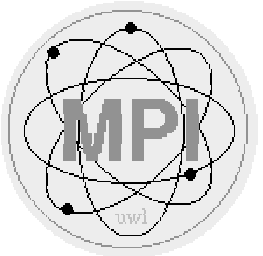
A radial TPC for STAR



A.Schüttauf for the STAR-collaboration

- Reminder on RHIC+STAR.
- The FTPC`s in STAR.
- Why radial drift.
- The FTPC hardware.
- Status + Outlook.

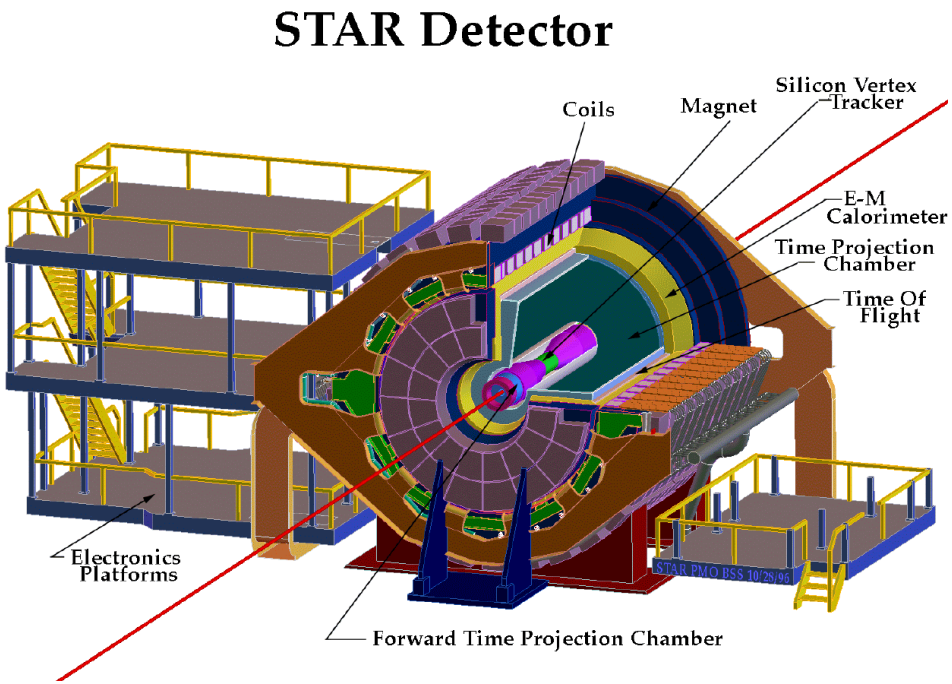
RHIC+STAR

RHIC offers 200 AGeV Au + Au.

Starting period NOW !

STAR Solenoidal Tracker At RHIC.

GOAL := Search for QGP



FTPC‘s

Final design

2 Chambers 1200 mm x 730 mm.

Each FTPC has 5 rings with 6 sectors.

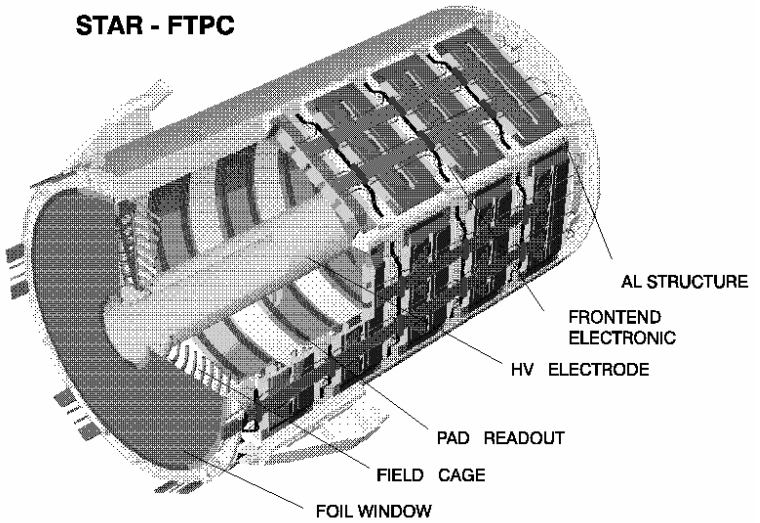
Each chamber has 10 padrows.

One padrow has 960 pads.

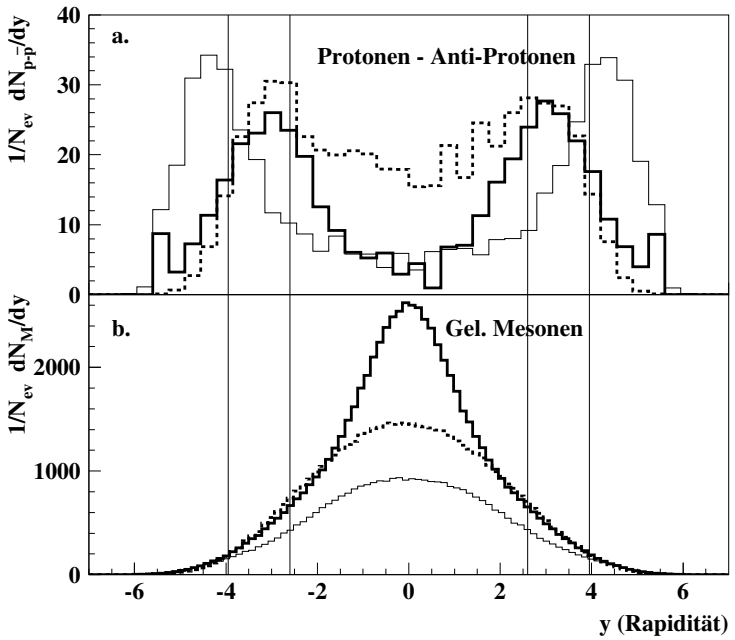
In total 9600 pads/FTPC.

Gas = Ar/CO_2 (50/50).

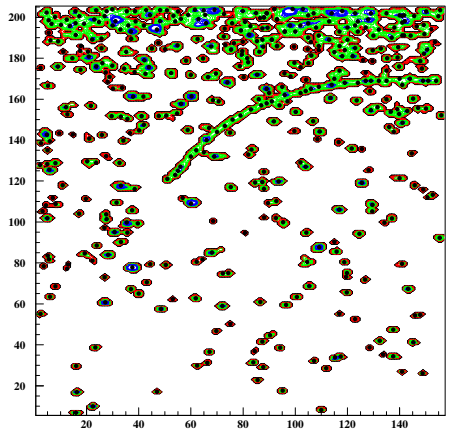
Each electronic channel has 256 timebins (200 ns) and a 8 bit ADC.

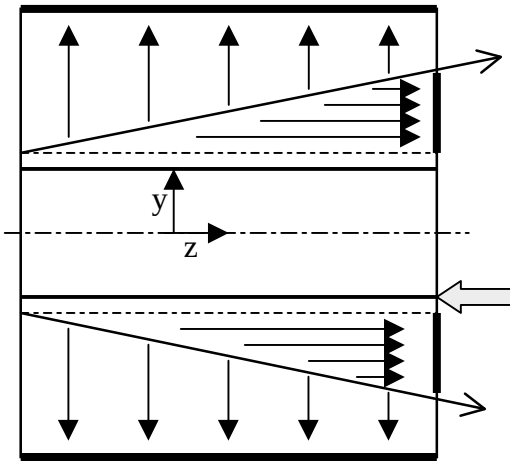


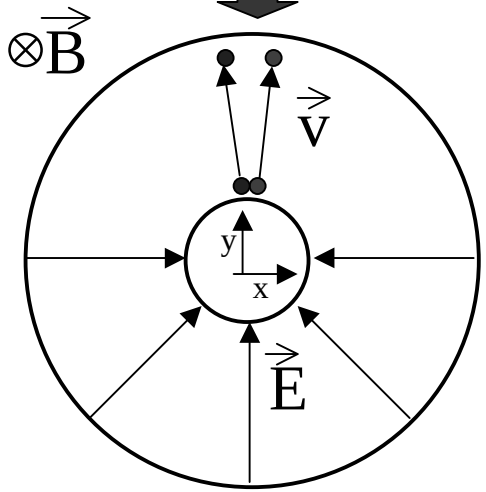
- Extend acceptance of STAR tracking into region $2.5 < |\eta| < 4.0$, $p_t > 40$ MeV/c.
- Charged paricles dp/p ~ 12%.
- Neutral strange particles K_s, Λ.
- Inclusive measurements $dN/dydp_t$.
- N+-N-net proton distribuion.
- Event-by Event fluctuation in dN/dy , $\langle p_t \rangle$.
- Study of directed ,elliptical flow.
- Asymmetric systems.



Why radial drift







High track density for 2.5< |η|<4.
Occupancy of ~30-35% at inner radius.

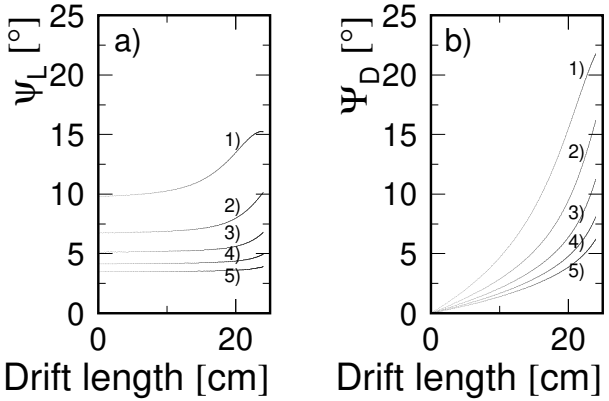
Large dip angle for drift to end caps .

Small track to track distance at small angles or high η.

Lorentz angle

Gas Ar/CO_2

1) 80/20
2) 70/30
3) 60/40
4) 50/50
5) 40/60



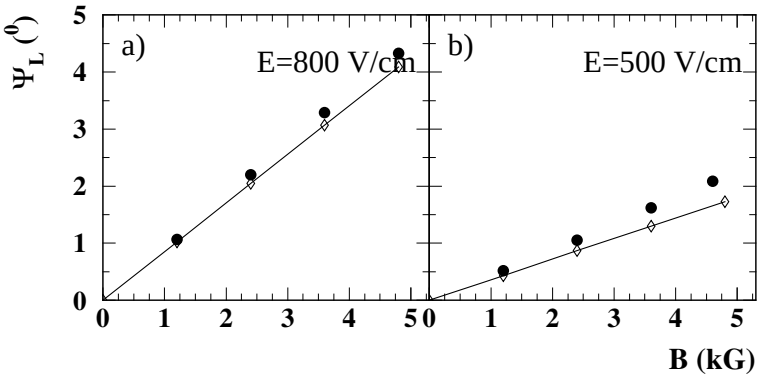
Deflection in $\vec{E} \perp \vec{B}$ field.

$\Psi_D = Deflection\ \ angle$

$\Psi_L = Lorentz\ \ angle$

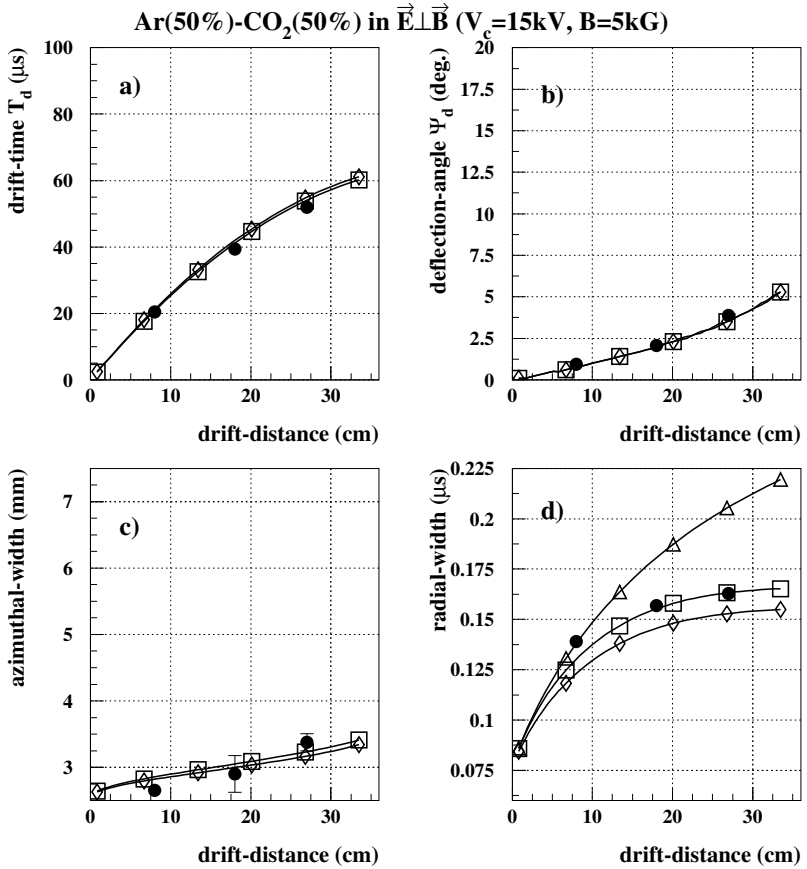
$B = 0.5T$

$$\Psi_D = \int_{r\,0}^{r} \frac{\Psi_L(r)}{r}\, dr$$



Ar/CO_2 Ar/DME

Cluster parameter



Cluster width

$$\sigma_\phi^2 = \sigma_{prf}^2 + \sigma_{diff,\phi}^2$$

$$\sigma_r^2 = \sigma_{prf}^2 + \sigma_{diff,r}^2$$

$\sigma_\phi = azimutal\ \ cluster\ \ width$

$\sigma_r = radial\ \ cluster\ \ width$

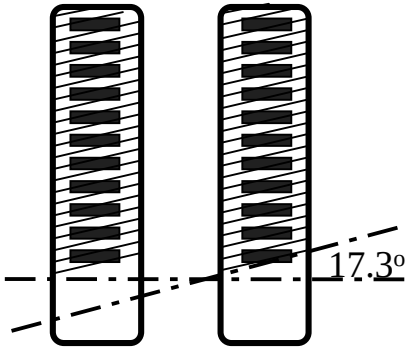
$E = 240 - 1000\ V/cm$

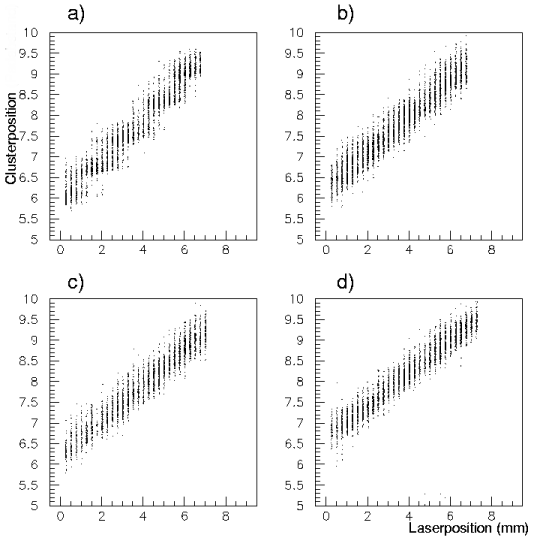
$B = 0.5\ T$

Pad-sense plane

- One pad plane has 320 pads oriented in 2 parallel rows.
- One Pad 1.7 x 20 mm^2.
- Pad pitch 1.9 mm.
- Bending radius 310 mm.

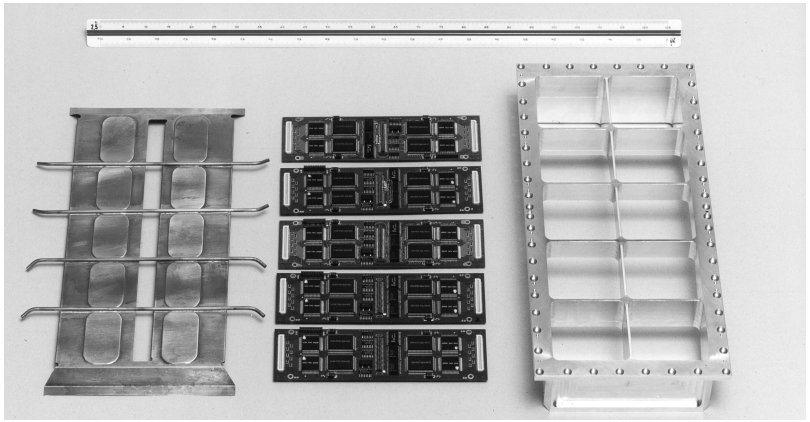
- Sense wire tension 30 g.
- Sense wire / pad angle 17.3^o.
- Sense wire / pad gap 1.5 mm. Sense wires are fixed by conductive glue.

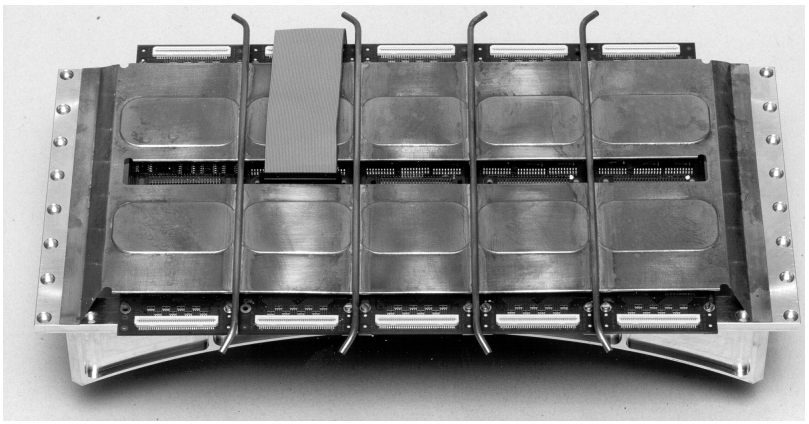




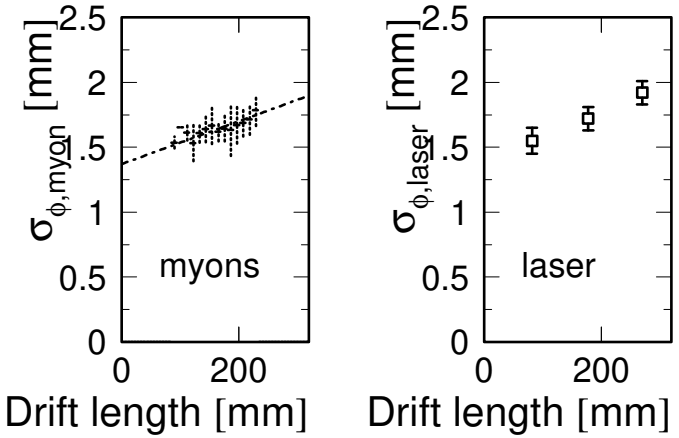
Readout chamber

- 30 RC /FTPC.
- 6 RC in one ring.
- Each RC consist of
  - 1 Alu-stucture
  - 1 Pad-sense plane
  - 5 FEE-cards
  - 1 Cooling plate
- Gas tigthness is done by pad plate.
- Power consumtion pro RC ~ 10W





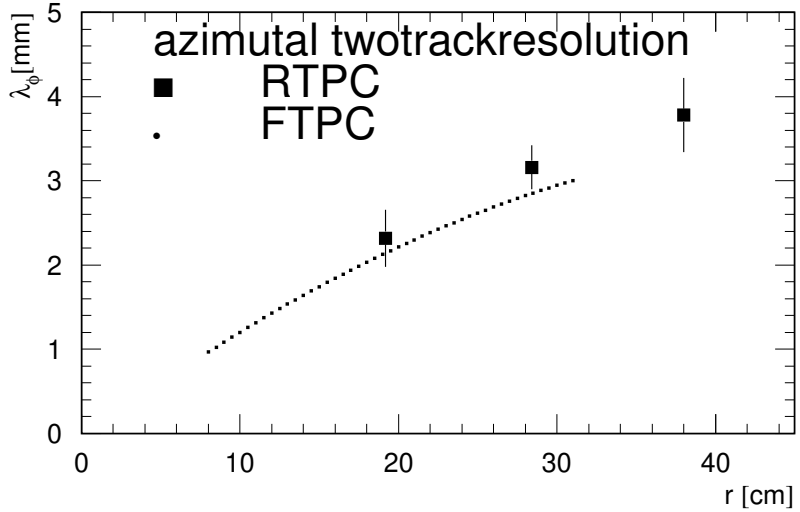
RC-parameter



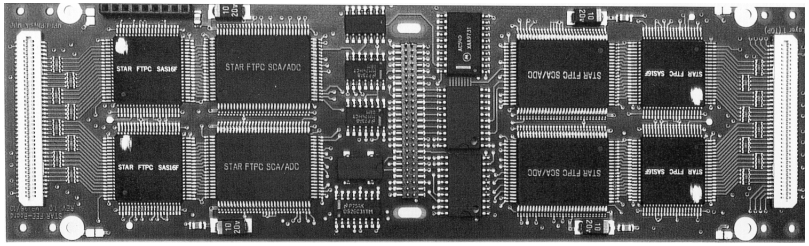
Pad response function

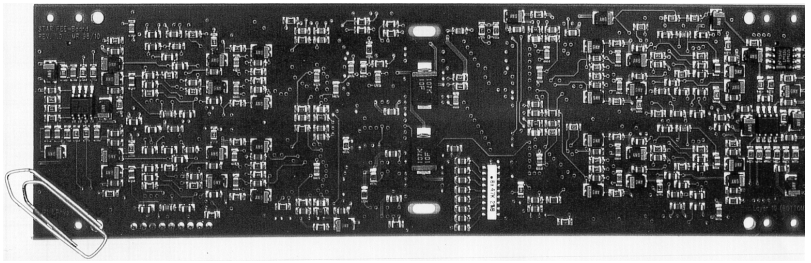
$\sigma_{prf} \cong 1.4\,mm$

Two-track resolution



Electronics





- 150 FEE-cards/FTPC
- 64 channels / FEE-card
- 256 time bins /channel
- 200 ns /bin
- 8 bit ADC

Status + Outlook

- Status
- We finished the final design for the FTPC.
- The complete production scheme is finished.
- The prototype FTPC is under construction.
- Mass production of all readout chambers has started.
- Electronic design is finished, we will start mass production end may `99.

- Outlook
- Building test setup for prototype FTPC.
- Build field cages for both of the FTPC`s.
- Test of all readout chambers in the test setup.
- Electrical and laser test with the FTPC`s.
- GOAL := Ship one FTPC end `99 to BNL.
- See beam beginning year 2000.

FTPC-Collaboration

Name	Position	99 [%]	Activities
Munich			
V.Eckardt	P	90	FTPC coordination, TPC design+construc,physics
H.Fessler	I	30	Safty, TPC construction
H.Huemmler	Student (PHD)	100	Software,TPCdesign, physics
R.Marstaller	Student (Dip.)	10	TPC tests
E.Schaefer	P	40	DAQ, online computing, slow control
N.Schmitz	P	20	General support, physics
A.Schuettauf	P	100	Software, FTPC-Testsetup,DAQ, physics
J.Seyboth	P	75	Software offline
P.Seyboth	P	30	General contribution to soft+hardware, physics
M.Heffner	Student (PHD)	10	Software
T.Eggert	Student (Dip.)	100	Calibration
M.Oldenburg	Student (PHD)	100	FTPC-Testsetup, Software
Davis			
J. Draper	P	70	Laser
D.Cebra	P	70	Laser, software
M.Heffner	Student (PHD)	50	Software
M.Anderson	Student (PHD)	30	NN
J.Clay	Student (PHD)	30	NN
BNL			
T.Hallman	P	20	General support, physics
K.Foley	P	20	Magnet
M.LeVine	P	10	DAQ
B.Love	P	20	Software
LBL			
H.G.Ritter	P	10	General support
F.Bieser	P	20	FE-Electronic
C.Vu	P	20	FE-Electronic