

ϕ meson production in pp @ 10 GeV with SPD spectrometer

Elena Zemlyanichkina (JINR)

SPD Physics & MC Meeting
16/04/2025

Simulation+Reconstruction

- ◆ Production name: `PROD2025-004`
- ◆ `pp@10 GeV` with Pythia 8 + SPDroot-dev-4.1.7 (~40 mln events)
- ◆ Micromegas based Central Tracker ($-45 \text{ cm} < Z < 45 \text{ cm}$, $R = 5 \text{ cm}$)
- ◆ Central part of beam pipe is made of Aluminum
- ◆ Options for track reconstruction:
 - `CheckMinItsHits(true, 0);`
 - `CheckMinTsHits(true, 6);`
 - `CheckMinHits(true, 7);`
 - `Check MinPartPt(true, 0.1);`
 - `CheckMinPartMomentum(true, 0.15);`

Thanks to MLIT JINR team!

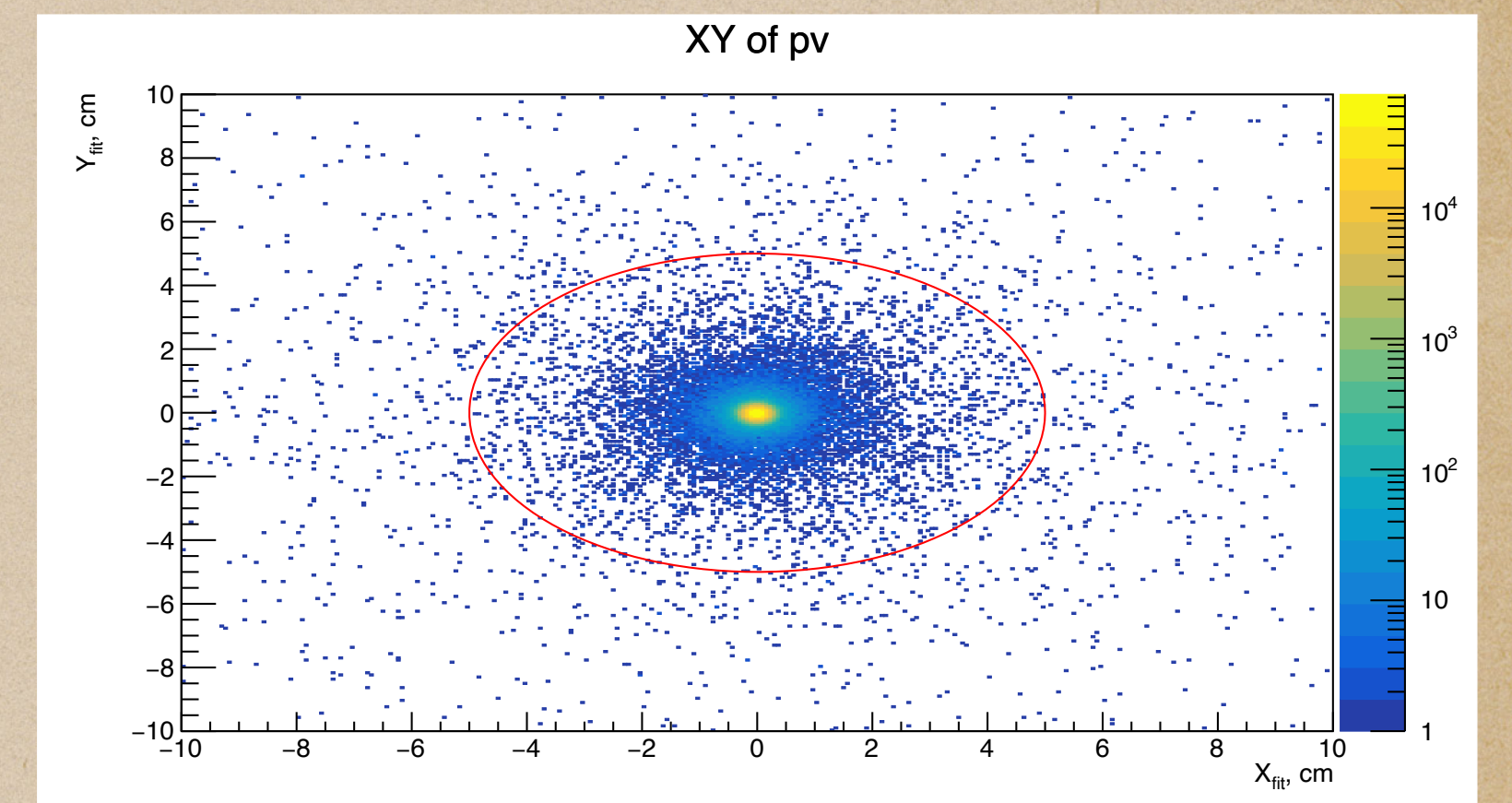
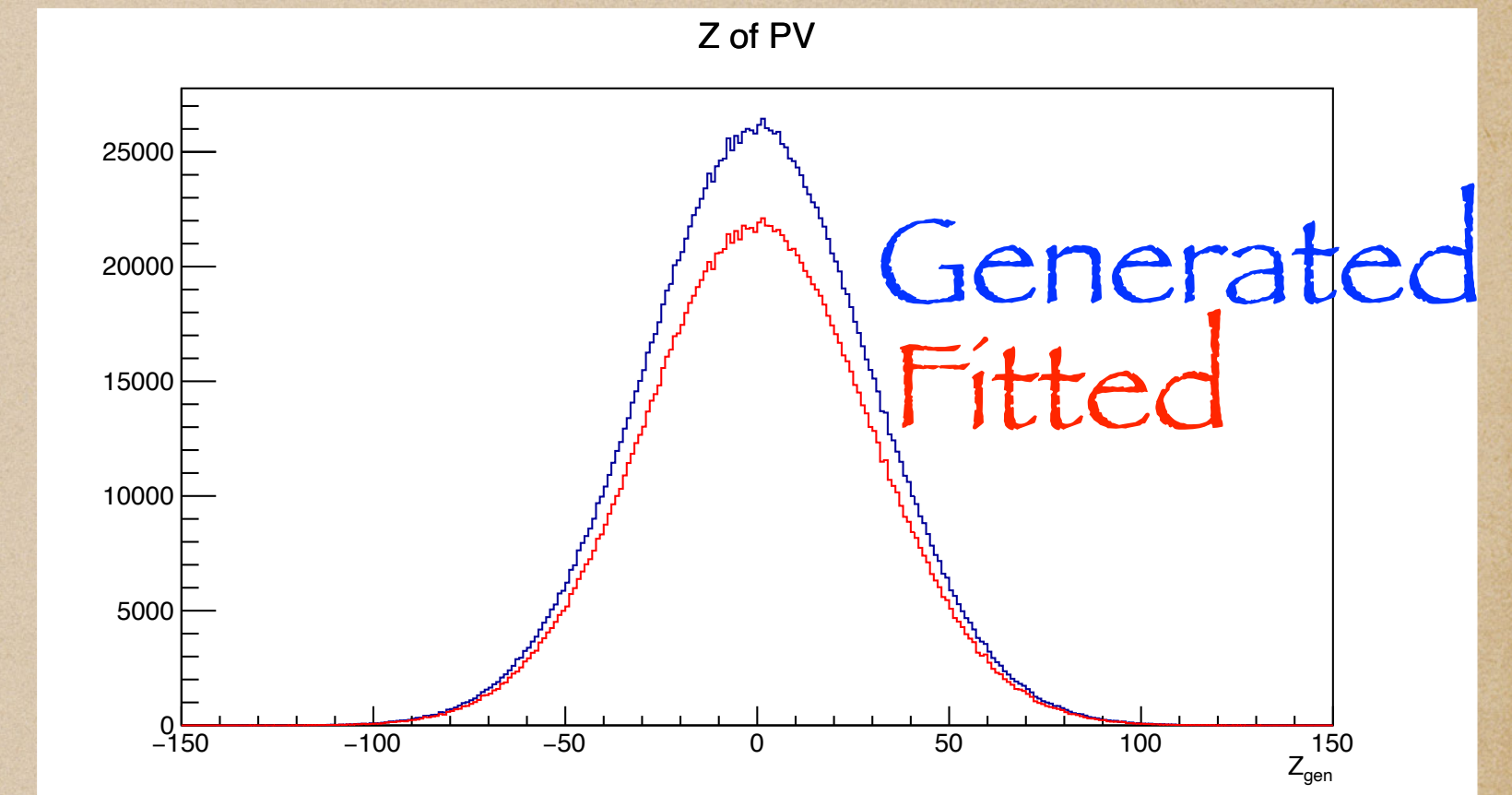
Selection

Vertex selection:

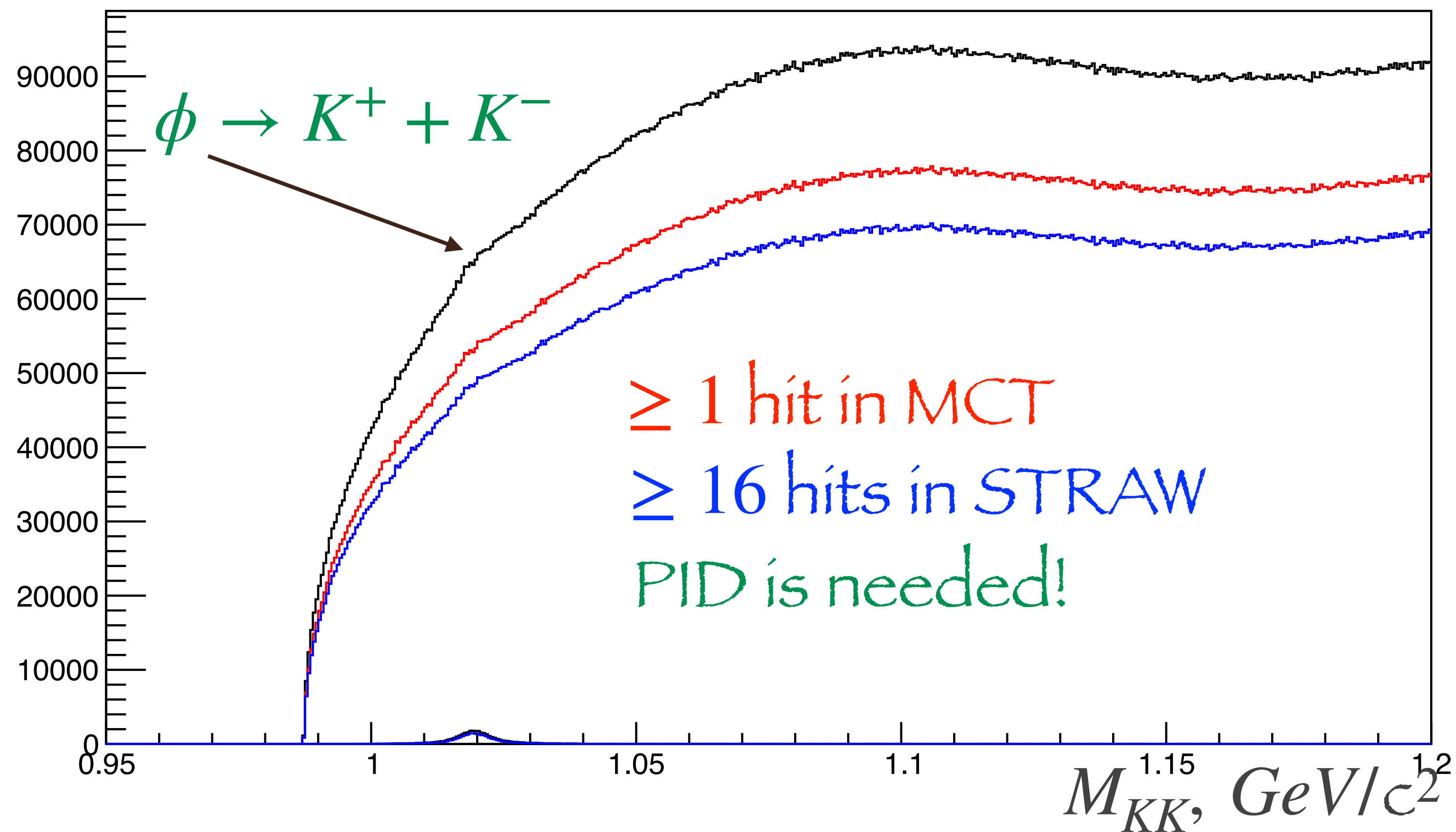
- ◆ $-45 \text{ cm} < Z < 45 \text{ cm}$ and $\sqrt{X^2 + Y^2} < 5 \text{ cm}$

Track selection:

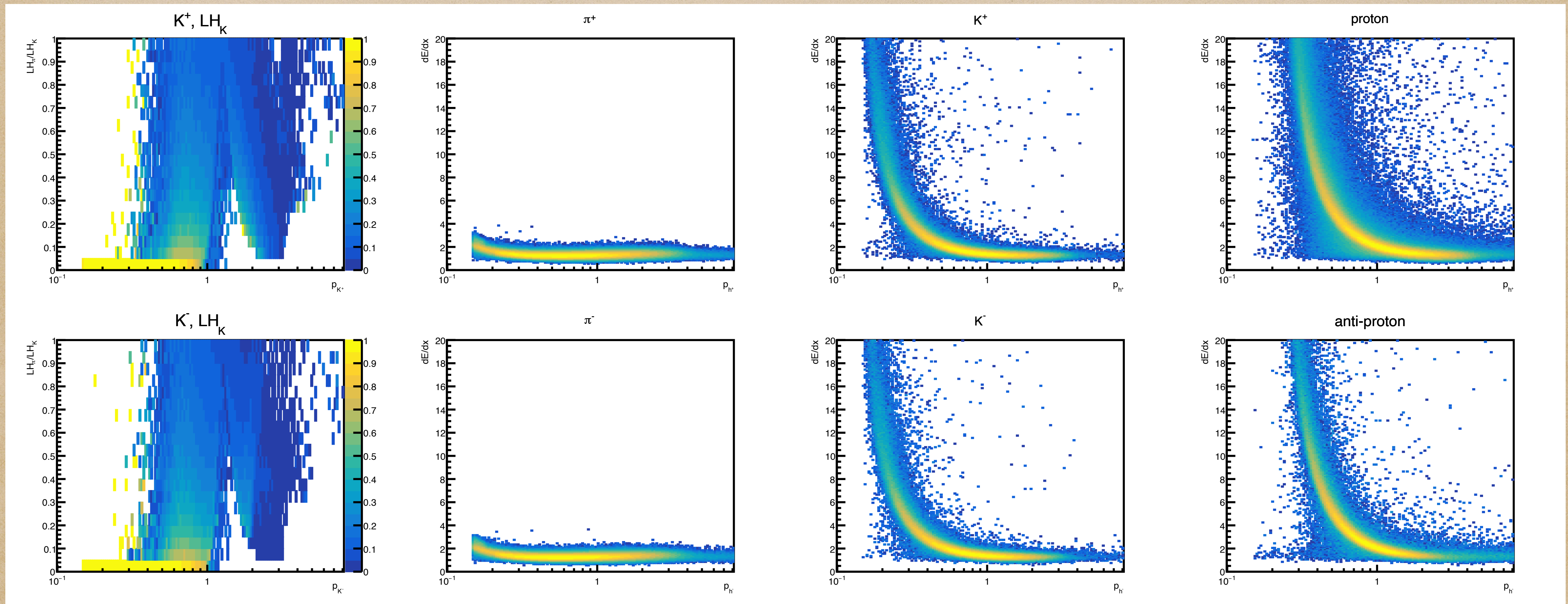
- ◆ All tracks produced in PV (fitted, *convergency!=0*)
- ◆ Number of hits: $N_{MCT \text{ hits}} \geq 1$ and $N_{STRAW \text{ hits}} \geq 16$
- ◆ Hadron momentum $p > 150 \text{ MeV}/c$



K^+K^- invariant mass: no PID

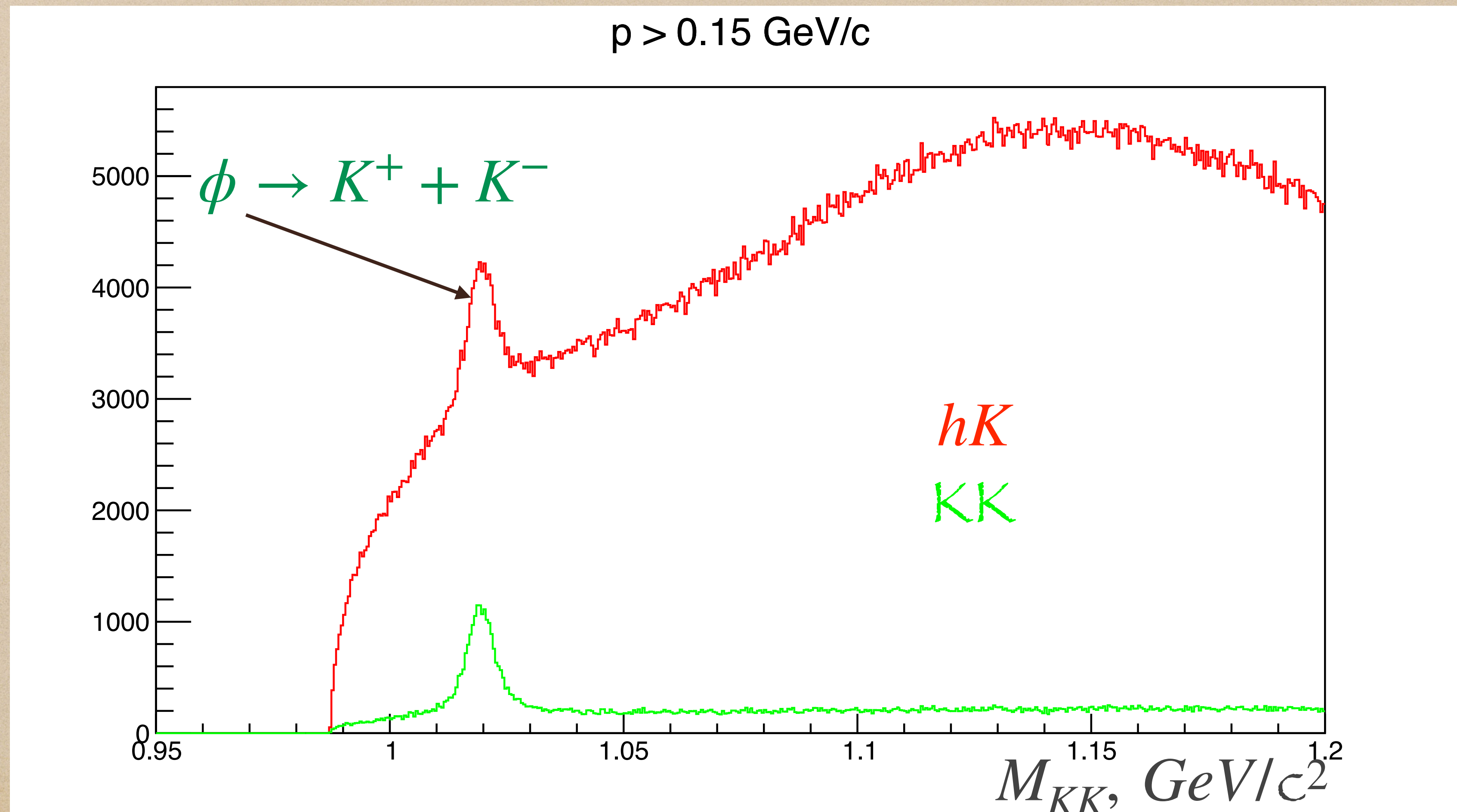


PID with STRAW: $LH_{\pi}/LH_K < 0.1$



Momentum, GeV/c

K^+K^- invariant mass: PID with STRAW



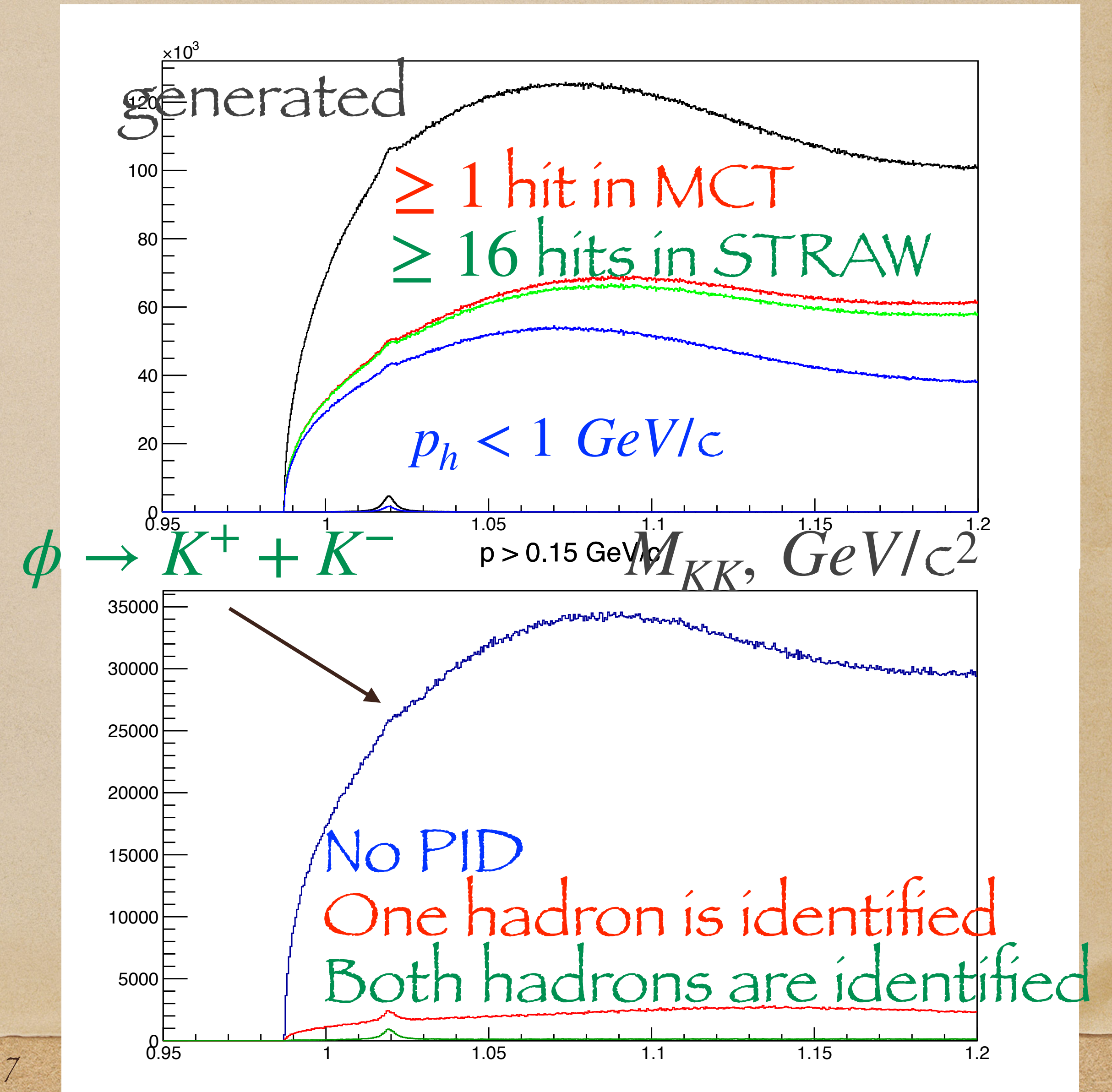
Geometry acceptance (40.5 % / 36.7 %)

Selection of generated $\phi \rightarrow K^+ + K^-$:

- `SpdMCParticle::GetGeneration() == 1`
- Momentum of charged tracks $> 150 \text{ MeV}/c$

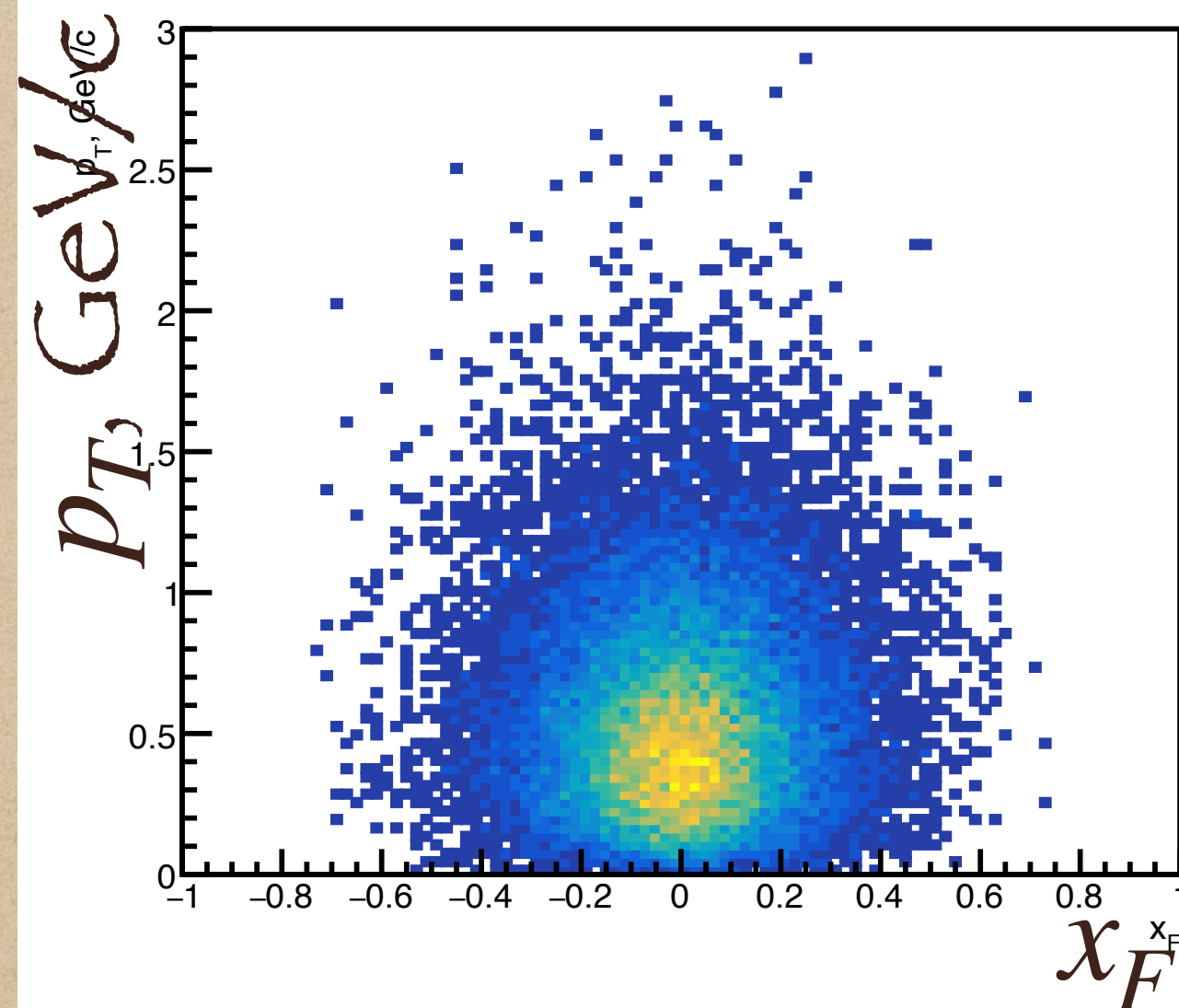
Selection of accepted $\phi \rightarrow K^+ + K^-$:

- Number of ITS hits ≥ 1
- Number of STRAW hits ≥ 16
- Momentum of charged tracks $< 1 \text{ GeV}/c$
(PID with STRAW only)



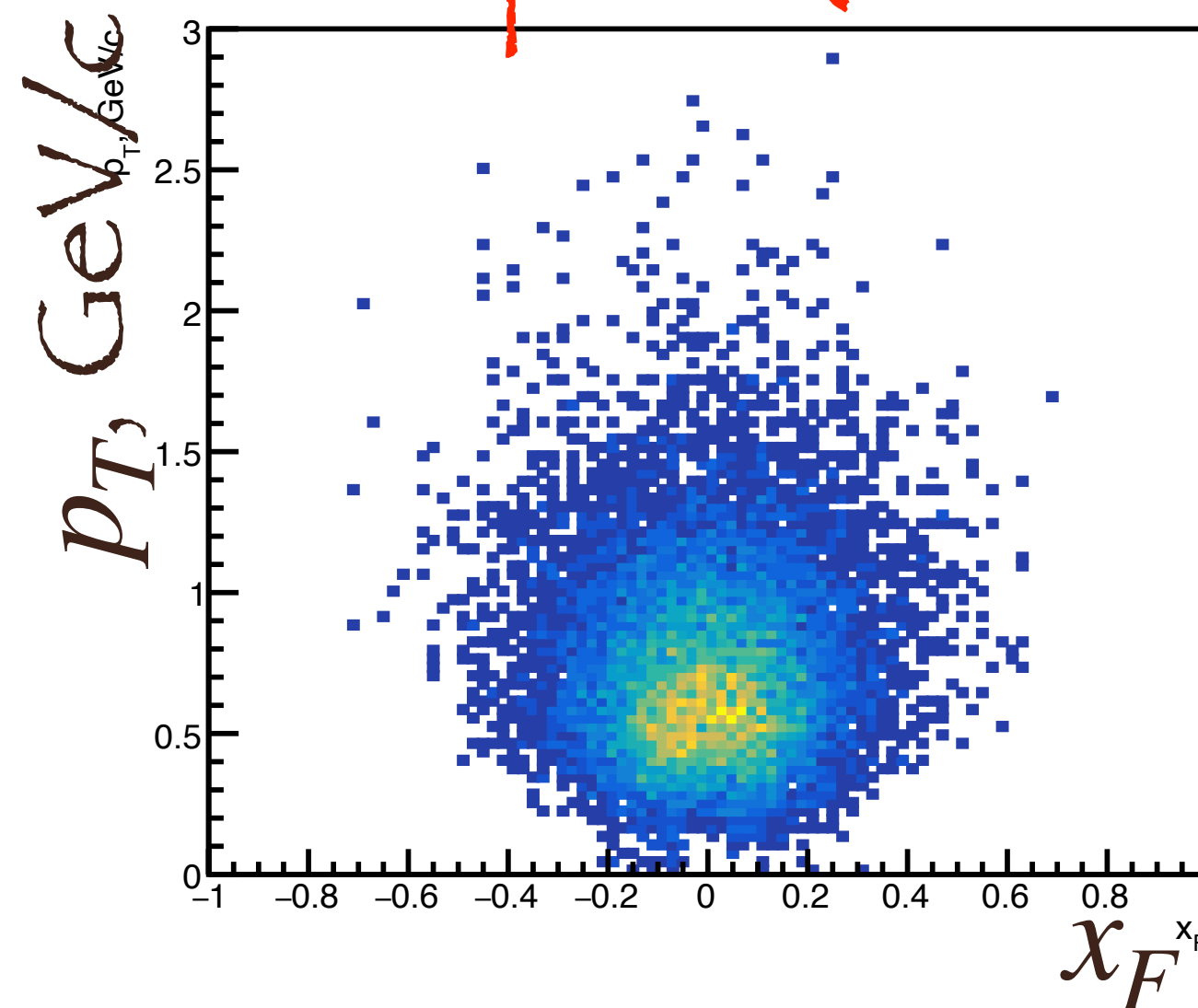
$$\phi \rightarrow K^+ + K^-$$

Generated



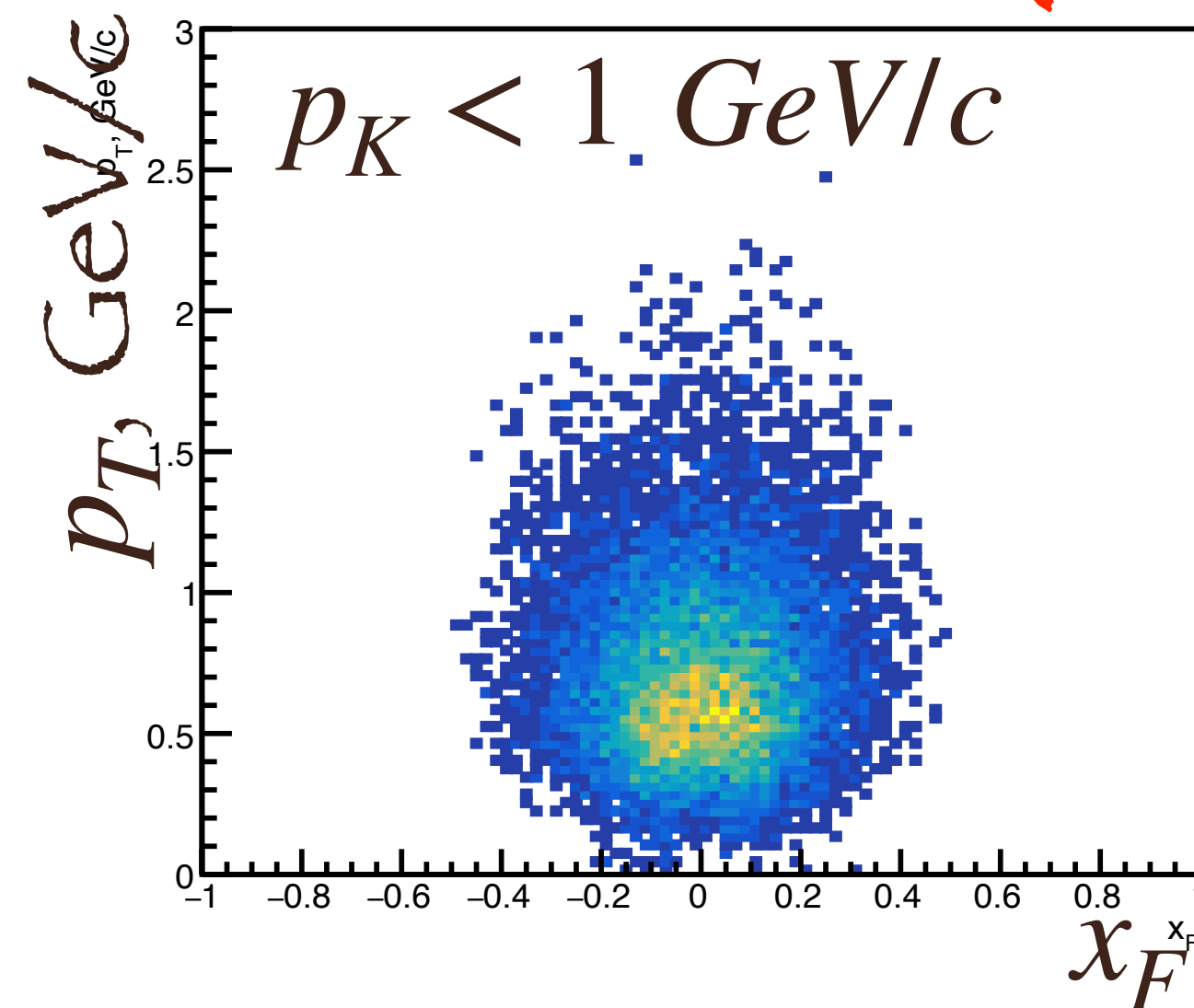
Generated

Accepted (40.5 %)

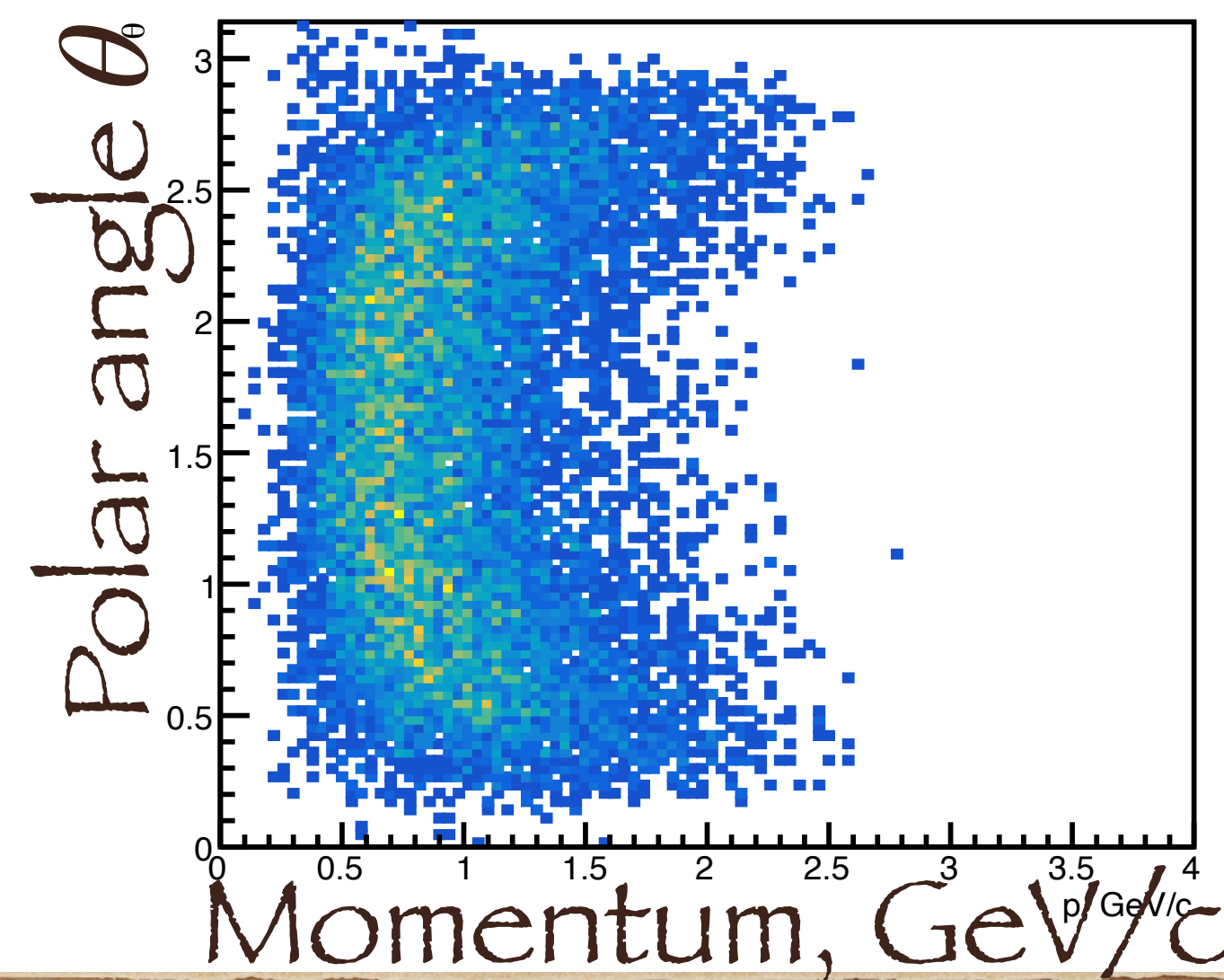
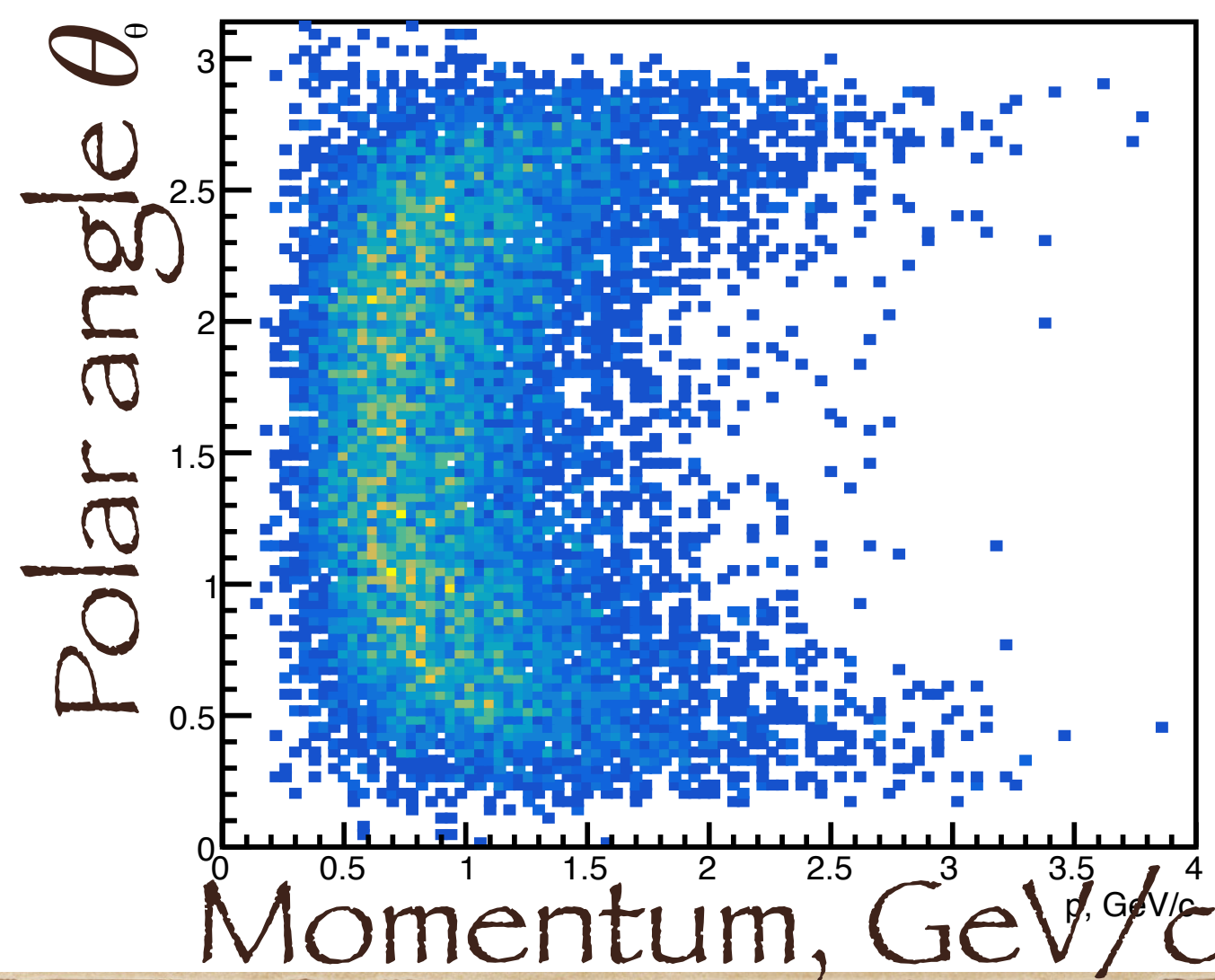
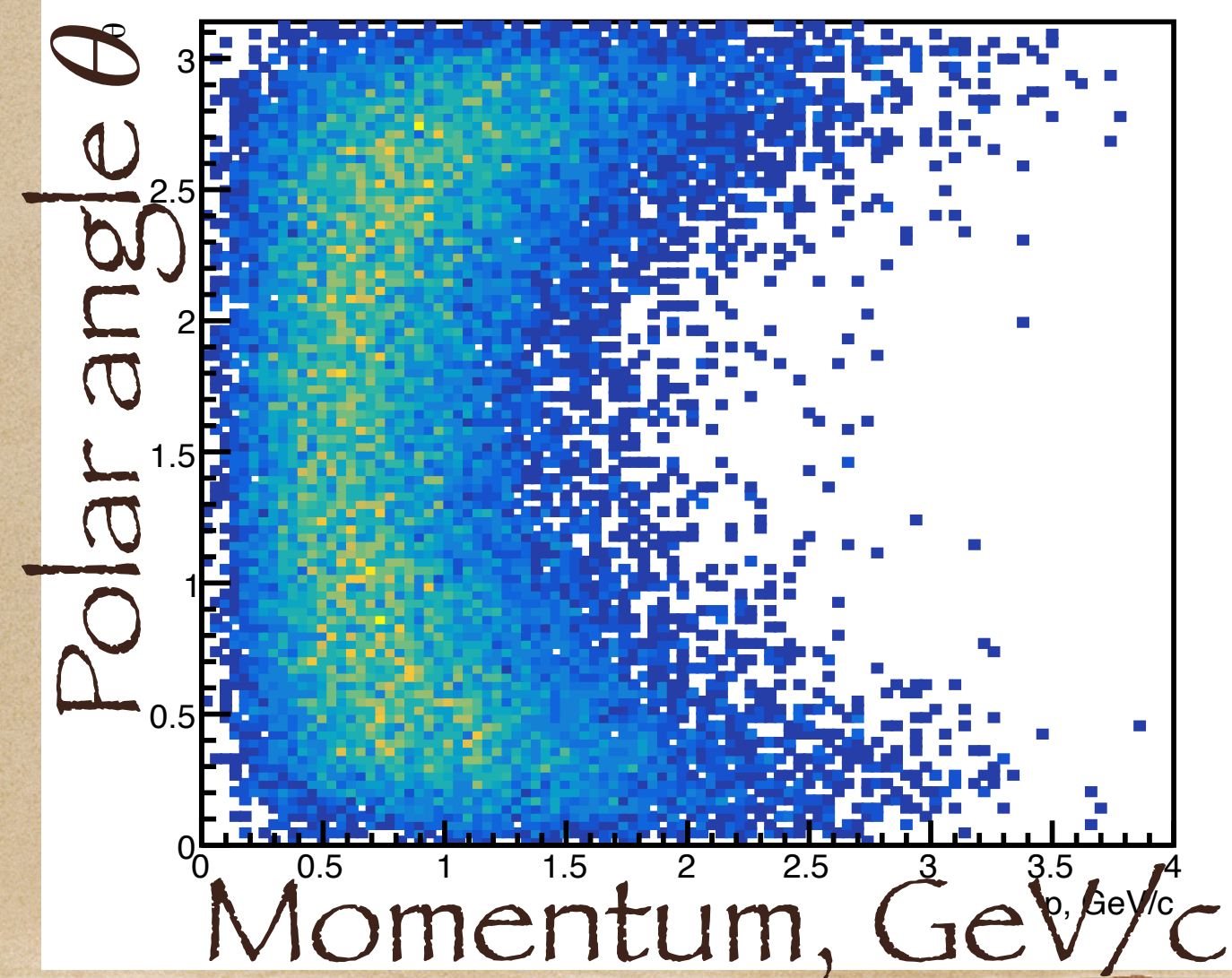


Accepted

PID with STRAW (36.7 %)



1 PID

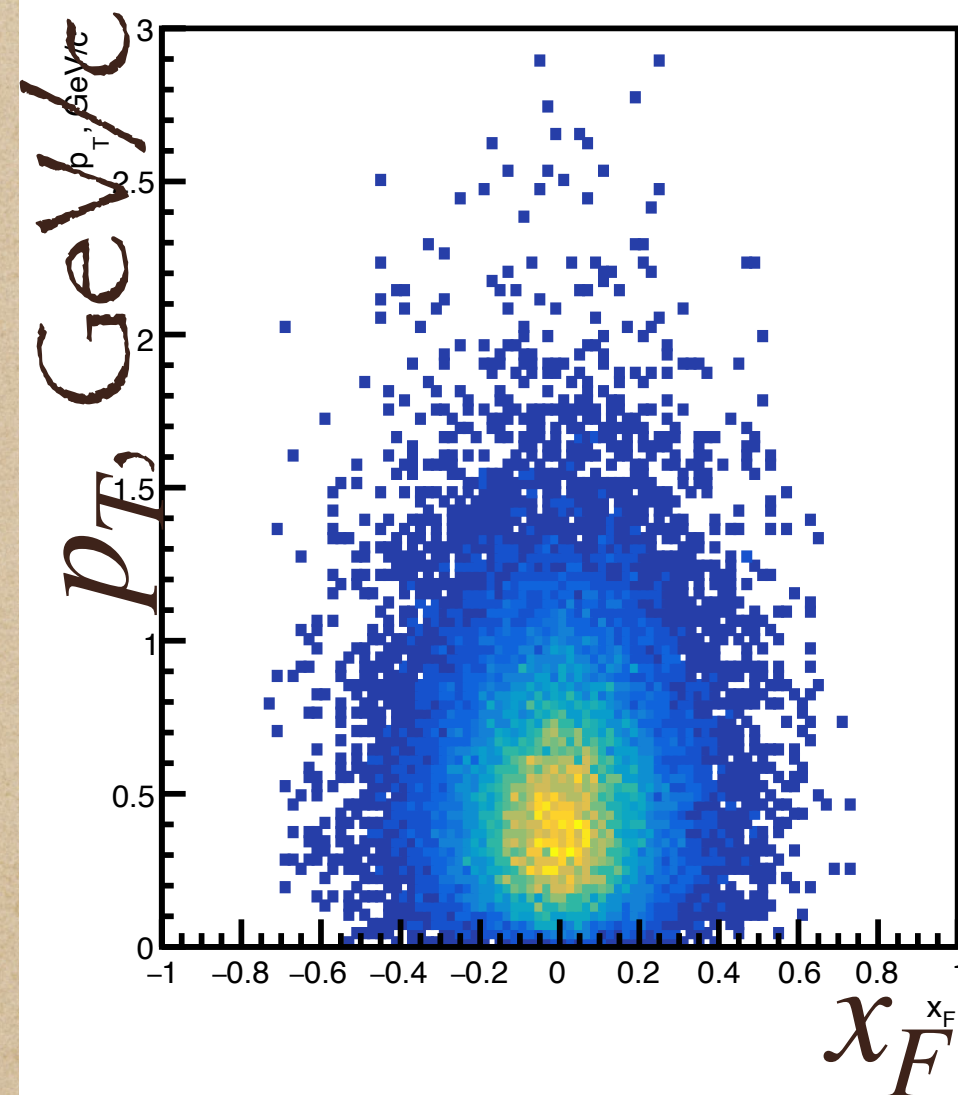


Summary

- ◆ 40.5 % of $\phi \rightarrow K^+ + K^-$ are accepted by the SPD spectrometer
- ◆ Particle identification is needed to select $\phi \rightarrow K^+ + K^-$
- ◆ With STRAW only one can select kaons with momentum $p < 1 \text{ GeV}/c$
- ◆ 36.7 % of $\phi \rightarrow K^+ + K^-$ mesons can be selected
- ◆ Available kinematical range is $-0.4 < x_F < 0.4$, $p_T < 2.0 \text{ GeV}/c$

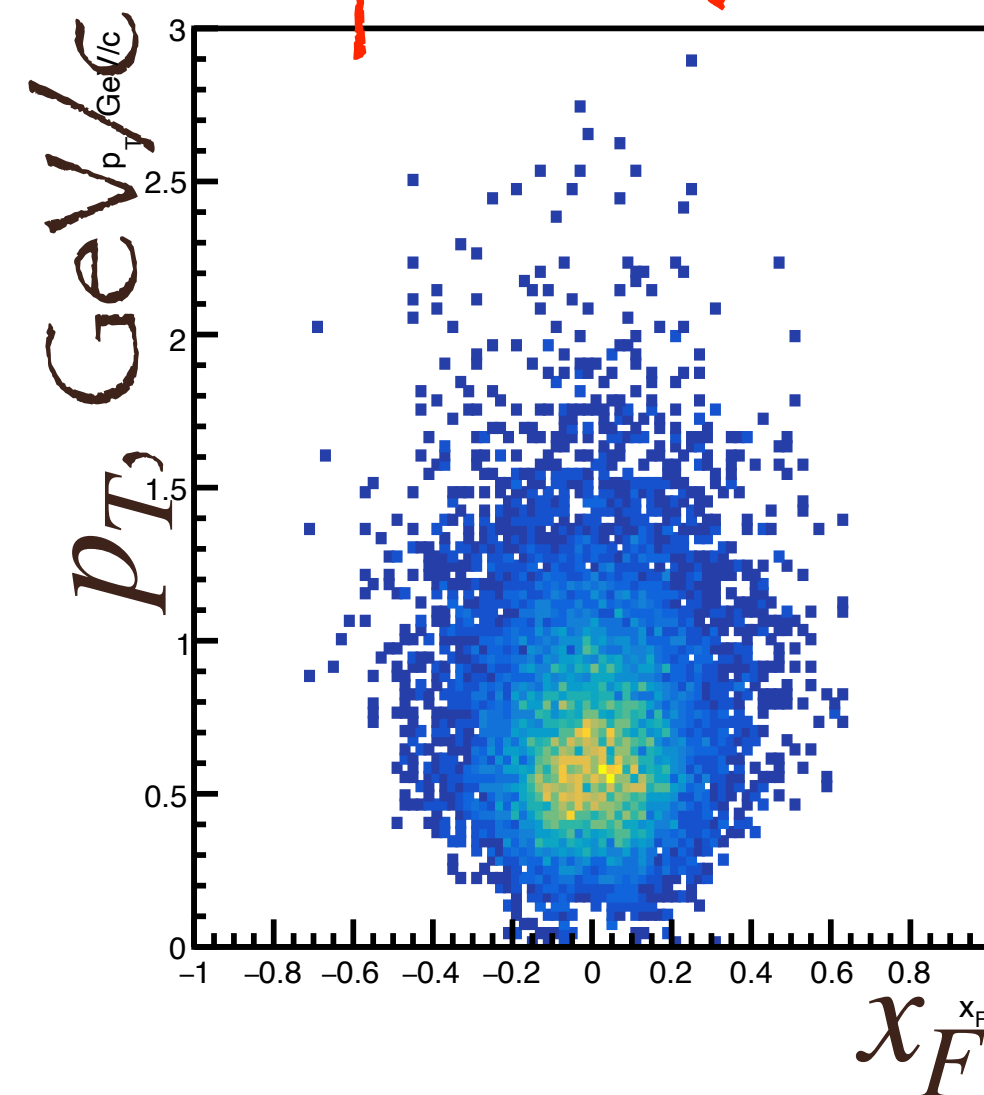
$$\phi \rightarrow K^+ + K^-$$

Generated

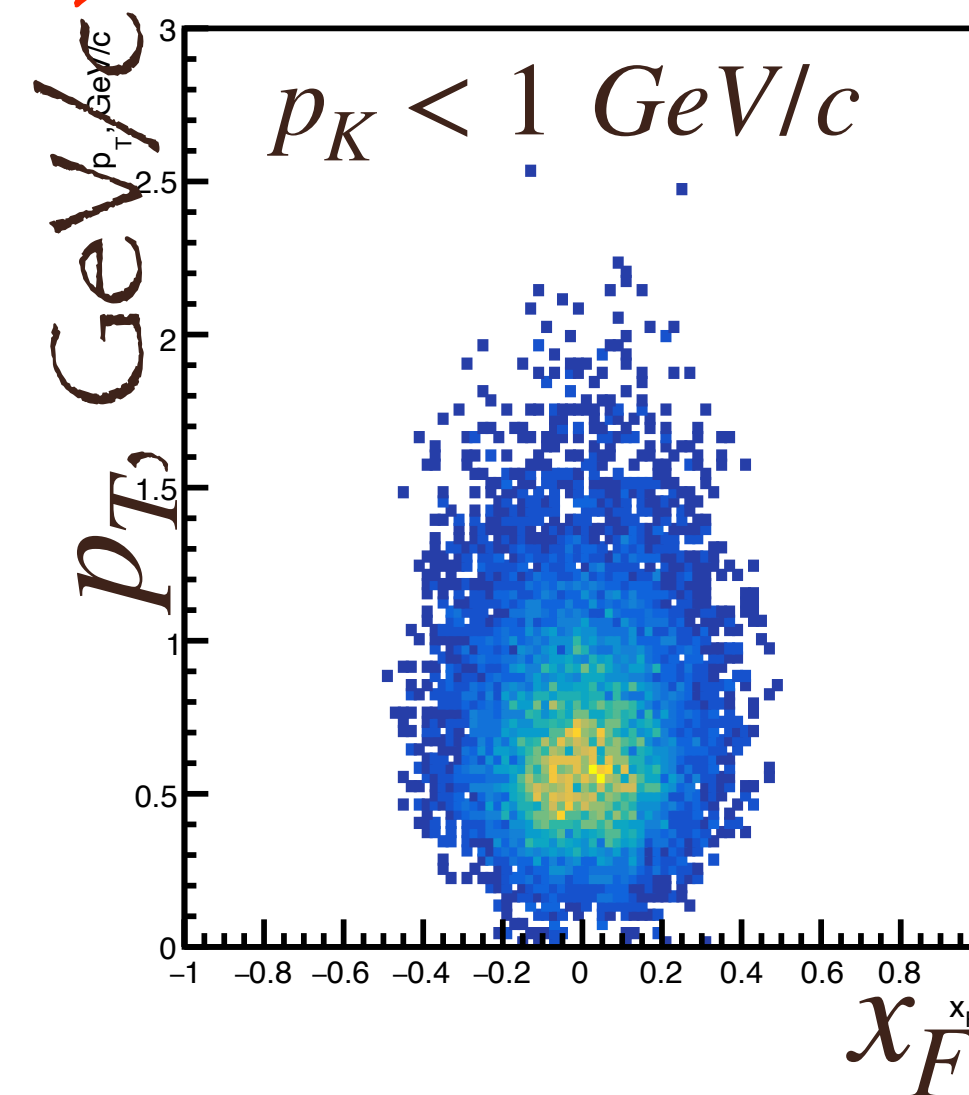


Generated

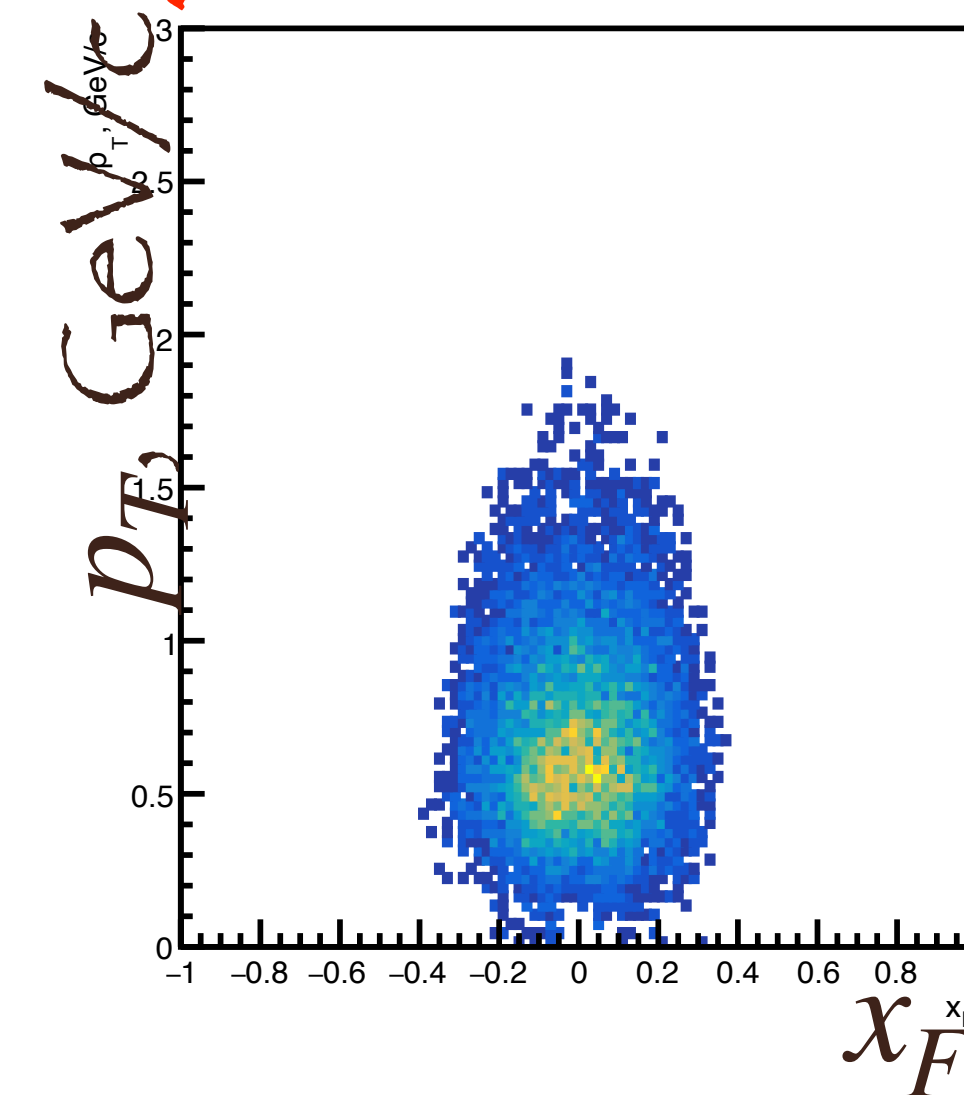
Accepted (40.5 %) PID with STRAW (36.7 % / 34.2 %)



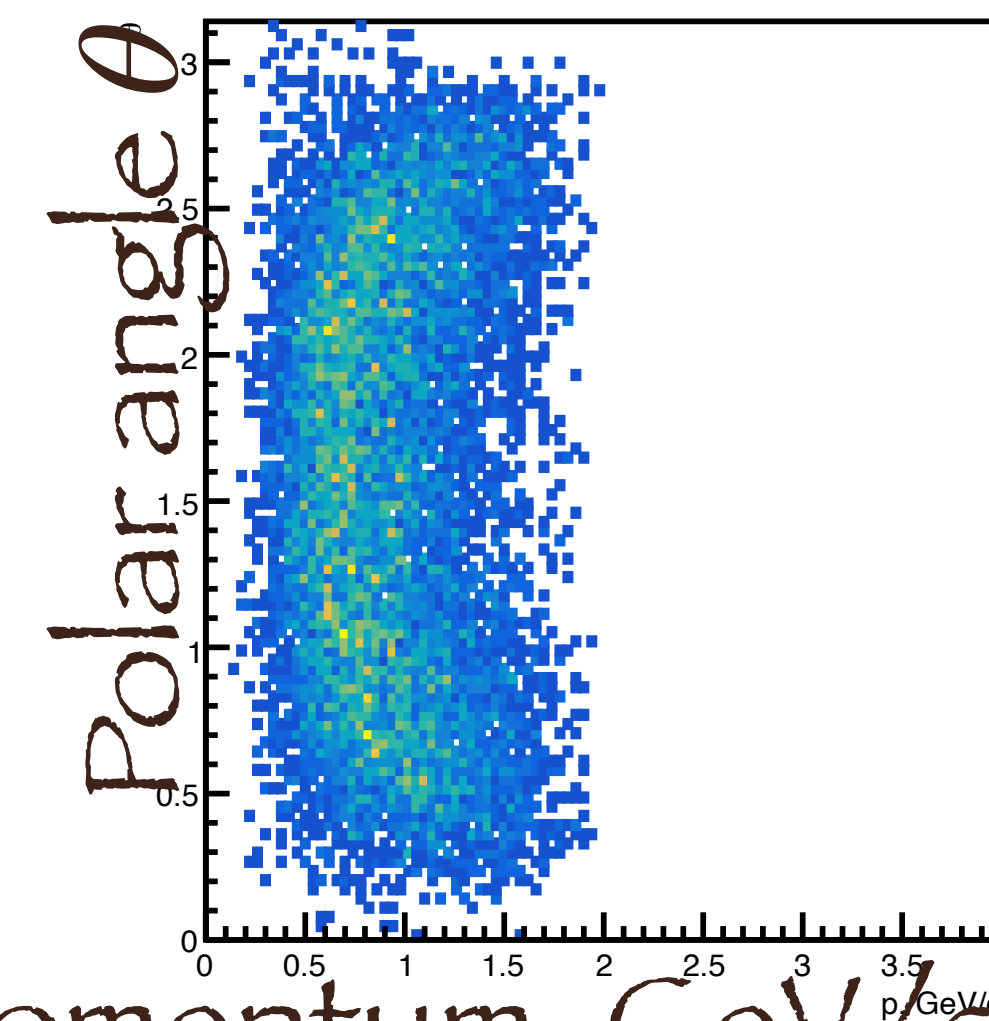
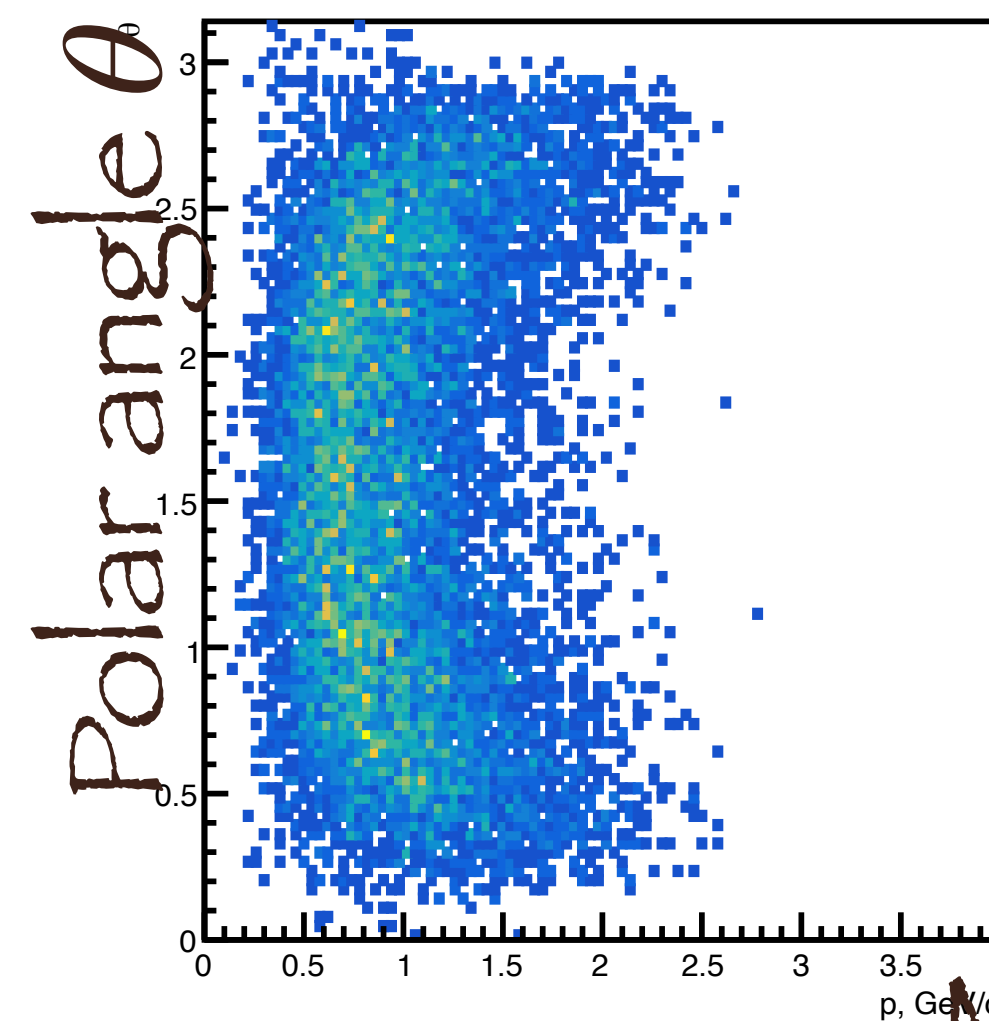
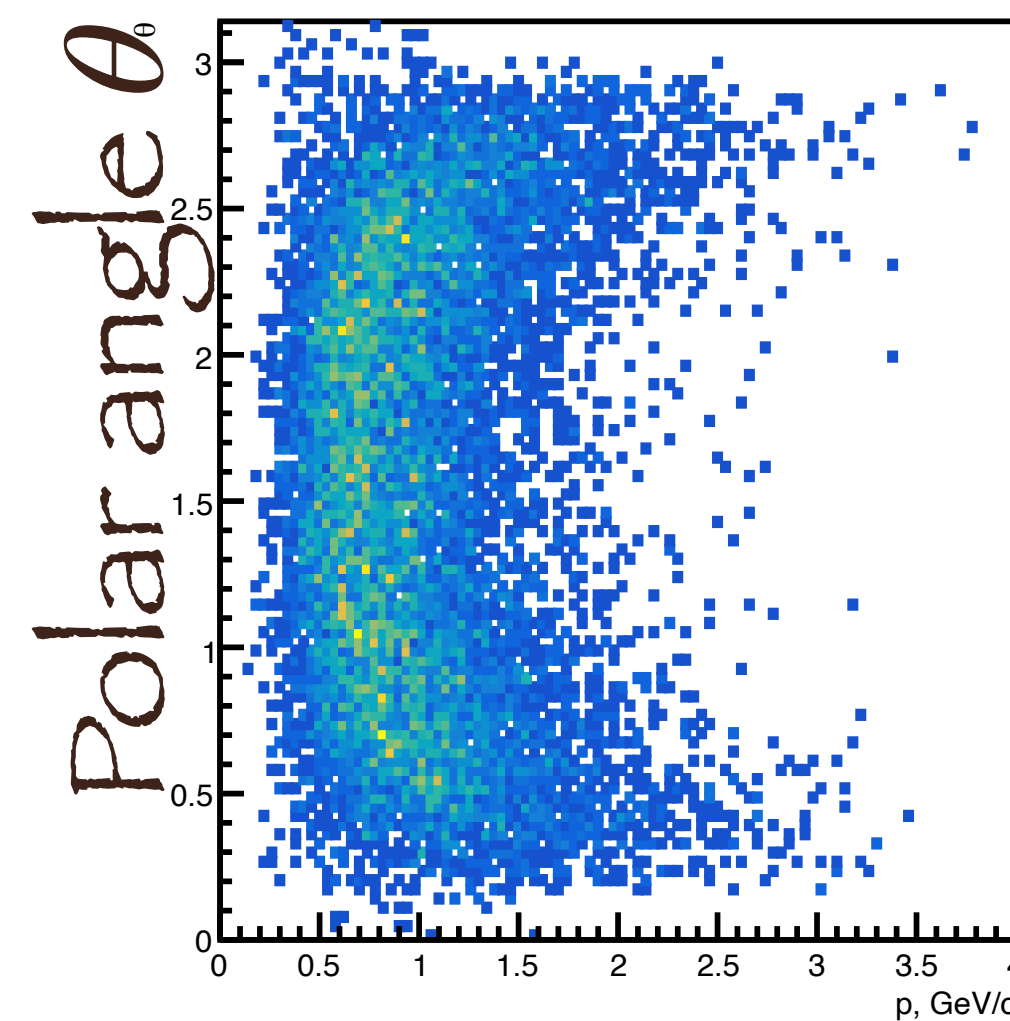
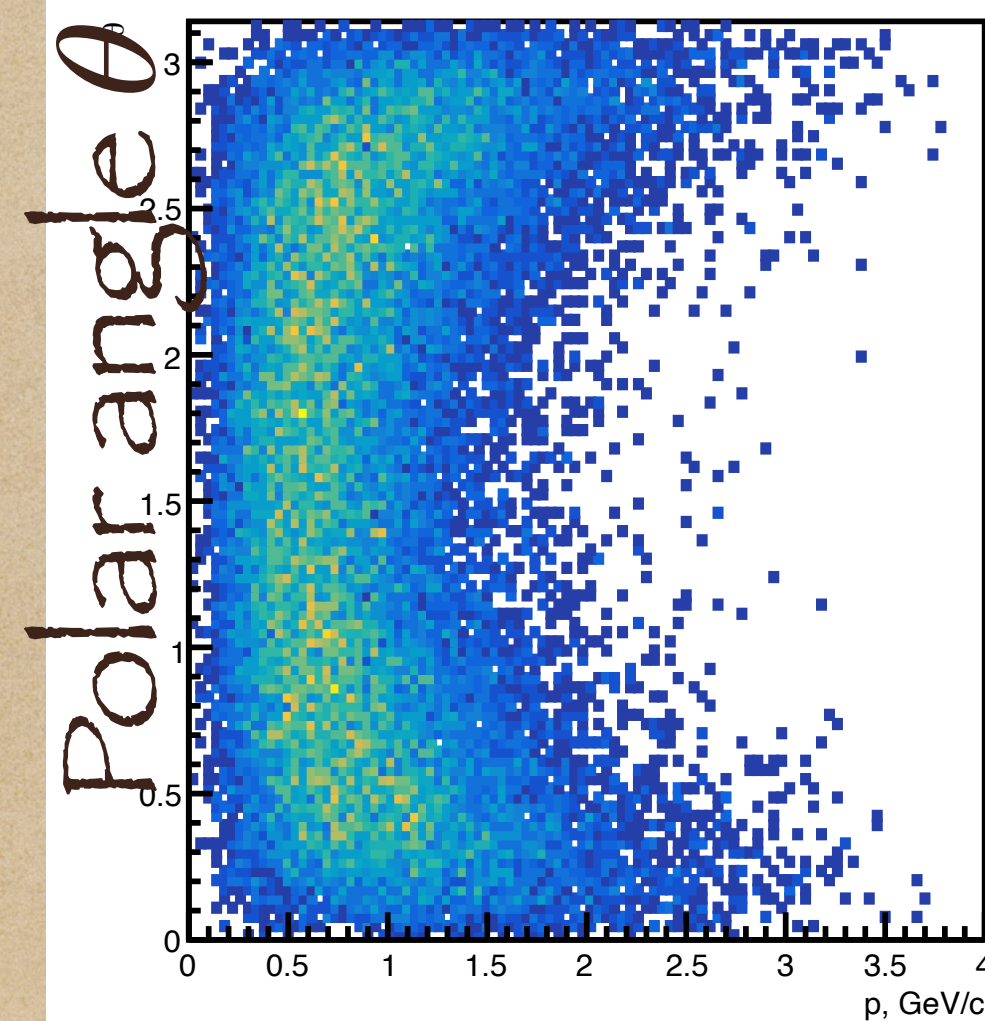
Accepted



1 PID

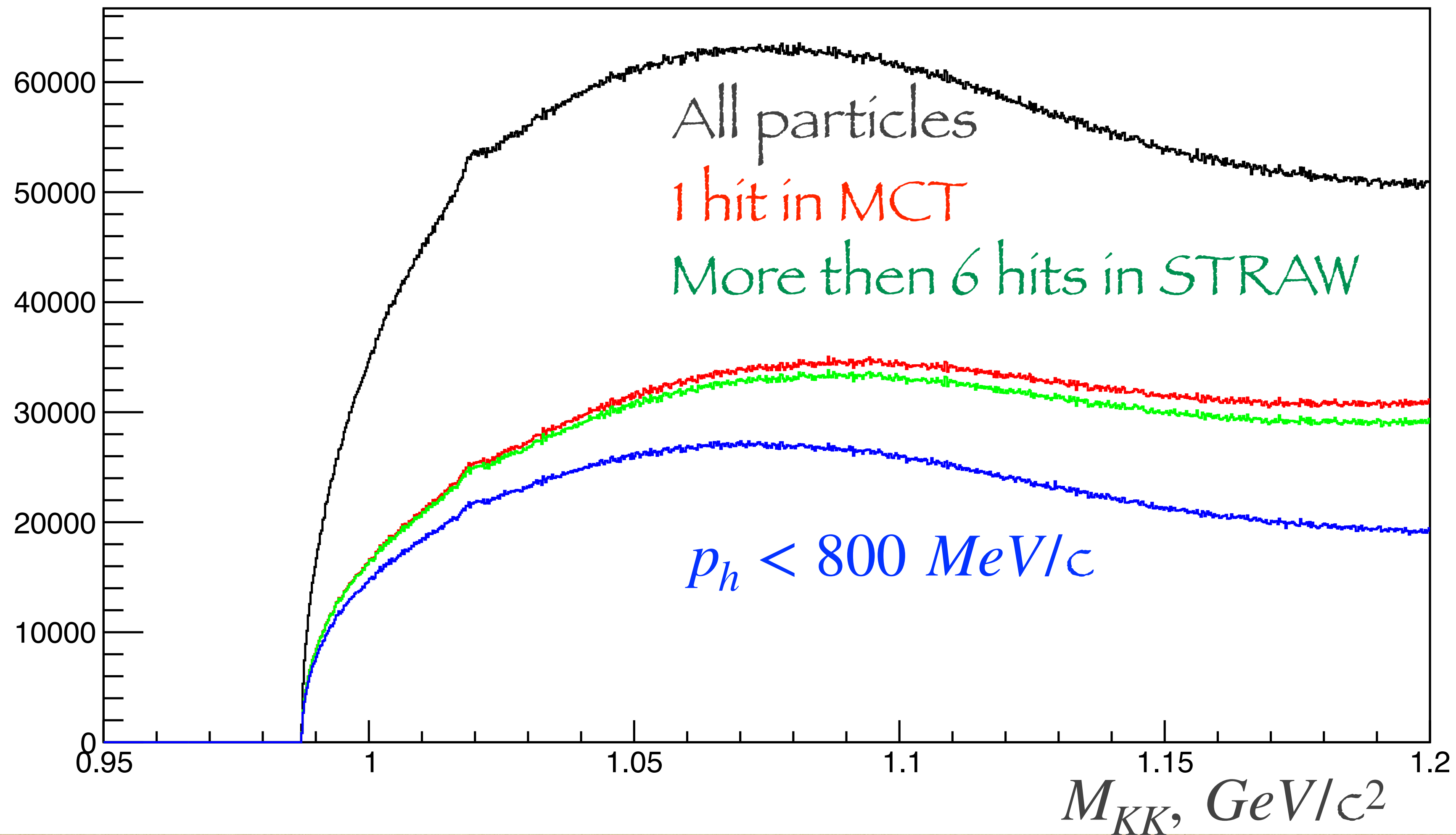


2 PID



Momentum, GeV/c

K^+K^- invariant mass



K^+K^- invariant mass

$p > 0.15 \text{ GeV}/c$

