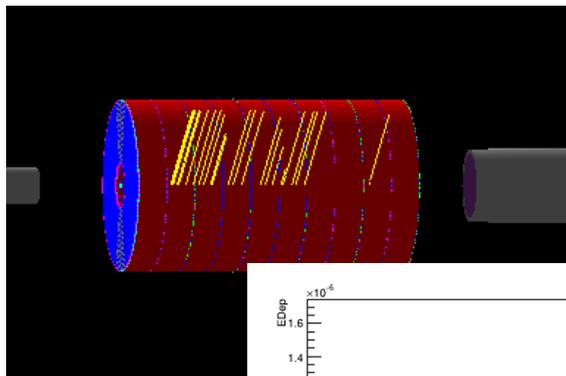


Z-Resolution Study for Conical Shape



Steps:

Generated 10k protons along target

Each track had theta=70deg, phi=45deg, momentum=400MeV/c

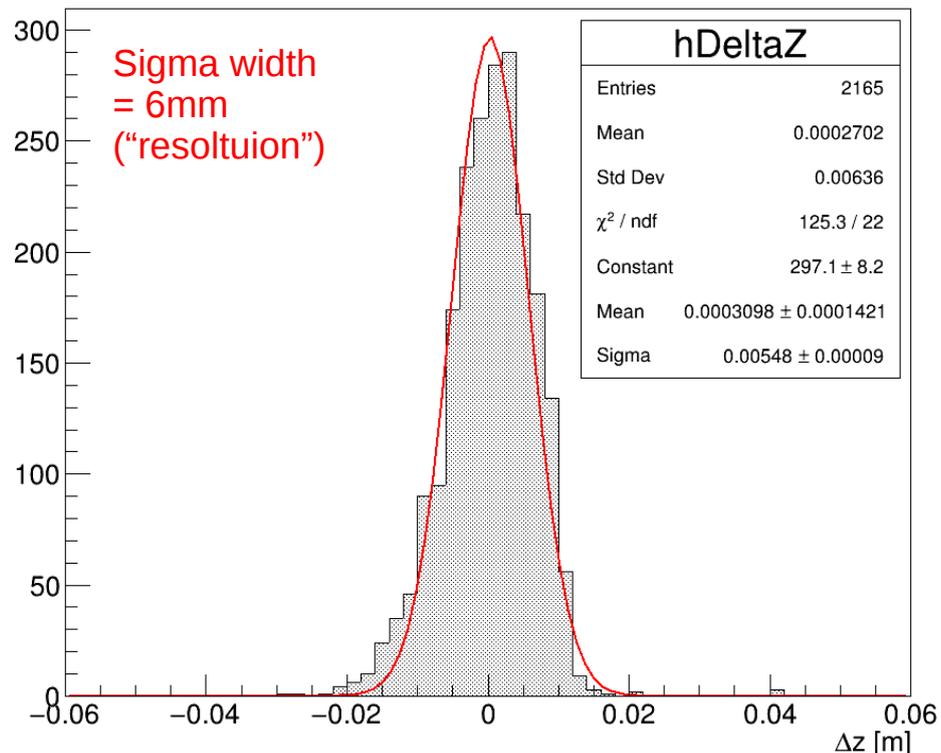
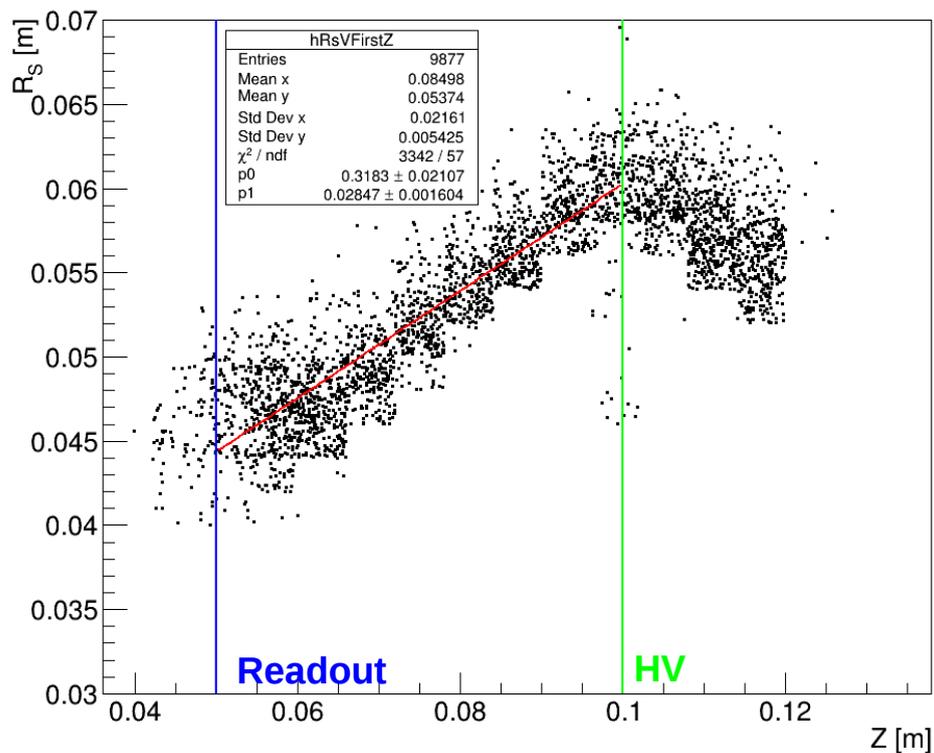
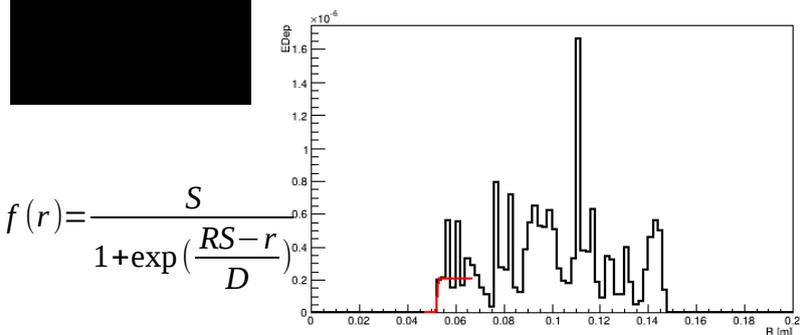
For each track – perform Rs step fit in Edep vs R graph to extract Rs

Plot Rs Vs Z at Rs, for all 10k tracks

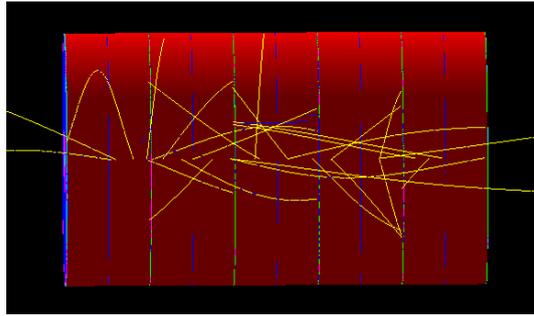
Fit simple straight line ($R_s = [0]*Z + [1]$) to region on Rs Vs Z at Rs between physical structures (blue=readout plane, green=HV plane)

For each point in Rs Vs Z at RS graph, calculate difference between theoretical Z from straight line fit and actual Z (delta Z)

Histogram delta Z values and take sigma width as resolution

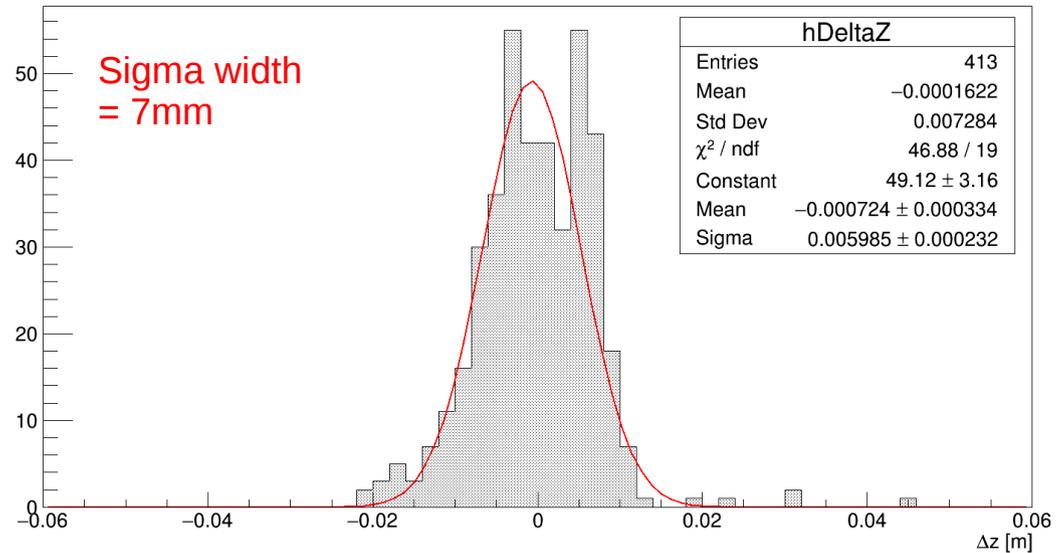
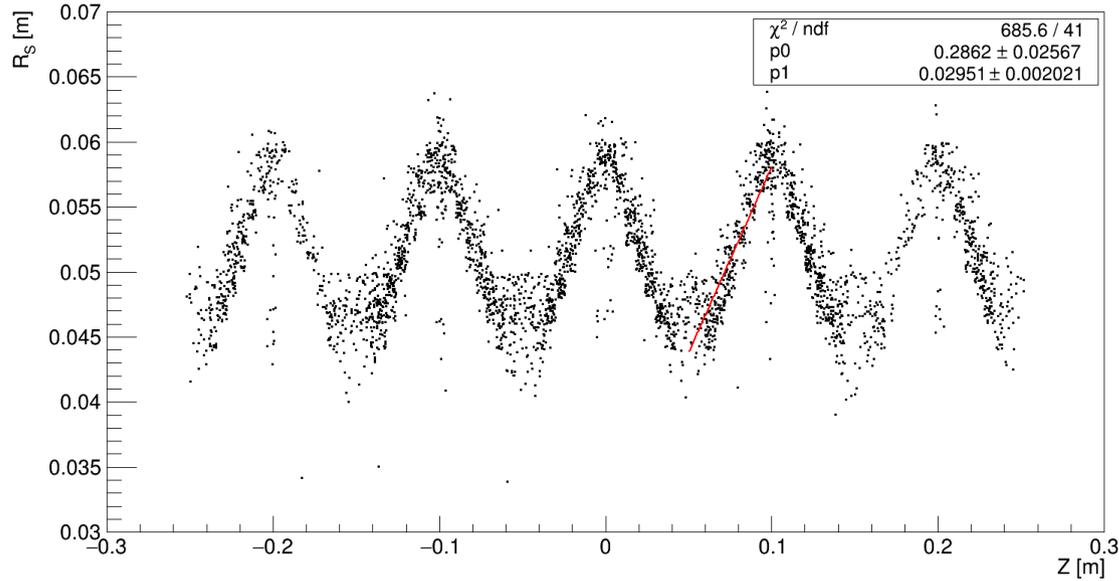


Z-Resolution Study for Conical Shape



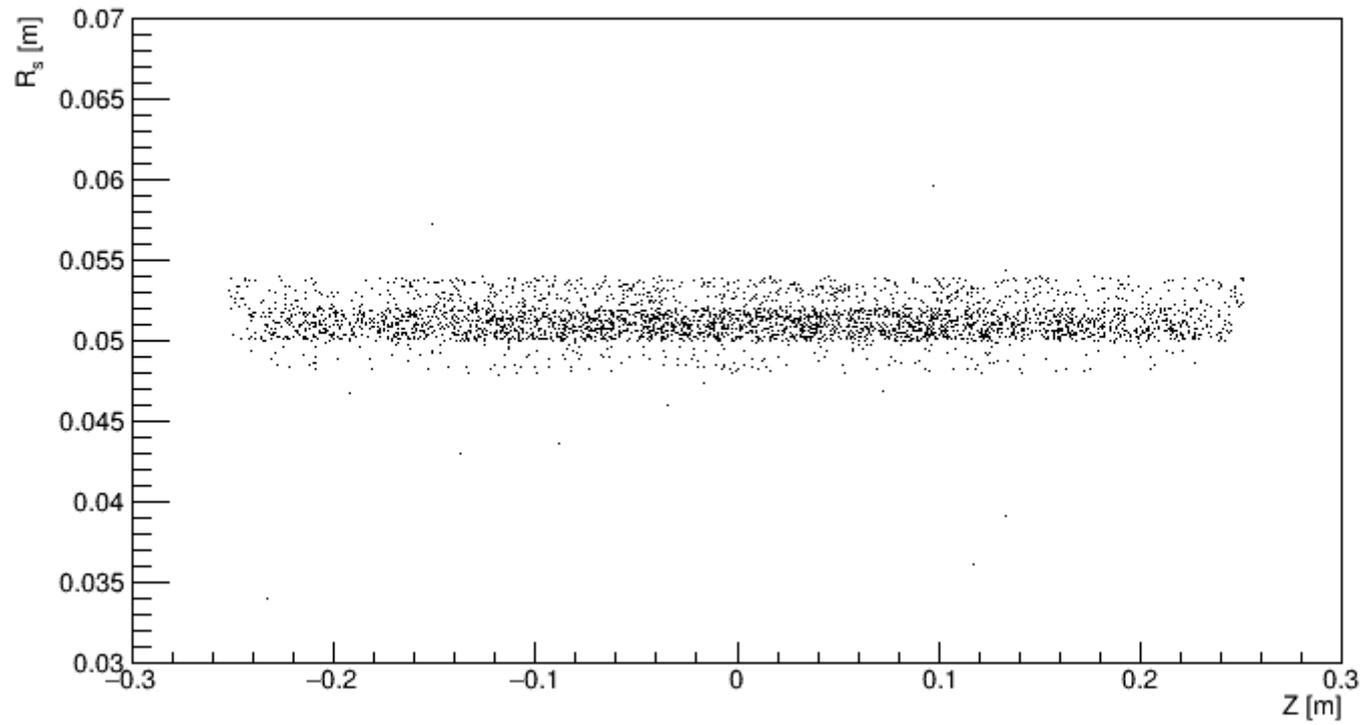
Steps:

Repeated previous study for 10k events with theta=30-70degrees, all phi, and p=60-400MeV



Non-Conical (i.e. standard) Shape

Reminder: no such z-dependence for standard shape, so no comparison from this technique



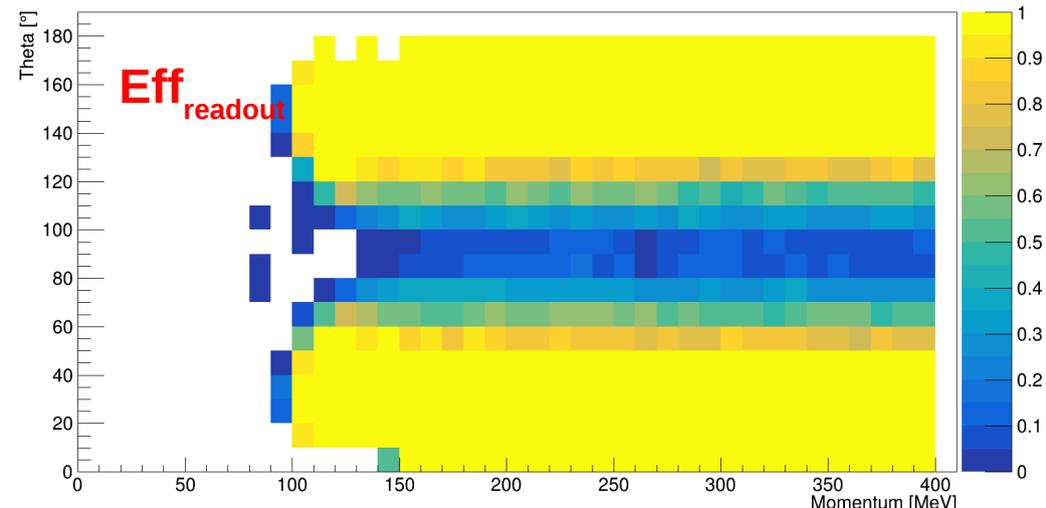
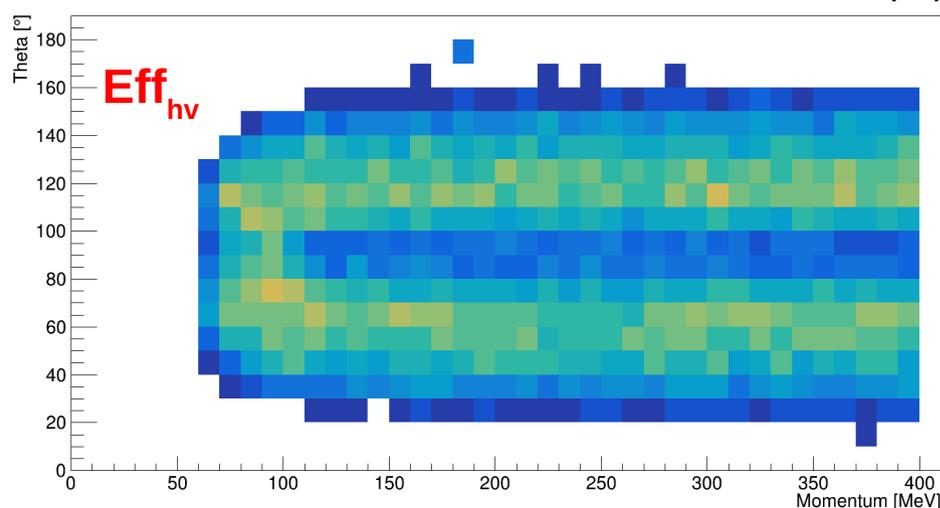
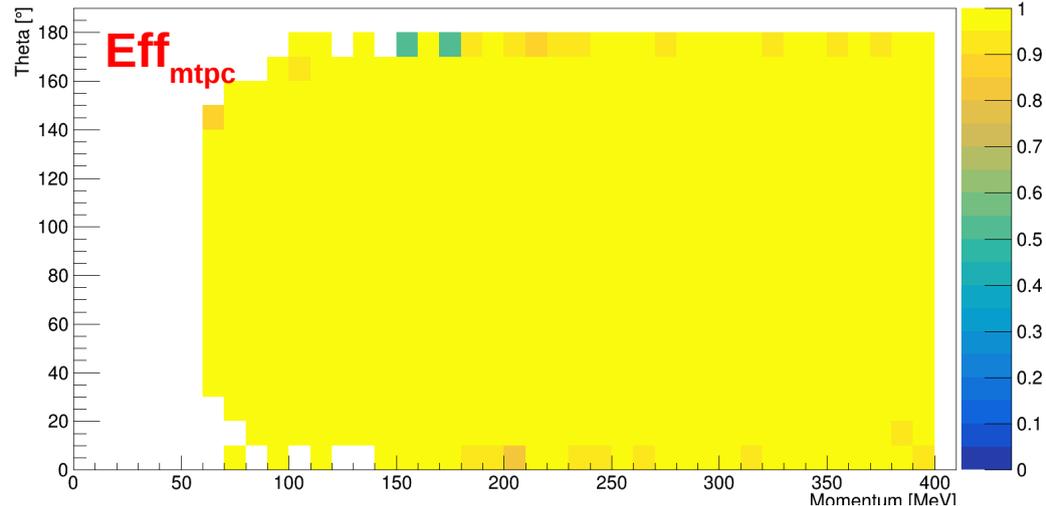
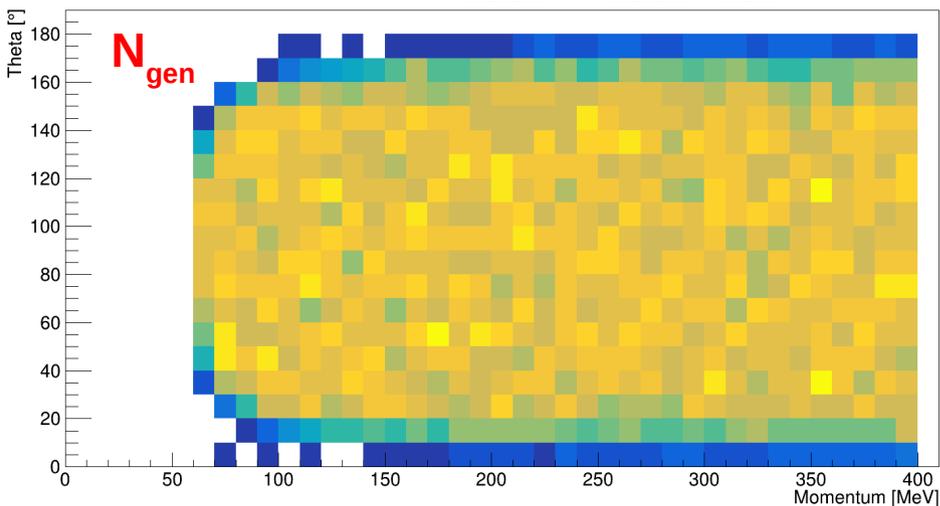
Track Intersection Study with Conical Geometry

Generated 100k protons along target, with varying track properties (theta=0-180deg, phi=All, momentum=60-400MeV/c)

$N_{\text{gen}} = 100\ 000$ tracks

For each generated track, check how many enters mtpc gas volume (N_{mtpc}), check if they hit any HV planes (N_{hv}), or readout planes (N_{readout})

Calculate efficiencies: $\text{Eff}_{\text{mtpc}} = N_{\text{mtpc}} / N_{\text{gen}}$
 $\text{Eff}_{\text{hv}} = N_{\text{hv}} / N_{\text{mtpc}}$
 $\text{Eff}_{\text{readout}} = N_{\text{readout}} / N_{\text{mtpc}}$



Track Intersection Study with Conical Geometry

The crucial plot!

How many do not strike either the HV plane or the readout plane i.e. those which only interact with the gas.

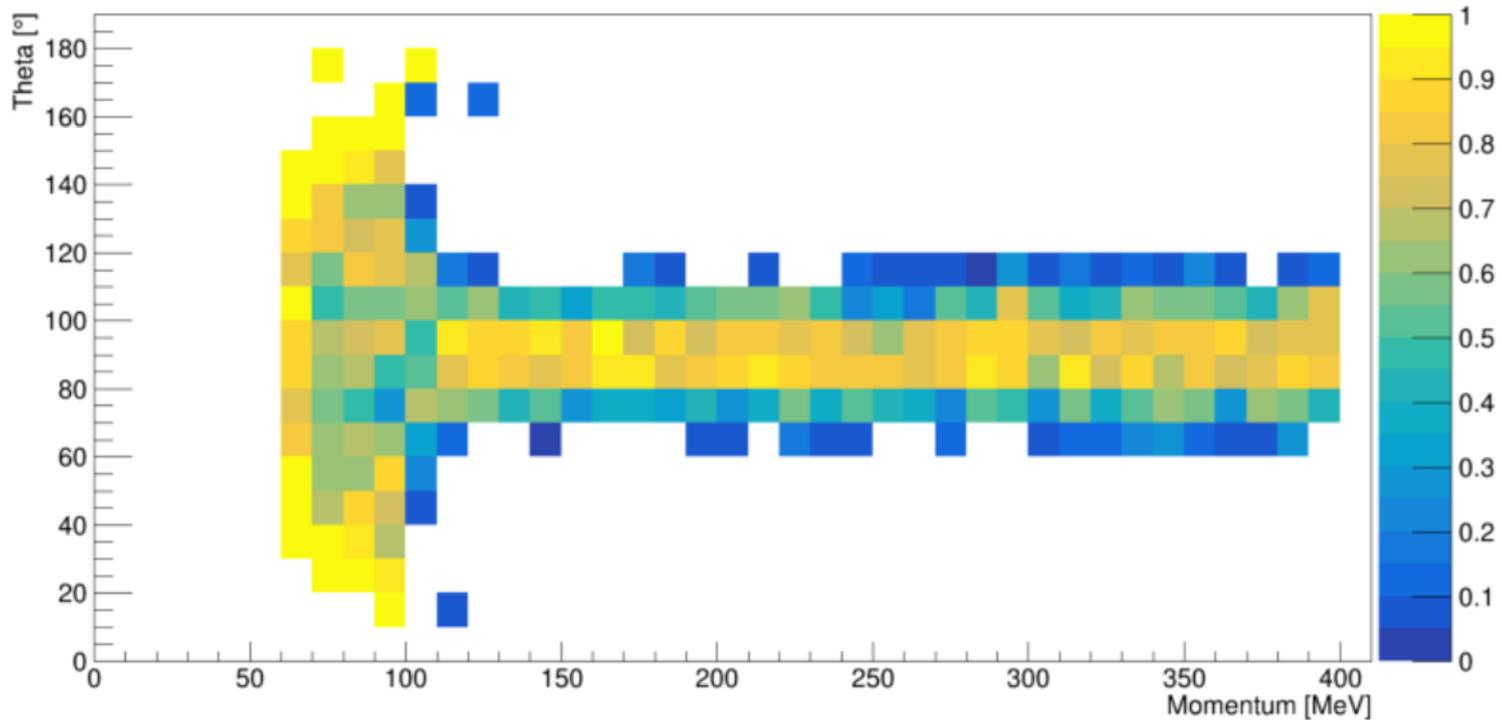
Colour shows #tracks which don't hit HV or Readout / # tracks entering gas

Total numbers were:

Tracks entering mtpc gas = 82 378

Tracks which strike neither HV or readout = 18 836

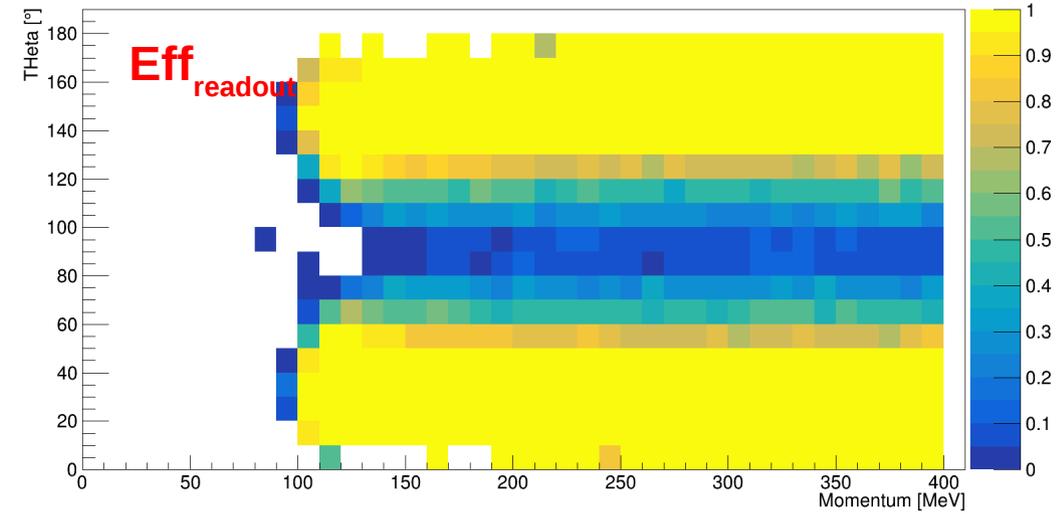
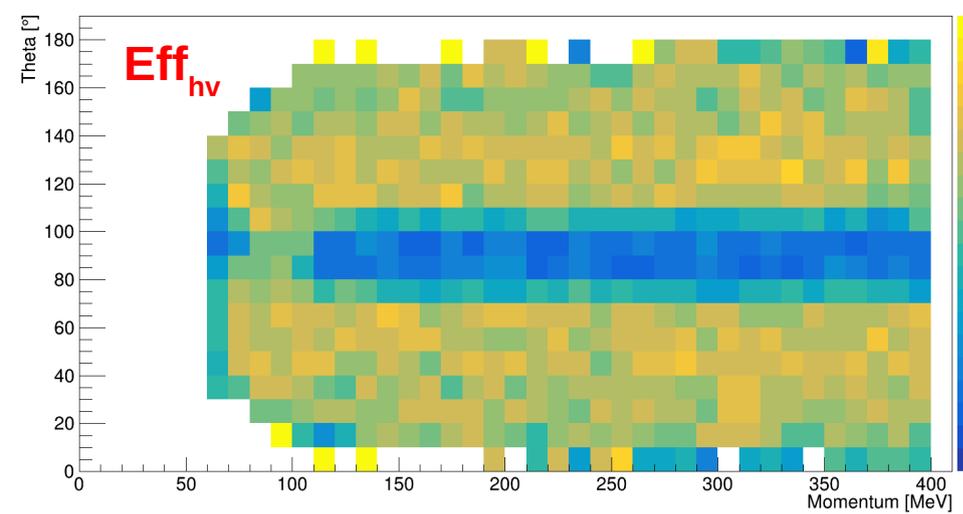
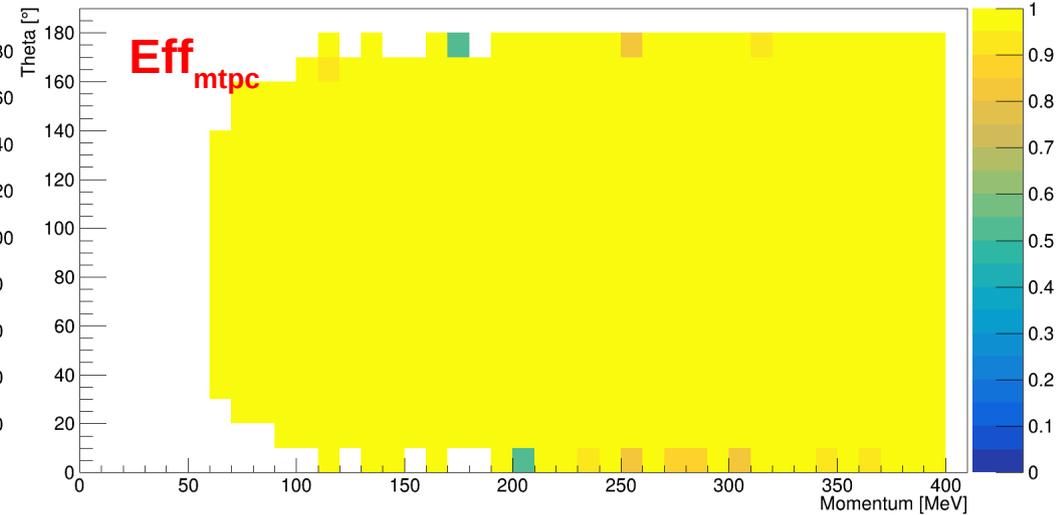
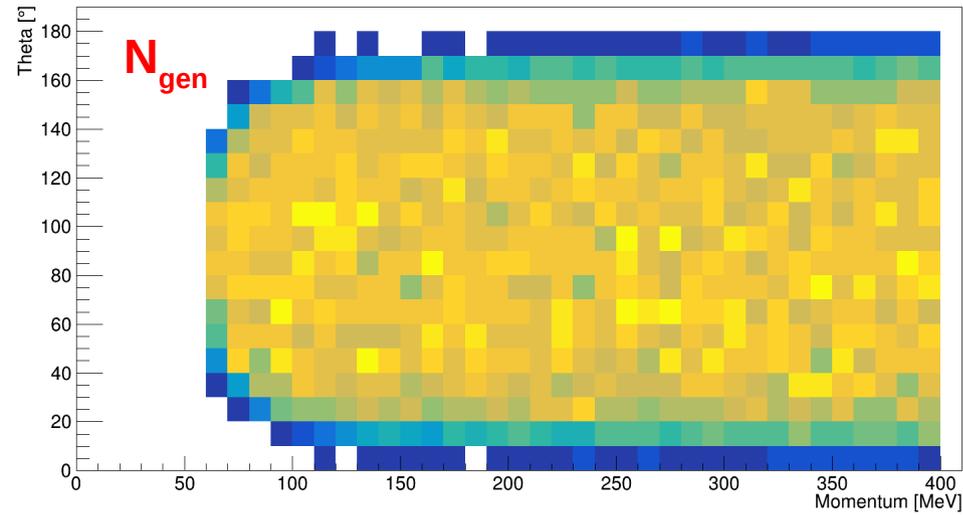
About 23% hit neither.



Track Intersection Study Cross Check with Non-Conical (ie standard) Geometry

Performed same study for standard cylindrical inner wall mTPC design

Eff_{hv} values are increased by $\sim 10\%$



Track Intersection Study Cross Check with Non-Conical (ie standard) Geometry

How many do not strike either the HV plane or the readout plane i.e. those which only interact with the gas.

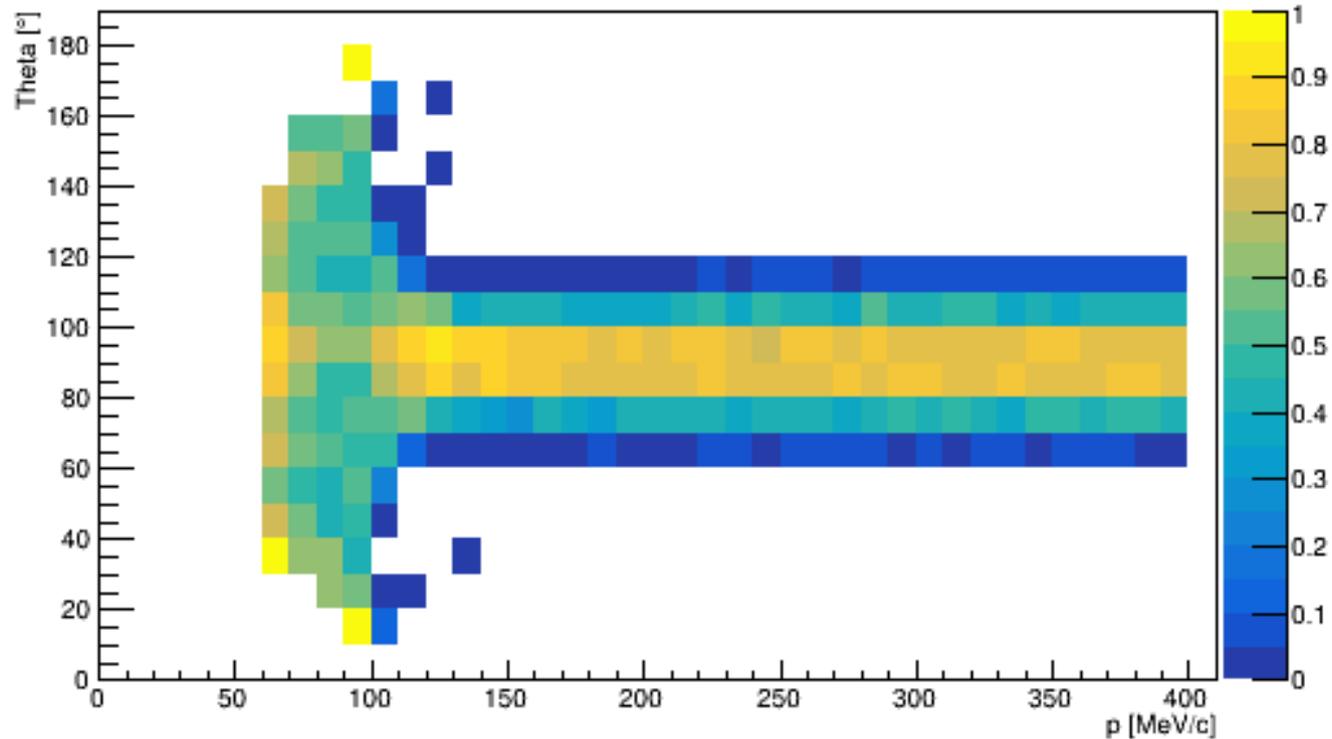
Colour shows #tracks which don't hit HV or Readout / # tracks entering gas

Total numbers were:

Tracks entering mtpc gas = 78 799

Tracks which strike neither HV or readout = 16 850

About 21% hit neither.



Next Steps

Do similar thing for drift time of ionisation (perhaps less fluctuation and better z-resolution achievable, would like to get to ~4mm?)

Simultaneously work on g4sbs digitisation