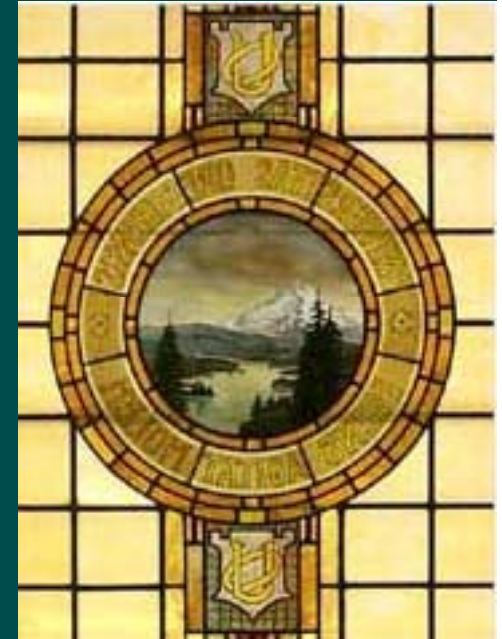


# Detector Summary

David Strom  
University of Oregon



- Vertex Detector
- Tracking
- Calorimetry + Simulation
- Muons/PID/Test Beam
- Forward Detectors
- MDI

# Vertex Detector

Conceptual question:

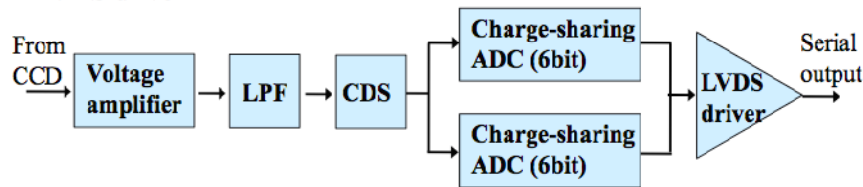
- **How big can we make the B field?**
- Many options, but can a detector that meets the ILC specs be built? (5 micron resolution at high p,  $<0.1\%$  X0/layer, background immunity)

n.b. On-going Vertex Detector Review was summarized Wednesday by Park -- outcome will be reported at the next ILC meeting.

# Design concept of readout ASIC

## ASIC elements

- Voltage amplifier
- LPF (Low-pass filter)
- CDS (Correlated double sampling)
- ADC
  - > 2 charge sharing ADC are used alternatively to achieve 10Mpix/sec.
- LVDS driver

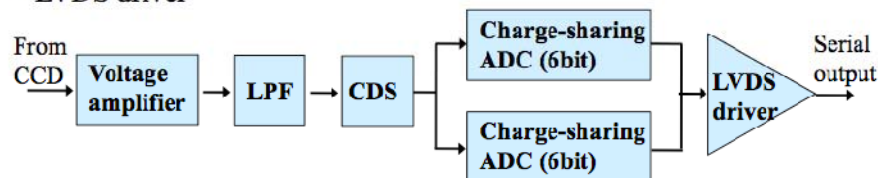


The design was optimized with SPICE simulation.

# Design concept of readout ASIC

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- LPF (Low-pass filter)
- CDS (Correlated double sampling)
- ADC
  - > 2 charge sharing ADC are used alternatively to achieve 10Mpix/sec.
- LVDS driver



The design was optimized with SPICE simulation.

Y. Takubo (Tohoku University)

# Effect of the electric field

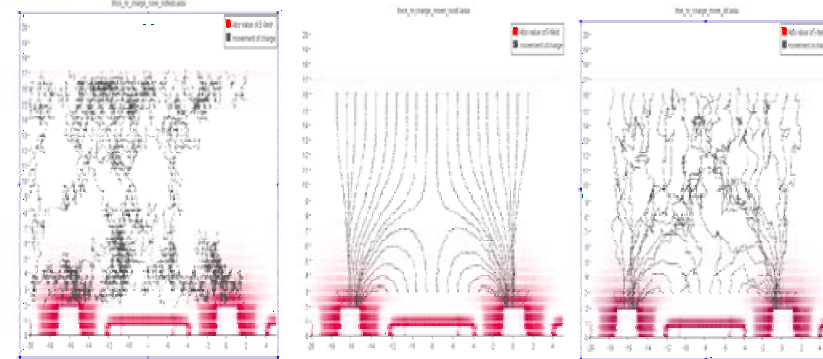


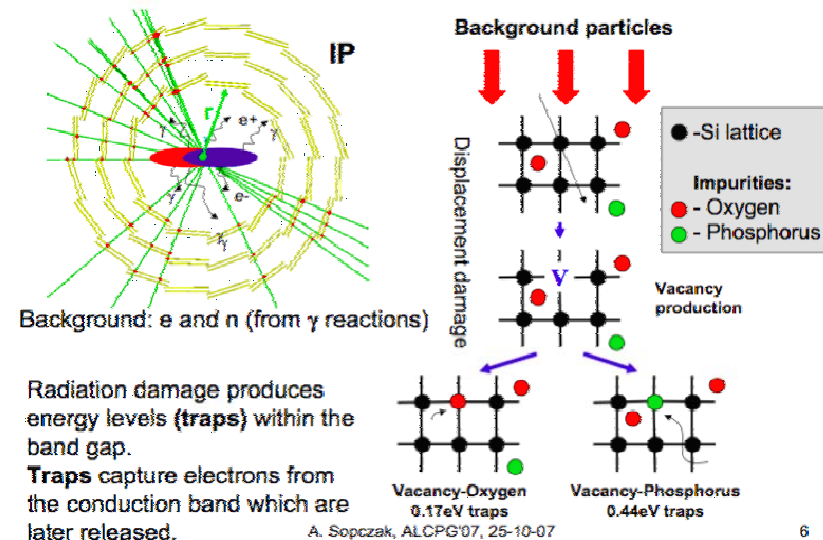
Illustration of the electric field effect on the charge collection in silicon sensor: On the left picture only diffusion is simulated, in the middle charge is moving only by electric forces, and the right picture shows how it moved in our simulations

10/25/2007

Nick Sinev, ALCPG07, FNAL, October 2007

7

# ILC Background and CCD Radiation Damage



6

# Tracking

Conceptual questions:

- Gaseous Tracking or Silicon Tracking

Answer depends on many factors,  
including:

- Space point resolution
- Material in the tracker and in front of ecal
- Robustness to (un)expected background

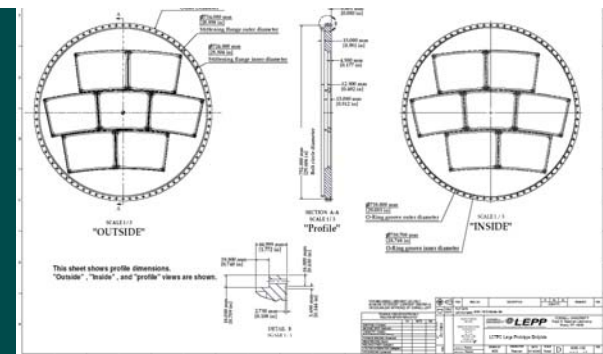
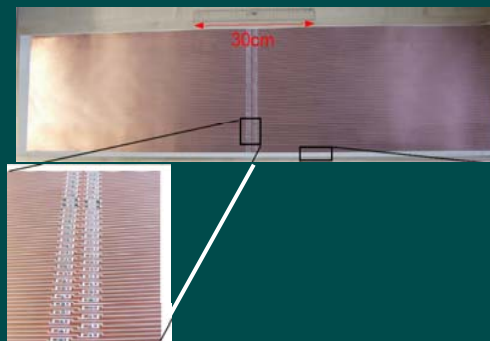
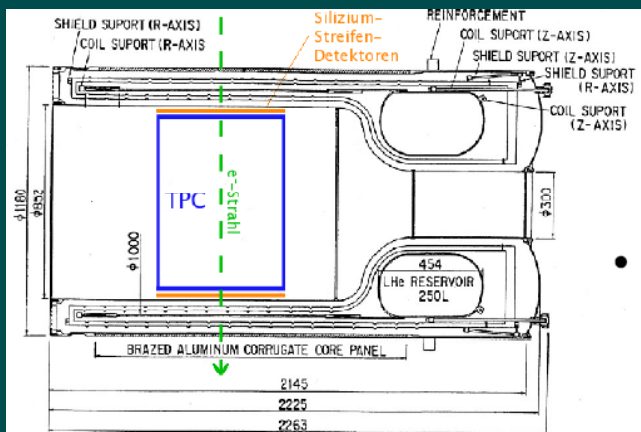
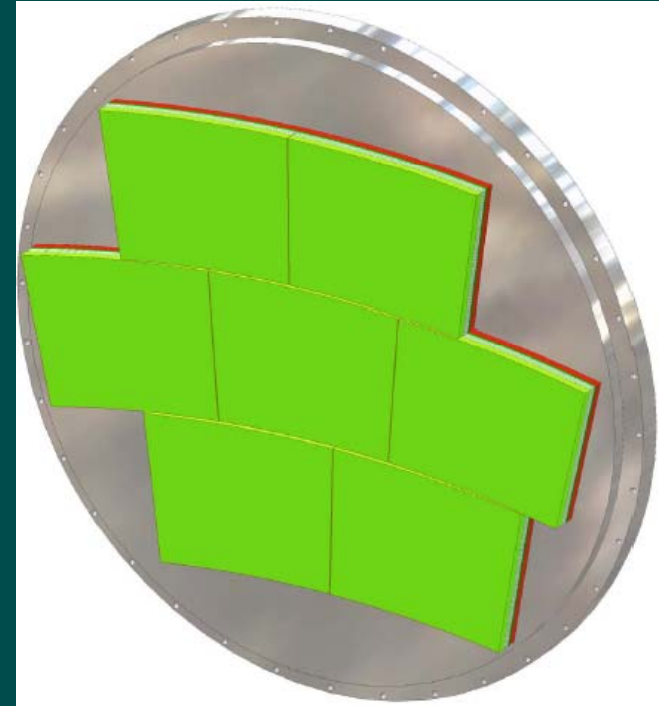
Slides: Peterson and Schumm

# The LC-TPC Large Prototype

Plans and progress for the LC-TPC Large Prototype were discussed in several talks : Colas(Saclay), Diener(DESY), Killenberg(Bonn), Peterson(Cornell), Ishikawa(Saga).

The prototype will be operated at the EUDET facility at DESY in a 1.2 Tesla Field. Progress is being made on the infrastructure including the magnet.

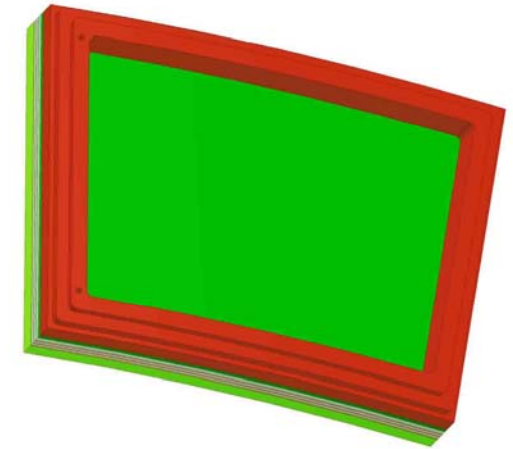
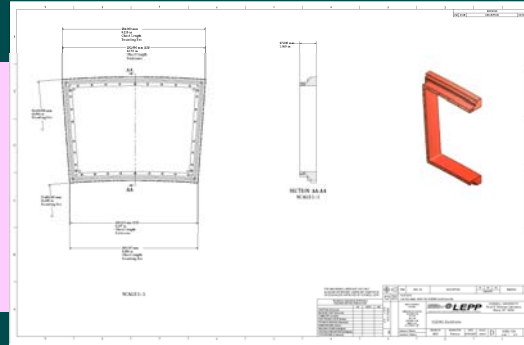
The field-strip foil is double sided, on Kapton. Delivery is expected this week.



Plans for the endplate, and mating module structural parts are final.

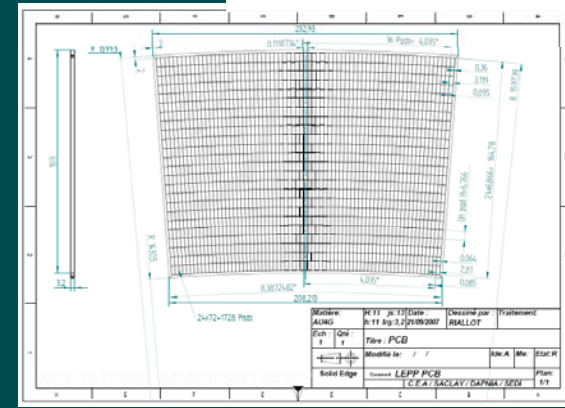
# LC-TPC Large Prototype: Modules

Module mechanical parts are moving into construction at Cornell for delivery to the groups constructing the modules. Peterson(Cornell)

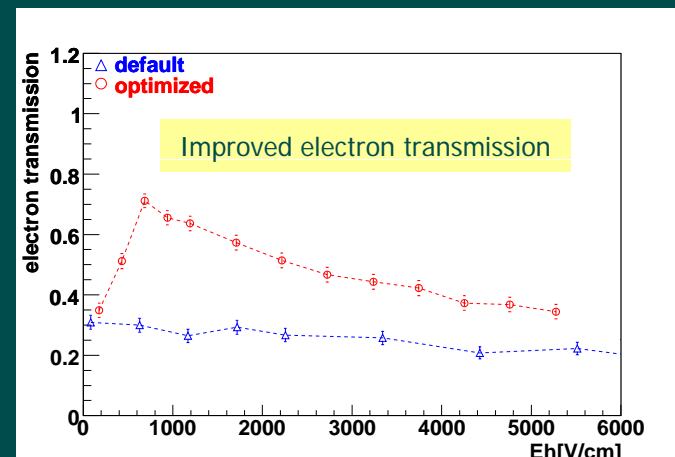


Readout modules with Micromegas gas-amplification and resistive charge dispersion are being prepared at Saclay (Colas).

Readout modules with triple-GEM gas-amplification are being prepared at Saga University. (no talk at this meeting)



A report on simulation of the GEM transmission for electrons, and suppression of transmission for ions showed progress in understanding the applicability of a GEM as an ion gate in the Large Prototype. Ishikawa (Saga)



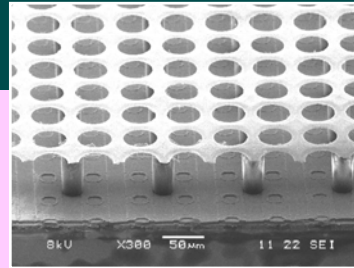
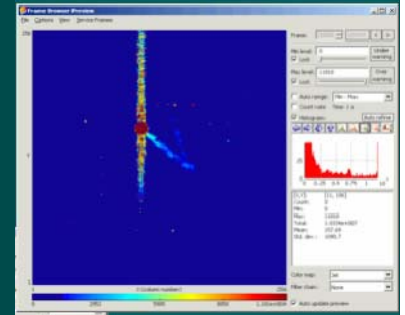
# TPC pixel readout

There has been progress with Timepix pixel readout for a TPC, with both Micromegas and GEM gas-amplification.

For the Micromegas case, new discharge protection for the Ingrid has been tested with favorable results. Recorded sparks do not damage the readout. Timmermans (NIKHEF)

For the GEM case, an effort is starting to study triple-GEM amplification with plans to mount the device in the LC-TPC large prototype. Killenberg (Bonn)

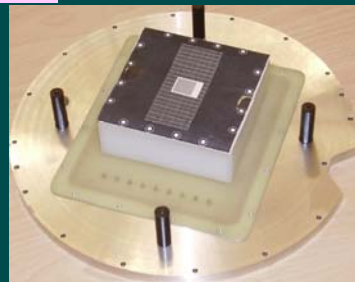
He-isobutane events (see original)



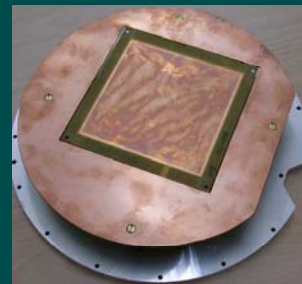
Ar-isobutane Events (see original)

Ingrid

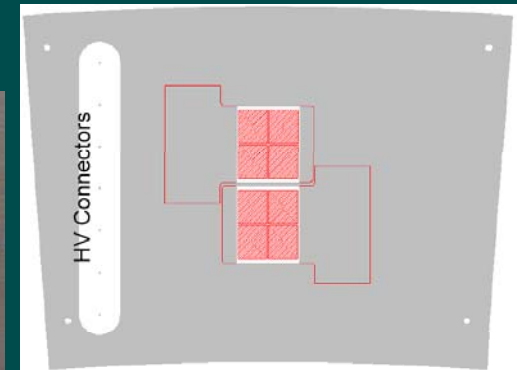
recorded discharge



Timepix



triple-GEM mounted above the Timepix

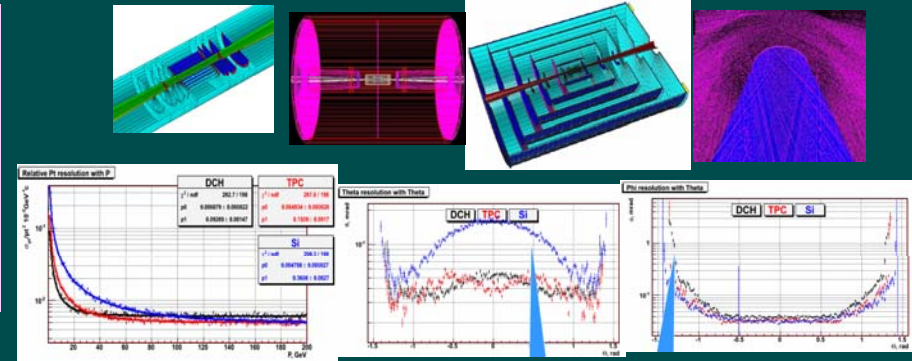


plans for developing a module for the LC-TPC Large Prototype

# Tracking system simulations

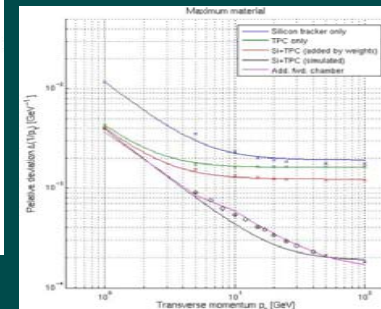
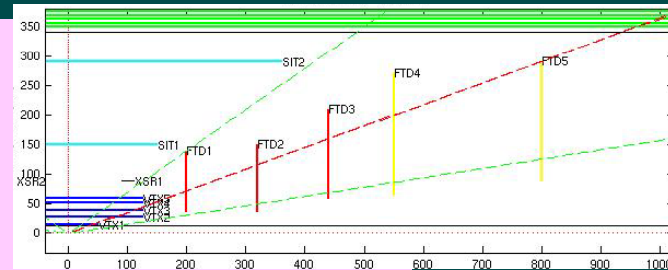
Progress from three software projects were presented.

In one, performance of a pixel TPC, an SiD tracker, and a drift chamber were compared. Regions where the various options are superior were identified. Gatto (INFN Napoli) (ILC root)

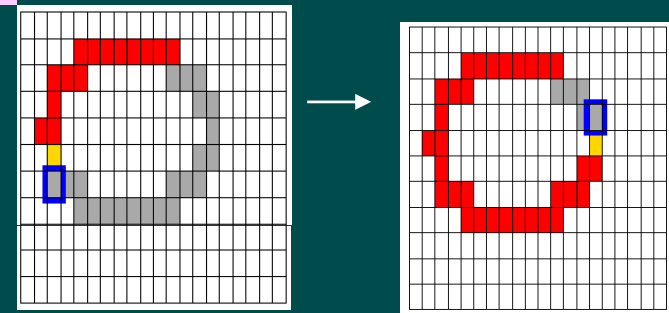


This simulation studies the low polar angle region of the LDC concept.

A region where neither the TPC nor the silicon tracker dominate the measurement leads to a degraded momentum resolution. Mitaroff (Austrian Acad. Sci.)



A topological hit and track finder is being developed within the Marlin TPC framework. Killenberg (Bonn)





# Report from the SiLC Collaboration

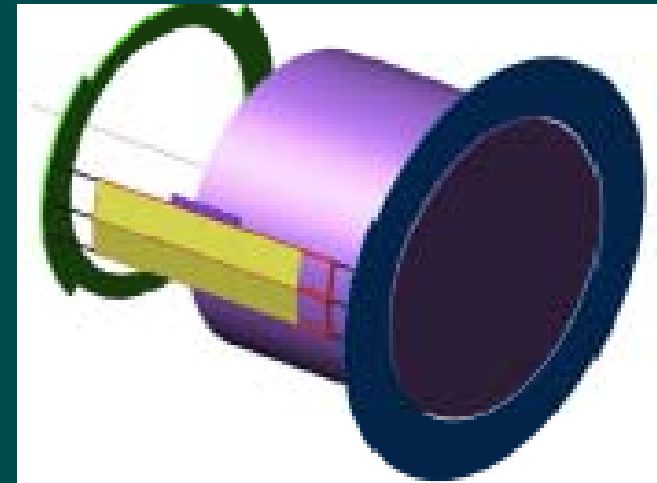
(generic R&D group for ILC Silicon)

Many activities geared towards large-area  $\mu$ -strip system

- Migration of front-end chip into 0.13  $\mu\text{m}$ ; testing underway
- In-situ alignment schemes, including semi-transparent detectors and frequency-scanned interferometry (a la ATLAS SCT; see next slide)

## SiLC Large Prototype

- Sensors: Developing 50  $\mu\text{m}$  pitch on 6" wafers; exploring thinning of sensors
- Mechanics: Structures and tooling for large prototype  $\rightarrow$  Several modules under beam test this week

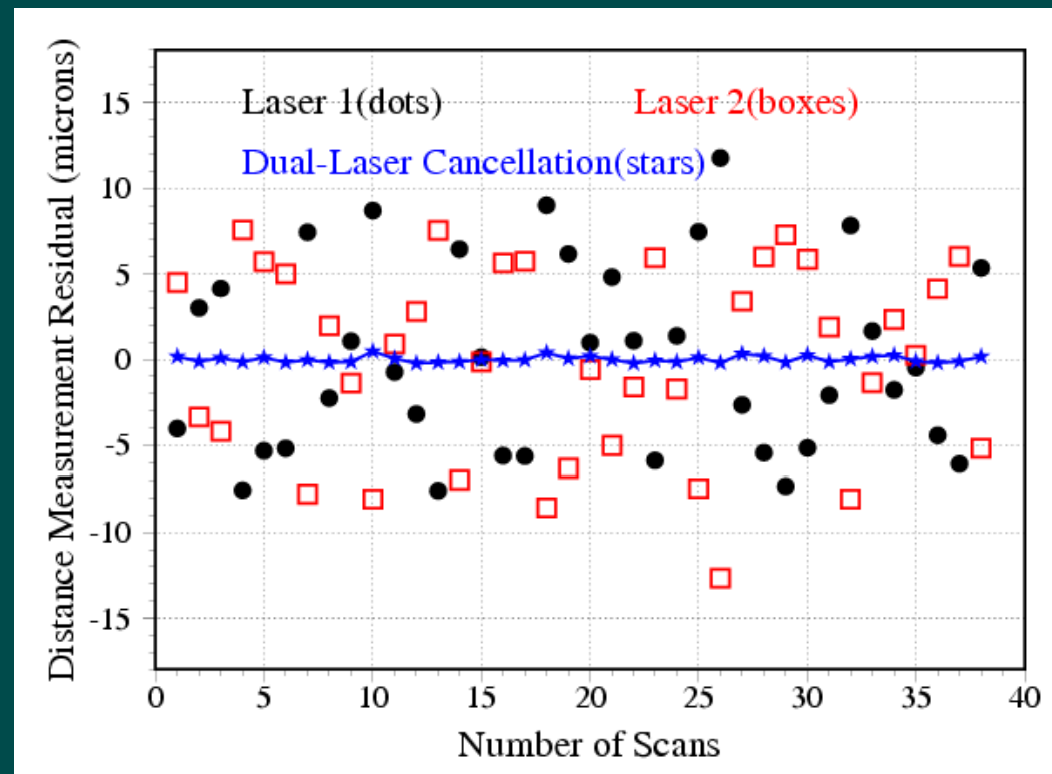
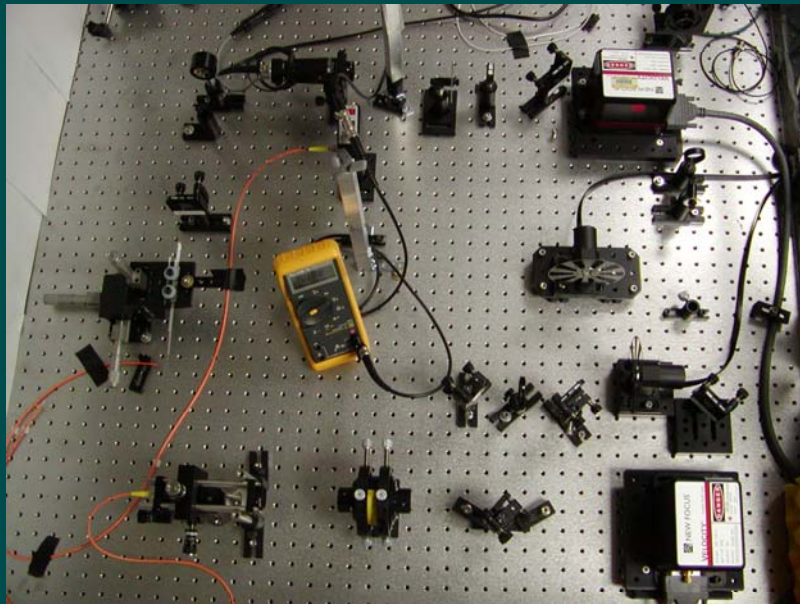


# Frequency-Scanned Interferometry

Yang, Nitz, Jung, Riles, U. of Michigan

Combining information from two independent scans at different frequencies reduces sensitivity to environmental conditions

Achieve sensitivity of 200 nm [Nucl. Inst. & Meth. A575, 395(2007)]



# Calorimetry + Simulation

## Conceptual Questions:

- Should jets be measured in the calorimeter alone, or should particle flow be used? See talks by Anna Mazzacane
- Assuming a PFA approach, how can a calorimeter technology be selected if we don't know what the optimum PFA is? See talk by Mathew Charles
- How will the calorimetry technology choice affect tau polarization, b-tagging, etc.

Slides from Repond and Stanitzki

# Round-up of other PFAs

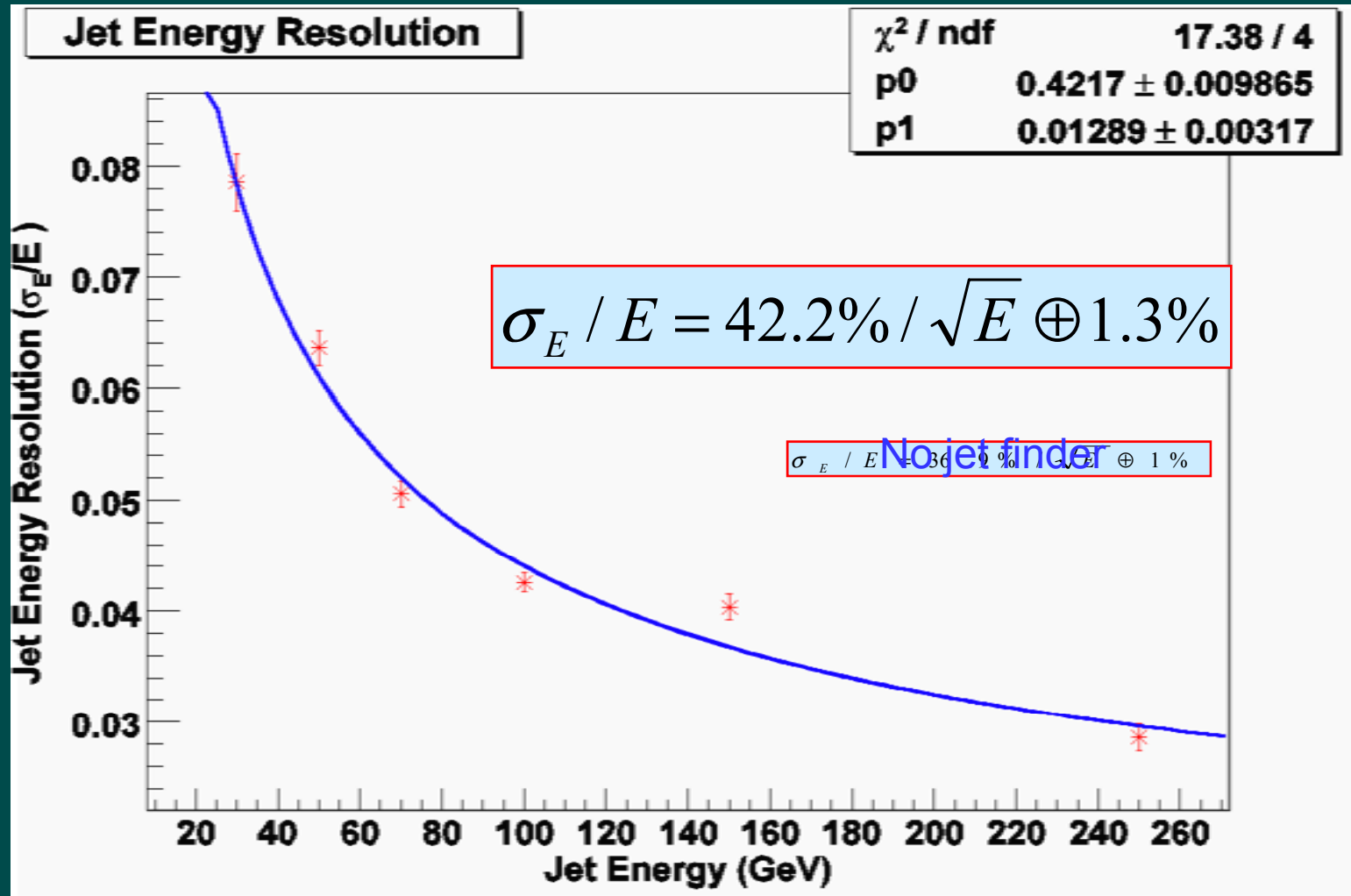
rms<sub>90</sub> of dijet  
mass residual  
[GeV]

Table idea stolen from Lei Xia (ANL)

rms<sub>90</sub> of energy sum [GeV]

PFA/Group	Detector	uds dijet 91 GeV	uds dijet 200 GeV	uds dijet 360 GeV	uds dijet 500 GeV	ZZ 500 GeV
PandoraPFA	LDC00	2.2	4.1	7.5	11.9	
Wolf	LDC00	5.1				
TrackBasedPFA	LDC00	3.9				
ANL(1)+SLAC	SiD	3.2/9.9 [dbl gaus]				
ANL(2)	sidaug05_np	3.3	9.1		27.6	
Iowa	sid01					5.6
NIU	sidaug05_tcmt	3.9/11.0 [dbl gaus]				
GLD	GLD	2.8	6.4	12.9	19.0	
Needed for dM/M = 3%		1.9	4.2	7.6	10.6	2.7
Needed for dM/M = 4%		2.6	5.7	10.2	14.1	3.6

# Jet Energy Resolution (Gaussian fit)



4th concept using ILC root Anna Mazzacane

# Summary Slides for the CALORIMETER Parallel Session

Wednesday, 24 October 2007	
08:00	[171] <b>SLAC KPIX test beam results</b> by Timothy NELSON (SLAC) (Hornets Nest (WH8X): 08:30 - 08:45)
09:00	[172] <b>Silicon-Tungsten ECAL R&amp;D progress</b> by Prof. Mani TRIPATHI (University of California, Davis) (Hornets Nest (WH8X): 08:45 - 09:05)
	[173] <b>CALICE Silicon-Tungsten ECAL - Performance in the test beam and results</b> by Dr. Roman POESCHL (LAL Orsay) (Hornets Nest (WH8X): 09:05 - 09:25)
	[174] <b>Analysis of scintillator ECAL data</b> by Dr. Satoru UOZUMI (Shinshu University) (Hornets Nest (WH8X): 09:25 - 09:45)
	[175] <b>MAPS - ECAL</b> by Marcel STANITZKI (Hornets Nest (WH8X): 09:45 - 10:00)
10:00	break (10:00 - 10:30)
11:00	[176] <b>Electronic readout system for the DHCAL</b> by Mr. Gary DRAKE (Argonne National Laboratory) (Hornets Nest (WH8X): 10:30 - 10:50)
	[177] <b>The DHCAL vertical slice test</b> by Dr. Jose REPOND (Argonne National Laboratory) (Hornets Nest (WH8X): 10:50 - 11:10)
	[178] <b>Data analysis of the DHCAL vertical slice test</b> by Dr. Lei XIA (Argonne National Laboratory) (Hornets Nest (WH8X): 11:10 - 11:30)
	[179] <b>GEM - DHCAL update</b> by Prof. Andy WHITE (University of Texas at Arlington) (Hornets Nest (WH8X): 11:30 - 11:45)
	[180] <b>Direct coupling studies</b> by Dr. Alexandre DYCHKANT (Northern Illinois University) (Hornets Nest (WH8X): 11:45 - 12:00)
Thursday, 25 October 2007	
08:00	[199] <b>Future scintillator HCAL studies</b> by Felix SEFKOW (DESY) (Racetrack (WH7X): 08:30 - 08:50)
09:00	[200] <b>Dual readout tests: BGO and neutrons</b> by Prof. John HAUPTMAN (Iowa State) (Racetrack (WH7X): 08:50 - 09:05)
	[201] <b>Calorimeter simulations in the context of the 4th concept</b> by Dr. Corrado GATTO (INFN) (Racetrack (WH7X): 09:05 - 09:20)
	[202] <b>Dual readout calorimeter for the ILC detector</b> by Dr. Niki SAOULIDOU (Fermilab) (Racetrack (WH7X): 09:20 - 09:40)
10:00	[203] <b>Studies of the response and readout strategies for the GM-APDs</b> by Dr. Adam PARA (Fermilab) (Racetrack (WH7X): 09:40 - 10:00)
	break (10:00 - 10:30)
11:00	[222] <b>An experimental program demonstrating precision jet energy measurement at the ILC</b> by Dr. Rajendran RAJA (Fermilab) (Racetrack (WH7X): 10:30 - 11:00)
	[204] <b>MIPP discussion</b> by Dr. Rajendran RAJA (Fermilab) (Racetrack (WH7X): 11:00 - 11:15)

## Talks

5 ECAL

6 HCAL

3 Dual readout

HCAL

Neutral hadron beam

## Electromagnetic Calorimeters

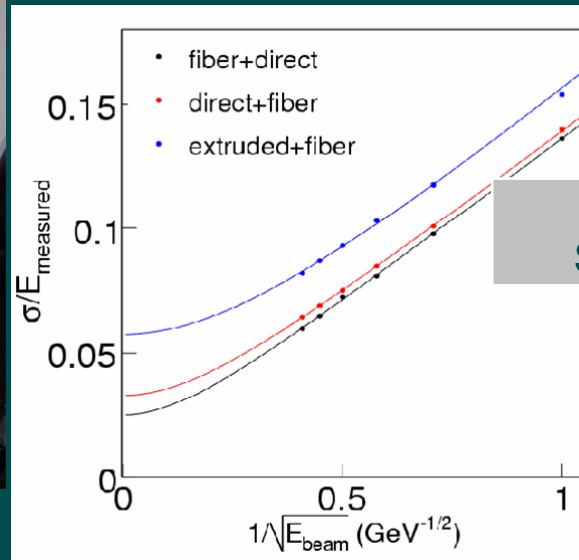
Active element	Pad/pixel size	Collaboration	Technology demonstration	Testbeam of ministack	Construction of prototype	Test beam with prototype	R&D beyond prototype
<b>Scintillator</b>	1 x 4 cm <sup>2</sup>	CALICE (Japan)	Completed	DESY 2007	Initiated	FNAL 2008	
<b>Silicon</b>	0.13 cm <sup>2</sup>	BNL Davis Oregon SLAC	Ongoing		2008	SLAC/FNAL 2008	KPiX
<b>Silicon</b>	1.0 → 0.25 cm <sup>2</sup>	CALICE (CZ, F, Korea, RU, UK)	Completed	DESY 2005/6	Completed	CERN 2007/ FNAL 2008	Initiated
<b>MAPS</b>	50 x 50 μm <sup>2</sup>	CALICE (UK)	Ongoing				

All projects use Tungsten plates (of various thickness) as absorber



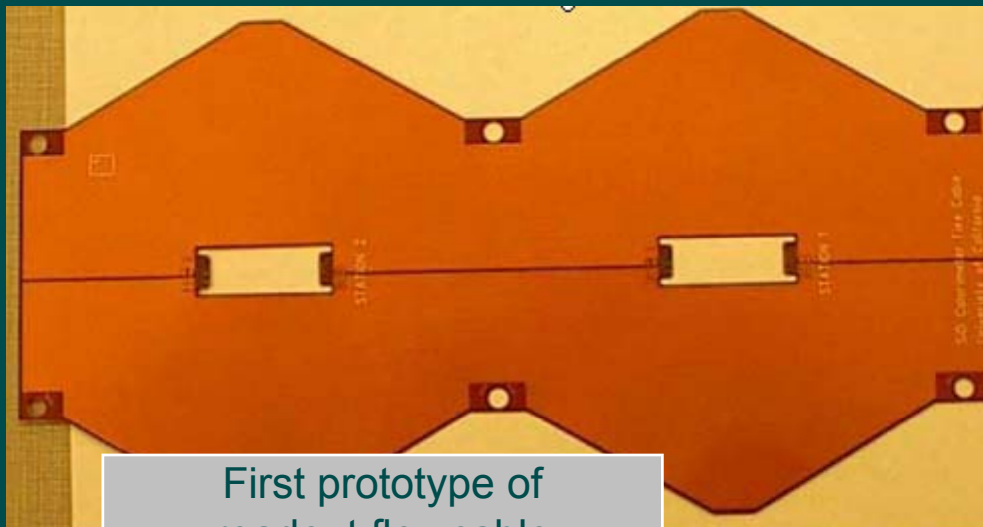


## Scintillator ECAL



Preliminary  
Statistical errors only

## US - Silicon ECAL



First prototype of  
readout flex cable



### Gold Stud Bump Bonding



**Palomar Technologies**  
Vista, Ca.

- Machine Development
- Process Optimization
- Prototyping

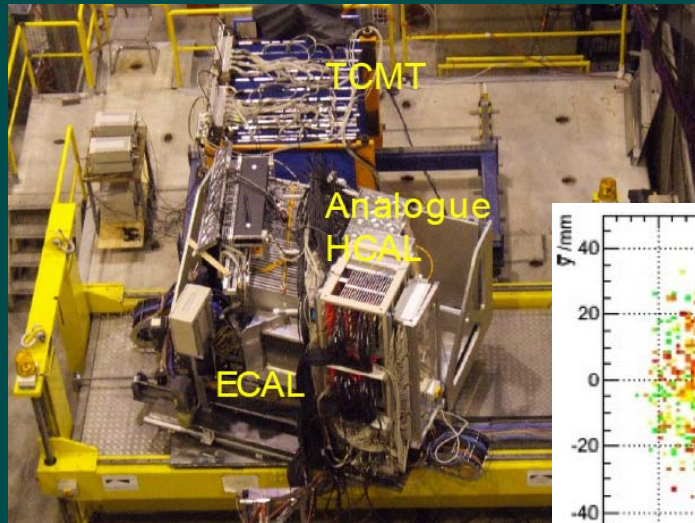




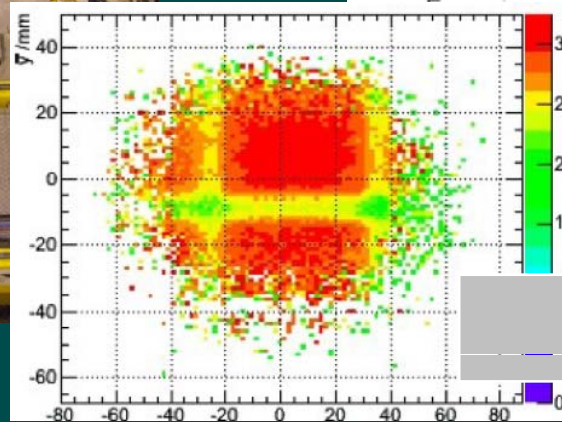
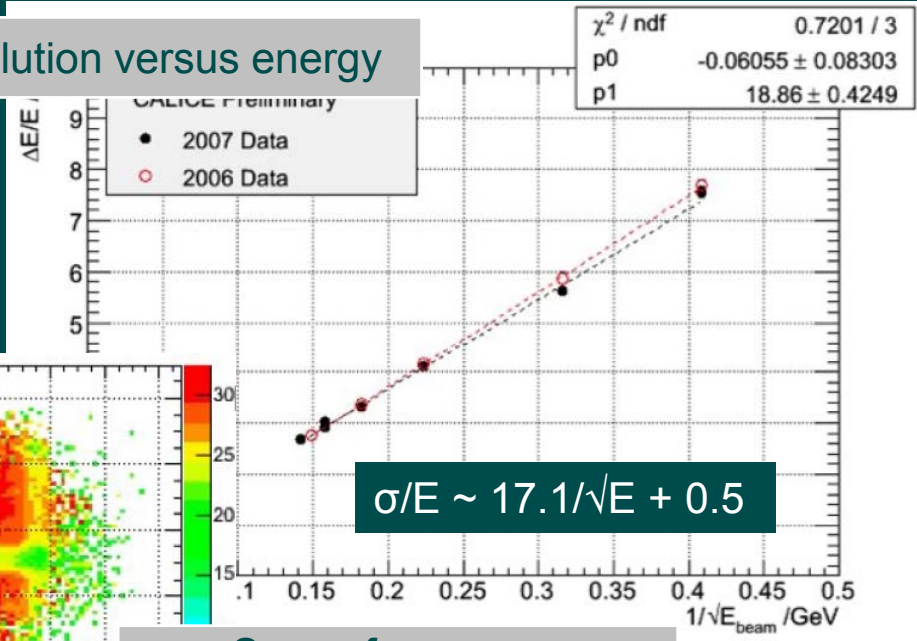

**Palomar**



# CALICE - Silicon ECAL

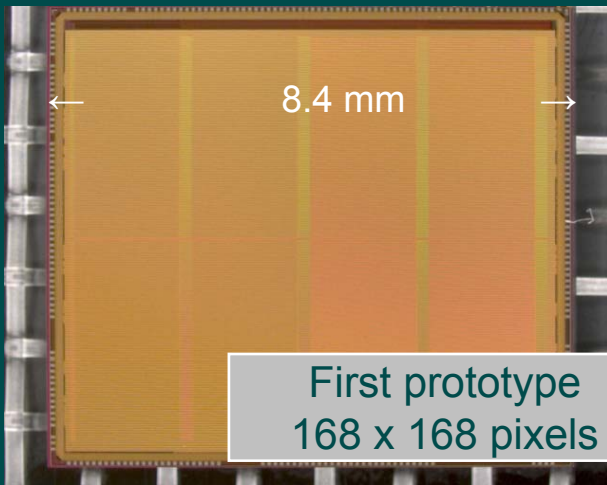


## Resolution versus energy

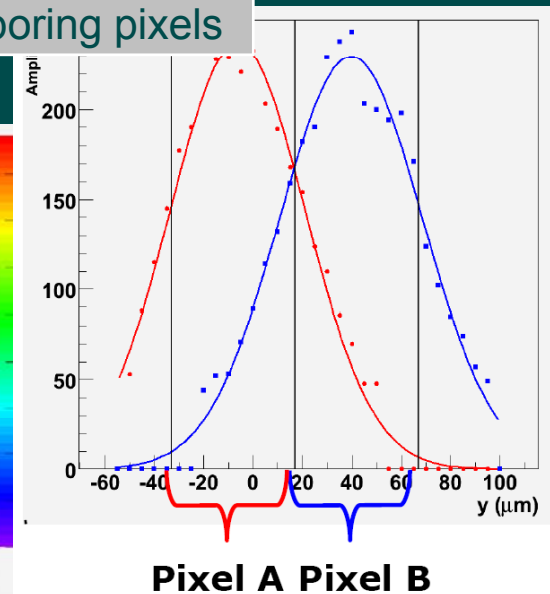
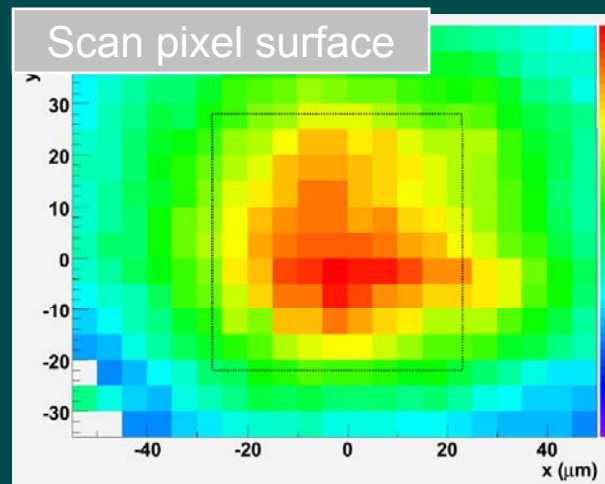


Scan of response between wafer

# MAPS ECAL



## Scan of neighboring pixels

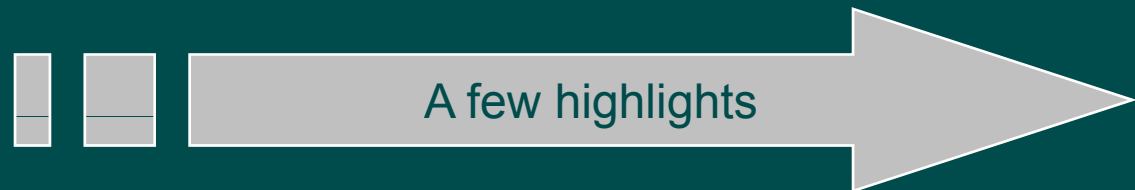


Pixel A Pixel B

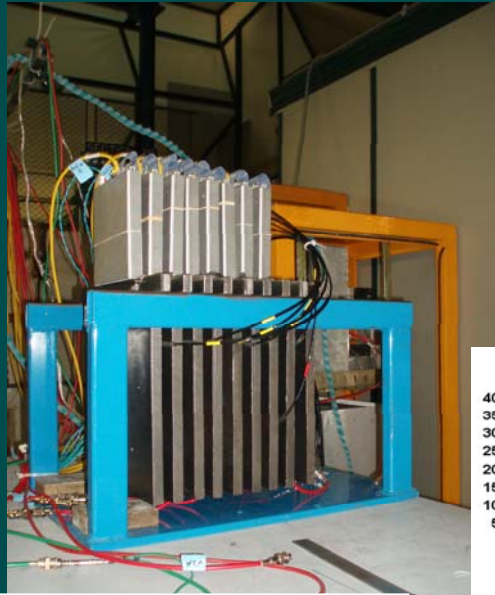
## Hadronic Calorimeters

Active element	Pad/ pixel size	Collaboration	Technology demonstration	Testbeam of ministack	Construction of prototype	Test beam with prototype	R&D beyond prototype
<b>Scintillator</b>	3 x 3 cm <sup>2</sup>	CALICE (CZ, F, G, Ru, UK, USA)	Completed	DESY 2005	Completed	CERN 2006 - 2007/ FNAL 2008	Initiated
<b>RPCs</b>	1 x 1 cm <sup>2</sup>	CALICE (F, RU, USA)	Completed	FNAL 2007	Initiated	FNAL 2008	
<b>GEMs</b>	1 x 1 cm <sup>2</sup>	CALICE (Korea, USA)	Ongoing	FNAL 2008			
<b>μmegas</b>	1 x 1 cm <sup>2</sup>	CALICE (F)	Initiated				

All projects use Steel (+ copper) plates as absorber

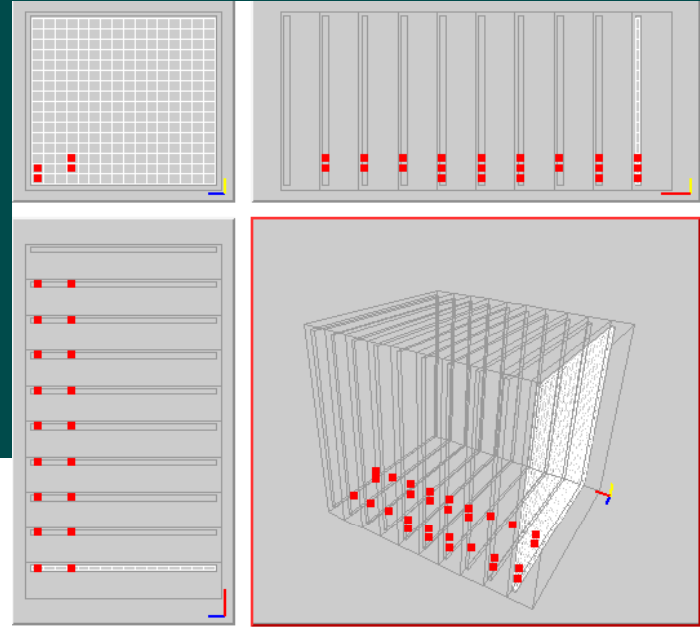


# RPC HCAL

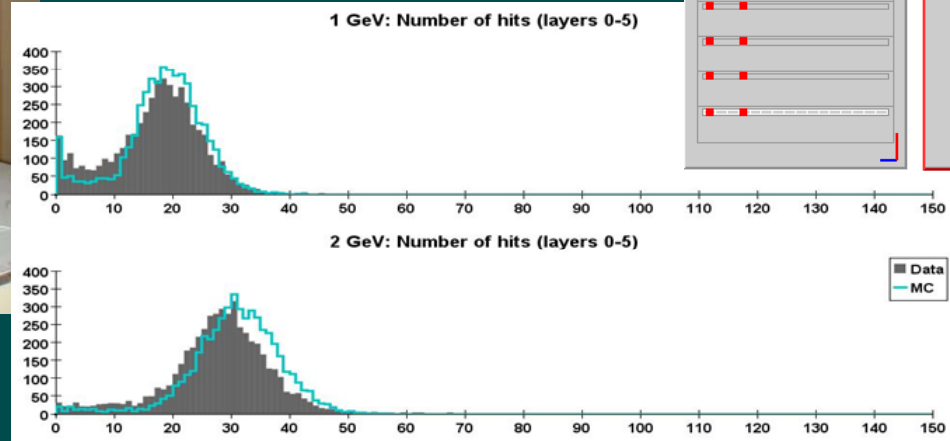


Vertical Slice Test at FNAL

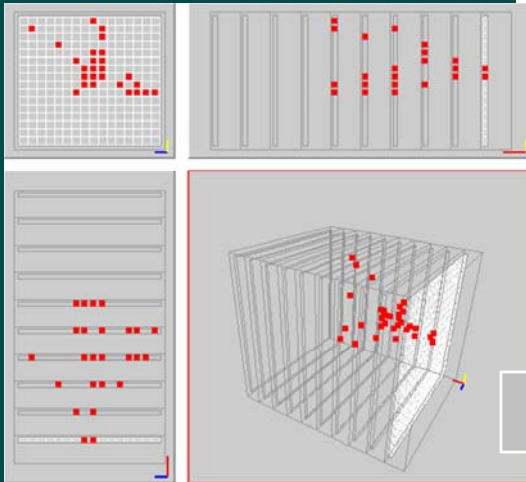
Double muon event



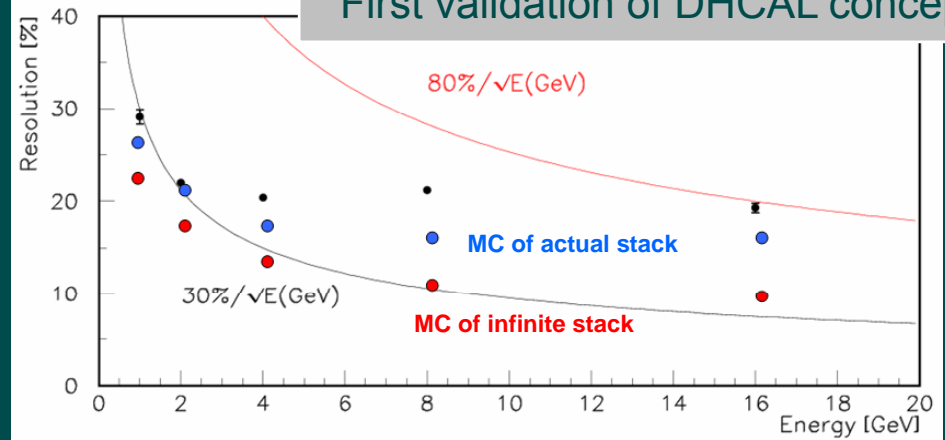
Positron reponse



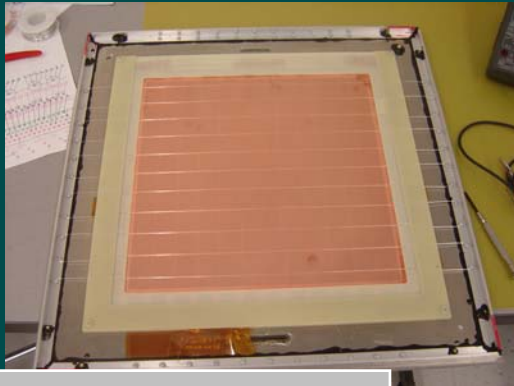
8 GeV pion



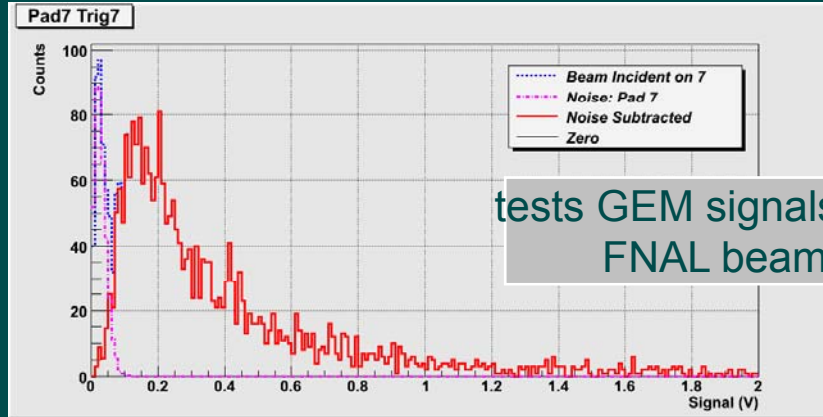
First validation of DHCAL concept



# GEM HCAL



New GEM chamber

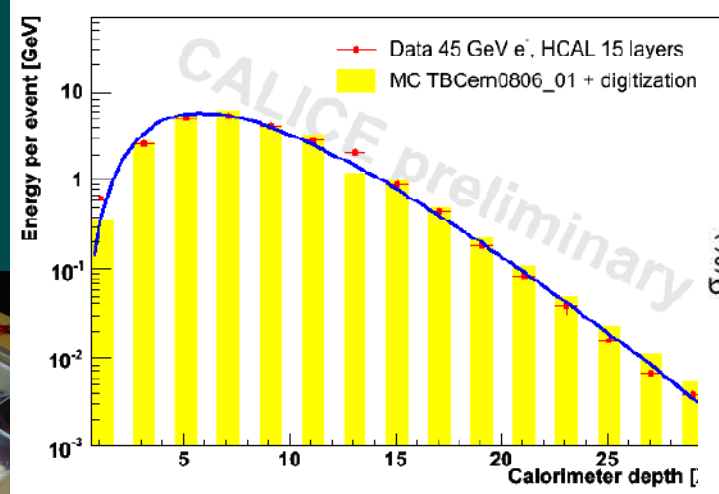


tests GEM signals from FNAL beam

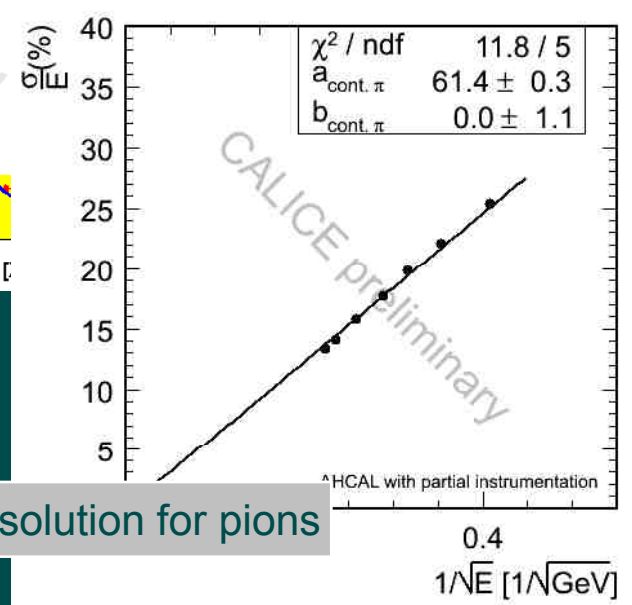
# Scintillator HCAL



One of 40 layers of the prototype section



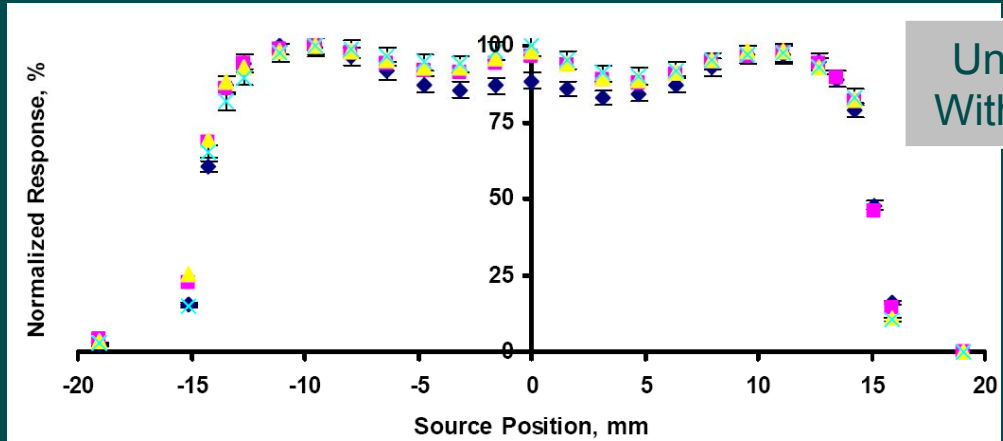
EM shower shape compared to MC



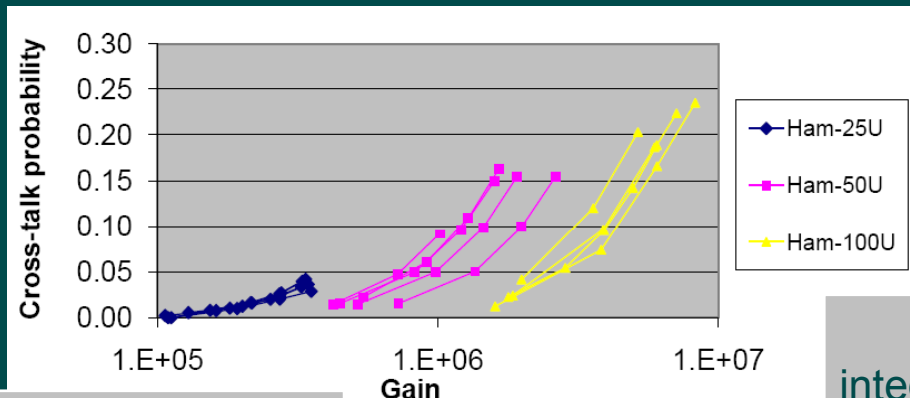
Energy resolution for pions



New scintillator design for direct SiPM coupling



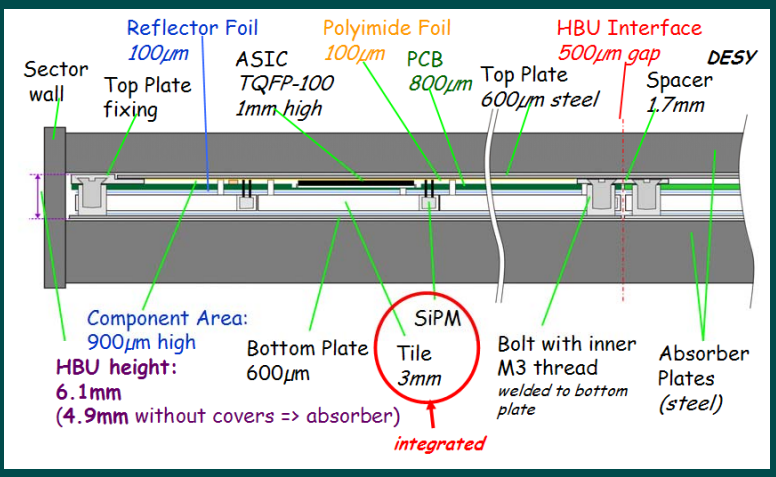
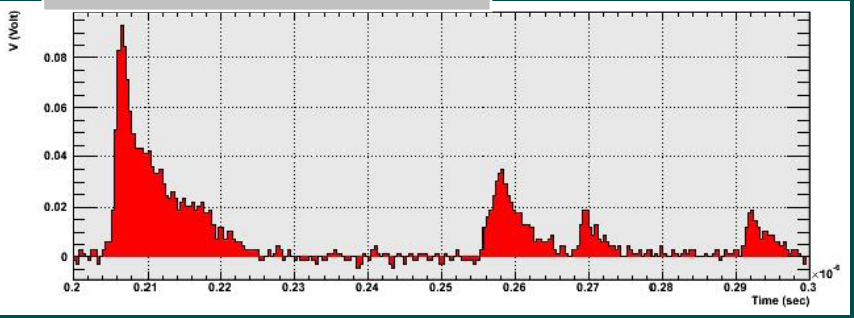
Uniform response With direct coupling



SiPM: studies of cross talk

First design of integrated HCAL layer

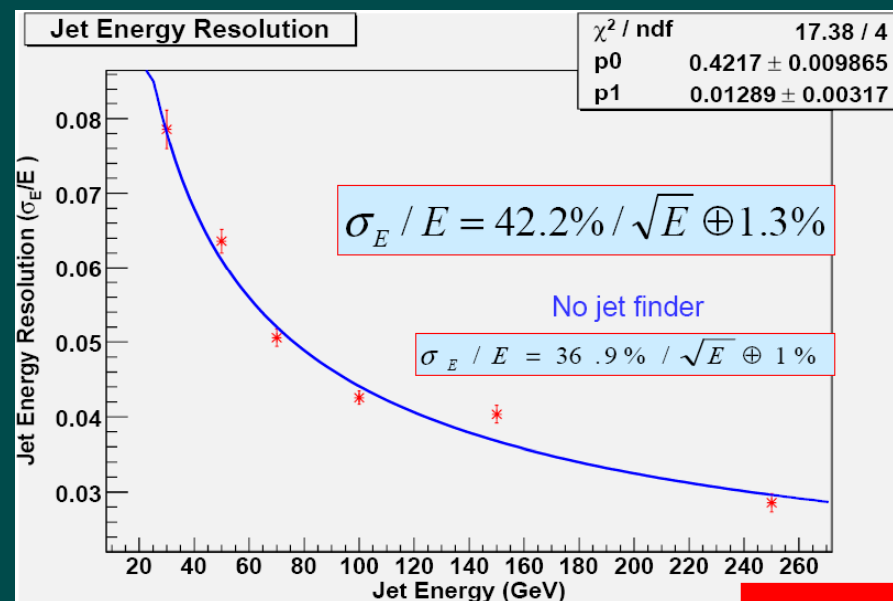
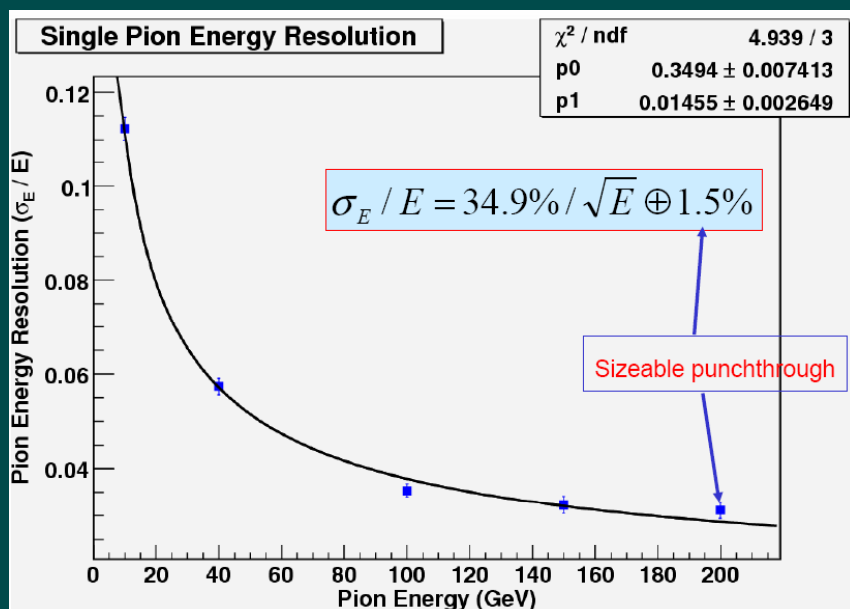
SiPM: studies of afterpulsing



# Dual-readout Calorimeters

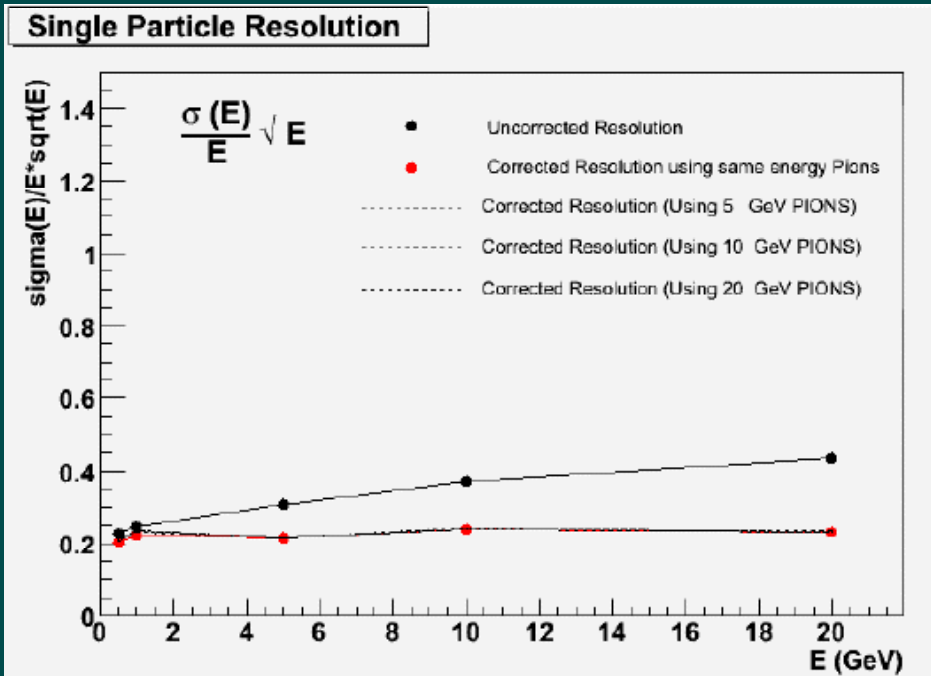
Active elements	Collaboration	Simulations	Proof of principle	Mini-calorimeter	Construction of prototype	Test beam with prototype
Fibers (quarz, scintillating) BGO, PbF <sub>2</sub>	DREAM	Ongoing	On some technologies	Of quarz technology		
Pb-glass (?)	FNAL	Ongoing				

## MC studies of fiber module



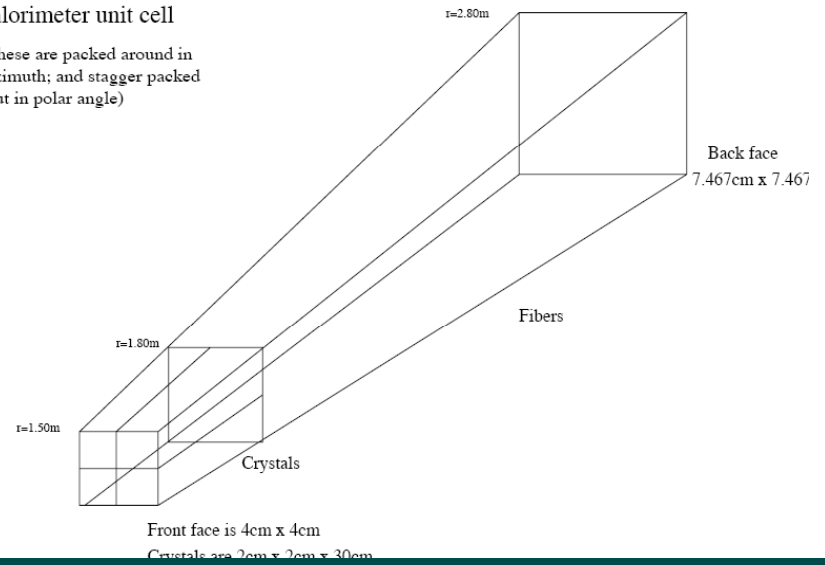
## MC studies of fiber module

# MC studies of Pb-glass block

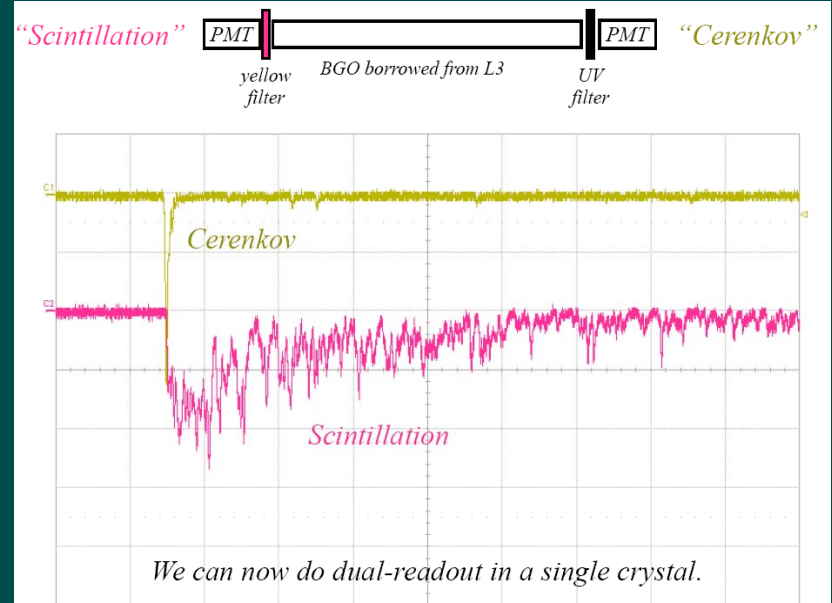


## Calorimeter unit cell

(these are packed around in azimuth; and stagger packed out in polar angle)



## Separate measurement of scintillation and Cerenkov light



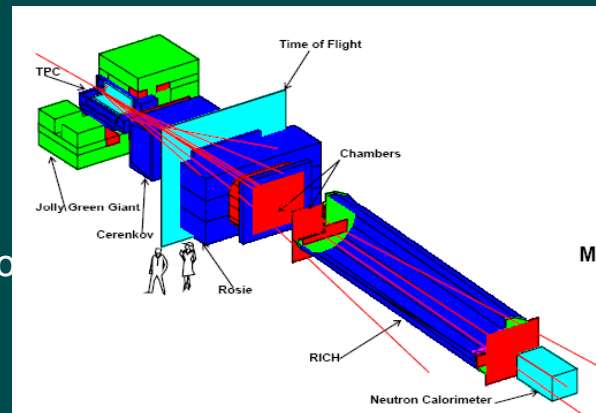
## BGO module with dual readout



## GEANT4 improvements and neutral hadron beams

MIPP upgrade experiment at FNAL (P960) can provide

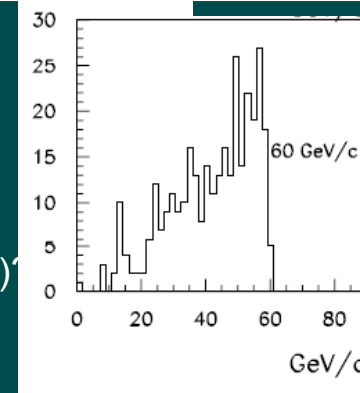
- a) nuclear cross sections on thin targets (as input for GEANT4...)
- b) tagged neutral hadron (neutron,  $K_L^0$ ) beams with 2% momentum resolution  
↳ important for PFAs



### Questions/Issues related to b)

- Do proton and neutron showers differ in current hadron shower models?
- What is the effect of 'inadequate' modeling on physics performance?
- What is the overall rate of particles on the calorimeter?
- What is the ratio of tagged neutral to all particles on the calorimeter?
- Is a trigger available for the readout of the calorimeter (latency)?
- Are the (CALICE) DAQs and the MIPP DAQs compatible (event reconstruction)?
- Are there space restrictions for the calorimeter?
- What is the amount of upstream material in the beam line?
- ...?

Tagged n spectrum from 60 GeV p



Need to identify task force to address these questions

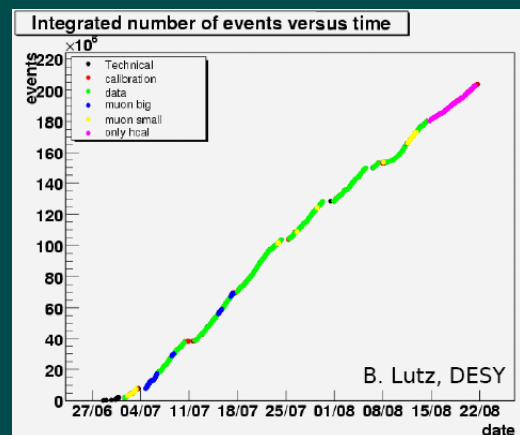


## Summary of Calorimetry

### Great progress with physics prototypes

- Large data sets

CALICE Silicon-Tungsten ECAL  
CALICE Scintillator-Steel HCAL  
CALICE Scintillator TCMT



(CERN test beam)

- Proof of concept

CALICE RPC-Steel HCAL  
CALICE Scintillator-Tungsten ECAL

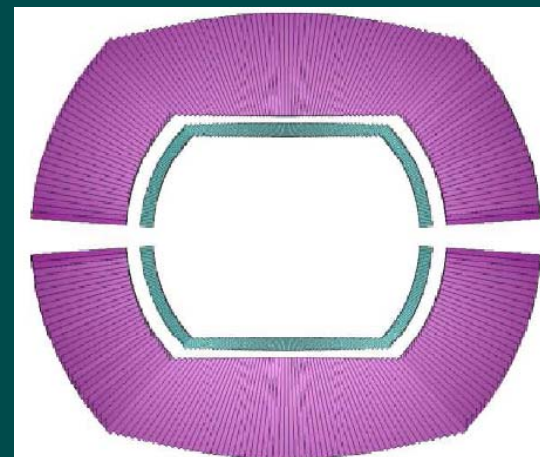
(FNAL test beam)  
(DESY test beam)

### Progress towards technical prototypes

CALICE Silicon-Tungsten ECAL  
US Silicon-Tungsten ECAL  
CALICE Scintillator-Steel HCAI  
SiPM/MPPC studies

### Progress with dual readout concepts

Simulation and hardware studies



# Simulation Session

- New Charge
  - *This time we'd like to see users giving talks about the experience with the simulation and reconstruction software chain. The goal is more to show how things were done in order to get a result and what are the problems encountered on the way instead of focussing on the results*
- *Talks from the software frameworks*
- *Talks from users*

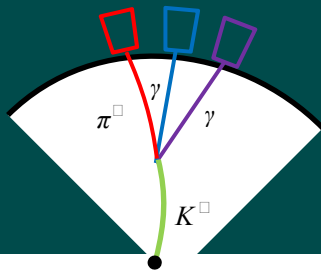
# Framework status

- SLIC/org.lcsim
  - SLIC production ready
  - org.lcsim gearing towards a release
  - tracking/PFA still
- Mokka/Marlin
  - almost production ready and tested by testbeam program
- Jupiter
  - Implements LCIO output
- ILD framework
  - will use both LDC and GLD frameworks for the LOI

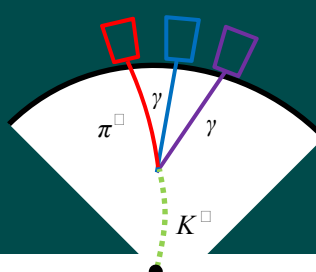
# Some PFA studies

- Perfect PFA studies using GLD framework
  - Impact of Resolutions
  - V0 finding
- Comparisons between GLD PFA and Pandora

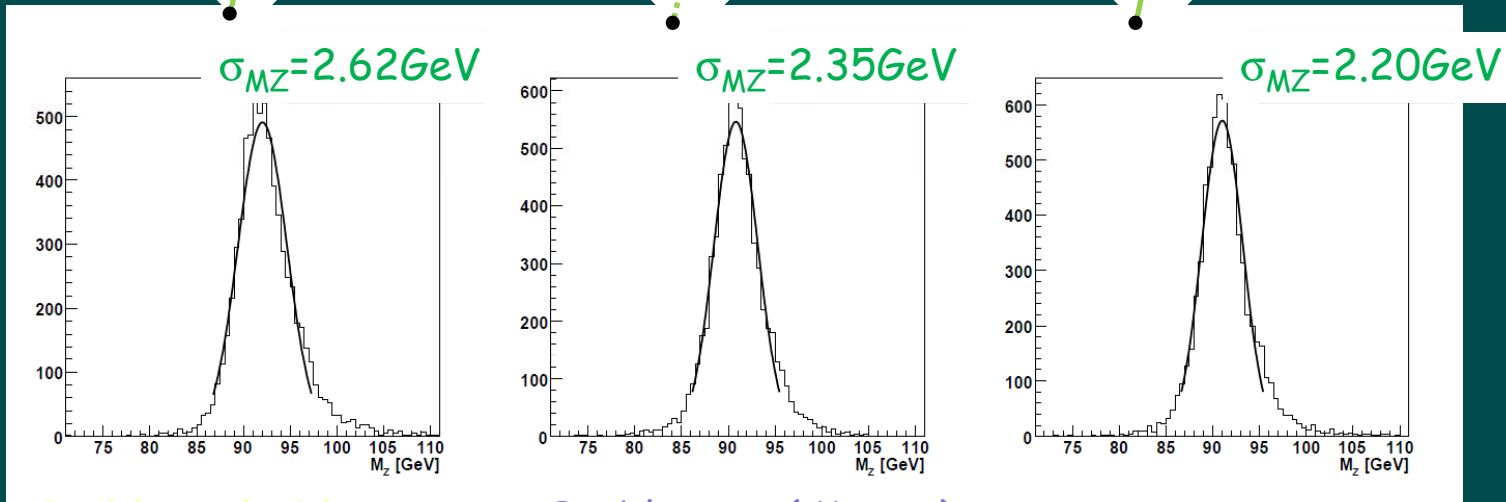
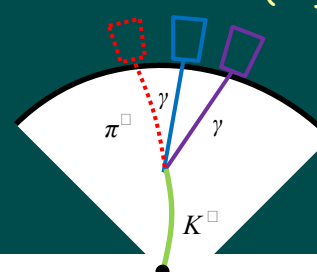
No Kink Treatment



Kink Daughter



Kink Mother  
(neglect charged PFOs)



Problem: double count

Problem:  $\nu$  ( $K \rightarrow \mu \nu$ )

*Kink mother scheme works better for Z0 events*

VO treatment: no significant effect on Z0 mass resolution

# User reports

- Users reported on their experiences
  - Tracking, Vertexing, Segmentation, Calorimetry
- LCIO wishlist
  - current objects need some extensions
  - questions on new objects ?
  - Will make webpage to collect ideas
- ROOT
  - Some people like to have an LCIO interface to ROOT
- General feeling of a lot of progress
- Overall very useful for everyone, lot of idea exchanged

# Muons/PID/Test

## Conceptual Questions:

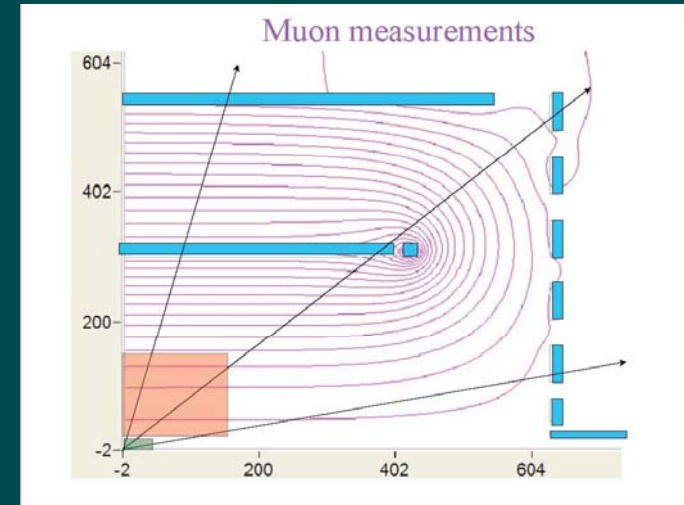
- Is a tail catcher needed?
- Fe v. air (CMS v. ATLAS?)
- Do we need a neutral hadron test beam?

Slides from Karchin and Fisk

# Highlights of Muon/PID Talks

## Iron vs. No-iron Muon Detection John Hauptman

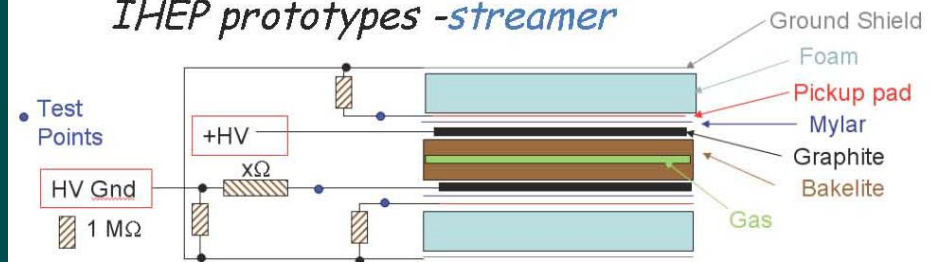
- 4<sup>th</sup> concept – magnetic field with dual solenoid and wall of coils
- muon ID using calorimeter as absorber
- 2<sup>nd</sup> muon mtm measurement in return field with little multiple Coulomb scattering
- instrumented concrete radiation shield



## Muon (RPC) Detector Studies for SiD Henry Band

- RPC performance in BaBar – increased currents may be due to humidity
- fluorine production can cause damage to bakelite surface
- test stand results with IHEP RPC & KPIX readout – need reduced KPIX integration time or different signal coupling

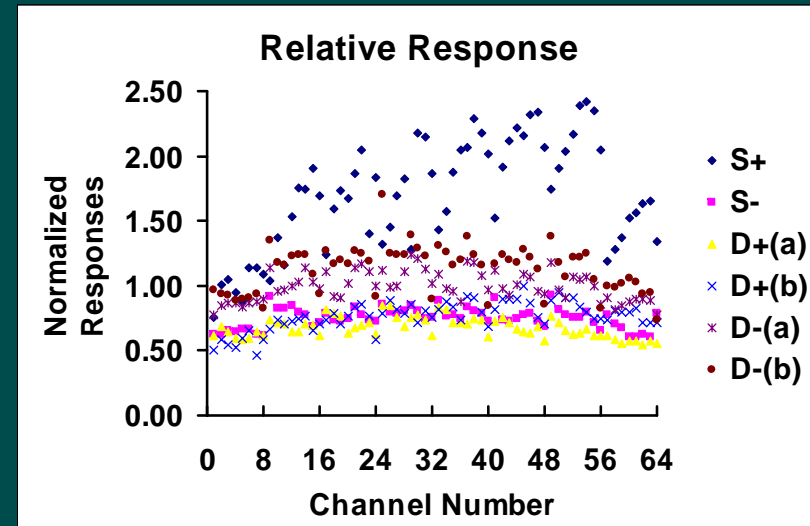
- *Initial tests of small 15 \*15 cm IHEP prototypes -streamer*





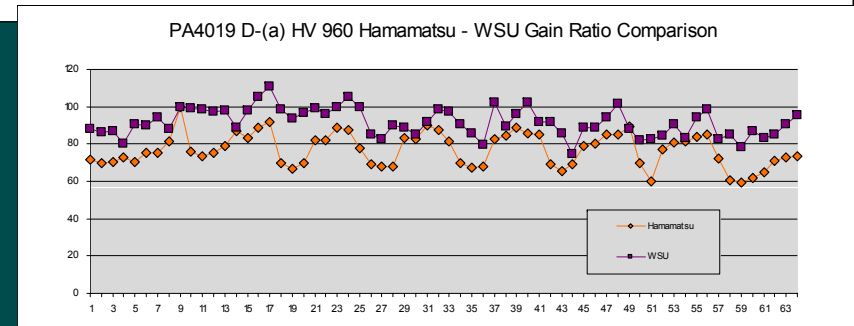
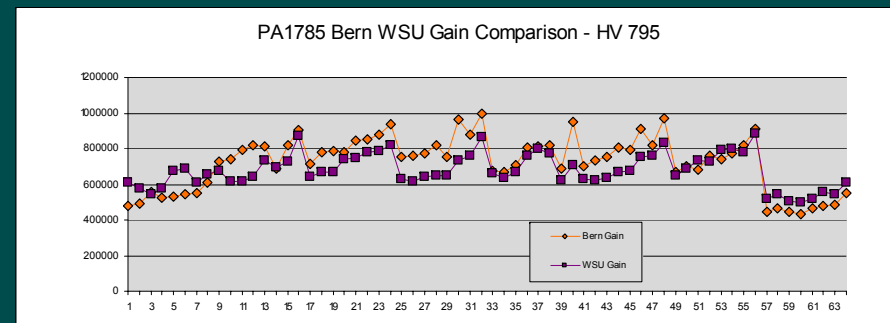
## Radioactive Source Calibration of Multi-Anode Phototubes (MAPMT) Alexandre Dyshkant

- goal: measure relative gain of each of 64 channels of tubes used in Fermilab beam tests of scintillator strip based muon detector
- Sr-90 source with EJ-200 scintillator
- Y-11 wavelength shifting optical fiber, 1.2 mm diameter, 1 m length
- picoammeter measures channel response



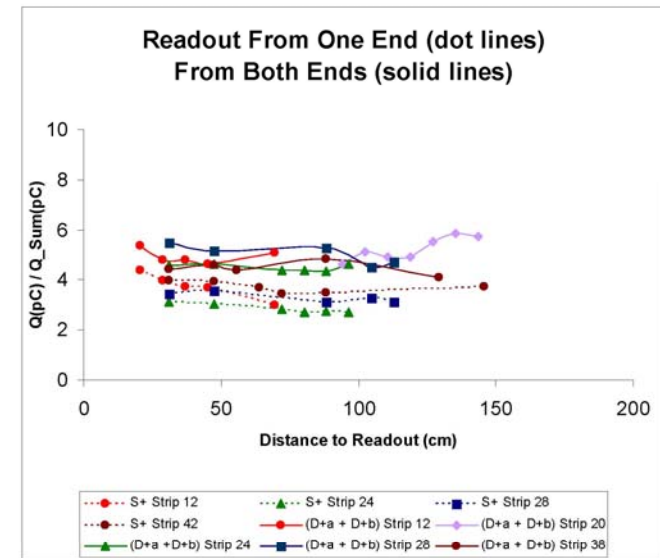
## Pulsed LED Calibration of MAPMTs Paul Karchin

- alternative measurement of MAPMT gain for tubes used in Fermilab beam test
- response measured with gated (100 ns) ADC
- good agreement with measurement of same tube at Univ. Bern using similar technique
- good agreement with Hamamatsu and A. Dyshkant measurements using DC current



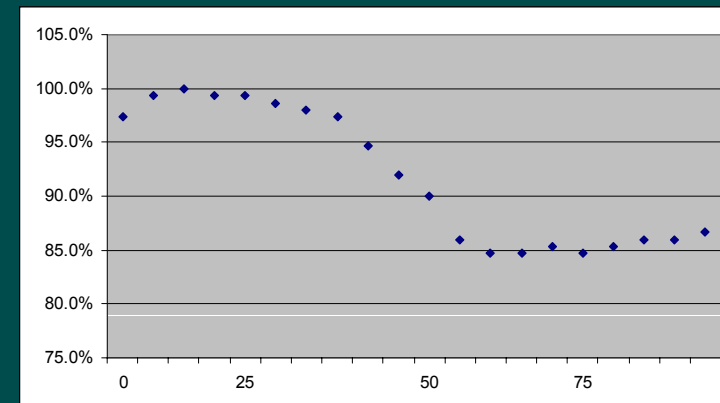
## LC Scintillator-based Muon/Tail-catcher R&D: Analysis of 9/06 MTest Data Using Measured MAPMT Channel Response – Gene Fisk

- scintillator-strip planes installed in Fermilab beam
- planes: 1.25m X 2.5m; 256 scintillator strips 4.1cm (W) X 1cm (T) X 1.8m (L).
- two planes have single-ended readout and 2 planes have both ends of strips readout.
- 384 MAPMT channels
- measure  $N_{pe} \sim 9$
- double readout  $\sim 50\%$  more signal than single
- plans: construct & test planes with SiPM readout



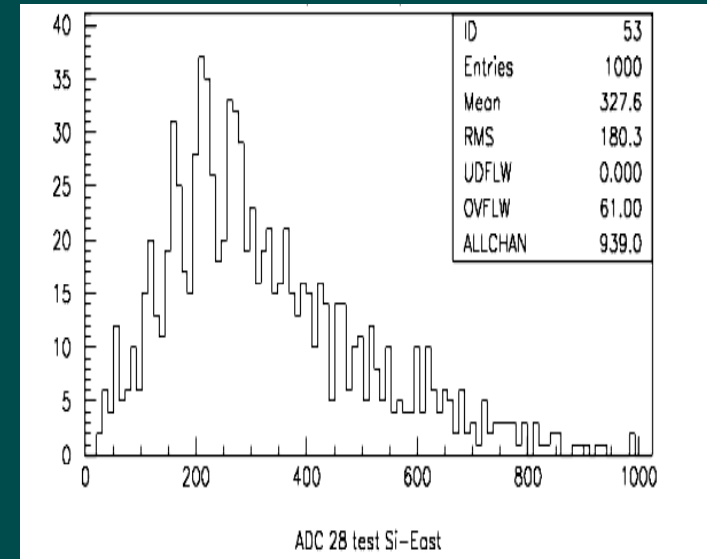
## CALICE Tail-Catcher Muon-Tracker (TCMT) Preliminary Test Beam Results – Kurt Francis

- 16 layers of steel absorber with scintillator planes
- scint. strips 5 mm thick, 5 cm wide, 1 m long
- readout with WLS fiber; SiPM photo detection
- analysis here of 2006 test beam data from CERN
- average light yield  $\sim 10$  photo-electrons
- response decreases with distance from SiPM
- plans: analyze summer 2007 data; move TCMT to Fermilab test beam

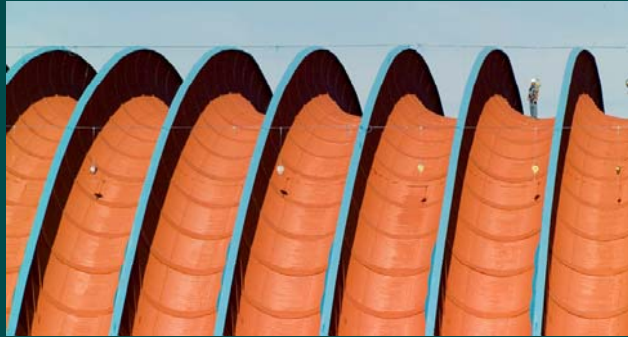


## Tests of IRST SiPMs - Giovanni Pauletta

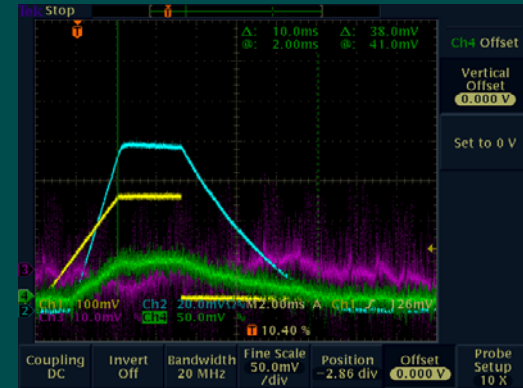
- C. Piemonte “A new Silicon Photomultiplier structure for blue light detection” NIM-A 568 (2006)
- distinguishing characteristics: very shallow junction; optimized for short wavelenghts ( $\sim 400\text{nm}$ ); polysilicon quenching resistors
- readout of scintillator bar at Fermilab test beam
- $N_{pe} \sim 6.5$ ; noise rate  $\sim 1.5\text{ MHz}$ , gain  $\sim 1.6 \times 10^6$
- plans: instrument multi-strip plane for beam test at Fermilab



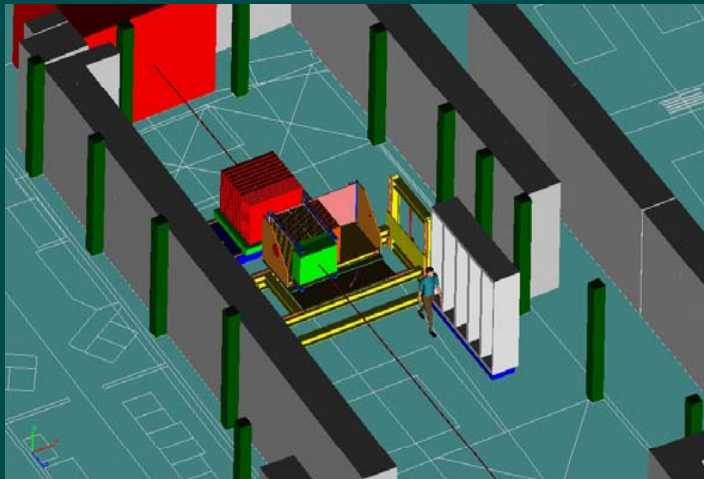
# Fermilab's Meson Test Beam Facility



- **Accelerator Division created a new beamline for MTest:**
  - 13 magnets moved, 11 new elements, new target
- **Significant upgrade to user facility:**
  - New roof, new floor, diff. Cerenkov, pixel telescope
- **AD now investigating how to simulate ILC beam structure**



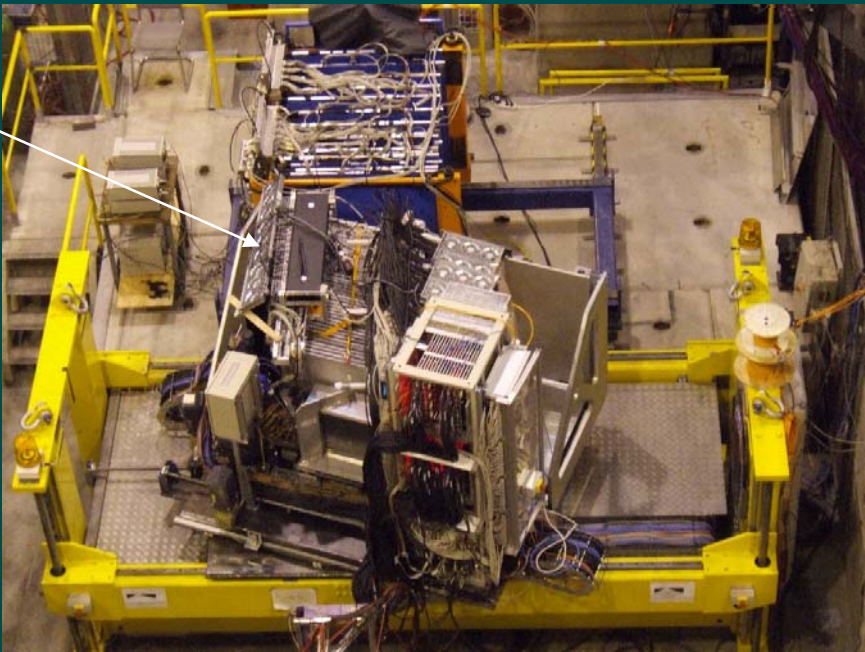
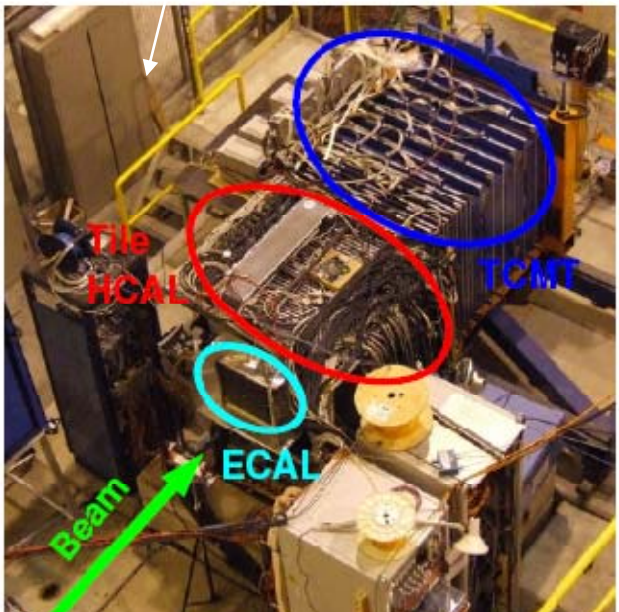
**Pulsing the QXR supply with ~3 msec / 45 Volts**



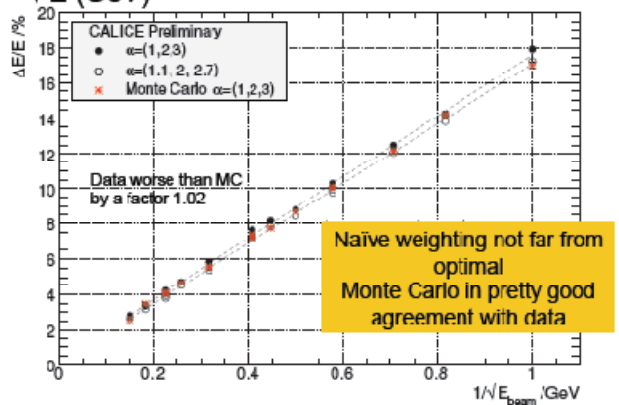
Beam Energy (GeV)	Rate per spill for 1E11 in MI	%Pions, Muons**	% Electrons**
16	95,000	82%	18%
8	65,000	42%	58%
4	51,000	26%	72%
2	38,000	34%	65%
1	23,000	<50%	>50%

CALICE's studies at Fermilab will benefit from the increased low energy flux

# 2006/2007 CALICE tb results



$$\frac{\Delta E}{E} (\%) = \frac{17.7 \pm 0.07}{\sqrt{E \text{ (GeV)}}} \oplus (1.1 \pm 0.08) \quad (\alpha_1, \alpha_2, \alpha_3) = (1, 2, 3)$$



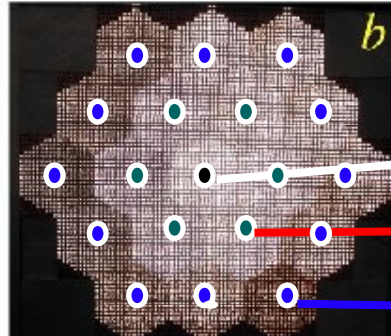
$$\frac{\Delta E}{E} (\%) = \frac{17.1 \pm 0.07}{\sqrt{E \text{ (GeV)}}} \oplus (0.5 \pm 0.15) \quad (\alpha_1, \alpha_2, \alpha_3) = (1.1, 2, 2.7)$$

- **06/07 test beams extremely successful !**
  - More than **250M data events** collected
- **Excellent performance** of all calorimeter prototypes
  - Very encouraging preliminary results on resolution, linearity and shower development
- First results from ECAL analysis of 06 data will be published by the end of the year
  - AHCAL results will follow shortly
- **Analysis of 07 data well under way**
  - Preliminary results in agreement with 06
- **Next step: test beam at FNAL in 2008**

J. Hauptman

## DREAM Concept

Measure neutrons in DREAM by summing time-history of rings of channels. Panels are raw data dual-readout of a 50 GeV e and a 300 GeV  $\pi$ .



DAQ was 1 GHz 4-chan digital storage scope

transfer to counting house in fast air-core cables

*Scintillating fibers*

“Fast 1”

“Fast 2”

“Fast 3”

10+6+90 “Fast 4”

*Cerenkov fibers*

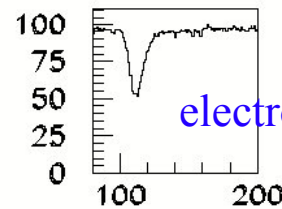
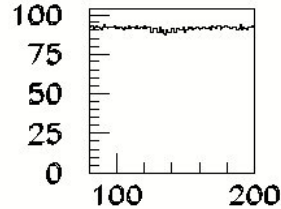
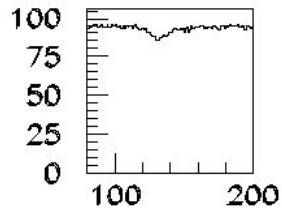
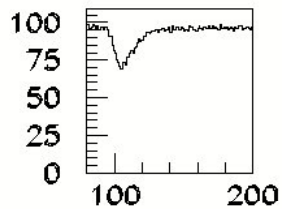
Fast 1

Fast-2

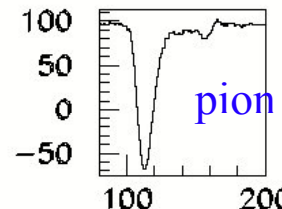
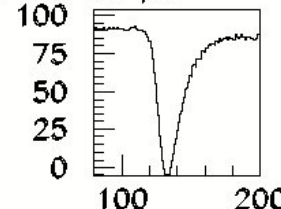
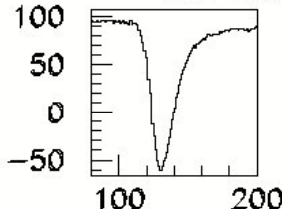
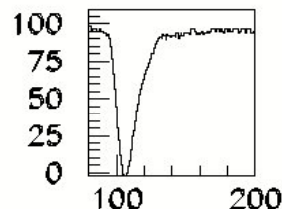
Fast-3

Fast-4

Run 1919 50 GeV e-



Run 1926 300 GeV pi+



pi+ S0(t)

pi+ S1(t)

pi+ S2(t)

pi+ Ch(t)

## Vertex – M. Battaglia

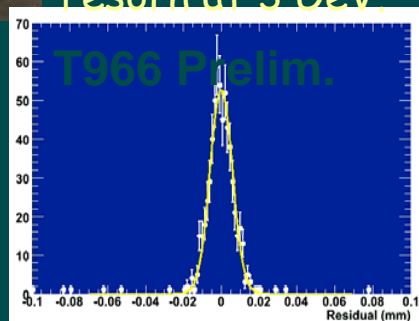
Facilities for vertex detector tests:

### 1. EUDET DESY Pixel Telescope



(EU Consortium, IPHC sensors) 6 planes thin CMOS analog pixel telescope, expect  $\sim 1\mu\text{m}$  resol'n at 3 GeV

2. T966 (LBNL) Pixel Telescope @ MTest. Thinned Si  $50\mu$ , 4 stations



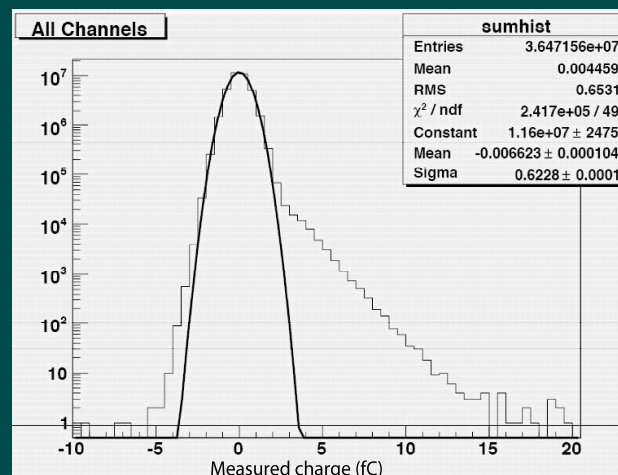
3. Hybrid Pixel Telescope at MTest FPix (BTeV) 4-6 high time resol'n,  $\sim 10\mu$  measuring stations.

### 4. LBNL LOASIS

$e^-$  beams with  $10\text{ MeV} < E < 1\text{ GeV}$ ; Can expose VTX detector elements to  $e$ 's &  $\gamma$ 's. Request for test area submitted.

## Si/W E-Cal - R. Frey

➤ '07 KPiX BeamTests: ESA/ SLAC



➤ Measure 30 layer ECal module in a clean electron beam – at SLAC - 2008

➤ Tests with an H-Cal module at FNAL late '08-? *calibrate the hadron shower simulations; measure response.*

➤ Pre-assembly tests of actual ECal . test module in beam –  $\rightarrow$ 2010-?

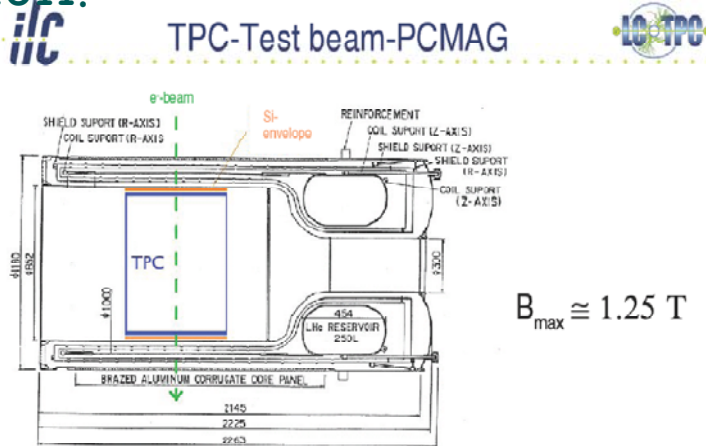
## Tracking TB R&D – R. Settles

**CluCou:** Tests w/cosmics. No TBplans.

**SiD tracking:** Prototypes at SLAC;  
Plans evolving. May want  $B = 5T$  in future.

**SiLC tracking:** Standalone prototype test at CERN. Combine w/TPC at EUDET.

**TPC:** Continue small prototype tests. Commission LP in PCMAG (Eudet) at DESY 07-09. Same apparatus at FNAL w/ILC RF X-ing structure '09-10. **Need 3-4T B-field.** Final LCTPC tests at FNAL 2011.



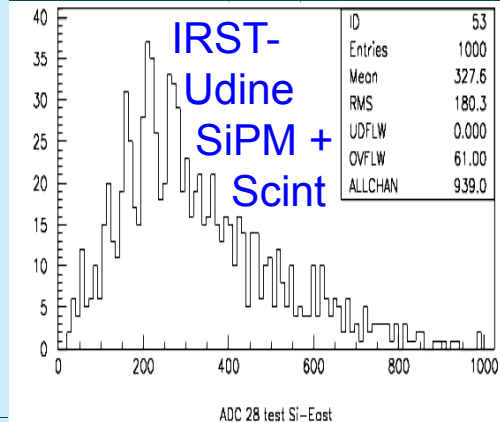
L. Hallermann, DESY

EUDET Annual Meeting 2007,  
Status report TPC tasks

K. Dehmett

## Muons – TB Plans: Strip Scintillator & RPC's - H. Band

SiPM read-out of muon scintillator planes. Data with 120 GeV protons.



Possibility of ILC-like time structure @Fermilab - E. Ramburg very useful for a realistic measurement of RPC deadtimes: '09 test of IHEP Beijing RPCs/ SiD.



# Forward Detector / MDI

Conceptual Questions:

- Can a hermetic detector be build?
- Should forward detectors be sensitive to MIPs?

Slides: Bill Morse, Mike Woods

# Forward Calorimeters

- LumiCal – precision integrated luminosity measurement (Bhabhas), and hermeticity
- $dL/L < 10^{-3}$  for  $\sqrt{s} = 0.5\text{TeV}$  - challenging
- $dL/L < 2 \times 10^{-4}$  for GigaZ – very challenging
- LHCaL – ID muons behind LumiCal
- BeamCal – instantaneous luminosity optimization (beam-strahlung pairs) and hermeticity  
(Electronics from SLAC, Haller and Abusleme )
- GamCal - instantaneous luminosity optimization (beam-strahlung  $\gamma$  detector at  $z \approx 190\text{m}$ )  
(Morse, BNL)

More US involvement needed!

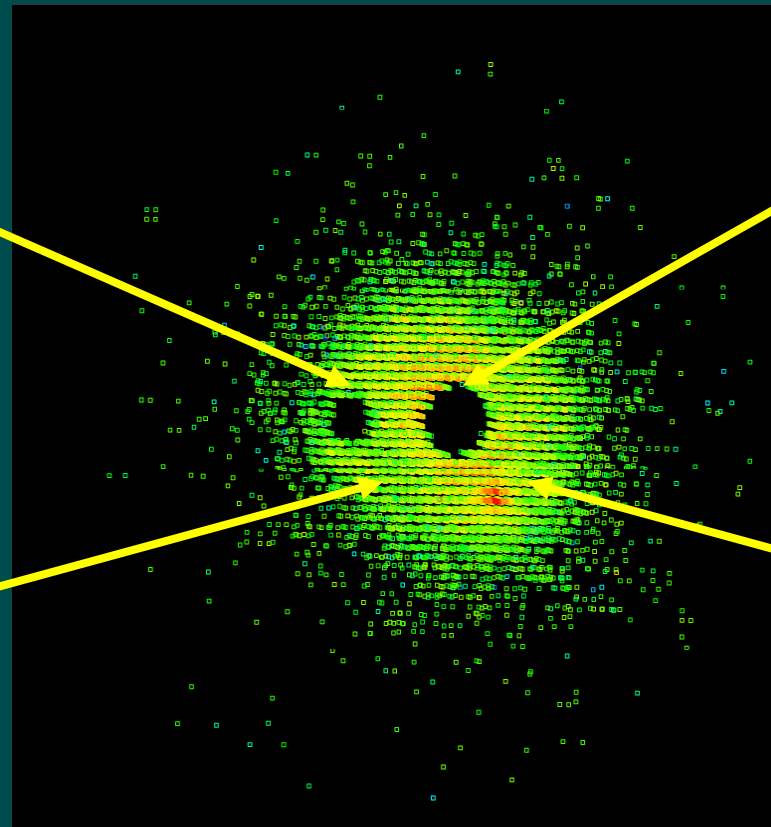
# BeamCal Hermeticity Studies - Univ. of Colorado, Boulder

Incoming beam hole

Outgoing beam hole

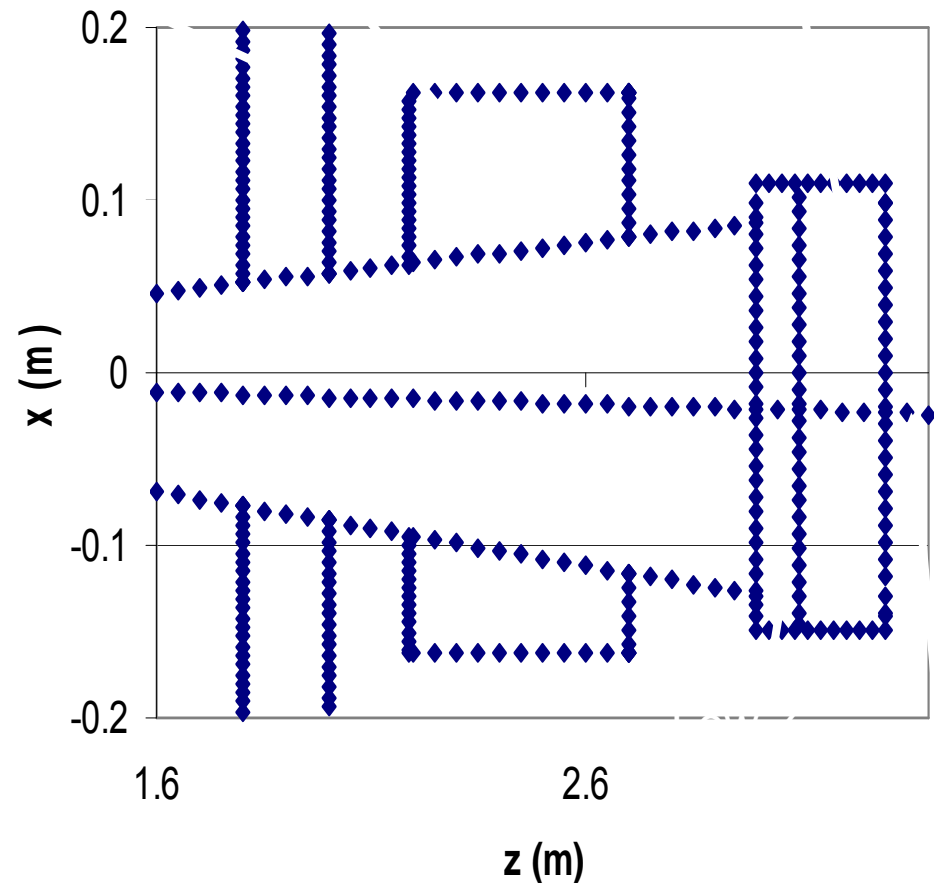
Beam-  
strahlung

High energy electron

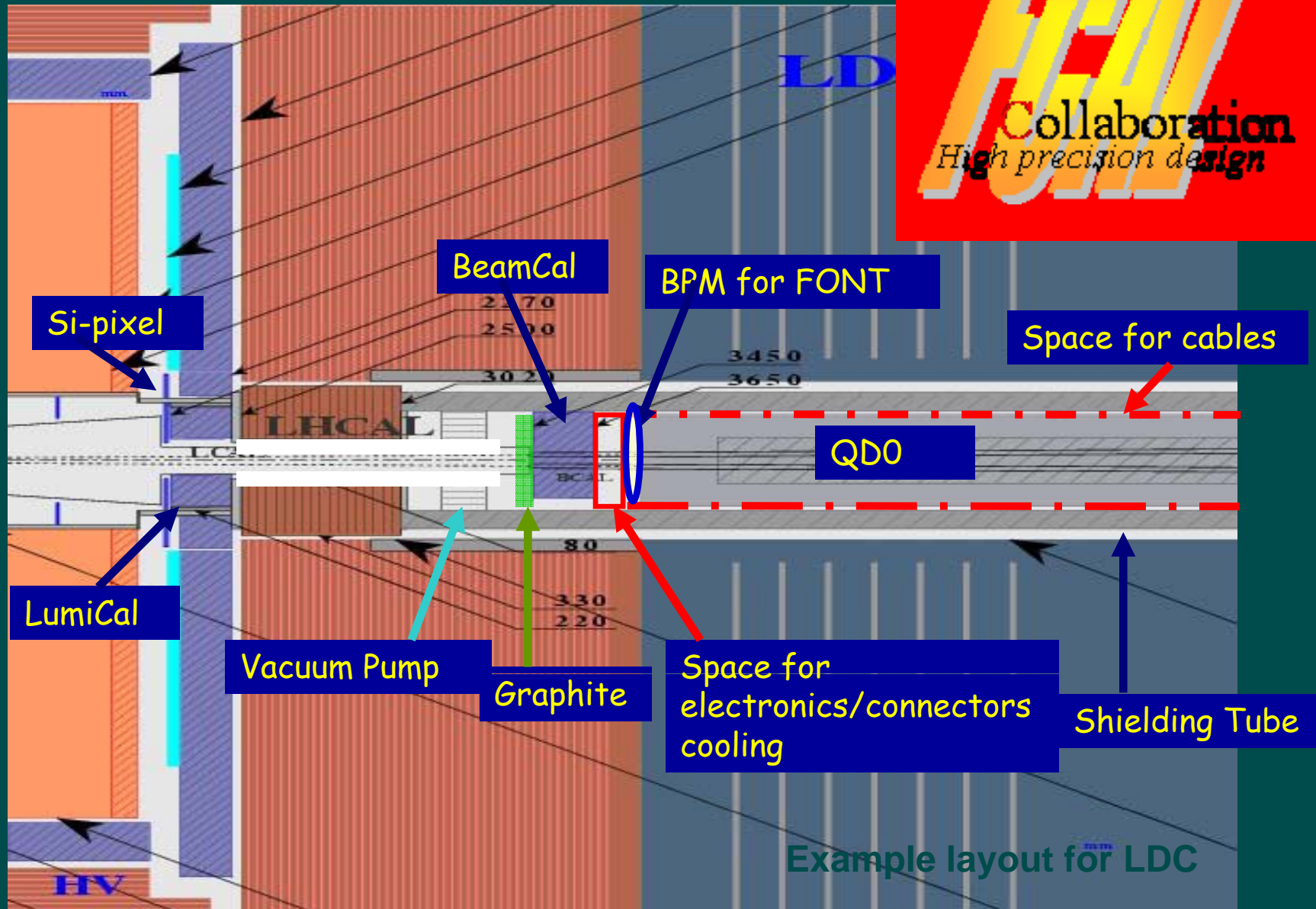


# SiD LumiCal, LHCAL, BeamCal

- Centered on outgoing beam
- Vacuum chamber, support tube, etc. design – Bill Cooper et al.
- Beam-strahlung pairs just miss LumiCal
- $\approx 10\text{K}$  pairs/BX hitting BeamCal,  $\approx 3\text{MGy/yr}$
- BeamCal/GamCal optimizes luminosity



# Forward Region Detectors



# IP Beam Instrumentation WG Summary

Talks presented at this meeting:

## 1. LCDRD-funded projects:

- SR stripe energy spectrometer (E. Torrence, Oregon)
- BPM energy spectrometer (Y. Kolomensky, Berkeley)
- Polarimeter Backgrounds (B. Oliver, Tufts)
- Polarimeter Quartz Fiber Detector (T. Yetkin, Iowa)
- Wide-angle Beamsstrahlung Monitor (G. Bonvicini, Wayne St.)
- BeamCAL and GamCAL Beamsstrahlung Detector (B. Morse, BNL)

## 2. Other talks

- Beamsstrahlung pairs (Y. Takubo, Tohoku)
- LumiCAL (W. Lohmann)
- Polarization-Energy Workshop next April at DESY-Zeuthen

- energy spectrometer, polarimeter and GamCAL will have Beam Delivery System work packages in ILC Project Management
- will complete energy spectrometer R&D program at SLAC's End Station A at end of FY08; aim to demonstrate proof-of-principle systems with results

# ILC Polarization-Energy Workshop

DESY-Zeuthen (Berlin) April 9-11, 2008



## Local Organizing Committee

Sabine Riemann-DESY Zeuthen  
Andreas Schaelicke-DESY Zeuthen  
Heinz Juergen Schreiber-DESY Zeuthen  
Jenny List-DESY Hamburg  
Peter Schuler-DESY Hamburg

## Program Committee

Stewart Boogert-RHUL  
Mike Hildreth-Notre Dame  
Jenny List-DESY Hamburg  
Ken Moffeit-SLAC  
Gudrid Moortgat-Pick - IPPP, Durham  
Sabine Riemann-DESY Zeuthen  
Peter Schuler-DESY Hamburg  
Eric Torrence-University of Oregon  
Mike Woods-SLAC

## Topics

Polarization Physics

Overview of electron and positron polarization sources and spin transport

Polarimeter specifications and design (beamline chicanes, optics and backgrounds, integration with other instruments, laser systems, detectors, conventional facilities)

Energy spectrometers (Beam position monitors, Synchrotron radiation, Compton)

EDR work and co-ordination with GDE (Work packages, Milestones, Deliverables)



# Forward Region EDR Work / R&D

## (LumiCAL, BeamCAL)

**IR integration issues** (see talk by A. Seryi on IRENG07 Workshop)

**Hermeticity for electrons and muons**

**Forward region system design** well developed for LDC;  
not as well developed for other collaborations

### LumiCAL

- precision LUMI requirements:
  - mechanical alignment (esp. following push-pull); laser alignment system?
  - geometry (inner radius and distance between LumiCALs at  $\sim \pm 3$  meters)
  - energy scale and luminosity spectrum

### BeamCAL

- requirements: rad hard, electron id efficiency
- choice of sensors: CVD diamond, rad-hard Si, other?
  - area of active R&D



# IR & Backgrounds WG Summary

**IR Design and Integration:** work is being led by ILC Beam Delivery System, in co-ordination with Detector Concepts

**Backgrounds:** *work needs to be led by Detector Concepts!*

## Work needed:

- re-evaluation of all background sources (beamsstrahlung pairs, synchrotron photons, neutrons, muons, hadronic  $2\gamma$ )
- synchrotron radiation: beam halo and masking. How to achieve a 2-bounce line-of-sight system wrt vertex detector?
- detailed IR geometry, field maps and detector descriptions
- range of machine parameters and operating conditions
- ***incorporate backgrounds directly into physics and performance benchmark studies***

Recent work from T. Maruyama on neutron fluence at IP:

- 1-MeV neutron equivalent fluence from beam dump + pairs estimated to be  $2 \cdot 10^9$  n/cm<sup>2</sup>/year at the SiD VXD detector  
( $10^{10}$  n/cm<sup>2</sup> at the VXD would cause displacement damage to CCD Si)

# Conclusion

- Many of the important conceptual questions for a detector at the ILC have been addressed
- As letter intent are prepared the focus will shift from concepts to development of specific solutions