

TestBeam for Tracker

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What we did w/ beam

case of LCTPC

What R&D are head of us

Beam?

where ? when?

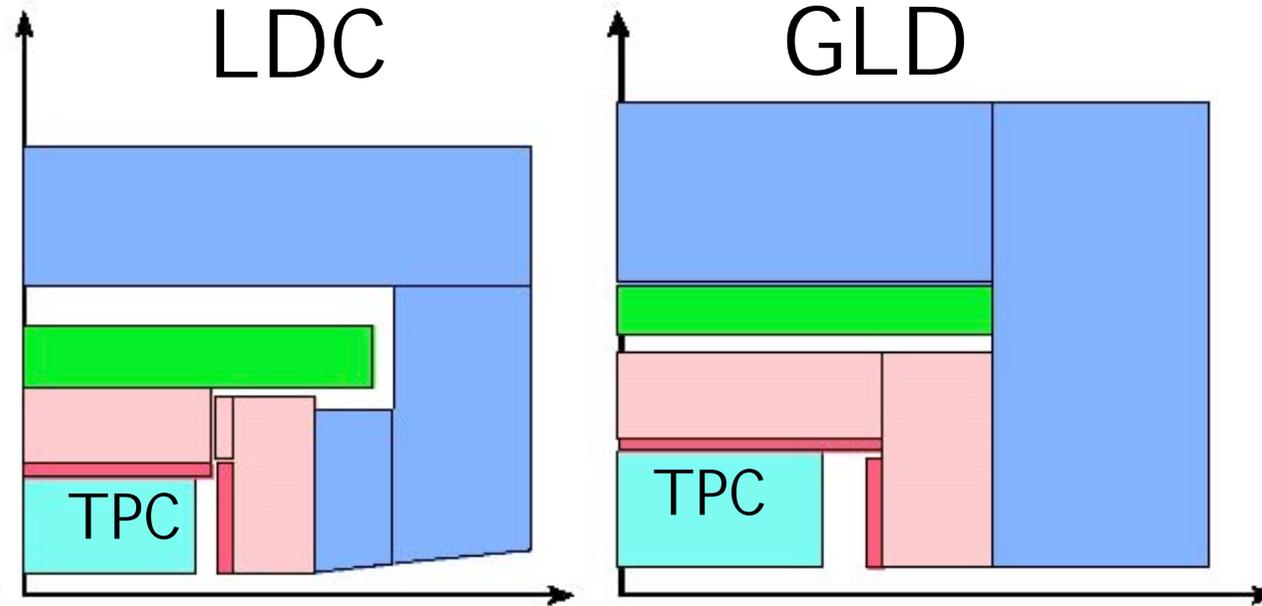
facilities at beam

International collaboration

Case of TPC

TPC is a only candidate
of main Tracker
for LDC and GLD

same goal (performances)



good P_t resolution
good 2track separation
good tracking efficiency

$$\frac{\delta p_t}{p_t} \sim 5 \times 10^{-5} p_t \quad \text{with inner tracker and VTX}$$

R&D groups in the world are working together as LCTPC collab.

North America : Victoria, Carlton, LBL, Cornel, Purdue,,

Europa : Saclay, Orsay, DESY, Aachen, MPI ,,,

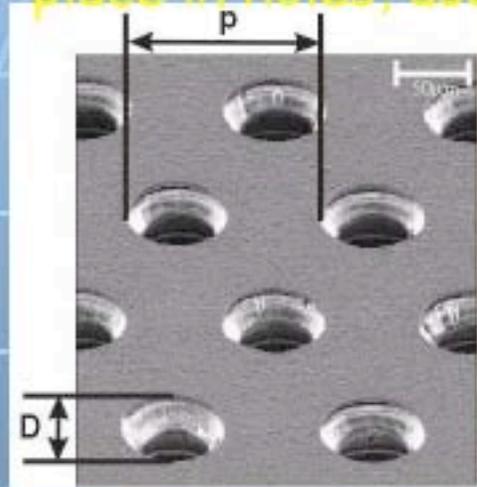
Asia : CDC(Mindanao,KEK, Tsukuba,TUAT,Kogakuin,Kinki,Hiroshima, Saga)

R&D are based on MPGD + TPC scheme

Gas-Amplification Systems: Wires & MPGDs →

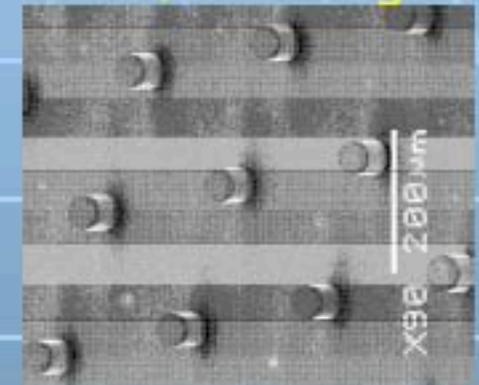
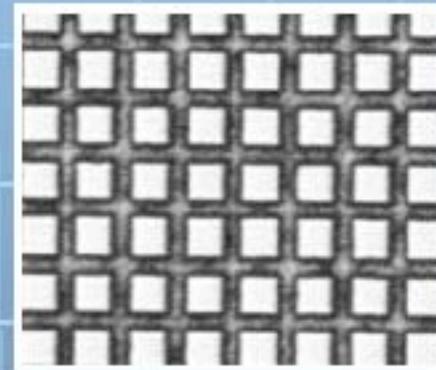
GEM: Two copper foils separated by kapton, multiplication takes place in holes, uses 2 or 3 stages

Micromegas: micromesh sustained by 50 μ m pillars, multiplication between anode and mesh, one stage

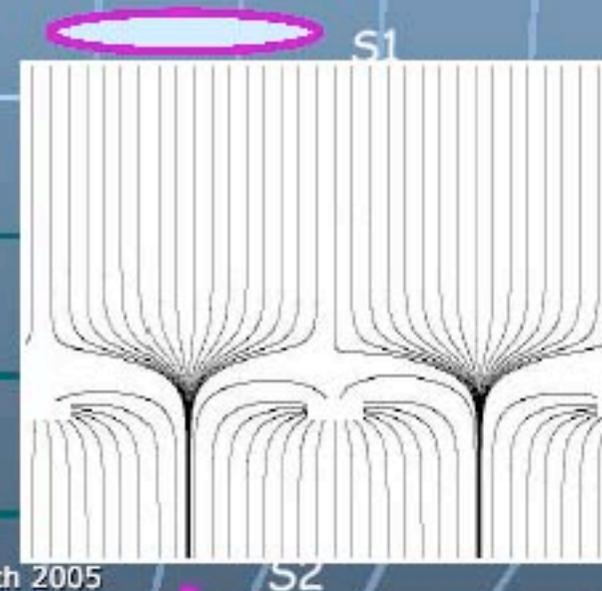
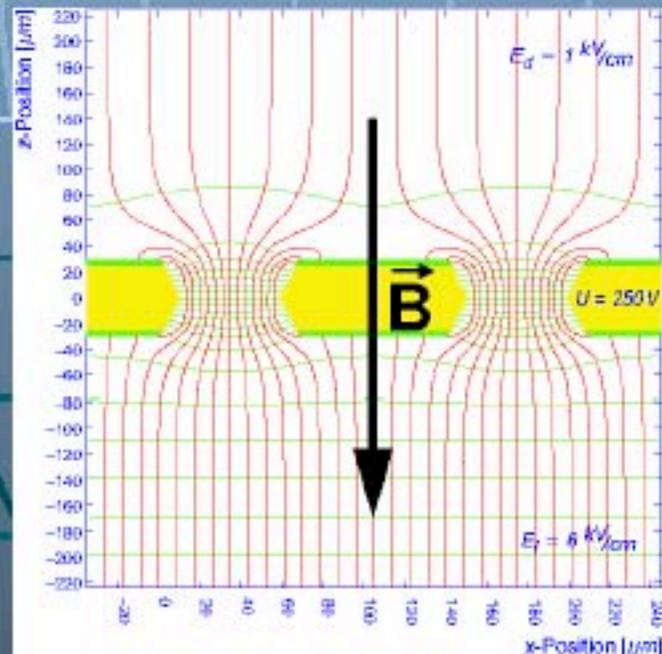


$P \sim 140 \mu\text{m}$

$D \sim 60 \mu\text{m}$

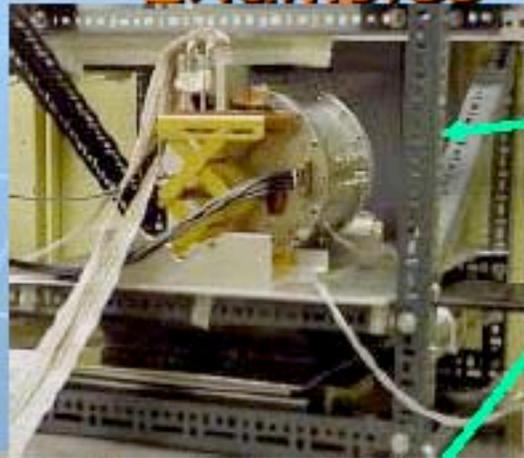


$S1/S2 \sim E_{\text{amplif}} / E_{\text{drift}}$



R&D groups have own prototype chamber

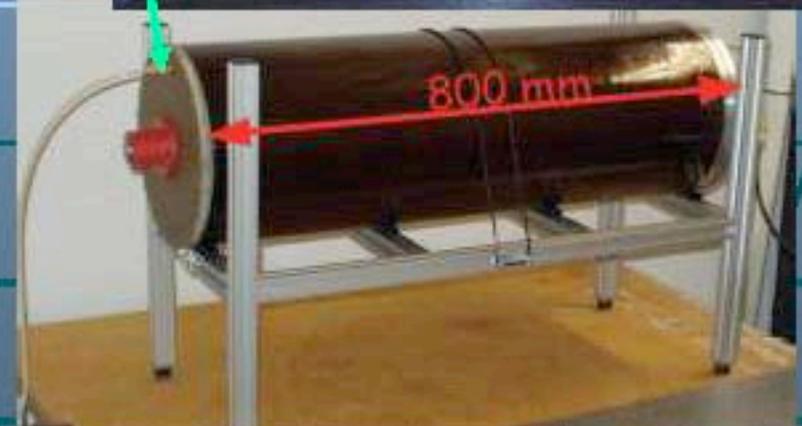
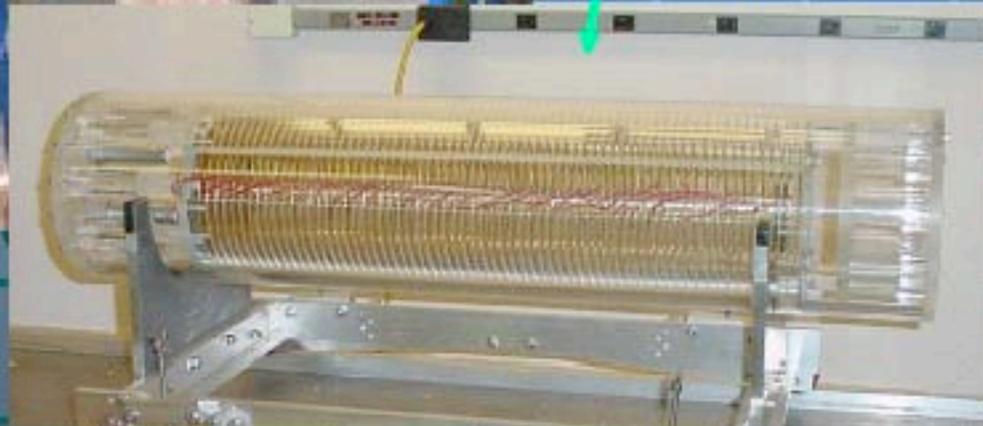
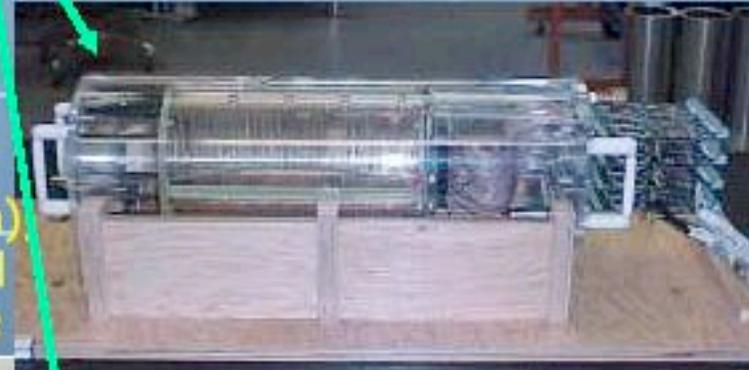
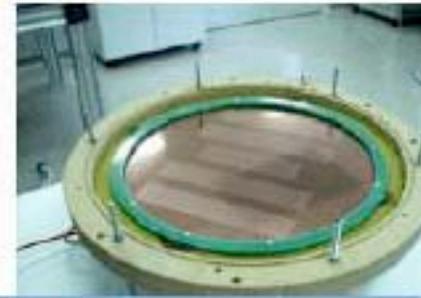
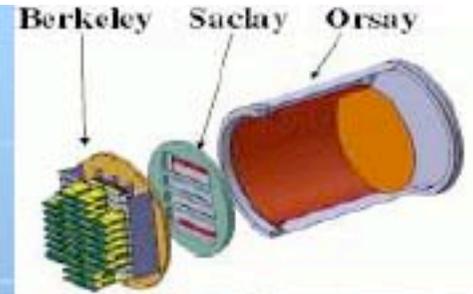
Examples of Prototype TPCs



Carleton, Aachen,
Cornell/Purdue, Desy(not
shown) for B=0 studies

Desy, Victoria, Saclay
(fit in 2-5T magnets)

Karlsruhe, MPI/Asia,
Aachen built test TPCs
for magnets (not shown)
other groups built small
special-study chambers



R&D: "proof of principle"

Scheme of MPGD + TPC

understand property (resolution, diff., ion bk-drift..)

using **small Prototype**

Beam is essential for the test

Magnet is another important facility

Alternative is Laser facility

- Approx. 2 m long to reach into magnet

ex. Victoria's laser @DESY

free from machine schedule
no negotiation to other exp.

laser + optics

laser power supply

TPC holder

Engineering by
Mark Lenkowski
Univeristy of Victoria



Facilities



Desy 5T magnet,
cosmics, laser

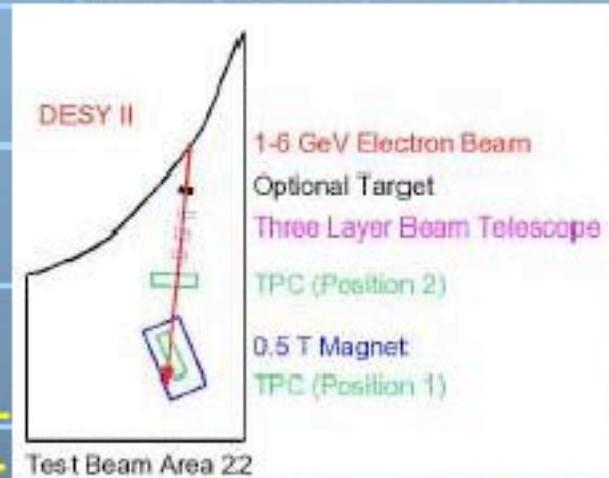


Saclay 2T magnet,
cosmics



Cern test-
beam (not
shown)

vek 1.2T, 4GeV
ladr. test-beam



Desy 1T, 6GeV e-
test-beam

Magnet

TPC prototype beam test at KEK

- 2004 Jun. WMPC-TPC
MPI, DESY + CDC(Asia) group
- 2005 Apr. GEM-TPC
MPI, DESY + CDC
- 2005 Jun. MM-TPC
Saclay, Orsay, Carlton, MPI, CDC
- 2005 Oct. MM-TPC, GEM-TPC : Registive Foil
Saclay, Orsay, Carlton, MPI, CDC

Now collaboration became really international.

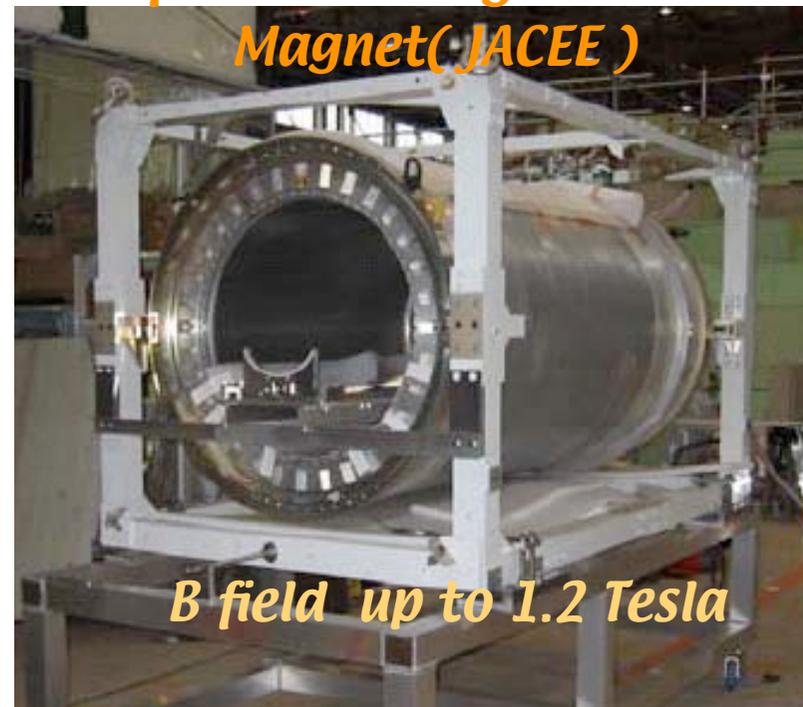


Setup at KEK beam

π^2 beam line
provide 0.6~4.0 GeV/c



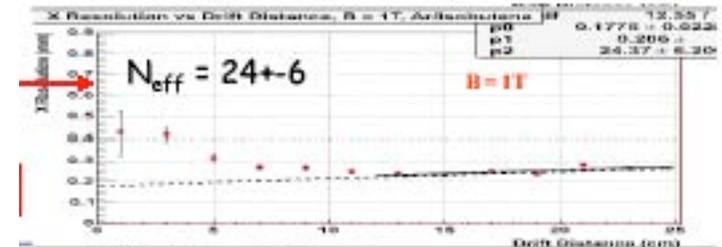
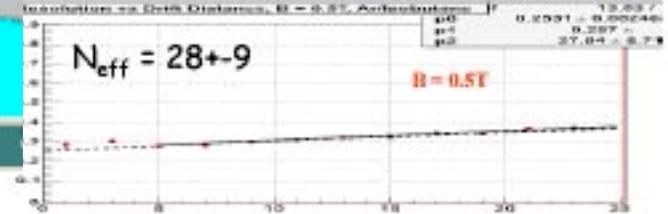
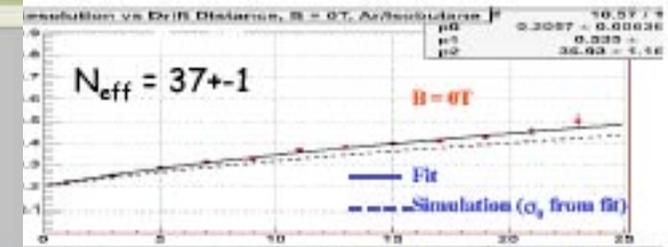
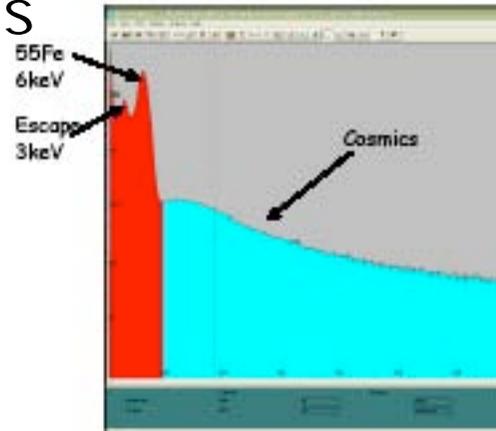
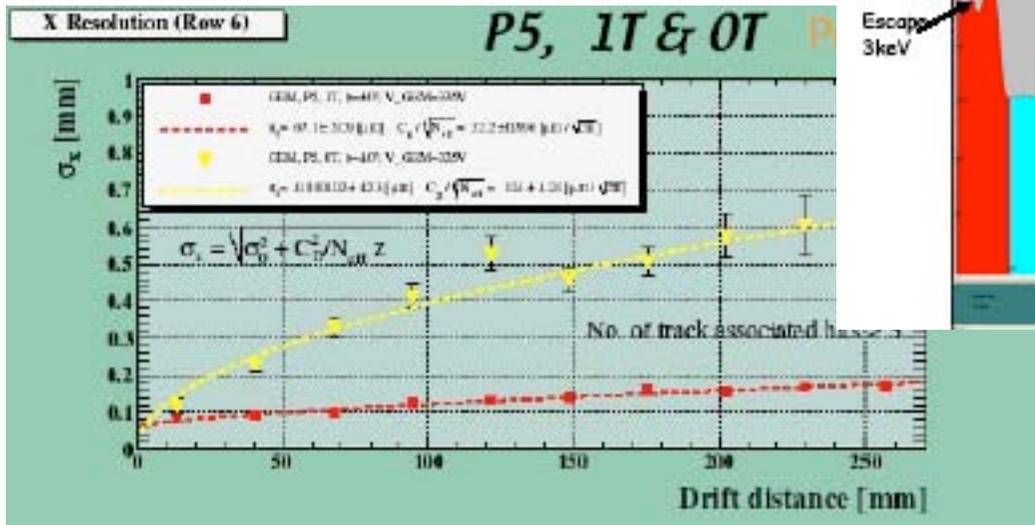
Superconducting Solenoid Magnet(JACEE)



B field up to 1.2 Tesla

portable, standalone operation

We obtain many good results



discussing results is not a subject here

About Beamtest (personal comment)

Good thing

- Direct exchange of information, technology, technique know-how (something hard to be described by word)
- Variety of idea, opinion activate discussions
- Good opportunity for grad. students

difficulties

- People working around facility have to do many things: beam time scheduling, maintain magnet, maintain cosmic ray test bench
- administrative work **the most important**
- budget

R&D ahead of us

- 1) Demonstration phase almost finished
- 2) Consolidation phase NEXT
- 3) Design phase

Large Prototype is main R&D item for next few~ years

study model for "real TPC"
size ~ R~0.4m, Z~1m

just size for JACEE



TPC will cover large area

huge number of readout channels will be necessary

60k for 1mm pad, 30k for 2mm (not be read all)

O(10k) readout ?

large area help to accumulate cosmic ray data with high rate

beam is not so necessary. Laser is enough?

TPC + huge electronics prevent portability

large Prototype must be build near beam facility?

High rate test is unique at Beam

R&D items with Large Prototype

Endplate

padplane : optimal pad size and arrangement/segmentation

MPGD : GEM/Micromegas. how to hold ?. segmentation

gating : ion back-drift

structure

Field cage

structure : field uniformity, discharge

E-field distortion due to ionization

gas container

Electronics

mounting method, readout method

Magnet

precise B measurement

tracking under non-uniform B field

Gas system

Laser calibration system

Status

DESY plans to build a facility for Large Prototype

based on EUDET

magnet, electronics, field cage...

specific R&D items are left for every R&D groups

electron beam is available

Asia(KEK) submit a proposal for Large Prototype, but

KEK PS will be shut down from the end of this year

but J-PARC testbeam will be available from 2008(?)

KEK has SC solenoid excited every day

CERN, Fermilab, SLAC,,, have beam lines

but member of LCTPC doesn't exist here

DESY will be a only place for LCTPC test?

Test beam @DESY is enough ?

Hadron beam ??

Status of other tracker?

Sorry. I couldn't get any information.

Summary

Test beam is very important facility for prototype study.
good opportunity to collaborate w/ other group.
-> good chance to form World Wide collaboration
before I LC exp. starts

Magnet is another important facility for LC(at least TPC)

Host institute has an important role for LC(TPC) collab.

a lot of work related to facility itself must be exist

Organization under I LC is a little bit complicated.

WWS Det. R&D panel

test facility (such as EUDET)

LCTPC collab.

Concept group