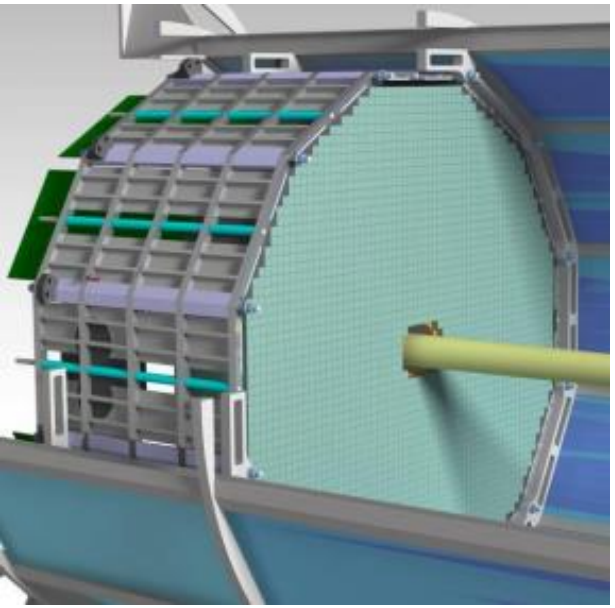
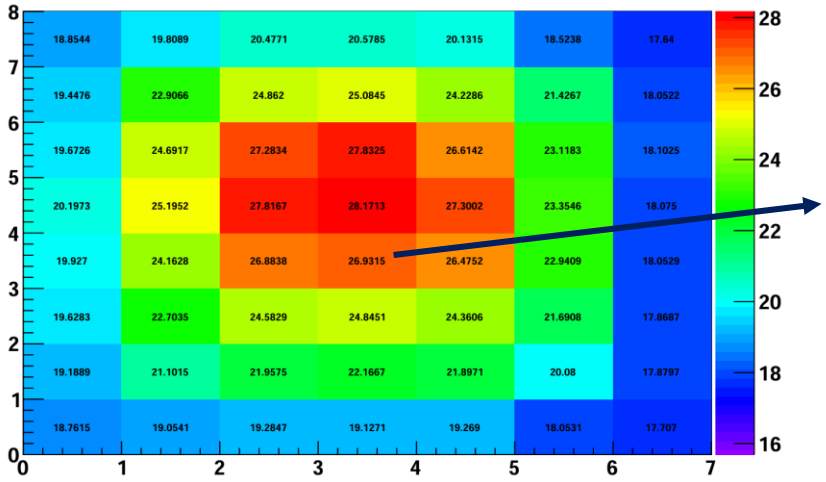
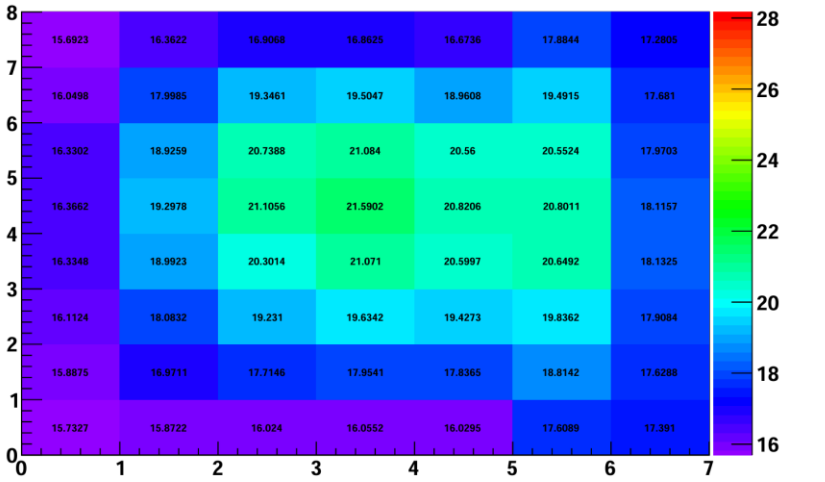
Backward ECal: cooling needs

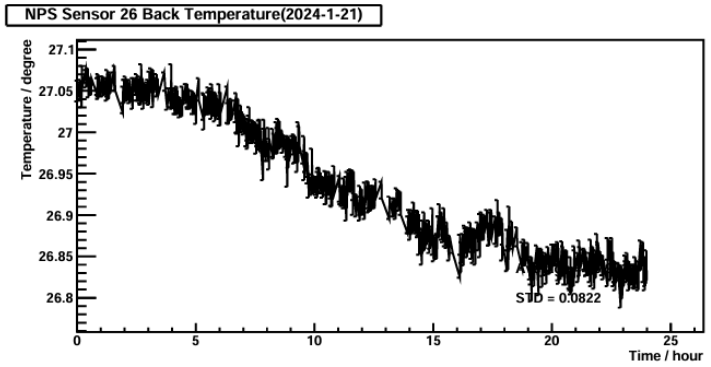


- PWO light yield is very sensitive to temperature: 2%/°C
- Goal: maintain temperature of crystals constant within ±0.1°C
- Temperature gradients across the detector and along the crystals should be minimized (but is less critical)
- Main heat sources: backward ECal electronics (50-500 W), pfRICH (~ 400W ??), DIRC (?)

NPS experience: temperature stability



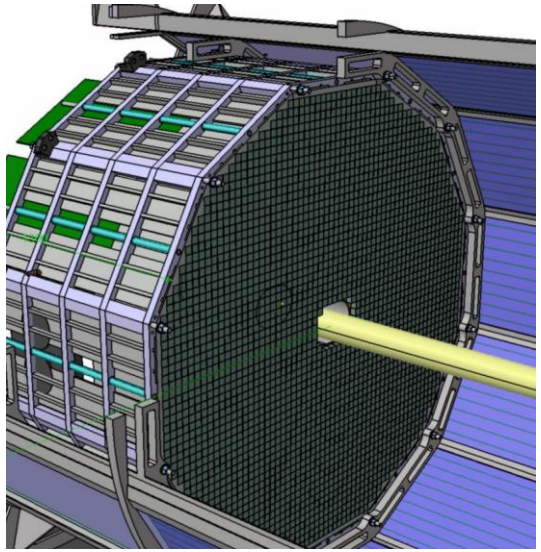


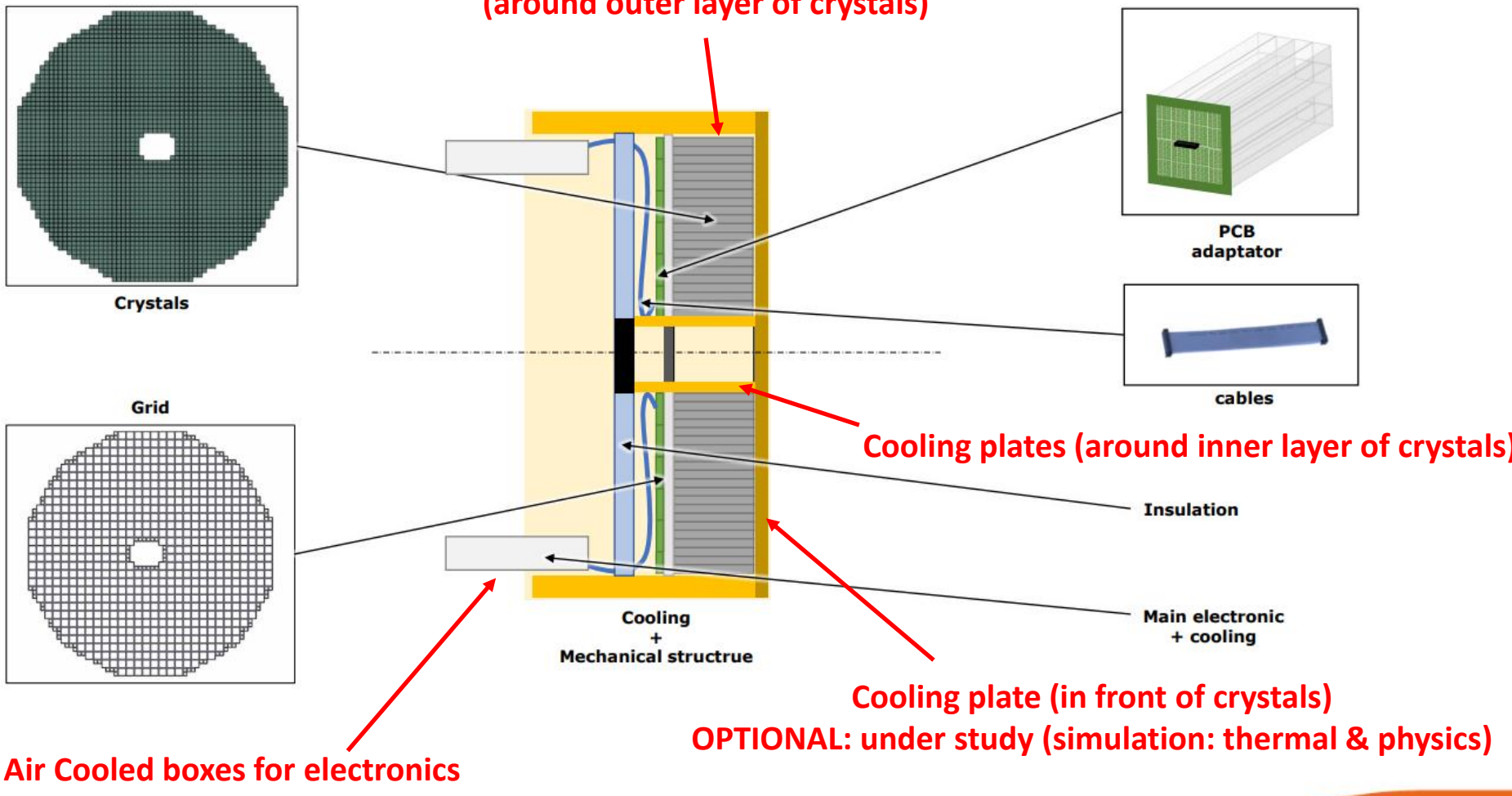


NPS voltage dividers:
500 W

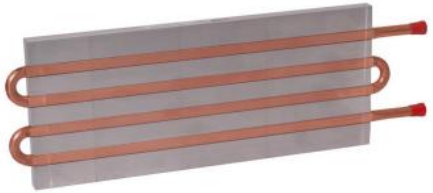
- Good stability achieved: ±0.1°C
- Very slow temperature variations: *O*(days)
- Significant gradient across the surface
- Significant gradient across crystals
- Light yield can be potentially corrected with temperature data

Backward ECal: cooling concept



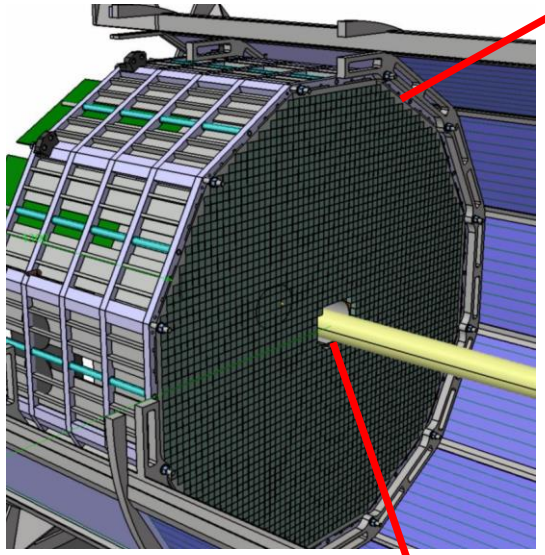


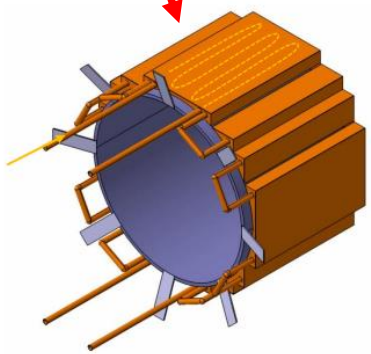
Cooling overview

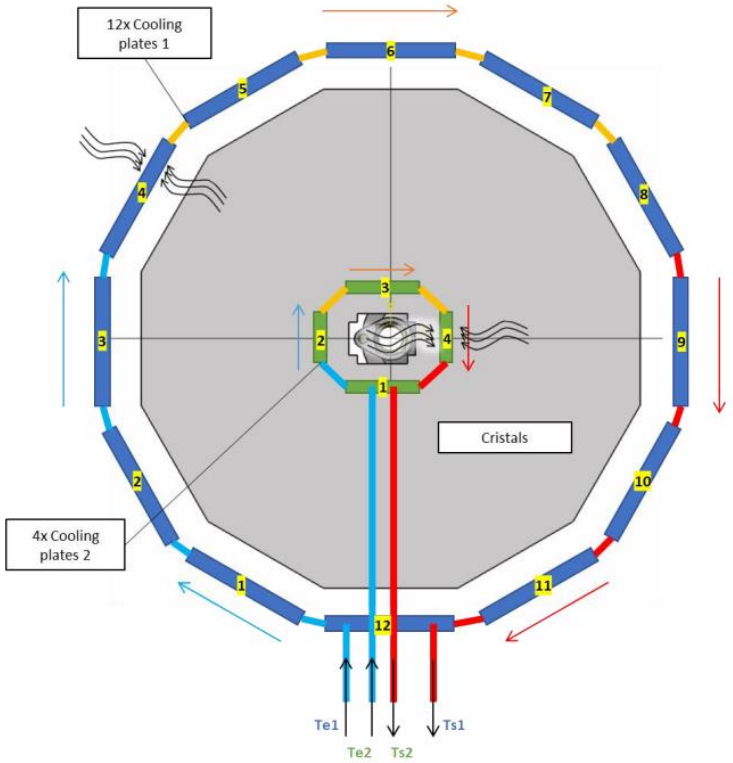


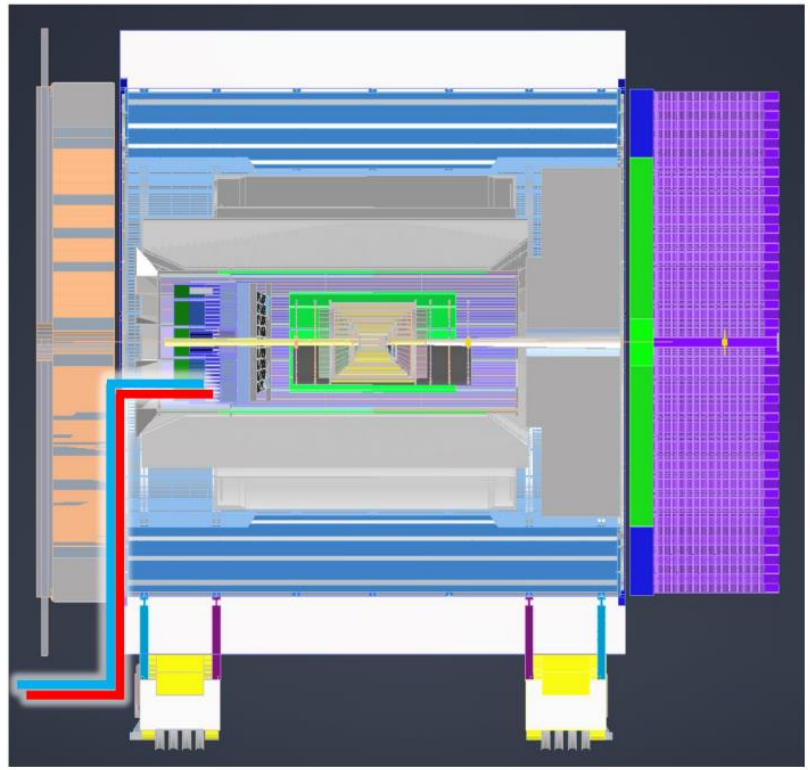
Standard coolling plates

Machined cooling plates (NPS)









Lenght of the tubing for the input & Output cooling = 10 m

Possible hardware options

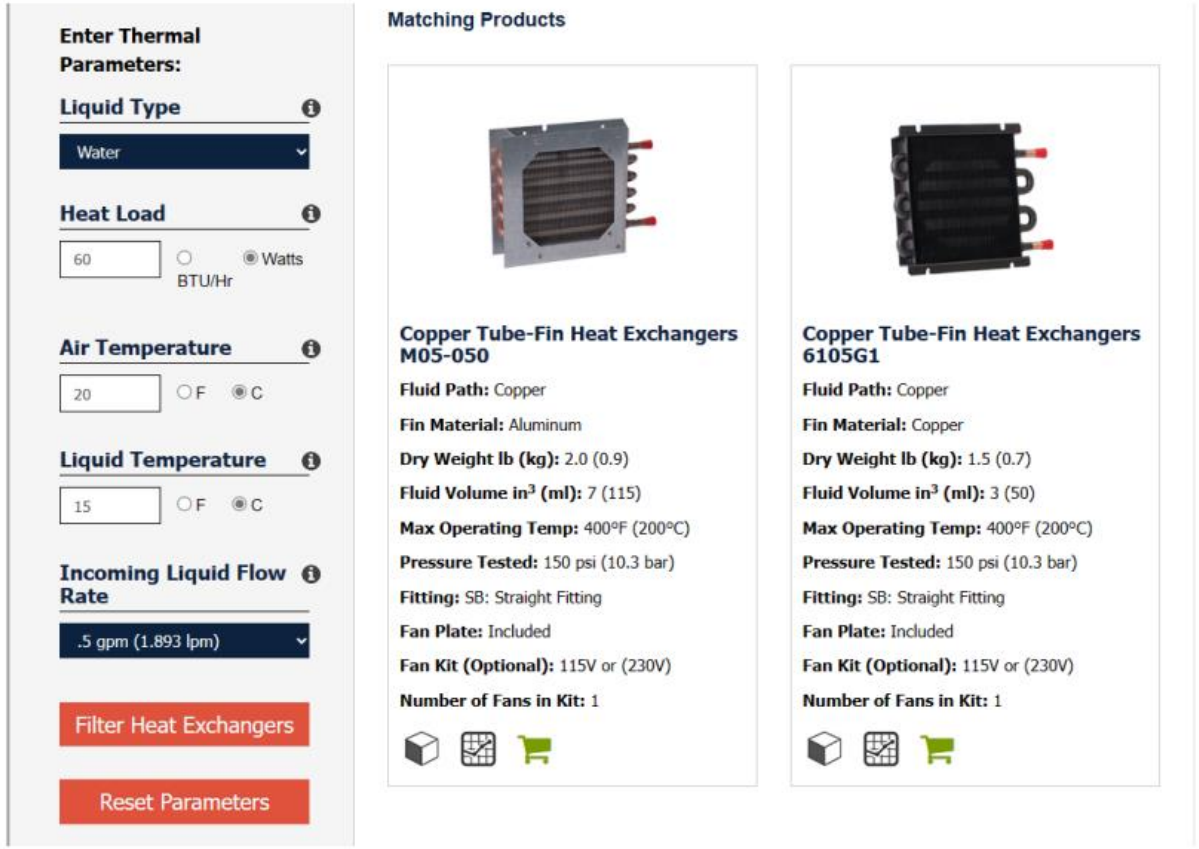
Heat exchangers:

Configuration with 12 sectors (12 boxes):

- ≈60 W to dissipate
- Ambiant air= 20-20°C
- T°C inside the boxe= to be confirmed
- Stability= 0,1°C

Solution:

- 2 chillers (1 for the boxes & 1 for the front plate)
- Power= 720W
- Flow= 1,9 Lpm (water temperature= 15°C)
- Flow= 23 Lpm (720W)



Chillers:

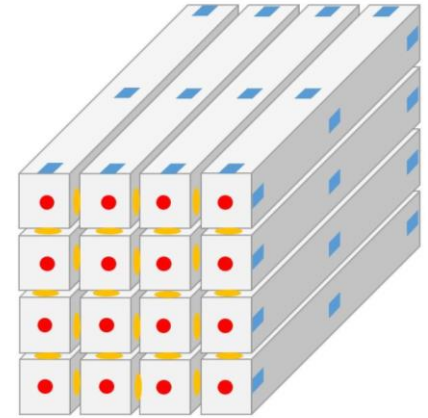
KODIAK RECIRCULATING CHILLERS
MODELS RC006, RC009, RC011, RC022, RC030 AND RC045
SERIES G03/H03/J03

Chiller (2-5 GPM)

5x5 prototype

Current design of a 5x5 SiPM readout PWO prototype

Thermal sensors along all crystals



- **Primary goal:**

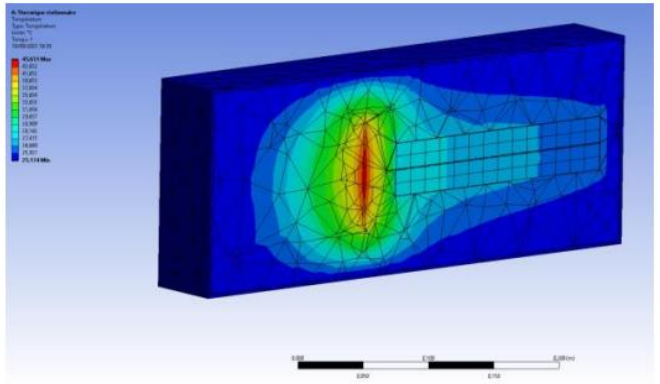
  thermal stability studies

- **Can be fully instrumented** for beam tests:
  - May/August @ CERN
  - June@DESY?
  - Fall'24 @ JLab

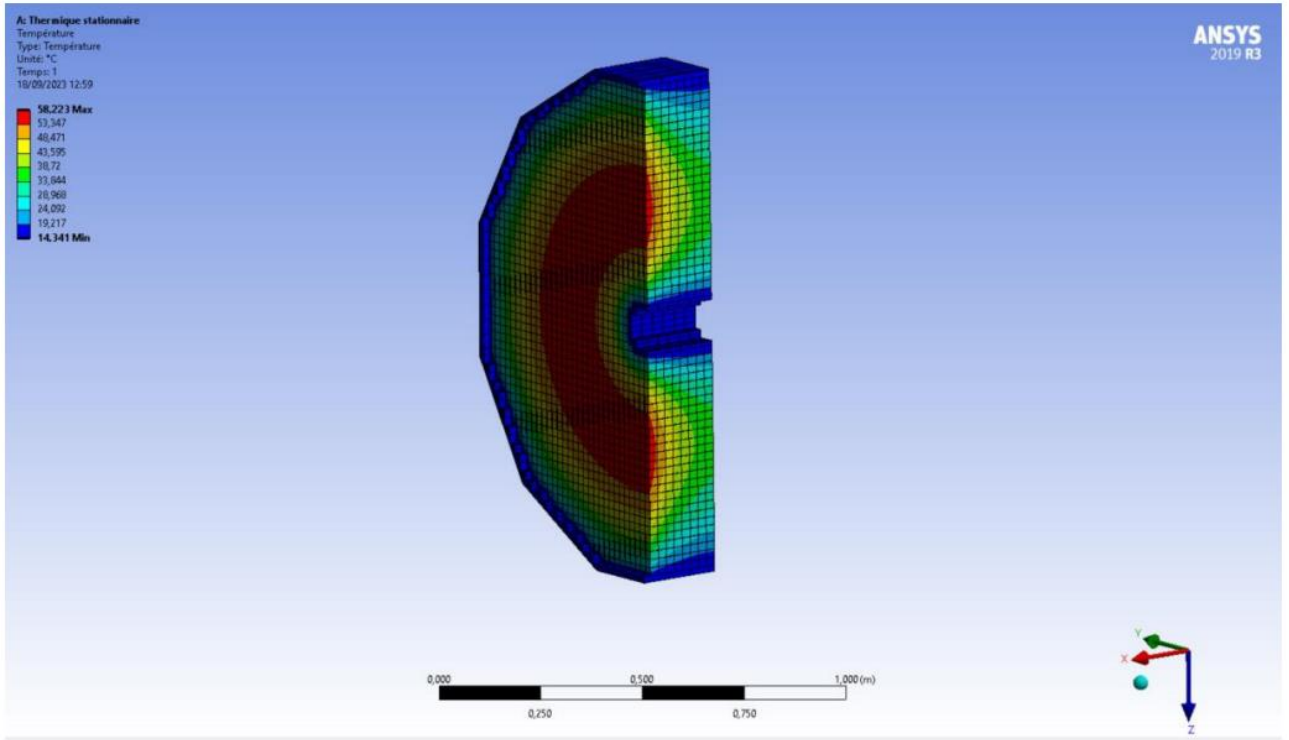
Thermal simulations

ANSYS simulations ongoing:

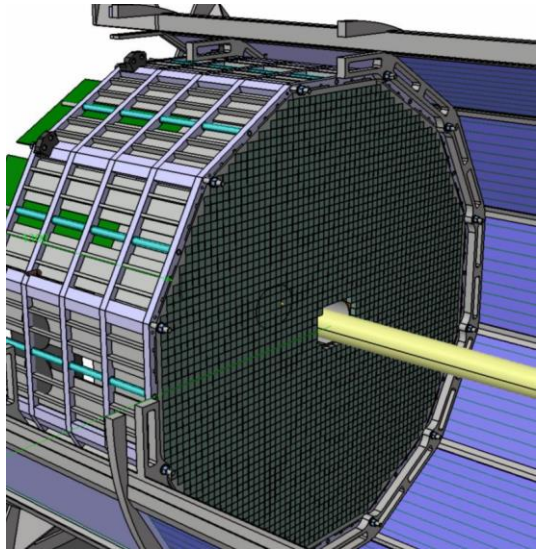
5x5 prototype simulation :



Full detector simulation



Summary



- Conceptual model for cooling of the backward ECal exists
- Exact details can only be implemented when more information is known on electronics and power dissipation from other detectors