MDT Performance in 7 TeV Data

Look at hardware, software, and calibrations of MDT's in collision data.

Today, will concentrate on residuals and resolutions.

Data Sets

Have looked at two data sets:

1. Original processing of an early run (155112).
Includes t_0 fitting and larger resolution.

2. Reprocessing by Muon Combined Performance group of large data set, selected for Z's.
No t_0 fit, smaller resolution.

Muon Selection

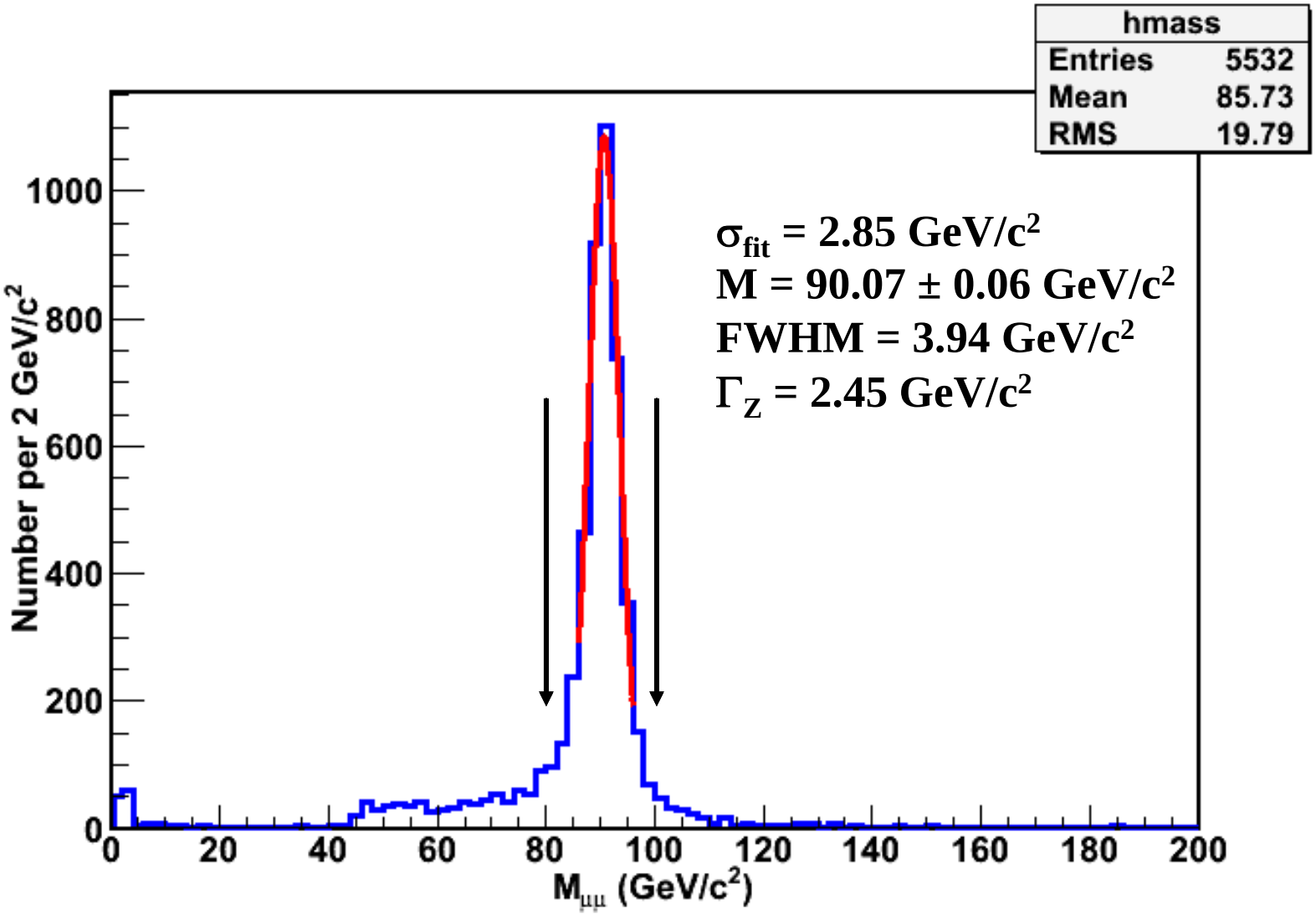
1. Muid combined (author 12). [I have also looked at Staco muons for a subset of the reprocessed data and the results are similar.]

2. ID track requirements:

- **A. P > 5 GeV/c**
- **B. $N_{pixel} > 1$**
- **C. $N_{SCT} > 5$**

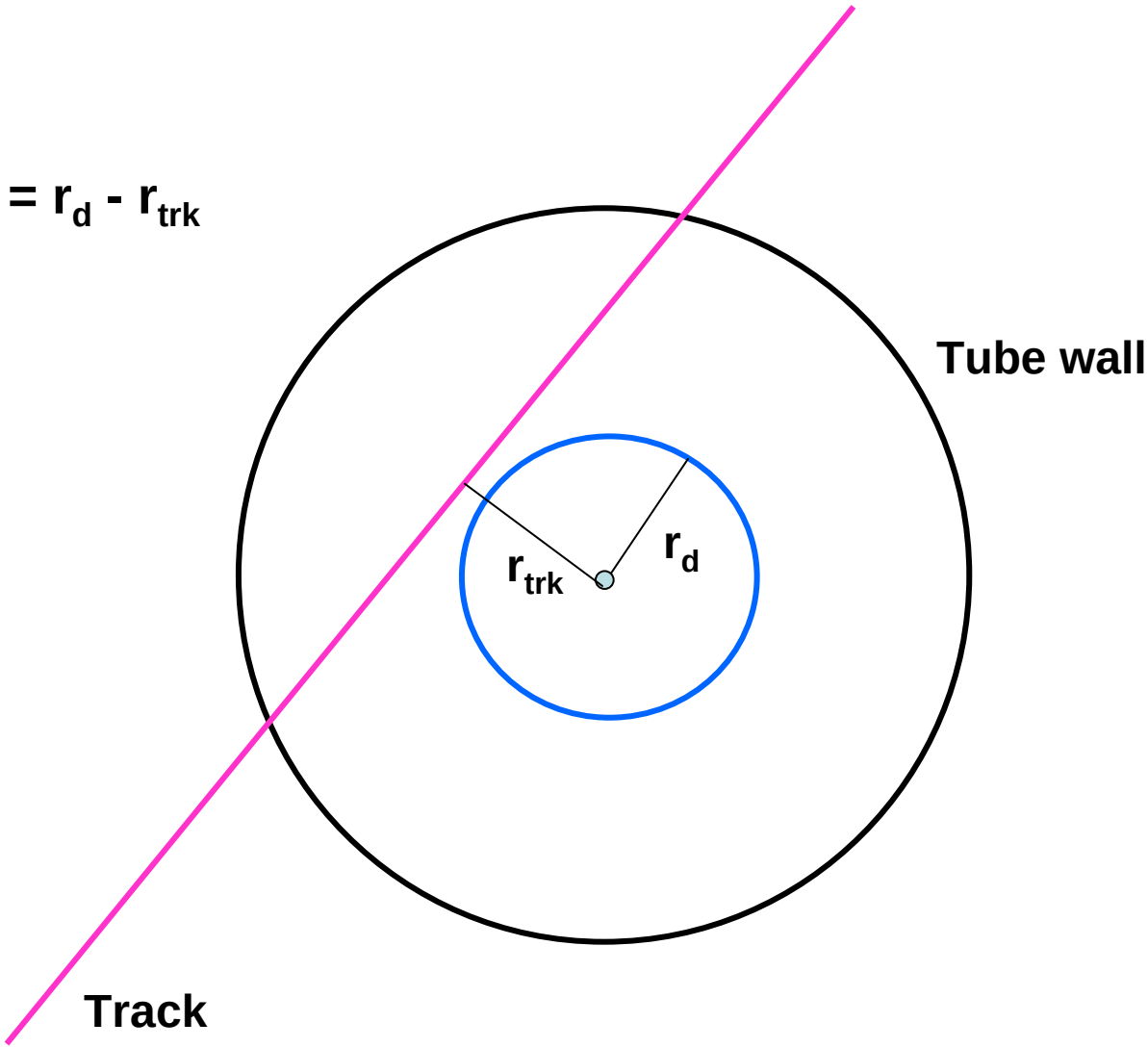
3. Only look at segments where all hits are in the same chamber.

4. For reprocessed data, require two muons who invariant mass is consistent with a Z.

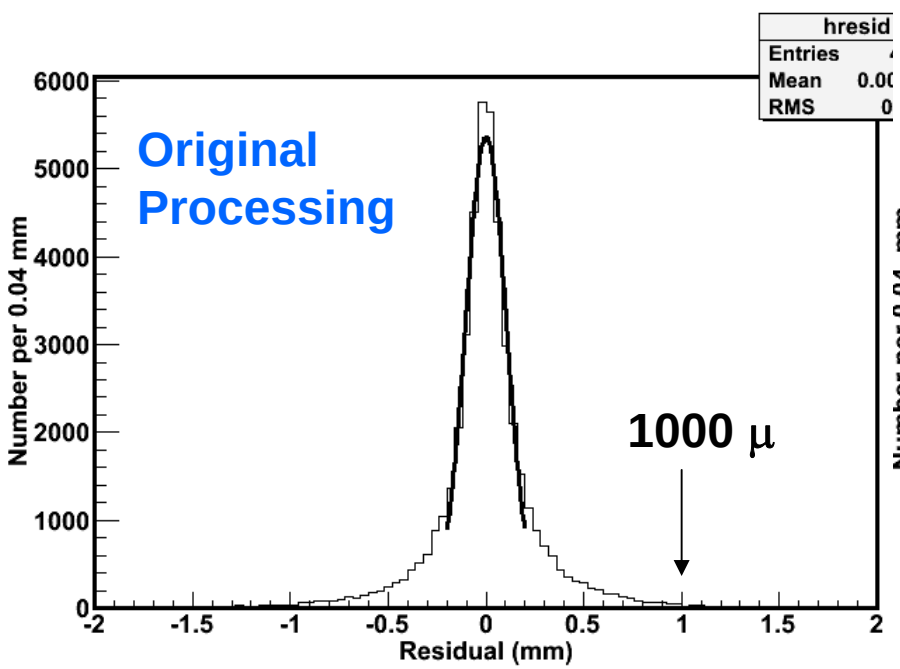

hmass
Entries 5532
Mean 85.73
RMS 19.79
σ_{fit} = 2.85 GeV/c^2
M = 90.07 ± 0.06 GeV/c^2
FWHM = 3.94 GeV/c^2
Γ_Z = 2.45 GeV/c^2
Number per 2 GeV/c^2
$M_{\mu\mu}$ (GeV/c^2)
0
200
400
600
800
1000
0
20
40
60
80
100
120
140
160
180
200

Residuals

residual = $r_d - r_{trk}$

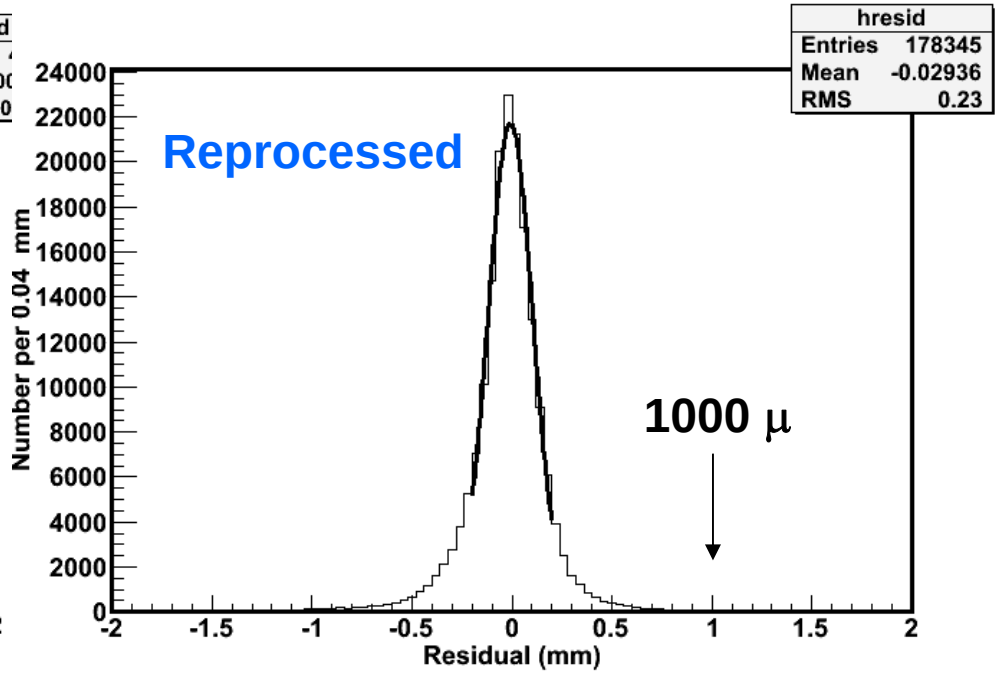


Residuals



Residual (mm)

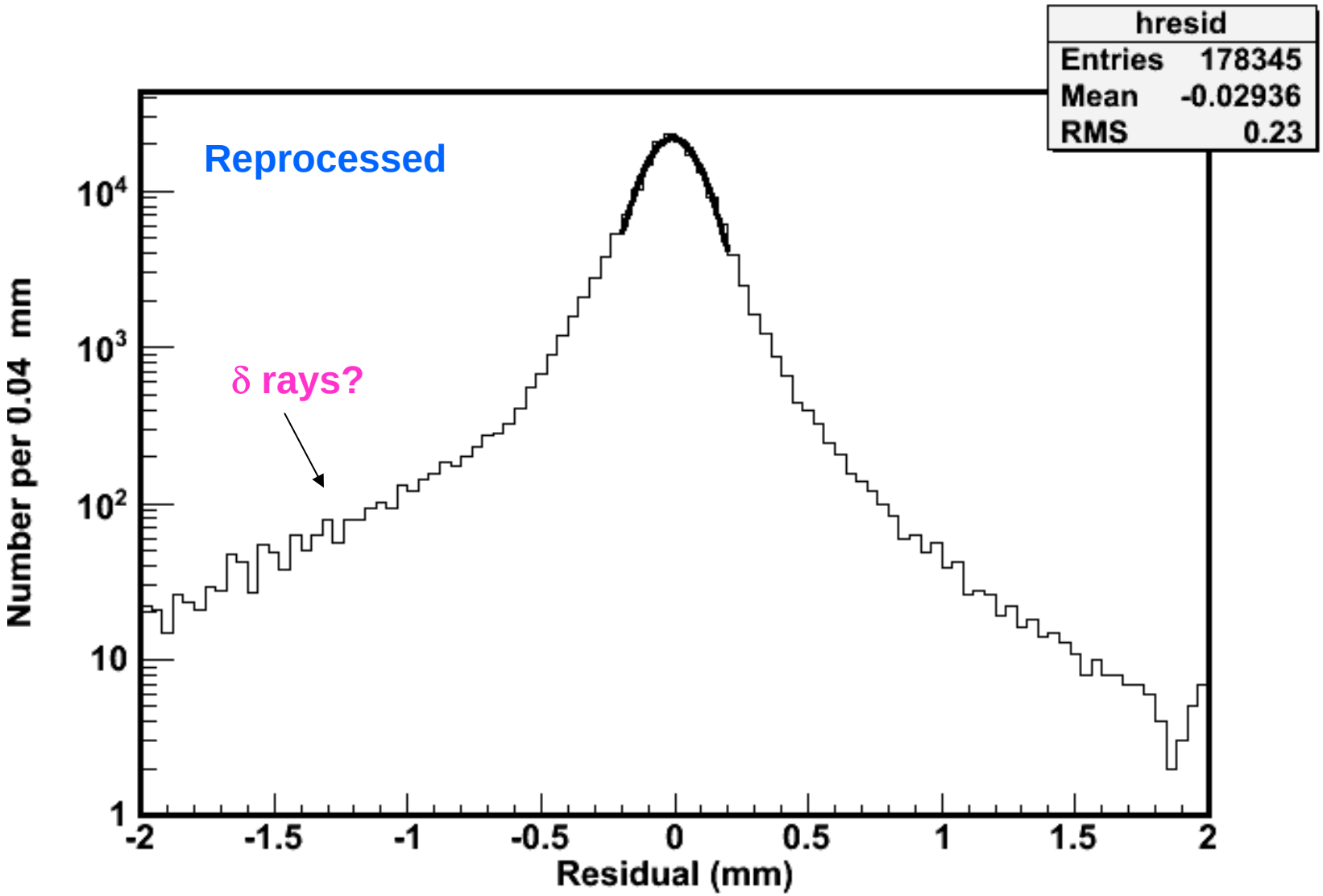
fit mean = 0.25 ± 0.67 μ
fit σ = 104.5 ± 0.7 μ
rms = 302 μ



Residual (mm)

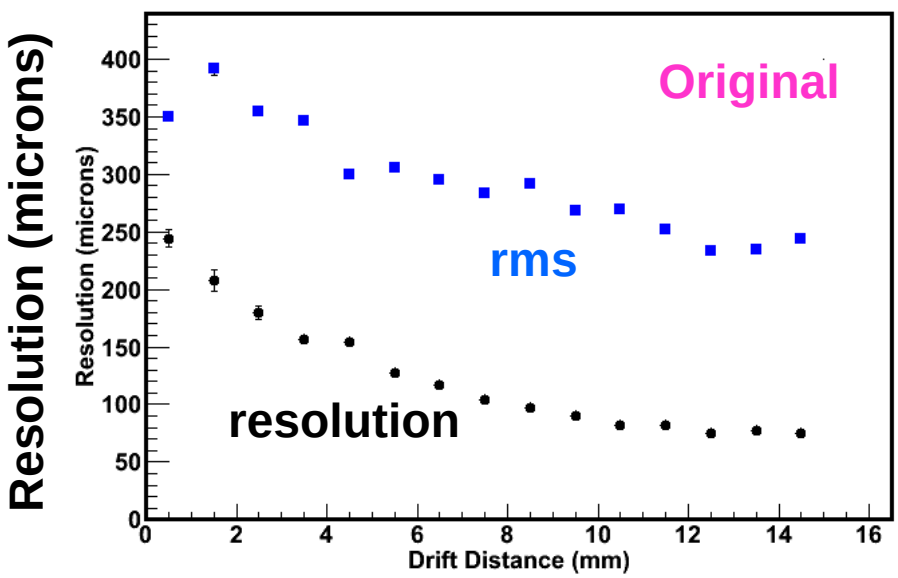
fit mean = -7.51 ± 0.36 μ
fit σ = 112.3 ± 0.4 μ
rms = 230 μ

Residuals

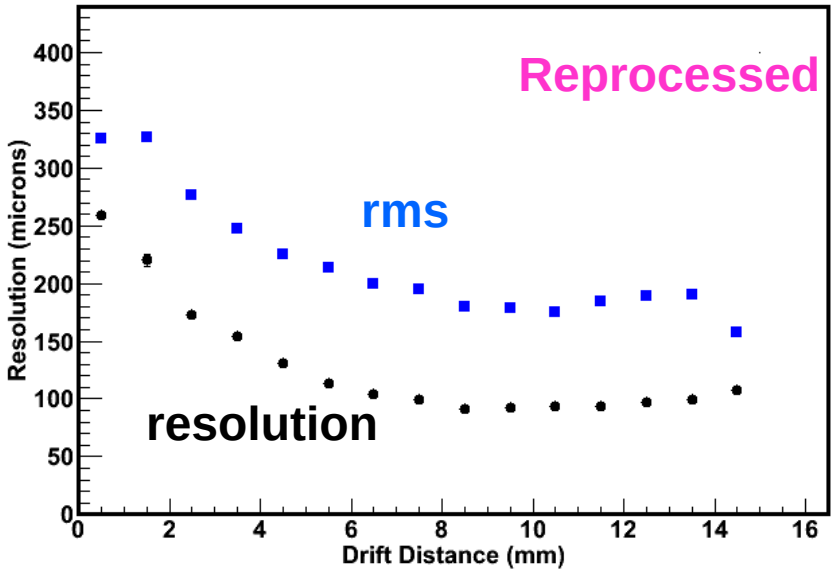

hresid
Entries 178345
Mean -0.02936
RMS 0.23
Reprocessed
δ rays?
Number per 0.04 mm
10⁴
10³
10²
10
1
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
Residual (mm)

Resolution vs r

Histogram residuals in bins of drift distance. Fit narrow core to Gaussian. Plot resolution (width of Gaussian) vs drift distance.



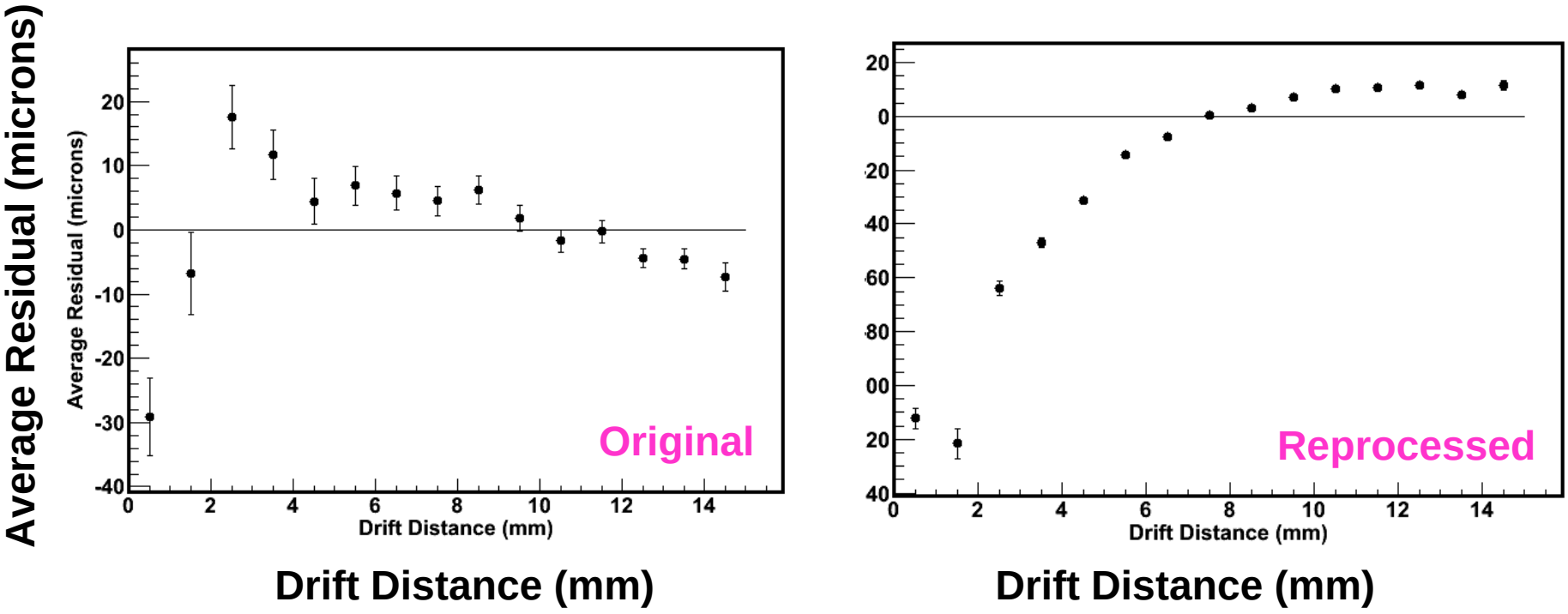
Drift Distance (mm)



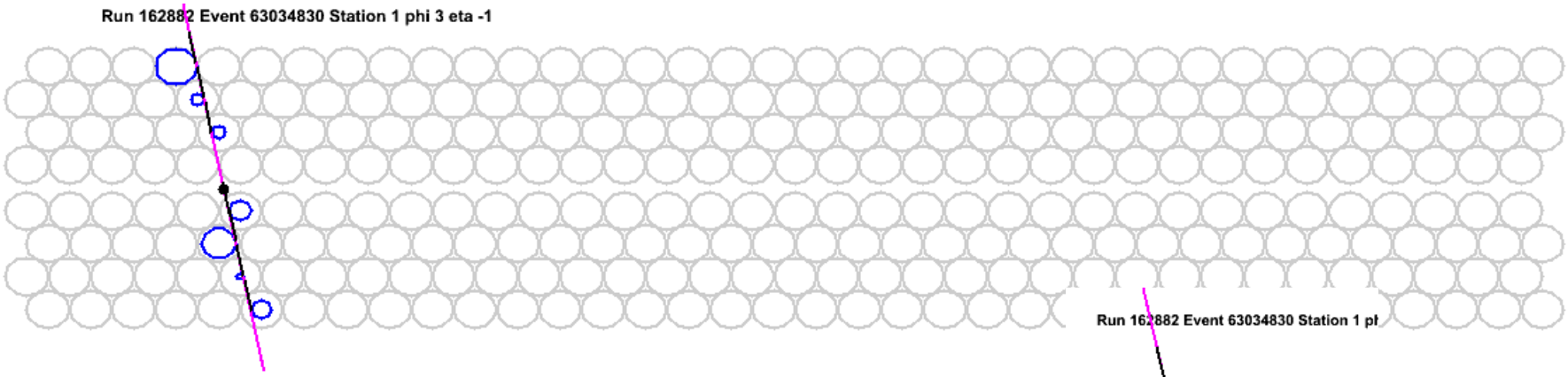
Drift Distance (mm)

Average Residual vs r

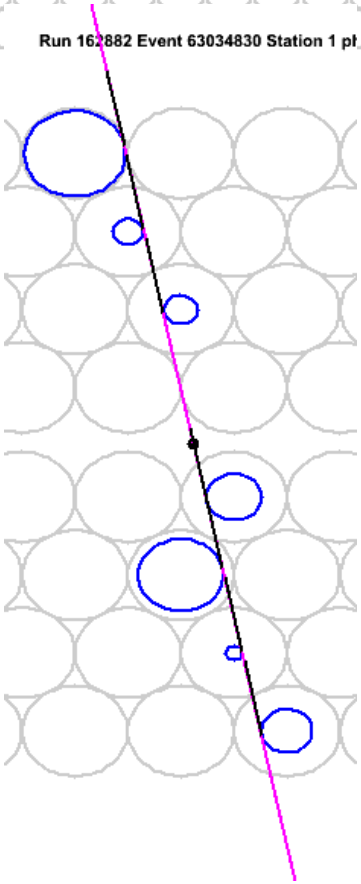
Histogram residuals in bins of drift distance. Fit narrow core to Gaussian. Plot mean of Gaussian vs drift distance.



Good Segment



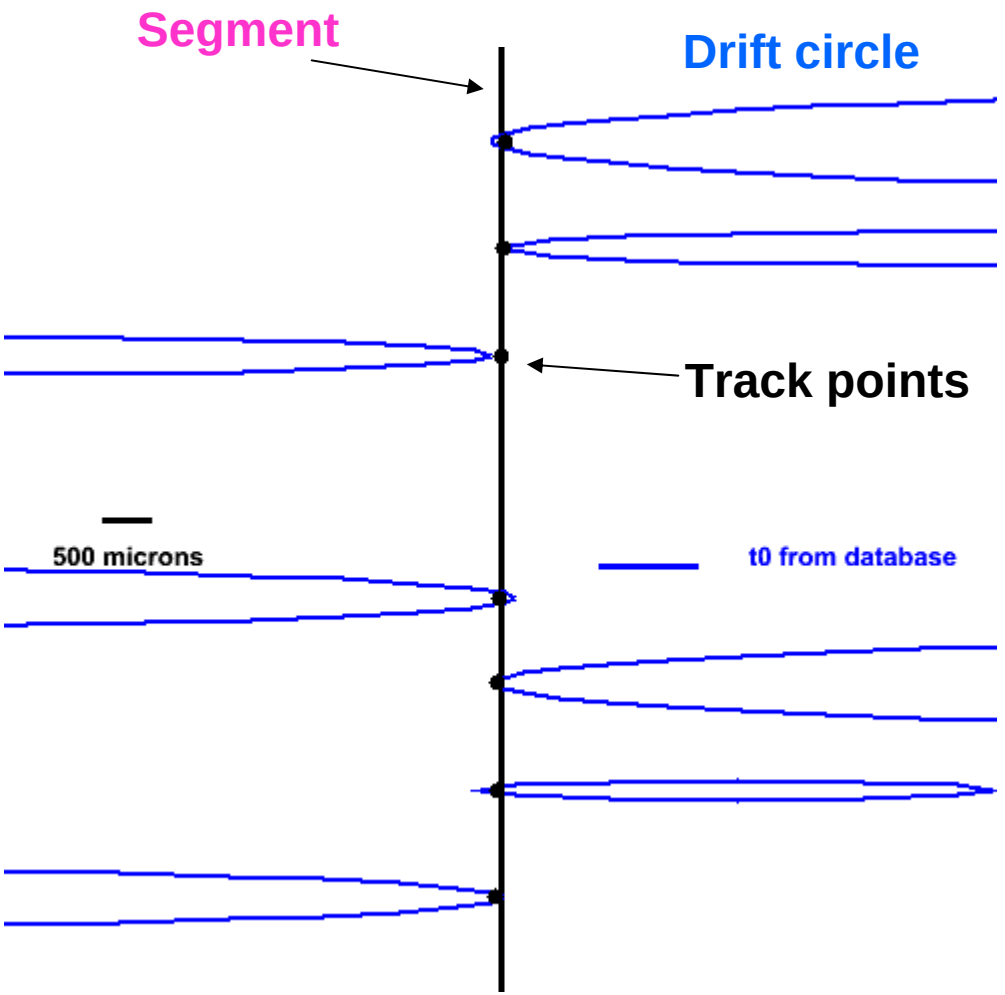
Chamber View



Zoomed View

Good Segment

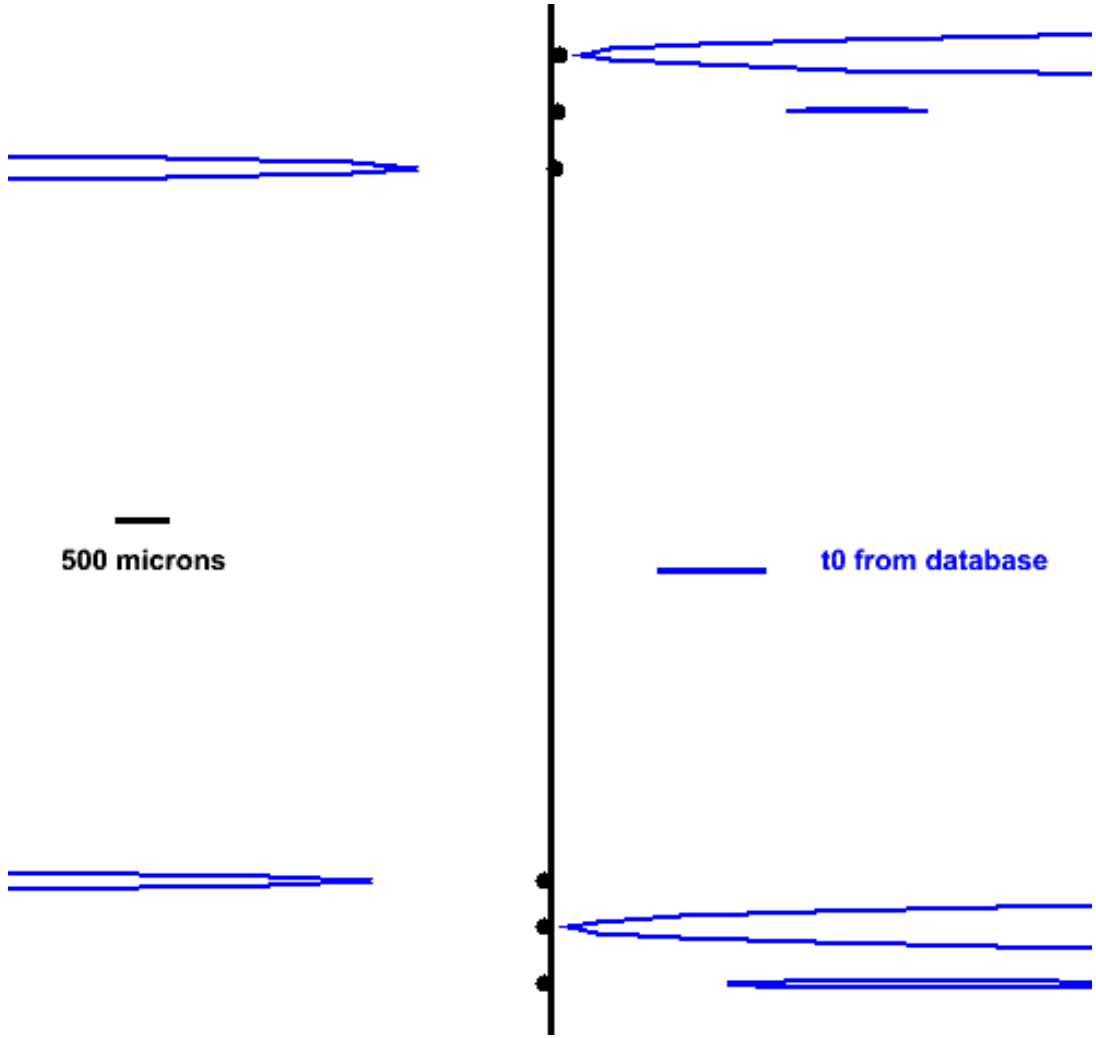
Exploded View – make segment vertical and expand horizontal dimension



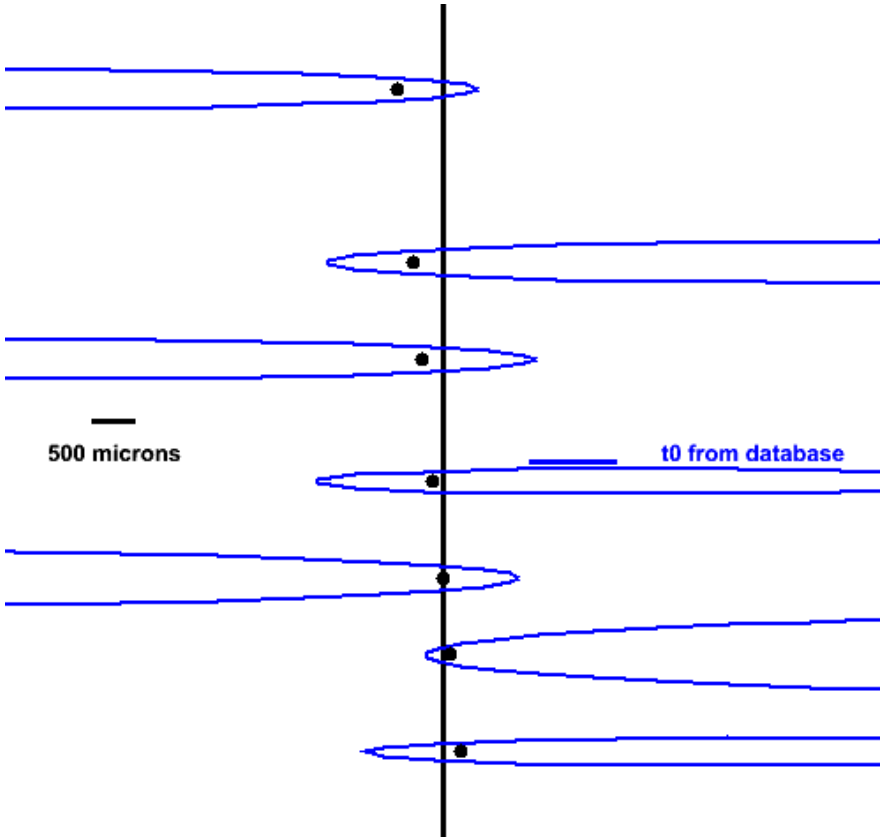
Reprocessed

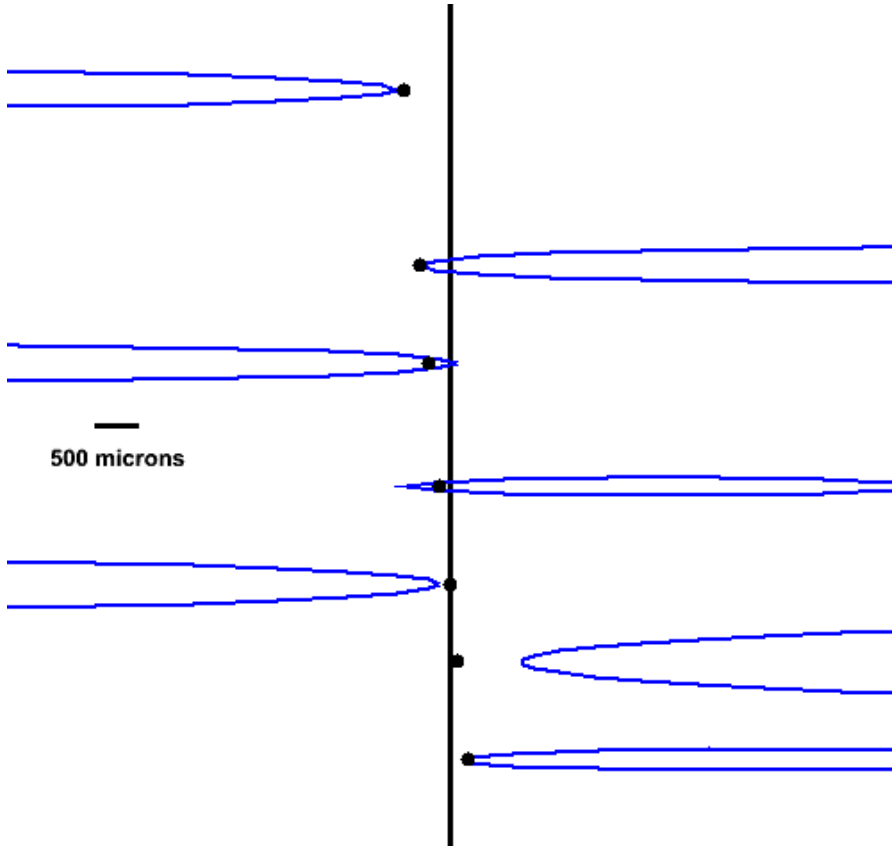
Bad Segment

Same muon but different chamber as last slide.



Bad Segment II

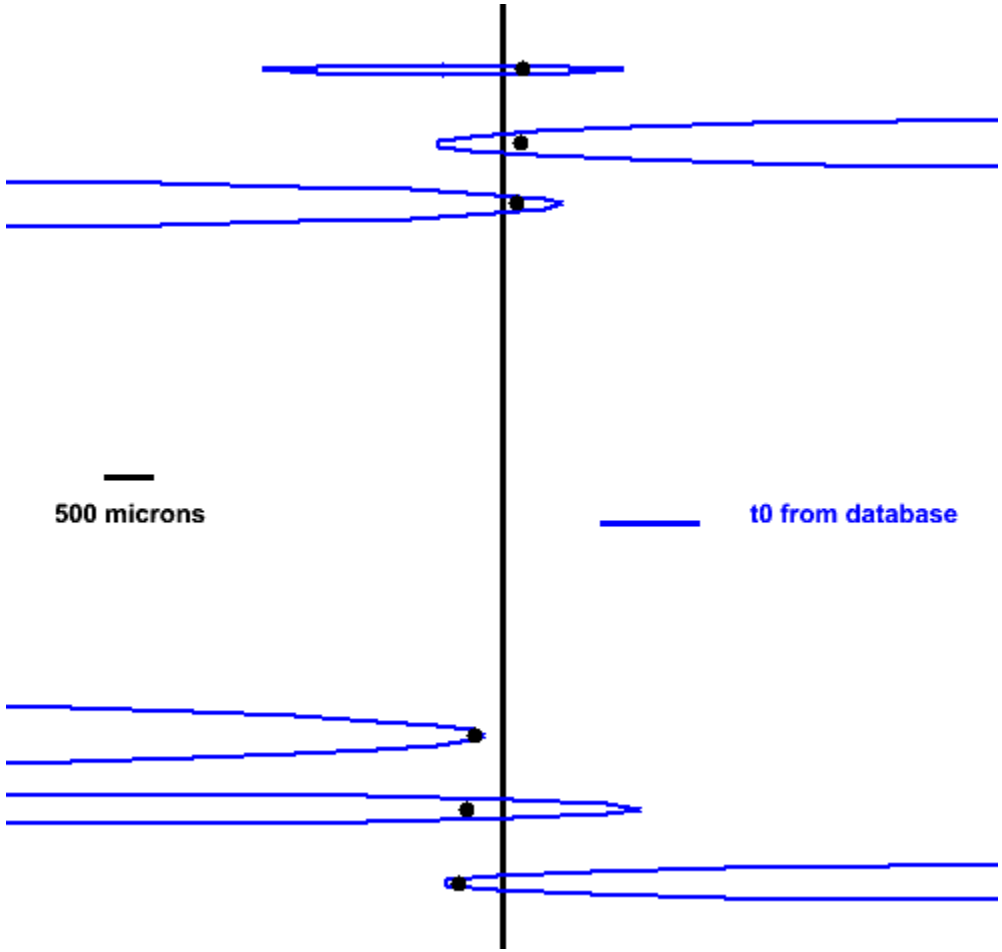




Same event but different muon as last slide.

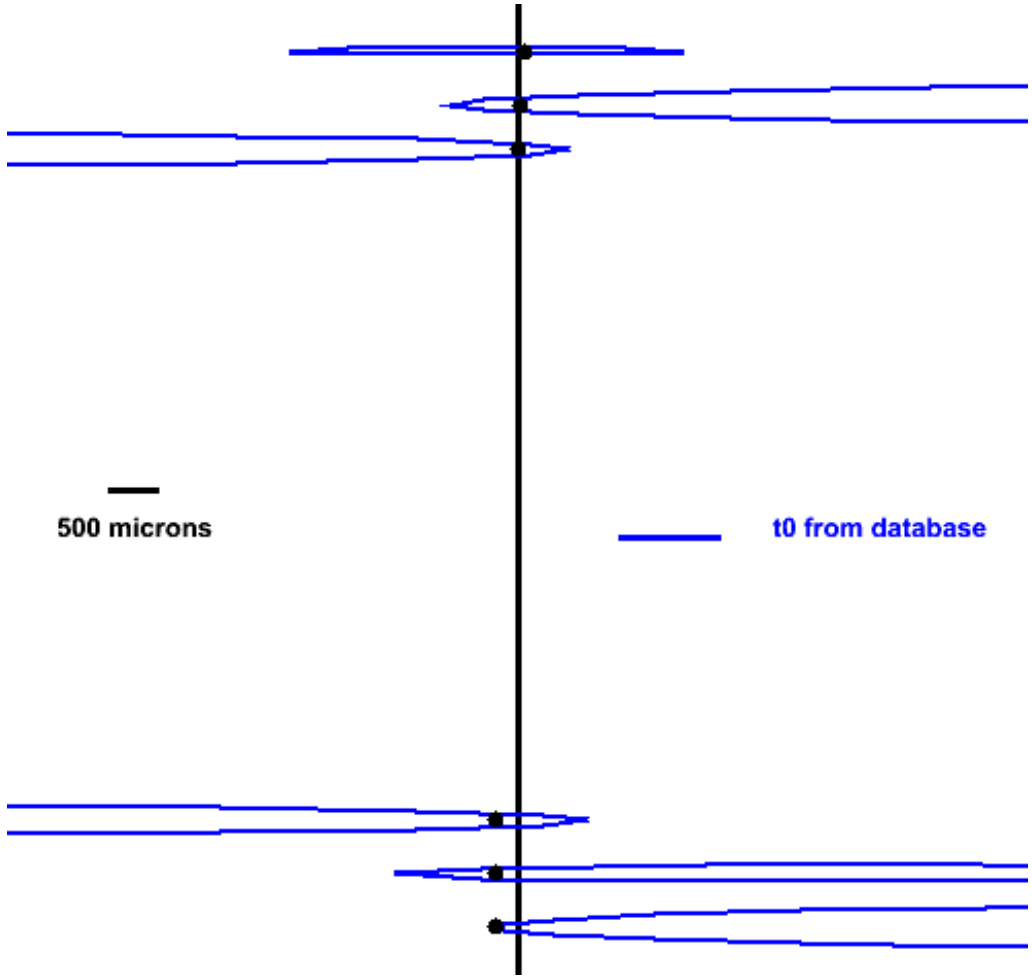
Same as left, but reduce each drift distance by 1000 μ.

Bad Segment III



Same muon but different chamber as last slide.

Bad Segment IV



Same muon but different chamber as last slide.

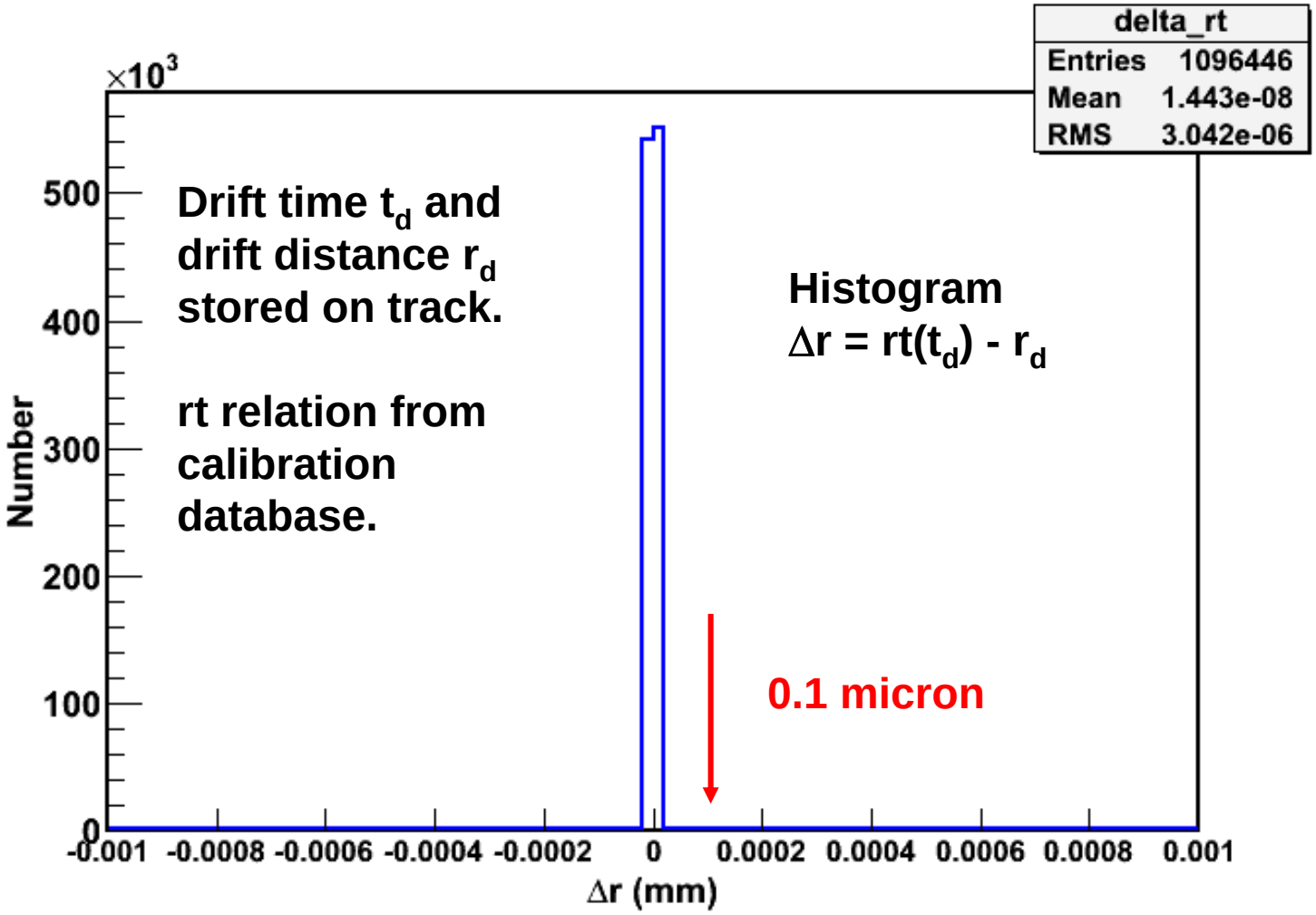
Summary

Not doing t_0 fit and tightening hit selection have reduced but not eliminated tails on residuals.

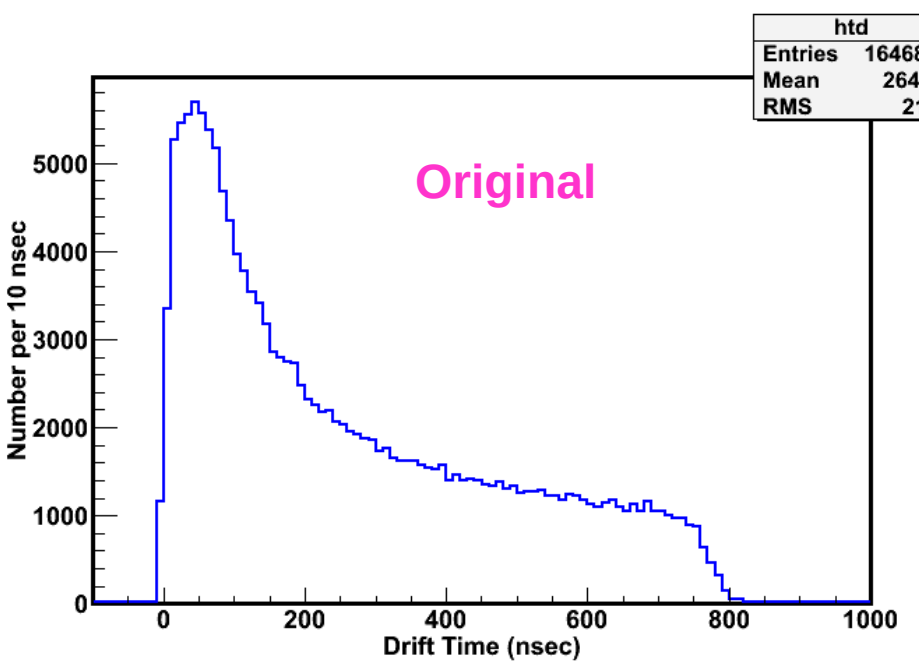
Selection of hits on tracks, t_0 calibration, and rt relations need to be looked at carefully.

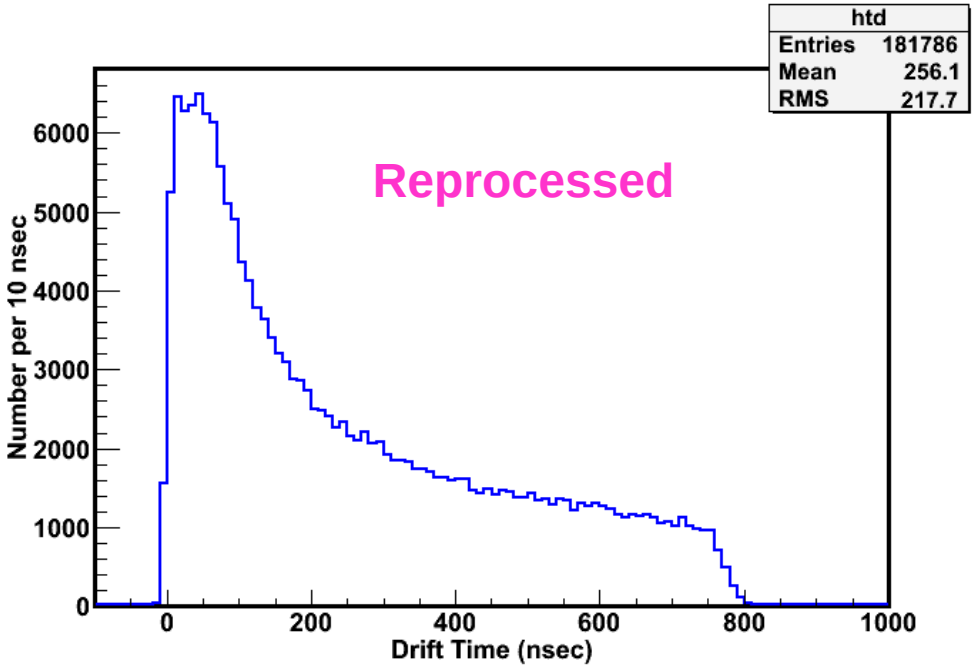
Backup Slides

rt Relation Check

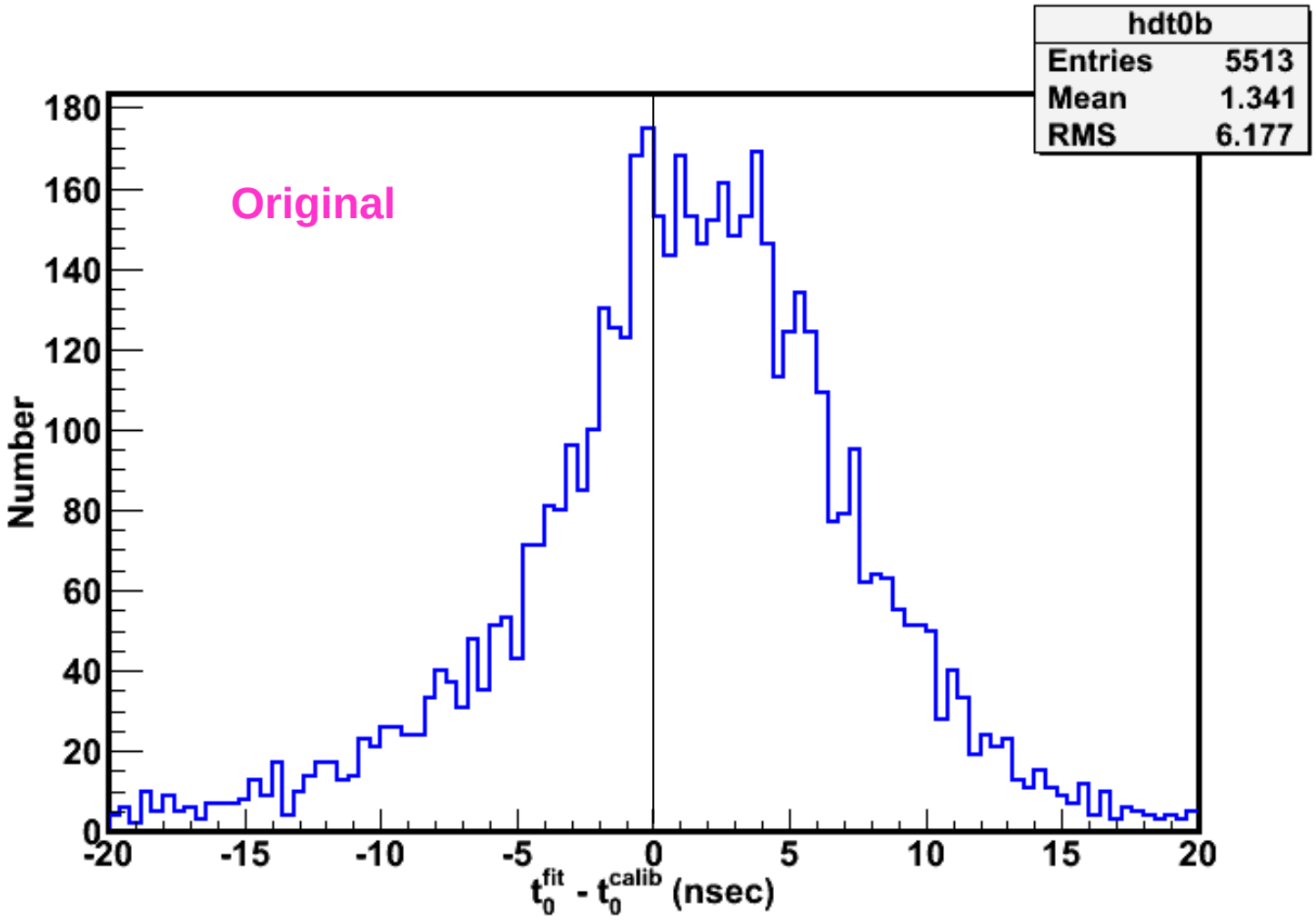


Drift Times


htd
Entries 16468
Mean 264
RMS 21
Original
Number per 10 nsec
Drift Time (nsec)
0
1000
2000
3000
4000
5000
0
200
400
600
800
1000


htd
Entries 181786
Mean 256.1
RMS 217.7
Reprocessed
Number per 10 nsec
Drift Time (nsec)
0
1000
2000
3000
4000
5000
6000
0
200
400
600
800
1000

Fit t_0's


hdt0b
Entries 5513
Mean 1.341
RMS 6.177
Original
Number
180
160
140
120
100
80
60
40
20
0
-20
-15
-10
-5
0
5
10
15
20
$t_0^{fit} - t_0^{calib}$ (nsec)