CEPCSW中TPC的PID性能

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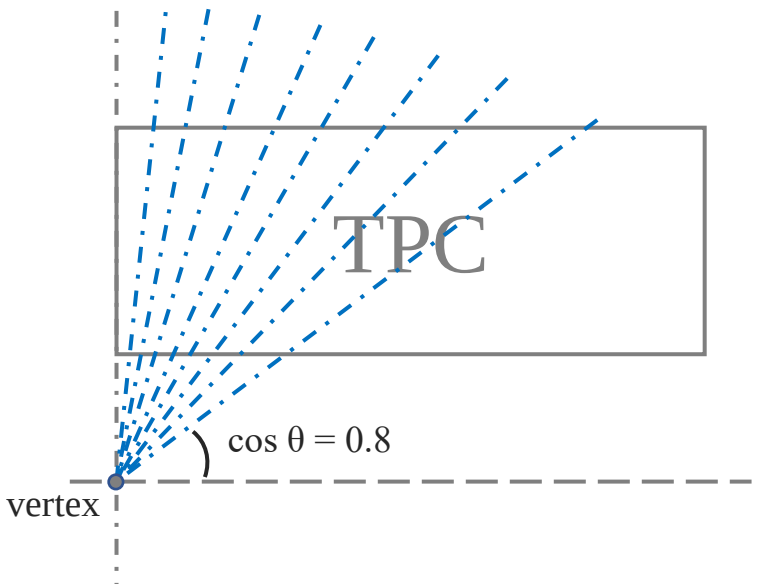
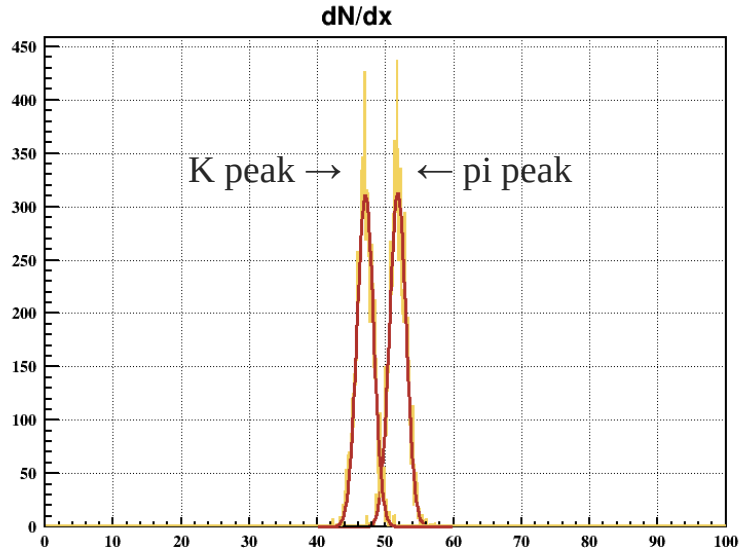
Introduction

- 软件版本：CEPCSW (2024/8/12)
- 动量：0.8 GeV ~ 20 GeV
- cos θ: 0.0 ~ 0.8
- 通过拟合不同样本的dN/dx分布，给出动量 vs 角度二维的粒子鉴别性能（包括pi/K, pi/p, K/p）
- 统计量：separation power, efficiency, mis-PID rate
- 样本量：10000粒子/数据点

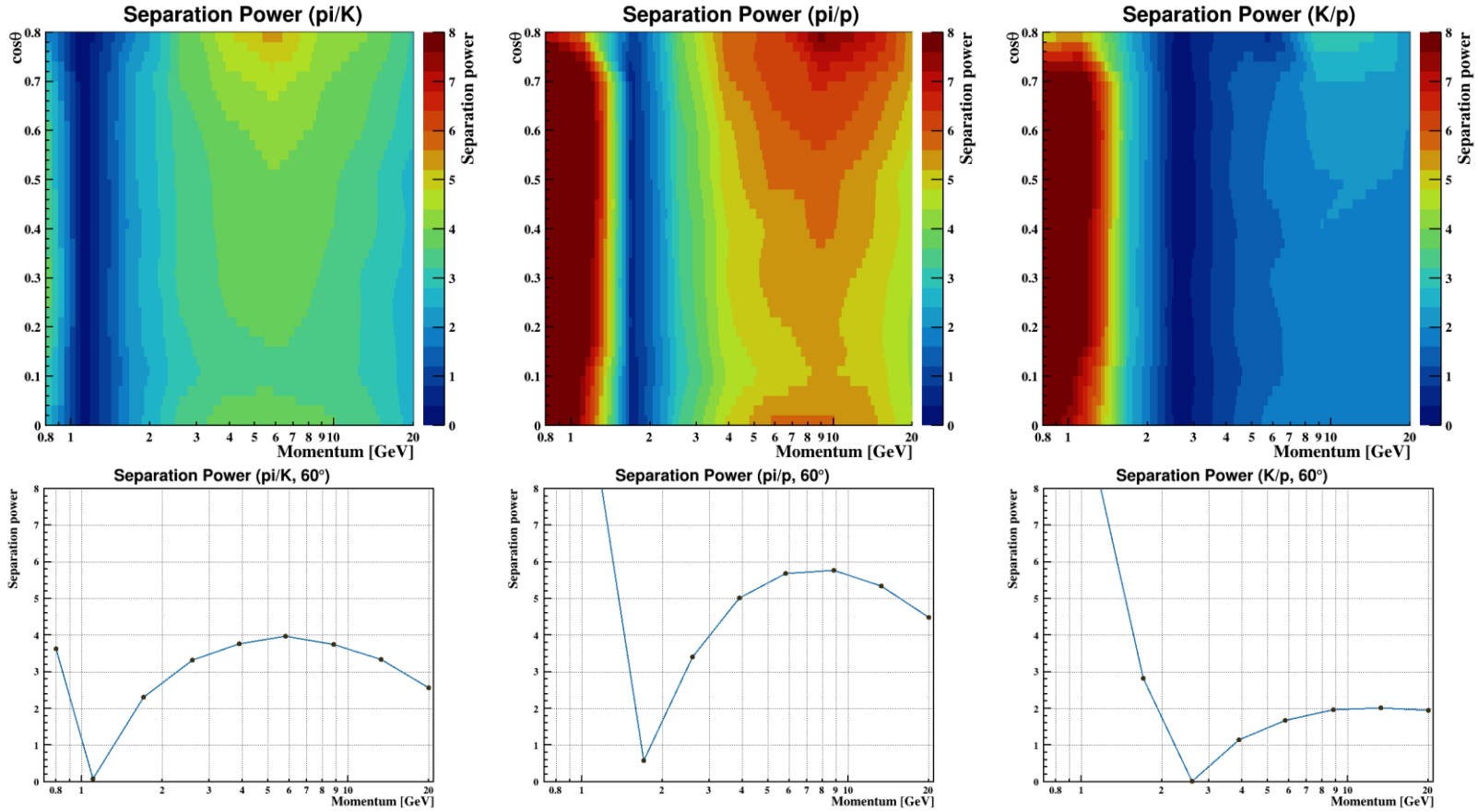




Separation power

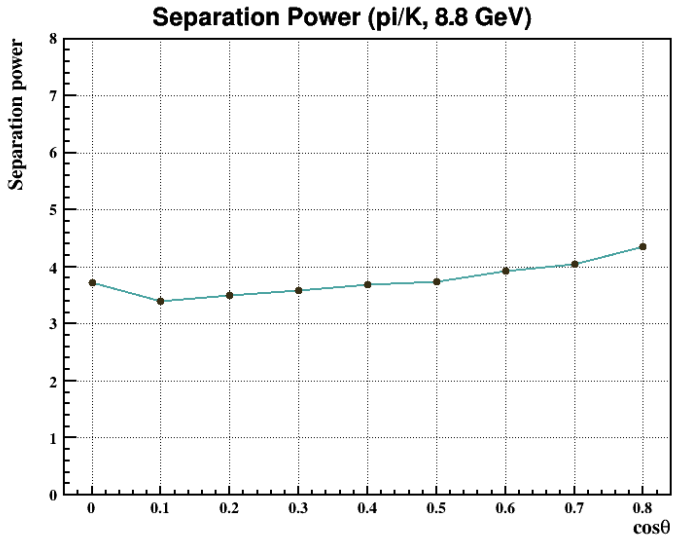
- separation power: $|\mu_A - \mu_B|/(\sigma_A + \sigma_B) \times 2$

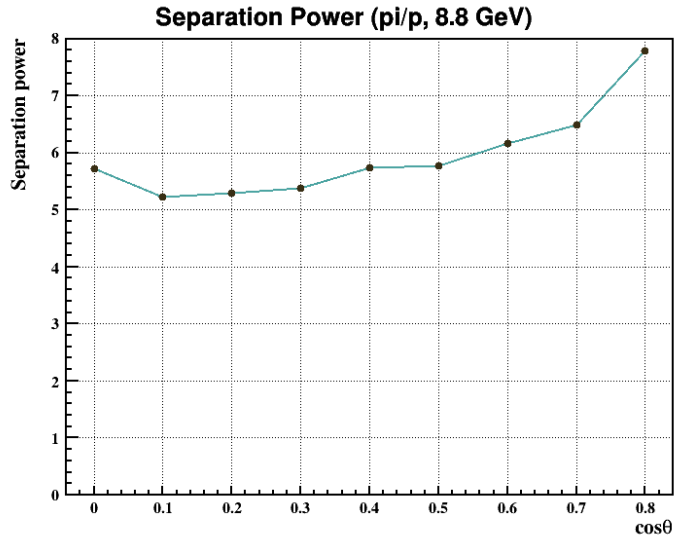
- 对于20 GeV动量的粒子:
  - pi/K: > 2.5σ
  - pi/p: > 4σ
  - K/p: > 2σ

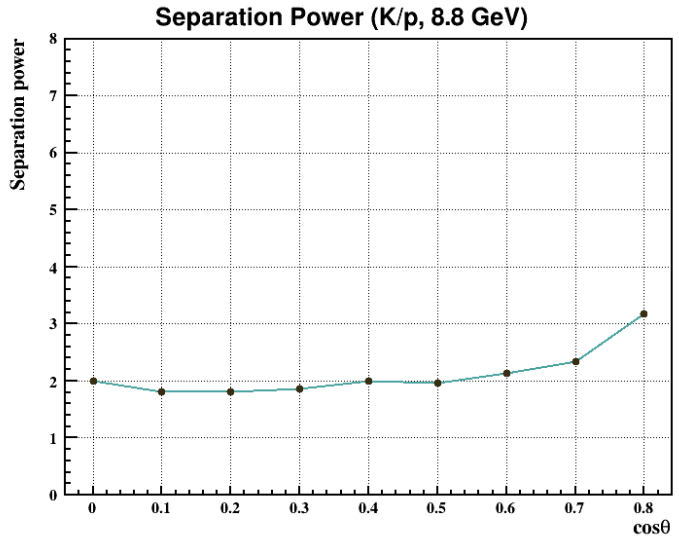


Separation power

- separation power: $|\mu_A - \mu_B|/(\sigma_A + \sigma_B) \times 2$



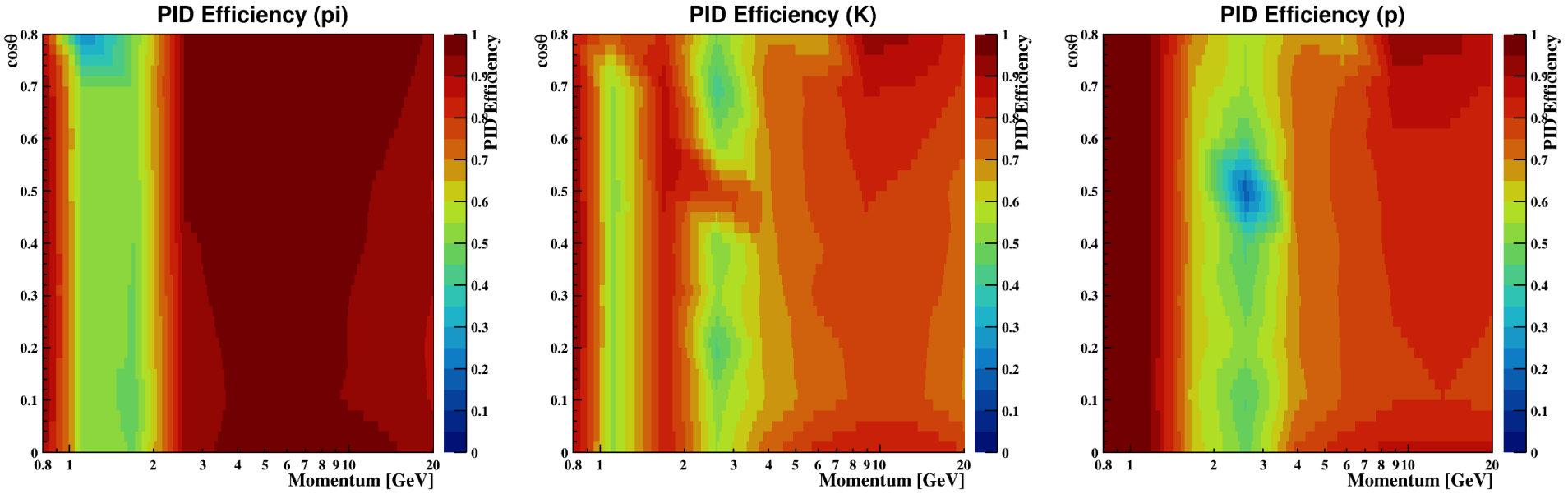




- 在不同的角度（cos θ = 0 ~ 0.8），PID能力接近

Eff & mis-PID rate

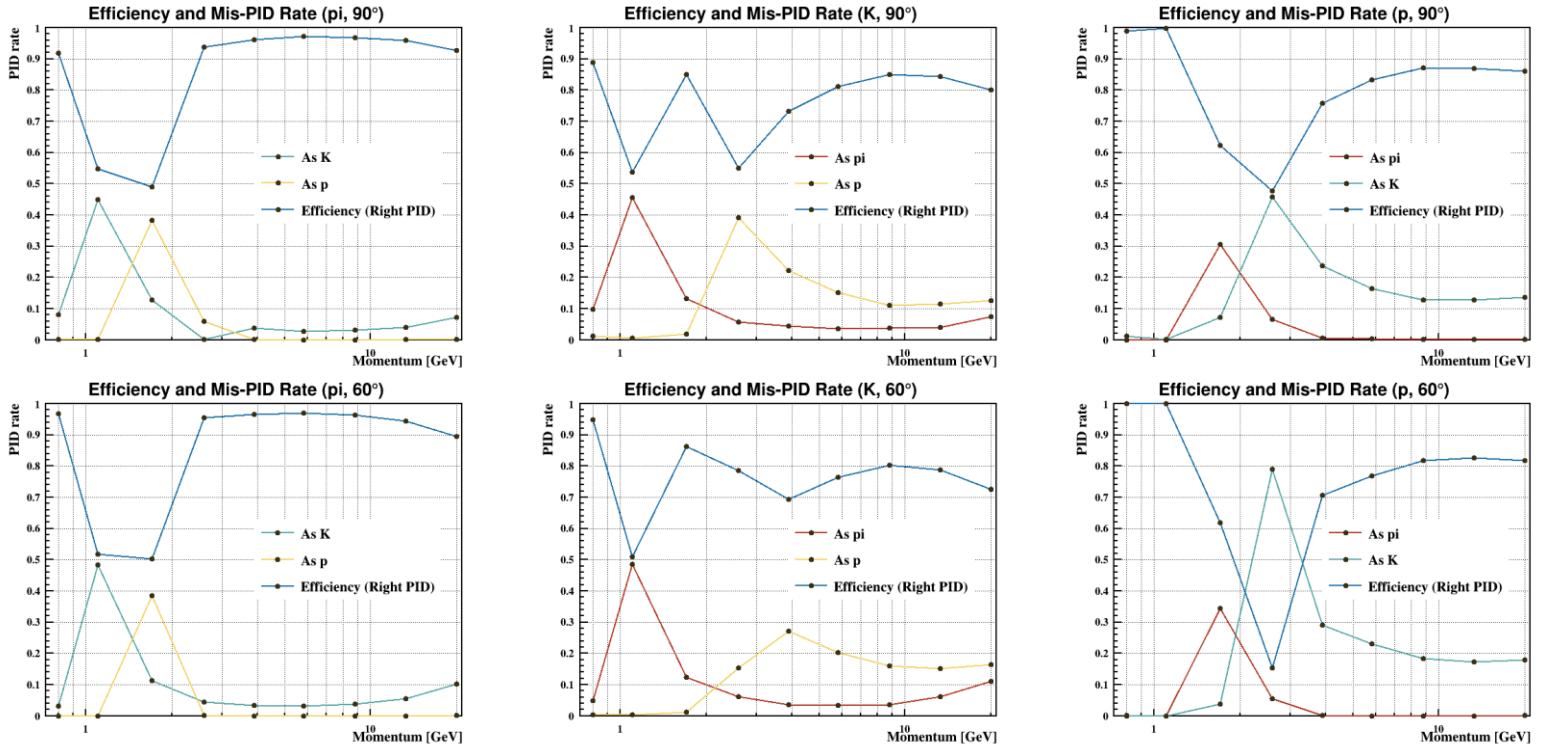
- efficiency: $N(\text{PID as } A|A)/N(A)$
  - PID as $A \Leftrightarrow \chi_A < \chi_B, \chi_A < \chi_C$
- mis-PID rate: $N(\text{PID as } B|A)/N(A)$



- 对于大部分情况，efficiency ~ 90%

Eff & mis-PID rate

- efficiency: $N(\text{PID as } A|A)/N(A)$
  - PID as $A \Leftrightarrow \chi_A < \chi_B, \chi_A < \chi_C$
- mis-PID rate: $N(\text{PID as } B|A)/N(A)$



Conclusion

- 对于20 GeV动量的径迹，pi/K/p的粒子区分能力均大于2σ，cos θ = 0.0 ~ 0.8范围内鉴别能力稳定
- 高动量pi/K/p的粒子鉴别效率大于80%，低动量需要进一步联合TOF信息