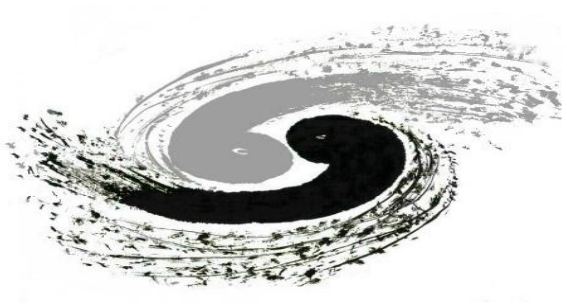


CEPC

Kaili Zhang

zhangkl@ihep.ac.cn

Fast Simulation Re-design

To latest Delphes

- Previously Gaoxu maintained Delphes_CEPC, not the latest release
- Now https://code.ihep.ac.cn/zhangkl/delphes_cepc/-/tree/CEPC follow the official release.
  - Fix one Cov matrix crash issue.
  - Provide 2 version of cards: One for geometry ideal case, one for closer to full simu.

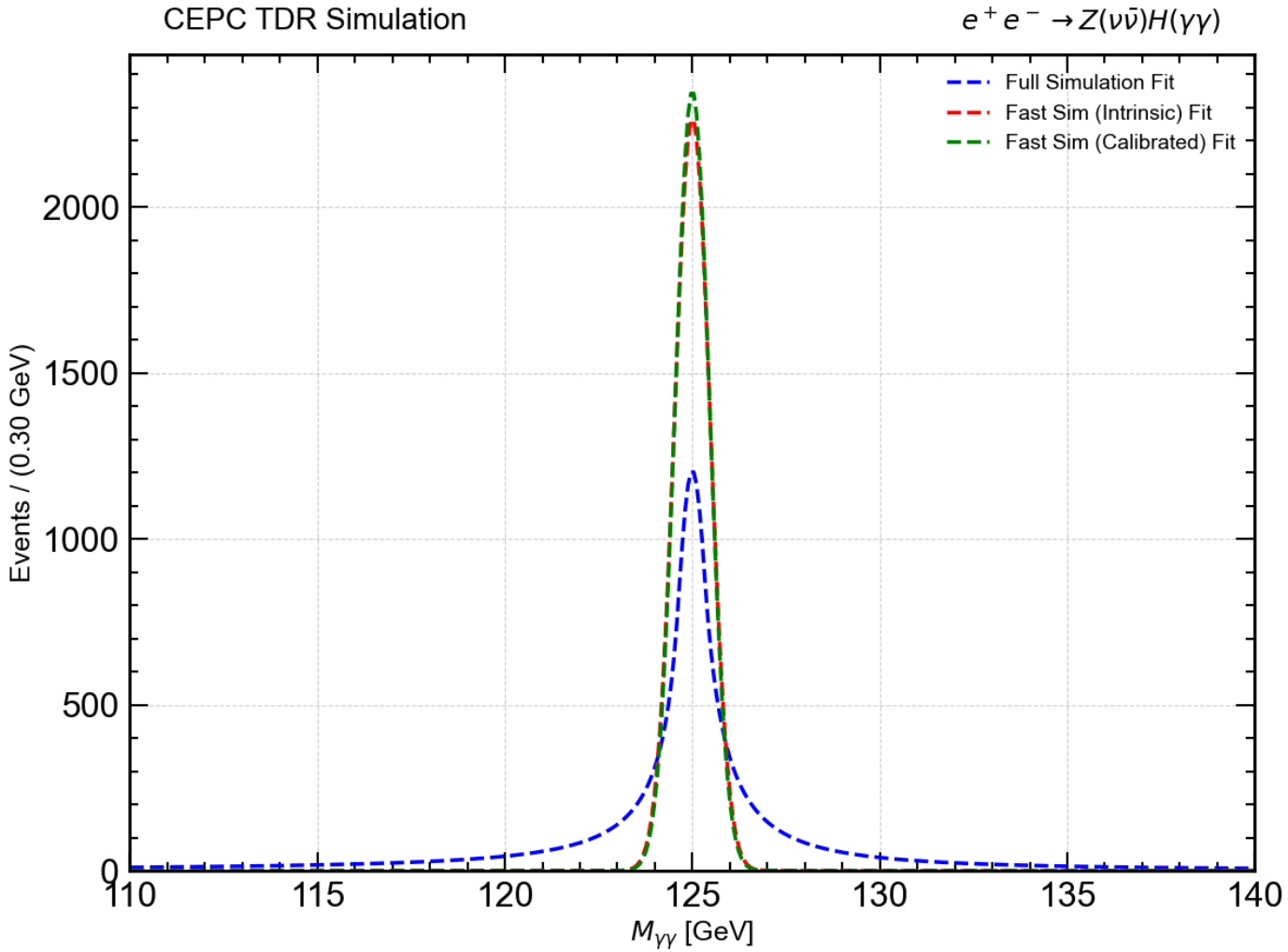
Diphoton mass

TDR Ecal resolution $1.3\%/\sqrt{E} \oplus 1\%$

Latest value from Reda: $1.14\%/\sqrt{E} \oplus 0.44\%$

It gives diphoton sigma 0.5 GeV. (Resolution 0.4%)

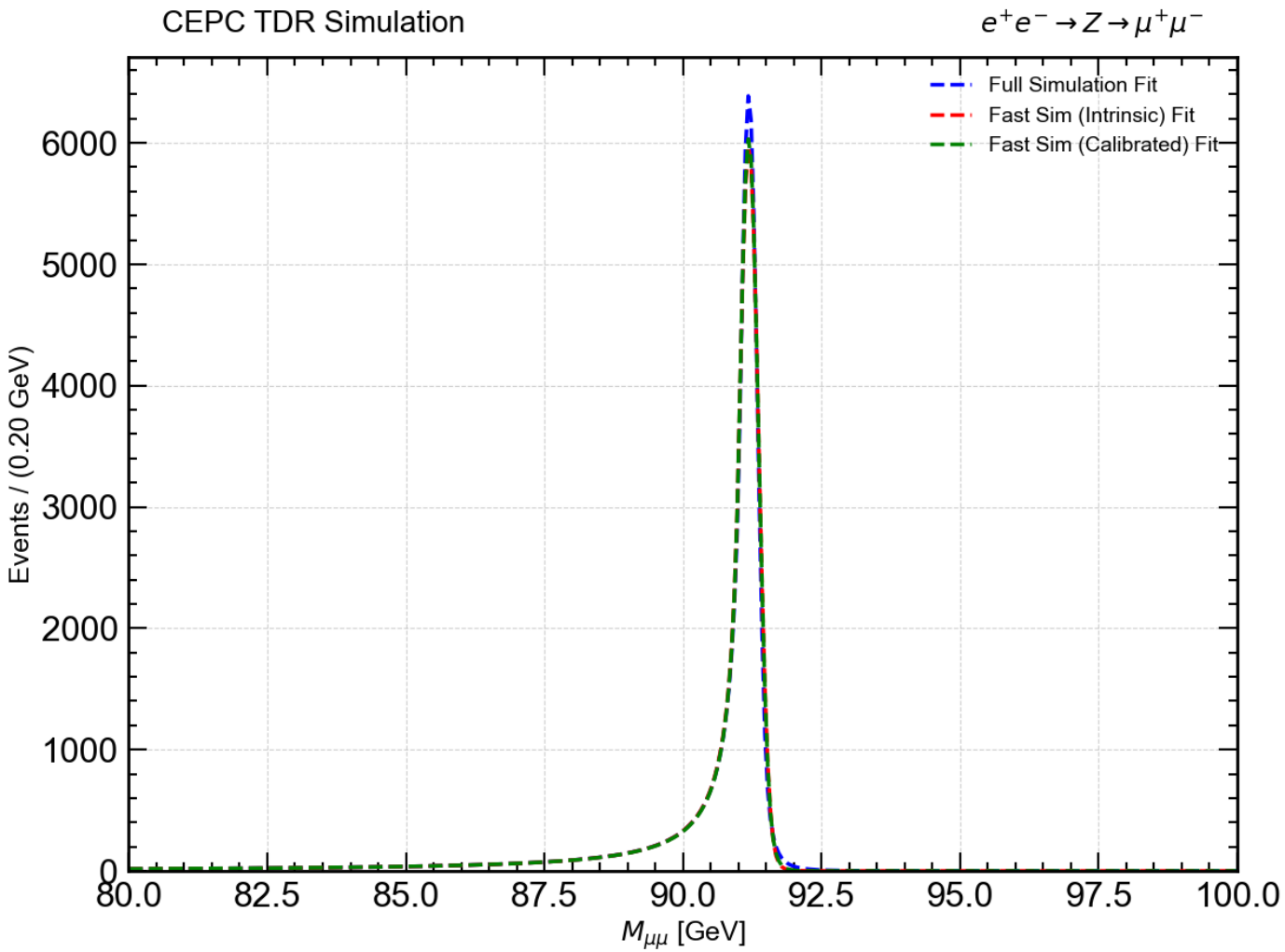
The effect of full simulation 0.3% can not be simulated in Delphes.



Plot from Yangchao

Dimuon Mass

Dimuon works well.

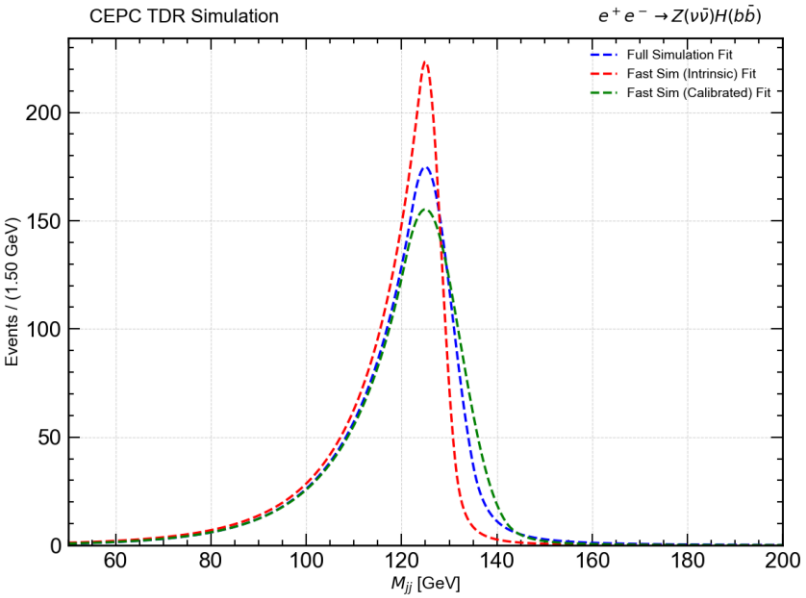


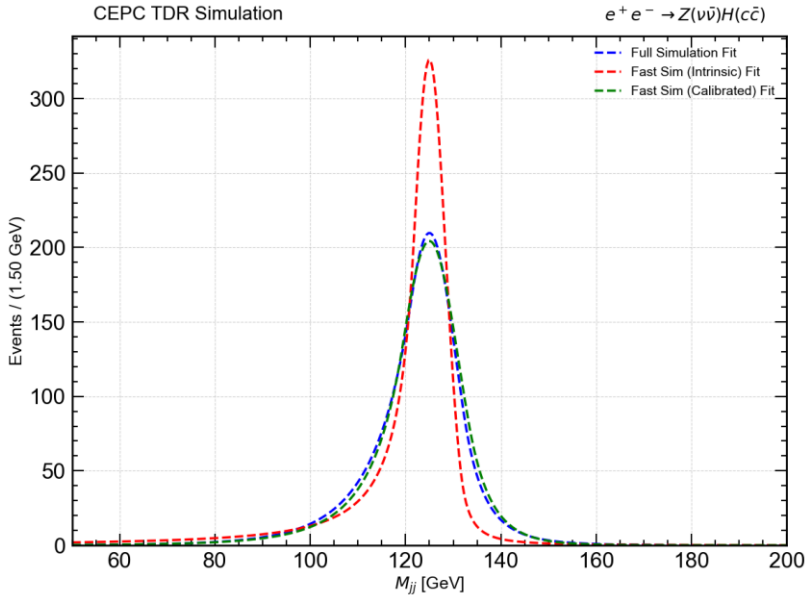
Dijet Hcal calibration

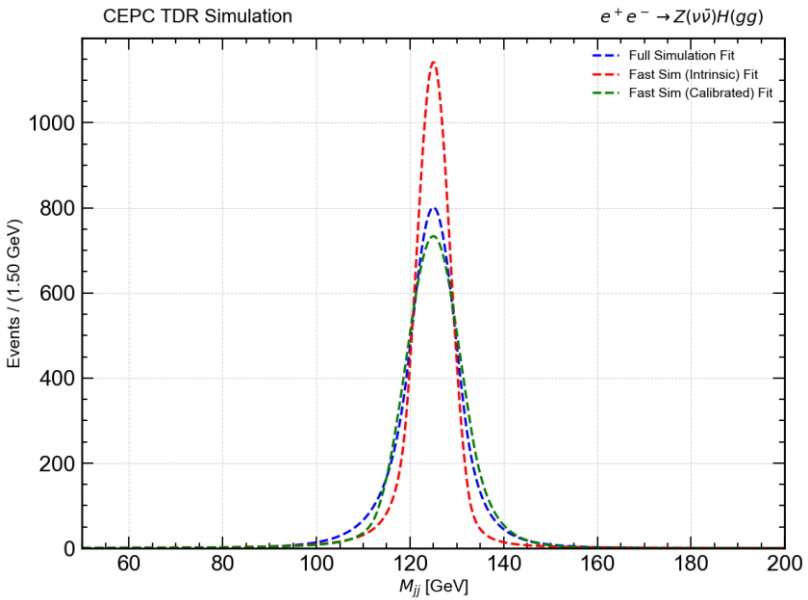
- Due to PFA reconstruction, the reconstructed full BMR is worse the fast expected.
  - In different flavor 20%-60% difference.
    - Better algo, like one-one correspondence may help?
  - We use raw hcal value in intrinsic Delphes card ($35\%/\sqrt{E} \oplus 5\%$) for ideal Hcal
    - In calibrated card, ($70\%/\sqrt{E} \oplus 10\%$) used.

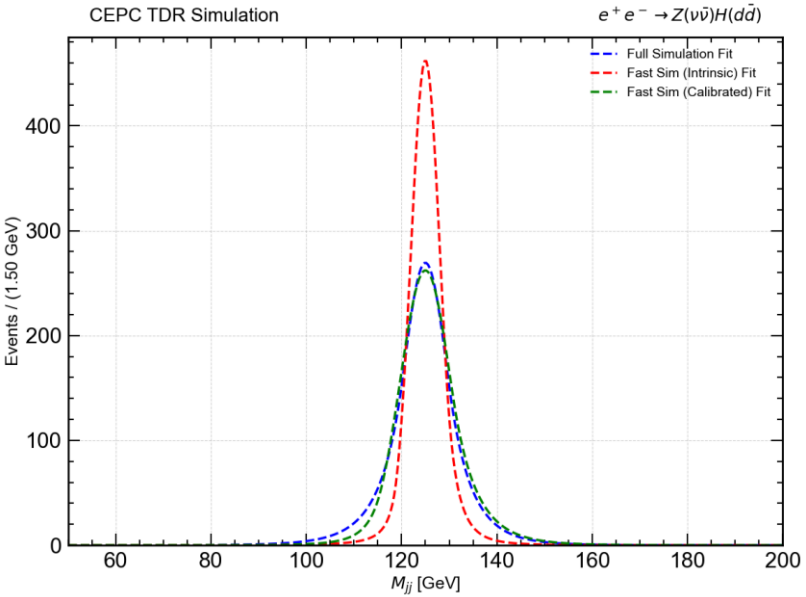
Dijet mass

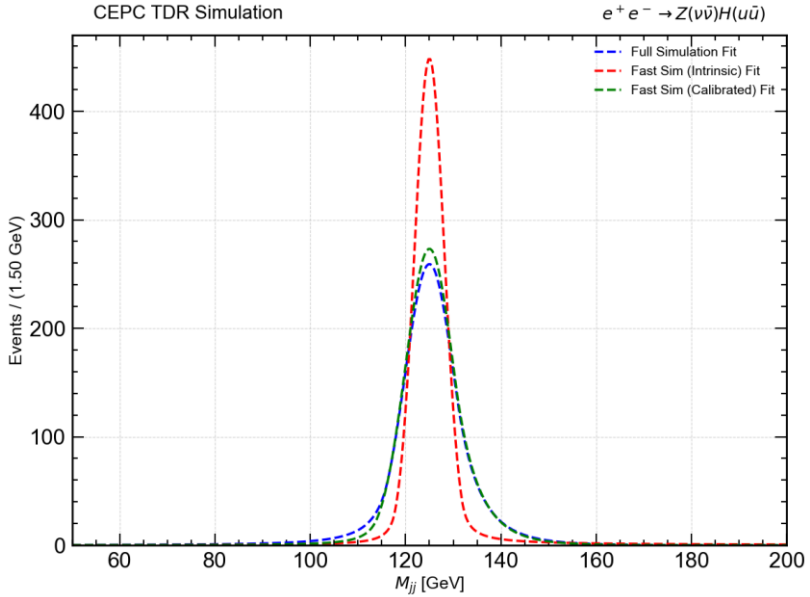
$(70\%/\sqrt{E} \oplus 10\%)$ difference between full and fast exist but small.

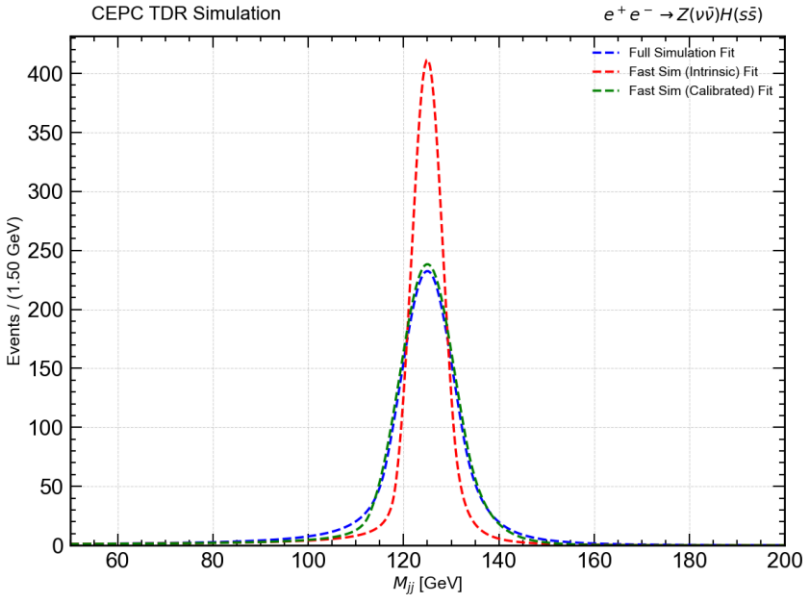






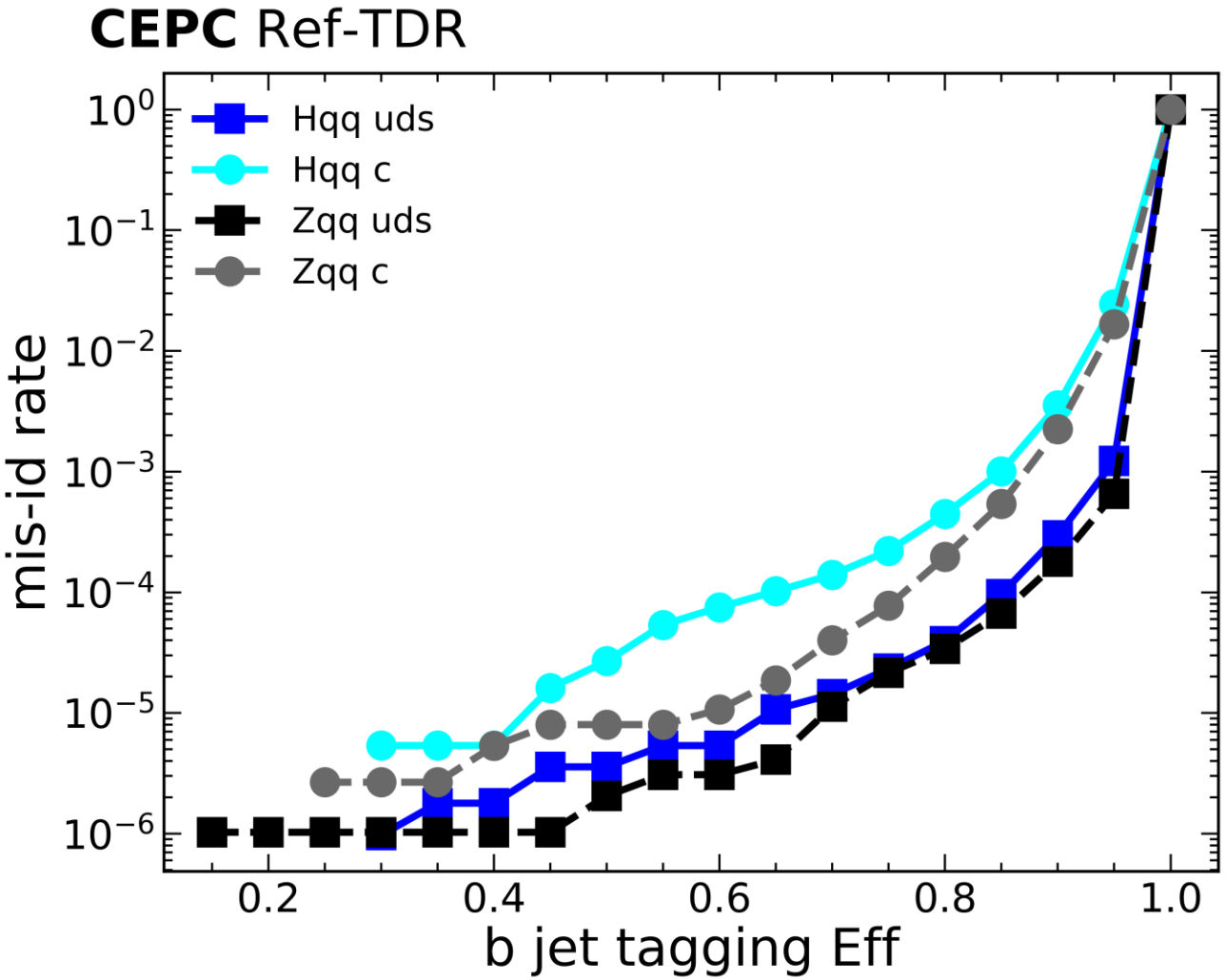


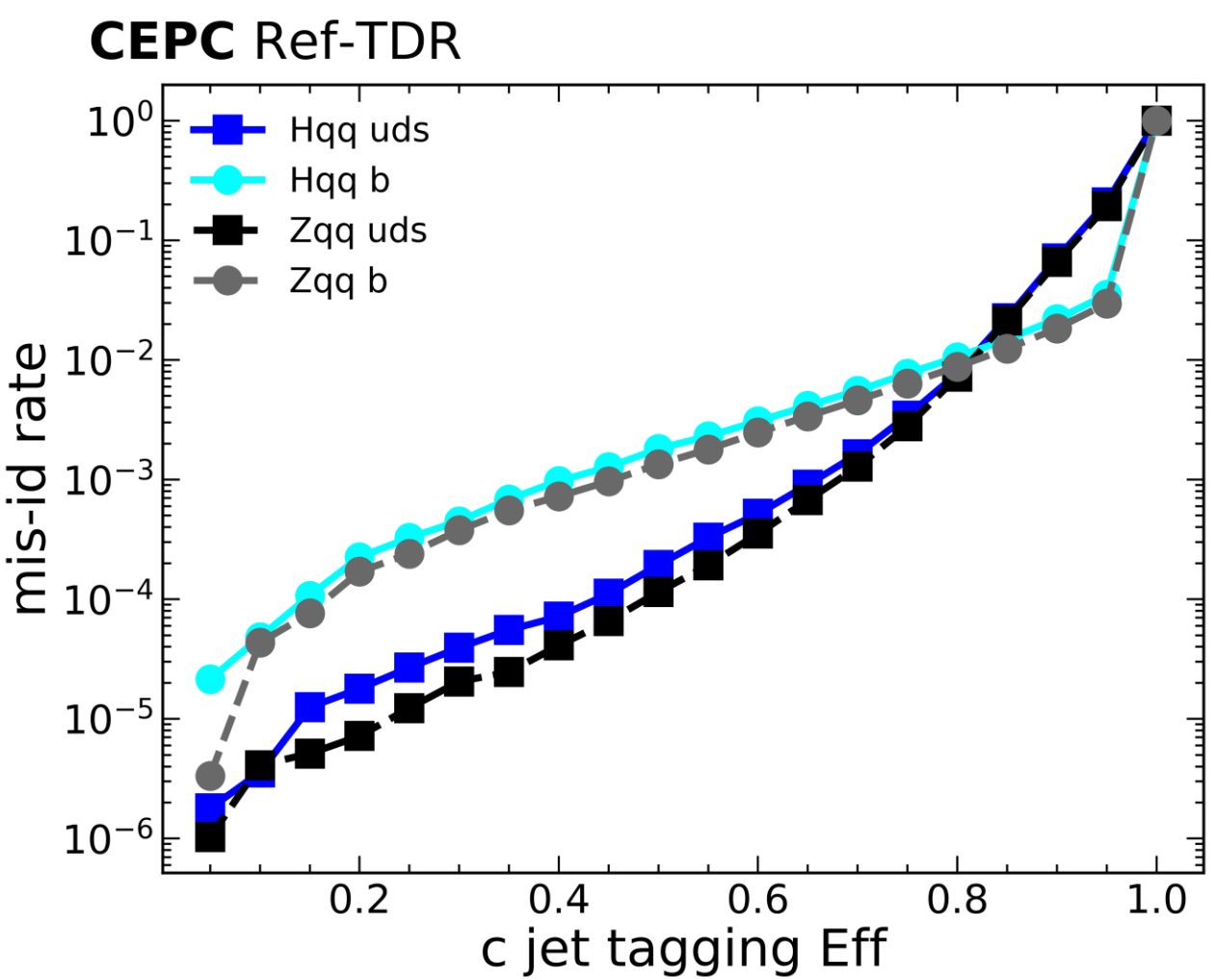


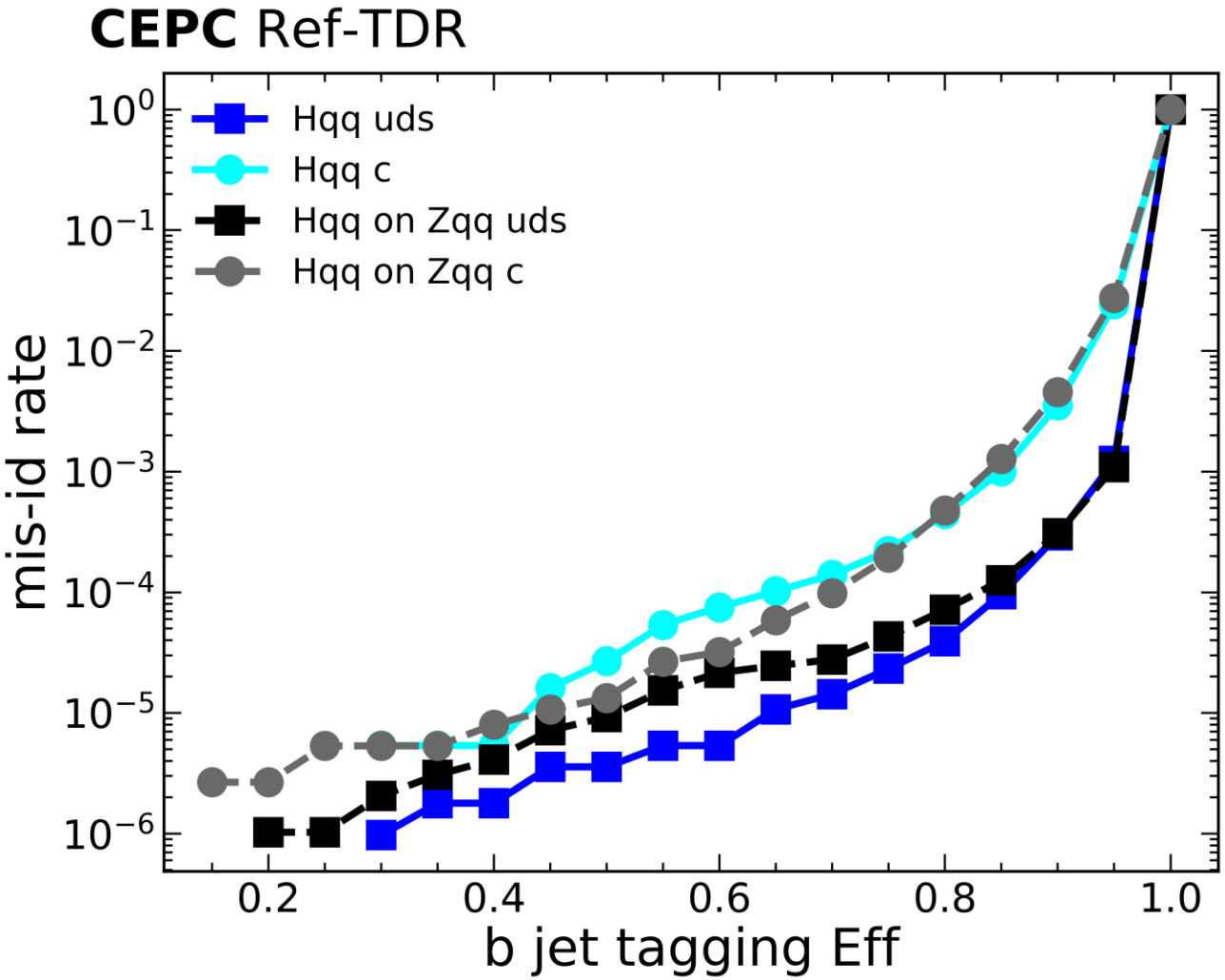


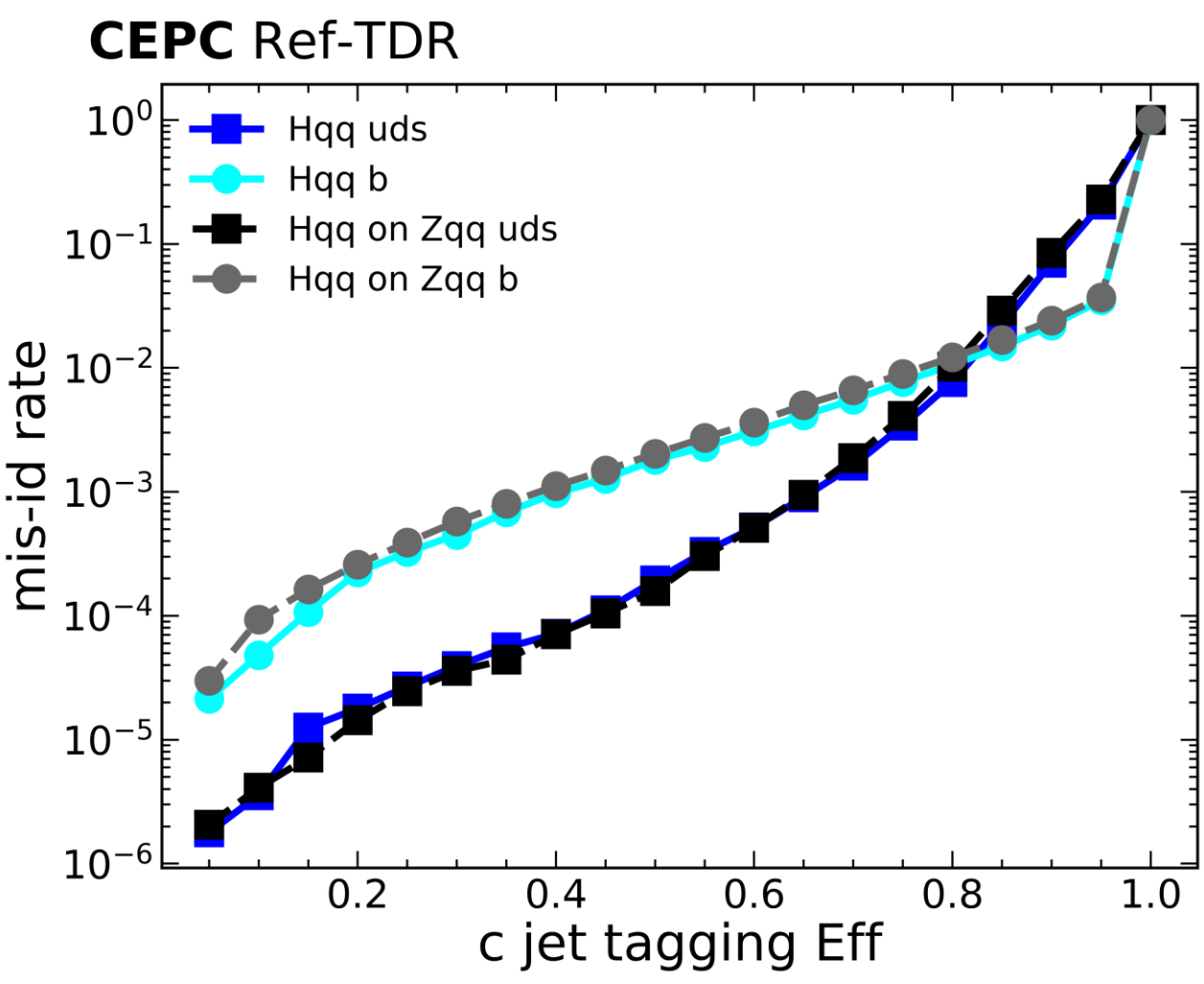
JOI

Hqq Zqq Tagging eff vs mis-id rate



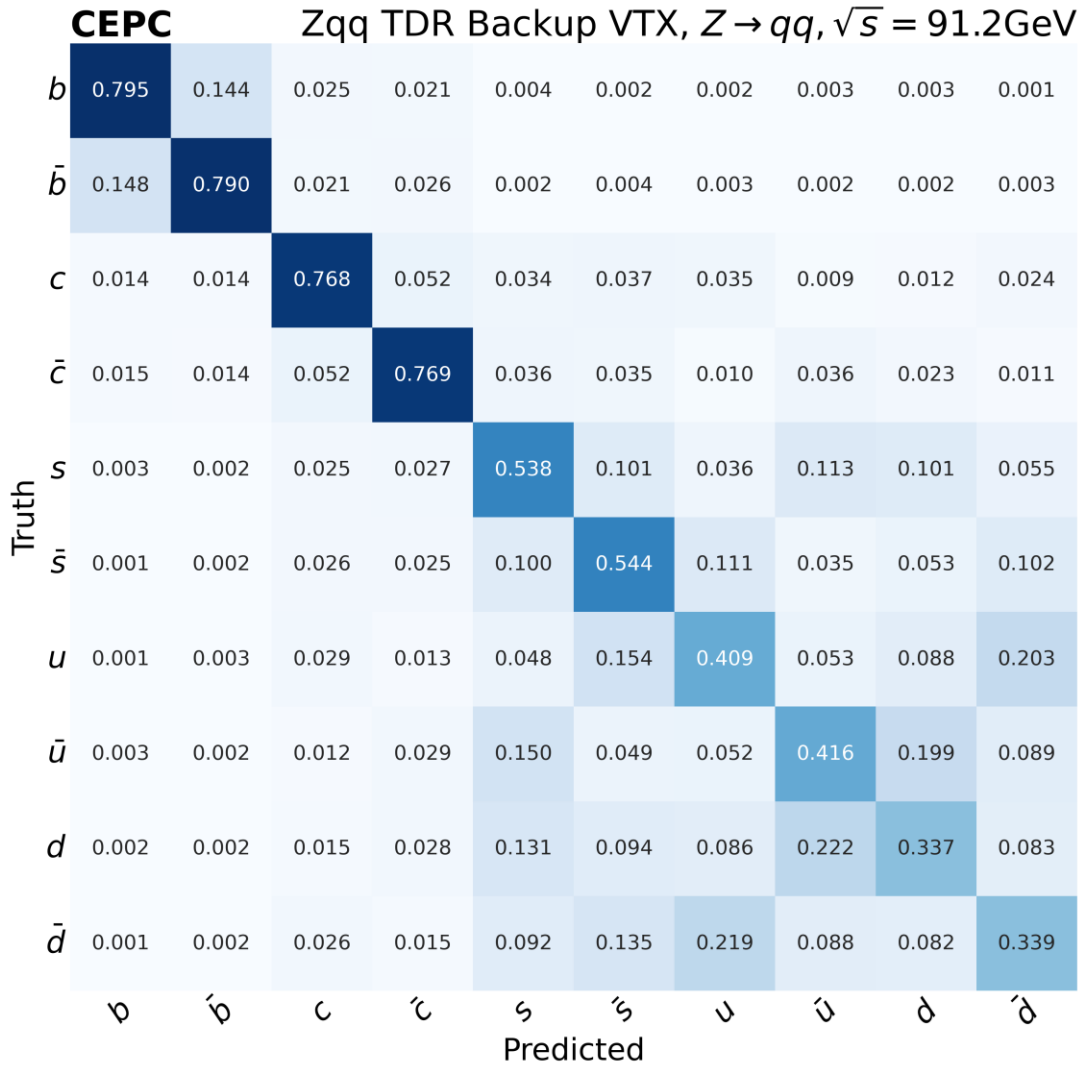


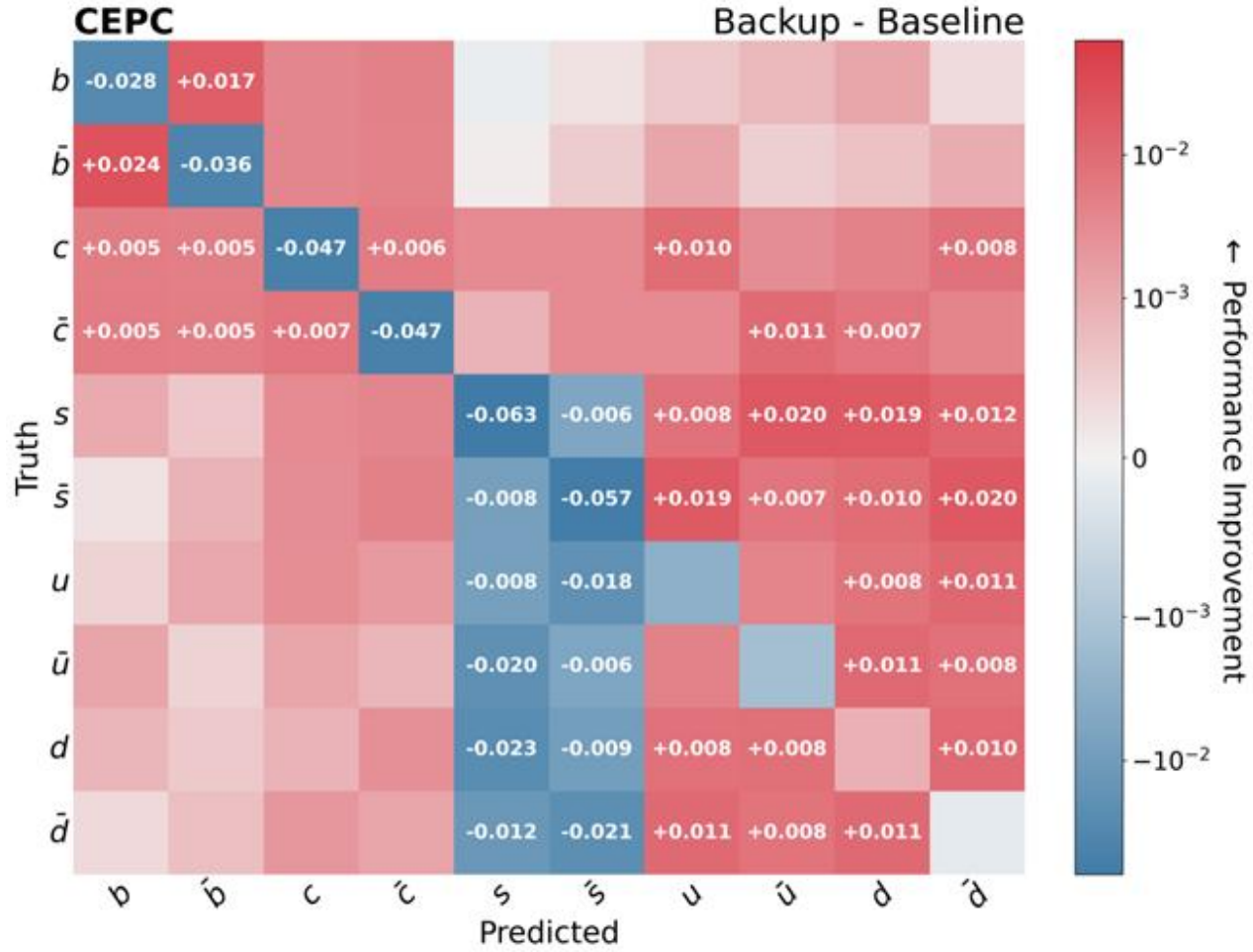

CEPC Ref-TDR
Hqq uds
Hqq c
Hqq on Zqq uds
Hqq on Zqq c
mis-id rate
b jet tagging Eff


CEPC Ref-TDR
Hqq uds
Hqq b
Hqq on Zqq uds
Hqq on Zqq b
mis-id rate
c jet tagging Eff

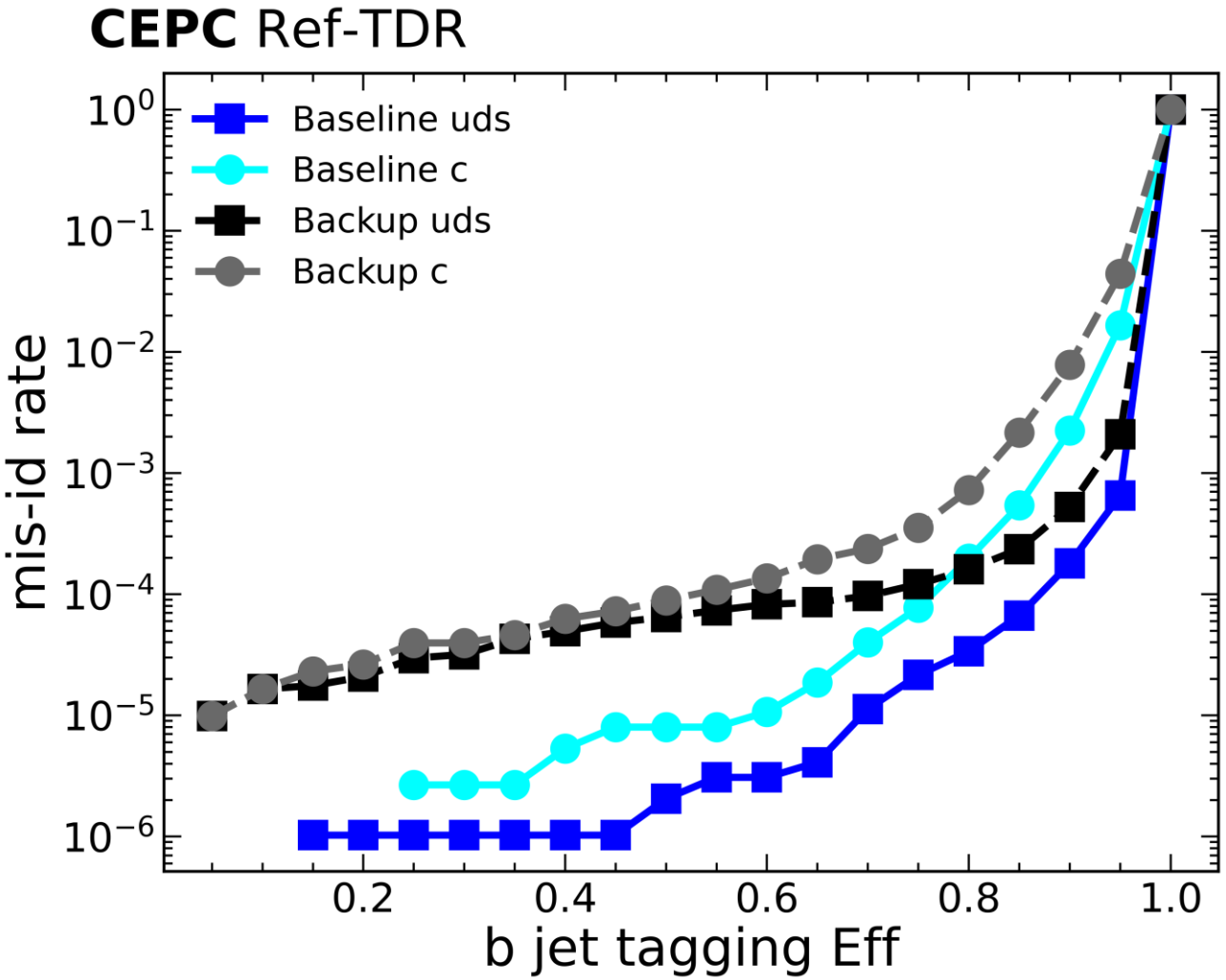
Detector optimization: Vertex design

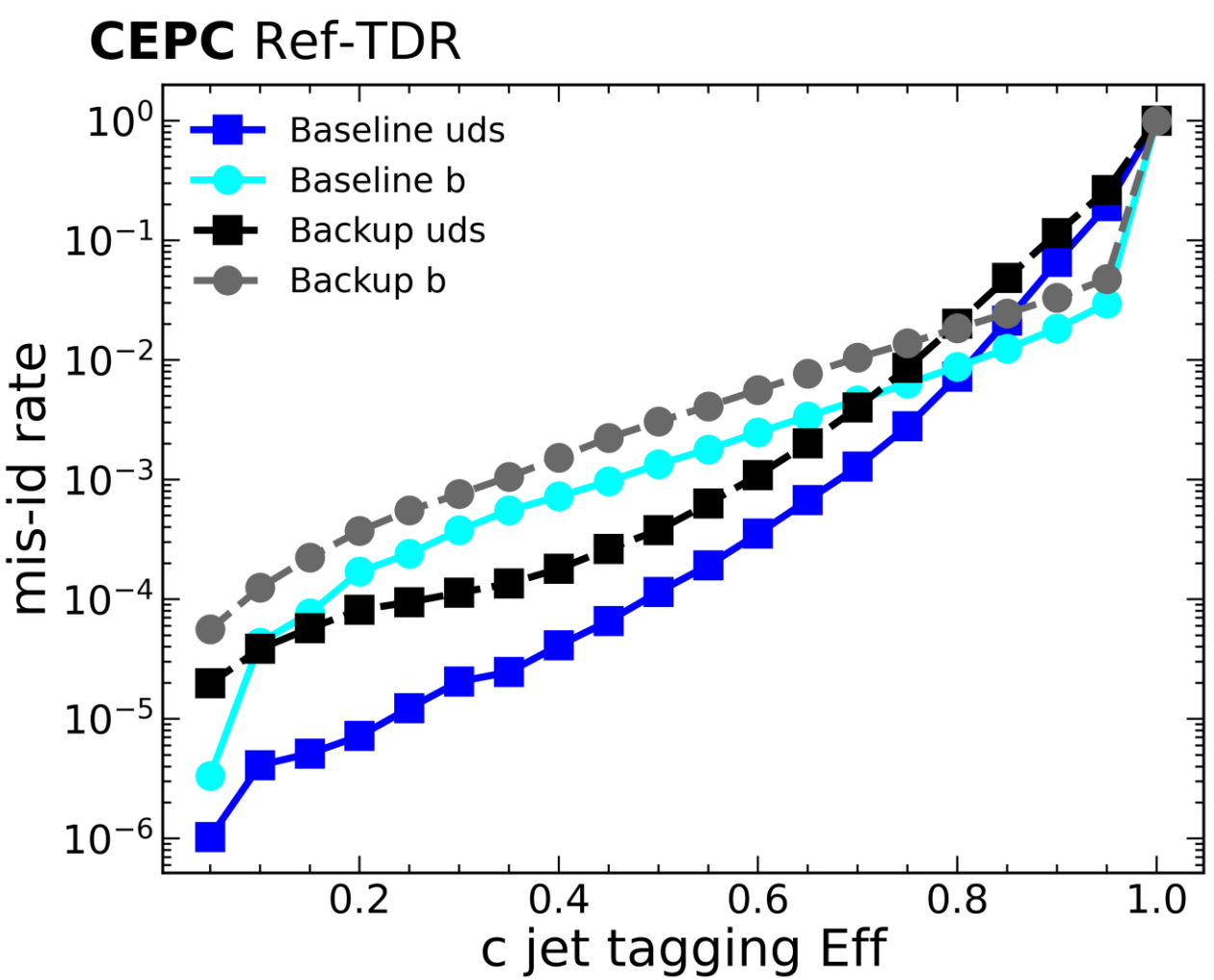
CEPC Backup Vertex design is 3-5% worse than baseline design.





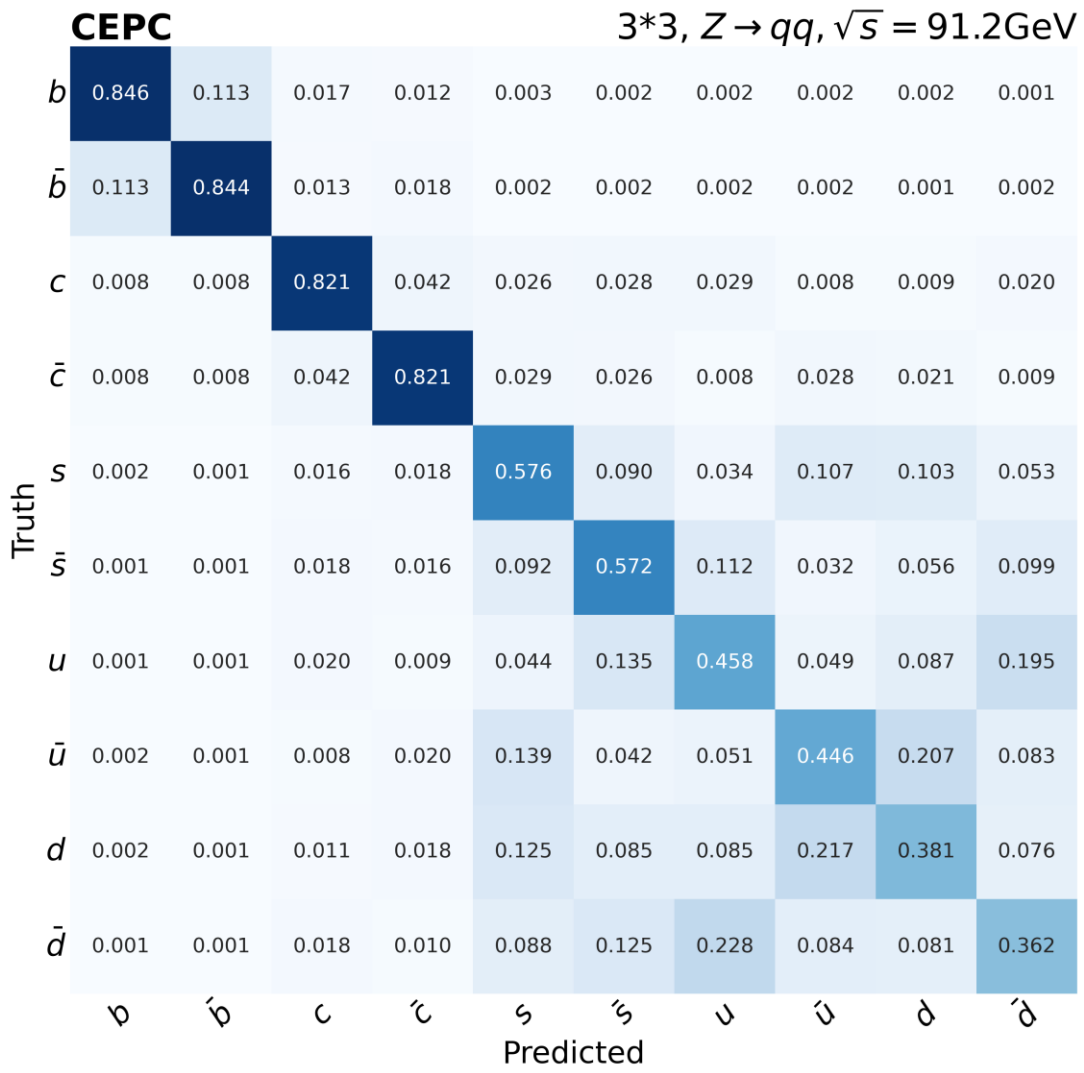
Vertex design ROC curve



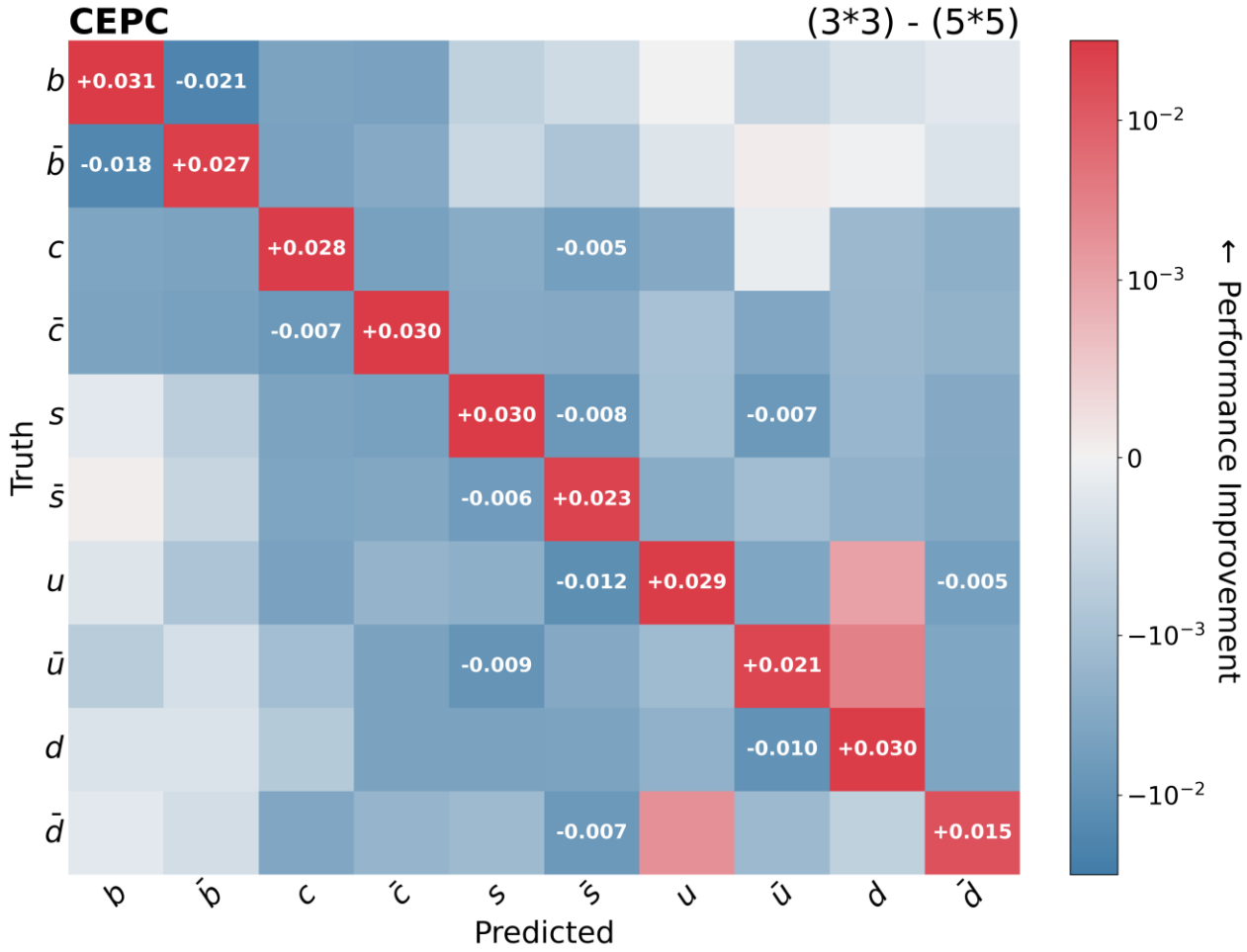


Detector optimization: Vertex resolution

Baseline: (5,5)um for rphi and z direction. Alternative: 3*3um, and 3*8um. (We did 3*10um before)

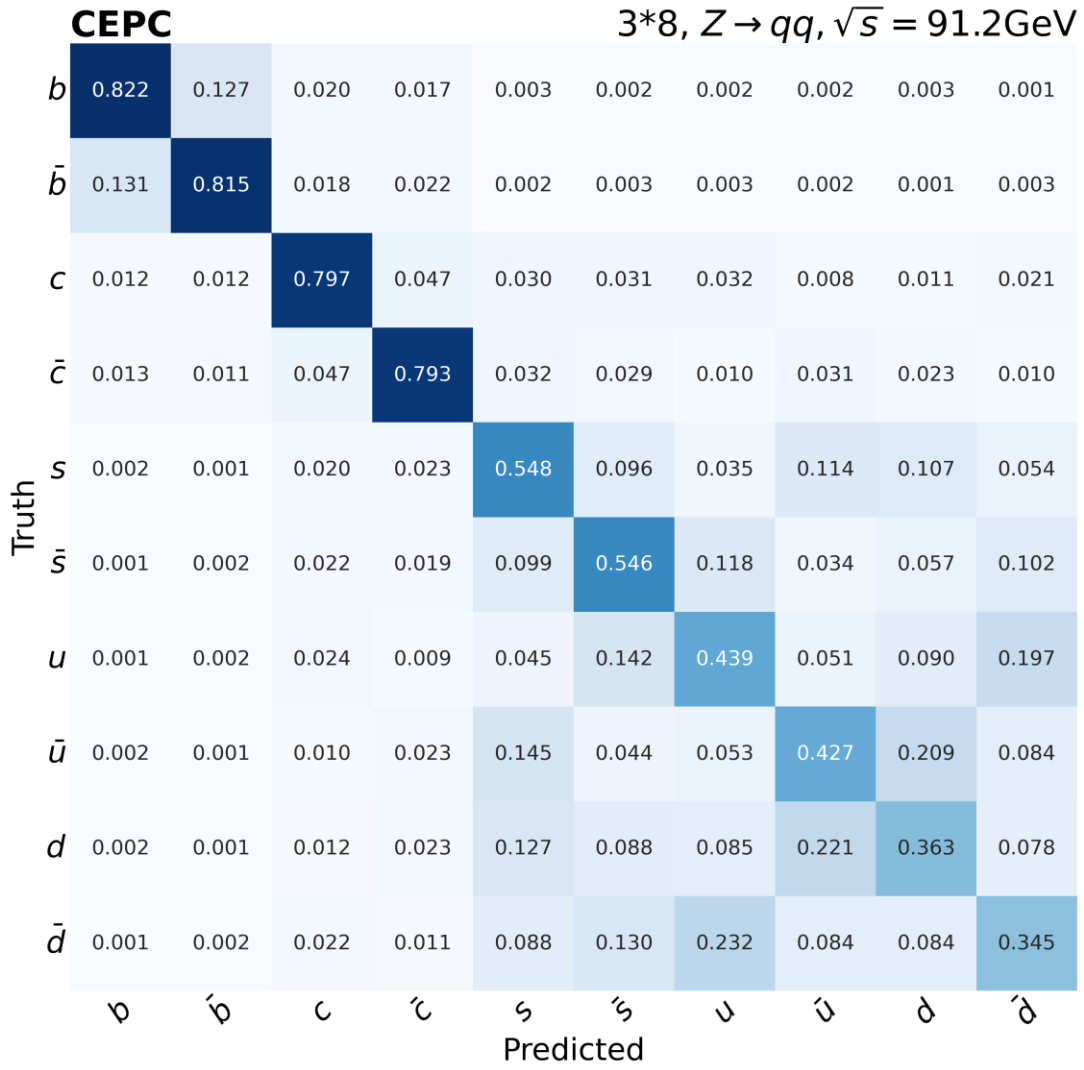


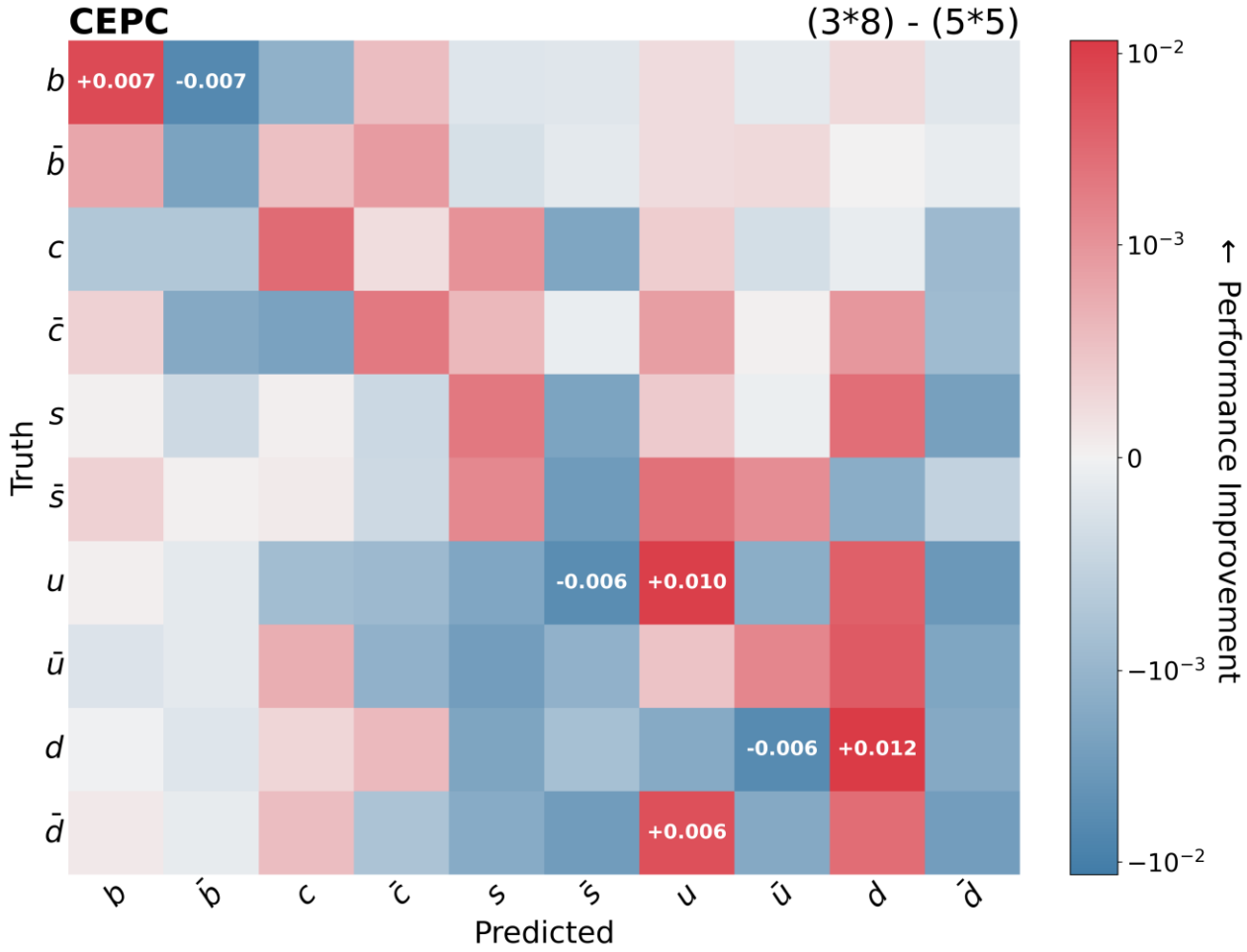
3*3 is 3% better than 5*5.

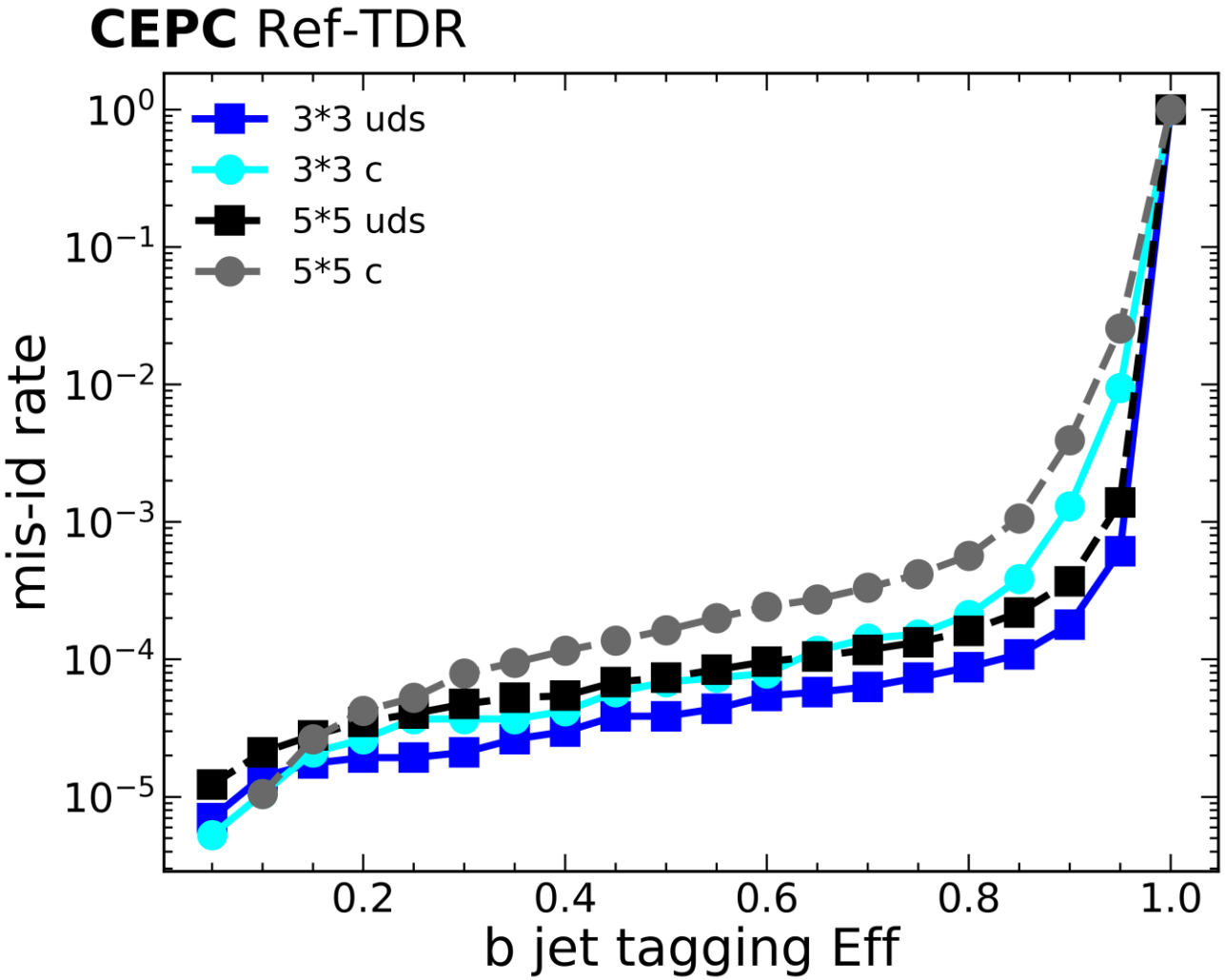


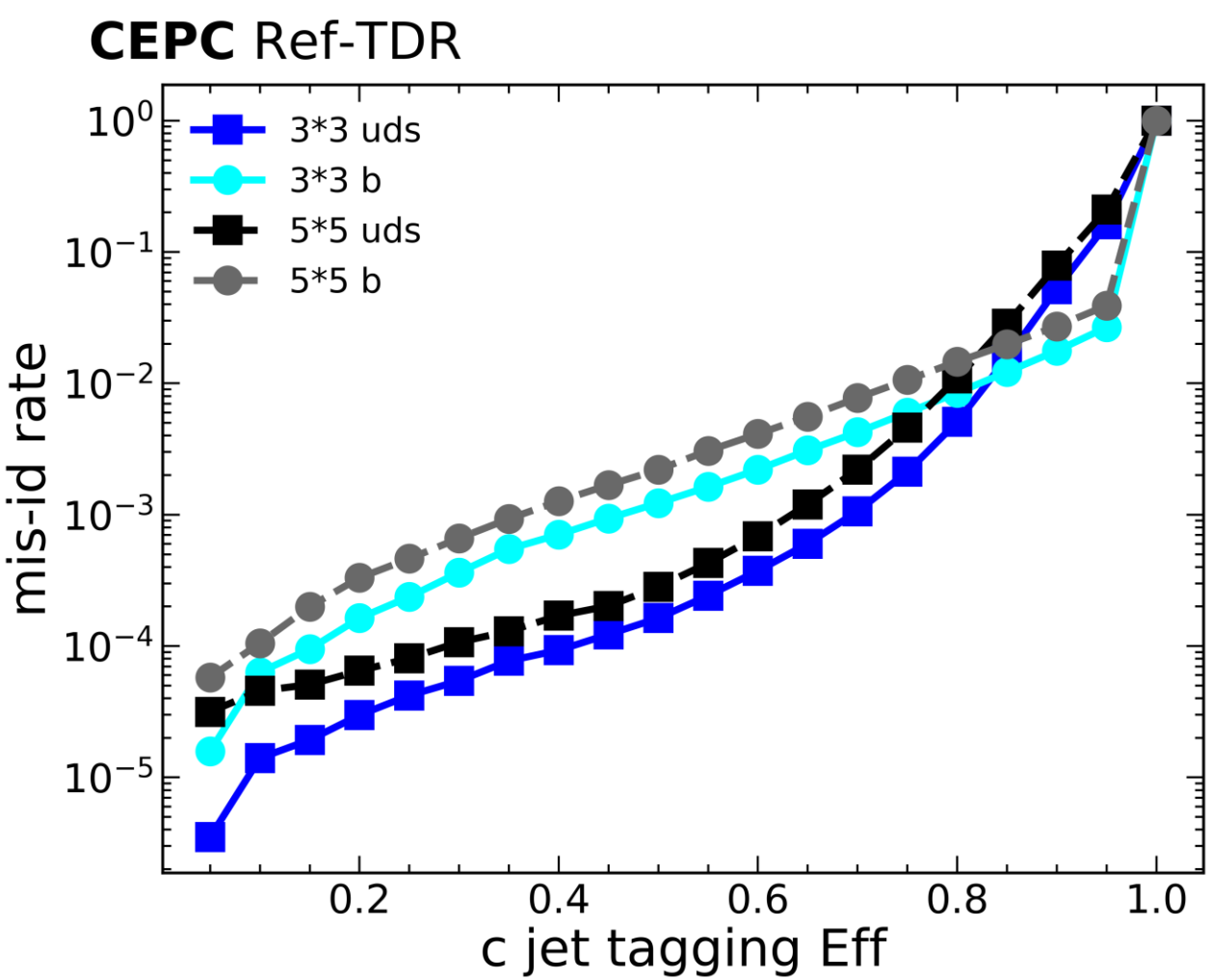
Vertex: 3*3, 3*8 and 5*5

3*3 >> 3*8 > 5*5.






CEPC Ref-TDR
3*3 uds
3*3 c
5*5 uds
5*5 c
mis-id rate
b jet tagging Eff


CEPC Ref-TDR
3*3 uds
3*3 b
5*5 uds
5*5 b
mis-id rate
c jet tagging Eff

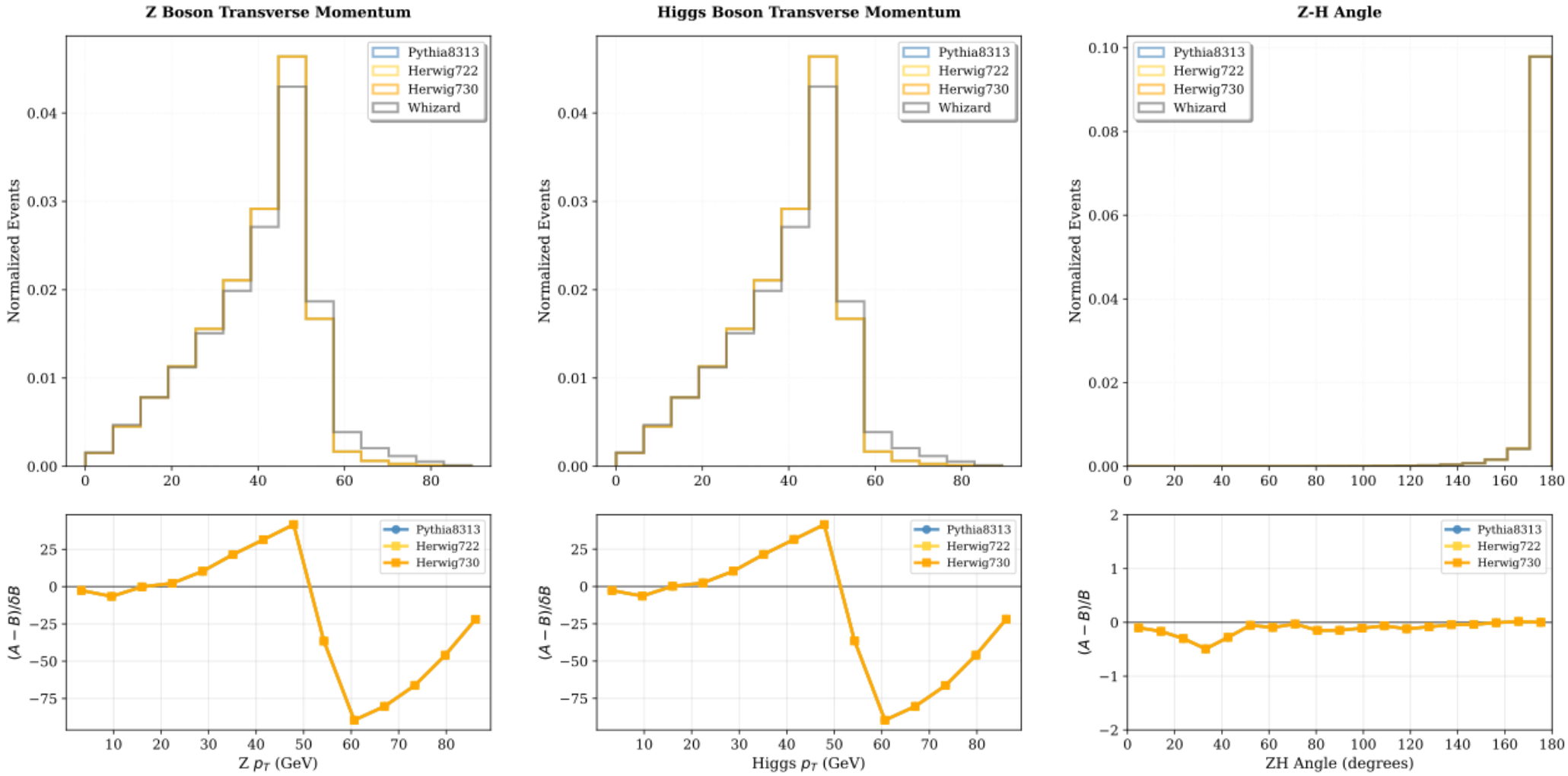
Generator

- CEPC uss Whizard1.9.5+Pythia6.3 before
- Now Madgraph 3.6.3 + Pythia 8313 / Herwig 730 available.
  - Herwig 7.3.0(2019) has a big update, much more different with Pythia8.
  - HepMC3/HepMC2 available. Currently CEPCSW/Key4HEP do not support 3, so we provide 2.
  - Sample: /cefs/higgs/jiangjianfeng/workspace/madgraph_p8_h7
  - https://code.ihep.ac.cn/jiangjf/madgraph_p8_h7

ZH cross section & pT distribution

Process	pythia8131	herwig730	whizard
ZH	39.88	39.88	
vvH	46.11	46.11	46.29

ZH cross section & pT distribution



ZH final particle: charged particles && neutral partilces

Channel	herwig	pythia	whizard
zh_vv_bb	23.0609	25.5117	26.6726
zh_vv_cc	23.2326	23.7906	24.4139
zh_vv_dd	21.0216	22.6345	22.7797
zh_vv_gg	33.6911	37.2938	33.583
zh_vv_ss	21.1604	22.6799	22.8001
zh_vv_uu	20.9728	22.7223	22.8835

Charged particles multiplicity per event

Channel	herwig	pythia	whizard
zh_vv_bb	28.622	34.9513	34.9765
zh_vv_cc	27.53	31.23	30.9491
zh_vv_dd	24.605	29.7067	28.8468
zh_vv_gg	37.9099	45.4142	40.3237
zh_vv_ss	24.0171	28.8654	27.9509
zh_vv_uu	24.6222	29.5249	28.6898

Neutral particles multiplicity per event

ZH final particle: pi/K/p hadrons

Channel	herwig	pythia	whizard
zh_vv_bb	18.09854	20.1383	21.7205
zh_vv_cc	18.88169	19.15454	20.0179
zh_vv_dd	17.78566	19.02861	19.64328
zh_vv_gg	27.8959	30.84	28.5033
zh_vv_ss	17.17831	18.23373	18.78558
zh_vv_uu	17.76245	18.92466	19.56854

Pi multiplicity

Channel	herwig	pythia	whizard
zh_vv_bb	2.82505	3.05482	2.81232
zh_vv_cc	2.8786	2.79638	2.65402
zh_vv_dd	2.0357	2.03694	1.797867
zh_vv_gg	3.84055	3.66539	2.92923
zh_vv_ss	2.84143	2.88453	2.62273
zh_vv_uu	2.05104	2.13346	1.856584

Kaon(K+K-) multiplicity

Channel	herwig	pythia	whizard
zh_vv_bb	0.977948	1.088781	0.934895
zh_vv_cc	0.826512	1.137116	1.060974
zh_vv_dd	0.941664	1.260729	1.055779
zh_vv_gg	1.488299	2.21996	1.657043
zh_vv_ss	0.89372	1.268418	1.123666
zh_vv_uu	0.900966	1.357104	1.176404

Proton multiplicity