Tuning TPC Digitizer

Andre Lebedev
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Summary of the Digitizer

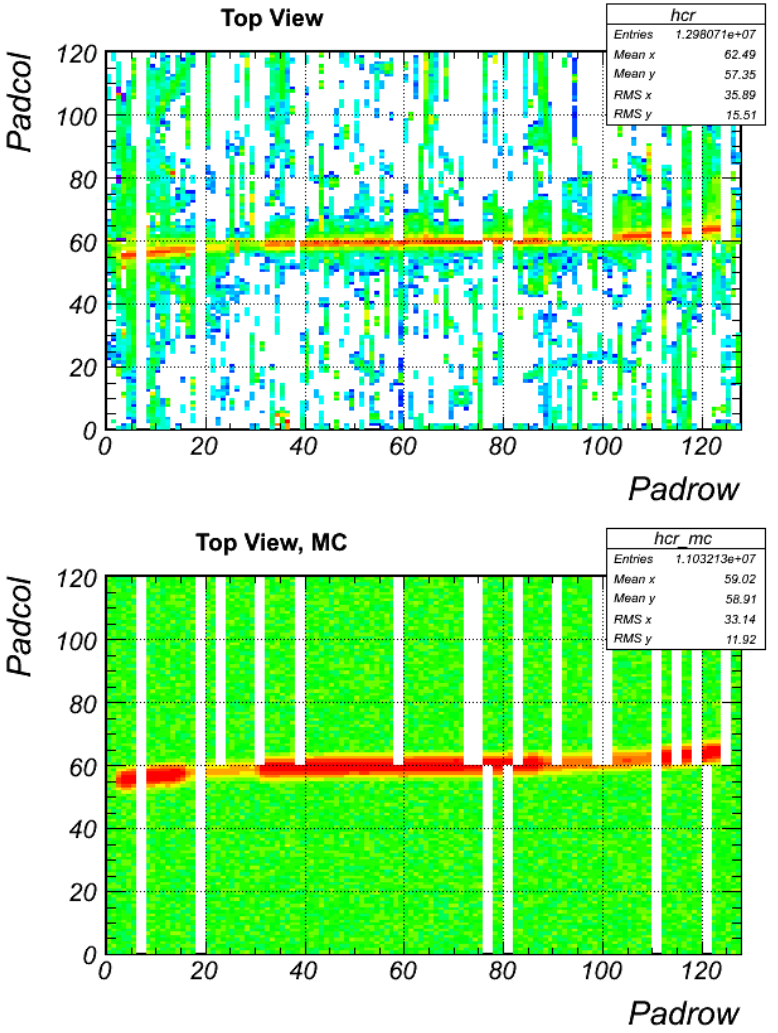
- Each GEANT hits is drifted to the pad plane
  - Long hits (>4 mm) are split into 2 hits
- Hit deposited energy is multiplied by appropriate anode section gain
- The signal is then shared between pads and voxels
  - Gaussian in X and Z
  - Gamma function in Y
- Total charge on each voxel is smeared by 1%
- Pedestal is added to each voxel with charge

Making it all look worse

- TPC raw data contains hot pads and voxels
  - These are in the digitizer per my estimate in run 15634
  - Important difference: in data the hot pads do not move, in TPCDigitizer they are random
- Dead sticks can have affect track finding and fitting
  - 22 dead sticks in run 15634 are turned off in the digitizer as well
  - These should ultimately come from DB so that operation conditions of a run can be better represented

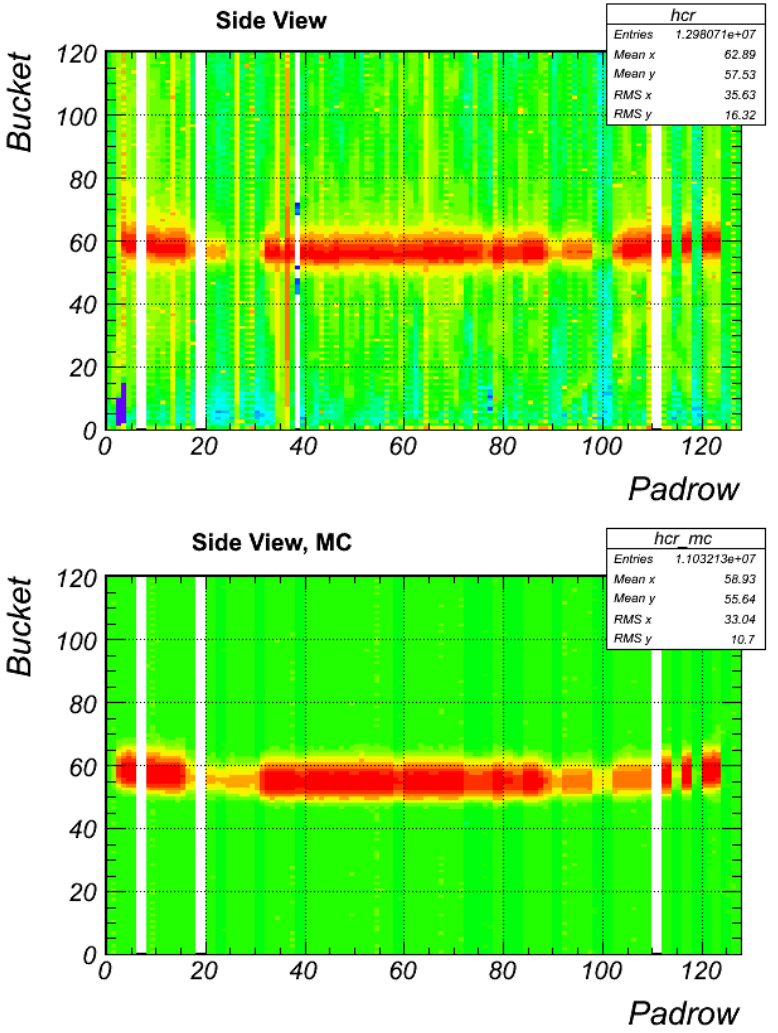
TPCDigiGain Module

- I began tuning MC with single-track 120 GeV protons
  - Should be ok for now
- TPCDigiGain makes a large ntuple for single-track events
  - Raw TPC data
  - TPCRTrack fit
  - Clusters from the track



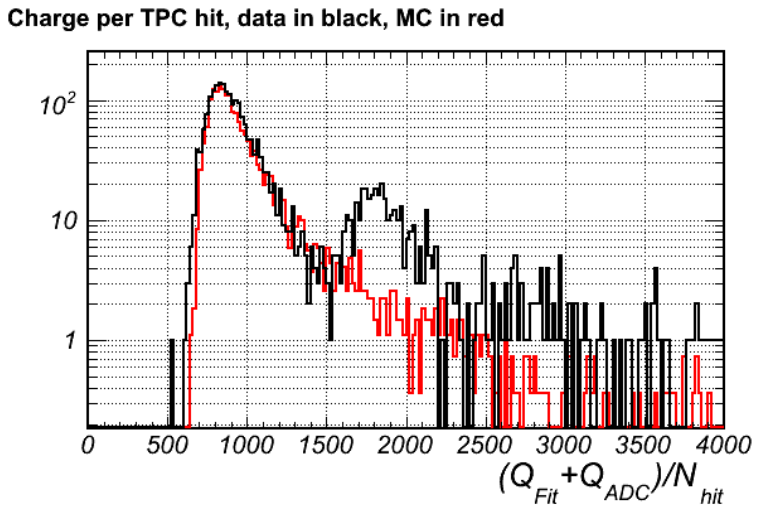
Differences in 2D Profiles

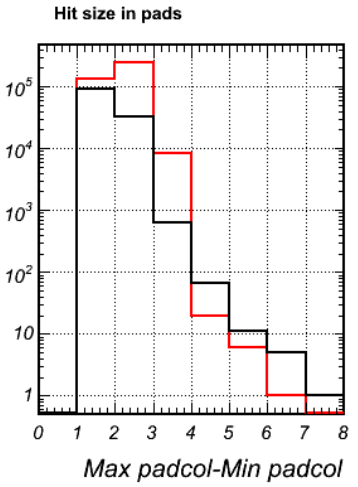
- This plot and the one before demonstrate that having “fixed” hot pads is different from having them jump around
- TPCReco ignores hot pads in any case, so it shouldn't matter much

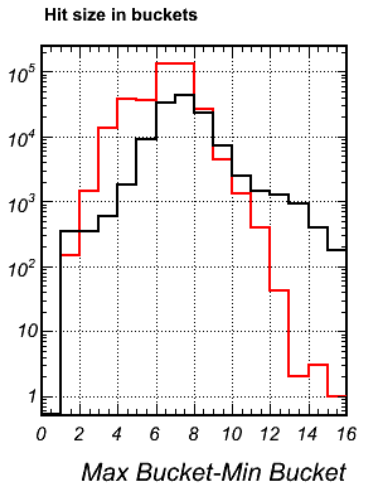


Hit Charge and Size

- On average the gain is tuned well
  - Cut on tracks with Q/N<1500
- Hit size in X is a bit too large in MC (easy fix)
- Hit size in Y doesn't have the tails we see in data (not-so-easy fix)

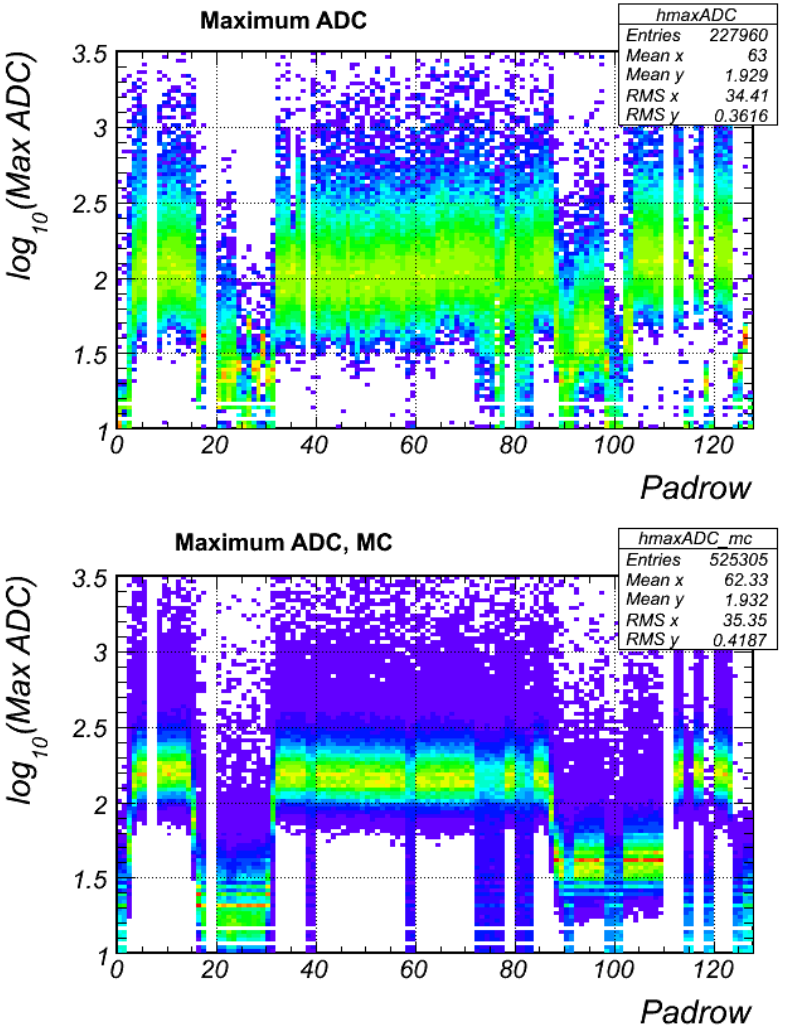






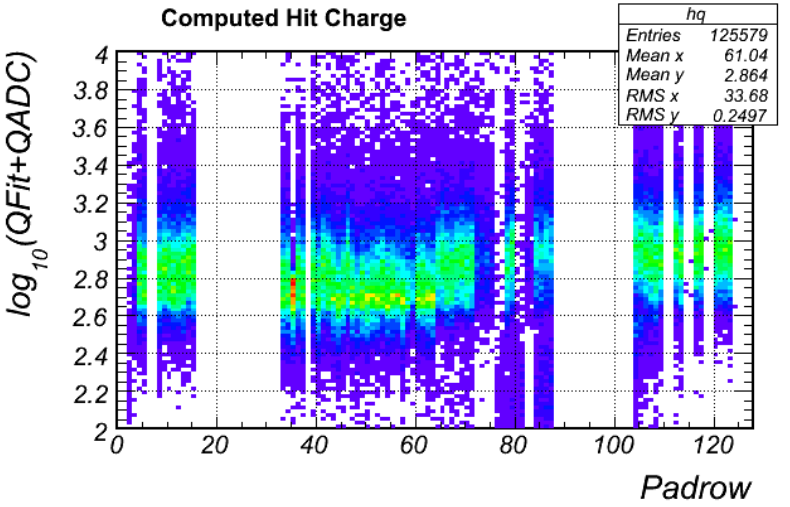
ADC Comparison

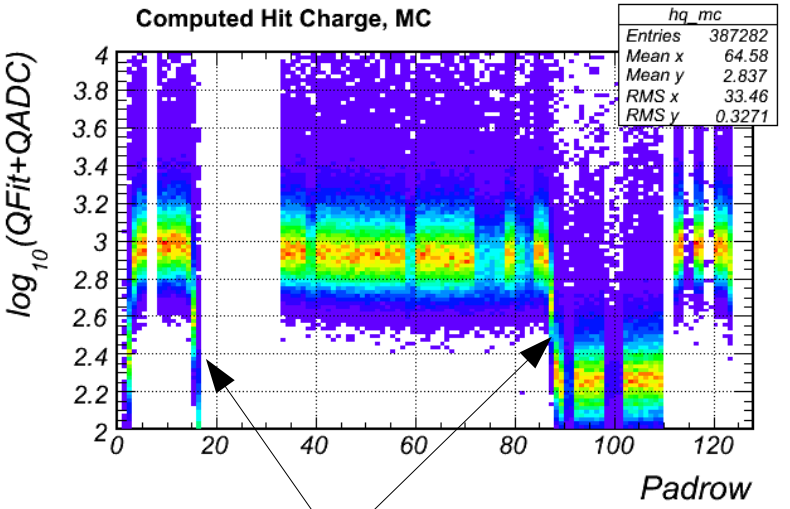
- I haven't spent much time introducing random gain variations, but that clearly needs some work
- Gain in padrows ~105 is down in MC because it was set based on a different run



ADC (cont.)

- Yet computed hit charge compares much better
- Order of magnitude for hit charge is similar, GEANT tails are a bit larger





This is due to a bug, it's fixed now

Summary

- TPC digitizer is in a usable state
- More tuning and coding is required to make MC look more like data
  - Tails in y are important
  - Why apparent discrepancy between max ADC and total ADC?
- Different run conditions are not automatically picked up
  - Dead sticks do vary from run to run