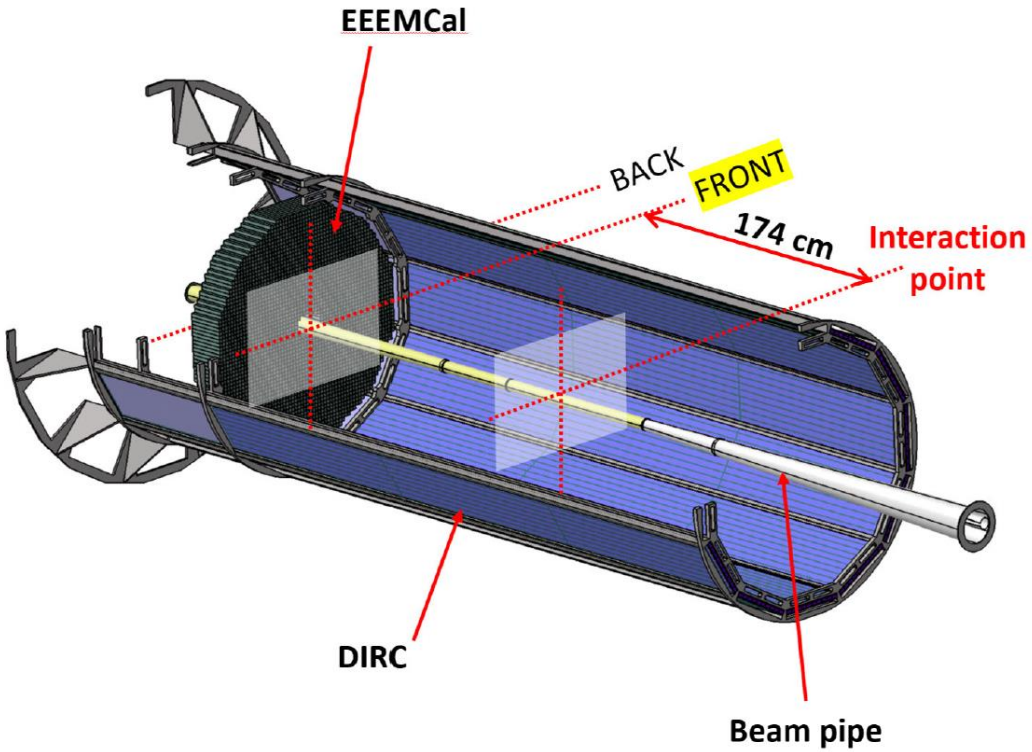
Backward Ecal / EEEMCal

Triple I Engineering Meeting Update (03/03/2025)

Julien Bettane

Detector Views

Positioning and clearance



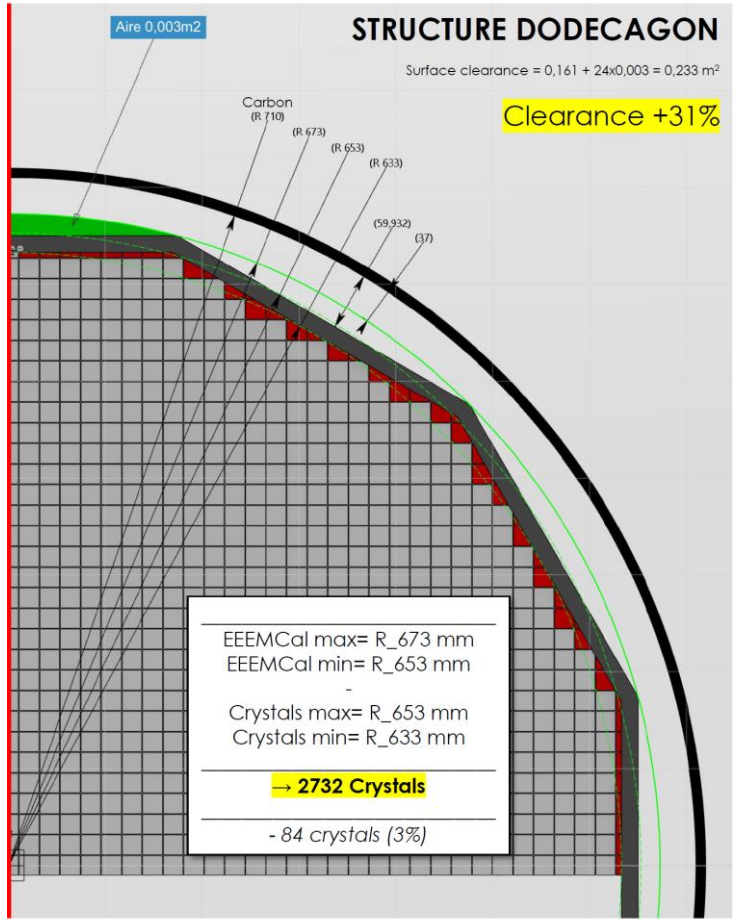
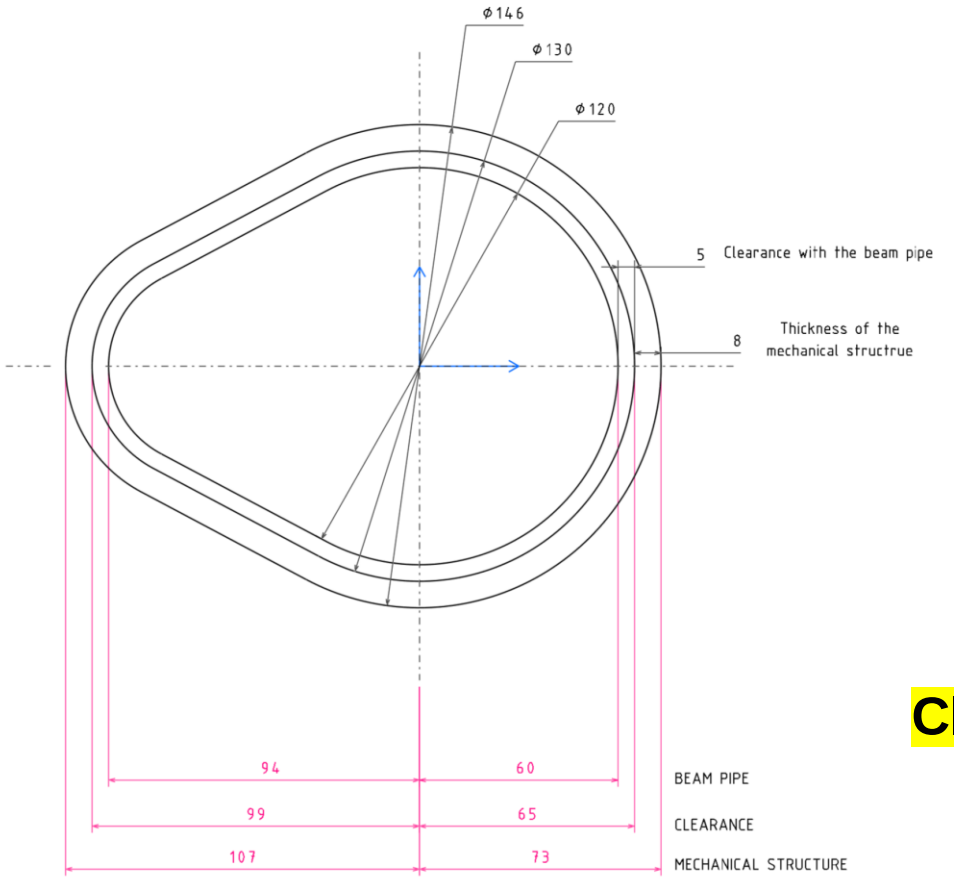
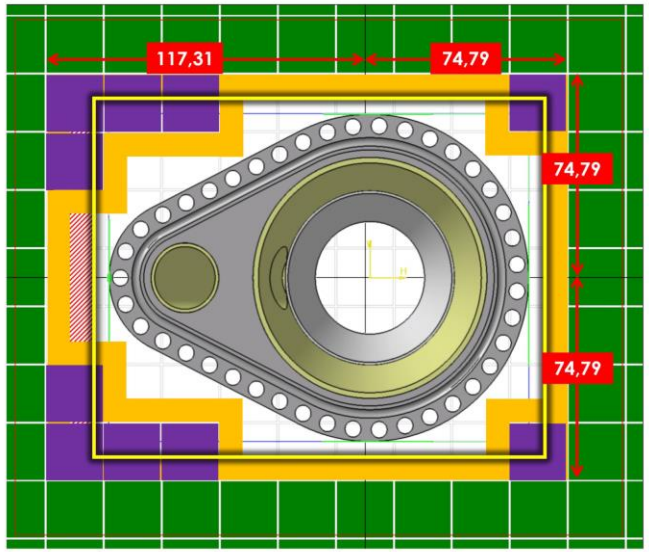


Figure 5: Positioning of the EEEMCal into the ePIC Detector, 176 cm $< d <$ 179 cm for the crystals (ideal position for physics: 174 cm)

Detector Views





CENTERED

Mechanical structure + cooling

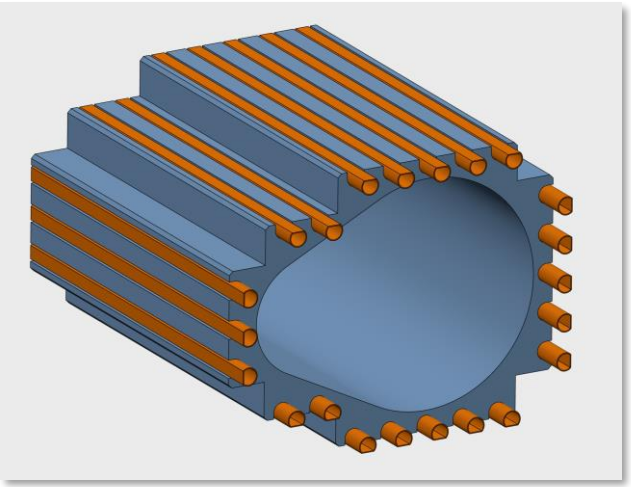
Dead area

Additional crystals in the corners

Clearance

Total crystals = 2722 + 10 = 2732

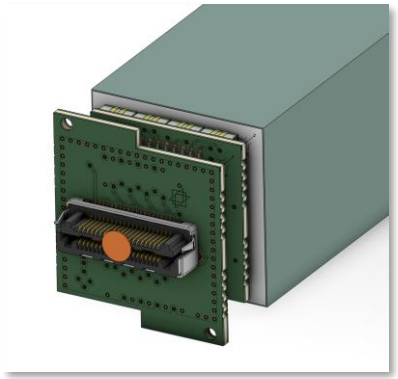
Clearance with the beam pipe

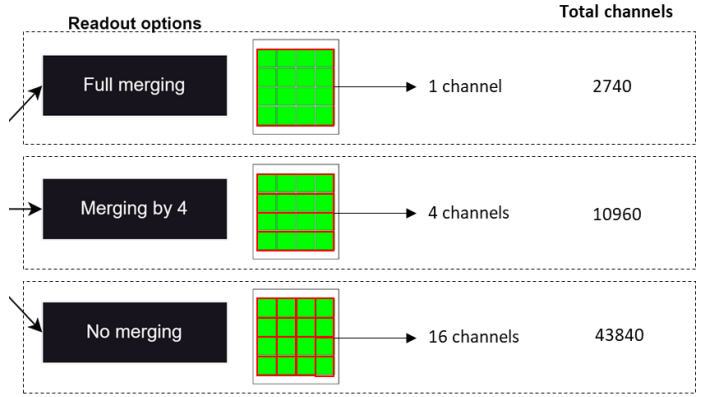


Status / Updates | Beam test & Prototype

Beam test:

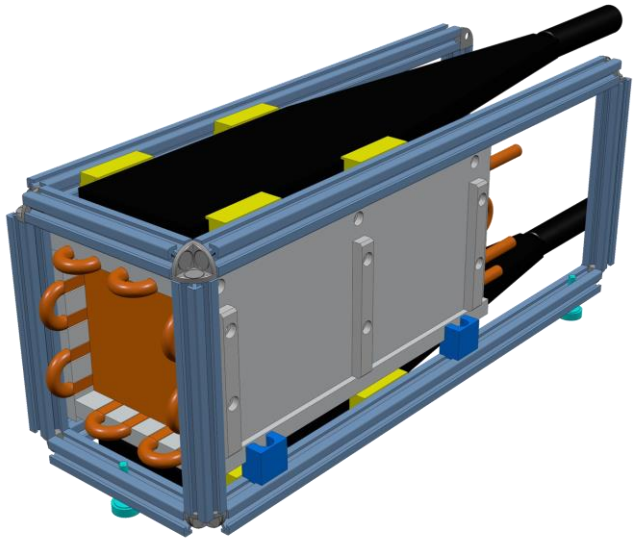
- @DESY : 16th Feb → 02th March 2025
- Test the SiPM readout (among others…)
- Ongoing results/Analysis



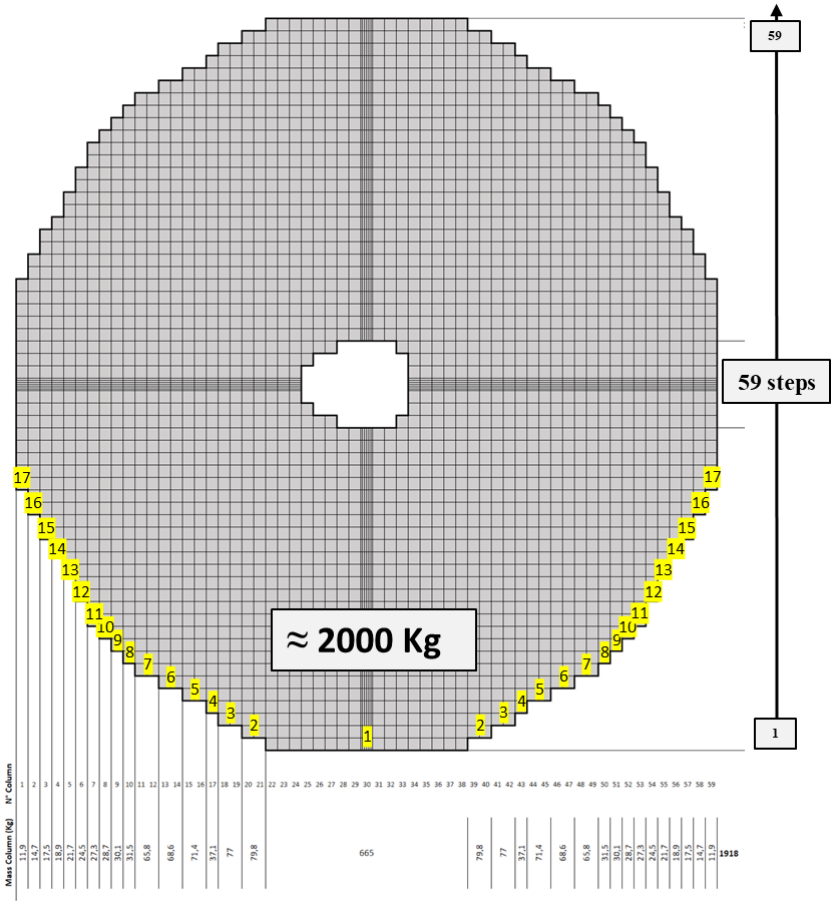


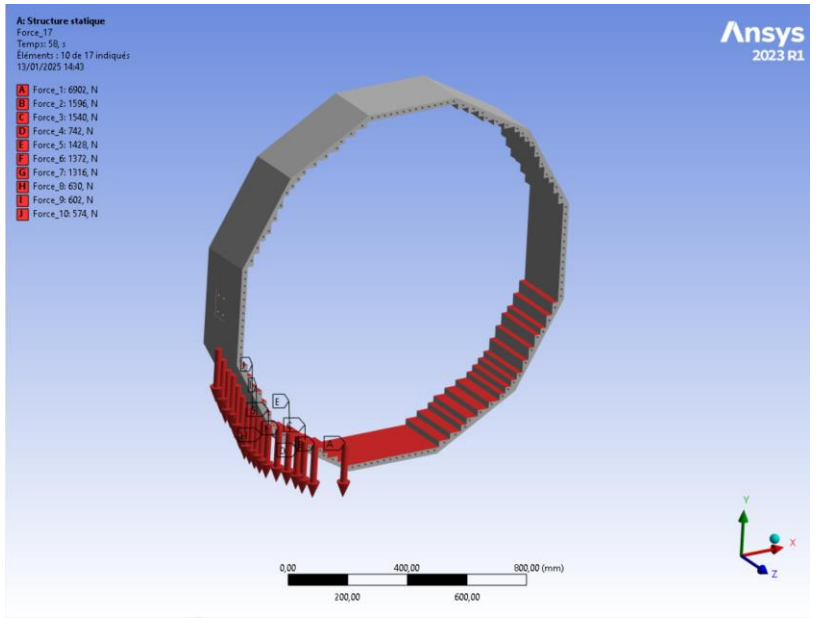
Prototype upgrade:

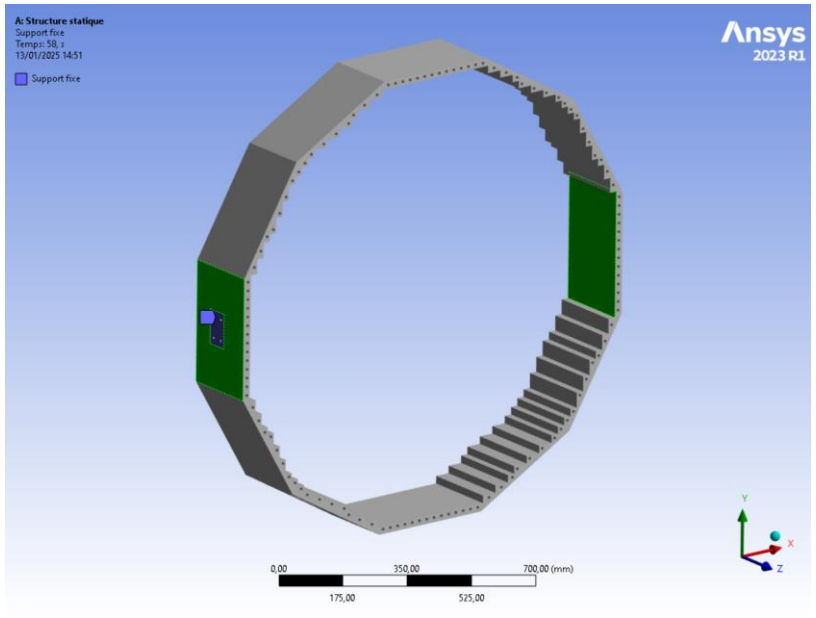
- Cosmic bench
- 2 scintillators + 2 PMTs
- 25 PWO crystals
- PCB SiPM with different readout
- Beam tests compatible



Status / Updates | External structure







FEA Model:

- 1 face at the center

→ 665 Kg

- 16 other faces on both sides

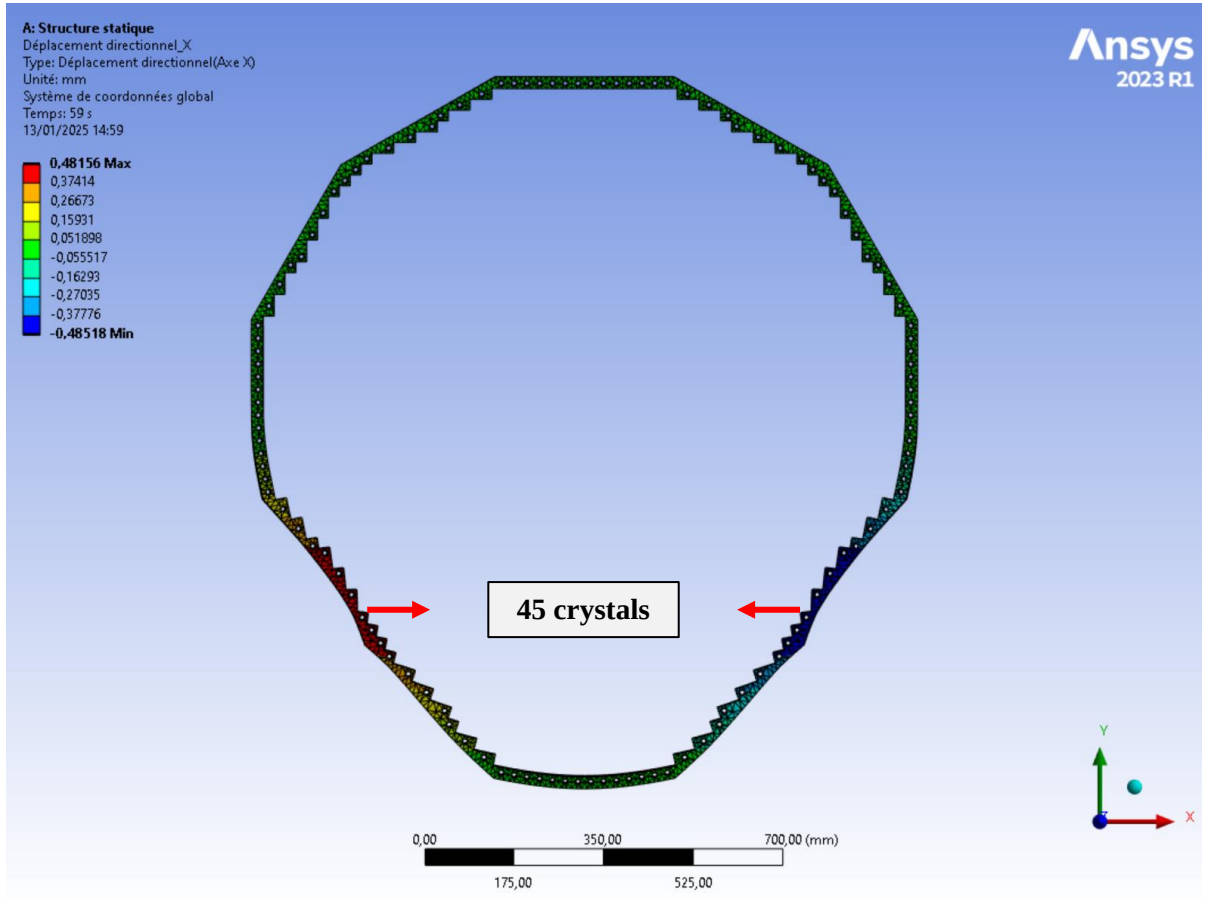
→ 626,5 Kg x2 (11,9 kg to 79,8 Kg)

- 59 steps to check the deflection during the assembly

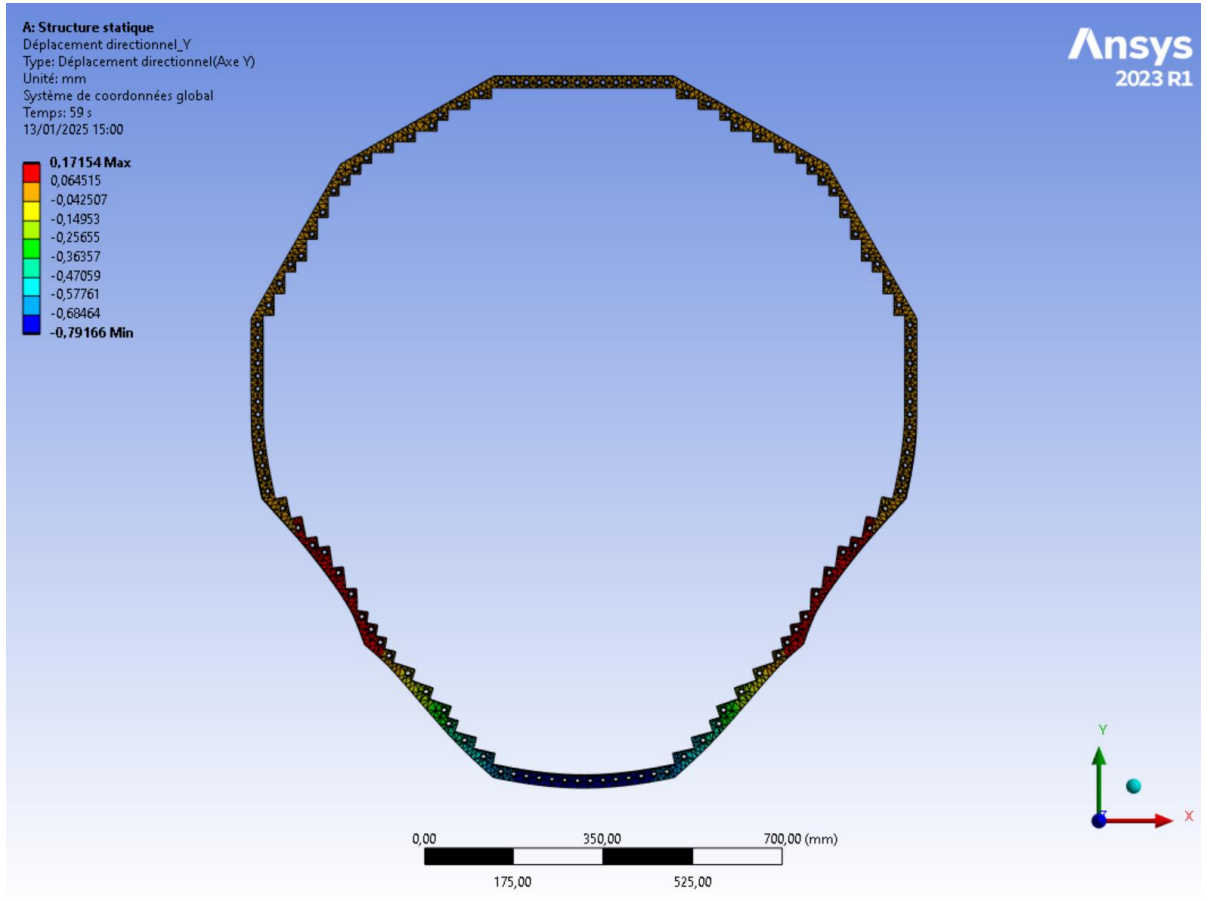
FEA Model:

- Worst case: fastened at 3 and 9 o'clock
- The way to fasten the structure increase the results in terms of stress

Status / Updates | External structure



Displacement X < 0,5 mm



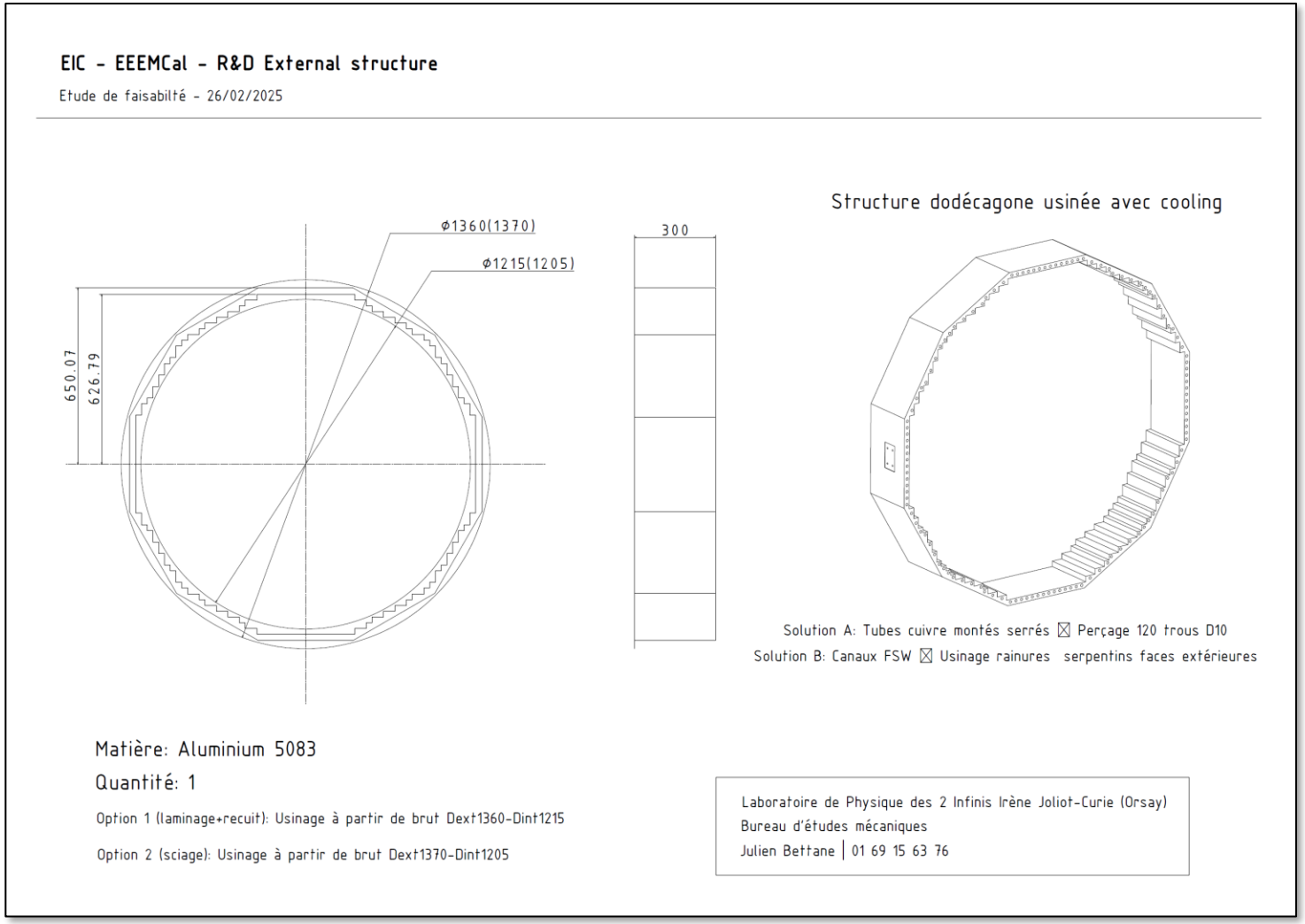
Displacement Y < 0,8 mm

Status / Updates | External structure

Mechanical feasibility study

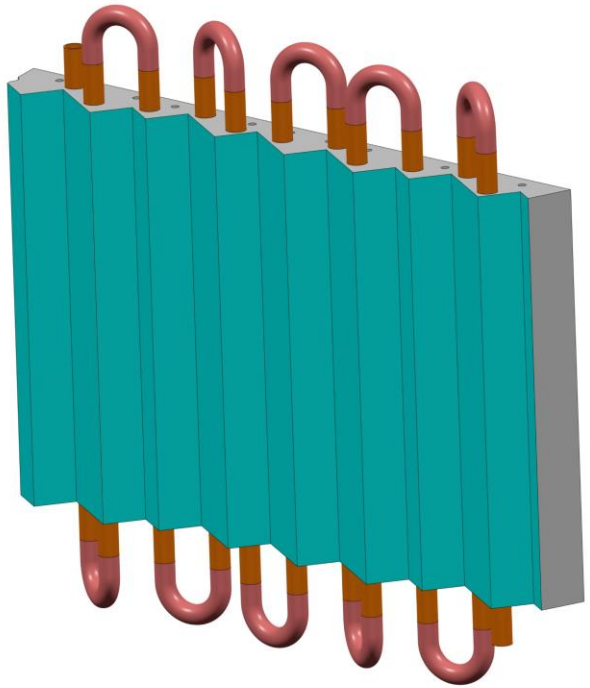
- **How to cool ?**
  → Copper tubes insert in the aluminum
  → FSW + machined coil

- **How to build the structure?**
  → Foundry (not selected)
  → Machining (bandsaw cutting)

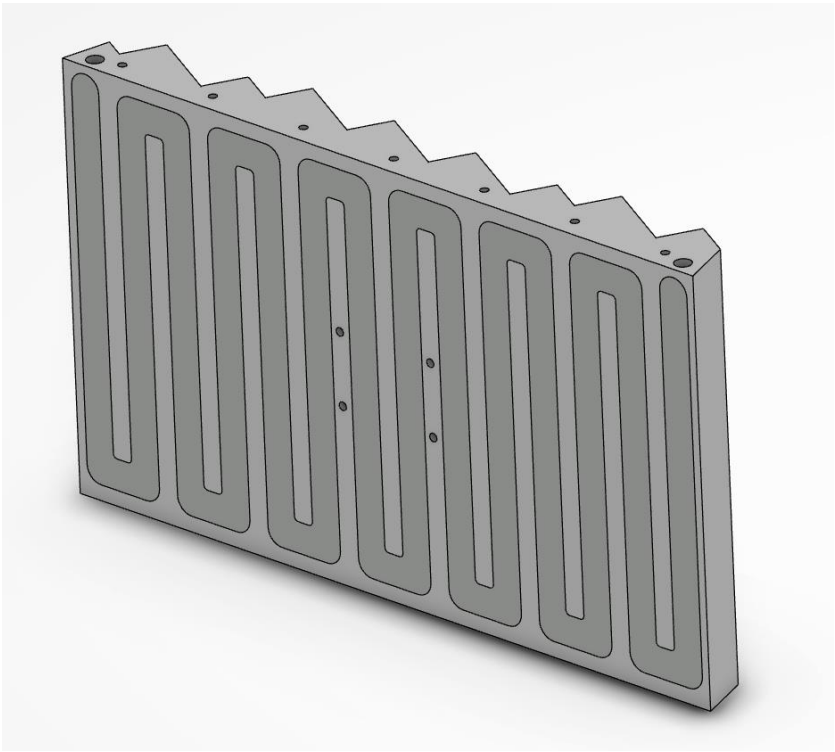


Status / Updates | External structure

Mechanical prototypes to compare the feasibilty and the efficiency of the cooling



→ Copper tubes insert in the aluminum



→ FSW + machined coil

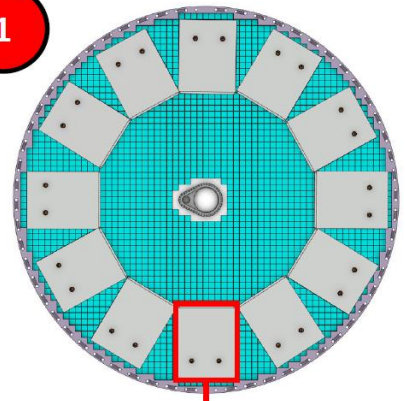
Quotation under preparation

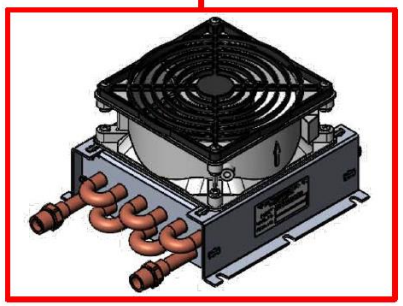
Status / Updates | FEB

3 main options for the Front End Board

Boxes all around

1

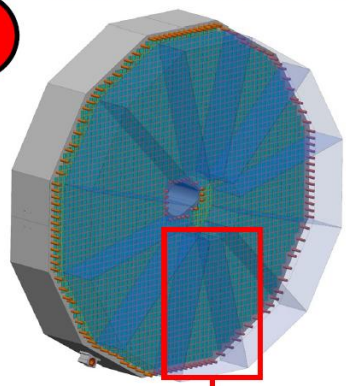




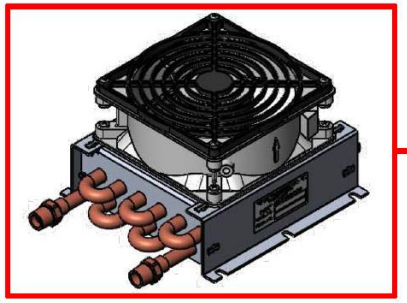
With cables → Fan + Exchanger

Boxes in front of the SiPM

2

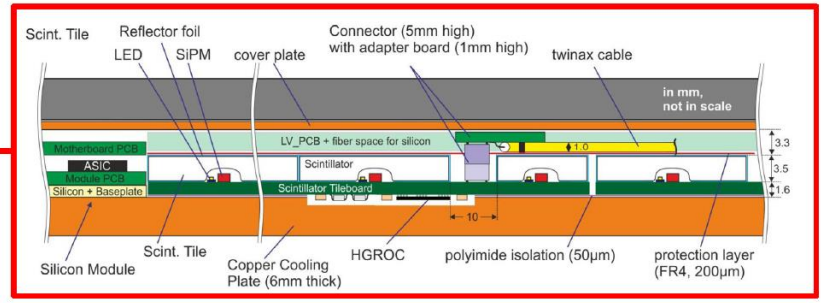


(A)



With cables → Fan + Exchanger

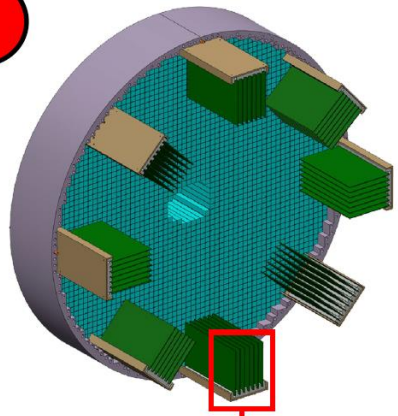
(B)

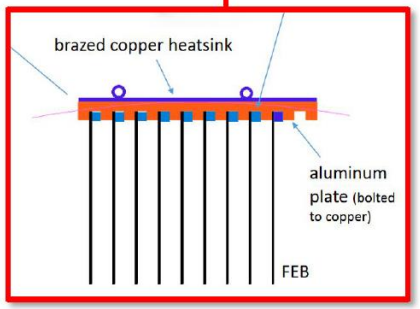


Without cables → Cold plate

Racks with cold plates

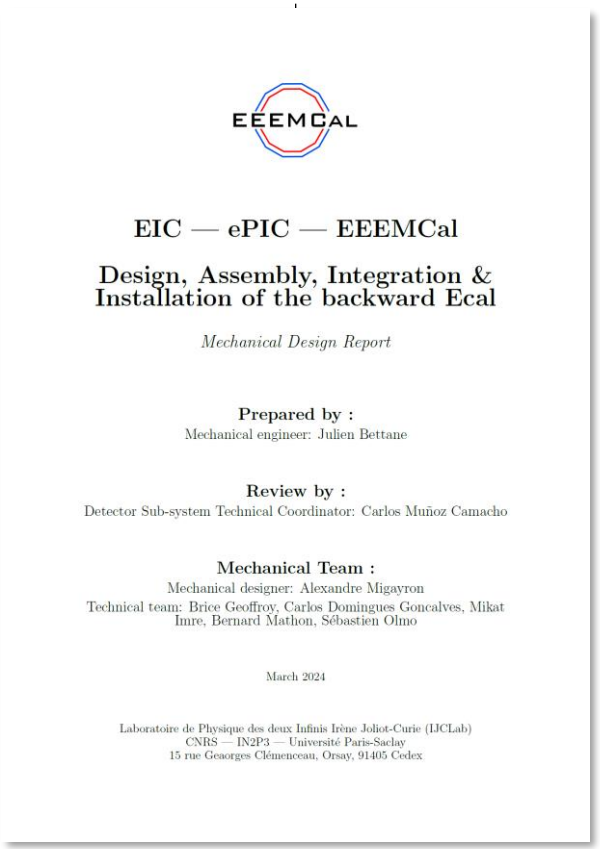
3





With cables → Rack + cold plate

Plans Towards PDR



EEEMCAL

EIC — ePIC — EEEMCal

Design, Assembly, Integration & Installation of the backward Ecal

Mechanical Design Report

Prepared by :
Mechanical engineer: Julien Bettane

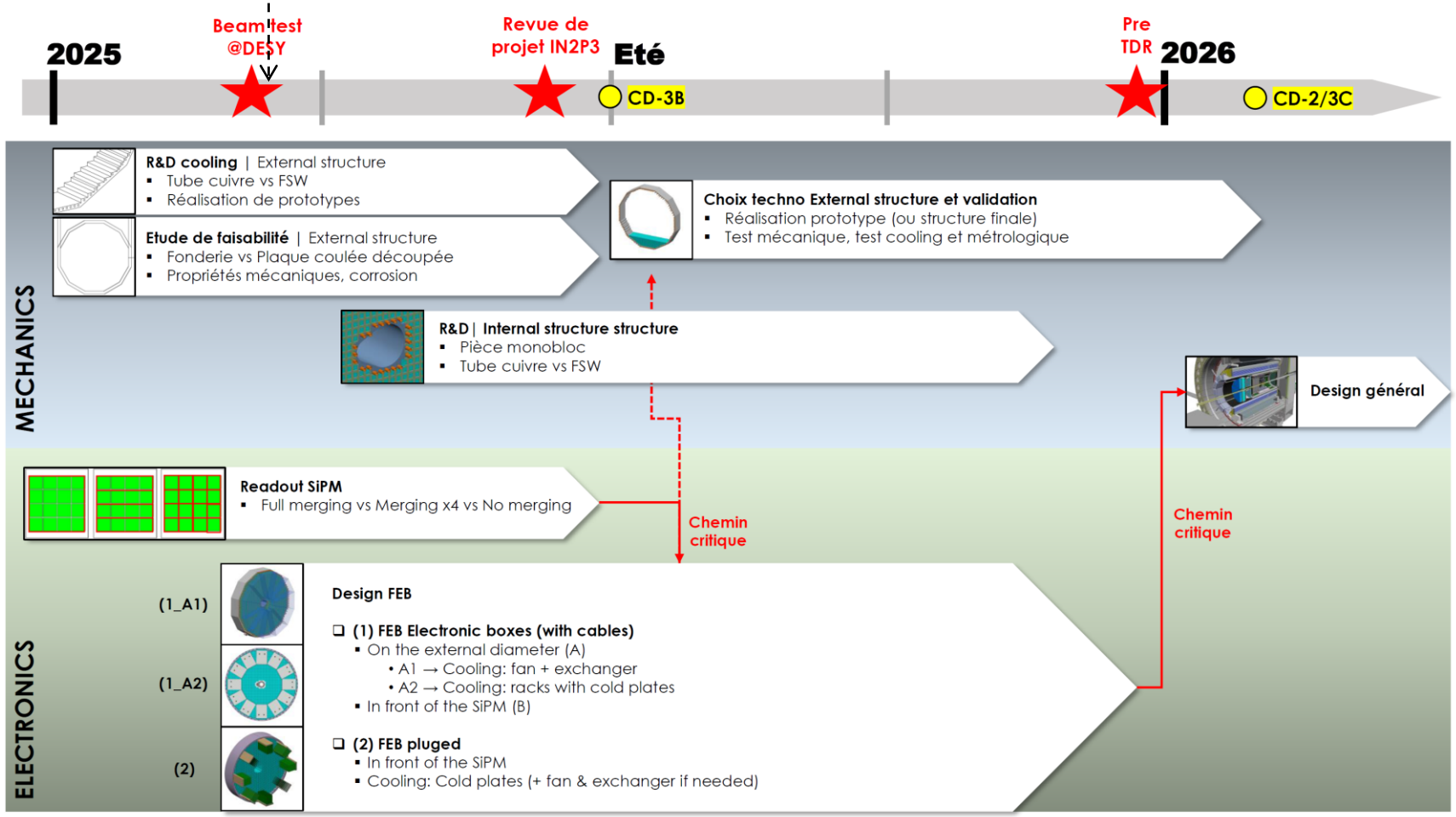
Review by :
Detector Sub-system Technical Coordinator: Carlos Muñoz Camacho

Mechanical Team :
Mechanical designer: Alexandre Migayron
Technical team: Brice Geoffroy, Carlos Domingues Goncalves, Mikat Imre, Bernard Mathon, Sébastien Olmo

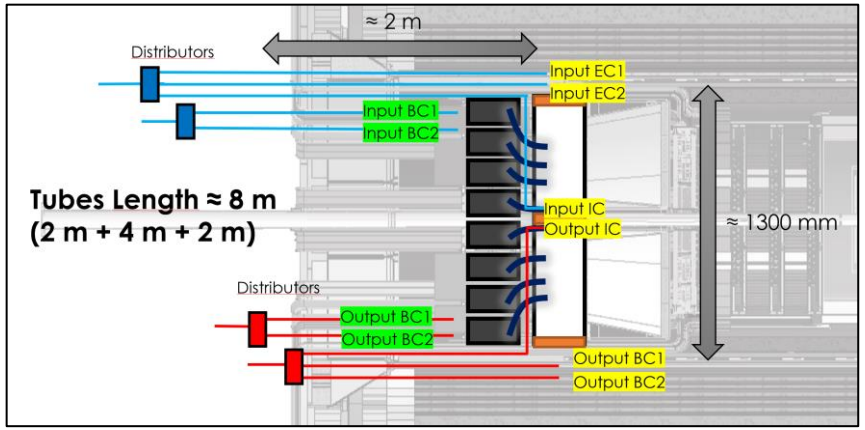
March 2024

Laboratoire de Physique des deux Infinis Irène Joliot-Curie (IJCLab)
CNRS — IN2P3 — Université Paris-Saclay
15 rue Georges Clémenceau, Orsay, 91405 Cedex

Mechanical Design Report



Services Estimates



Tubing drawing of the cooling

Chillers

1

2

Chiller 1: Cooling for the crystals
- External cooling EC (2 systems)
- Internal cooling IC (1 sytem)
- ΔT room = 3°C → 50 W for the crystals

Chiller 2: Cooling for the electronics
- 12 boxes BC (2 sytems)
- 120 W per box (1500 W)

Cables:

- LED (1 LED per crystal → controled by the FEB)
- Thermal sensors (10% of the crystals x2 → 600 cables)
- Signal cables (Depend on the regroupment, reading with 16 SiPM vs 4 SiPM)
- Power supply cables

Work in progress