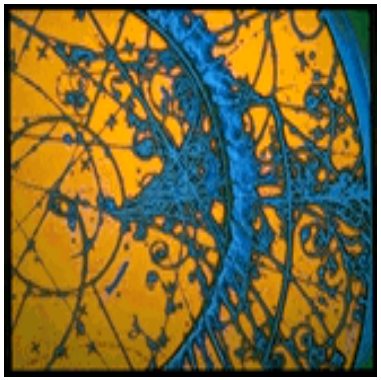


FTPC calibration status & plans for Y03

Joern Putschke

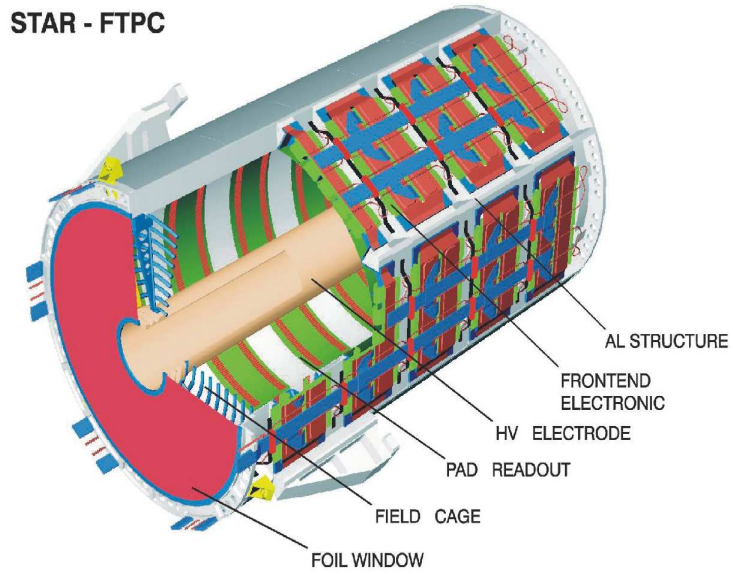
for the STAR FTPC group

STAR Calibration Meeting 2002
November 7, 2002

Overview

- The Forward-TPC layout
- Laser Calibration
- “TimeStep problem”
- DCA distribution
- ToDo list & Plans before Y03 physics run
- Online tool & calibration runs in Y03

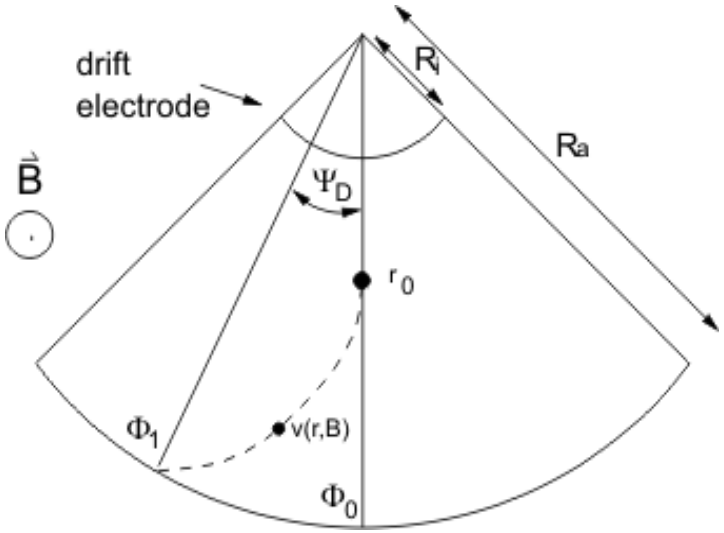
The Forward-TPC layout



Volume	
inner radius	7.73 cm
outer radius	30.05 cm
chamber length	120 cm (|z| = 150 – 270 cm)
acceptance	□=2.5 –4.0 (□=2° - 9°)
Field properties	
drift cathode voltage	10-15 kV
drift electrical field	240-1400 V/cm (radial, □ beam)
Solenoid magnetic field	0.5 T (|| beam)
Gas properties	
gas mixture	Ar(50%)-CO_2(50%)
drift velocity	0.3 – 2.0 cm/□s
trans. Diffusion DT	100-130 □ m/□cm
long. Diffusion DL	100-130 □ m/□cm
Lorentz angle	4 deg.

- **2 FTPCs**
- **2.5 < |η| < 4.0**
- **6 azimuthal sectors (~60 deg.) with 5*2 rows in z- direction**
- **electron drift ~1/r and ⊥ to magnetic field**

Radial drift / space point reconstruction



$$E \propto \frac{1}{r} \propto v_D \propto v_D(r) \propto \text{const}$$

$$E \propto B \propto F \propto q \propto v_D(r) \propto B \propto F(r) \propto \text{const}$$

$$T_D(r) \propto \int_{r_0}^{r} dt \propto \int_{r_0}^{r} \frac{dr}{v_D(r)} \propto r$$

$$\propto_D \propto \int_{r_0}^{r} \frac{\Phi_L(r)}{r} dr \propto \propto$$

$$(\Phi_L \propto \text{Lorentzangle})$$

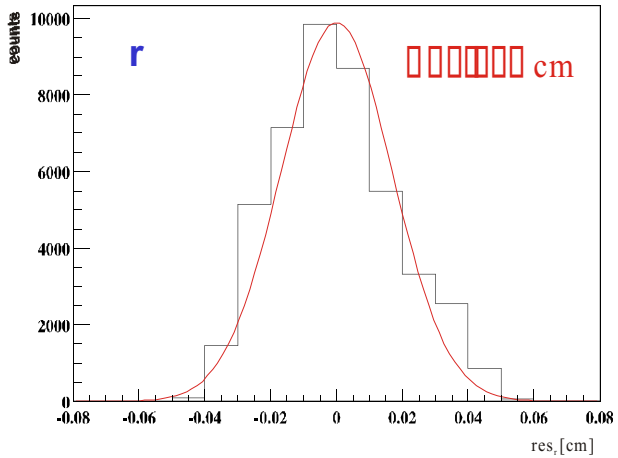
$v_D(r)$ and $\Psi_D(r)$ have to be known with high accuracy

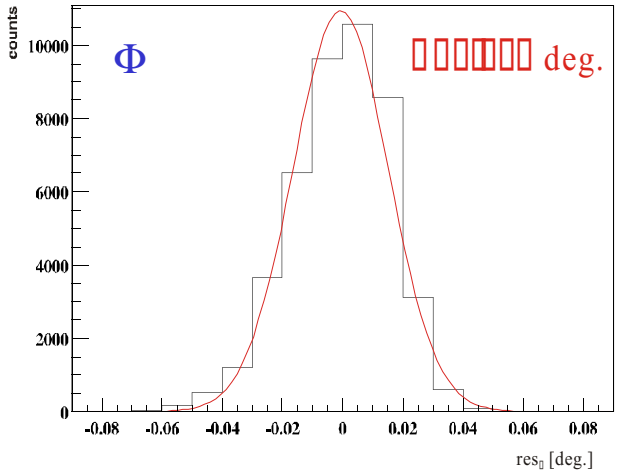
$\Rightarrow$ using **MAGBOLTZ** calculations

How to check ?

Laser residuals & momentum resolution

Residuals of the inclined laser tracks

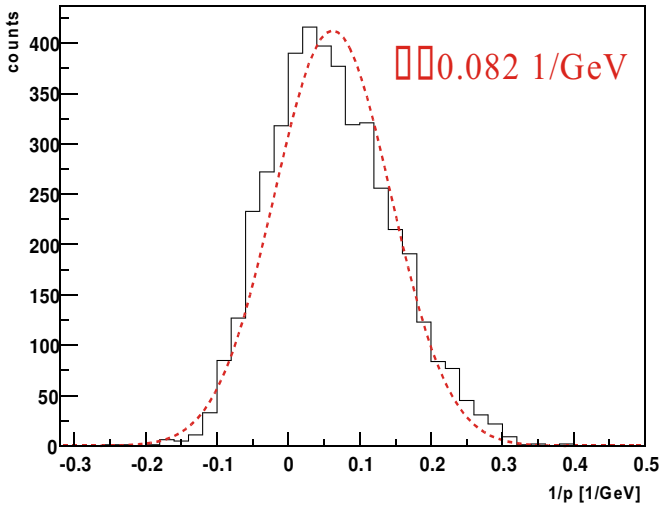




Momentum resolution

$$\frac{dp}{p} \propto \frac{A \cdot p}{B \cdot L^2}$$

B : magnetic field
A : accuracy in point measurement and number of used points
L : track length
p : transverse momentum



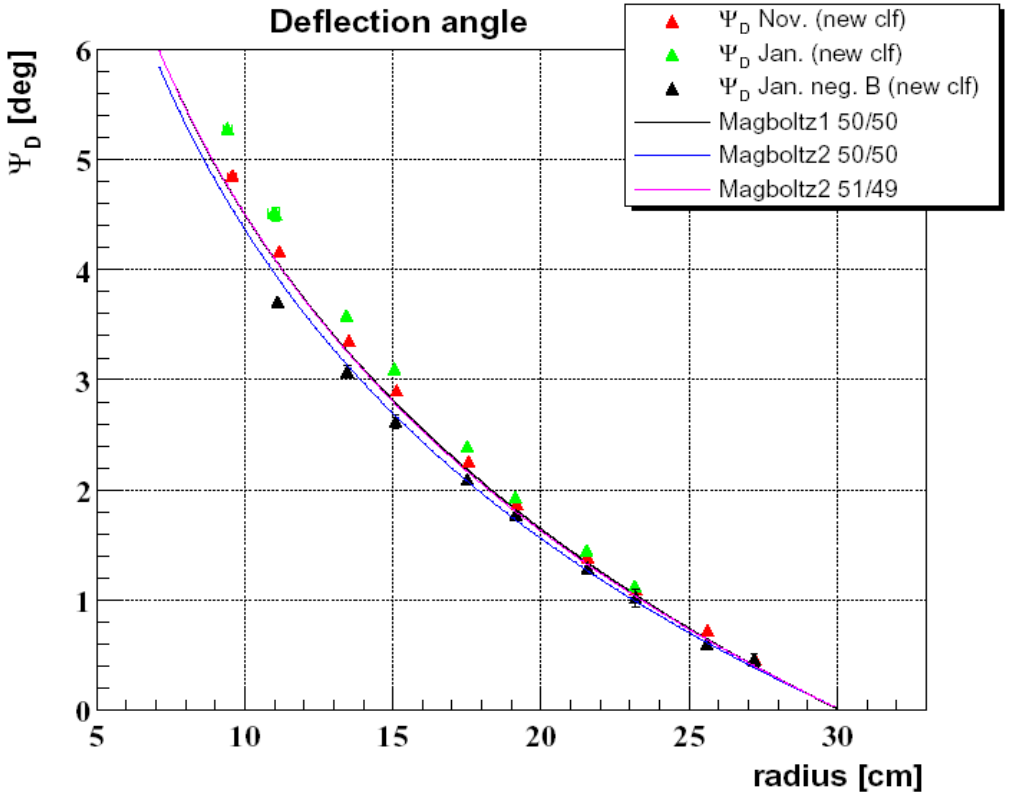
⇒ momentum resolution and residuals reach design goals (for laser tracks) !

Deflection angle

Comparsion of the measured deflection angle vs. raidus and MAGBOLTZ calculations

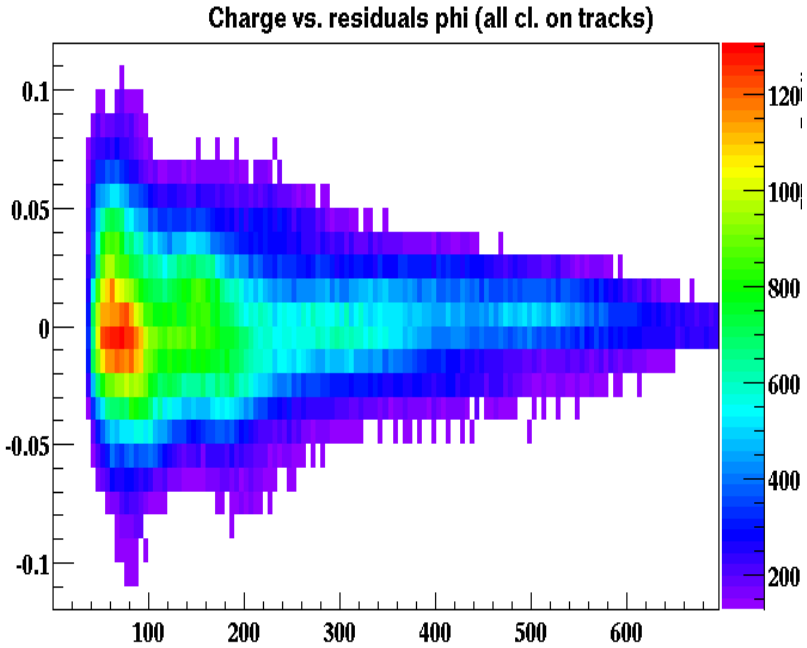
$$\Psi_{D,laser} = \left| pad_{B,nofield} - pad_{B,fullfied} \right| \cdot RadiansPer\ Pad$$

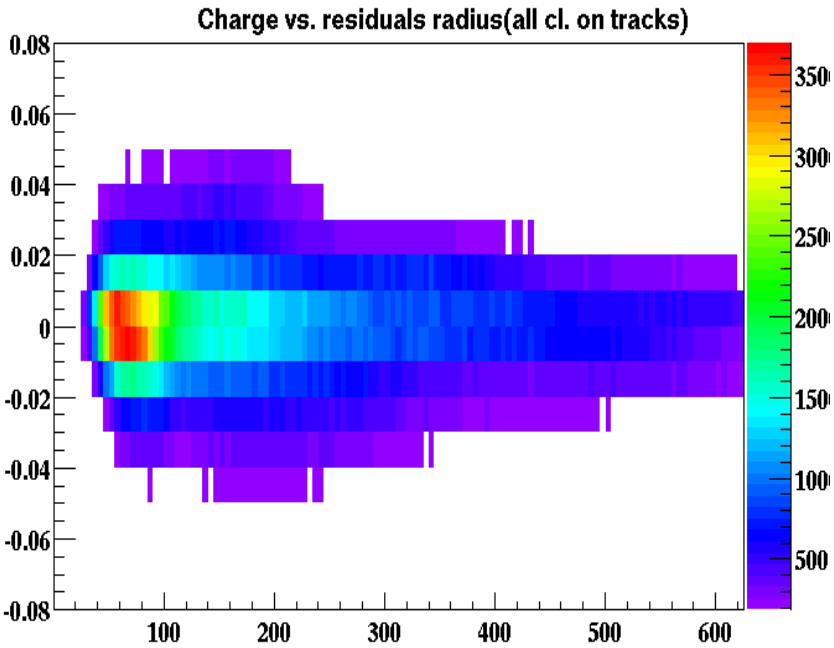
$$RadiansPer\ Pad = 0.0062296 \text{ rad}$$



- differences between different laser calibration sets in the azimuthal direction due to mirror movement in laser system
- tool to compare different MAGBOLTZ versions calculations

Residuals of different intensity laser tracks



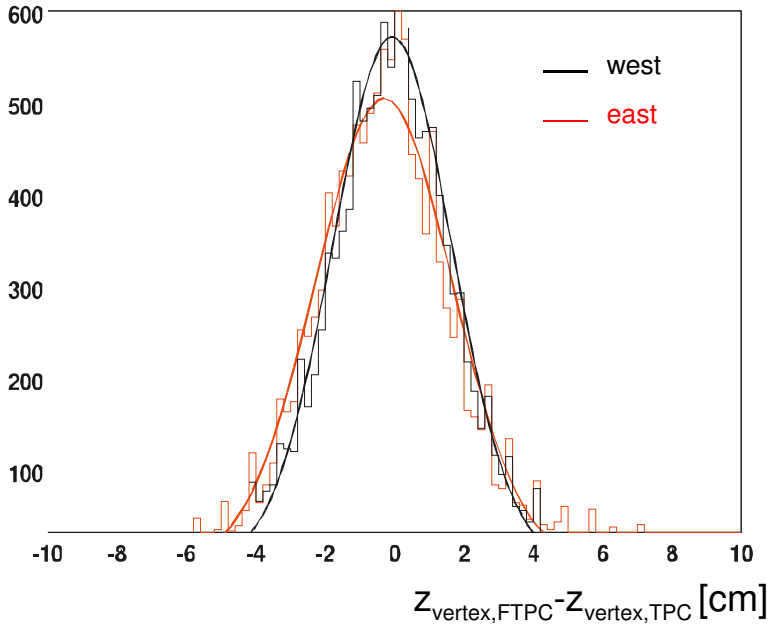


charge (cluster geometry) dependence of residuals explains the poor space point resolution in Y02 (factor of 2) because of low gas gain (for safety reasons due to earlier problems with contaminated gas) !

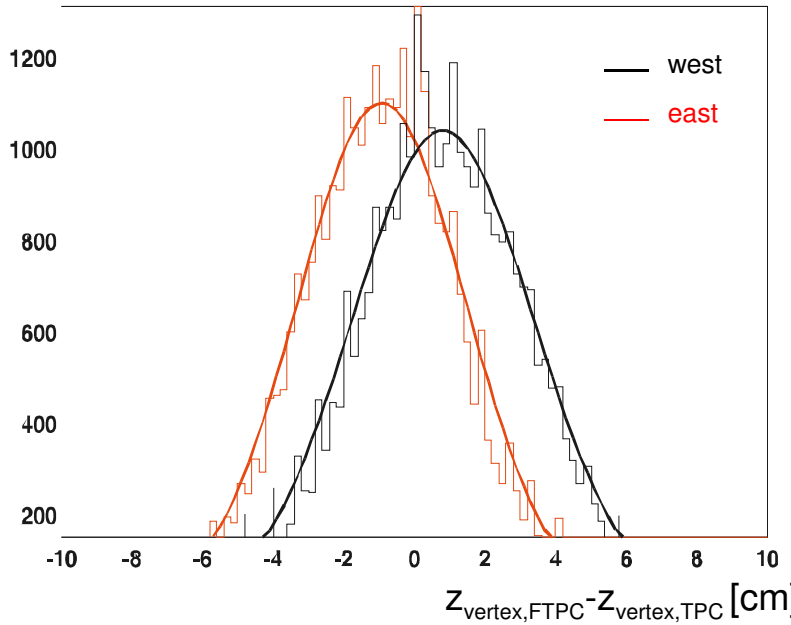
Vertex reconstruction of minBias data

tool to adjust drift velocity (and t0) with physics data

ReversedFullField Run 311



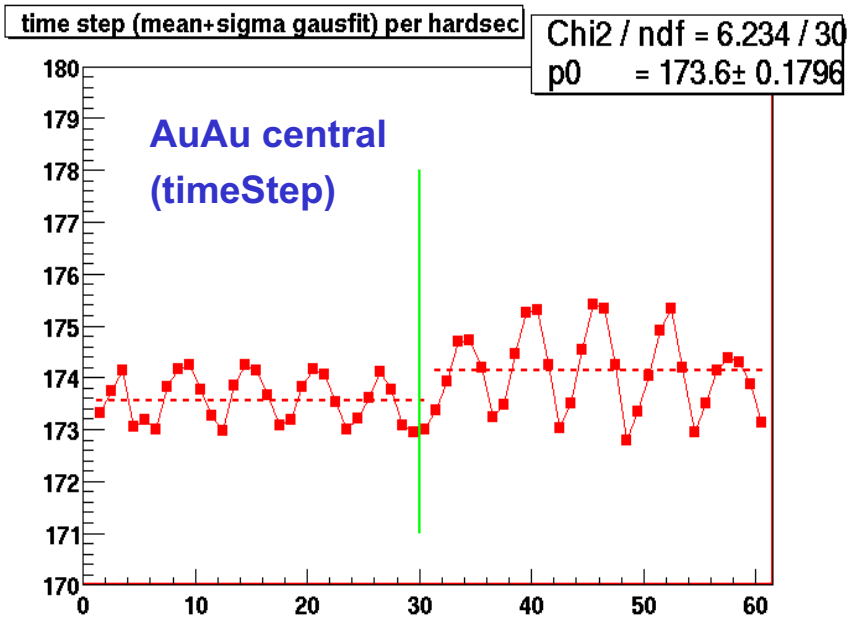
FullField Run 313

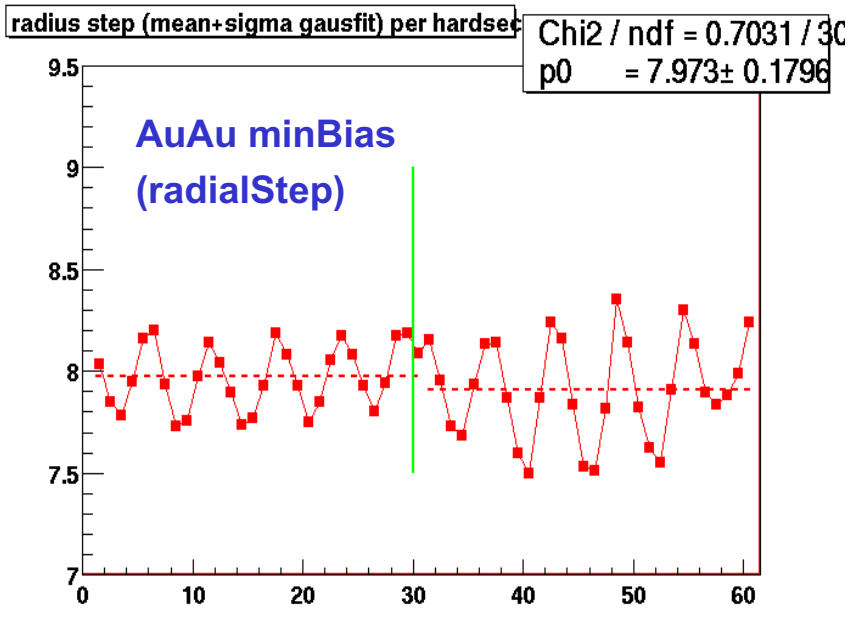


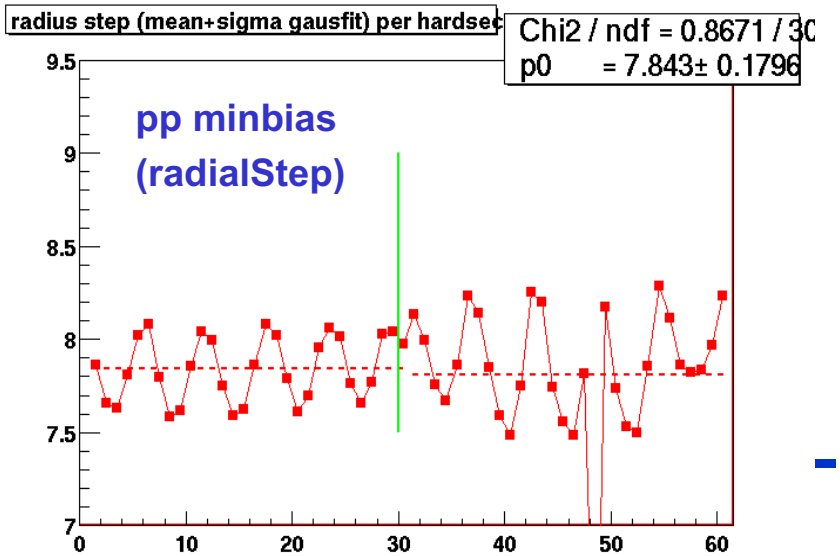
- possible explainations: drift velocity change, wrong B-field distortion corrections (bug in geant magnetic field table ?)

⇒ **but effect could not be explained at current calibration level !**

"TimeStep problem"







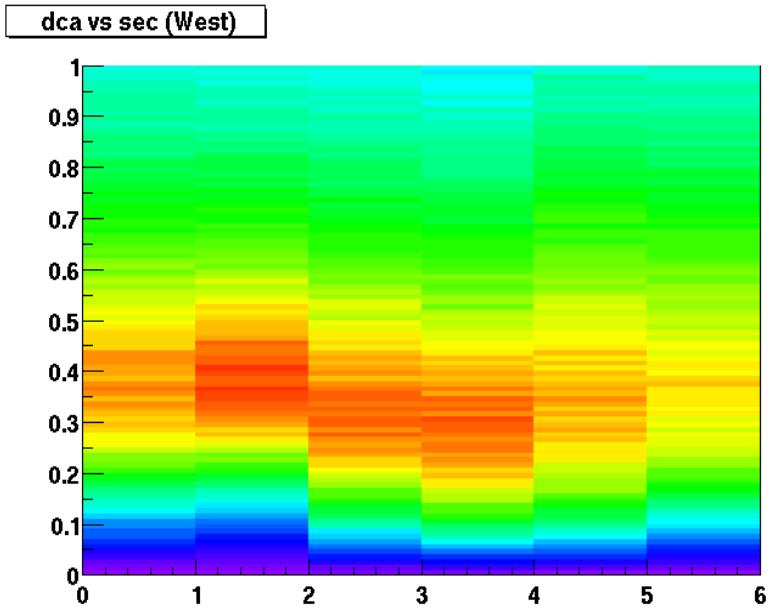
⇒ azimuthal dependence of the TimeStep/inner radius of reconstructed hits !

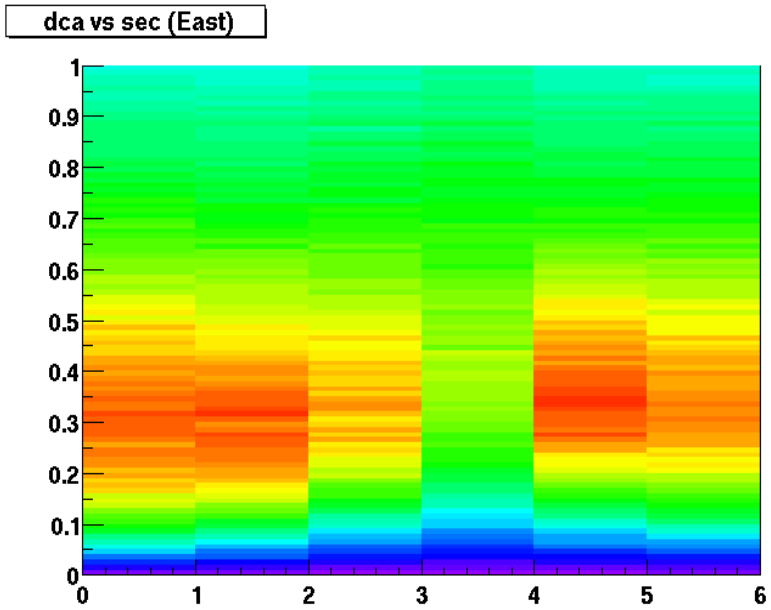
No idea …

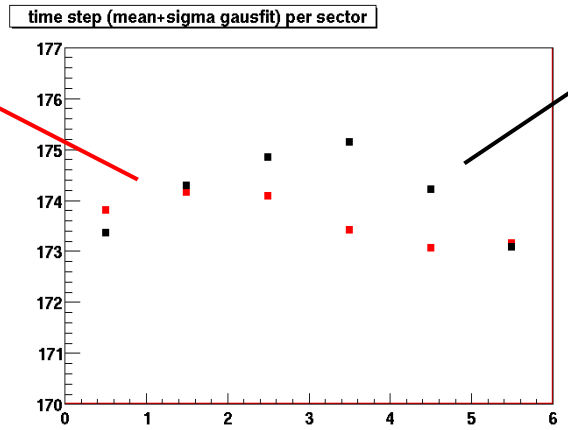
(maybe a new one, thanks Dave)

DCA distribution

(ReversedFullField Run313)







west

east

ToDo list

priority	task
h	timeStep problem
h	pulser/electronic check
h	magboltz I/II (laser/DVM)
h	laser calibration
h	vertex B-field problem
h	FTPC residuals
h	realistic simulations
m	definition of FTPC pico events
m	new QA histograms
m	Tracker noise/holes
m	gas, T & p simulations studies
m	embedding (infrastructure)
lr	ITTF

← **also in TPC ???**
(heard about …)

There are a lot of tasks more …

⇒ need help from outside FTPC group (small group) !!!

Plans before Y03 physics run

1. **Pulser runs**
   - check exchanged FE cards
   - gain correction

2. **Laser Calibration (as soon as possible)**
   1. gain scan → residuals (azimuthal reproducibilty of laser tracks)
   2. zero field laser ⇒ look at timeStep problem
   3. zero field laser and drift velocity mointor
      ⇒ fix drift velocity and MAGBOLTZ
   4. B-field scan → check ExB corrections
   5. laser during data runs → spacecharge

3. **Data calibration runs**
   1. gain scan → cluster shapes and residuals
   2. B-field scan → solve vertex-z position puzzle
   3. zero field run, laser and drift velocity mointor
      ⇒ fix drift velocity and MAGBOLTZ

Online tool & calibration runs in Y03

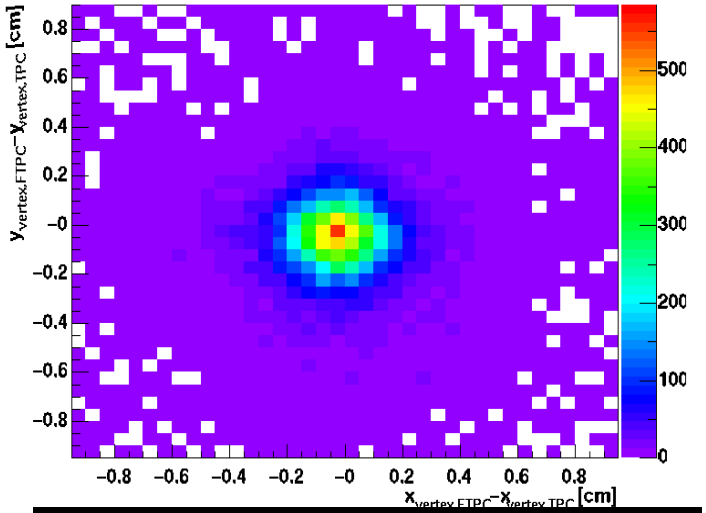
- **online tools**
  - use event pool and FTPC clf & tracker (not ready yet)
  - laser calibration online tool possible with L3 ?
  - integration into L3 (DAQ 100) need separate hitfinding module - maybe not for dAu (has to be checked)

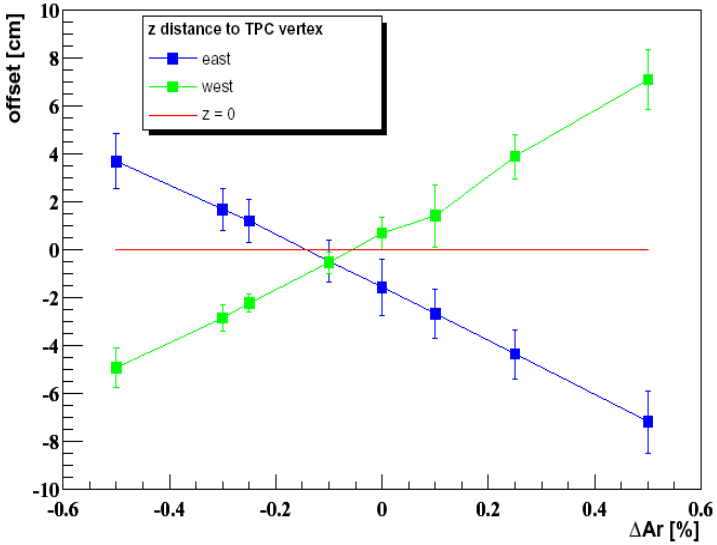
- **calibrations runs**
  - daily laser runs to check drift velocity and ExB
  - zero field physic runs
  - combination zero field physic and laser runs as often as possible

The STAR FTPC group

- Volker Eckhardt
- Maria Mora Corral
- Markus Oldenburg
- Joern Putschke
- Janet Seyboth
- Peter Seyboth
- Frank Simon

Vertex reconstruction

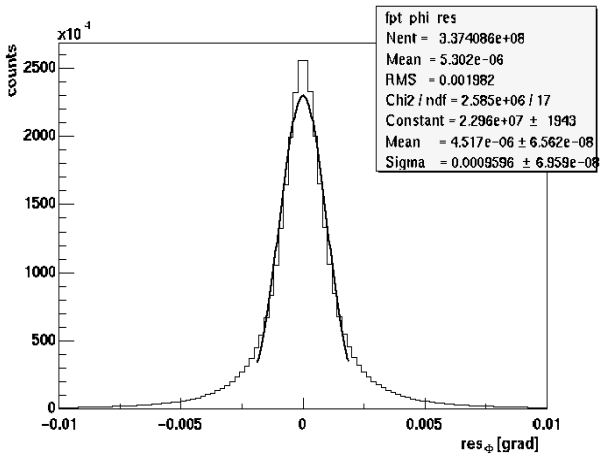




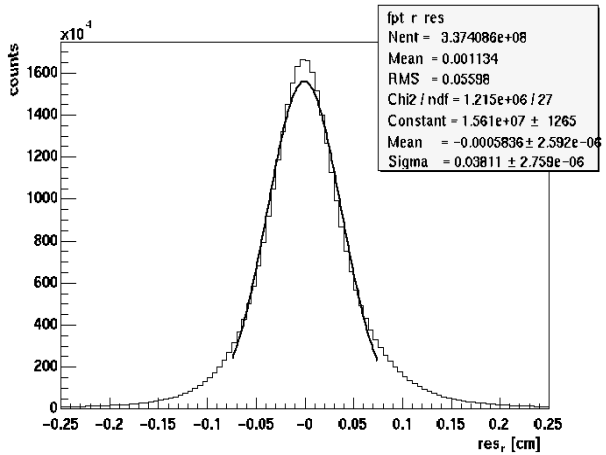
- transform to STAR coordinate system
- compare FTPC and TPC vertex pos.
- a tool to check our drift velocity with real data

Reconstruction quality

Residuals Φ



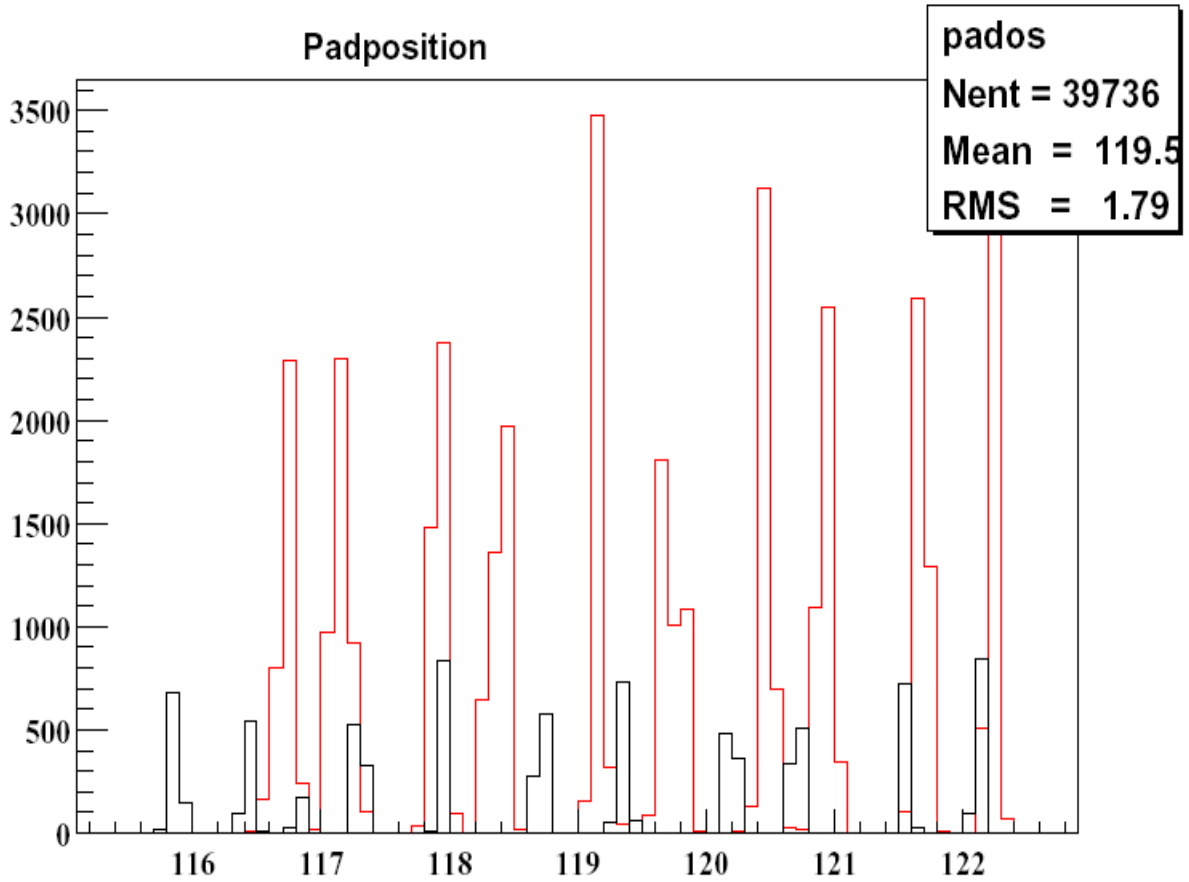
Residuals r



Cluster geometry (on track)

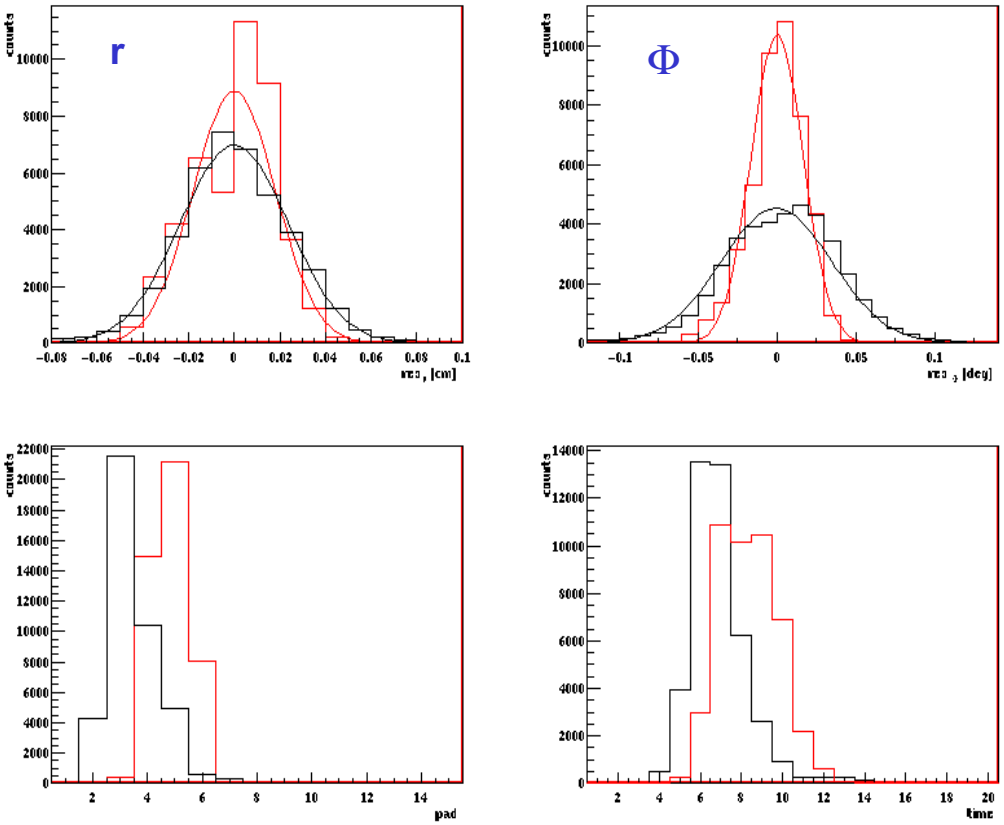
Why are the residuals a factor of 2 larger than expected ?

Laser shift


Padposition
pados
Nent = 39736
Mean = 119.5
RMS = 1.79
3500
3000
2500
2000
1500
1000
500
0
116
117
118
119
120
121
122

Residuals of different intensity laser tracks

Residuals



selection of a low intensity laser track (black) with cluster geometry similar to physics data to compare with the high intensity laser track (red)

⇒ factor of 2 visible