MPI TPC Prototype, “Wheel Studies”...

by Ron Settles, MPI/DESY

for the MPI, DESY, ASIAN, IPN Orsay groups listed on next slide

...plus a few words about “Si-readout” discussion

(see talk by Jan Timmermans)
MPI TPC Prototype Activities

MPI, DESY, ASIAN, IPN Orsay groups:

MPI
Tscharlie Ackermann, Helmut Schendzielorz, Heinrich Keppeler, et al
Volker Eckardt, Peter Maierbeek, Ron Settles

DESY
Markus Ball, Markus Hamann, Thorsten Kuhl, Thorsten Lux, Peter Wienemann, et al

ASIA
Keisuke Fujii, Makoto Kobayashi, Takeshi Matsuda, Osamu Nito, Tohru Takahashi, et al

IPN Orsay
Joel Pouthas, Philippe Rosier, Vincent Lepeltier et al
MPI-Munich prototype for Wires, Gem or Micromegas test in 5T magnet at DESY

Wire version ready, Gem version in preparation
- Pad plane 100mm x 100mm
- Pad size 2mm x 6mm
- 12 of 16 rows (384 pads) instrumentable
- Wire spacing 2mm (without fieldwires)
- Pad-wire distance 1mm ($\sigma_{\text{PRF}} \sim 1.4\text{mm}$, in principle -> to be measured)
- No gating plane for the moment
MPI-Munich TPC Prototype
MPI-Munich TPC Prototype
MPI-Munich TPC Prototype

Polished optical fibre fits here to reflect axial laser ray into the drift volume.
MPI-Munich TPC Prototype
MPI-Munich TPC Prototype - first tests
Some of the steps...

- First tests “by hand” (previous slide)
- Wire connection pad<->preamp replaced original flexible circuits
- Connectors adapted for Aleph preamps
- Final tests at MPI end Feb -> sent to Desy
- Test for ~ 2 months -> send to KEK
Cosmics in 5T Magnet at DESY
Planning with Asian Colleagues

Video meetings every 2 weeks

8-9 March          VE transports MPI TPC to Desy
10-28 March        Set up and test MPI TPC at Desy
31 March-2 April   MPI chamber working—cosmics taken
12-18 April        Test in 5T magnet at DESY
18-21 March & 14-17 April Keisuke Fujii & Osamu Nito at Desy
Early May          Ship MPI TPC + electronics to KEK
May-June           Set up at KEK, test in magnet/beam
JACEE magnet at KEK
Studies with IPN Orsay

(Joel, Philippe, Vincent and others…)

Meetings about once a month

• Looking at end-plate mechanics ->
  material dominated by electronics ->
  will < 30% rad. length be possible?

• Now designing triple-Gem plane for MPI
  prototype, to be tested later at KEK
Exploded view of the modified MPI TPC equipped with 2 GEM planes

- Some minor modifications seem already necessary: More holes for the SHV connectors.
- 2 support frames for GEM can be built.

GEM planes for MPI prototype
Arrangements of detectors on the active area of the end cap (2/2)

Trapezoidal shapes assembled in iris shape

Annotations: P\textsubscript{x} is the type number of PADS boards or frames

12 sectors (30° each) as super modules are defined
On each, 7 modules are fixed
The sizes of detectors are varying from 180 to 420 mm

By rotation of 15° around the axe, these frames are the same

These arrangement seems to be the best as only 4 different PADS are necessary

End-plate studies
End-plate studies

Principle for a Super Module equipped with detector 1

- Detector 1 made of 8 mm of epoxy or sandwich
- Frame of the super module made of 10 mm epoxy reinforced with 15x40 mm carbon bar
- Carbon wheel with frames 20x100 mm

Deformation limit acceptability to define
Here is 20 μm/mbar of pressure

Complete wheel with 12 super modules
Possibilities for Silicon readout
(see talk by Jan Timmermans)

Momentum measurement--
- for TPC only (from TDR) \( \delta(1/p) = 10^{-4} \) GeV/c \(^{-1}\) (200 pad rows, 120 \(\mu\)m point resolution and vertex constraint)
- can get same \( \delta(1/p) \) with digital TPC and 1mm pads (1200 pad rows “pads partout”). Here, need only time-bucket i.d. of pads above threshold. Readout speed?...see next point.
Possibilities for Silicon readout

$dE/dx$ measurement -

Study by Michael Hauschild
**dE/dx**

*Particle Identification Techniques with dE/dx*

- **Some restrictions**
  - Large scale particle physics detectors only
  - Gaseous detectors only
  - no dE/dx with silicon detectors

- **Outline**
  - Basics and fundamental problems of dE/dx measurements
  - Some performance figures (resolution, particle separation power)
  - A 20-years summary
  - The future of dE/dx (at the e⁺e⁻ Linear Collider)
    - Cluster Counting in 2D with micropattern detectors + small pads?
Possibilities for Silicon readout

**dE/dx measurement by cluster counting**

- needs slow gas with small diffusion coefficient (e.g., He/NeCO₂)
- needs detailed simulation with diffusion properly included, but it looks like
  - need ~ 100 - 200 μm pads “partout”
  - need ~ 100 MHz sampling speed