

---

# SLAB COOLING

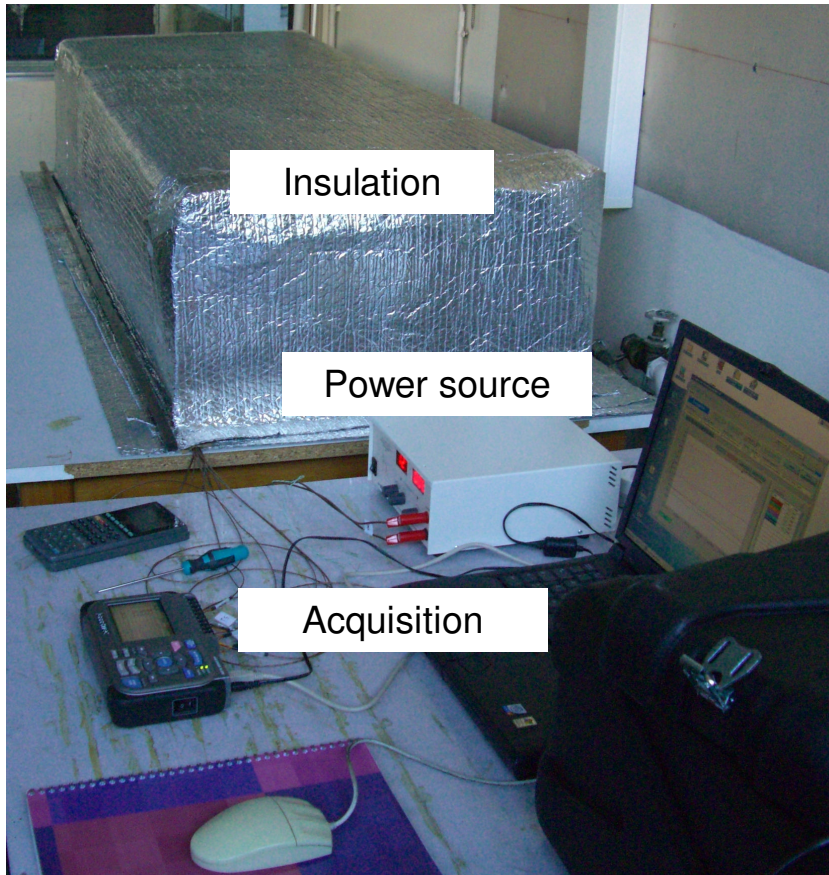
## Calice week IPN Lyon

---

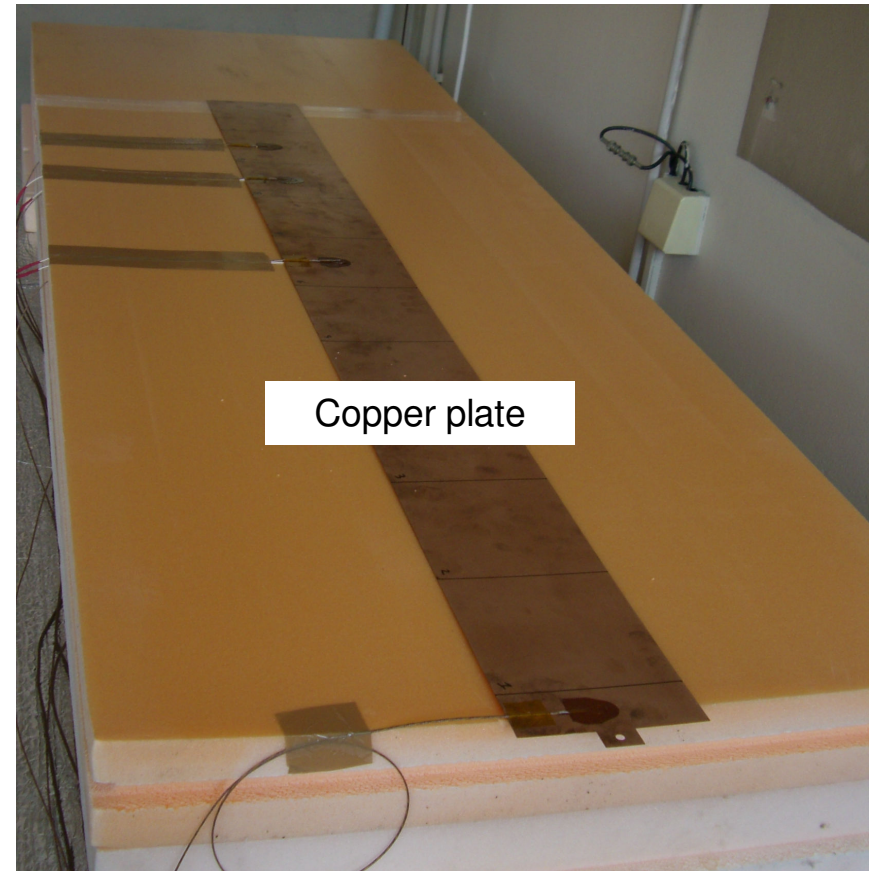
Julien Giraud ([giraud@lpsc.in2p3.fr](mailto:giraud@lpsc.in2p3.fr))



## First part : thermal comportement along the slab



Global installation



Sensor on copper plate

## Parameters of the test:

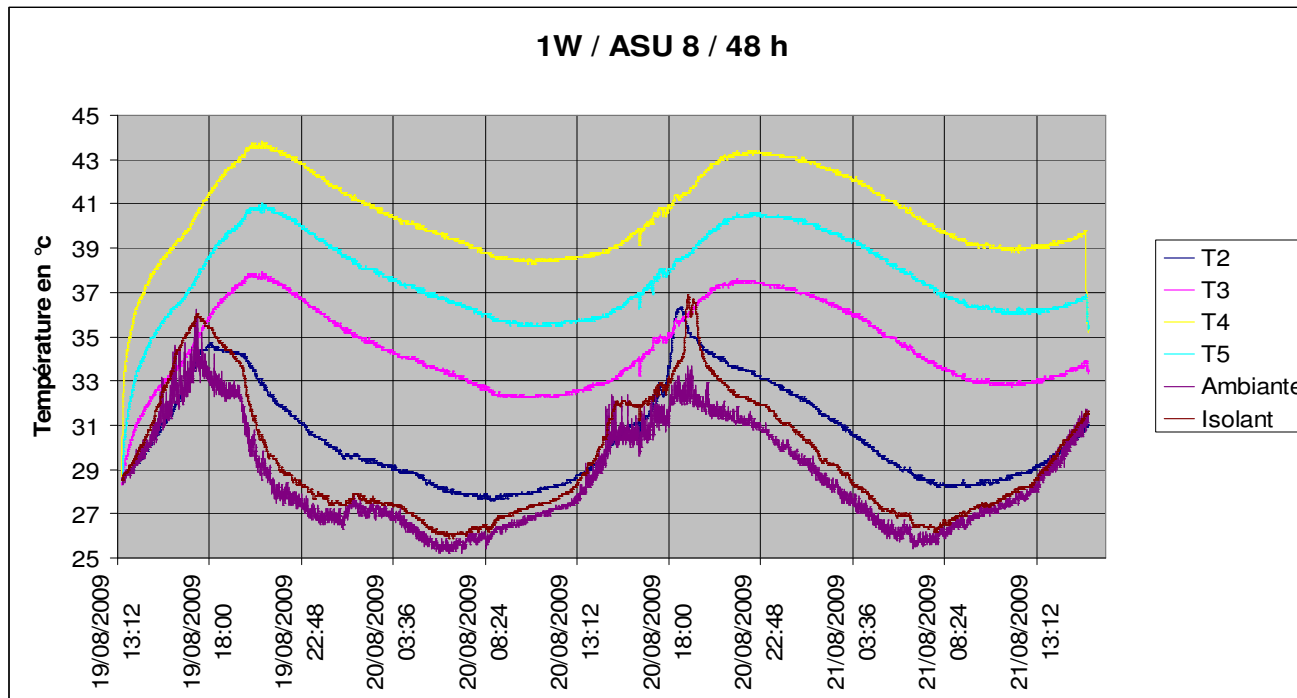
Huge insulation / No cooling / 1 W on ASU number 8 directly stick on the copper plate (0.5 mm) / 5 sensor temp / 48 h of test

What we expected:

⇒ Temperature of the copper plate should increase dangerously

What we found:

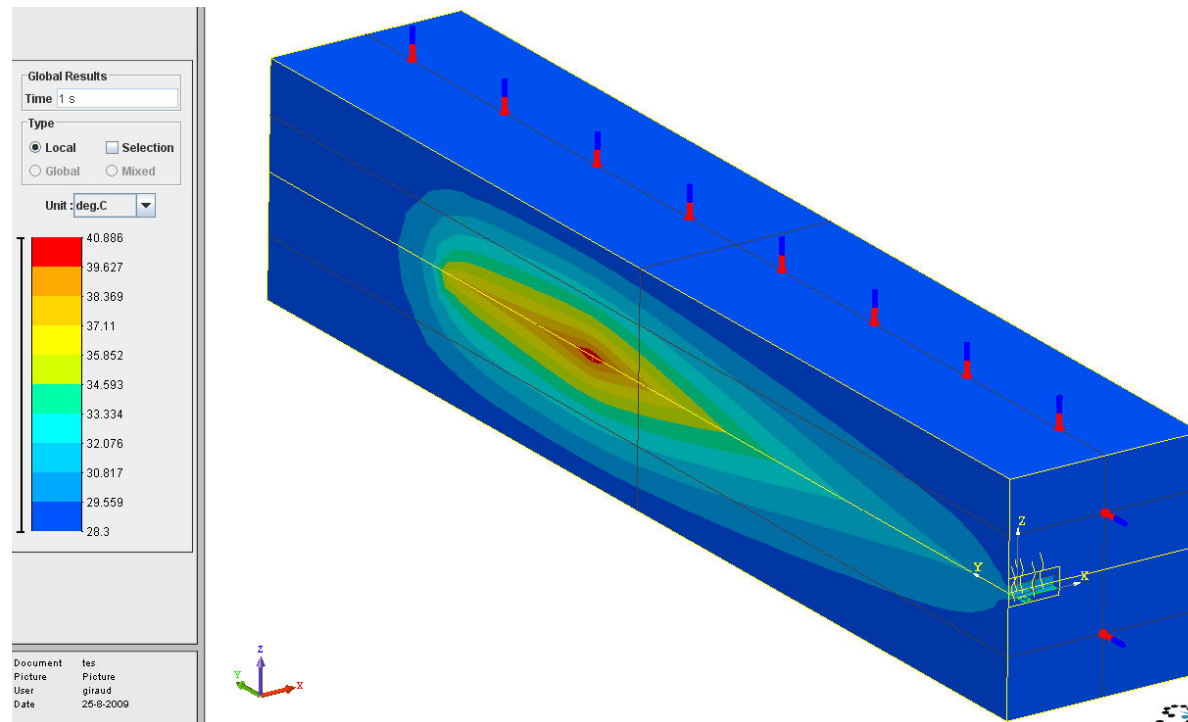
⇒ Temperature of the copper plate increase of a maximum of 14.5°C



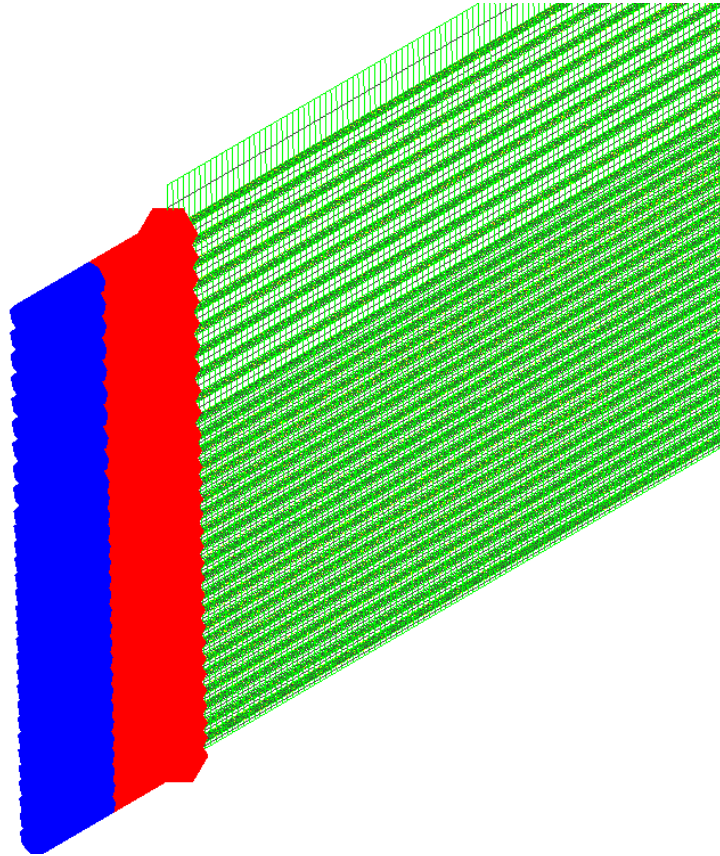
## Conclusion of this test:

The thermal slab compartment can't be based to the compartment of the copper plate with conduction only.

⇒ We need to take into account the rest of the structure (W, composite material...)



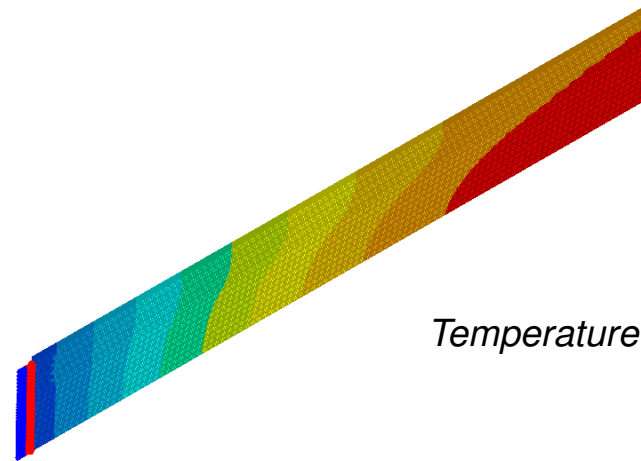
On going : global simulation on slab section



*Imposed temperature on copper plate*



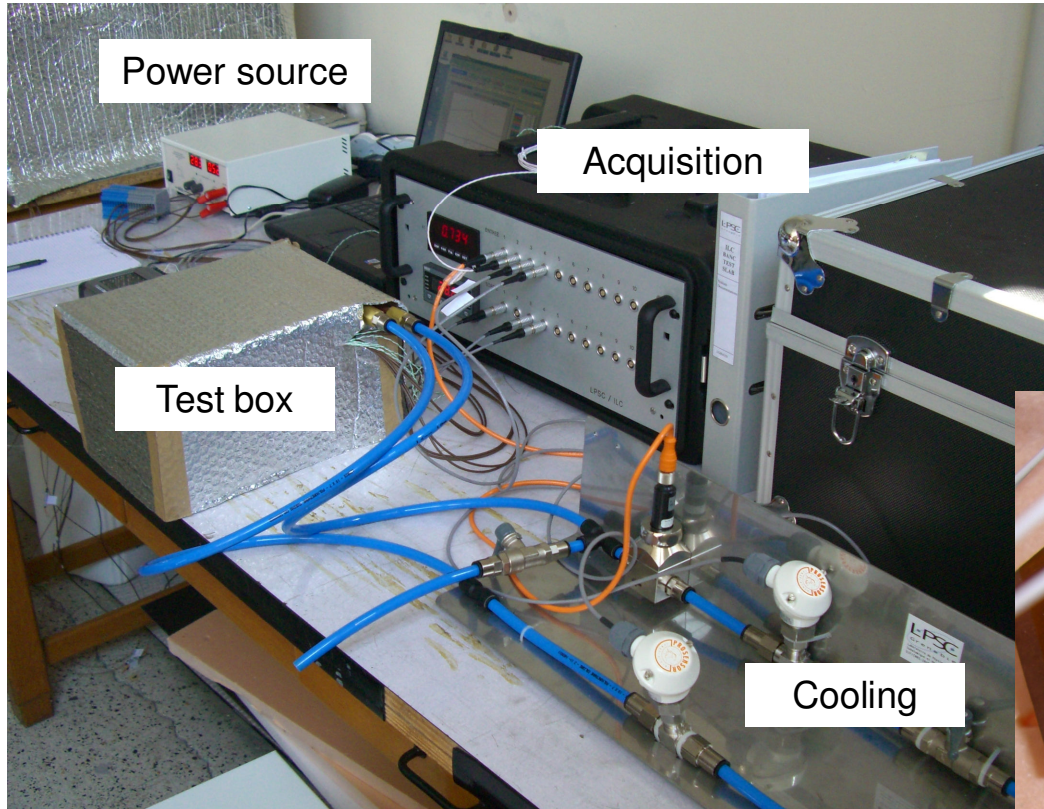
*2.5 m long*



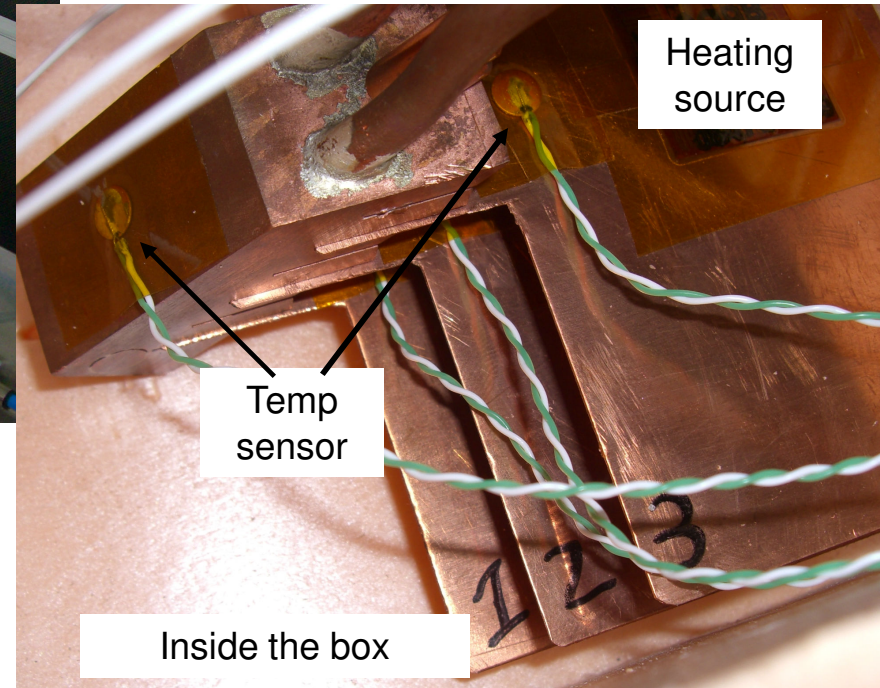
*Temperature*

- ⇒ We need to improve the model to take into account the material discontinuities
- ⇒ May have add cooling plate at the fastening side => we need space specially for the Endcap (30 mm)

## Second part : Thermal contact resistance characterization



Global installation



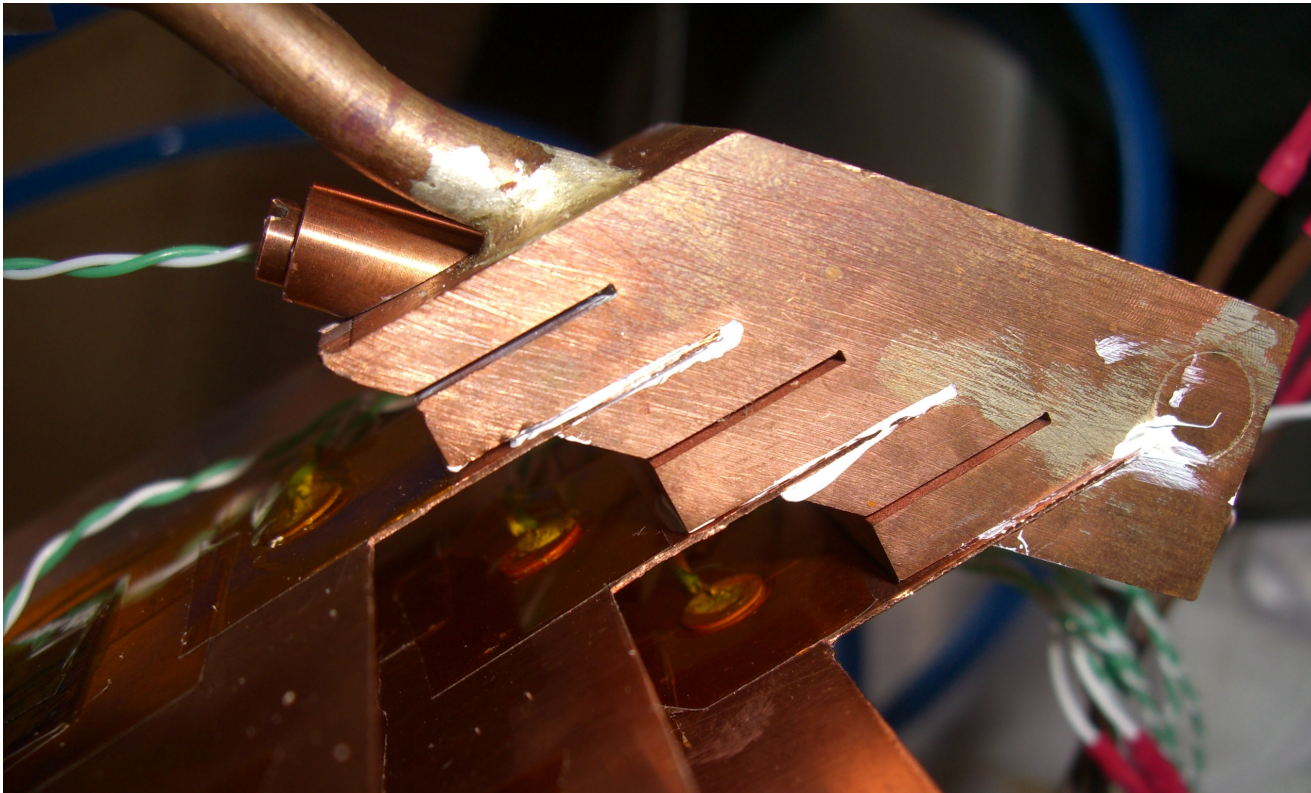
Inside the box

## Conclusion of the thermal contact resistance test :

Dry contact : 3.9 K / W

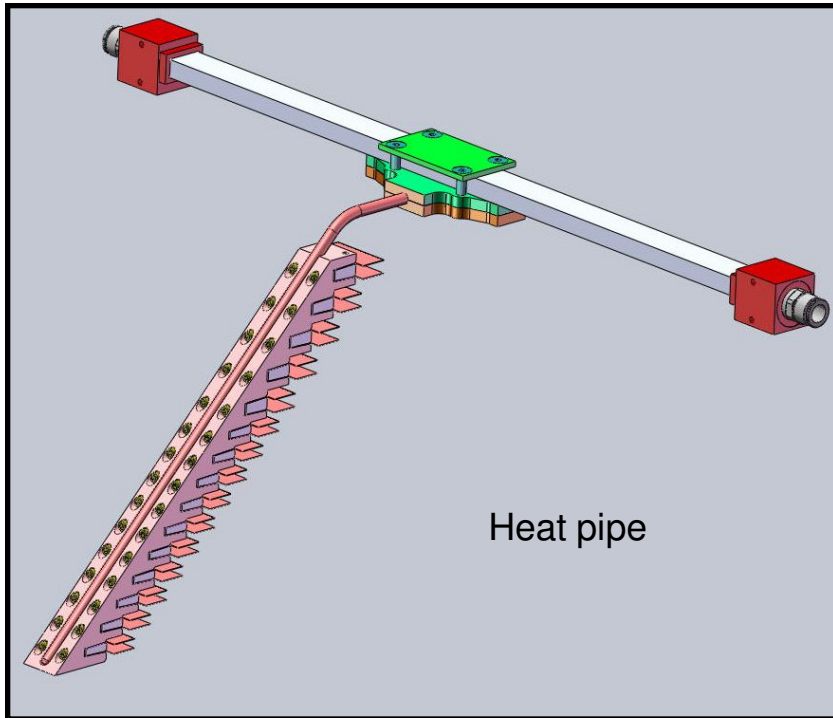
Contact with thermal paste (0.4 W/m/K) : 3.1 K / W

Thermal Paste => 20% gain

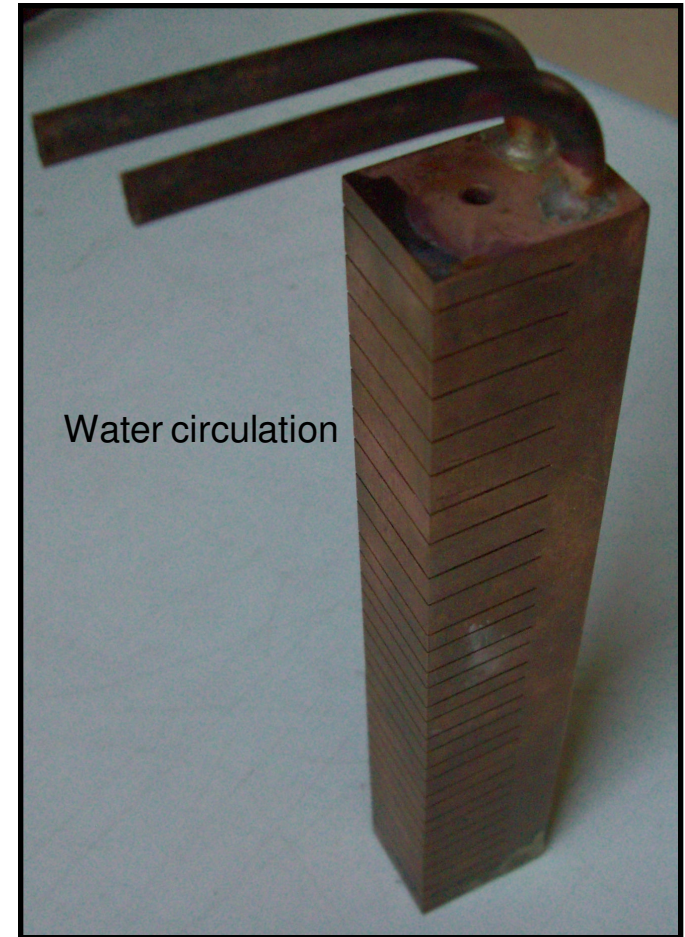


Ok if we have  $0.5W / \frac{1}{2} \text{ slab} \Rightarrow 1.55^\circ\text{...}$  but .....  $3.5W / \frac{1}{2} \text{ slab} \Rightarrow 11^\circ\text{C}$

# EUDET COOLING



- Test performance of heat pipe system (easy to fix but lot of pieces (contact resistance)).
  - Water circulation system with better connection with copper plate.
- => Adapt the design of the heat pipe system for the connection with the copper plate



..... Need a 45° one

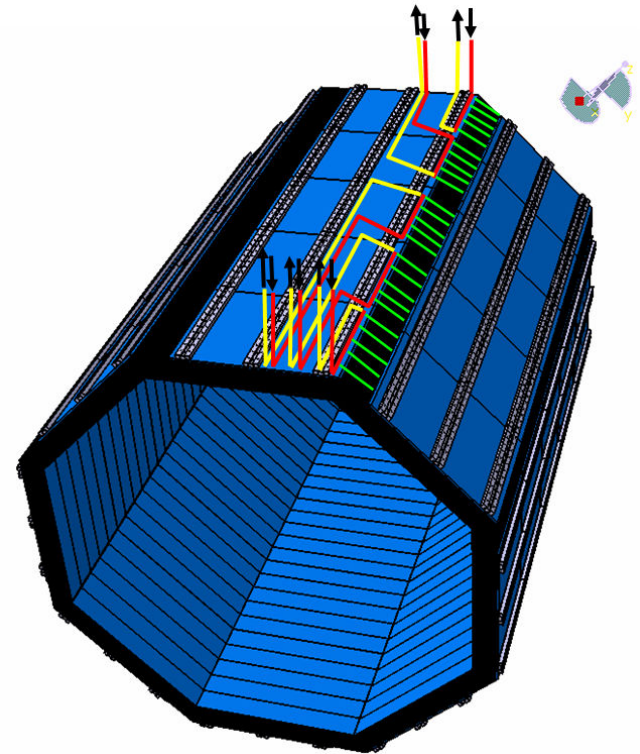


## Leakless system :

- Low water speed => We need space for the pipe, so we have check (3D model).
- Temperature and power range **ok** (use on many detector in CERN)

## Co2 system : we are working on !

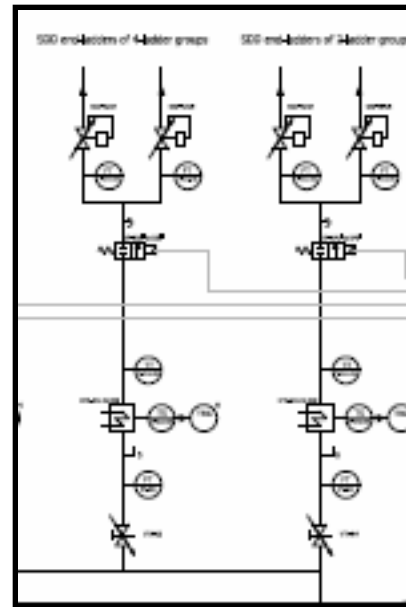
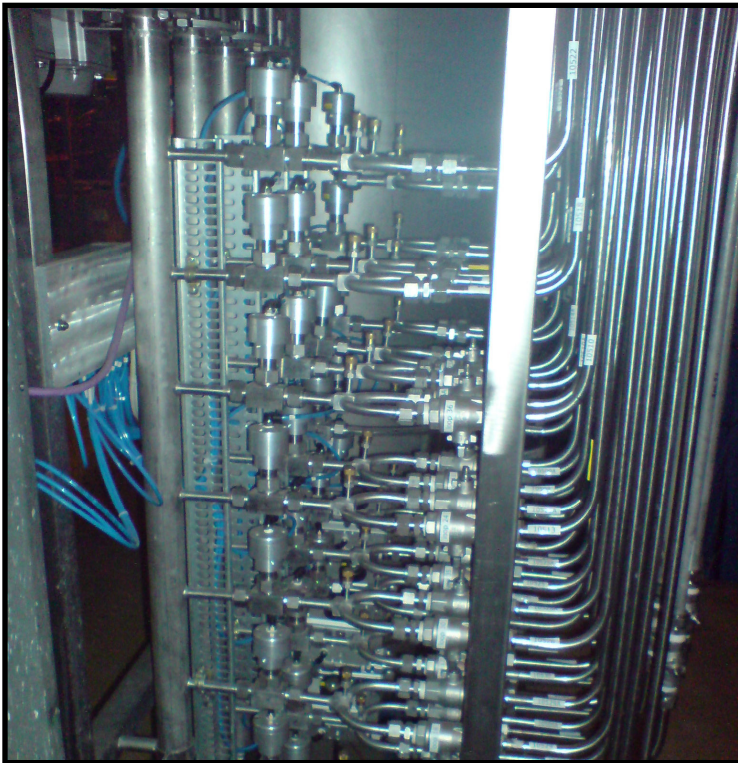
- High pressure
- Enable very low temperature (we don't need)
- Small pipe



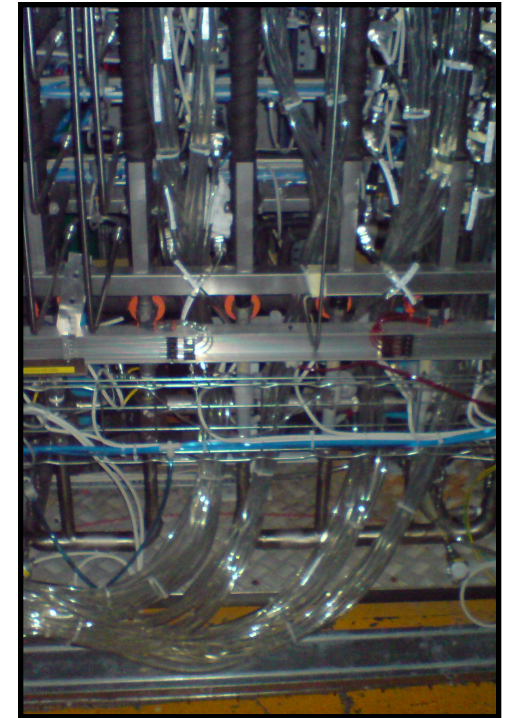
## True scale leakless cooling system test :

Base line => leakless system => many different system to control the process  
(number of sensor, pressure and flow regulation)

We propose to build a true scale leakless cooling system (only one loop) to find the right component and process => 2010.



Alice leakless system



## Slab test

- Slab cooling\_tests in alveolar structure (LAL) **Oct 09**
- Test heat pipe system in EUDET configuration (angle and power) **Oct 09**
- Design and build a new water circulation cooling with better thermal contact **End 09**

## Global cooling

- Thermal numerical simulation of a section (barrel and end cap) **End 09**
- => determine if we need cooling near fastening system **End 09**
- 3D pipe integration in the global detector **2010**
- Design and build a "true scale test loop" of the cooling system **2010**