PID efficiency study

- Version: CEPCSW_master on 10.21, 2024 with ParticleID changed

- Samples: Use ParticleGun to generate $\pi/K/p$ samples at different $p(0.8-20\mathrm{GeV})$ and $\theta(45^\circ-90^\circ)$

PID efficiency study

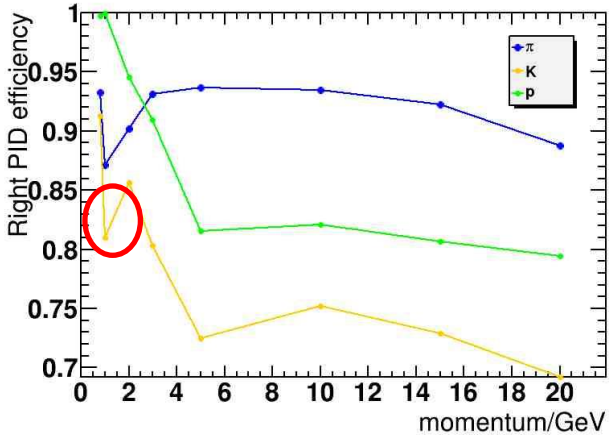
- K/π eff fall rapidly around 1 GeV
- K/p eff dip around 5 GeV
- Abnormal effs at $\boldsymbol{\theta = 45°}$
- Discussion of standards of efficiency
- Other distributions in backup

$$\chi^2(i) = \chi^2_{\mathrm{TOF}}(i) + \chi^2_{\mathrm{TPC}}(i), i = \pi/K/p$$

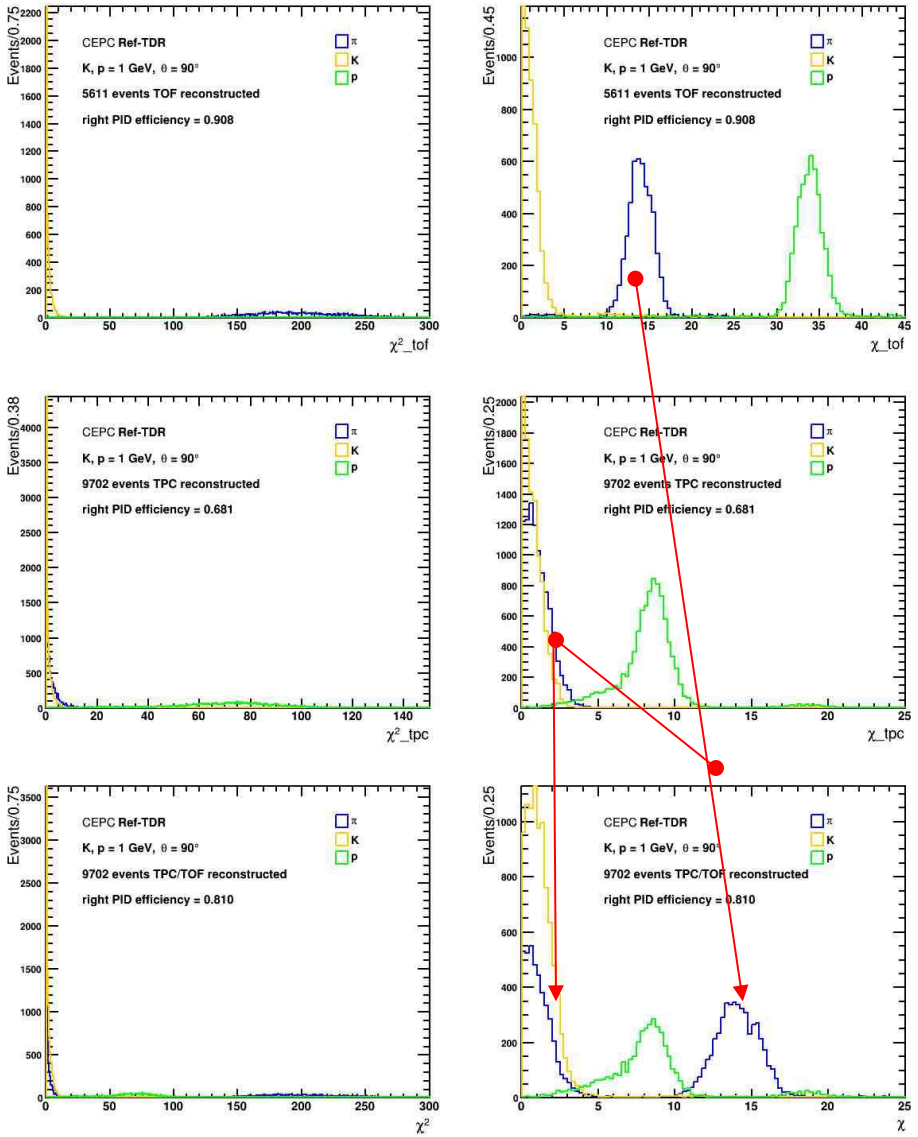
$$\mathrm{Efficiency}(i) = N^{reco}_{i\left(\chi^2(i)<\chi^2(j)\right)}/N^{reco}_i$$

K eff falls rapidly around 1 GeV

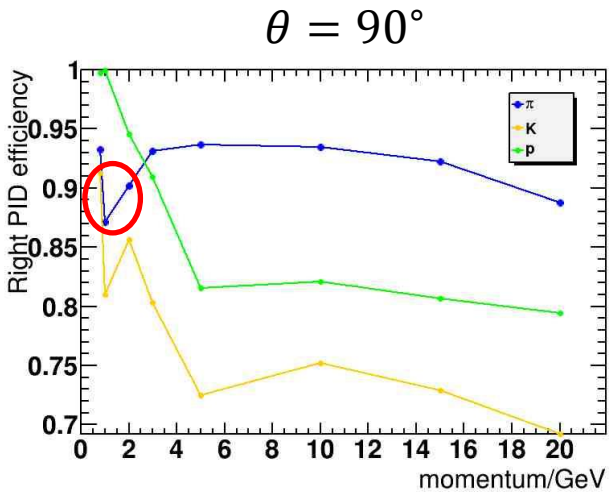
$\theta = 90°$



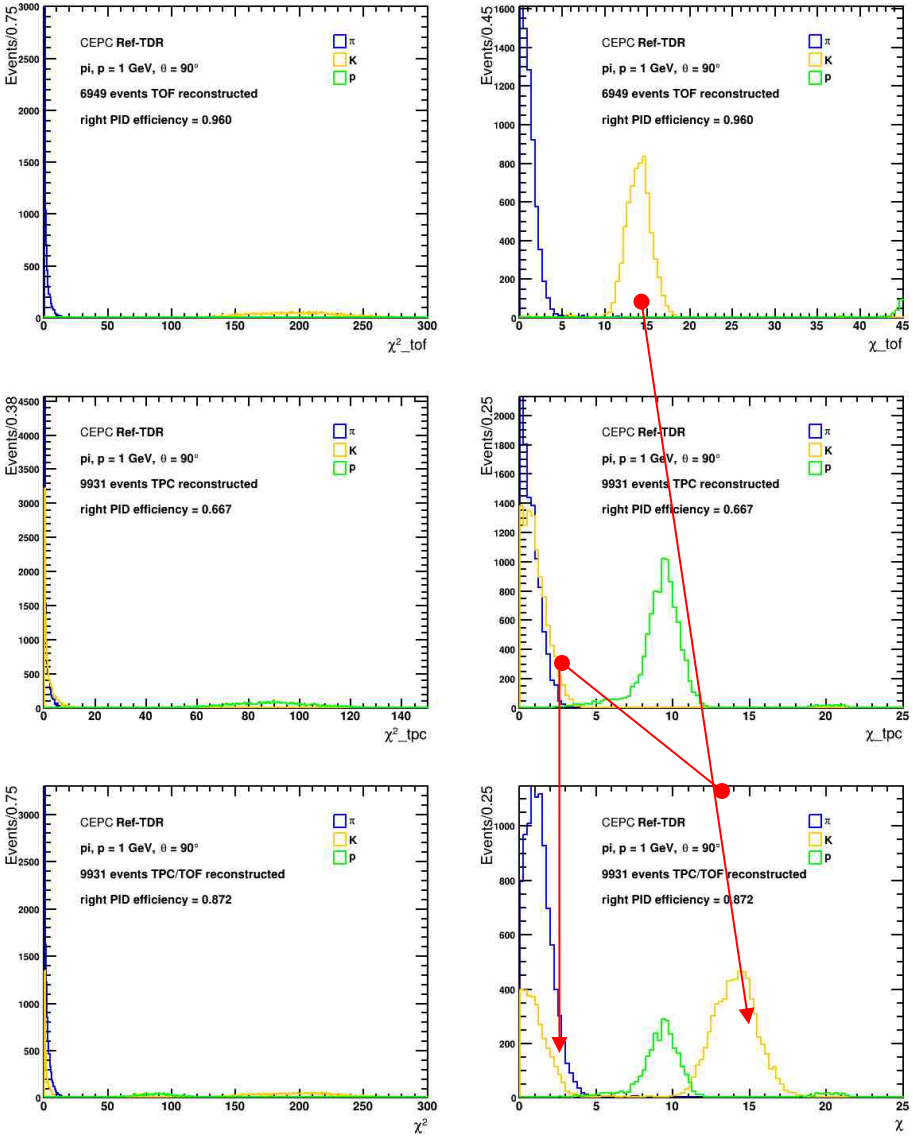
- TOF reconstructed only 56% (former 58%) of TPC + TOF reconstructed events
- Information loss in TOF caused lower $\chi^2(\pi)$

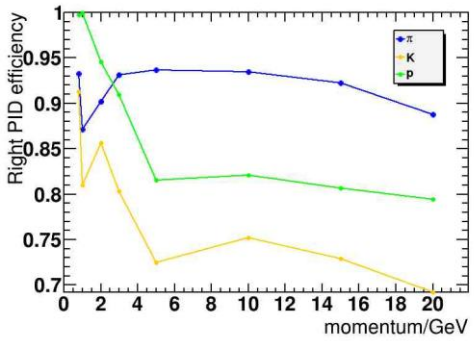


π eff falls rapidly around 1 GeV

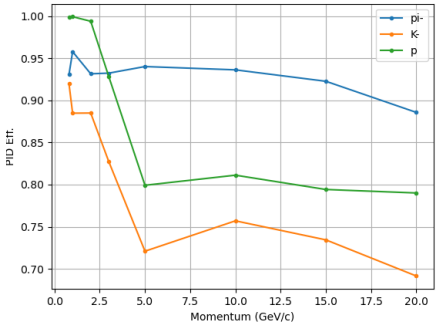


- TOF reconstructed only 69% (former 70%) of TPC + TOF reconstructed events
- Information loss in TOF caused lower $\chi^2(K)$

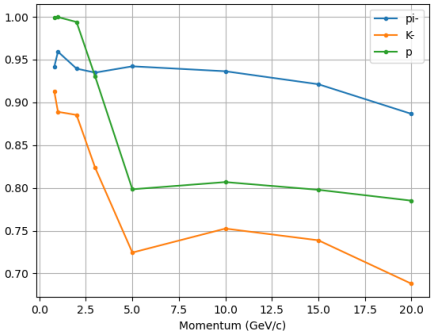




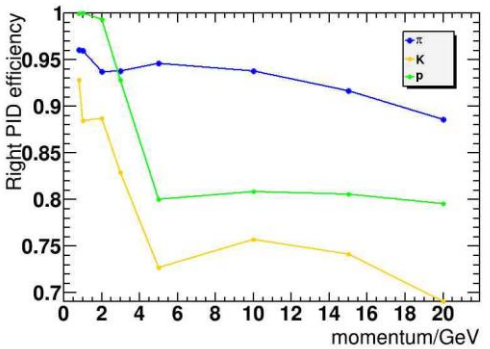
$\theta = 90°$



$\theta = 89°$



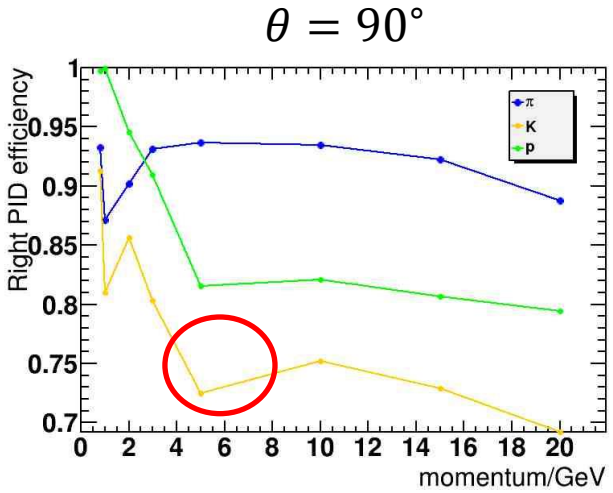
$\theta = 88°$



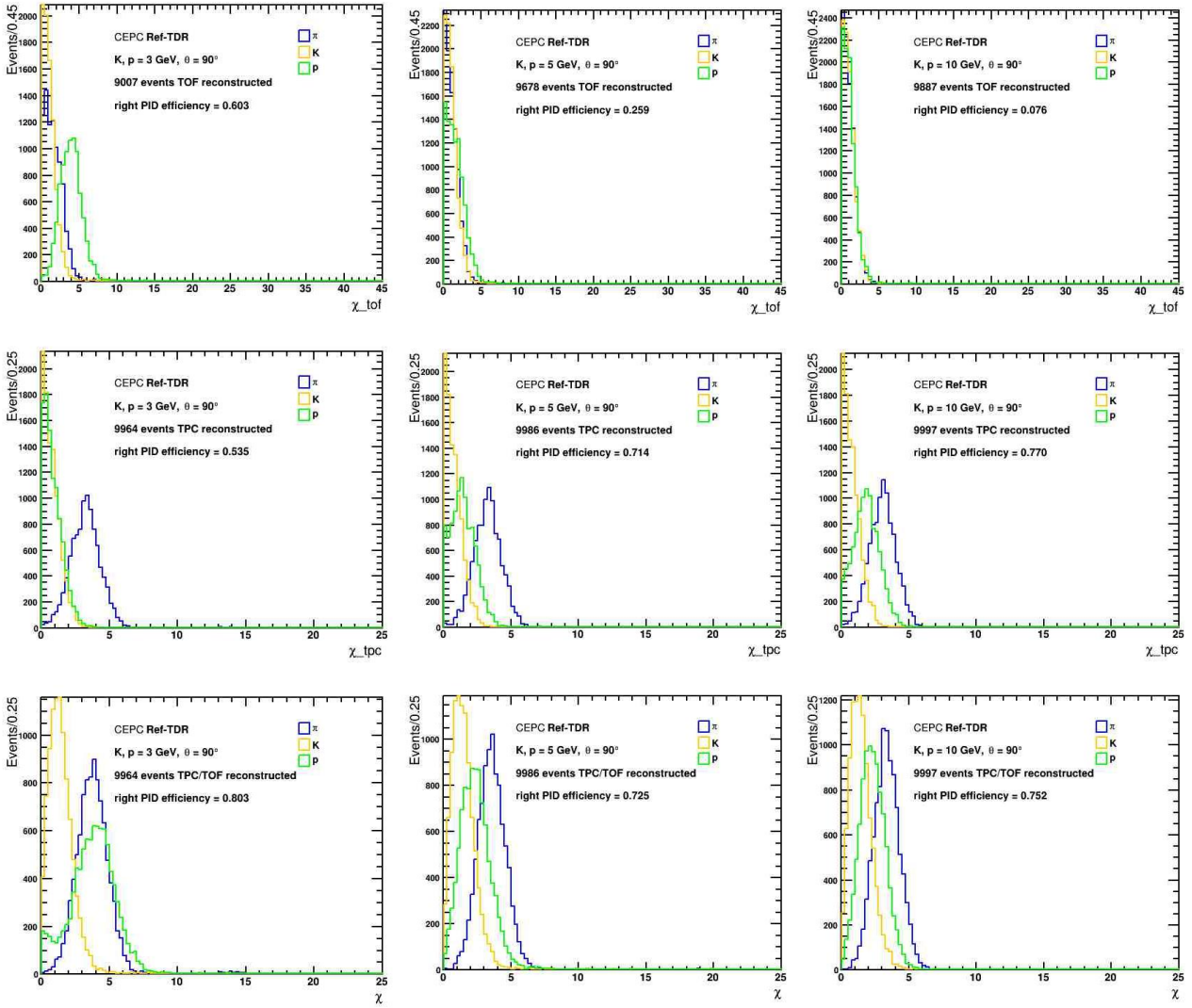
$\theta = 85°$

- At $\theta = 90°$: May hit TPC electrode plate, causing TOF information loss

K eff dip around 5 GeV

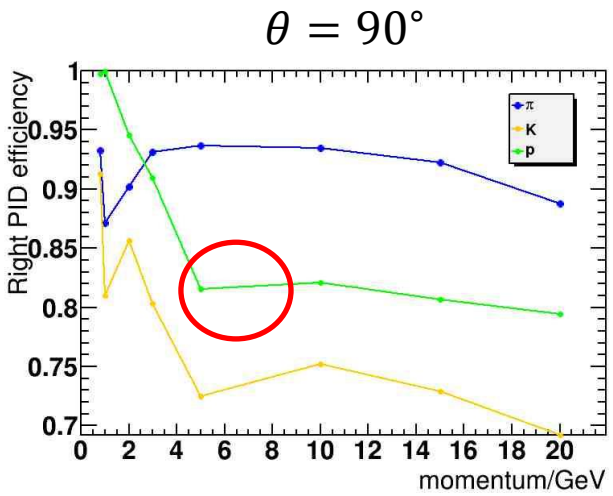


- Haven't understood yet

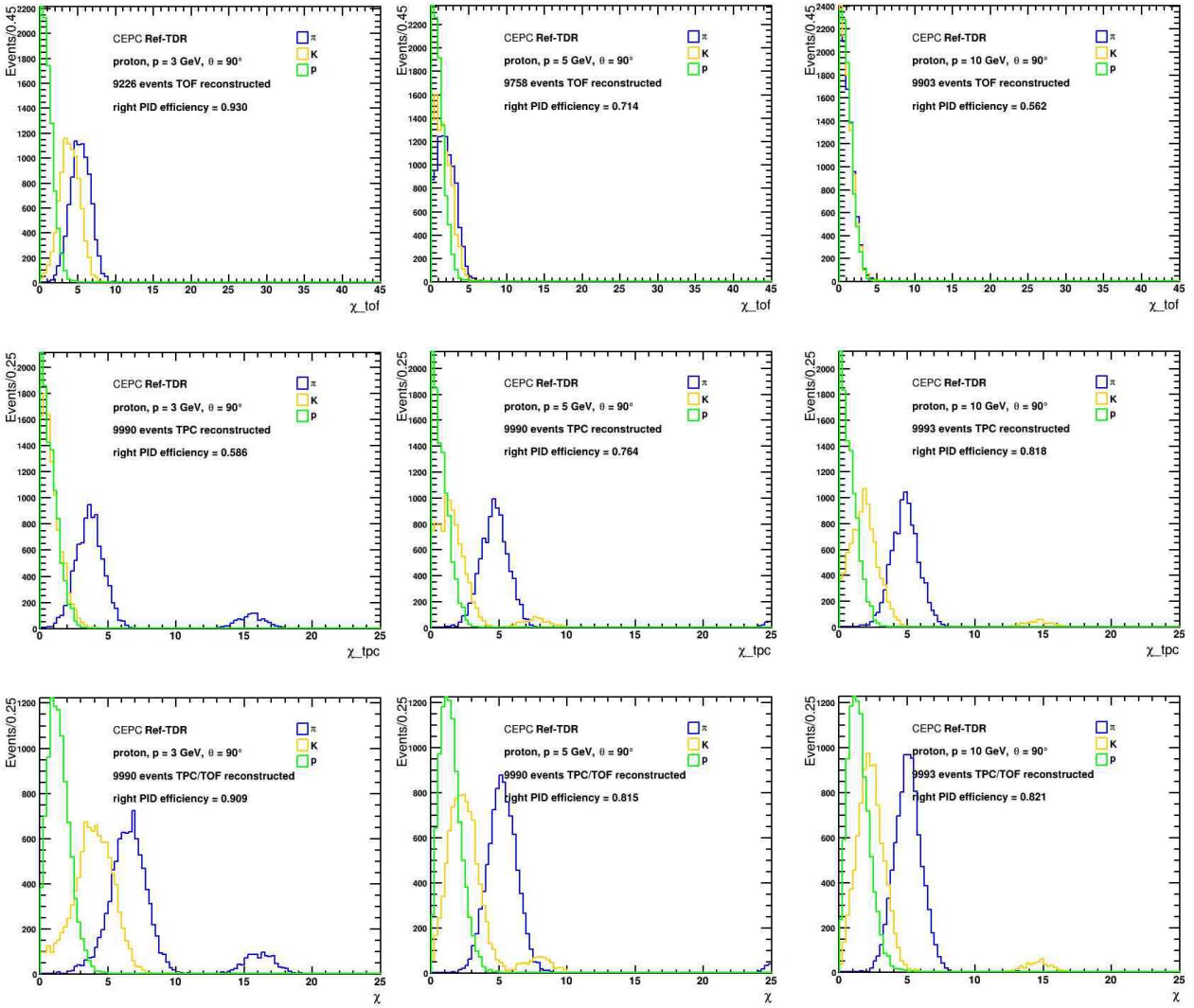


$p = 3$GeV $p = 5$GeV $p = 10$GeV

p eff dip around 5 GeV

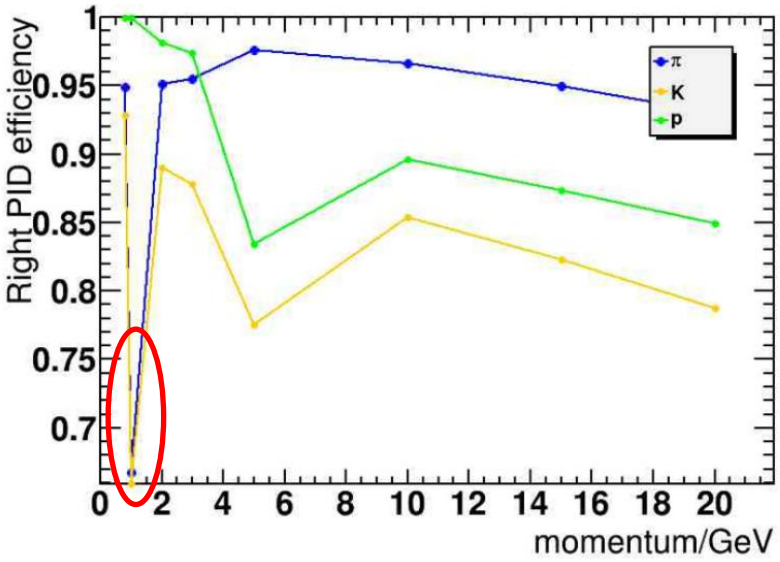


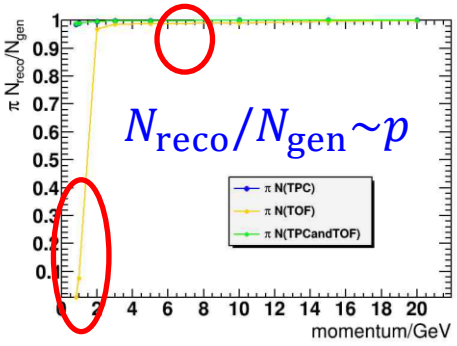
- Haven't understood yet



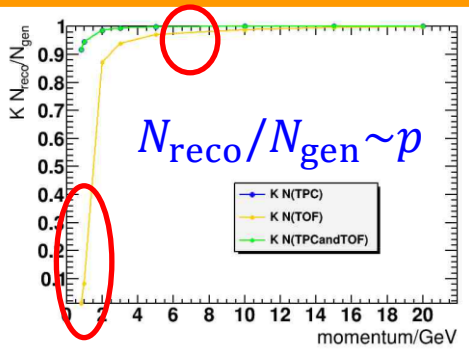
$p = 3$GeV $p = 5$GeV $p = 10$GeV

Abnormal effs at $\theta = 45°$

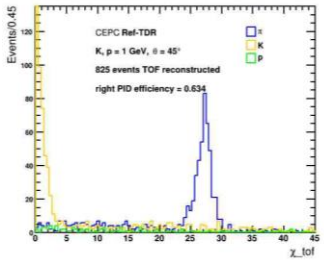


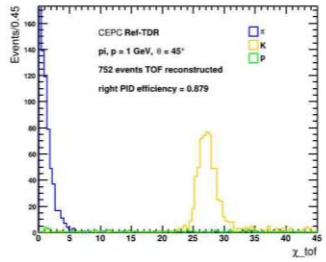


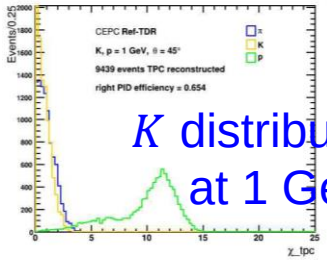
$N_{\mathrm{reco}}/N_{\mathrm{gen}} \sim p$



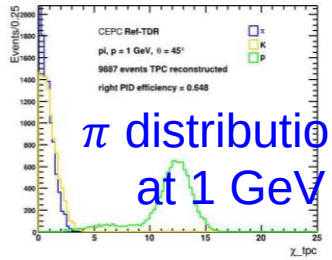
$N_{\mathrm{reco}}/N_{\mathrm{gen}} \sim p$



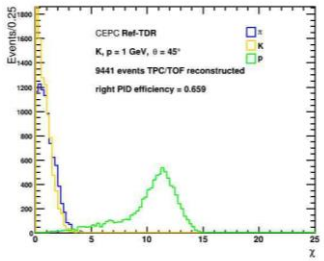


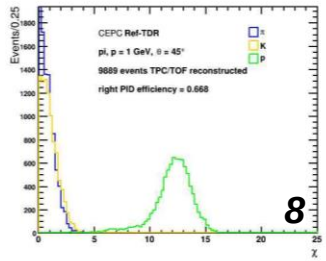


K distributions at 1 GeV



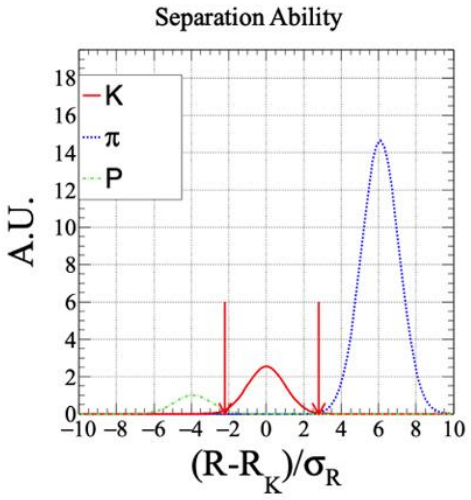
π distributions at 1 GeV

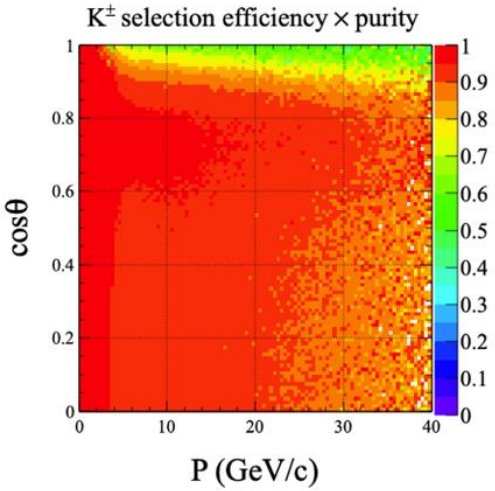




- Much lower π/K effs around 1 GeV
- Low TPC reconstructed Nevents of 0.8 GeV and 1 GeV disappear
- Dip in TOF reconstructed Nevents around 7 GeV disappear

Discussion of standards of efficiency



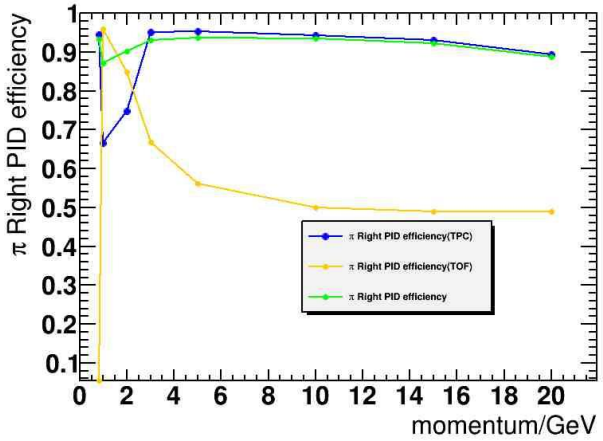


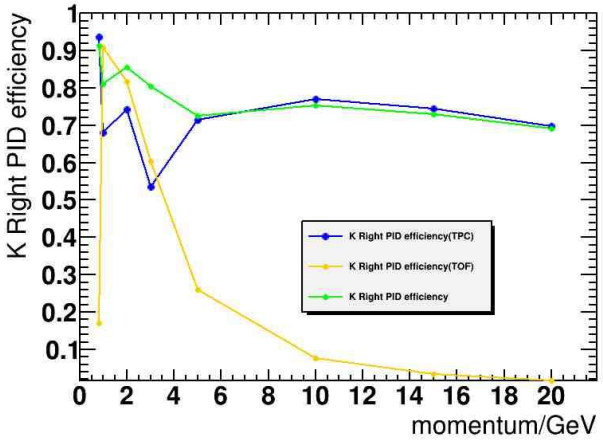
Reference
Cut based on maximizing efficiency * purity

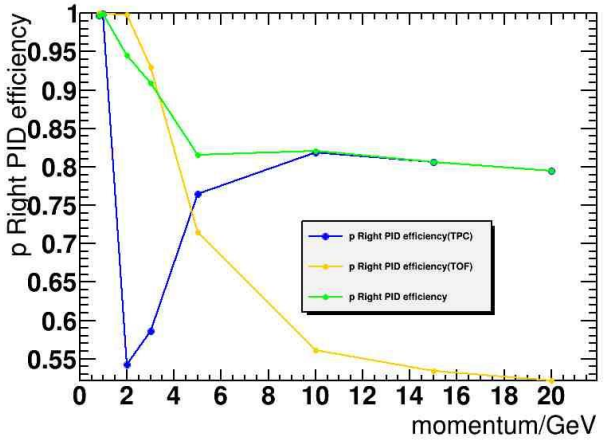
- Need physical process? Now events are only from particlegun
- Or such Z->jj process samples?
- Need cut optimization for each point? Now only choose the smallest χ^2 to identify the particle and we don't have the χ information

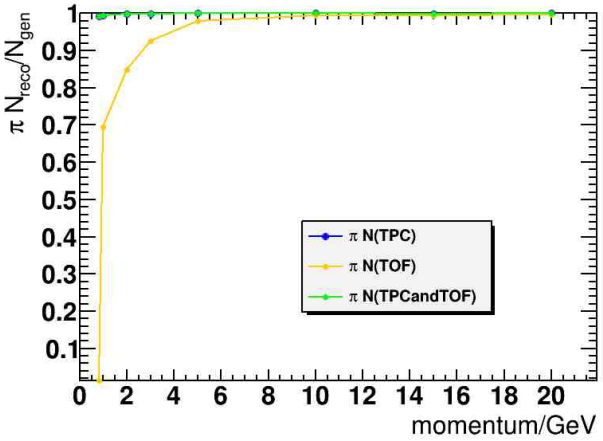
back up

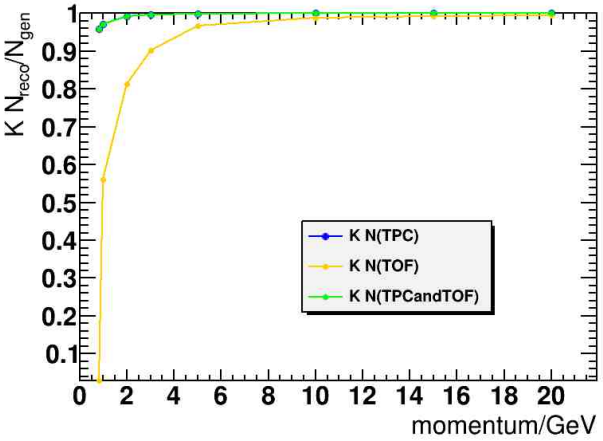
Distributions at 90 degree

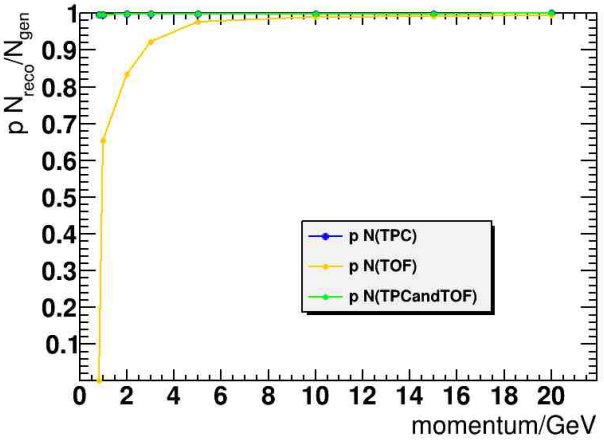




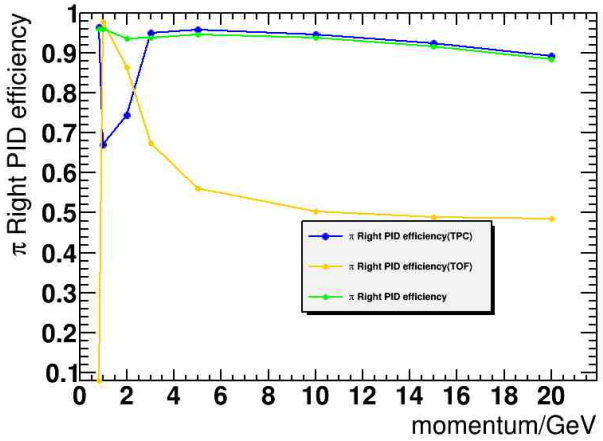


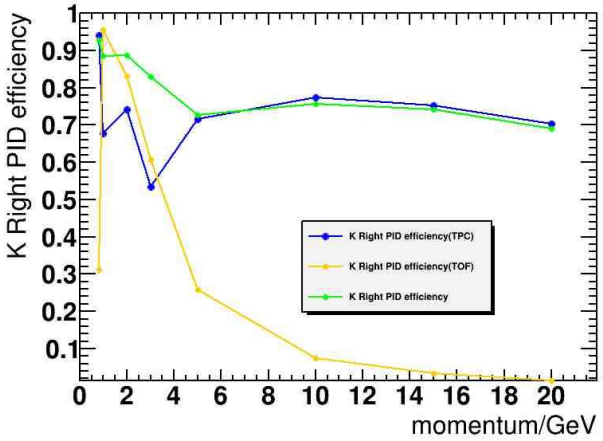


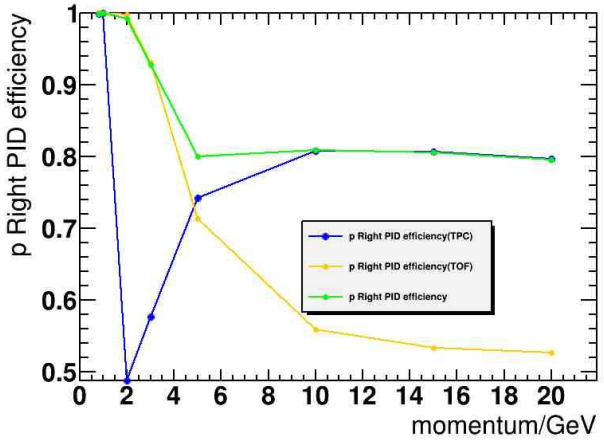


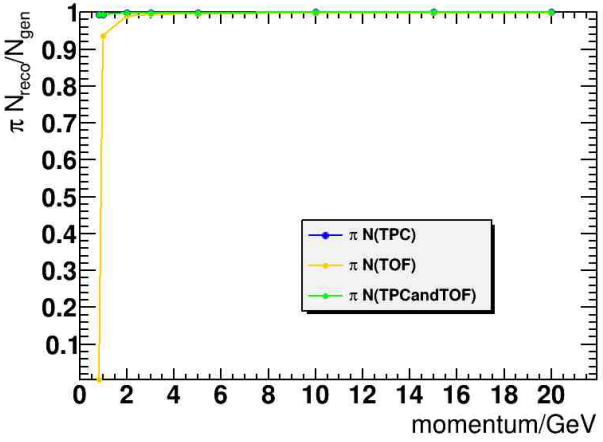


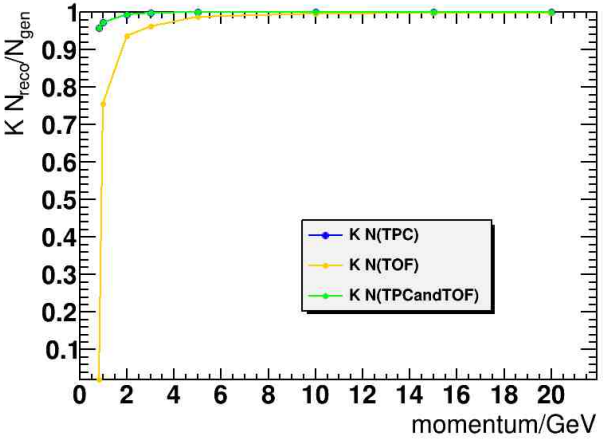
Distributions at 85 degree

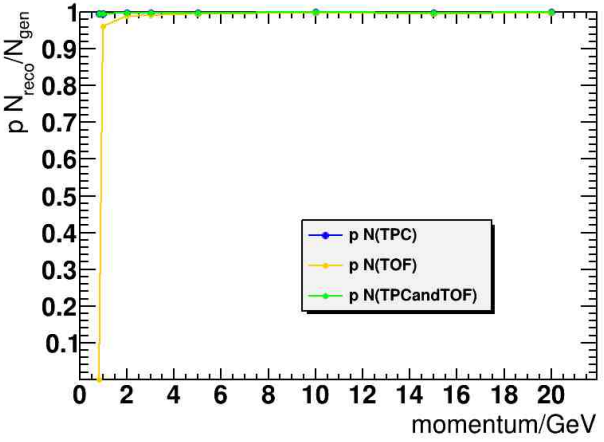




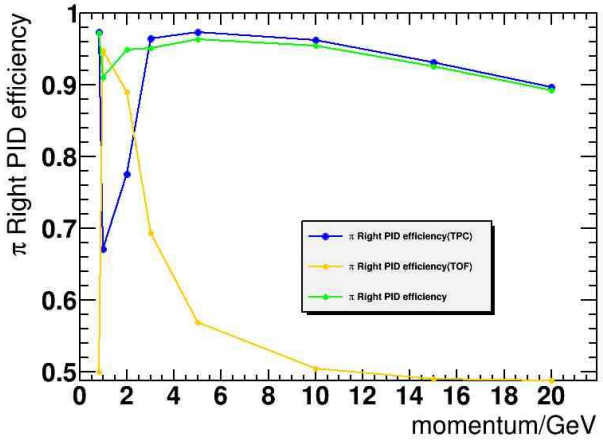


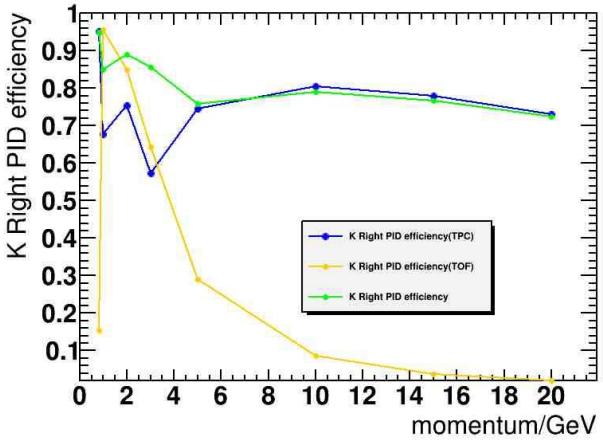


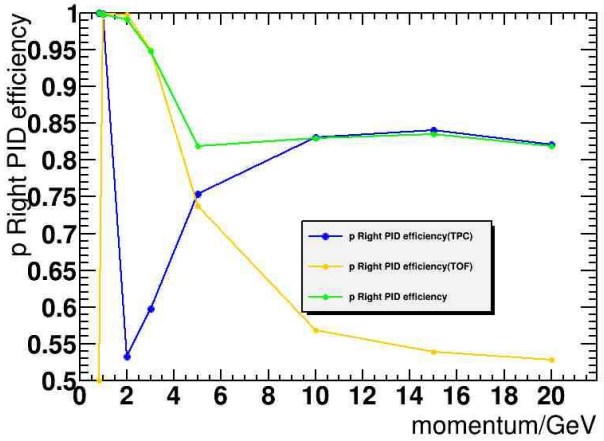


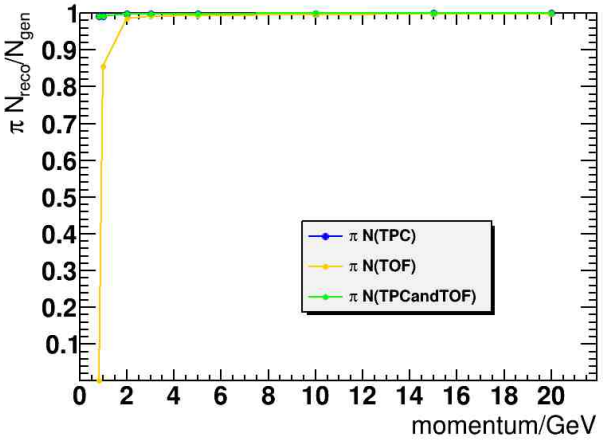


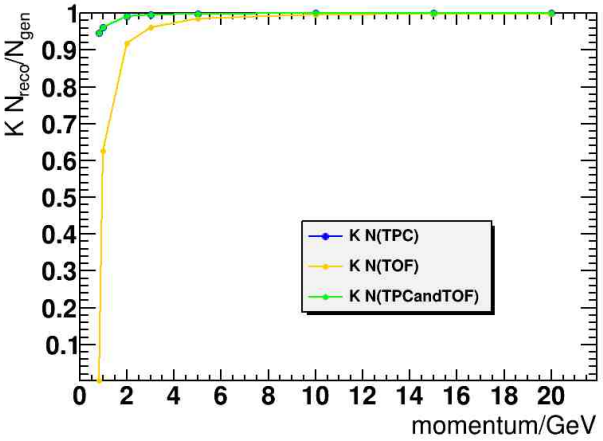
Distributions at 60 degree

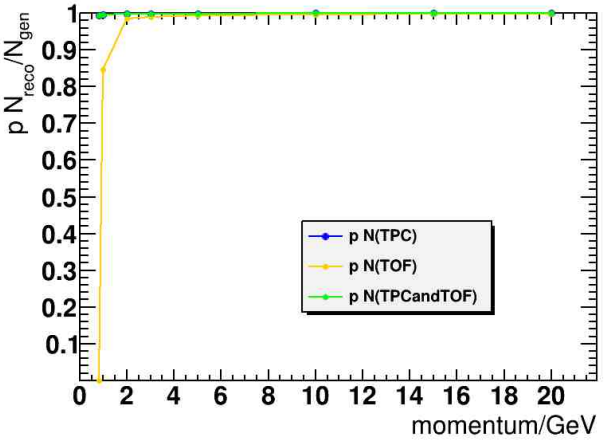












Distributions at 45 degree