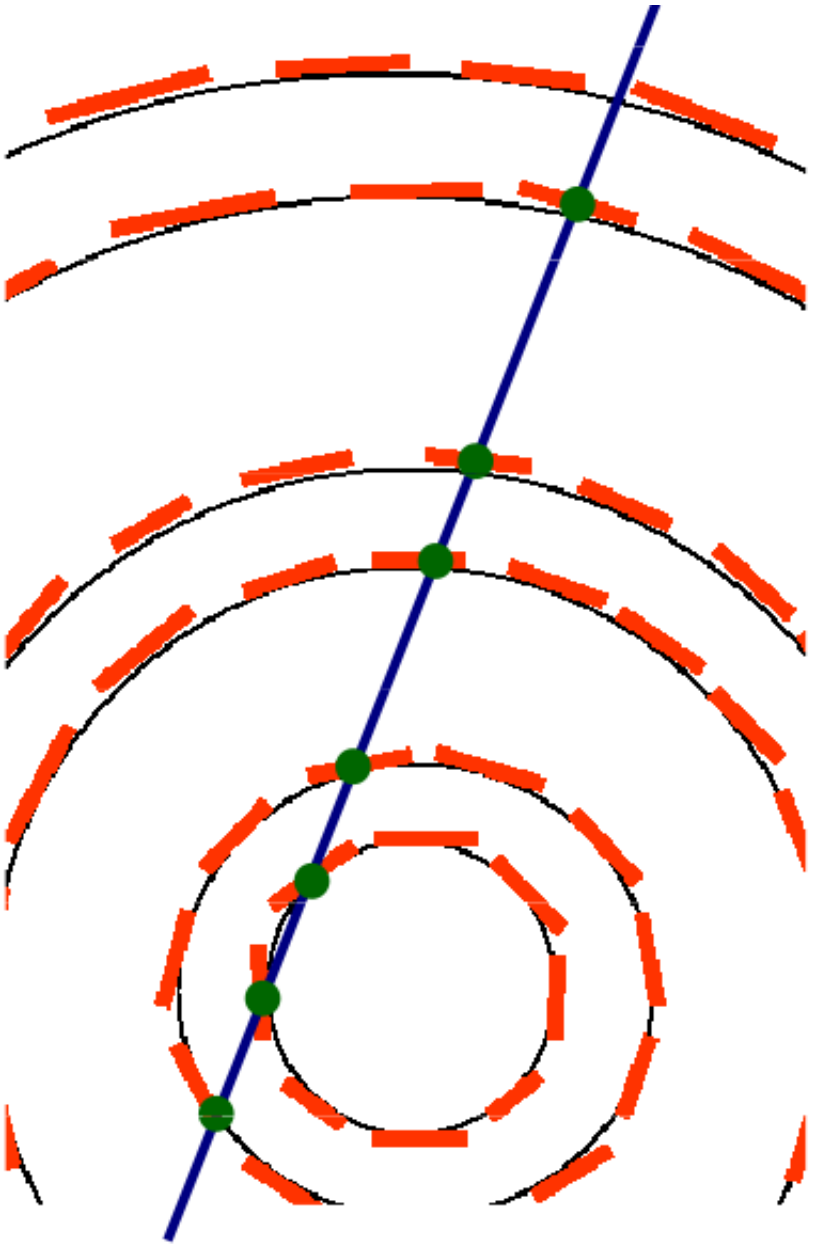
Alignment

Mikolaj Krzewicki
Nikhef/UU

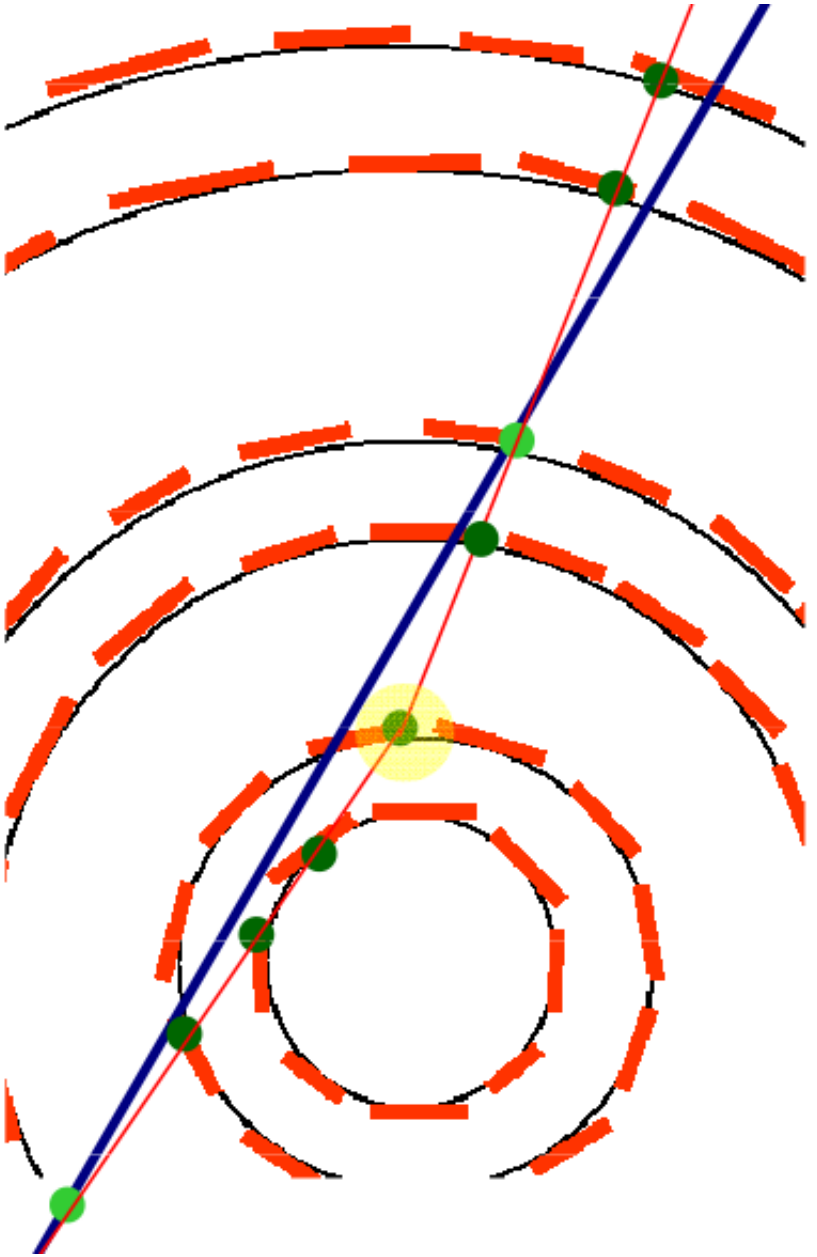
Ideal case

- Ideally the detector is built exactly to specifications
- Means the positions of the sensitive elements are exact to within resolution (~10micron)
- residuals=0



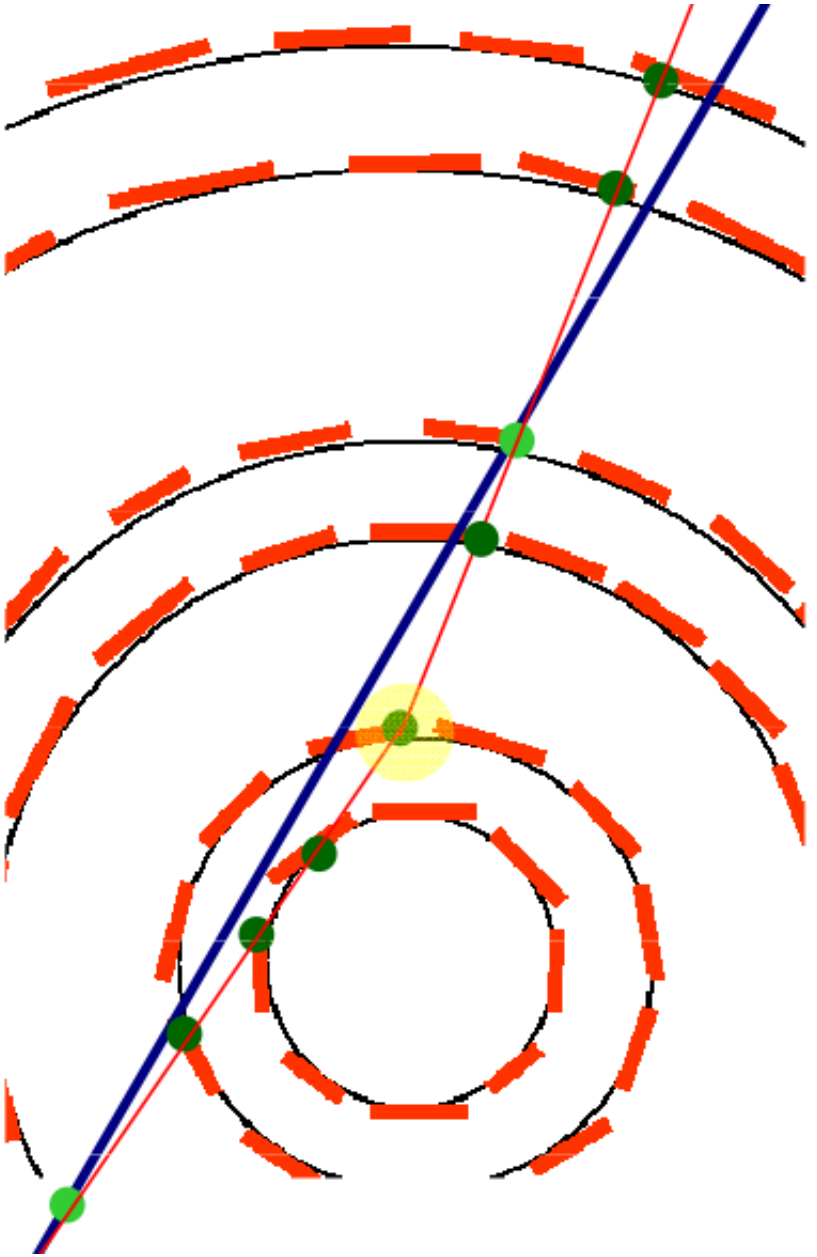
Real case

- Difficult to assemble within few tens microns tolerance
- Result: wrong track parameters!
- Residuals != 0
- Need to correct hit positions in software



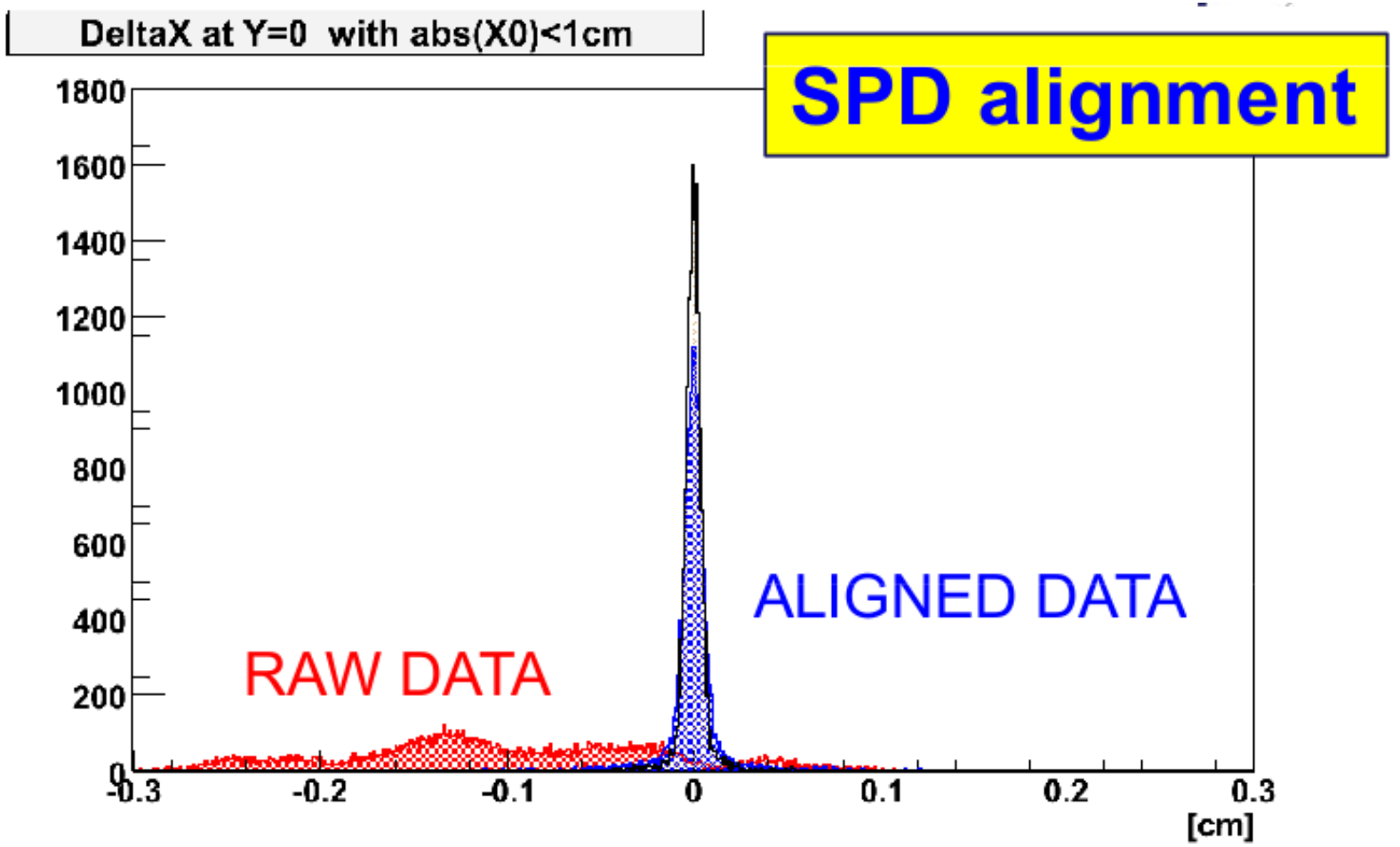
Real case

- Use data (tracks) to optimize
- Find alignment parameters to minimize some criterion (residuals)
- 6 parameters (xyzψθφ) per module
- Every track brings n=hits*6 parameters into the equation
- Constraints: not all parameters are created equal



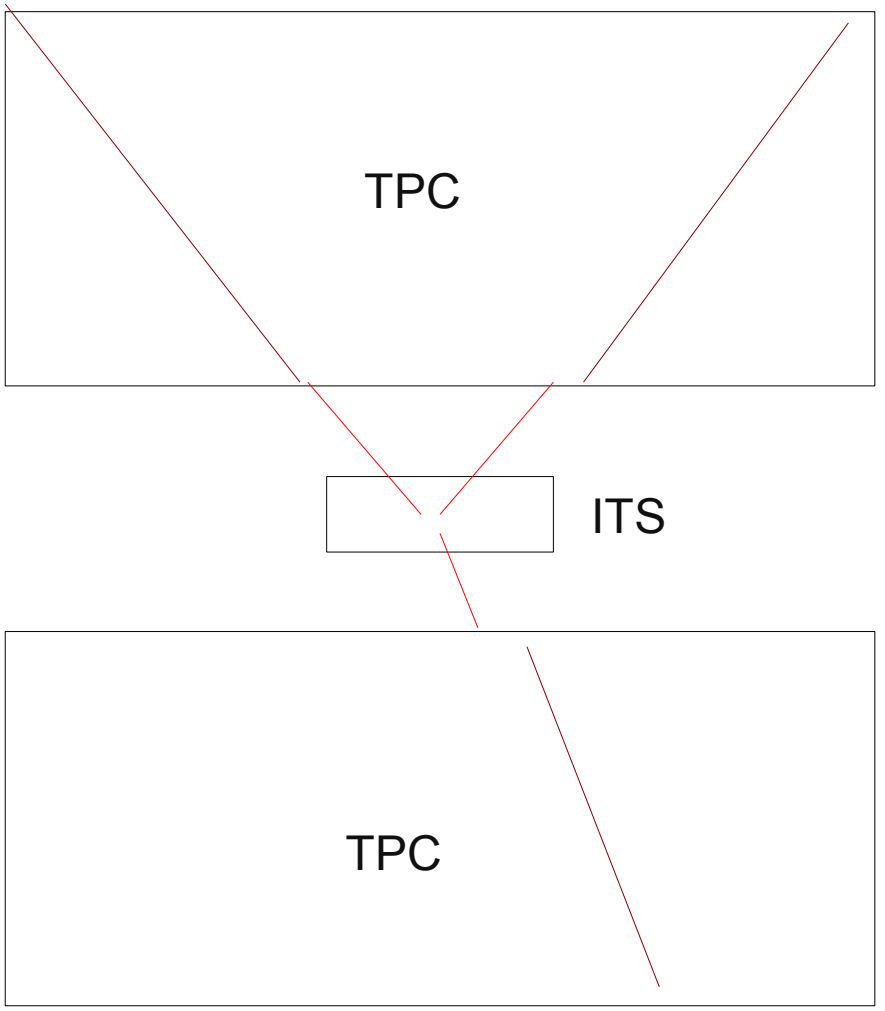
Real case

- Results Milepede algorithm



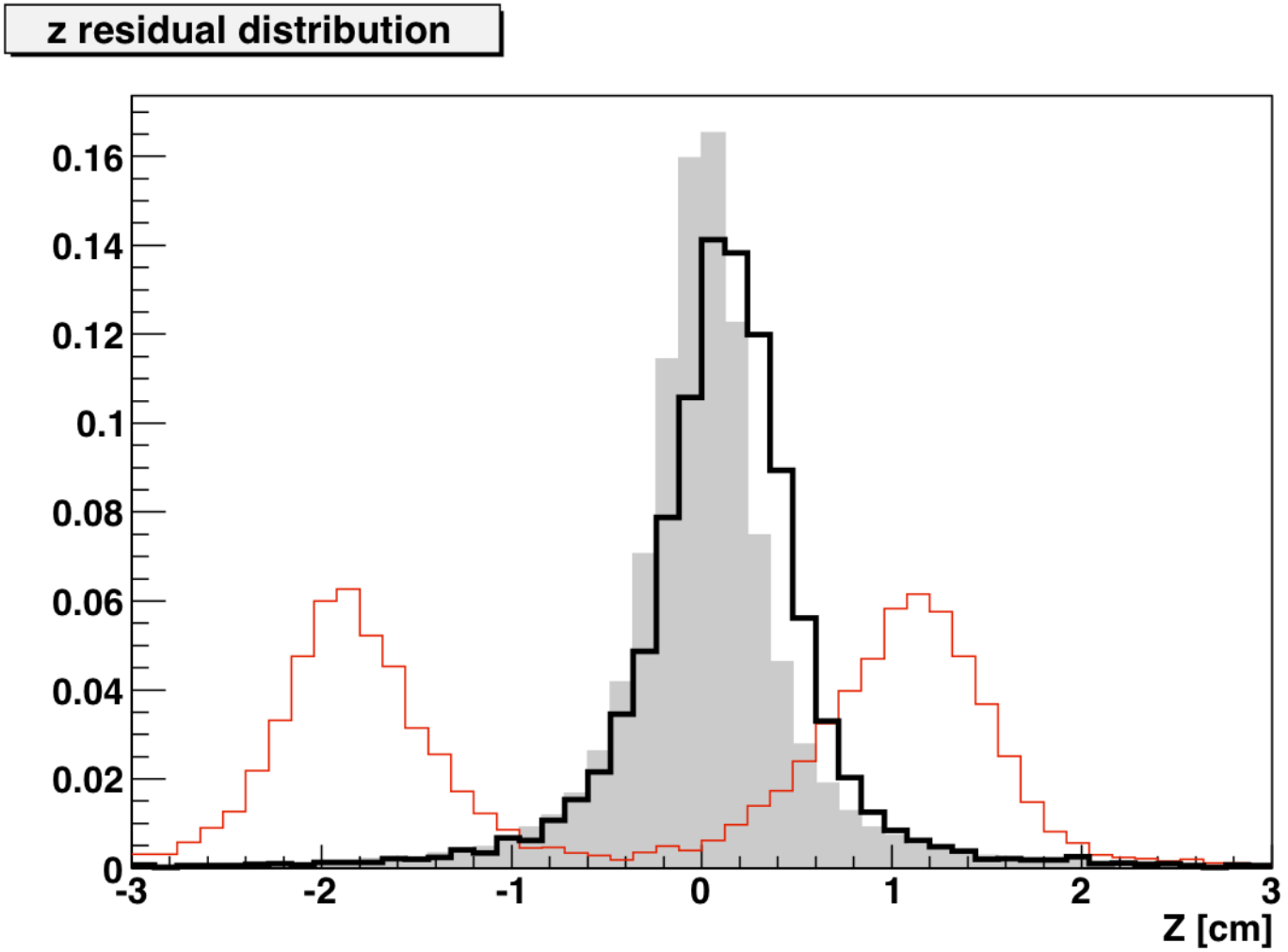
ITS-TPC relative alignment

- Detectors need to be aligned relative to each-other.
- TPC: z position of track depends on drift velocity – time dependent
- Use tracks to determine 6 alignment params + few TPC calibration parameters



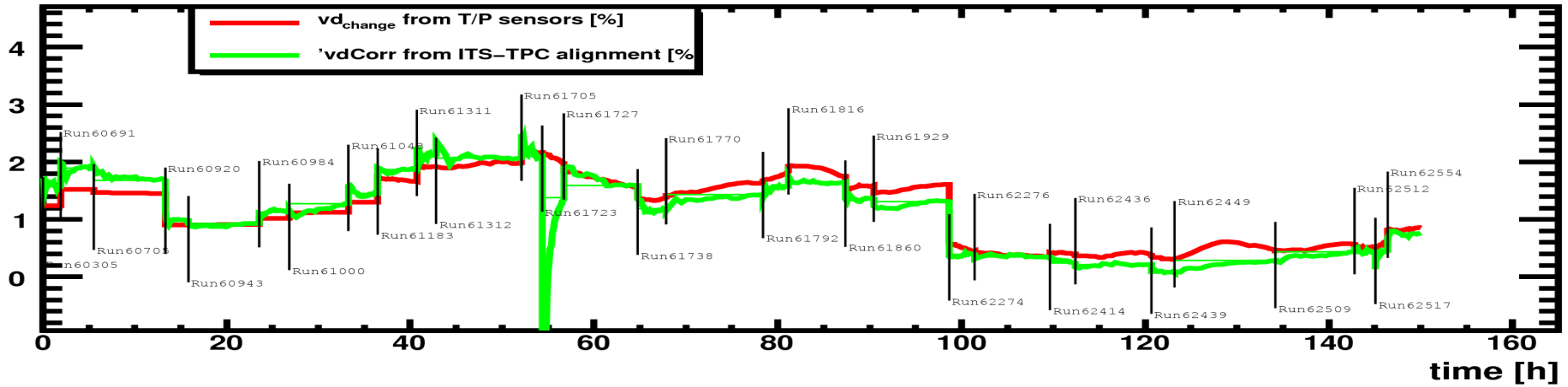
ITS-TPC relative alignment

- Before
- After
- Ideal



TPC calibration

- Using data we can follow the changes of the drift velocity



ITS-TPC alignment/calibration