Cavity, helium vessel and tuner assembly

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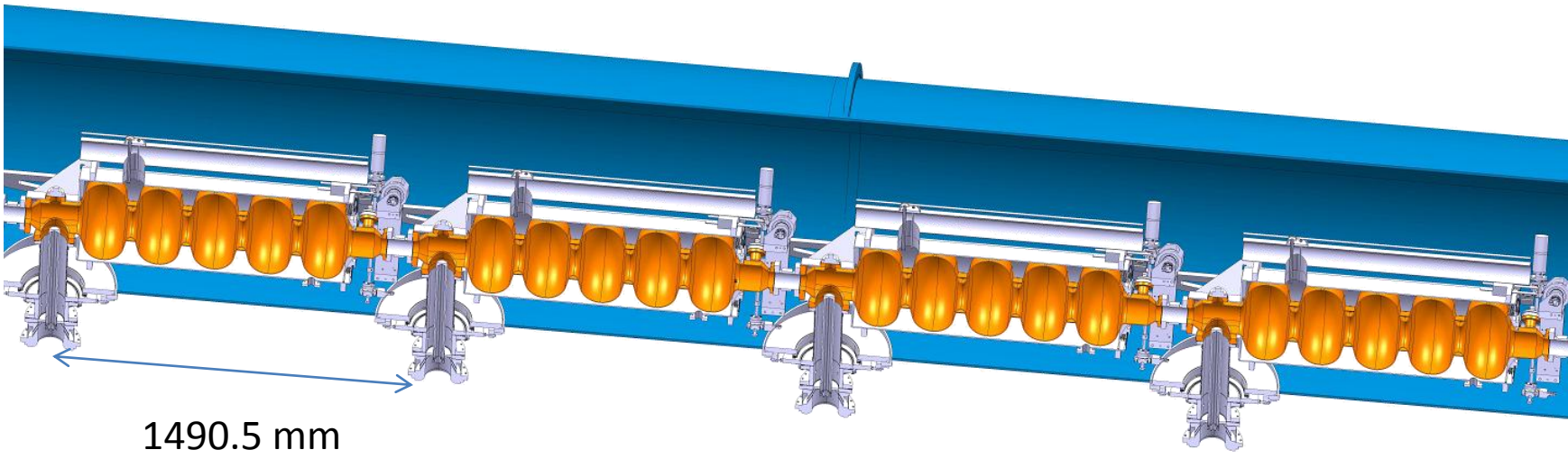
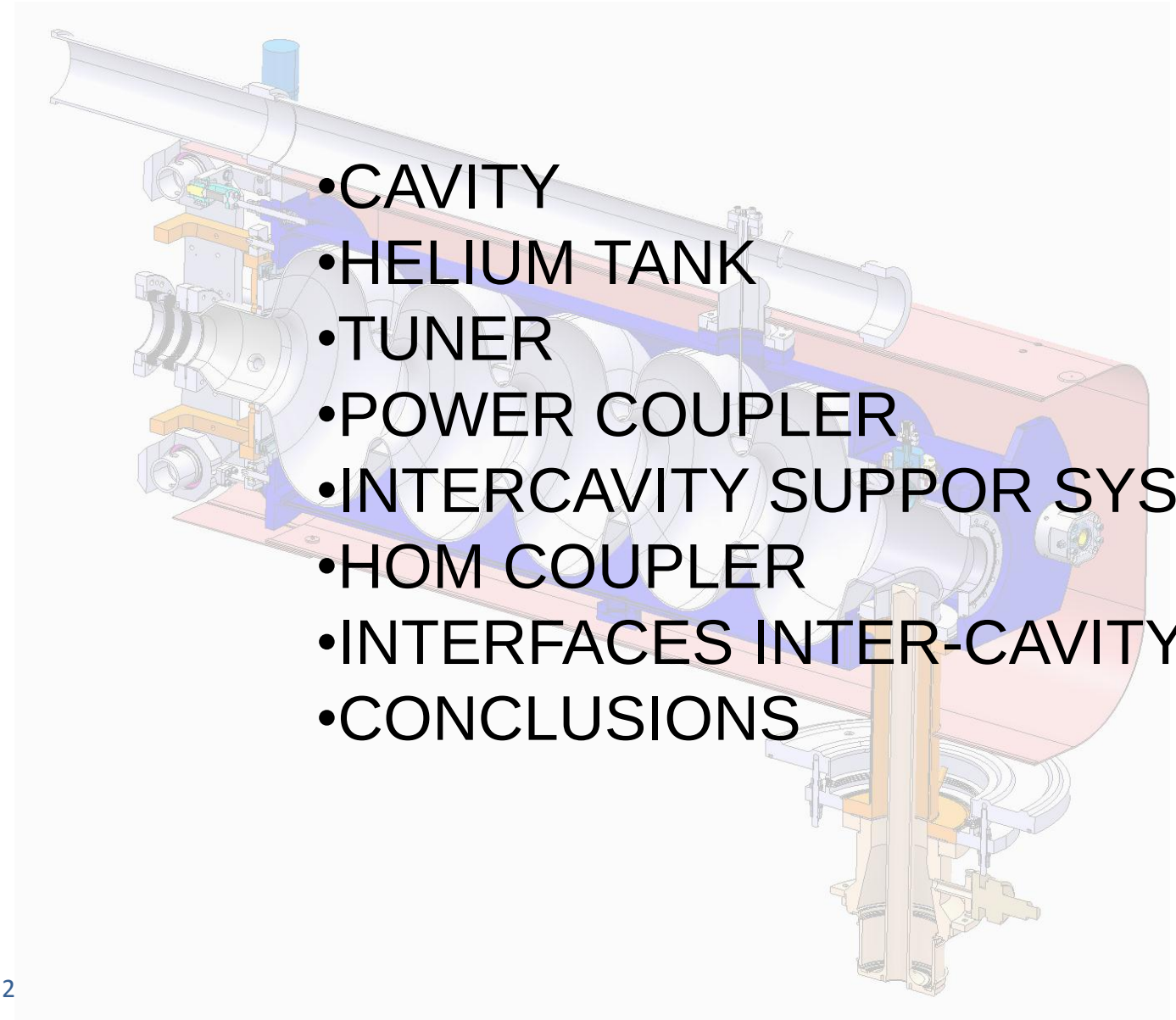
INTRODUCTION- CAVITY SPL

A string of 4 equipped β=1 bulk niobium cavities to be tested into a short cryo-module

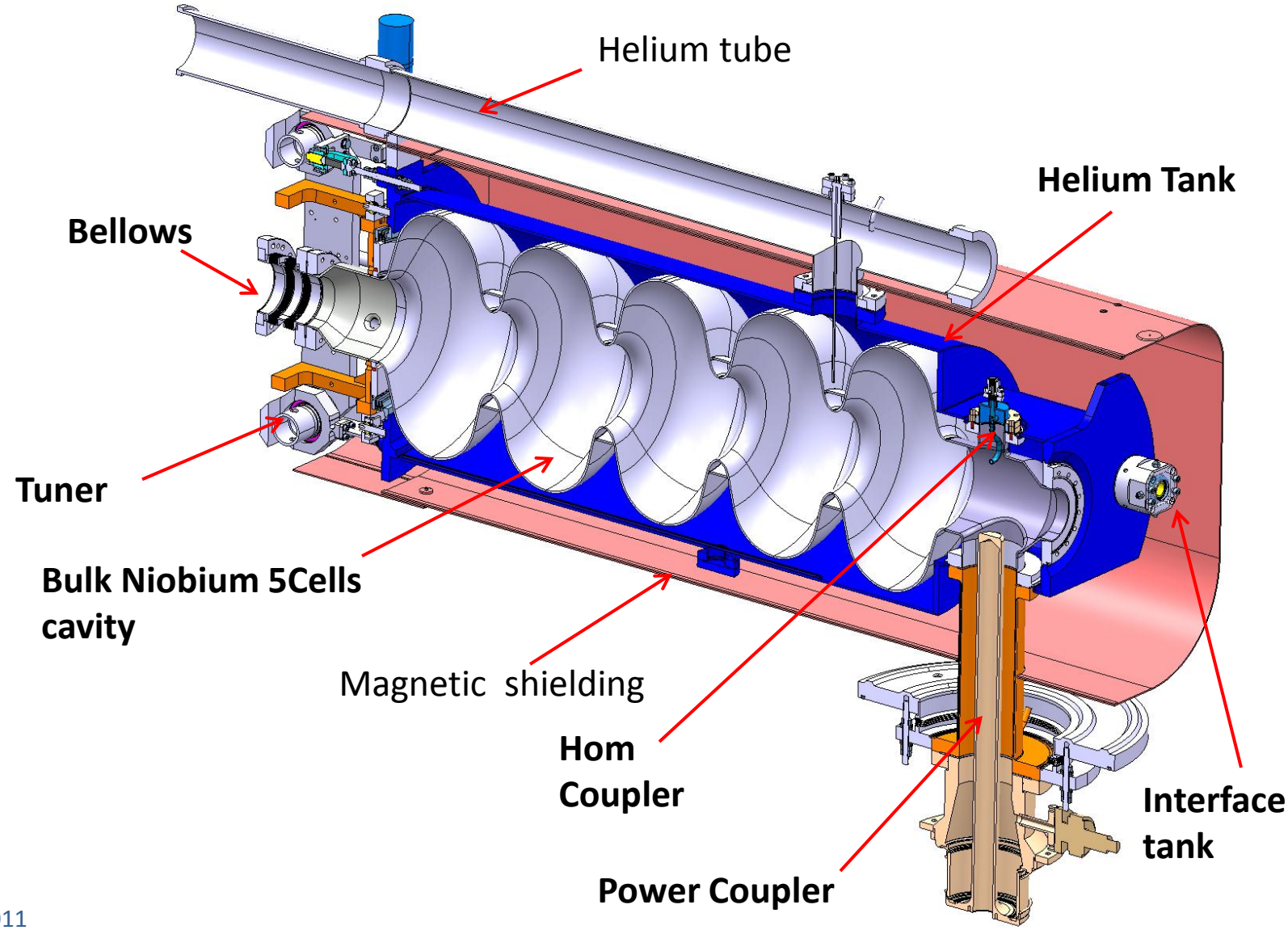


OVERVIEW

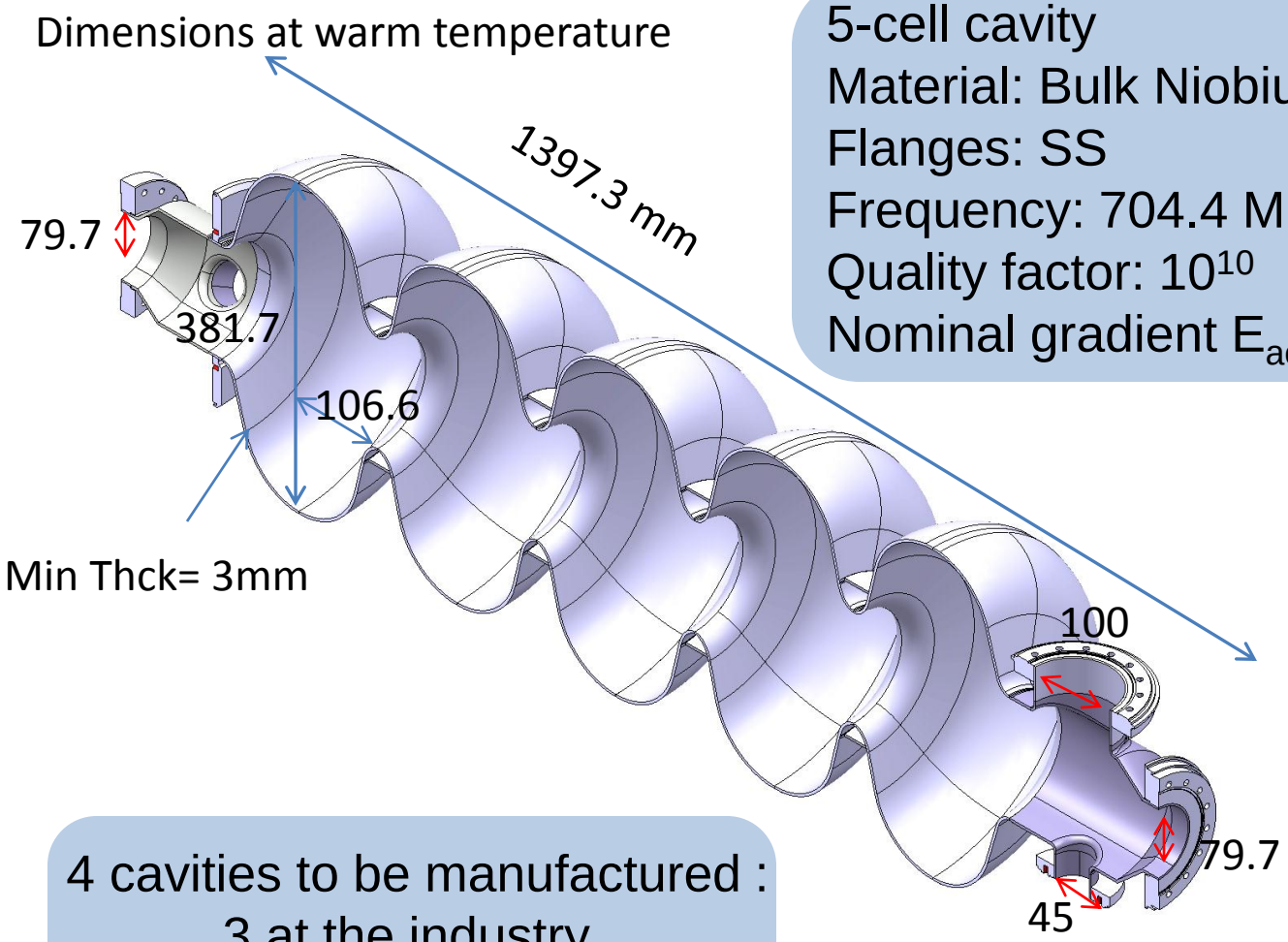


- CAVITY
- HELIUM TANK
- TUNER
- POWER COUPLER
- INTERCAVITY SUPPOR SYSTEM
- HOM COUPLER
- INTERFACES INTER-CAVITY
- CONCLUSIONS

INTRODUCTION- CAVITY SPL



CAVITY



5-cell cavity
Material: Bulk Niobium
Flanges: SS
Frequency: 704.4 MHz
Quality factor: 10^{10}
Nominal gradient E_{acc}= 25 MV/m

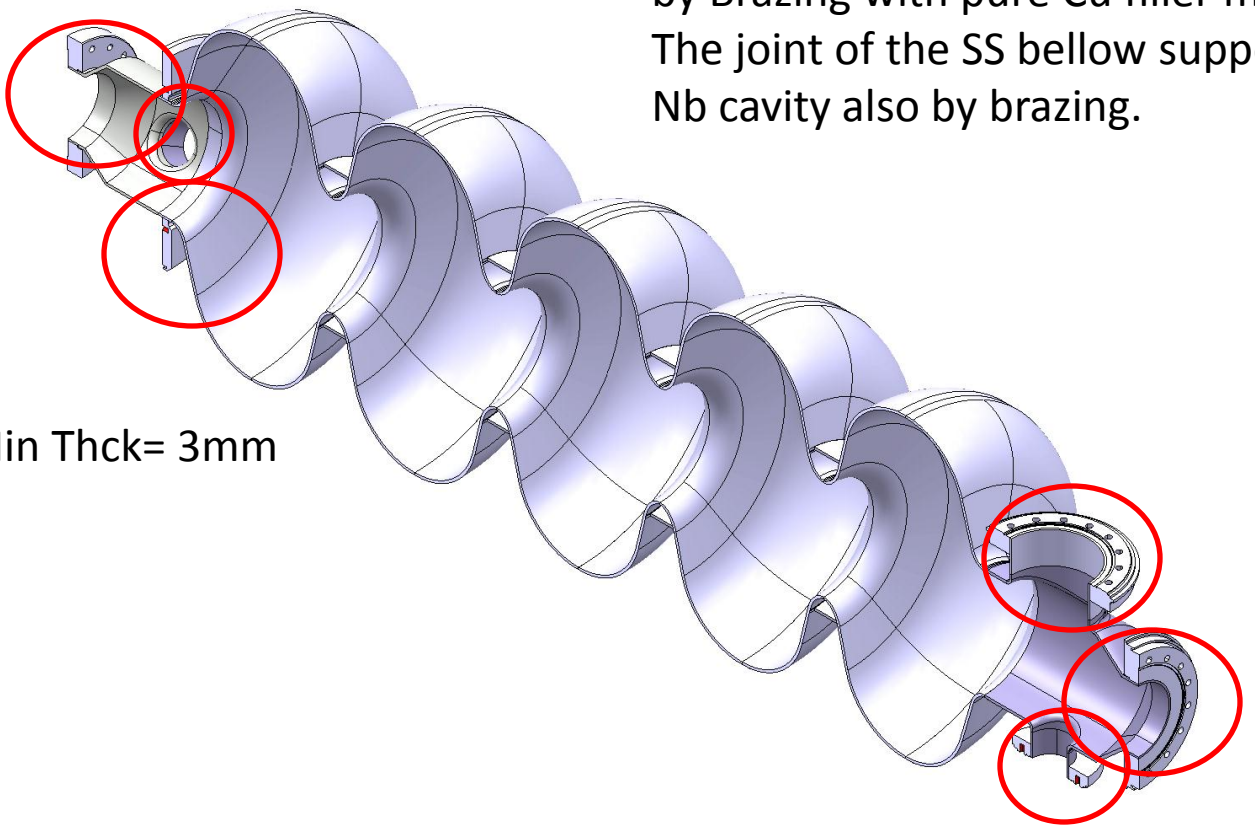
4 cavities to be manufactured :
3 at the industry
+
1 at CERN (Tbc)

Standard delivery: 11 M

CAVITY

Half-cells fabricated by spinning and welded by EB welding.
Cavity made of Niobium and SS flanges

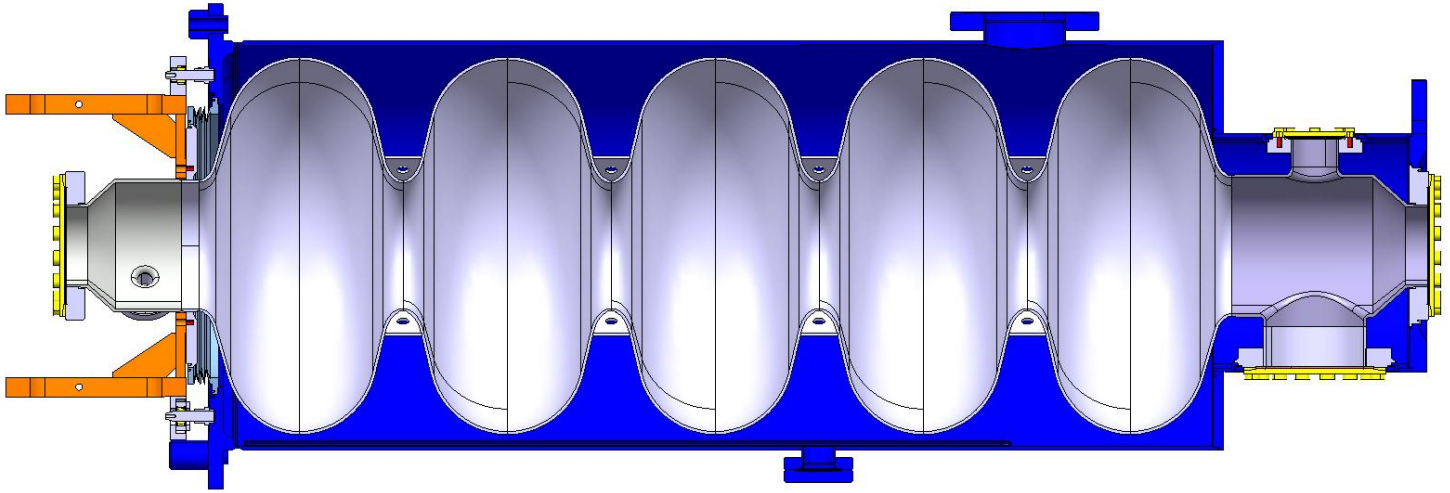
Nb tubes are joined to the SS CF flanges by Brazing with pure Cu filler metal.
The joint of the SS bellow support to the Nb cavity also by brazing.



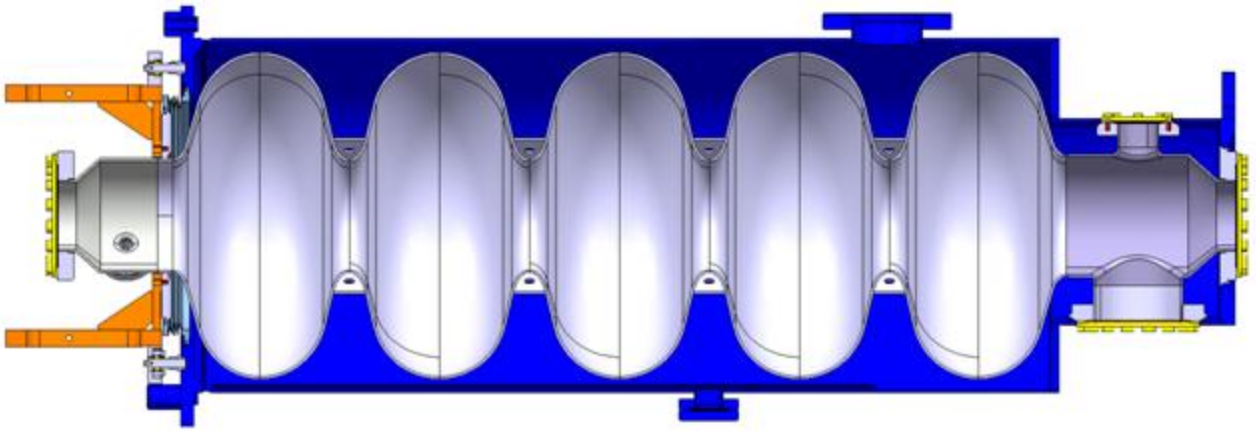
Min Thck= 3mm

HELIUM TANK

- Designed by CERN (SS material)
- To be manufactured by CEA
- Assembly cavity-tank by CERN



HELIUM TANK



2 Functions are fulfilled:

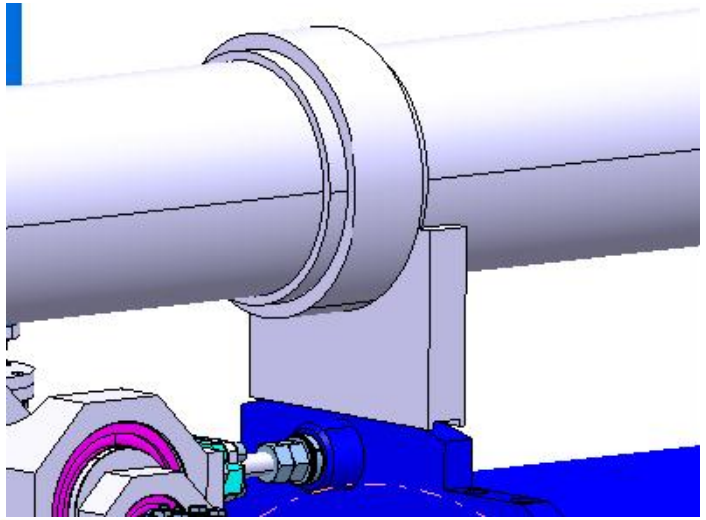
Cryogenic– Keep the helium II (2K) and allowing extraction of the heat dissipated into the cavity.

Structural – To transmit the effort applied by the tuner to the cavity.

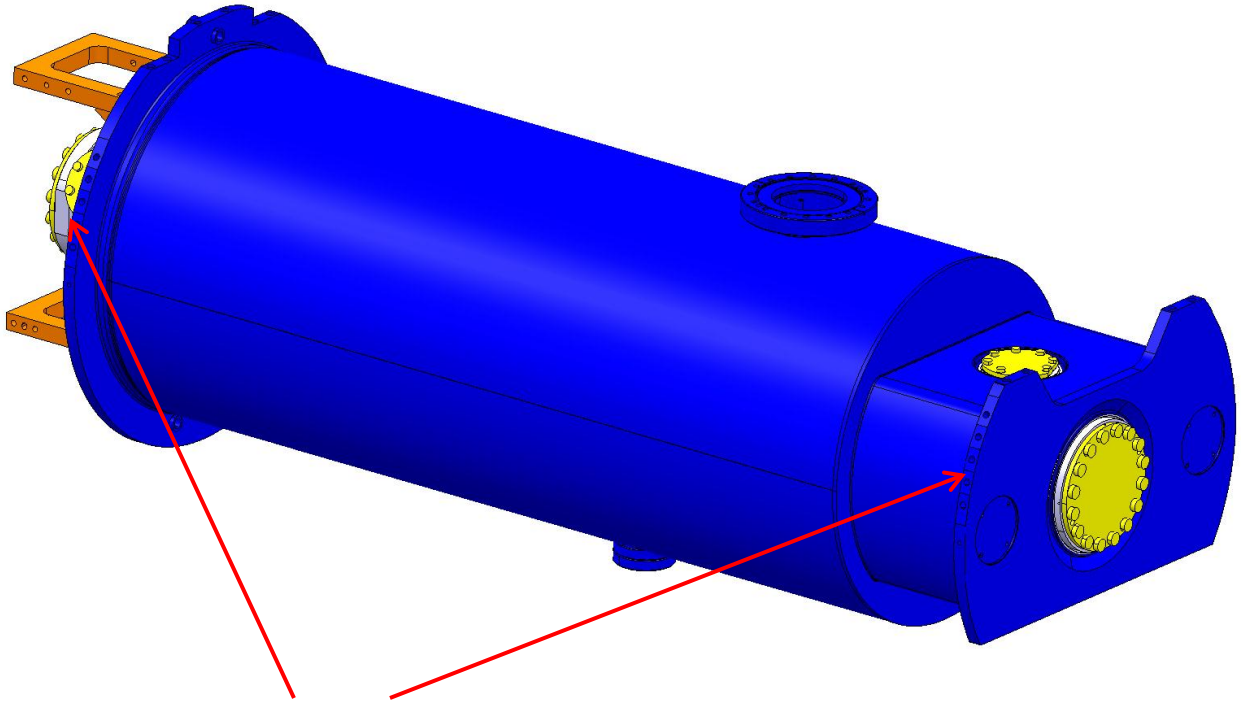
Design pressure 1.5 bars => not considered as pressure vessel

HELIUM TANK

Support for helium tube

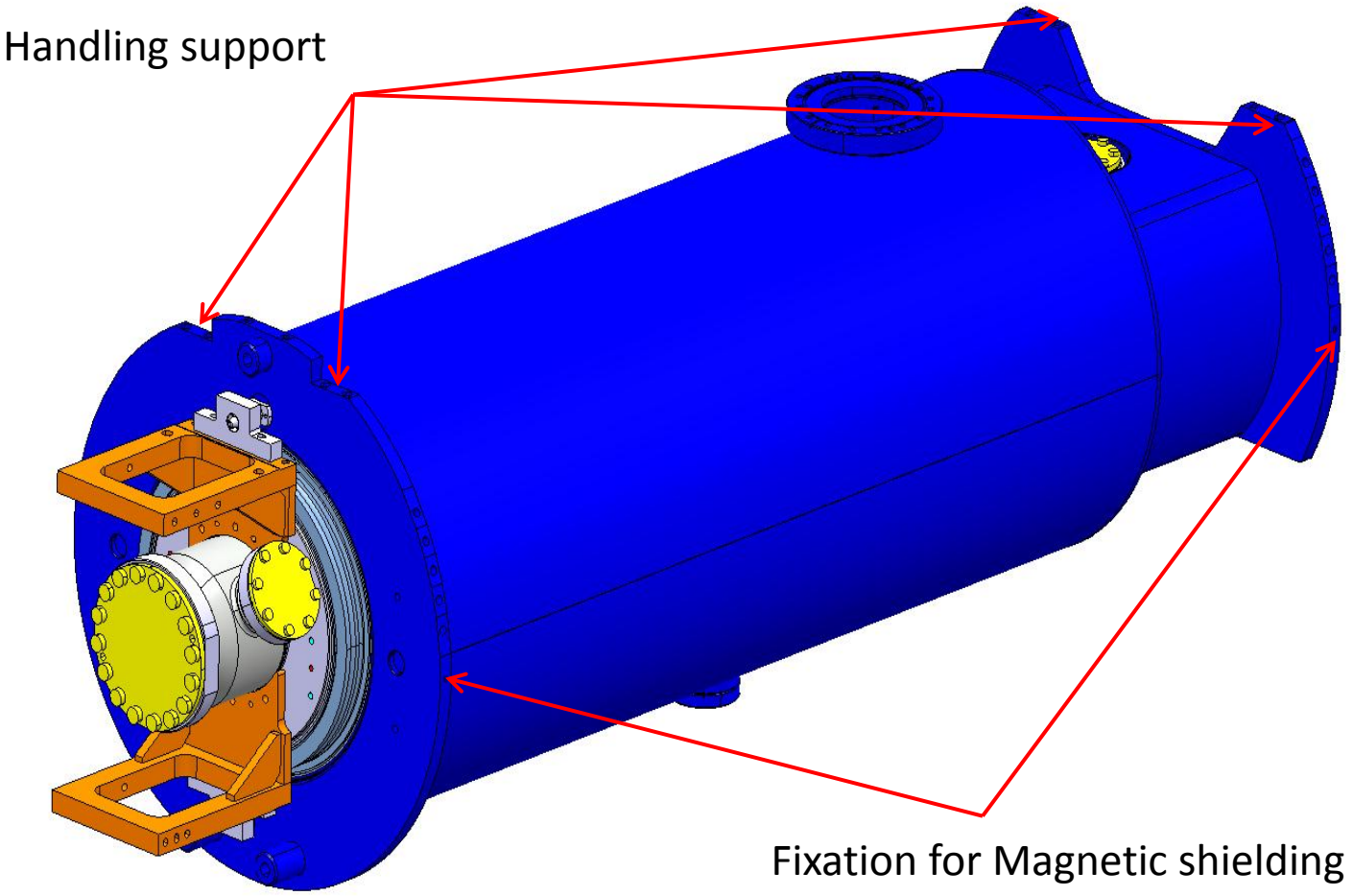


HELIUM TANK

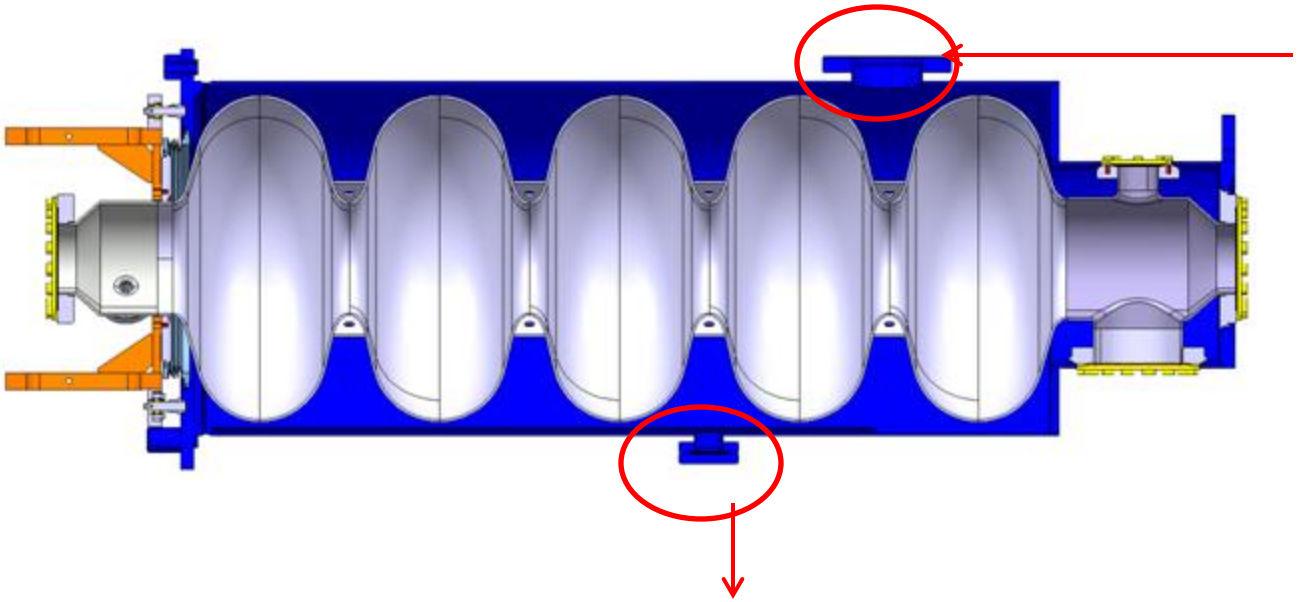


The alignment system supports are designed by the cryo-module team compatible with all adjacent equipment (magnetic shielding etc...)

HELIUM TANK



HELIUM TANK- Interface Cryo



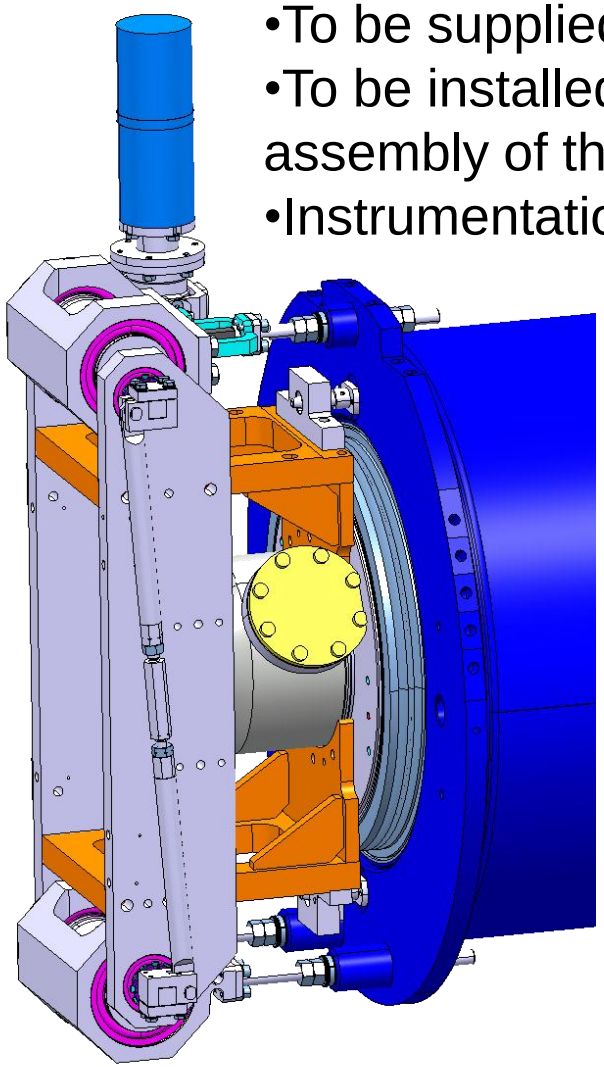
SS CF UHV DN100, tube dia 80 mm -It has been designed to extract the heat in a nominal performance (pulsed).

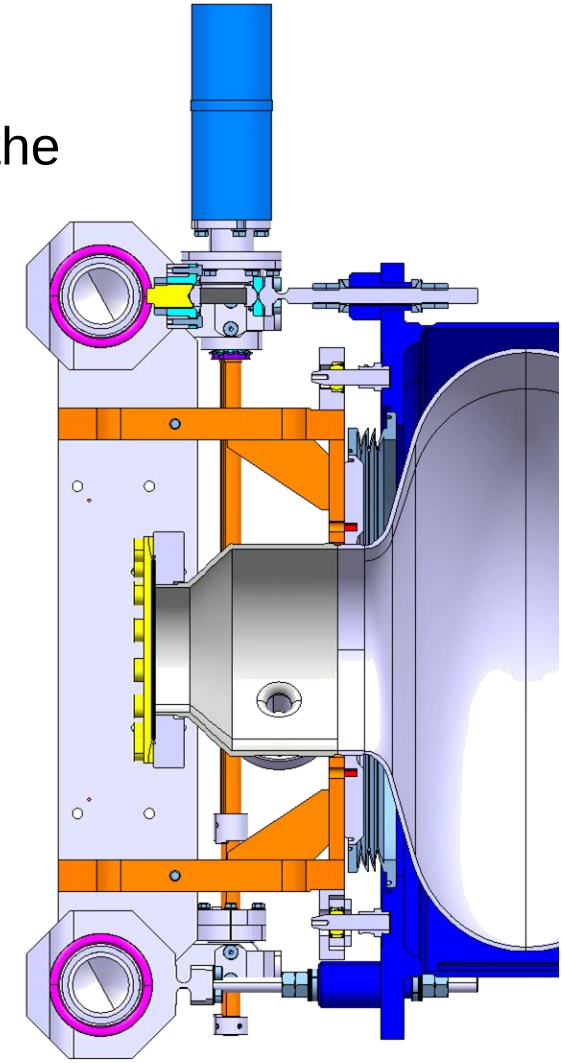
SS CF UHV DN 40, tube dia 27 mm. In principle not needed in a first phase. Will be closed with a flange.

Needs to be defined by cryo if instrumentation (ex. heaters...) or other equipments (ex. helium supply pipe...) need to be installed before assembly of the helium tank.

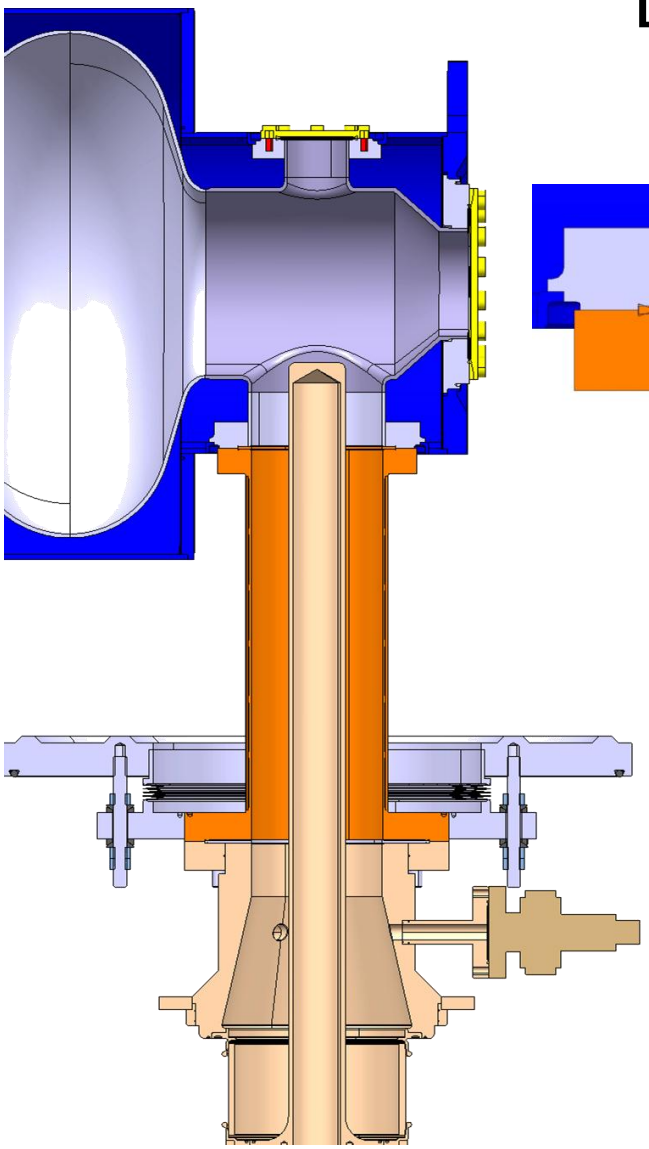
TUNER

- To be supplied by CEA
- To be installed by CERN during the assembly of the cryo-module
- Instrumentation / control cables

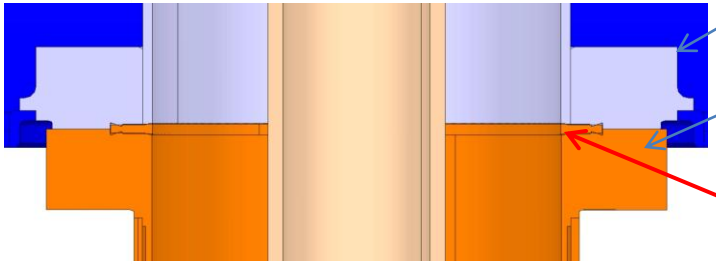


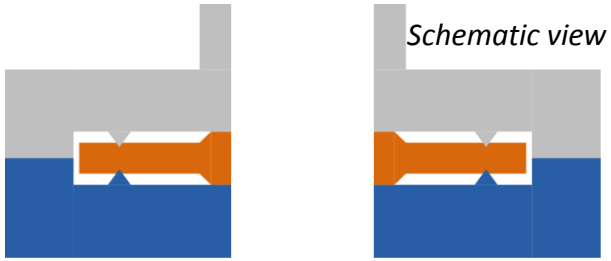


POWER COUPLER



Designed and provided by CERN (BE/RF)

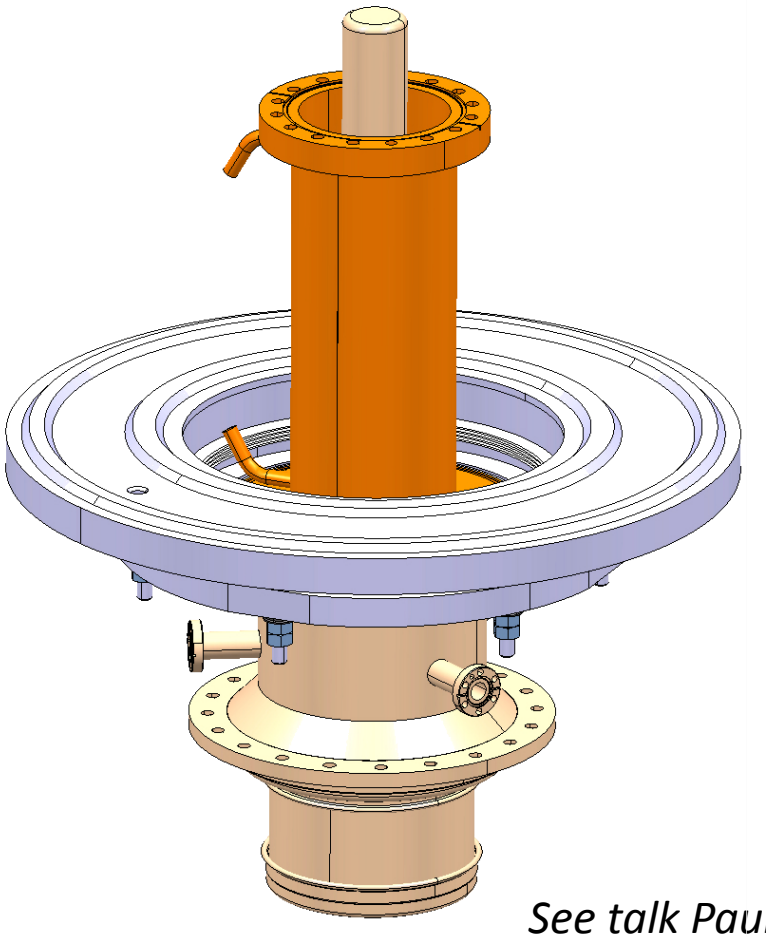




Requirements to fulfill:

- RF Electric continuity
- Support for the cavity→ <u>(The cavity + tank is not designed for cantilever supporting)</u>

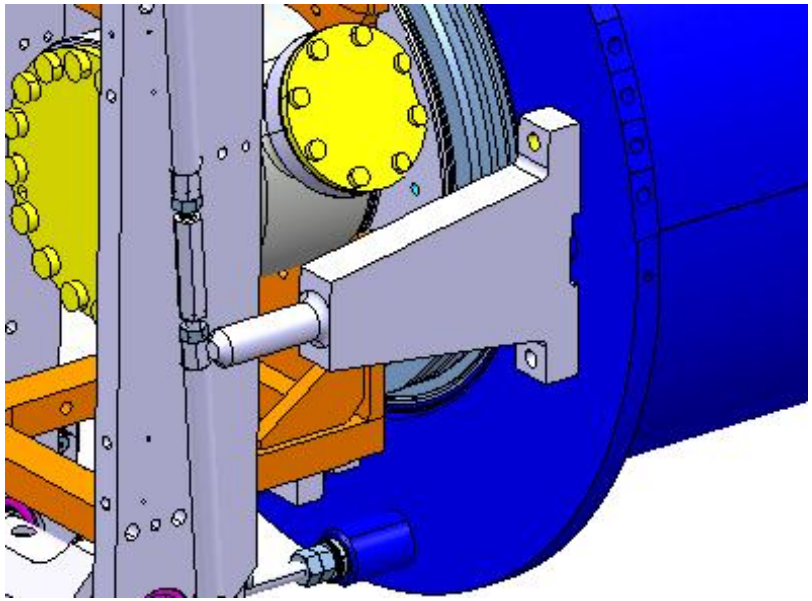
POWER COUPLER

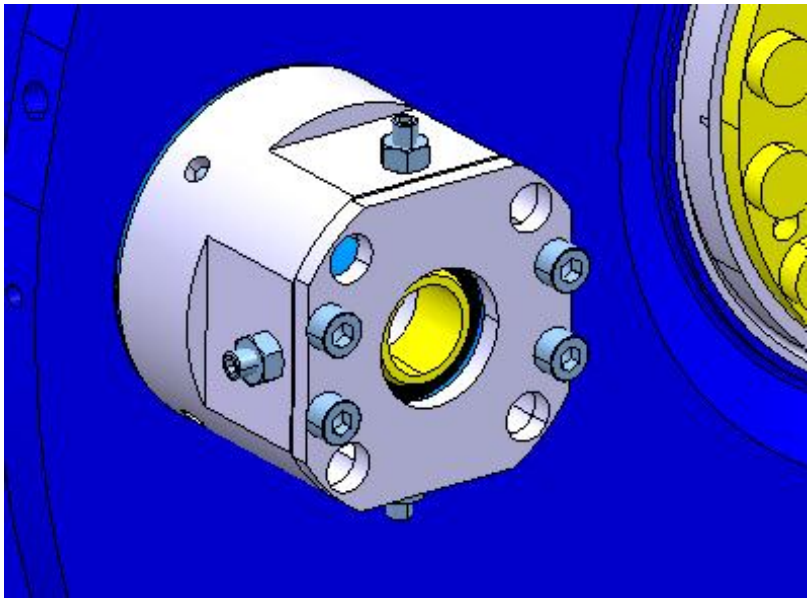


- The double-walled tube of the main coupler will need to be actively cooled
- The cooling circuit in/out are foreseen inside the cryostat vacuum

See talk Paulo for more info double wall coupler

Intercavity support system

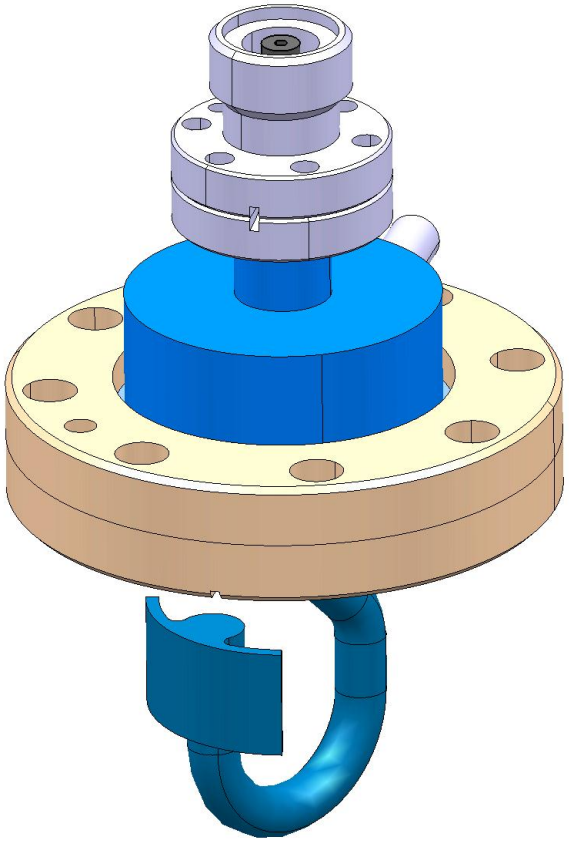




Interfaces foreseen on the helium tank for the second support of the cavity: the « intercavity supporting system »

See talk Arnaud for more info inter-cavity supporting system

HOM COUPLER



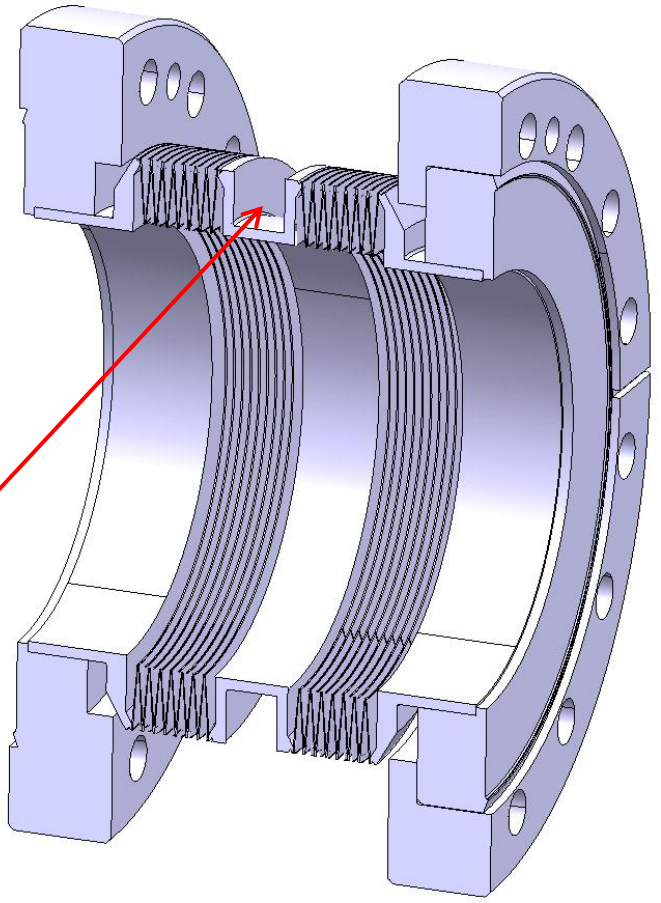
HOM: Not installed at the first stage.

The cavity will be delivered closed with a flange at the HOM port.

It has to be foreseen a cooling system at the cryo-module for the HOM installation in a later phase.

INTERFACES INTER-CAVITIES

SS bellow not actively cooled.
CF SS flanges + standard gasket.
Instrumentation cable (temperature) to be foreseen.



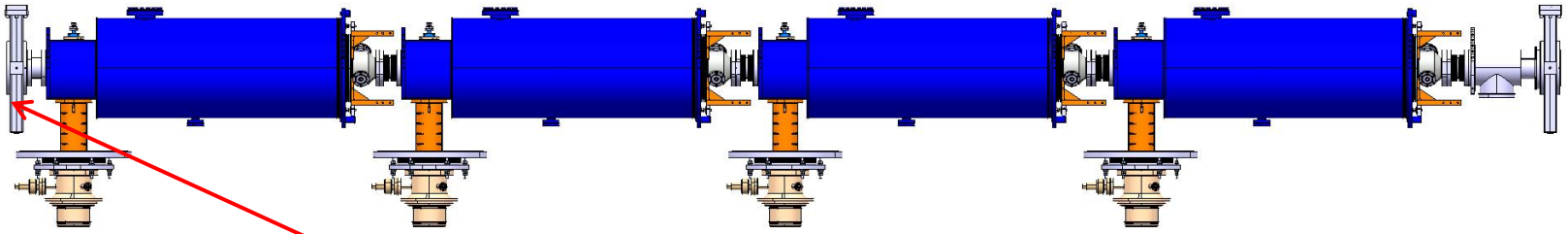
Conclusions

Niobium cavities manufacturing procedure ongoing.

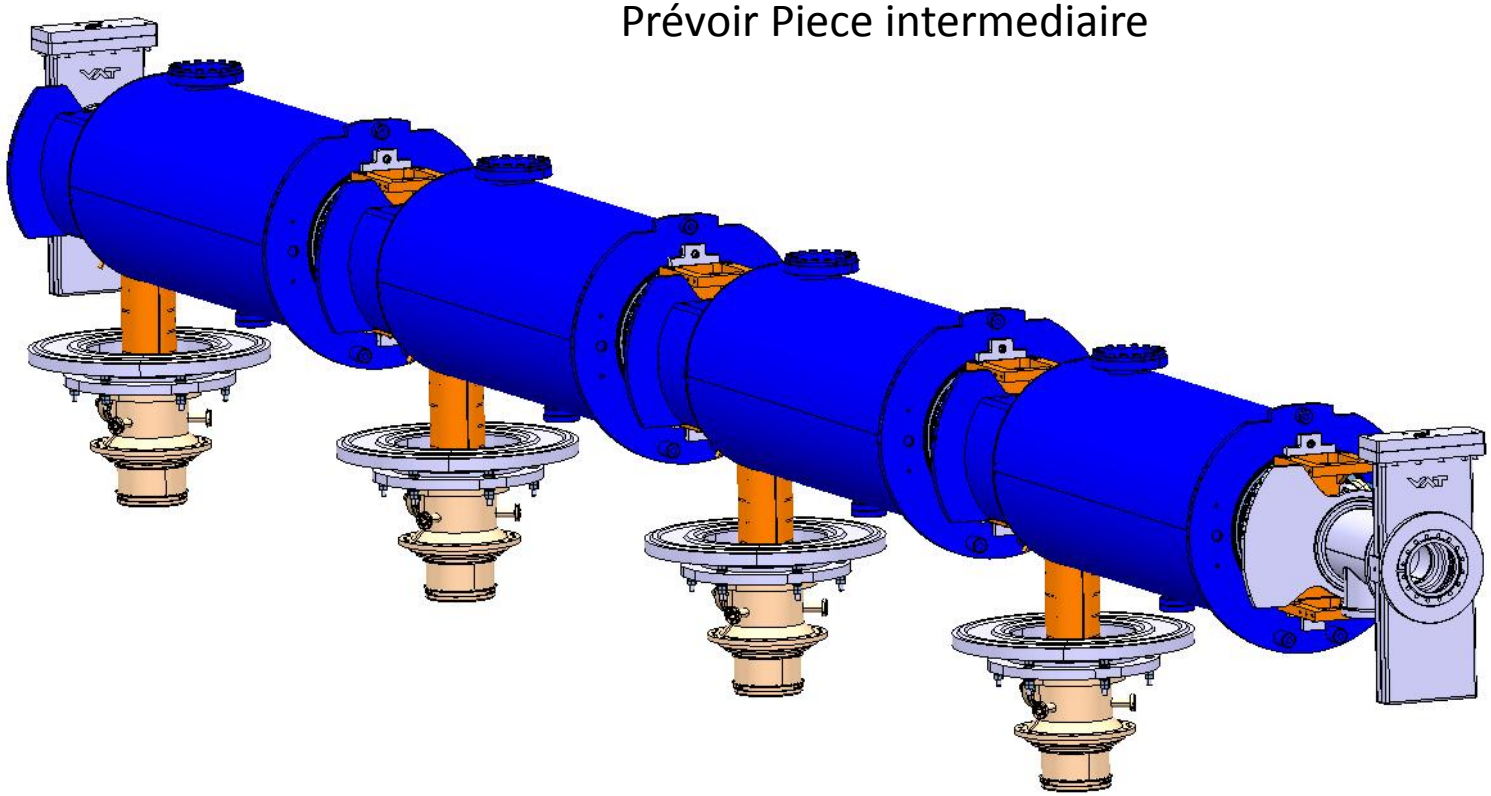
This review will allow us to go ahead (or modify) with the design of the helium tank for the cavities.
This design has then to be provided to CEA for manufacturing.

FIN

Train de cavite assemble en Salle blanche



Prévoir Piece intermediaire



Brazing Nb / SS 316 LN is a key technology

Developed at CERN in the 1987.

Joint design:

Difference in dilatation of Nb/SS

Nb tube fitted to SS flange

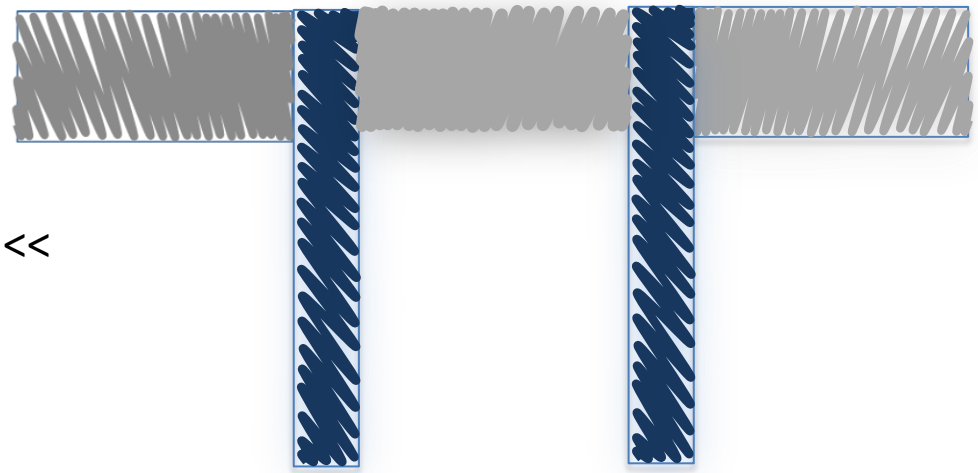
Clearance ≤ 20 µm

SS plug to expand the Nb

Pure Cu filler metal

Brazing temperature 1100°C, Δ_{time} <<

P< 10^{-5} mbar



SPL cryo-module conceptual design review