

Tracking Detector R&D at Cornell University and Purdue University

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We have requested funding for this research from NSF through UCLC.

Information available at the web site:

http://w4.lns.cornell.edu/~dpp/tpc_test_lab_info.html

- * this presentation
- * presentation to UCLC meeting at Santa Cruz 30-June-2002,
- * project description from the NSF proposal, 29-August-2002

The project description can also be found at the UCLC site:

<http://w4.lns.cornell.edu/public/LC/UCLC/projects.html>

Detector Development, Cornell/Purdue Program

Systematic study **spatial resolution** and **signal width** using **GEM and MicroMegas TPC readout** devices

- details of spacings and gain,
- pad size and shape
- gas mixture
- applied signal spreading

Spatial resolution and signal width studies using **traditional anode-wire-amplification read-out** devices

- Investigate a readout using smaller wire spacing to reduce the **ExB** effects.
- Establish a baseline for the MPGD studies.

Ion Feedback measurements

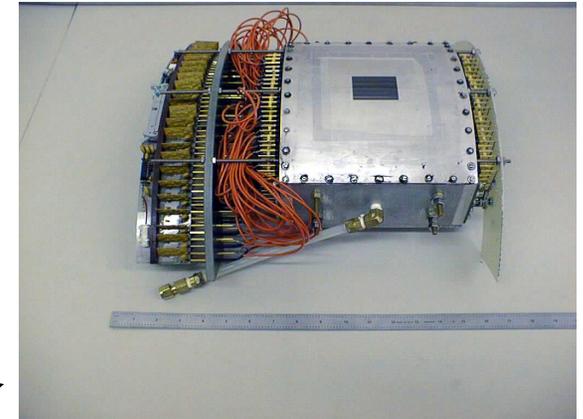
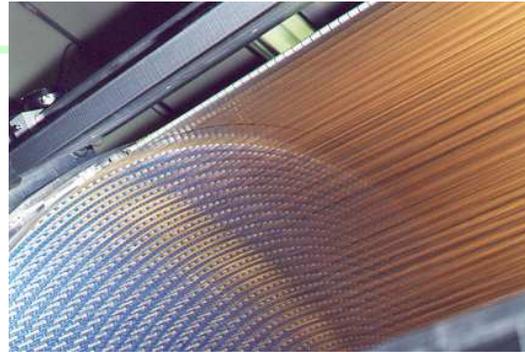
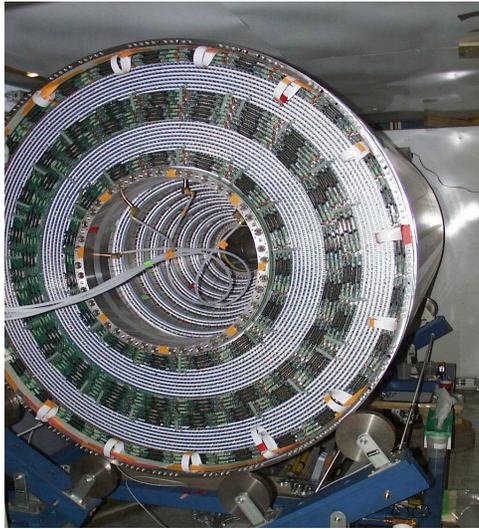
- Instrument the high voltage plane, or an intermediate grid.

Tracking studies in a **high radiation environment**

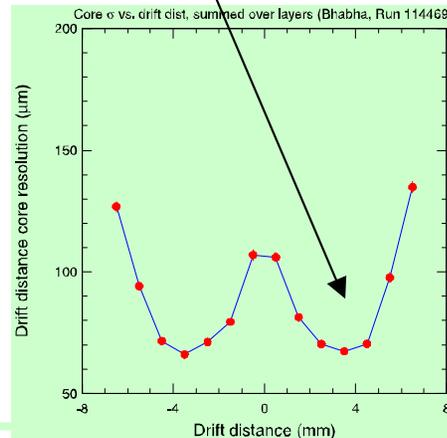
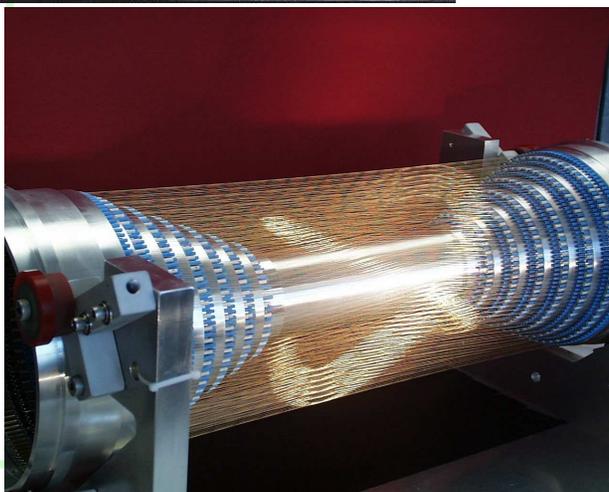
Tracking studies in a **magnetic field**

- Cornell has the expertise and utilities to build and operate a superconducting test magnet.

what Cornell offers



Experience with ...
Large drift chambers for CLEO
Test chambers
Manufacturing
Small drift chambers
Innovative construction
calibration



what Purdue offers

Years of experience with MPGDs

Micro Pattern Detector Aging (Radiation Hardness)

Example: triple GEM with PCB readout

Gas Ar/CO₂ 70/30 (99.99%)

GEM1= 400 V

GEM2= 390 V

GEM3 =380 V

PCB as e⁻ collector

Cr X-rays (5.4 KeV)

@ 6 x 10⁴ Hz/mm² for 750hrs

Gas gain 6,000

Detector performance

small (~15% gain loss) after

~ 8 years @LHC 10 cm from IP.

(~ 130,000 years @LC on 1st 20cm of TPC)

Minimal signs of aging.

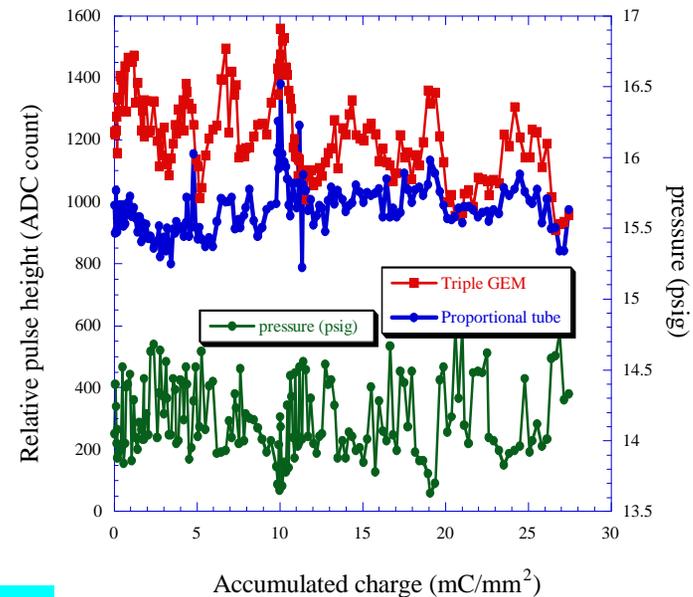
Best aging result obtained with a GEM.

Similar result obtained with

a MicroMEGAS + GEM Miyamoto/Shipsey

2001 IEEE NSS Conference Record

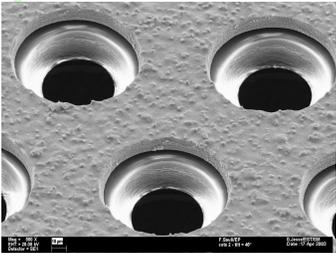
ISBN 0-7803-7326-X (CD ROM)



Stolen from I. Shipsey, NIM A 478 (2002) 263

All publications at: <http://www.physics.purdue.edu/msgc/>

what Purdue offers



Chicago/Purdue/3M 1st mass production of GEMs, hep-ex/0304013.
 Talks: Imaging 2003, ALCW Cornell July 03, next talk by Juan Collar.
 Preliminary studies: performance is equivalent to GEMs made at CERN.

Summary Comparison CERN and 3M GEM

Table stolen from
 I. Shipsey, ALCW
 Cornell July 03.

	3M GEM	CERN GEM
I_{leak}	0.02nA/cm ² @ 600V, air at 40% R.H.	0.005nA/cm ² @ 500V in N ₂
Gain $\Delta E/E$ $\Delta G(x,y)/G(x,y)$	~1,000 @ 500V Ar/CO2 7:3 ~16% 9%	~1,000 @ 500V Ar/CO2 7:3 ~18% (typical) --
Electron Transparency Ion Transparency	0.9 0.9	0/9 0.6
Ion Feedback	0.1 at G=20 $E_{\text{drift}}=150\text{V/cm}$	0.08 $E_{\text{drift}}=150\text{V/cm}$
Ageing	result at IEEE next week	25 mC/mm ² Triple GEM @ Purdue 2000



New: Purdue/3M prototype run of mass produced MicroMEGAS has begun.
 Detectors available in a few weeks.
 After initial evaluation, will distribute to all who would like to test them.

Short Term Activities

Cornell:

Electronics Purchase:

Lab funds, Sept 2003

VME Crate and Interface

FADC, 100 MHz, 32 channels

HV crate and interface

HV supplies: GEMS

Drift = 66cm

Set-up and testing of electronics (14 weeks)

Construct a first TPC device.

Construct telescope drift chambers and trigger scintillators.

Technical staff and machine shop staff are available,
some residual competition from the CESRc Wiggler production.

Purdue:

Ready to construct a readout module.