

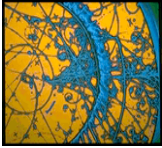
FTPC : From calibration to physics analysis

Joern Putschke
for the STAR FTPC group



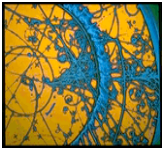
STAR Collaboration Meeting 2003
February 25 - March 1, 2003





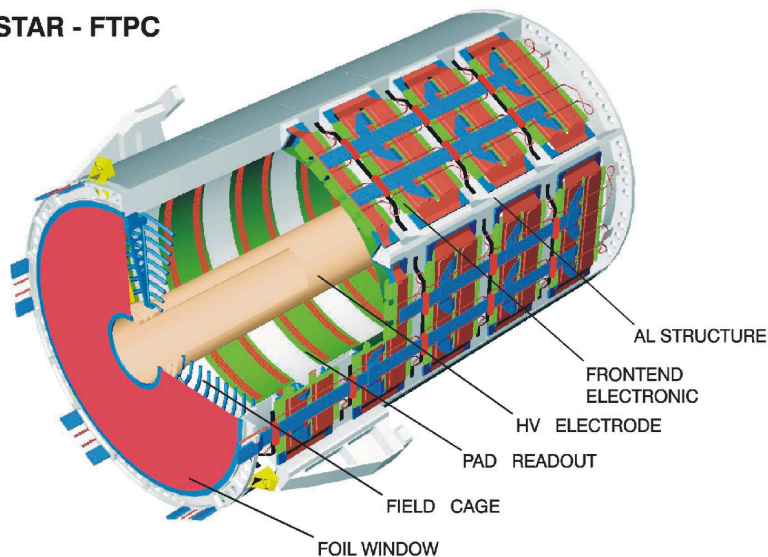
Overview

- **calibration**
 - TimeStep problem
 - time dependence of FTPC gas temperature
- **AuAu minbias**
 - flow analysis
 - Event plane angle correlations (v_1 and v_2)
 - FTPC east/west, TPC & FTPC
 - v_2 (cumulant method) \square & p_t dependence
 - multiplicity & raw charged particle spectra
- **dAu**
 - raw \square distribution
 - FTPC east/west multiplicity asymmetry
 - first look at p_t spectra



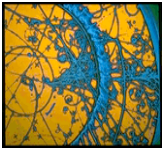
The Forward-TPC layout

STAR - FTPC

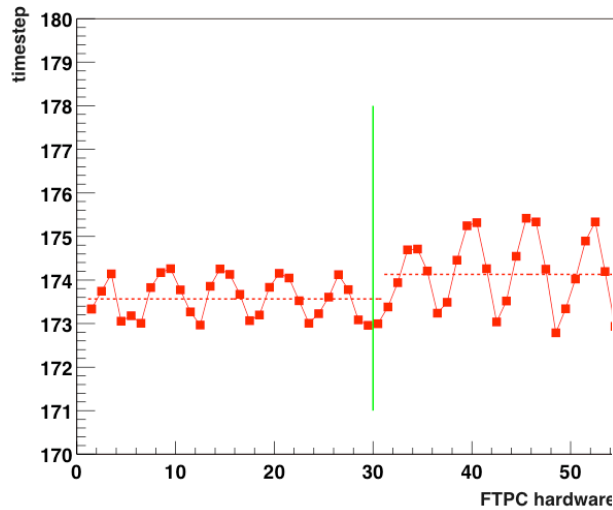


- 2 FTPCs
- $2.5 < |\eta| < 4.0$
- 6 azimuthal sectors (~60 deg.) with 10 rows in z- direction
- electron drift $\sim 1/r$ and \perp to magnetic field

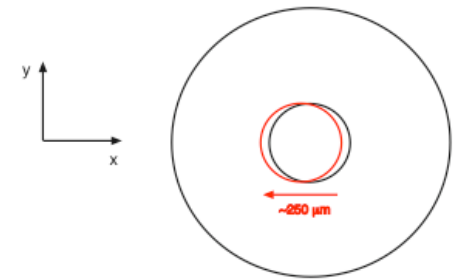
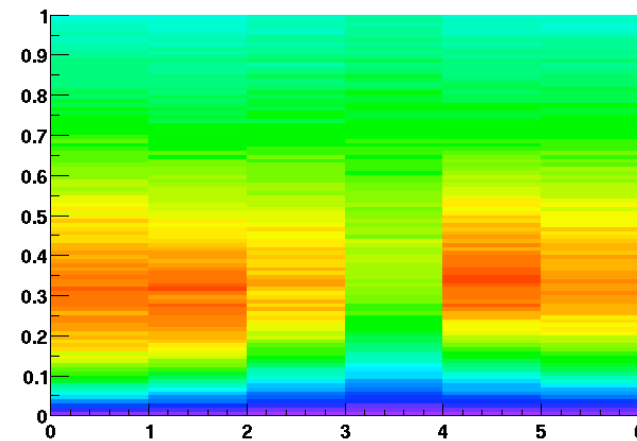
Volume	
inner radius	7.73 cm
outer radius	30.05 cm
chamber length	120 cm ($ z = 150 - 270$ cm)
acceptance	$ \eta = 2.5 - 4.0$ ($\theta = 2^\circ - 9^\circ$)
Field properties	
drift cathode voltage	10-15 kV
drift electrical field	240-1400 V/cm (radial, \perp beam)
Solenoid magnetic field	0.5 T (\parallel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



TimeStep problem „solved“



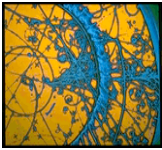
dca vs sec (East)



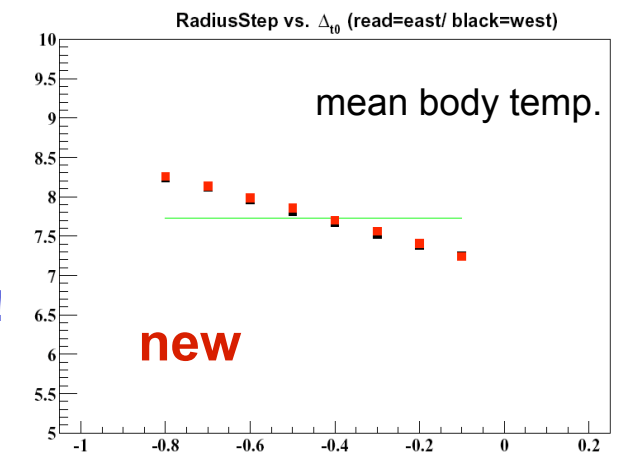
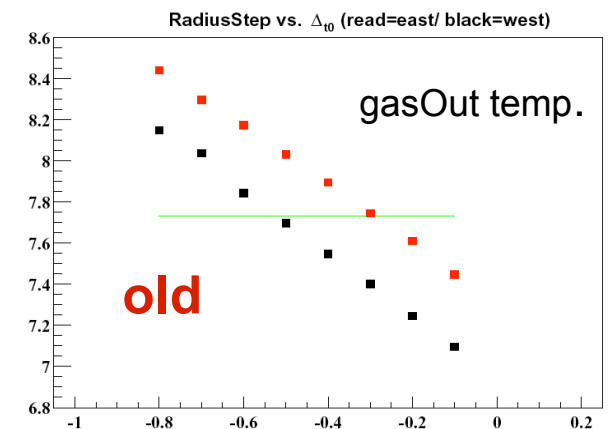
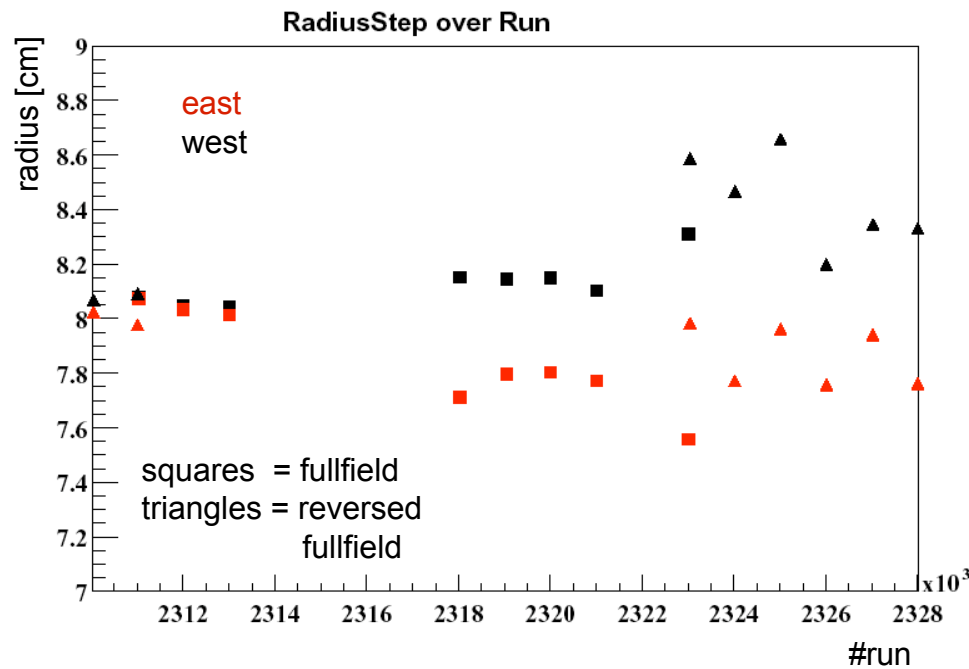
shift of the inner cathode relative to the padplane

**Offset of the inner cathode by 0.25 mm
can explain the TimeStep structure !**

**Influence on the momentum reconstruction under study,
but corrections can be applied !**

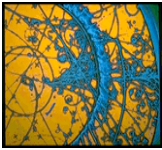


Time dependence of FTPC gas temperature „understood“

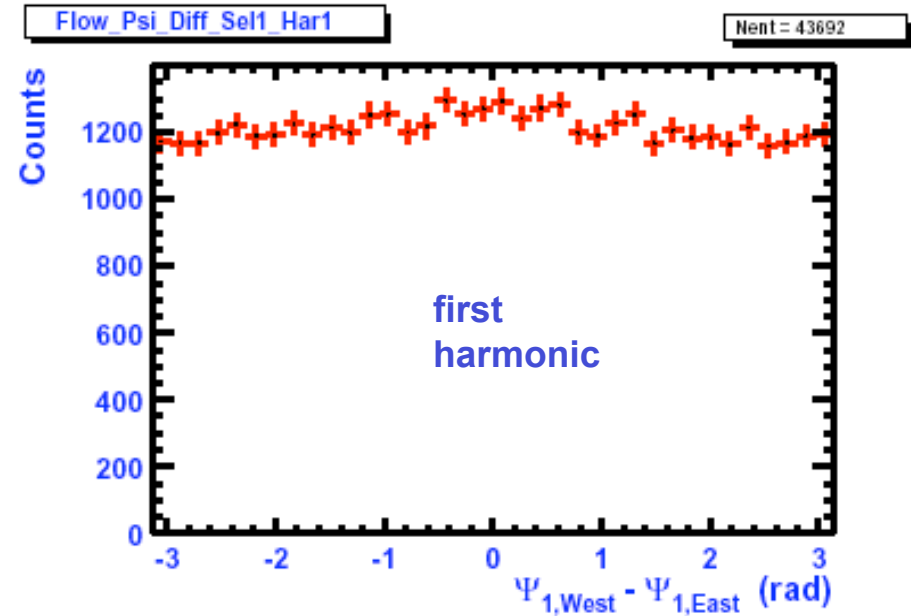
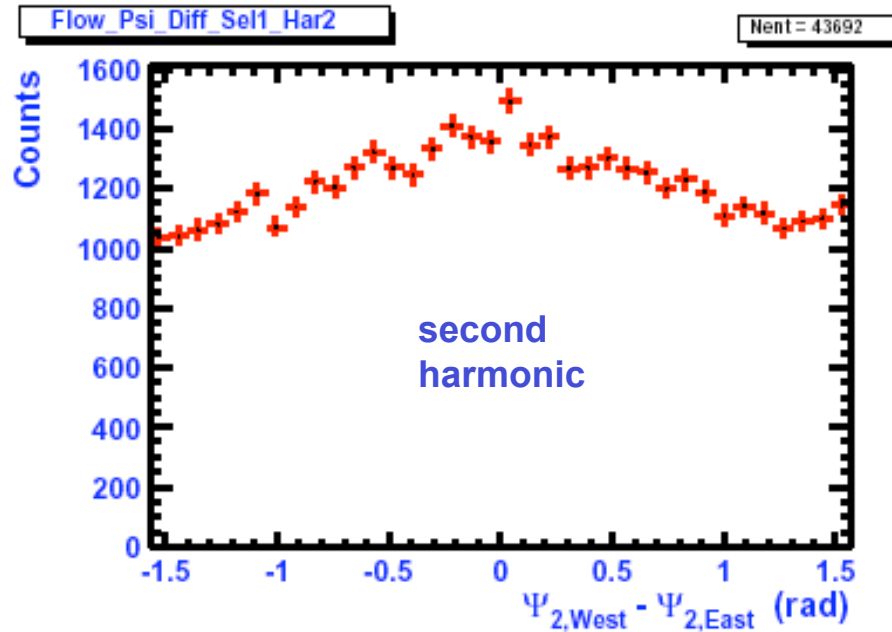


Difference in the radialStep between FTPC east and west
due to wrong temperature correction in the reconstruction !

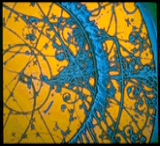
**body temperature added in Db,
check is in progress !**



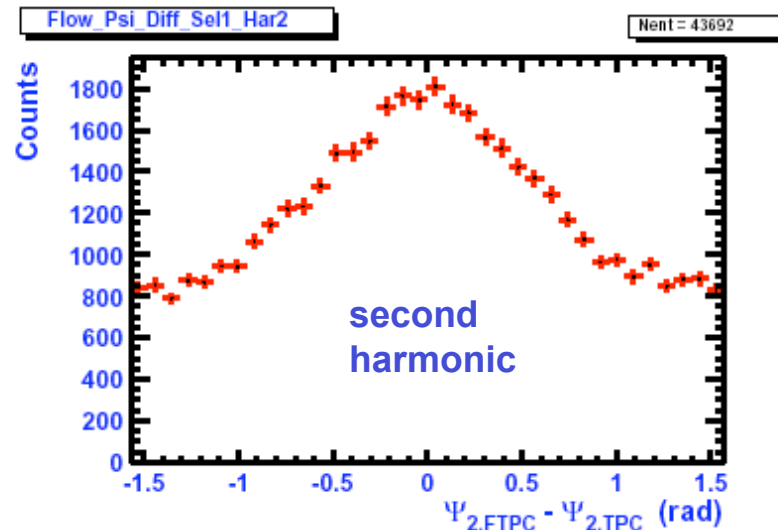
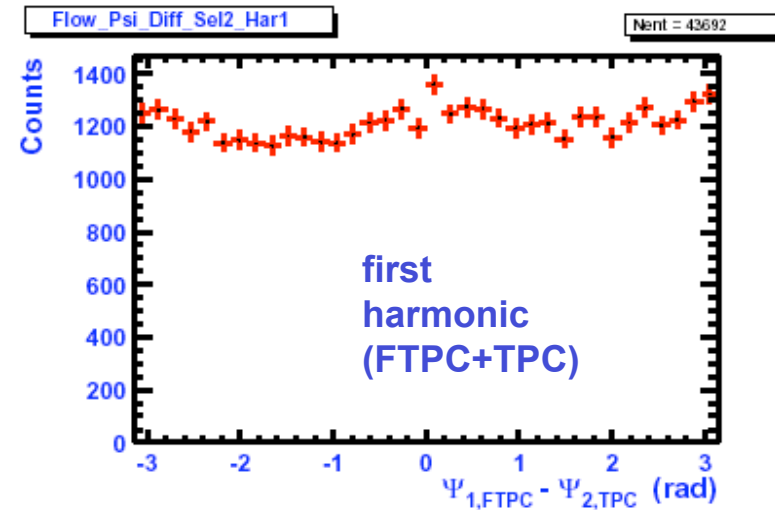
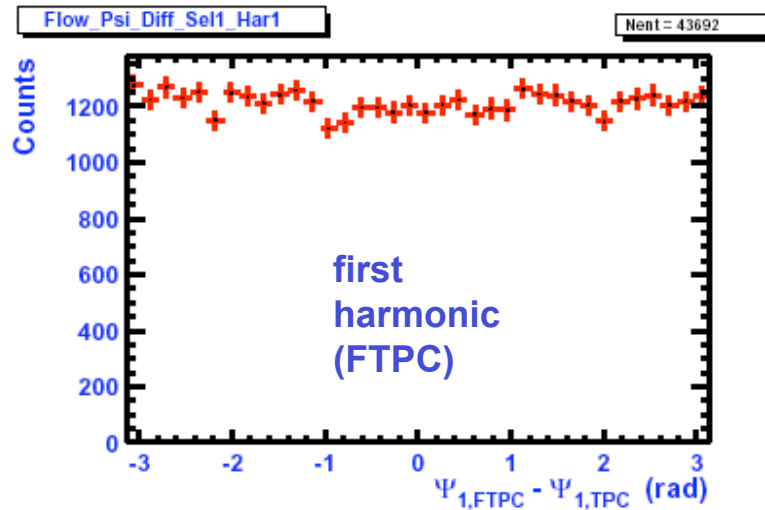
Event plane correlations FTPC East/West



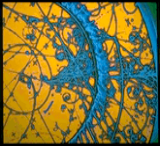
- elliptic flow visible in the FTPCs
- direct flow not visible or very small with FTPCs only



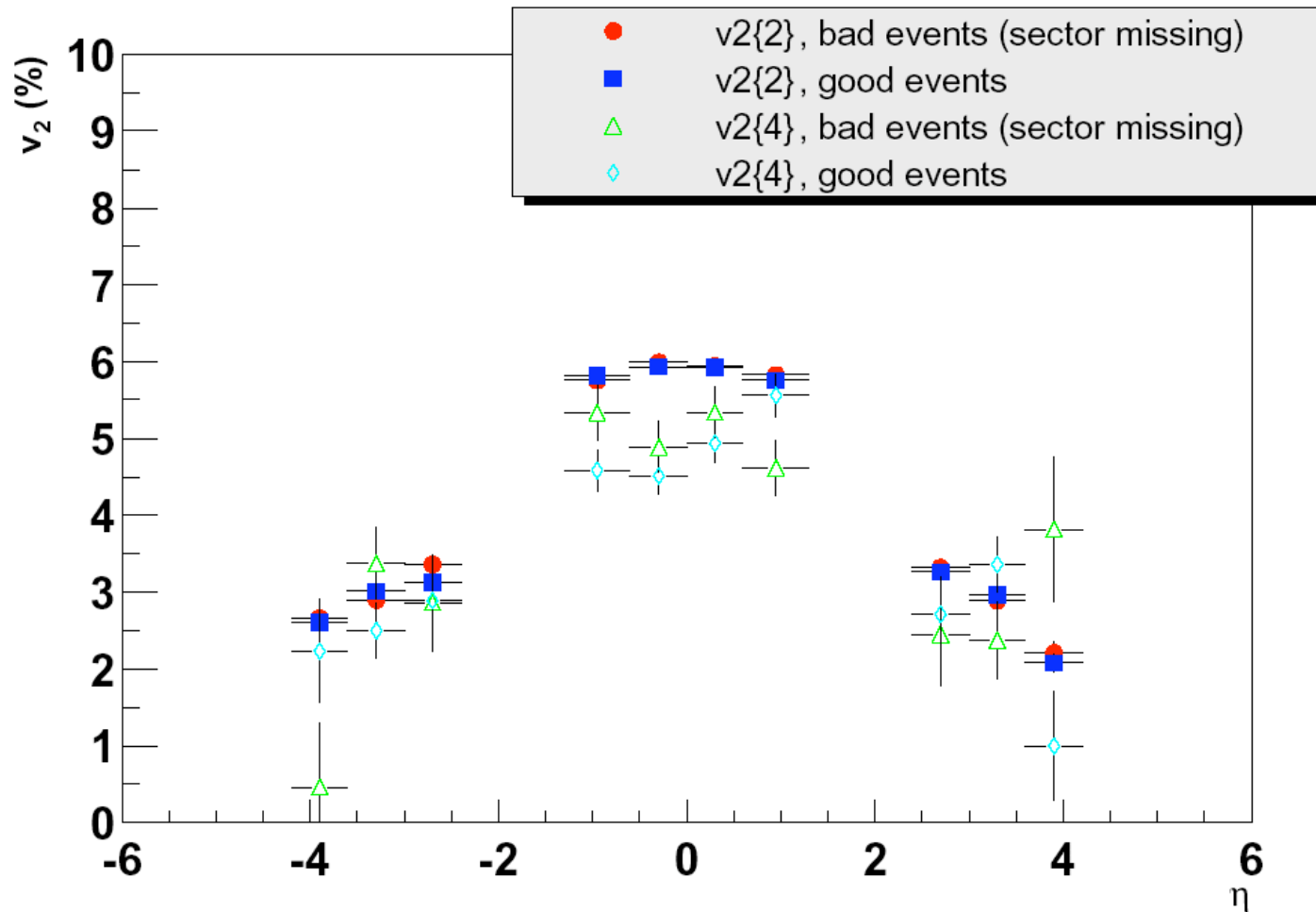
Event plane correlations FTPC/TPC



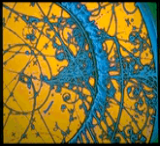
- improved elliptic flow signal
- maybe small signal for directed flow visible with FTPC and TPC together



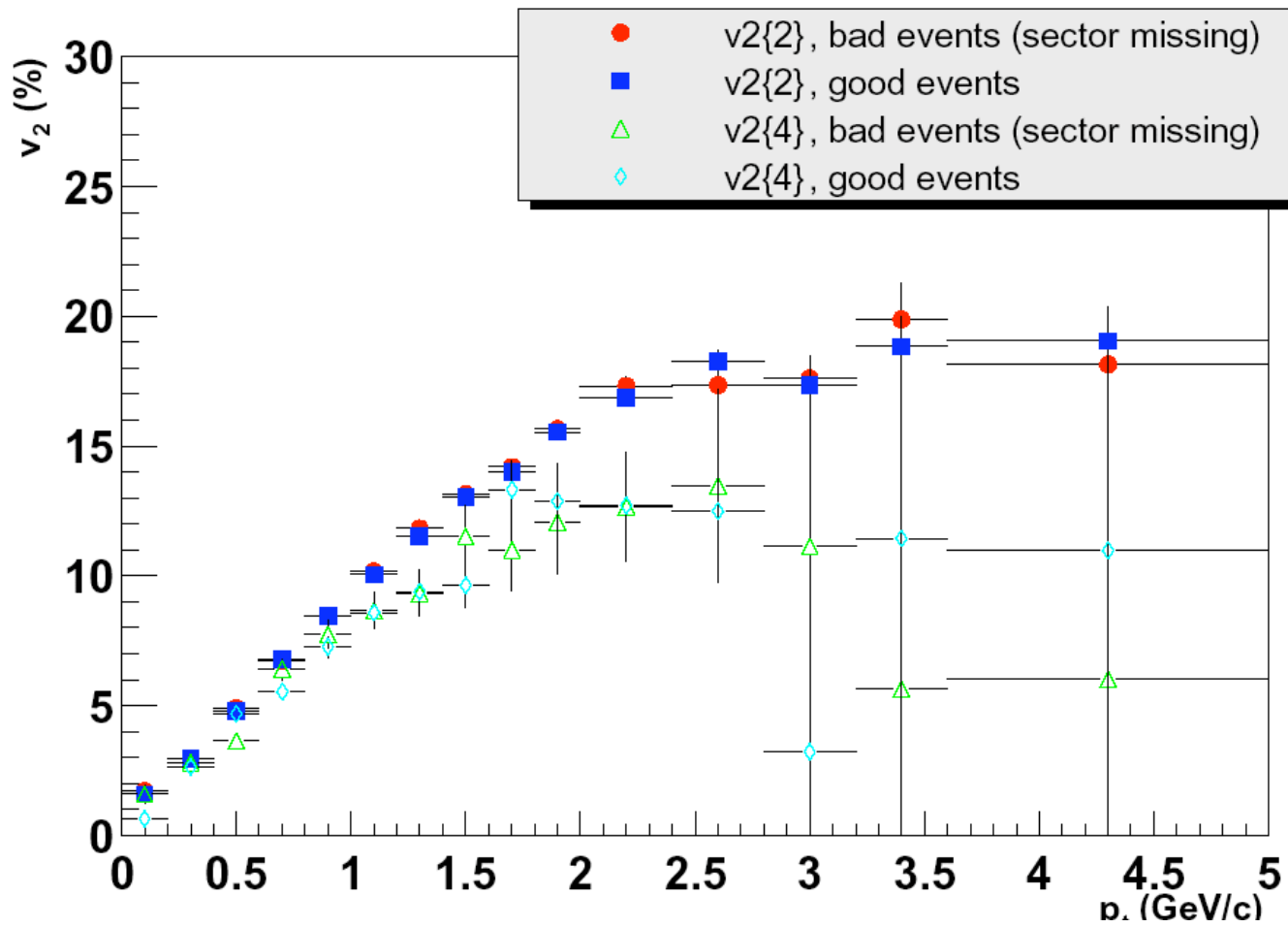
v_2 VS. η



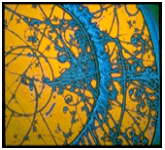
Aihong Tang



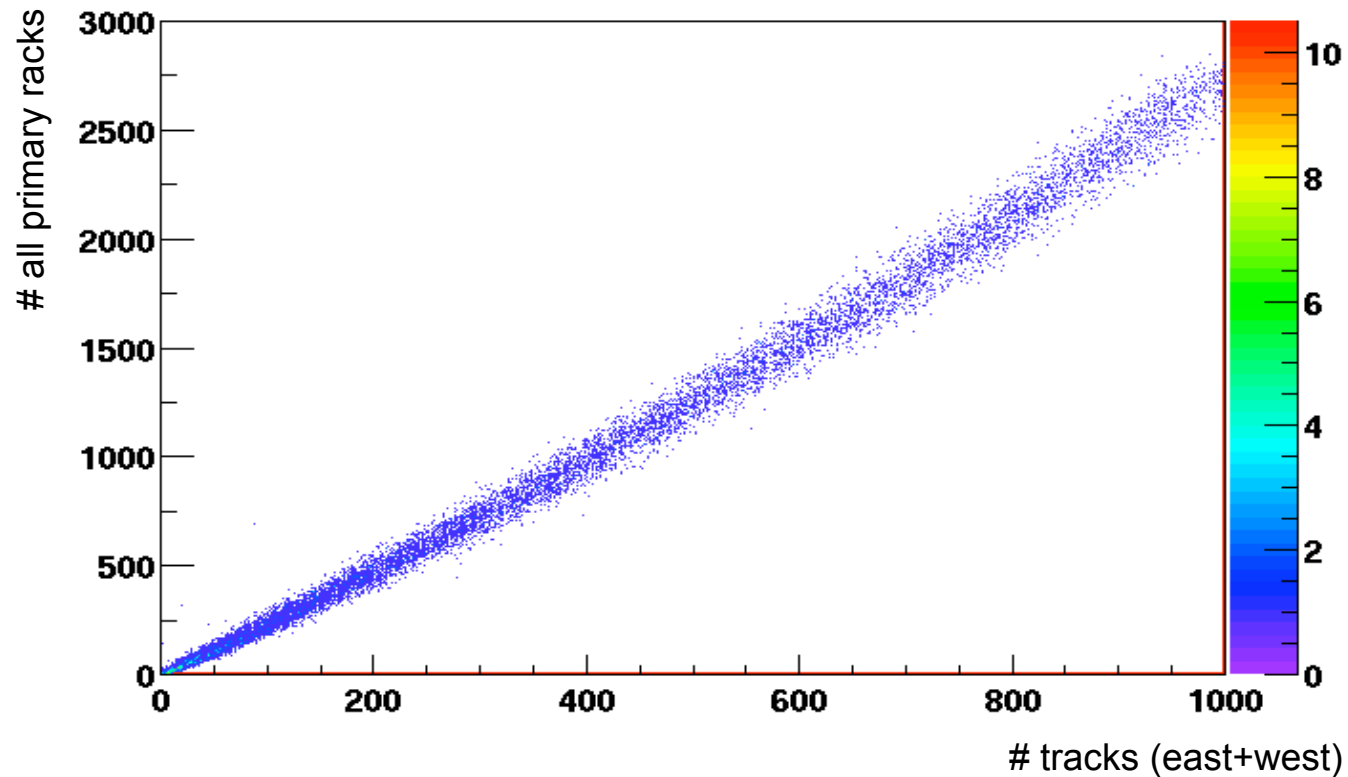
v_2 vs. p_t



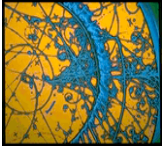
Aihong Tang



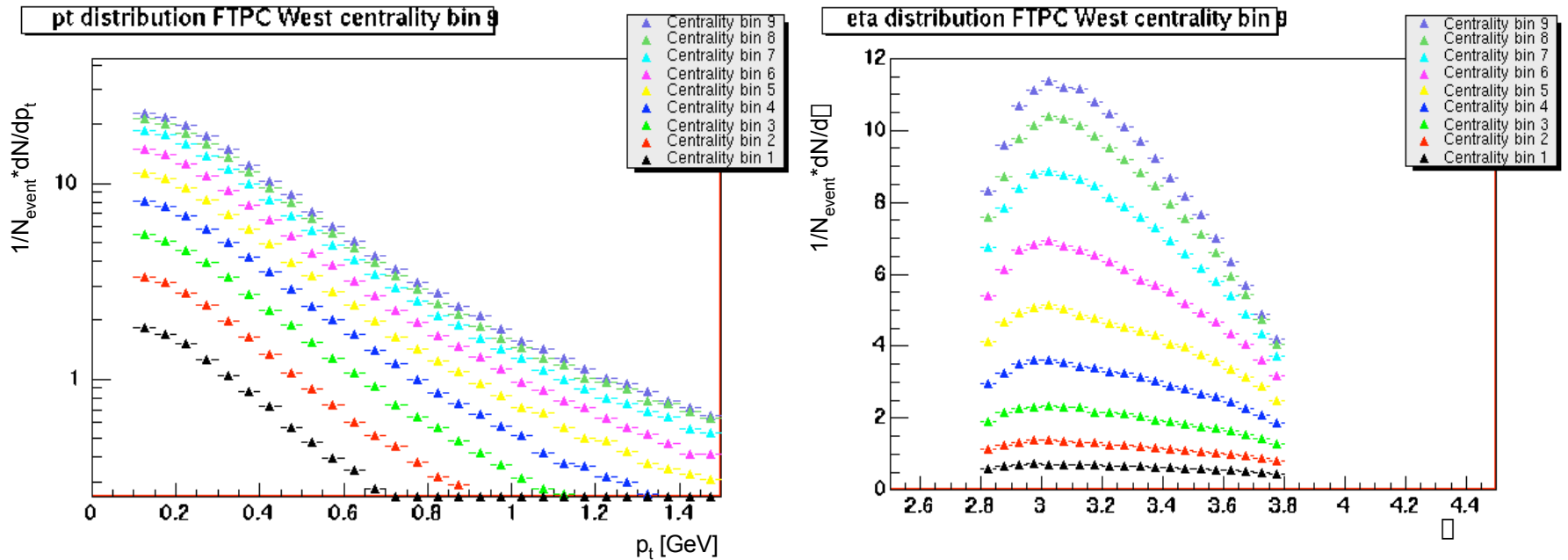
Multiplicity AuAu minbias FTPC vs. TPC (raw)



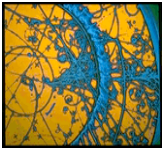
no quality cut applied on FTPC tracks (primary & secondaries)



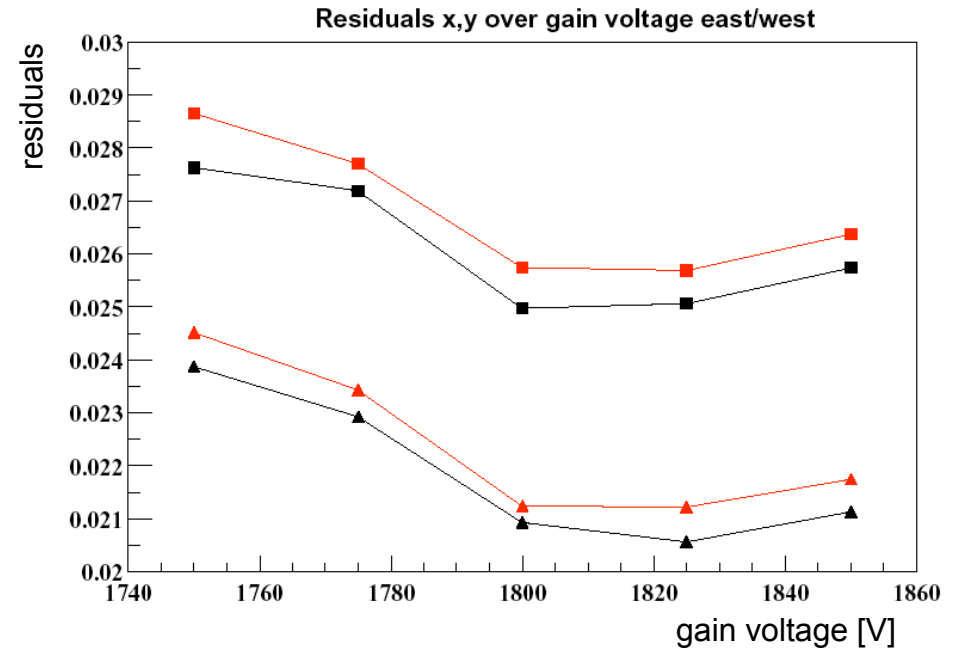
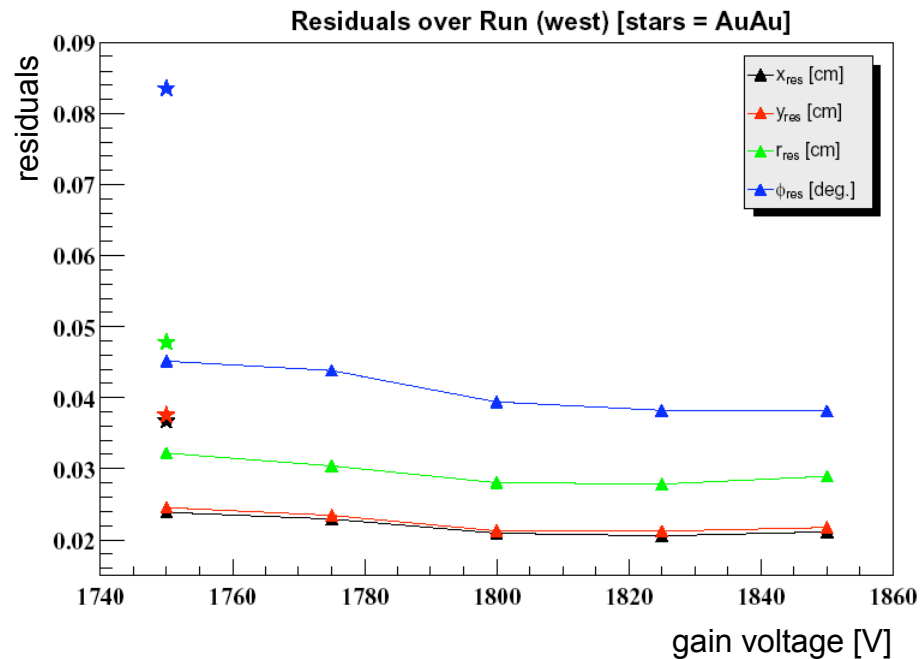
AuAu minbias (raw) charged particle spectra



**Efficiency and acceptance calculations have started,
embedding is on the way !**

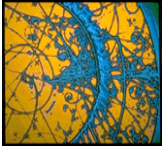


Global residuals in dAu

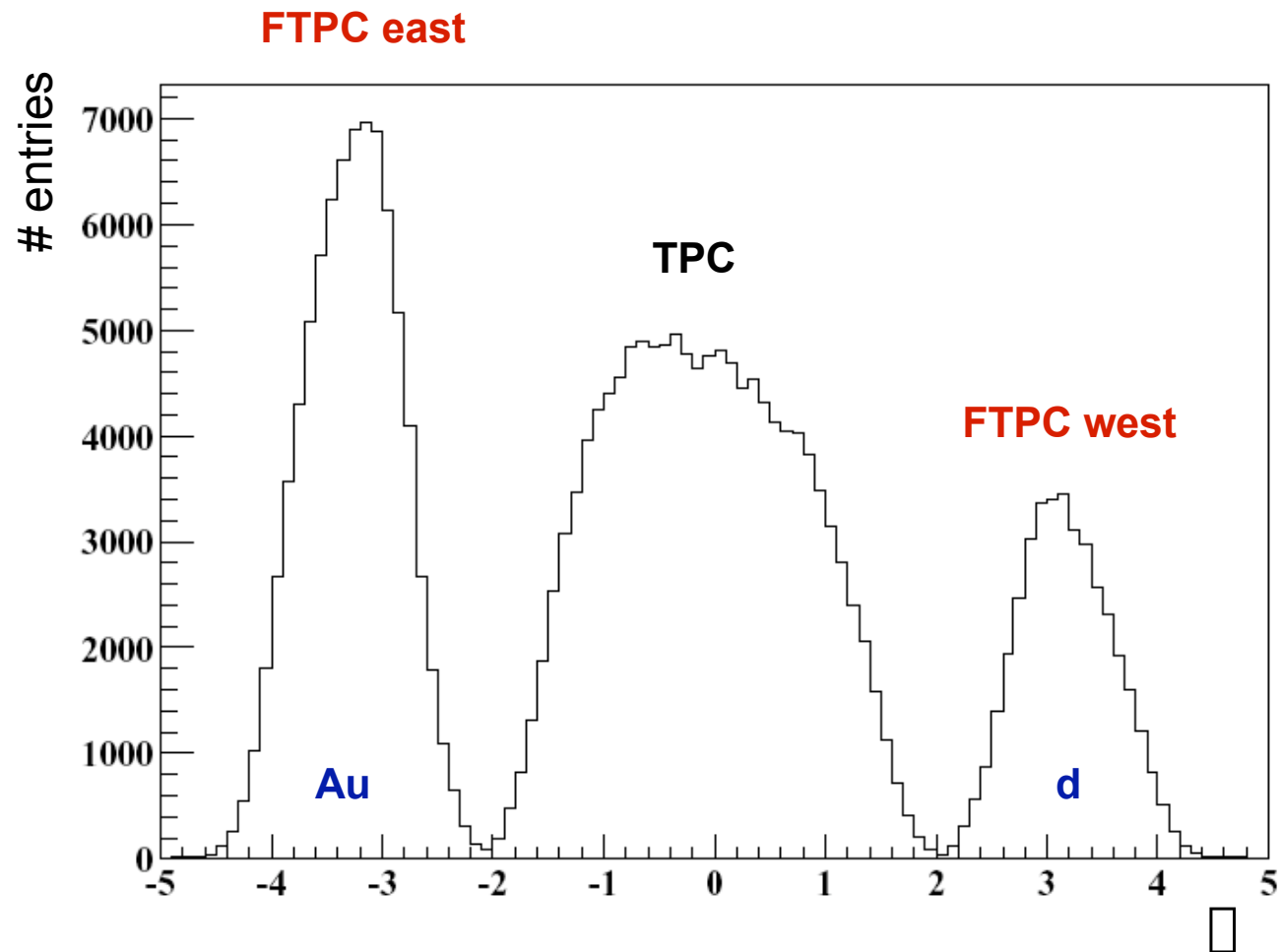


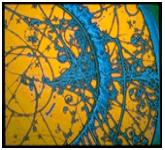
- improvement of a factor 2 compared to AuAu (central)
- „residual plateau“ reached at 1800 V (current FTPC setup)

But need to be redone with all corrections !

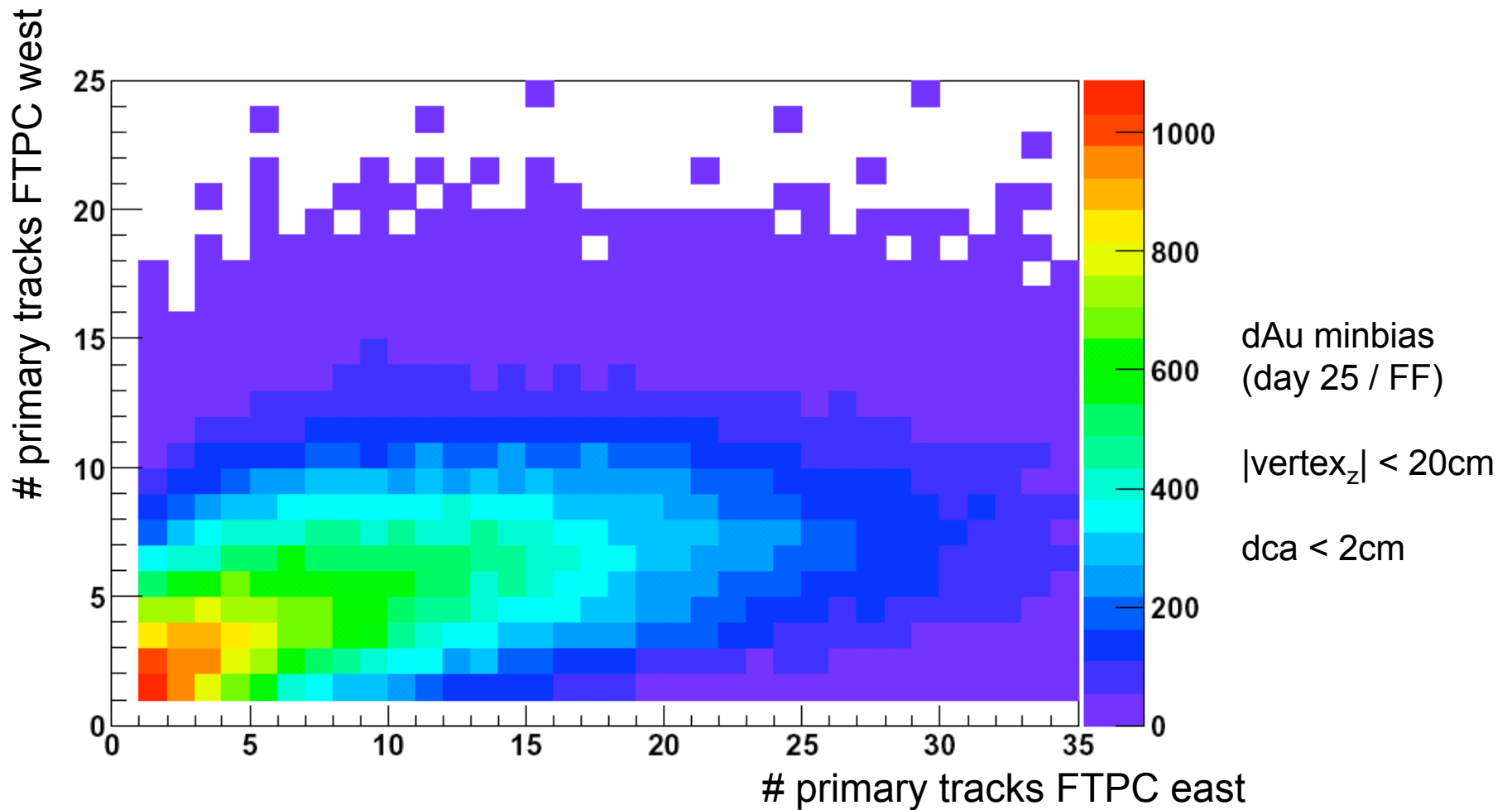


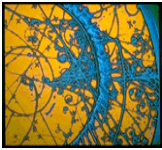
dAu (raw) η distribution





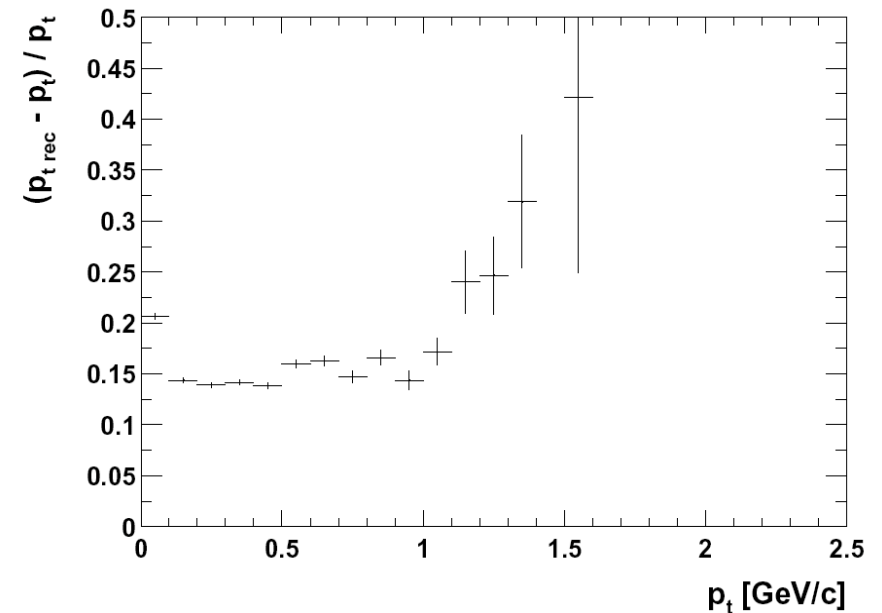
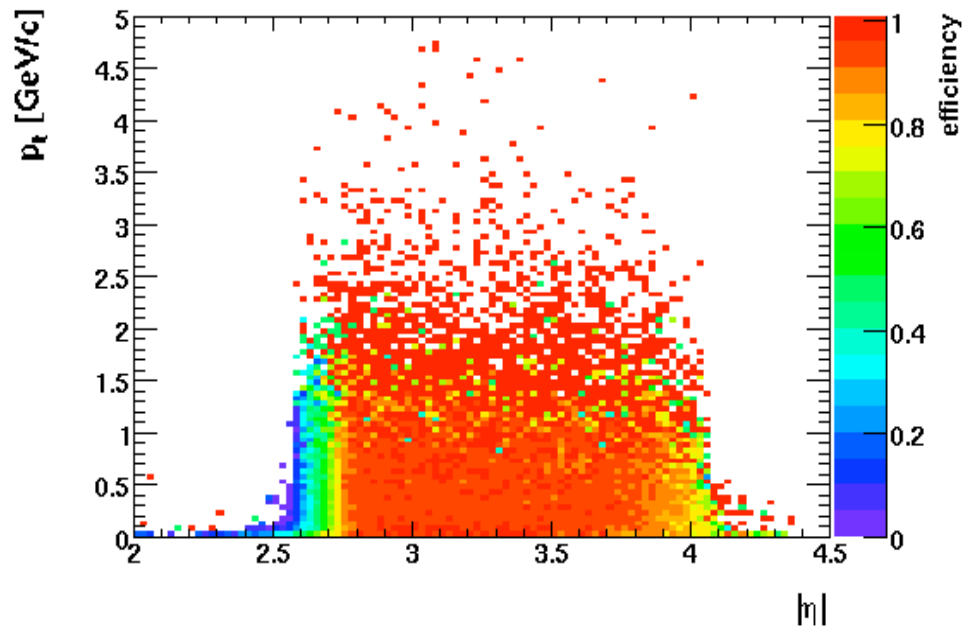
FTPC east/west multiplicity asymmetry (raw)





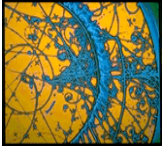
dAu efficiency and momentum resolution

$|\text{vertex}_z| < 20\text{cm}$

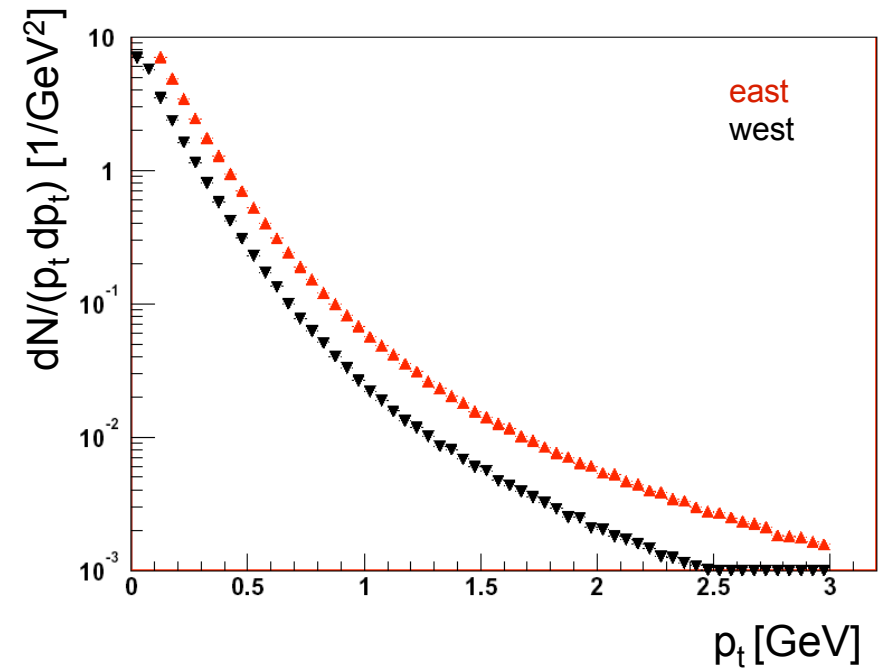
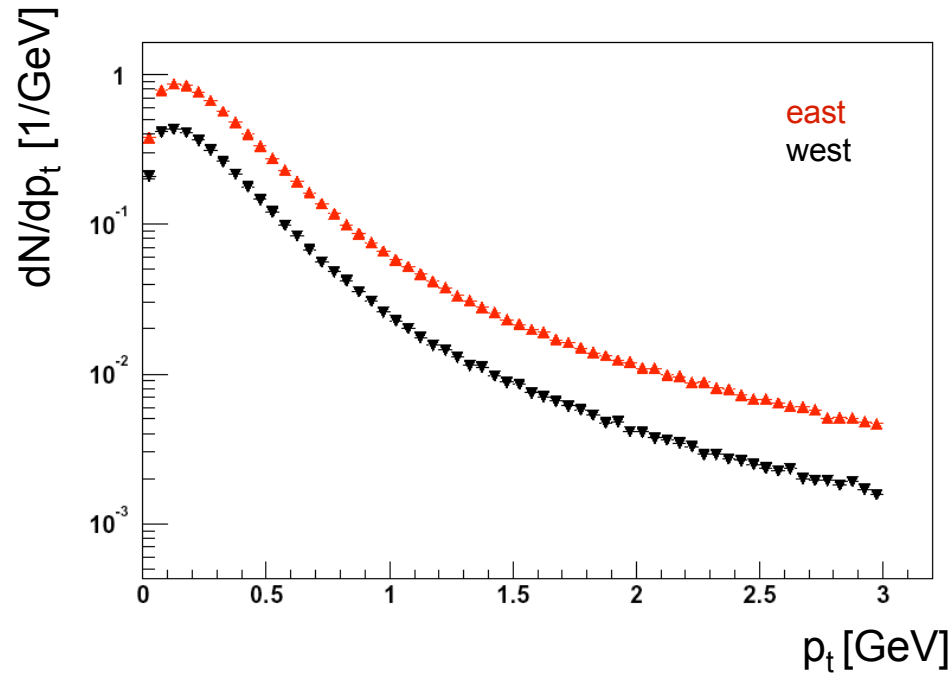


- high efficiency in dAu for a wide η range due to low multiplicities in dAu events
- efficiency almost constant in p_t
- momentum resolution $\sim 15\%$ up to 1 GeV

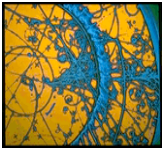
**Now only MC simulations,
but embedding is on the way !**



Raw p_t spectra in dAu

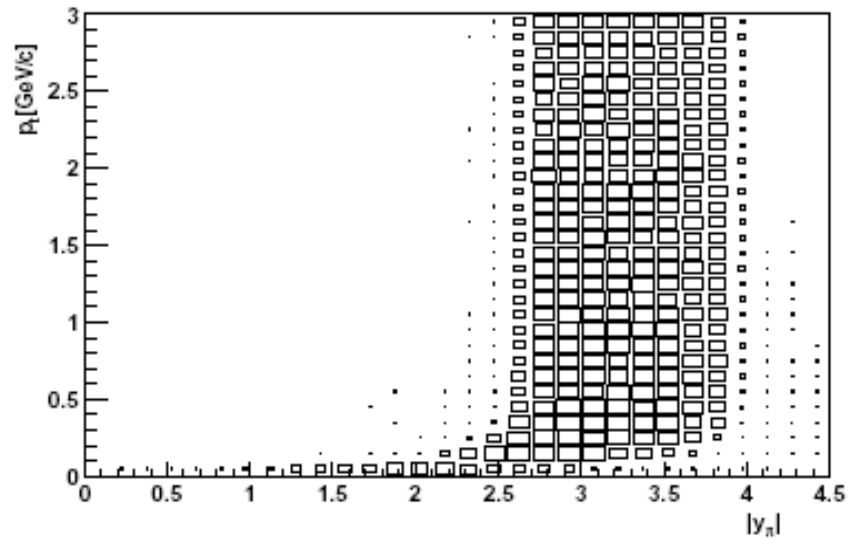


Measurement of charged particles up to 3 GeV and higher possible, but with a very bad momentum resolution !



Pion acceptance in the FTPCs

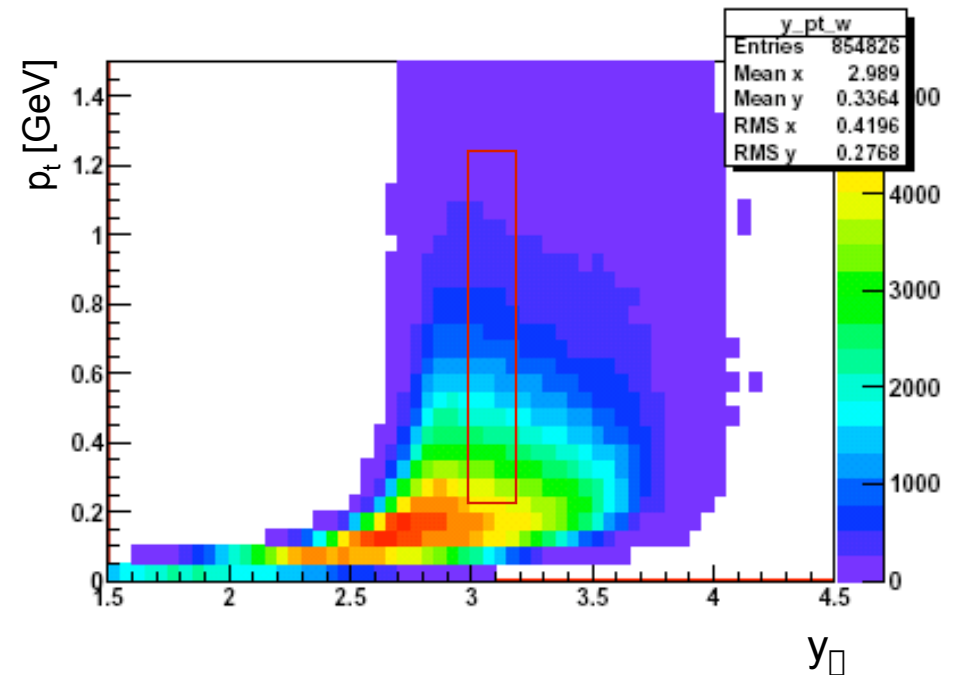
FTPC acceptance, 5 hits minimum

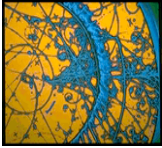


simulated AuAu events

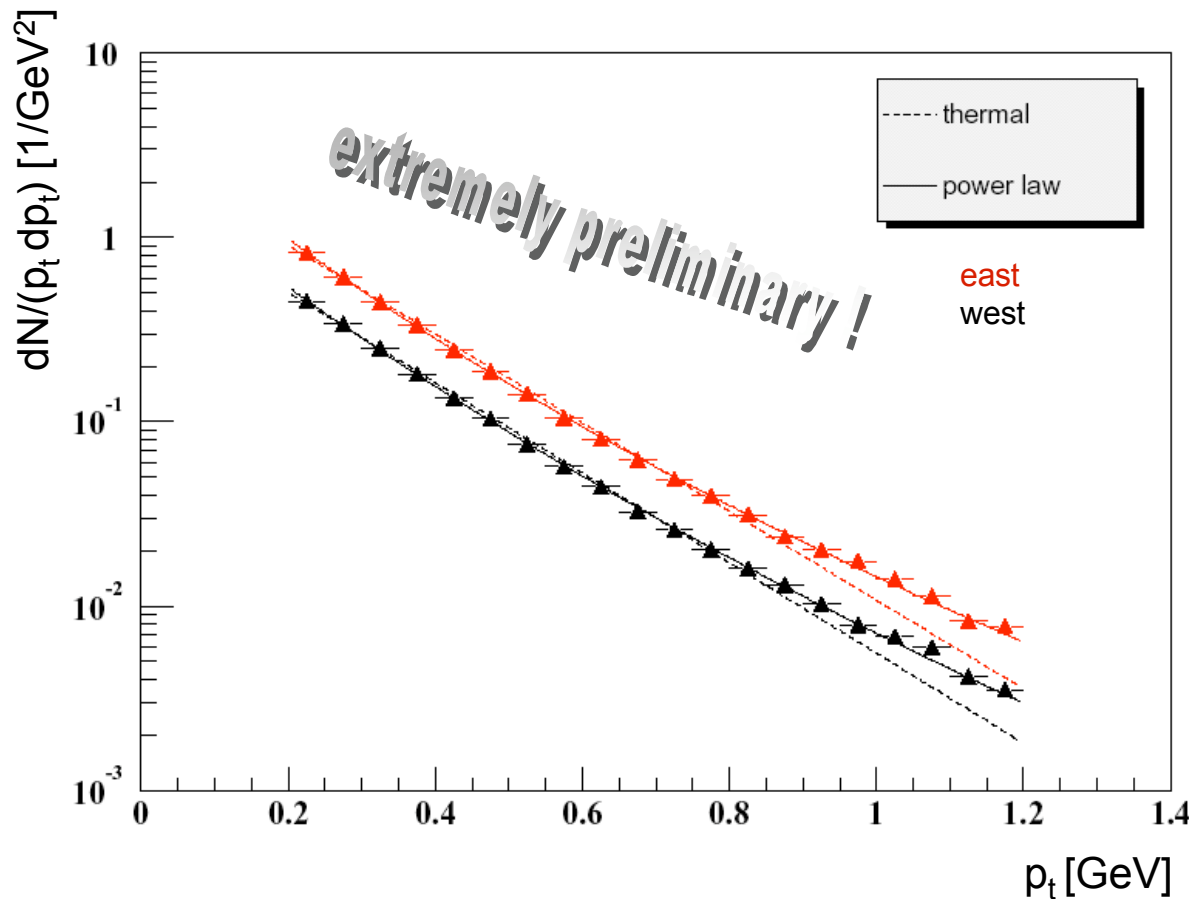
apply cut in y and p_t of the pions to prevent bias of the p_t distribution at low p_t

dAu data FTFC west





First look at p_t spectra in dAu



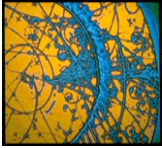
570k (215k)
FF dAu minbias
(day 25 & 26)

- $|\text{vertex}_z| < 20\text{cm}$
- $\text{dca} < 2\text{cm}$
- $3 < |y_\square| < 3.2$
- $p_t > 0.2\text{ GeV}$
- $n_{\text{points}} = 10$

- **no momentum resolution correction!**
- MC efficiency correction applied

$\langle p_t \rangle = 0.38\text{ GeV}$

$\langle p_t \rangle = 0.37\text{ GeV}$

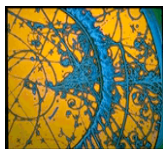


Summary



- **FTPC calibration will be finished soon (2-4 weeks)**
 - TimeStep correction must be applied and checked
- **flow analysis “on the way”**
 - need reproduction of the AuAu minbias data set after final calibration
- **spectra for dAu & AuAu look very promising**
 - improved detector setup for dAu
 - reproduction needed
- **embedding & efficiency studies will start soon**

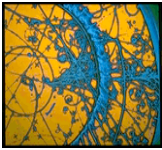
FTPC „ready“ for physics analysis !



The STAR FTPC group

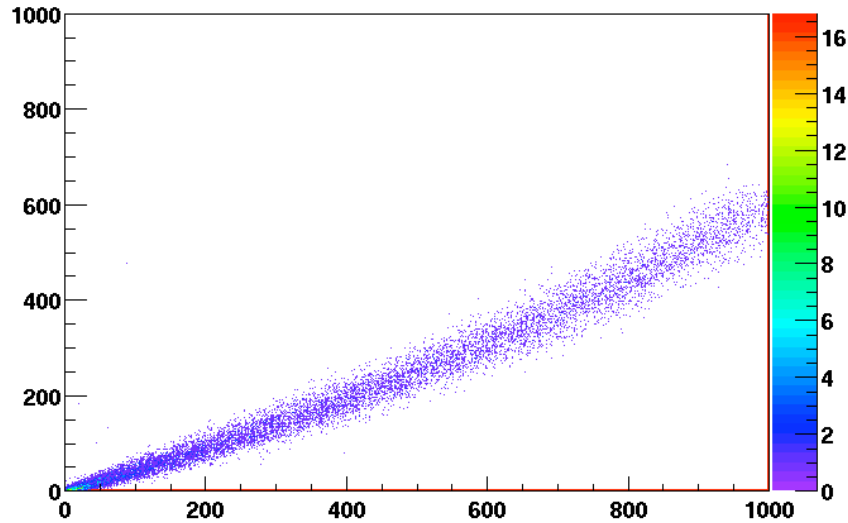
- Volker Eckardt
- Peter Maierbeck
- Maria Mora Corral
- Markus Oldenburg
- Joern Putschke
- Janet Seyboth
- Peter Seyboth
- Frank Simon



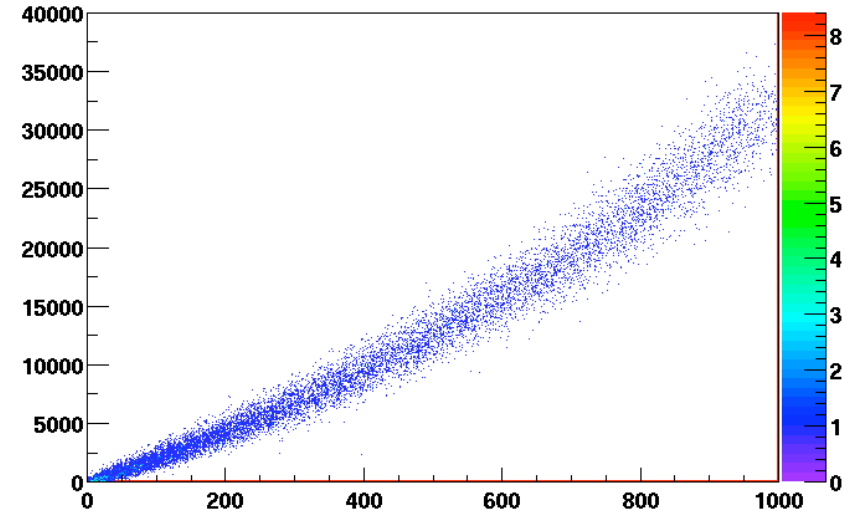


FTPC raw multiplicity vs. TPC/CTB

#tracks FTPC vs TPC



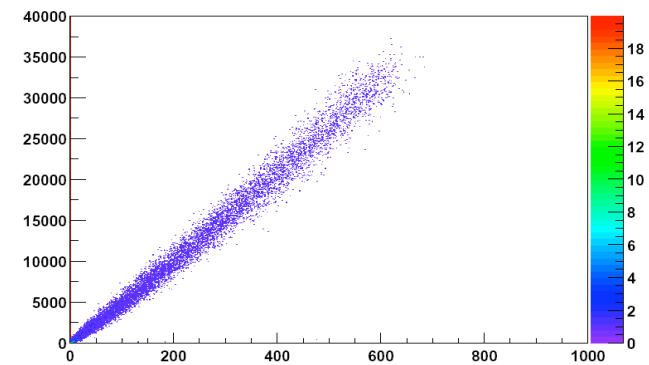
#tracks FTPC vs ctb

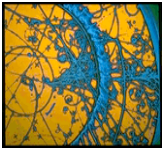


no quality cut applied on FTPC tracks
(primary & secondaries)

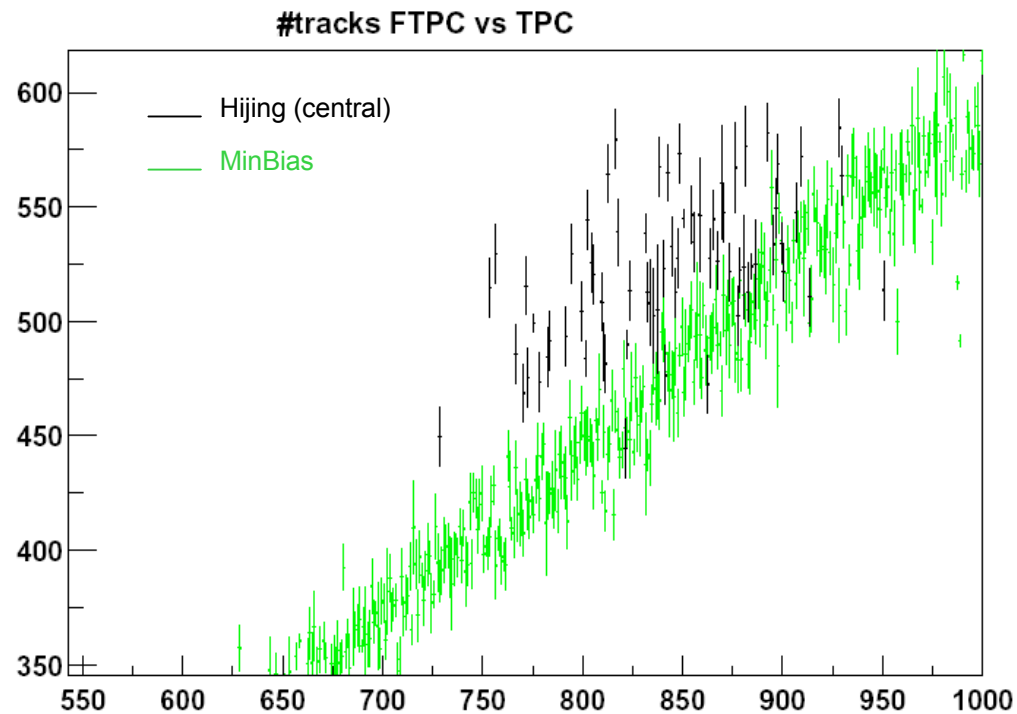
**but good correlation between FTPC
and TPC / CTB multiplicity !**

#tracks TPC (centrality) vs ctb

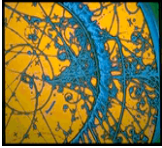




FTPC raw minBias and raw Hijing multiplicity

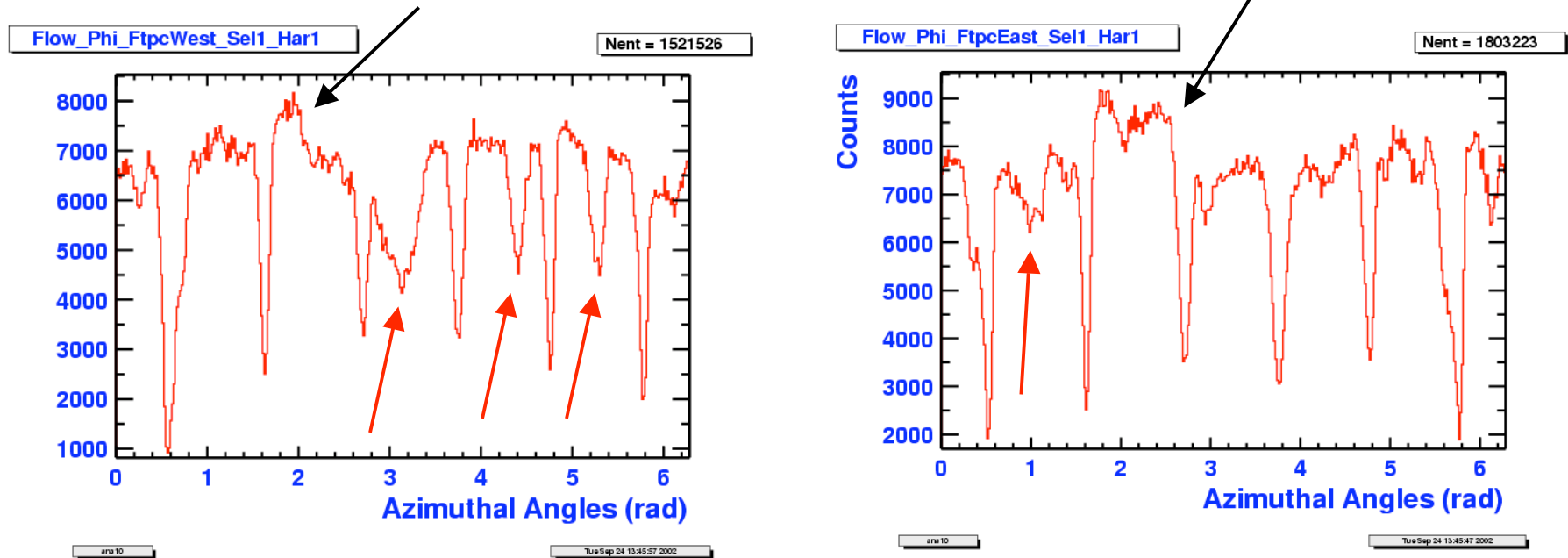


- “good” agreement between Hijing and minBias data
- more reconstructed tracks in data could be due to higher background and additional noise

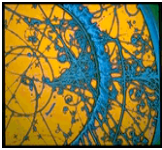


Azimuthal angle distribution

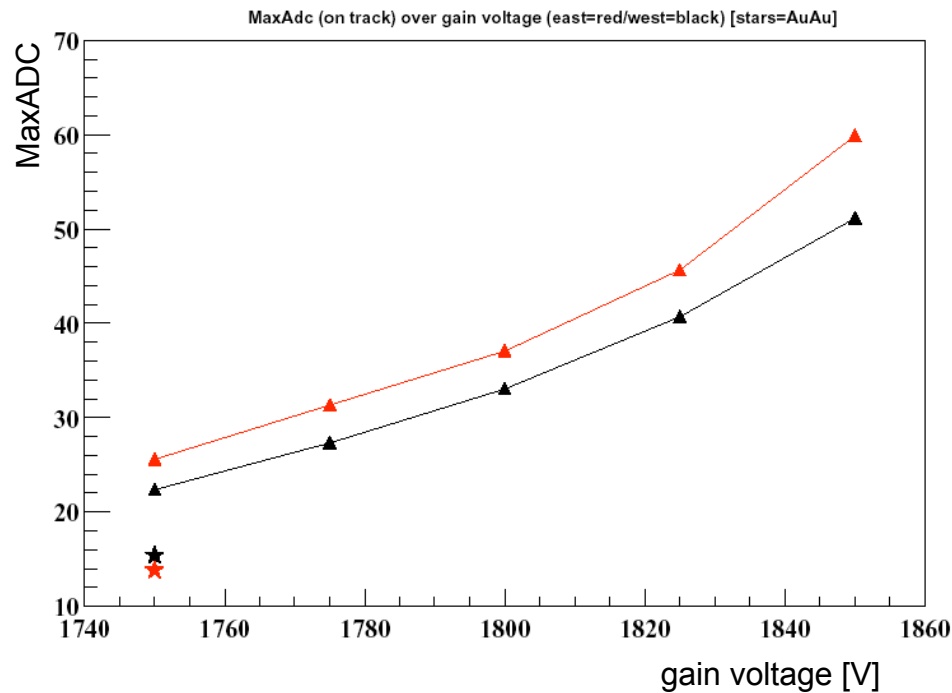
Flow analysis with ~32k minbias events (after day 308)



- 6 fold structure reflects azimuthal FTPC sector design
- additional holes \square electronic loss
- higher sector due to eta weighting (noise cluster on tracks)

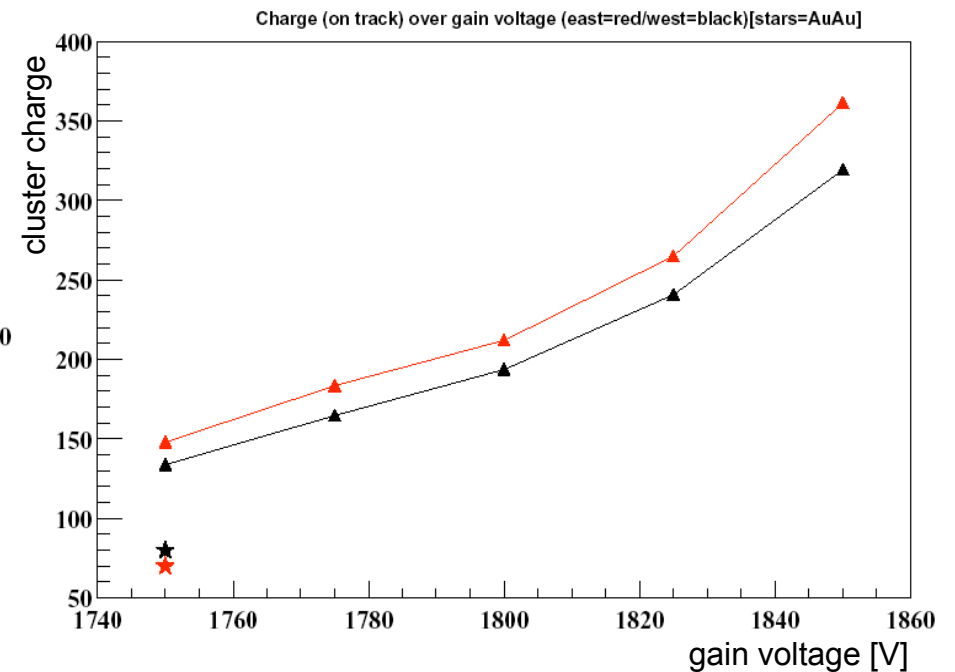


FTPC dAu gain

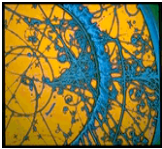


MaxADC and cluster charge scales like expected:

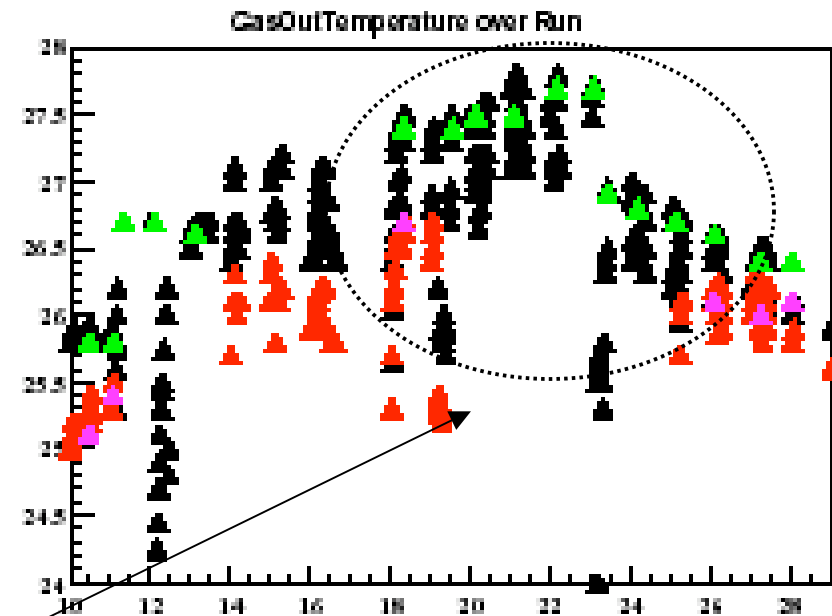
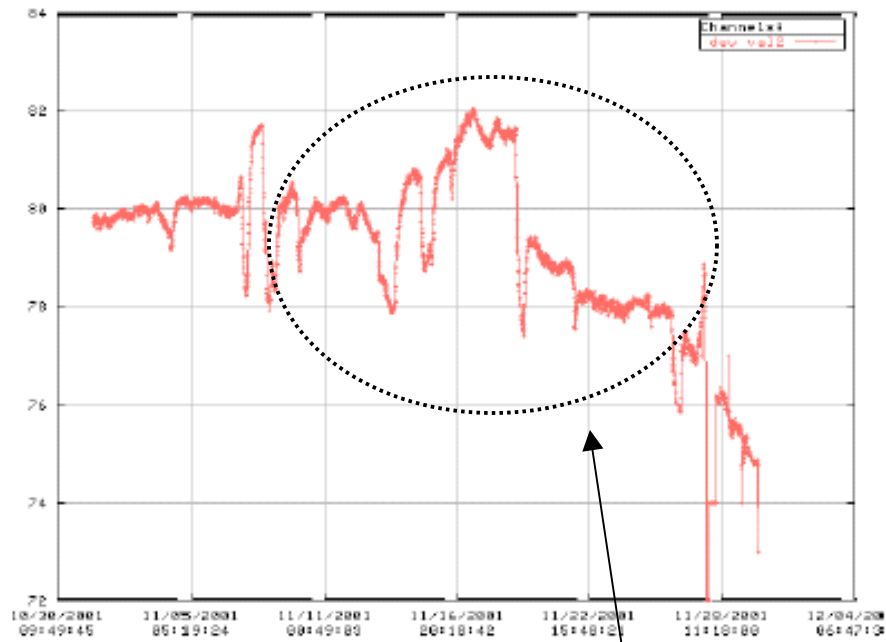
100 V ~ a factor of two in charge/MaxADC.



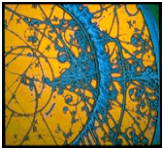
**Difference between AuAu and dAu
maybe due to a grounding problem !?
(pulser data show the same effect)**



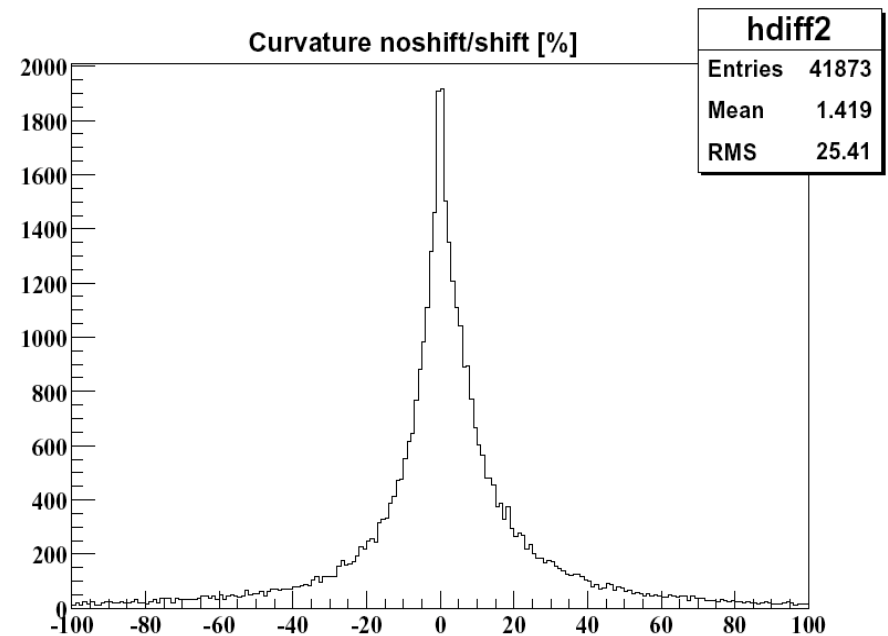
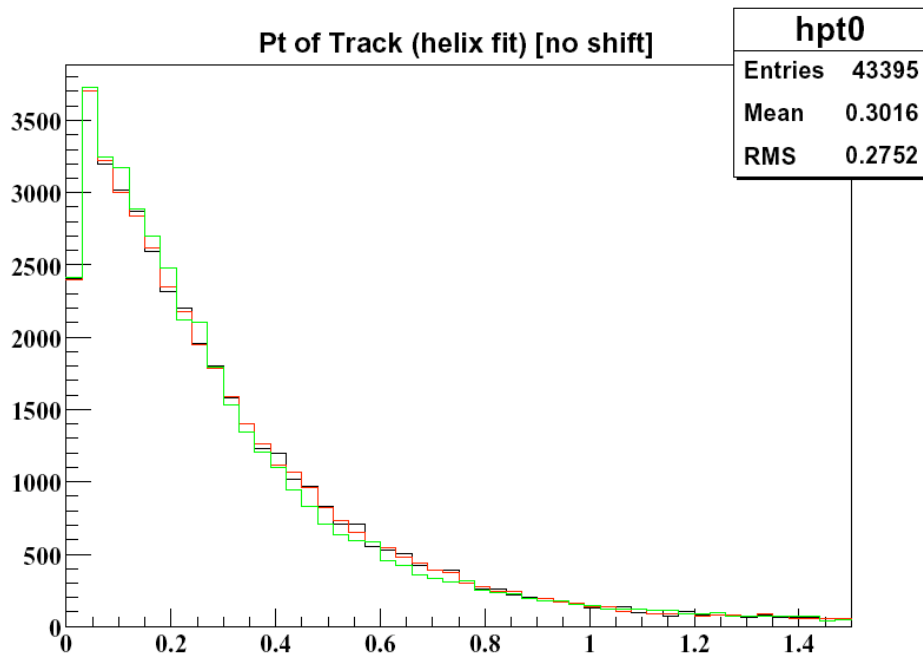
gasOut temperature (AuAu)



correlation between gasOut and environment (hall) temperature !



Influence of 'TimeStep' on momentum ?



**Influence visible; my guess up to 5% !
(Check with more realistic time-shift must be done!)**

**Principle problem of our momentum fit :
point order has an influence !?**

