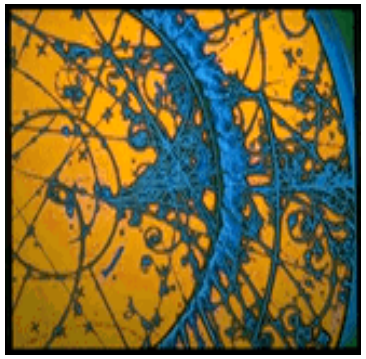
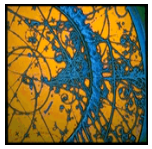


FTPC status report

Joern Putschke / Frank Simon

for the STAR FTPC group

STAR Collaboration Meeting 2002
July 11-16, 2002 Nantes



Overview

The Forward-TPC detector layout

Calibration

- Laser tracks
- Reconstructed vertices

Reconstruction

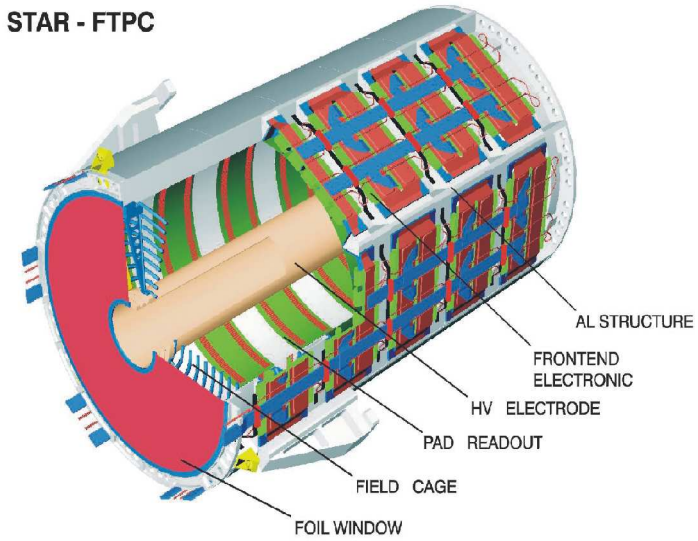
- Cluster and tracks
- "Φ – problem"

First physics results

- Flow
- Raw charged particle spectra

Simulations (Frank Simon)

FTPC layout



inner radius	7.73 cm
outer radius	30.05 cm
chamber length	120 cm (|z| = 150 270 cm)
acceptance	η=2.5 4.0 (θ=2° - 9°)
drift cathode voltage	10-15 kV
drift electrical field	240-1400 V/cm (radial, $\perp$ beam)
Solenoid magnetic field	0.5 T (|| beam)
gas mixture	Ar(50%)-CO_2(50%)
drift velocity	0.3 2.0 cm/μs
trans. Diffusion DT	100-130 μ m/$\sqrt{}$cm
long. Diffusion DL	100-130 μ m/$\sqrt{}$cm
Lorentz angle	4 deg.

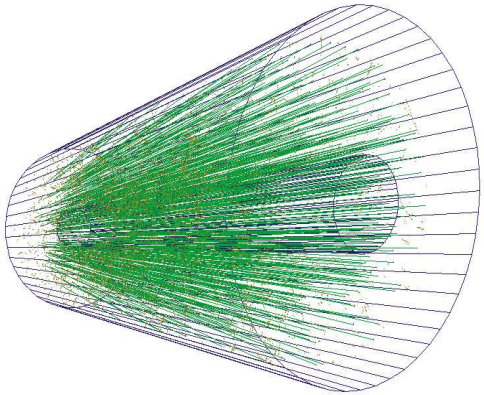
$2.5 < |\eta| < 4.0$

2 FTPCs

10 rows with 960 pads each = 19200 channels

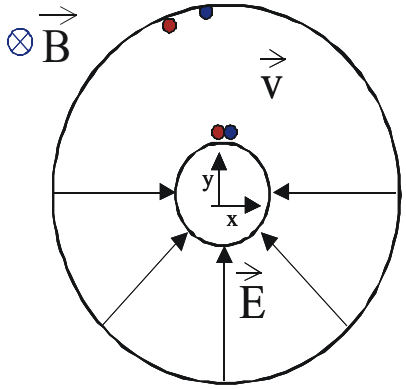
read out in 256 time bins

Why radial drift ?



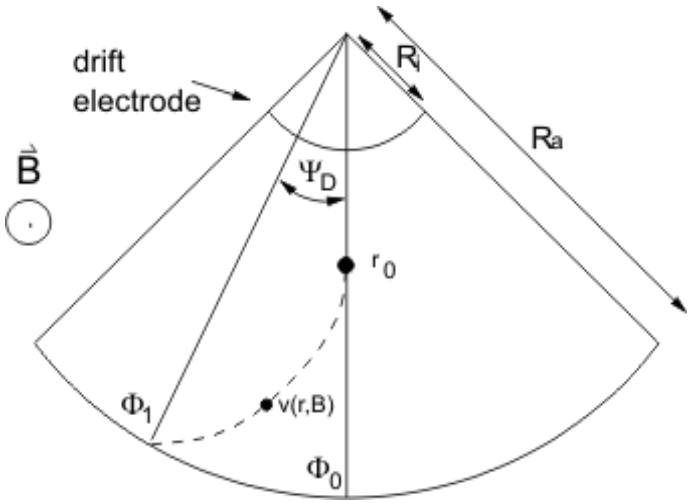
High track density ~ 500 charged particles in each FTPC.

Occupancy of ~30-35% at the inner radius.



A two track resolution of 1-2 mm, which is an order of magnitude better than in a standard configuration TPC.

Radial drift / space point reconstruction



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

$$E \perp B \perp F \propto q[v_D(r) \times B] \Rightarrow F(r) \propto \text{const}$$

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

$$\Psi_D = \int_{r_0}^{r} \frac{\omega_L(r)}{r} dr \propto \omega_L$$

($\omega_L \propto$ Lorentzangle)

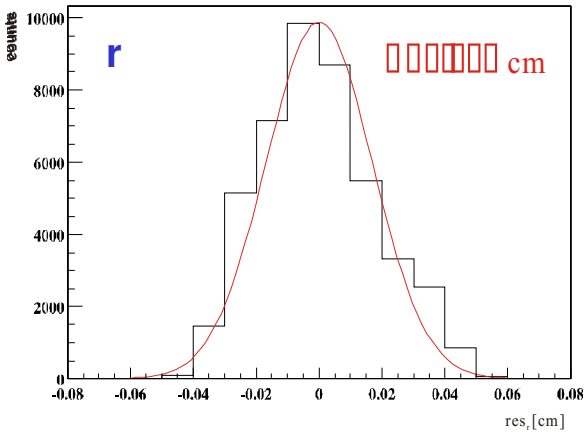
Space point reconstruction

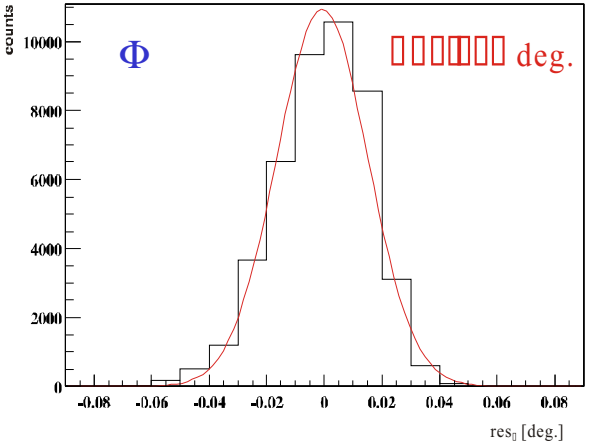
$v_D(r)$ and $\Psi_D(r)$ have to be known with high accuracy
$\Rightarrow$ using MAGBOLTZ calculations

How to check ?

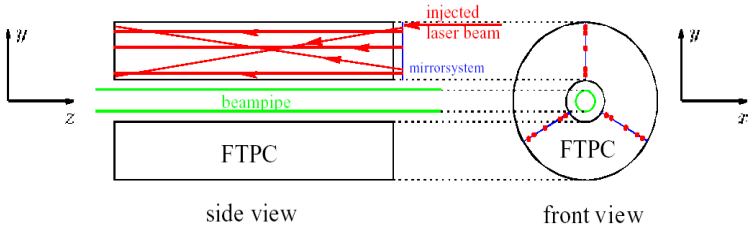
Laser calibration I

Residuals of the inclined laser tracks





The FTPC laser system



the beam parallel laser tracks reconstruct at the known radial positions

the inclined laser tracks reconstruct straight with the expected space point resolution

⇒ $v_D(r)$ and $\Psi_L(r)$ calculated by MABGOLTZ can be used for data reconstruction

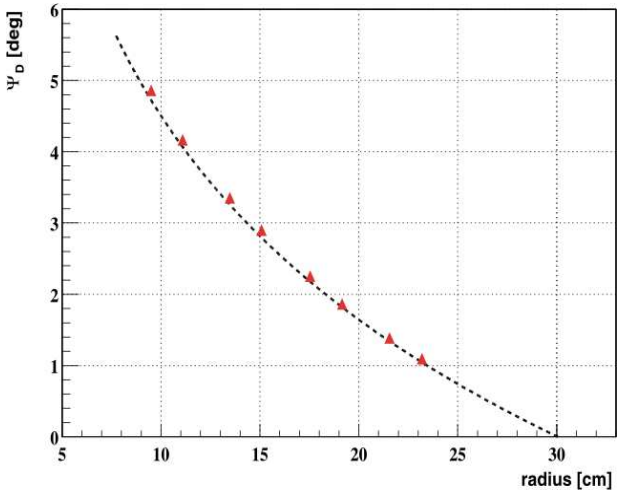
Laser calibration II

Measurement of the deflection angle

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

$$RadiansPerPad = 0.0062296 \text{ rad}$$

Comparsion of the measured deflection angle vs. raidus and MAGBOLTZ calculations (dotted line)

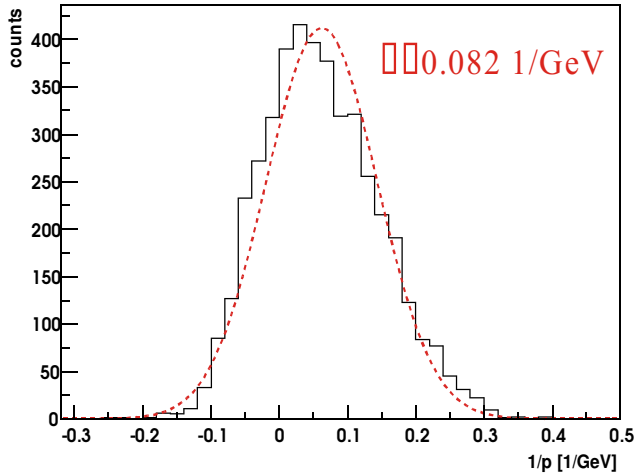


⇒ good agreement
(small deviations at lower radii)

Momentum resolution

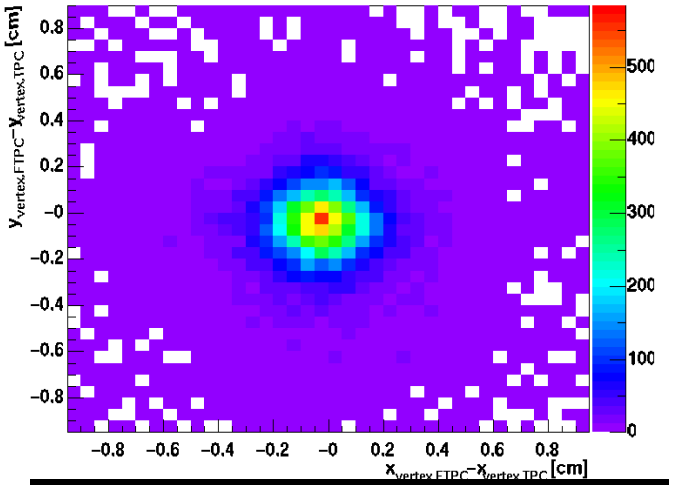
$$\frac{dp}{p} = \frac{A \cdot p}{B \cdot L^2}$$

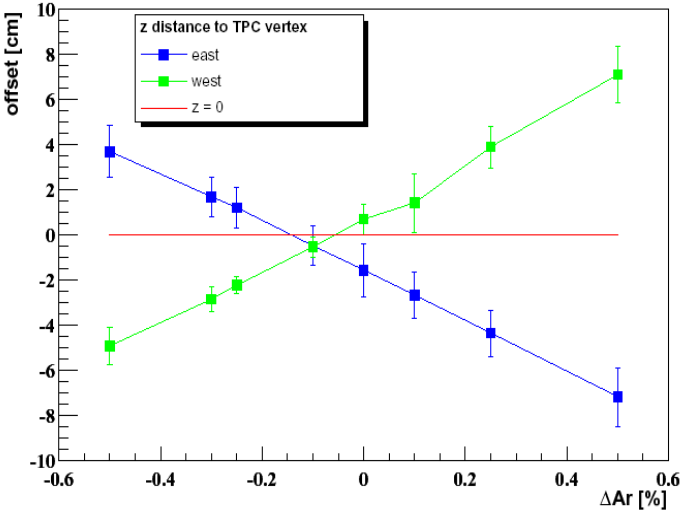
B : magnetic field
A : accuracy in point measurement and number of used points
L : track length
p : transverse momentum



⇒ momentum resolution in the designed accuracy of about 12%

Vertex reconstruction





transform to STAR coordinate system

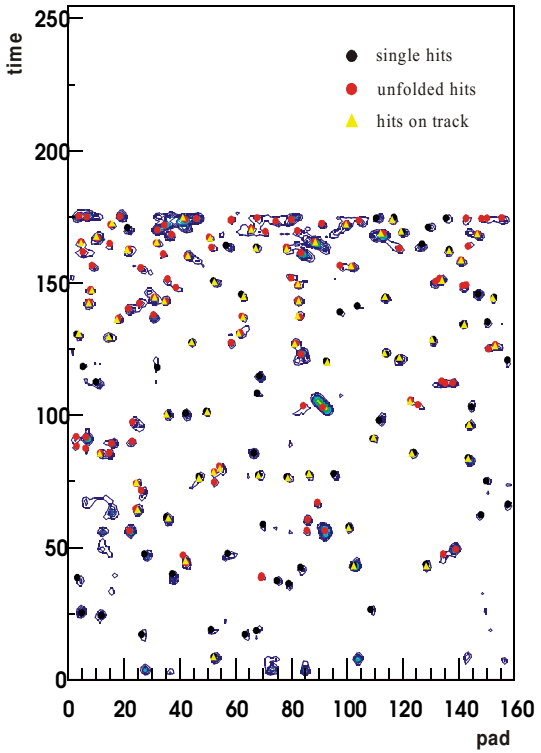
compare FTPC and TPC vertex pos.

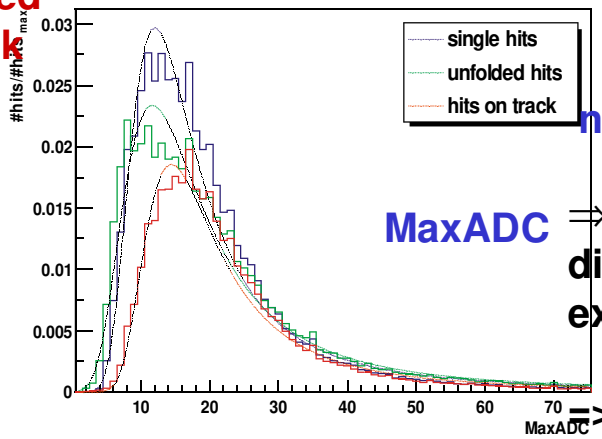
fine tuning of FTPC rotations

a tool to check our drift velocity with real data

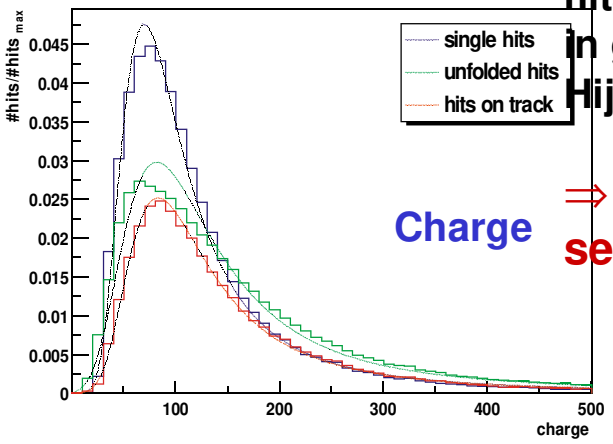
Cluster distributions

Substantial amount of merged clusters due to the high track density at the inner radii !





MaxADC



Charge

new hitfinding algorithm

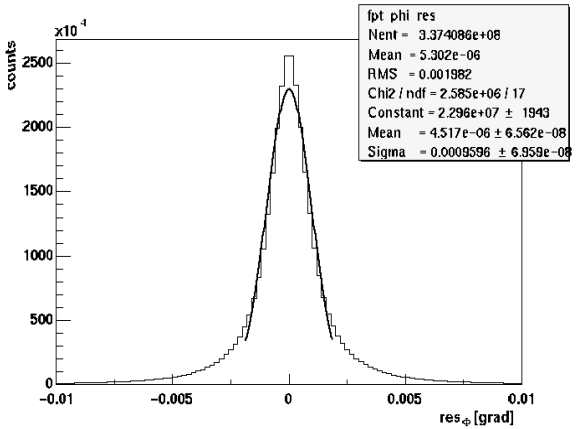
⇒ charge and MaxADC-distributions now show the expected Landau shape

=> number of reconstructed hits and tracks are in good agreement with Hijing simulations

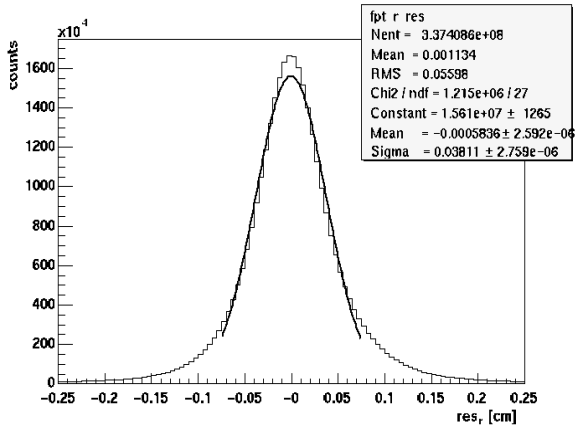
⇒ cluster/hit finding seems to be okay !

Reconstruction quality

Residuals Φ



Residuals r

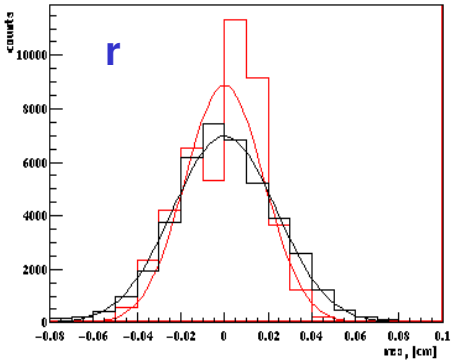


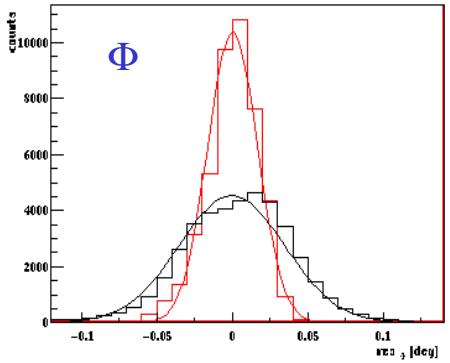
Cluster geometry (on track)

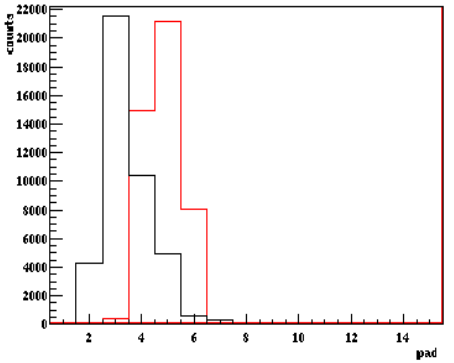
Why are the residuals a factor of 2 larger than expected ?

Residuals of different intensity laser tracks

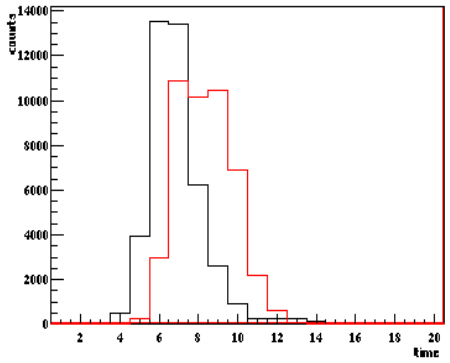
Residuals







padwidth

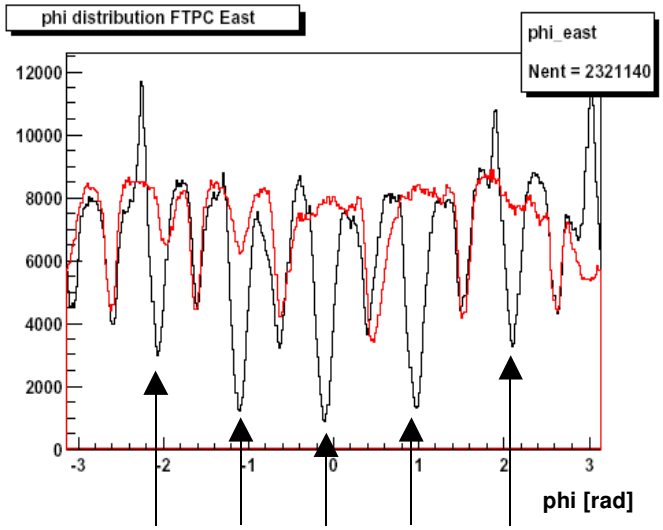


timewidth

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

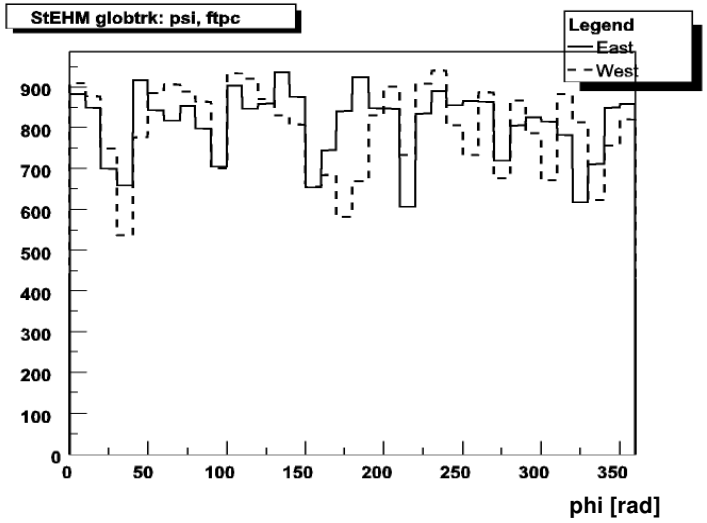
⇒ factor of 2 visible

Φ – problem



strange behaviour of the Φ – distribution in the middle of each FTPC east sector (black line)

Identified as a DAQ mapping problem !

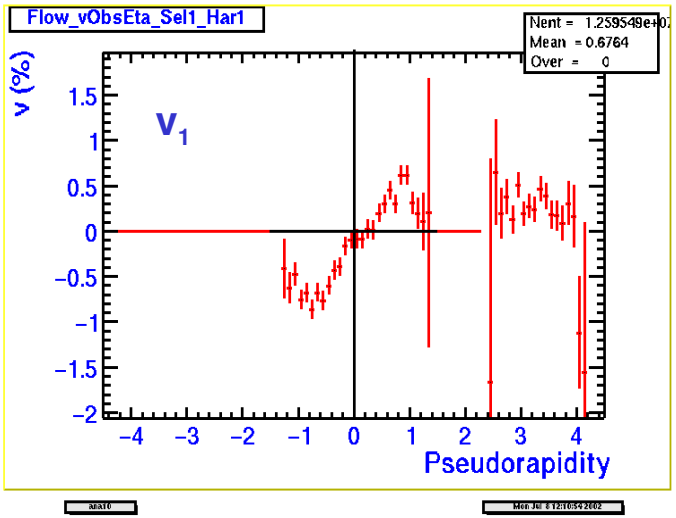


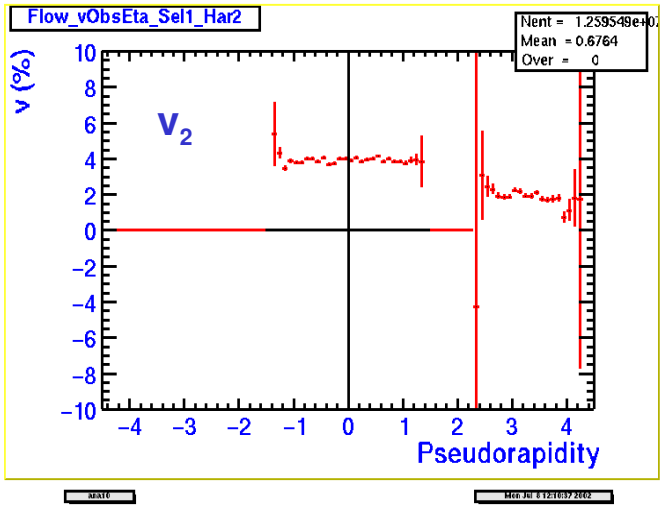
First flow signals in the FTPCs

Flow analysis with ~32k minbias events

Only FTPC west, because of the distorted azimuthal distribution in the east chamber

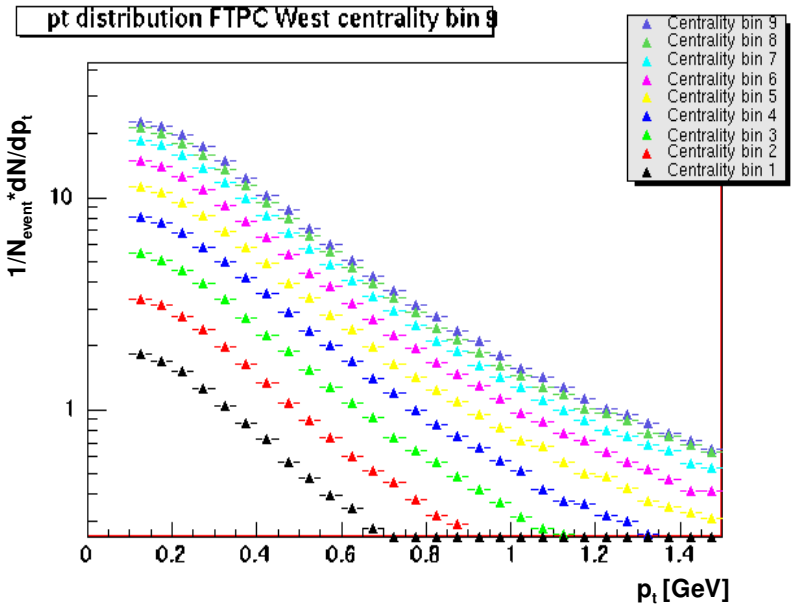
⇒ only qualitative (momentum conservation correction would be required)

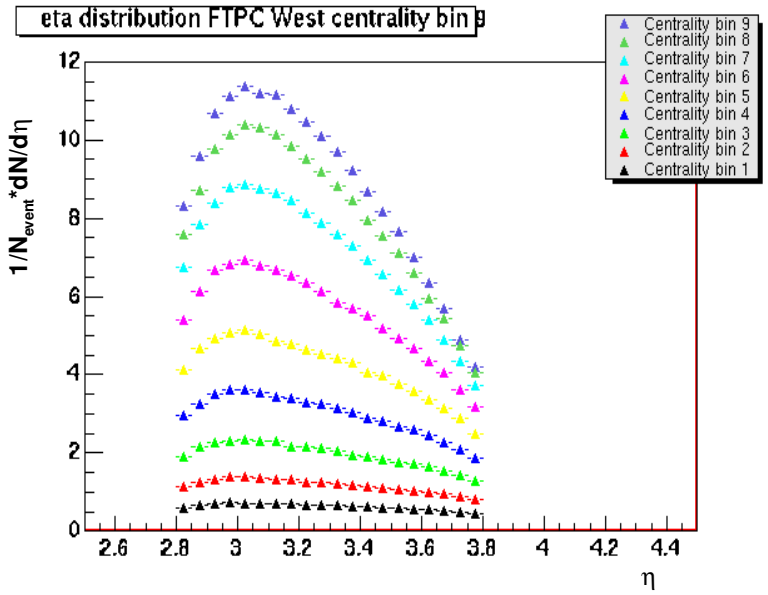




⇒ flow signal in the FTPC !

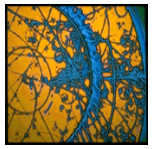
Raw charged particle spectra





Efficency and acceptance calculations have started

to extract corrected charged particle spectra !



Summary

First round of calibration finished

Clusterfinder/Tracker improved and working well

Φ – problem solved

First flow signals observed

Request for physics production

- **Reproduction of AuAu minbias events**
- **Production of AuAu central and pp samples**

Efficency and acceptance calculations have started

The STAR FTPC group

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