



**High
Luminosity
LHC**

Assembly tooling for CRAB

Assembly tooling for CRAB Cryomodule:

1-Tooling overview SM18 zone

2-Assembly procedure of string

3- External assembly sequence gantry side

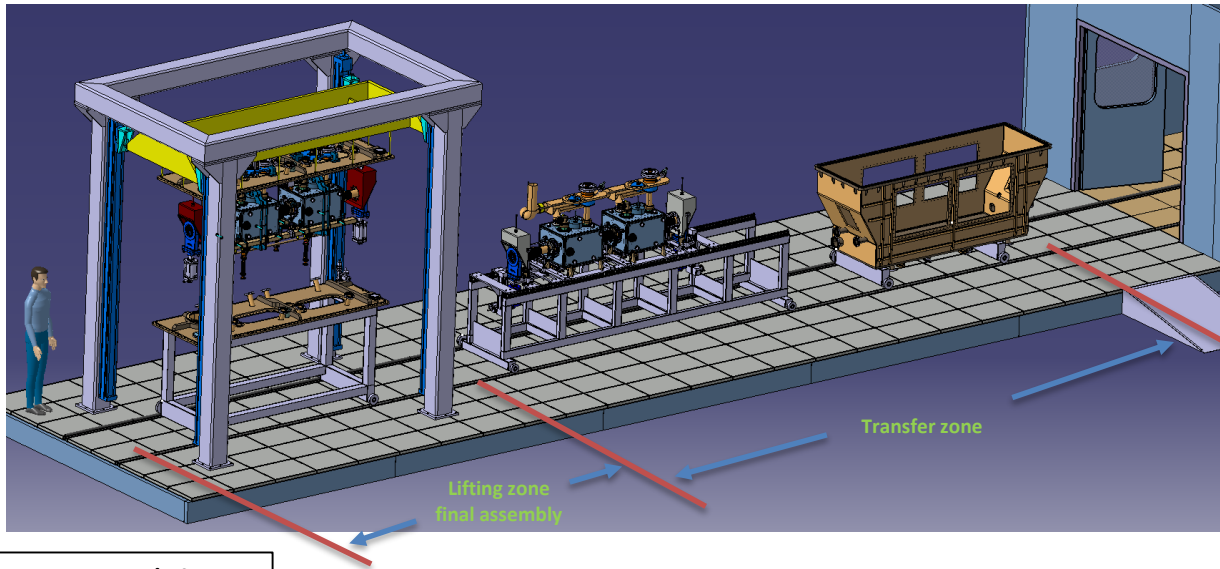


The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.

Pierre MINGINETTE
09/11/2015 CERN/EN/MME



1-Toolings overview SM18 external clean room mounting area



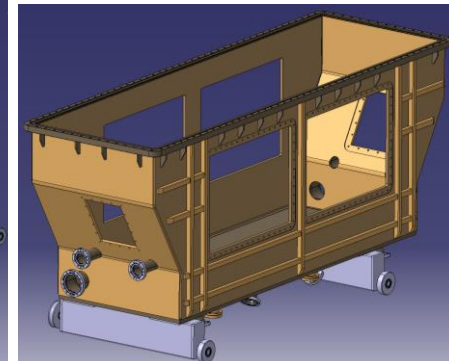
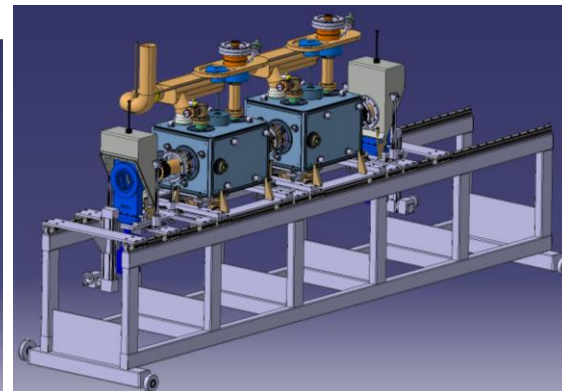
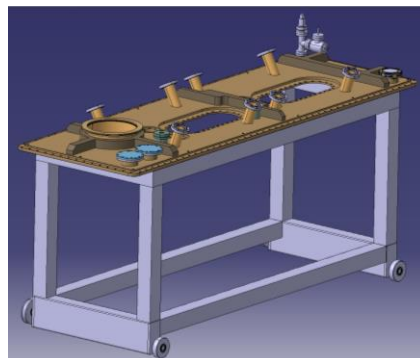
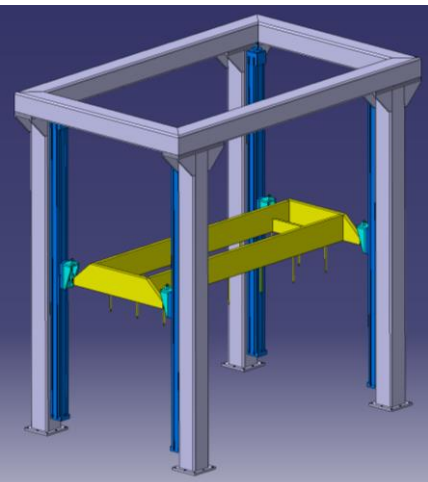
- 4 systems for all assembly sequence

Gantry CMU 2 tons / lifting stroke 3000 mm

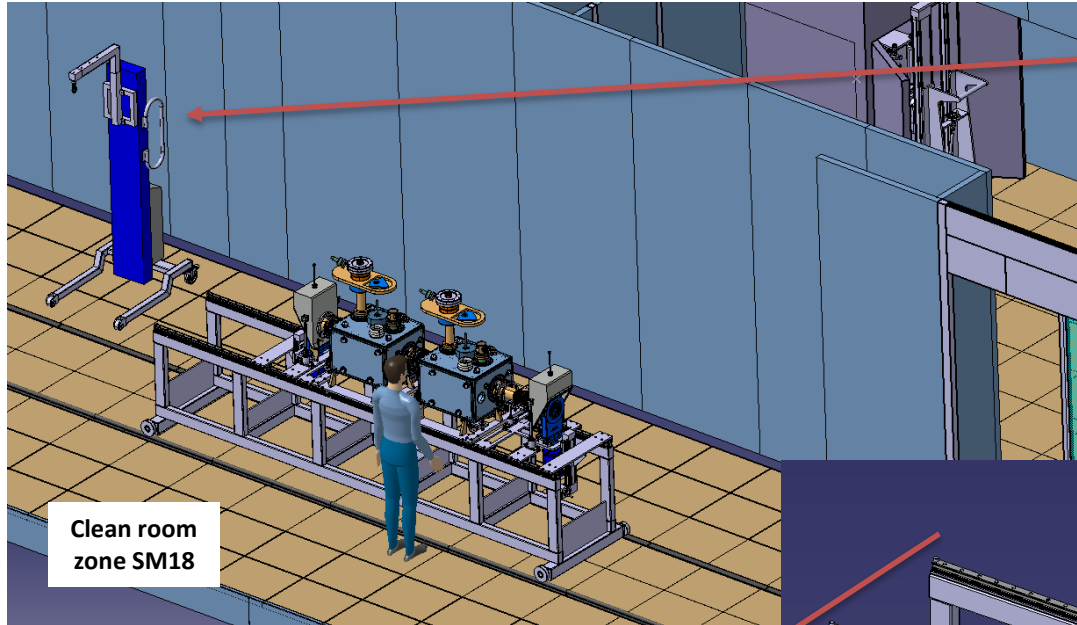
Trolley for top plate /Magnetic shield/ thermal screen

Trolley for string assembly

Roller for vacuum vessel



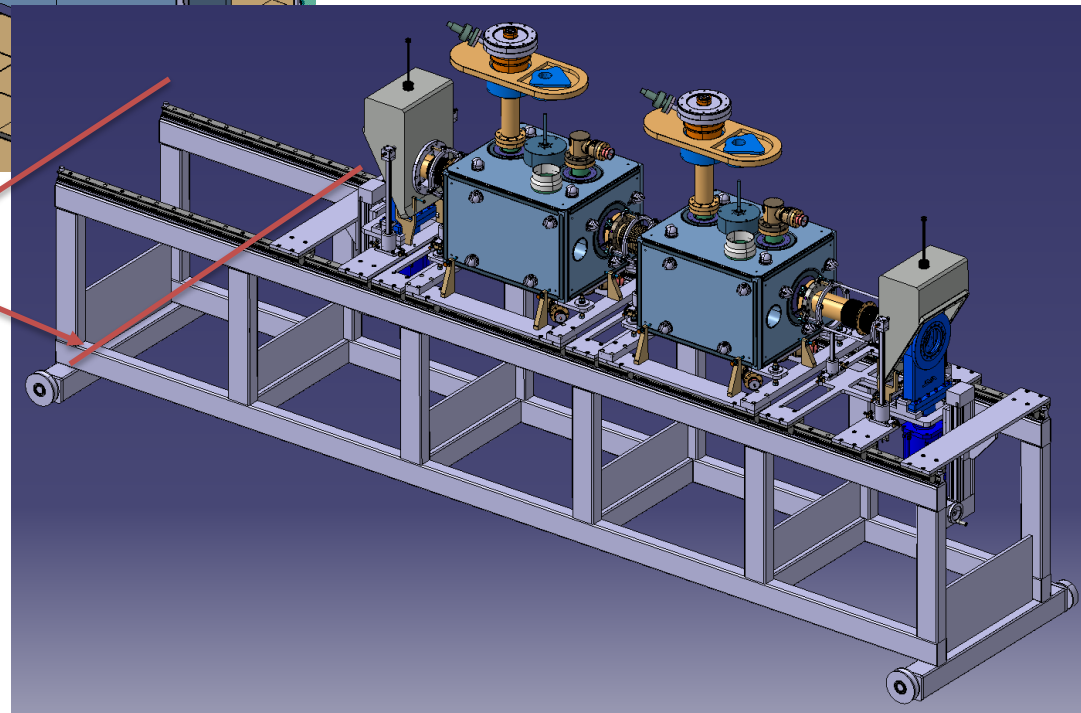
2-Assembly procedure of string



Clean room zone SM18

Manual crane for loading every components on trolley (9 components)

Aperture stroke 1000 mm



- Every components of string trolley compatible with Clean room ISO5.

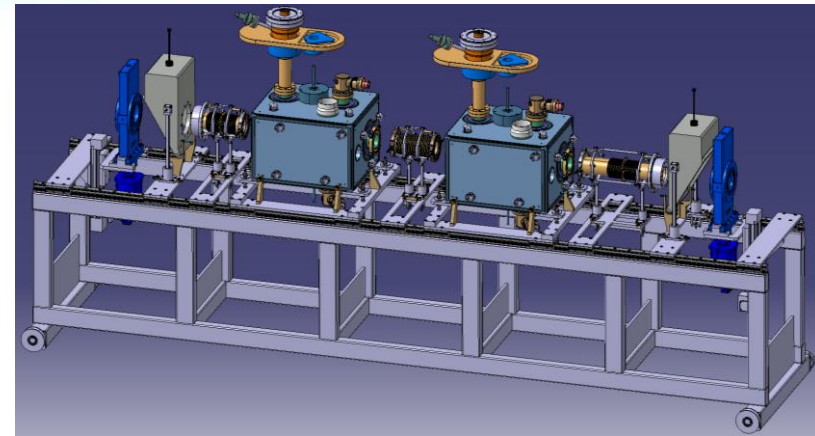
***Every components are clean and closed by flanges**

Step 1 : Load every components in open position on trolley with manual crane

Step 2 : Alignment of cavity with the vertical and horizontal plan of external gantry

Step 3 : Alignment of every connection bellow in function of opposite flange of cavity

Step 4 : Final closure / open the flanges and connect every components with X displacement



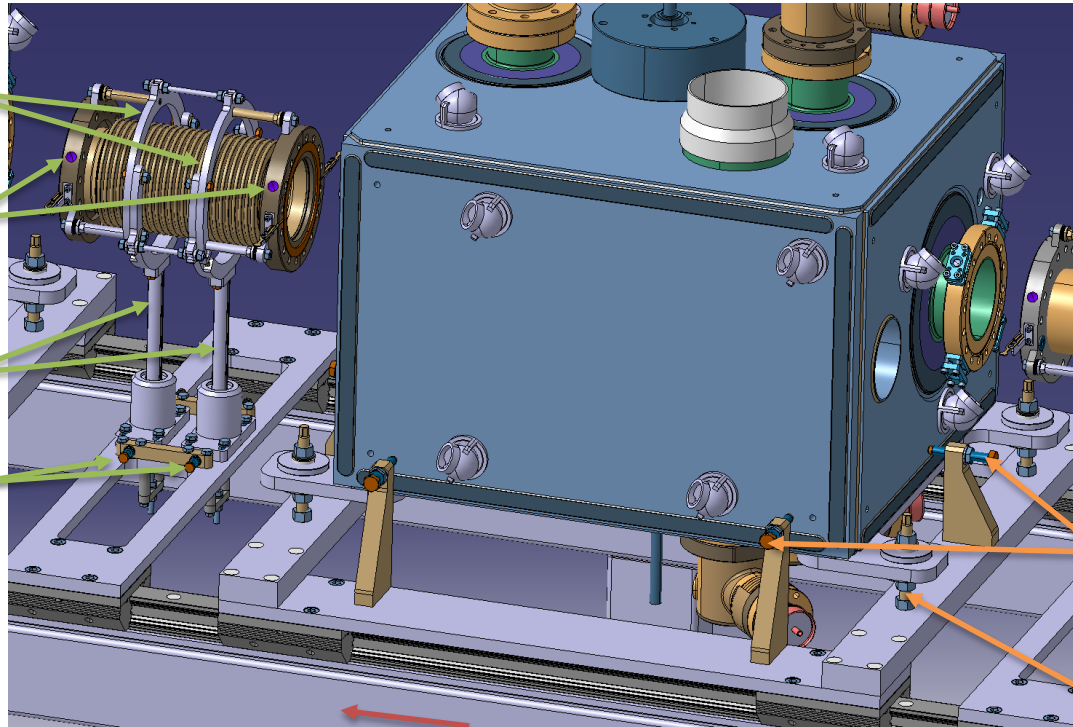
Details of adjustments on the string trolley

Rotation adjustment ring X axis

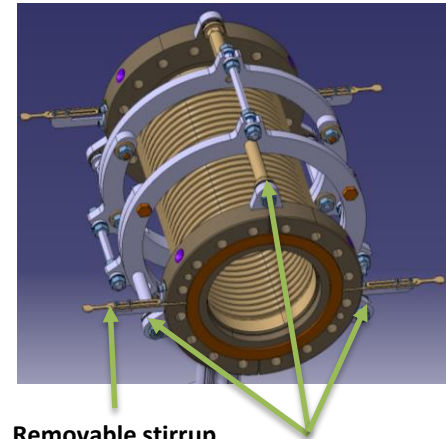
3 conical Holes around the flange on 2 side for alignment target

2 independents columns Z axis adjustment

2 independents screw Y axis adjustment



X free adjustment

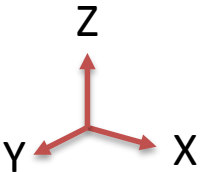


Removable stirrup
Retaining Cu Gasket

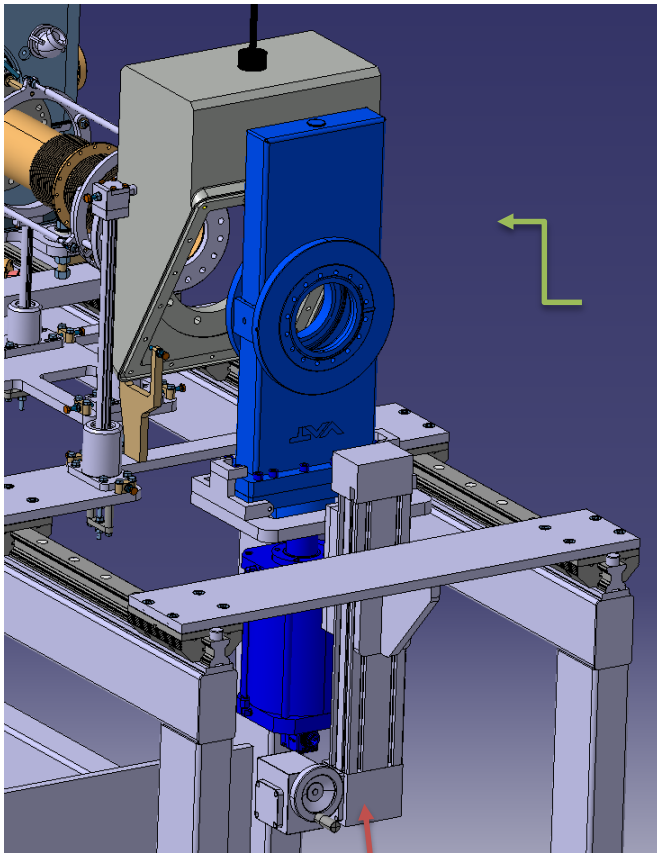
Mounting on spring washer small adjustment for final closure

X/Y Cavity adjustment 6 screw stroke +/-10mm

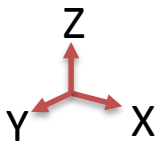
Z Cavity adjustment 4 screw stroke +/-10mm



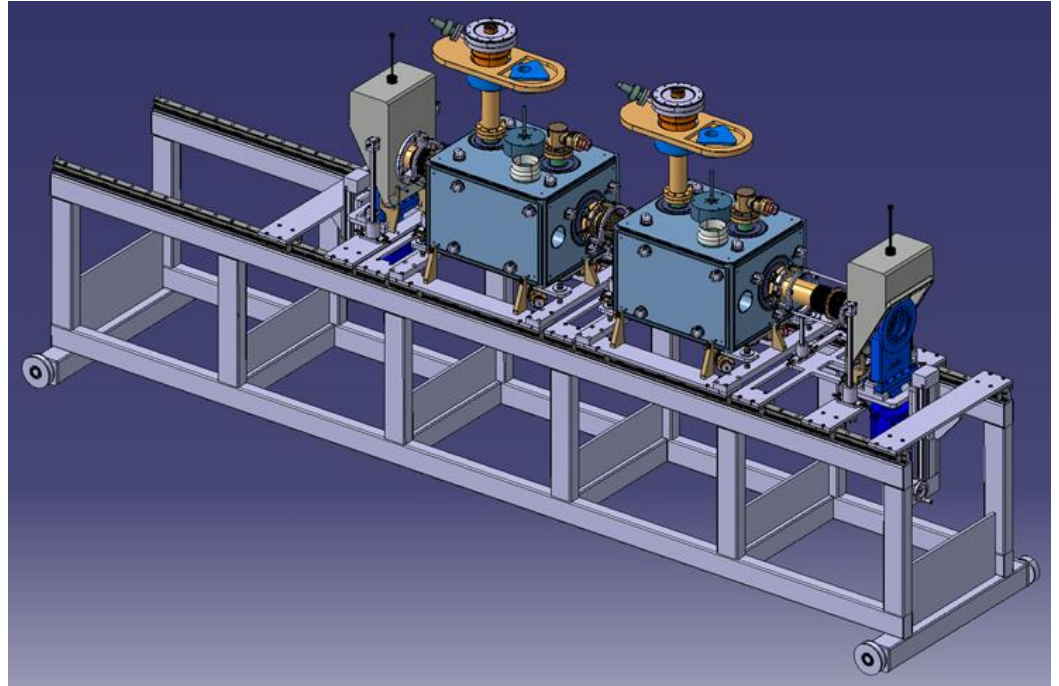
*Additional displacement for valve insertion on the valve box



Manual linear actuator Z stroke 200mm
(-180mm/+20mm with beam axis referential)



*Clean room assembly finished
Ready to go to the transfer zone

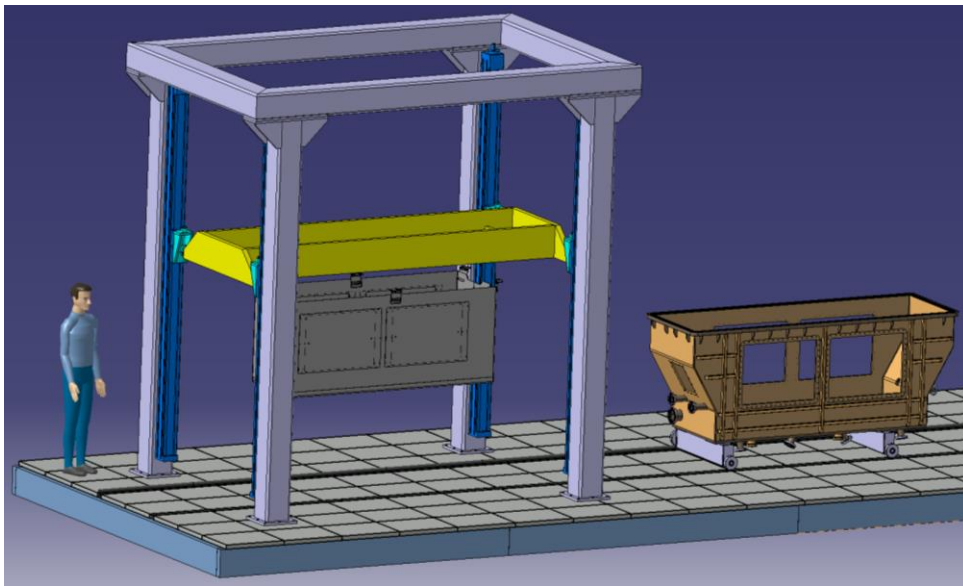


3-External assembly sequence

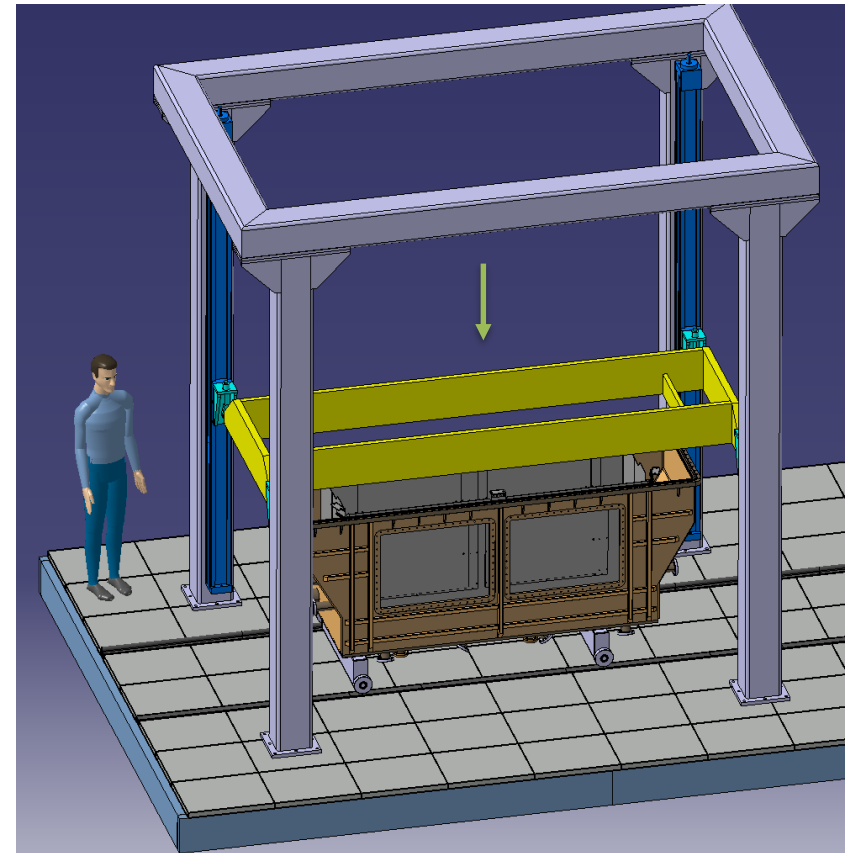
Step 1 : Insertion of magnetic shield on vacuum vessel

- Assembly and attached the magnetic shield on suspension frame of gantry / transfer to the vacuum vessel

Assembly magnetic shield

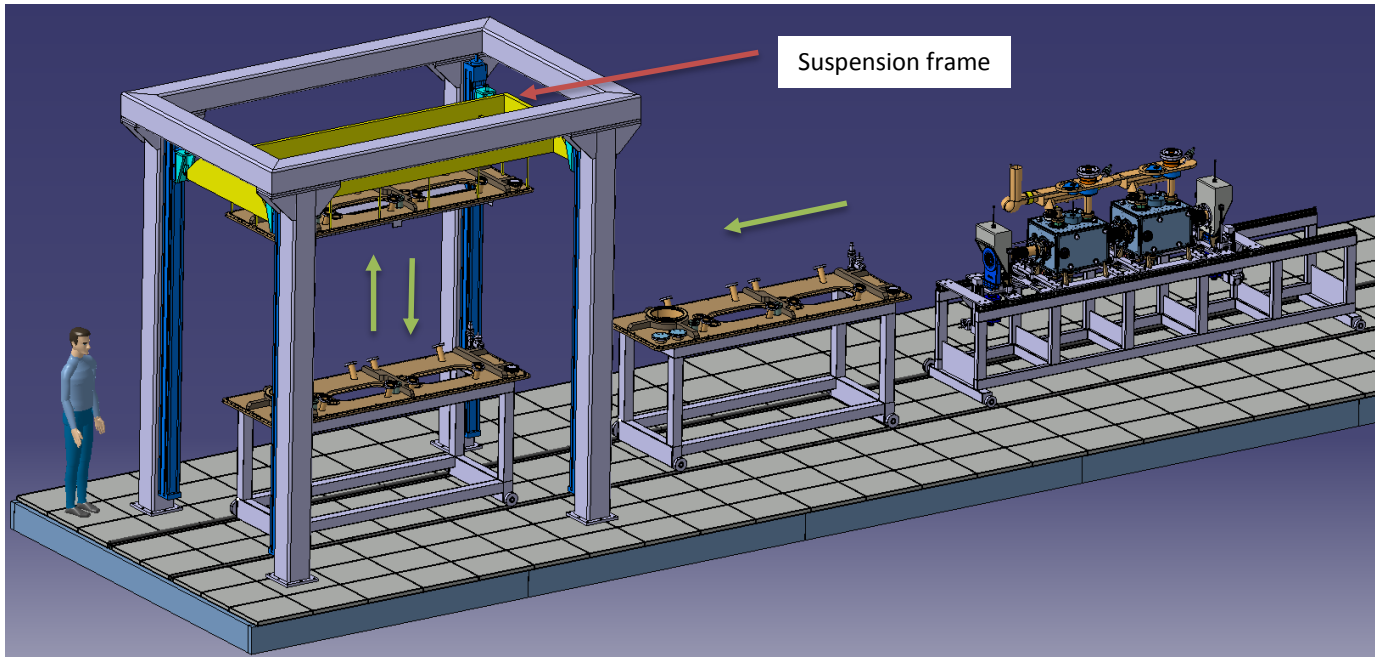


Magnetic shield insertion on vacuum vessel



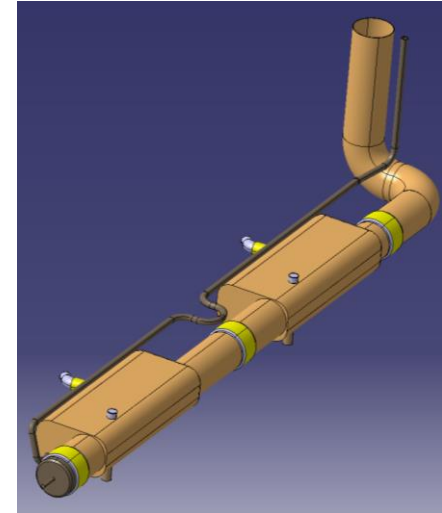
Step 2 : Transfer and fixed to suspension frame:

- Top plate / Upper plate of thermal shield / Welding the main Helium tank tube to cavity



Suspension frame

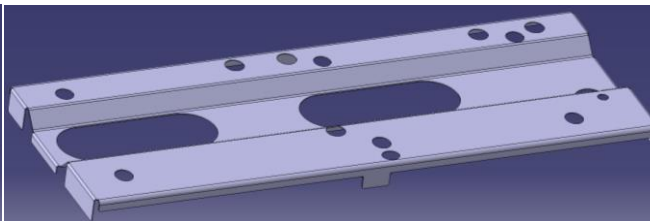
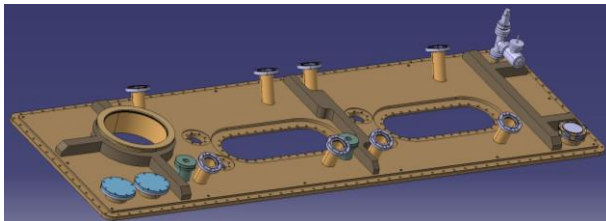
Connexion tube Helium Tank



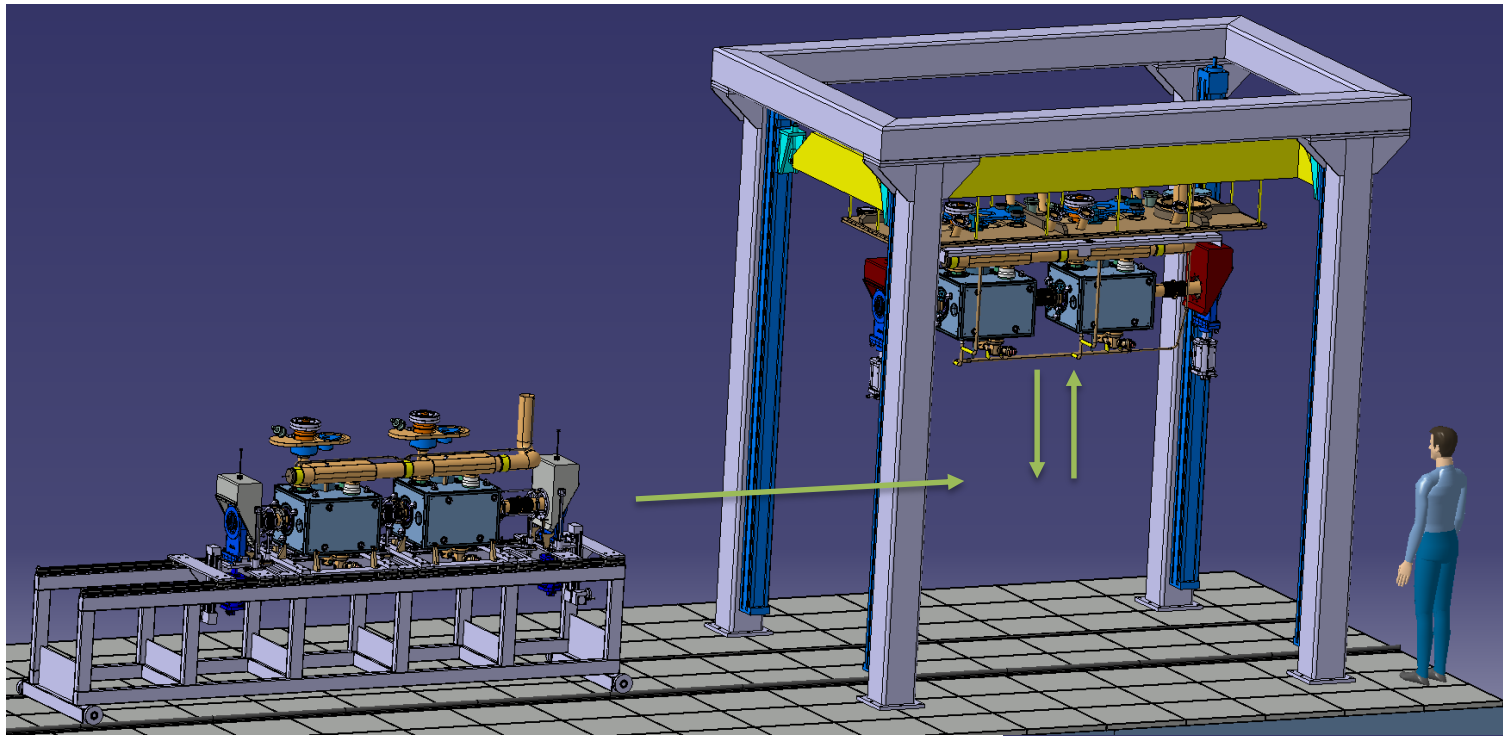
Top plate

Upper plate thermal shield

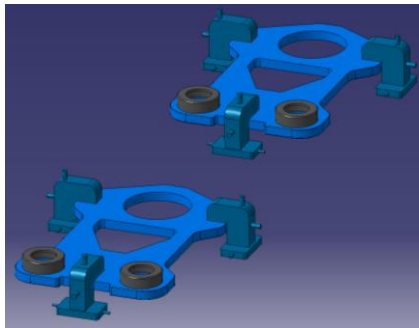
Welds



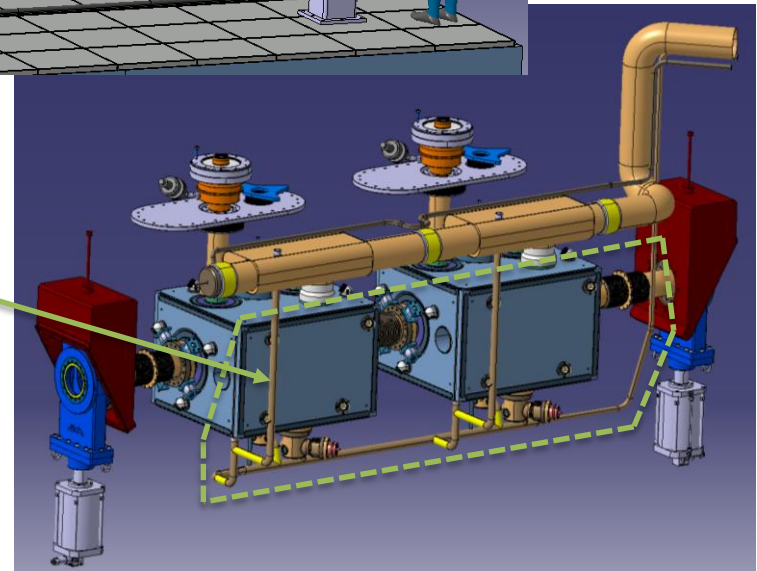
Step 3 : Transfer and Fixed string assembly on the top plate /Mounting alignments plates / Welding small tube on He tank



Alignments plates

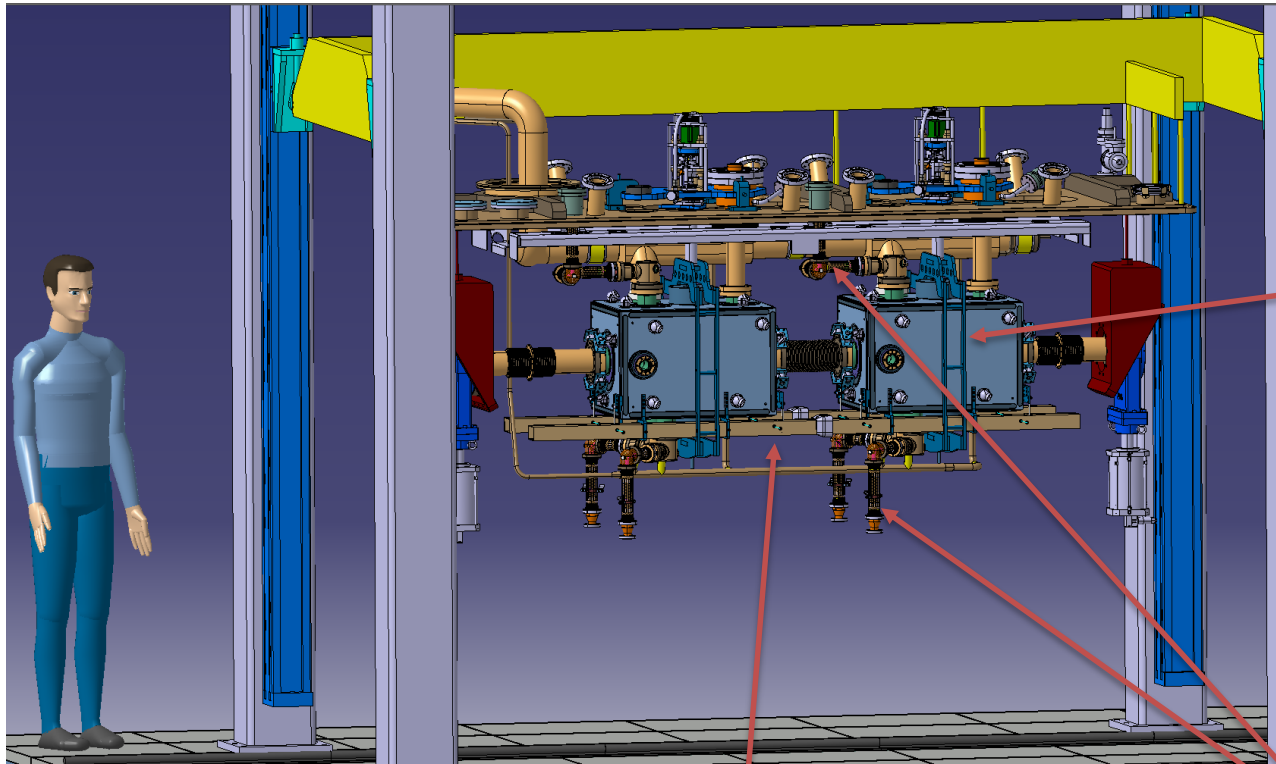


Small tubes on Helium Tank



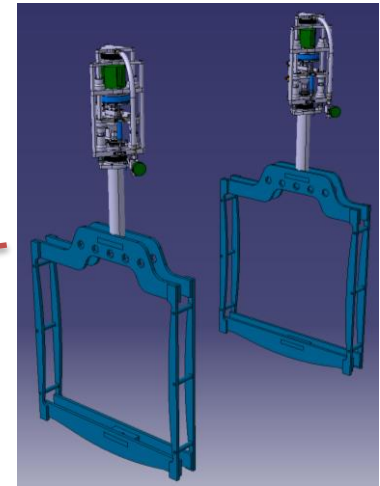
Step 4 : Mounting directly on the gantry:

- Alignment BECAM system / Tuning frame + tuner actuator / HOM coaxial connection

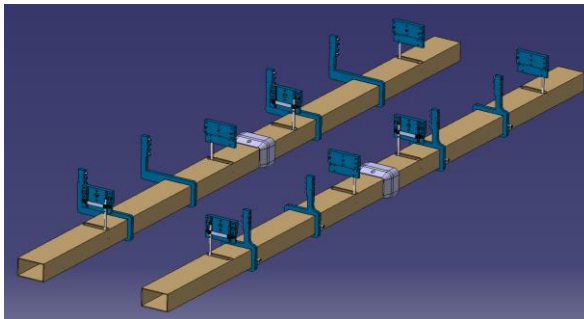
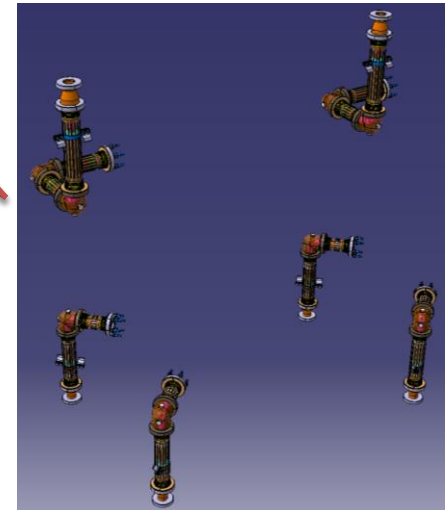


BECAM System

Tuning frame + tuner actuator



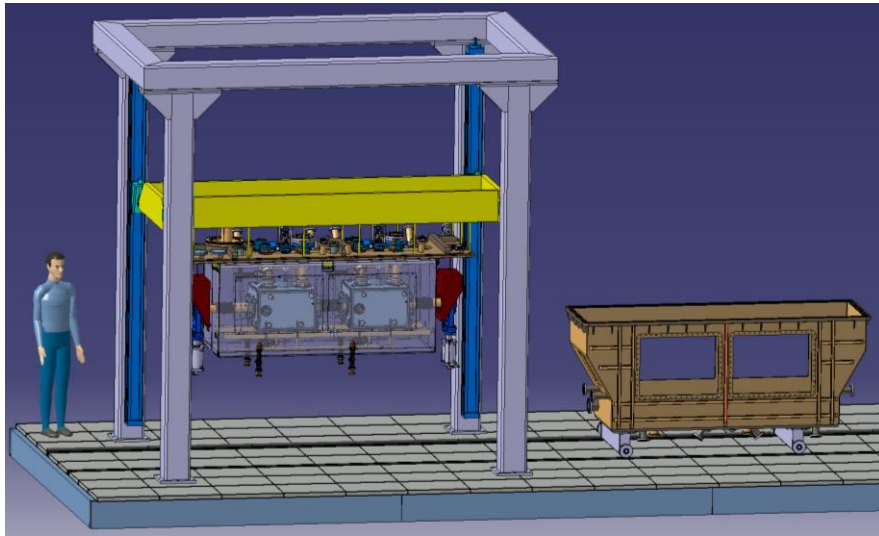
HOM coaxial connection



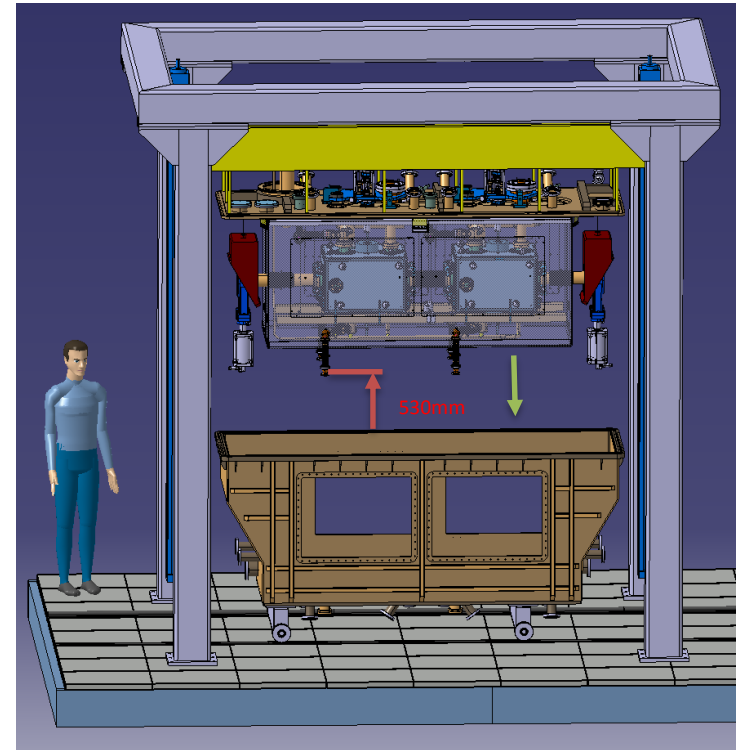
Step 5 : Mounting directly on the gantry:

- Thermal shield assembly / Transfer vacuum vessel + magnetic shield to gantry zone / cryostating

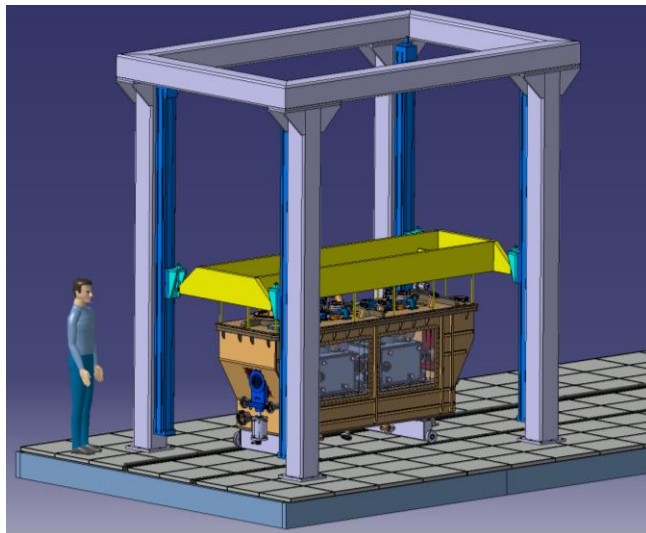
Thermal shield assembly



Insertion on vacuum vessel



Cryostating



Thank you for your attention



High Luminosity LHC



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