SLAB COOLING

- *DEMONSTRATOR*

Denis Grondin (grondin@lpsc.in2p3.fr)
Julien Giraud (giraud@lpsc.in2p3.fr)

SLAB COOLING - DEMONSTRATOR

Calorimeter for ILC

- Goal of experimental tests:
  - a real thermal test to be compared to numerical simulation,
    - In order to answer to simplification of slab's model,
    - To know more precisely transfert coefficients,
  - To verify the behaviour of the cooling system.
  - To reproduce as precisely as possible these tests in simulations.

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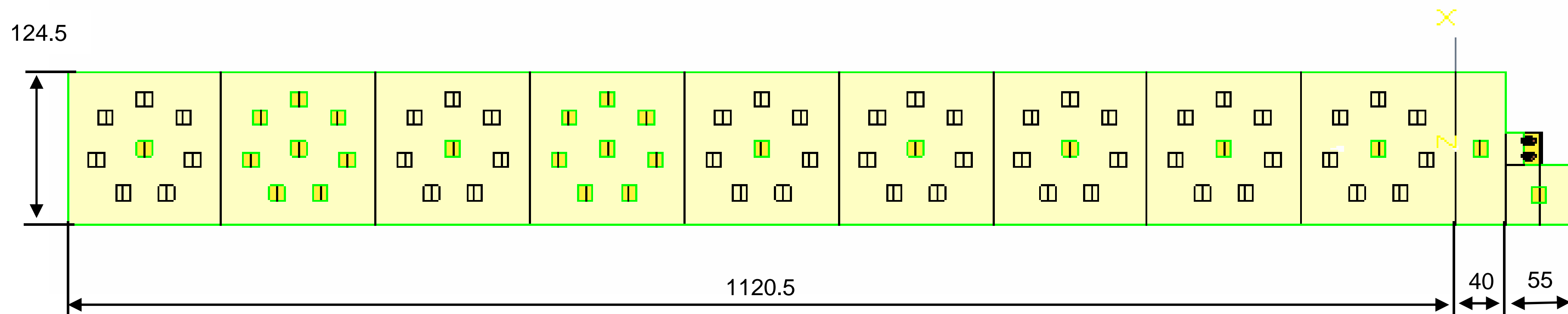
Finite element model

- Many configuration of heater ASU can be test.
- Shell model => the thikness of the copper plate can be changed.
- Convection can be adjusted between water and pipe (cold plate).
- Thermal foam between the copper plate and the cold plate is included in the model
- All the contact thermal résistances can be adjusted (cold plate / foam, foam / copper plate, copper plate / Resistance).
- Temperature is available at the center of each sensor (listing)



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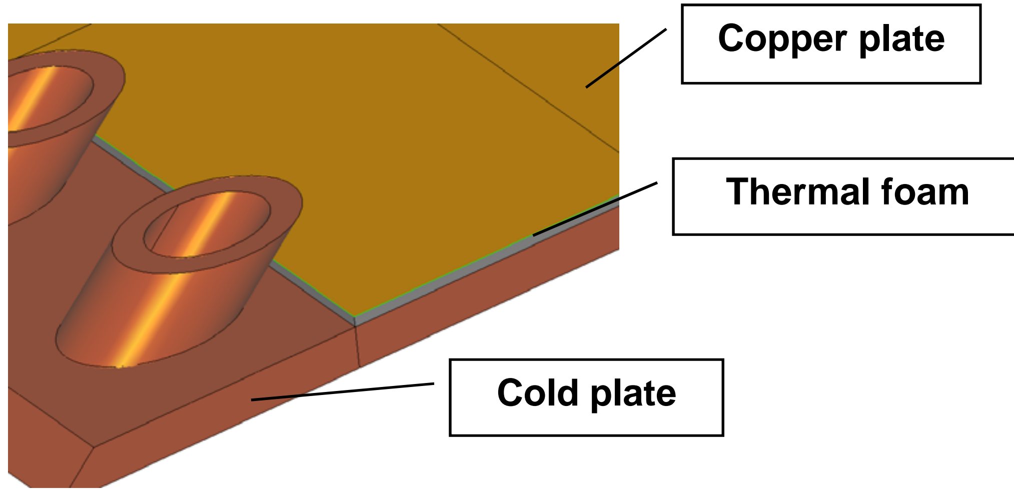

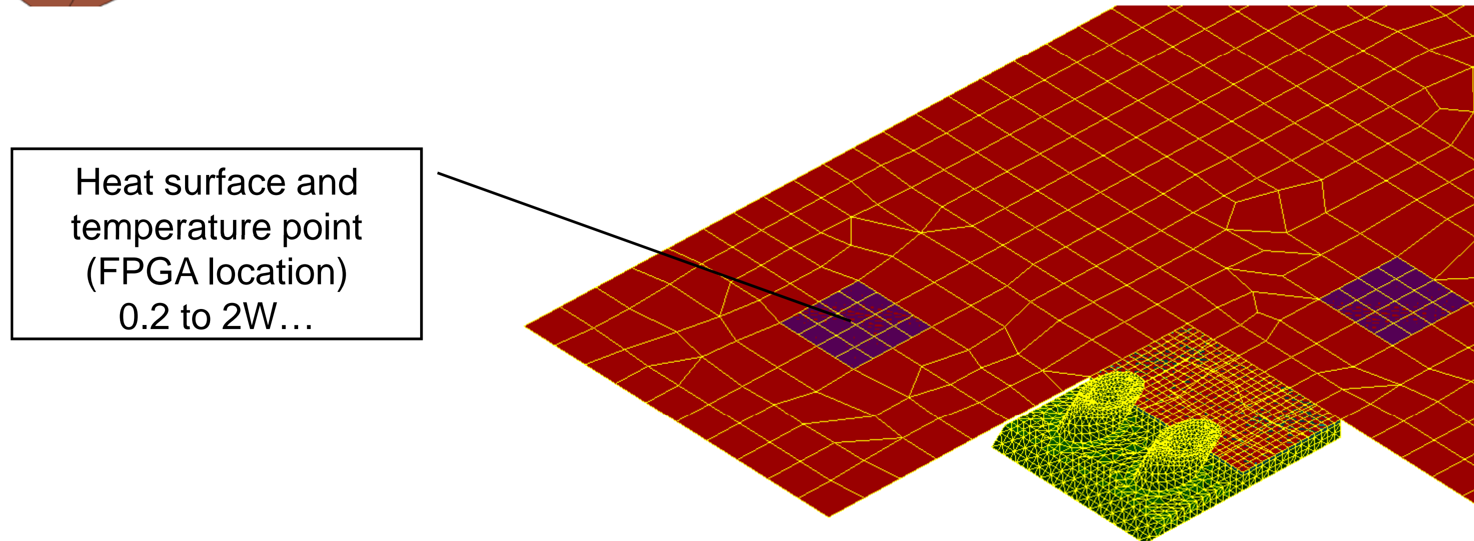

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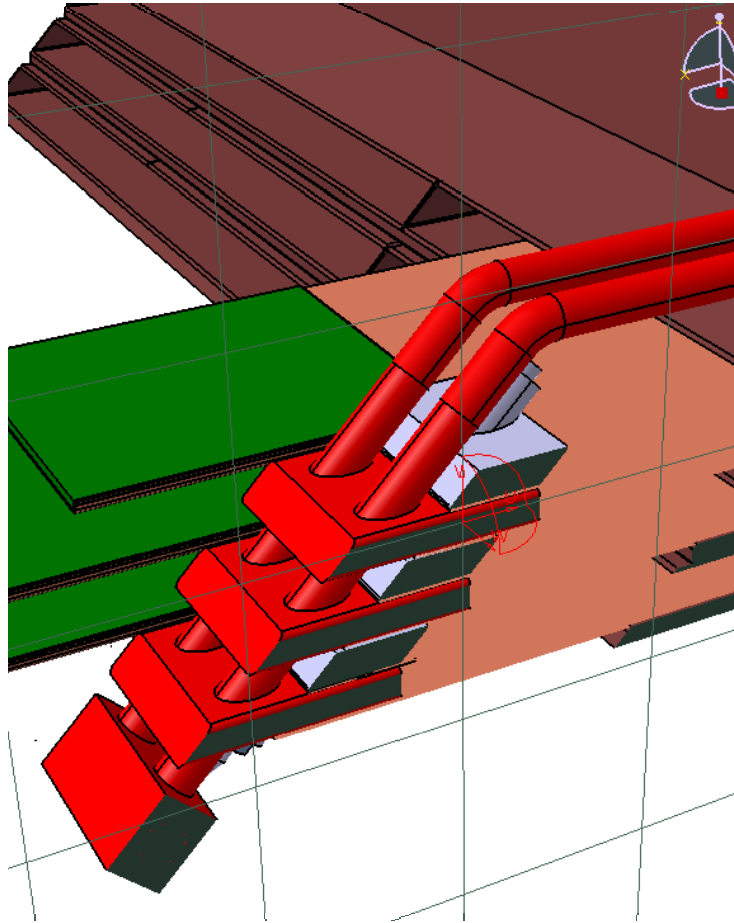
Cold plate : 3 Solutions

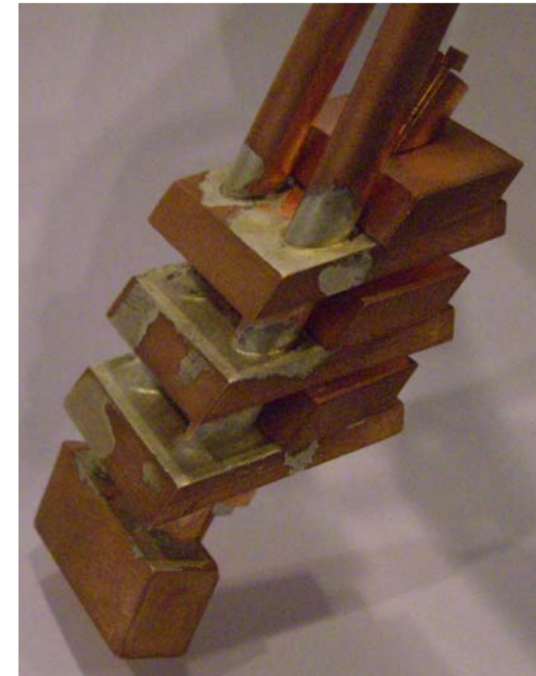
Solution 1



-Assembled solution

-Water circulating into copper pipe (Internal diameter : 4 mm)

- Lot of welded pieces=> tricky assembly



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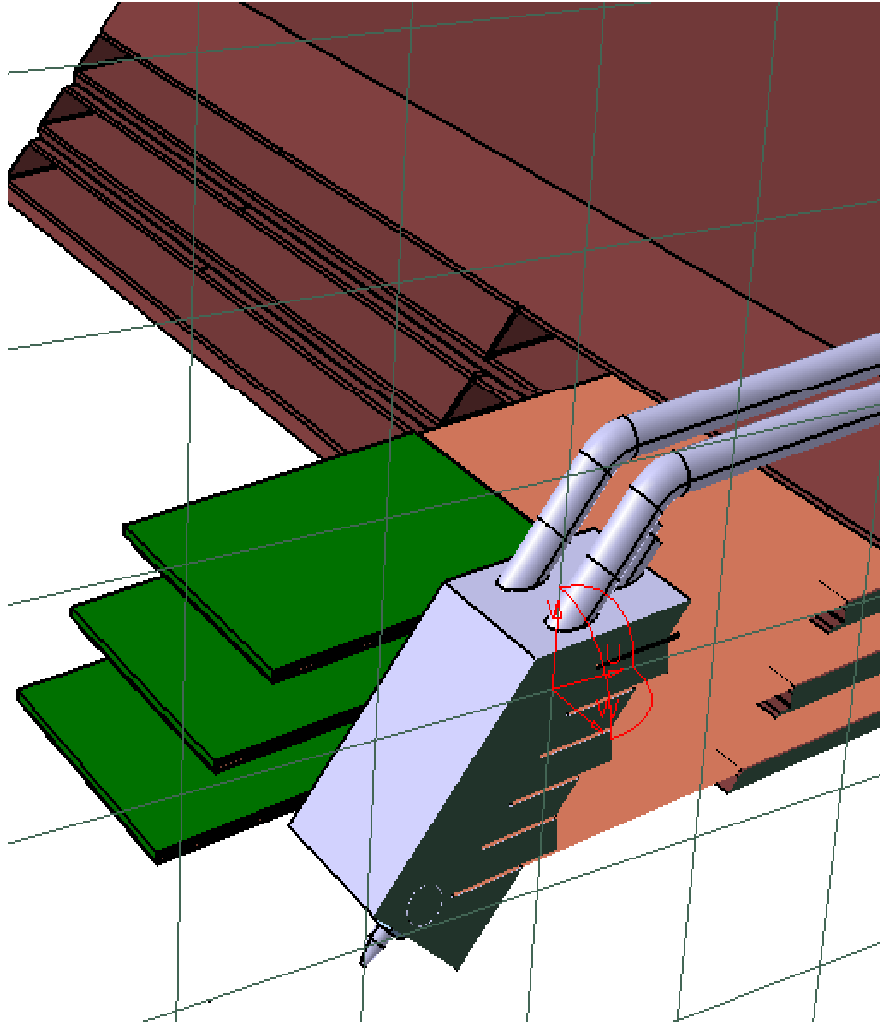
Cold plate : Solution 2



-Machining solution: 1 block

-Water circulating into copper pipe (Internal diameter : 4 mm)

- Easier to build

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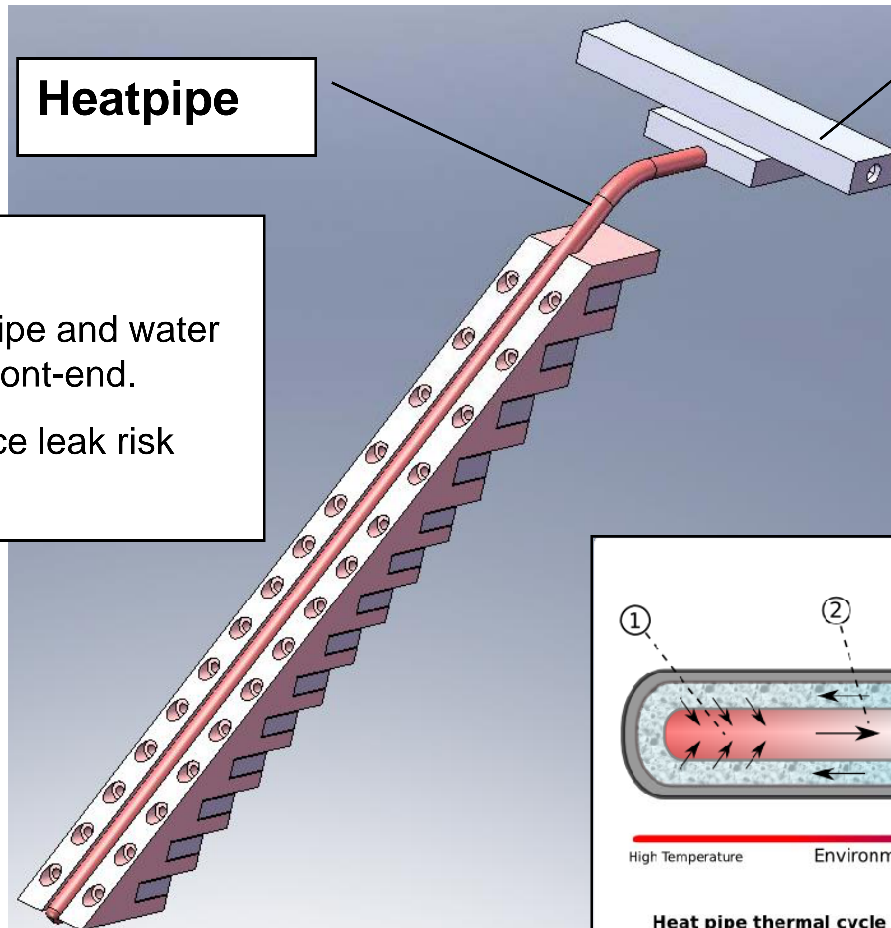
Cold plate : Solution 3

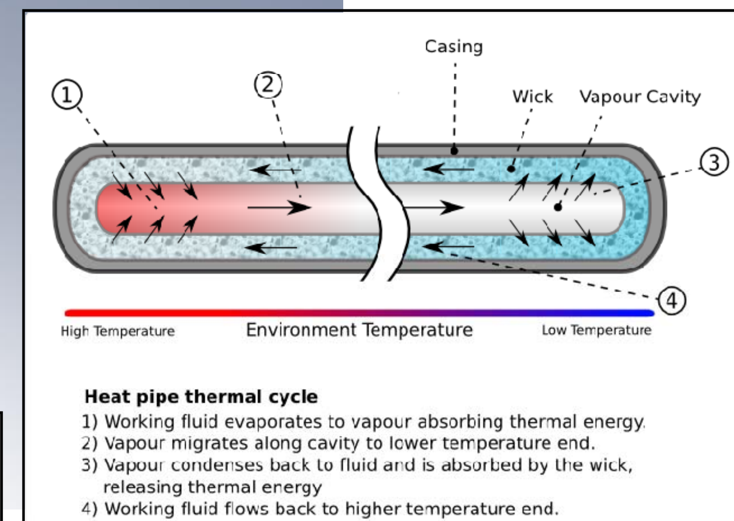


Main advantage :

Connection between Heat pipe and water circuit => contact, far from front-end.

Easy to assemble and reduce leak risk

~ Same geometry



Inside a heat pipe, at the hot interface a fluid turns to vapour and the gas naturally flows and condenses on the cold interface. The liquid falls or is moved by capillary action back to the hot interface to evaporate again and repeat the cycle.

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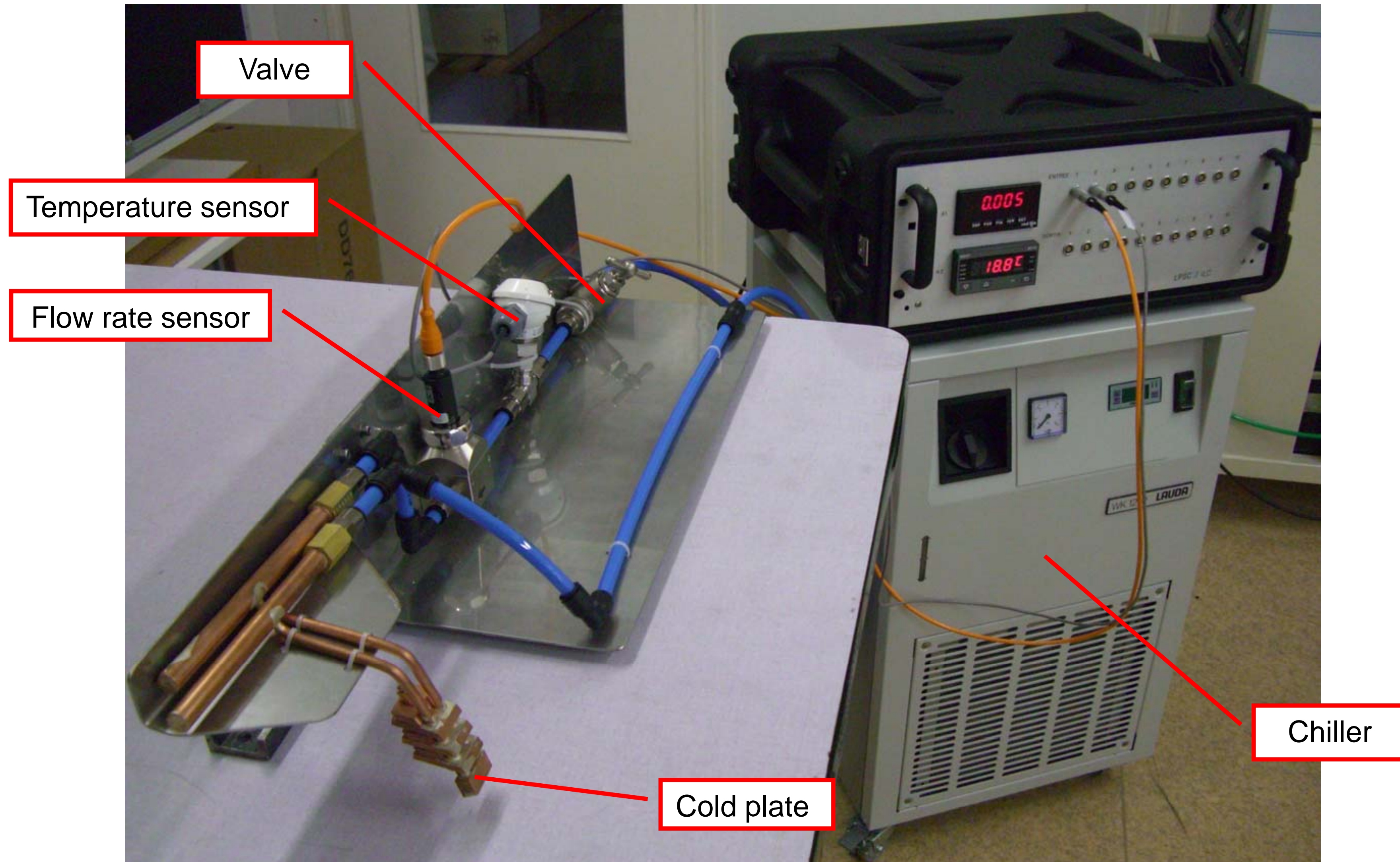
Cooling system



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What is important: to make the simulation closest to the reality

In the simulation only the cold plate is used for cooling the system => no extra convection with the ambiant air or conduction with the support is taken into account.

⇒ **The demonstrator have to be insulated (conduction and convection)**

⇒The simulation is a **steady state** one. We have to determine the minimal time to avoid transient effect. Estimate time with analytic formulation and confirm with test.

⇒Temperature of the colling fluid : in order to minimise the thermal exchange with the surrounding air we suggest to adjust the cooling fluid temperature at **the ambiant temperature room**.

Simulation and tests for the whole power to be dissipated:

FPGA (DIF Card) and Adaptator Card consumption and component location are to be validated