Test beam analysis status

LCTPC-Pixel Meeting
23.07.2015

Michael Lupberger

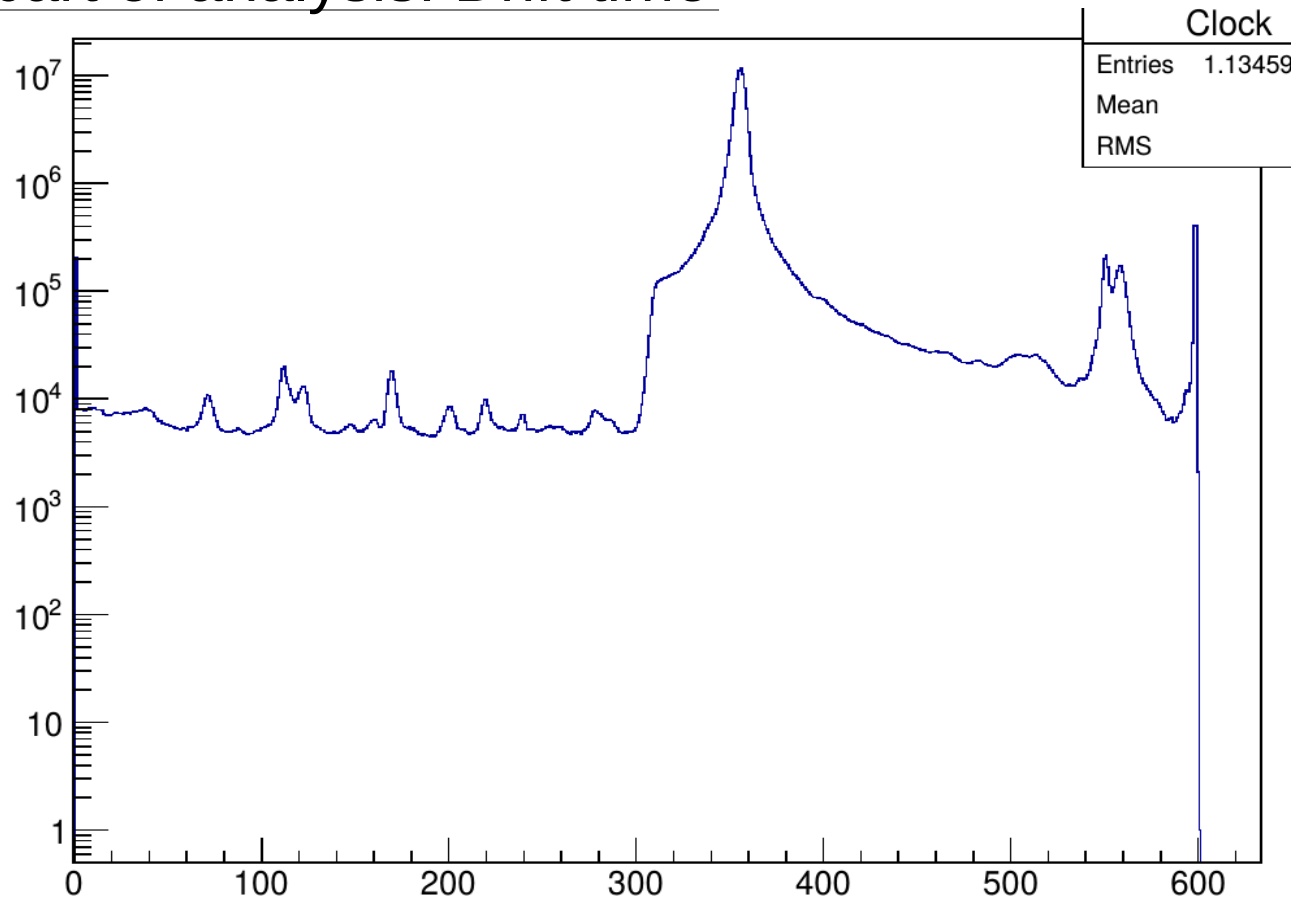
Preanalysis

Data cleaning finished

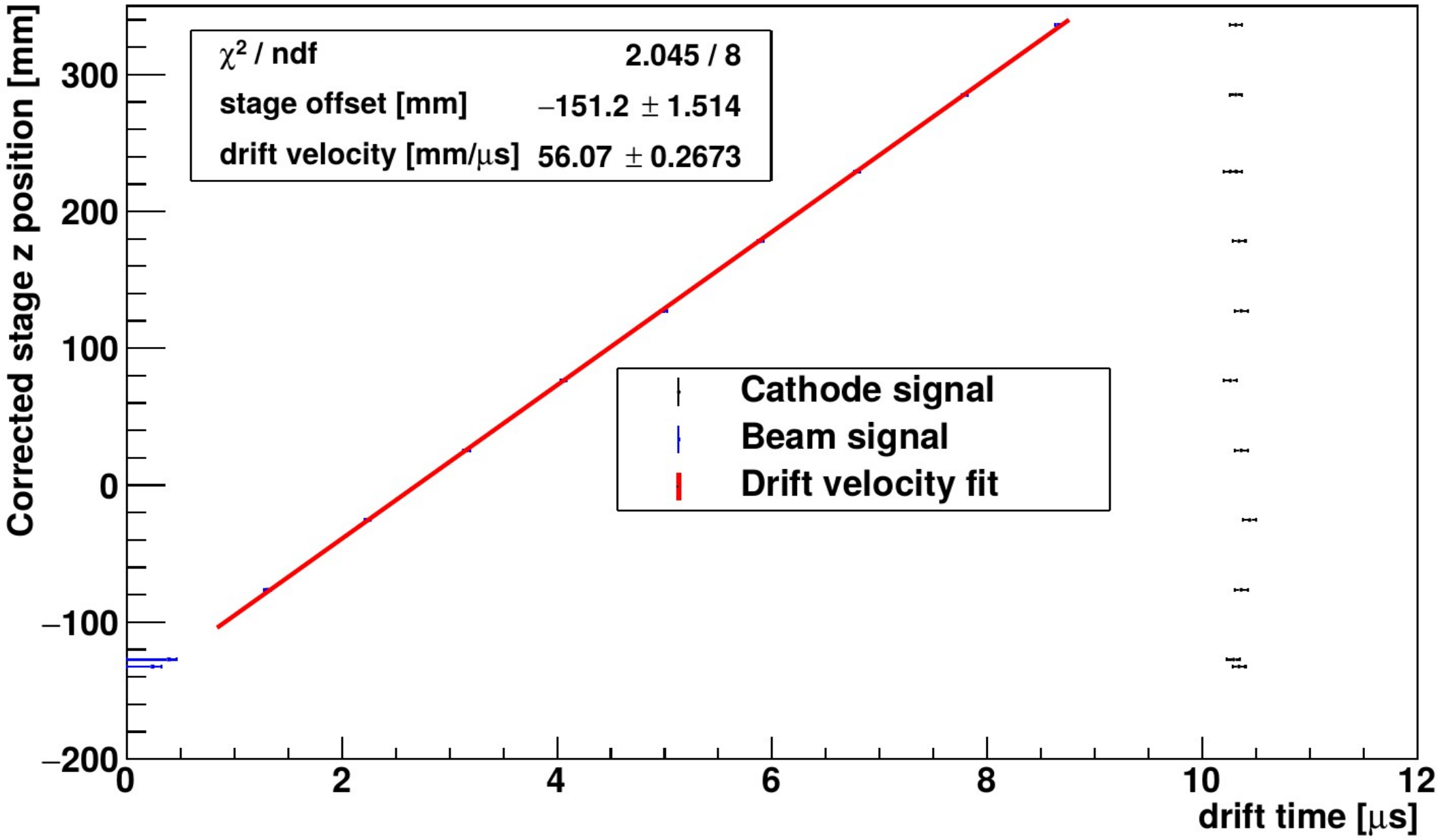
Data quality control finished

→ bit shifts mostly of dead pixel
→ some very few events with bit shifts located on single octoboards
Reject complete events

First part of analysis: Drift time

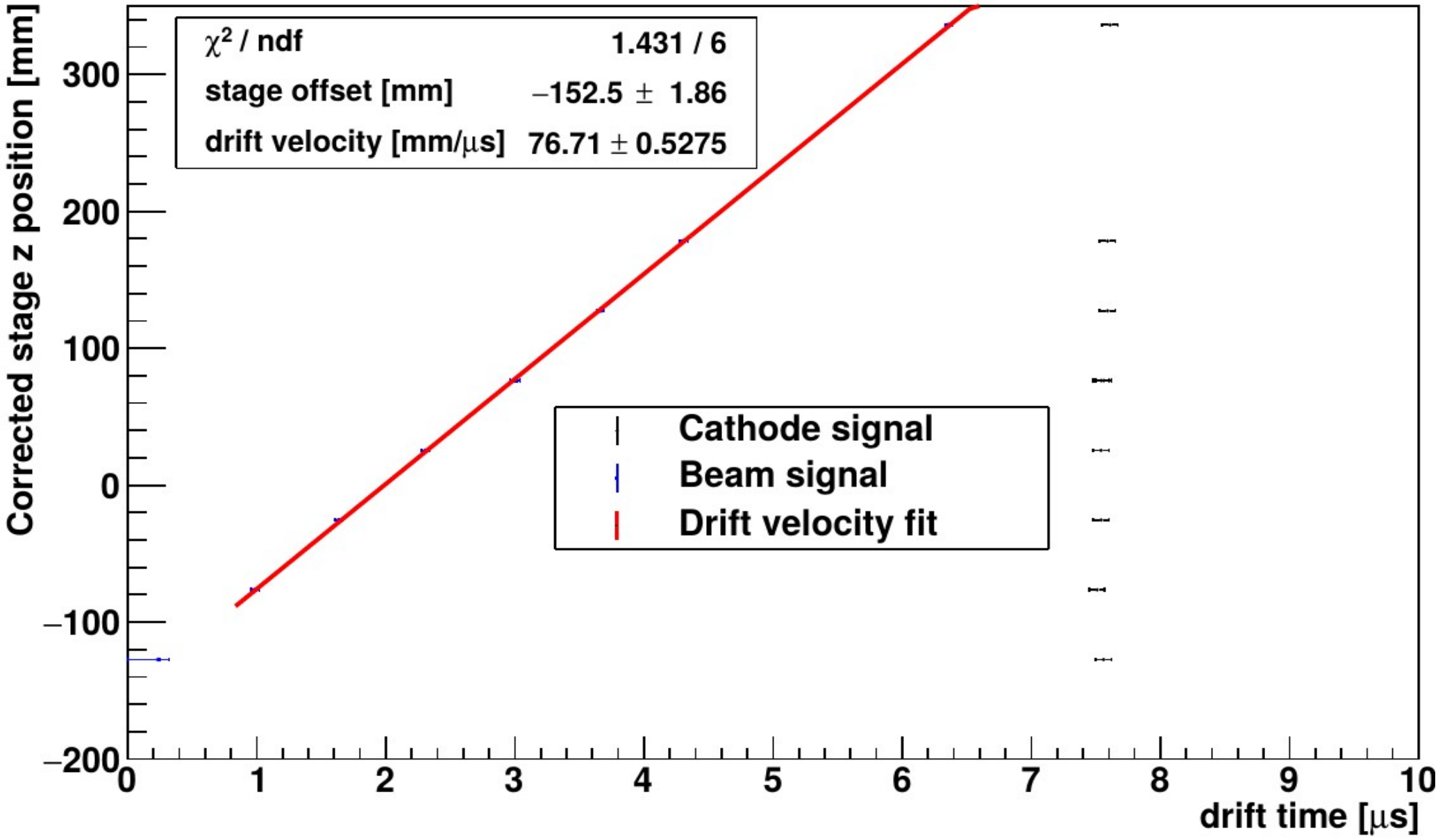


Drift velocities, 40 MHz readout frequency

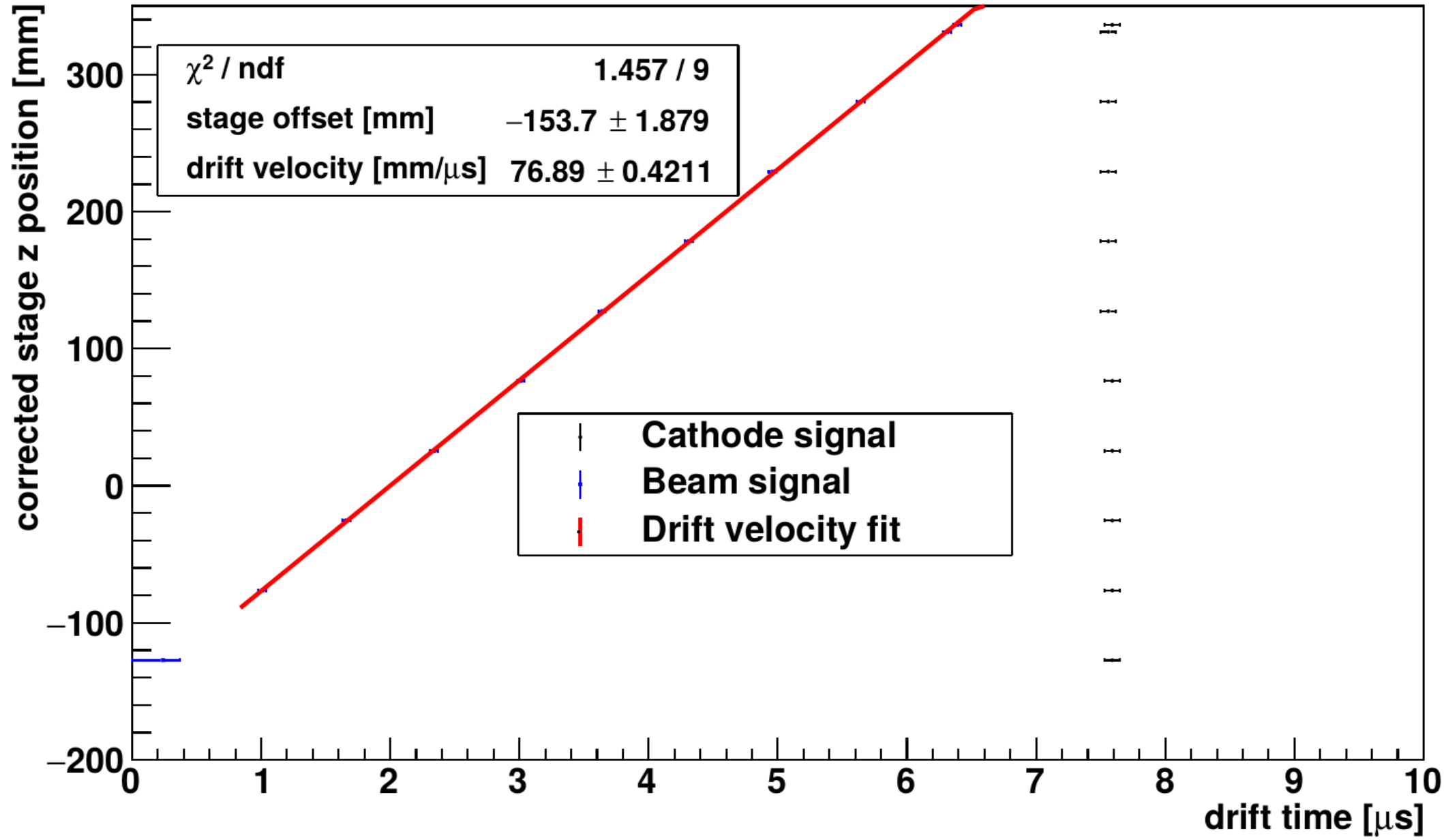


Drift velocities, 40 MHz readout frequency

Run 051-059: B=0T, V_d=230 v/cm

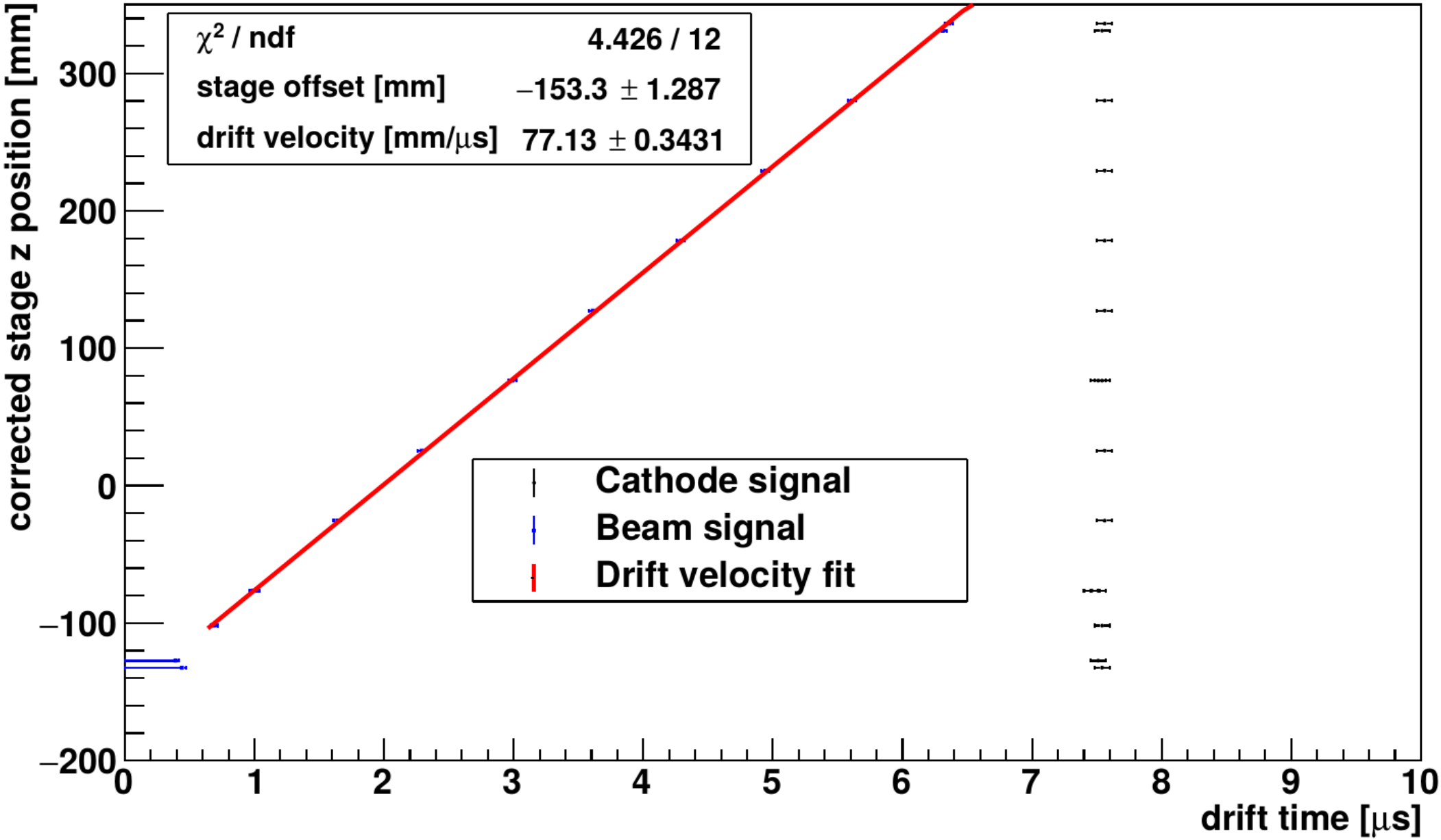


Drift velocities, 40 MHz readout frequency



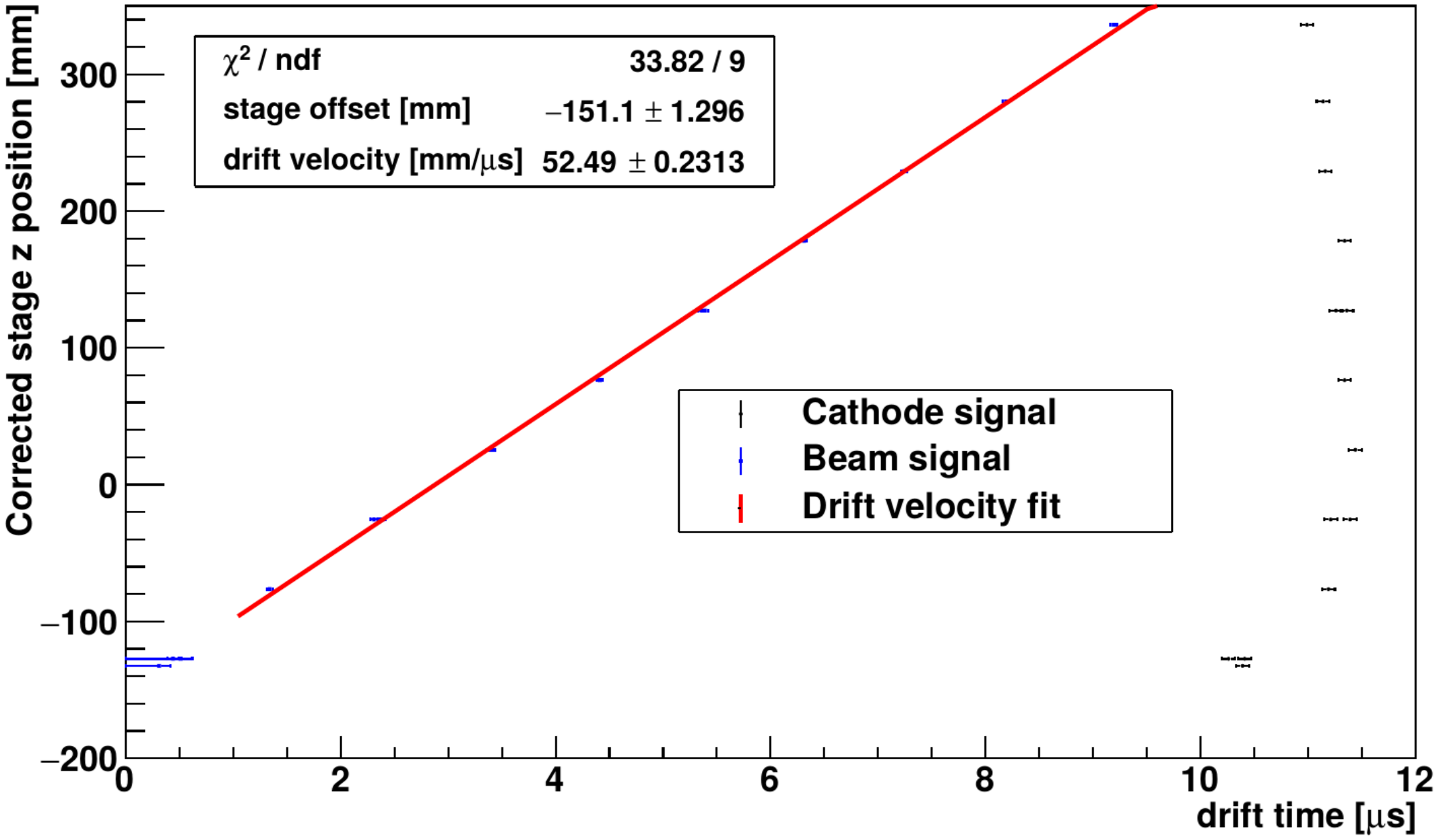
Drift velocities, 40 MHz readout frequency

Run 090-105: B=0T, V_d=230 v/cm



Drift velocities, 40 MHz readout frequency

Run 121-135: B=1T, V_d=130 v/cm

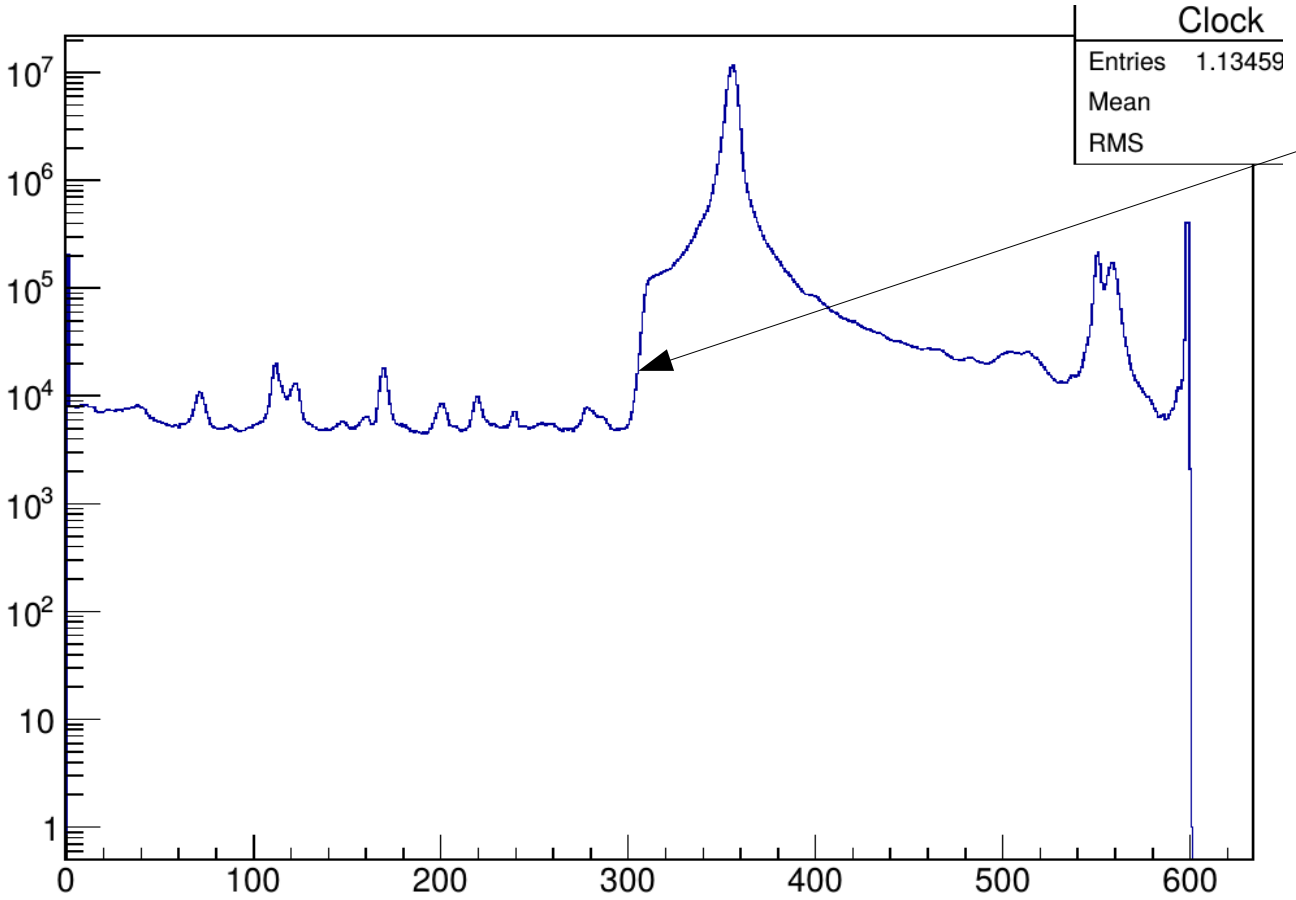


Drift velocities, 40 MHz readout frequency

Summary

Run	B[T]	E_{drift}[V/cm]	Stage offset[mm]	$v_{d,meas}$[mm/µs]	$v_{d,sim}$[mm/µs]
51-59	0	230	-152.5 ± 2.0	76.7 ± 0.6	76.50 ± 0.02
61-72	0	130	-151.2 ± 1.6	56.07 ± 0.27	56.42 ± 0.01
76-89	1	230	-153.7 ± 1.8	76.9 ± 0.5	76.39 ± 0.01
90-105	0	230	-153.3 ± 1.3	77.1 ± 0.4	76.38 ± 0.01
121-135	1	130	-151.1 ± 1.3	52.49 ± 0.24	53.23 ± 0.01

Drift time from cathode signal: all systematically too small



Cathode signal
Brezis method:

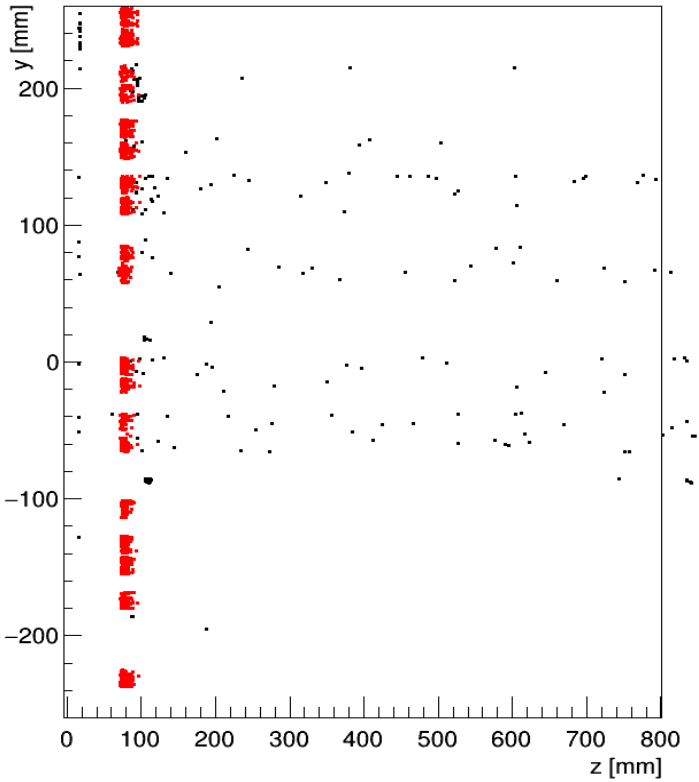
Center of Error function

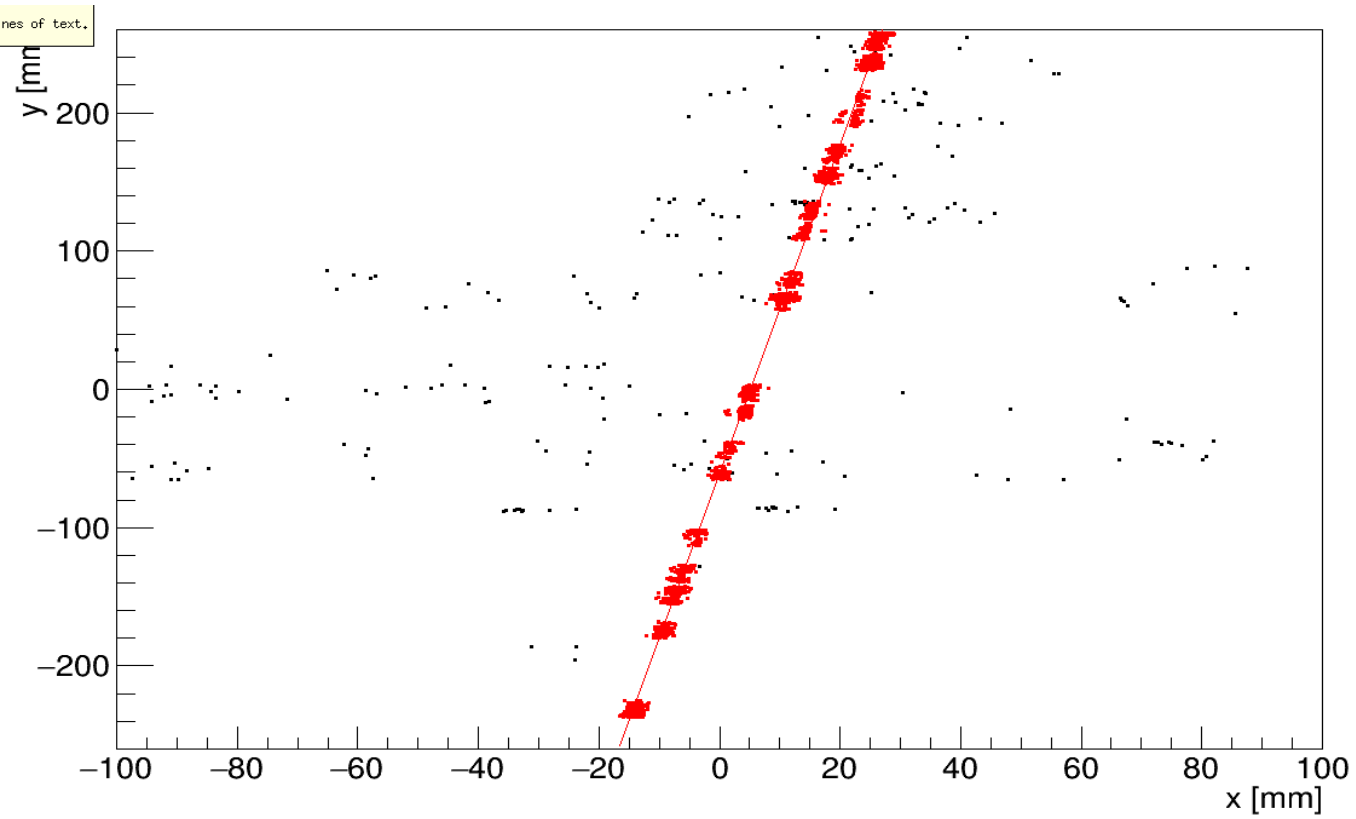
Discussion with Felix:

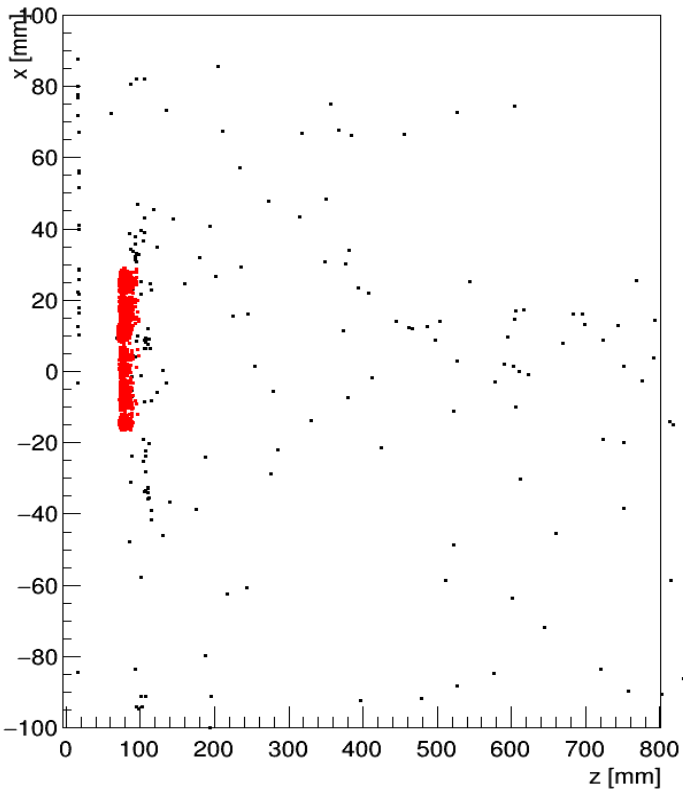
What we see is the edge of the diffused signal of a gaus from the cathode->
Take mean of gaus
=top of top/90% of error function

Straight track analysis

Convert TrackerData to hits (gear information)
Track finder: HoughTransformNormal (M. Rogowski)
Track fitter: LinearRegression
Reassign hits afterwards







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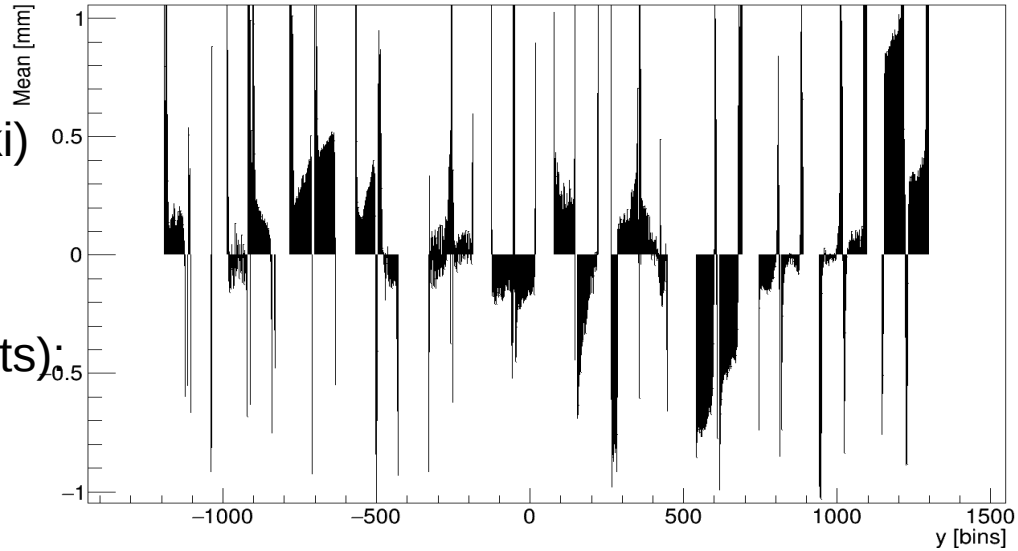
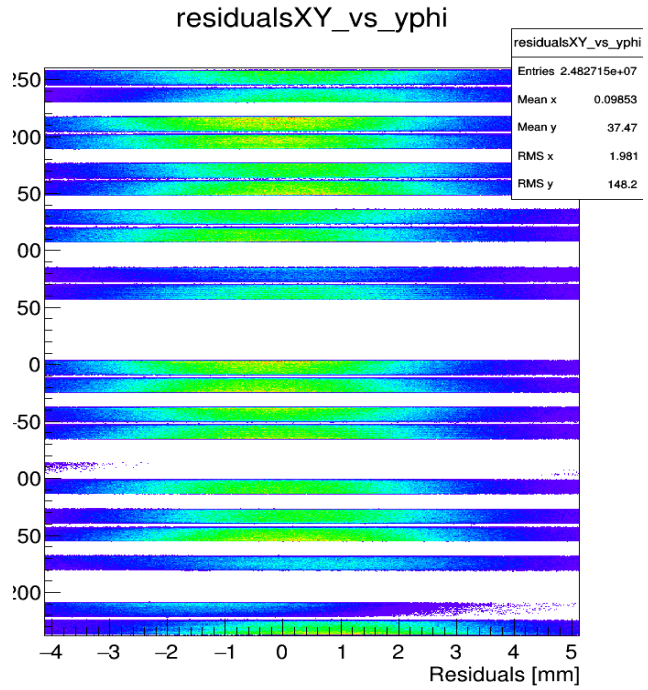
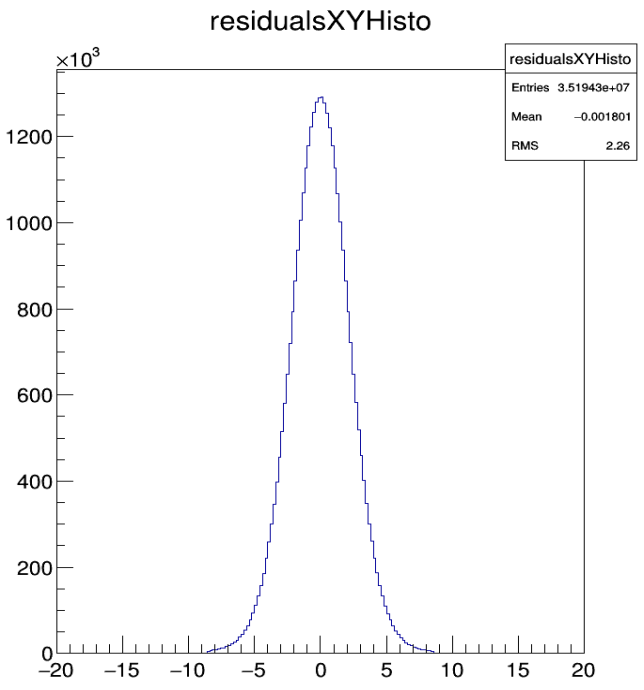
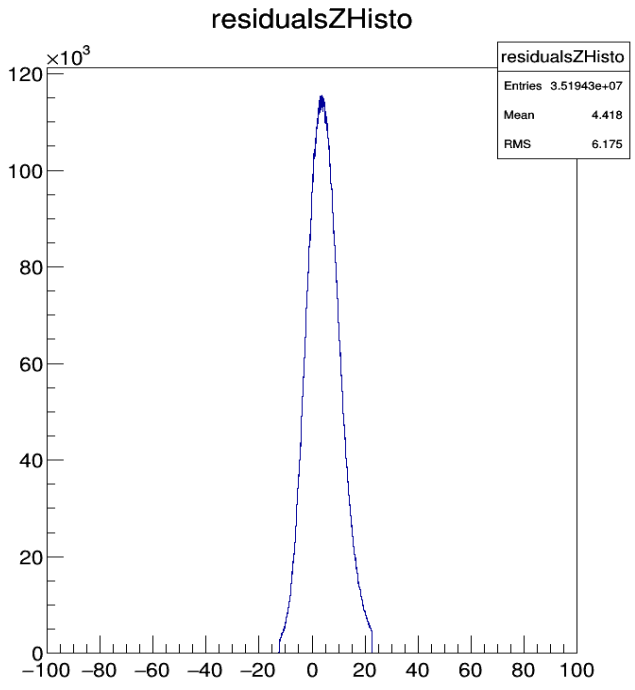
Analysis of track/hits on track parameters (after cuts):

Residuals, Residuals mean along y axis
GeometricMean (resolution)
Track parameters
Hits distributions









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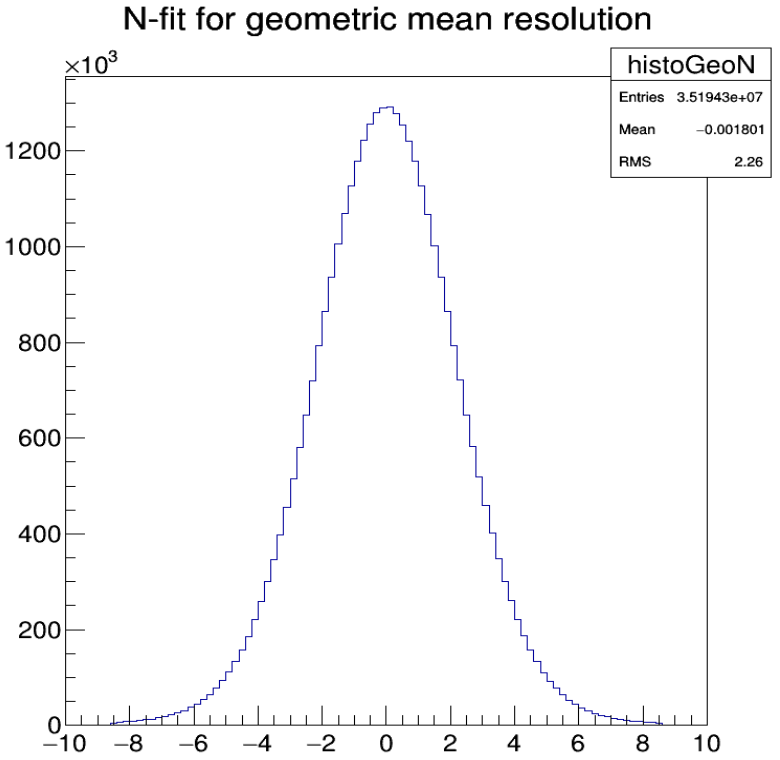

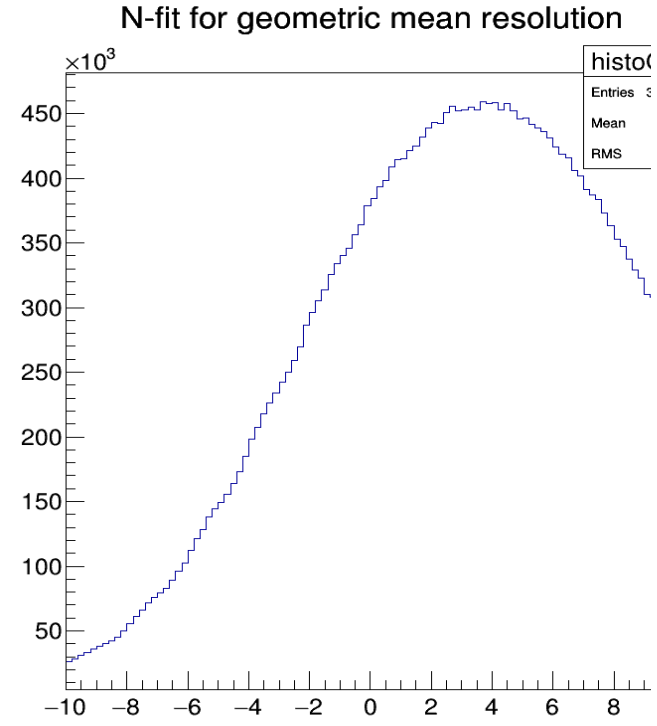

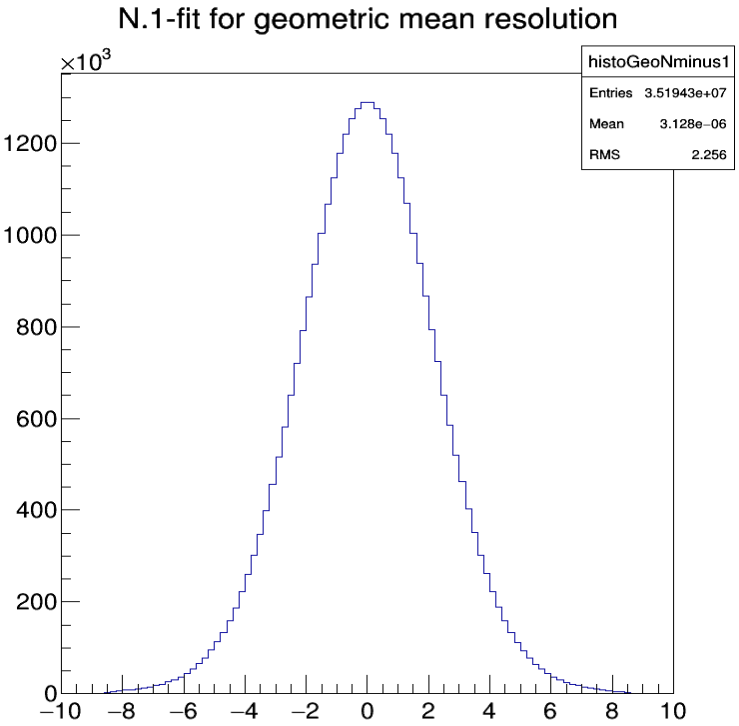

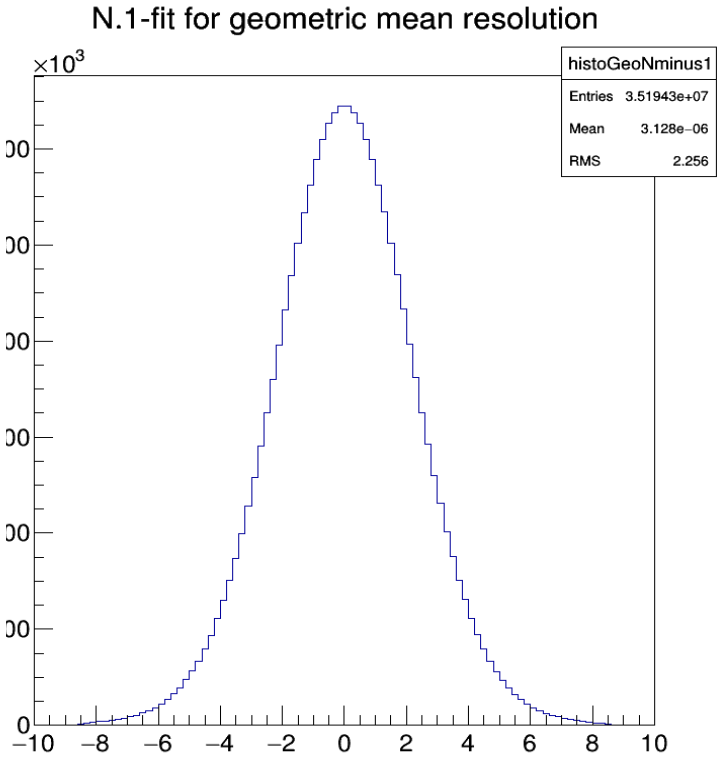

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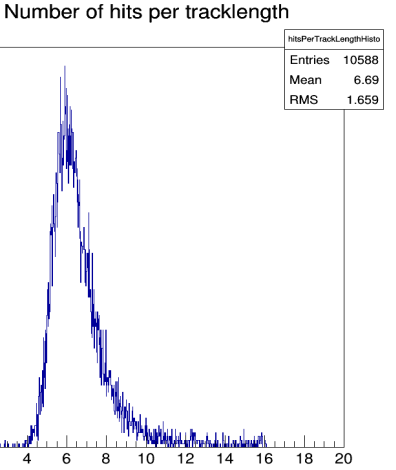

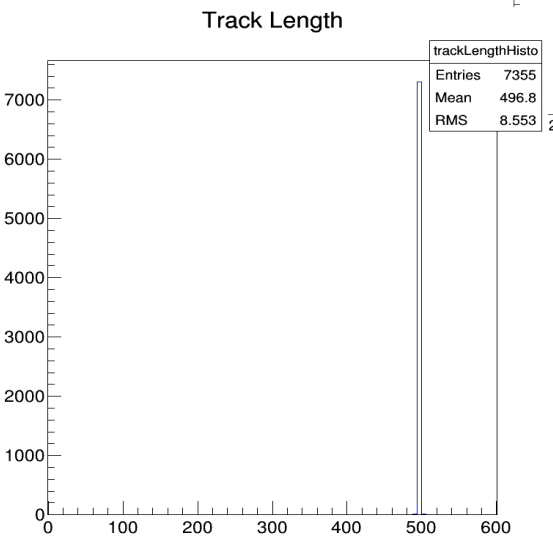

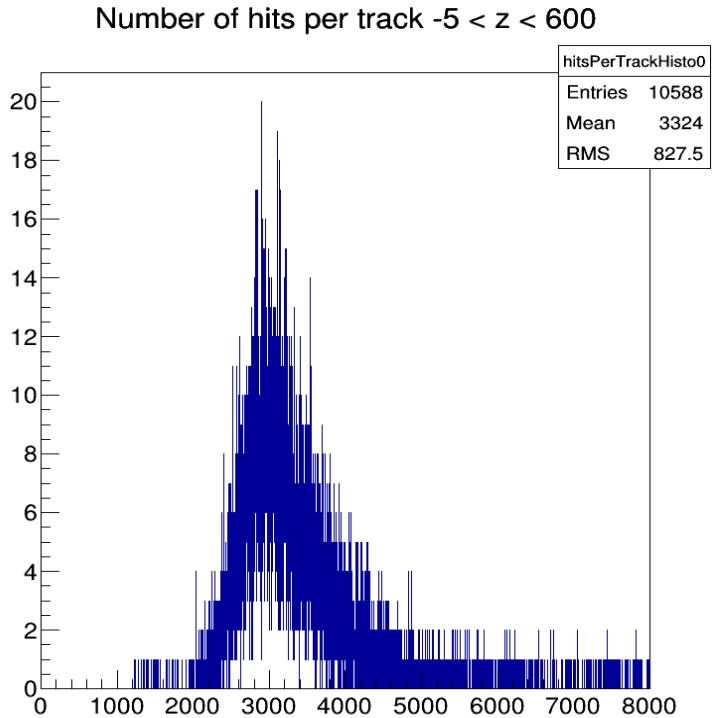

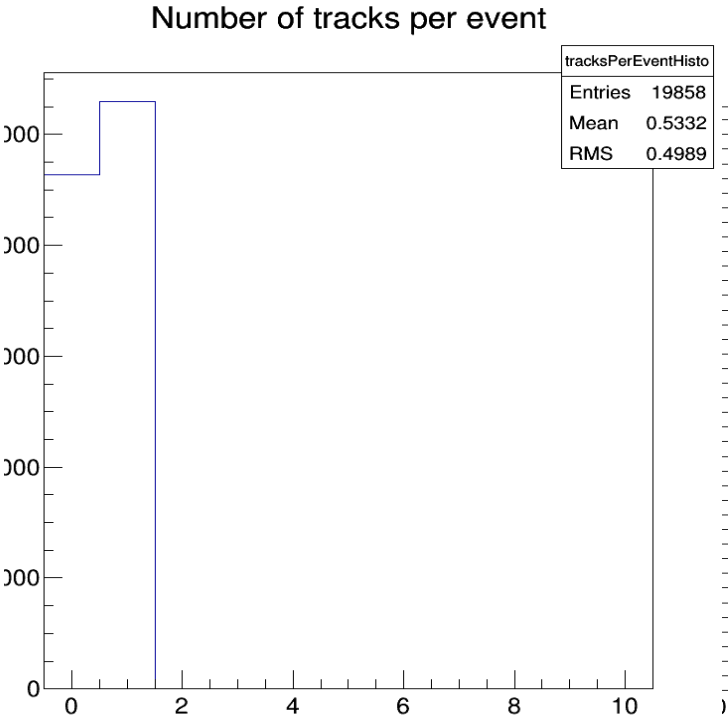

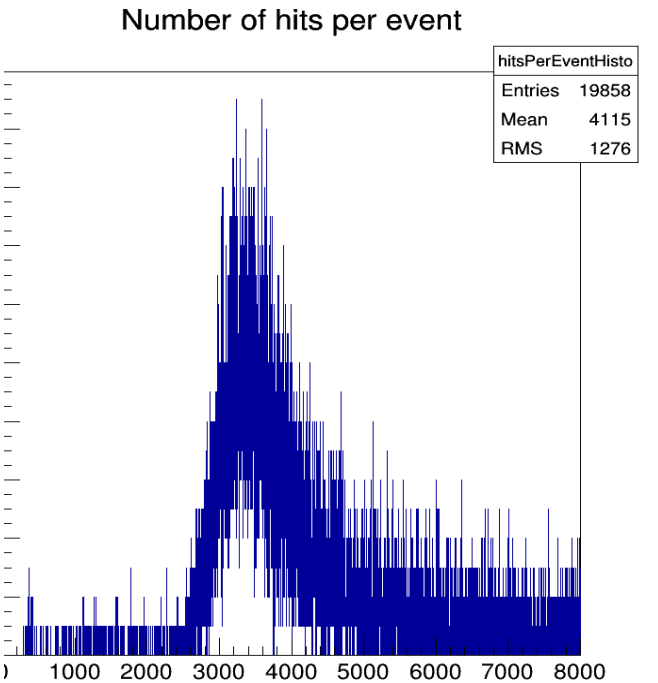

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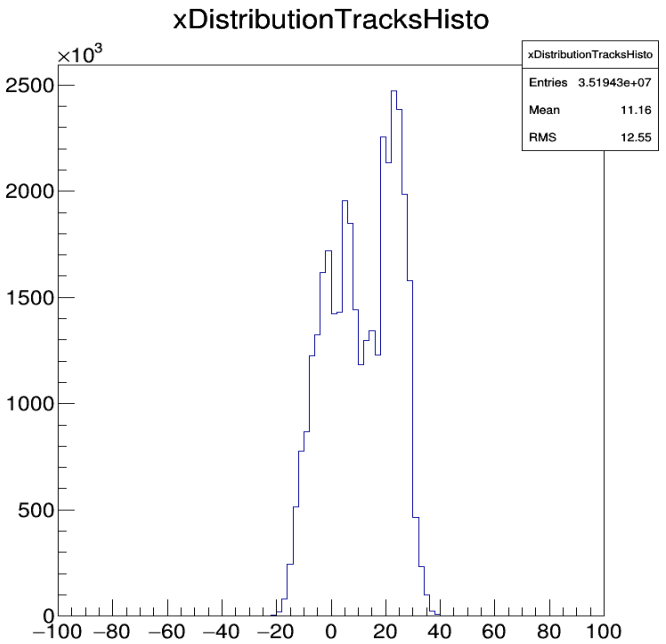
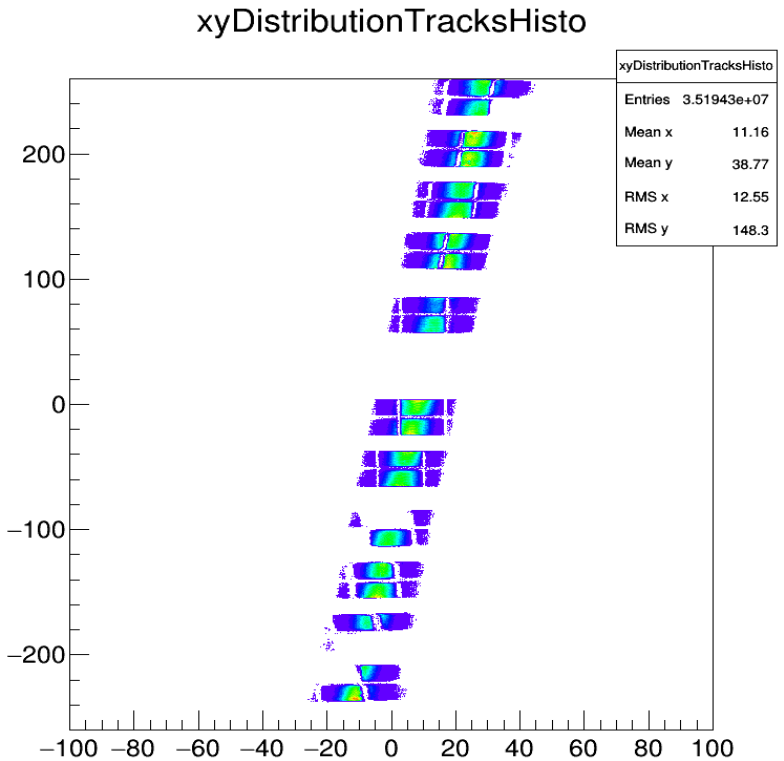
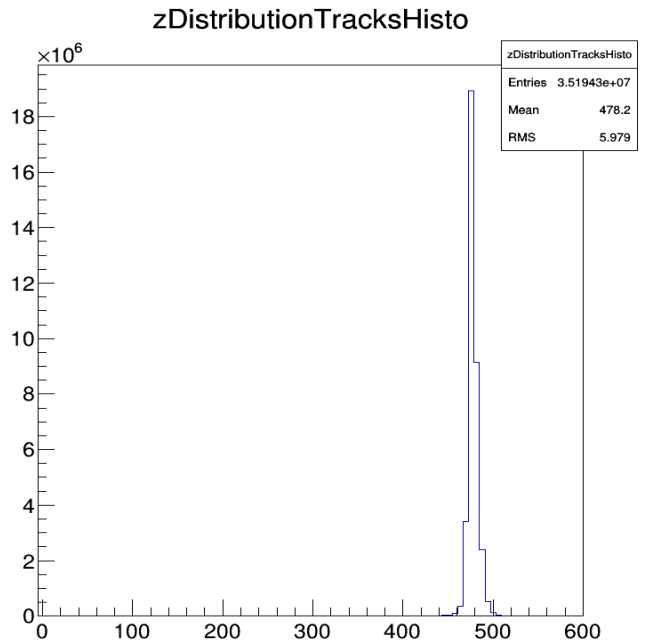
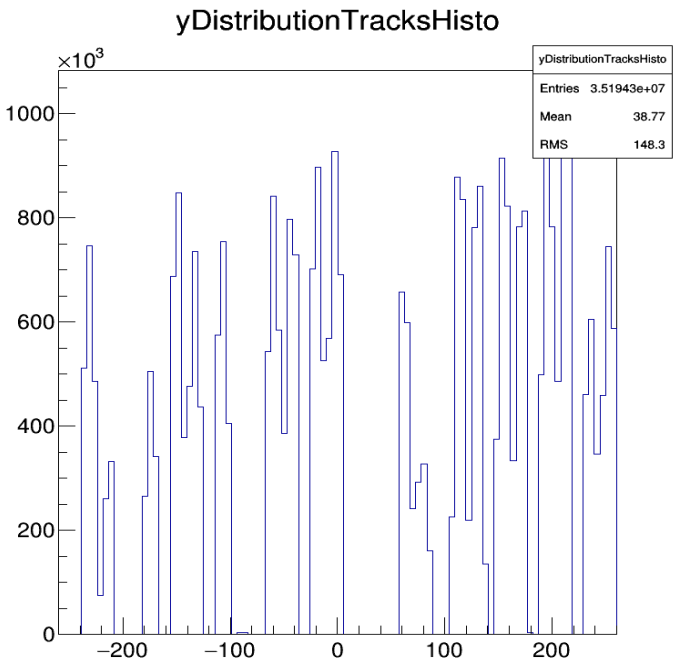




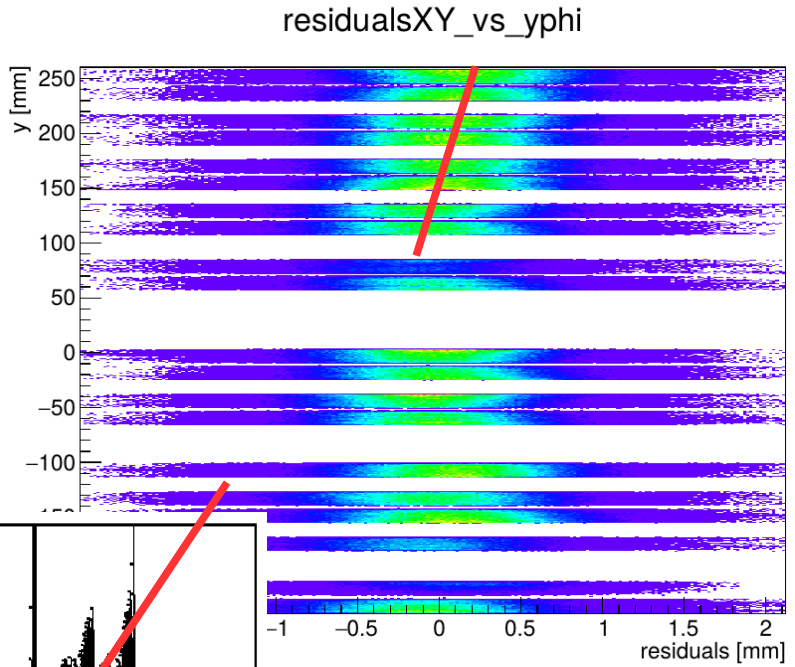


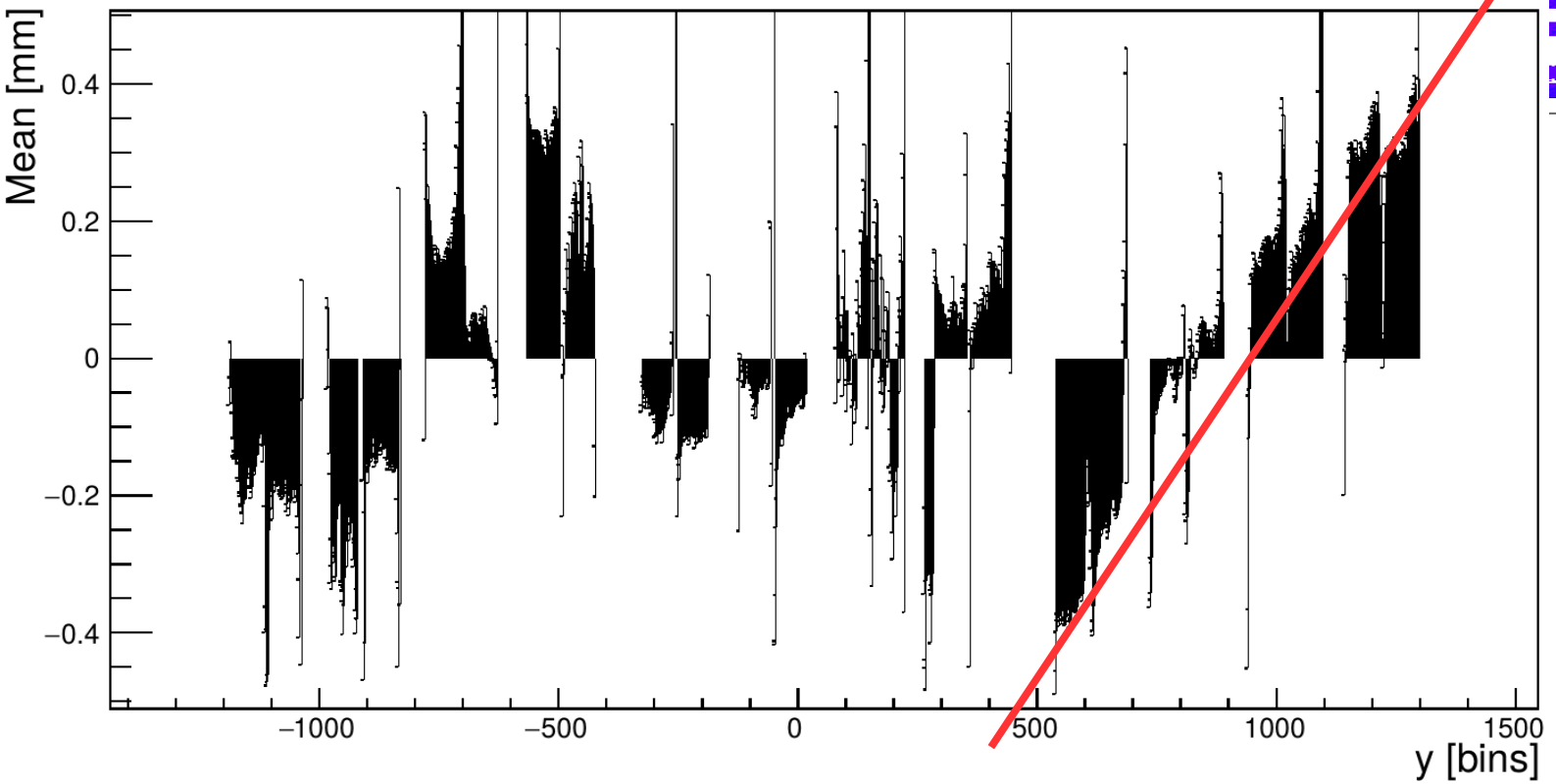


Alignment correction

Gear file from Alex:
→ Precise intra module
→ module to module: estimate from CAD

Look at mean residuals along track





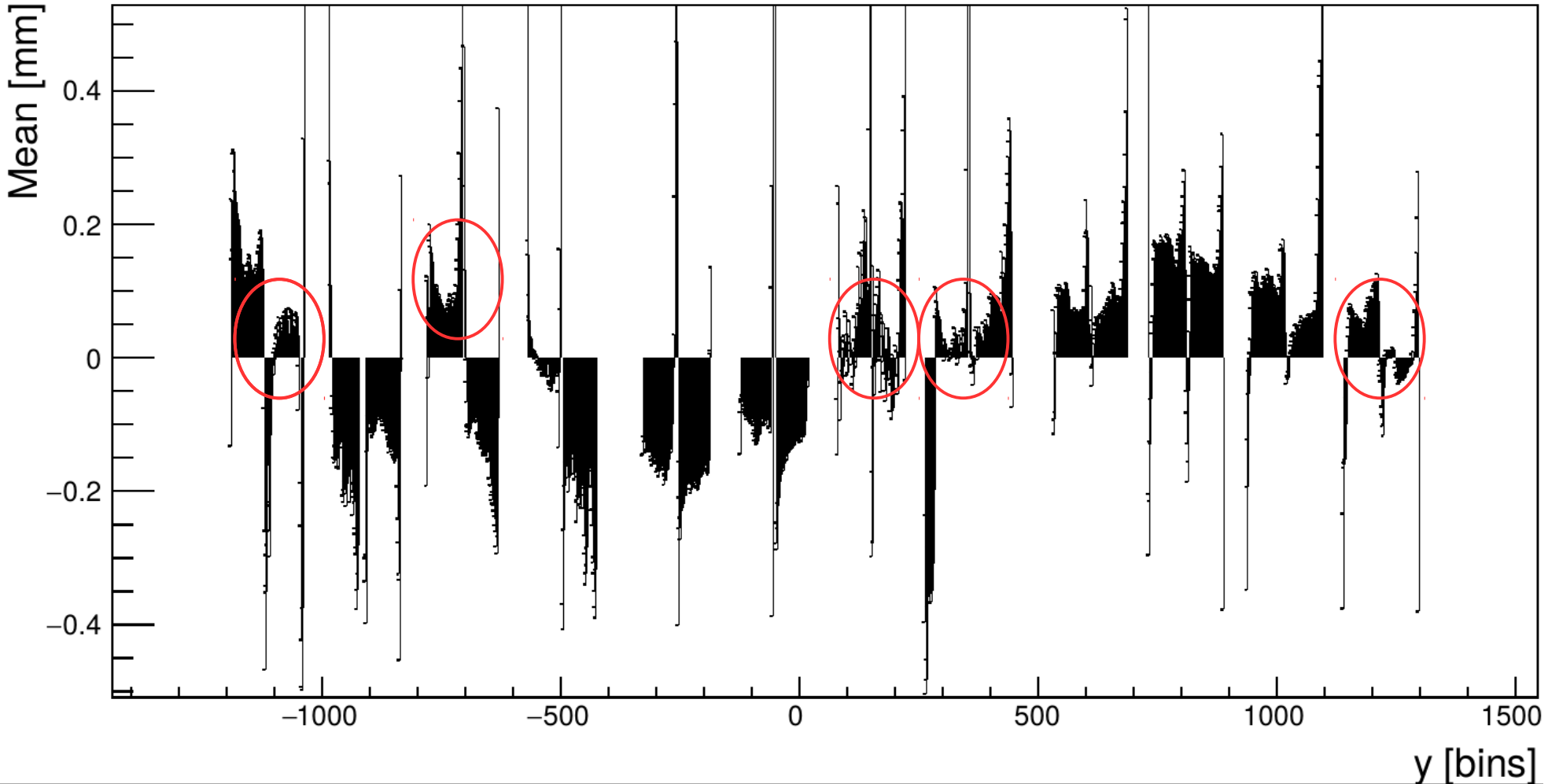
Systematic effect → shift/rotate modules

Best result: rotation of top and bottom module by 0.9°

Alignment correction

Gear file from Alex:
→ Precise intra module
→ module to module: estimate from CAD
→ estimated guess alignment

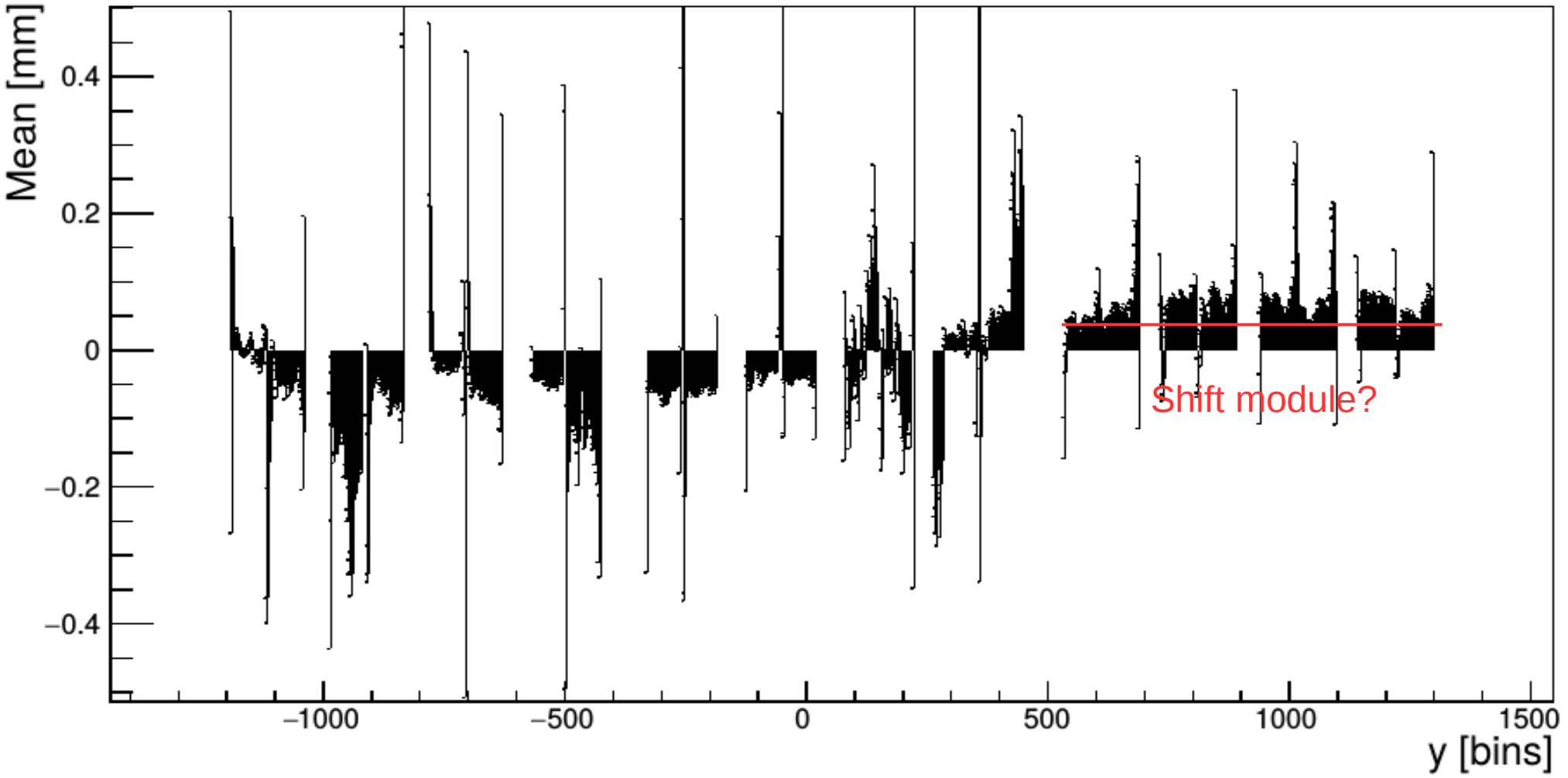
Look at mean residuals along track → **field distortions become visible**.
Problem: Beam not on same position on all chips → complete correction complicated (map ?)
Need??? Track will undergo many field distortions in all directions



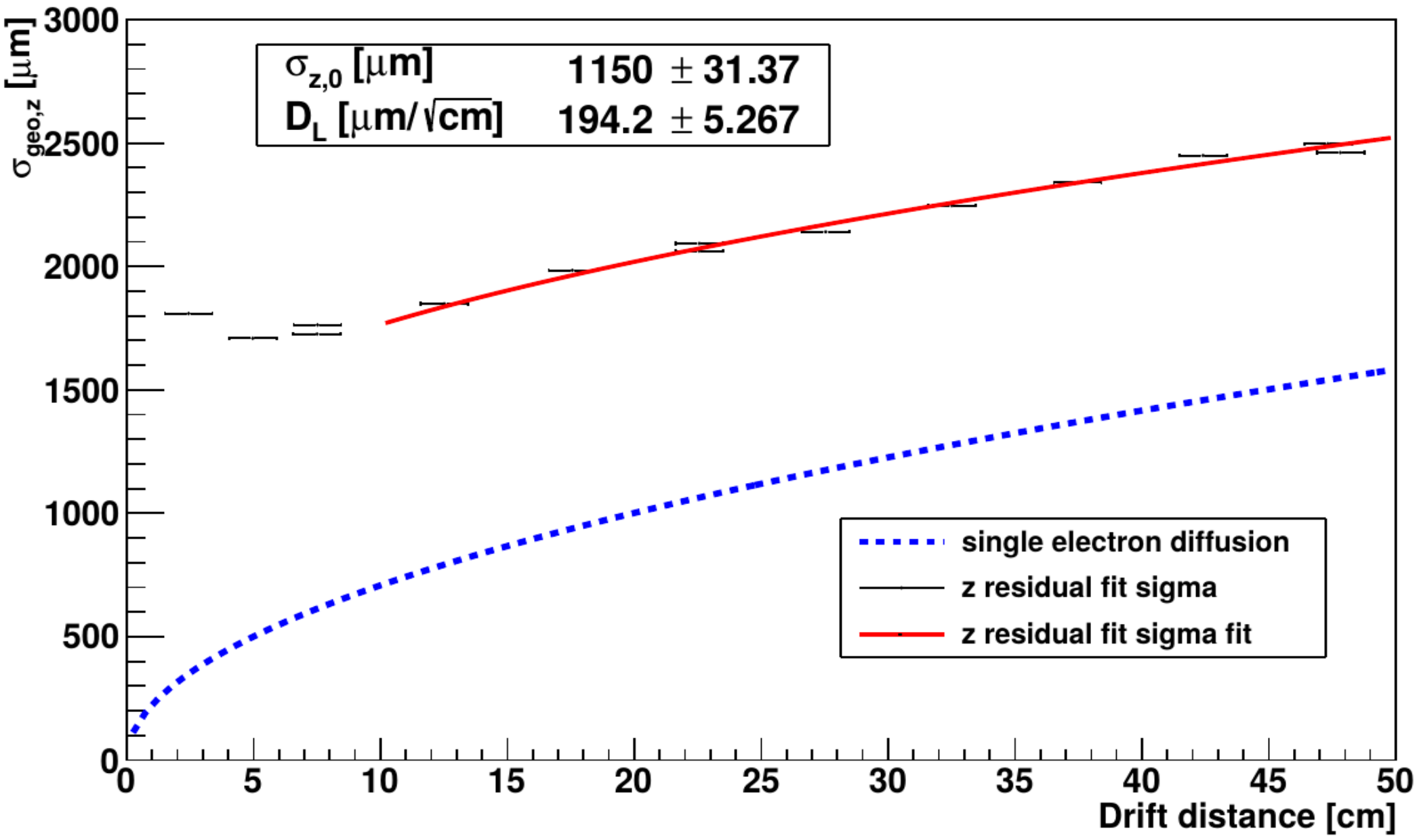
Field distortions correction

Gear file from Alex:
→ Precise intra module
→ module to module: estimate from CAD
→ estimated guess alignment

Use M. Rogowskis field distortions correction to shift means, see how good our detector would be.
(will not work 100% because beam on different positions on chips.)

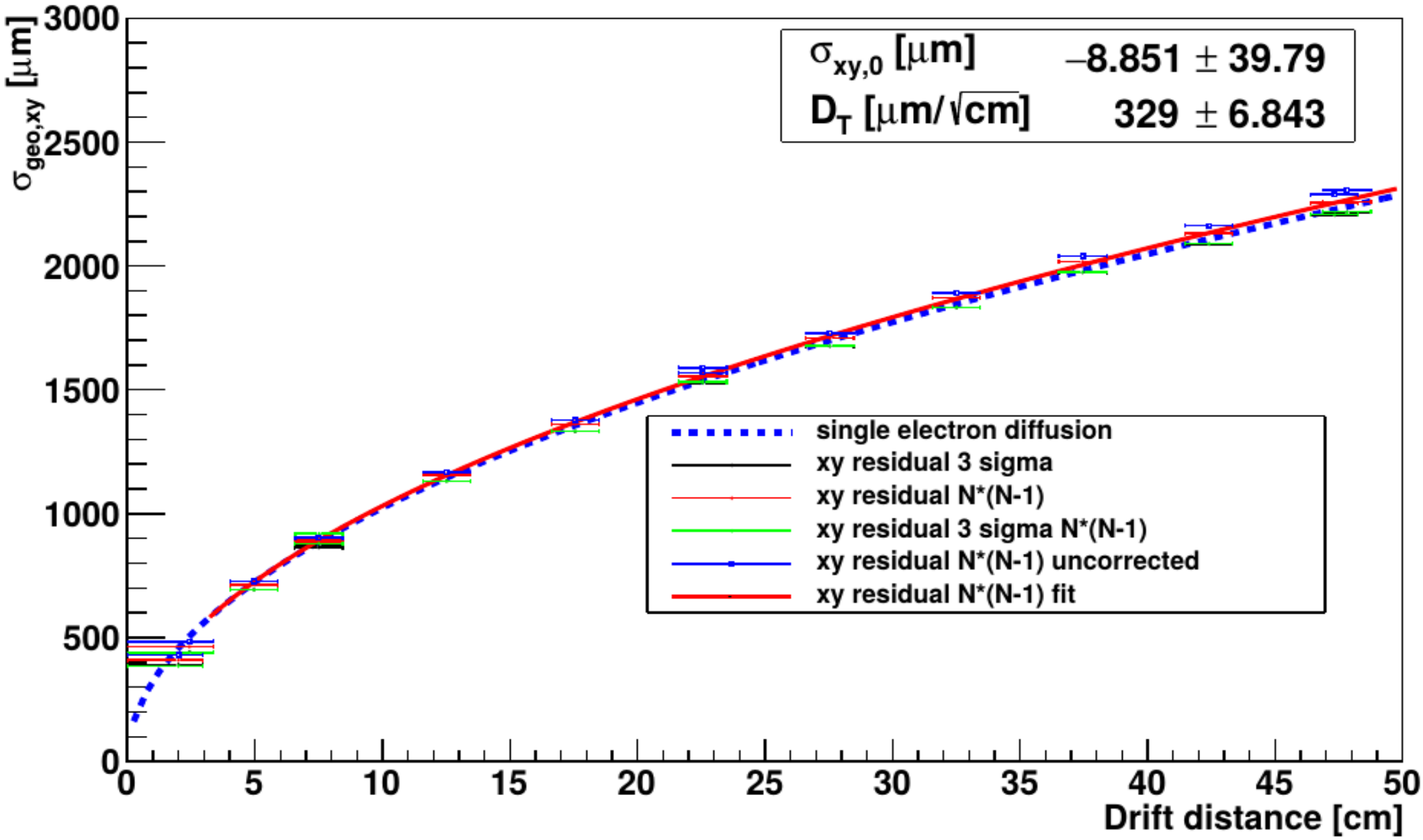


Z Resolutions



Magboltz simulation: D_L = 224+-9

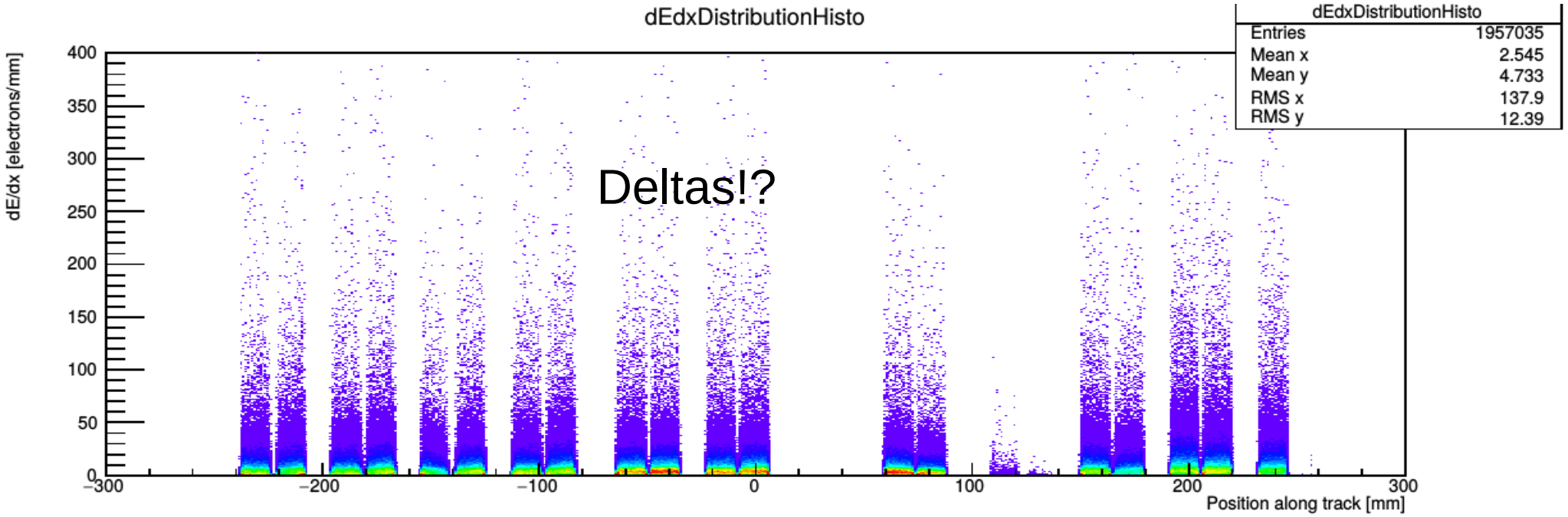
XY Resolutions



Magboltz simulation: D_T = 324+-12

dE/dx

New Processor:
Go along track, count number of electrons in interval
(e.g. 1 mm track length)
Plot n/Δx along track
So far: do not take care of chip edges.

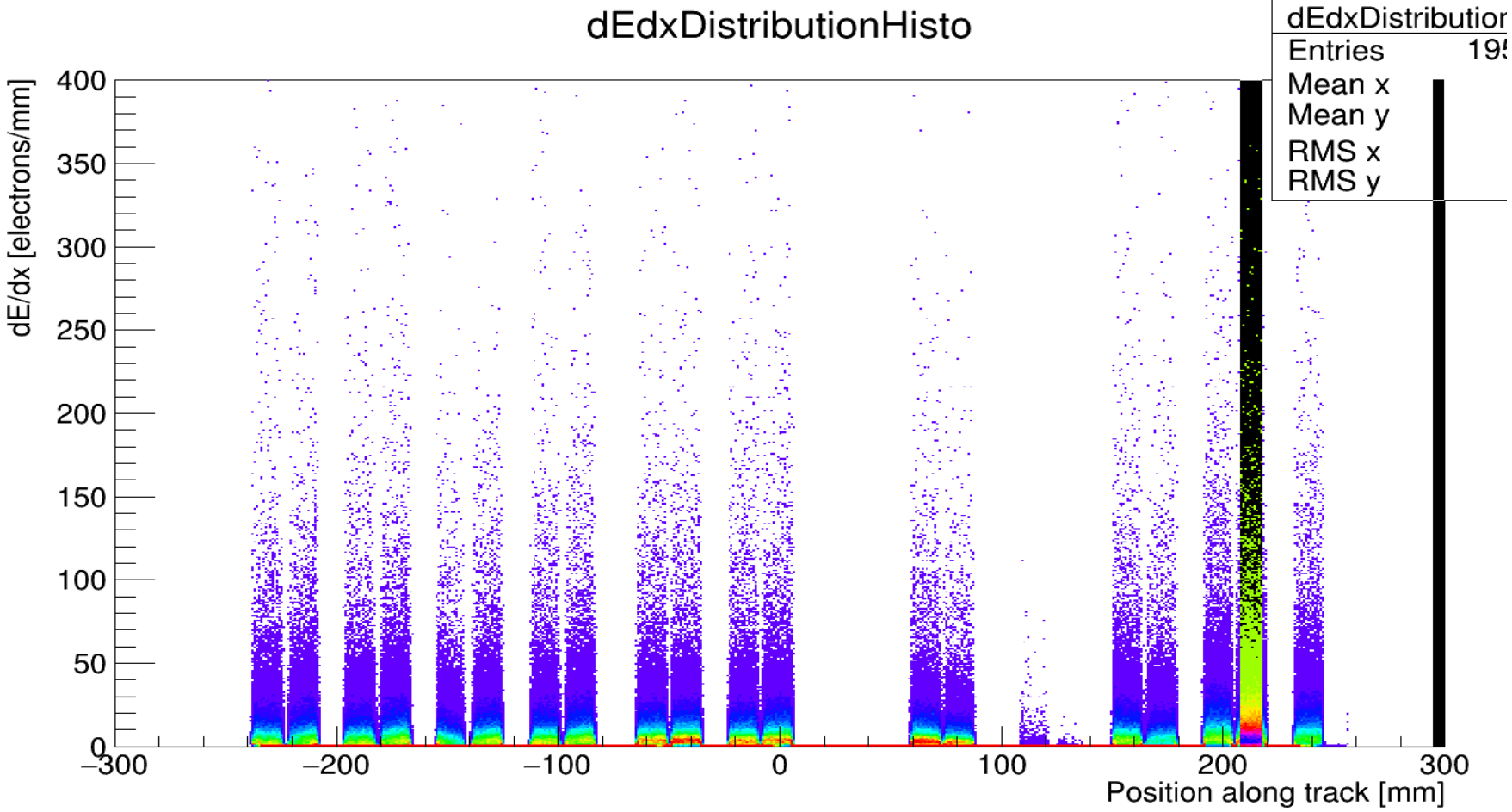


Chips become visible
Clearly many entries at dE/dx =0 even on chips

dE/dx

New Processor:
Go along track, count number of electrons in interval
(e.g. 1 mm track length)
Plot n/Δx along track
So far: do not take care of chip edges.

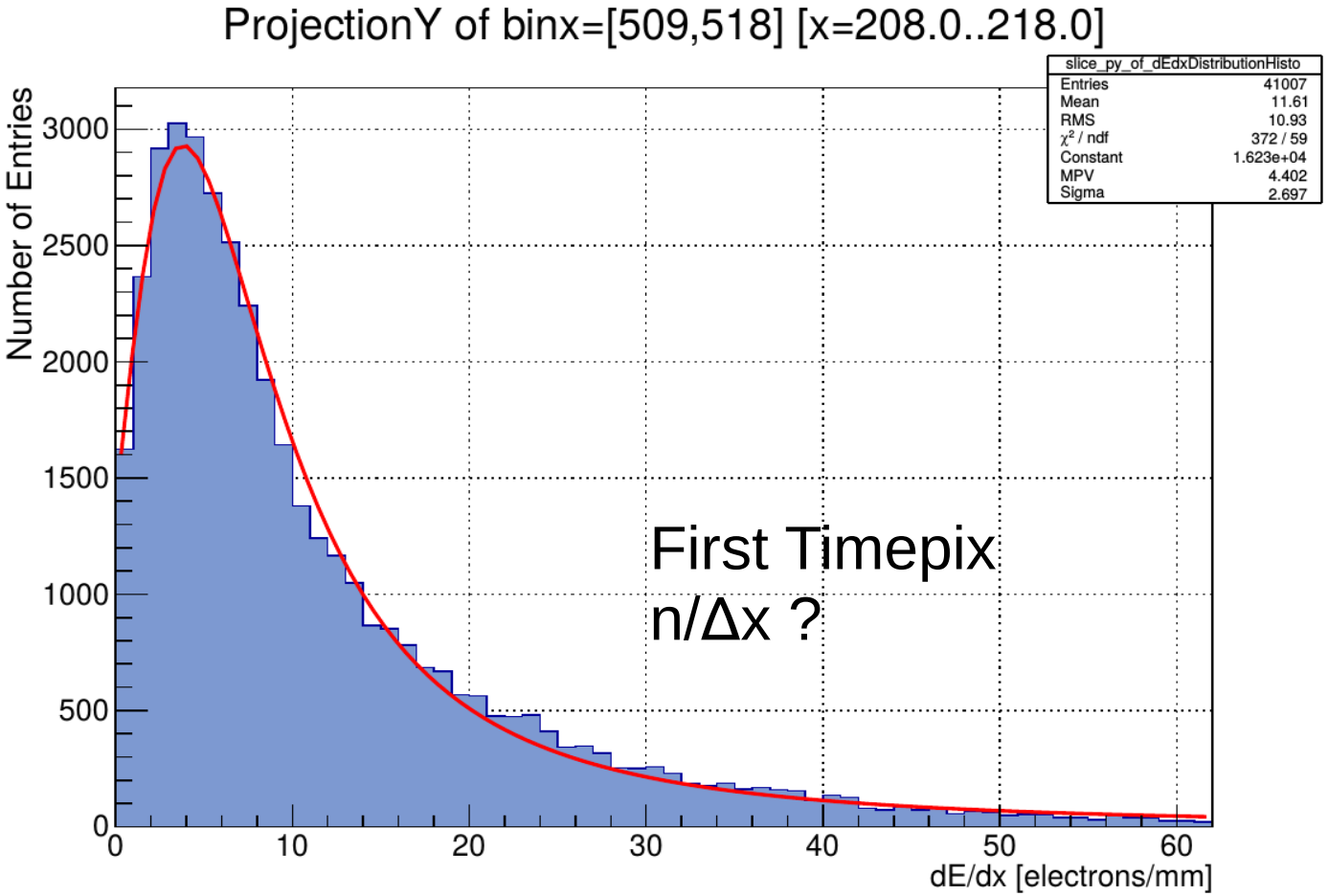
Look at a single chip: projection on dE/dx axis of chip center (10mm)



dE/dx

New Processor:
Go along track, count number of HitsOnTrack in interval
(e.g. 1 mm track length)
Plot n/Δx along track
So far: do not take care of chip edges.

Look at a single chip: projection on dE/dx axis of chip center (10mm)



Landau fitted

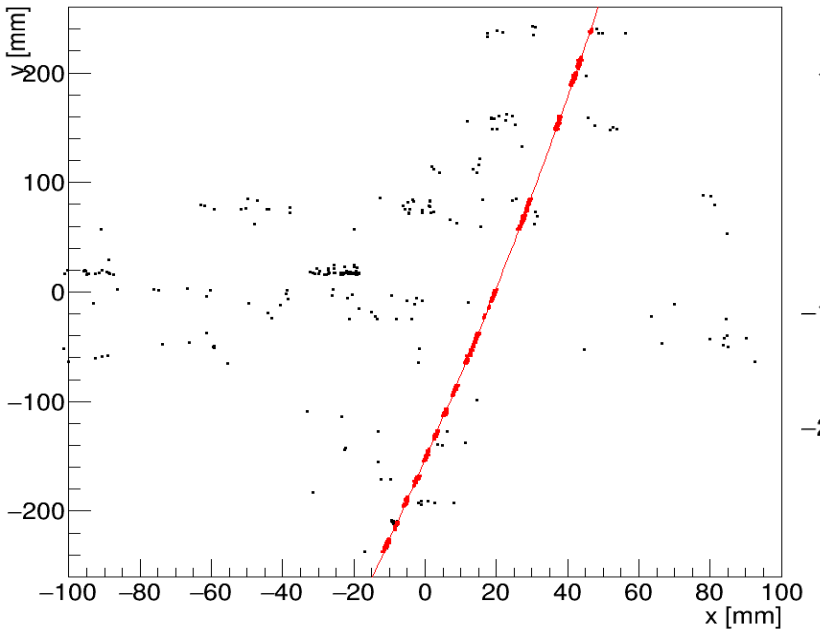
Ionisation density from literature:
Argon: 9,5 / mm
CF4: 10,0 / mm
Isobutane: 19,5 / mm

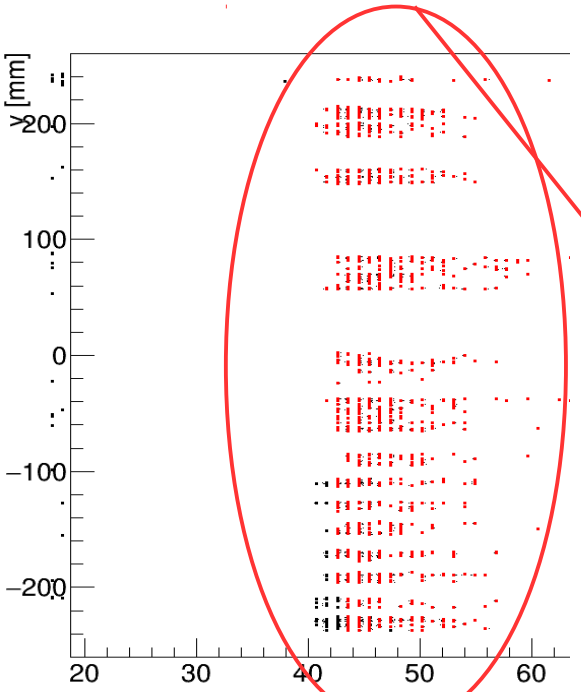
Mean n/dx here: 11.61
Full range to 400 e/mm: 13,46

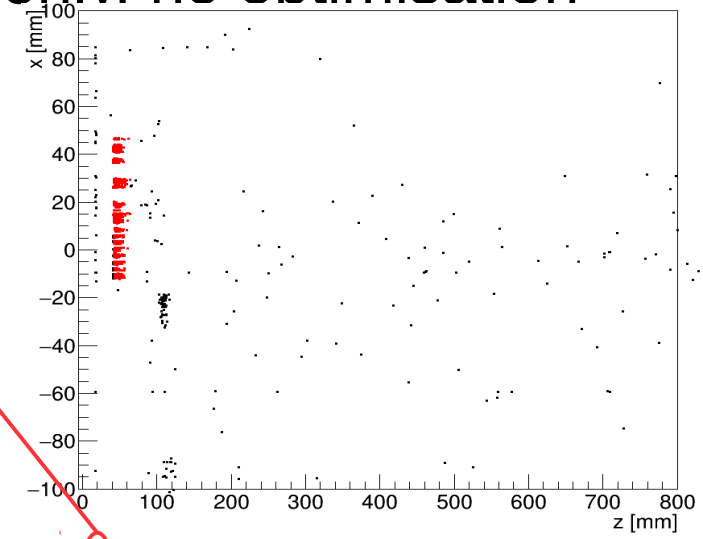
Curved Tracks in B-Field

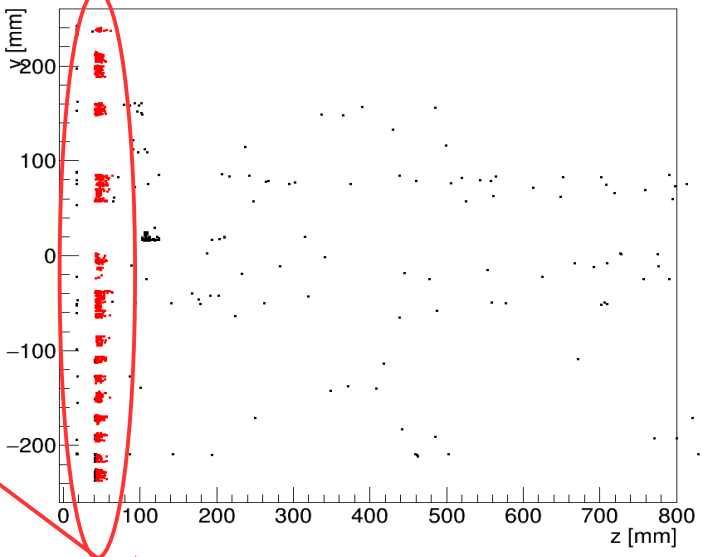
New track finding processor, as existing ones not good/unusable:
Circle finder (see last meetings)
→ best of curved track finder for pixelised readout (compared to RowbasedFHT, WindowedHT)
→ in preliminary state: find almost straight tracks only, no optimisation

Fitter: SimpleHelix, 3D ReasignHits



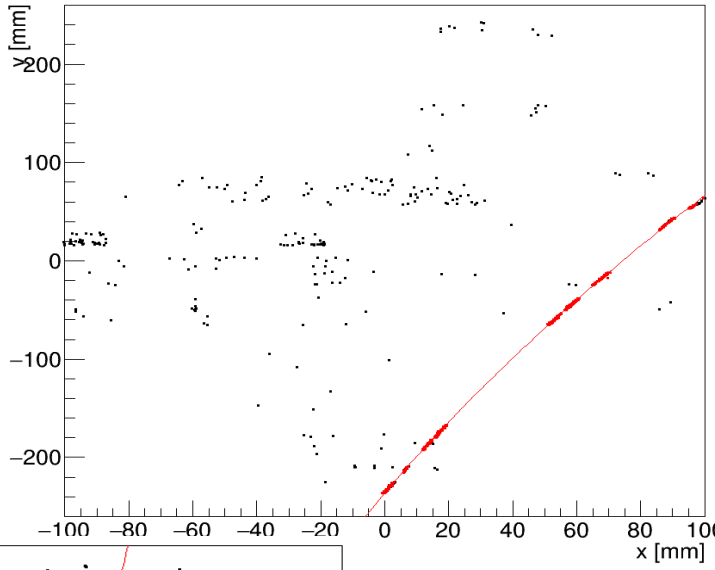




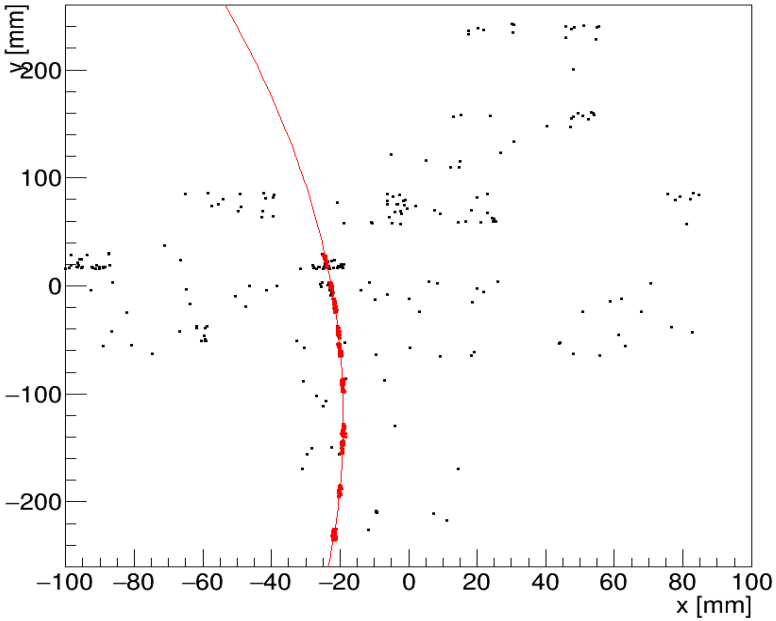


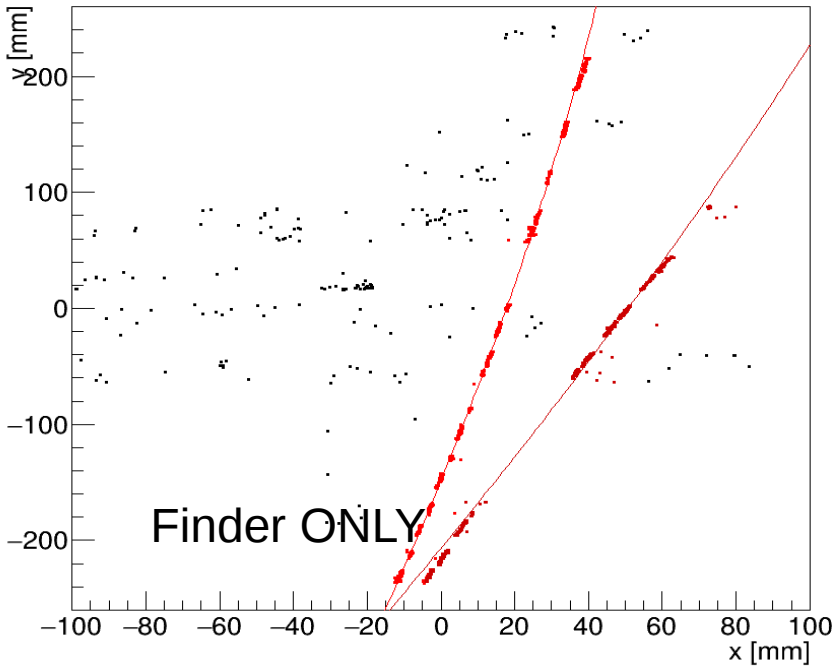
Curved Tracks in B-Field

New track finding processor, as existing ones not good/unusable:
Circle finder (see last meetings)
→ best of curved track finder for pixelised readout (compared to RowbasedFHT, WindowedHT)
→ double track and delta finding not exploited
→ in preliminary state
→ find almost straight tracks only
→ no optimisation



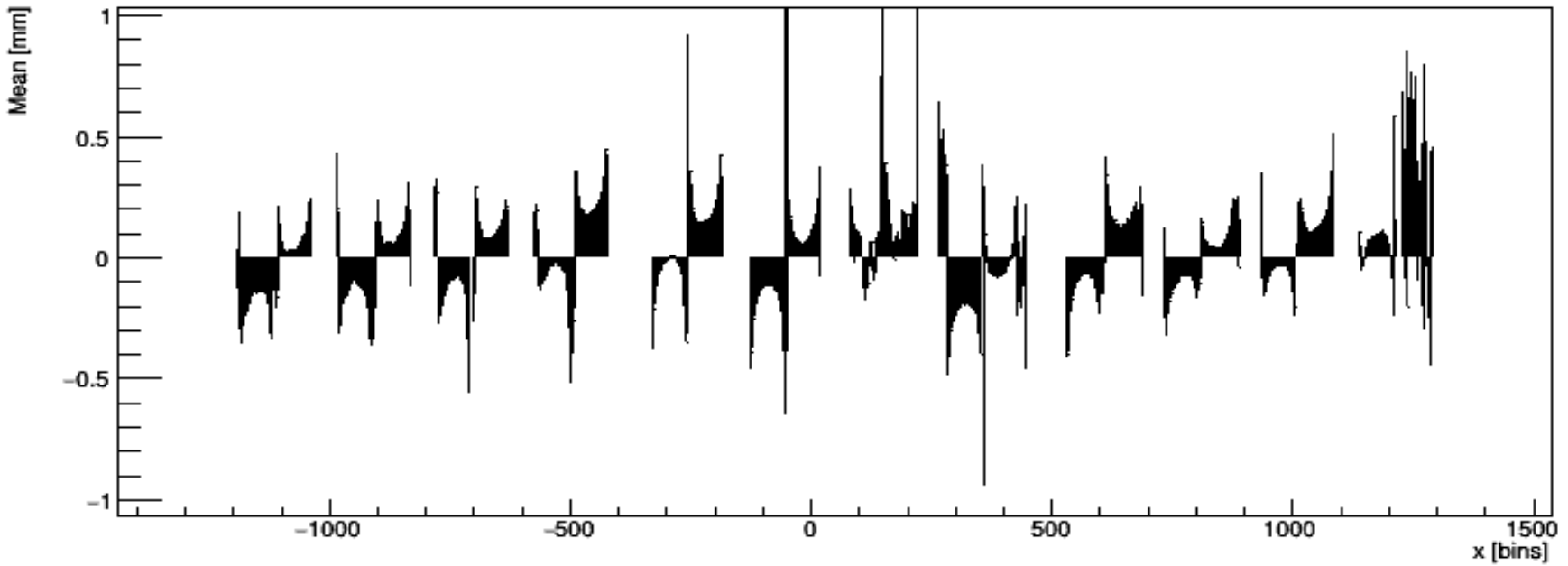
Fitter: SimpleHelix, 3D ReassignHits



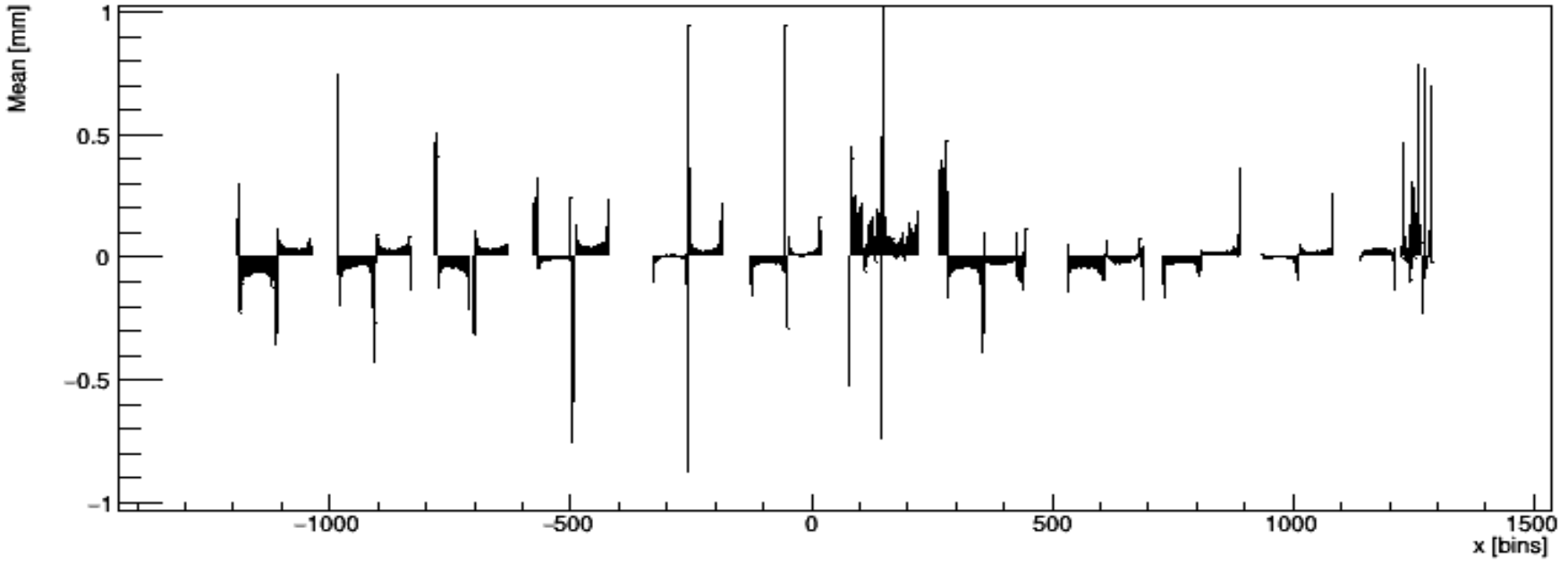


Field distortions

Nice ExB effects

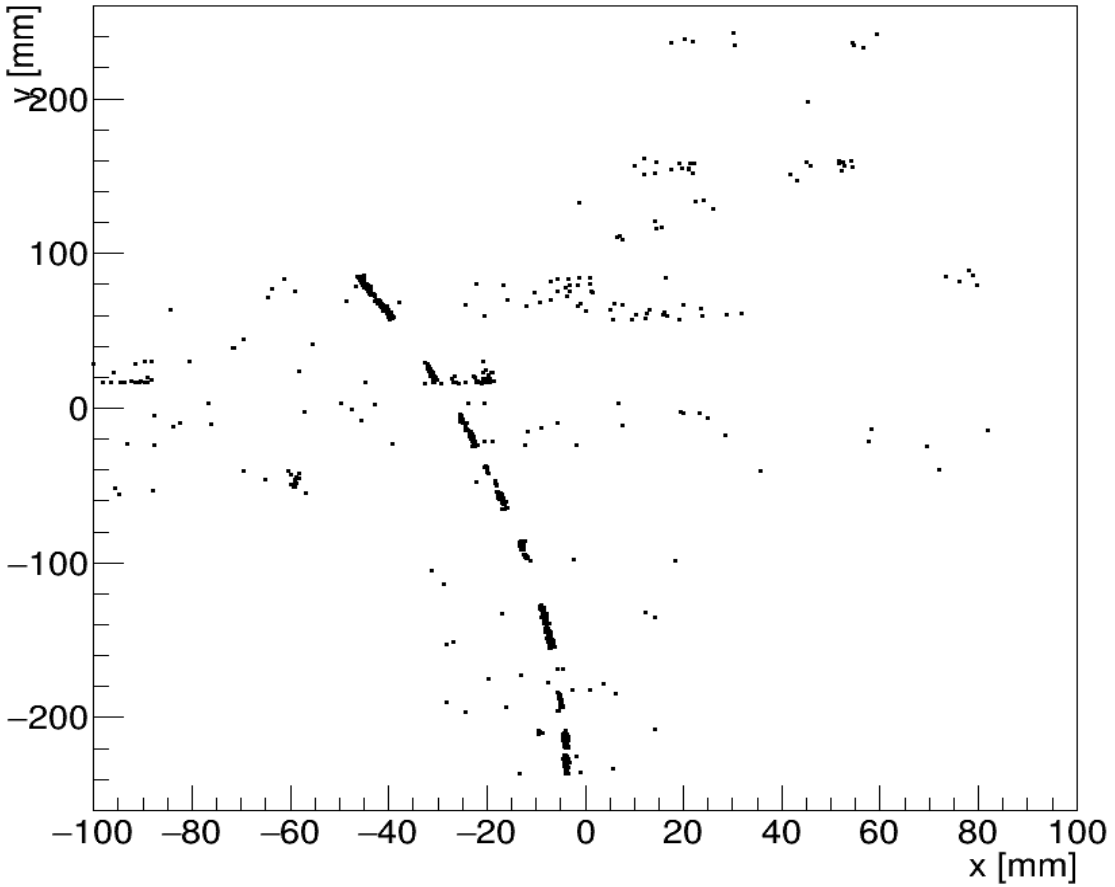


After correction

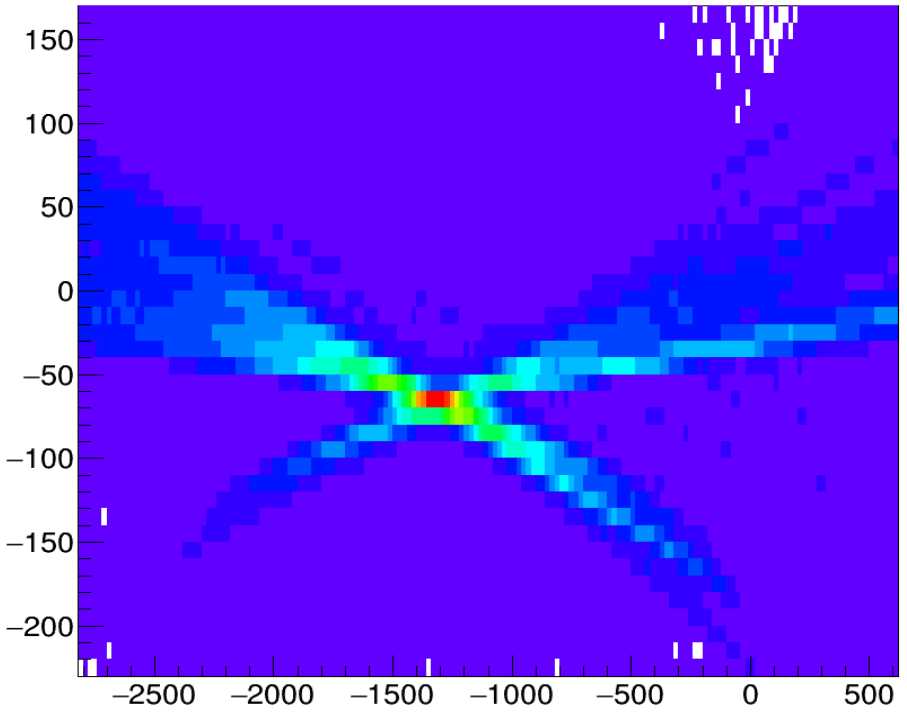


Curved Tracks in B-Field

Curved Track Reco Problems:
Finder
- too much curved (R<2m) track finding not jet implemented

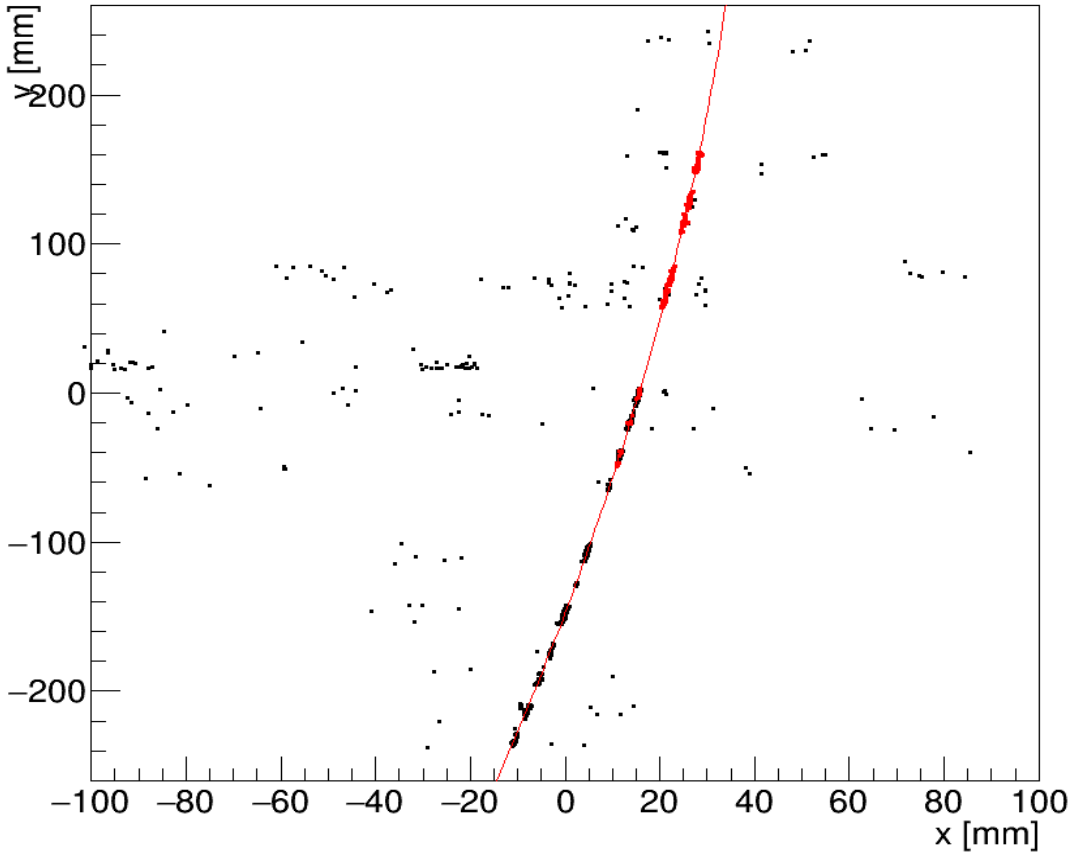


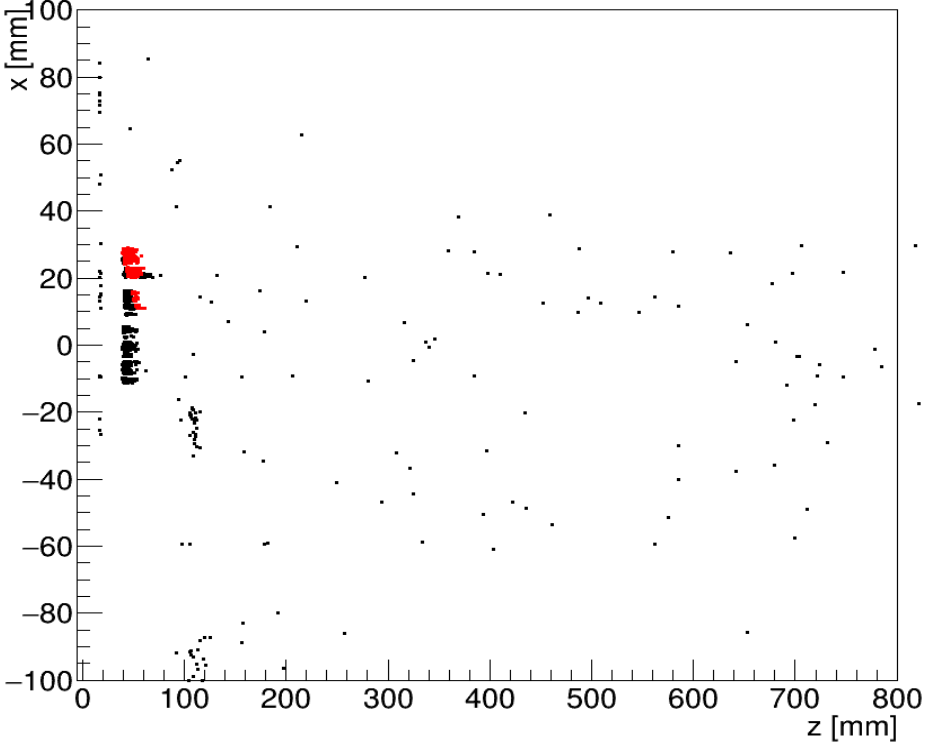
Clear maximum in parameter space
→ can be found, but scan space takes time

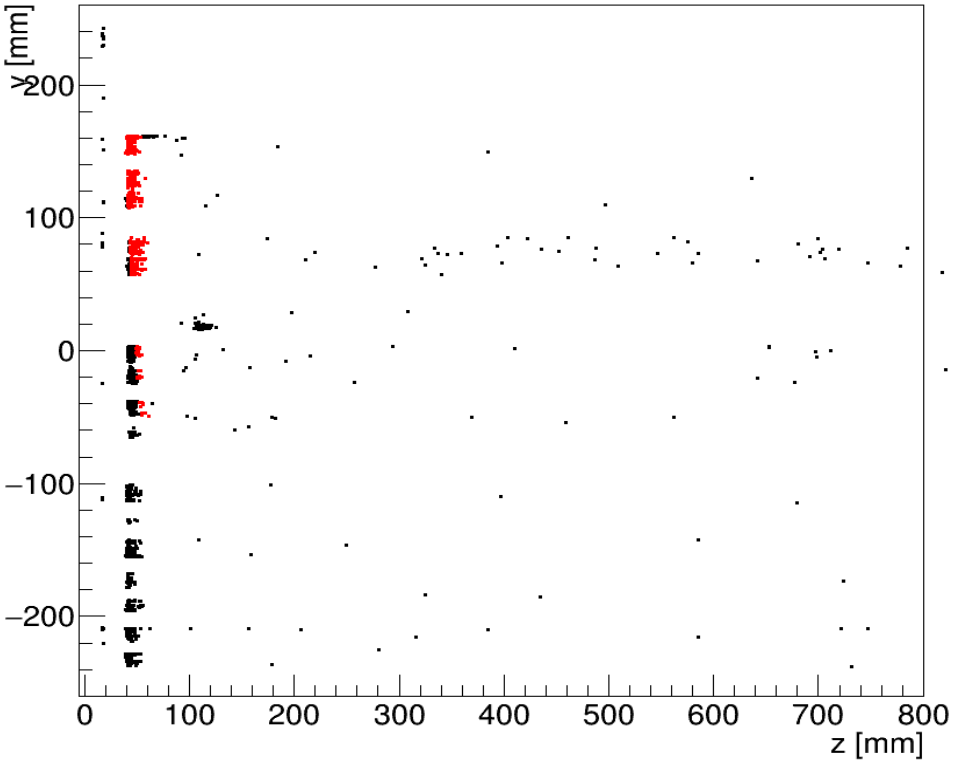


Curved Tracks in B-Field

Curved Track Reco Problems: Fitter

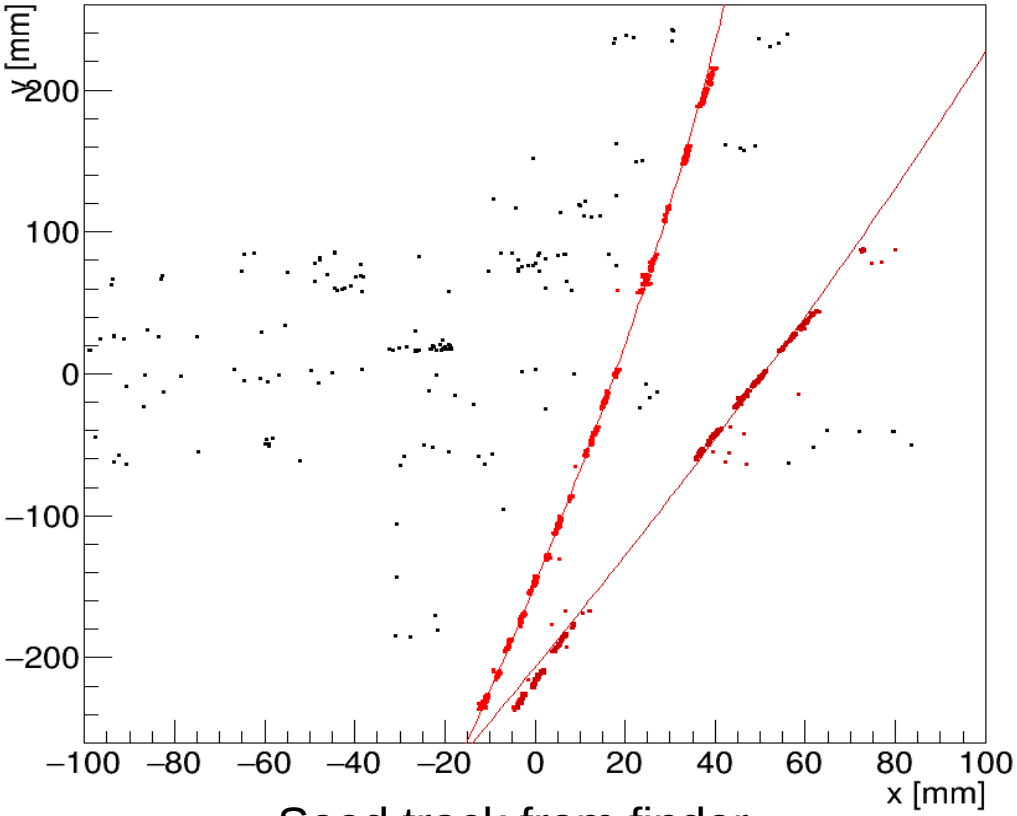




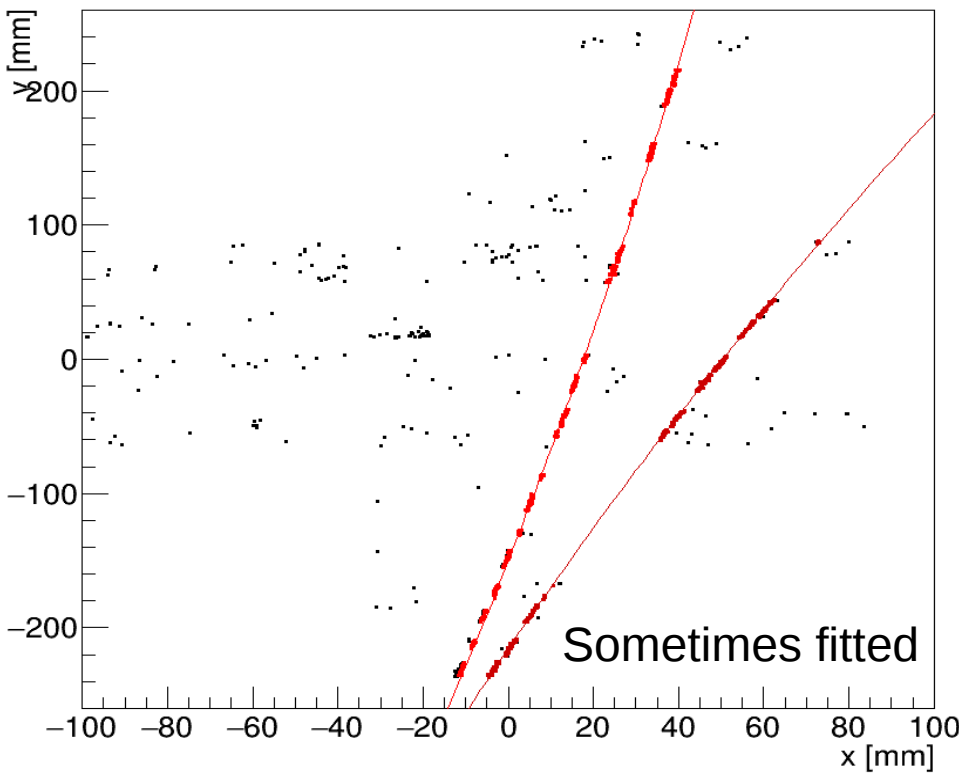


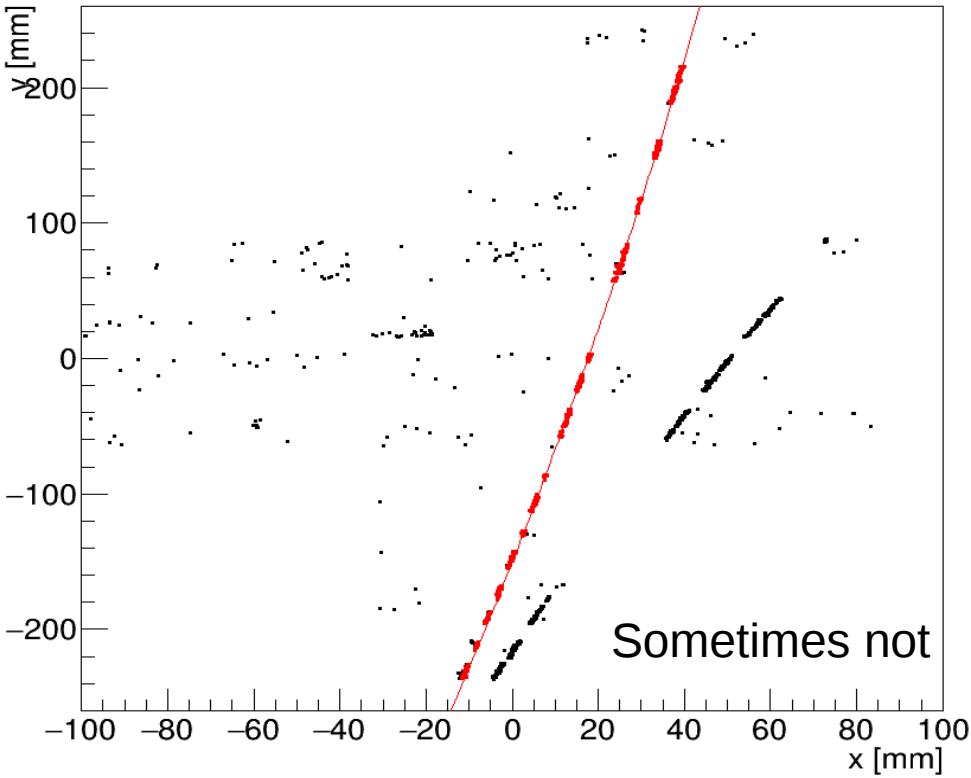
Curved Tracks in B-Field

Curved Track Reco Problems: Fitter



Seed track from finder





Curved Tracks in B-Field

Ongoing:
Reco and analysis of z-scan at 80 MHz

→ Z resolution might be interesting
→ XY resolution as good? Possibly not: ExB effects

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