Space charge distortions in the TPC

David, Ernst, Jens, Ross, Hugo

Goals

Simulations of the TPC space charge distortions

Constraint from outer detector - define performance parameters

Workfest achievement

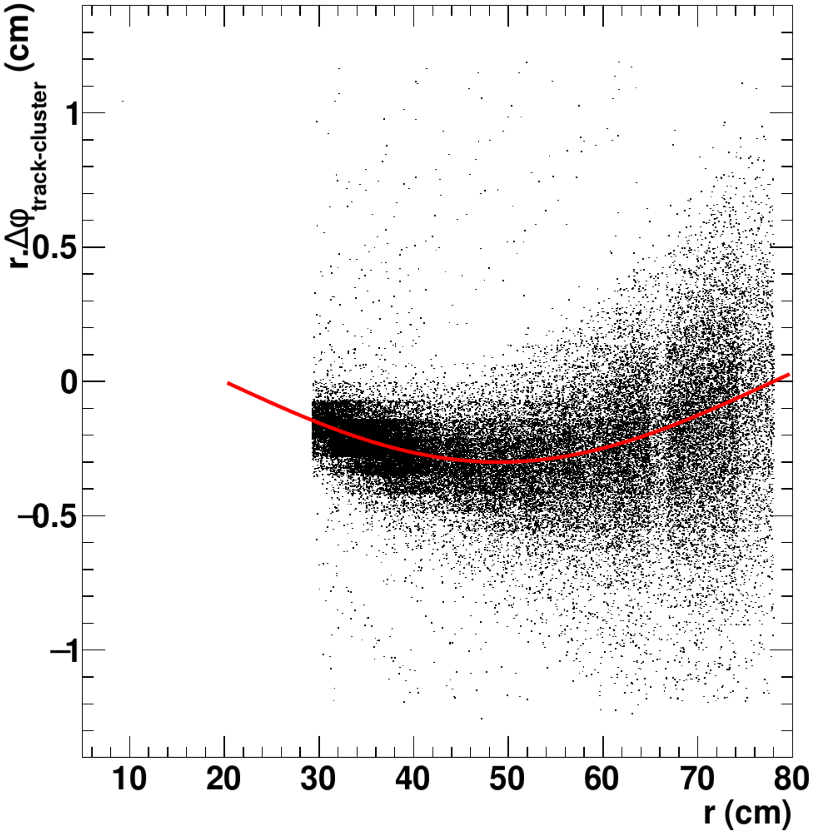
- fruitful discussions with ALICE experts

  How to define the granularity of the distortion map
  How to model the distortions in the simulations
  How to monitor the distortions (integrated digital currents, tracks, laser)
- setup (two) modules to include “ad hoc” distortions in the simulation chain, at either the electron drift level or at the cluster level
- start assessing the ability to recover these distortions from tracks

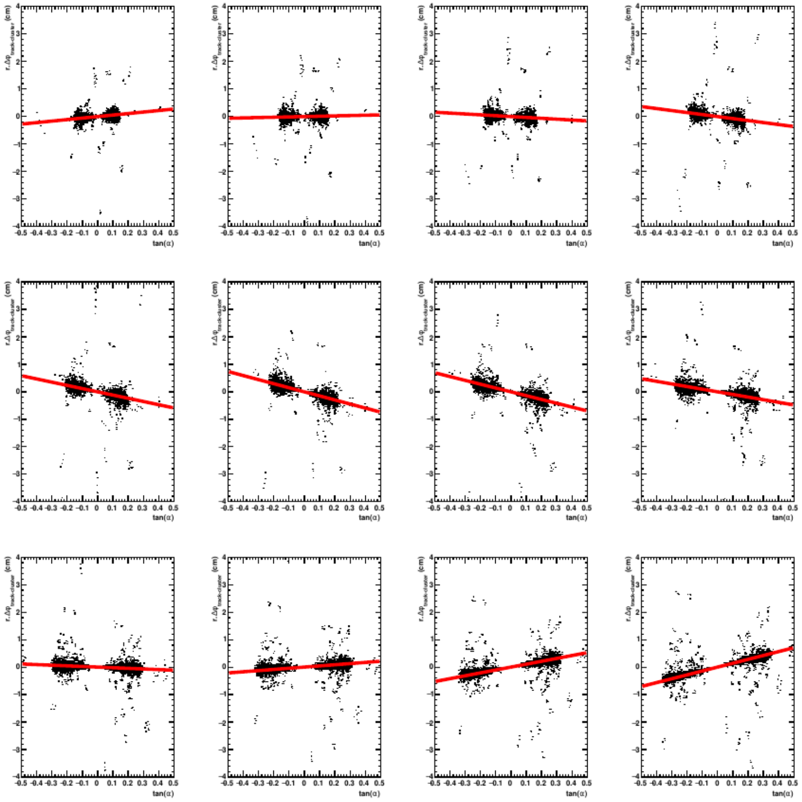
  (for now using truth track finding and single particle simulations)

Illustration

rΦ distortions



r distortions



Residuals (track - clusters) in the TPC qualitatively capture the input distortions

Quantitatively, need to run realistic simulations (Hijing), get the with of the distributions, see how many tracks are needed for a given detector configuration (with/without outer tracker)

Next steps

- Compare sPHENIX/ALICE computation of the distortions using same input charge density (Green functions vs numerical solution)
- Understand the gas parameters (ion drift velocity, deflection in the ExB direction) and measure
- Define the granularity of the calculated distortion map (WIP)
- Get a realistic space charge distortion map. Get a feeling of it’s lumpiness, and time variation (ALICE: ~5-10ms)
- Use realistic simulations to assess the ability to recover the distortions from tracks, with/without an outer tracker
- Estimate how many track are needed, and corresponding integration time
- Work on a global minimization implementation of the distortions ala millepede (also used for alignment)