CEPC Jet&Clusters

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CEPC sample/release

- Please use latest master release.
- Sample under generation
- Need 6GB memory, speed slower.
- H->qq, Z->qq, WW/ZZ->4q sample available under
  - /cefs/higgs/zhangkl/Production/2412/
  - /cefs/higgs/guofy/CEPCSW_tdr24.12.1/performance/JER_eeqq
  - New PID, vertex fit in latest: /cefs/higgs/zhangkl/Production/24122
- Other processes and generators under study @Nazima

Sample Requirement for TDR note

No endcap;
Ecal 10*10mm.
Also we assume there are no big change in detector level.

Following samples are almost ready.
For ttbar, Vcs/Vcb, LLP, weak mixing angle, need analyzer to participate.

	Process @ c.m.e	Domain	Relevant Det. Performance
Z→μμ	Z@ 91.2 GeV	Z	lepton ID, tracking
H→γγ	qqH	Higgs	photon ID, EM resolution
Higgs recoil	ℓℓH	Higgs	Lepton ID, track dP/P
H→ss	νν̄H @ 240 GeV	Higgs	PID, Vertexing, PFA + JOI
H→inv	qqH	Higgs/NP	PFA, MET
Vcs/Vcb	WW→ℓνqq @ 240/160 GeV	Flavor	PFA, JOI + PID (lepton, tau)
H→LLP	ℓℓH	NP	TPC, TOF, calo, muon detectors
H→μμ	qqH	Higgs	lepton ID, tracking, OTK
Top mass & width	Threshold scan @ 360 GeV	EW	Beam energy
Weak mixing angle	Z→bb @ 91.2 GeV	EW	JOI

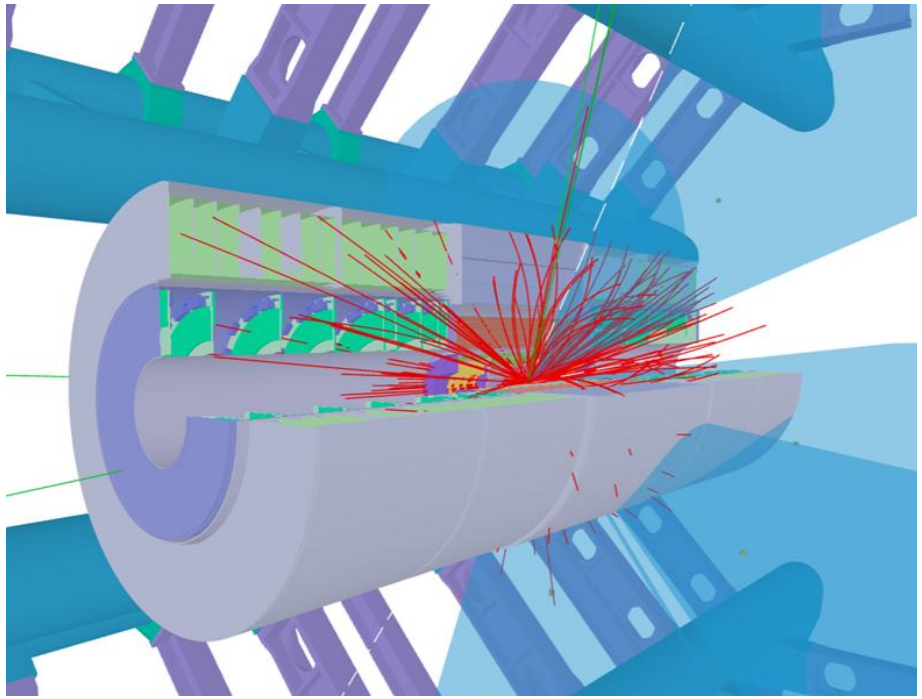
Signal Process	Sample Stats	Bkg Process	Stats
Z->mm@91.2GeV	100k	ee->mm@91.2	In barrel nearly bkg free.
H->yy Z->qq	100k	ee->qqy, ee->WW/ZZ->qqy	
Z->ll, Hrecoil	100k	ee->WW/ZZ->ll+qq	
Z->vv, H->ss	100k	ee->(WW/ZZ)->qq	
Z->qq, H->invisible	100k	ee->(WW/ZZ)->qq	
Z->qq, H->mm	100k	ee->(WW/ZZ)->ll+qq	

Generally, for bkg, need 240GeV, ee->qq(y); ee->WW/ZZ->(qq)qq; ee->WW/ZZ->ll(same flavor)+qq.

Event display

@Zeng Yujie, You Zhengyun

- His slides
- Version ready in 2-3 months?
- Phoneix from https://hepsoftwarefoundation.org/phoenix/
  - Edm4hep, json, can be used now.
  - Detector layout support
  - Reco support but not for truth
  - Track/Cluster support but not for jet
- Unity
  - Further development

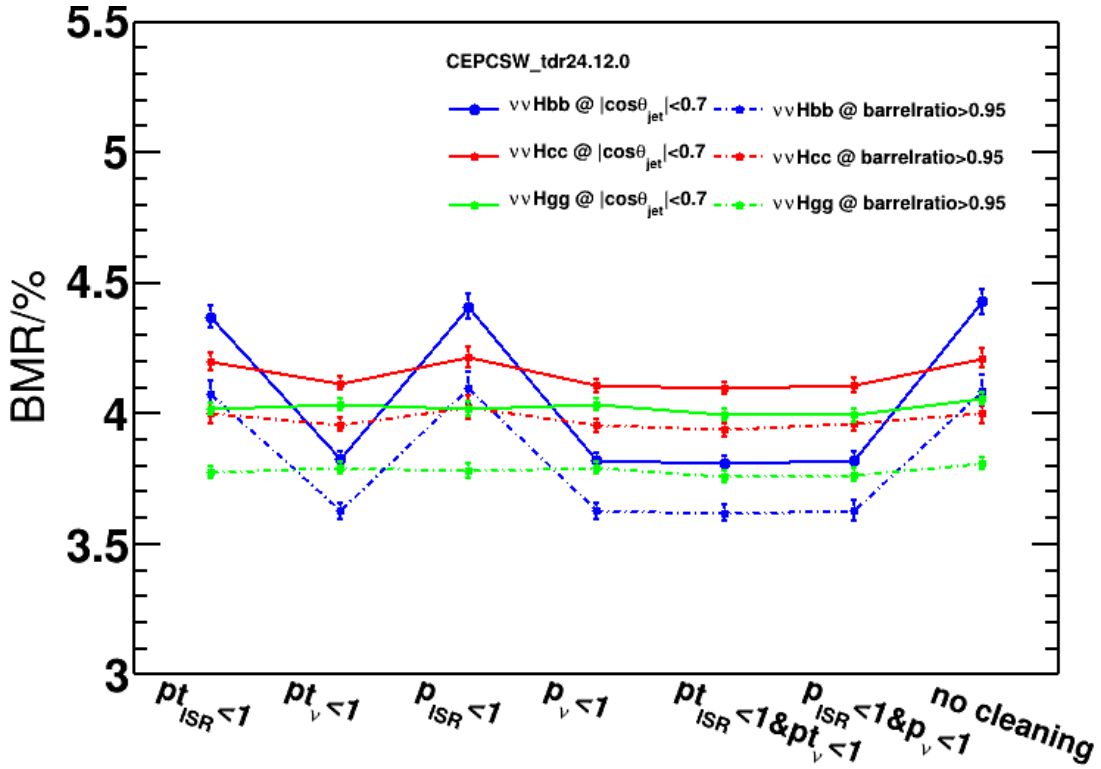


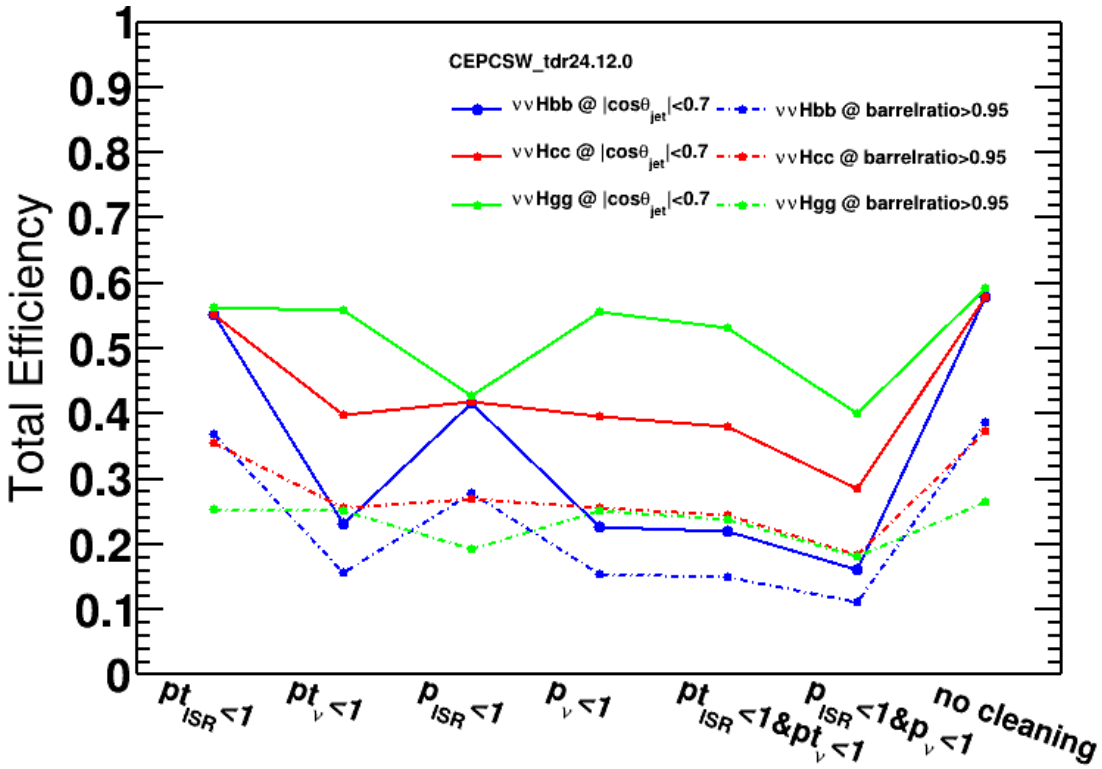
BMR

@Xiaotian

Event cleaning results consistent with CDR.

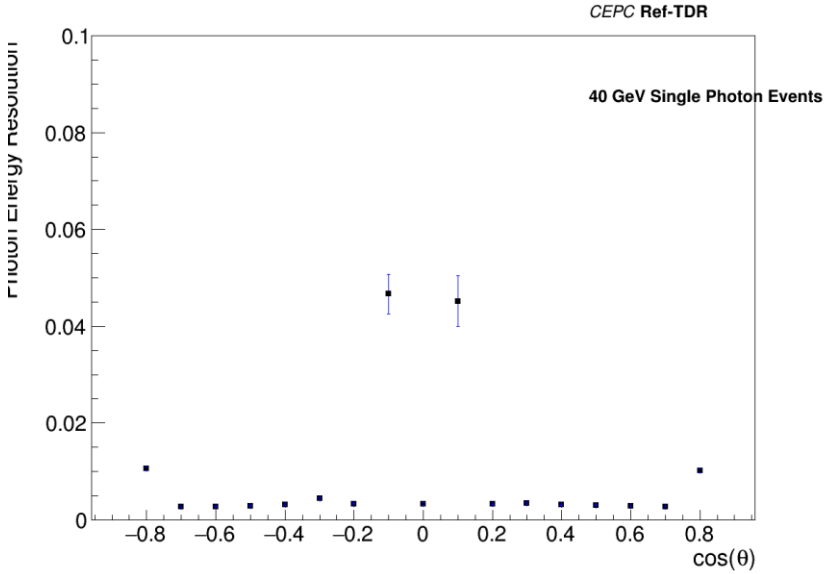
Efficiency cutflow/%	$ZH \to \nu\nu gg$	$ZH \to \nu\nu bb$	$ZH \to \nu\nu cc$
$\Sigma\|Pt_{\mathrm{ISR}}\| < 1\mathrm{GeV}/c$	95.3	95.4	95.4
$\Sigma\|Pt_{\nu}\| < 1\mathrm{GeV}/c$	89.8	39.3	66.6
$\|\cos\theta_{\mathrm{jet}}\| < 0.7$	53.1	22.0	38.0
BMR/%	3.99 ± 0.02	3.81 ± 0.03	4.10 ± 0.02
$\|\cos\theta_{\mathrm{jet}}^{\mathrm{truth}}\| < 0.7$	48.5	20.8	35.9
BMR/%	3.97 ± 0.02	3.76 ± 0.03	4.07 ± 0.02
barrelratio > 0.95	23.9	15.0	24.4
BMR/%	3.76 ± 0.02	3.62 ± 0.03	4.10 ± 0.03

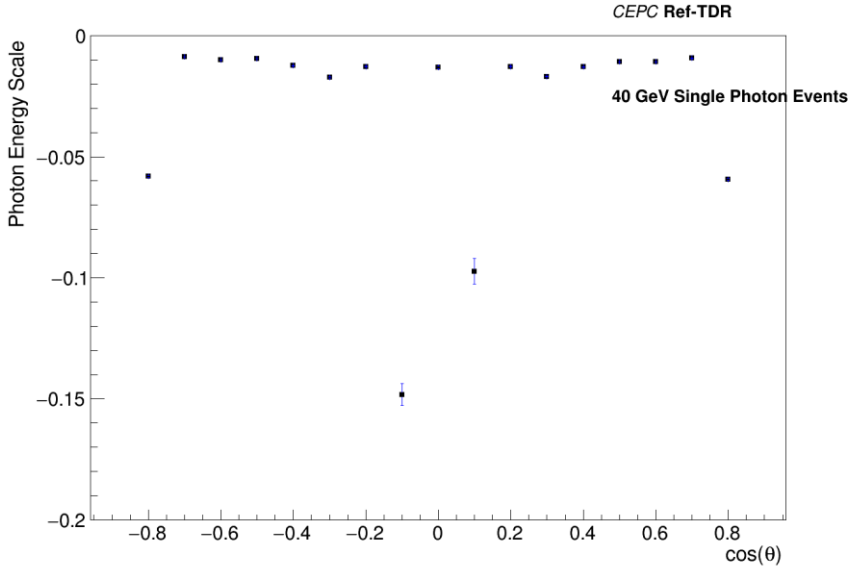


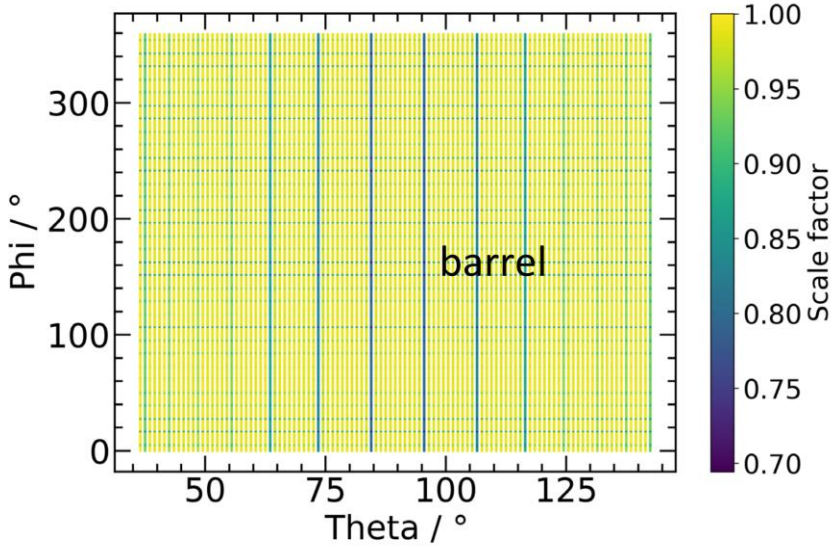


Photon Performance: costheta scan

@Reda





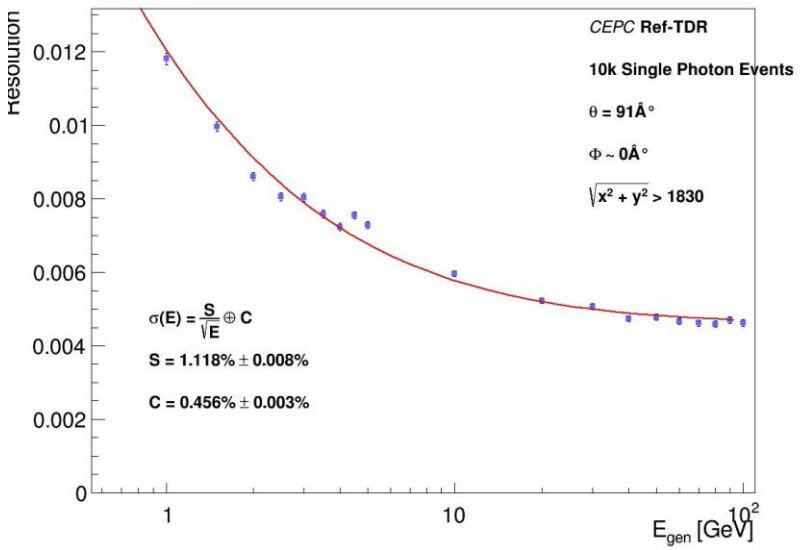


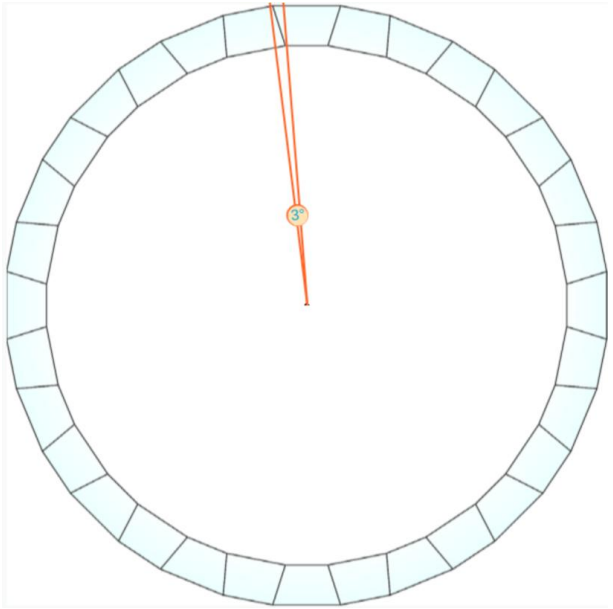
- Cos theta 0.1, 0.8:

crack at ecal modules.

Photon Performance

@Reda

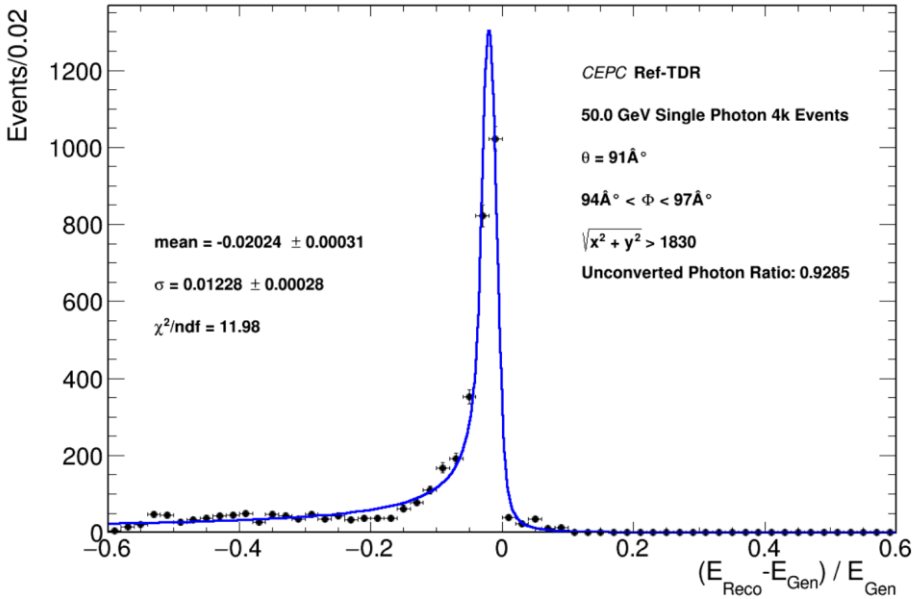




- For 50 GeV, the module crack region photon resolution 1.2%.

(0.46% in module center)

- Reda is working on the full angular coverage scan for phi/theta.



EDM4HEP structure

- EDM4HEP do not have jet type
  - How to store?
  - In PFO like container, create one entry using jet's 4 momentum.
  - In Fcc: Create one PFO container named (VertexJet), storing all PFOs in this jet.
- PFO should not be the final output put for analyzers
  - Tag them as Physics objects: e, mu, photon, jet…
  - After CyberPFO, PID + Recalibration + Categorization.

Summary

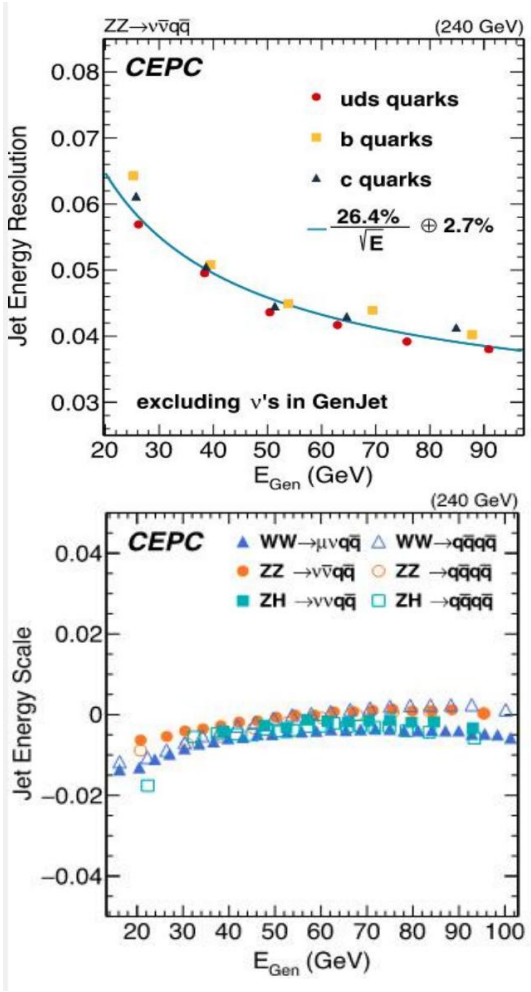
- Current jet/photon performance are in good understanding level.
- Results consistent with CDR
- Further performance development rely on
  - algo update
  - recalibration after pid and vertex fit
- Group agrees to move to analysis more for preparing TDR note.

Backups

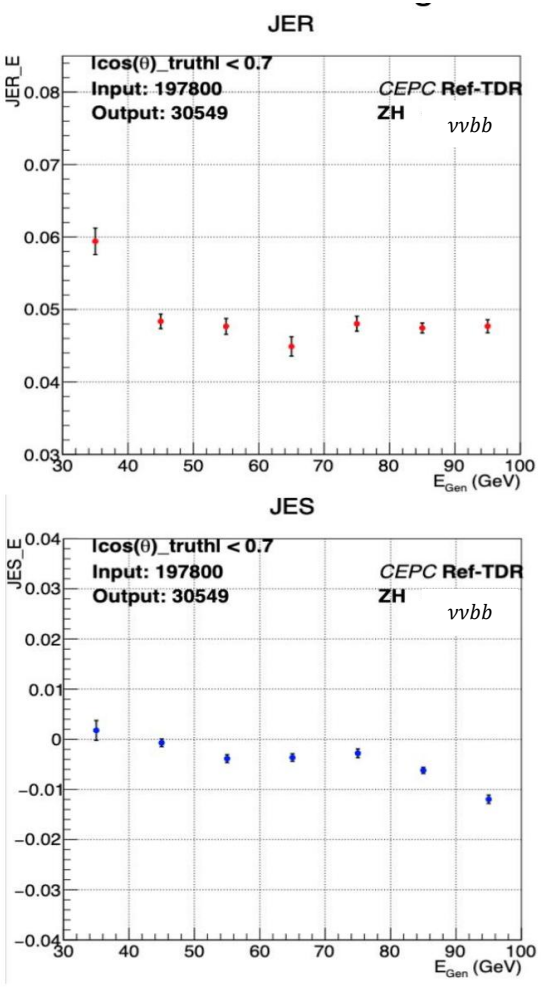
JES/JER

@Yingqi

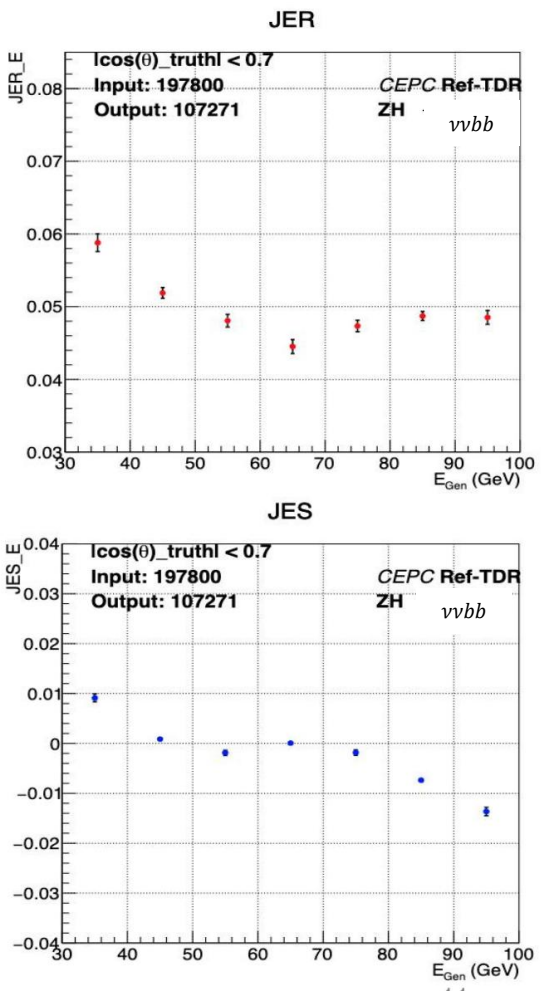
CDR



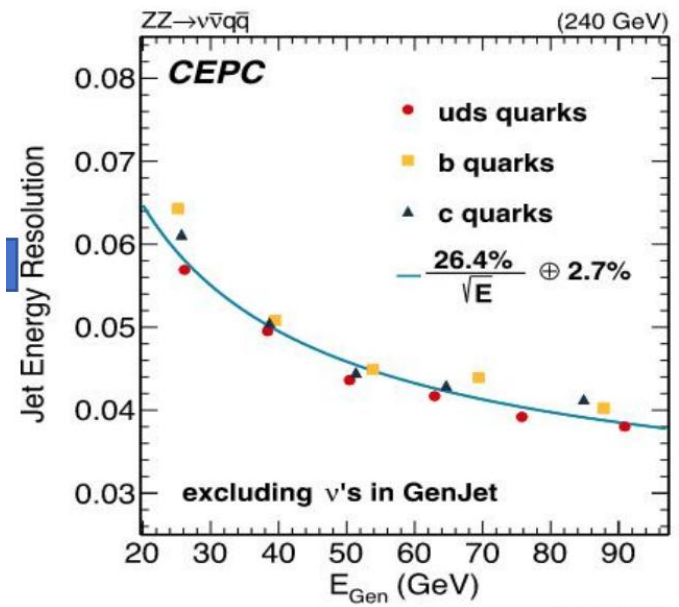
Ref-TDR, with event cleaning

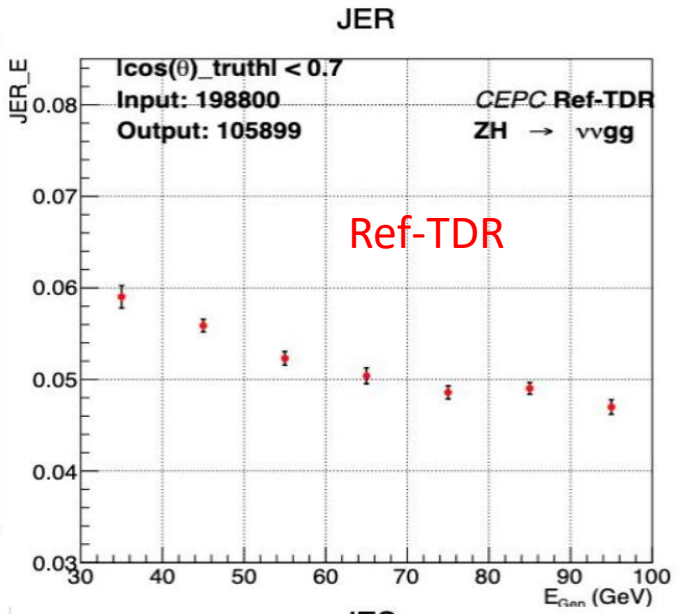


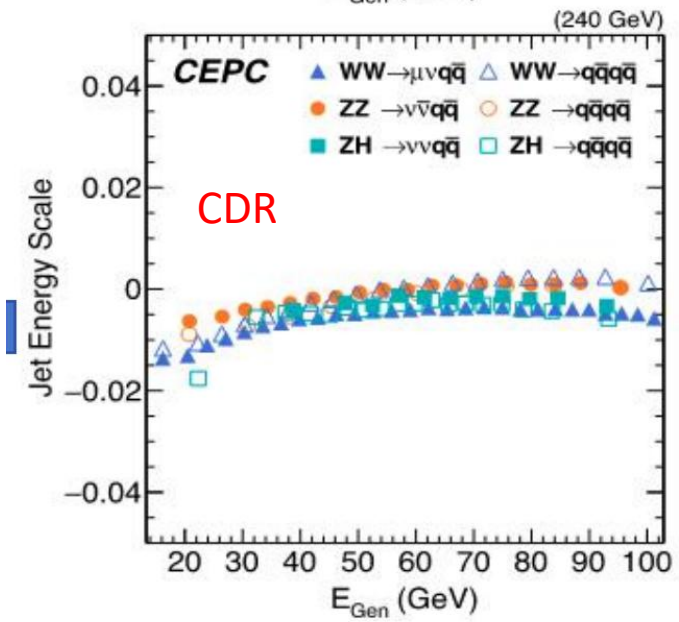
Ref-TDR

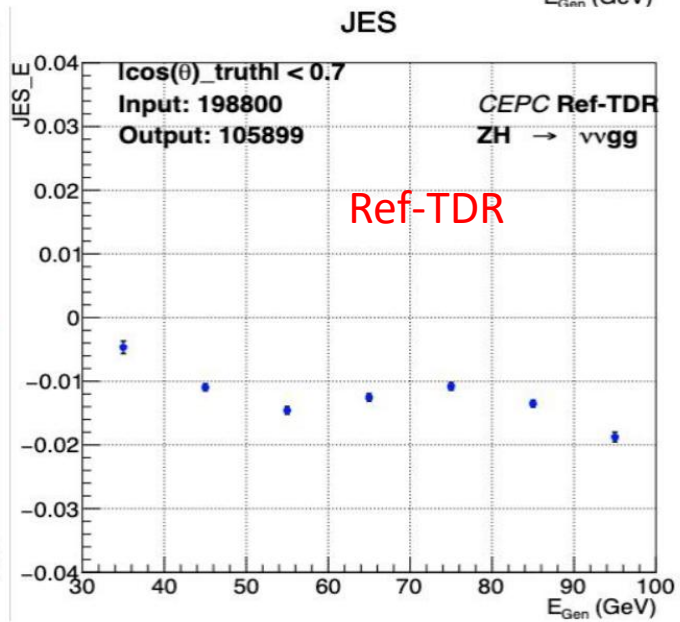


@Yingqi









Gluon has more neutral components so 0.15% worse than bb.

JER roughly consistent.
JES depends on PFA calibration.