An electromagnetic calorimeter for ILD

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An interesting piece of detector

toward a common design

which exists in three technological options

Si diodes 5x5 mm2

Sci pieces 1x4 cm2

MAPS

but in one common structure

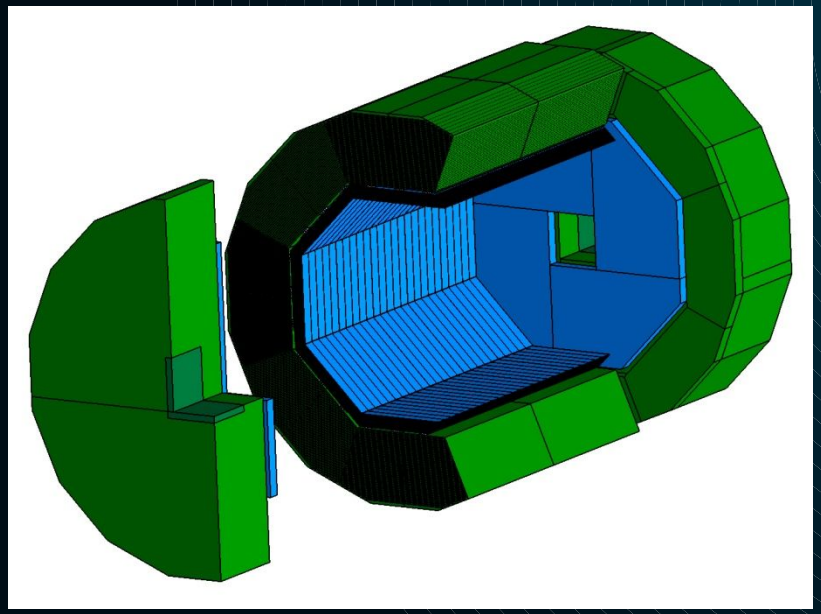
with 2 geometrical variants 8/12

currently under beam tests

to validate the design

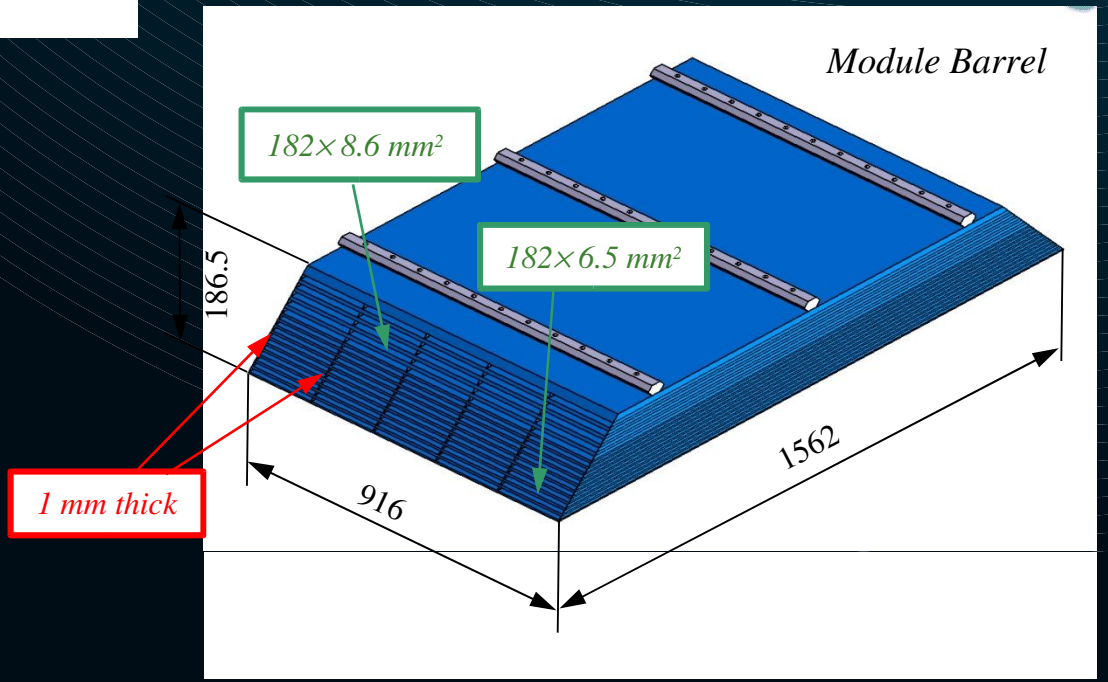
and Geant4

ECAL



The LDC eightfold structure with square hole

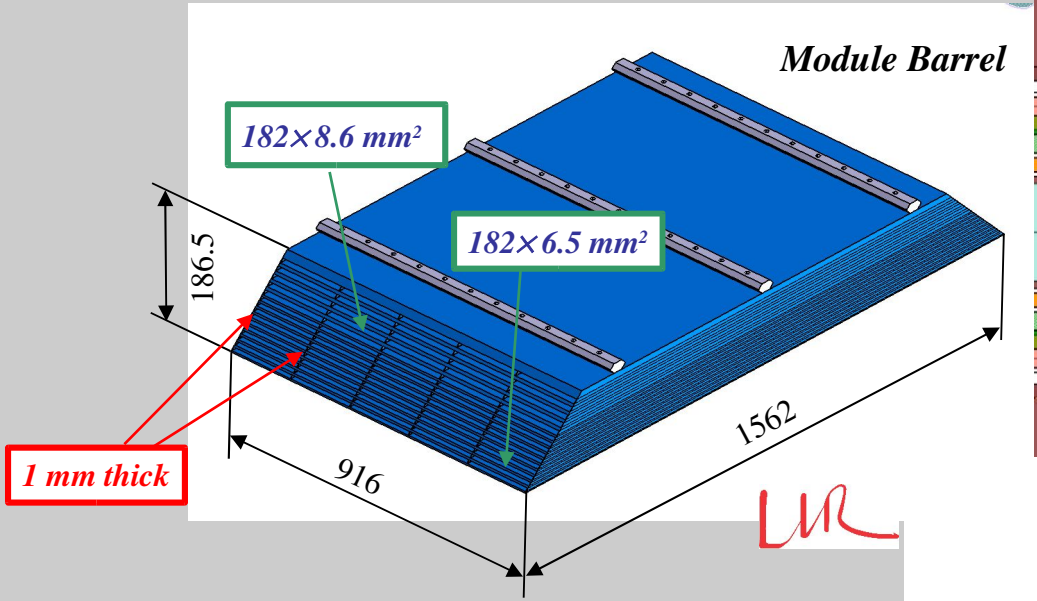
5 modules per stave

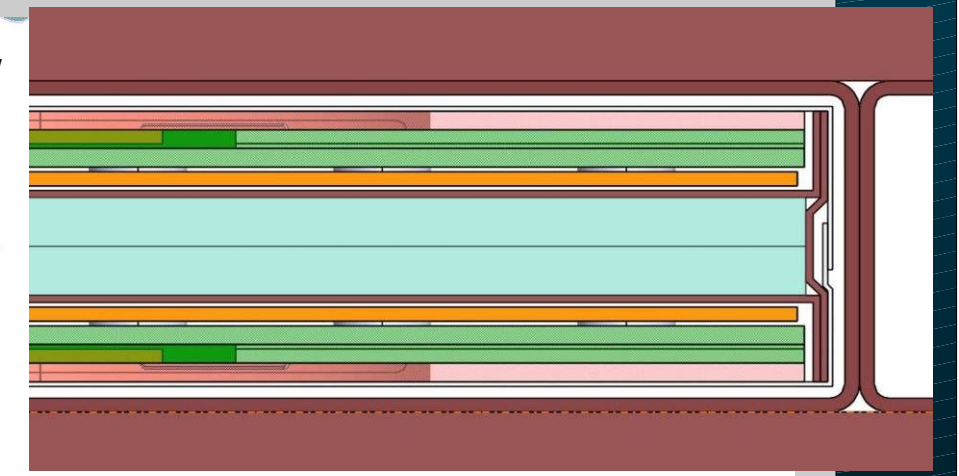


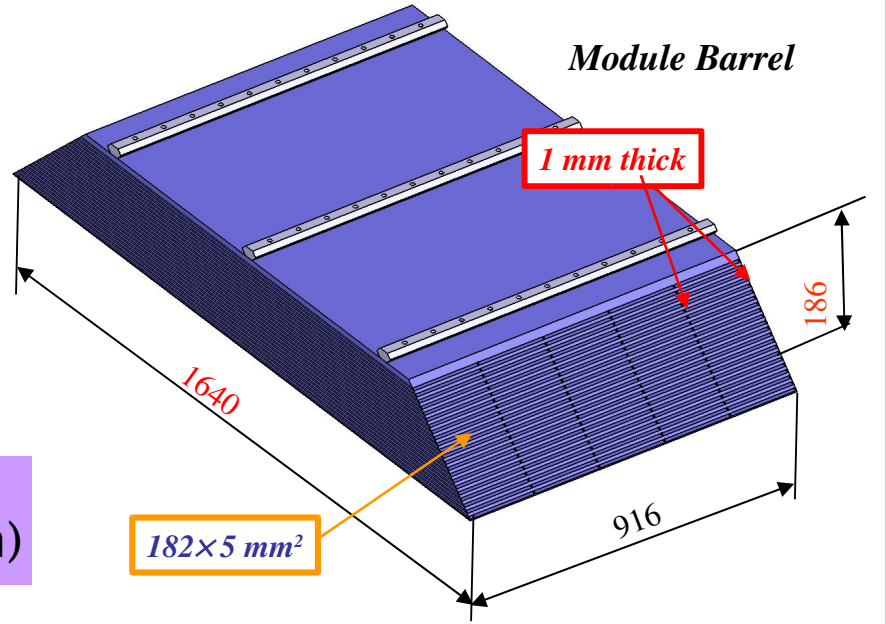
The module structure for Si or Sci-W or MAPS

Si/W ECAL :
22.8 X0 (20 x 2.1mm+9 x 4.2 mm)

Marc Anduze

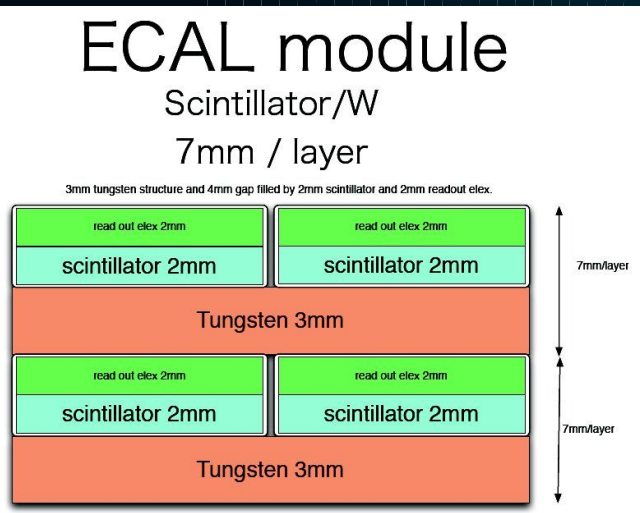




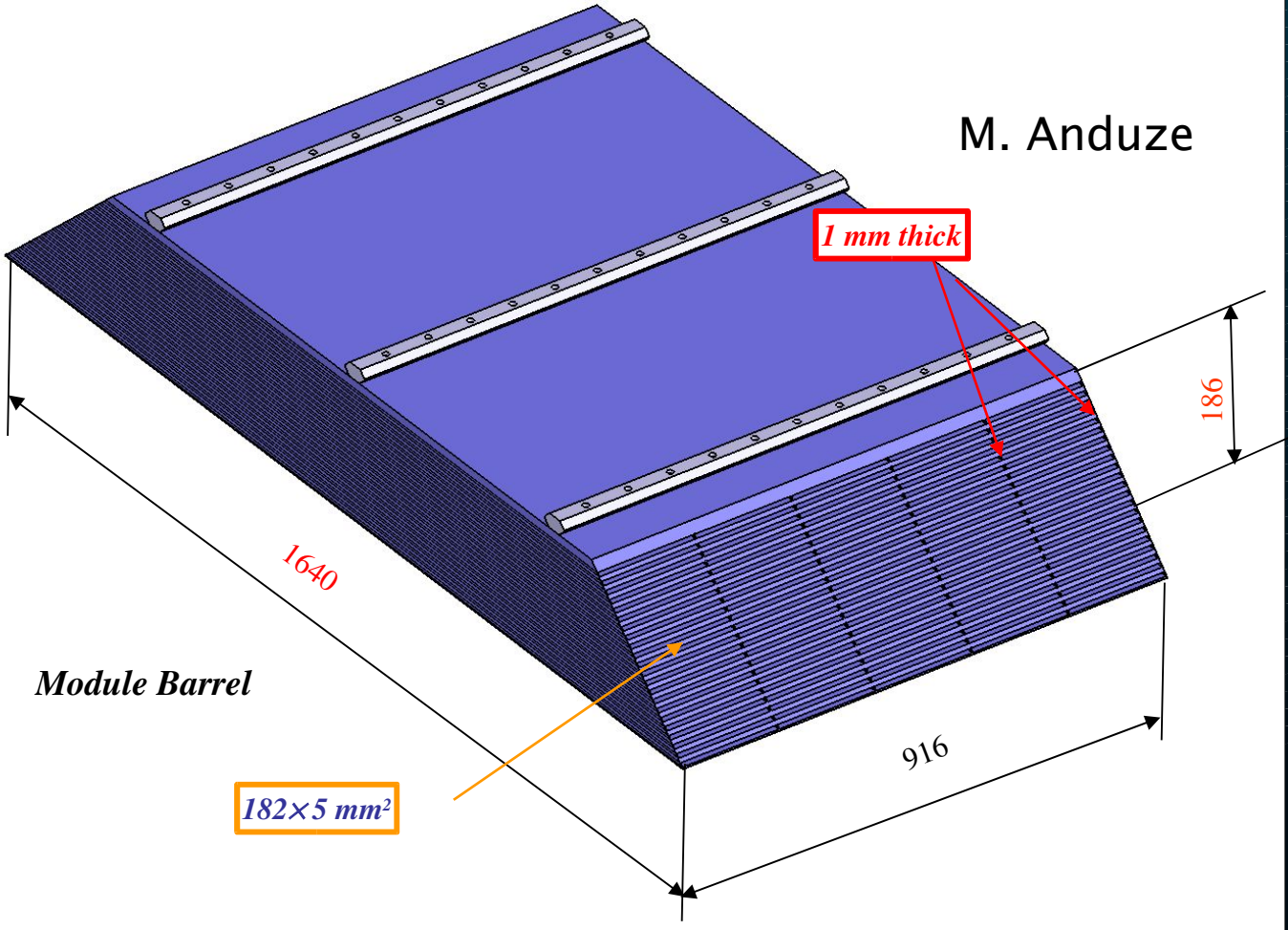


Scin/W ECAL :
22.8 X0 (21 x 3.8mm)

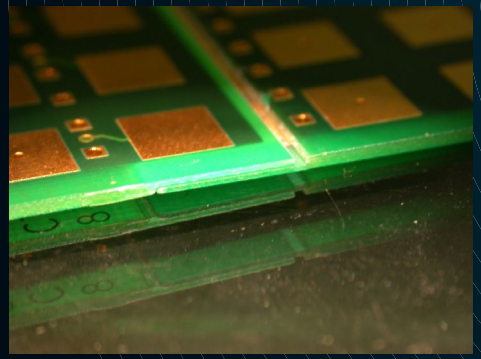
Scintillator fingers 1x4 cm^2

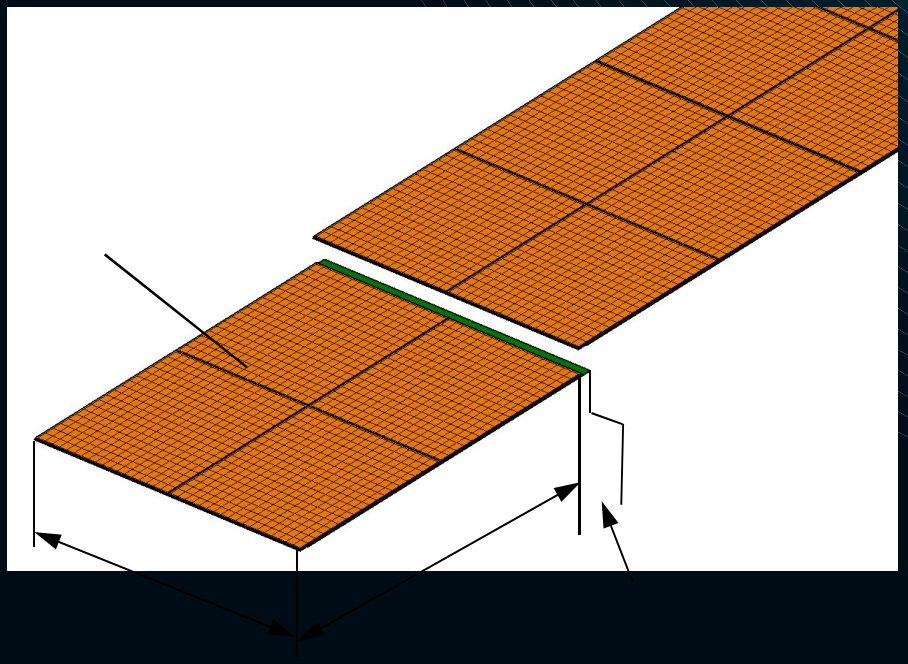


T. Takeshita



The sensitive elements for Si-W slabs and wafers

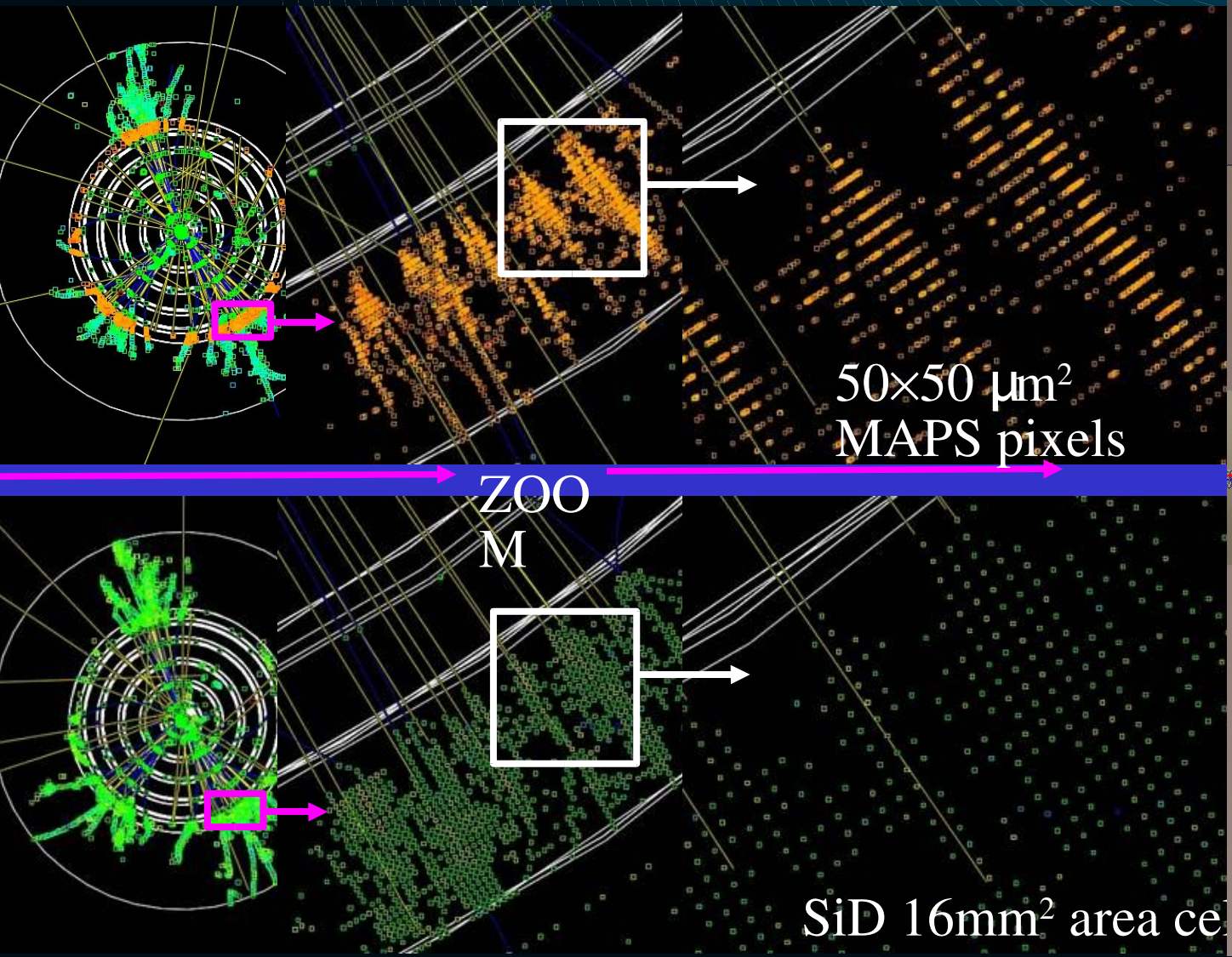


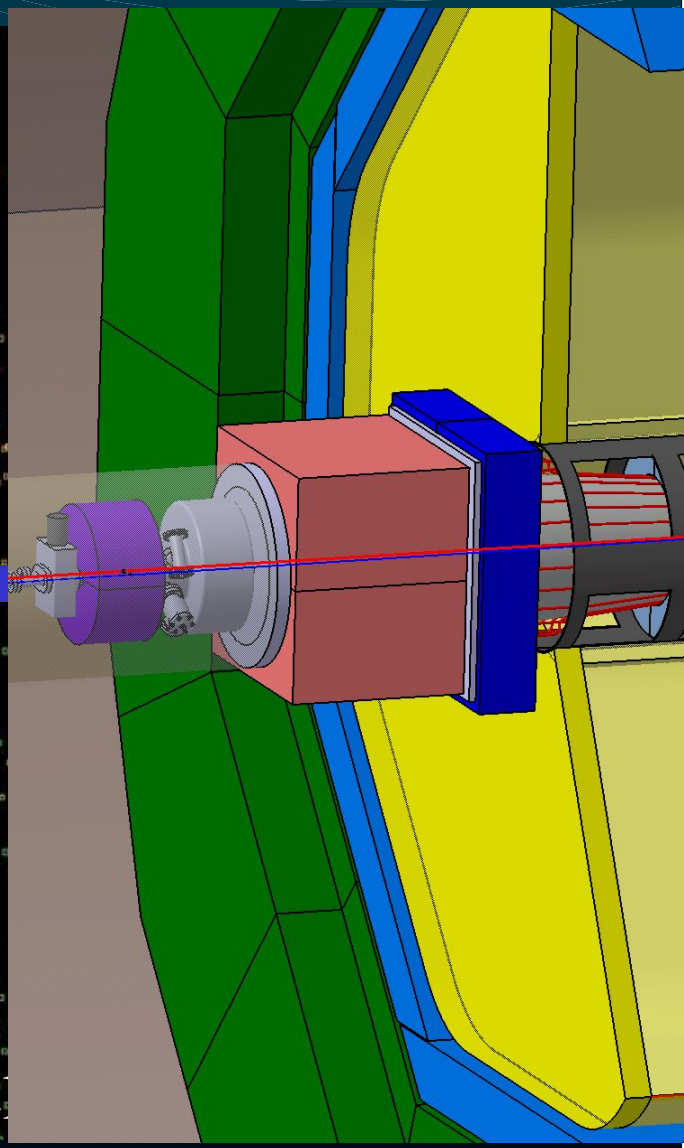


from R. Pöschl presentation

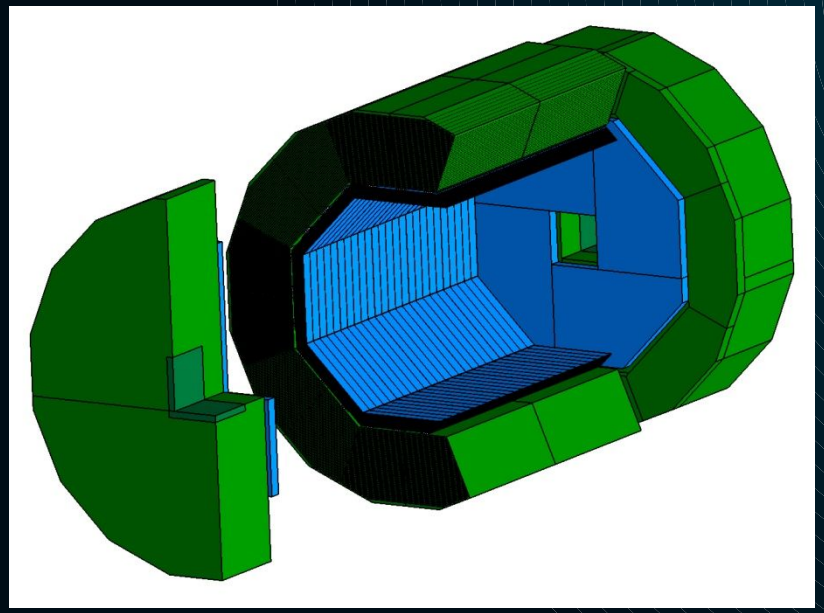
or a MAPS version: the TPC (TeraPixel Calorimeter)

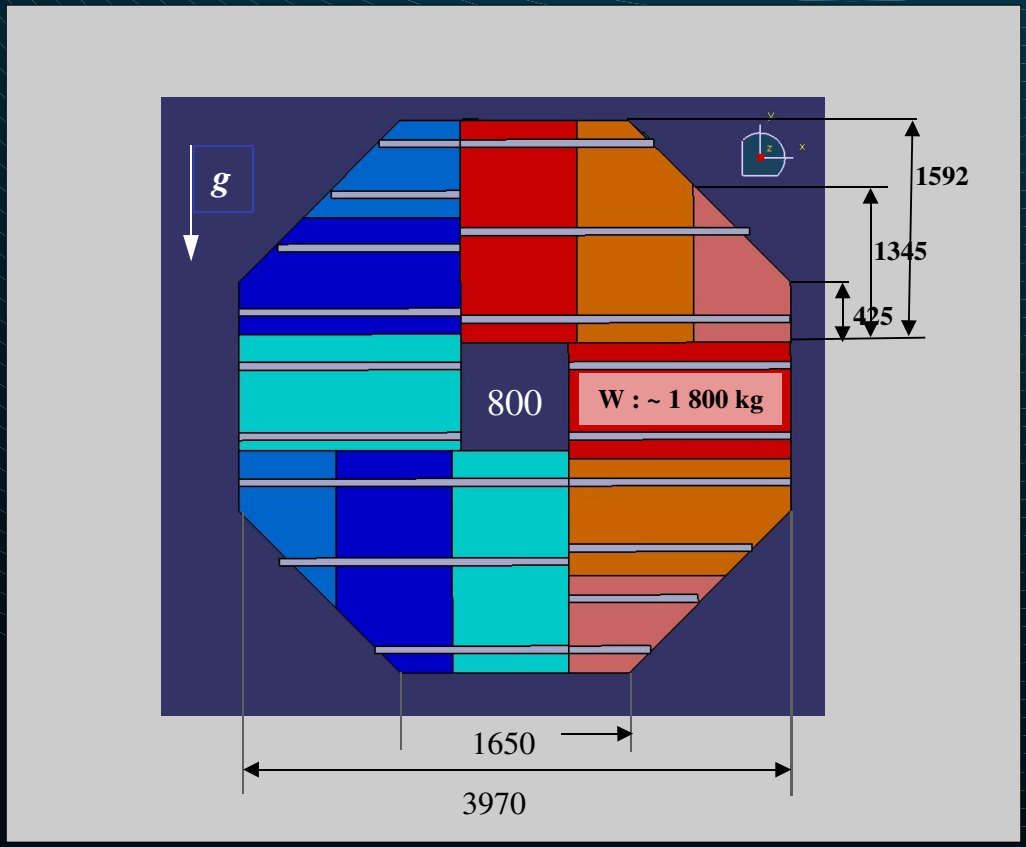
Nigel Watson





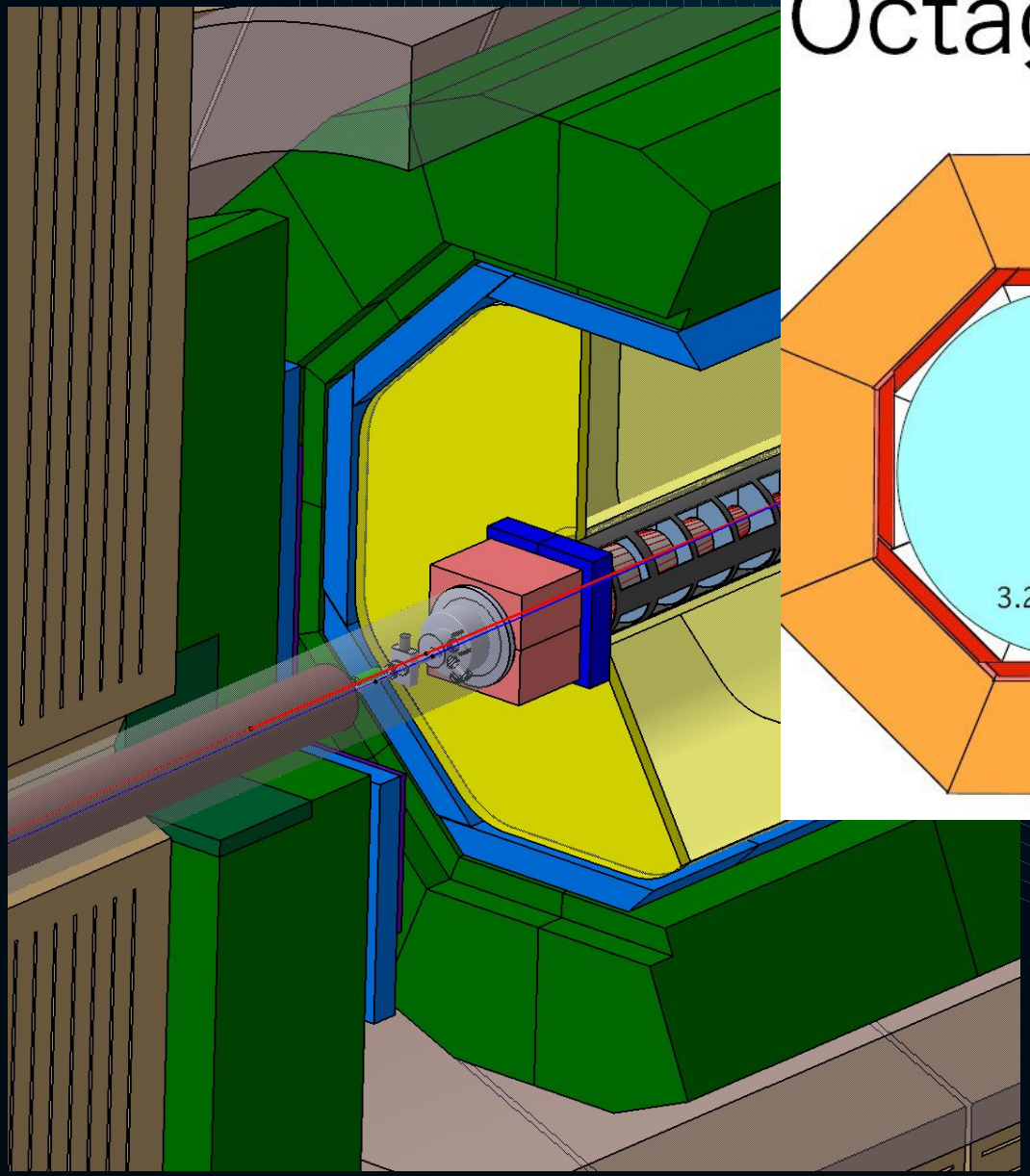
The end-cap structure



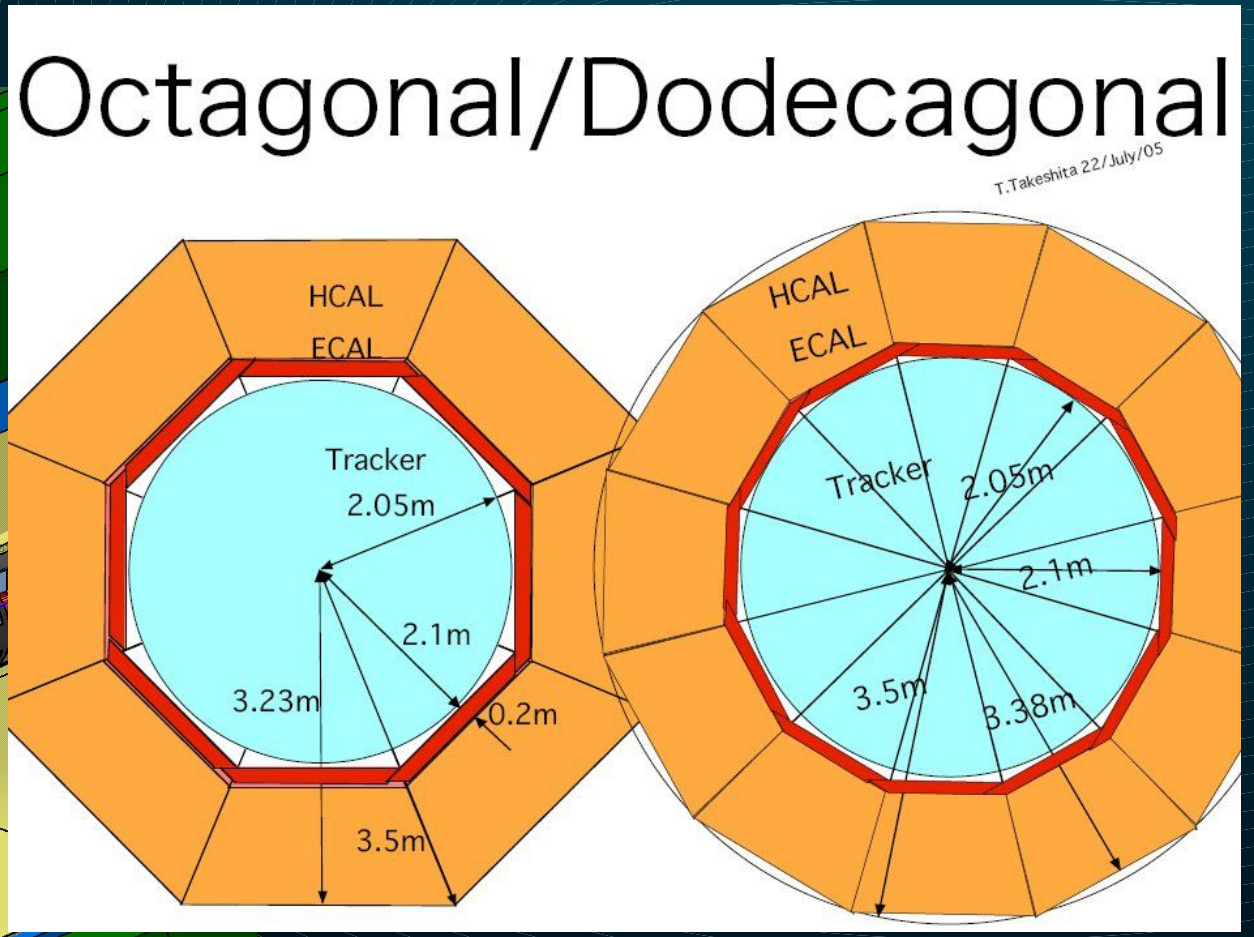


a square hole?
even in the yoke?

Denis Grondin LPSC

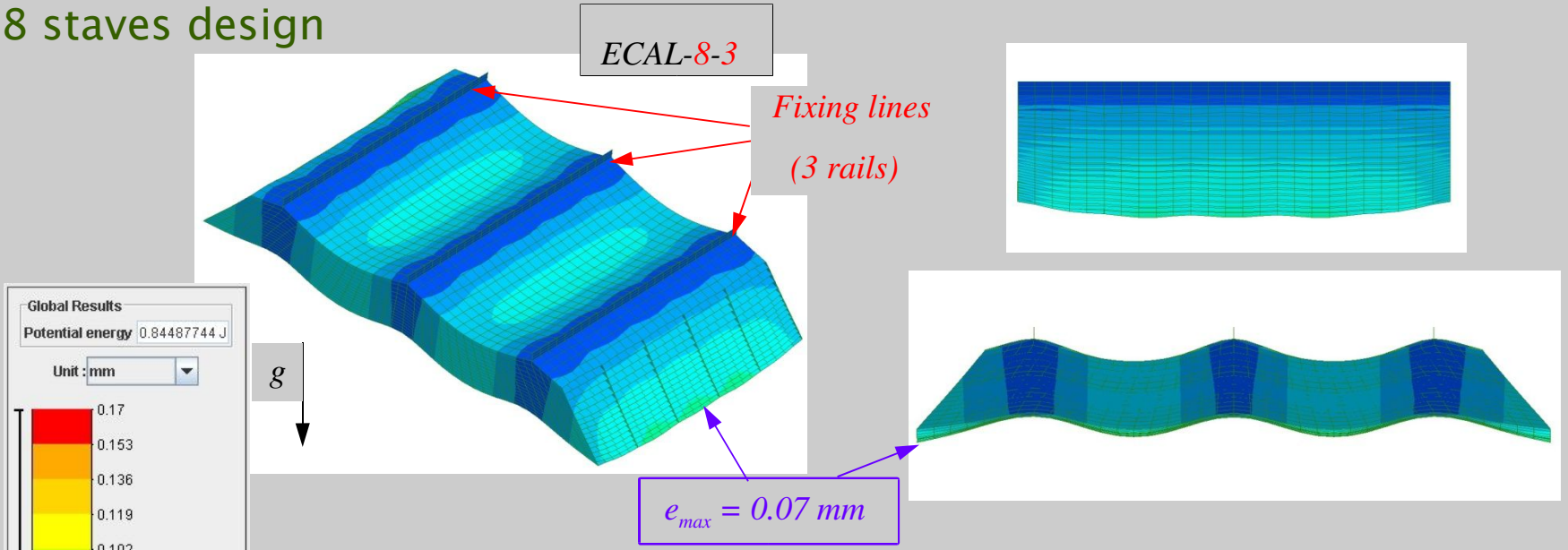


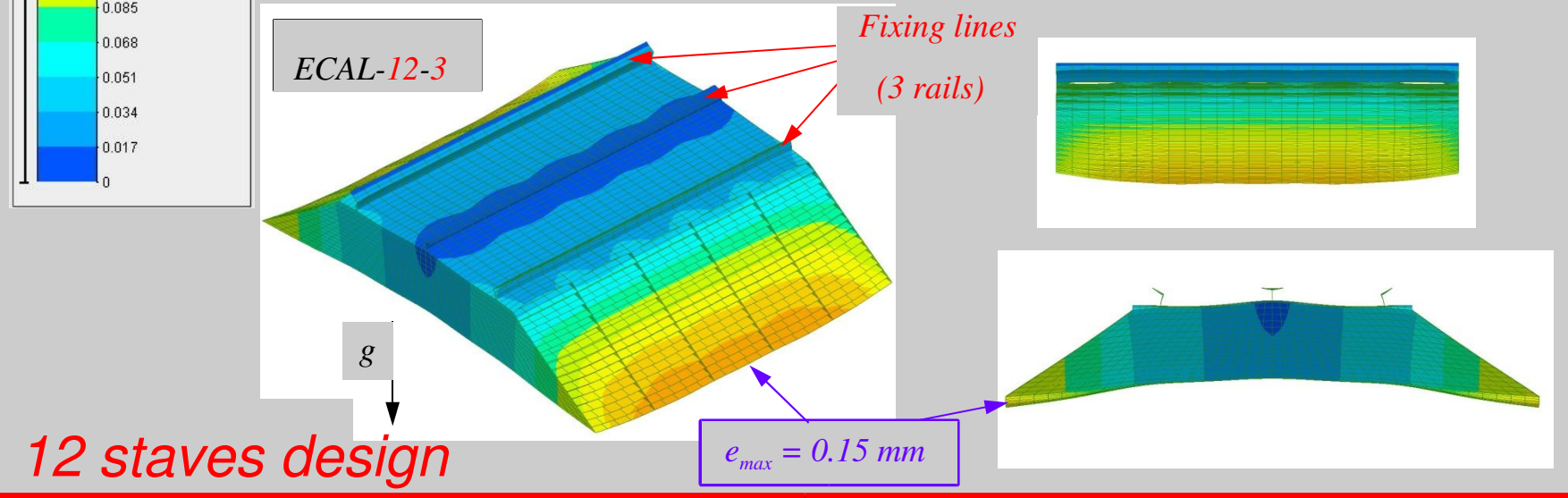
Octagonal/Dodecagonal



ECAL – 8 vs 12 staves

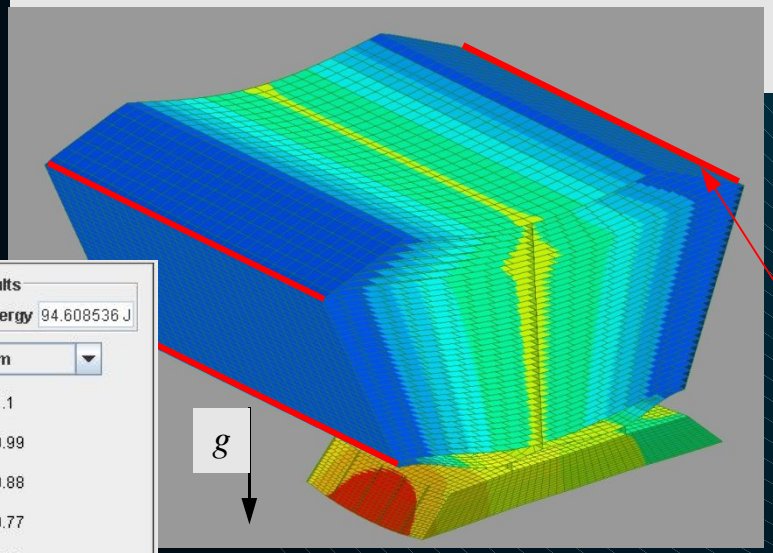
8 staves design

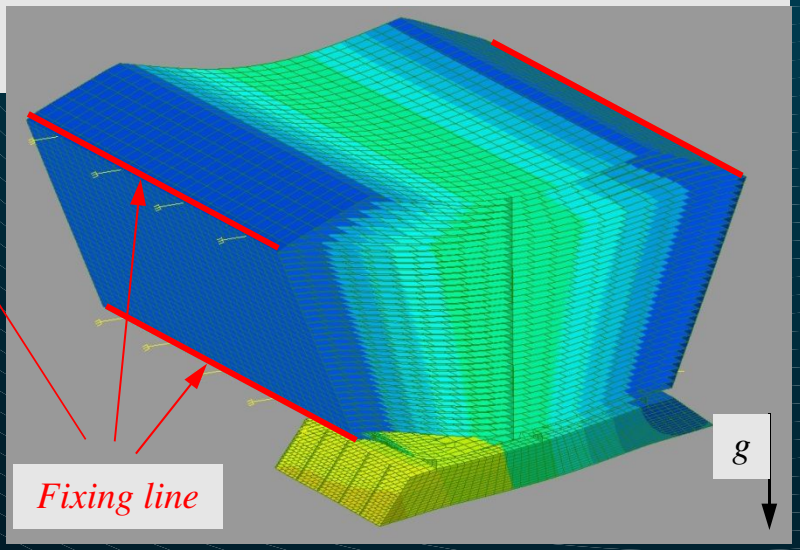


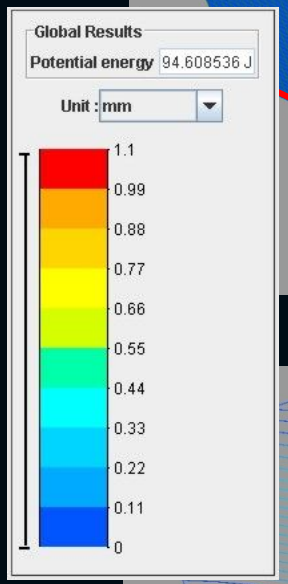


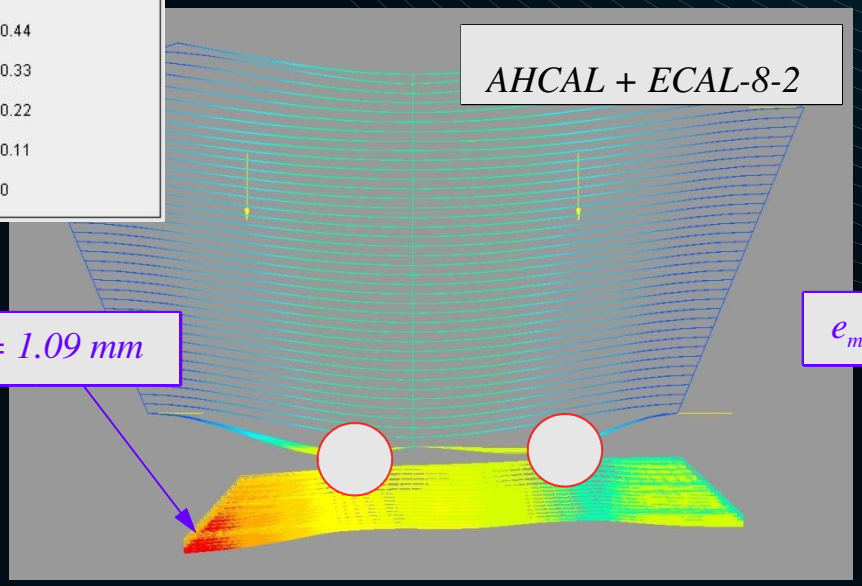
12 staves design

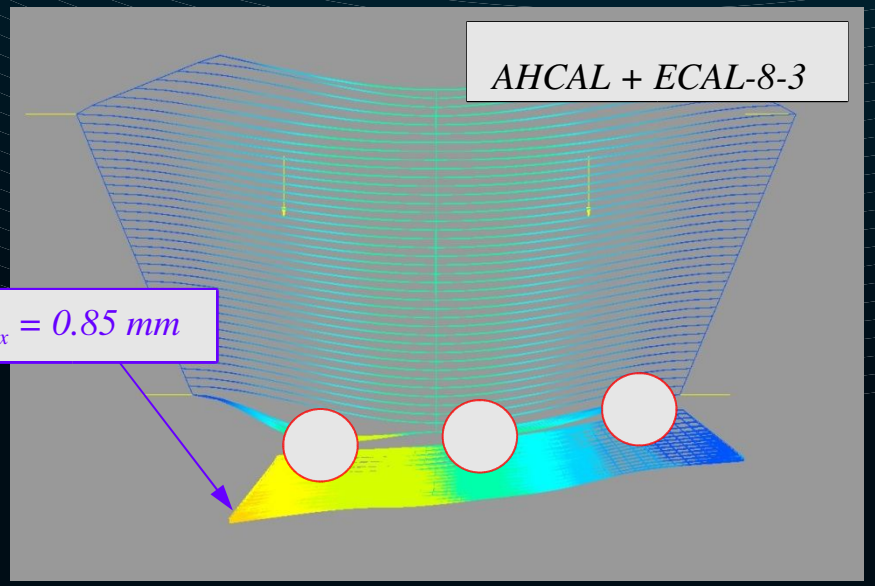
« AHCAL » + ECAL


g

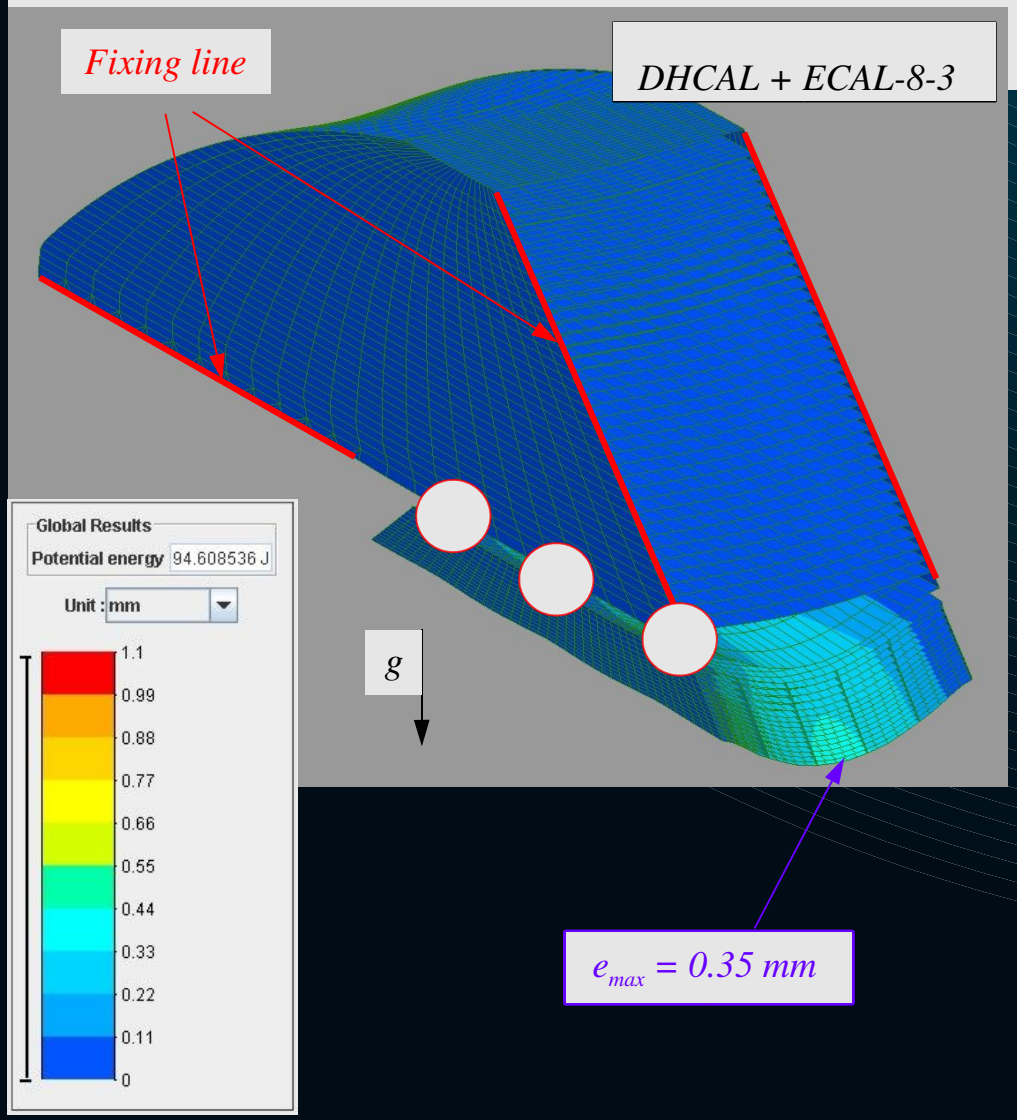

Fixing line
g

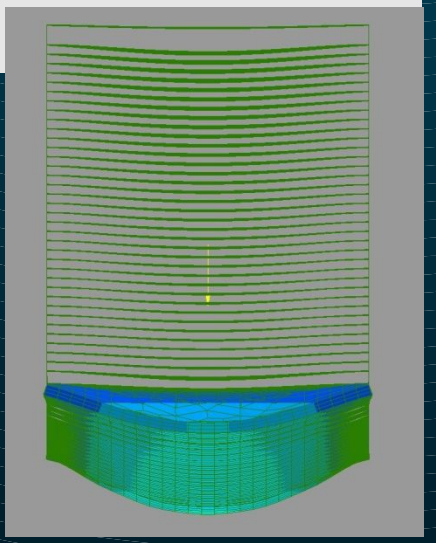

Global Results
Potential energy 94.608536 J
Unit : mm
1.1
0.99
0.88
0.77
0.66
0.55
0.44
0.33
0.22
0.11
0

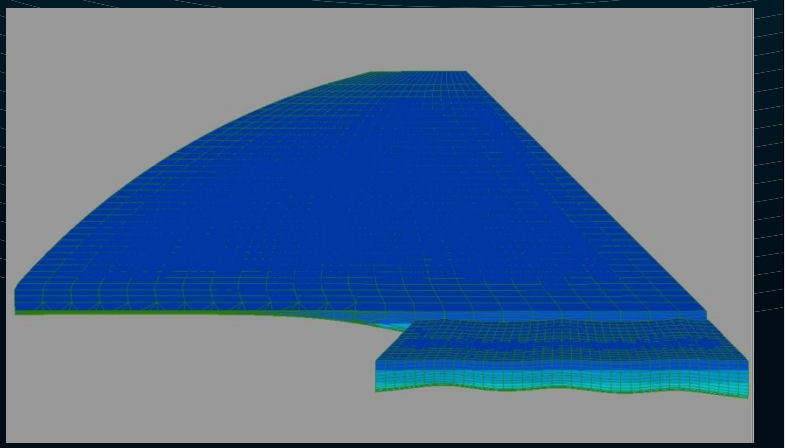

AHCAL + ECAL-8-2
e_{max} = 1.09 mm


AHCAL + ECAL-8-3
e_{max} = 0.85 mm

« DHCAL » + ECAL


Fixing line
DHCAL + ECAL-8-3
g
Global Results
Potential energy 94.608536 J
Unit : mm
1.1
0.99
0.88
0.77
0.66
0.55
0.44
0.33
0.22
0.11
0
e_{max} = 0.35 mm





electronics

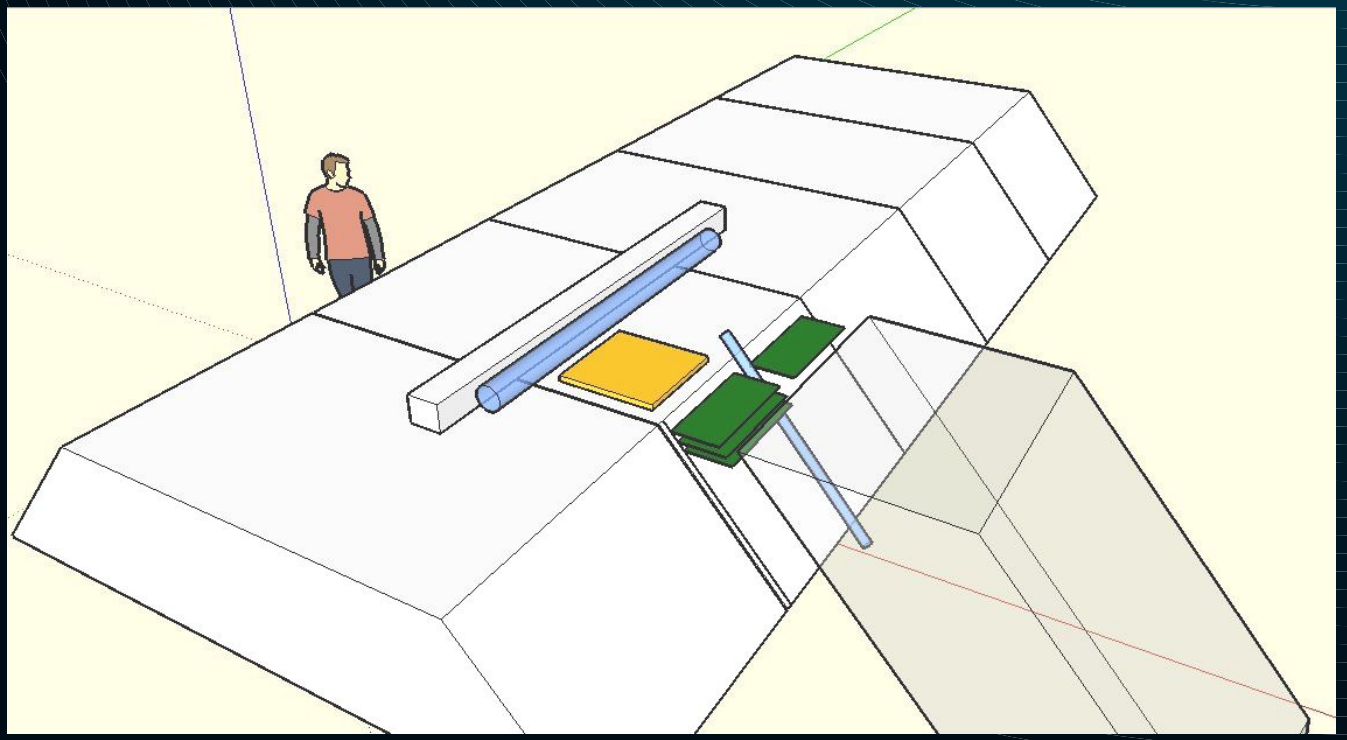
Progressive development of the adequate electronics

Skiroc and FLC-SiPM by OMEGA

for a granularity of about 5x5 mm2
- dynamics
- integrated
- highly multiplexed
- reduced consumption

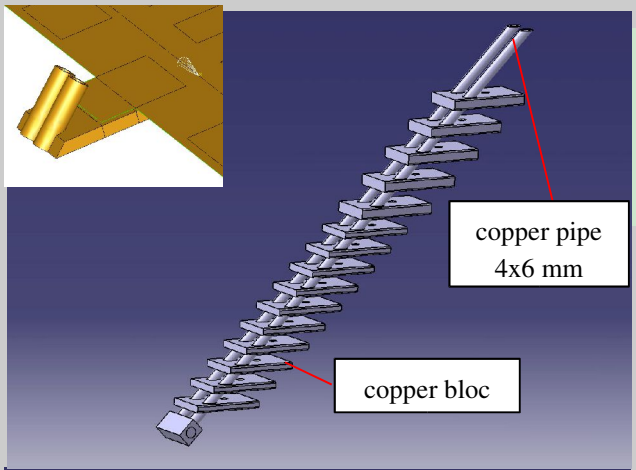
ECAL Cables : numbers and routing, a first thought

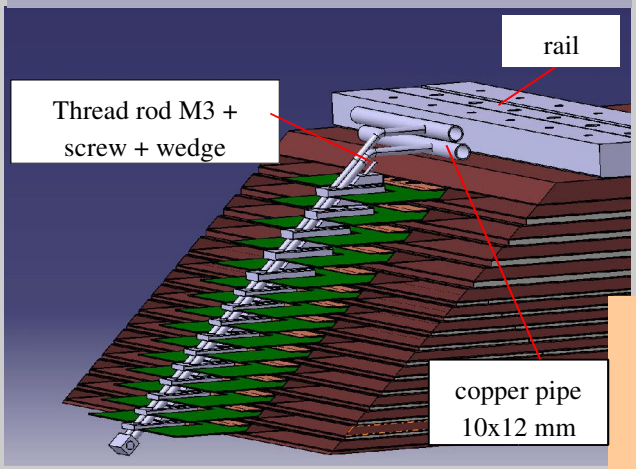
Rémi Cornat - LLR



2 types of cooling systems to test:

❶ Copper pipes brazed



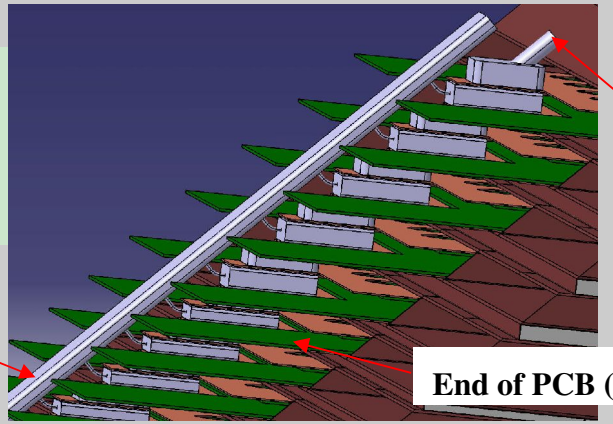


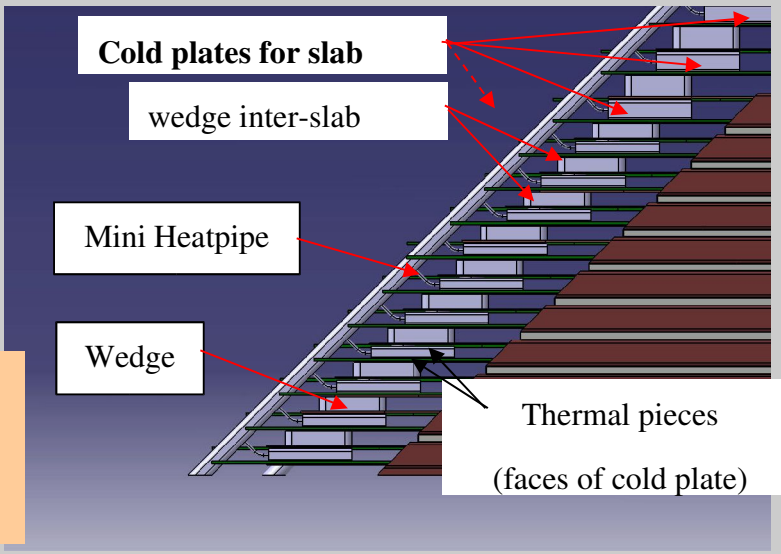
A column,
(25 mm wide minimum)
to ensure quick thermal system's connection

Cold plate for column

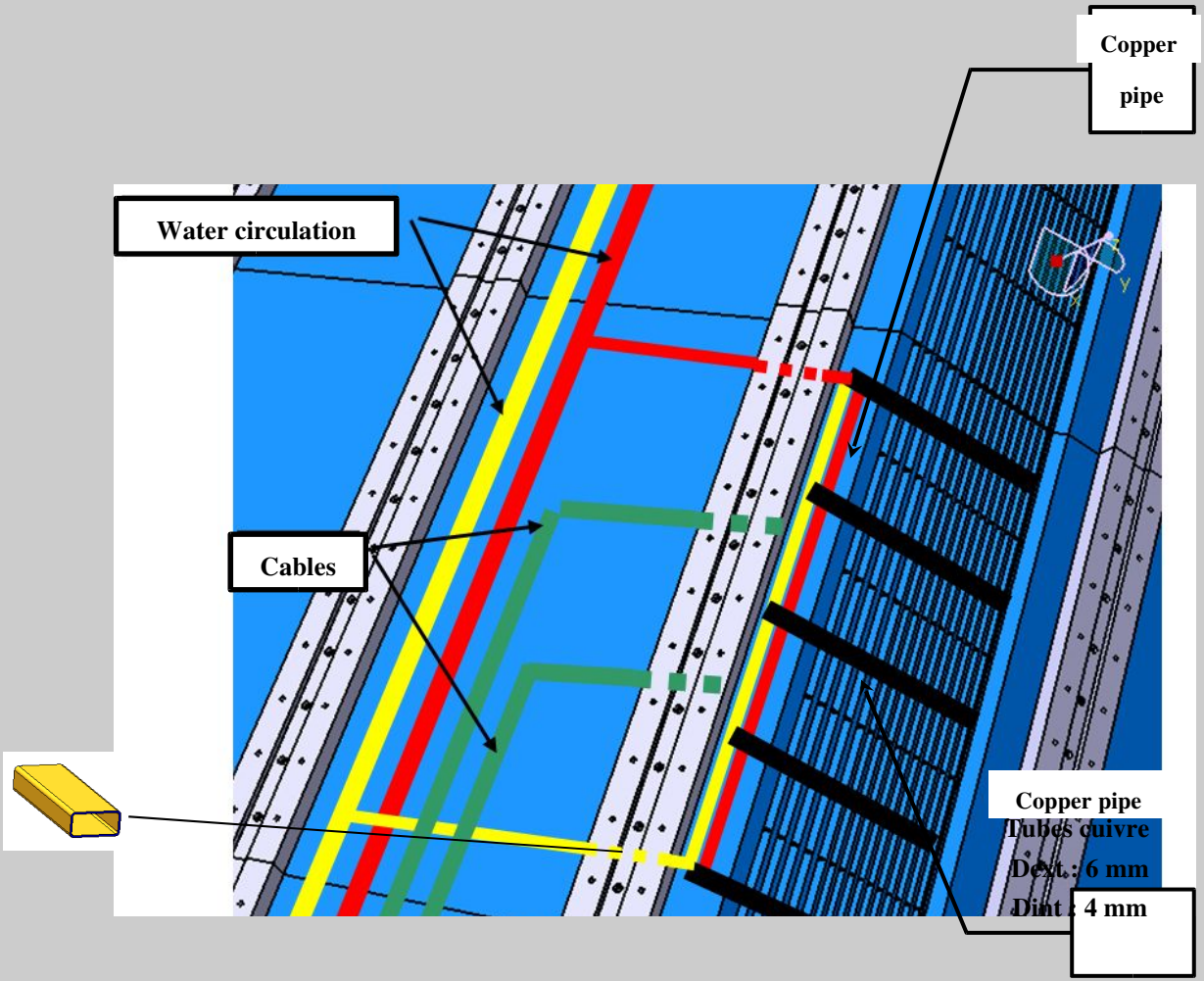
Both to be tested on : EUDET and demonstrator

❷ Heat pipes





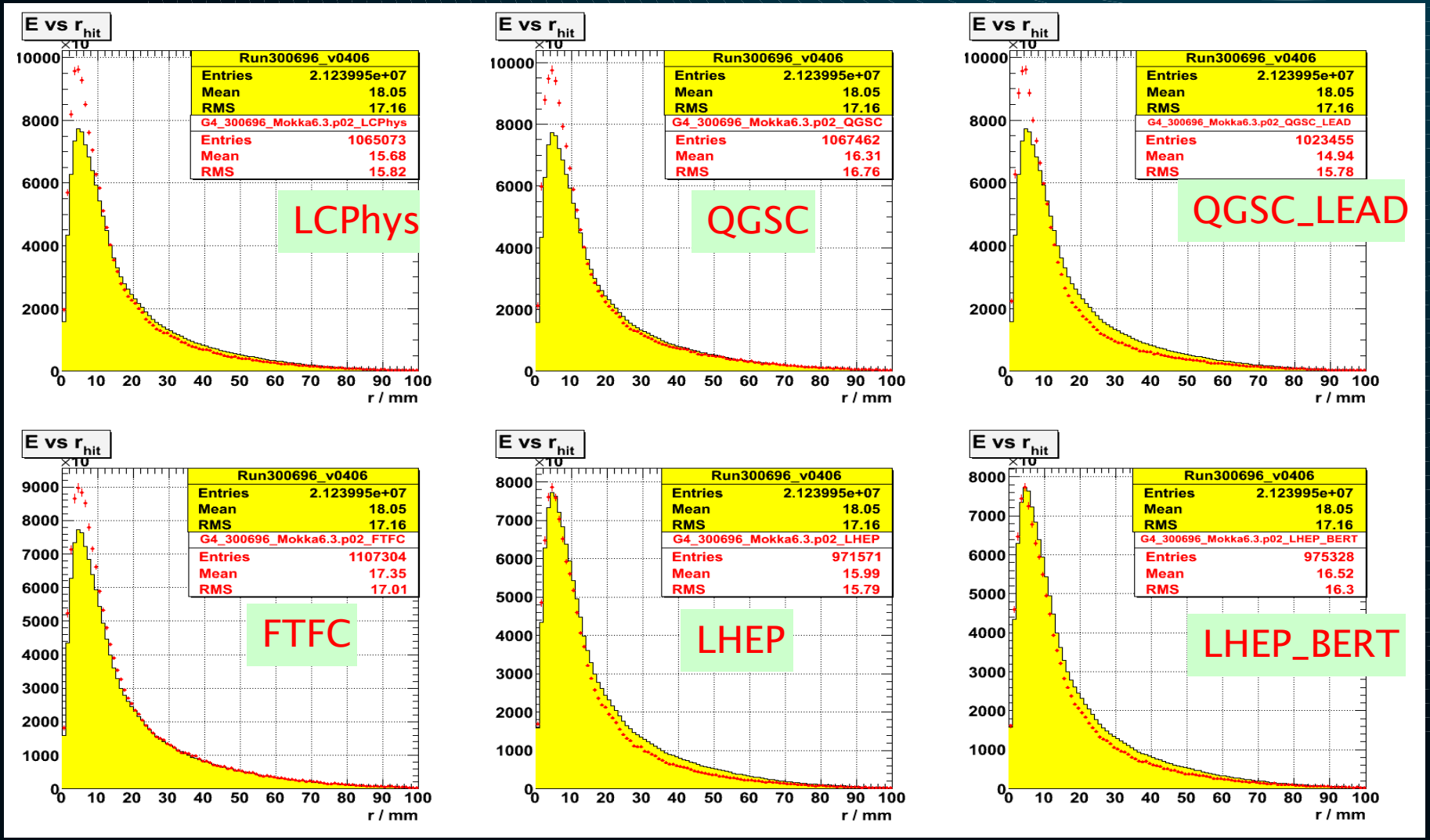
Denis Grondin LPSC


Copper
pipe
Water circulation
Cables
Copper pipe
Tubes cuivre
Dext.: 6 mm
Dint.: 4 mm

Beam tests

Hadronic showers in SiW ECAL

Run300696 vs Simulations
Transverse Energy Distribution

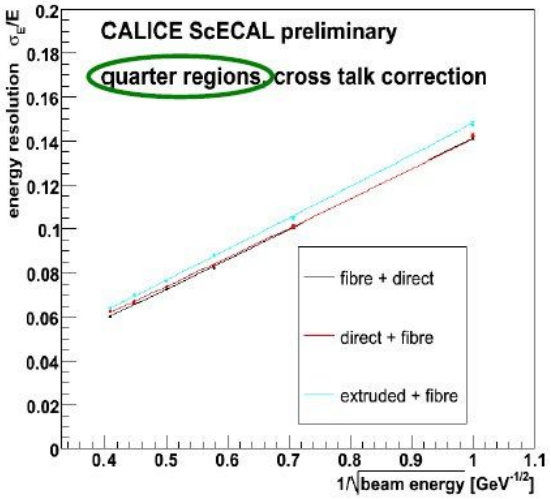


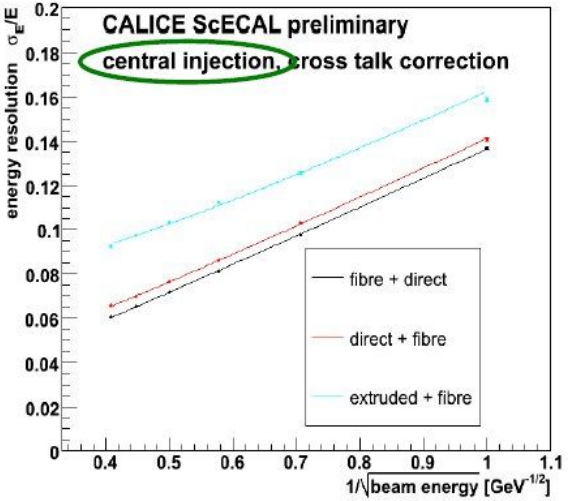
Takuma Goto June 3rd

Beam tests

Physics tests in Sci-W ECAL

Energy resolution of 3 configurations





resolution of configurations similar in quarter regions

at centre of detector, extruded+fibre much worse:
effects of strip uniformity enhanced in this region

Daniel Jeans

Conclusions

Backed by a strong R&D effort in Calice,
the ECAL for ILD is developed in a comprehensive way:
- a mechanical structure at ~full scale,
- the ancillary systems, cooling, current supplies,
- the integration in the global calorimeter and in the detector
- the adequate electronics,
- the adequate software.

this with still different options.

The point is not so much to be ready to build
but rather to prove that we would be able to
... remaining open to new solutions