TPC Calibration

- Calibration vs. alignment
- V_{drift} calibration
- ExB
- Calibration of the electronics
- Plans

It is difficult to decouple the TPC alignment from the calibration

The distortion in z-coordinate can originate from both – the temperature gradient (V_{drift}) and the misalignment in z

The misalignment of the TPC in the magnet:

- for the TPC itself – calibration problem ExB
- for the external trackers – alignment problem

Drift velocity

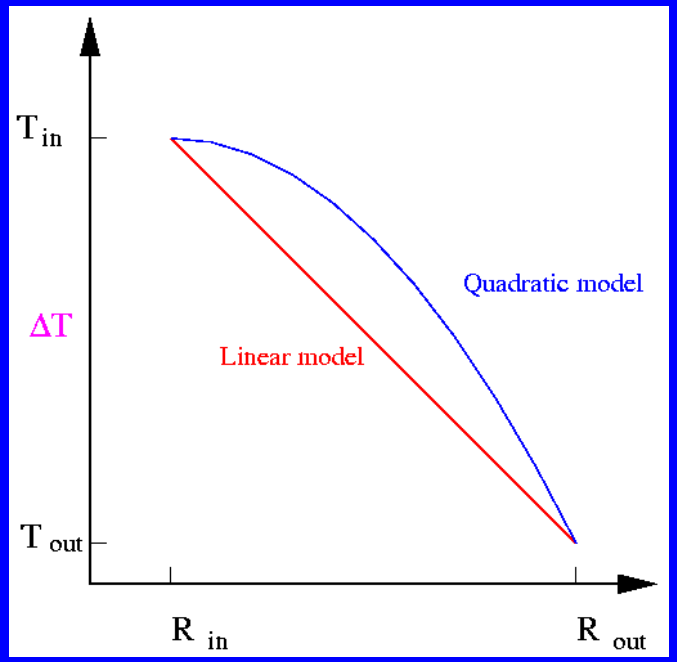
Drift velocity is sensitive to the temperature

For E = 400 V/cm $\Delta V_{drift}/V_{drift}$ = 0.34% per 1 deg

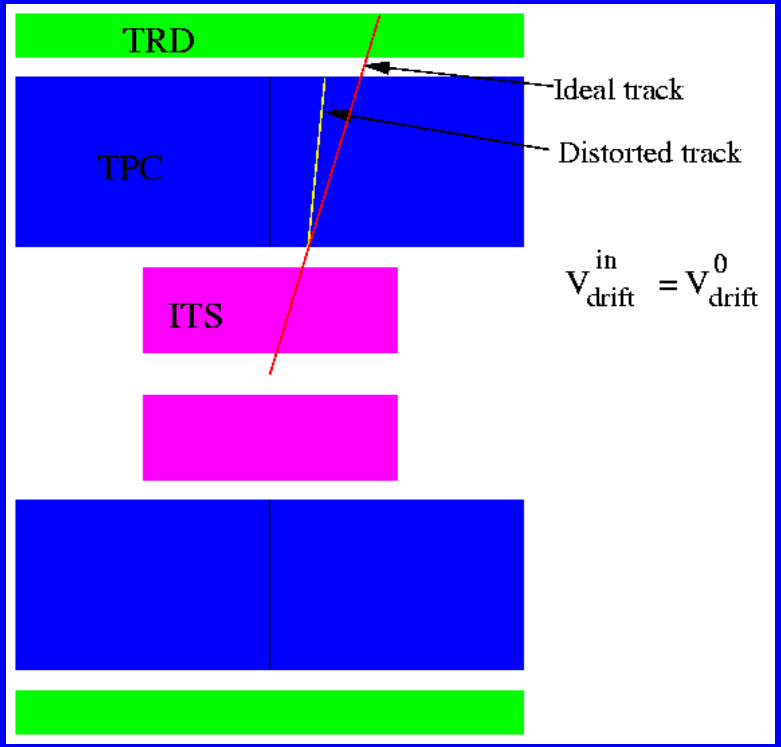
For 0.1 deg gradient ΔZ = 850μm (L_{drift} = 250 cm)

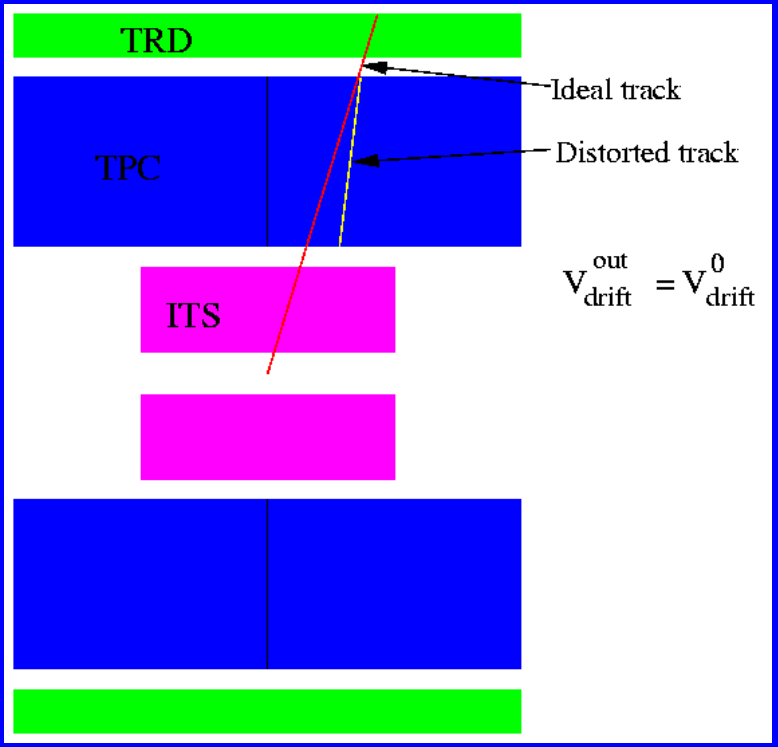
$T = T(R,\varphi,Z)$

One needs a temperature map



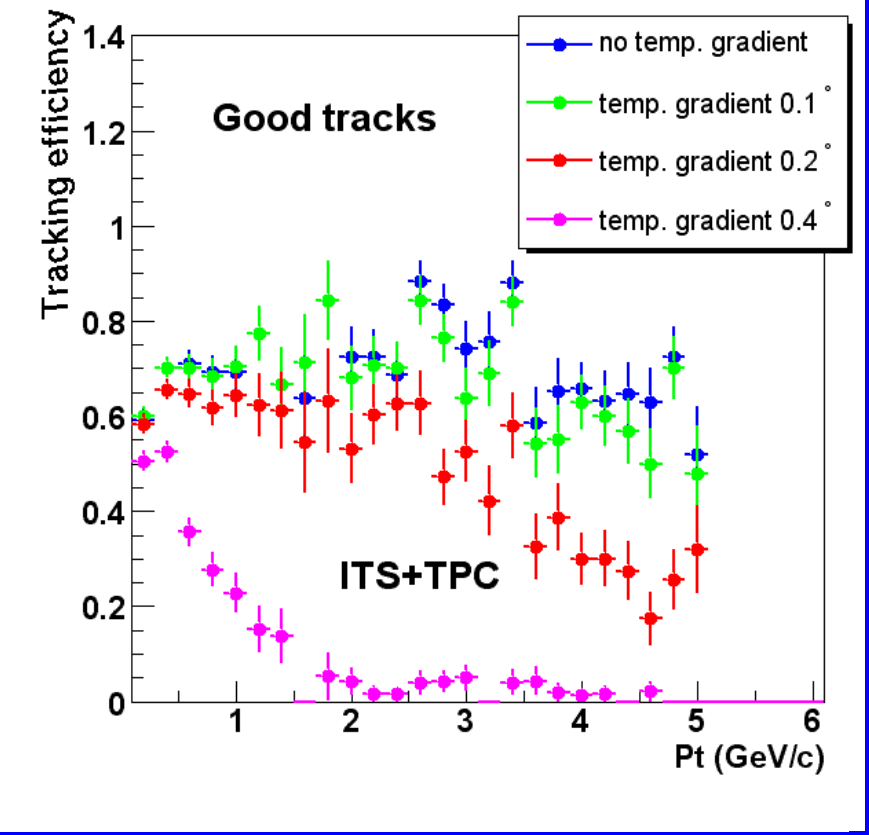
Two simple models tried

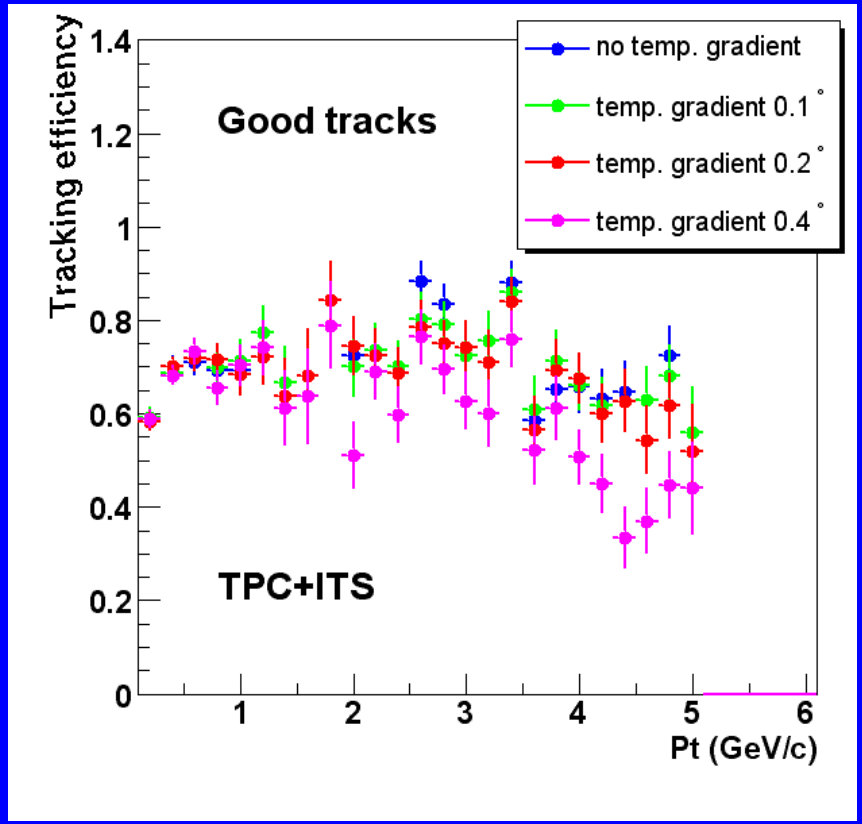




If the temperature behaves linearily, the tracks in the TPC are not affected, but the mathing to the other detectors is, in any case.

Linear vs. quadratic model, V_d normalization at the inner radius

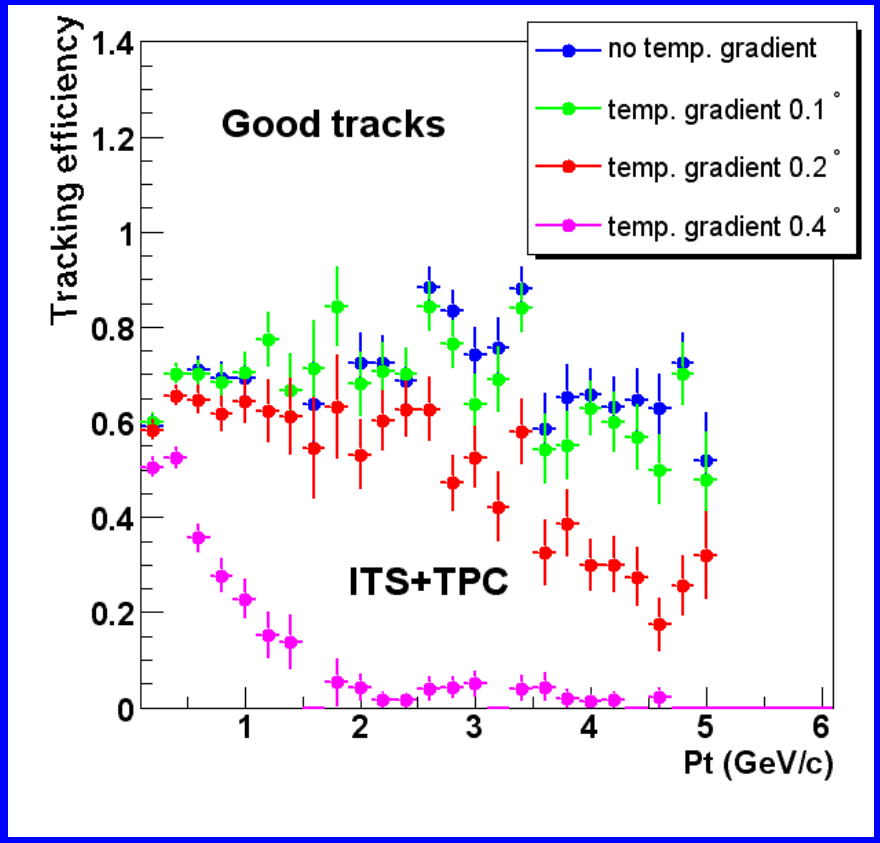


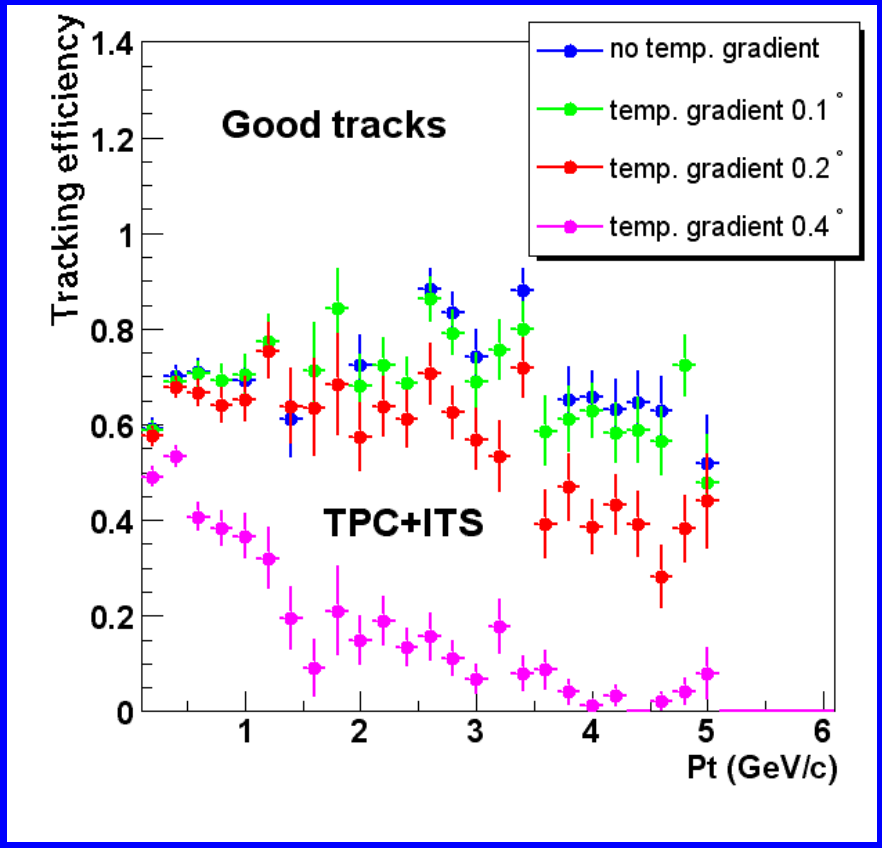


Linear model

Quadratic model

Linear vs. quadratic model, V_d normalization at the outer radius





Linear model

Quadratic model

What do we need?

- measured drift velocity, external T, preassure
  – from the CDB, measured once a day
- temperature gradient map or V_{drift} corrections

How to get this map (correction table)?

From the data? (z-distribution)
From the temperature probes? (400)

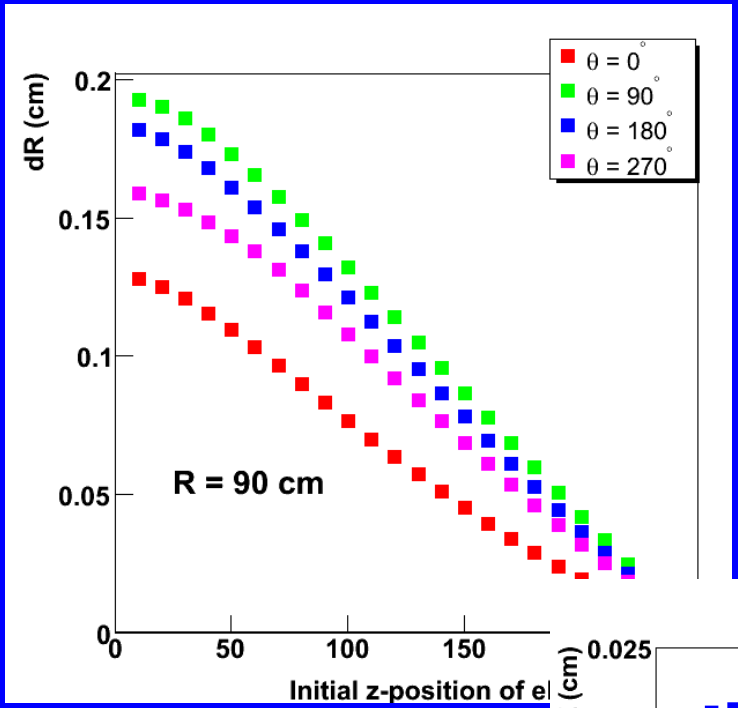
Update frequency – we do not know exactly, but rather infrequently

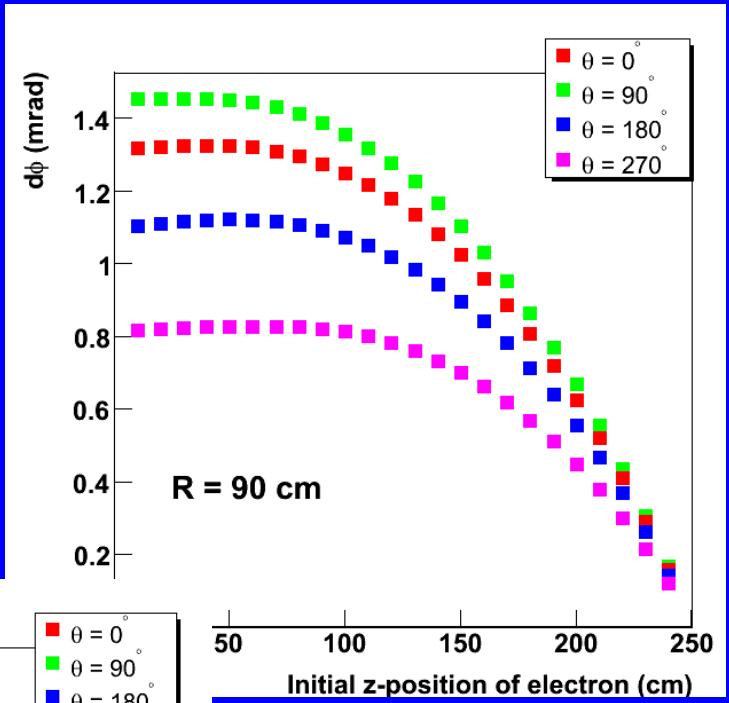
ExB distortions

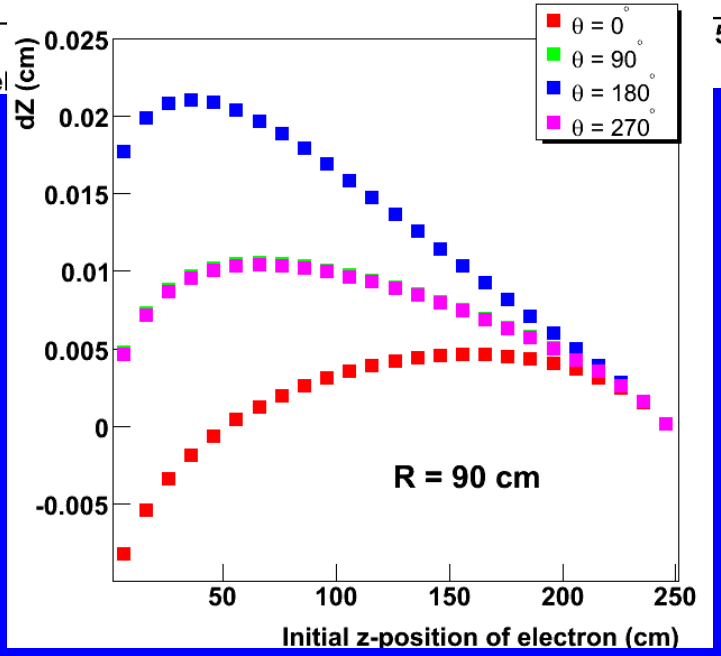
Even with the ideal alignment we have:

- Nonuniform magnetic field
  - ✓ L3 filed has the radial component
  - ✓ LHC is 30 cm above the magnet axis
- Space-charge inside the drift volume

Misalignment of the TPC inside the magnet creates additional radial E filed – larger distortions







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Marek Kowalski

Where to get the corrections from?

- laser tracks
- low multiplicity events in ion-ion interactions

Update frequency – this depends on the luminosity stability mainly. It can be on the run-basis in the best case, or on the event-basis in the worst case.

Electronics calibration

Each channel have to be calibrated individually

Method:

- Using the radioactive ^{83}Kr
- Using the data

Nothing decided yet – under discussion

Plans

One thing at a time:

1. Vdrift – the way to „decalibrate” the data known
2. ExB – more work, but we know how to do it
3. Electronics – when the decision comes

The reconstruction algorithms are not sensitive to points 1. and 2.