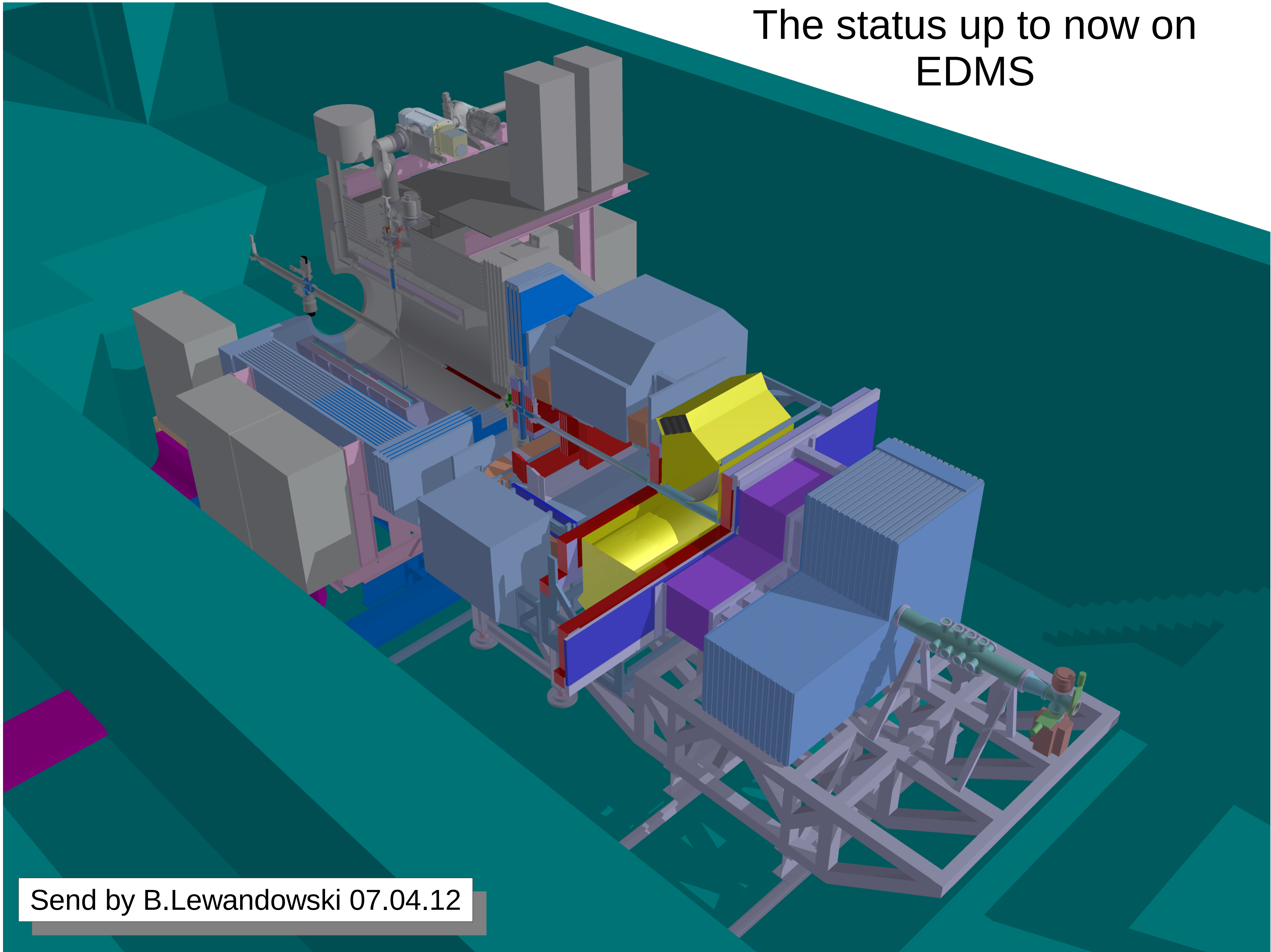
The PANDA beam pipe
From the view of
The luminosity detector

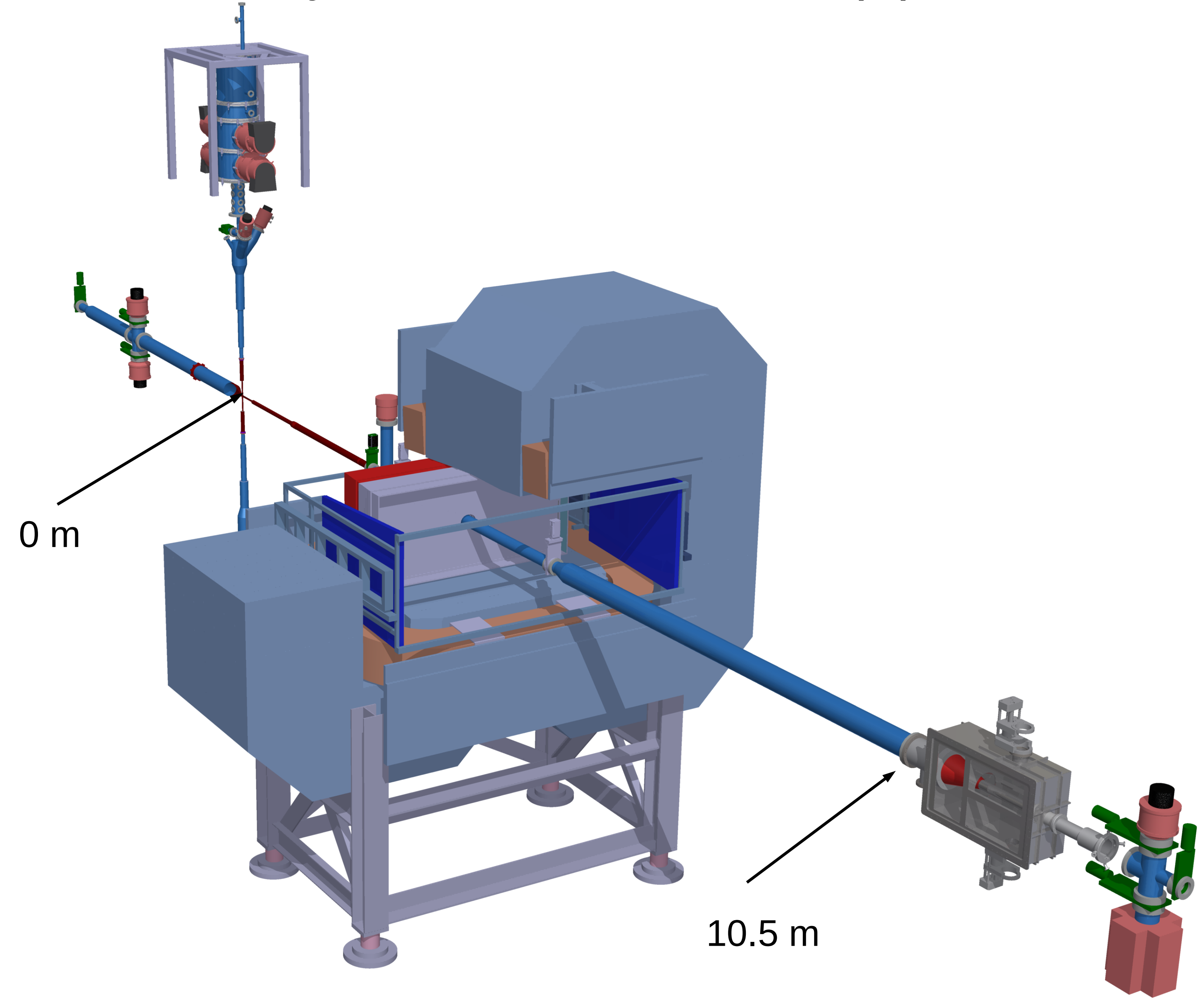
Prometeusz Jasinski
for the PALUMA group
04.02.2013
PANDA beam pipe meeting

The status up to now on EDMS



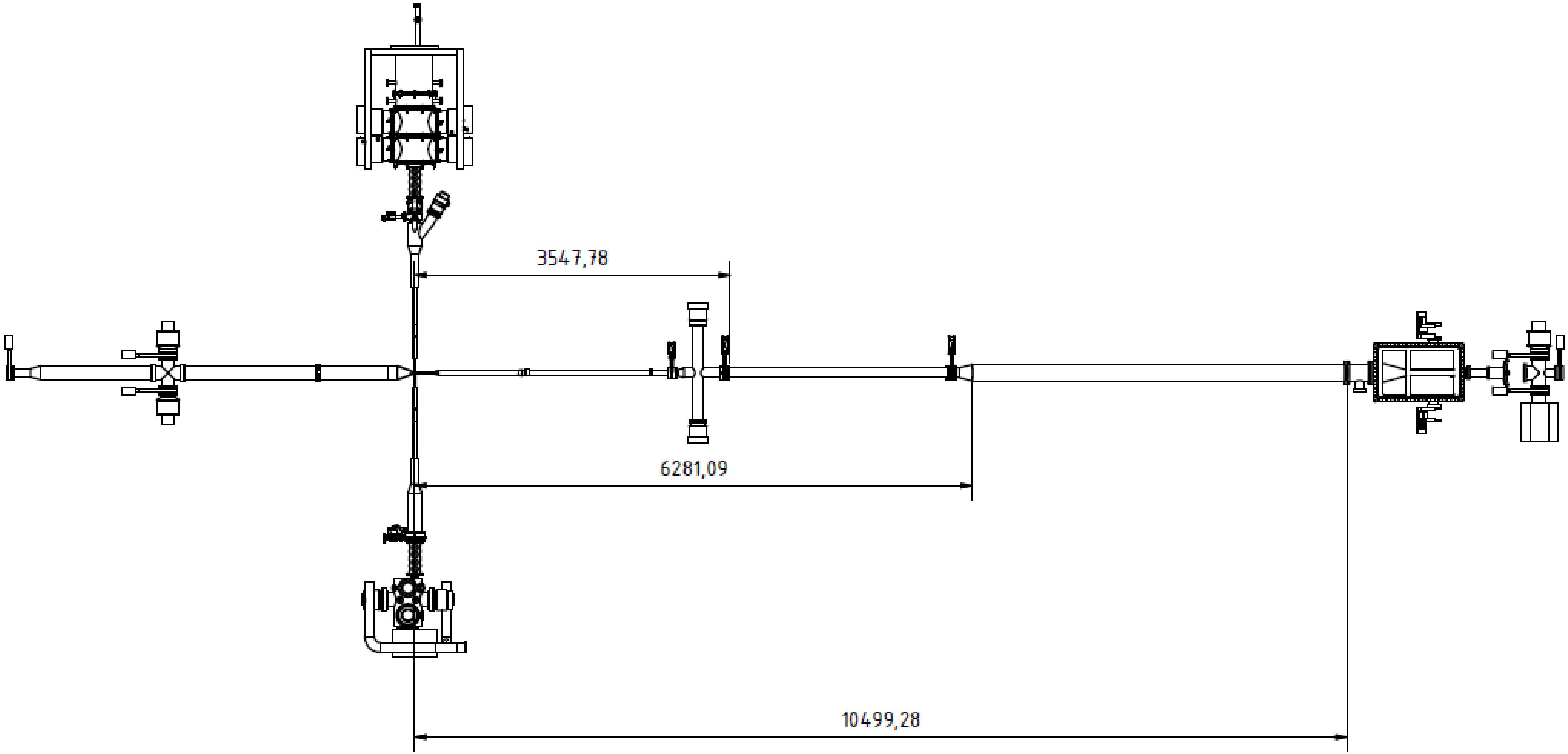
Send by B.Lewandowski 07.04.12

The luminosity detector in the beam pipe



Beampipe and the simplified luminosity detector are available on EDMS

Current beam pipe design

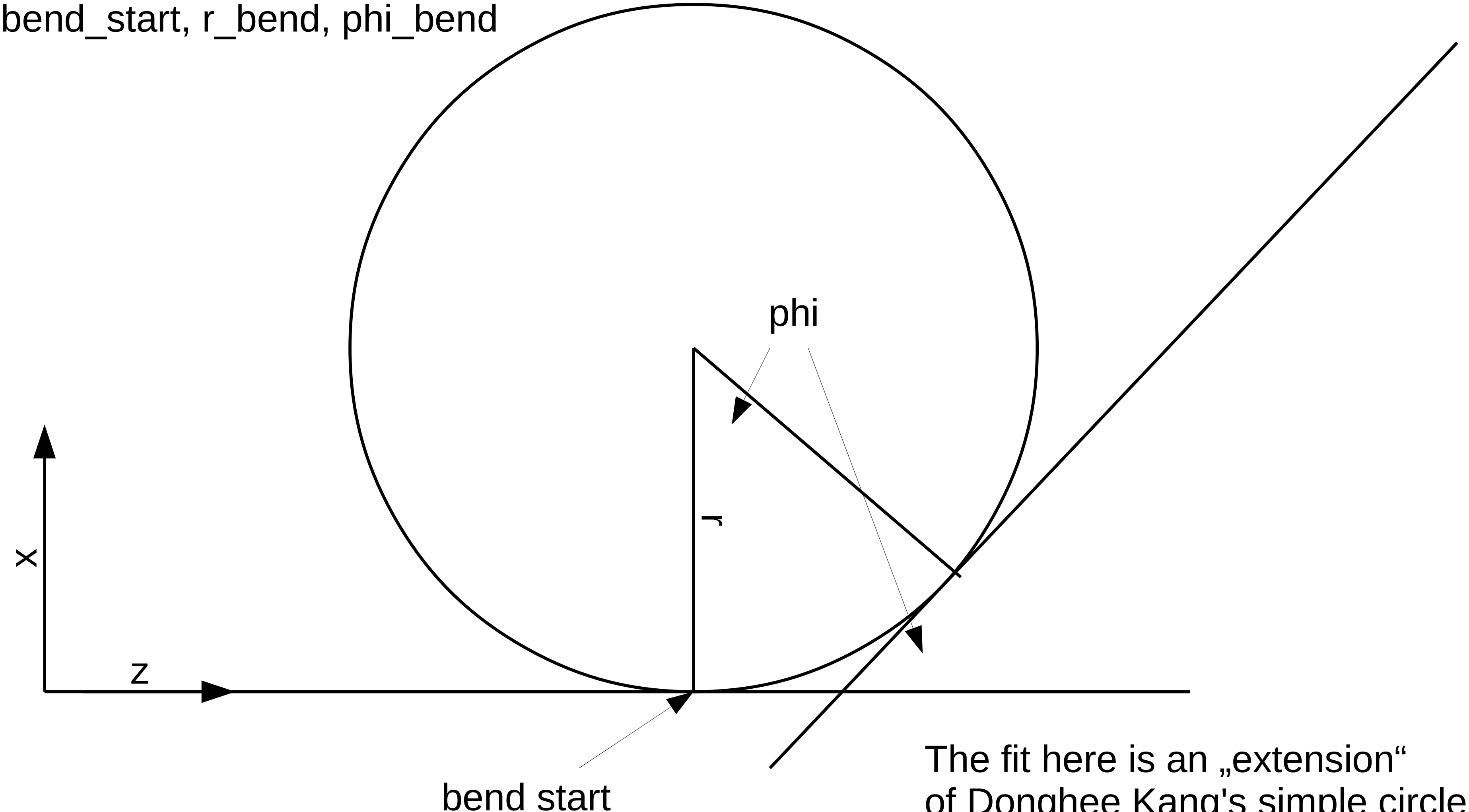


Our studies on the

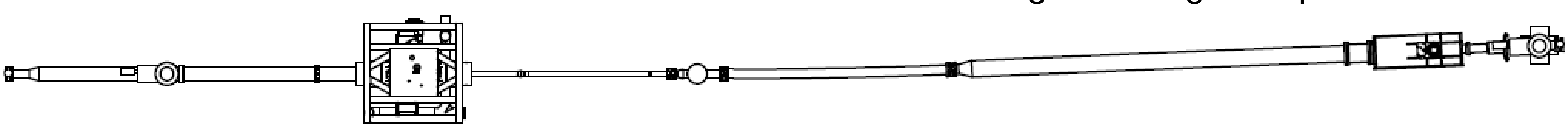
Bending radius + acceptance

Fit of a „beam pipe“-function to the data

When both straight lines are tangents to the circle,
the „beam pipe“-function is fully determined by 3 parameters:
bend_start, r_bend, phi_bend



The fit here is an „extension“
of Donghee Kang's simple circle fit.



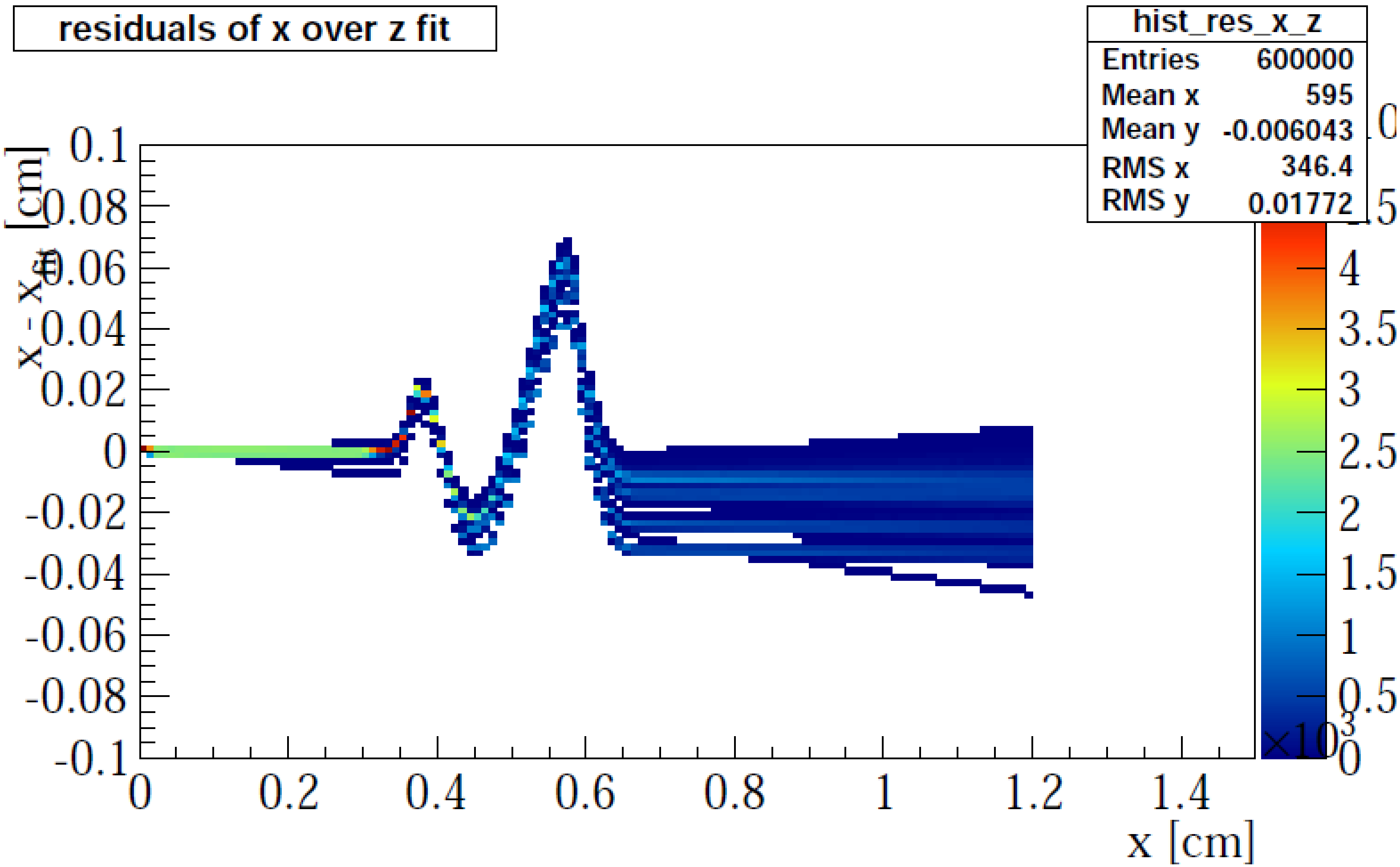
Proposal for a parameter modification

	Fit fixed phi	**proposal**	Current values
bend start	360.2 cm	**361 cm**	361 cm
bend radius	5754 cm	**5700 cm**	6000 cm
bend phi	40.00 mrad	**40.00 mrad**	40.00 mrad
(z bend end)		361+227.93	361+239.93

A straight part of 12 cm must be inserted
to the current CAD design

Engeneers from Juelich are working with „current values“ and do not
Intent to modify the PANDA boundry conditions.

Residuals for the proposed parameters



The target spread

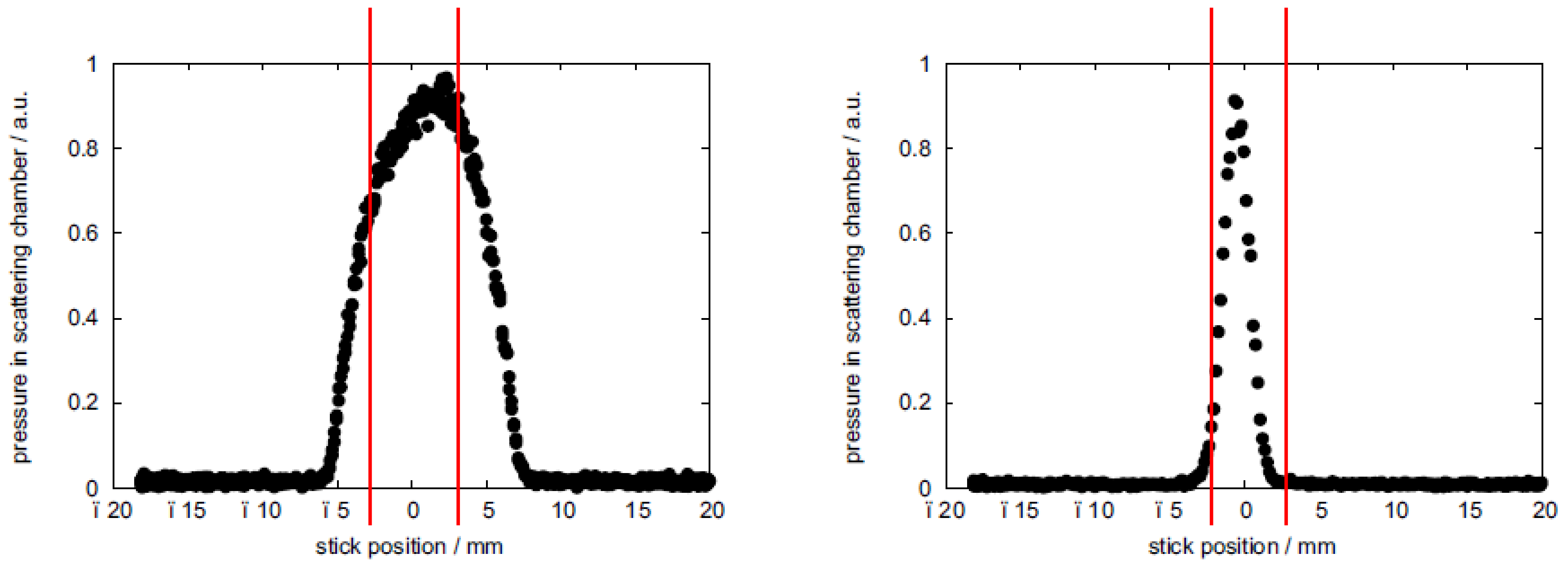
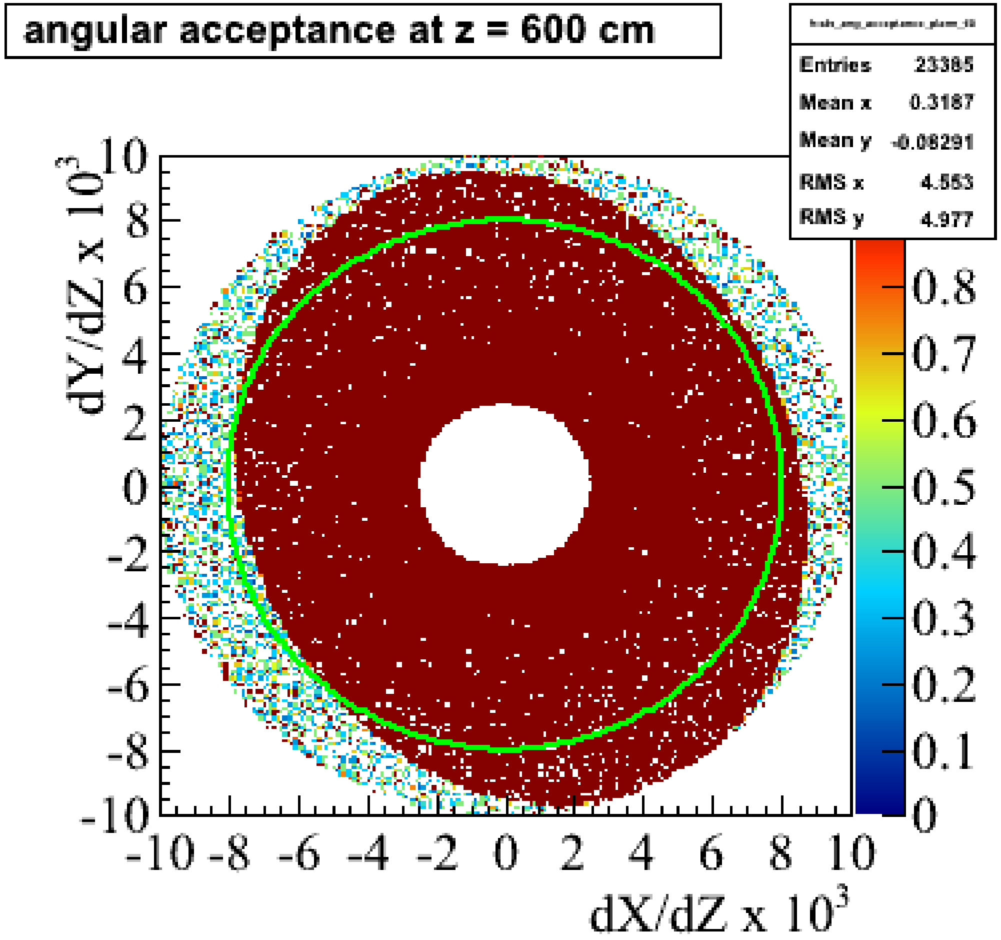


Figure 8: Cluster beam profiles with the use of a collimator of with a round opening (left) and a slit (right). The profiles show that the cluster beam is slightly shapeable.

Design and performance of the future cluster-jet target for $\overline{\text{P}}$ANDA at FAIR
8th International Conference on Nuclear Physics at Storage Rings-Stori11, October 9-14, 2011
Laboratori Nazionali di Frascati dell'INFN, Italy

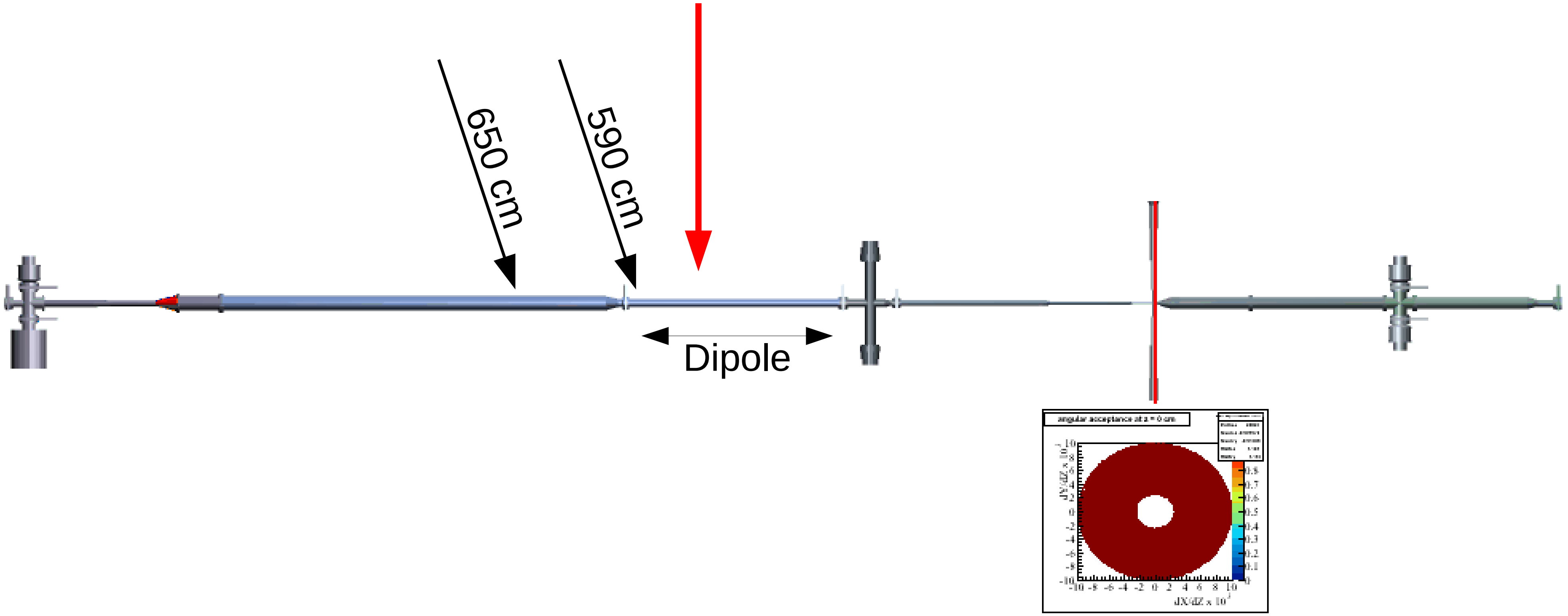
The beam pipe acceptance in the dipole region

Primary vertex displacement **x = -1.5 mm** **y = -1.5 mm**



1.5 GeV

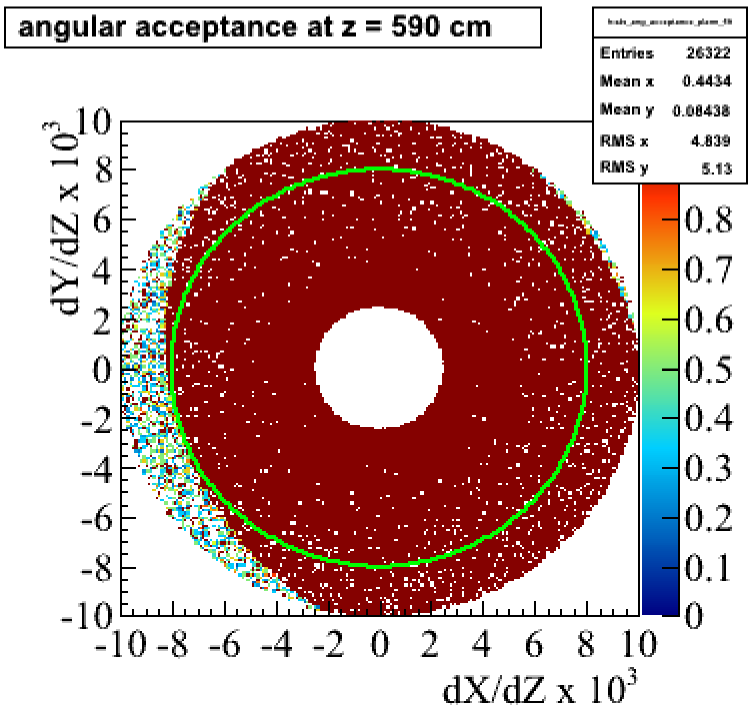
The position of the „bottle neck“



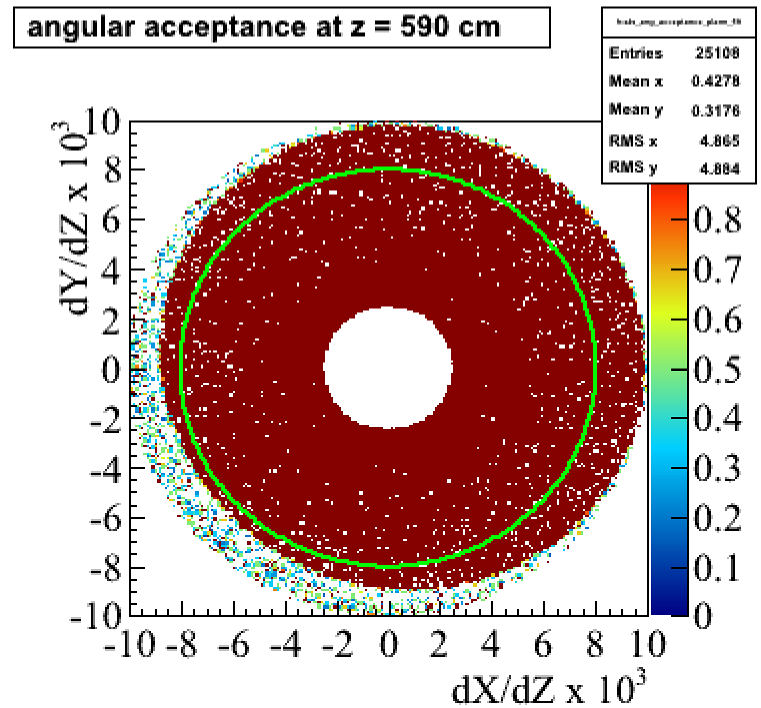
(animated gif not available in the pdf version)

Dipole pipe enlarged by R += 0.5 cm

Primary vertex displacement **x = -3 mm** **y = -3 mm**



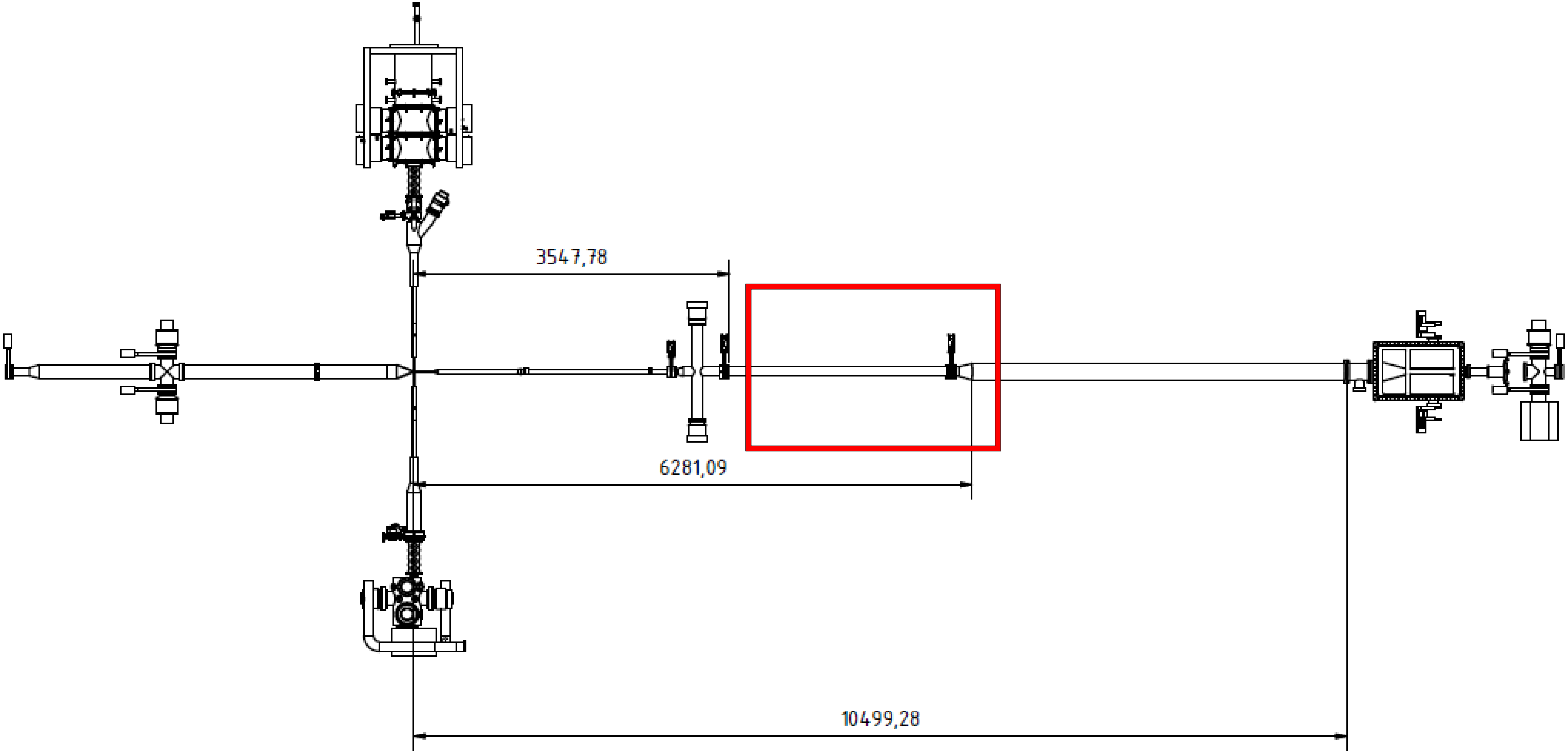
1.5 GeV



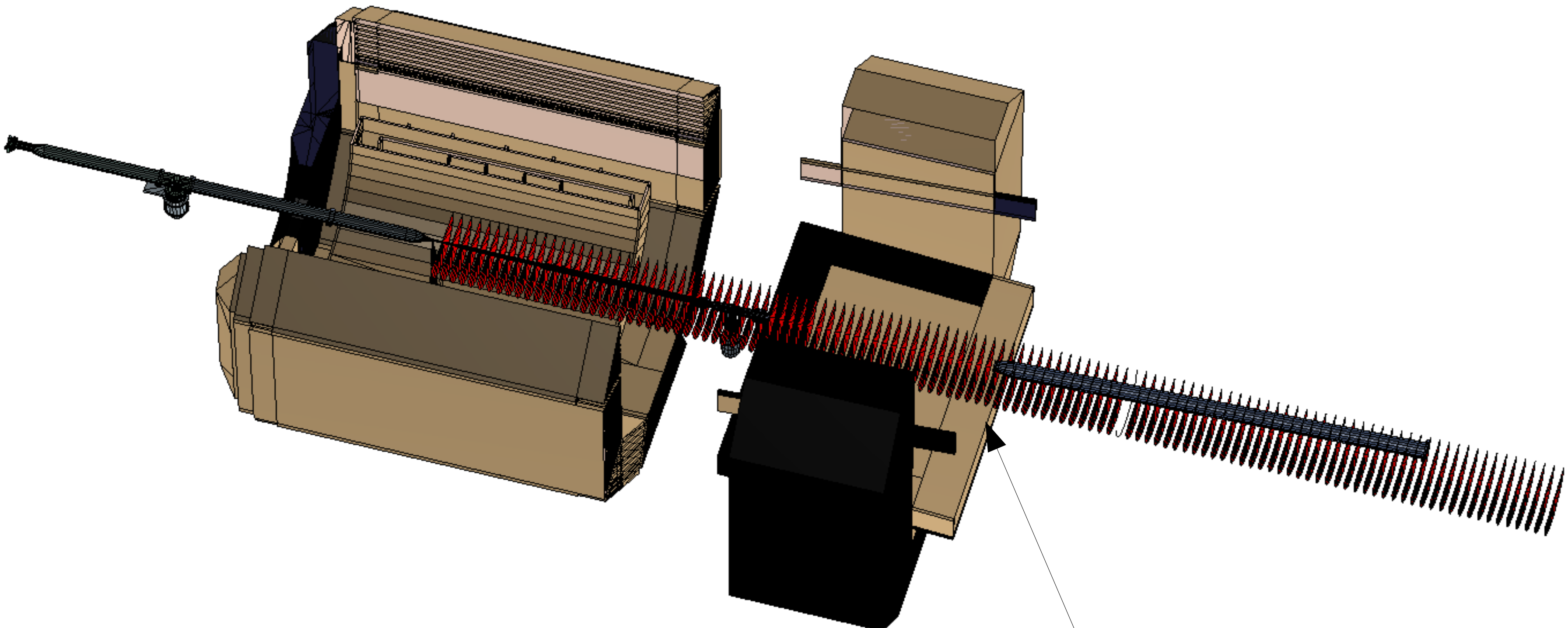
8.9 GeV

Approved at the Paris PANDA collaboration meeting

Enlargment of the dipole region diameter



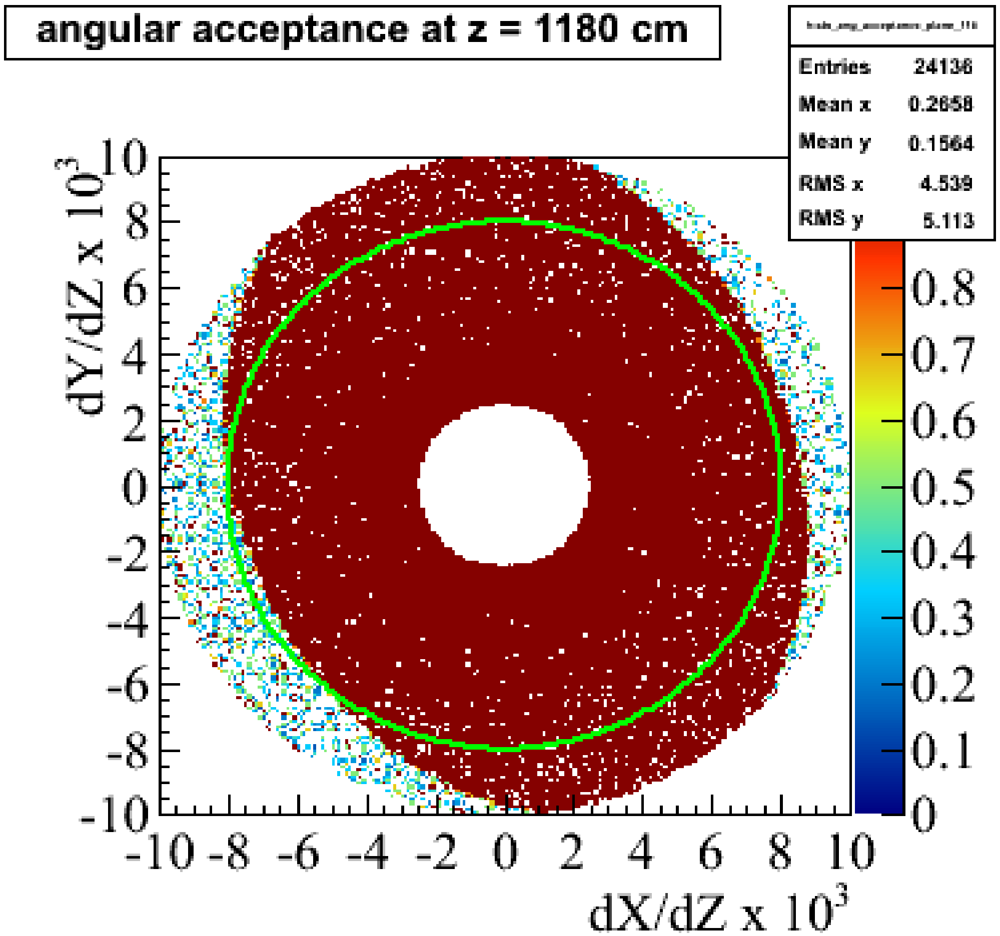
Checking the downstream part of the beam pipe

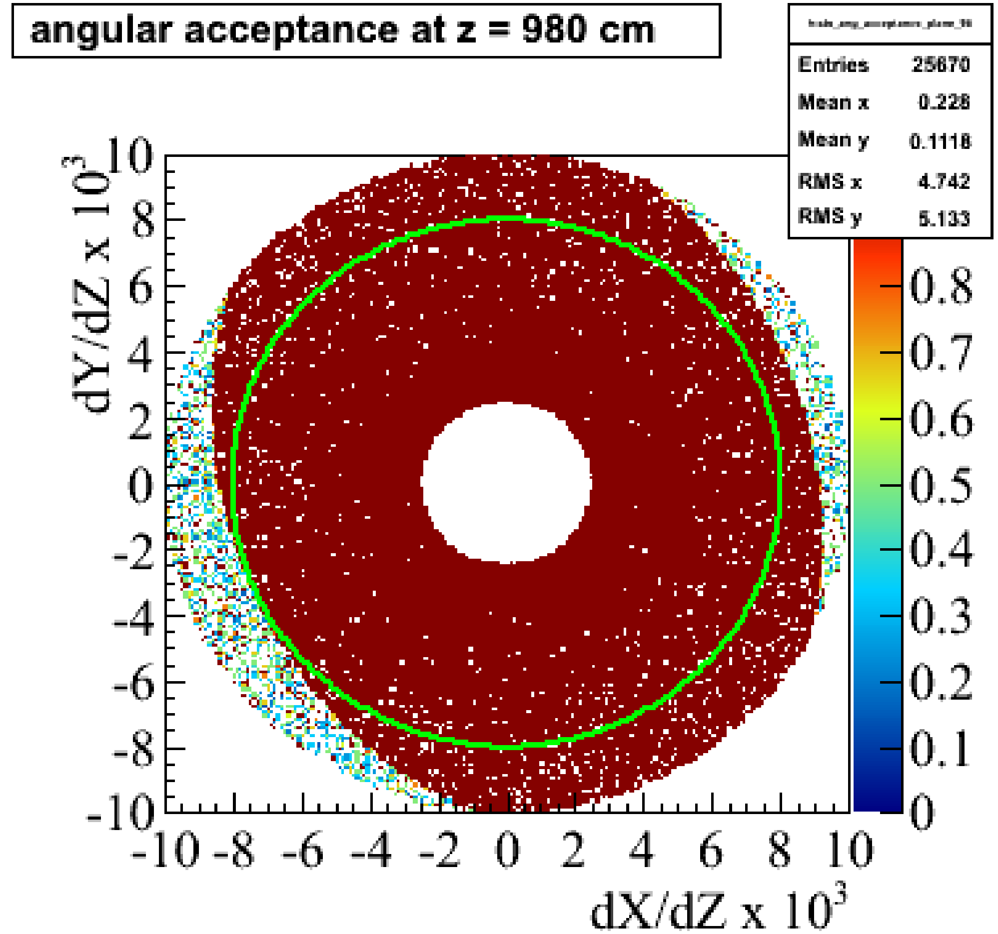


Dipole part removed

Checking the downstream part of the beam pipe

Primary vertex displacement **x = -2 mm** **y = -2 mm**



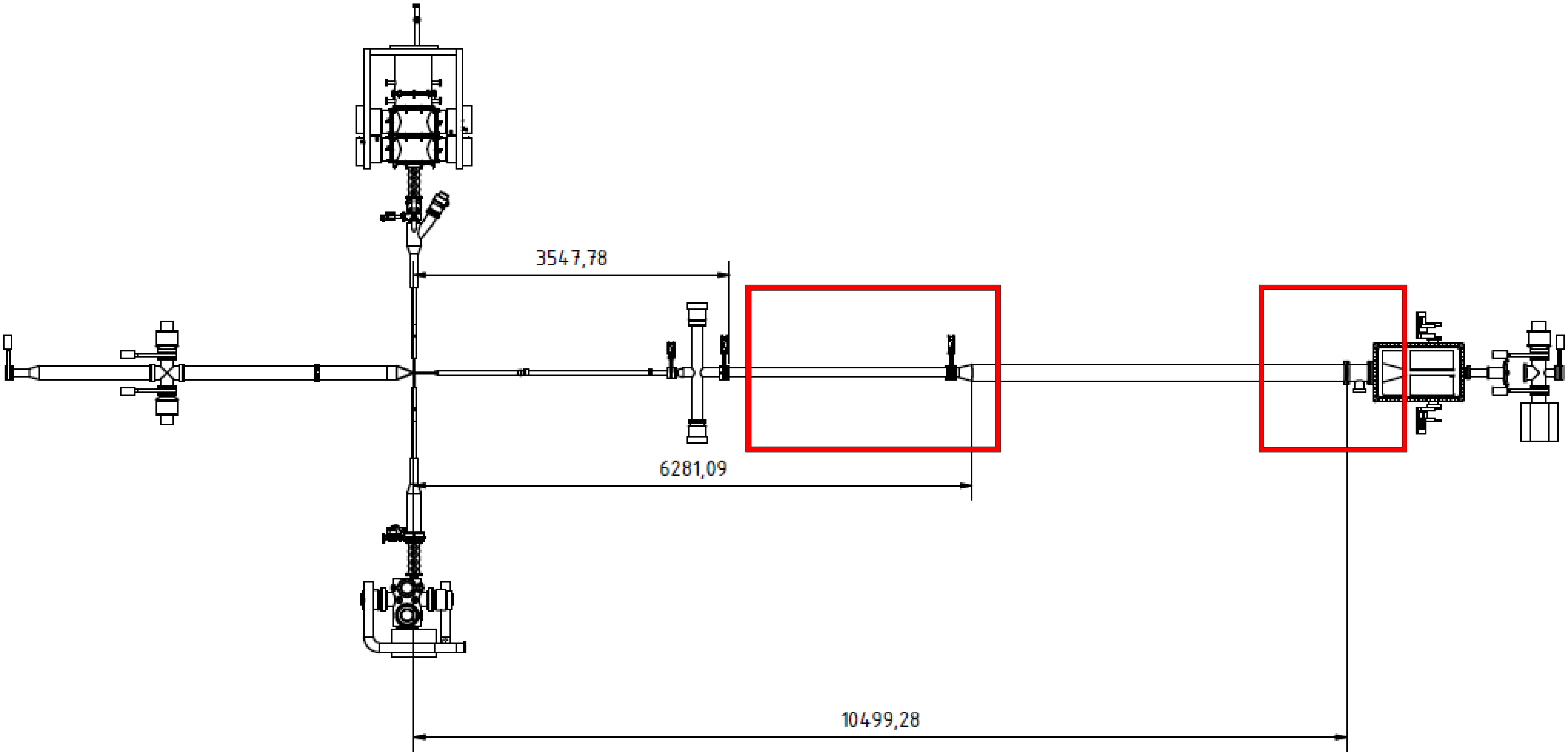


1.5 GeV

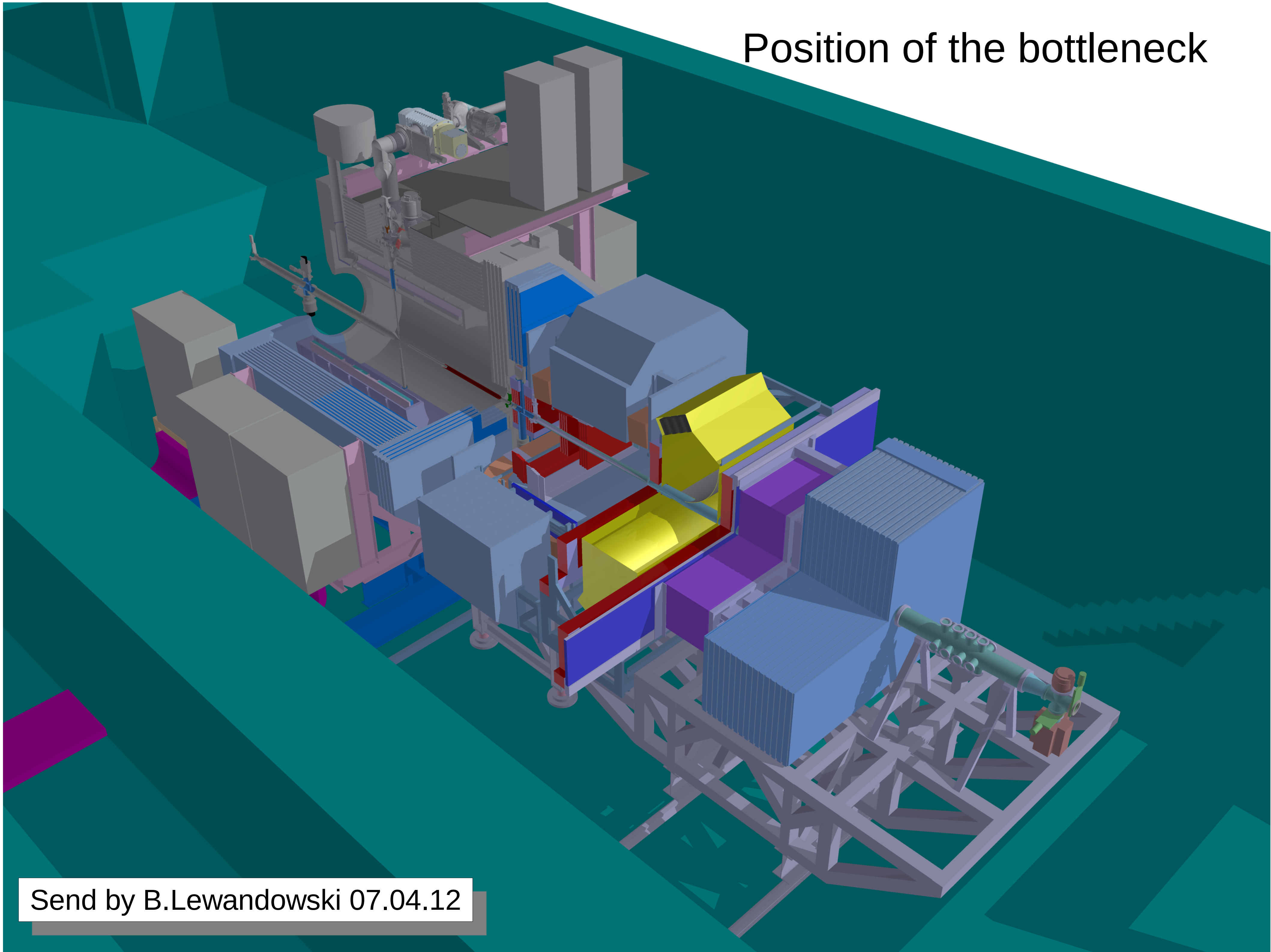
Comunication with Alexeev

- DN 160 (dia 180 mm) beam pipe can be replaced by DN 200 pipe (dia 200 mm)
- The present design foresees flange sizes up to 280 mm. DN 200 outer diameter of the flage is 253.2 mm. Should be safe.

Regions to be enlarged



Position of the bottleneck

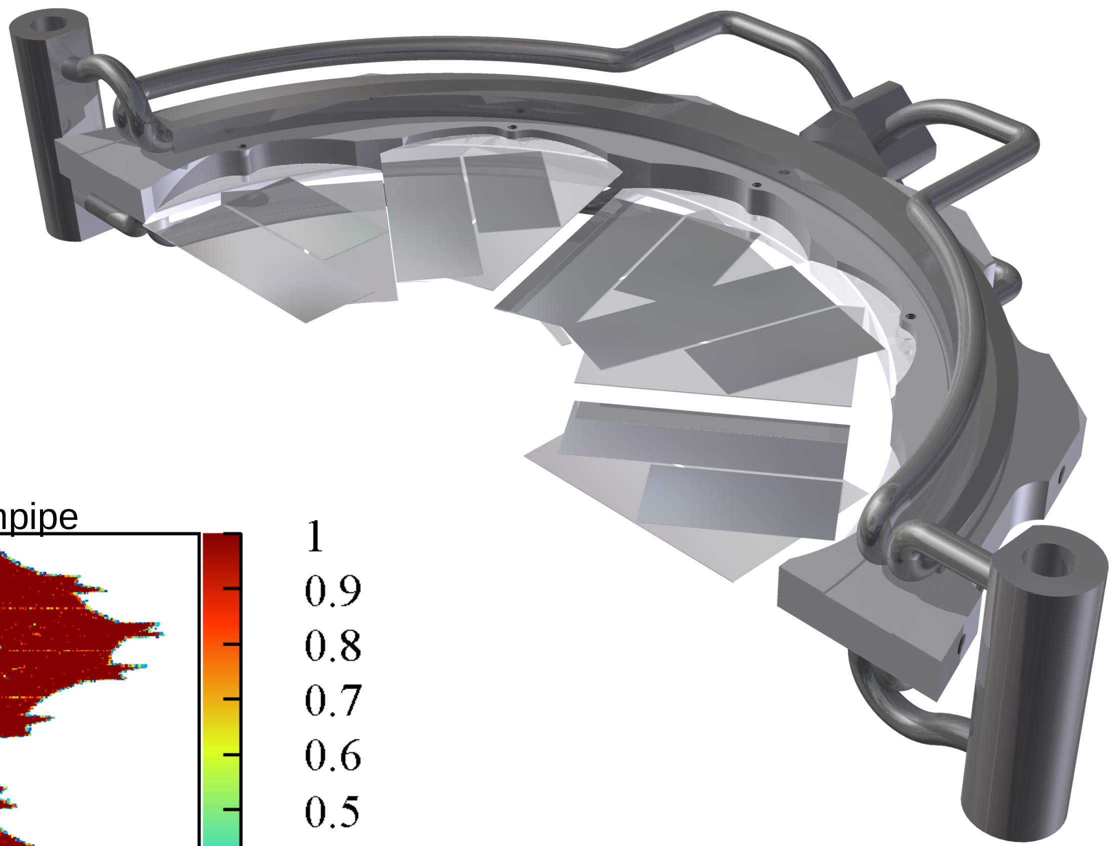


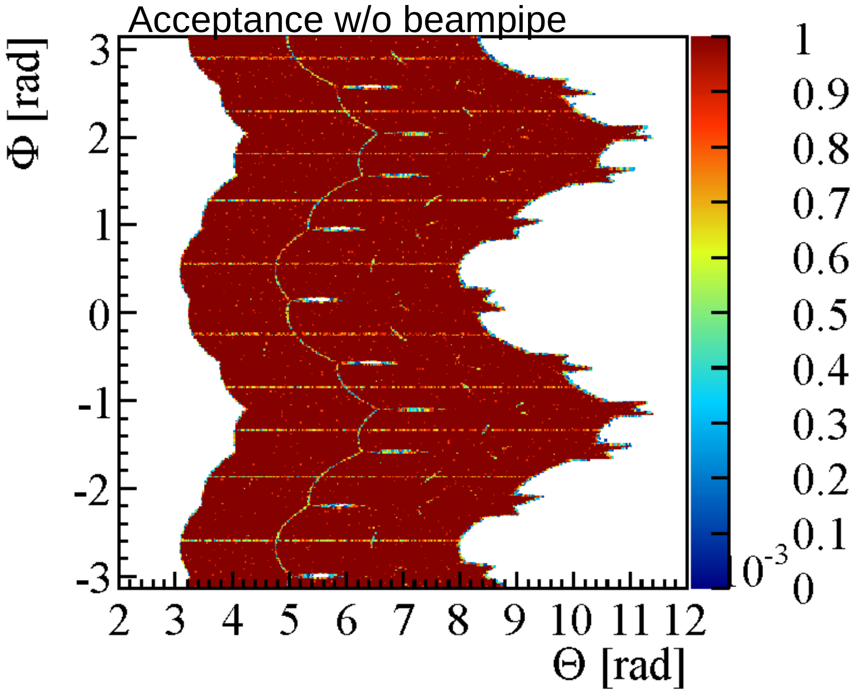
Send by B.Lewandowski 07.04.12

Thank you

Details on the luminosity detector

One detector plane half





10 CVD wafers per plane
400 sensors in total
est. total power consumption: 1.12 kW + 0.224 kW

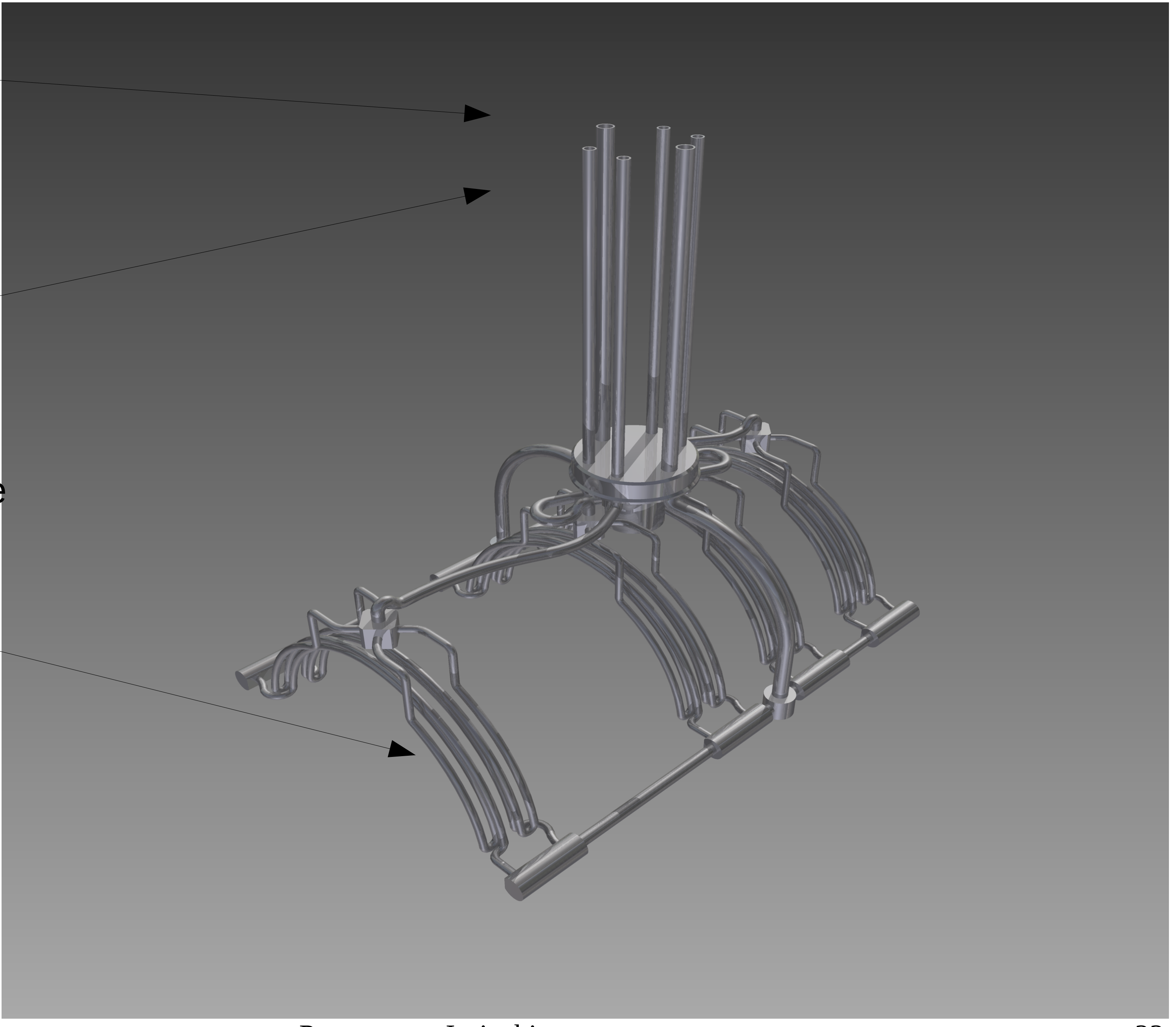
Cooling concept

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



Cooling stations for cooling liquids

Huber Unistate 425 w

versus

Cooling power @-20°C

1.9 kW 2.2kW

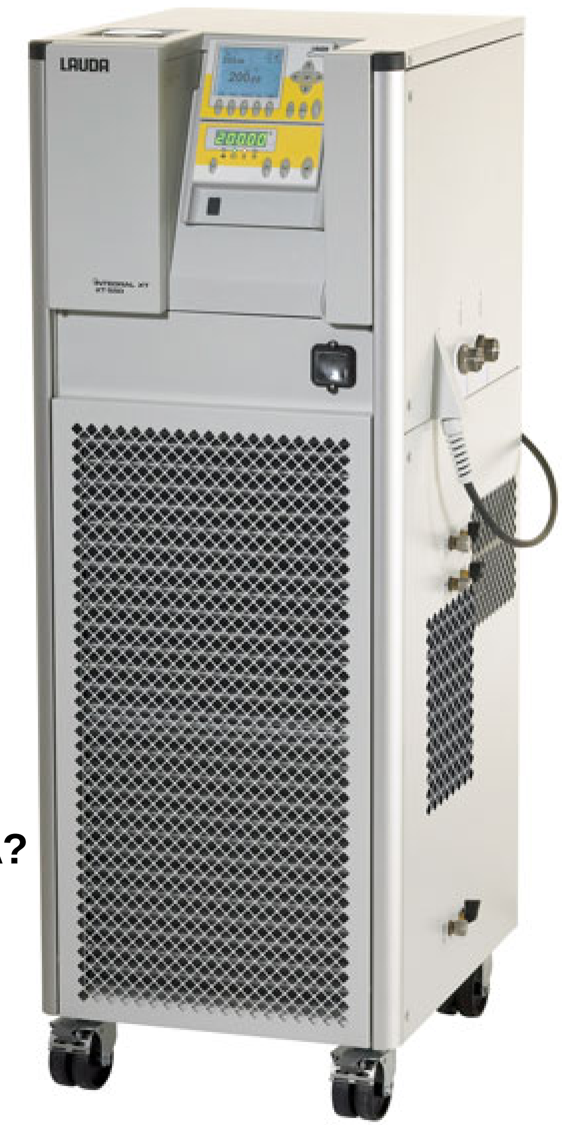
max. pumping speed

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?
(water cooled and radiation protected)



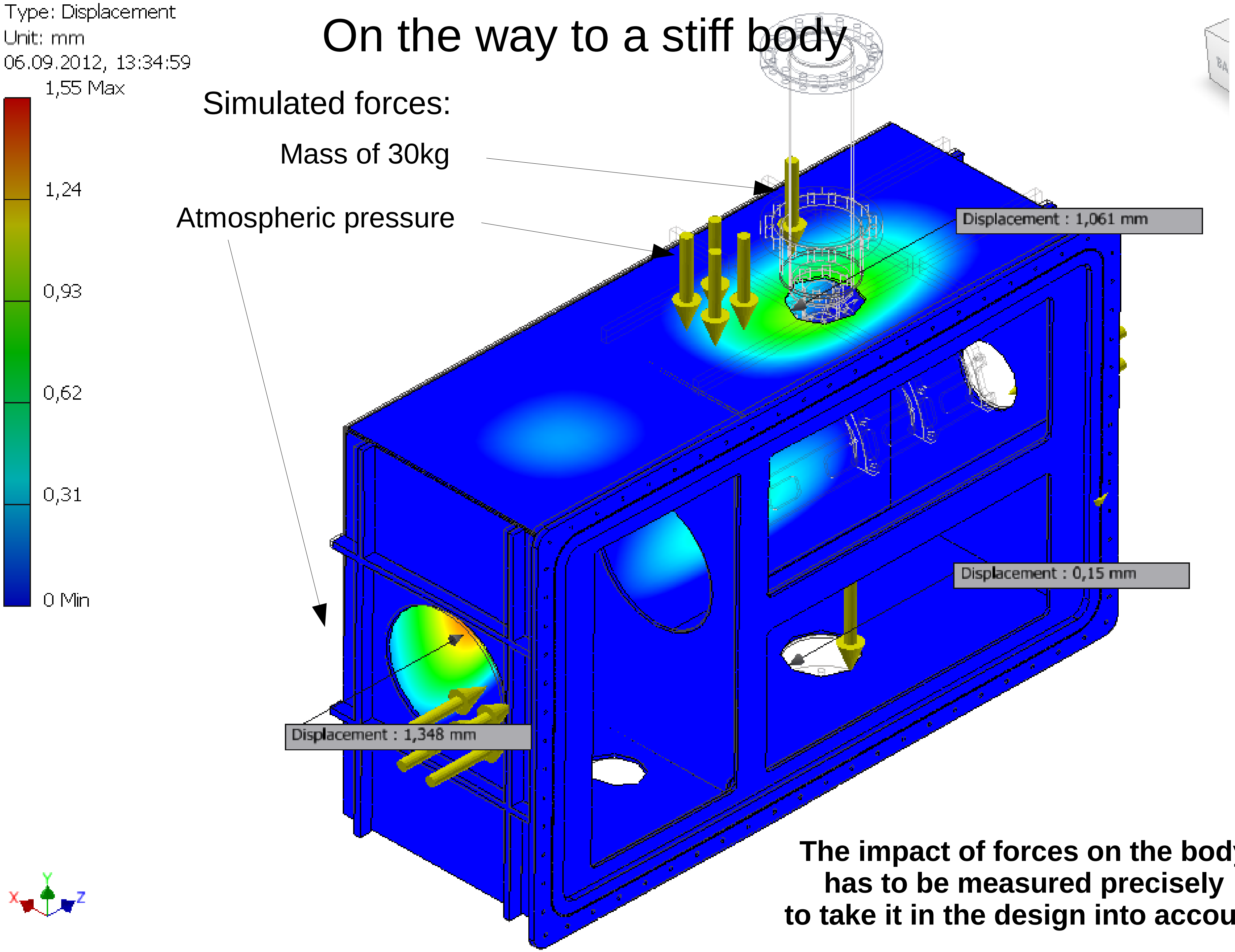
Lauda XT 550 (W)

On the way to a stiff body

Simulated forces:

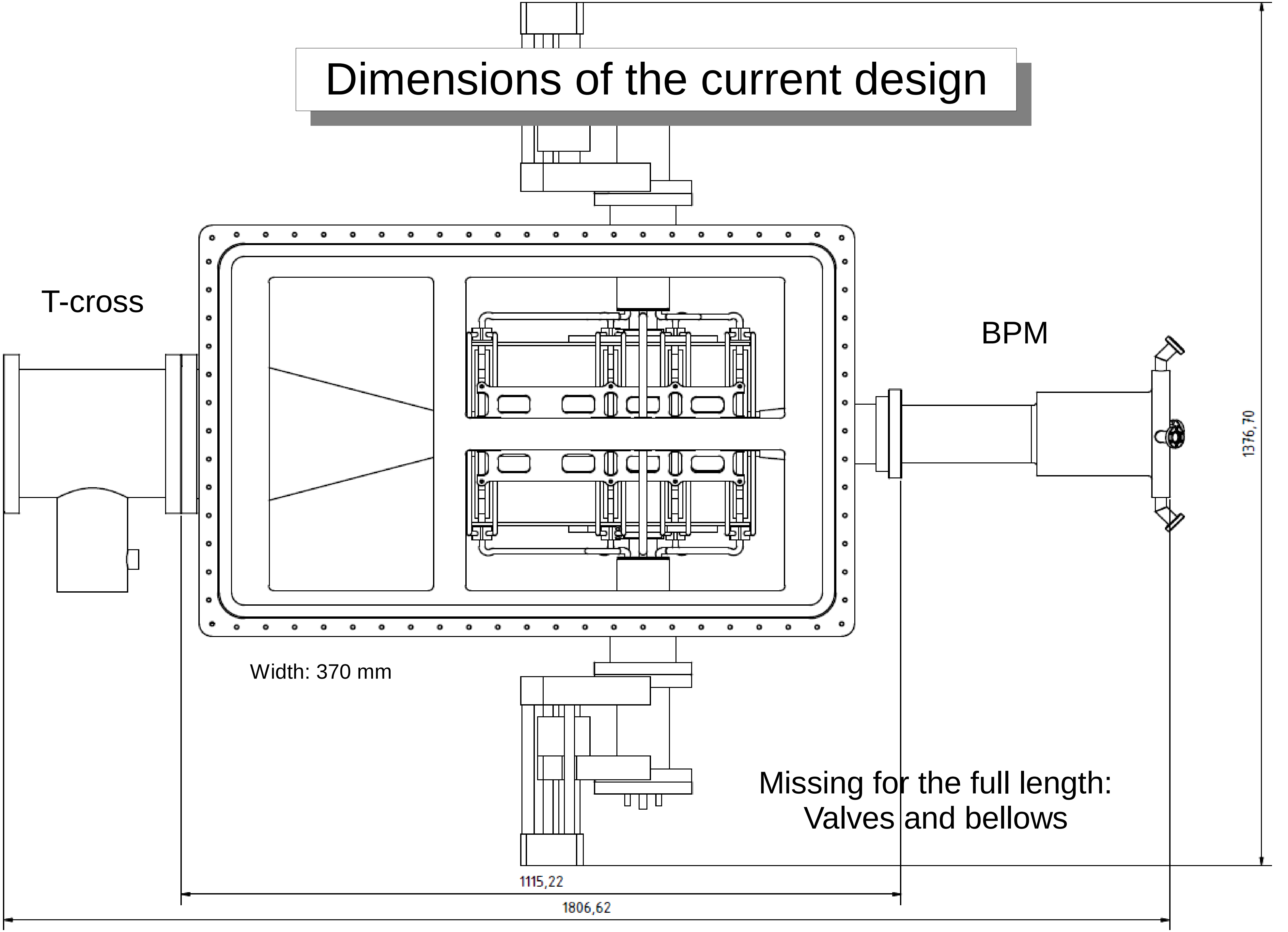
Mass of 30kg

Atmospheric pressure



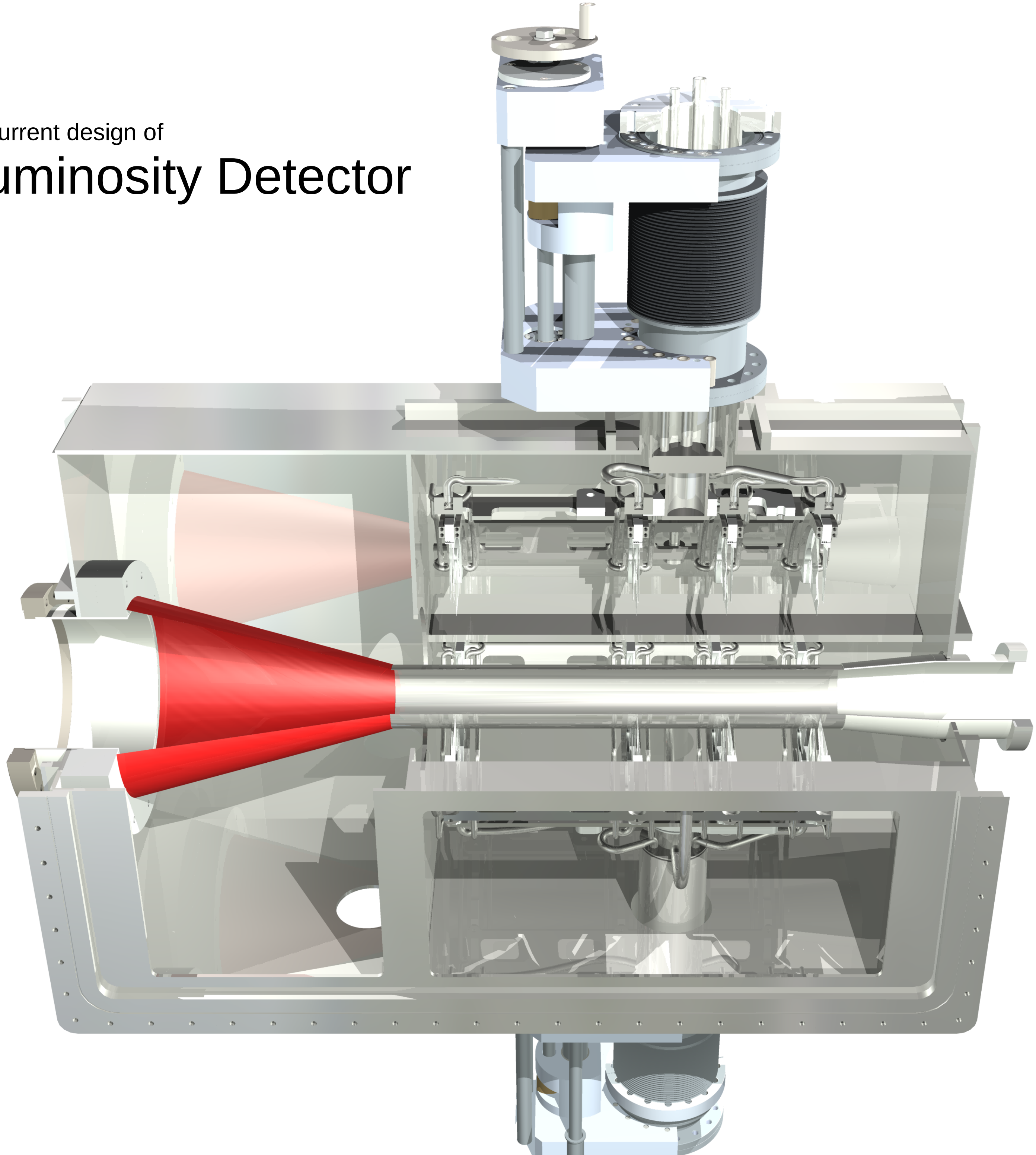
The impact of forces on the body has to be measured precisely to take it in the design into account

Dimensions of the current design



Finally: The current design of

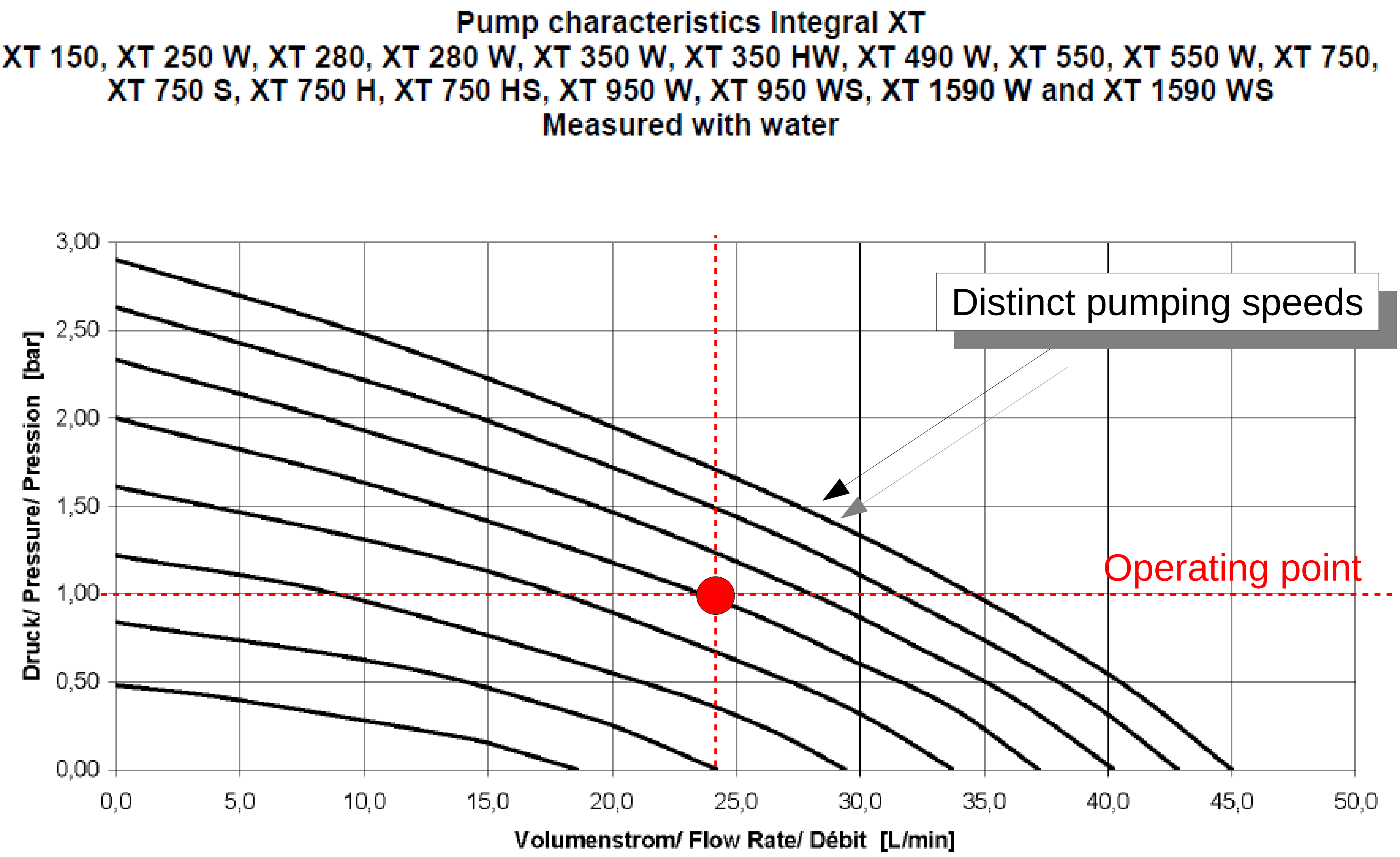
The Luminosity Detector



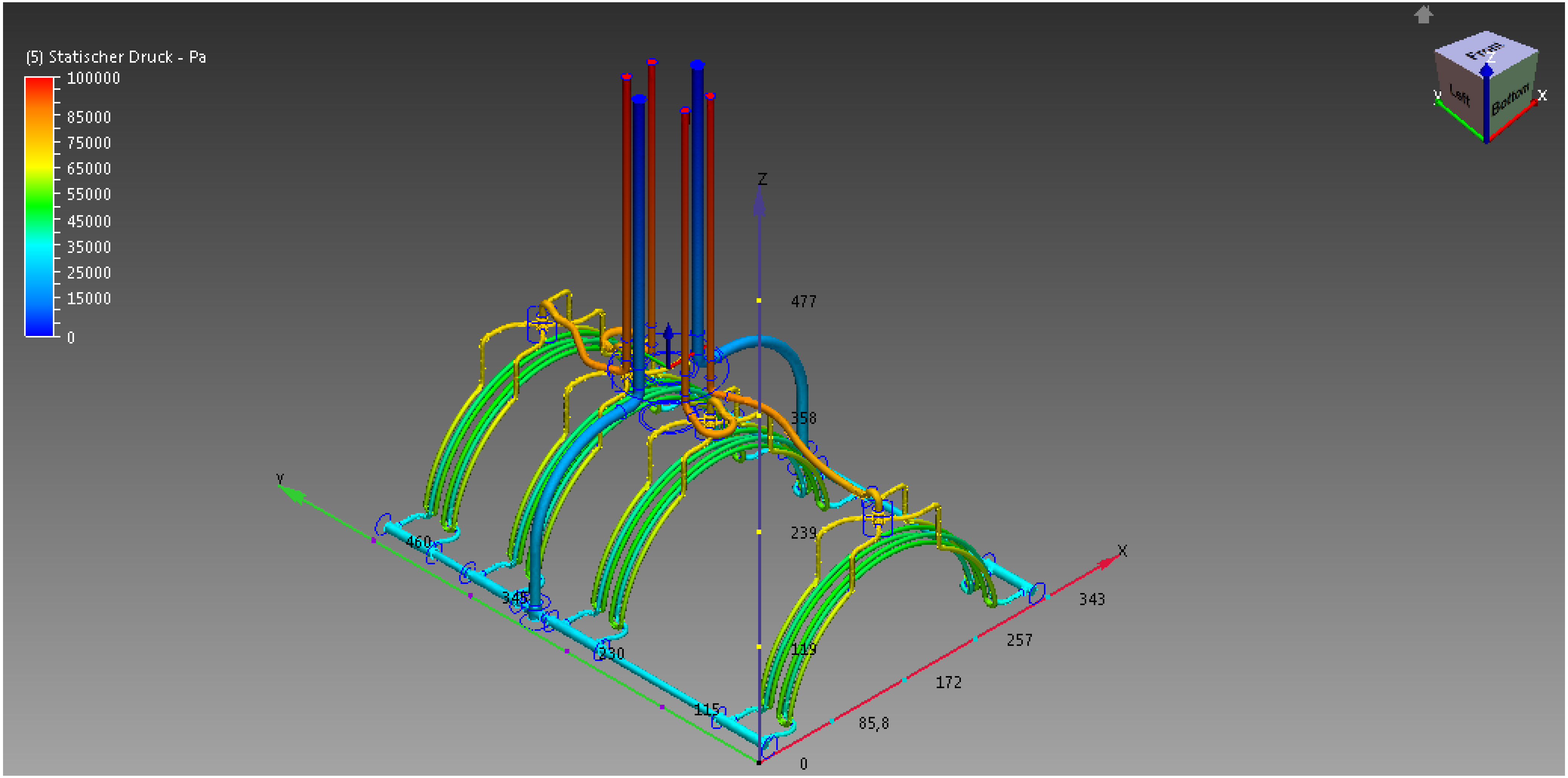
Thank you!

Backup slides

Load performance of the LAUDA pump

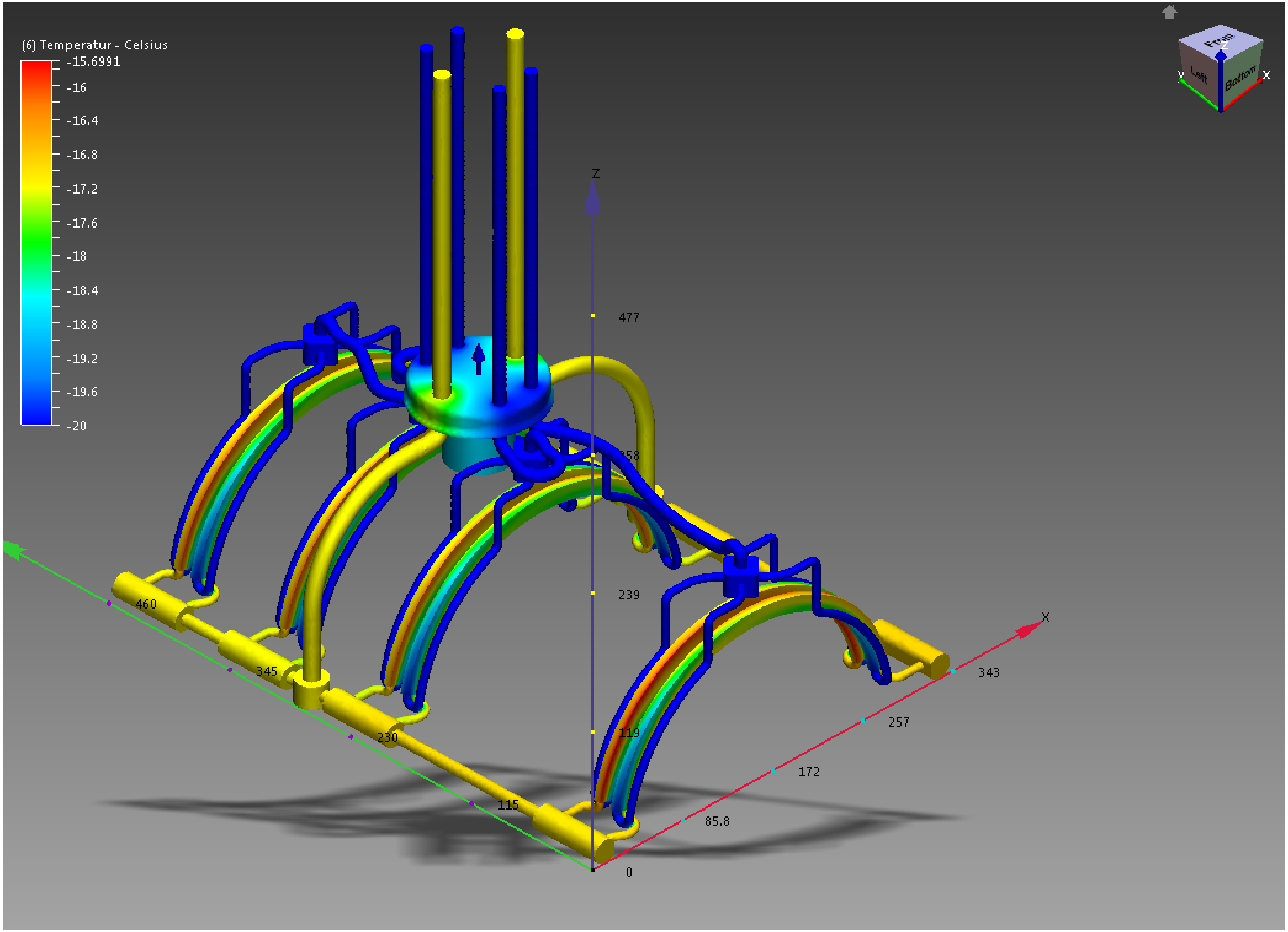


CFD studies on the concept



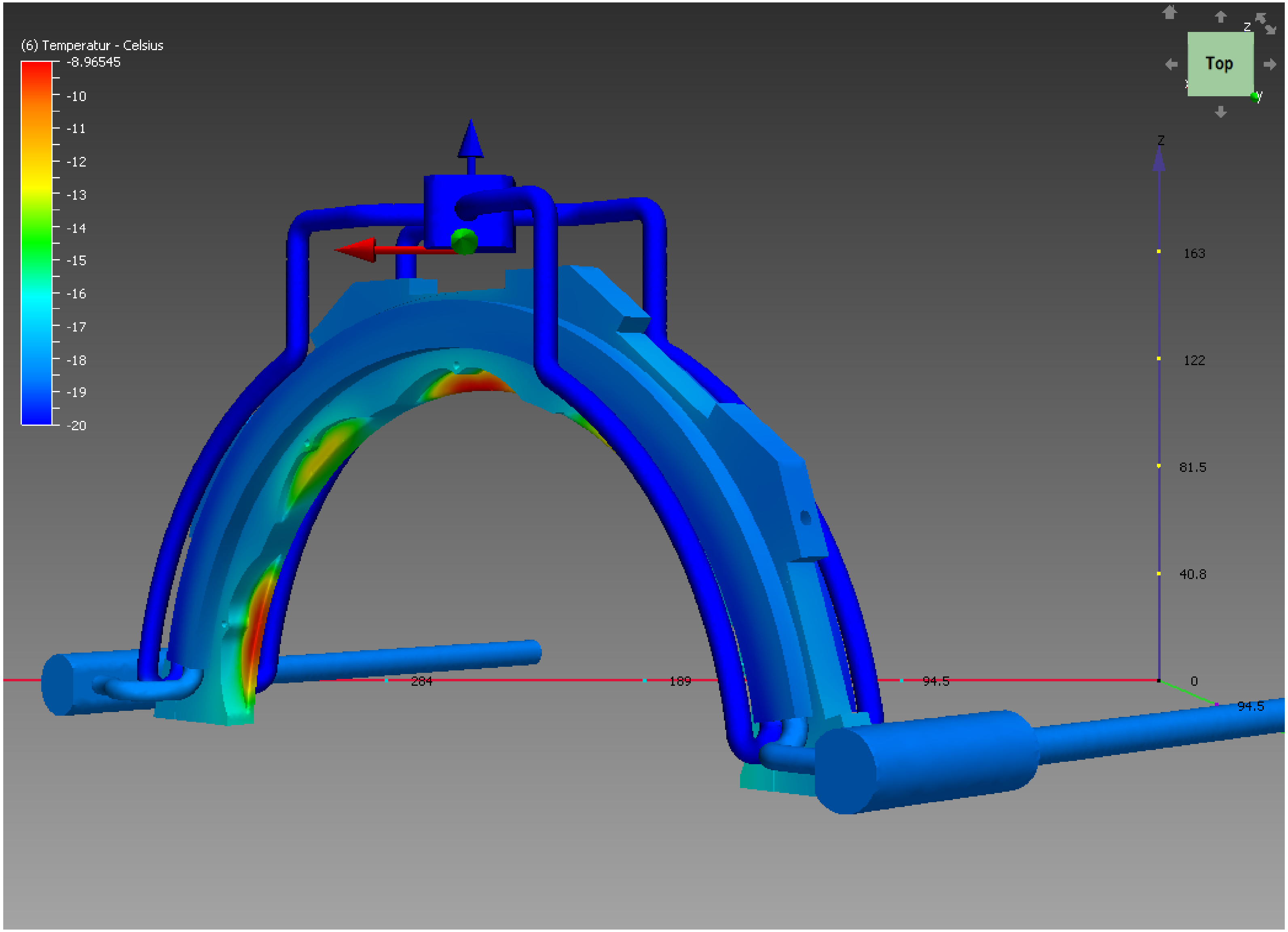
1 bar at the inlet applied. 0 bar at the outlet. → No significant pressure drop observed.
Flow 200 ml/s = 12 l/min of ethylglycol

Temperature distribution



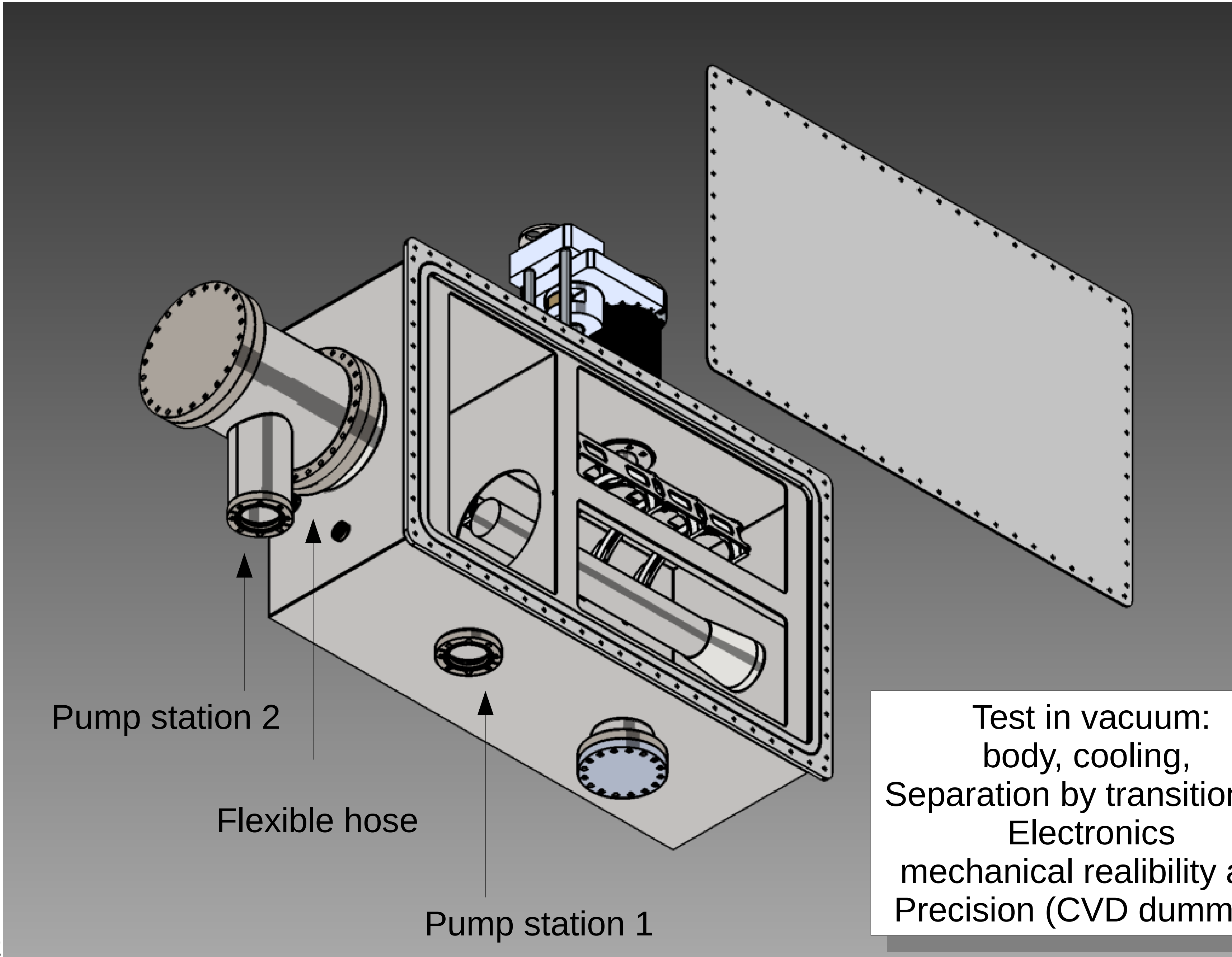
Temperature difference of up to 3.3 degree at 1.6 kW power consumption per detector half.

Temperature distribution on one plane half



Cooling task will be taken over by a new PhD student. Prototype tests in preparation.

The LUMI prototype

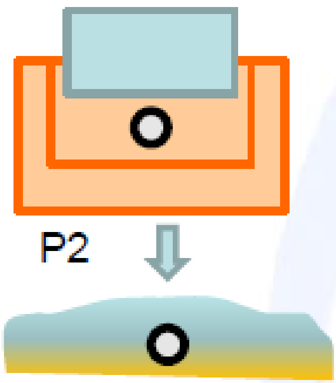


Test in vacuum:
body, cooling,
Separation by transitionfoil,
Electronics
mechanical realibility and
Precision (CVD dummies)

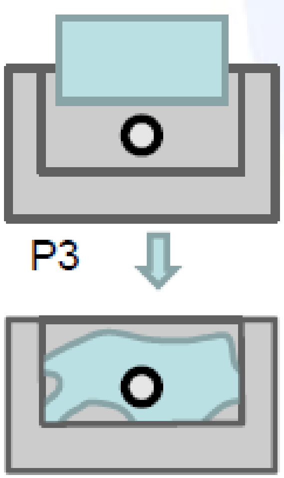
bverlaat@nikhef.nl

The biggest fun we had: *"Baking cookies"*

Welding tube inside



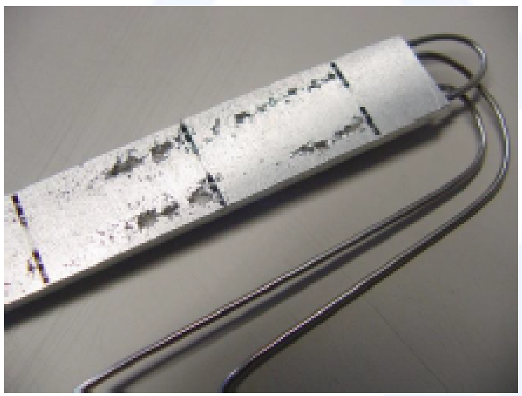
Melting in a copper mold



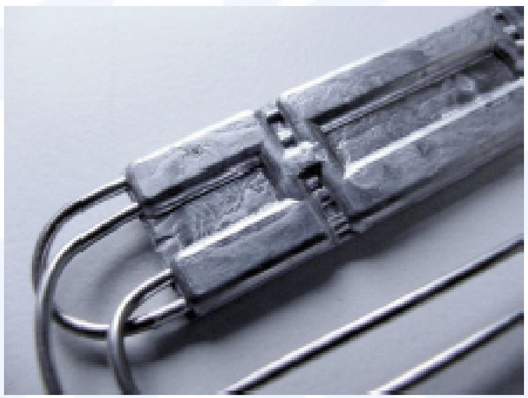
Melting in a SS mold with inert gas

- 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?

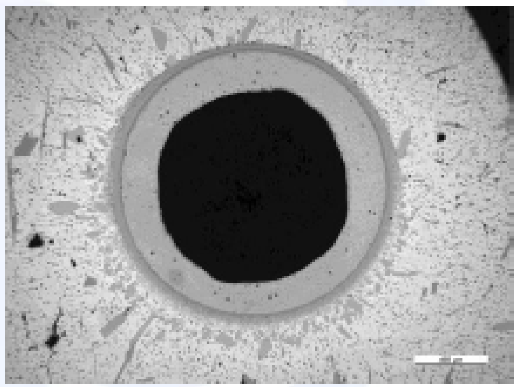
Prototype 4: Mg vapor bubbles due to vacuum



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

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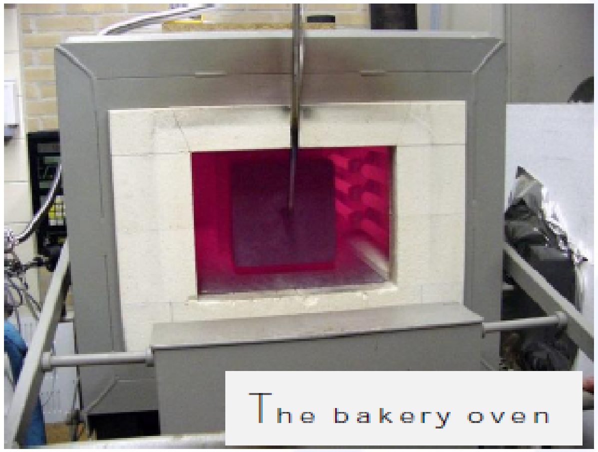
CERN

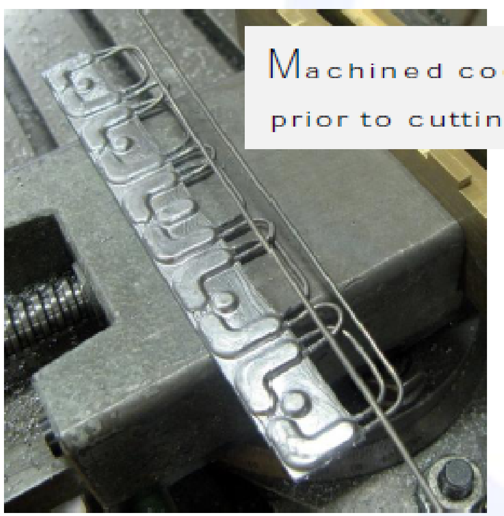
"The cookie bakery"


The bakery oven


Serial production baking


A bare cake

A sliced cake


Machined cookie prior to cutting


Tube bend jig


Mold detail


A delicious aluminum cake!

Magic pen to stop "super fluid aluminum"

Assembly tools