CEPC Jet&Clusters

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Fcc Reference

Fcc-ee: https://hep-fcc.github.io/FCCeePhysicsPerformance
https://hep-fcc.github.io/FCCAnalyses/

General information

Table of Contents

Higgs physics

General references

- The introduction to the Higgs session, 2nd FCC-France workshop talk by P. Janot, Jan 21, 2021
- Precision Higgs physics at the CEPC Fenfen An et al 2019 Chinese Phys. C 43 043002
- EPJ+ essay, Measuring the mass and production cross section with ultimate precision at FCC-ee, P. Azzurri et al, June 2021

Case studies

- Measurement of the ZH production cross section with hadronic Z decays (and the Higgs self-coupling): hadronic mass and hadronic recoil-mass resolutions
- **The Higgs coupling to charm quarks (and bottom quarks, and gluons)**: flavour tagging, vertexing (hence beam-pipe radius, tracker material etc)
- Determination of the HZγ effective coupling: photon identification, energy and angular scale
- **The invisible Higgs branching fraction**: hadronic mass resolution, hadronic recoil-mass resolutions, maybe b-tagging performance
- The total decay width of the Higgs boson via ZZZ* events: jet clustering algorithms, jet directions, kinematic fits (separation of H → ZZ* and H → WW*)
- The total decay width of the Higgs boson via bbnunu events: visible and missing mass resolutions
- **The Higgs boson mass and σ(ZH) from the recoil mass with leptonic Z decays**: lepton momentum resolution
- The Higgs boson mass from ZH -> bbqq: jet angular resolution, b-tagging
- **Electron Yukawa coupling via s-channel e+e- → H production at the Higgs pole**: monochromatization

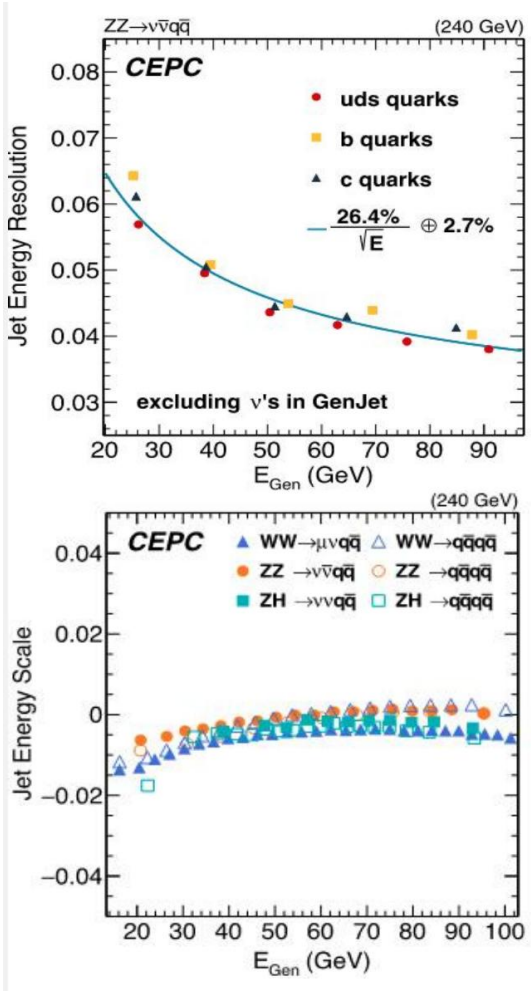
CEPC sample/release

- Hcal but fixed
  - Please use fix 48bcef3d instead of 24.12.0.
- Sample under generation
  - Need 6GB memory, speed slower.
  - H->qq, Z->qq, WW/ZZ->4q sample available under
    - /cefs/higgs/zhangkl/Production/2412/
    - /cefs/higgs/guofy/CEPCSW_tdr24.12.1/performance/JER_eeqq
  - Other processes and generators under study @Nazima

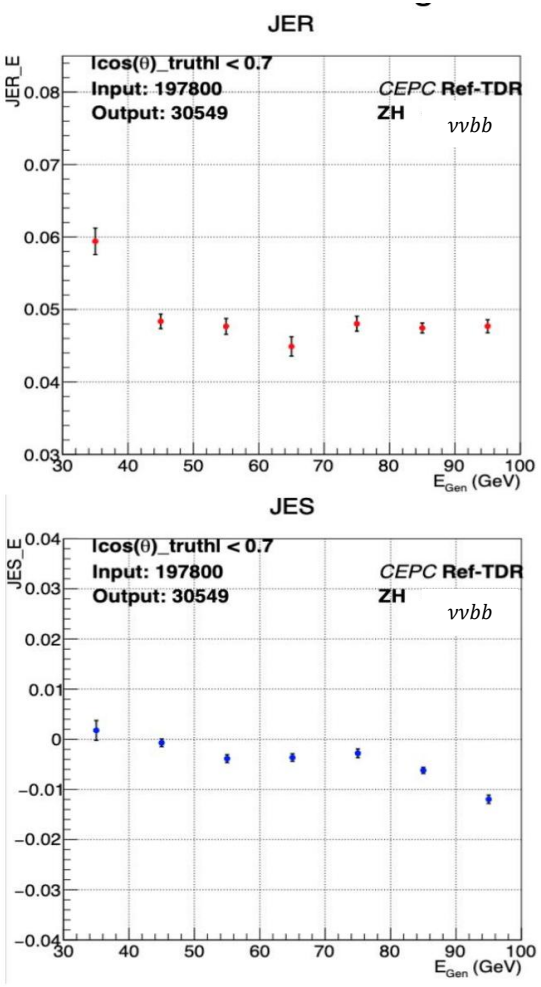
JES/JER

@Yingqi

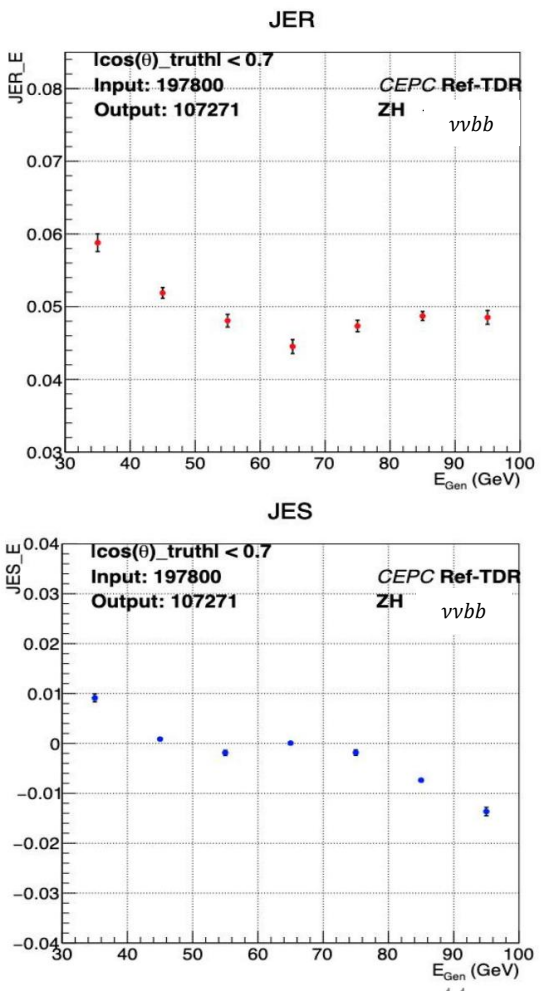
CDR



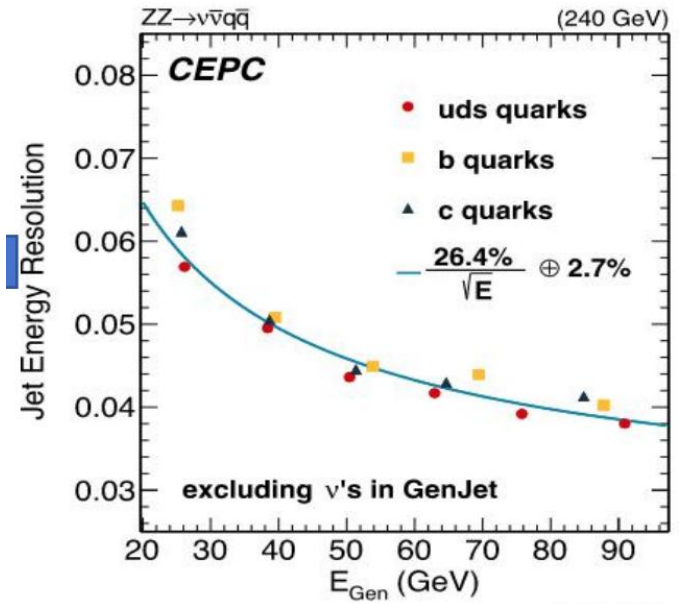
Ref-TDR, with event cleaning

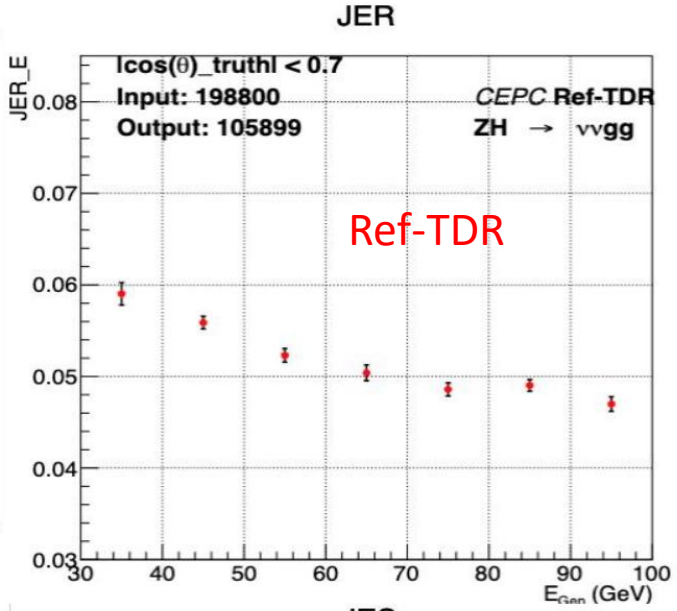


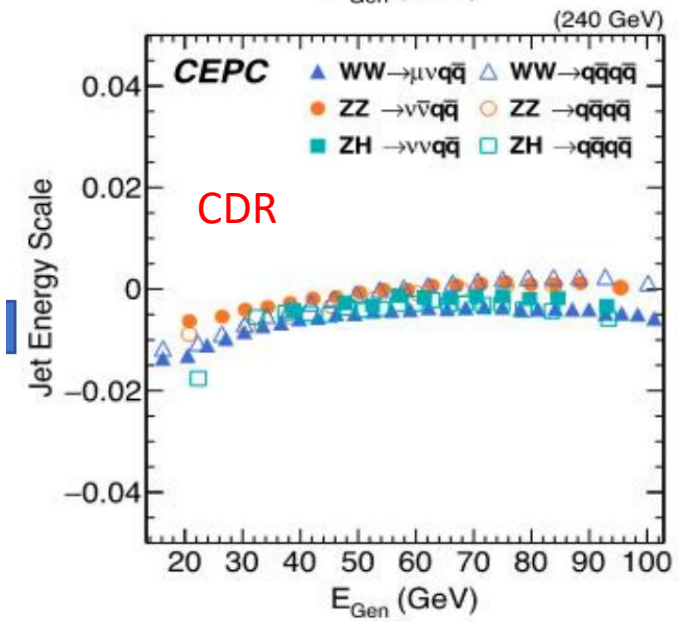
Ref-TDR

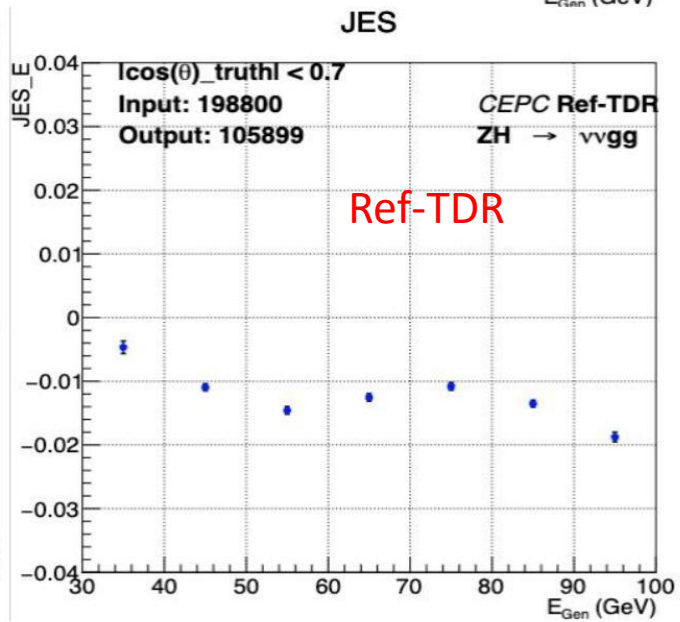


@Yingqi









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

JER roughly consistent.
JES depends on PFA calibration.

BMR

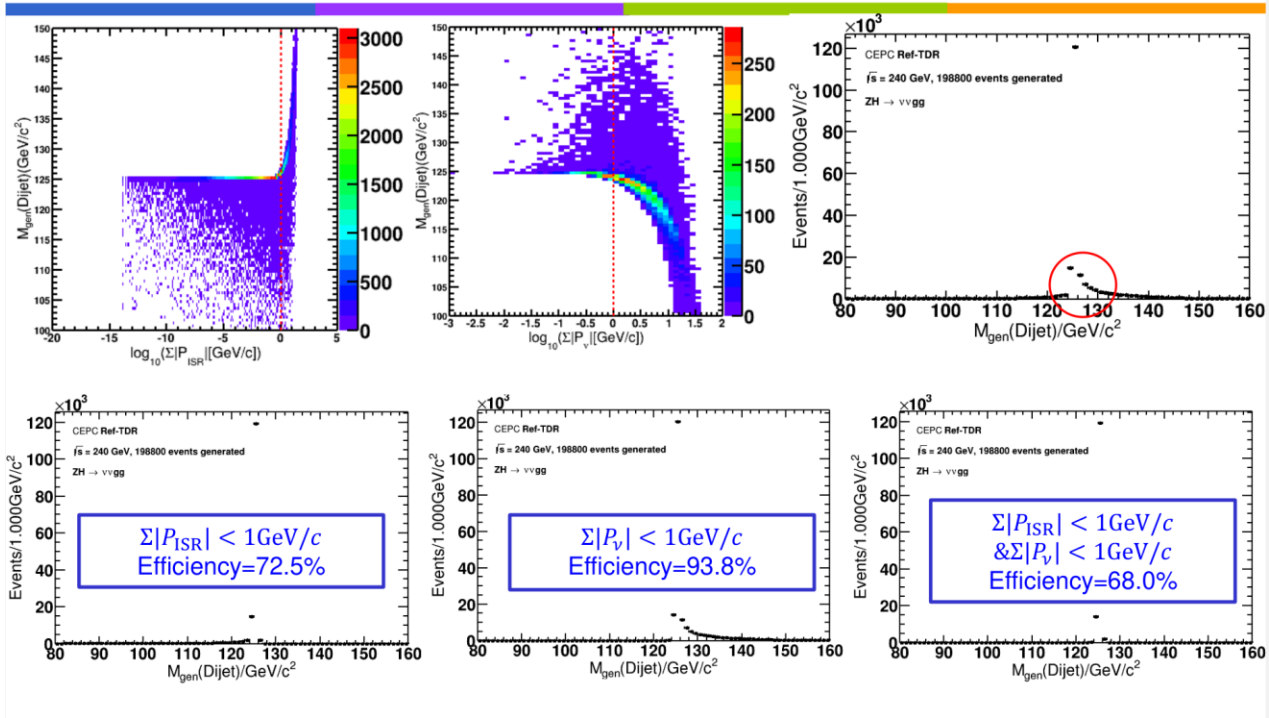
@Xiaotian

For truth dijet distribution, use |Pisr| and |Pv| cut to exclude the left/right tail. No big improvement for BMR.

BMR<4%. Results and eff consistent with CDR practice.

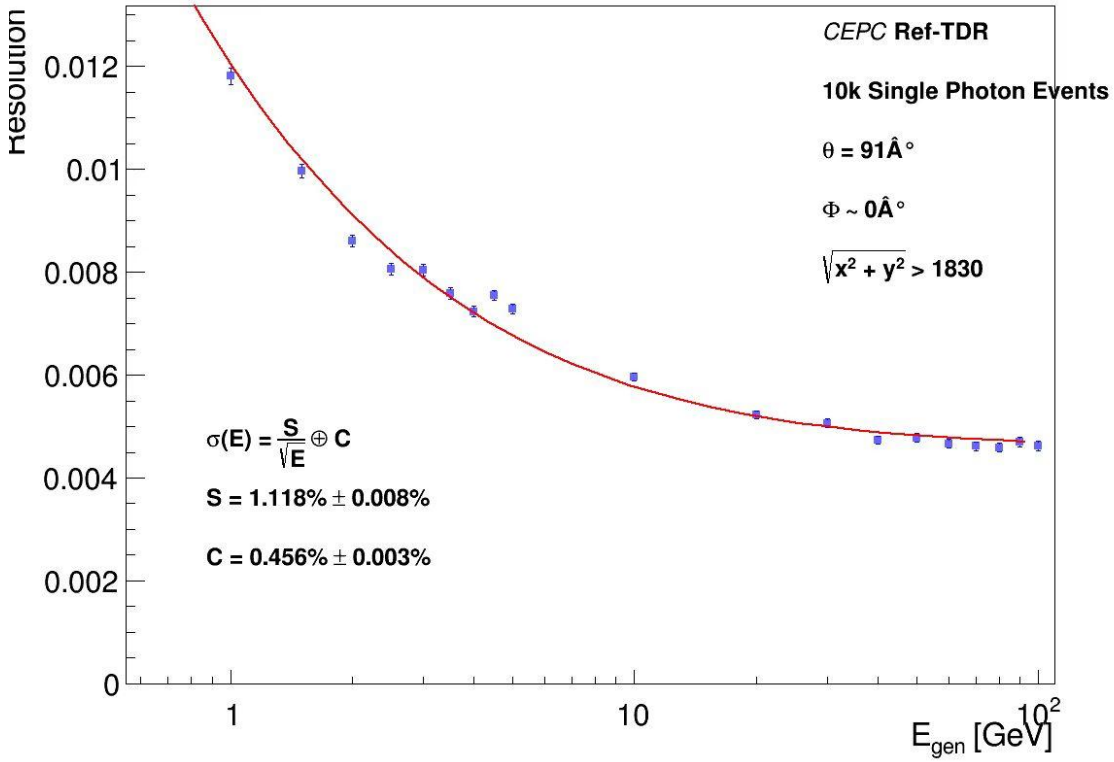
Selection	process	$ZH \to \nu\nu gg$	$ZH \to \nu\nu bb$	$ZH \to \nu\nu cc$
$\lvert\cos\theta_{\rm jet}\rvert < 0.7$	BMR/%	4.06 ± 0.02	4.43 ± 0.05	4.21 ± 0.04
	Efficiency/%	59.3	58.0	57.9
$\lvert\cos\theta_{\rm jet}^{\rm truth}\rvert < 0.7$	BMR/%	4.03 ± 0.02	4.41 ± 0.05	4.18 ± 0.04
	Efficiency/%	54.1	54.6	54.7
$\rm barrelratio > 0.95$	BMR/%	3.81 ± 0.02	4.09 ± 0.06	4.00 ± 0.04
	Efficiency/%	26.5	38.8	37.4

$M^{\rm gen}_{\rm Dijet}$ VS $P_{\rm ISR}/P_\nu$

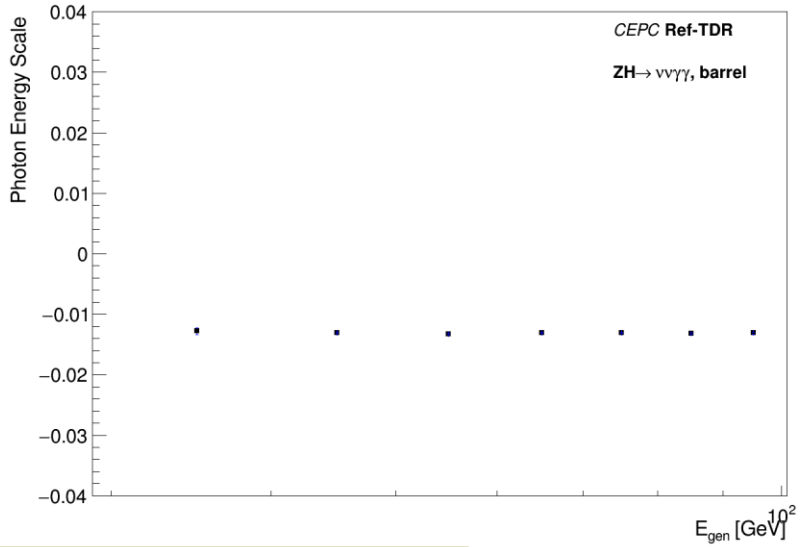


Photon Performance

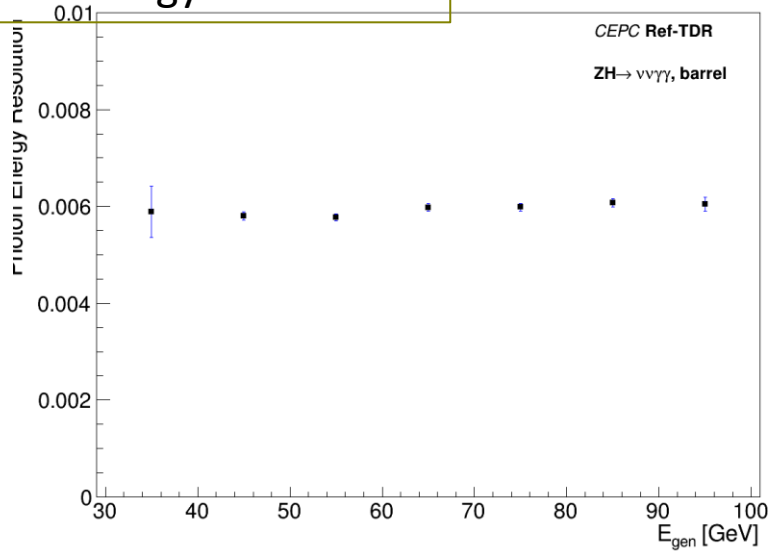
@Reda



Photon Energy Scale



Photon Energy Resolution



Summary

- Current Ref-TDR jet/photon performance roughly consistent with previous study, and difference is understandable.
- Jet/Photon energy scale now negative around 1.5%.
- Jet energy scale/BMR meets 4% requirement.
  - JES & JER can be better from knowing its ID and recalibration.
- Other factors, like jet flavor, jet angular, need further study with differential plot.