

CEPC Jet&Clusters

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

General information

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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

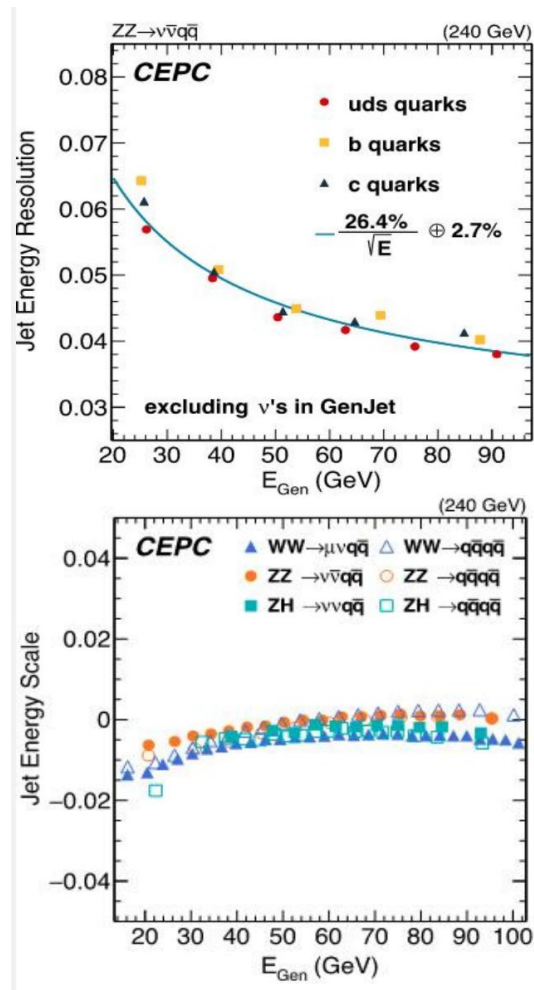
- [Measurement of the ZH production cross section with hadronic Z decays \(and the Higgs self-coupling\)](#): hadronic mass and hadronic recoil-mass resolutions
- [The Higgs coupling to charm quarks \(and bottom quarks, and gluons\)](#): flavour tagging, vertexing (hence beam-pipe radius, tracker material etc)
- [Determination of the HZ \$\gamma\$ 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 $H \rightarrow ZZ^*$ and $H \rightarrow WW^*$)
- [The total decay width of the Higgs boson via bbnunu events](#): visible and missing mass resolutions
- [The Higgs boson mass and \$\sigma\(\text{ZH}\)\$ from the recoil mass with leptonic Z decays](#): lepton momentum resolution
- [The Higgs boson mass from ZH \$\rightarrow\$ bbqq](#): jet angular resolution, b-tagging
- [Electron Yukawa coupling via s-channel \$e^+e^- \rightarrow H\$ production at the Higgs pole](#): monochromatization

CEPC sample/release

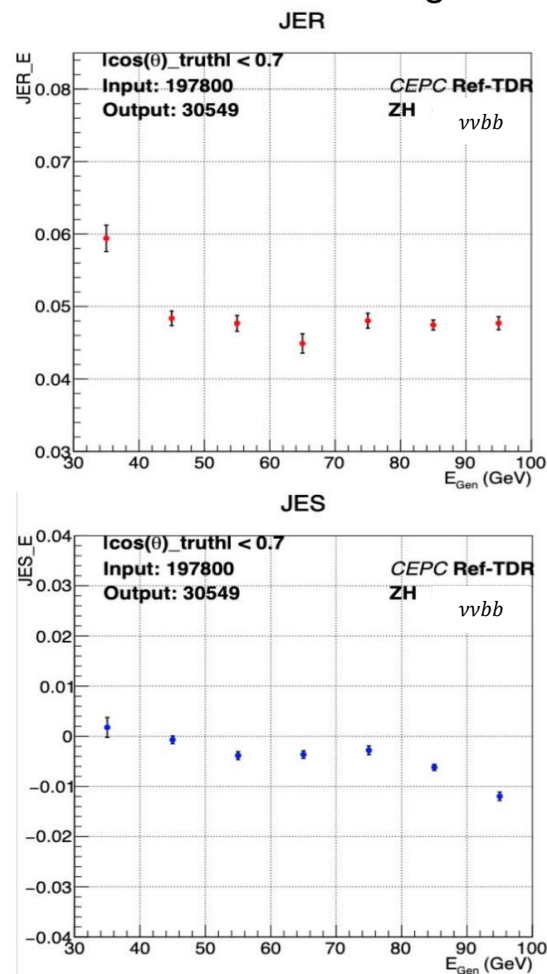


- Hcal but fixed
 - Please use fix 48bcef3d instead of 24.12.0.
- Sample under generation
 - Need 6GB memory, speed slower.
 - H->qq, Z->qq, WW/ZZ->4q sample available under
 - /cfs/higgs/zhangkl/Production/2412/
 - /cfs/higgs/guofy/CEPCSW_tdr24.12.1/performance/JER_eeqq
 - Other processes and generators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

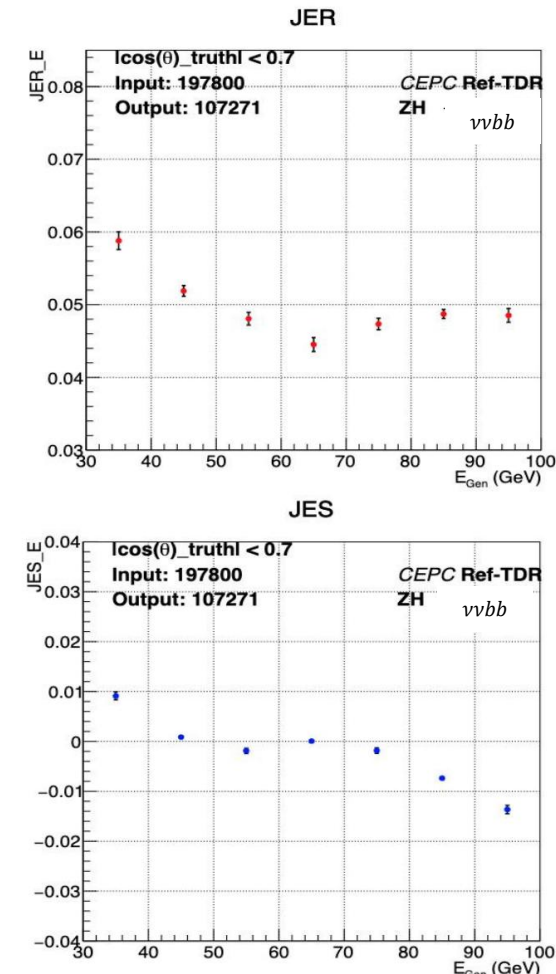
CDR

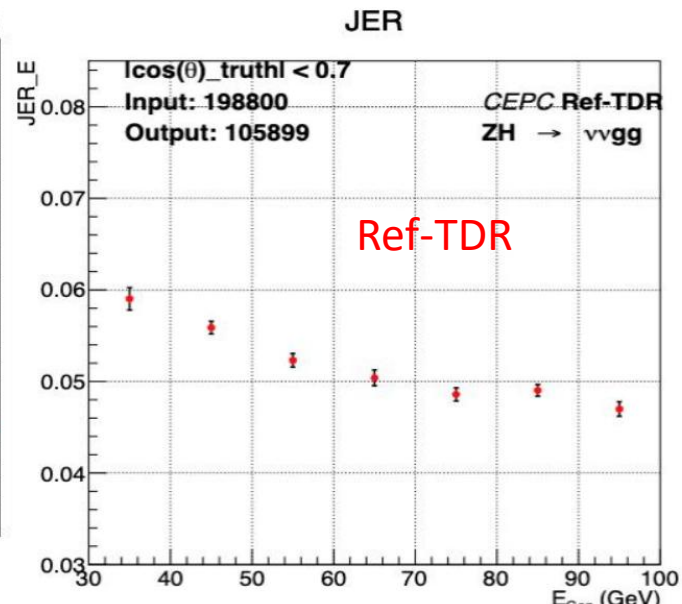
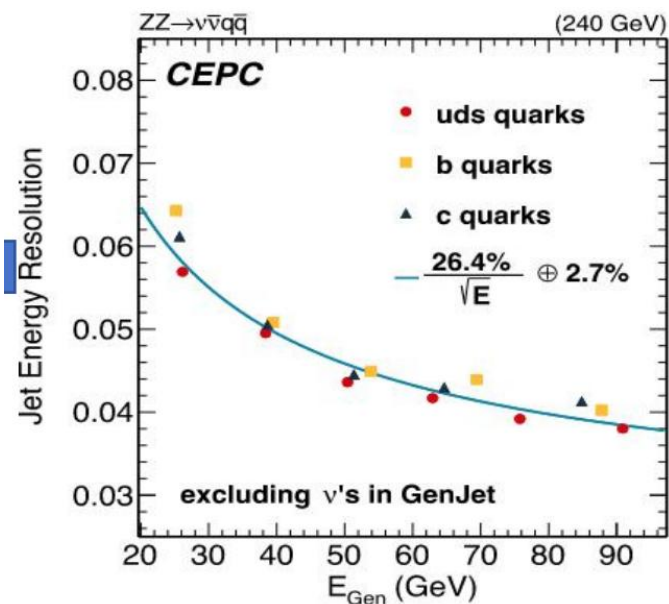


Ref-TDR, with event cleaning



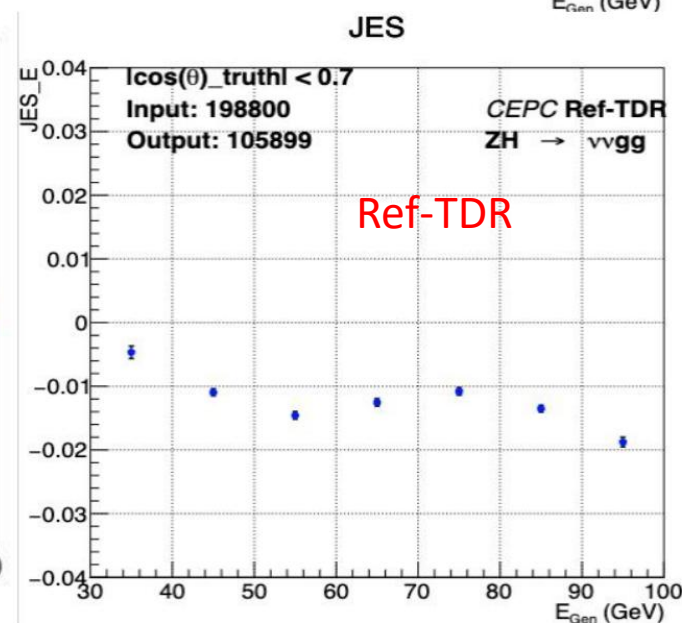
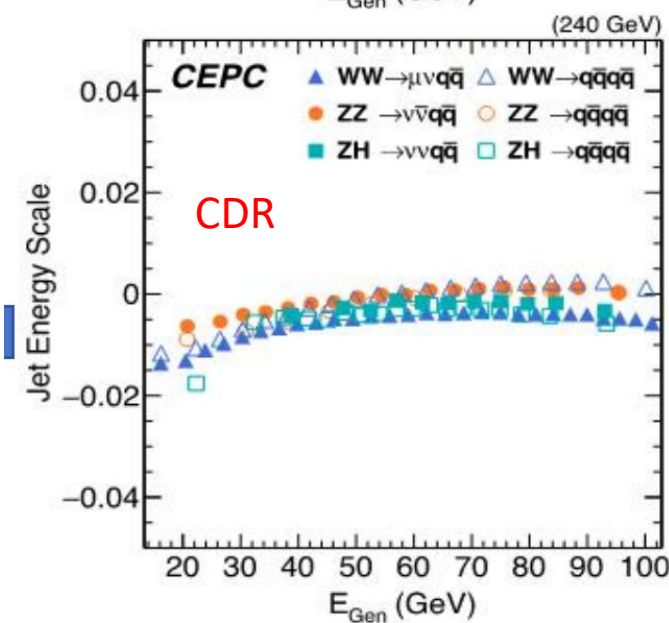
Ref-TDR





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

JER roughly consistent.
JES depends on PFA calibration.

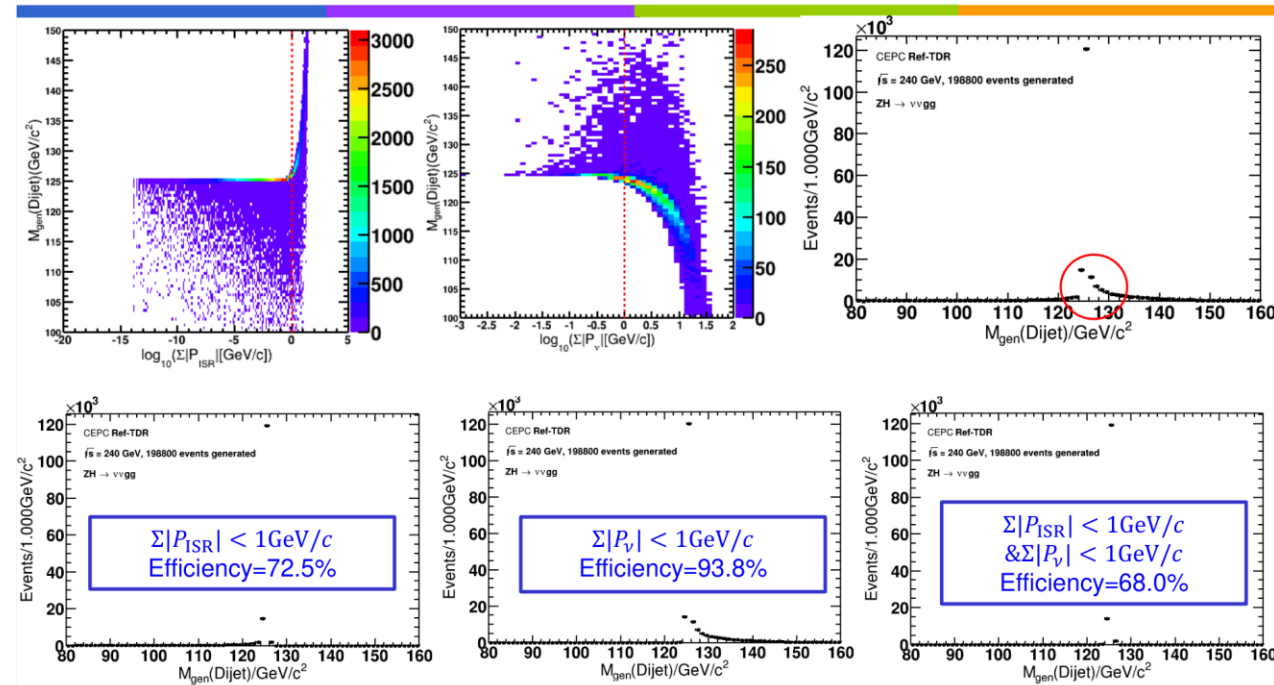


For truth dijet distribution, use $|P_{ISR}|$ and $|P_v|$ cut to exclude the left/right tail. No big improvement for BMR.

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

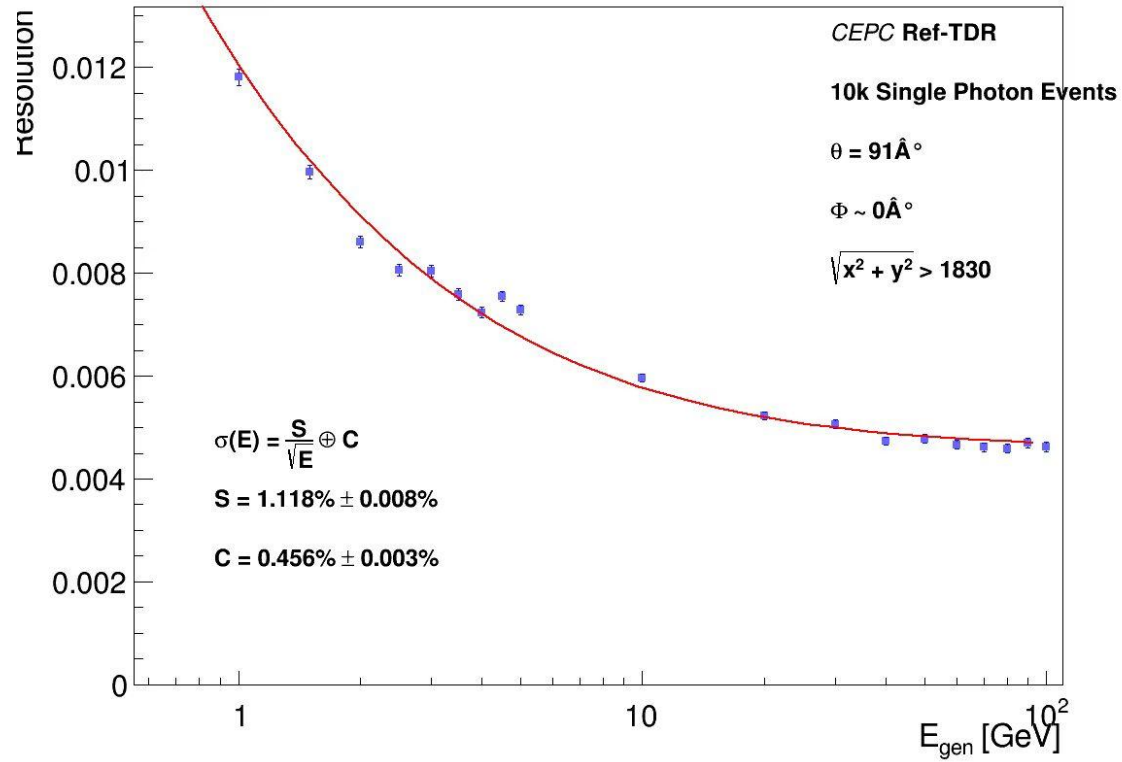
M_{Dijet}^{gen} VS P_{ISR}/P_v

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

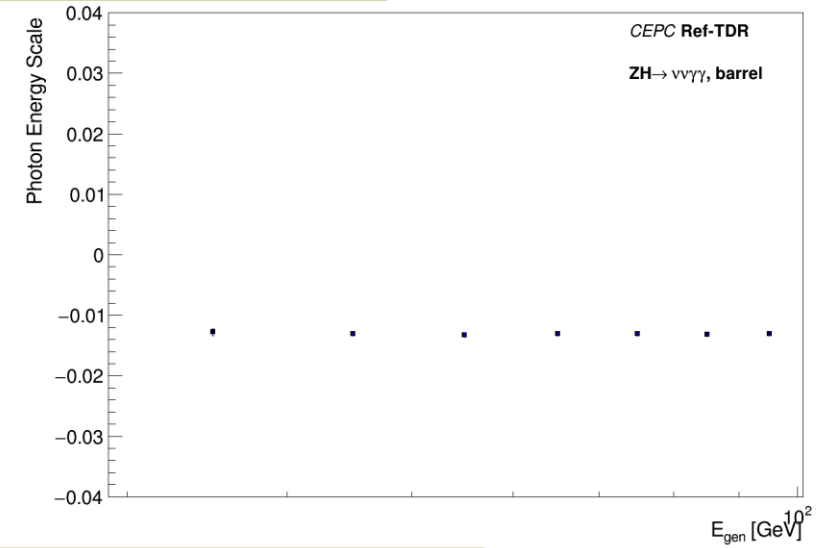


Photon Performance

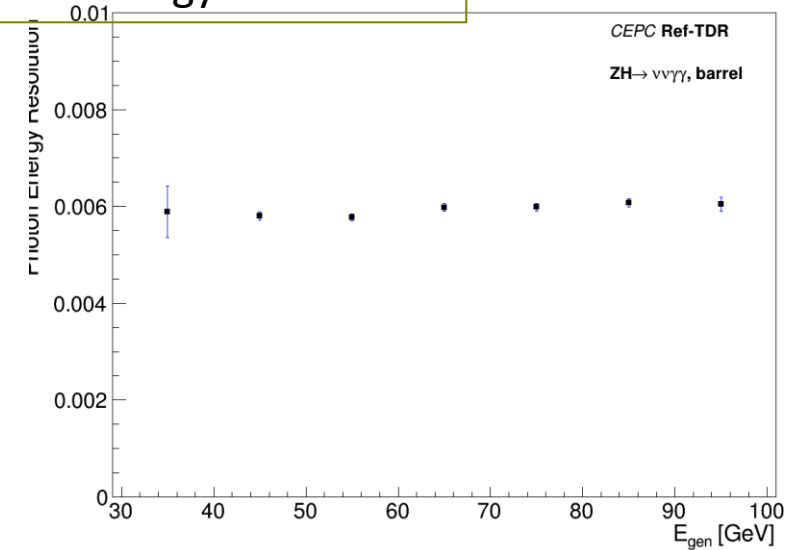
@Reda



Photon Energy Scale



Photon Energy Resolution



- 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.