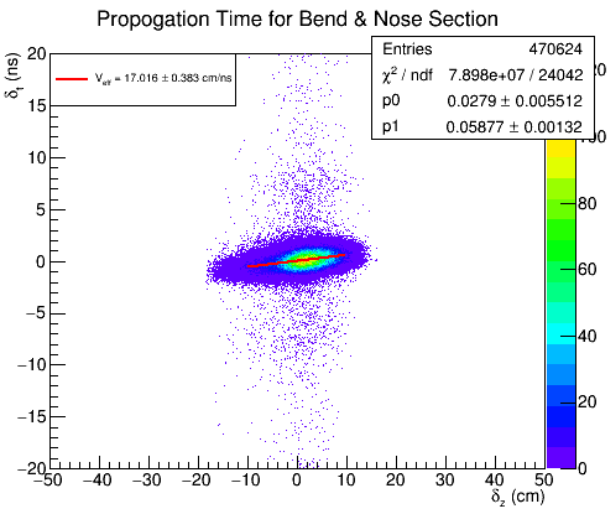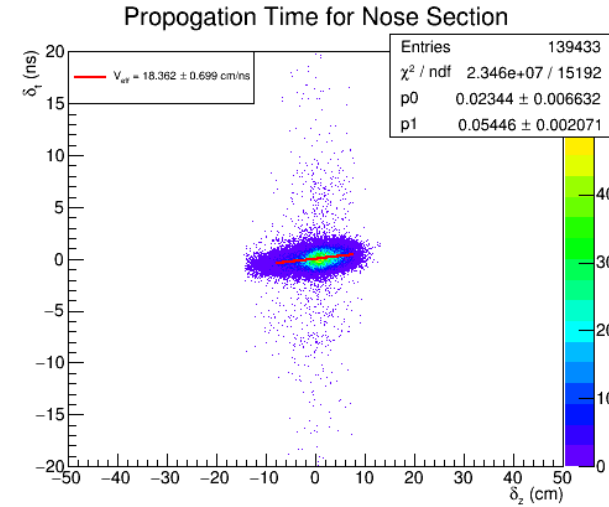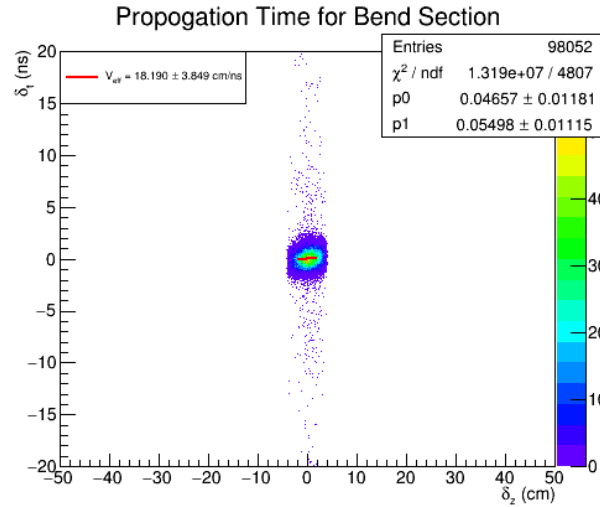# ST Propagation Time Correction Studies
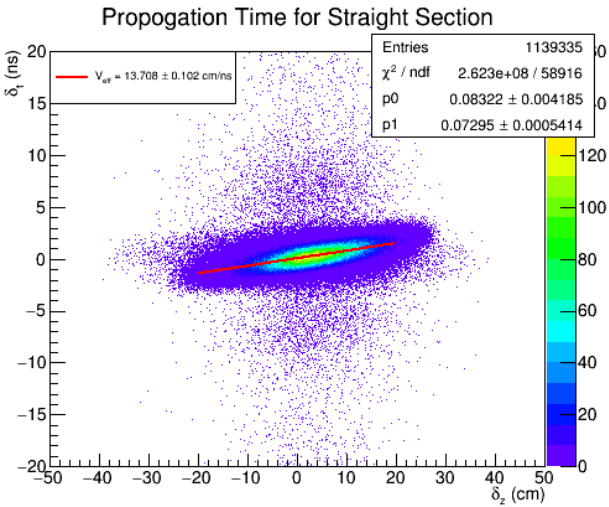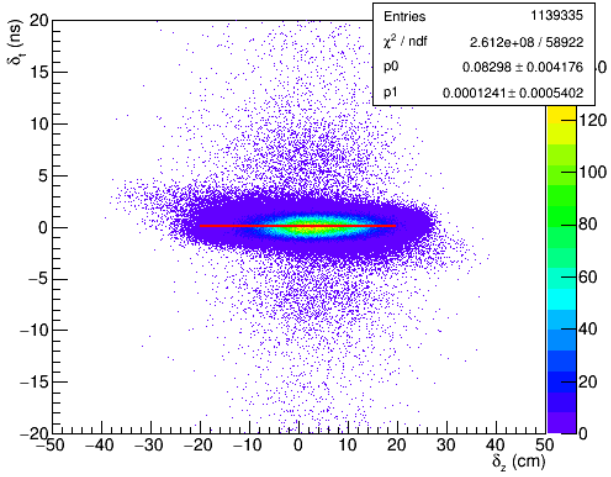
05/21/2015

ROOT Fitter Method (Straight Section)
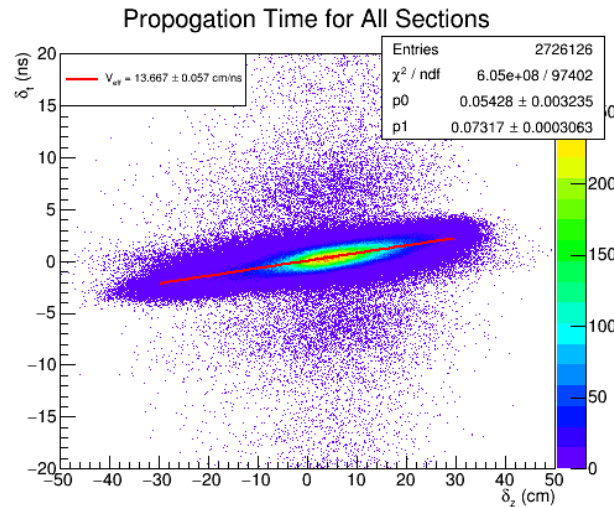
- ## For Straight Section:
  - Veff ≈ 13.7 cm/ns

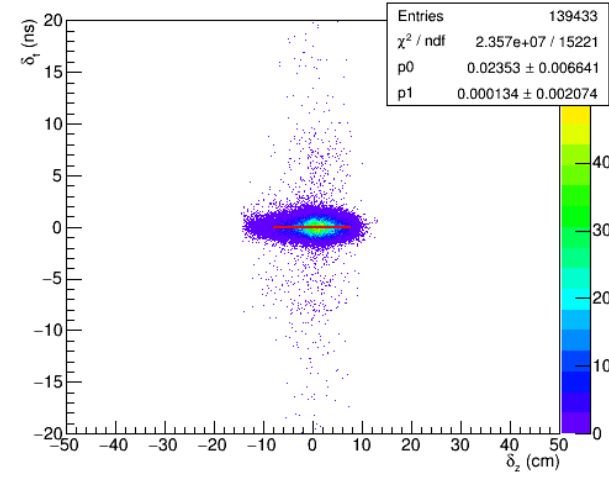Propogation Time for Straight Section Corrected

Entries	1139335
χ^2 / ndf	2.612e+08 / 58922
p0	0.08298 ± 0.004176
p1	0.0001241 ± 0.0005402

Propogation Time for Bend Section Corrected

Entries	98052
χ^2 / ndf	1.307e+07 / 4799
p0	0.04682 ± 0.01176
p1	0.0004014 ± 0.01111
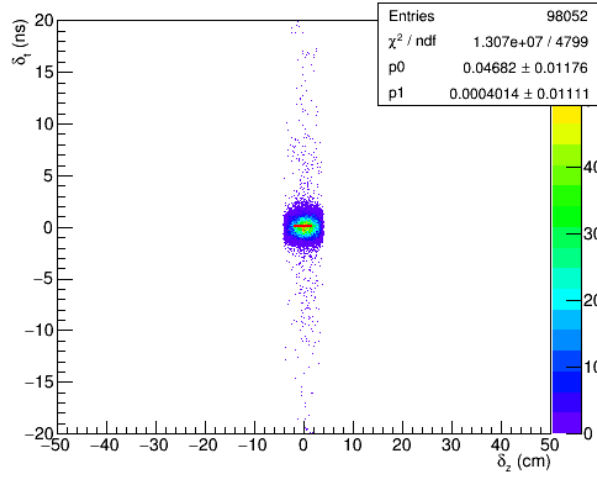
Propogation Time for Nose Section Corrected

Entries	139433
χ^2 / ndf	2.357e+07 / 15221
p0	0.02353 ± 0.006641
p1	0.000134 ± 0.002074

Propogation Time for Bend & Nose Section Corrected

Entries	470624
χ^2 / ndf	7.907e+07 / 24082
p0	0.02788 ± 0.00551
p1	0.0001319 ± 0.00132
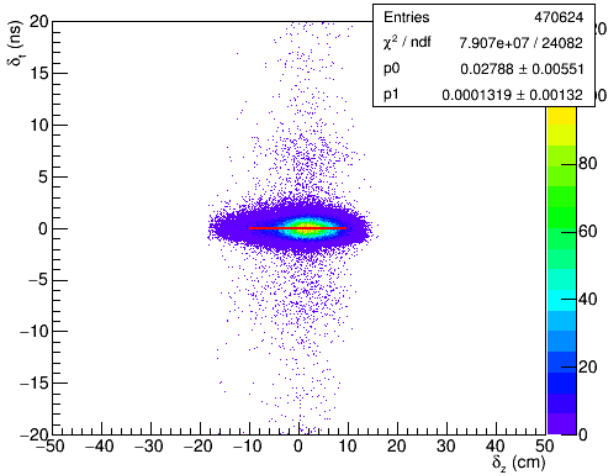
Propogation Time for All Sections Corrected

Entries	2726126
χ^2 / ndf	6.021e+08 / 97416
p0	0.05401 ± 0.003227
p1	0.000165 ± 0.0003056
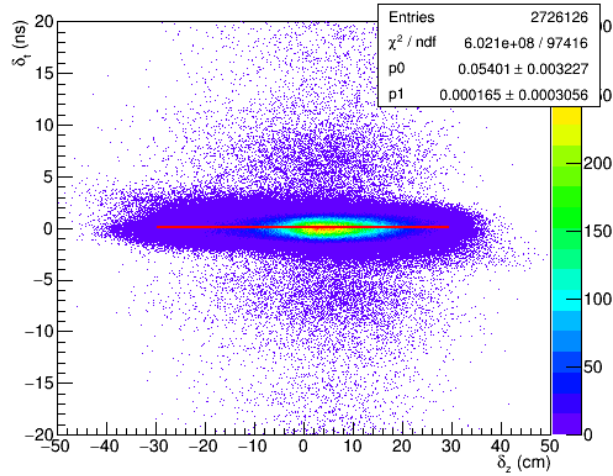
Time Resolution for Straight Section

Entries	1139335
p0	3.15e+04 ± 3.75e+01
p1	0.3344 ± 0.0008
p2	0.8509 ± 0.0006

- σ_{meas} = 0.851 ± 0.001 ns
- σ_{paddle} = 0.602 ± 0.000 ns
- σ_{meas}^{corr} = 0.638 ± 0.000 ns
- σ_{paddle}^{corr} = 0.451 ± 0.000 ns
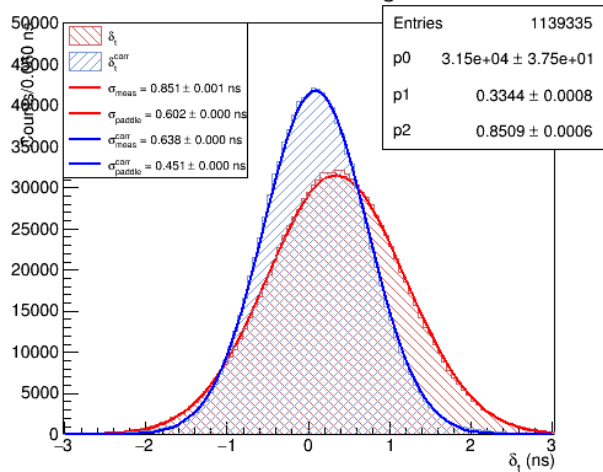
Time Resolution for Bend Section

Entries	98052
p0	3867 ± 15.2
p1	0.07129 ± 0.00193
p2	0.5992 ± 0.0014

- σ_{meas} = 0.599 ± 0.001 ns
- σ_{paddle} = 0.424 ± 0.001 ns
- σ_{meas}^{corr} = 0.591 ± 0.001 ns
- σ_{paddle}^{corr} = 0.418 ± 0.001 ns
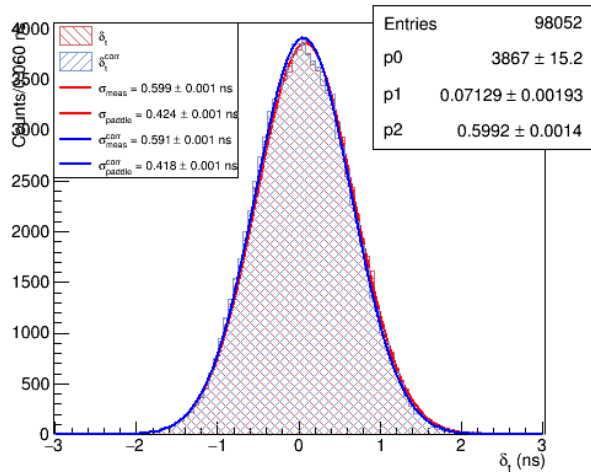
Time Resolution for Nose Section

Entries	139433
p0	5576 ± 18.4
p1	0.06252 ± 0.00159
p2	0.5898 ± 0.0011

- σ_{meas} = 0.590 ± 0.001 ns
- σ_{paddle} = 0.417 ± 0.001 ns
- σ_{meas}^{corr} = 0.559 ± 0.001 ns
- σ_{paddle}^{corr} = 0.395 ± 0.001 ns
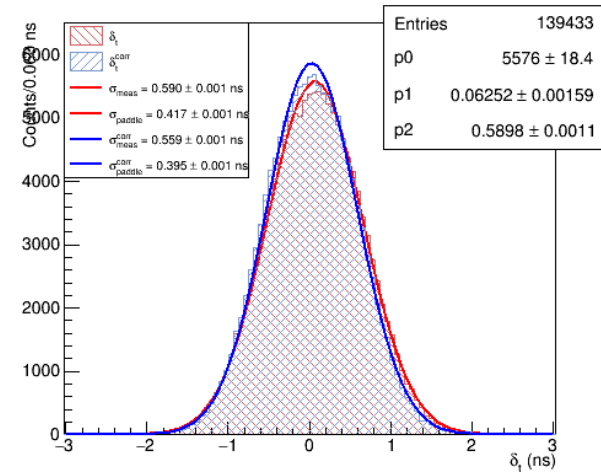
Time Resolution for Bend & Nose Section

Entries	470624
p0	1.769e+04 ± 3.218e+01
p1	0.1184 ± 0.0009
p2	0.6287 ± 0.0007

- σ_{meas} = 0.629 ± 0.001 ns
- σ_{paddle} = 0.445 ± 0.000 ns
- σ_{meas}^{corr} = 0.576 ± 0.001 ns
- σ_{paddle}^{corr} = 0.407 ± 0.000 ns
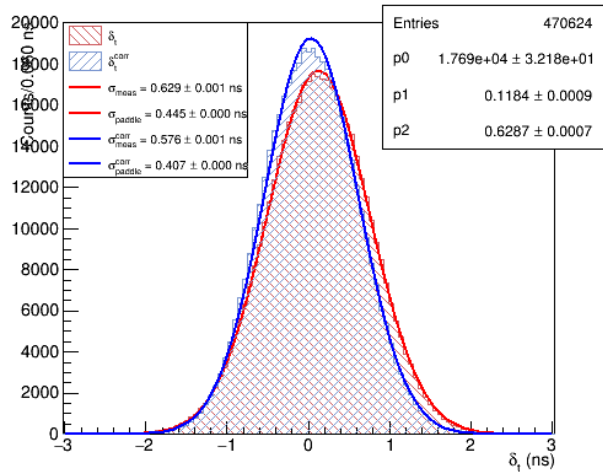
Time Resolution for All Sections

Entries	2726126
p0	6.813e+04 ± 5.463e+01
p1	0.4231 ± 0.0006
p2	0.9352 ± 0.0005

- σ_{meas} = 0.935 ± 0.000 ns
- σ_{paddle} = 0.661 ± 0.000 ns
- σ_{meas}^{corr} = 0.629 ± 0.000 ns
- σ_{paddle}^{corr} = 0.445 ± 0.000 ns
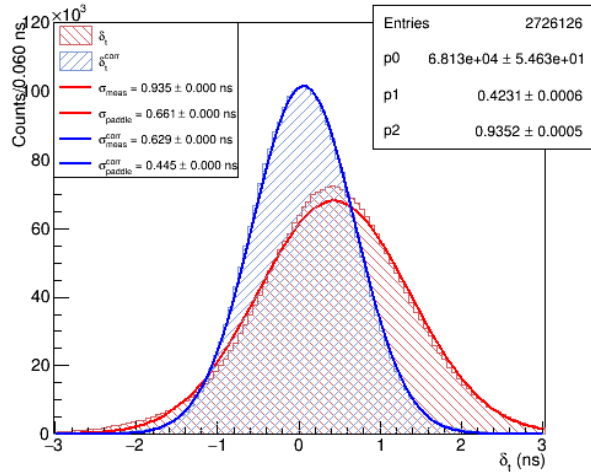
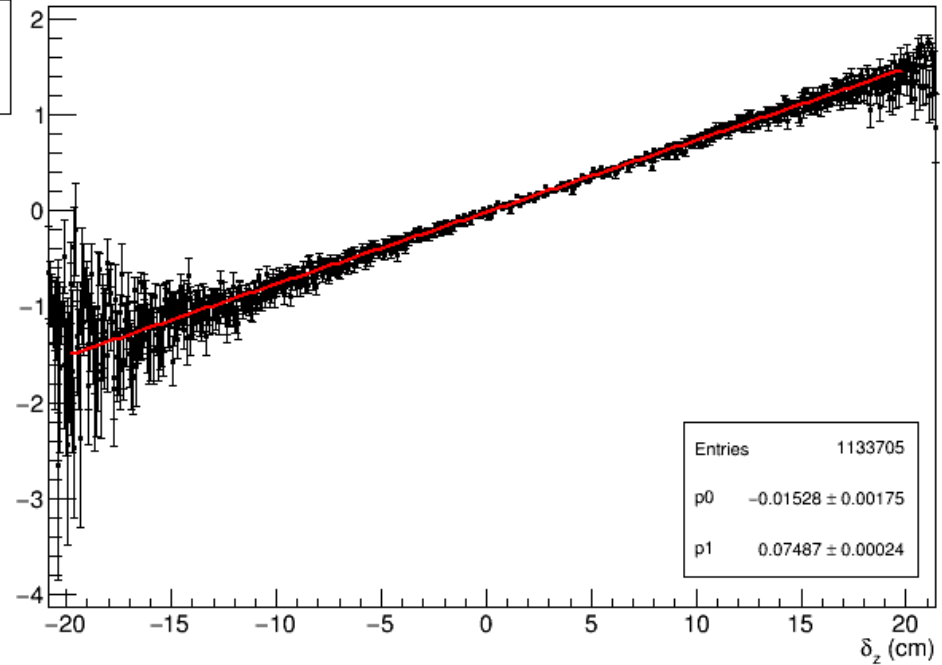# ProfileX Method (Straight Section)
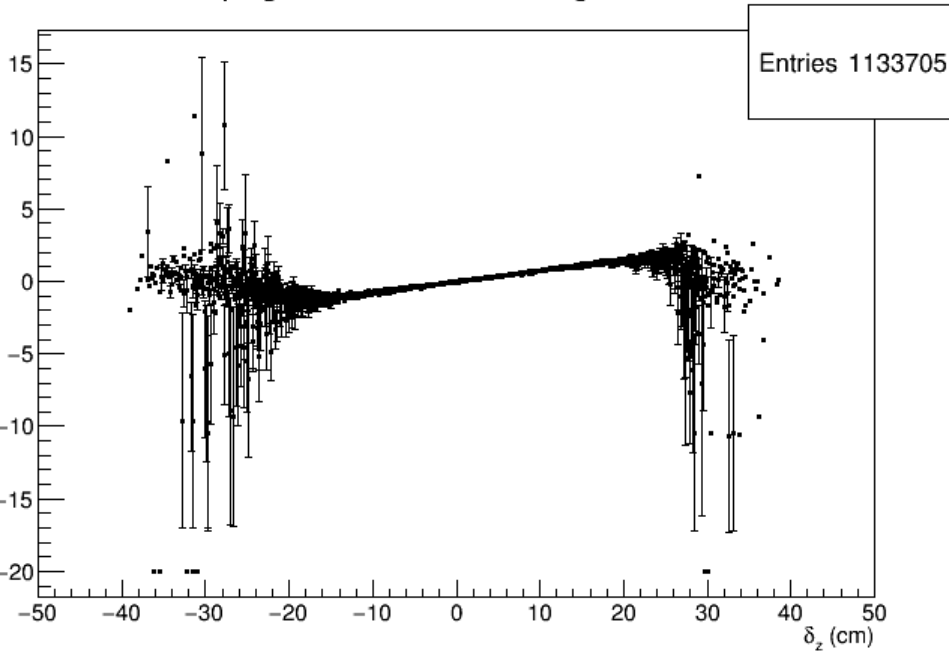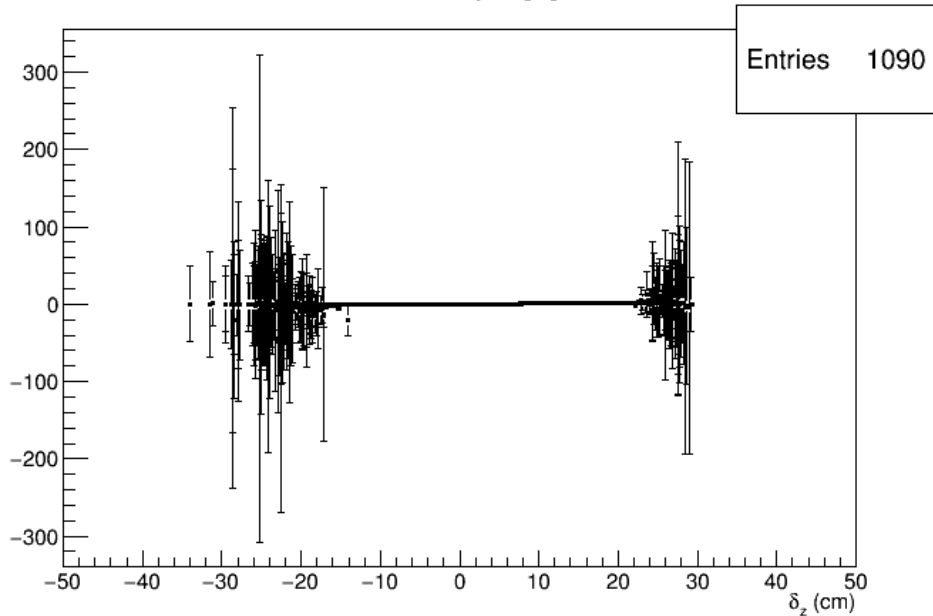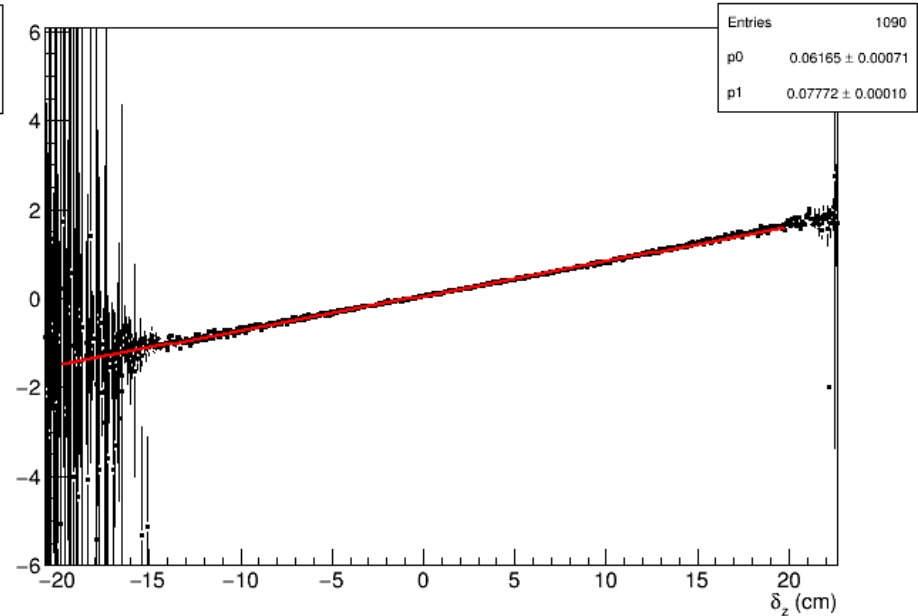

Propogation Time for Straight Section

- Calculates the mean value of δt and its error for each bin (500 μm) along δz
  - The error calculated is the standard error on the mean
- Veff ≈ 13.35 cm/ns

FitSlicesY (Straight Section)
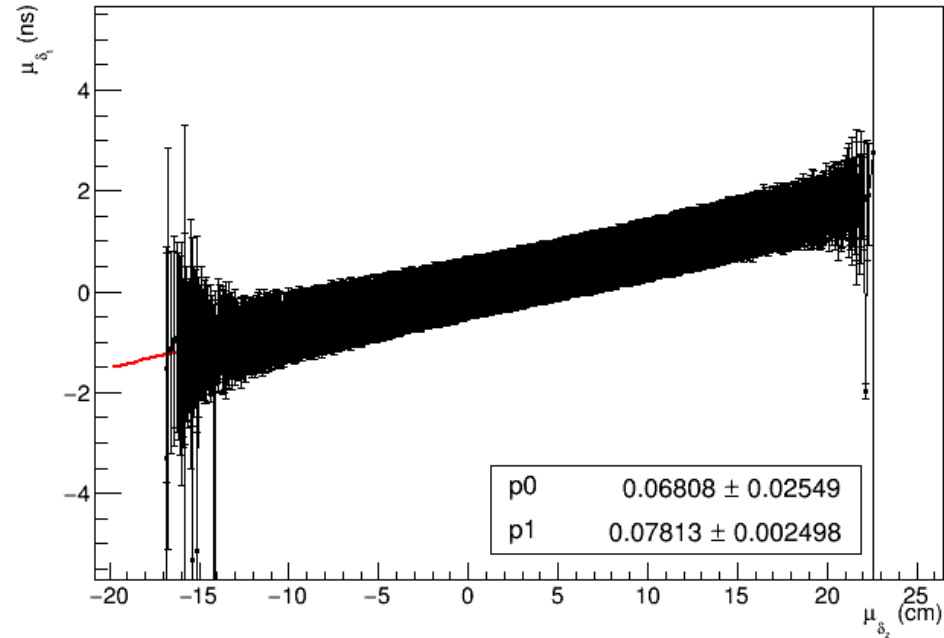

- Project slices along δt and fits them with a Gaussian for each bin (500 μm) along δz

  – The error calculated is the error on the mean as calculated by the fit

- Veff ≈ 12.86 cm/ns

Custom Method (Straight Section)
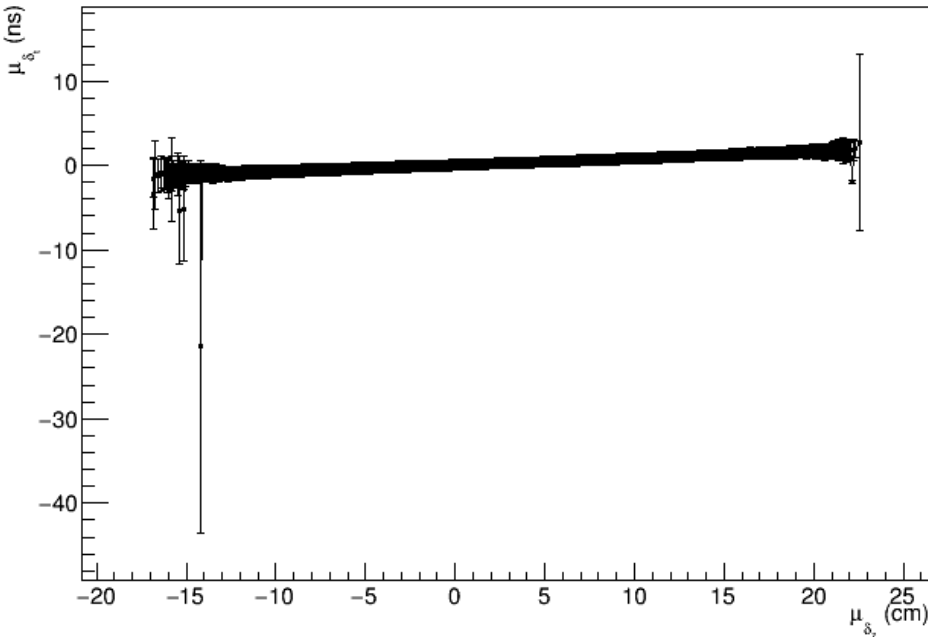
- Project slices along δt and fit them with a Gaussian for each bin (500 µm) along δz
  - Require that the number of entries for each projection be grater than some predefined value (100 entries)
  - Other cuts are obviously possible
  - The error calculated is σ returned by the fit
- Veff ≈ 12.79 cm/ns

Which Method Is Best?

- ROOT Fitter (Minuit & Fumili) is a black box
  - Outliers have same weight as "good" data points
- ProfileX underestimates the error
- FitSlicesY underestimates the error
- Custom method provides much more control
  - Cuts on σ, χ^2 / ndf, number of entries etc.
- What about binning?
  - Current binning scheme:
    - 500 µm in Z, 60 ps in TDC time
  - Analysis is extremely sensitive to binning