



# DFX integration and transport

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***Conceptual design review of the DFX 31.01.2019***

# Summary

- Installation scenario of the DFX box

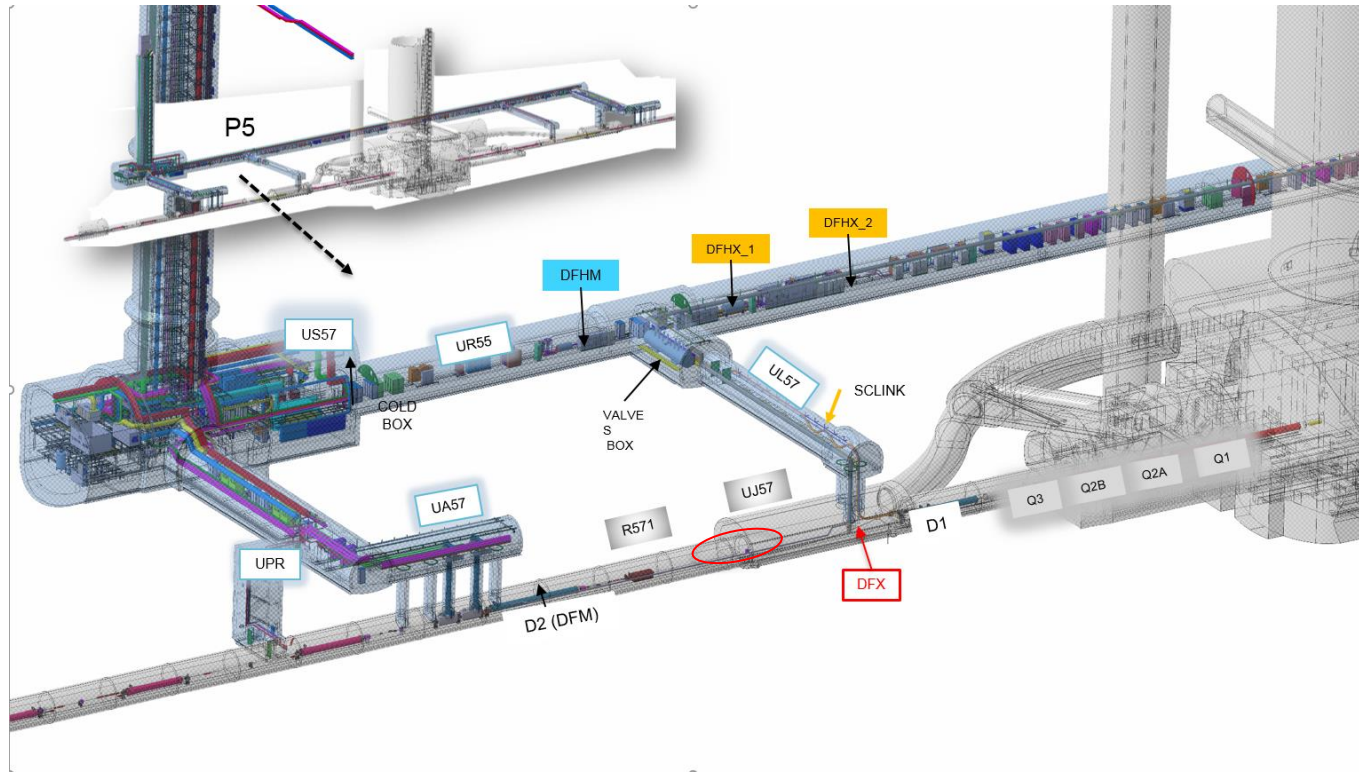
Goal of this scenario:

- Define and check the design constraints.
- Define the request of tools.

- MgB<sub>2</sub> / NbTi splices access

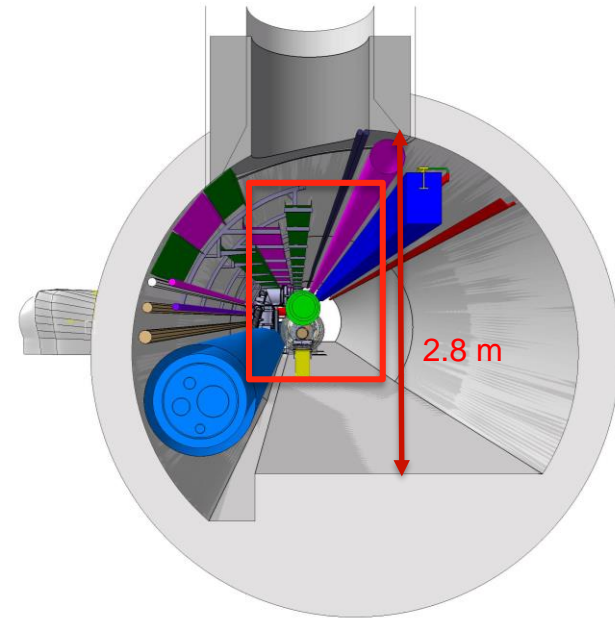
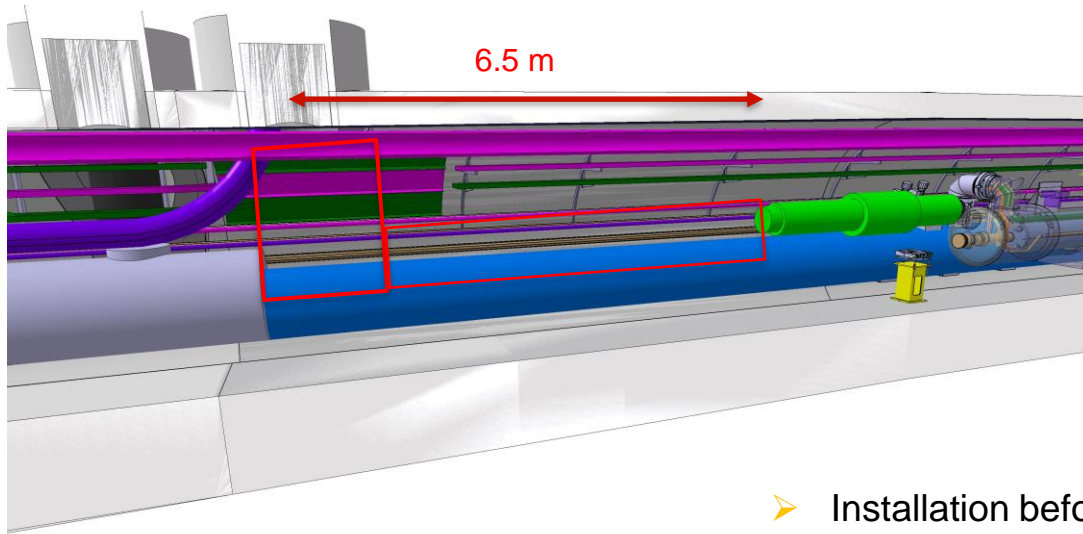
- Unexpected problem repair of the MgB<sub>2</sub>/NbTi splices.

# General layout 5L



# Integration area

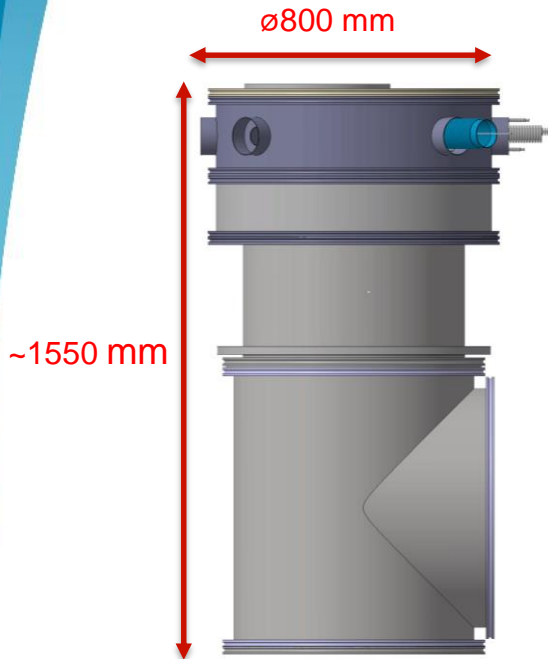
- Use point 5L as reference area



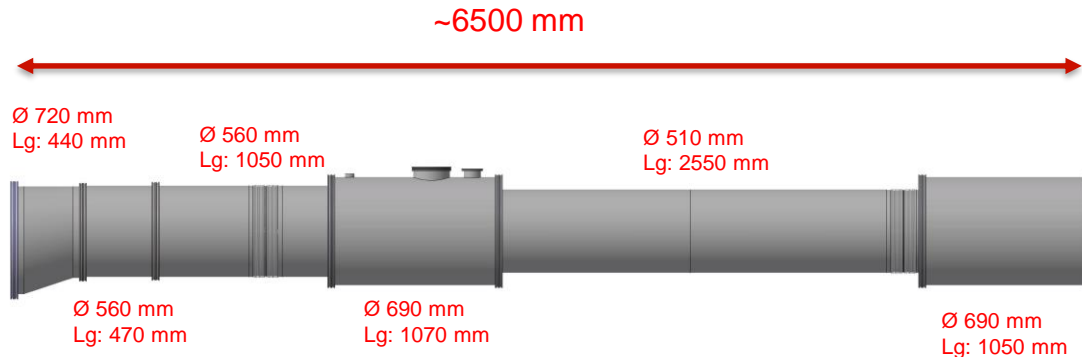
- Installation before the beam pipe

# DFX unit to be transport & install

## ➤ DFX vertical unit

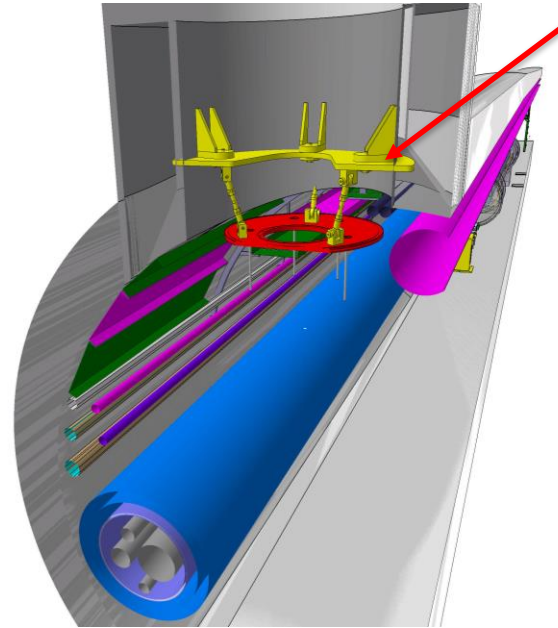
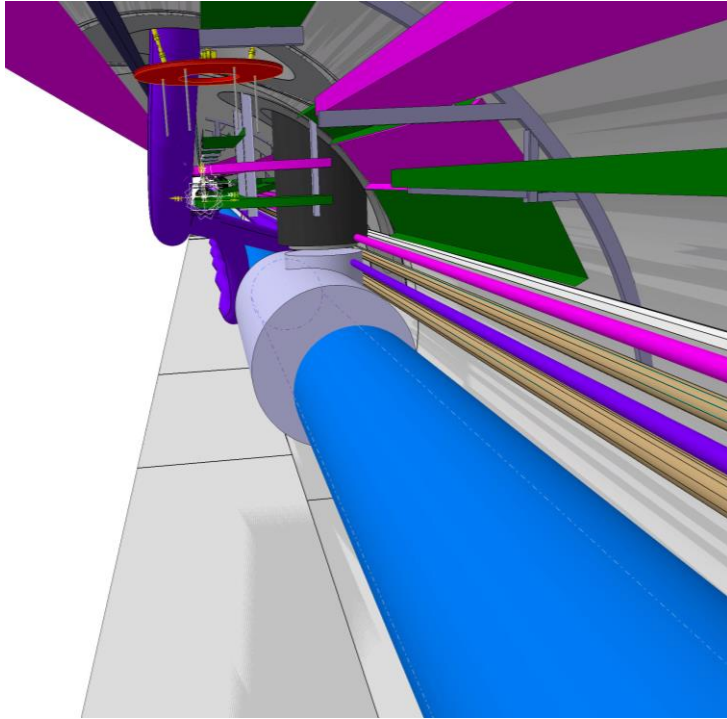


## ➤ DFX horizontal unit



- The horizontal part should be done in several sub units (lg: 2500 mm)
- We don't expect any problems for the transport of those parts in the UJ tunnel. An additional check should be done with the detailed drawings

# Installation of the top flange

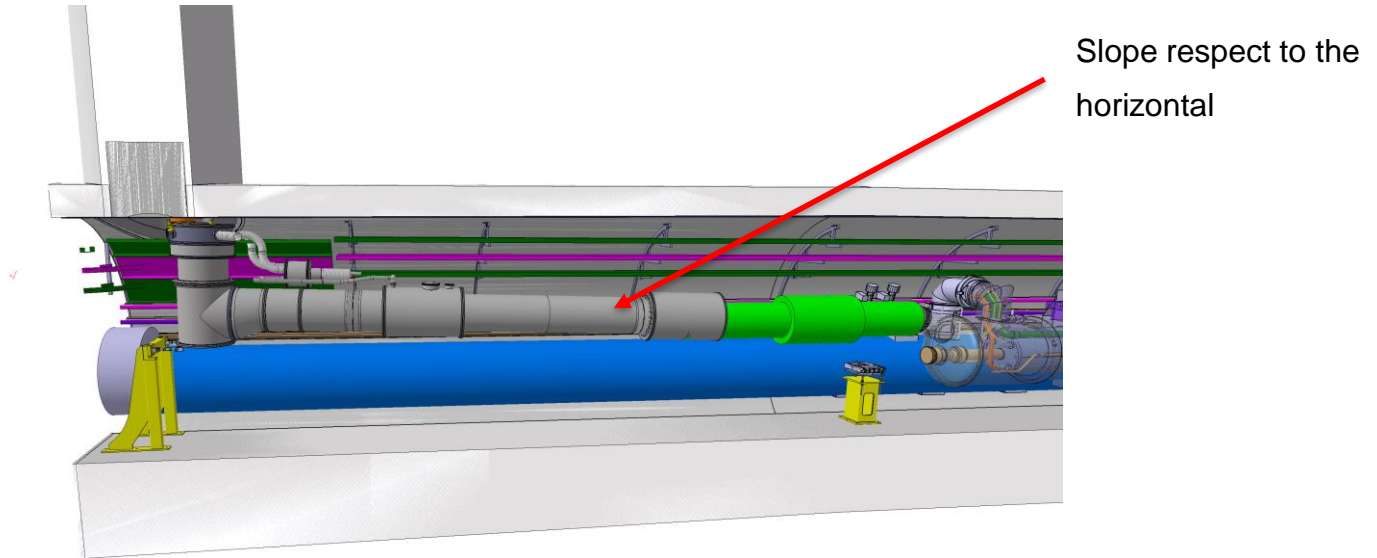


Support fixe  
in the shaft

- The top flange is use as reference
- Support allow the adjustment for alignment

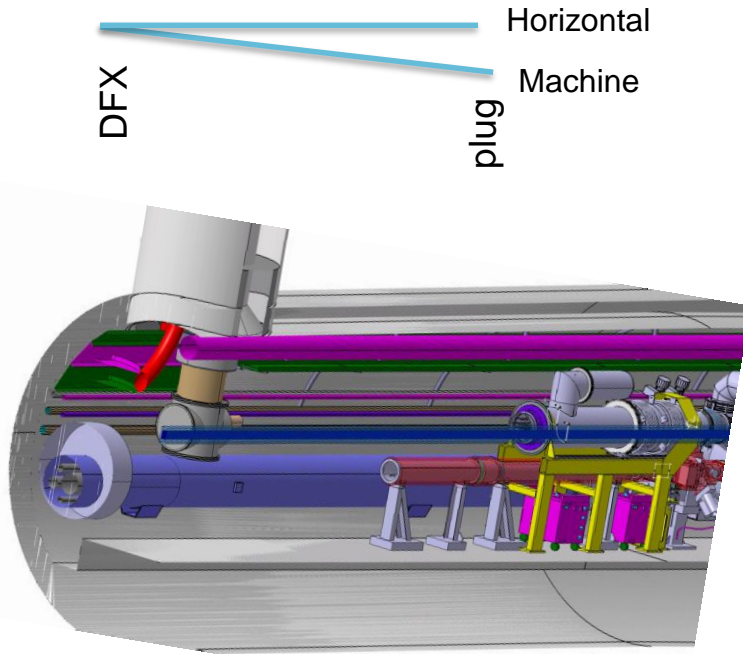
# Installation request

- To avoid any gas trap the horizontal unit of the DFX should be tilted with respect to the horizontal

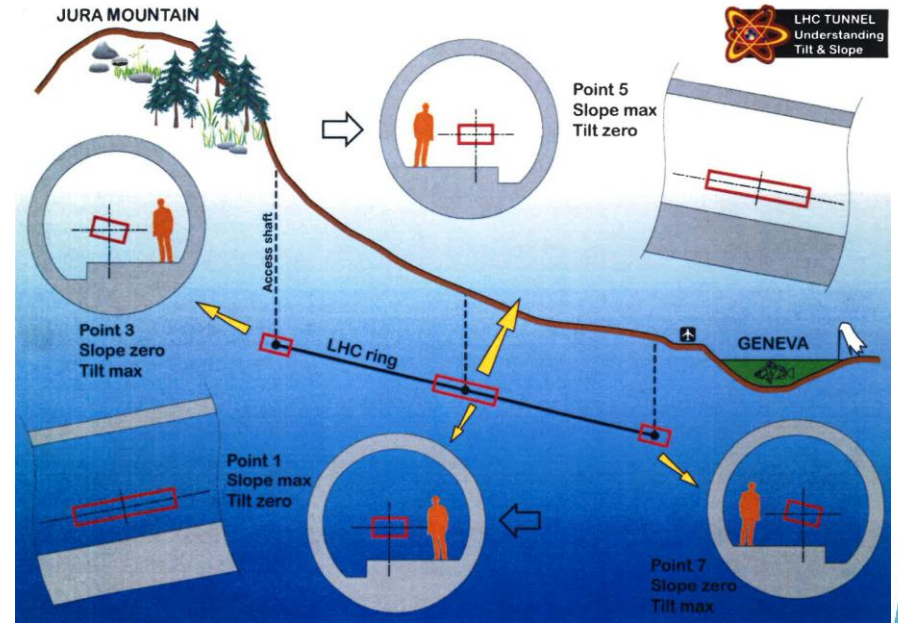




# LHC Tunnel Slope



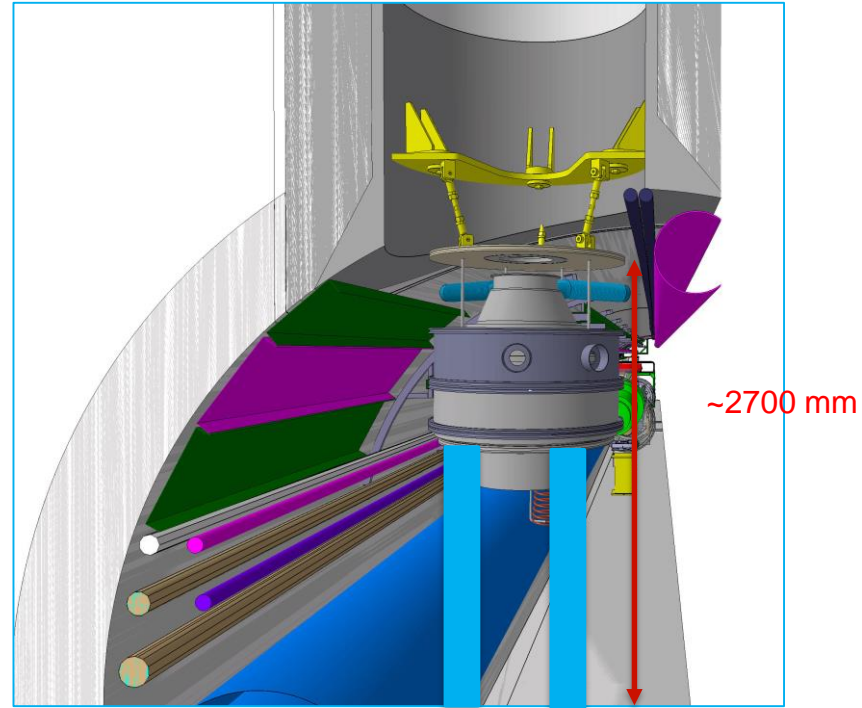
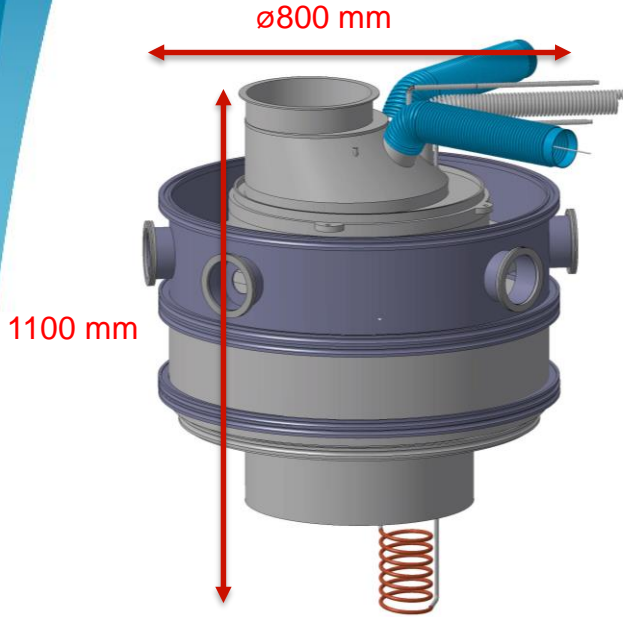
➤ 65 mm for point 5L



- ❑ 5L: Slope -1.234% tilt -0.707%
- ❑ 5R: Slope -1.234% tilt -0.707%
- ❑ 1L: Slope 1.236% tilt 0.708%
- ❑ 1R: Slope 1.236% tilt 0.708%



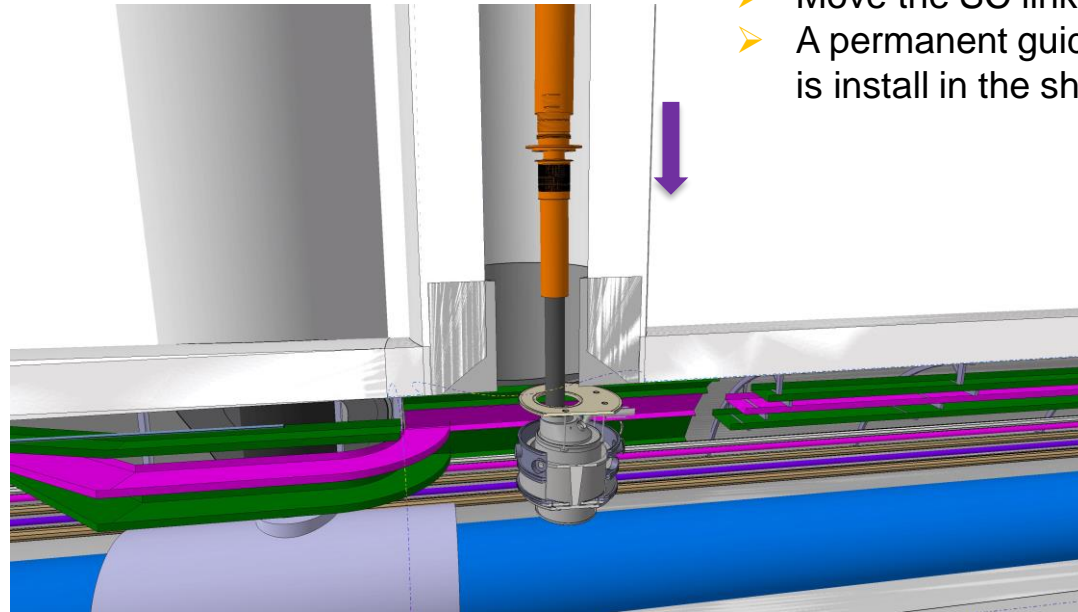
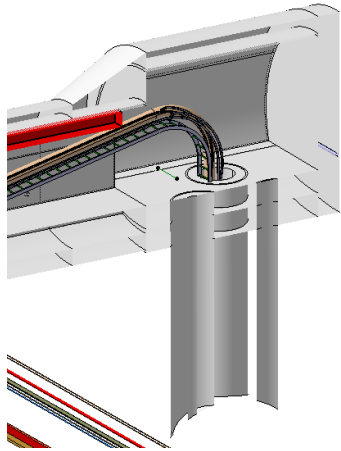
# Installation of the vertical part of the DFX



- Fix the vertical unit to the top flange
- ☐ Tooling and support request

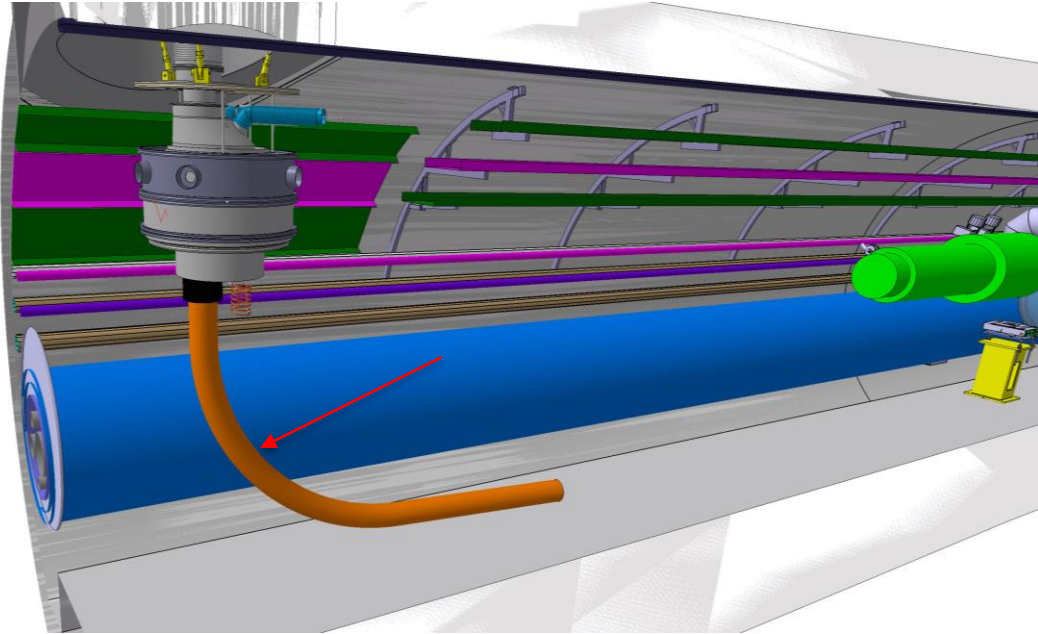
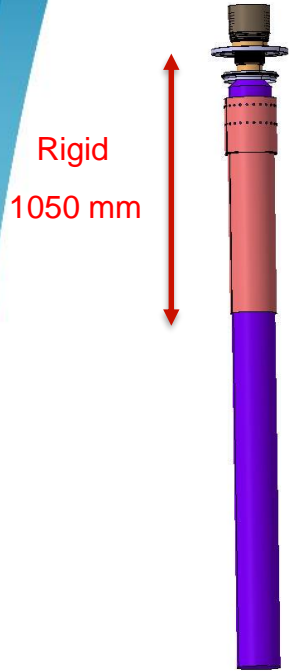
# SC link in the shaft

- Move the SC link in the shaft



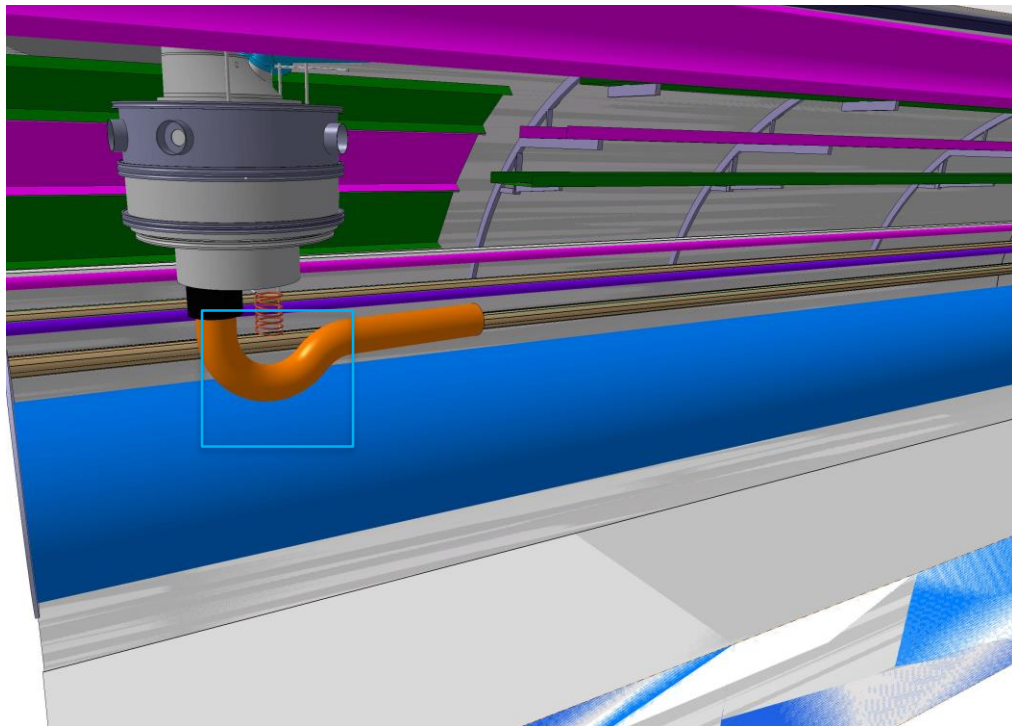
- Move the SC link in the shaft
- A permanent guiding system is install in the shaft

# SC link in place



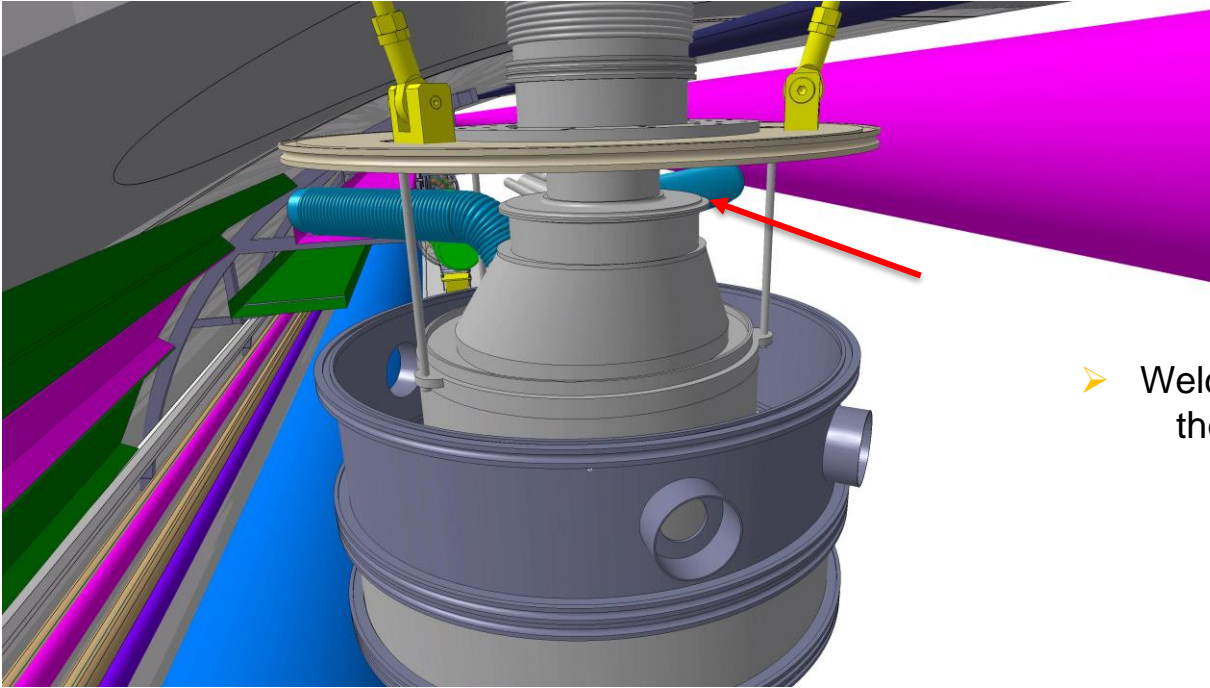
- Bend of the LTS (NbTi) cable 1,2 m during insertion

# LTS cable bending



- Bend the LTS cables to the final dimensions
- Intern Bending Radius 150 mm
- ❑ Tools and support request

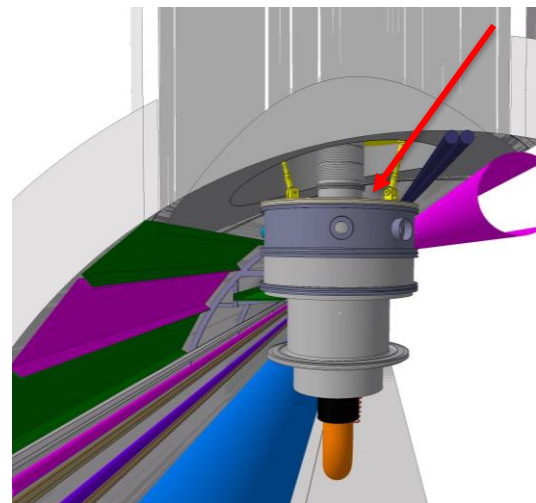
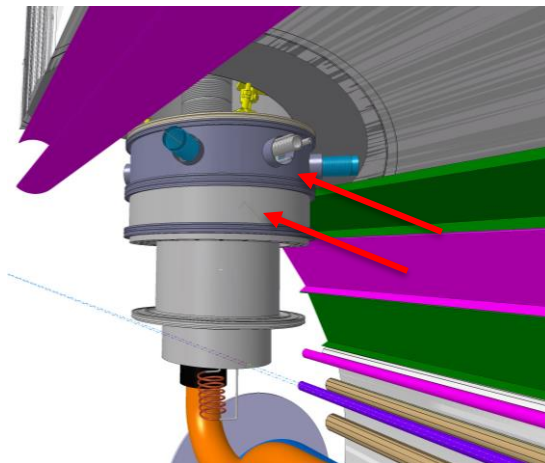
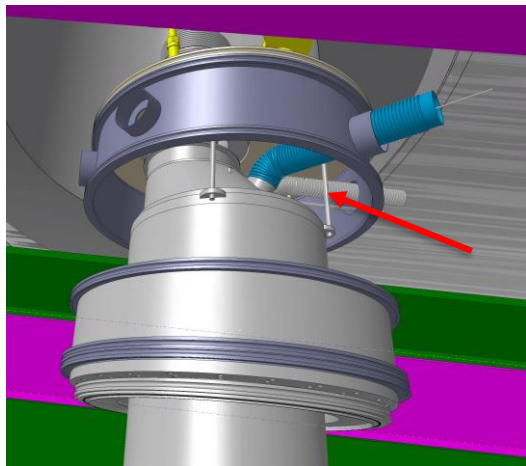
# Welding of the SC link Flange



- Welding of the SC link flange and the top flange of the DFX



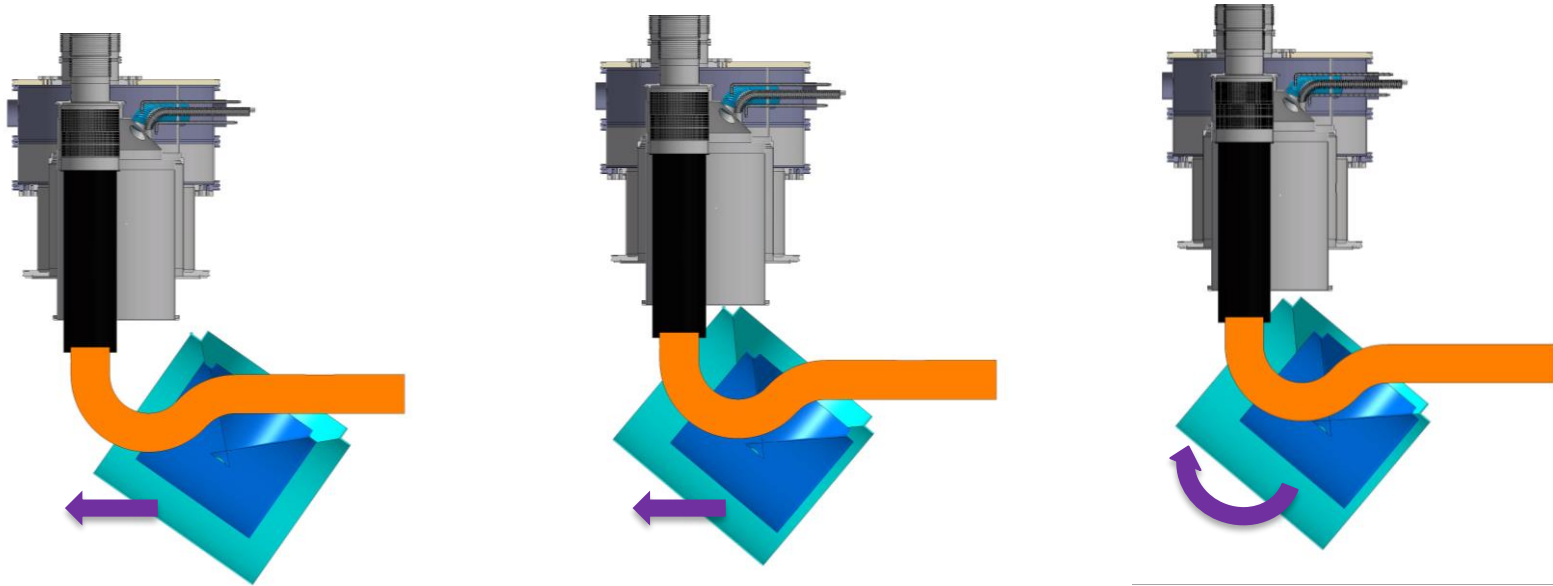
# Close the top vacuum chamber



- All the instrumentation bellows and pipes should be extracted
- The vacuum chamber is closed
- The fixation rods should be removed (from the top)



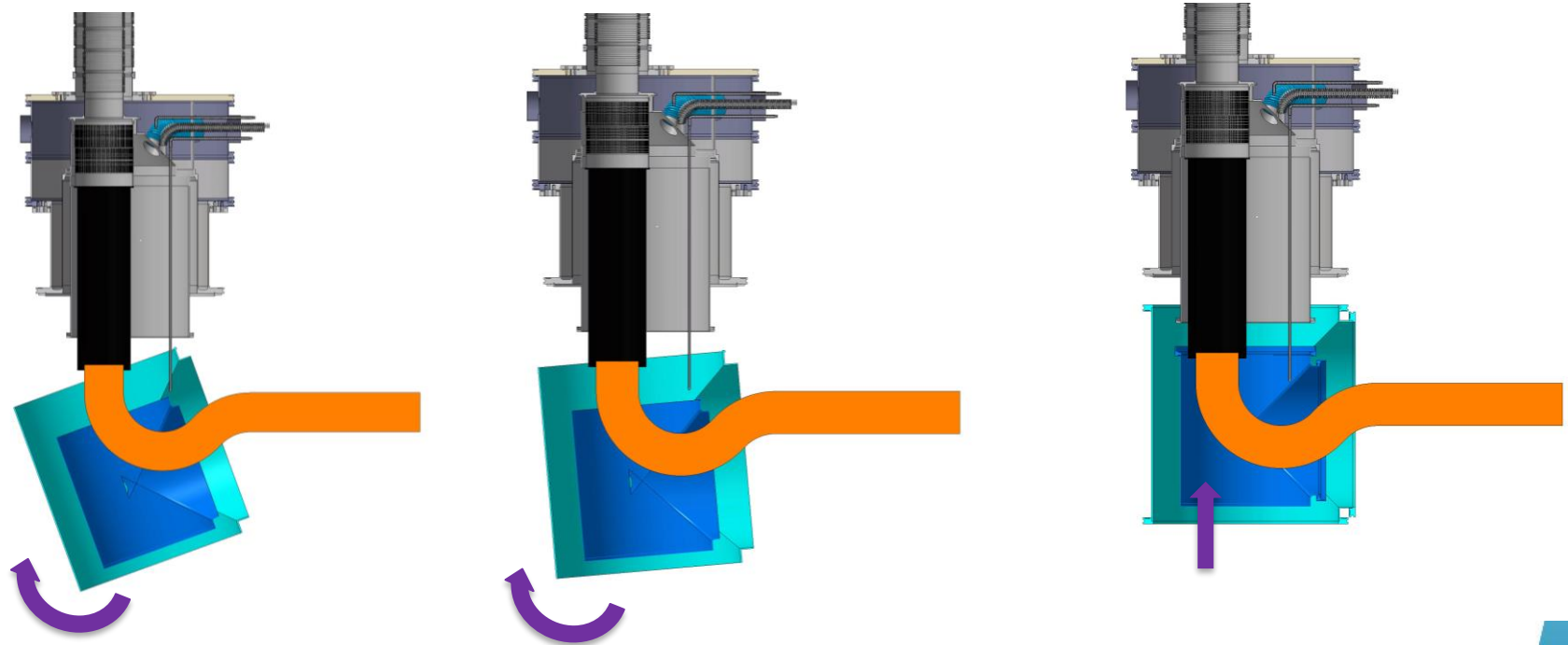
# Installation of the low chambers



- The 2 chambers are fixed together
- The 2 chambers move around the LTS cables

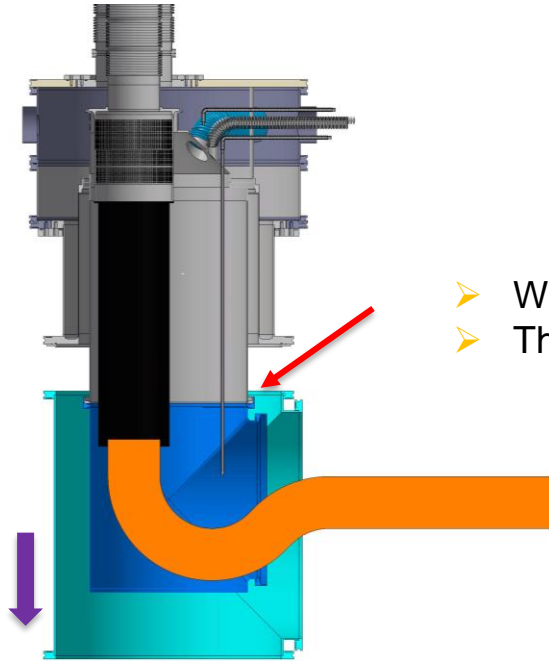
□ Tools and support request

# Installation of the low chambers



□ Tools and support request

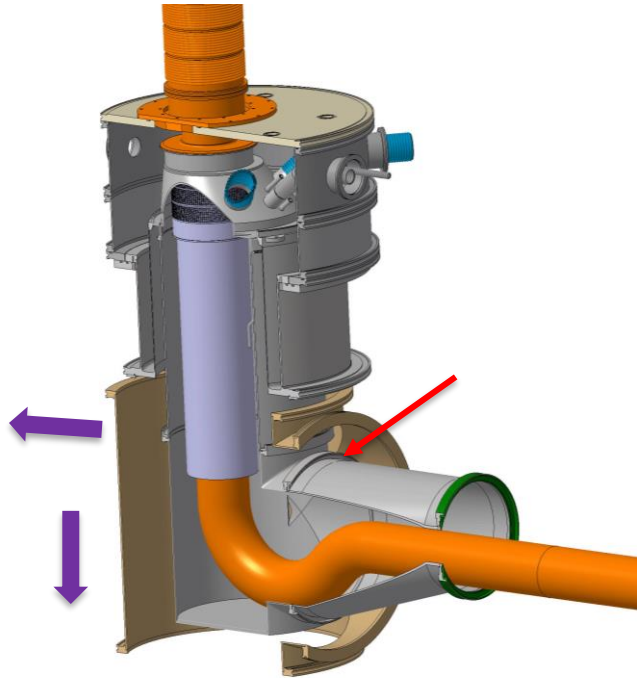
# Welding of the low flange



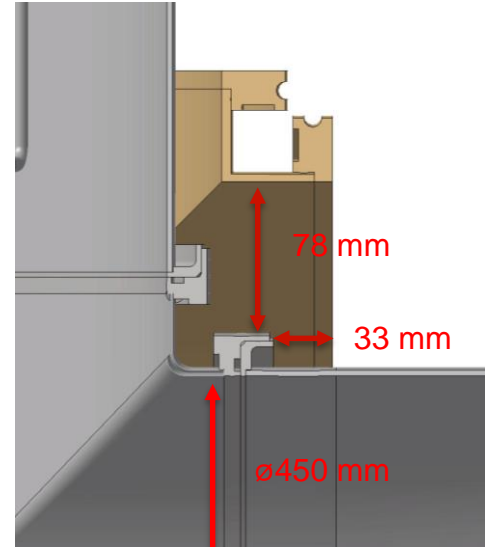
- Weld of the flange
- The 2 chambers have to be disconnected

❑ Tools and support request

# Welding of the low flange

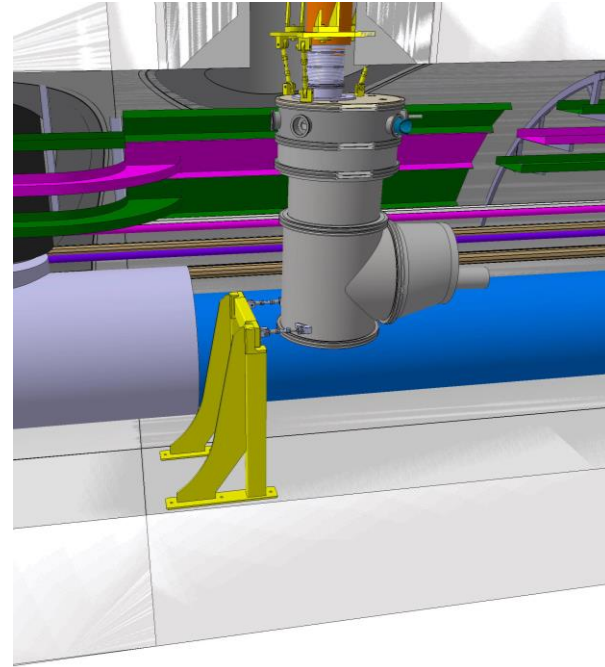
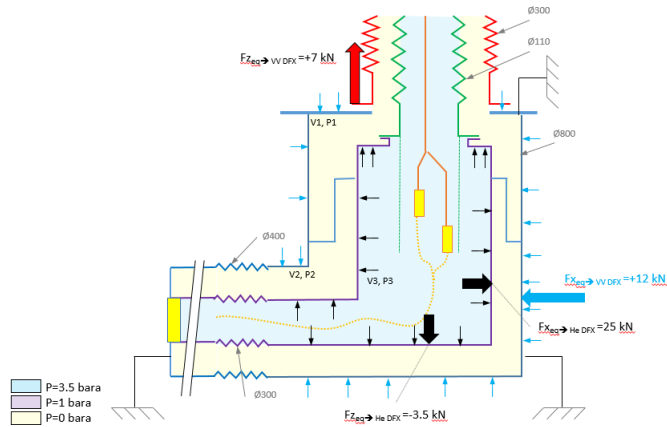


- Centring of the vacuum chamber
- Weld of the flange
- The 2 chambers have to be disconnected



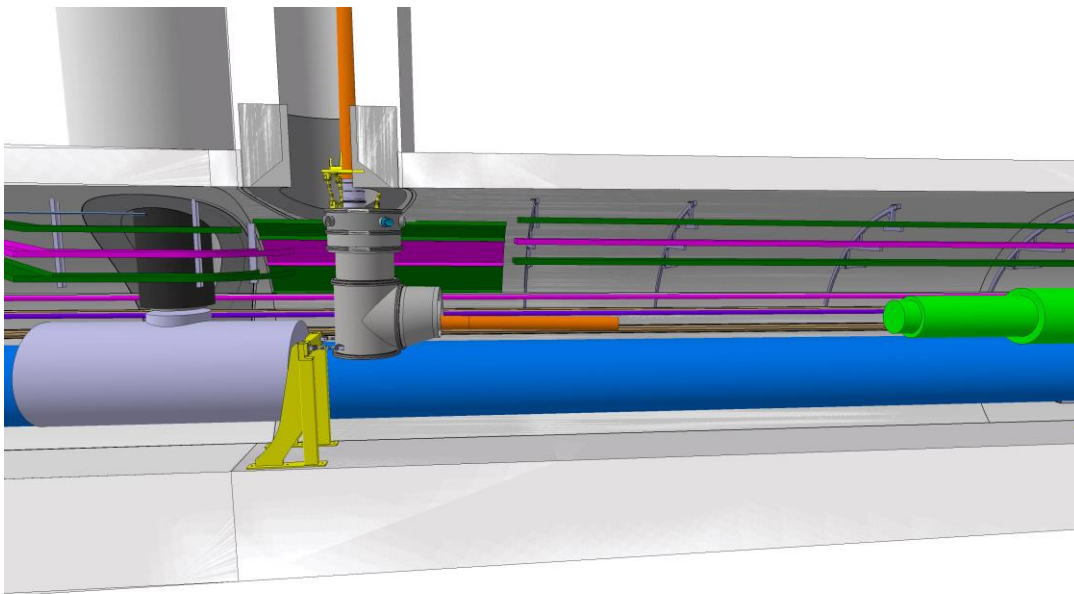
❑ Tools and support request

# Support installation DFX unit



- The top flange support and lower support take the forces generated by loads cases

# Assembly of the DFX horizontal section

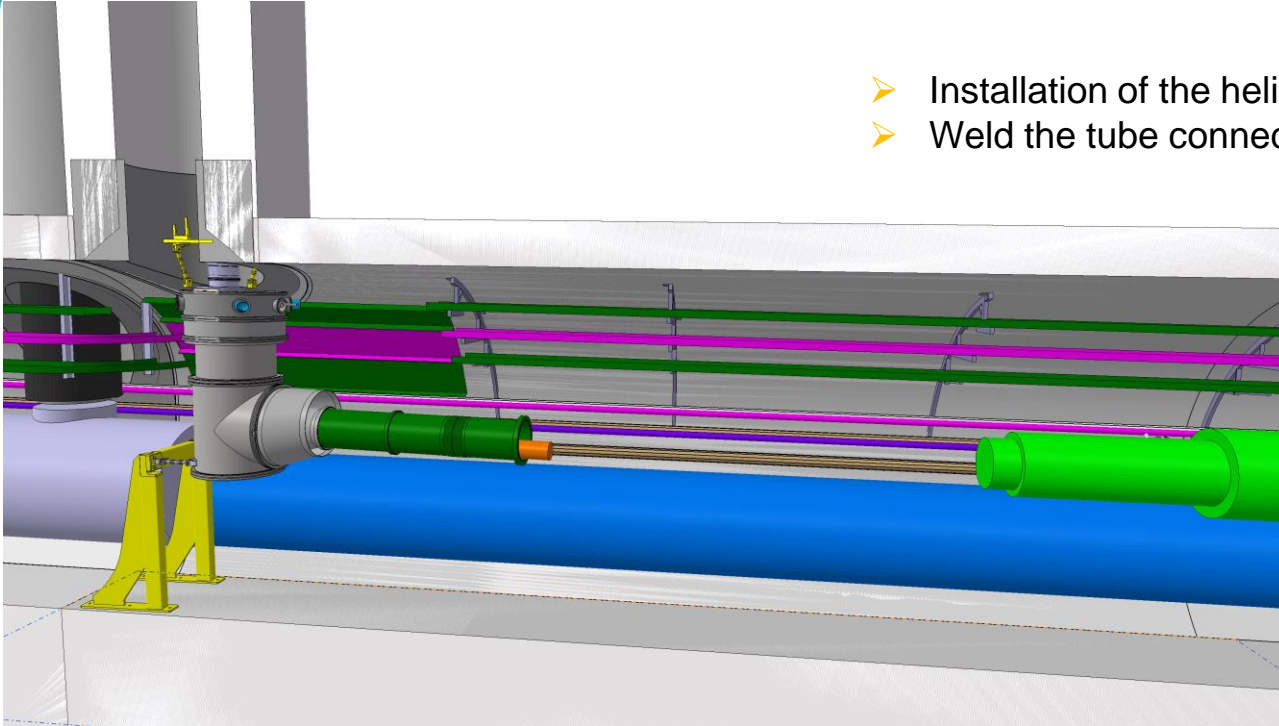


- Tools and support request



# Assembly of the DFX horizontal section

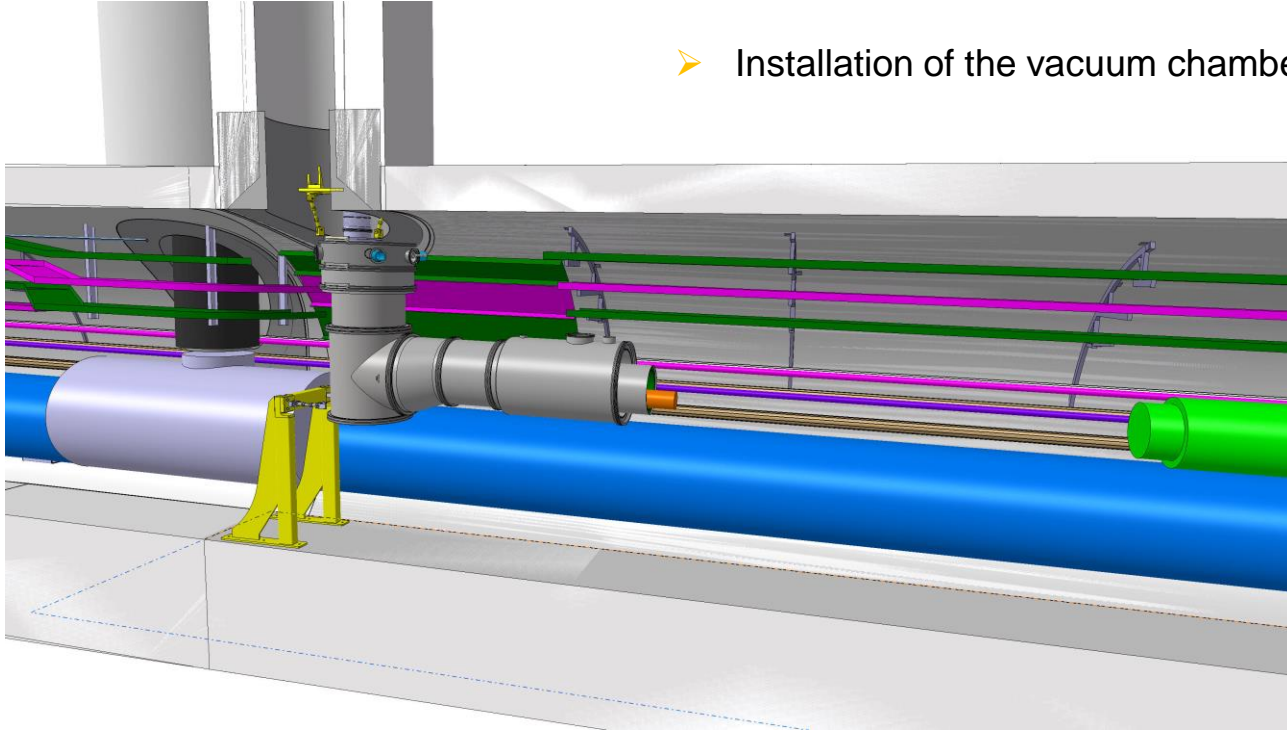
- Installation of the helium tube and bellows
- Weld the tube connections



- ❑ Tools and support request

# Assembly of the DFX horizontal section

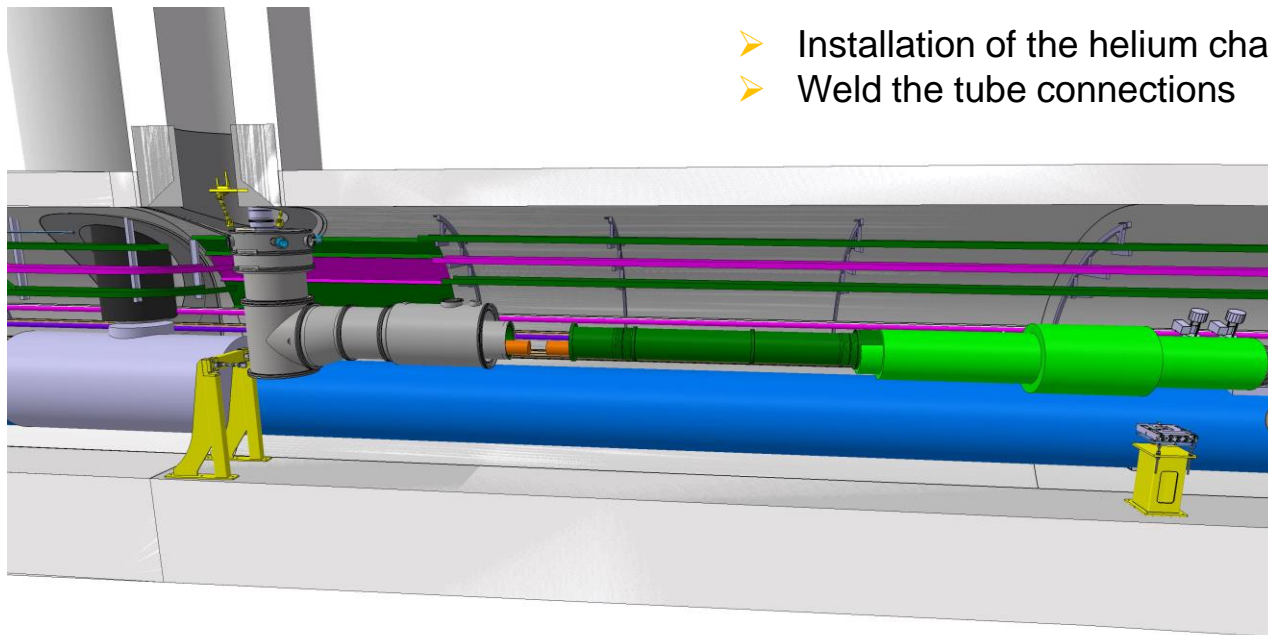
- Installation of the vacuum chamber and sliding oversleeve



- Tools and support request

# Assembly of the DFX horizontal section

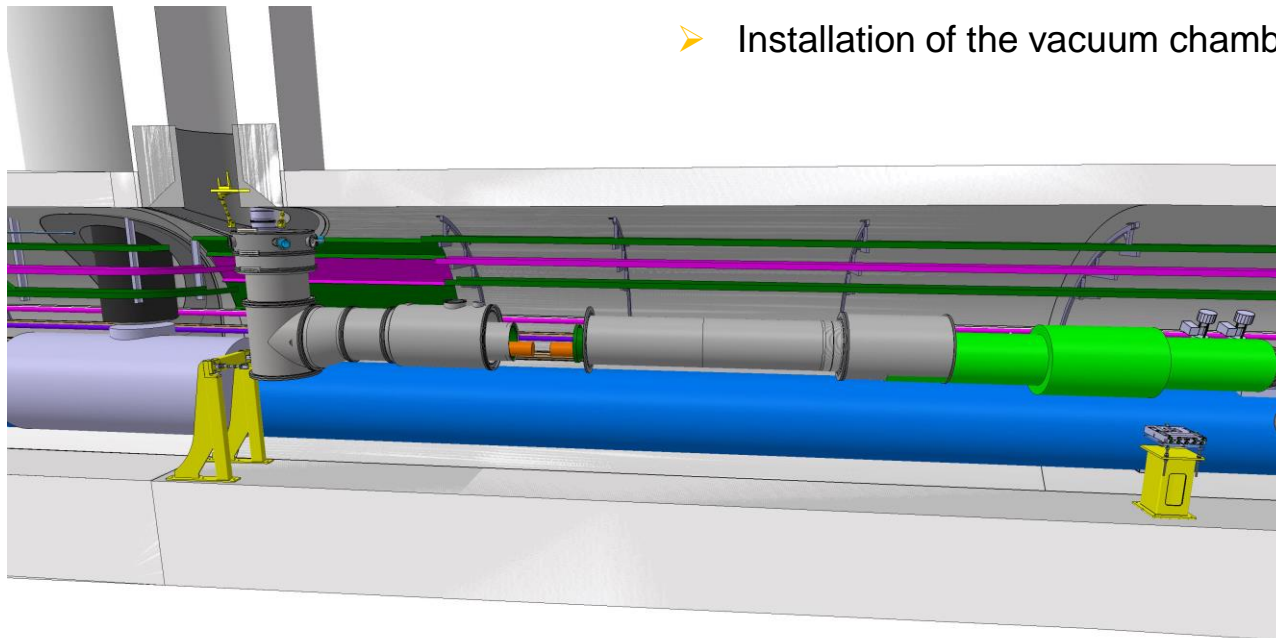
- Installation of the helium chamber on the plug side
- Weld the tube connections



- ❑ Tools and support request

# Assembly of the DFX horizontal section

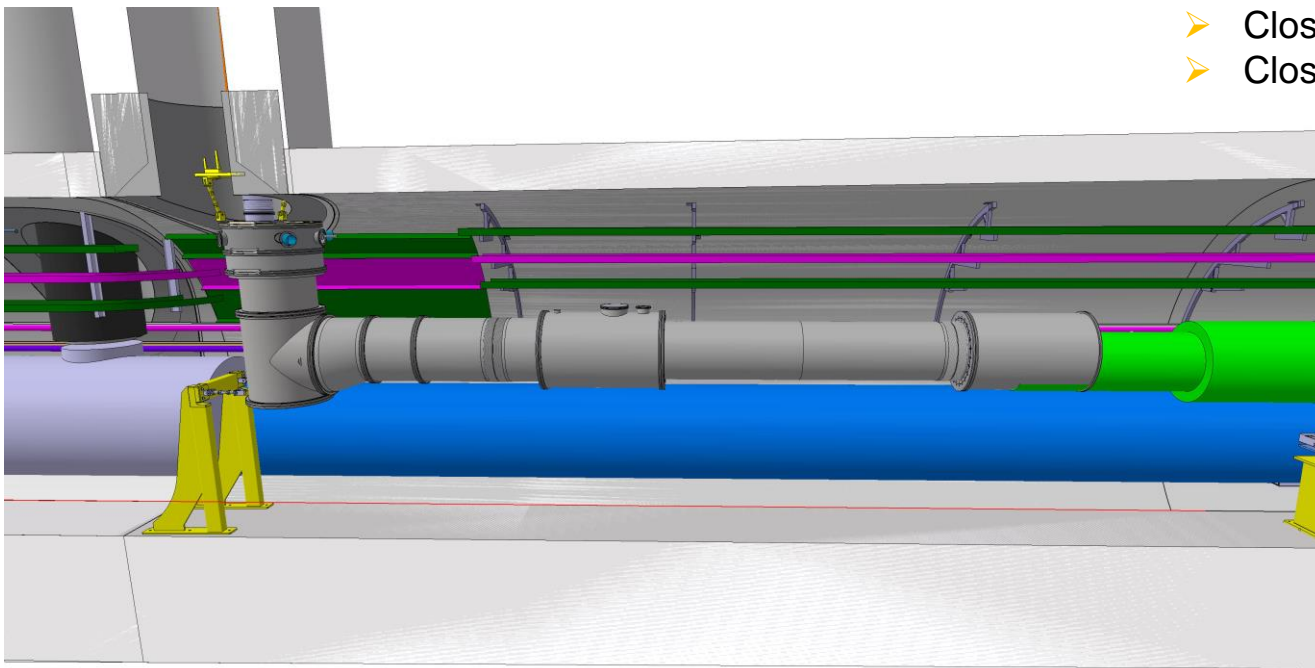
- Installation of the vacuum chamber on the plug side



- Tools and support request

# Assembly of the DFX horizontal section

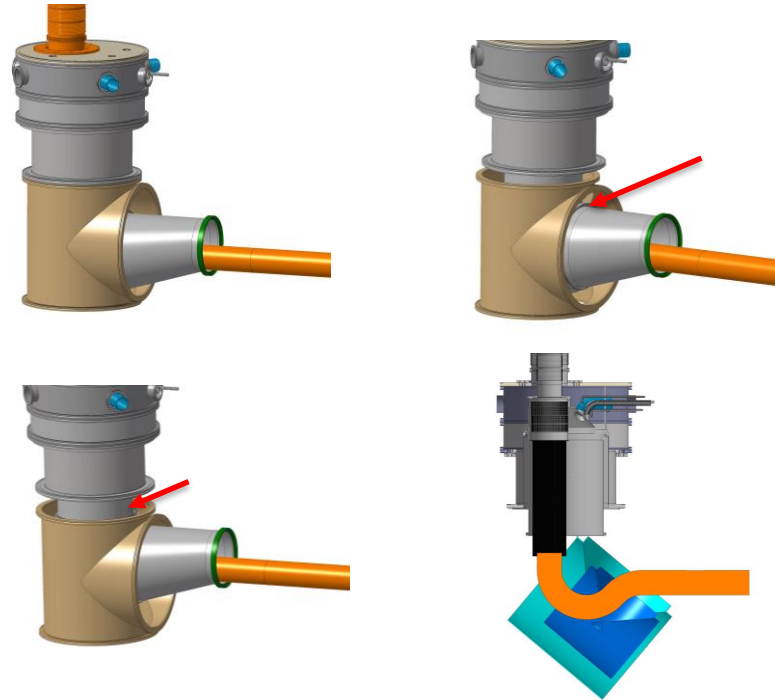
- Soldering of NBTi /NbTi splices
- Close the helium chamber
- Close the Vacuum chamber



Tools and support request

# Disassembly of the SC link

- Remove the horizontal section
- Open the vacuum chamber
- Cut the welds
- Remove the chamber down
- Bend the LTS cable

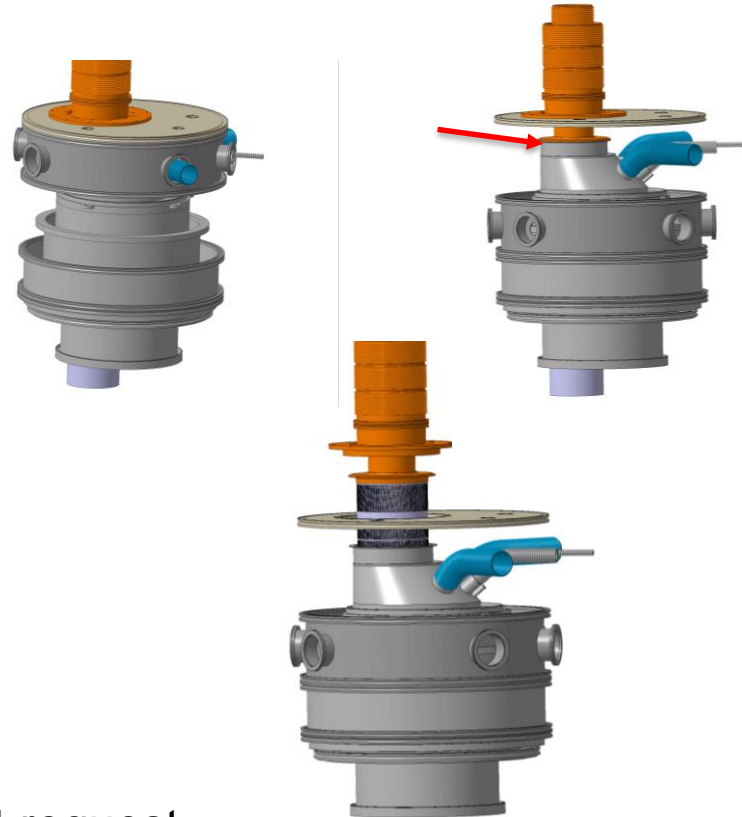


□ Tools and support request



# Disassembly of the SC link

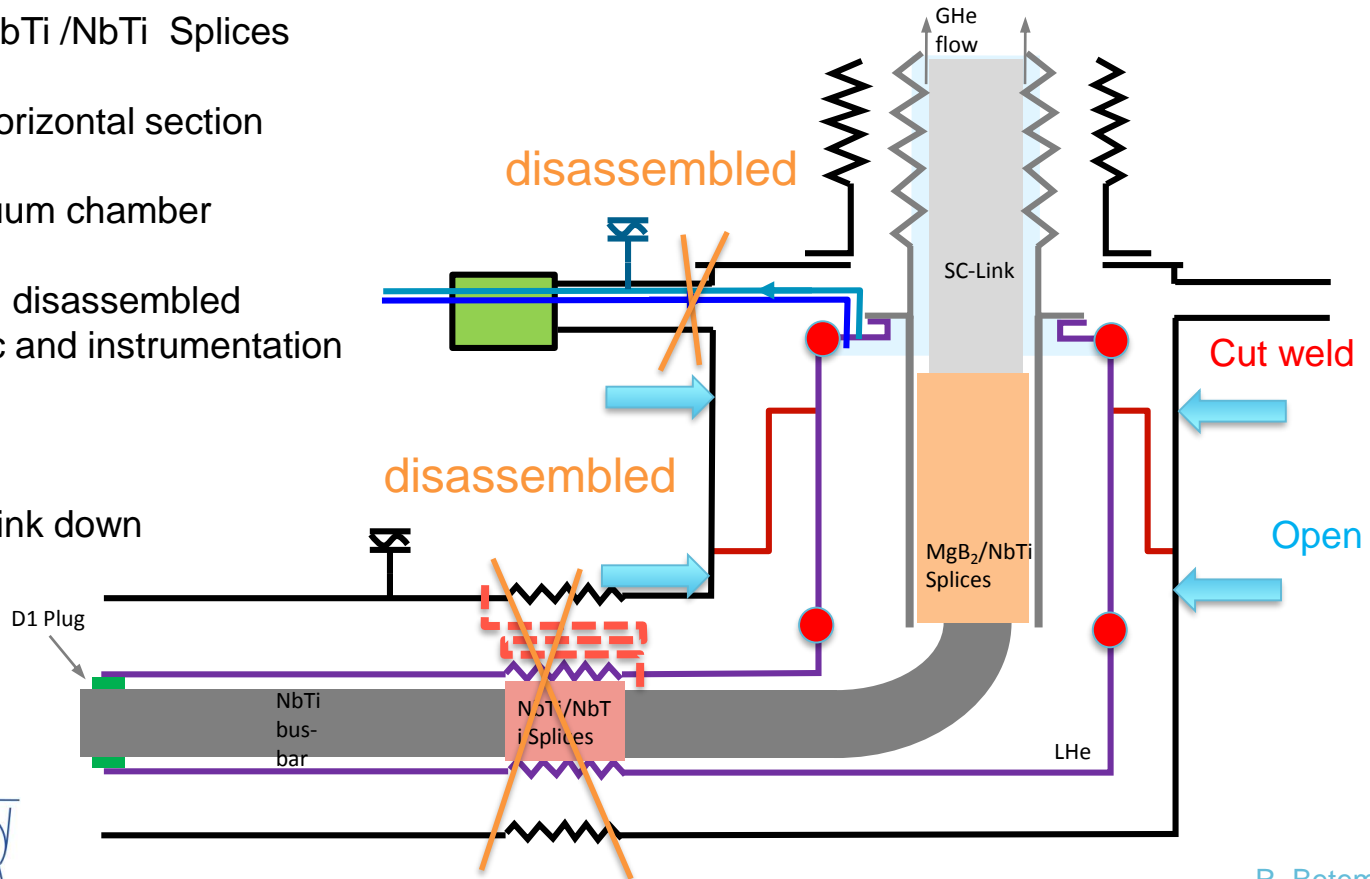
- Open the top vacuum chamber
- Remove / cut/ disassembled all cryogenic and instrumentation
- Cut the top weld
- Remove the SC Link



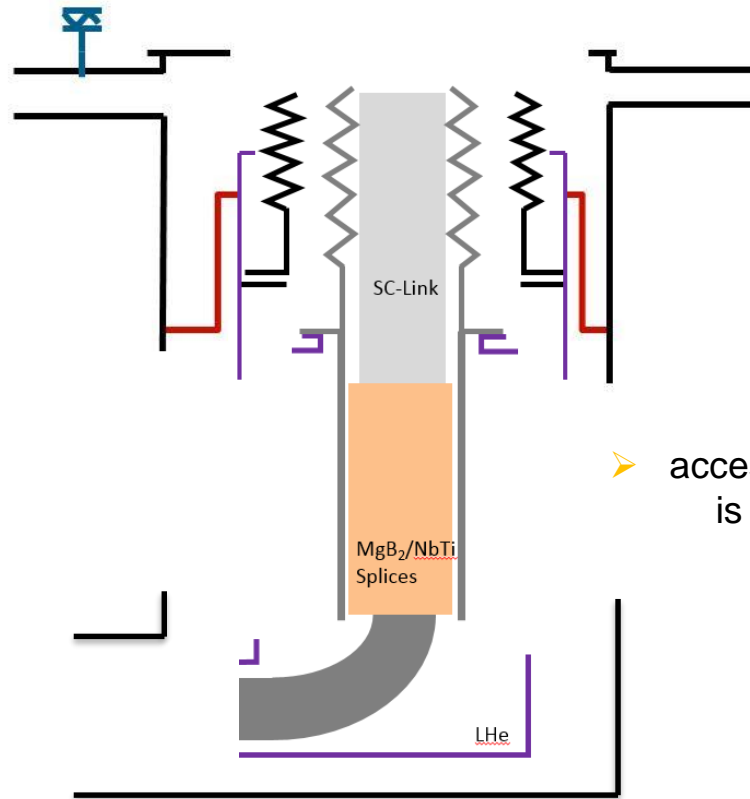
□ Tools and support request

# MgB<sub>2</sub> / NbTi splices access

- Remove the NbTi /NbTi Splices
- Remove the horizontal section
- Open the vacuum chamber
- Remove / cut/ disassembled all cryogenic and instrumentation
- Cut the weld
- Move the SC link down



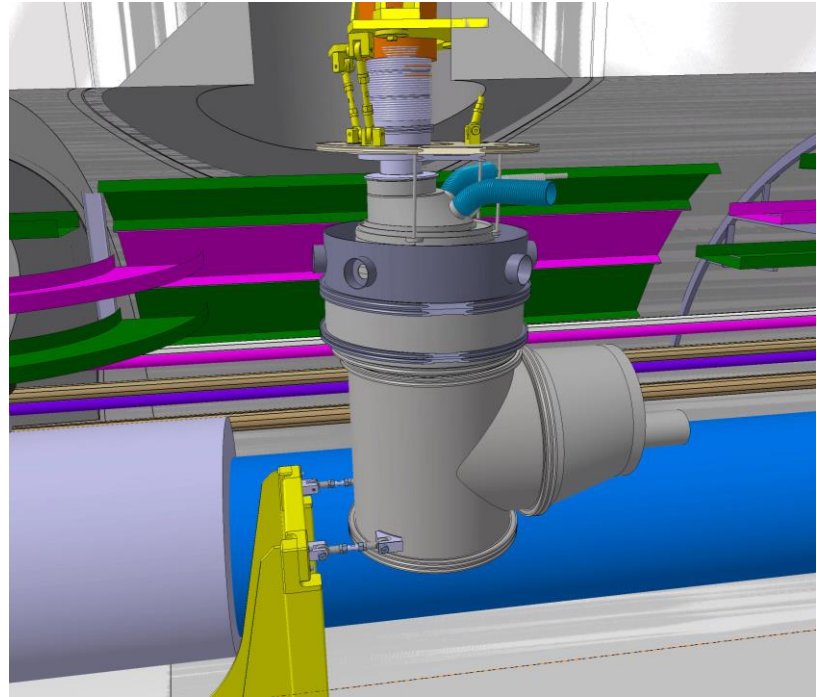
# MgB<sub>2</sub> / NbTi splices access



➤ access to the splices MgB<sub>2</sub>/NbTi is possible.

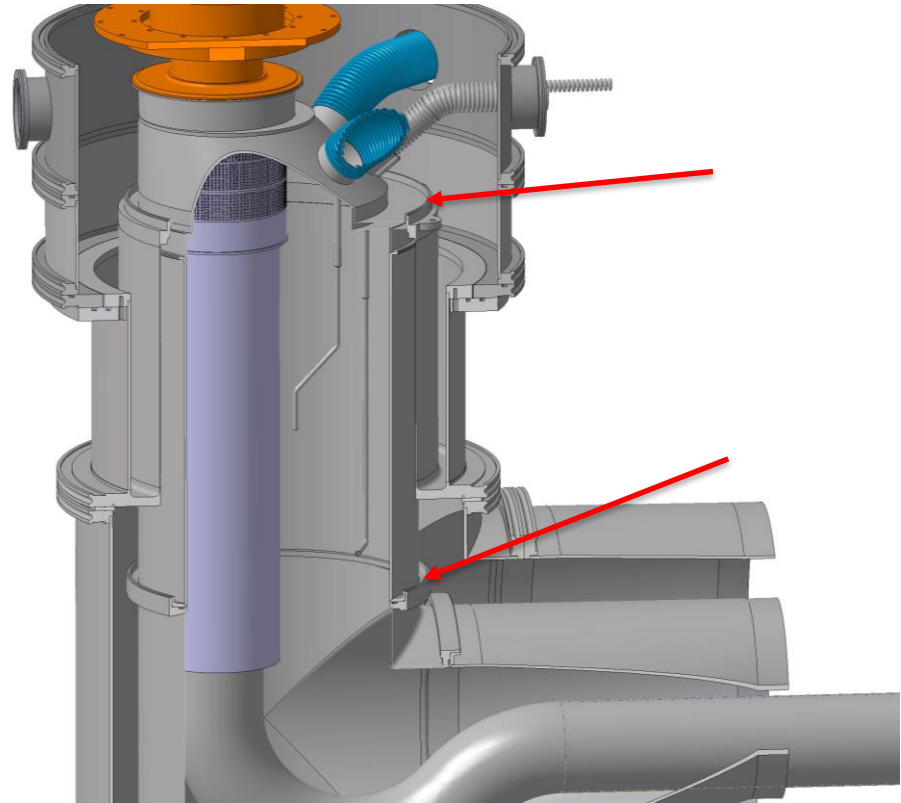
# MgB<sub>2</sub> / NbTi splices access

- Remove the NbTi /NbTi Splices
- Remove the horizontal section
- Open the vacuum chamber
- Remove / cut/ disassembled all cryogenics and instrumentations



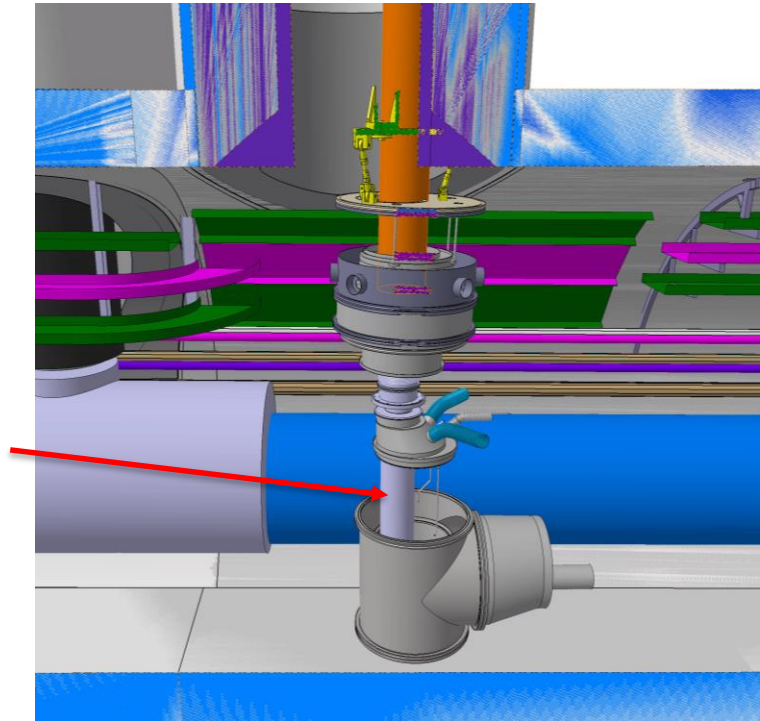
# MgB<sub>2</sub> / NbTi splices access

- Slide the low vacuum chamber
- Cut the welds top and down



# MgB<sub>2</sub> / NbTi splices access

- Move down the SC link through the DFX
- an access to the splices MgB<sub>2</sub>/NbTi is possible.





# Conclusion

- Installation of the DFX possible.
- The 3 welds to be done in the machine should be studied in detail.
- Detail design of the tooling and supports to be done



***Thank you***

