# Tracking Performance Update

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# Muon Gun Data Selection

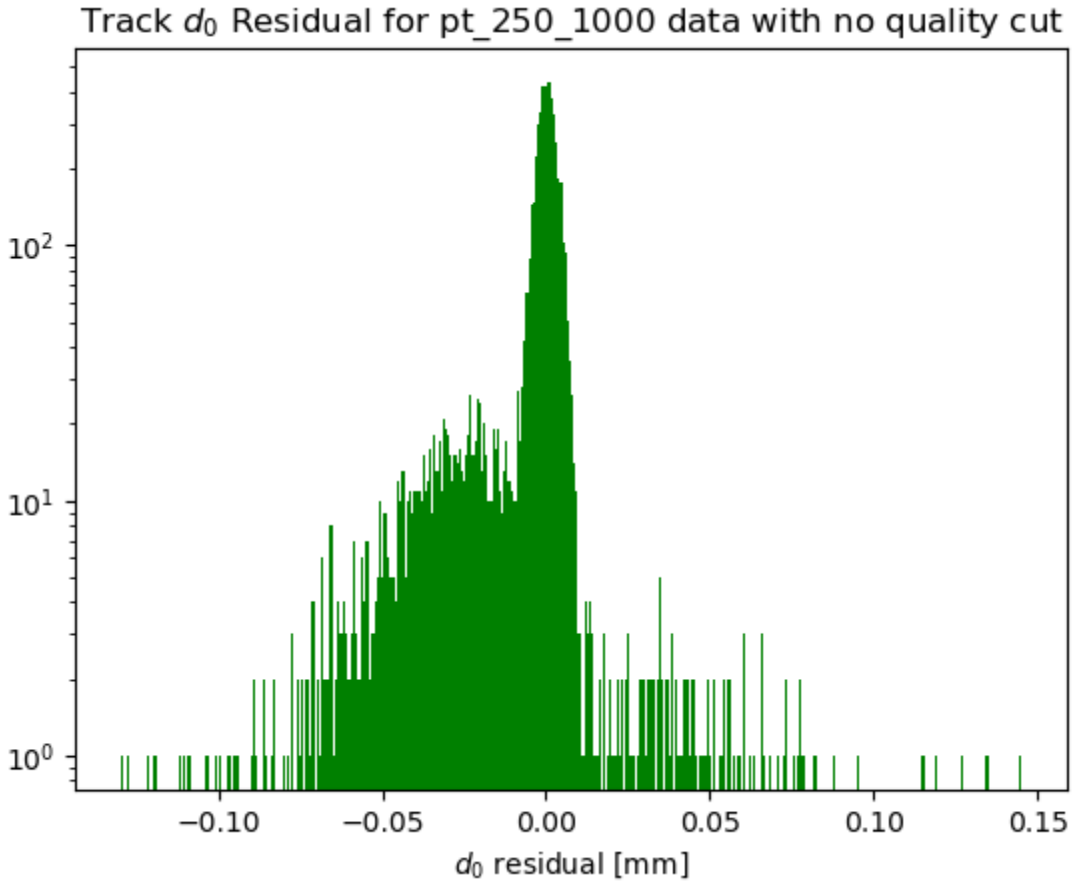


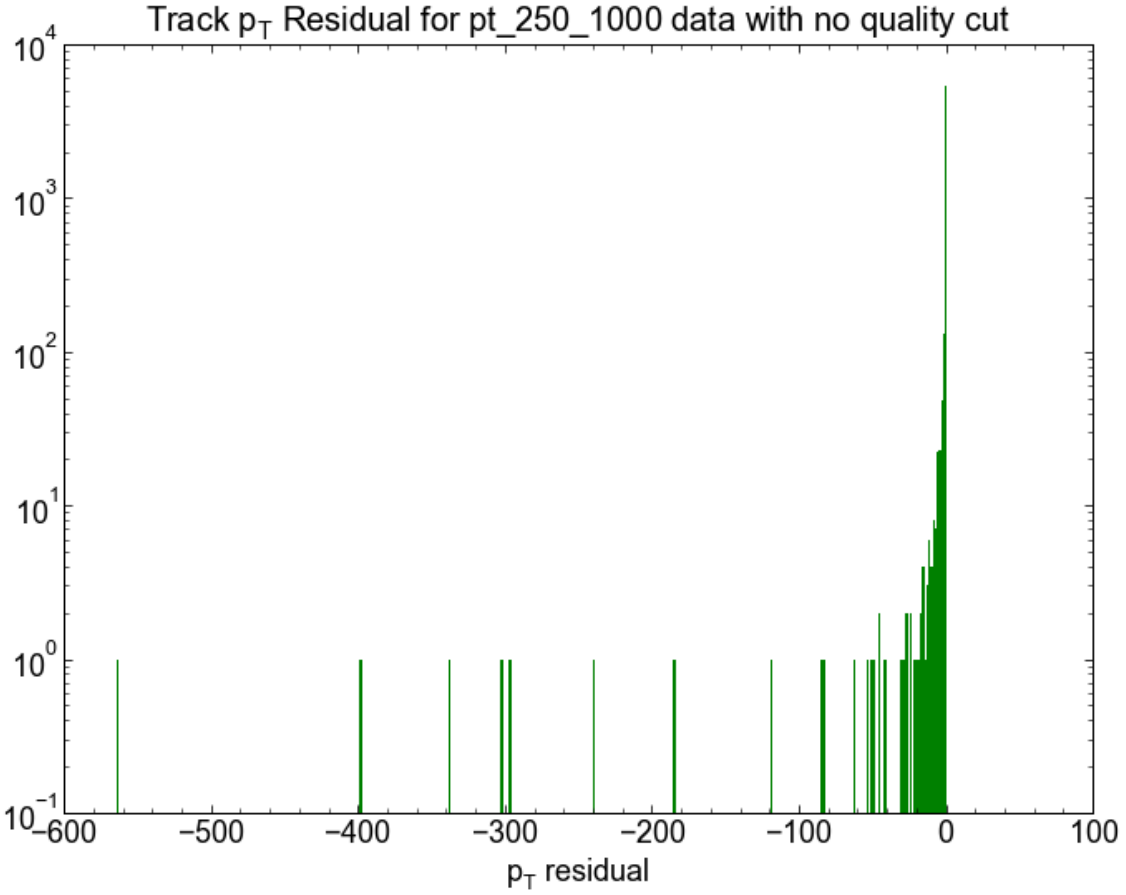
- Data from /tank/data/snowmass21/muonc/fmeloni/DataMuC_MuColl10_v0A/reco/muonGun_pT_0_50, pt_50_250, and pt_250_1000 (note: no BIB)
- I matched the reconstructed Muon tracks to truth Muons using only dR matching with dR < 0.005
- Where there were multiple reconstructed tracks for a single event, I chose the track with the highest nhits
- pT residual is calculated using dpT/pT, or (truth pT – reco pT)/truth pT
- D0 residual is just d0 because truth particles are generated at the origin

# Basic Residual Plots



- The worst d0 residuals are no more than 0.1mm away from the origin
- The worst pT residuals are many orders of magnitude off. Every plot hereon has a quality cut of dpT/pT < 1

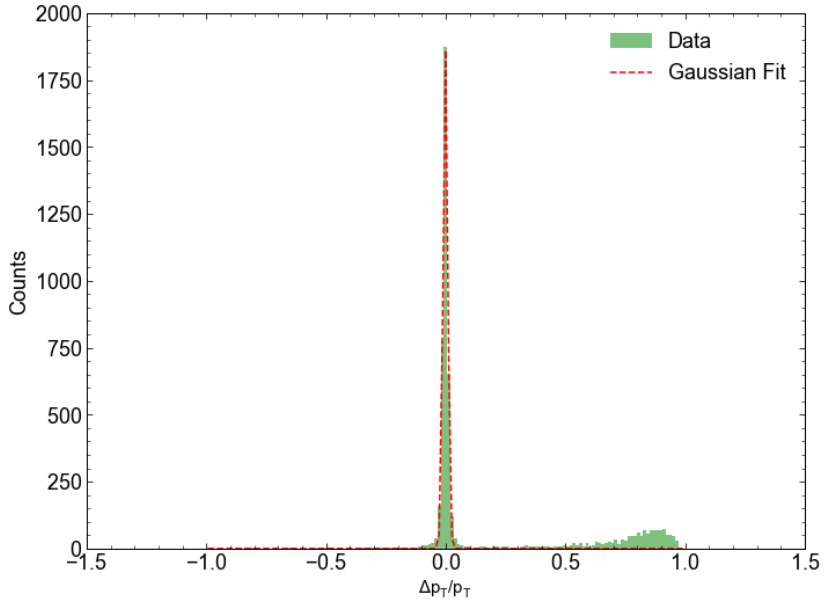


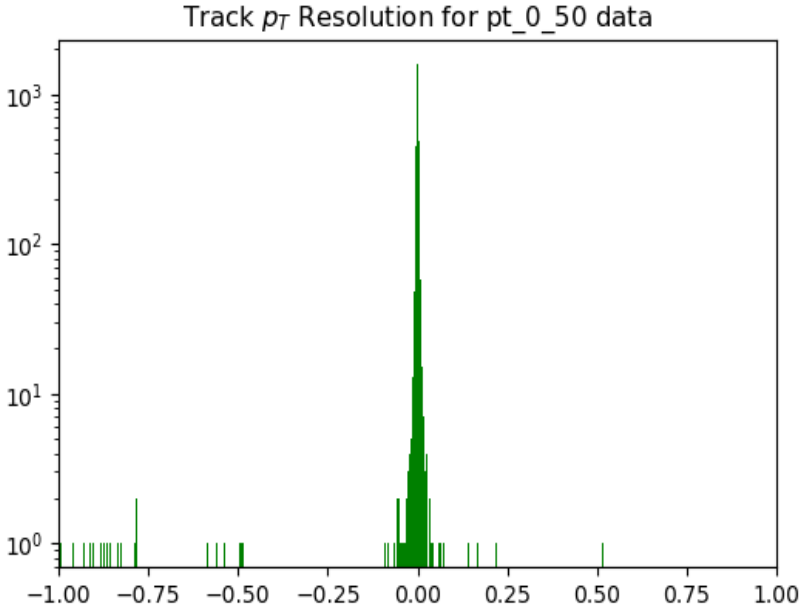



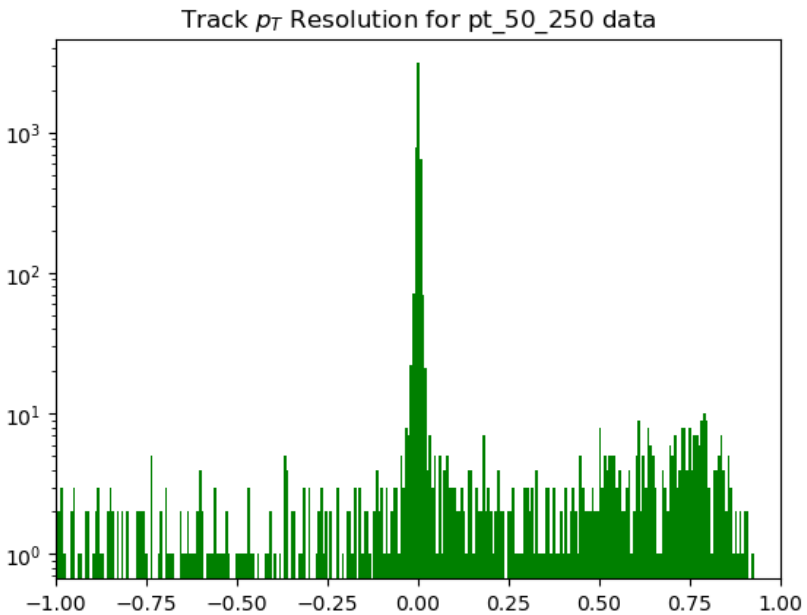
# Basic Residual Plots - pT

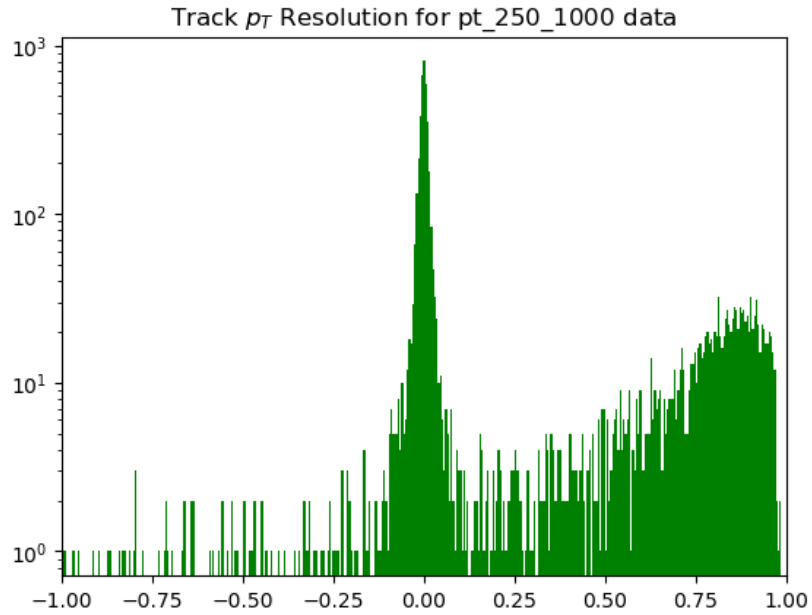


- With the quality cuts in place (i.e fitting the Gaussian between [-1,1]), the pT plots have the expected gaussian shape around 0 (right)
- NB: Bottom plots are log scale, right plot is not
- The plot on the right is only for pt_250_1000 data but looks similar for the others



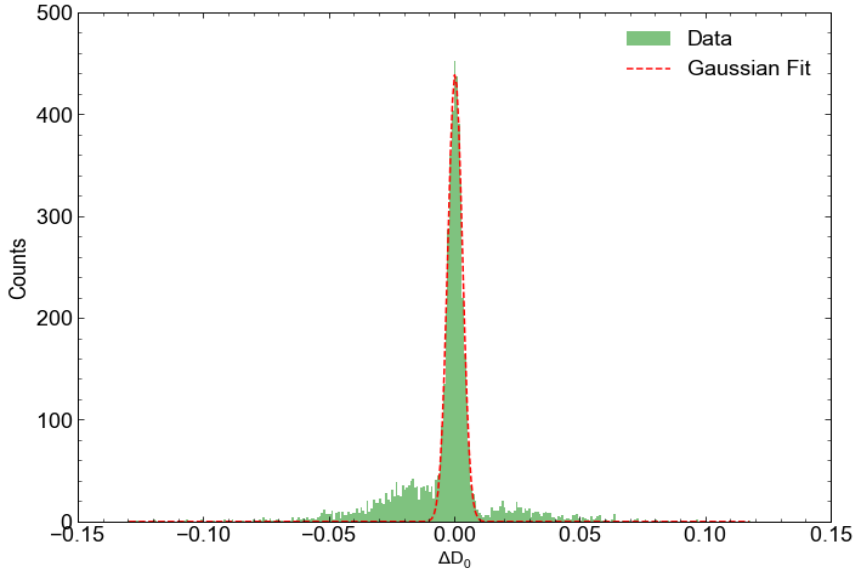



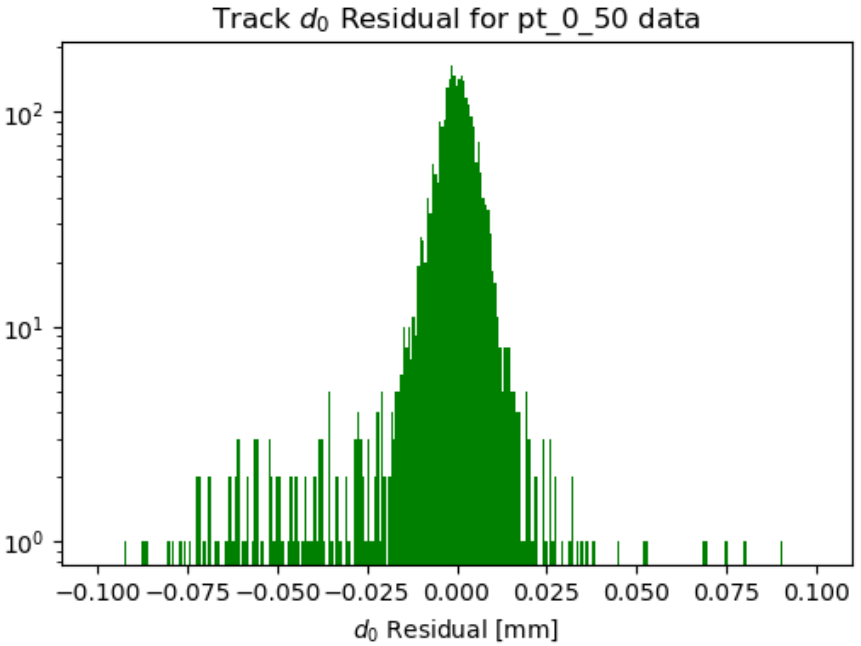



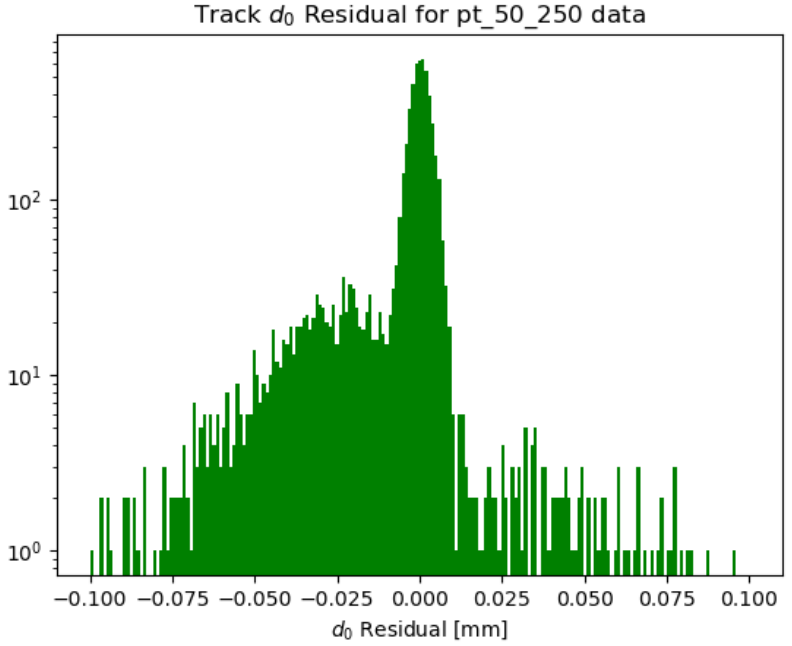
# Basic Residual Plots – d0

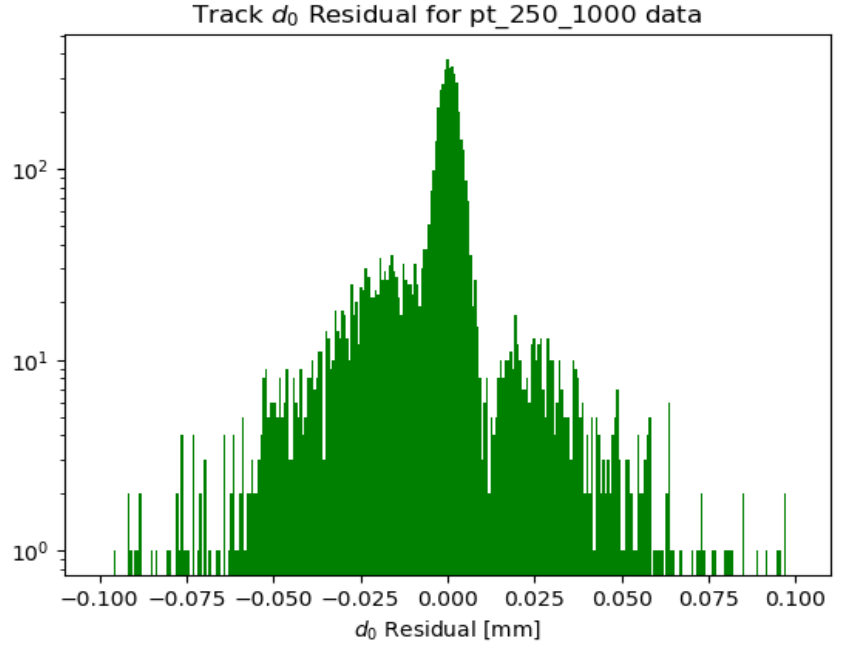


- Similarly for d0 plots
- NB: Bottom plots are log scale, right plot is not
- The plot on the right is only for pt_250_1000 data but looks similar for the others



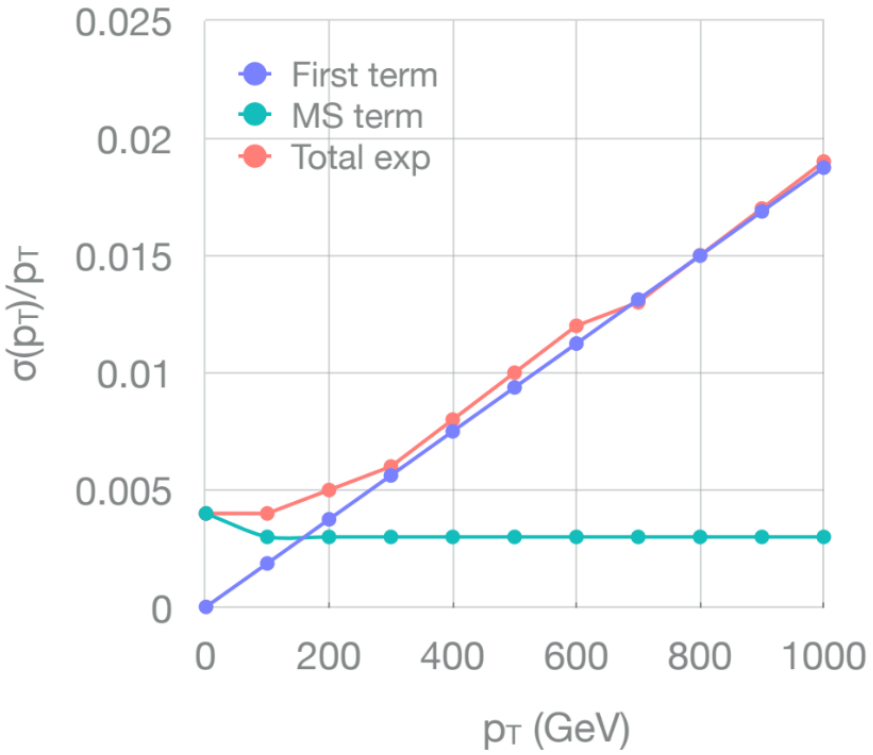



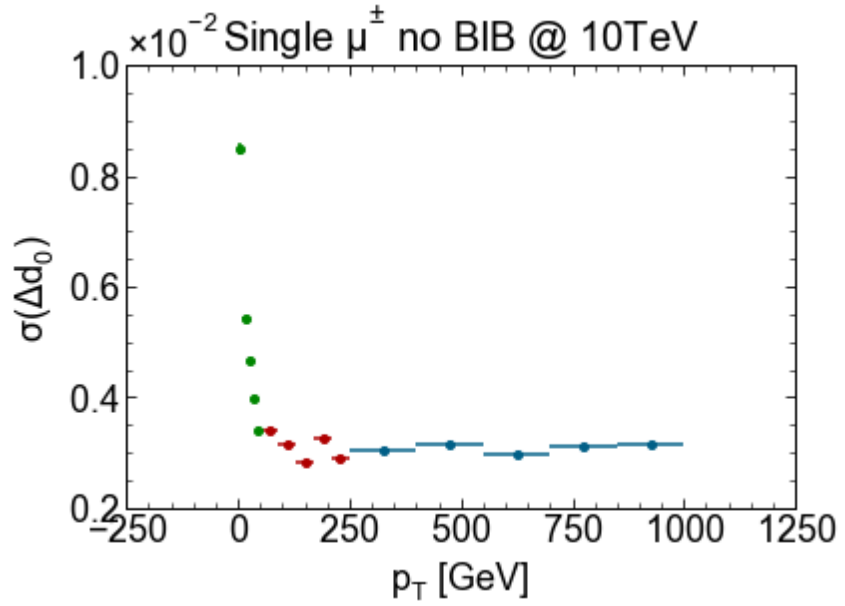



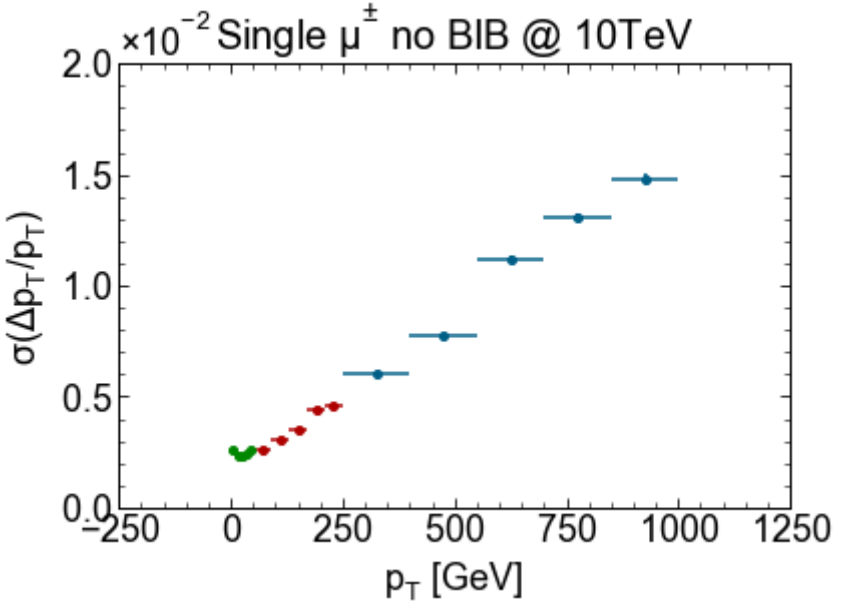
# Sanity Check



- On the bottom left is the pT resolution calculated from first principles for a 3.5T B-field (credit Karri Dipetrillo)
- On the bottom right is what I find from the data, for a 5T field
- I added a similar plot for the d0 resolution for completeness



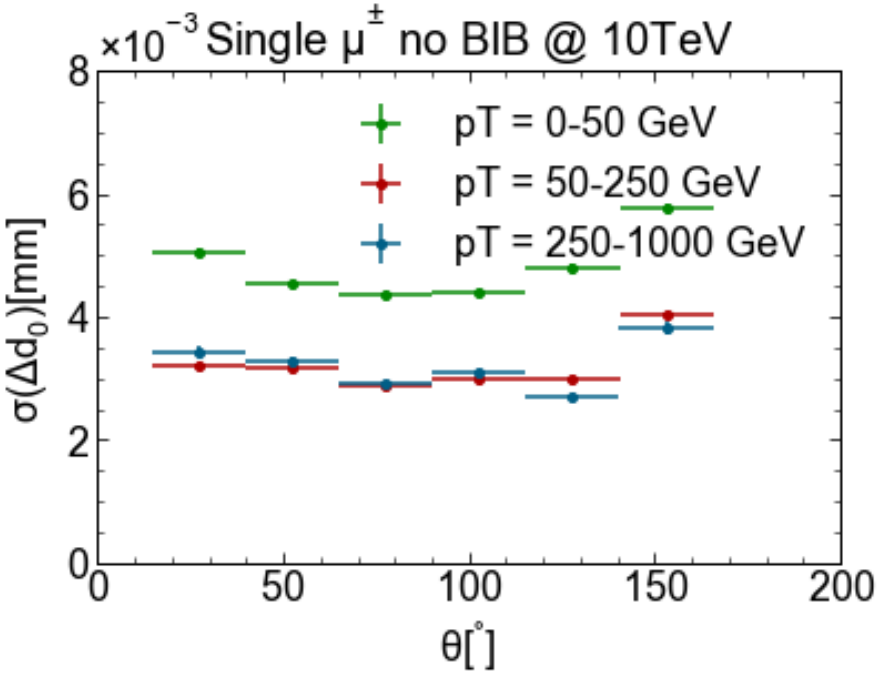



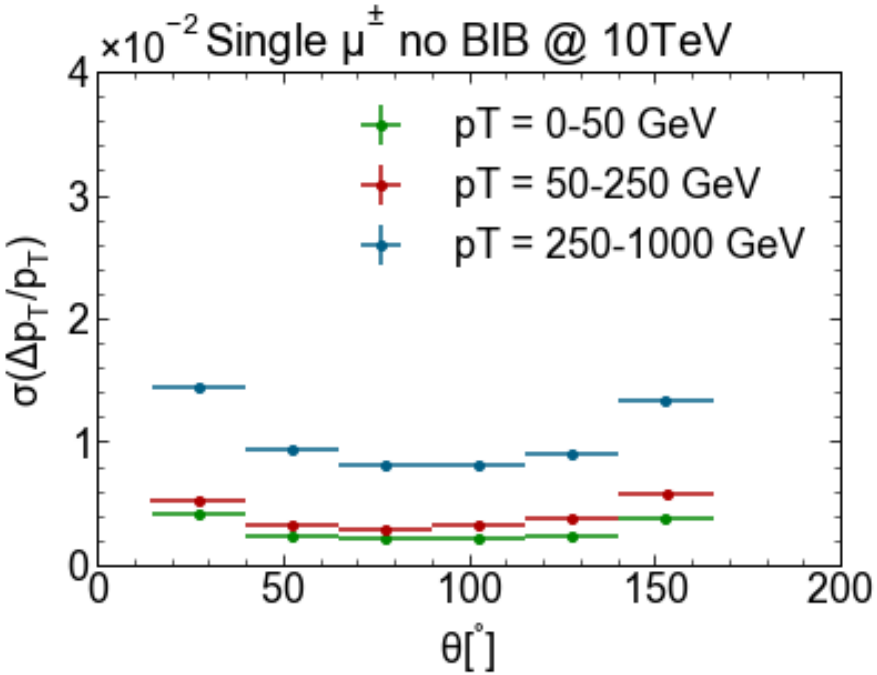



# pT and d0 Resolution



- The resolutions are found by taking the standard deviation of the previous plots
- In this case they are binned in theta and split into the three pT data sets
- In both plots, the resolution is worse in the endcaps, and better in the barrel
- Not sure why the pt_250_1000 is not symmetric around 90 degrees, but the effect is small



# pT and d0 Resolution from ‘Towards a Muon Collider’



- We can compare these to the same plots from *Towards a Muon Collider (March 2023)*
- Some differences to be noted
  - my plots are from theta = 0-180, theirs are from 0-90
  - The detector geometries, energies, and magnetic field strengths are different