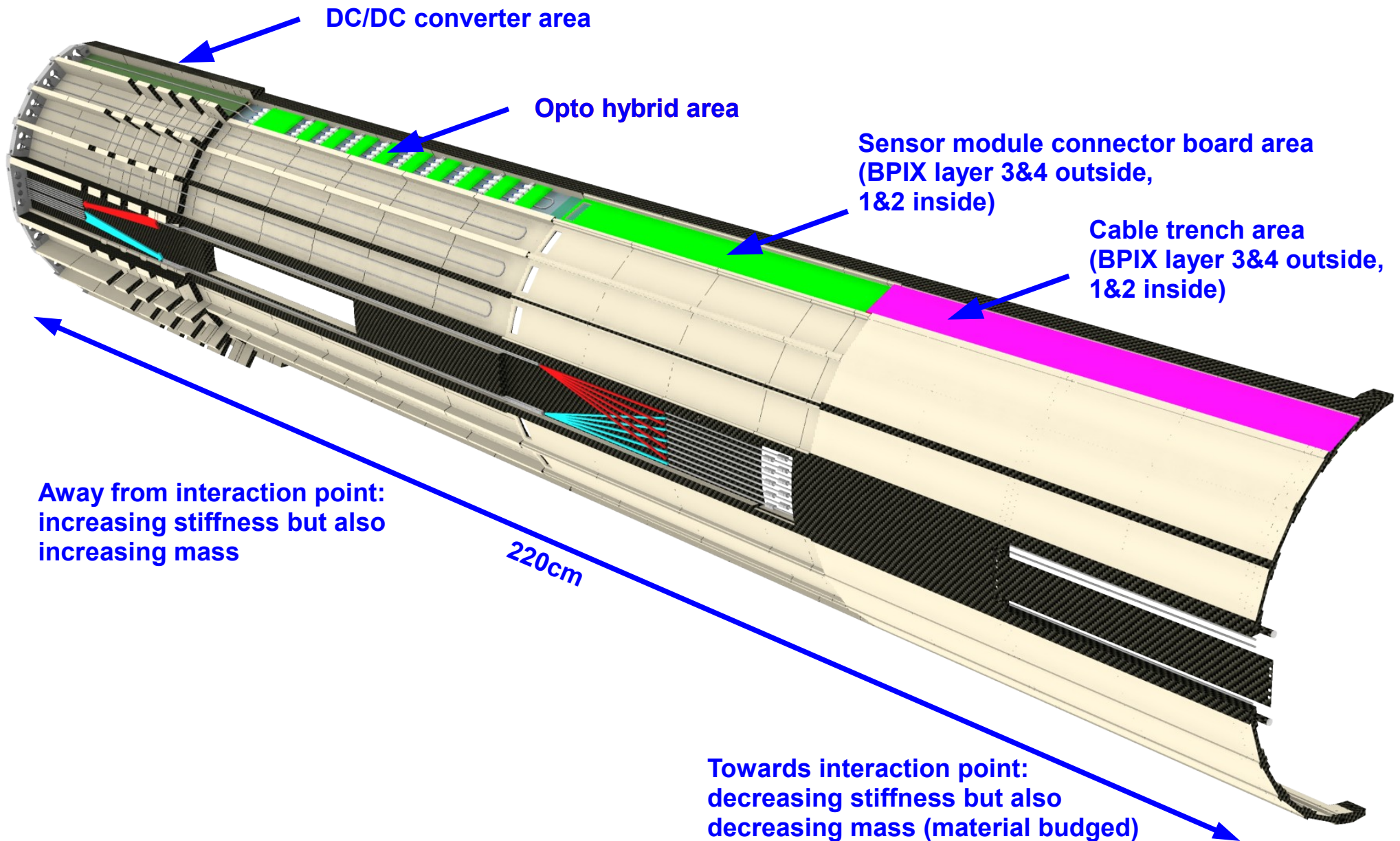


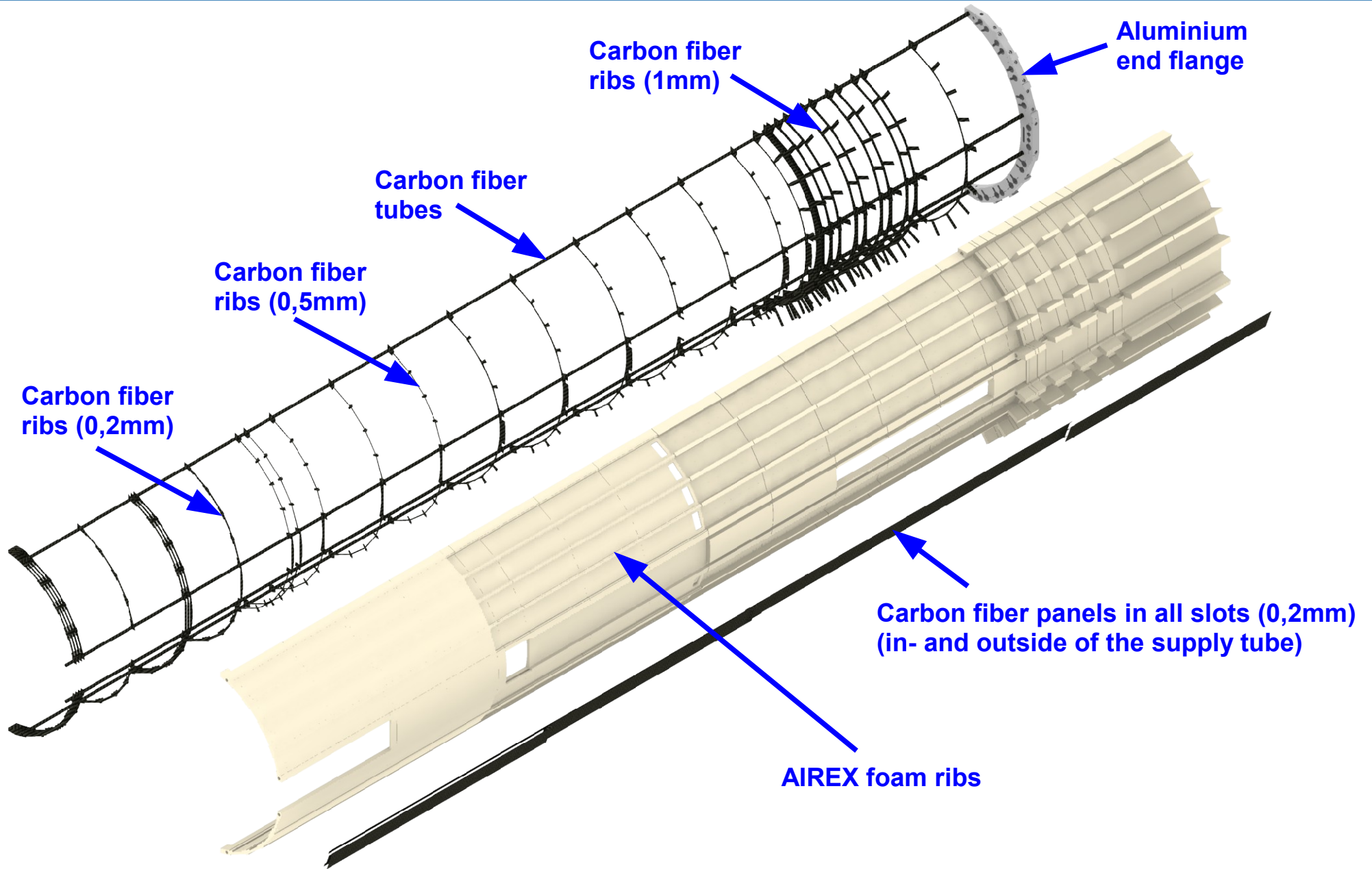
# **Mechanics & Supply Tube for a CO<sub>2</sub> cooled 4 Layer Barrel Pixel System**

Silvan Streuli, PSI  
Tracker Phase 1 Upgrades  
10/28/2009

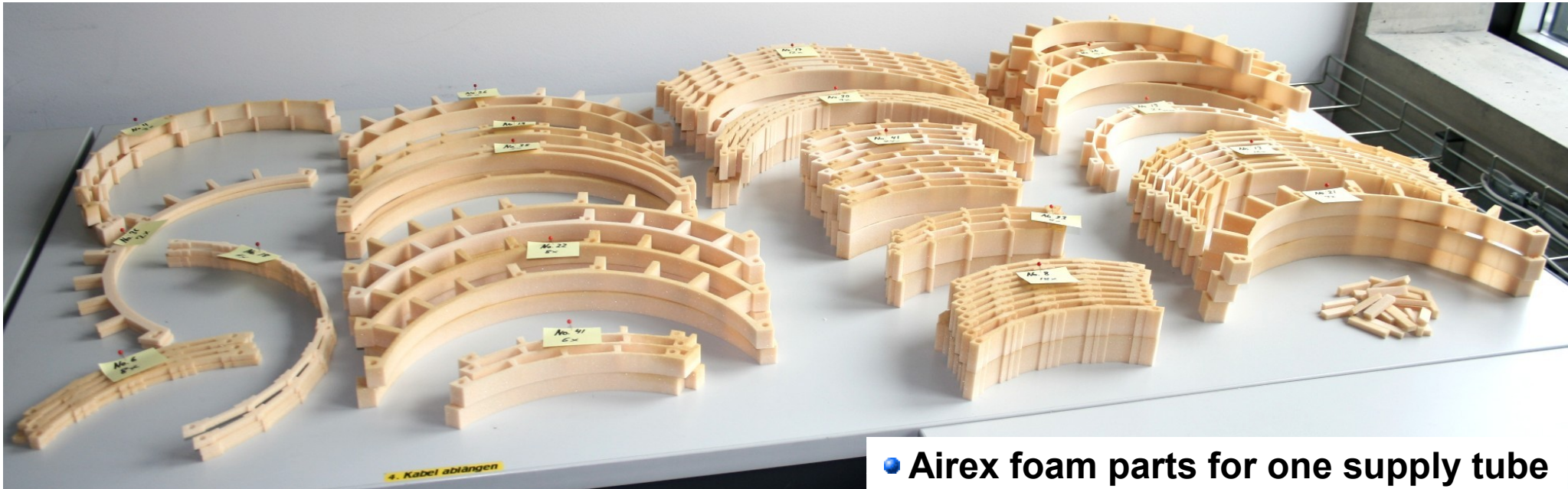
# Overview of new supply tube



# Primary elements of the supply tube



# Airex & carbon fiber ribs and facettes

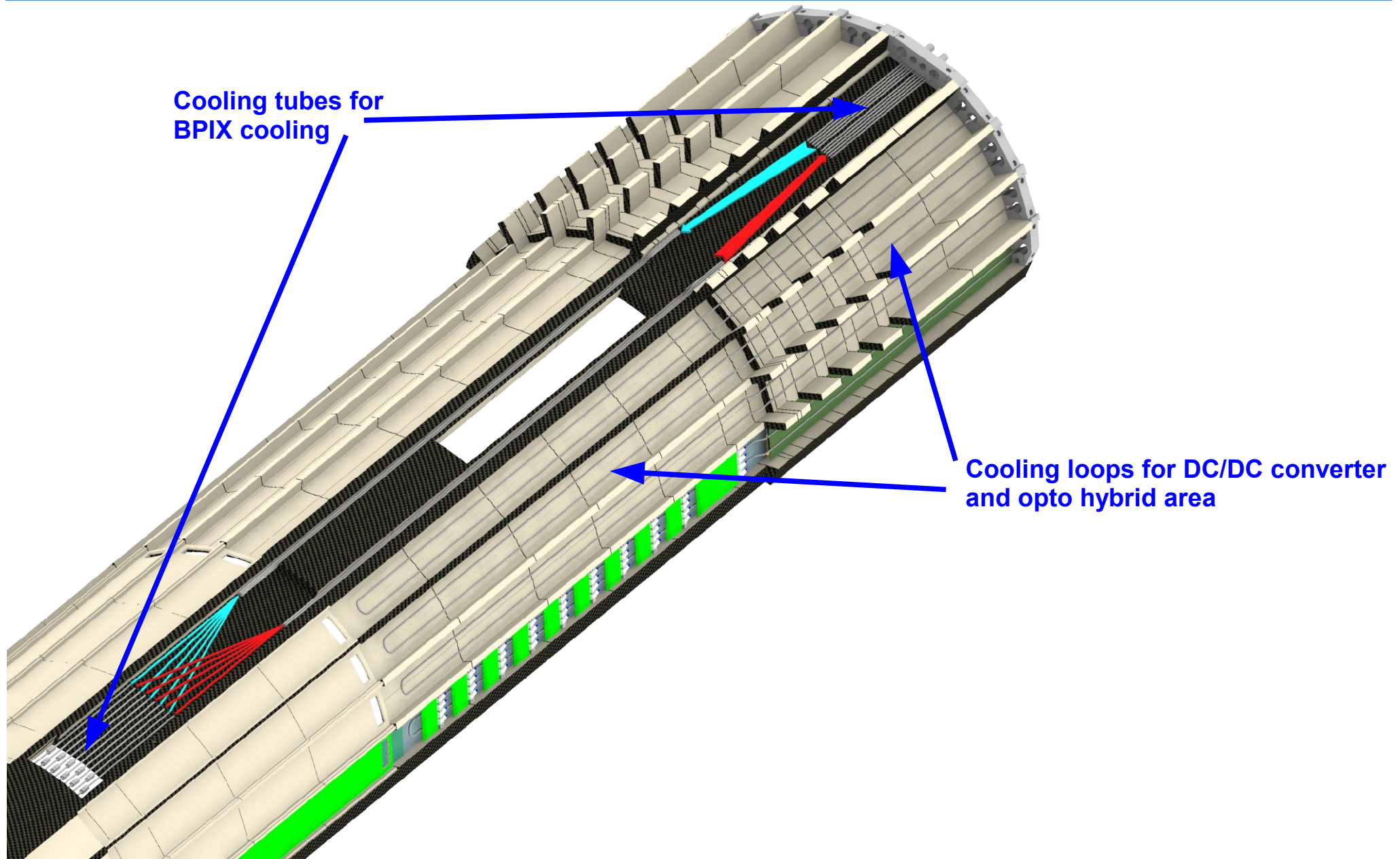


• Airex foam parts for one supply tube

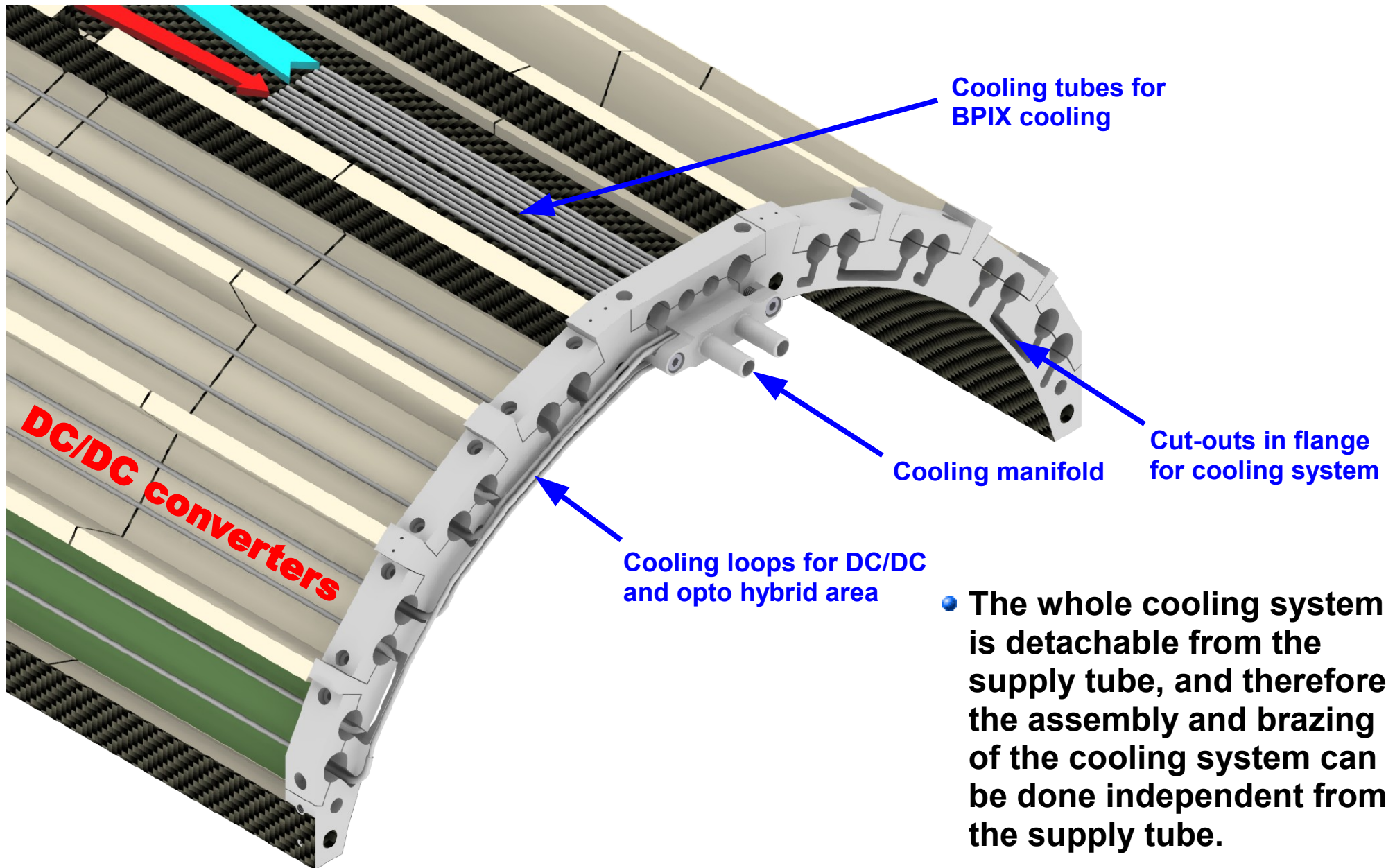


• Carbon fiber parts for one supply tube

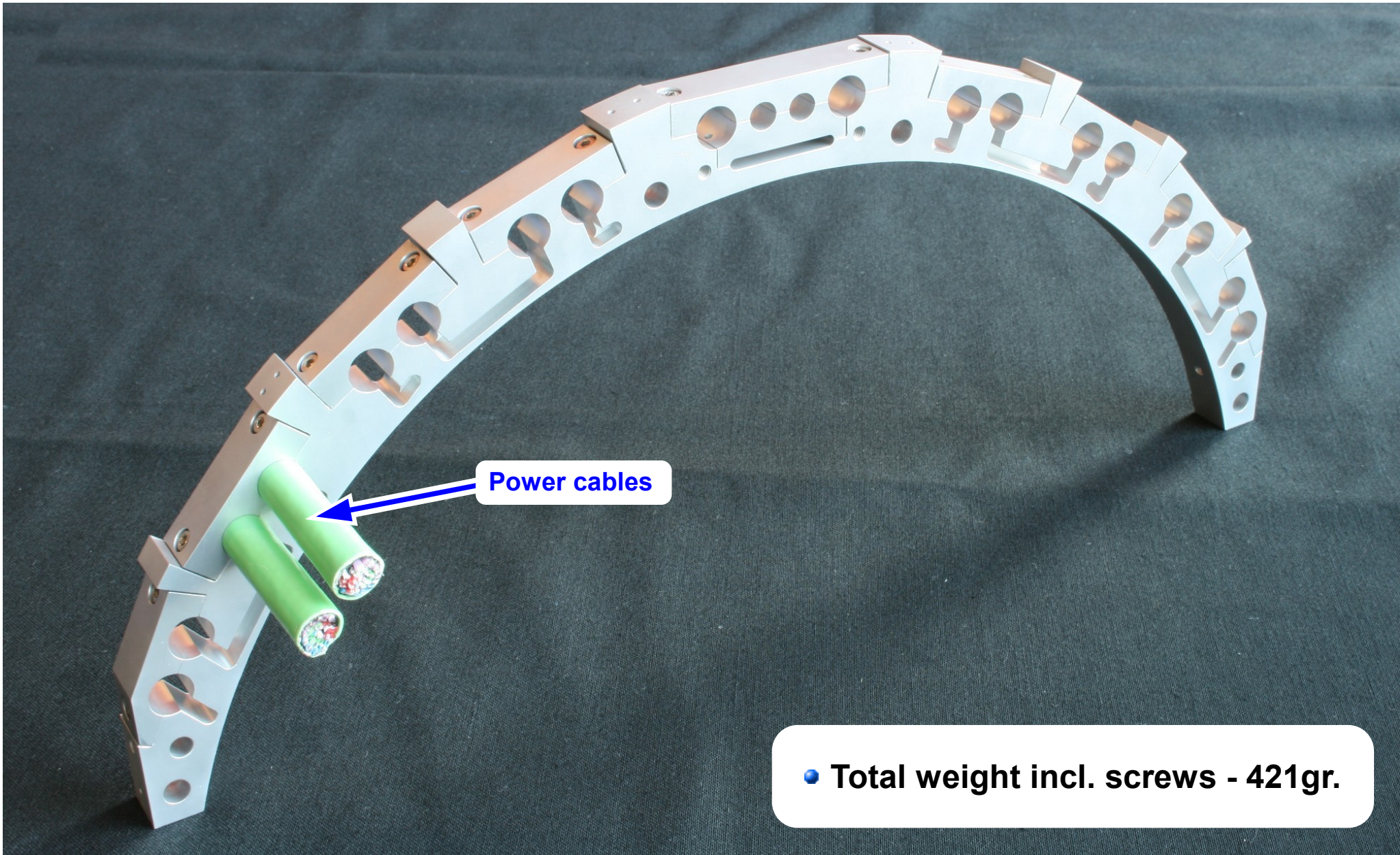
# Cooling pipes & cooling loops on supply tube



# Close-up of cooling manifold

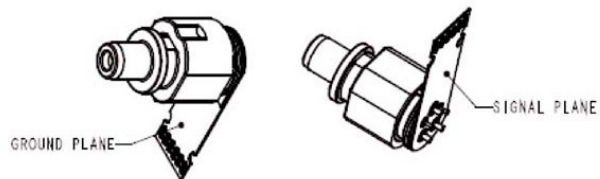
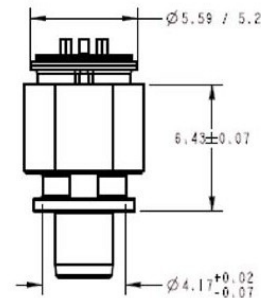
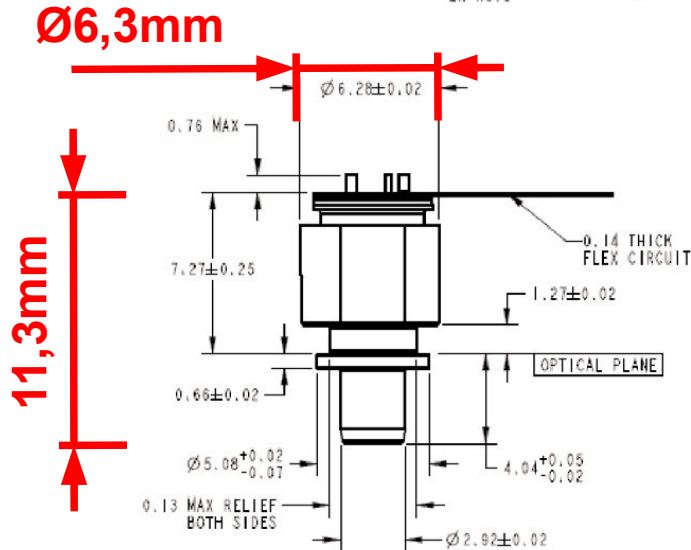
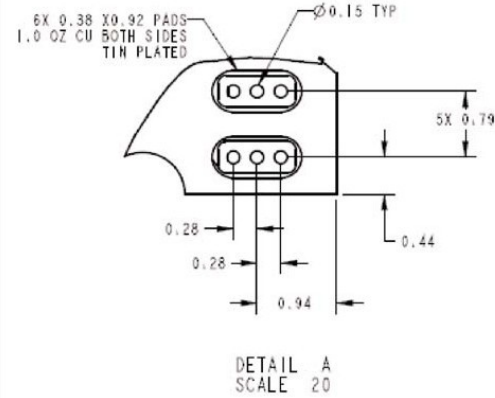
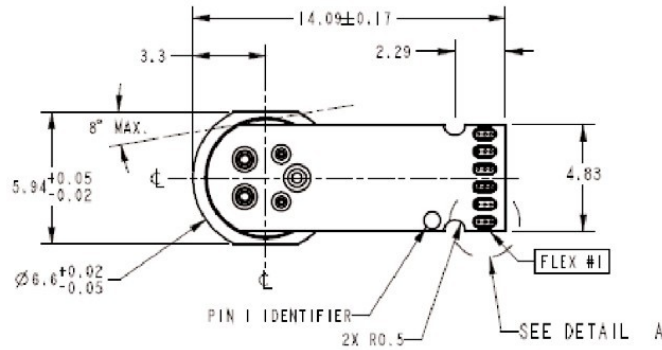


# Prototype aluminium endflange



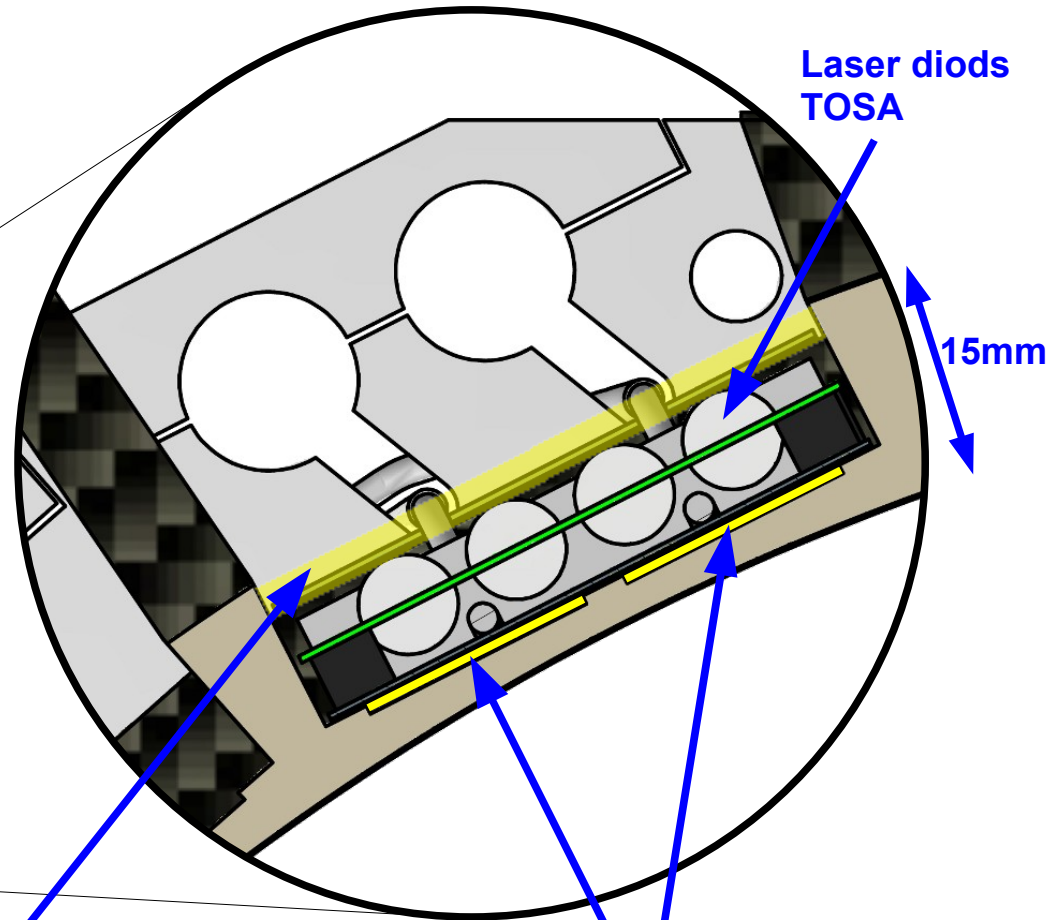
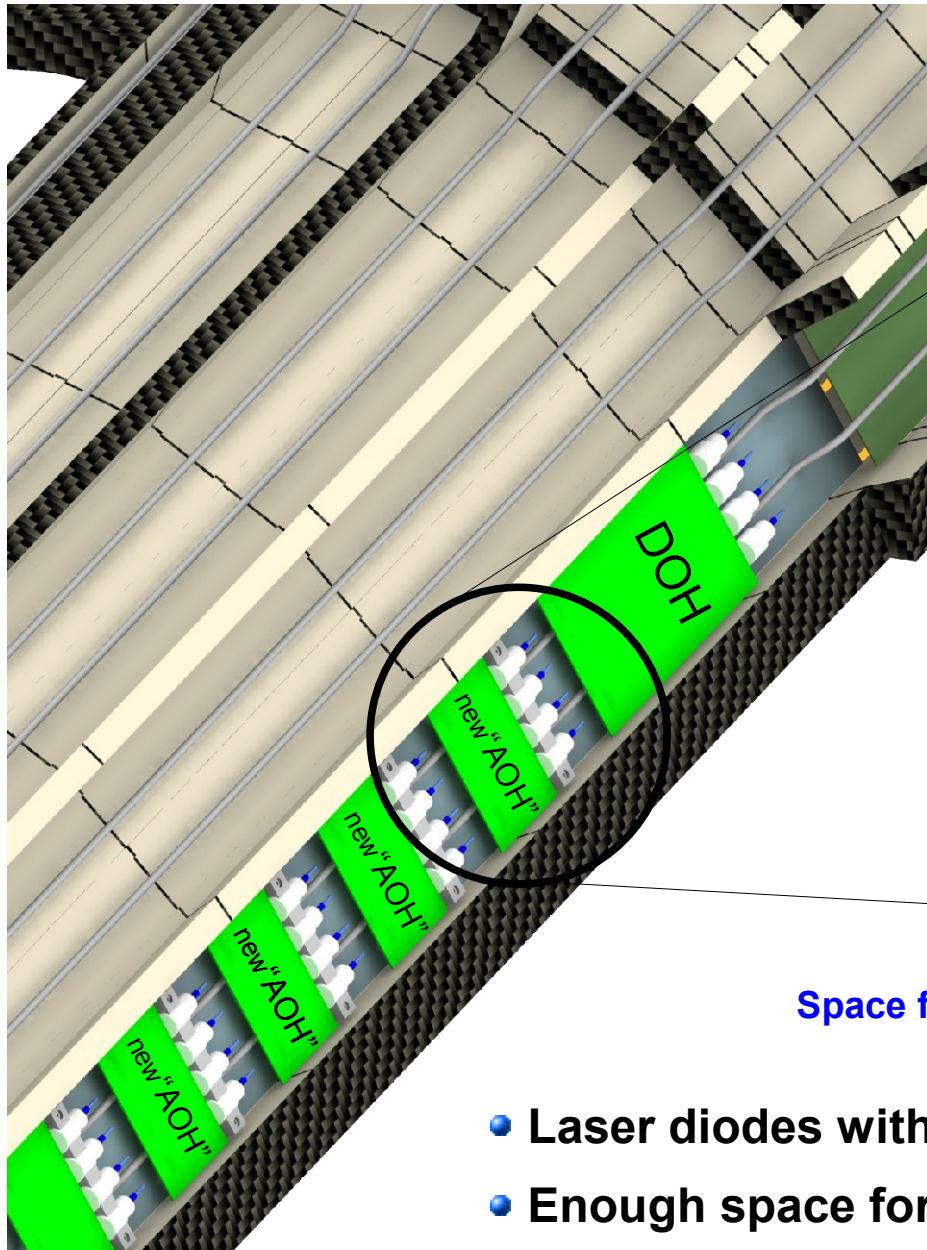
• Total weight incl. screws - 421gr.

# Laser in TOSA housing (Transmitter Optical Sub Assembly)





# Available space for new opto hybrids

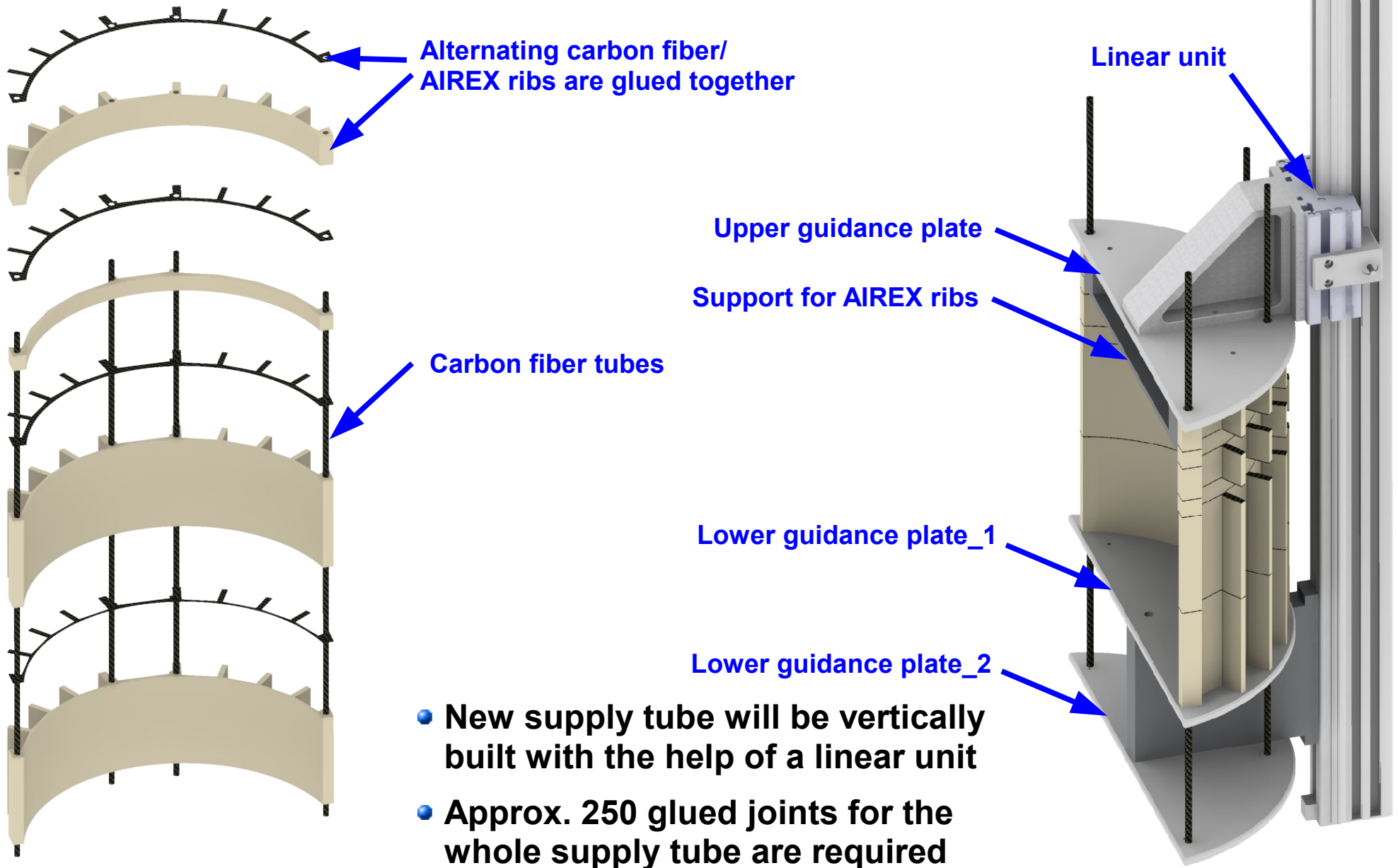


Space for optical fibers

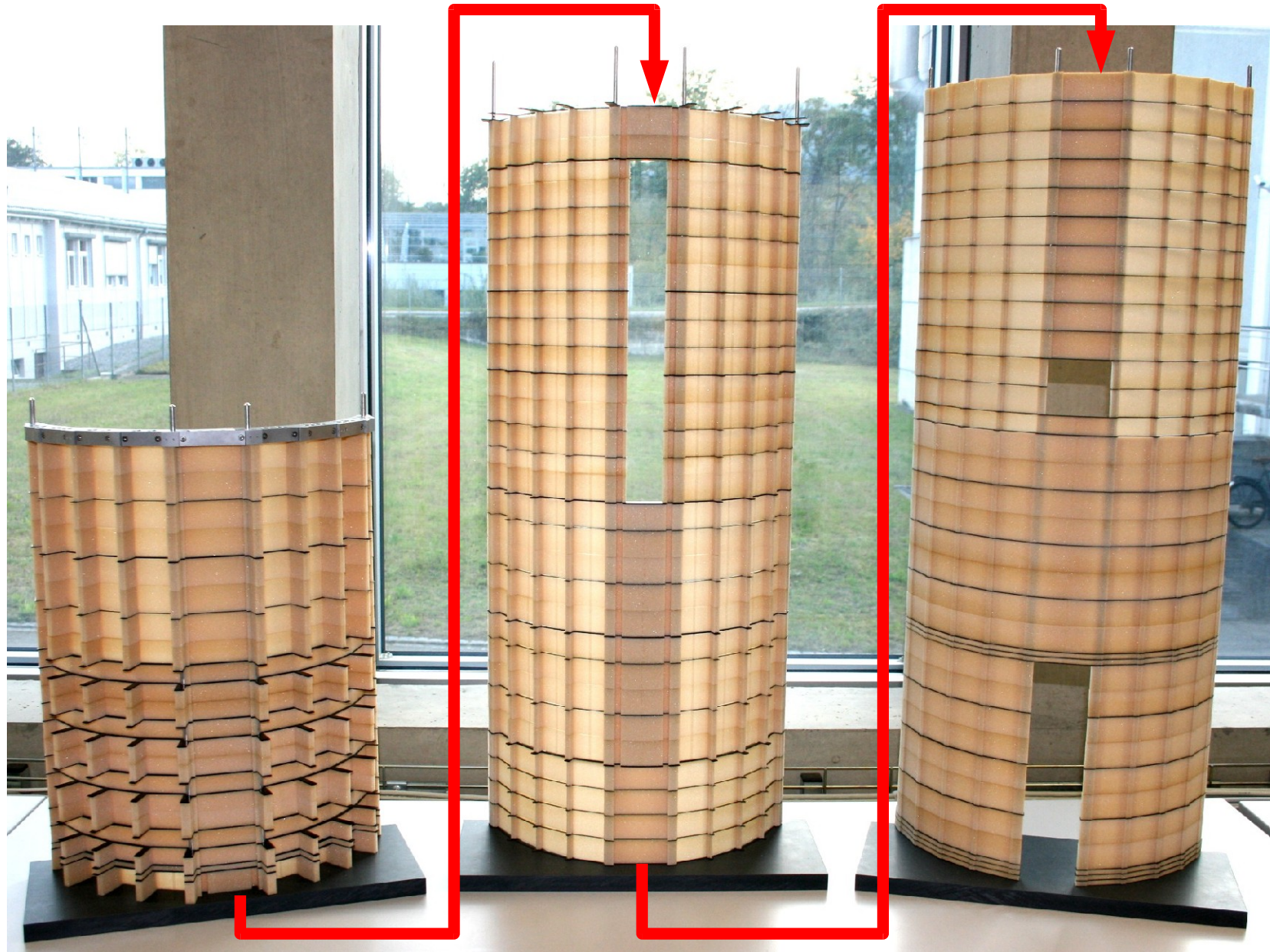
Space for power cables

- Laser diodes with TOSA housings is O.K.
- Enough space for power cables & optical fibers in slots

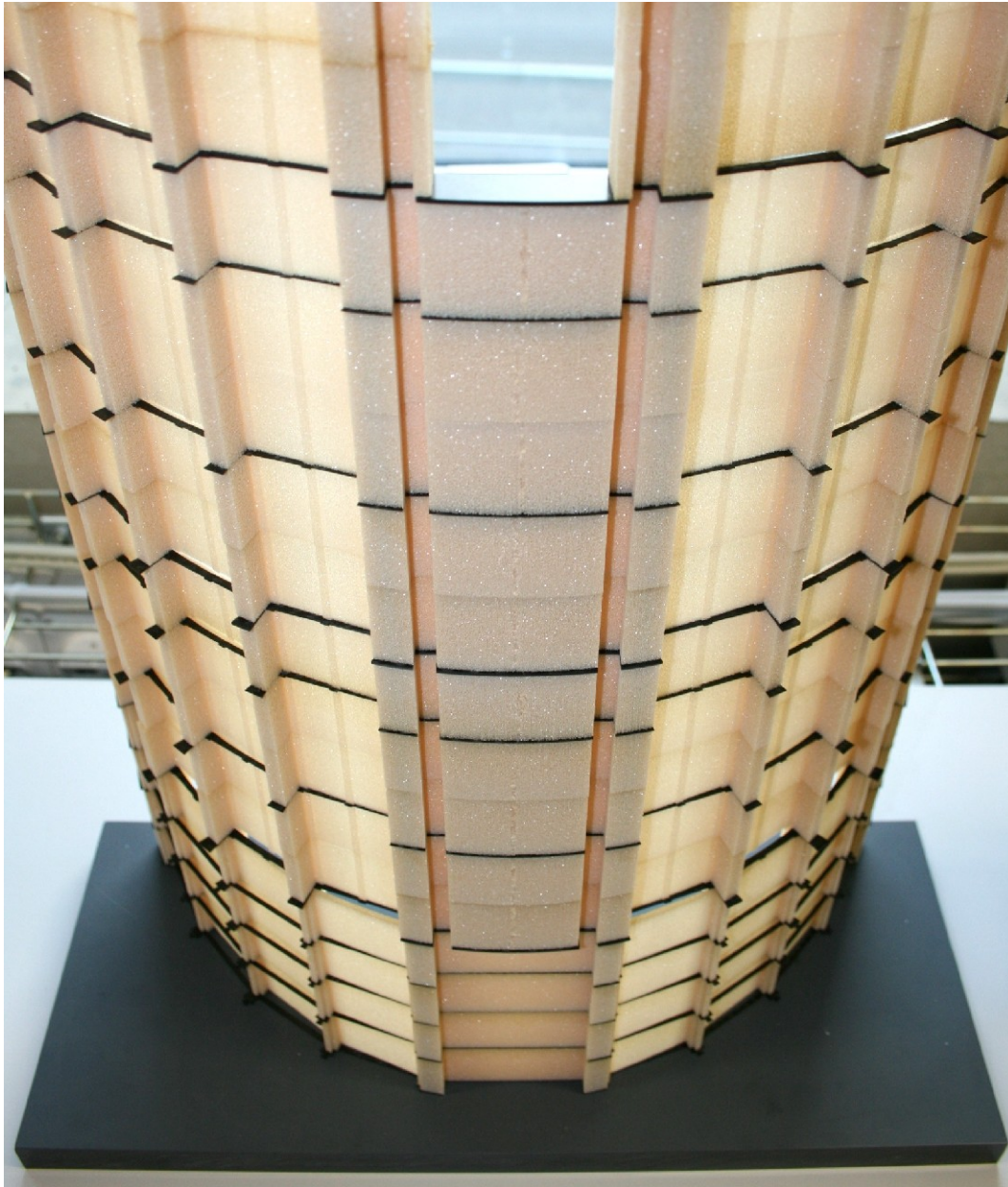
# Assembly of new supply tube



# Airex – carbon fiber stack (storage)



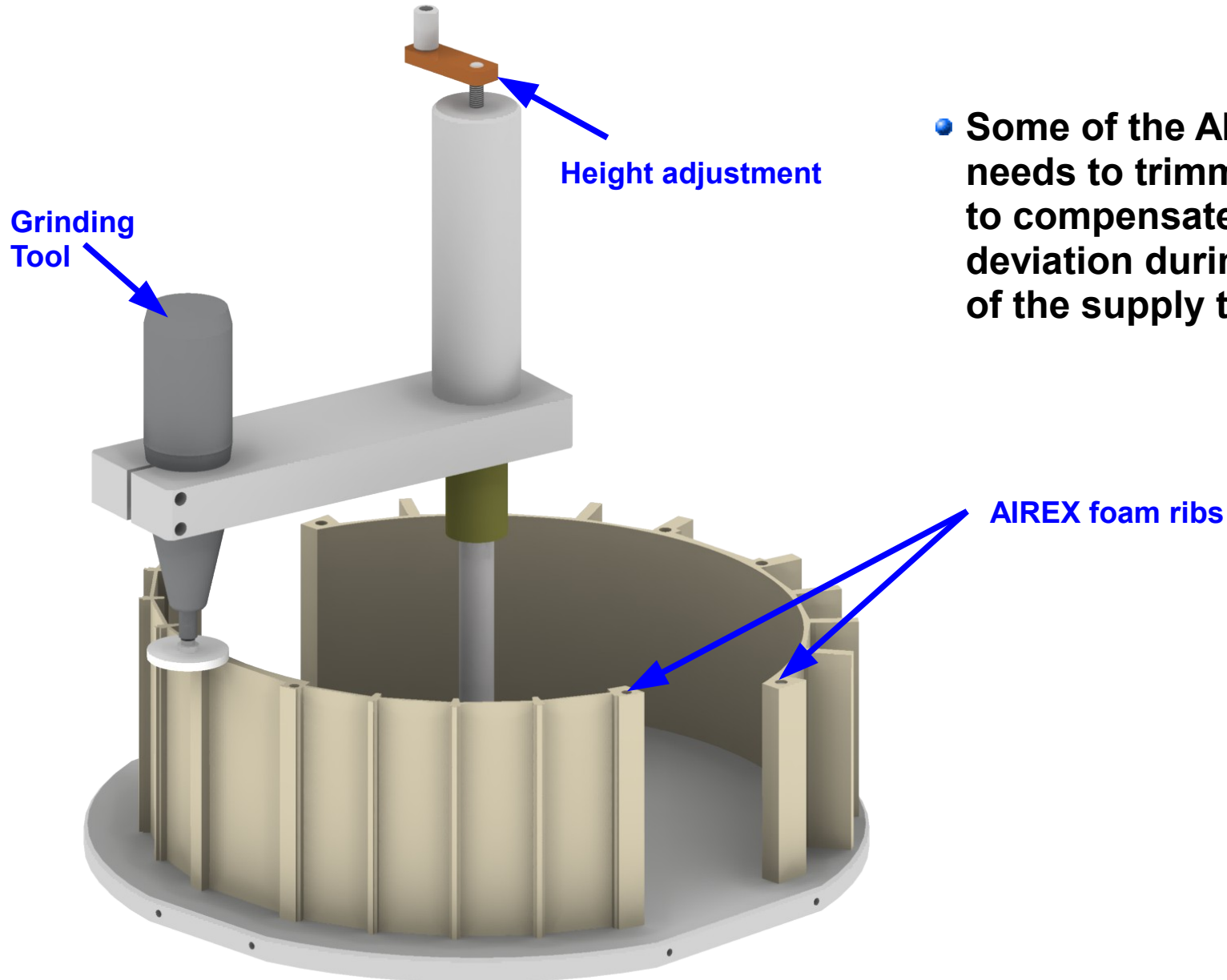
# Airex shrinking after water jet cutting



- After the water jet cutting, shrinking of the Airex ribs were observed.
- After some investigations it turns out, that solvent in the Airex is responsible for this behaviour.
- This can be avoided, if the Airex panels are tempered in an oven for about a week (temp. 40°C). After this the panels will not shrink anymore, an water jet cutting is possible.



# Trimming tool for AIREX foam ribs

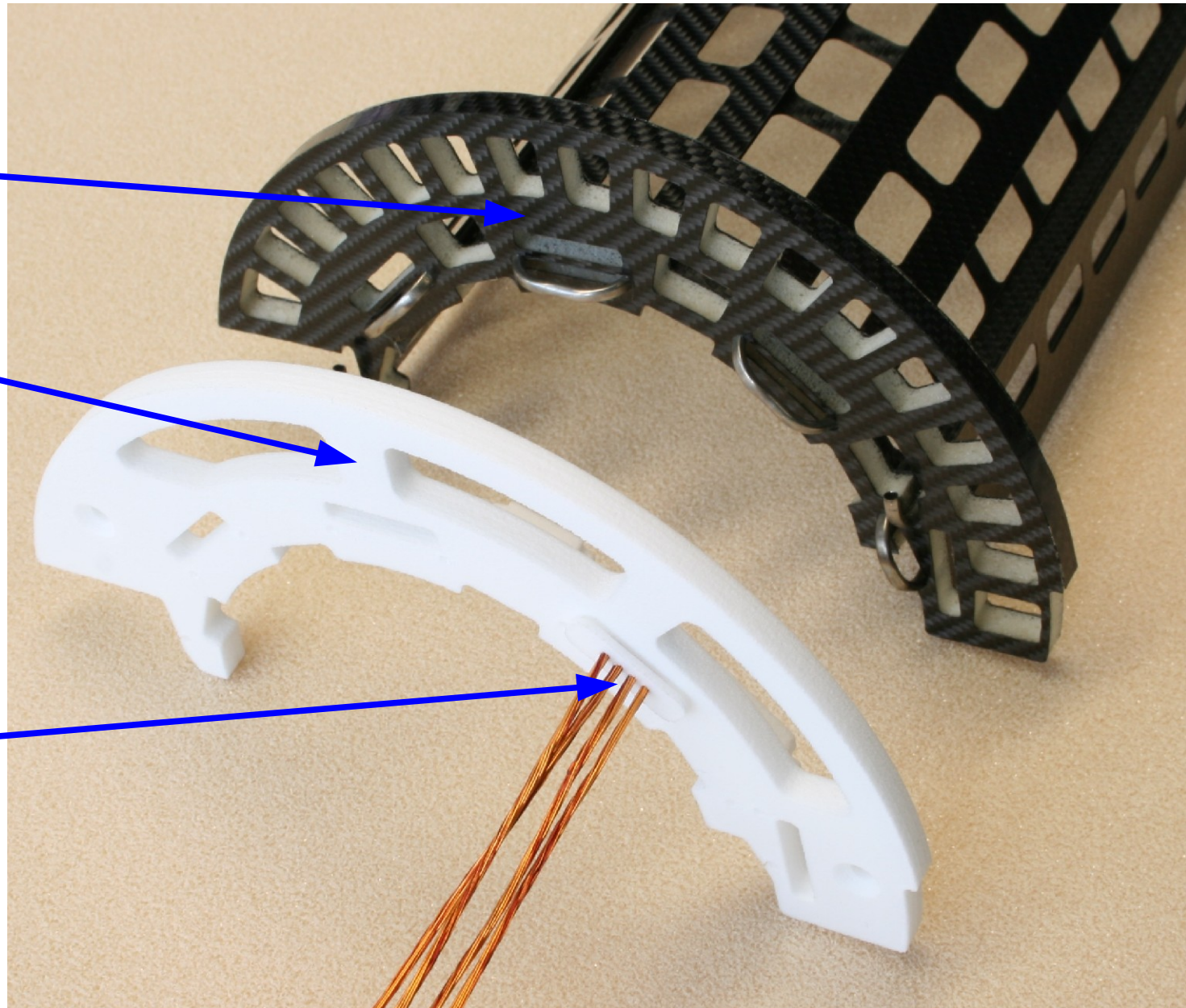


# BPIX dummy detector for cabling & insertion

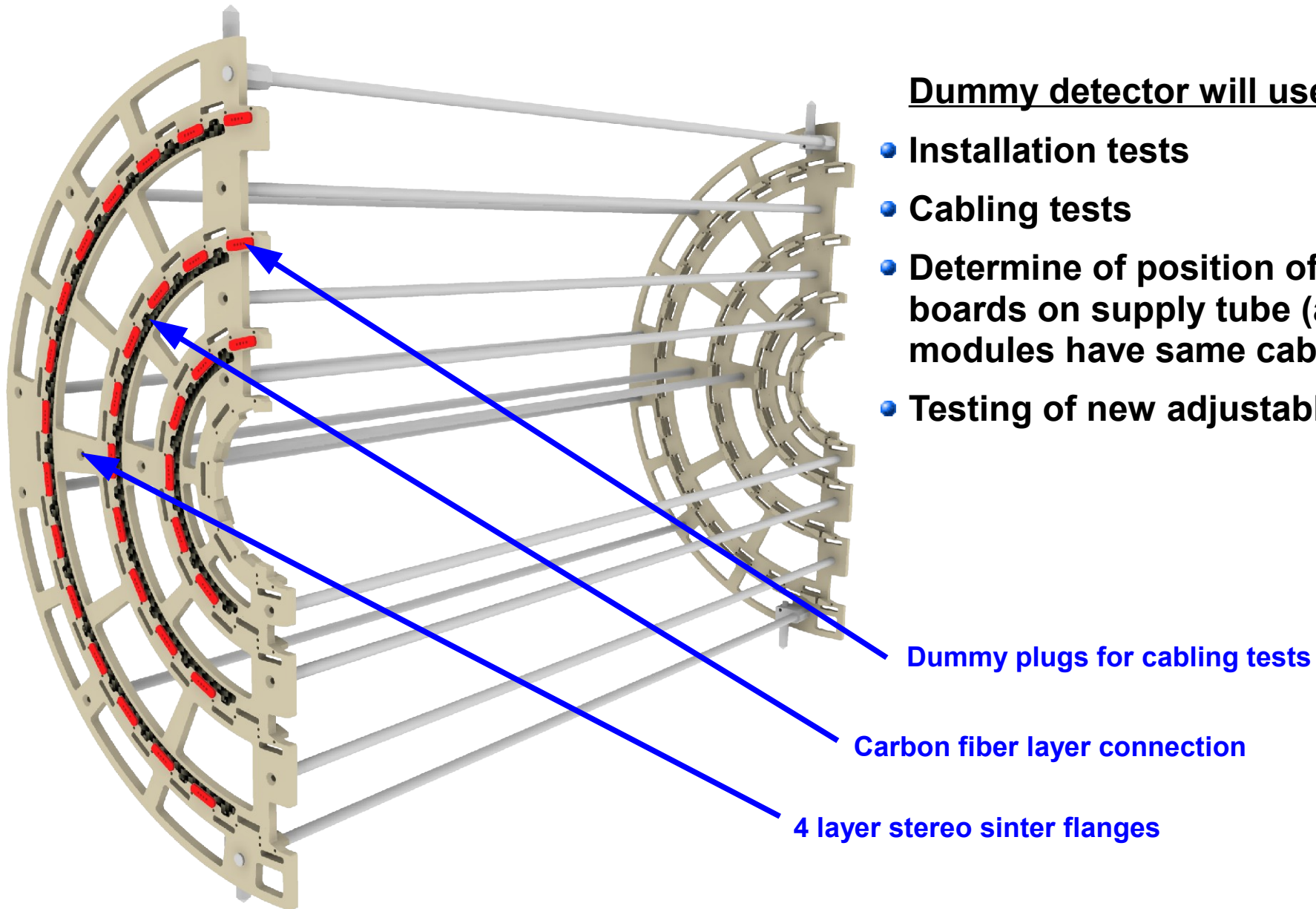
Layer #1 prototype mechanics with foam/ carbon fiber endflange

Reproduction of layer #1 endflange in 3D stereo-sintered plastic for cabling tests with dummy detector

Dummy plug for cabling tests



# BPIX dummy detector for various tests



## Dummy detector will used for

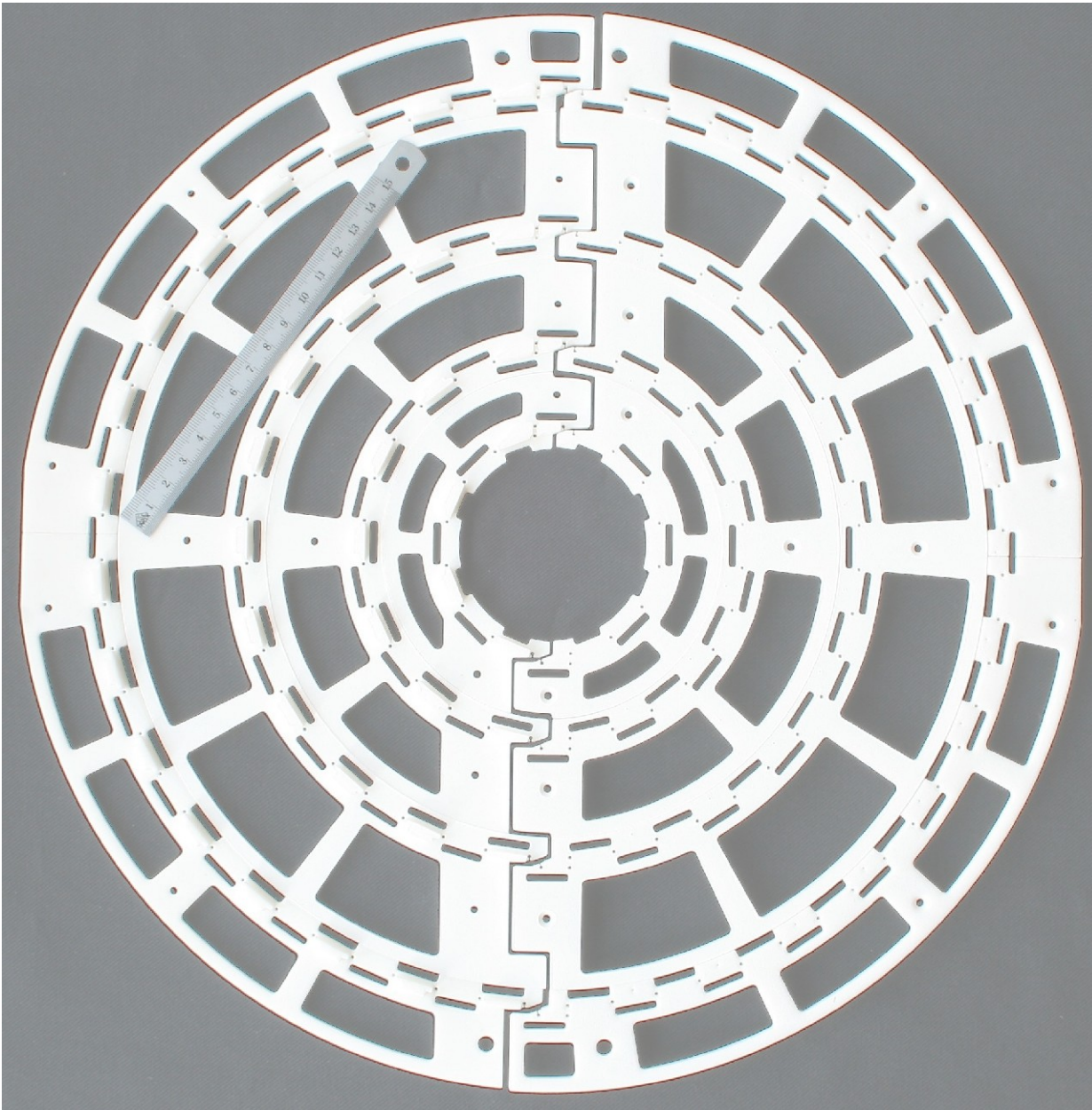
- Installation tests
- Cabling tests
- Determine of position of connector boards on supply tube (all sensor modules have same cable length)
- Testing of new adjustable wheels

Dummy plugs for cabling tests

Carbon fiber layer connection

4 layer stereo sinter flanges

# Image of 3 D direct laser sintering end flanges



- Made by **BUSCH COMPOSITES AG**  
2900 Porrentruy
- Made from **POLYAMIDE 12**

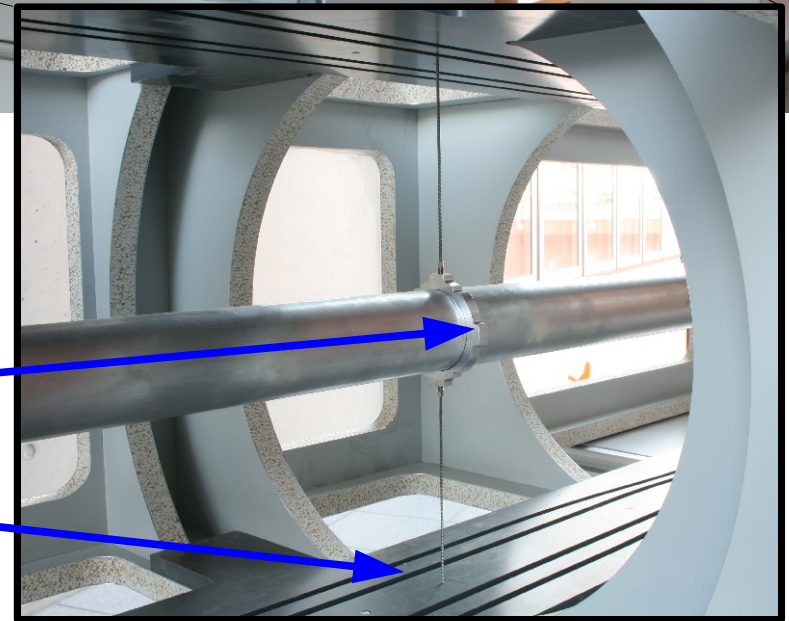


# CMS tracker installation mock-up

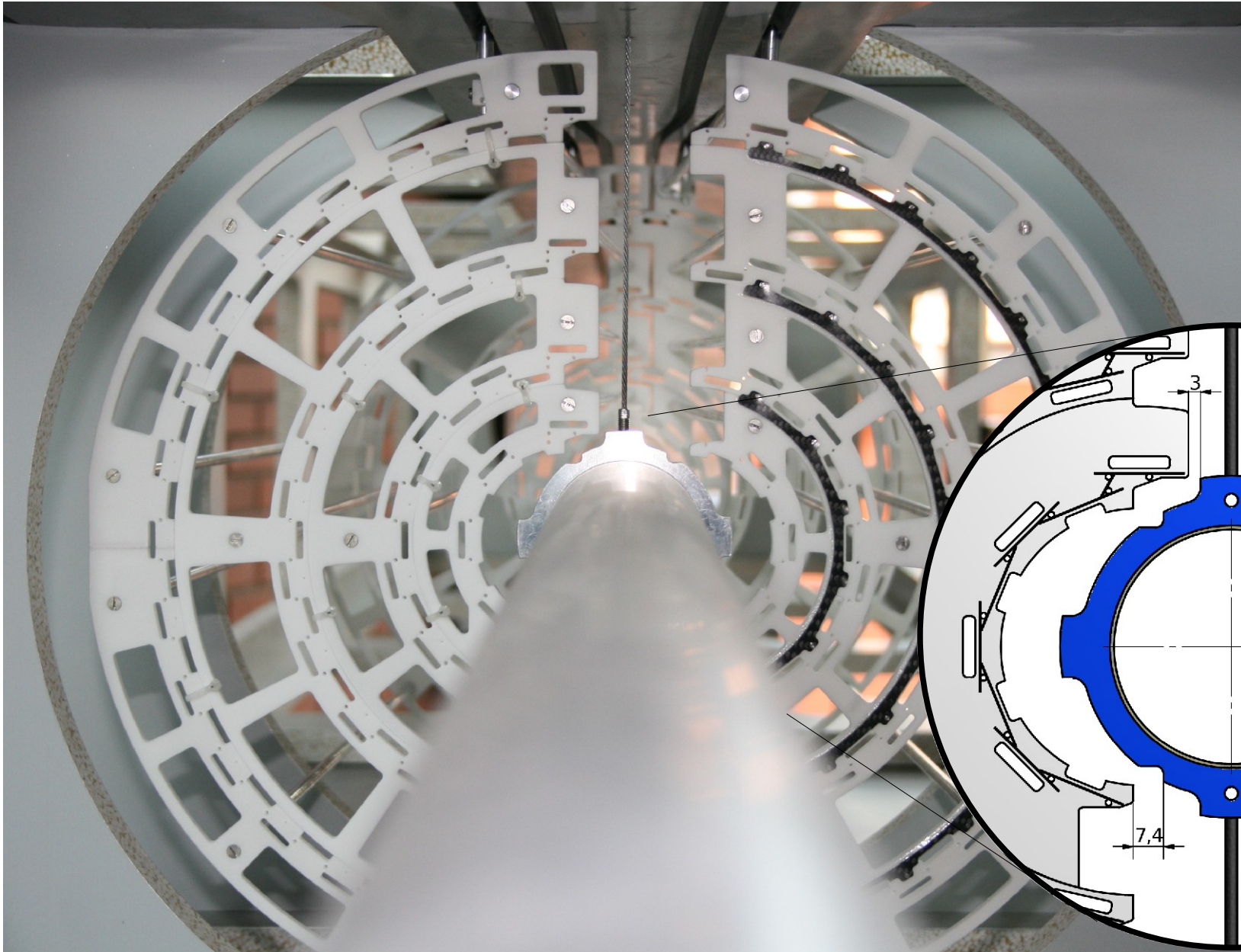


Beam pipe support

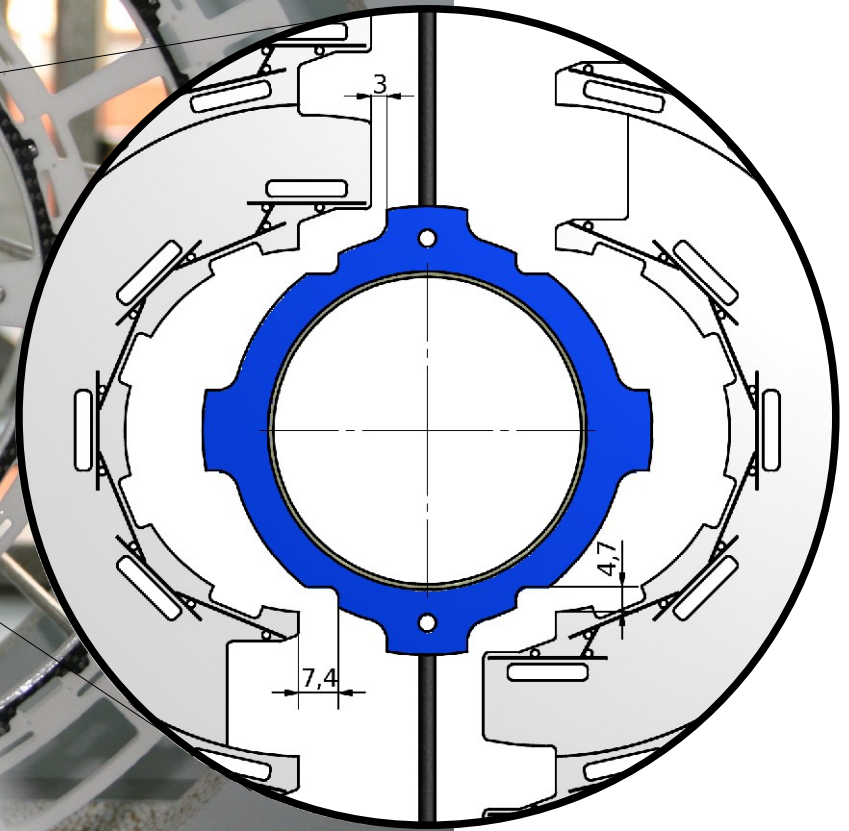
Rails



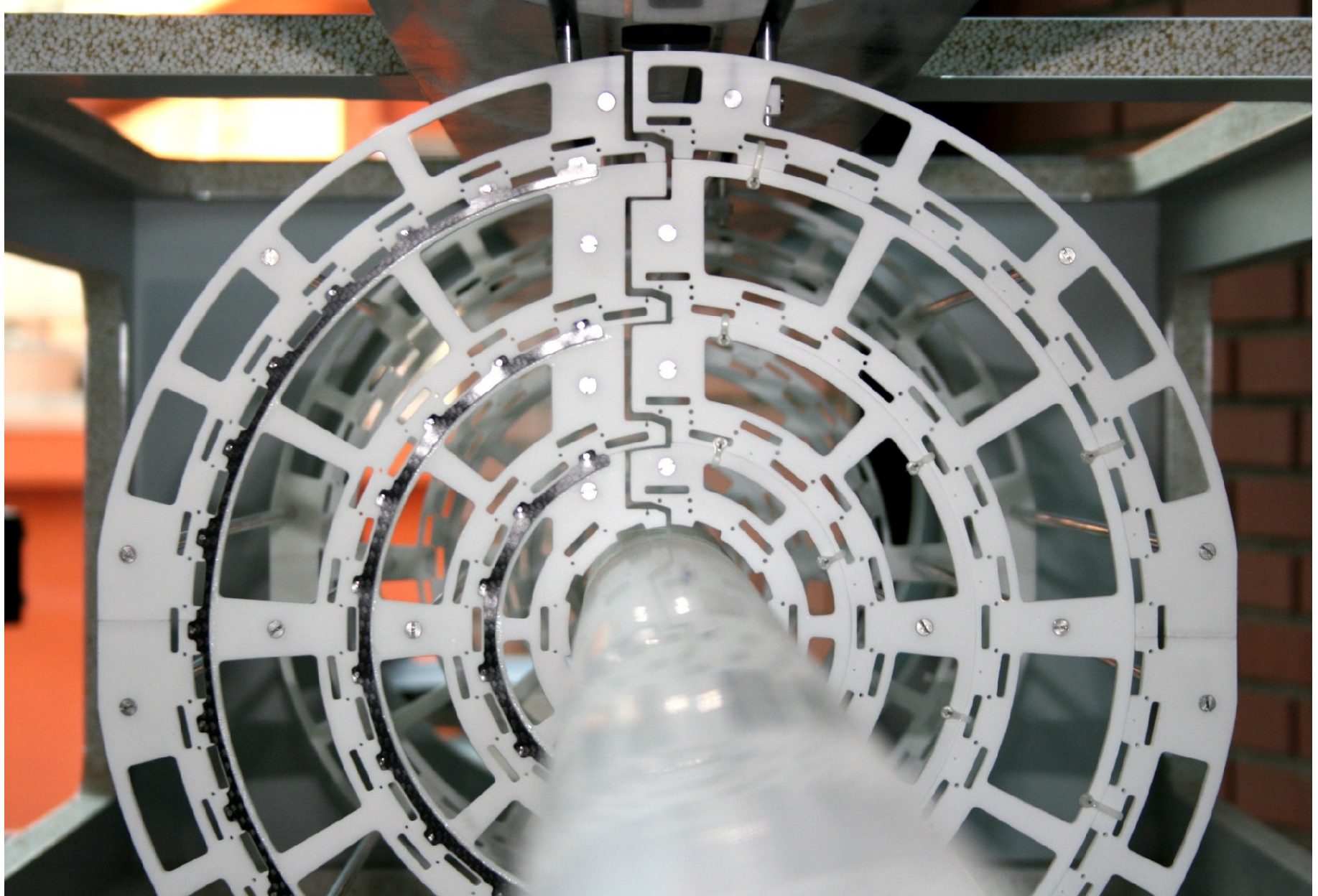
# Clearance between BPIX and beam pipe support



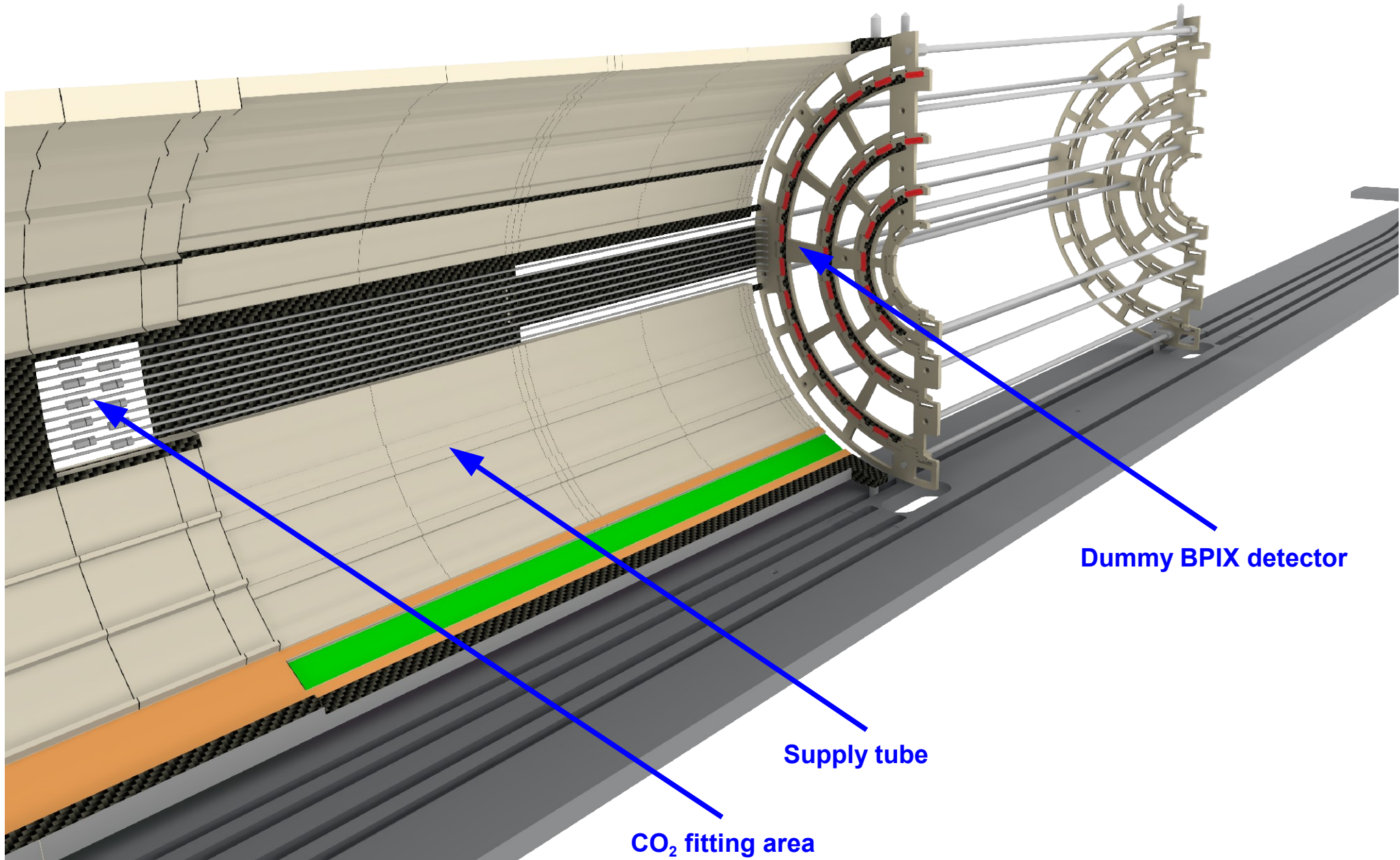
• Z = 1635mm



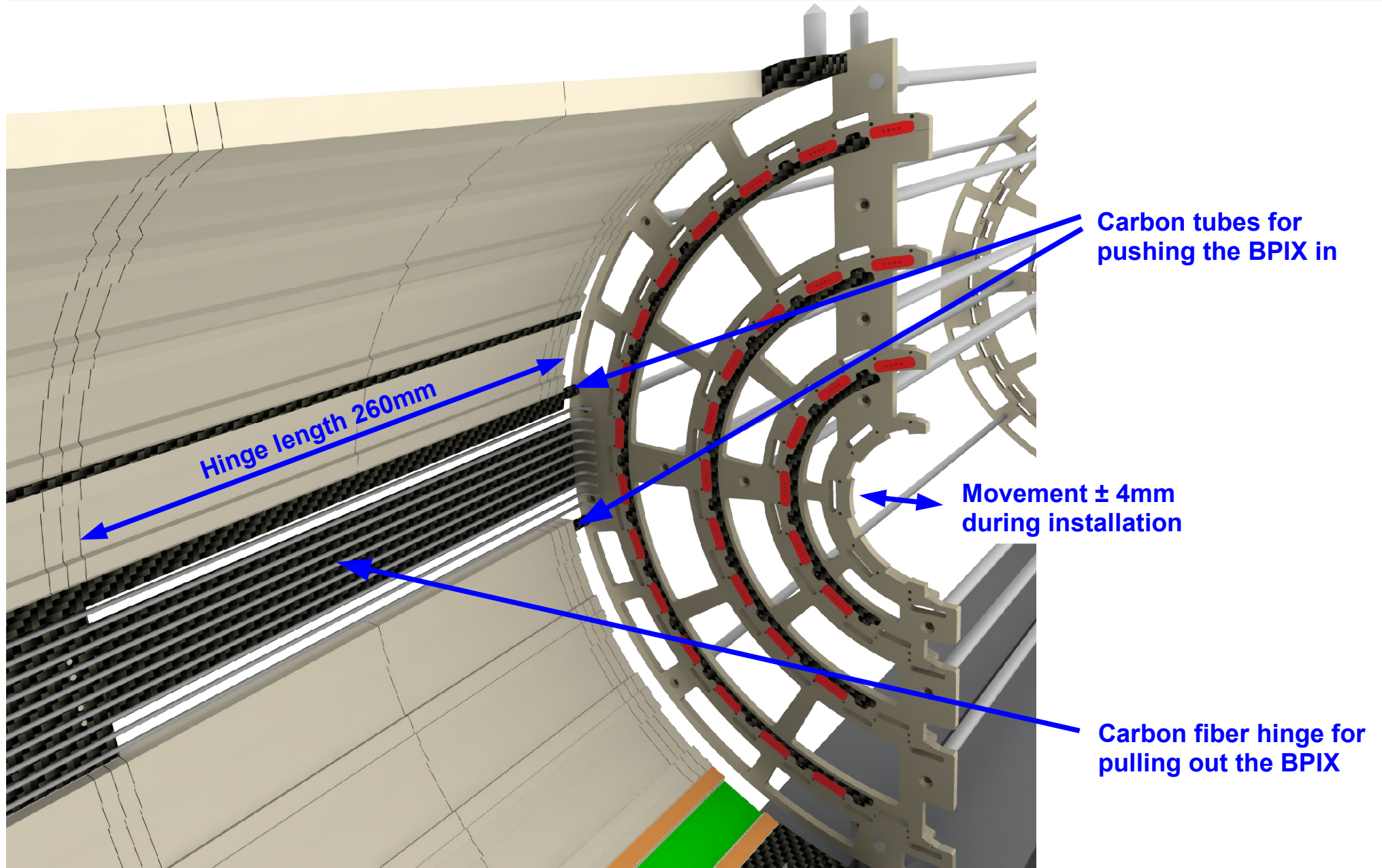
# BPIX at final position



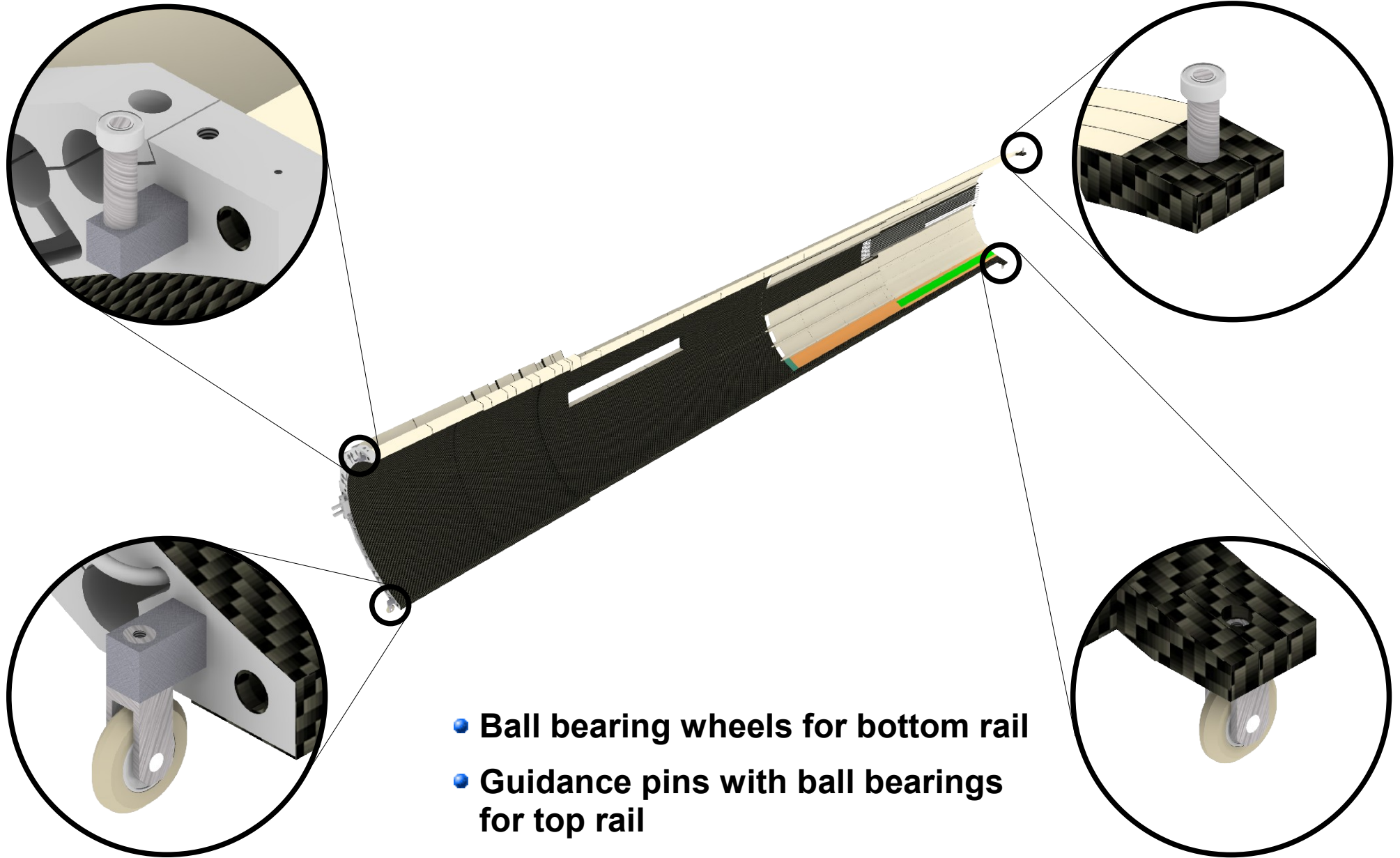
# Supply tube with BPIX dummy detector



# Close up of supply tube hinge area

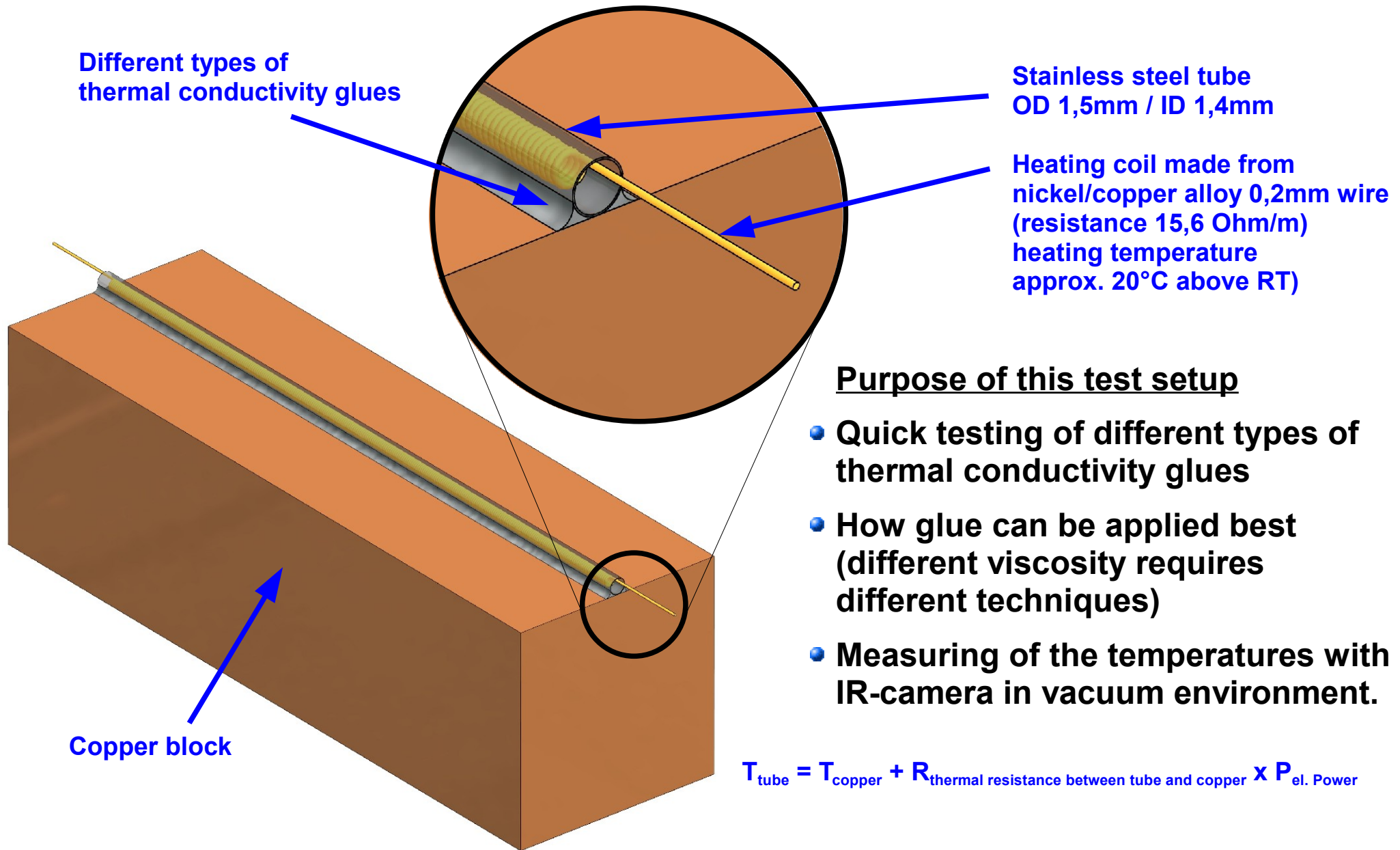


# New wheels for the supply tube



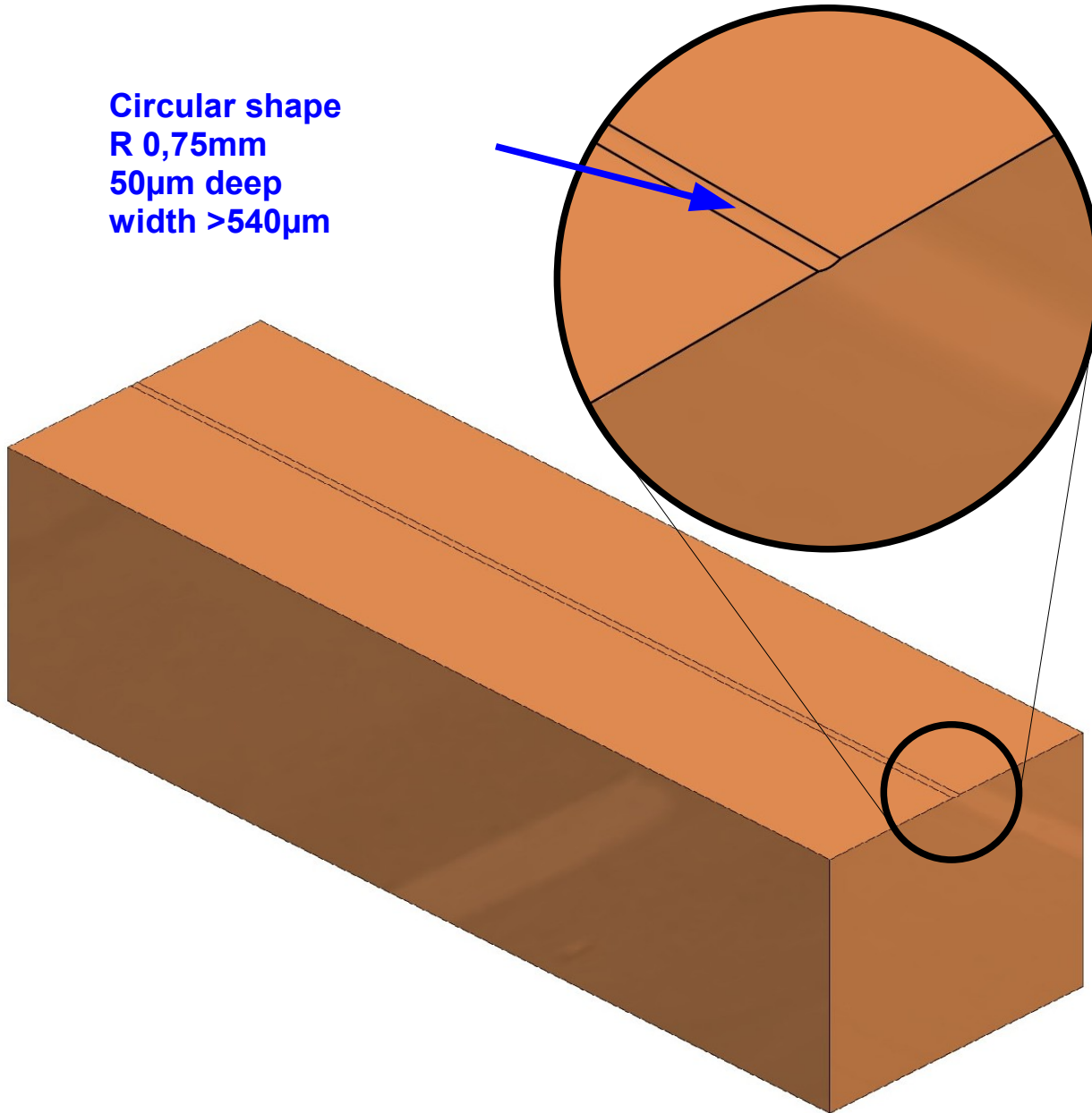
- Ball bearing wheels for bottom rail
- Guidance pins with ball bearings for top rail

# Thermal conductivity glueing tests at PSI



# Improvements for better thermal conductivity

Circular shape  
R 0,75mm  
50µm deep  
width >540µm



## Purpose of this test setup

- Even such a tiny circular shaped slot would increase the direct contact surface between the cooling pipe and the copper block dramatically. And therefore a much better thermal conductivity can be expected.
- It looks feasible to grind also such shaped slots with the help of a diamond grinding disc into our carbon fiber faces.



# Summary

- All necessary components for assembling a prototype supply tube in production now.
- Starting assembling of prototype supply tube, November
- Prototype supply tube finished March 2010 (approx. 250 glued joints)
- CO<sub>2</sub> cooling loops on supply tube completely independent (detachable)
- Laser in TOSA housing → **O.K. with new supply tube**
- Installation **clearances** for **new supply** tube envelope **verified** in **CAD**
- Installation tests of new supply tube and dummy 4-layer BPIX in installation mock-up (~March 2010)
- Thermal conductivity glueing tests & tests with circular shaped slots
- Finalize BPIX mechanics design after successful cooling tests at CERN & Lyon