

CALICE Scintillator-ECAL Beam Test @ Fermilab

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for the CALICE collaboration

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CALICE beam test September Run @ Fermilab

The CALICE Beam Test has been performed since Apr `08
At Fermilab Meson Test beam facility.
The ScECAL was tested in September.

Main Objectives:

- Establish feasibility of the Scintillator-ECAL
- Combined test with Analog HCAL

ECAL :

- Silicon-Tungsten
- Scintillator-Tungsten

HCAL :

- Analog HCAL

Sep running!

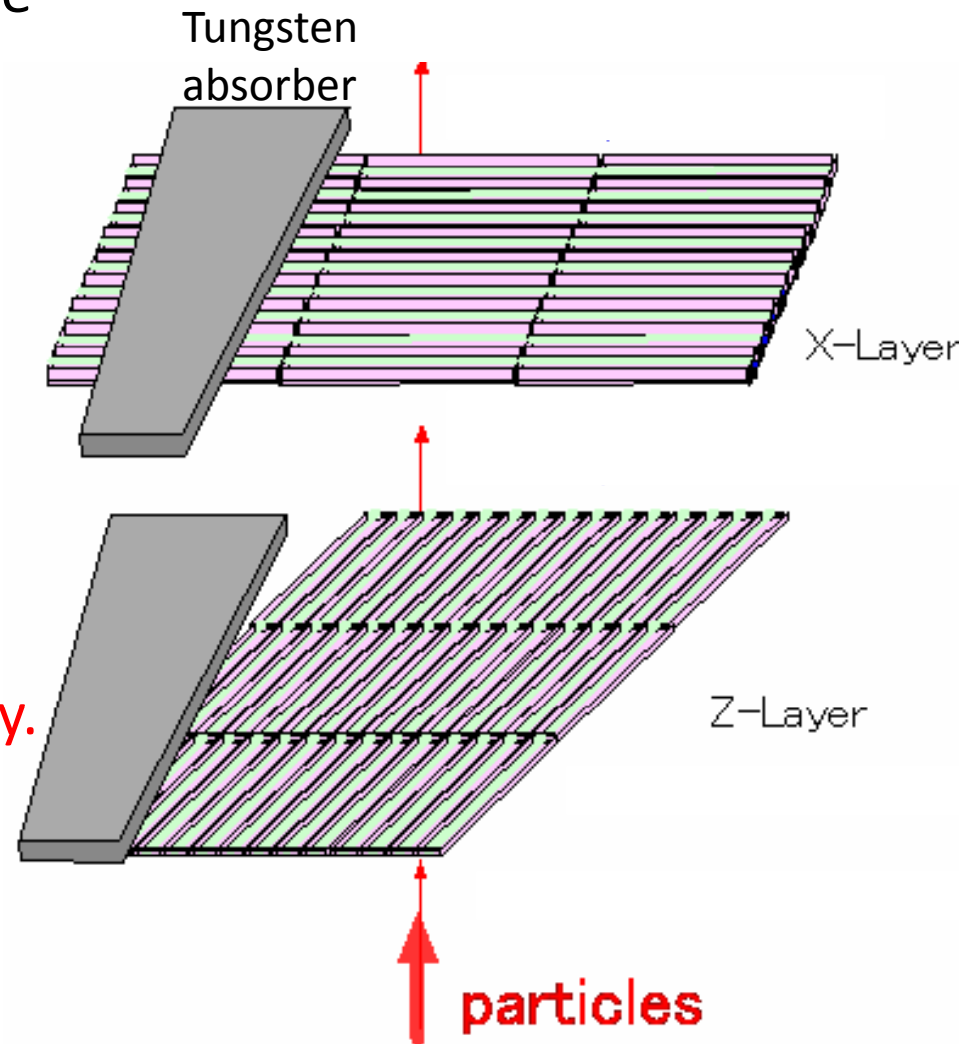
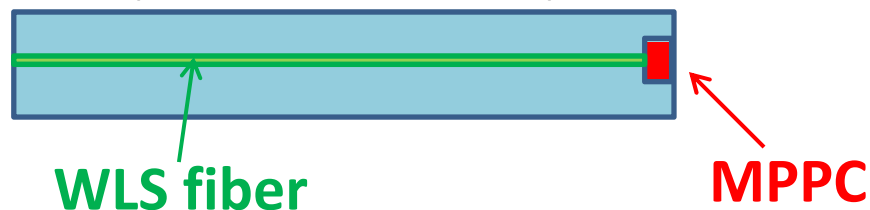
*Done in
May & Jul*

The Scintillator-Strip ECAL concept

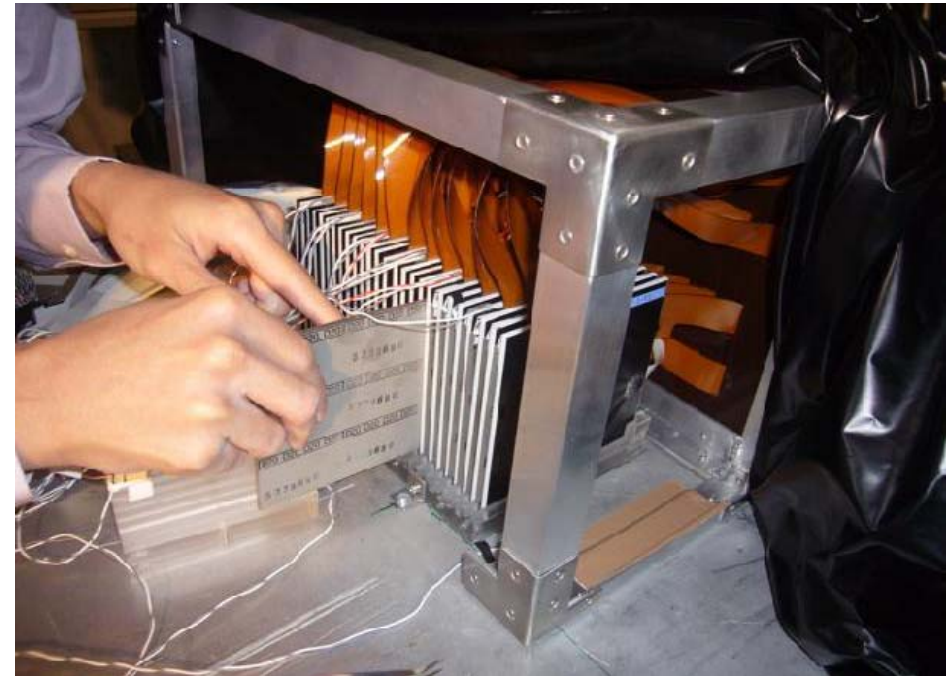
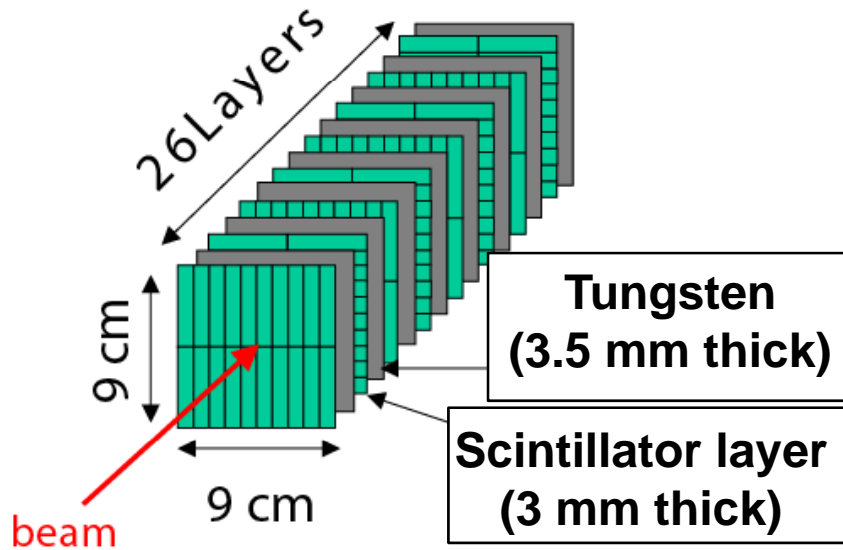
- Scintillator strip structure to achieve fine granularity for PFA.
- Many Challenging points:
 - Strip production
 - Photon sensor (MPPC)
 - Operation of huge number of channels
 - Gain monitoring system
- **First need to establish the feasibility.**

→ **Beam Test !**

Scintillator strip
(4.5 x 1 x 0.3 cm)

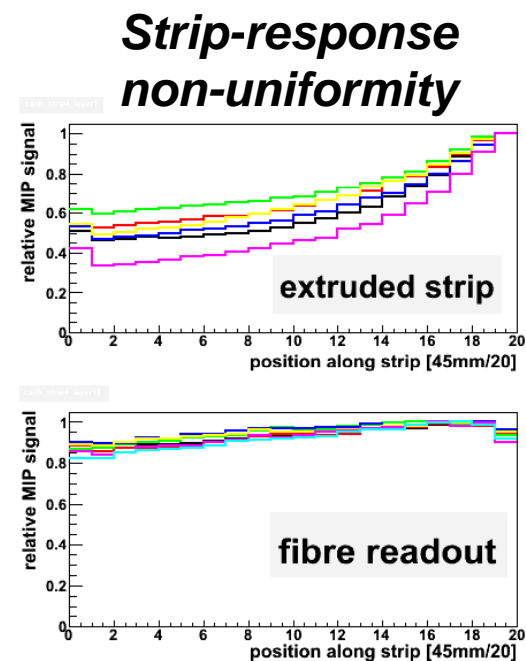
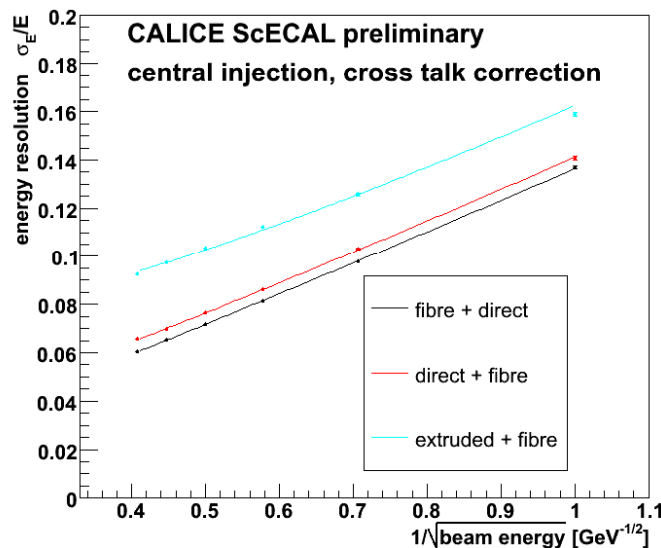
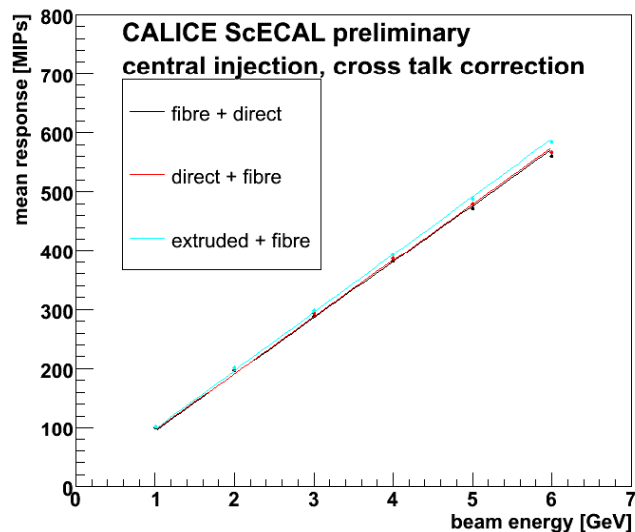


Past Beam Test @ DESY In March 2007



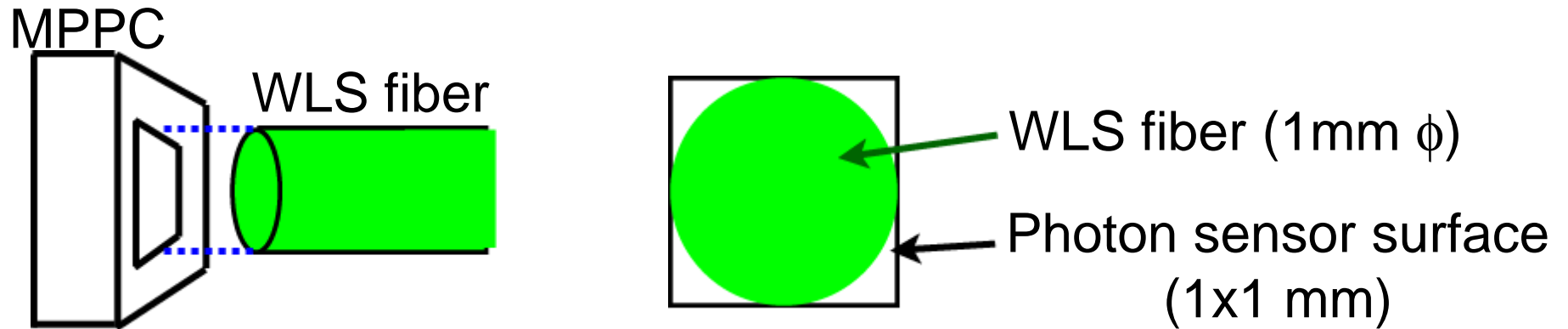
- First test module of the ScECAL has been tested at DESY using 1-6 GeV e^+ beams.
- First attempt of a calorimeter with full MPPC readout.
- 3 types of scintillators examined.
(Kuraray w/ WLS fiber / Kuraray w/o fiber / Extruded w/ fiber)

Past Beam Test @ DESY in March 2007

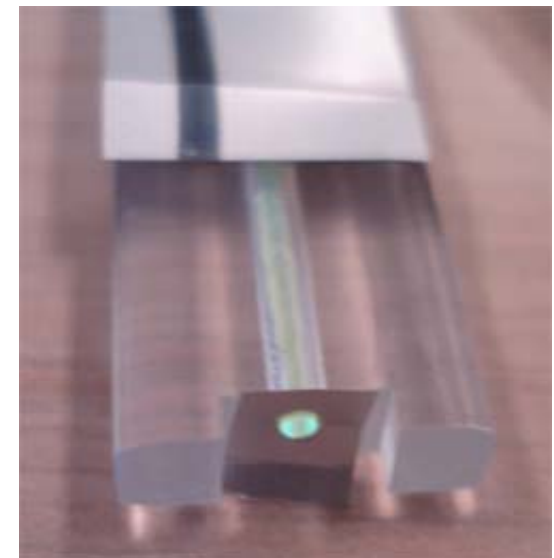
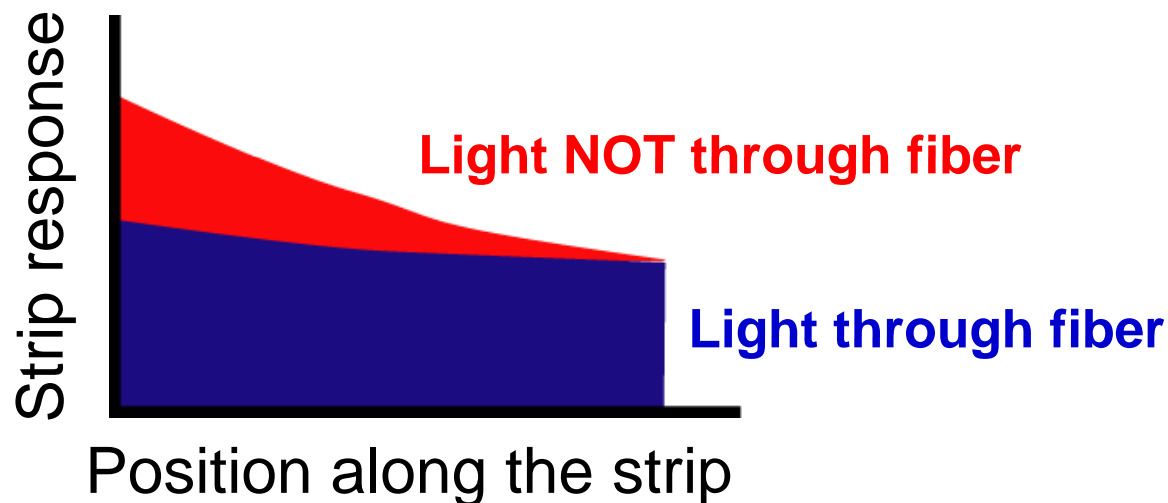


- Performance of the small test module is promising.
- Strip response non-uniformity of extruded scintillator gives deterioration of the performance.

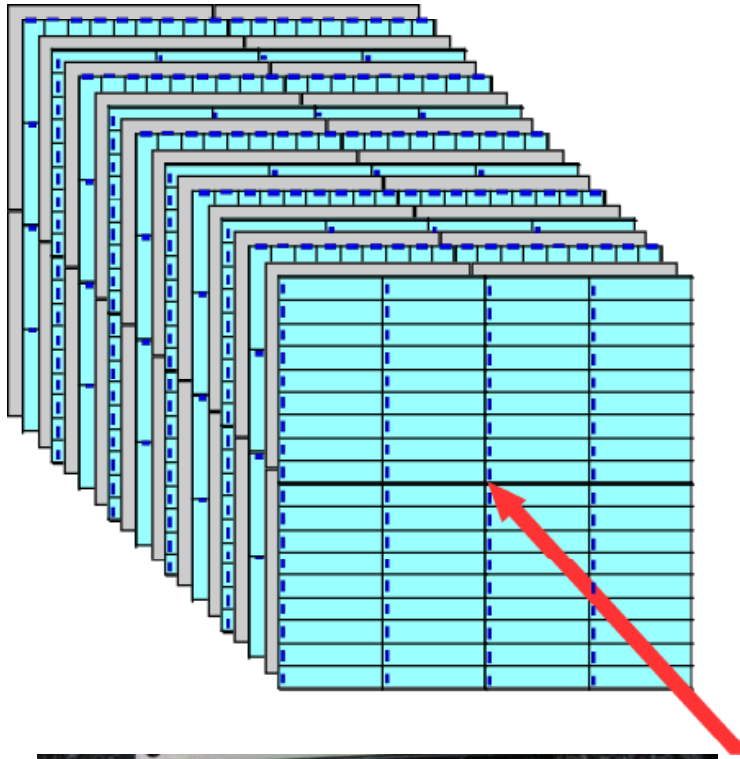
Improvement of the strip response uniformity



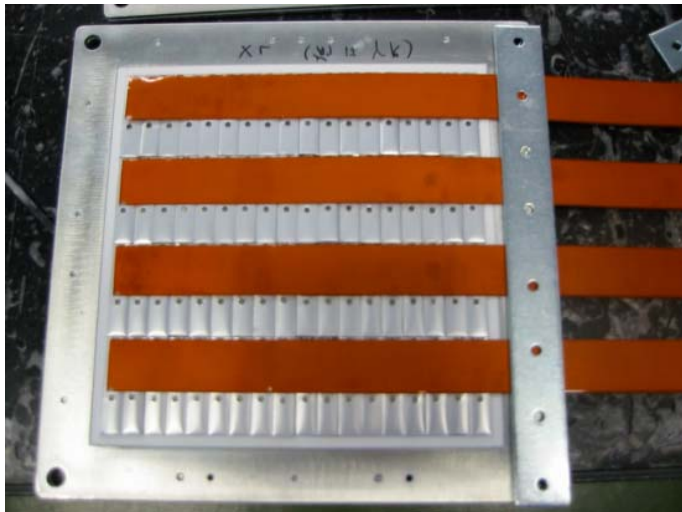
- Light through WLS fiber ... uniform
- Light **NOT** through the fiber ... not uniform
- Shielding direct light improves the non-uniformity.
- Changing reflector (white -> mirror) also gives some effect.



The ScECAL Test Module

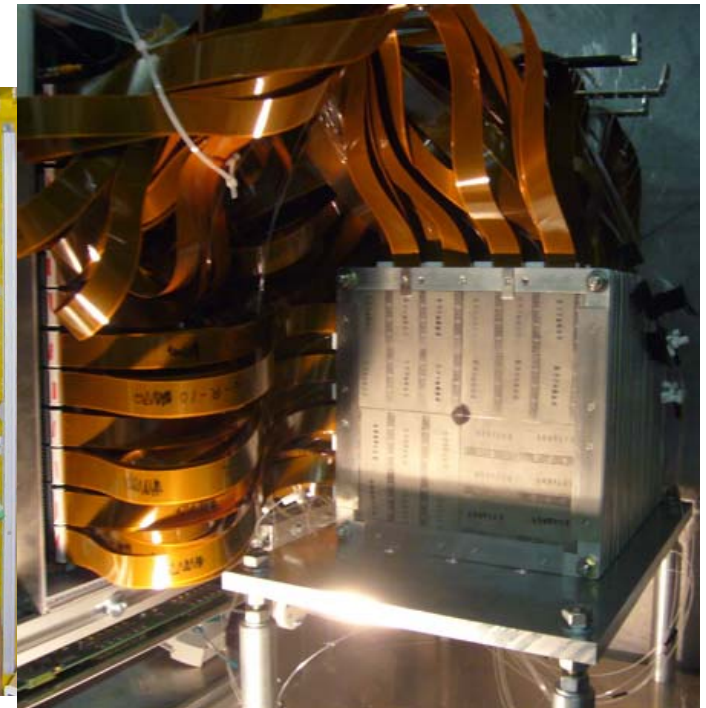
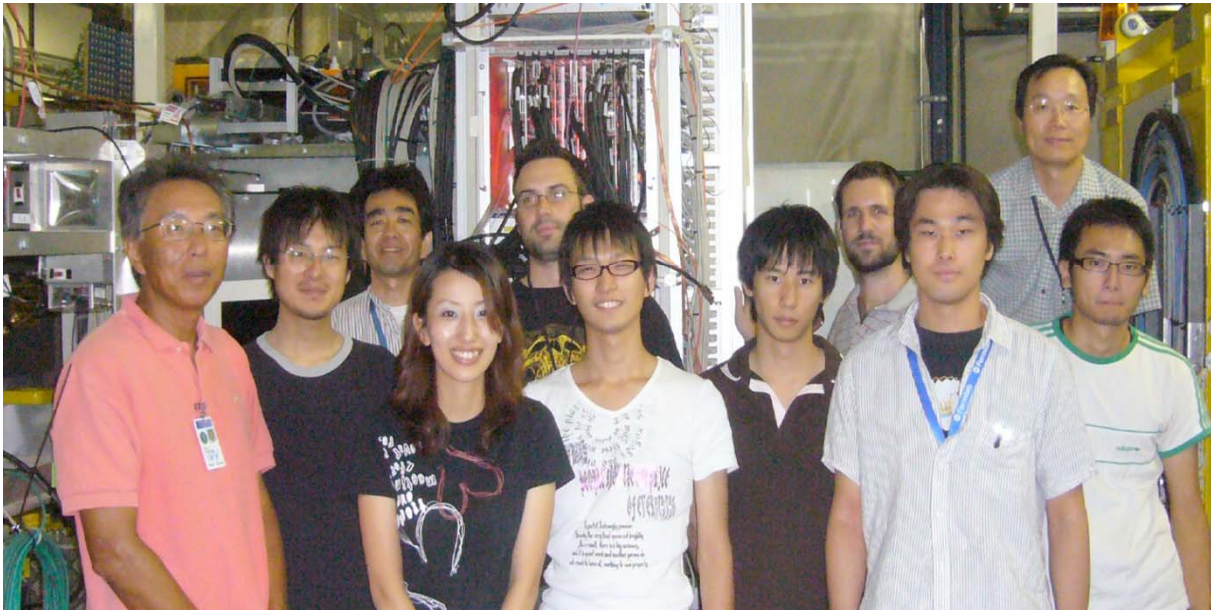


- Sandwich structure with scintillator-strips (3 mm) and tungsten layers (3.5 mm).
- Extruded scintillator and new generation photon sensor (MPPC) are fully adopted.
- Strips are orthogonal in alternate layers.
- 72 strips x 30 layers = 2160 channels.
- Overall size $\sim 20 \times 20 \times 25$ cm.
- Signal read by electronics same with Analog HCAL.



Beam Test in Sep 2008 @ MTBF

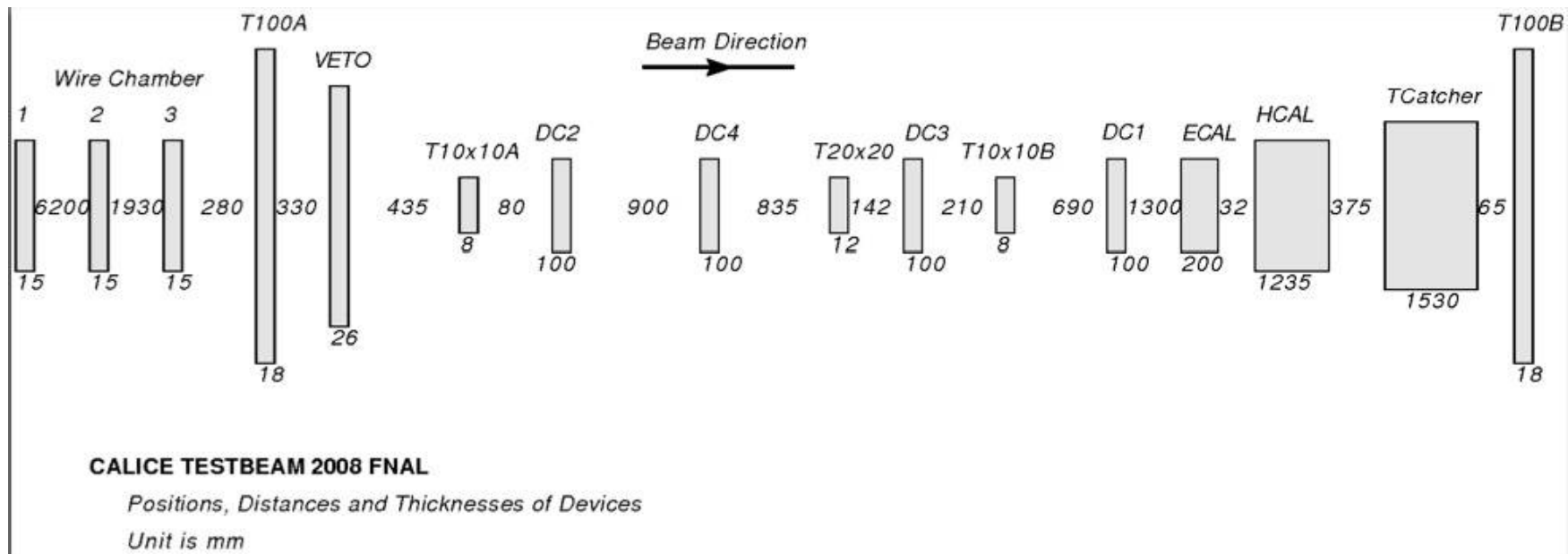
- Objective : Establish the feasibility of Scintillator-ECAL + Analog HCAL with various types of beams in wide energy range.
 - Energy resolution, Linearity for electrons and pions.
 - Position and angular scan.
 - π^0 reconstruction ability of the Scintillator-ECAL
 - MPPC gain monitoring system with LED.
- Beam running during Sep 3rd – 29th at MT6.



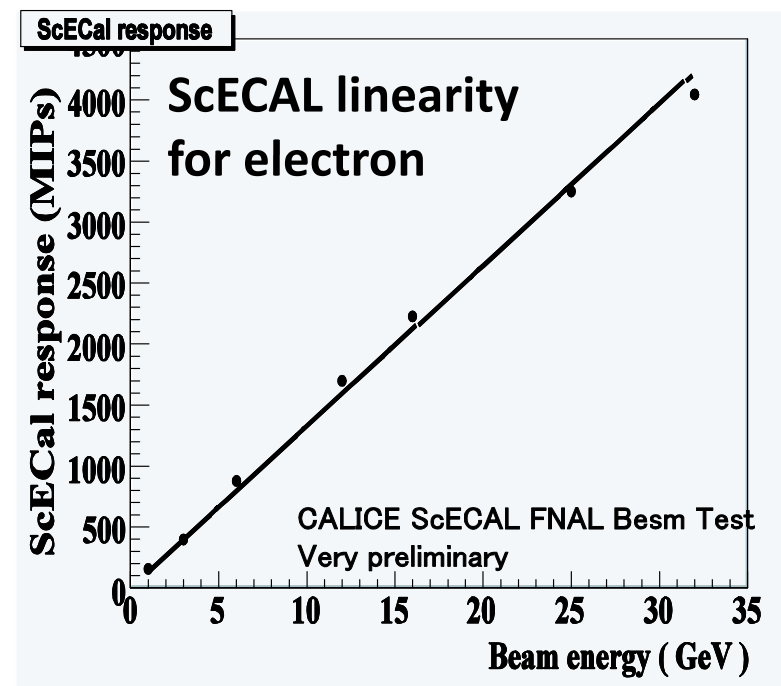
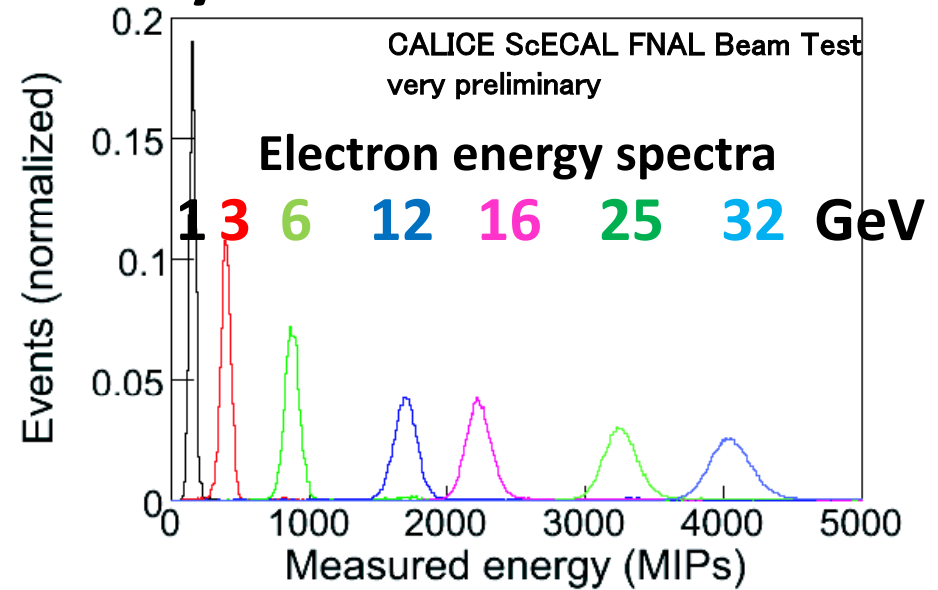
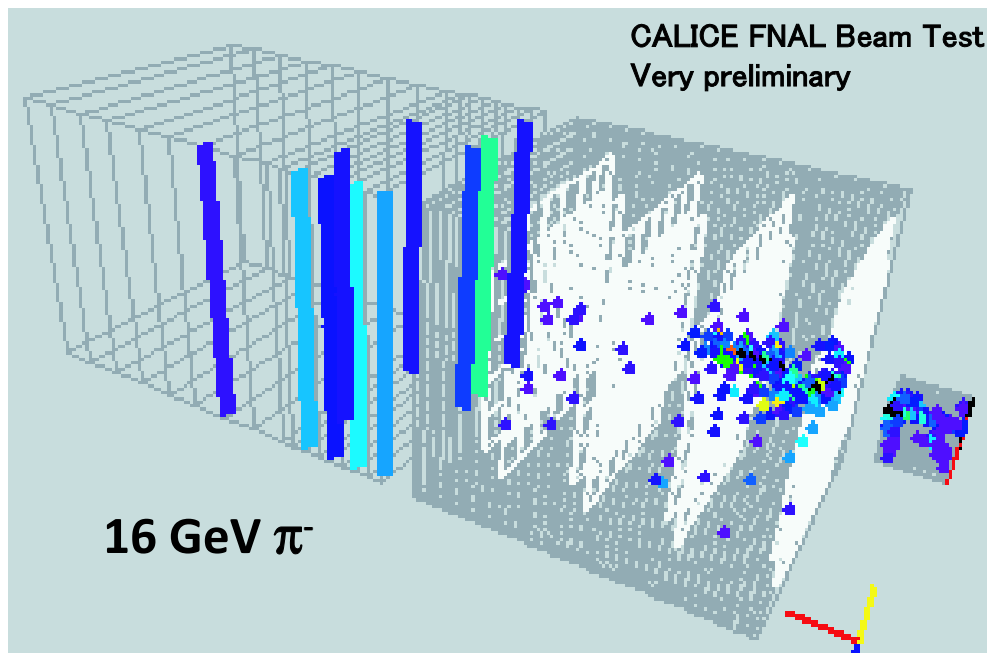
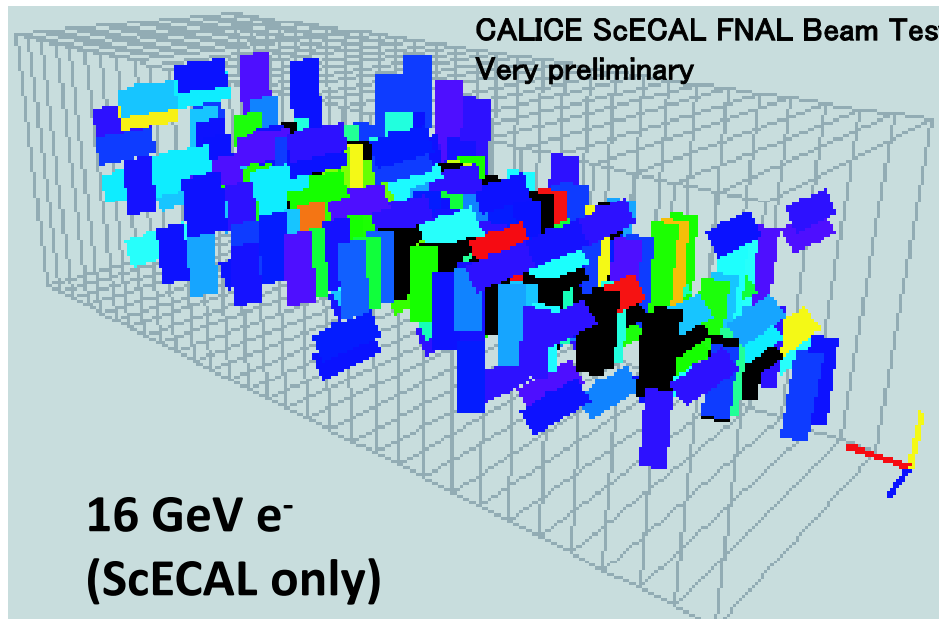
The Fermilab Meson Test Beamline

Various types of beams available

- 1-32 GeV electrons
- 1-60 GeV pions
- 32 GeV muons
- 120 GeV protons
- Cerenkov counter available to discriminate electron or pion.

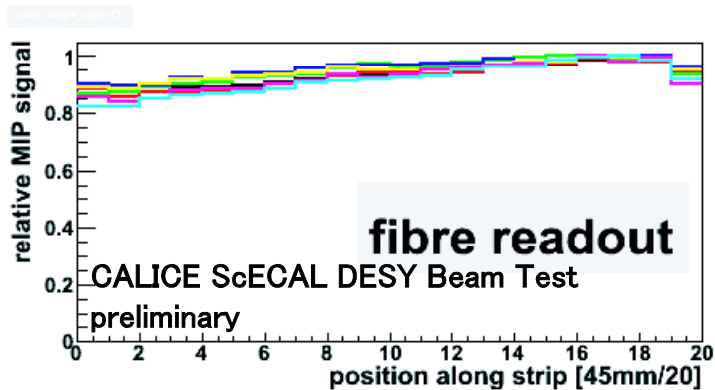
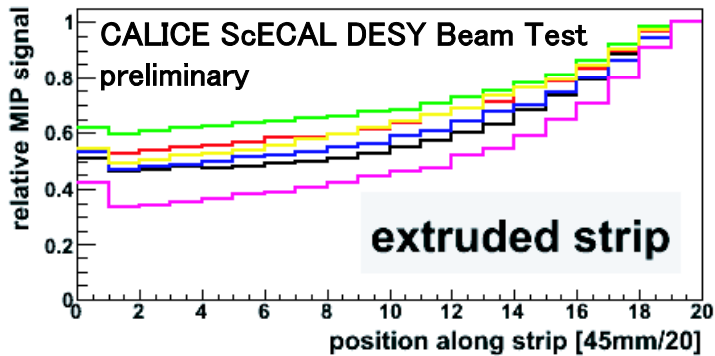


Very Preliminary Results

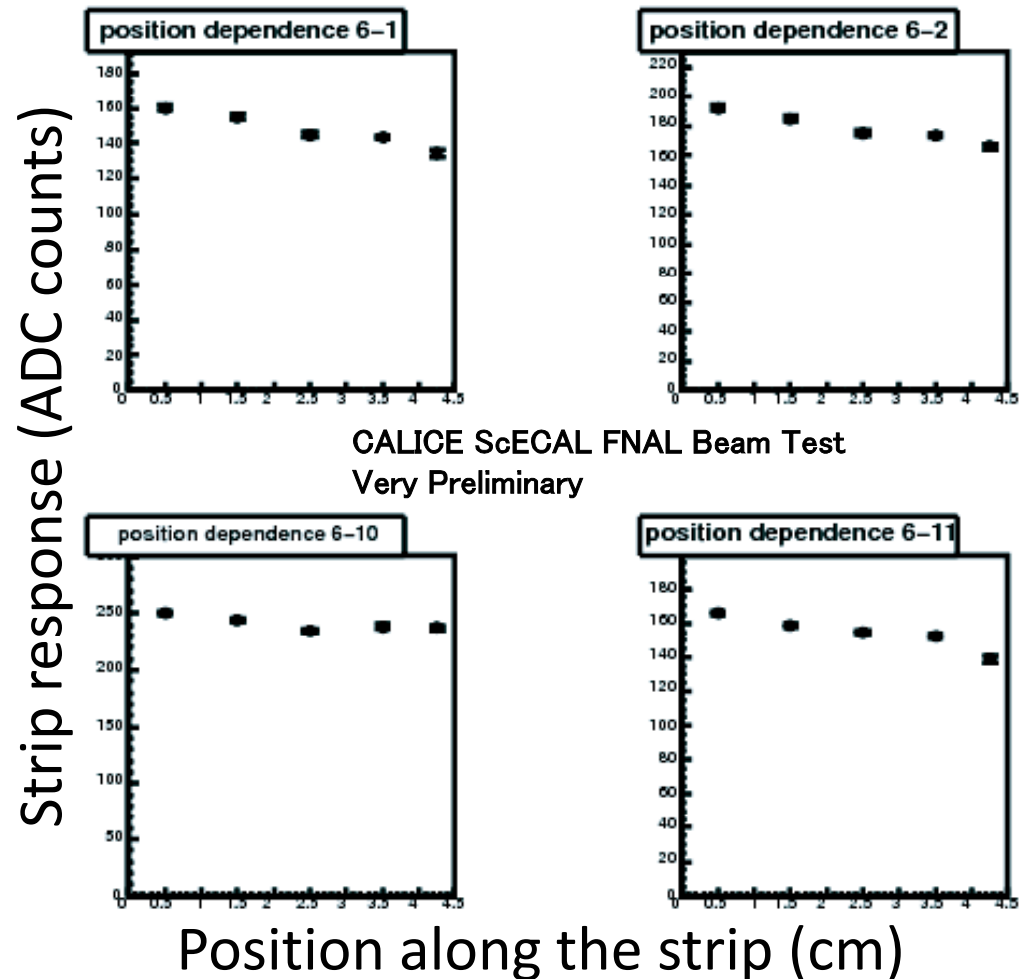


Strip Response Non-uniformity

DESY Beam Test
2007

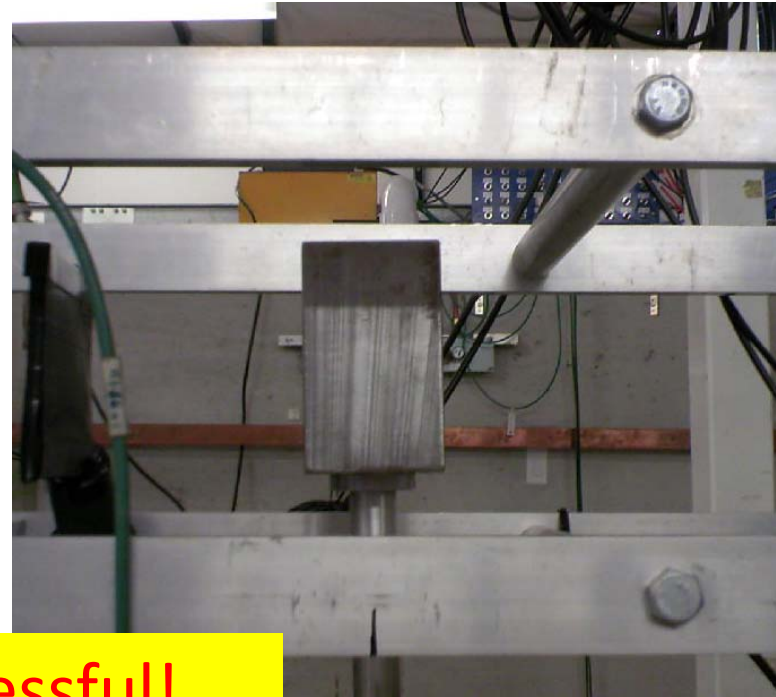


FNAL Beam Test 2008

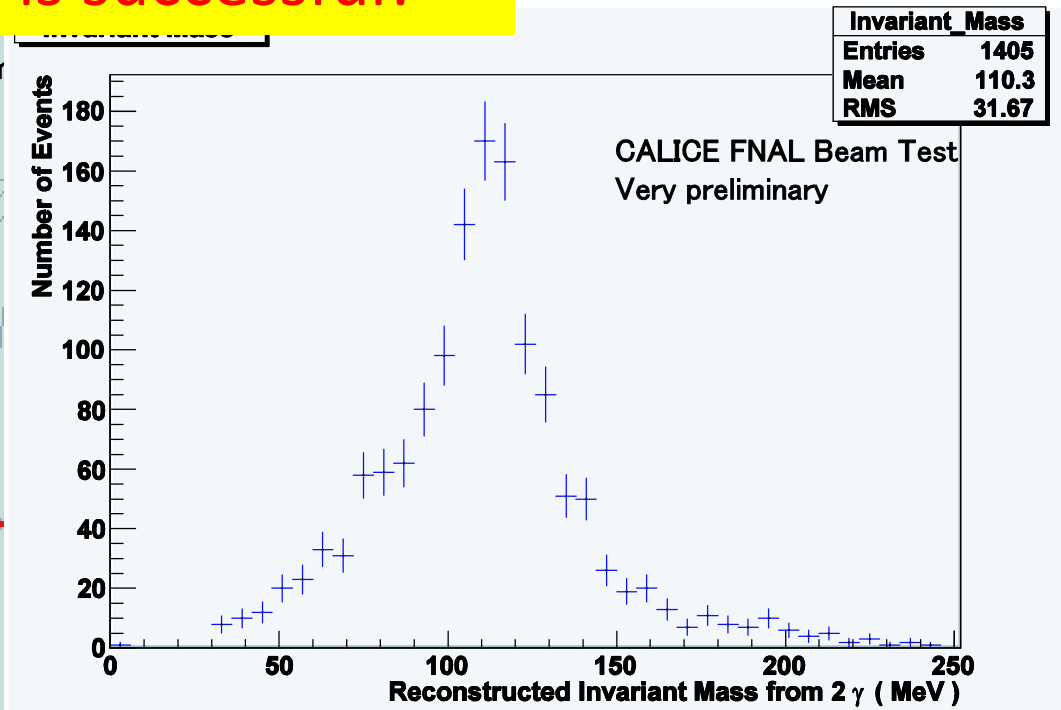
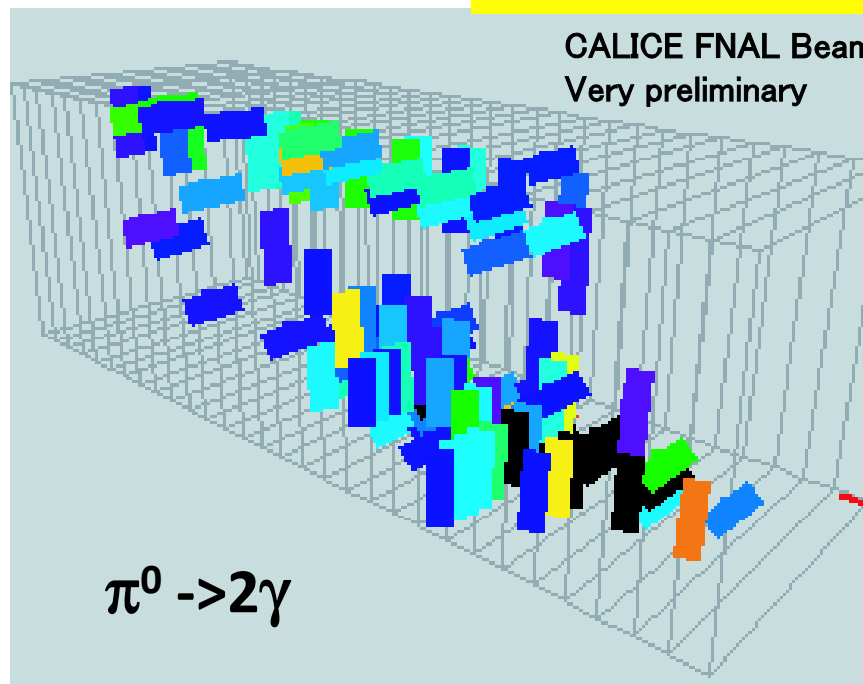


π^0 runs (Very preliminary)

- Ability of π^0 reconstruction from 2γ is useful to improve jet energy resolution.
- Generate π^0 by putting iron on beamline and injecting 16-32 GeV π^- beam.
- Try reconstruction of the generated π^0 with Scintillator-ECAL.



π^0 detection is successful!



Summary

- September run of the CALICE beam test is successfully done.
- We have collected various data to evaluate fundamental performance of the Scintillator-ECAL + Analog HCAL.
- First trial of the π^0 reconstruction with ScECAL is in good shape.
- Extensive Analysis is currently underway.
- We appreciate everyone who gave great help for the successful beam test!