First MiniDT tracking studies

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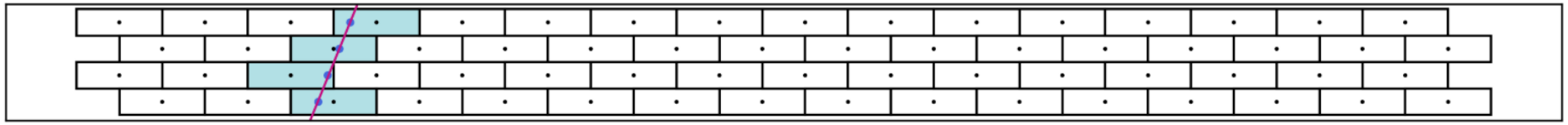
TPGs and hit selection for tracks

- Events from sndRun_20250314_2 See here
- TPG matching between MiniDT X and MiniDT Y by requiring:
  - 'L' quality TPG (3 hits) on MiniDT X
  - A corresponing 'L' quality TPG (3 hits) on MiniDT Y within a 30 ns time window
- Compatible hits from a separate hit stream are selected within a relaxed time window (600 ns) due to congestion that may cause some mess in the hit ordering
  - Hits $T_{pedestal}$ is the corresponding TPG X timestamp
- These hits are matched with hits belonging to TPG that share the same wire and cell, in order to solve the laterality ambiguity that is computed by the TPG algorithm

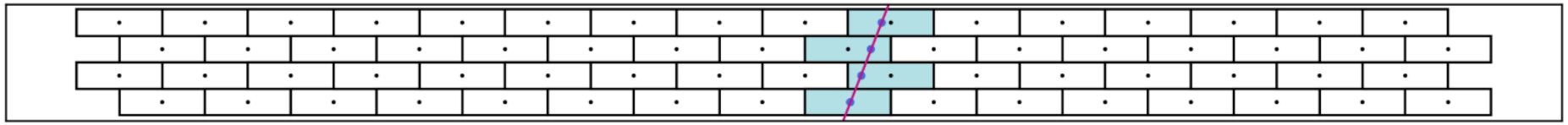
  → We can reconstruct tracks

Reconstructed Tracks
- MiniDT X event display

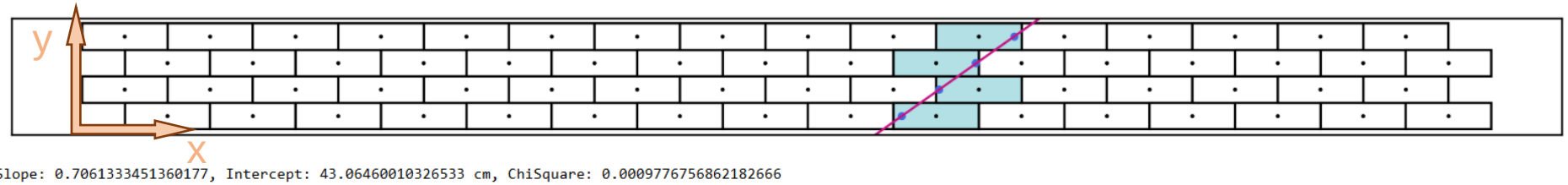
Slope: -3.4500825637518915, Intercept: 28.410093200905067 cm, ChiSquare: 0.01230031513784364



Slope: 2.461856472280389, Intercept: 12.614600107969949 cm, ChiSquare: 0.014661501568785753



Slope: 2.5590730103713115, Intercept: 38.68314162594909 cm, ChiSquare: 0.0065838587769965025



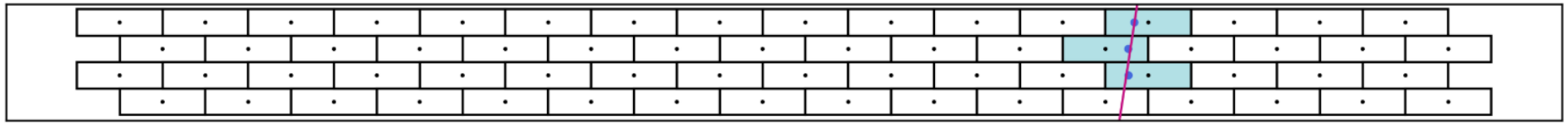
Slope: 0.7061333451360177, Intercept: 43.06460010326533 cm, ChiSquare: 0.0009776756862182666

For these preliminary studies, a local system of reference has been chosen

3 hit TPG X, 3 hit TPG Y, 30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

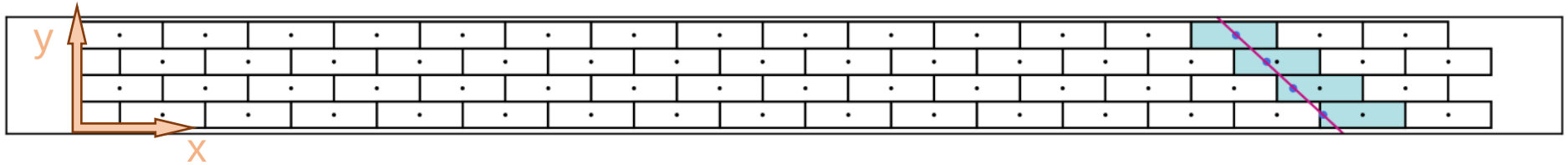
Reconstructed tracks
- MiniDT Y event display



Slope: 6.52943736243897, Intercept: 51.52246857761829 cm, ChiSquare: 0.9722243840990198

Slope: 1.162323414074156, Intercept: 20.246173610607748 cm, ChiSquare: 0.022014552824875994

Slope: -0.9367568427962282, Intercept: 58.91872171182542 cm, ChiSquare: 0.004074386775530551

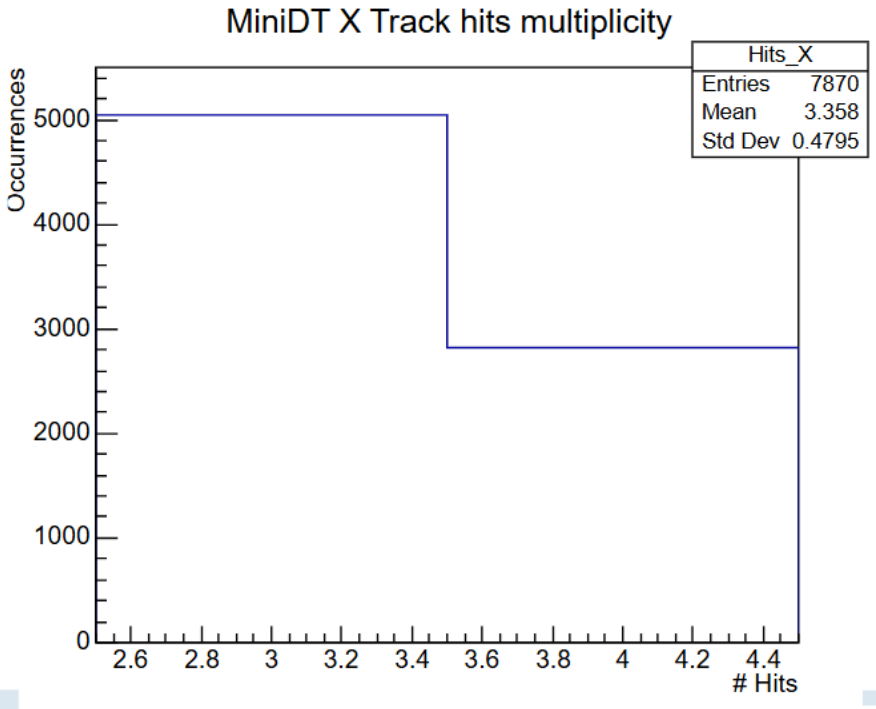


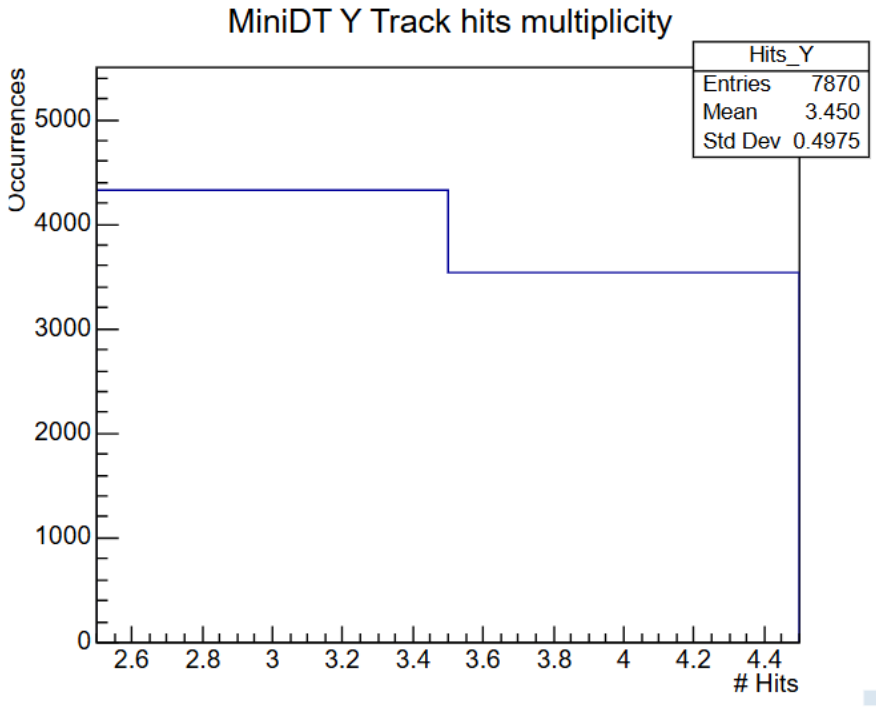
Slope: -0.9199702035735395, Intercept: 58.93957900620612 cm, ChiSquare: 0.00575788517031229

3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Track hits multiplicity

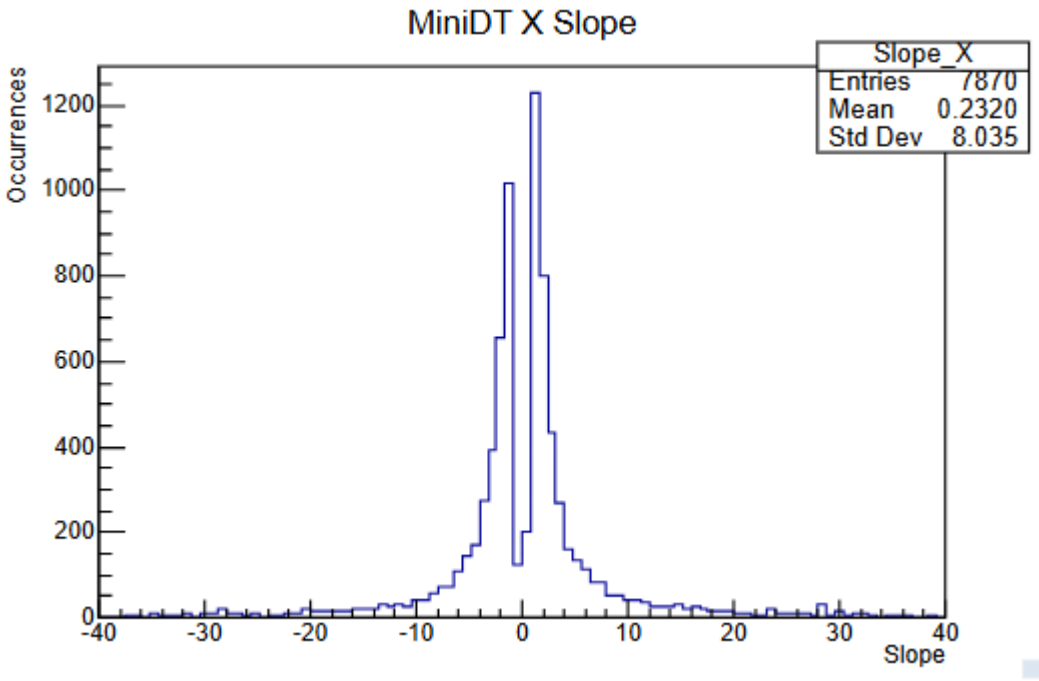


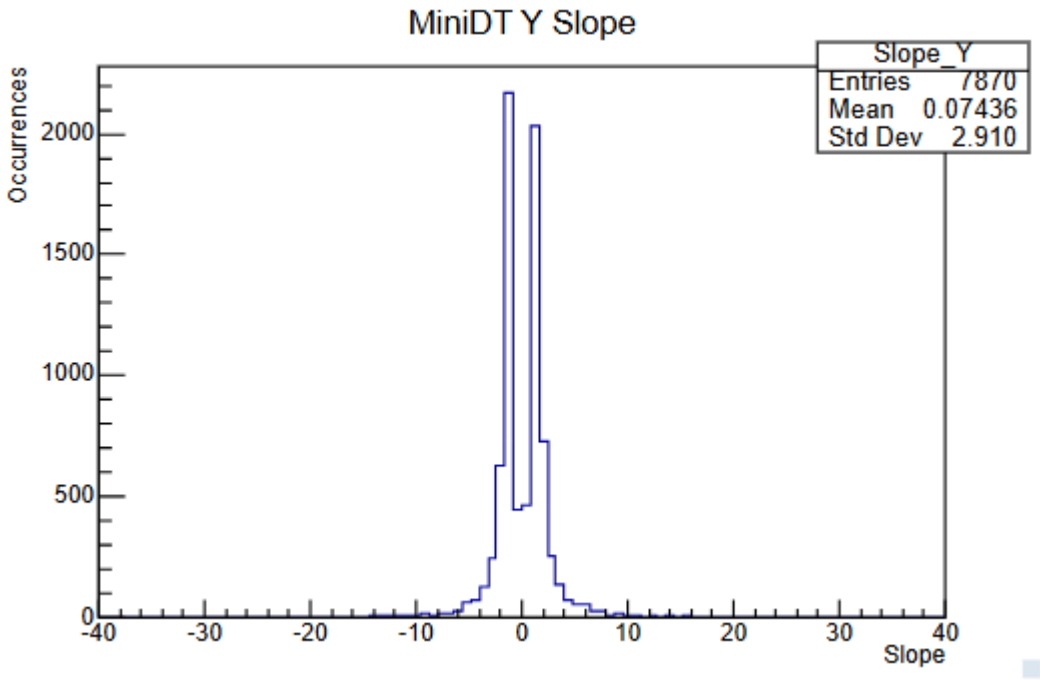


3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Track slope – 3 and 4 hits

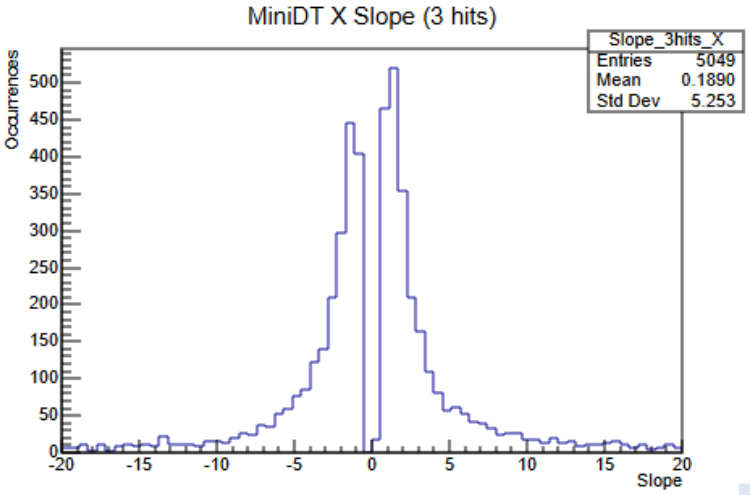


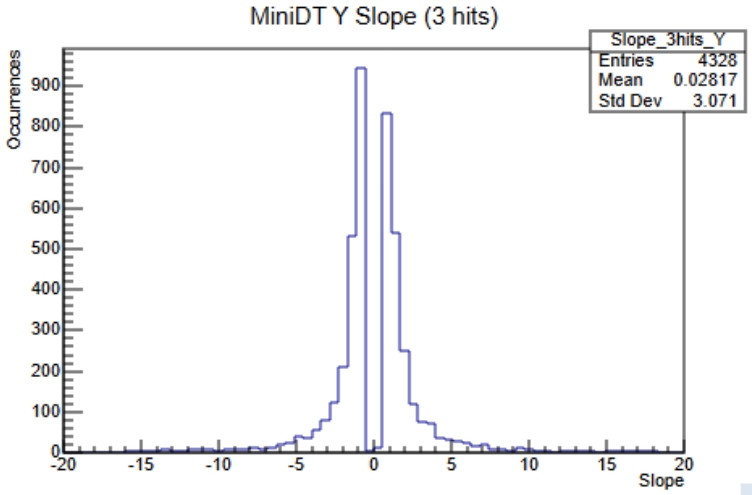


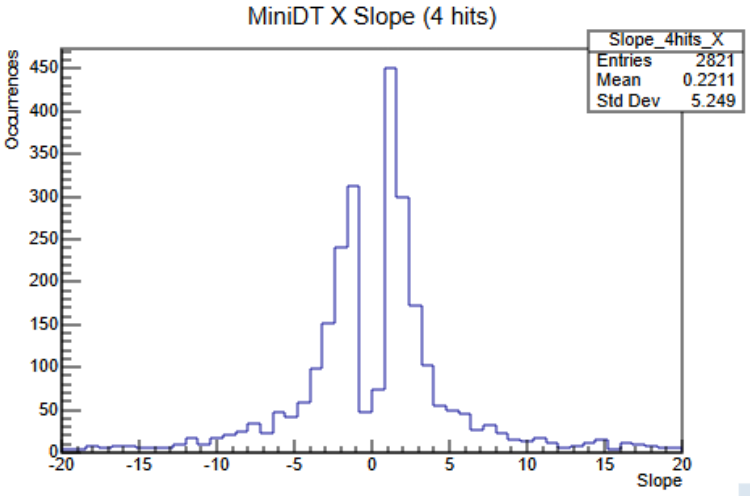
3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

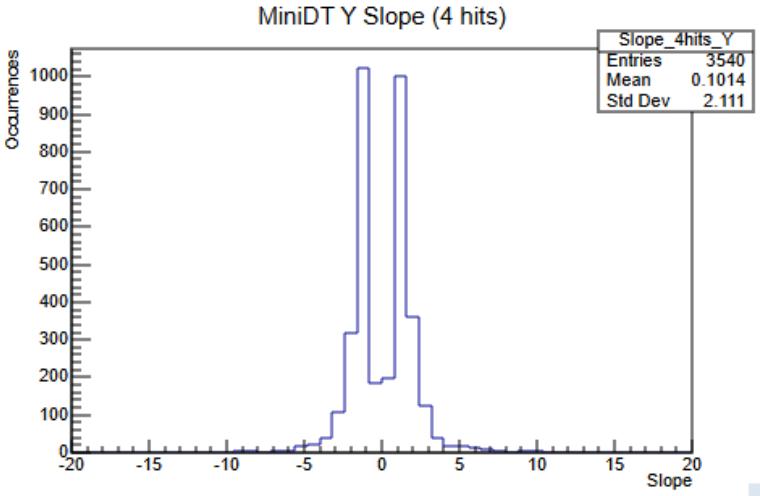
sndRun_20250314_2

Track slope – 3 vs 4 hits





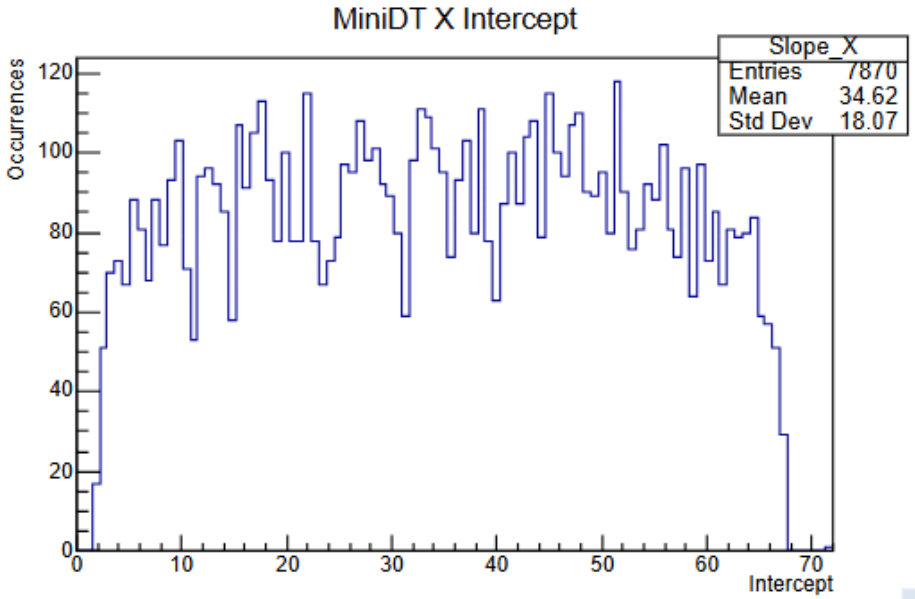


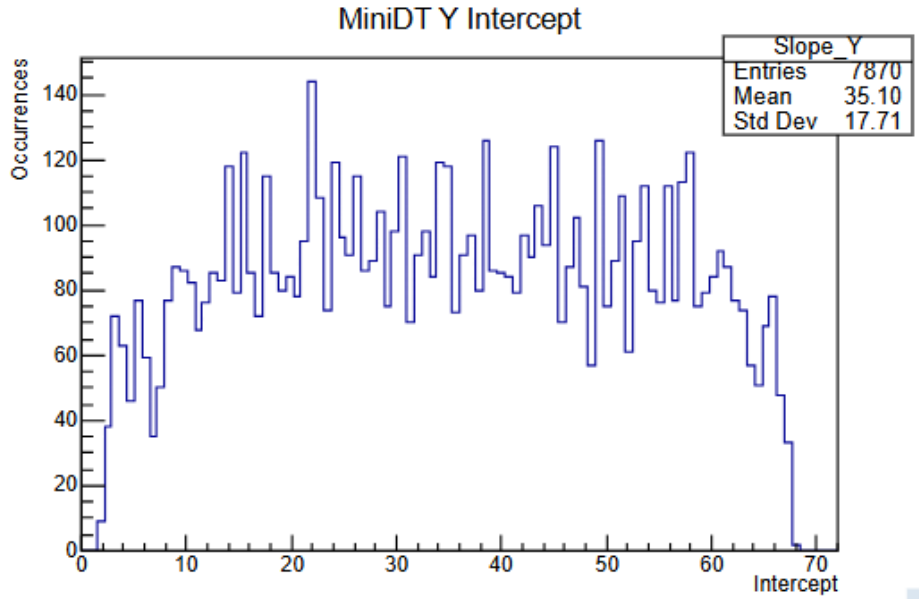


3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Track intercept – 3 and 4 hits





3 hit TPG X, 3 hit TPG Y,
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$T_{pedestal}$ from TPG_X
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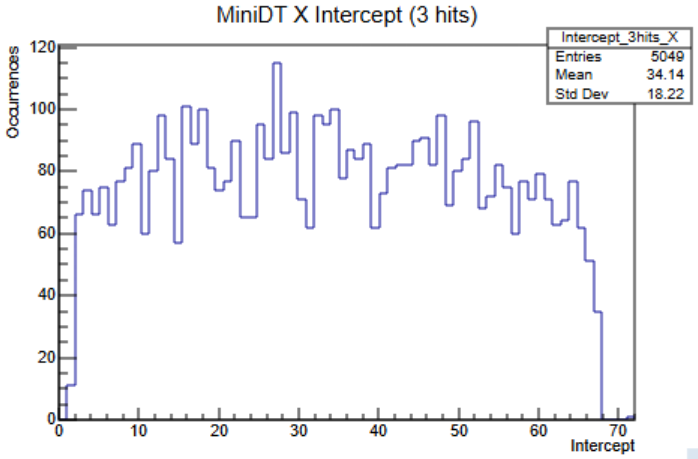
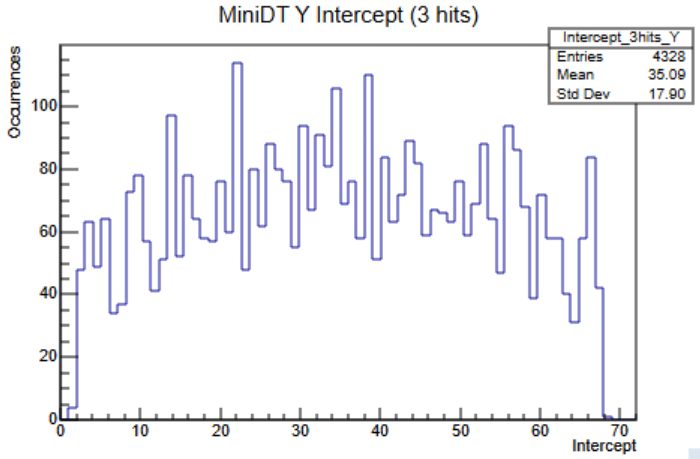
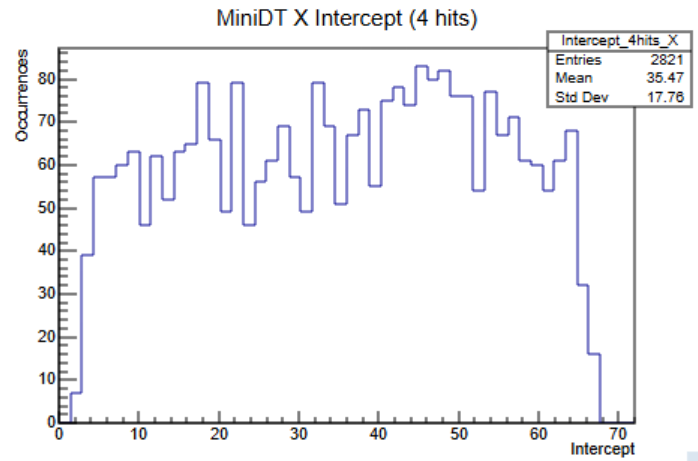
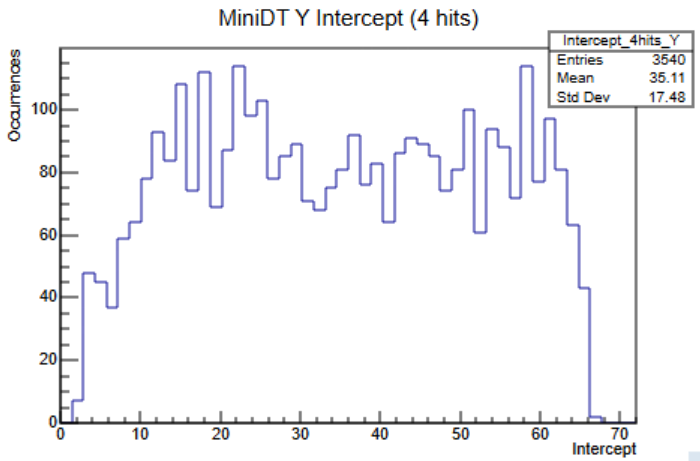
sndRun_20250314_2

Track intercept – 3 vs 4 hits





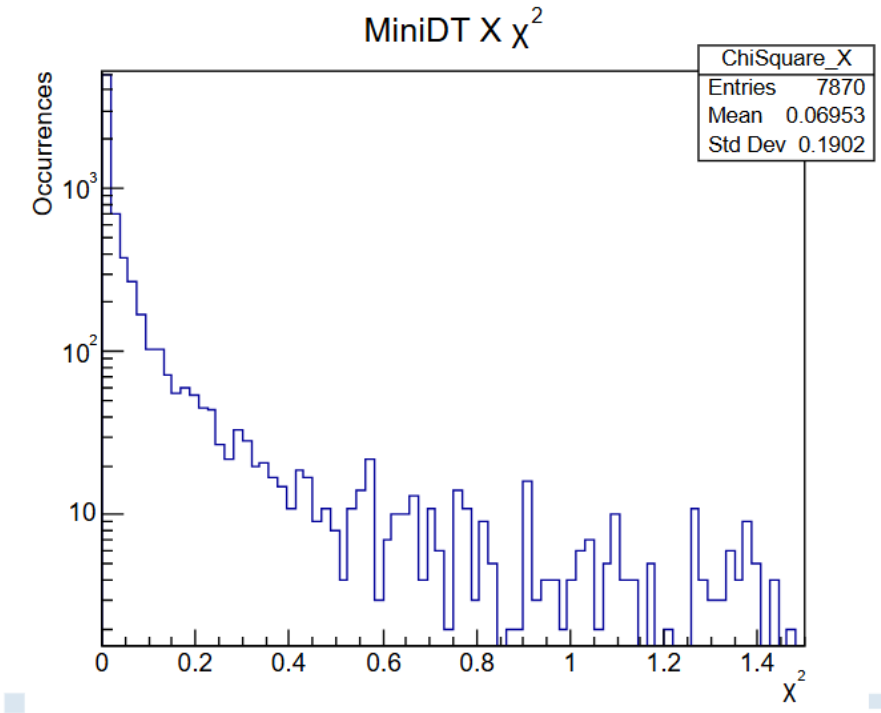


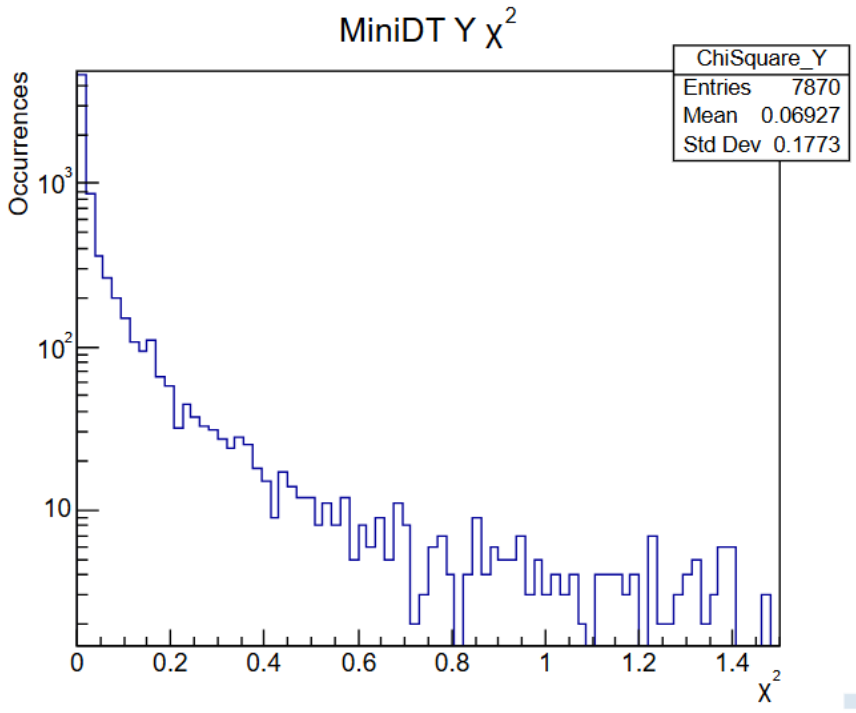


3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

χ^2 – 3 and 4 hits

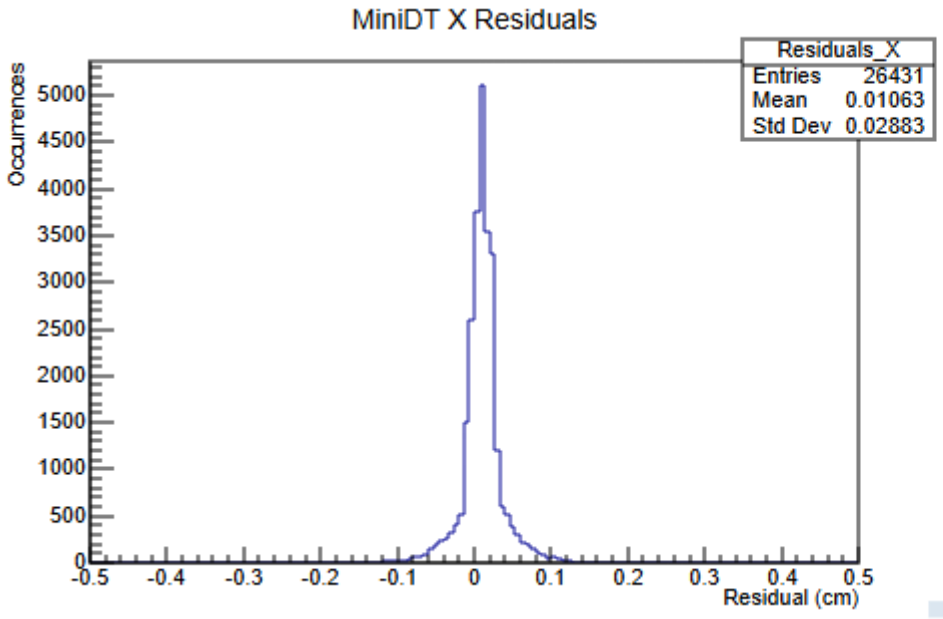


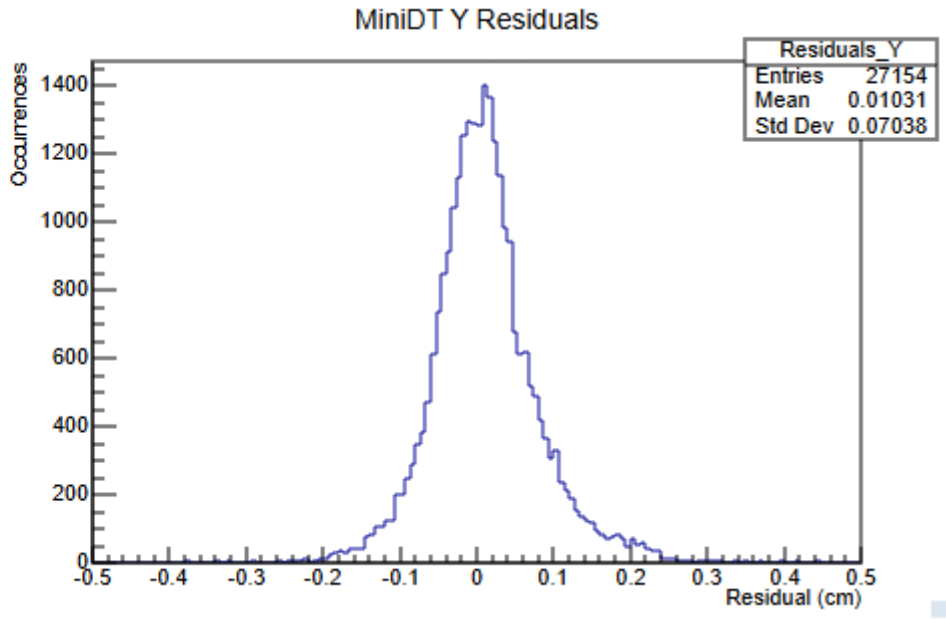


3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Residuals





3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
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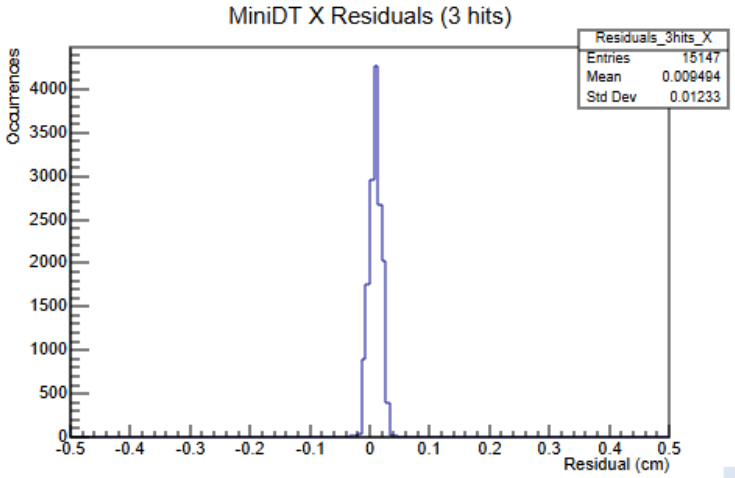
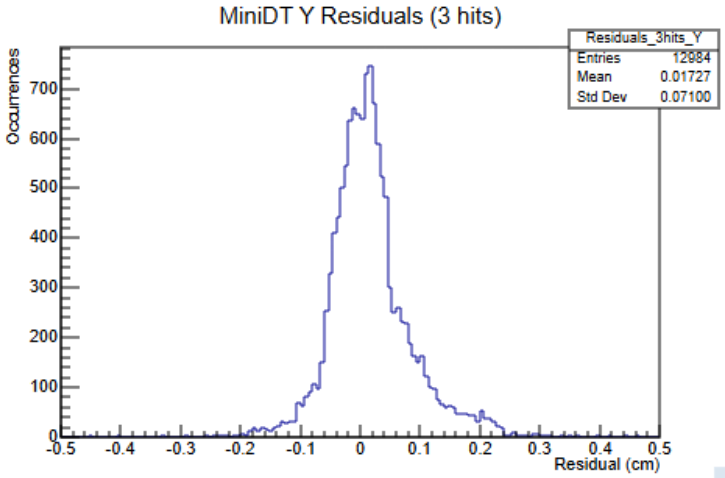
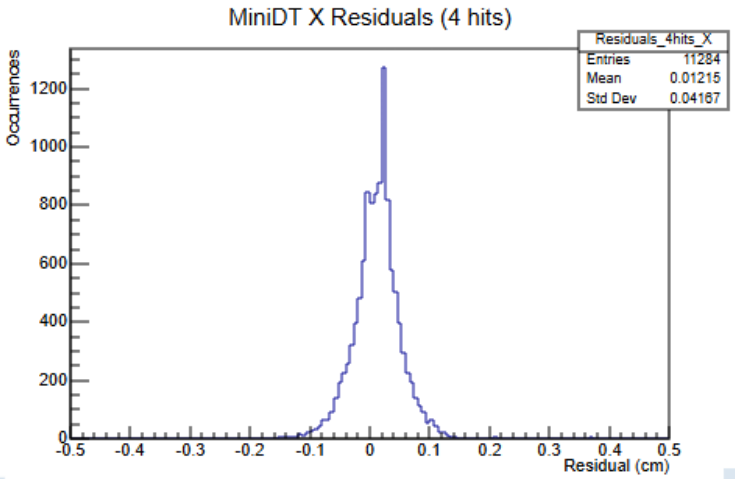
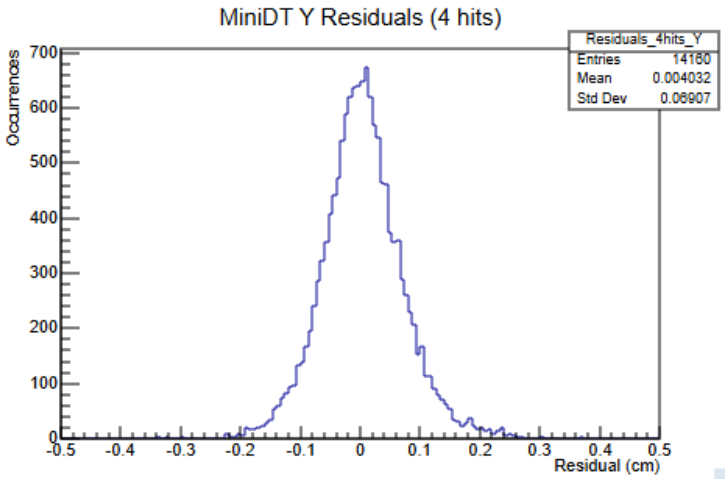
sndRun_20250314_2

Residuals









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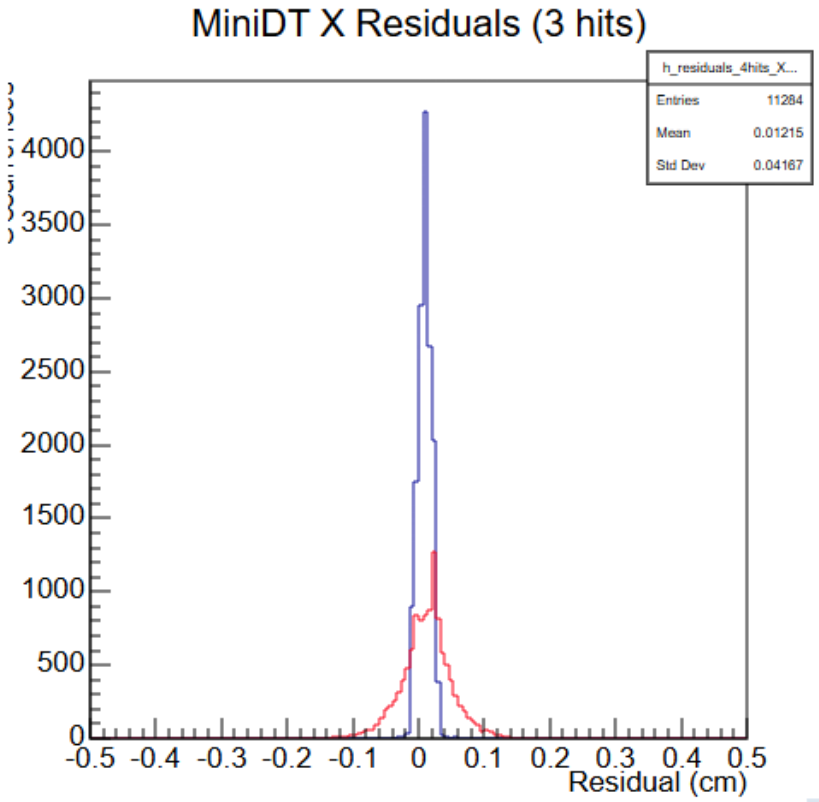
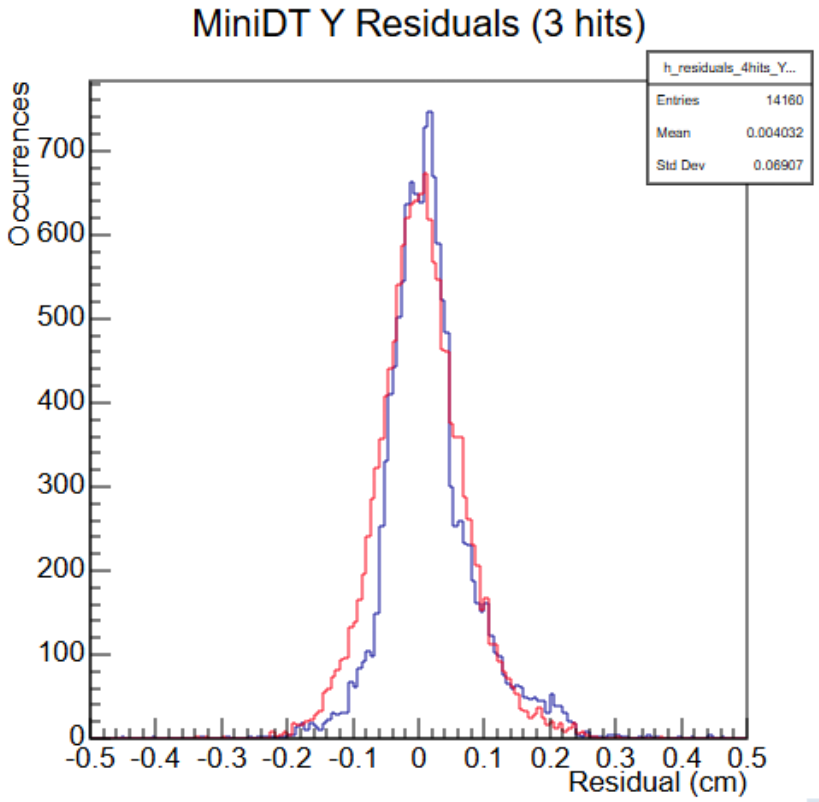
sndRun_20250314_2

Residuals



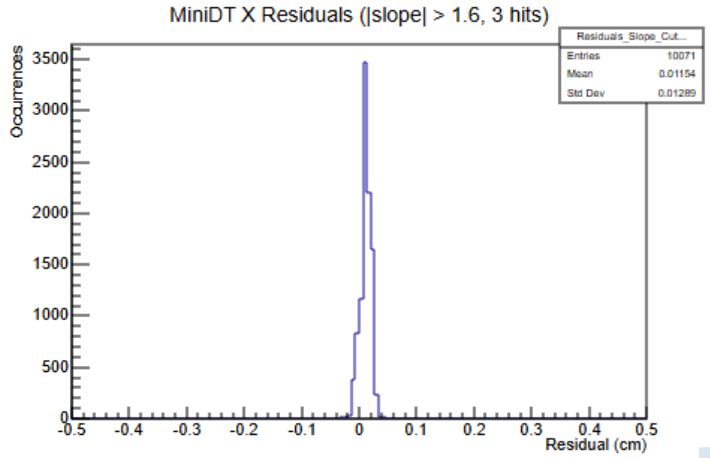


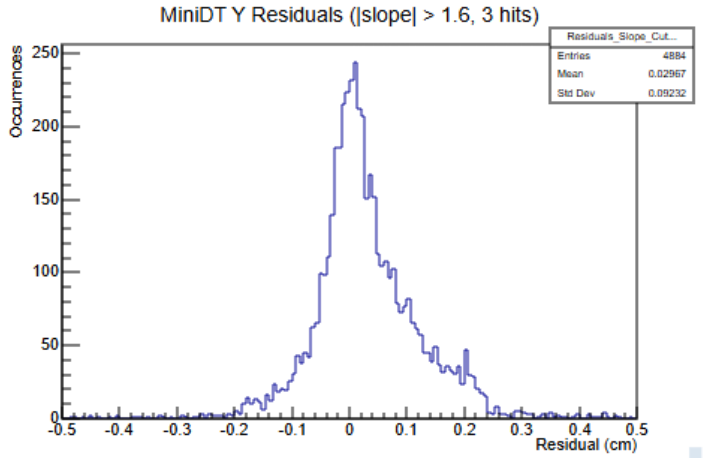
3 hits
4 hits

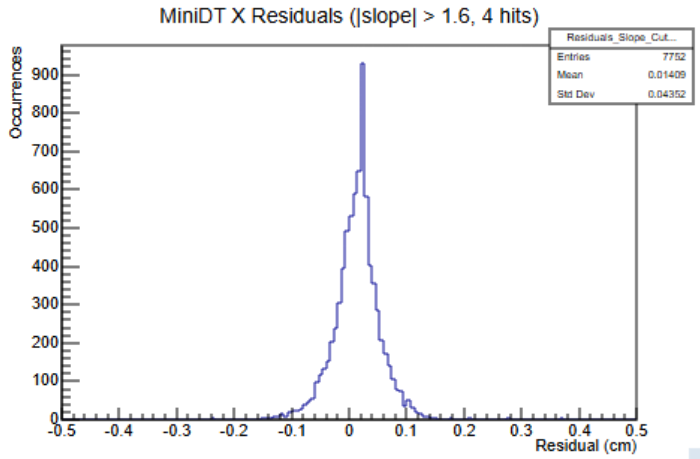
3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

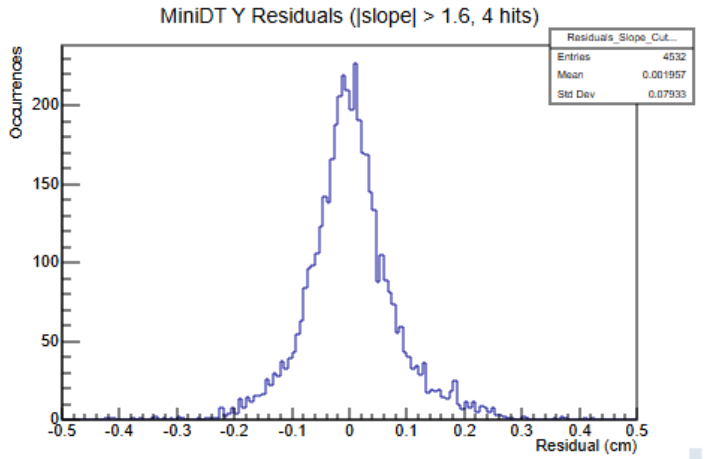
sndRun_20250314_2

Residuals - Cut for |slope| > 1.6









3 hit TPG X, 3 hit TPG Y,
30 ns window
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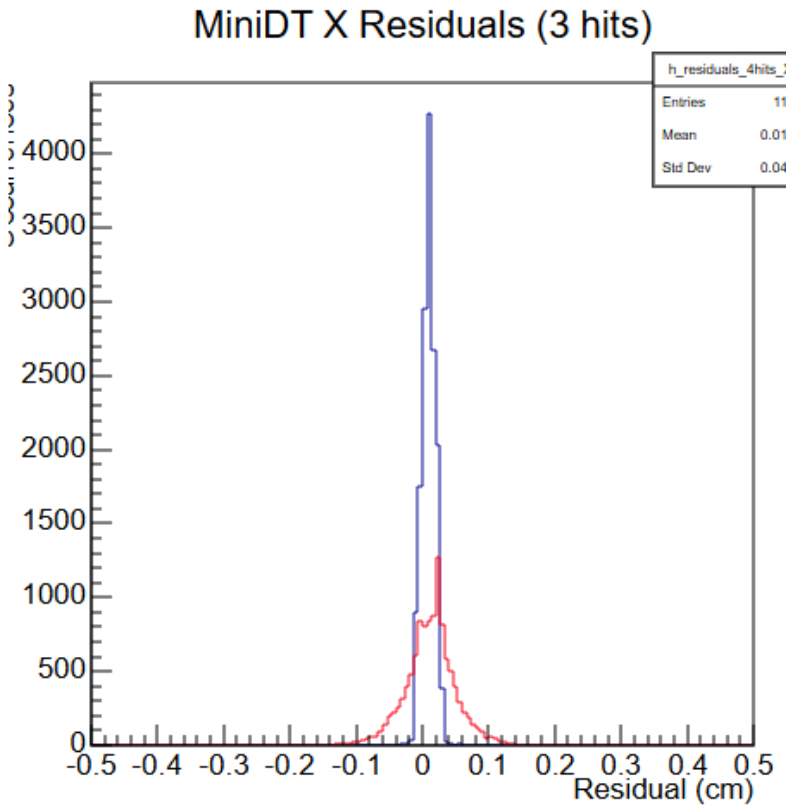
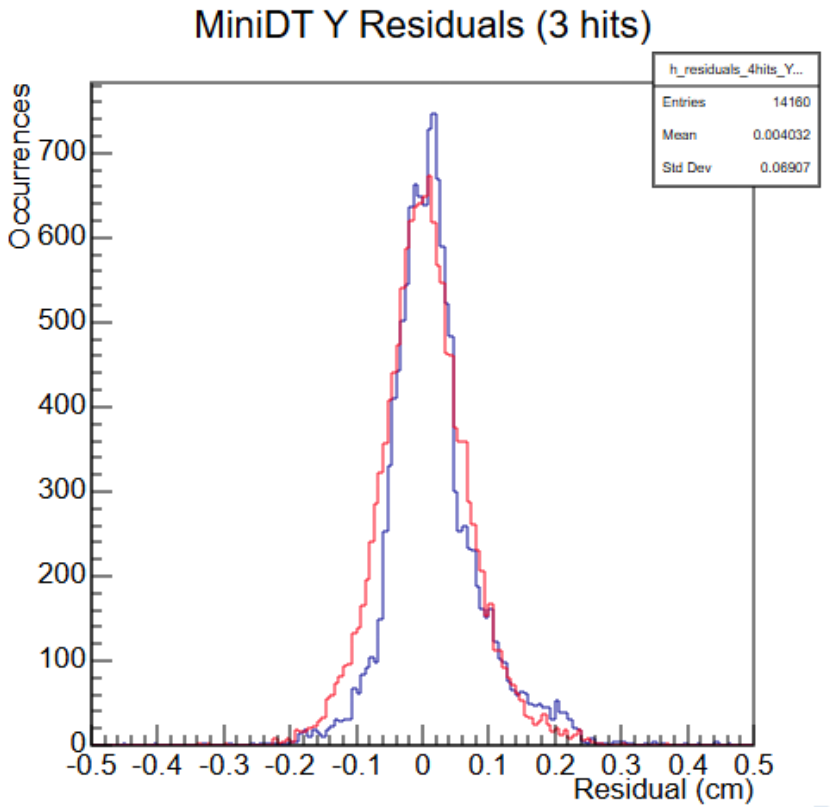
sndRun_20250314_2

Residuals - Cut for |slope| > 1.6



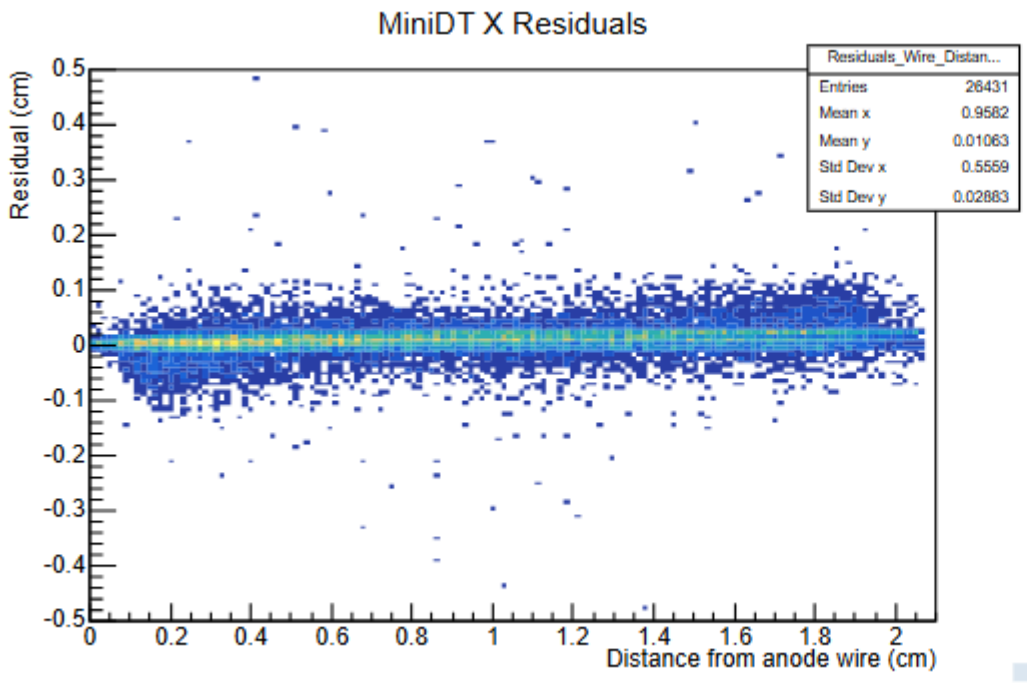


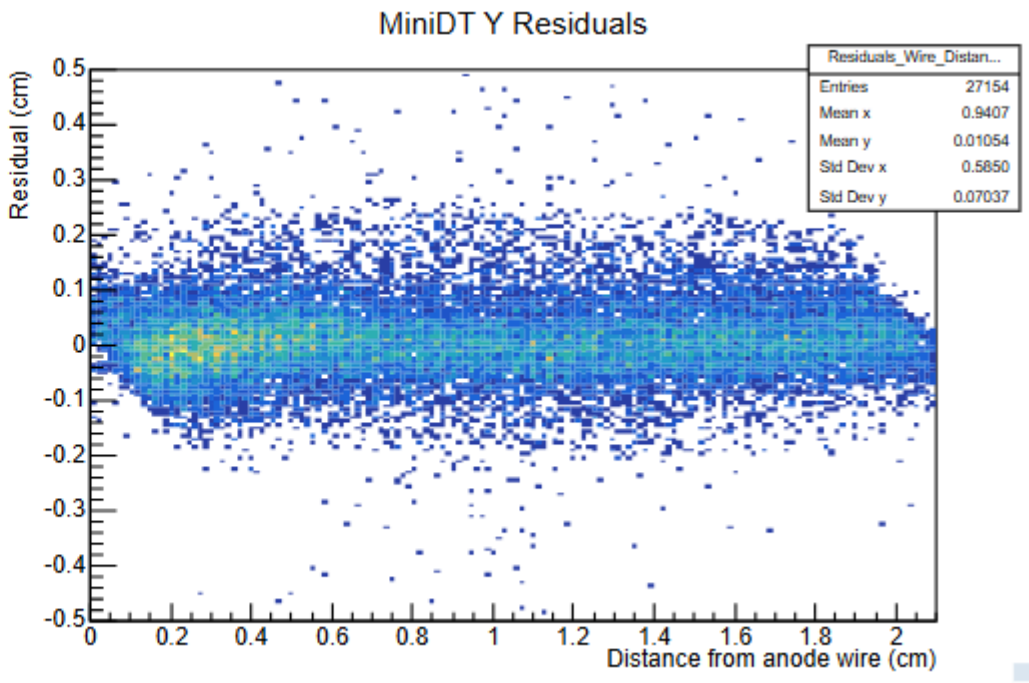
3 hits
4 hits

3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Residuals vs Distance from anode wire



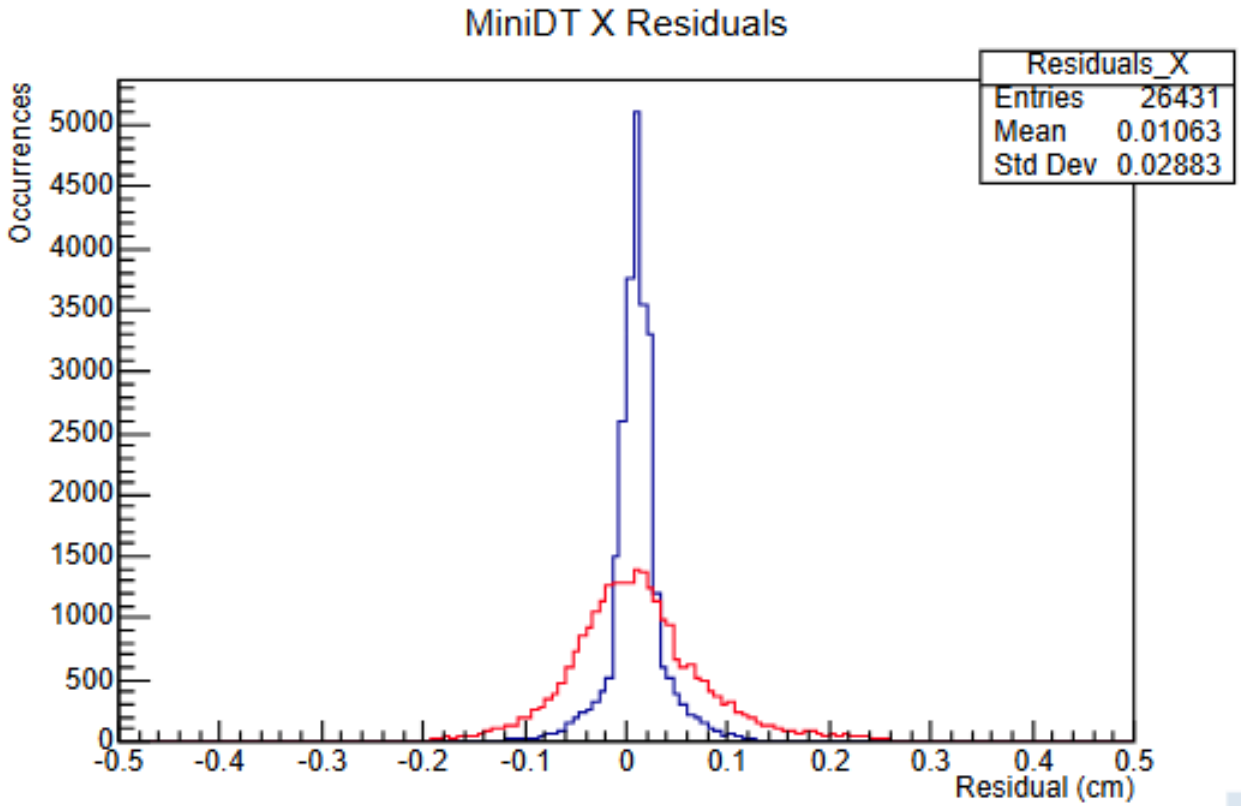


3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2

Backup slides

Residuals - MiniDT X vs MiniDT Y



3 hit TPG X, 3 hit TPG Y,
30 ns window
$T_{pedestal}$ from TPG_X
$v_{drift} = 53.5\ \mu$m/ns

sndRun_20250314_2