

GEM-LP1

Analysis Report



Topic (single module analysis)

- Hit efficiency
- Spatial resolution

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on behalf of part of LC-TPC collaboration

• Track-associated hit efficiency

Motivation

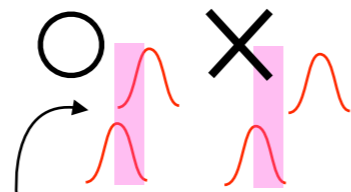
It seemed that we have obtained good spatial resolution with LPI.

However there is a possibility that we might have just picked up only the events which shows good spatial resolution.

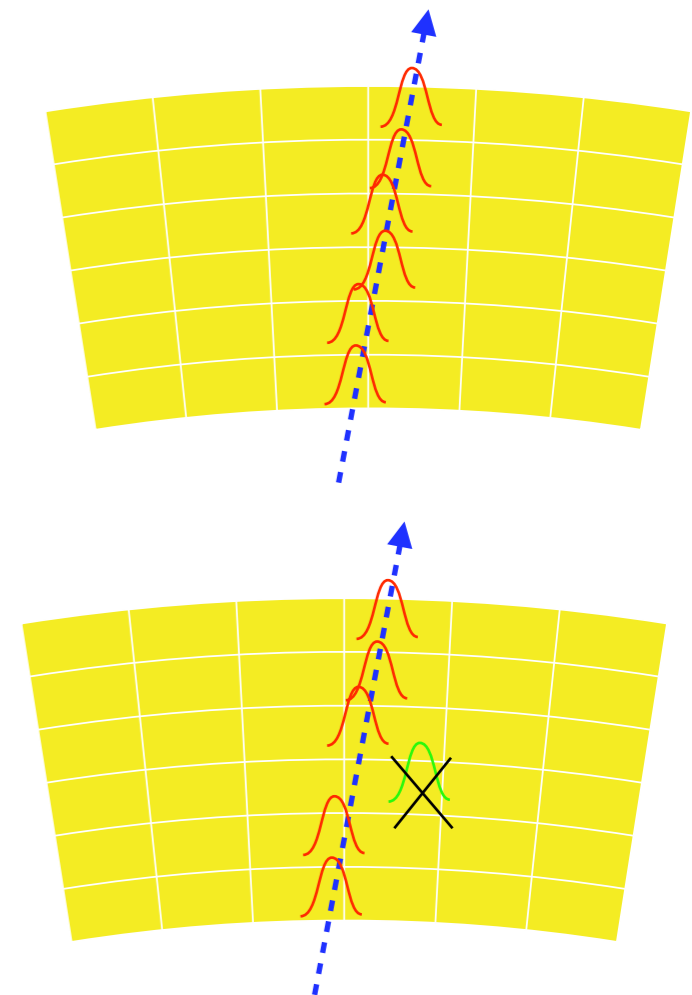
So we should check the efficiency for each row.

Idea to estimate track-associated hit efficiency of Row-X

Tracks are composed of some hit clusters.



If a cluster has no overlap with the next one, the cluster will not be included in the track.



In order to estimate the efficiency of row-k,

1. Check if there is a track-associated hit on row-(k-1) and row-(k+1).

If yes, I assumed row-k should also have hit.

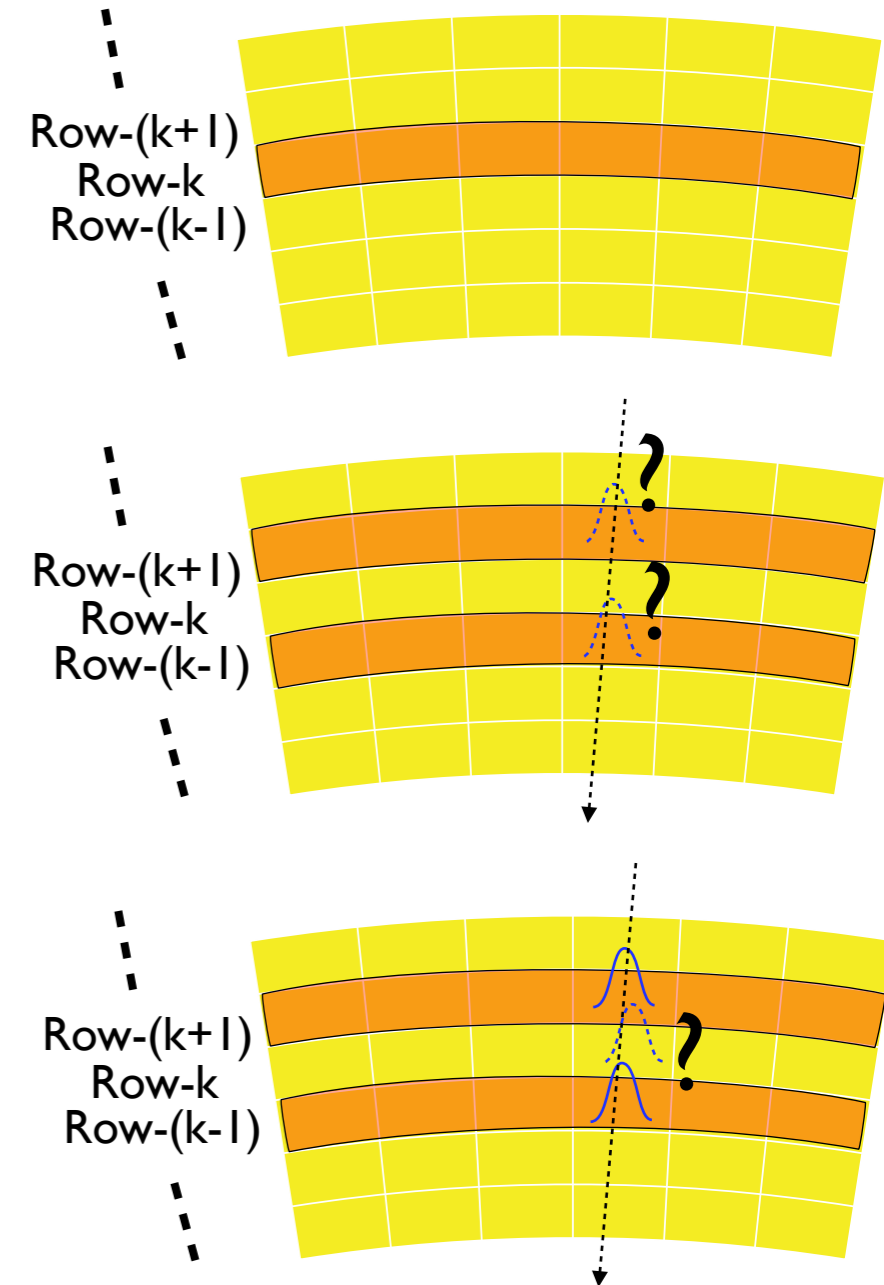
→ denominator

2. Furthermore check if there is a track-associated hit on row-k.

→ numerator

Define:

$$\text{Track-associated hit efficiency(Row-k)} = \frac{\# \text{ of events passed through requirement 2}}{\# \text{ of events passed through requirement 1}}$$



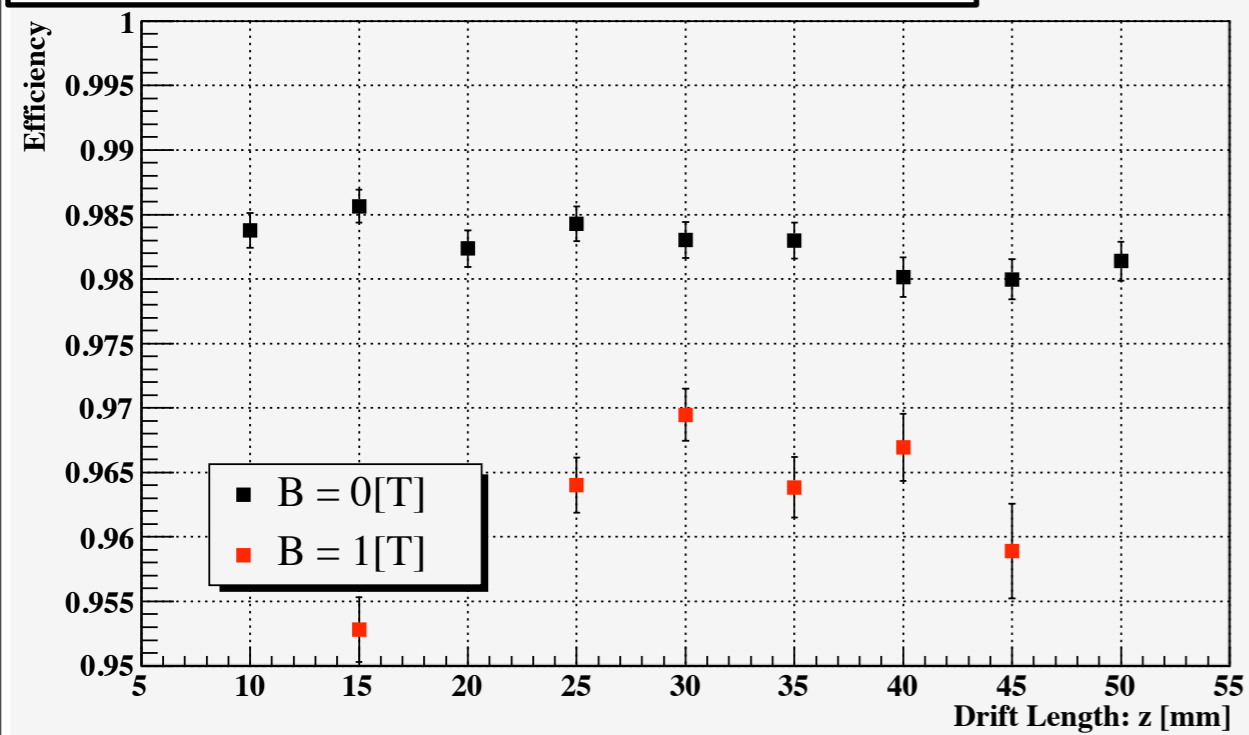
Sample Results

I checked the efficiency on track-associated hit for all rows.

Worst Row

Track-associated Hit Efficiency of Row-11

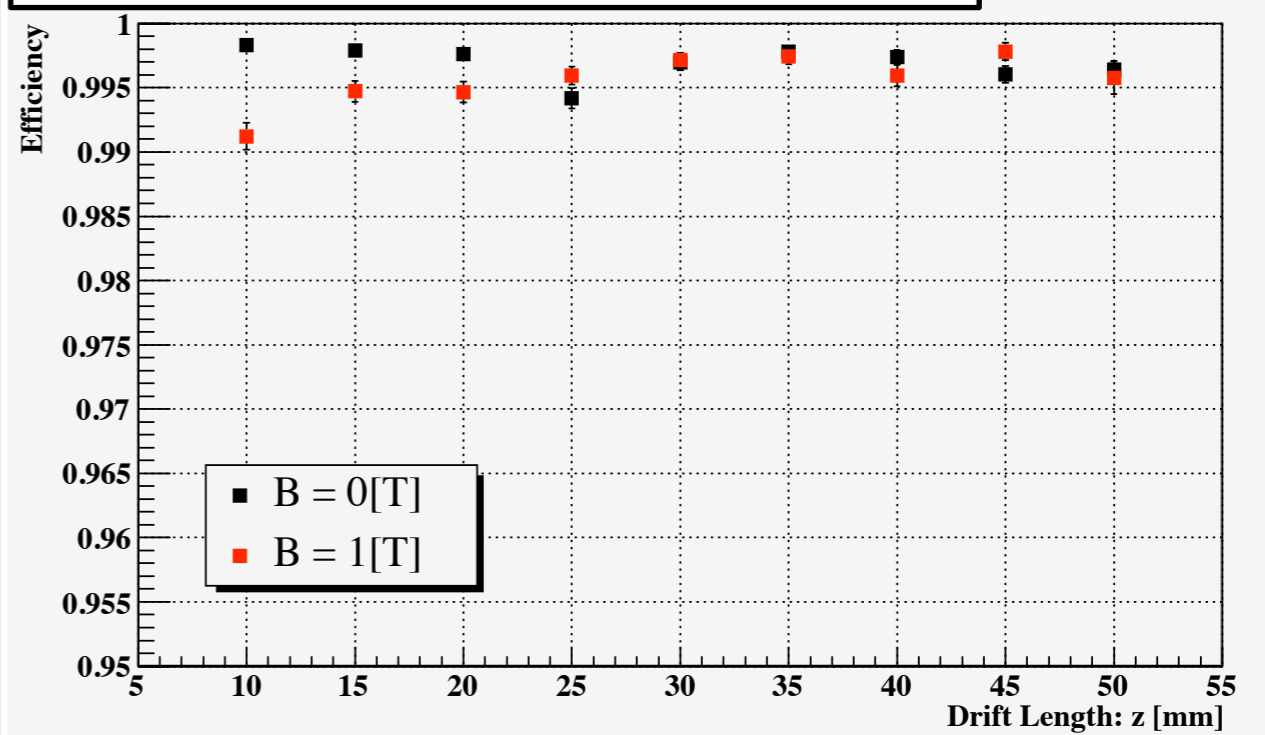
Preliminary



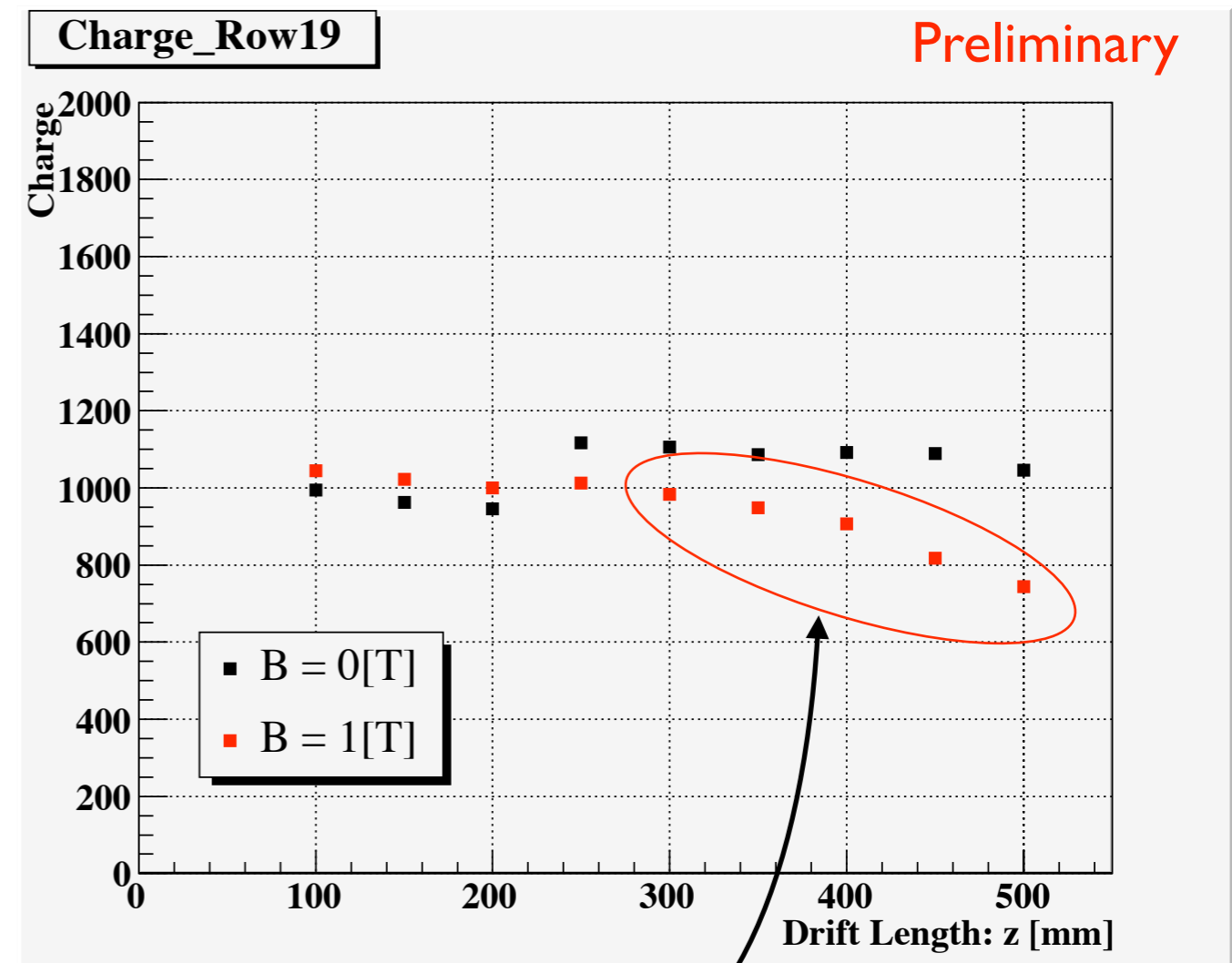
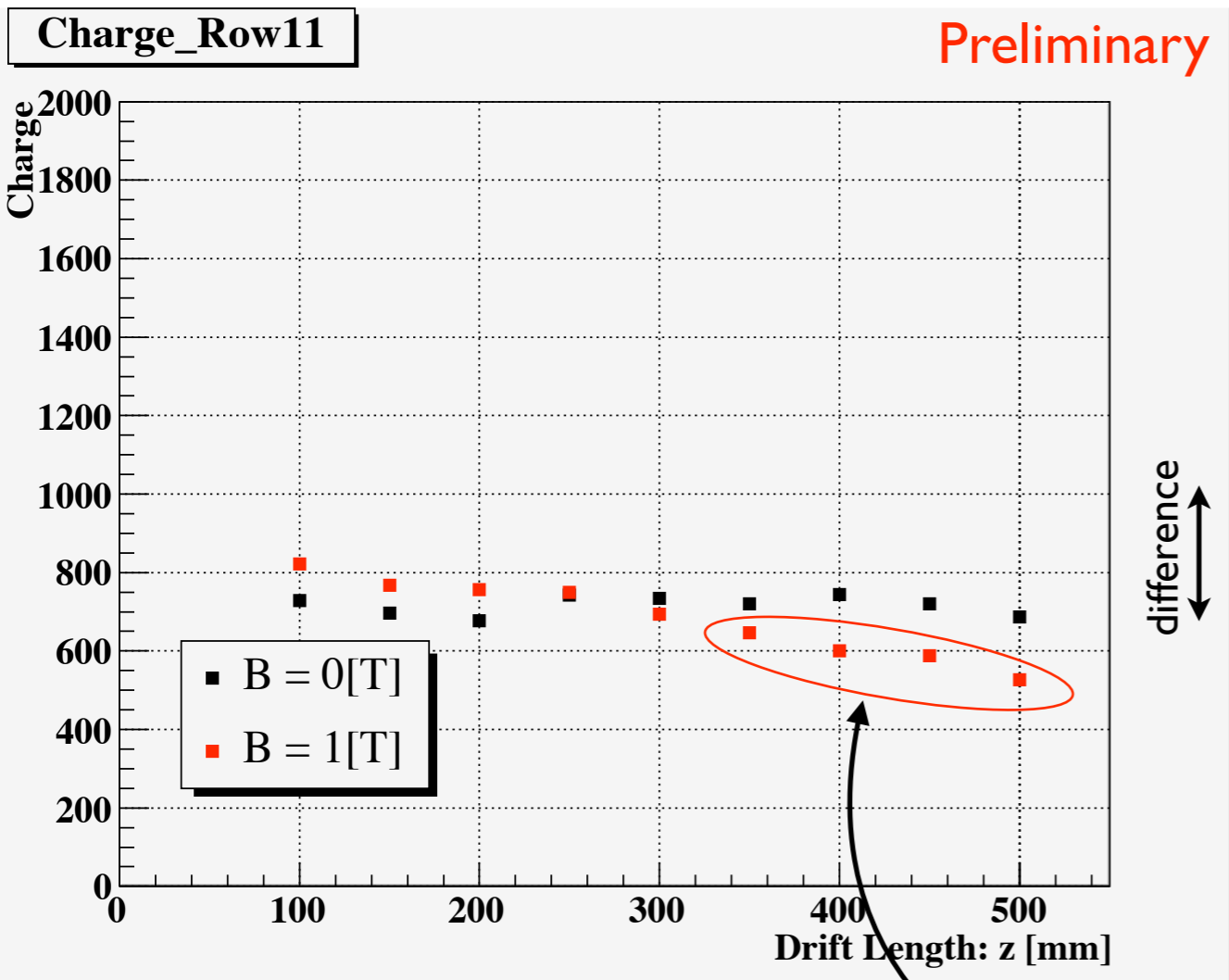
Best Row

Track-associated Hit Efficiency of Row-19

Preliminary



Charge Sum corresponding to previous 2 samples



E X B effect in the non-uniform field ?
(electrons might have gone out of readout region)

•Spatial Resolution

Sample Results

(Row-19, B=0T) → p.7

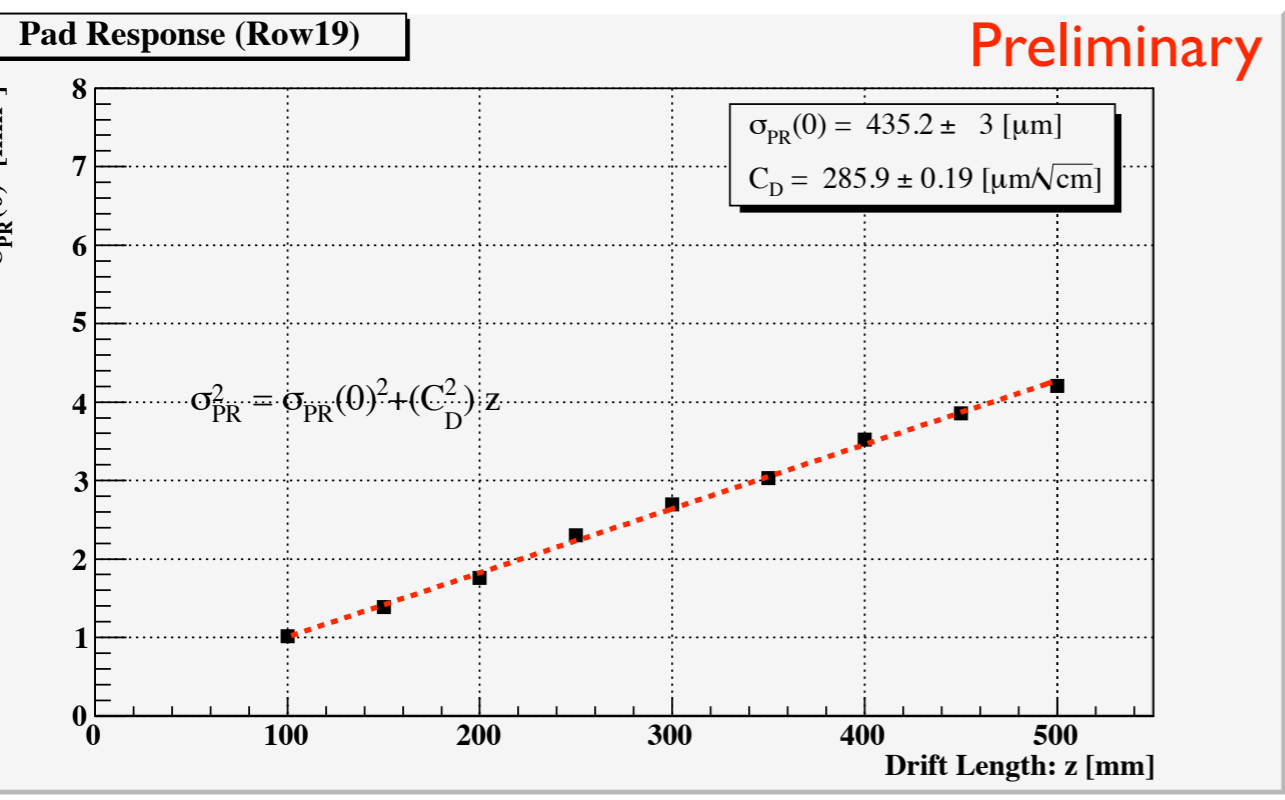
(Row-19, B=1T) → p.8

(Row-11, B=0T) → p.9

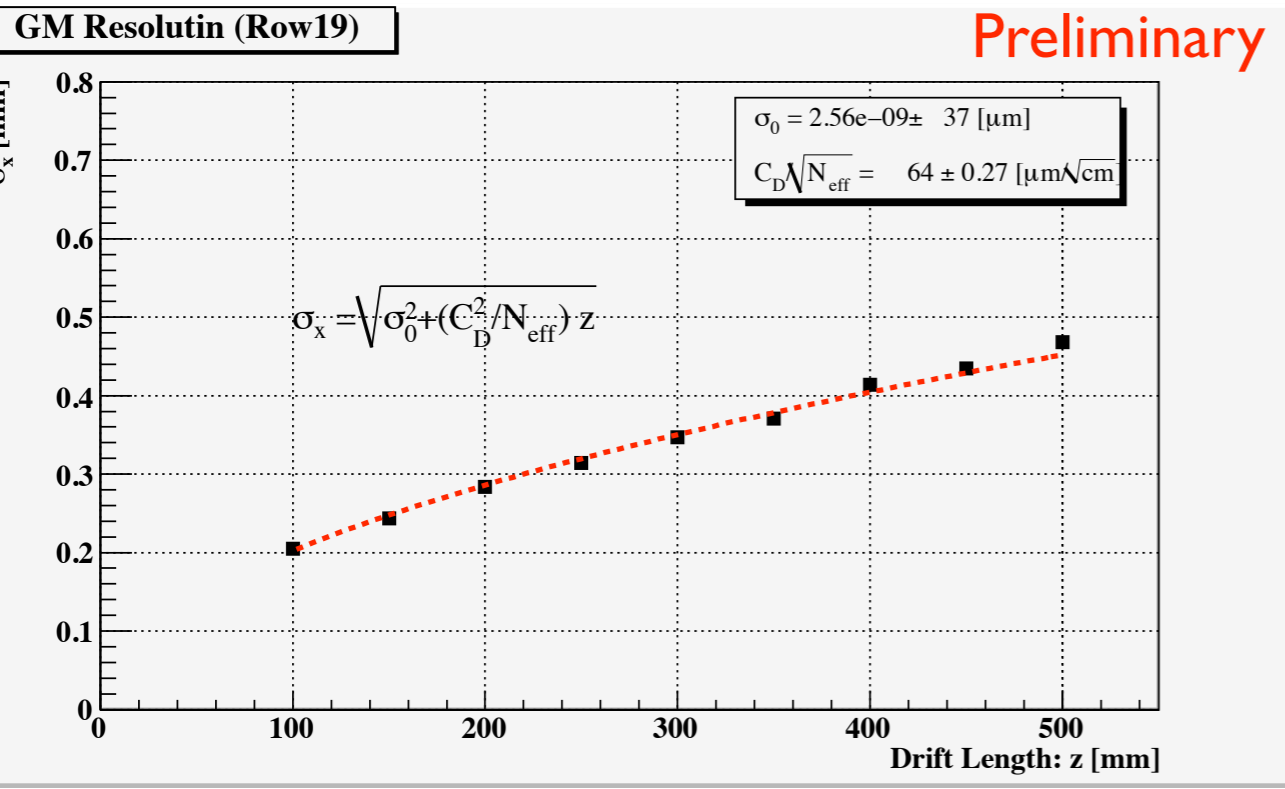
(Row-11, B=1T) → p.10

Width of Pad Response & Spatial Resolution as a function of drift length

B=0T, Row19



GARFIELD
 $C_D = 315 \text{ [}\mu\text{m}/\sqrt{\text{cm}}]$

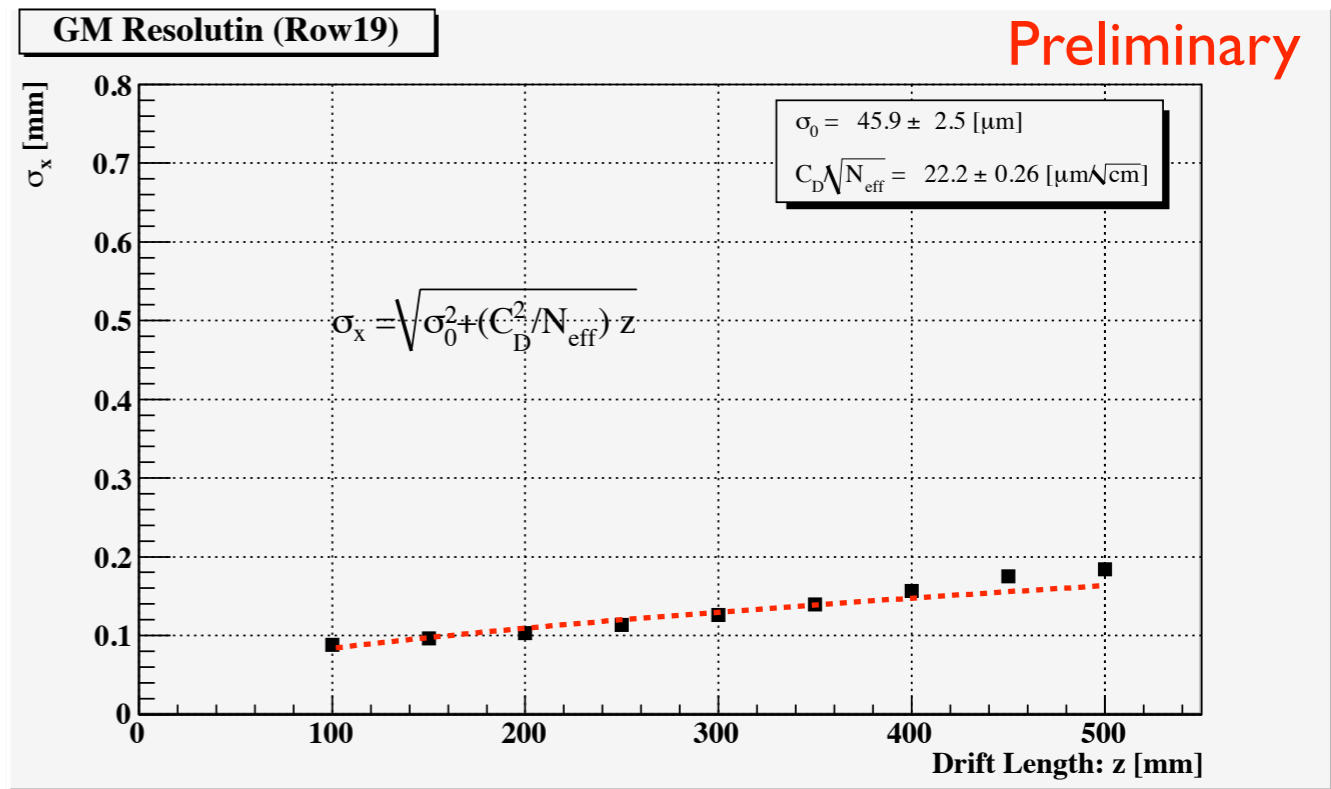
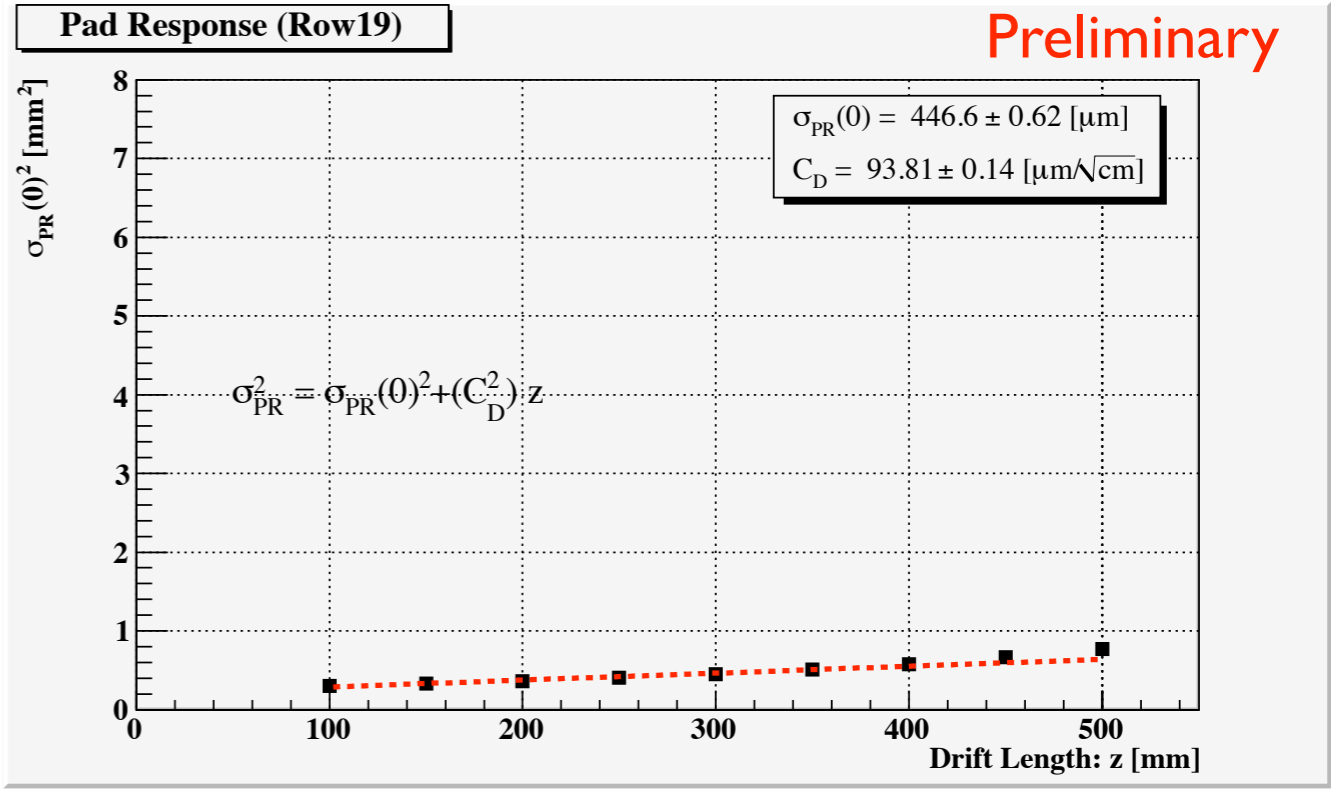


→ $N_{eff} \sim 20.0 \pm 0.2$

Width of Pad Response & Spatial Resolution as a function of drift length

B=1T, Row19

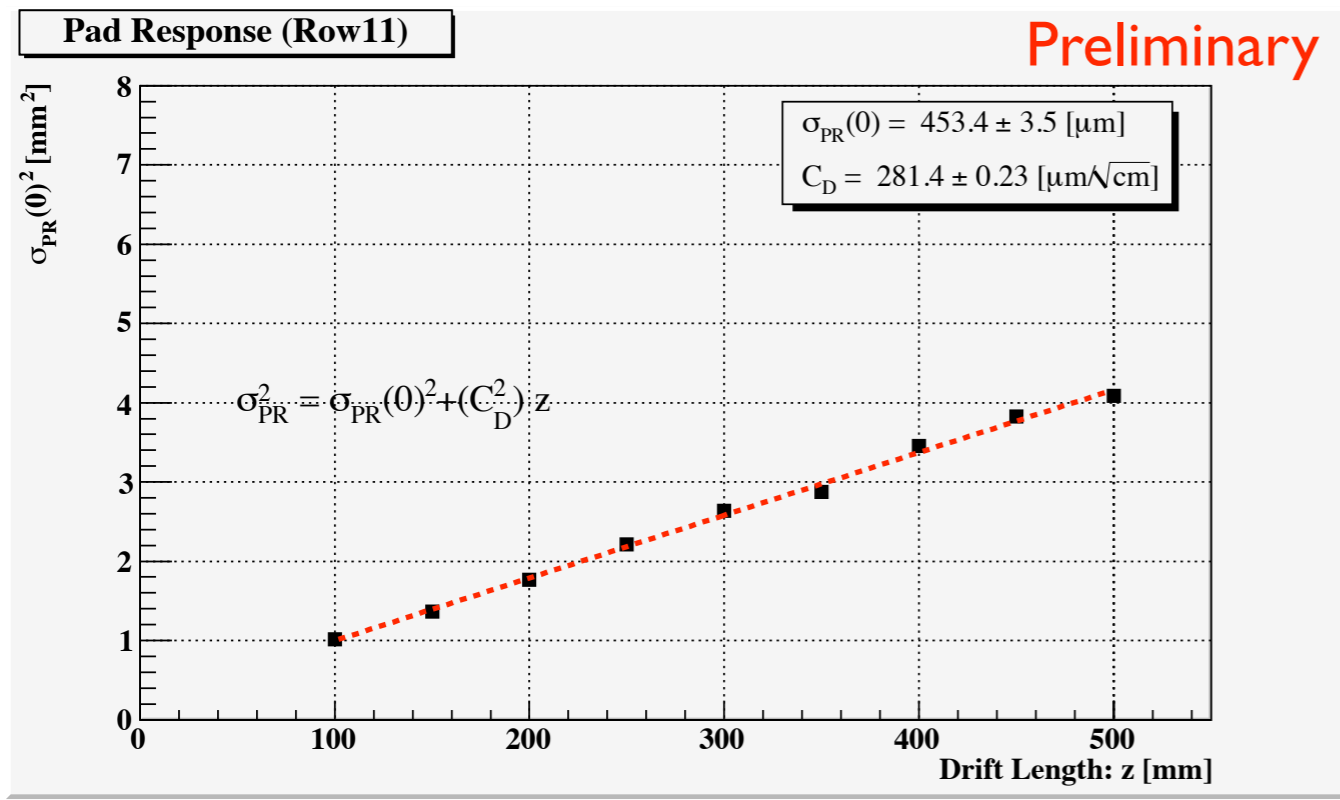
GARFIELD
 $C_D = 99.3 \text{ } [\mu\text{m}/\sqrt{\text{cm}}]$



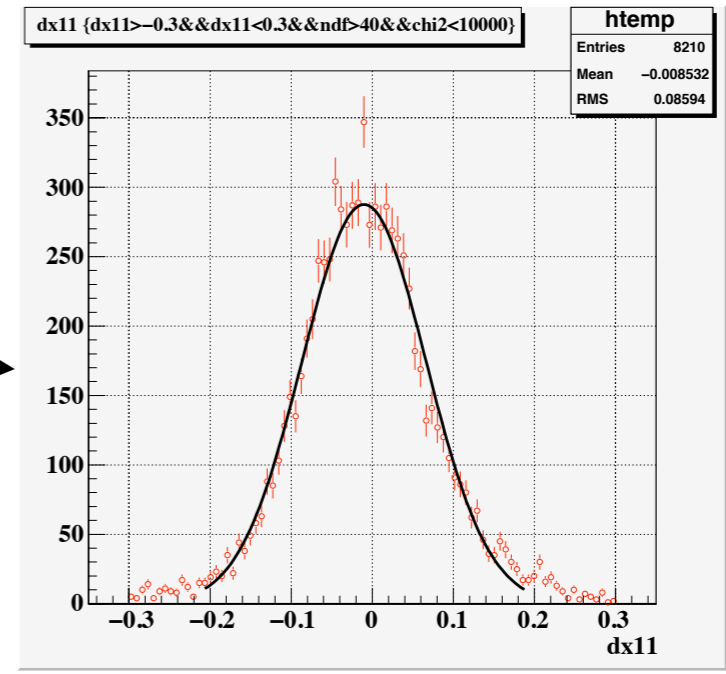
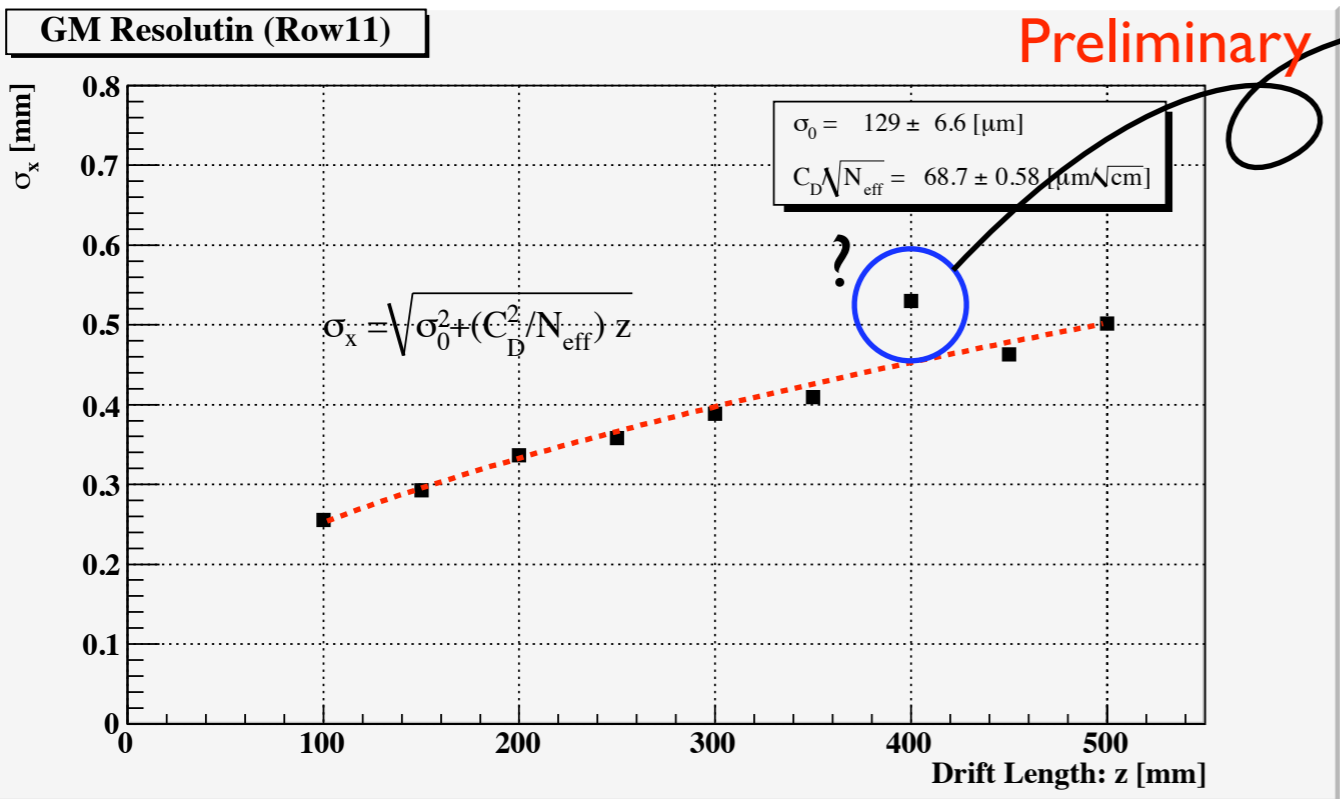
$N_{\text{eff}} \sim 17.9 \pm 0.4$ ←

Width of Pad Response & Spatial Resolution as a function of drift length

B=0T, Row I



GARFIELD
 $C_D = 315 \text{ [}\mu\text{m}/\sqrt{\text{cm}}]$



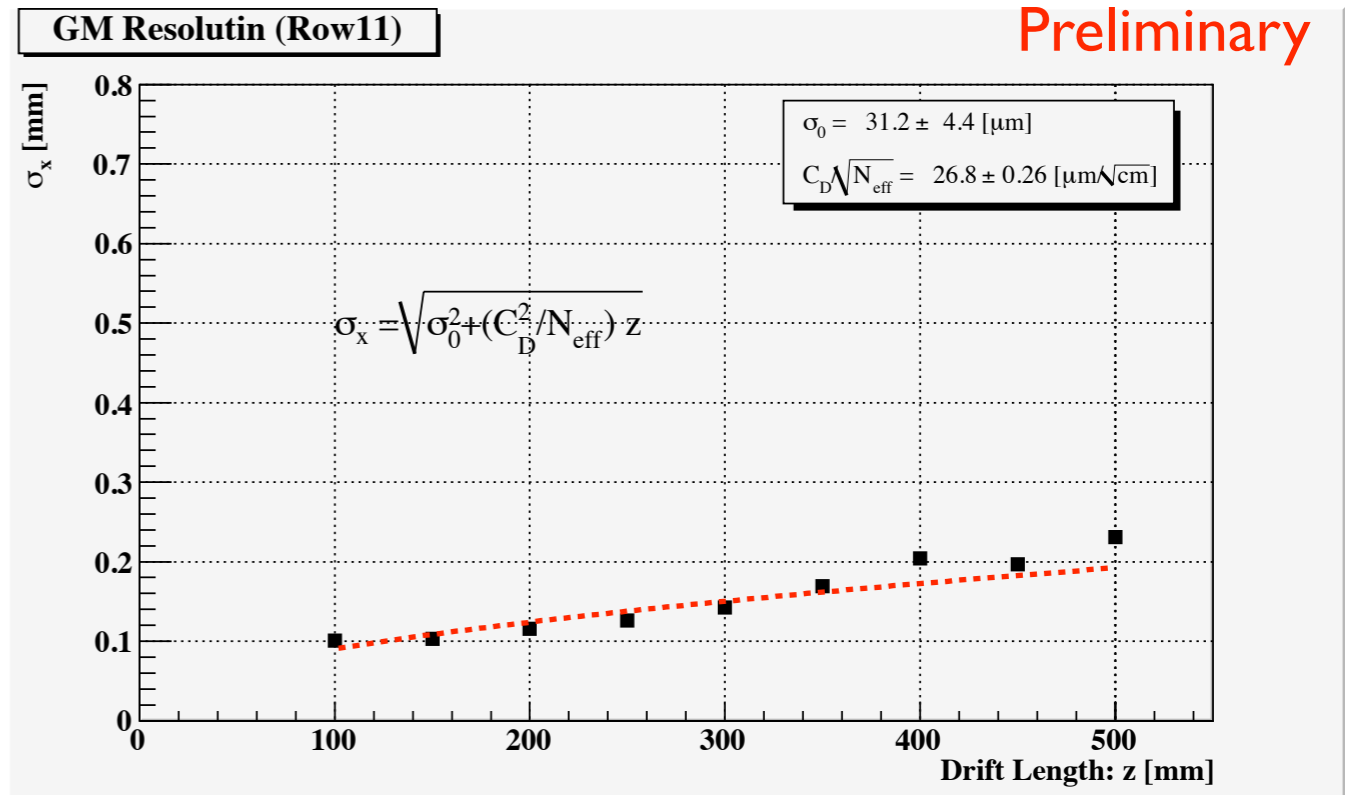
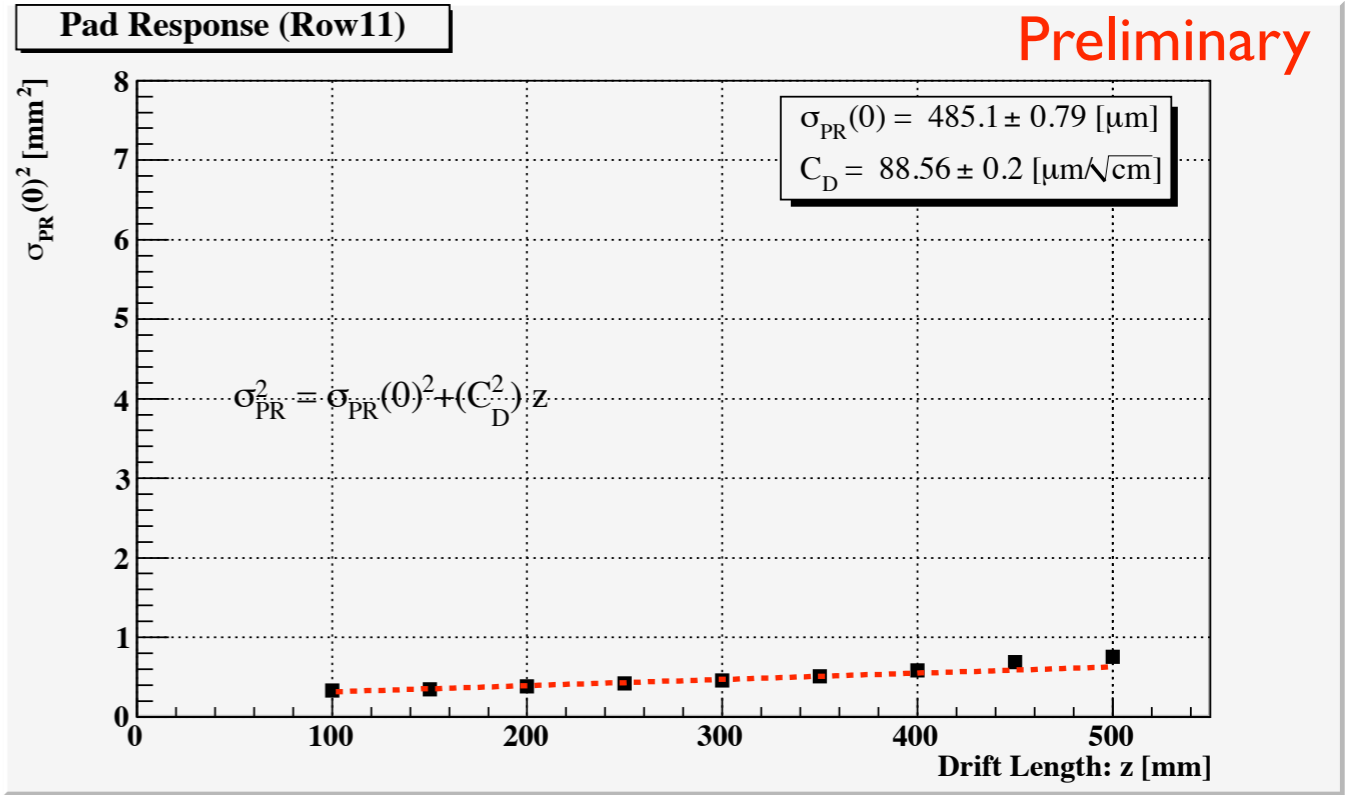
Fitting looks not so bad ...

→ $N_{\text{eff}} \sim 16.8 \pm 0.3$

Width of Pad Response & Spatial Resolution as a function of drift length

B=1T, Row11

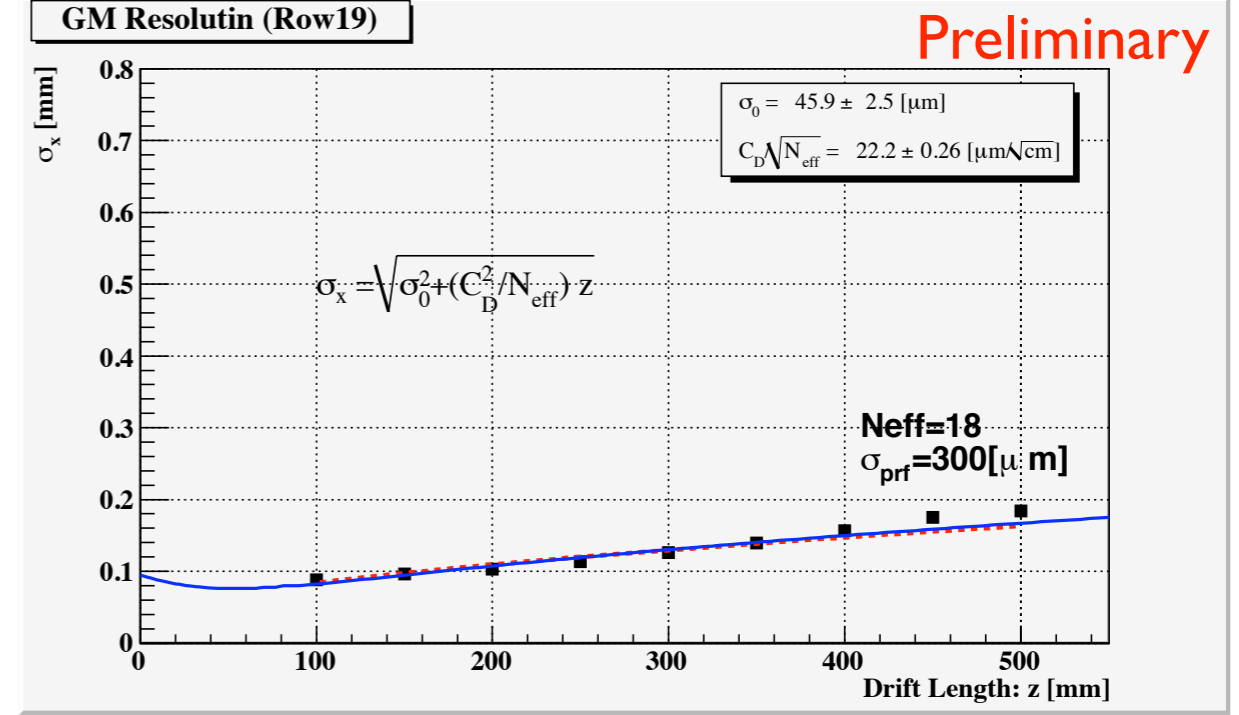
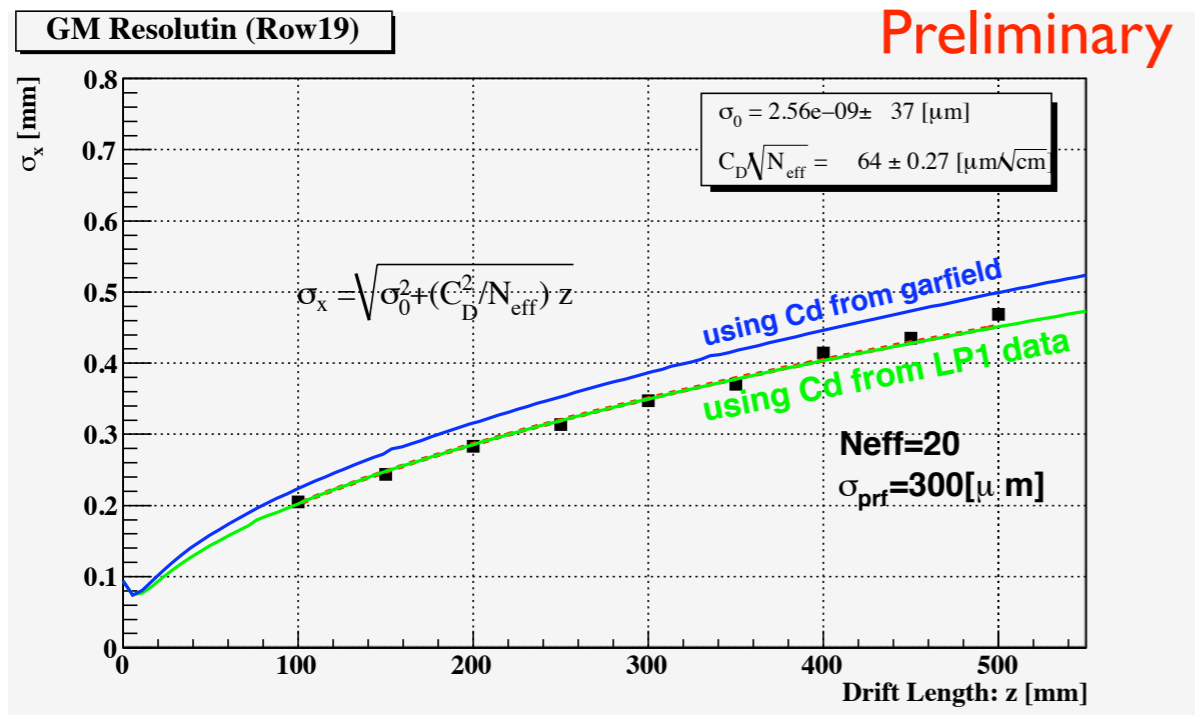
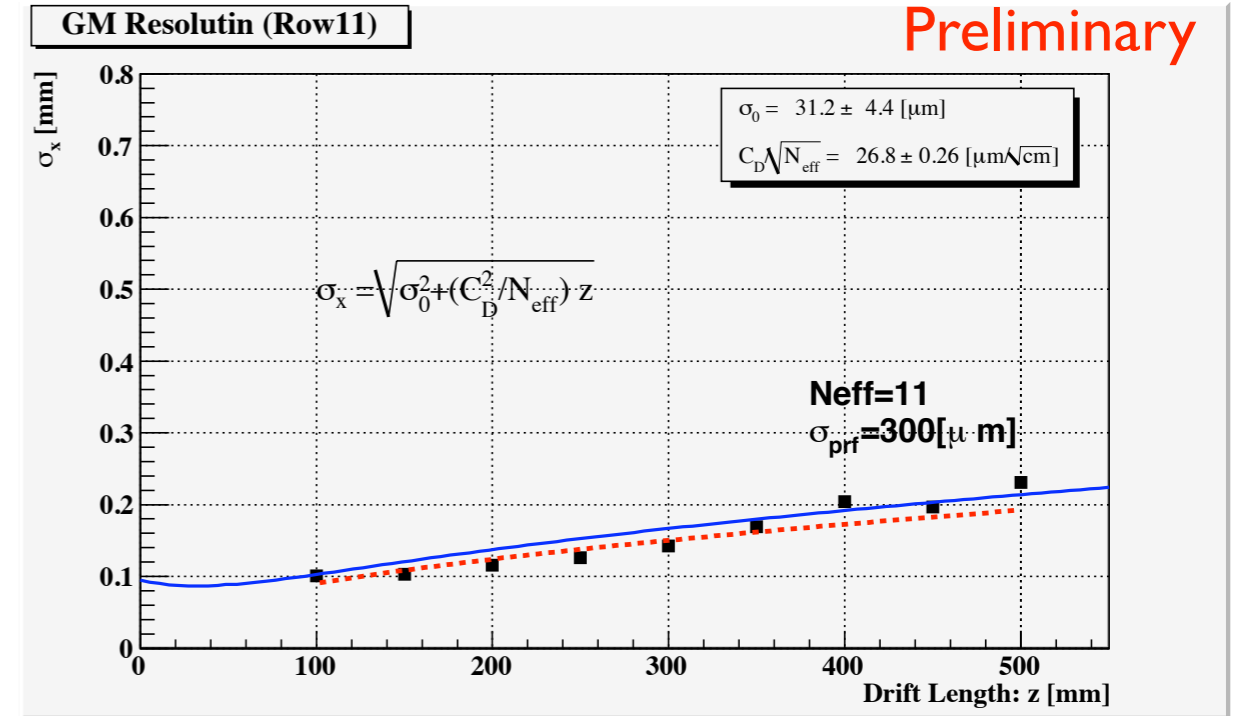
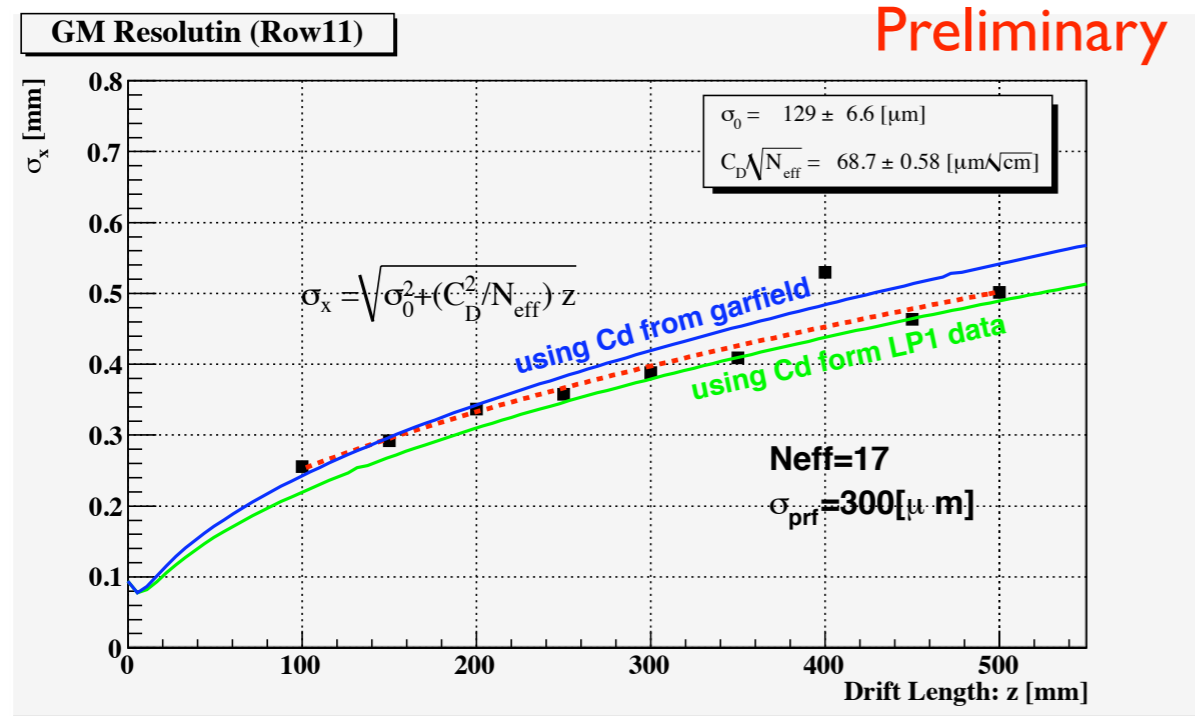
GARFIELD
 $C_D = 99.3 \text{ } [\mu\text{m}/\sqrt{\text{cm}}]$



$N_{eff} \sim 10.9 \pm 0.2$ ←

Analytic Calculation of Spatial Resolution

Input parameters: **C_D**(diffusion coefficient), **σ_{prf}**(diffusion in amplification region), **N_{eff}**(effective number of seed electrons))



Summary

Checked hit efficiency for each row

————→ There are some pad rows which efficiency are not so good(~ 0.96)
(We should check this efficiency when discussing resolution.)

Next Step

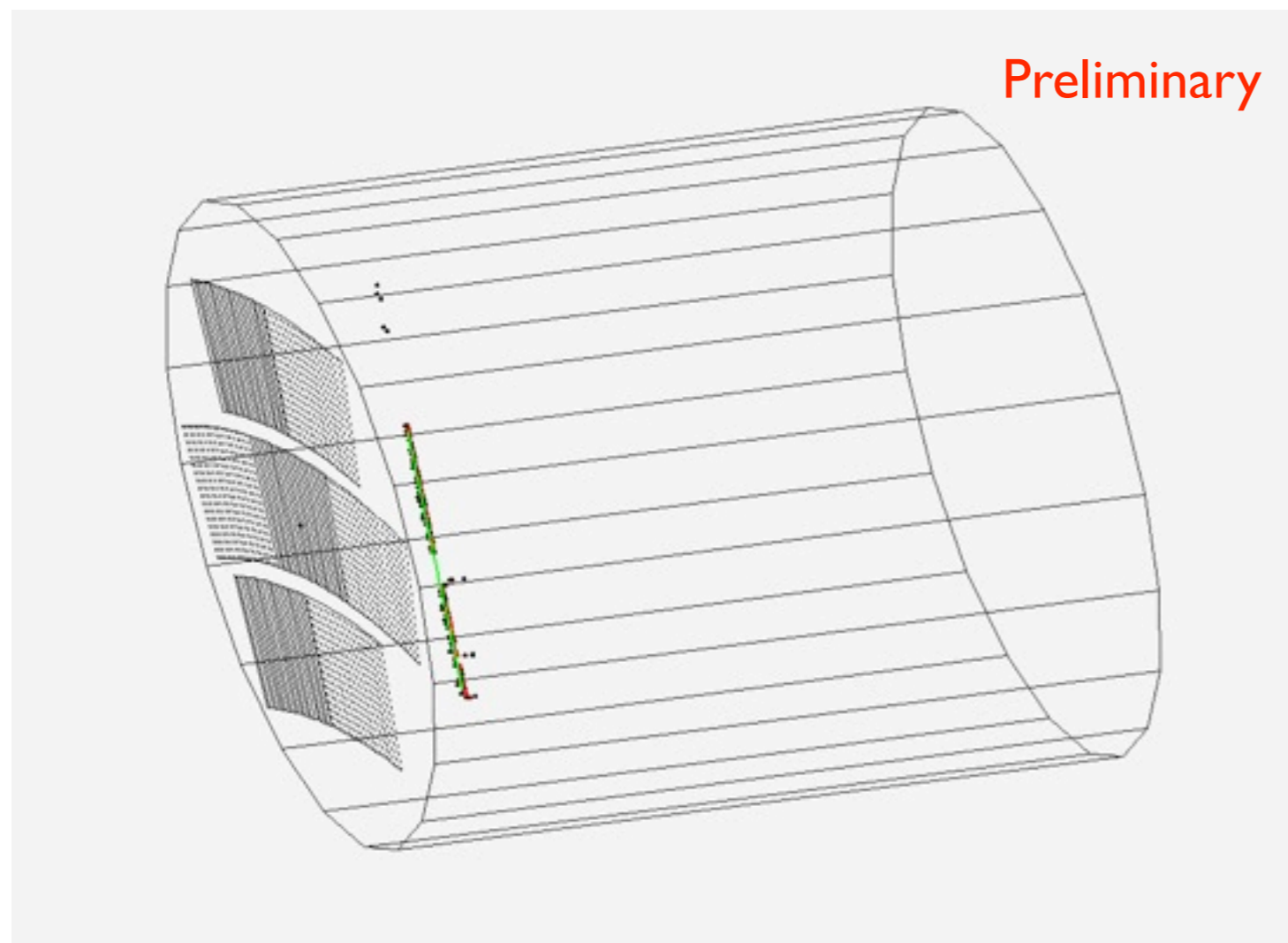
Develop our event display in order to look a fitted line

Check the fitting efficiency

Extend our analysis for multi-module

Additional Slide

Now we're developing the event display in order to check track fitting.



But at this moment, this can be done for single module analysis. (We think it will be done easily to extend to multiple-module analysis.)

I believe we can start multi-module analysis soon.