EUDET Prototype – The next months

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LAL Orsay

EUDET – Extended Steering Board Meeting
1/9/08

- Timelines
- The Demonstrator
- ECAL Design Note

Time Lines

Demonstrator

- Allows for studying important steps and items of Module production now

- Essential Pieces ready
  Structures and H boards
  FEV6 – PCB for temperature studies
  Prediction from simulation do exist
  Gluing feasible
  Glass Plates will mimic Si Wafers

- Mimicking of DIF?

Assembly can start now
Tests until end of 2008

EUDET Protoype

- Design need to be fixed now!!!
  What can we build with the knowledge of today?

- Note on Ecal Design until Amsterdam

- Ordering of pieces for moulds by end of the fiscal year 08 (30th November)

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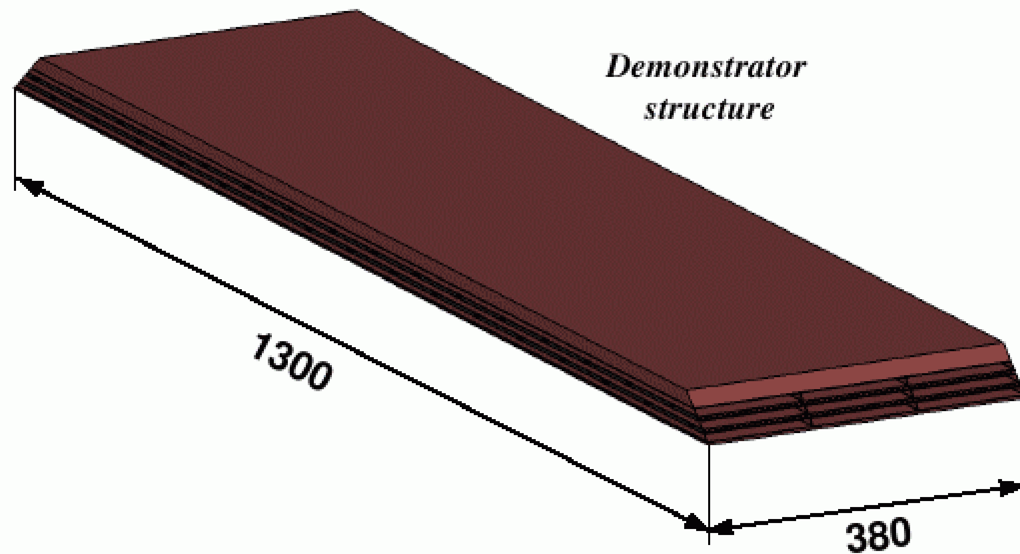
Demonstrator design

- 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



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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

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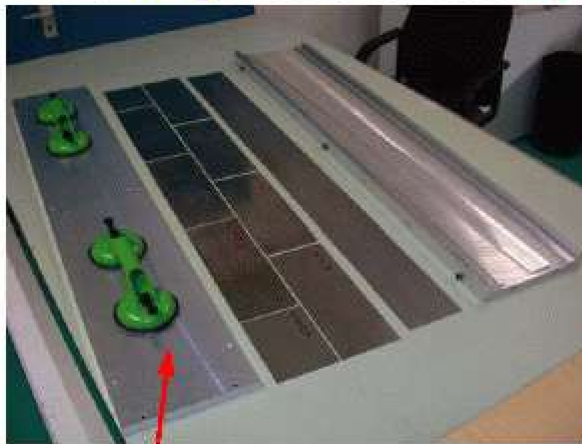
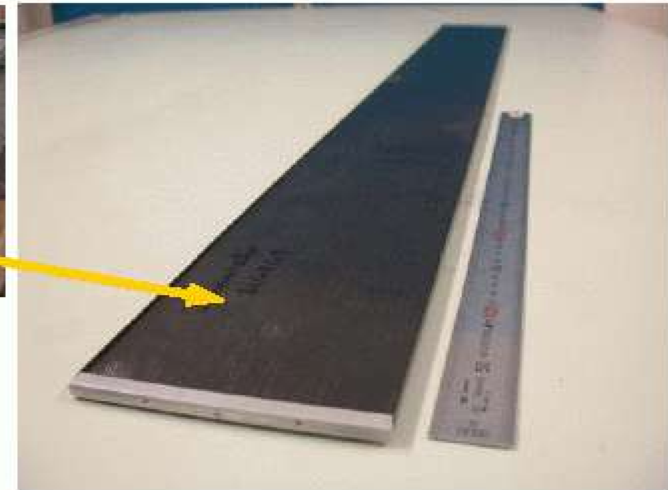
Demonstrator - H structure

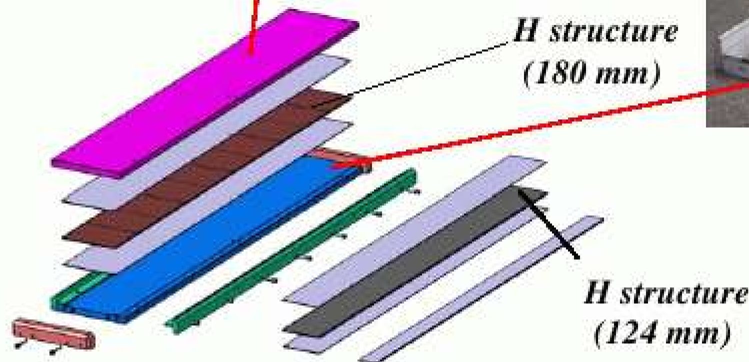
Study of one mould for whole structures:

- 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*





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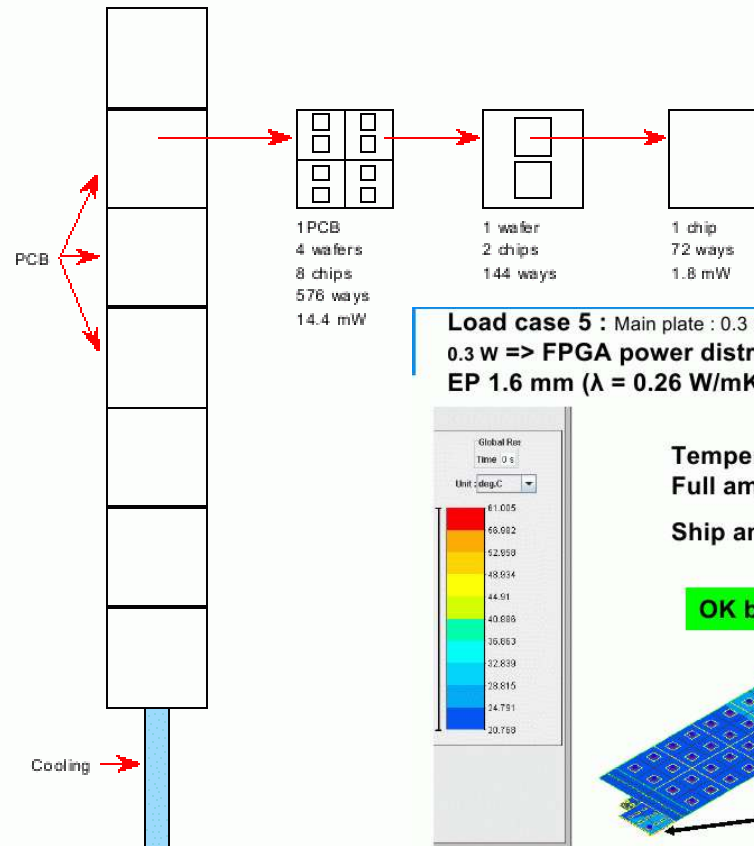
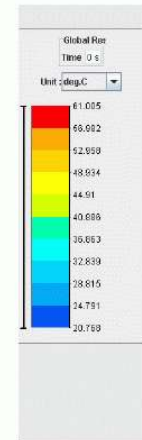
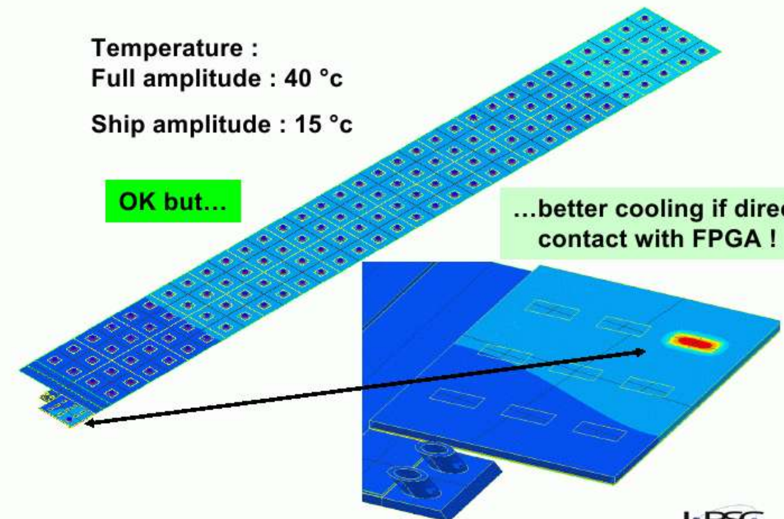
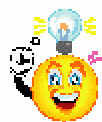
Realization of slab model, to simulate the heat dissipation of chips in a slab EUDET in order to valid the future cooling system



Load case 5 : Main plate : 0.3 mm; Upper plate : 0.1 mm; SHIP power : 0.205 W; FPGA power 0.3 W **=> FPGA power distribution : 10 x 5 extrema position through PCB EP 1.6 mm (λ = 0.26 W/mK) and foam ep 0.2 mm**







To simulate the slab heat dissipation, we decided to use resistances with a temperature control

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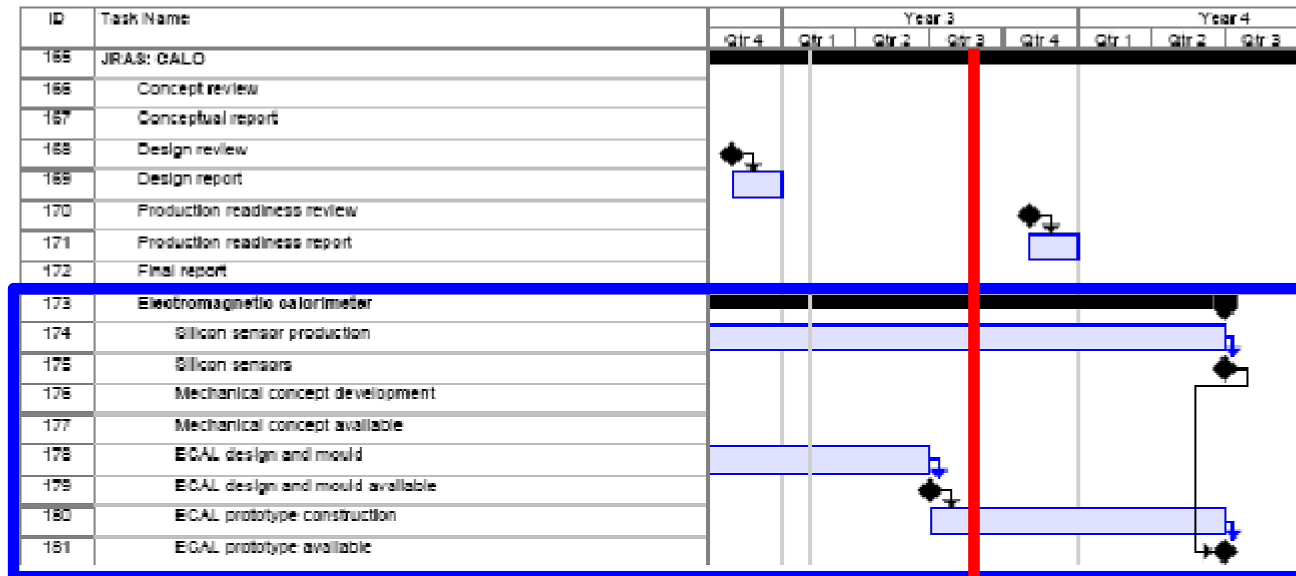
2008 2009



We are here

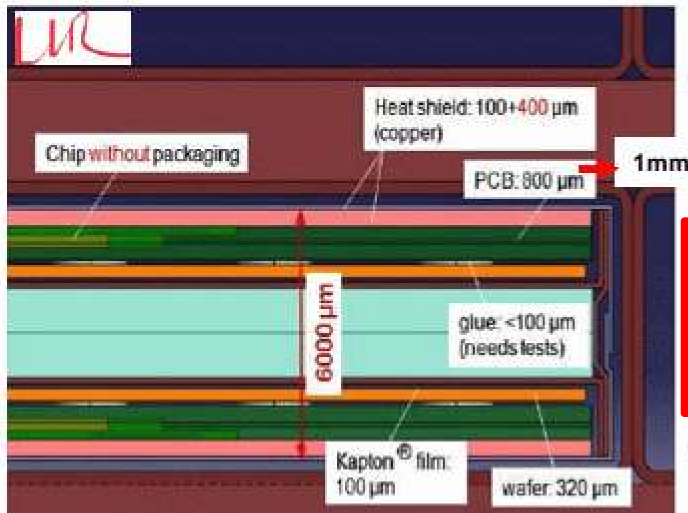
At least ~3 Months of delay

Settling down the design ...

<u>The expected heat shield thickness is 500 µm=100+400 µm:</u>

⇨ Brazing of copper foils (T<300°C) to be validated

Heat shield : 100 (housing Al or CuBe?**)** + 300 or 400 µm Cu = 4 options for copper assembling to test:



- **Options 1**
  - 100µm housing Cu.. + **400 µm** Cu (without brazing – with holes) / **0.4 mm** considered for simulation. Thermal grease only in holes (1.8x1.8 cm^2 chips***400 µm** thick).
- **Options 2**
  - 100µm housing Cu.. + **400 µm** Cu + 0.05 (silver brazed) / **0.5 mm** considered for simulation. Thermal grease only in holes (1.8x1.8 cm^2 chips***400 µm** thick).
- **Options 3**
  - 100µm housing Cu.. + **300 µm** Cu + 0.05 (silver brazed) / **0.4 mm** considered for simulation. Thermal grease only in holes (1.8x1.8 cm^2 chips***300 µm** thick).
- **Options 4**
  - 100µm housing Cu.. + **400 µm** Cu (whithout brazing) / **0.4 mm** considered for simulation. No holes (1.8x1.8 cm^2), chip no overlapping.

- Design close to 'Option 3' but ...

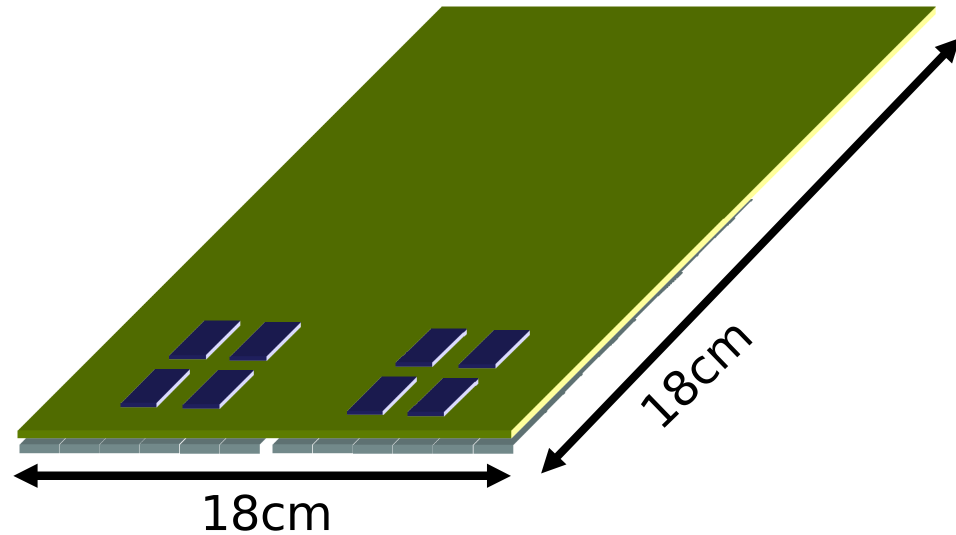
Baseline was: 100µm Al housing and 1.3x1.3cm^2 holes for chips?

Need to consider 1.2mm for PCB!!

Design of PCBs: FEVN – Parallel Developments

Most critical part of EUDET Ecal Module Design
Height: 1.2mm Current State of the Art, 0.8mm ultimate Goal

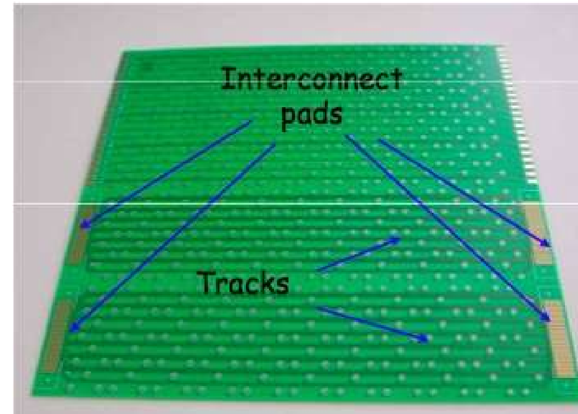
FEV5



Allow to advance with
PCB Design

Equipped with HARDROC Chip (64 Chan.)
(for EU-DHCAL)
Digital Part identical to SKIROC
Study of Bonding and Gluing

FEV6



Gluing tests
Heat Dissipation
mechanical Rigidity
Dimensions

Produced for
Demonstrator

Rather and imitation
than a real PCB

FEV7

Expected
Jan. 09

Will be equipped
with SPIROC
(i.e. AHCAL Chip)

Can be used to
equip the EUDET
Module

FEV8

.. for the final
SKIROC Chip

Summer 2009

Try to establish collaboration with Corean Groups
to benefit from existing expertise

Ecal Design Note

Editorial Work: R.P.

Envisaged Chapters/Sections:

1) Introduction and Purpose
2) Overall Design
3) Structures and Moulds
4) Si Wafers
5) SKIROC Chip
   How detailed?
6) PCB and ASU + Interconnection
   How detailed?
7) DIF Card
8) Gluing Wafer <-> PCBs
9) Heat Dissipation of EUDET Module
10) Assembly of Prototype
11) First Validation Steps – The Demonstrator
12) Conclusion and Outlook

Note should describe the state of the Art of today and what realistically can be built
Not what we may expect in one year, note improvements are always welcome

Deadline 30th of September!?

Summary and Conclusion

- Ecal EUDET Module moves from Design Phase to Construction Phase

Overall 3 Months of delay

- Demonstrator to validate important items of final Module

(Mechanical) feasibility
Heat dissipation – Remember: Low power and limited space are key ingredients of the EUDET proposal
Assembly issues

Results until End of 2008

- Design note until the Amsterdam Meeting

Critical points:
Thickness of PCB, have to consider 1.2mm at the moment
Reduced longitudinal granularity – Impact on Physics?
Details of Assembly

- Final Ecal Module to be ready until end of 2009

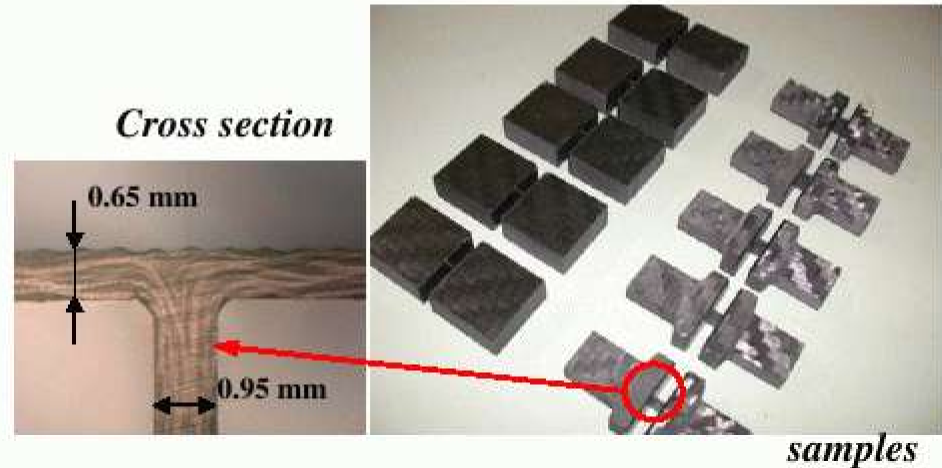
Supplementary Material

Destructive tests – first results

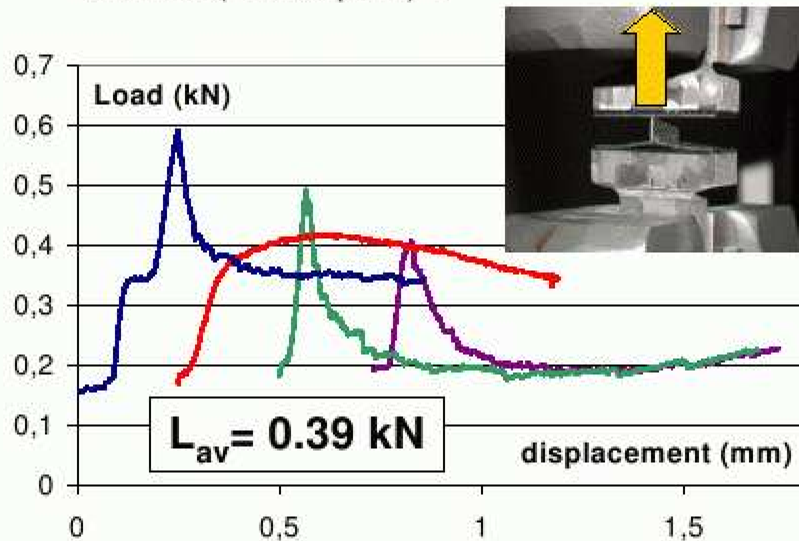
Mechanical tests :

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

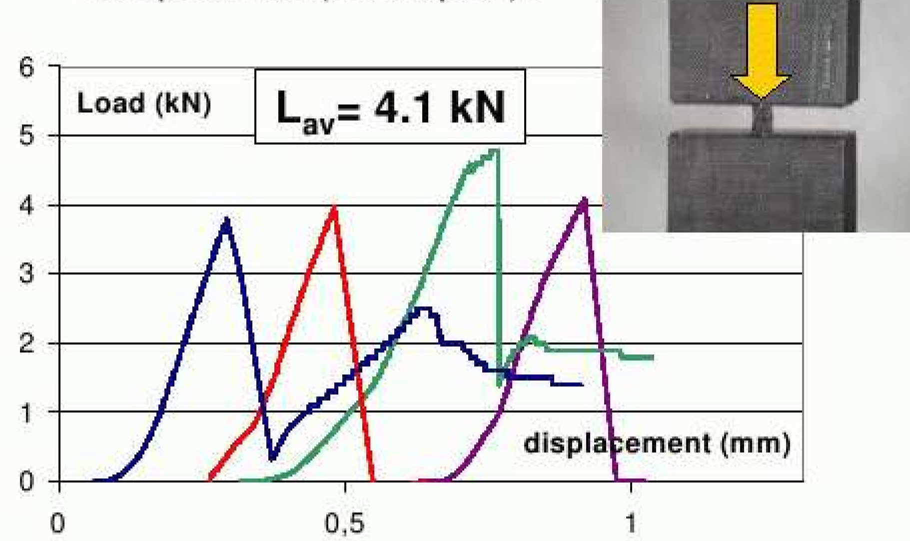
sample section : 0.95×15 mm2



- Tensile (4 samples) :



- Compression (4 samples) :



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