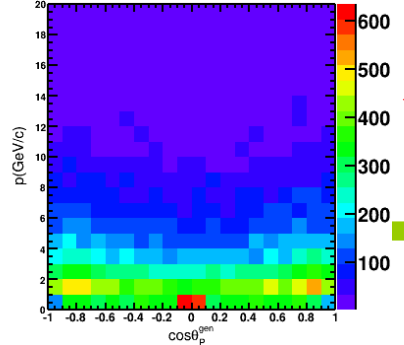
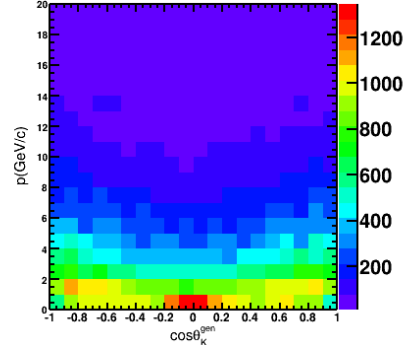
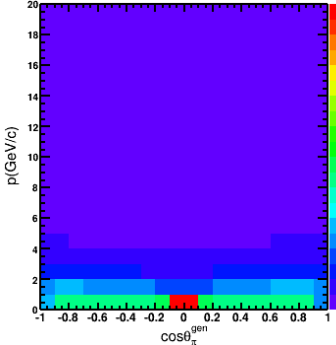
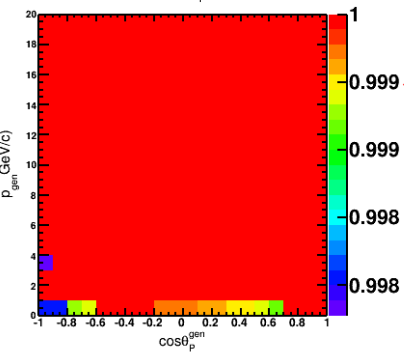
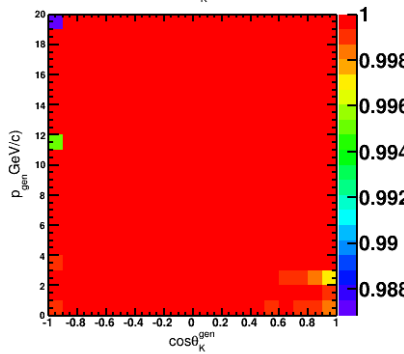
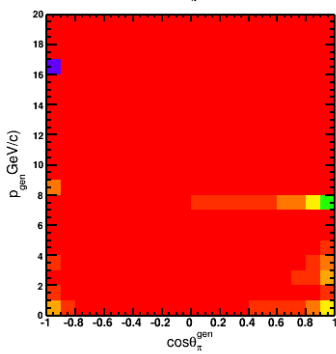


PID efficiency study

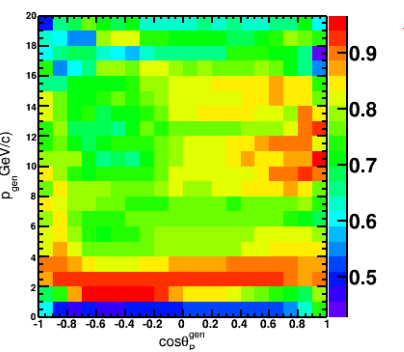
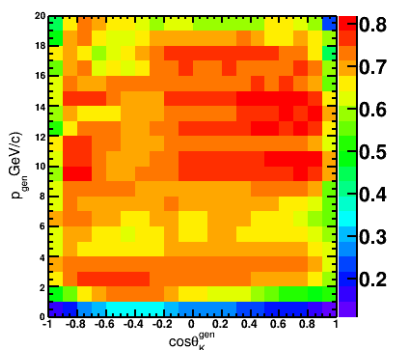
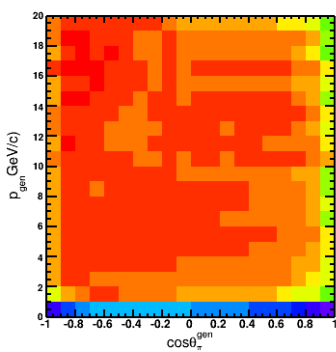
- ❖ Perform efficiency study in physical process $Z \rightarrow qq$
 - Calculate efficiency and purity in all phase space using minimum χ^2 PID
 - Modify one bug which caused wrong gen costheta
- ❖ Samples used
 - Release version: CEPCSW_tdr24.10.0
 - $Z \rightarrow qq$ 40000 events (truth π : K : $p = 744788$: 95489 : 39552)
 - 10 times events ongoing



❖ Phase space
 $(p_{gen}, \cos\theta_{gen})$
 0-20GeV

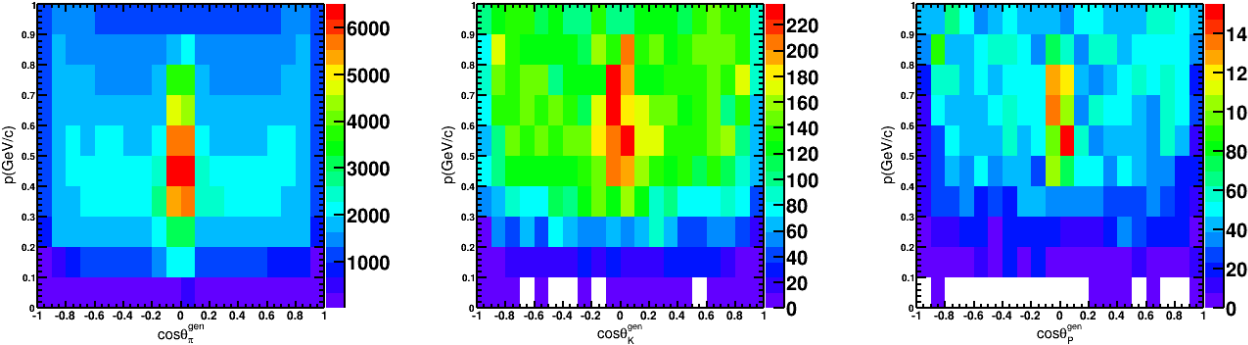


❖ Track efficiency
 distribution of truth
 $\pi/K/p$ (have dN/dx or t)

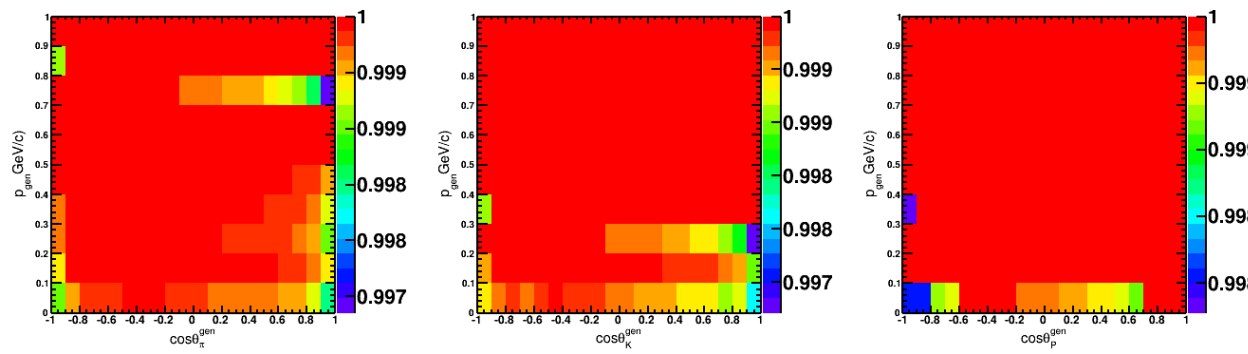


❖ PID efficiency
 distribution of truth
 $\pi/K/p$ (minimum
 combined χ^2)

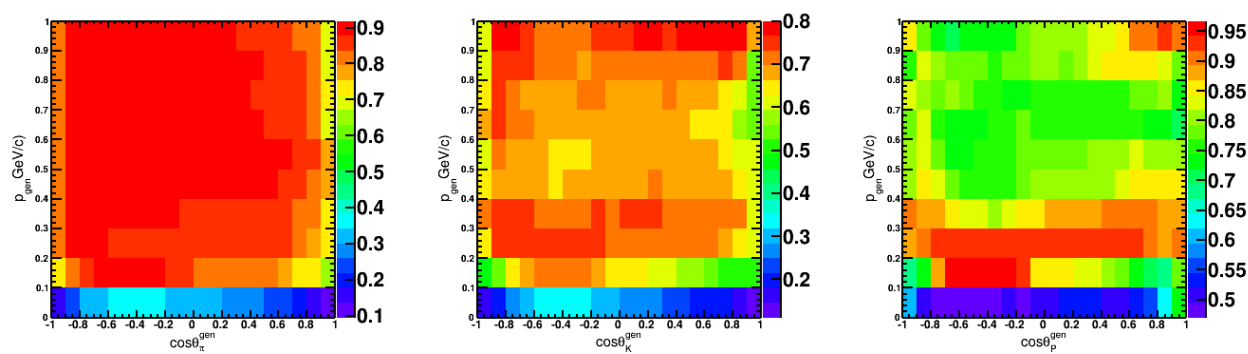
❖ Purity distribution of
 truth $\pi/K/p$



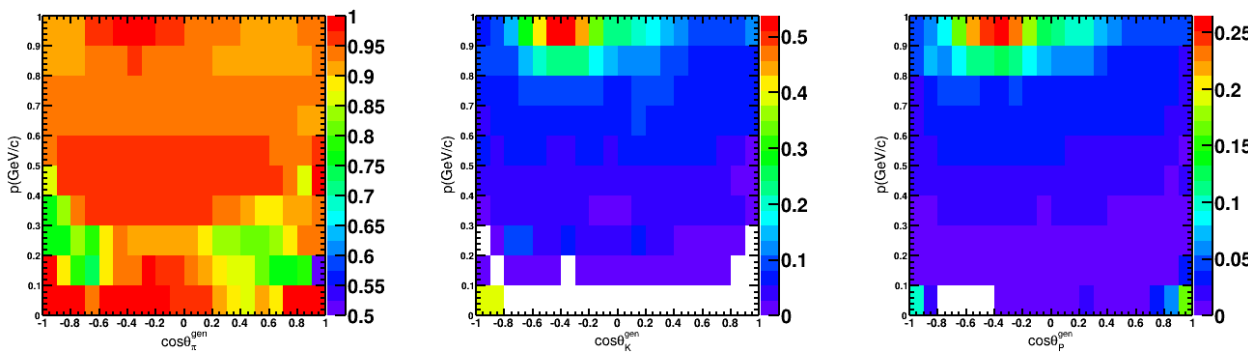
❖ Phase space
 $(p_{gen}, \cos\theta_{gen})$
 0-1GeV



❖ Track efficiency
 distribution of truth
 $\pi/K/p$ (have dN/dx or t)

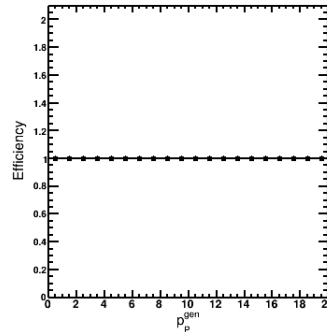
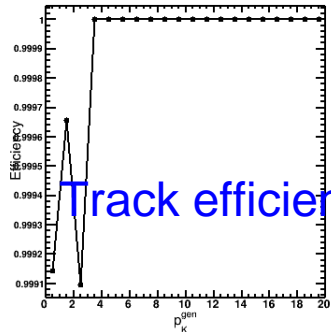
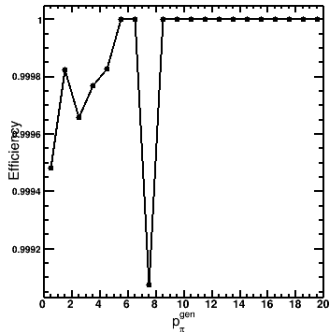


❖ PID efficiency
 distribution of truth
 $\pi/K/p$ (minimum
 combined χ^2)

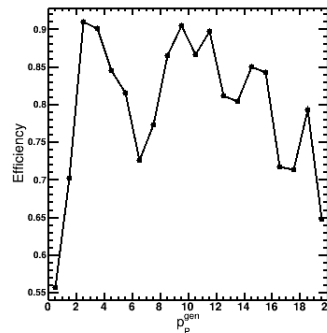
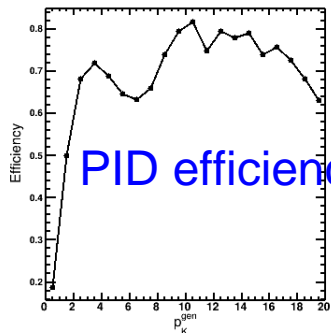
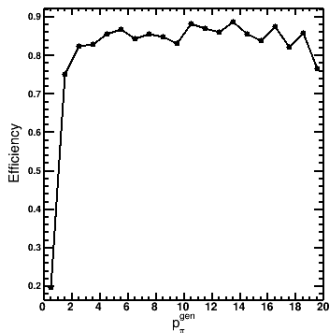
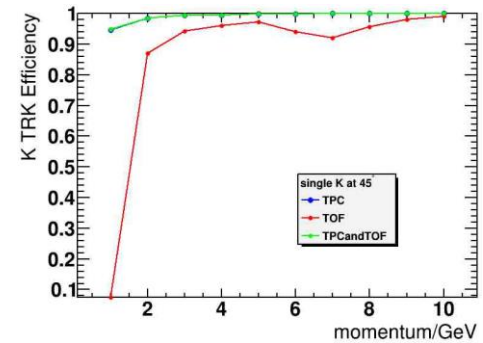


❖ Purity distribution of
 truth $\pi/K/p$

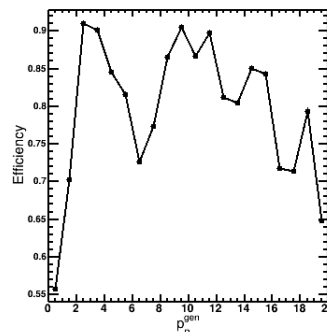
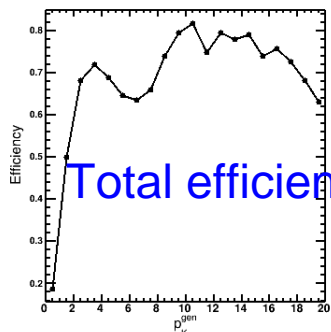
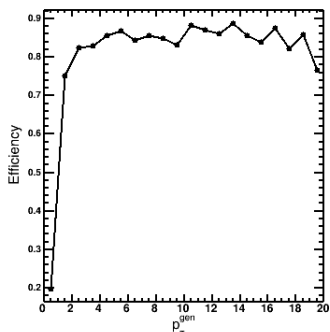
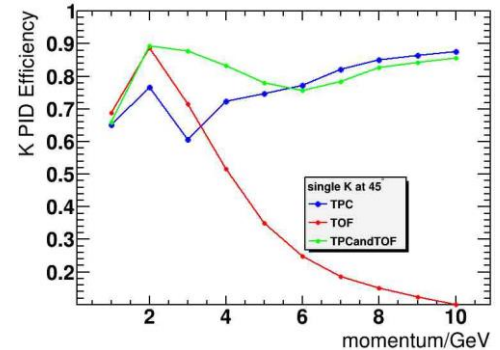
PID efficiency comparison



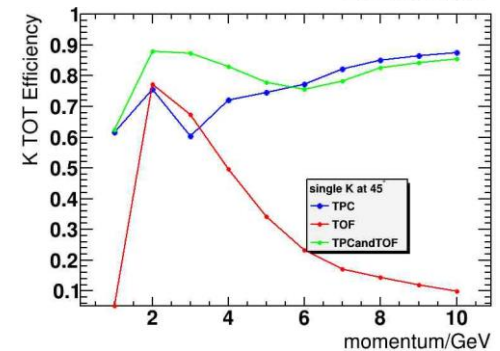
Track efficiency



PID efficiency



Total efficiency



$\pi/K/p$ efficiency at $\cos\theta=0.7-0.8$ (37-45 degree)

ParticleGun's K efficiency

Backup

$$\chi_{\text{TPC}}(i) = \frac{(dN/dx)_{\text{meas}} - (dN/dx)_{\text{exp}}^i}{\sigma_{(dN/dx)_{\text{meas}}}}, i = \pi/K/p$$

$$\chi_{\text{TOF}}(i) = \frac{t_{\text{meas}} - t_{\text{exp}}^i}{\sigma_{t_{\text{meas}}}}, \sigma_{t_{\text{meas}}} = \sqrt{0.05^2 + 0.02^2}$$

$$\chi^2(i) = \chi_{\text{TOF}}^2(i) + \chi_{\text{TPC}}^2(i)$$

$$\chi(i) = \sqrt{\chi^2(i)}$$

$$\text{Efficiency}_{\text{tot}}(i) = \text{Efficiency}_{\text{trk}}(i) \times \text{Efficiency}_{\text{PID}}(i)$$

$$\text{Efficiency}_{\text{trk}}(i) = \frac{N_i^{\text{reco}}}{N_i^{\text{gen}}}$$

$$\text{Efficiency}_{\text{PID}}(i) = \frac{N_i^{\text{reco}}(\chi^2(i) < \chi^2(j))}{N_i^{\text{reco}}} (j \neq i)$$

$$\text{purity}(K) = \frac{N_{K \rightarrow K}}{N_{K \rightarrow K} + N_{\pi \rightarrow K} + N_{p \rightarrow K}}$$

$$= \frac{3 \times \text{Efficiency}_{K \rightarrow K} + 10 \times \text{Efficiency}_{\pi \rightarrow K} + 1 \times \text{Efficiency}_{p \rightarrow K}}{3 \times \text{Efficiency}_{K \rightarrow K} + 10 \times \text{Efficiency}_{\pi \rightarrow K} + 1 \times \text{Efficiency}_{p \rightarrow K}}$$

$$\text{Efficiency}_{\text{opti. PID}}(i) = \frac{N_i^{\text{reco}}(a < \chi(i \rightarrow i) < b)}{N_i^{\text{reco}}}$$

$$\text{purity}_{\text{opti.}}(K)$$