
Demonstrator - Assembly

LAL

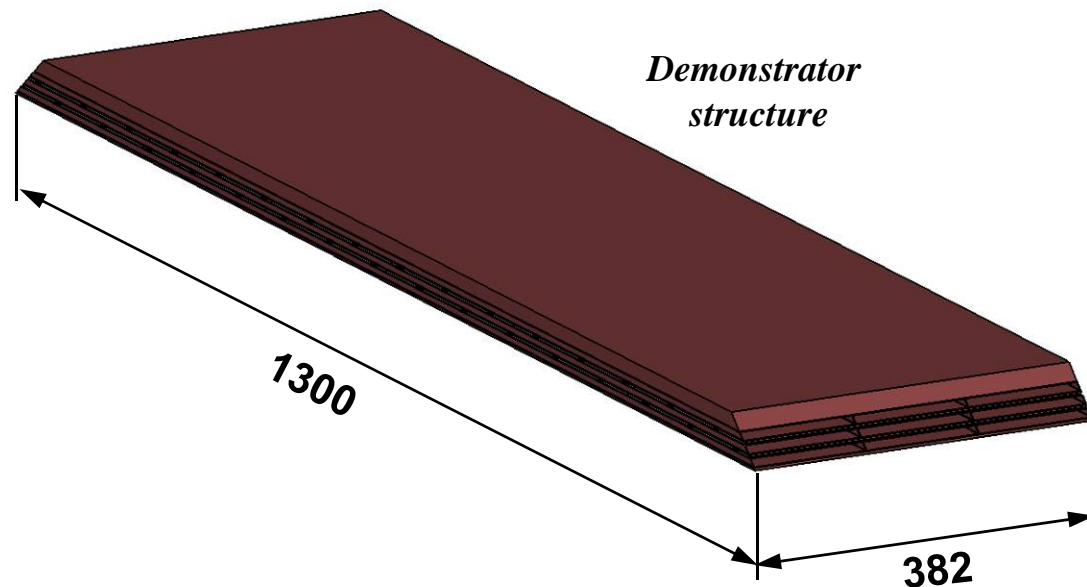
ECAL meeting - London



Demonstrator design

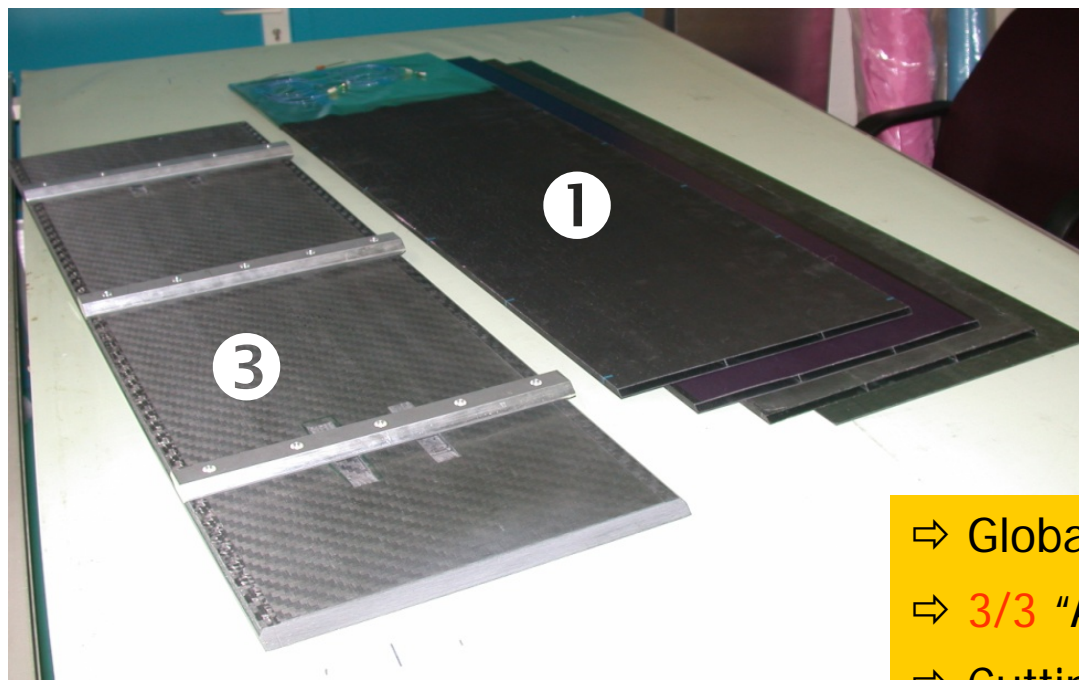
- We have built a first **small demonstrator** to validate all composite process before the EUDET module
- Width is based on physic prototype (124 mm)
- Used for **thermal studies** and analysis : design of a thermal PCB and cooling system.
- First test of **slab integration** (gluing, interconnection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

- **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**
- **weight : ~ 60 Kg**



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)



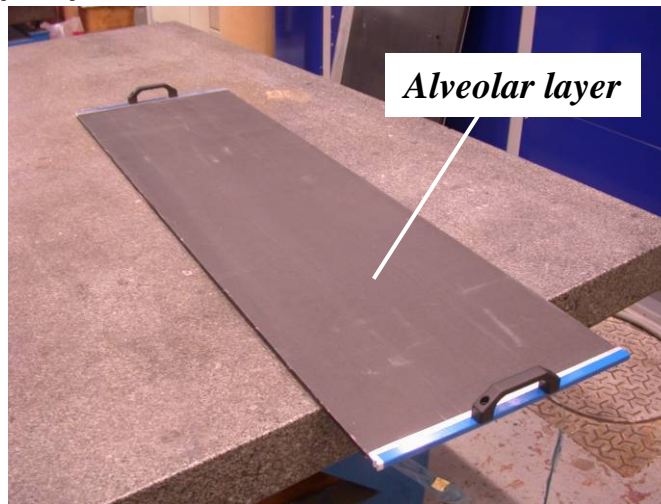
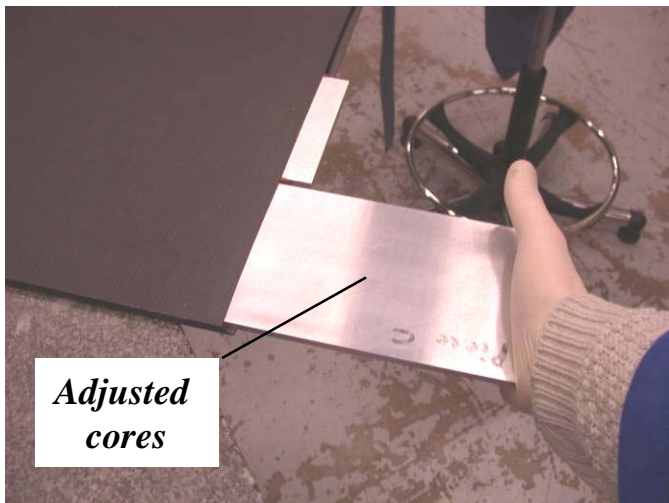
Cutting tests



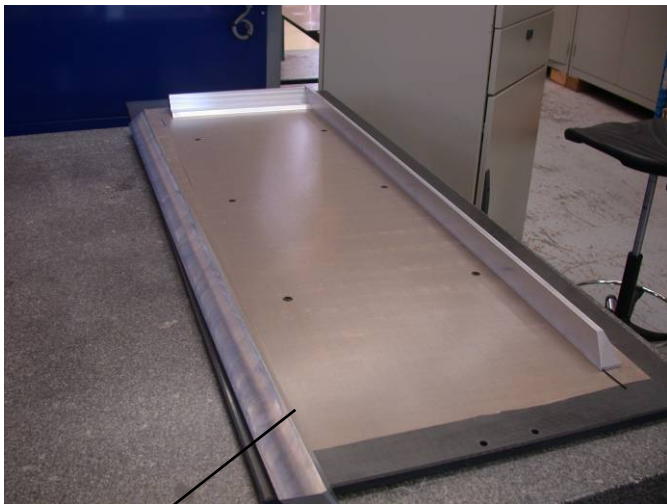
- ⇒ Global design : **OK**
- ⇒ 3/3 "Alveolar layer" structure ❶ : **OK**
- ⇒ Cutting test ❷ : **OK**
- ⇒ Composite plates ❸ (LPSC) : **OK**
- ⇒ W plates (12) : **OK**

Assembly Steps (1/5)

1 - Alveolar layers preparation

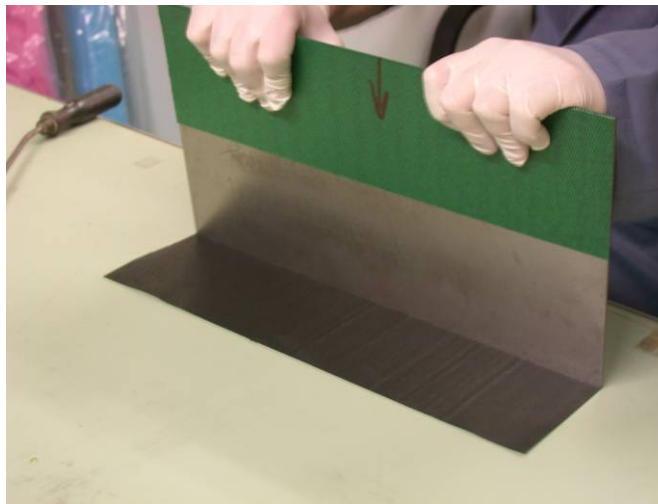


2 - Mould preparation



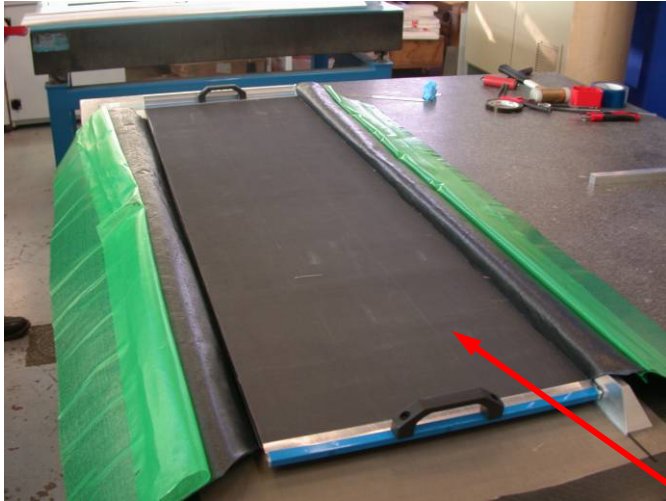
Mould

3 - Wrapping (W plates)

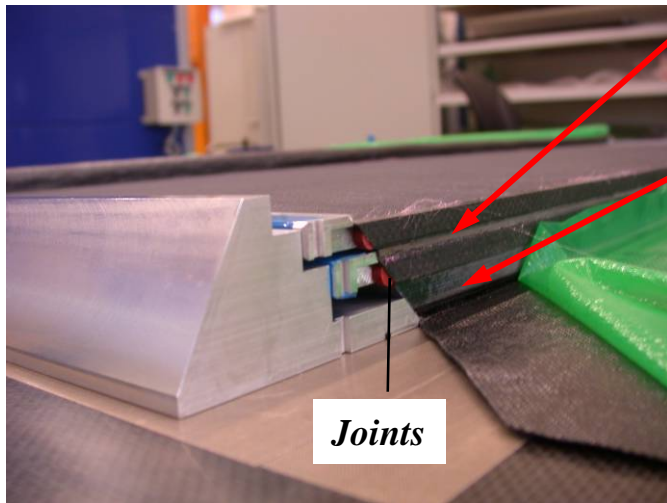
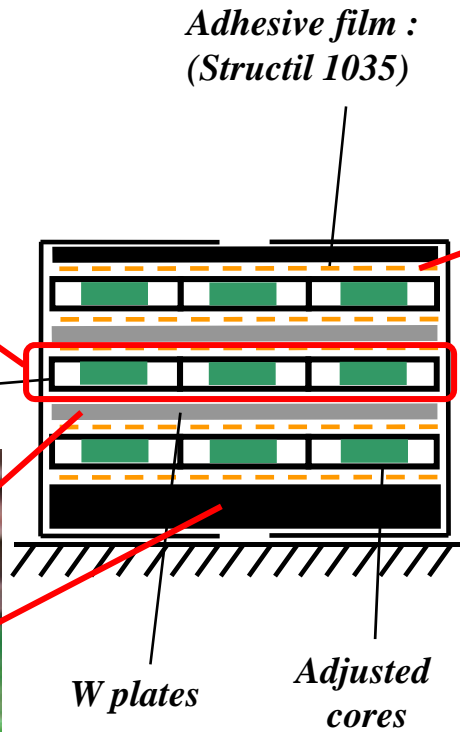


Assembly Steps (2/5) :

4 – Assembly in the mould (3 alveolar layers + 2 W layers)



Alveolar layer structure

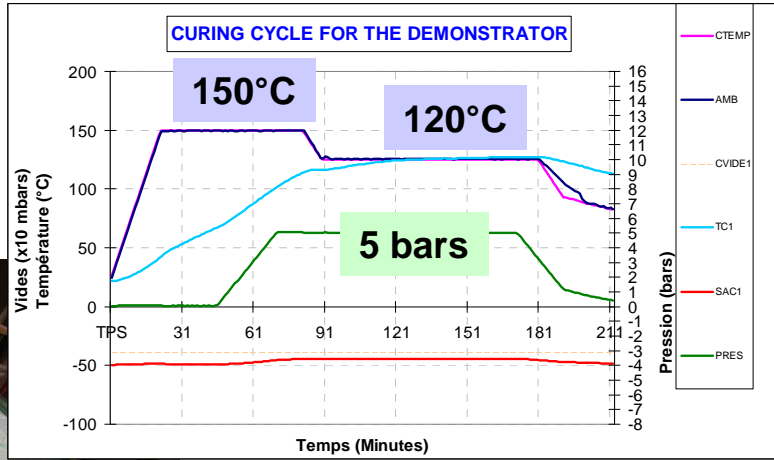


Joints

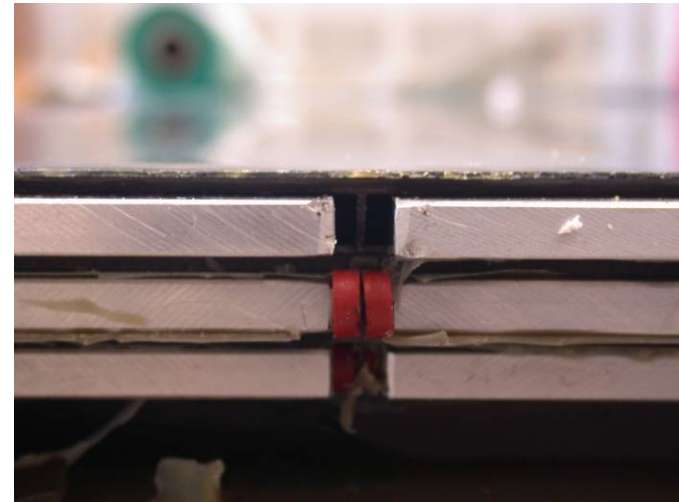
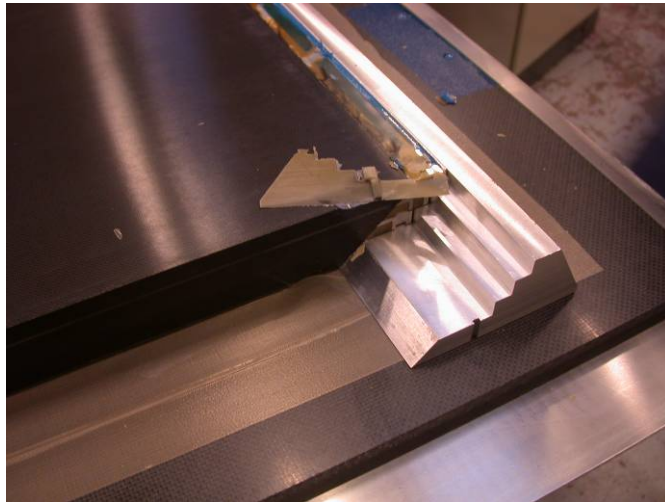


Assembly Steps (3/5)

5 - Curing



6 - Dismounting

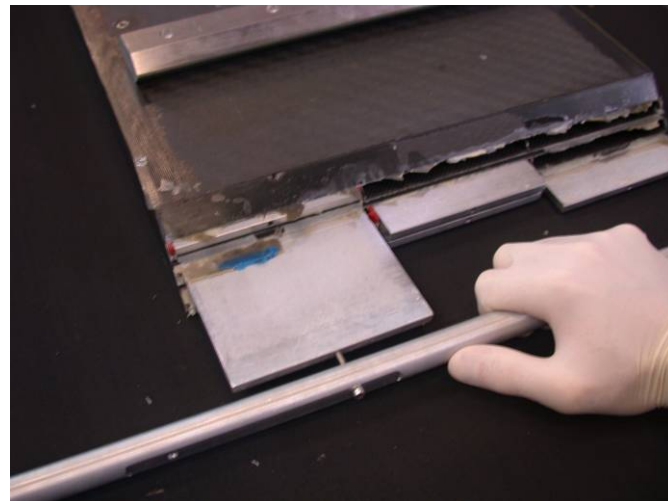


Assembly Steps (4/5)

6 - Dismounting

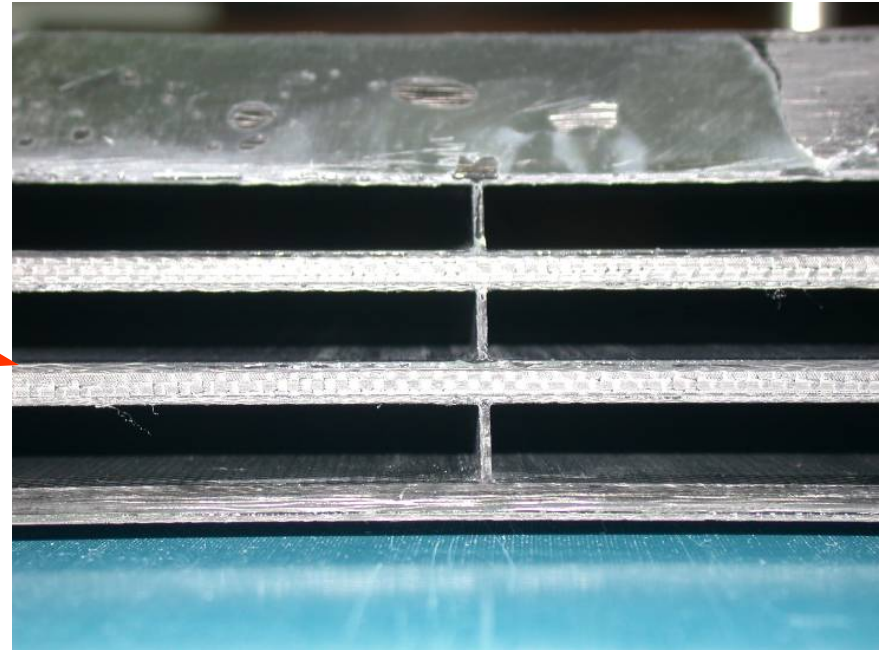
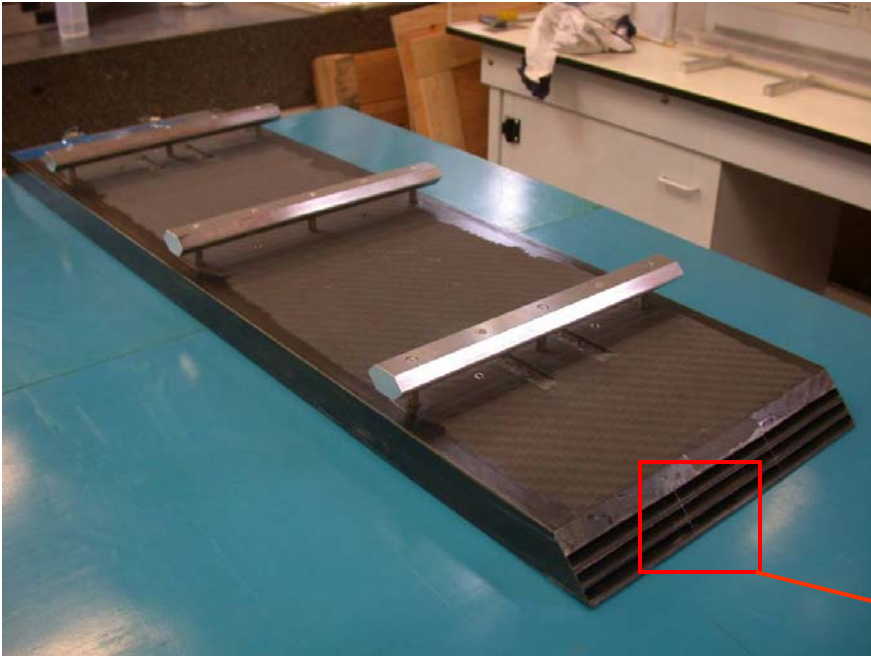


7 - Cleaning



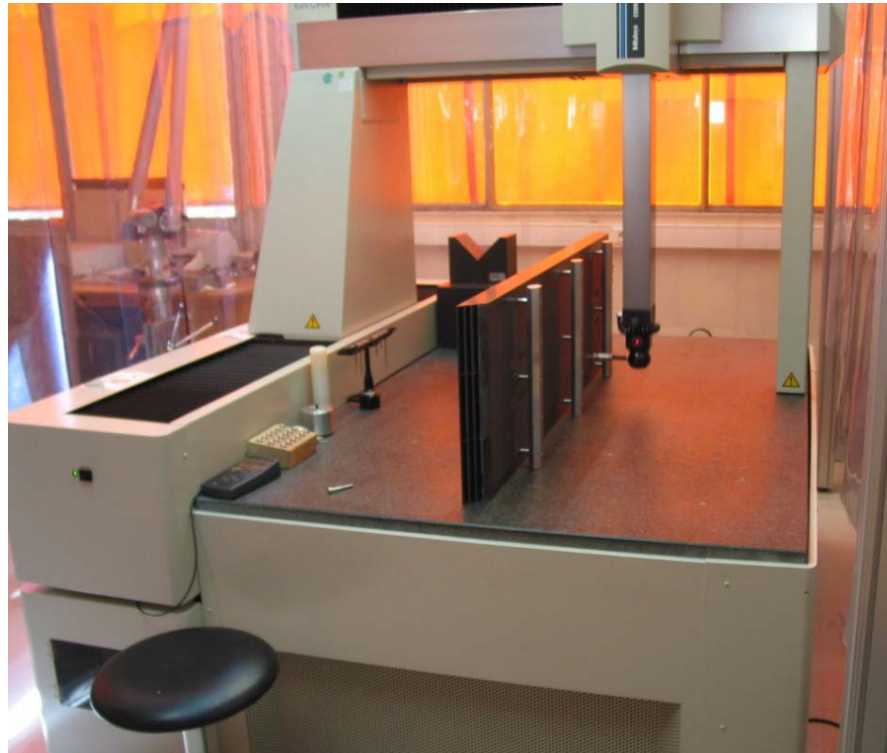
Assembly Steps (5/5)

8 - Results



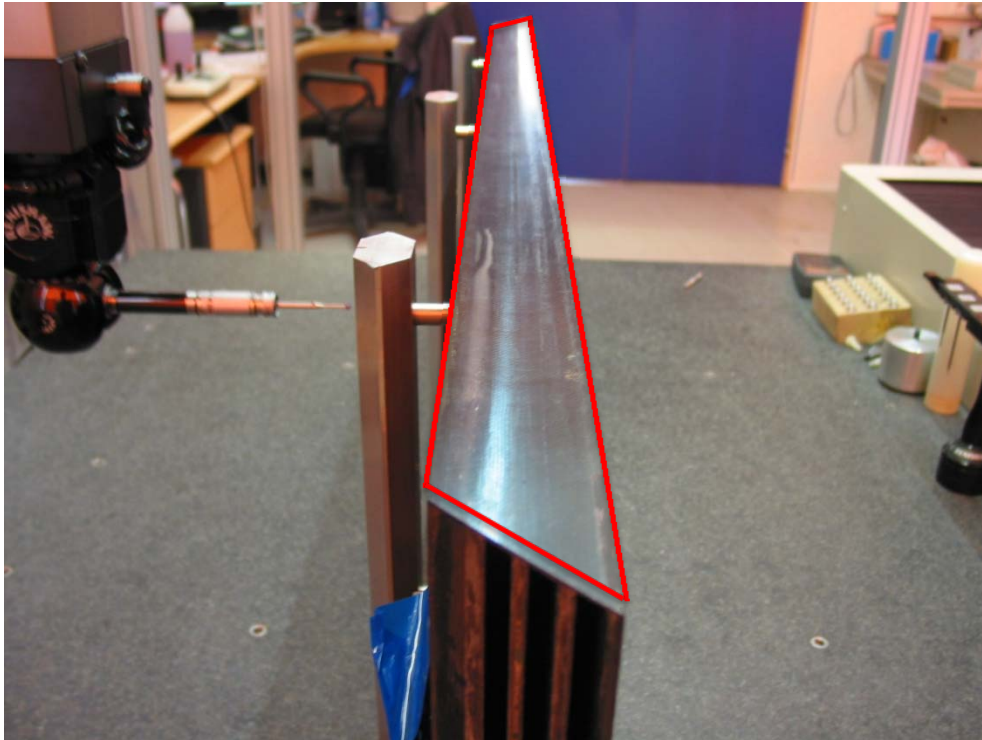
Dimensional inspection (1/3)

- We have controlled this first demonstrator with an automatic 3D control machine @LAL (thanks Julien Bonis)
- 264 Points of control
- Global dimensions : Thickness, Width
- 2 Flatness controlled (top and bottom)
- All cells and dead zones (thin walls) dimensions (each side)



Steps 1 : Global dimensions

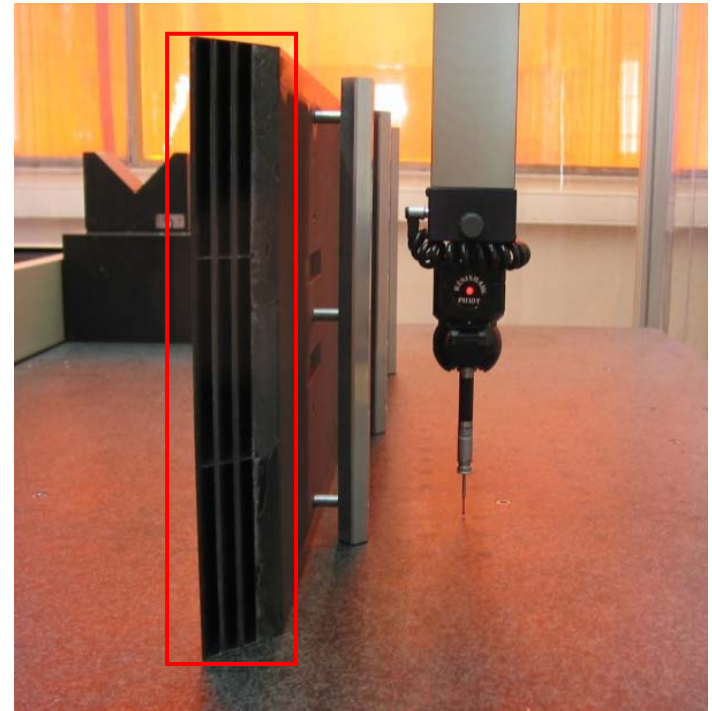
Expected (structure dim.) **VS** Measured



Global width :
382 mm vs 381,76 mm +/- 0.02

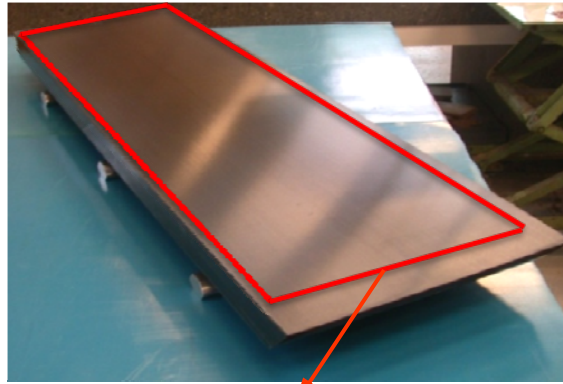
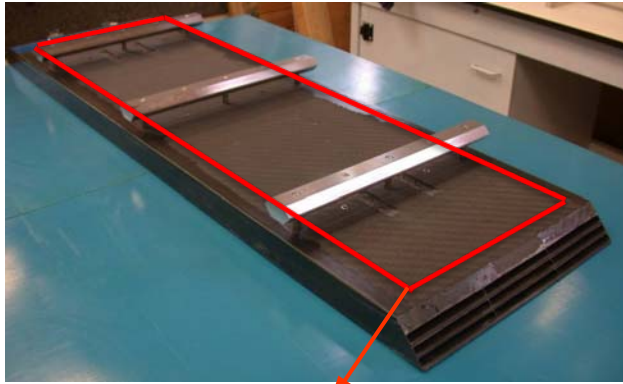
Total thickness (3 layers) :
48 mm vs 47,4 mm +/- 0.2

- Excellent wide precision (+/- 0.02)
- Smaller thickness due to the compacting of each glue layers



Steps 2 : Flatness

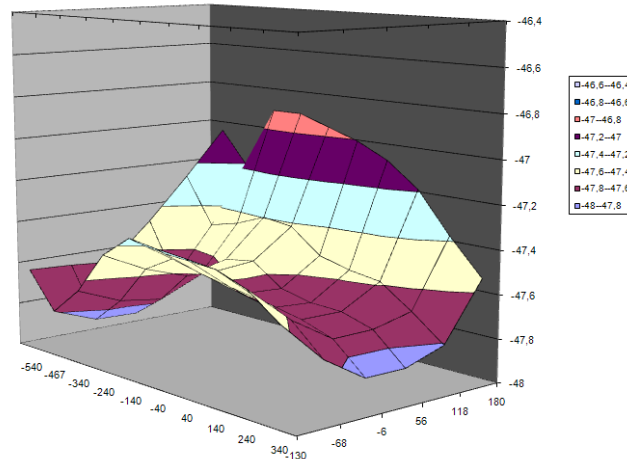
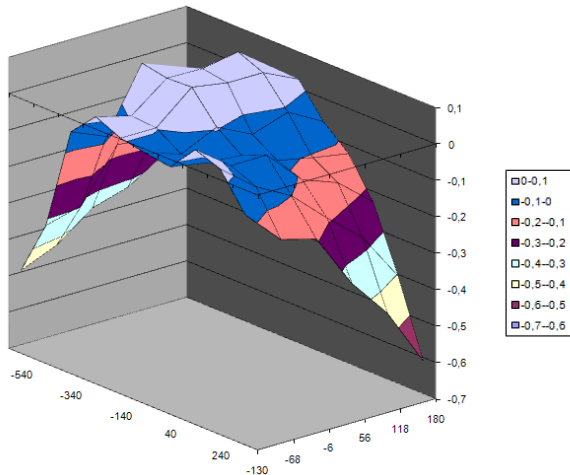
The Flatness: 120 points of control



Flatness top :
.... mm vs **0,59 mm**

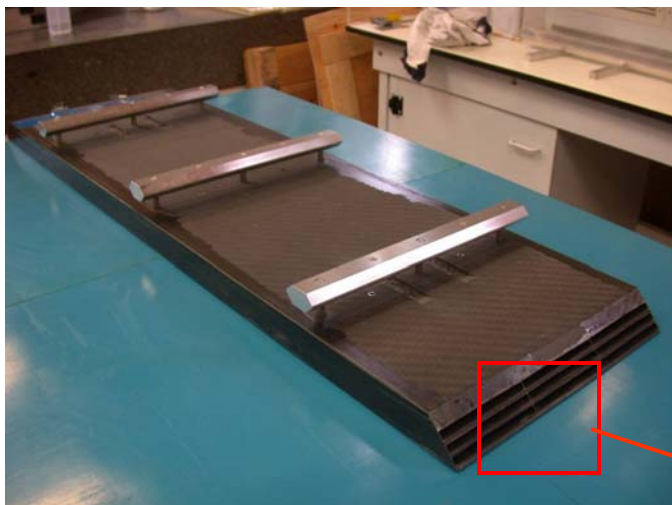
Flatness bottom :
.... mm vs **0,65 mm**

- This Flatness can be improve by a better flatness control of different layers.
- Is it necessary to have a better flatness? (the top and bottom flatness don't influence the cells position!)



Steps 3 : Cells and dead zones

Measure values (144 points of control)

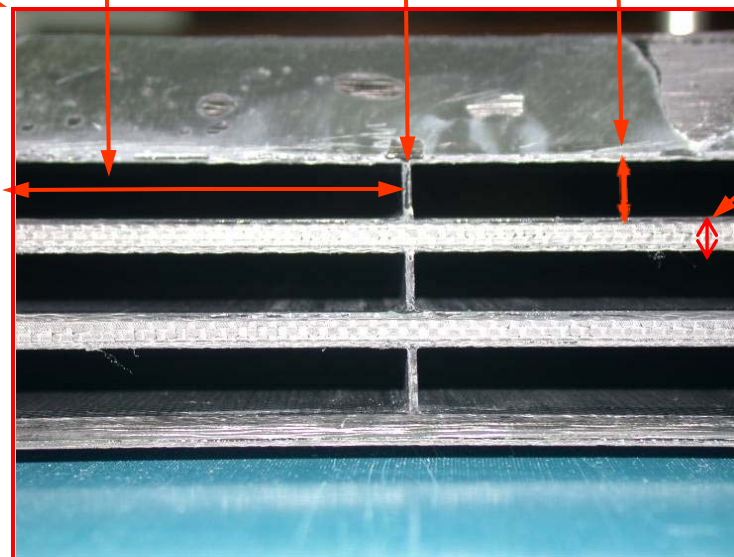


Global Cells width :
126.1 mm vs 126,24 mm +/- 0.02

Dead zones :
1 mm vs 0,97 mm +/- 0.02

Cells thickness :
6.5 mm vs 6,59 mm +/- 0.08

Spacing inter-cells :
3.9 mm vs 3,84 mm
+/- 0.06



- Good precision (width, dead zone, cells thickness) due to the rectification of cores (global tolerance +/- 0,01mm).
- The initial width and thickness are respected. No problem to insert the slabs if the slabs dimension don't change.

So, we 're ready

- We have realized a very important step :
 - Acquired knowledge in the Carbon cells structures building.
 - Validation of the mono-layer step and demonstrator assembly.
 - The global dimensions are correct to envisage the ILD assembly as planned.
 - The internal dimensions are respected.
 - No problem to insert the slab.

- The next step :
 - Integrate the thermal inertias for EUDET Module (15 layers).
 - Desing and Study the EUDET assembly mould - END of 2009
 - Study the thermal inertias parameters (2 T = 700 kg (W) + 1000 Kg (mould))
 - Realize the insertions slab tests
 - Continue the mechanical tests on demonstrator (with bragg grating) until destroy ?

- Demonstrator :
 - Demonstrator (3 layers) assembled **Feb 2009**
- Eudet module :
 - Composite reception **Apr 2008**
 - "Alveolar layer" mould reception **Apr 2008**
 - "Assembly mould" design (with thermal curing studies) **Oct 2009**
 - 1 Alveolar layers **Jun 2009**
 - Eudet structure assembled **first half-year 2010**