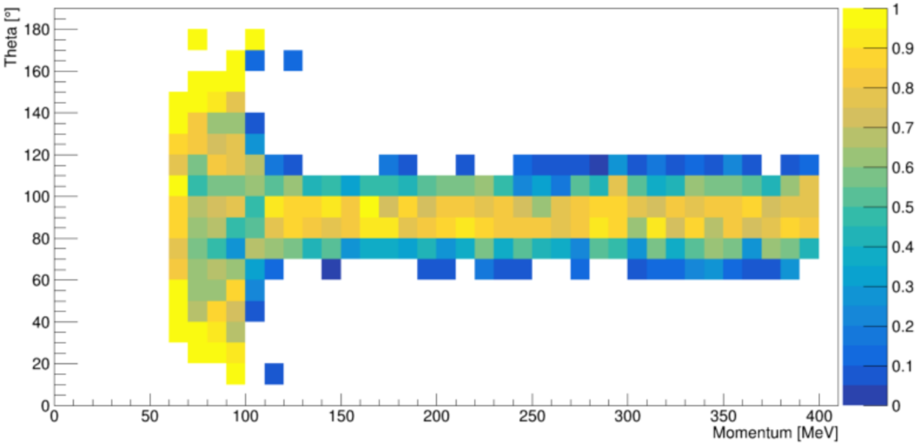
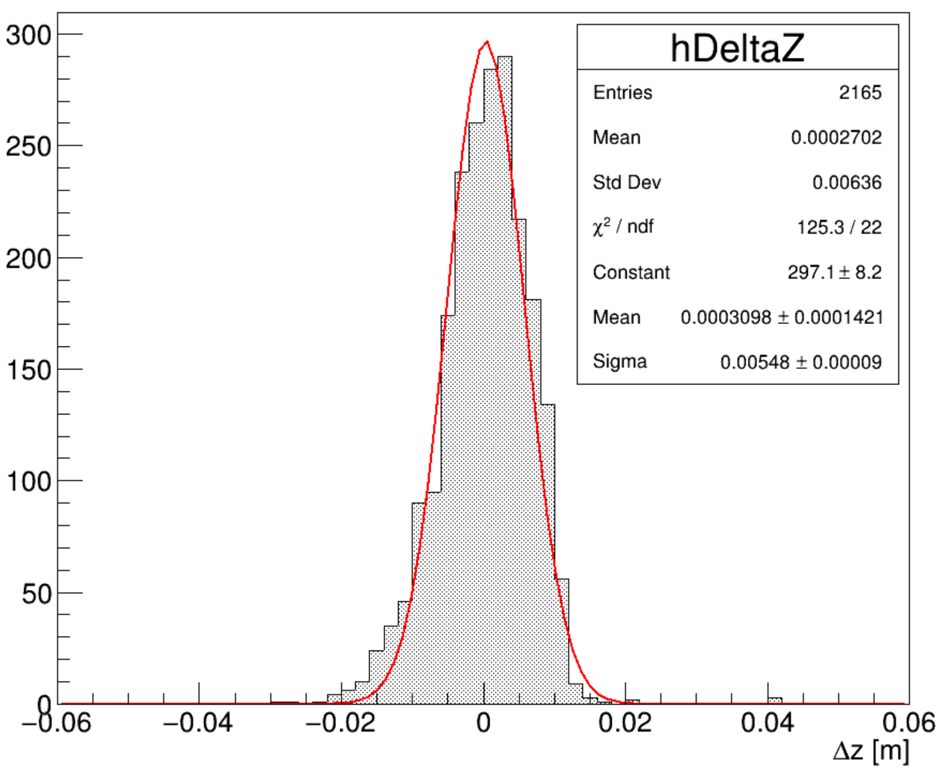
Reminder of Last Time



Conical design – tracks which do not hit either HV plane or readout
Tracks randomnly generated across theta 0-180deg, all phi, momentum 60-400MeV/c

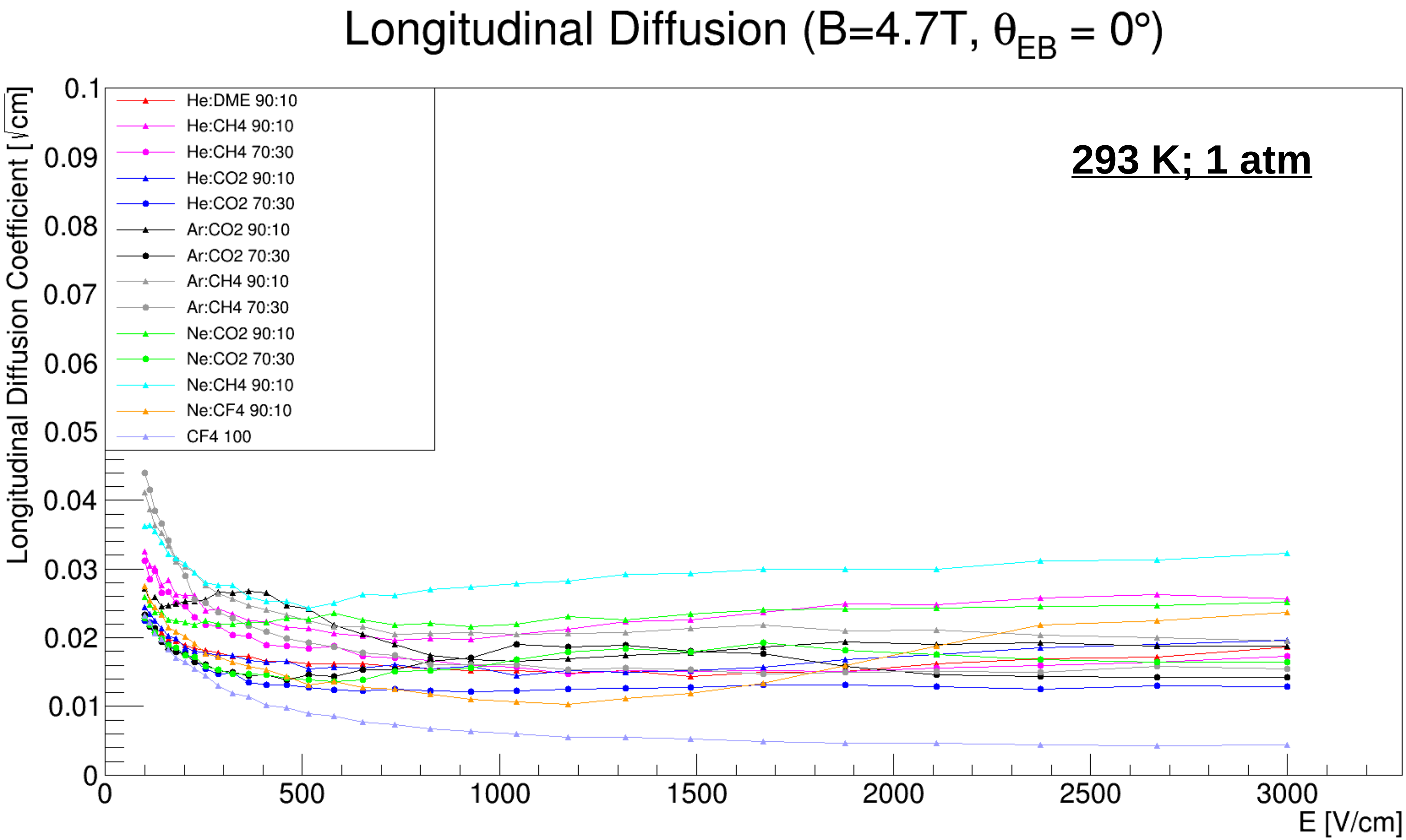
23% tracks hit neither HV or readout



Determined relationship between fittted position of radius of first point of track in gas volume and Z. Difference between expected and actual z gave 6mm sigma width resolution number for z-resolution estimate.
(This is for 100k tracks, each protons with 400MeV/c, theta=70deg, phi=45deg)

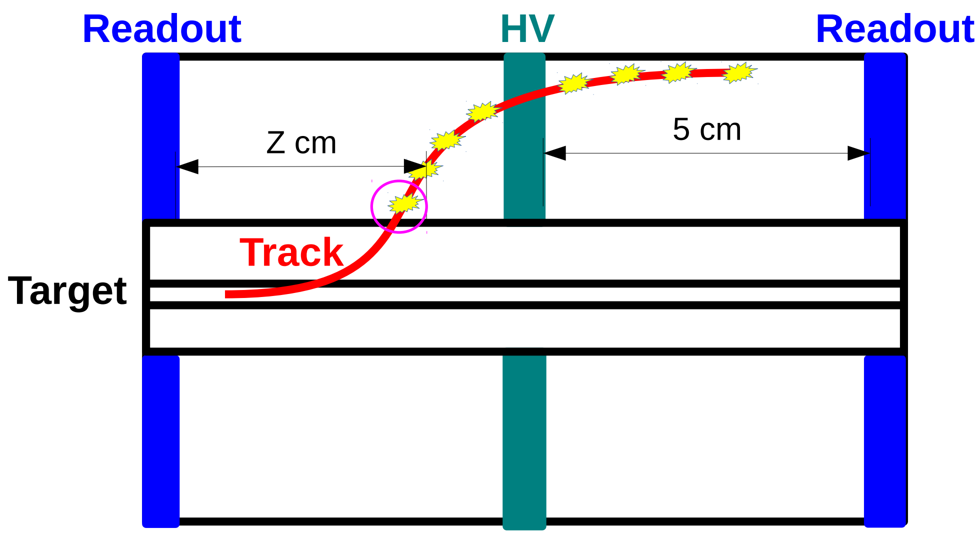
Next planned step – look at arrival time of drift charge to extract resolution

Diffusion Coefficient from Magboltz Simulations



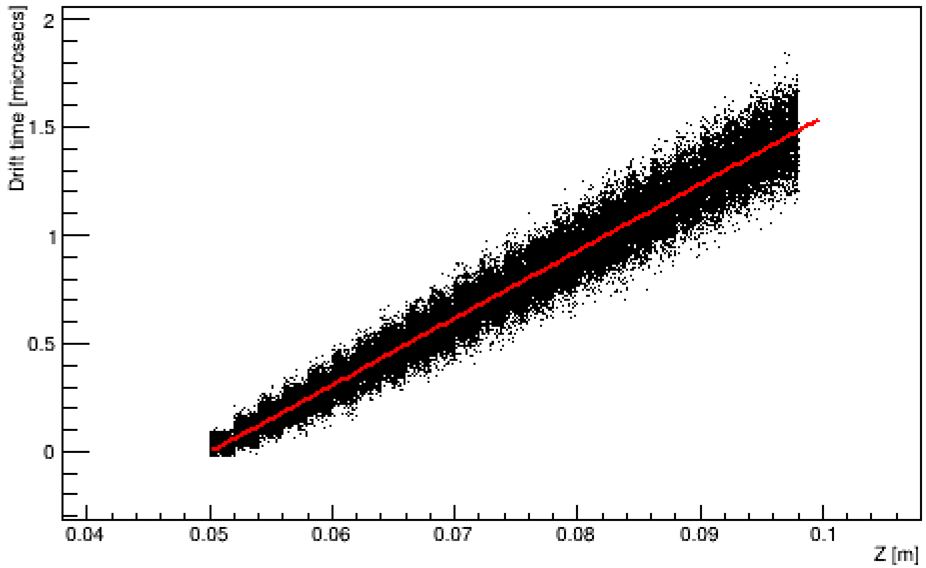
- Longitudinal diffusion will affect time of arrival on pad, in direction of E and B
- Taking as example study, E=~1.2kV/cm and He:CH4 70:30 mix for a ~1.55us drift time over 5cm and this gived D_L = 0.015 cm^0.5

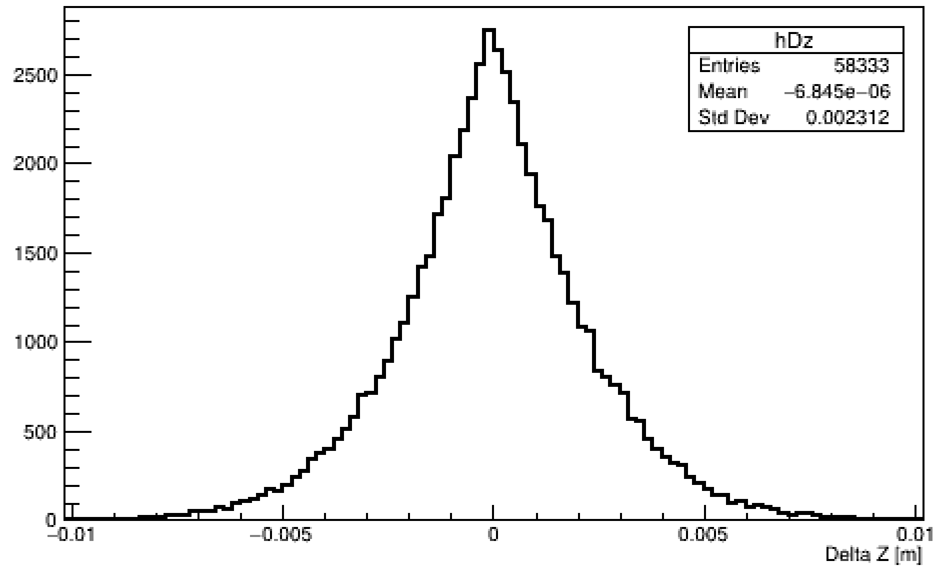
Estimation of this Spread in Geant4



- Currently generation and drift of electron clouds is not in geant4 simulation (can do separatey in garfield++ if required, or can put into geant4 (did this for rtpc)). But current estimate:
- Take position of first energy deposition in gas volume, assume charge generated (circled pink above)
- Assume drift time of 1.55us over 5cm achievable (see later slide for reminder on magboltz simulations)
- Distance Z is smeared by Gaussian with sigma width = D_L * sqrt(Z), i.e. Z = Z + Gauss(0,D_L*sqrtZ)
- (this technique was mirred by transverse diffusion smearing used in ALICE TPC garfield++ simulation)
- t_drift = (Smeared Z/5) * 1.55us
- t_drift is then plotted against Z_Edep
- This distribution is then fitted with a straight line
- The difference in expected (from straight line relation) and actual z is then plotted in histogram and sigma width taken as resolution

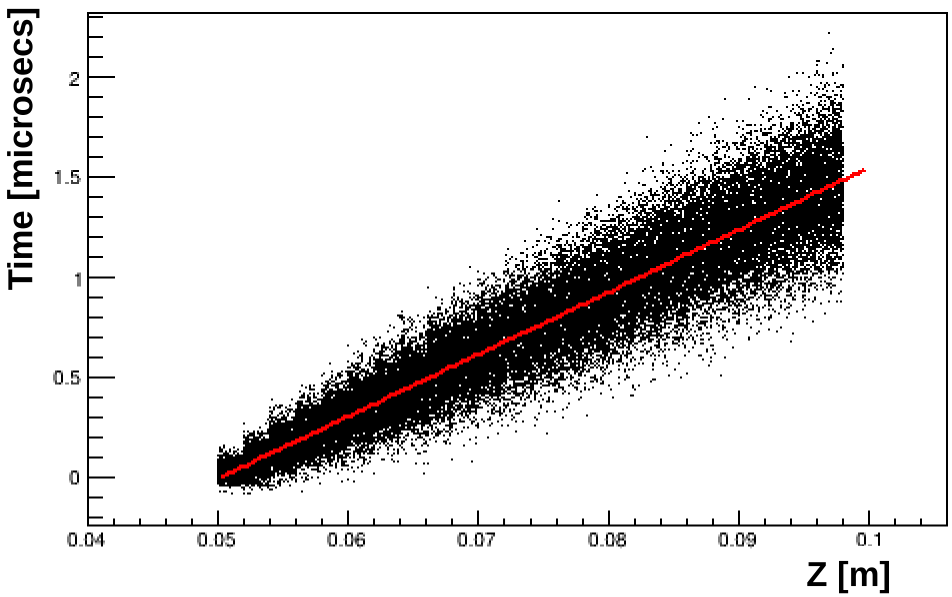
Geant4 Results

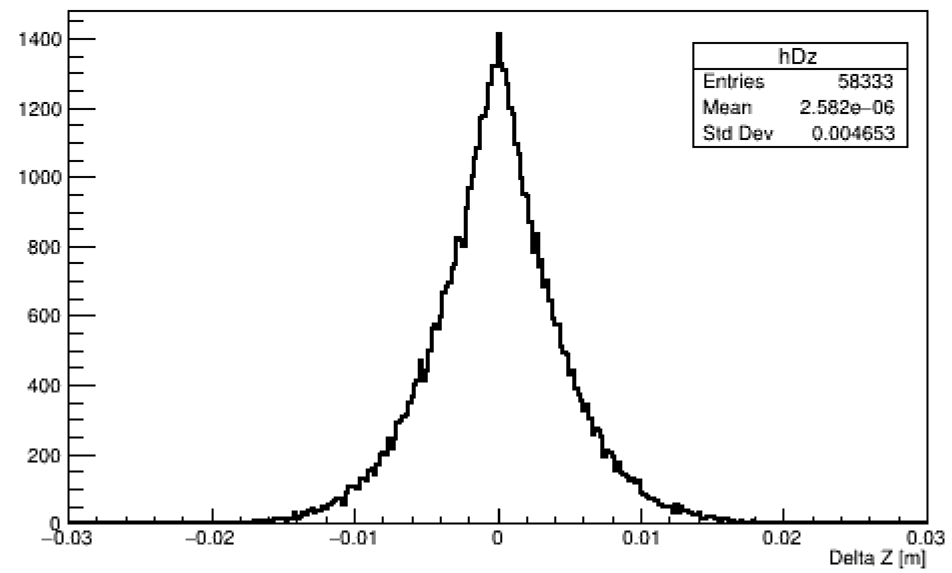




- 100k proton tracks, 400MeV/c, theta 70deg, phi 45deg (D_L = 0.015cm^0.5 for smearing)
- In this case 2mm sigma width is obtained for z-resolution
- Is thisover optimistic? Here the position of the edep in the gas volume is smeared once, in reality would each electron in the resulting cluster undergoing smearing affect this much more? Could try to simulate this too in geant, by creating cluster at e-dep and smearing each of these drifts too, although already by repeating so many proton tracks kind of artificially doing this to some extent anyway.

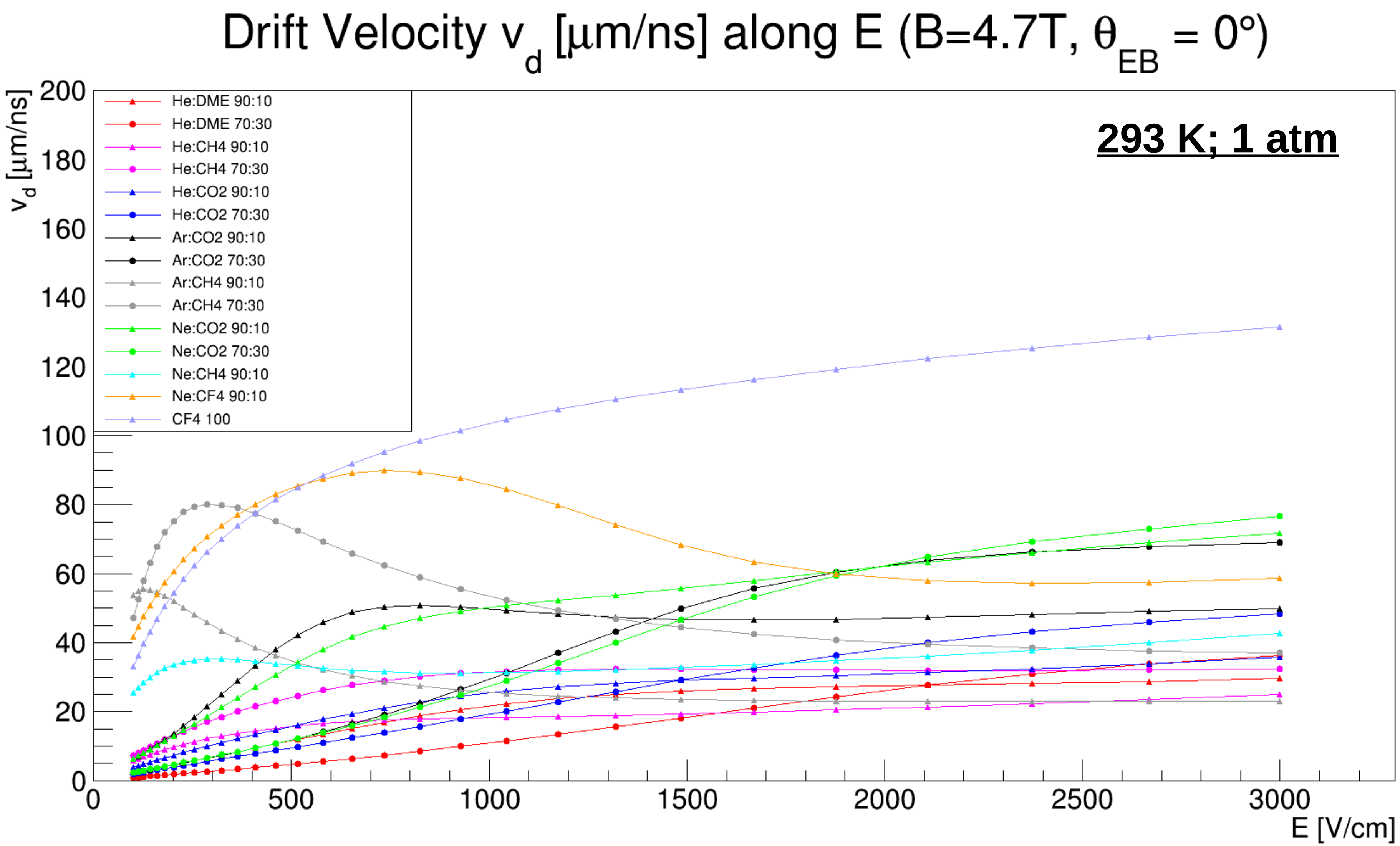
Geant4 Results





- Repeated previous study but used D_L = 0.03 sqrt(cm), ie worst case in slide 2
- Again 100k proton tracks, 400MeV/c, theta 70deg, phi 45deg
- In this case 4.7mm sigma width is obtained for z-resolution

For Reference: Drift Velocity along E from Magboltz Simulations



For Reference: Transverse Diffusion from Magboltz Simulations