CEPC Jet&Clusters

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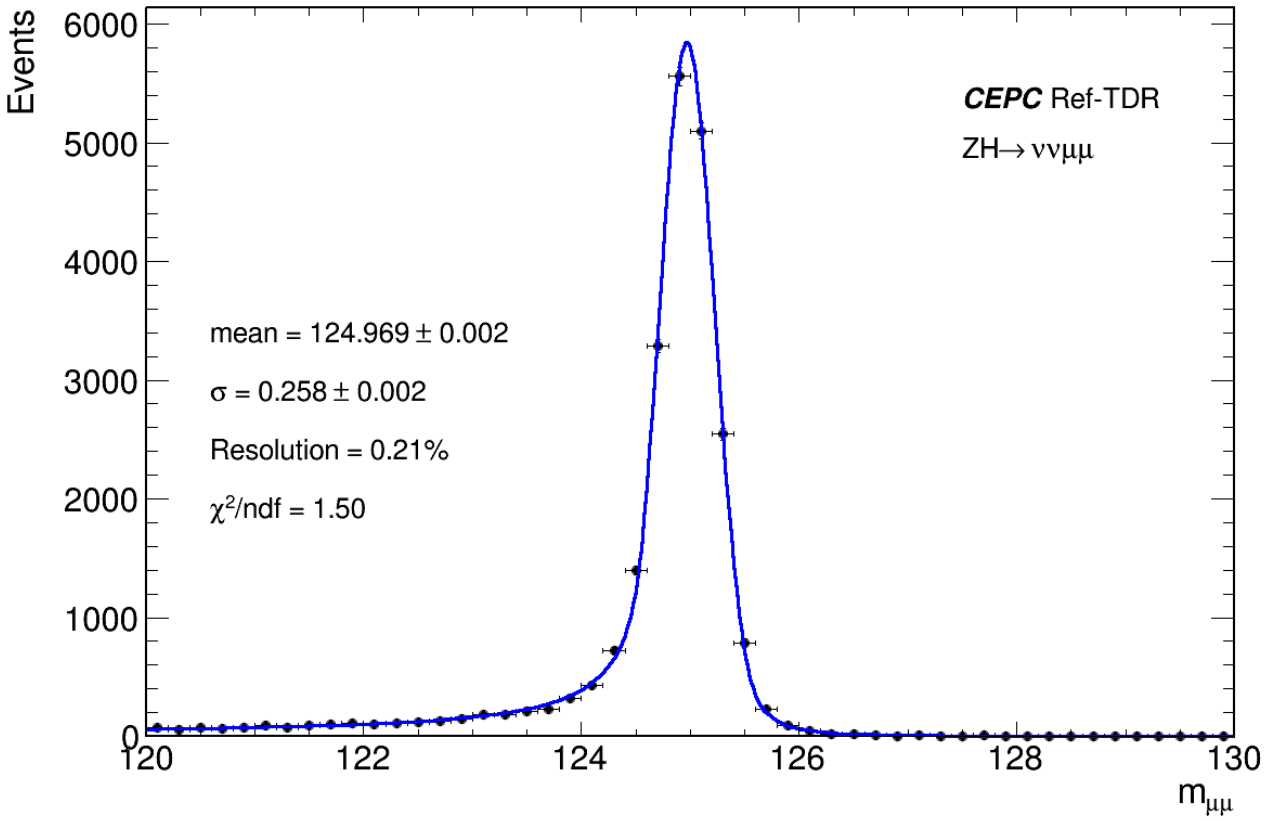
CEPC sample/release

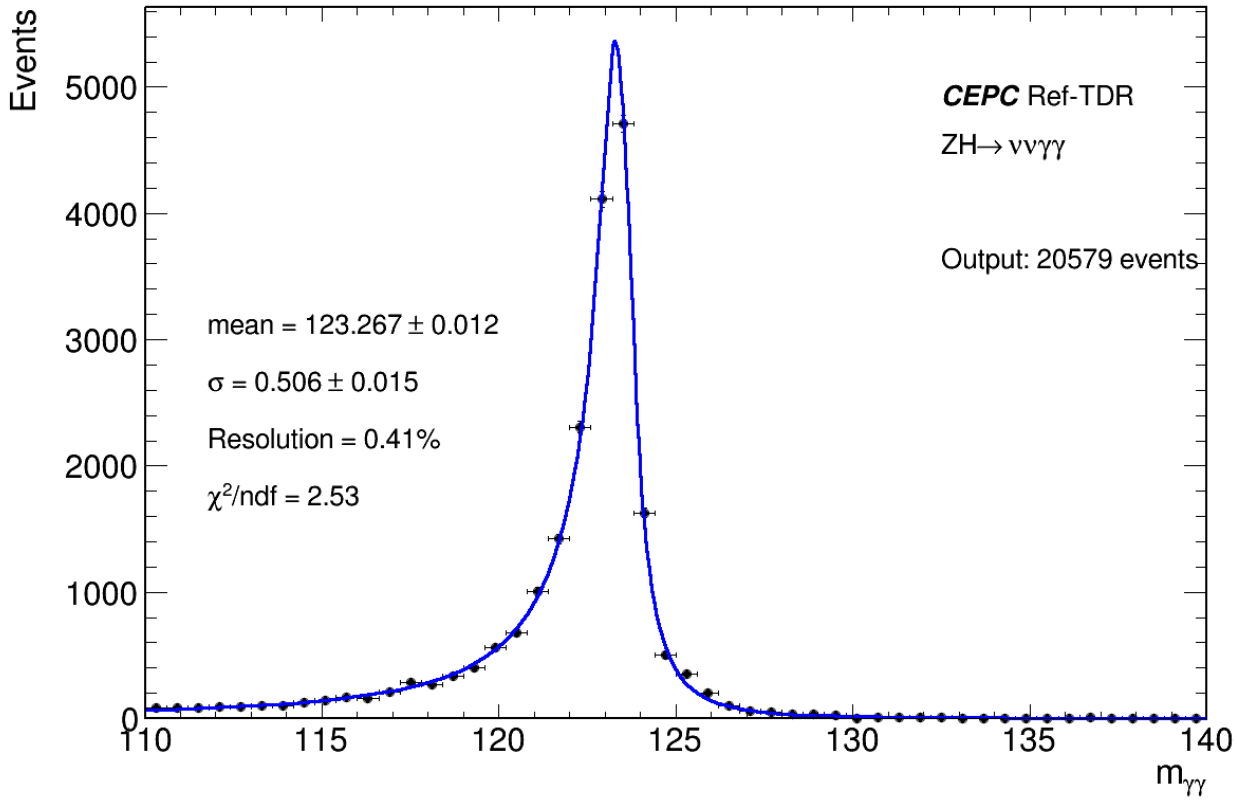
- Hcal but fixed
  - Please use fix 48bcef3d instead of 24.12.0.
- Sample under generation
  - Need 6GB memory, speed slower.
  - H->qq and Z->qq sample available under /cefs/higgs/zhangkl/Production/2412/
  - Other processes and generators under study @Nazima

Sample performance

No muon chamber information used.
(Only tracking).
Mass 0.2% -> Track 0.1%.

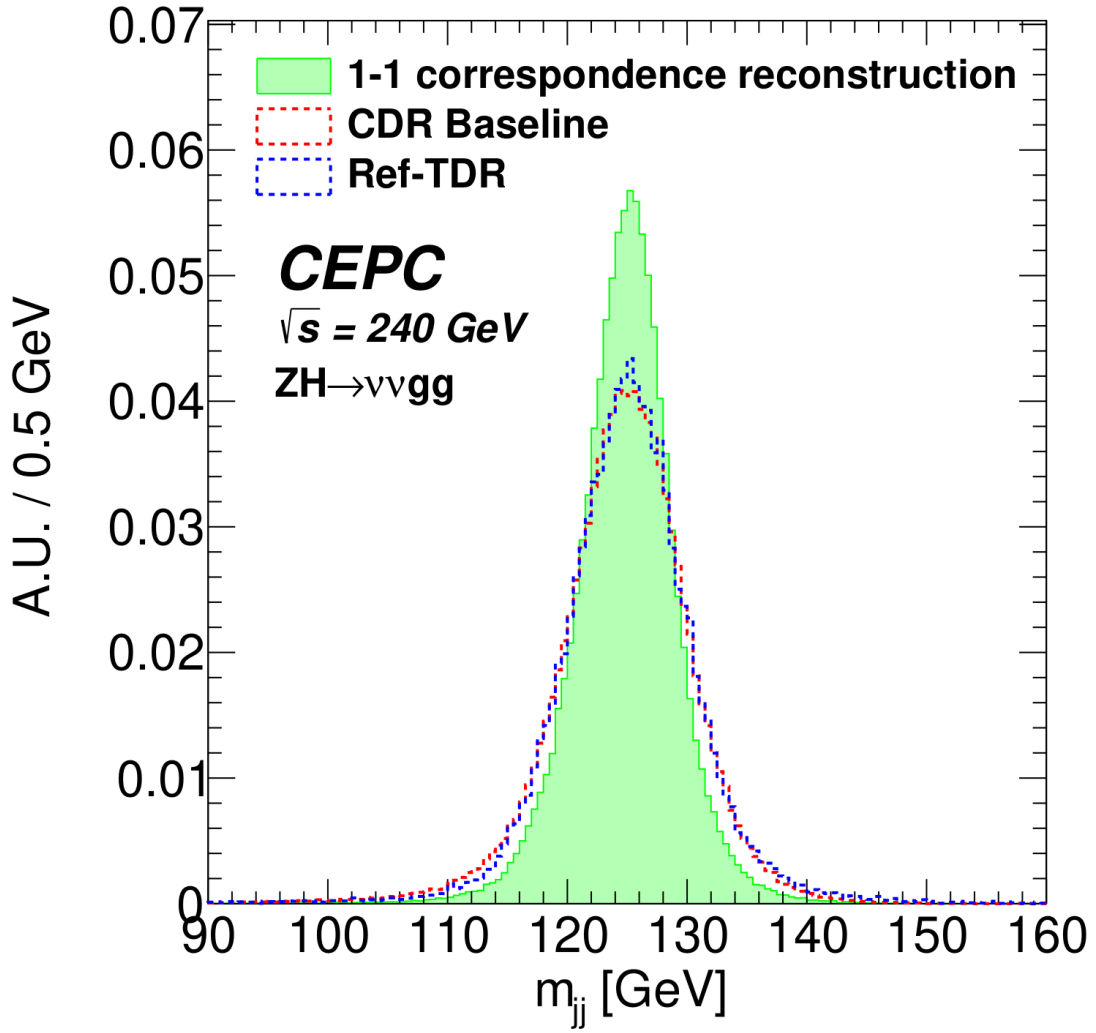
Energy 0.41%: corresponds to $1.1\%/\sqrt{E} \oplus 0.3\%$

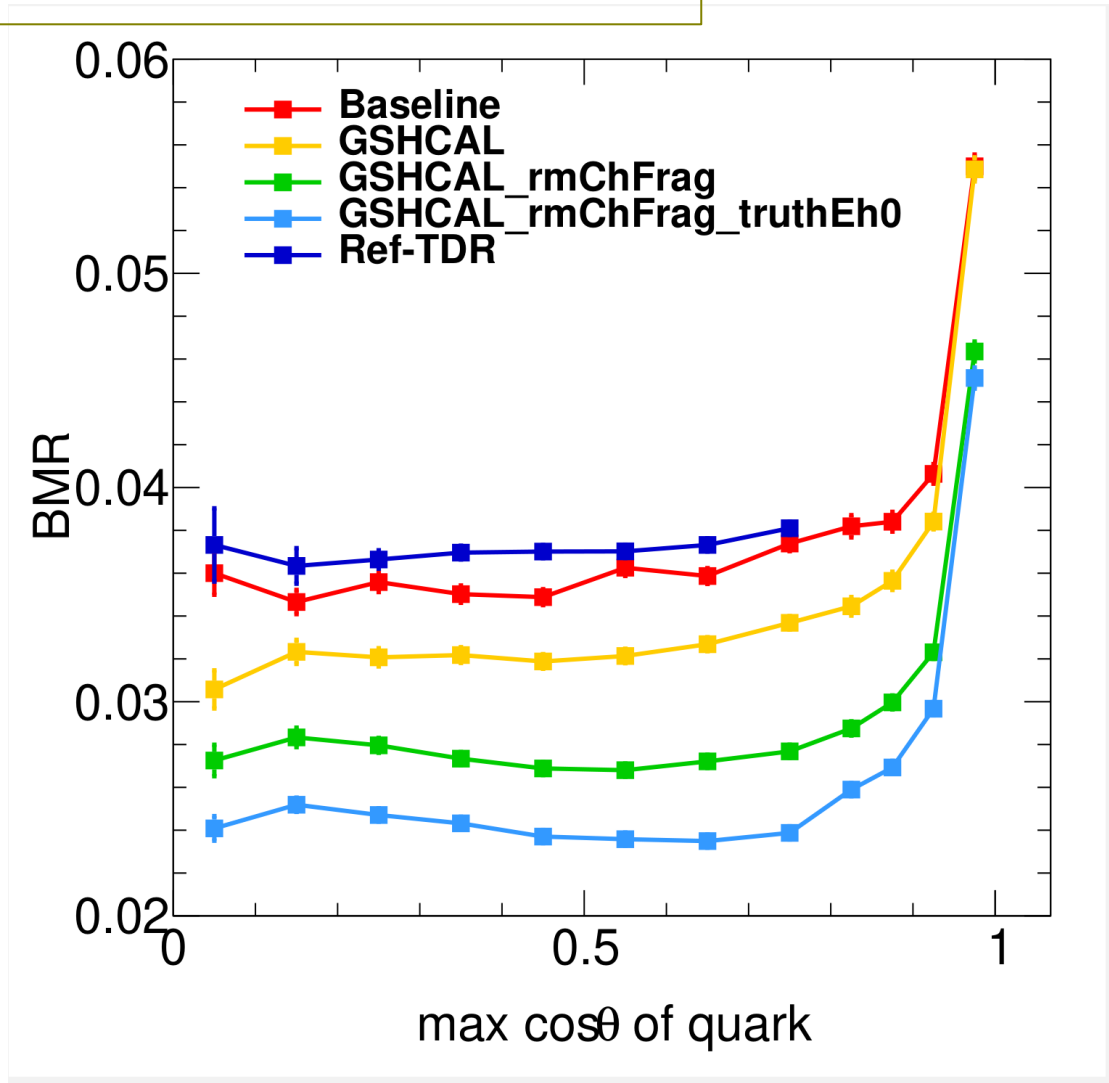




CDR BMR comparison

In 2024.12, Ref-TDR jet BMR performance consistent with CDR(baseline).
Blue/Red curve just match.





BMR

In truth M_jj level,
Neutrino energy missing = left tail;
ISR included in jet clustering =right tail.
Cuts added to veto.

@Xiaotian

Table 1. Event cumulative efficiency for Higgs boson exclusive decay at the CEPC with $\sqrt{s} = 240$ GeV.

	$gg(\%)$	$bb(\%)$	$cc(\%)$	$WW^*(\%)$	$ZZ^*(\%)$
Pt_ISR < 1 GeV	95.15	95.37	95.30	95.16	95.24
Pt_neutrino < 1 GeV	89.33	39.04	66.36	37.46	41.39
|Cos(Theta_Jet)| < 0.85	67.30	28.65	49.31	–	–

Table 3. Higgs boson mass resolution (sigma/Mean) for different decay modes with jets as final state particles, after event cleaning.

$H \to bb$	$H \to cc$	$H \to gg$	$H \to WW^*$	$H \to ZZ^*$
3.63%	3.82%	3.75%	3.81%	3.74%

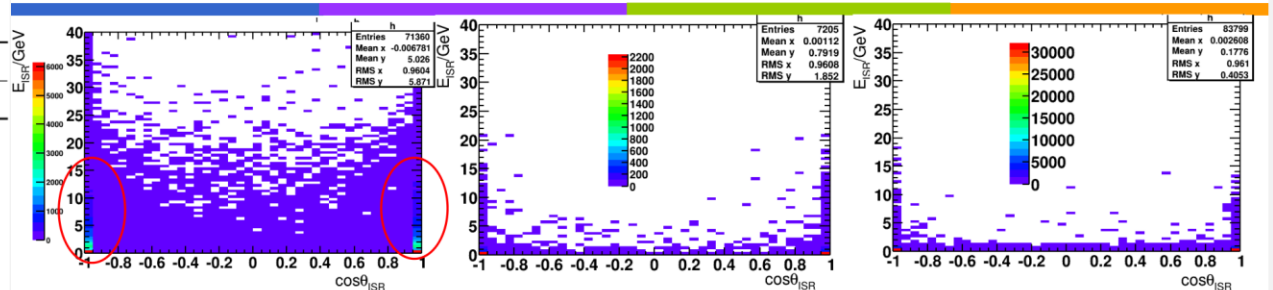
CDR reference

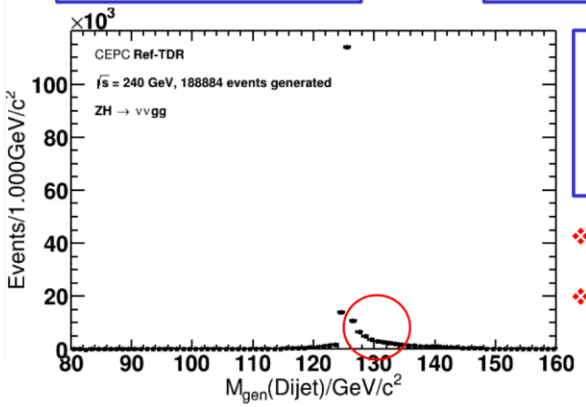
Process		$ZH \to \nu\nu gg$	$ZH \to \nu\nu bb$	$ZH \to \nu\nu cc$	$ZH \to \nu\nu uu$	$ZH \to \nu\nu dd$	$ZH \to \nu\nu ss$
Cumulative efficiency /%	$\Sigma\|Pt_{\mathrm{ISR}}\| < 1\mathrm{GeV}/c$	95.3	95.4	95.4	95.4	95.4	95.3
	$\Sigma\|Pt_{\nu}\| < 1\mathrm{GeV}/c$	89.8	39.3	66.5	94.9	94.9	94.8
	$\|\cos\theta_{\mathrm{jet}}\| < 0.7$	53.1	22.0	38.0	55.1	55.2	55.1
DSCB BMR/%		3.99 ± 0.02	3.81 ± 0.03	4.04 ± 0.03	3.90 ± 0.02	4.06 ± 0.02	4.53 ± 0.02

- Comparison between CDR reference and current results
  - Efficiencies of event cleaning match for $ZH \to \nu\nu gg/\nu\nu bb/\nu\nu cc$
  - BMR for $ZH \to \nu\nu gg/\nu\nu bb/\nu\nu cc$ is worse by 0.24%/0.21%/0.22%

Results consistent with CDR.

E_{ISR} VS $\cos\theta_{\mathrm{ISR}}$ VS $M^{\mathrm{gen}}_{\mathrm{Dijet}}$





$ZH \to \nu\nu gg$
GenJet:
generatorStatus==1 and veto neutrinos
MCParticle pass ee_kt_algorithm

- Most ISR photons are along the beam
- Long tail in the right side could be explained by the ISR photons in the round circle which are included in the ee_kt_algorithm

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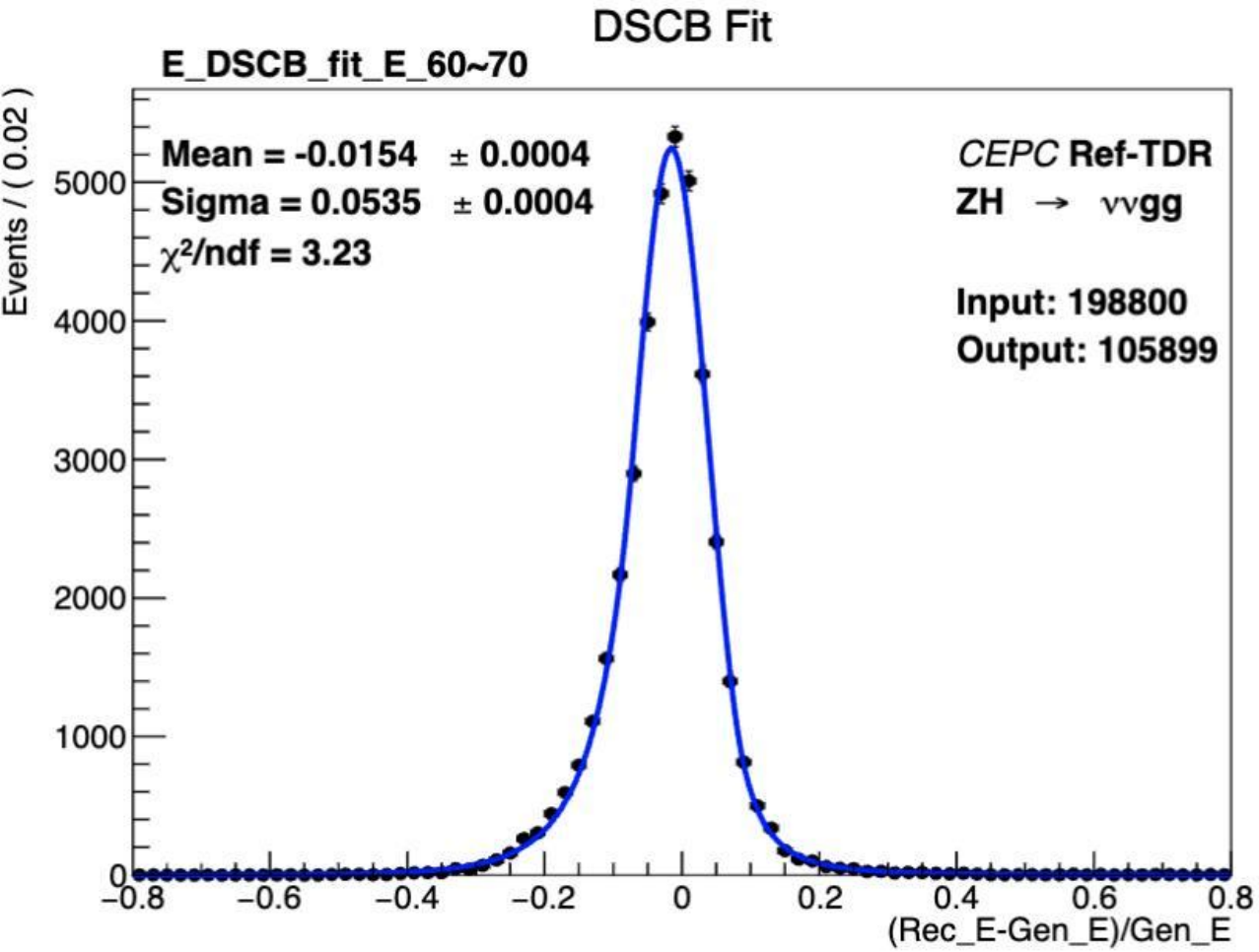
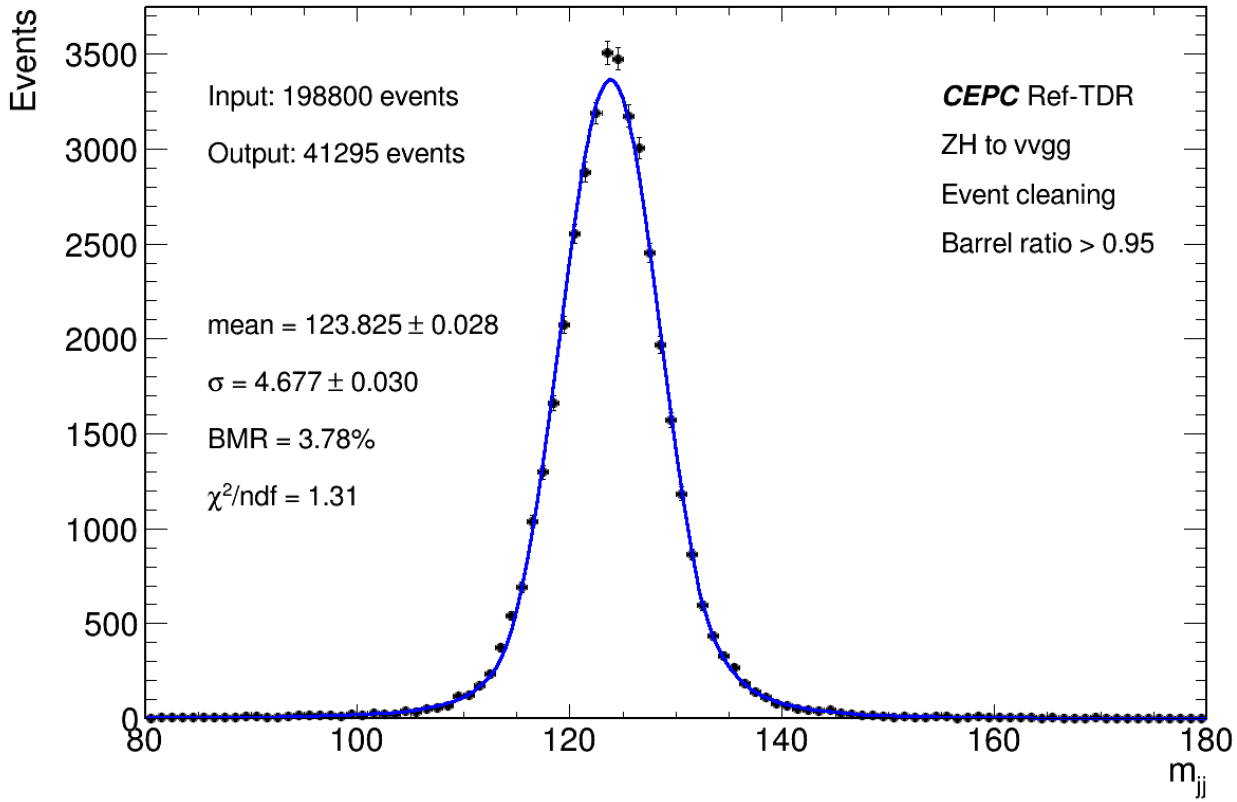
Jet performance

@Yingqi

Use Delta(J1, J2)>2 to select back-to-back jets. Eff ~90%.
Most of jets for Higgs are already back-to-back.

Barrel ratio >0.95

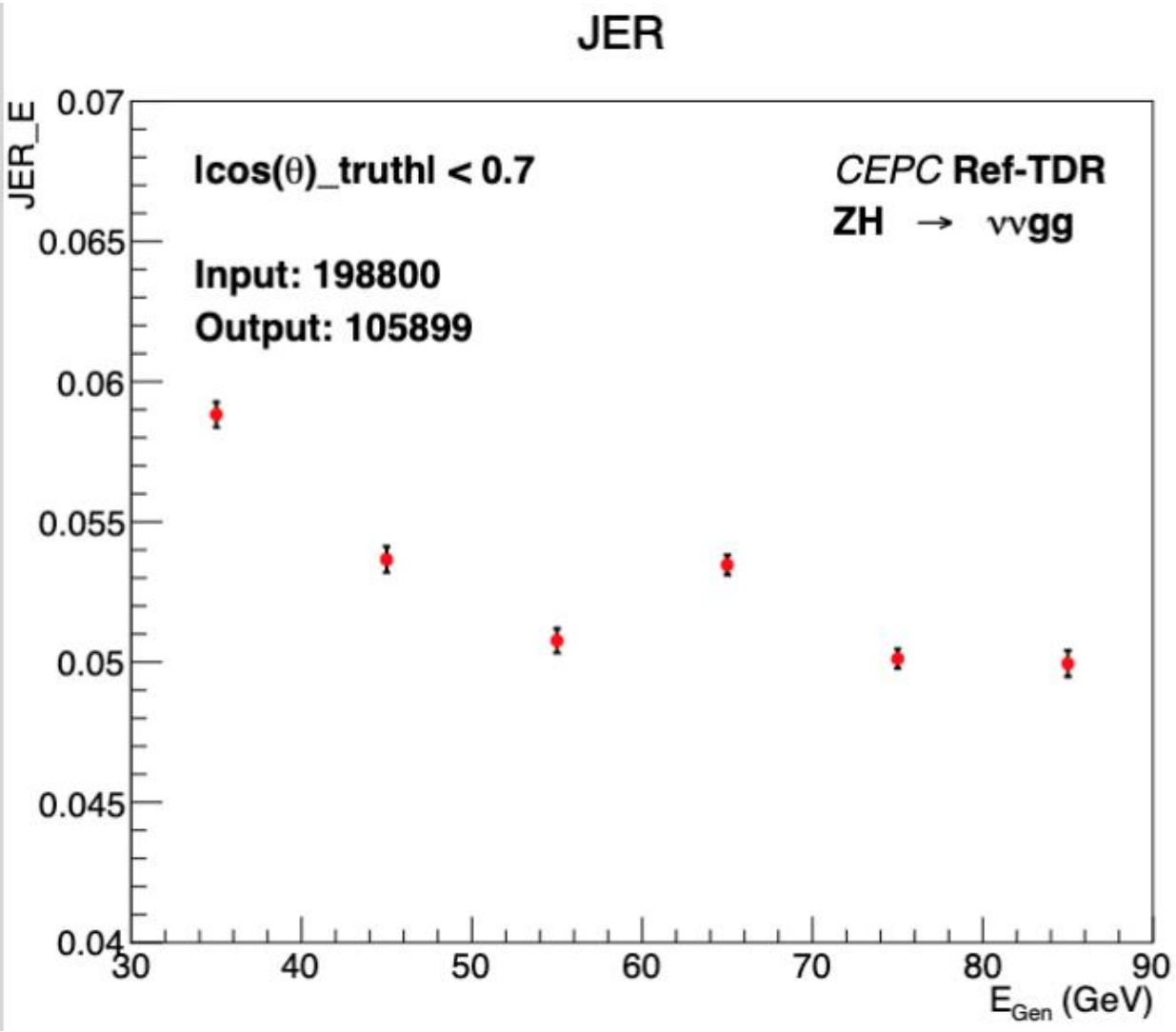


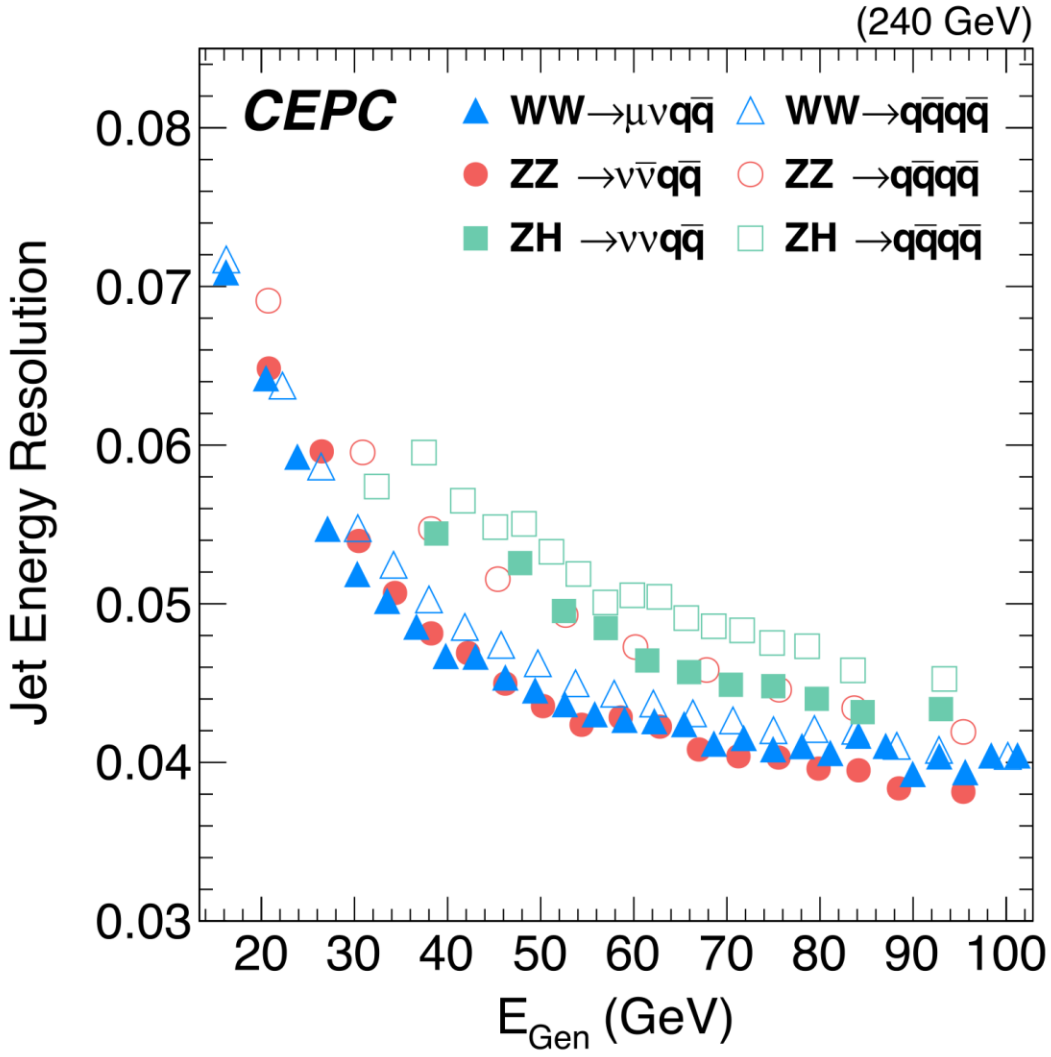


Jet performance

@Yingqi

Fit details checked. Enough statistics used in fit.
Differential difference < 5%.

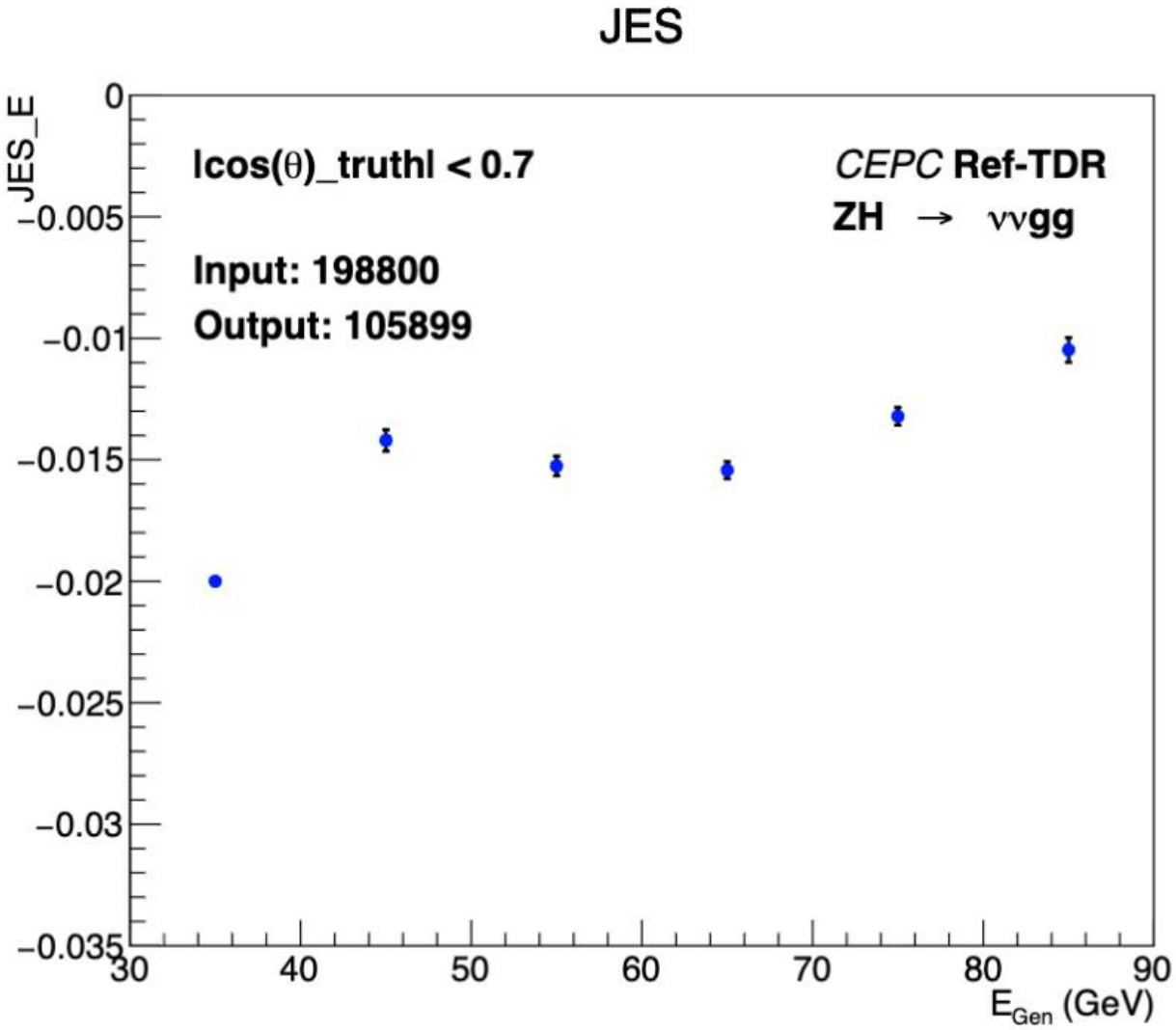


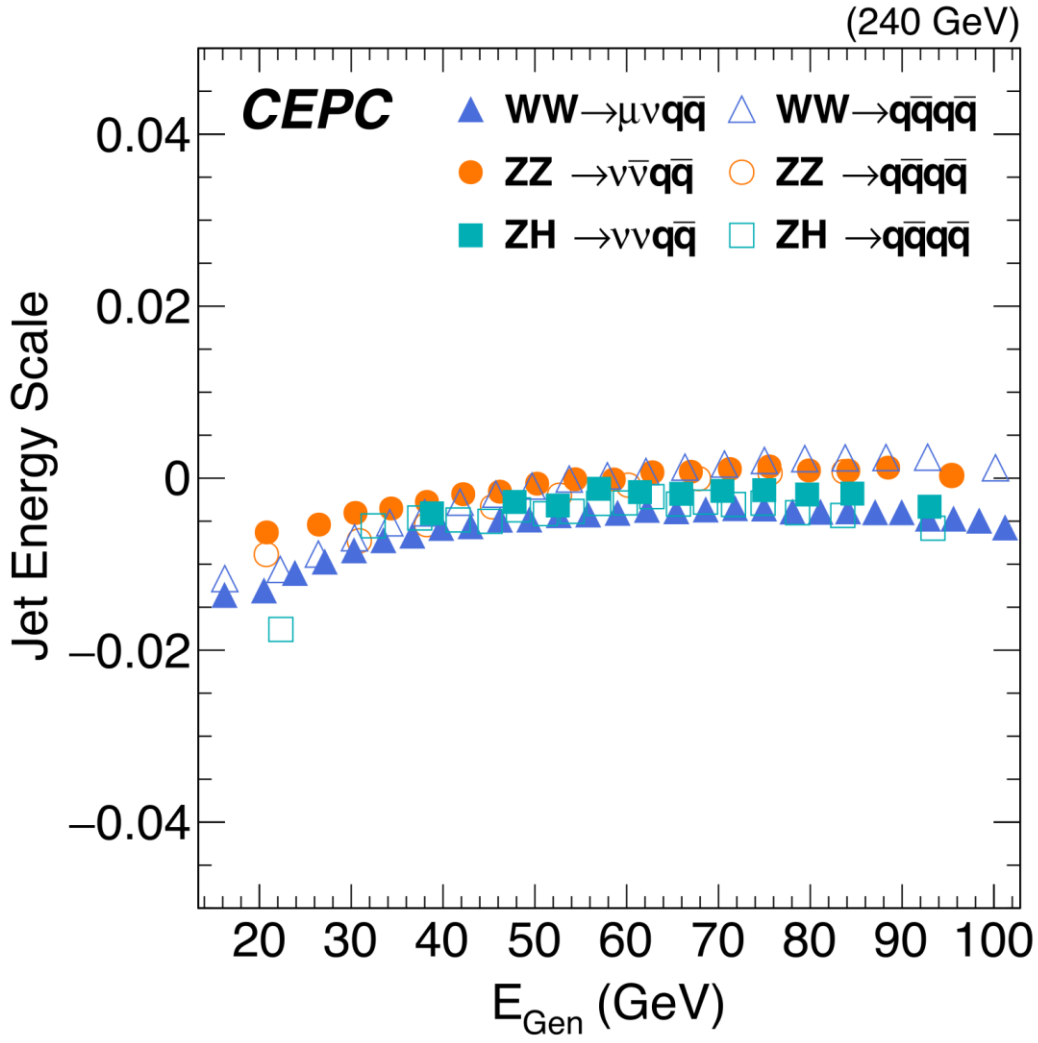


Jet performance

@Yingqi

Fit details checked. Enough statistics used in fit.
Tendency and range between Ref-TDR and CDR is similar.



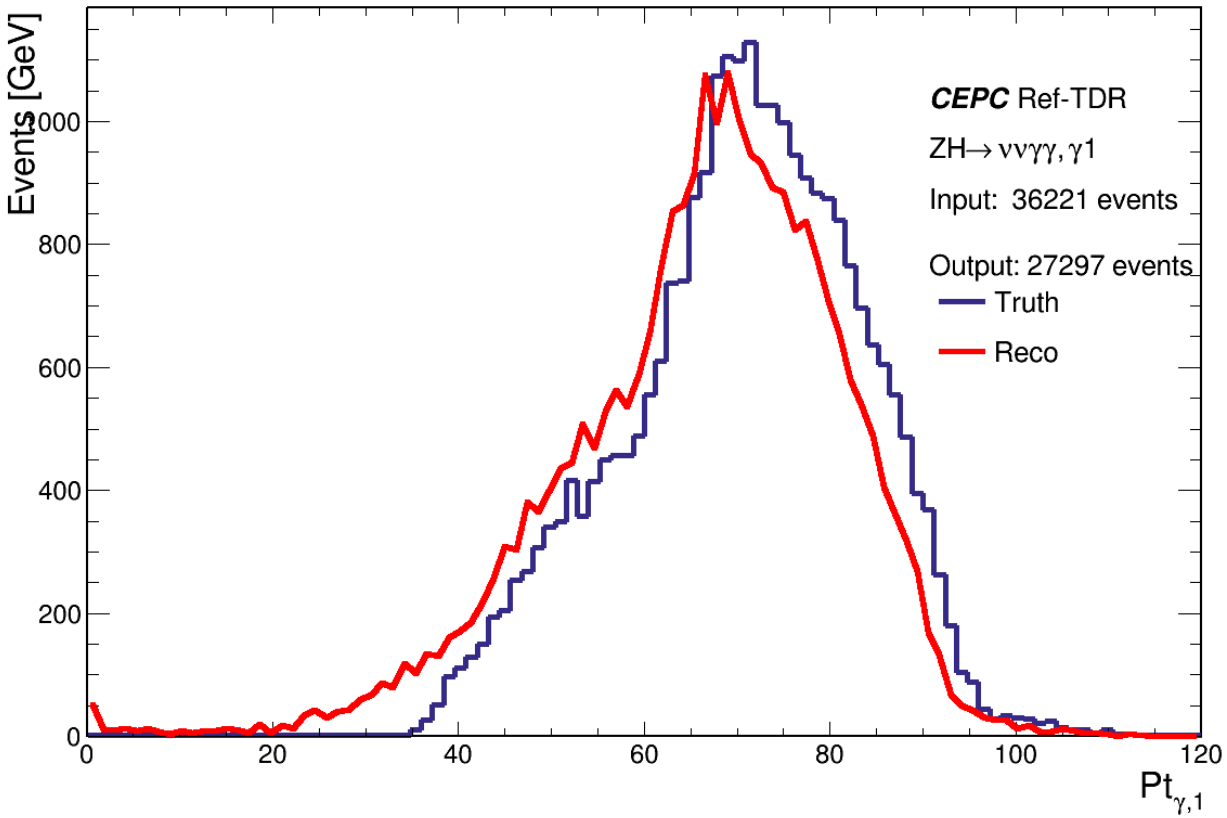


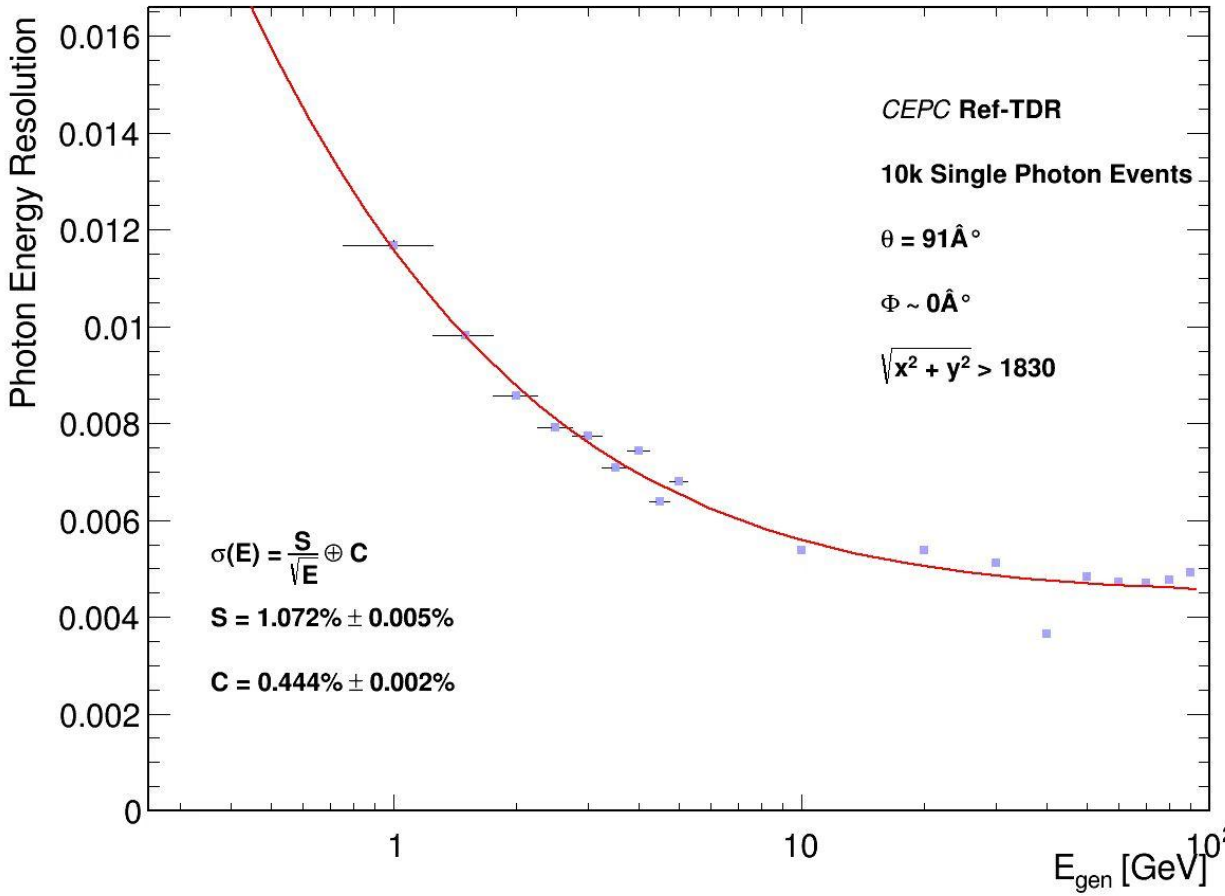
Photon Performance

@Reda

Currently the leading 2 PFOs chosen as photons, energy shifted.
Using (m_yy= 123.367) ~1.5%.
Using Pt_gamma ~3%.

Ecal fit curve fixed.
Now consistent with Ecal response.



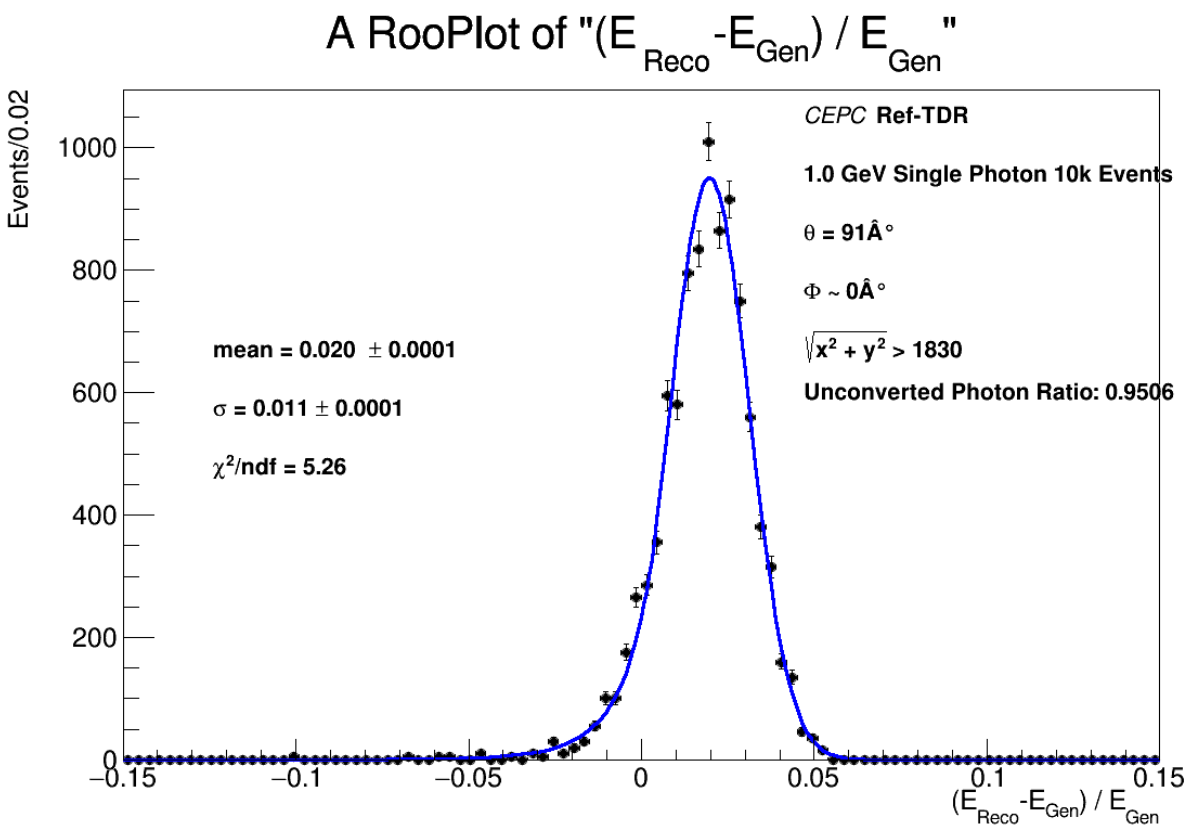


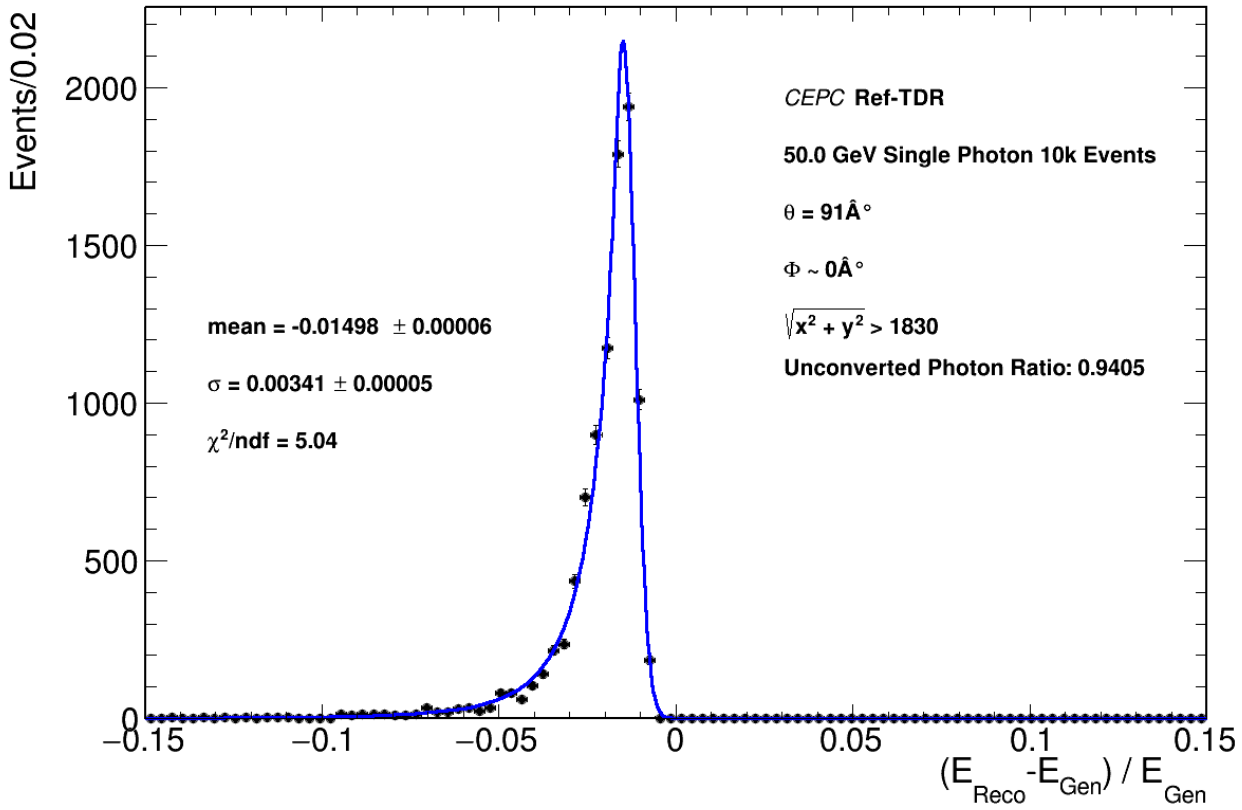
Photon Performance

@Reda

Photon has positive energy scale in low mass region. PFA group under calibration.

As ecal scaling factor currently 1 for photon,
The high energy photon loss can be Hcal energy leakage.





Photon energy differentials rely on different phi – (1.2% and 2.4%) Ecal model crack region. Reda working on it.