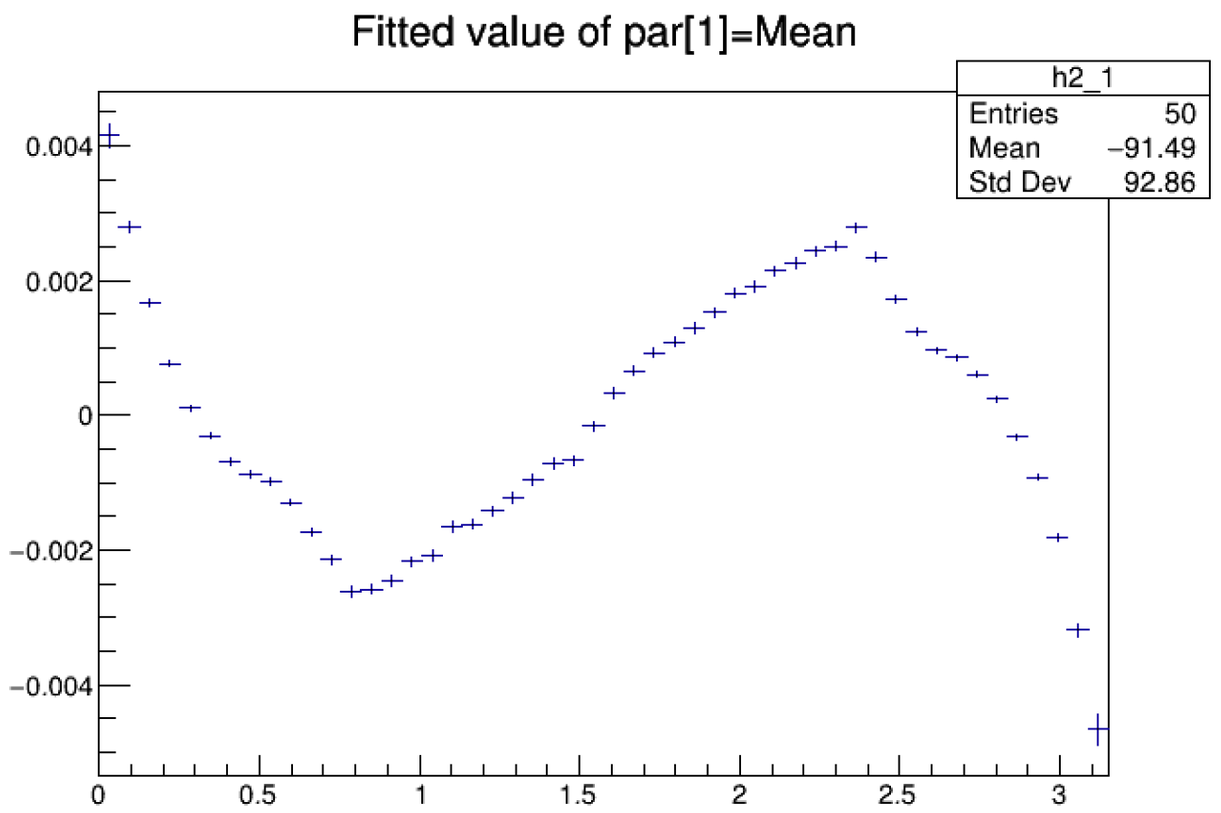
eLpR Samples
MC Cut:
Correct photon selection
Method 3 has answer

Theta-dependence



Theta

FitSlicesY



Theta

Phi Abs. Difference

eLpR Samples
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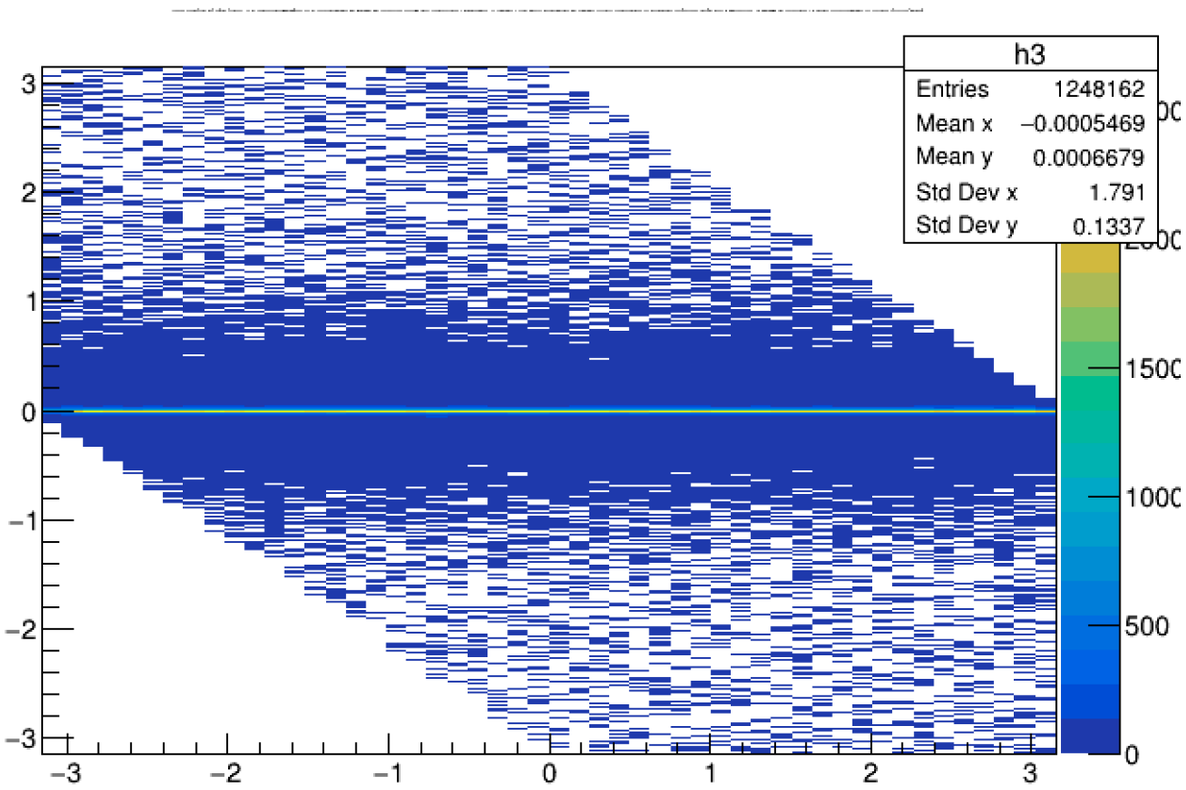
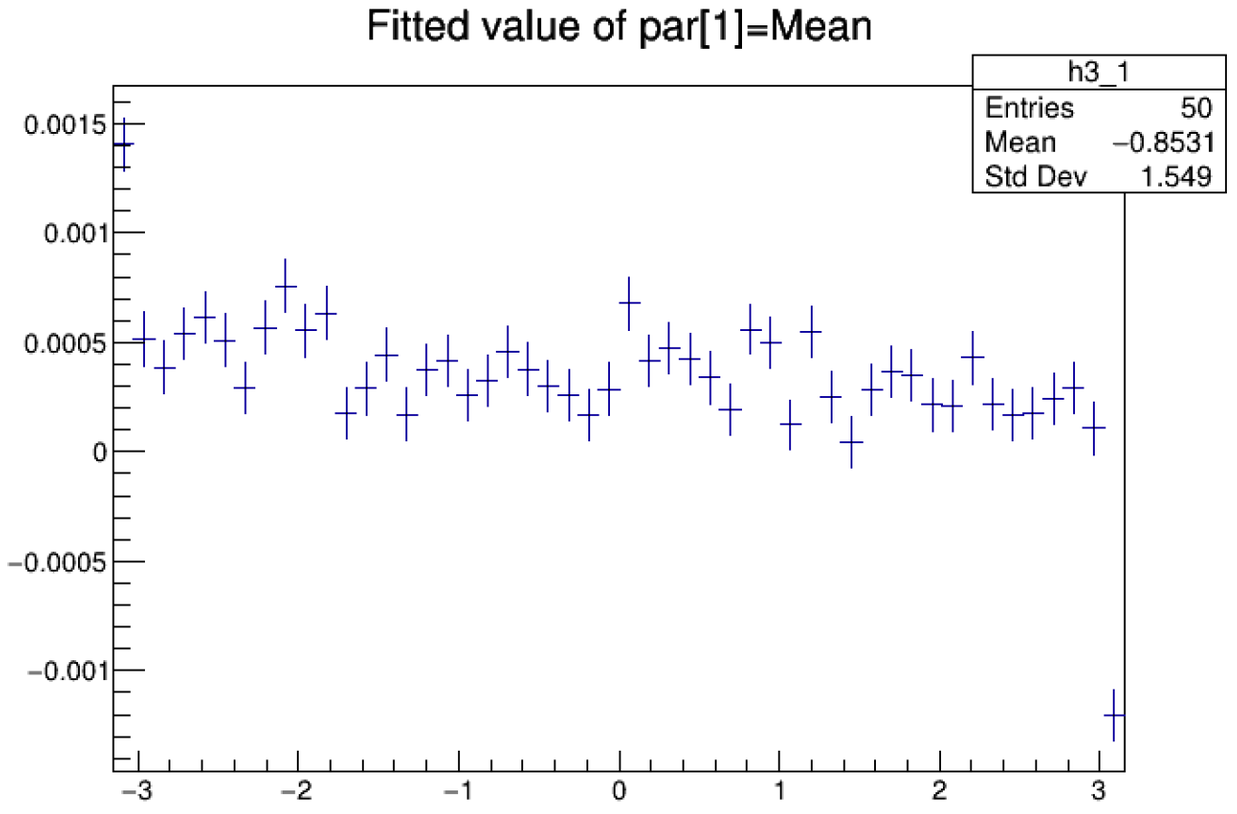


Phi

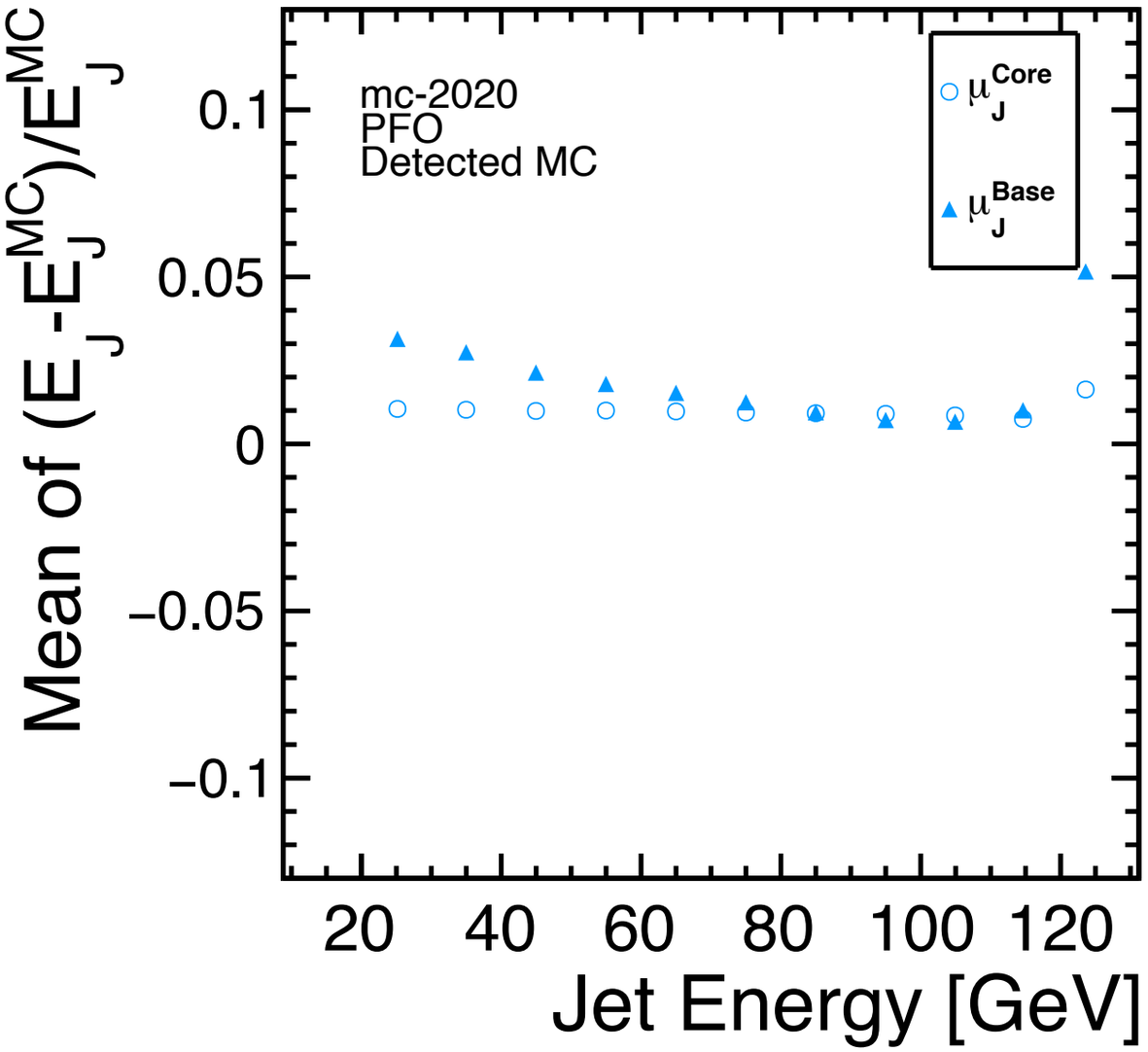
FitSlicesY



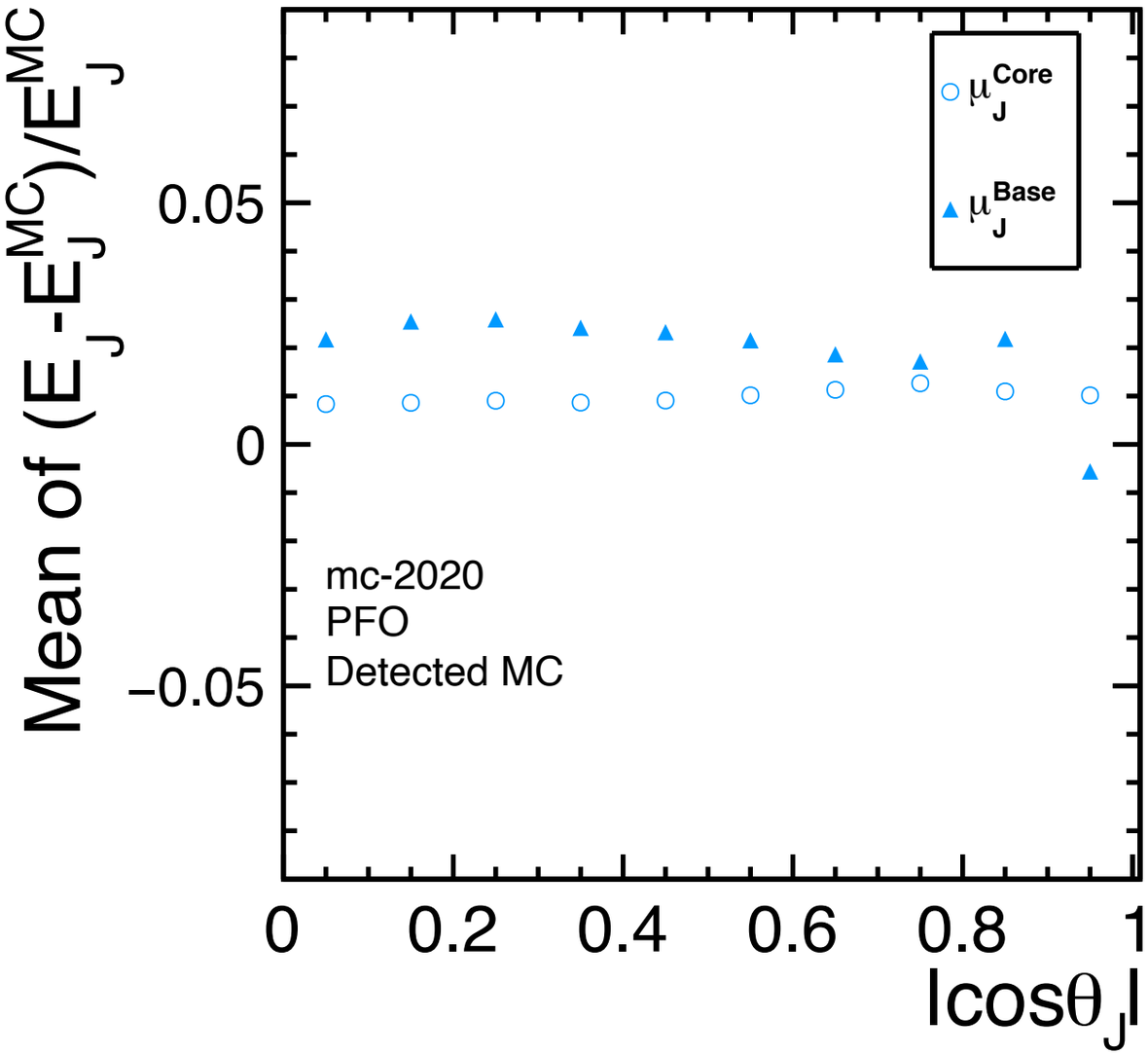
Phi

PFO E,T-Dep (De-MC)

E-Dep

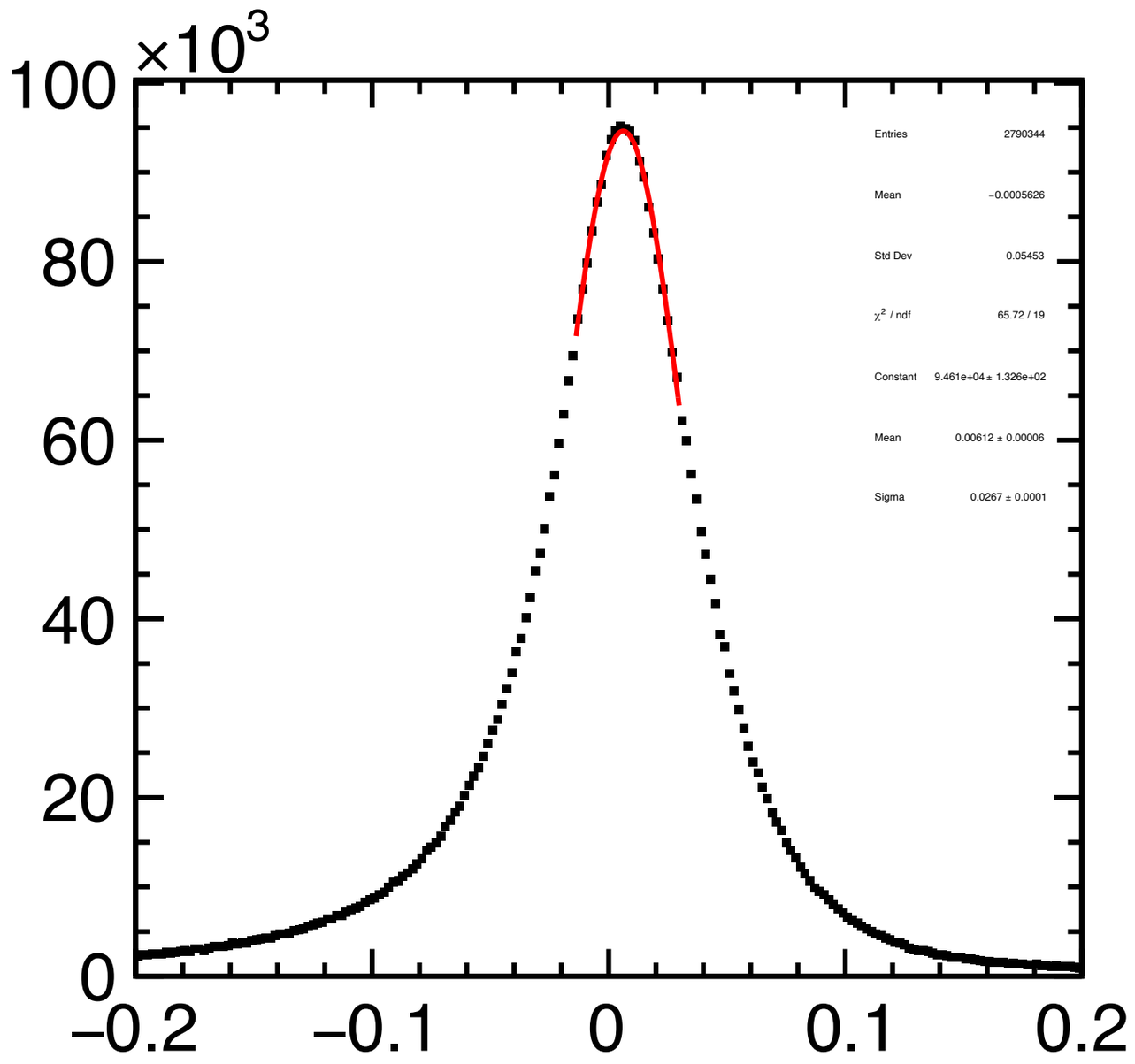


T-Dep



PFO has positive bias.

PFO total jet energy



Mean of the gaussian ~0.00612
Should be fitted with more reliable way