



# **WA105/ProtoDUNE-DP**

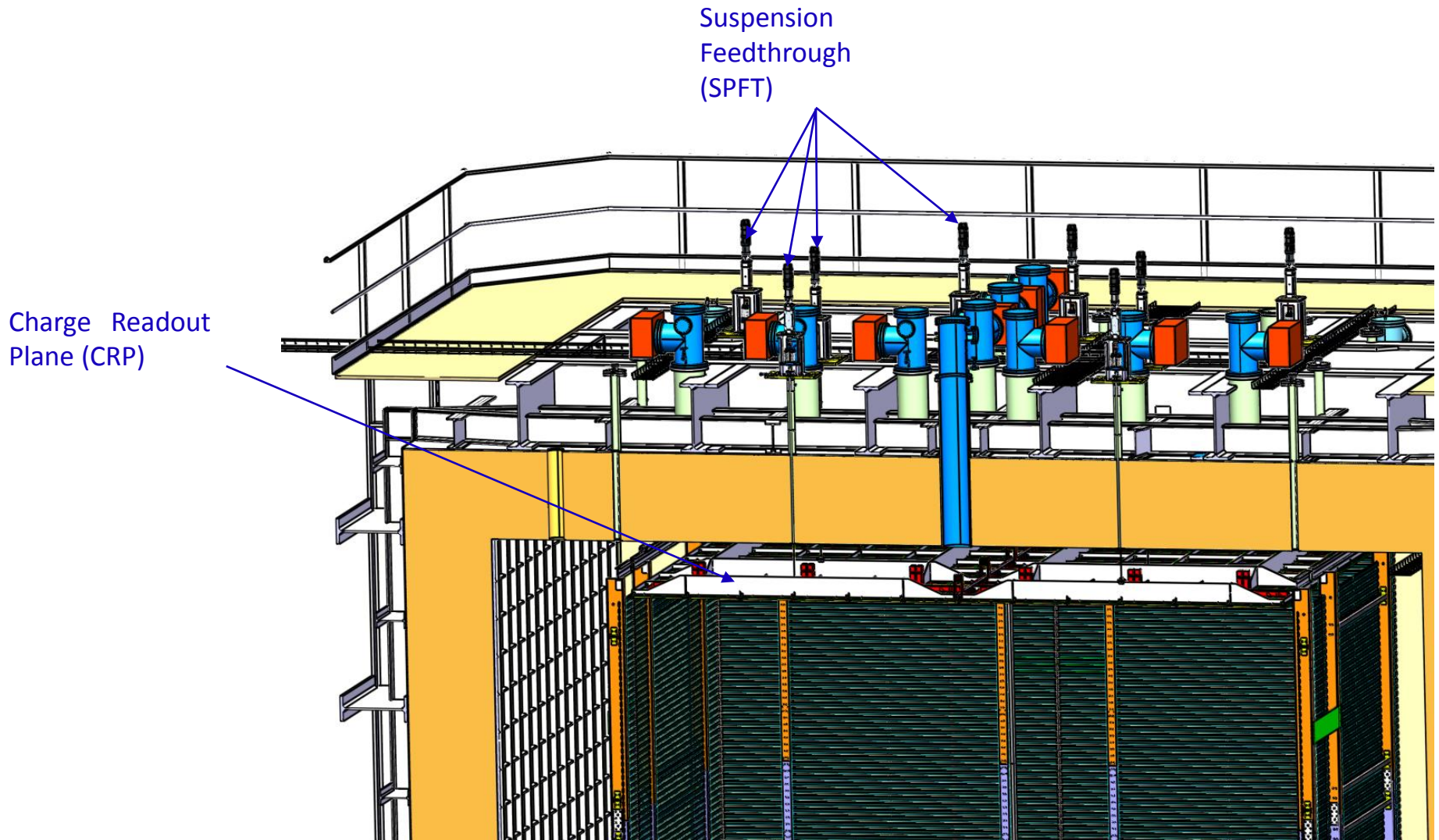
## ***Charge Readout Plane Construction and Installation procedure***

*DUNE Collaboration Meeting – 23<sup>rd</sup> of March 2017*

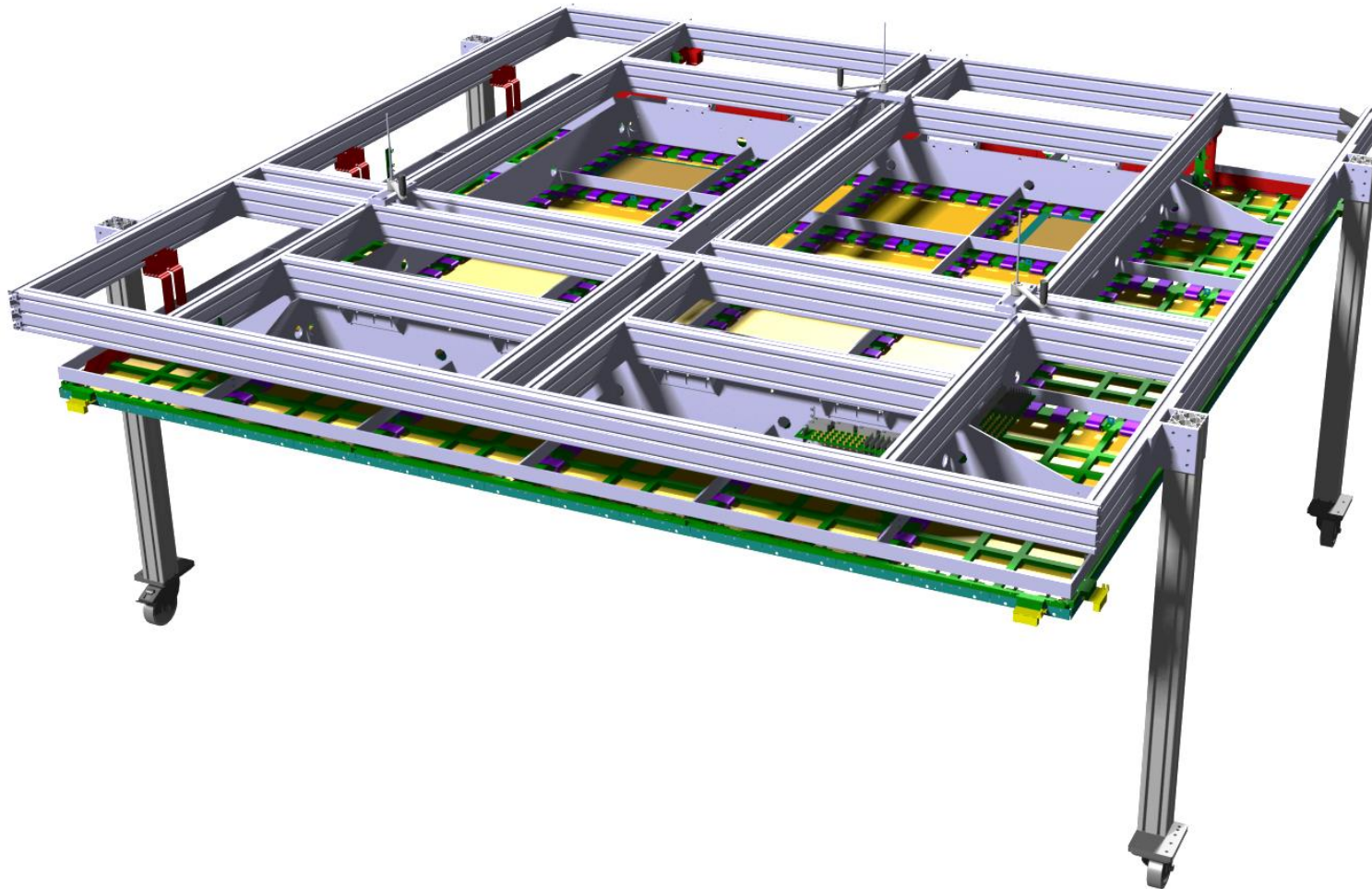
***B. Aimard, N. Allemandou, M. Cailles, G. Deleglise, D. Duchesneau,  
N. Geffroy, Y. Karyotakis, T. Yildizkaya***



# Detector Overview



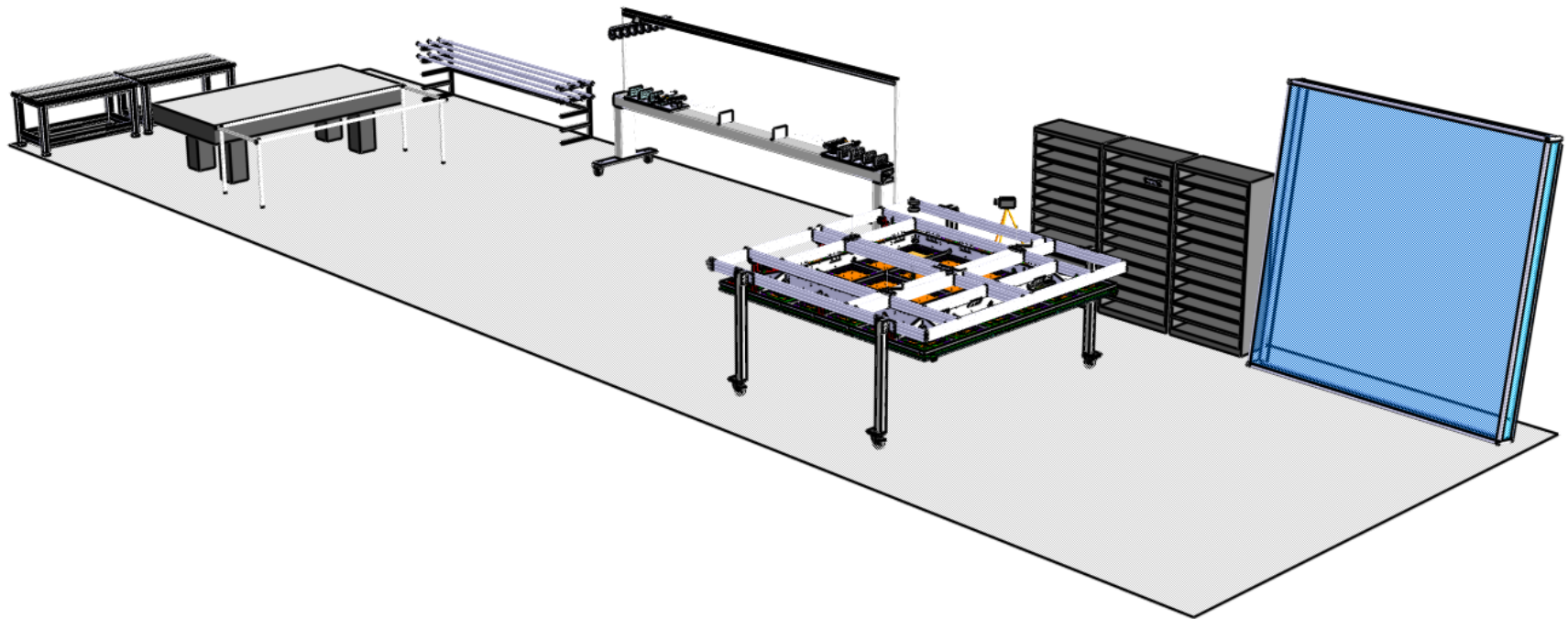
# CRP Assembly : Clean Room 185



# Assembly in Clean Room 185

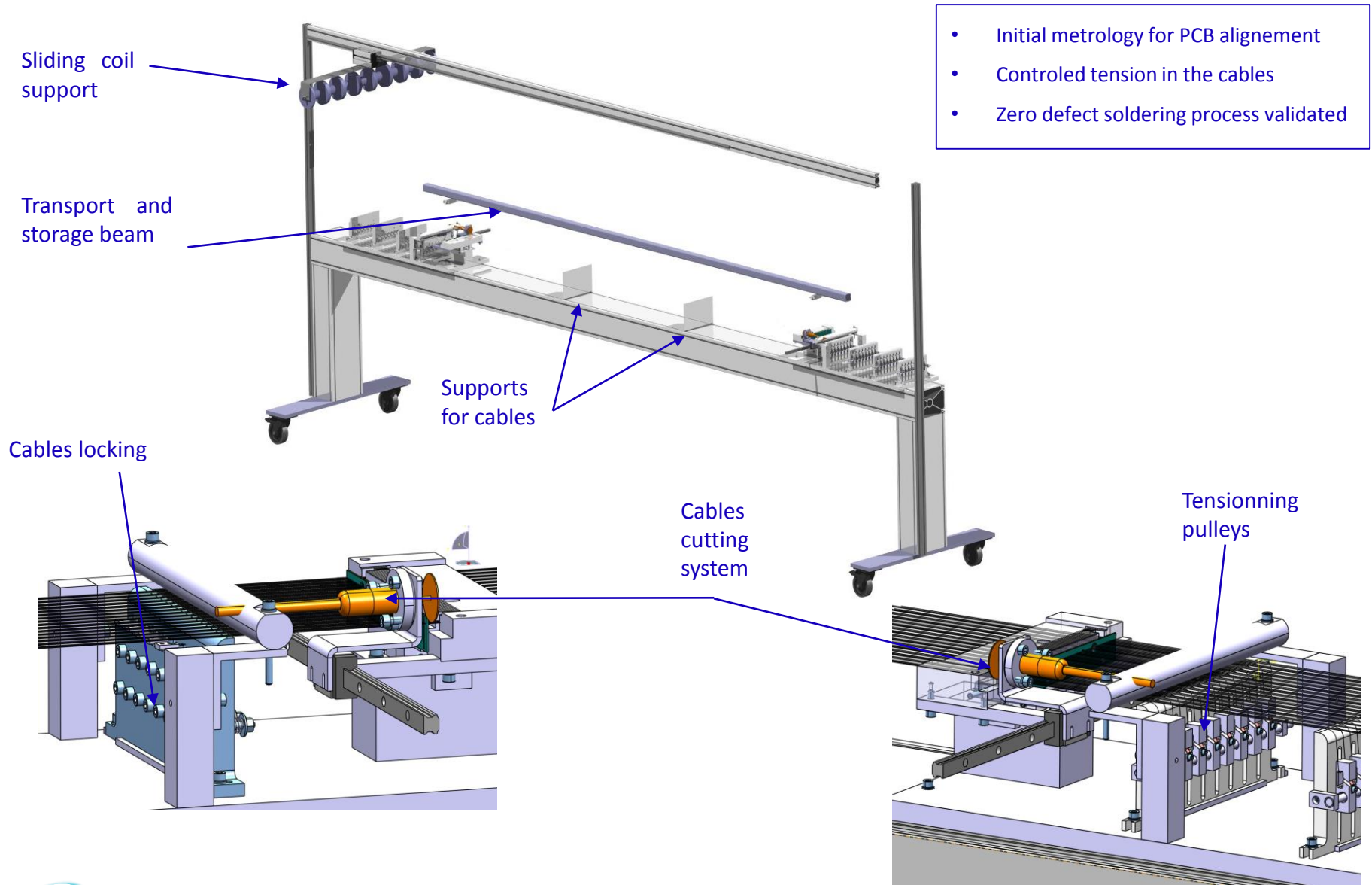
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- See the animation of the assembly : <https://youtu.be/jcnJjIU-Cyc>





# Tooling for Grid production



## *Box for transport*

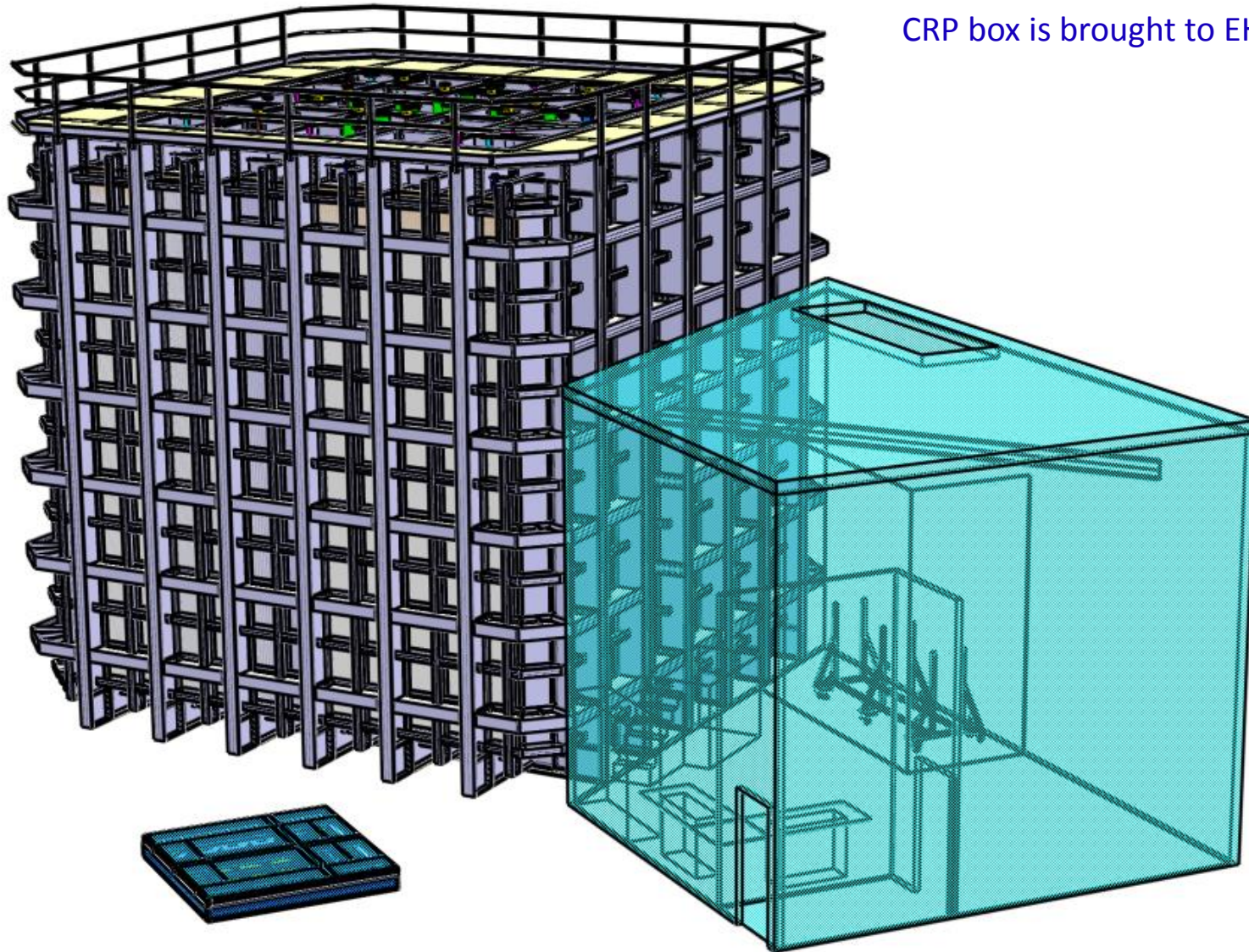
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Dimensions and weight suitable for insertion and for DUNE installation



# Cryostat insertion

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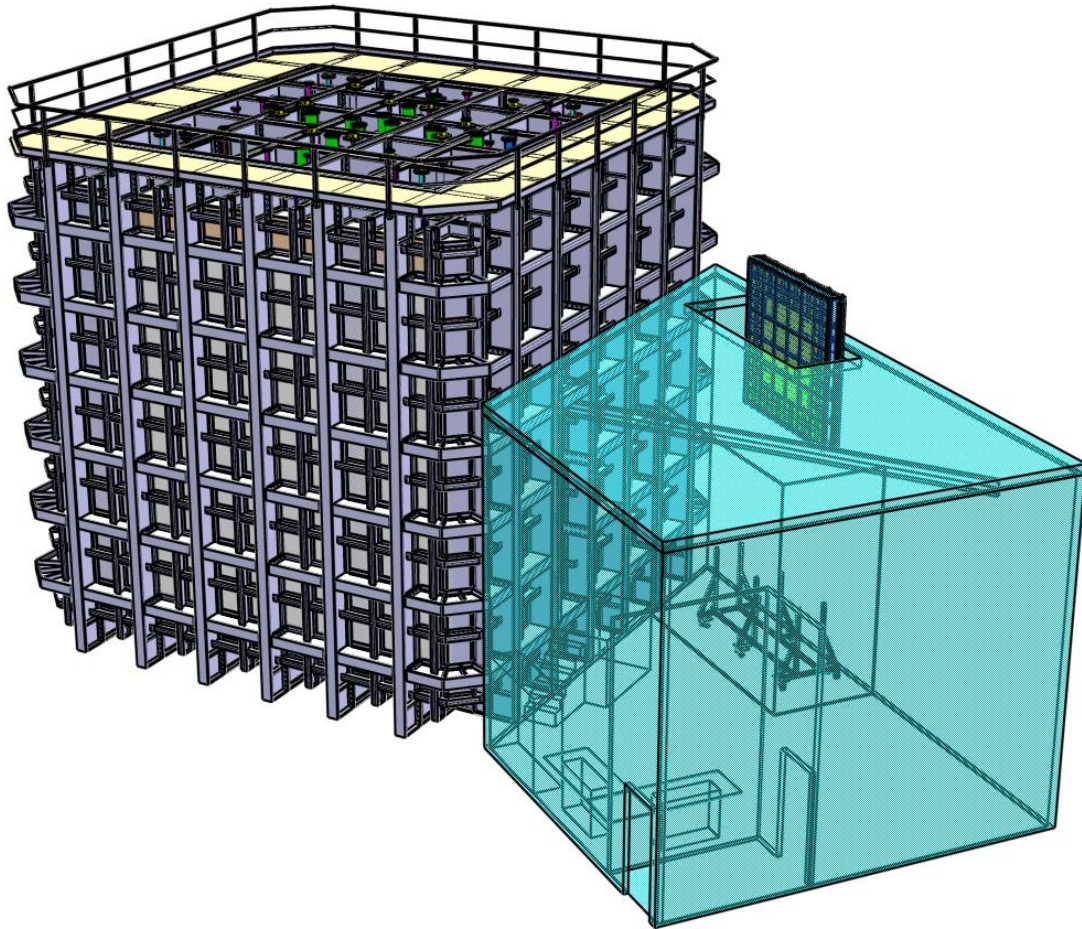
CRP box is brought to EHN1 from CR185



# Cryostat insertion

The box is inserted in the CRB thanks to the Hall's crane

- *The box is suspended by a special handling IPE stiffener*

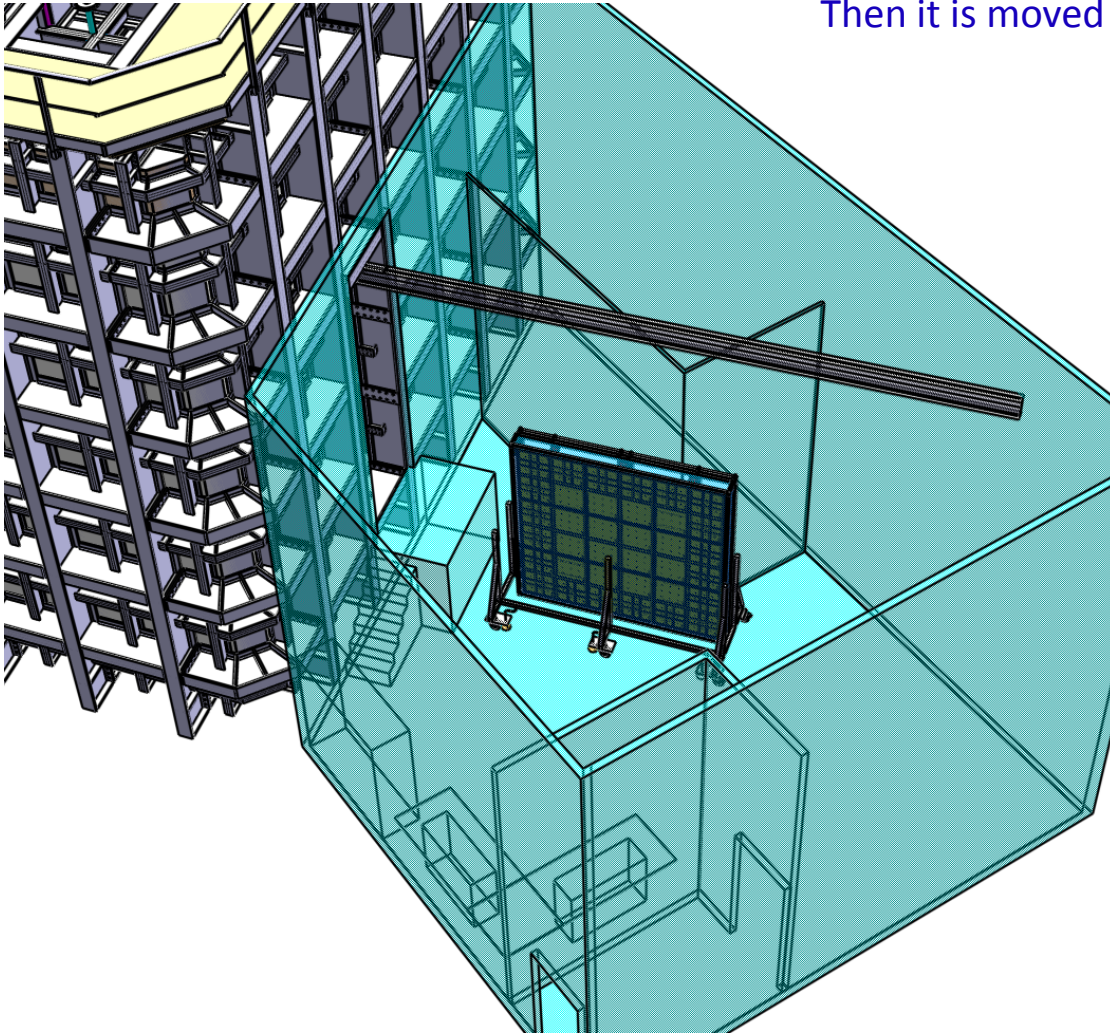




# Cryostat insertion

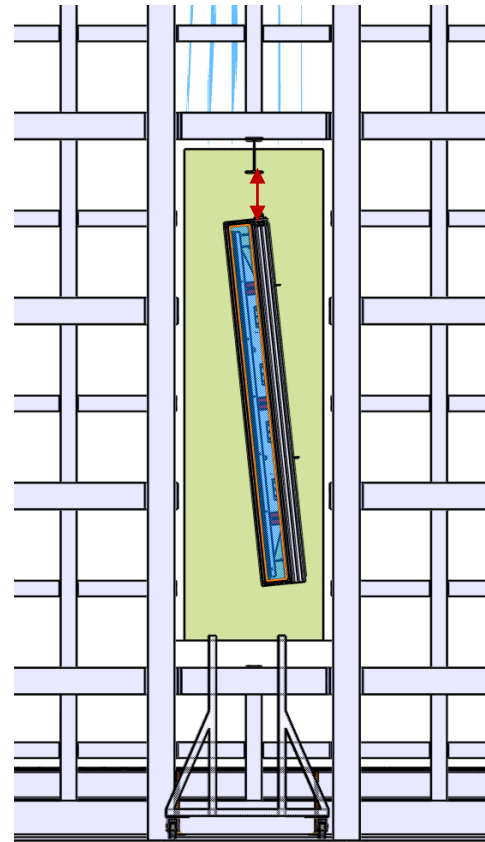
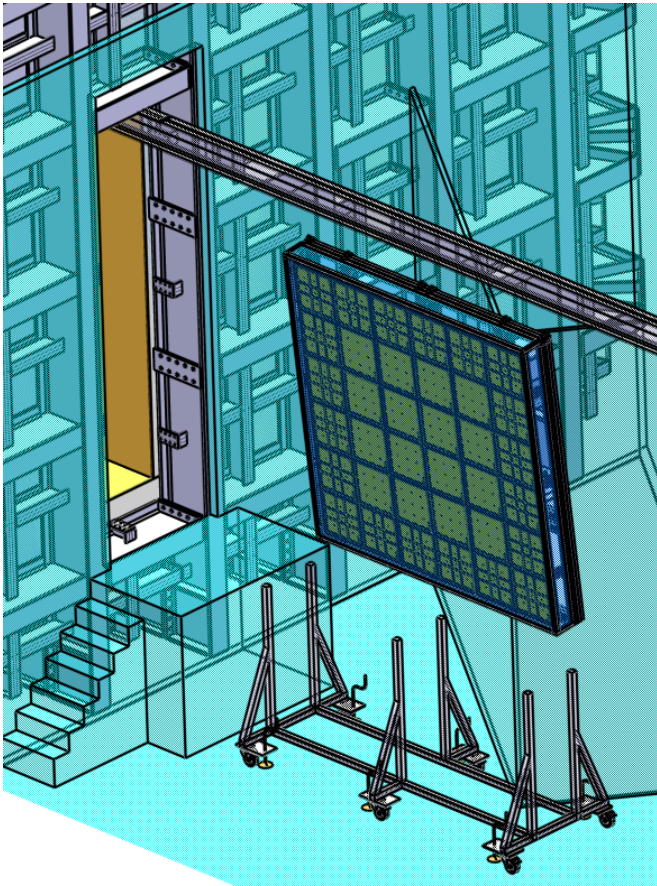
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The box is « unfilmed » to preserve CRB cleanness  
Then it is moved under the rail to be lifted



# Cryostat insertion

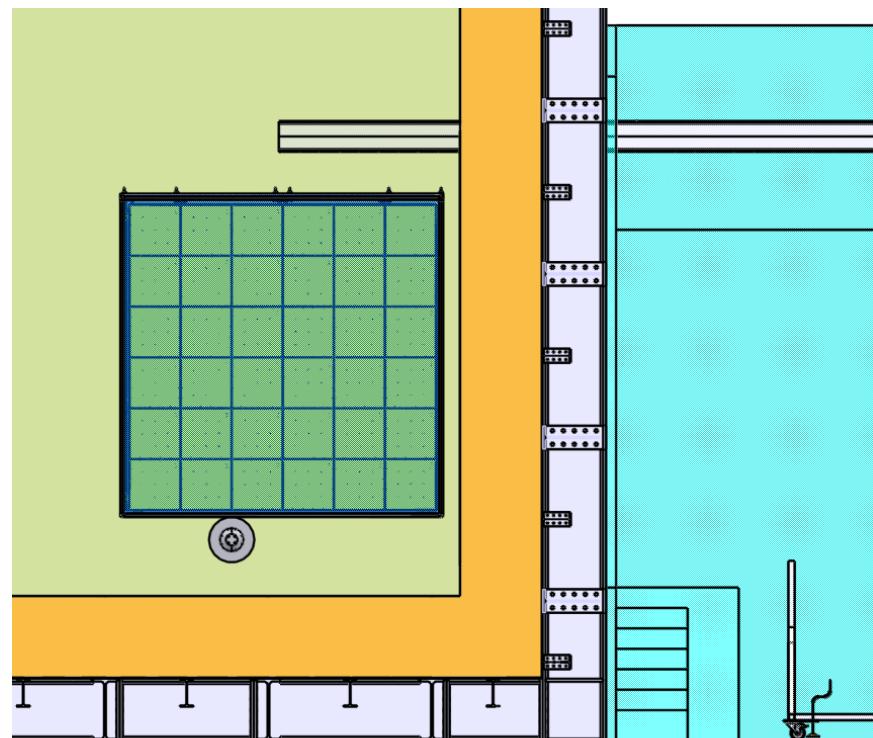
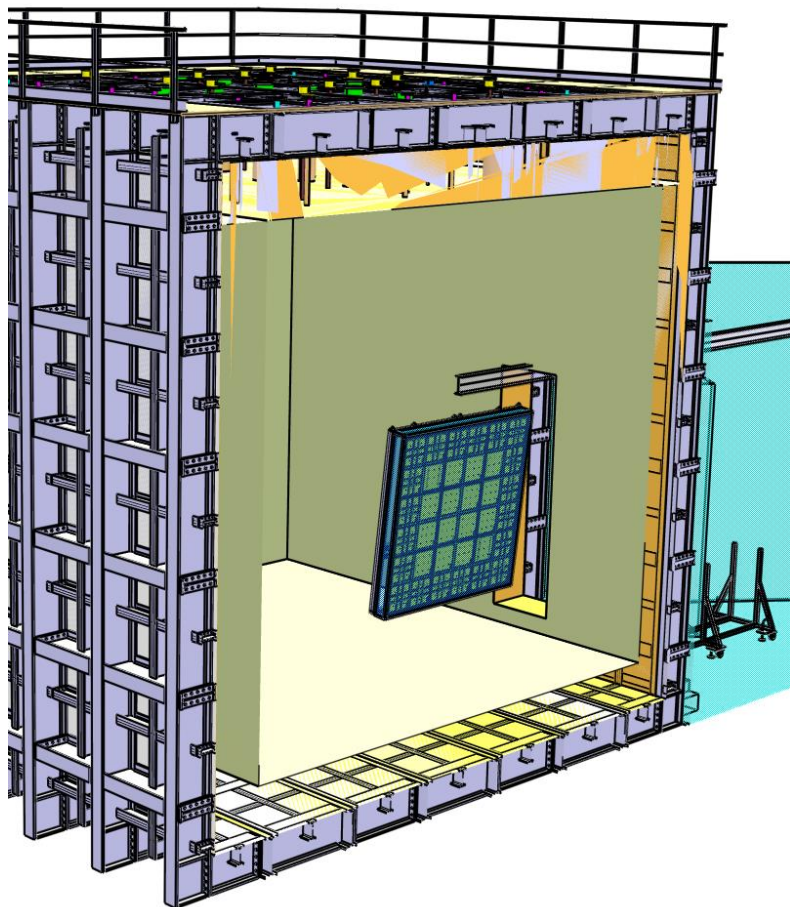
The box is lifted under the rail





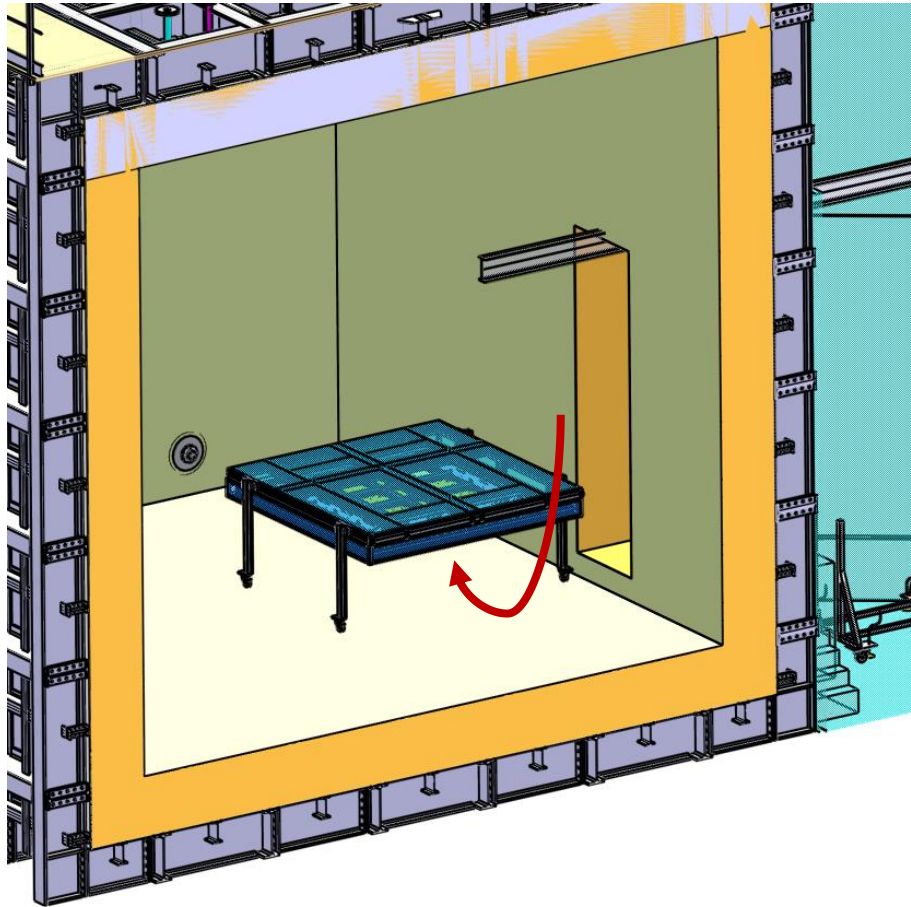
# Cryostat insertion

The box is inserted inside the cryostat through the rail



# Cryostat insertion

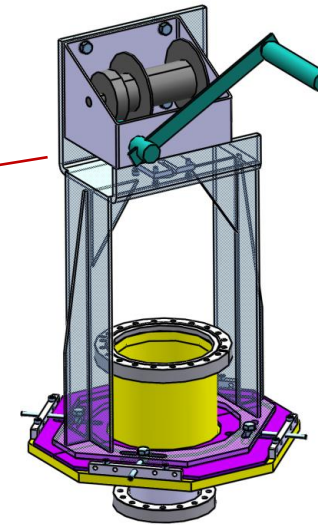
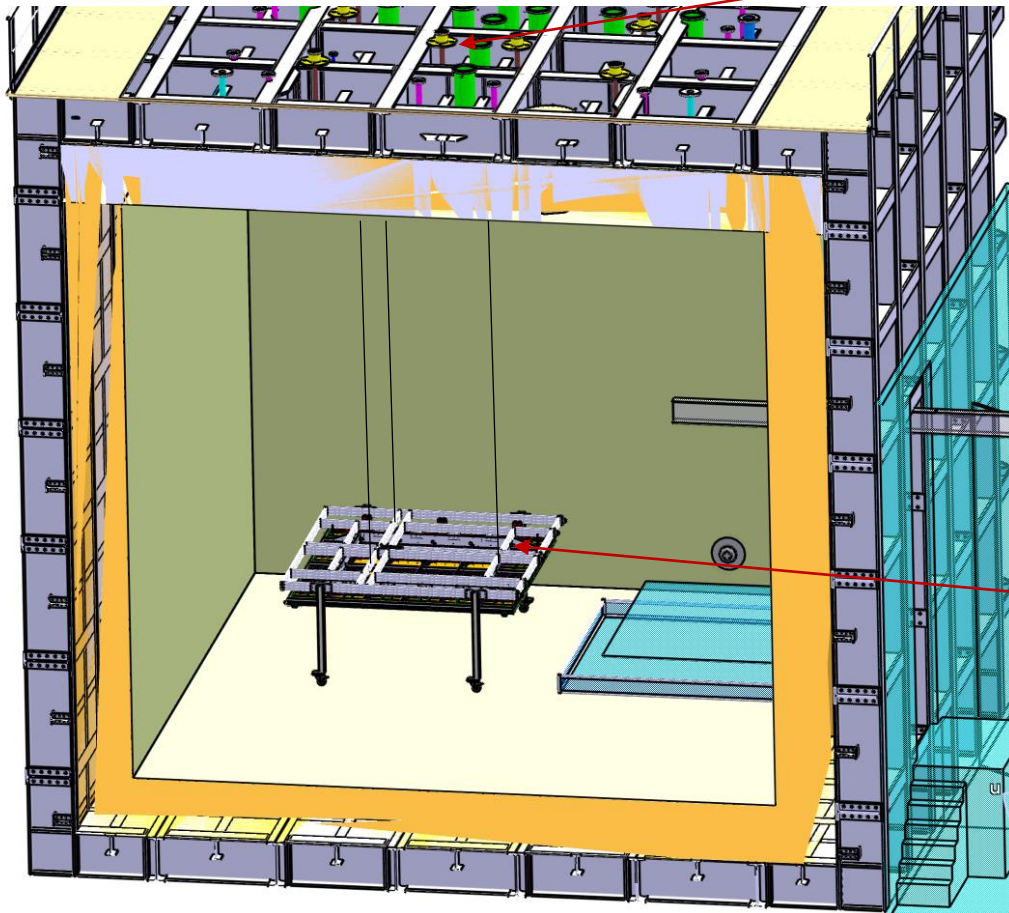
The feet of the box are replaced, the box is lowered and rotated, then placed on its wheels



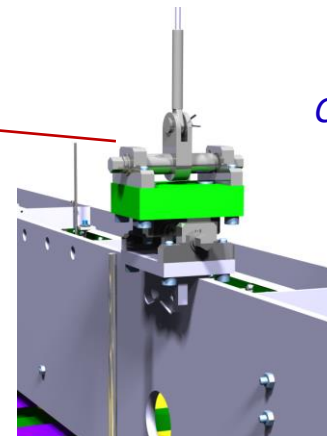


# Cryostat insertion

The box is placed below its SPFT chimneys  
The top and the bottom of the box are removed  
Cables from the SPFT are connected to the module



*SPFTs are equipped with special winches at this time*



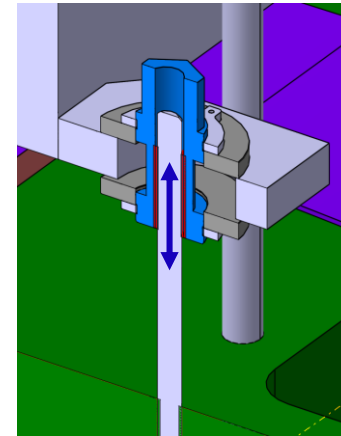
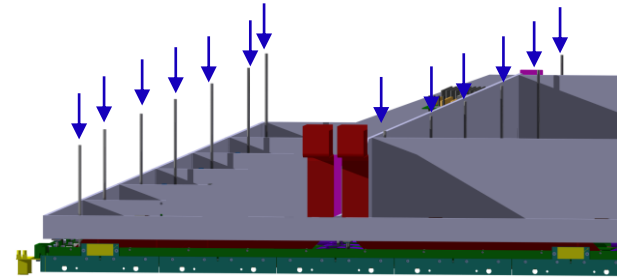
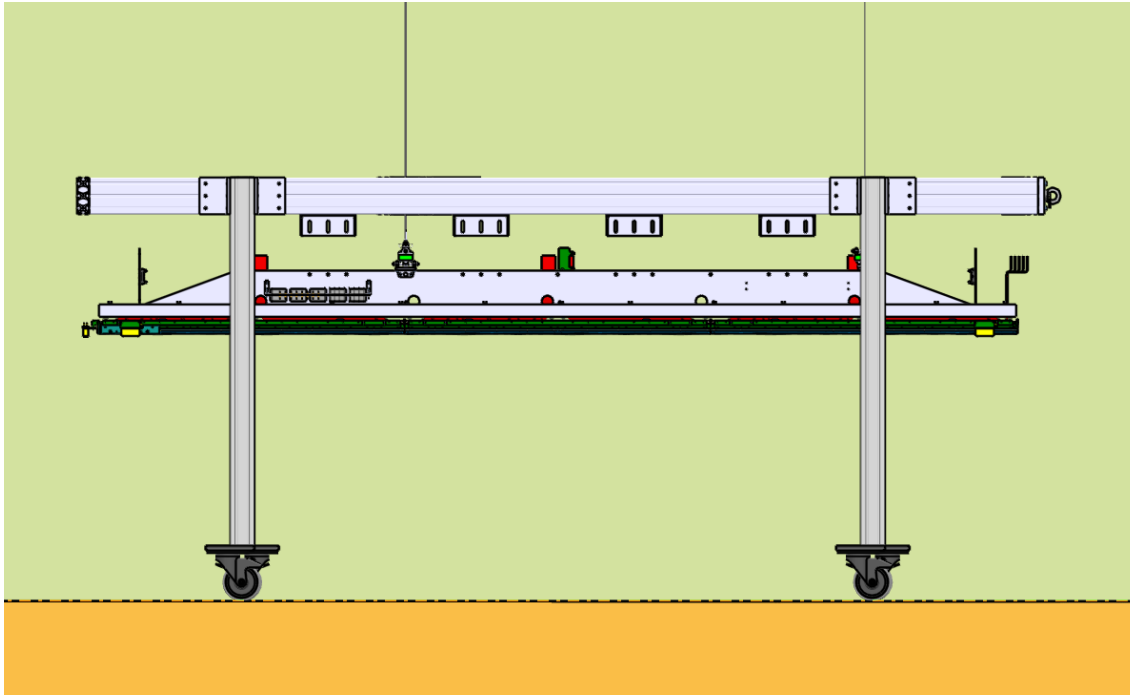
*CRP suspension systems*

# Cryostat insertion

Once the module is suspended, it can be detached from the structure

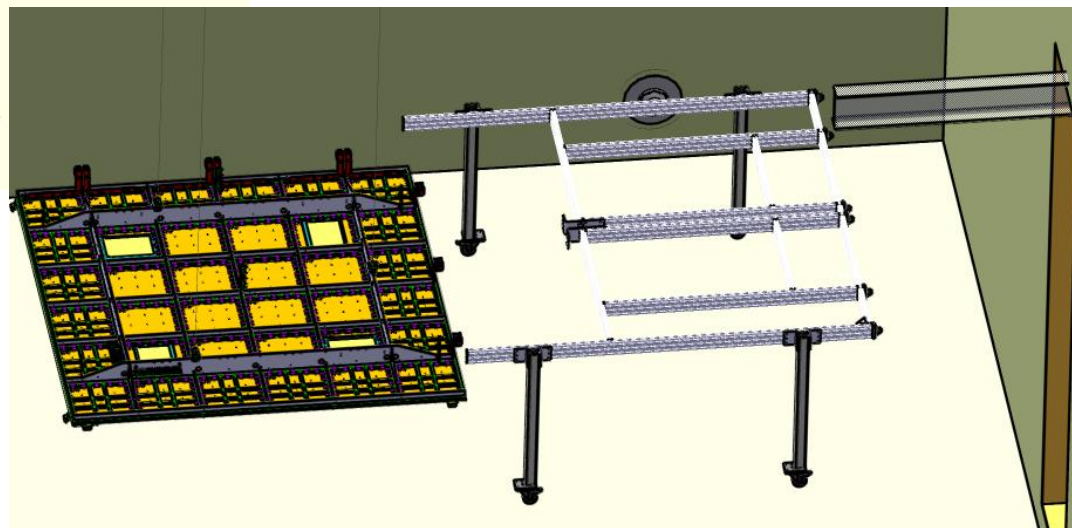
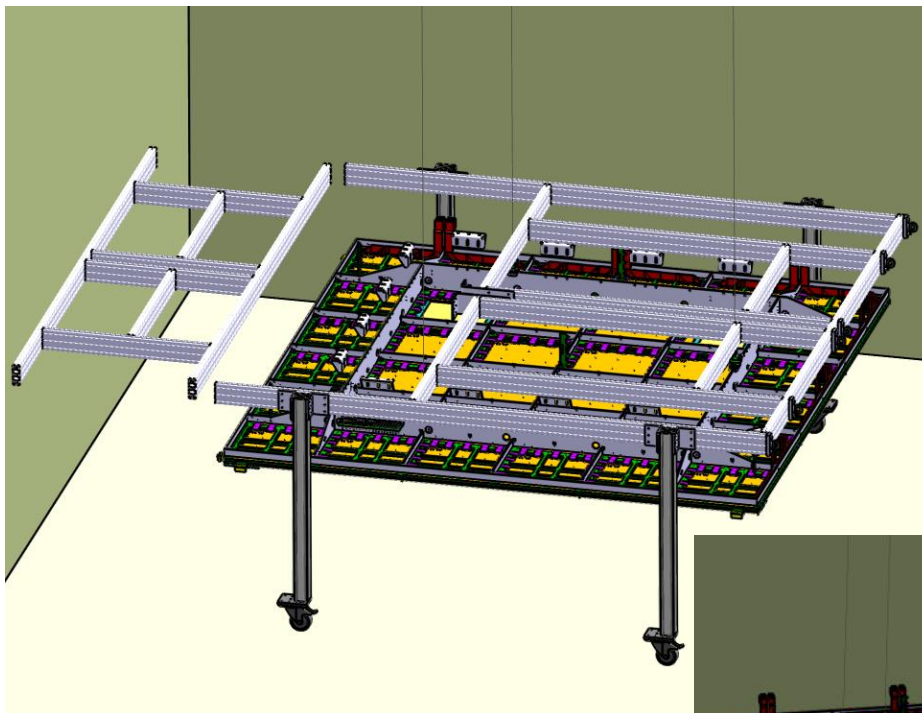
All the supporting squares for transport are removed

The planarity is checked thanks to laser-tracker or optical level



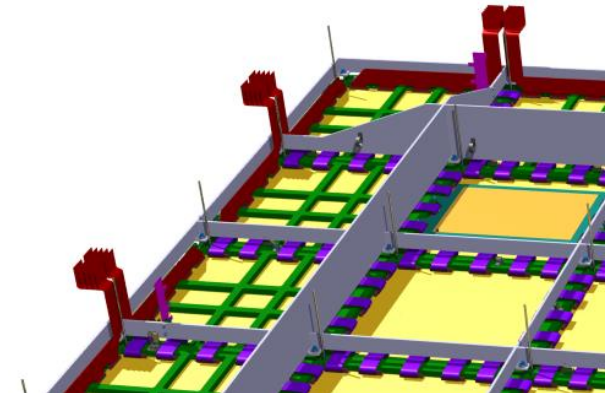
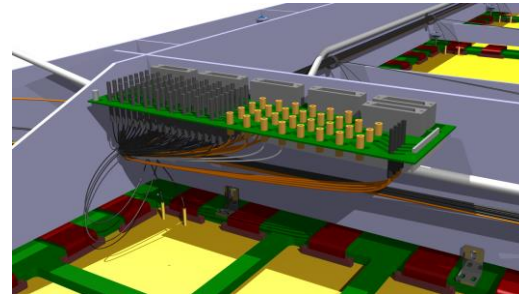
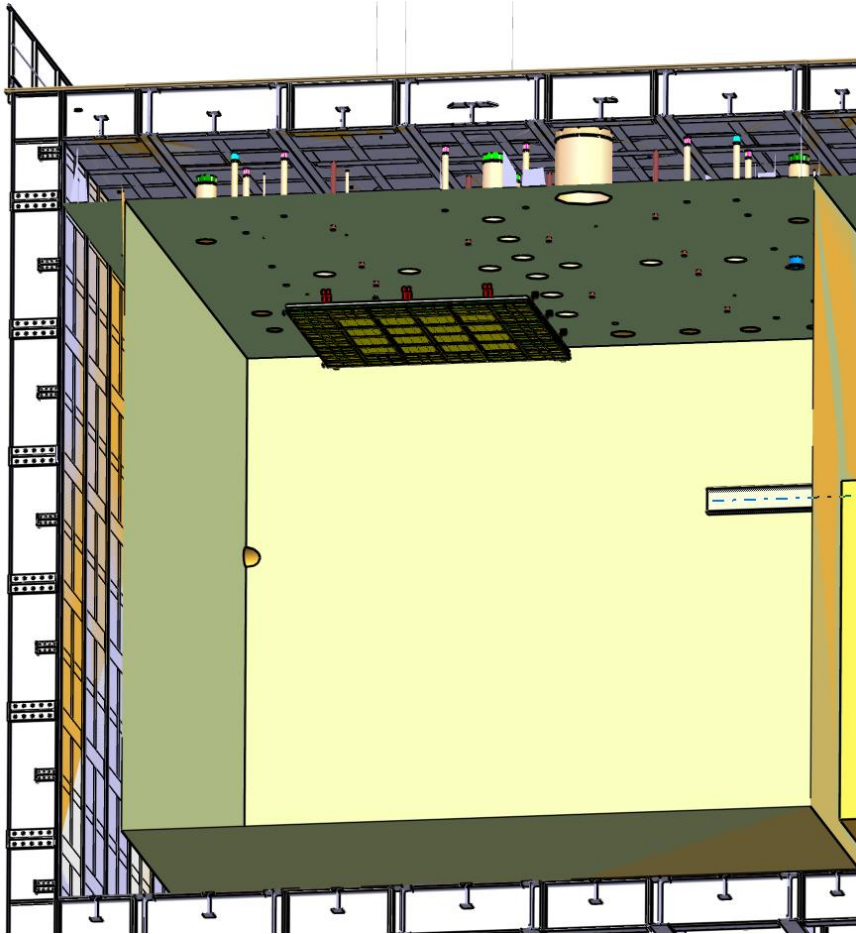
# Cryostat insertion

The structure is then removed in two parts



# Cryostat insertion

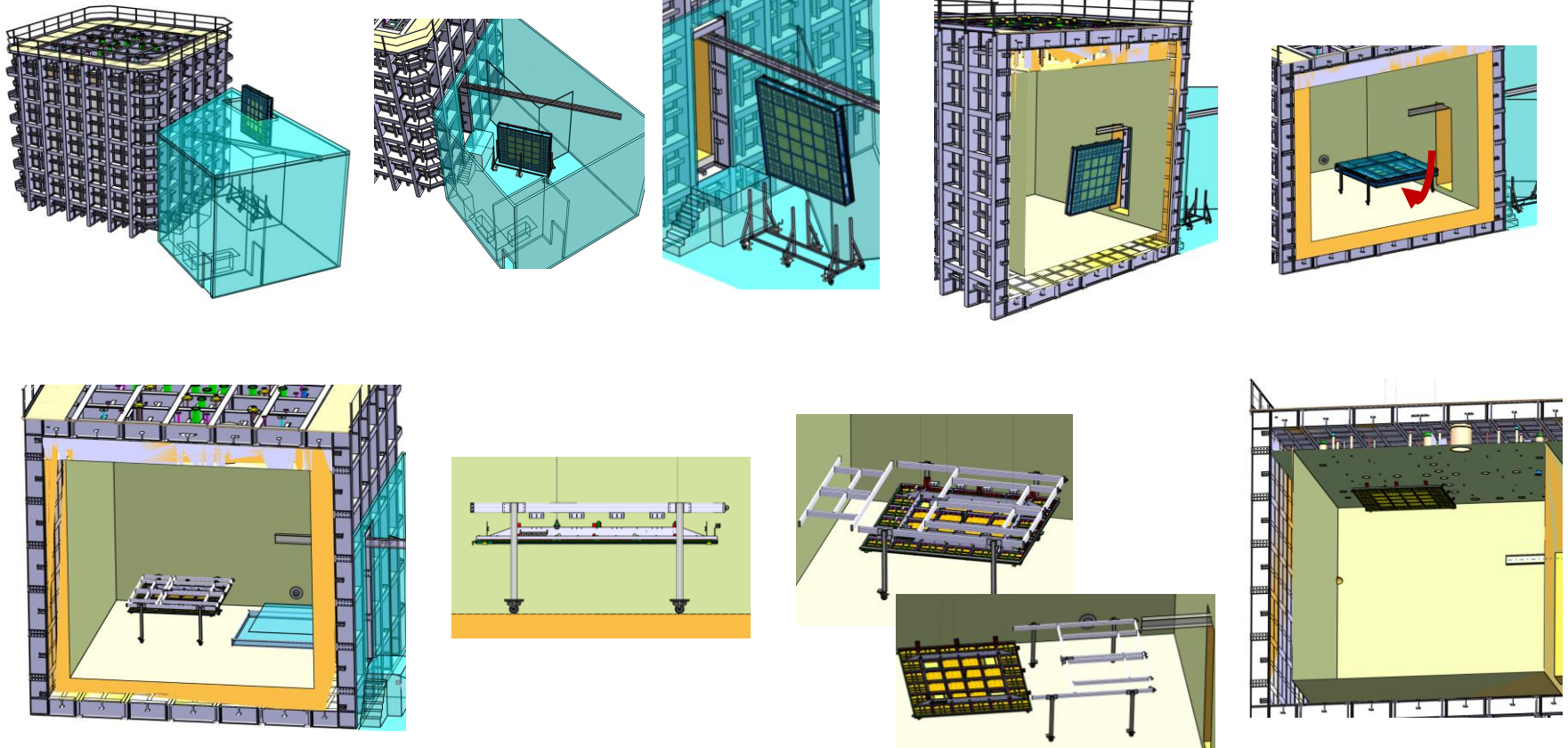
The module is lifted to the roof, and connected to chimneys (signal, HV, control...)





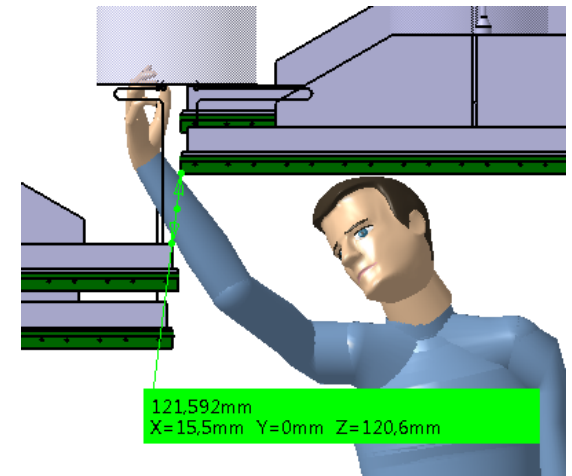
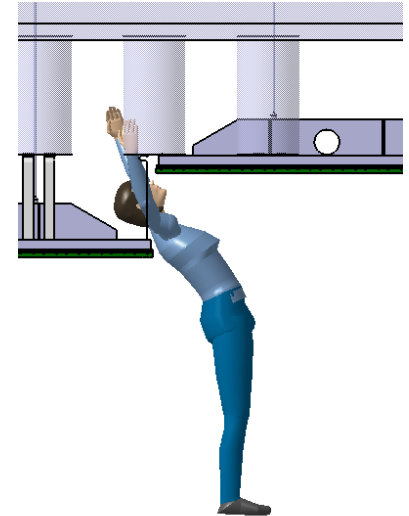
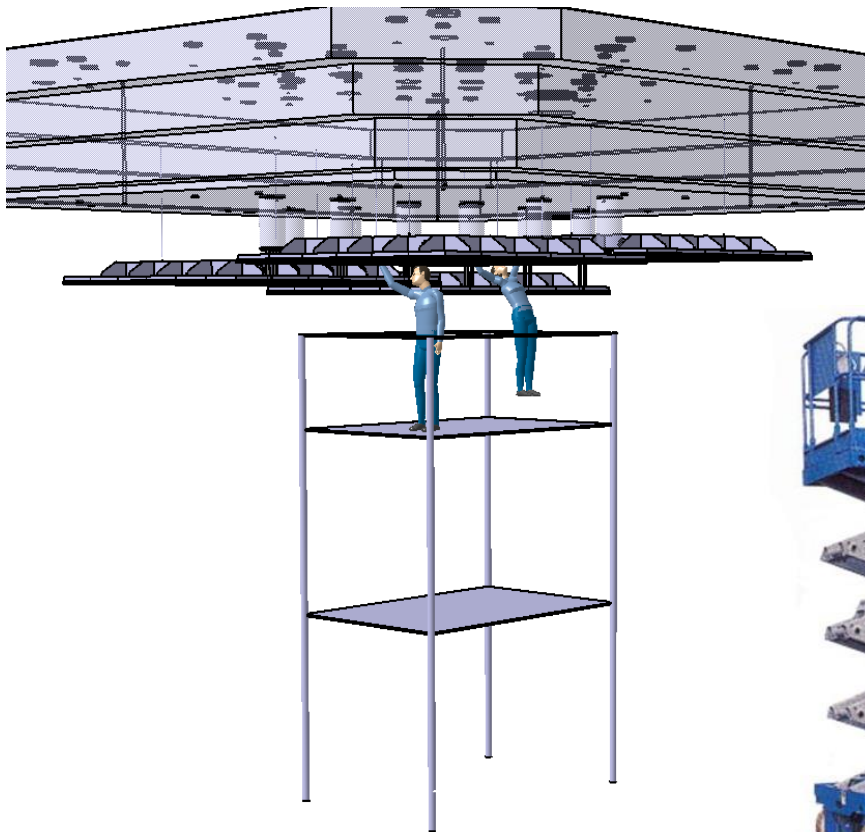
# Cryostat insertion

The operation is then repeated to insert the other modules ...



# Cryostat insertion

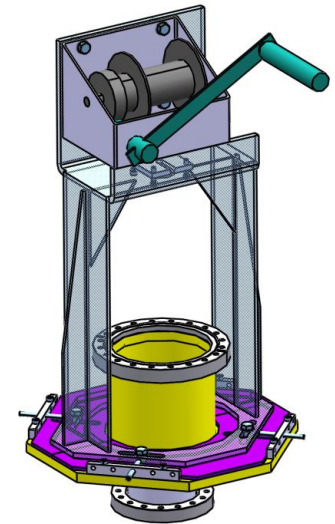
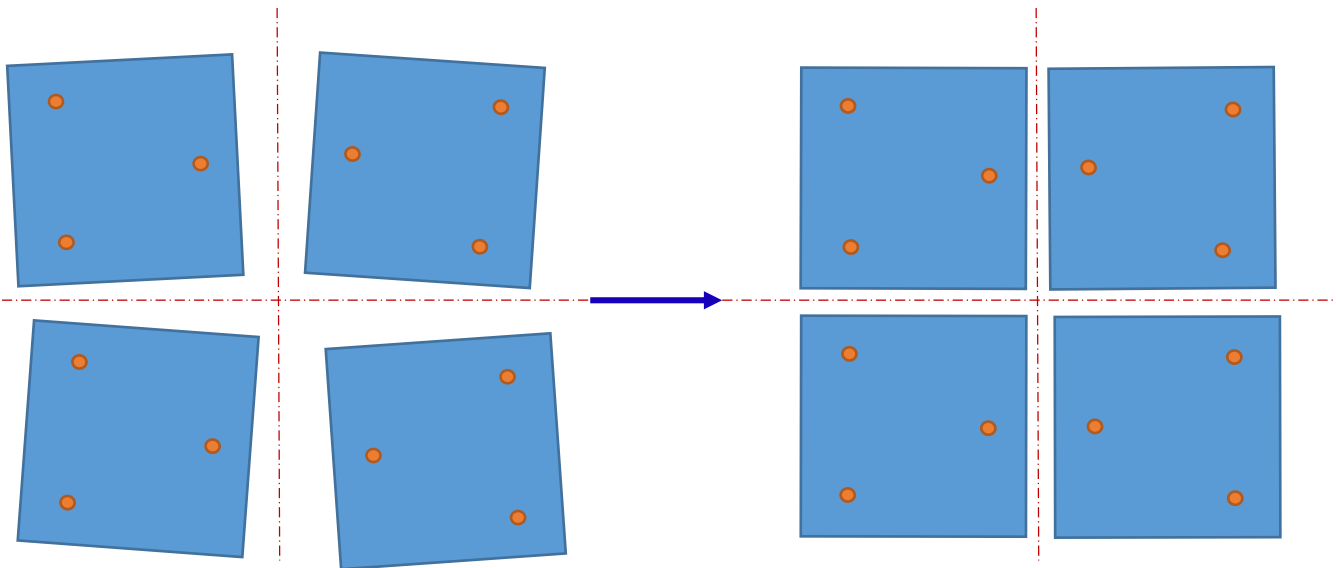
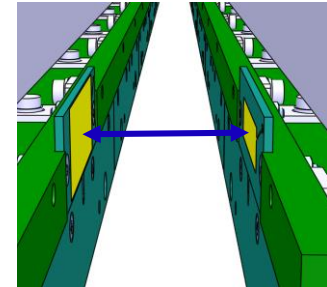
To connect plugs between modules, the modules are vertically shifted



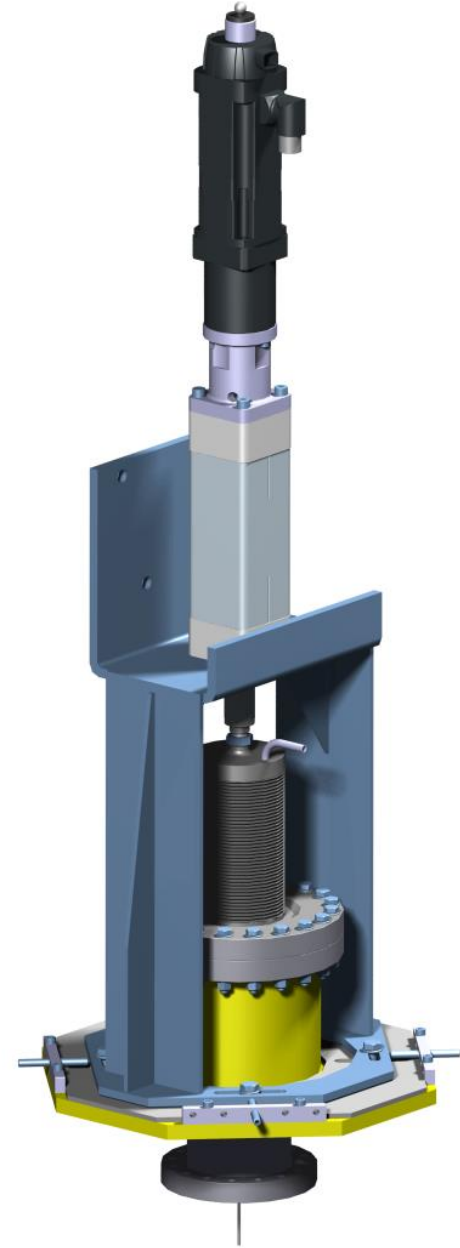
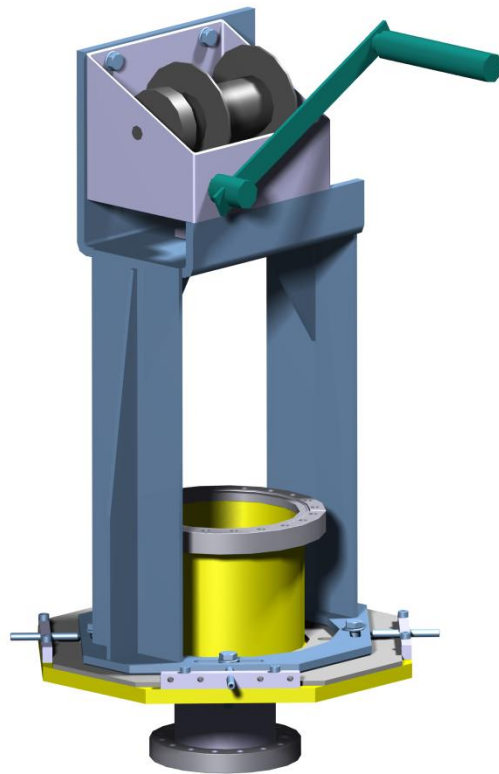
# Cryostat insertion

Modules' alignment is made from the roof

- *Distance-Meters* to get information on relative position
- *SPFT* system to translate modules

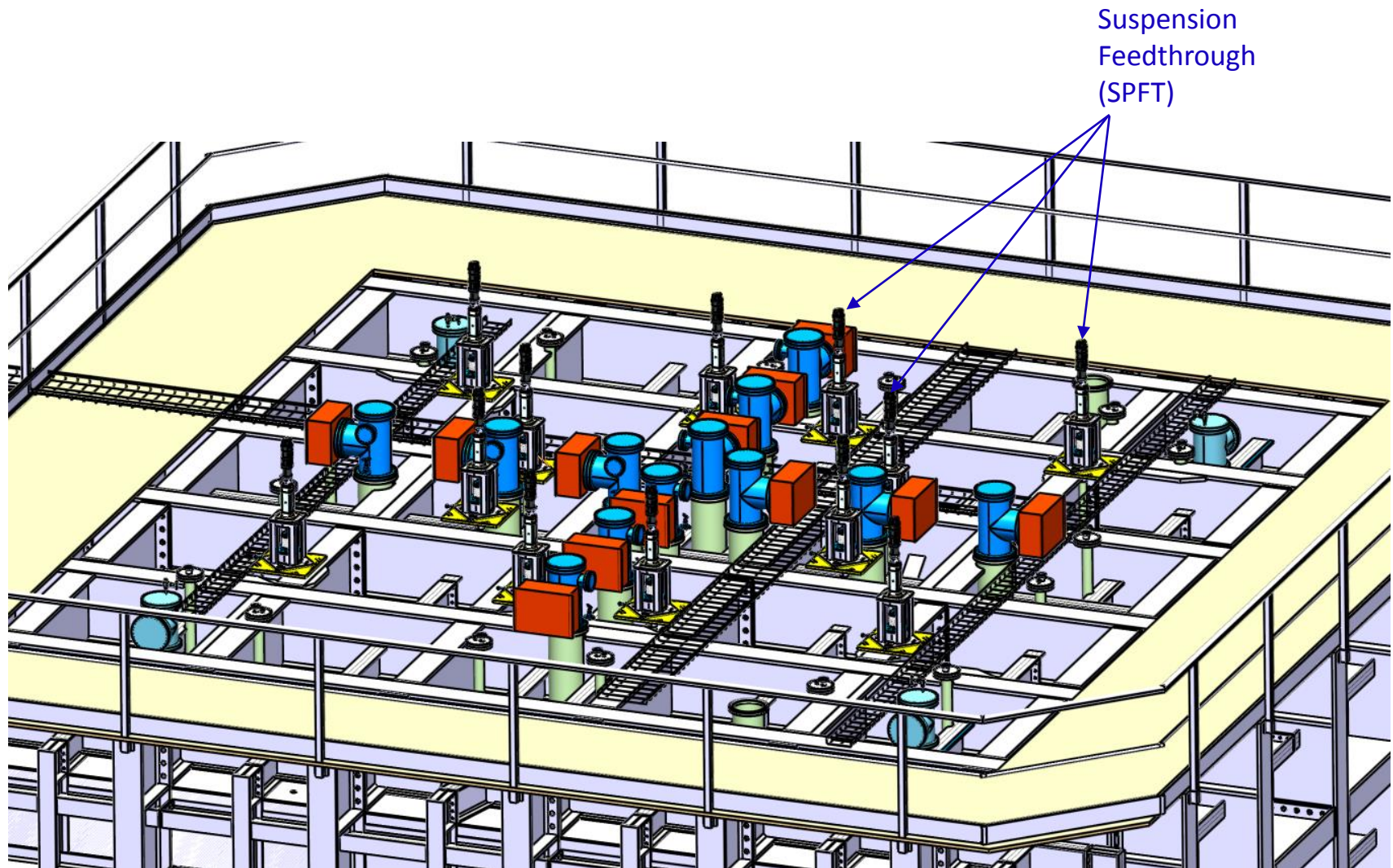


# Suspension Feedthrough



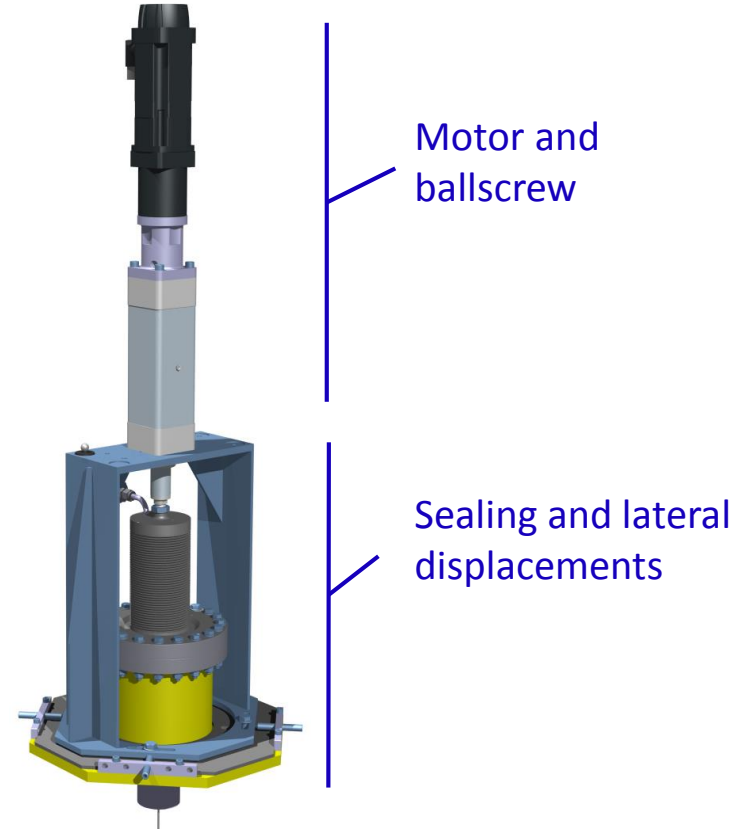
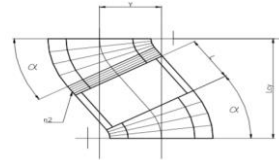
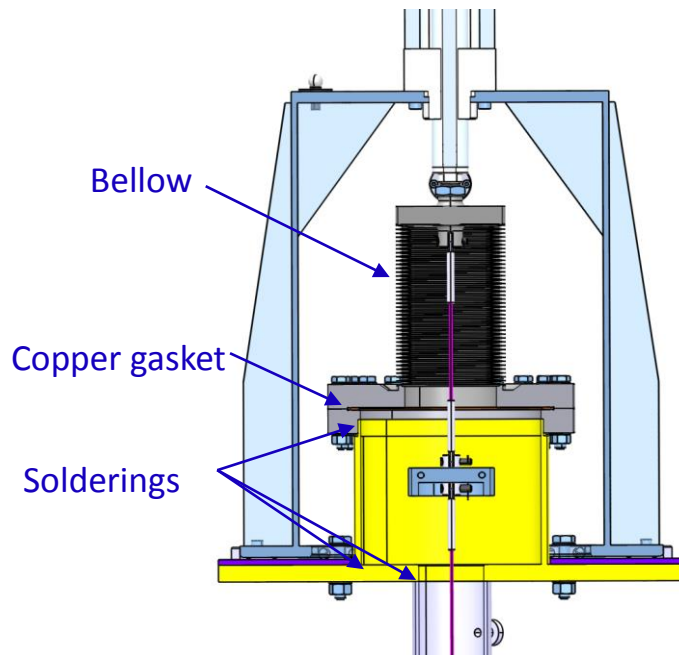


## SPFTs on detector's roof



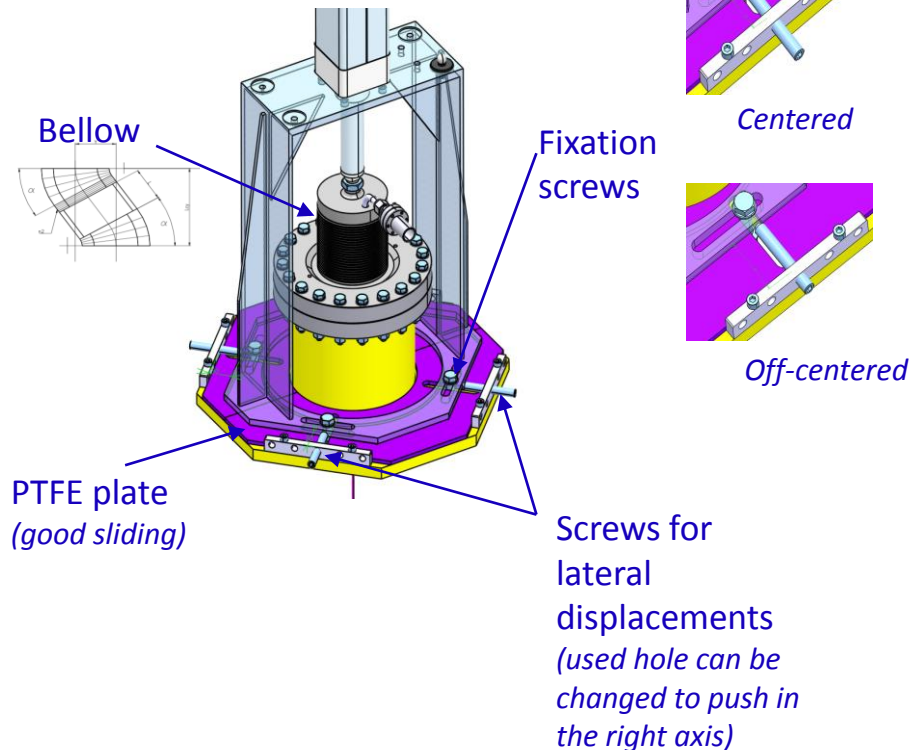
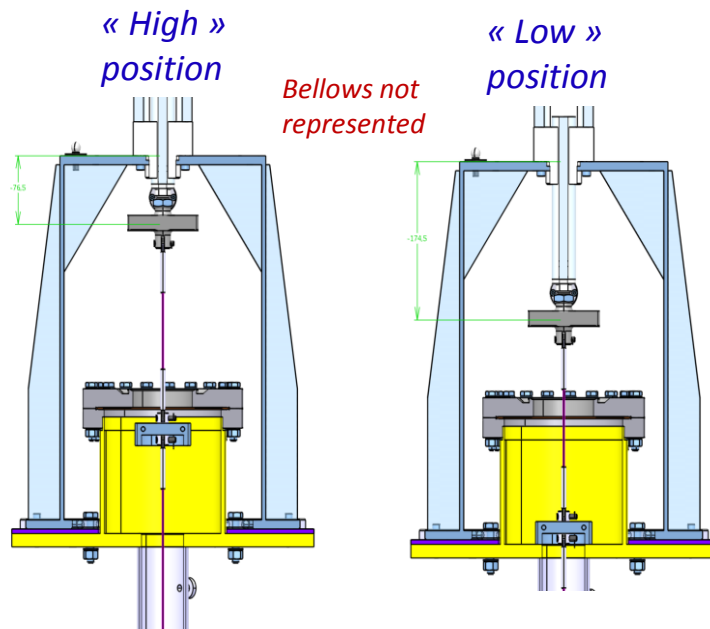
# Design & features – Overview

- GAR volume completely closed
  - *no sliding parts,*
  - *no moving sealing*
- Movement absorbed by lateral deformation of the bellow



# Design & Features – Vertical displacements

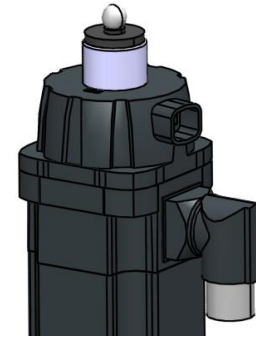
- Vertical stroke : **98mm**
  - Even with max lateral displacement
- Lateral stroke : **+/- 26mm**
  - Displacement in a circle  $\varnothing 52\text{mm}$



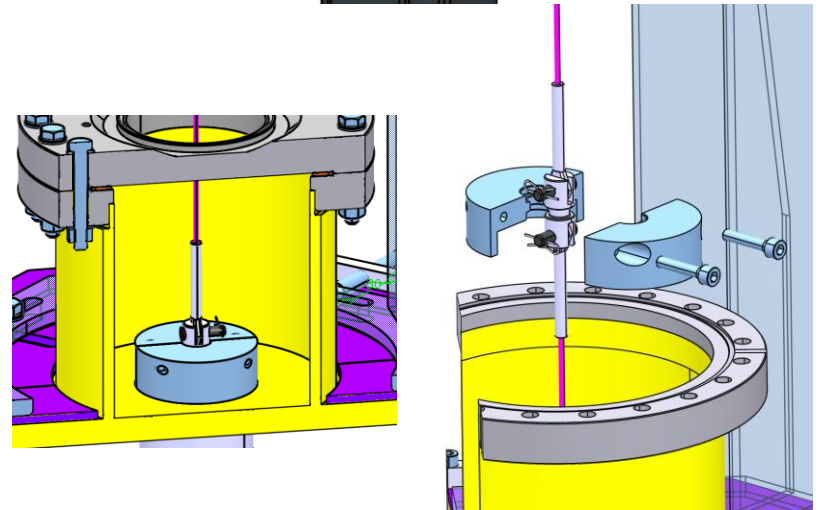


## Design & Features – Additional features

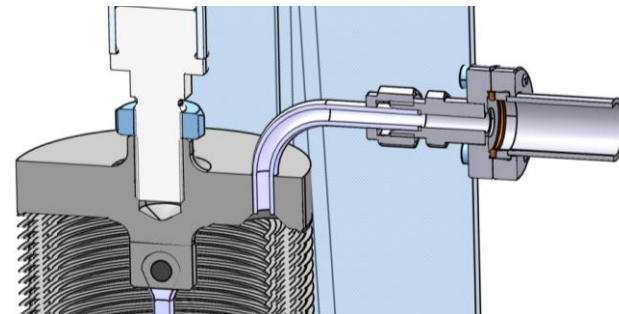
- Special slot for Laser Tracker target
  - *SPFT position monitoring during installation*



- Mechanical stop and chimney rough obstruction for maintenance or bellow replacement

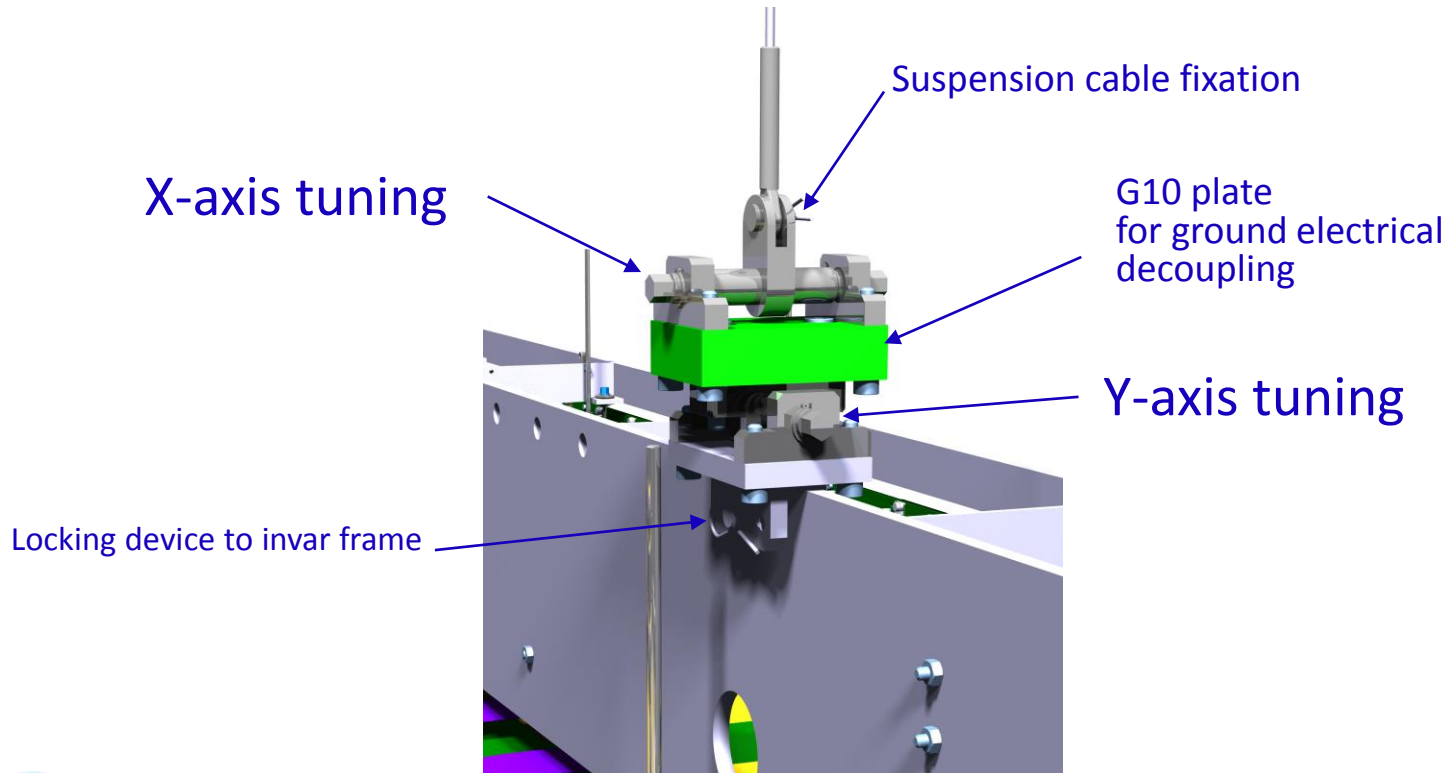
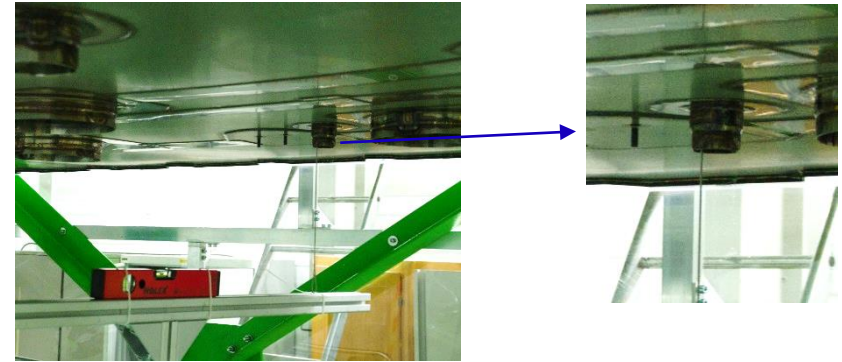


- Air purge at the highest point for best GAr purity



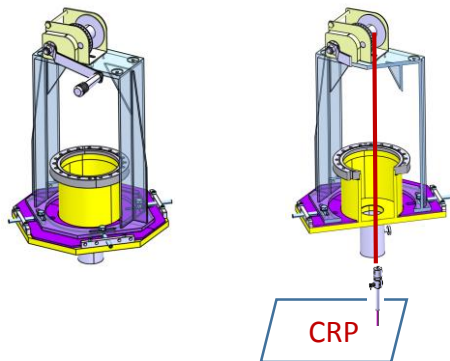
## Suspension cables anchoring system

- In case of variation of the cryostat pipes verticality, this system allows to change anchoring point on module, in warm conditions
- In cold conditions, this is done with SPFTs positions

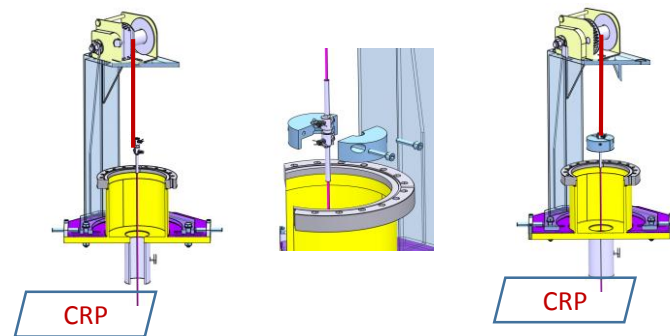


# Installation procedure on top cap

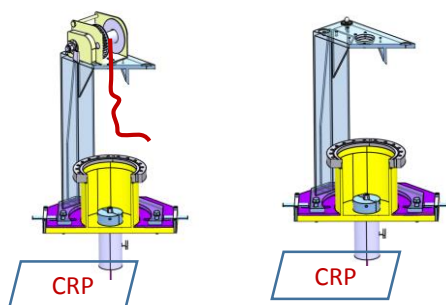
Cable from the winch is descended through the chimney to attach the CRP final cable :



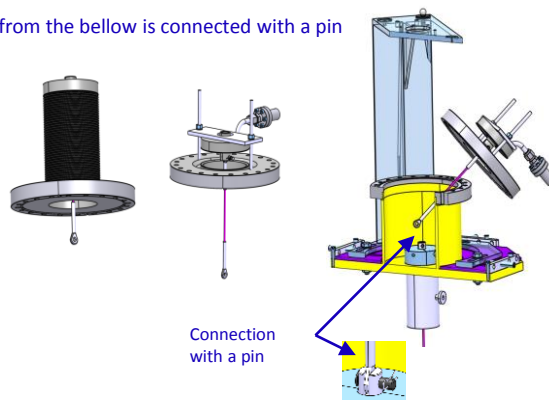
CRP is raised up with the winches, then the mechanical stop is assembled



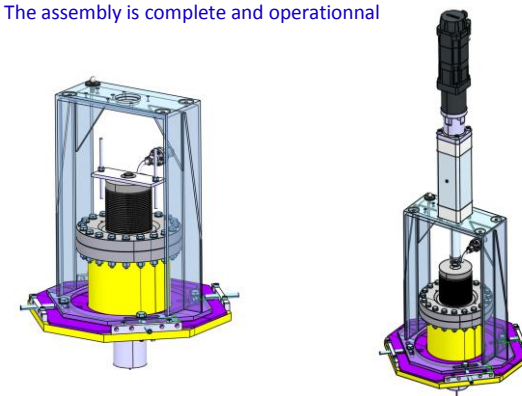
The CRP is laid down on the mechanical stop  
The winch cable is disconnected  
The winch is removed



The bellow is compressed thanks to special tooling  
The cable from the bellow is connected with a pin

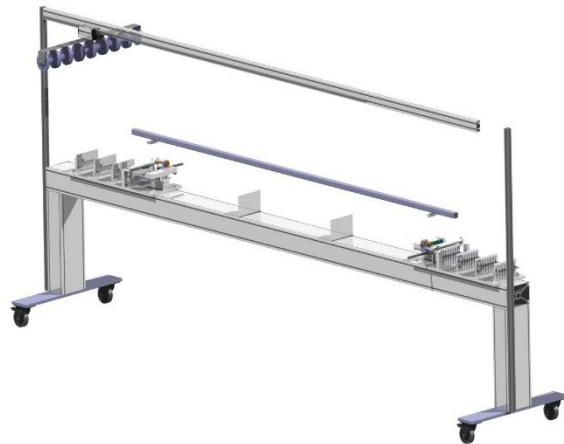
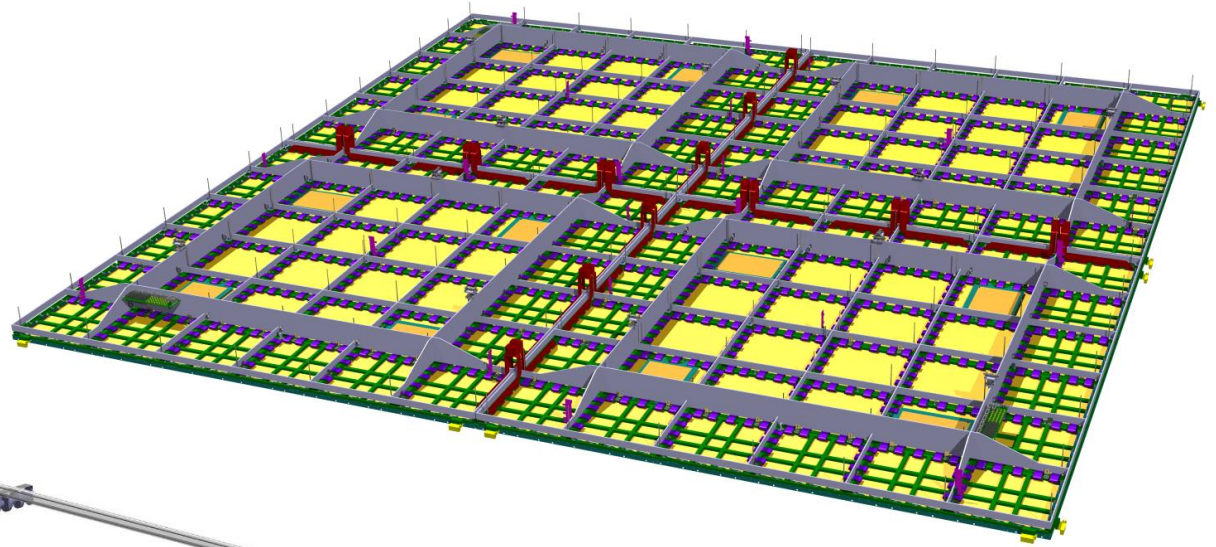
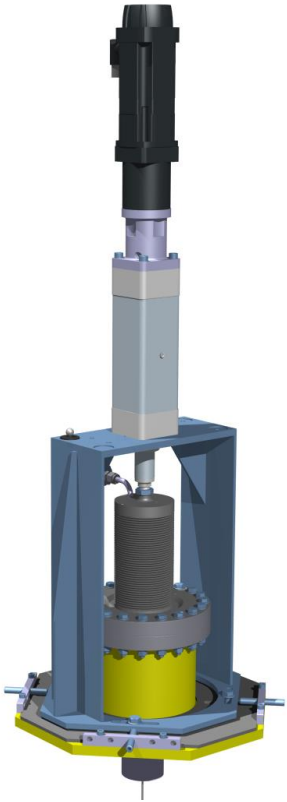


The compression tool is removed and the bellow fixed  
The motor is inserted and screwed from the top  
The assembly is complete and operational



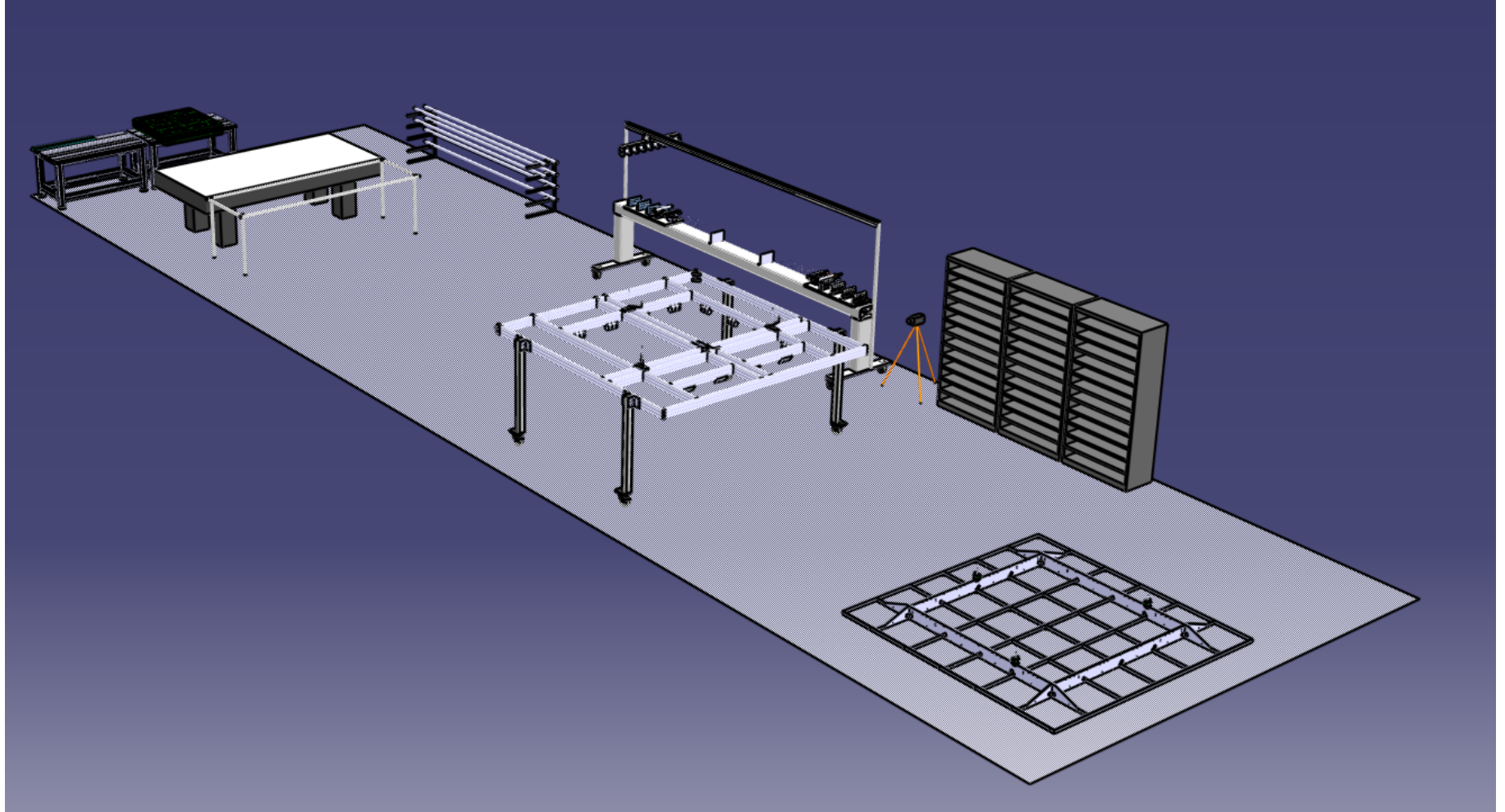


# Thanks for your attention



# Spares slides

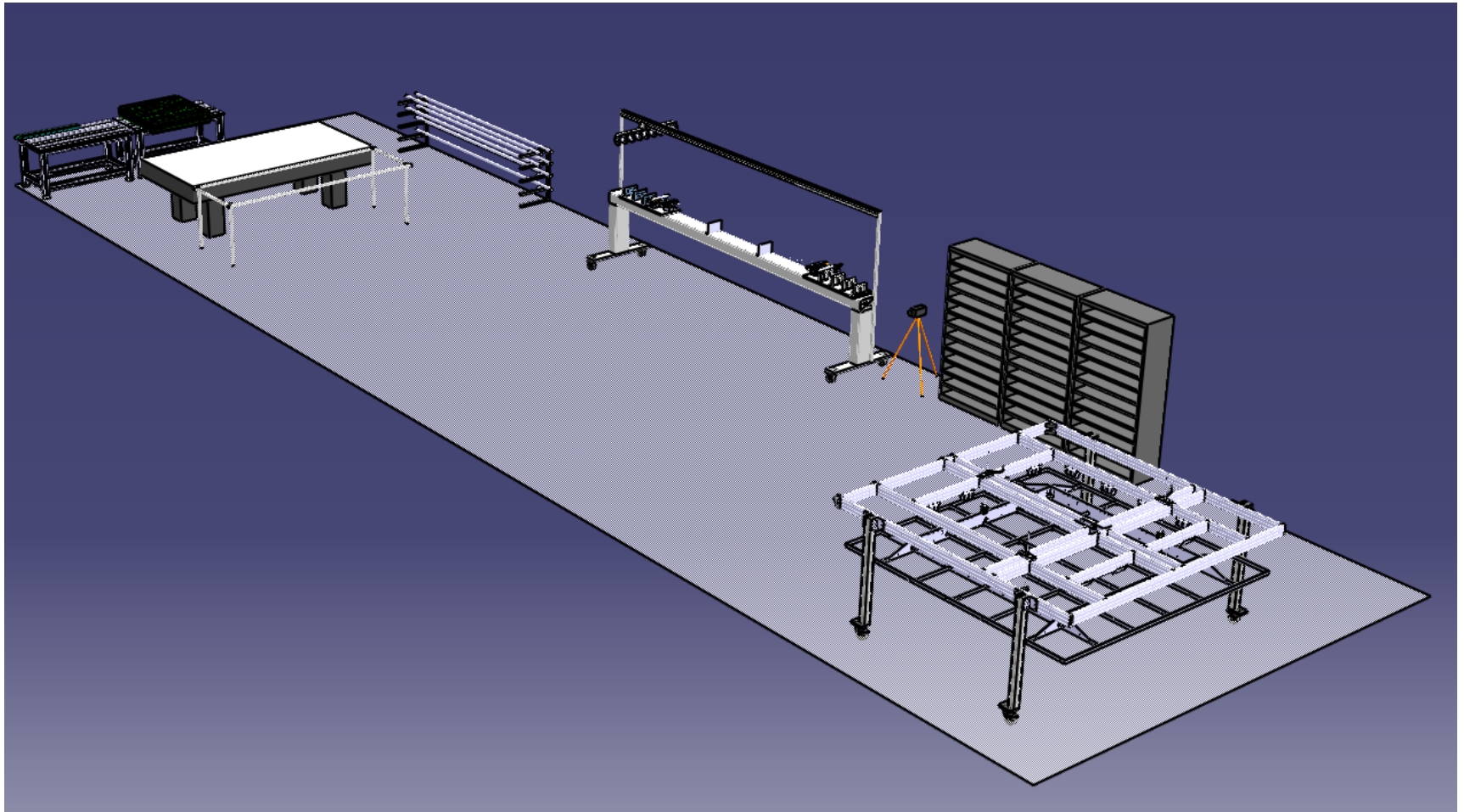
*(in case of pb with the installation animation...)*





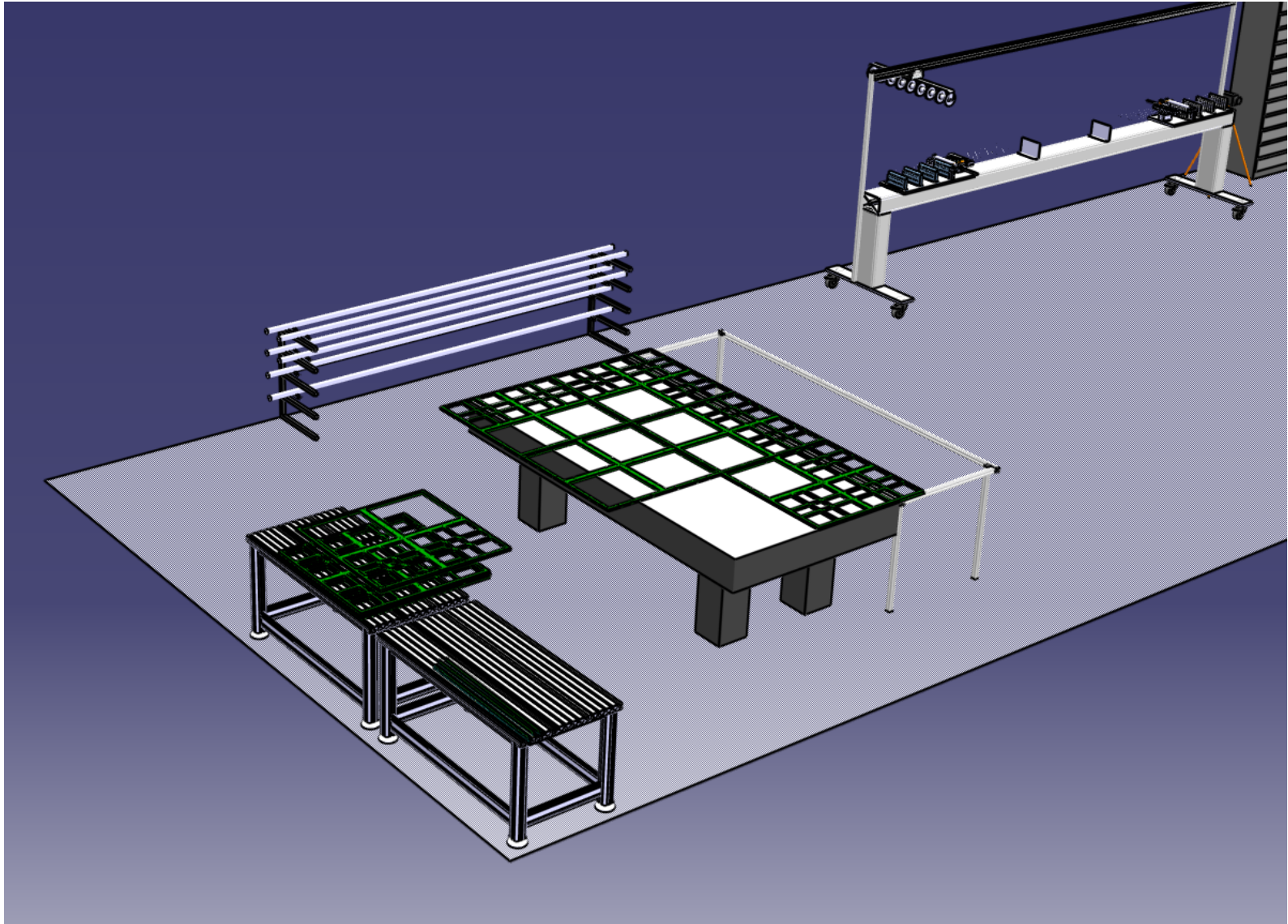
# CRP Assembly

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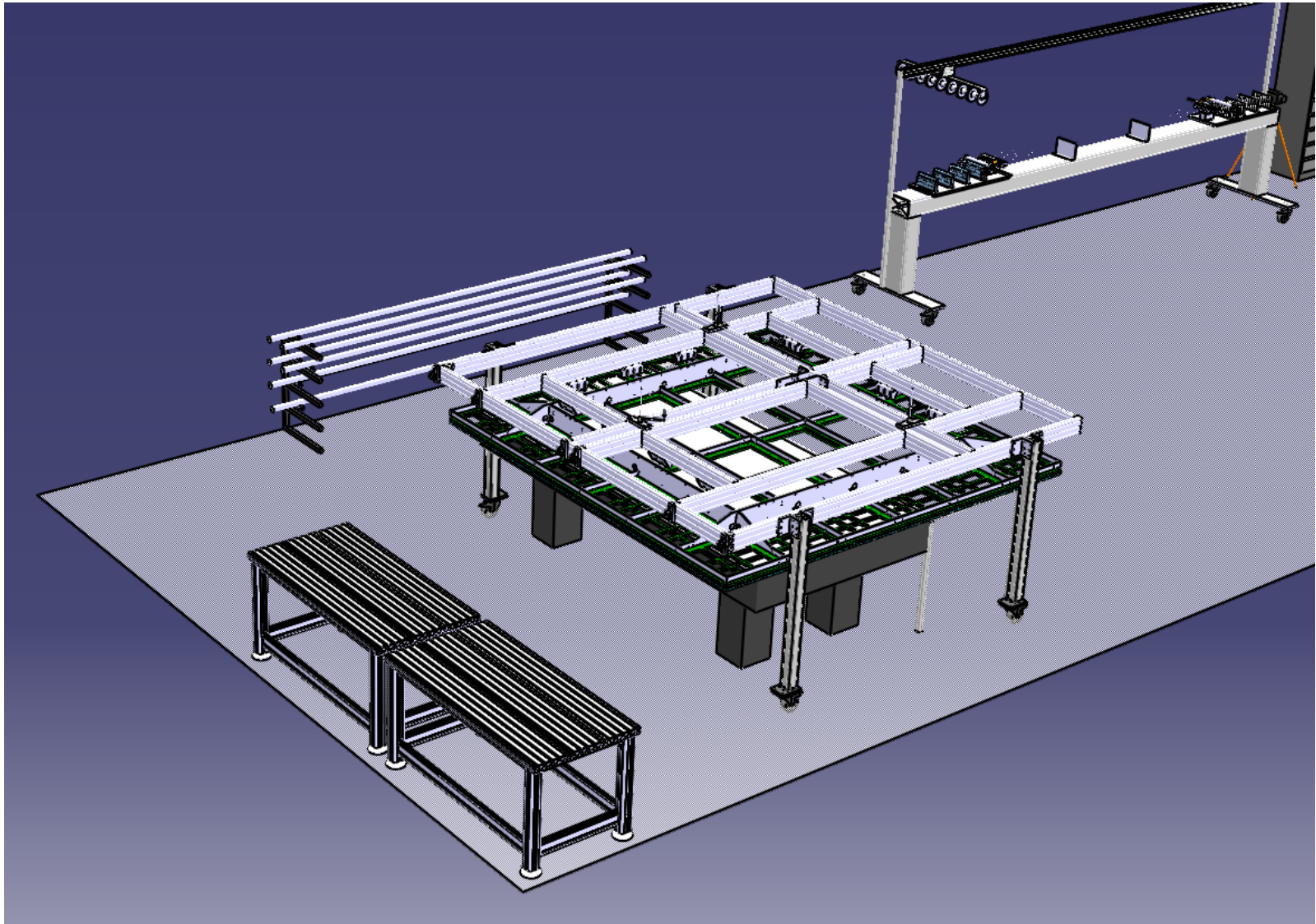
# CRP Assembly

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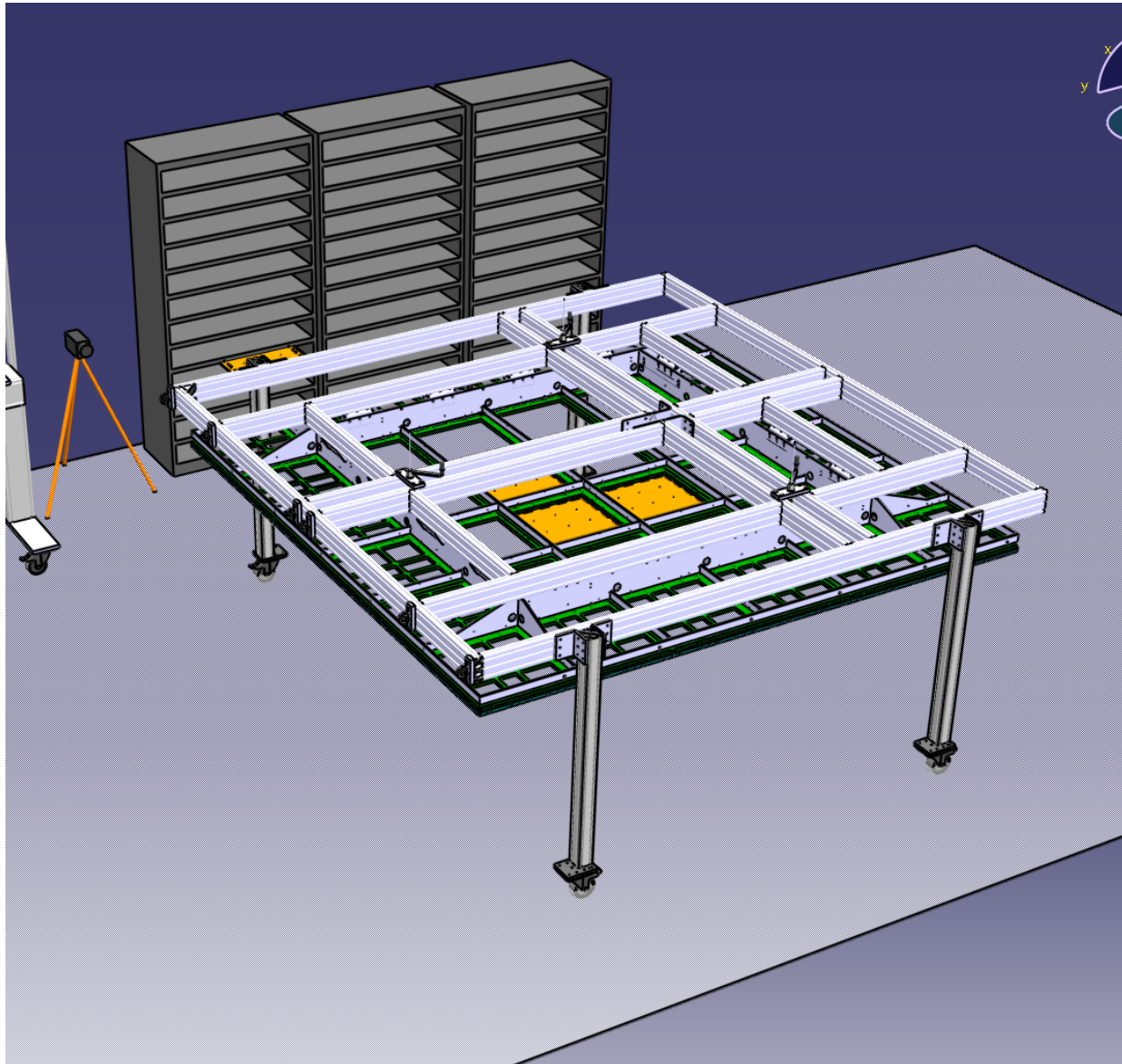


# CRP Assembly



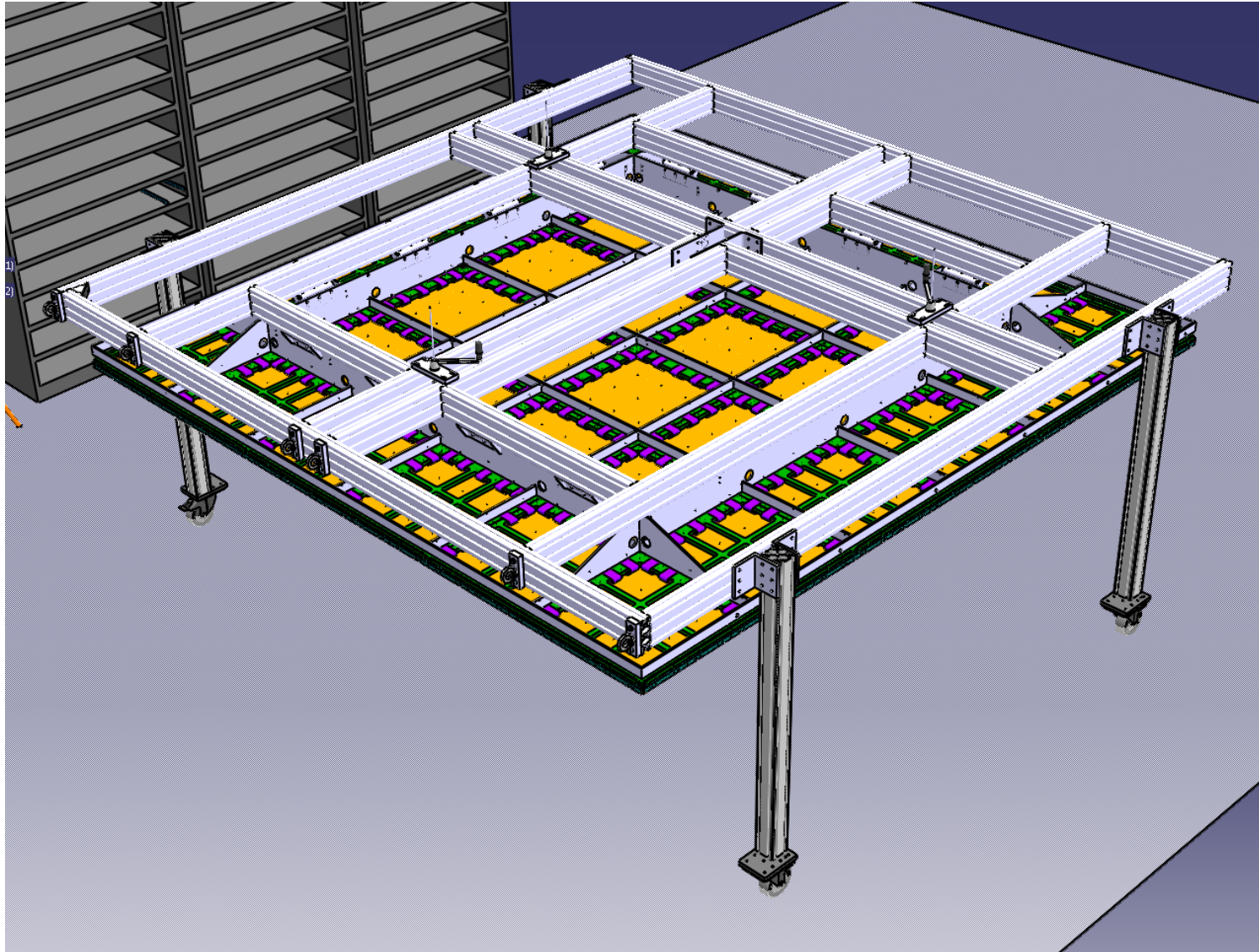


# CRP Assembly



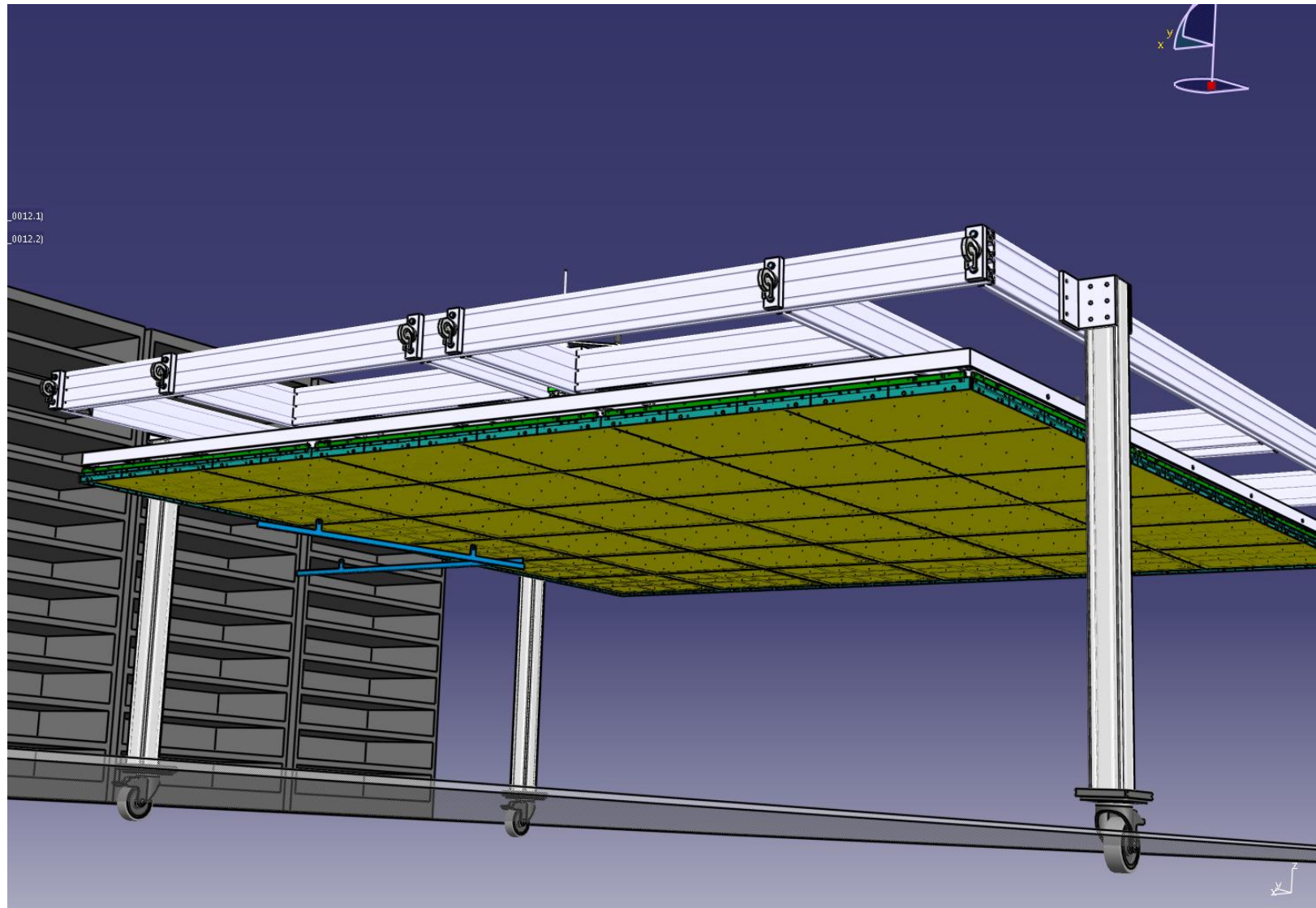
# CRP Assembly

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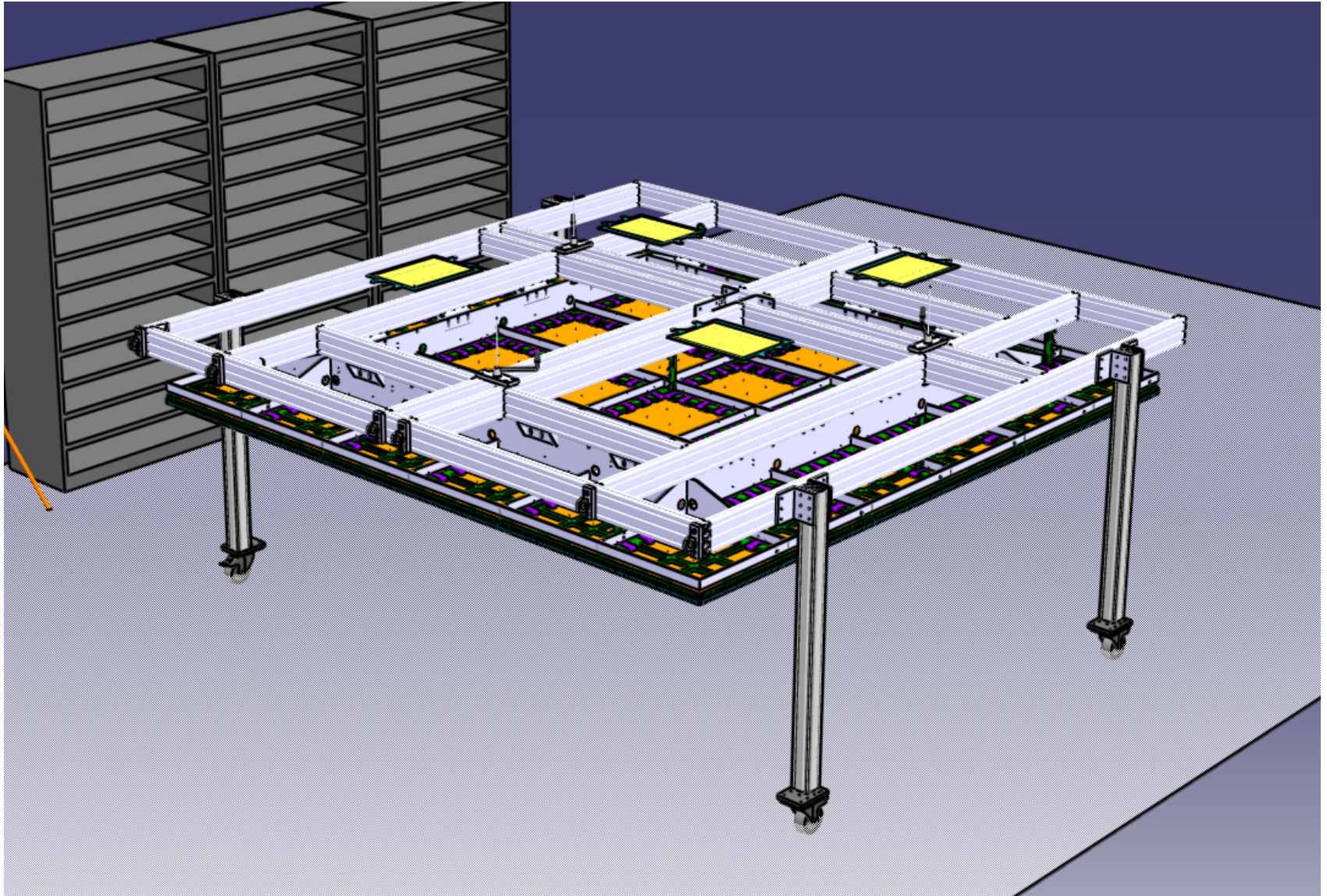




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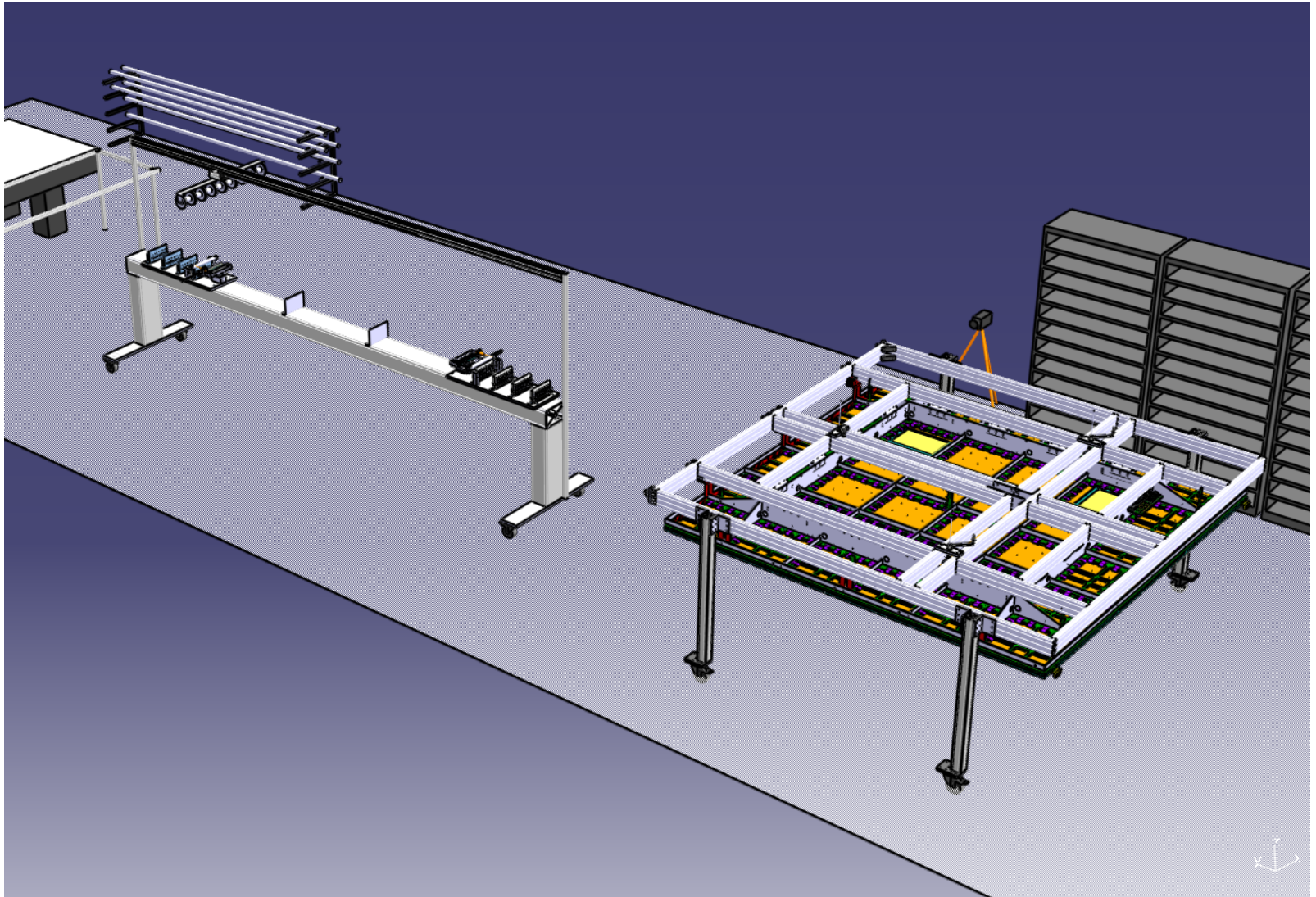


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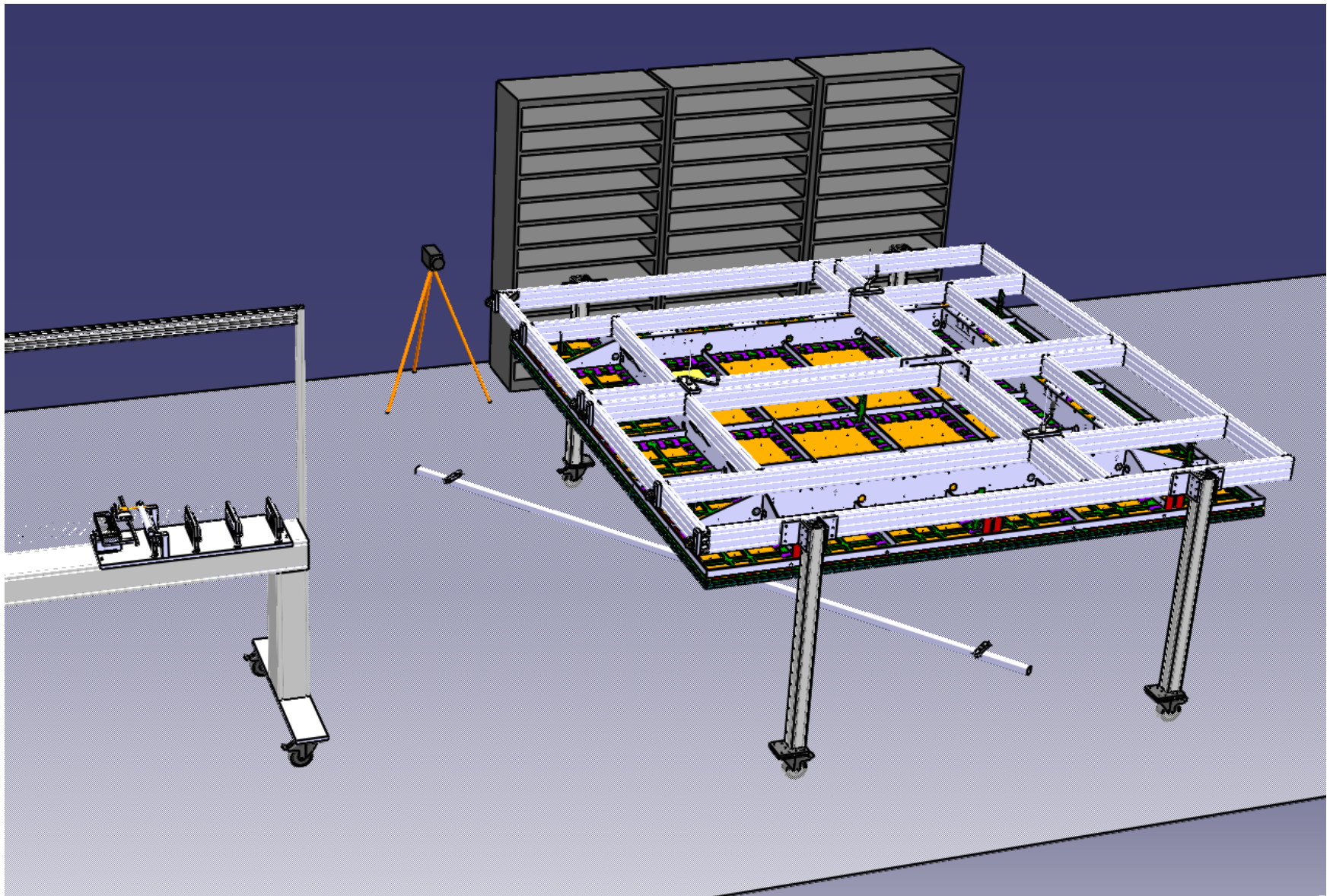




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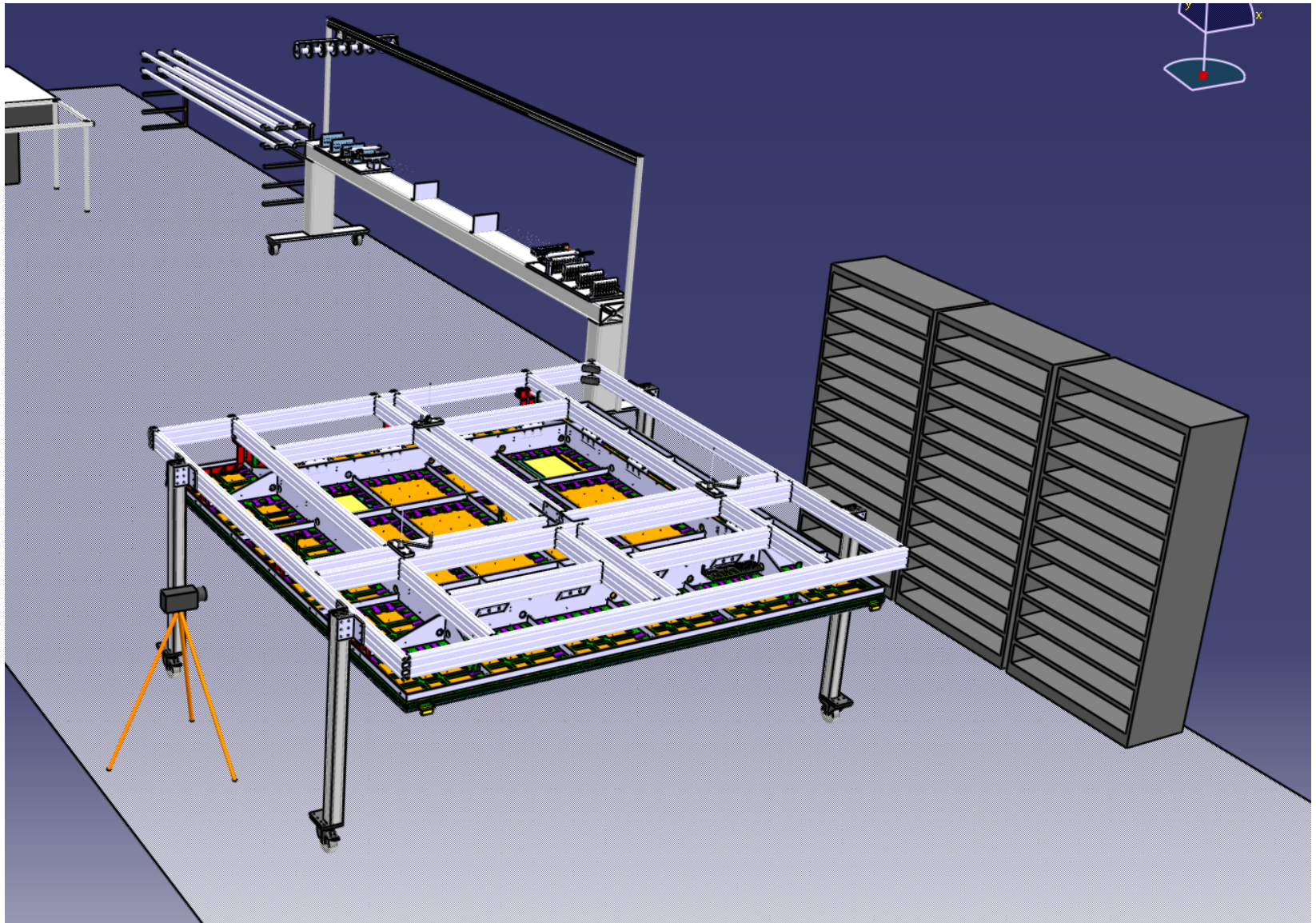


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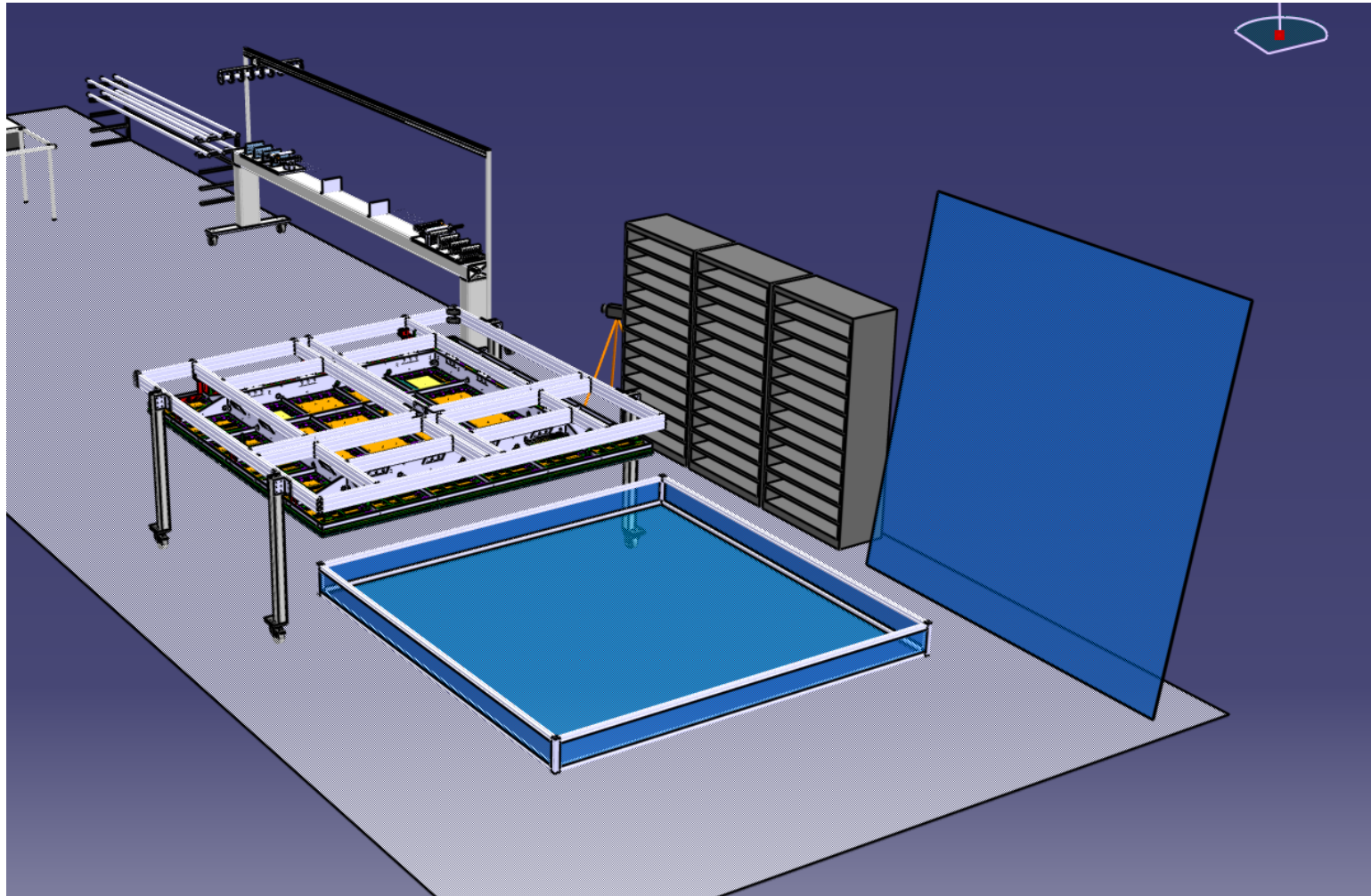


# CRP Assembly



# CRP Assembly

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# CRP Assembly

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