

Particle Identification using dE/dx in Straw Tracker of SPD

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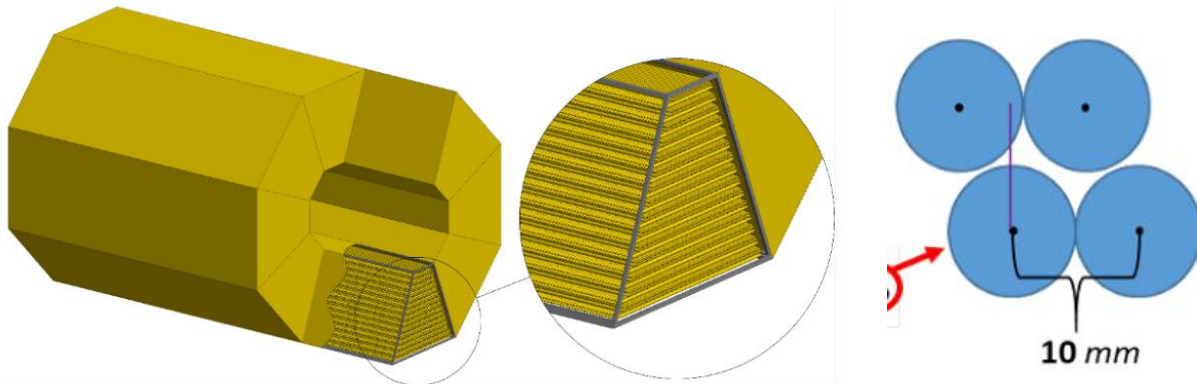
SPD Physics and MC meeting
02.12.2020

Introduction

PID using dE/dx :

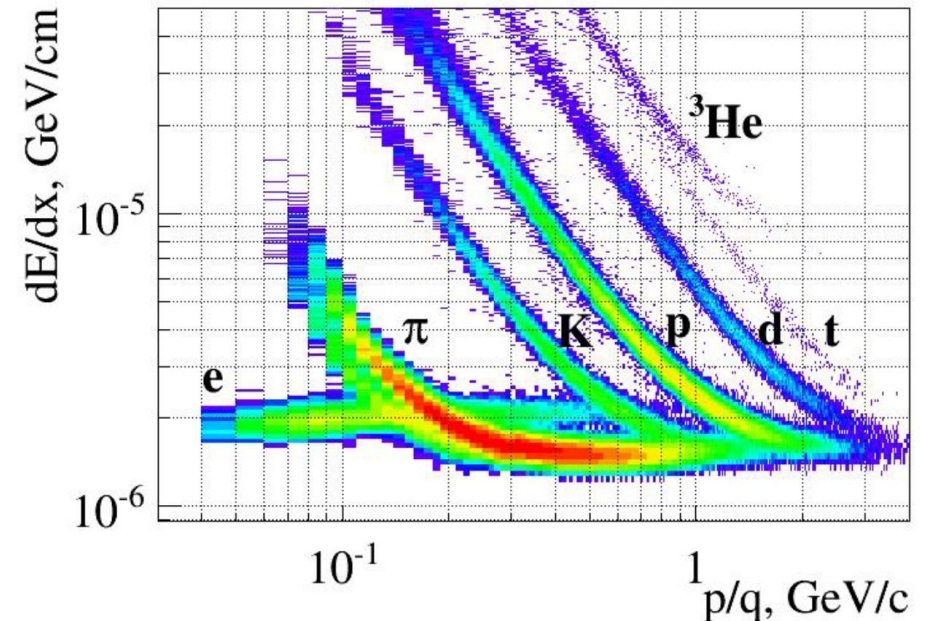
Different particle types, same momenta
→ different $\beta\gamma$ → different dE/dx (Bethe-Bloch)

SPD Straw Tracker:



allows to measure dE/dx for each hit (for each straw)

Preliminary goal of the exercise:



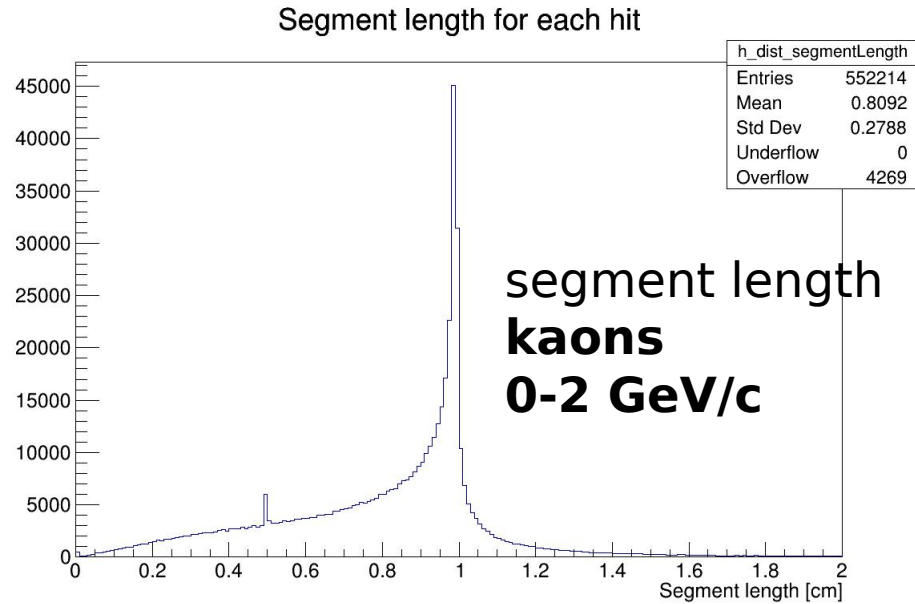
taken from MPD TDR

<http://mpd.jinr.ru/wp-content/uploads/2019/01/TpcTdr-v07.pdf>

Setup

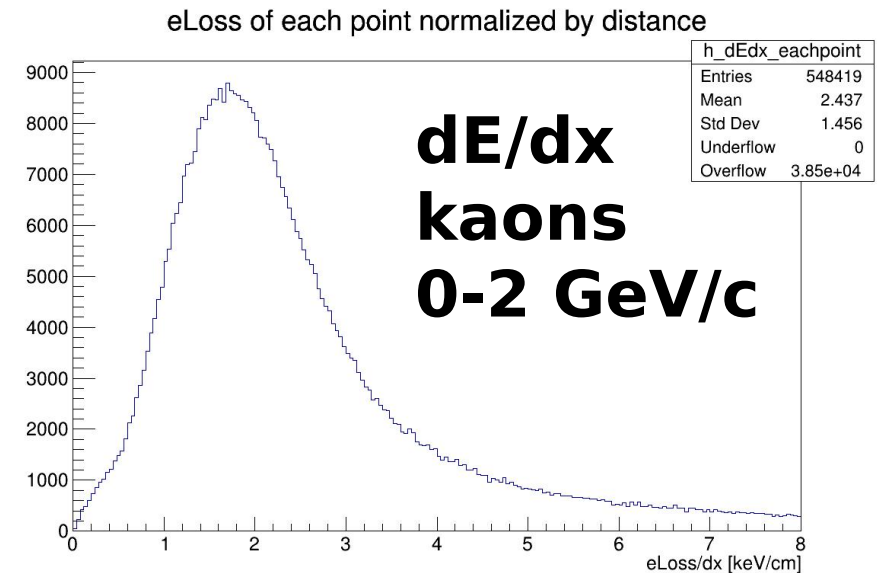
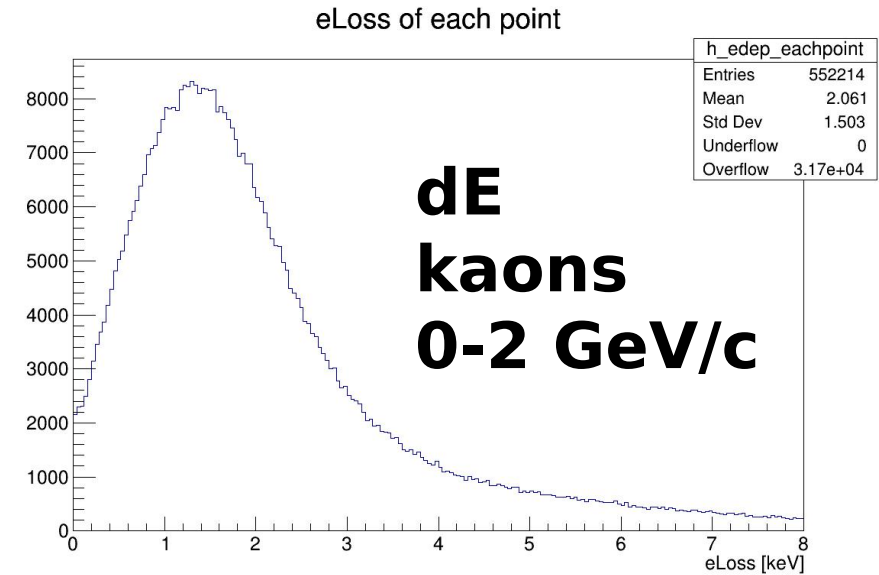
- **Particle types:** K, π , ρ , e: $\sim 10\text{k}$ each
- **One particle per event**
- **Momenta:** 0-2, 0-10 GeV/c
- **Vertex** or origin: (0,0,1) cm
- **Polar angle:** 89°
- **Azimuthal angle:** 1°

Calculating dE/dx

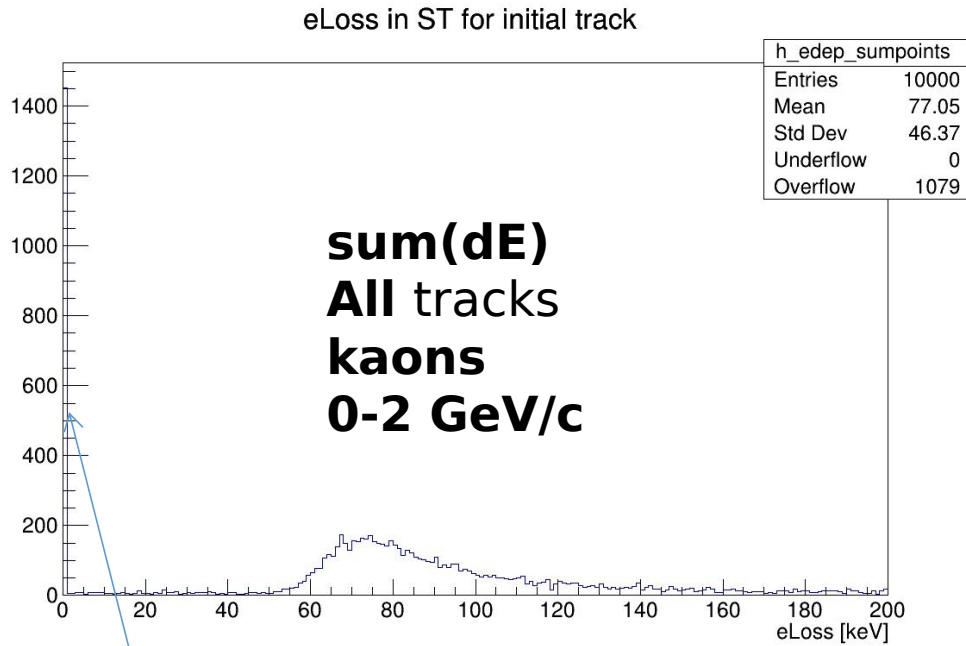


Segment = (exit-entry) for each straw

For each hit, $dE/dx =$
(deposited energy)/(segment length)



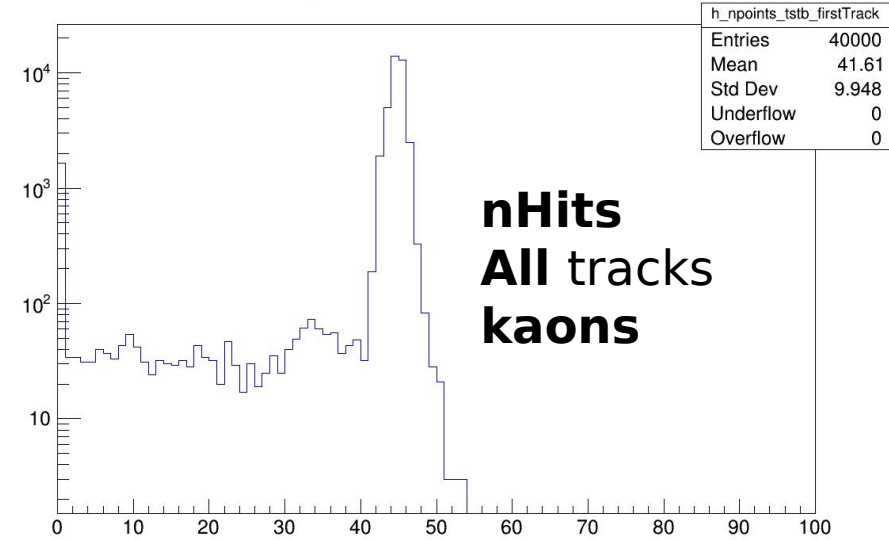
Additional selection criteria



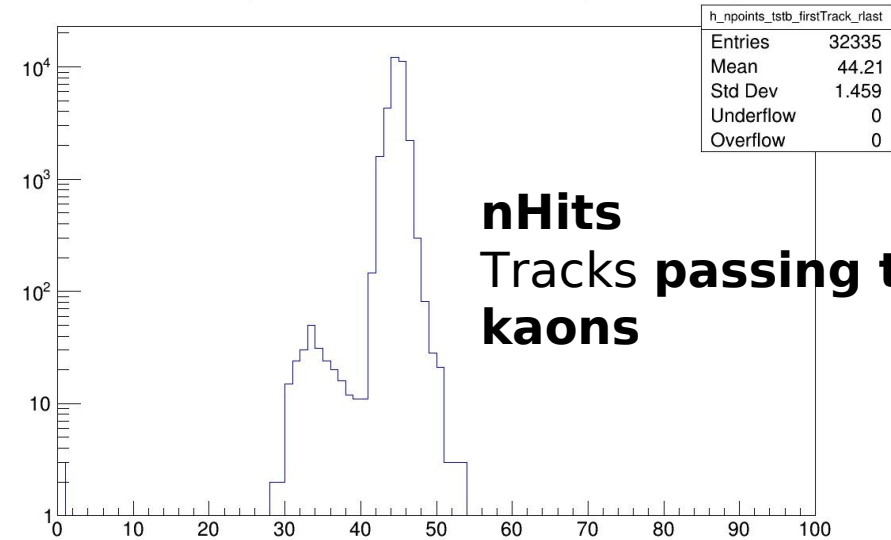
If particle decayed before straw → skip the event

Requirement: track decay position outside outer TS dimensions

Number of points in TsTB from initial track



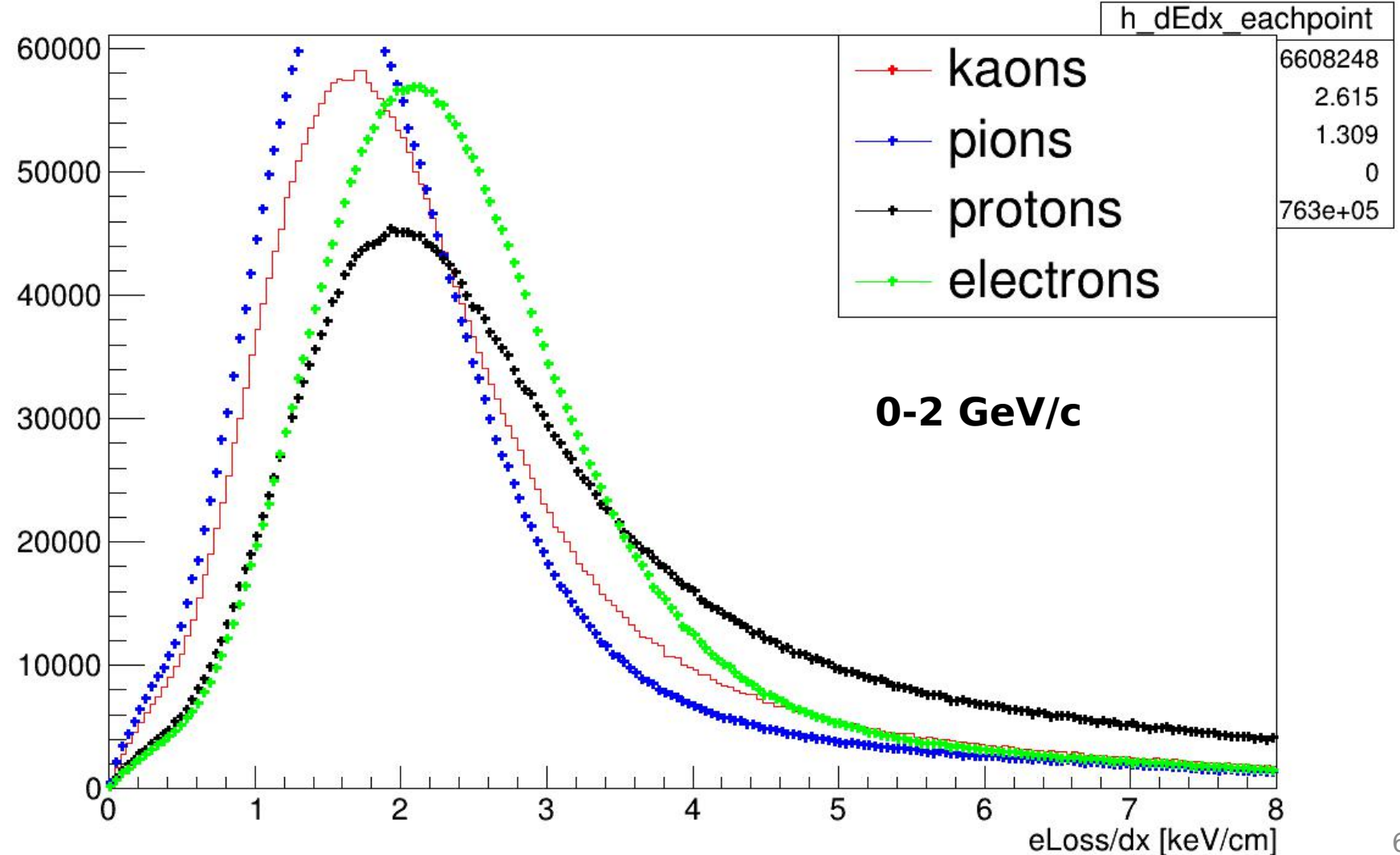
Number of points in TsTB from initial track (Rlast > 90 cm)



dE/dx distributions

eLoss of each point normalized by distance from initial track

**dE/dx for hits
of initial particle:**
energy loss for
each point (straw)
normalized to
distance



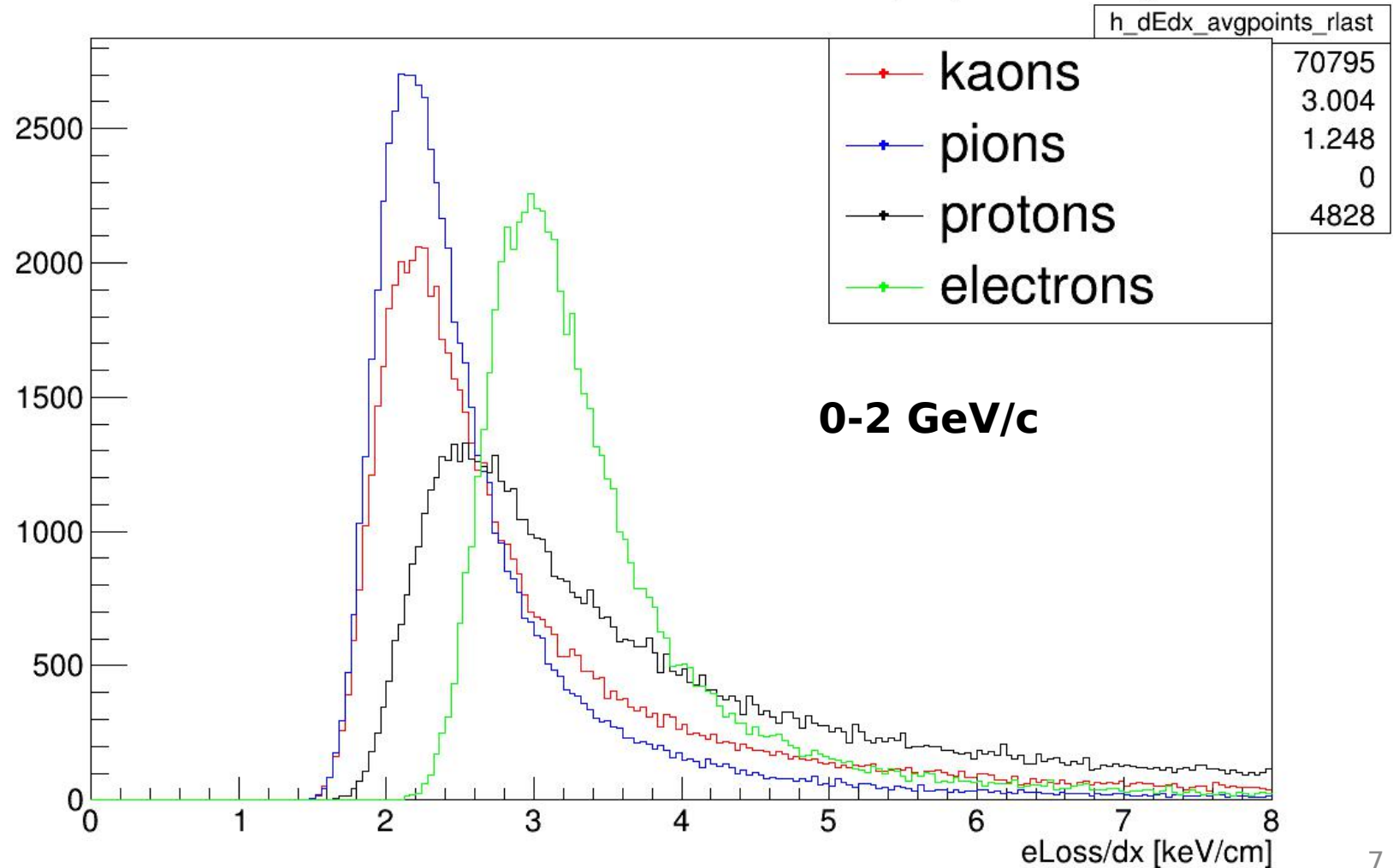
Mean dE/dx in **all** hits

Mean dE/dx for hits of initial particle:

Mean dE/dx in straws (only corresponding to the initial particle)

Only tracks passing all straw layers are considered

mean dE/dx in all hits from initial track, if (Rlast > 90)

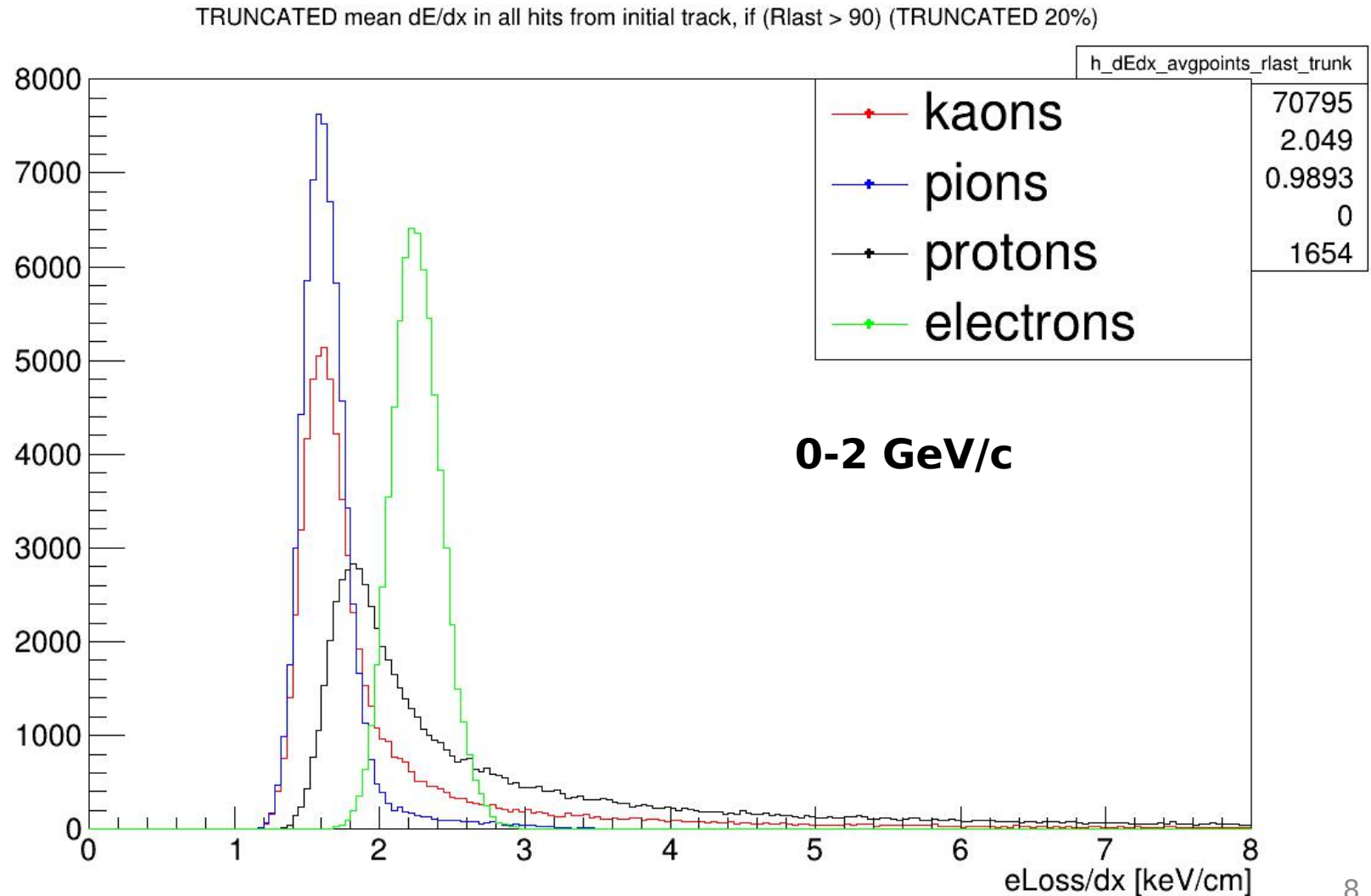


Truncated mean dE/dx in **all** hits

Truncated mean dE/dx for hits of initial particle:

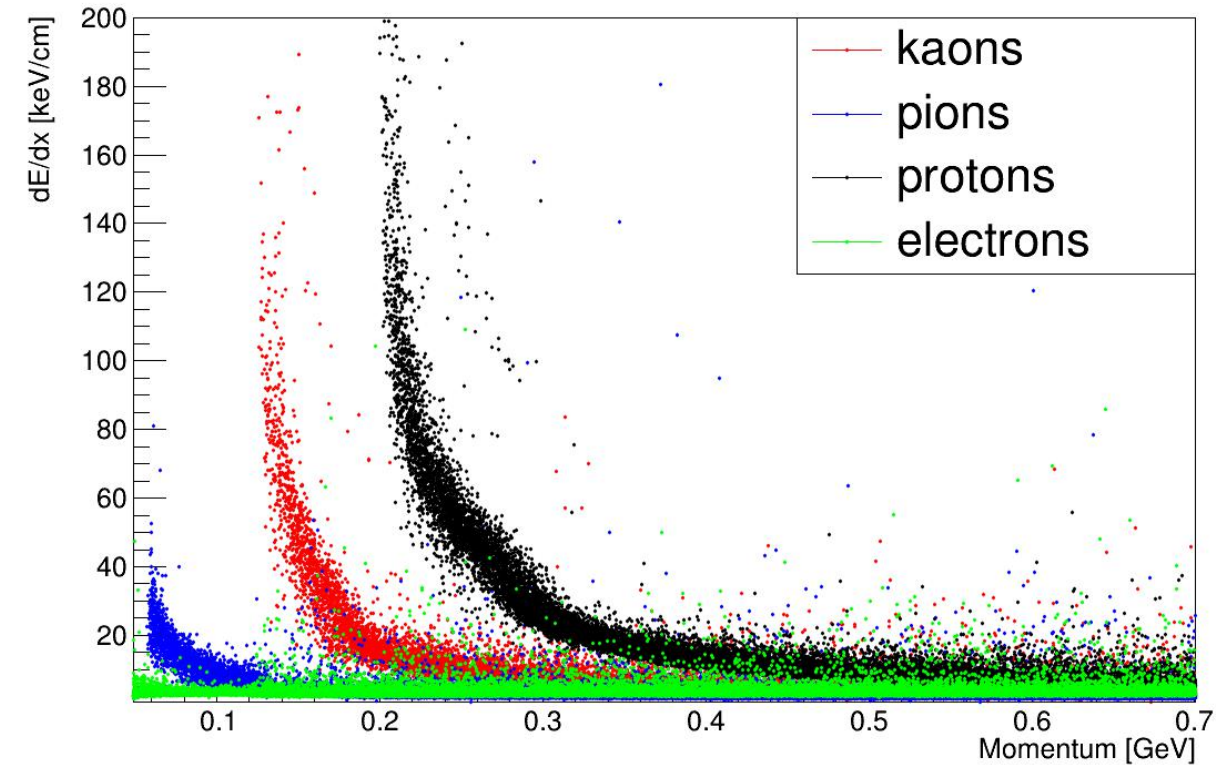
Only tracks passing all straw layers are considered

Truncated mean: 20% of large values are rejected

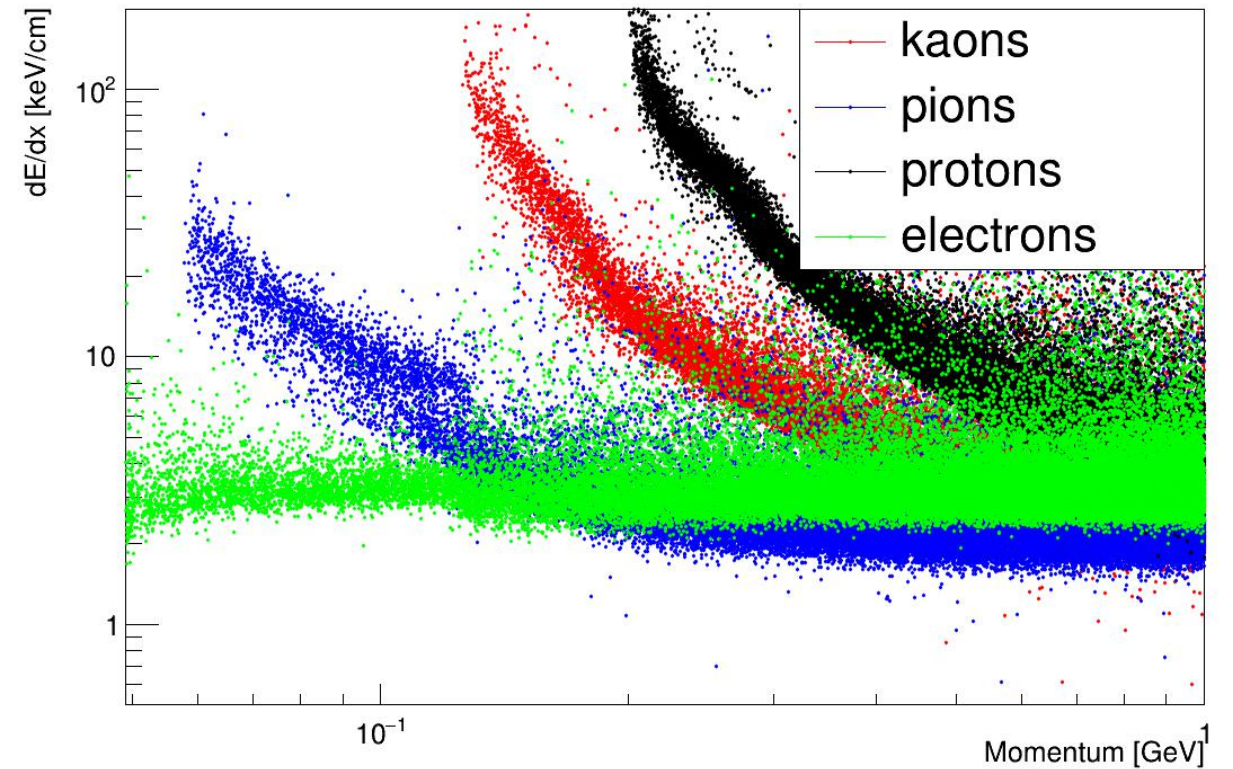


dE/dx separation (mean of all hits)

dE/dx vs initial track momentum

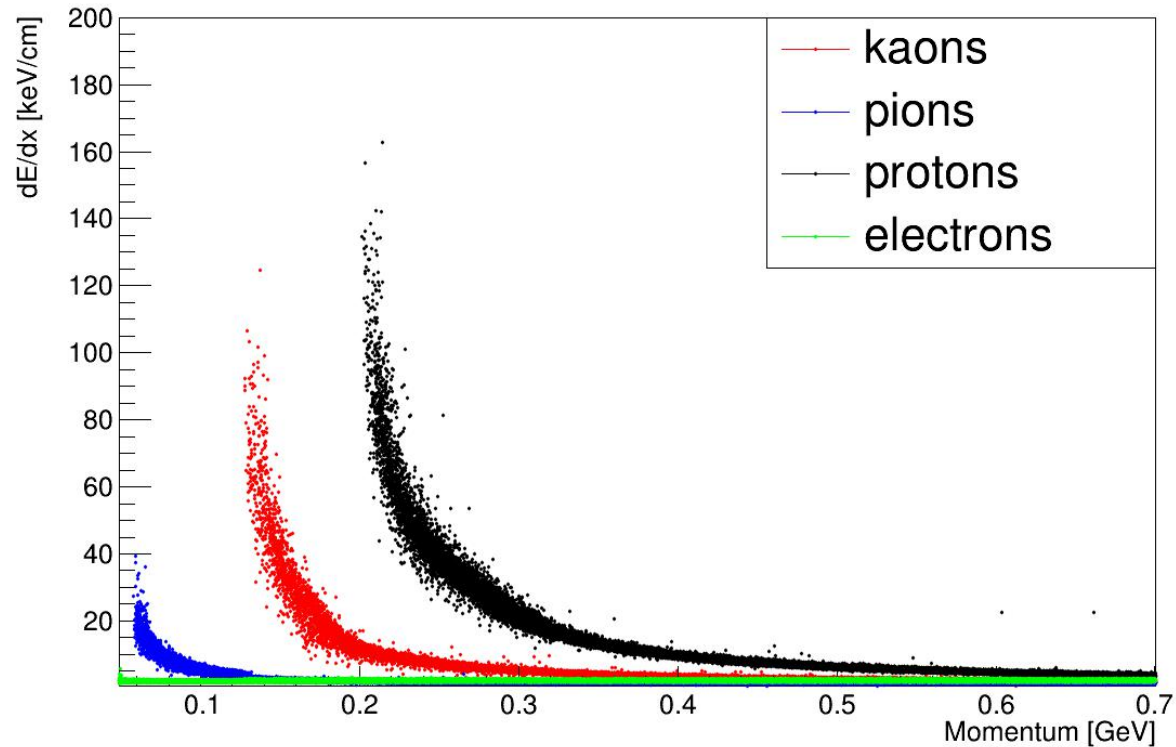


dE/dx vs initial track momentum

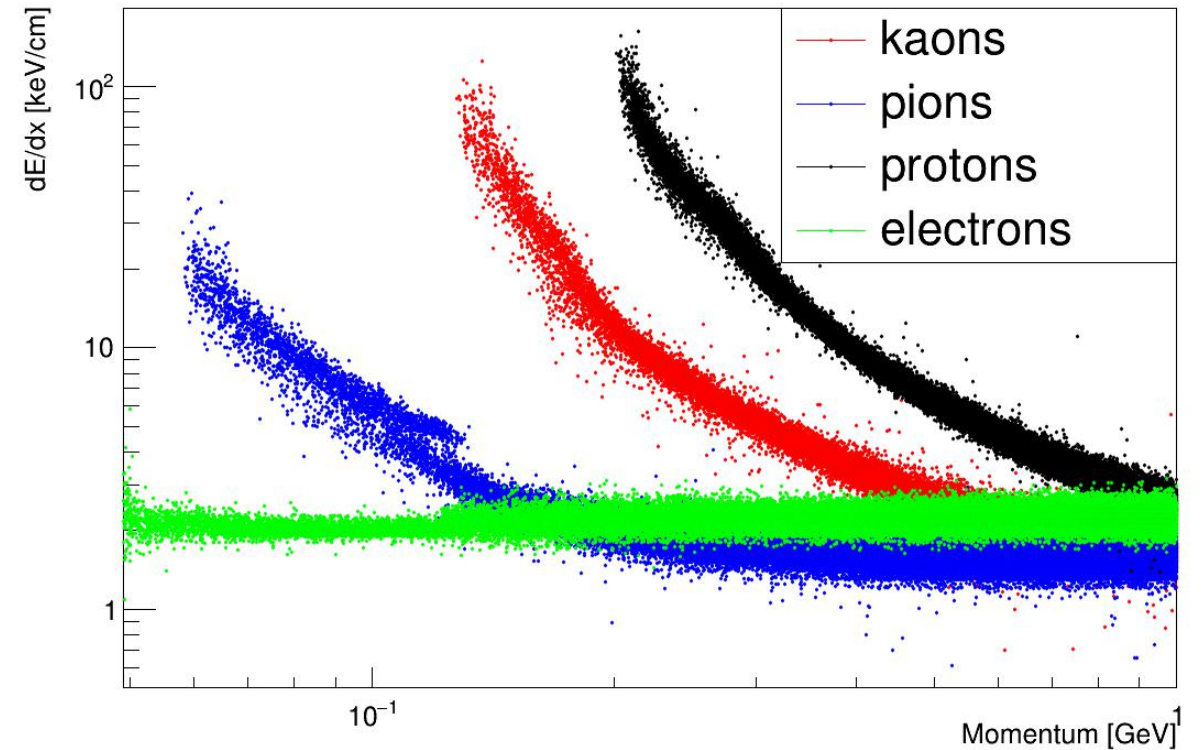


dE/dx separation (truncated mean)

dE/dx vs initial track momentum (TRUNCATED 20%)



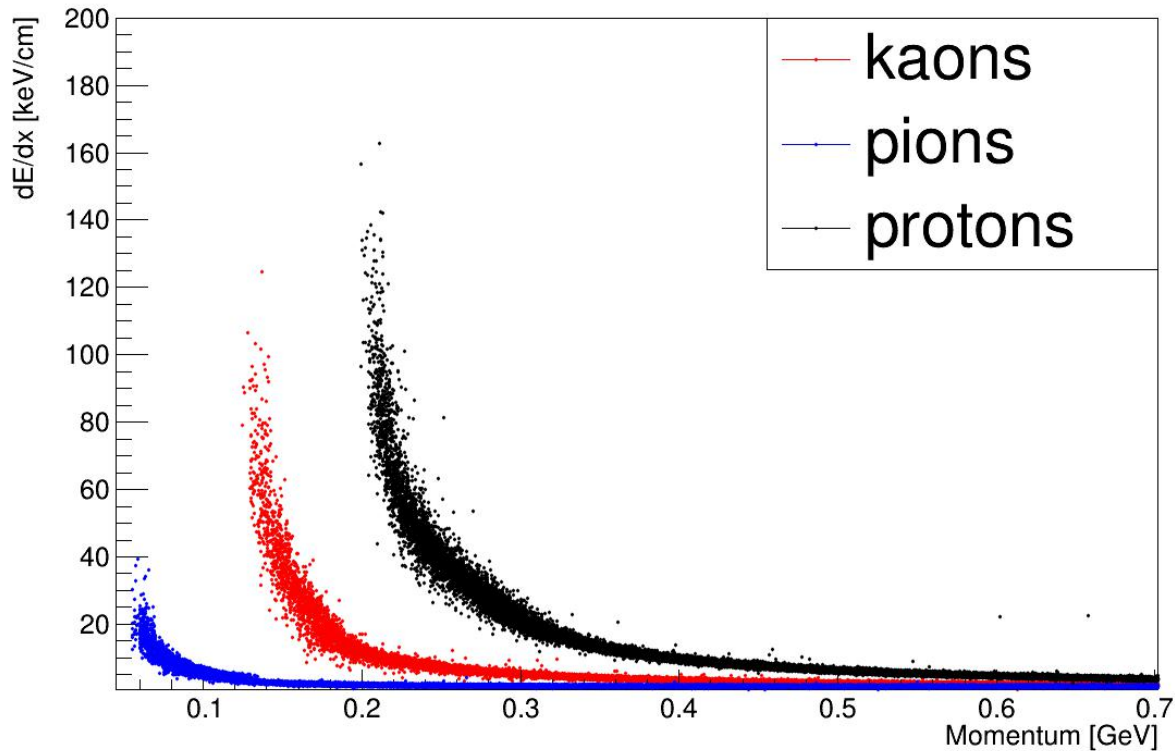
dE/dx vs initial track momentum (TRUNCATED 20%)



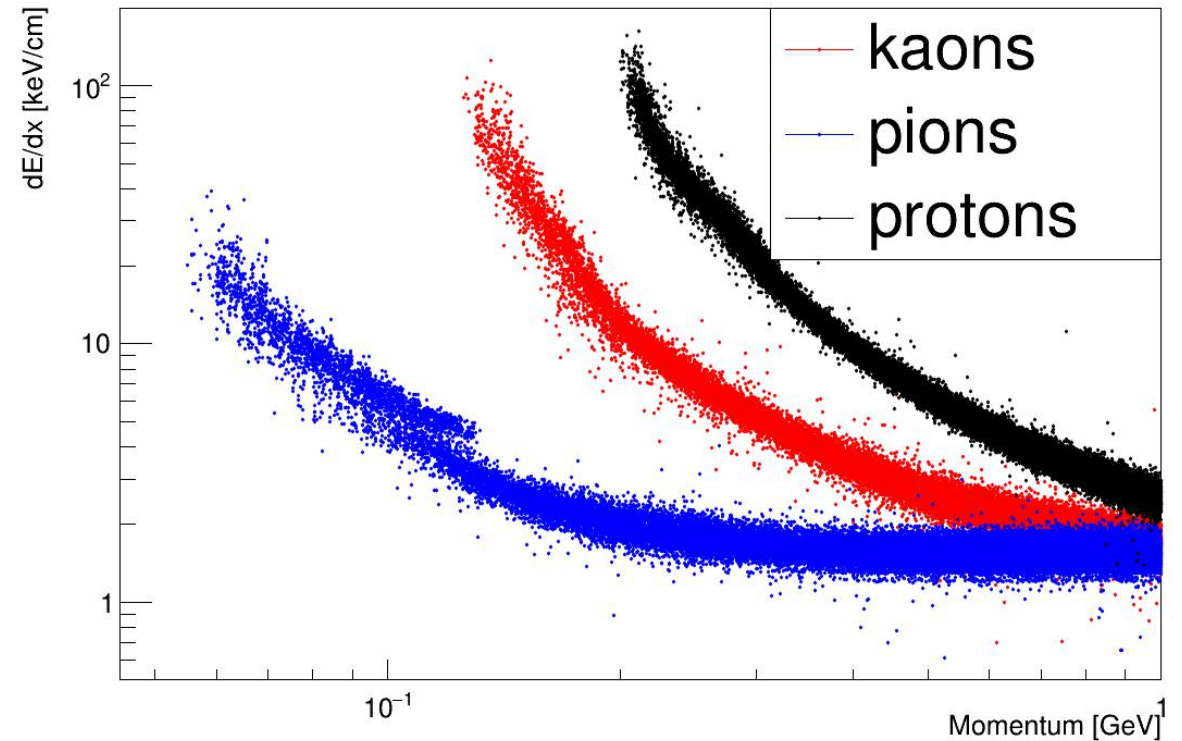
dE/dx separation (truncated mean)

(same as before, but without electrons)

dE/dx vs initial track momentum (TRUNCATED 20%)

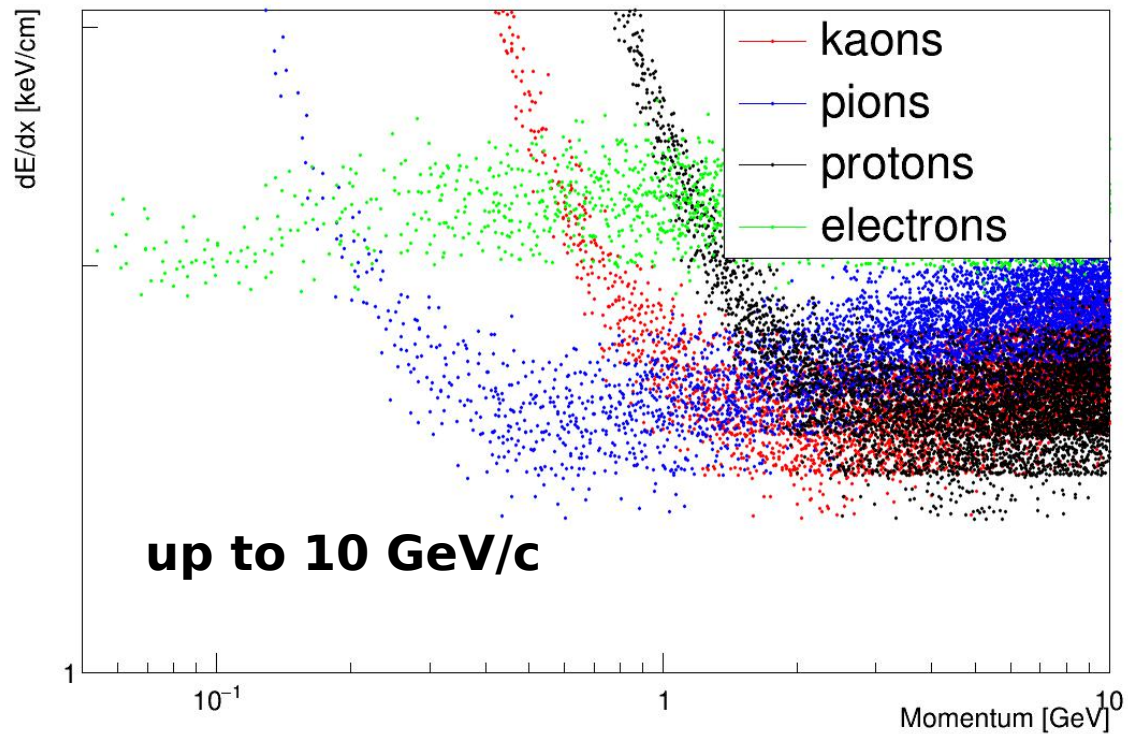


dE/dx vs initial track momentum (TRUNCATED 20%)

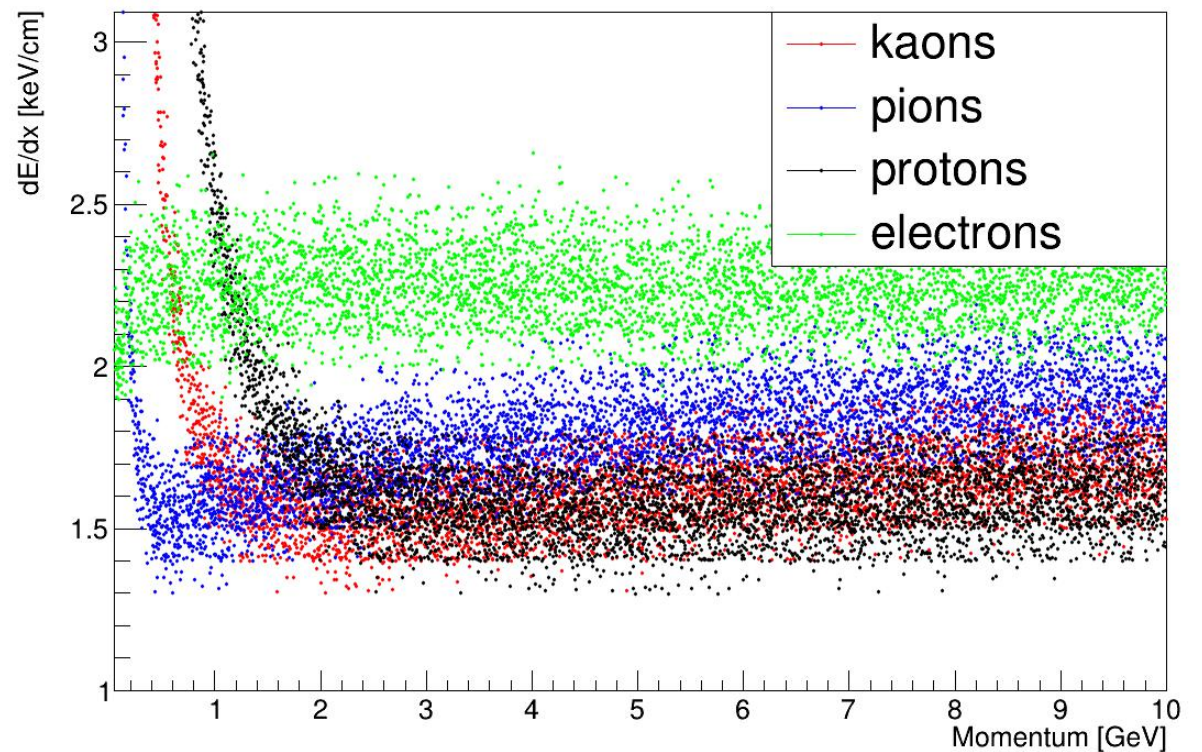


dE/dx separation (truncated mean)

dE/dx vs initial track momentum (TRUNCATED 20%)

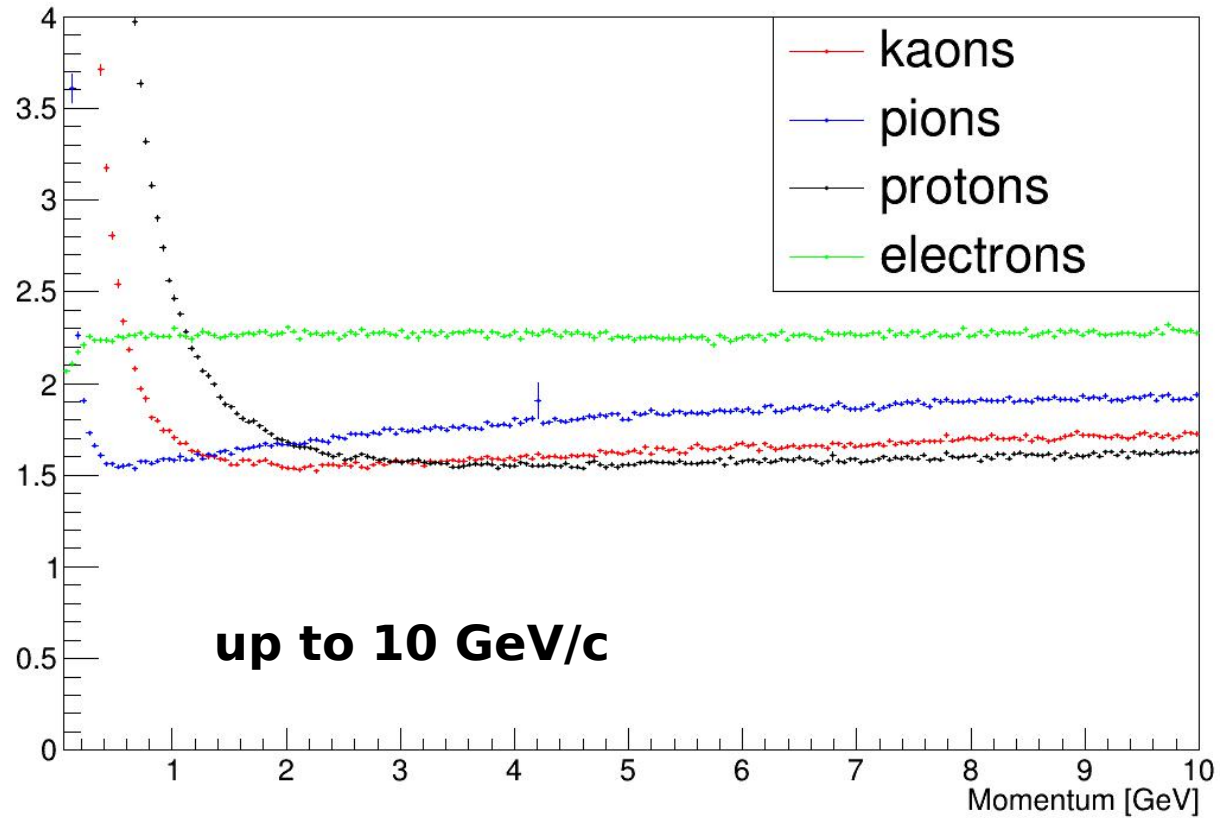


dE/dx vs initial track momentum (TRUNCATED 20%)



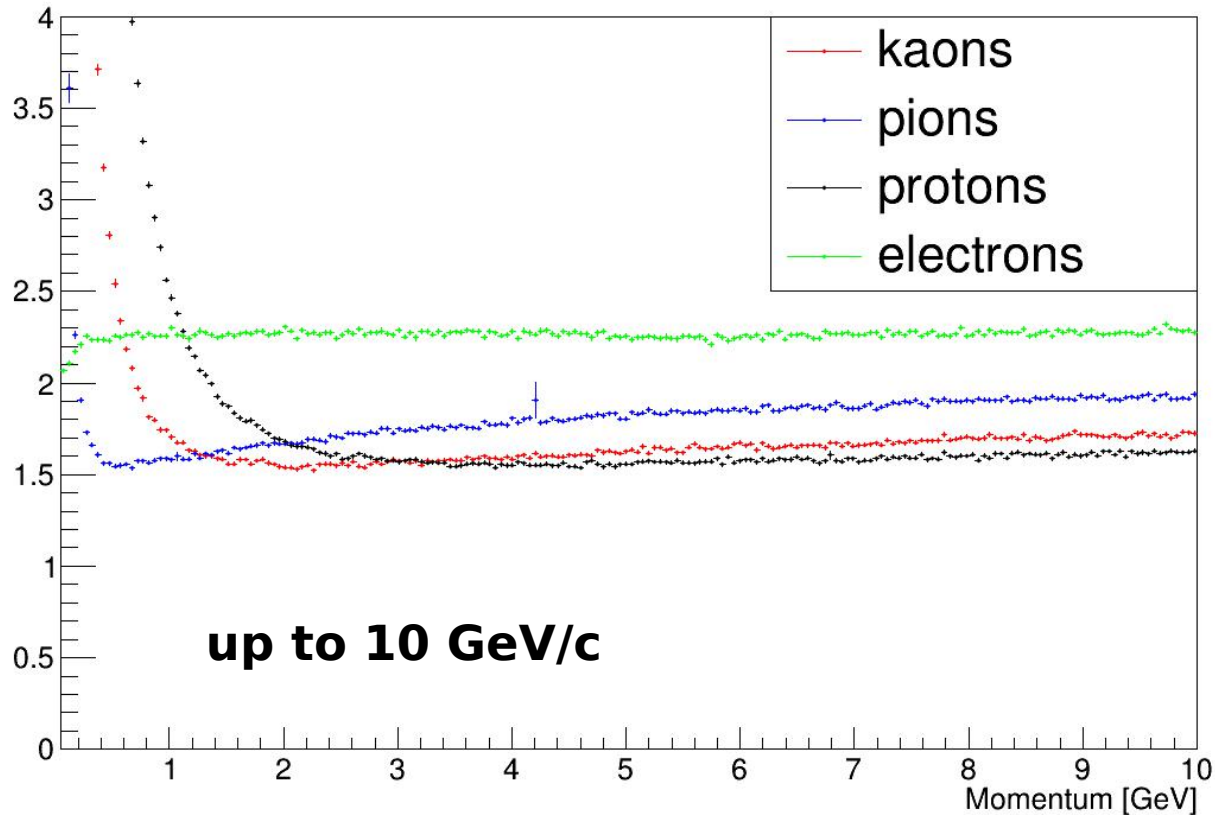
dE/dx separation (truncated mean)

dE/dx vs initial track momentum (TRUNCATED 20%)



dE/dx separation (truncated mean)

dE/dx vs initial track momentum (TRUNCATED 20%)



Seemingly good K/ π separation up to ~ 0.5 GeV/c
and K/p separation up to ~ 1 GeV/c

**Any further
suggestions?**