CEPC Tau Analysis
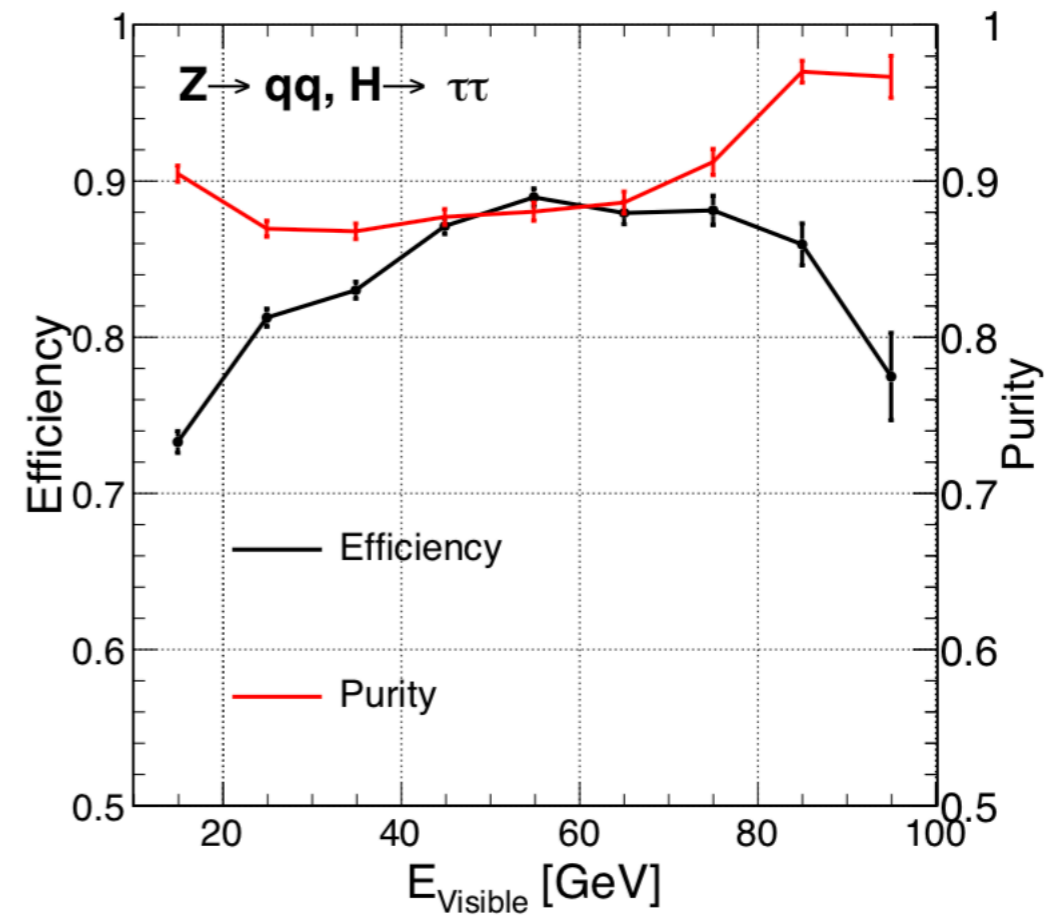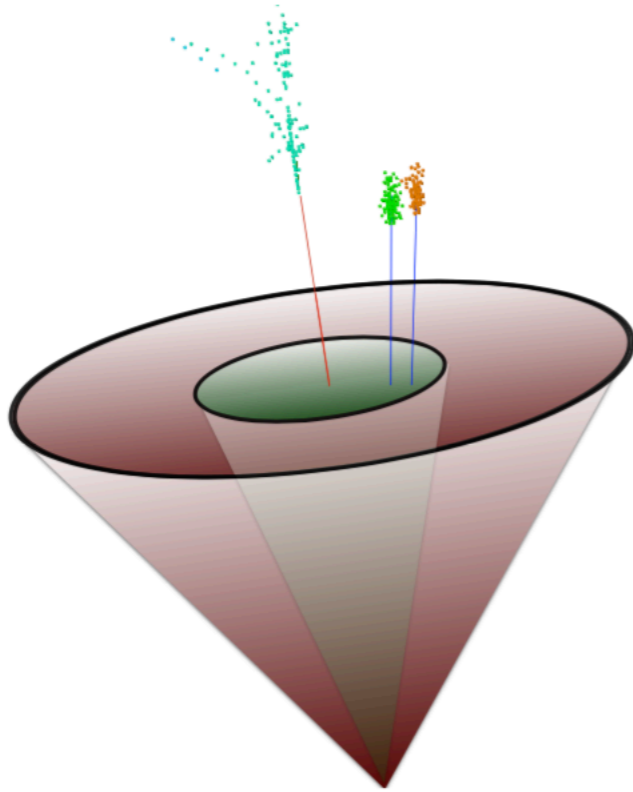
2019/07/02 CEPC Workshop

Content

- The CEPC H->tautau signal strength analysis

  - Package

  - Combined accuracy

- CEPC tau decay mode analysis

  - Dependencies

  - Current status

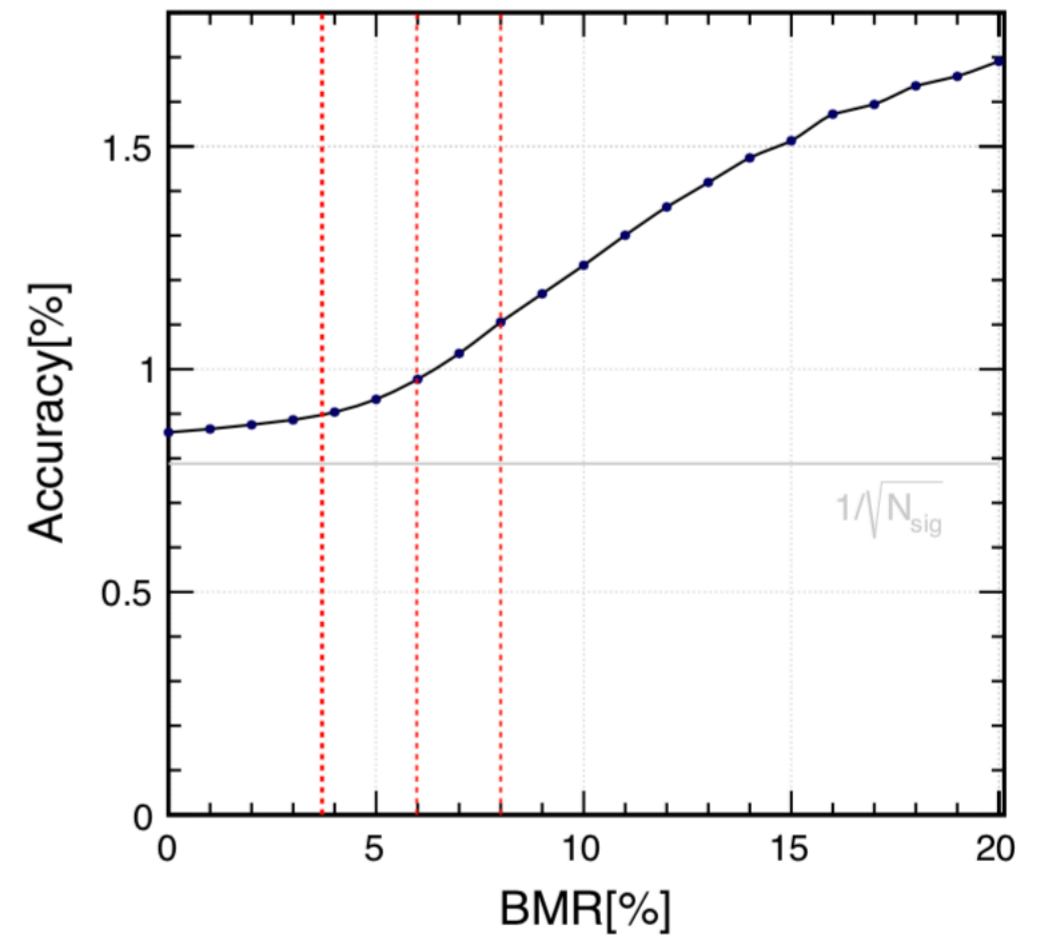# Taurus

- A dedicate tau reconstruction package

Signal Strength Analysis

- For events without jets

- For event with jets

	$\delta(\sigma \times \mathrm{BR}) / (\sigma \times \mathrm{BR})$
$\mu\mu H$	2.8%
eeH	5.1%
$\nu\nu H$	7.9%
qqH	0.9%
combined	0.8%

Dependence on BMR
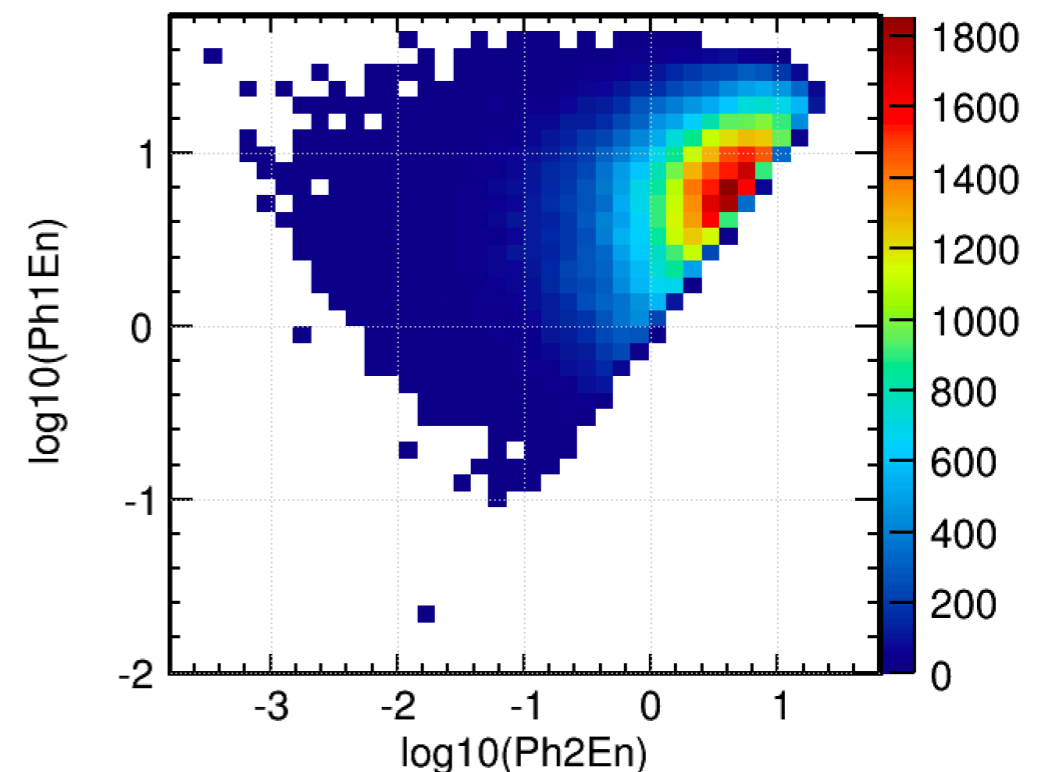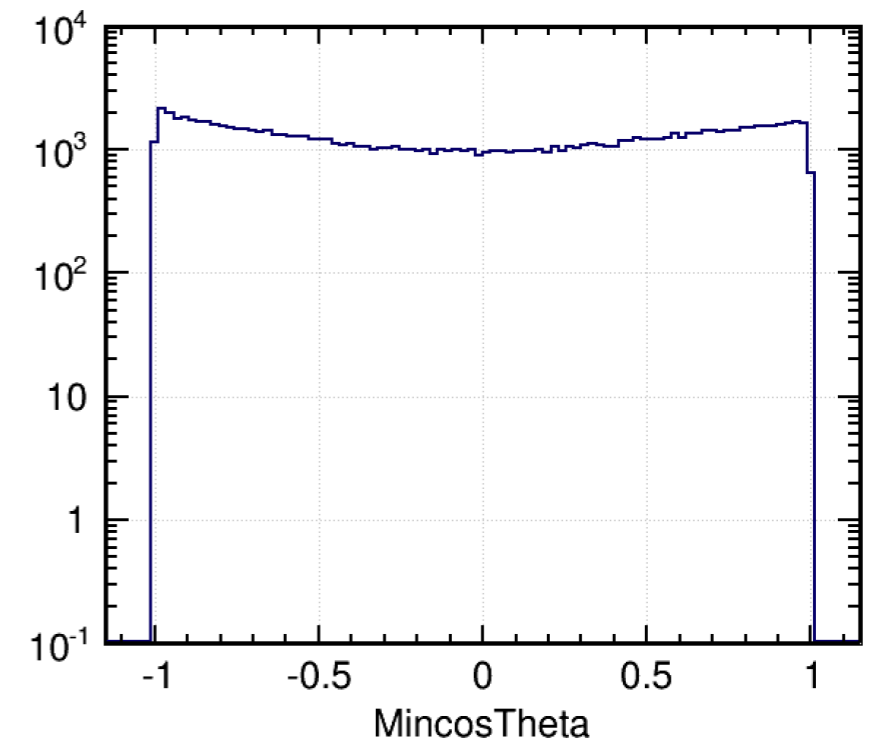
- BMR: boson mass resolution

-

Next

- Taurus in other ZH channels

- Measurement of polarization

  - decay modes identification

    - event selection, non-τ background

    - photon detection efficiency, bremsstrahlung and radiative photons

    - particle identification, converted photons, photon identification, fake photons, π0 reconstruction, tracking of charged particles
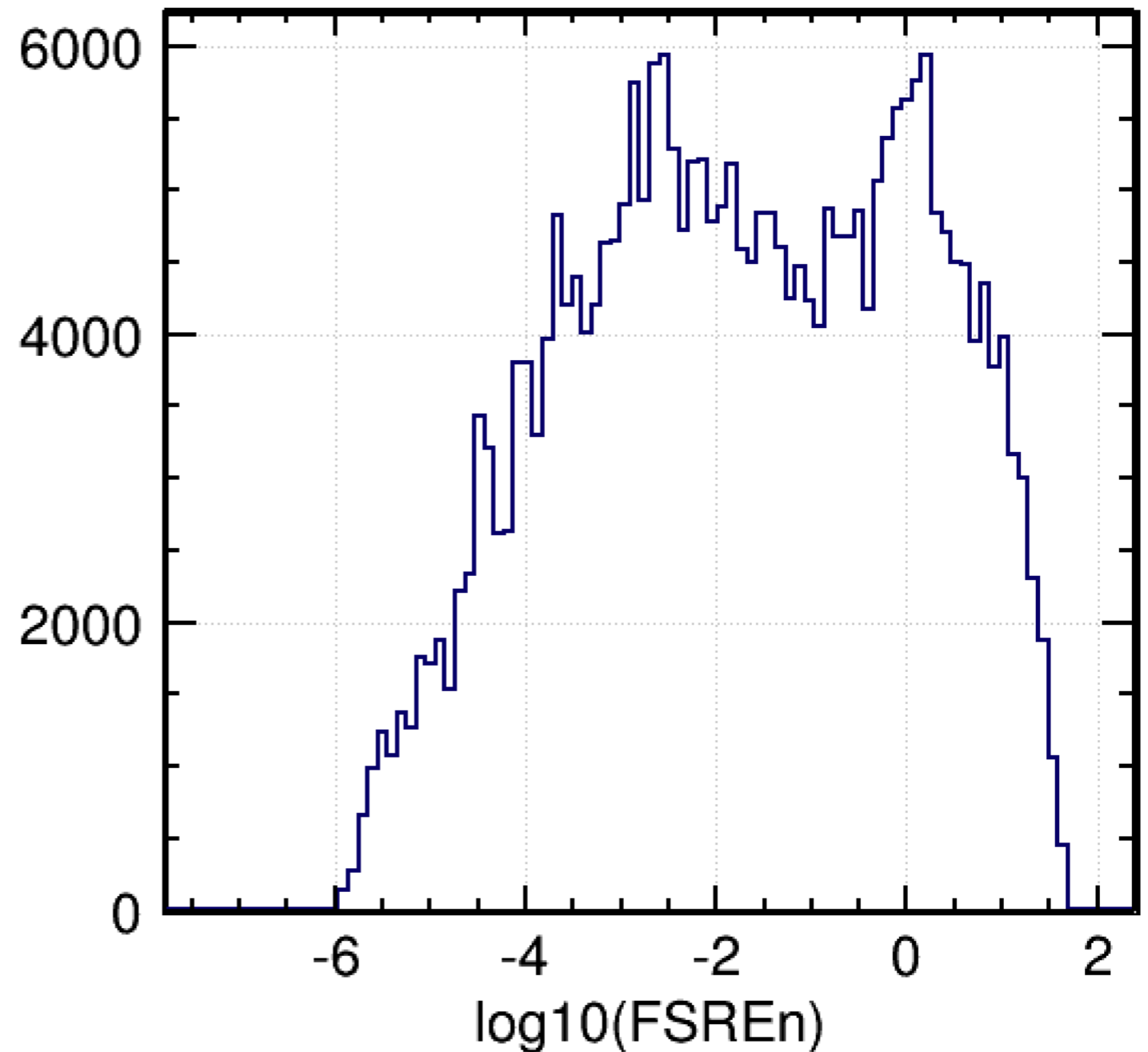
Detector & Physics Dependency

photon detection efficiency

- Detector acceptance

  - Angle distribution: <0.98

  - Energy distribution: >0.5GeV

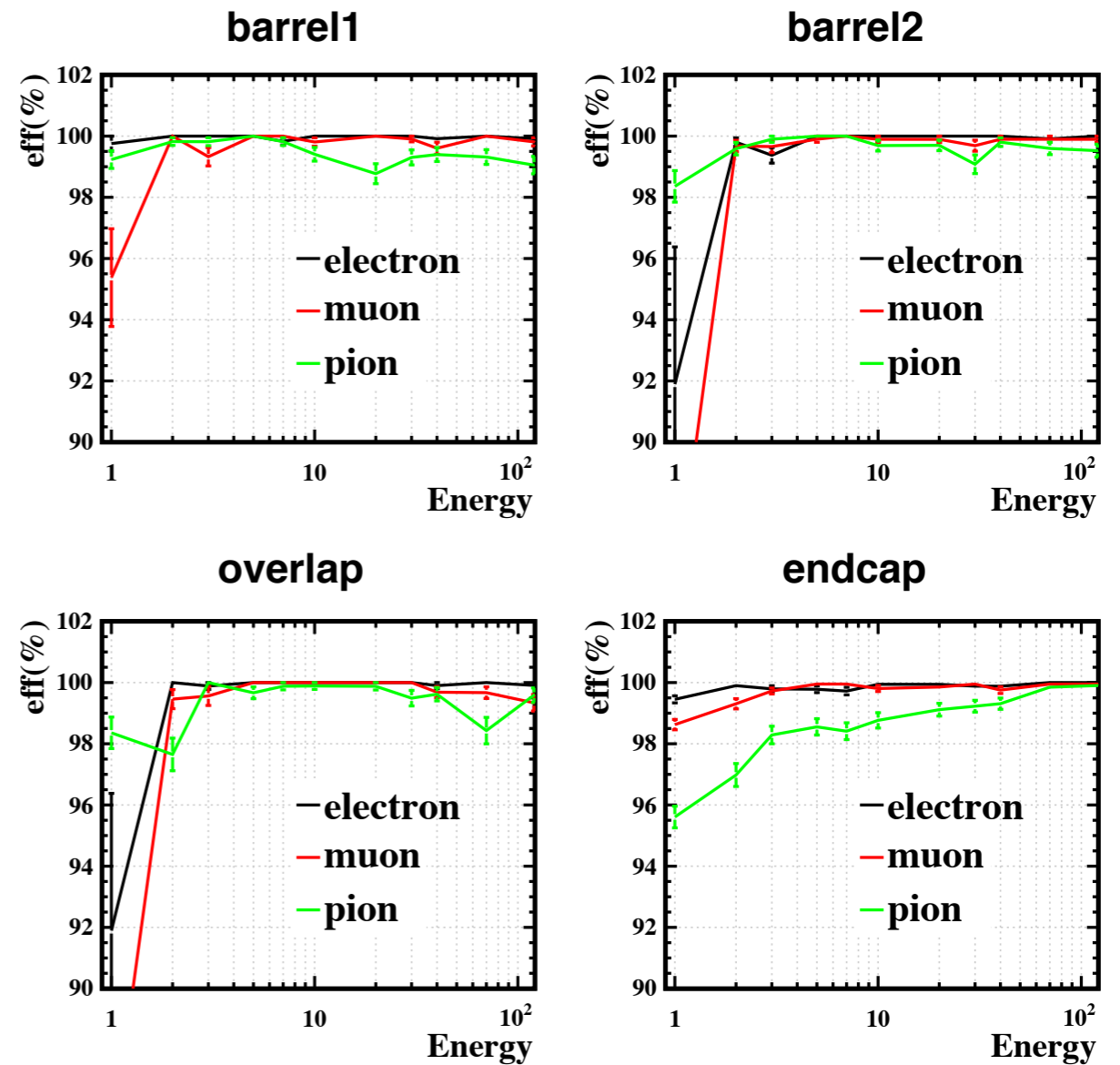 - efficiency: 81.21%

bremsstrahlung and radiative photons

- Bremsstrahlung rate

- FSR rate

Reconstruction Dependency

particle identification

- Tracks in Tau are isolated

- Performance comparable to single particle

photon identification

- eff vs mis-id rate

- No neutron mis-id

- Probability for tracks
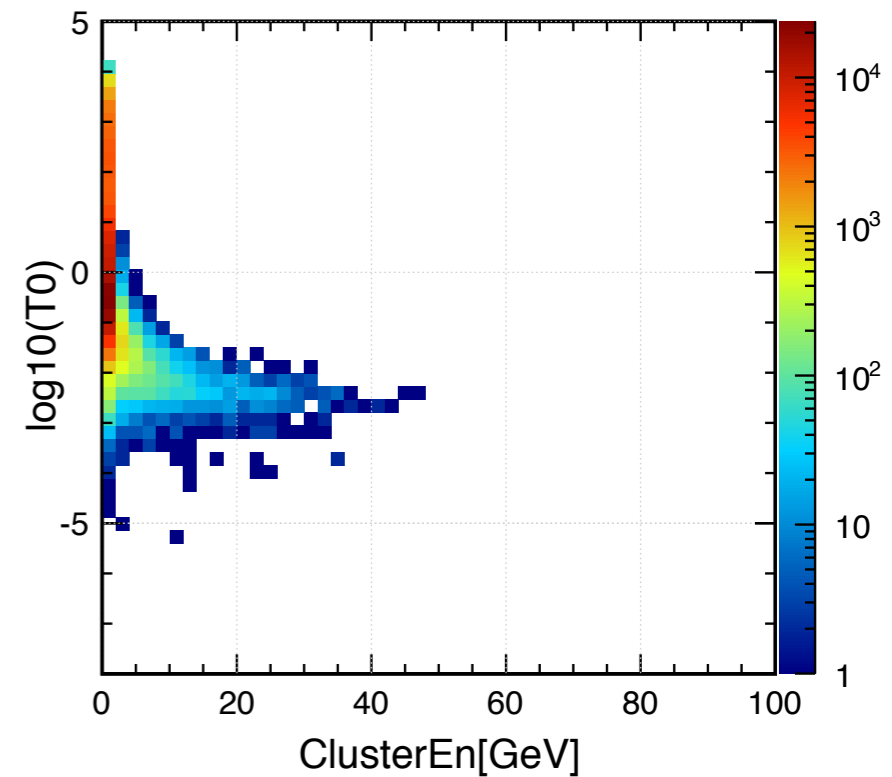 to have no fragments:
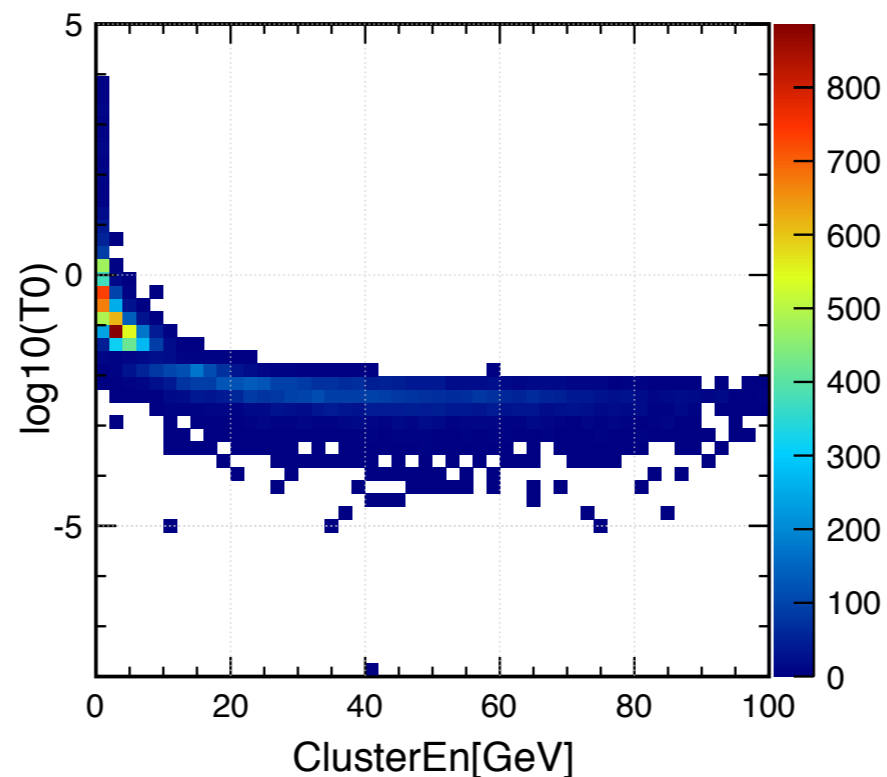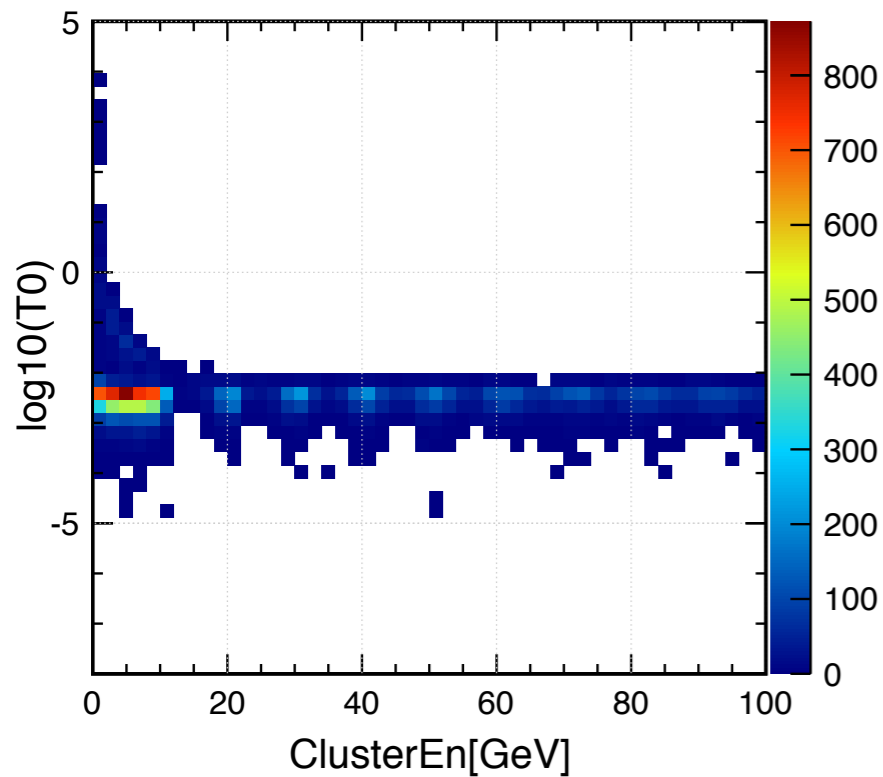
  - e:90.26%

  - mu:88.66%

  - pi: 65.11%

	<1GeV	1-5GeV	>5GeV
Photon	99.37	99.34	99.85
EM Fragments	39.53	45.08	33.44
Hadron Fragments	0	0.04	3.71
Neutron	0	0.02	4.7

fake photons

- Fluctuations of a shower can generate "fake photons" which are artefacts of the clustering algorithm or true photons produced by secondary interactions in the ECAL.

- Time

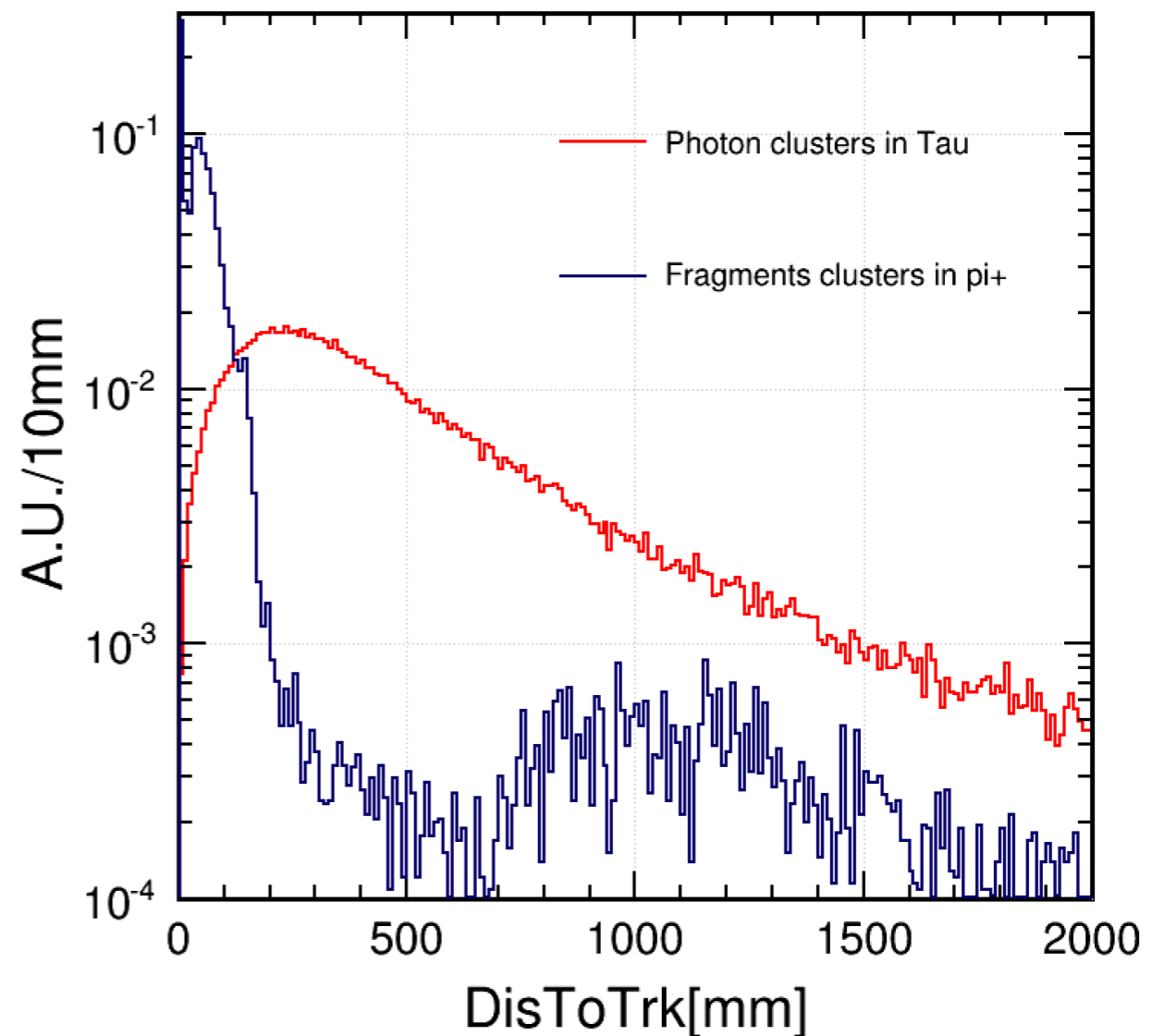- distance to the closest charged track

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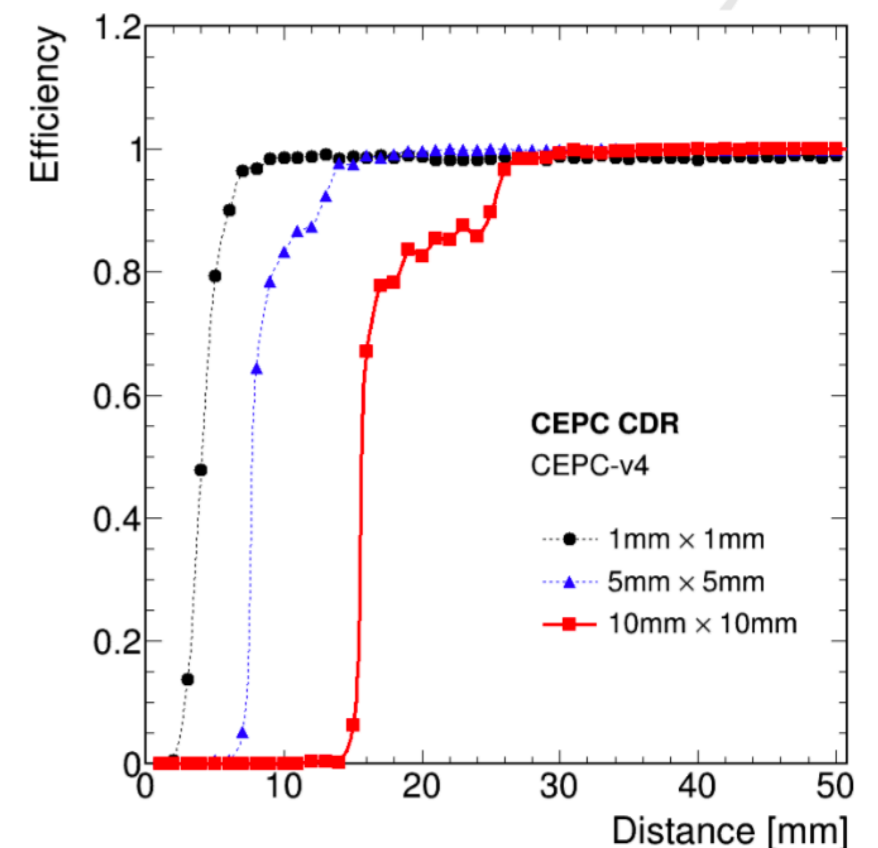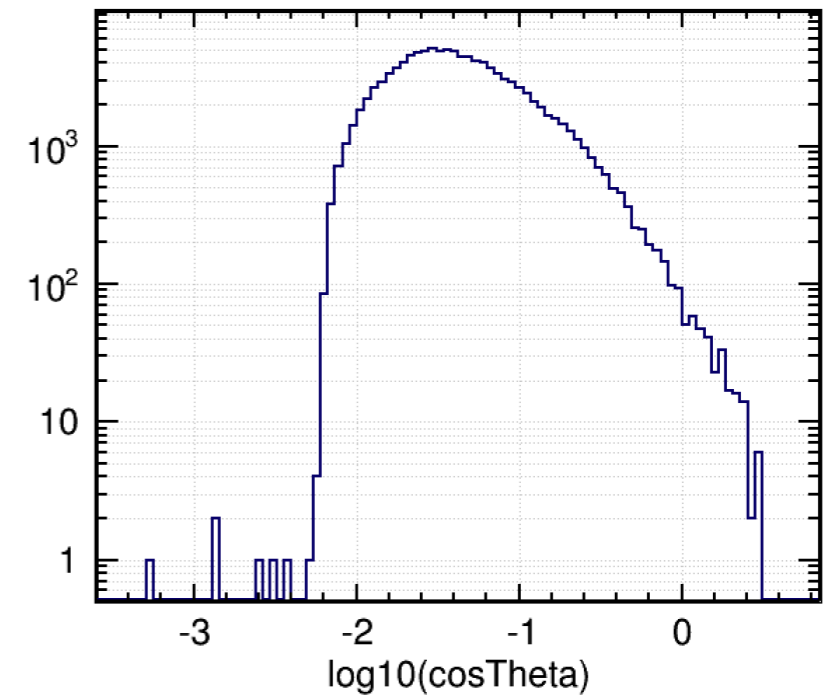- distance to the closest charged track

π0 reconstruction

- No dedicate π0 reconstruction yet — Efficiency of well reconstructed photon pair

- photon distance (>10mm~Theta>0.008)

  - photons well reconstructed: 90%

- photon energy resolution

tracking of charged particles

- Tracking efficiency in CDR (Generally 97% for Z pole to tau events)

Others

- event selection, non-τ background, converted photons, π0 Dalitz decays, secondary nuclear interactions dynamics in the Monte Carlo generator.

Estimate Migration Matrix

- 1 prong without photon: Eff_trk * (1-Prob_frag*MisPh)

  - Tracking efficiency, Probability of having fragments, MisID rate of fragments to photon

- 1 prong with two photon: Eff_trk * (Eff_ph^2 * (1-Prob_frag*MisPh)^2 +Eff_ph*(1-Eff_ph)*(1-Prob_frag*MisPh))

- …

- ISR/FSR, photon conversion not included

Estimate Migration Matrix

	1-prong(l)	1-prong(h)	1prong + 2photon	1prong + 4photon	3prong	3prong + 2photon
1-prong(l)	95%					
1-prong(h)		96%				
1prong + 2photon			63%			
1prong + 4photon				42%		
3prong					90%	
3prong + 2photon						59%

Current Migration Matrix

	No Trk	1-prong(l)	1-prong(h)	1prong + 1photon	1prong + 2photon	1prong + 3photon	1prong + 4photon	1prong + 5photon	3prong	3prong + 2photon
1-prong(l)	3.58	89.42	3.17	0.07	0	0	0	0	0.35	0
1-prong(h)	5.90	5.76	78.17	4.49	0.72	0.16	0.05	0	1.15	0
1prong + 2photon	2.47	1.43	0.80	26.56	54.48	2.97	0.19	0.01	0.04	1.59
1prong + 4photon	1.93	1.38	0.07	1.39	8.45	28.61	42.03	3.04	0	0.19
3prong	1.34	2.13	0.19	0.11	0.04	0	0	0	88.47	0.24
3prong + 2photon	1.12	1.81	0.08	0.06	0.23	0.08	0.02	0.01	1.08	63.94