TPC to Beam Matching

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Recap of last time

- Found the shift in the extrapolated position in the beam matching was dominated by the reconstructed direction which could be corrected by a Gaussian fit.
- The measurement of track length is affected by the SCE.

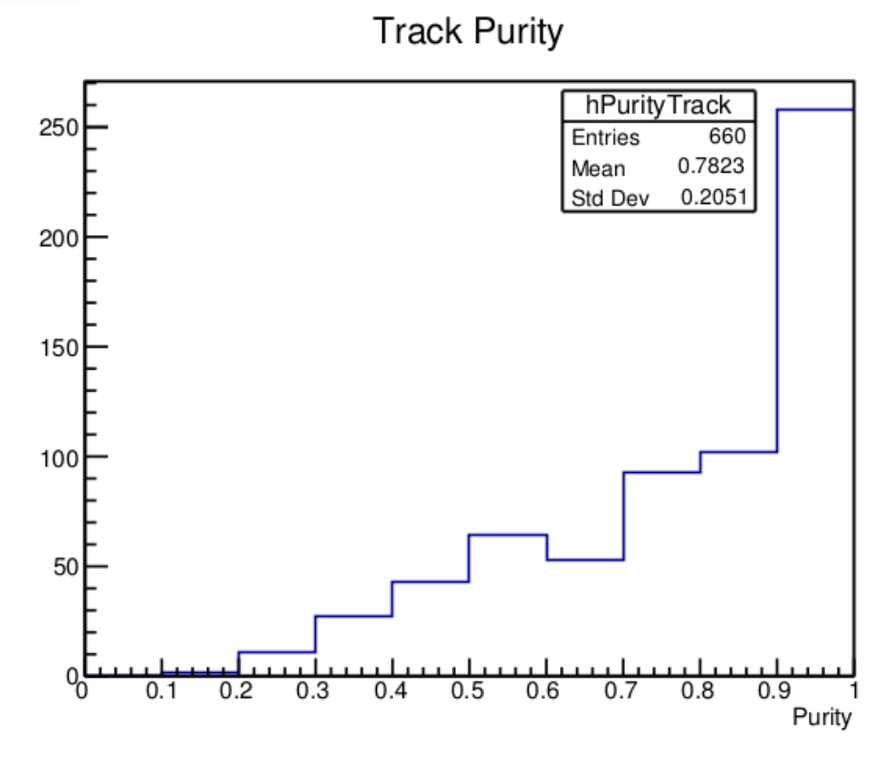
Here the performance of the track reconstruction and the energy loss per track length and how it is affected by the SCE is looked at.

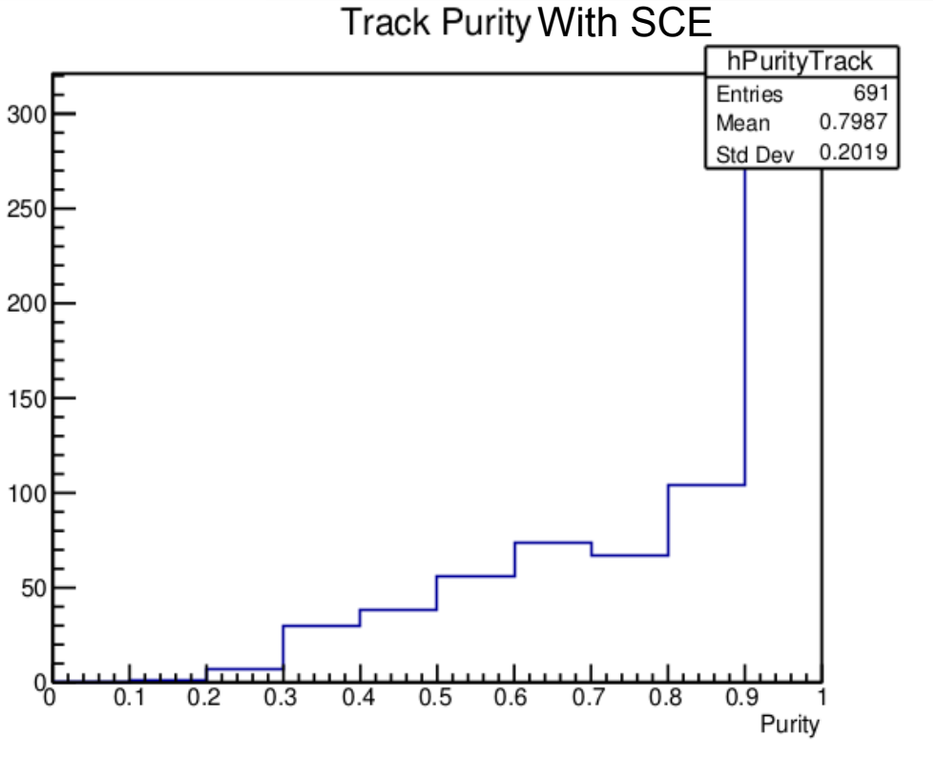
- A correct track length is crucial for the identification of the particle based on the dE/dx.

Slides from last time:
https://indico.fnal.gov/getFile.py/access?contribId=4&resId=0&materialId=slides&confId=15113

Purity

- Looking at track purity enables us to check the quality of the tracks being looked at.
- Purity here is defined as the fraction of hits that come from the matched particle divided by the total number of reconstructed hits.

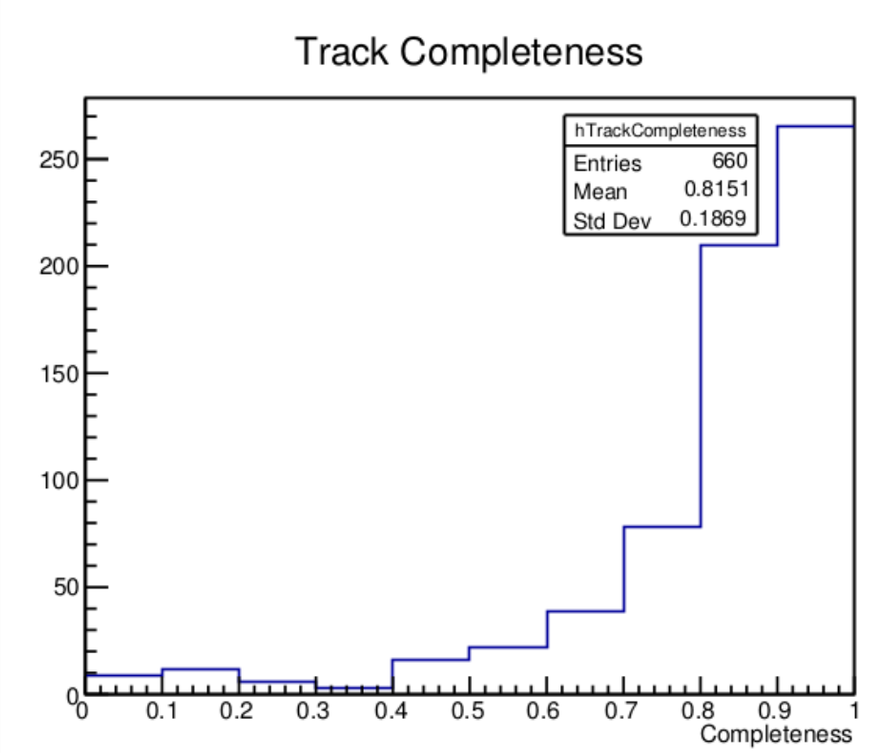


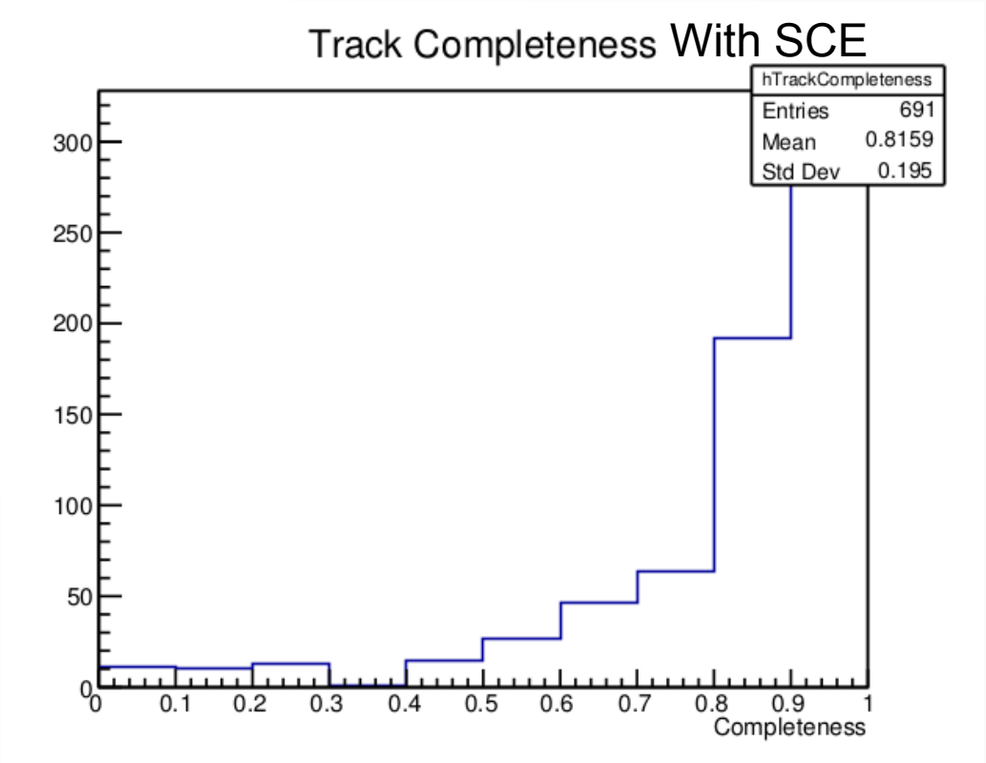


Completeness

Looking at track completeness enables us to check the quality of the tracks being looked at.

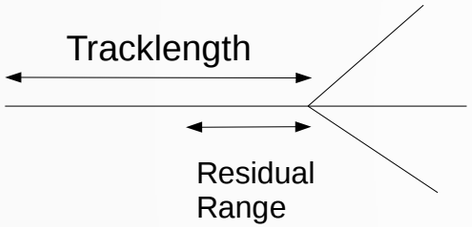
Completeness is defined as the fraction of the number of true hits that are found in a track divided by total number of true hits in the object.



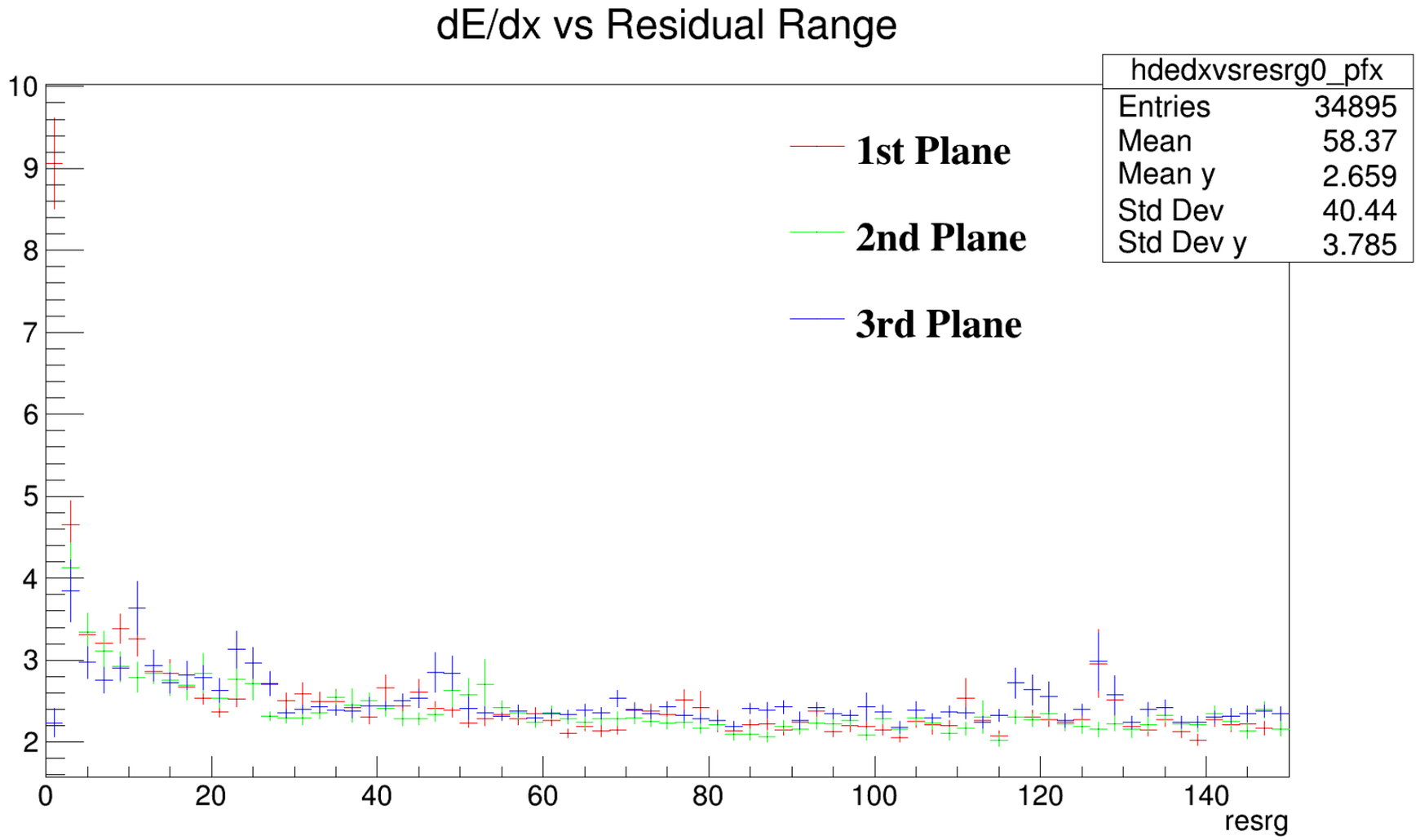


dE/dx vs Residual Range 3 Plane View

Residual Range:
This is the distance left between a given hit and the end point of a track.



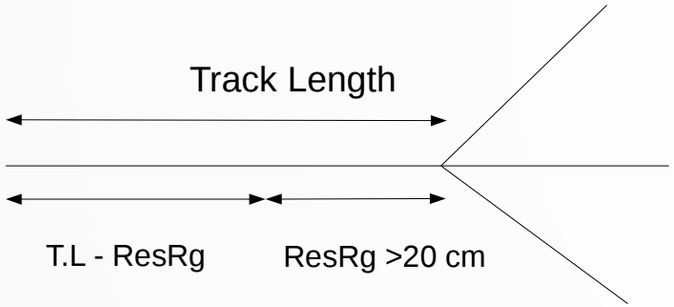
A cut at 20 cm has been used for the following plots as the slope shown here increases below 20 cm due to other particle interactions.



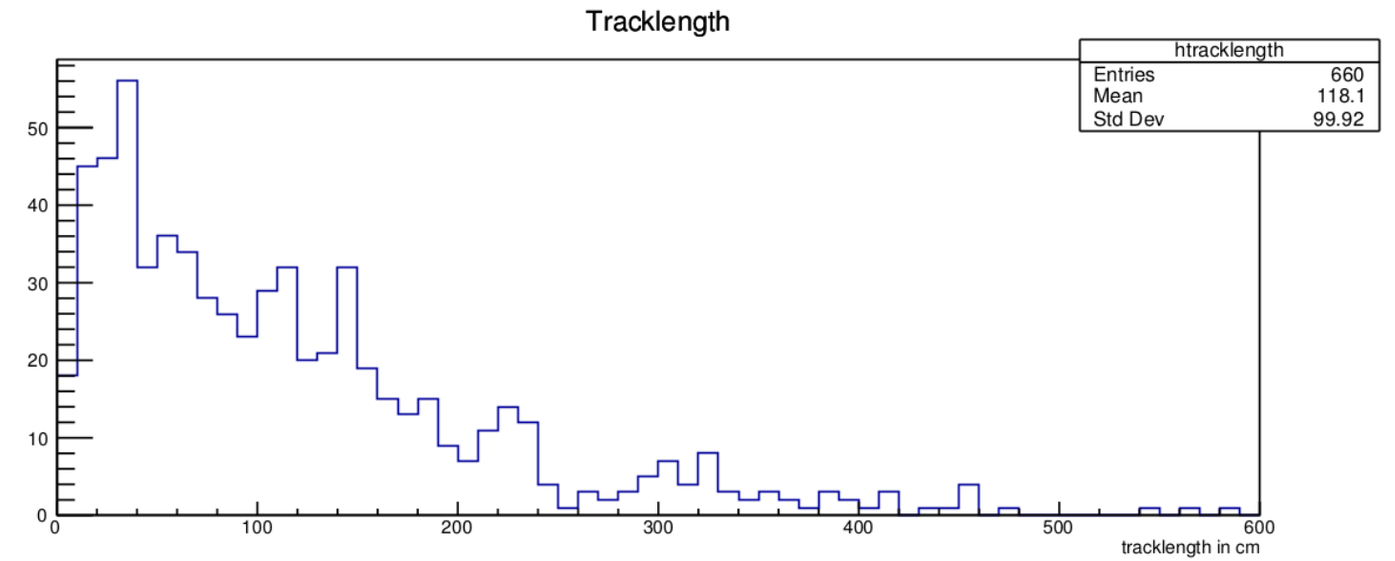
Track length & Residual Range

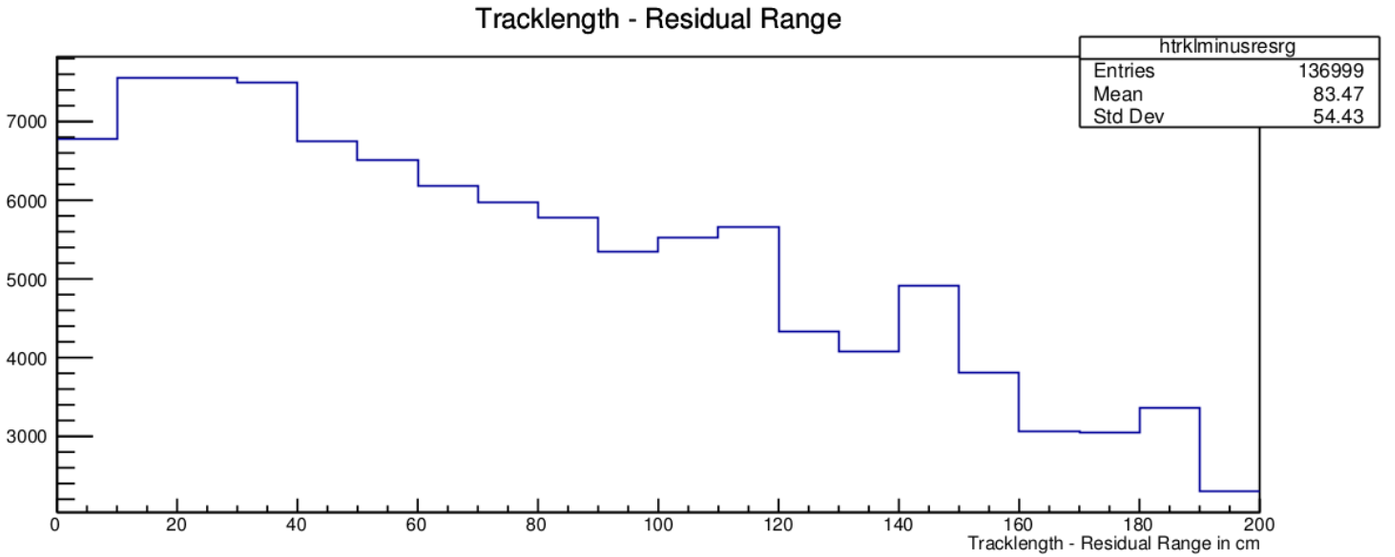
These plots are for pions only.

Track length is distance between start and end point of track.



The residual range used here must be greater that 20 cm.

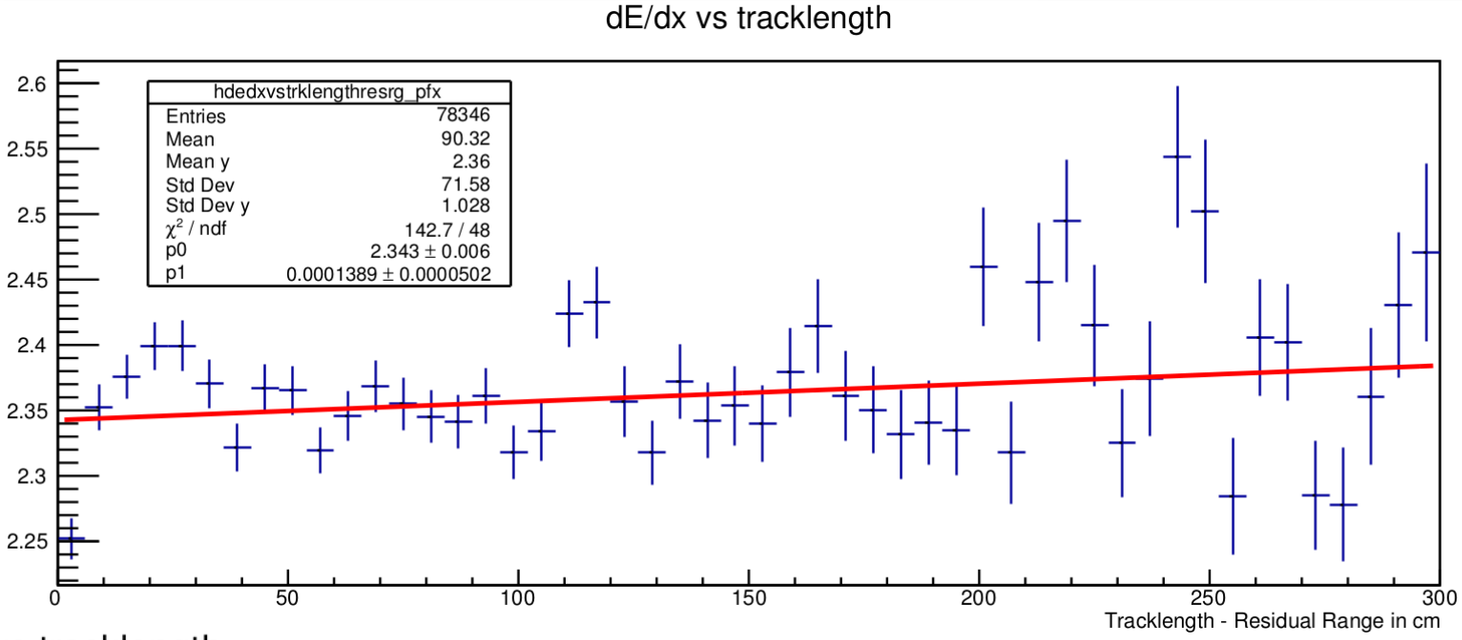


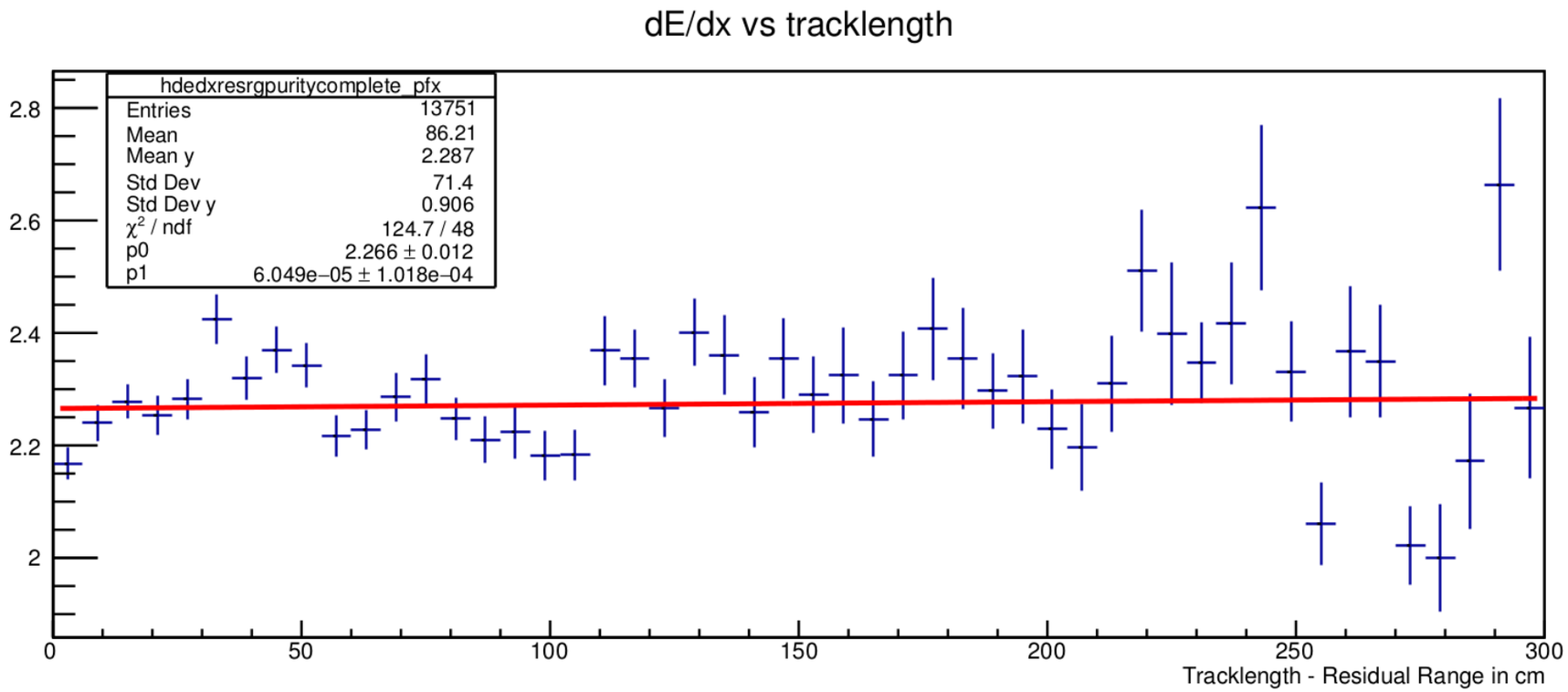


dE/dx vs tracklength

These plots are for pions only and without space-charge.

The cuts used here are:
dE/dx and the residual range value not equal to 0
Residual range > 20cm





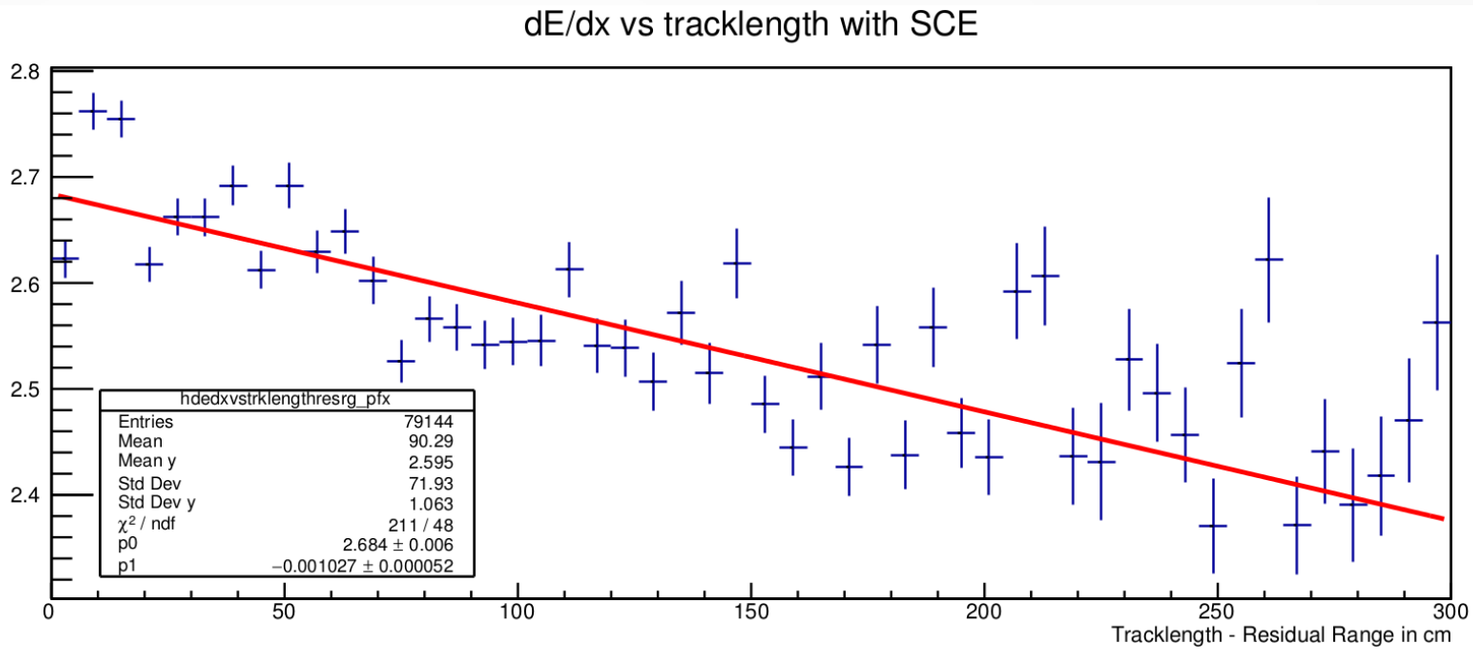
Also including cut on purity and completeness of the track >0.9

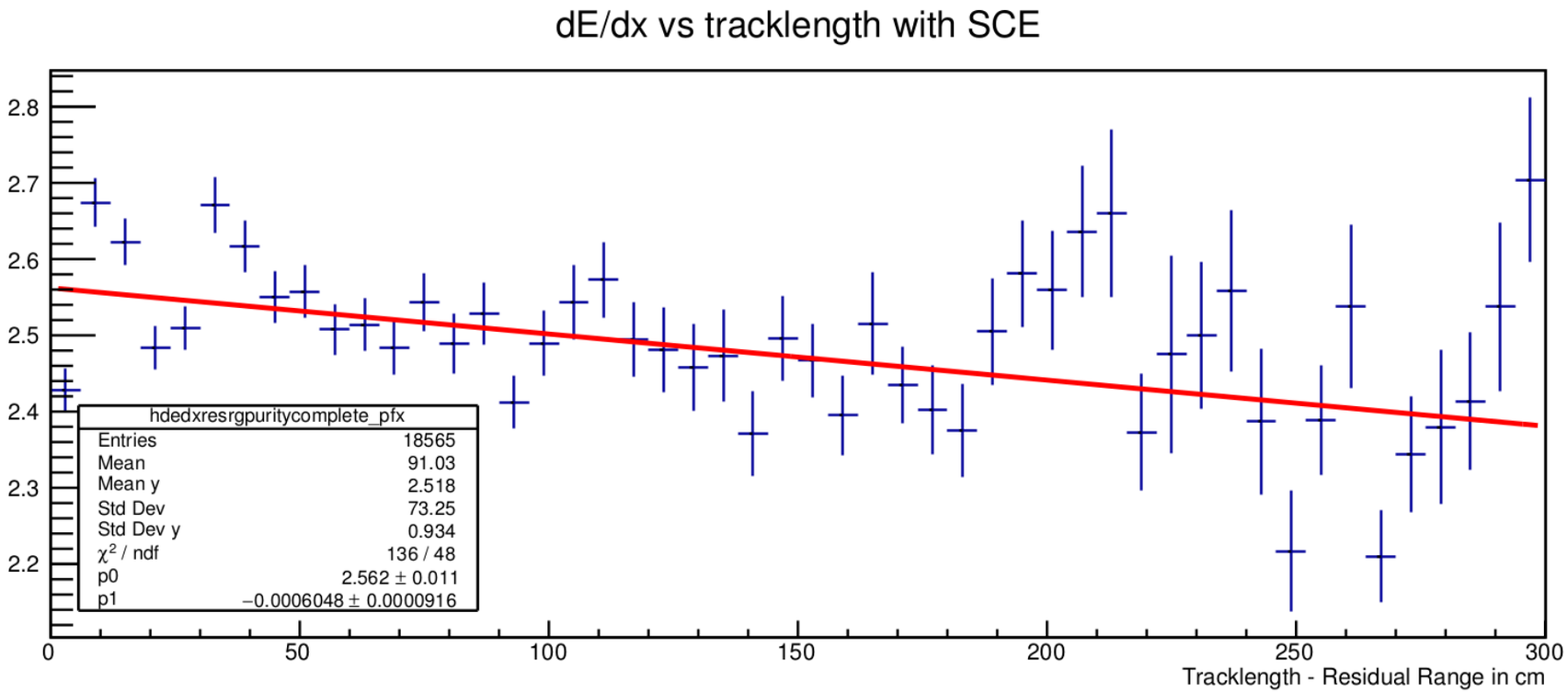
Neither has very much of a slope.

With purity and completeness the slope is flatter suggesting this is more of the true behaviour.

dE/dx vs tracklength with SCE

These plots are for pions.
The cuts used here are:
dE/dx and the residual range value not equal to 0
Residual range > 20cm





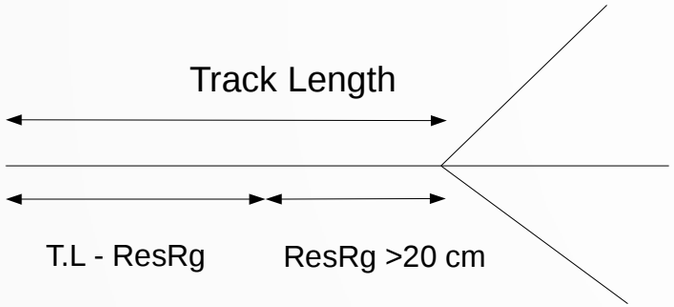
Also including cut on purity and completeness of the track >0.9.

The gradient with SCE has increased even when taking the best tracks.

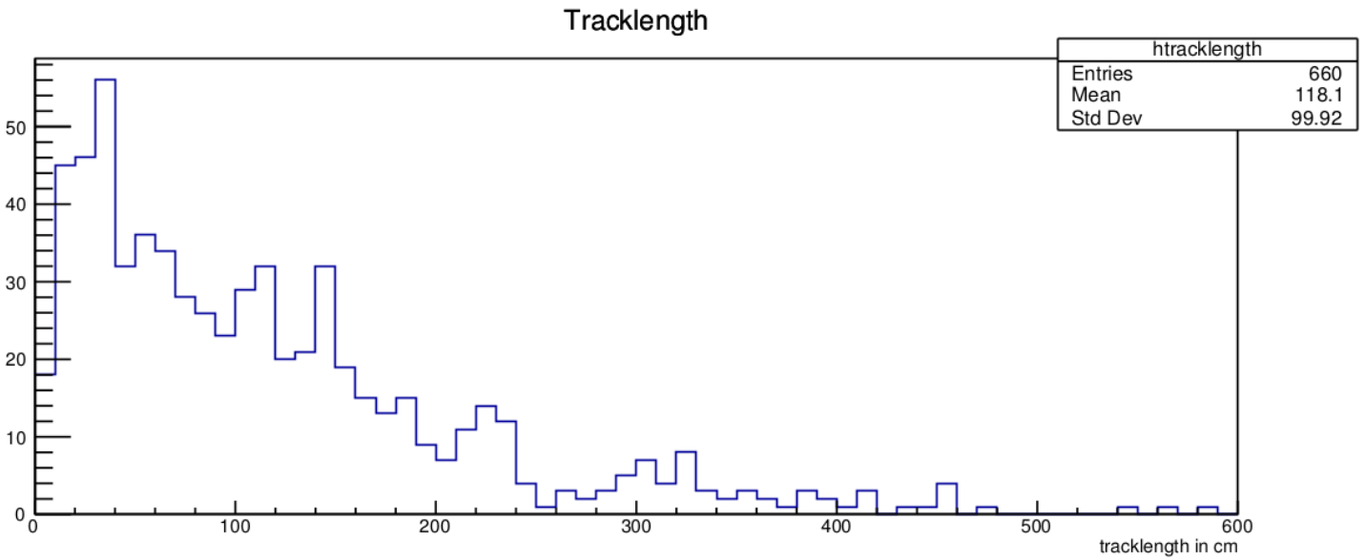
Track length & Residual Range

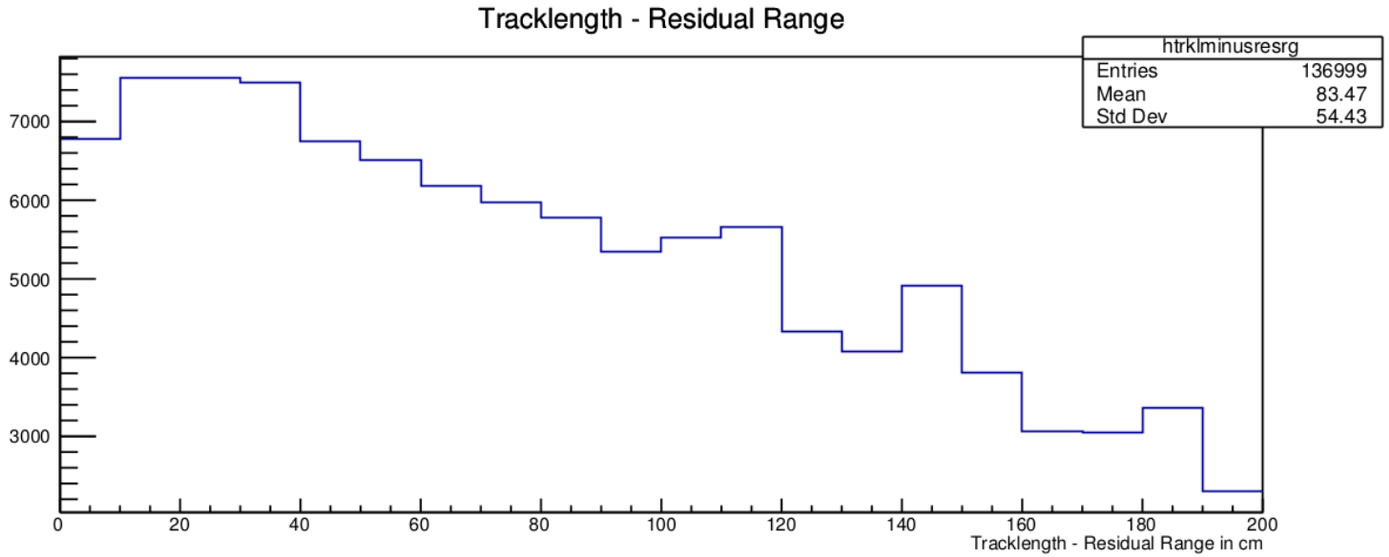
These plots are for pions only.

Track length is distance between start and end point of track.

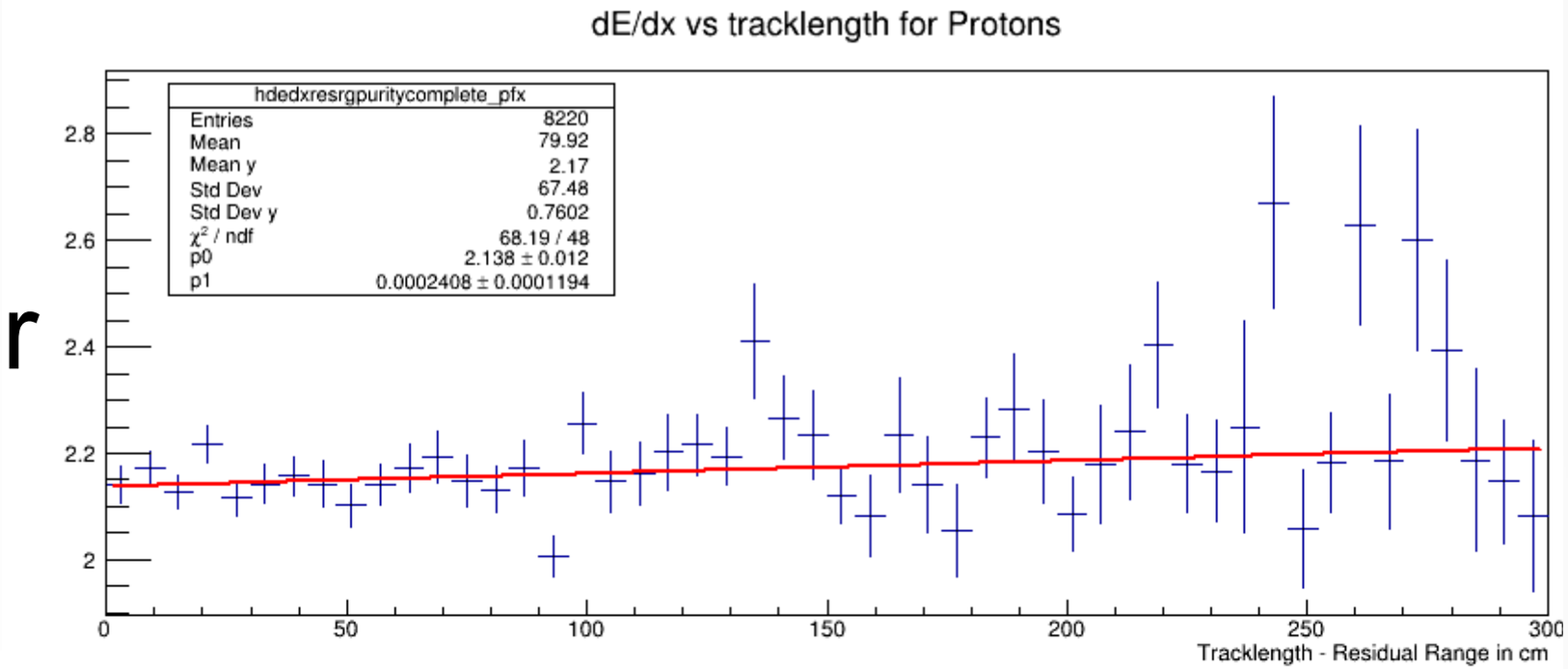


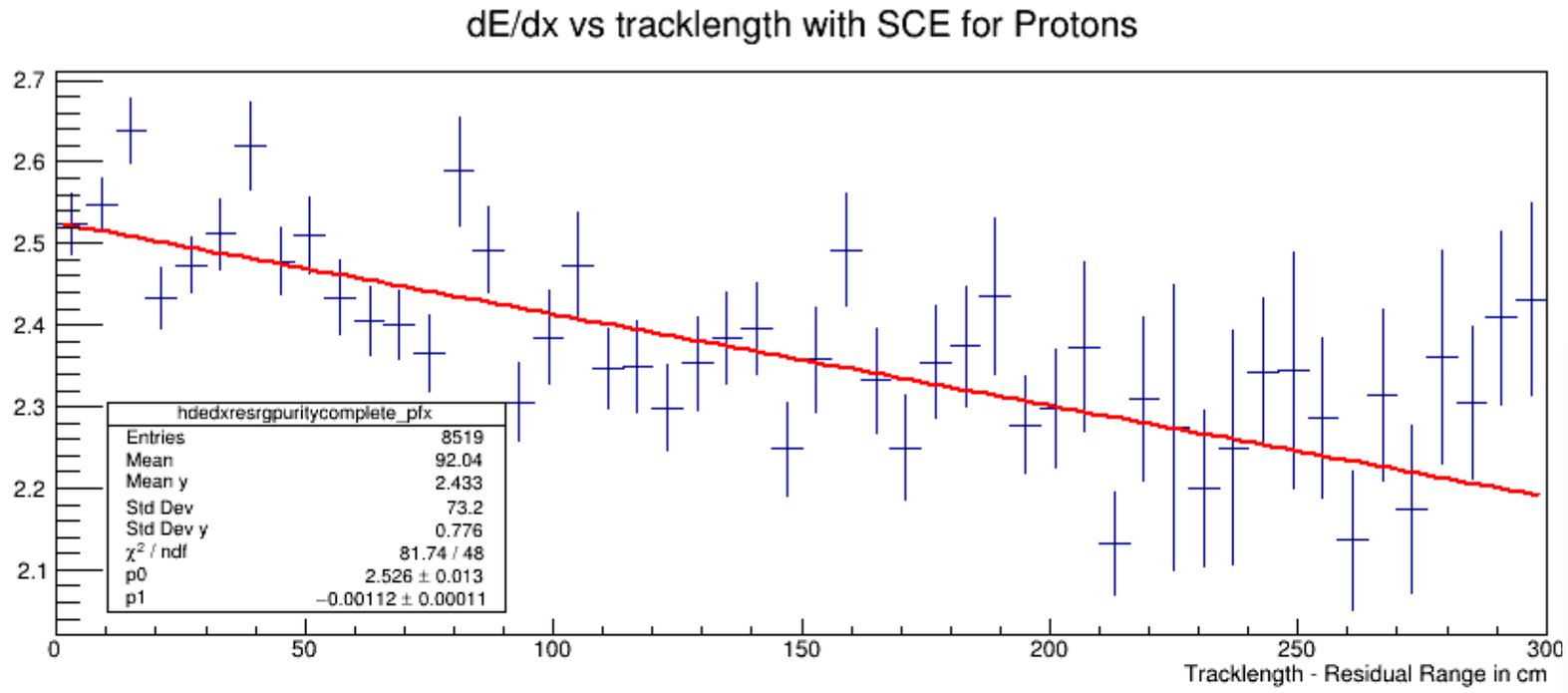
The residual range used here must be greater that 20 cm.





dE/dx vs Tracklength for Protons





SCE for Protons has increased the gradient here again.

This is problematic when trying to identify particles using dE/dx.

Conclusion

- The dE/dx vs tracklength is effected by the SCE seen by the increase in gradient of the line used to fit the histograms.
- This is problematic for particle identification when using dE/dx and must be accounted for.
- Many aspects of the pion cross section analysis are affected by space charge. In the absence of a full space charge calibration some simple monte carlo analysis can be used as a calibration.