

# Backward Electromagnetic Calorimetry Proto 5x5 review

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Meeting on designing progress of the  
prototype 5x5

# Aims of the prototype

## ☐ Thermal tests:

- Check the stability of the temperature (+/- 0,1°C)
- Perform tests in a climatic room
- Use heating PCB to add and change power near to the crystals
- Validate the power dissipation of the cooling
- Compare with the ANSYS Thermal model and optimize

## ☐ Beam tests:

- In May@CERN and/or in October@Jlab
- Without the heating PCB used for the thermal tests
- Use 25 crystals connected if possible for the tests (9 at least)
- With the cooling

### **COMMENT:**

*The prototype 5x5 is not perfectly representative to the final calorimeter. It's a design to check the operation of the cooling and improve the digital model.*

# Requirements

## **Mechanical assembly:**

- SiPM must be removable (not glued) -> MECHANICAL ASSEMBLY NEEDED
- Optical coupling with optical grease
- With a cooling system
- With a heating PCB near to the crystals

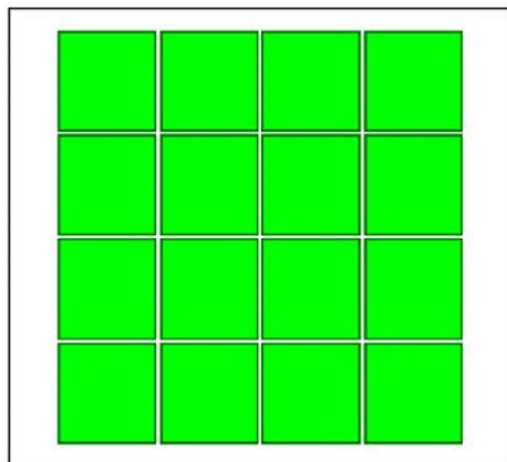
## **SiPM:**

- Compatible with the SiPM 3x3 mm<sup>2</sup> size
- Compatible with the SiPM 6x6 mm<sup>2</sup> size

## **Electronic:**

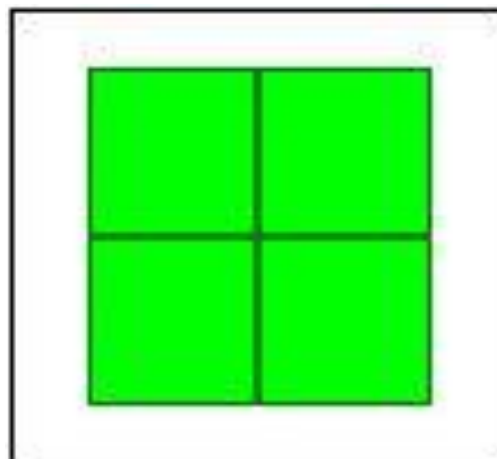
- Compatible with the « independent » reading
- Compatible with the « addition of all the channels» reading
- Compatible with an ASIC
- Compatible with a flash ADC

# SiPM configurations / SiPM PCB



% couvert par le SiPM 36,00 %

	H 4,35
Hamamatsu S14160 3010 (10µm)	L 3,85
	Active 3x3



% couvert par le SiPM 36,00 %

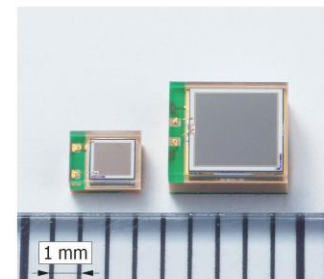
	H 7,35
Hamamatsu S14160 6010 (10µm)	L 6,85
	Active 6x6

PCB external (18x18 mm<sup>2</sup>) size is the same for the SiPM 3x3 mm<sup>2</sup> and the SiPM 6x6 mm<sup>2</sup>

**HAMAMATSU**  
PHOTON IS OUR BUSINESS

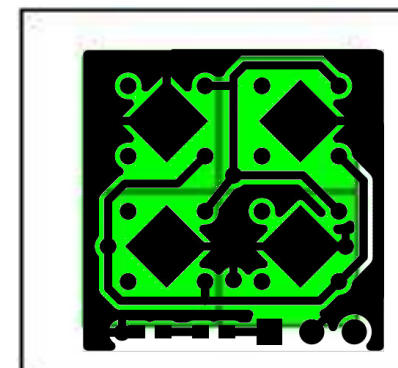
**MPPC® (multi-pixel photon counter)**

S14160-1310PS/-1315PS/-3010PS/-3015PS



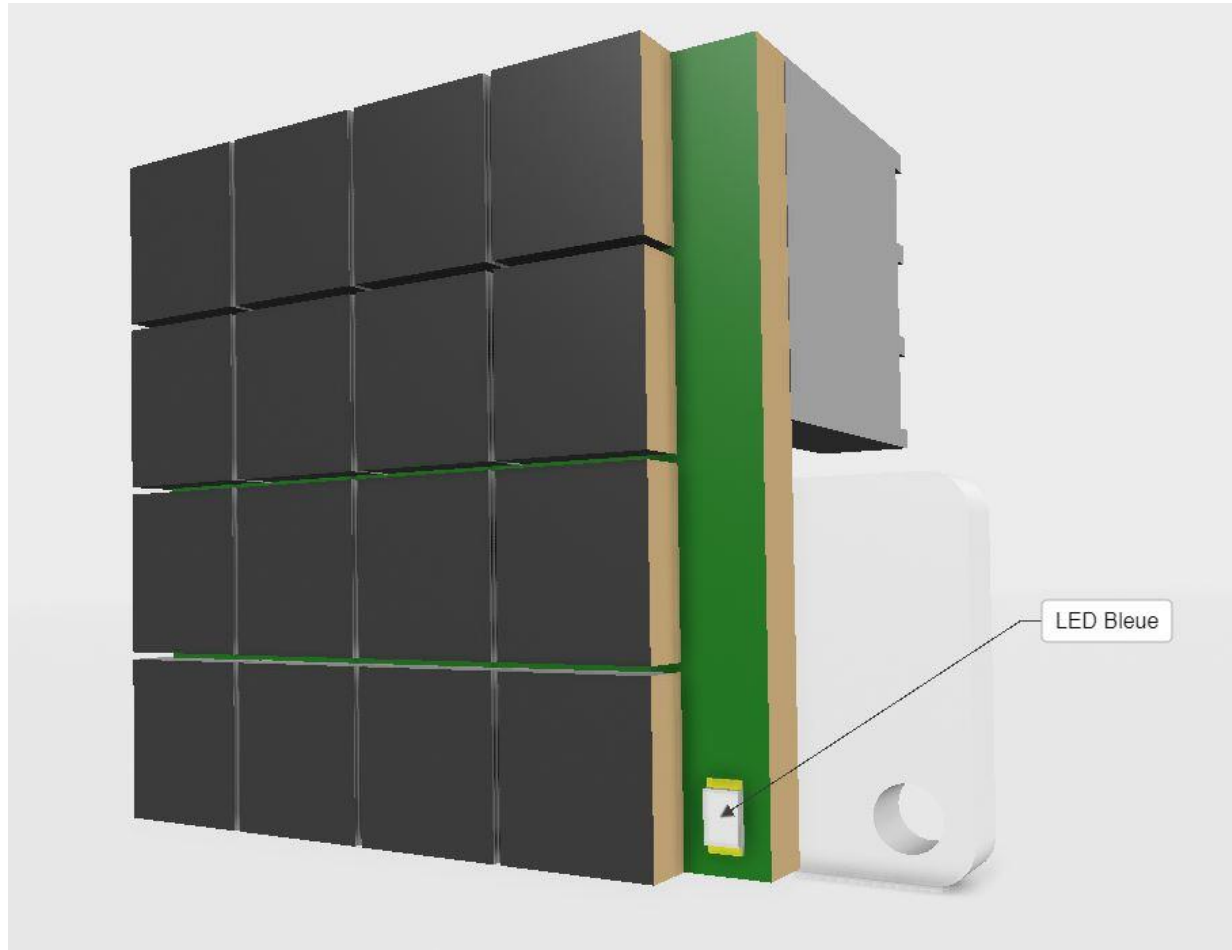
**Low breakdown voltage, wide dynamic range type MPPC with small pixels**

The S14160 series is a small-pixel MPPC that features wide dynamic range. Even with an extremely narrow pixel pitch of 10 or 15 µm, it features high fill factor, reduced crosstalk, and dark count.

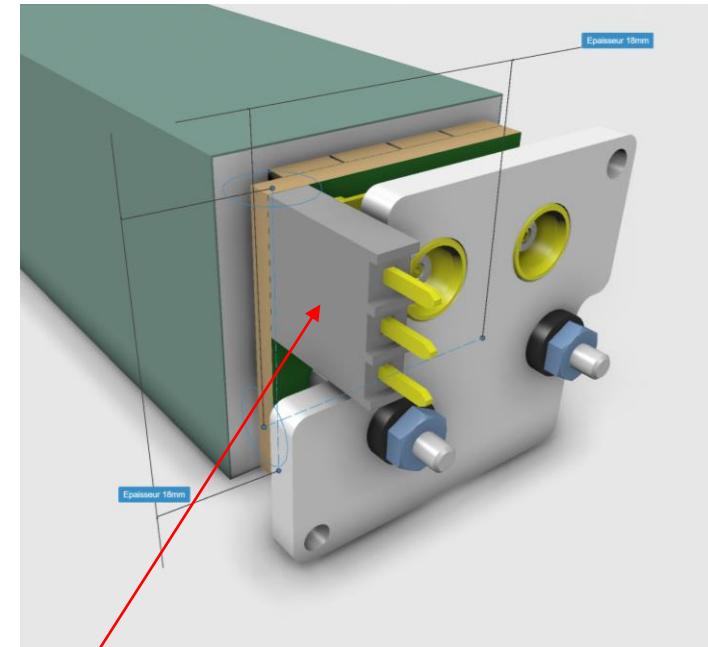


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# SiPM PCB / Calibration by a blue LED



**COMMENT:**  
*No optical fiber needed.  
Radiation tests must be performed to  
ensure the lifespan.*

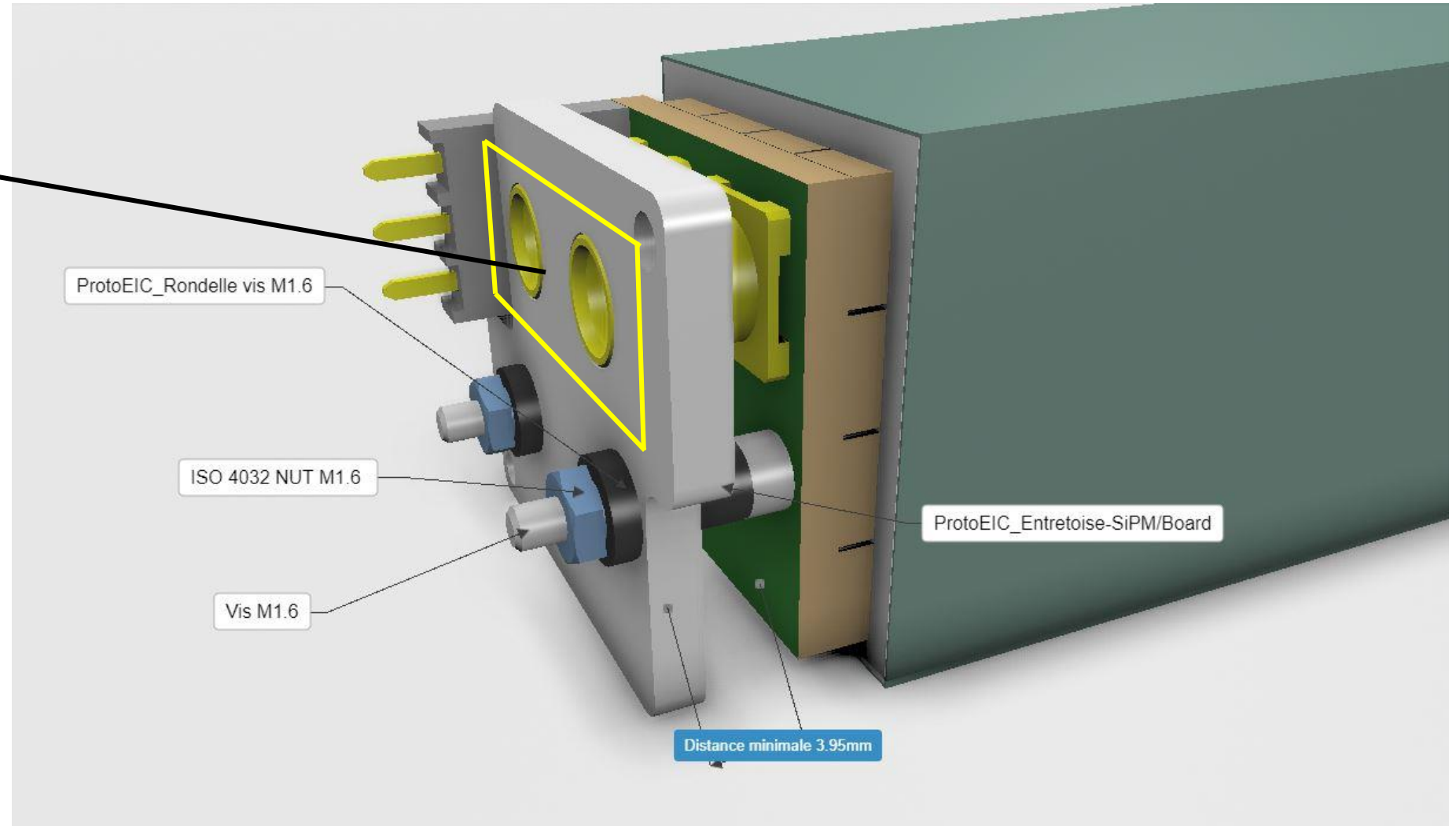


**Connector  
for the LED**

# SiPM PCB Assembly + crystal

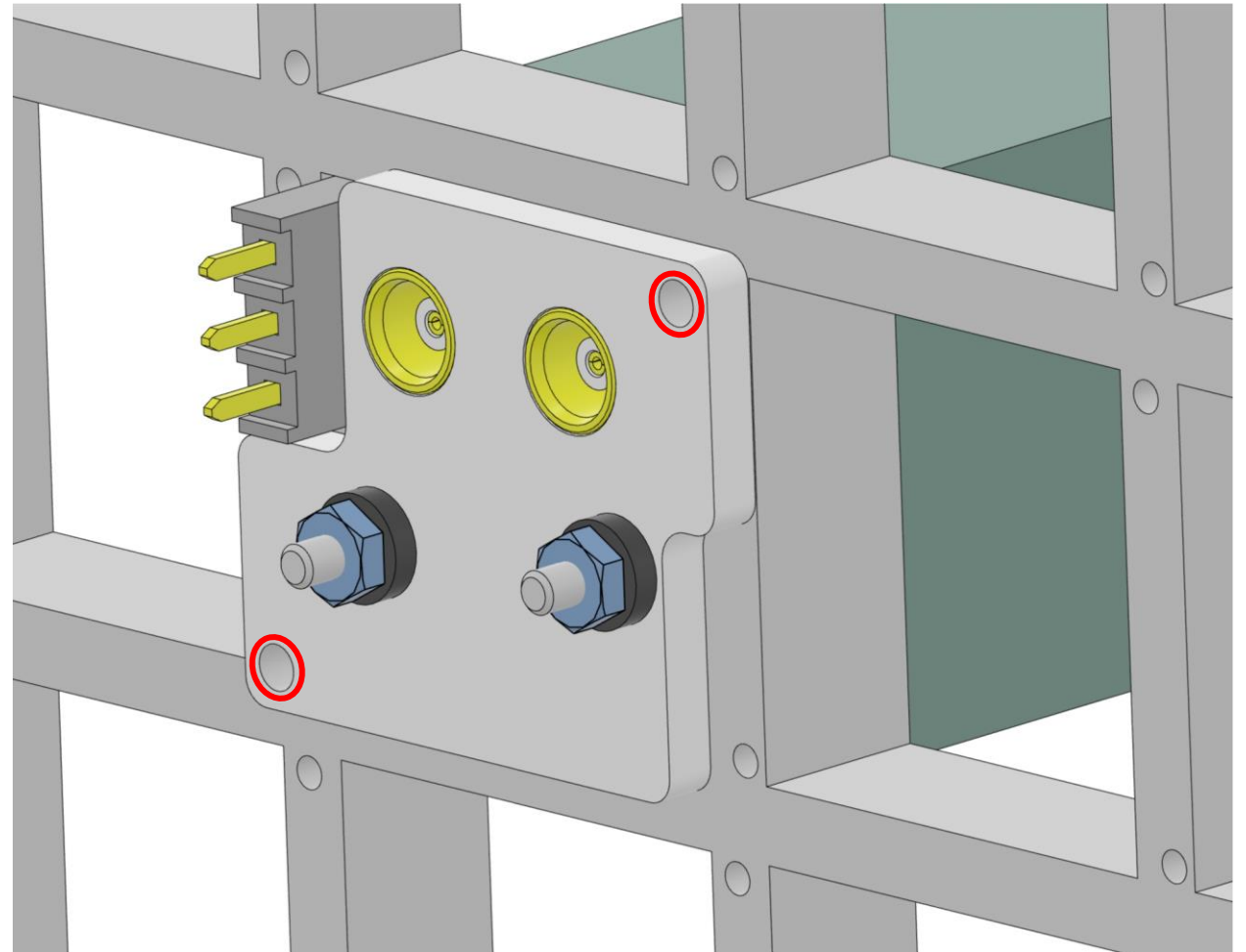
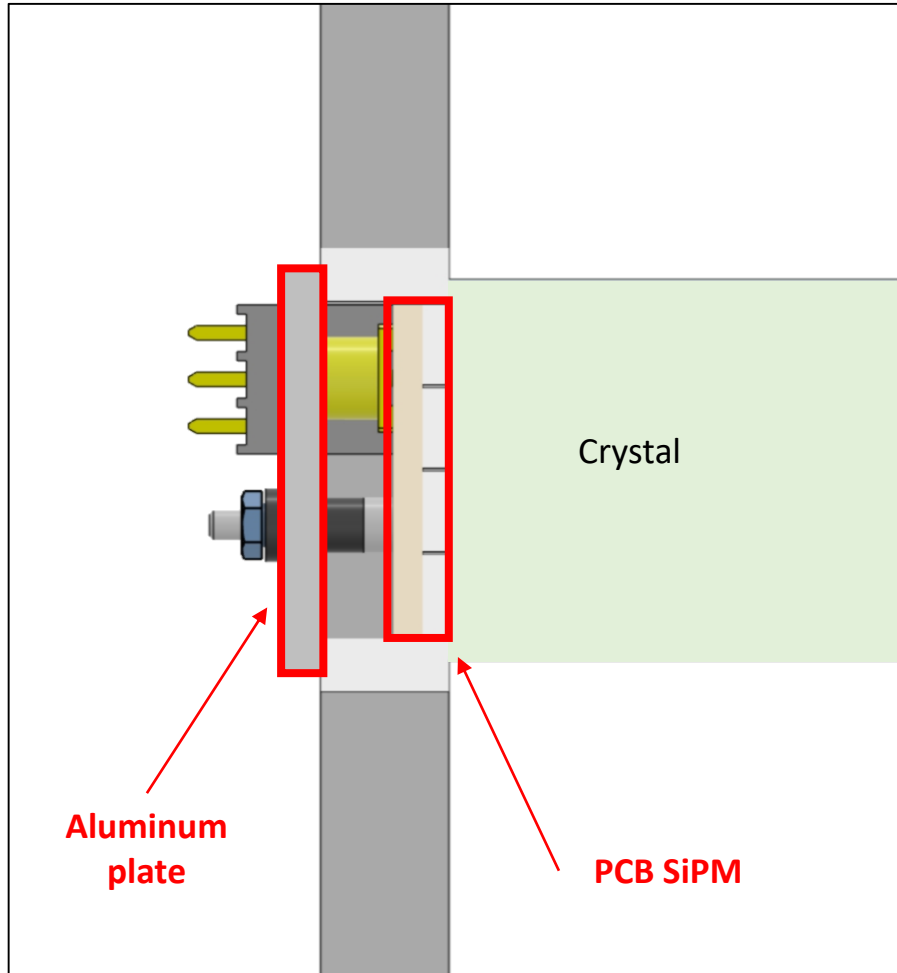
2 MCX connectors for the  
“independent”

1 Flat cable for the  
“addition”



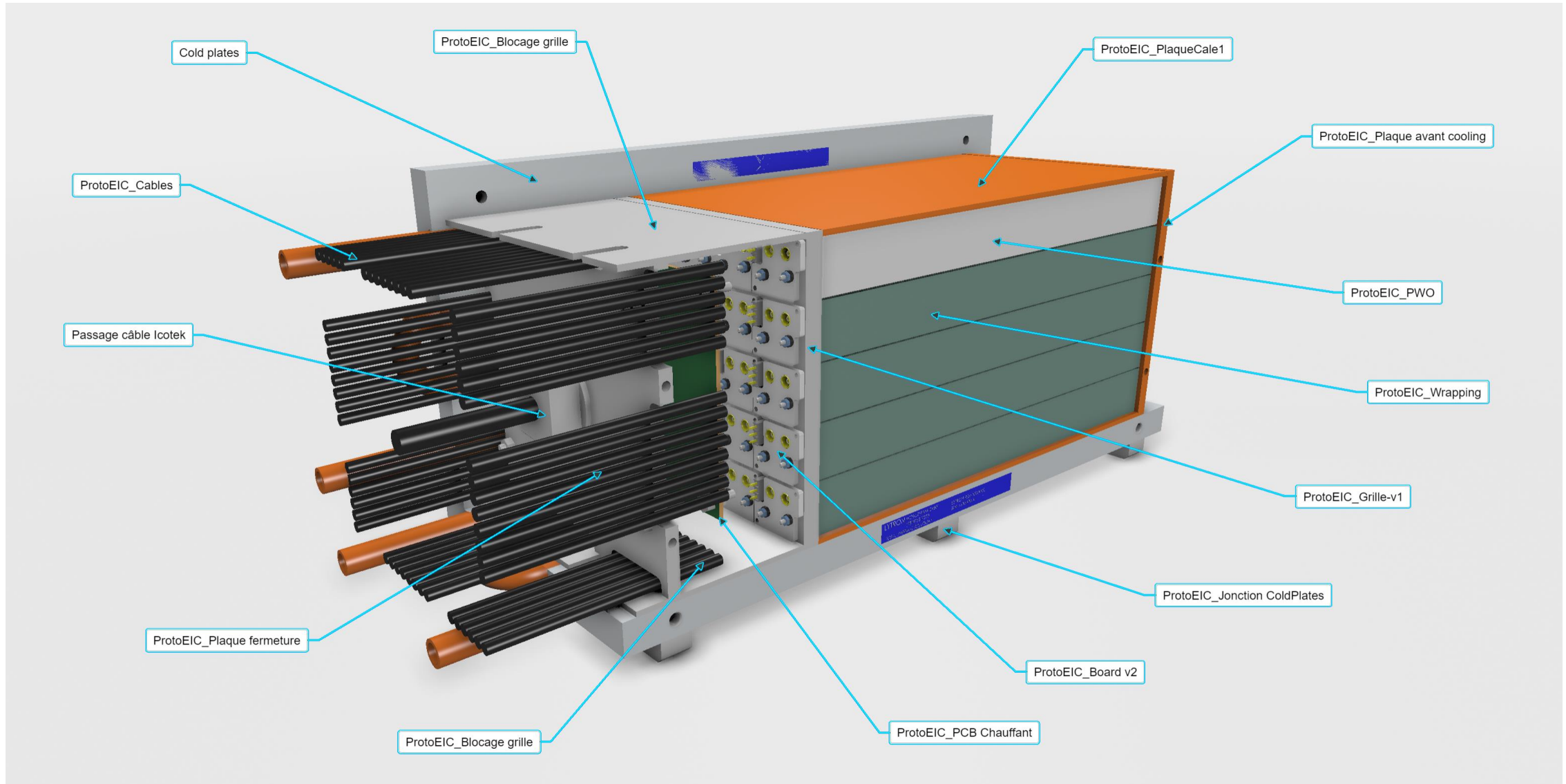
SiPM PCB assembly = SiPM PCB + Aluminum plate

# Fastening of the SiPM PCB assembly



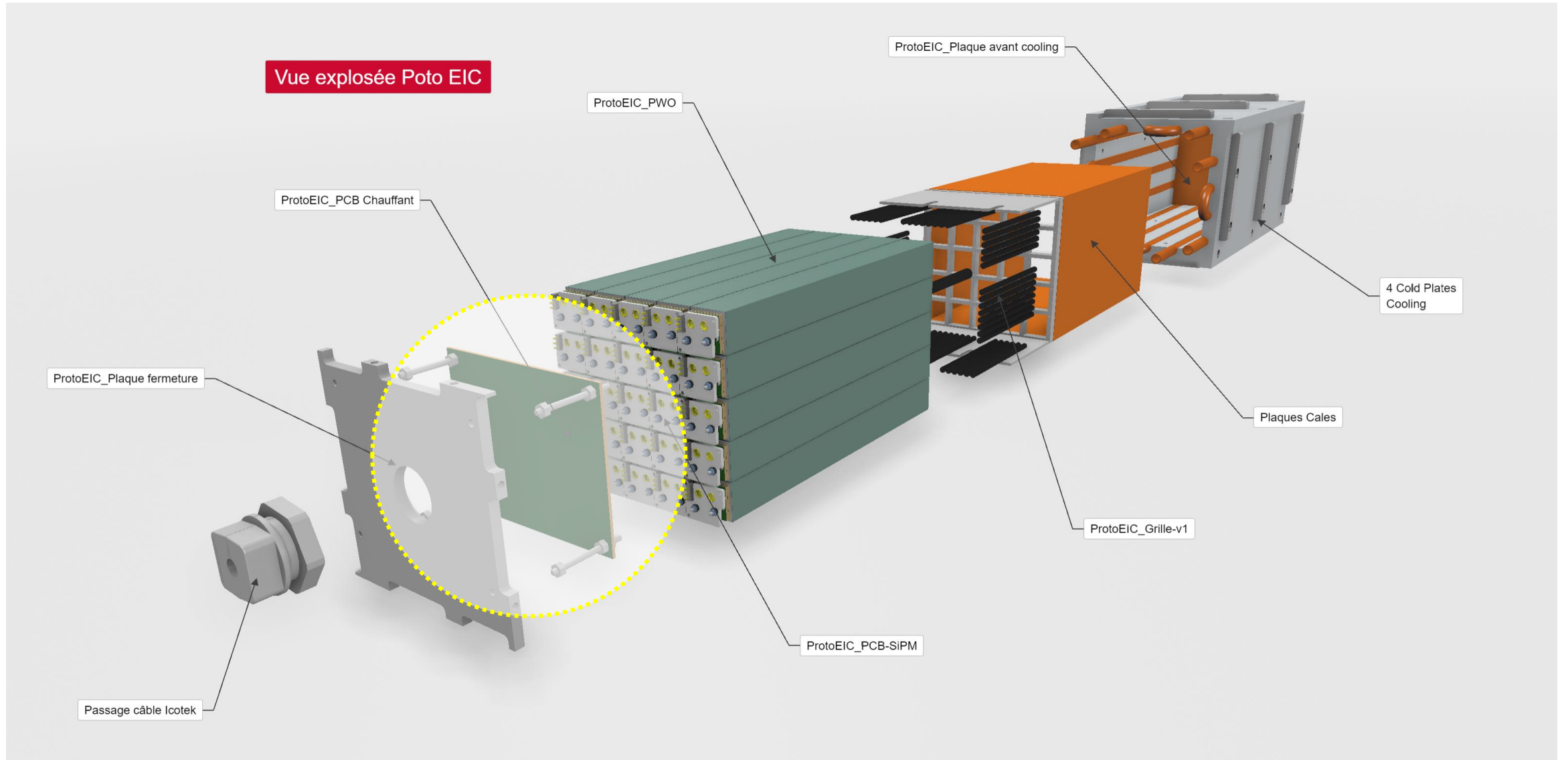
Fastening by screws on the mechanical grating

# Overview with the MCX cables (flat cables for “addition”)

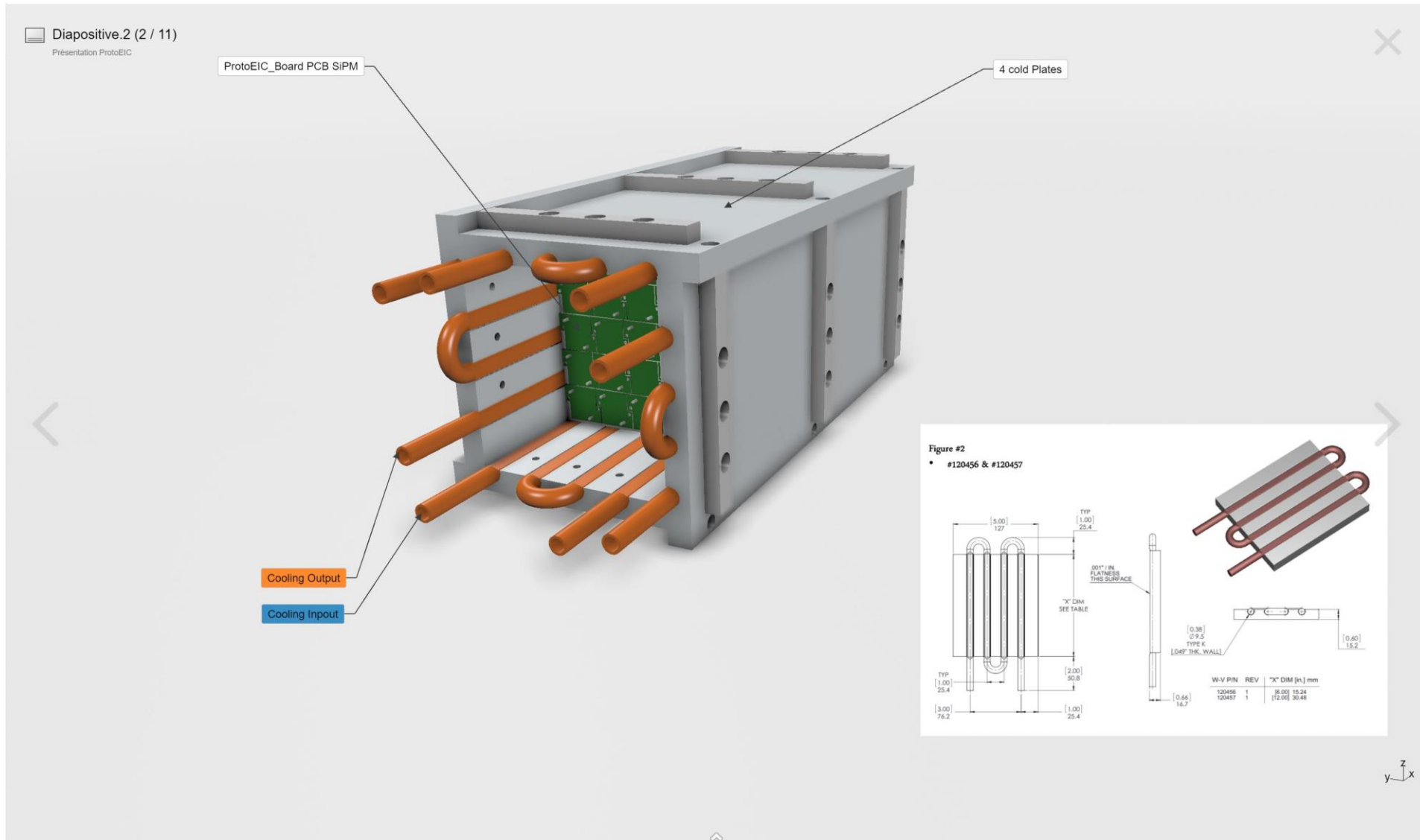




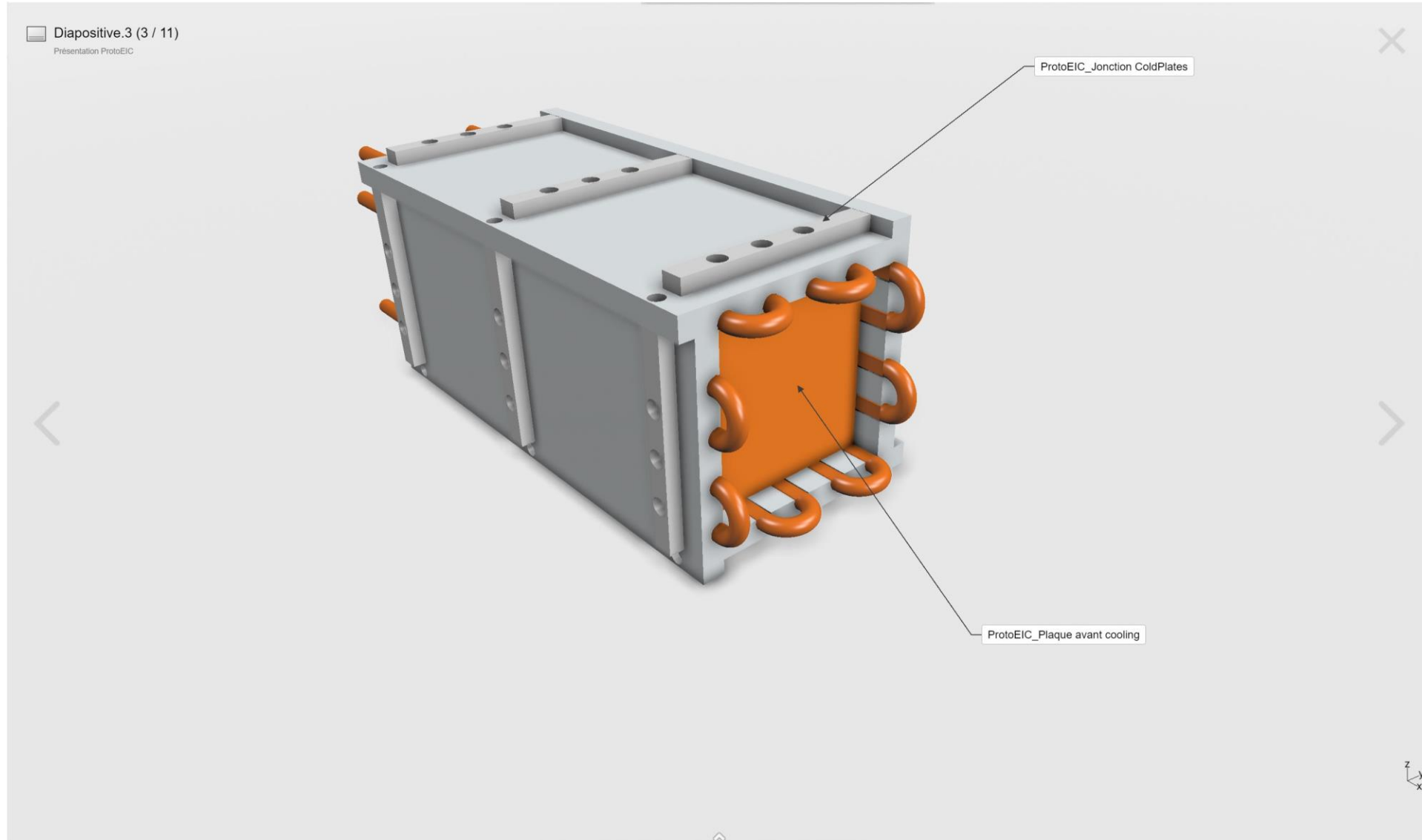
# Overview / Heating PCB for the thermal tests



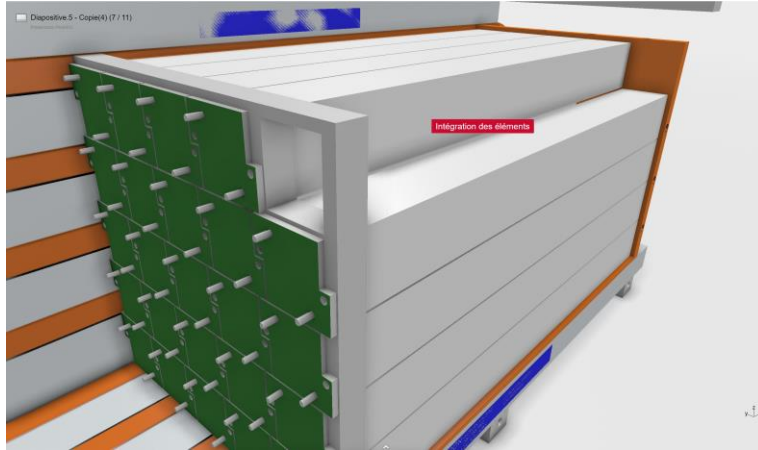
# Overview / Cooling with 4 cold plates



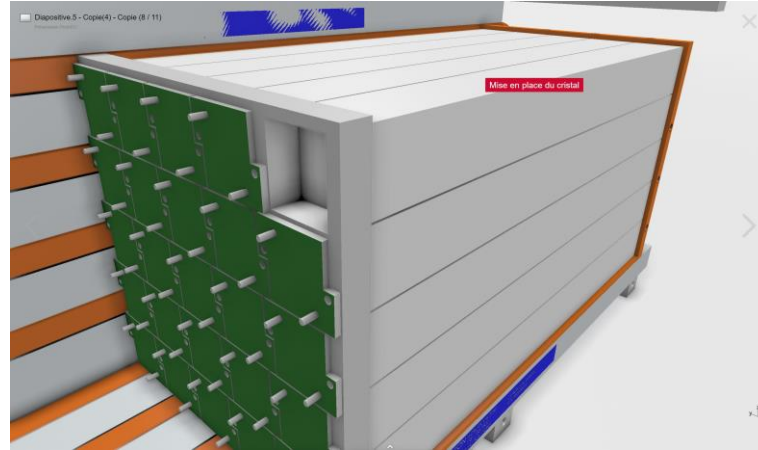
# Overview / Front view (copper plate or plastic plate)



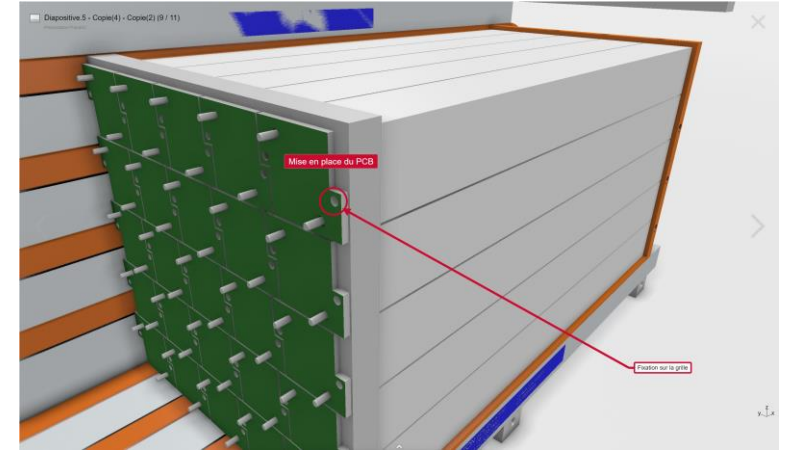
# Assembly of the prototype



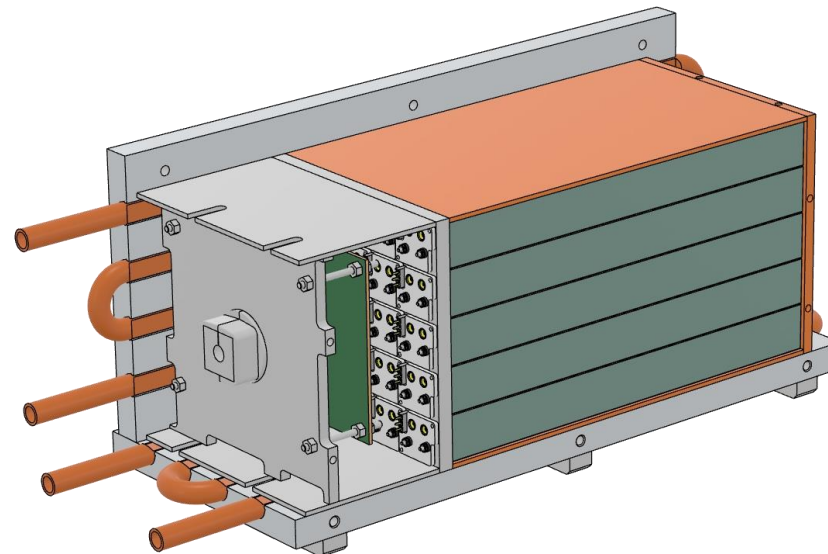
The crystals are stacked one by one



Positioning with the carbon plates



Fastening of the SiPM PCB assembly



# Crystals clearances & Wrapping

## Crystal:

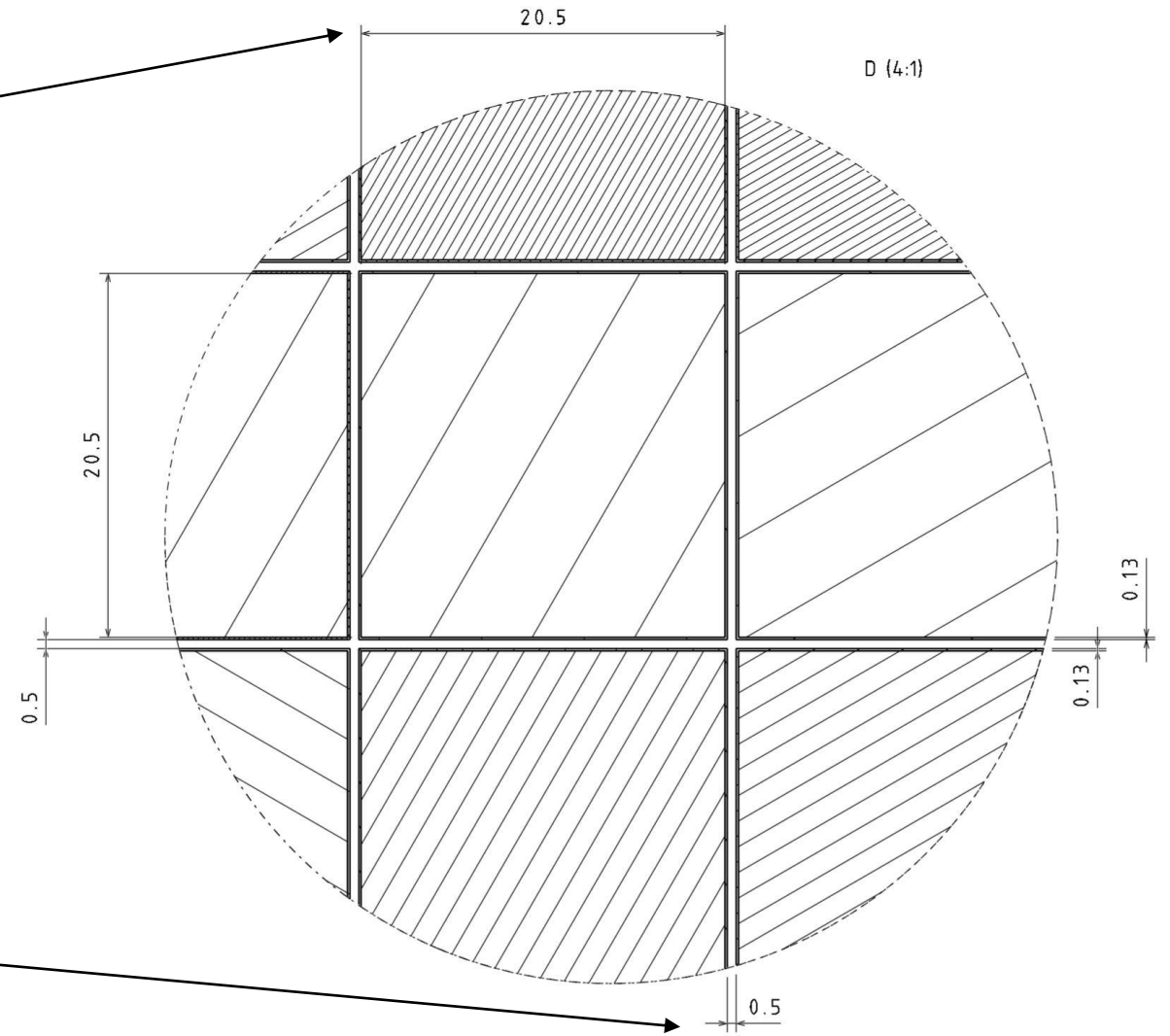
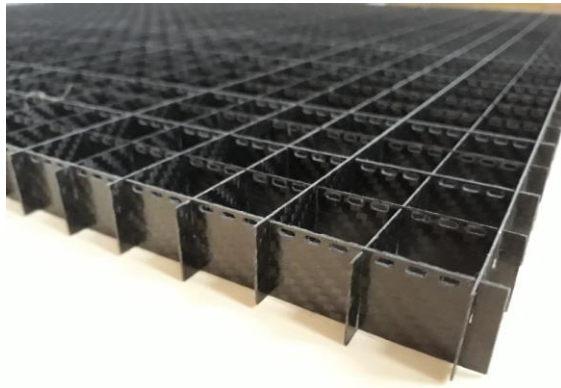
Size measured on the crystals at the lab: 20.5 mm

## Wrapping:

- VM 2000 (65  $\mu\text{m}$ )
- Tedlar (65  $\mu\text{m}$ )

Total thickness= 0.13 mm

0,5 mm carbon plate



# Conclusion & Schedule

## Design

- Mechanical drawings
- PCB design for the “addition” reading

January-February 2024

## Construction

- Mechanical machining
- Comparison between the SiPM PCB “independent” vs “addition”

February-March 2024

## Assembly

- Mechanical assembly with PCB

March 2024

## Thermal tests

- With and without the cooling & the heating PCB

March-May 2024

## Beam tests

- @ CERN (if possible)
- @ Jlab

May 2024

October 2024

