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+,** π+, e-, proton
- ArCO2 70% - 30% 1 bar
- sigma/MPV ~20%
- Secondary: e- (most), e+, gamma
- 10000 events,
- Physics list: QGSP_BERT, QBBC

dedX Measurements – PRIMARY mu+, pi+, proton, e-

Different approach:

- Sum of all *Edep* in event

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

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

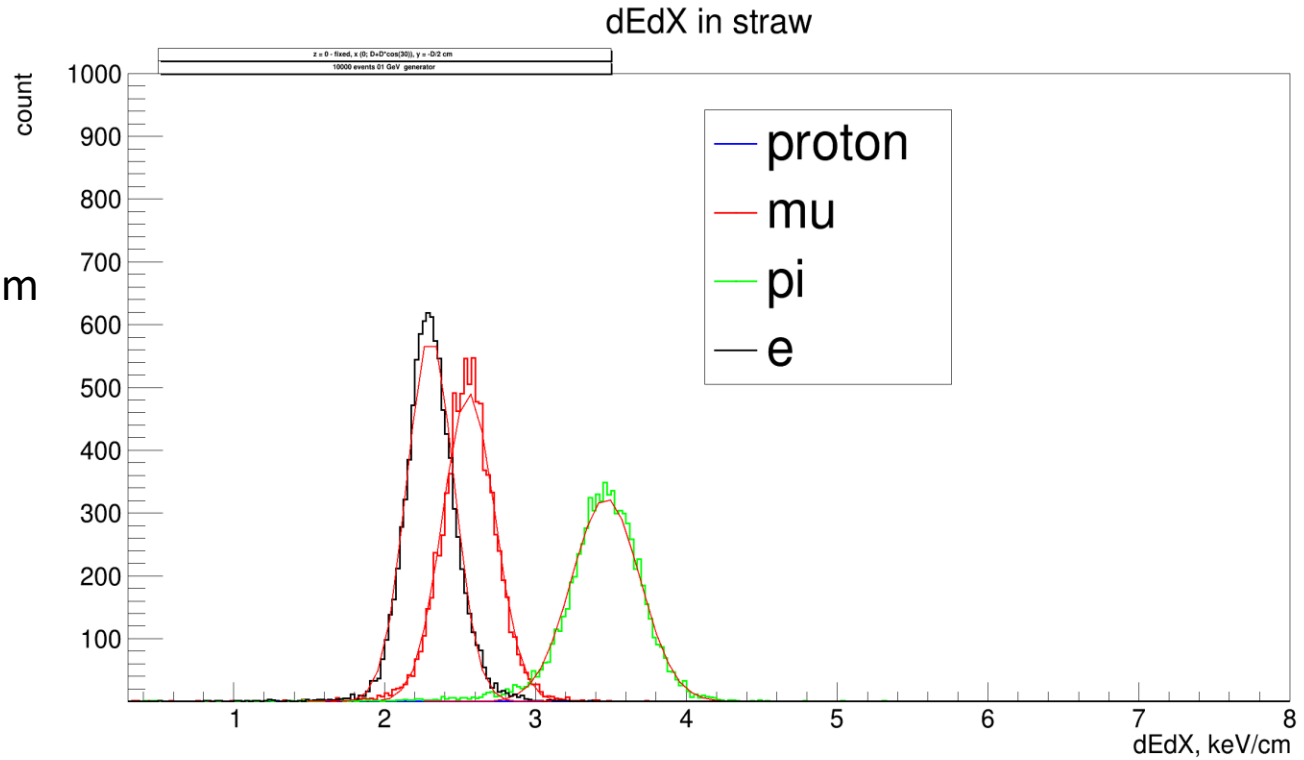
- Sum of all *Edep/L* (each step) in event $\sum_{n=0}^{nSteps} \frac{Edep}{L}$

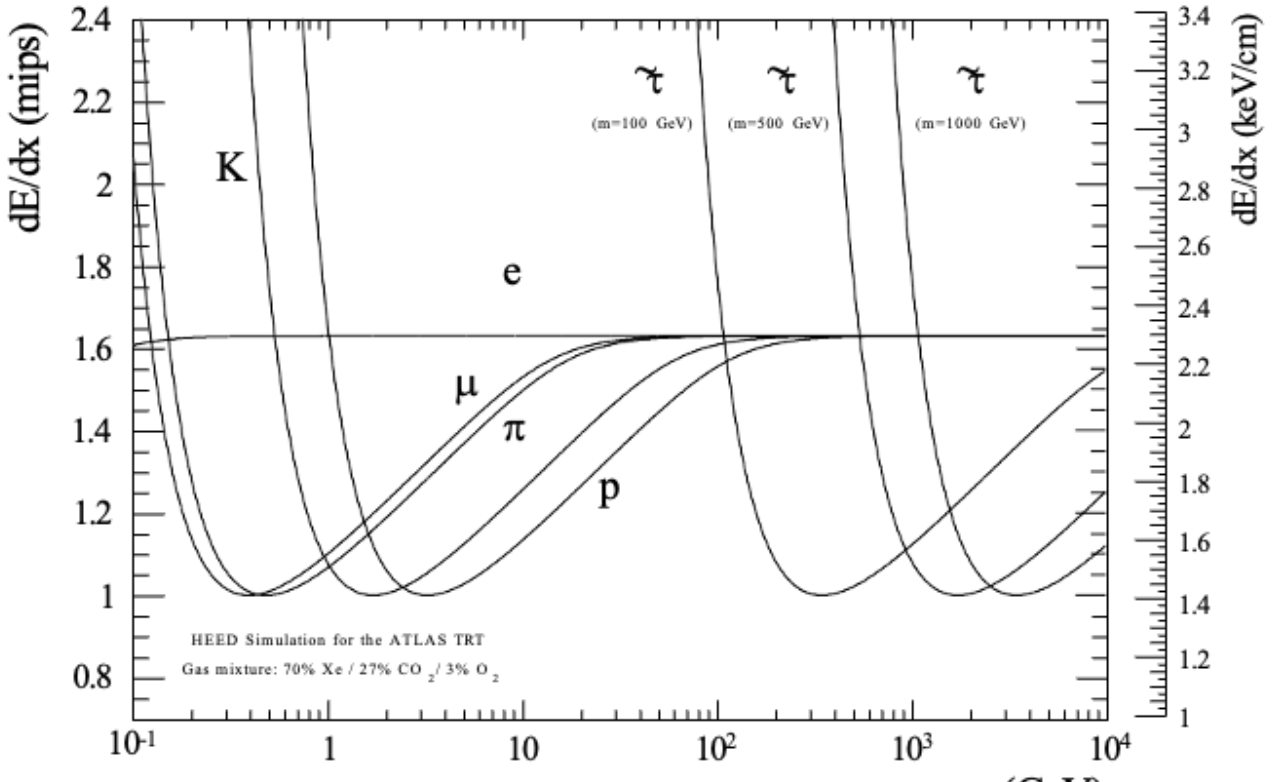
(green, red on previous talks)

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

dEdX for 100 MeV/c

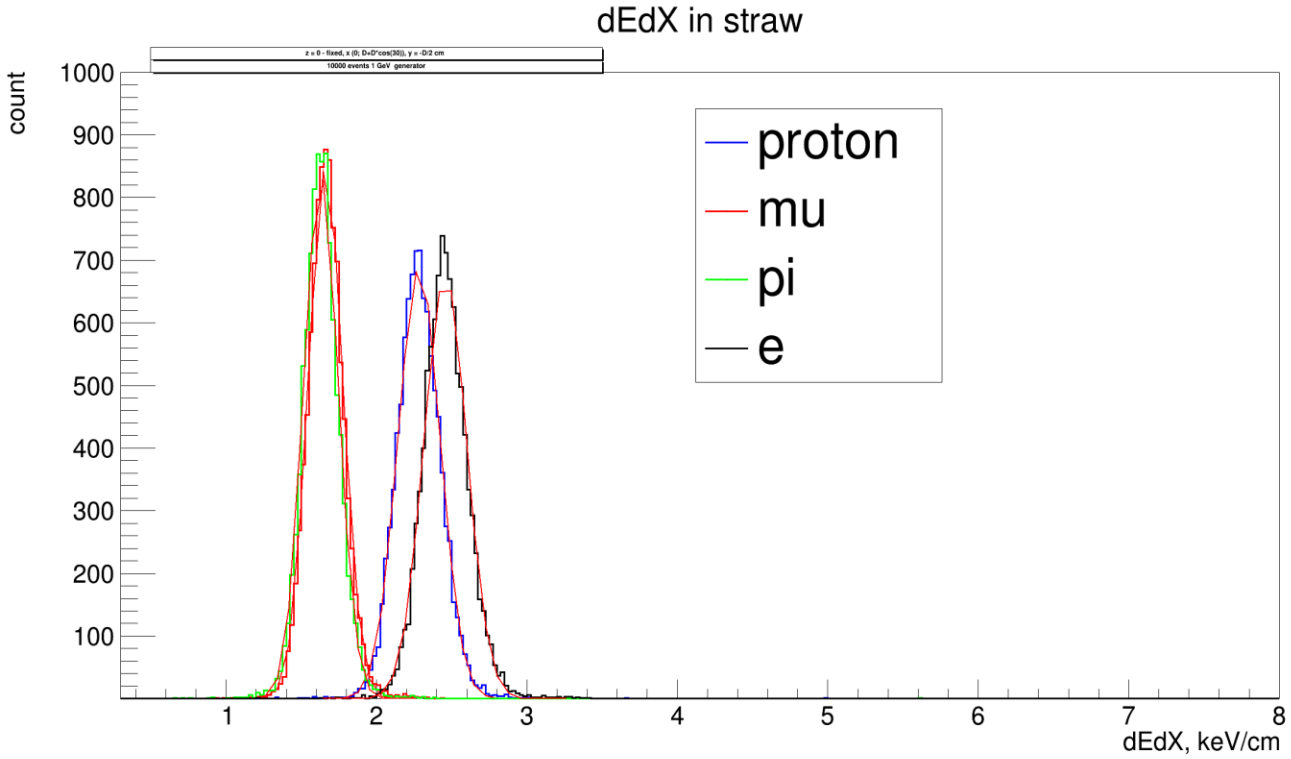
- Electrons 2.55197 KeV/cm
- Mu+ 2.55197 KeV/cm
- Pi+ 3.44153 KeV/cm

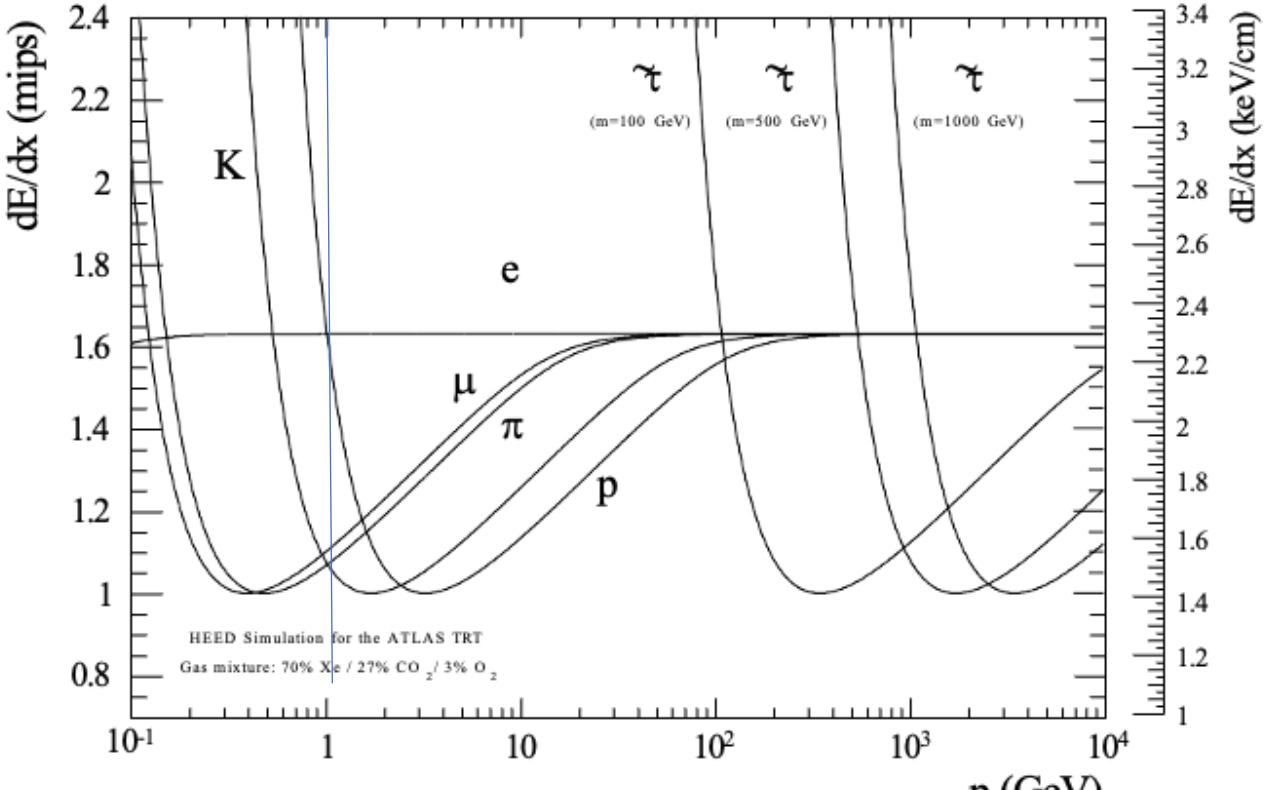




dEdX for 1 GeV/c

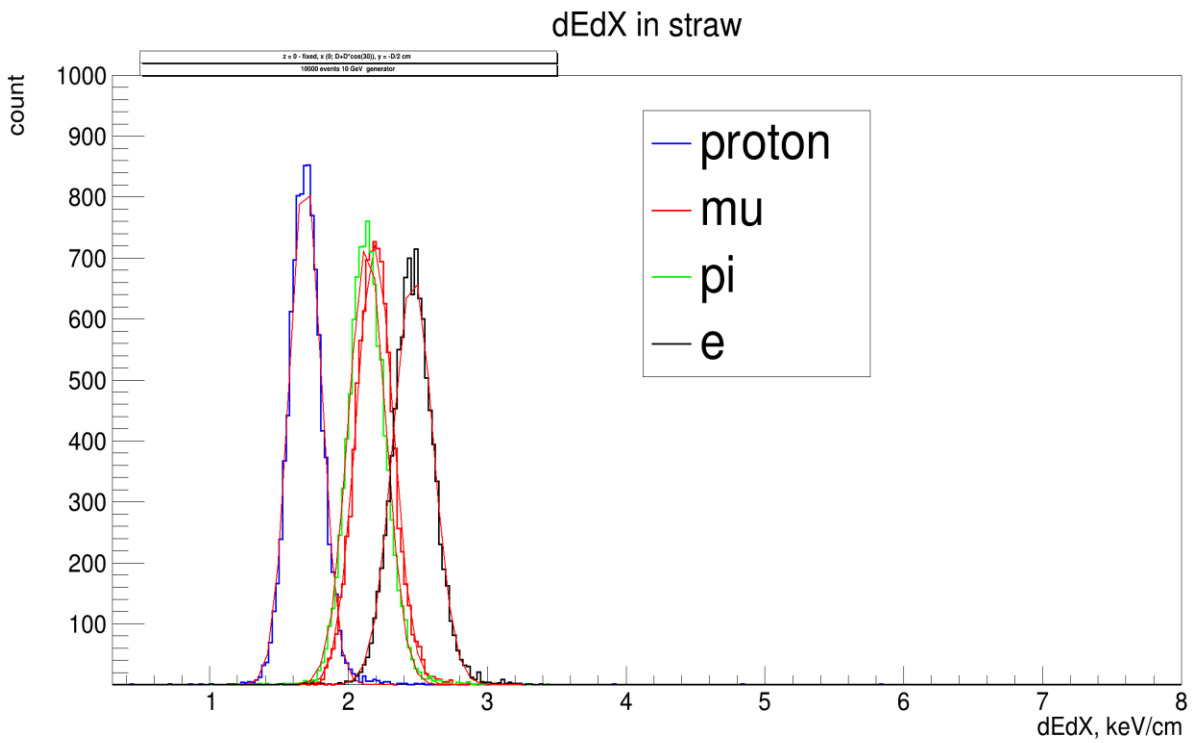
Protons: 2.28378
Muons: 1.66428
Pions: 1.63173
Electrons: 2.45969

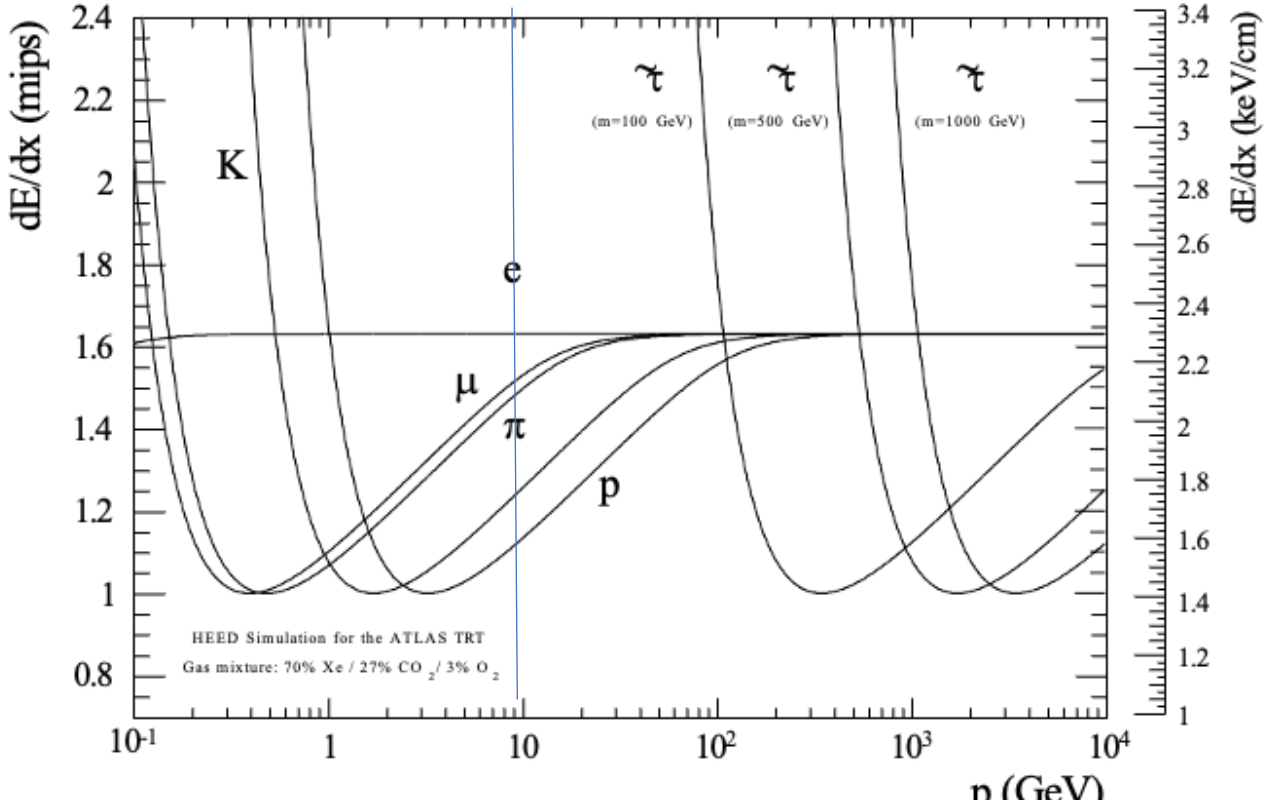




dEdX for 10 GeV/c

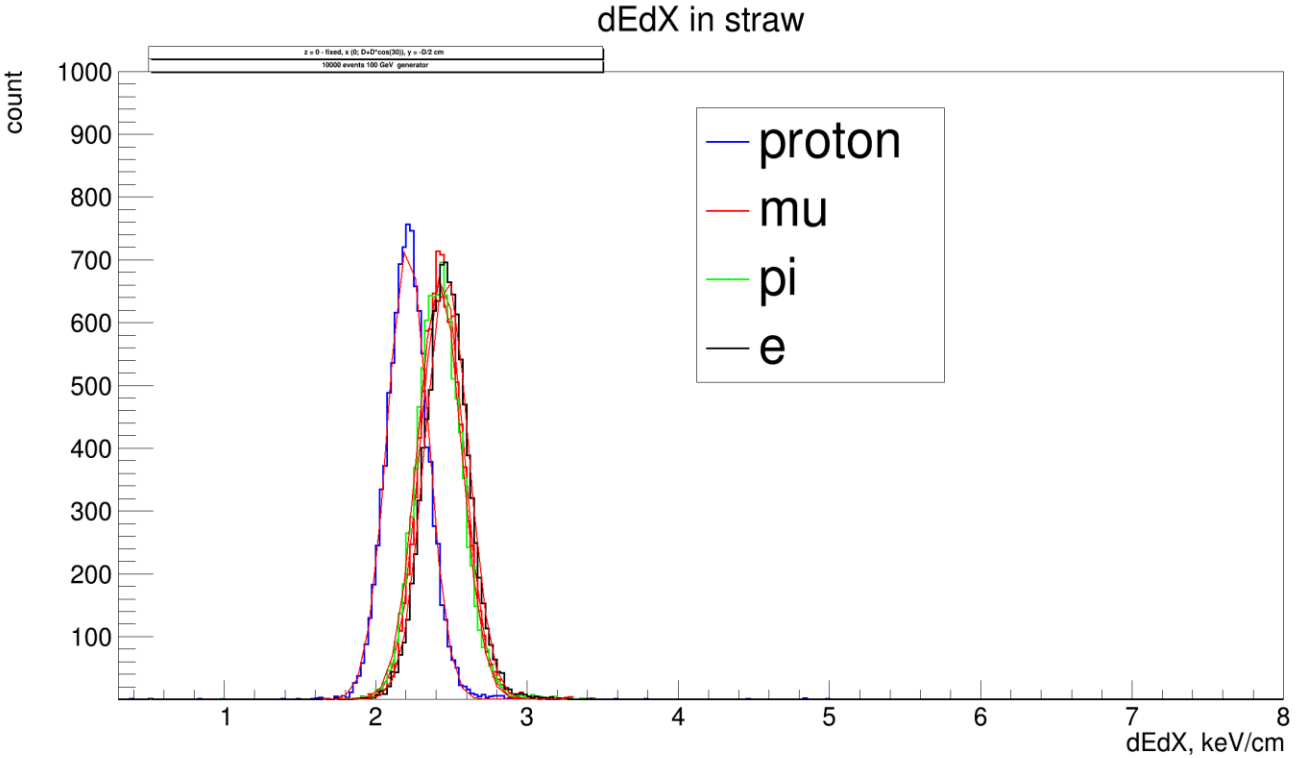
- Protons: 1.69384
- Muons: 2.19125
- Pions: 2.1352
- Electrons: 2.46752

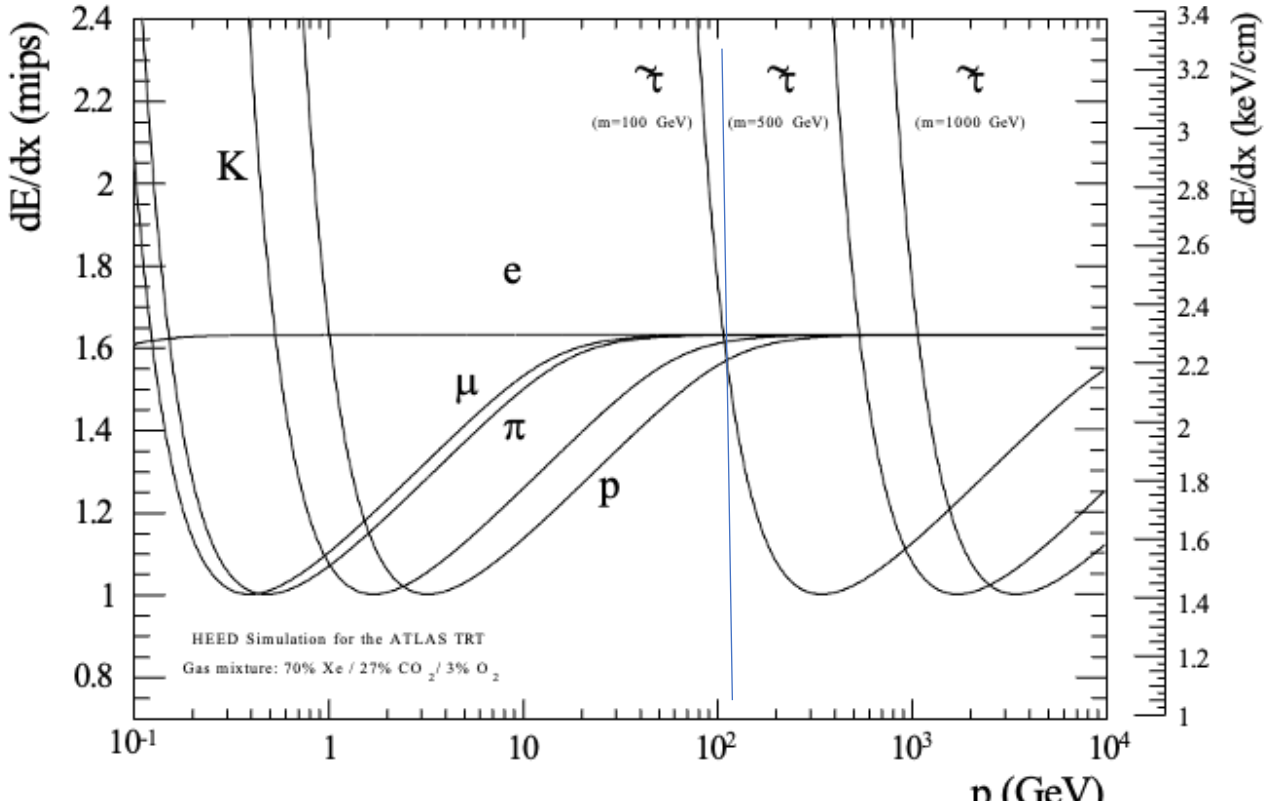




dEdX for 100 GeV/c

- Protons: 2.21523
- Muons: 2.43977
- Pions: 2.42382
- Electrons: 2.46992

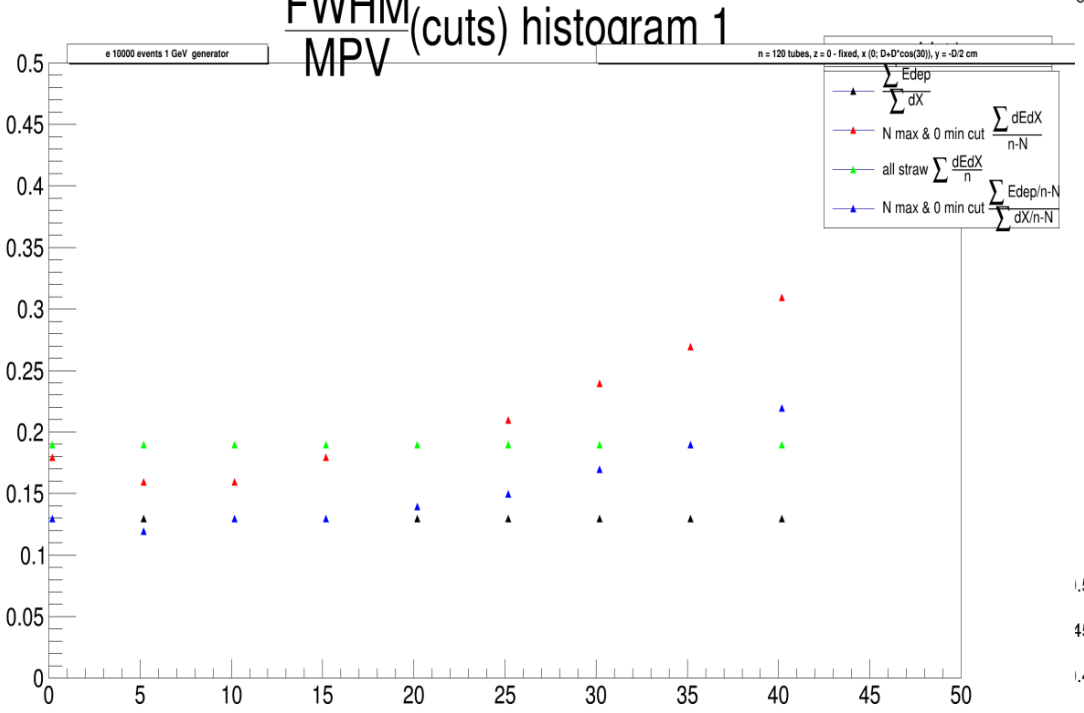


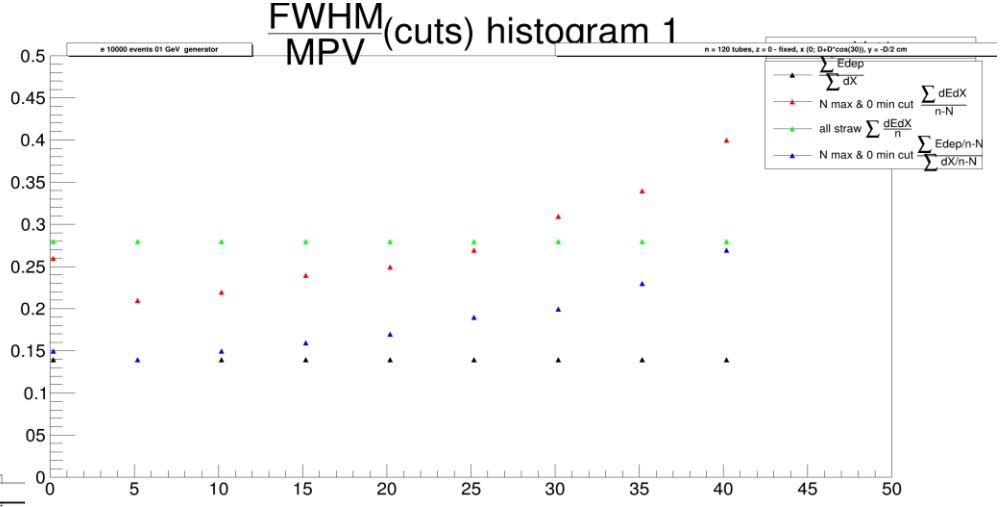


Cut comparizon: FWHM/MPV 0.1GeV/c
Maximum cut
5, 10, 15, 20, 25, 30, 35, 40
cuts

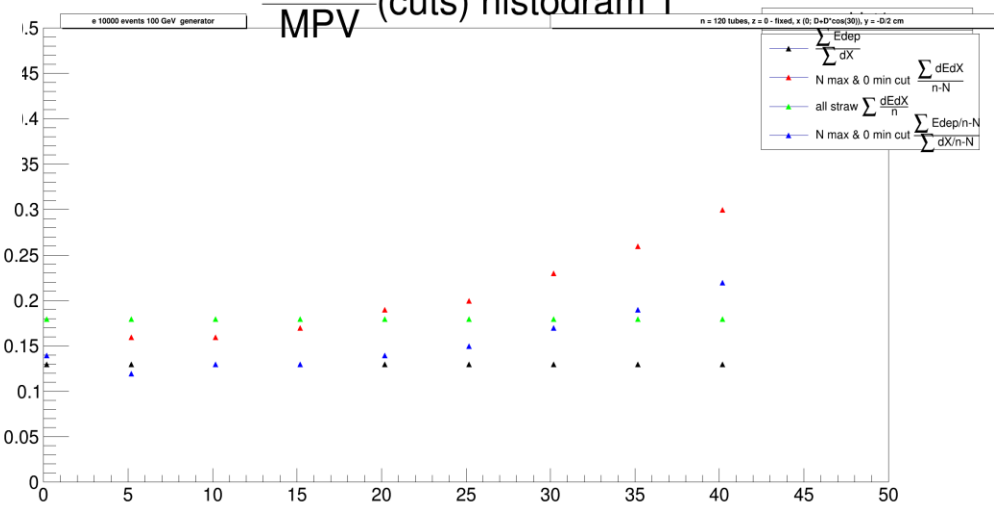
Electrons:

1 GeV/c



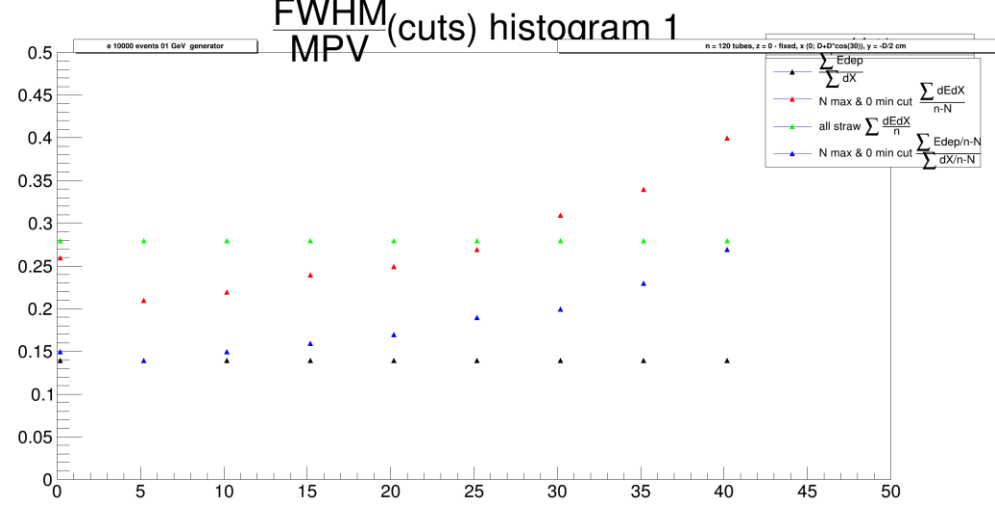


100 GeV/c

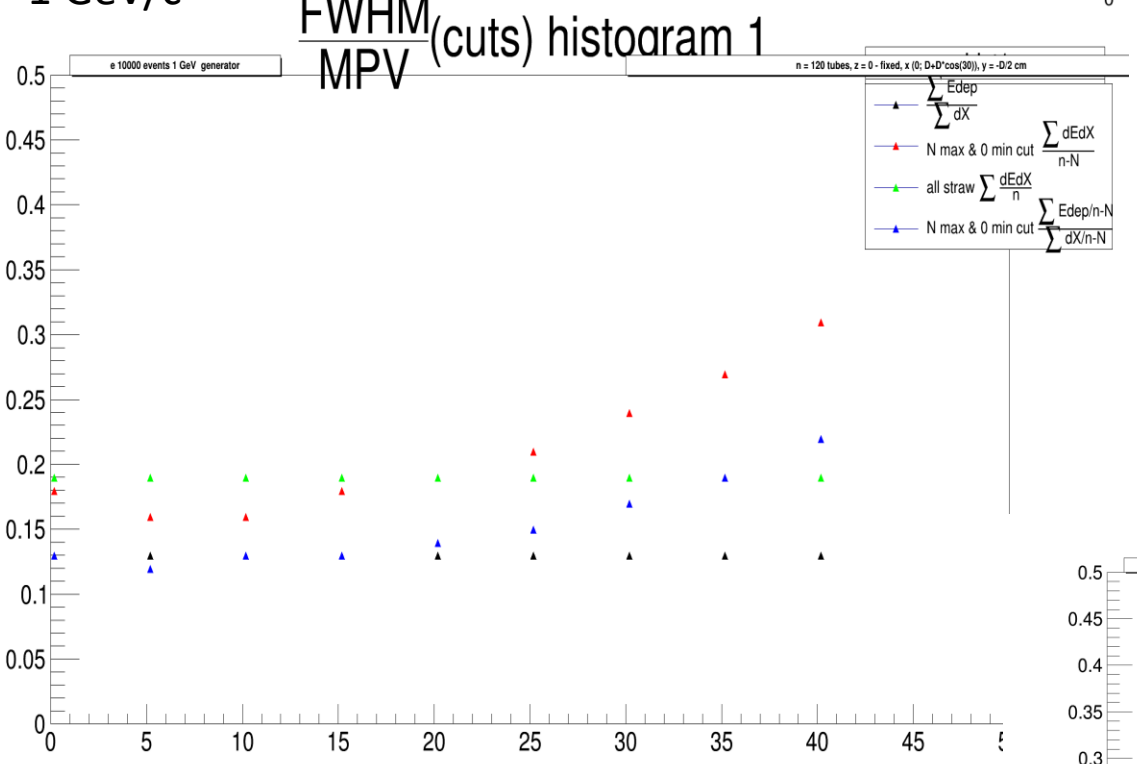


Cut comparizon: FWHM/MPV 0.1GeV/c
Maximum cut
5, 10, 15, 20, 25, 30, 35, 40
cuts

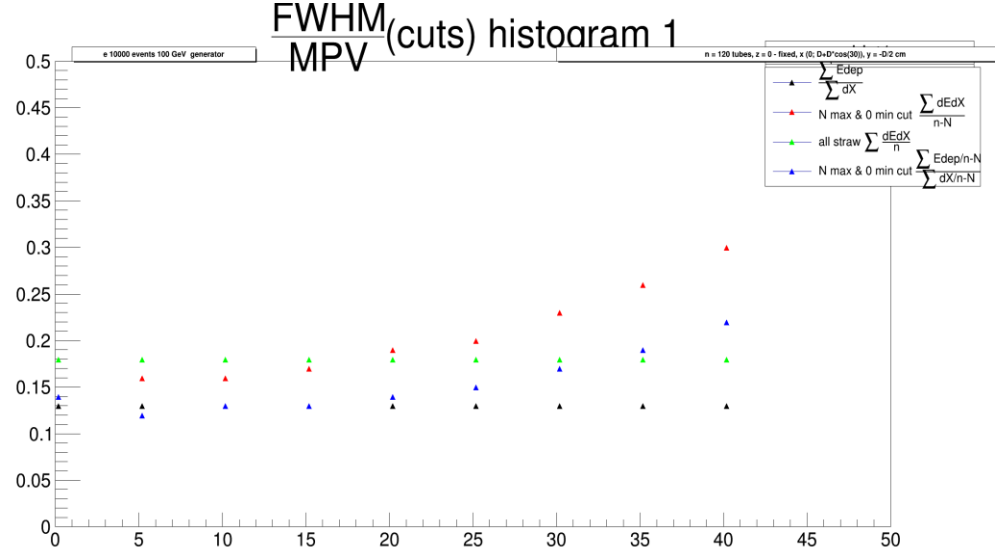
Protons:



1 GeV/c



100 GeV/c



Cut comparizon: FWHM/MPV 0.1GeV/c

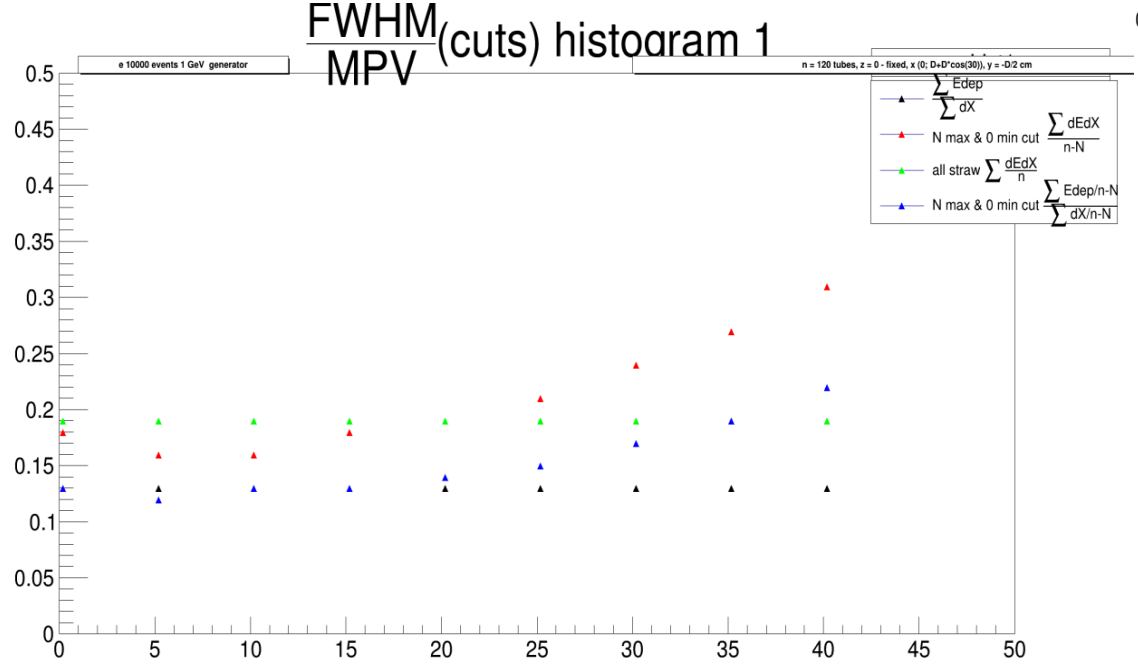
Maximum cut

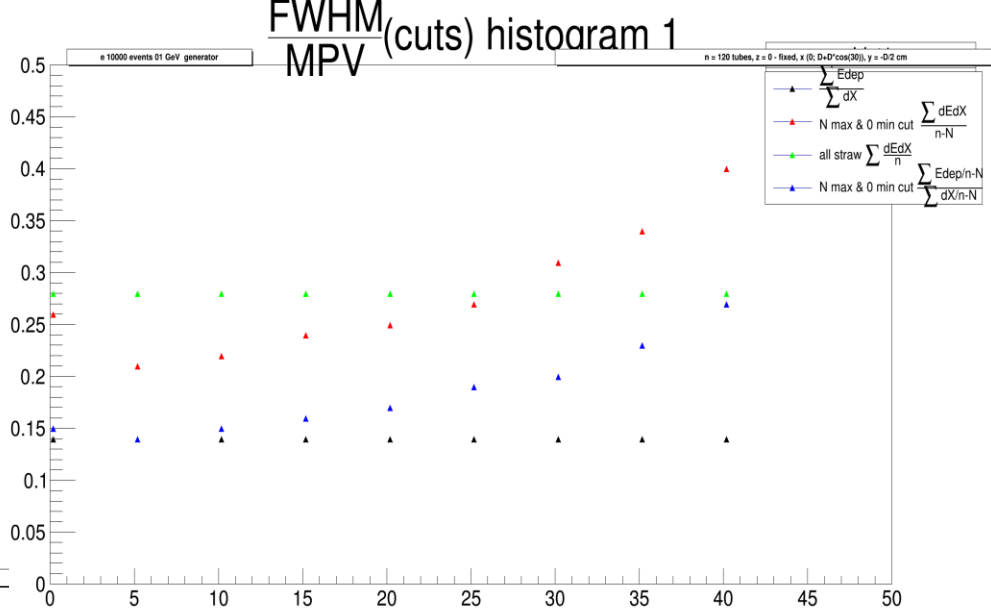
5, 10, 15, 20, 25, 30, 35, 40

cuts

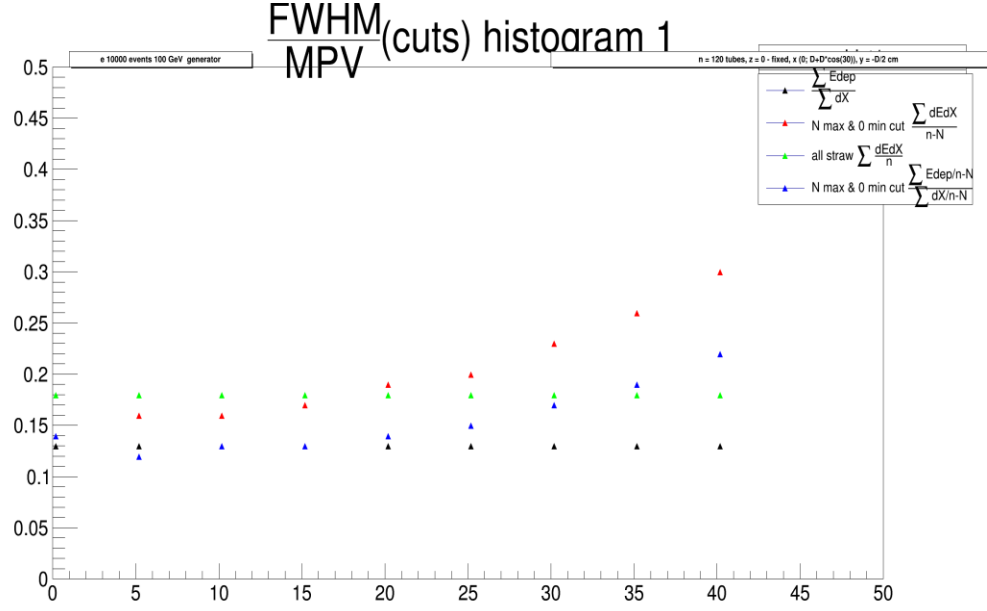
Muons: (mu+)

1 GeV/c





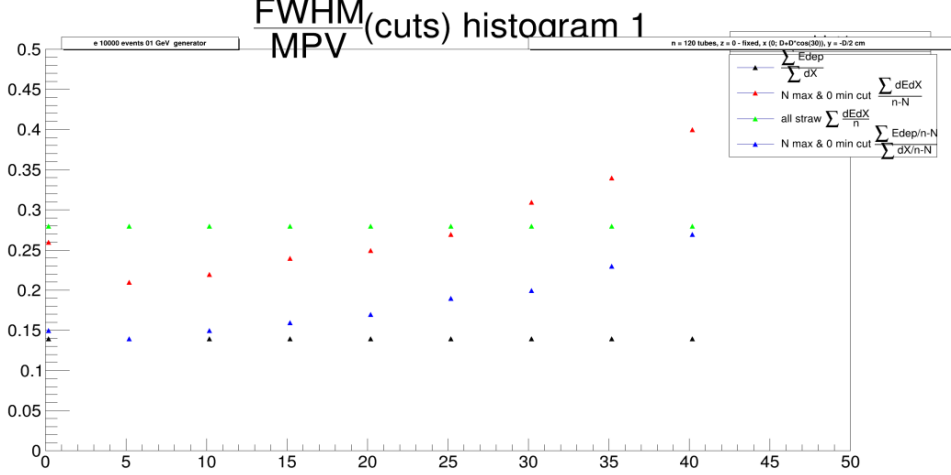
100 GeV/c



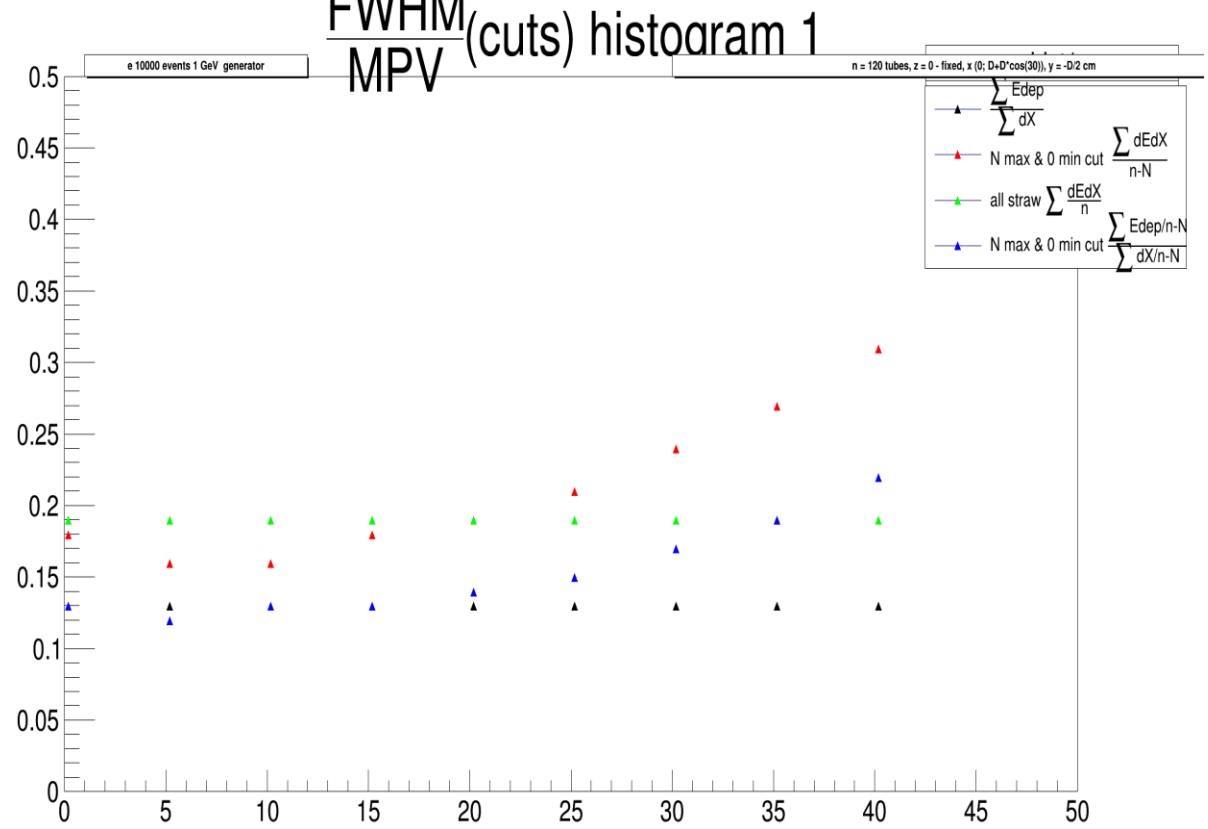
Cut comparizon: FWHM/MPV
Maximum cut
5, 10, 15, 20, 25, 30, 35, 40
cuts

Pions: (pi+)

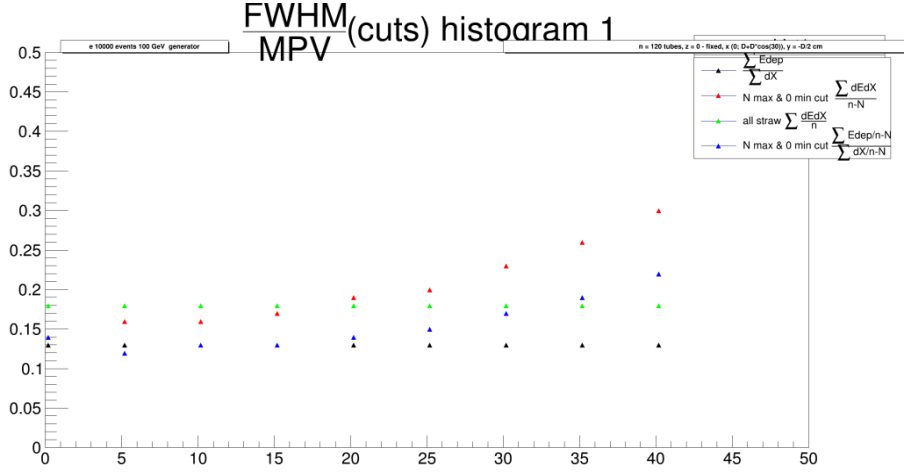
0.1GeV/c



1 GeV/c



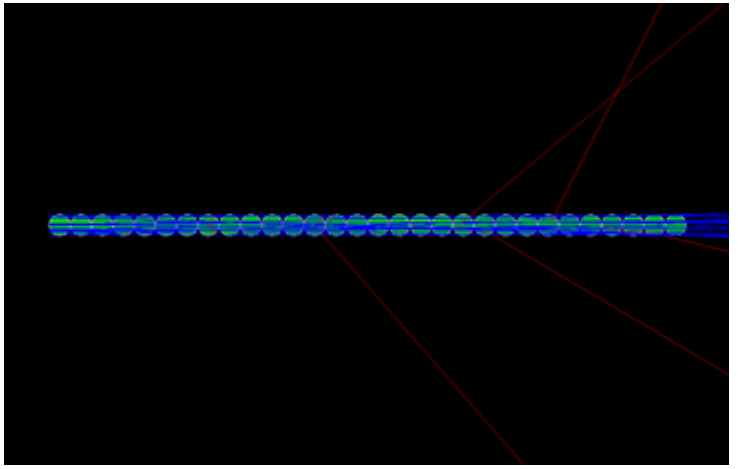
100 GeV/c

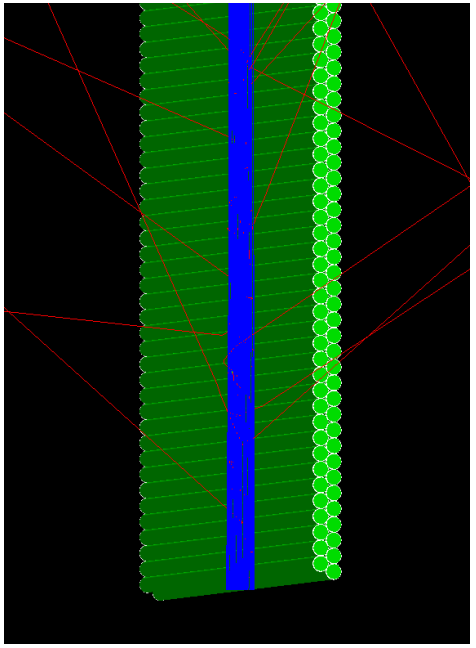


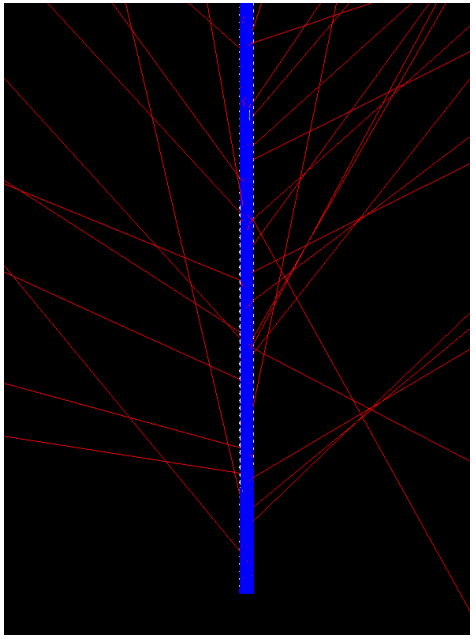
Geant4 geometry model and simulation

120 straw tubes

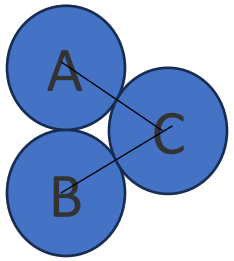
- Diameter d = 10 mm
- 2 layers -> 60 tubes in each



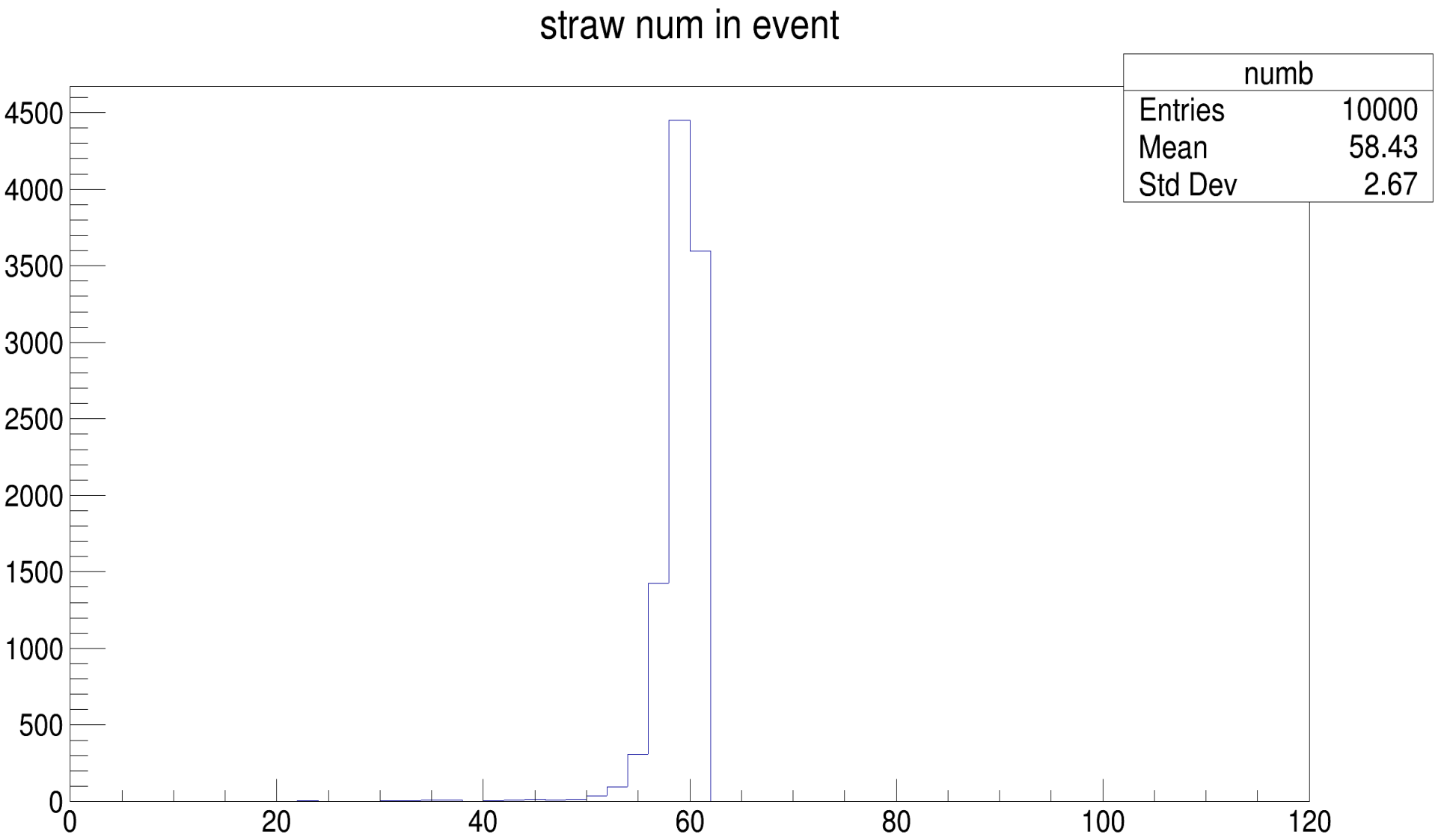




AB = BC= AC= d

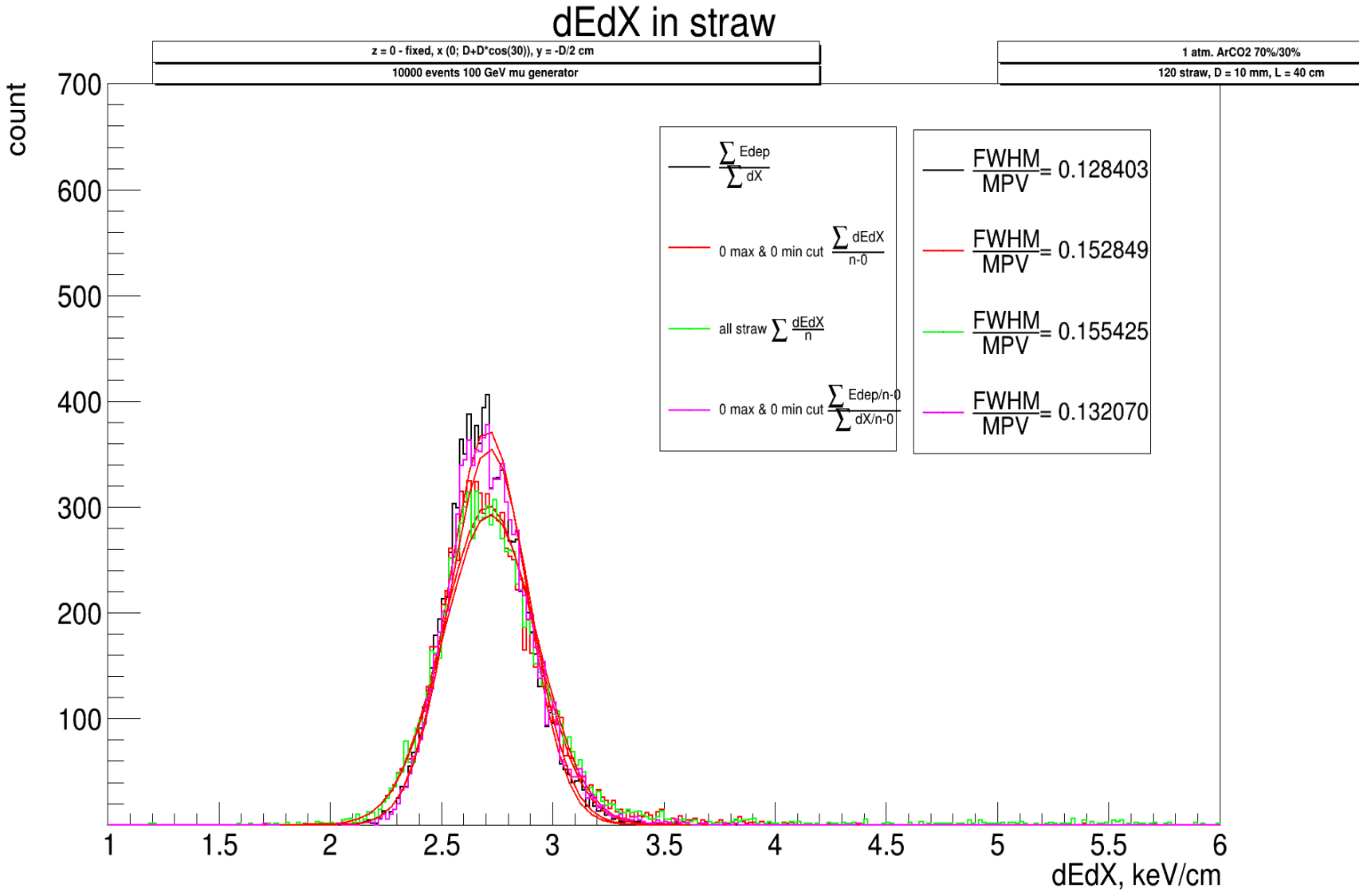


Number of worked tubes in event



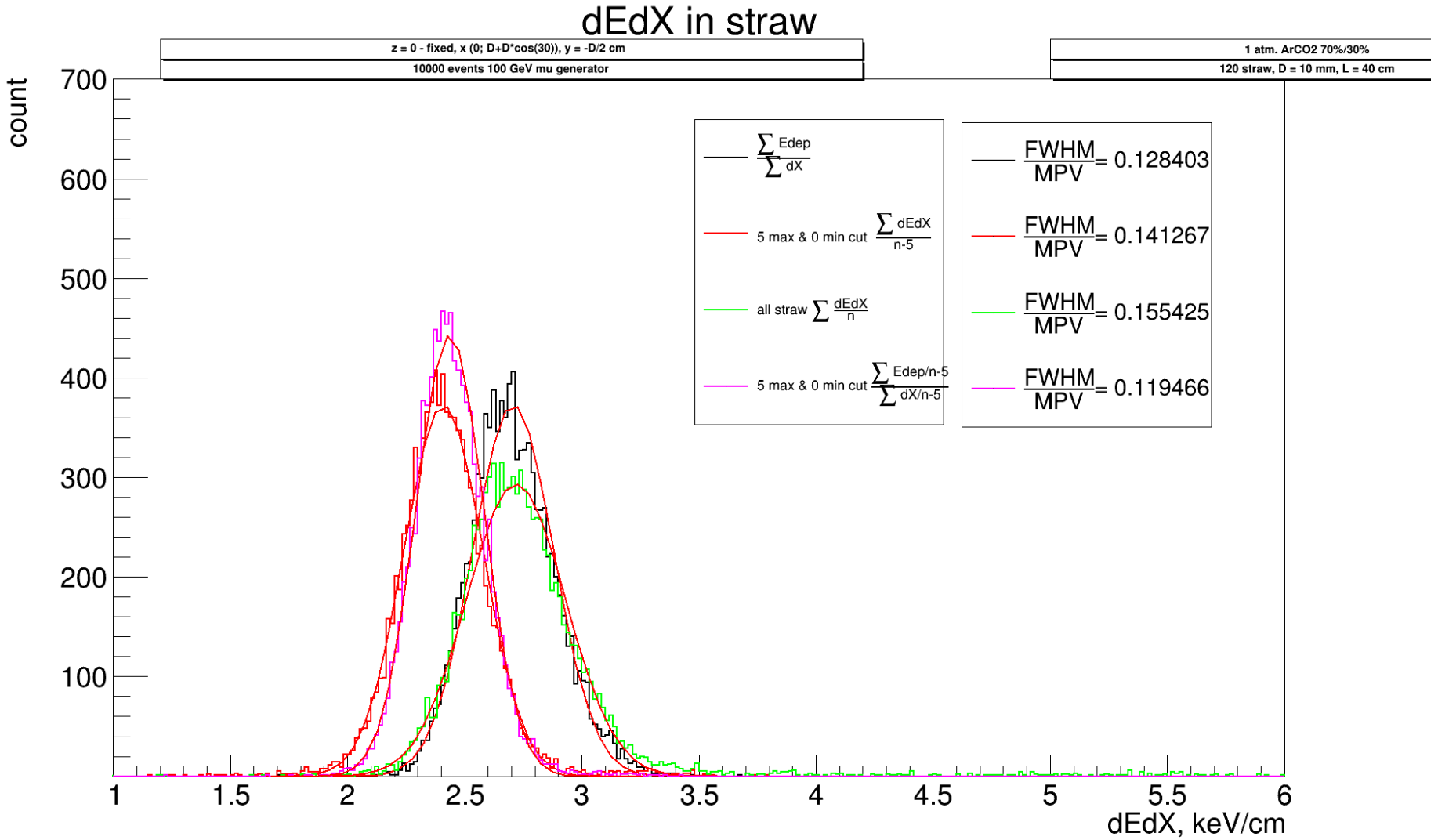
100 GeV 10000 mu+ events: primary de/dx on transportation

No cuts



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

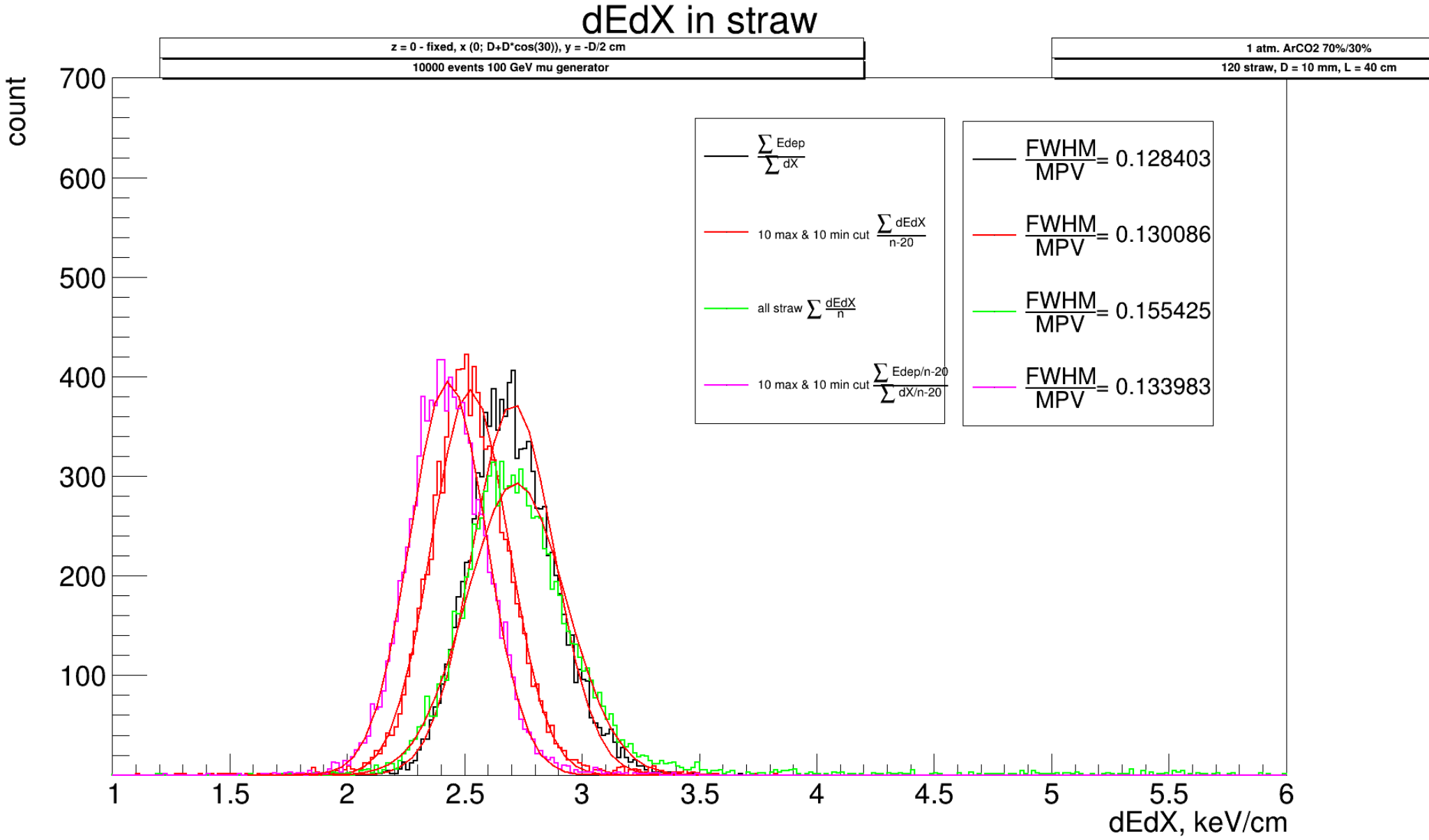
5 cuts maximum Edep



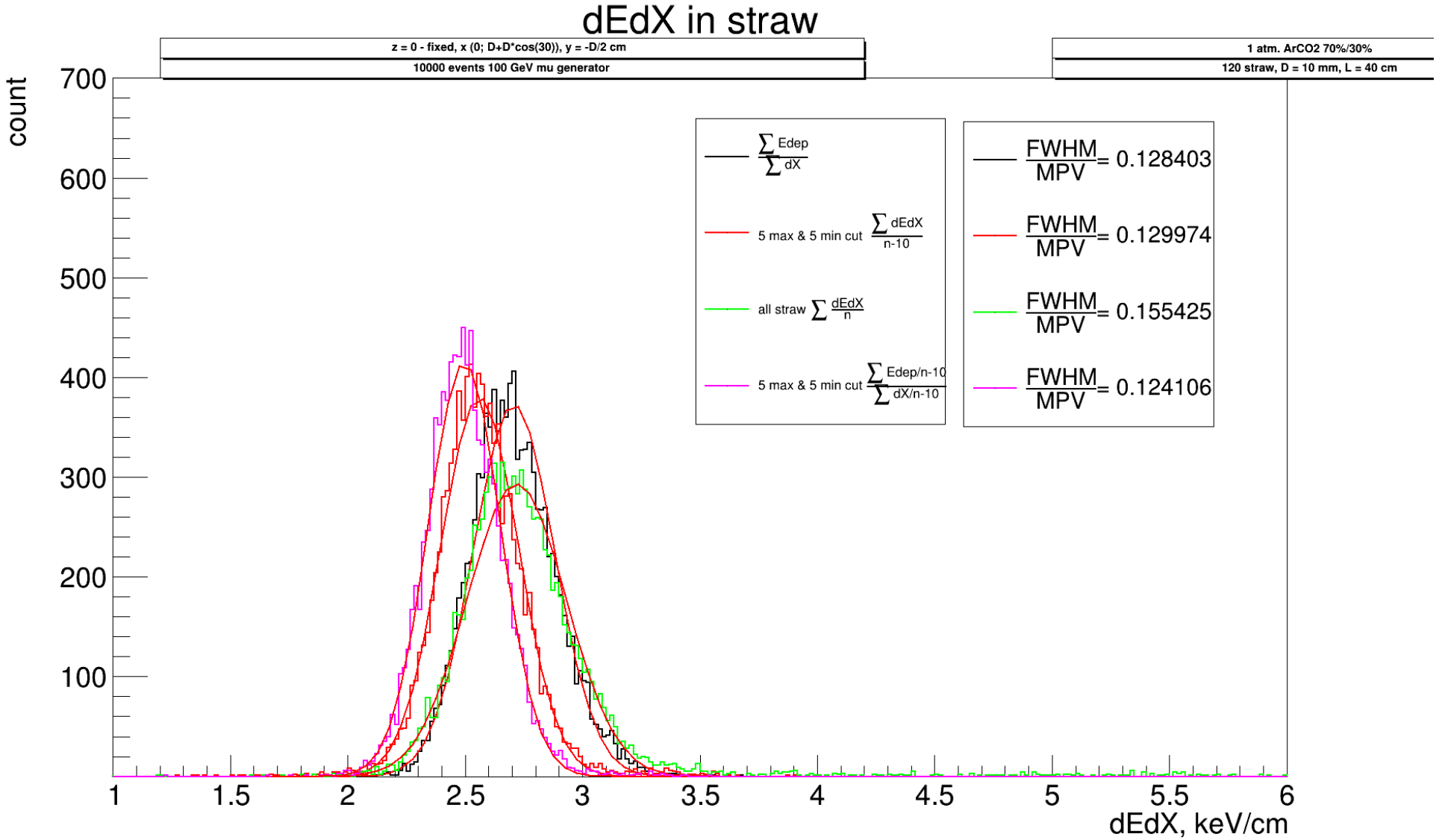
100 GeV 10000 mu+ events: primary de/dx on transportation

10 cuts maximum Edep

10 cuts minimum Edep



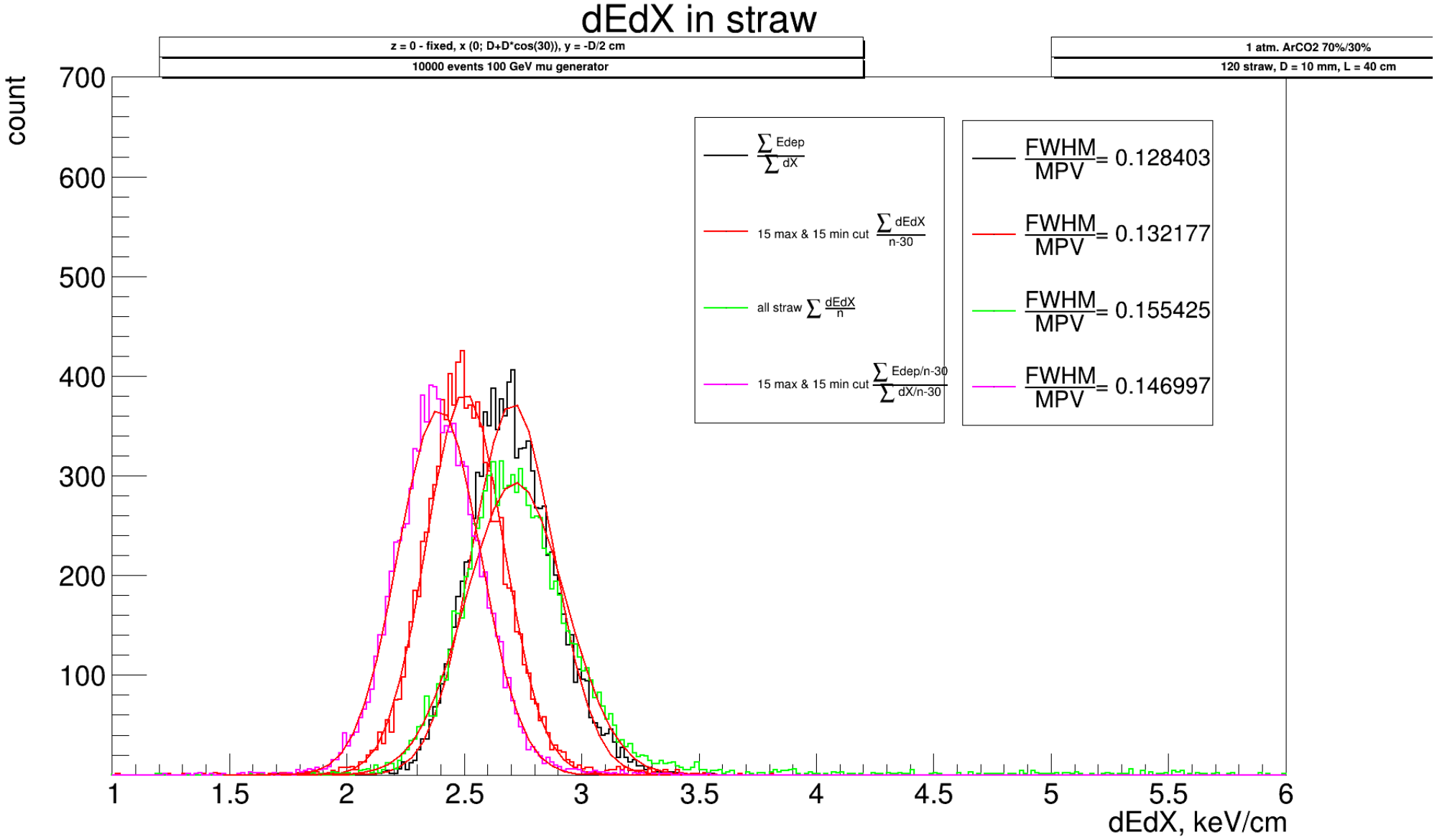
100 GeV 10000 mu+ events: primary de/dx on transportation
5 cuts maximum Edep
5 cuts minimum Edep

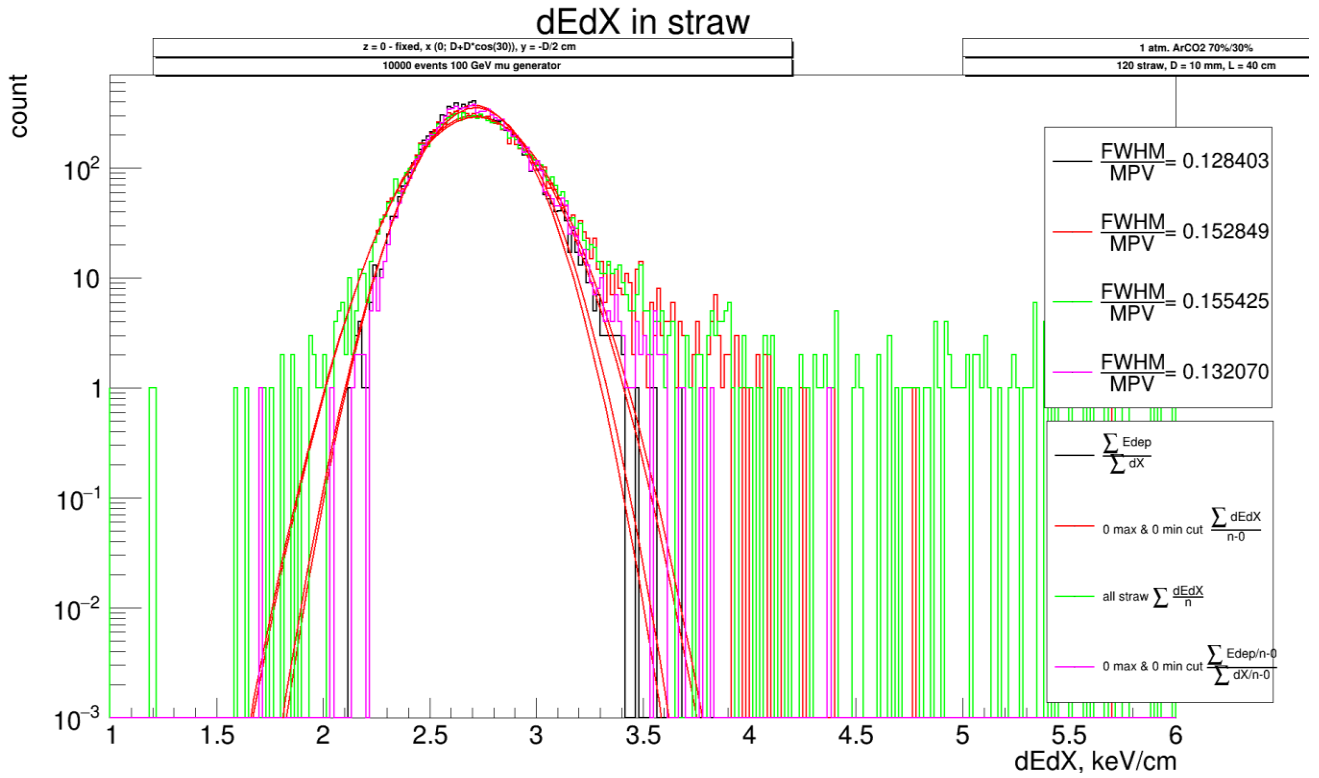


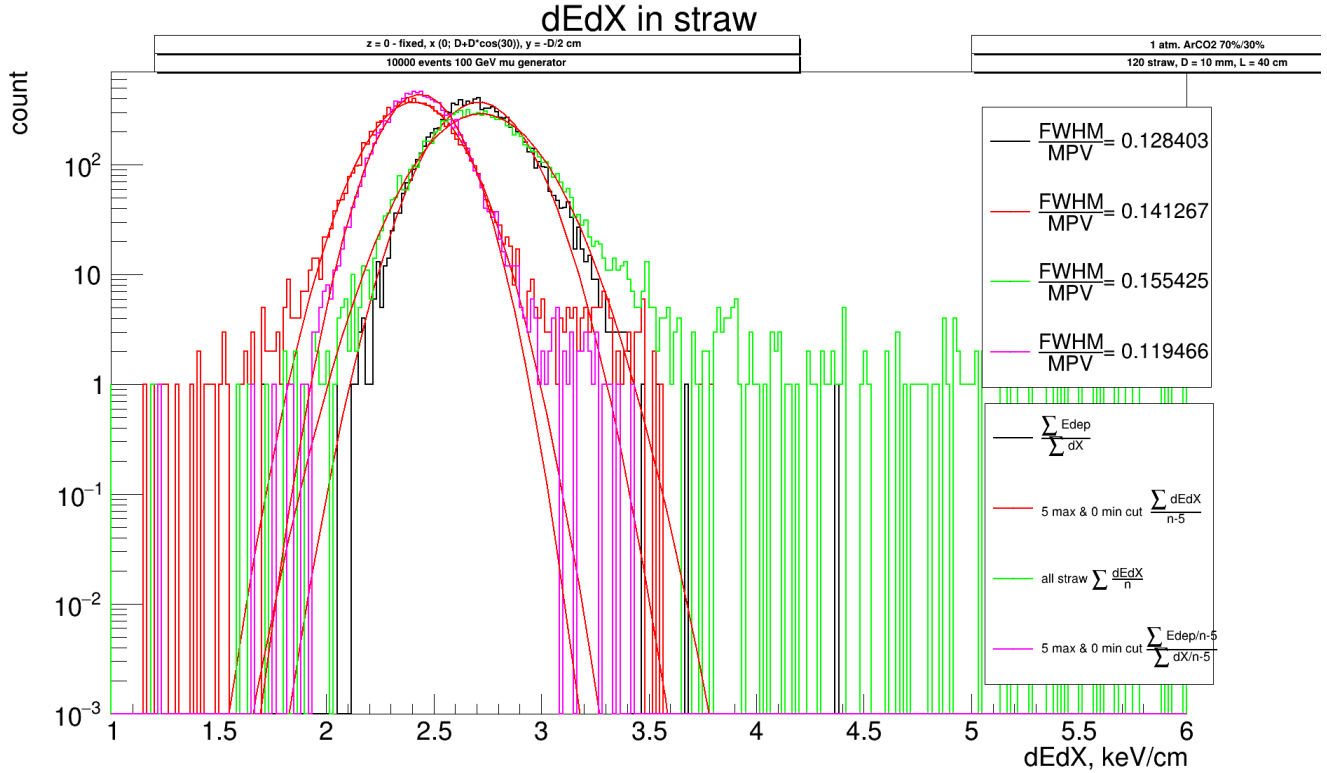
100 GeV 10000 mu+ events: primary de/dx on transportation

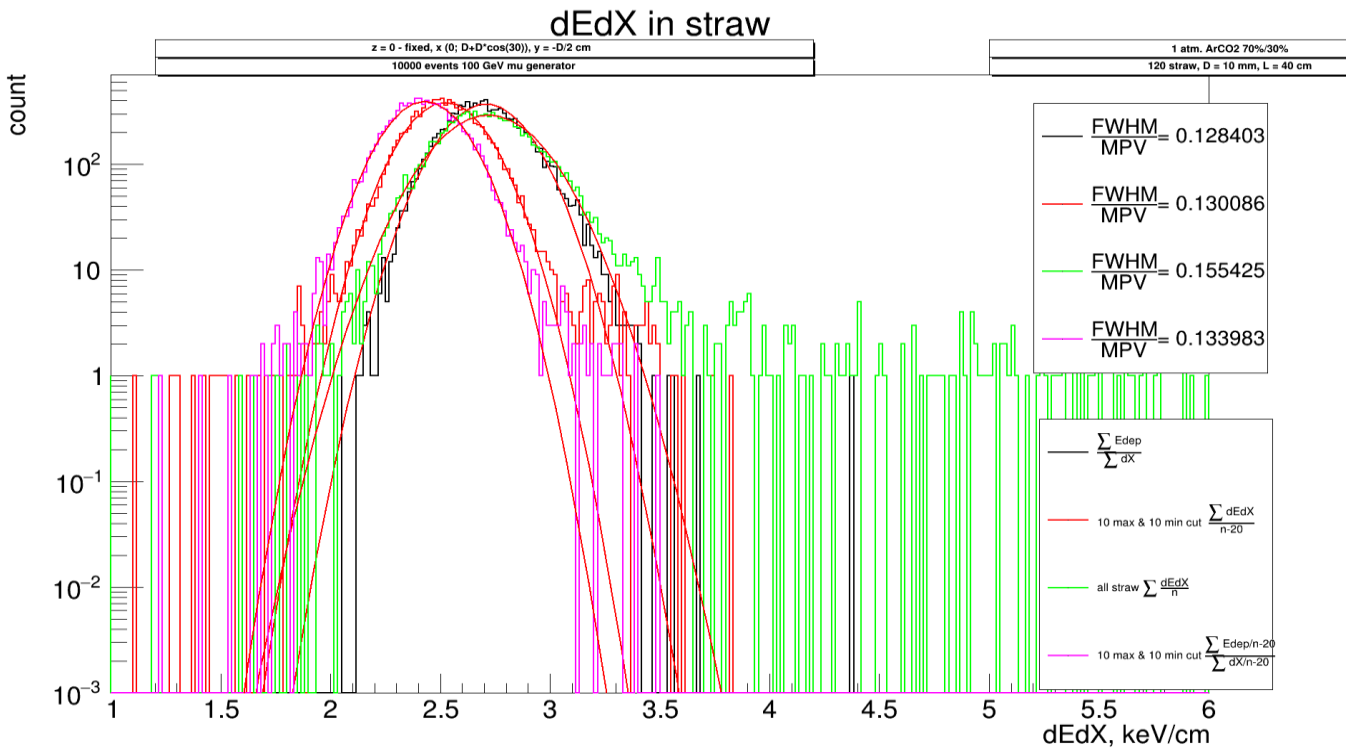
15 cuts maximum Edep

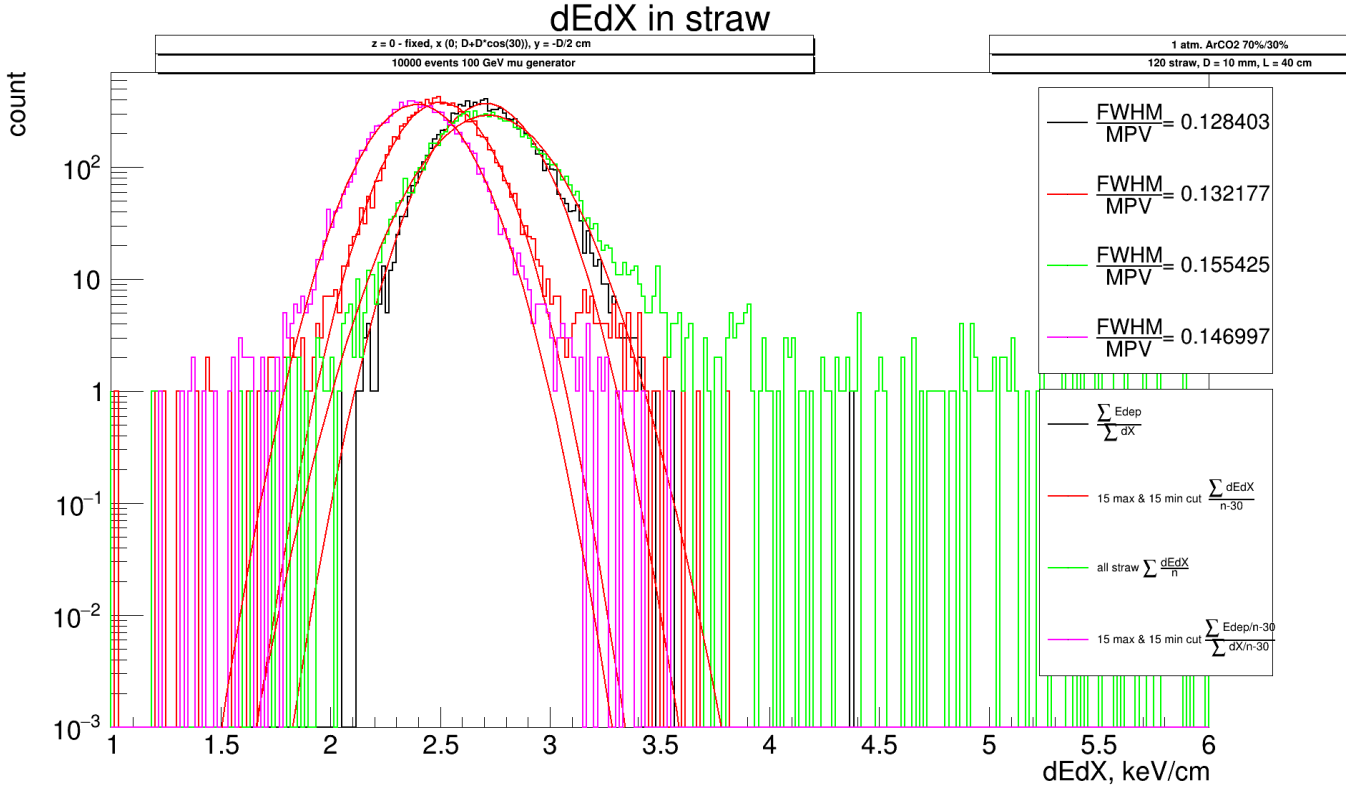
15 cuts minimum Edep




dEdX in straw
z = 0 - fixed, x (0; D+D*cos(30)), y = -D/2 cm
10000 events 100 GeV mu generator
1 atm. ArCO2 70%/30%
120 straw, D = 10 mm, L = 40 cm
count
dEdX, keV/cm
FWHM/MPV = 0.128403
FWHM/MPV = 0.152849
FWHM/MPV = 0.155425
FWHM/MPV = 0.132070
∑Edep/∑dX
0 max & 0 min cut ∑dEdX/n-0
all straw ∑dEdX/n
0 max & 0 min cut ∑Edep/n-0/∑dX/n-0


dEdX in straw
z = 0 - fixed, x (0; D+D*cos(30)), y = -D/2 cm
10000 events 100 GeV mu generator
1 atm. ArCO2 70%/30%
120 straw, D = 10 mm, L = 40 cm
count
dEdX, keV/cm
FWHM/MPV = 0.128403
FWHM/MPV = 0.141267
FWHM/MPV = 0.155425
FWHM/MPV = 0.119466
∑Edep/∑dX
5 max & 0 min cut ∑dEdX/n-5
all straw ∑dEdX/n
5 max & 0 min cut ∑Edep/n-5/∑dX/n-5


dEdX in straw
z = 0 - fixed, x (0; D+D*cos(30)), y = -D/2 cm
10000 events 100 GeV mu generator
1 atm. ArCO2 70%/30%
120 straw, D = 10 mm, L = 40 cm
count
dEdX, keV/cm
FWHM/MPV = 0.128403
FWHM/MPV = 0.130086
FWHM/MPV = 0.155425
FWHM/MPV = 0.133983
∑Edep/∑dX
10 max & 10 min cut ∑dEdX/n-20
all straw ∑dEdX/n
10 max & 10 min cut ∑Edep/n-20 / ∑dX/n-20


dEdX in straw
z = 0 - fixed, x (0; D+D*cos(30)), y = -D/2 cm
10000 events 100 GeV mu generator
1 atm. ArCO2 70%/30%
120 straw, D = 10 mm, L = 40 cm
count
dEdX, keV/cm
FWHM/MPV = 0.128403
FWHM/MPV = 0.132177
FWHM/MPV = 0.155425
FWHM/MPV = 0.146997
∑Edep/∑dX
15 max & 15 min cut ∑dEdX/n-30
all straw ∑dEdX/n
15 max & 15 min cut ∑Edep/n-30 / ∑dX/n-30