PID Efficiency of $\pi^{\pm}$ for XYZ Data Samples

Jingyi Zhao, Ryan Mitchell, Xinchou Lou

2019/6/3

Charmonium Group Meeting

Abnormal reconstruction efficiency

- We simulated MC samples of $e^+e^- \rightarrow 2(\pi^+\pi^-)$ at XYZ energy points.

- Selection requirements:
  - $N^{track} >= 4$.
  - Good track: $|V_{xy}|<1cm$, $|V_z|<10cm$, $|cos\theta|<0.93$.
  - 4-C kinematic fit: $\chi^2<50$.
  - All possible combinations are saved.

- In addition to those selection criteria, if we use PID selection requirements:

$$Prob_\pi > Prob_K$$

(based on dE/dx+TOF), the reconstruction

efficiency would be abnormal.

**Efficiencies are obtained by analyzing PHSP signal MC**



2
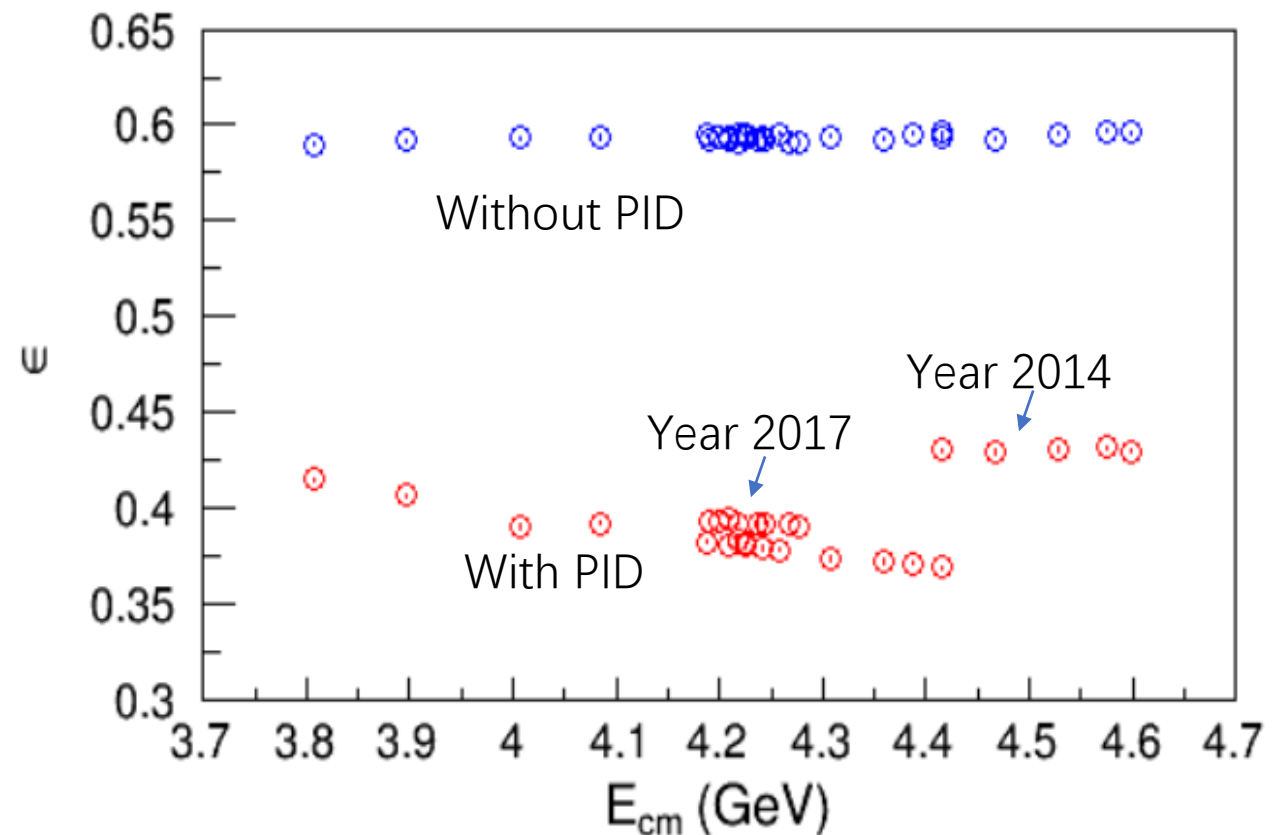
Control sample selection

- To understand this problem, we studied the PID efficiency.
- I selected a control sample using the following requirements:
  - $N^{track} >= 4$
  - Track: $|V_{xy}| < 1cm$, $|V_z| < 10cm$, $|\cos\theta| < 0.93$, $E_{EMC}/p < 0.7$
  - 4-C kinematic fit: $\chi^2 < 50$
  - $M_{\pi+\pi-}$ not in J/ψ signal region.
  - $\cos\theta_{\pi+\pi-} < 0.98$
  - PID: $Prob_\pi > Prob_K$ (based on dE/dx+TOF) for 3 tracks, the 4th track is taken as control sample.
- PID efficiency is calculated using:
  - $\varepsilon = N^{PID}/N^{noPID}$
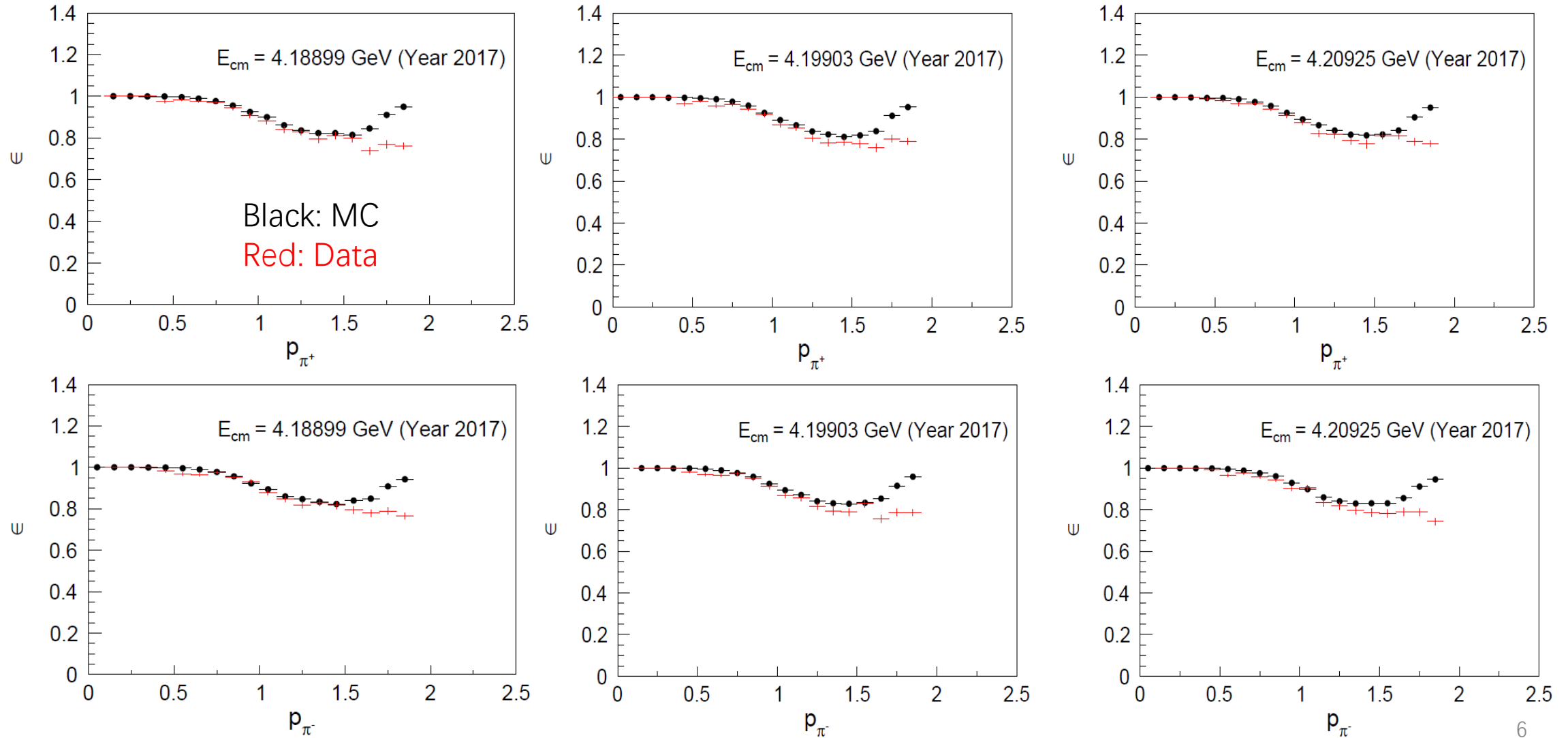
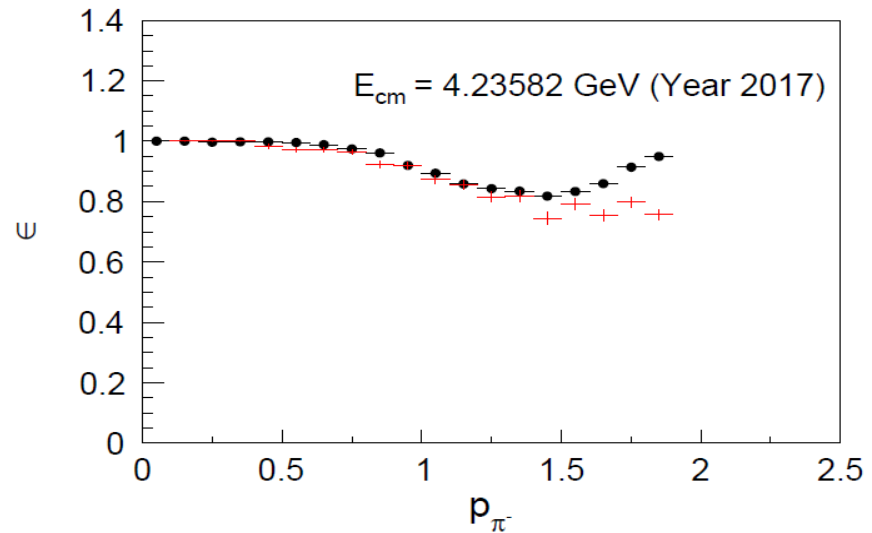Number of events with/without PID requirement for the 4th track.

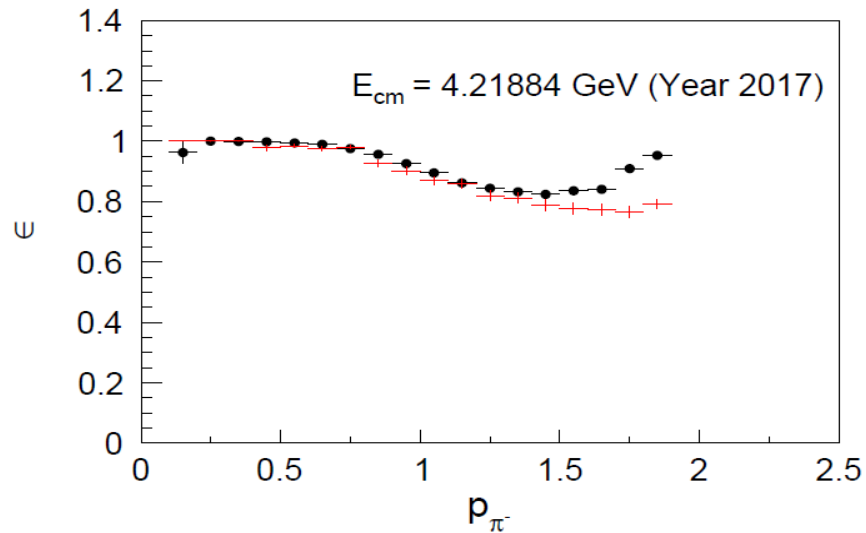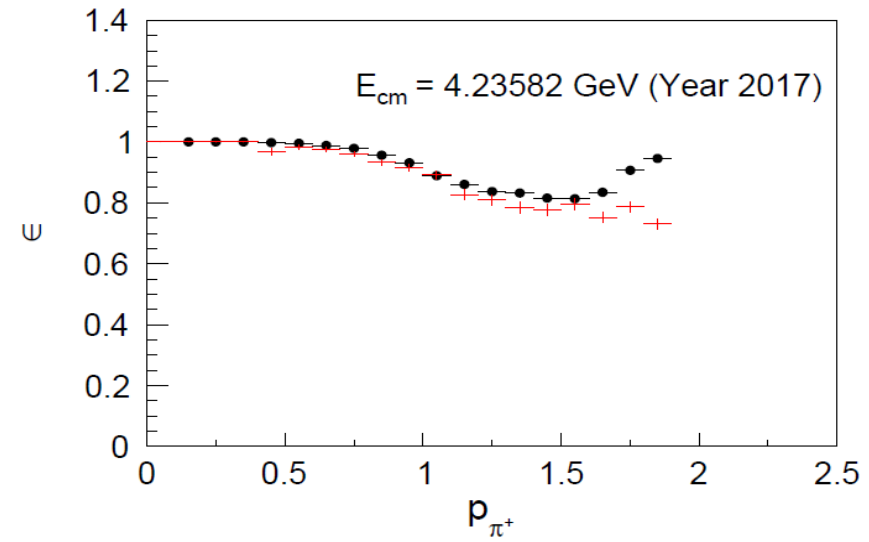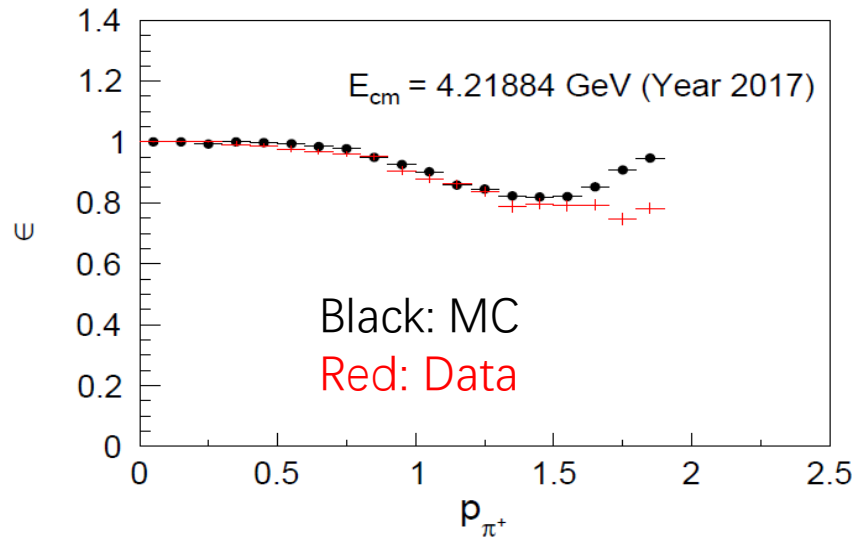# PID Efficiency (dE/dx & TOF) – Year 2009 & Year 2013
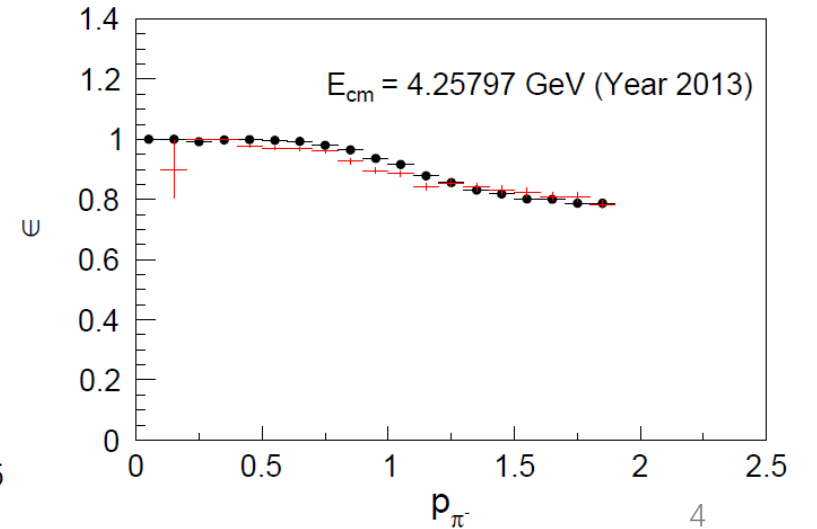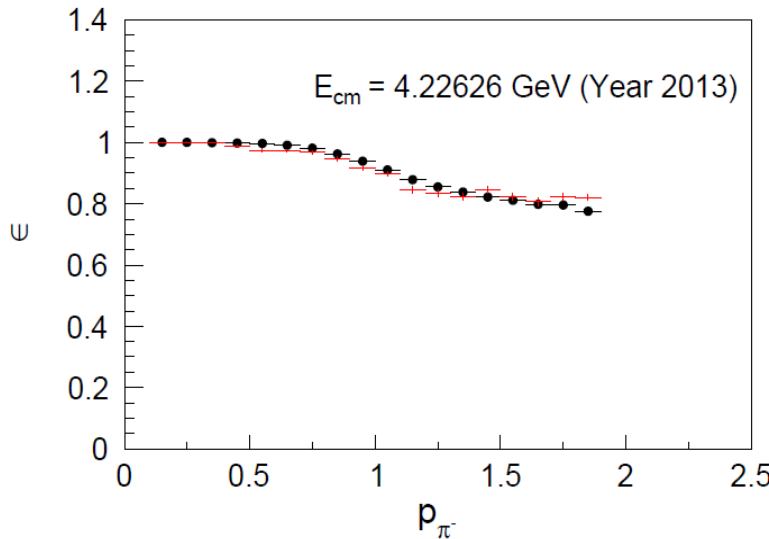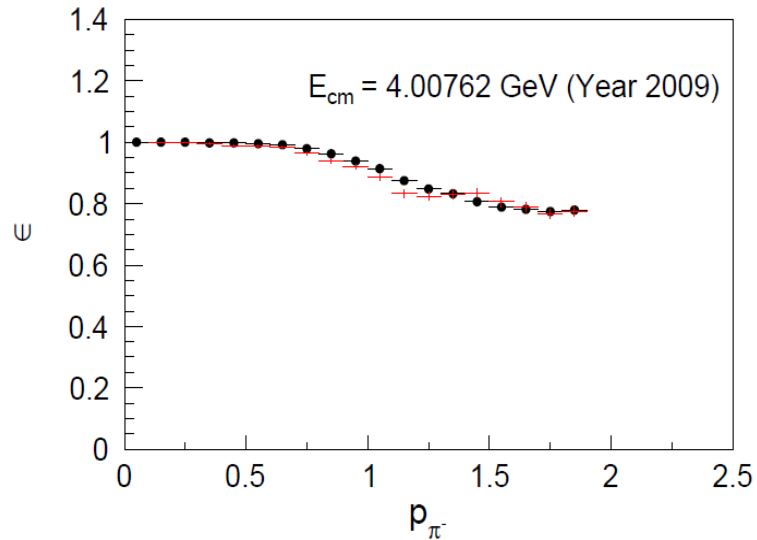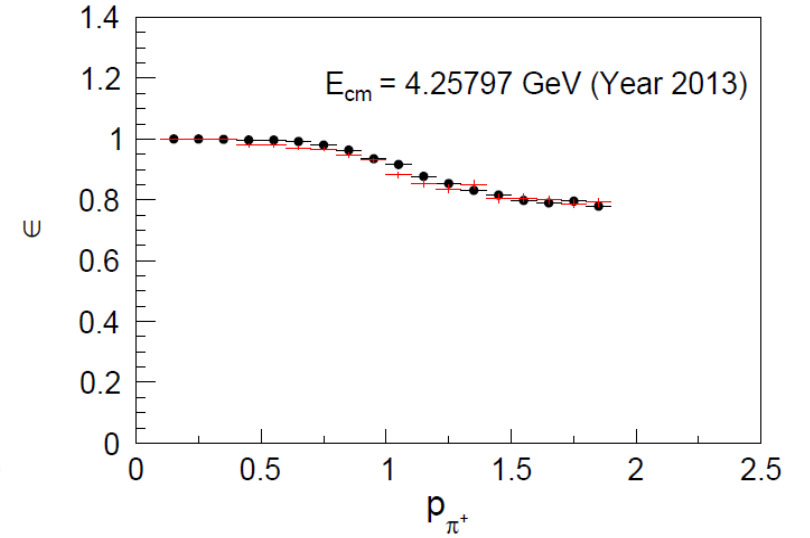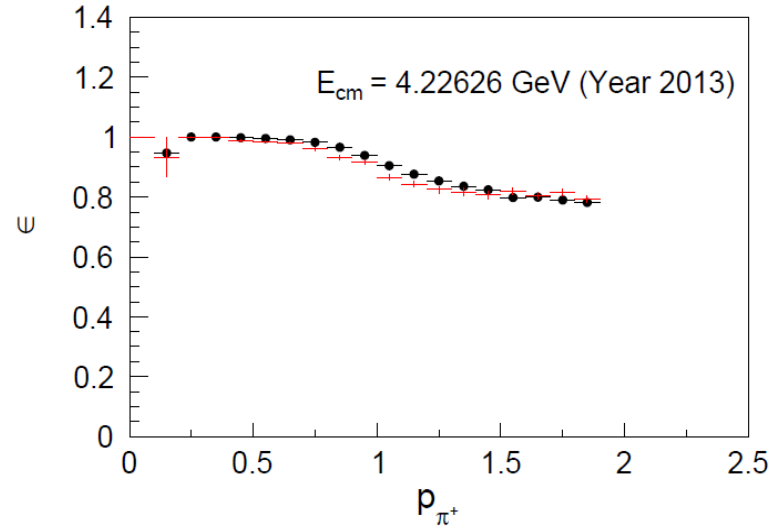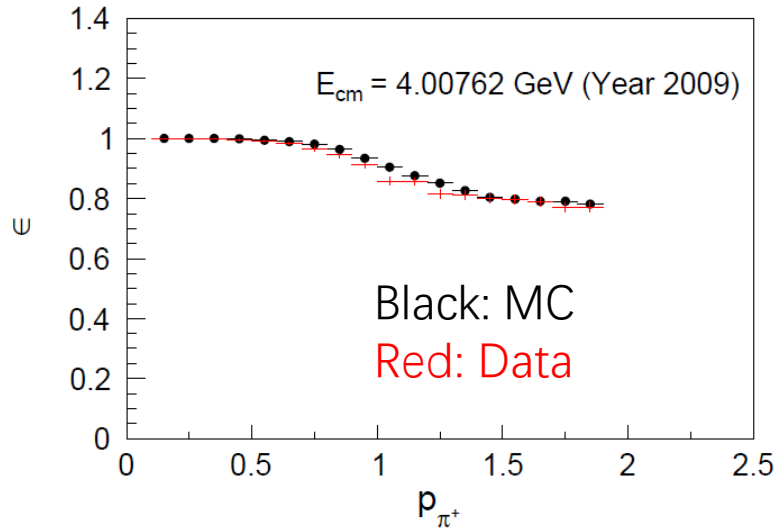
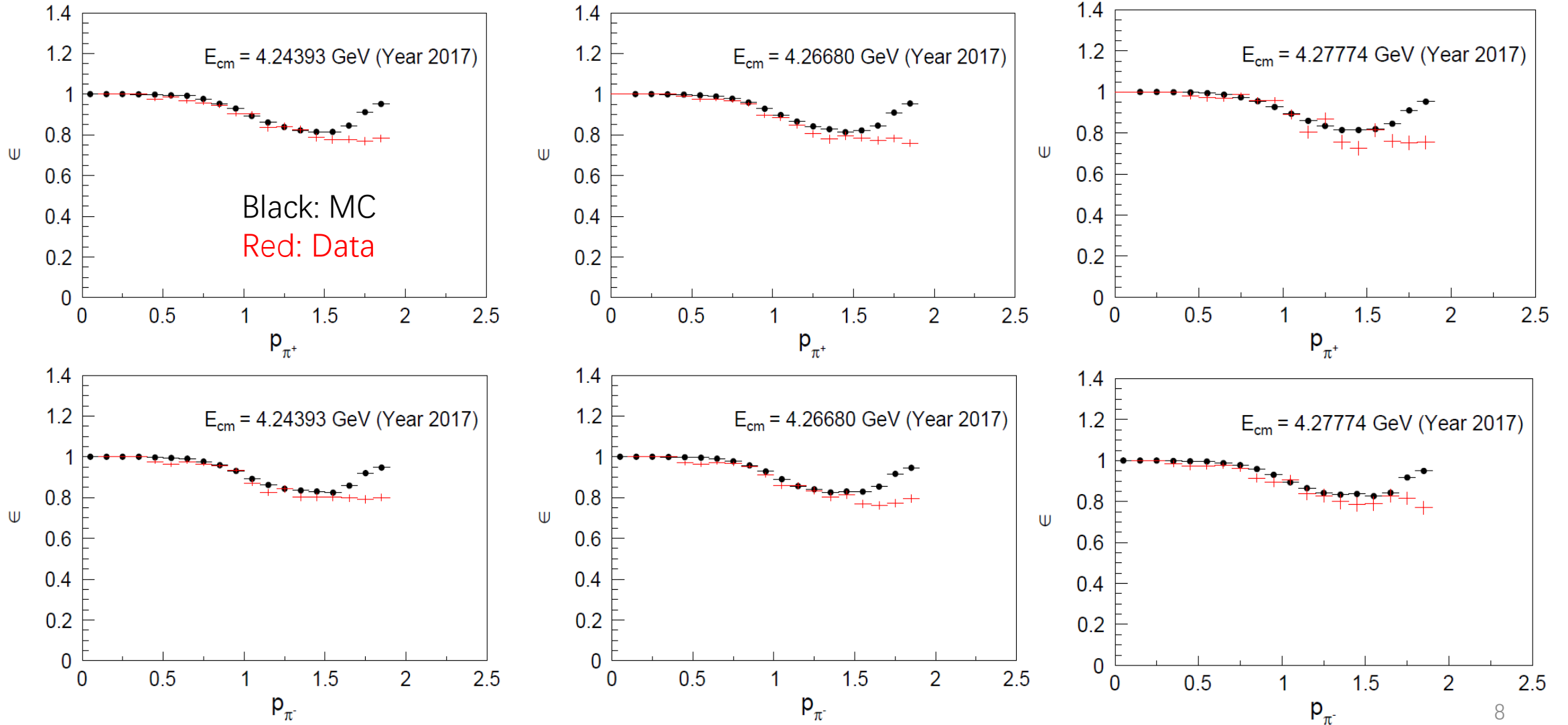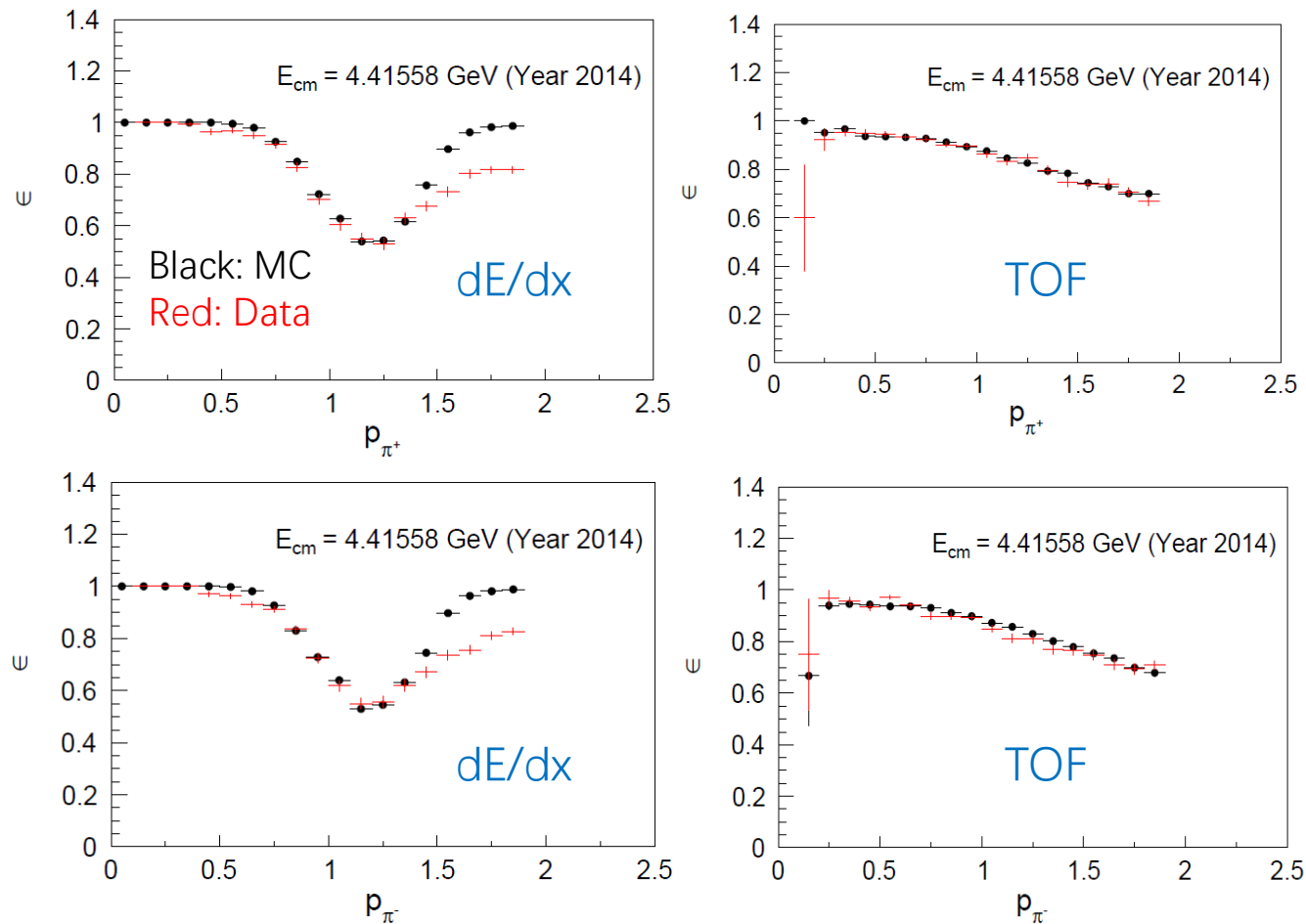# PID Efficiency (dE/dx & TOF) – Year 2014
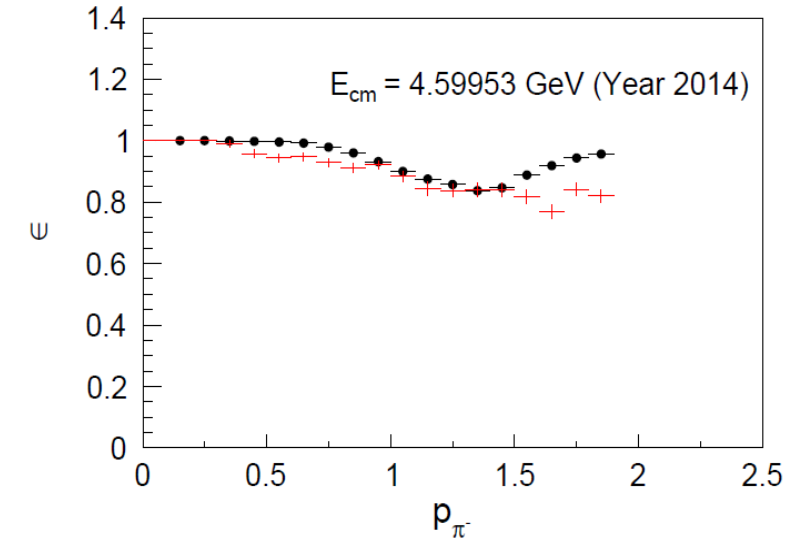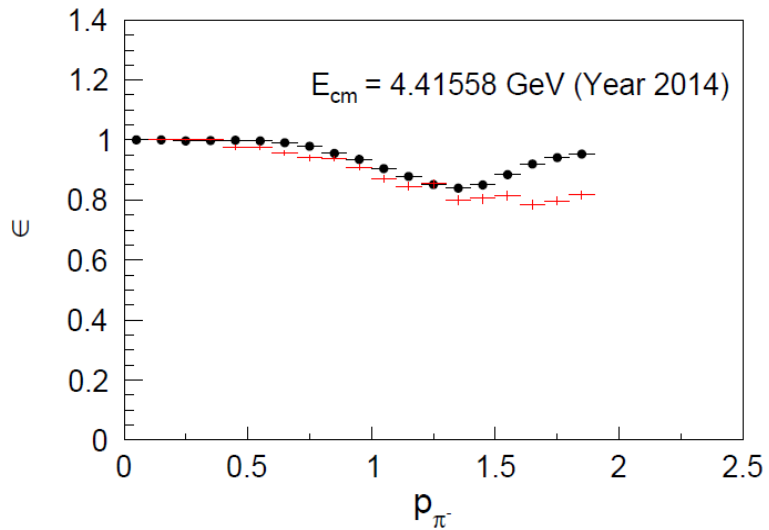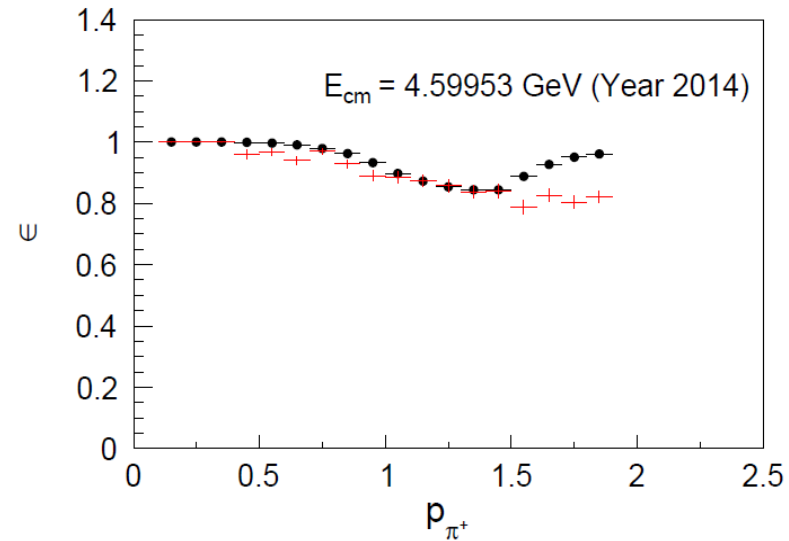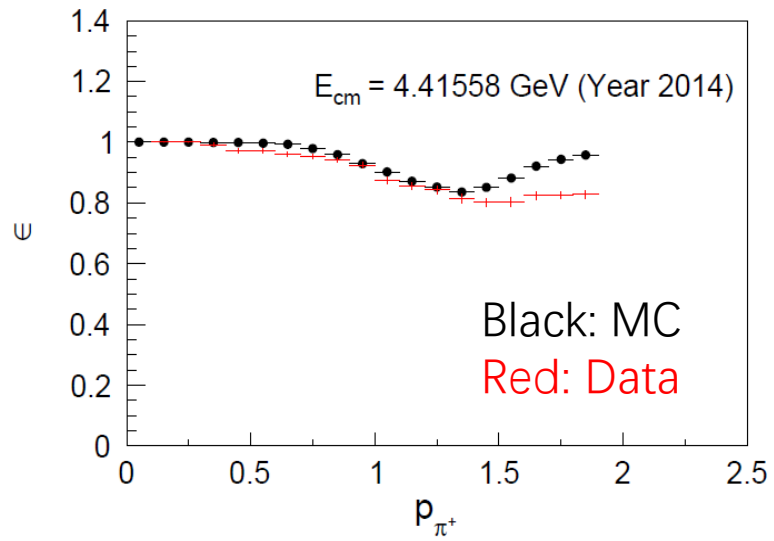
PID Efficiency (dE/dx & TOF) –Year 2017

PID Efficiency (dE/dx & TOF) –Year 2017

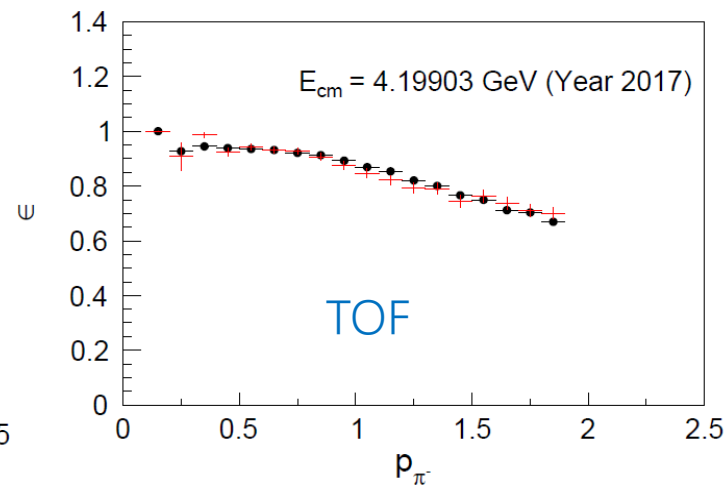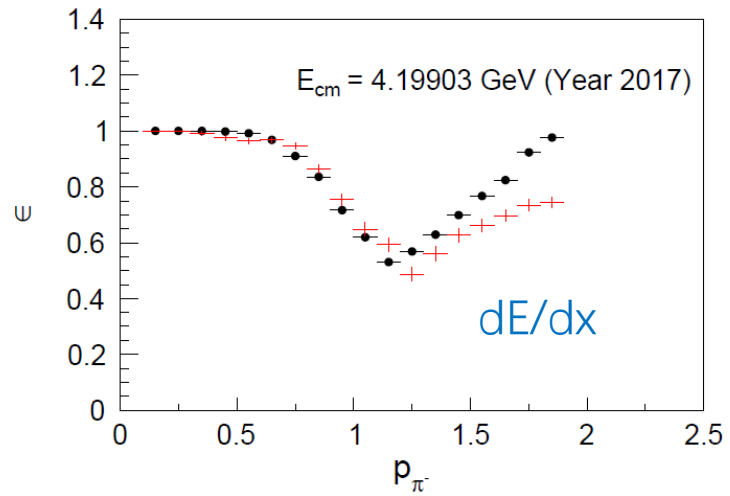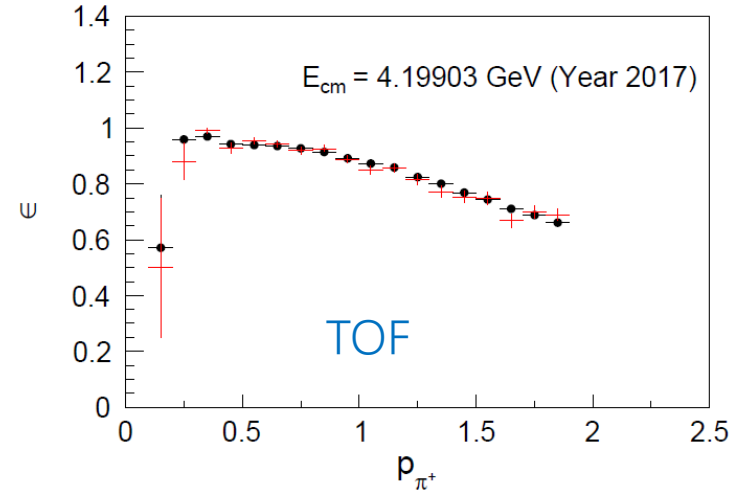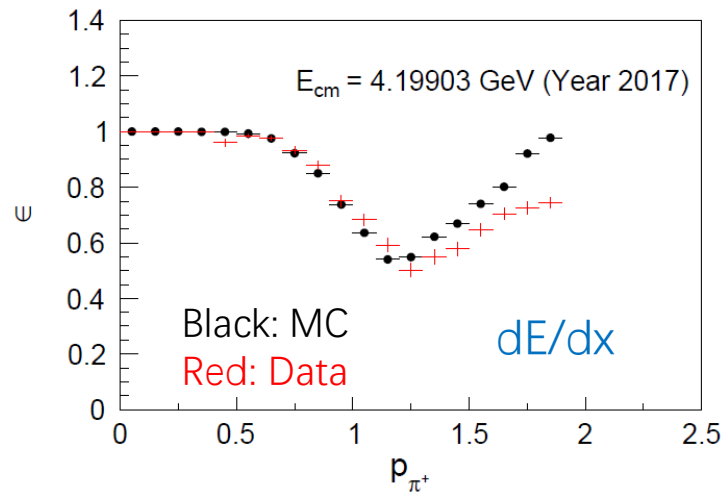# PID Efficiency (dE/dx & TOF) –Year 2017

PID system

- PID is based on dE/dx and TOF. To understand which system caused this problem, I checked the PID efficiency (Year 2014 and Year 2017) based on dE/dx and TOF, separately.

PID system

Summary

- Particle identification efficiency of charged pions for XYZ data samples have been checked.

- The consistency between data and MC samples for Year 2009 and Year 2013 are good.

- But an obvious difference between data and MC sample is observed for Year 2014 and Year 2017.

- We checked PID efficiency based on dE/dx and TOF, separately. We found the discrepancy between data and MC is due to dE/dx.

- People working on related channels should be careful.

Thank you!