

Test Beam: Calorimetry

Vishnu V. Zutshi

NIU/NICADD

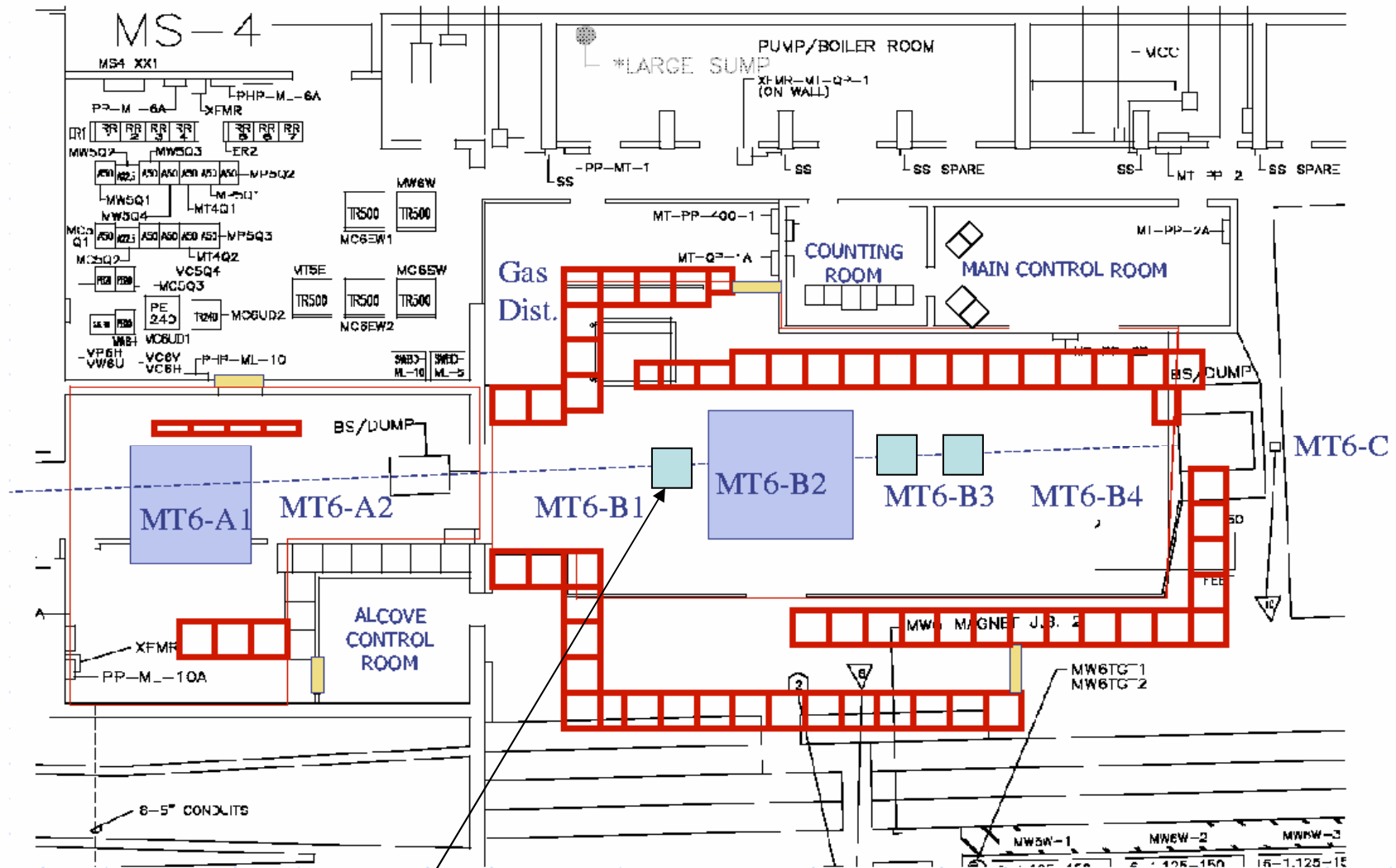


NORTHERN ILLINOIS
UNIVERSITY

General Comments

- LC calorimetry R&D: a diverse effort
- Apologies for missing out or inadvertently misrepresenting any particular project
- Schedules are tentative and reflect the technical assessment of groups and may not reflect the funding realities

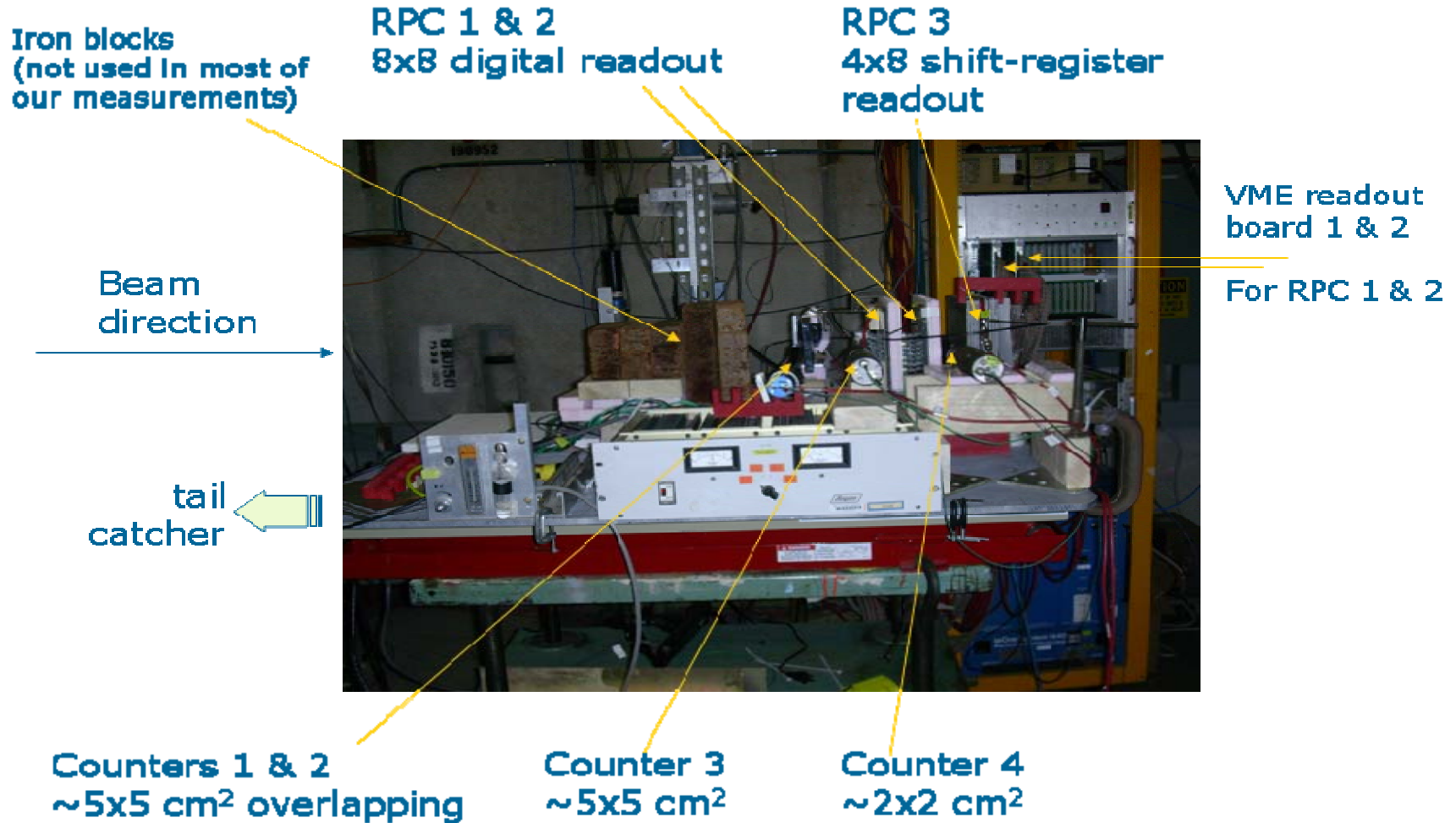
MT6 Test Beam User Areas



= Concrete
 = Enclosed climate control areas
 = Controlled access gate

See talk by R. Abrams

CALICE RPC HCAL

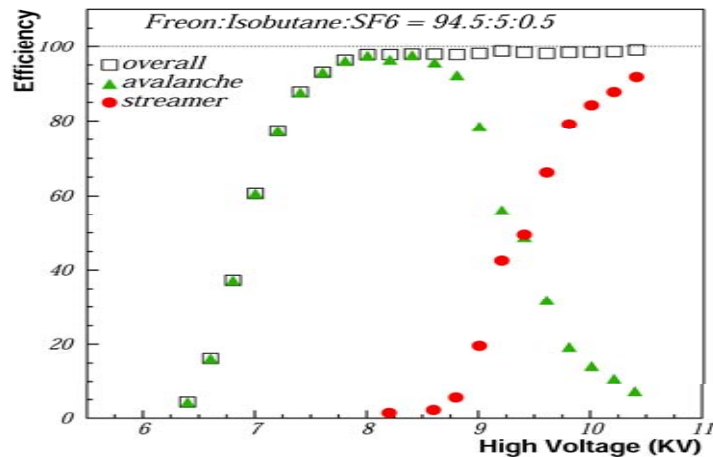


CALICE RPC HCAL

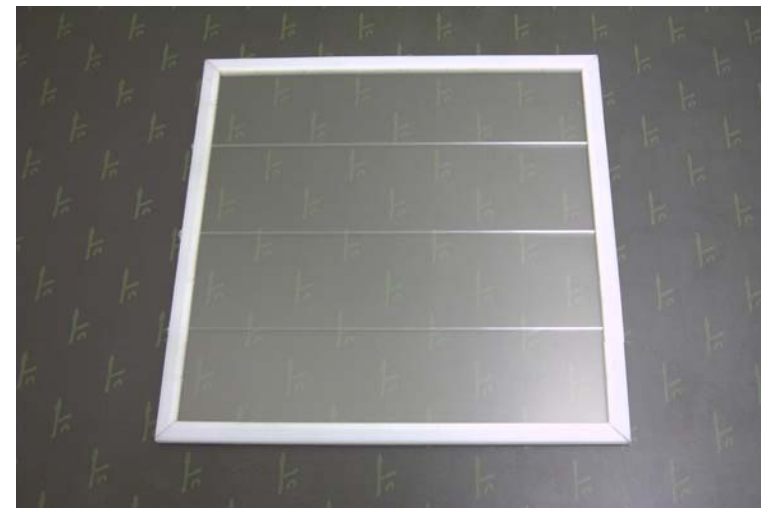
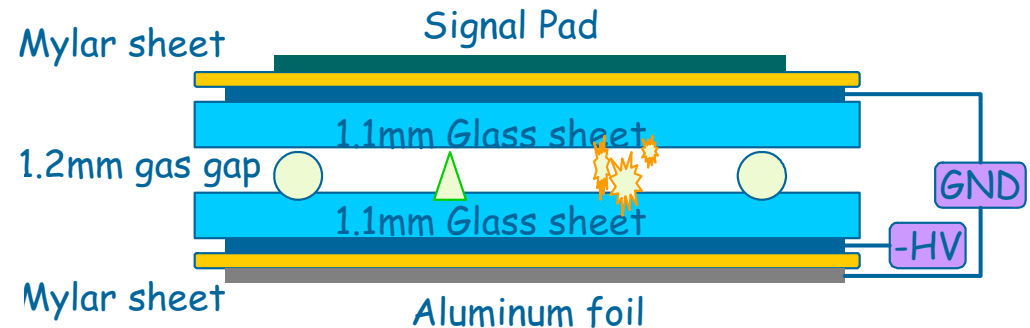
- Set-up behind beam dump Jan. 2006
- Moved into beam on Feb. 22nd
- Took data for 2 x 6 hrs.
- 120 GeV/c protons with beam intensity varying between 70 and 5000 Hz/cm²
- Hope to have measurements of efficiency and pad multiplicity vs particle rate

CALICE RPC HCal

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



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



Slice test in 2006
Full prototype constructed in 2007

CALICE RPC HCal (Russia)

Was done

1. Chamber R@D itself

2. Tests of 1m² RPC plane with strips

- 1.2 mm monogap glass RPC, 6 mm thickness
- robust design with 2mm steel caps
- efficiency ~94 %, nonuniformity ~2%

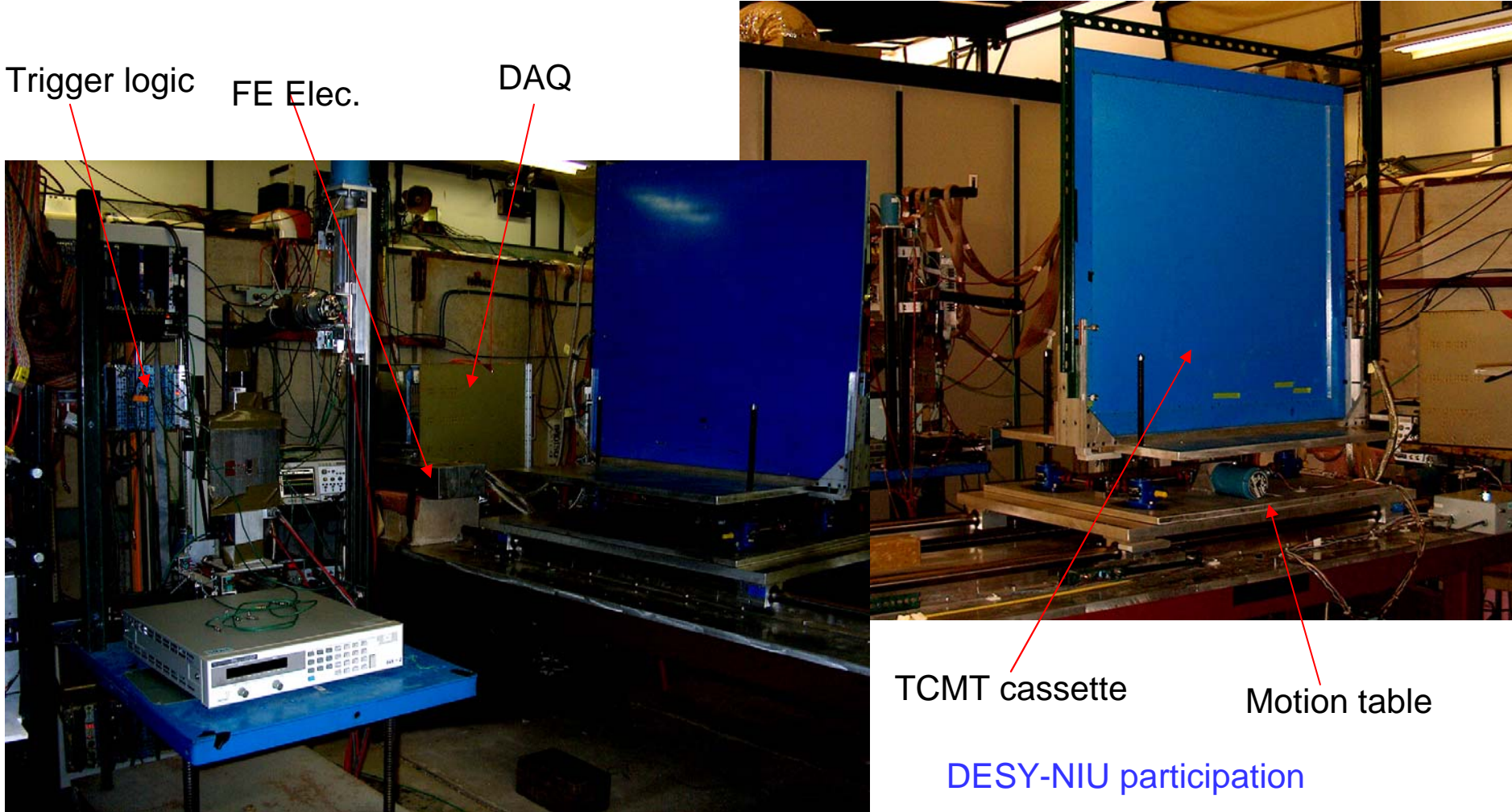
3 .Tests of RPCs in 5T mag field in DESY

- There was no difference in RPC behavior when 5T was on or off
- Prototype of 64 ch. FEE printed board was tested successfully , PCB is outside of RPC and includes 8 channel MINSK chips OKA (amp.+disc.), ALTERA EP1K50 as FPGA and RS232 driver for sequential read out with PC

Ongoing

Beam tests in IHEP of 1 m² RPC plane with 32x32=1024 channels
(Nov05)

CALICE Tail-catcher/Muon Tracker



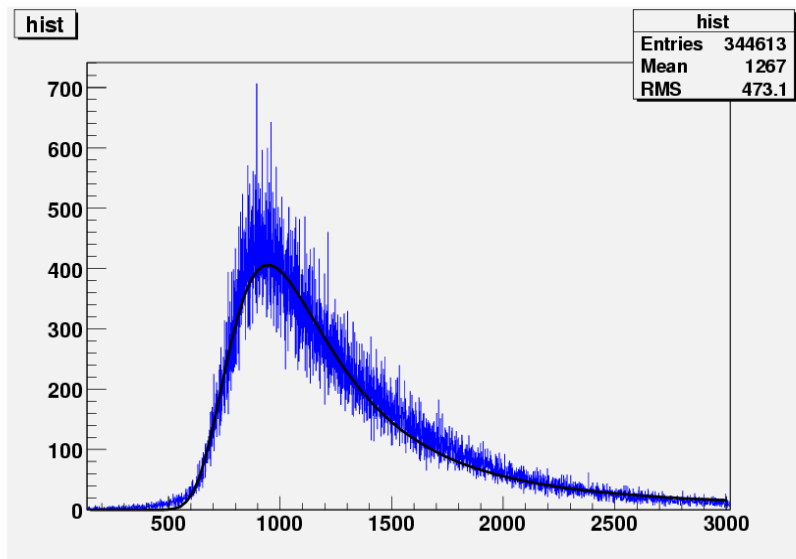
3/14/2006

V. Zutshi, LCWS 2006

CALICE TCMT

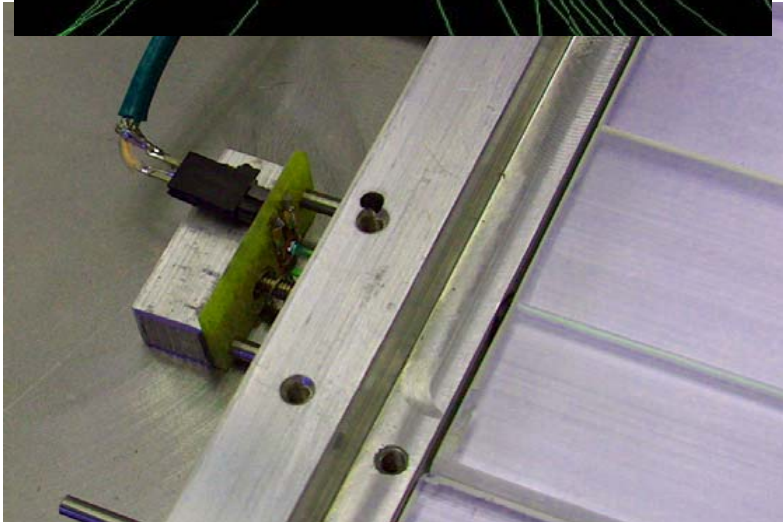
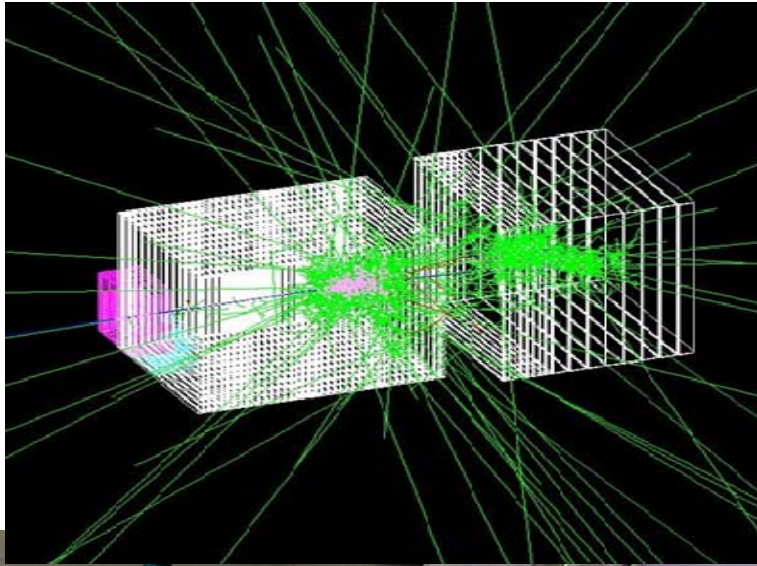


- Moved into the facility 3rd week of Feb.
- Took beam in the last week ~ 5 days
- Took 120 GeV/c protons, 16 GeV/c (mostly pions) and some beam dump muon runs
- ~ 1M events collected



3/14/2006

V. Zutshi, LCWS 2006

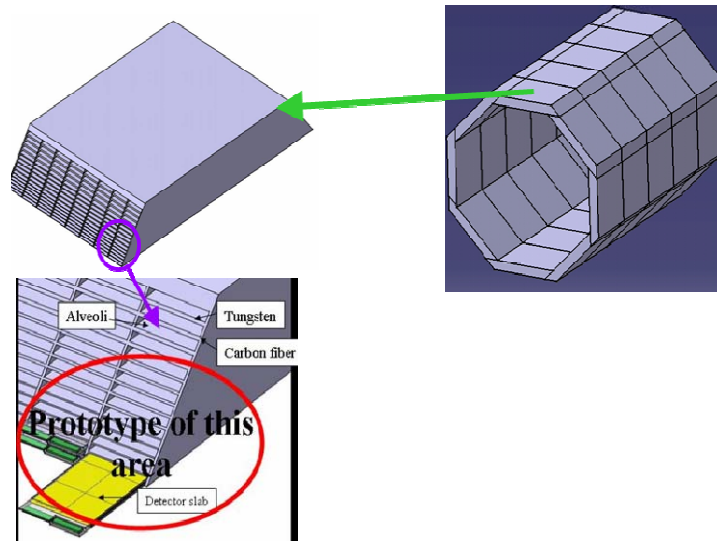


In construction and assembly phase
Plan to see beam beginning mid-2006

Experience at MTBF

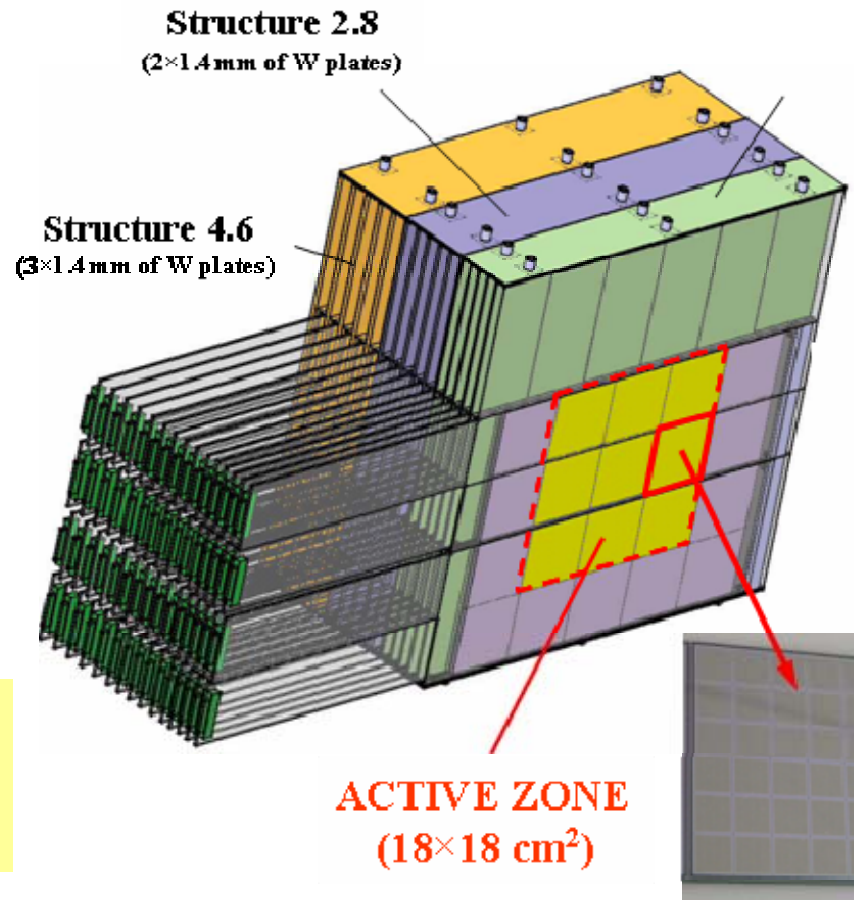
- Overall very positive
- Responsive to competing needs of the users in the last minute rush
- SY120 kept operational while rest of the complex shut down
- Safety
- Environment control outside beam area

CALICE Si-W ECAL

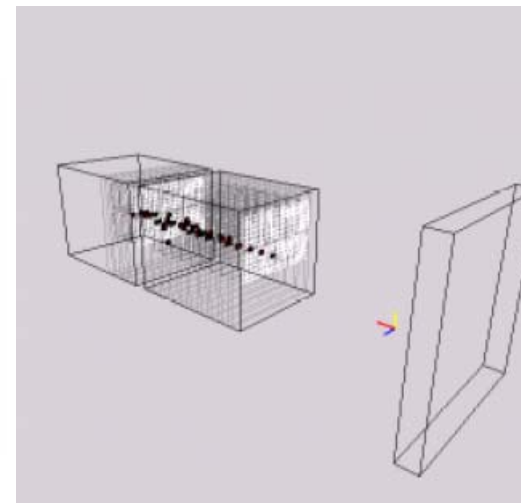
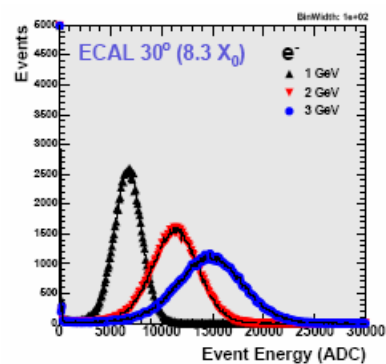
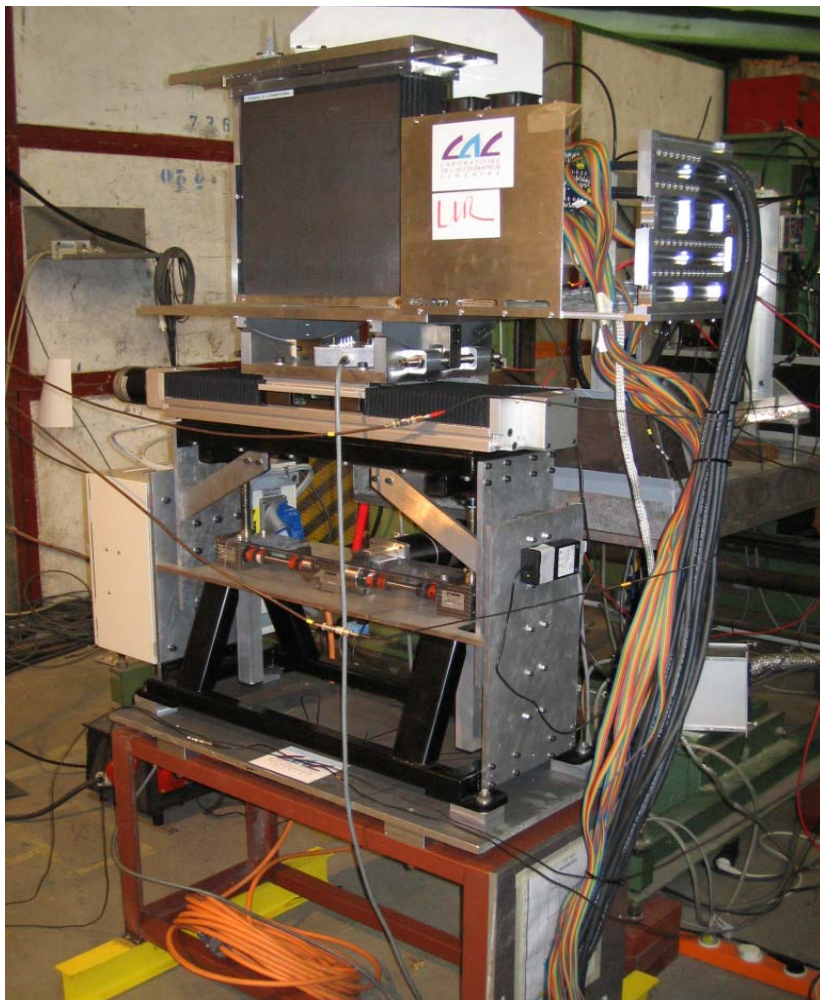


30 layer prototype
 3 independent W-CFi structures
 (1.4, 2.8 and 4.6mm W plates)
 Detectors can be slid in the gaps

Active area: 3x3 wafers
 Each wafer has 36 1cm x 1cm pads
 Total channel count ~10k



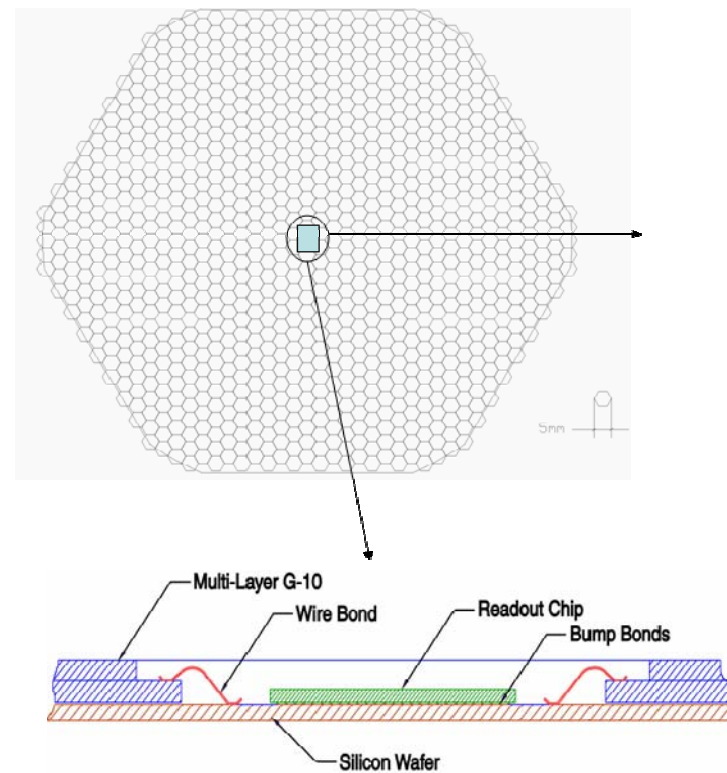
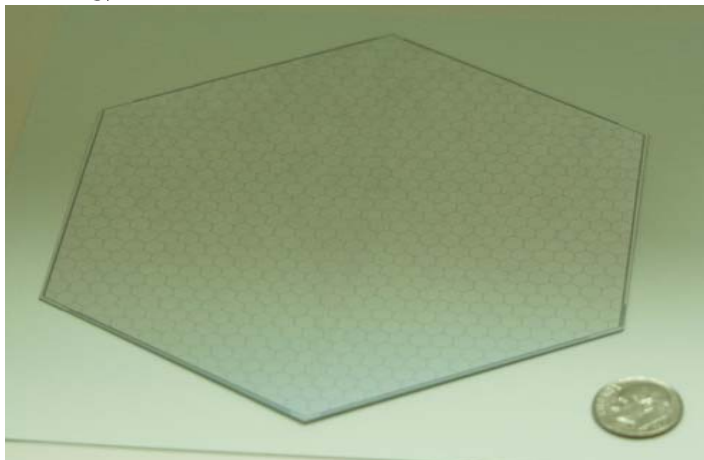
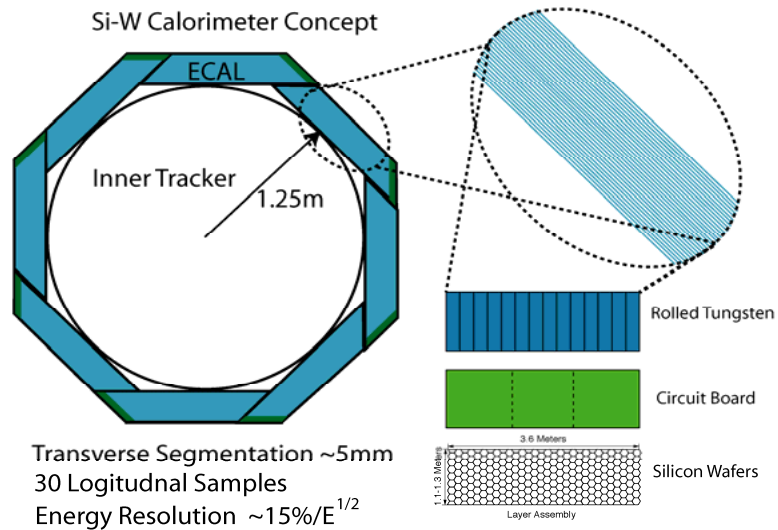
CALICE Si-W ECAL



Test in Feb. 2005 at DESY
14 layers (~ 3k channels)
20x10⁶ events collected

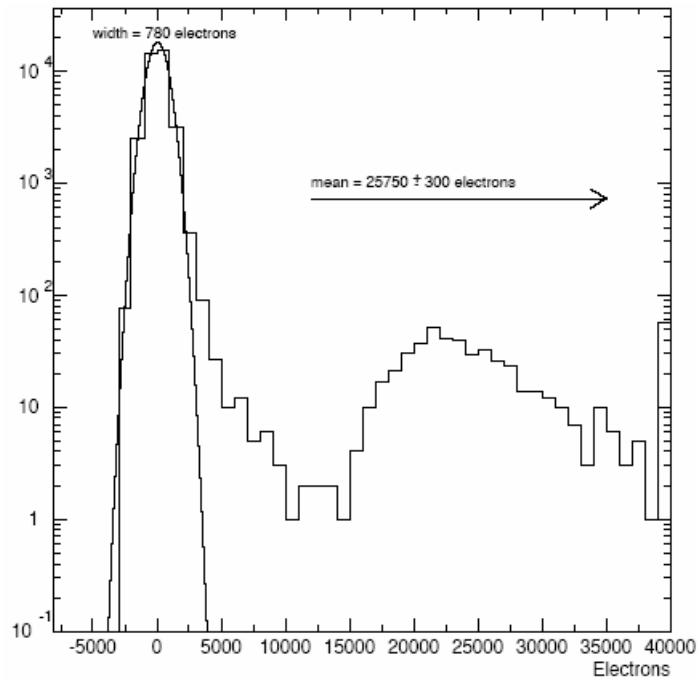
Longer run with full(er) detector
in 2006 at CERN

Si-W ECal (SOB)



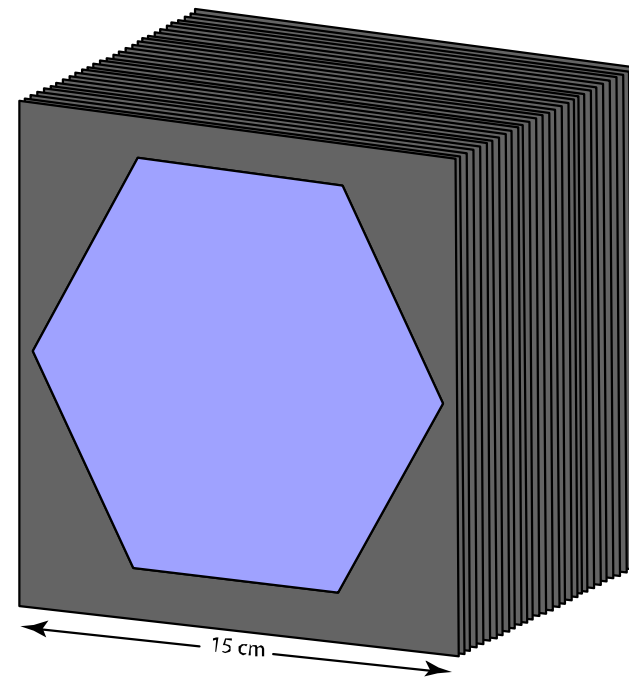
1 chip/wafer
 Chip bump-bonded to wafer

Si-W ECAL (SOB)



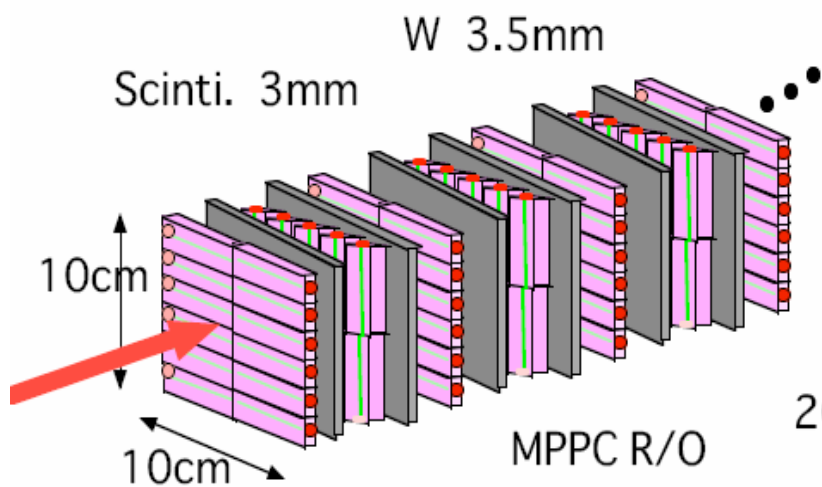
1 wafer/layer (750 pixels)
30 layers
2.5 and 5 mm Tungsten plates

64-channel chip bump bonding
KPIX prototyping funding dependent
One layer beam test in 2006
Full assembly in 2007 (?)

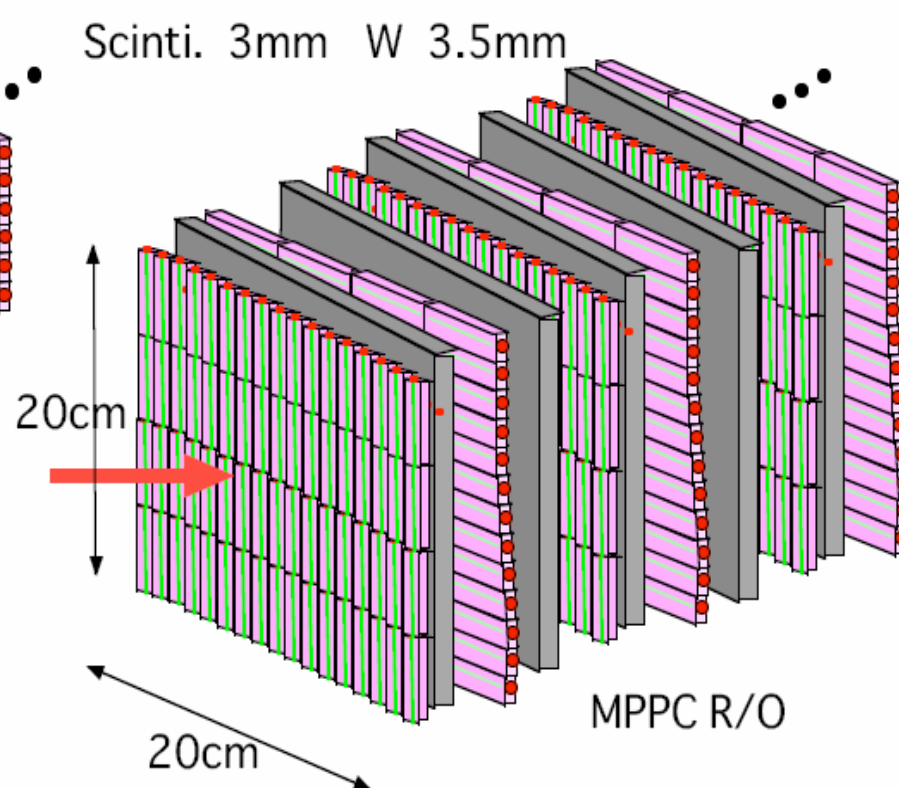


GLD Scint-W ECAL

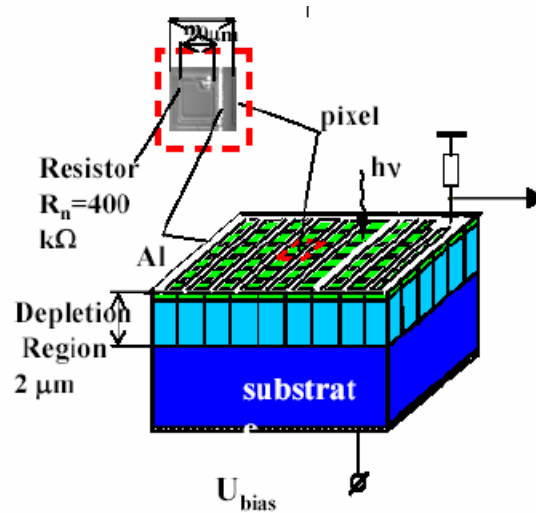
2006 at DESY



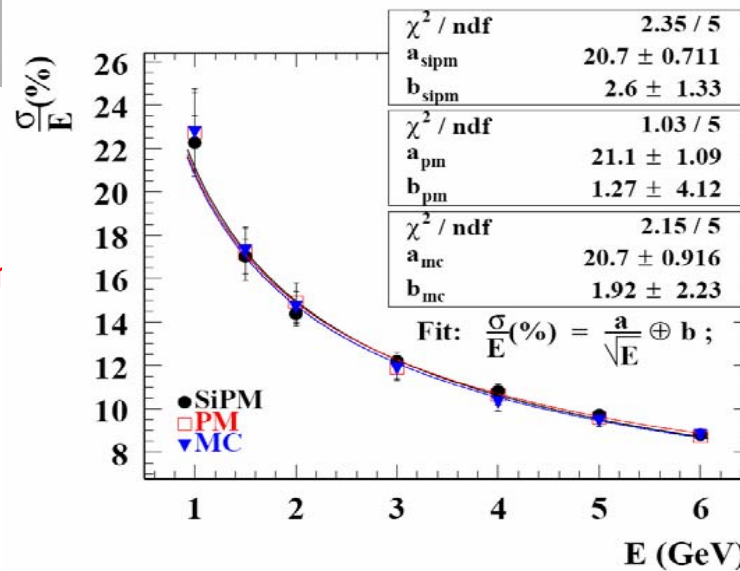
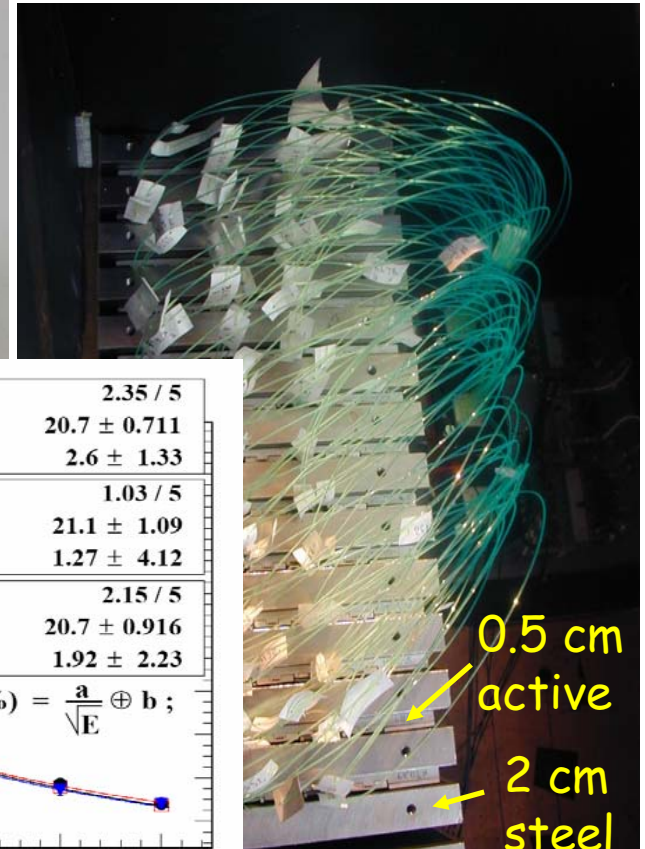
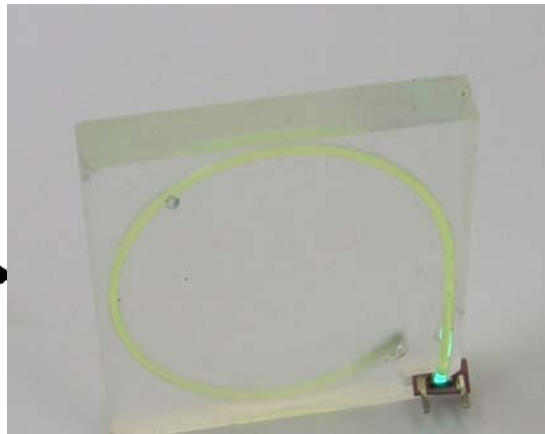
2007 at Fermilab



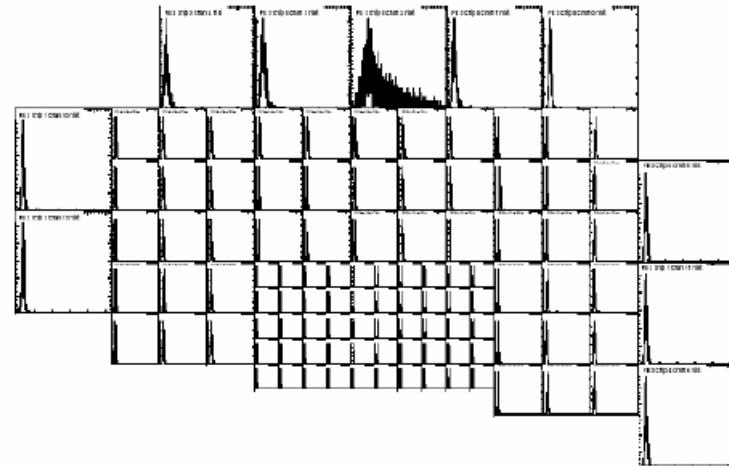
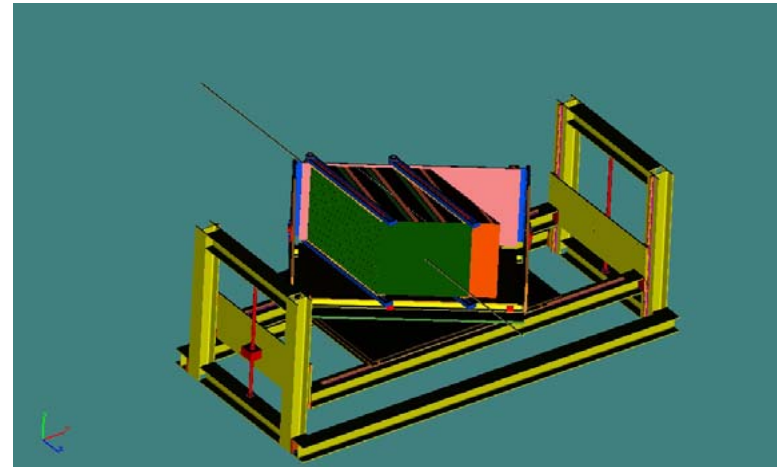
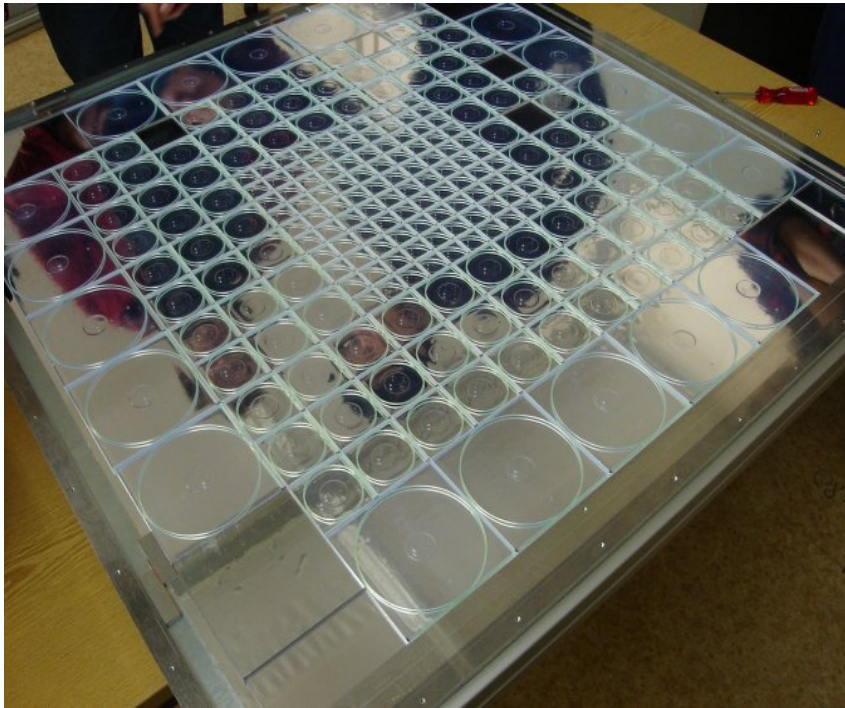
CALICE Scint. HCal



~1000 pixels on 1mm x 1mm
 Bias voltage ~ 50-60V
 Gain ~ 10^6
 Quantum x geom ~ 12-15%



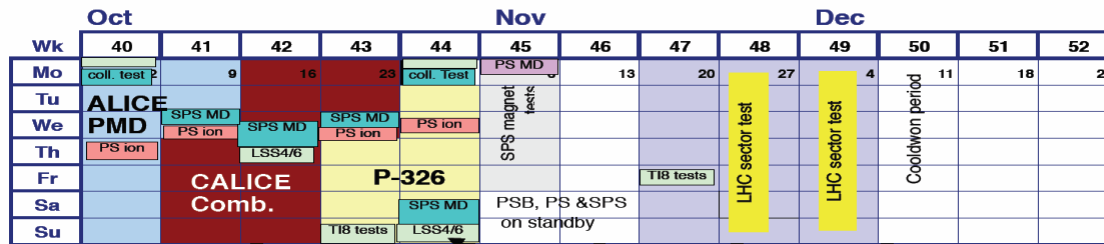
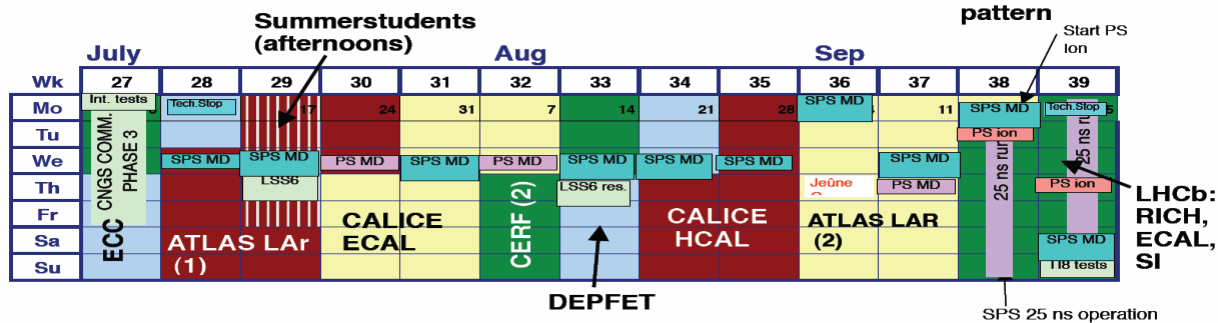
CALICE Scint. HCAL



In the construction and assembly phase
Will see beam at CERN in 2006

CALICE @ CERN

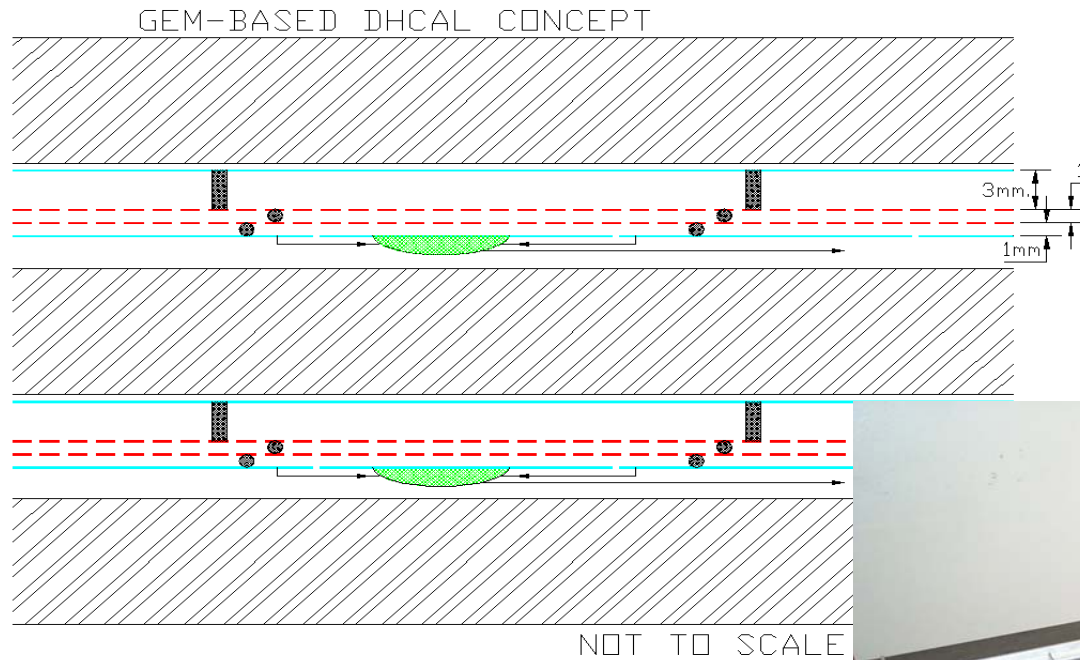
DRAFT



Total of 5.5 wks (request was 8)
 'ECAL Running' July-Aug (2 wks)
 'HCAL Running' Aug-Sept (1.5 wks)
 'Combined' Oct. (2 wks)
 Parasitic running not included

Setup is expected to move to Fermilab in 2007

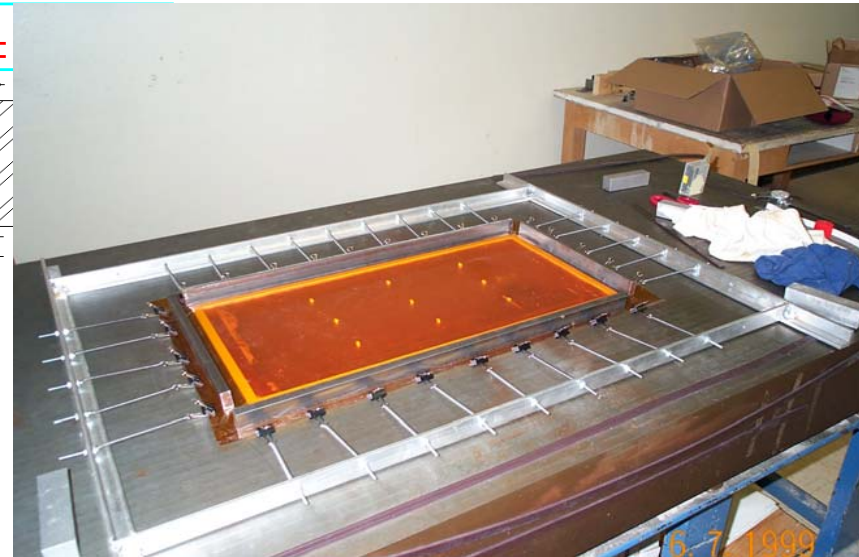
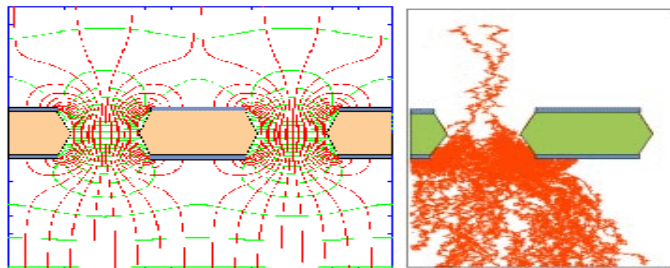
CALICE GEM HCAL



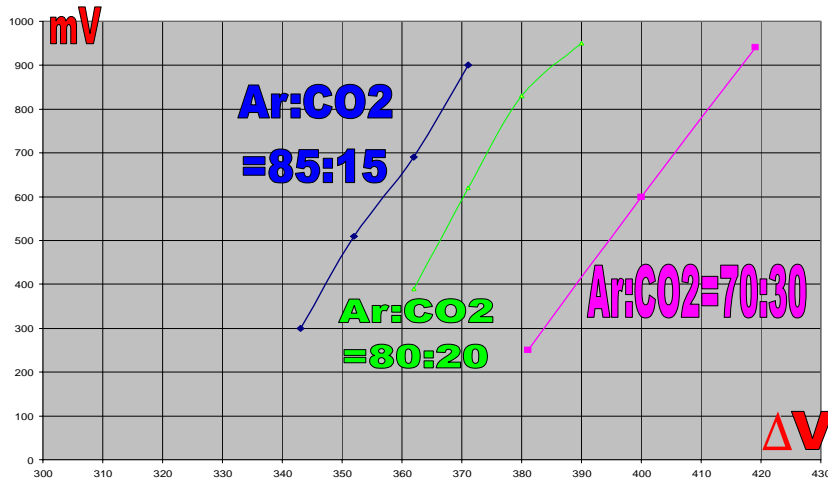
Ar/CO₂ gas mixture

1cm x 1cm pads

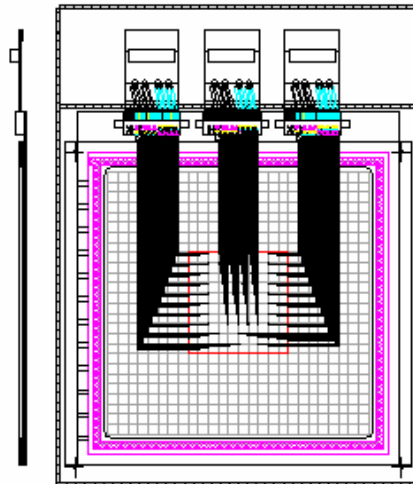
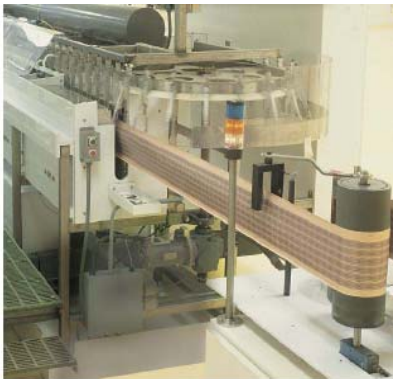
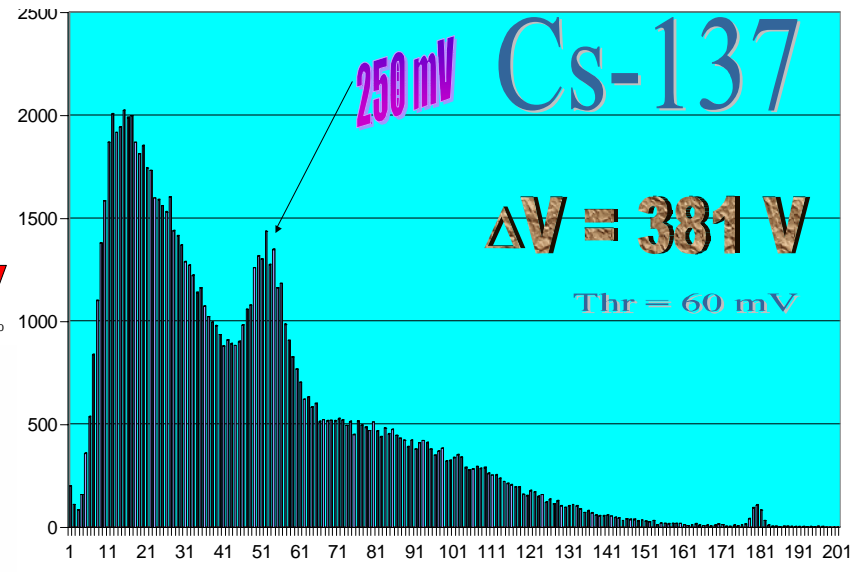
1-bit readout



CALICE GEM HCAL



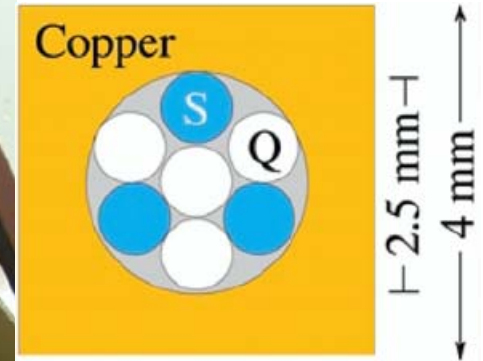
Signal size, cross-talk, efficiency studies with prototype detector



Exposure of 30cm x 30cm GEM foil to low E electron beam in Korea
Completion of 1m³ prototype in 2007

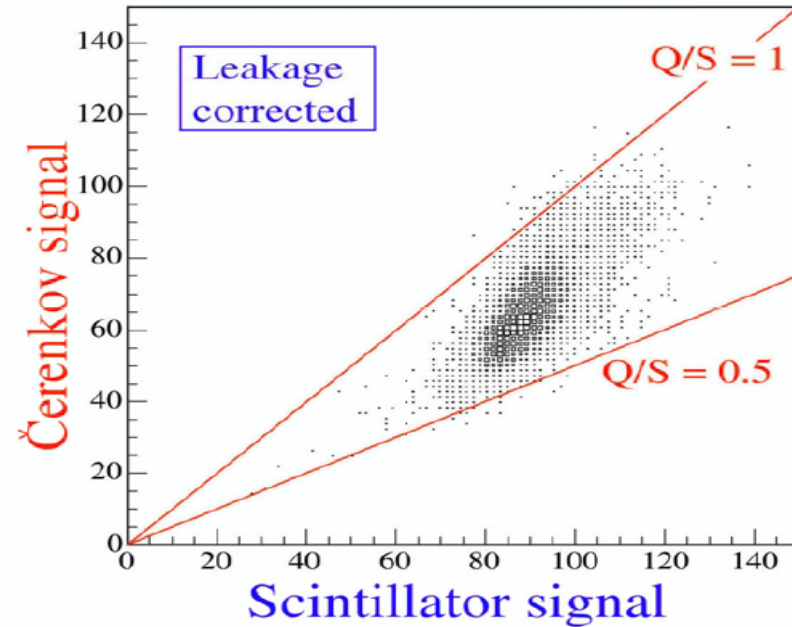
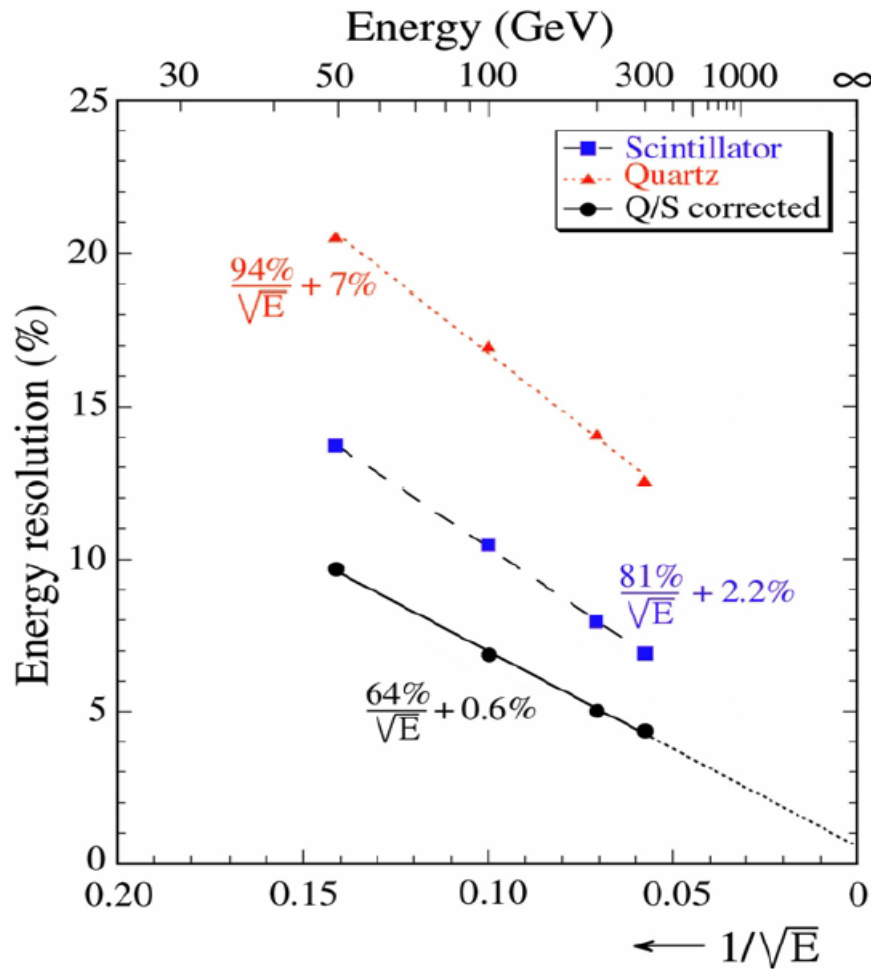
DREAM

Measure the EM content event by event



Copper absorber structure
Scintillating (dE/dX) and
Quartz fiber (Cerenkov)

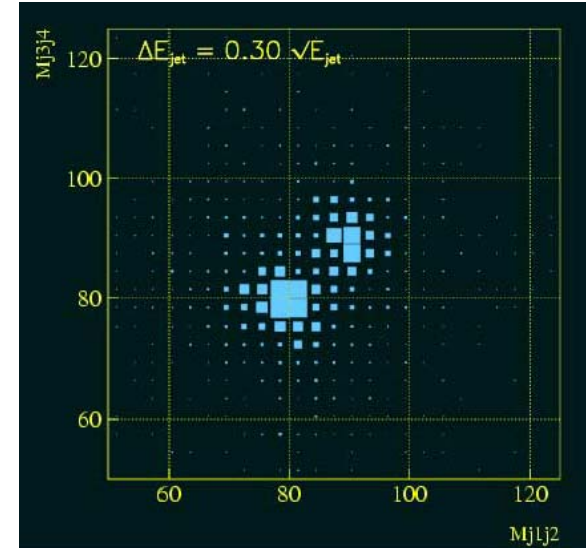
DREAM



Investigate designs suitable for an ILC detector
 Introduce non-hydrogenous Sci-Fi
 2006-07 test beam timescale

Summary

Unprecedented calorimetric performances demanded at the ILC.



A world-wide effort gearing up to meet this challenge