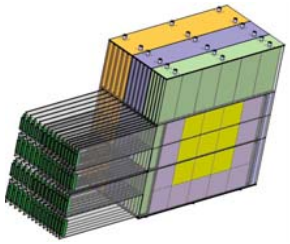
News on Moulds & Structures

CALICE meeting - Manchester

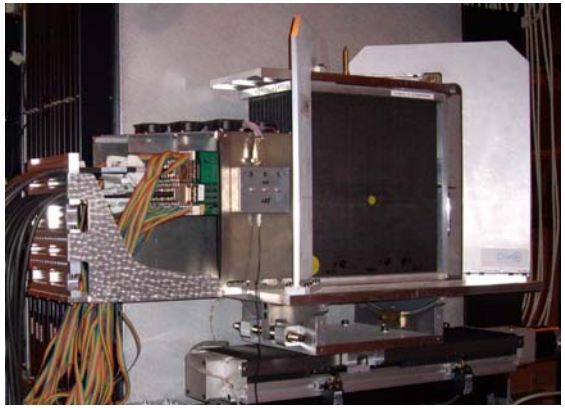
Marc Anduze – 09/09/2008

Technological prototype : EUDET module

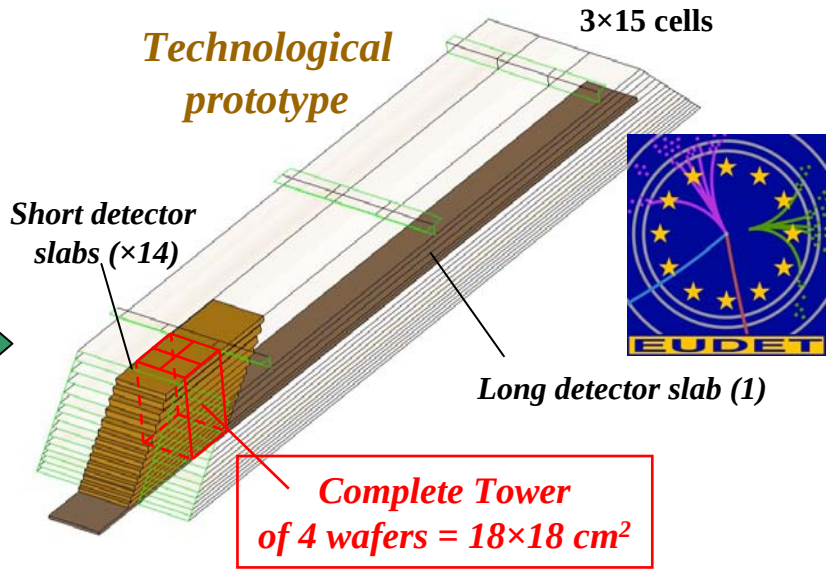
- Logical continuation to the physics prototype study which validated the main concepts : alveolar structure , slabs, gluing of wafers, integration
- Techno. Proto : study and validation of most of technological solutions wich could be used for the final detector (moulding process, cooling system, sizes of structures,...)
- Taking into account industrialization aspect of process
- Finest cost estimation of one module



Physical prototype



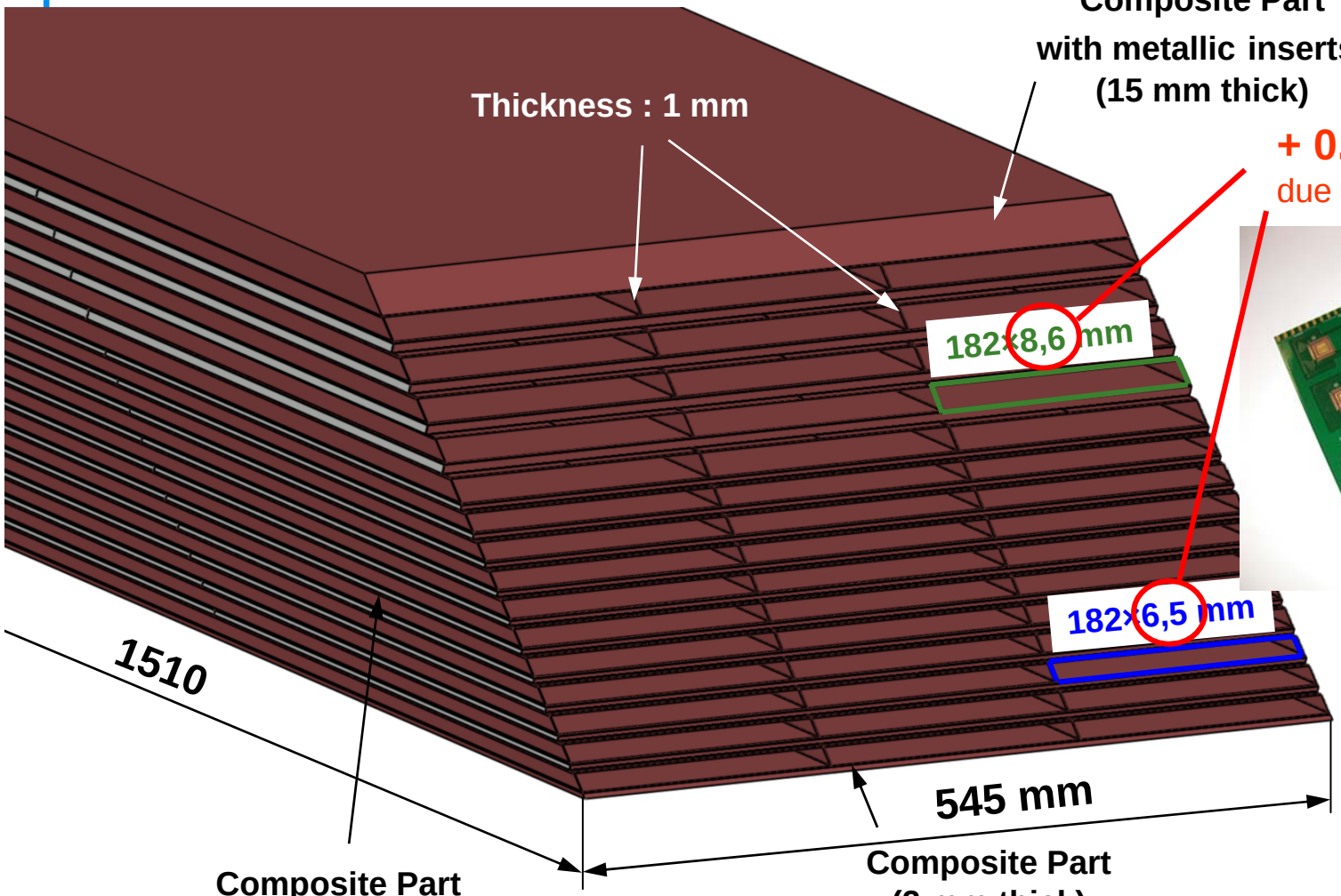
Technological prototype



- 3 structures : 24 X_0 (10×1,4mm + 10×2,8mm + 10×4,2mm)
- sizes : 380×380×200 mm3
- Thickness of slabs : 8.3 mm (W=1,4mm)
- VFE outside detector
- Number of channels : 9720 (10×10 mm²)
- Weight : ~ 200 Kg

- 1 structure : ~ 23 X_0 (20×2,1mm + 9×4,2mm)
- sizes : 1560×545×186 mm3
- Thickness of slabs : 6 mm (W=2,1mm)
- VFE inside detector
- Number of chan. : ~37890 (5.5×5.5 mm²)
- Weight : ~ 700 Kg

Alveolar structure – current design



Weight ~ 650 Kg

+ 0.8 mm or more ?
due to real PCB thickness:

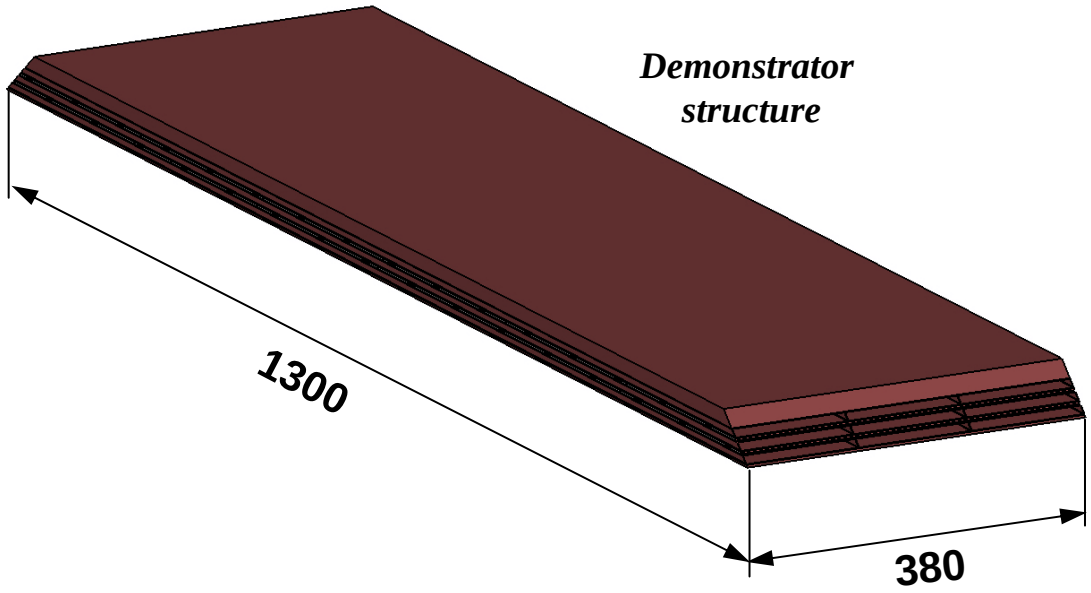
Thickness :
FEV5-1 : 1.17mm (+-0.04)
FEV5-2 : 1.19mm (+-0.04)
FEV5-3 : 1.20mm (+-0.02)

Demonstrator design

- We plan to build a first small demonstrator to validate all process before the EUDET module
- Width based on physic prototype (124 mm)

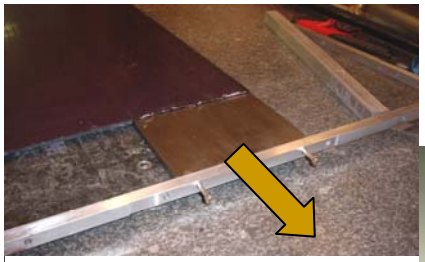
  ⇒ still need to validate all Eudet dimensions !!!
- Could be used for thermal studies and analysis : design of a thermal PCB and cooling system.

• 3 alveolar layers + 2 W layers
• 3 columns of cells : representative cells in the middle of the structure
• Thermal studies support
• Width of cells : 124 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)

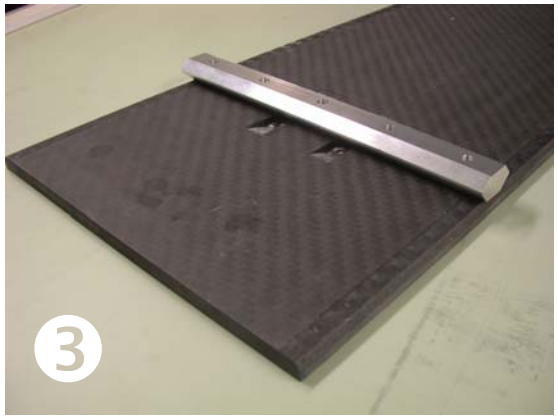


cores extraction: OK

first test of alveolar layer

Cutting tests

top composite plate (15mm)



⇨ Global design : ***OK***

⇨"Alveolar layer" first test ❶ : ***OK***

⇨ Cutting test ❷ : ***OK***

⇨ Composite plates ❸ (15mm and 2 mm) : ***OK***

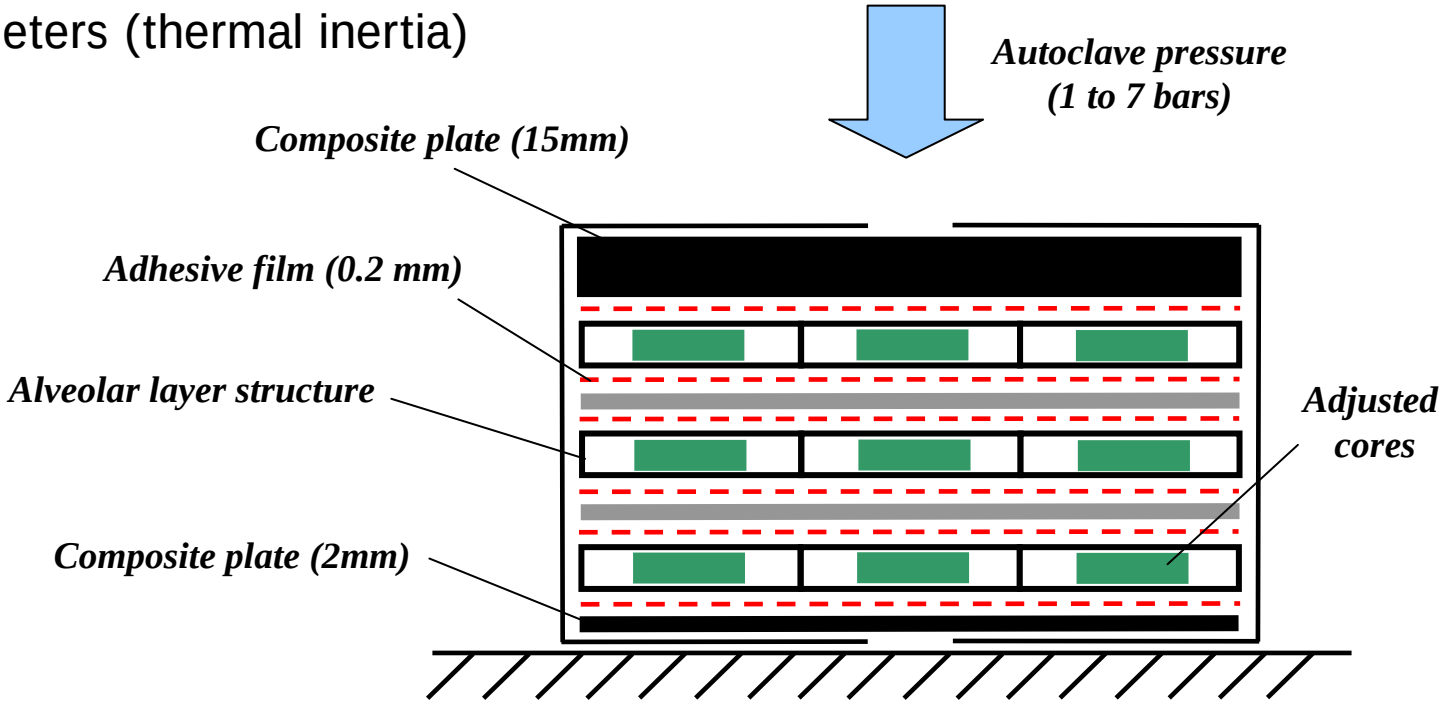
⇨ Design of assembling mould : ongoing

Demonstrator – Assembling mould

The design of the asembling mould has started :

Several issues have to be studied yet:

- The definition of the compacting pressure, according to the mechanical behaviour of the inter alveolar wall (destructive tests)
- The study of core system, keeping each alveoli against W plates to obtain a correct assembly during the curing : Use of adjusted metallic cores (thickness)
- Curing parameters (thermal inertia)

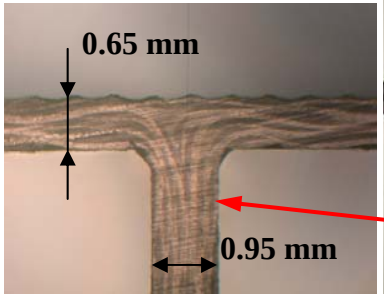


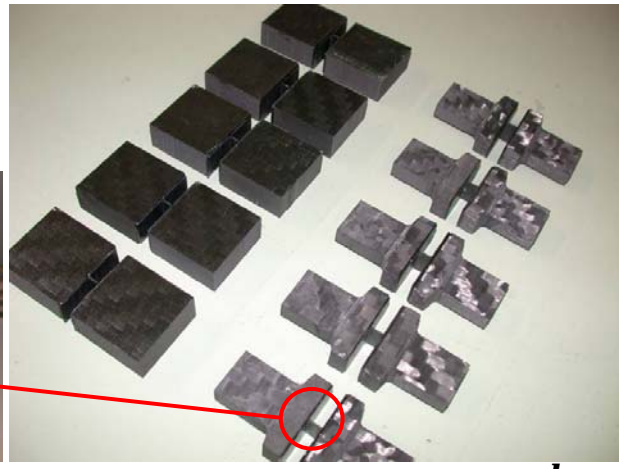
Destructive tests – first results

Mechanical tests :

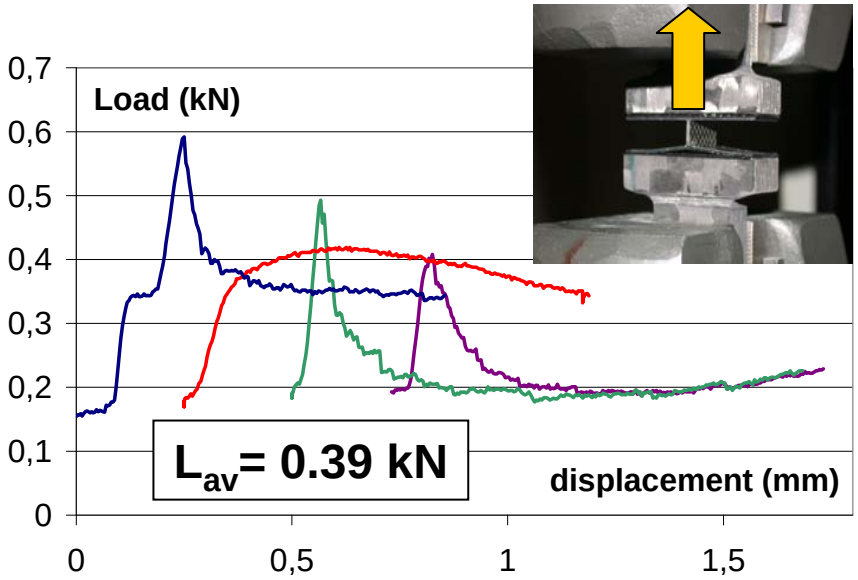
Destructive tests of inter alveolar walls until breaking of interface in order to evaluate loads and elongations under different loading cases:

sample section : 0.95×15 mm2

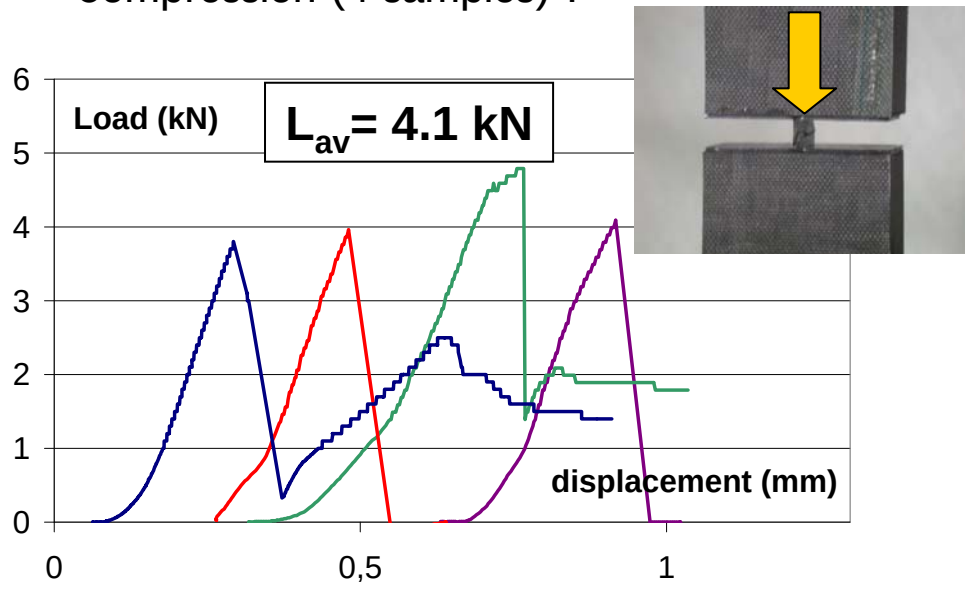




- Tensile (4 samples) :



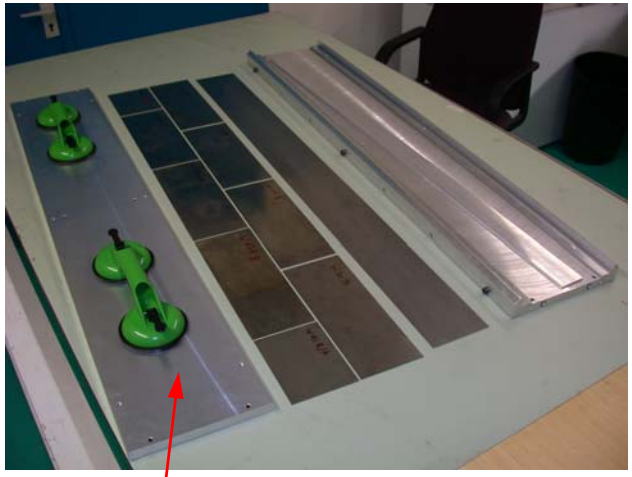
- Compression (4 samples) :



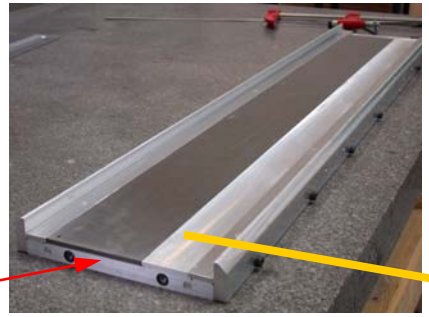
Demonstrator - H structure

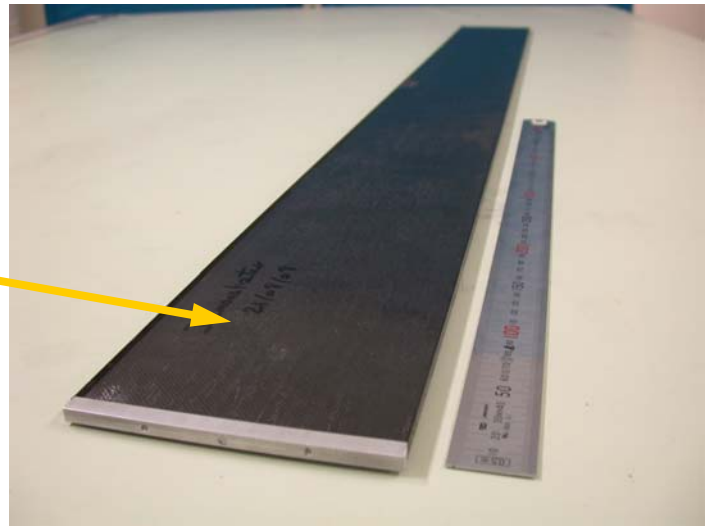
Study of one mould for whole structures:

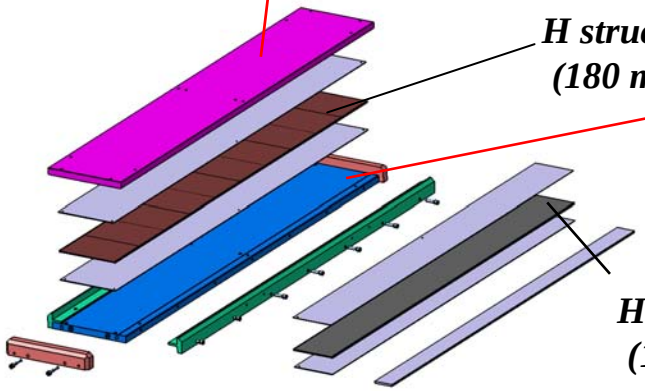
- Same principle than the mould used to do H physical prototype structures but using the autoclave)
- One long mould for both long and short H structures and 2 width (124 and 180 mm)



⇨ Design : ***OK***
⇨ machining : ***OK***
⇨ first H structure (1300×124): ***OK***







Conclusion : schedule

Composite **Structures** part :

- "alveolar layer" mould + first long structure *(demonstrator)* — **May 08** ⇨ OK
- First destructive tests — **Jun 08** ⇨ OK
- H Mould available + first H structure (126 mm) *(demonstrator)* — **Aug 08** ⇨ OK
- Assembling mould design and fabrication — **Oct 08**
- **Demonstrator** (3 layers – 126 mm) — **Nov 08**
- Final moulds design and order (dimensions adjustment: width-OK but thickness ?) — **Nov 09**
- EUDET layer structures production + H (long & short) — **Feb 09**
- **EUDET structure** assembly — **Jun 09**