



MECHANICAL MODEL OF THE IR BEAM PIPE

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Many thanks for discussions and input to:
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Outline

The presentation concerns:

- Proposal of using AlBeMet162 until the bellows.
- Central chamber design:
 - Paraffin cooling.
 - Proposal sequence for the assembling of the central part.
 - Acceptance cone for the cooling system.
- Problems with the space for the vacuum remote connection system.
- Proposal for prototypes.

Proposal of using AlBeMet162 until the bellows

- It is necessary a transition to change the material from AlBeMet162 (central part) to Cu.
- We can **avoid** to insert **a transition** between the IP and the Lumical. In this way there won't be a discontinuity in central area.
- We can **move the transition to the bellows**, in this way we can use the bellow like a transition element.

From: 11-10-2021/ FCC-ee MDI meeting #34 and FCCIS WP2.3 meeting #5

Characteristic of AlBeMet162

DESCRIPTION

AlBeMet® is a family of **metal matrix composites** made up principally of beryllium and aluminum. The ratio of the two metals can be varied to alter the physical, thermal and mechanical properties.

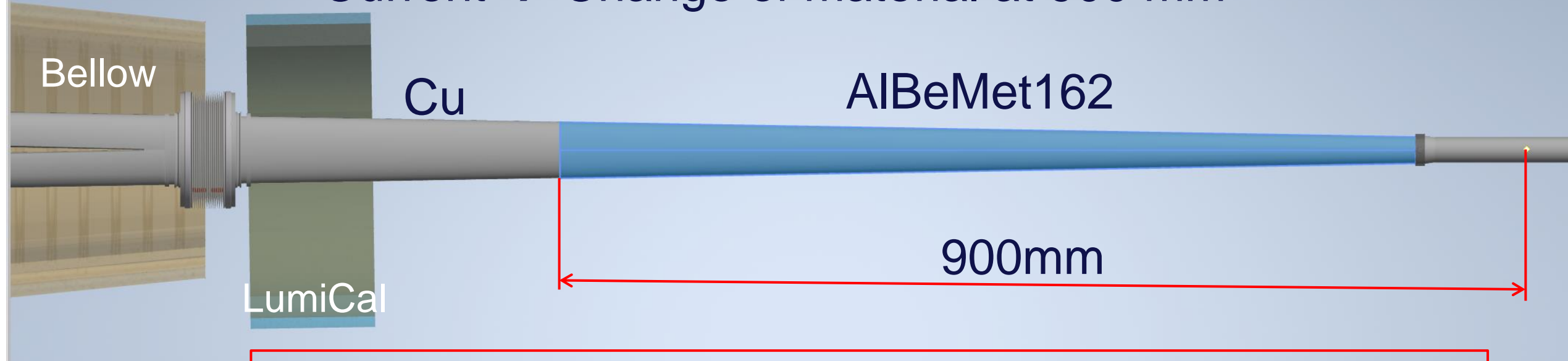
AlBeMet162 contains **62 wt% commercially pure beryllium** and **38 wt% commercially pure aluminium**; it combines the **high modulus** and **low-density** characteristics of beryllium with the **fabrication and mechanical property** behavior of aluminum. These metal matrix composites are **weldable**, and can be **formed, machined**, and **brazed** like conventional aluminum metal matrix composites.

USED IN:

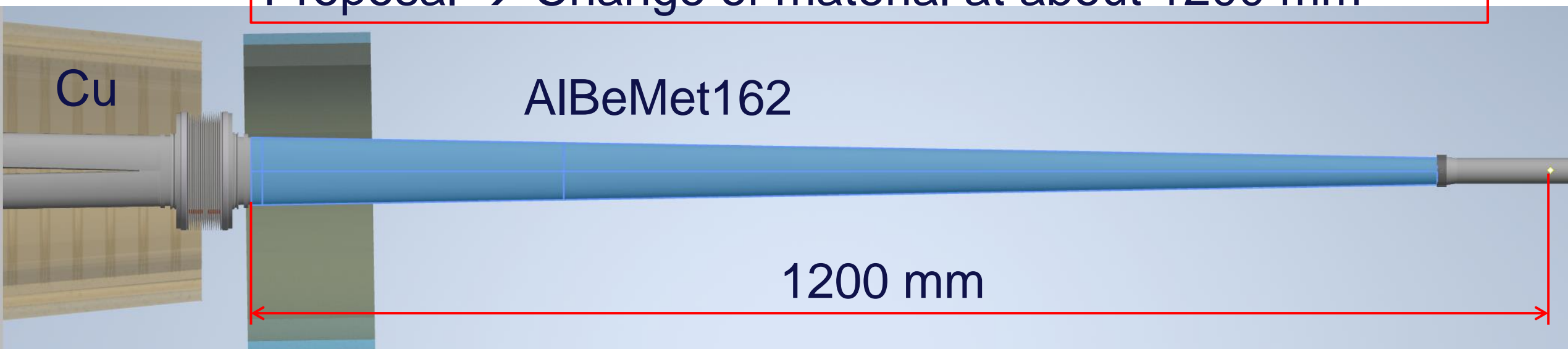
- IR of **DAFNE / KLOE** at LNF-INFN
- **LHCb** experiment at CERN

Density g/cm3 (Lbs/in3)	2.10 (0.076)
Modulus GPa (Msi)	193 (28)
Poisson's Ratio	0.17
Thermal Conductivity @ W/m²K (BTU/hr Ft² F)	210 (121)
Electrical Conductivity @ 20°C, % IACS	49
Damping Capacity 25°C, 500 HZ	1.5x10-3
Yield Strength MPa (Ksi)	276 (40)
Ultimate Strength MPa (Ksi)	386 (56)
Coefficient of Thermal Expansion at 25°C ppm/°C (ppm/°F)	13.91 (7.73)

Current → Change of material at 900 mm



Proposal → Change of material at about 1200 mm





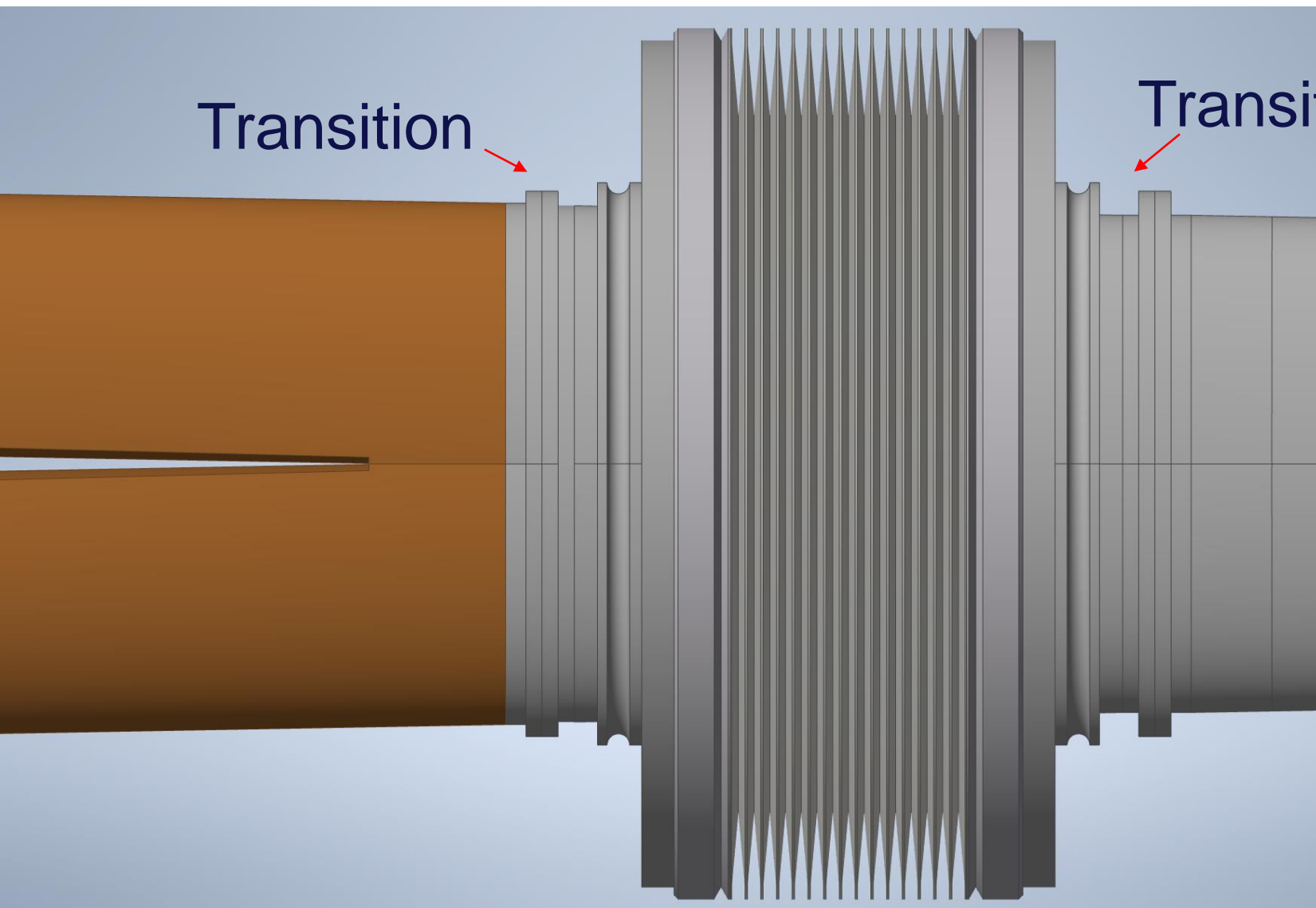
Bellow

Copper

Transition

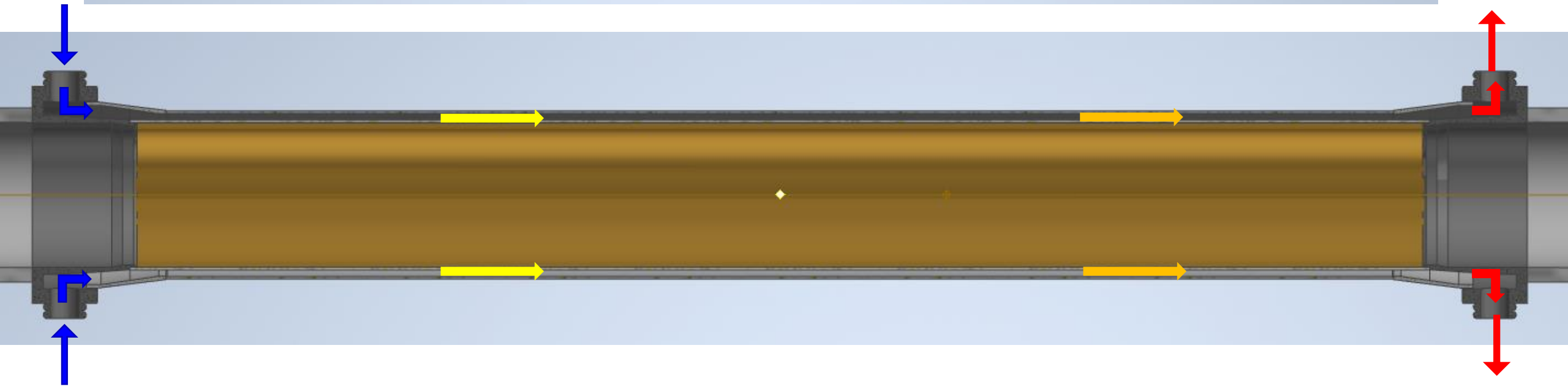
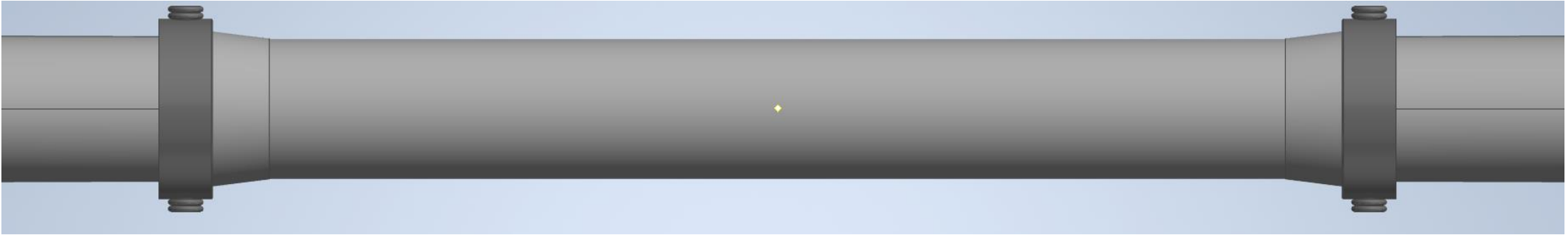
Transition

AlBeMet162



Central chamber

- Paraffin cooling

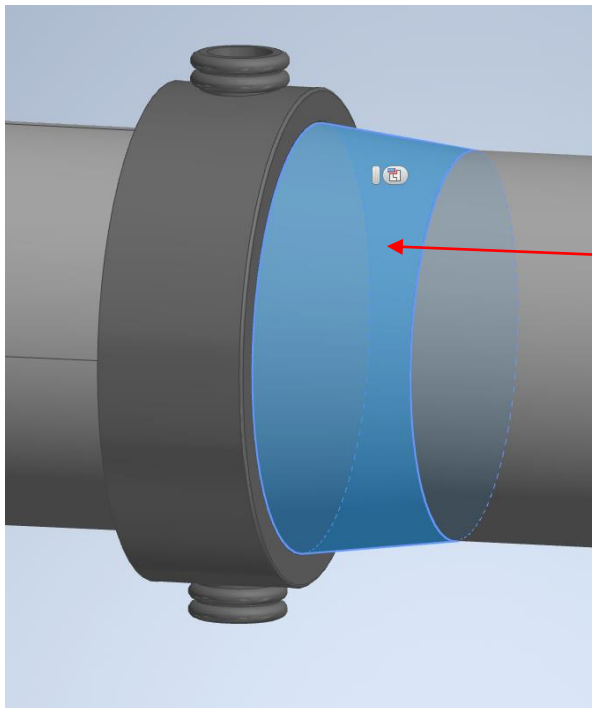


Central chamber

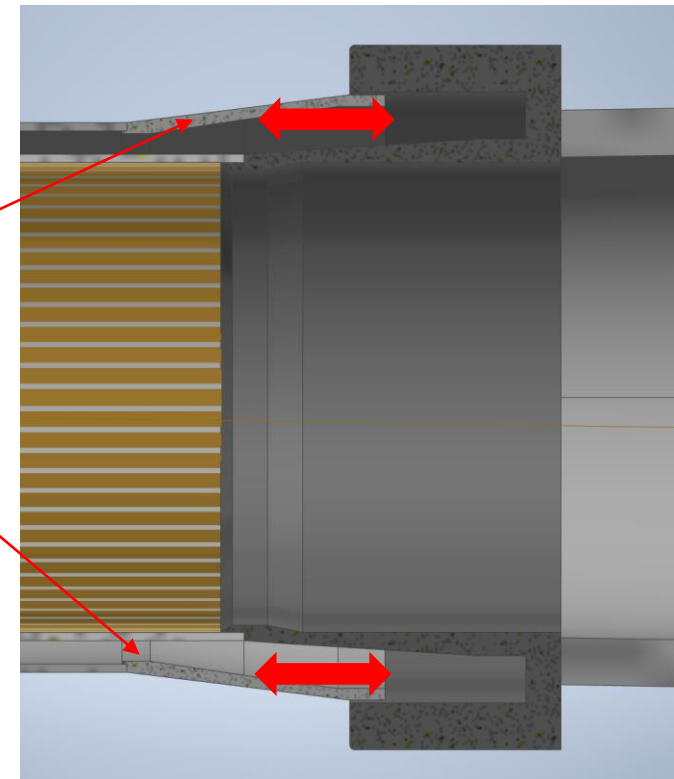
- Proposal sequence for the assembling of the central part

To assemble the central part, with the two concentric cylinder, it is necessary to do four different weldings.

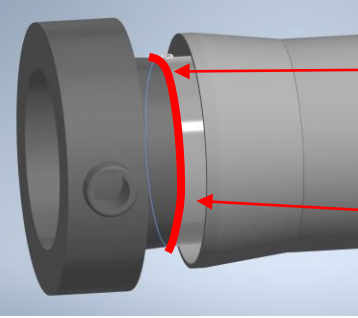
For this reason we are thinking about the possibility to create a system with two sliding elements that allow the relative movement between the two cylinders, exposing the part that have to be welded.



Sliding
element

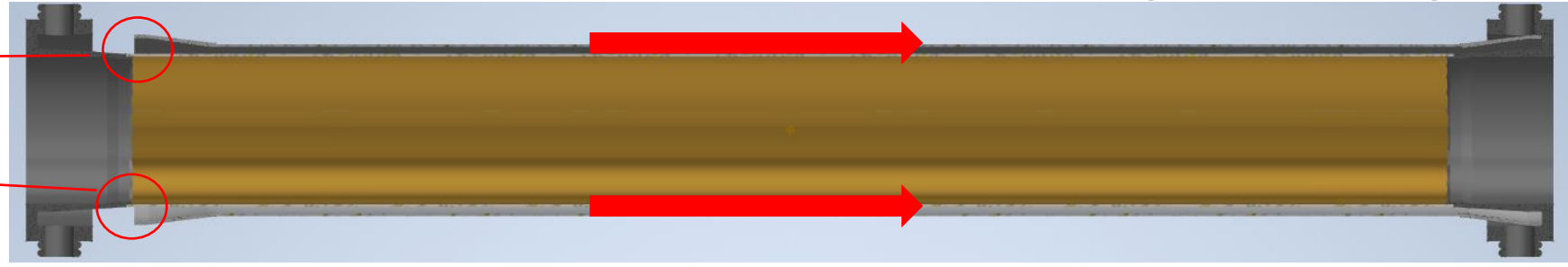


Welding



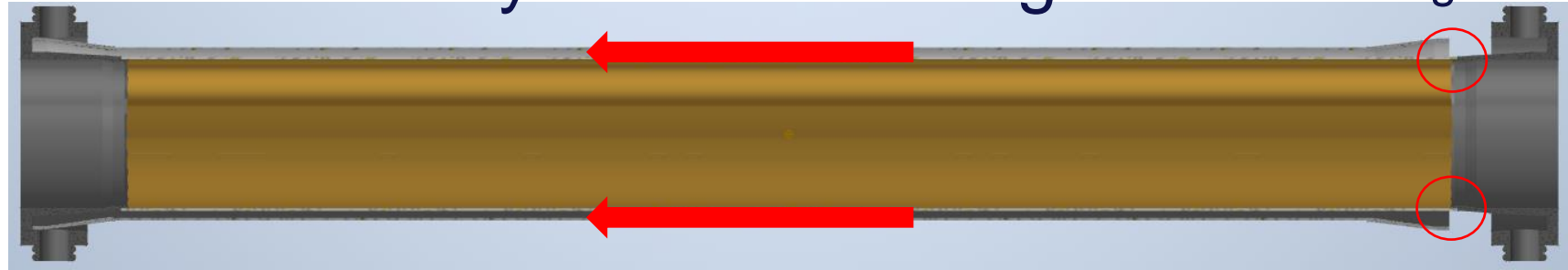
EBW vacuum tight #1

External cylinder right sliding



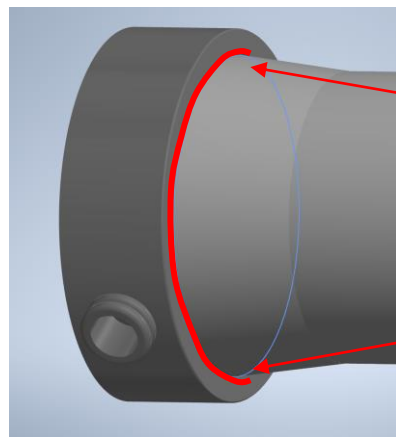
External cylinder left sliding

EBW vacuum tight #2



Test of vacuum tight

Centered position



EBW #3

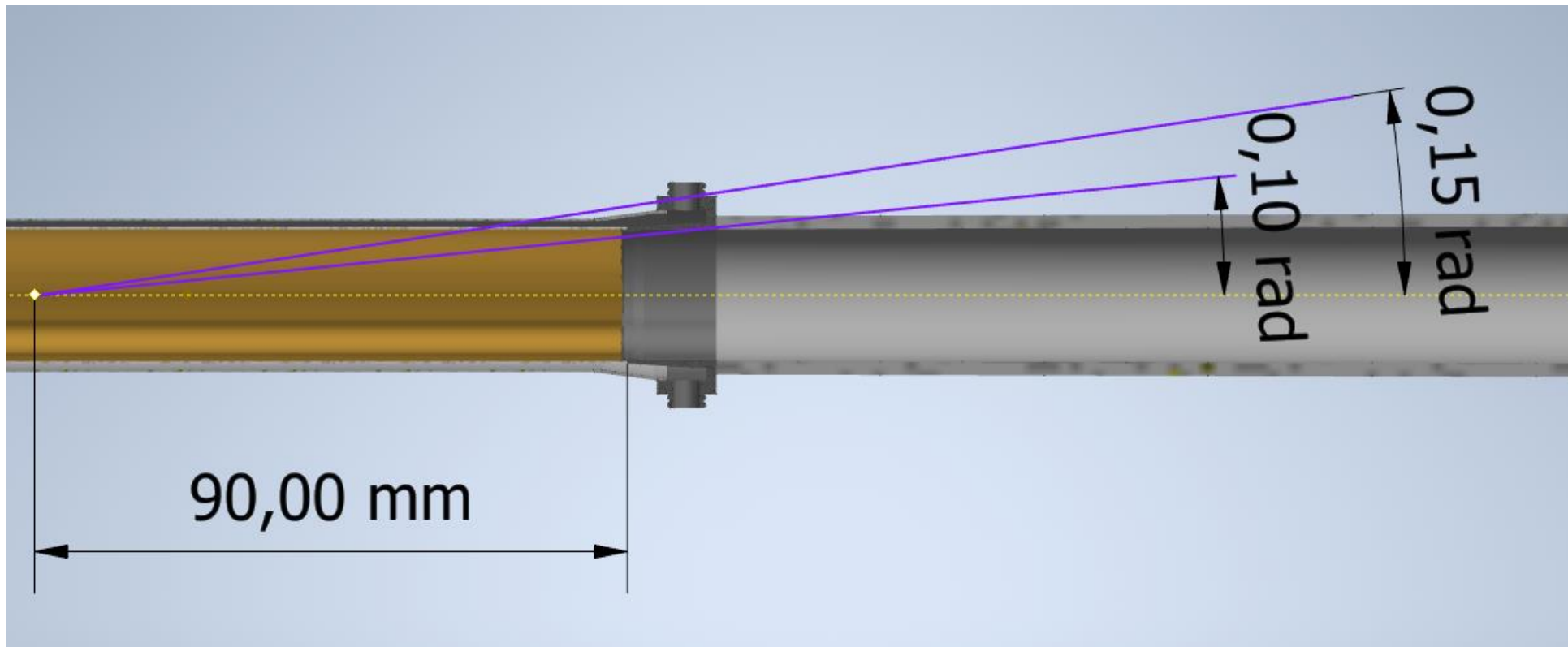
EBW #4



Test of hydraulic tight

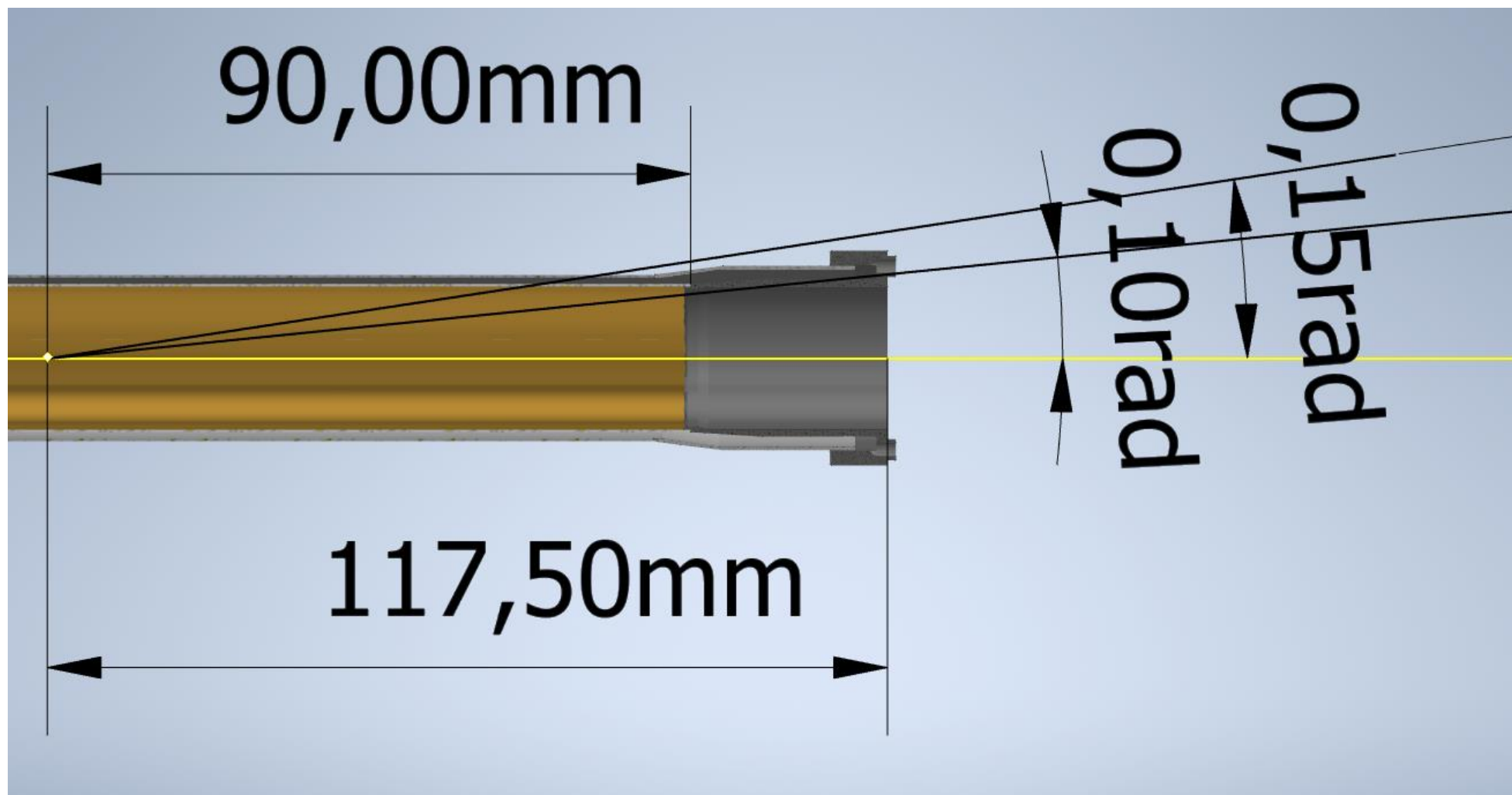
Central chamber

- Acceptance cone: the cooling system come out of the 100mrad acceptance cone. If we want to maintain everything inside the cone it is necessary to move the cooling inlet.



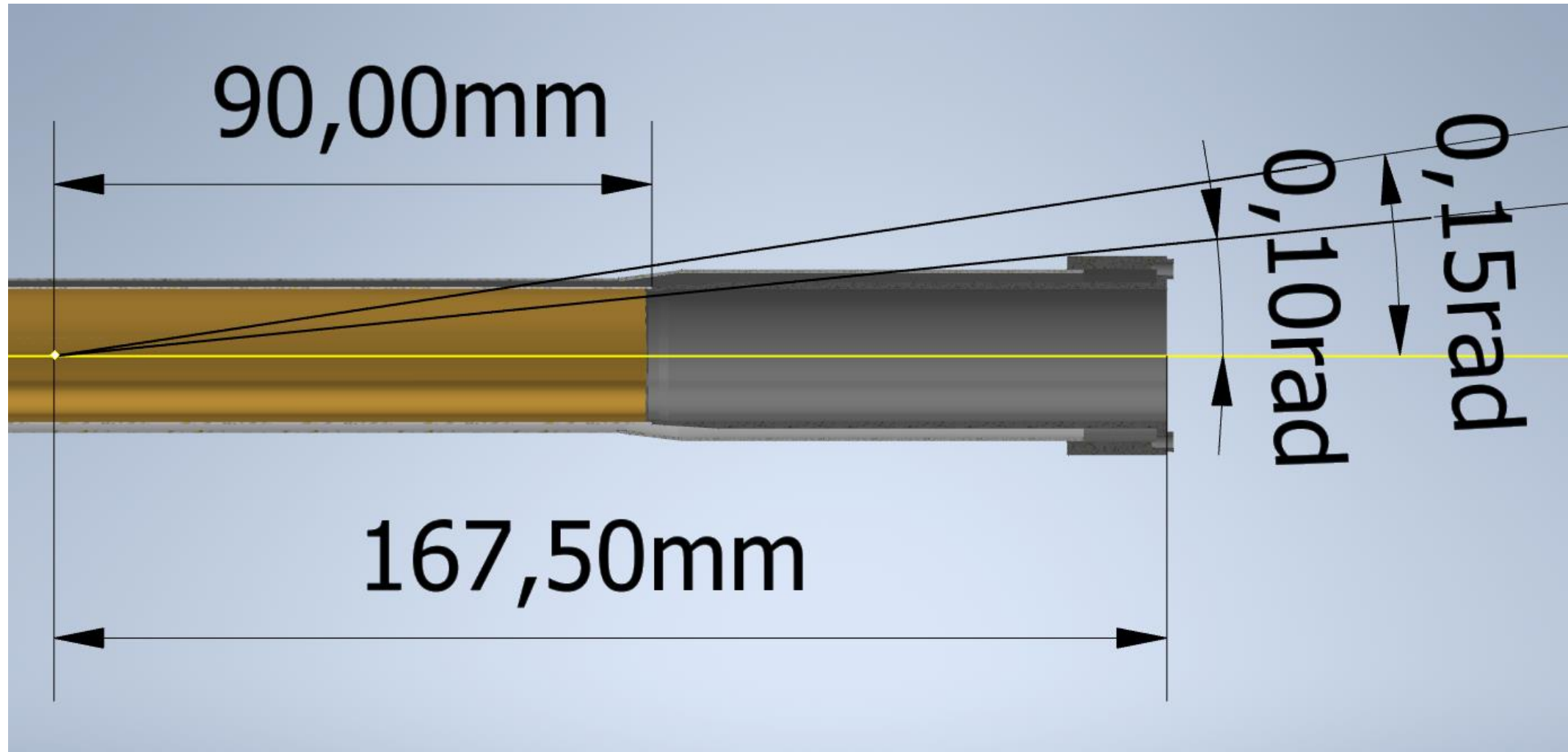
Central chamber

- Movement of the inlet to be inside the cone of 150 mrad



Central chamber

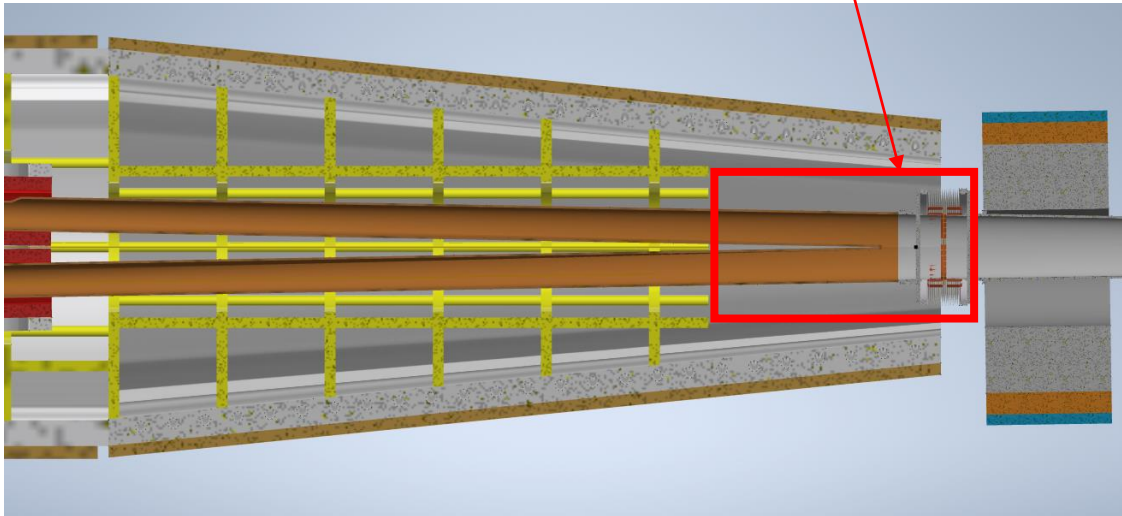
- Movement of the inlet to be inside the cone of 100 mrad



Problems with the space for the vacuum remote connection system and bellow

- We are thinking about the possible assembly methodology for the IR.
 - Everything assembled and then put into the detector from one side.
 - Creation of multipart assembly and connection between the different part with a remote vacuum connection.

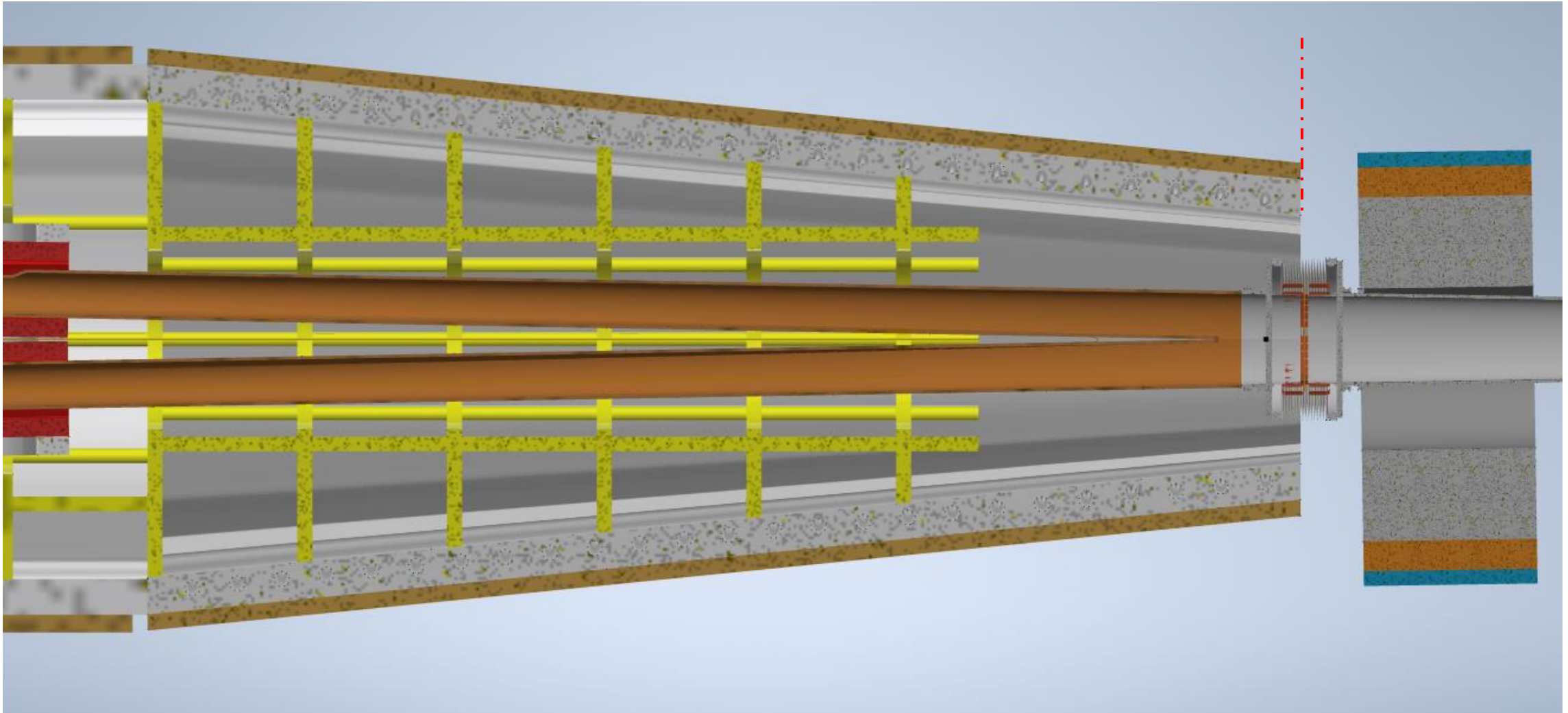
According to the present configuration (optics v. 241) it seems that we don't have enough space to insert the bellow and the remote vacuum connection.



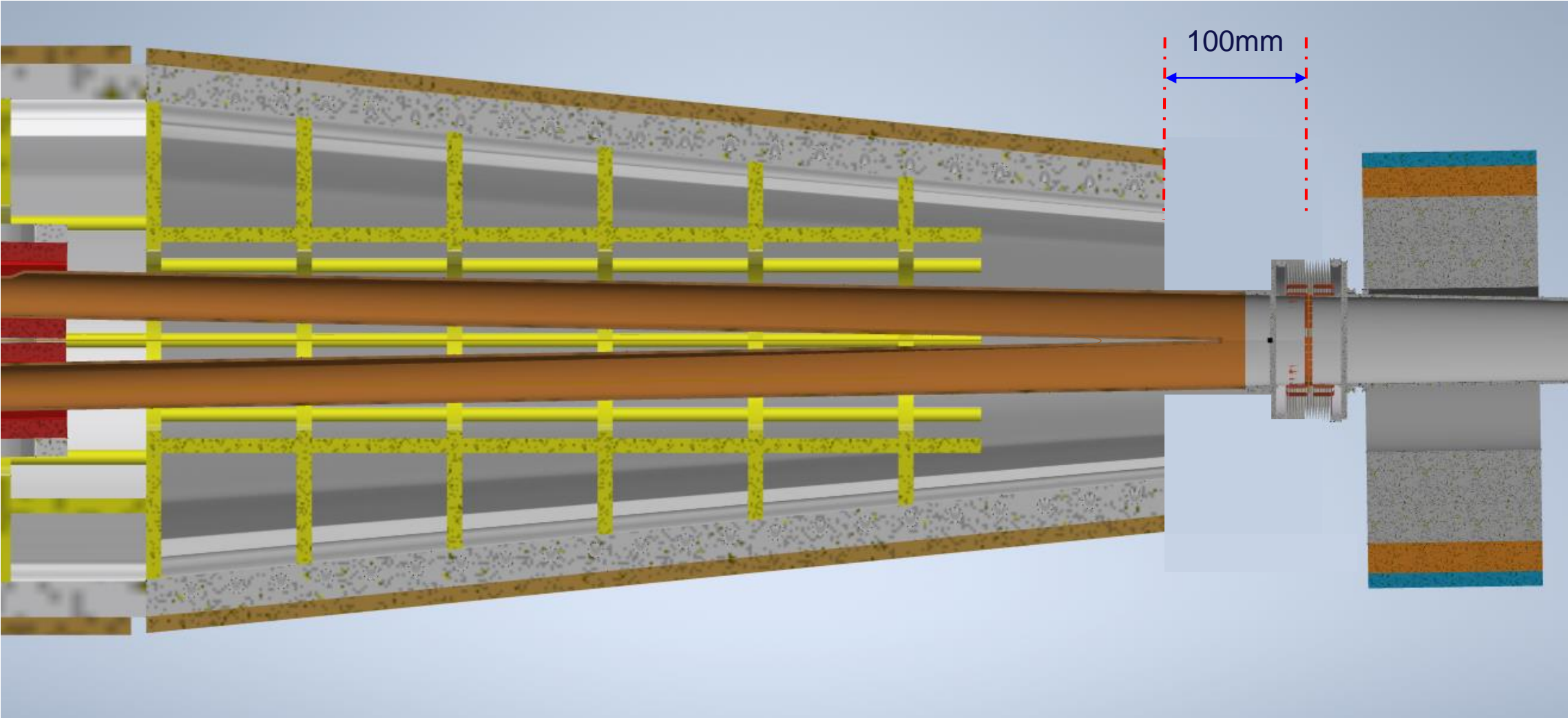
Solution:

- Move the crotch away from the IP, to avoid the spatial coexistence of crotch, bellow and vacuum connection
- Augment the space between the solenoid and the Lumical reducing the length of the solenoid

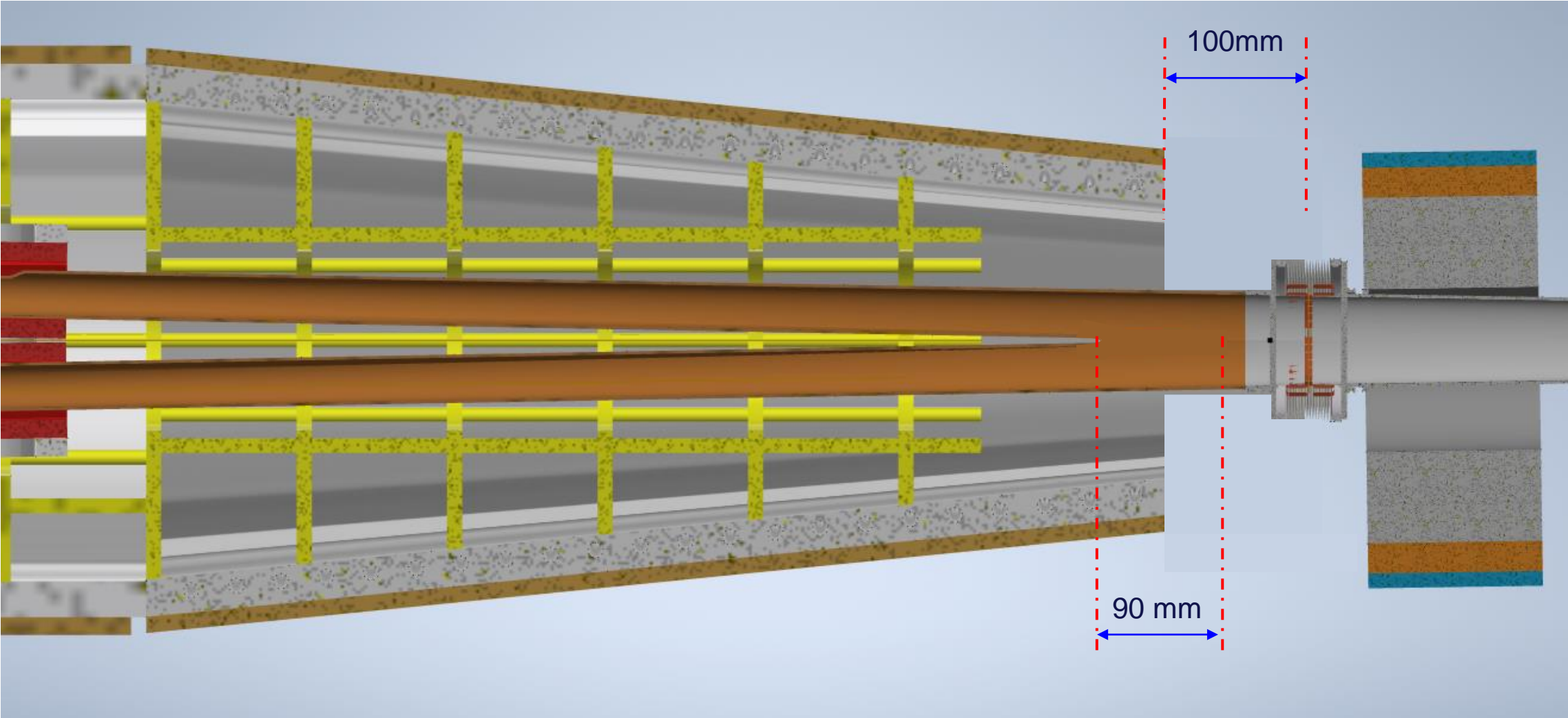
Current



Proposal



Proposal



Proposal for prototypes

Some prototyping is necessary to check the feasibility of the chosen technological solutions:

- **Central IP chamber:** to set and test the paraffin cooling system and to verify the assembly procedure from a vacuum point of view.
- **AlBeMet162-Cu transition**
- **Bellow:** we are studying an upgrade of the bellow used in DAΦNE at INFN (Frascati)



FCC

FCC Collaboration meeting-03/12/2021

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*THANK YOU FOR YOUR
ATTENTION*

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