

CFD simulation

- Thermal mock-up program -

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CERN (EN/CV/PJ)

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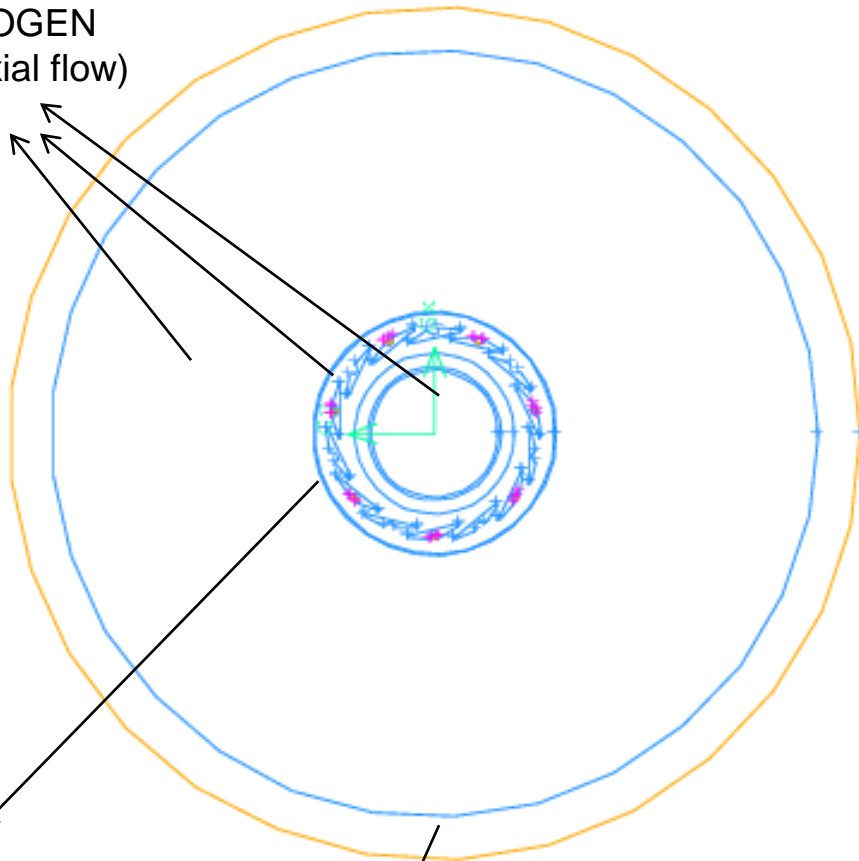


Motivation

- ❑ CFD simulations have already been performed to check the thermal behavior of IBL during bake-out and normal operation.
- ❑ A validation of CFD simulations is needed.
- ❑ The results of CFD simulations will be compared against experimental data from the thermal mock-up.

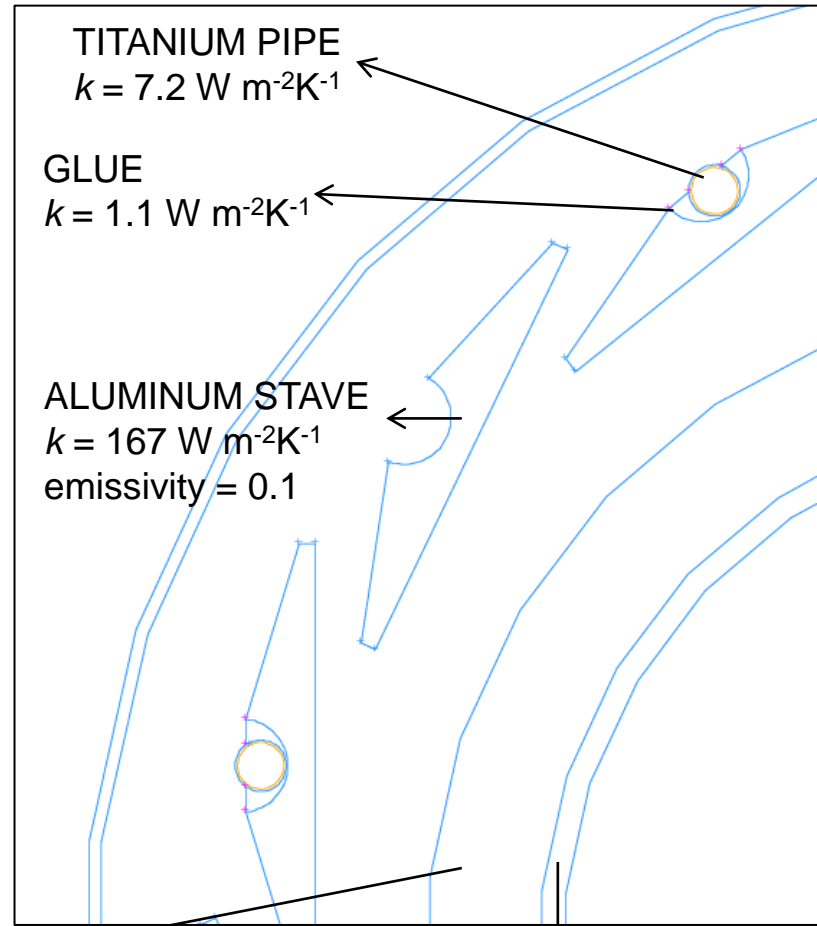


NITROGEN
(no axial flow)



IST
OD 85.8 mm, 0.52 mm thick
 $k = 155 \text{ W m}^{-2}\text{K}^{-1}$
emissivity = 1

PLEXIGLASS TUBE
ID 270 mm, OD 300 mm
 $k = 0.2 \text{ W m}^{-2}\text{K}^{-1}$



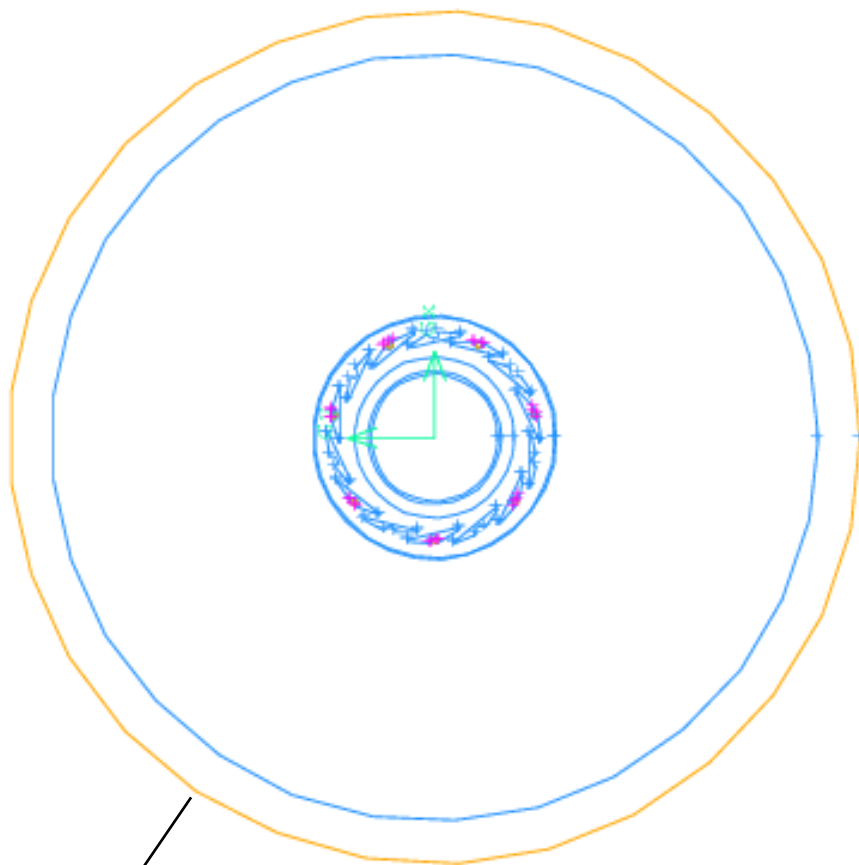
TITANIUM PIPE
 $k = 7.2 \text{ W m}^{-2}\text{K}^{-1}$

GLUE
 $k = 1.1 \text{ W m}^{-2}\text{K}^{-1}$

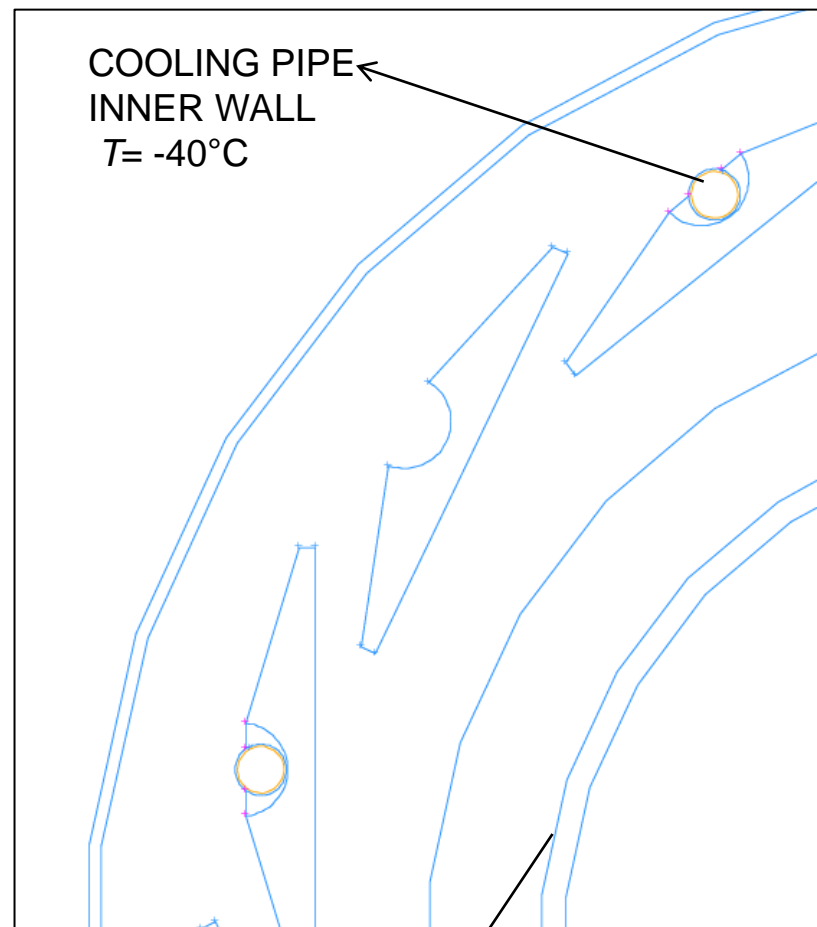
ALUMINUM STAVE
 $k = 167 \text{ W m}^{-2}\text{K}^{-1}$
emissivity = 0.1

PYROGEL
thickness 3 mm
 $k = 0.0147 \text{ W m}^{-2}\text{K}^{-1}$ @ 38 °C
 $k = 0.028 \text{ W m}^{-2}\text{K}^{-1}$ @ 250 °C
emissivity = 0.5 (kapton)

ALUMINUM BP
ID 44.68 mm, 1.05 mm thick
 $k = 167 \text{ W m}^{-2}\text{K}^{-1}$

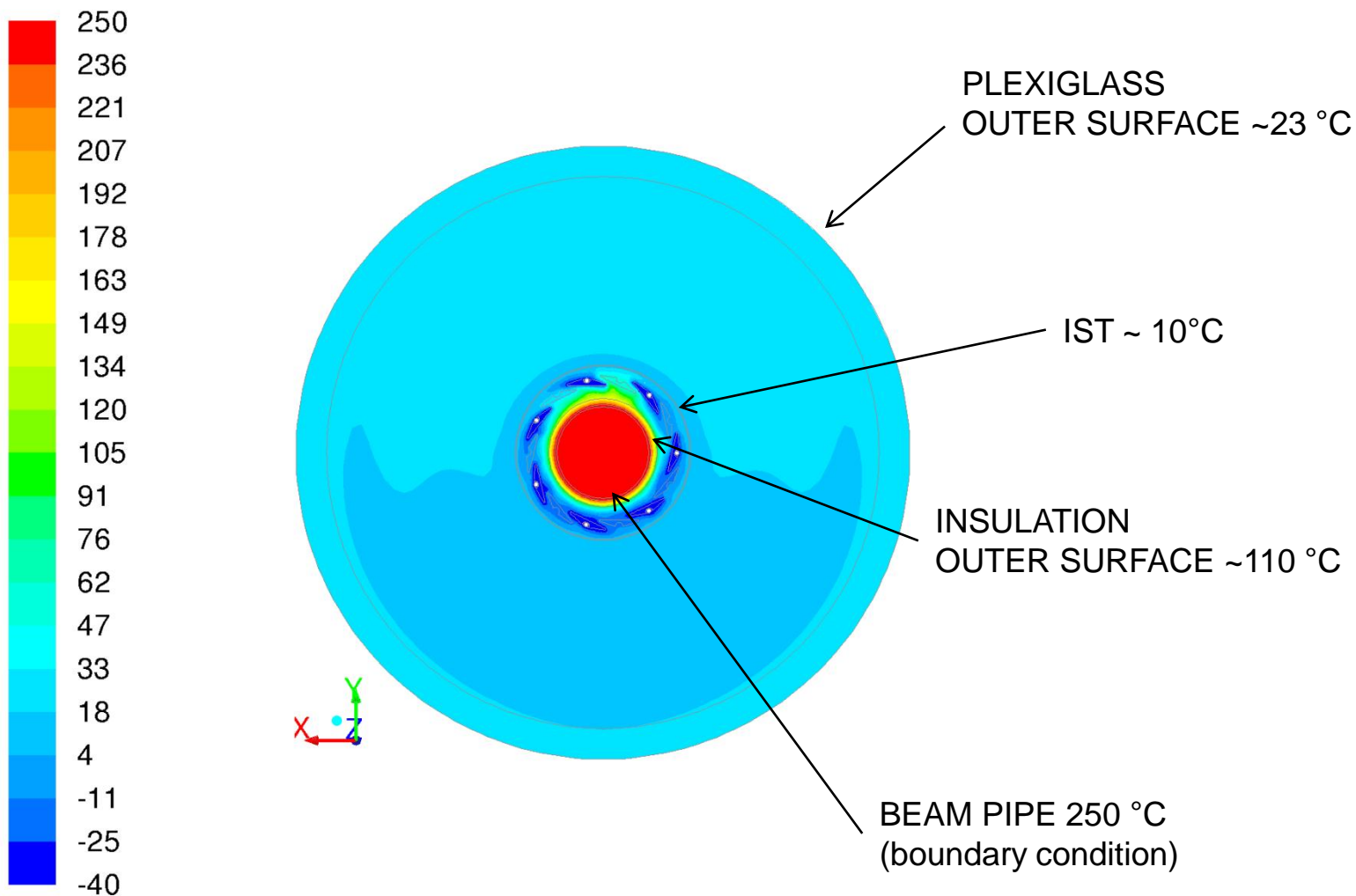


OUTER ENVIRONMENT
 $h = 10 \text{ W m}^{-2} \text{ K}^{-1}$, $T = 25^\circ\text{C}$



COOLING PIPE
INNER WALL
 $T = -40^\circ\text{C}$

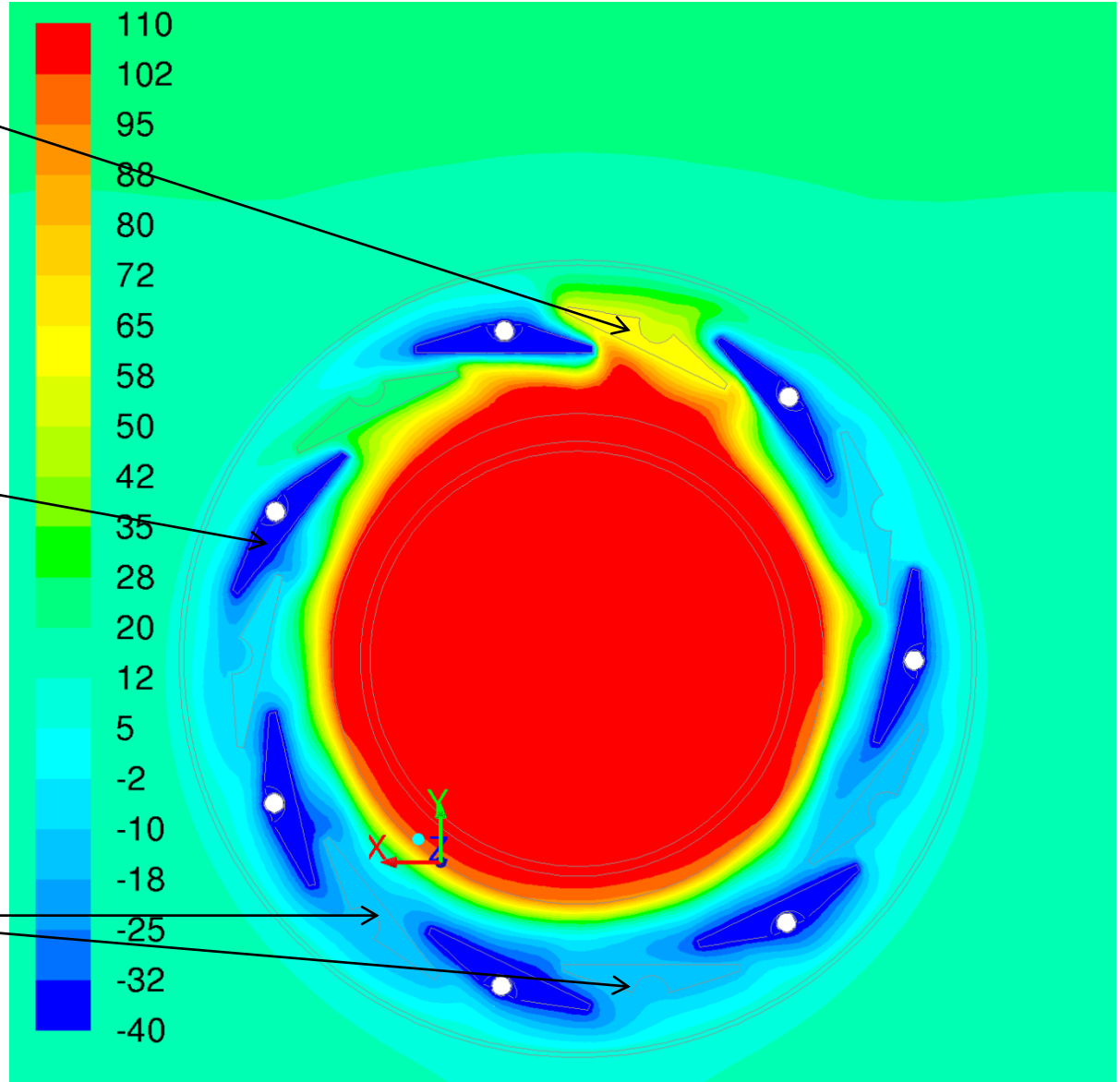
ALUMINUM BEAM PIPE
 $T = 250^\circ\text{C}$

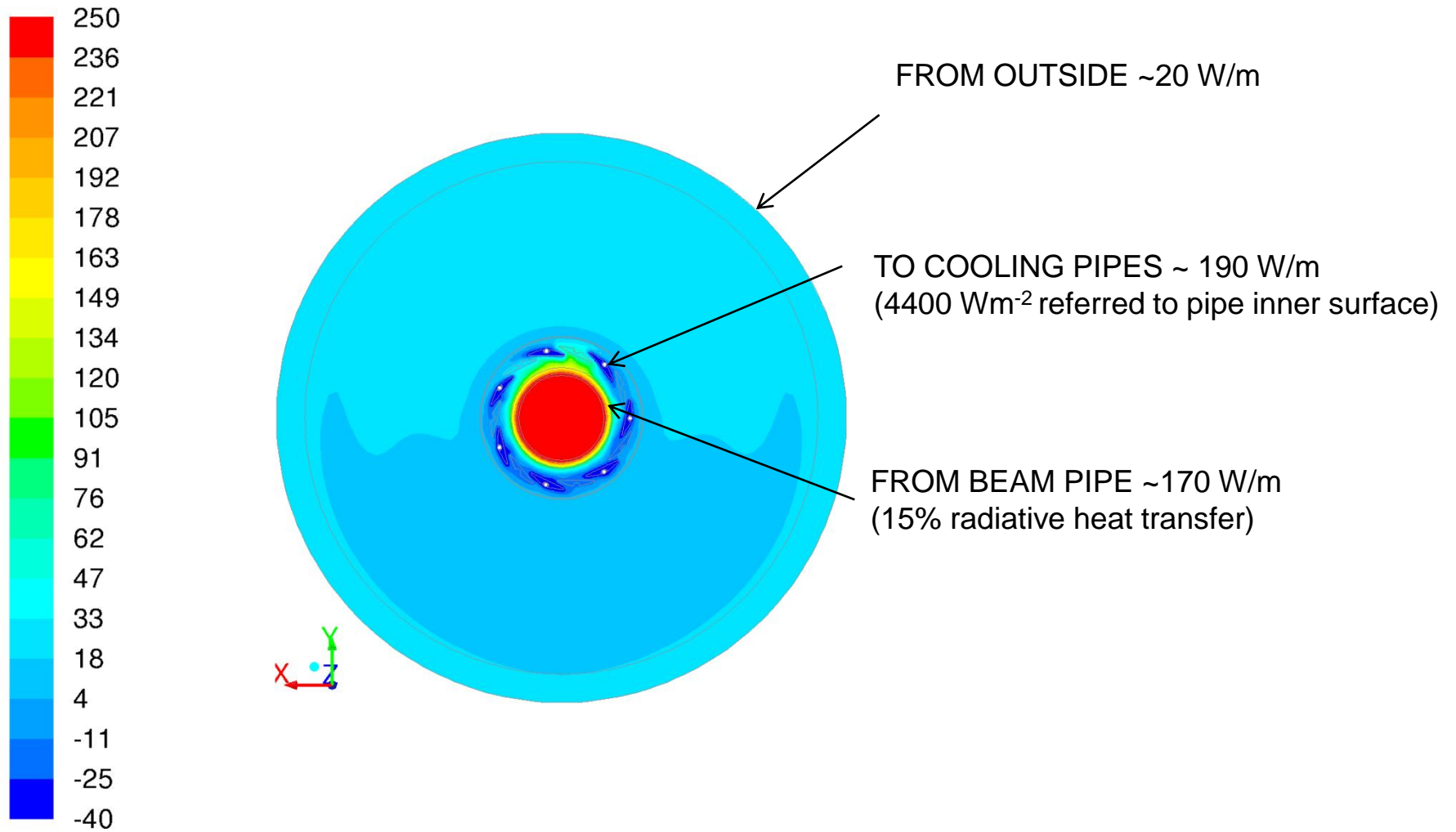


UNCOOLED STAVE
(TOP) ~ 60°C

COOLED STAVES ~ -40 °C

UNCOOLED STAVE
(BOTTOM) ~ -15°C





Thank you