

ILC Test Beam

Snowmass 2005 / Aug. 15 – 27, 2005

Kiyotomo Kawagoe / Kobe University

TB conveners: Jae Yu and Felix Sefkow

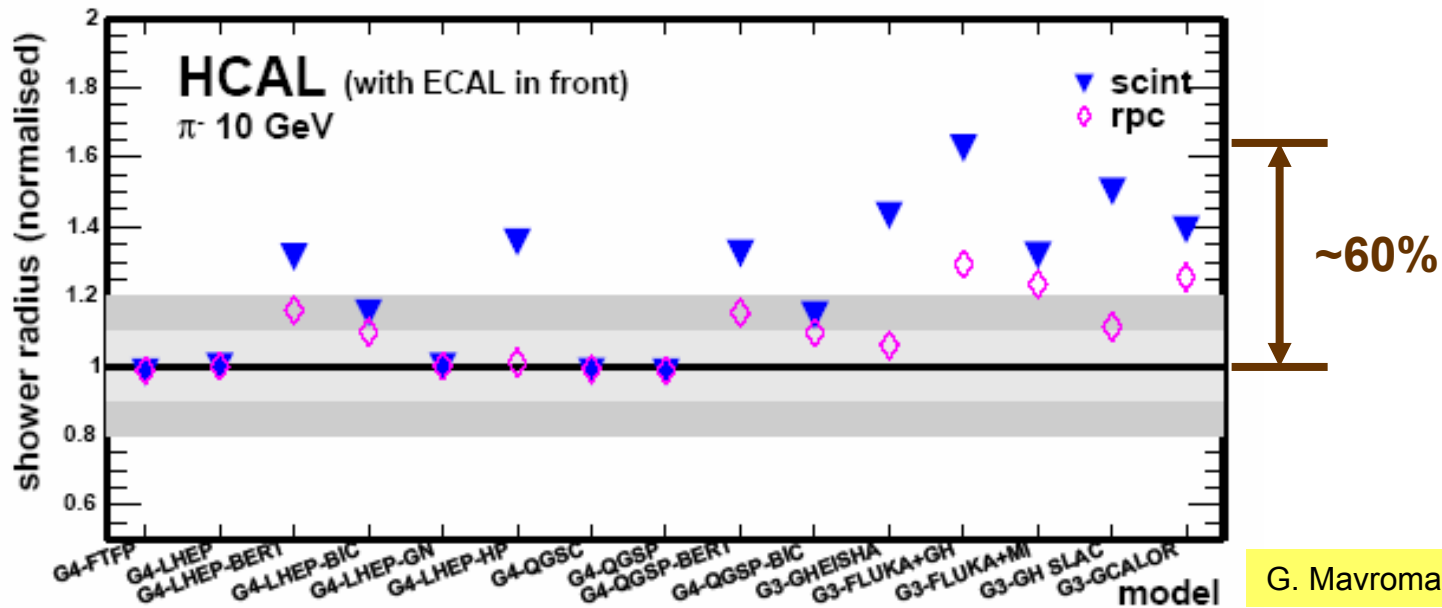
- Introduction
- What has been happening?
- Beam Test Timeline
- World-wide TB Organization
- Conclusions

Talks at Test Beam session

- Introduction --- Jae Yu
- Facilities
 - SLAC: FFTB and ESA --- Carsten Hast
 - FNAL: MTBF --- Erik Ramberg
 - FNAL: MIPP experience --- Rajendran Raja
 - CERN:PS&SPS/DESY --- Felix Sefkow
- Beam test activities
 - MDI/BI --- Toshiaki Tauchi
 - Calorimeter --- Vishu Zushi
 - Muon --- Marcello Piccolo
 - Vertex --- David Bailey
 - TPC --- Akira Sugiyama
 - Si-tracker --- Bruce Schumm
- Can't do justice in a 15 minute talk
- I am sure I have left out some important activities
- Please forgive me of this...

Introduction

- ILC TDR expected in 2008 puts urgency on detector R&D
 - Detector TDRs should be at the same time
- Concept studies and Detector R&D activities maturing rapidly
 - Technology choices need beam tests
- Significant progress in PFA development
 - Still need better understanding of hadronic shower



Aug. 26

G. Mavromanolakis *et al.*

What's been happening?

- Presentation at FNAL PAC meeting in April for CAL/Muon TB
 - resulted in a very positive invitation from FNAL directorate
 - A planning document for CAL TB submitted in Feb.
- Additional resources are being invested into MTBF
 - Beam line improvements have been made in the past several months
- Fermilab shut down schedule to finalize soon.
- CERN PS and SPS are available in 2006 (not clear in 2007 and onward): LHC has the priority.
- Funding for TB
 - In Europe, EUDET will deliver necessary infrastructure
 - In US, CAL Test Beam request to NSF through MRI not awarded

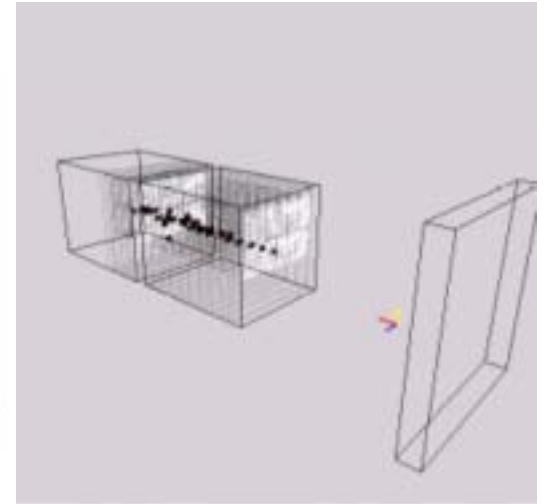
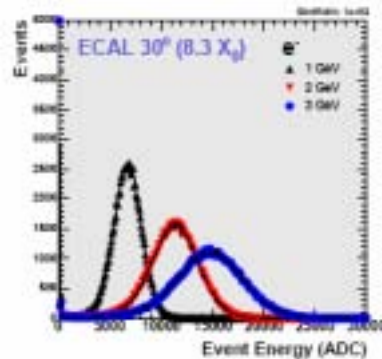
What's been happening?

- Detector TB plans are being crystallized
- Calorimeter groups making progress toward meaningful beam tests
 - CALICE prototype constructions in progress
 - Part of CALICE prototype being tested at DESY
 - Other TB runs (GLD ECAL, US SiW ECAL, etc.) expected in 2007 at Fermilab
- Tracking and Vertex groups' needs and requirements being documented
 - Massimo Caccia and David Bailey

CALICE ECAL: Exposure to beam



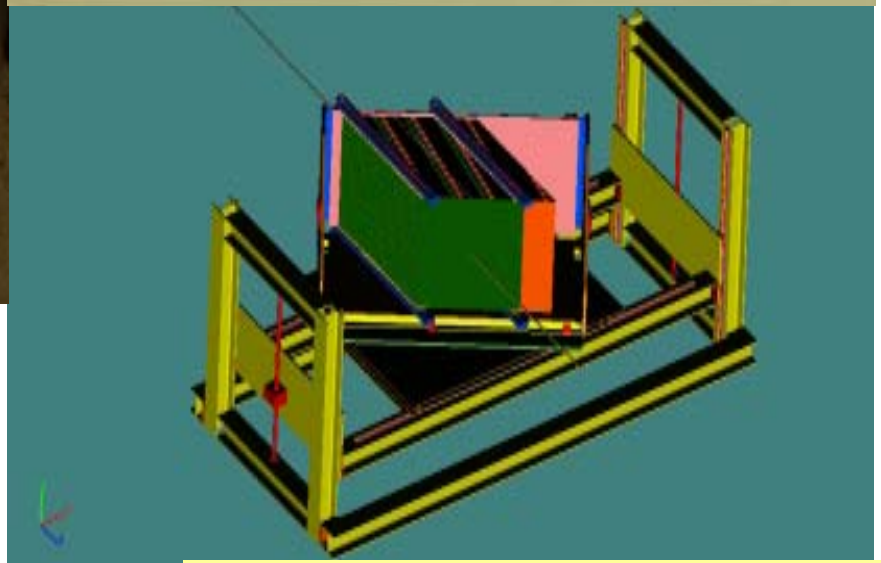
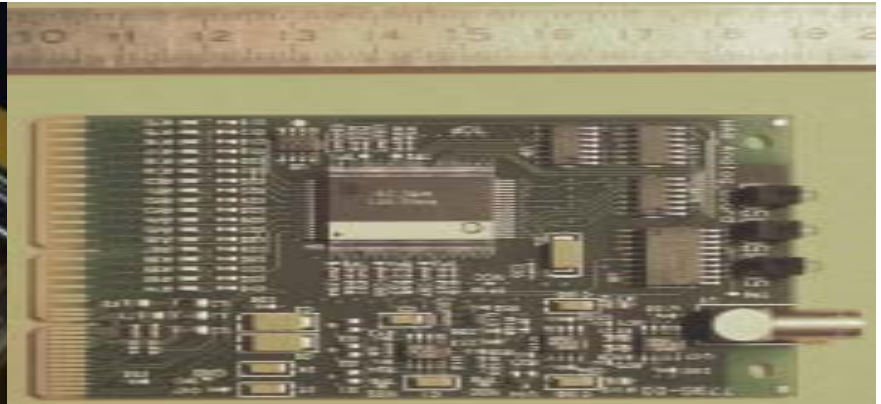
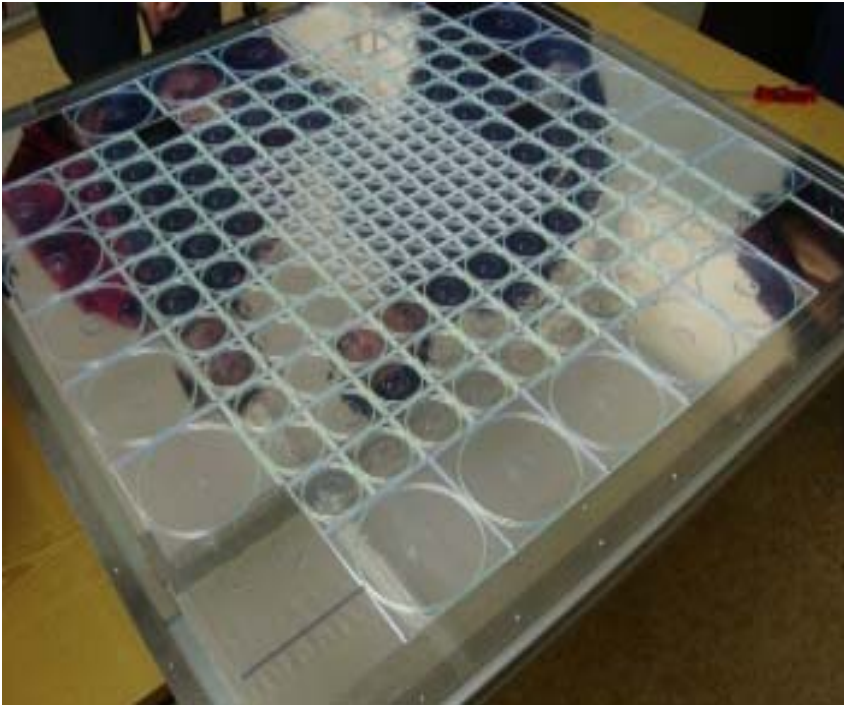
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Test in Feb. 2005 at DESY
14 layers ($\sim 3k$ channels)
 20×10^6 events collected
with Japanese drift chambers

Longer run with full detector in 2006
Readout integration R&D continues

CALICE Scintillator AHCAL



In the construction and assembly phase
Hoping to see beam in mid-2006

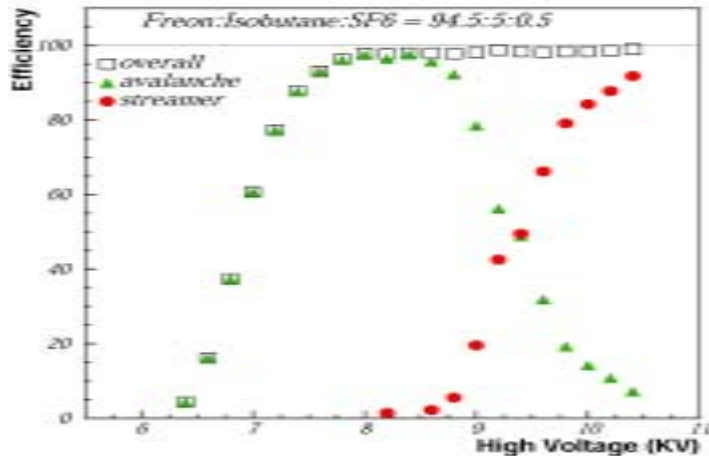
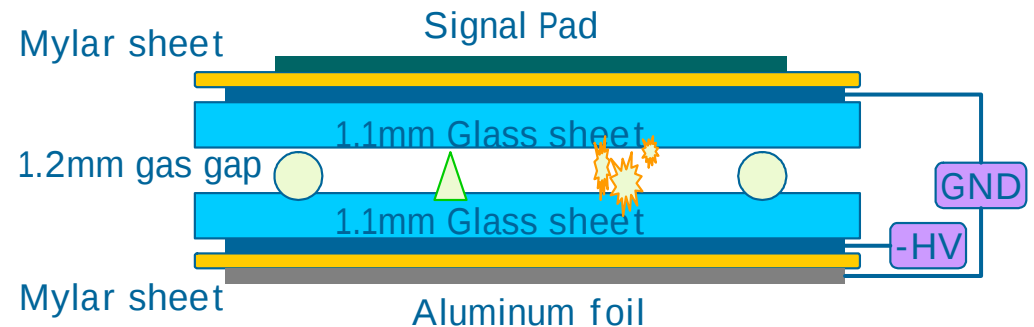
This moving stage can be used
for other ECAL/HCAL

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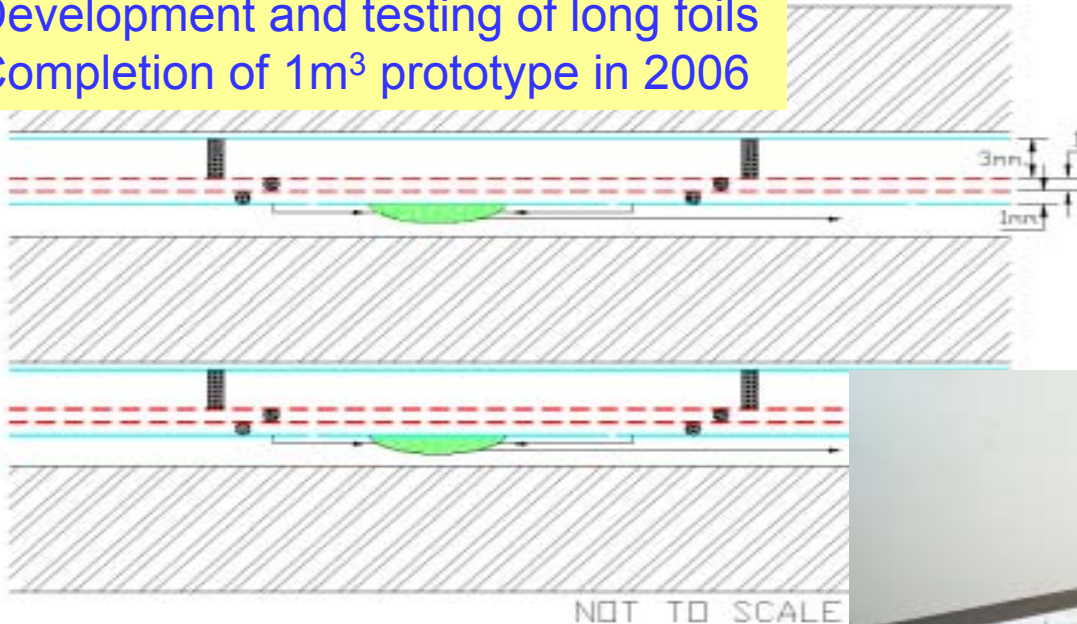
CALICE RPC-based DHCaI

10 RPC's built for studying
no. of gaps, resistivity,
chamber configuration and size

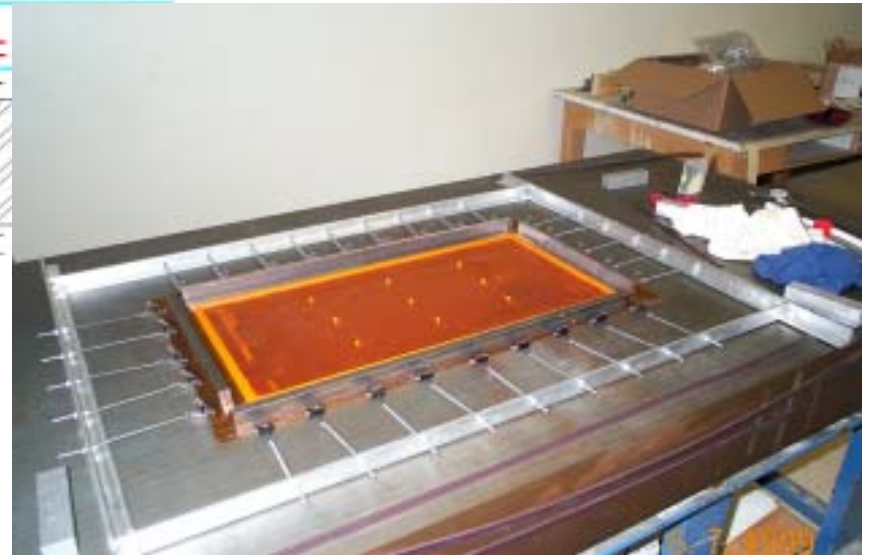
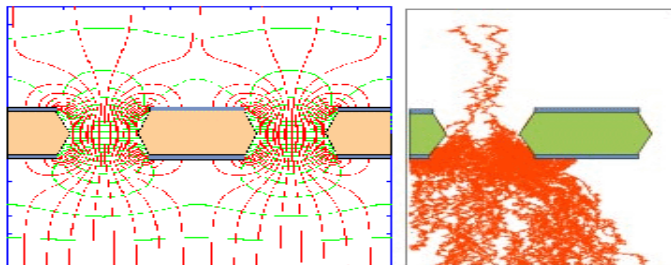


CALICE GEM-based DHCaI

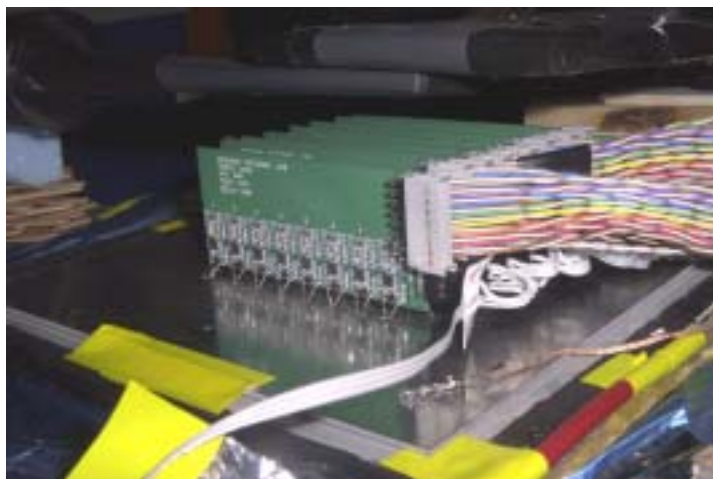
Assembly of five 30cm x 30cm GEMs
Development and testing of long foils
Completion of 1m³ prototype in 2006



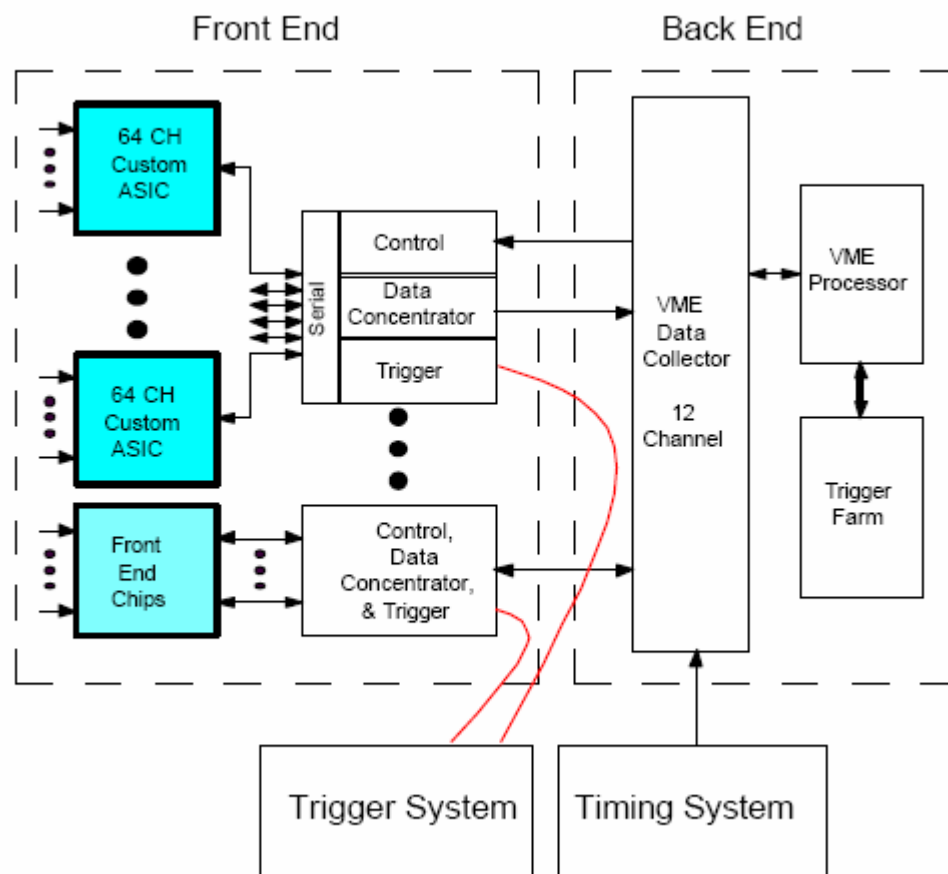
Ar/CO₂ gas mixture
Amplification with dual foils
 $G \sim$ several thousand
Each layer 8-9 mm thick
1cm x 1cm pads
1-bit readout



CALICE DHCAL READOUT

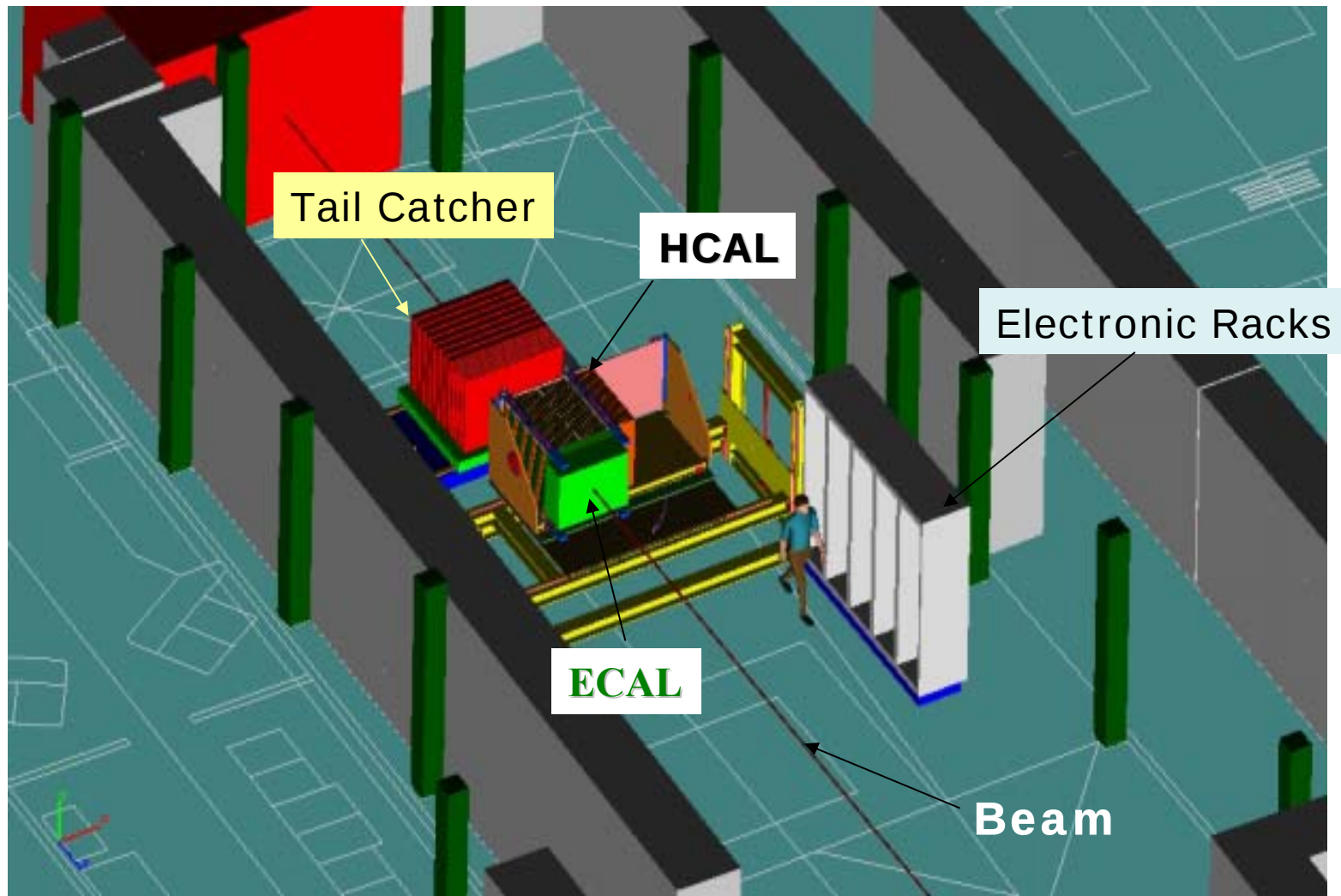


40 layers
1cm x 1cm pads
64 channel custom ASIC
(1-bit readout)
Also used for GEM-based
HCal prototype

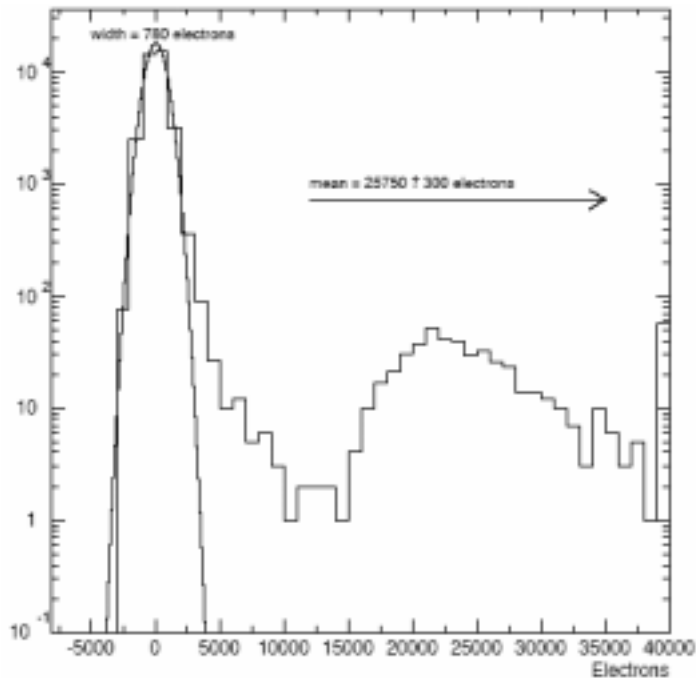


Hope to be ready for beam in 2006-07

Example of CALICE Setup at MTBF

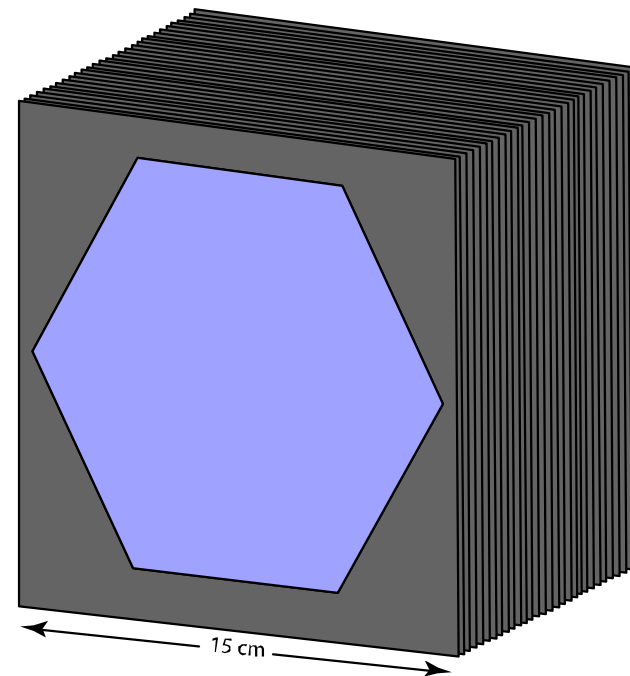


US SiW ECAL



1 wafer/layer (750 pixels)
30 layers
2.5 and 5 mm Tungsten plates

64-channel chip submission soon
One layer beam test in 2006
Full assembly in mid-2007

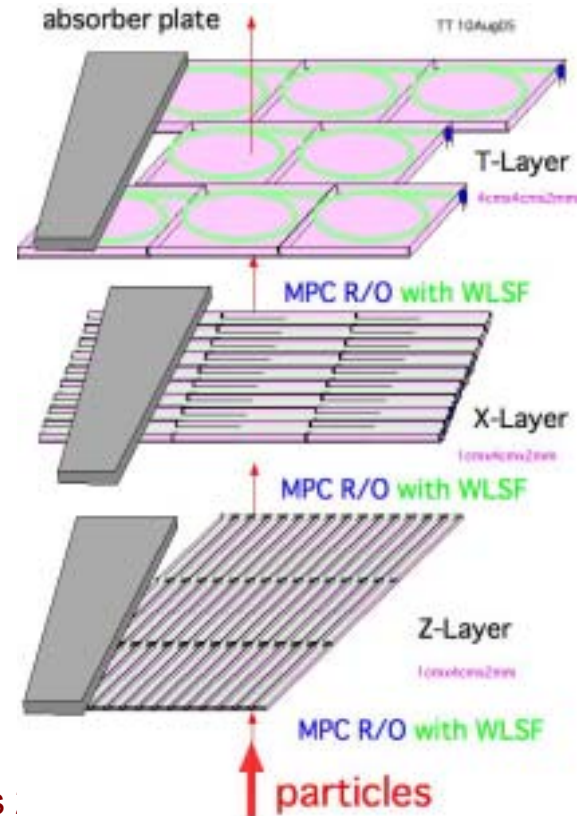


GLD Scintillator ECAL

OLD ECAL module tested at KEK
Lead + scintillator strips
Clean fiber + MAPMT for readout



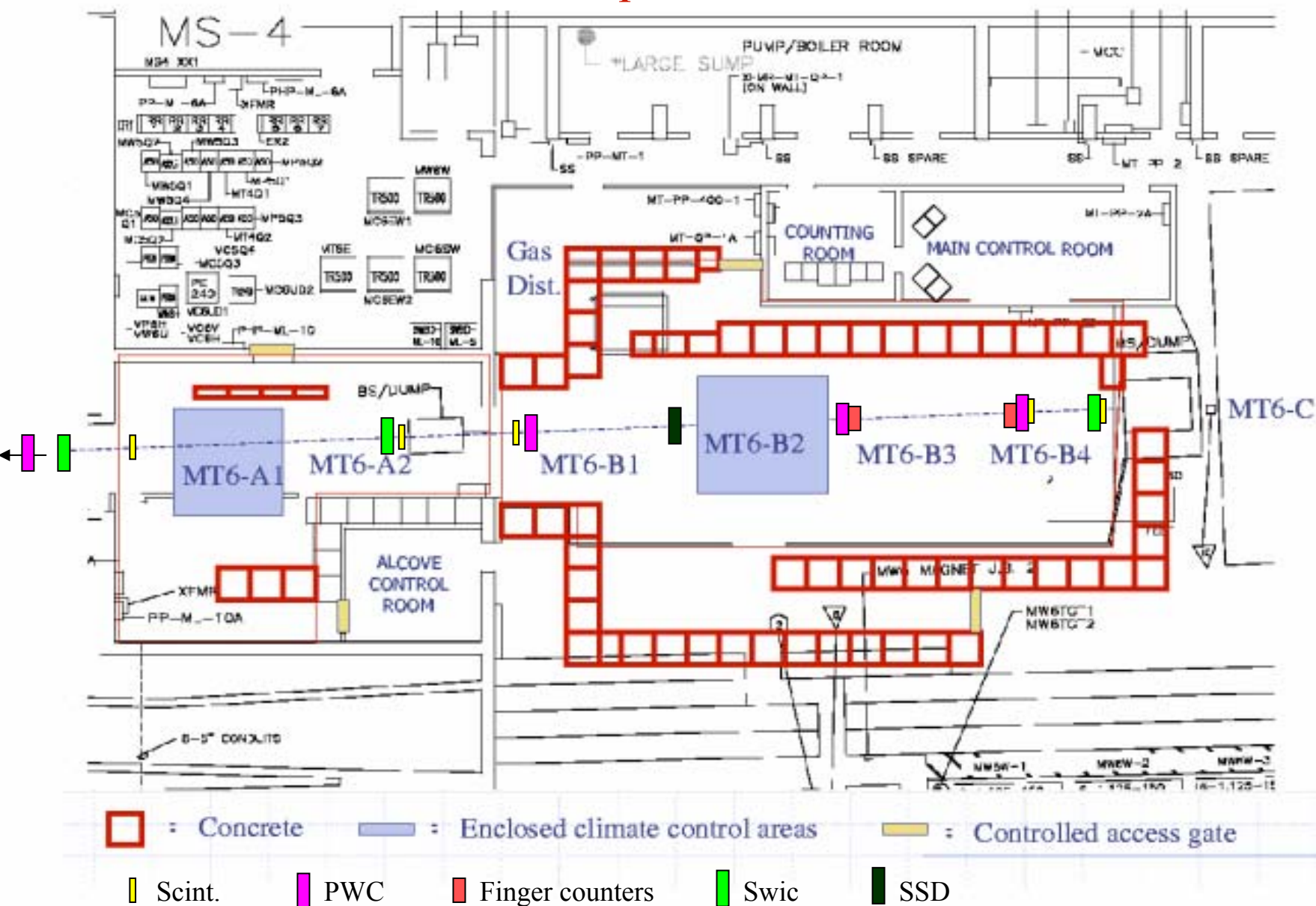
Planning New ECAL module
Tungsten + scintillator strips
Directly attached SiPM/MPC for readout
To be tested in 2007 at Fermilab



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MTBF experimental area





← One of the two beamline Cerenkov counters

One of three MWPC stations →



← Remote controlled scintillator finger counters

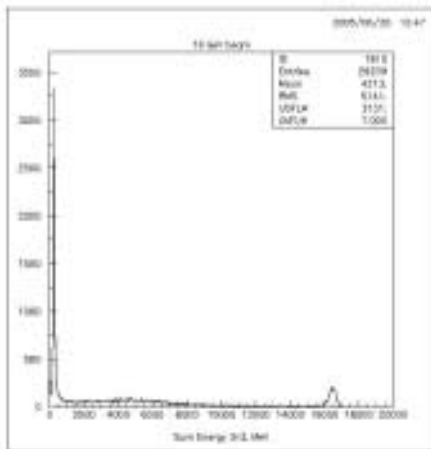


→ Silicon tracker



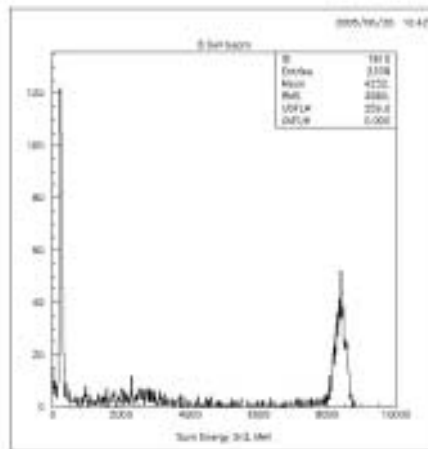
Electrons at MTBF

- During the last run of the BTeV EMCAL group in June, the lead tungstate calorimeter was calibrated using MIP peaks.
- Momentum selected electrons were easily identified in the 4, 8, 16 and 33 GeV tunes.
- Improvements in the beamline (better vacuum and reduction of material) made for a better electron peak.
- Rates can probably be doubled rather easily.
- The Cerenkov trigger worked very well but, of course, introduces material in the beam.



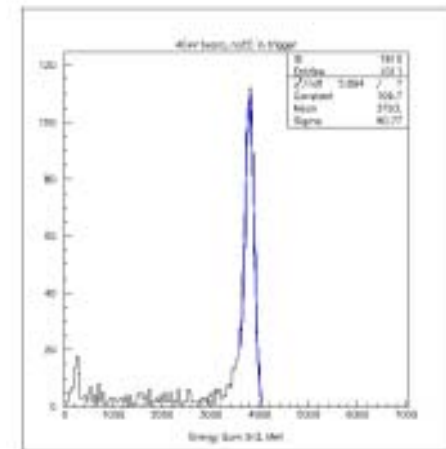
16 GeV tune

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8 GeV tune

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4 GeV tune

TPC prototype beam test at KEK

- 2004 Jun. WMPC-TPC
MPI, DESY + CDC(Asia) group
- 2005 Apr. GEM-TPC
MPI, DESY + CDC
- 2005 Jun. MM-TPC
Saclay, Orsay, Carlton, MPI, CDC
- 2005 Oct. MM-TPC, GEM-TPC : Registive Foil
Saclay, Orsay, Carlton, MPI, CDC

Now collaboration became really international.



portable, standalone operation

Status

DESY plans to build a facility for Large Prototype
based on EUDET

magnet, electronics, field cage...
specific R&D items are left for every R&D groups
electron beam is available

Asia(KEK) submit a proposal for Large Prototype, but
KEK PS will be shut down from the end of this year
but J-PARC testbeam will be available from 2008(?)
KEK has SC solenoid excited every day

CERN, Fermilab, SLAC,,, have beam lines
but member of LCTPC doesn't exist here

DESY will be a only place for LCTPC test?
Test beam @DESY is enough ?
Hadron beam ??

Si-tracker and VTX

- Si-tracker
 - For μ strip tracking, resolution studies point towards stiff (10-50 GeV) beam with 1-cm² beam profile and slow spill with $\sim 10^4$ Hz rate during beam spill
 - Lower energy (~ 5 GeV) beam in high field (~ 5 T) might be useful – would need to explore.
- VTX
 - Sensor technologies need an infrastructure that will provide point resolutions of $\sim$ few microns
 - EUDET for the infrastructure in Europe
 - Testbeam plans at CERN and Fermilab considered
- Requirements for the beam tests being documented

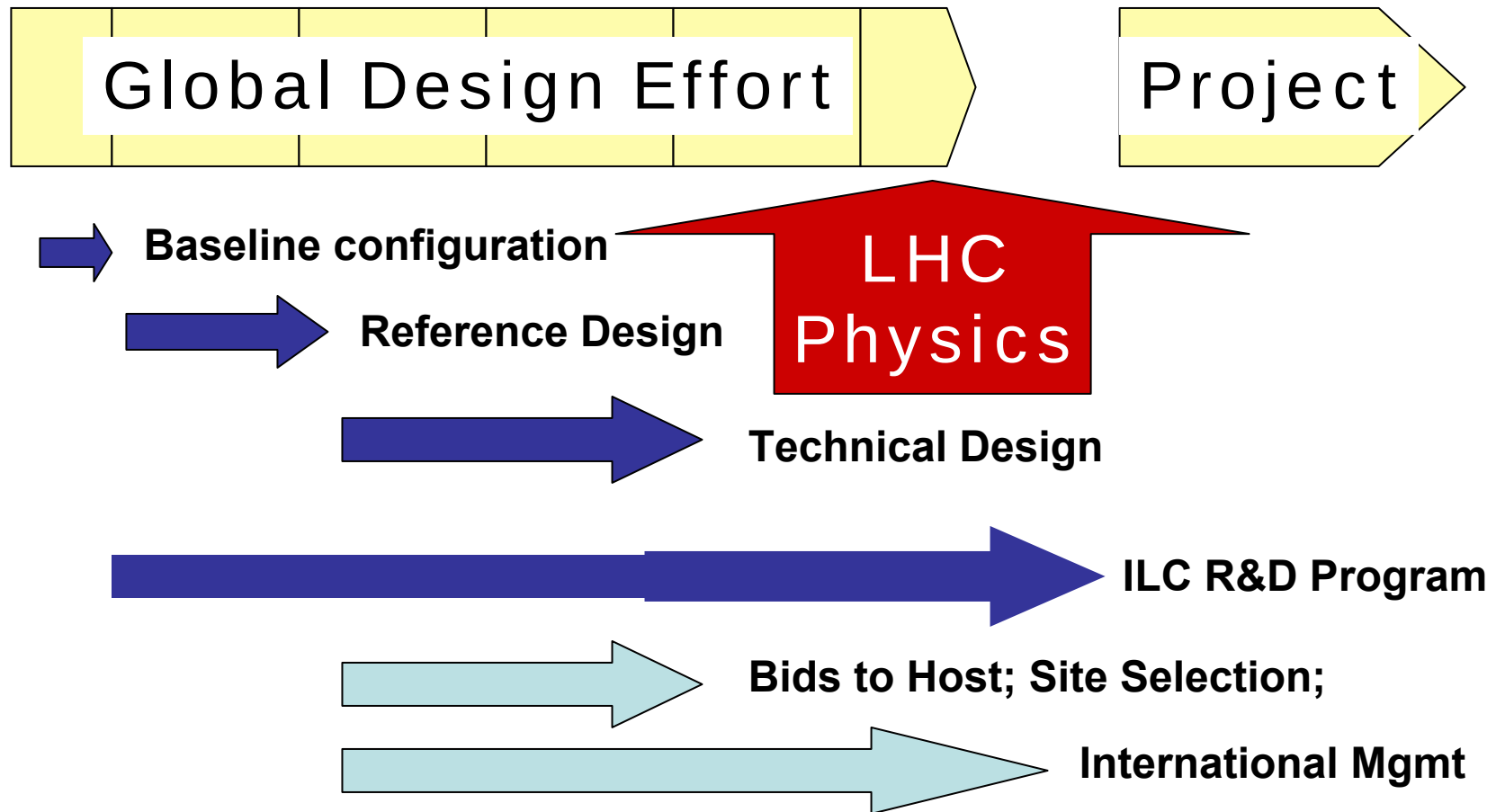
Two Major Test Beams for MDI/IPBI

Typical Parameters

Test Beam	ESA@SLAC	ATF(2)@KEK
Energy	28.5 GeV	1.3 GeV
Bunch Intensity	2×10^{10} single bunch	0.5×10^{10} /bunch 1-20bs/train
Frequency	10Hz	a few Hz
Beam size	100-200um	37nm - 10um
Bunch length	300um	8mm

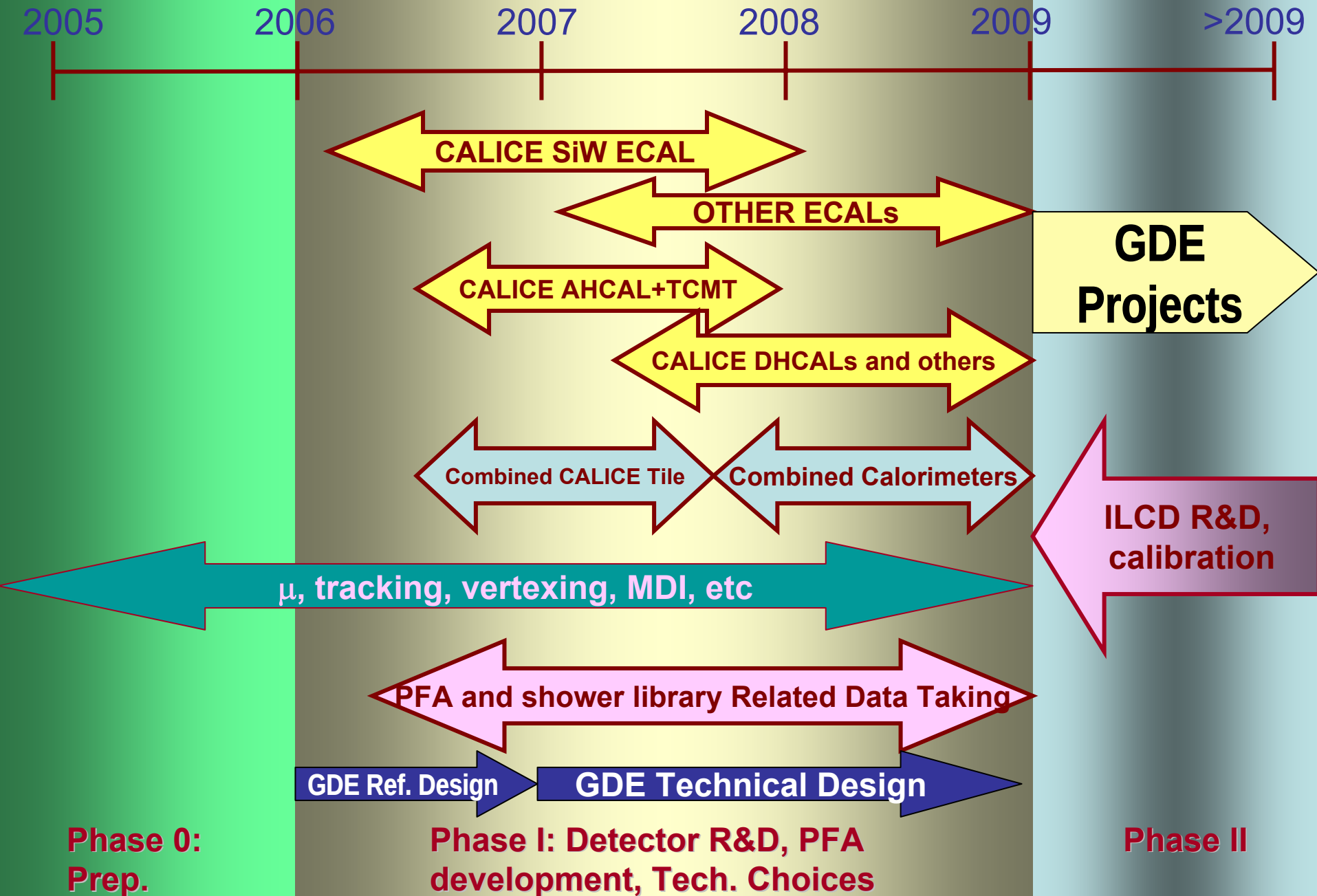
The GDE Plan and Schedule

2005 2006 2007 2008 2009 2010



Barish

Timeline of Beam Tests



Coordination and Funding

- WW TB Coordination efforts
 - Regional TB contacts
 - Europe: F. Sefkow & V. Vrba
 - Asia: K. Kawagoe
 - North America: G. Fisk and J. Yu
 - Have been meeting regularly every 6 weeks for coordination since LCWS2005 at SLAC
 - Important for you to keep the regional contacts up-to-date on your plans and activities
- Funding efforts
 - EUDET proposal for European test beam infrastructure successful
 - US Calorimeter groups' MRI proposal for testbeam not awarded

Conclusions

- Tremendous amount of activities
 - Anticipated to increase dramatically
 - Though US CALTB activities rely heavily on availability of funds
- Limited number of facilities for a combined calorimeter beam tests
 - CERN possibility being investigated
 - Fermilab making facility improvement with LC TB community
- VTX and Tracking integration effort begun
 - Requirement document being prepared
- WW coordination effort to pick up momentum