Detector Summary

David Strom
University of Oregon

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

Vertex Detector

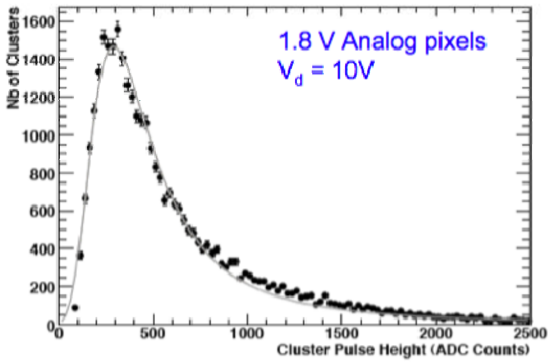
Conceptual question:

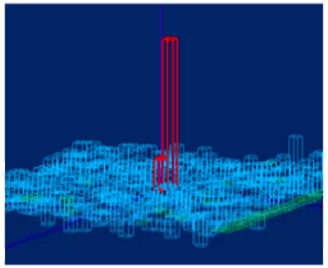
- **How big can we make the B field?**
- Many options, but can a detector that meets the ILC specs be built? (5 micron resolution at high p, <0.1% X0/layer, background immunity)

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

Electron beam tests: Analog sectors

1.35 GeV electrons extracted from the booster ring of the Advanced Light Source (ALS) at LBNL.

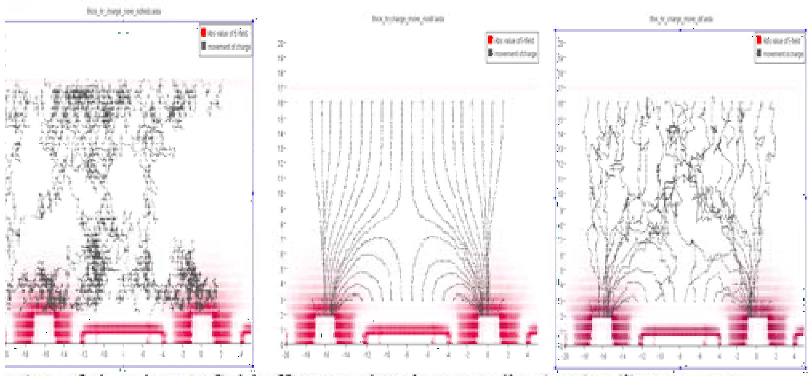




For comparison purposes, data were taken both with the beam on and off.

to appear in NIM A (2007)

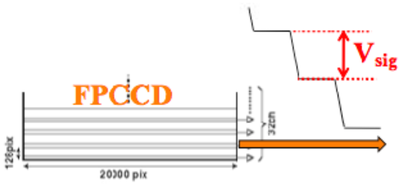
Effect of the electric field

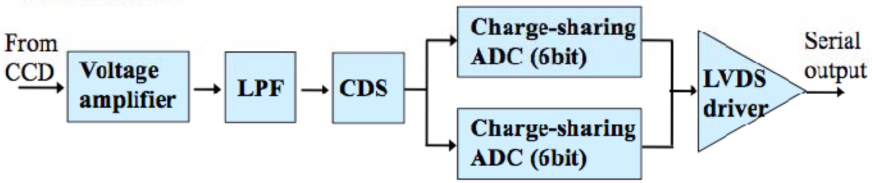


ation of the electric field effect on the charge collection in silicon sensor:
e left picture only diffusion is simulated, in the middle charge is moving only by
ic forces, and the right picture shows how it moved in our simulations

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

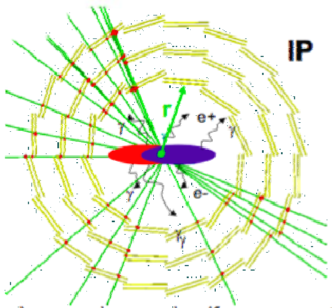


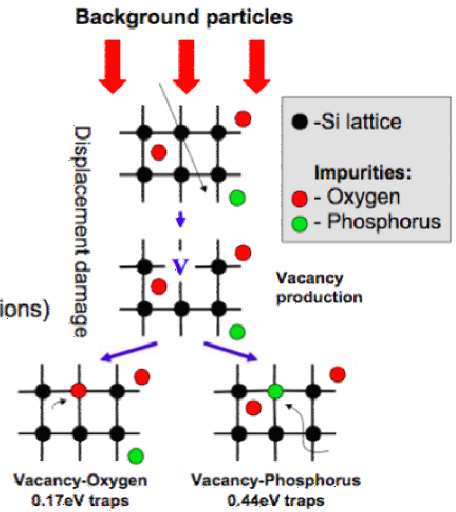


The design was optimized with SPICE simulation.

Y. Takubo (Tohoku University)

ILC Background and CCD Radiation Damage





Radiation damage produces energy levels (**traps**) within the band gap.
Traps capture electrons from the conduction band which are later released.

Tracking

Conceptual questions:

- Gaseous Tracking or Silicon Tracking

Answer depends on many factors,
including:

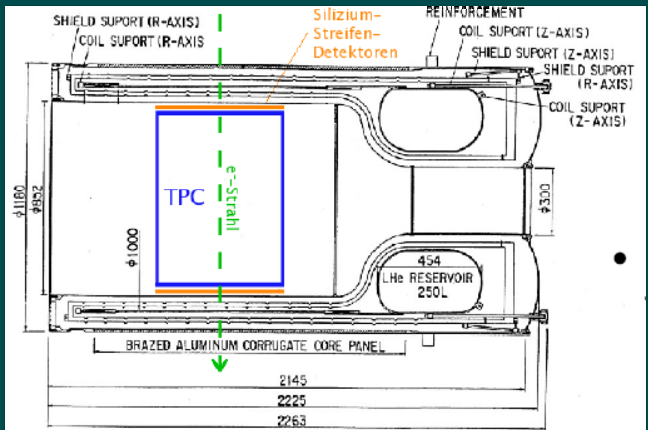
- Space point resolution
- Material in the tracker and in front of ecal
- Robustness to (un)expected background

Slides: Peterson and Schumm

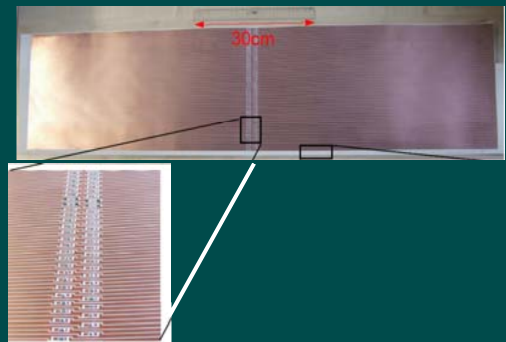
The LC-TPC Large Prototype

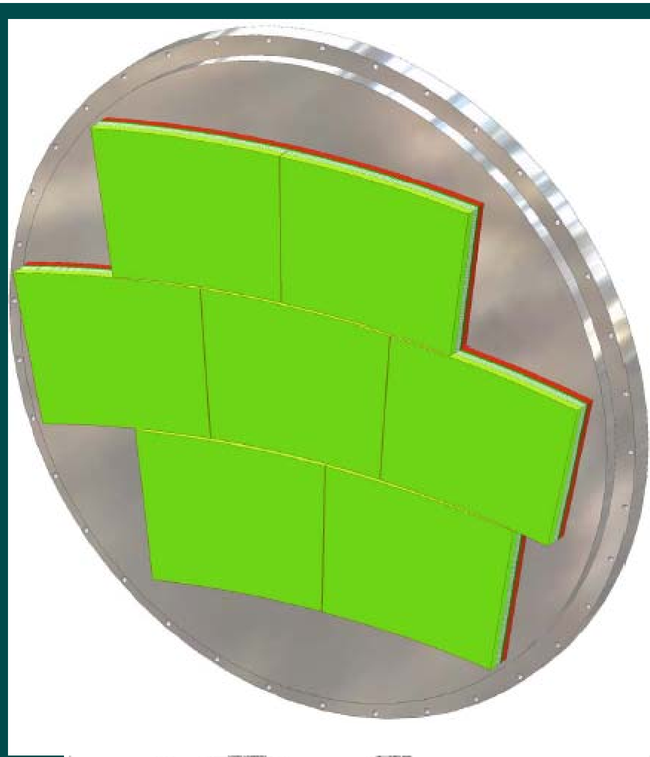
Plans and progress for the LC-TPC Large Prototype were discussed in several talks : Colas(Saclay), Diener(DESY), Killenberg(Bonn), Peterson(Cornell), Ishikawa(Saga).

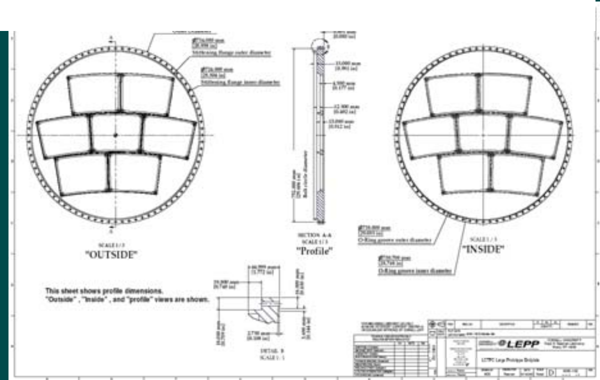
The prototype will be operated at the EUDET facility at DESY in a 1.2 Tesla Field. Progress is being made on the infrastructure including the magnet.



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



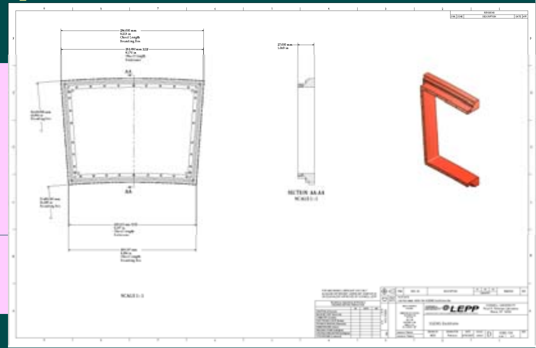


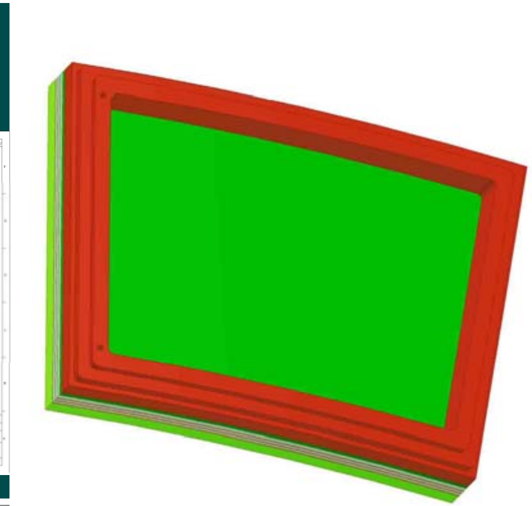


Plans for the endplate, and mating module structural parts are final.

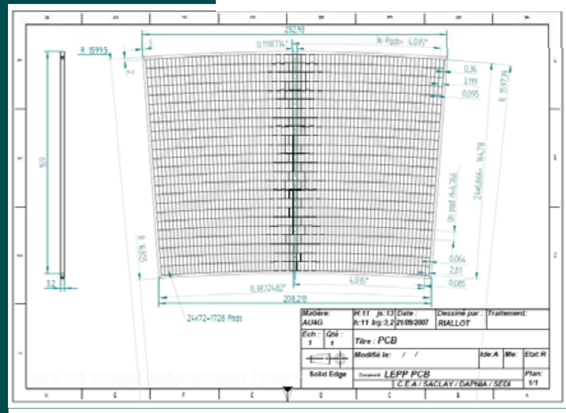
LC-TPC Large Prototype: Modules

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



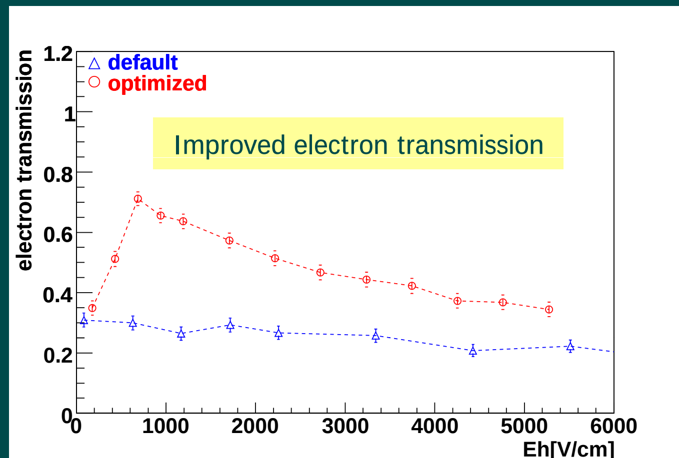


Readout modules with Micromegas gas-ampification and resistive charge dispersion are being prepared at Saclay (Colas).



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

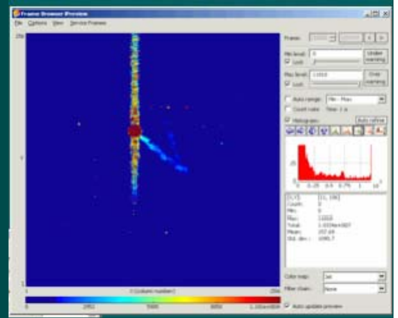
A report on simulation of the GEM transmission for electrons, and suppression of transmission for ions showed progress in understanding the applicability of a GEM as an ion gate in the Large Prototype. Ishikawa (Saga)



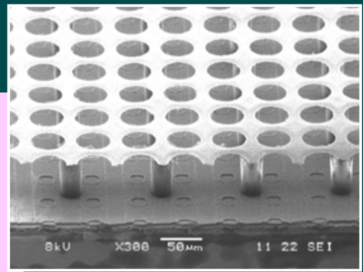
TPC pixel readout

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

He-isobutane events (see orginal)



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)

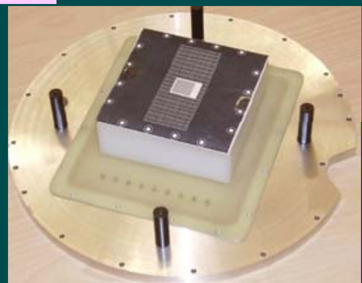


Ingrid

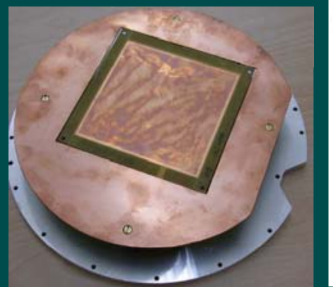
Ar-isobutane Events (see orignal)

recorded discharge

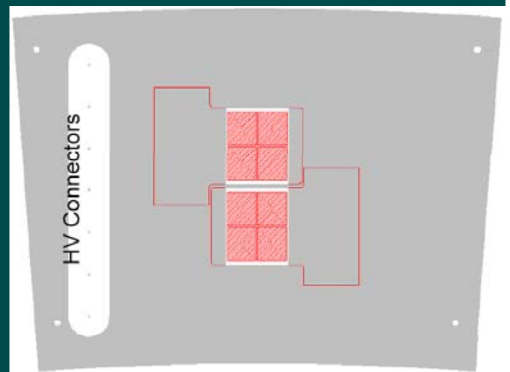
For the GEM case, an effort is starting to study triple-GEM amplification with plans to mount the device in the LC-TPC large prototype. Killenberg (Bonn)



Timepix



triple-GEM mounted above the Timepix

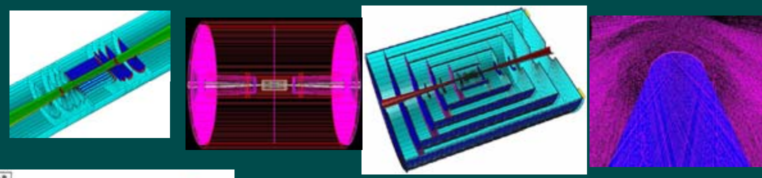


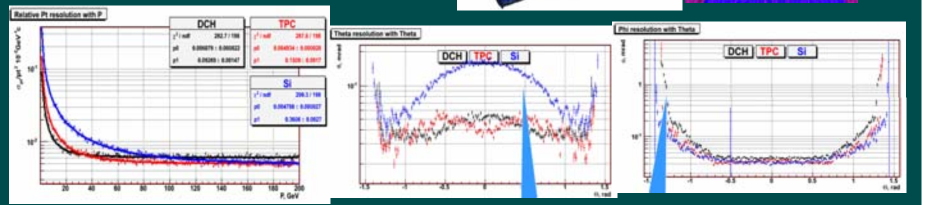
plans for developing a module for the LC-TPC Large Prototype

Tracking system simulations

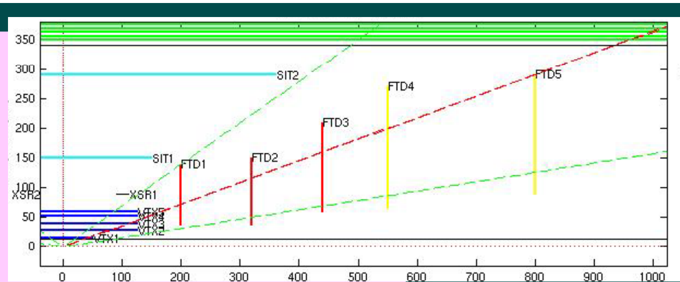
Progress from three software projects were presented.

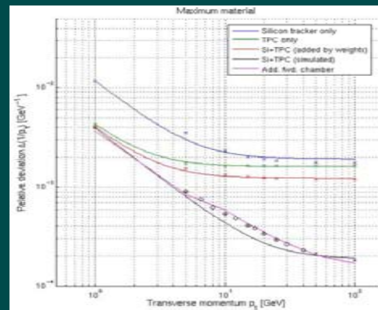
In one, performance of a pixel TPC, an SiD tracker, and a drift chamber were compared. Regions where the various options are superior were identified. Gatto (INFN Napoli) (ILC root)





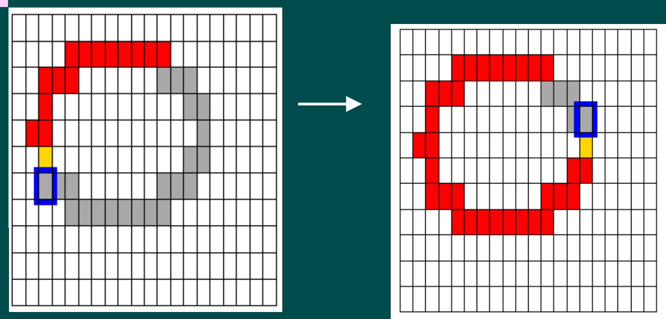
This simulation studies the low polar angle region of the LDC concept.





A region where a 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)



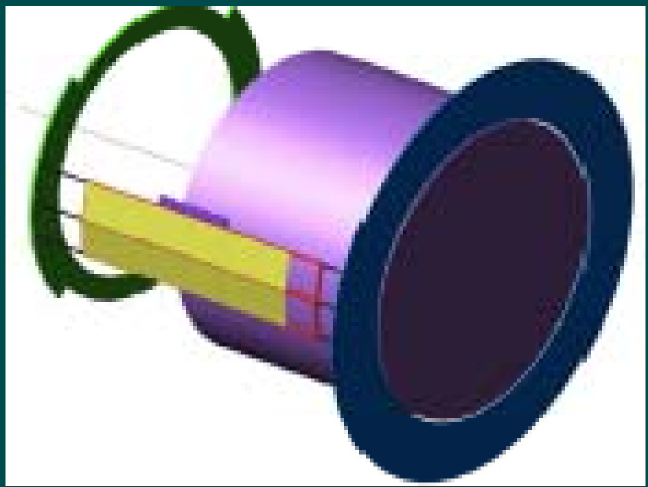
Report from the SiLC Collaboration
(generic R&D group for ILC Silicon)

Many activities geared towards large-area μ-strip system

- Migration of front-end chip into 0.13 μm; testing undereway
- 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 μm pitch on 6” wafers; exploring thinning of sensors
- Mechanics: Structures and tooling for large prototype → Several modules under beam test this week

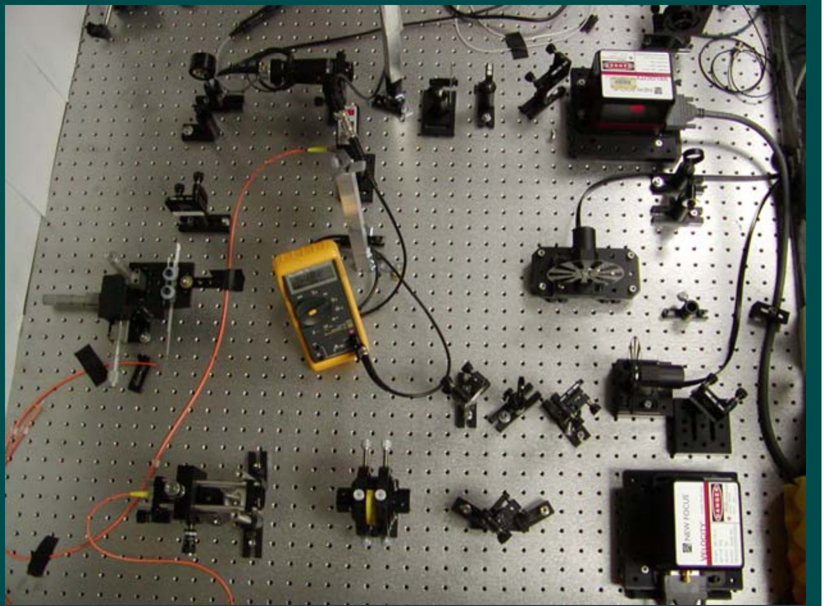


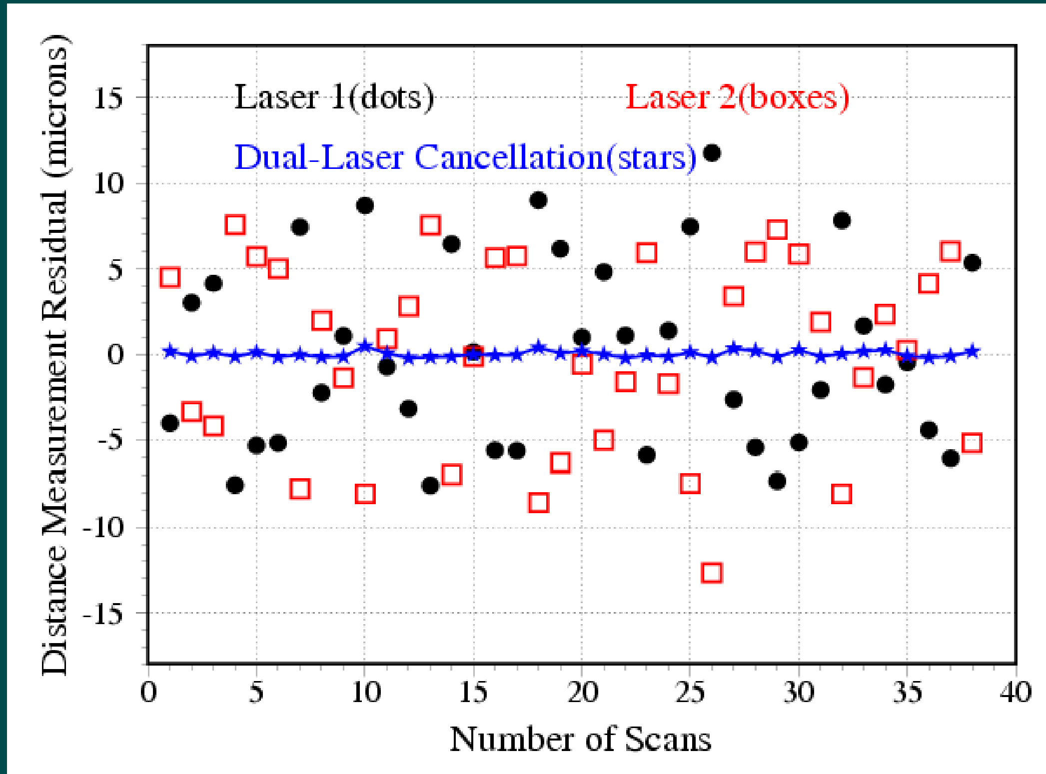
Frequency-Scanned Interferometry

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

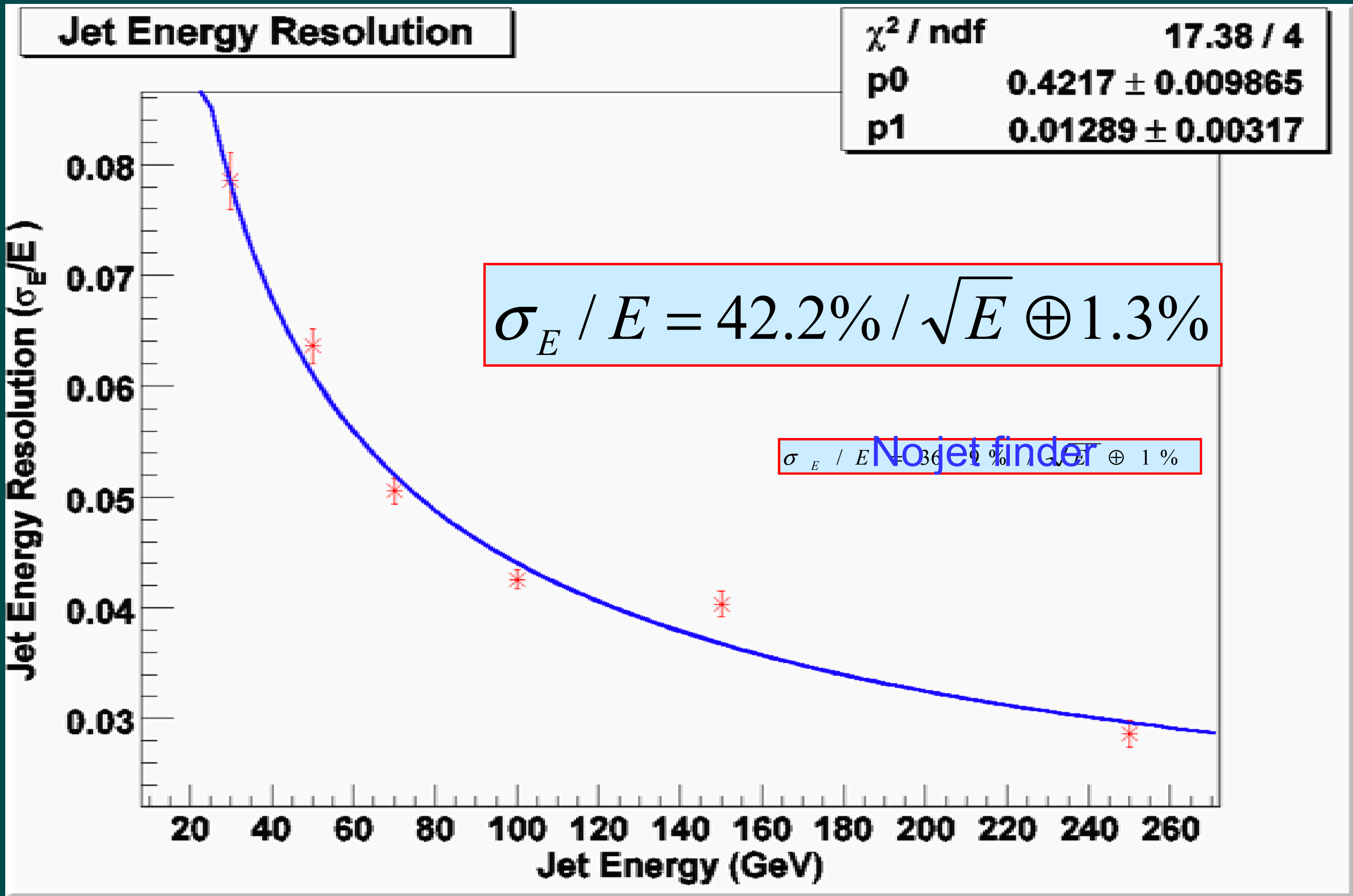
Round-up of other PFAs

Table idea stolen from Lei Xia (ANL)

rms$_{90}$ of energy sum [GeV] — rms$_{90}$ of dij[et] mass residu[al] [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] **SLAC KPiX test beam results** by Timothy NELSON (SLAC) (Hornets Nest (WH8X): 08:30 - 08:45) slides
	[172] **Silicon-Tungsten ECAL R&D progress** by Prof. Mani TRIPATHI (University of California, Davis) (Hornets Nest (WH8X): 08:45 - 09:05) slides
09:00	[173] **CALICE Silicon-Tungsten ECAL - Performance in the test beam and results** by Dr. Roman POESCHL (LAL Orsay) (Hornets Nest (WH8X): 09:05 - 09:25) slides
	[174] **Analysis of scintillator ECAL data** by Dr. Satoru UOZUMI (Shinshu University) (Hornets Nest (WH8X): 09:25 - 09:45) slides
	[175] **MAPS - ECAL** by Marcel STANITZKI (Hornets Nest (WH8X): 09:45 - 10:00) slides
10:00	break (10:00 - 10:30)
	[176] **Electronic readout system for the DHCAL** by Mr. Gary DRAKE (Argonne National Laboratory) (Hornets Nest (WH8X): 10:30 - 10:50) slides
11:00	[177] **The DHCAL vertical slice test** by Dr. Jose REPOND (Argonne National Laboratory) (Hornets Nest (WH8X): 10:50 - 11:10) slides
	[178] **Data analysis of the DHCAL vertical slice test** by Dr. Lei XIA (Argonne National Laboratory) (Hornets Nest (WH8X): 11:10 - 11:30) slides
	[179] **GEM - DHCAL update** by Prof. Andy WHITE (University of Texas at Arlington) (Hornets Nest (WH8X): 11:30 - 11:45) slides
	[180] **Direct coupling studies** by Dr. Alexandre DYCHKANT (Northern Illinois University) (Hornets Nest (WH8X): 11:45 - 12:00) slides

Thursday, 25 October 2007

08:00	[199] **Future scintillator HCAL studies** by Felix SEFKOW (DESY) (Racetrack (WH7X): 08:30 - 08:50)
09:00	[200] **Dual readout tests: BGO and neutrons** by Prof. John HAUPTMAN (Iowa State) (Racetrack (WH7X): 08:50 - 09:05)
	[201] **Calorimeter simulations in the context of the 4th concept** by Dr. Corrado GATTO (INFN) (Racetrack (WH7X): 09:05 - 09:20)
	[202] **Dual readout calorimeter for the ILC detector** by Dr. Niki SAOULIDOU (Fermilab) (Racetrack (WH7X): 09:20 - 09:40)
	[203] **Studies of the reponse and readout strategies for the GM-APDs** by Dr. Adam PARA (Fermilab) (Racetrack (WH7X): 09:40 - 10:00)
10:00	break (10:00 - 10:30)
	[222] **An experimental program demonstrating precision jet energy measurement at the ILC** by Dr. Rajendran RAJA (Fermilab) (Racetrack (WH7X): 10:30 - 11:00)
11:00	[204] **MIPP discussion** by Dr. Rajendran RAJA (Fermilab) (Racetrack (WH7X): 11:00 - 11:15)

Talks

5 ECAL

6 HCAL

3 Dual readout

HCAL

Neutral hadron beam

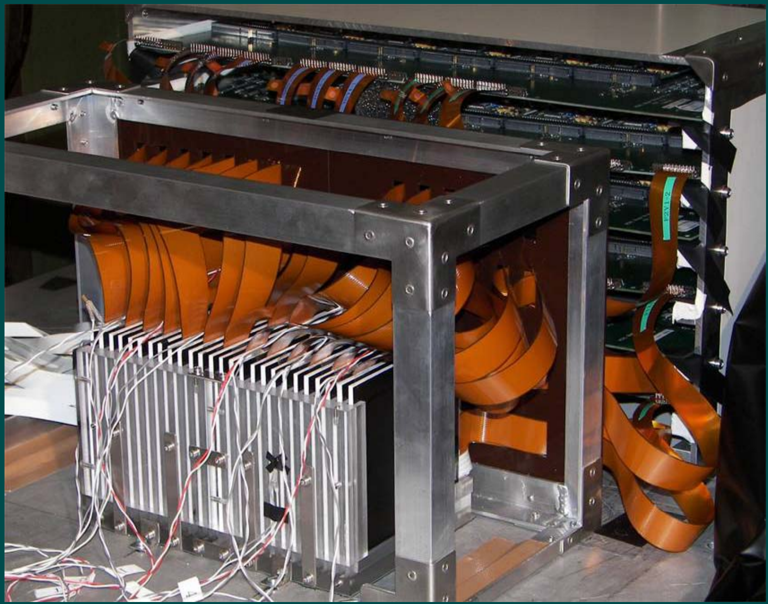
Electromagnetic Calorimeters

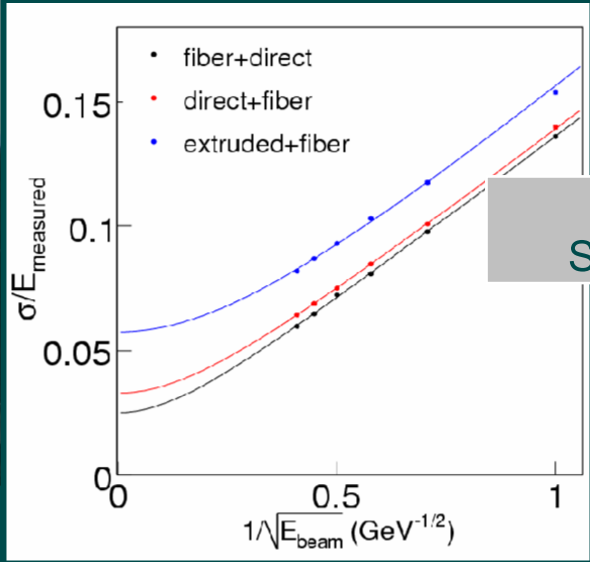
Active element	**Pad/pixel size**	**Collaboration**	**Technology demonstration**	**Testbeam of ministack**	**Construction of prototype**	**Test beam with prototype**	**R&D beyond prototype**
Scintillator	1 x 4 cm^2	CALICE (Japan)	Completed	DESY 2007	Initiated	FNAL 2008	
Silicon	0.13 cm^2	BNL Davis Oregon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

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

A few highlights

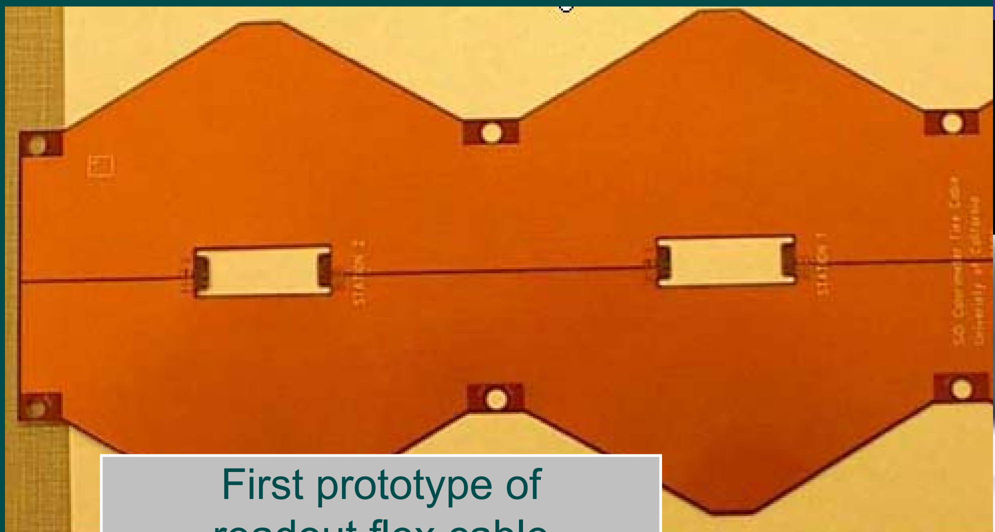
Scintillator ECAL



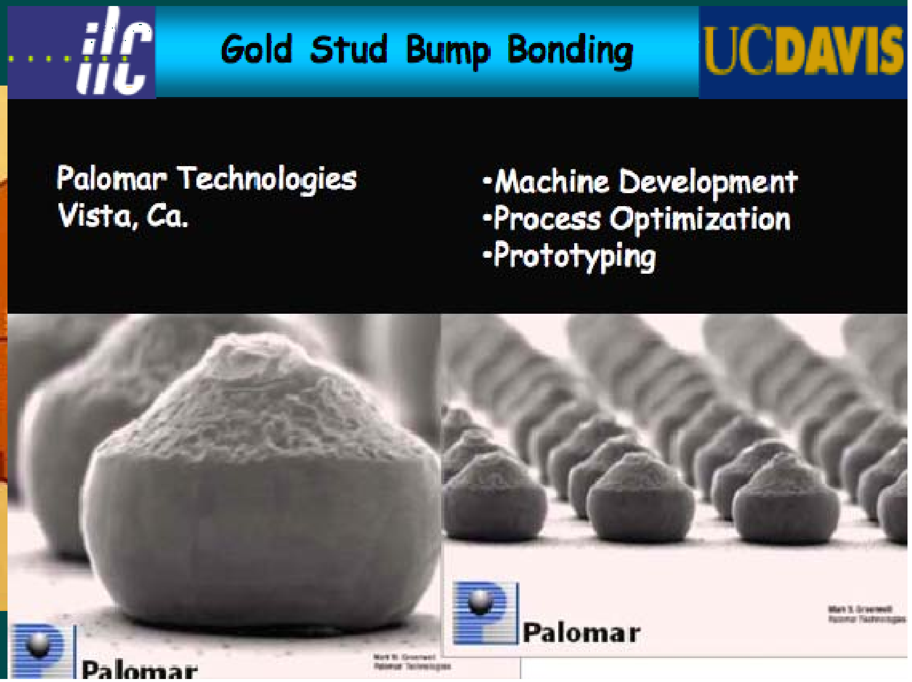


Preliminary
Statistical errors only

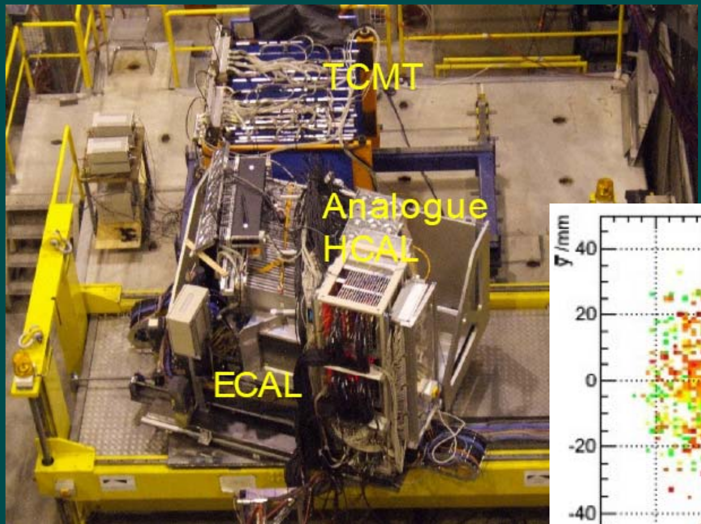
US - Silicon ECAL

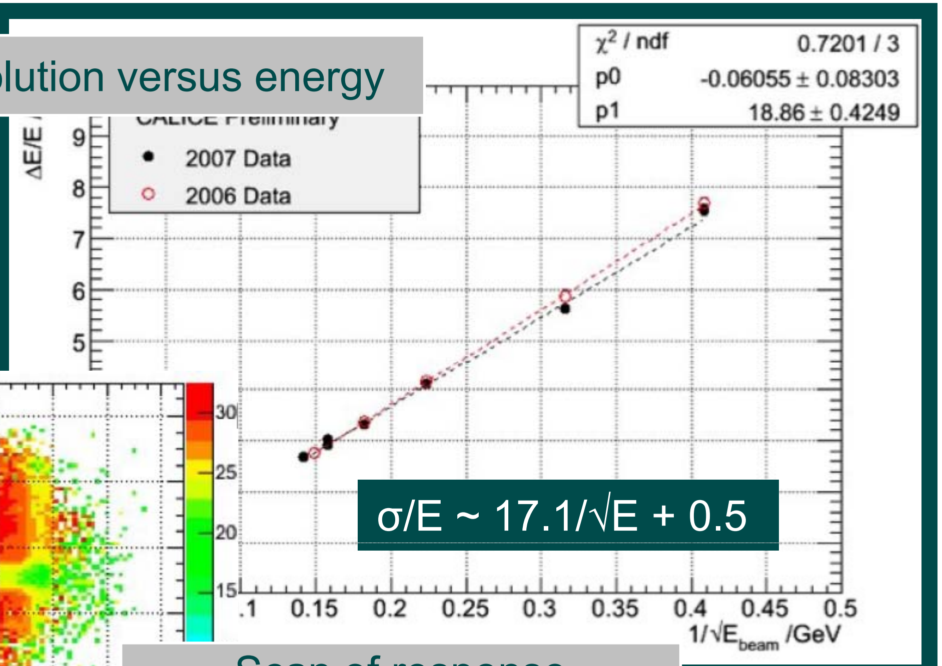


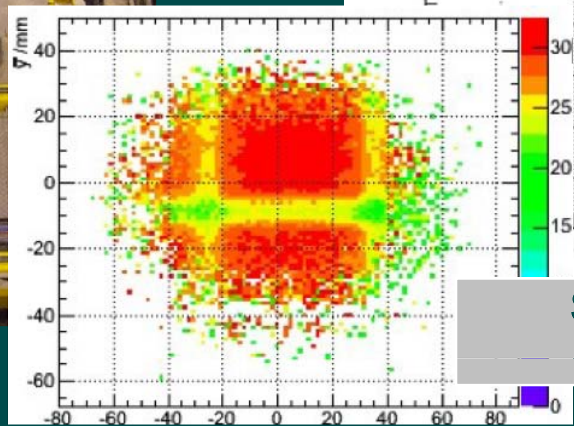
First prototype of readout flex cable



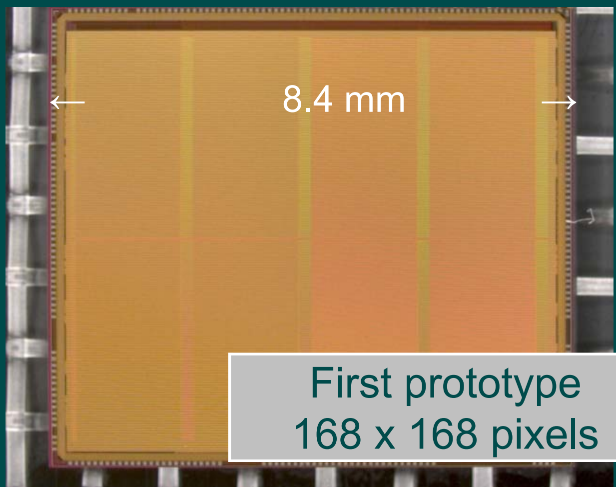
CALICE - Silicon ECAL

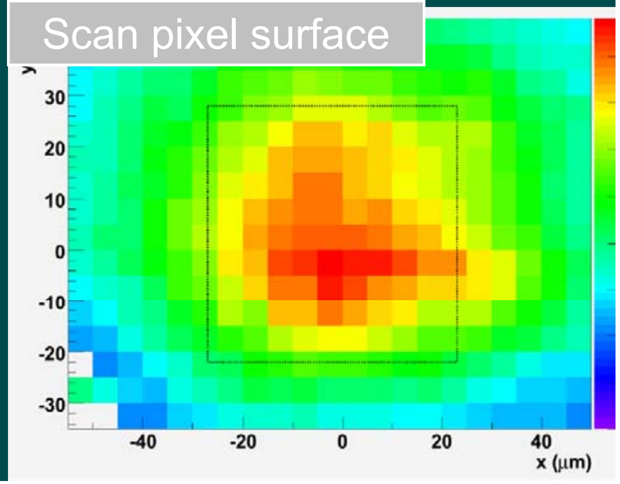


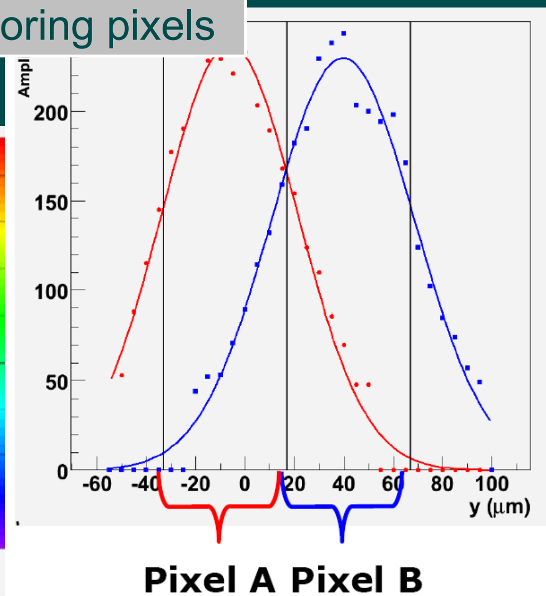




MAPS ECAL







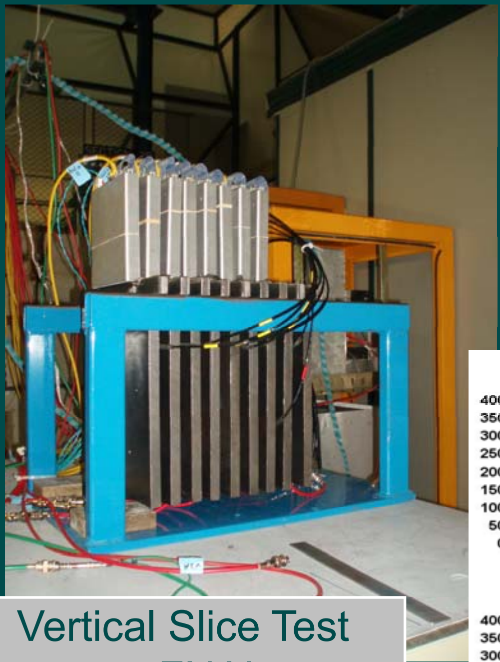
Hadronic Calorimeters

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

All projects use Steel (+ copper) plates as absorber

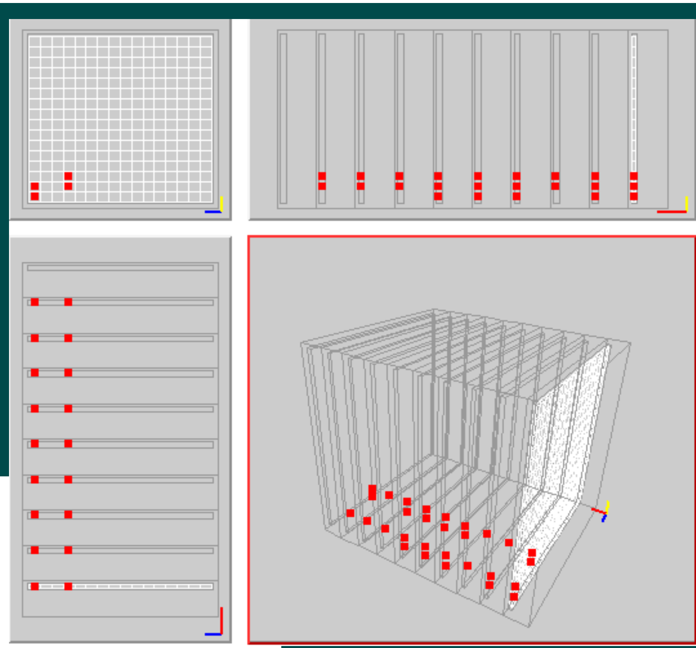
A few highlights

RPC HCAL

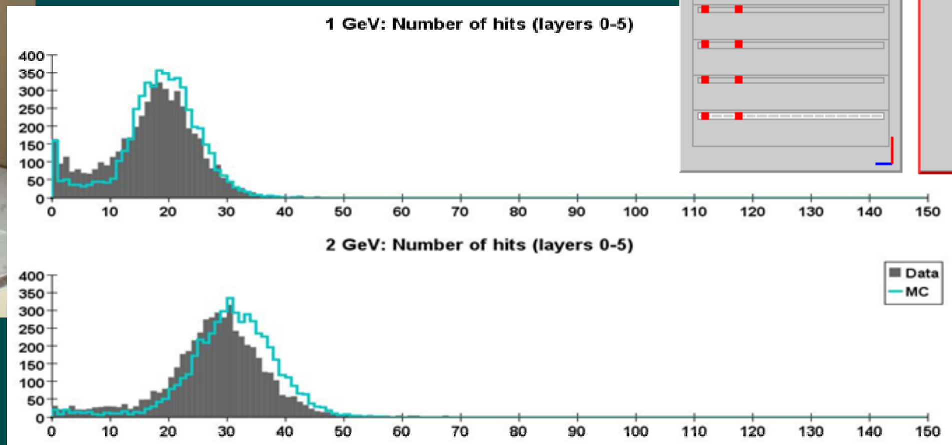


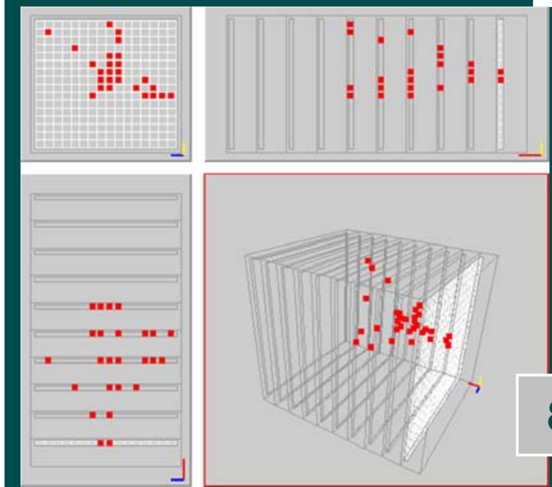
Vertical Slice Test at FNAL

Double muon event



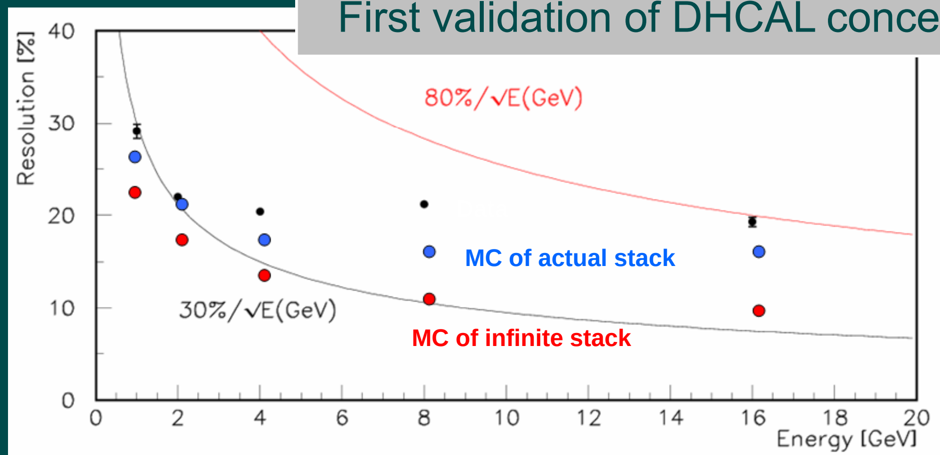
Positron reponse



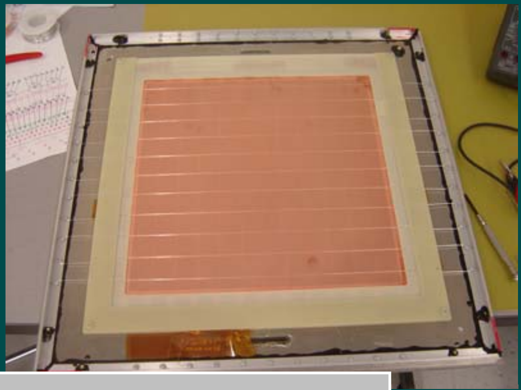


8 GeV pion

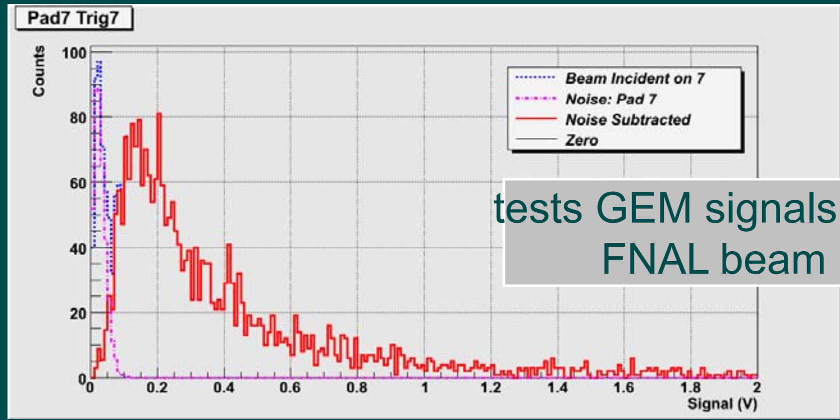
First validation of DHCAL concept



GEM HCAL

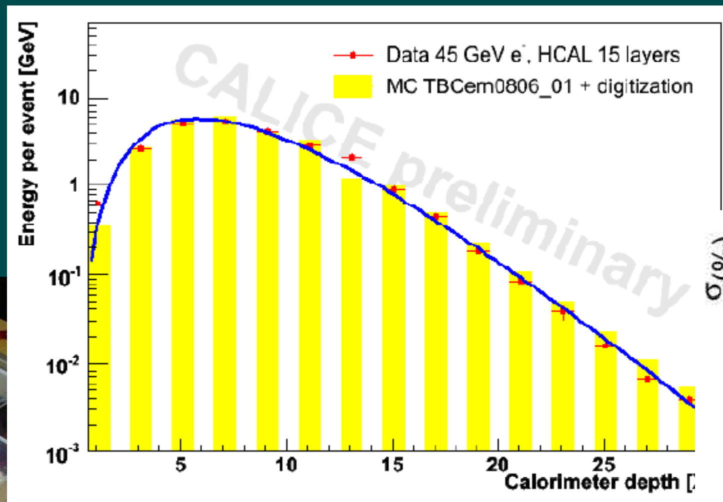


New GEM chamber

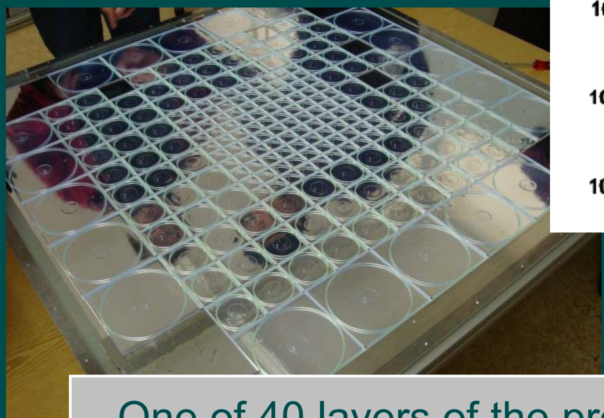


tests GEM signals from FNAL beam

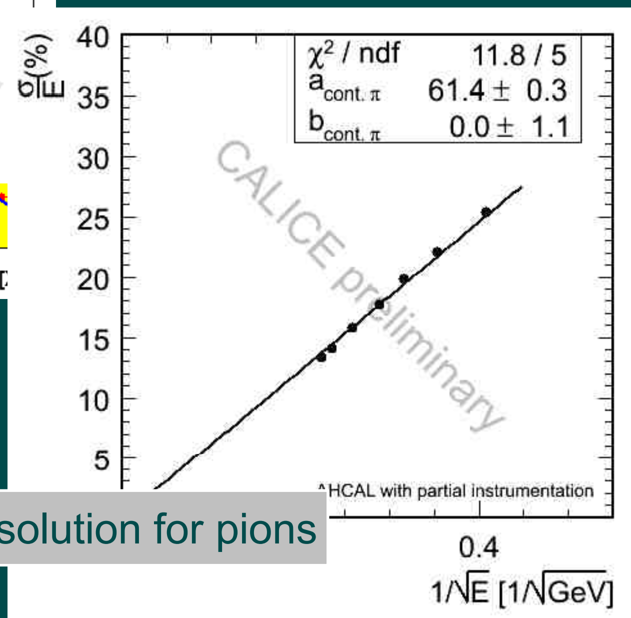
EM shower shape compared to MC



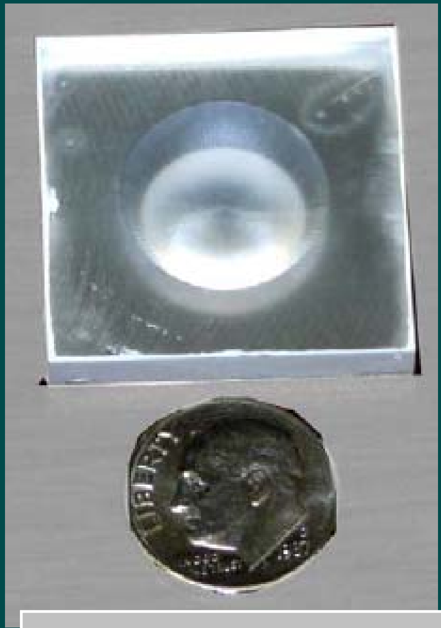
Scintillator HCAL



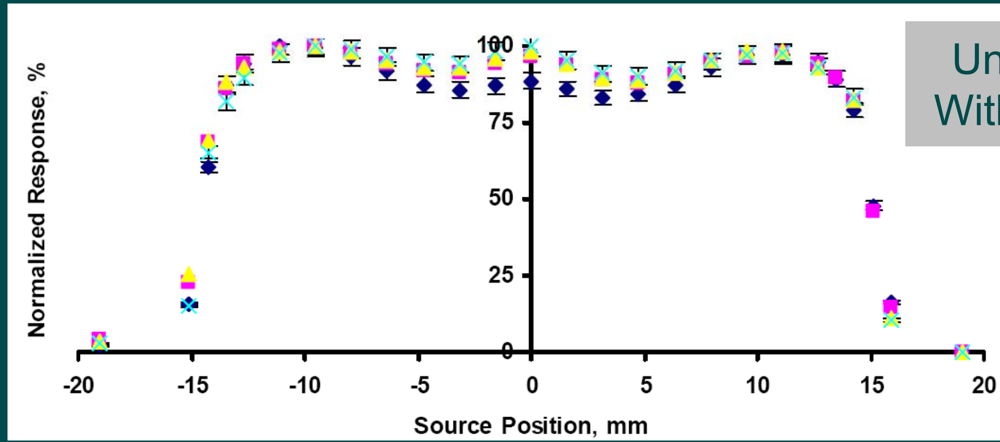
One of 40 layers of the prototype section



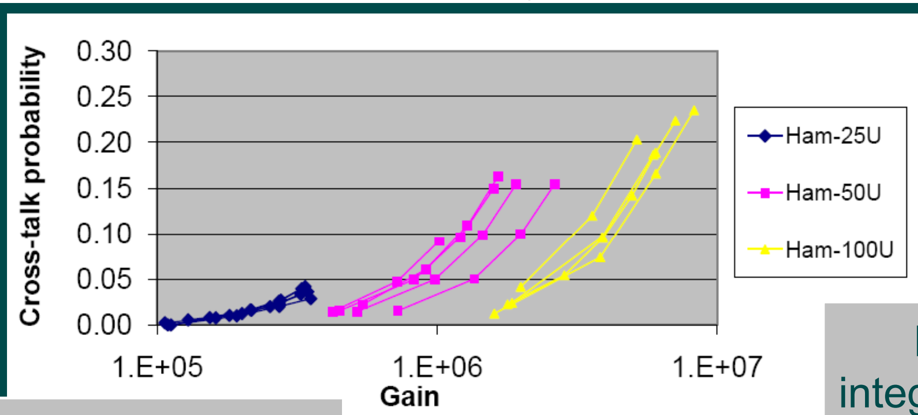
Energy resolution for pions



New scintillator design for direct SiPM coupling

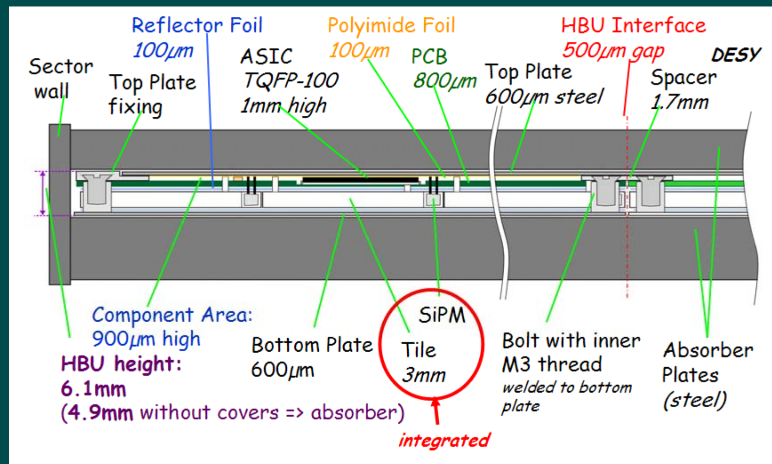


Uniform response With direct coupling

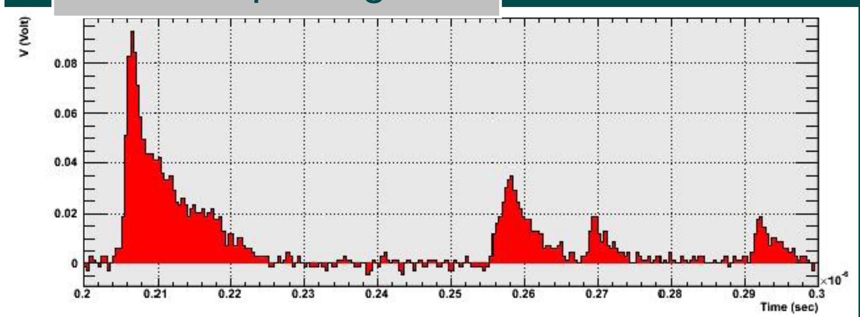


SiPM: studies of cross talk

First design of integrated HCAL layer



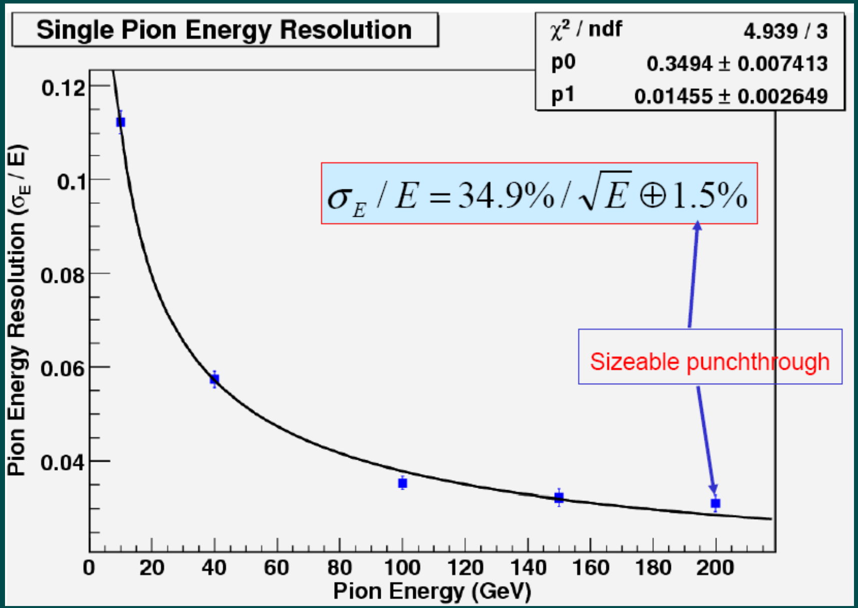
SiPM: studies of afterpulsing

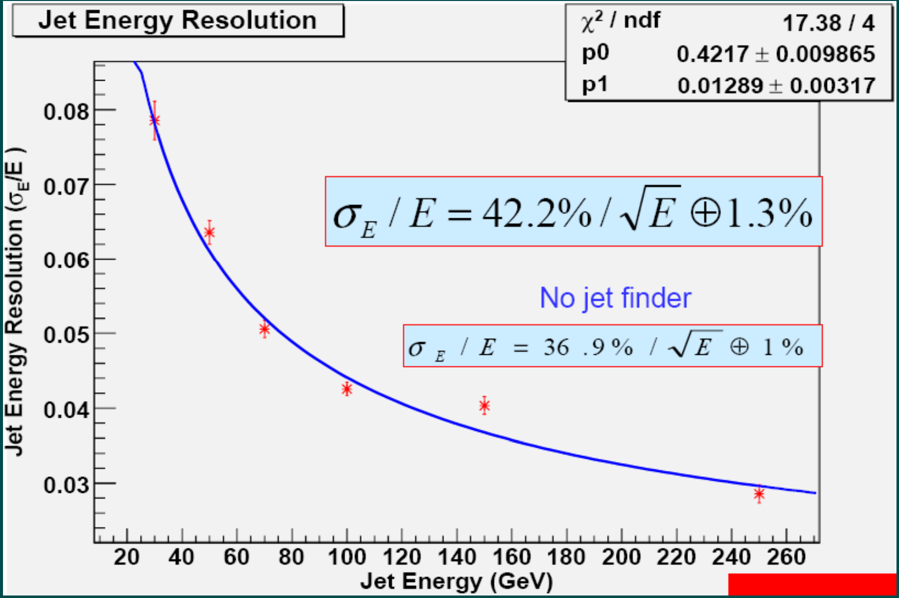


Dual-readout Calorimeters

Active elements	Collaboration	Simulations	Proof of principle	Mini-calorimeter	Construction of prototype	Test beam with prototype
Fibers (quarz, scintillating) BGO, PbF_2	DREAM	Ongoing	On some technologies	Of quarz technology		
Pb-glass (?)	FNAL	Ongoing				

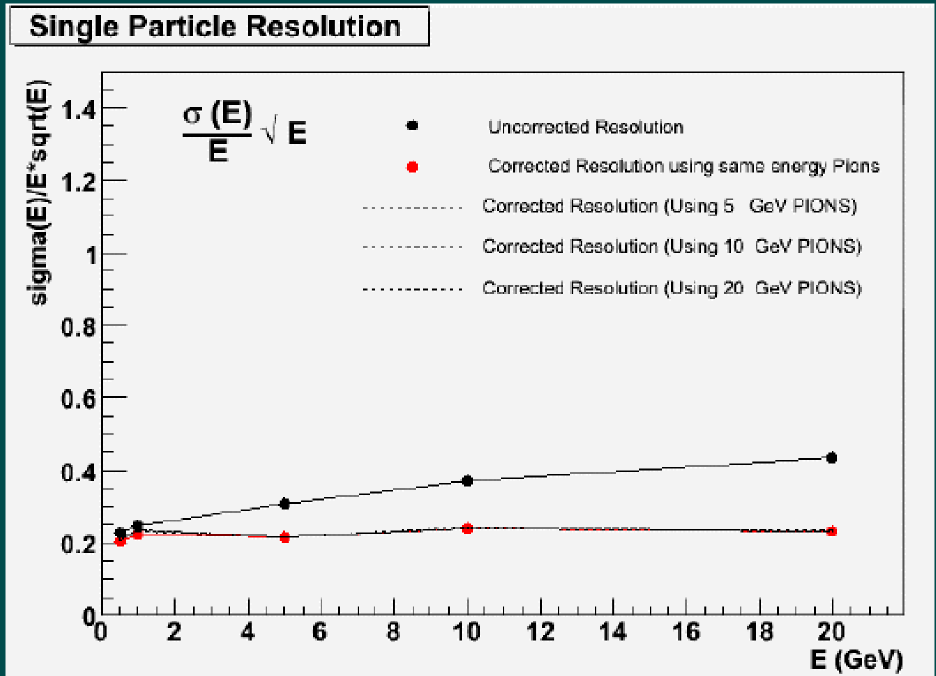
MC studies of fiber module

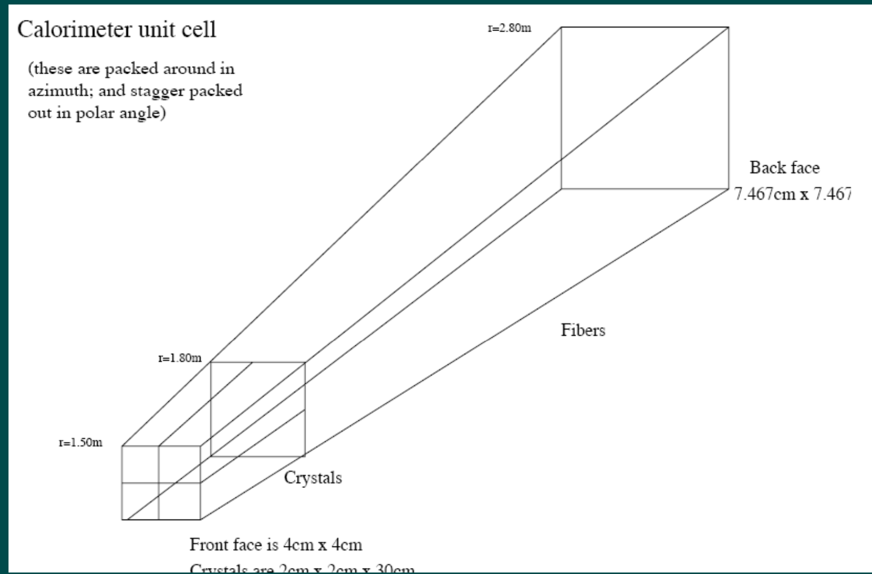




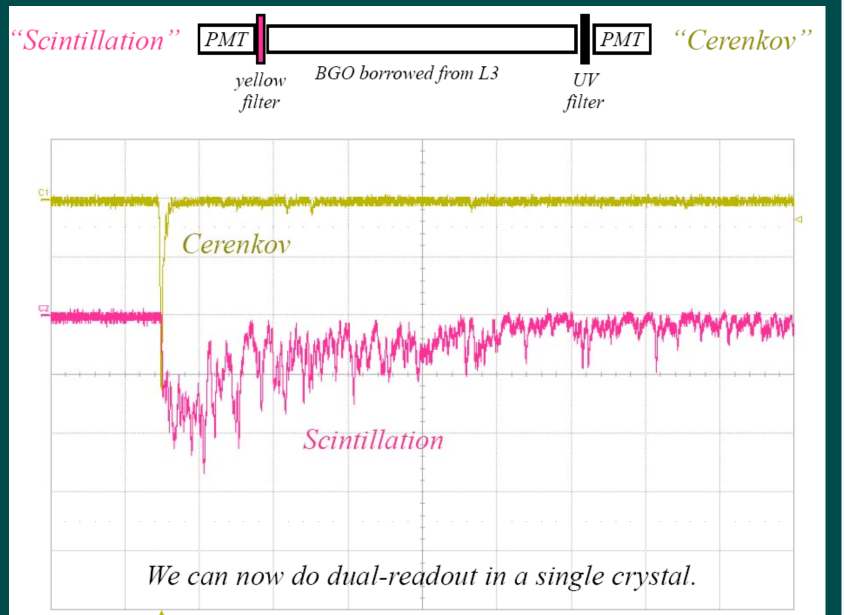
MC studies of fiber module

MC studies of Pb-glass block

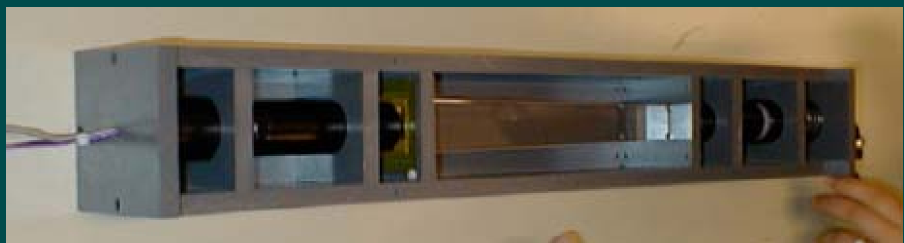




Separate measurement of scintillation and Cerenkov light



BGO module with dual readout



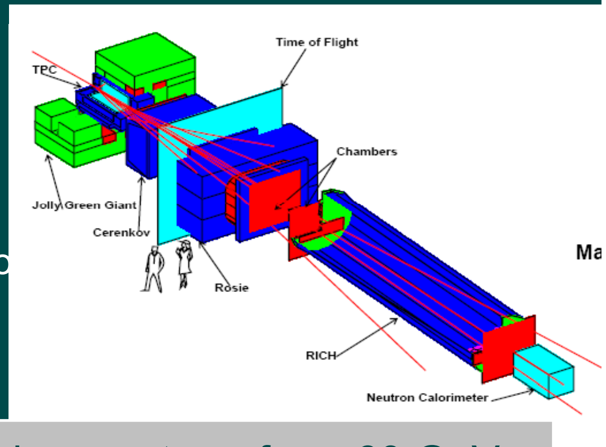
GEANT4 improvements and neutral hadron beams

MIPP upgrade experiment at FNAL (P960) can provide

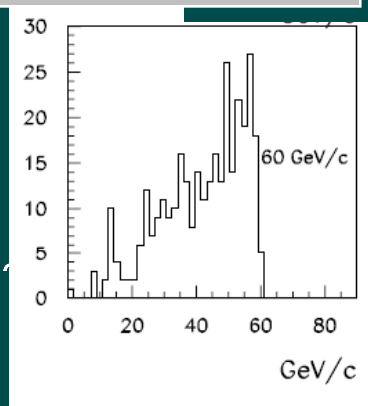
a) nuclear cross sections on thin targets (as input for GEANT4…)

b) tagged neutral hadron (neutron, K_L^0) beams with 2% momentum reso

→ important for PFAs



Tagged n spectrum from 60 GeV p



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?
- …?

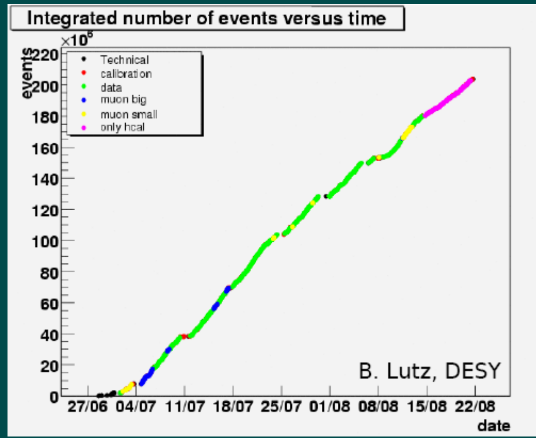
Need to identify task force to address these questions

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)

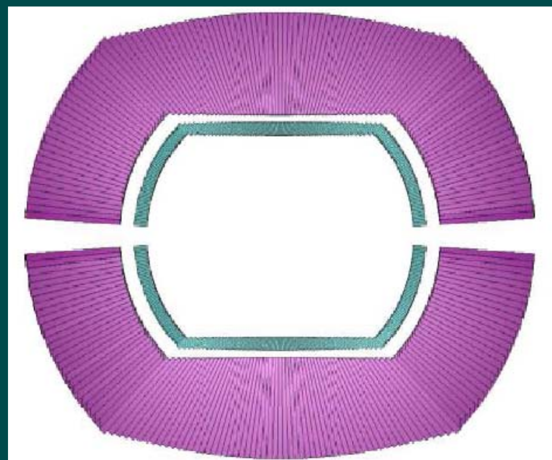


- Proof of concept

CALICE RPC-Steel HCAL (FNAL test beam)
CALICE Scintillator-Tungsten ECAL (DESY test beam)

Progress towards technical prototypes

CALICE Silicon-Tungsten ECAL
US Silicon-Tungsten ECAL
CALICE Scintillator-Steel HCAl
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*

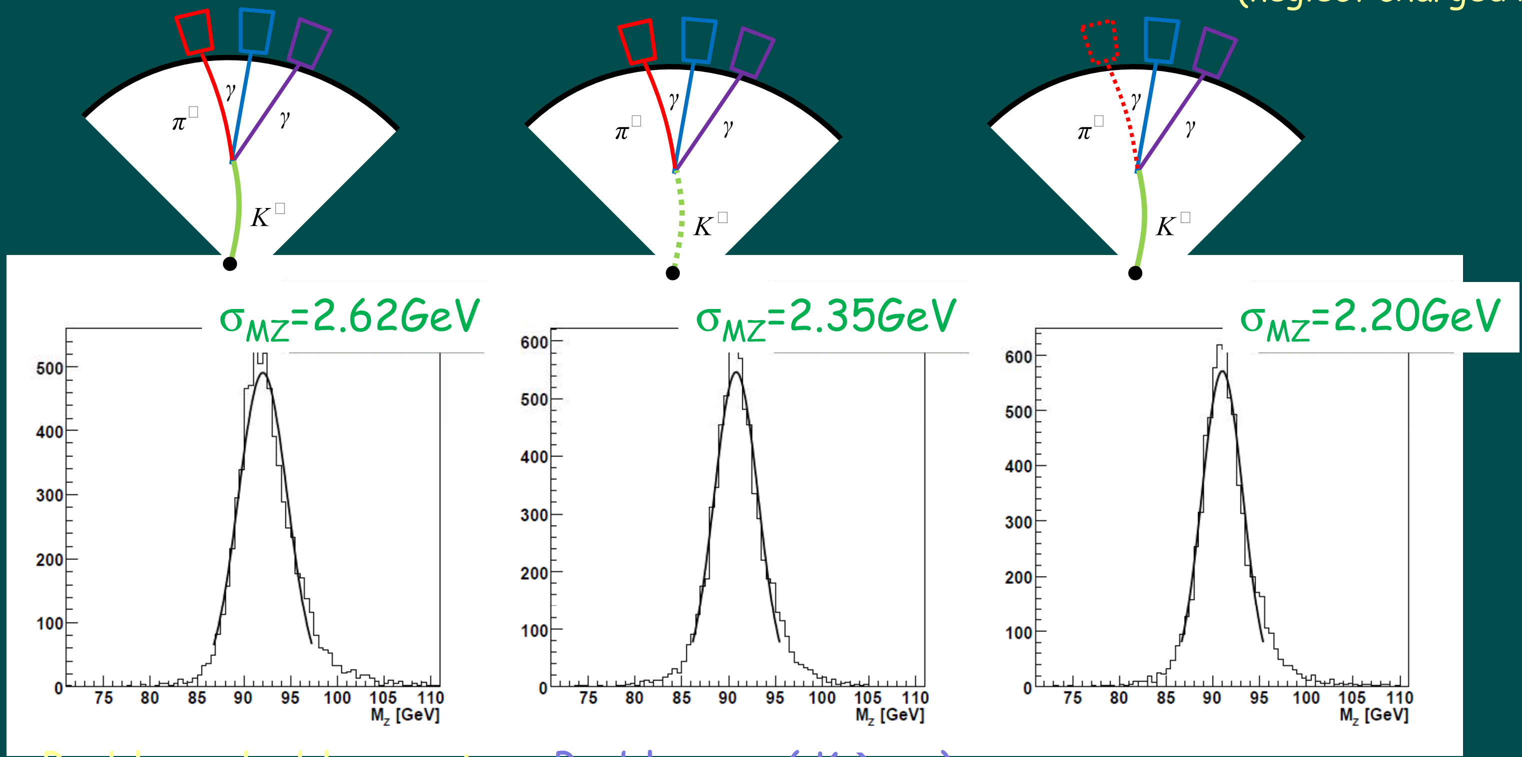
Framework status

- 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: ν ($K \rightarrow \mu\nu$)

Kink mother scheme works better for Z0 events

V0 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

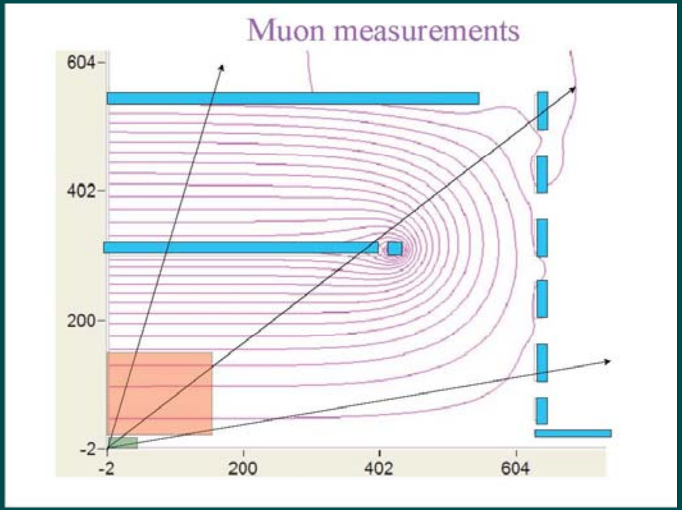
Conceptual Questions:

- 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

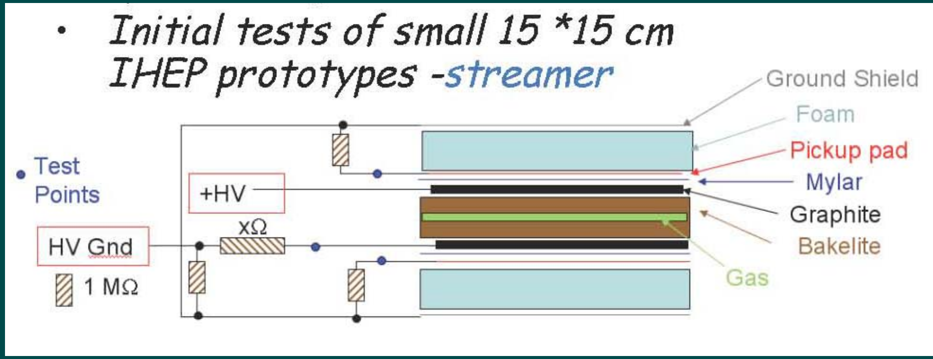
Iron vs. No-iron Muon Detection
John Hauptman



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

Muon (RPC) Detector Studies for SiD
Henry Band

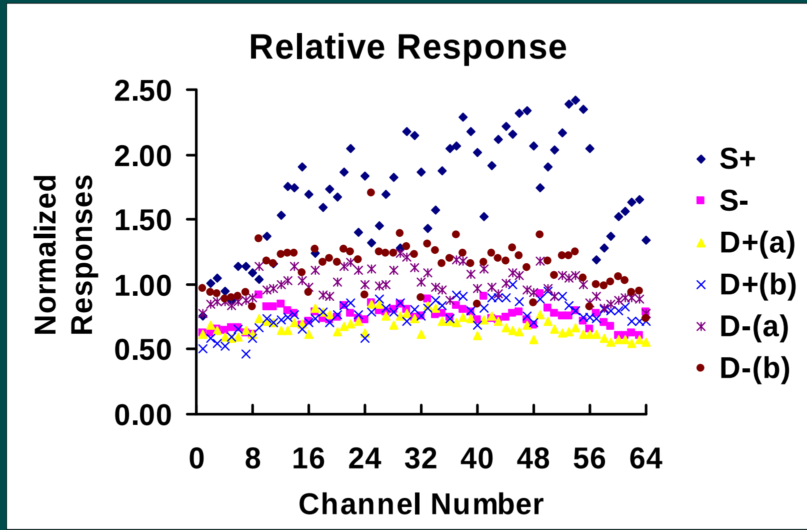
• RPC performance in BaBar – increased currents may be due to humidity
• fluorine production can cause damage to bakelite surface
• test stand results with IHEP RPC & KPIX readout – need reduced KPIX integration time or different signal coupling



Radioactive Source Calibration of Multi–Anode Phototubes (MAPMT)

Alexandre Dyshkant

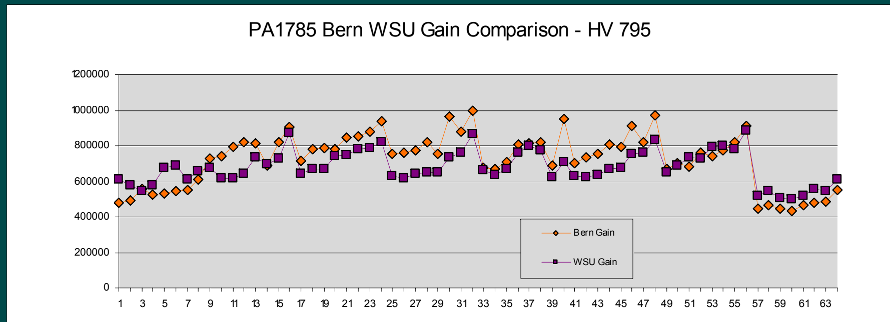
• goal: measure relative gain of each of 64 channels of tubes used in Fermilab beam tests of scintillator strip based muon detector
• Sr-90 source with EJ-200 scintillator
• Y-11 wavelength shifting optical fiber, 1.2 mm diameter, 1 m length
• picoammeter measures channel response

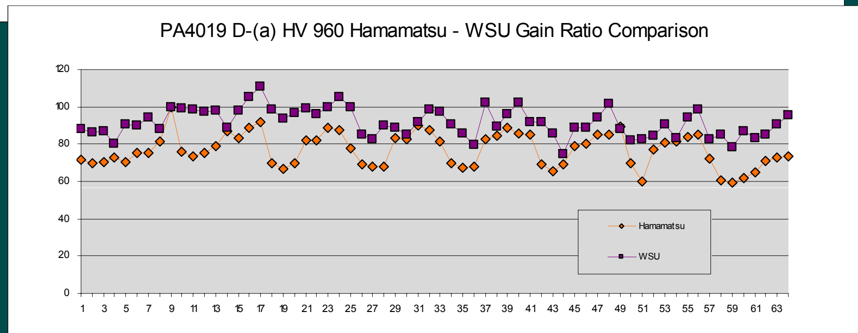


Pulsed LED Calibration of MAPMTs

Paul Karchin

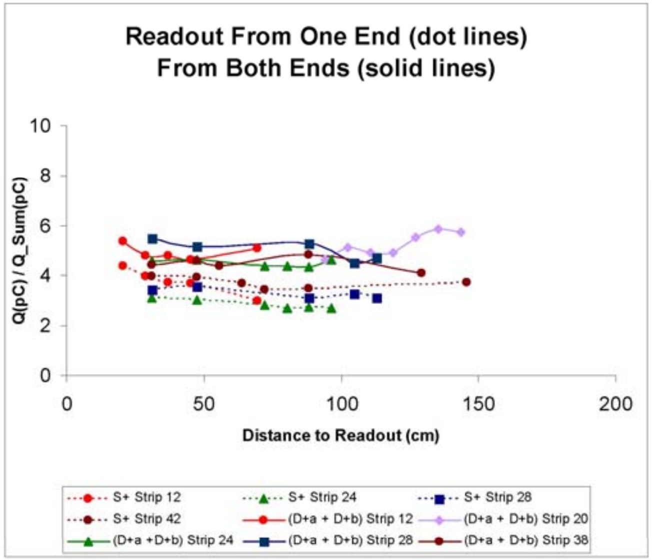
• alternative measurement of MAPMT gain for tubes used in Fermilab beam test
• response measured with gated (100 ns) ADC
• good agreement with measurement of same tube at Univ. Bern using similar technique
• good agreement with Hamamatsu and A. Dyshkant measurements using DC current





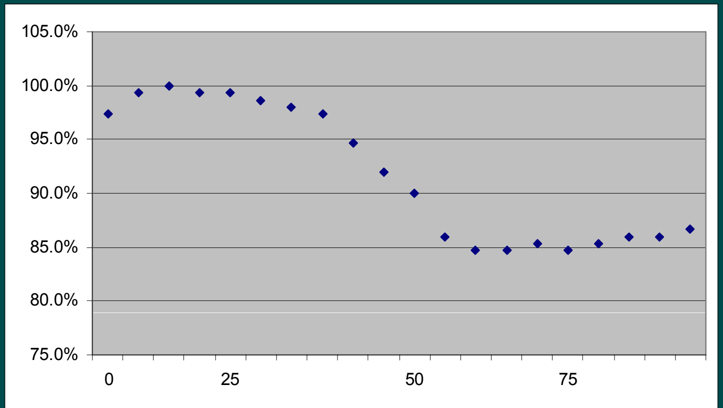
LC Scintillator-based Muon/Tail-catcher R&D: Analysis of 9/06 MTest Data Using Measured MAPMT Channel Response – Gene Fisk

- 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 Npe ~ 9
- double readout ~50% more signal than single
- plans: construct & test planes with SiPM readout



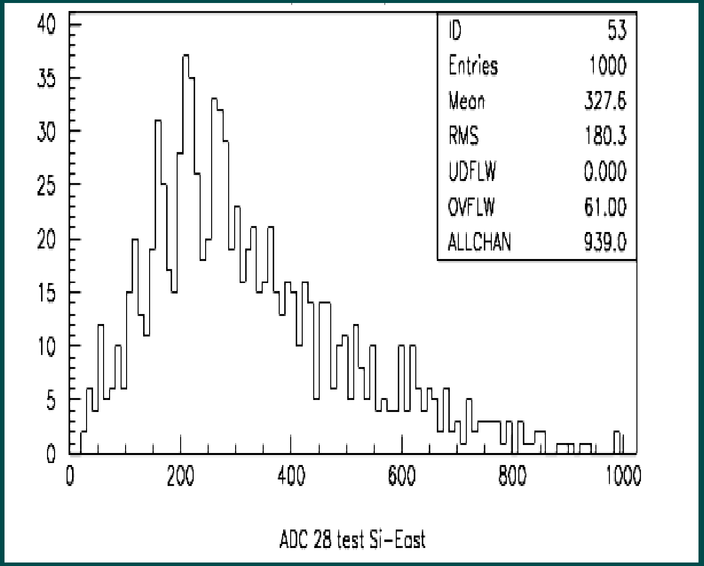
CALICE Tail-Catcher Muon-Tracker (TCMT) Preliminary Test Beam Results – Kurt Francis

- 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 ~ 10 photo-electrons
- response decreases with distance from SiPM
- plans: analyze summer 2007 data; move TCMT to Fermilab test beam

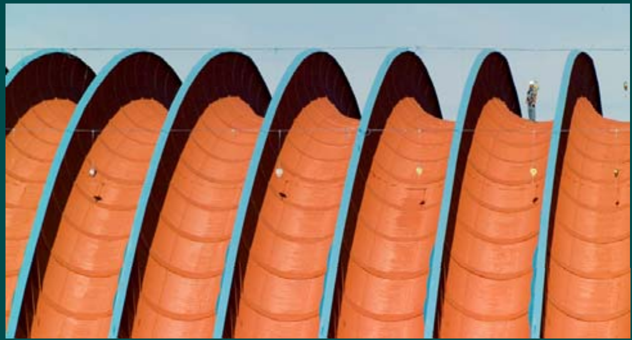


Tests of IRST SiPMs - Giovanni Pauletta

• C. Piemonte "A new Silicon Photomultiplier structure for blue light detection" NIM-A 568 (2006)
• distinguishing characteristics: very shallow junction; optimized for short wavelenghts (~400nm); polysilicon quenching resistors
• readout of scintillator bar at Fermilab test beam
• Npe ~ 6.5; noise rate ~ 1.5 MHz, gain ~ 1.6 x 10^6
• plans: instrument multi-strip plane for beam test at Fermilab

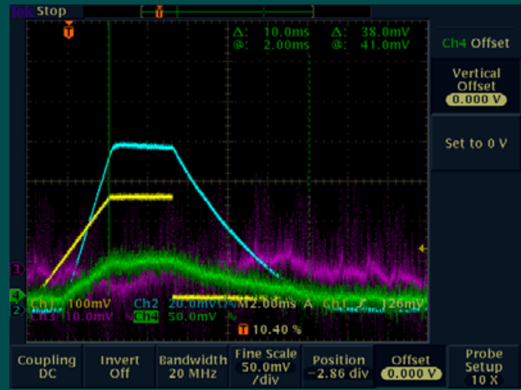


Fermilab's Meson Test Beam Facility

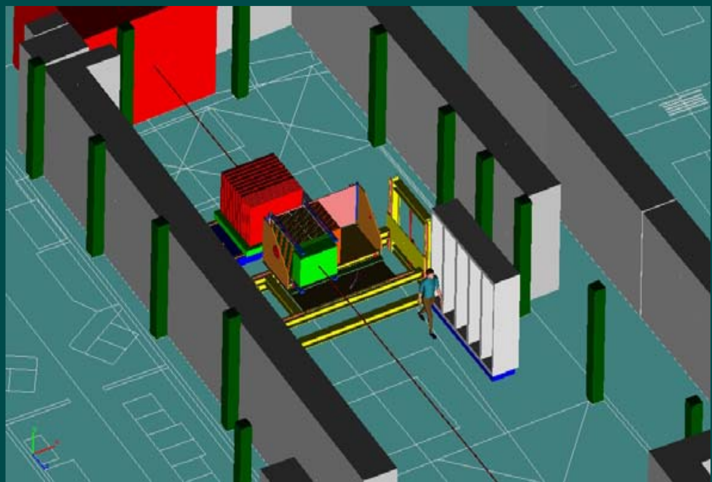


- **Accelerator Division created a new beamline for MTest:**
  - 13 magnets moved, 11 new elements, new target
- **Significant upgrade to user facility**:
  - New roof, new floor, diff. Cerenkov, pixel telescope

- AD now investigating how to simulate ILC beam structure



Pulsing the QXR supply with ~3 msec / 45 Volts

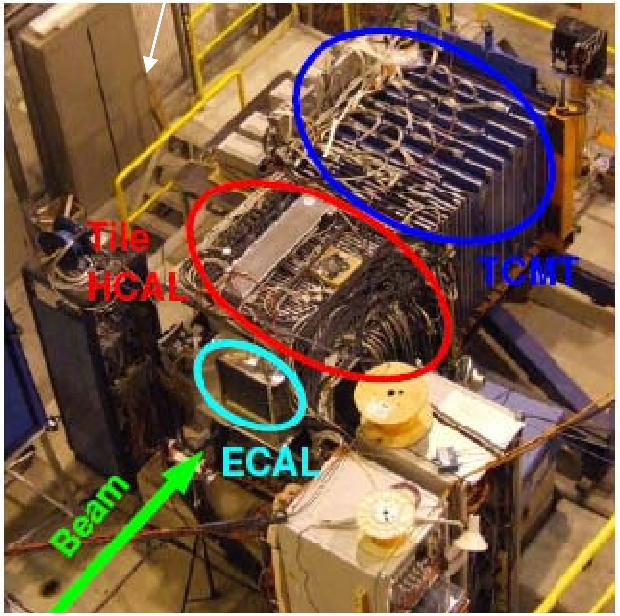


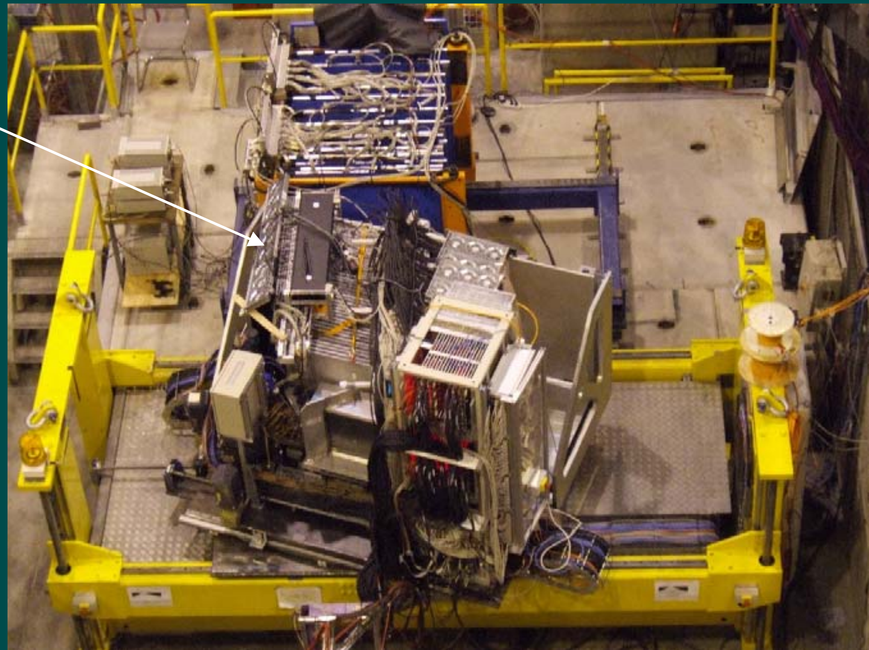
Beam Energy (GeV)	Rate per spill for 1E11 in MI	%Pions, Muons**	% Electrons**
16	95,000	82%	18%
8	65,000	42%	58%
4	51,000	26%	72%
2	38,000	34%	65%
1	23,000	<50%	>50%

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

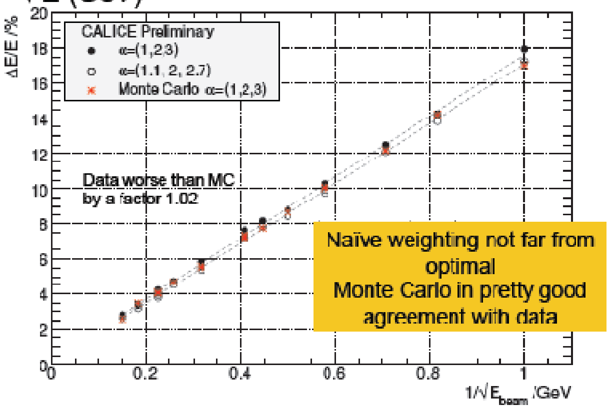
F. Salvatore

2006/2007 CALICE tb results





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



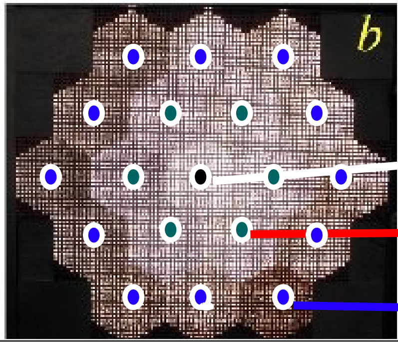
$$\frac{\Delta E}{E}(\%) = \frac{17.1 \pm 0.07}{\sqrt{E\,(GeV)}} \oplus (0.5 \pm 0.15) \qquad (\alpha_1, \alpha_2, \alpha_3) = (1.1, 2, 2.7)$$

- 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 π.



DAQ was 1 GHz 4-chan digital storage scope

transfer to counting house in fast air-core cables

Scintillating fibers

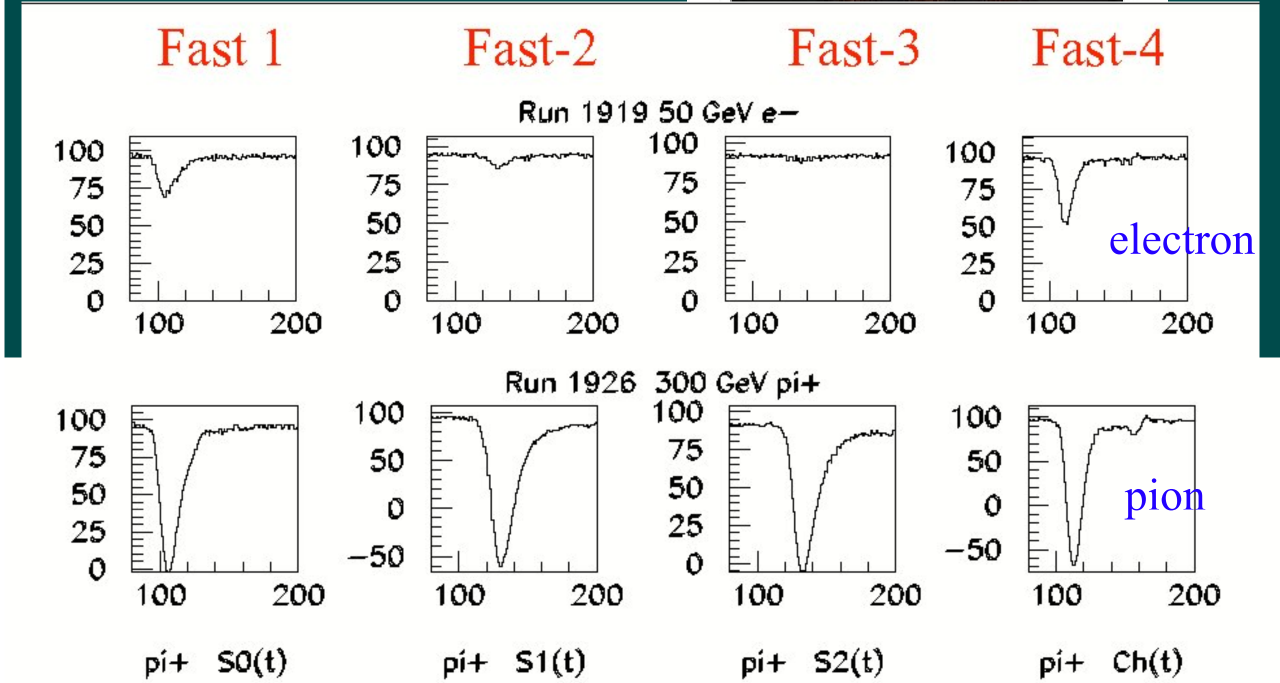
"Fast 1"

"Fast 2"

"Fast 3"

1o+6o+9o "Fast 4"

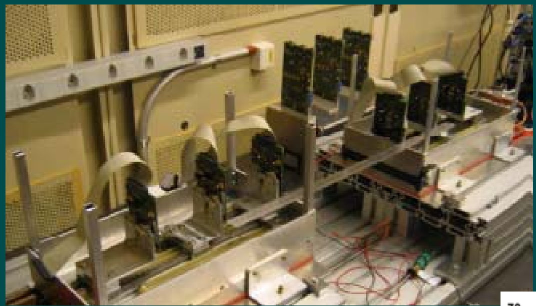
Cerenkov fibers



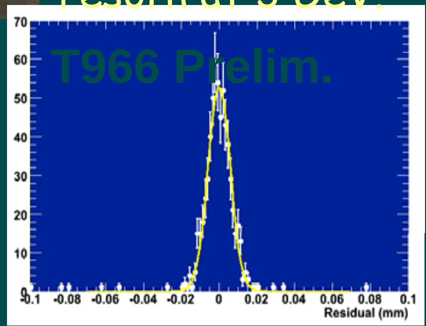
Vertex – M. Battaglia

Facilities for vertex detector tests:

1. EUDET DESY Pixel Telescope



(EU Consortium, IPHC sensors) 6 planes thin CMOS analog pixel tele-scope, expect ~ 1μm resol'n at 3 GeV.



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

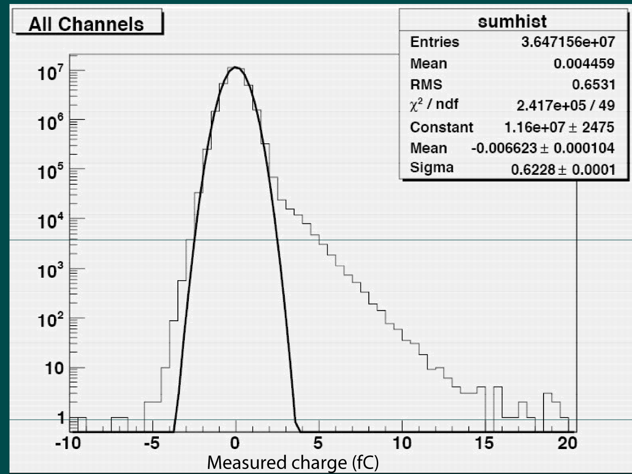
3. Hybrid Pixel Telescope at MTest FPix (BTeV) 4-6 high time resol'n, ~10 μ measuring stations.

4. LBNL LOASIS

e- beams with 10 MeV < E < 1 GeV; Can expose VTX detector elements to e's & γ'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 – >2010-?

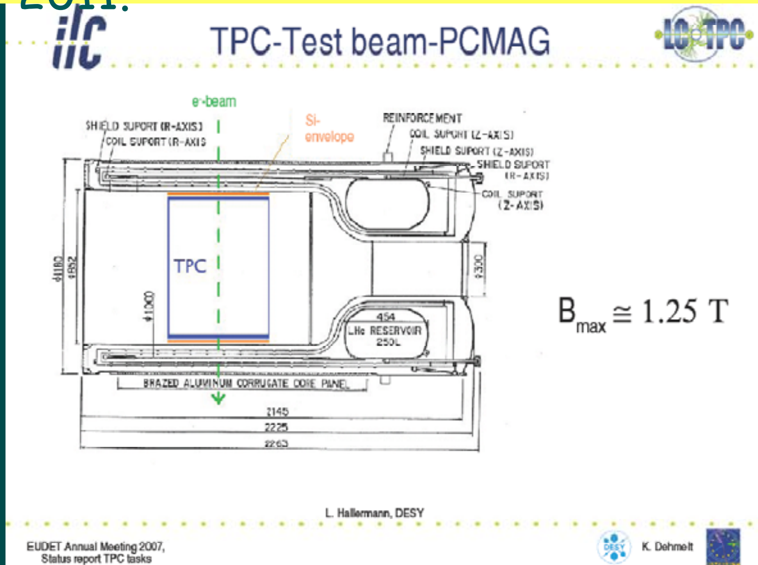
Tracking TB R&D – R. Settles

CluCou: Tests w/cosmics. No TBplans.

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

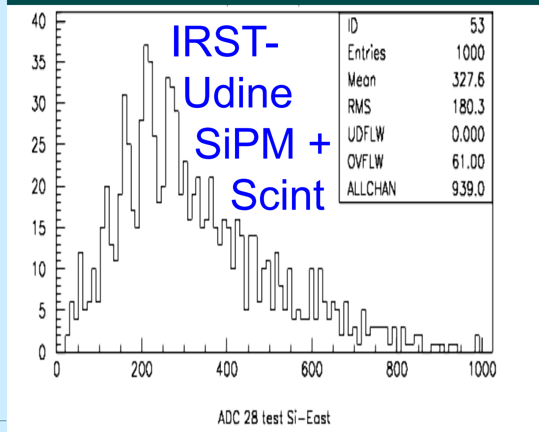
SiLC tracking: Standalone prototype test at CERN. Combine w/TPC at EUDET.

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.



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 $\sqrt{s} = 0.5$TeV - challenging
- dL/L $<2\times10^{-4}$ for GigaZ – very challenging
- LHCal – ID muons behind LumiCal
- BeamCal – instantaneous luminosity optimization (beam-strahlung pairs) and hermeticity

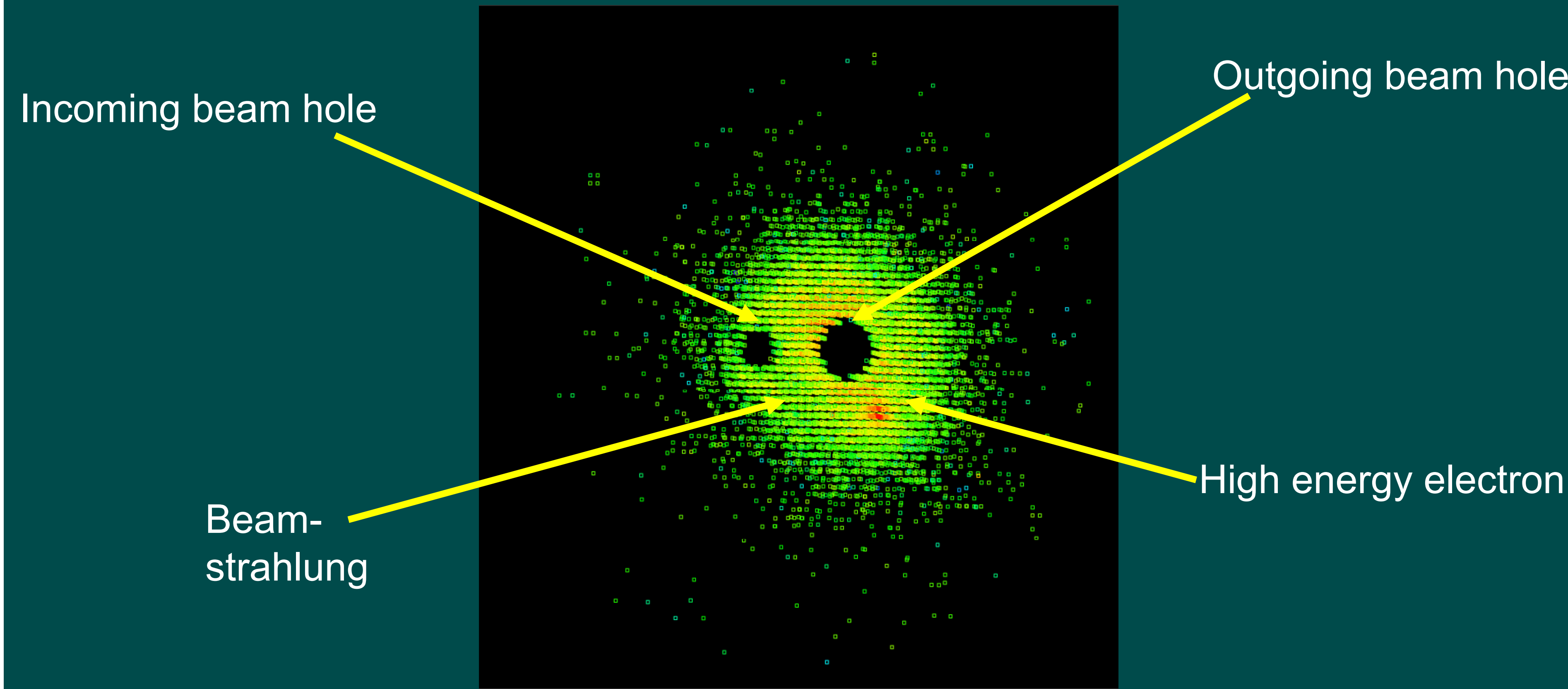
(Electronics from SLAC, Haller and Abusleme)

- GamCal - instantaneous luminosity optimization (beam-strahlung γ detector at z $\approx$190m)

(Morse, BNL)

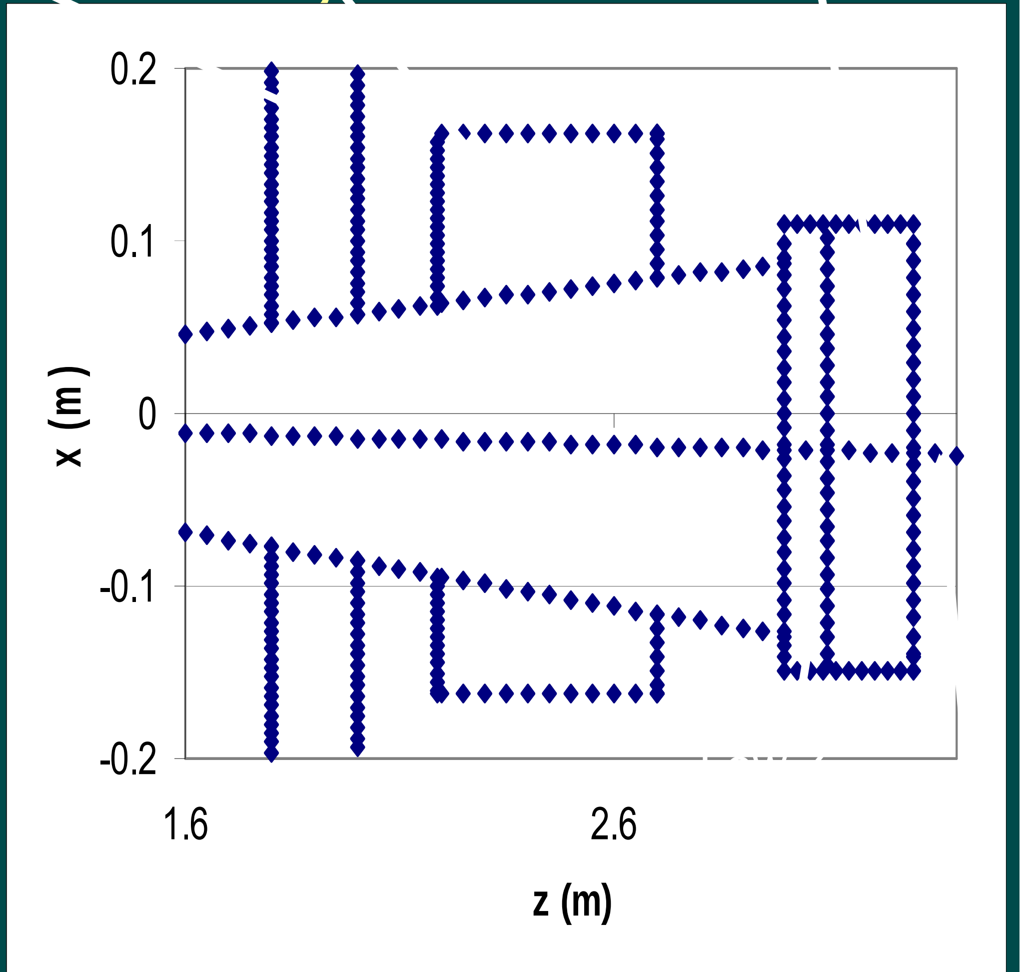
More US involvement needed!

BeamCal Hermeticity Studies - Univ. of Colorado, Boulder



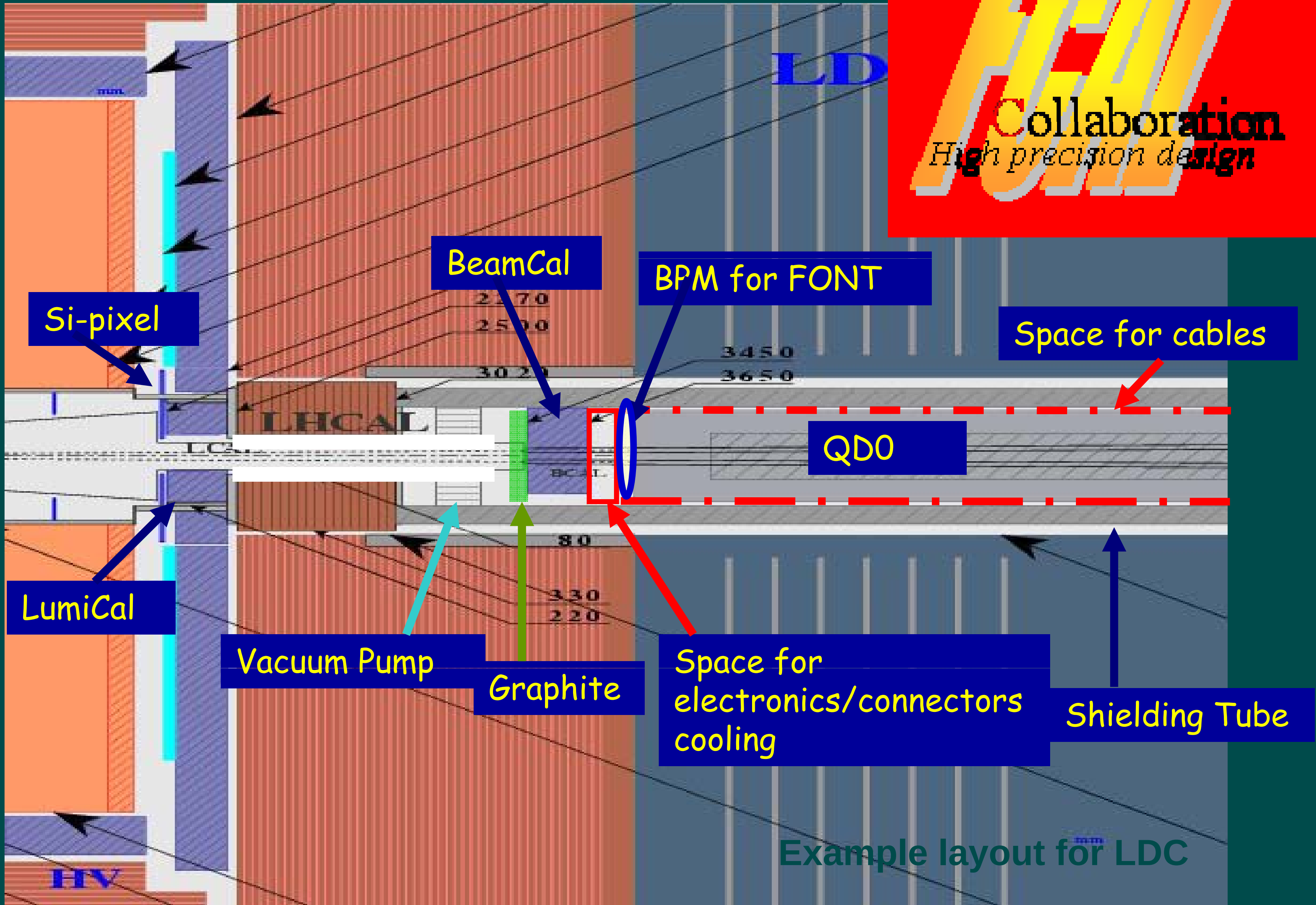
SiD LumiCal, LHCal, BeamCal

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



Forward Region Detectors

FCAL Collaboration
High precision design



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

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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 ~±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 2γ)
- 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^2/year at the SiD VXD detector
  (10^{10} n/cm^2 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