FTPC Software Status Report

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for the STAR FTPC group

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People involved in software

M. Mora-Corall (post-doc):	calibration (drift monitor, etc.)
M. Oldenburg (post-doc):	tracking
J. Putschke (PhD student):	calibration (laser), cluster finder
F. Simon (PhD student):	embedding
J. Seyboth:	infrastructure, QA

Overview

- recent changes in our software (coordinate system, momentum fit, gain table, cluster unfolding)
- open questions (drift velocity calibration)
- What to do next?

Coordinate System Problem

- FTPC East/West are exactly the same regarding their hardware.

? How to count sectors and pads, in global or in local coordinate system?

- Something went wrong while FTPC people talked to DAQ people.

→ FTPC West: $x \rightarrow -x$

→ FTPC East: pads are counted in the wrong direction with regard to the sectors.

! Problem was realized (and fixed) by looking to laser tracks.

- $\vec{E} \times \vec{B}$ corrections were applied in the wrong direction.

→ FTPC West was ok ($x \rightarrow -x$).

→ FTPC East was wrong.

! Fixed. DCA and p_t distributions for FTPC East/West look similar now.

Momentum Fit

- Tracks inherit from StPhysicalHelix now.

$\rightarrow$ Residuals are very easily available.

$\rightarrow$ Vertex reconstruction with FTPC East/West possible.

$\rightarrow$ Errors of momentum fit are calculated using the cluster widths.

$\rightarrow$ χ^2 looks much better now.

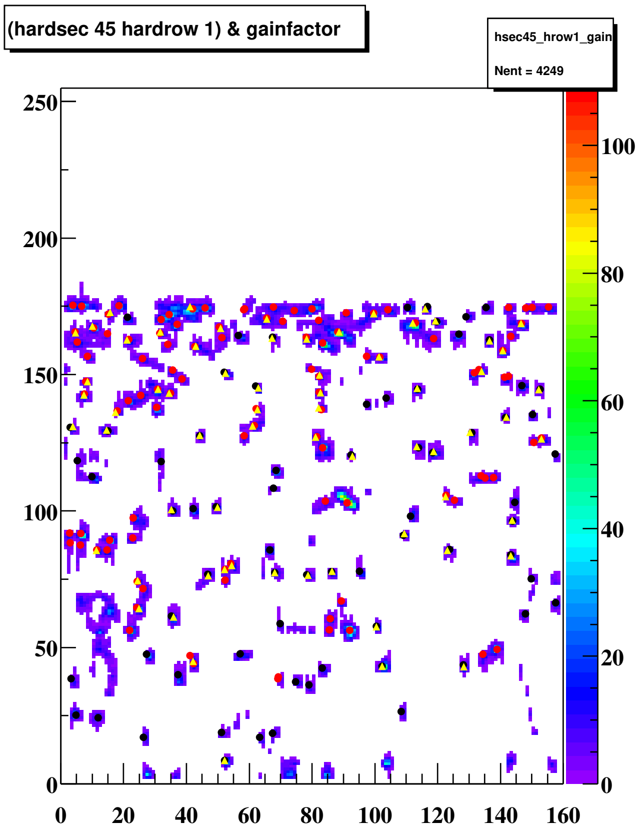
- Code cleanup $\Rightarrow$ momentum fit is two times faster than before.

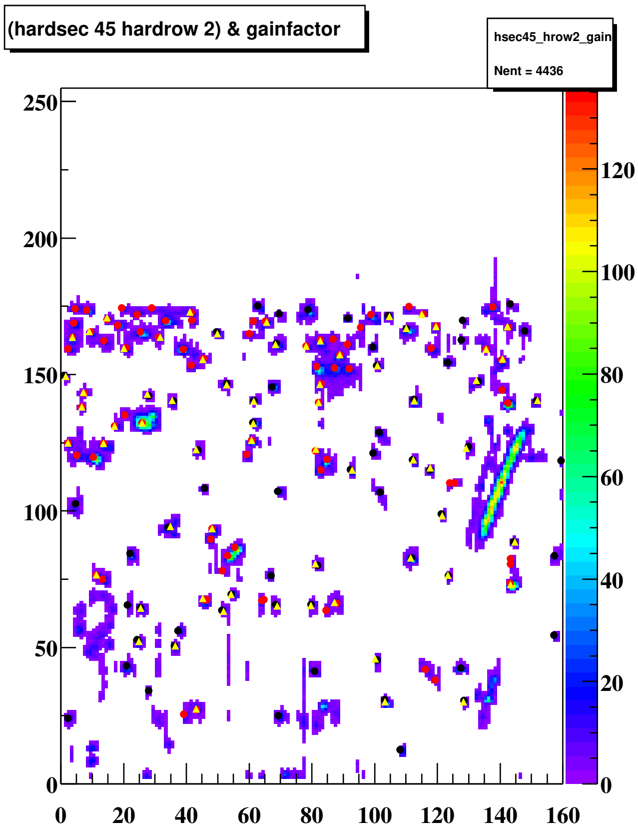
New Gain Table

- removal of noisy pads
- dead pads set to zero

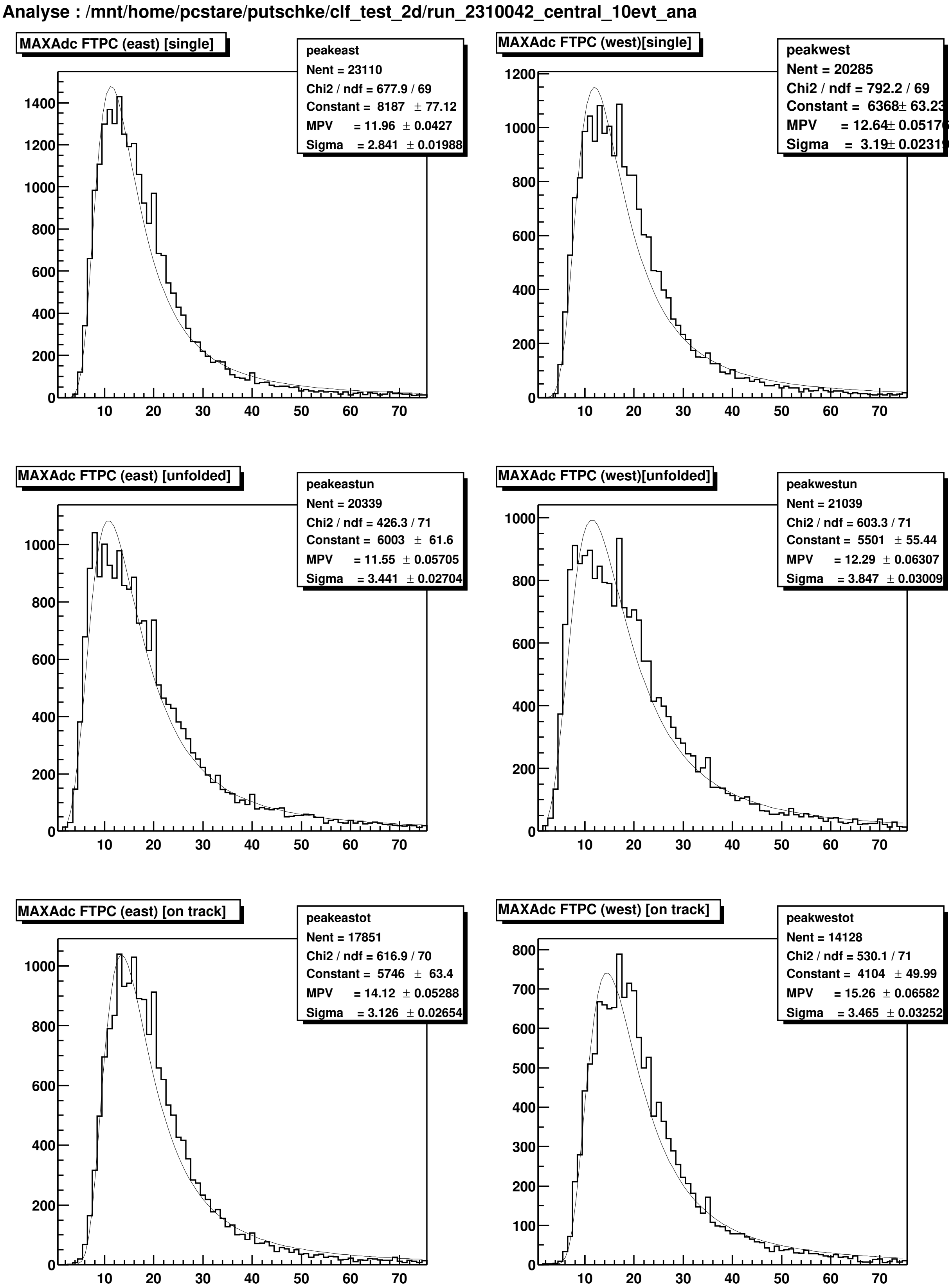
! Tracker has to be tuned to be able to treat missing points tracks in a better way.

Cluster distributions

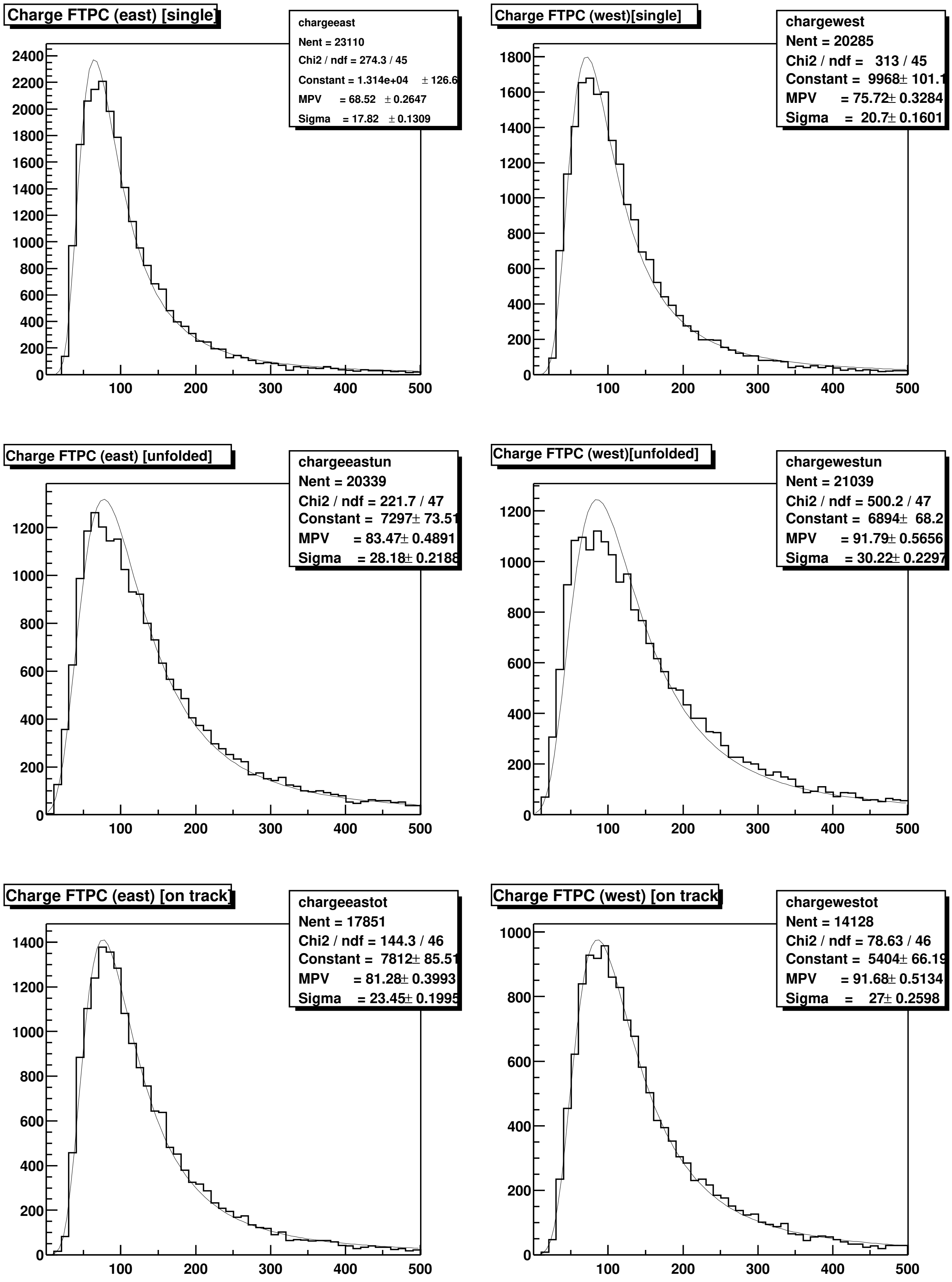




- cluster density is pretty high (up to 30 % occupancy) at inner radius
- unfolding procedure and geometrical cuts were refined

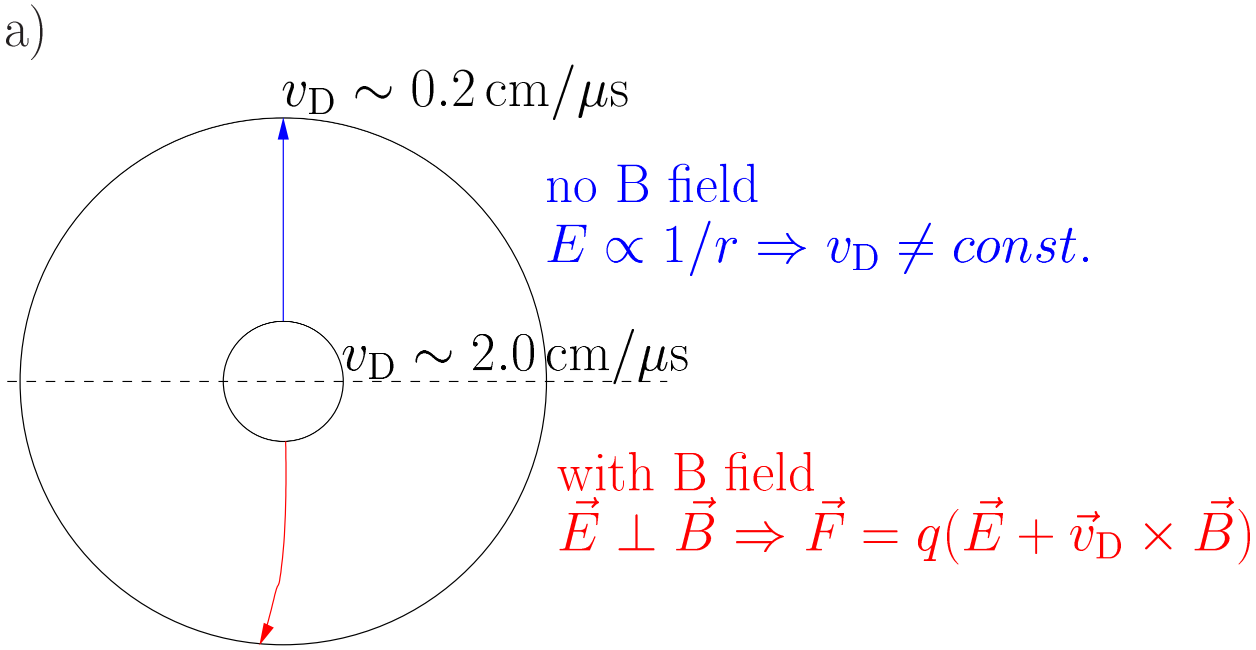


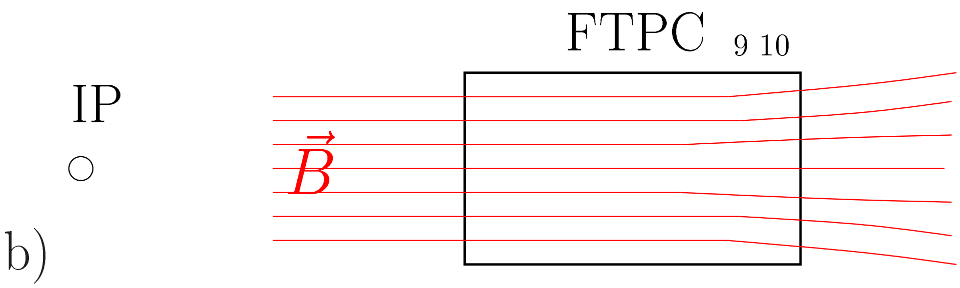
- maxADC distributions look like expected (Landau)



- charge distributions look like expected (Landau)

Specific problems due to radial drift



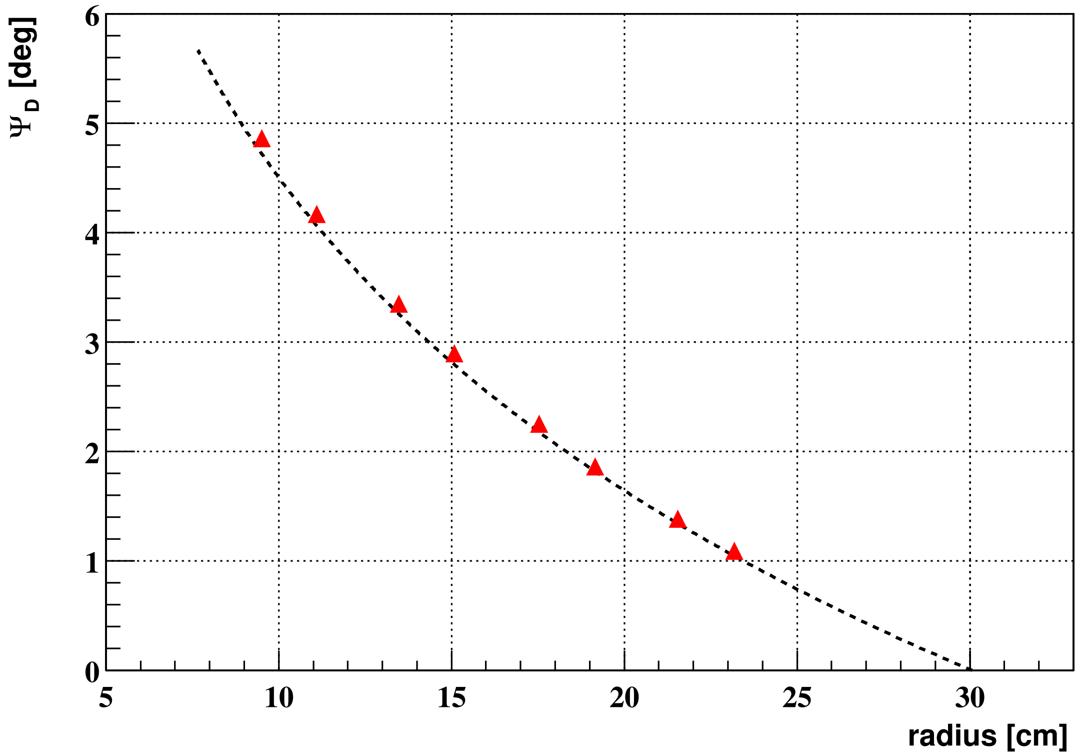


- drift velocity $\vec{v_{\mathrm{D}}}$ has to be known to about 0.1 % accuracy (to be able to get the momenta right)
- MAGBOLTZ calculations
- independent checks:
  - charge step
  - laser tracks
  - drift velocity monitors
  - vertex reconstruction

Does MAGBOLTZ do it right?

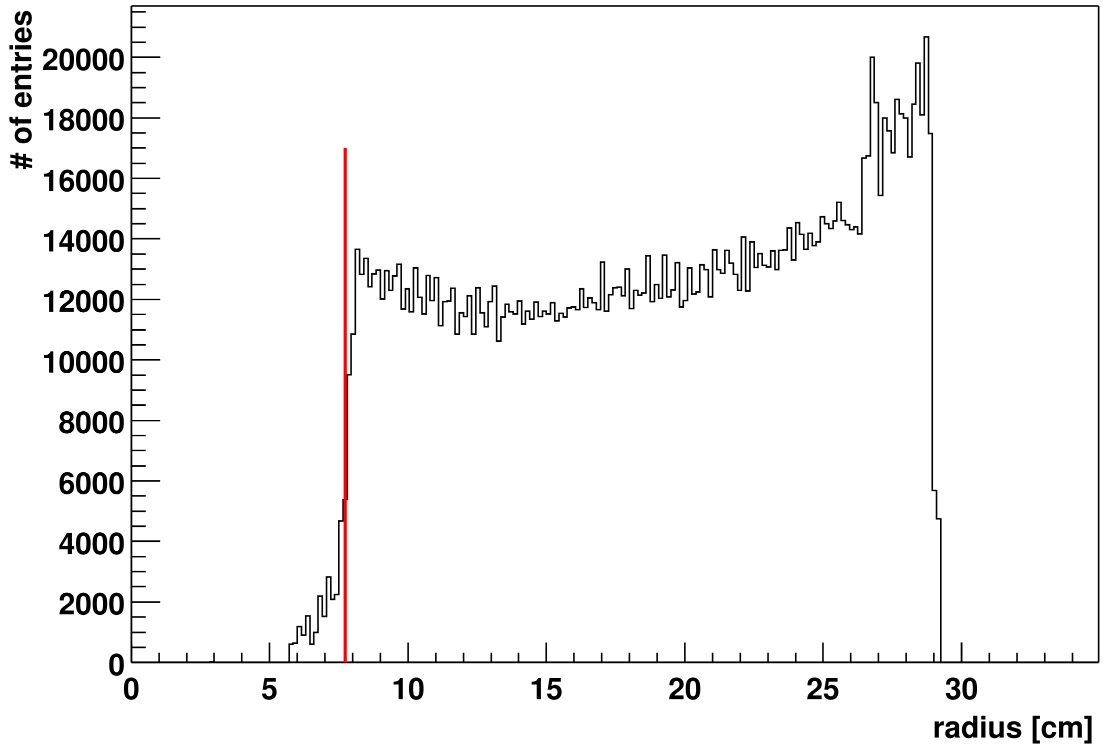
- MAGBOLTZ calculates the drift velocity $\vec{v}$ for a given gas mixture, pressure and temperature as a function of $\vec{E}$ and $\vec{B}$.
- MAGBOLTZ 1 shows a difference to MAGBOLTZ 2 in the order of 3–5%.

Comparison: inclined laser tracks to MAGBOLTZ



- looks ok on large scale
- some problems visible at smaller radii

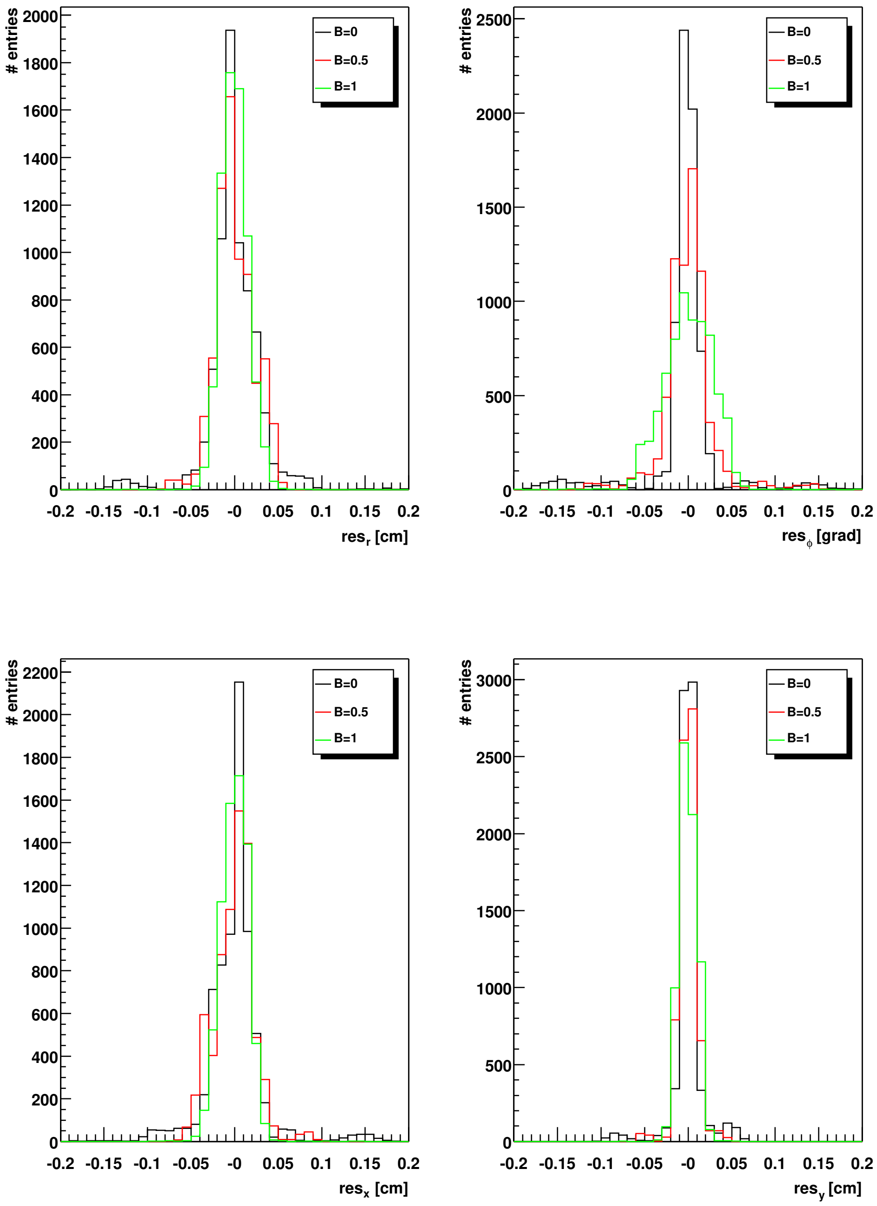
Charge step



- calibration procedures (MAGBOLTZ with adjusted temperature and pressure; $t_0 = 2.45\mu s$) brings back edge to where it should be
- result: gas mixture is

$$\mathrm{Ar} : \mathrm{CO}_2 = 50.7\,\% : 49.3\,\%$$

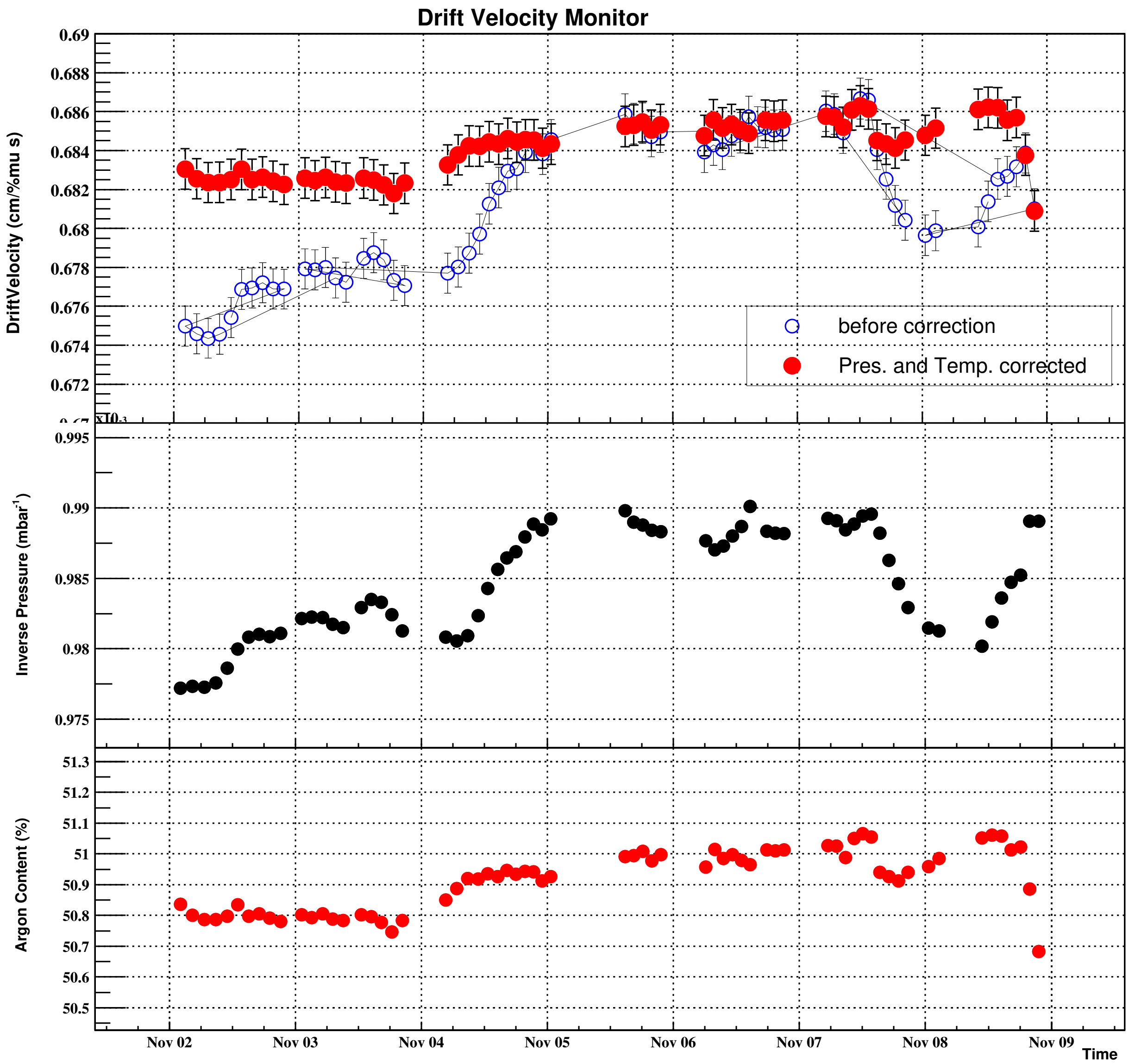
Residuals of inclined laser tracks



Magnetic field	σ_r [cm]	σ_ϕ [°]	σ_x[cm]	σ_y [cm]
$B = 0$	0.0199	0.01	0.0178	0.00685
$B = 0.5$	0.0198	0.0173	0.01962	0.0086
$B = 1$	0.015	0.0246	0.015	0.01

- consistent $\vec{E} \times \vec{B}$ correction is possible with $\mathrm{Ar} : \mathrm{CO}_2 = 50.0\,\% : 50.0\,\%$

Drift velocity monitor measurements

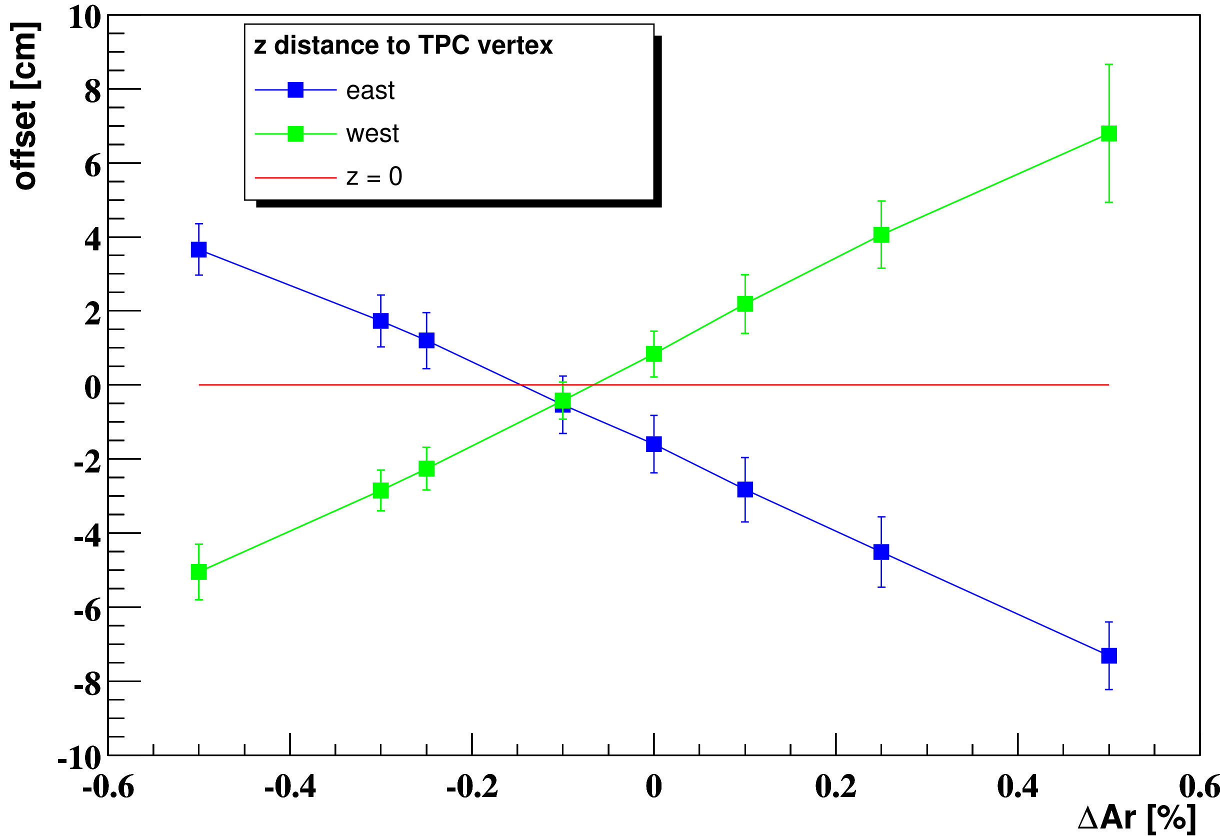


- temperature and pressure corrected
- sole free parameter is the gas mixture
- if MAGBOLTZ is right

$$\mathrm{Ar} : \mathrm{CO_2} = 51.2\,\% : 48.8\,\%$$

(and slightly rising over time)

Vertex reconstruction with FTPC tracks



- if MAGBOLTZ is right

$$\text{Ar} : \text{CO}_2 = 50.6\,\% : 49.4\,\%$$

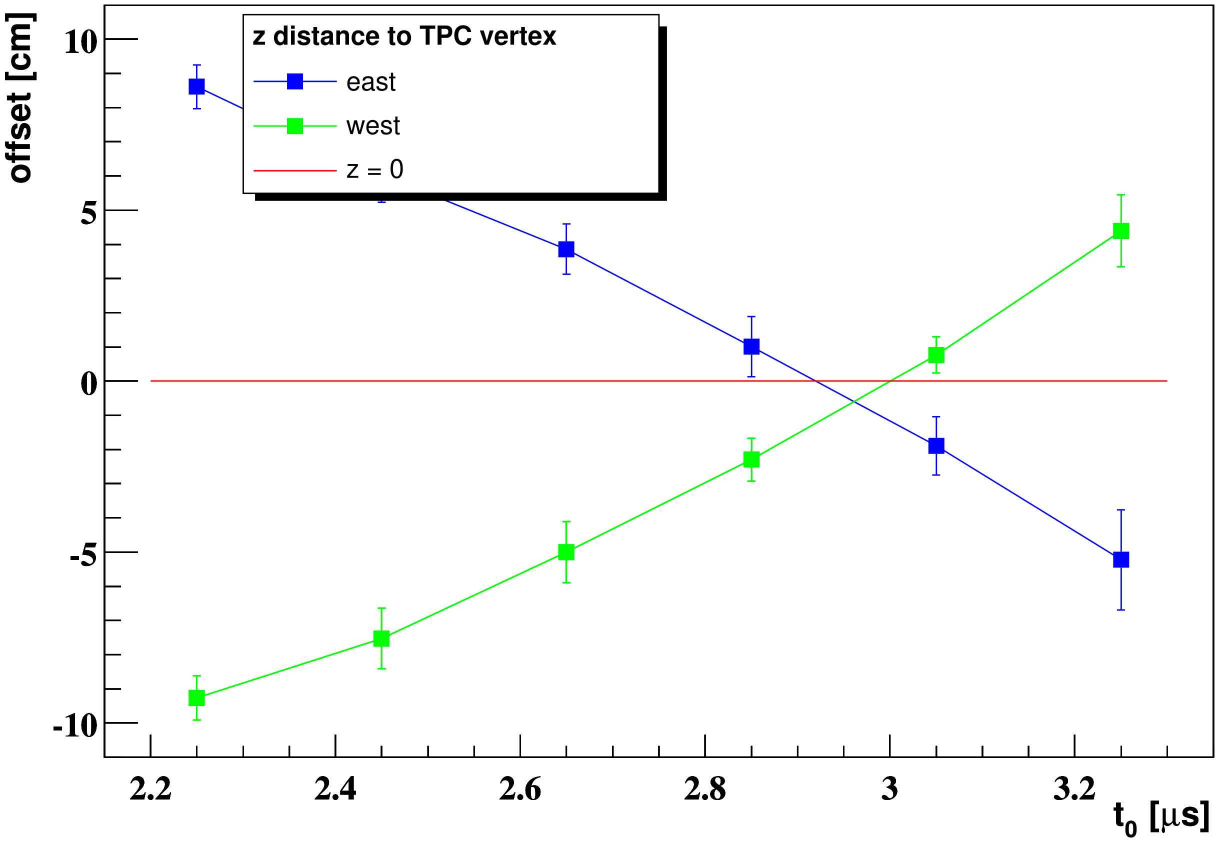
(within the errors consistent with charge step result)

How to solve these ambiguities?

- better understanding of drift velocity measurements
- check MAGBOLTZ (will take time)
- space charge effects?

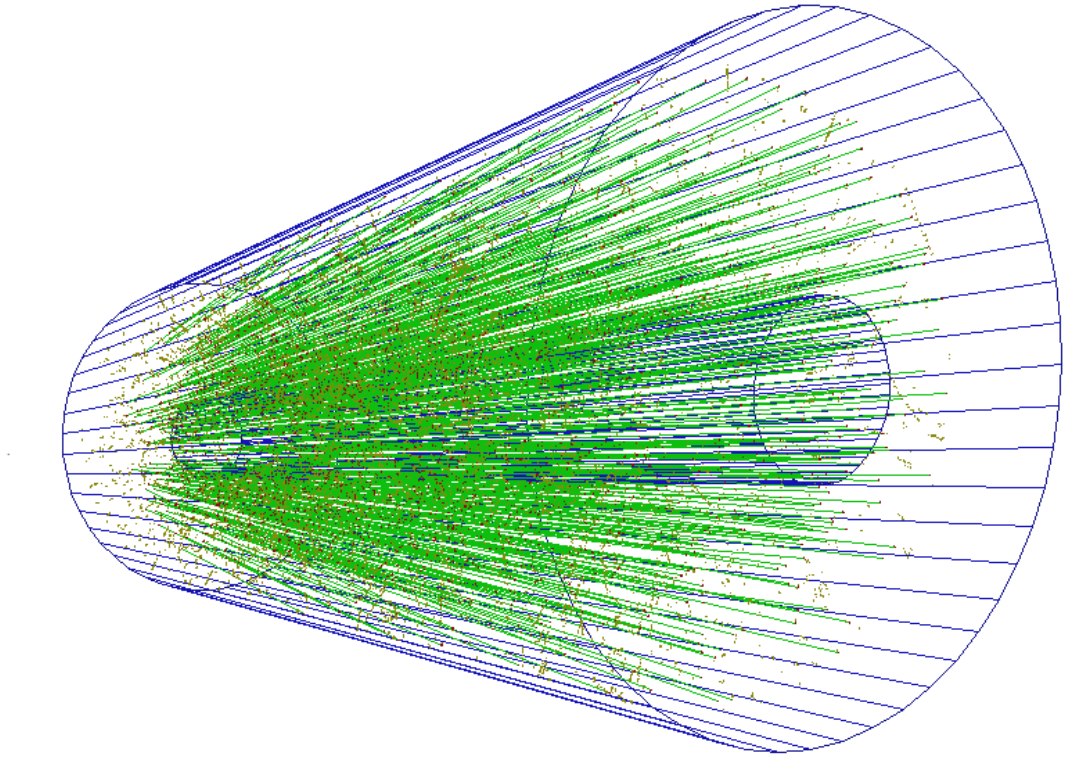
t_0 studies

- Gas mixture fixed to 50 : 50 Ar : CO_2



$\Rightarrow t_0 = 2.95\mu s$?

Reconstructed FTPC tracks in a central Au+Au collision
($\approx$ 500 per FTPC)



FTPC events taken **(gas ok, all sectors)**

	Full field	Half field	Zero field
Hadronic central	**1 569 039**	7 079	1 236
Hadronic minbias	**89 589**		
pp MinBias	**15 053 757**		76 300

FTPC events taken (gas ok, *one sector missing*)

	Full field	Half field	Zero field
Hadronic central	139 012	69 200	
Hadronic minbias	122 797		

To do list

- check/improve tracking parameters
- 'final' decision for driftmap and t_0

! Reproduction of our 90k (200k) minBias data end of May (QM02 flow production).

- embedding
- slow simulator refinements
- make use of association maker