Investigation of non-uniformity in the charge collected by individual wires: fixing bugs

LArIAT Analysis Summit Meeting
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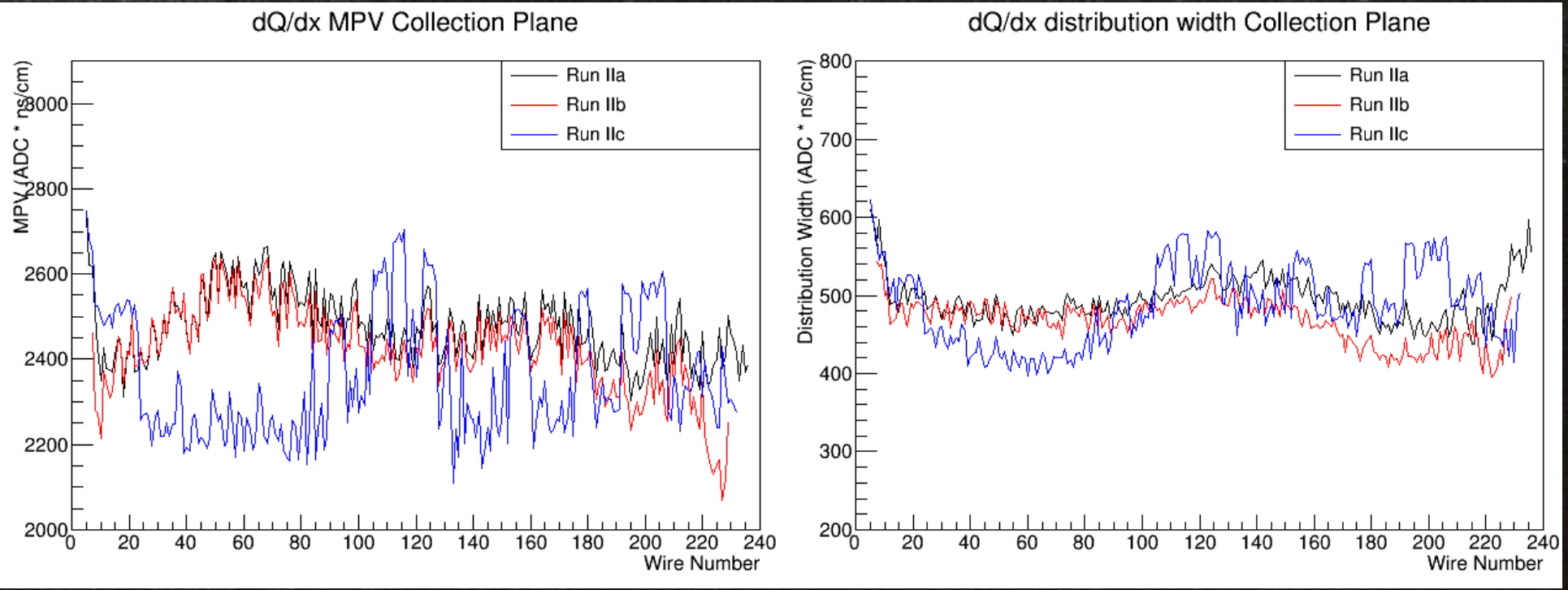
In my last presentation...

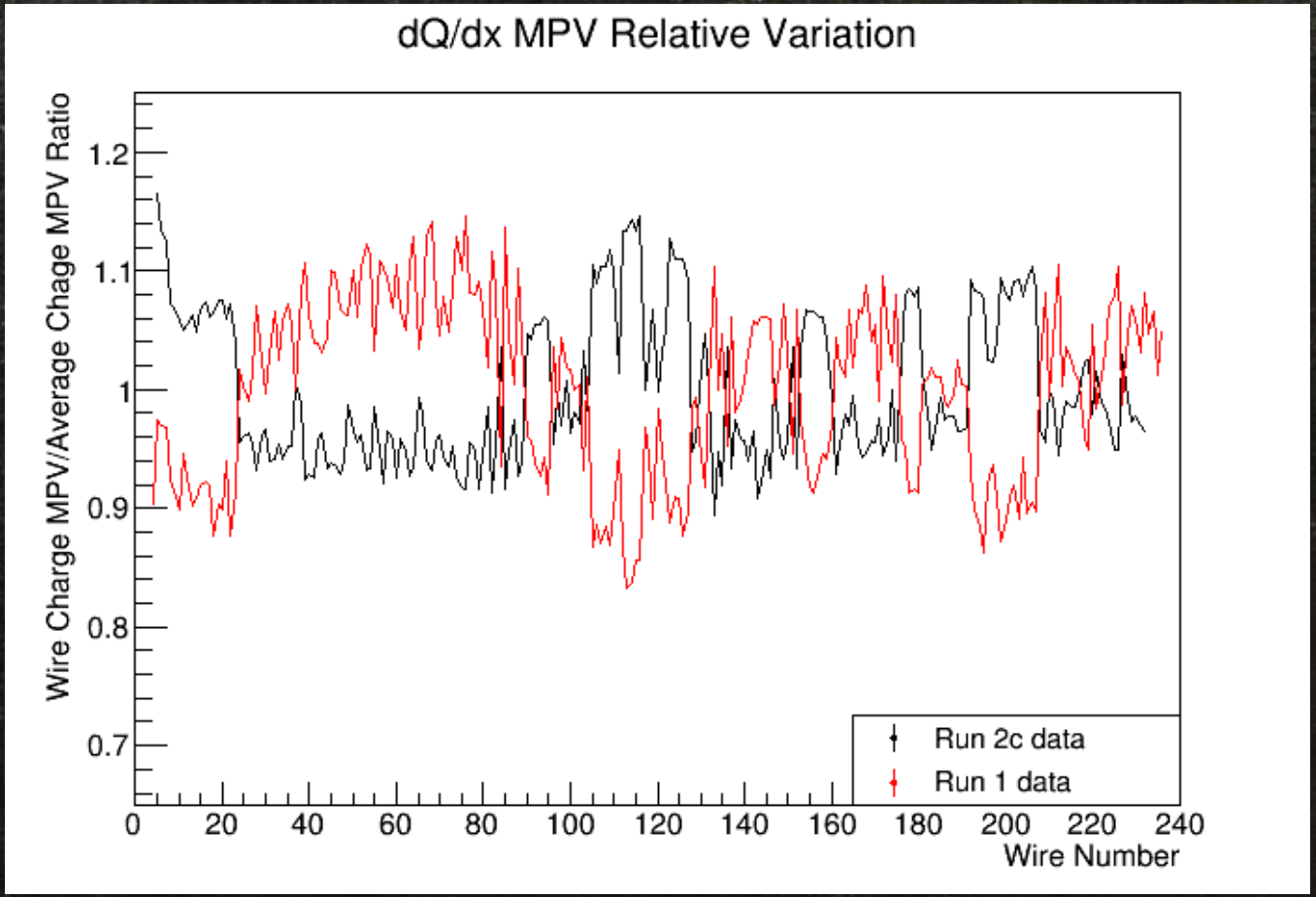
- I showed some inconsistency found while checking the wire by wire variation
- Defined three data samples:
  - Run IIa: data at the beginning of Run II, from end of February to mid-March
  - Run IIb: ~10 days of data immediately after first filter regeneration (cryostat fully emptied and opened)
  - Run IIc: ~10 days of data immediately after second filter regeneration (cryostat only partially emptied, not warmed up)

From my last presentation



No difference between Run IIa and IIb. What happened in Run IIc???

From my last presentation: Run IIc vs Run I



This plot **should** have made me suspect the problem was software, more than hardware...

What actually happened

- I reconstructed Run IIa and Run IIb data with the same LArIATSoft version I used for Run I, i.e. v05_01_01
- I reconstructed Run IIc with a newer LArIATSoft version instead, v05_14_00
- I realized the LArIATSoft version was the problem, but I couldn't understand why till I spoke with Tingjun!
- When Tingjun modified the calorimetry module to implement the wire corrections I calculated for Run 1, he added a parameter in the module to turn the corrections on and off. This parameter is ON by default

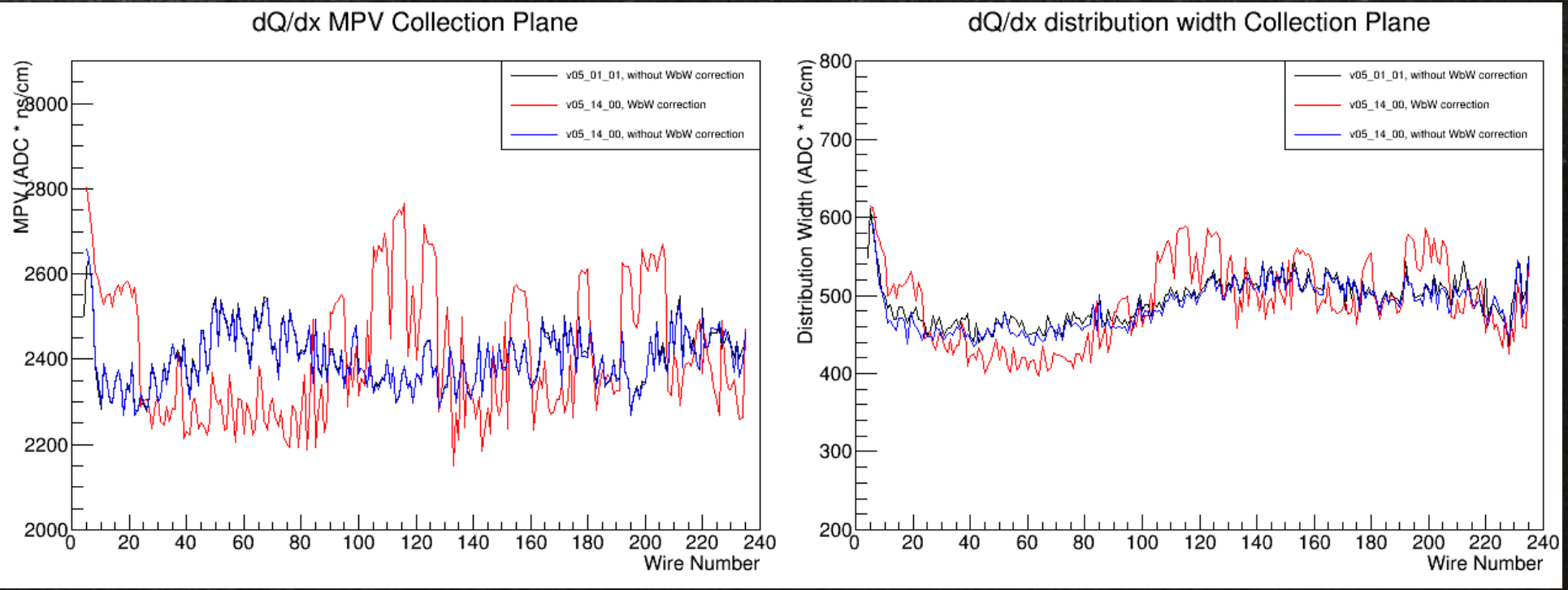
What you'll see in your Reco.fcl

```
#####physics.producers.wctrack.WCTrackBuilderAlg.PickyTracks:   false
physics.producers.caldata.DigitModuleLabel:                     "daq"
physics.producers.caldata.DodQdxCalib:                          true

physics.producers.gaushit.CalDataModuleLabel:                   "caldata"
physics.producers.gaushit.Chi2NDFRetry:                          1000.
```

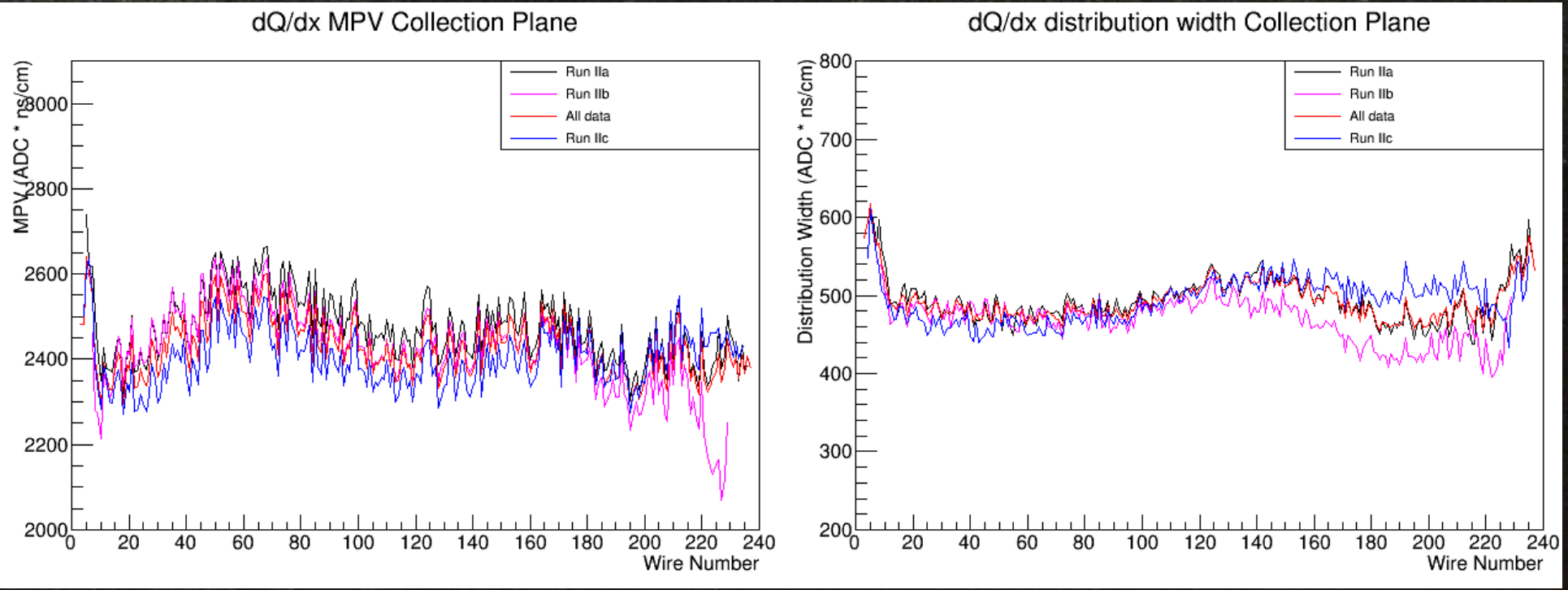
LArIATSoft v05_14_00 (and newer) utilizes the new calorimetry module version and I didn't turn the parameter off: I was correcting for Run I wire gain variations data which didn't have such variations!

Cross Check



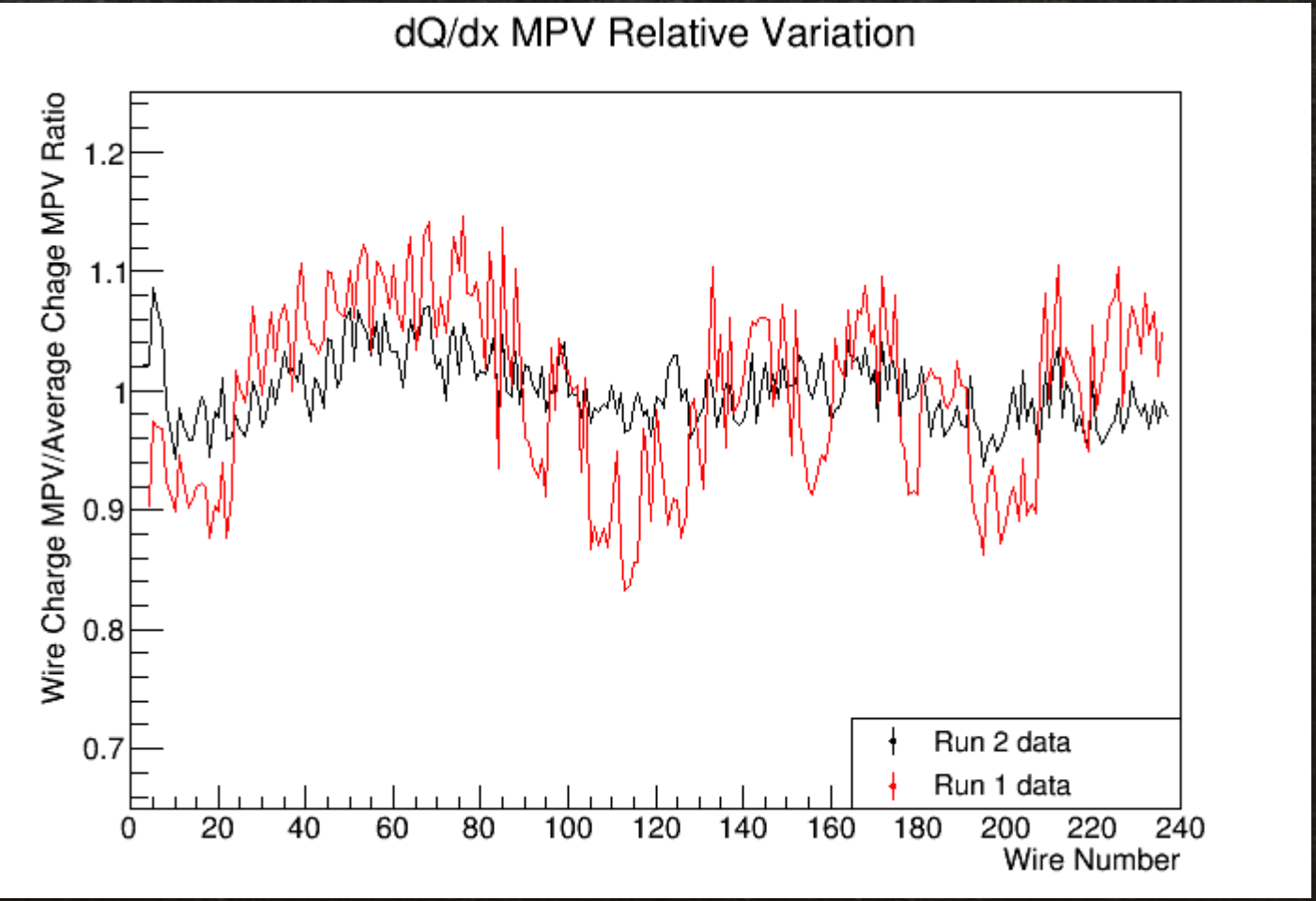
Yep, that's the problem

Run 2 Wire by Wire Variation



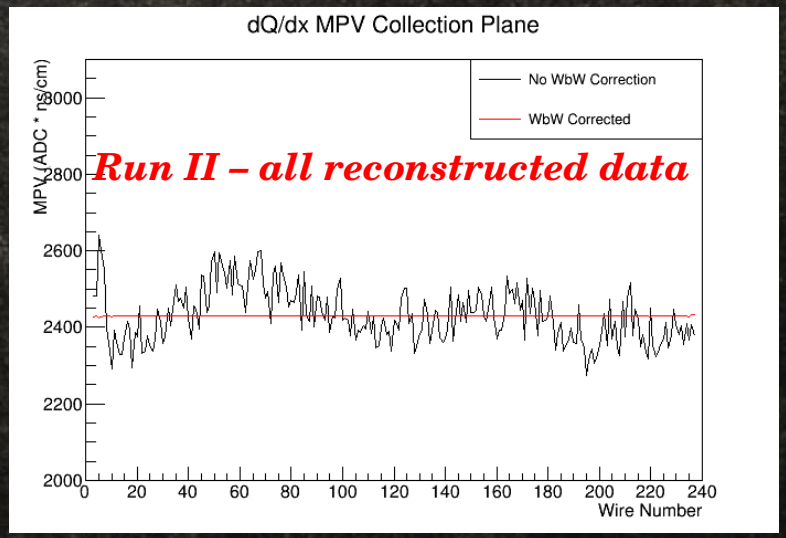
Now I can proceed calculating the correction factors for Run II using the full Run II data sample I reconstructed

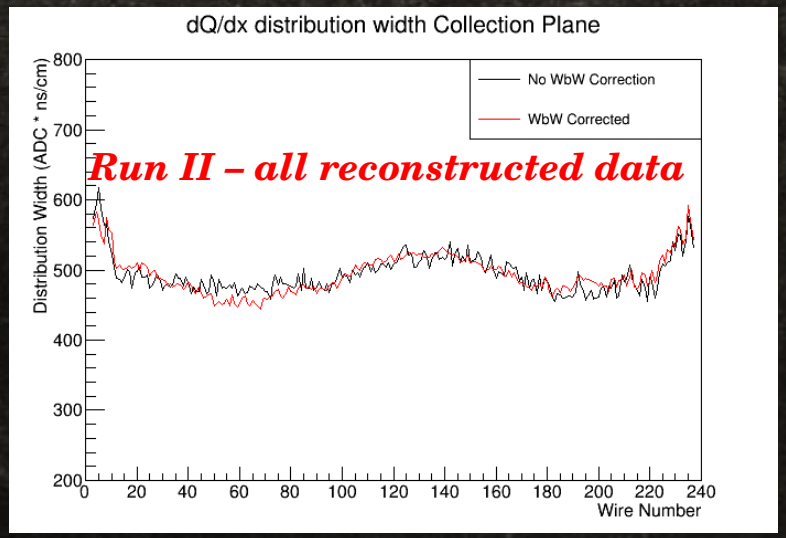
dQ/dx MPV relative variation: Run II vs Run I

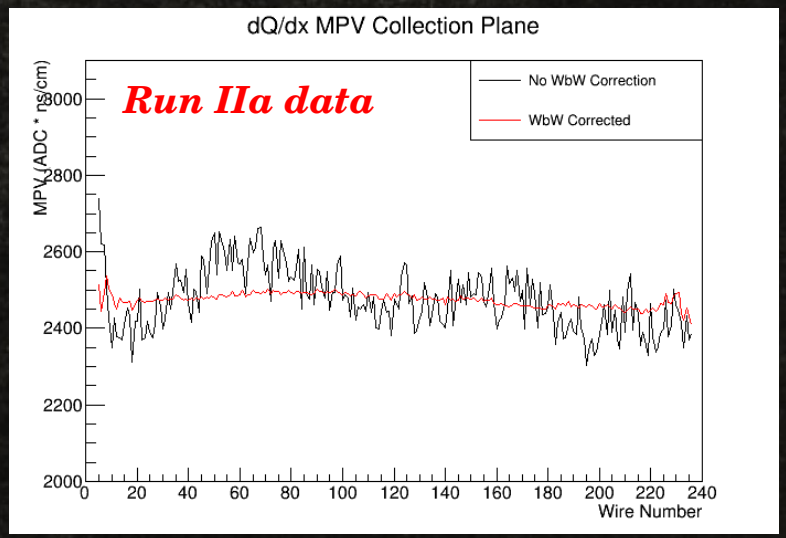


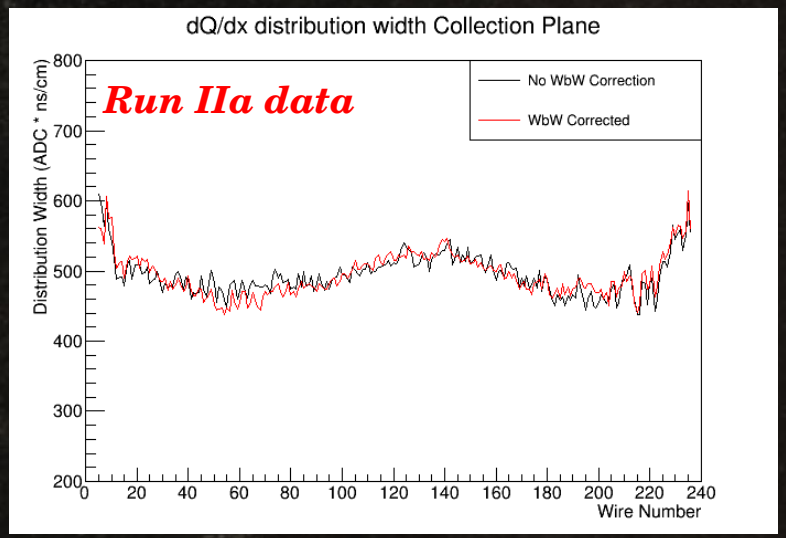
The inverse of the quantity in the Y axis gives the correction factors for Run II

dQ/dx MPV for Run II with/without applying correction

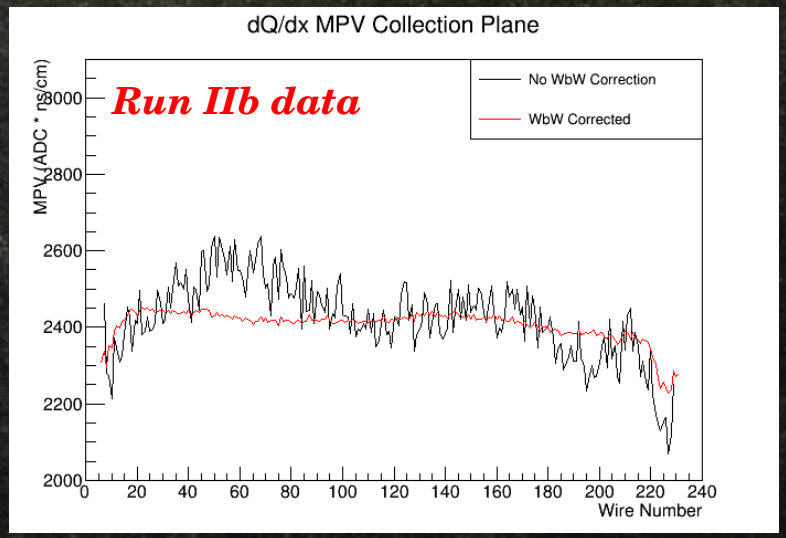


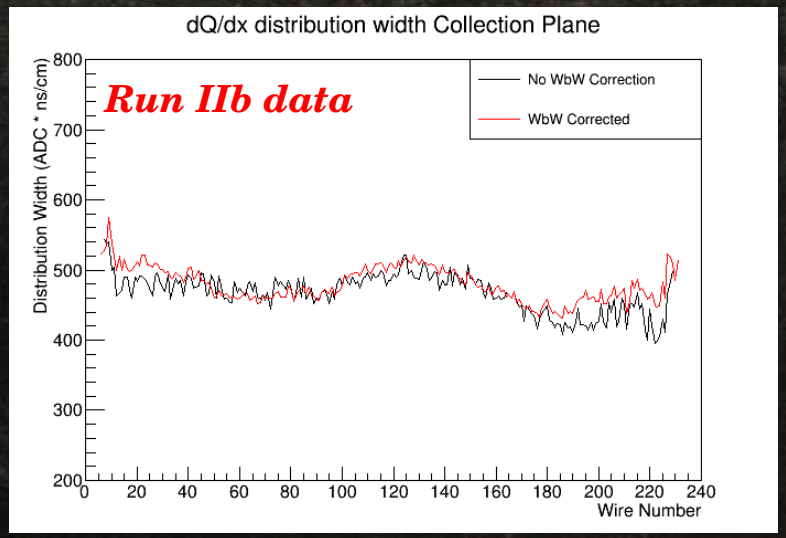


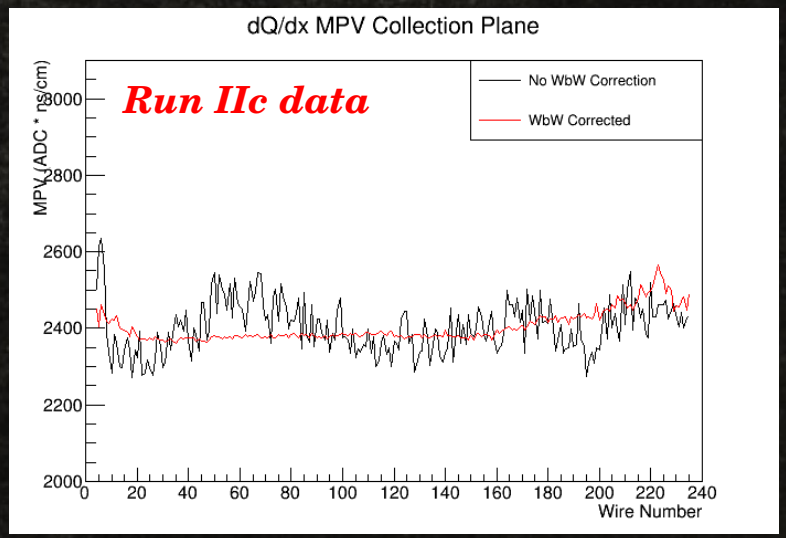


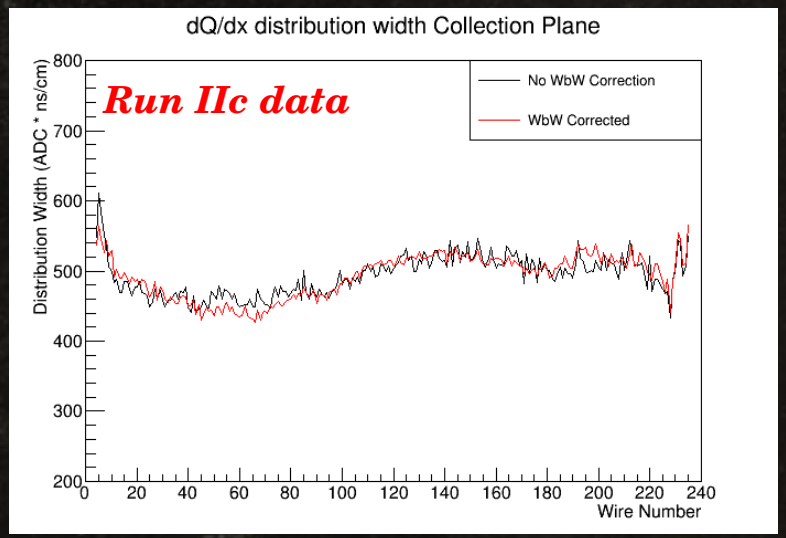


dQ/dx MPV for Run II with/without applying correction









In conclusion

- I calculated the wire correction factors for Run II and sent to Tingjun
- Tingjun created a new fcl file to reconstruct data, *JobConfigurations/Reco_run2.fcl* which uses the new correction factors. This fcl file ***should be used to reconstruct Run II data***

Left to do

- Had a discussion with Mitch about the “low charge” hits seen in Run I (and not in Run II). Following that discussion, I'm starting to look at a subsample of these hits in the event display, hoping to find some hint to their origin
- Finish up the wire gain variation tech note and send it to the world of LArIAT!