

# Louisiana Tech University High Energy Physics

## Outline

- Group Members and History
- Activities on DØ
  - ICD and Calorimeter
    - Hardware Maintenance
    - Software
  - Level 3 Filtering
    - Missing ET Filters
    - Calorimeter Objects
    - Data Quality
  - Offline Software
    - MissingEt
    - em-cert
  - Offsite Computing, SAR, and GRID
  - Layer 0 Silicon Tracker Upgrades
  - Physics Analyses
    - W asymmetry
    - Improved Z Measurements
- Linear Collider Activities
  - GEM Tracker Prototyping
  - Simulations
  - LDC conceptual design
- Future Plans with ATLAS
- Budget



13 April 2006  
2006 DOE Review



Lee Sawyer  
Louisiana Tech University



LA Tech HEP  
Slide 1

# Louisiana Tech HEP Group Members

- Faculty
  - Lee Sawyer
  - Z.D. Greenwood
  - Search underway for a new junior faculty member.
- Research Faculty/PostDocs
  - Joe Steele
  - Julie Kalk
  - Previous postdocs include Sudhir Malik (now with Nebraska), Alan Stone (now with UIC), Prabir Roy (now at LBNL)
- Graduate Students
  - Naveen Prochiraju
    - MS Physics - ICD upgrades
    - Will continue in PhD program, working on GEM-based tracker for ILC
  - Sreekanth Gurappa
    - First year student
    - Was working on GEANT4 simulations for ILC
    - Will move to D0 missingET reconstruction code this summer.
  - Some previous students include:
    - Qun Yu (CAM PhD) Electron sampling weights and identification in InterCryostat RegiorSupport: DoE Base
    - Mayukh Das (CAM PhD) Level 3 b-taggingSupport: LA Board of Regents
    - Moreshwar Dhole (M.S. EE) Silicon Cable testingSupport: FNAL MoU
    - Bharat Madireddy (M.S. Physics) GEM tracker readout, LC simulationsSupport: DoE LC
    - Subrmanian Narayanan (M.S. Physics) GEM current monitor & triggerSupport: DoE LC
    - Greg Giering (M.S. Physics) SUSY Searches in Hemispheric EventsSupport: DoE Base
    - Sunitha Polam (M.S. CS) DOGRIDSupport: DoE/EPSCOR
    - Sowmya Reddy (M.S. EE) Silicon Cables & R/OSupport: FNAL MoU, DoE/EPSCOR
- Undergraduates
  - Joshua Hignight -> Tevatron SUSY simulations
  - Michael Bryant -> Computer management and DOGRID software
  - Nathan Mann -> LINUX cluster management



# Current DØ Activities by Member

- **Dick Greenwood**
  - DOSAR & DOGRID
  - Remote analysis & maintaining local release of DØ software
  - Electroweak Physics
  - Run 2b Silicon cable testing
  - Calorimeter shifts
  - Supervising three MS students
  - Heading effort to join ATLAS
- **Lee Sawyer**
  - Calorimeter Software coordination (w/ Jan Stark)
  - ICD maintenance and repairs
  - Level 3 missing Et tools
  - Offline missingET
  - Calorimeter shifts
  - Electroweak and SUSY physics
  - Supervising two PhD and three MS students
  - Grant administration, IB rep., etc.
  - ILC simulation studies
  - ILC GEM Tracker prototyping
  - Co-editor of LDC document
- **Julie Kalk**
  - ICD repairs and monitoring
  - ICD on-call expert
  - Supervision of LA Tech students at DØ
  - $W \rightarrow e \nu$  Asymmetry Measurement
- **Joe Steele**
  - DØ reconstruction certification
  - DØ SAMGrid software development
  - $Z \rightarrow ee$  cross-section with 1 fb<sup>-1</sup>
  - Luminosity Task Force: Cross-check luminosity using Z and W production
  - em\_cert software



# D0 Service Tasks

- Compiled by Blazey & Womersley

System	# of FTEs Required/ People Now Identified	Current Institutions
Run Coordination	4/4	Aachen(1), FNAL(1), FSU(1), Indiana(1)
Framework	1/1	Michigan State(1)
SMT	6/7	Strasbourg(1), NIKHEF(1), Moscow(1), FSU(1), FNAL(3)
CFT & PS & Trig	6/11	FSU(1), Notre Dame(1), BNL(1), Rice(2), FNAL(5), Kansas(1)
Calorimeter & Trig	6/10	LTech(1), SUSB(2), Dalh(1), NDU(1), FSU(1), Marseille(1), Orsay(1), Tata(1), Paris(1)
Muon & Trig	6/18	ITEP(1), JINR(4), RNP1(4), IHEP(1), Arizona(2), NIU(1), Boston(1), FNAL(3), Northeastern(1)
FPD & Trig	3/4	LITA(2), CBPF(2), UERJ(1), UPR1(1)
Luminosity	3/8	Czech Tech(1), Brown(1), Northwestern(3), CBPF(2), CPPF(1), UERJ(1), Tata(1)
L2	4/9	NIU(1), Maryland(1), Boston(2), Oklahoma(1), Virginia(1), Columbia(2), Michigan(1)
DAQ	3/4	Brown(2), Washington(2)
Online/Controls	2/5	FNAL(5)
Filtering	4/4	Imperial(1), LBL(1), LTech(1), Indiana(1)
Data Quality Monitoring	2/4	FNAL(1), Manchester(1), Arizona(1), Marseille(1)
Executable Management	3/2	FNAL(1), Riverside(1)
Data & MC Form Operation	3/9	Wuppertal(1), Tata(1), NIKHEF(1), Lancaster(1), Imperial(2), BNL(1), FNAL(1), Charles University(1)
Data Access	3/0	-
ClueDO Admin	2/0	-
Analysis Tools Development	4/0	-
Software Infrastructure	4/7	Marseille(1), Riverside(1), BNL(1), FNAL(4)
Object ID & Tracking Infrastructure	10/24	Grenoble(2), Strasbourg(2), Frelburg(1), Lancaster(1), Imperial(2), Arizona(2), Kansas(1), Riverside(2), Notre Dame(2), Maryland(1), Oklahoma(1), FNAL(2), LBL(1), NIU(1), Paris(3)

Red: Current Need Additional Help

N.B. Does NOT include SAR/D0GRID work



# D0 Effort Reporting (Fall, 2005)

Louisiana Tech, LA

Activities	Activity %
Algorithms/Algorithms/Calorimetry	10
Algorithms/Executables/L3	60
Algorithms/Executables/Reco	10
Computing & Core Software Fields/Development Databases/Remote Computing Tools	60
Computing & Core Software Fields/Operations/MC Production	20
Operation Fields/Detector/ICD	10
Operation Fields/Shifts/	15
Operation Fields/Trigger/DAQ/STT	10
Physics/Analysis/EW	15
Physics/Analysis/New	5
Physics/Analysis/QCD	5
Physics/Editorial Board/	5
Physics/ID/B-tagging	25
Upgrade/Detector/STT	35
<b>Institute Total</b>	<b>285</b>

Average for all D0 institution was 605

LA Tech effort comparable to Nebraska, Mainz, Charles University – Prague

Larger than SMU, Princeton

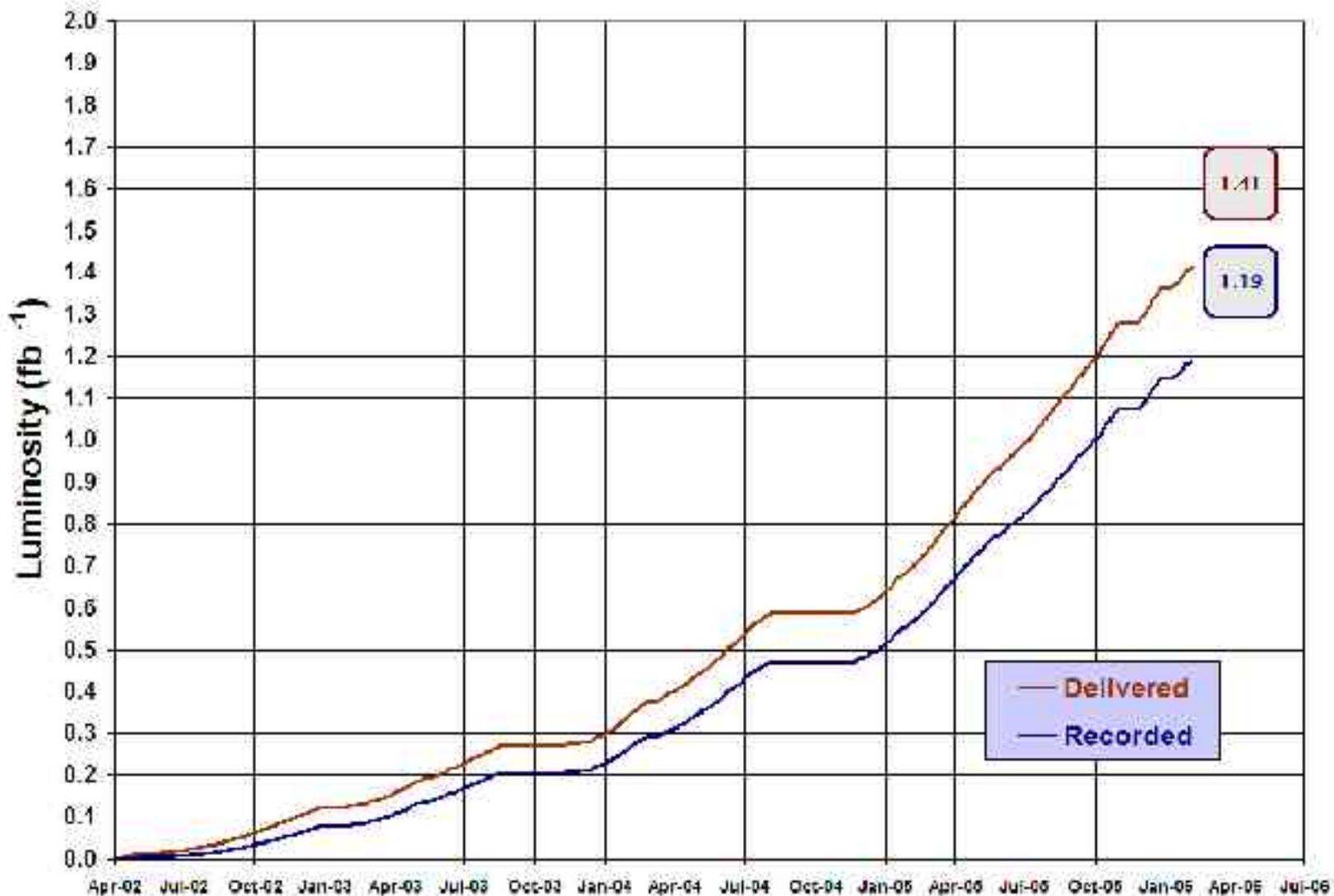
**13 April 2006**  
**2006 DOE Review**



**Lee Sawyer**  
**Louisiana Tech University**



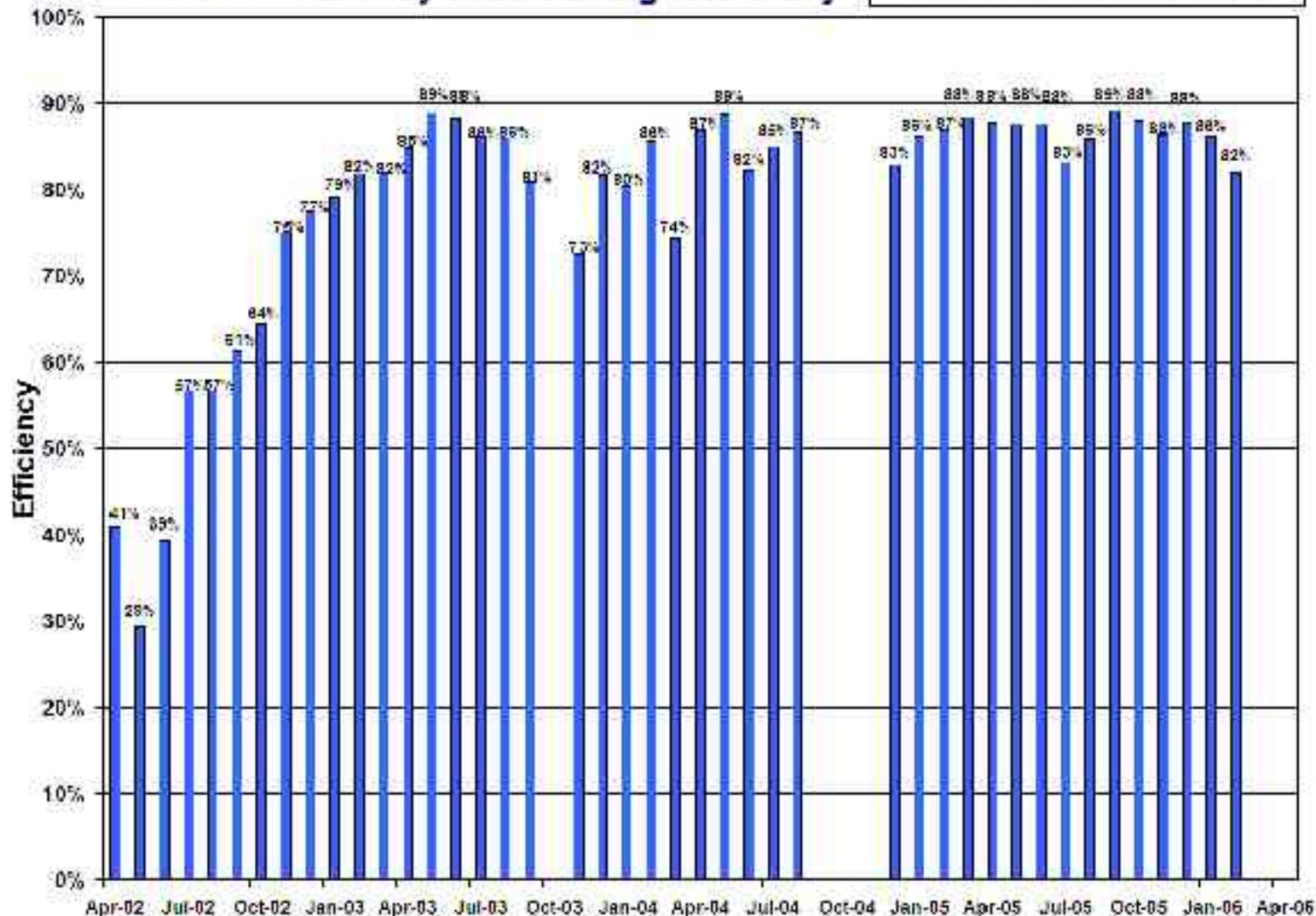
**LA Tech HEP**  
**Slide 5**





# Monthly Data Taking Efficiency

19 April 2002 - 19 February 2006





# International Linear Collider

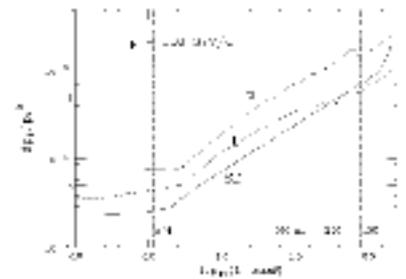
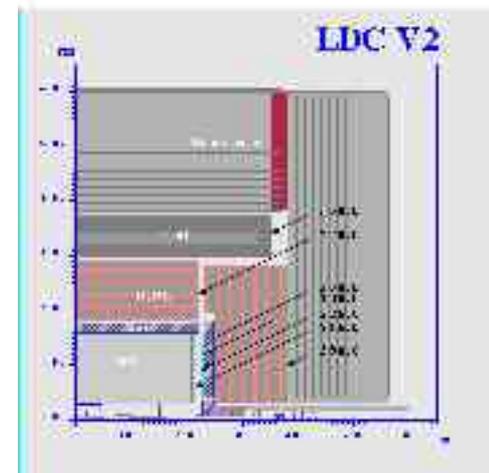


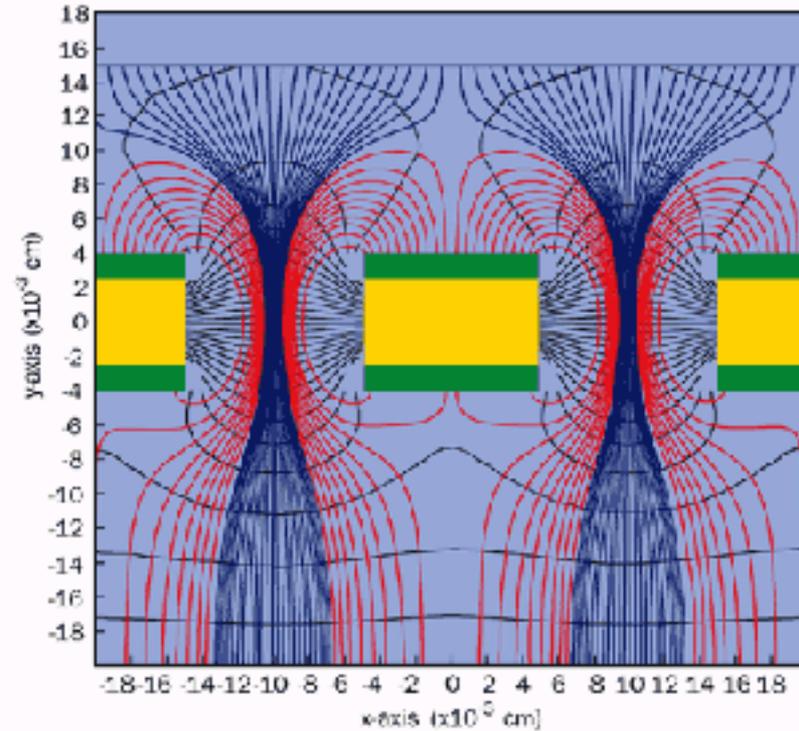
Figure 15.12: Expected fractional momentum

- **Dual Track R&D Program**
  - **Hardware:** Build a prototype GEM chamber suitable for forward tracking
  - **Software:** Study design parameters for a tracker in the far-forward region.
  - Part of the LCRD group proposal since 2003
  - Funding at the \$34k (initially) to \$27k (current) level per annum
- **GEM detector R&D for ILC in collaboration with GEM chamber development for QWEAK experiment at JLab**
- **Forward tracking identified as area needing work**
  - Physics needs include luminosity, precision electroweak measurements (WW, WZ), SUSY searches & measurements (e.g. selectron production)
- **Can a GEM-based detector work in the Intermediate to Forward region of proposed LC detector?**
  - Concentrating on the ETD in the LDC conceptual design
    - Was FCH in the TESLA detector design
  - Region from lower TPC to mask
  - Competing technologies are straw tubes, scintillating fibers (intermediate tracker), and long silicon strips

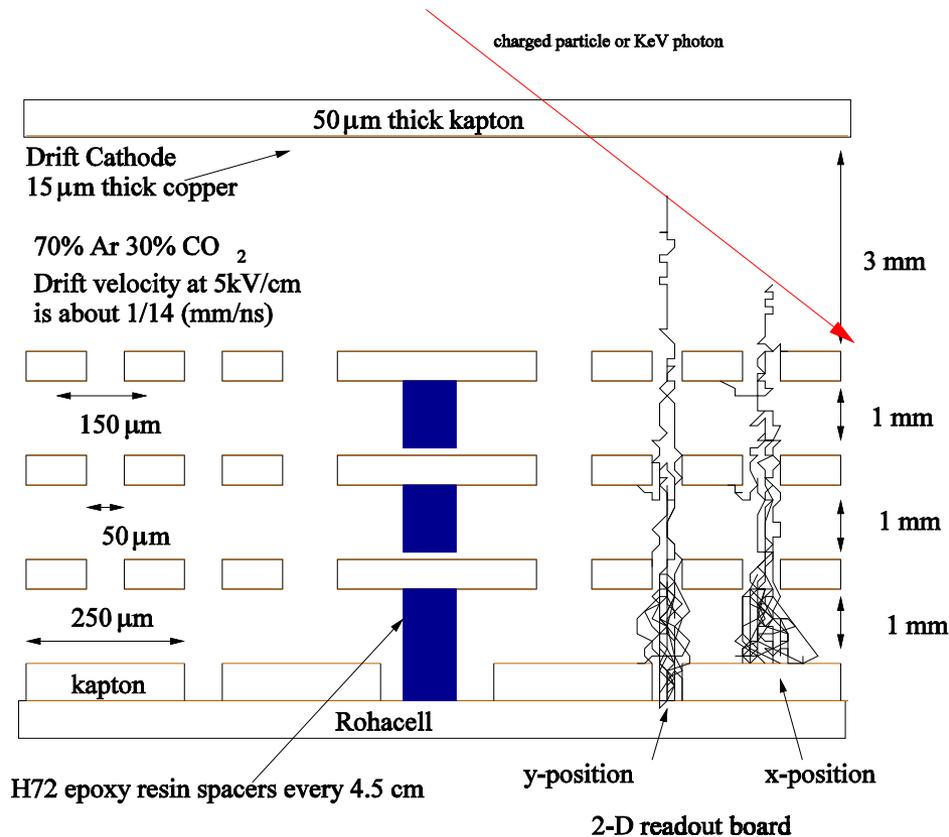


# GEM Detectors

Side view of a tracker based on 3 GEM preamps and a 2-d readout board



Example of the electric field lines produced by a square-hole structure representing a GEM foil



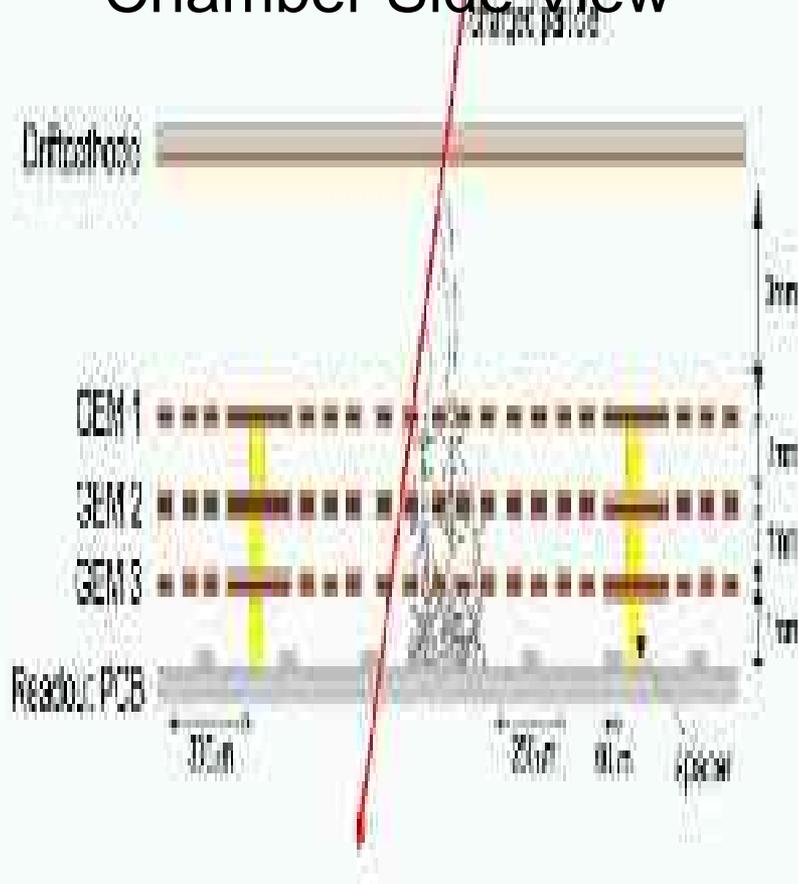
# GEM Work on 2003-2005

- Procured sets of GEM foils
  - Working prototype chambers with 10cm X 10cm foils
  - New chamber for 30cm X 30 cm being designed
- Design for cathode
  - LASER milled at local manufacturer
  - Expect delivery summer, '04
- Developing HELIX-128 chip for readout
  - Used in COMPASS experiment
  - Other readout solutions being pursued
- Studies of electric field using ANSYS simulations
  - Important for QWEAK resolution studies
  - Input to tracking algorithm
- All work represents a partnership between QWEAK/LC groups
  - Two grad. Students supported by DoE LC supplement - finished in Summer, 2005
    - Bharat Madireddy (HELIX r/o, JAS2)
    - Subramanian Narayanan (Current monitor & trigger)
    - 3 new MS students joined in Fall, 2005
  - Two more students supported by Nuclear group (GEM field simulations, tracker construction)

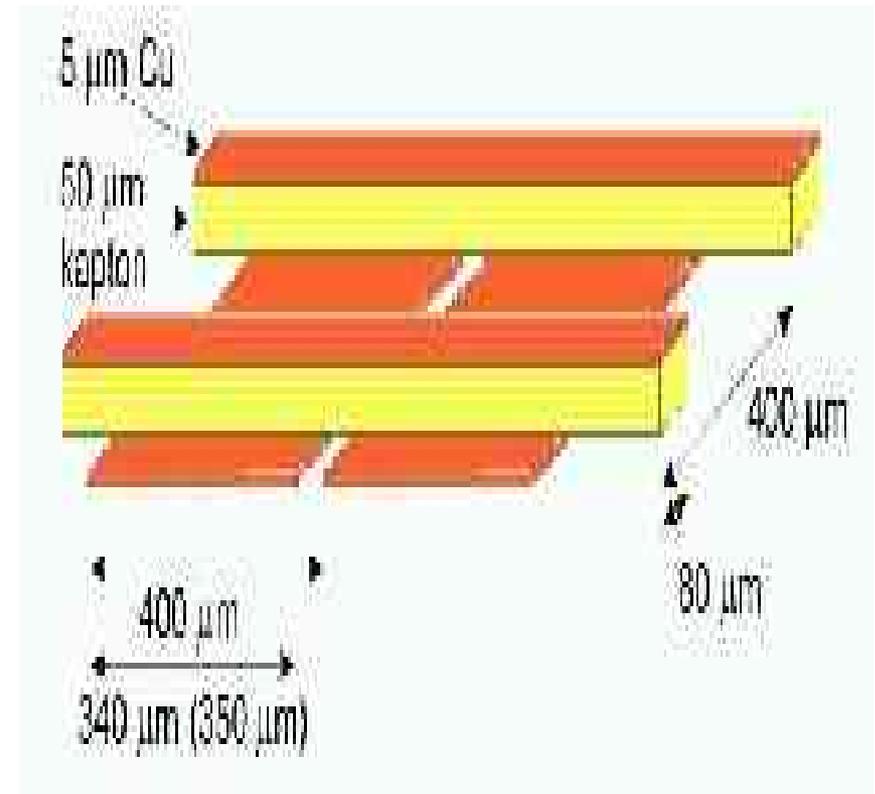


# Ionization Chamber

## Chamber Side View



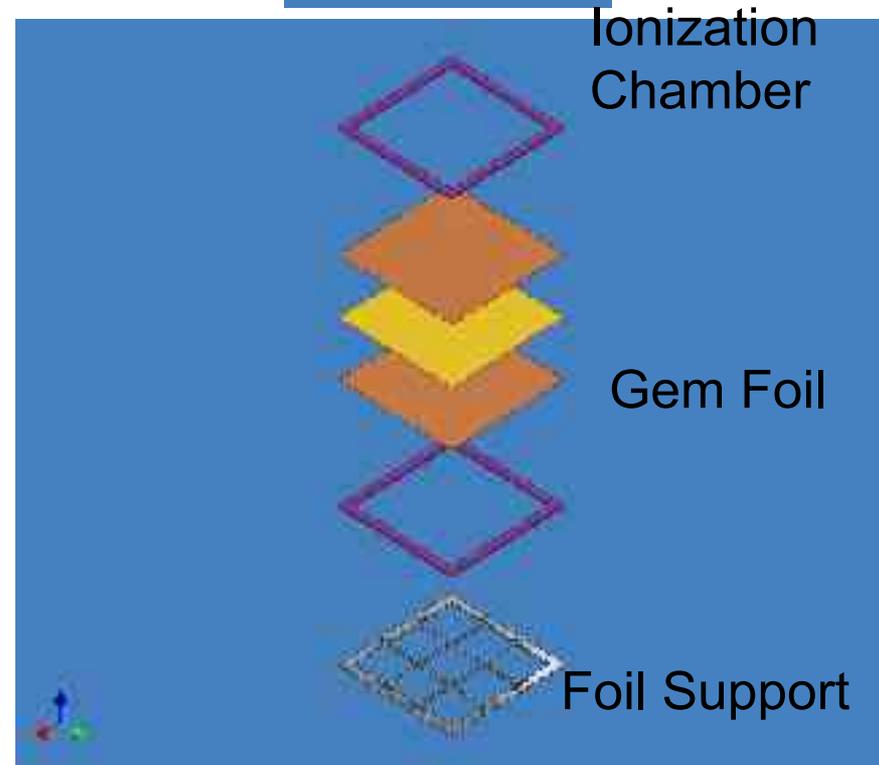
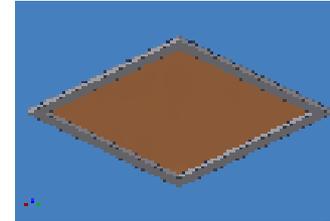
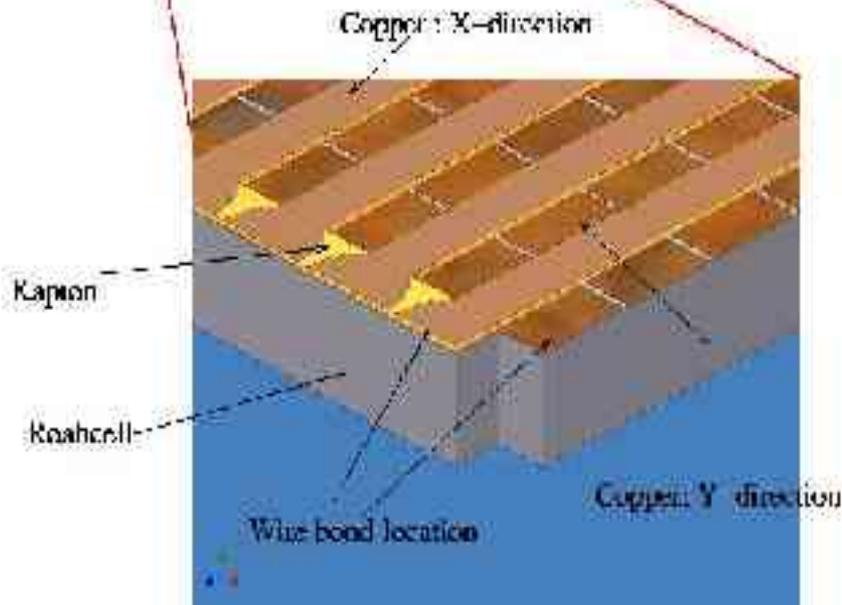
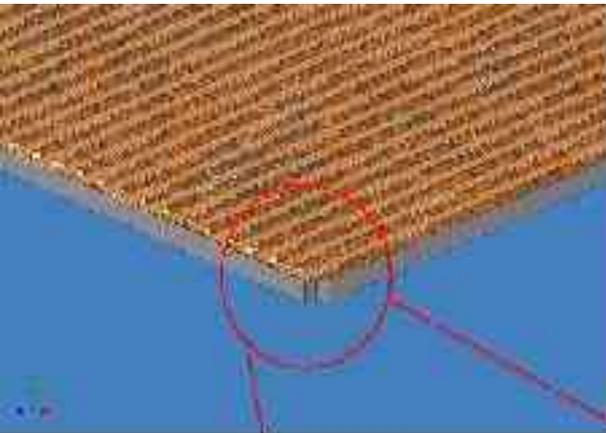
## Charge collector



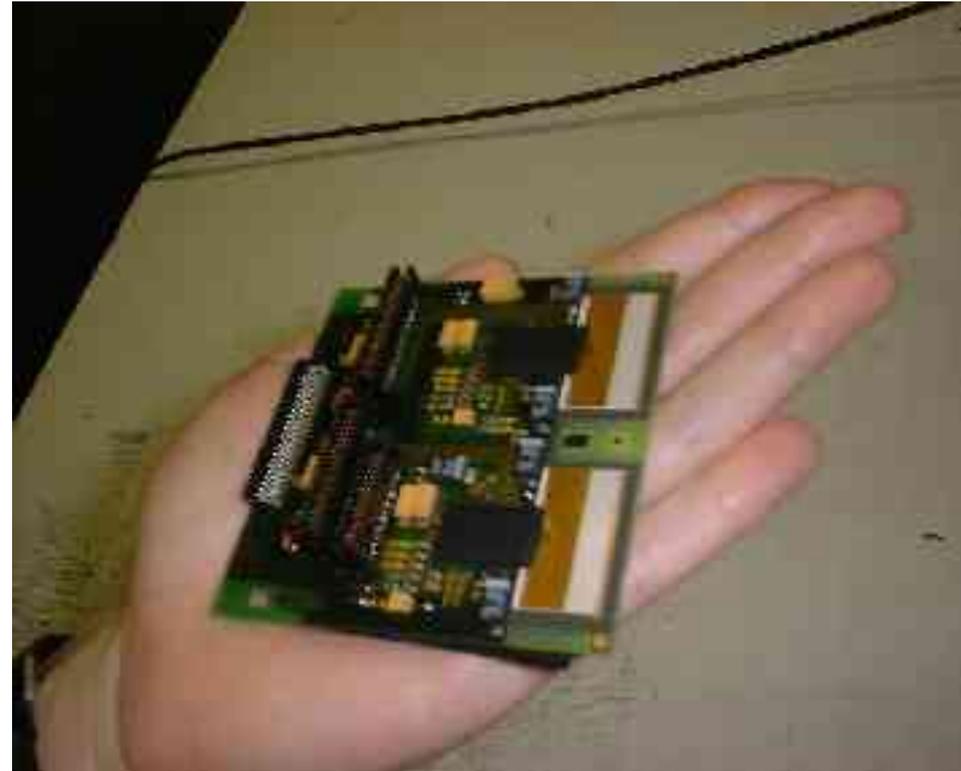
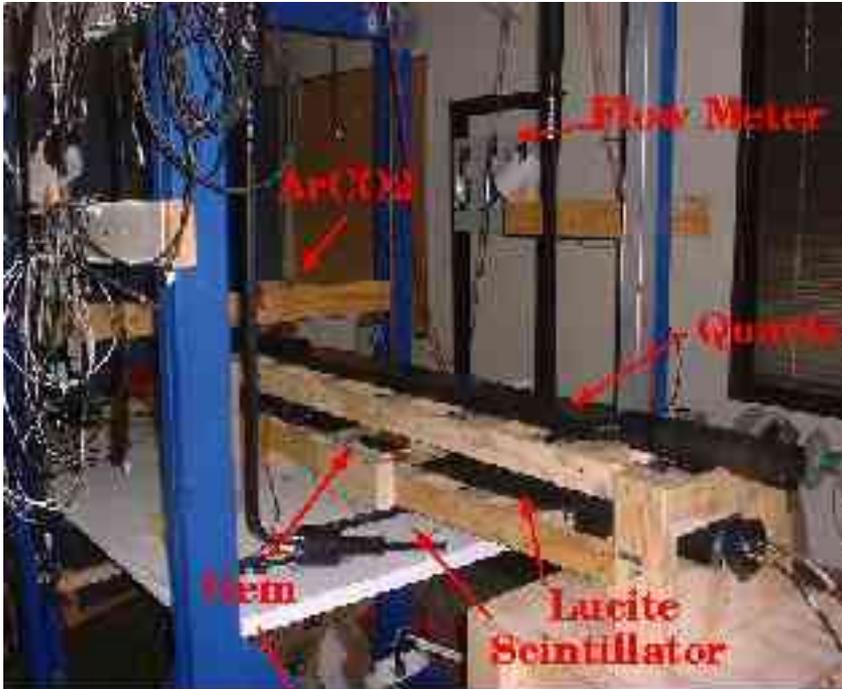
# Design

“Dynamic” CAD  
design template

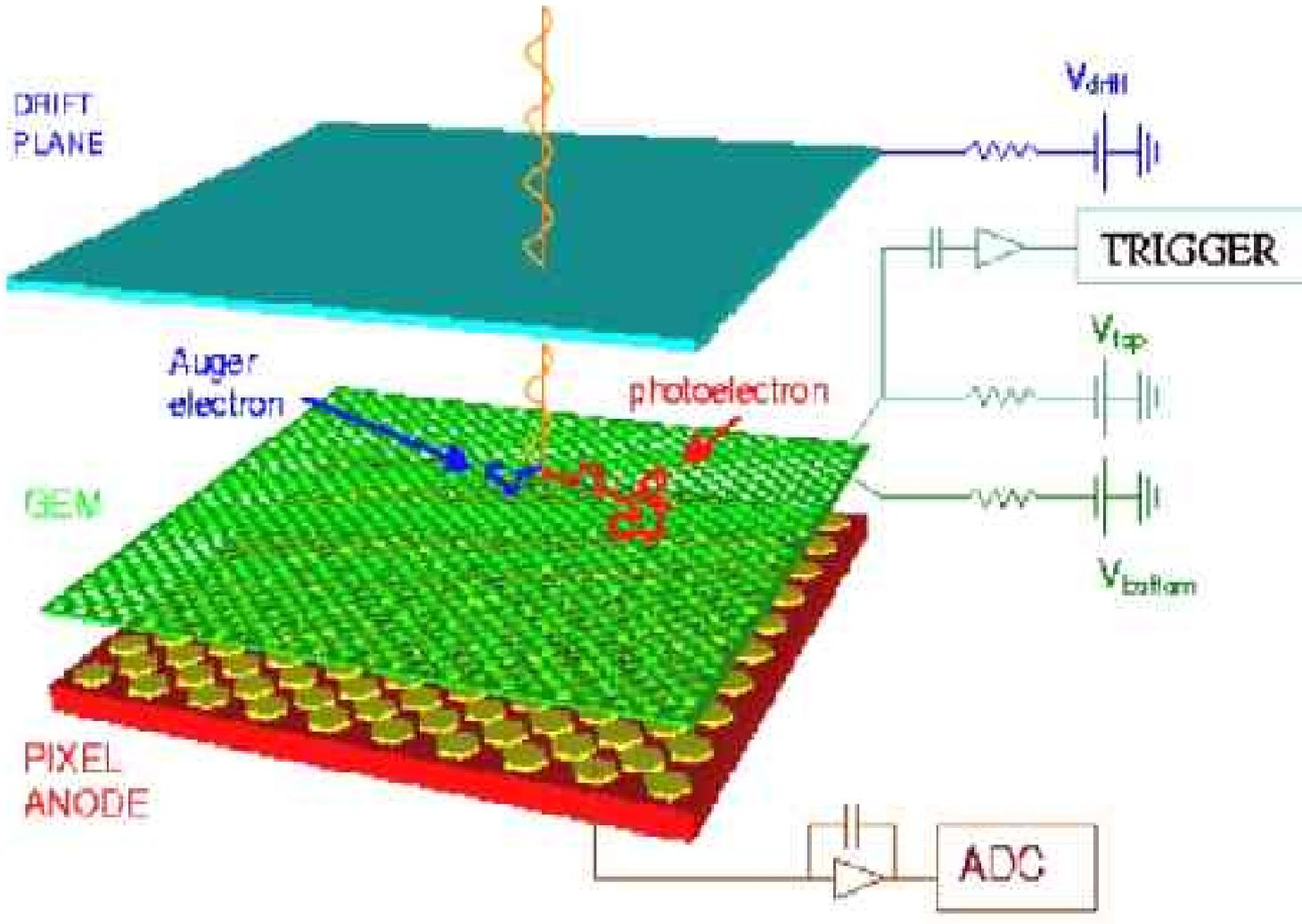
- Pitches and geometries are parameters
- Flexible design changes



# Prototype



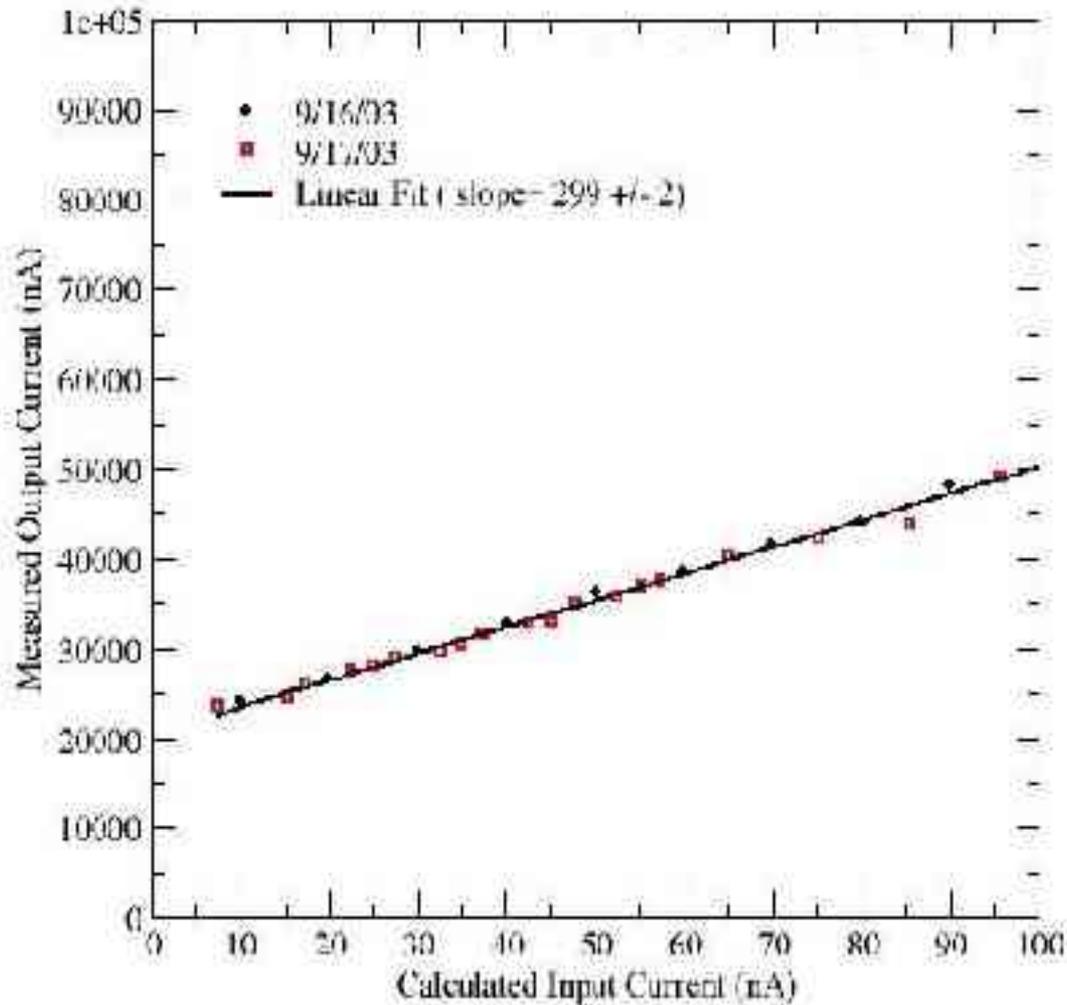
# Trigger Electronics



R.Bellazzini , NIM A478, (2002)13-25

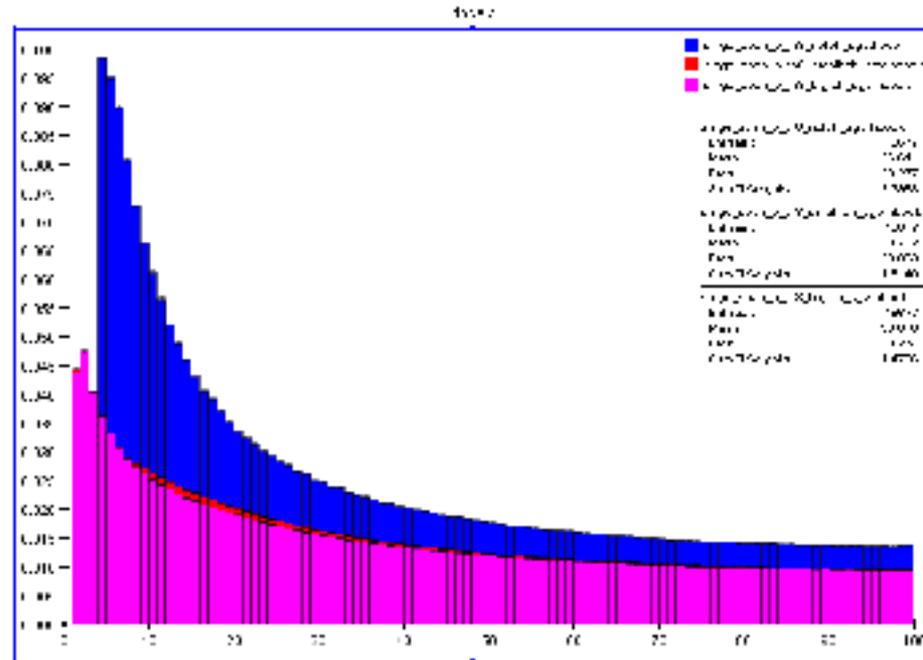
# Power supply current Monitor

## GEM Current Monitor Amplifier



# LCD Simulations

- Using MOKKA to study tracking in the forward region
- Several studies have also been made using the SGV fast simulation
  - Presentations at Snowmass, Vienna
- Have recently been joined by Indiana (Rick van Kooten) in forward tracking and reconstruction, particle flow studies.



Single Electron Momentum Error  
 $dp$  vs  $p$ , at  $\theta = 8$  deg

# Plans for the Coming Year

- **Continue Work on GEM tracker design**
  - ILC prototype tracker in parallel development with QWEAK tracker
  - Cosmic tests of prototype tracker underway
  - Beam tests at JLAB in 2006?
- **Ramp-up simulations work**
  - Closer collaboration with other forward tracking groups (OK, Hampton, UCSC) + Indiana
- **Complete work on LDC DoD for ILC Baseline Document**
  - Due at the end of the year.



# Budget

- **Current year budget: \$170,000 + \$27,000 for LC R&D**
  - Currently providing support for Kalk from the postdoc line.
  - Grad students split between DoE and university matching support
    - Strong history of university match on grad student, both MS and PhD
  - Took a strong hit from post-Hurricane budget cuts by state
    - No overhead return, normally used to support technician, secretary
    - Grad student money very tight next year
- **Next year's base budget \$170,000**
  - Identical to current base
  - LCRD proposed supplement for 2006 is \$27,000 + \$10,000 for Indiana
- **Additional funding from DoE EPSCOR (Greenwood)**
  - Support for Steele, two MS students
  - Hope that new hire can apply for EPSCOR matching or partnership grant.

