CALICE/ILD SiW-ECAL+SDHCAL T2-H2 26/09–10/10/2018

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(slides from Vincent Boudry)

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for the CALICE/ILD SiW-ECAL & SDHCAL groups

LLR+LAL+Kyushu & IPNL+CIEMAT+Gent+LPC

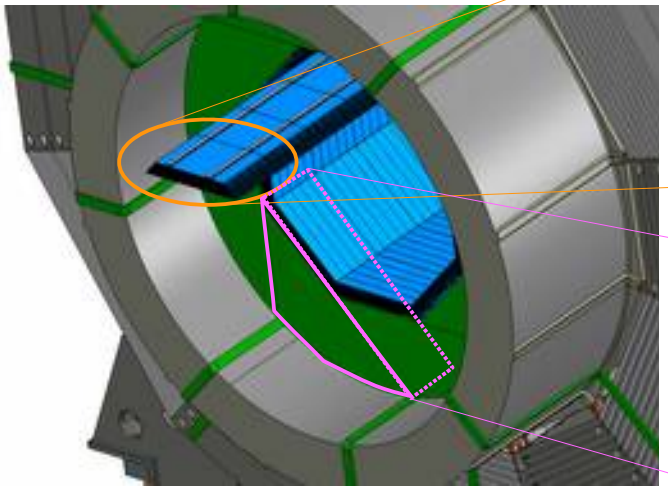
SPS Users meeting
04/10/2018

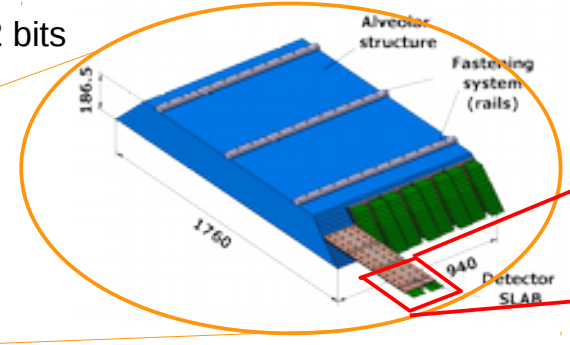
CALICE ‘high-granularity’ Prototypes

Highest granularity options for the ILC Calorimeters: SiW-ECAL + SDHCAL

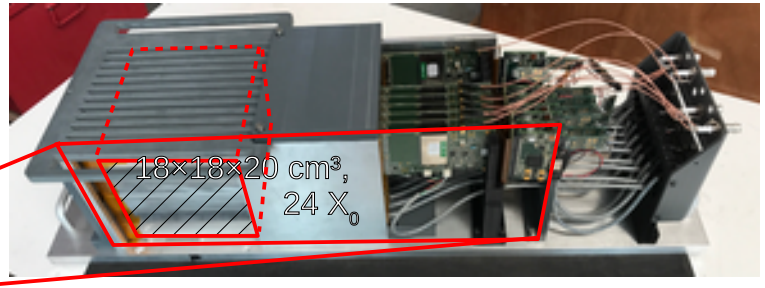
– Embedded, pulsed readout electronics

Silicon-Tunsgten ECAL, 12 bits
5×5 mm² cells

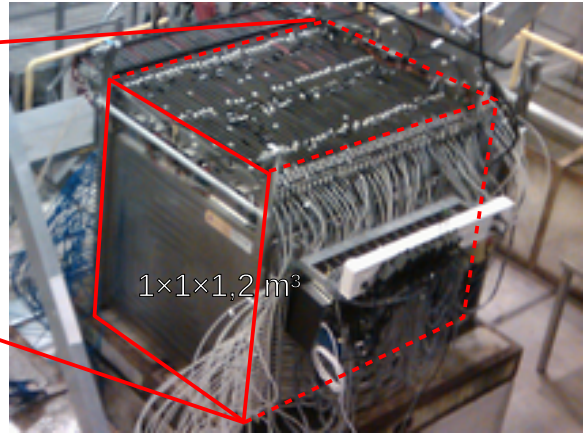


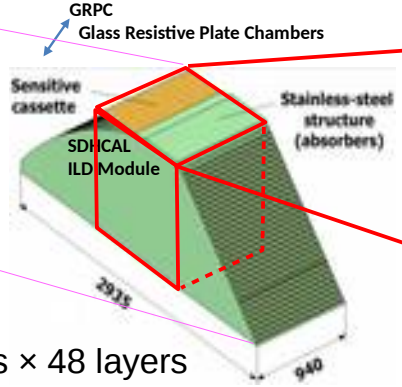


Being built (11 working layers)



Operational for ≥4 years





Semi-Digital (3thr. → 2 bits) readout,
Fe-Gaseous Detector , 1×1 cm² pads × 48 layers

Setup

First week dedicated to ECAL program

- Nice electron beams, thanks to the beam operators.

Second week dedicated to hadrons

- First ECAL +SDHCAL successfully running together and recording common events.

First : low energy negative pions (10 to 30 GeV)

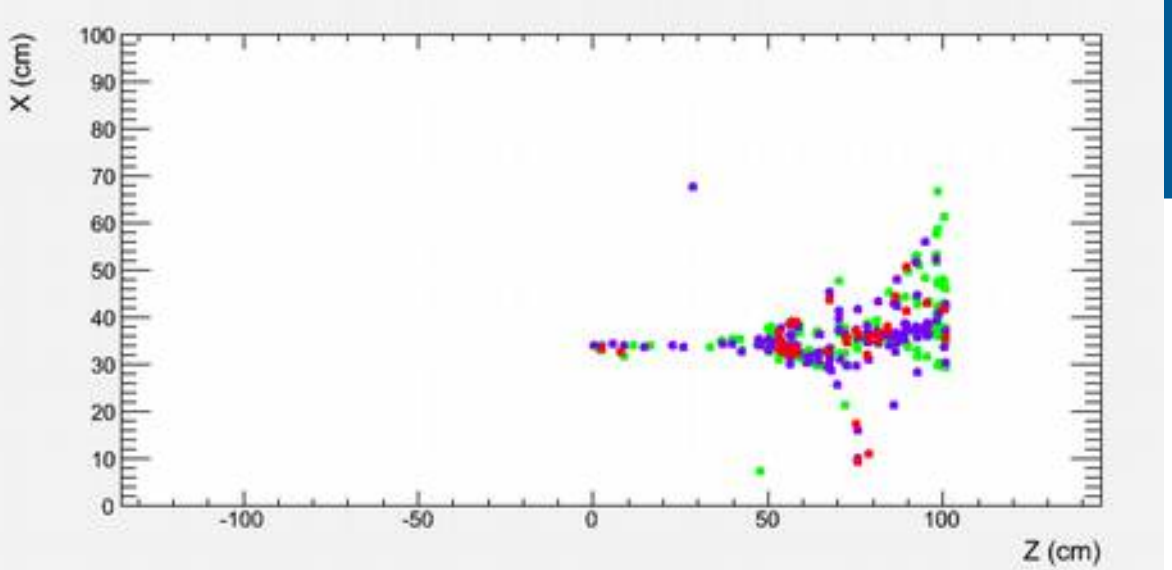
- Few thousands pions collected at each energy (thanks for the setting)
  However, most of the particles are muons. Bastian currently trying to increase the pion rate (thanks).

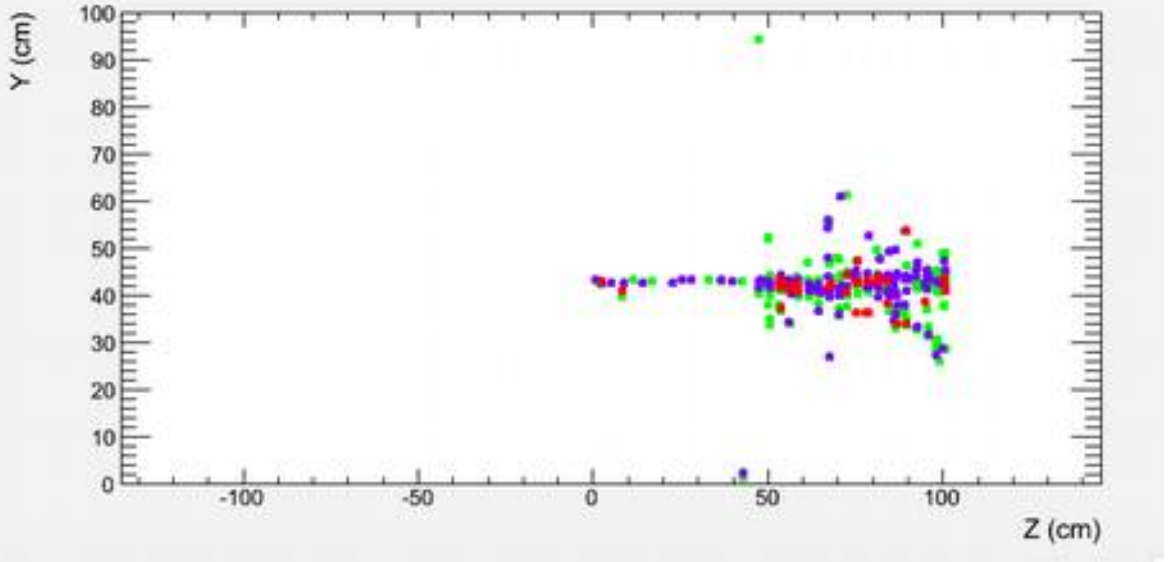
Then higher positive and negative pions (40 to 90 GeV)

Proton/pion discrimination, collecting data for Particle Flow Algorithm training, improves SDHCAL calibration, ...

Installation of new concept of RPC behind the setup and of CMS RPC for muon upgrade will be finalized on friday and included in a planed long muon run.

A pion in the HCAL

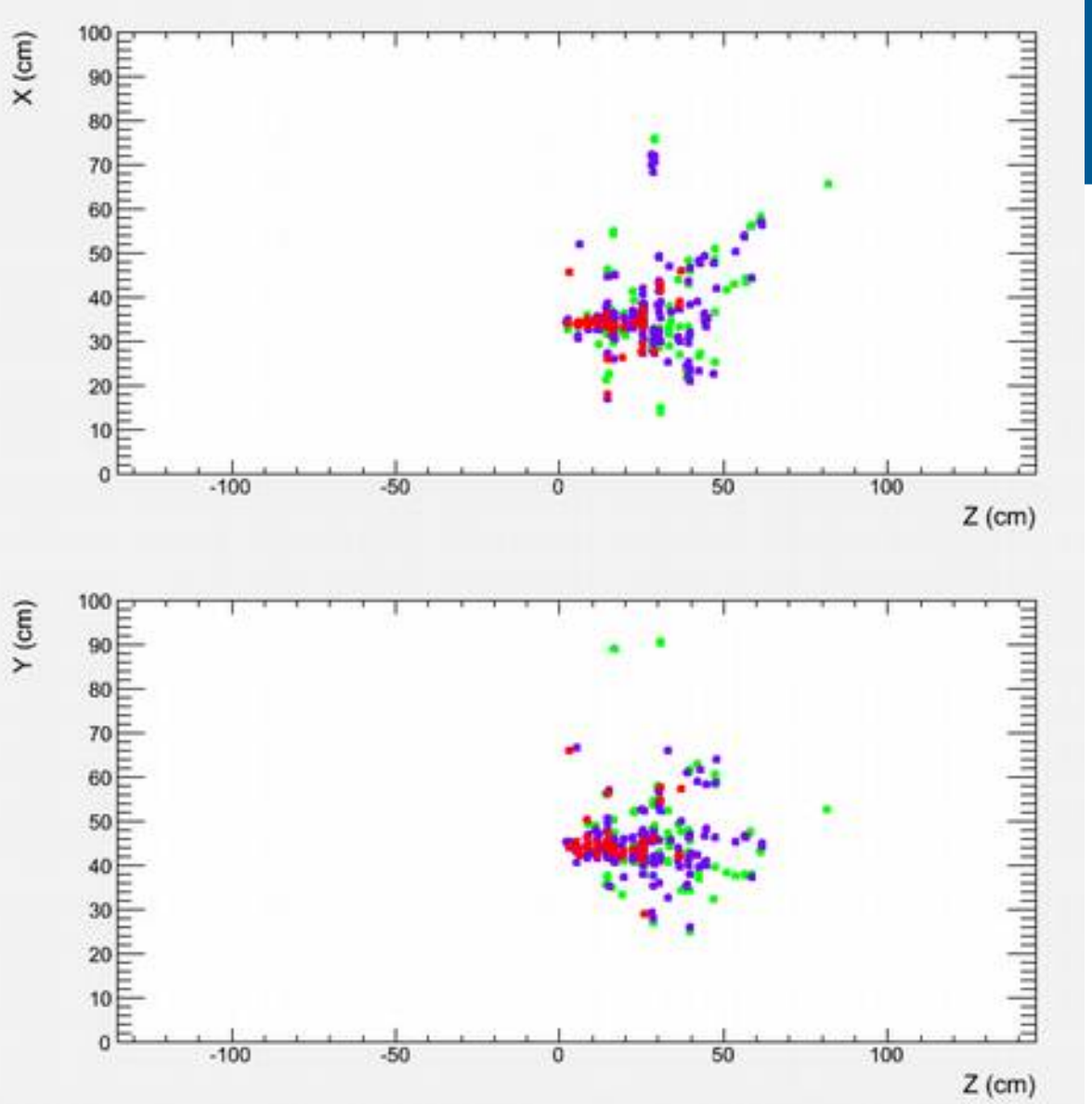




A pion

This pion has interacted in the ECAL before Entering the HCAL.

Common ECAL-SDHCAL event display under development.



Extra’s

Beam test in 2018

2 weeks @ **DESY June 2017** for SiW-ECAL

- excellent behaviour of 7 layers (1024 chan each): uniformity ~1%, thr @ 1/2 of mip (with auto-trigger), S/N ~20 (ADC) in Pulsed mode

2 weeks @ **DESY July 2018** → test of new SiW-ECAL layers:

- Same + new designs, ≠ Wafers thickness & Guard Ring designs, new ASICs (⊃ TDC) → low energy (1–5 GeV) response: 1 single layer.

2 weeks SiW-ECAL+SDHCAL, **CERN Sept 2018**

Fixed ECAL compact structure 10 layers 24 X_0 W + SDHCAL almost full prototype → **Test of combined DAQ**

Goals:

1) Response to **High Energy electrons** (min (10?) GeV – 150 GeV)

Linearity, (Uniformity), Leakage, SEU, TDC responses, "Square events"

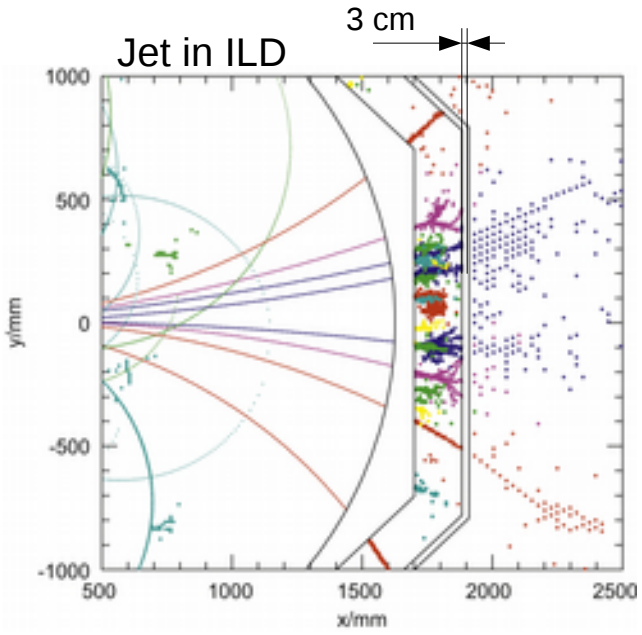
2) Response to **"High rates" EM showers** ~ 10Hz – 10kHz (=max rates in endcaps @ ILC "as high as" 10 evts in 1 ms).

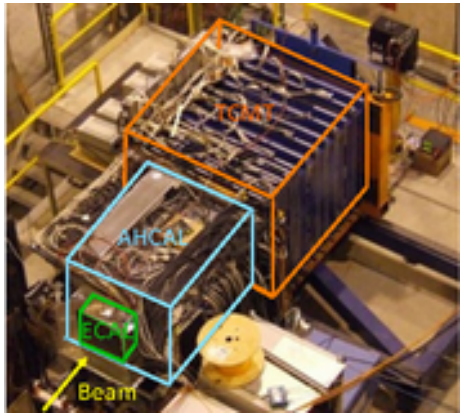
Linearity ECAL+SDHCAL, SEU, (sensitivity to fraction of π, μ's in EM showers, PID with high granularity, ...)

3) **Hadronic showers responses** (largest E scan), low freq (10 Hz)

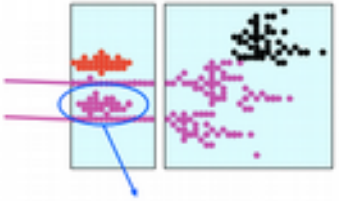
- Detailled description of hadronic showers (Number of secondaries, angles, ...), PFlow algorithms tests with 2 dets (tracking between 2 detectors).

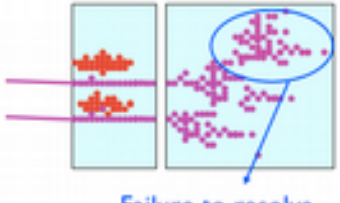
Particle Flow oriented calorimeters

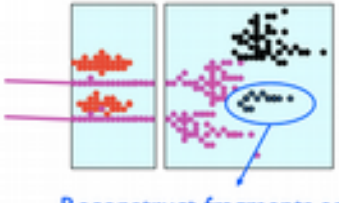




Physical prototypes
Combined BT in 2007
+ FNAL 2010–11
(1×1 cm² SiW-ECAL+
DHCAL, but no SDHCAL)


Failure to resolve photons

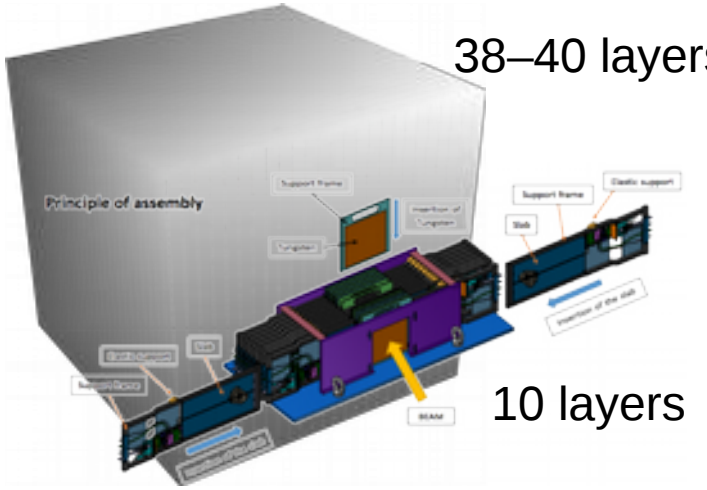

Failure to resolve neutral hadrons


Reconstruct fragments as separate neutral hadrons

Response of from **mip** to **High Energy** showers and High(er) rates

Test of **combined system for PFlow** in **realistic conditions** (number of layers, W configuration, gap).

– e(γ) + h for SW superposition



38–40 layers

10 layers