SiW Ecal EUDET Module

Construction of Demonstrator

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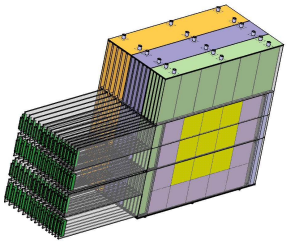
Summary of activities to underline contributions by the various groups

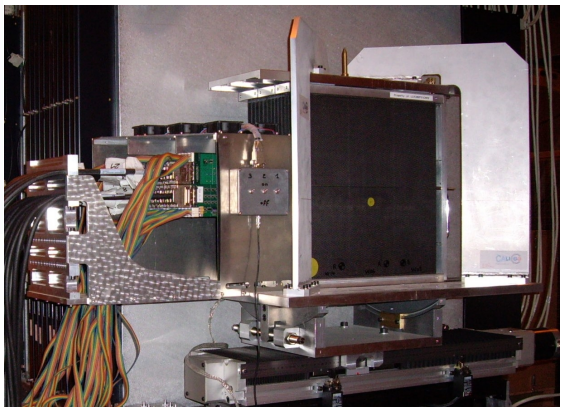
To learn more ....

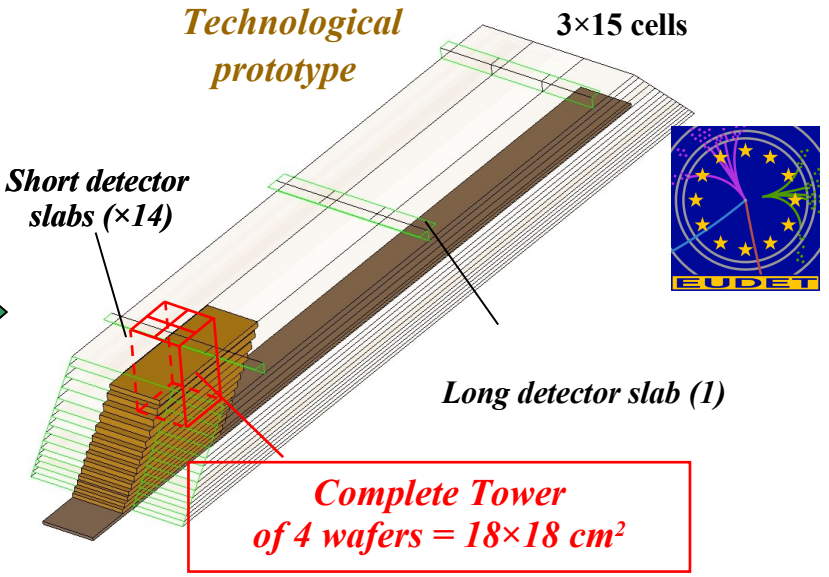
http://flc.web.lal.in2p3.fr/poeschl/siwecal.html

EUDET Prototype

- Logical continuation to the physical 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, wide size structures,…)
- Taking into account industrialization aspect of process
- First cost estimation of one module







• 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

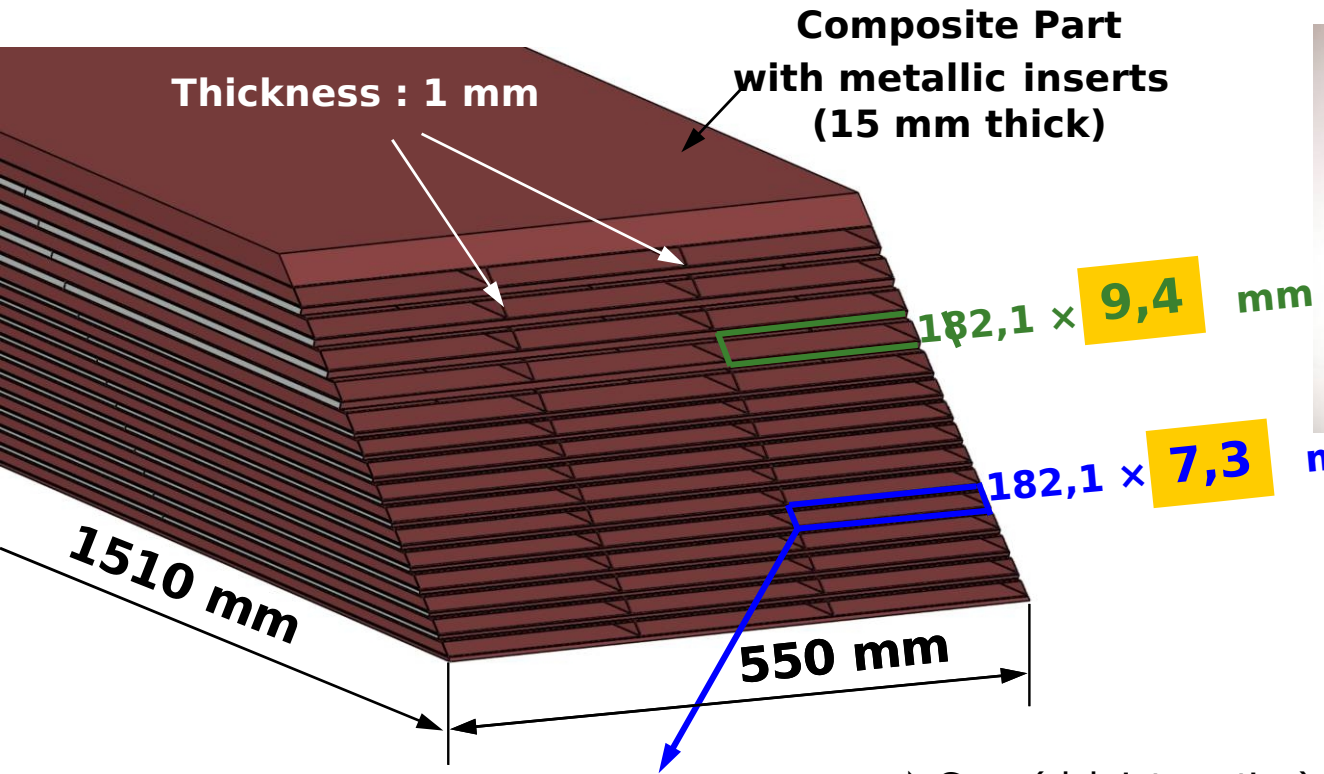
• 1 structure : ~ 23 X_0
(20×2,1mm + 9×4,2mm)
• sizes : 1560×545×186 mm3
• Thickness of slabs : 6 mm (W=2,1mm)
• VFE inside detector
• Number of channels : 45360 (5×5 mm²)
• Weight : ~ 700 Kg

The groups working on the EUDET Electromagnetic Calorimeter

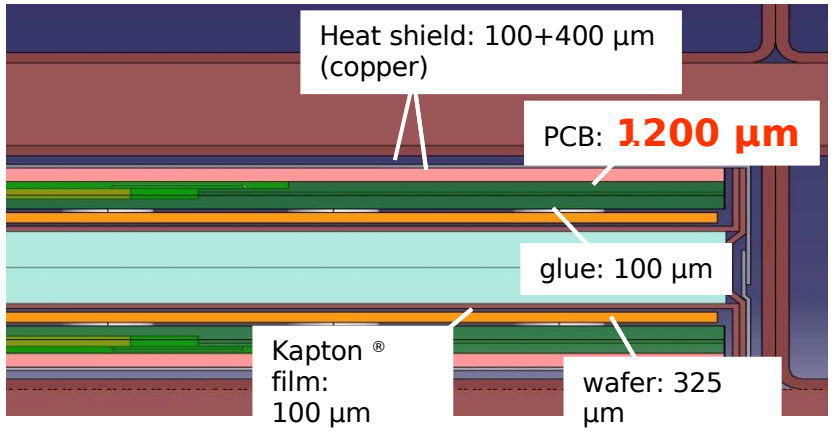
- What we call “EUDET Module” is in fact the next SiW Ecal CALICE Prototype

- Financial support by EU but largest fraction of funding still from “Calice” ressources!!!!

Module EUDET – Current Design (final)



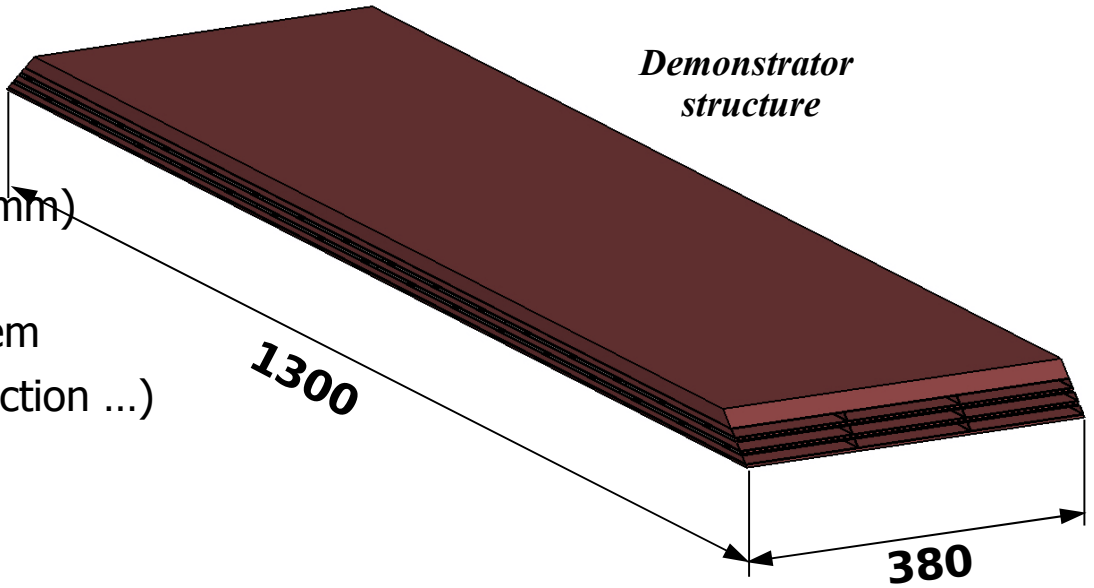
Thickness :
FEV5-1 : 1.17mm (+-0.04)
FEV5-2 : 1.19mm (+-0.04)
FEV5-3 : 1.20mm (+-0.02)



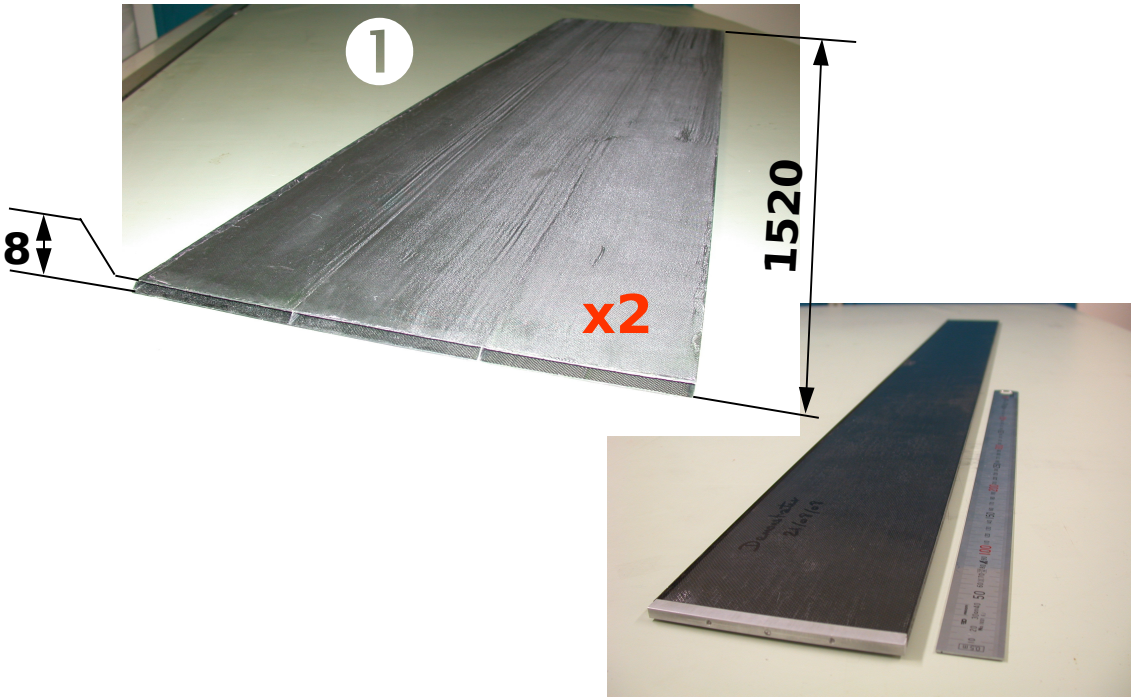
- ⇨ Gaps (slab integration) : 500 µm
- ⇨ Heat Shield: **400 µm ?** Validation with the demonstrateur
- ⇨ PCB : ~~800 µm~~ **~1200 µm**
- ⇨ Thickness of Glue : 100 µm
- ⇨ Thickness of SiWafer : 325 µm
- ⇨ Kapton® film HV : **100 µm ?**
- ⇨ Thickness of W : 2100/4200 µm (± 80 µm)

Demonstrator design

- We have constructed a demonstrator
  validate the assembly process
  before the actual EUDET Module
- Width the same as for physics prototype (124 mm)
- Thermal Studies:
  Equiped with thermal PCBs and a cooling system
- First test of slab integration (gluing, interconnection …)



first test of alveolar layer



- **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**

Parties Involved

6 Laboratories are sharing out tasks in according to preferences and localization:

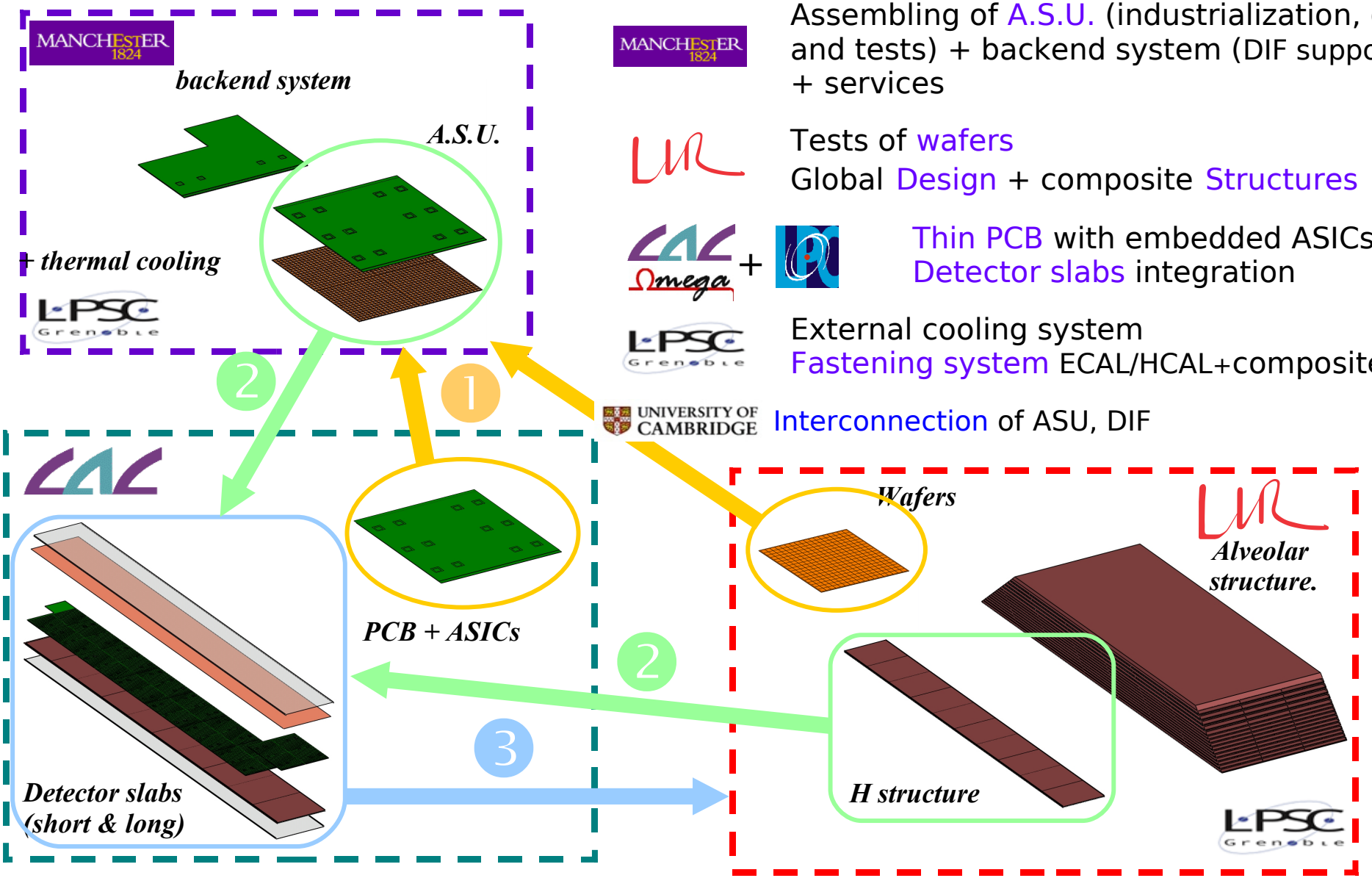
Assembling of A.S.U. (industrialization, gluing and tests) + backend system (DIF support) + services

Tests of wafers
Global Design + composite Structures

Thin PCB with embedded ASICs
Detector slabs integration

External cooling system
Fastening system ECAL/HCAL+composite plates

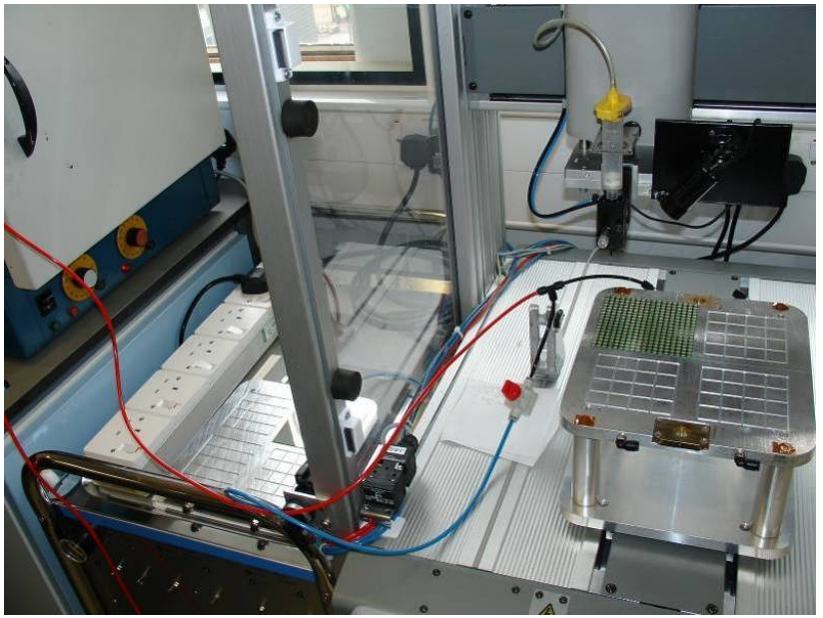
Interconnection of ASU, DIF



Gluing of ASUS

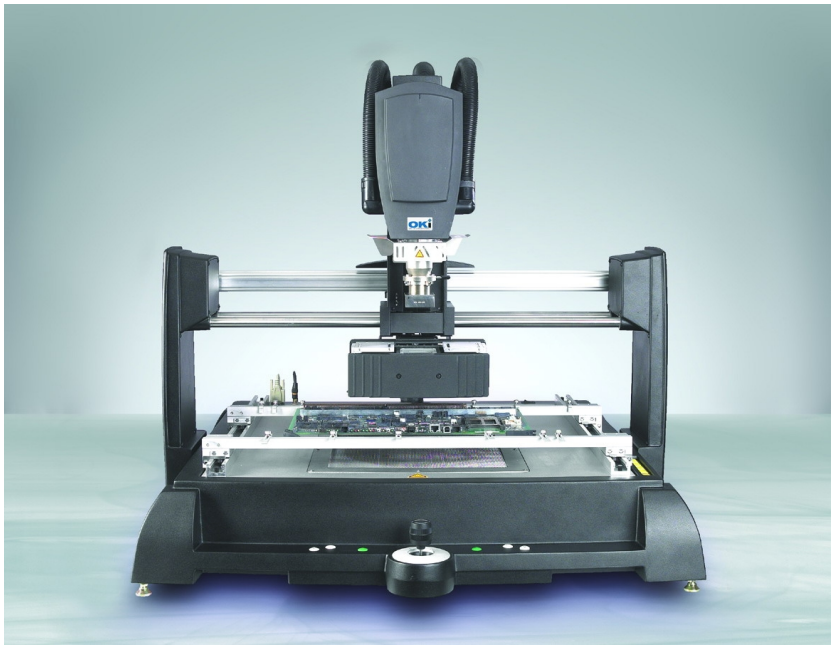
- Controlled glue dot deposition on the PCB
- The (four) Si Wafers are picked up, aligned and placed on the PCB
- Accurate thickness and planarity control via vacuum jigs
- The assembled ASU is allowed to cure

Test board with Dispenser Robot



"Gluing" rate 0.4 Hz

BGA Workstation for Wafer Placement

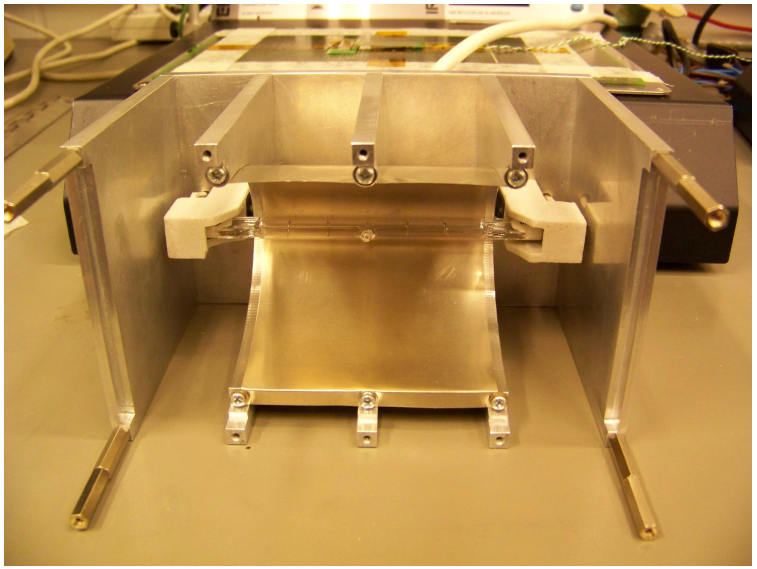


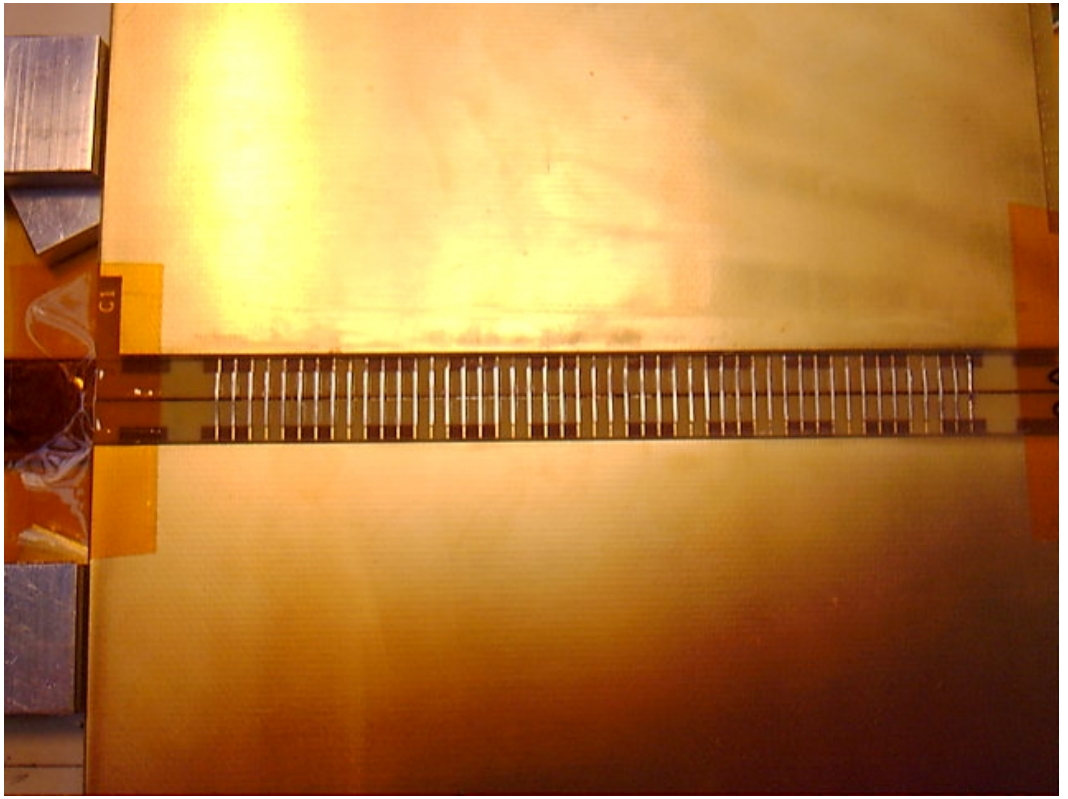
Precise Wafer Placement
by Split Field Optics

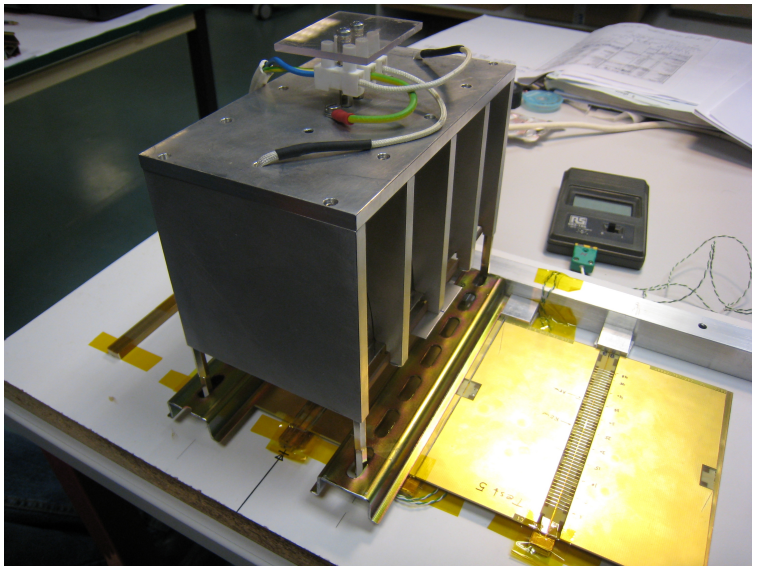
ASUs for four thermal layers glued at Uni Manchester

Workshop with H and Thermal Boards

The joint between two boards





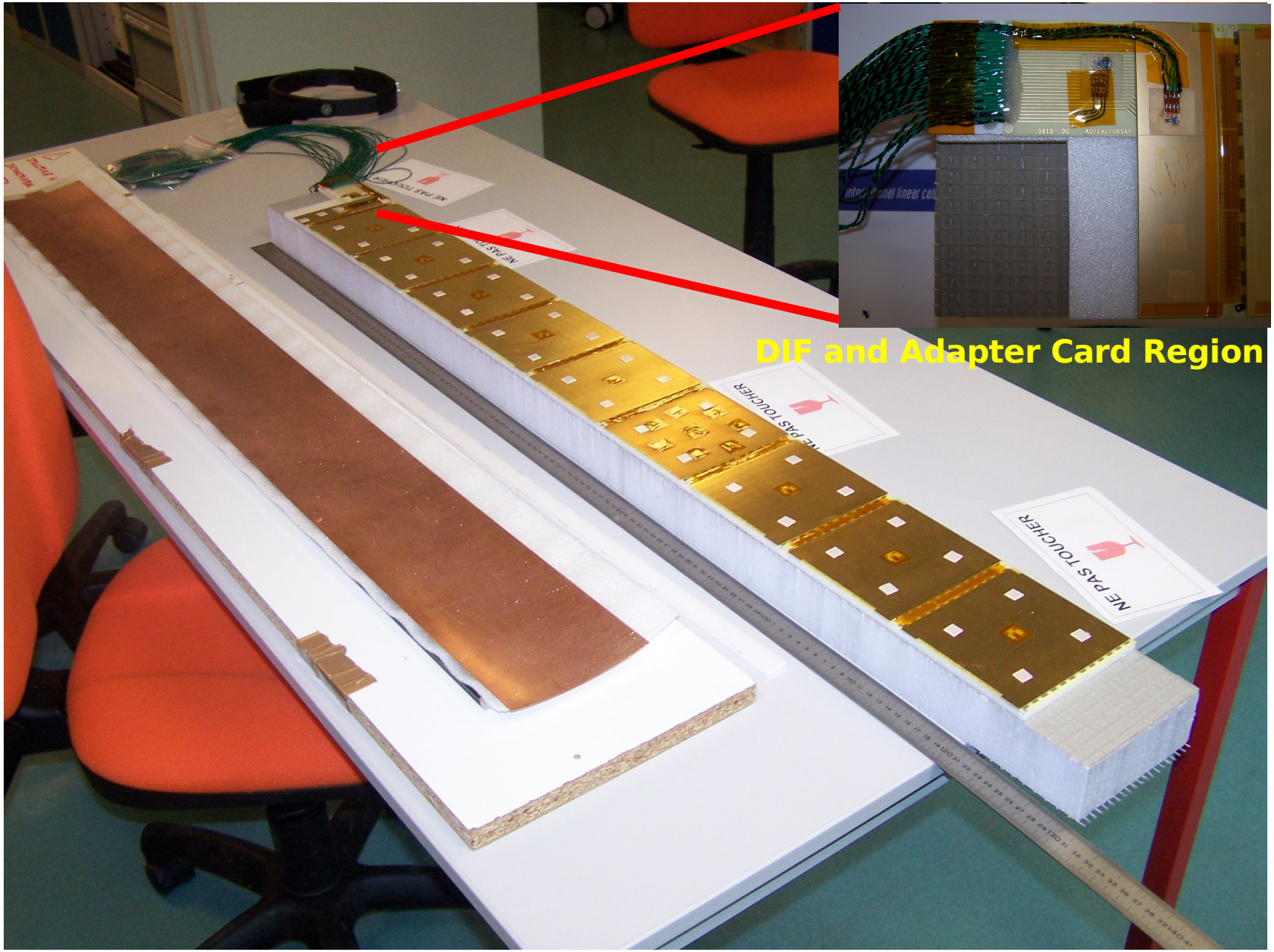


- Joint by halogen lamp heating up tin-bismuth soldering paste
  (Method developed by U. Cambridge)

- Heating Temperature ~200° C

Delicate Process for Demonstrator – Easier for EUDET Module

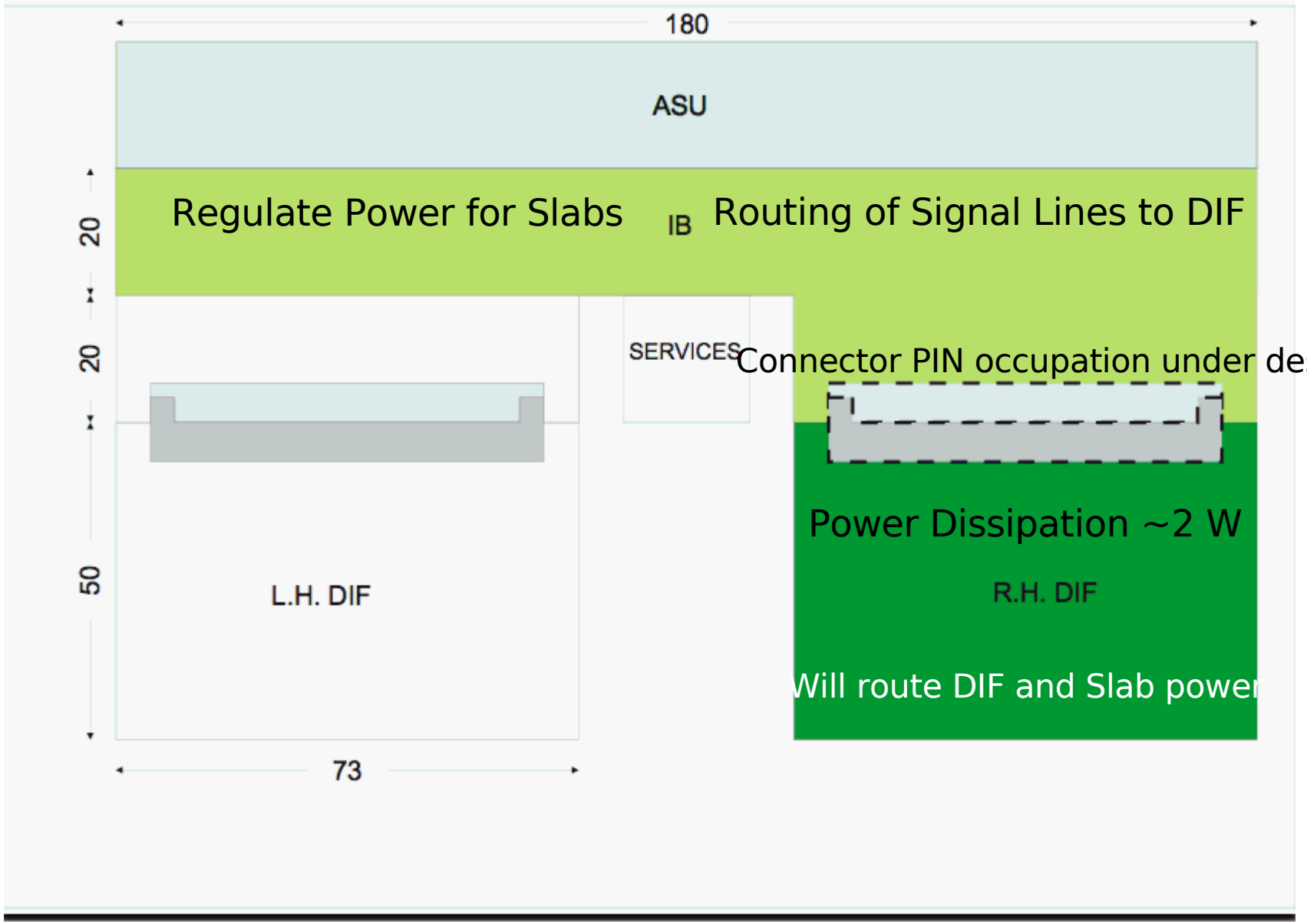
Thermal Layer and (bended) Copper Shield



Details by J. Bonis

SiW Ecal Meeting June 2009

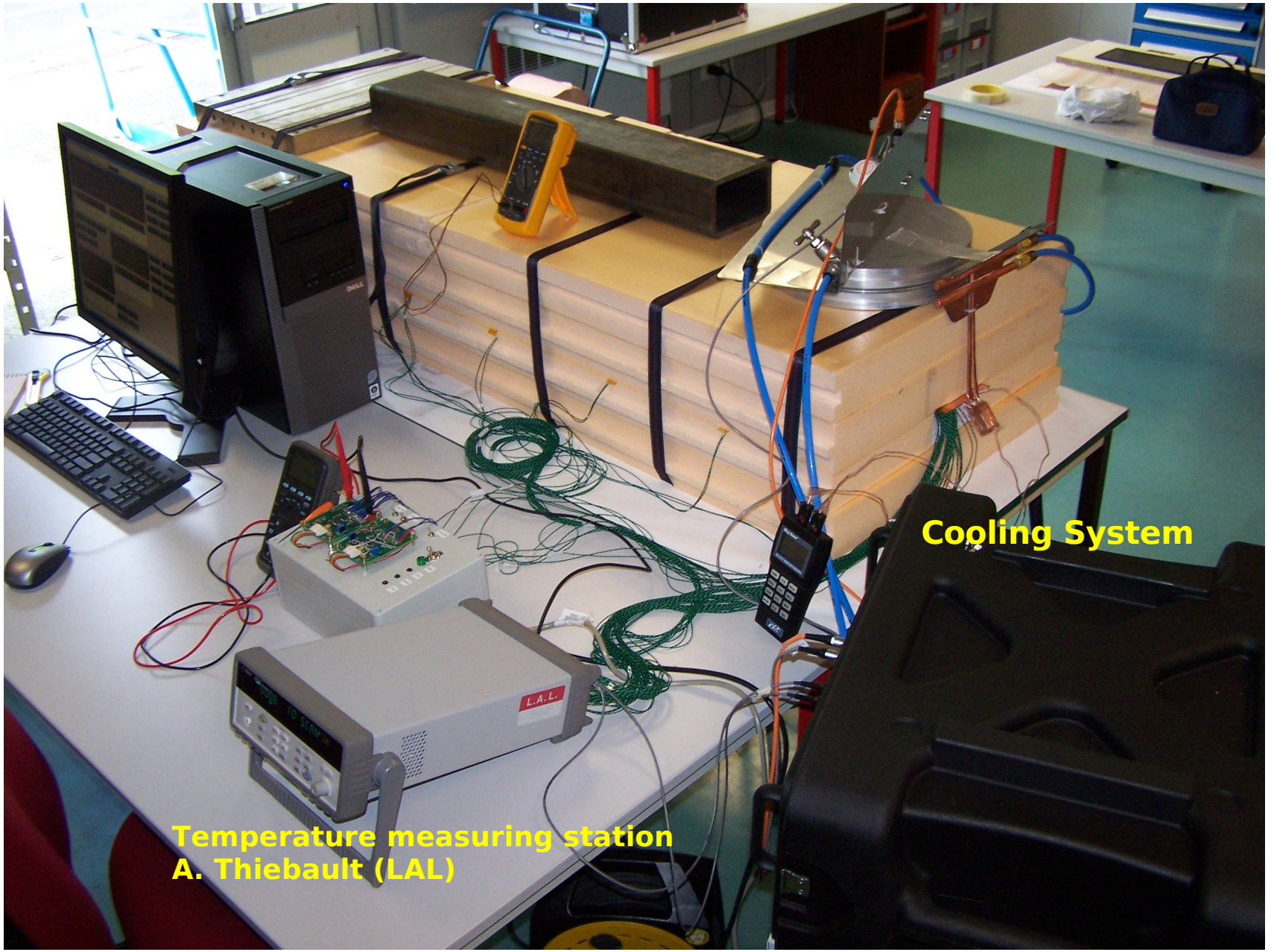
Intermezzo - Agreed Dimensions DIF/IB Region



More in talk by Bart today and Electronics Meeting tomorrow

Performing the thermal tests – May 2009

Improved insulation w.r.t. To February test

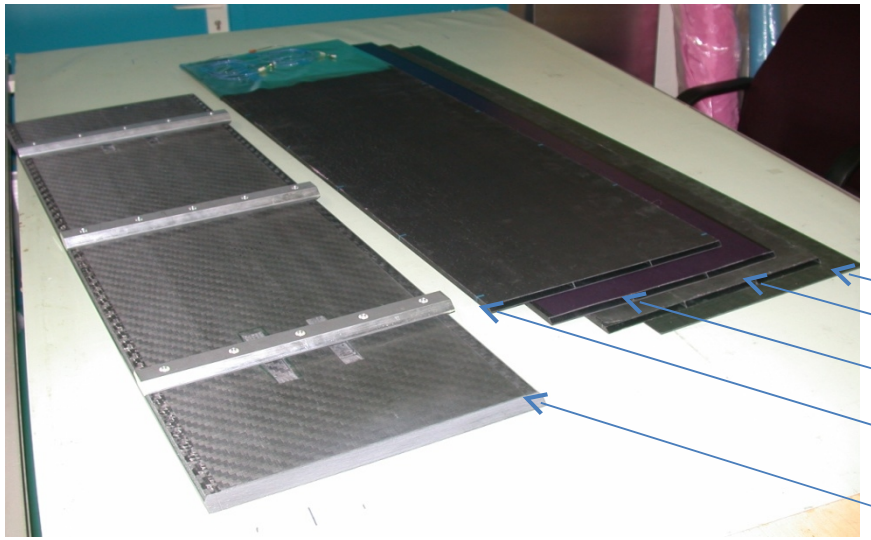


Snapshot of measurements during thermal tests

Details by J. Giraud

Assembly of the Alveolar Structure for the Demonstrator

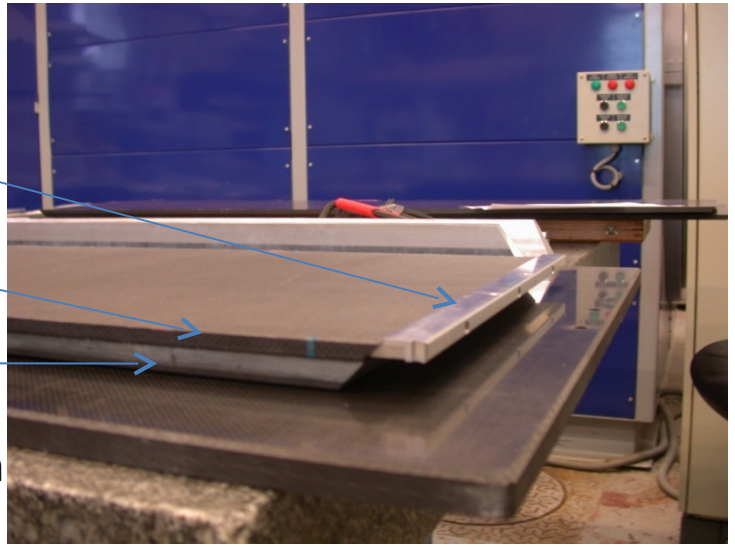
Mechanical Structure only slightly smaller than for EUDET Module

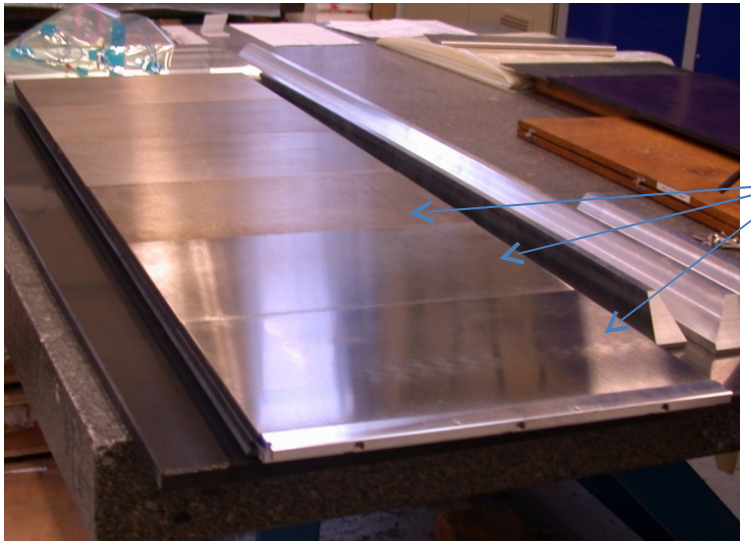


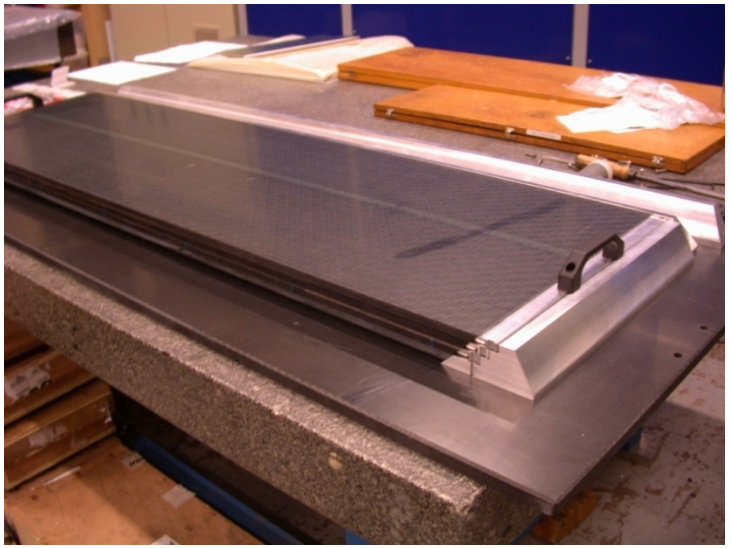
Small Plate
Cell structure N°1
Cell structure N°2
Cell structure N°3
Big Carbon plate

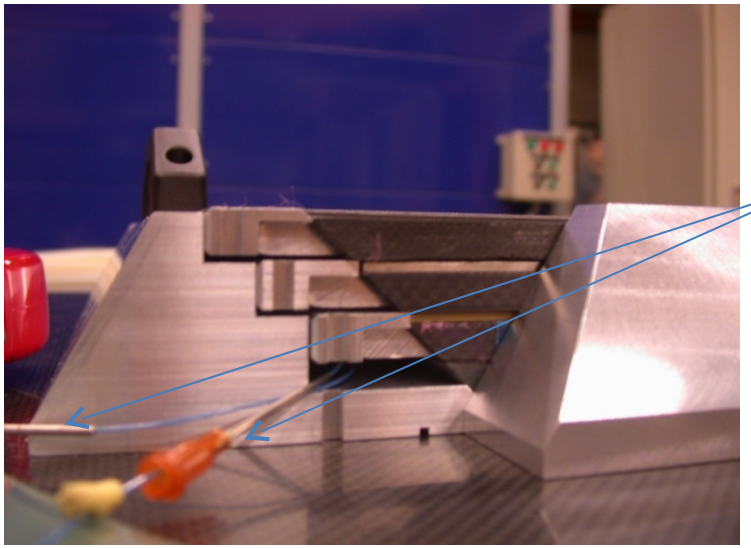
Final Temporary assembly

Full Assembly









...including Aluminum Cores and Assembly Mould

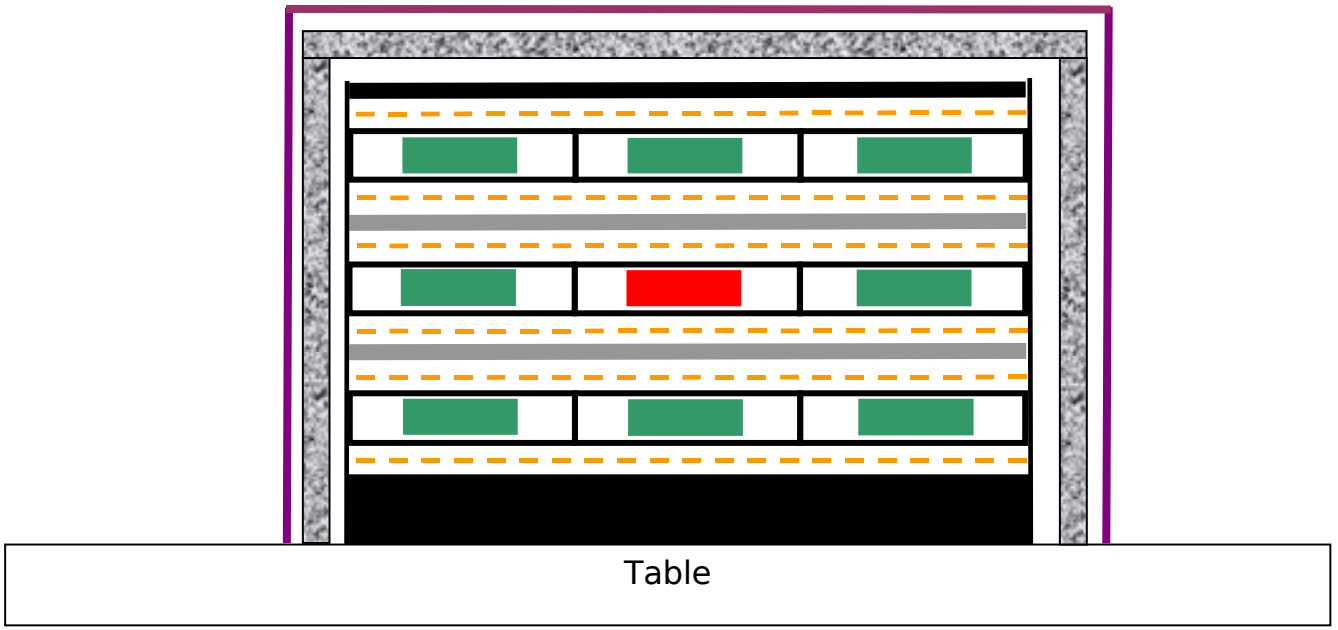
Details by M. Frotin

What's next?

- Insertion of wrapped thermal slab into alveolar structure

  Important step towards EUDET (and ILC!!!)

  Details by J. Bonis



- Continuation of thermal tests with inserted thermal slab

  Construction of heating mock-ups to establish realistic conditions

  Time scale ~ September 2009

Conclusion and Outlook

- Technical Design finished in Oct. 2008

  Preparation of Demonstrator Tests since then

- Studies with the demonstrator

  We have already learned a lot about the details of the mechanical construction

Demonstrator studies finished by July 2009
(with extension in September 2009)
Will cover most if not all aspects described in EUDET proposal
The collaboration is a real pleasure, thanks to everbody involved!!!

- Demonstrator studies should/will be summarised in a NIM paper

(Strategy to be developped)

Conclusion and Outlook cont'd

- Towards the EUDET Module

  - Moulds for H Structures and alveolar layers ordered
    Fabrication of full blown alveolar stucture is EUDET deliverable
    Expected beginning of June

  - Assembly Hall for EUDET at LAL in preparation

  - “Wrapping” of Slab and Integration Cradle for 'real' slab
    - needs further study
    - needs special tools which are very expensive!!!!

- Focus of getting the VFE accomplished in early 2010
  - Meeting EUDET Timeline with “intermediate” solution for VFE
    SPIROC in SKIROC on a FEV7, let's look for a few cosmics
  - Special (expensive) equipment and manufacturing procedures needed for mass production of chips and boards (See talk by Stephane)
  - Michele at LAL to strengthen communication between engeneering and physics

- “Shipping” signals out
  Interface to the DAQ and beyond will be addressed -> Daniel