Mid-term plans for SiW ECAL EUDET module

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Overview of present status

A few possible scenarios

SiW ECAL goals for Technological/EUDET prototype

- Technological prototype
  - Mechanical W + CF structure
  - Embedded FE electronics
  - FE Cooling system
  - DAQ chain

To satisfy this it's enough to have
  - a structure (maybe larger than demonstrator)
  - one long slab

We also want to do physics with it:

Beam tests

- Test / tweak simulation
  - 4 times better transverse granularity than physics prototype
  - want good long. segmentation -> 30 layers

- Combined tests to understand ECAL-HCAL connection
  - (Not much work done here with present data...)

EUDET mechanical structure

- ready to start building mechanical structure

- Moulds for single layers are at LLR (with default layer thicknesses)

- money for mechanical structure needs to be spent in '09
    -> need to freeze dimensions by ~september '09

PCB (“FEV7”)

In present design, must be thin (<1.2mm)
-> embedded FE chips (SKIROC2)

This is still under study
Initially difficult to find companies able to build
Companies starting to deliver rather expensive estimates: ~700-1000 Euro
this is the main uncertainty at present

Intermediate solution:
by ~end June will have thick PCB with surface mounted SPIROC2 chip
SPIROC2 is run in SKIROC mode
Will be used for cosmic tests

- SKIROC2 (first version) will be available ~ spring 2010 (may need iteration)
first FEV8 with SKIROC chips ~ few months later

Silicon wafers

Ordered 40 wafers from Hamamatsu (~1k Euro each)

First test lot looks OK, will probably be able to accept all 40

(EUDET requires 120+ wafers in total)

no money for more wafers this year

For Silicon, would like a few manufacturers

-> not dependent one one company when we want to construct ILD

-> competition drives down cost of ILD

-> faster production of ILD

Working with >1 company will take more time and money for EUDET

At present:

- 9x9cm2 wafers (5mm segmentation) from Hammamatsu
- collaboration and small test wafers (guard rings) from On Semi
- recent progress with Bhabha Atomic Research Centre (India)

DAQ

- DAQ hardware ~ ready (more details tomorrow)
  Firmware & software under development

Budgetary constraints

- each fully equipped “short slab” will cost up to 10 k Euros
  (~4k wafers + ~1k PCB + 16*SKIROCs + extras...)

Will need to stage the buying of wafers over a few years

Shape of instrumented tower

45 degrees -
- Not so convenient for beam-tests
  - Particularly combination with hcal

90 degrees -
- A little messy technically
- Long adapter boards necessary
- Extra mechanical support

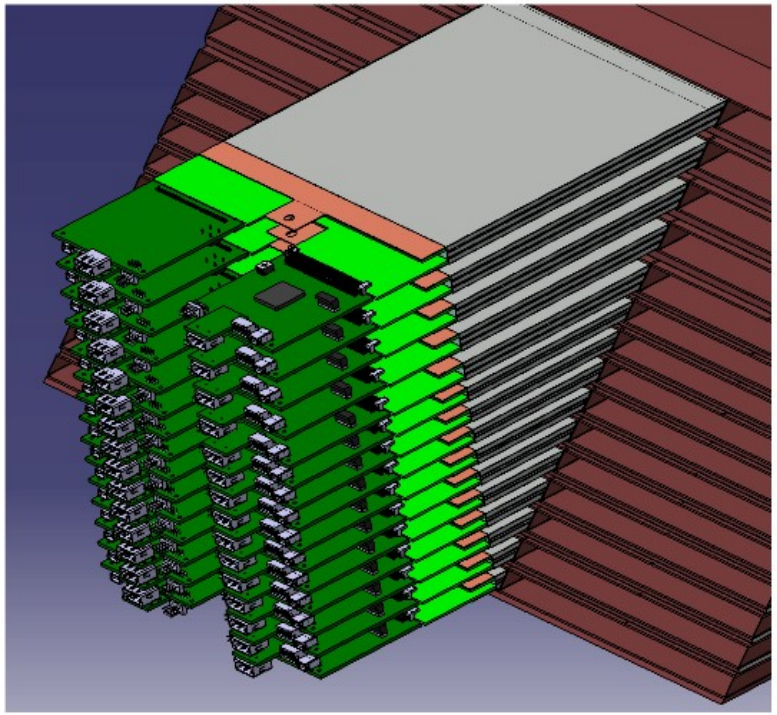
Design of cooling pipe is different for 2 options

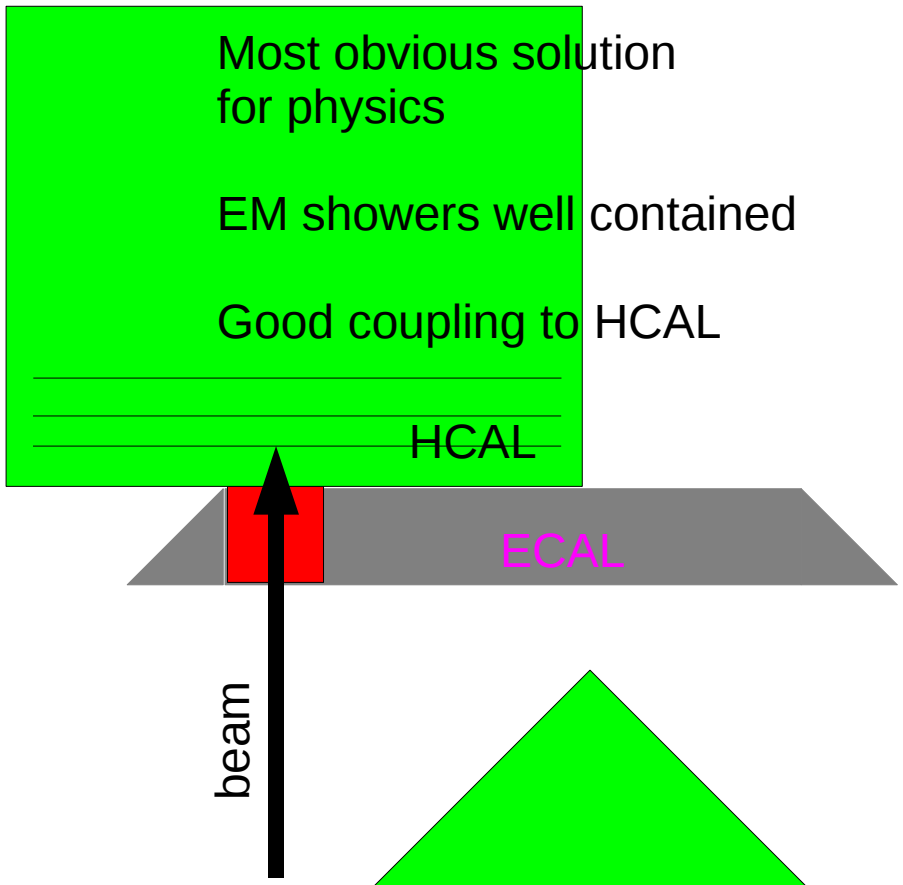
testbeam studies in both configurations
- interesting for physics

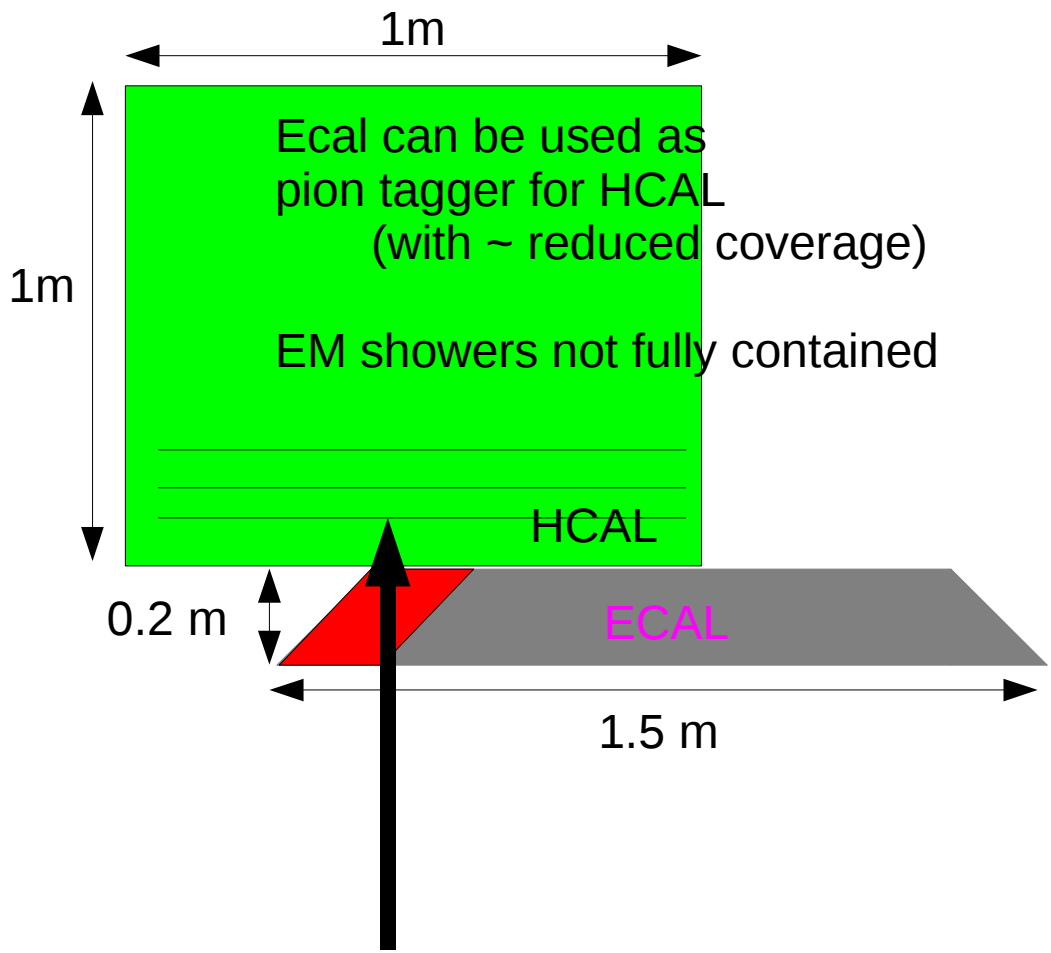
to keep both options need -
- Long adapter boards
- 2 different cooling pipes (extra cost ~ 10k Euro?)

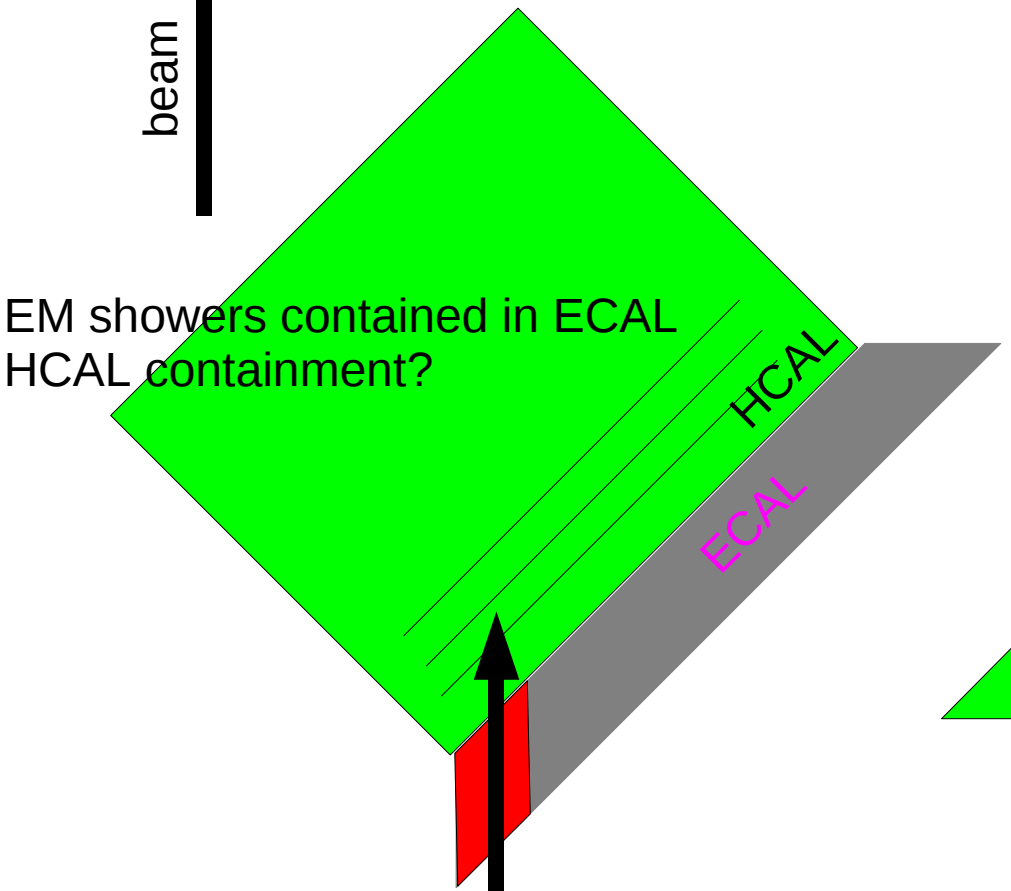
Should decide soon so Denis can proceed
- with cooling pipe design

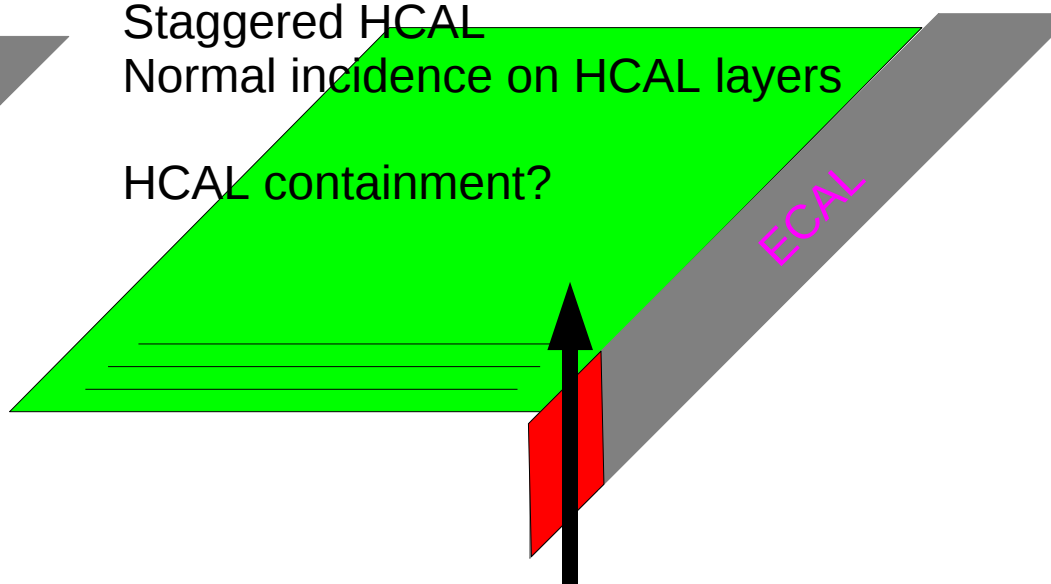
rpendicular tower




Most obvious solution
for physics
EM showers well contained
Good coupling to HCAL
HCAL
ECAL
beam


1m
1m
Ecal can be used as
pion tagger for HCAL
(with ~ reduced coverage)
EM showers not fully contained
HCAL
0.2 m
ECAL
1.5 m


EM showers contained in ECAL
HCAL containment?
HCAL
ECAL


Staggered HCAL
Normal incidence on HCAL layers
HCAL containment?
ECAL

A few possible scenarios of EUDET ECAL construction

Scenario A

Thin embedded ASU proven by September

- start with a couple of short slabs,
  then move to partially instrumented long slab

- progressively produce short slabs, as funding becomes available

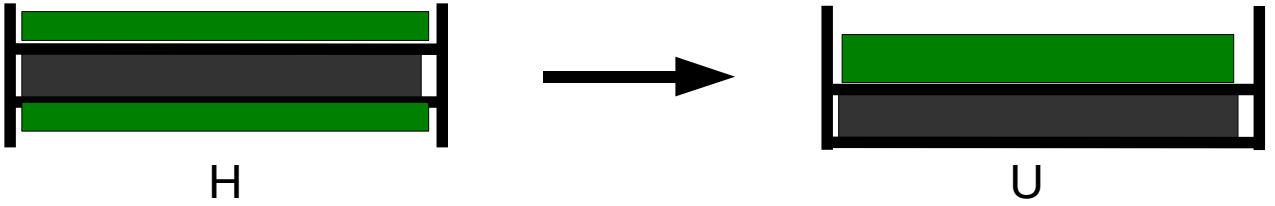
With 40 Hamamatsu wafers, have enough for 10 ASU
  ~ 4 short slabs (double layers) + 1 incomplete long slab

Scenario B

Thin embedded PCB not proven by ~september

With thick PCB, we cannot get a double layer into one alveola

- make wider alveolar thickness requires new moulds ~6k Euros: disfavoured
- move to single layers: W + 1 ASU in “U” shape rather than “H”



Instrument whole detector with single layers

- reduce the total costs significantly
- reduce the physics performance significantly (halved the sampling fraction)
- reduce technological “scope” for thin PCBs

Scenario C – hybrid solution

Thin embedded PCB not proven by ~september

Make a few layers of the single-layer “U” structure
- 1 Long + ~2 Short (for last calo layers)
- Mostly similar technological problems as double layers

Continue to develop thin PCB, proved ~early-mid 2010 ?
- Switch to H structure for remaining layers

Can replace original “U” structures with “H”
- There is enough tungsten to do this

Scenario D

Accept thicker ASU
-> easier/cheaper to build the PCB

Stay with double-layer “H” structure (somewhat thicker)

Increase thickness of alveolar structure
- Requires some retooling

summary

Decisions to make before next CALICE meeting (Sept '09)
e.g. today

- 45/90 degree instrumented column

- dimensions of mechanical structure

- do we start with single “U” layers (if thin PCB not available)