The luminosity detector and it's integration into PANDA

Progress report

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10.09.2012
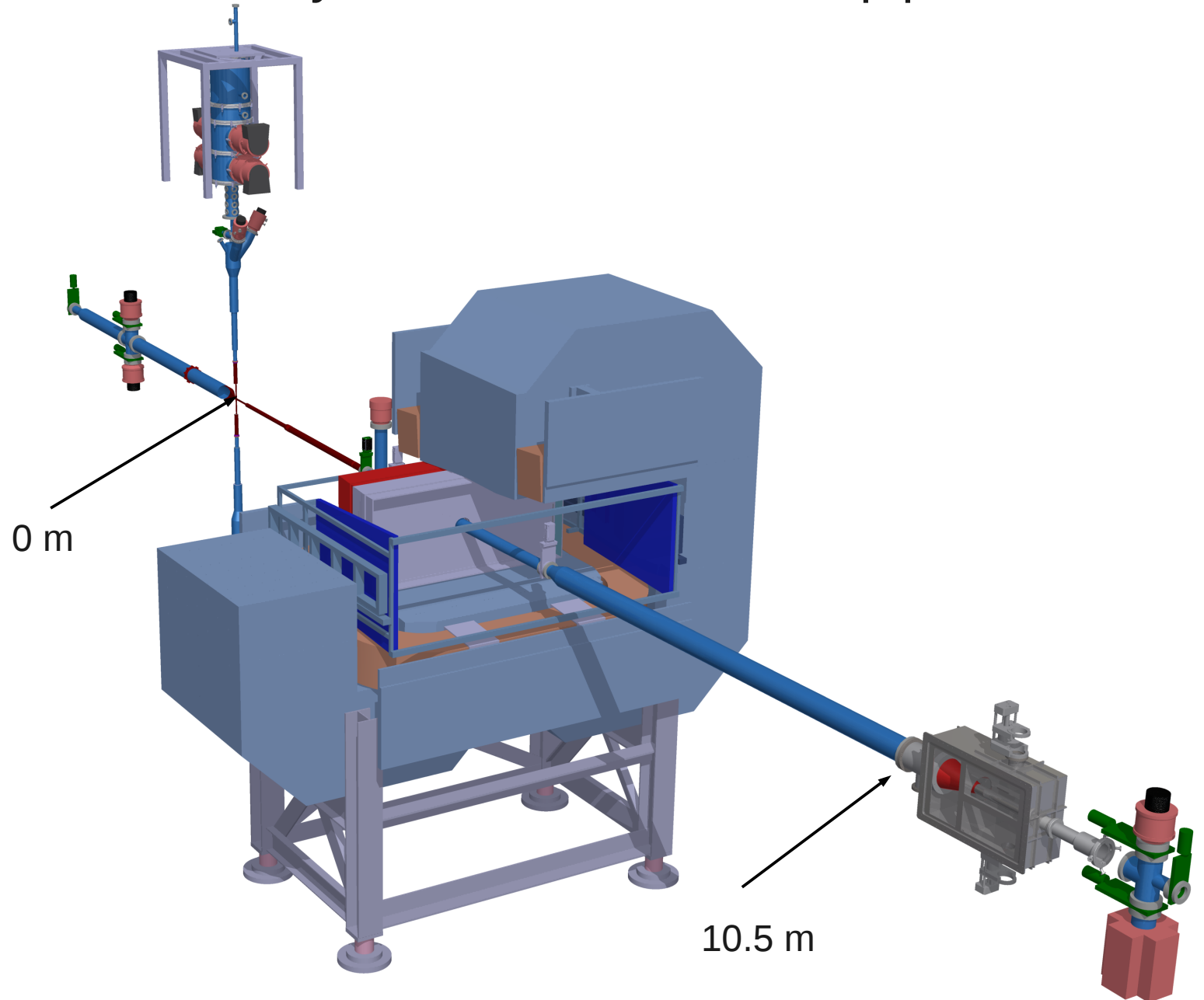PANDA Collaboration meeting

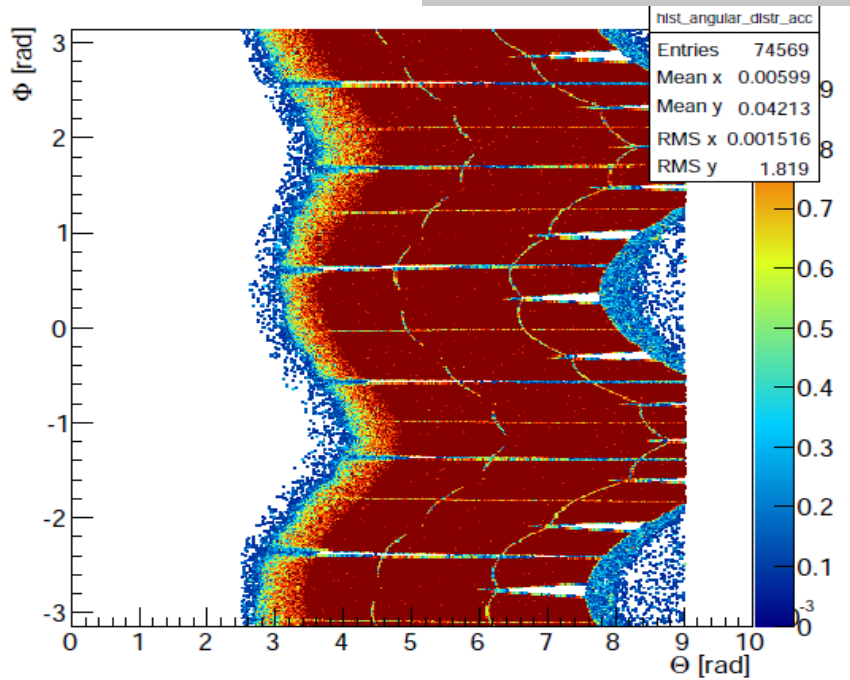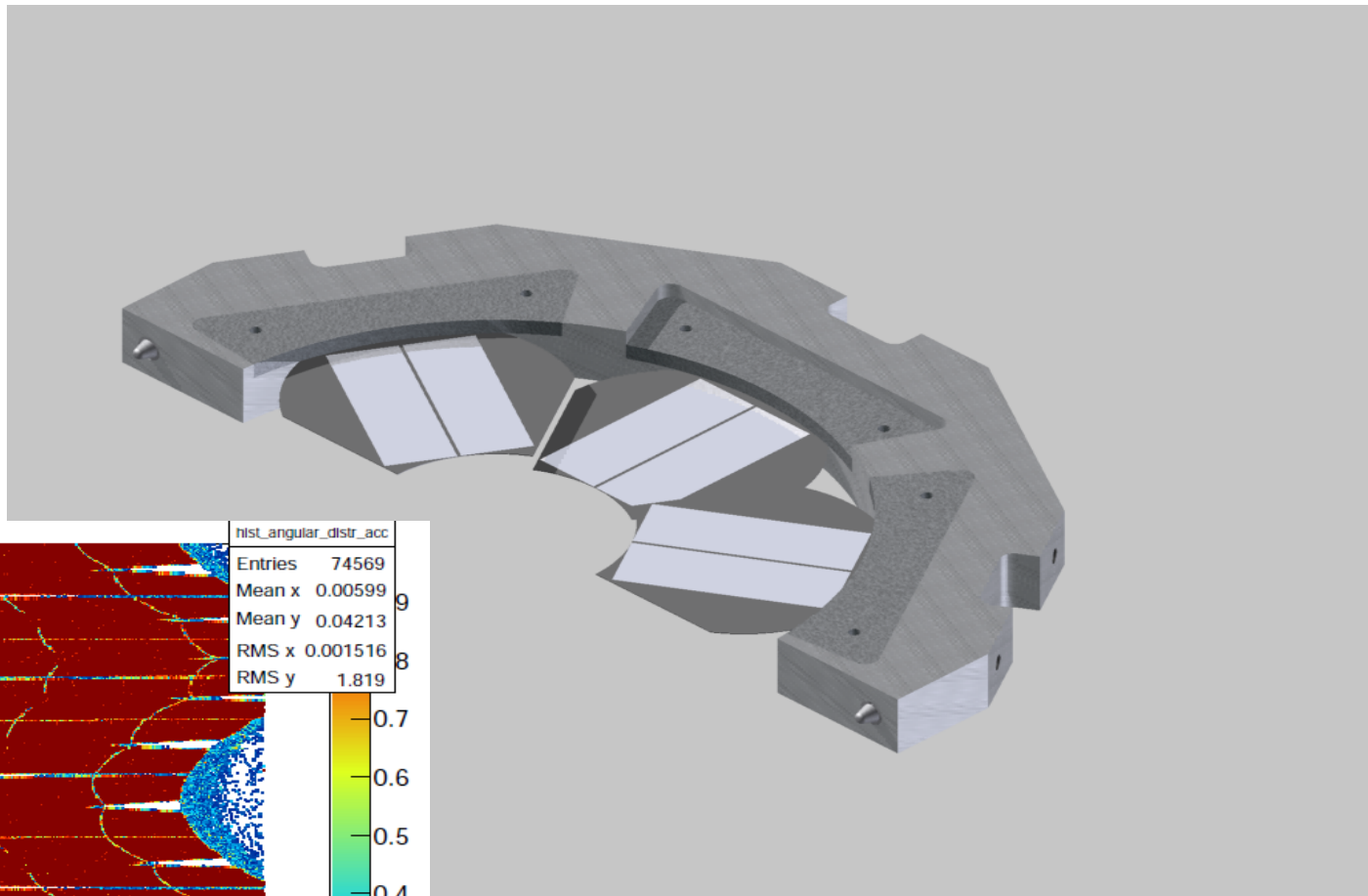# The Luminosity detector in the beam pipe

0 m

10.5 m

Optimizing the acceptance

Optimizing the acceptance

w/o beampipe
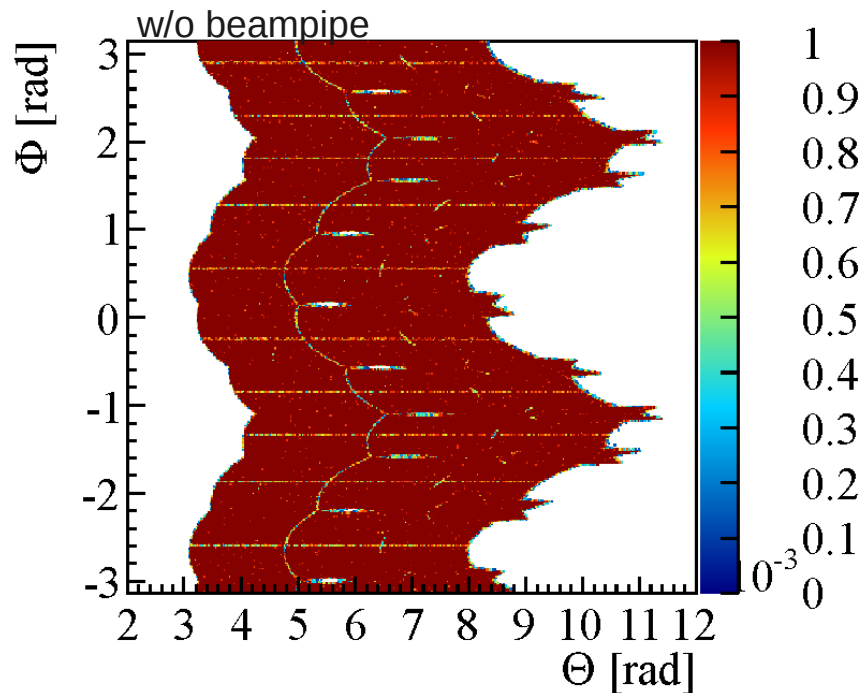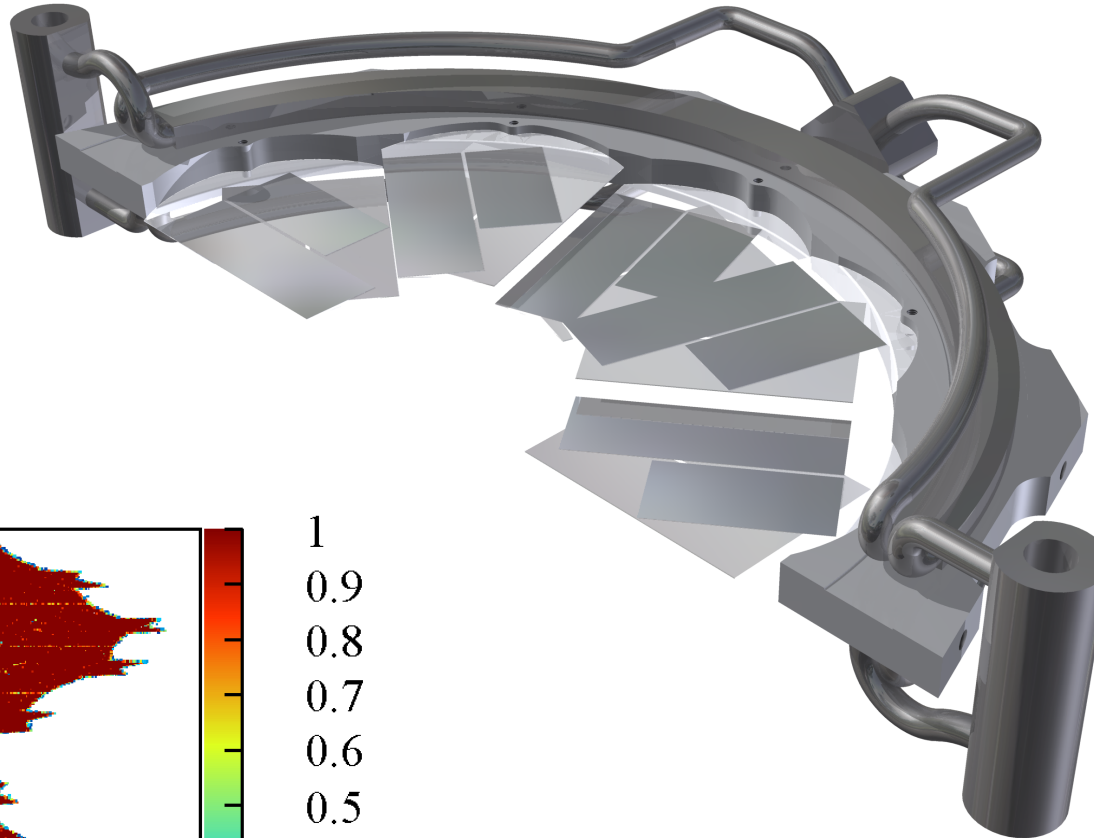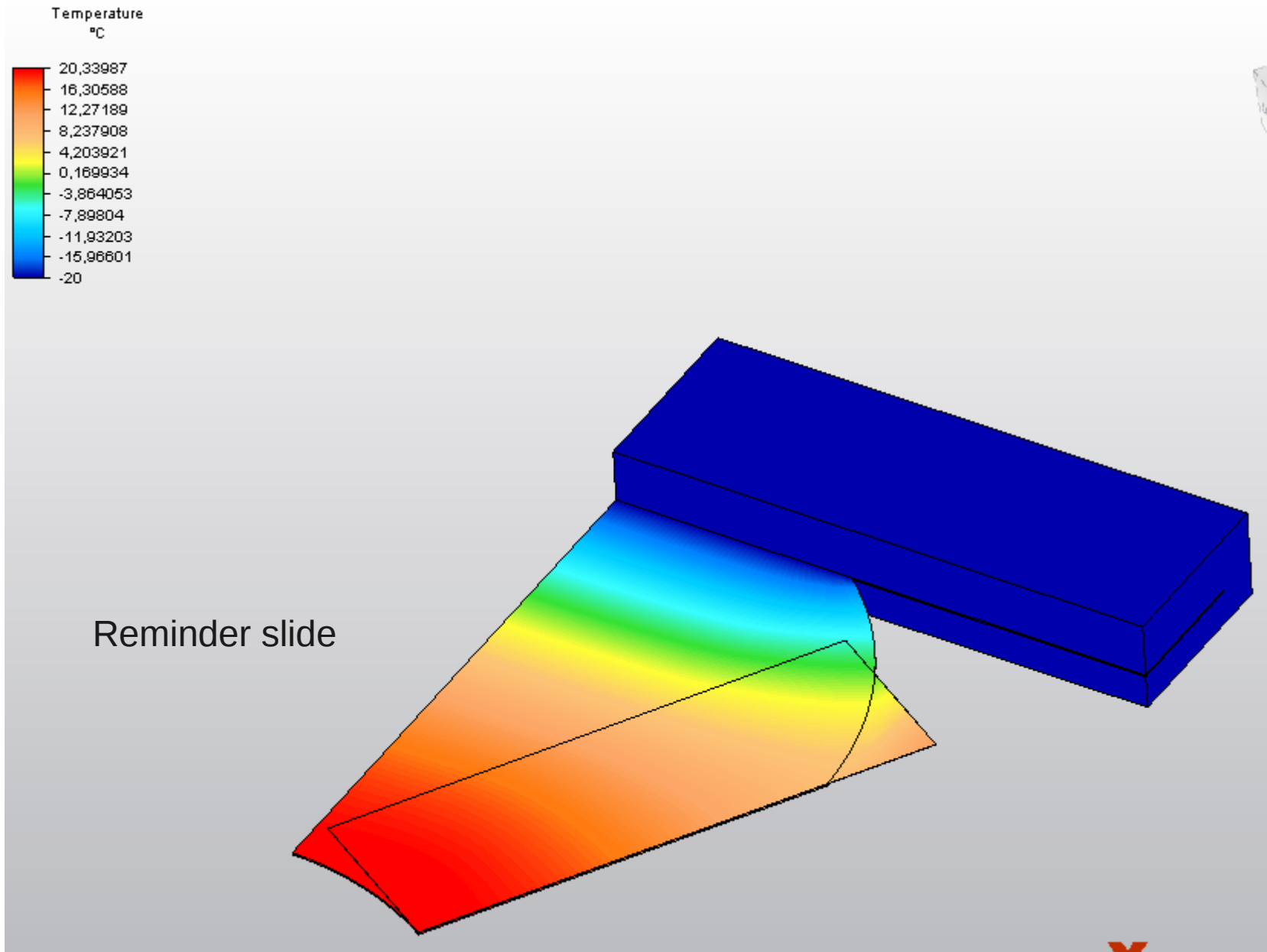
 # CVD wafers increased from 6 to 10 per plane
 # Sensors increased from 240 to 400
est. total power consumption: 1.12 kW + 0.224 kW

First thoughts on cooling

Temperature
°C

20,33987
16,30588
12,27189
8,237908
4,203921
0,169934
-3,864053
-7,89804
-11,93203
-15,96601
-20

Reminder slide

Cooling stations for cooling liquids

Versus

Cooling power @-20°C
1.9 kW   2.2kW
max. pumping speed
105 l/min   45 l/min
max. pumping pressure
1.5 bar(requested for more)   2.9 bar

Where can we place one of those at PANDA?

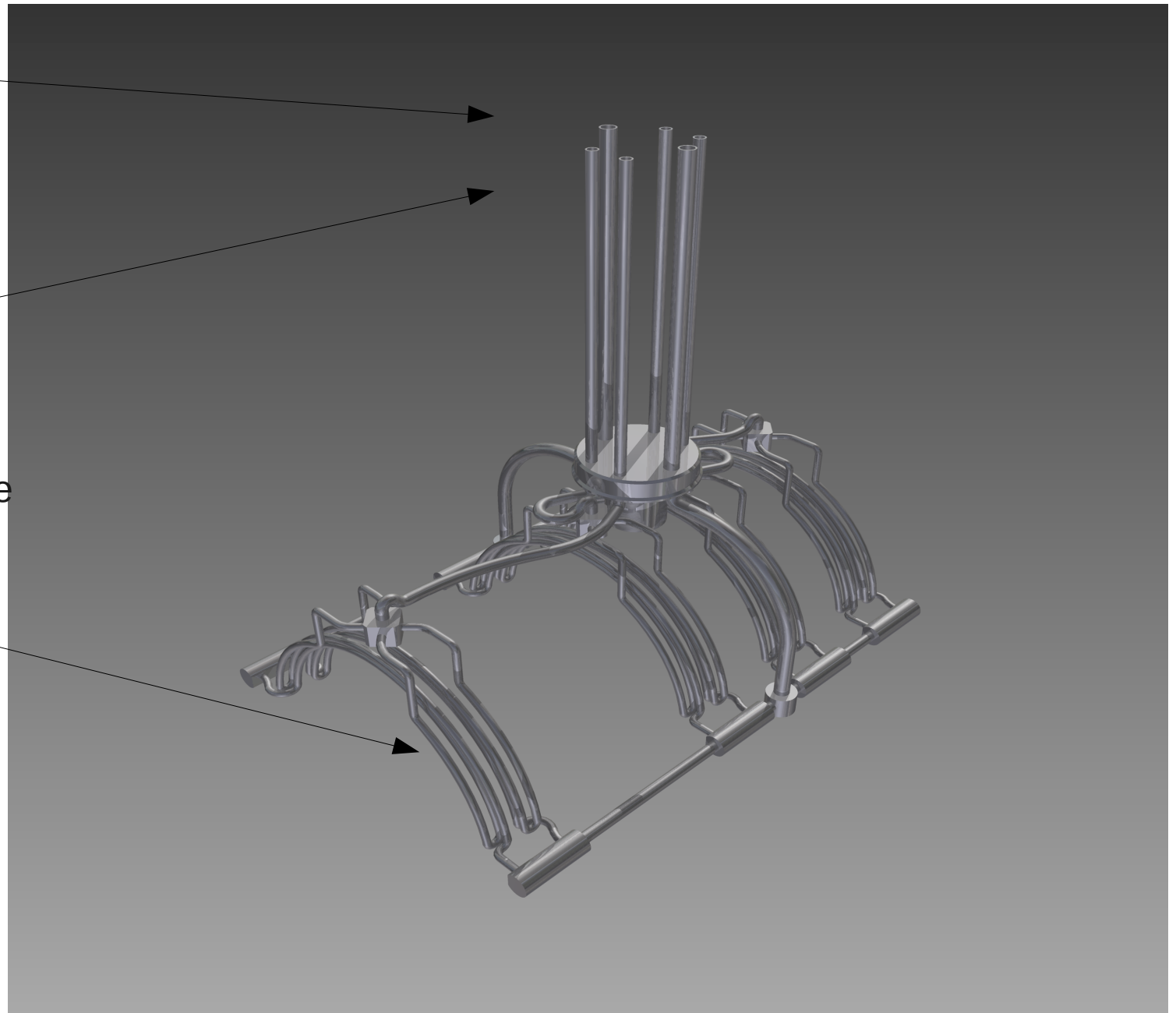Huber Unistate 425 w

Lauda XT 550 (W)

Cooling concept

4 inlets
for each station 1
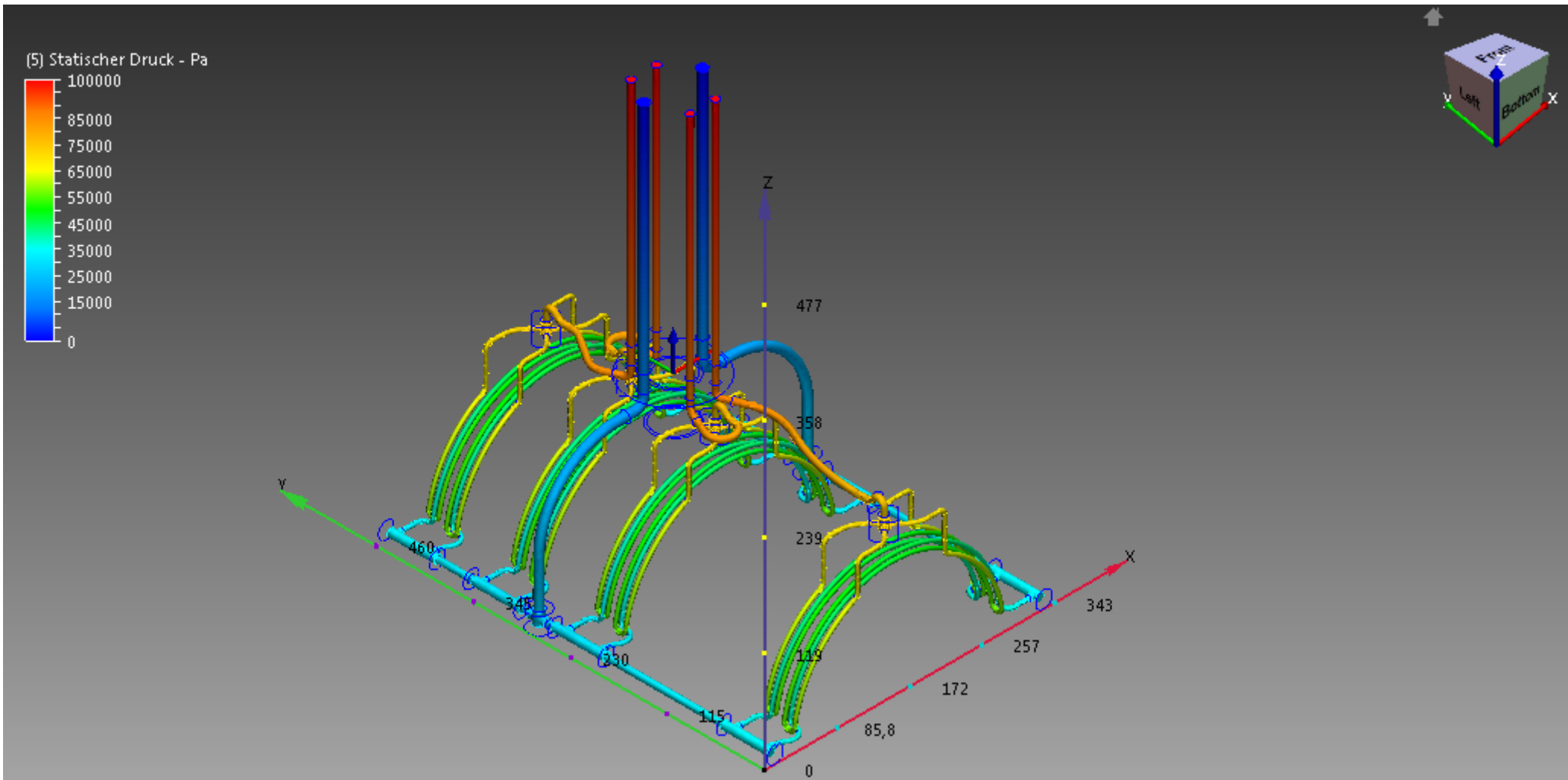for a pressure
adjustment between
planes

Merged to 2 outlets

Pipe diameters are
chosen to give a
similar flow resistance
at each stage.

4 pipes per plane
with opposite flow
directions for a more
uniform temperature
gradient

CFD studies on the concept

1 bar at the inlet applied. 0 bar at the outlet. → No significant pressure drop observed.
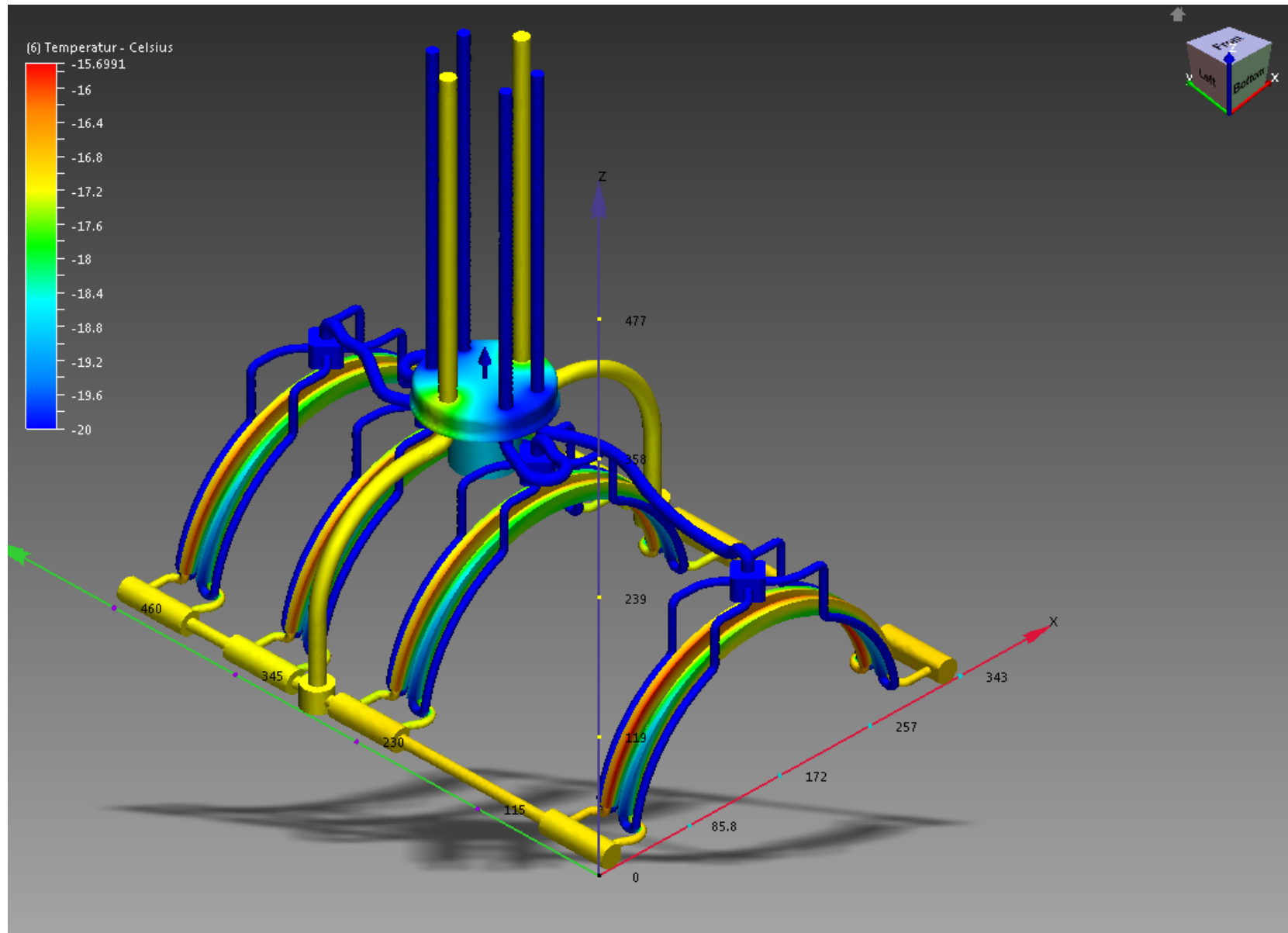Flow 200 ml/s = 12 l/min of ethylglycol

Load performance of the LAUDA pump

Pump characteristics Integral XT
XT 150, XT 250 W, XT 280, XT 280 W, XT 350 W, XT 350 HW, XT 490 W, XT 550, XT 550 W, XT 750, XT 750 S, XT 750 H, XT 750 HS, XT 950 W, XT 950 WS, XT 1590 W and XT 1590 WS
Measured with water

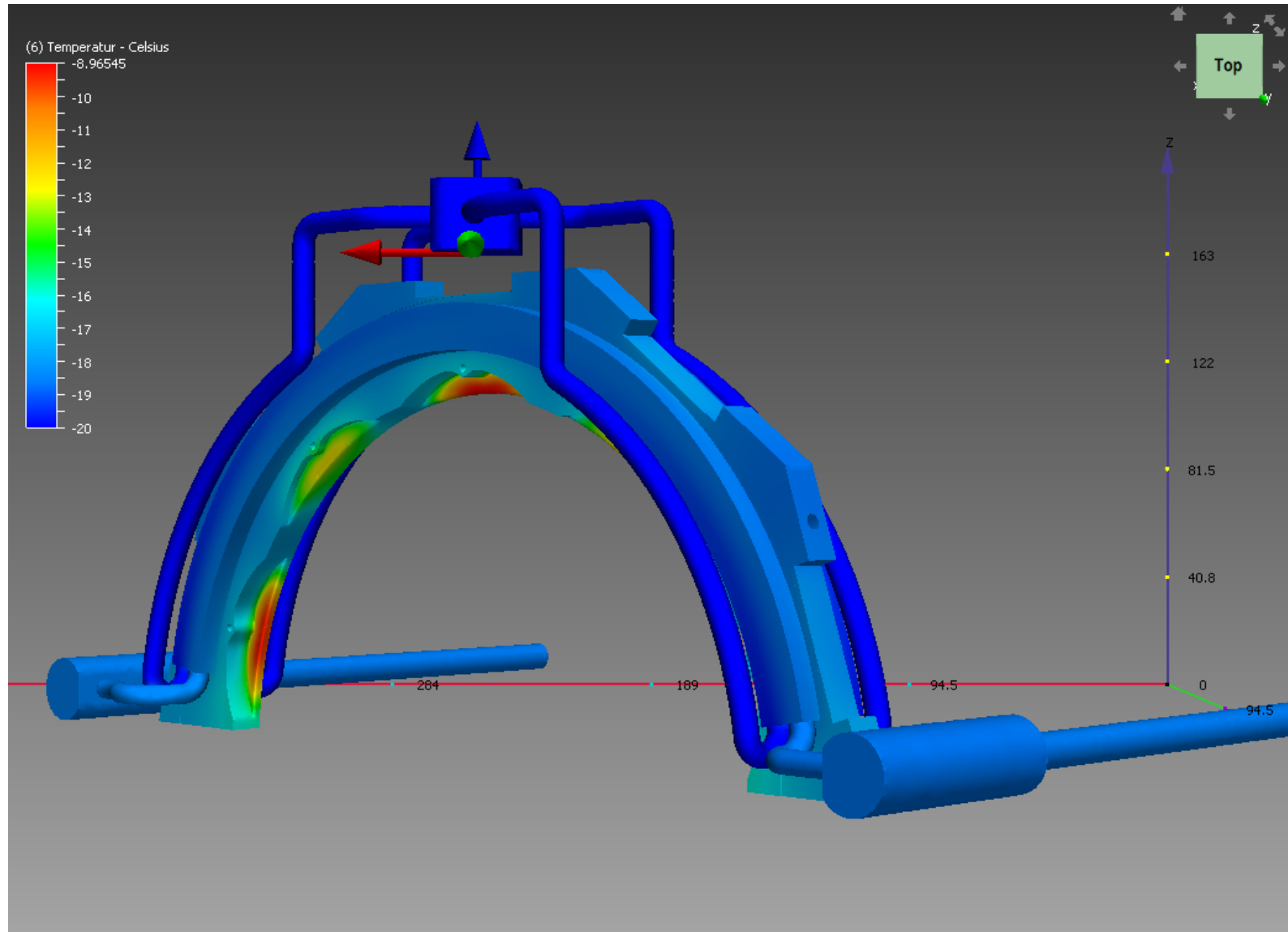Distinct pumping speeds

Operating point
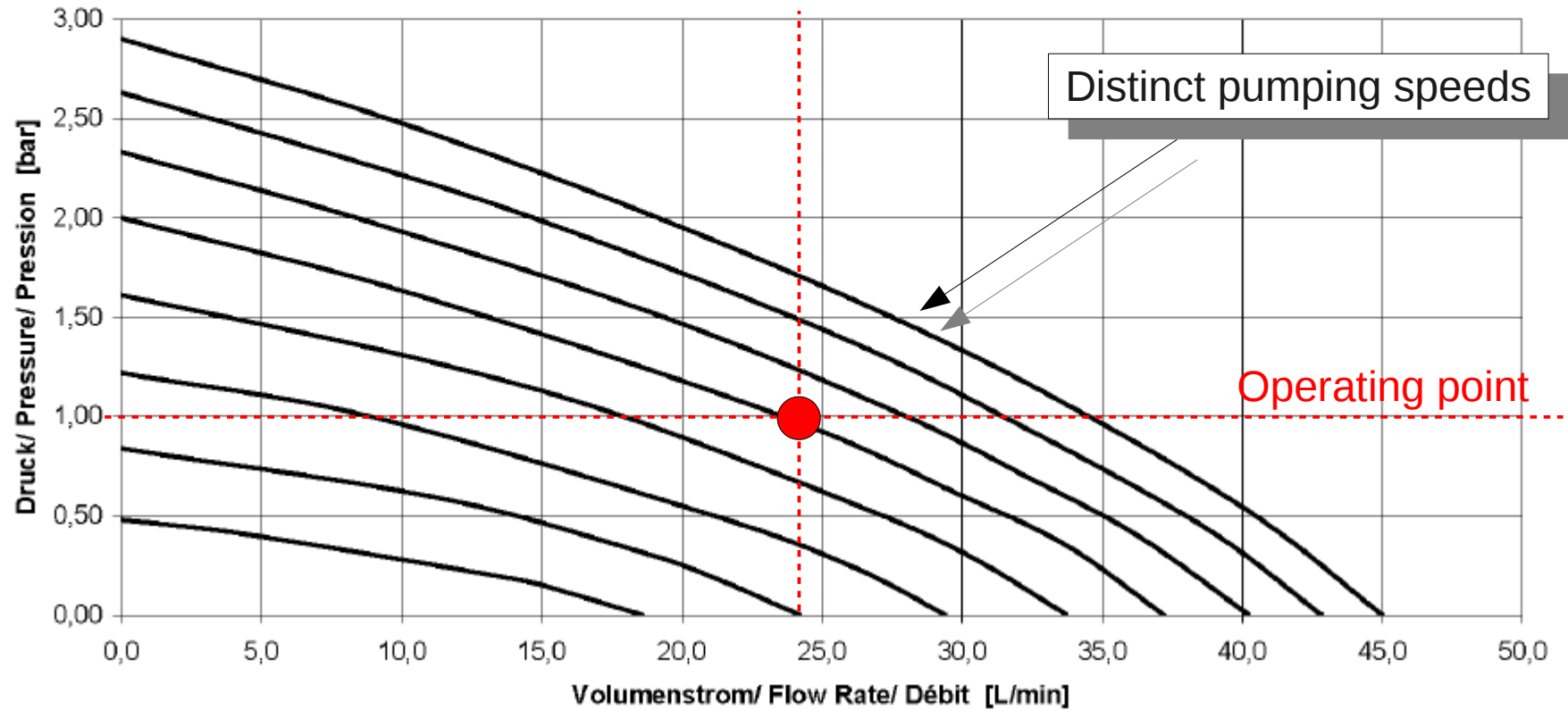
Temperature distribution

Temperature difference of up to 3.3°C at 1.6 kW power consumption per detector half.

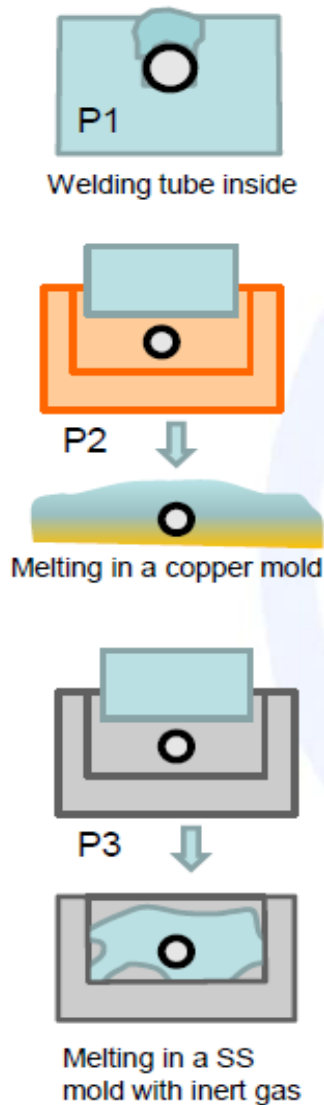# Temperature distribution on one plane half

Cooling task will be taken over by a new PhD student.
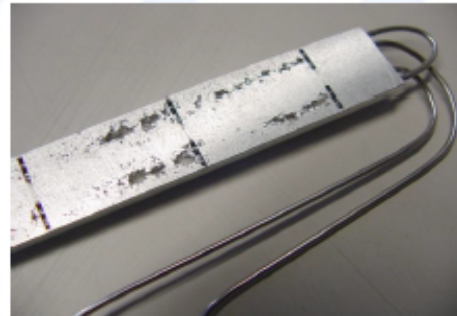
Thermal connection of cooling pipes

Procedure for the VELO detector at LHC-B:

P1

Welding tube inside

P2

Melting in a copper mold

P3

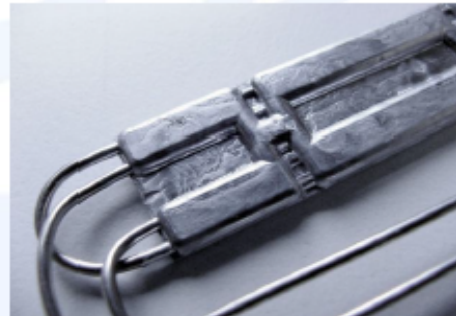Melting in a SS mold with inert gas

- Question was: Can we melt aluminum cooling blocks around a stainless steel pipe?
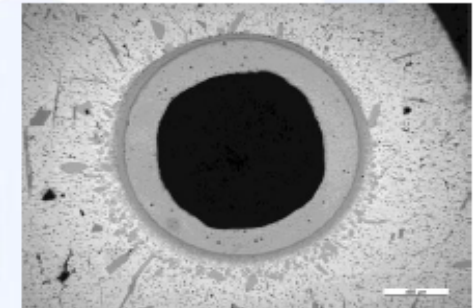 - As Aluminum crimps more we must get a nice crimp contact though?

Prototype 4: Mg vapor bubbles due to vacuum

Prototype 5: Vacuum melting / pressurized freezing.. Perfect!

Applied vacuum method bonded SS to Alu by diffusion of Fe into Al

Result of vacuum baking:
A: Perfect contact around the pipe, B: perfect contra shape of the mold

- Aluminum cookie recipe:
  - Take a stainless steel tin and fill with aluminum blocks or bars (AlMg4,5Mn)
  - Melt aluminum under vacuum <1e-3 mbar at 700°C for 1.5 hour
  - Apply 1 bar Argon pressure for 10 minutes
  - Switch of oven and let cool down.
  - Remove cookies from the mold and machine

On the way to a stiff body

1,55 Max

1,24

0,93

0,62

0,31

0 Min
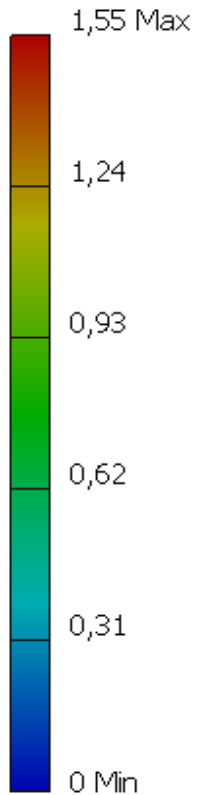
Simulated forces:

Mass of 30kg

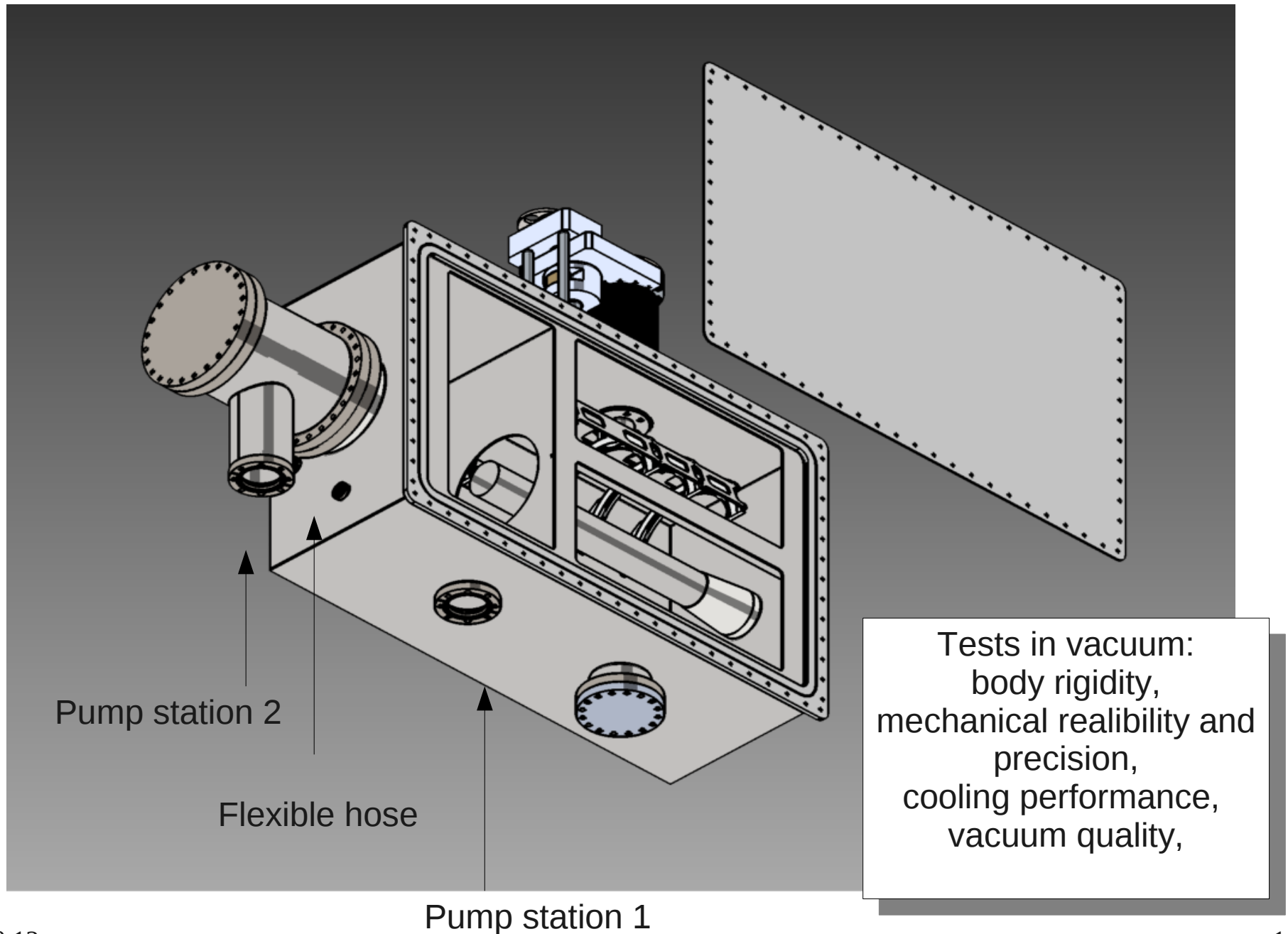Atmospheric pressure
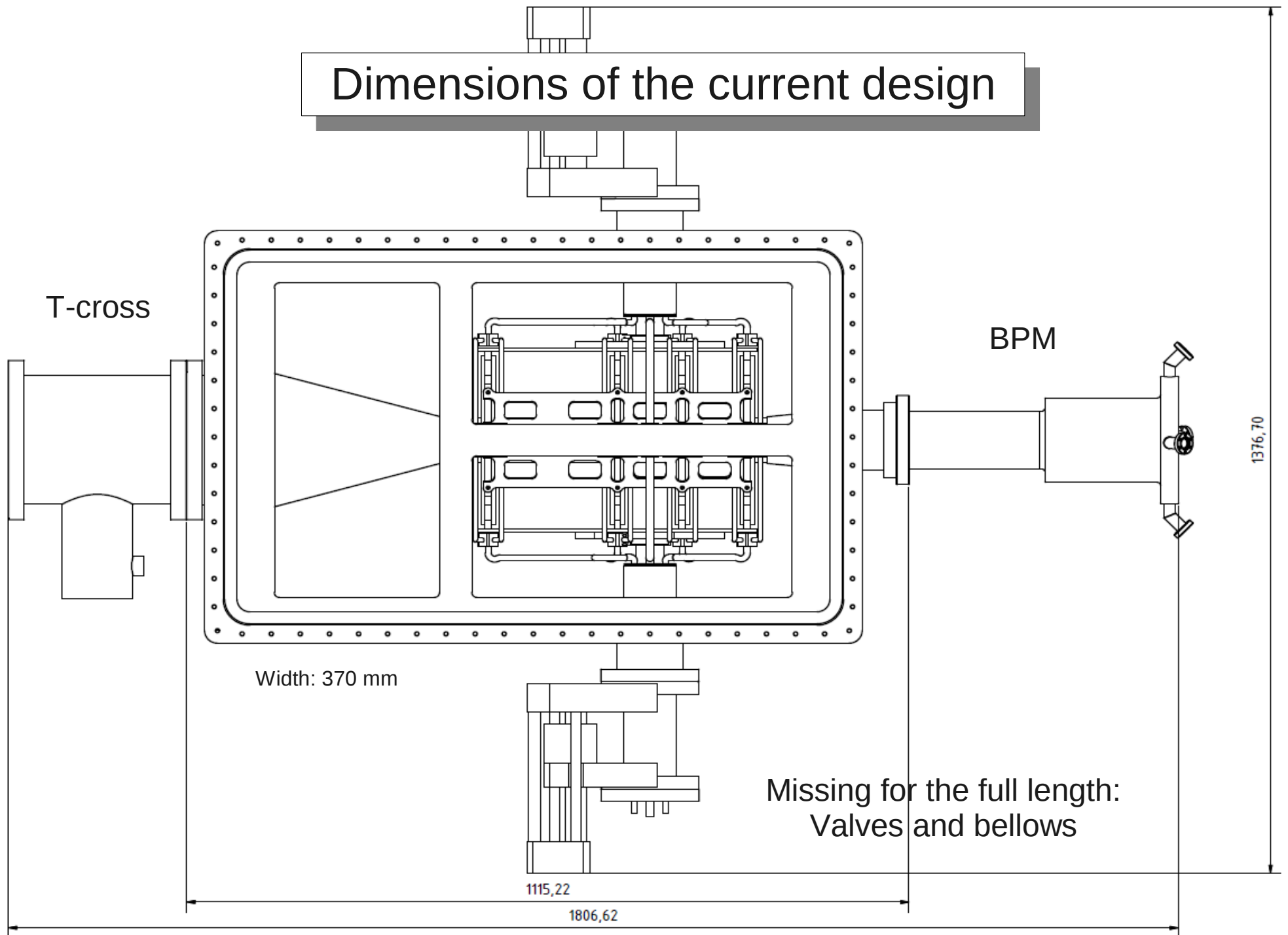
Displacement : 1,061 mm

Displacement : 0,15 mm

Displacement : 1,348 mm
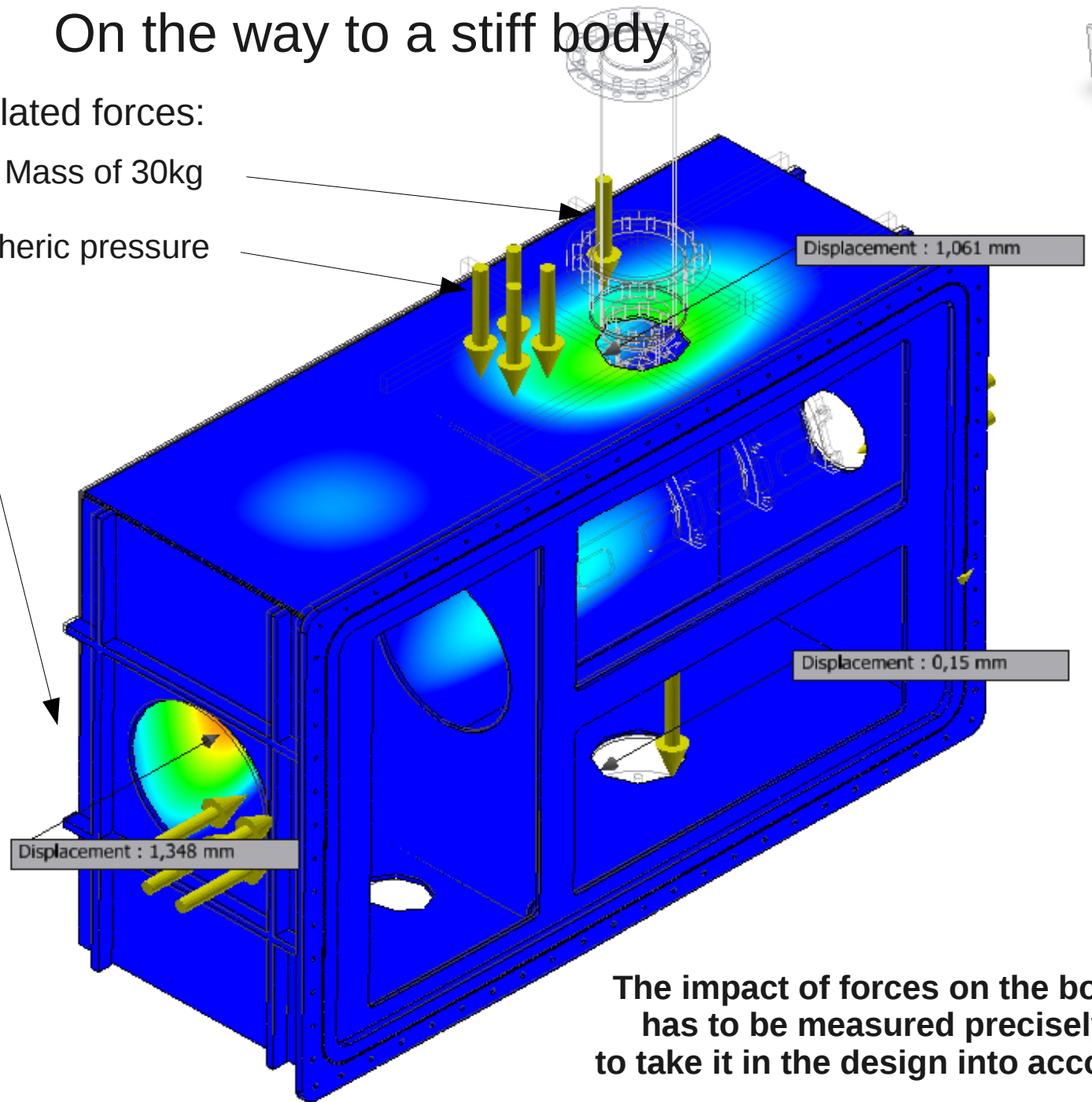
**The impact of forces on the body
has to be measured precisely
to take it in the design into account**

The LUMI prototype

Pump station 2

Flexible hose

Pump station 1

Tests in vacuum:
body rigidity,
mechanical realibility and
precision,
cooling performance,
vacuum quality,

Dimensions of the current design

T-cross

BPM

1376,70

Width: 370 mm

Missing for the full length:
Valves and bellows

1115,22

1806,62

The Luminosity Detector

~ 1 m
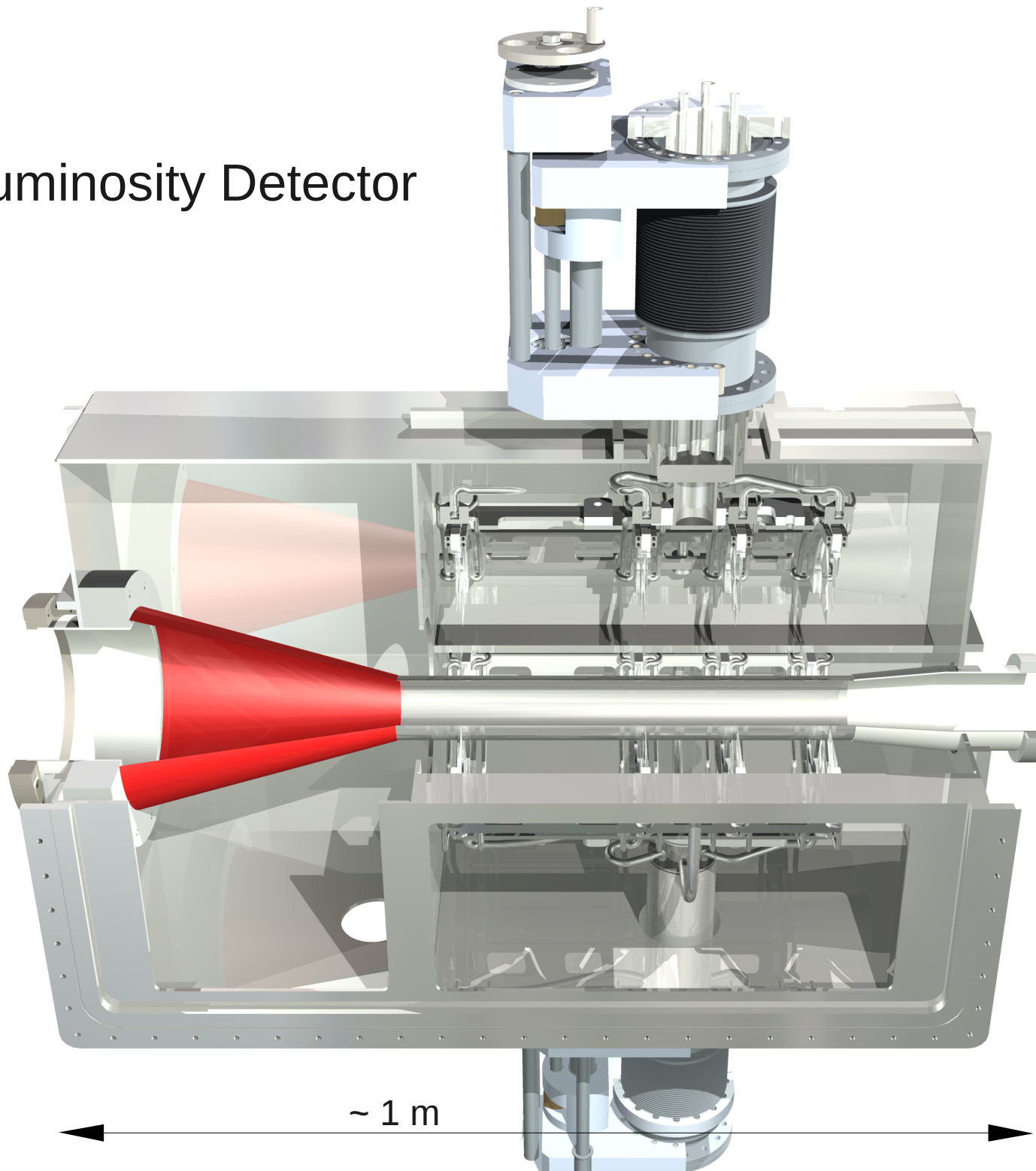
Thank you!

Backup slides

Assembly tools