

ECAL activities WP9.5

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In2p3



Develop a high granularity electromagnetic calorimeter
for use in combined test beams

Milestone (M36):

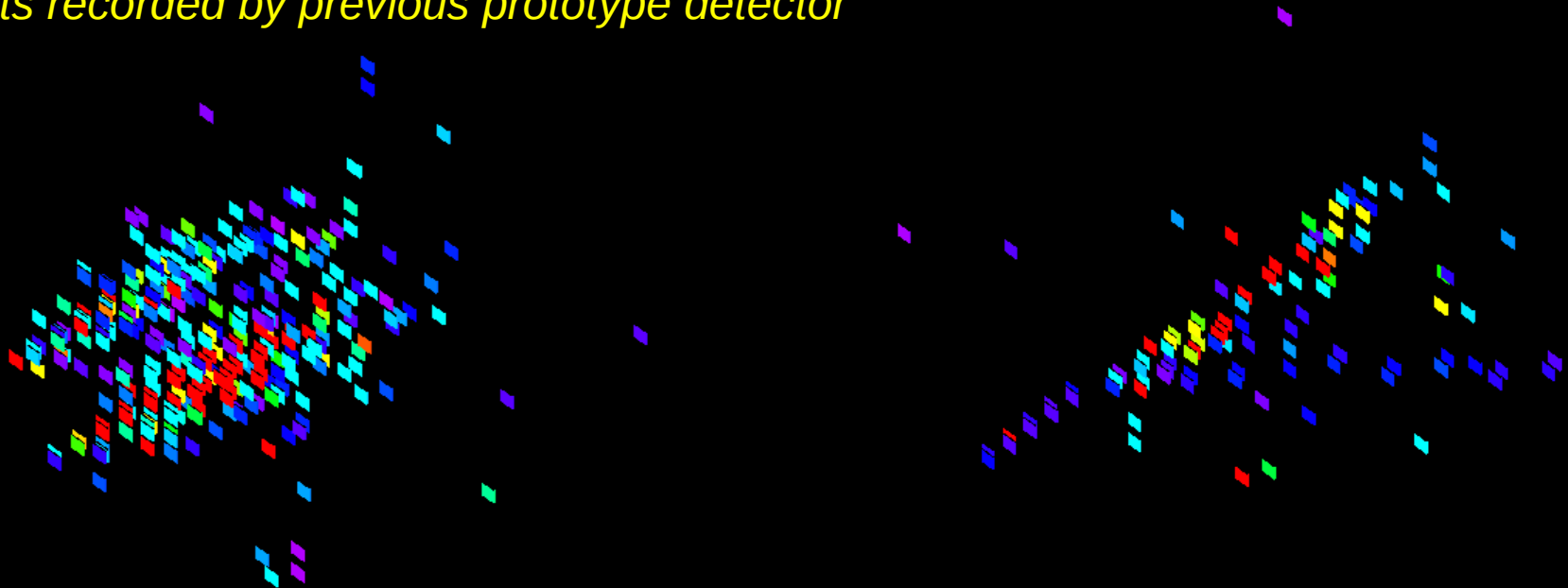
Provide an electromagnetic calorimeter extended from
the EUDET model

ECAL design concept

Sampling calorimeter with tungsten absorber and highly segmented silicon readout planes

Gives an ECAL with
Imaging capabilities (*e.g. interaction point*)
2-particle separation,
reasonable EM energy resolution

Events recorded by previous prototype detector

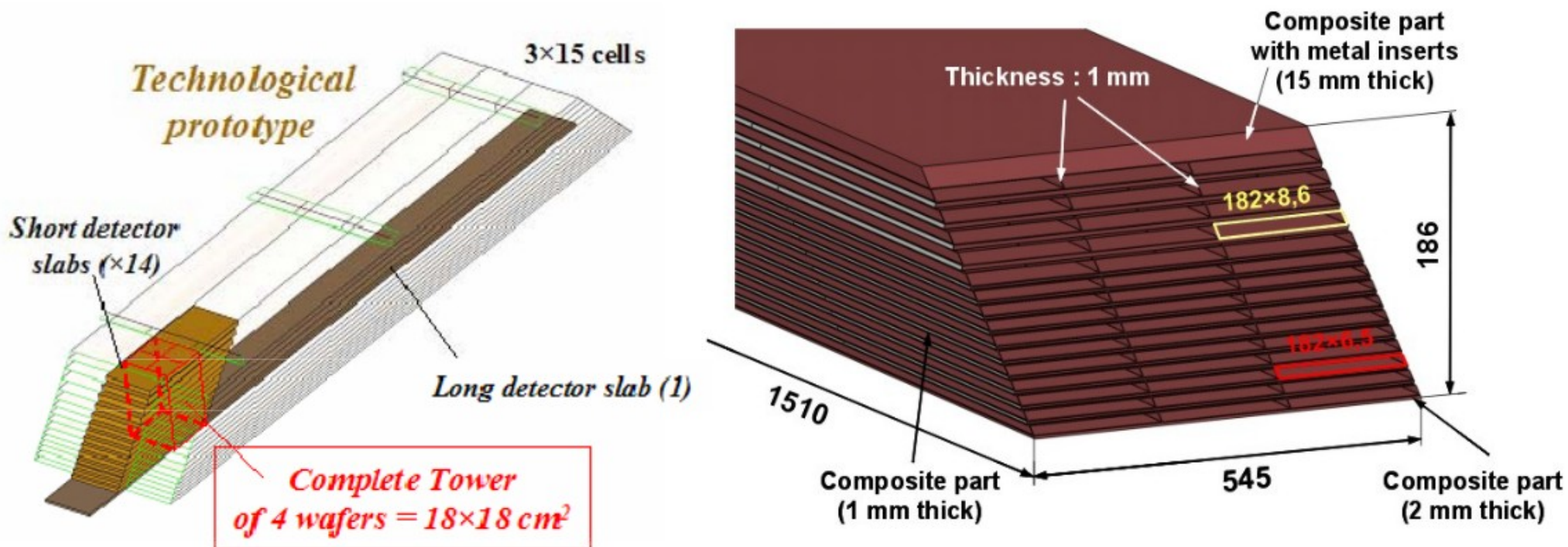


ECAL design

Mechanical support structure integrating absorber layers
carbon fibre composite material

18x18cm² tower instrumented with silicon sensors
5X5mm² readout granularity
finer longitudinal sampling in first detector section

Readout by CALICE DAQ"2" system
and eventually common DAQ from AIDA 8.6.2



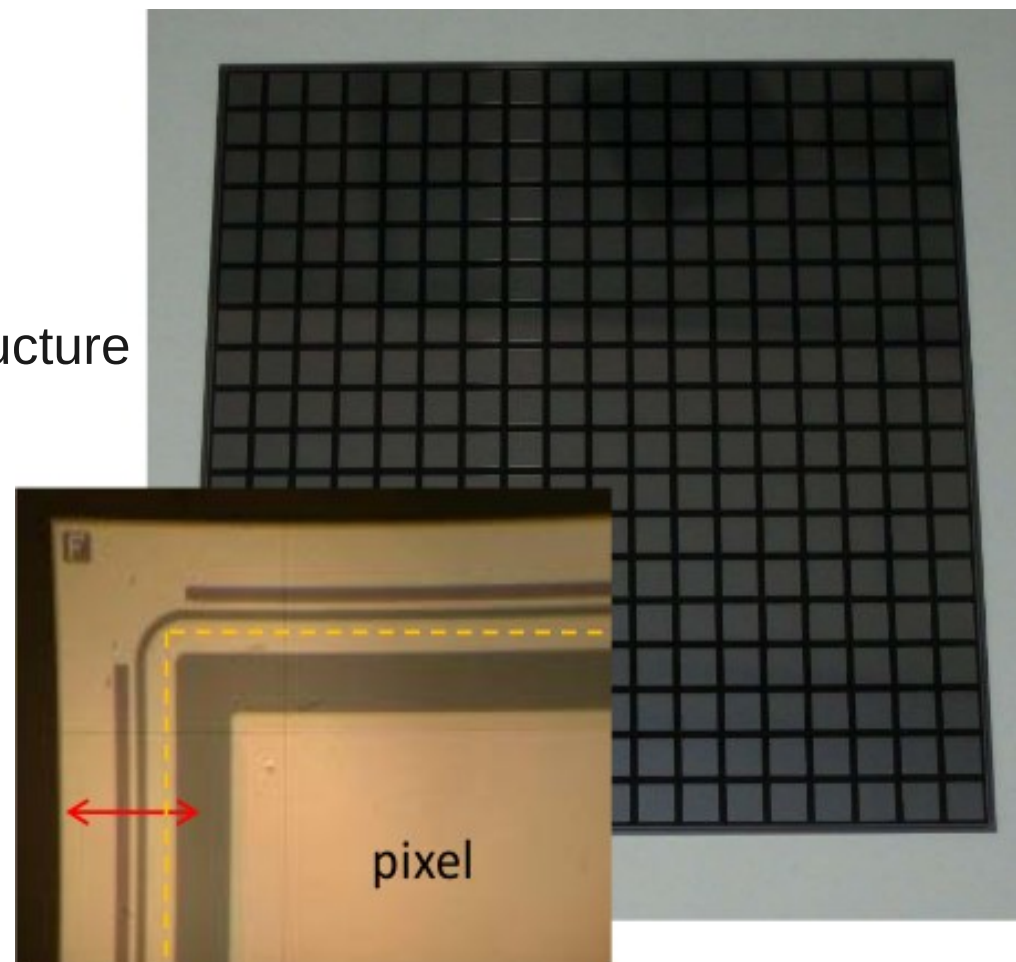
Silicon sensors

Matrix of 5x5mm² PIN diodes
sensor size typically 9x9cm²

High resistivity silicon ($\sim 5 \text{ k}\Omega\cdot\text{cm}$)
fully depleted by $\sim 100\text{V}$ reverse bias

Around 150 of such sensors required
>50 have been purchased

R&D continuing on sensor design:
reduced/modified guard ring (GR) structure
(introduced dead space,
GR-pixel xtalk)
design simplification
with aim to reduced unit price



Reaout ASIC

SKIROC2, developed by Omega
35um SiGe, 7.1x8.5mm²

64 channels / ASIC

Variable gain charge-sensitive pre-amp

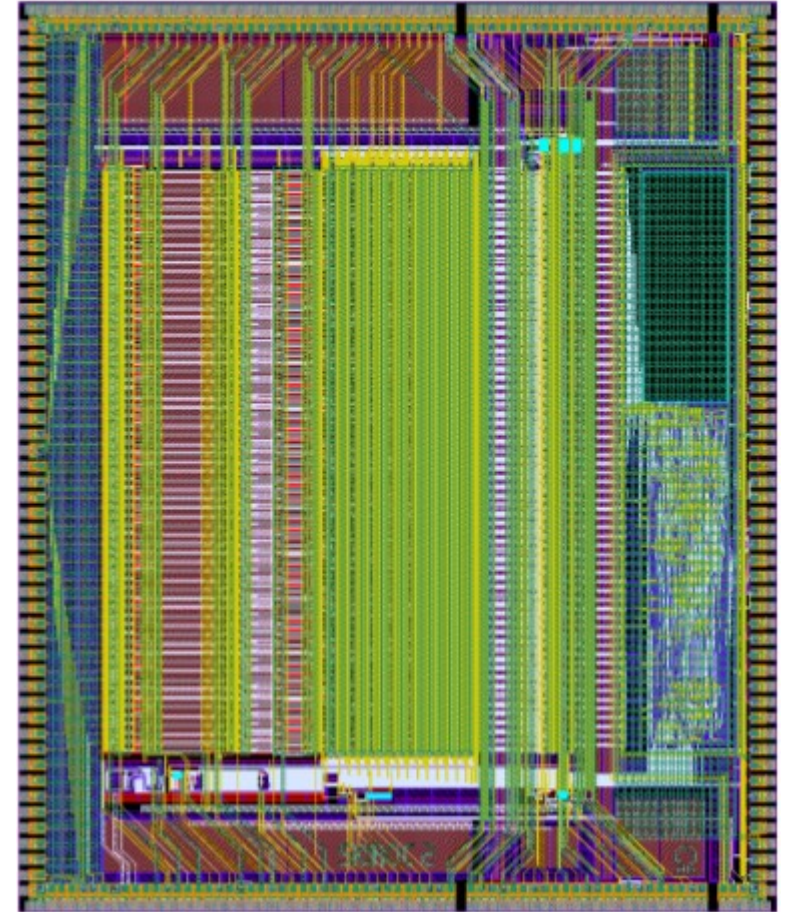
Dual-gain shaper, also fast shaper for trigger

15-depth memory

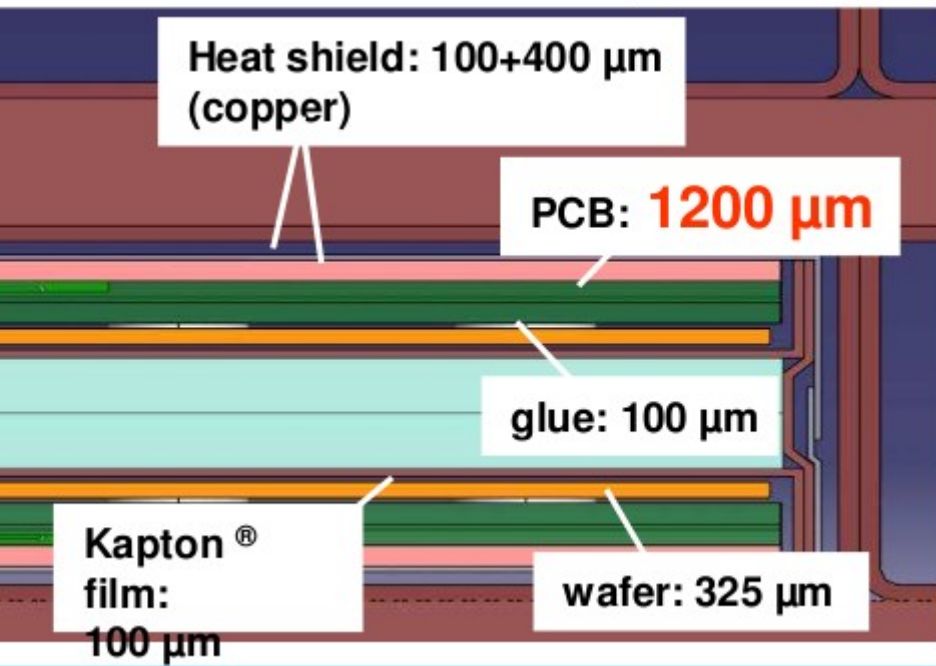
12-bit Wilkinson ADC

Low power design (~ 1.5 mW/channel)

Produced, functionality tested



PCB, detector integration



Sensors and ASICs mounted on PCBs
18X18cm², ~1mm thick
“Active Sensor Unit” ASU

Sensor mounted with dots of conductive glue

At present using packaged ASICs mounted on
PCB surface

Eventually encapsulate unpackaged ASIC into
PCB thickness

Compact connections used to connect ASUs
and adapter card (for power, DAQ
connections)

ASU placed onto mechanical support
(carbon fibre composite)
inserted into mechanical structure



Mechanical structure

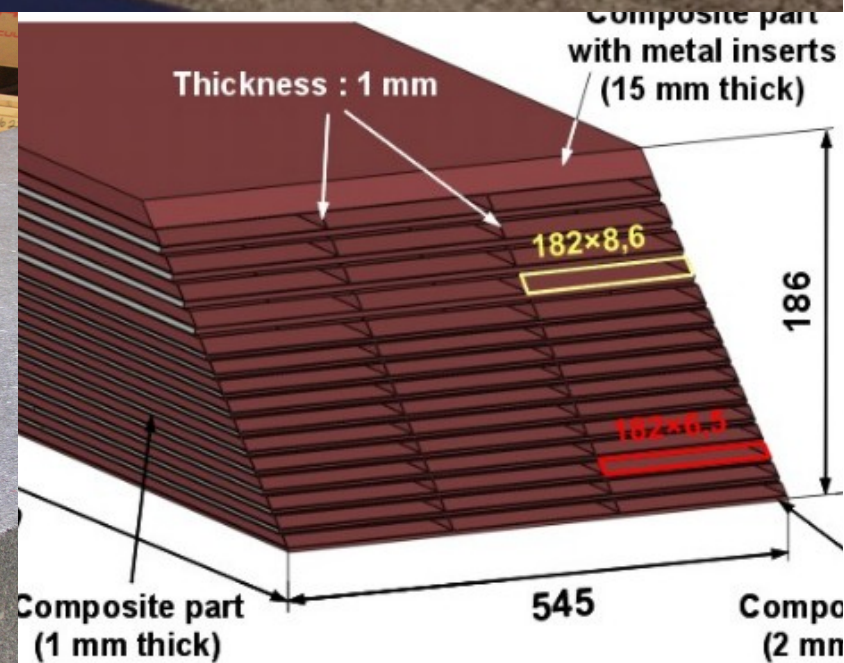
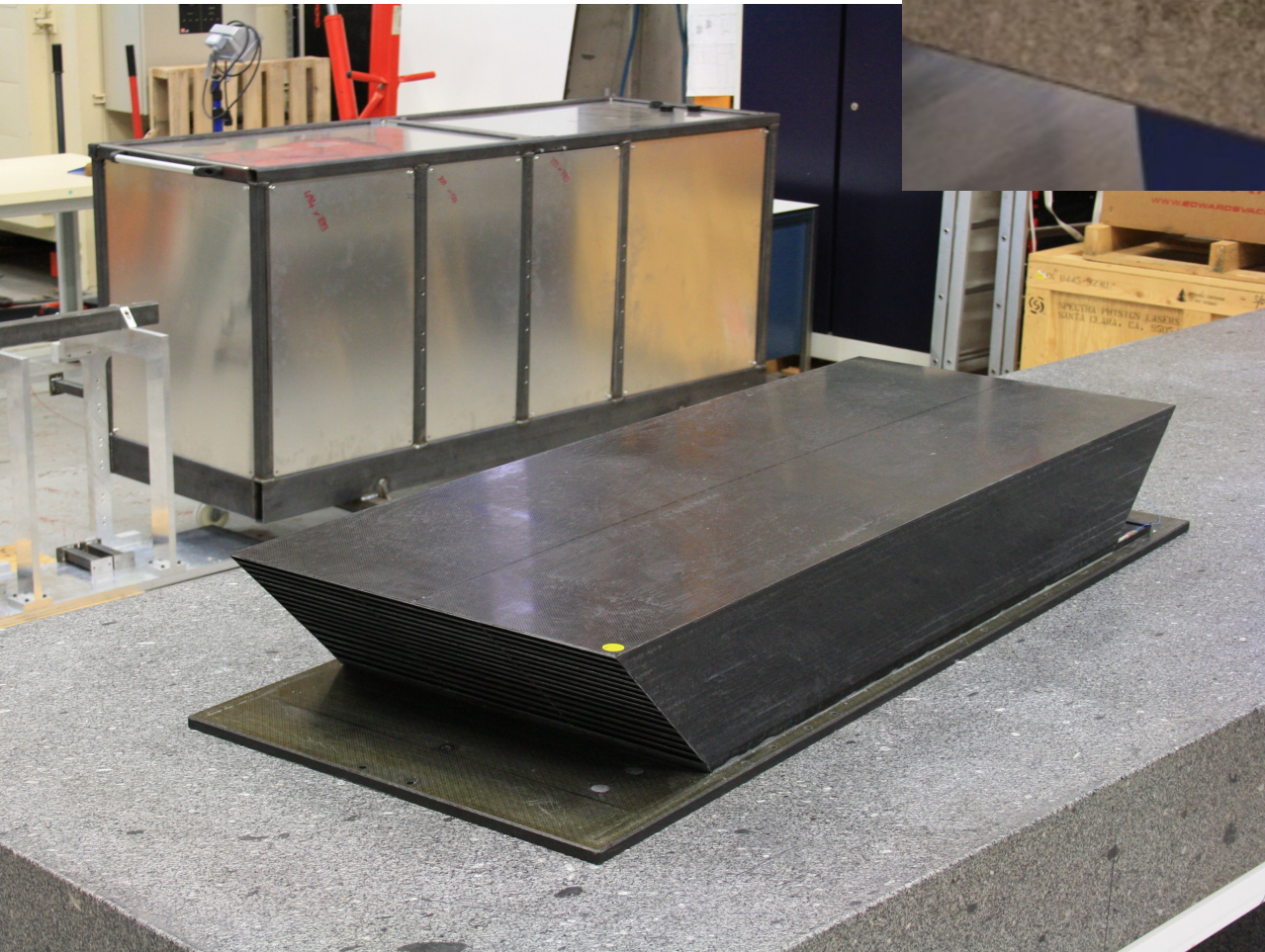
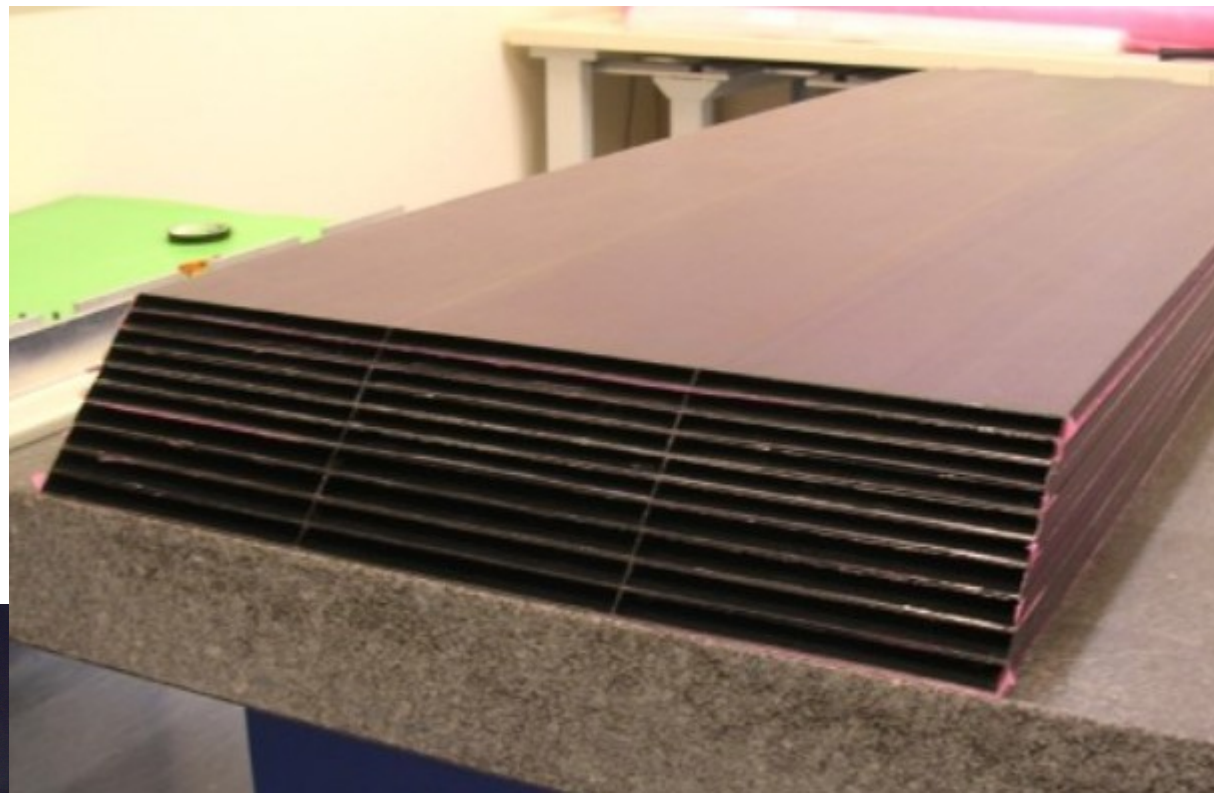
~1.5m long, ~0.5m wide, ~0.2m thick

Modular construction

15 alveola, cut to size

(2 thicknesses)

then assembles and cured
with W plates



Module completed 01/2012

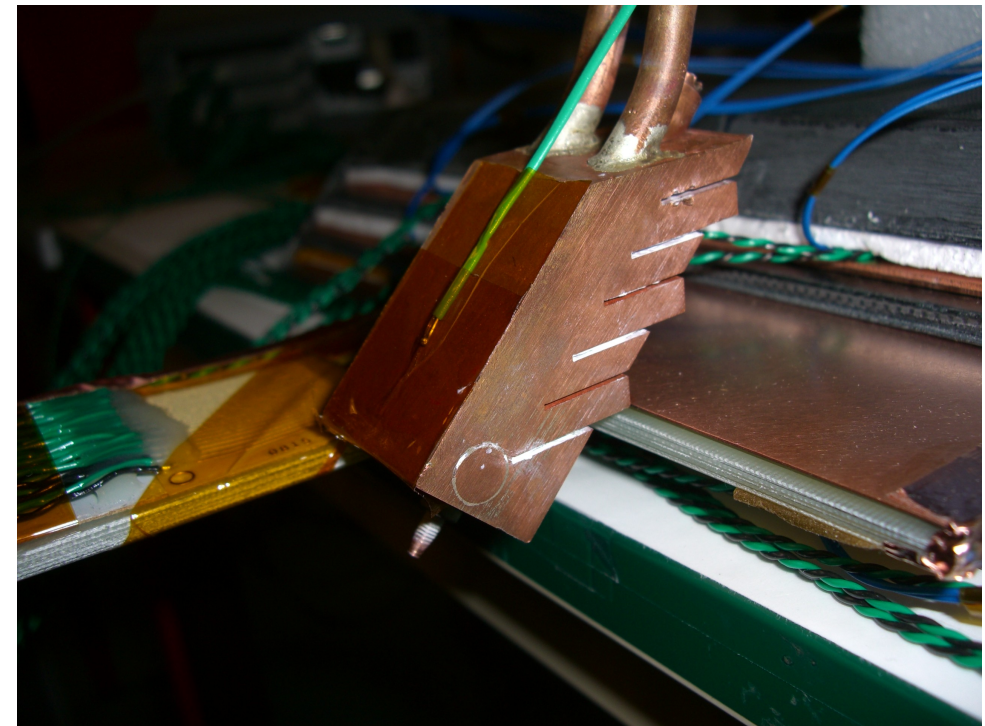
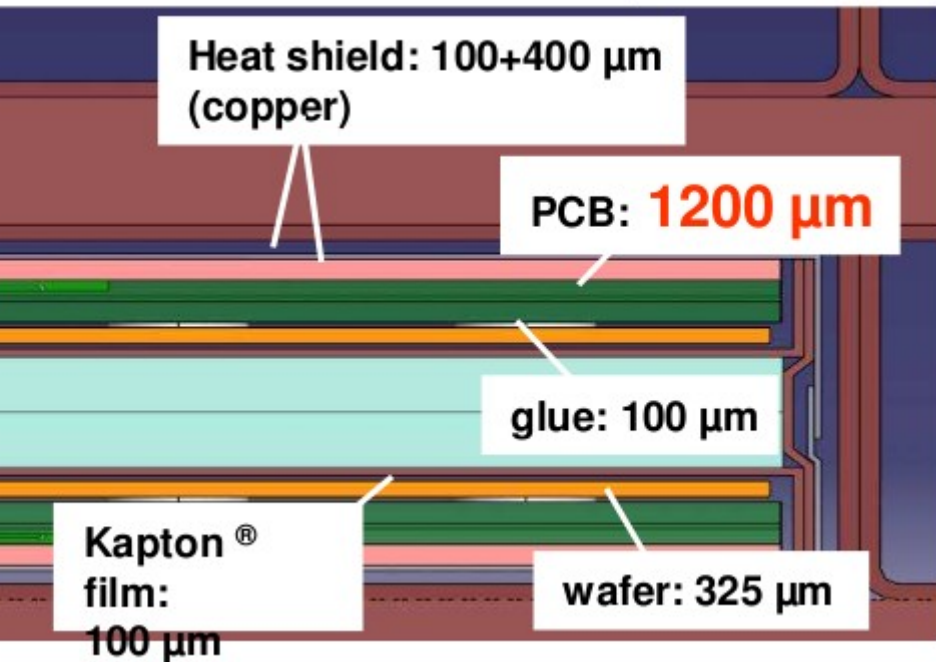
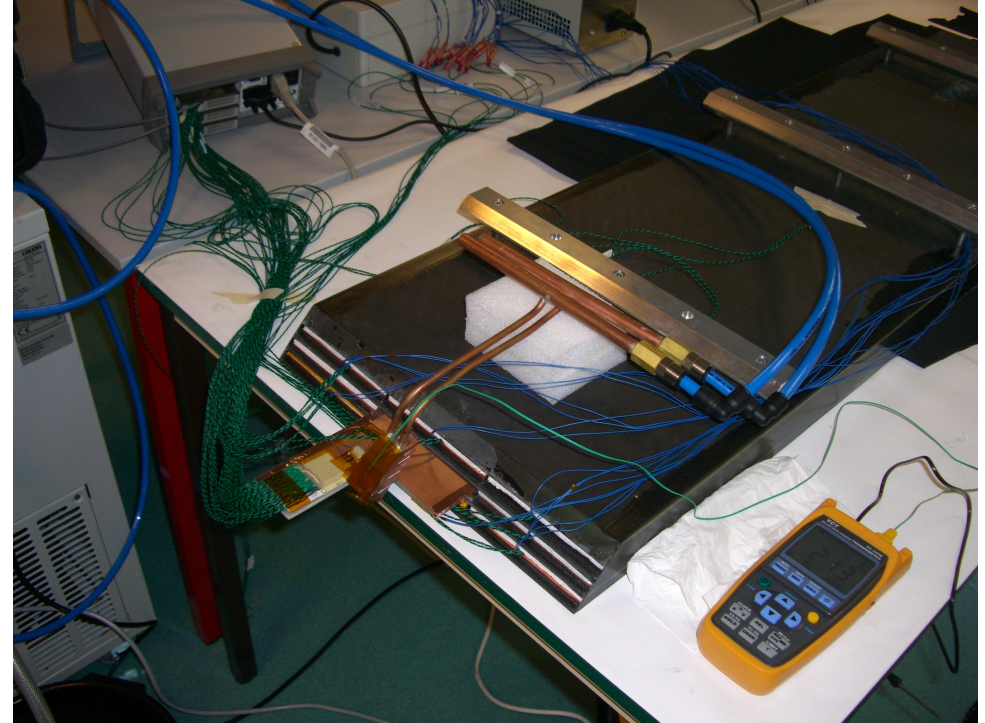
Cooling

Evacuate heat produced by ASICs

Passive copper layer in contact with ASUs inside structure

Water-cooled heat exchanger at end of module

System designed, constructed and tested

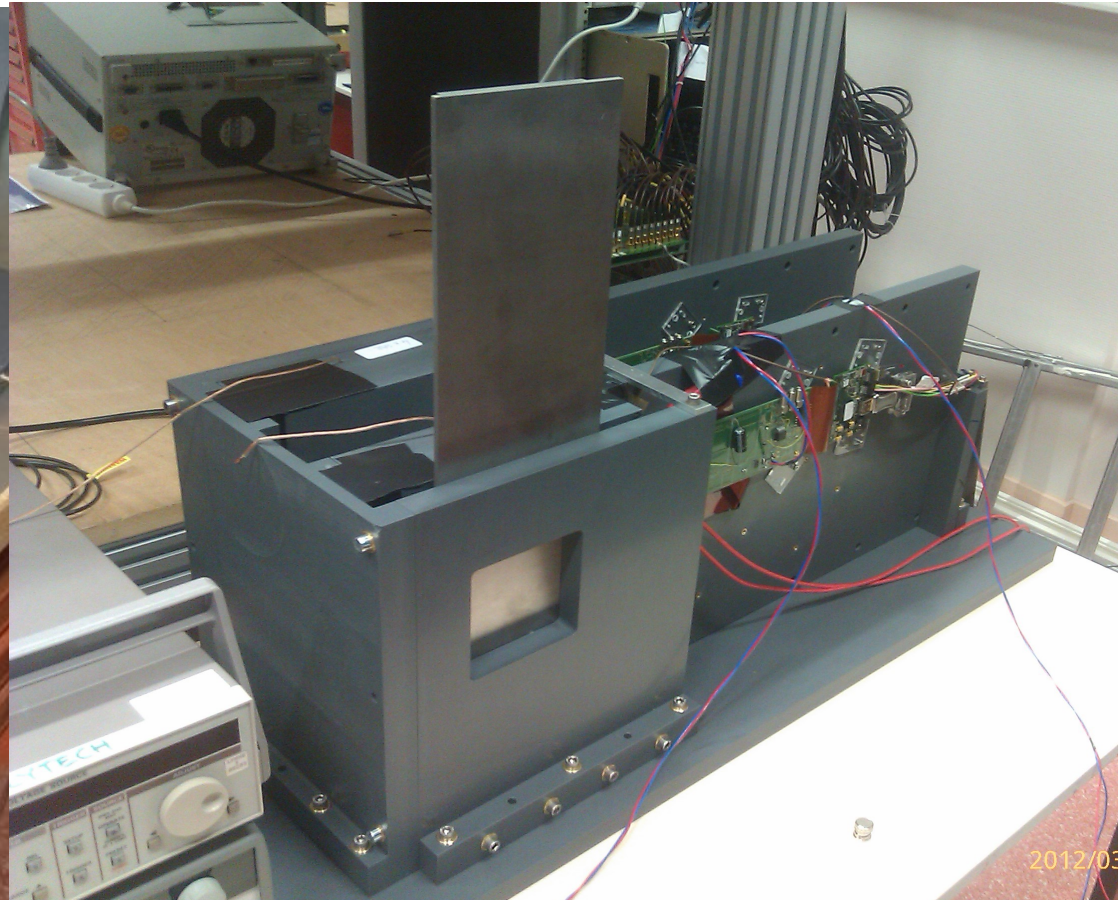
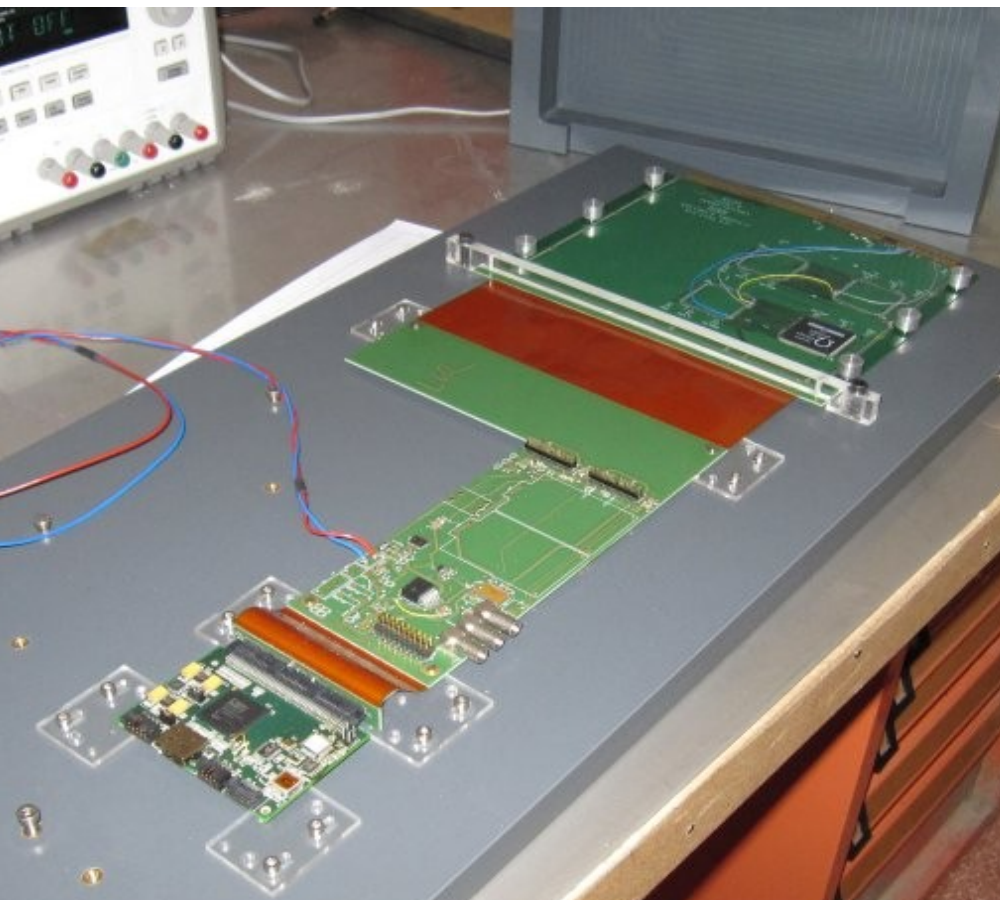


System commissioning

A few test ASUs have been produced
(reduced channels, sensitive area)

tested in the lab, currently being beam-tested
at DESY (H24 beam line) with e-
first signs are encouraging...

Larger-scale tests (~10 layers) planned for 07/2012



Summary

Developing high granularity ECAL for test beams

All elements more-or-less completed
(some in reduced/prototype form)

Small-scale system tests are now underway
Debugging, improvements,

Do not foresee major problems to achieve milestone
(Month 36, ~2 years from today)

