

# Measurement of $dE/dX$ for Geant4 simulation of straw-detector at interaction with $\mu^+$

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# Previous discussion

- Use of dEdX method for PID
- Primaries:  $\mu^+$ ,  $\pi^+$
- ArCO<sub>2</sub> 70% - 30% 1 bar
- $\sigma/\text{MPV} \sim 20\%$
- Secondary:  $e^-$  (most),  $e^+$ , gamma
- 10000 events,
- Physics list: QGSP\_BERT, QBBC

# dedX Measurements – PRIMARY mu+

Different approach:

- Sum of all Edep in event

over sum of all L in event (black, magenta)

$$\frac{\sum_{n=0}^{nSteps} Edep}{\sum_{n=0}^{nSteps} L}$$

- Sum of all Edep/L (each step) in event

(green, red)

$$\sum_{n=0}^{nSteps} \frac{Edep}{L}$$

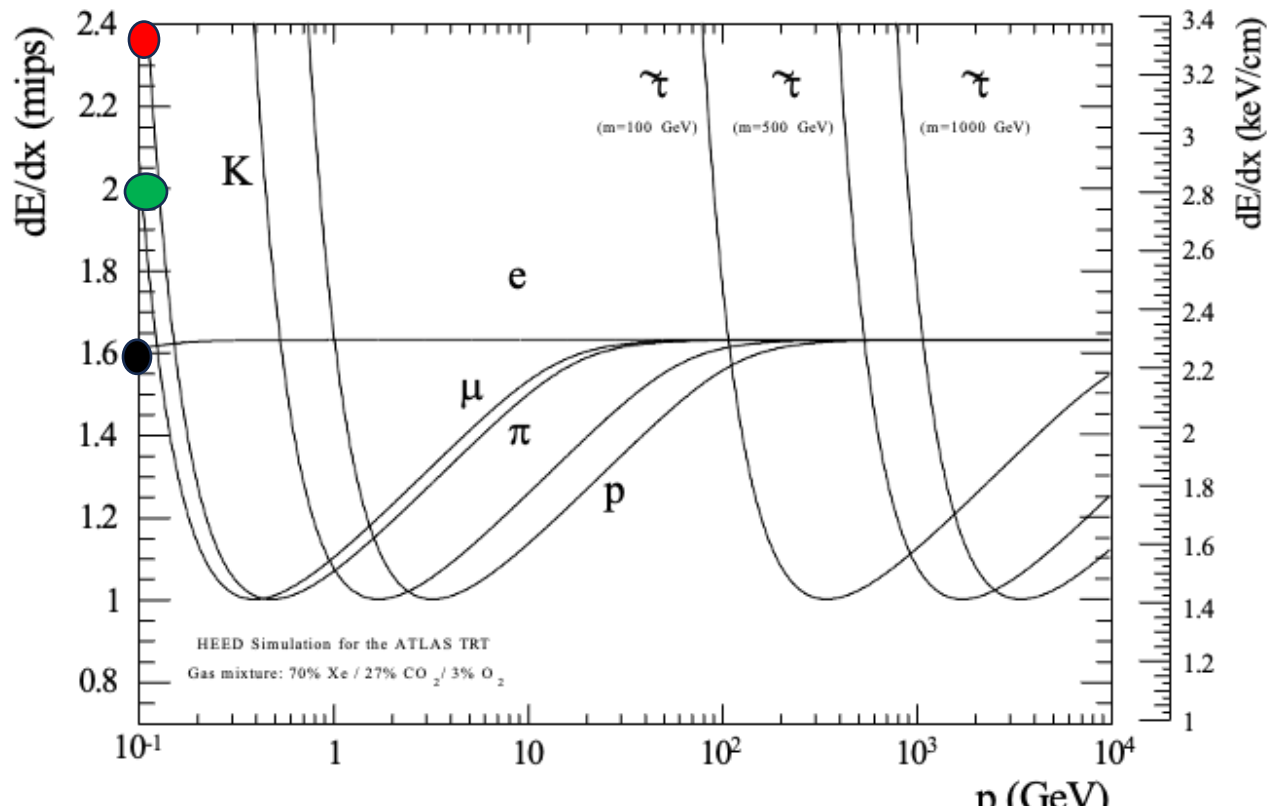
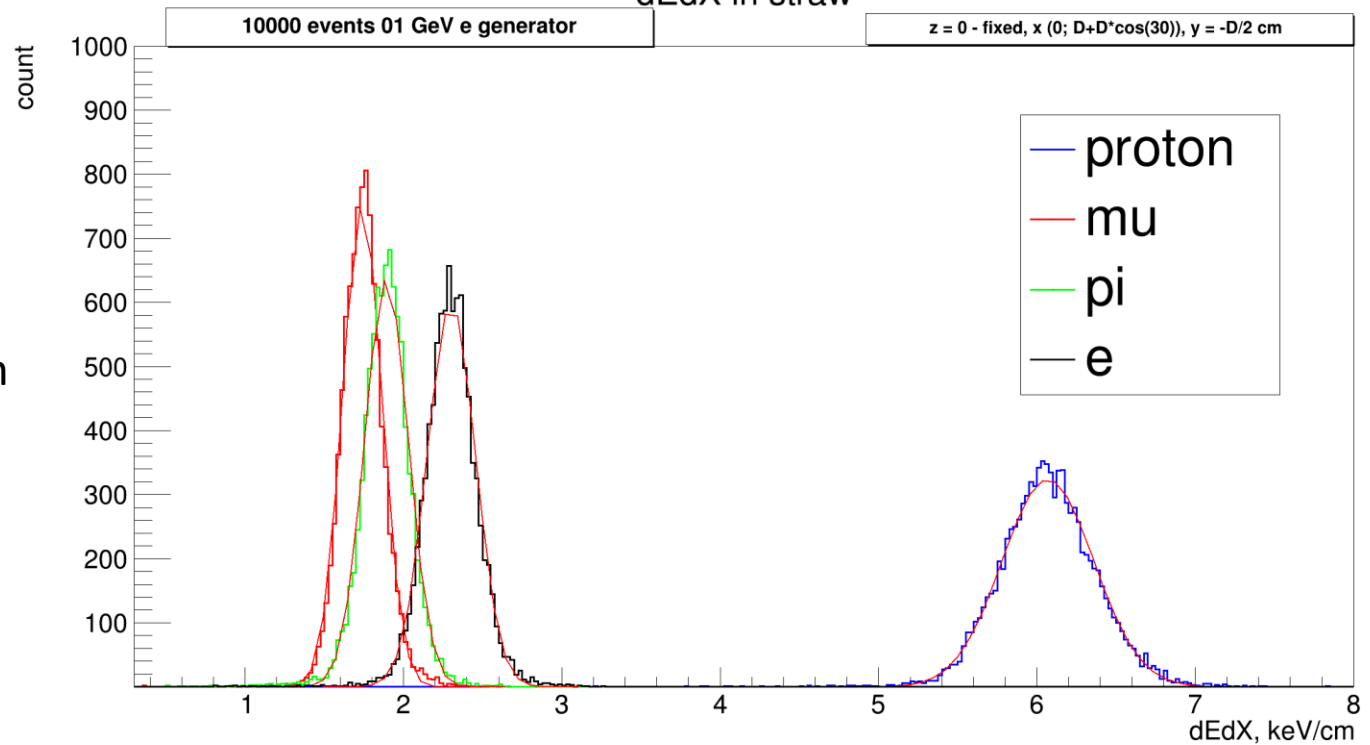
- Previous talk: use **max**/min cuts: 30% maximums of each event
- Best FWHM/MPV on 5 cuts

# dEdX in straw

## dEdX for 100 MeV

Differs from reference picture:

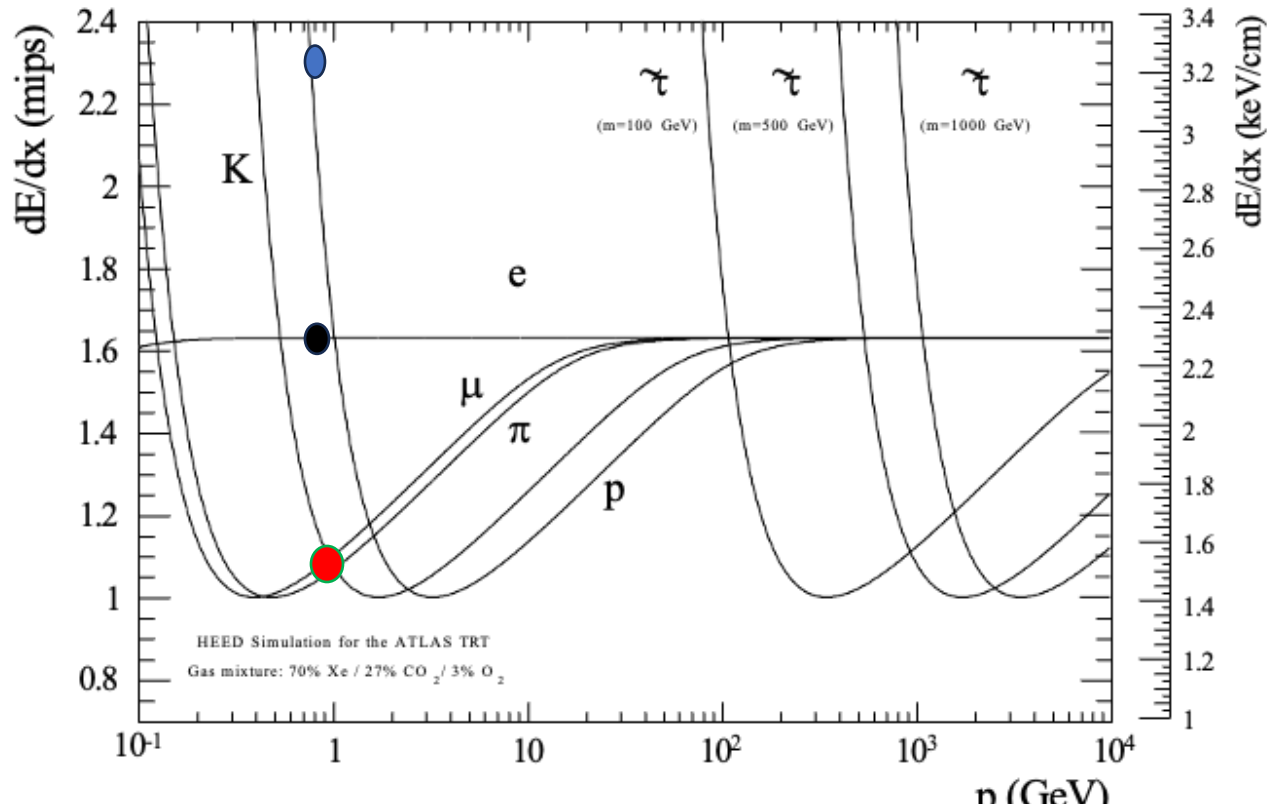
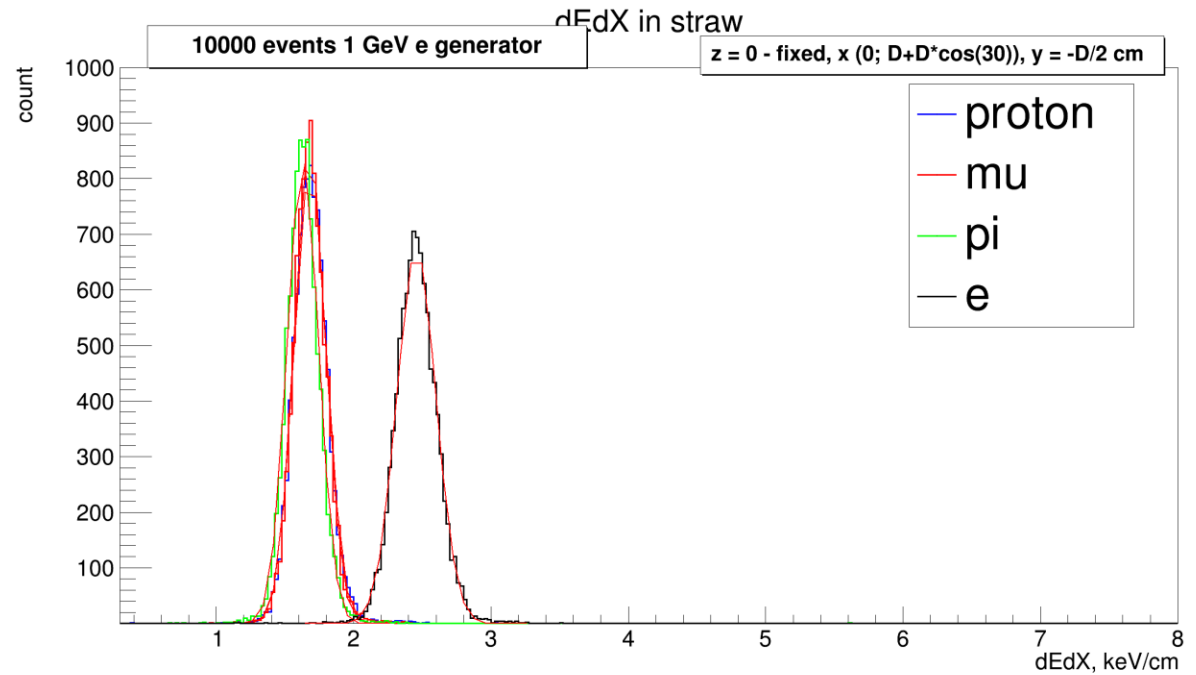
- Electrons 2.3 KeV/cm
- Mu+ 2.8 KeV/cm
- Pi+ 3.4 KeV/cm



## dEdX for 1 GeV

Differs from reference picture:

- Electrons 2.3 KeV/cm
- Mu+ 1.5 KeV/cm
- Pi+ 1.4 KeV/cm
- **Protons 3.2 KeV/cm**



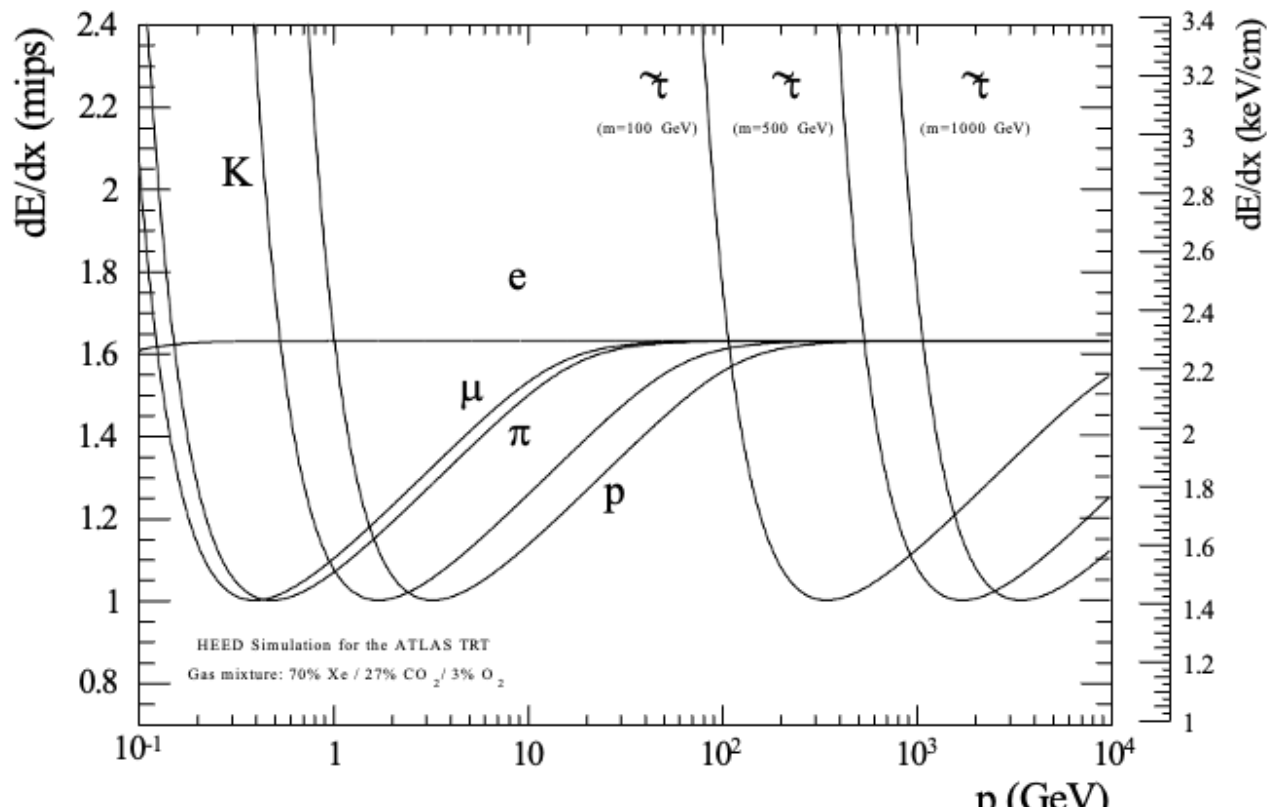
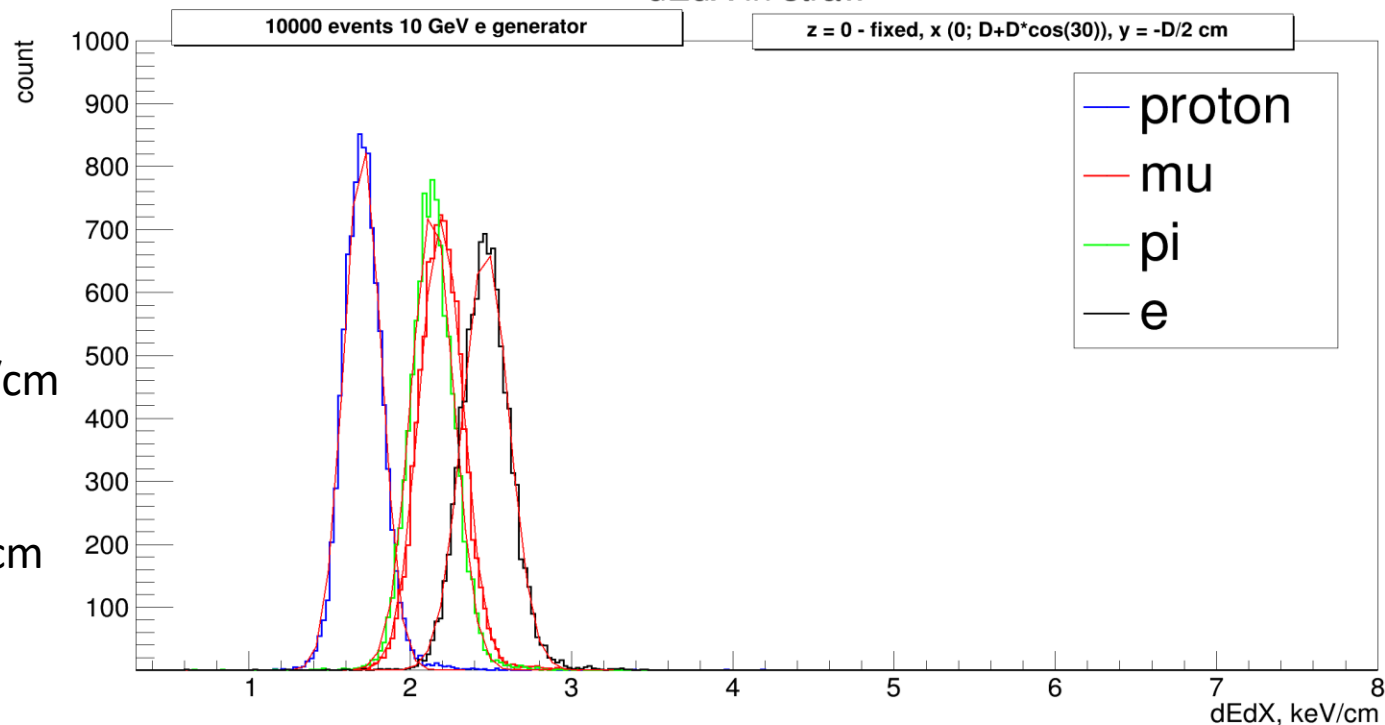


### dEdX for 10 GeV

Matches with reference picture:

- Electrons 2.3 KeV/cm
- Mu+ 2.1 KeV/cm
- Pi+ 2.1 KeV/cm
- Protons: 1.6 KeV/cm

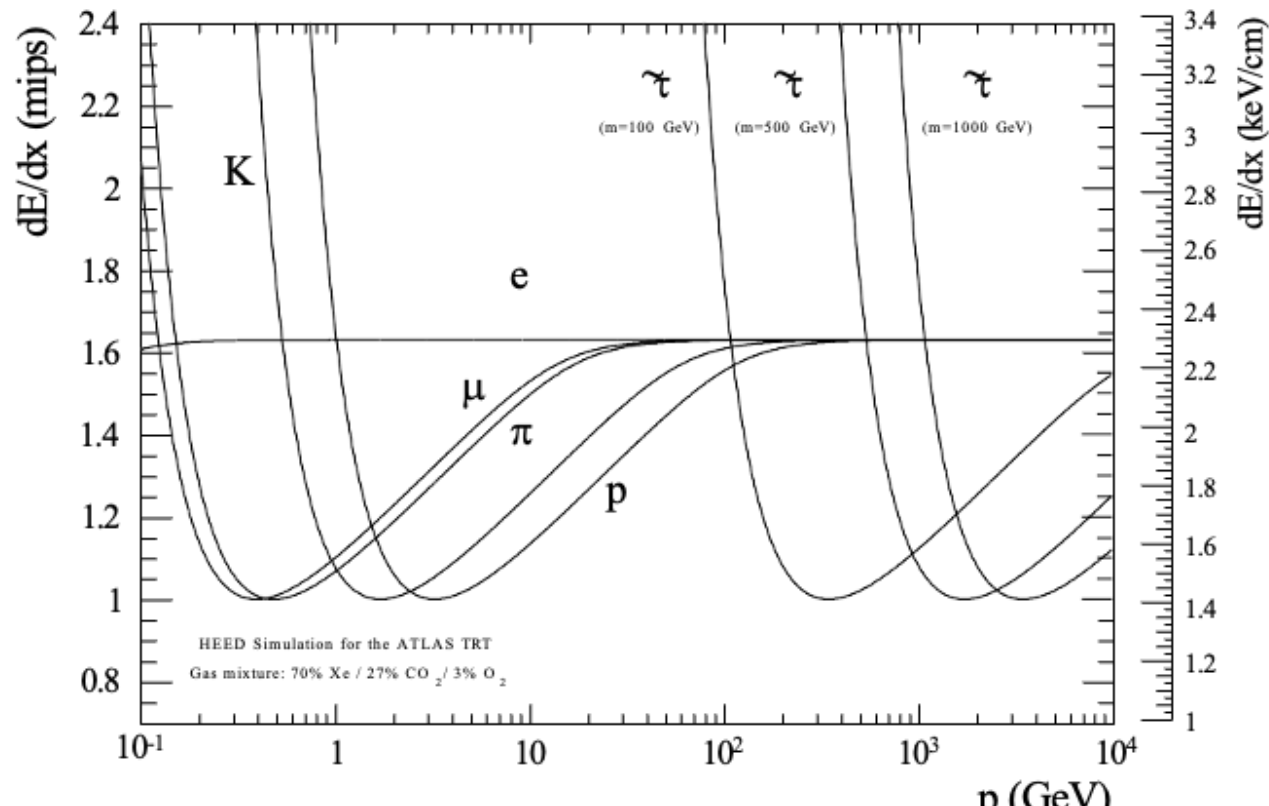
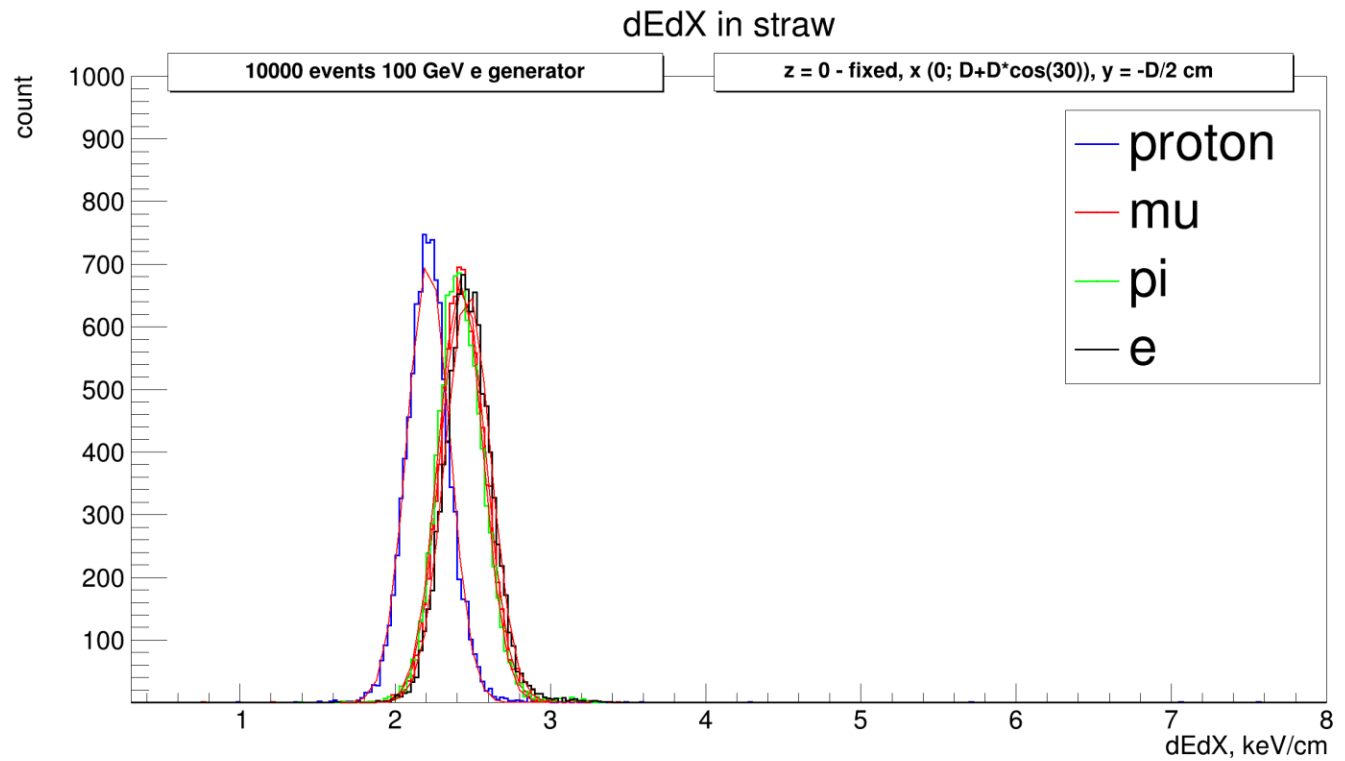
### dEdX in straw



## dEdX for 100 GeV

Matches with reference picture:

- Electrons 2.3 KeV/cm
- Mu+ 2.3 KeV/cm
- Pi+ 2.3 KeV/cm
- Protons: 2.2 KeV/cm





## Summary

- Work with low energies up to 10 GeV
- The best resolution of all  $dE/dX$

To use 5 maximum cuts

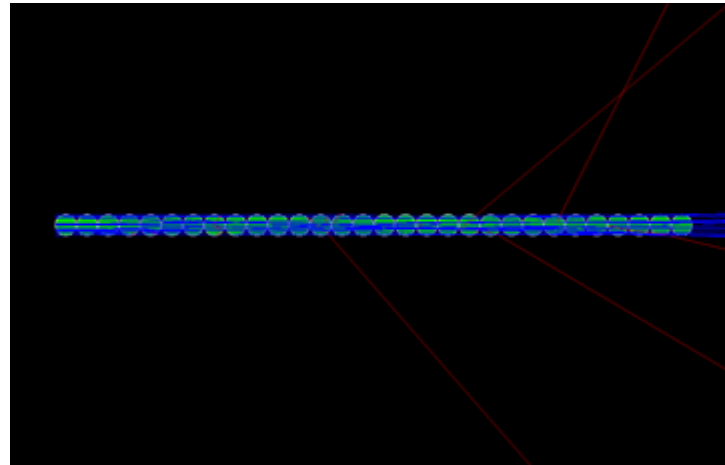
- Implementation of this method to 5mm and 20mm tubes



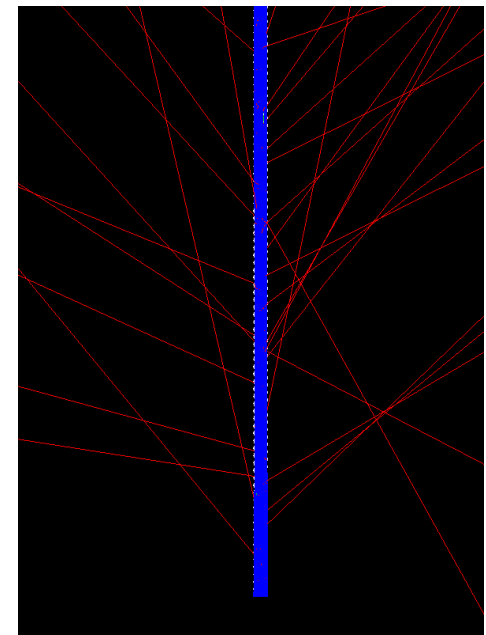
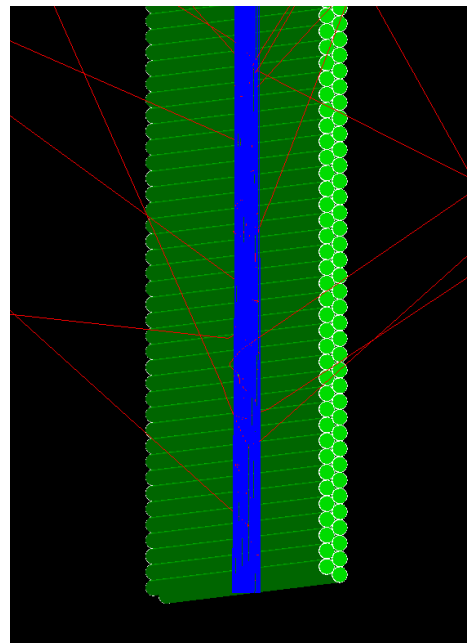
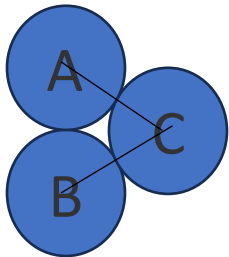
# Geant4 geometry model and simulation

120 straw tubes

- Diameter  $d = 10$  mm
- 2 layers  $\rightarrow$  60 tubes in each

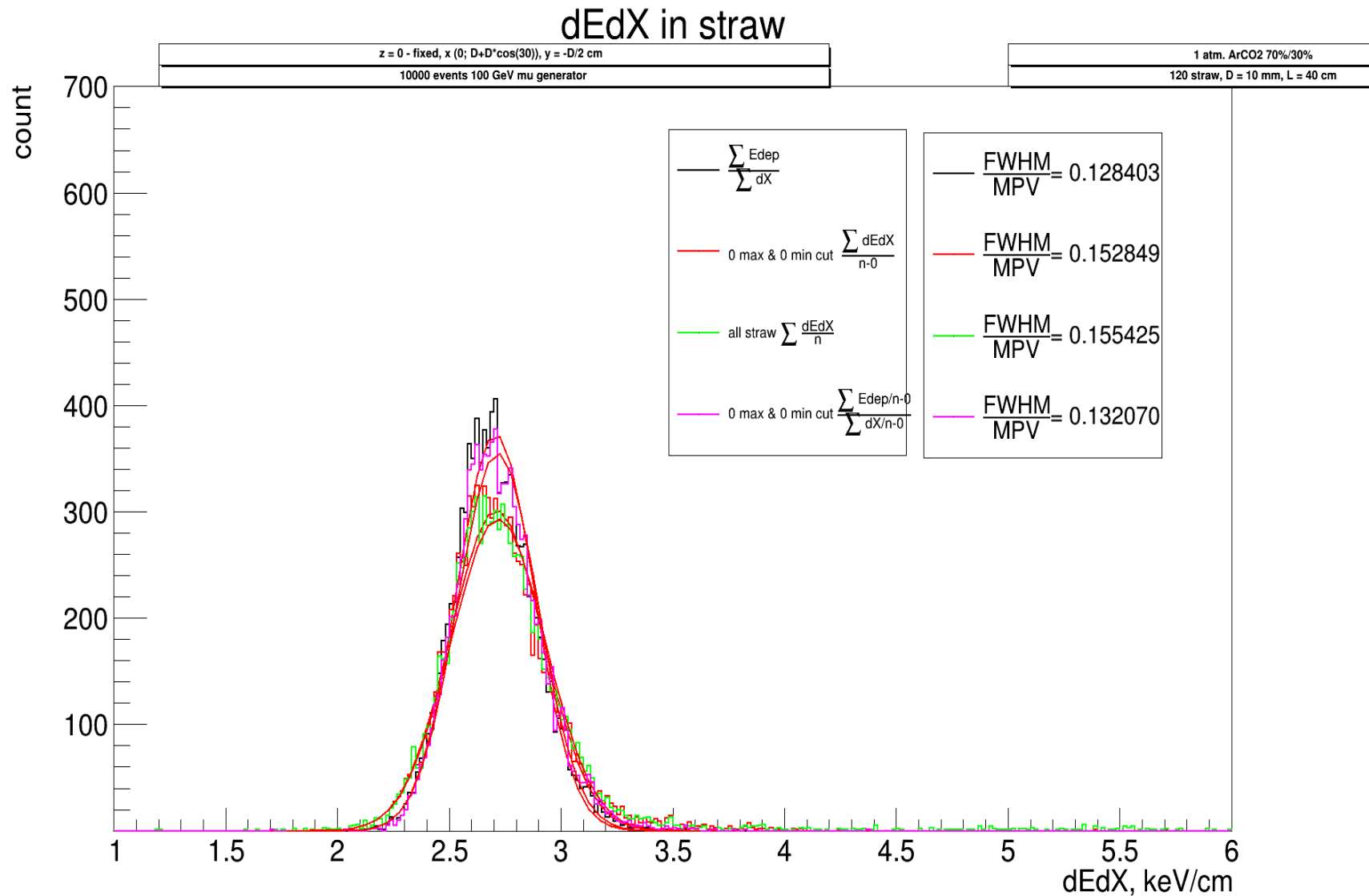


$$AB = BC = AC = d$$



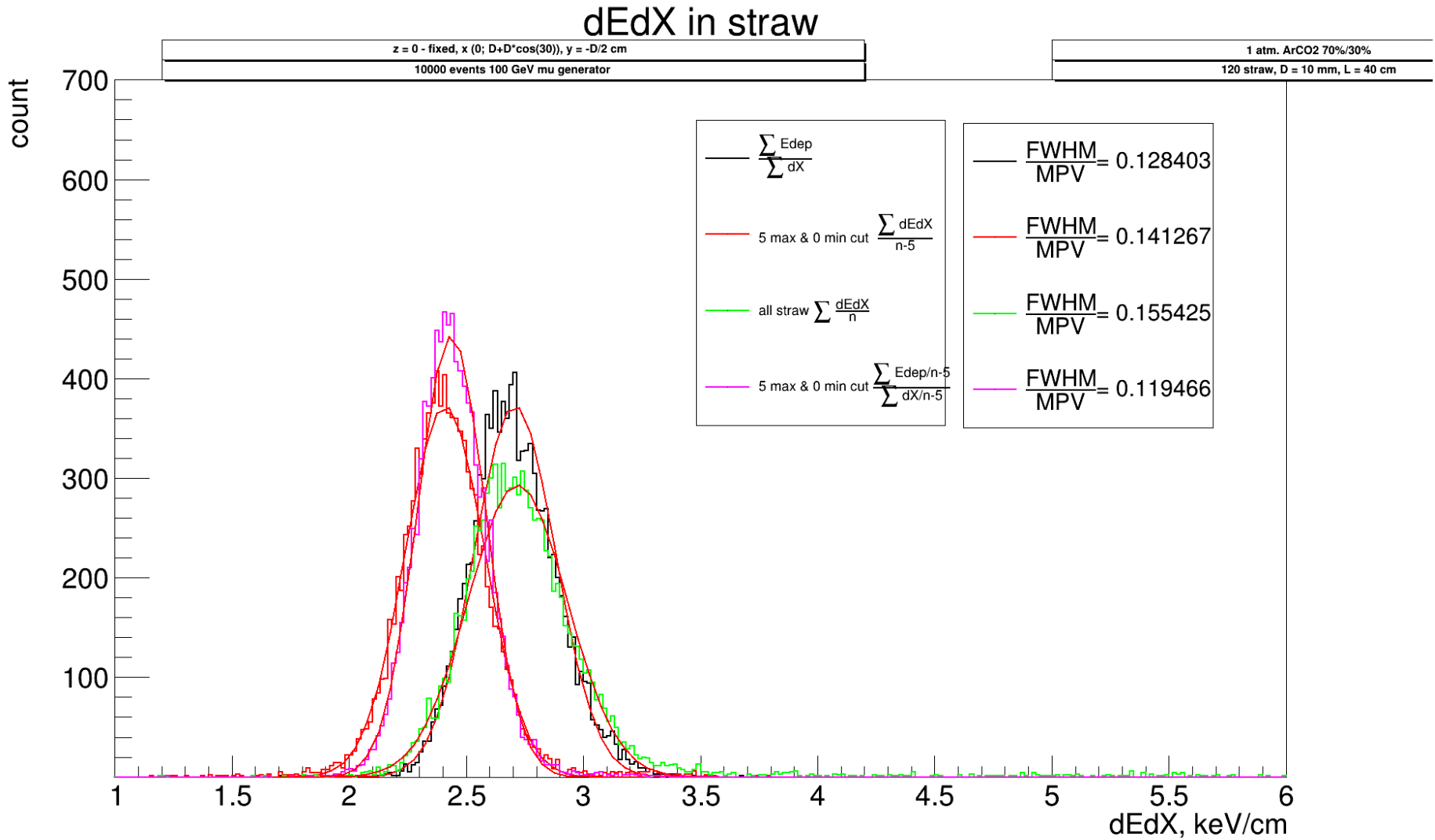
# 100 GeV 10000 mu+ events: primary de/dx on transportation

No cuts

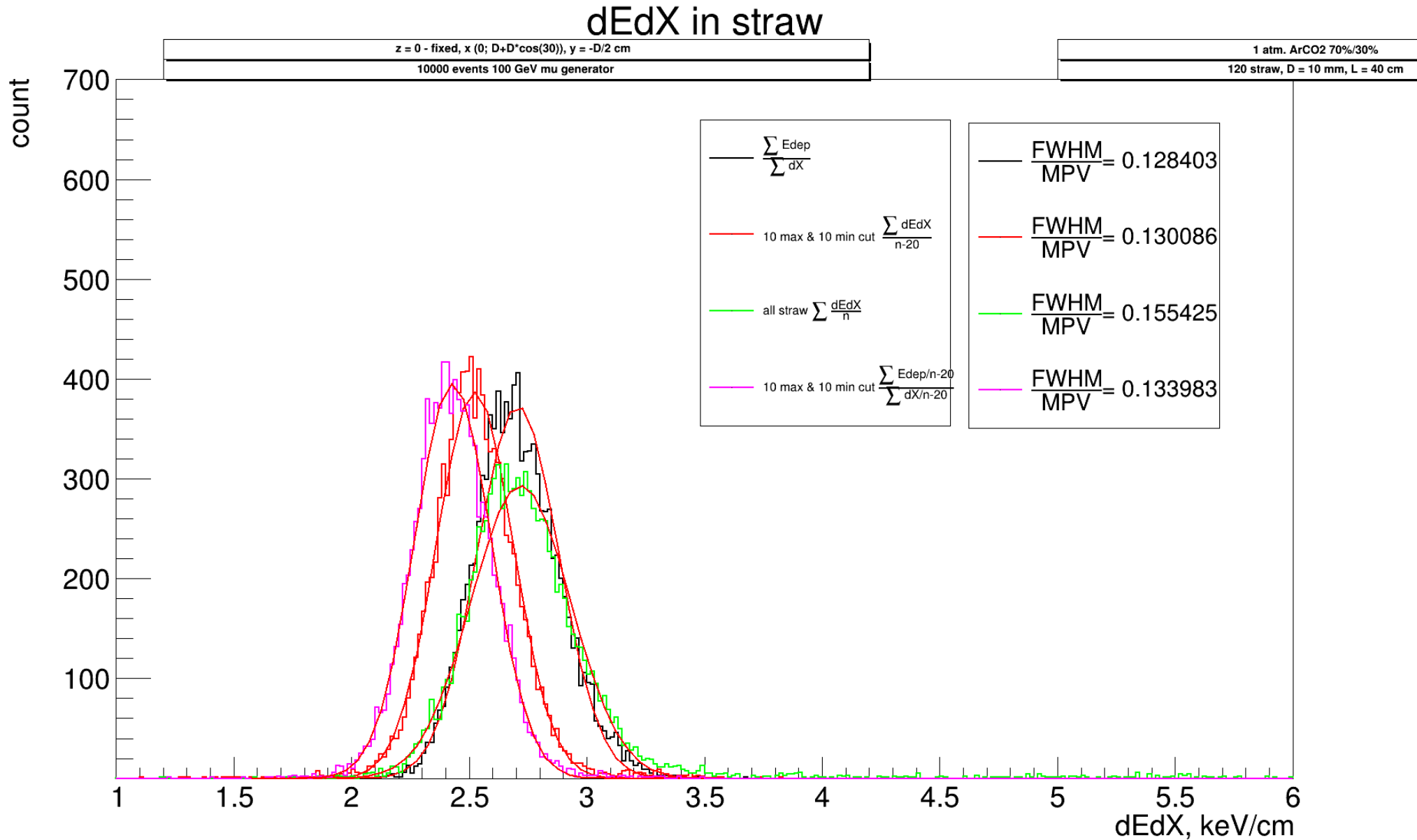


# 100 GeV 10000 mu+ events: primary de/dx on transportation

5 cuts maximum Edep



100 GeV 10000 mu+ events: primary de/dx  
 on transportation  
 10 cuts maximum Edep  
 10 cuts minimum Edep



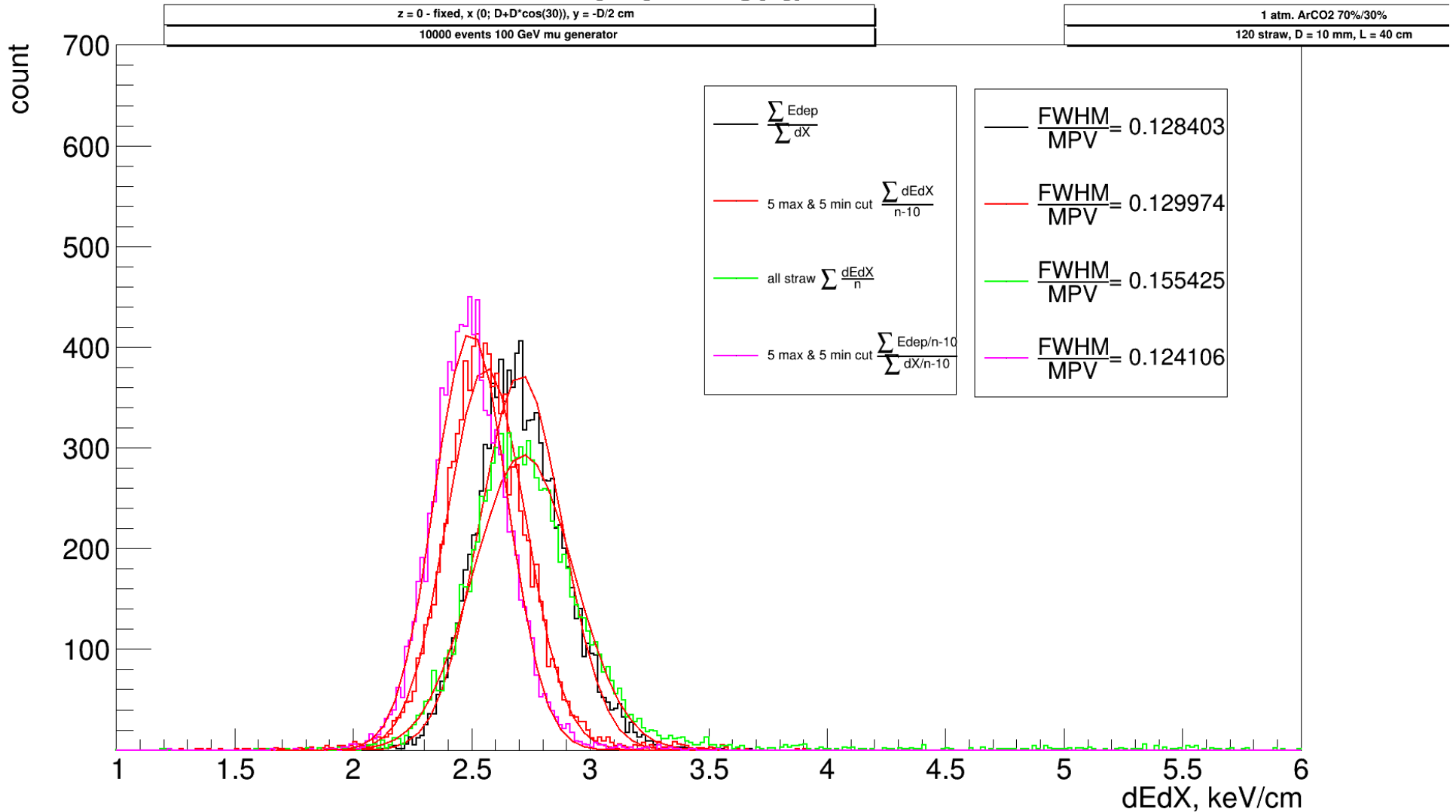
100 GeV 10000 mu+ events: primary de/dx

on transportation

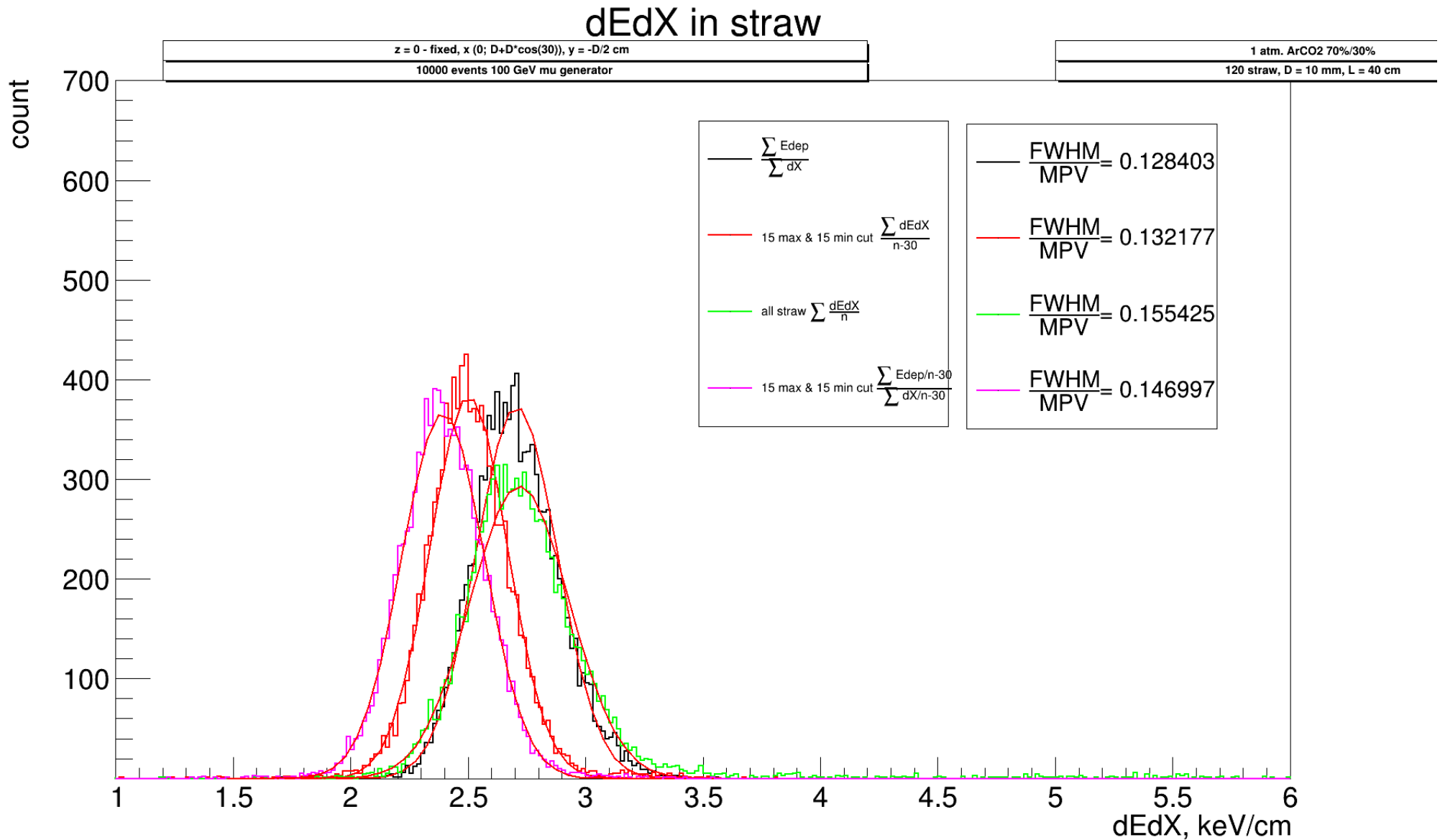
5 cuts maximum Edep

5 cuts minimum Edep

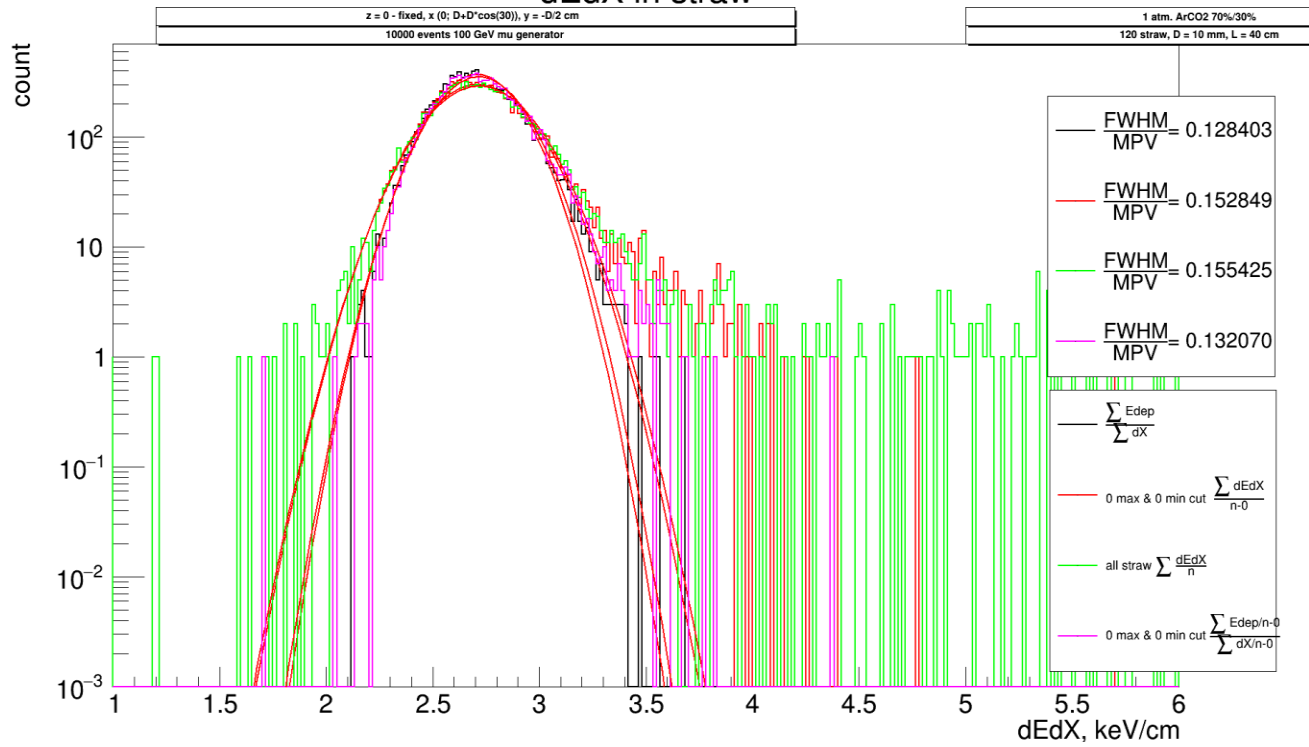
### dEdX in straw



100 GeV 10000 mu+ events: primary de/dx  
 on transportation  
 15 cuts maximum Edep  
 15 cuts minimum Edep



### dEdX in straw



### dEdX in straw

