Tracking Detector R&D at Cornell University and Purdue University

Cornell University

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

Information available at the web site:
http://w4.cornell.edu/~dpp/tpc_test_lab_info.html
(which is the parent site of this presentation)
including

* presentation to University Consortium for the Linear Collider 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.cornell.edu/public/LC/UCLC/projects.html)

Detector Development, Cornell/Purdue Program

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

amplification device,
details of spacings and gain,
pad size and shape
gas
applied signal spreading

Signal spreading must be optimized for segmentation and resolution.

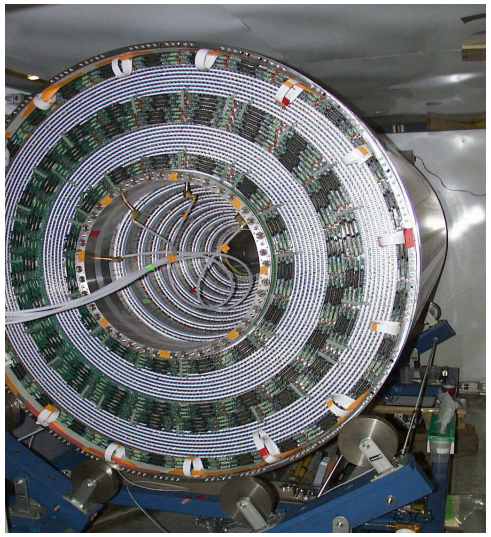
Spatial resolution and signal width studies using
traditional anode-wire-amplification read-out devices
Investigate a readout using smaller wire spacing to reduce the **ExB** effects.

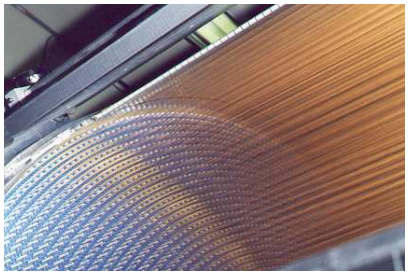
Ion Feedback measurements
Instrument the high voltage plane, or an intermediate grid.

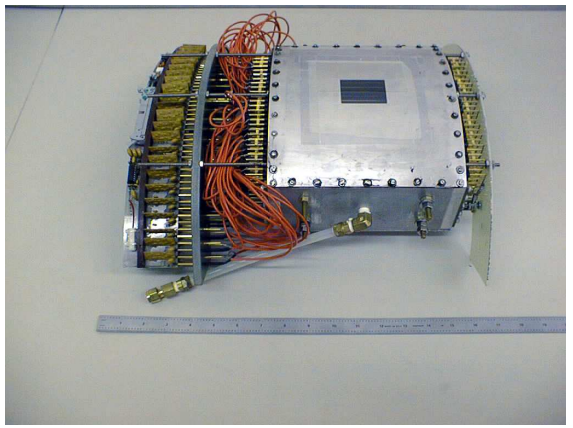
Tracking studies in a **high radiation environment**
Studies of signal distortion and electric-field break-down.

Tracking studies in a **magnetic field**
Cornell has the expertise and utilities to build and operate a superconducting test magnet.

what Cornell can offer







Experience with …

Large drift chambers for CLEO

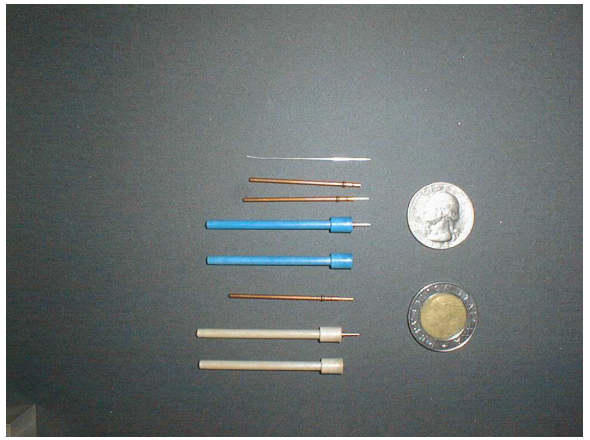
Test chambers

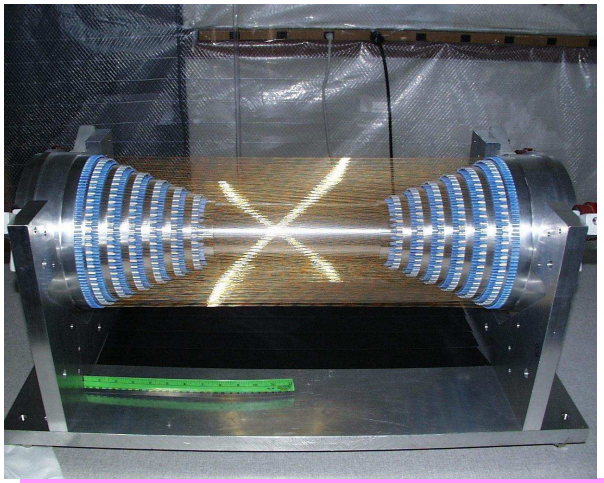
Manufacturing

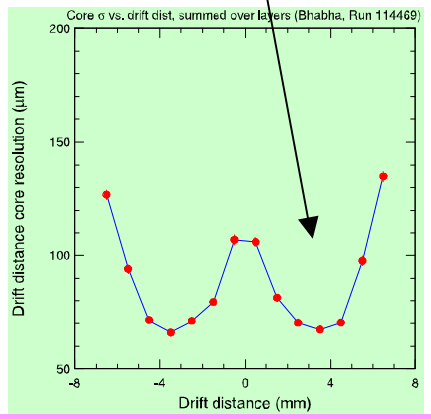
Small drift chambers

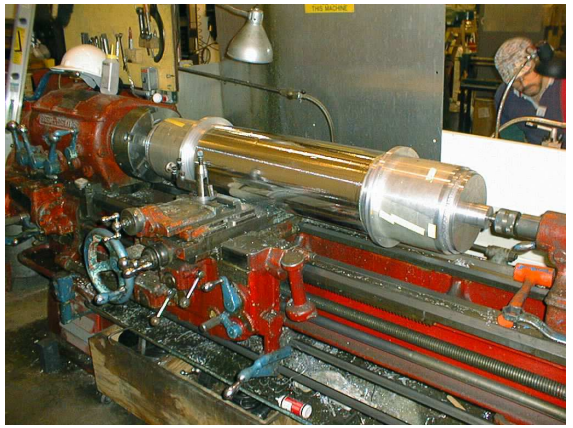
Innovative construction

calibration









what Purdue can offer

Years of experience with MPGDs,
preparation and radiation hardness measurements

Micro Pattern Detector Aging
(Radiation Hardness)

Example: triple GEM with PCB readout

Gas Ar/CO_2 70/30 (99.99%)

GEM1= 400 V
GEM2= 390 V
GEM3 =380 V
PCB as e^- collector

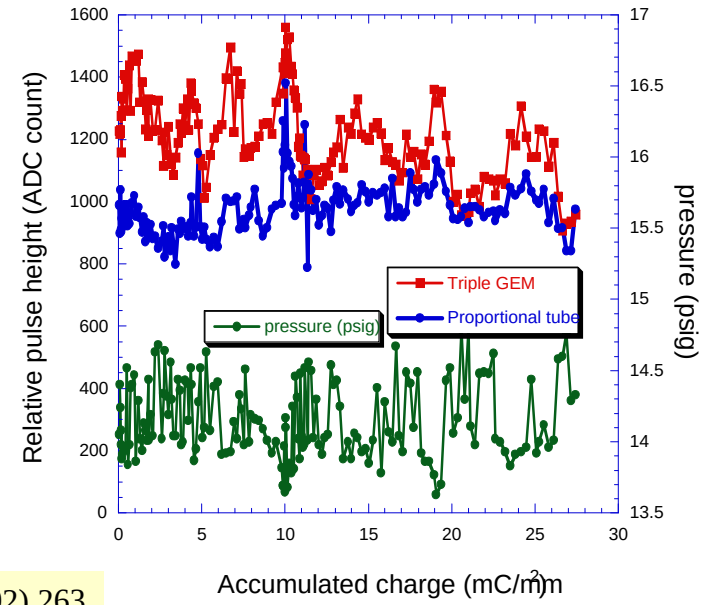
Cr X-rays (5.4 KeV)
@ 6 x 10^4 Hz/mm^2 for 750hrs

Gas gain 6,000

Detector performance
small (~15% gain loss) after
~ 8 years @LHC 10 cm from IP.
Minimal signs of aging.

Best result obtained with a GEM.

Similar result obtained with
a MicroMEGAS + GEM



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

D. Peterson, Cornell University, ALCPG-tracking-gas meeting 26-November-2002

TPC Test Chamber R&D at Cornell University and Purdue University Three Year Plan

		Plan	Purchases	
(at Cornell)	1st Year	track definition	VME crate	
		scintillator trigger	Computer and LabView controller	
		small drift chambers	discriminators for drift chambers	
		test device, TPC	TDCs for drift chambers	
		power supplies	FADCs for TPC (limited)	
		data acquisition	power supply frame	
			power supplies	
			electronics boards	$ 52,000 equipment
	2nd Year	expanded TPC	expanded DAQ	
		superconducting magnet		$ 121,000 equipment
	3rd Year	expanded TPC	expanded DAQ	
		superconducting magnet		$ 74,000 equipment
(at Purdue)	1st Year	MPGD readout modules	printed circuit pad readout planes	
			GEMs, MicroMegas	$ 10,000 equipment
				$ 16,000 student support
	2nd Year	advances in MPGD readout modules		$ 10,000 equipment
				$ 16,000 student support
	3rd Year	advances in MPGD readout modules		$ 10,000 equipment
				$ 16,000 student support

Short Term Activities

Cornell:

Purchases of electronics,
set-up and testing of electronics,

are delayed until we receive UCLC funding from NFS.

(That will be late spring 2003 under the absolute best conditions.)

construction of a first TPC device
construction of telescope drift chambers and trigger scintillators

We can start when technical staff and machine shop staff are available,
at the completion of the CESR-Wiggler/CLEO-inner-chamber installation,
~ June 2003 .

Purdue:

may be ready to construct a readout module