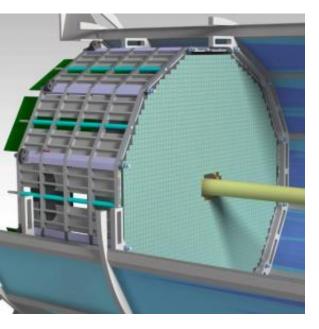


Backward ECal: cooling needs



- > 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 (?)

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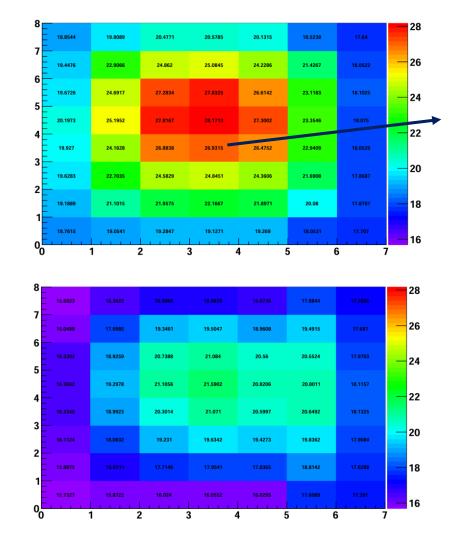


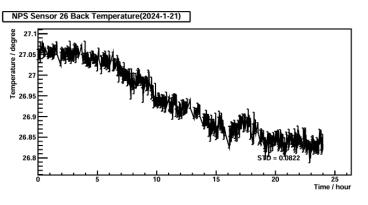
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NPS voltage dividers: 500 W

- 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

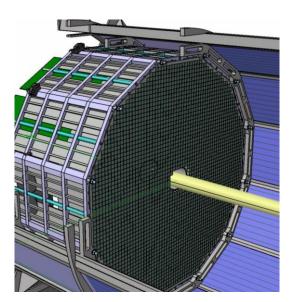
01/22/2024

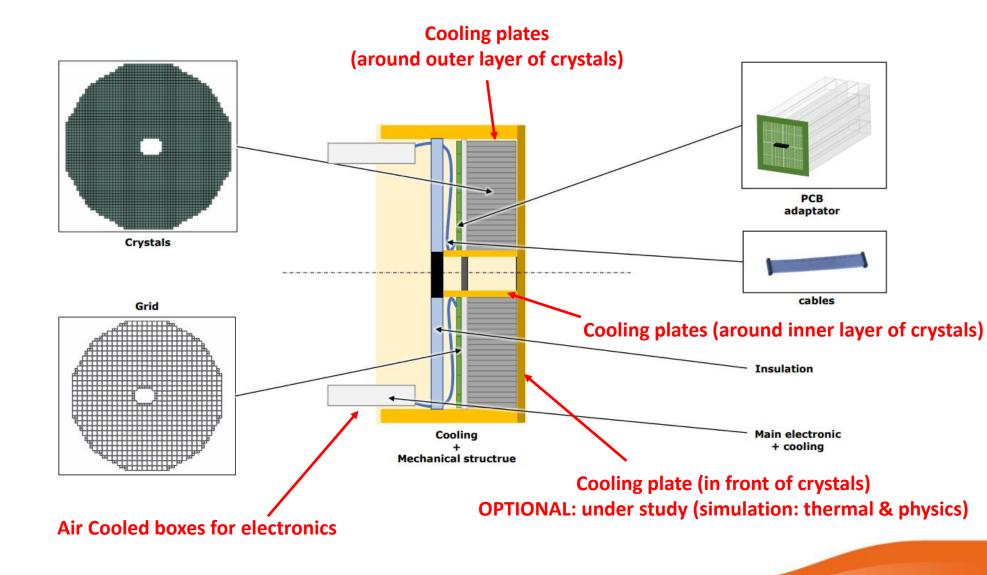
Backward ECal: cooling concept



D'ORSAY









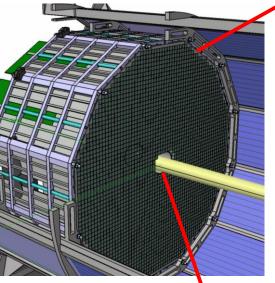
Cooling overview

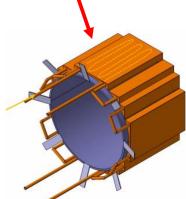


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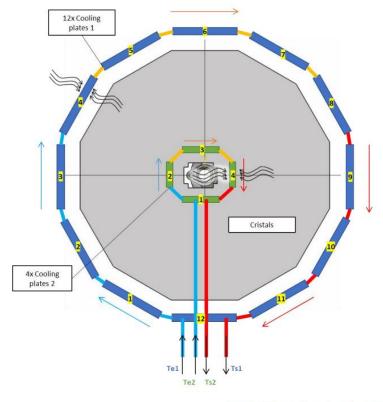


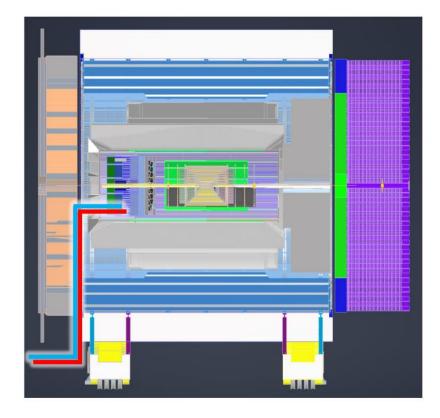


Standard coolling plates



Machined cooling plates (NPS)





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

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ePIC TIC meeting



Configuration with 12 sectors (12 boxes):

T°C inside the boxe = to be

2 chillers (1 for the boxes & 1

for the front plate)

Flow= 1,9 Lpm (water

temperature = 15°C)

Flow= 23 Lpm (720W)

 ≈60 W to dissipate Ambiant air= 20-20°C

confirmed

Solution:

Stability = 0,1°C

Power= 720W

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Possible hardware options

a



Chillers:

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



Chiller (2-5 GPM)



Heat exchangers:

Enter Thermal
Parameters:
Liquid Type
December 201

Heat Load Watts 60 BTU/Hr

Air Temperature 0 OF @C 20

Liquid Temperature () OF @C 15

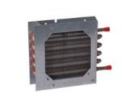
Incoming Liquid Flow () Rate

.5 gpm (1.893 lpm)

Filter Heat Exchangers

Reset Parameters

Matching Products



Copper Tube-Fin Heat Exchangers M05-050 Fluid Path: Copper Fin Material: Aluminum Dry Weight lb (kg): 2.0 (0.9) Fluid Volume in³ (ml): 7 (115) Max Operating Temp: 400°F (200°C) Pressure Tested: 150 psi (10.3 bar)

Fitting: SB: Straight Fitting

Fan Plate: Included Fan Kit (Optional): 115V or (230V)

> Number of Fans in Kit: 1 1



Copper Tube-Fin Heat Exchangers 6105G1 Fluid Path: Copper Fin Material: Copper Dry Weight lb (kg): 1.5 (0.7) Fluid Volume in³ (ml): 3 (50) Max Operating Temp: 400°F (200°C) Pressure Tested: 150 psi (10.3 bar) Fitting: SB: Straight Fitting Fan Plate: Included Fan Kit (Optional): 115V or (230V) Number of Fans in Kit: 1



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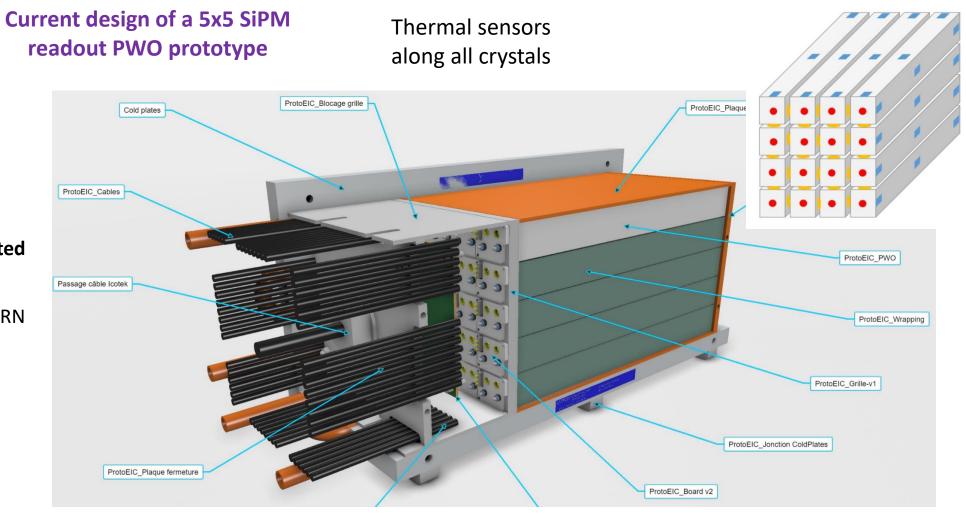
Primary goal:

thermal stability studies

- Can be fully instrumented for beam tests:
 - May/August @ CERN

5x5 prototype

- June@DESY?
- Fall'24 @ JLab



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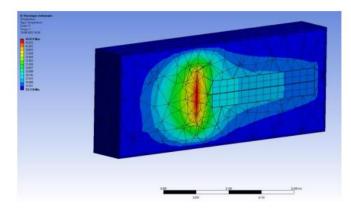
Thermal simulations



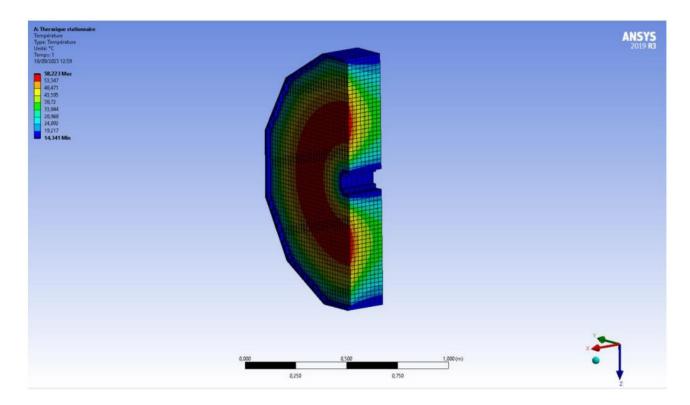
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ANSYS simulations ongoing:

5x5 prototype simulation :



Full detector simulation





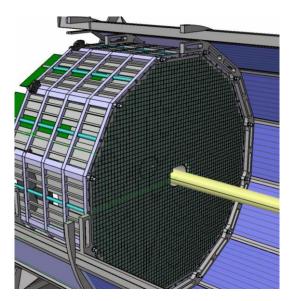


Summary



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- > 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