

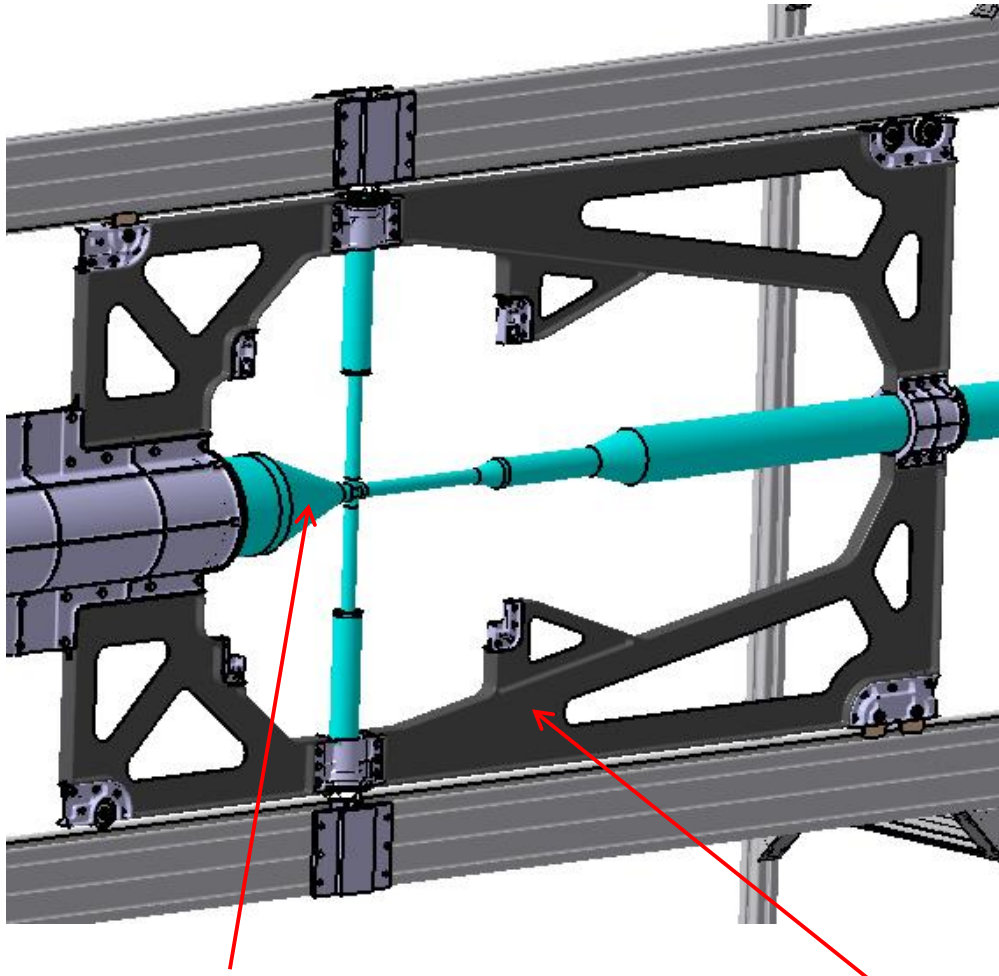
257 - Panda Vacuum System

Prototype: titanium vacuum chamber with IP-cross

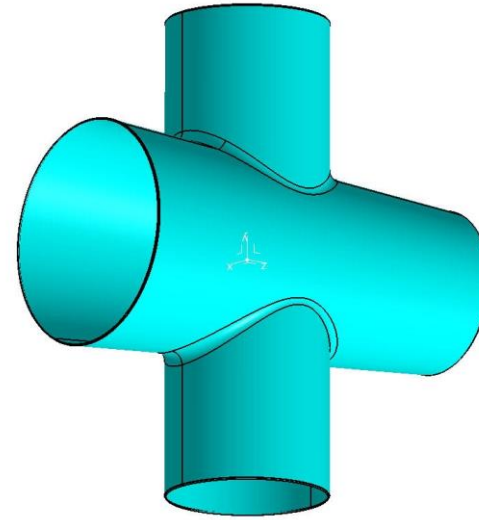
PANDA collaboration meeting from 25. to 29. October 2021

Björn Rottland, Ralf Schmitz, Herbert Schneider, Stephan Schönen

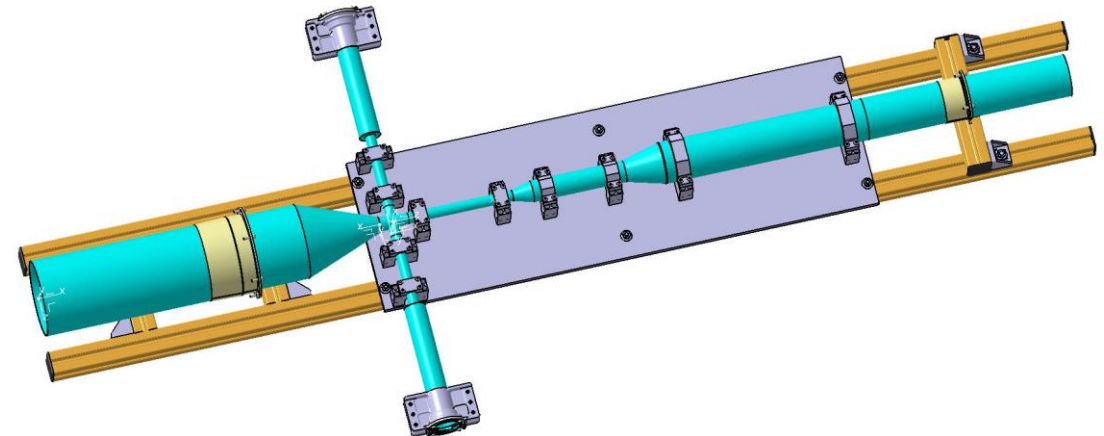
Prototype titanium vacuum chamber



Picture 1: Titanium vacuum chamber – supported by the central support frame (CSF)



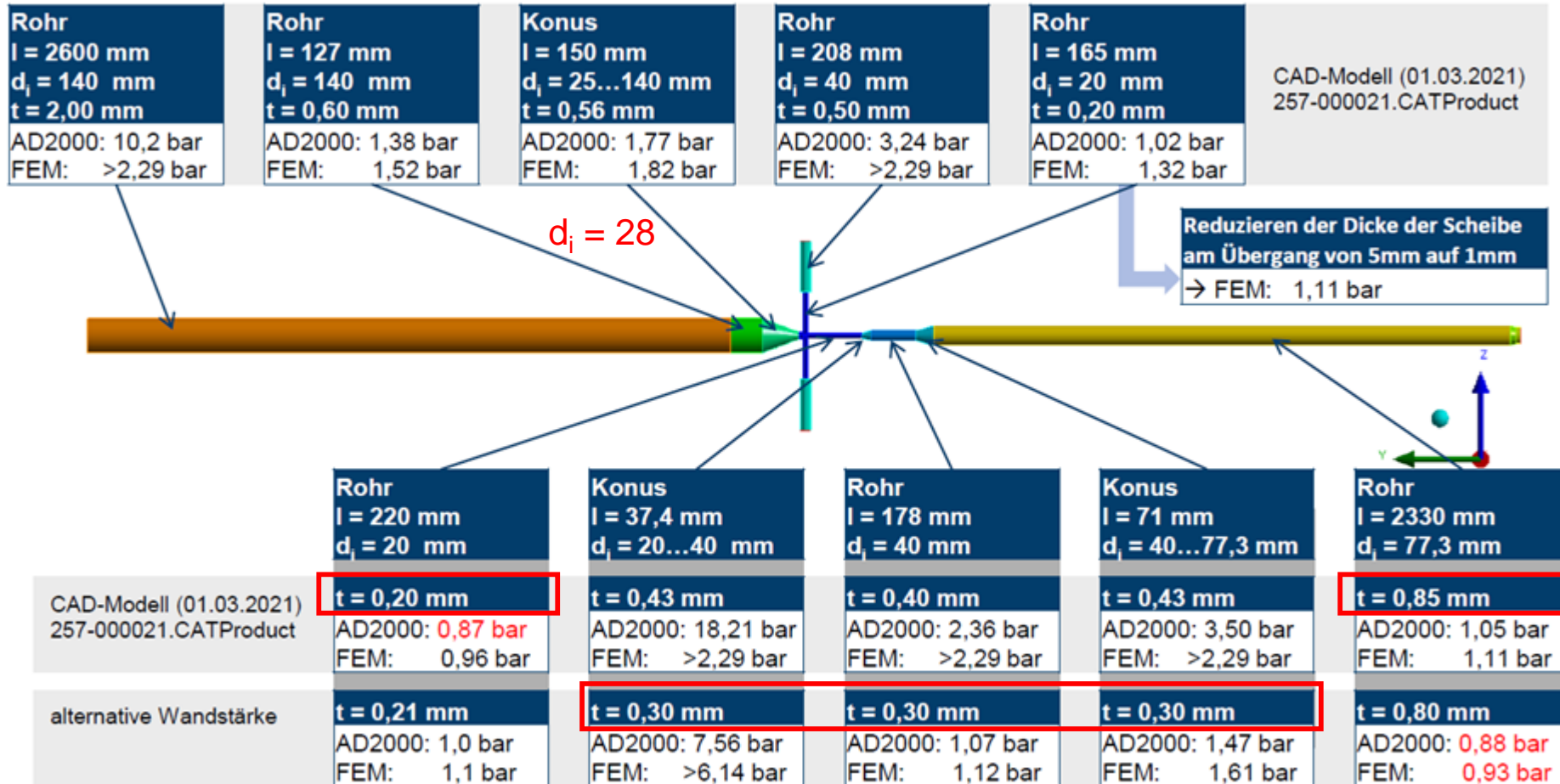
Picture 2: IP-cross – conical D_{inner} 20 mm to 28 mm



Picture 3: IP-Cross - kept in position by the welding-frame

Prototype titanium vacuum chamber

This table shows the wall thickness of each vacuum-pipe respecting a safety factor $S_k = 3,0$ (related to AD2000 standard)



The red framed t-values will be applied at the Vacuum-chamber

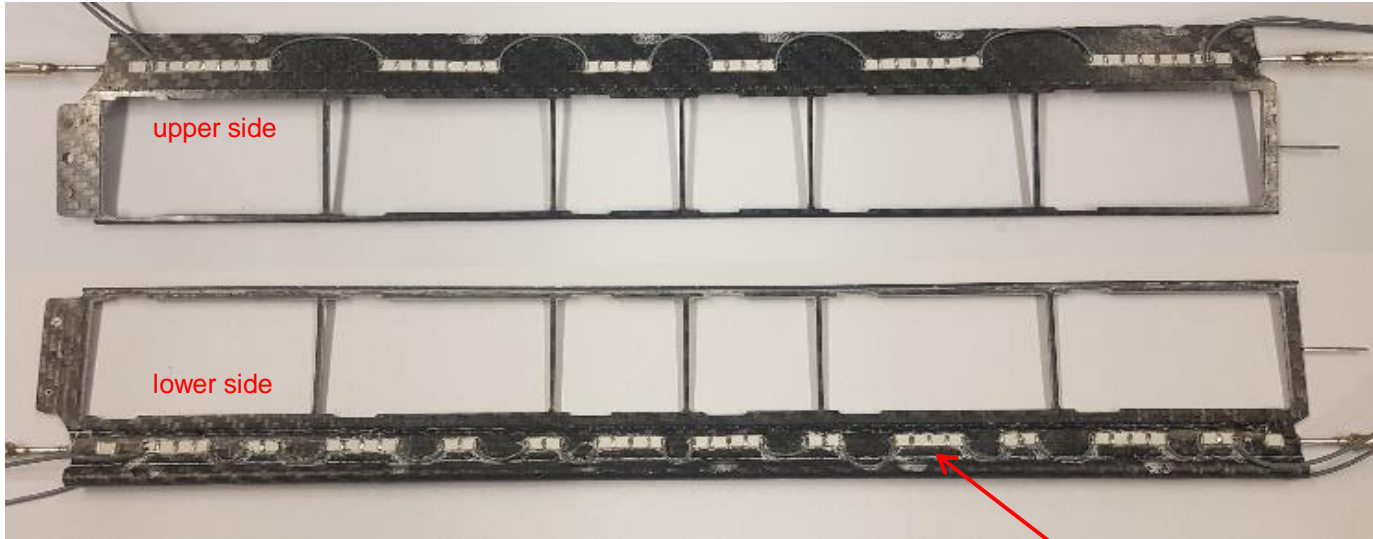
257 - Panda MVD

Status of the staves and half cylinder

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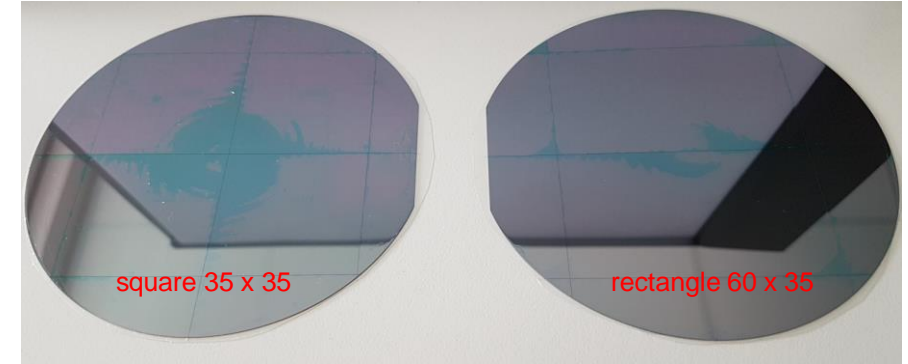
BL4-Stave



Picture 1: BL4-Stave 5 – prepared with $72 \times 0.27\Omega$ (white squares)

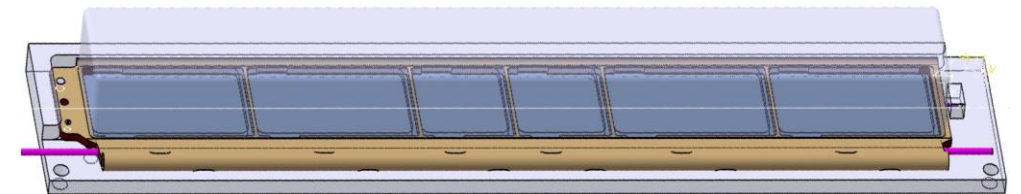
Two circuits are bonded by heat conductive adhesive on the stave.
The resistors serve as dummies for the TOAST and MDC chips with the aim to simulate the heat-losses of these.
 $2 \times 36 \times 0.27\Omega = 19.44\Omega$, $I=0,96A \Rightarrow P_{\max} = 18 W$

The measurement of the electrical properties of the resistor circuit shows a conductive connection between upper and lower side.
The heat conductive adhesive is supposed to electrically isolate the resistors from the surface.
Most likely electrical contacts between them have been caused by soldering the cables to the resistor-packages.
To avoid at least current flowing between upper and lower side, galvanic isolated power supplies were connected to each circuits.



Picture 2: Si-plates/slides as dummies for the sensors

The prototype of the MVD-half-cylinder, with 13 BL4-staves will be provided with Si-plates/slides as shown in the picture below.

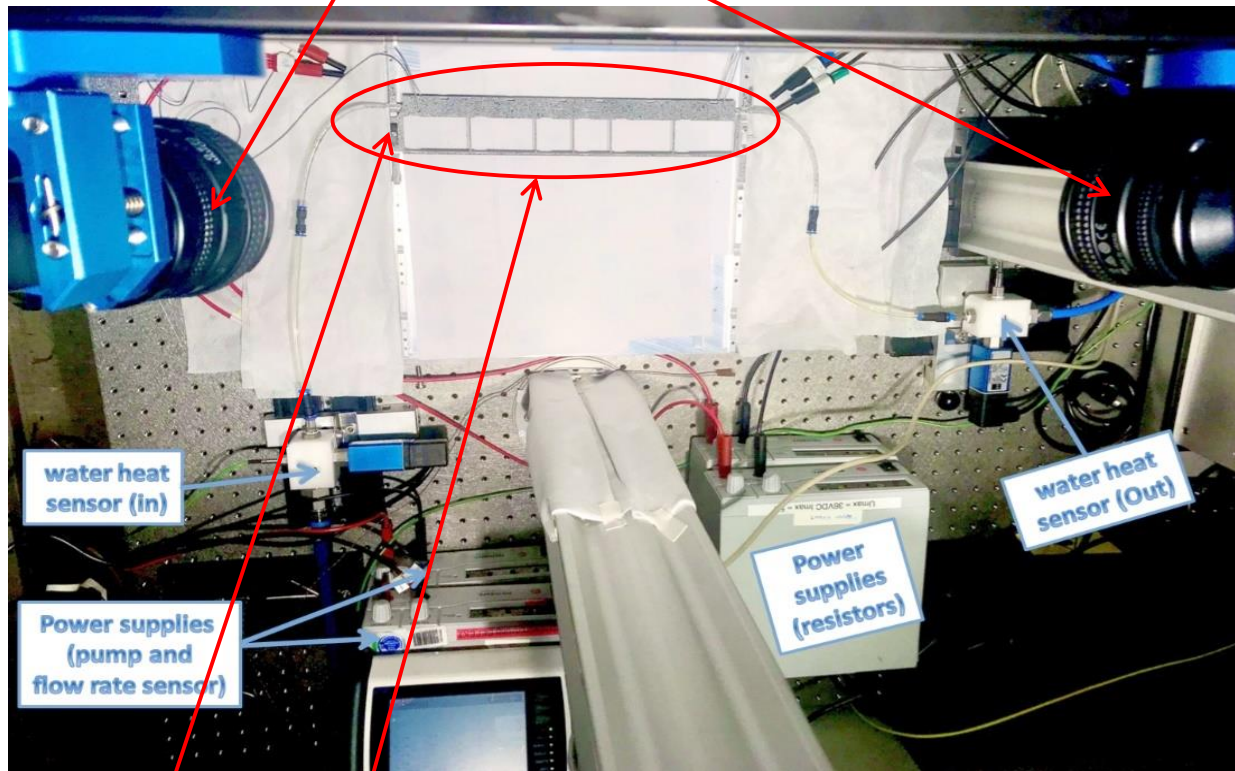


Picture 3: Mounting device for the Si-plates/slides in BL4-staves

The mounting device “MVR Sensor” allows a precise onset of the plates/slides into the windows of the staves.

BL4-Stave

Cameras for "Digital Image Correlation" (DIC)



ZEA-1 laboratory:

Two cameras for the measurement of changes in the spatial dimensions by "Digital Image Correlation".

Measuring the expansion of the stave due to the heating by the dummychips.

Conditions:	Electrical power (EP) 18 W
Water-cooling (WC):	On with different flow-rates, and off
Measurements:	Temperature of stave and resistors
	Expansion in X, Y and Z

Results:

WC on (400ml/min):

$$dX_{\max} = 2 \mu\text{m} \quad dY_{\max} = -7 \mu\text{m} \quad dZ_{\max} = 35 \mu\text{m} \quad dT_{\max} = 0.98 \text{ K}$$

WC on (250ml/min):

$$dX_{\max} = 5 \mu\text{m} \quad dY_{\max} = -11 \mu\text{m} \quad dZ_{\max} = 50 \mu\text{m} \quad dT_{\max} = 1.83 \text{ K}$$

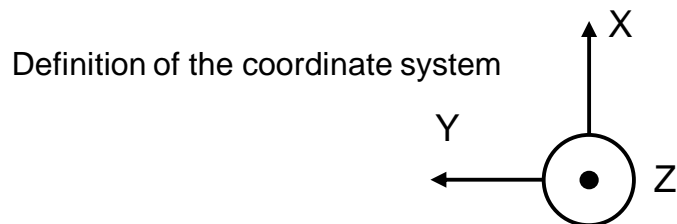
WC on (120ml/min):

$$dX_{\max} = 8 \mu\text{m} \quad dY_{\max} = -15 \mu\text{m} \quad dZ_{\max} = 75 \mu\text{m} \quad dT_{\max} = 3.40 \text{ K}$$

WC off (no water cooling) and EP 18 W for 15 sec:

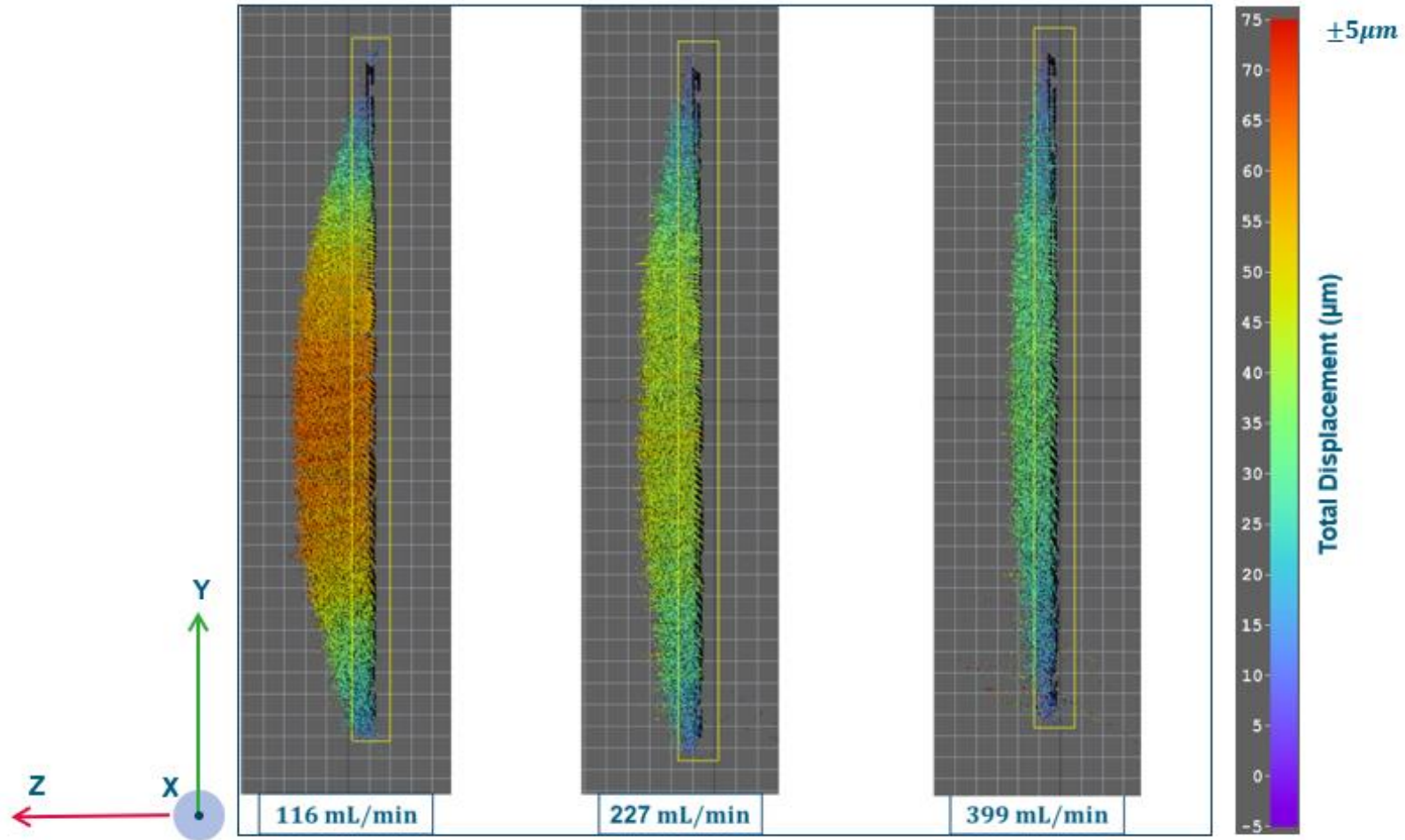
$$dX_{\max} = ?? \mu\text{m} \quad dY_{\max} = ?? \mu\text{m} \quad dZ_{\max} = 136 \mu\text{m} \quad dT_{\max} = 15 \text{ K}$$

Picture 4: Fix point of BL4-stave 5 in the test area with cameras for "Digital Image Correlation"



BL4-Stave

Total Displacement

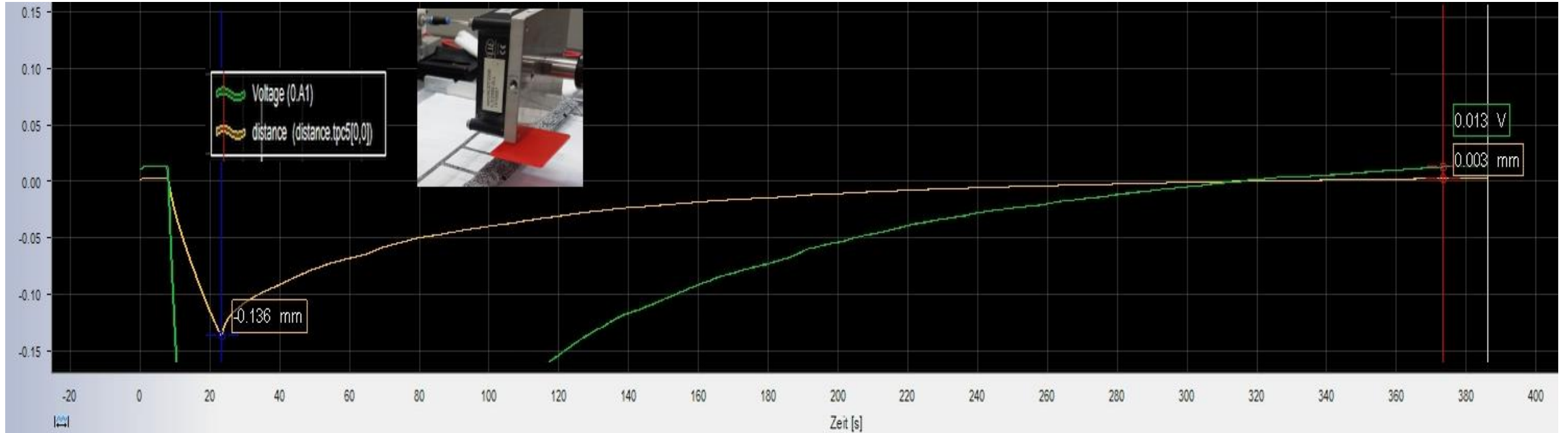


Picture 5: Total displacement of BL4-stave 5, measured with "Digital Image Correlation"

BL4-Stave

Step response, taken by applying 18 W electrical power for 15 sec **without** water cooling

$$dX_{\max} = ?? \mu\text{m} \quad dY_{\max} = ?? \mu\text{m} \quad dZ_{\max} = 136 \mu\text{m} \quad dT_{\max} = 15\text{K}$$

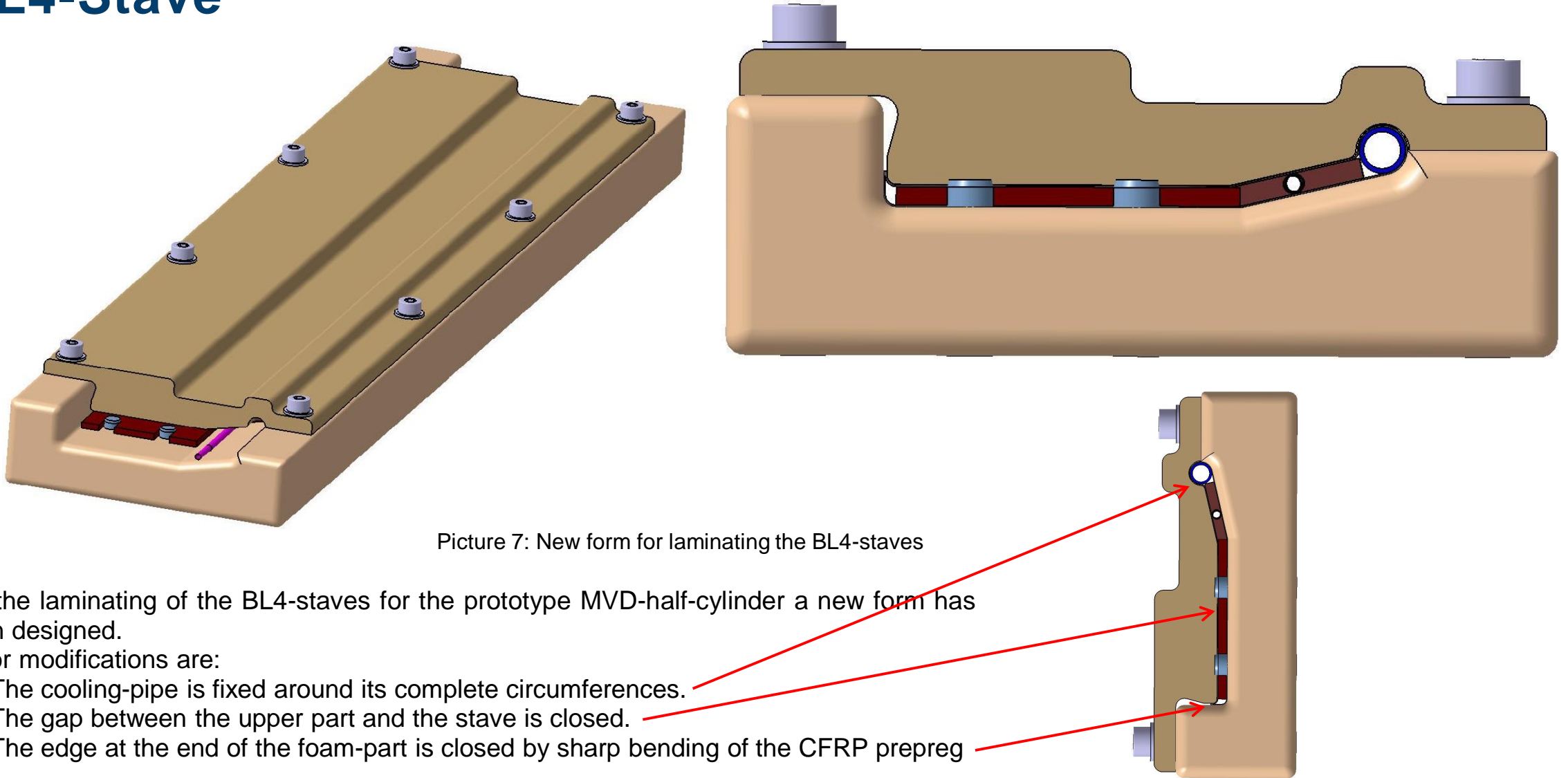


Picture 6: Displacement (bending) of the stave at the centre of the area consisting of cooling pipe and foam POCO-HTC .
Bending -0.136 mm means a movement of the measuring point towards the laser.

This video shows 500 thermo images taken in 15 sec

[20210813 thermo video - complete](#)

BL4-Stave



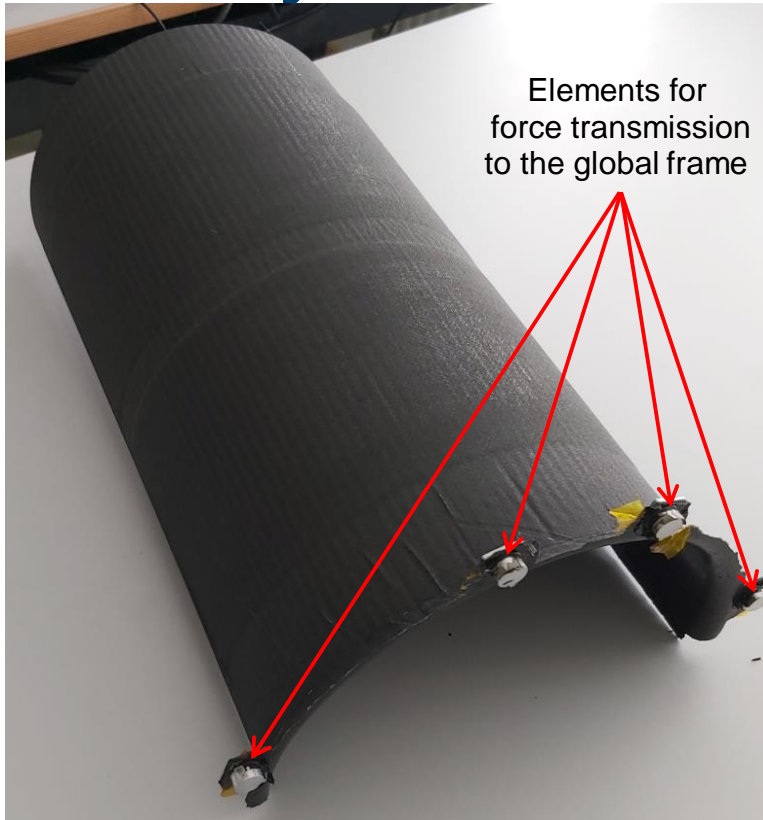
Picture 7: New form for laminating the BL4-staves

For the laminating of the BL4-staves for the prototype MVD-half-cylinder a new form has been designed.

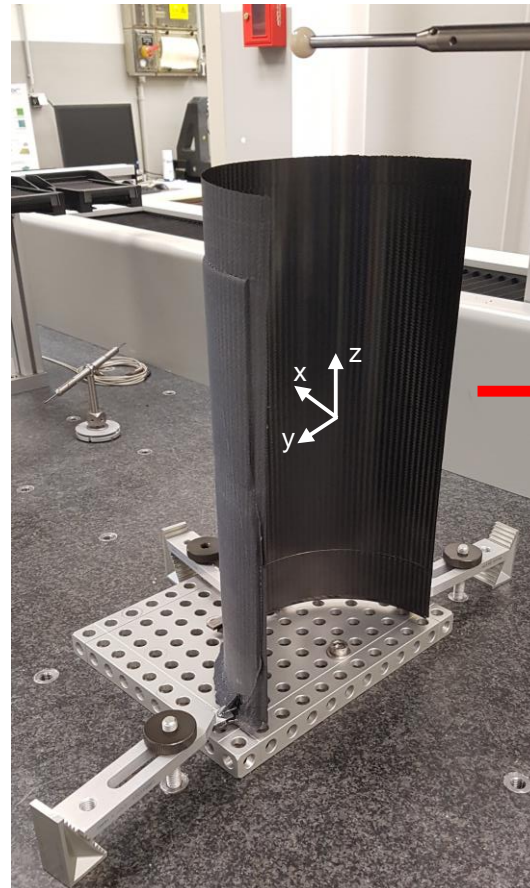
Major modifications are:

- The cooling-pipe is fixed around its complete circumferences.
- The gap between the upper part and the stave is closed.
- The edge at the end of the foam-part is closed by sharp bending of the CFRP prepreg

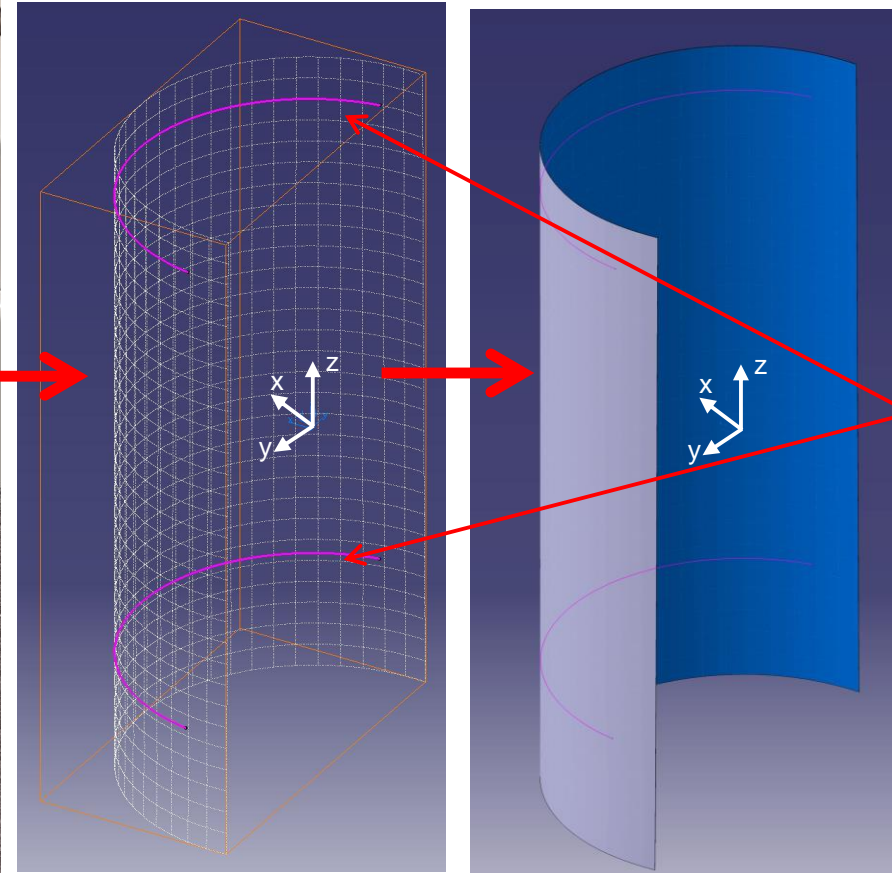
Half cylinder



Picture 8: Half cylinder – manufactured by IKV-Aachen



Picture 9: Half cylinder – during the measurement at ZEA-1



Picture 10: Results of the measurements of the outer circumference as a 3-dimensional surface in CATIA V5

The half-cylinder manufactured by the IKV-Aachen provides the basis for the prototype MVD-half-cylinder.

Results of the measurement of the inner and outer circumference of the half-cylinder: The deviations of the radius in the area of the saw teeth are between 1 mm to 1.4 mm. The deviations of the radius over the entire length of the inner surface are 3 mm and of the outer surface 3.1 mm.