Summary of Tracking Sessions

Stefan Roth, RWTH Aachen

Outline:

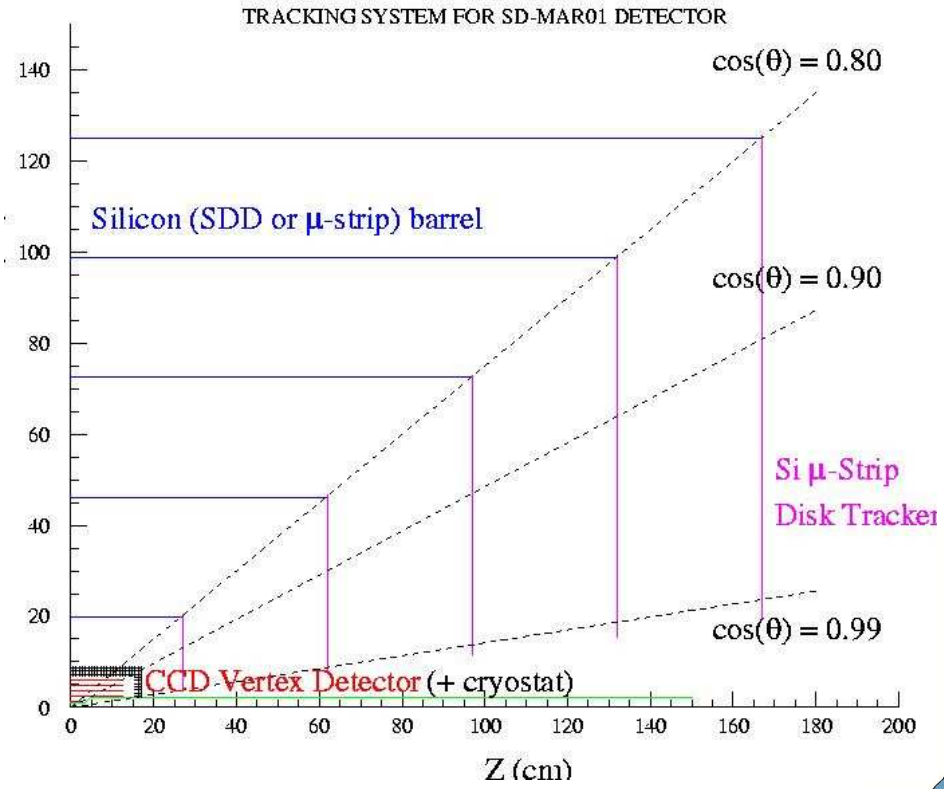
Silicon tracking:
A. Savoy-Navarro, B. Schumm

GEM-TPC studies:
J. Kaminski, D. Karlen, M. Killenberg, P. Wienemann

Micromegas-TPC:
M. Dixit, P. Colas

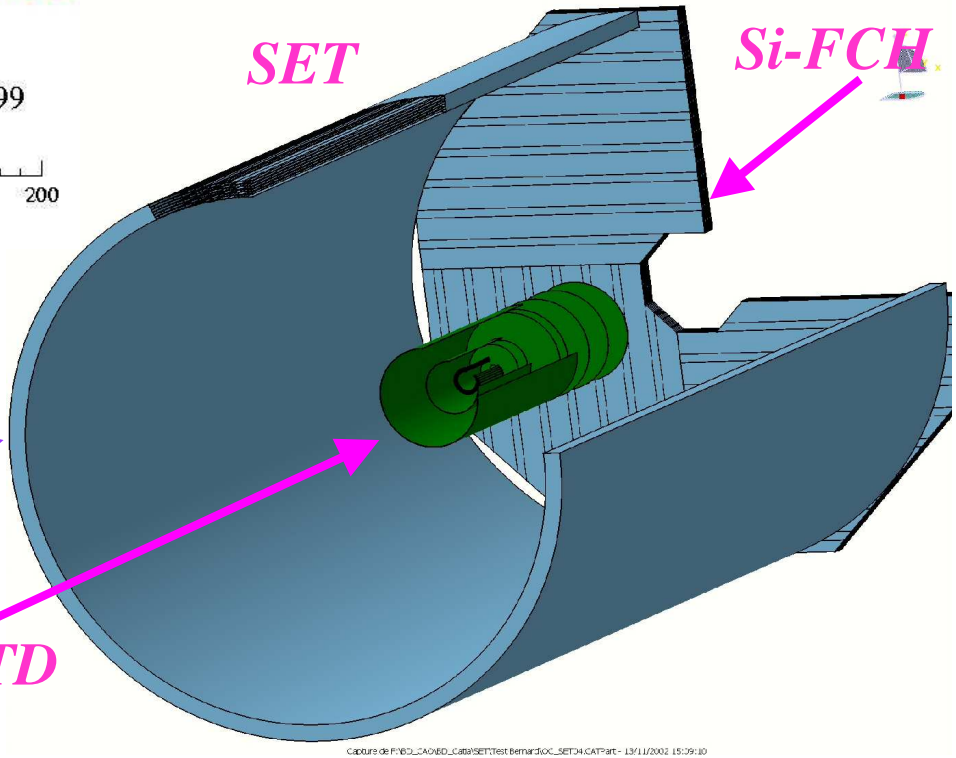
Other studies:
TPC with Si pixel readout: H. van der Graaf
TPC Fieldcage studies: P. Wienemann, A. Krivchitch
Readout electronics: J.P. Martin
General TPC R&D / TPC workshop: M. Ronan

Silicon Tracking



The SD detector (all Si detector)

The Si-Envelope:
Si-trackers surrounding the TPC



Two detectors concepts

SIT + FTD

A. Savoy-Navarro

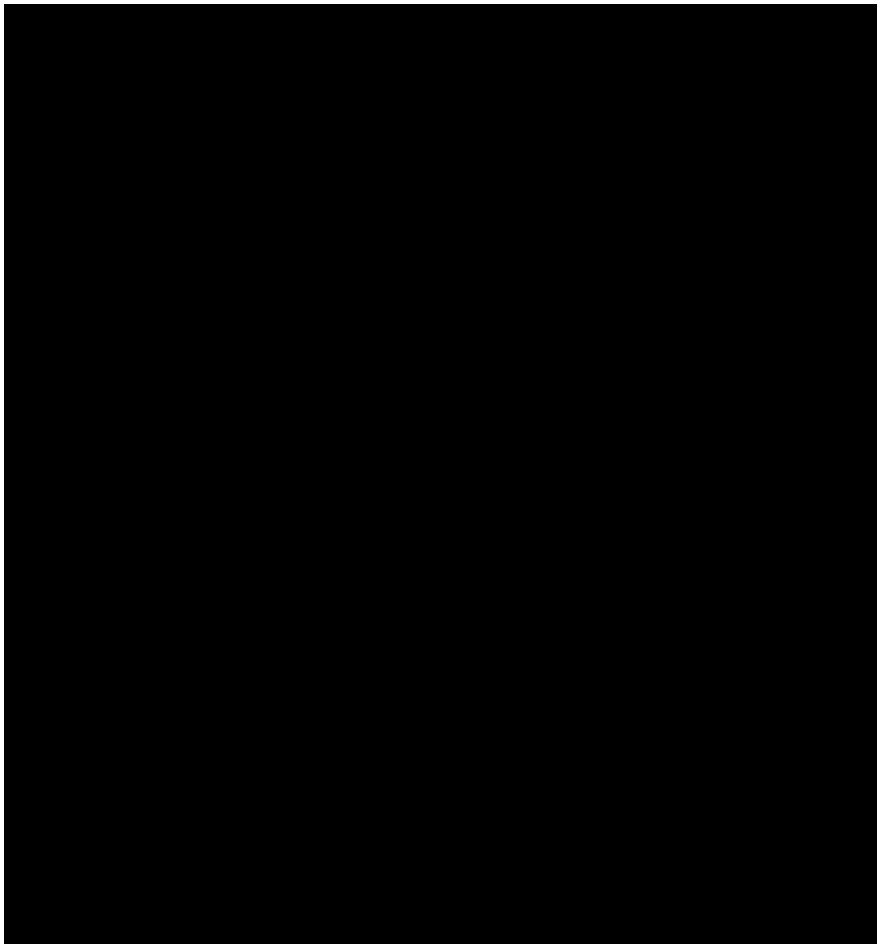
Long μstrips:

drastic diminution of FE channels
thus less material and power dissipation
high position resolution
Presently starting from AMS & GLAST exp.

A. Savoy-Navarro

Idea:

Use of long shaping-time read-out (low noise) plus exploitation of duty cycle permits development of very long, thin ladders



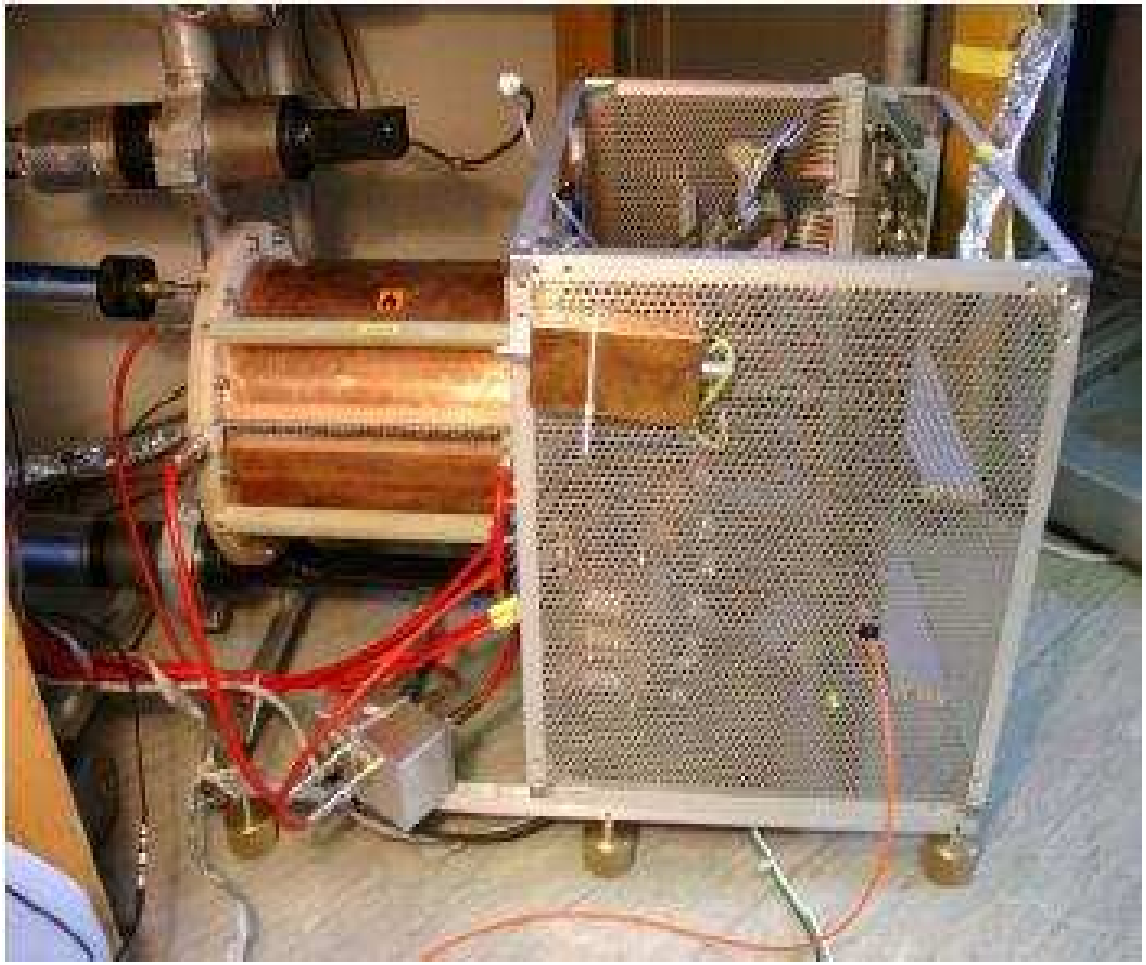
Questions to be adressed by simulation:

- Signal-to-noise for long ladders
- Optimal sensor geometry
- Evaluation of analog readout scheme
- Effect of large magnetic fields
- Effects of oblique angles of incidence
- Optimal detector bias

B. Schumm

GEM – TPC

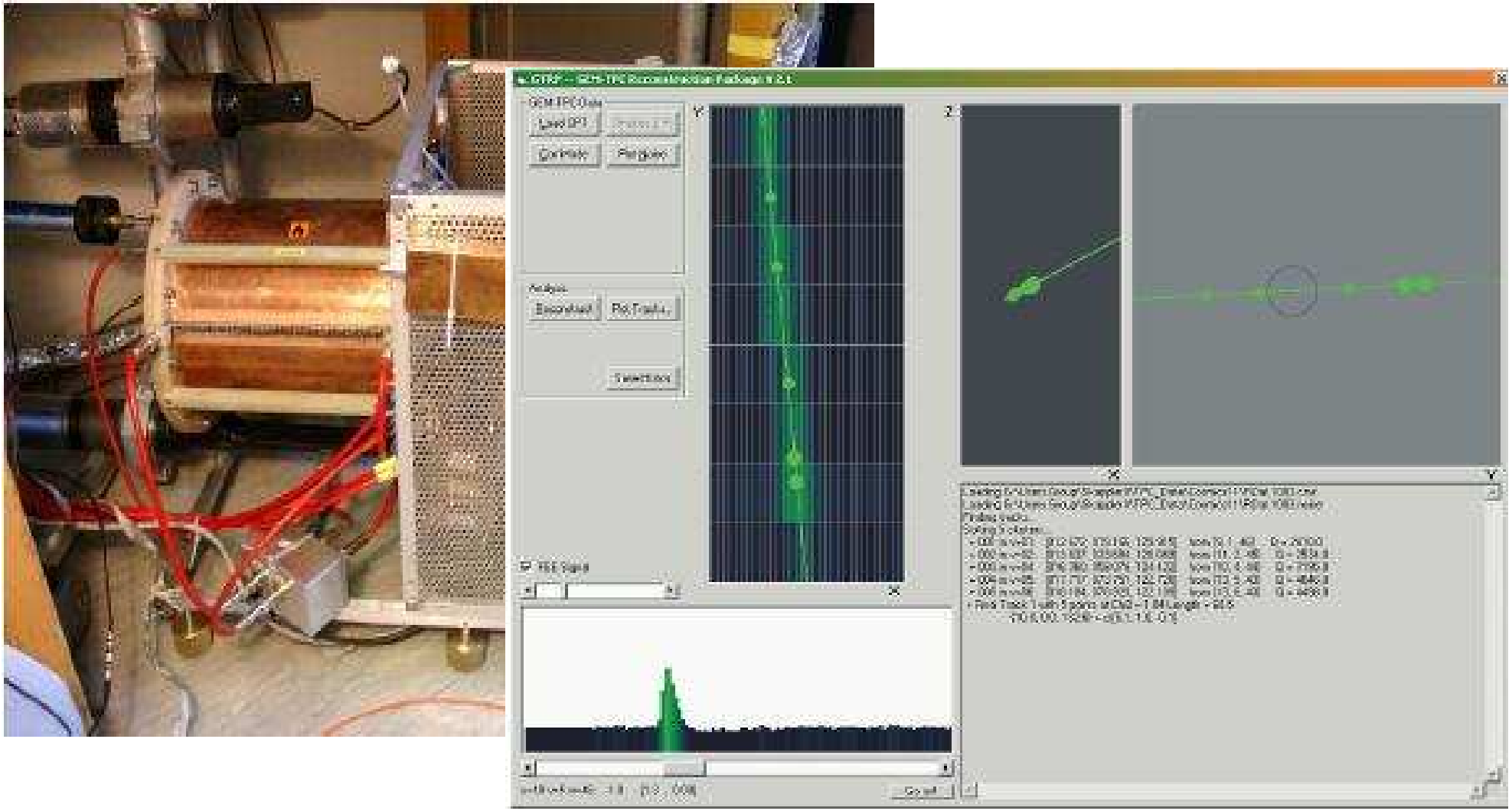
TPC cosmic tests at Karlsruhe



Cosmic ray setup using STAR electronics

J. Kaminski

TPC cosmic tests at Karlsruhe



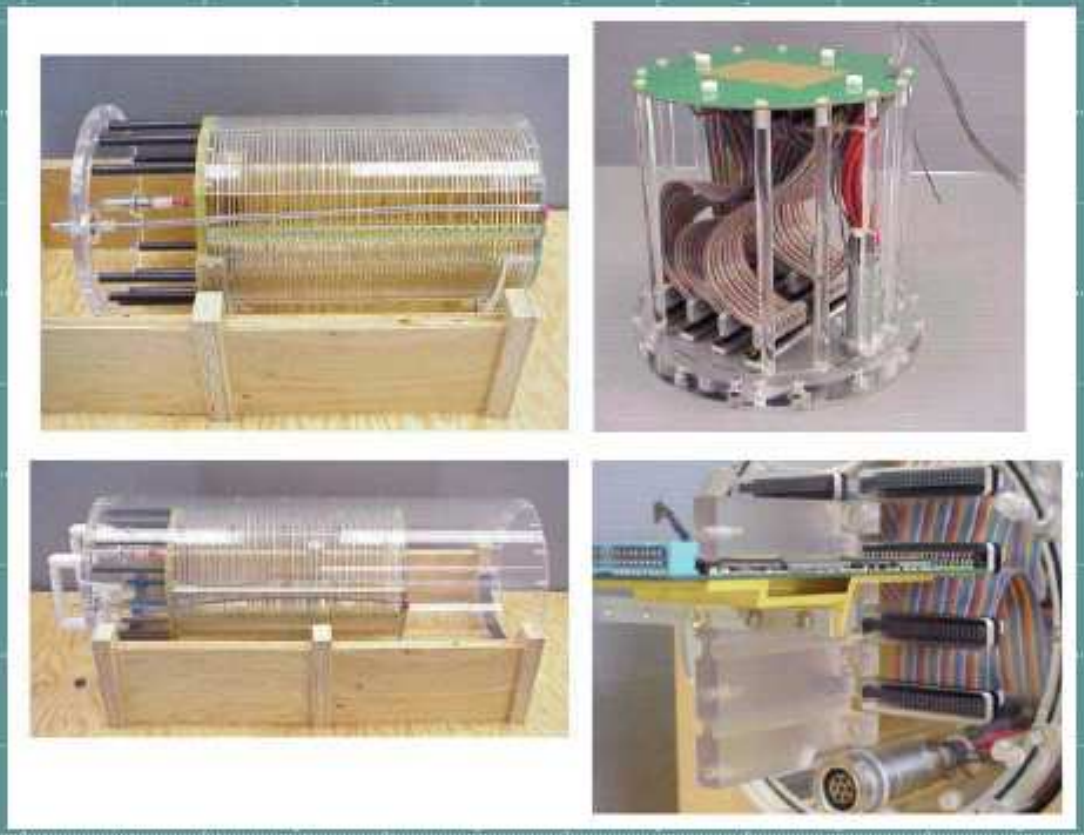
Cosmic ray setup using STAR electronics

Measured resolution 124 μm, S/N = 18:1

J. Kaminski

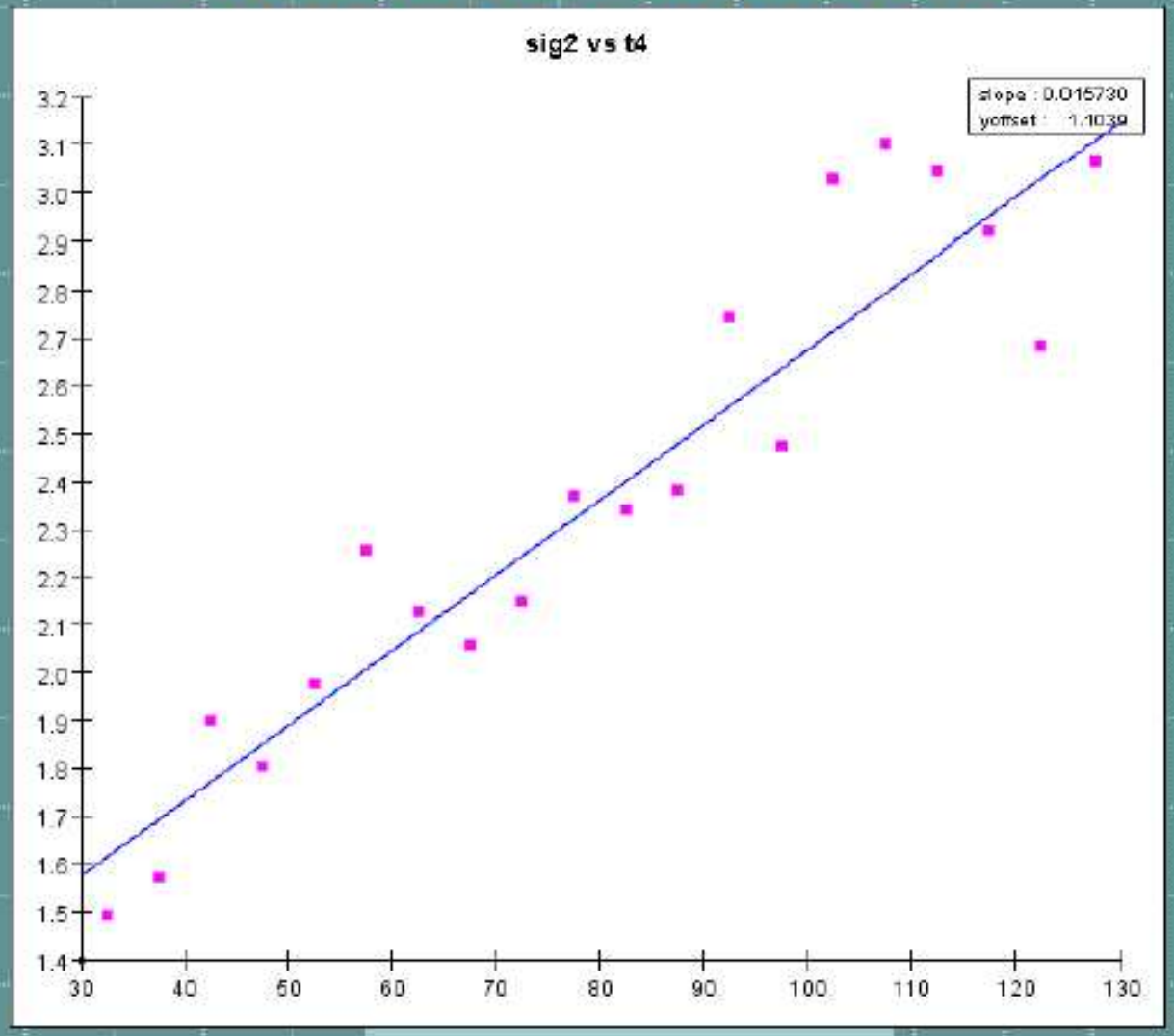
Construction of Canada-TPC2

- Designed for tests in magnetic fields:
  - TRIUMF (1T)
  - DESY (5T)
- Drift and readout sections are separate
- Connections for STAR readout



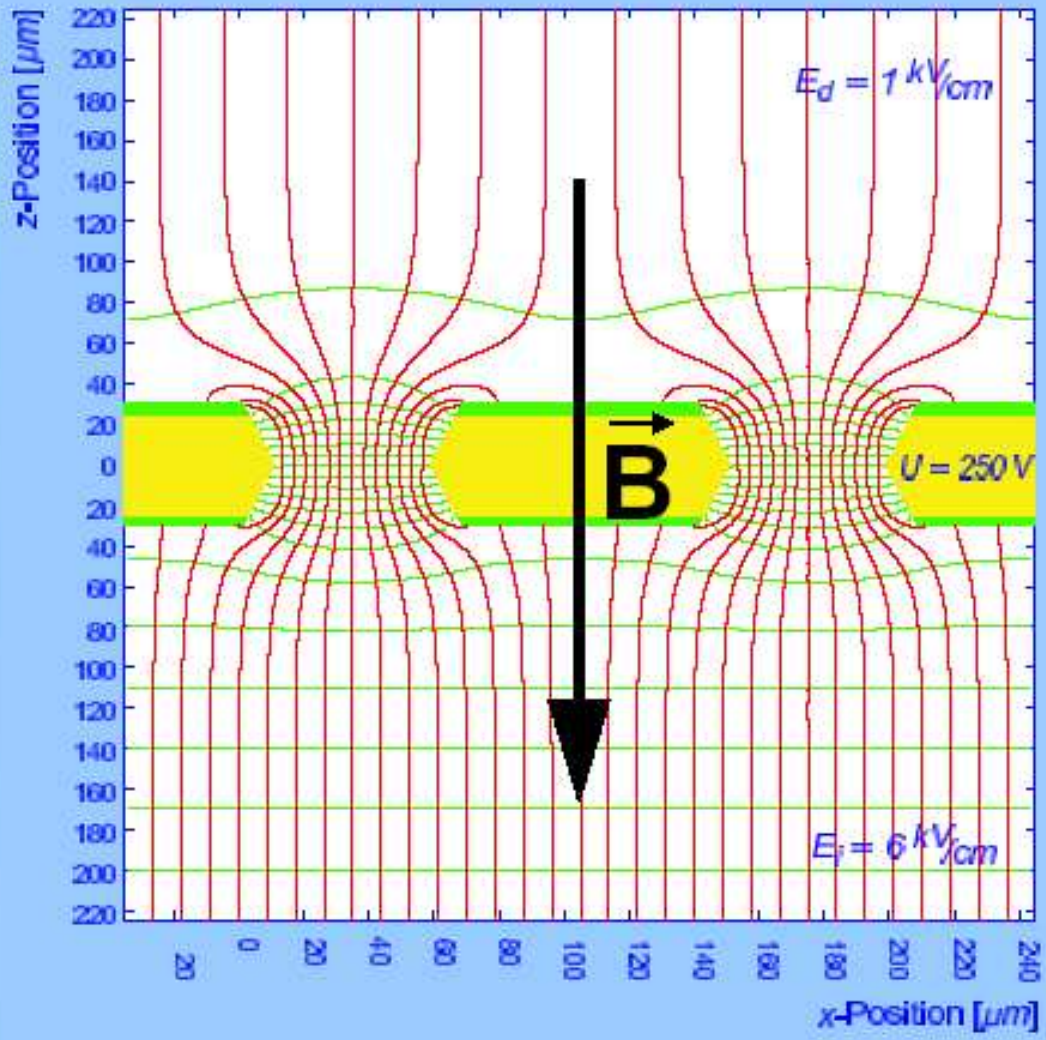
D. Karlen

Transverse diffusion



D. Karlen

GEM in an Electric and Magnetic Field



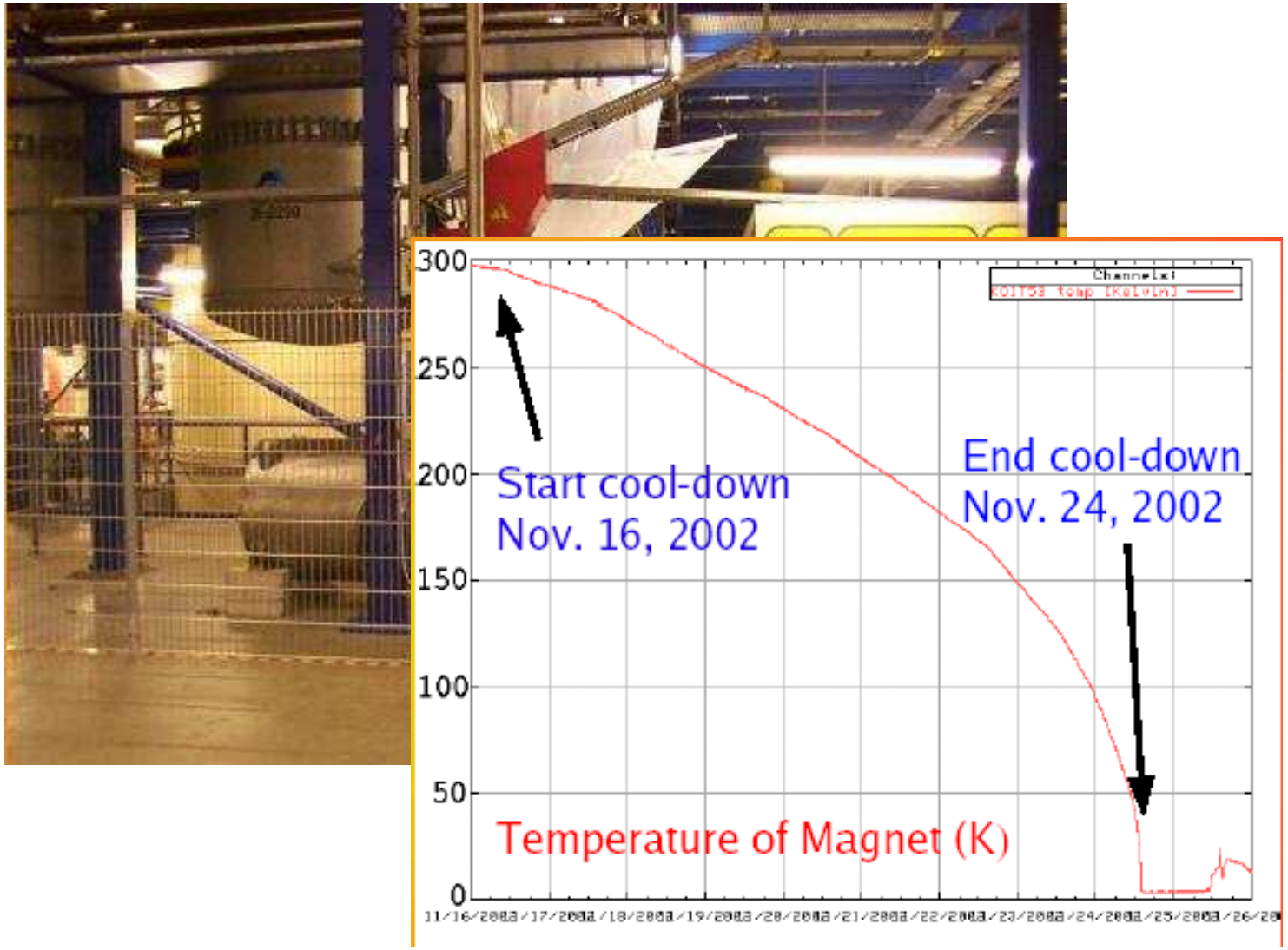
Langevin Formula:

$$\vec{v}_{Drift} \propto \frac{\vec{E}}{|\vec{E}|} + \omega\tau \left(\frac{\vec{E}}{|\vec{E}|} \times \frac{\vec{B}}{|\vec{B}|}\right) + \omega^2\tau^2 \left(\frac{\vec{E}}{|\vec{E}|} \cdot \frac{\vec{B}}{|\vec{B}|}\right) \frac{\vec{B}}{|\vec{B}|}$$

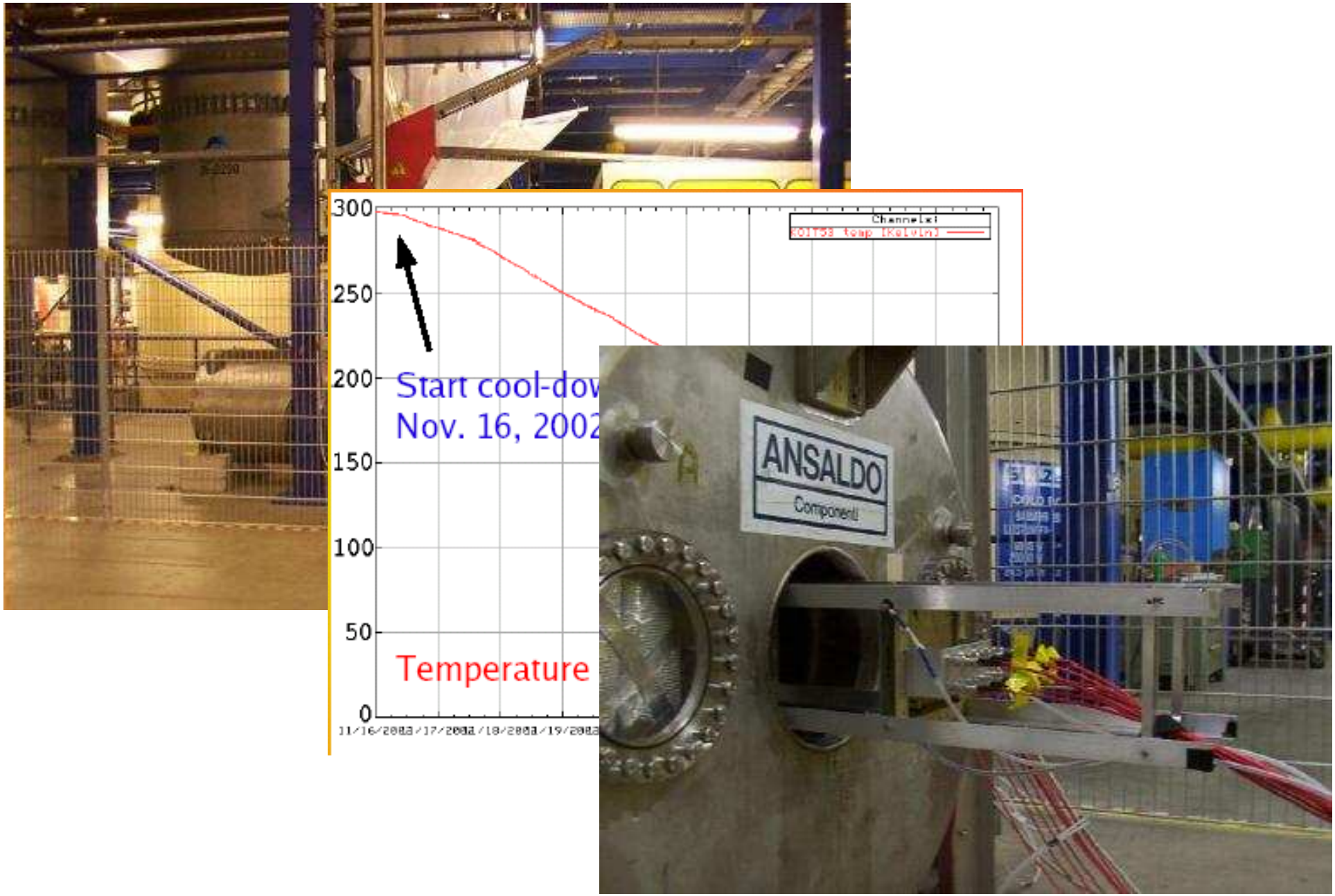
M. Killenberg

New test facility with superconducting 5 T Magnet at DESY

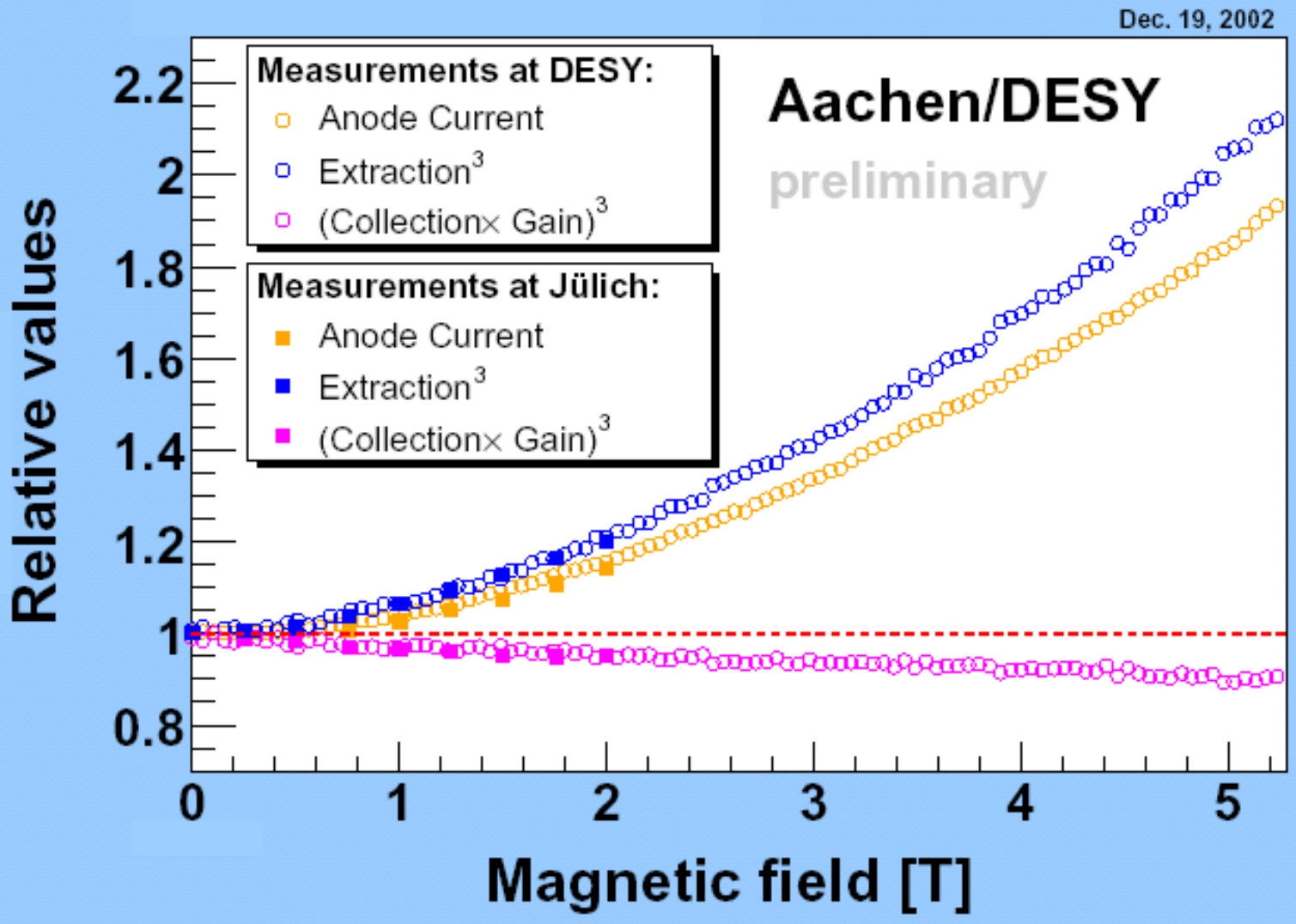
New test facility with superconducting 5 T Magnet at DESY



New test facility with superconducting 5 T Magnet at DESY



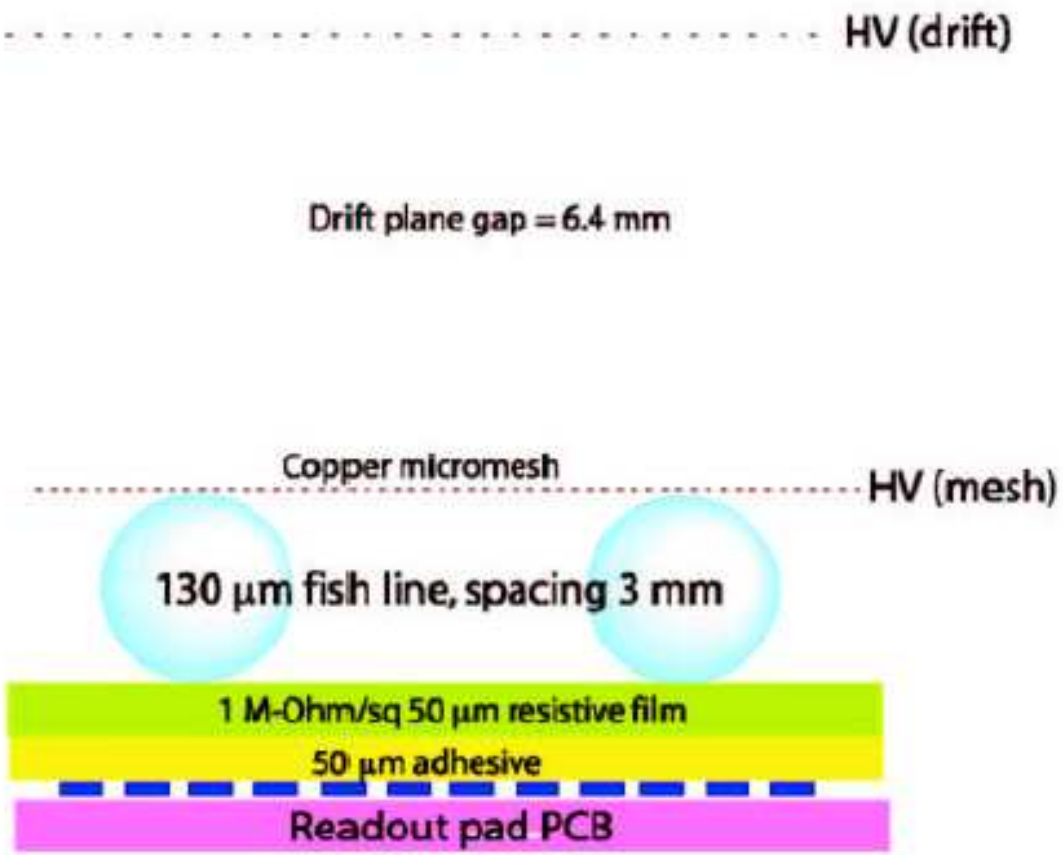
First Measurements at DESY



M. Killenberg

Micromegas TPC

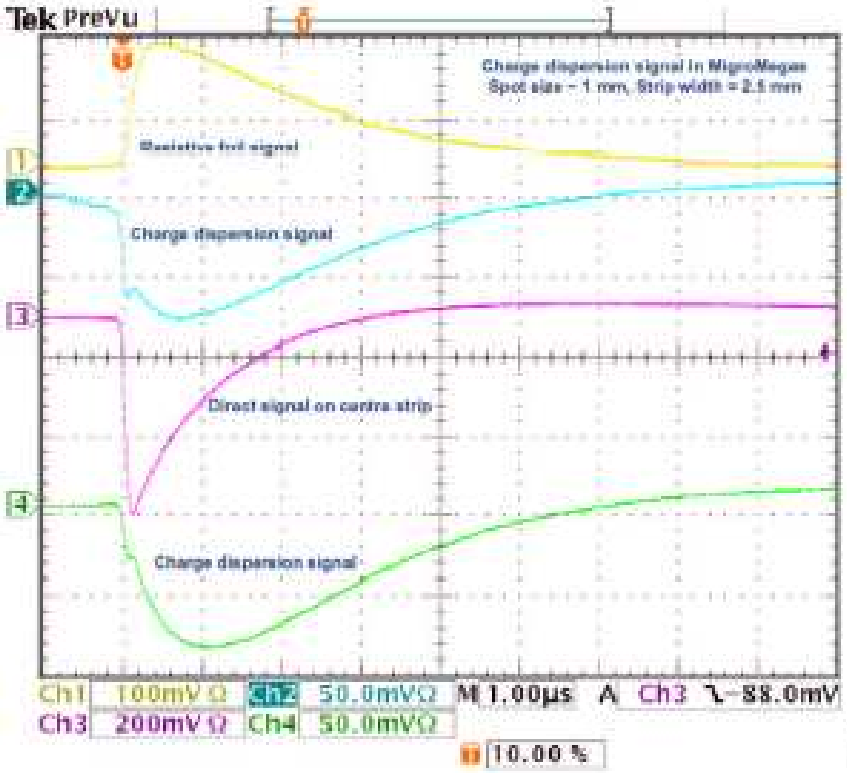
Resistive anode Micromegas for charge dispersion

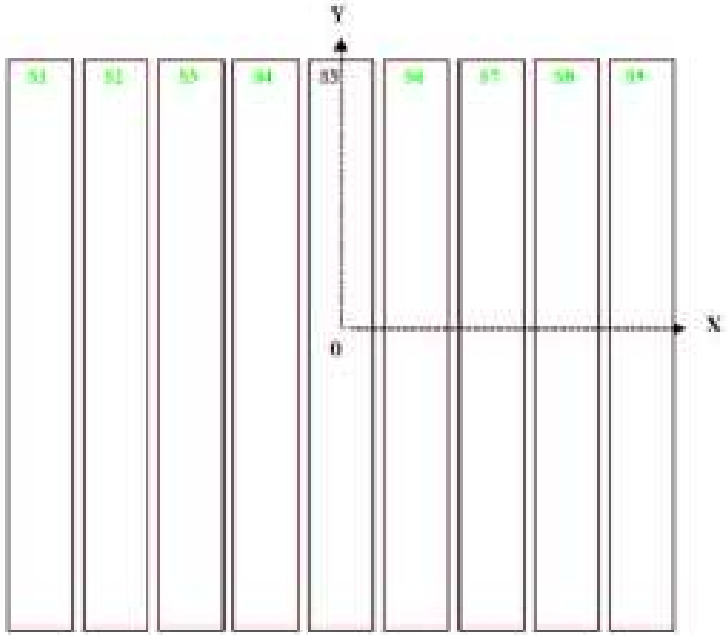


M. Dixit

Charge dispersion signal on 2.5 mm wide x 7 cm long readout pads

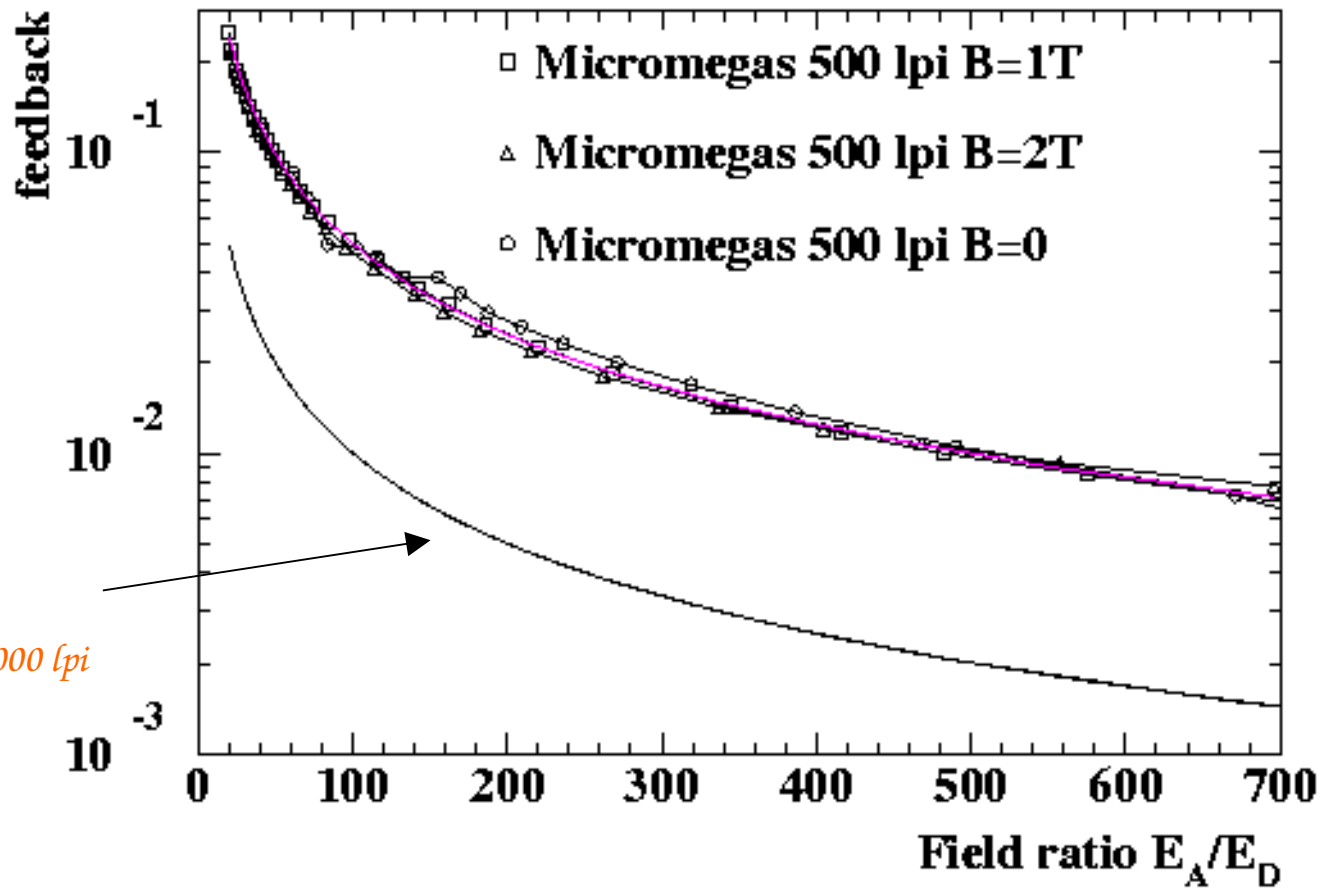
Ionization spot size ~ 700 µm centred on strip 3 (collimated Fe55 source)





M. Dixit

Measurements using 2T Magnet at Saclay



Optimal case

(reached for a 1000 lpi grid)

The feedback does not depend significantly on the magnetic field

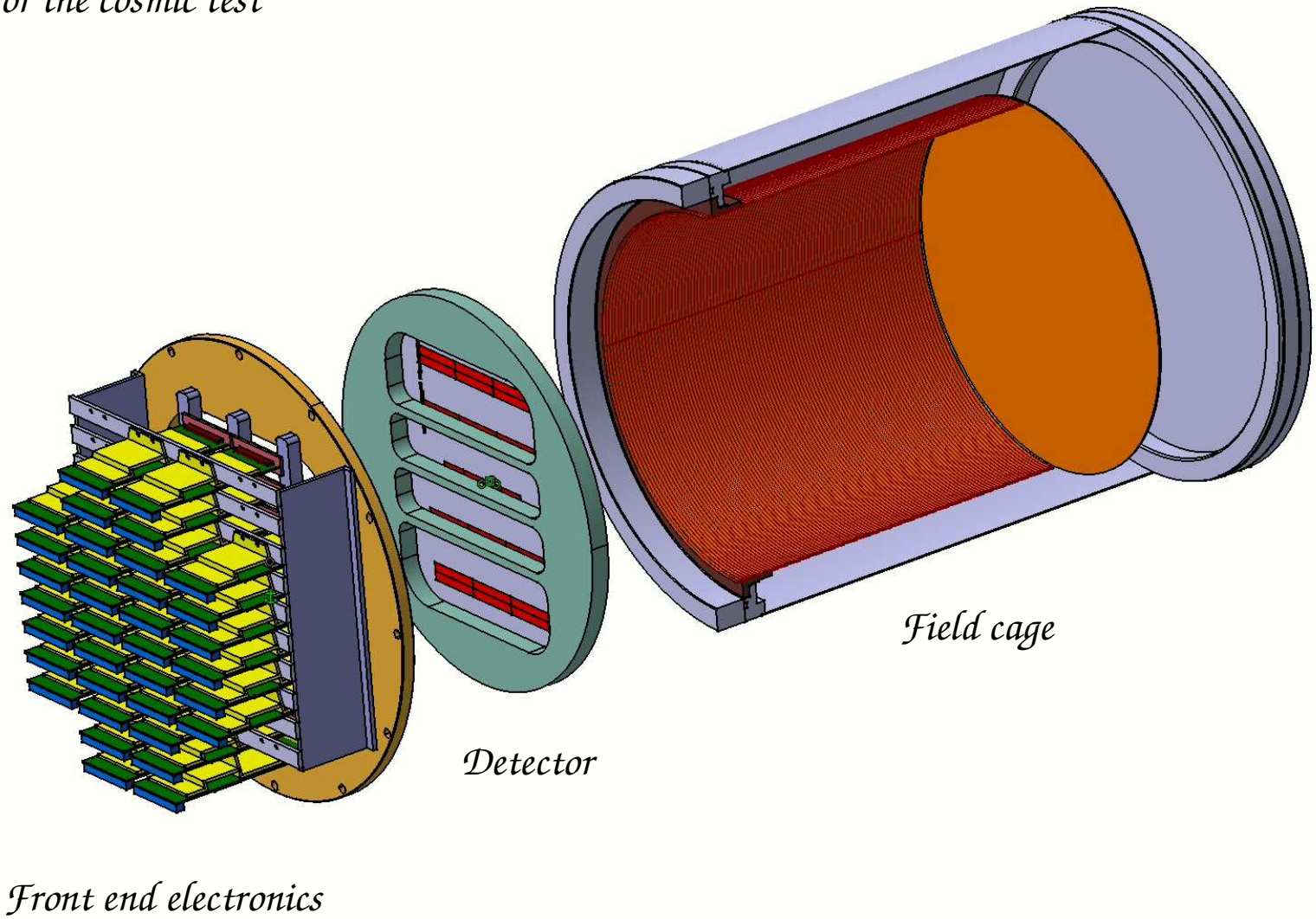
It is in agreement with prediction for Ar-CH_4 (90:10) and for a 500 lpi grid (data from June 2002)

P. Colas

TPC for cosmic tests

- Field cage fitting into magnet
- Star readout with 1000 channels

TPC for the cosmic test

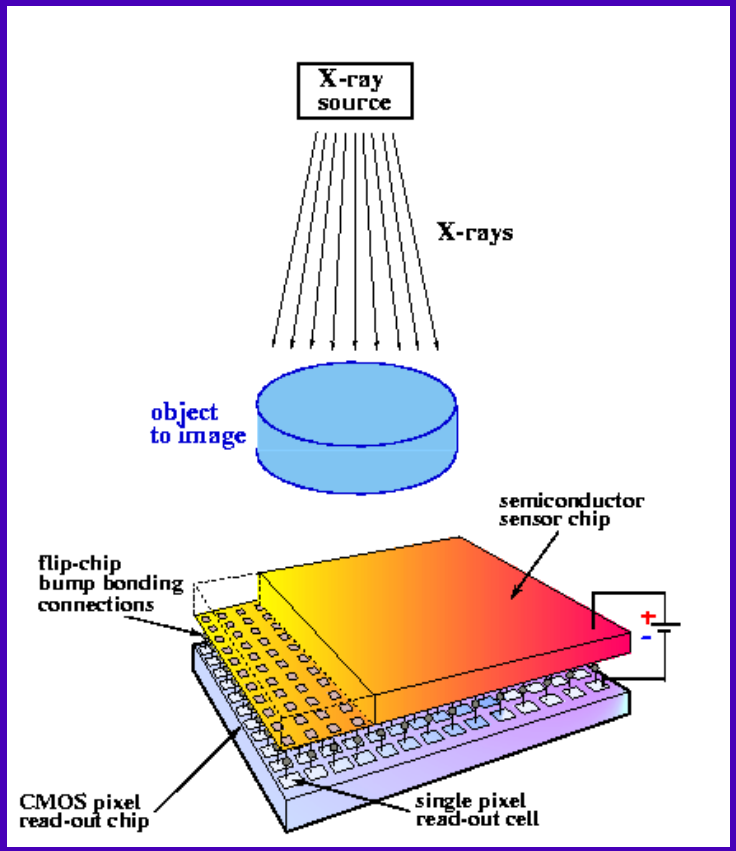


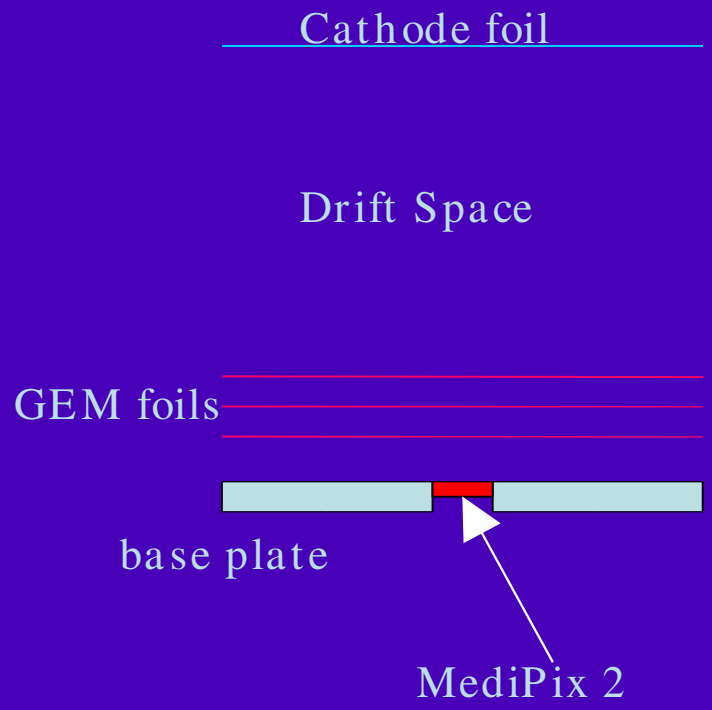
P. Colas

Other Studies

At NIKHEF:

MediPix 2 pixel sensor: Jan Visschers et al.





H. van der Graaf

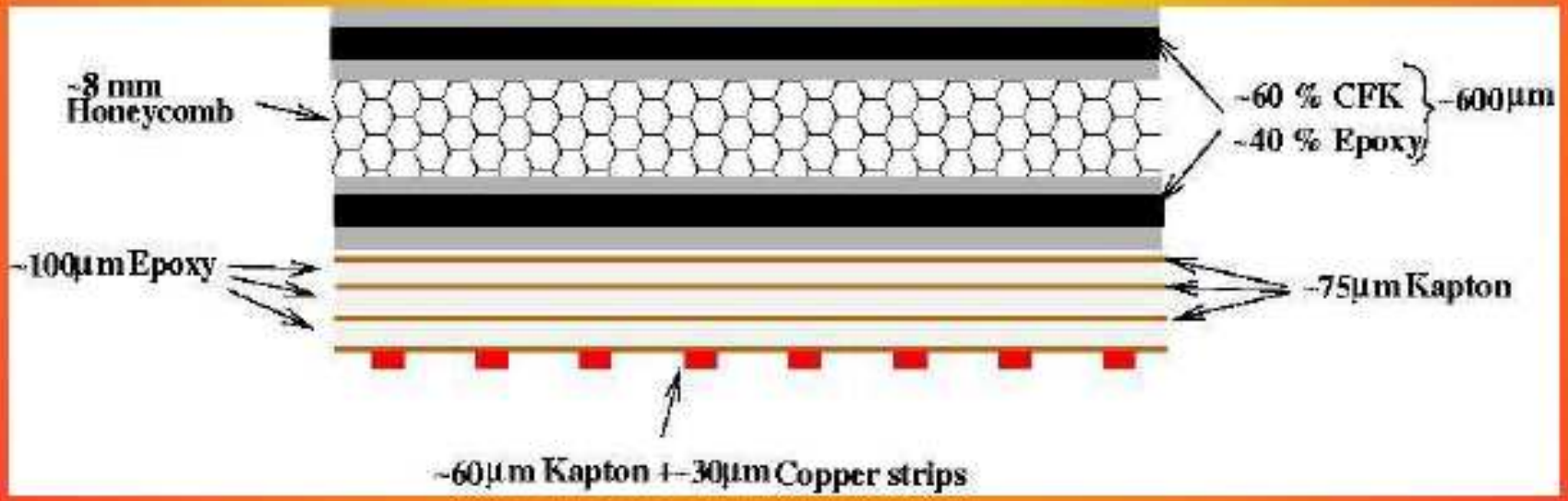
Field Cage Development

Goal: Inner + outer field cage only 3 % of a radiation length

More than a factor of 2 better than for the ALEPH TPC (7.1 %)

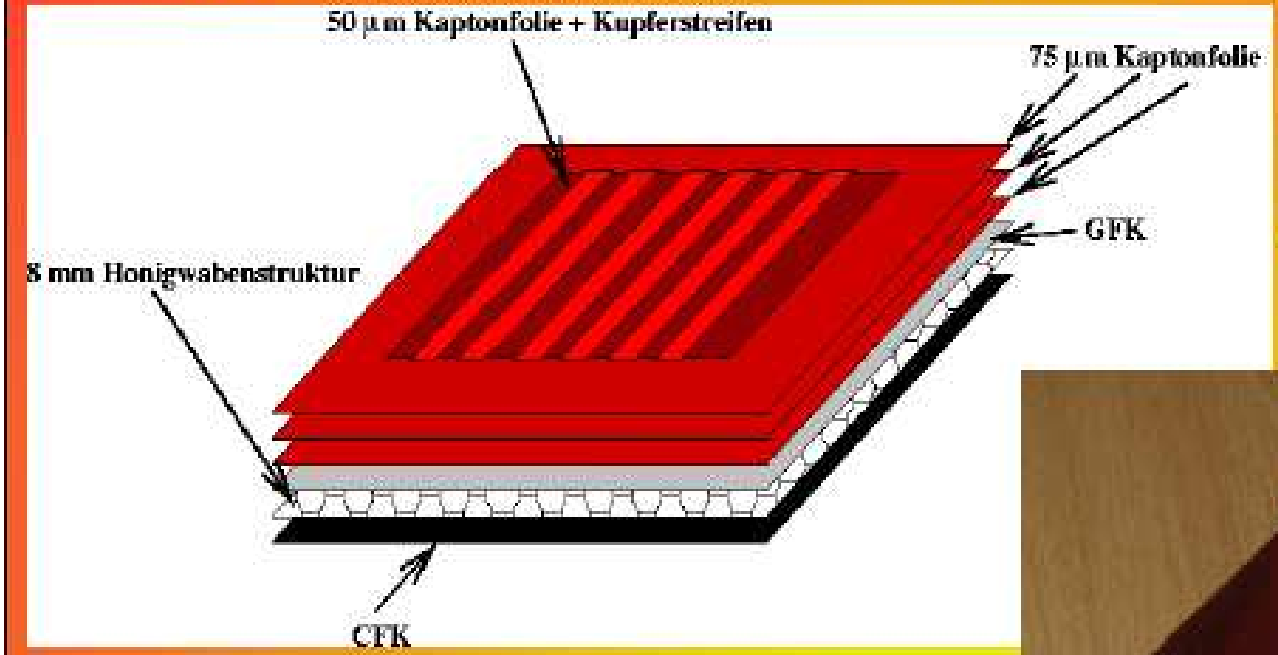
→ Requires use of sophisticated new materials

Favourite candidate:

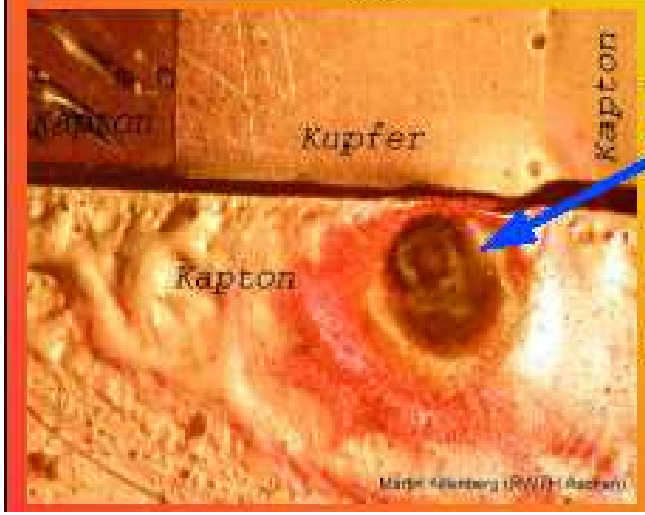


P. Wienemann

HV Tests of Field Cage Structure

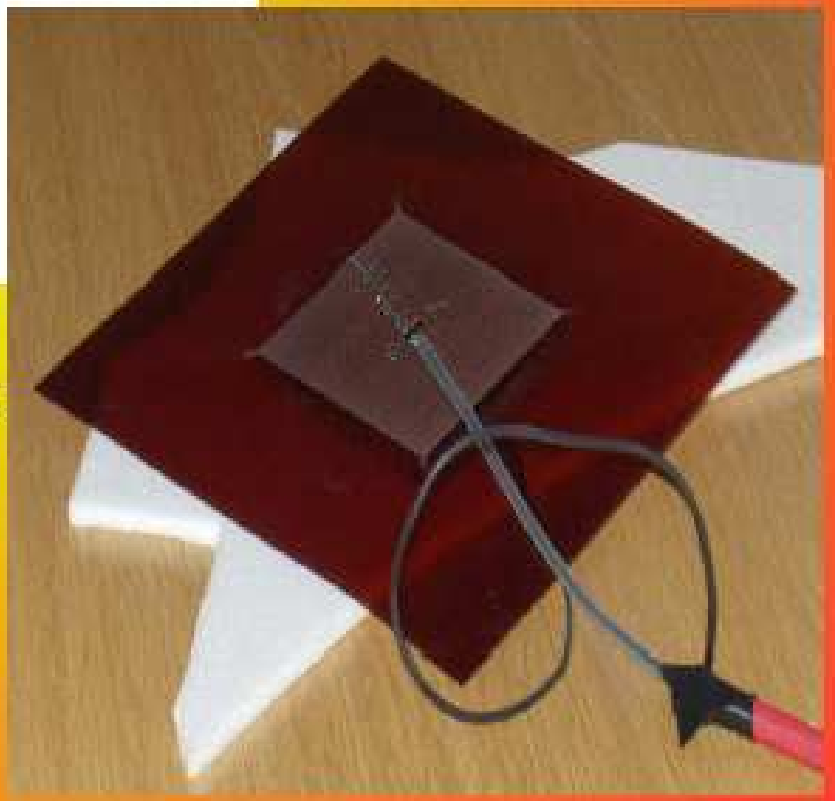


- Applied up to 30 kV between copper strips and outer CFK layer
- GFK sample passed HV test



Failed sample:

Kapton layer destroyed by spark



P. Wienemann

Field Simulations of the TPC field cage:

Conclusions:

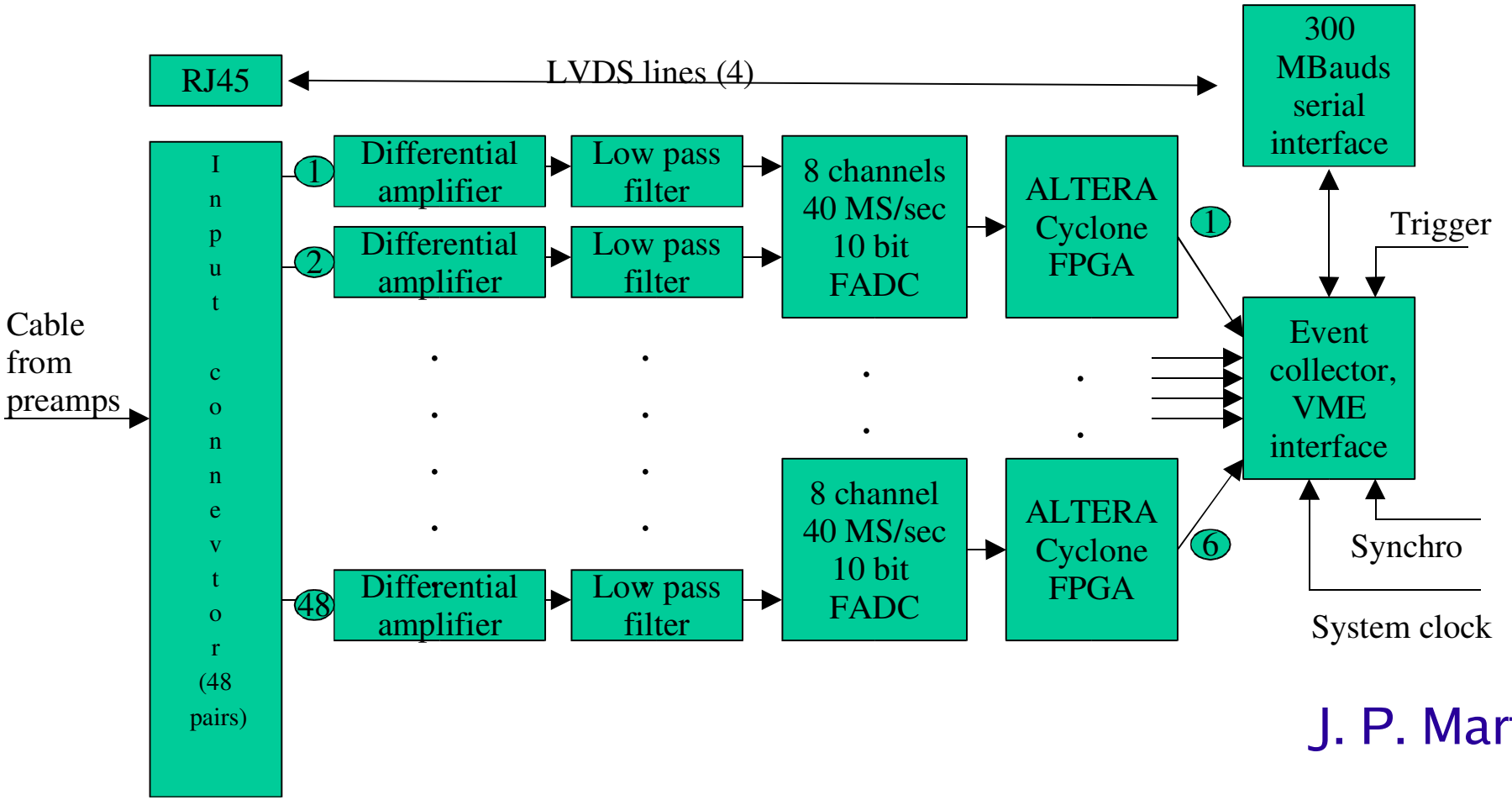
Optimization of the boundary conditions is necessary

Correct choice of the strip granularity mandatory

Readout Electronics :

A low cost DAQ card for detector R&D applications is developed at Université de Montréal for the KOPIO collaboration:

- Prototype version has VME interface
- 48 channels per card
- Based on 40 MS/sec 10 bit ADC
- Estimated fabrication cost for the VME prototypes is about 55 Euros/channel.



J. P. Martin

Time Projection Chamber Symposium

Date: Friday, 17 October 2003

Location: Lawrence Berkeley National Laboratory (LBNL)

Hosts: LBNL Physics and Nuclear Science Divisions,
and the U.S. Department of Energy (DOE)

M. Ronan