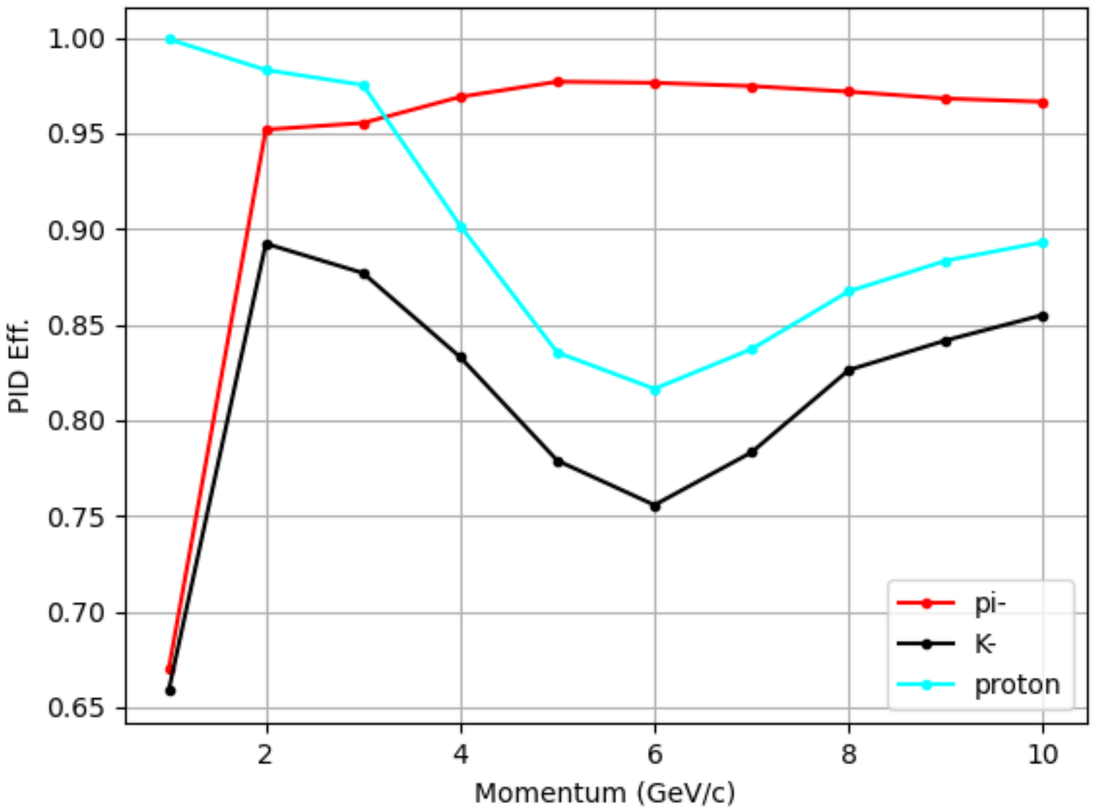
PID performance

X.Ma, H.Zhu, **C.Zhang** / 01Nov2024

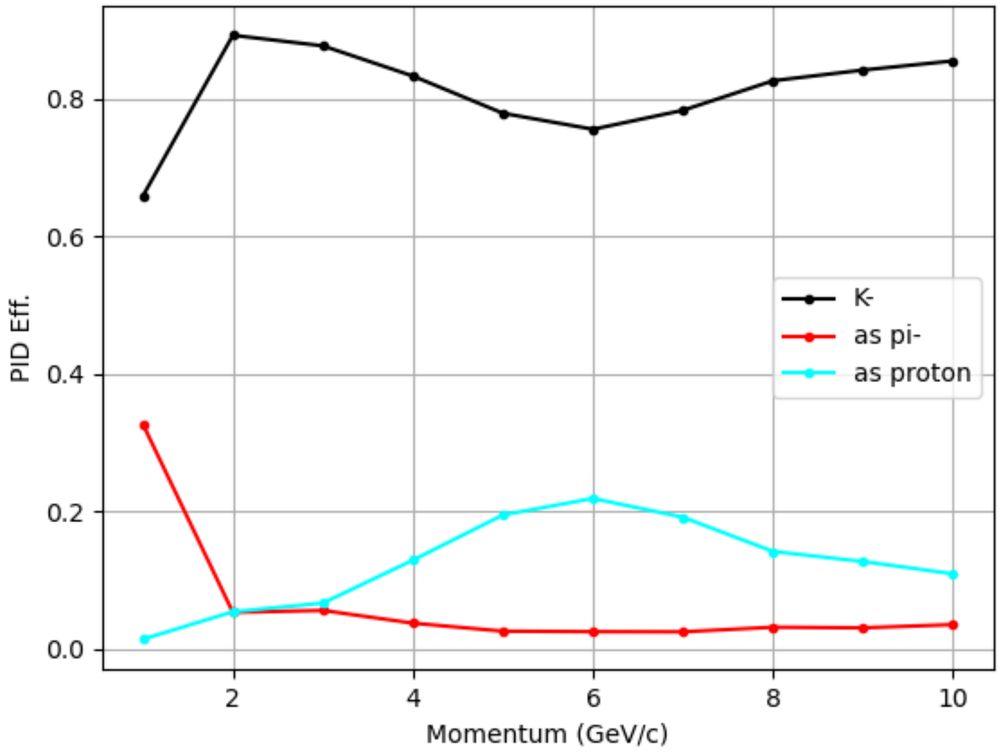
PID Eff @ $\theta = 45°$

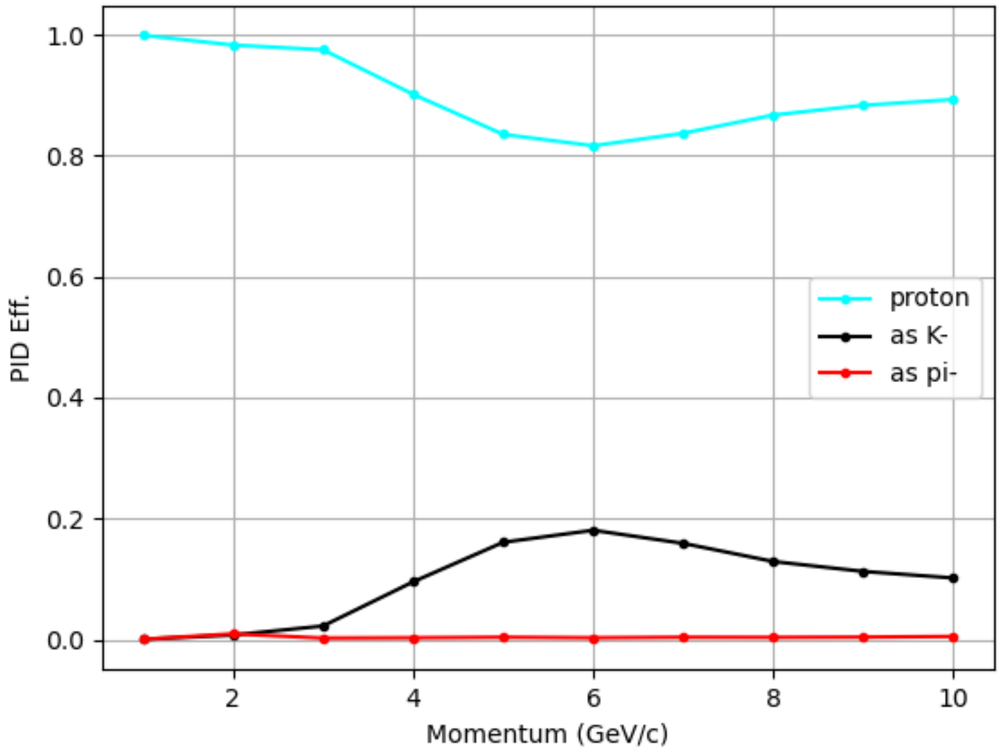


- Kaon efficiency loss around 1 GeV has been explained
  - Kaon/pion confusion
  - In principle, ToF should be able to separate them, but ToF efficiency is low around 1 GeV
- Today we focus on the drop at 6 GeV
  - Kaon/proton confusion

PID Eff @ $\theta = 45^\circ$

- Kaon/proton confusion @ 6 GeV
- Kaon/Pion confusion @ 1 GeV





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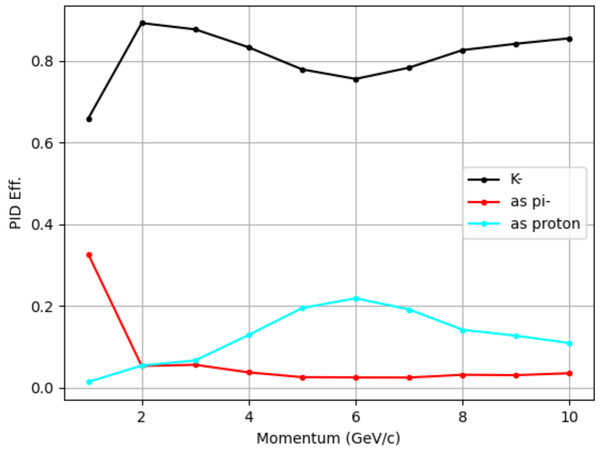
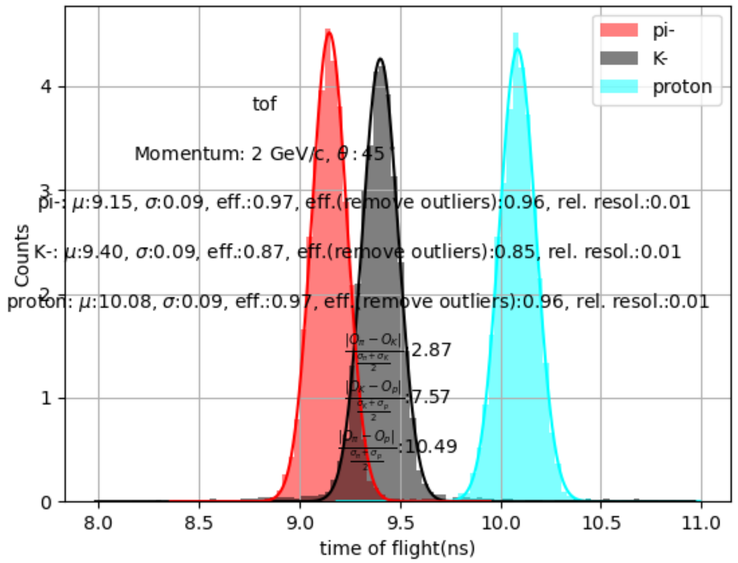
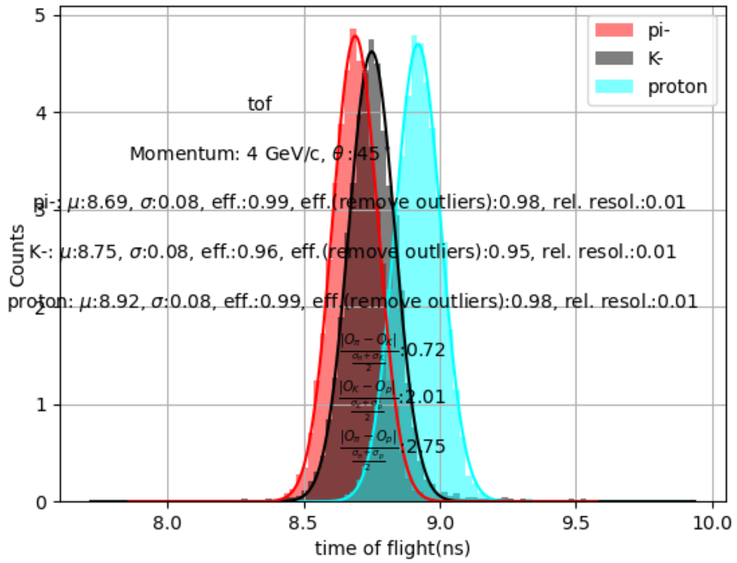
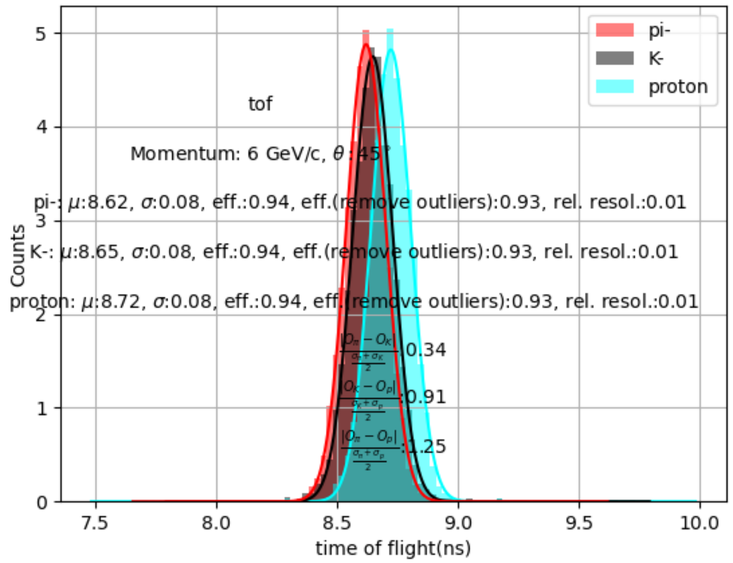


- 2-4-6 GeV, Kaon proton confusion increase from ToF
- **K/proton separation power, 7.6-2.0-0.9**







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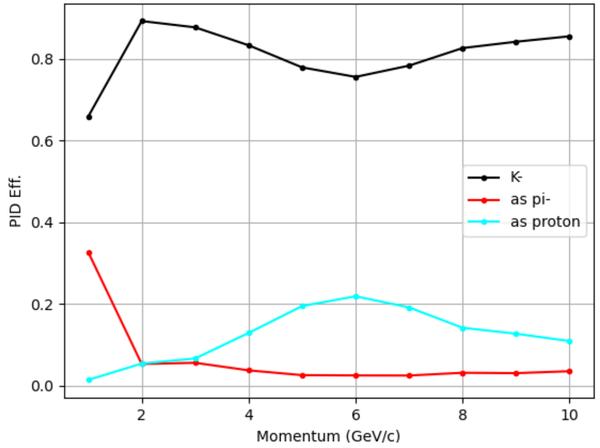
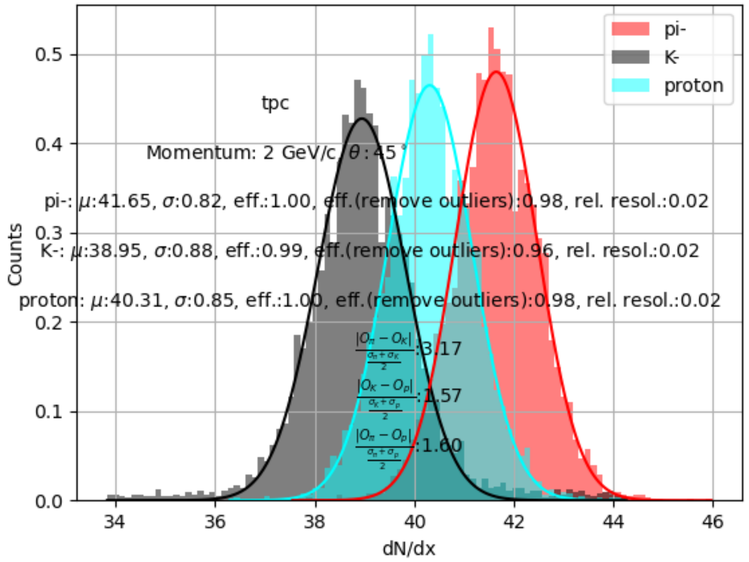
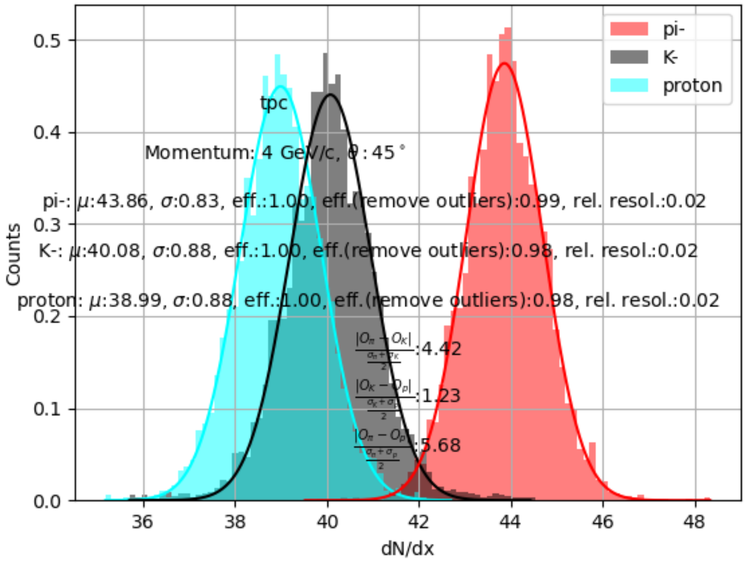
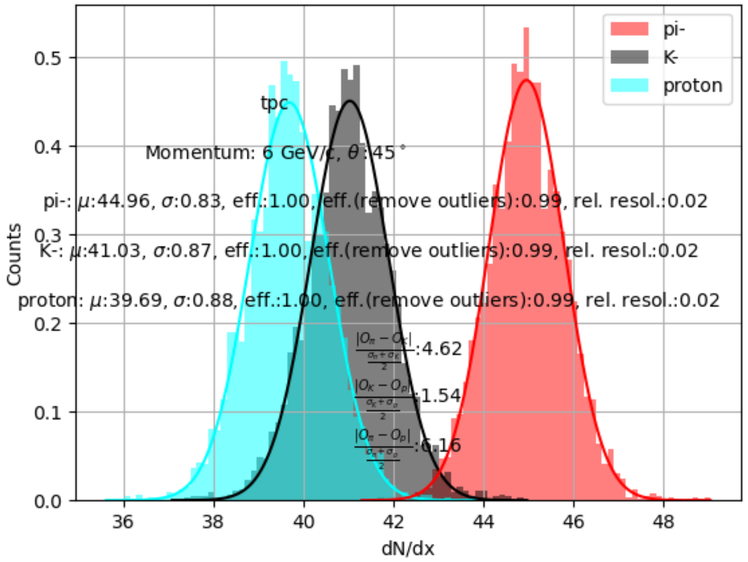


- 2-4-6 GeV, Stable kaon proton confusion from TPC
- **K/proton separation power, 1.6-1.2-1.5**







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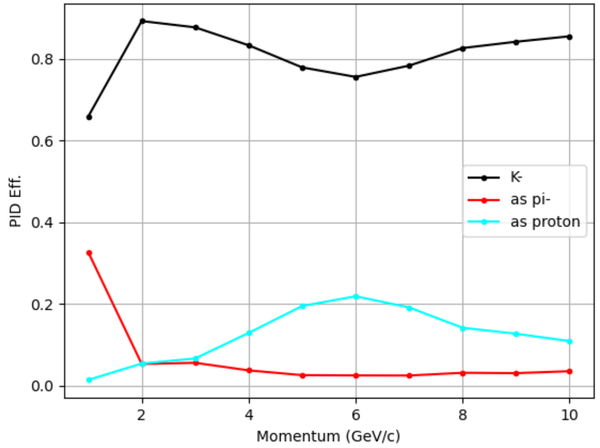
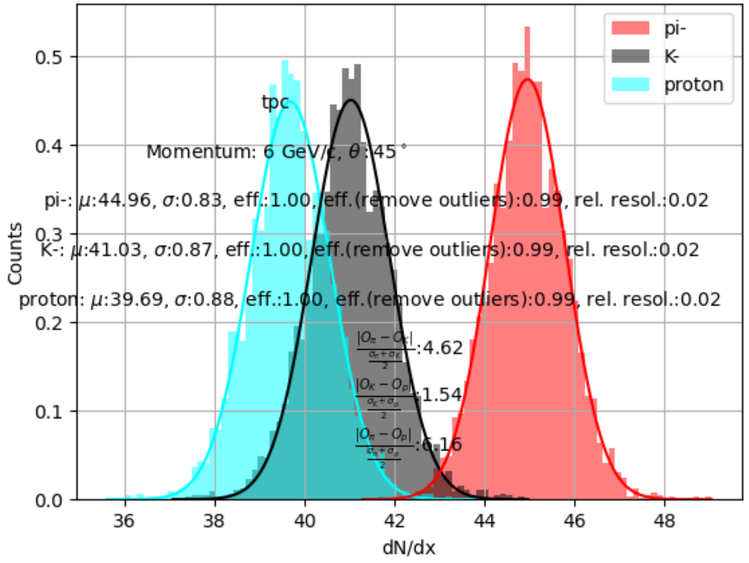
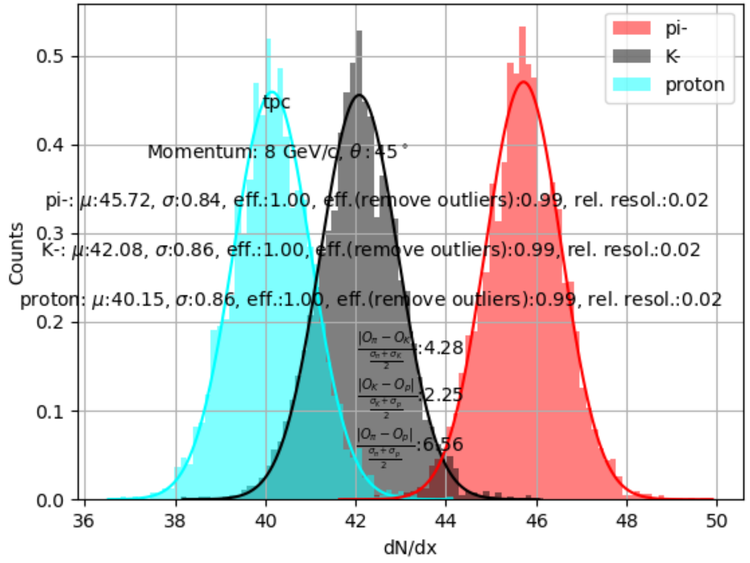
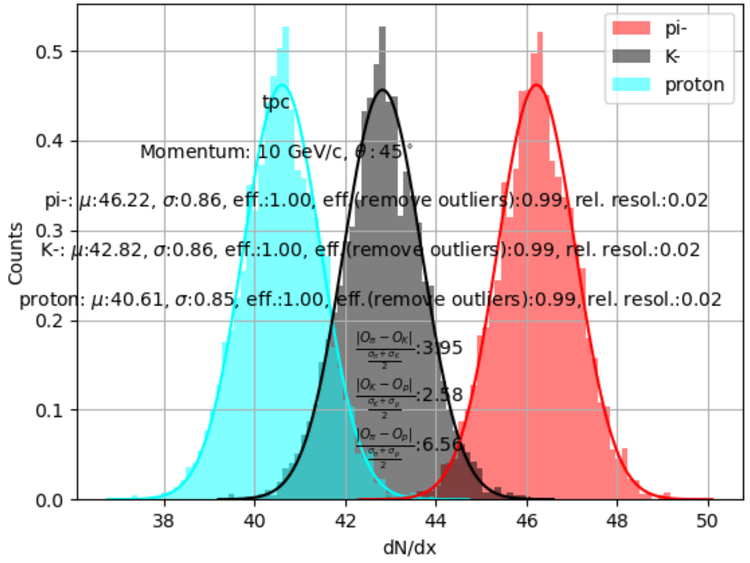


- 6-8-10 GeV, kaon proton confusion decrease from TPC
- **K/proton separation power, 1.5-2.3-2.6**







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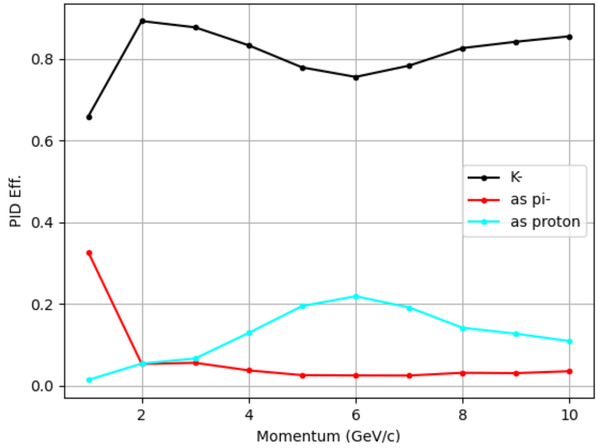
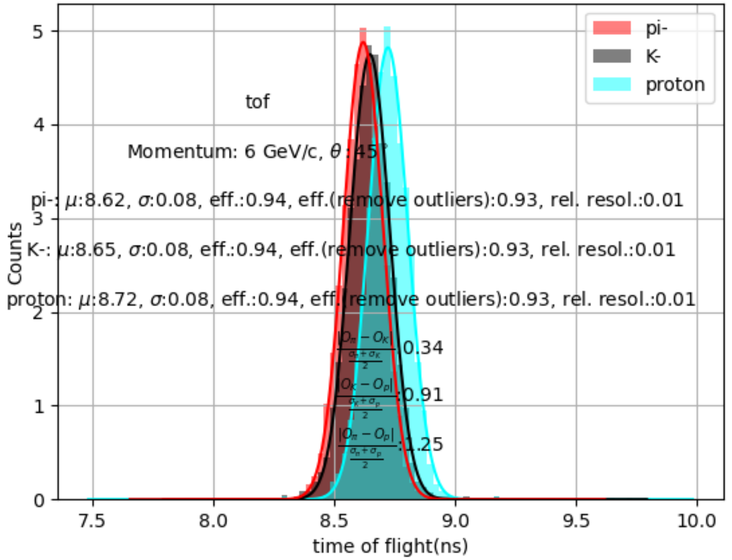
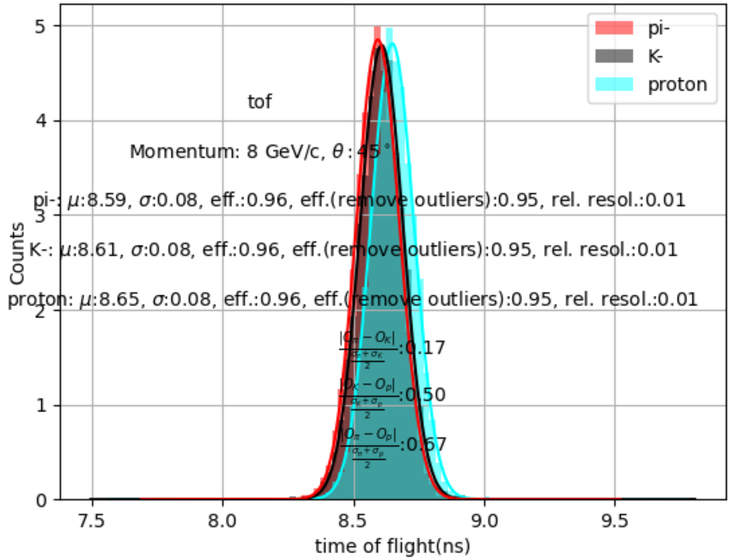
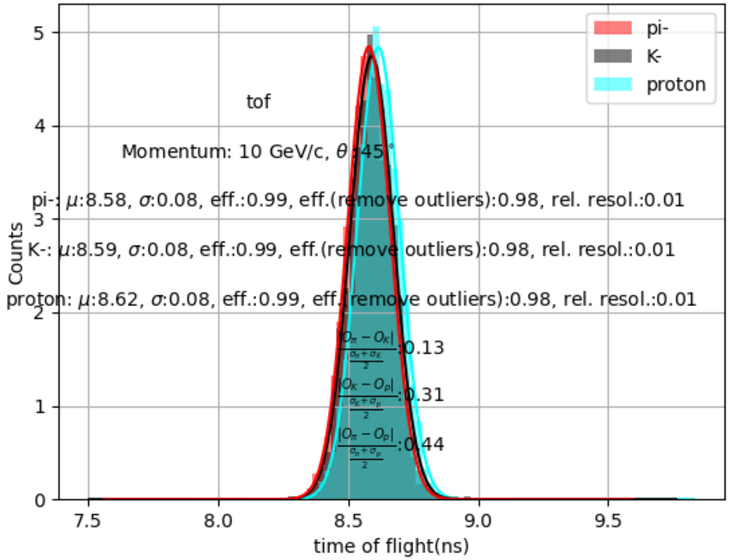


- 6-8-10 GeV, kaon proton confusion decrease from TOF
- **K/proton separation power, 0.9-0.5-0.3**







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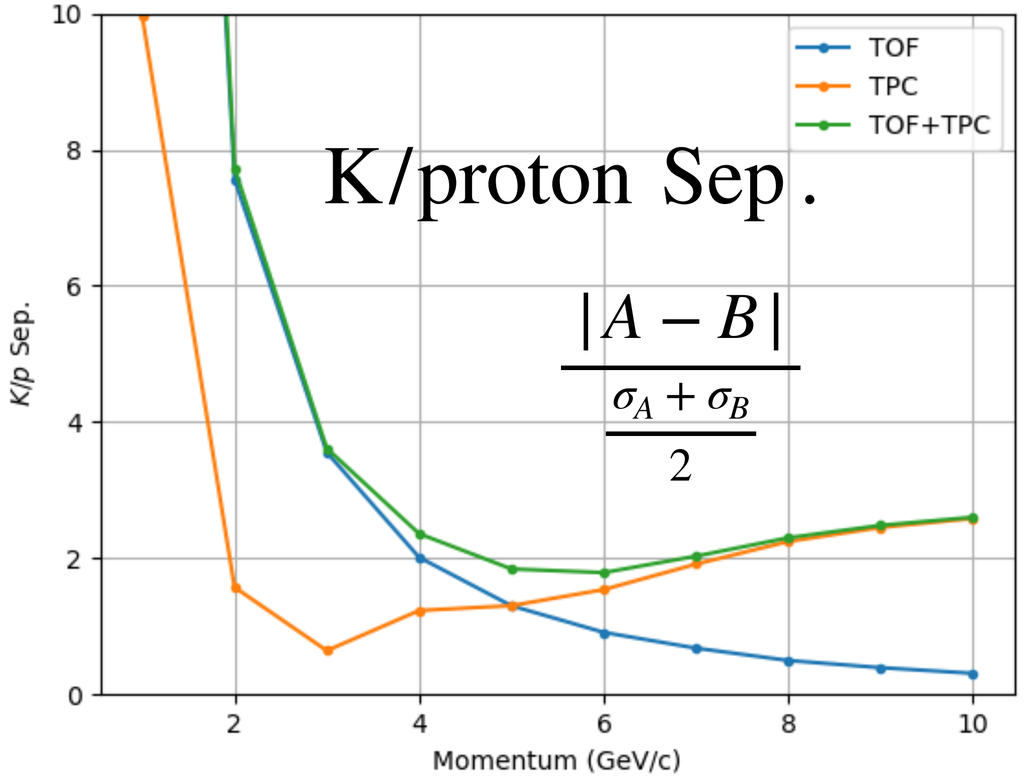
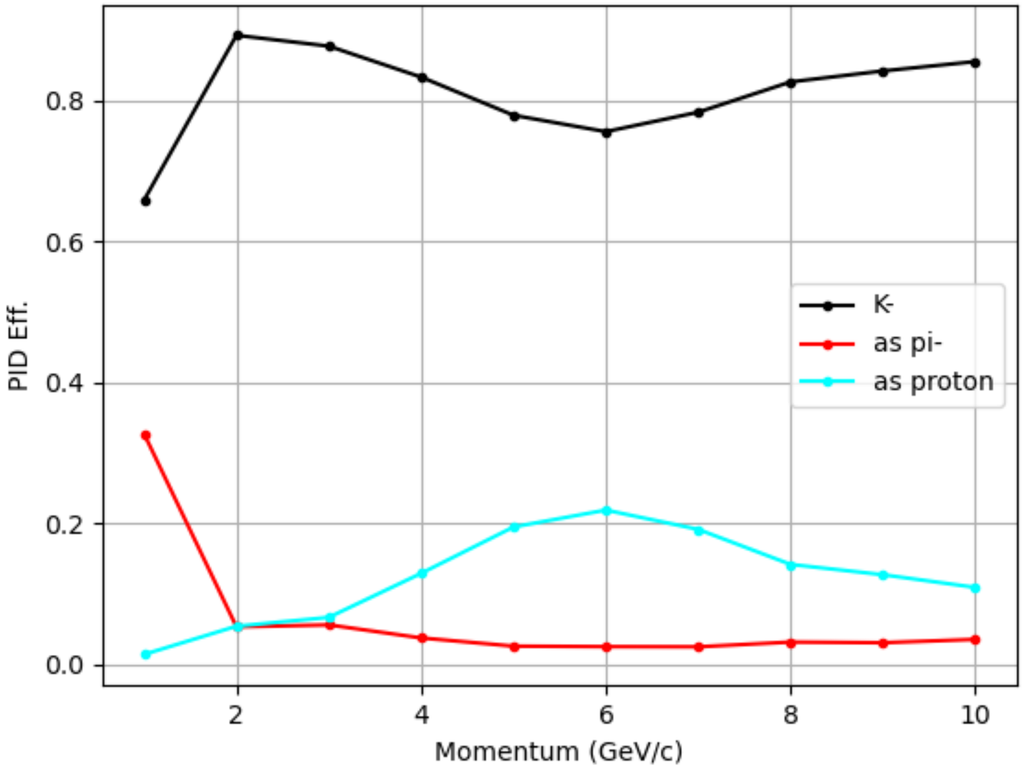
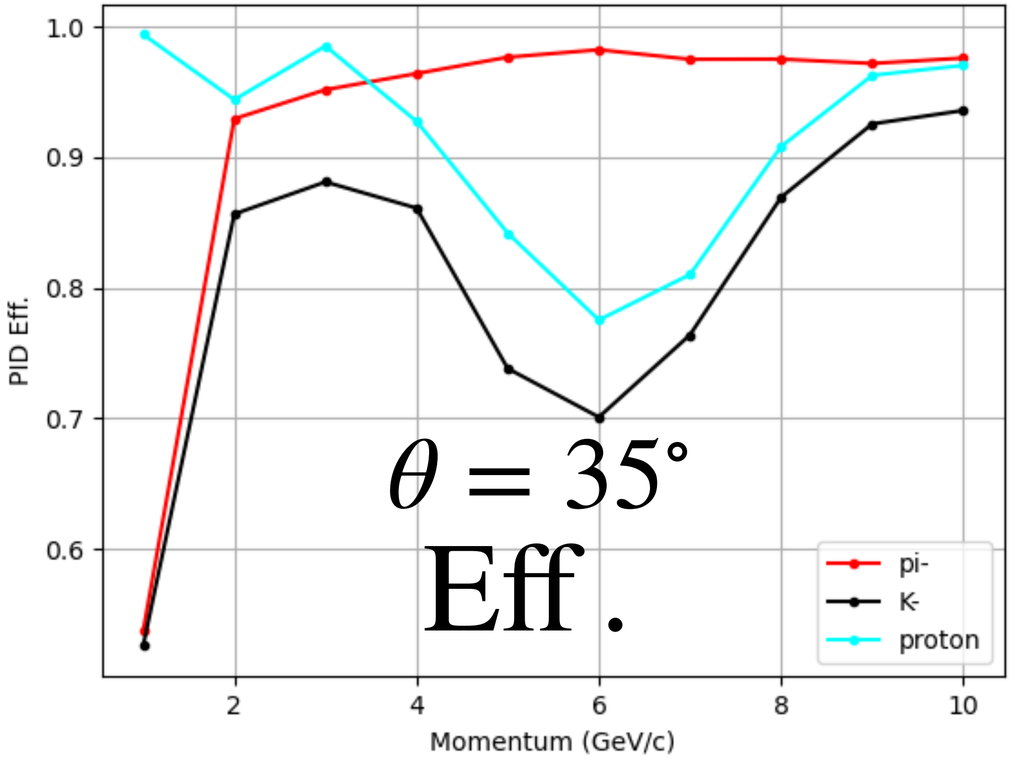


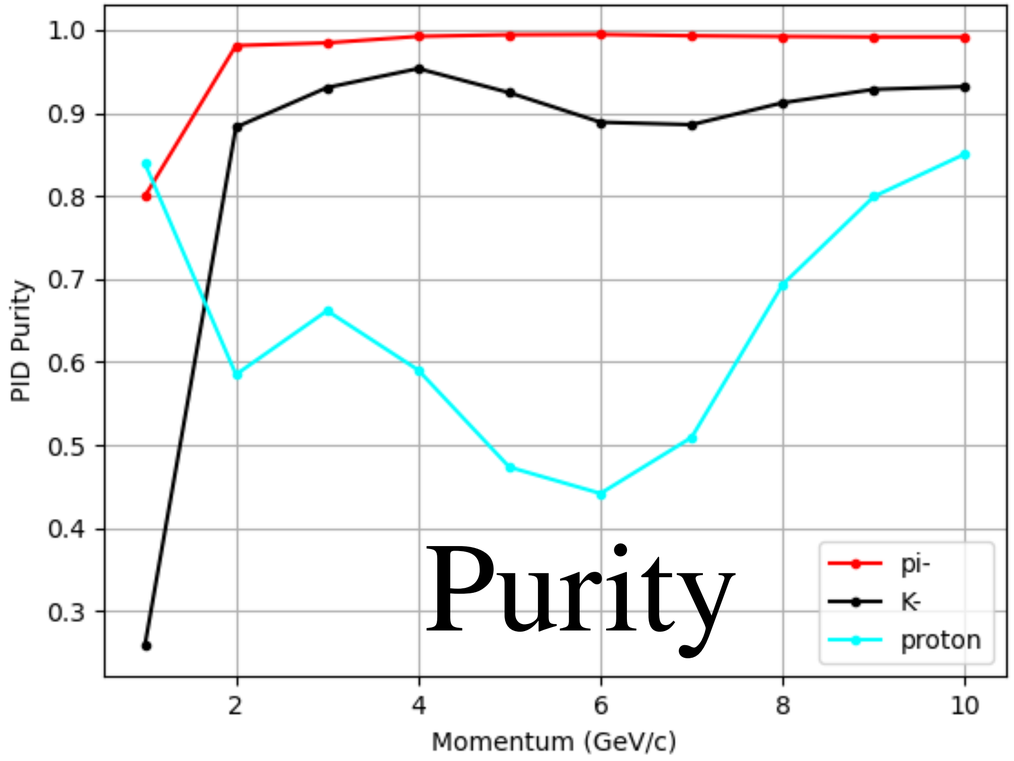


- Separation power $3\sigma \sim +\infty$: confidence level 99.7 % ~ 1
- Separation power $2 \sim 3\sigma$: confidence level 68 % ~ 99.7 %

Global PID Eff & Purity

- The two dips on Kaon Eff curves have been explained, to take a look at the global performance assuming $N_{pi} : N_K : N_p = 10 : 3 : 1$





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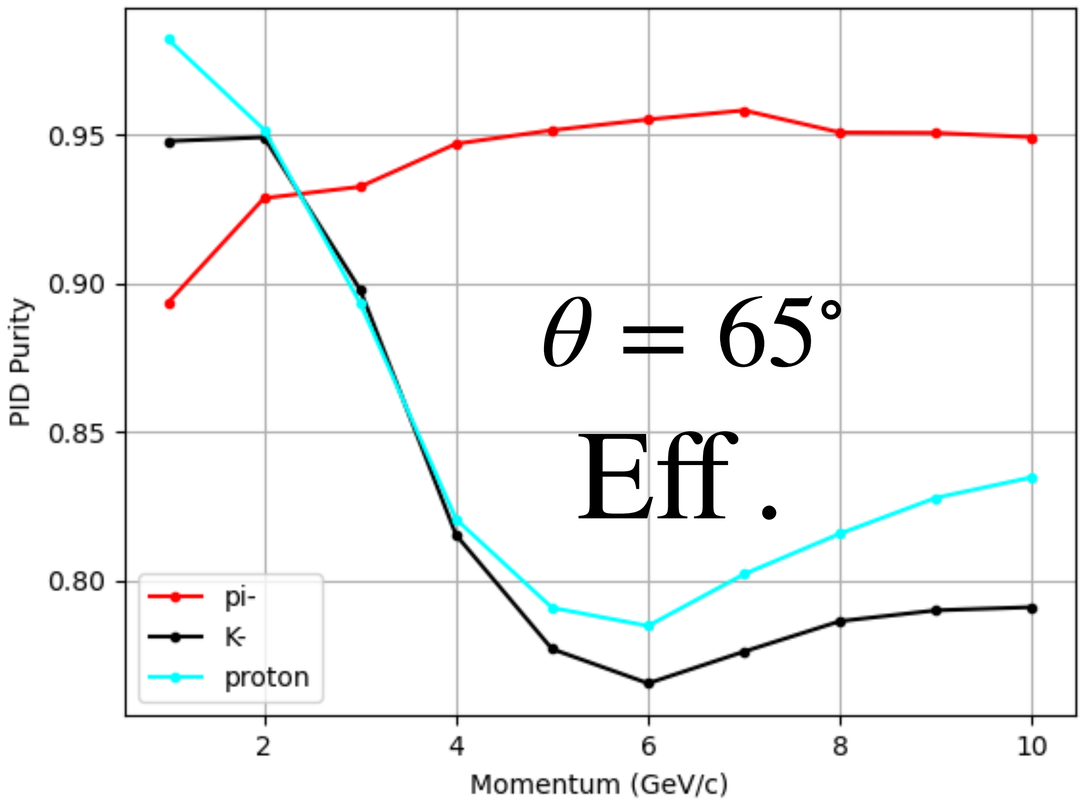

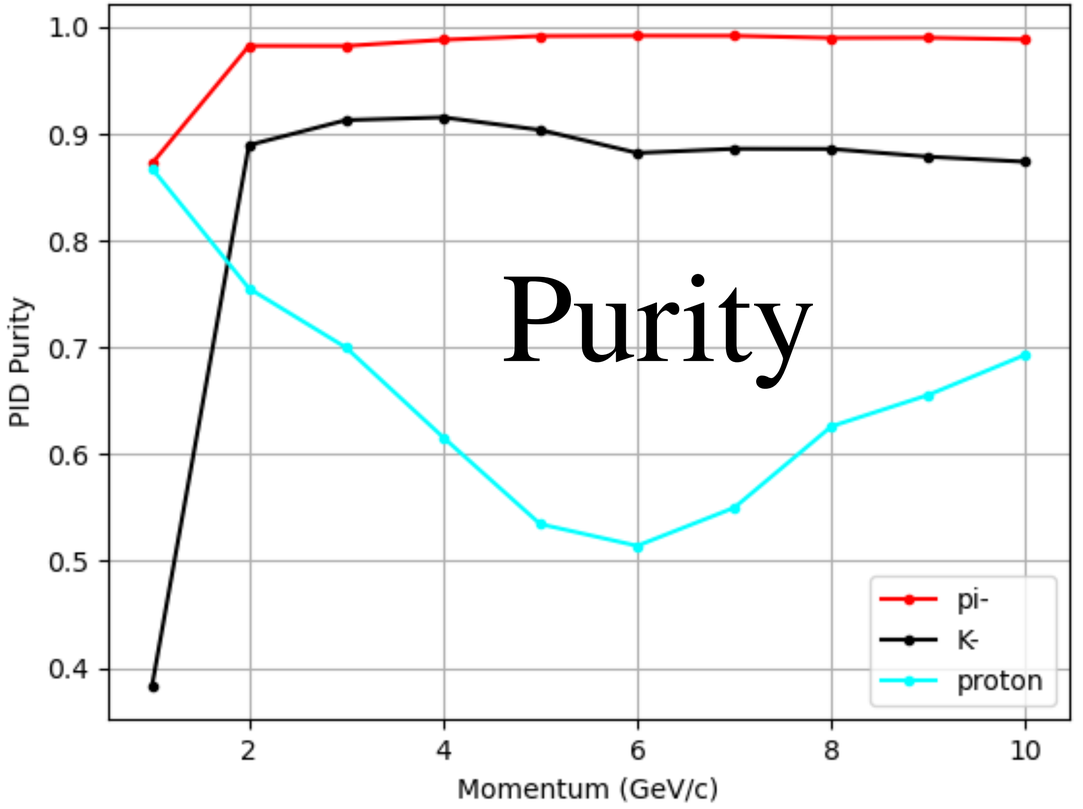

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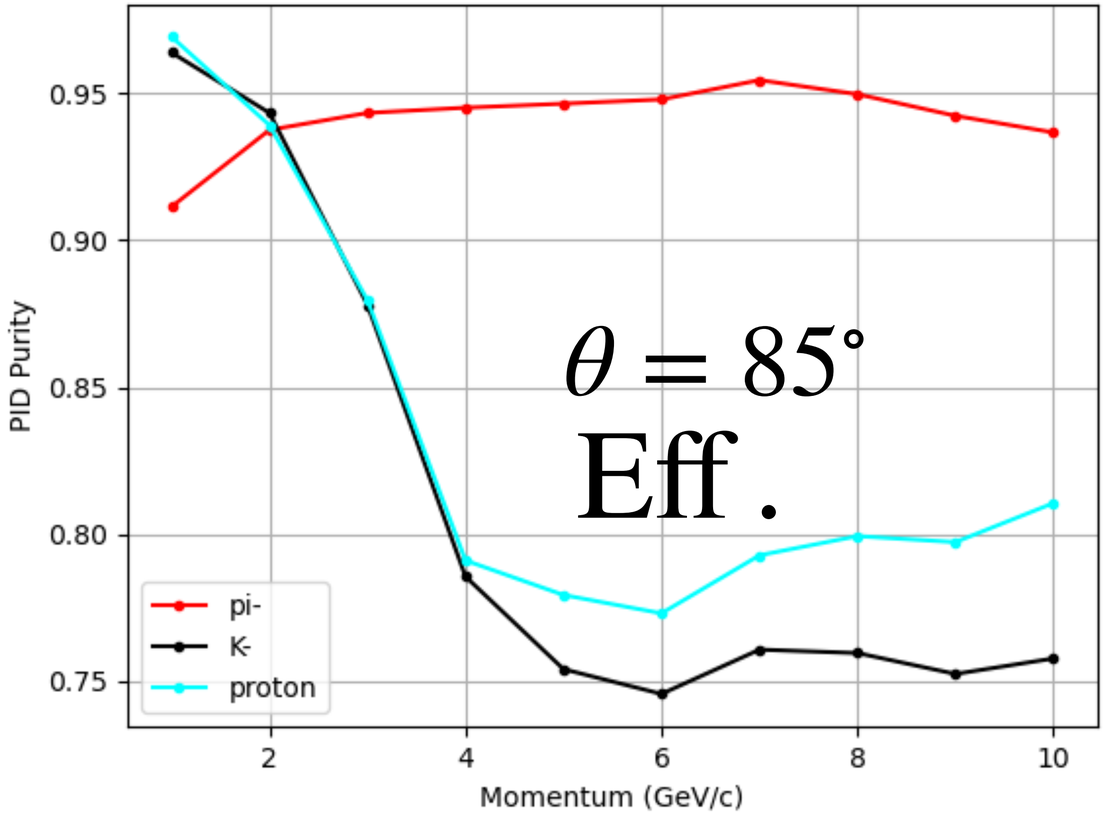
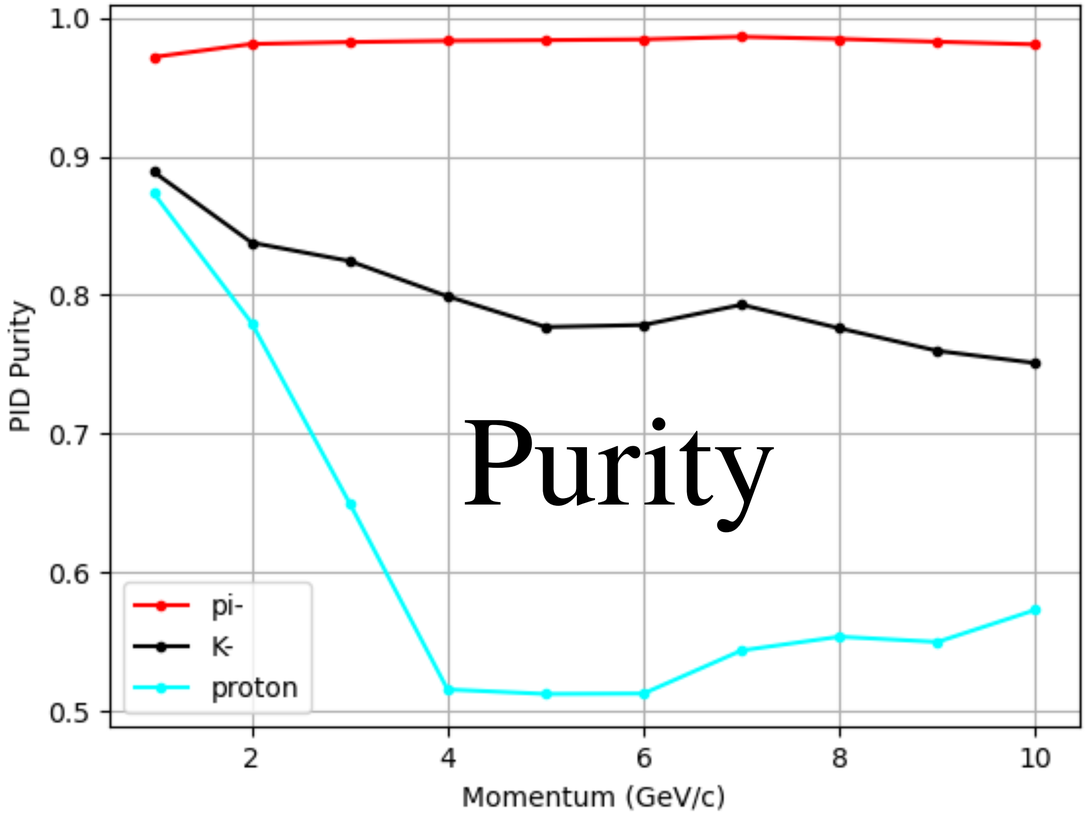
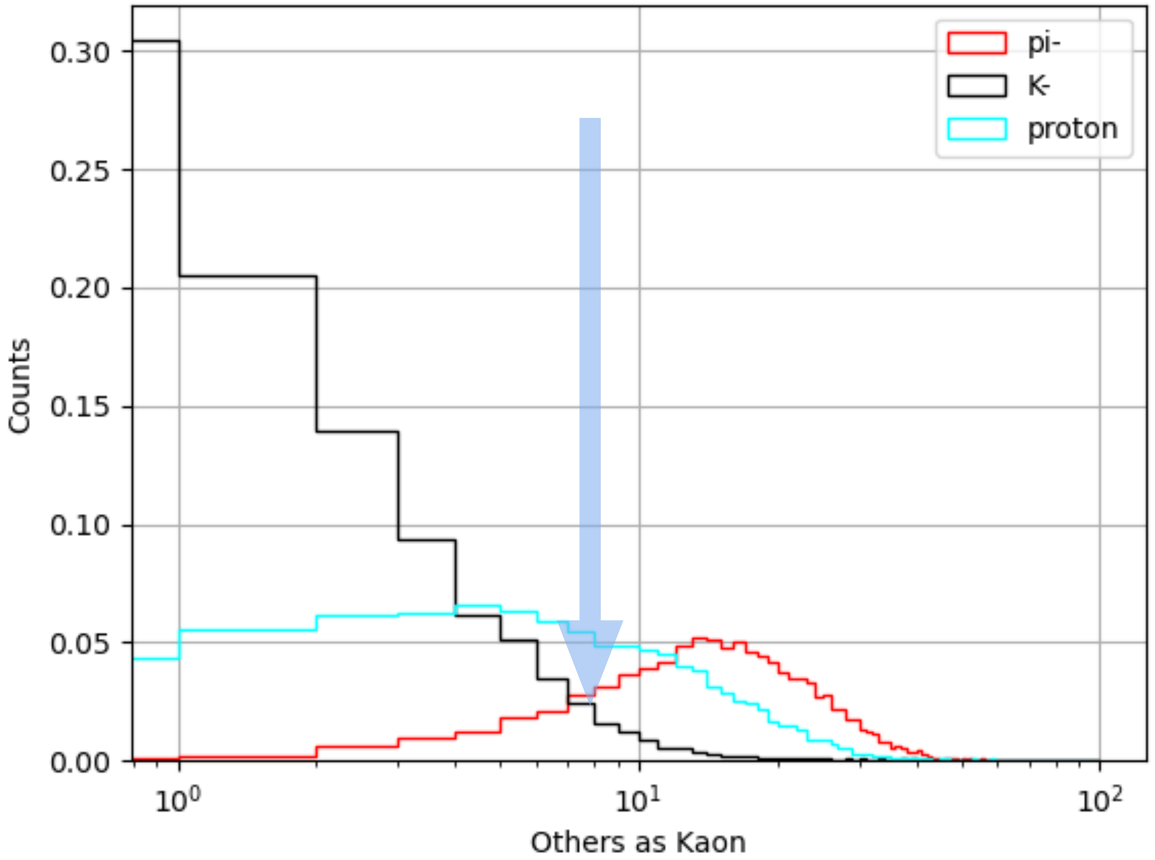




To do (optimal cut)

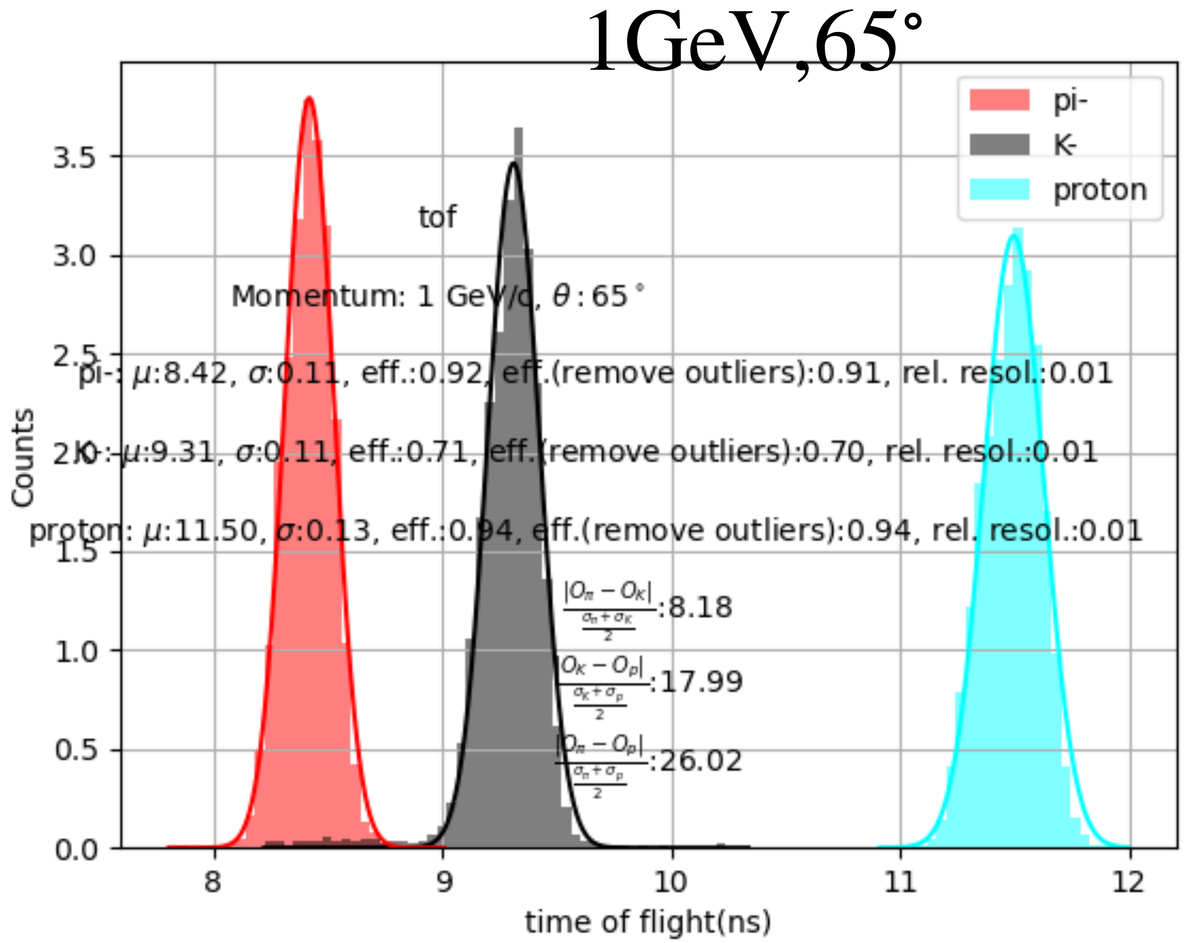
$4\mathrm{GeV}, \theta = 65°, \mathrm{Eff} = 82\,\%$



- Above results based on minimal χ^2
  - incident Kaon has 3 hypotheses (ignore e/μ)
  - $\chi 2_K$, $\chi 2_{pi}$, $\chi 2_p$
  - The smallest one is defined as Reconstructed PID
- Method in Reference is based on optimal cut.
  - Black, red and blue distributions are $\chi 2_K$ from truth Kaon, Pion and proton
  - To find a threshold which maximises Eff. times purity

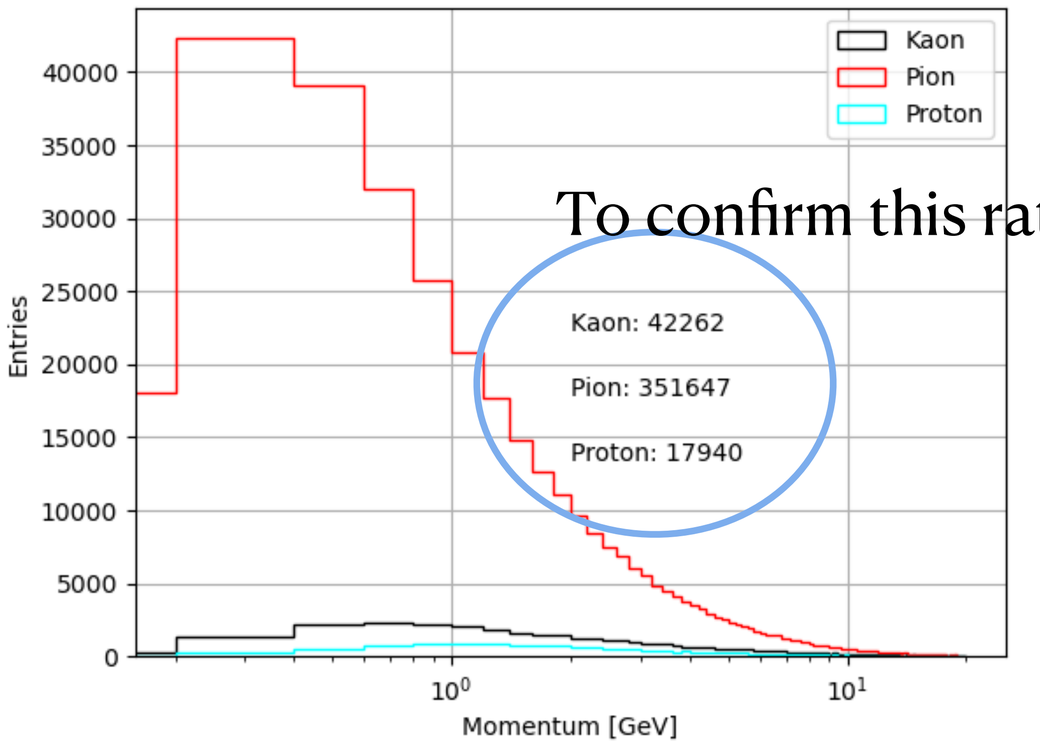
To do (ToF resolution)

- ToF was smeared 50 ps ~ 0.5 %



To do (Zqq events)

- 10:3:1 is very coarse, to make the view more clear, need to take a look at the K/pi/p kinematic distribution in Z to qq events, and their ratio

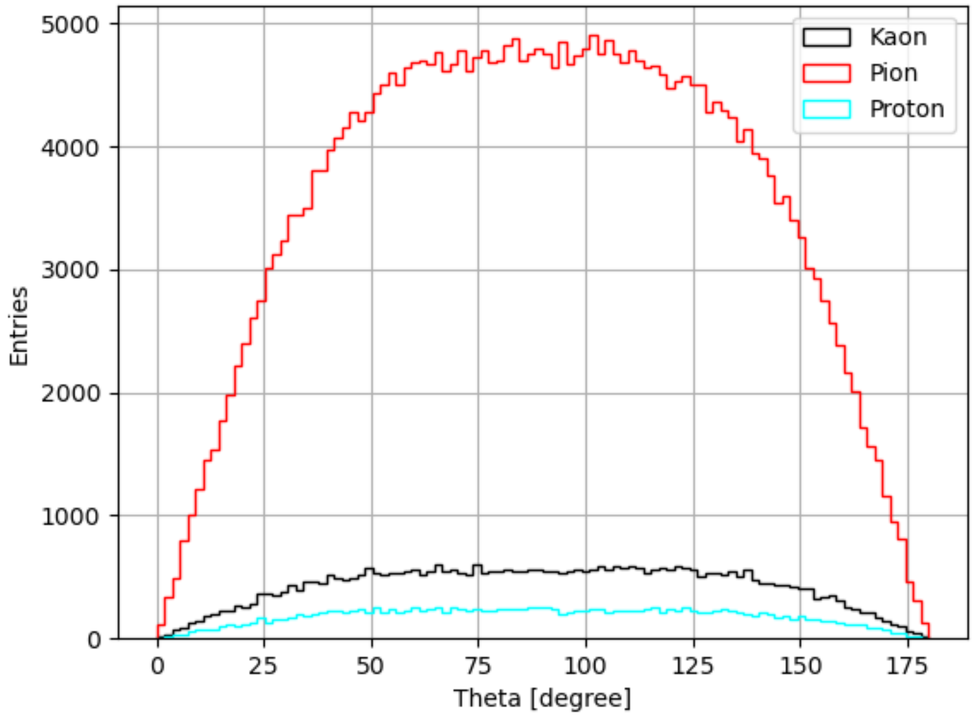


To confirm this ratio

Kaon: 42262

Pion: 351647

Proton: 17940



Trk performance

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Trk Eff.

- Trk. Eff. issue disappears with release of 24.10.0