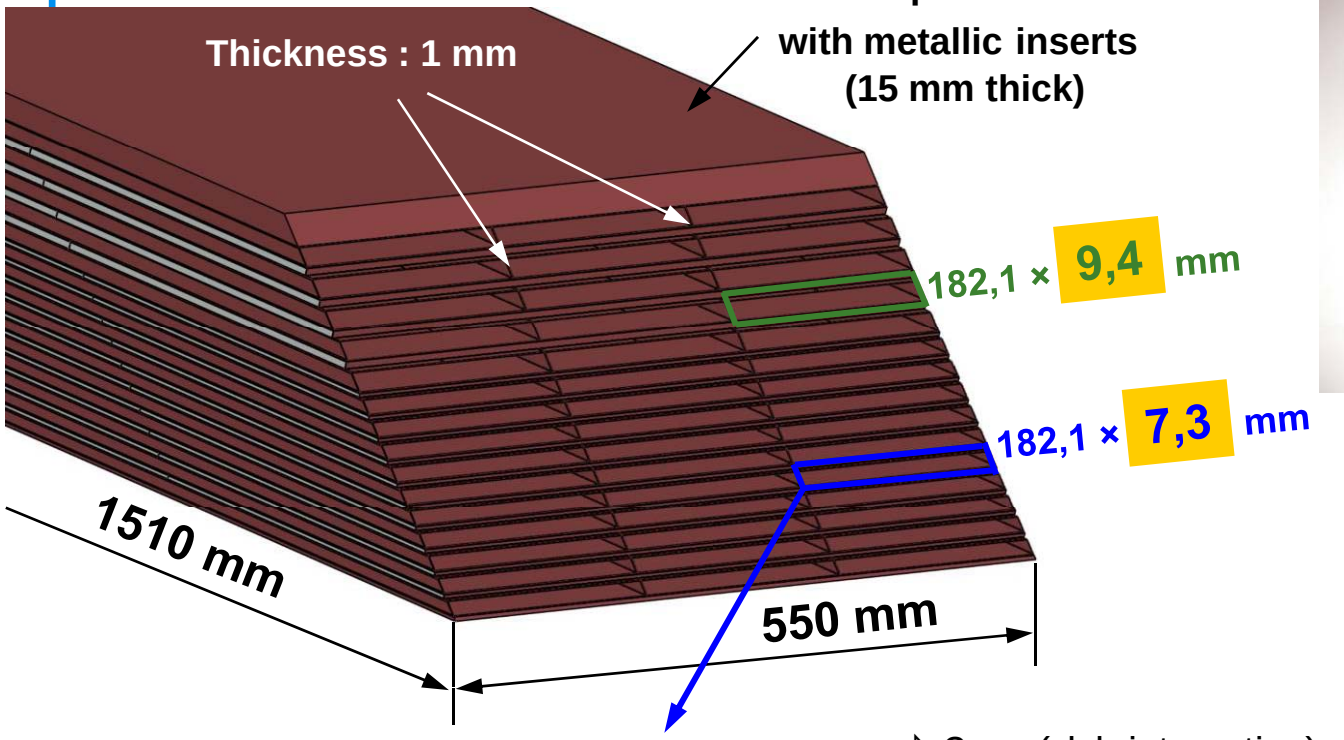
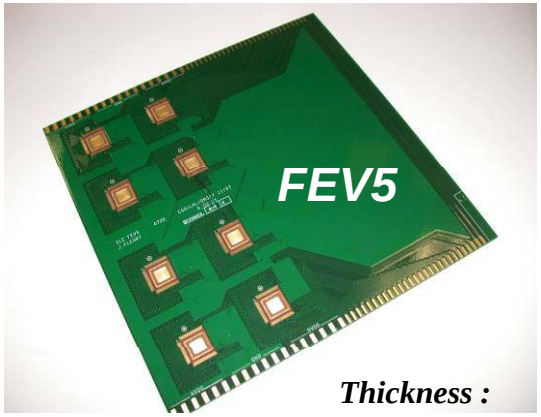
Demonstrator & EUDET
Composite structures

ECAL Si/W meeting – LAL Orsay

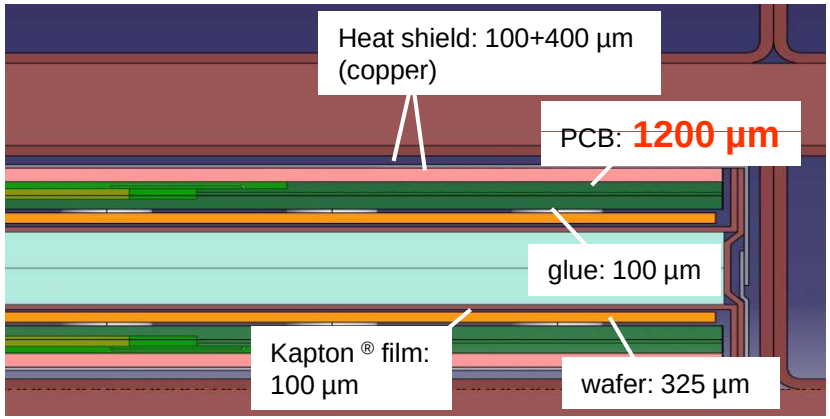
Marc Anduze – 01/12/2008

EUDET - Current design (final)





Thickness :
FEV5-1 : 1.17mm (+-0.04)
FEV5-2 : 1.19mm (+-0.04)
FEV5-3 : 1.20mm (+-0.02)

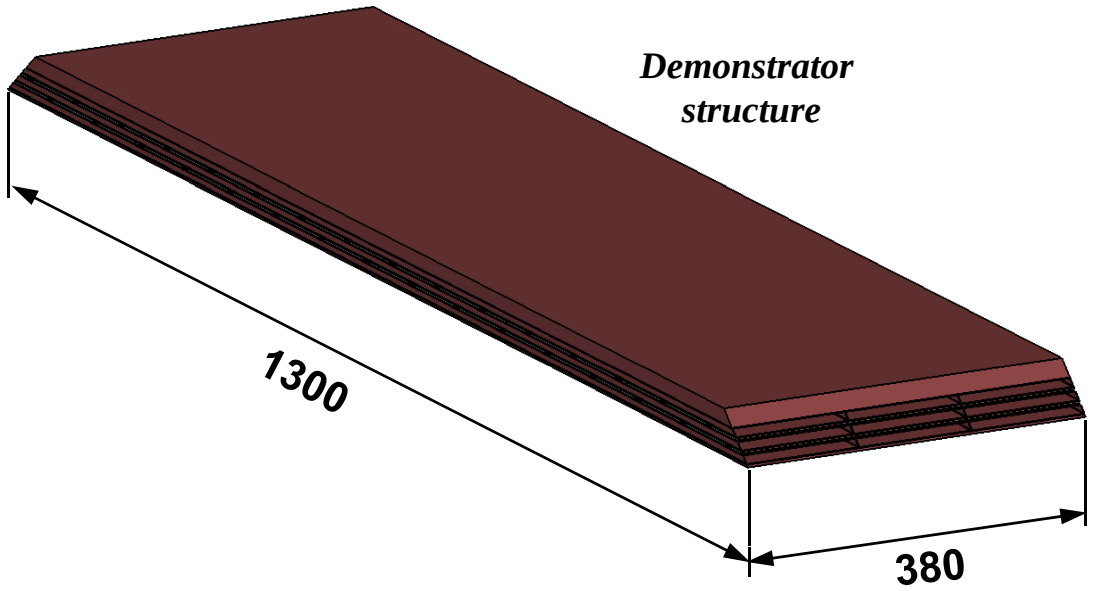


- ⇨ Gaps (slab integration) : 500 µm
- ⇨ Heat shield : **400 µm ?** Validation by the demonstrator
- ⇨ PCB : ~~800~~ µm → **1200 µm**
- ⇨ Thickness of glue : 100 µm
- ⇨ Thickness of wafer : 325 µm
- ⇨ Kapton® film HV : **100 µm ?** → Patrick's talk
- ⇨ Thickness of W : 2100/4200 µm (± 80 µm)

Demonstrator design

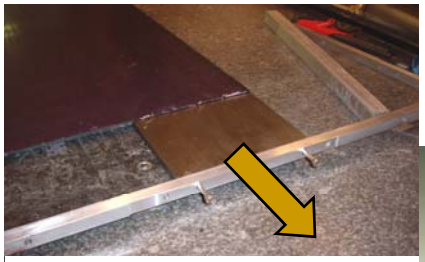
- We plan to build a first small demonstrator to validate all composite process before the EUDET module
- Width is based on physic prototype (124 mm)
- Used for thermal studies and analysis : design of a thermal PCB and cooling system.
- First test of slab integration (gluing, interconnection ...)

- **3 alveolar layers + 2 W layers**
- **3 columns of cells : representative cells in the middle of the structure**
- **Thermal studies support**
- **Width of cells : 126 mm**
- **Identical global length : 1.3m and shape (trapezoidal)**
- **Fastening system ECAL/HCAL**



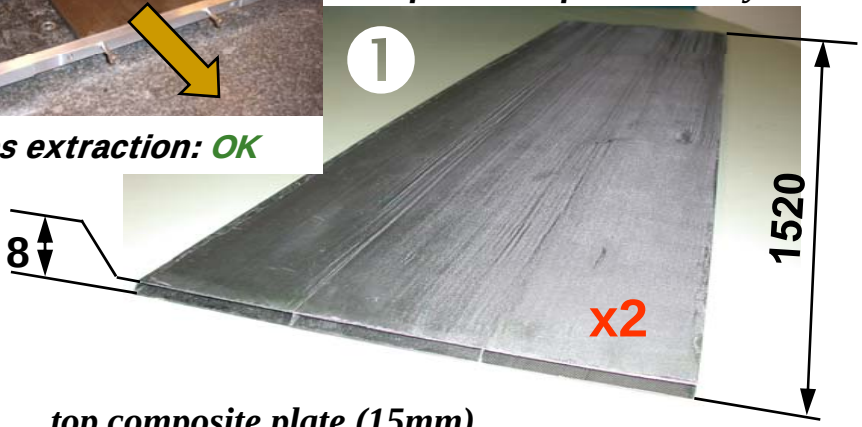
Demonstrator – Alveolar structure

Assembled structure : Each alveolar layer ❶ are done independently , cut to the right length and angle (❷) and bonded alternatively with W plates in a second curing step. The assembling is closed by 2 composite plates ❸ of 15 mm and 2 mm thick (from LPSC)



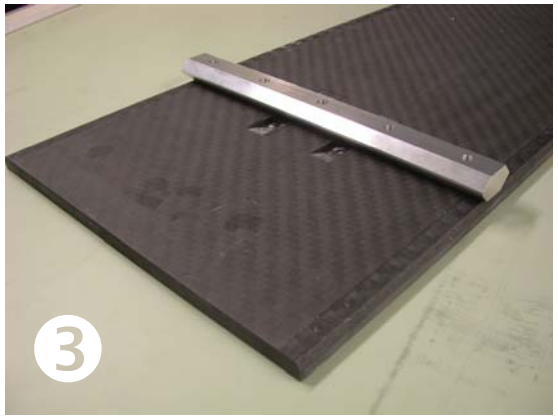
cores extraction: ***OK***

first test of alveolar layer



Cutting tests

top composite plate (15mm)



⇨ Global design : ***OK***

⇨ 2/3 "Alveolar layer" structure ❶ : ***OK***

⇨ Cutting test ❷ : ***OK***

⇨ Composite plates ❸ (LPSC) : ***OK***

Demonstrator – Assembly mould

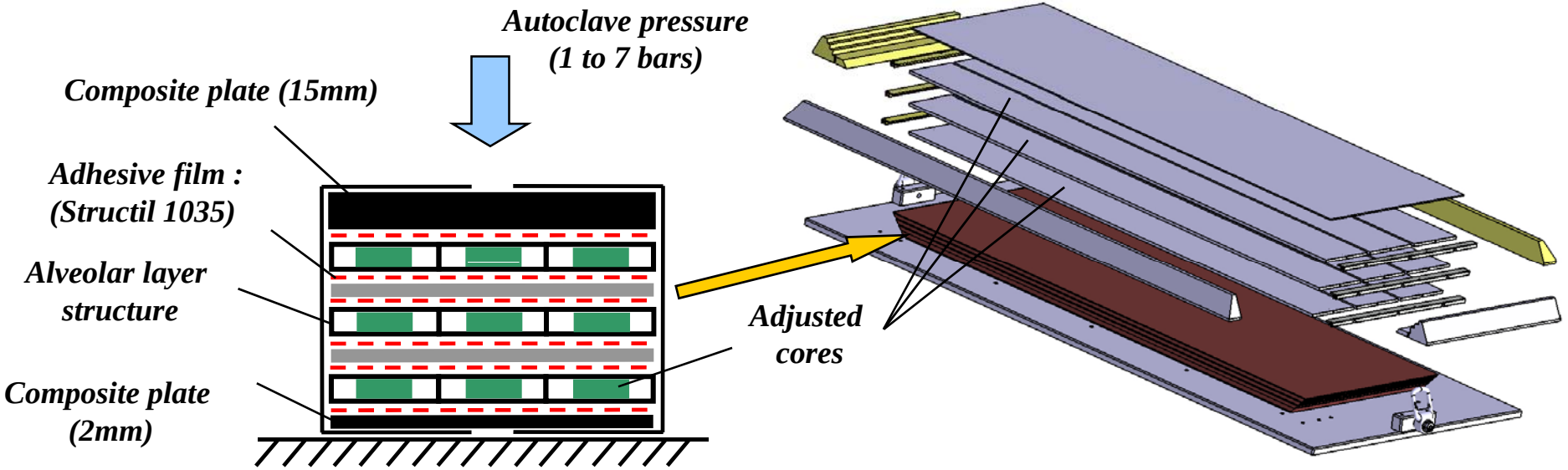
Several issues to be studied and validated yet:

- cores system for the assembly solution : use of adjusted metallic cores (in thickness) keeping each alveoli against W plates to obtain a correct assembly during the curing
- Curing parameters (thermal inertia)
- Reduce costs by changing the kind of carbon fibers
- Tests of deformation measurements by sensors embedded in the structure (optical fibers with bragg grating)

⇨ Design of mould : ***OK***

⇨ Ordered : ***OK***

⇨ W Needs : ***OK***



Mechanical tests

- Destructive tests of inter alveolar walls until breaking of interface in order to evaluate loads and elongations under Tensile and compression loading cases
- 2 kinds of carbon fibers :

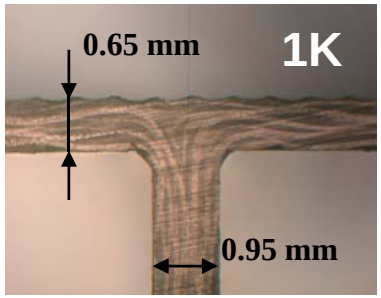
  CC120 (1K) : 0.12 mm thick ; 130€/m2

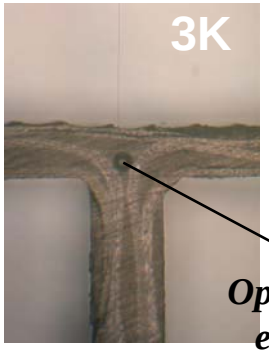
  CC202 (3K) : 0.25 mm thick ; 65€/m2

⇨ Destructive tests 1K: ***OK***

⇨ Destructive tests 3K: ***ongoing***

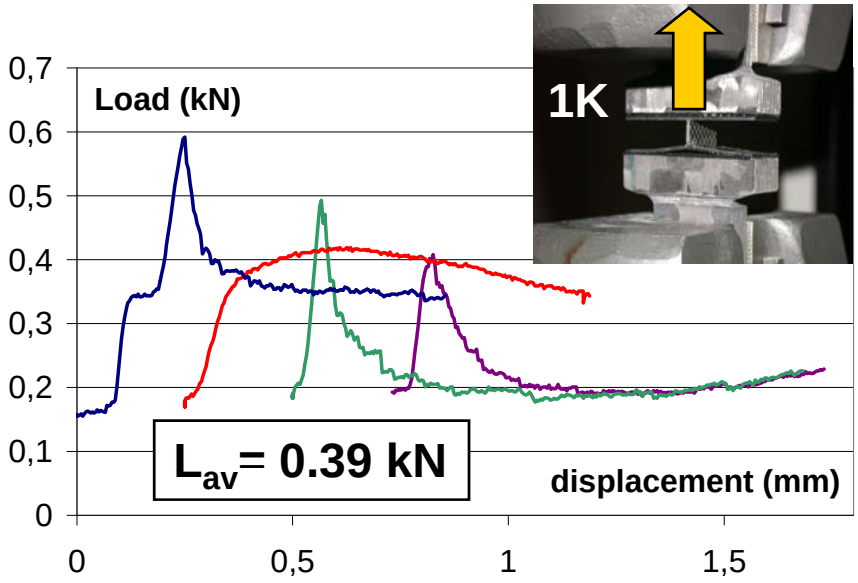
⇨ Measurements with optical fibers: ***ongoing***

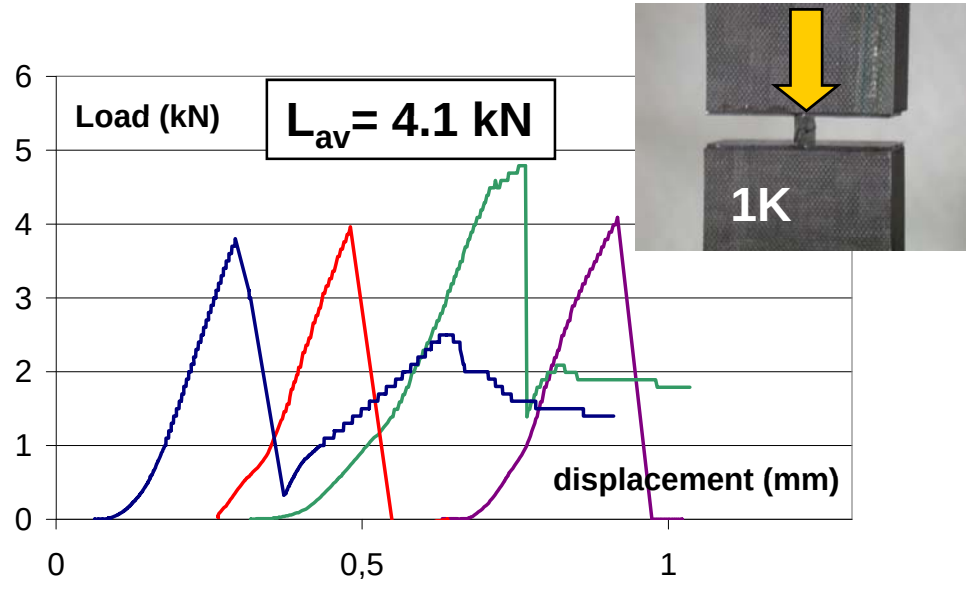




Optical fibers embedded

Cross section

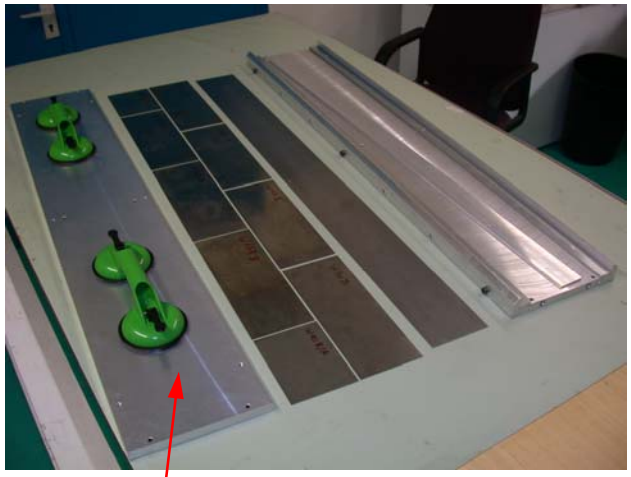




Demonstrator - H structure

Study of one mould for whole structures:

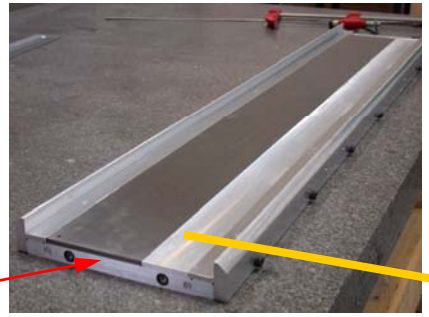
- Same principle than the mould used to do H physical prototype structures but using the autoclave)
- One long mould for both long and short H structures and 2 width (124 and 180 mm)

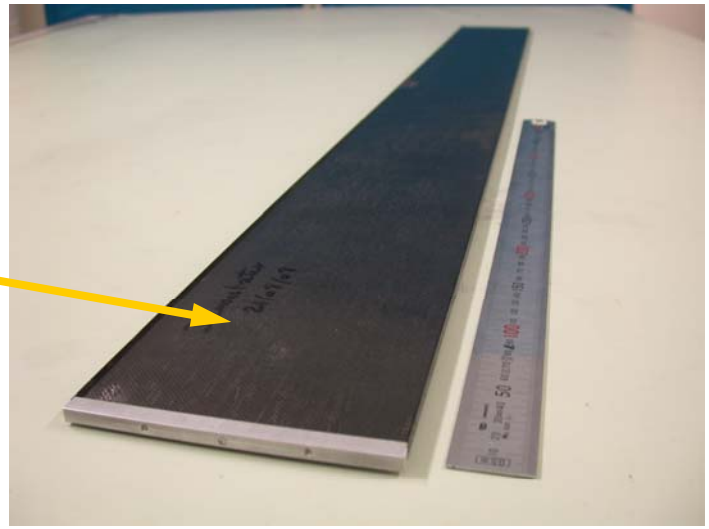


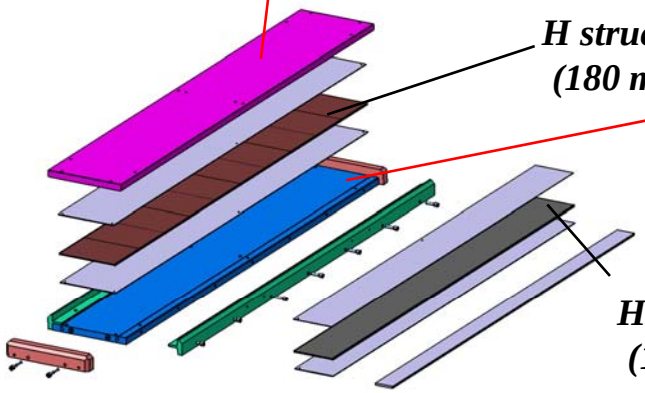
⇨ Design : ***OK***

⇨ Mould machining : ***OK***

⇨ H structure for demonstrator : ***OK***







Conclusion : schedule

- Demonstrator :
  - H structure — **Aug 08**
  - 2/3 “alveolar layer” structures — **Nov 08**
  - Carbon fibers choice & destructive tests — **Dec 08**
  - Reception of the Assembly mould — **Jan 09**
  - Third alveolar layer with sensors embedded (& tests) — **Jan 09**
  - Demonstrator (3 layers) assembled — **Fev 09**
- Eudet module :
  - “Alveolar layer” mould ordered — **Nov 08**
  - “Assembly mould” design (with thermal curing studies) — **Fev 09**
  - Alveolar layers & H production — **Mar 09**
  - Eudet structure assembled — **Jun 09**