# The cooling system of the luminosity detector

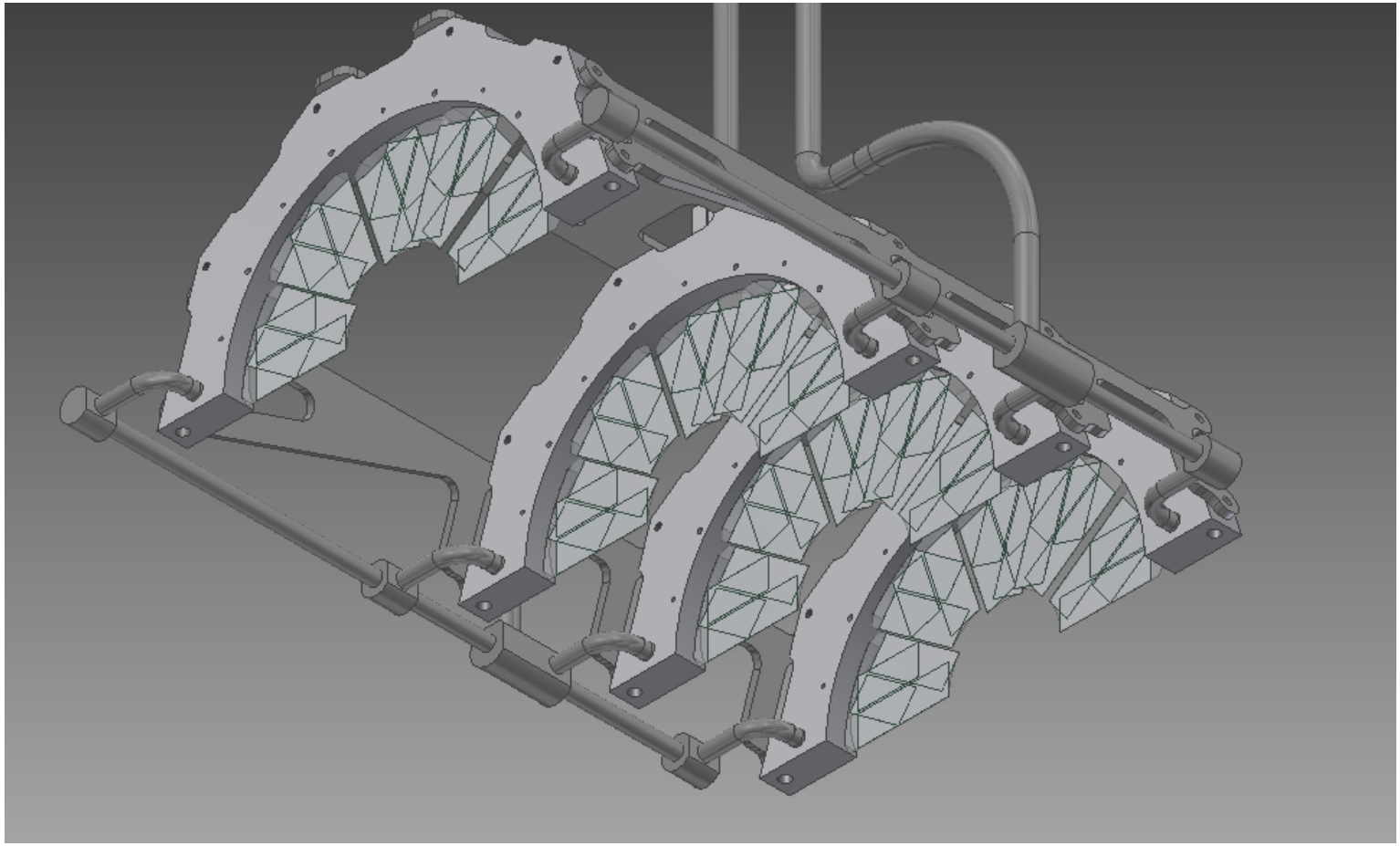
Heinrich Leithoff

Helmholtz Institut Mainz

PANDA-Collaboration-Meeting Darmstadt
December 11, 2012

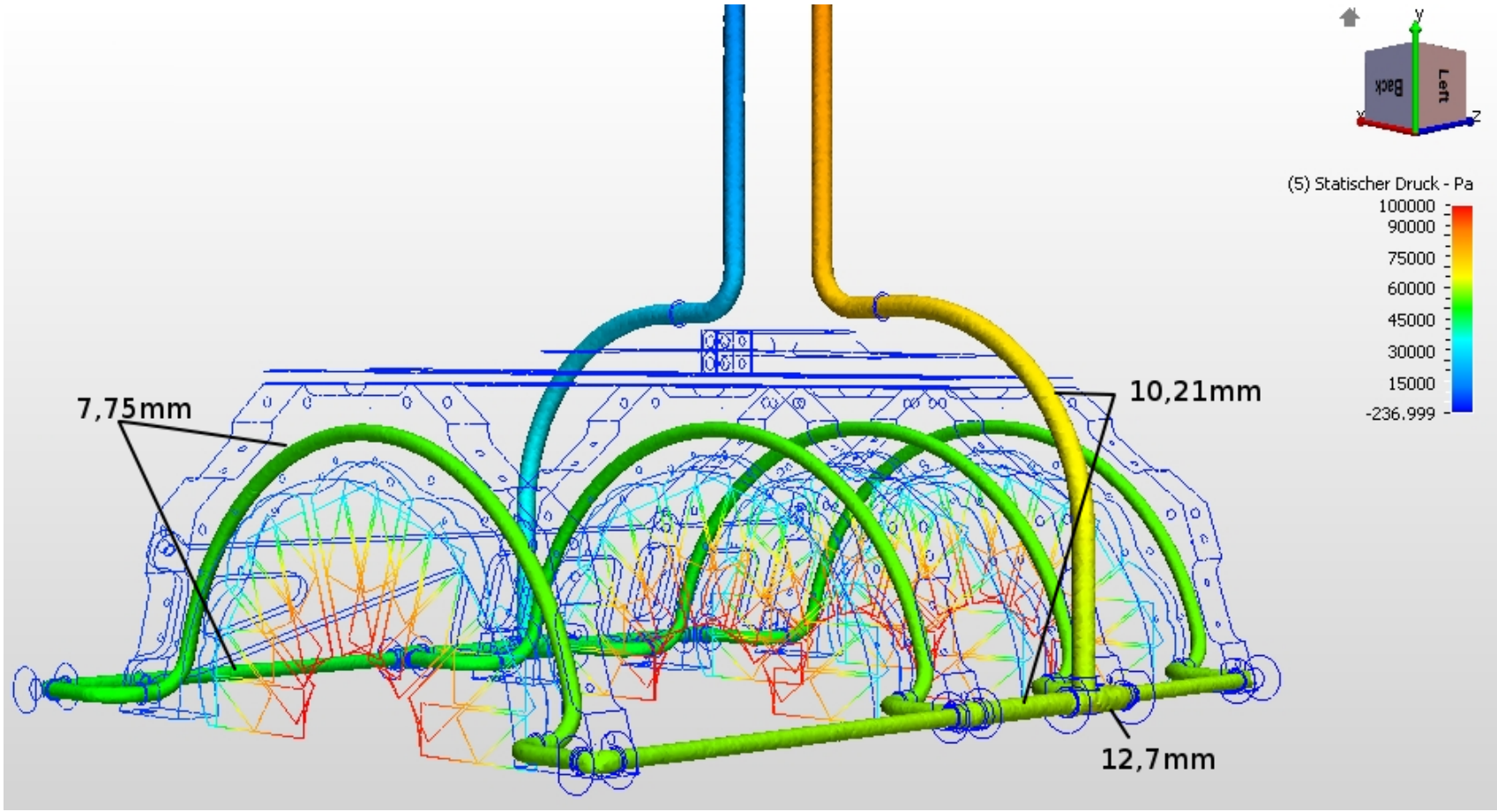

Helmholtz Institute Mainz

# General setup



Estimated power consumption: Up to 1,12 kW

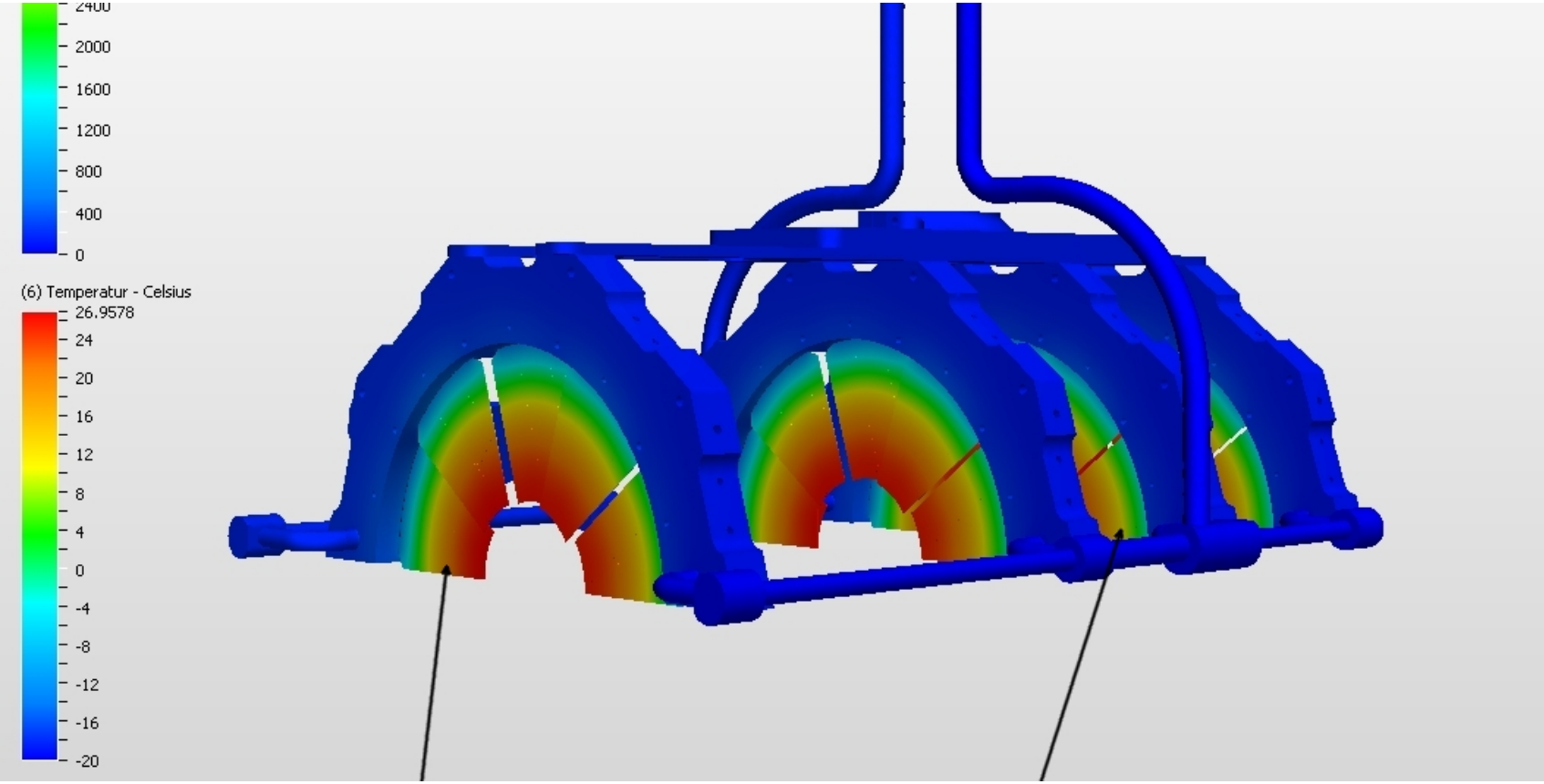
# Pressure distribution




1 bar at the inlet and 0 bar at the outlet applied

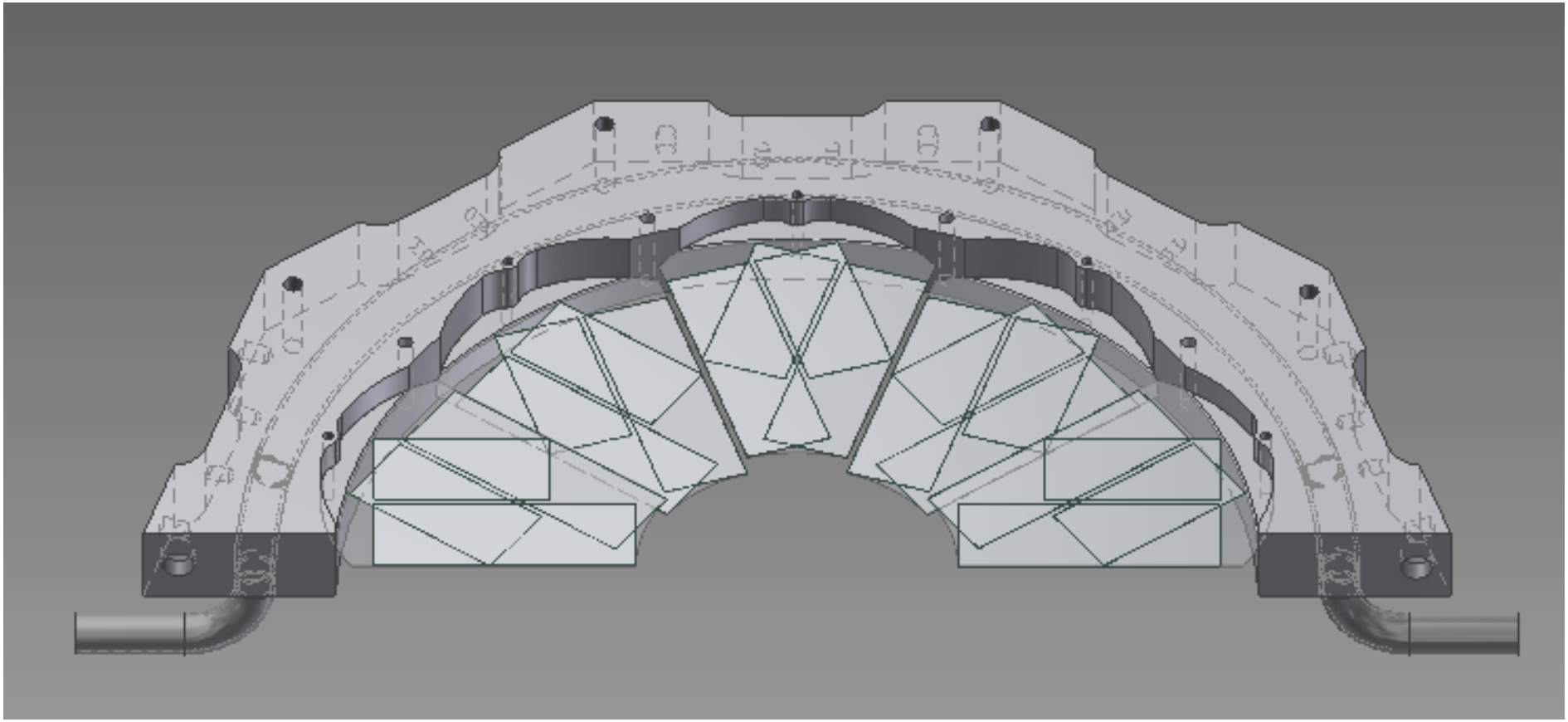
No significant pressure drop expected

# Temperature distribution



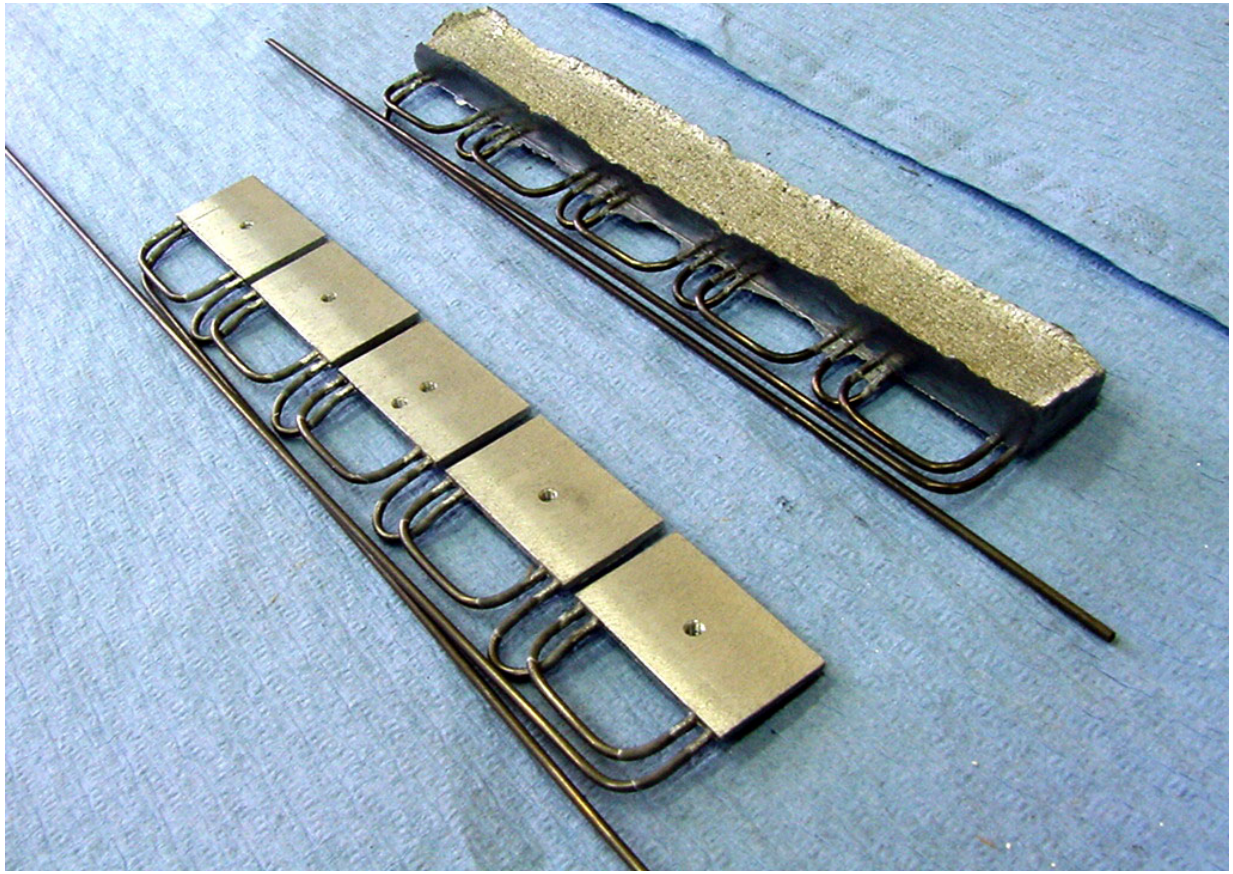

| | warmest diamond | coldest diamond |
|---|---|---|
| $\frac{T_{min}}{^\circ C}$ | -15,683 | -17,155 |
| $\frac{T_{max}}{^\circ C}$ | 26,955 | 25,494 |

# Cooling support with sensors



- A good contact between cooling pipe and aluminium is needed
- Can we melt aluminium around a stainless steel pipe?

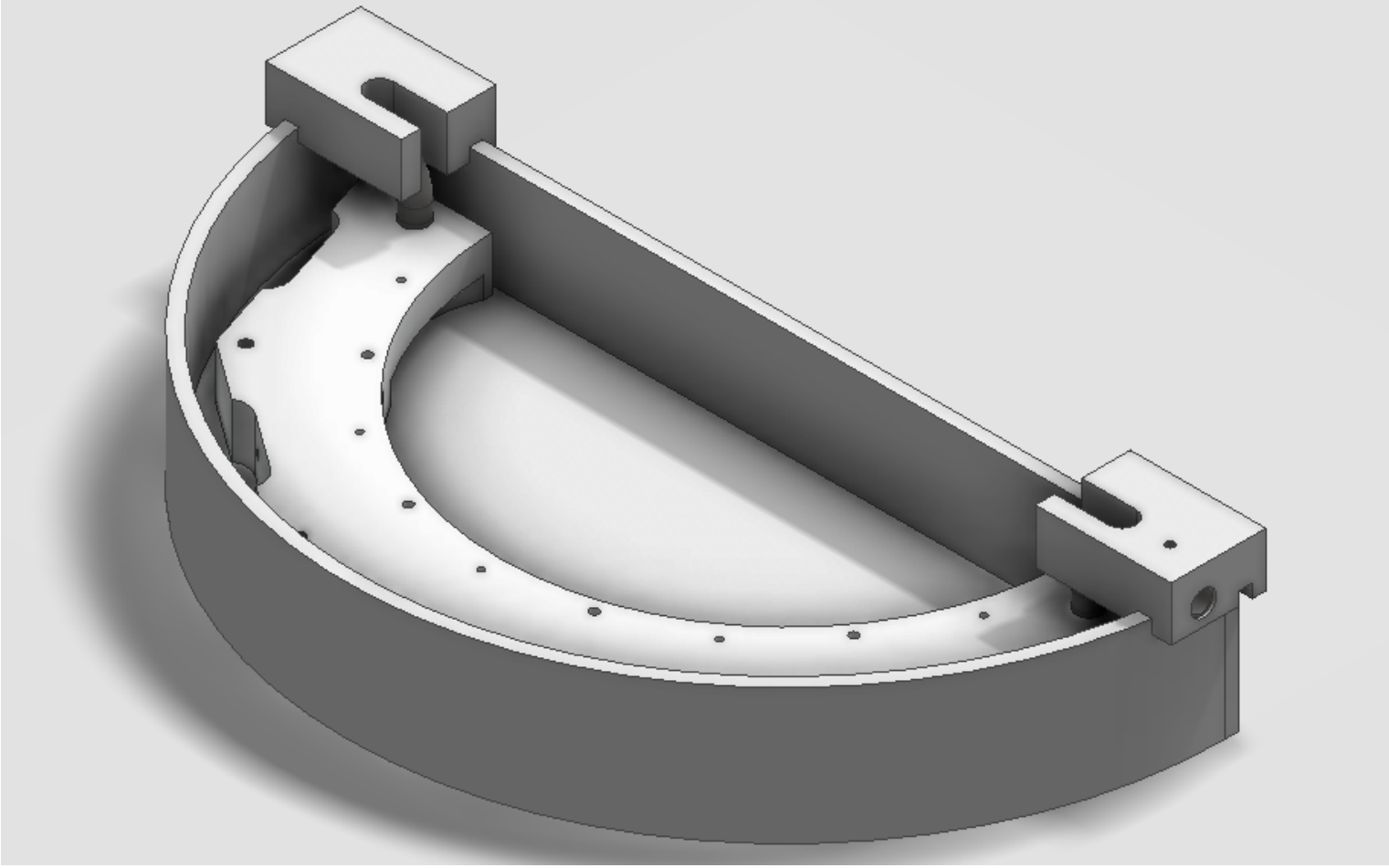
# Melting aluminium around stainless steel pipes



http://www.nikhef.nl/pub/departments/mt/projects/lhcb-vertex/production/Coolingsystem/DSC05408.JPG

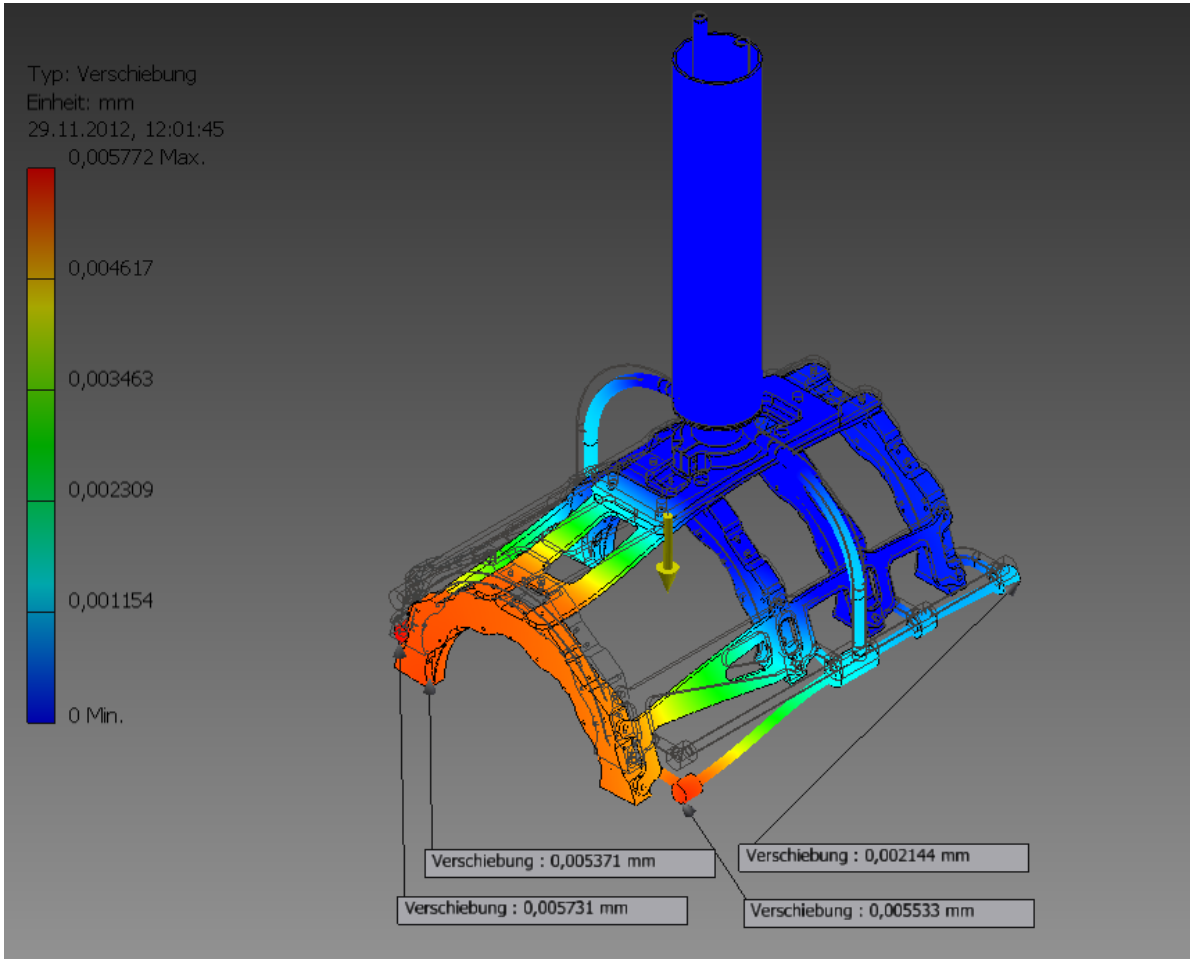
The VELO-detector used much smaller pipes (⌀ 1,5mm)

# Casting mould with cooling support



The pipe can move in one direction during the melting process
First tests are planned to be made in Jülich end of January

# Mechanical Stability



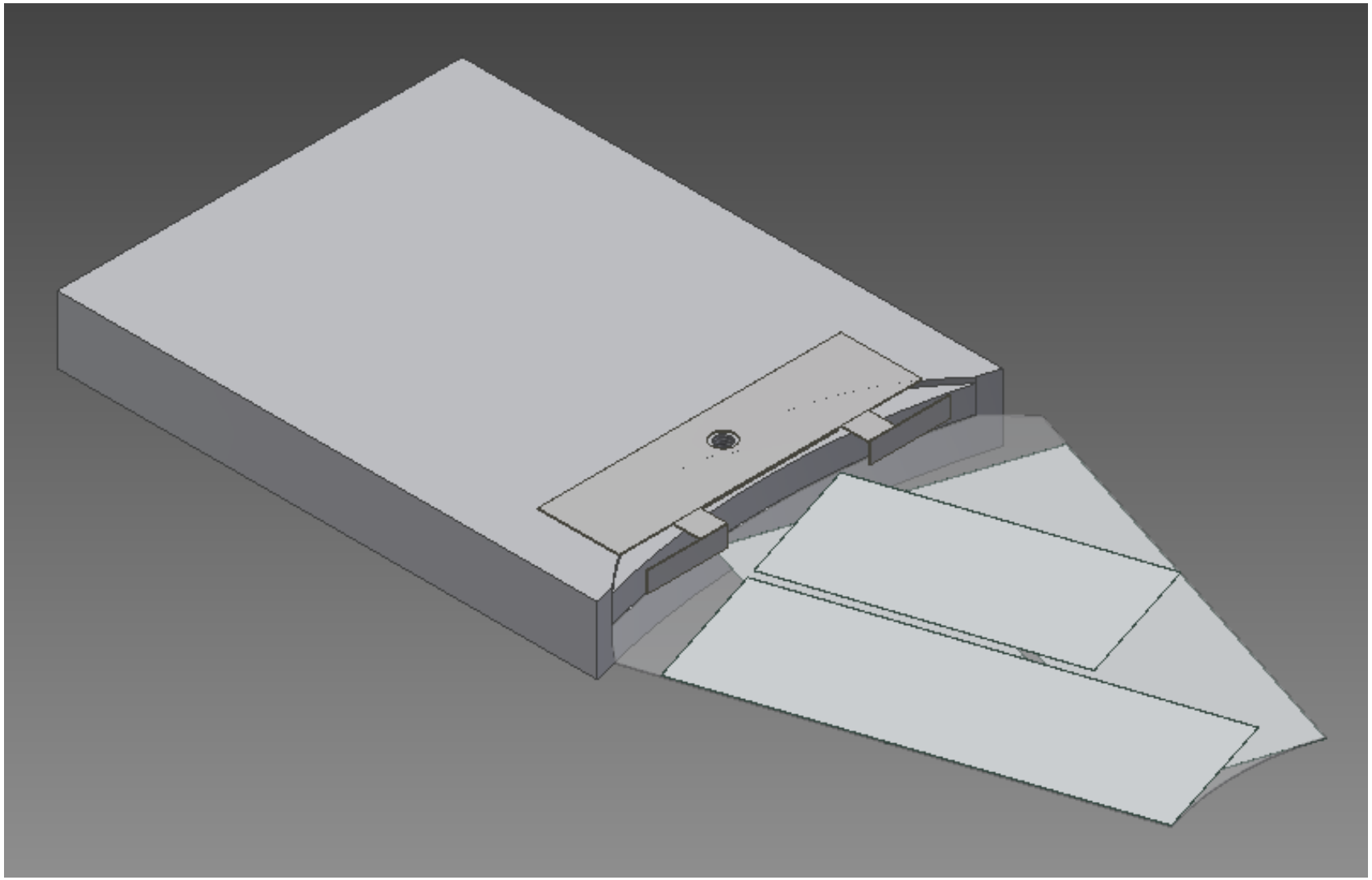

Displacement by gravitation is small ($< 10\%$ of pixel size)

# Summary and outlook

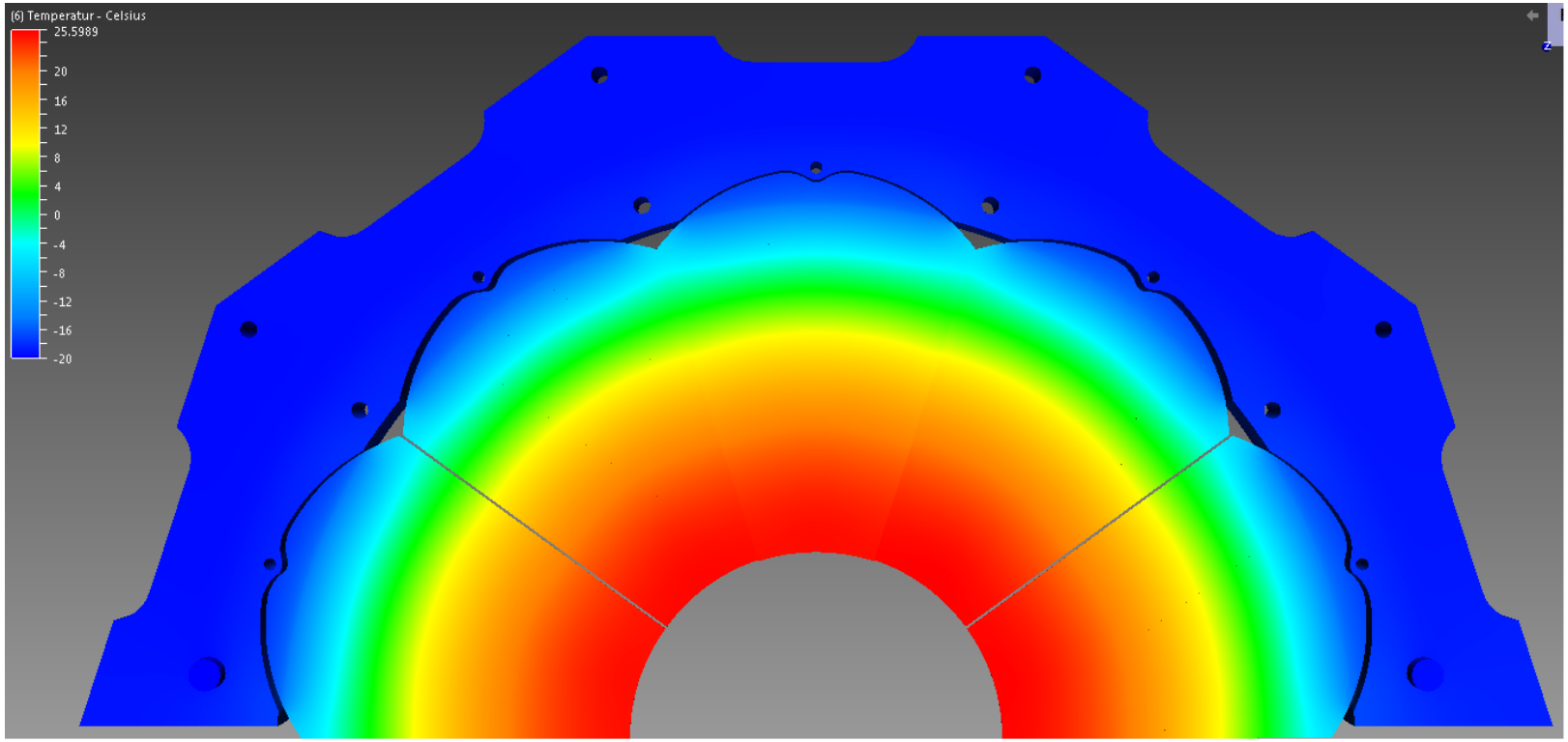
- Simulations of thermal behaviour are promising, but they need to be tested
- Current design has advantage of good thermal contact, but the production may be difficult

What is next:

- test the mounting of the diamond wafer on an aluminium block
- test the thermal behaviour of the diamond wafer
- melt aluminium around a pipe in the casting mould and find suitable process parameters

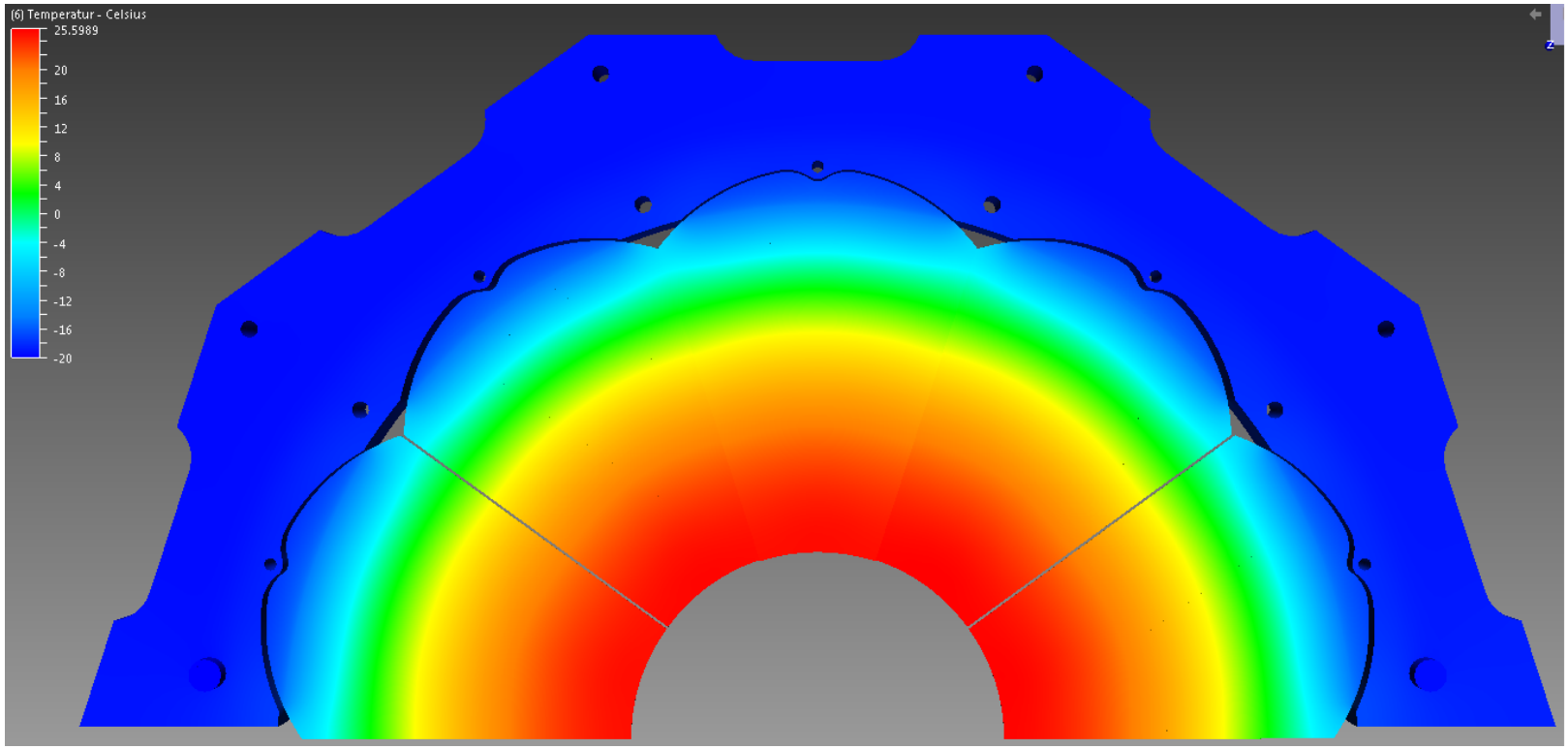


# How many pipes do we need?



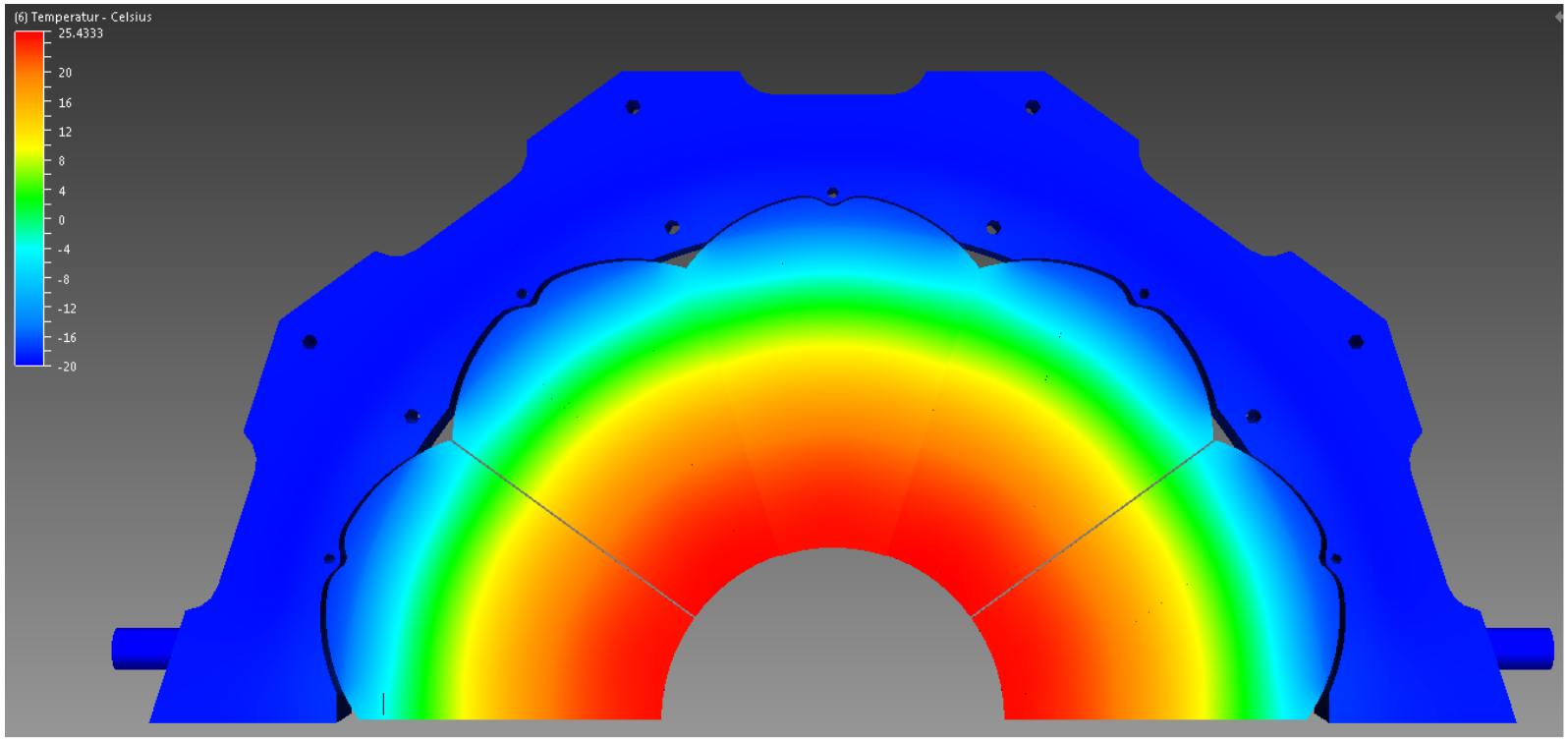

simulation with two pipes and opposite flow directions:

| | warmest diamond | coldest diamond |
|---|---|---|
| $\frac{T_{min}}{^\circ C}$ | -16,734 | -17,193 |
| $\frac{T_{max}}{^\circ C}$ | 25,882 | 25,566 |




simulation with two pipes and parallel flow directions:

| | warmest diamond | coldest diamond |
|---|---|---|
| $\frac{T_{min}}{^\circ C}$ | -16,989 | -17,717 |
| $\frac{T_{max}}{^\circ C}$ | 25,598 | 25,026 |




| | warmest diamond | coldest diamond |
|---|---|---|
| $\frac{T_{min}}{^\circ C}$ | -15,573 | -17,139 |
| $\frac{T_{max}}{^\circ C}$ | 26,998 | 25,139 |

Temperature gradient for 200 $\mu$m diamond wafer is roughly 40° in the worst case