TPC gain study

Alice Offline Week
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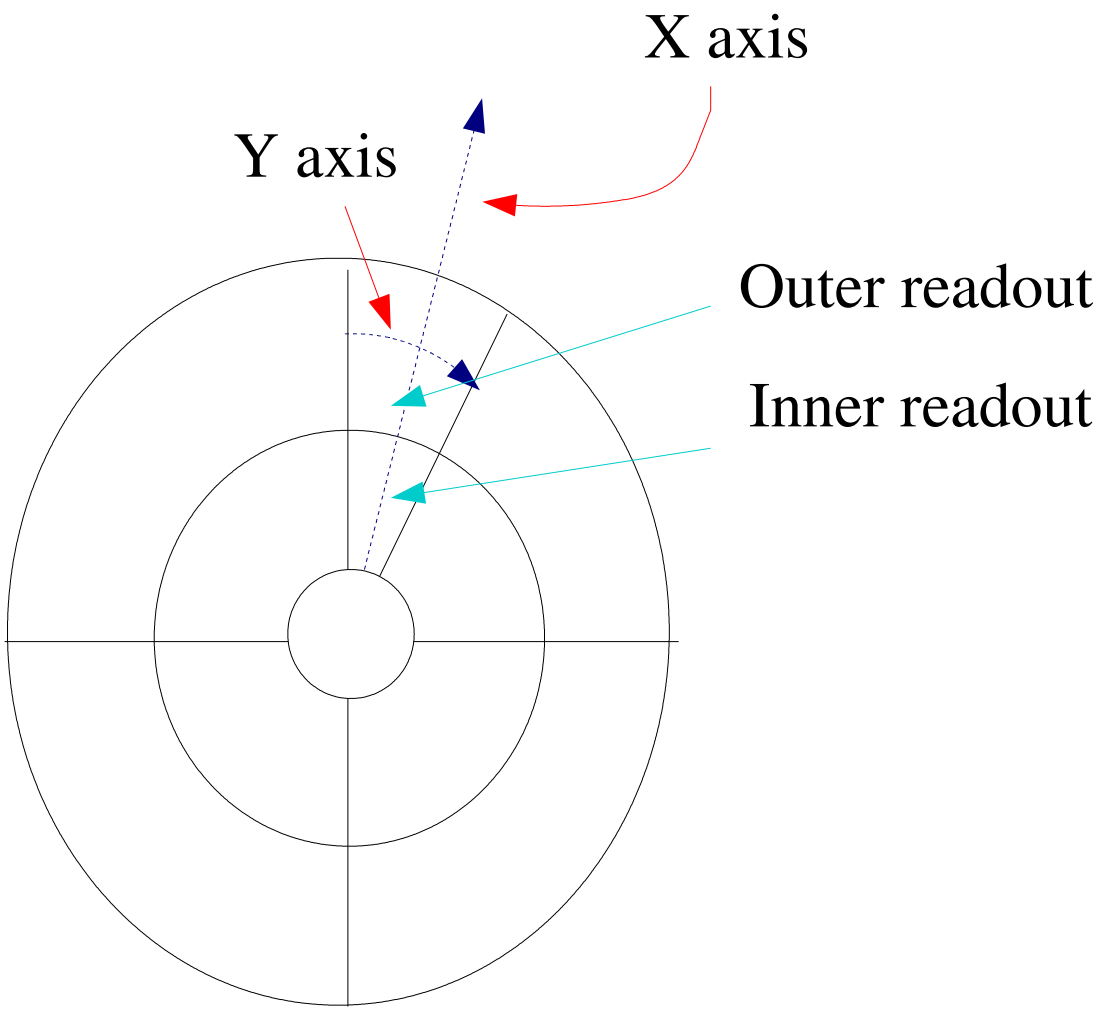
TPC Gain study

- Idea: investigate differences of TPC cluster charge depending on geometry
  - --> i.e. depending on underlying causes manifesting itself as apparently geometrical differences
- Based on simulated data (9760 pp events from PDC06)
  - to be compared with experimental measurements (simulated data useful for normalisations)
- Total charge per cluster histogrammed dividing each sector into 5x5 bins

TPC Geometry

- 18 sectors on each side (A + C)
- Each sector divided in inner (IROC) and outer (OROC) readout
- Z axis along beam direction
- X axis (local to each sector) outgoing track direction
- Y axis along readout plane



Drawing not to scale!

Binning

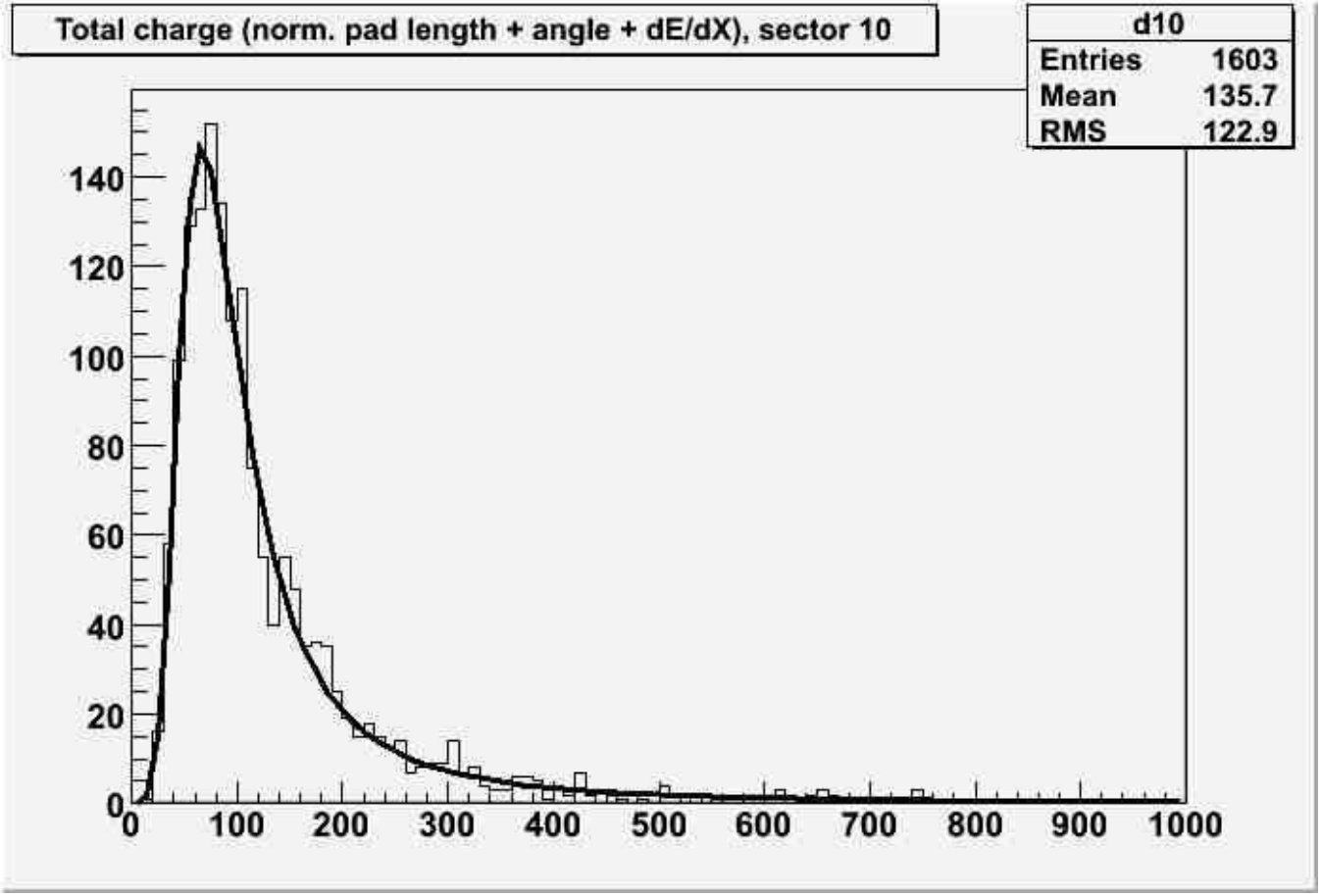
- Inner sectors:
  - 5 bins in x
  - 5 bins in y/x
- Outer sectors:
  - 6 bins in x (to ensure bin boundary where pad size changes)
  - 5 bins in y/x
- Z dependence:
  - 5 z bins averaged over complete (half) sectors in x,y

Cuts

- Clusters are obtained from tracks
- Selection cuts:
  - $p > 400$ MeV/c
  - $\theta < 1$
  - Number of clusters on track > 100

Charge distribution fit

- Landau fit to charge distribution in each bin
- Small statistics in some bins, but enough to see tendencies
- Landau parameters for each bin shown in following plots

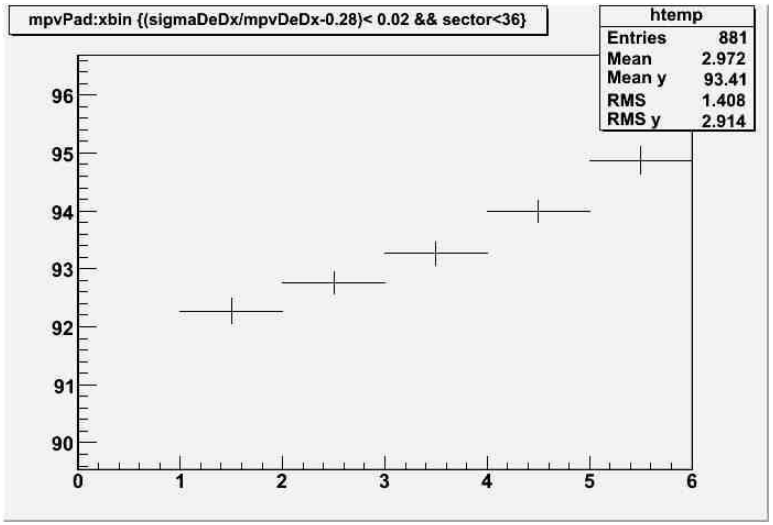


Cluster charge corrections

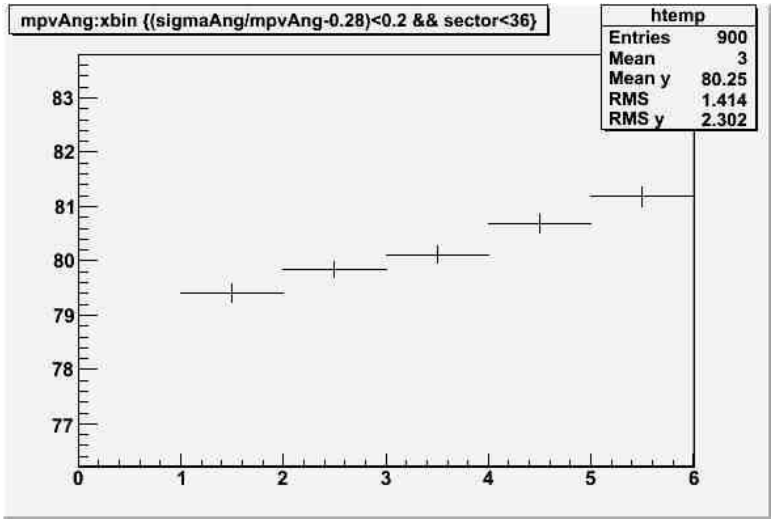
- Cluster charge has been corrected for
  - pad size differences in outer sectors
  - different track lengths inside cluster depending on track inclination angle
  - Bethe-Bloch dE/dx
    - assuming 85% π, 10% K, 5% p

Charge (most probable value): x dependence

- X dependence (profile)
- Inner sectors
- No cluster corrections

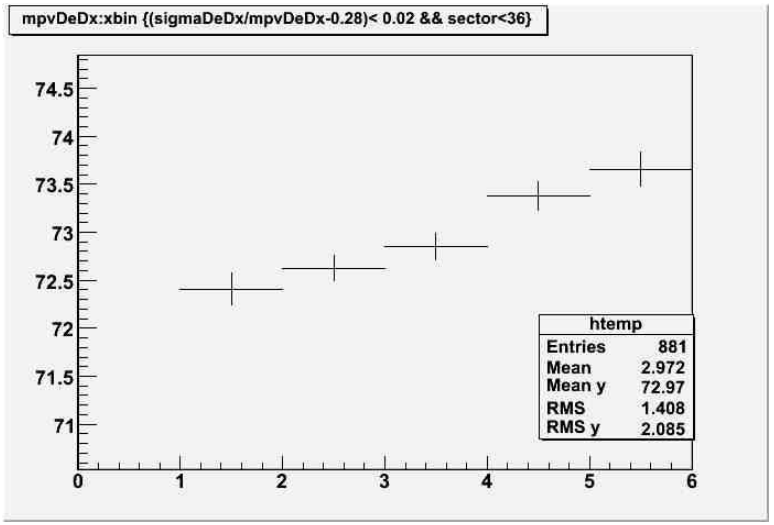


- Cluster charge corrected for track segment length inside cluster (track angles)



Charge (most probable value): x dependence

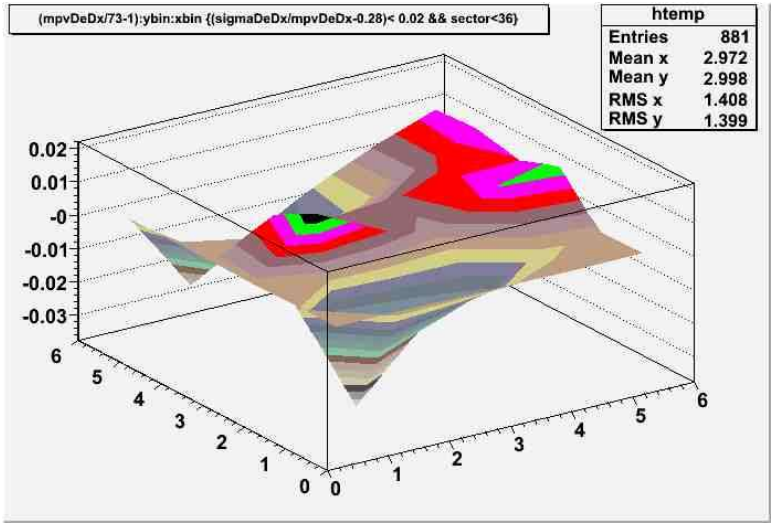
- Cluster charge corrected for angles and dE/dx
- Note different scale
- remaining systematic effect



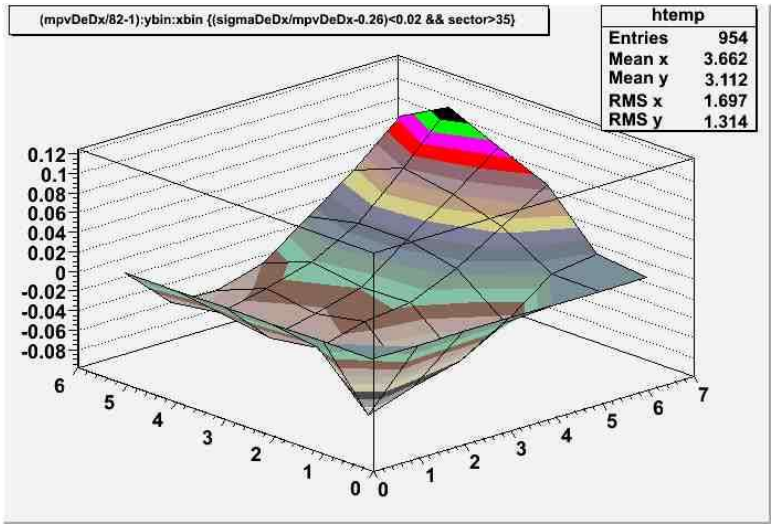
- Final histogrammed quantity:
  - $\mathrm{mpv}_{\mathrm{Landau}} = \frac{totalCharge}{padSize * \sqrt{1 + angle^2{}_y + angle^2{}_z} * (0.85 * BetheBloch_\pi + 0.10 * BetheBloch_K + 0.05 * BetheBloch_p)}$

Normalised y/x, x dependence

- Inner sectors
- Slight increase in x, irregular in y/x
- Differences at a level of a few %

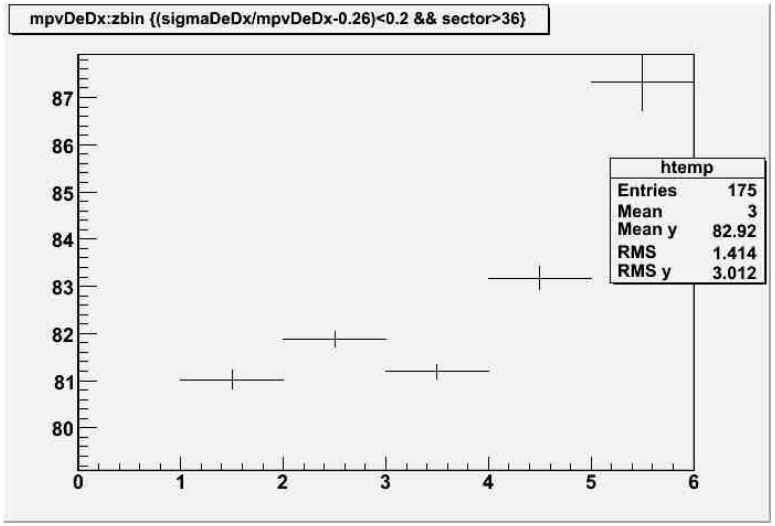


- Outer sectors
- Somewhat larger differences

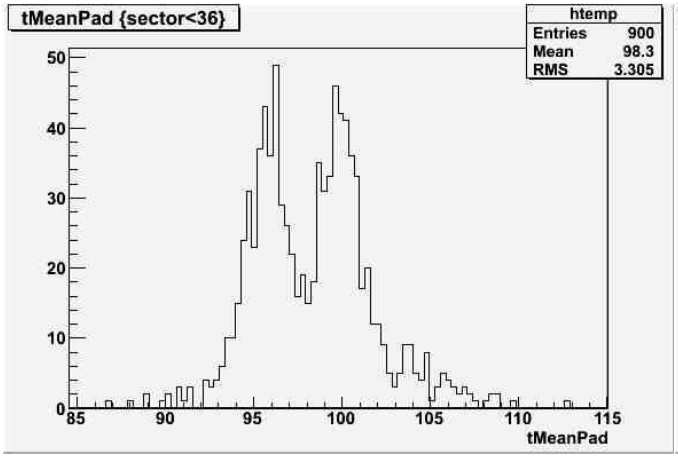


z dependence

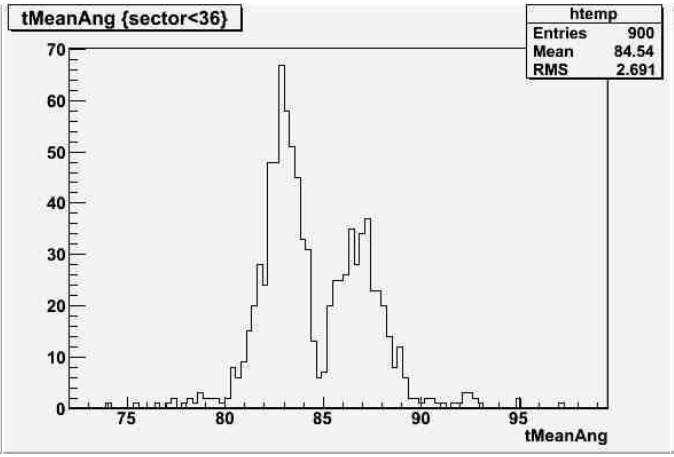
- Averaged over all y/x,x bins
- Outer sectors shown
  - too small statistics for outer z bins in inner sectors
- Compatible with a few % increase due to drift length/diffusion



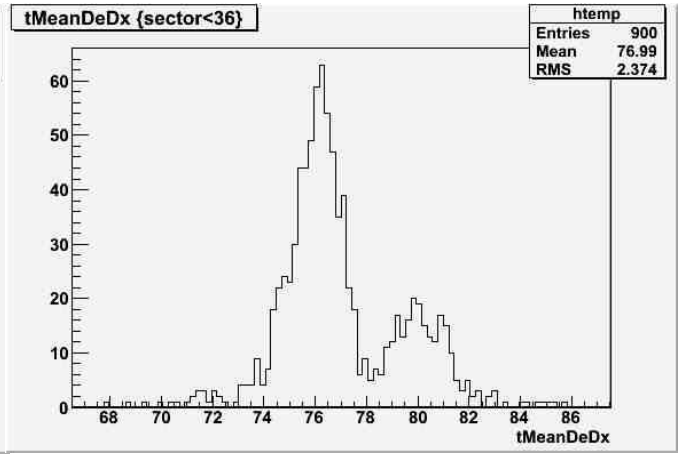
Truncated means



pad size corrected



pad size + angles



pad size + angles + dE/dx

- Inner sectors:
- Landau fits replaced by truncated means (60%)
- Second peak reduced by correction factors – still residual corrections to find

Conclusions

- Some effects/trends on cluster charge systematics can be seen in simulated data
- To be compared with measured data from commissioning
- Effects present in simulated data must be understood/normalised/ corrected for before raw data can be processed
- to be continued...