

CALICE Collaboration

Test Beam Status and Plans



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(with much help from Felix Sefkow et al. !)

Vancouver ALCPG, July 2006

Overview

- Motivation and technologies
- First Electromagnetic Calorimeter results
(from DESY)
- AHCAL: Hadronic 1m^3 Calorimeter preparation
- CERN Test Beam Area
- Installation and test preparation
- The first week's news !
- CERN schedule/modules/goals
- Fermilab Test Beam program

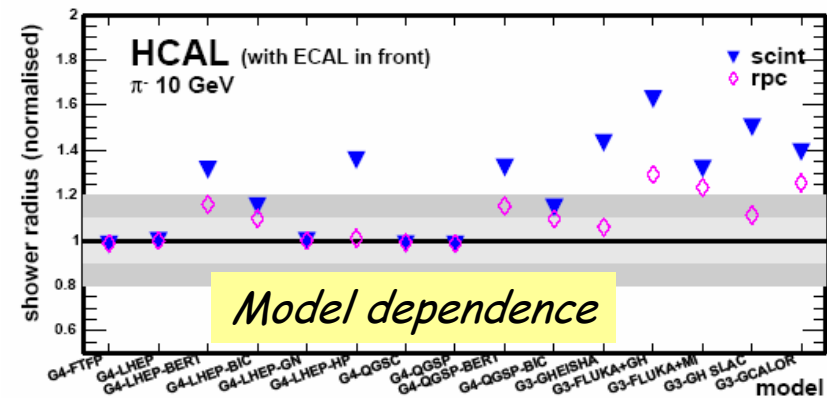


Testbeam start-up at CERN

Felix Sefkow
July 14, 2006

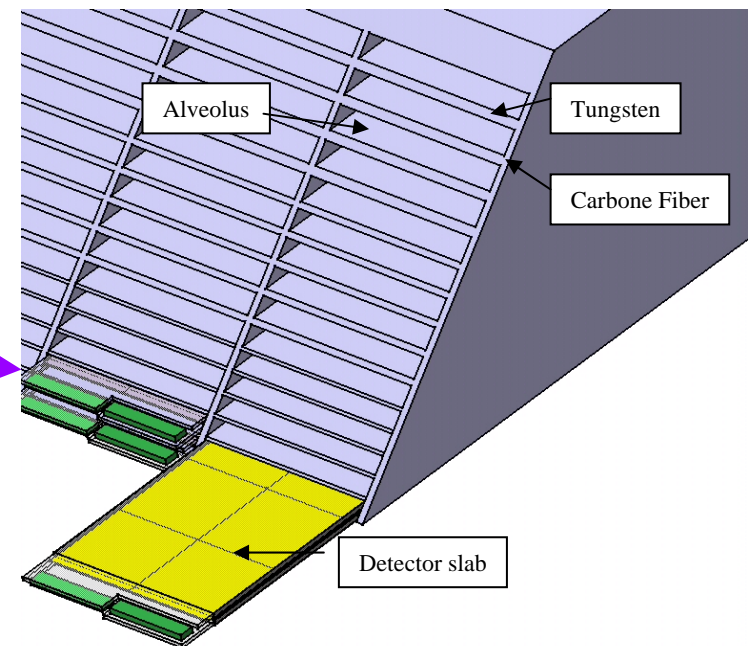
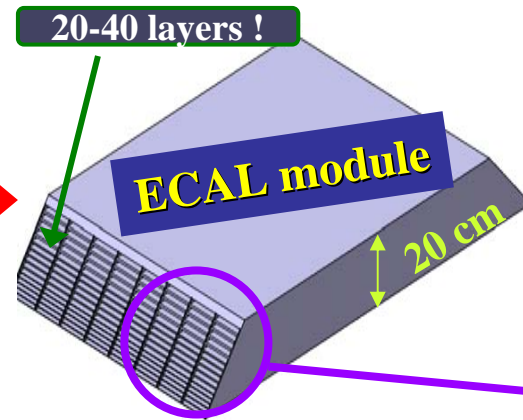
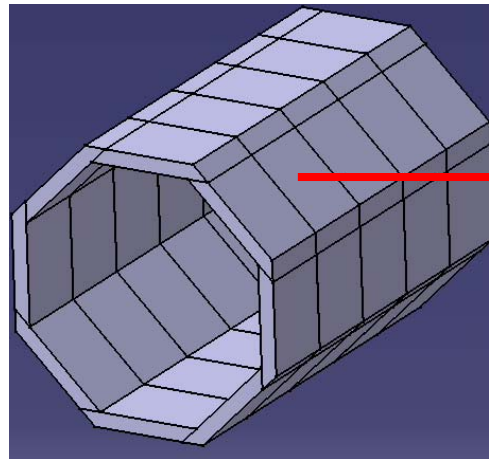
Testbeam programme

- Calorimetry at the ILC
 - Need 2x better resolution
 - High granularity for individual particle reconstruction
- Physics:
 - Structure of hadron showers
 - Validation of simulation
 - Development of particle flow algorithms
- Technology
 - Establish compact SiW technology
 - gain large scale, long-term experience with a SiPM / RPC / GEM readout detector
- Running at CERN and FNAL from July 2006 on



CALICE ECAL

- 130T of tungsten
- An octagonal geometry
- A high level of density
(20-40 layers, 24X0 in ~170mm)



- No large area of dead zone
- All modules are identical (Tungsten wrapped by Cfi)
- The detector slabs would be tested before assembling

CALICE - ECAL



Ewha Univ., Sungyunkwan Univ.,
Kangnung NU, Yonsei Univ.



LAL, LLR, LPC-Ct, LPSC, PICM



ITEP, IHEP, MSU

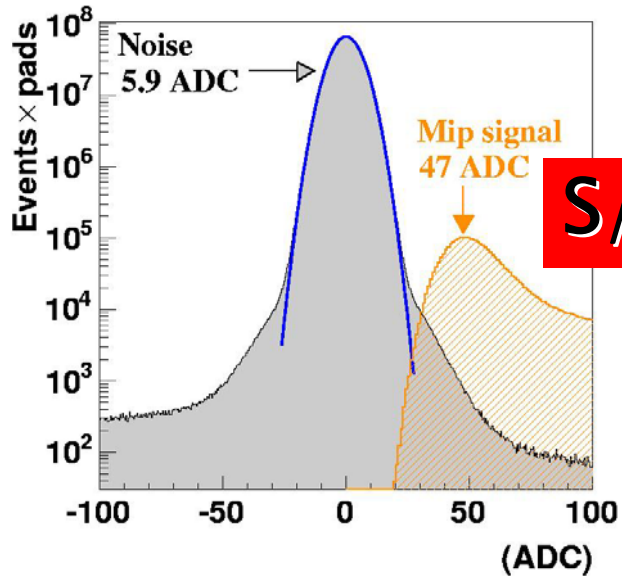


Prague (IP-ascr)



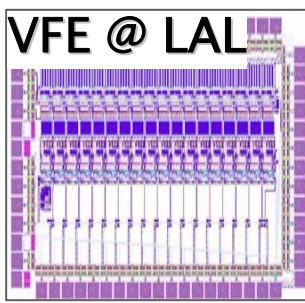
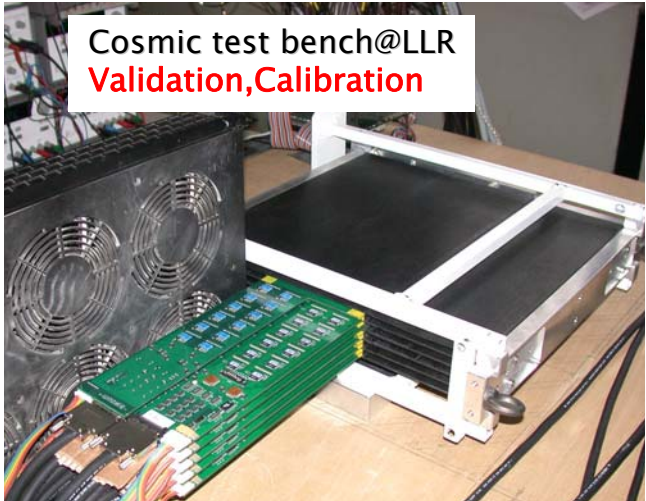
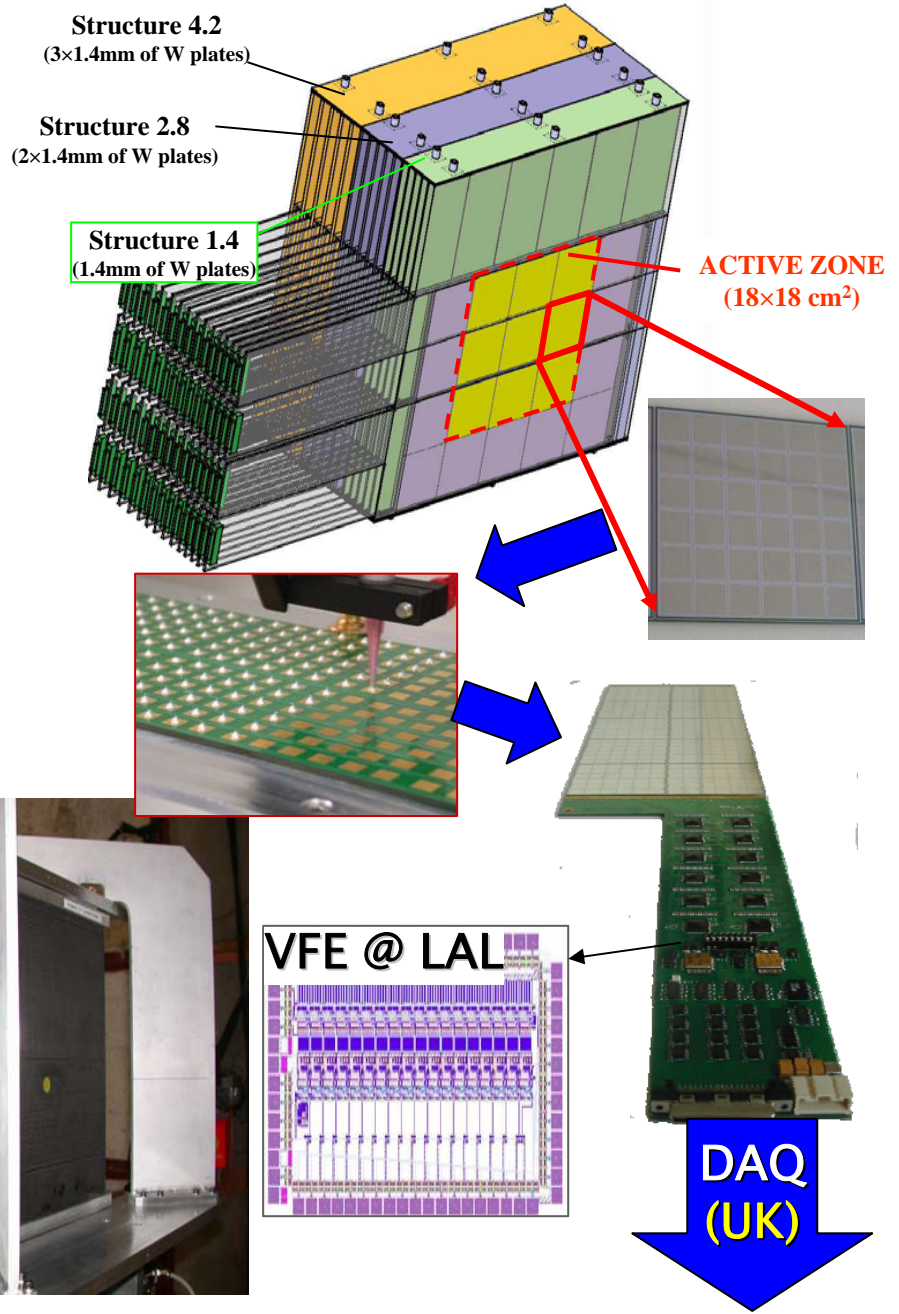
Imp. Coll, UCL, Cambridge
Birmingham, Manchester, RAL,
RHUL

The ECAL prototype



S/N \sim 8 !!

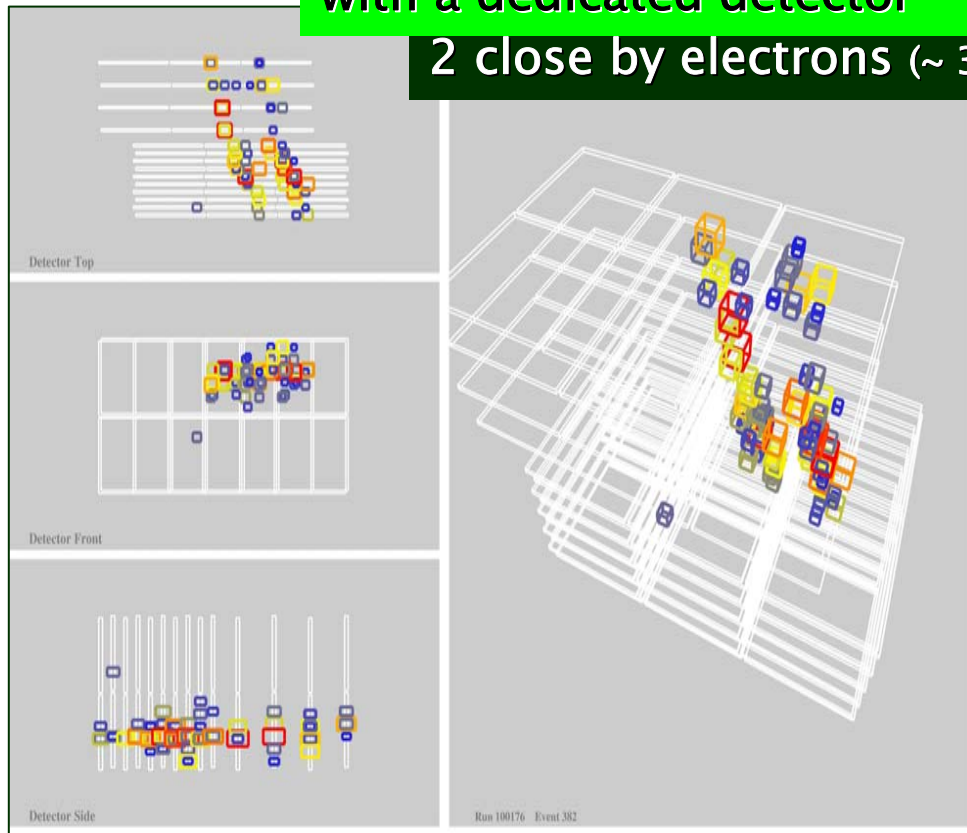
**9720 channels in 18 cm³
for this prototype**



ECAL: first testbeam results

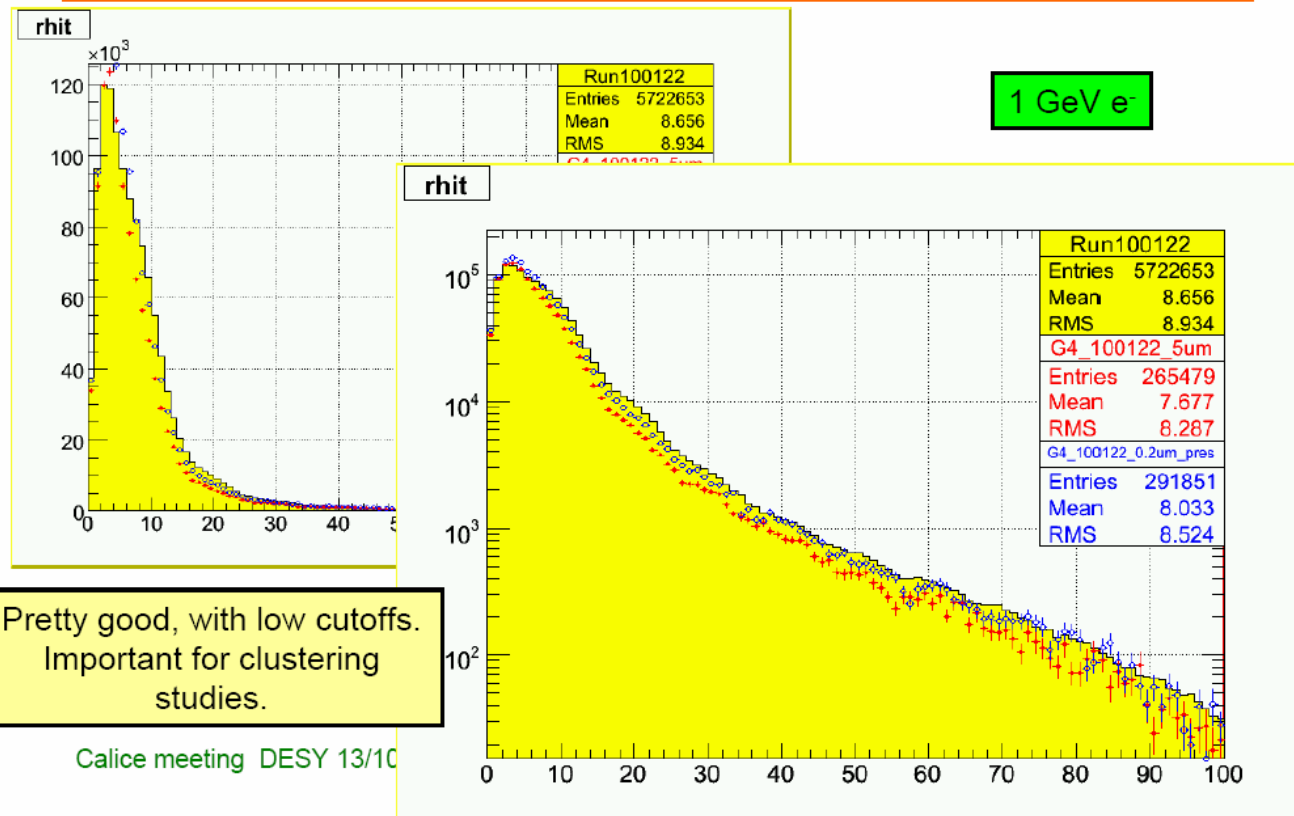
First real test versus
the « Particle Flow » method
with a dedicated detector

2 close by electrons ($\sim 3\text{cm}$)



ECAL: first testbeam results

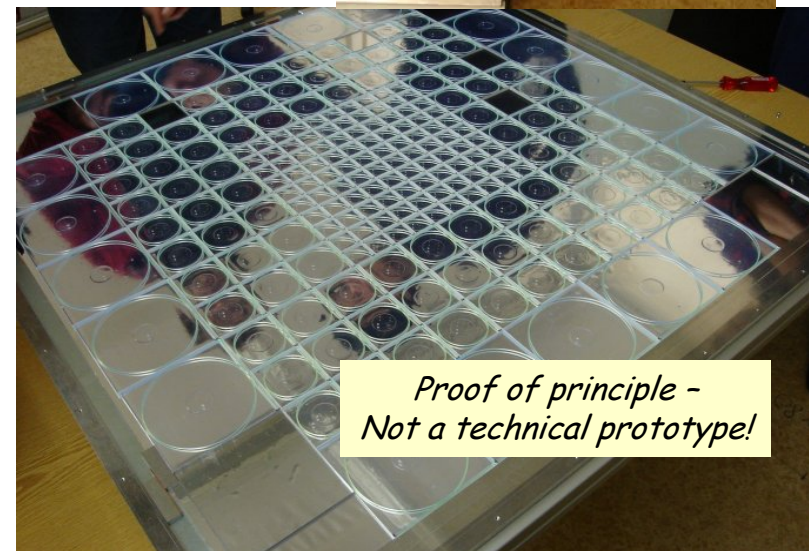
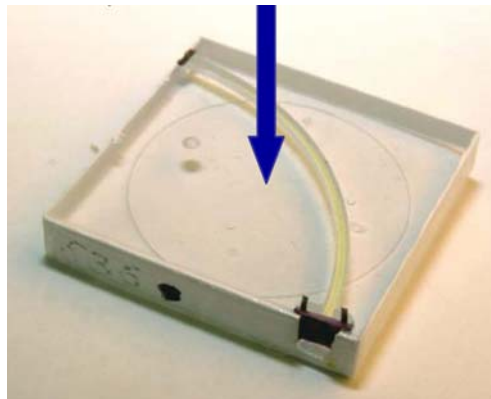
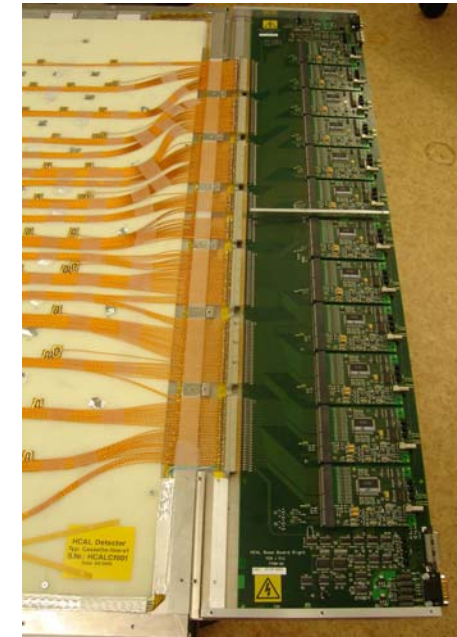
Transverse profile (w.r.t. barycentre)



CALICE HCAL testbeam prototype

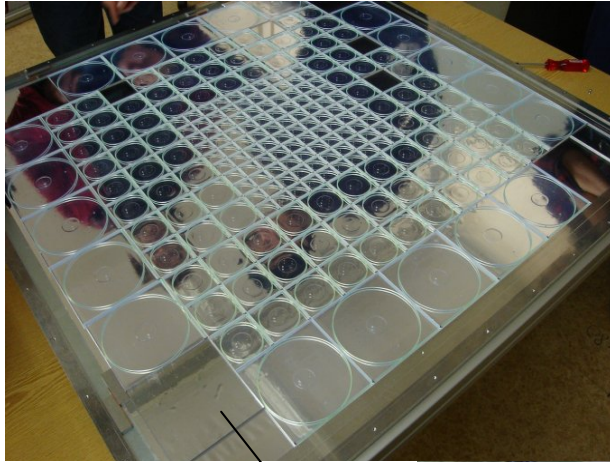
Calorimeter for ILC

- Scintillator HCAL construction at DESY
 - Mechanics
 - 1 cubic meter stack, cassettes, calibration light system
 - Assembly (with colleagues from ITEP, LPI, MEPHI)
 - FE electronics
 - With ASICs from LAL
 - Integration
 - 8000 Scintillator tiles and SiPMs (ITEP and MEPHI)
 - Calibration electronics (Prague)
 - DAQ (UK groups)
 - Tail catcher (Northern Illinois)



*Proof of principle -
Not a technical prototype!*

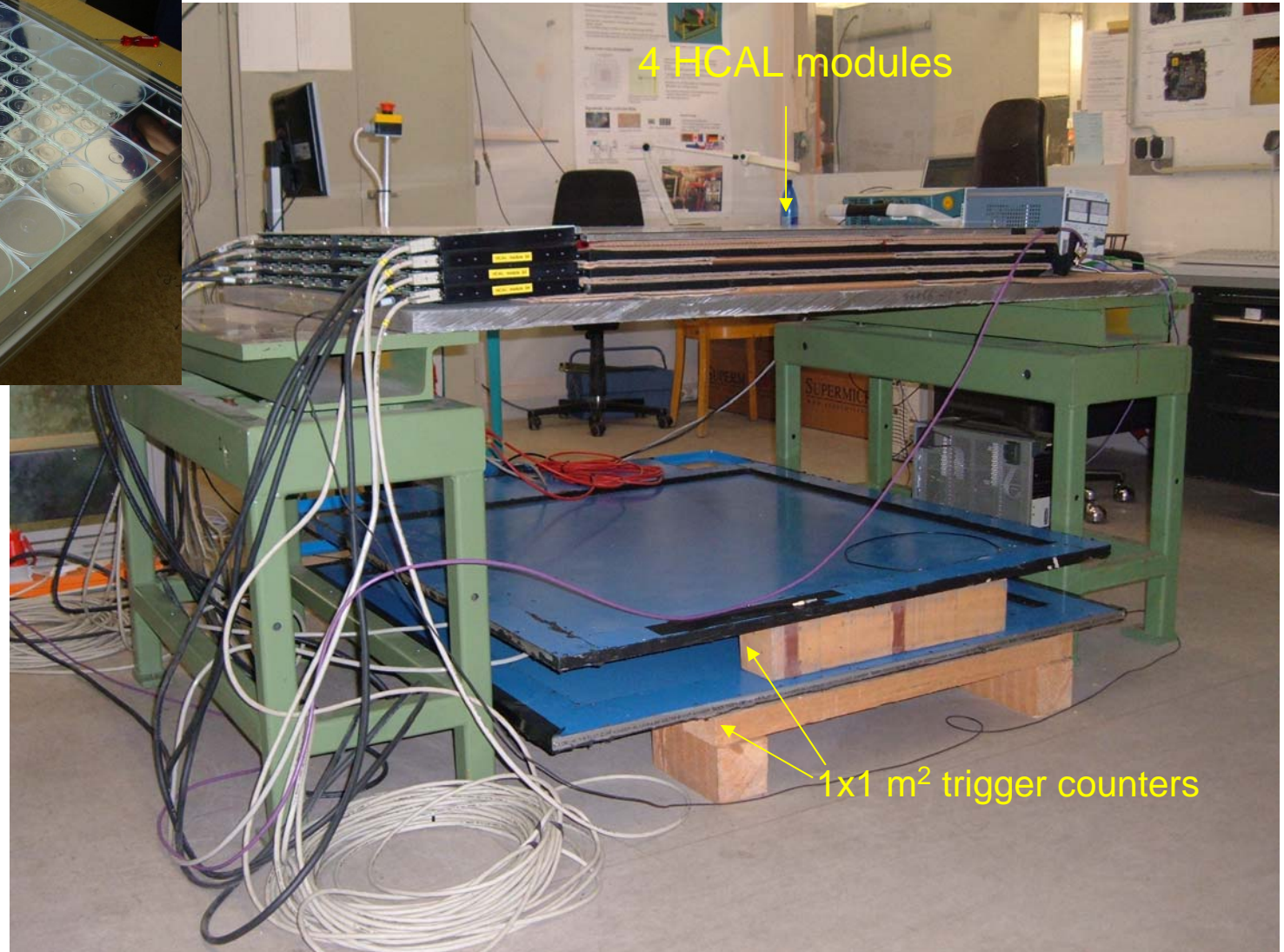
Commissioning at DESY



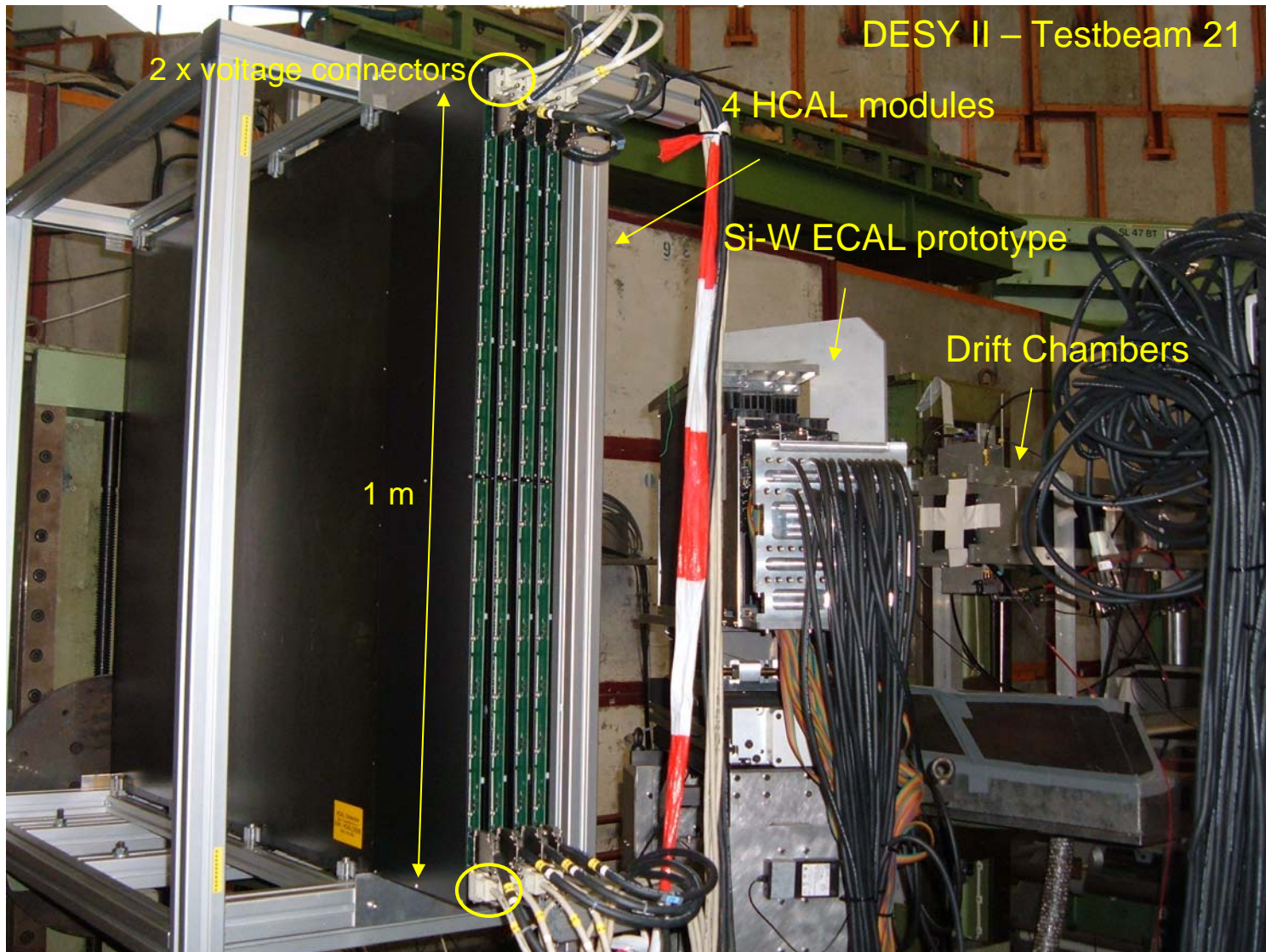
Cosmics set up

1x1 m² trigger plates
in coincidence

requires >3 modules
for telescopic cuts
analysis

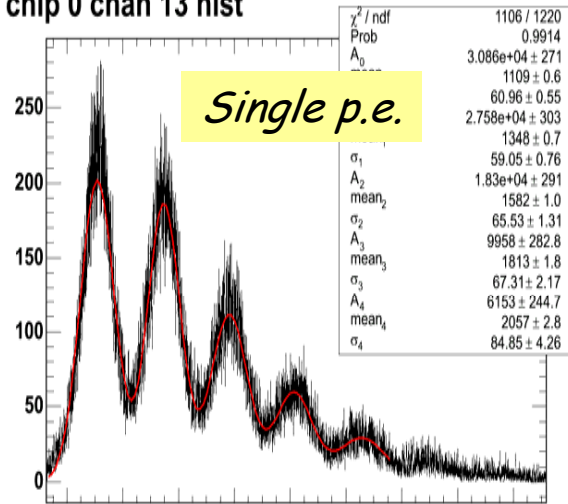


Commissioning at DESY

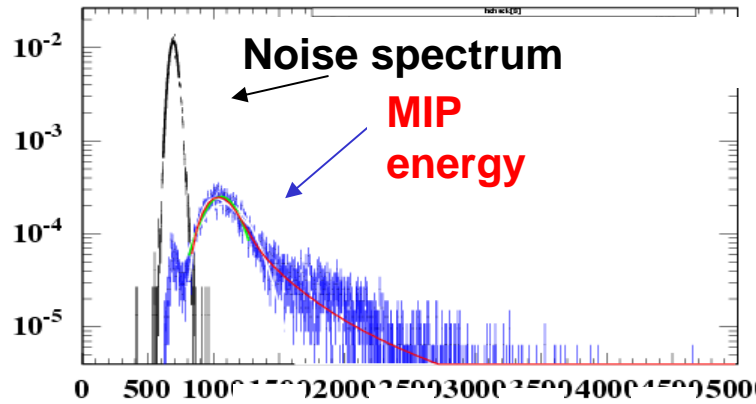


HCAL test results

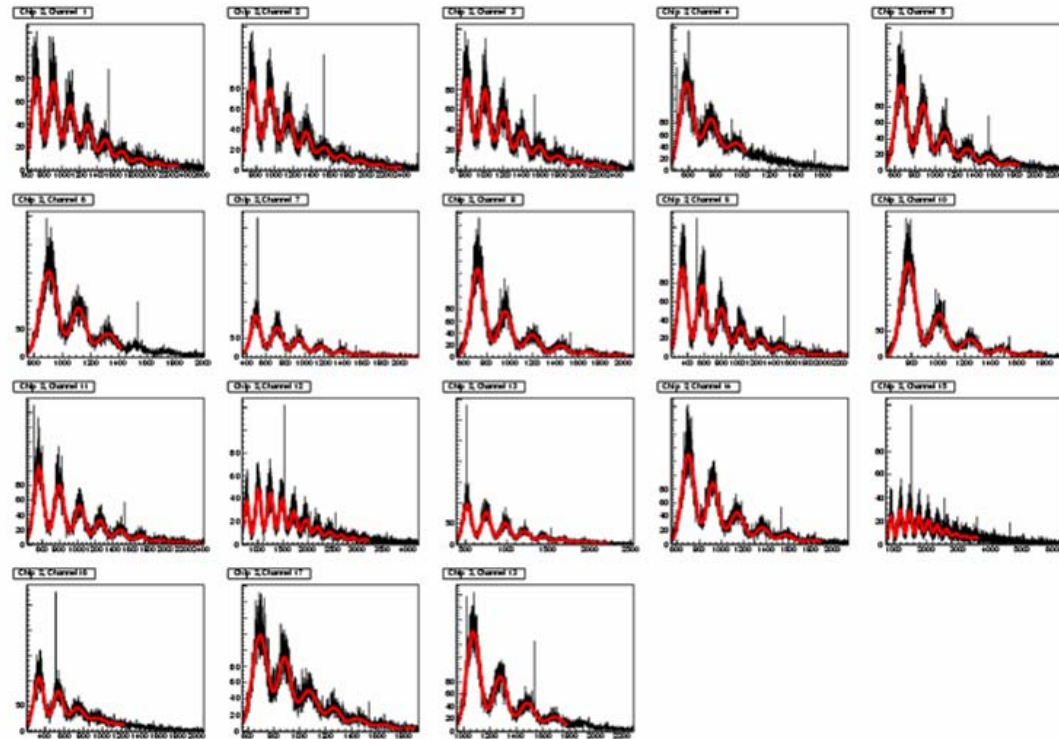
FE 0 chip 0 chan 13 hist



- From test bench to multi-channel system



Run 201353 - LED 2 - SER013, Slot 12, FE3 - Entries vs. ADC channels

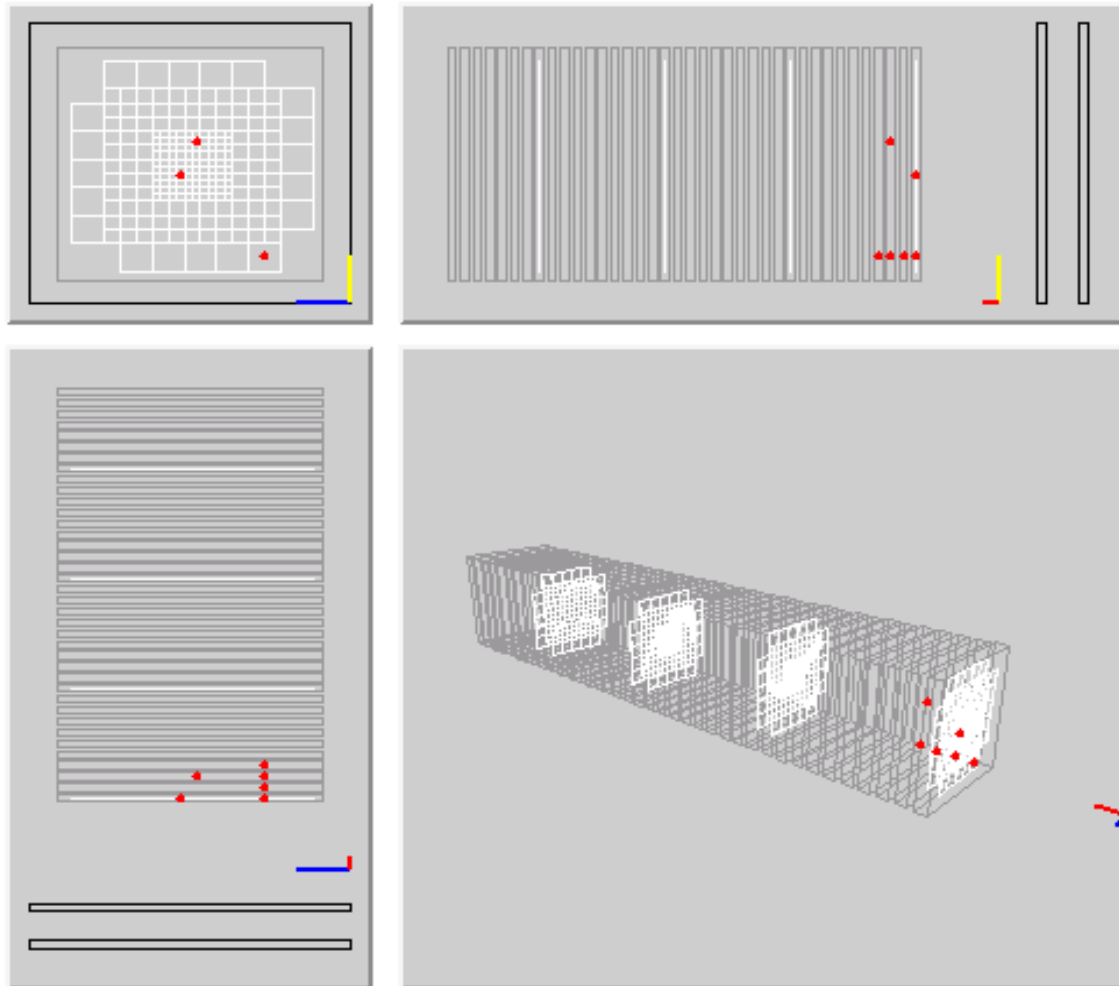


HCAL test results

Run 220124 Event 2630

Time: 20:03:03:734:556 Fri May 5 2006

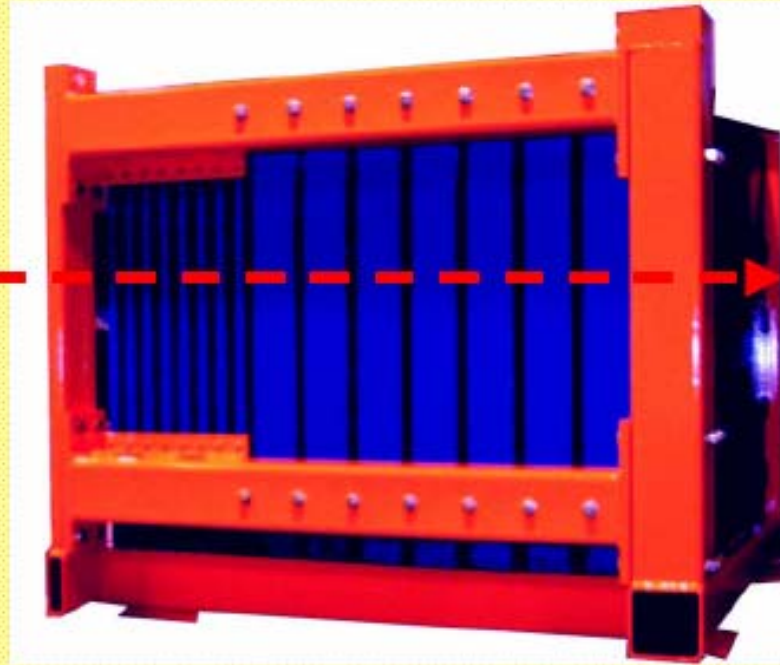
DaqEvent info ...



Tail Catcher (NIU)

The absorber has 8 layers of 2 cm thick and 8 layers of 10 cm thick steel. Length is 142 cm. Height is 109 cm. Weight is about 10 tons.

TCMT has 16 cassettes with about 1x1 m² active area, made from 5 cm extruded scintillator strips in alternating x-y orientation.



- All elements of the readout chain were fully tested, including common readout with AHCAL and electron beam test at DESY in November 2005.

Tail Catcher (NIU)

Beam Test at Fermilab in February 2006

Finger
counters
(trigger)



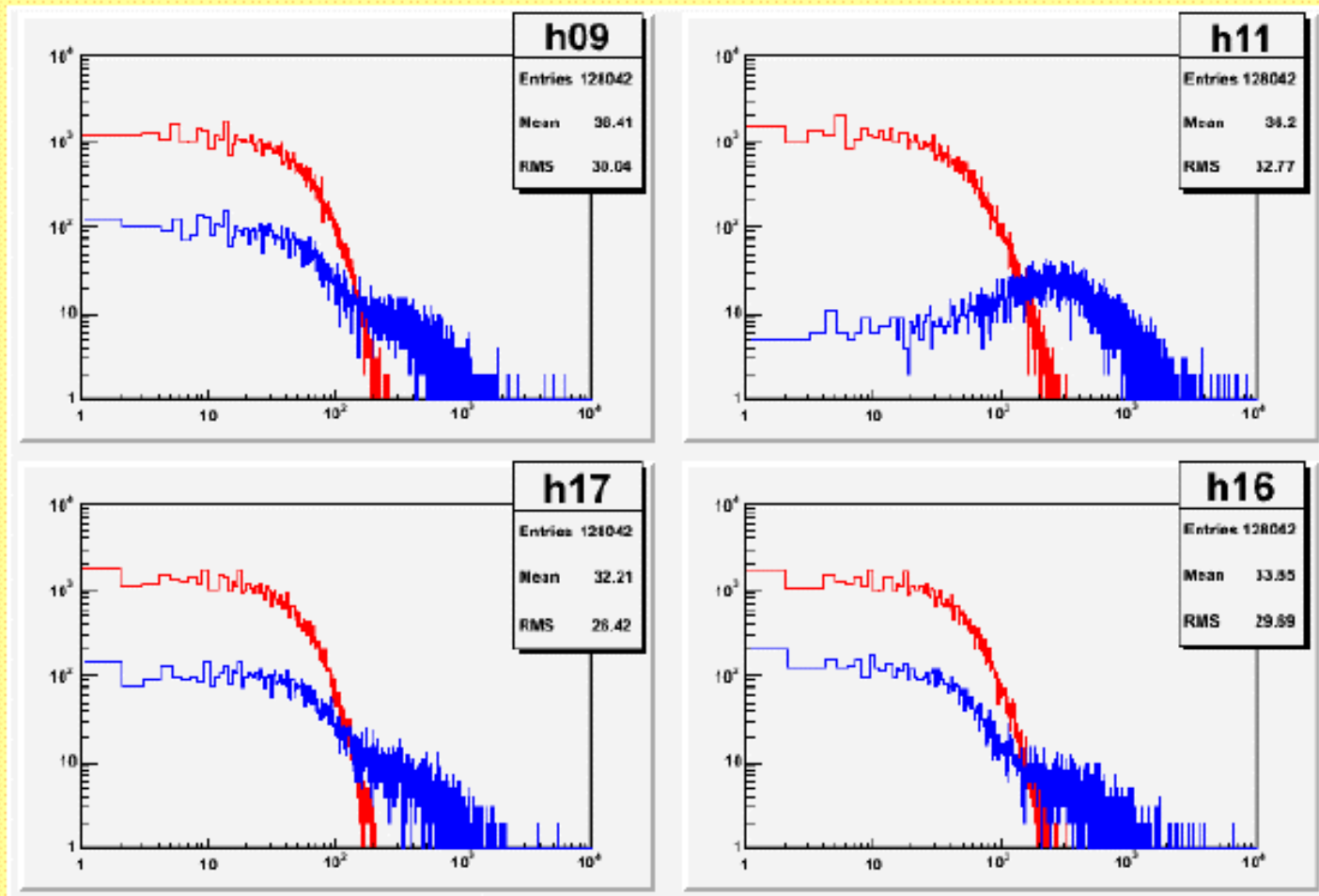
TCMT
cassette



The test involves DESY, NICADD at NIU, ICL, and Fermilab.

Tail Catcher (NIU)

Response to 120 GeV/c Protons

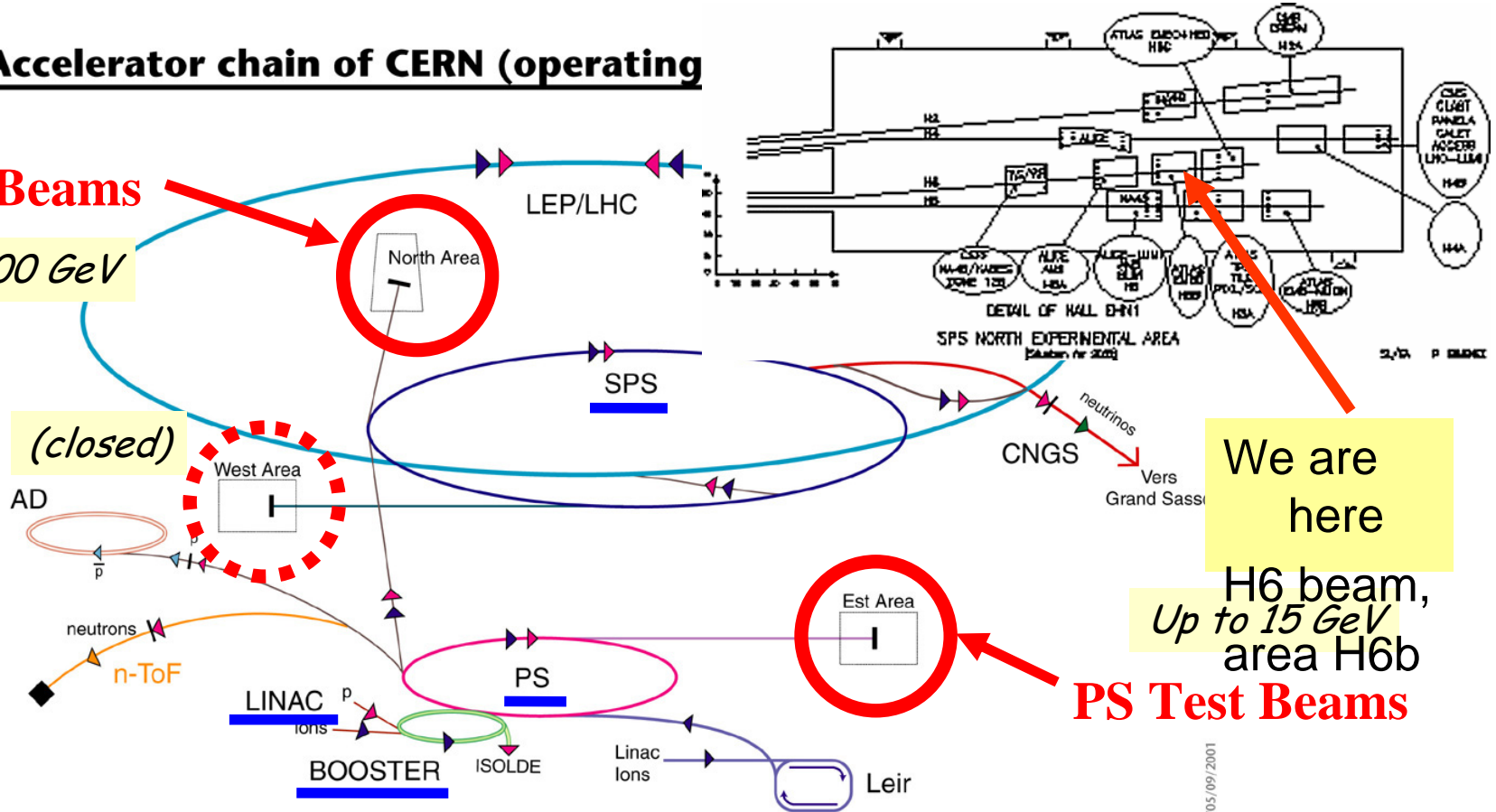


CERN SPS North Area

Accelerator chain of CERN (operating)

SPS Test Beams

Up to 400 GeV



CERN.AC_HF205_V05/09/2001

▶ p (proton)
▶ ion
▶ neutrons

▶ \bar{p} (antiproton)
▶ \leftrightarrow proton/antiproton conversion
▶ neutrinos

AD Antiproton Decelerator
PS Proton Synchrotron
SPS Super Proton Synchrotron

LHC Large Hadron Collider
n-ToF Neutrons Time of Flight
CNGS Cern Neutrinos Grand Sasso

We are here

Up to 15 GeV, area H6b

PS Test Beams

Mechanical installation at CERN

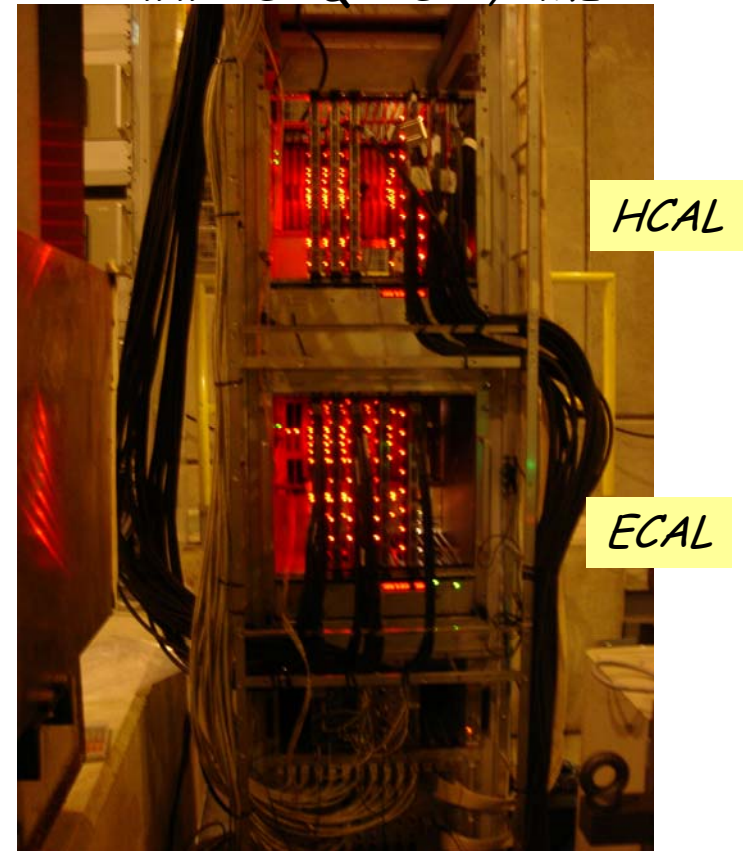


HCAL, common DAQ

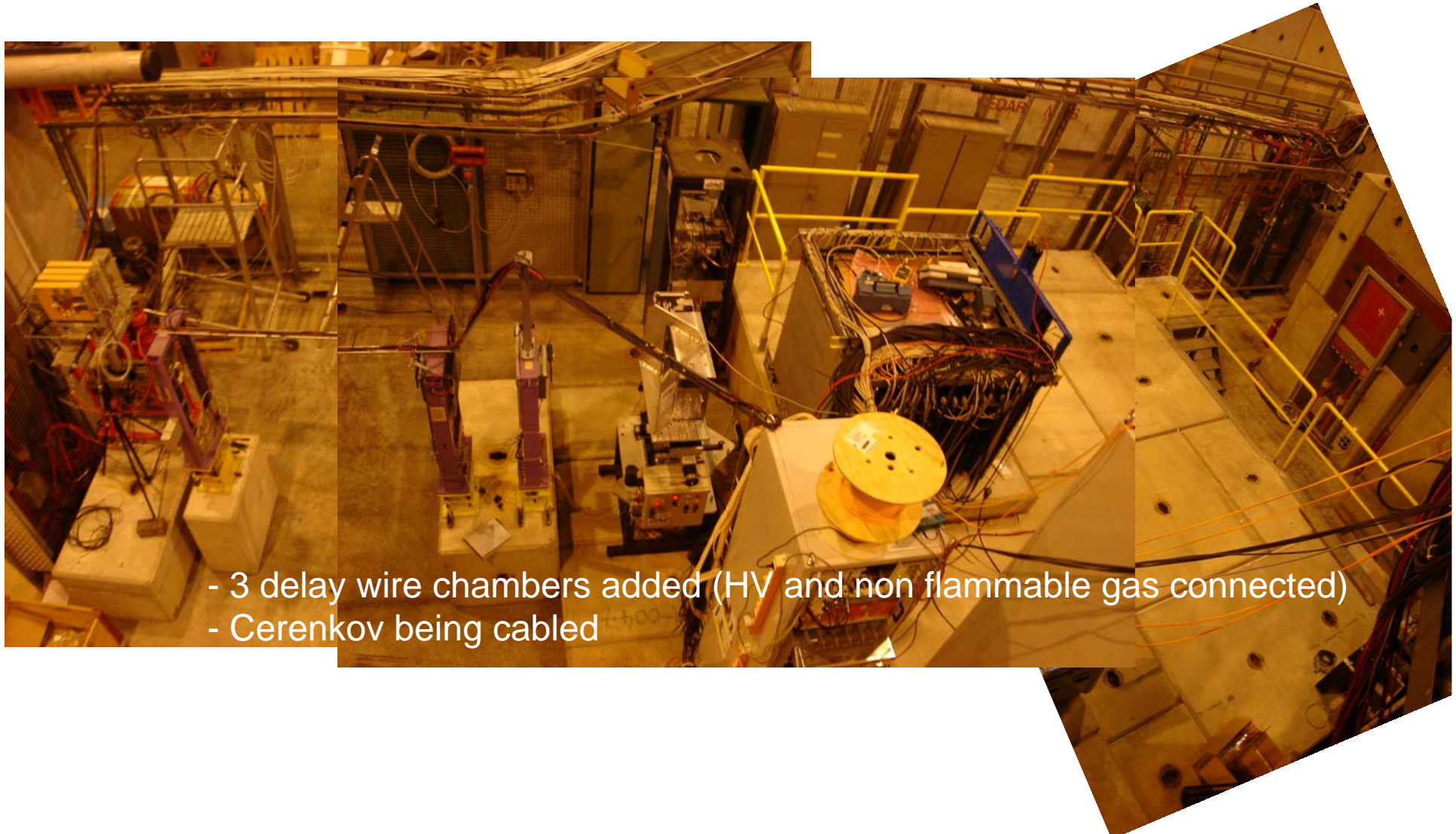
- HCAL looks like a real calorimeter for the first time



common DAQ: ADCs, VME



Overview, beam instrumentation



- 3 delay wire chambers added (HV and non flammable gas connected)
- Cerenkov being cabled



First week (July 3-7) Summary

- Monday: mechanical installation of ECAL, HCAL and racks, power
- Tuesday: DAQ tests, voltage supply, cable supports, first channels r/o
- Wednesday: DCs installed, full detector cabled and read out
- Thursday: trigger counters, r/o debugging, first LED signals seen
- Friday: Gigabit switch installed

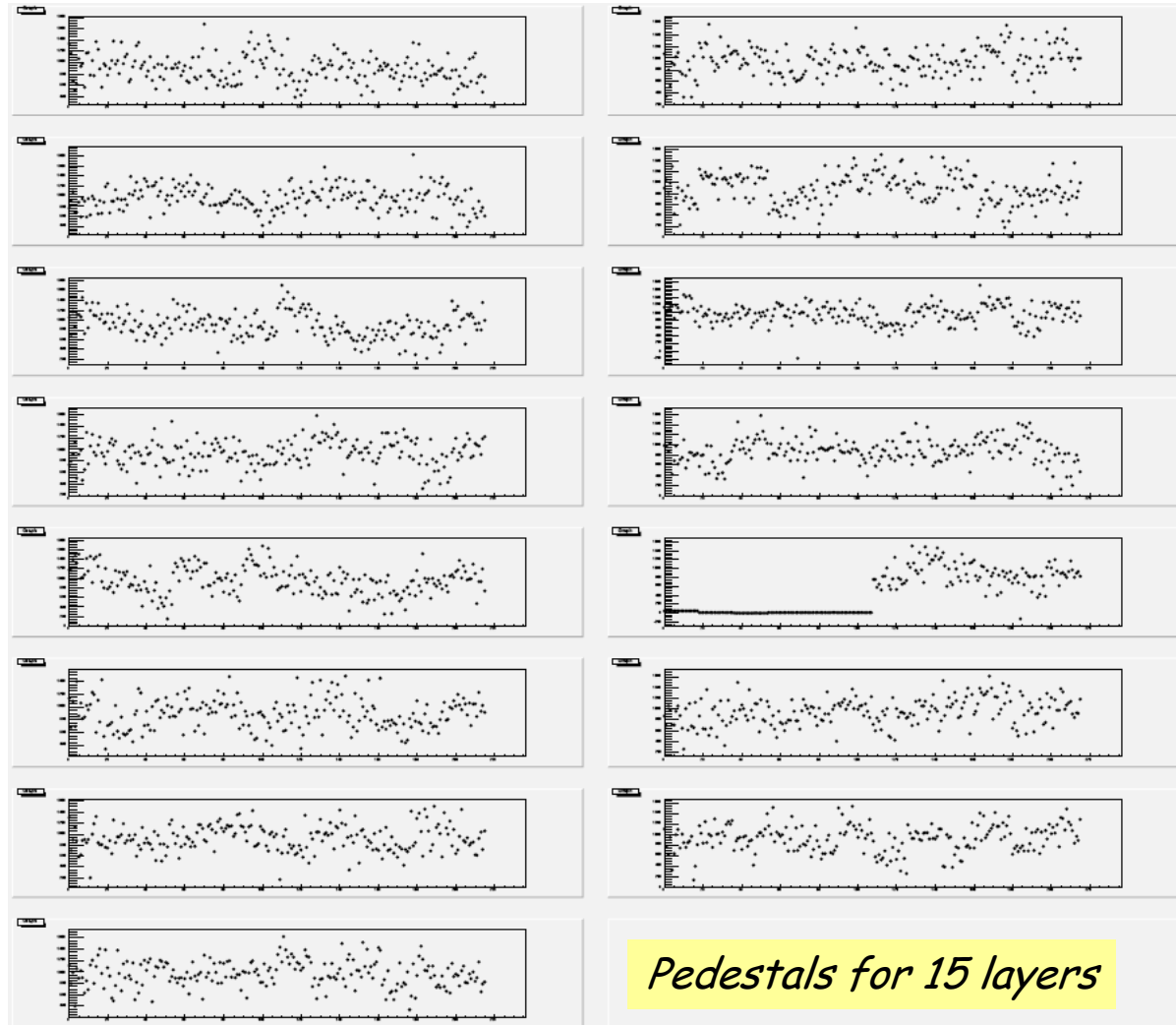
- Already now: a fantastic success
 - See <http://www-flc.desy.de/hcal/cerntestbeam/>

First week summary



Analysis feedback

- Data transfer to DESY dCache
- using GRID tools





Equipment

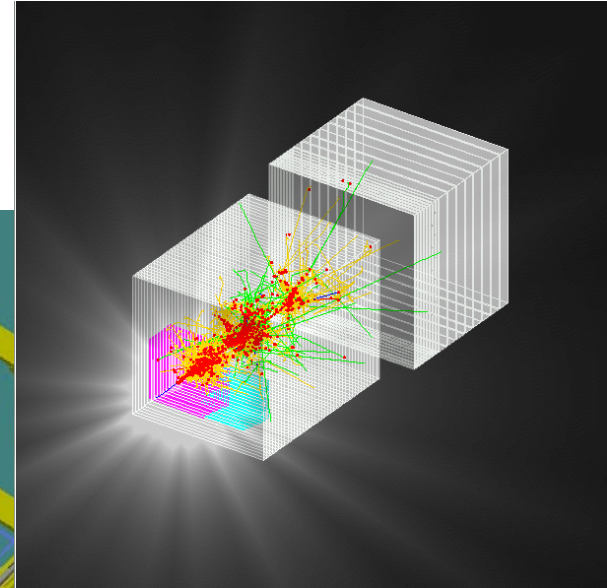
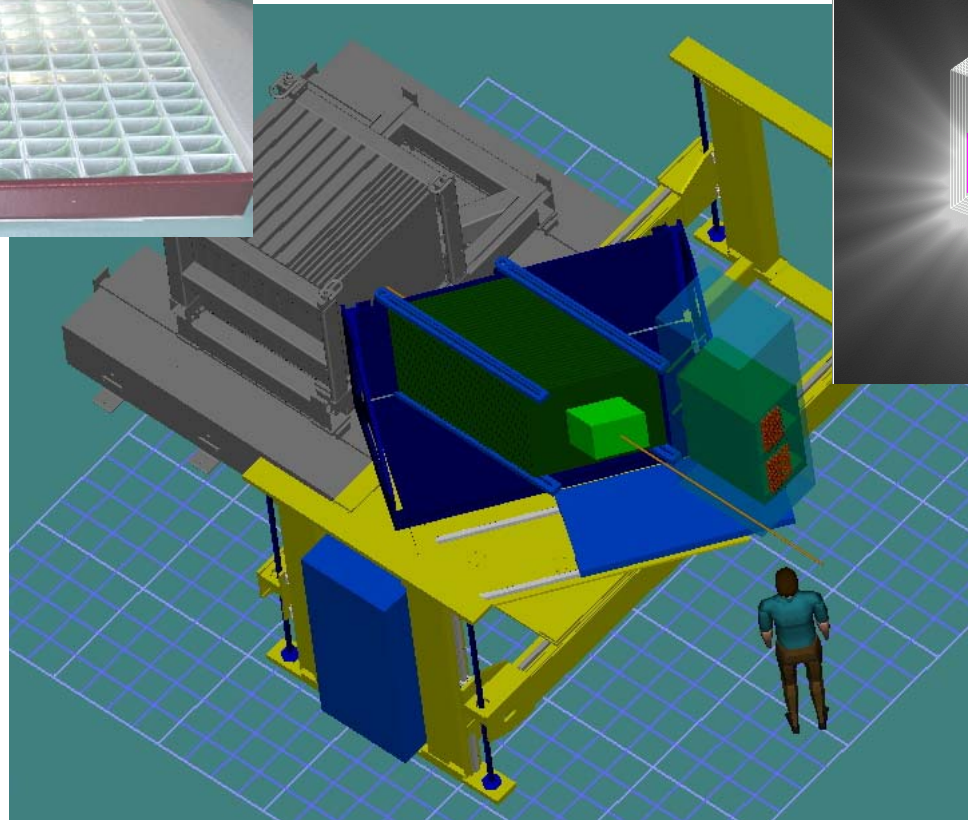
- ECAL: 27 of 30 layers in central part, almost full depth
- HCAL: 15 layers, every 2nd gap in 3.5λ , 25-30 in October
- TCMT: 50% of channels, first (fine) section (1λ)



Goals

- "CALICE ECAL":
 - 6-50 GeV electrons and pions
 - ECAL: data MC comparisons
 - HCAL: establish detector system and calibration
- "CALICE HCAL":
 - 6-100 GeV electrons and pions (+, -)
 - HCAL: First coarse data MC comparisons with HCAL only
 - TCMT: establish system and calibration
- "CALICE combined":
 - 6-100 GeV electrons and pions (+,-)
 - ECAL + HCAL + TCMT: data MC comparisons
 - Possibly some HCAL standalone with more layers and inclined incidence

Outlook



Outlook

Fermilab Test Beam - the next step!

(see next talk by Jose Repond)

- Move of ECal, AHCAL and TCMT from CERN to FNAL
- Repeat some of the CERN electron, hadron running
- Extend to low energy (1-5 GeV) running
- Stand alone tests with RPC 1m³ and GEM 1m³ DHCAL
- Comparison of AHCAL and DHCAL(s)
- Combination HCal ⊕ ECal running
- Tagged protons, anti-protons, neutrons ??