



WA-105

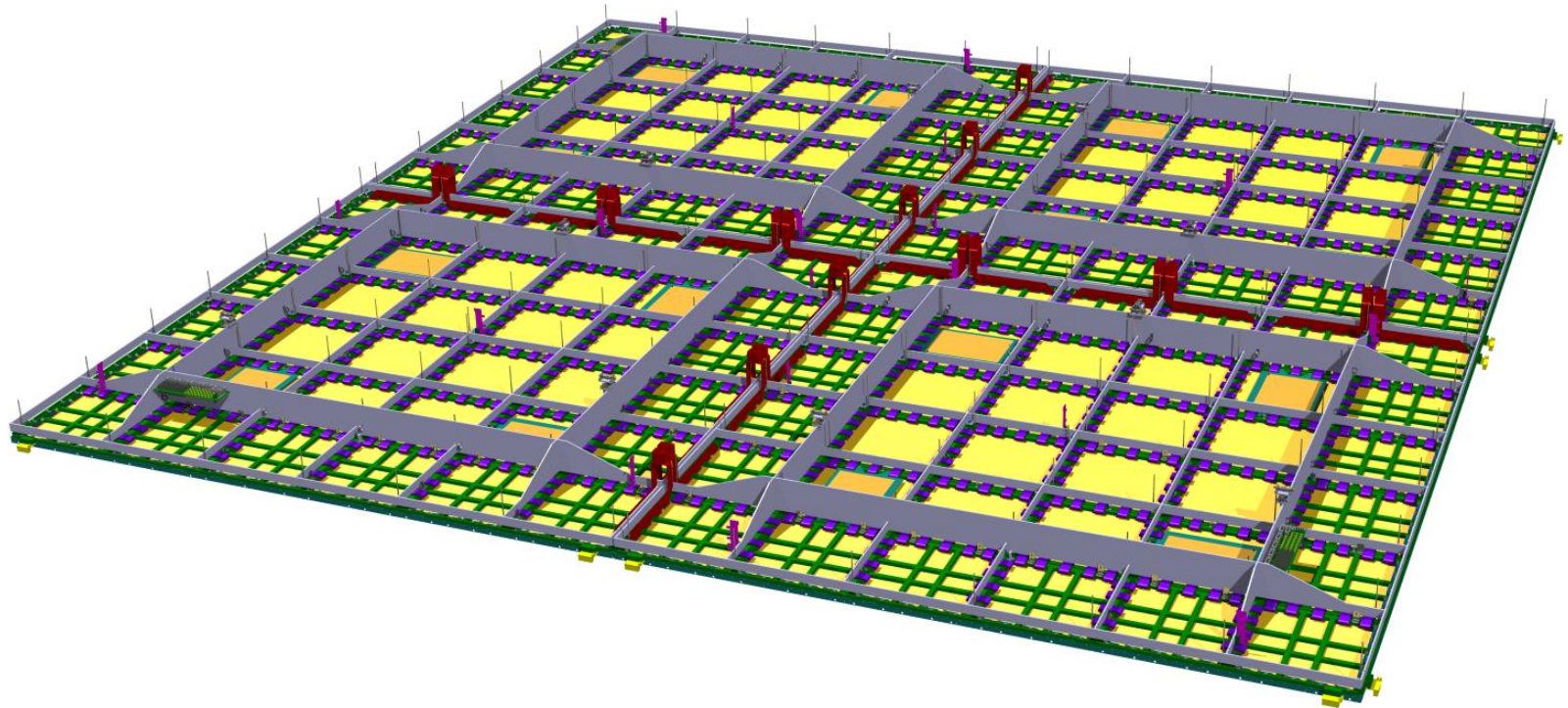
CRP & SPFT final design

WA105 Technical Board – 30nd of November 2016

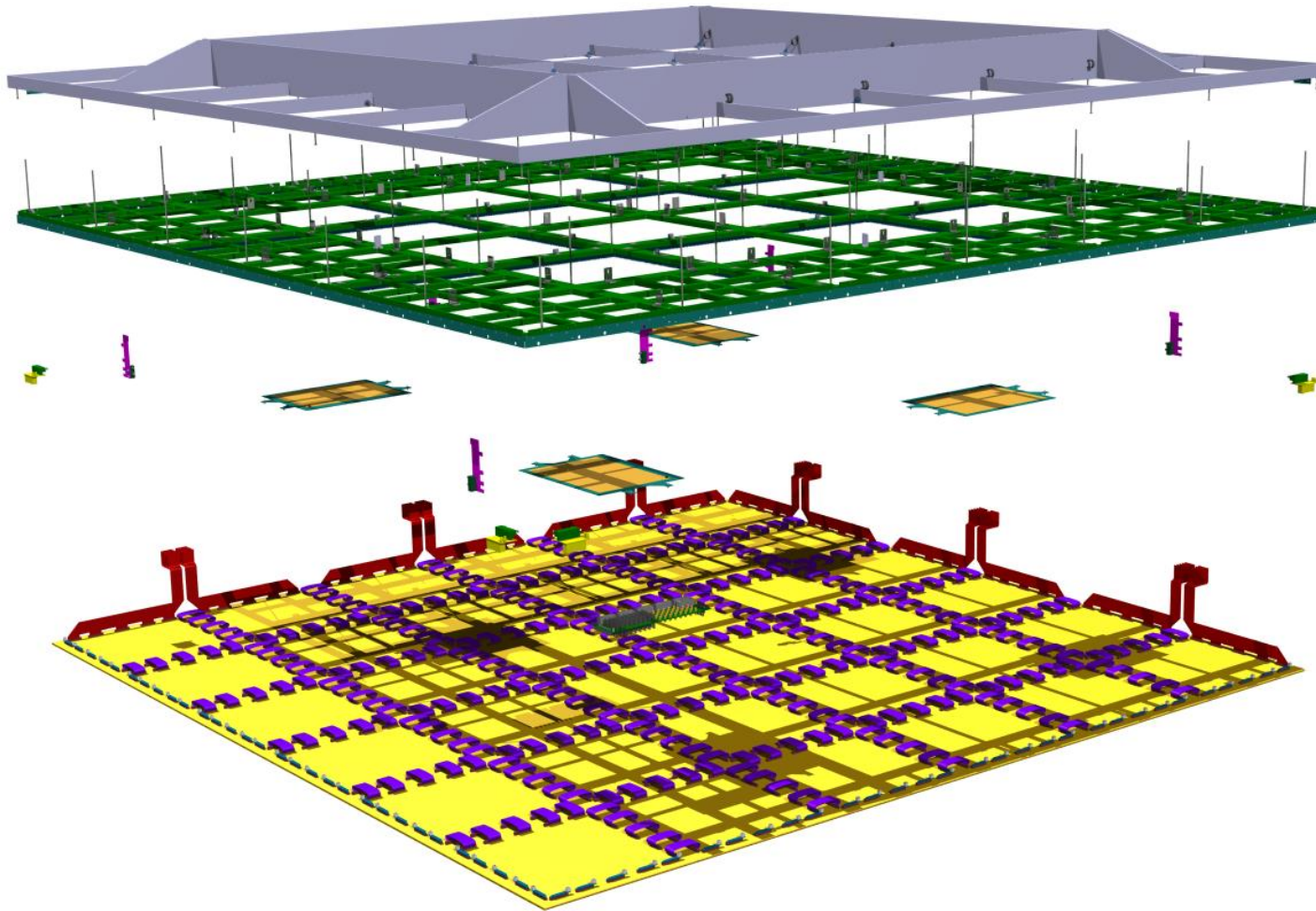
***B. Aimard, N. Allemandou, M. Cailles, G. Deleglise, D. Duchesneau,
N. Geffroy, Y. Karyotakis, T. Yildizkaya***



CRP Design & installation



CRP Overview and composition



Invar Frame

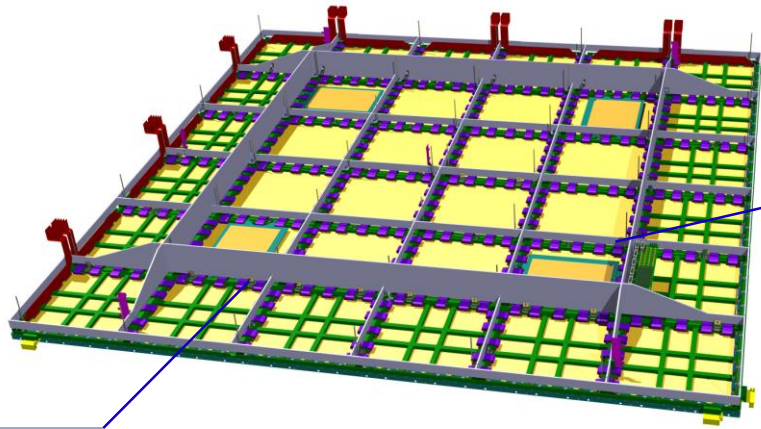
G10 Frame +
Extraction Grid

Instrumentation

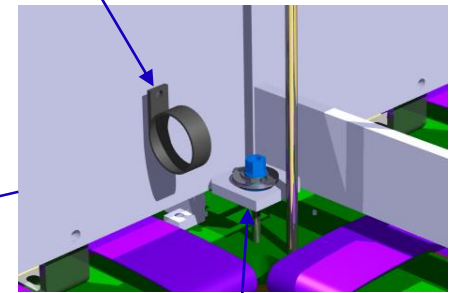
Detection plane

Invar Frame

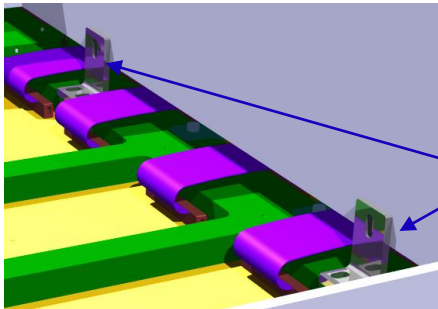
- Final geometry presented and discussed with manufacturers
 - *Material supply*
 - *Plates cutting and soldering process*
 - *Surfaces finishing*
- All the frames are identical
- Ok to start production



Stainless steel adaptable Cable fixations all around the frame



Supporting plates for thermal decoupling and planarity tuning soldered on the frame

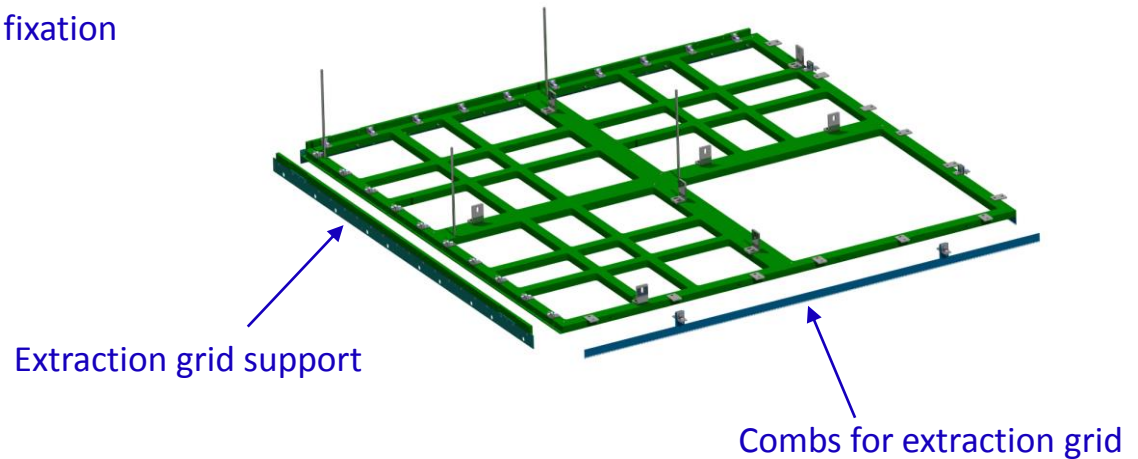
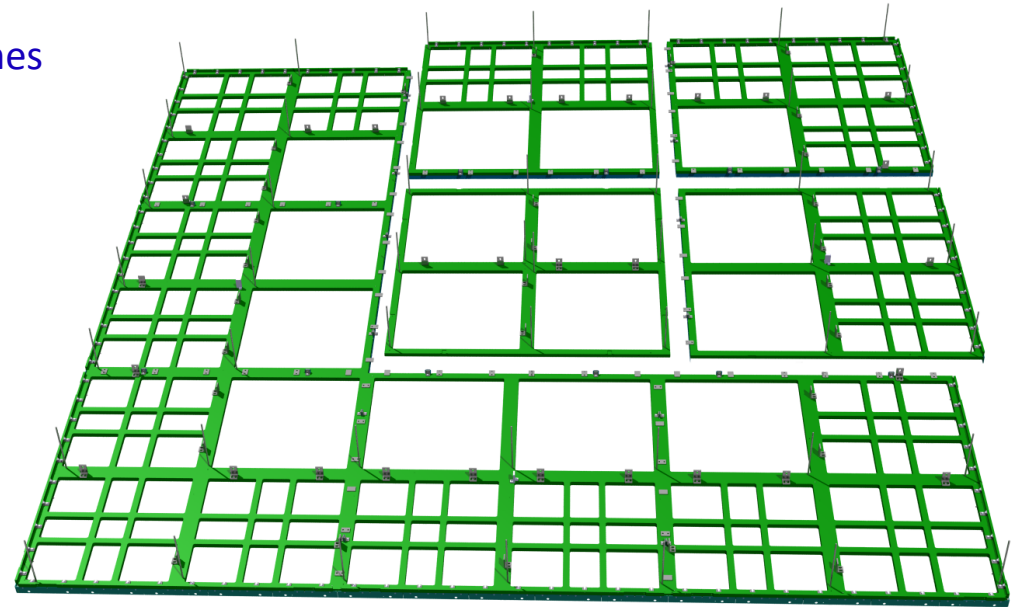
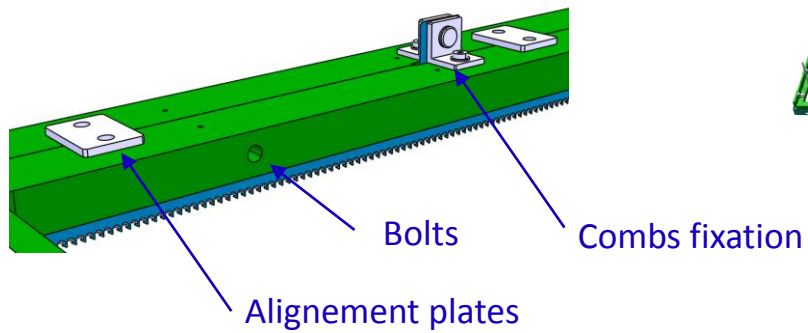


Square supports between invar and G10 for final assembly transportation

G10 Frame

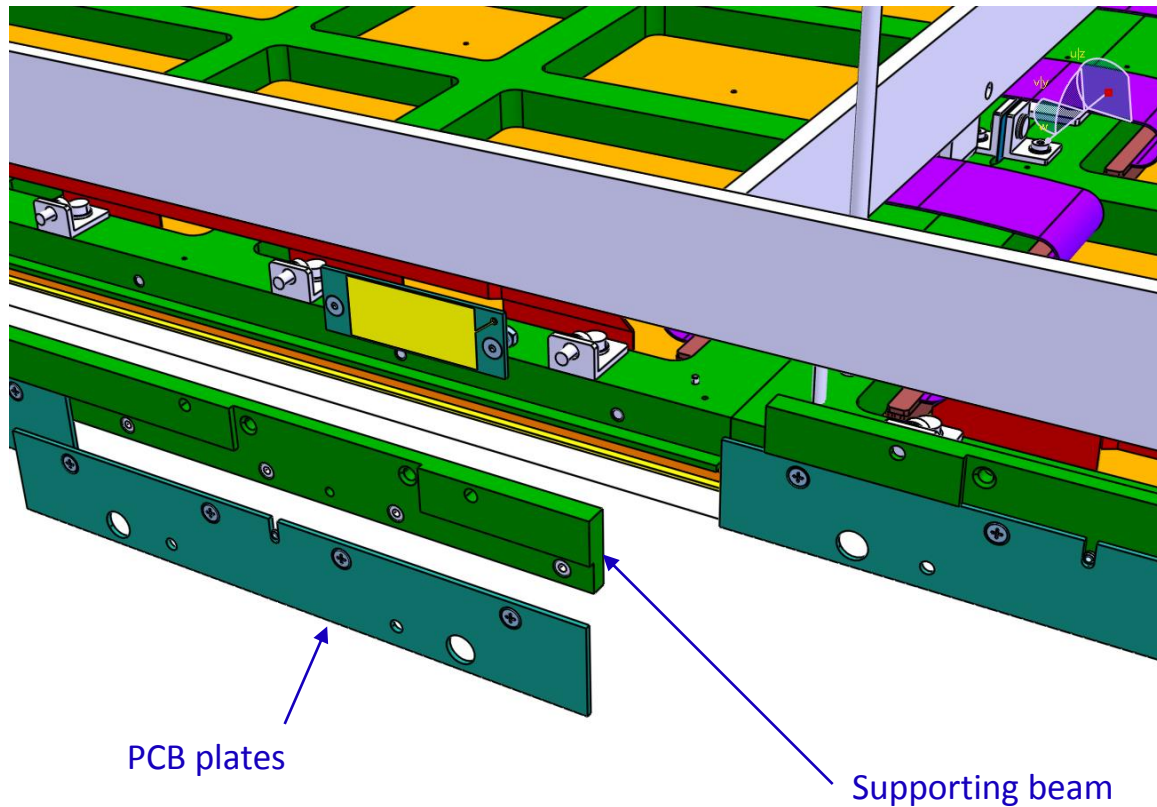
- 3x3m frame is an assembly of 1x1m frames
- Only 3 models of 1x1m frames

Junction between 1x1m frames :



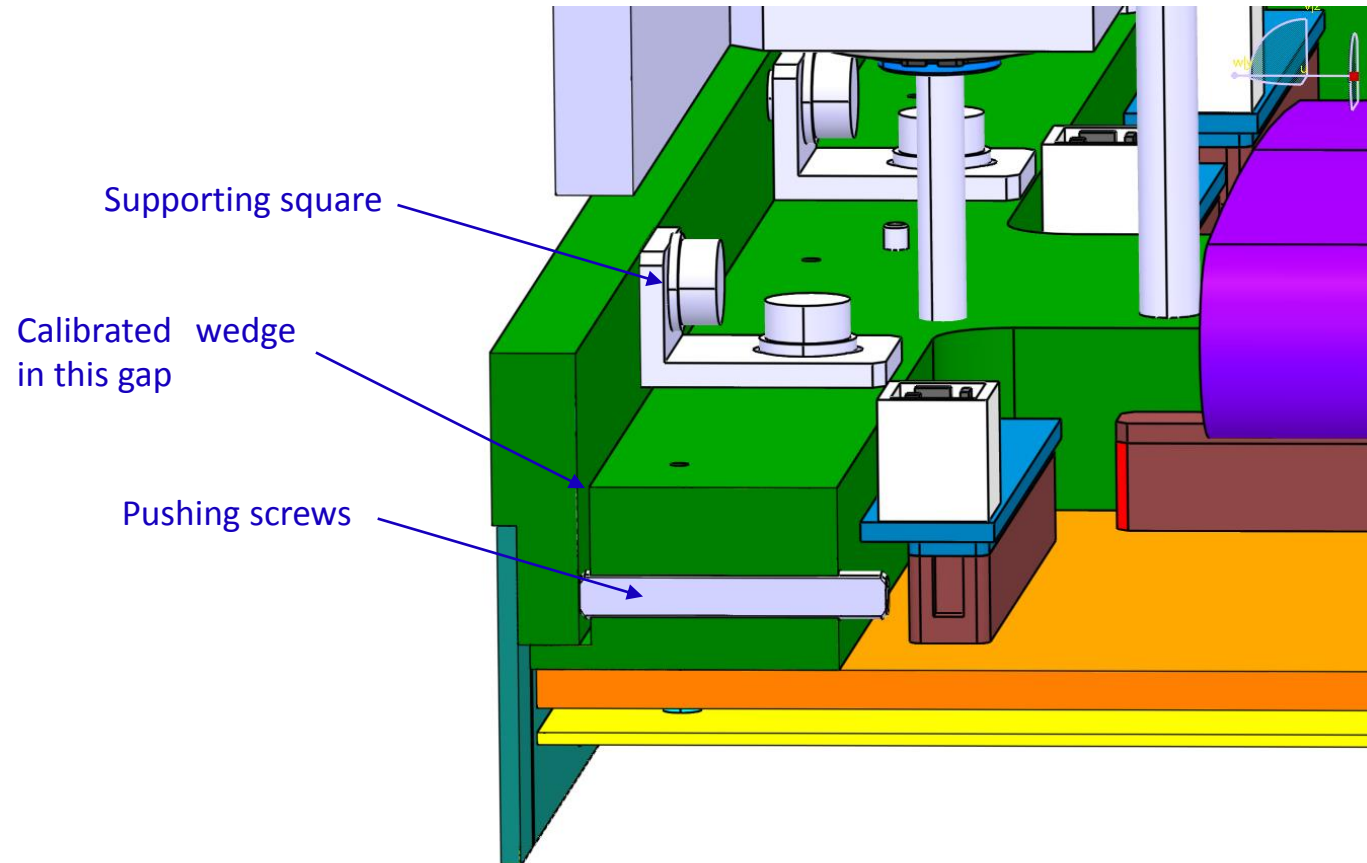
Extraction Grid

- Extraction grid's wires are soldered on supporting PCB plates, assembled on a supporting beam



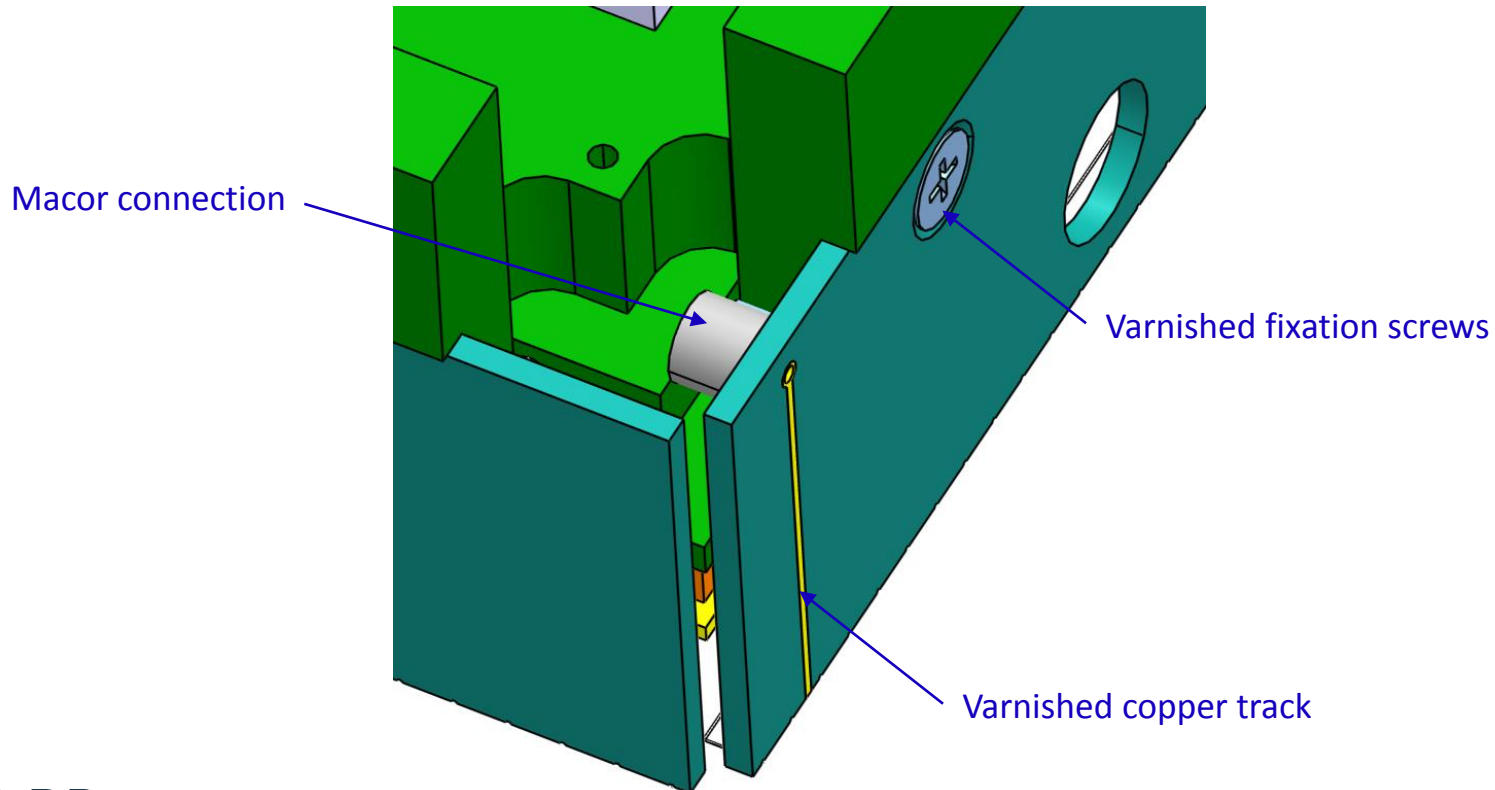
Extraction Grid

- Grid tensioning is performed by tightening « pushing screws », adding a calibrated wedge, and locking the supporting square



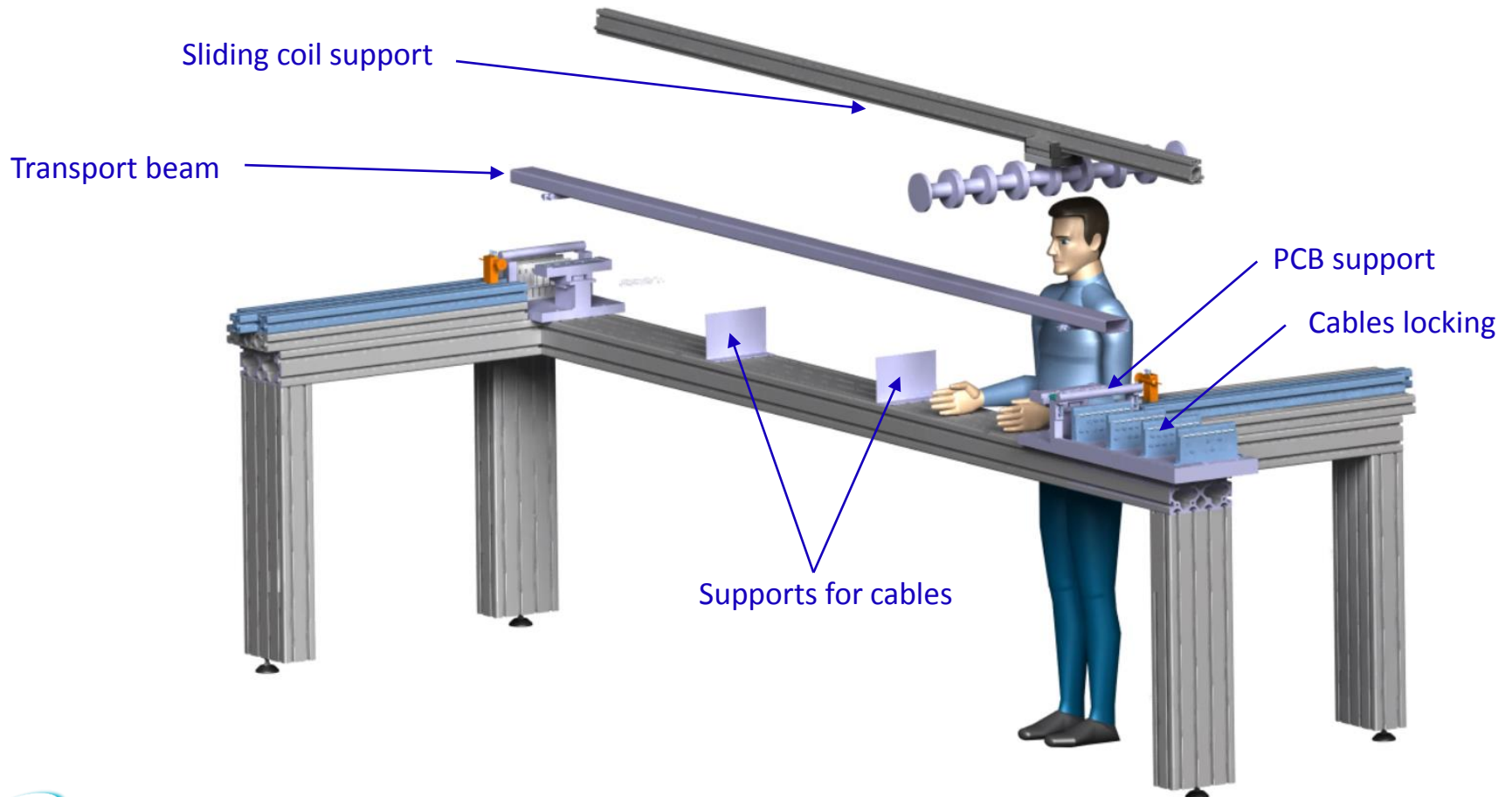
Extraction Grid

- At each angle of the 3x3m module, a PCB is equipped of a copper track for HV supply
- HV supply of other cables is realised by contact
- The copper track is varnished to avoid sparking
- The cable is soldered inside of the module, covered by a Macor cylinder, and glued with araldite
- Fixation screws (floating potential) are varnished to avoid loading then sparking



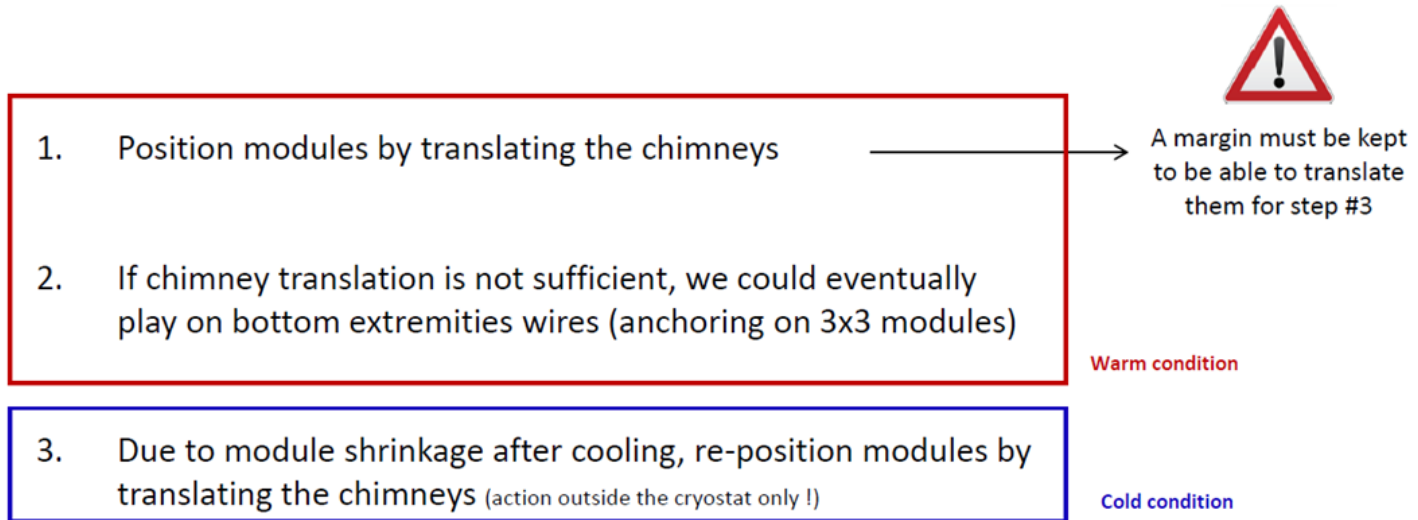
Tooling for Grid production

- Manufacturing of the grid is performed on a special bench
- Completed assemblies are transported on a special beam
- More details on next TB



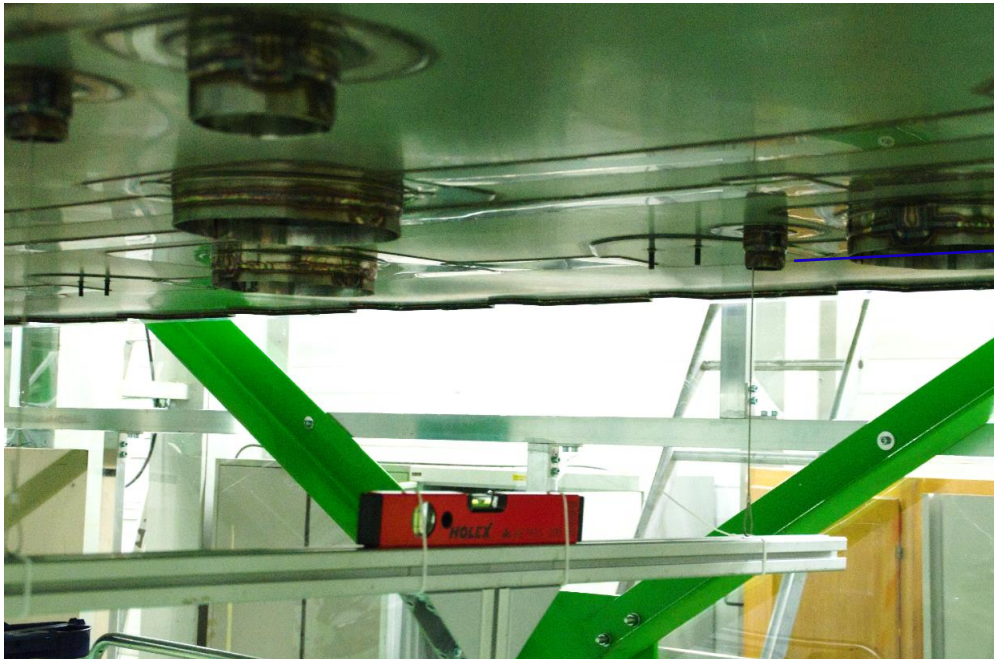
Suspension cables anchoring system

- Secure the required position of modules by doubling the position adjustment mechanism
- First mechanism on top of cryostat / second one inside in case the suspension cable is in contact with the crossing pipe leading to a module not at the proper location



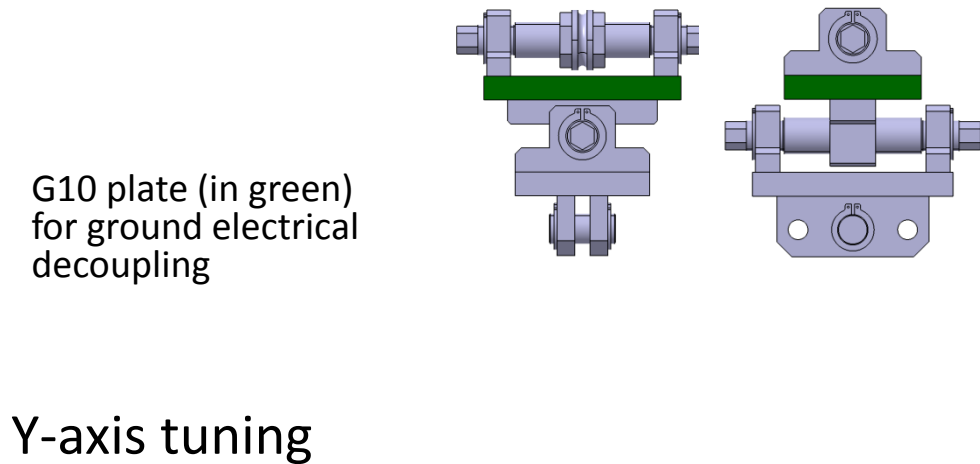
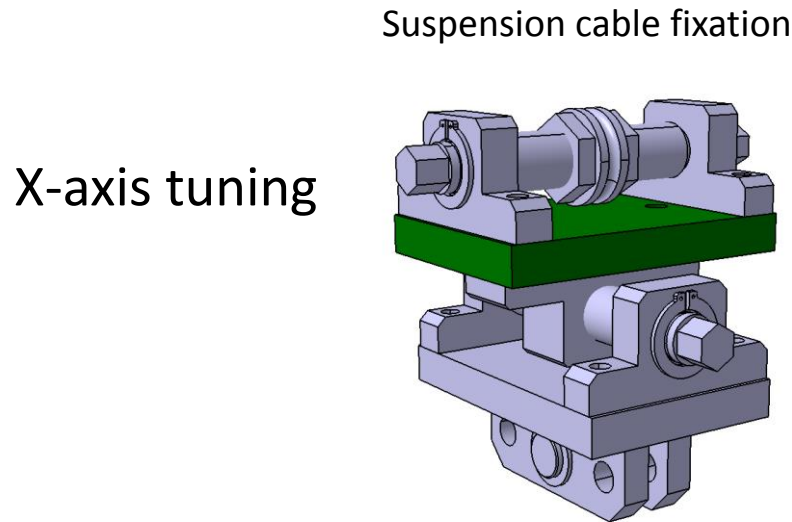
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Suspension cables anchoring system

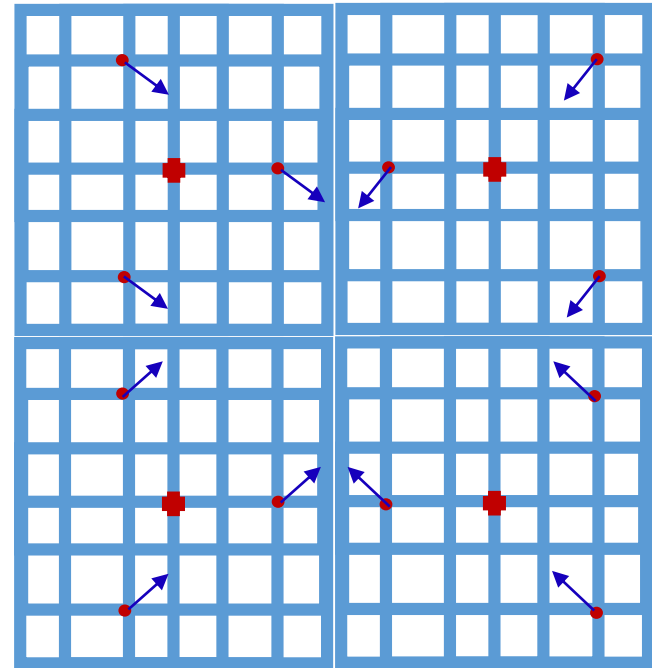
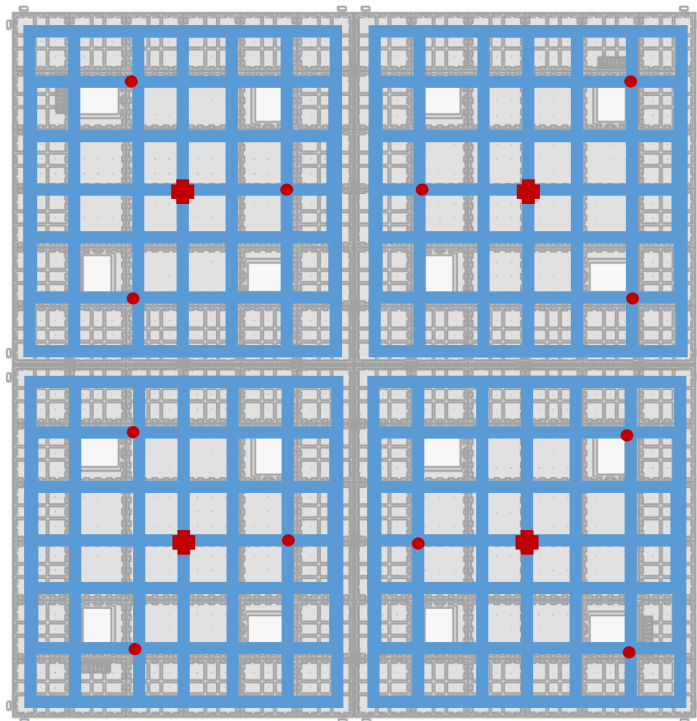
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Locking device to invar frame

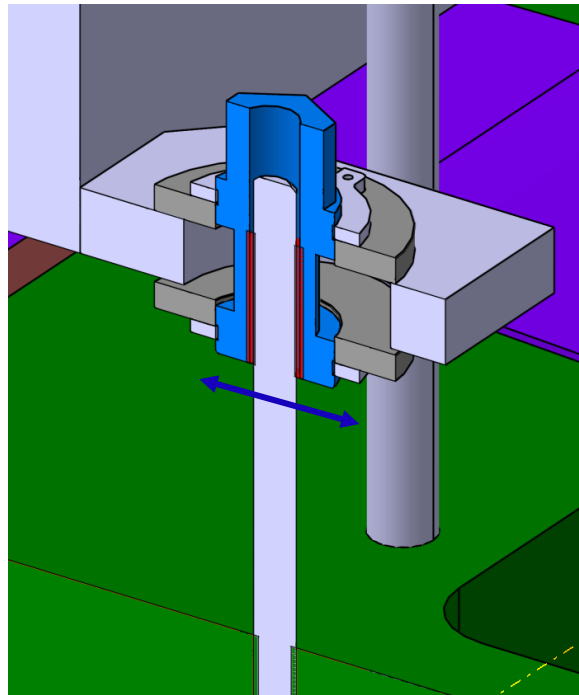
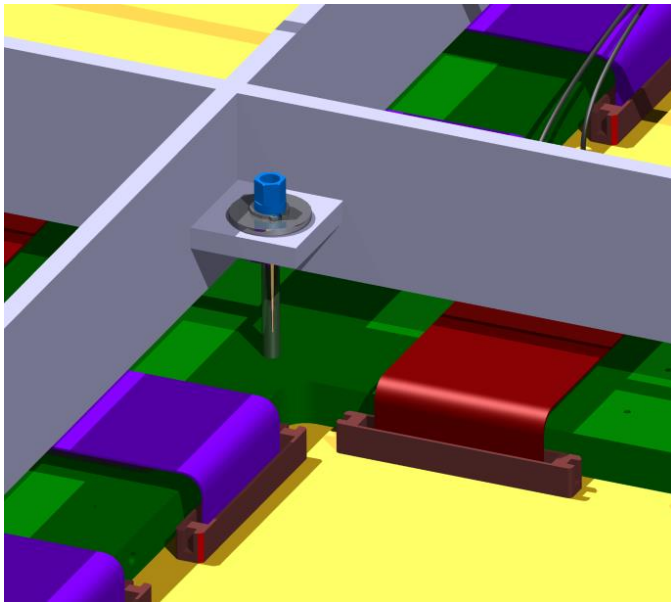
Thermal contraction pattern

- The contraction center of each 3x3m detection plane is at its center
- Once in cold condition, modules are moved thanks to SPFT lateral movement and Distance Meter measurements (see next slides)
- Interspaces between LEMs in cold conditions :
 - *0,5-0,8mm inside a 3x3m module*
 - *< 10mm between two 3x3m detection area*



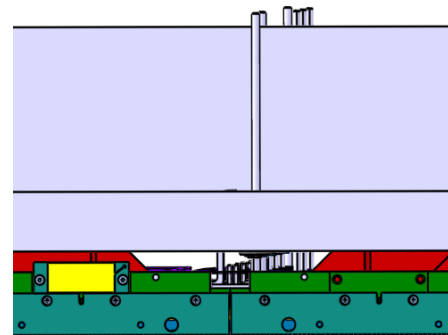
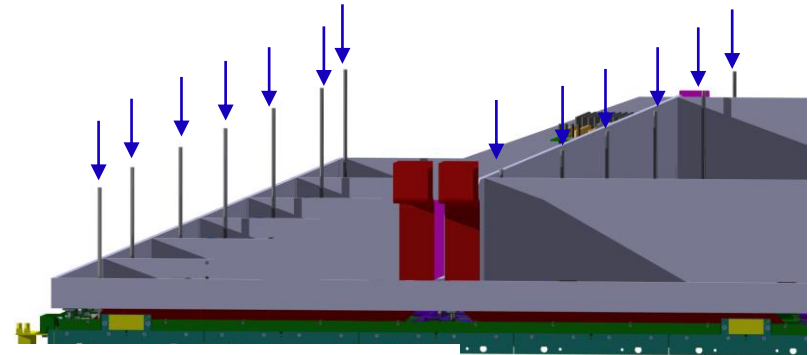
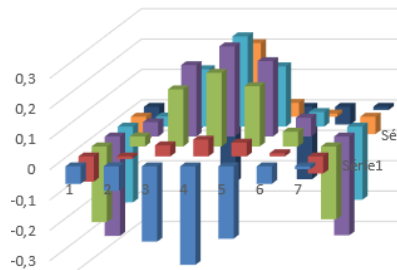
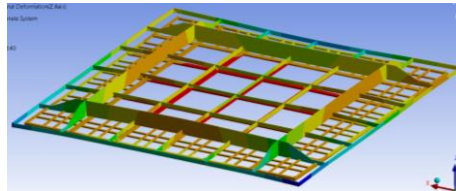
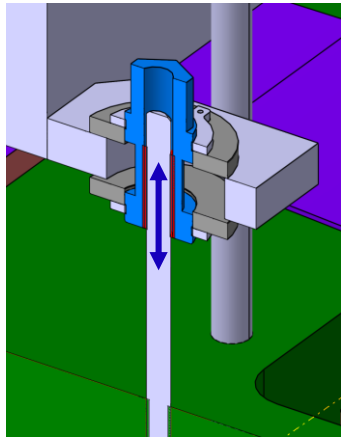
Thermal Decoupling

- During cooling, Invar is keeping its dimensions while G10 frame and LEMs/Anodes are contracting
- Thermal decoupling allows a lateral sliding of the G10 frame, conserving the altitude
- Decoupling systems are installed at each corner of the invar frame (50 systems by 3x3m module)

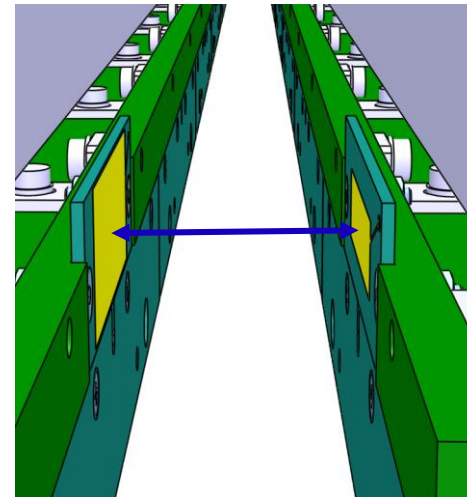
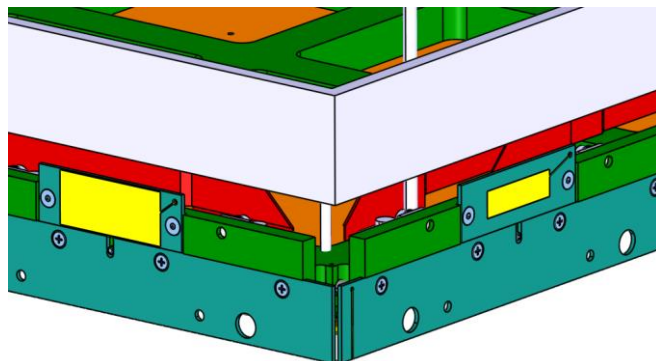
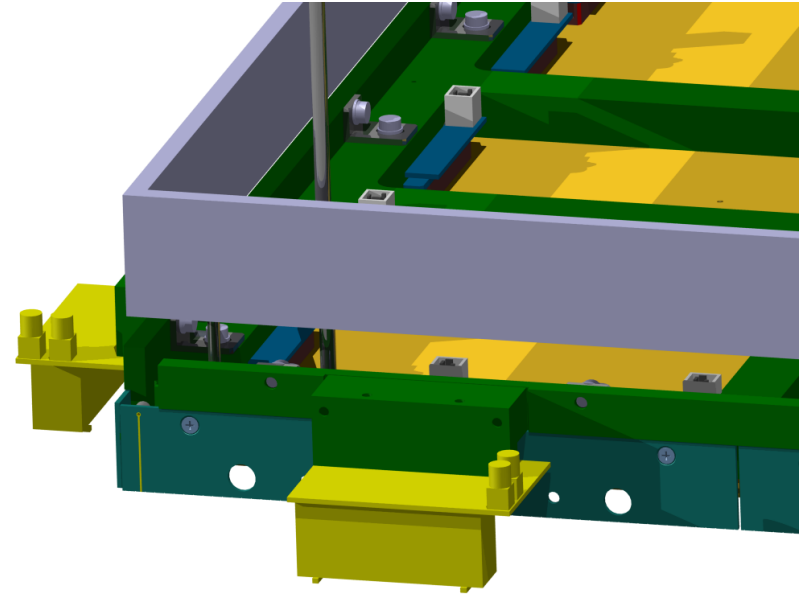


Planarity tuning

- Thermal decouplings are also used for planarity tuning
- Planarity is measured in warm condition thanks to rectified rods, seen from an optical level
- Deformation of the whole module has been calculated and optimised
 - Including extraction grid initial tension and contraction and sliding of the thermal decouplings.
 - Calculated final planarity defect is about 0,75mm.

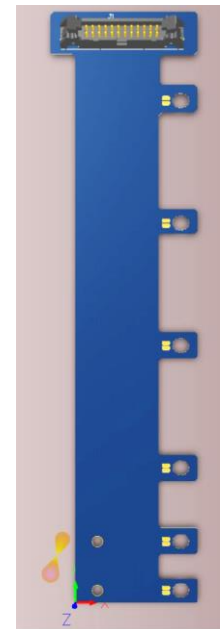
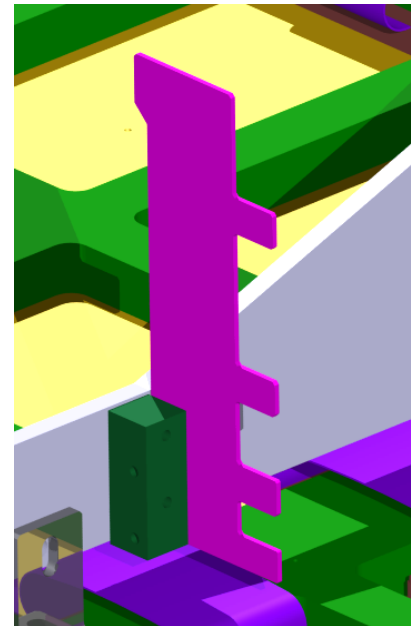
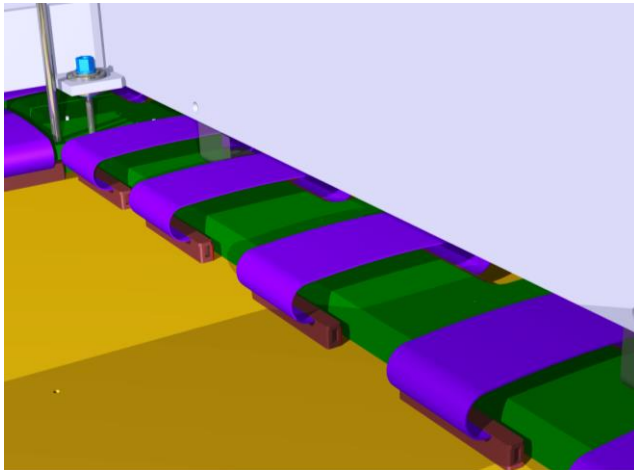
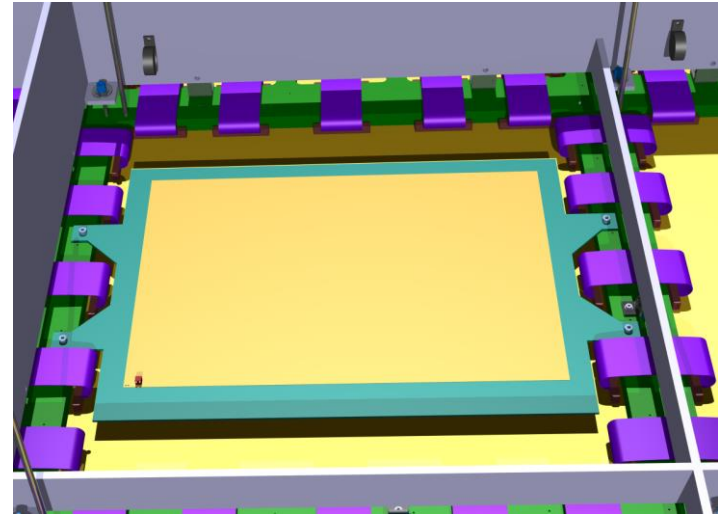


- Level Meters
 - 4 devices by external side of the 6x6m
 - Fixed on a very stiff G10 support
- Distance Meters
 - Gives informations on module's relative positions
 - Capacitive measurement, no contact
 - 4 devices by 3x3m side (contact side)



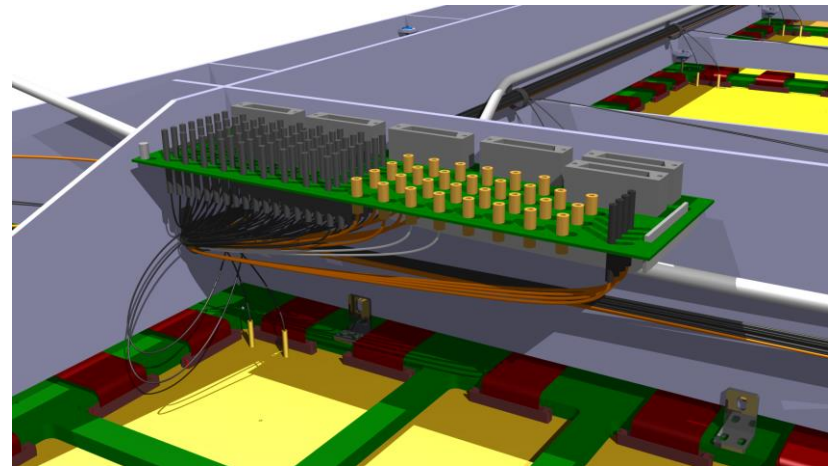
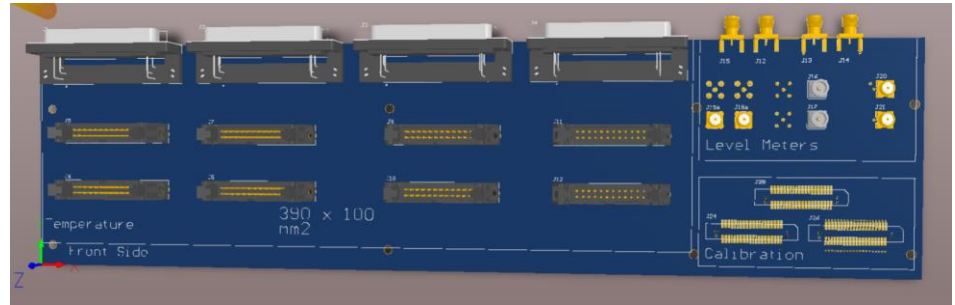
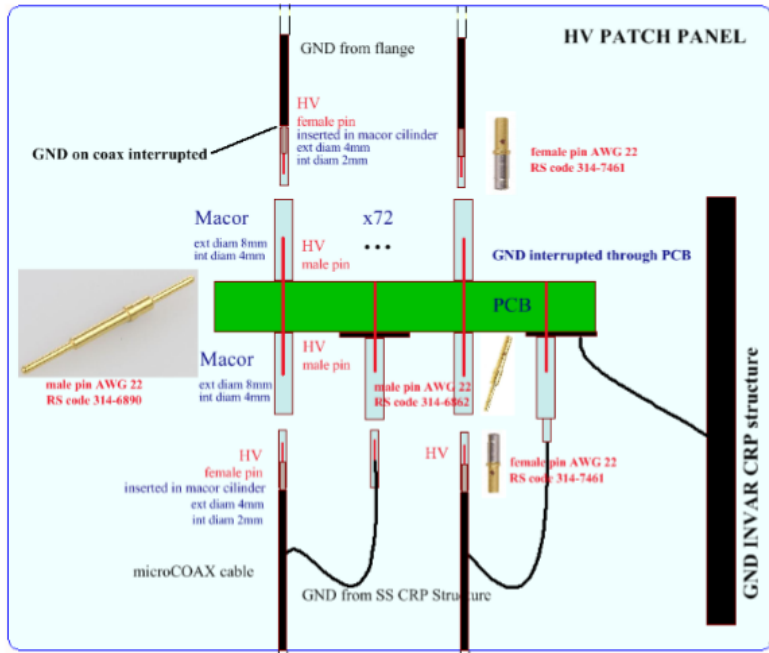
Instrumentation

- Heaters
 - *Fixed on a dedicated G10 plate*
- Thermometers
 - *Fixed on G10 blocs*
- Jumpers
 - *Re-shaped to be more flexible*

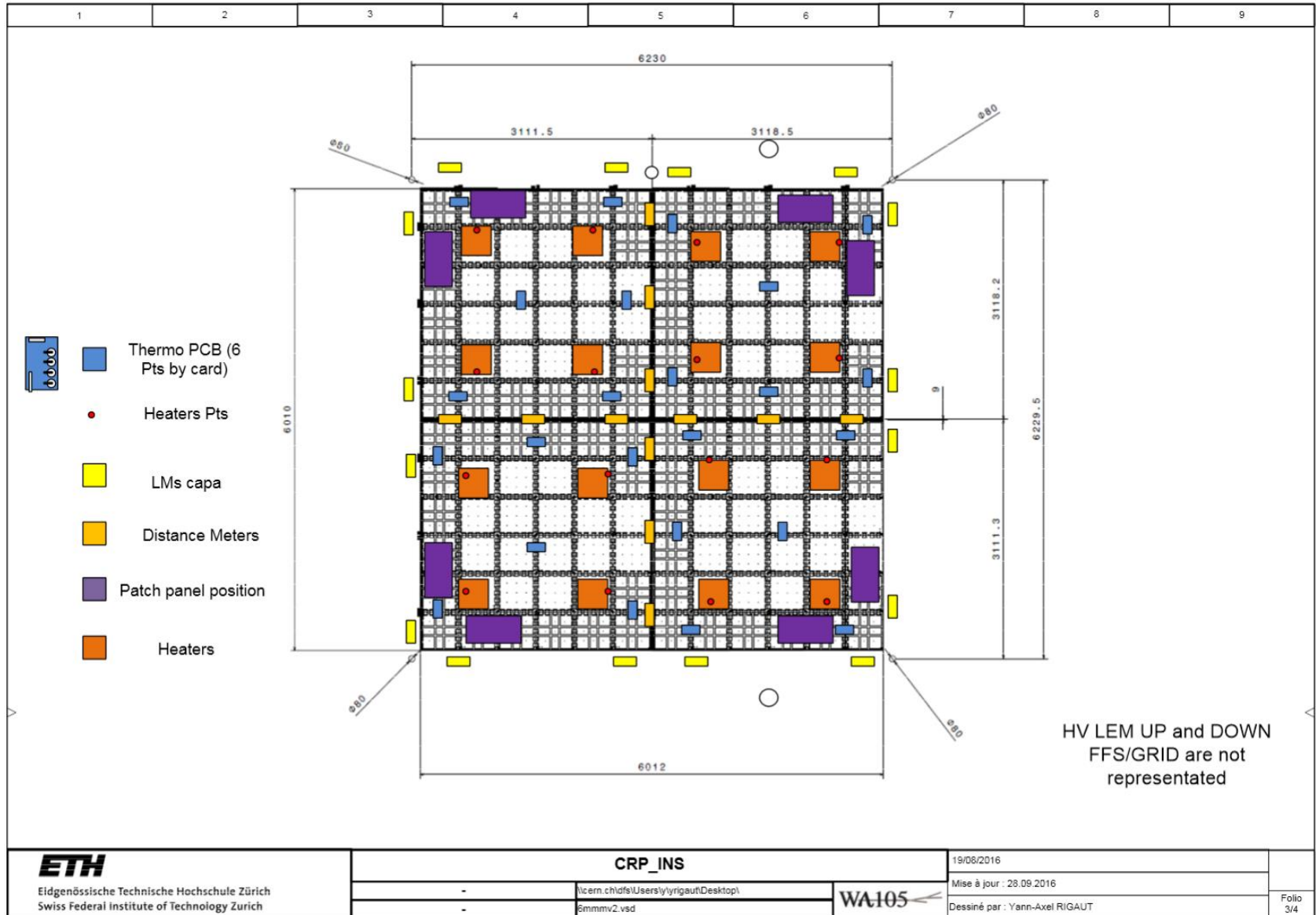


Instrumentation - Patch Panels

- Instrumentation from the module is connected first to Patch Panel, then Patch Panel to Cryostat
- Designed by Cosimo in collaboration with Conflectronics
 - *Signal and HV panels separated*
 - *Special Macor connector for HV*

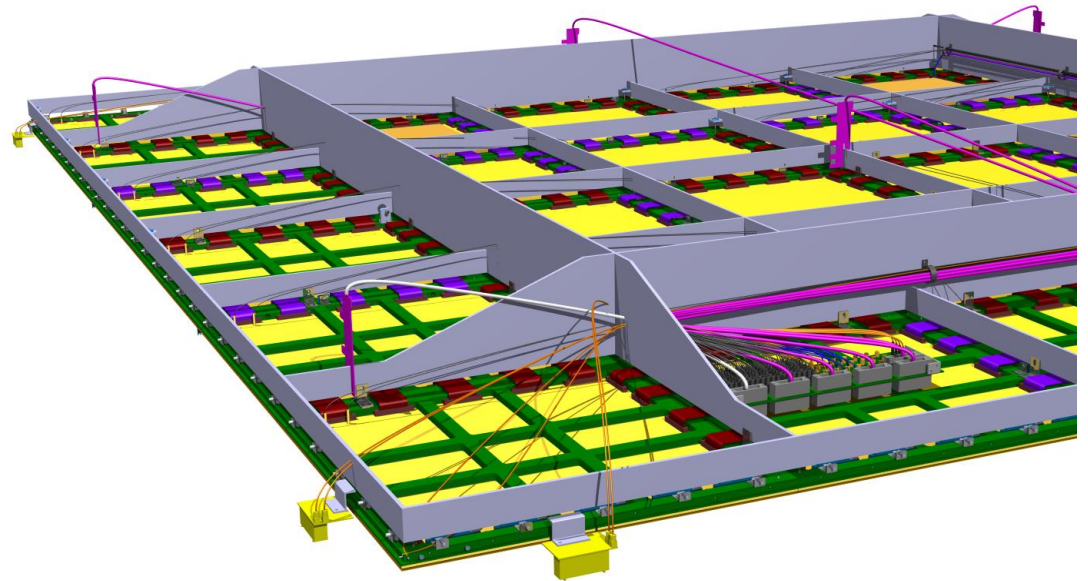
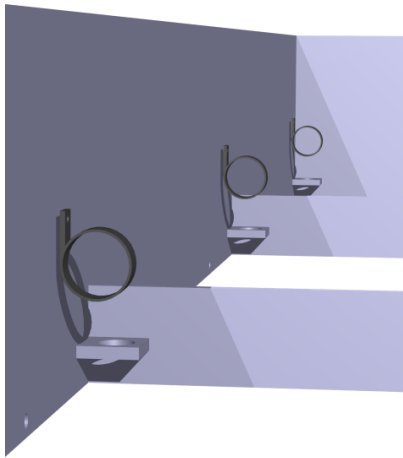
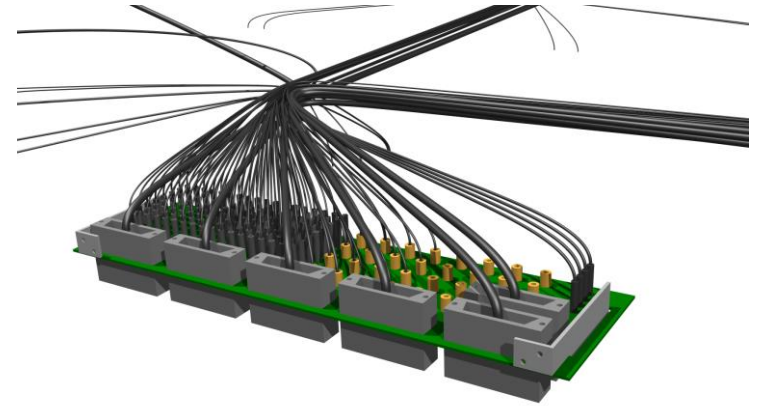


Instrumentation (Schema from Yann-Axel)



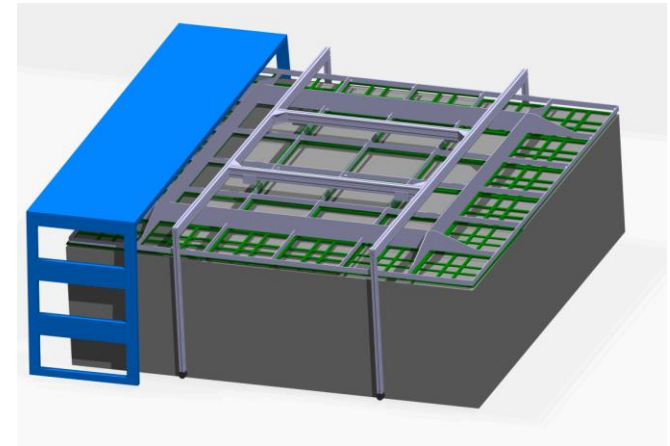
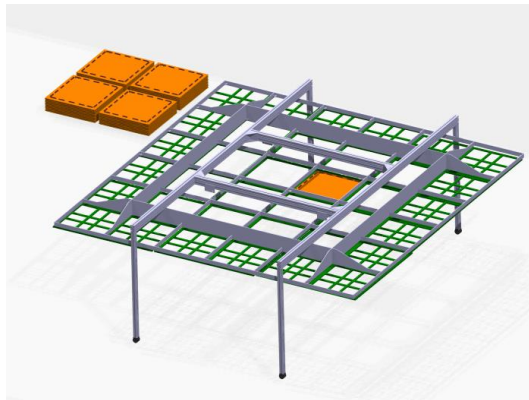
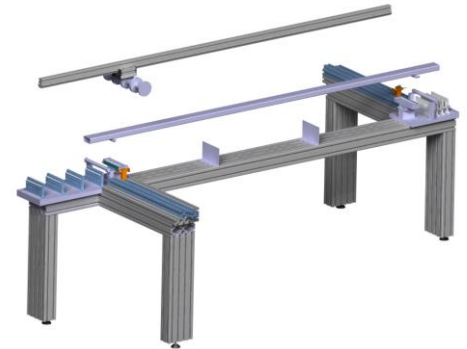
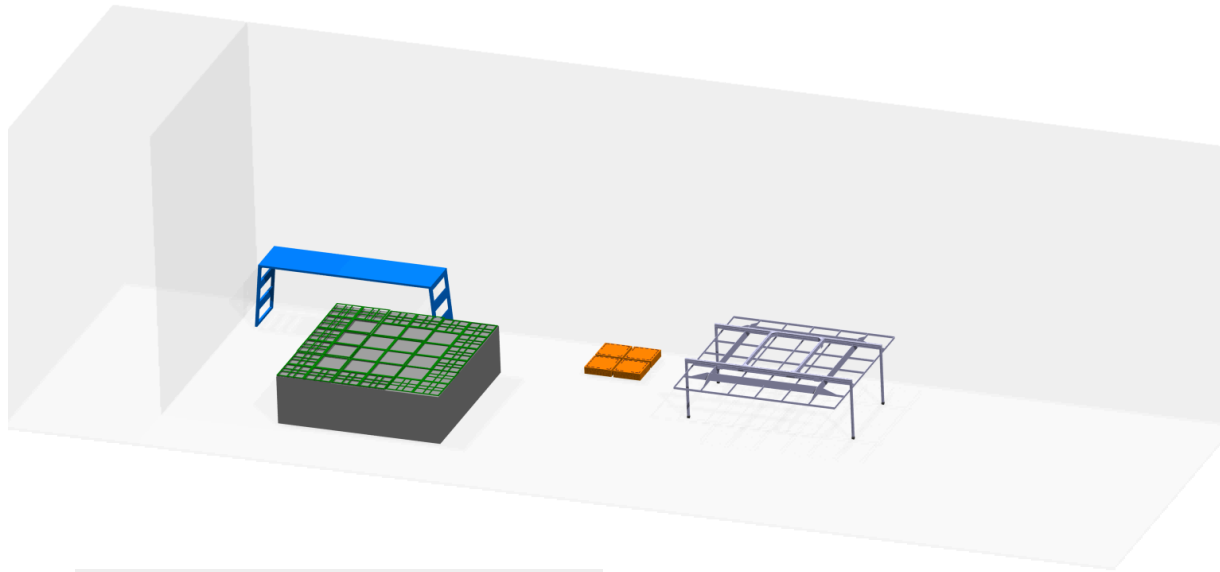
Cabling

- Final cabling will be performed when geometries of devices are available
- Additional fixation holes and cable supports are foreseen in the invar frame

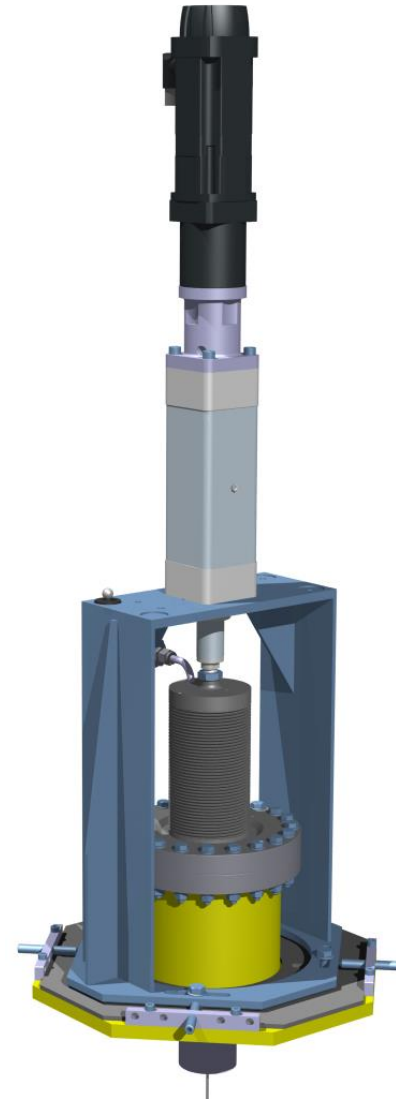


Assembly in clean room, Transport and Installation

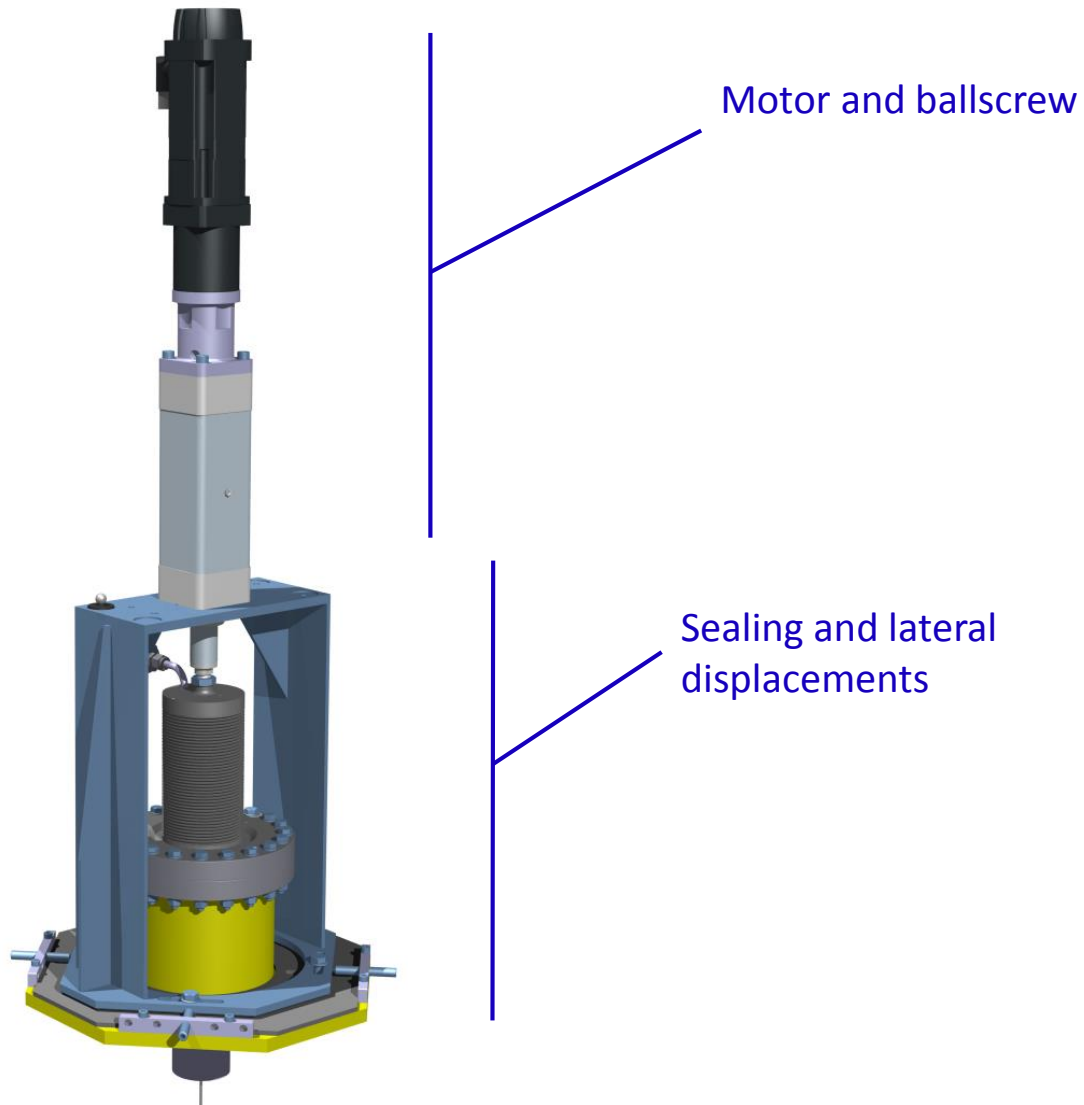
- Still under discussion, will be detailed as soon as possible



Suspension Feedthrough

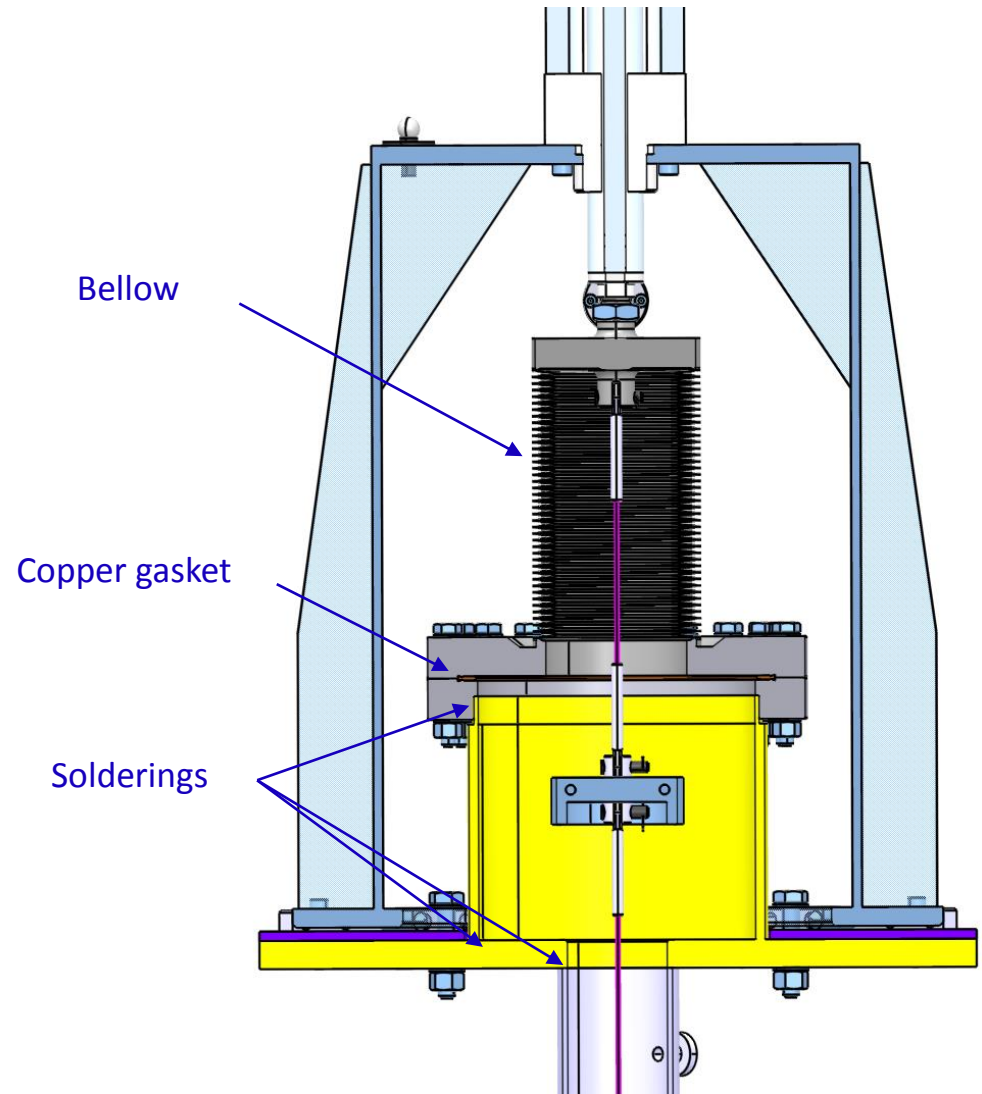
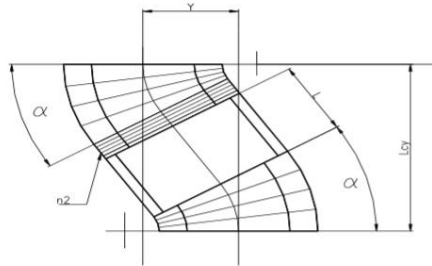


Design & features – Overview



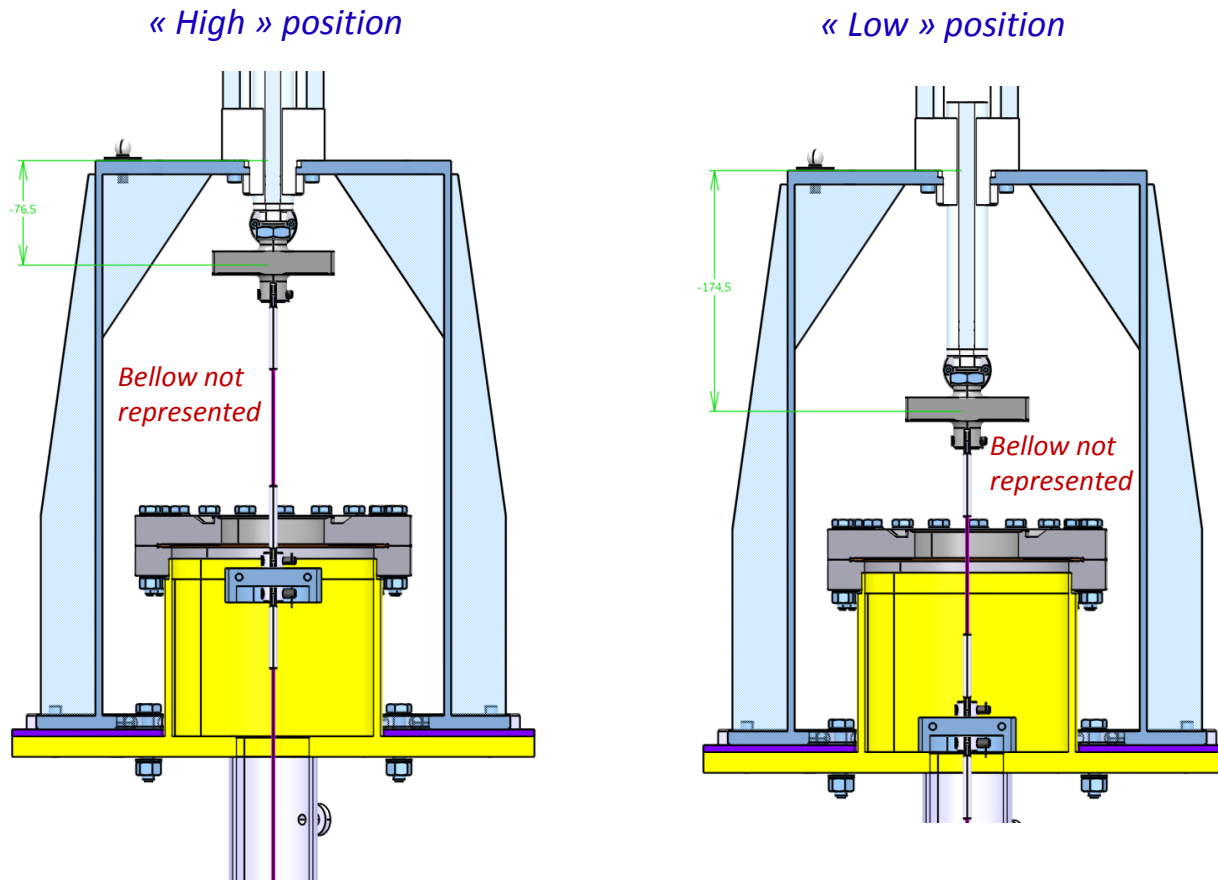
Design & Features - Sealing

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

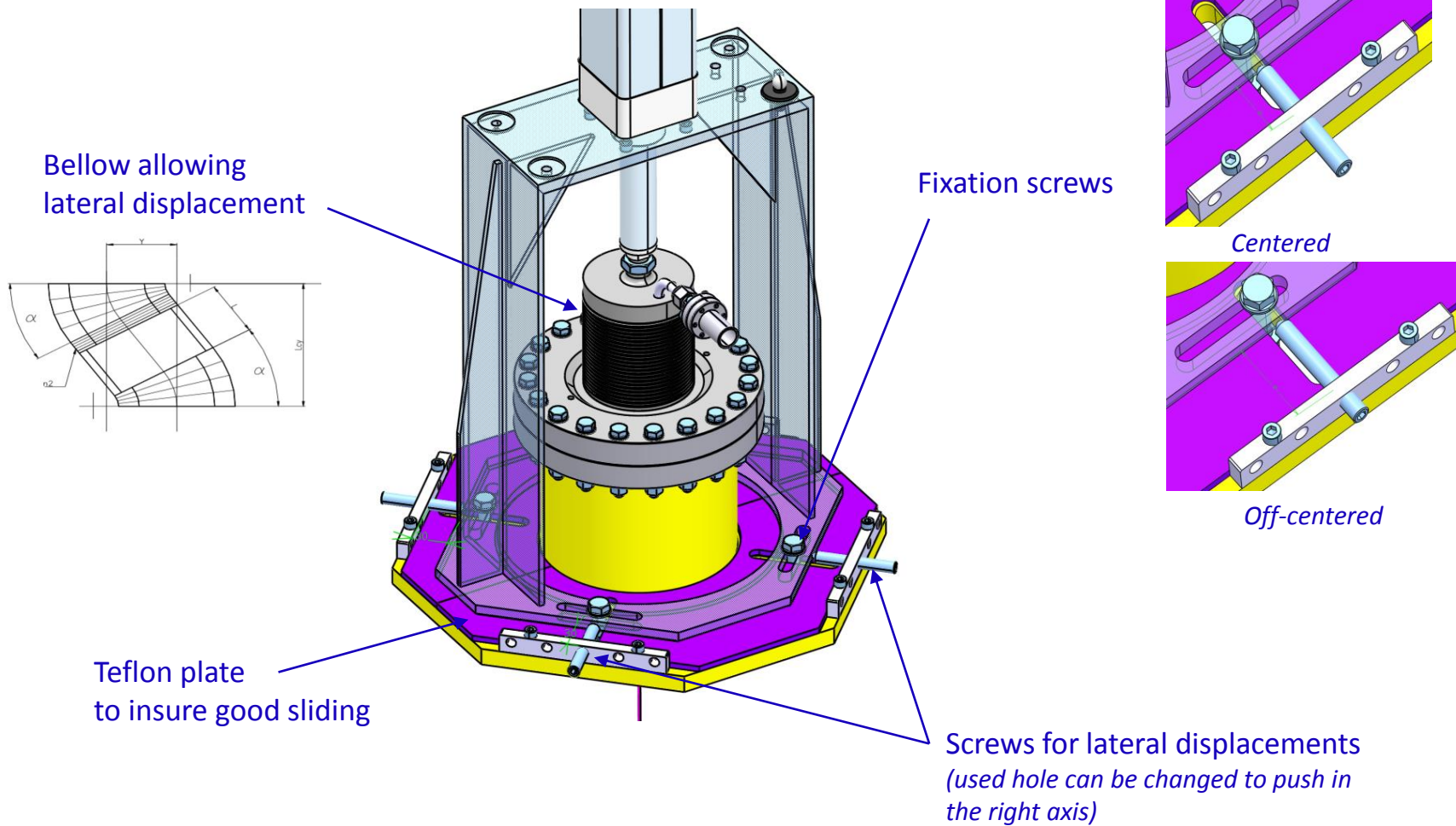


Design & Features – Vertical displacements

- Vertical stroke : **98mm**
 - *Even with max lateral displacement*

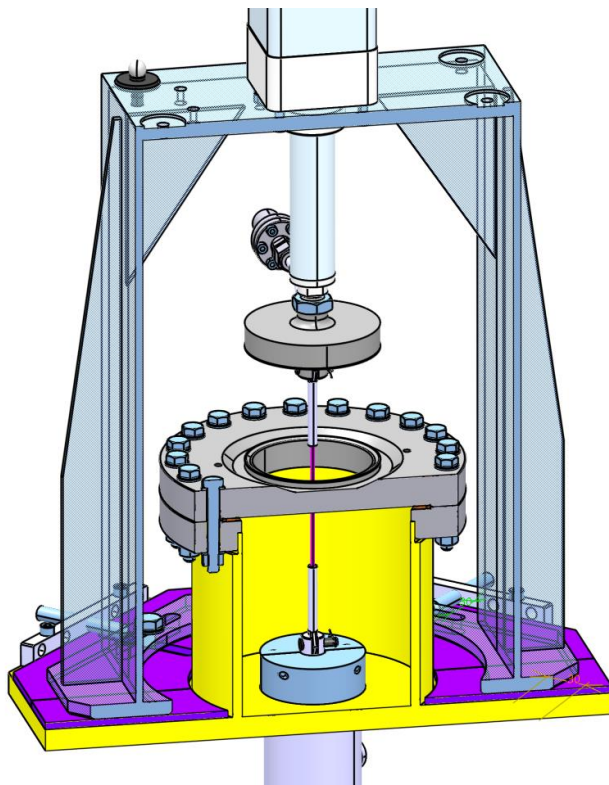


Design & Features – Lateral displacements

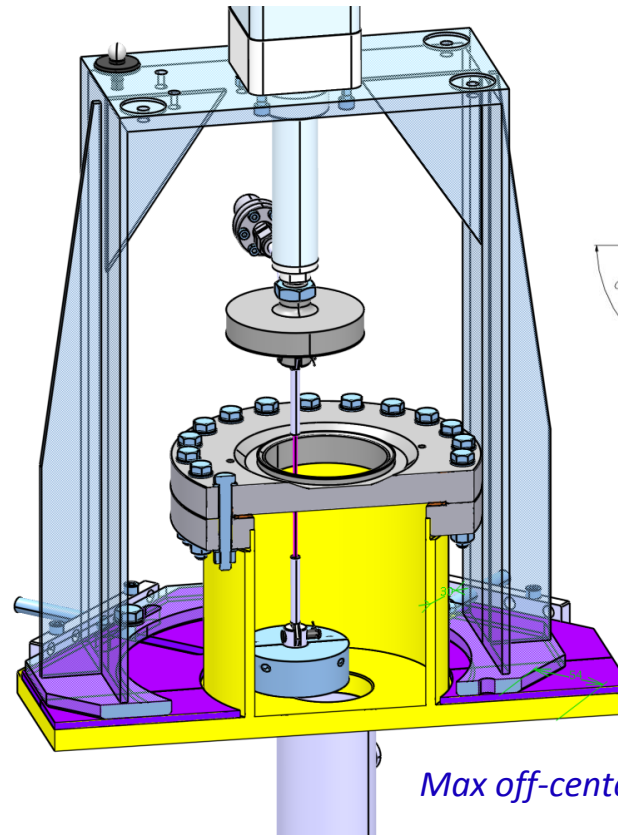


Design & Features – Lateral displacements

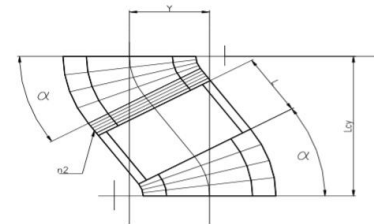
- Lateral stroke : $\pm 26\text{mm}$ in each direction
 - (circle $\varnothing 52\text{ mm}$)
 - Bellow system is covering the whole motor physical stroke : no possibility to break the system with a wrong command



Centered system

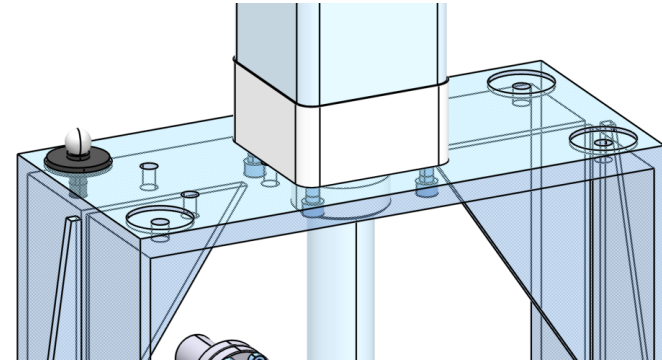


Max off-centered system

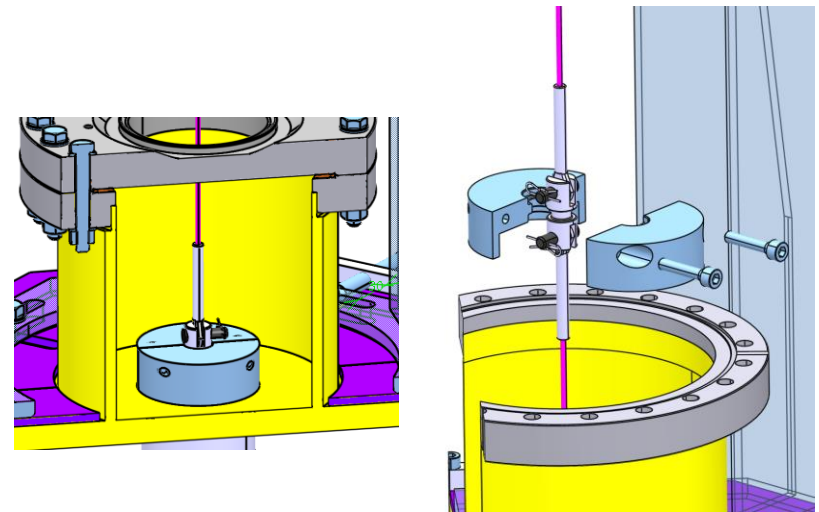


Design & Features – Additional features

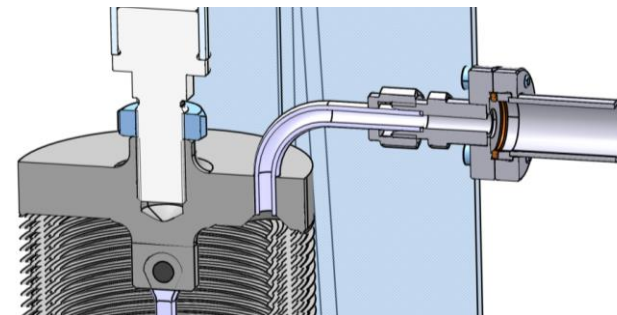
- Special slot for Laser Tracker target
 - *SPFT position monitoring during installation*



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

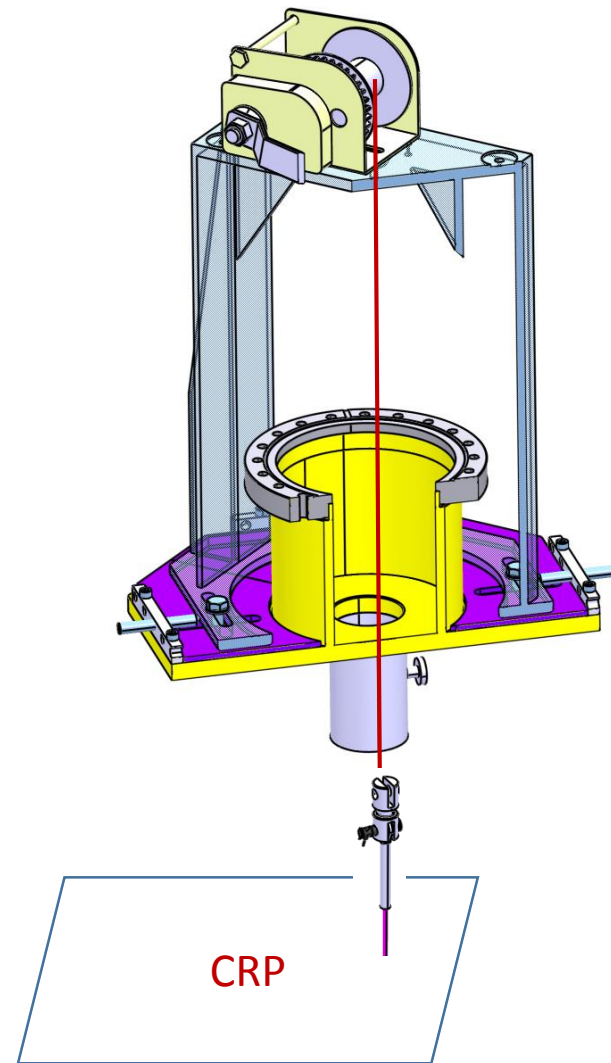
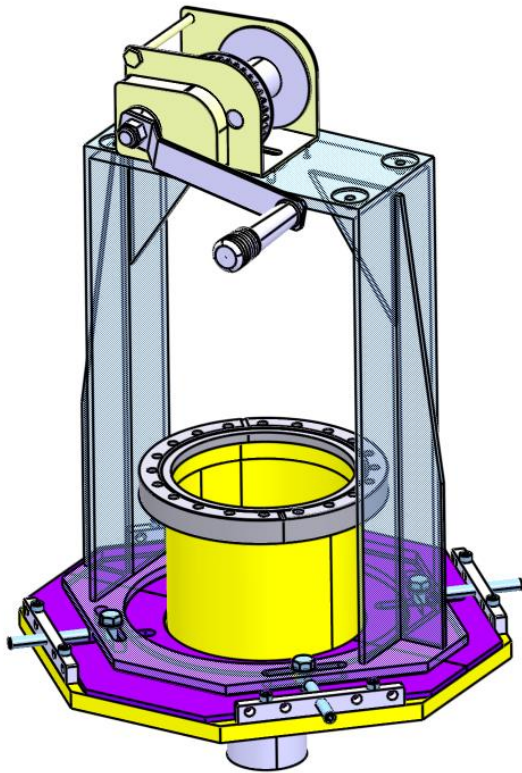


- Air purge at the highest point



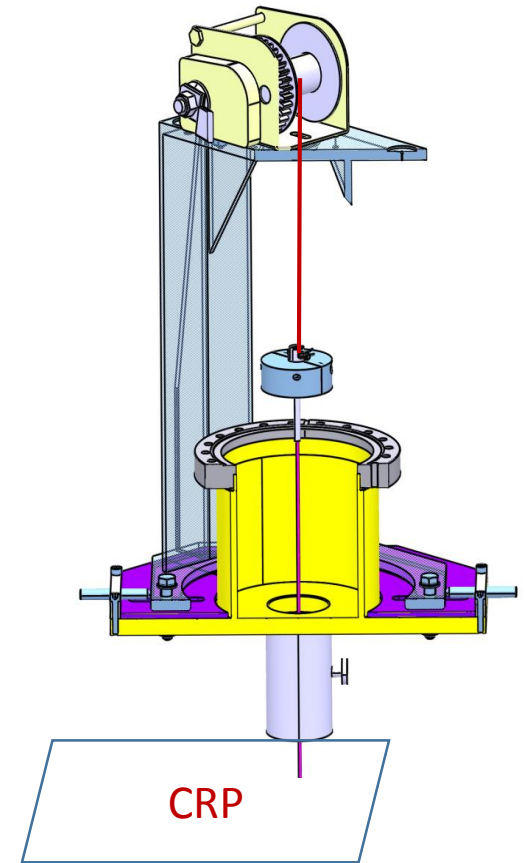
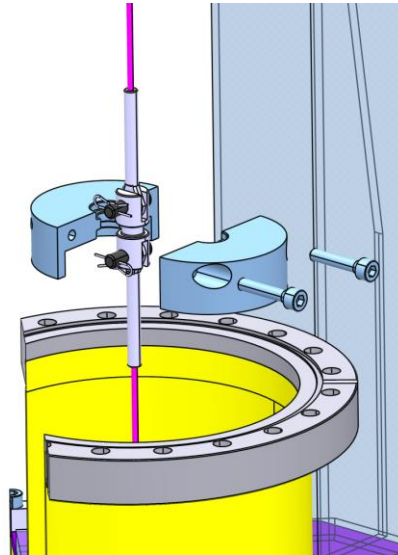
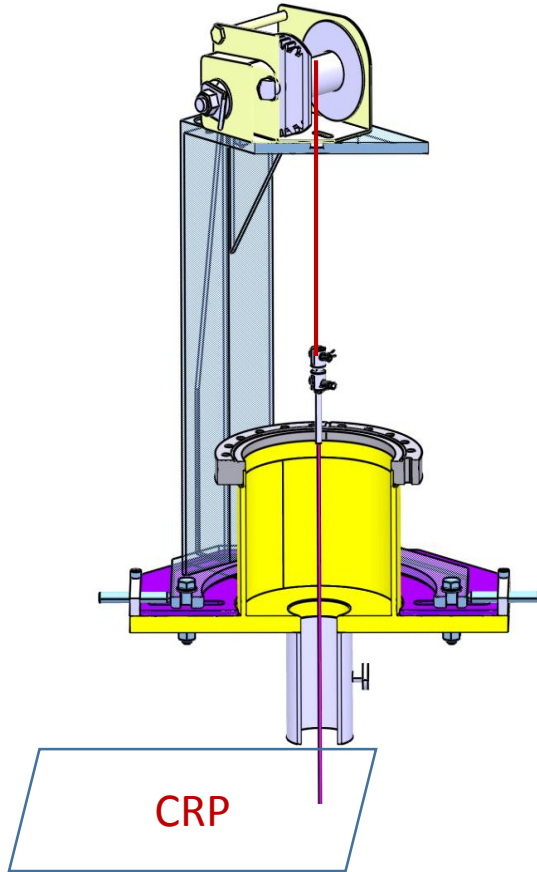
Installation procedure on top cap

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



Installation procedure on top cap

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

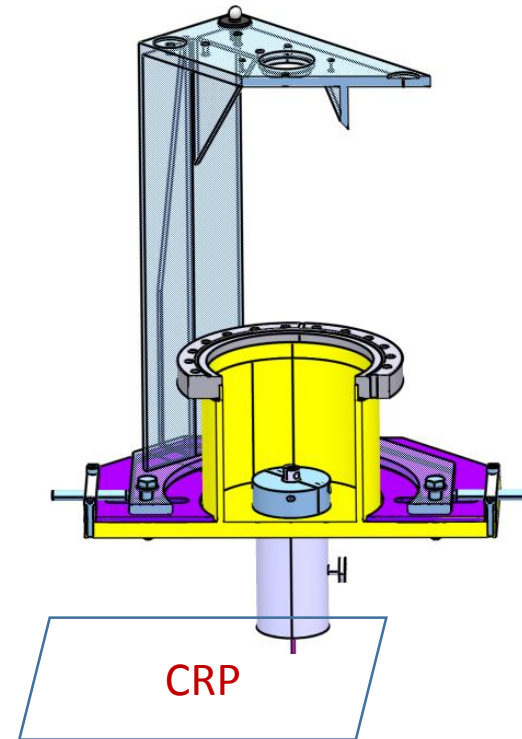
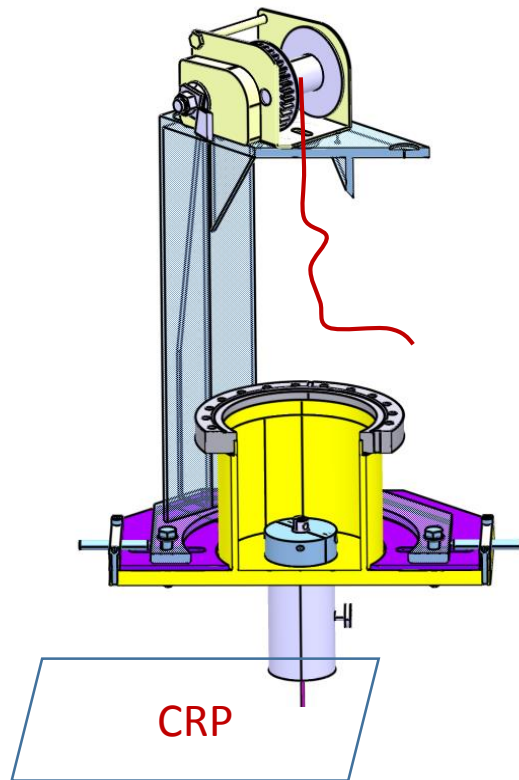


Installation procedure on top cap

The CRP is laid down on the mechanical stop

The winch cable is disconnected

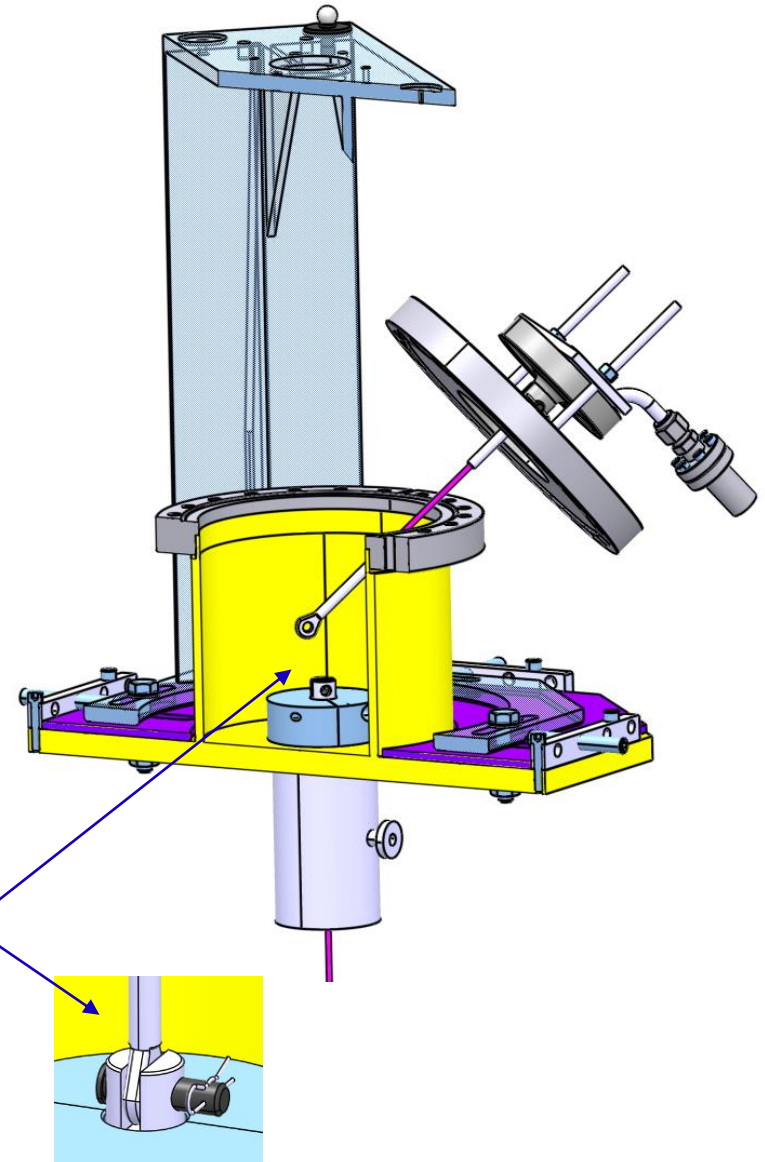
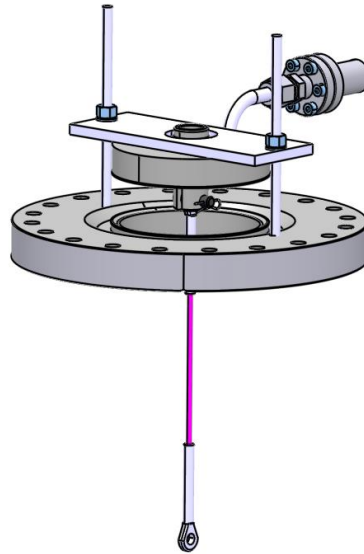
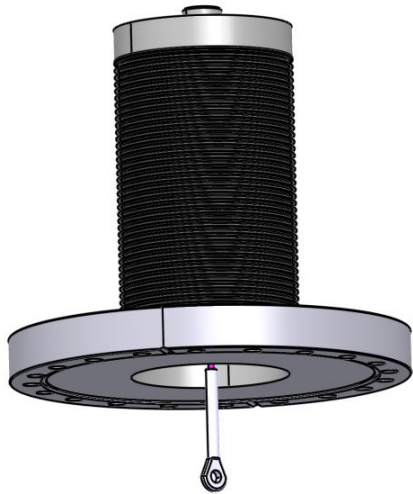
The winch is removed



Installation procedure on top cap

The bellow is compressed thanks to special tooling

The cable from the bellow is connected with a pin



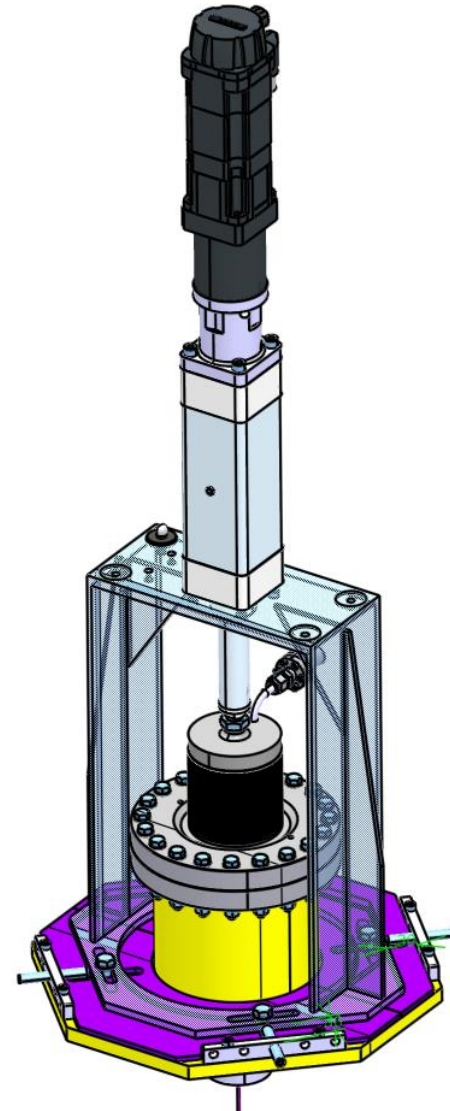
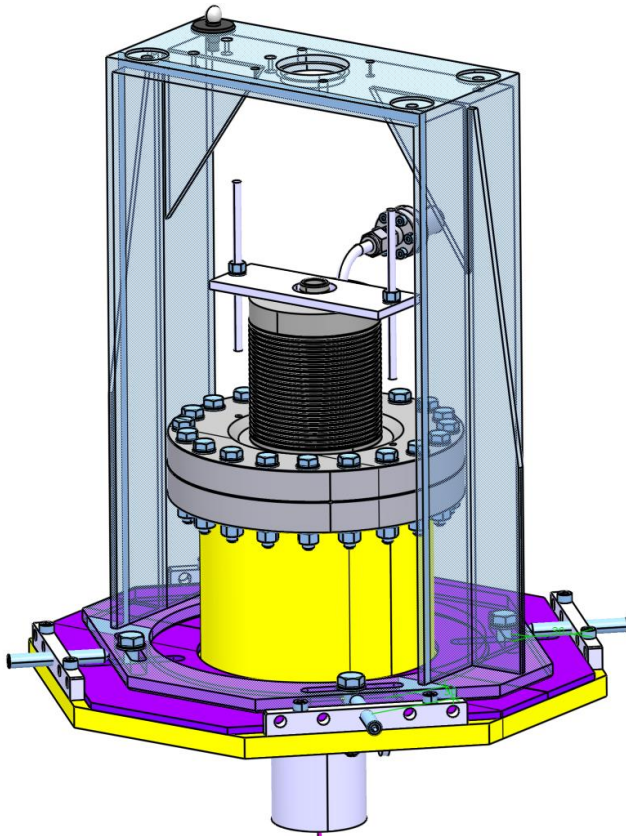
Connection with a pin

Installation procedure on top cap

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

