



Status Report

Sungbin Oh

FNAL DUNE Sim/Reco Group Meeting

2023-04-20

dE/dx Comparison between Data and MC

ProtoDUNE-SP 1GeV/c proton beam

- Applied some beam selection cuts and $\chi_{p^+}^2 < 10$ cut
- Used
 - reco_beam_calibrated_dEdX_SCE
 - reco_beam_resRange_SCE

dE/dx Comparison between Data and MC - Proton

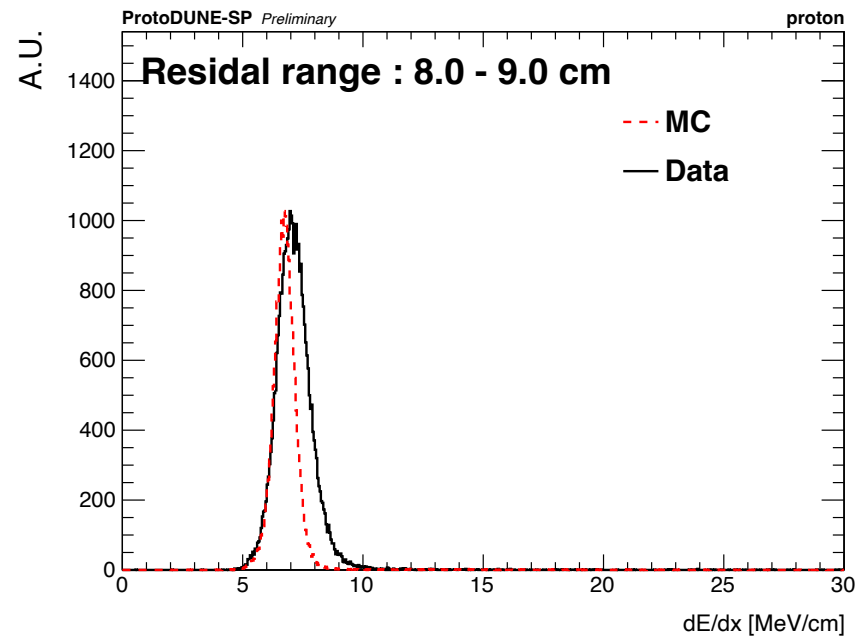
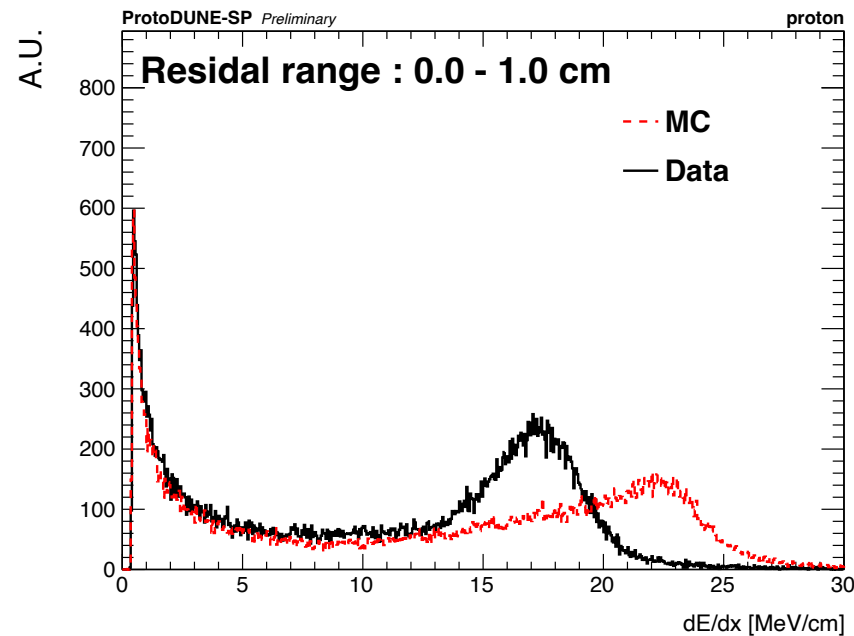
ProtoDUNE-SP 1GeV/c muon beam

- Selections
 - Pass beam PID cut
 - Beam scraper cut
 - Spectrometer momentum window : 0.8 - 1.2 GeV/c
 - Beam particle is reconstructed as track object by the Pandora
 - Not empty collection plane
 - $\chi_{p^+}^2 < 10$

dE/dx Comparison between Data and MC - Proton

ProtoDUNE-SP 1 GeV/c proton beam

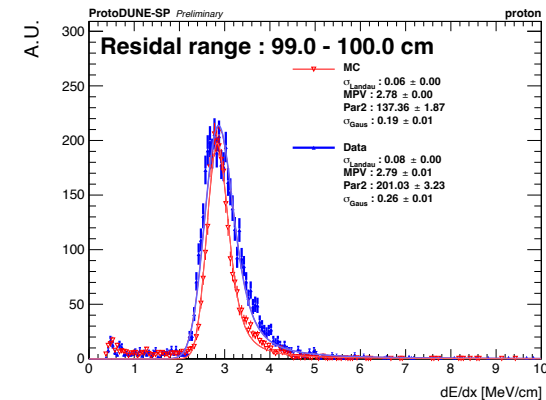
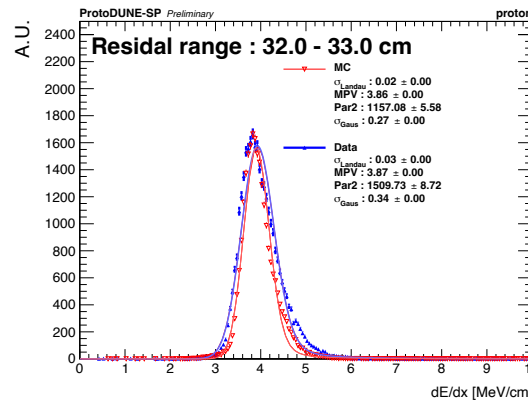
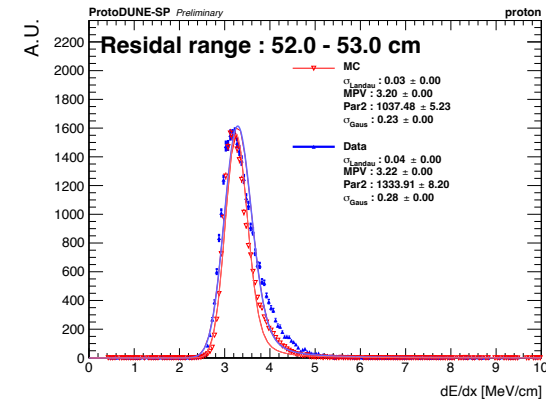
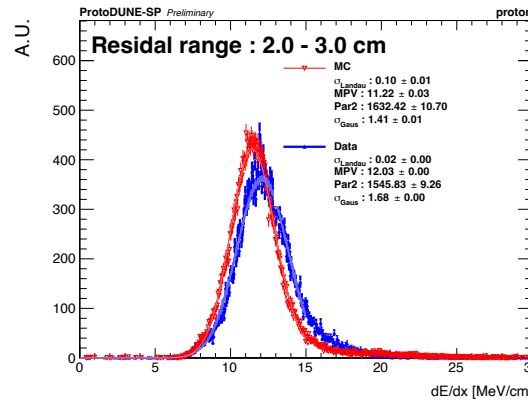
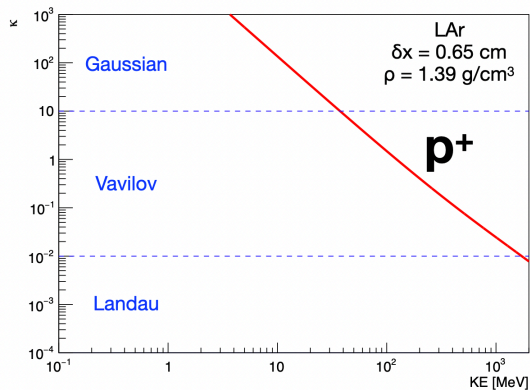
- dE/dx distribution as a function of residual range
- Scaled MC to have the same maximum y value with the data



dE/dx Comparison between Data and MC

ProtoDUNE-SP 1GeV/c proton beam

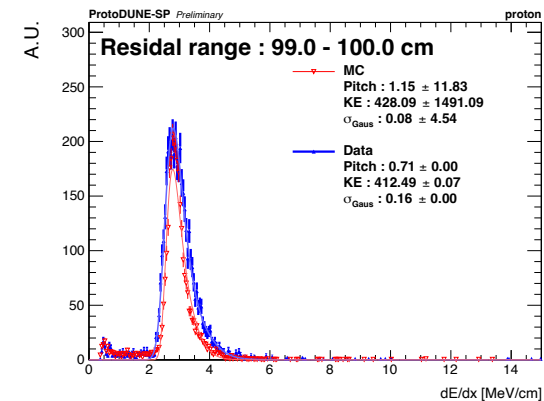
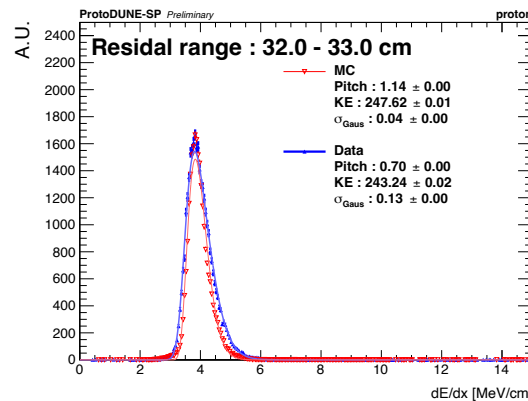
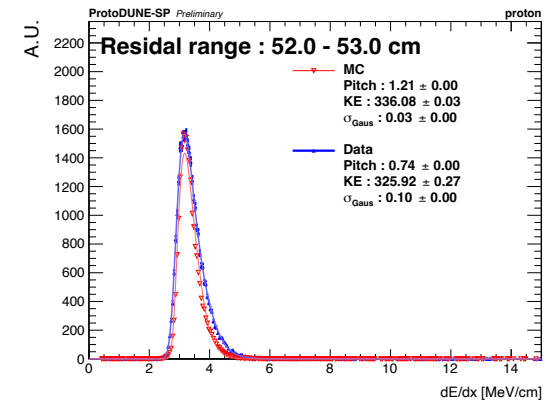
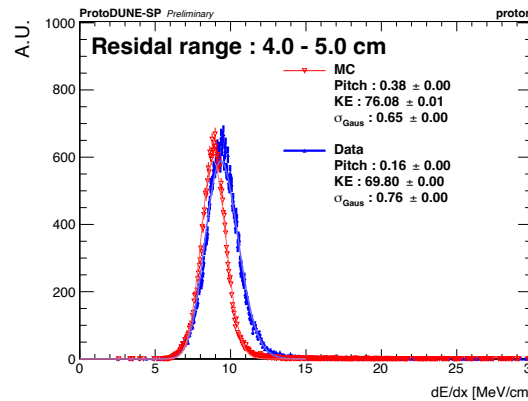
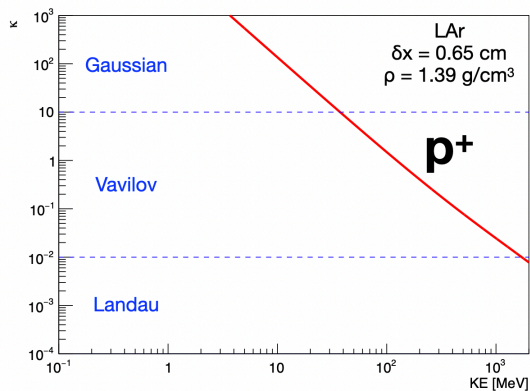
- Fitting with Landau⊗Gaussian function
 - Very short residual range
 - Fitted well
 - Intermediate
 - Not fitted well
 - Long
 - Fitted well
- Disagreement in general



dE/dx Comparison between Data and MC

ProtoDUNE-SP 1 GeV/c proton beam

- Fitting with Vavilov ⊗ Gaussian function
 - Approximations
 - $\kappa > 10$: Gaussian
 - $\kappa < 0.01$: Landau
 - Fitted well
- Disagreement in general



dE/dx Comparison between Data and MC - Muon

ProtoDUNE-SP 1 GeV/c muon beam

- Selections
 - Beam scraper cut
 - Spectrometer momentum window : 0.8 - 1.2 GeV/c
 - Beam particle is reconstructed as track object by the Pandora
 - Not empty collection plane
 - beam end Z : [260 cm , 420 cm]
 - Michel score > 0.6

dE/dx Comparison between Data and MC - Muon

ProtoDUNE-SP 1GeV/c muon beam

- Fitting with Landau⊗Gaussian function

- Very short : peak near 2 MeV/cm - maybe coming from broken tracks?

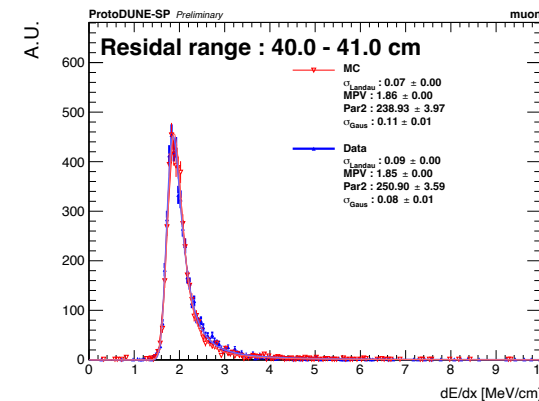
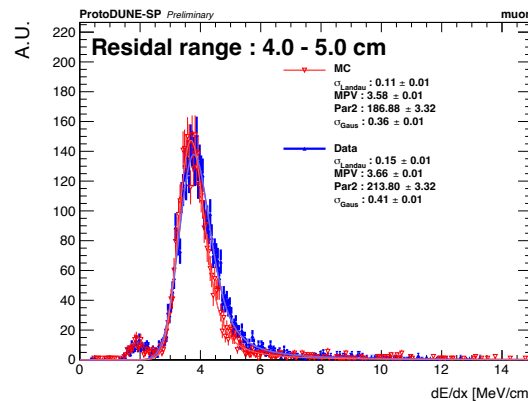
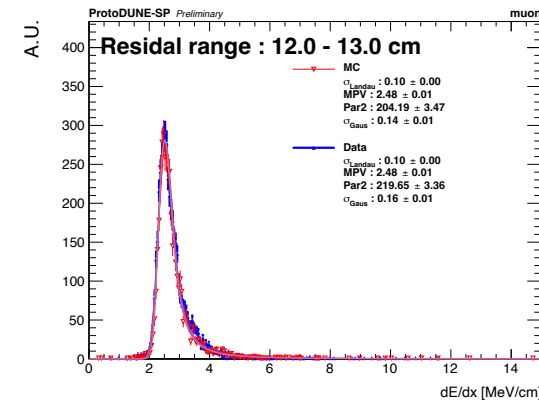
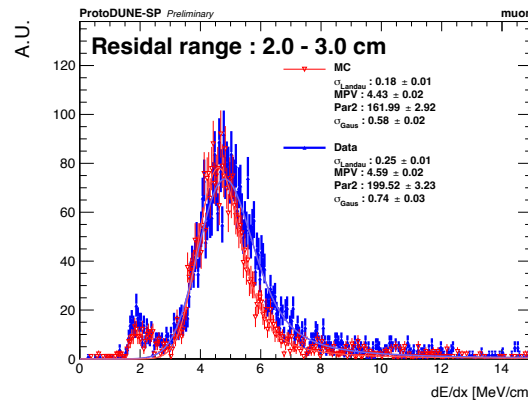
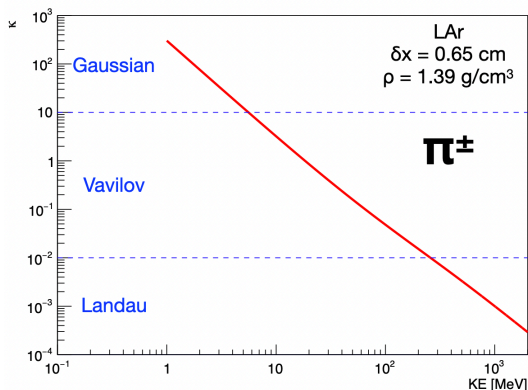
- In general

- Fitted well

- Good agreement in general

- Disagreement for very short region

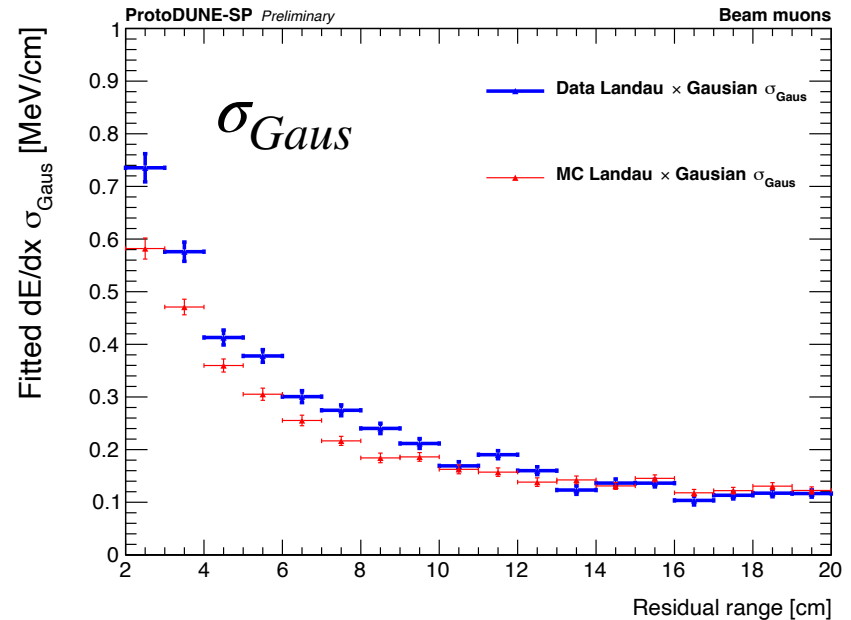
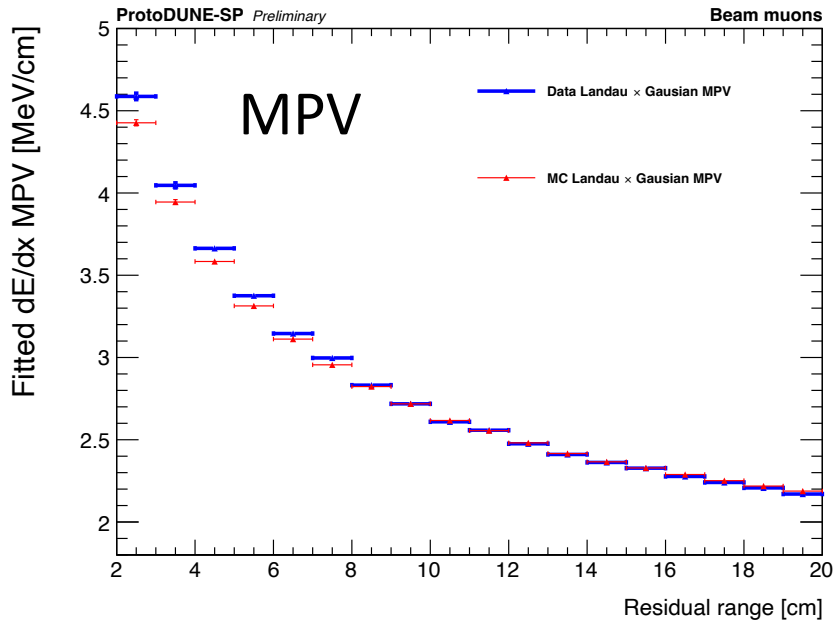
- MC shows smaller MPV and σ_{Gaus}



dE/dx Comparison between Data and MC - Muon

ProtoDUNE-SP 1GeV/c muon beam

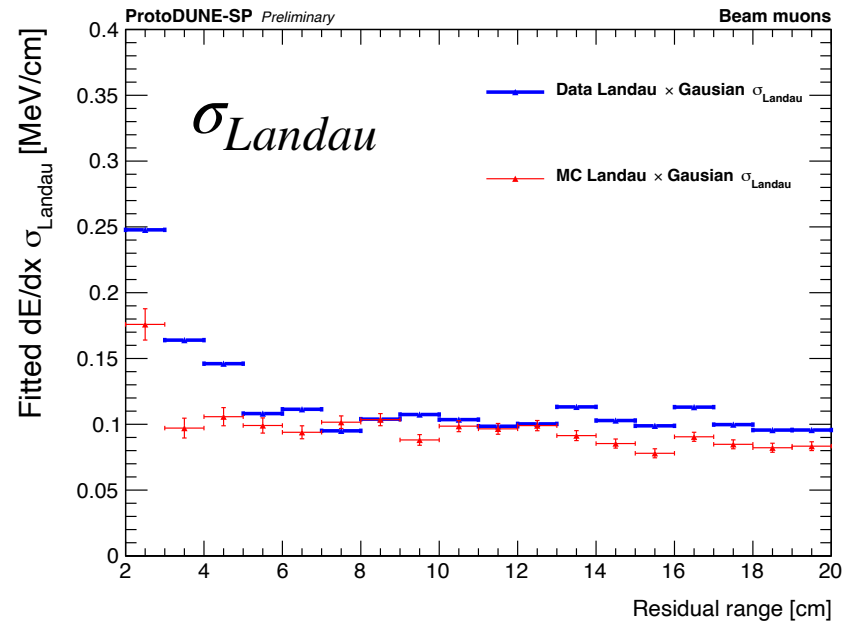
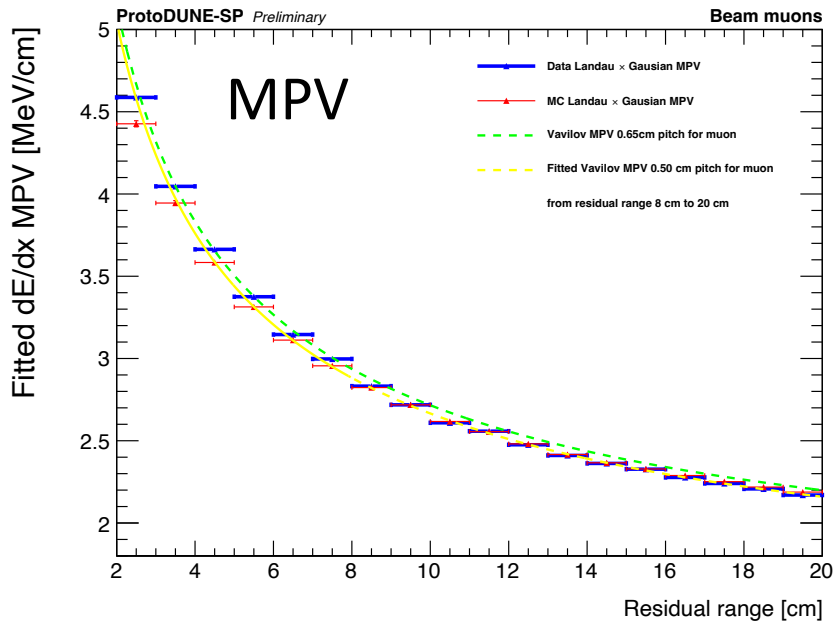
- Fitting with Landau⊗Gaussian function
- Summarized plots
 - MPV : meaningful difference where residual range is shorter than 8 cm
 - σ_{Gaus} : meaningful difference where residual range is shorter than 9 cm
- MC and data agree very well at MIP region



dE/dx Comparison between Data and MC - Muon

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Pitch Comparison between Data and MC

ProtoDUNE-SP 1GeV/c beam

• For i 'th hit :

•
$$\text{Pitch} = 0.5 \times (\text{ResRange}_{i-1} - \text{ResRange}_{i+1})$$

