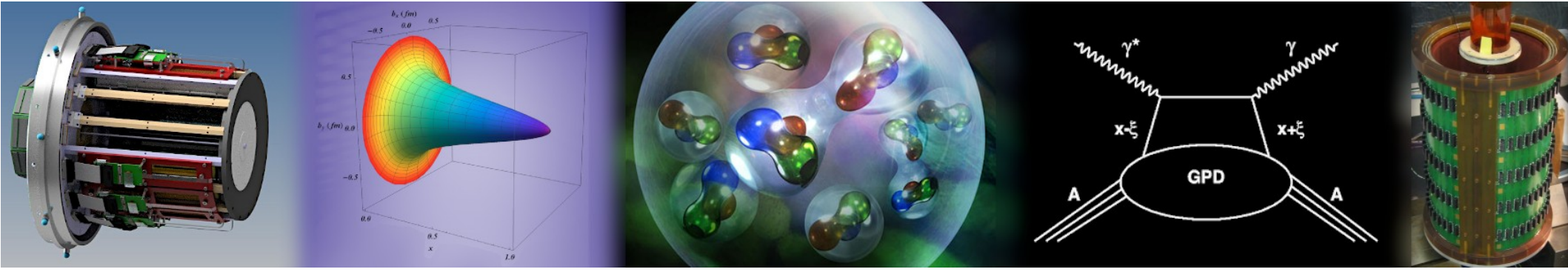
Roman Pots Cooling



Raphaël Dupré

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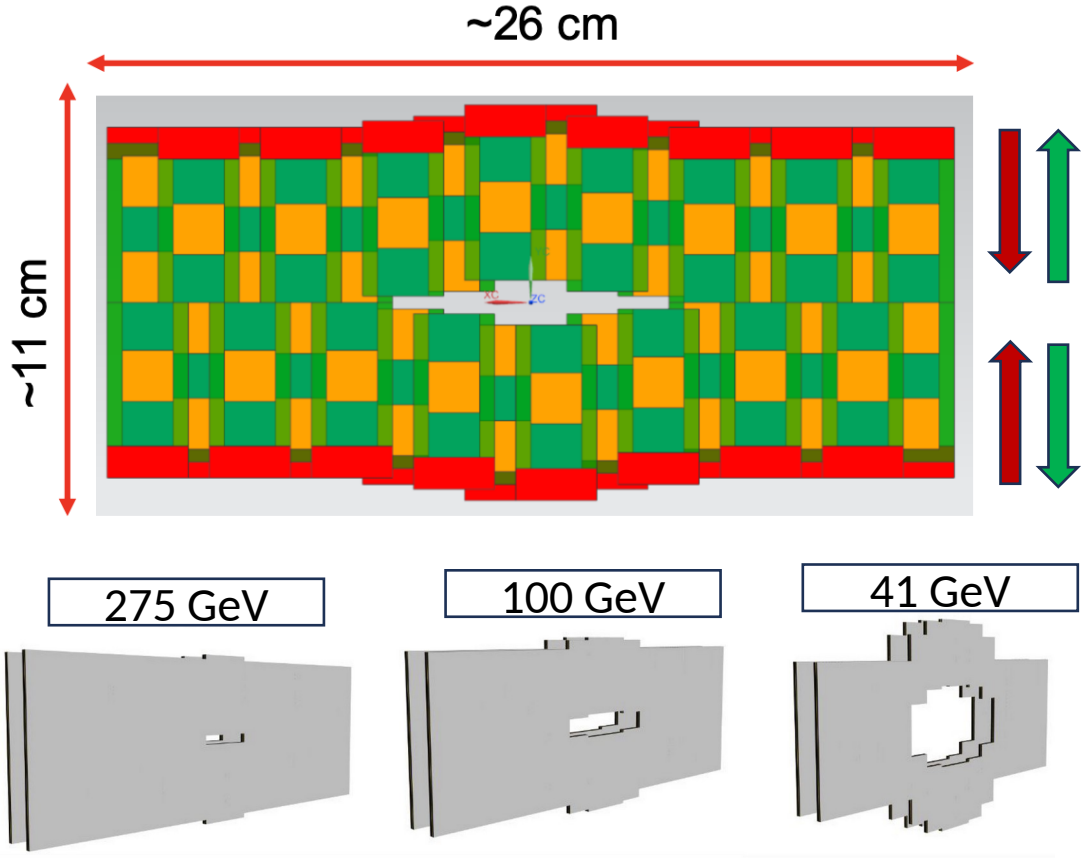
What is the problem we are working on ?

The AC-LGADs and their ASICs are in high vacuum

- Cooling is a major issue
  - **Must be very low maintenance and avoid fluids**
  - **Must adapt to the mechanical shape**
- Mechanics must adapt to the beam shape



Preliminary comments

The work presented here is from our engineers

- Christine Legaillard and Franck Legrand (IJCLab)

We are still at a preliminary design level

- The main goal is to check feasability and find the right concept to implement

There are many interactions to figure out

- Electronics, mechanics and cooling are going to compete for the same space on the exterior edges
- Impedence on the beam is a major issue to be careful about

Preliminary concept for cooling

Heat produced by the ASICs

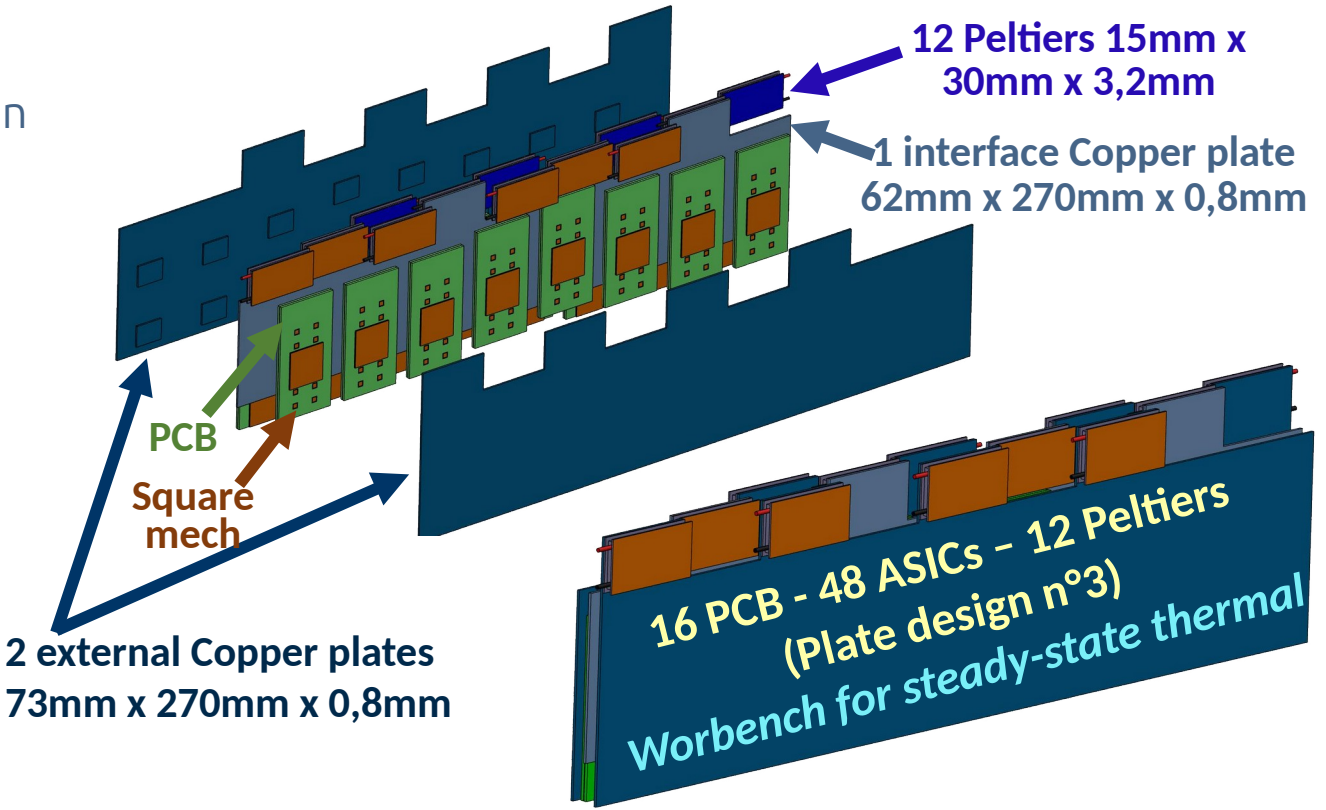
- ASICs are sandwiched between the PCB and the sensors
- Through copper pods embedded in the PCB

Copper plates between layers

- Need of very good heat transfer in small space

Thermoelectric heat pumps

- Cools the Copper plates
- Prevents using cryo temperatures



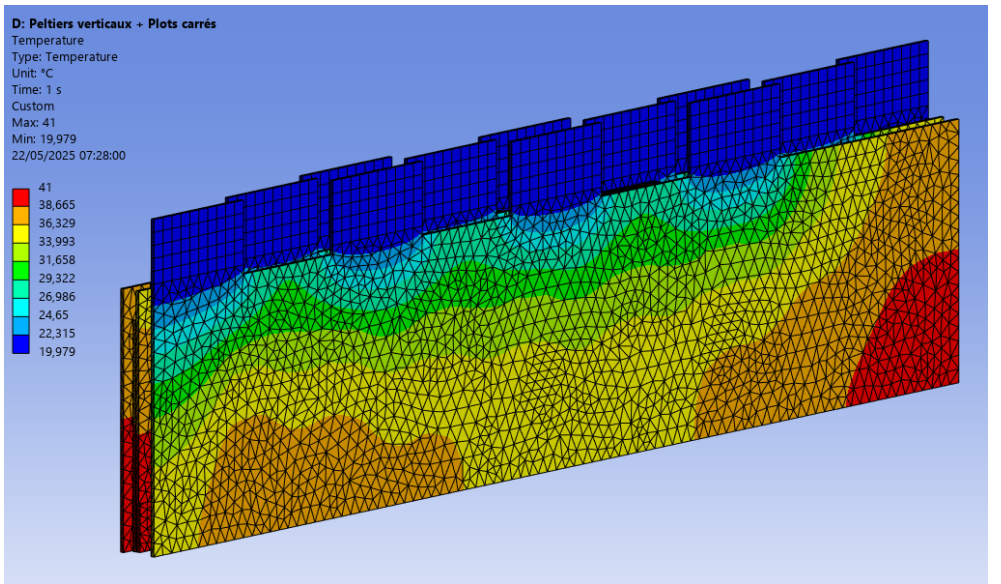
Steady-State thermal analysis

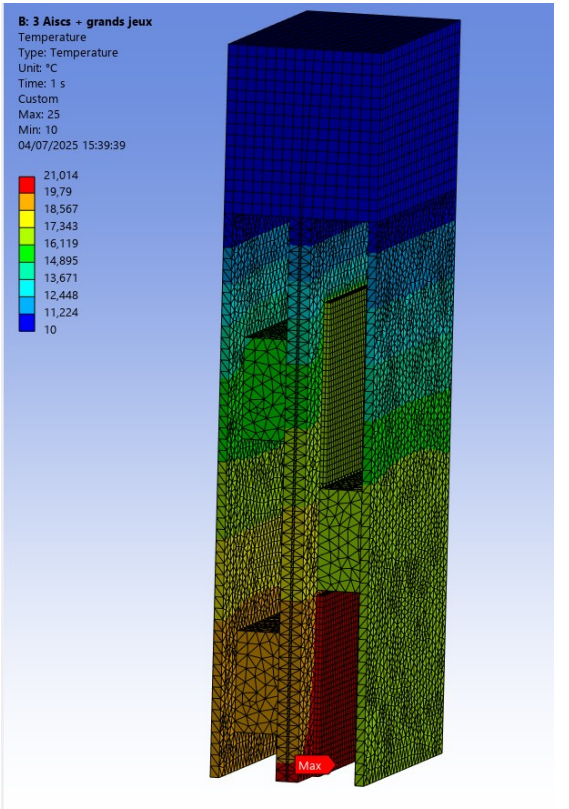
Simulation of the proposed concept

- Can keep the sensors at room temp.

/!\ Imperfect contacts and may need to move farther from the detector (need design)

	P_{ASICs} (W)	$T_{Peltier}$ (°C)	T_{max} (°C)
Design n°3	2,048	20	41
		10	31
		0	21
		-10	11
	1,024	20	30,5
		10	20,5
		0	10,5
		-10	0,5





Upcoming tests

Prototype for a module

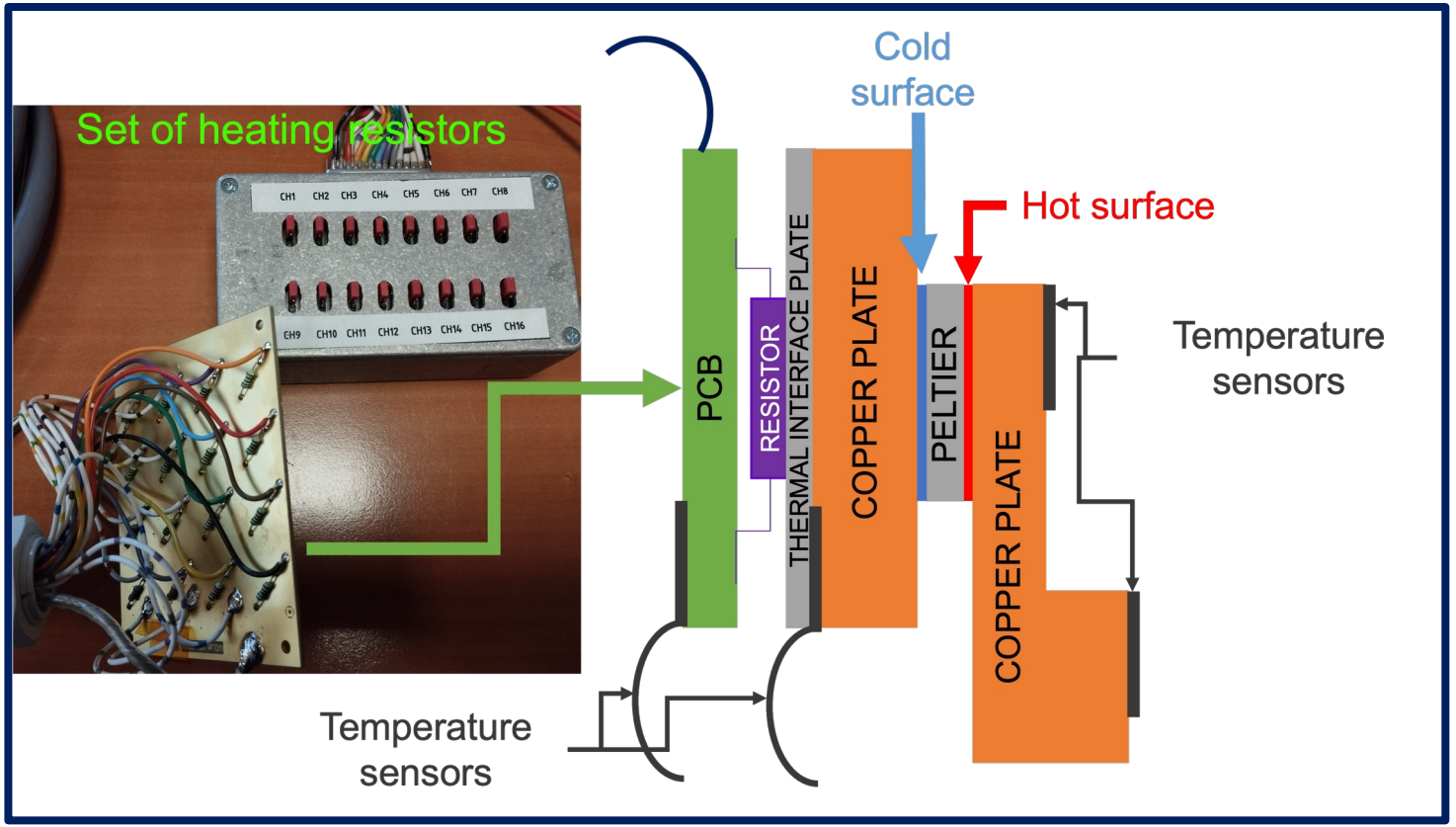
- Will test our calculations

Use for further tests in conditions

- Vacuum, radiations, stability…

All elements arrived in IJCLab

- Assembly starting

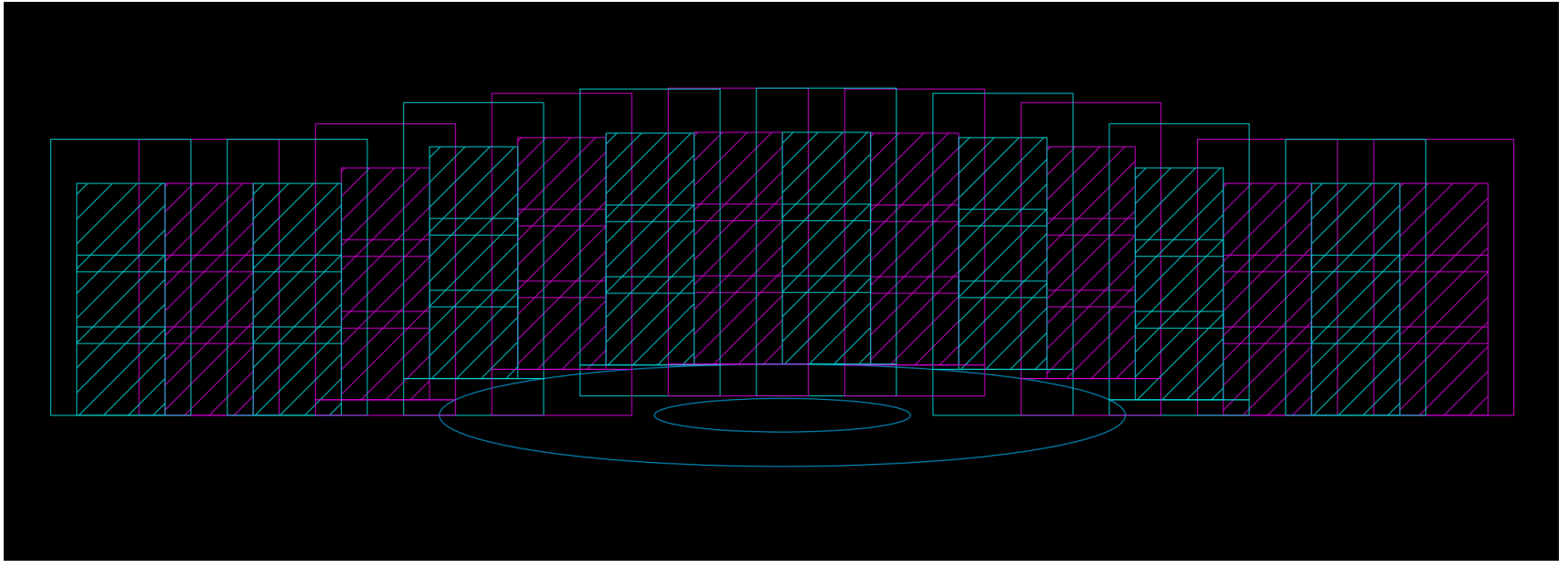


Integrating the Geometry

Now working on a modified concept with different mechanics

- Modules (1x3 sensors) cooled independently to be free to match the beam

  → Concept to be presented soon at a RP meeting



Summary

We have performed simulations for cooling

- Use copper plates with thermoelectric heat pumps
  - **Impact on impedence ? Need to change technology ?**
- Many things remain to be checked
  - **Interactions with other elements of the detector (electronics and mechanics)**
  - **Interactions with beam (radiations and impedence)**
  - **Select components that are compatible with high grade vacuum, high radiation environnement, and low maintenance over the years**
- Some of these topics will be addressed by a series of test to be performed in IJCLab

We are looking into the mechanical concept for the module assembly

- Our goal is to separate all modules and provide mobility to adapt to the beam shape