ESAC Review of the high field dipole design

Magnet structure design, manufacturing, assembly procedure and tests

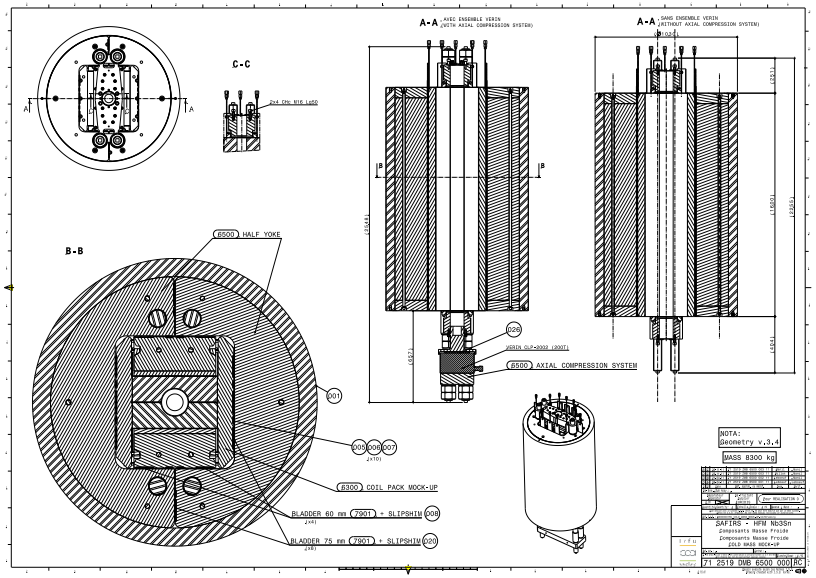
March 2012
for EuCARD-WP7-HFM

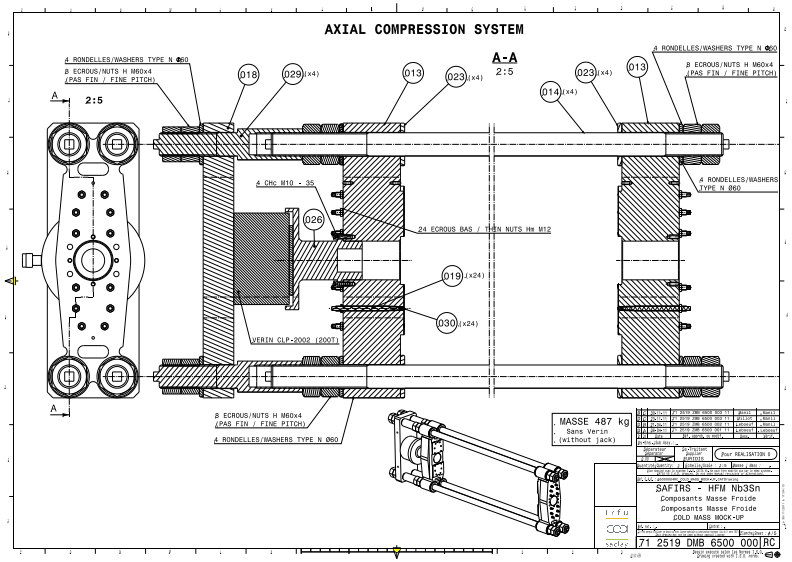
J.C. Perez

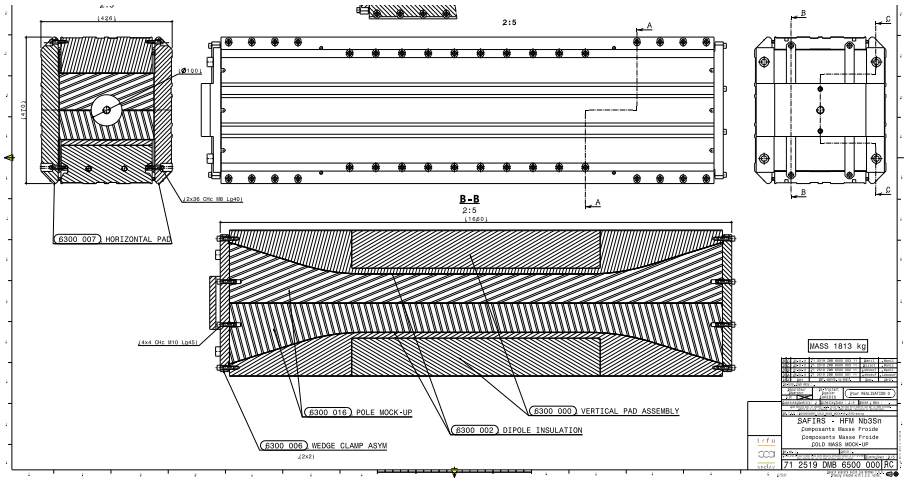
Outline

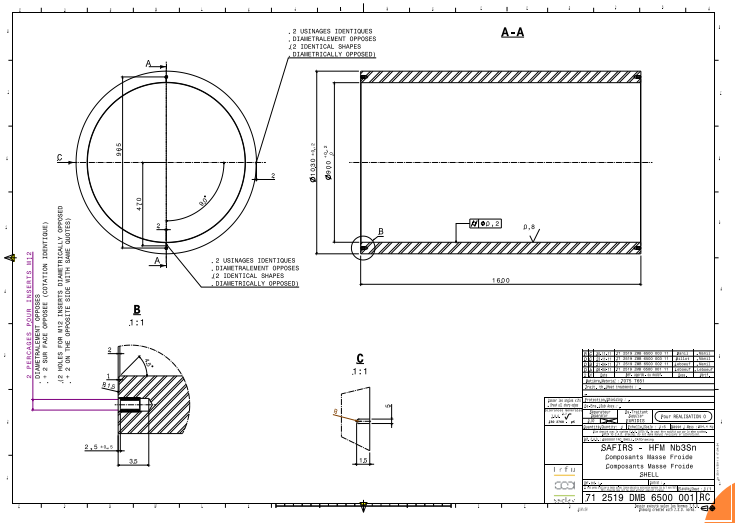
- Magnet structure design
- Manufacturing status
- Assembly procedure
- Preparation for cold tests

MAGNET DESIGN





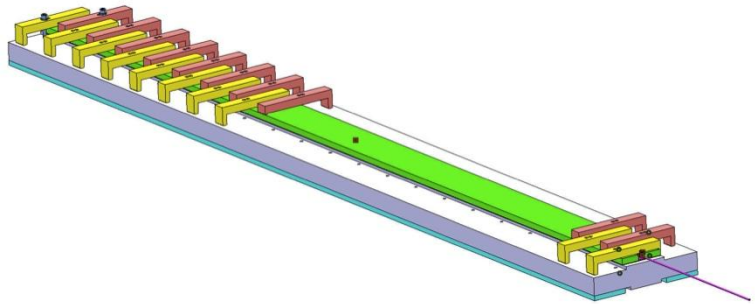




MANUFACTURING STATUS

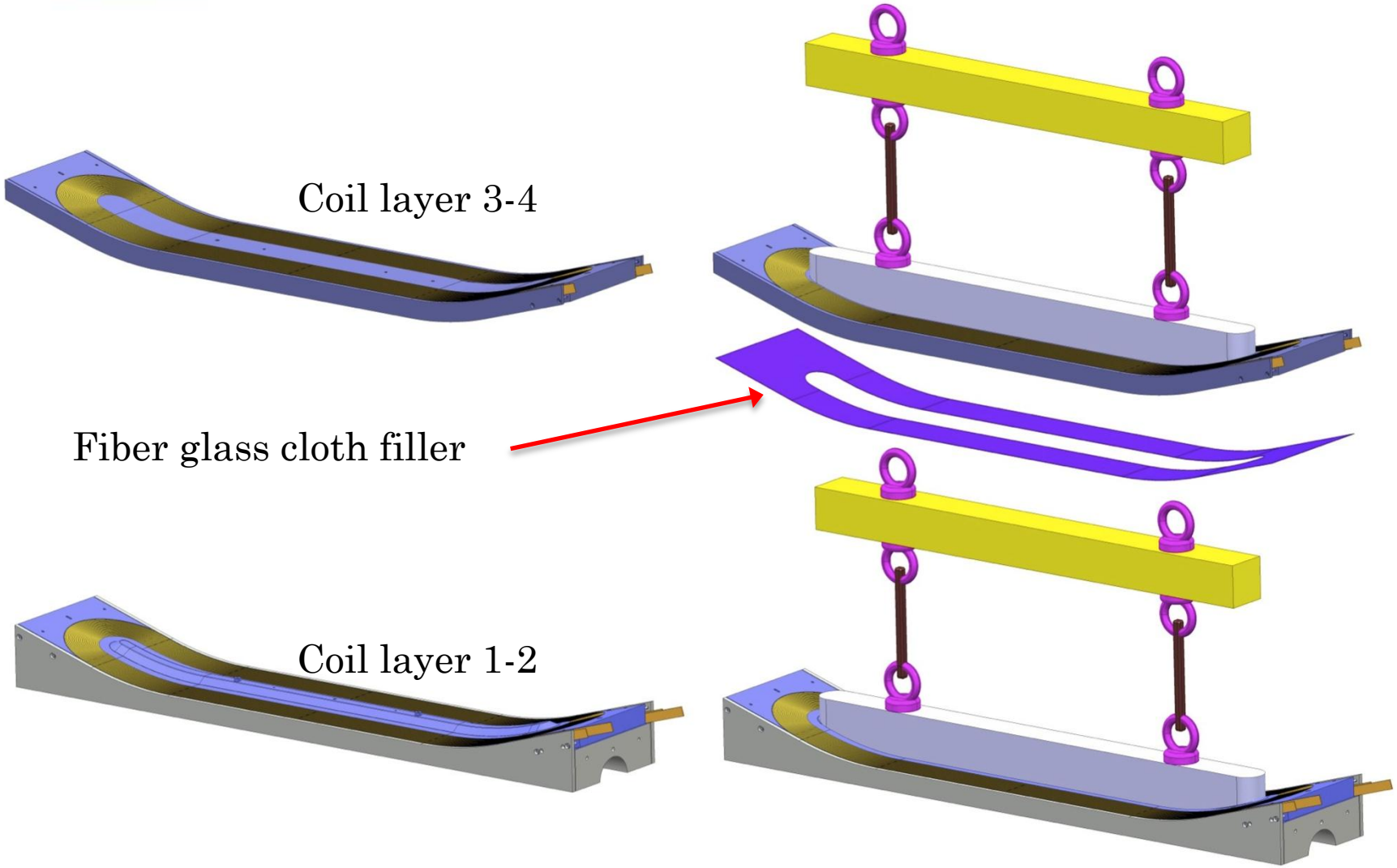
- Price inquiry for the structure launched in September 2011
- The order placed in November 2011 has been split between 3 European companies
  - Cold-mass to Aratz (Spain)
  - Coil-pack (& dummy coil) to Boessenkool (Netherland)
  - Axial compression system to Mectalent (Finland)
- All detailed drawings have been approved in December 2011
- Delivery of all components is expected by middle of April 2012

Work in progress on components



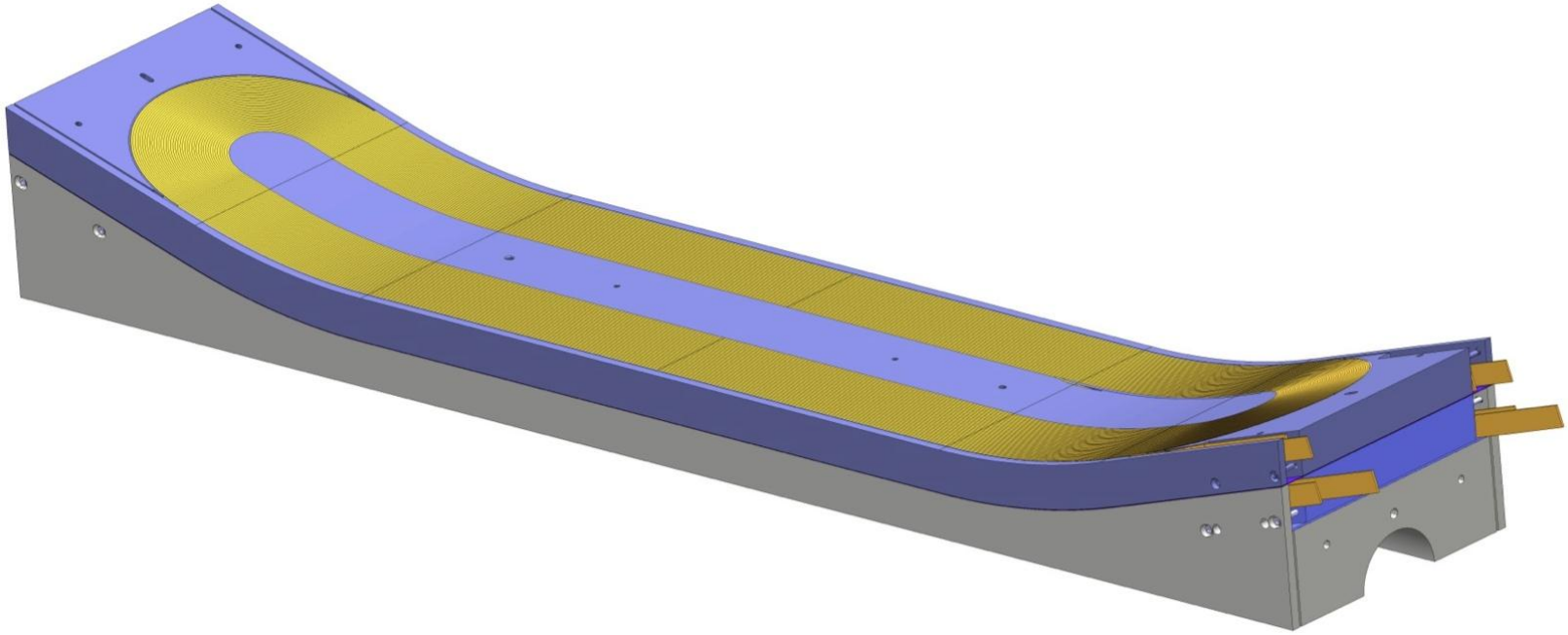
2 sets of Bladders (60 and 75 mm *1600mm) will be produced @ CERN by end of May

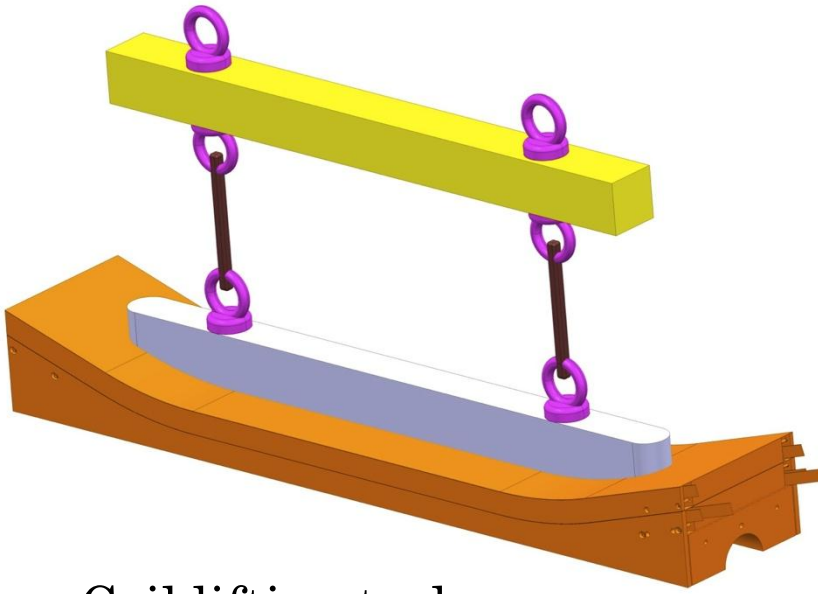
Assembly Procedure



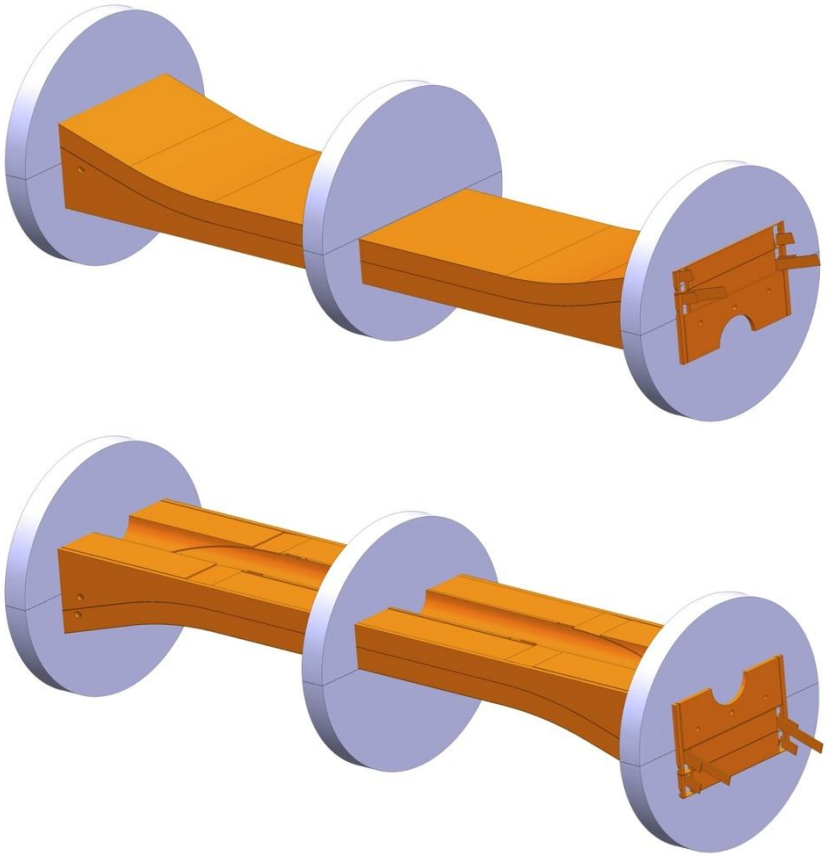
Gap Impregnation

- 2 facing surfaces of the coils will be mold released
- Gap between coils will be filled with 0.9 mm fiber glass cloth
- Impregnation of the fiber glass using the coils as cavity
- This will guarantee a perfect contact between the 2 coils
- This technique will allow to separate the coils in case of failure of one coil

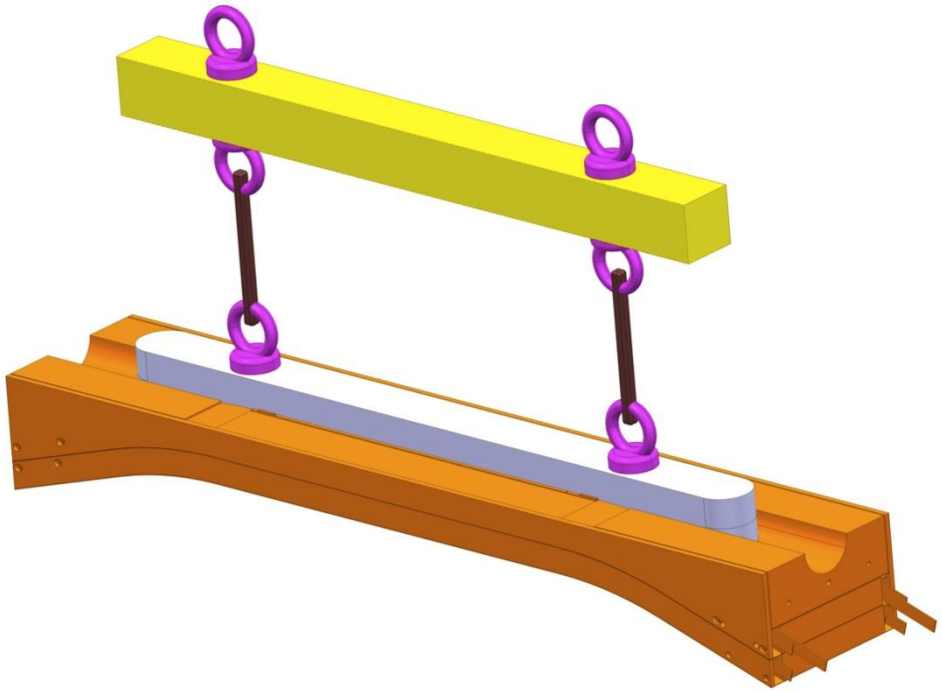


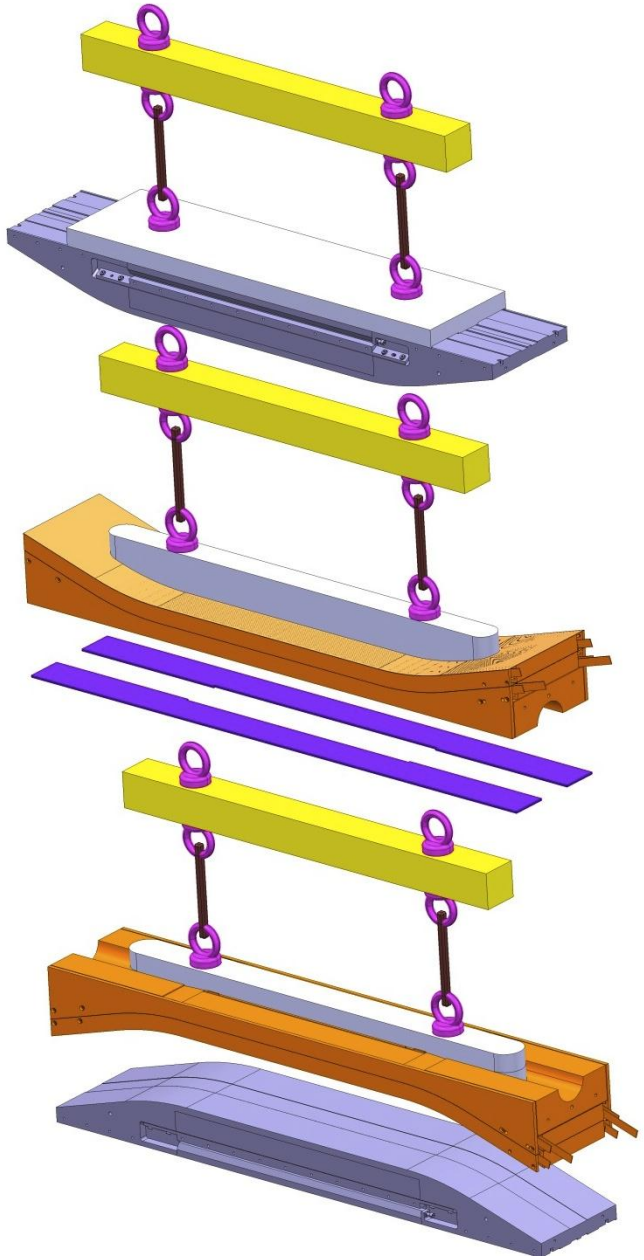


Coil lifting tool



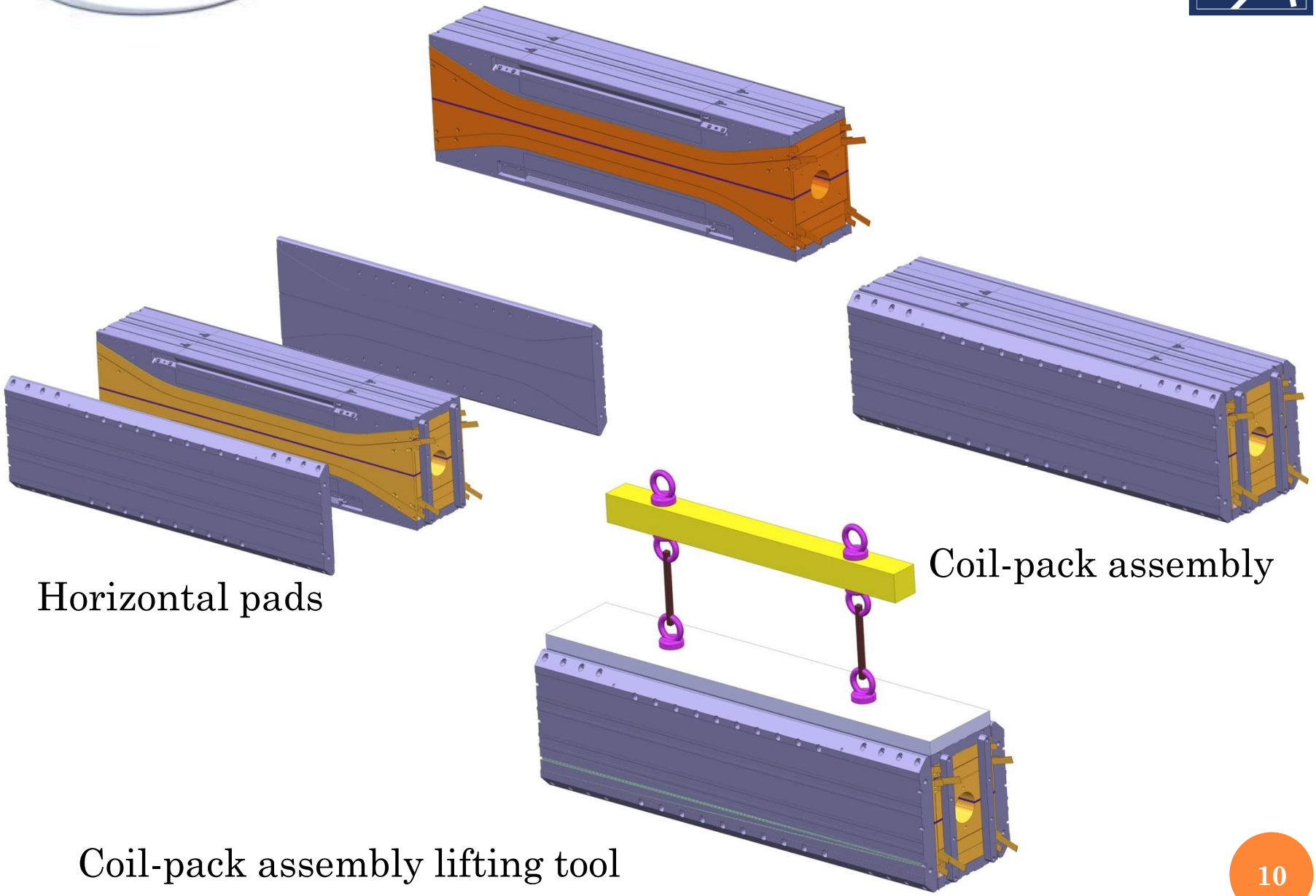
Coil rotation tooling

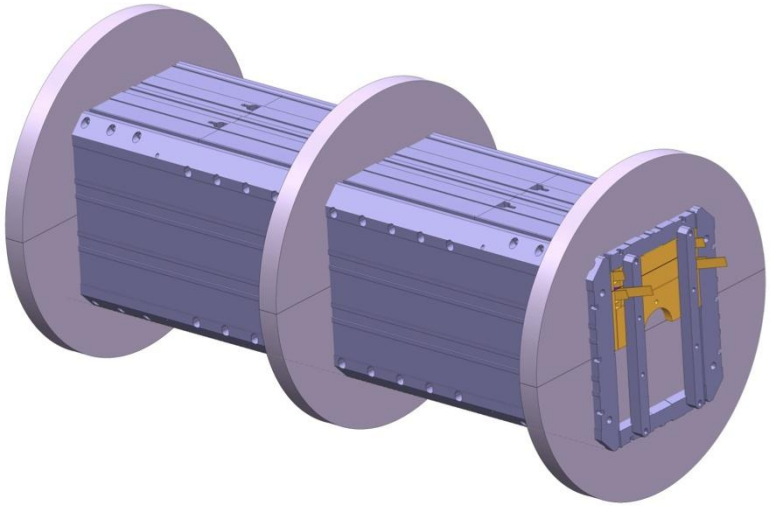


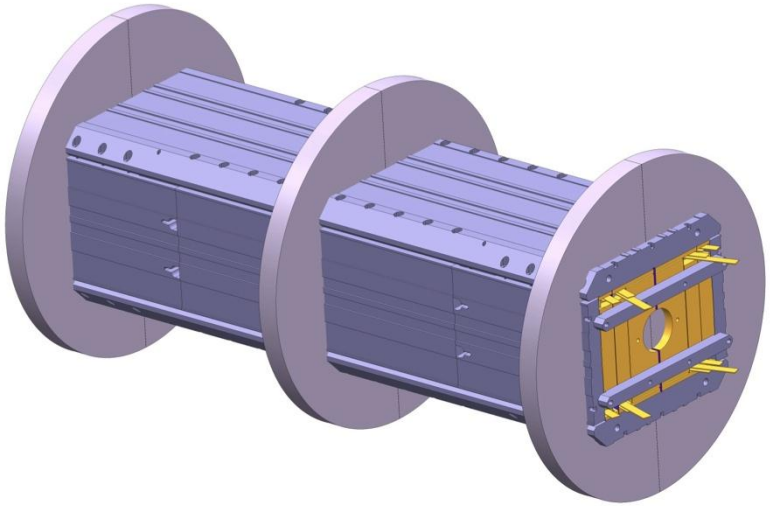


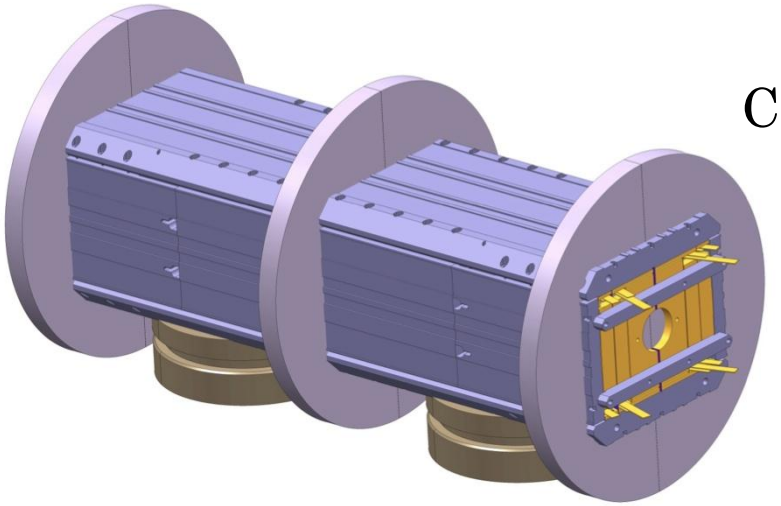
Assembly sequence of the coils in the vertical pads

COIL-PACK ASSEMBLY

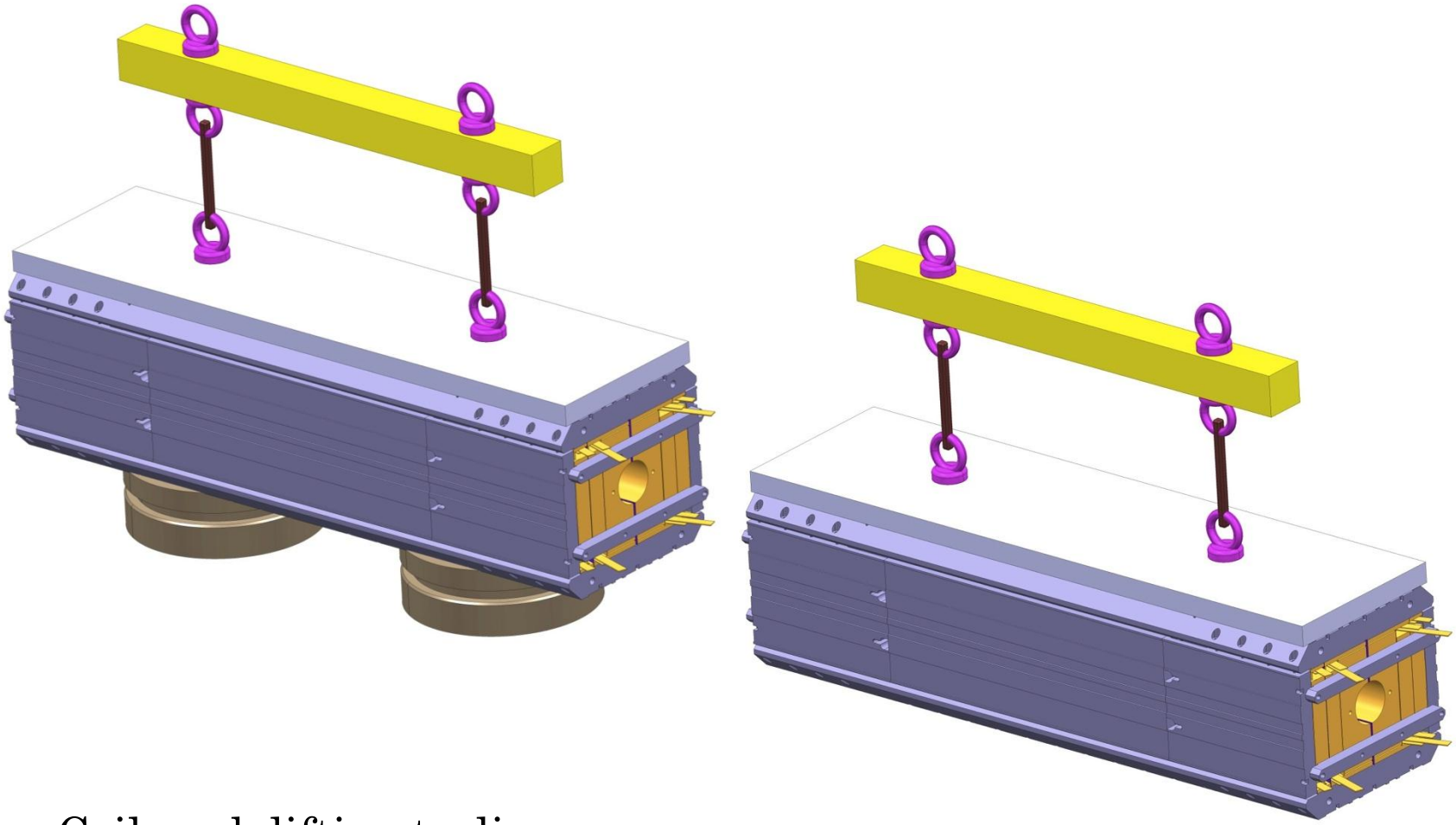






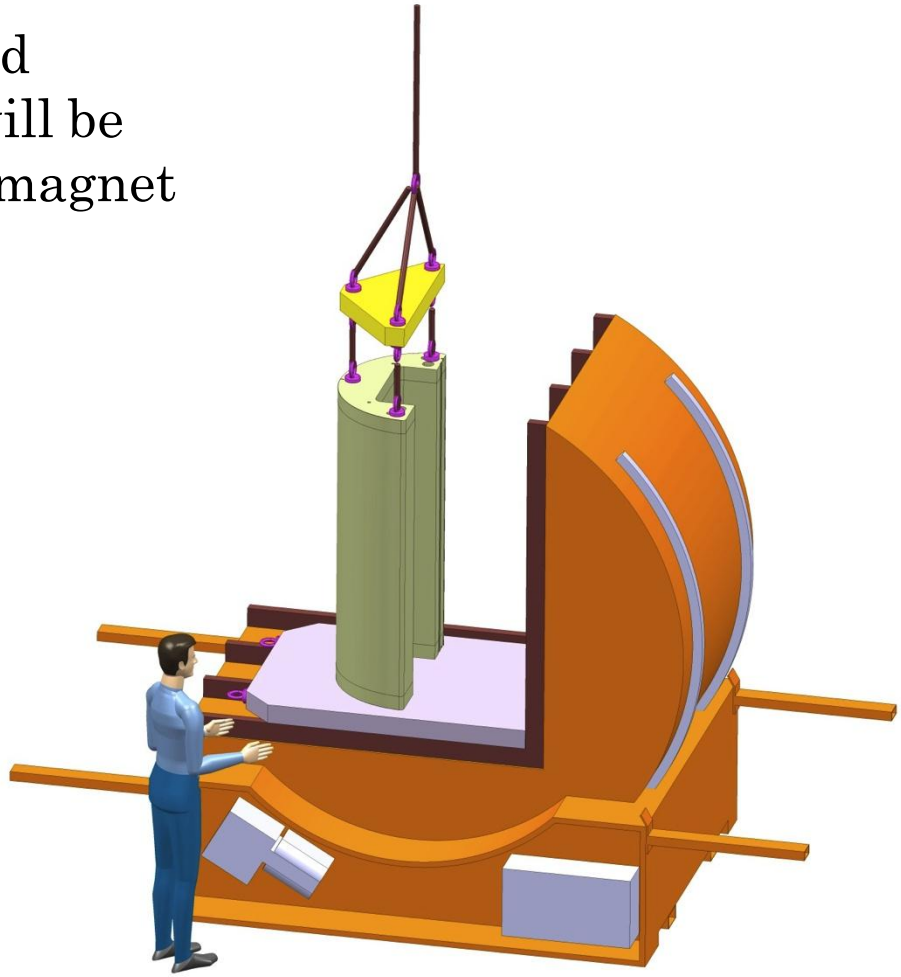


Coil-pack rotating tooling



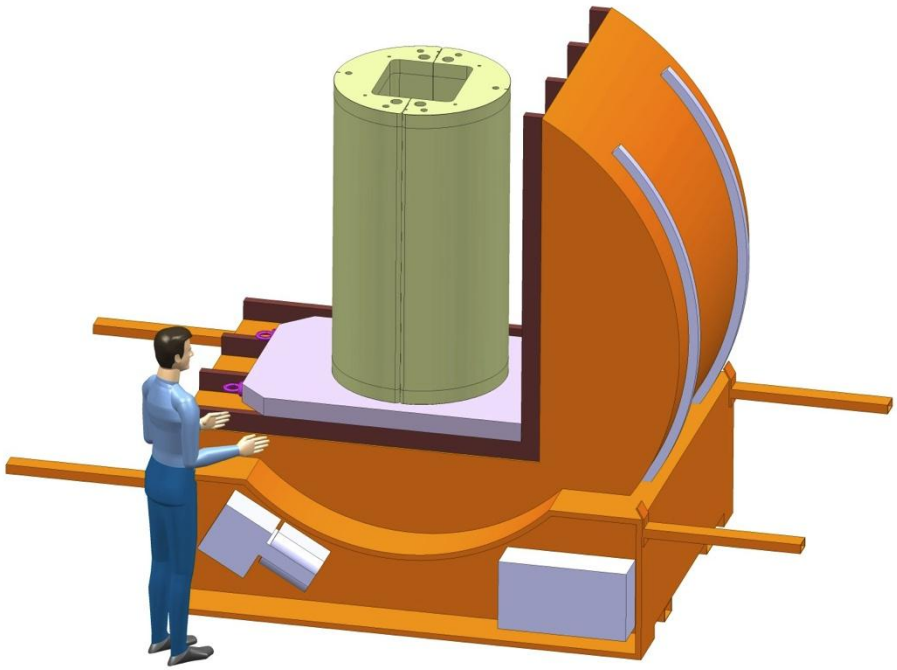
Coil-pack lifting tooling

A CERN standard rotating device will be used to turn the magnet

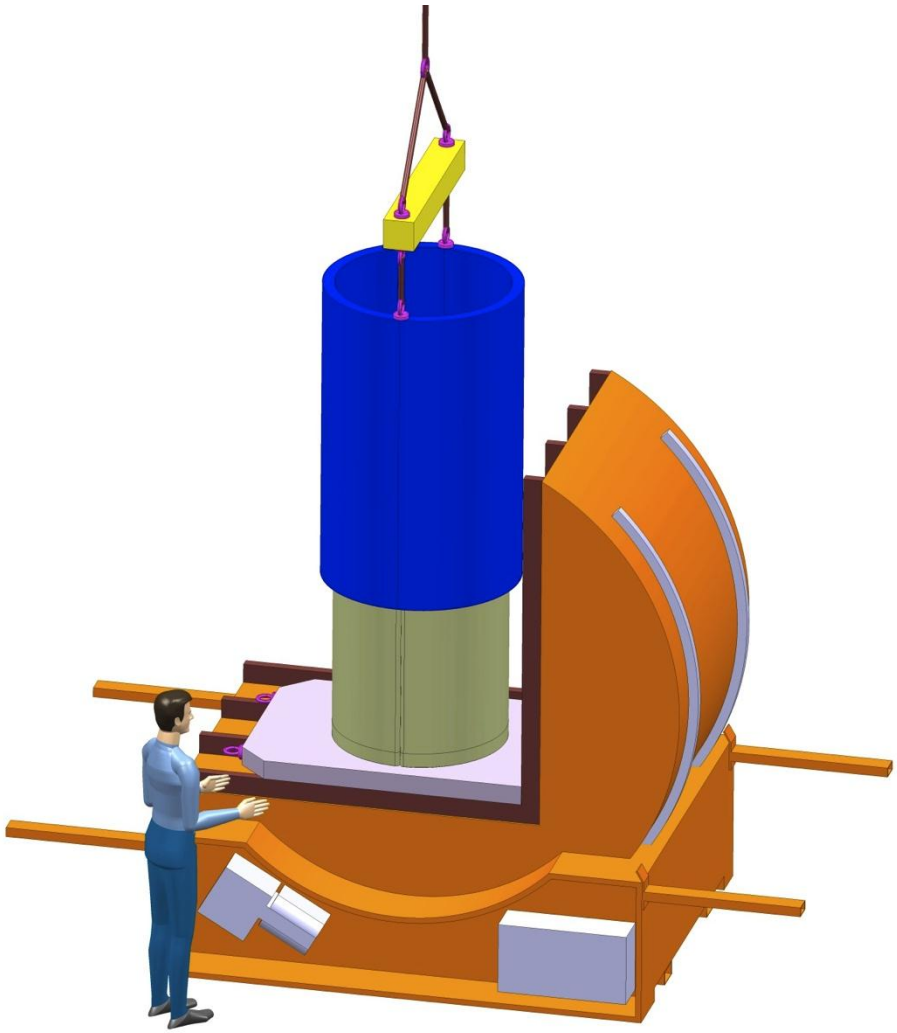


½ yoke weight: 2400 kg

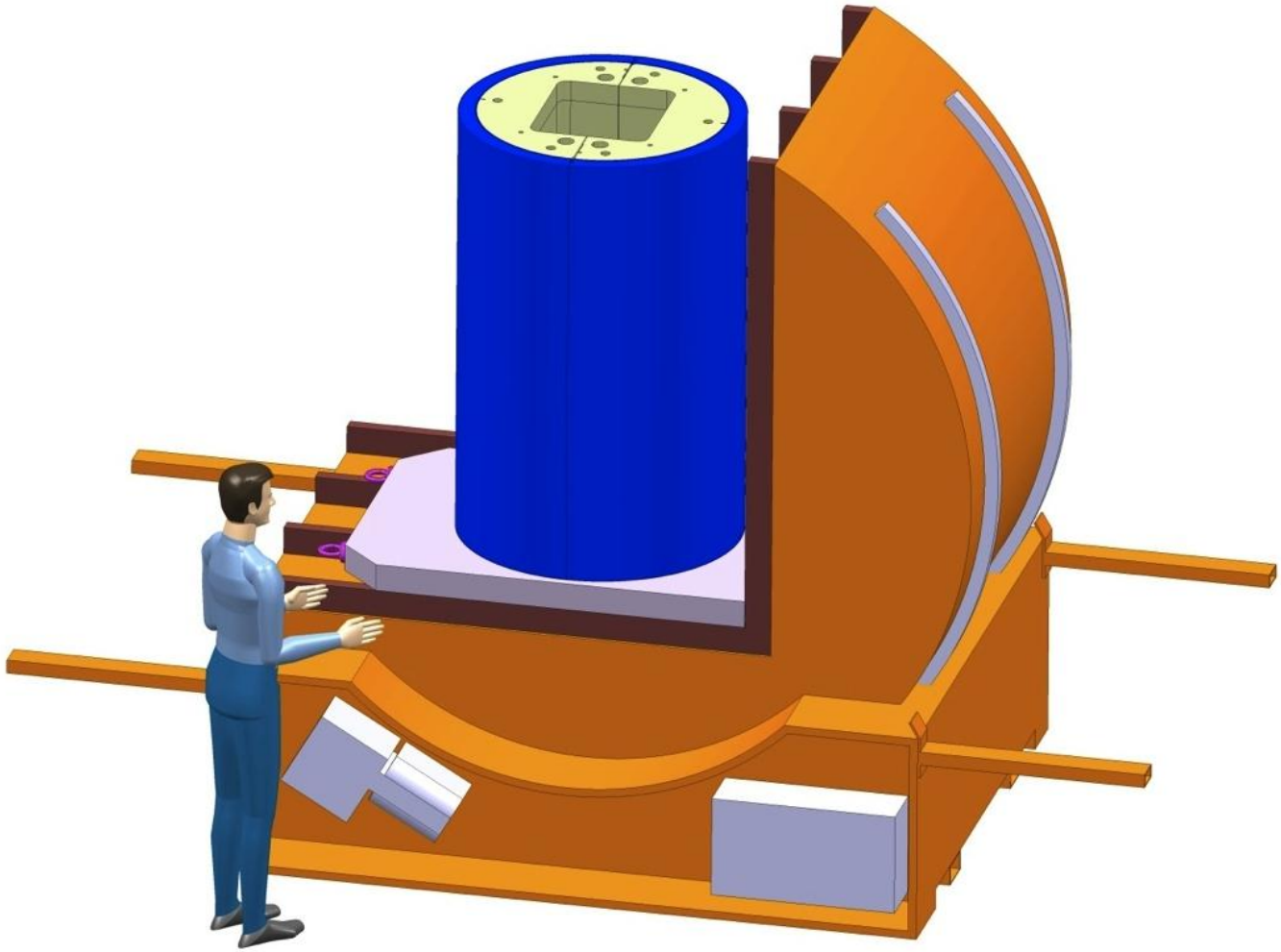
POSITIONING THE YOKE



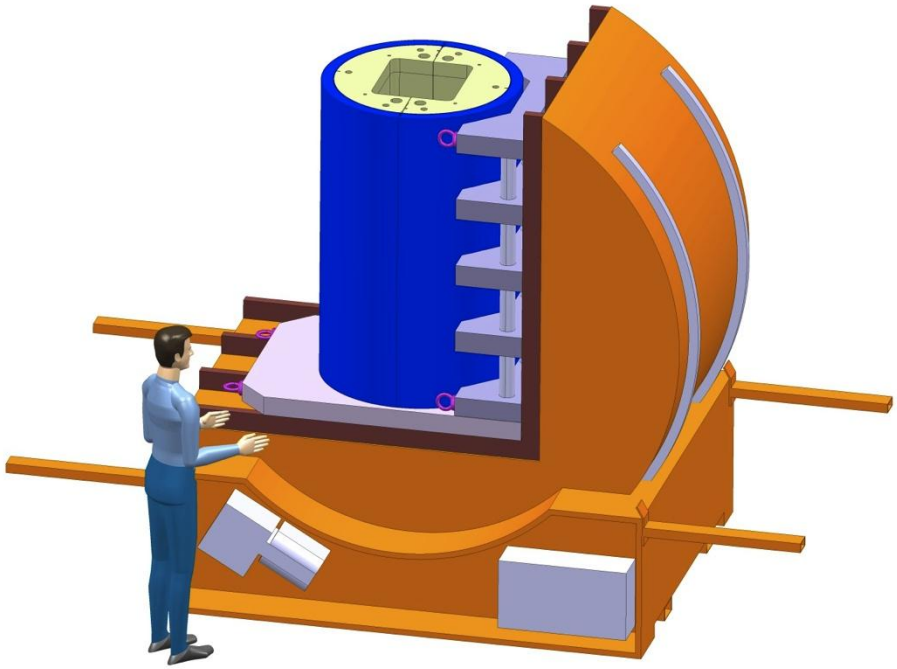
The 2 half yokes will be aligned with no gap in between



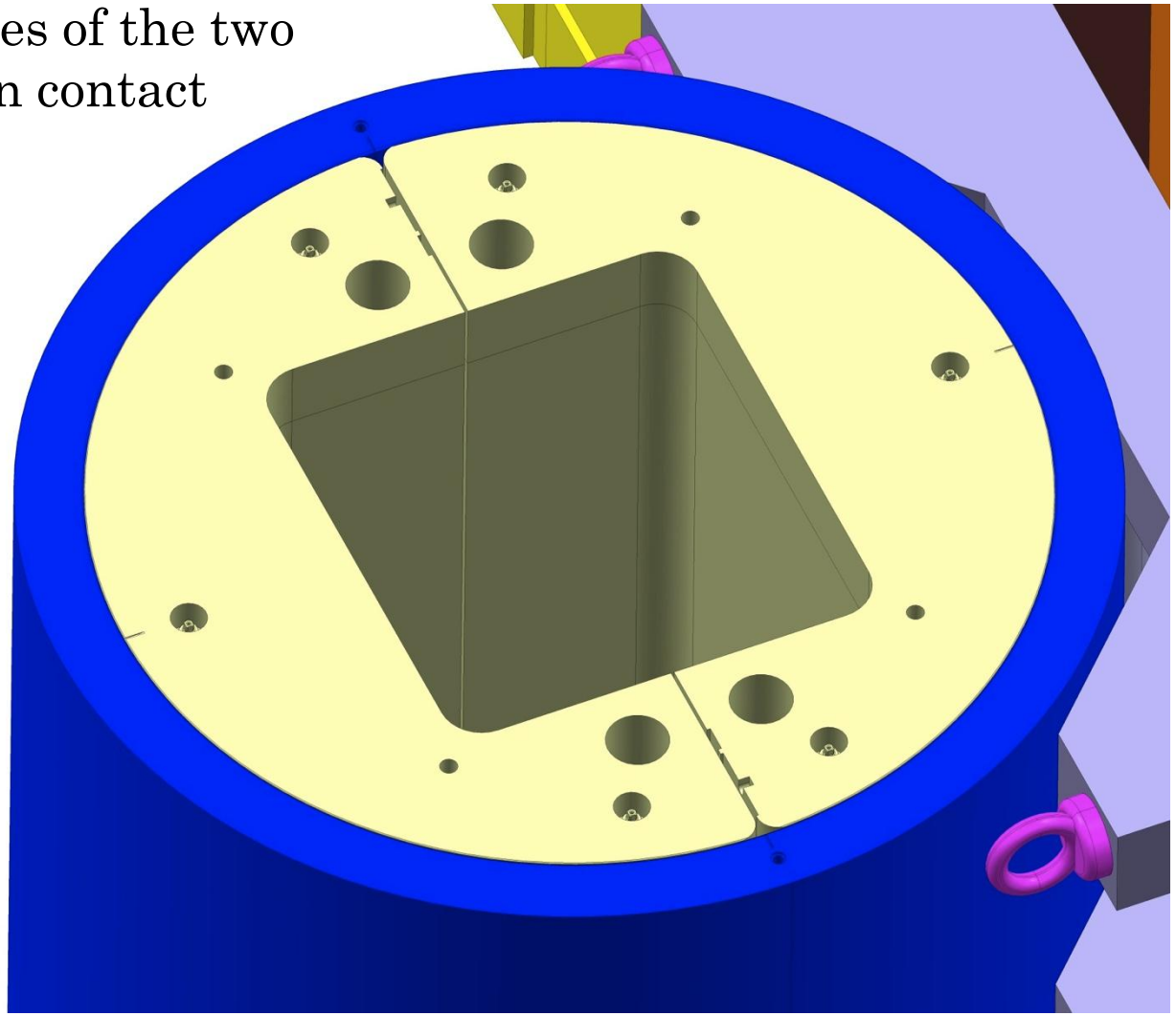
Sliding the aluminum shell



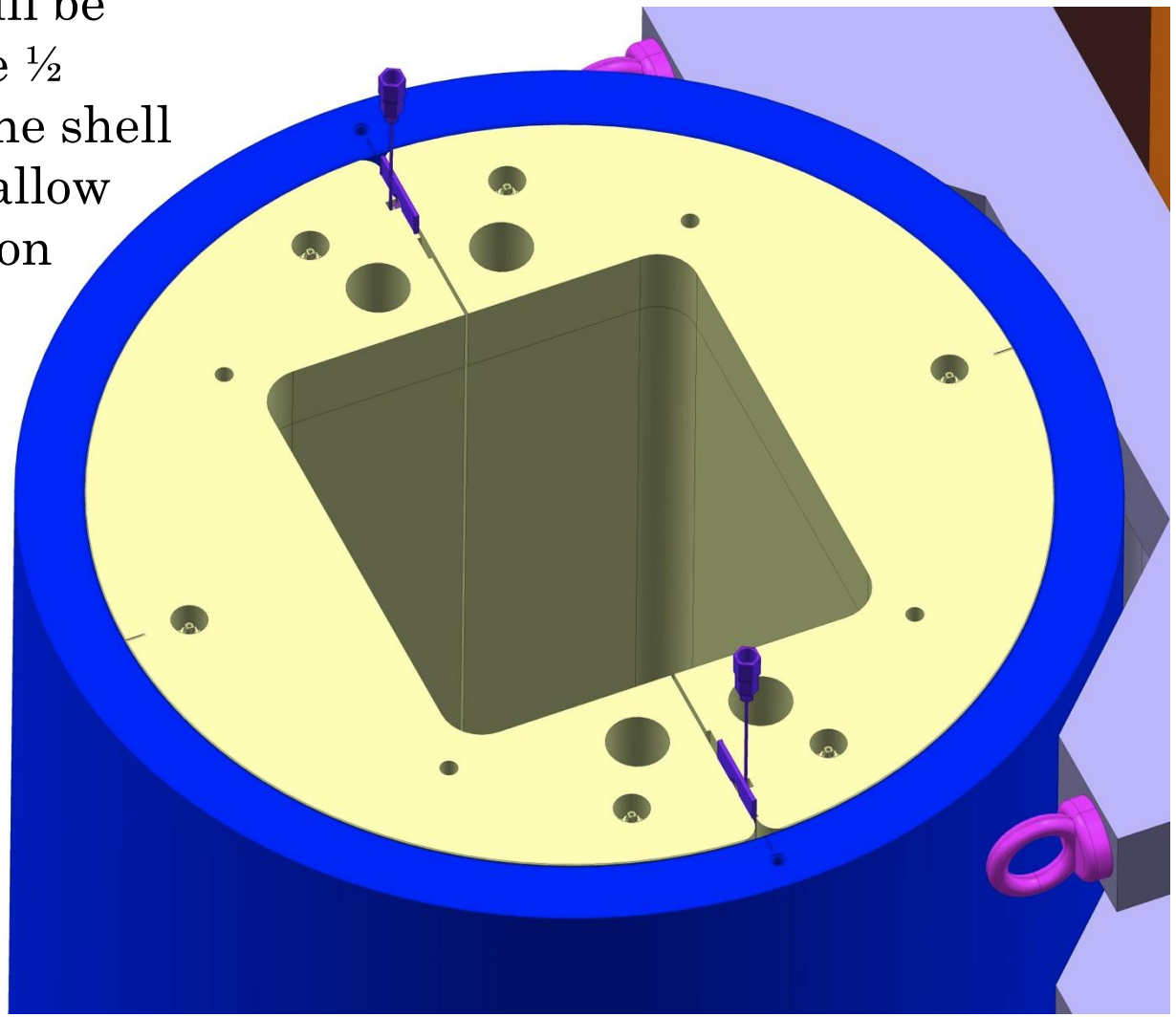
An aluminum support structure will be used to clamp the magnet to the rotating device



The flat surfaces of the two 1/2 yokes are in contact

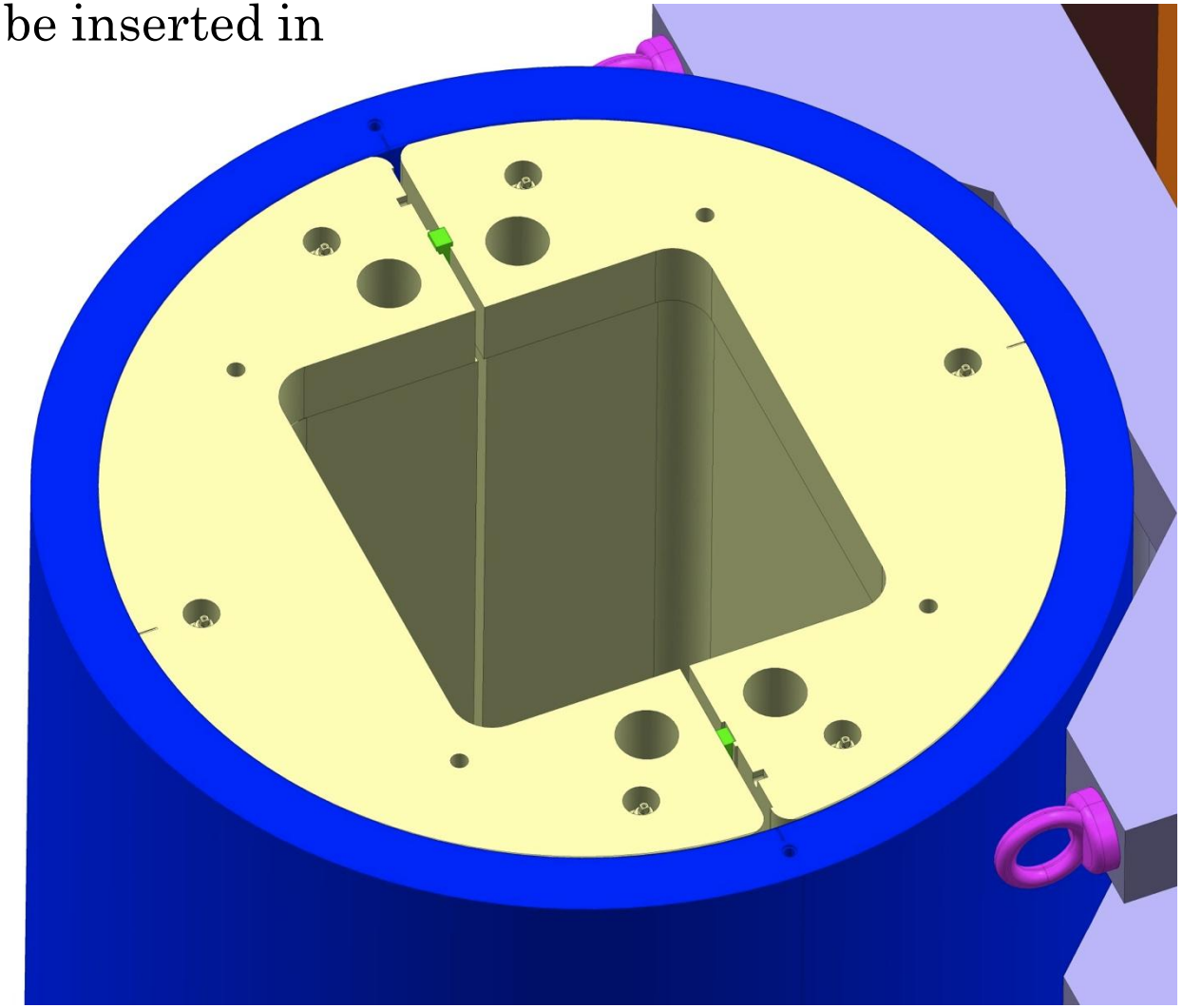


Two bladders will be used to push the ½ yokes towards the shell inner radius to allow gap keys insertion

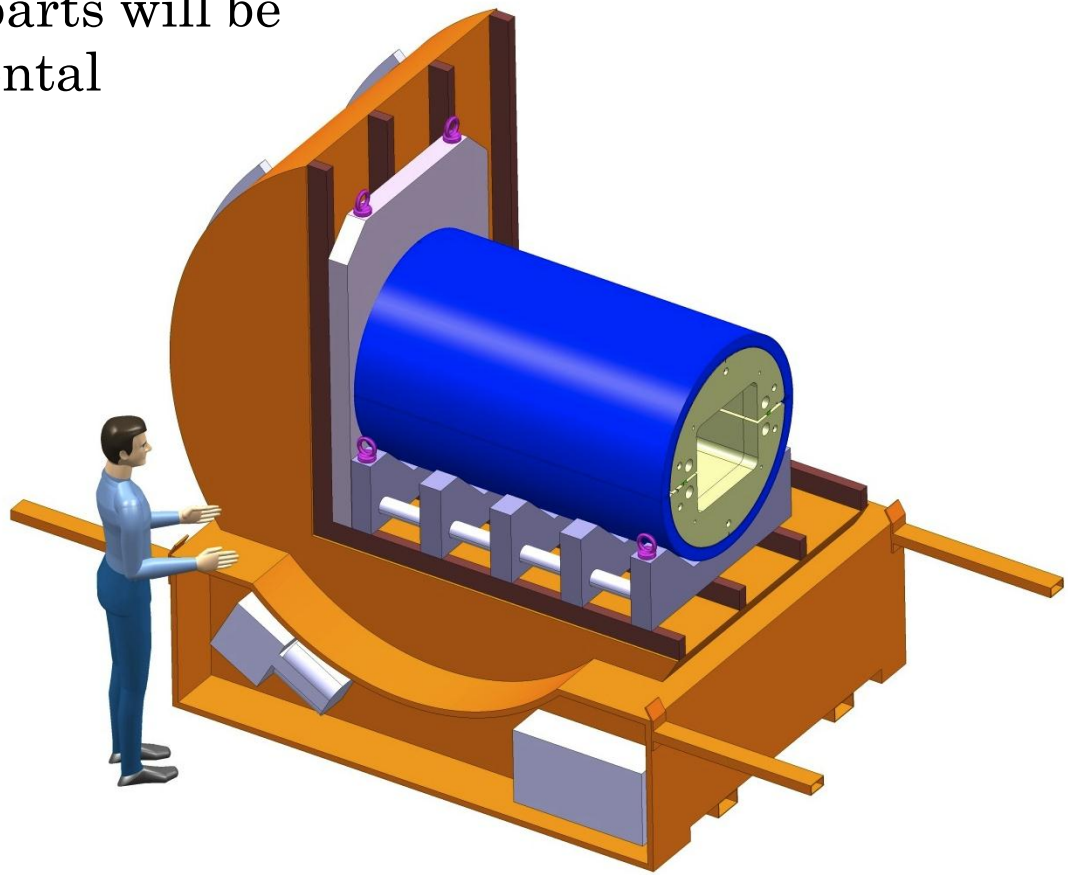


Standard hydraulic jacks can be used instead of bladders

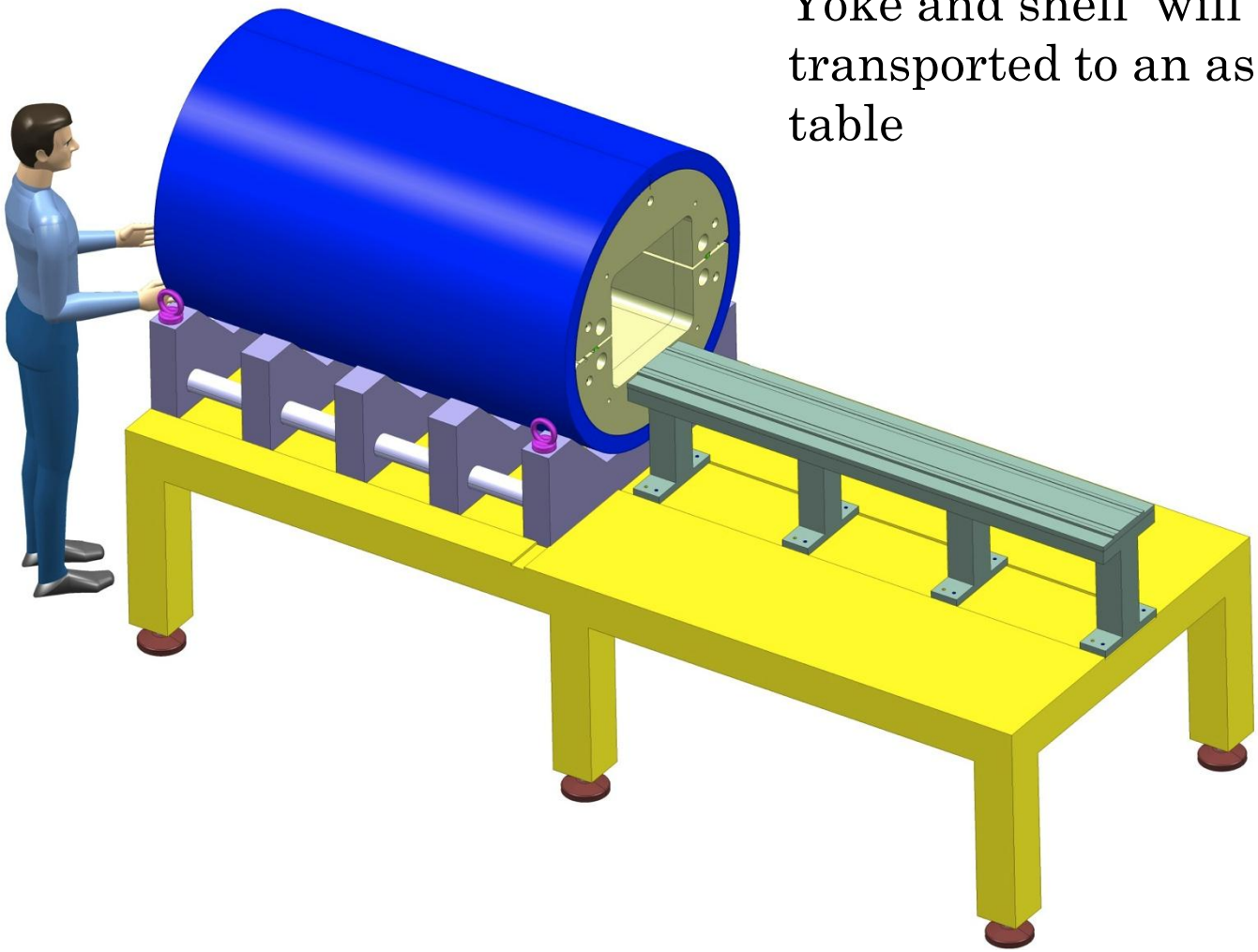
Gap keys will be inserted in the yoke gap

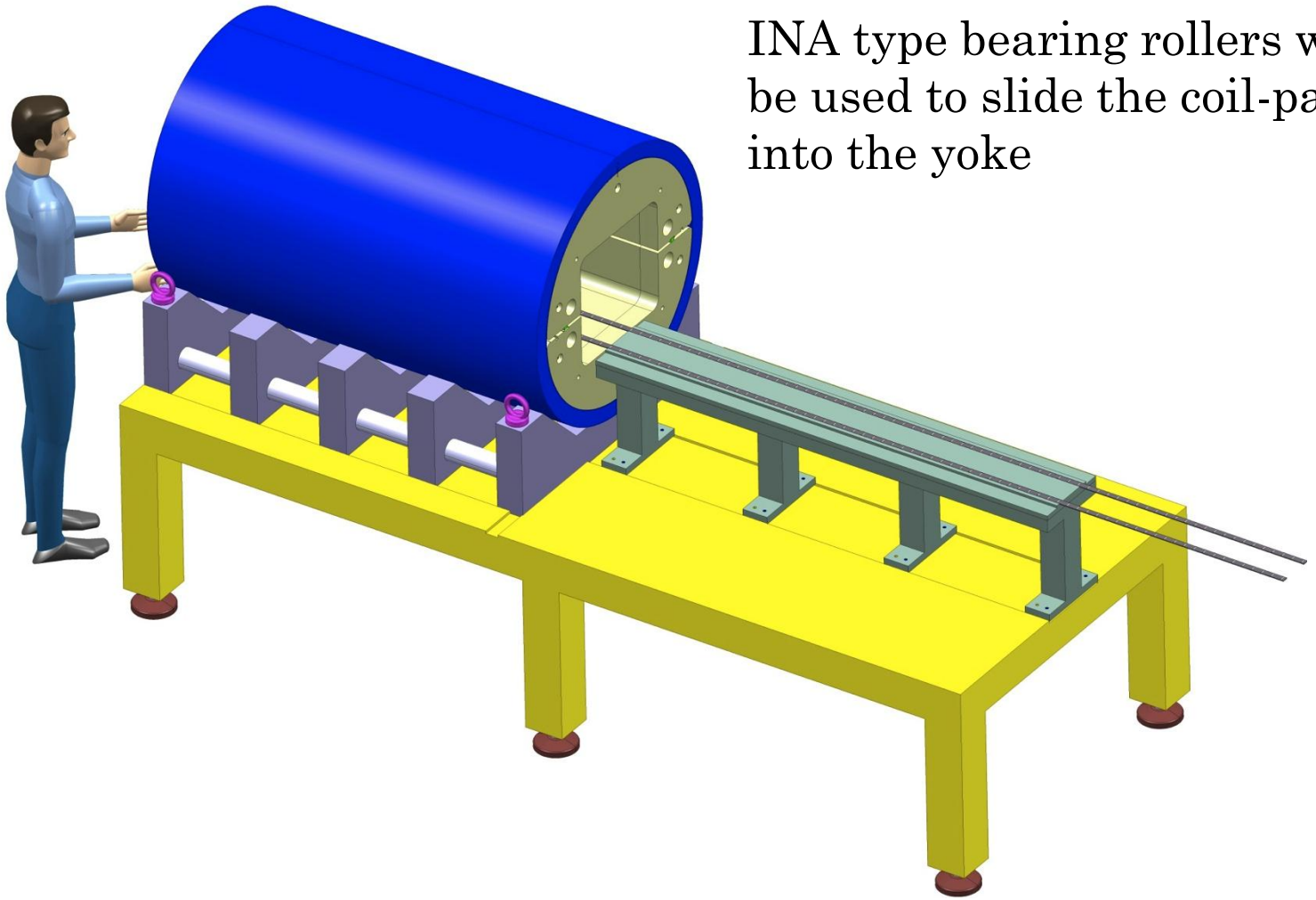


The assembled parts will be rotated to horizontal position



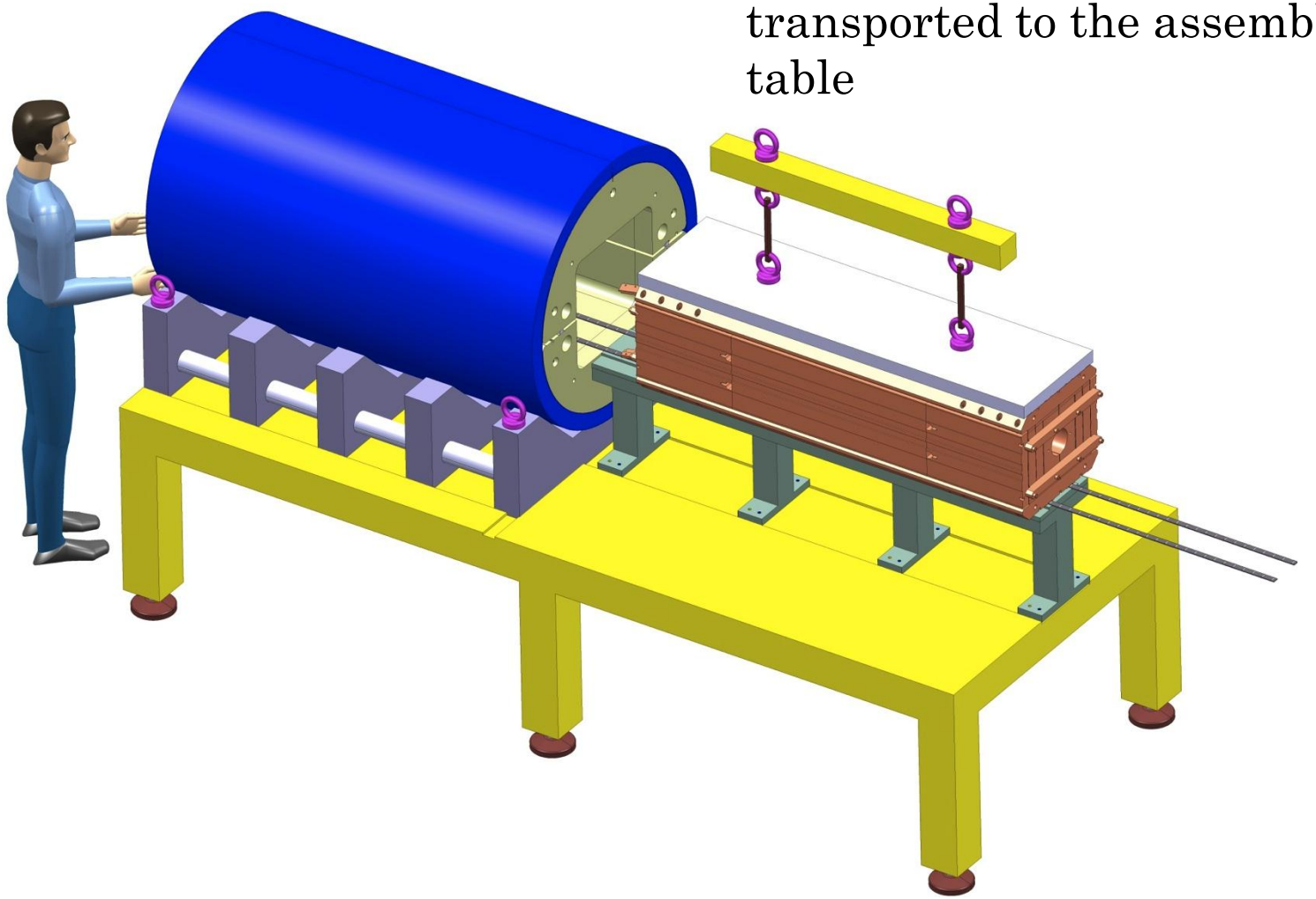
Yoke and shell will be transported to an assembly table



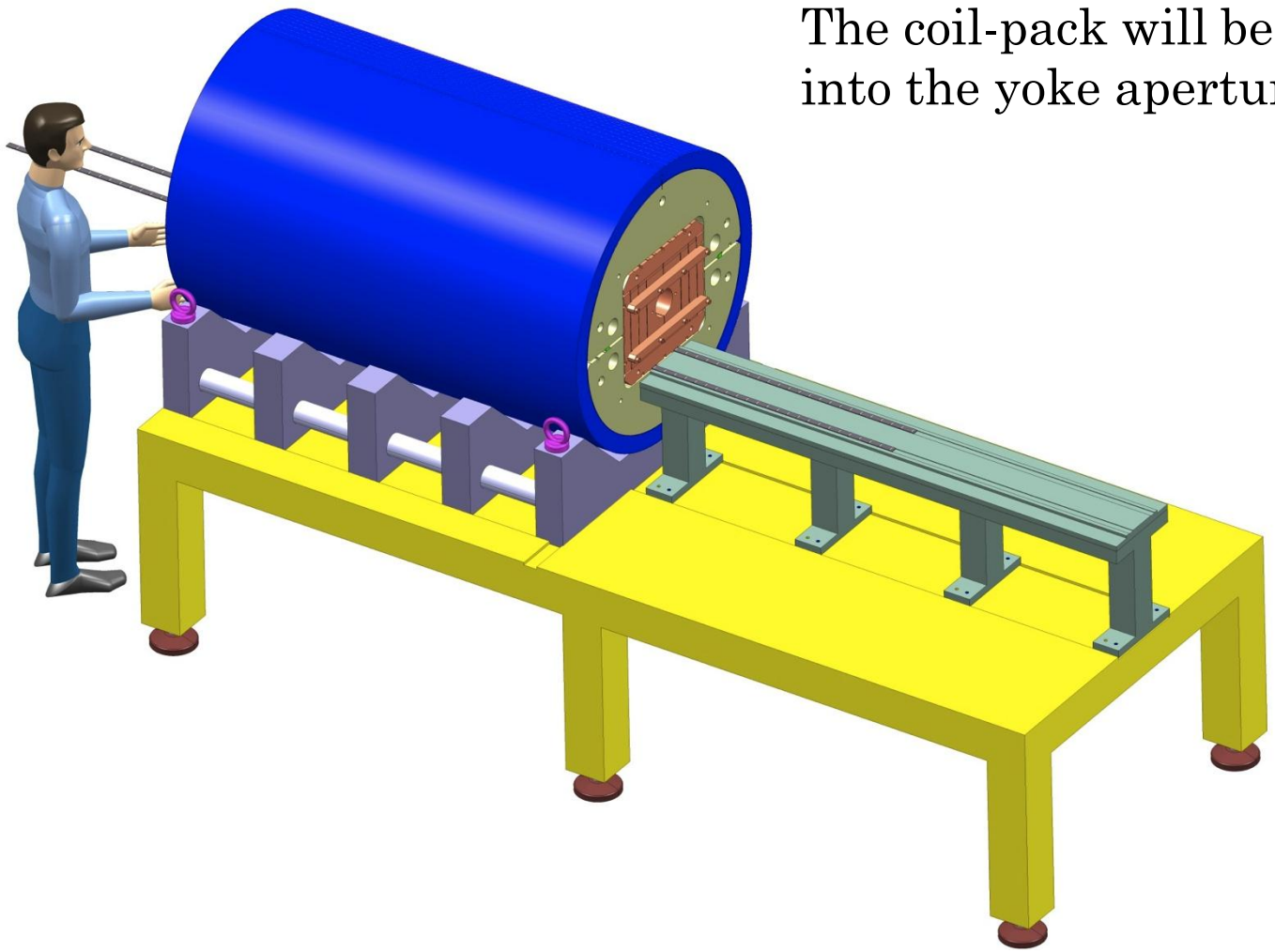


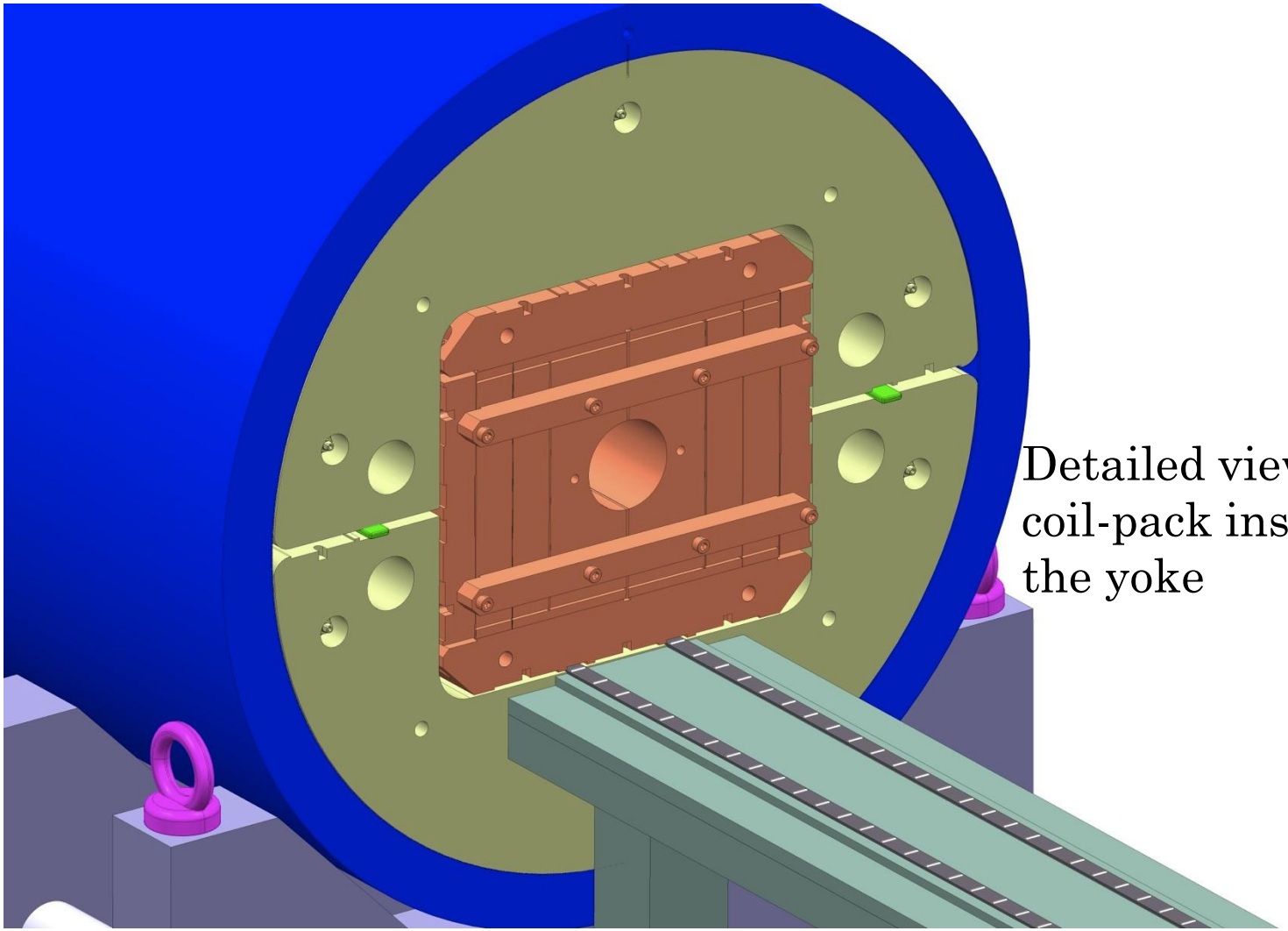
INA type bearing rollers will be used to slide the coil-pack into the yoke

The coil-pack will be transported to the assembly table

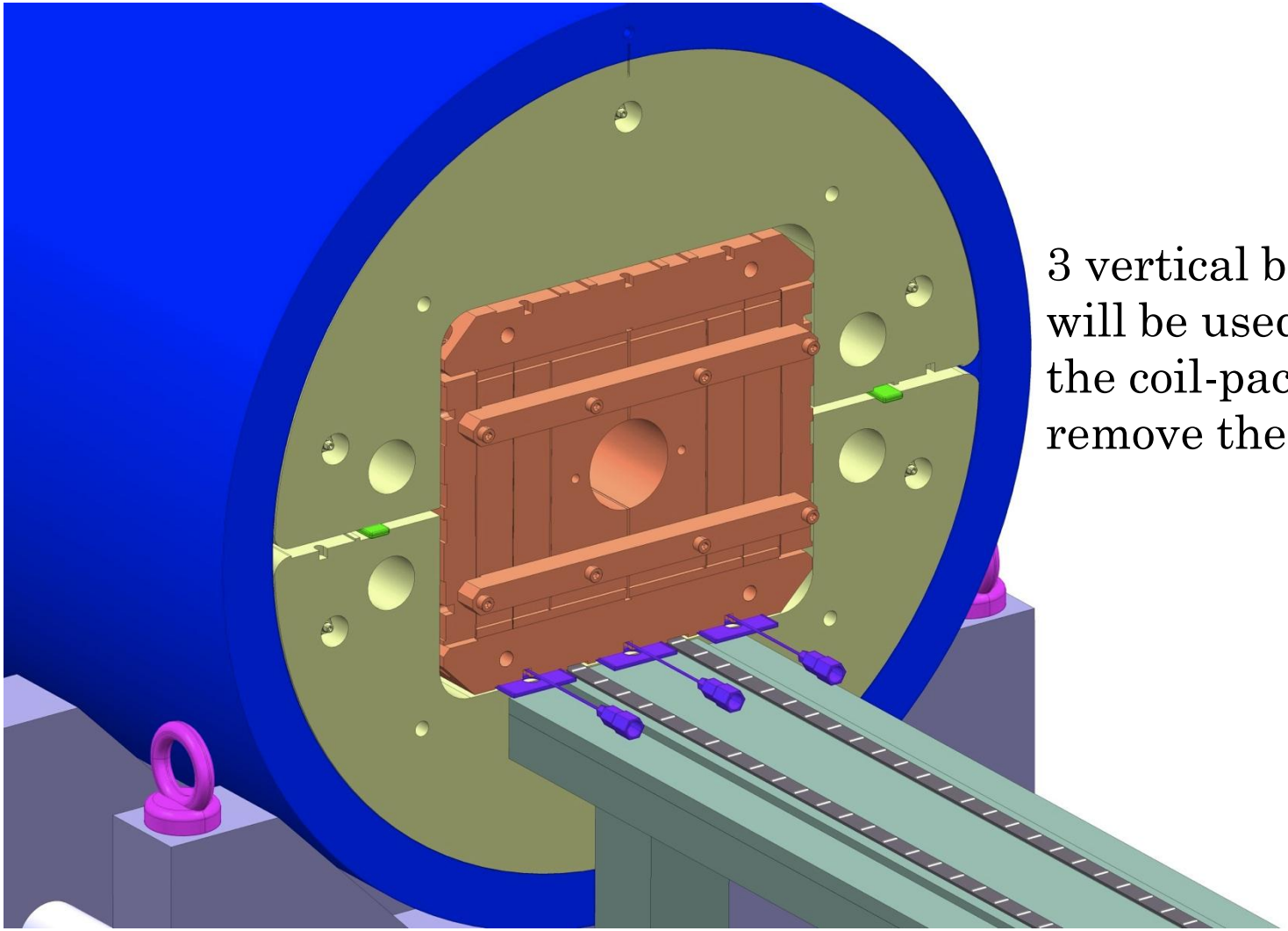


The coil-pack will be pushed into the yoke aperture



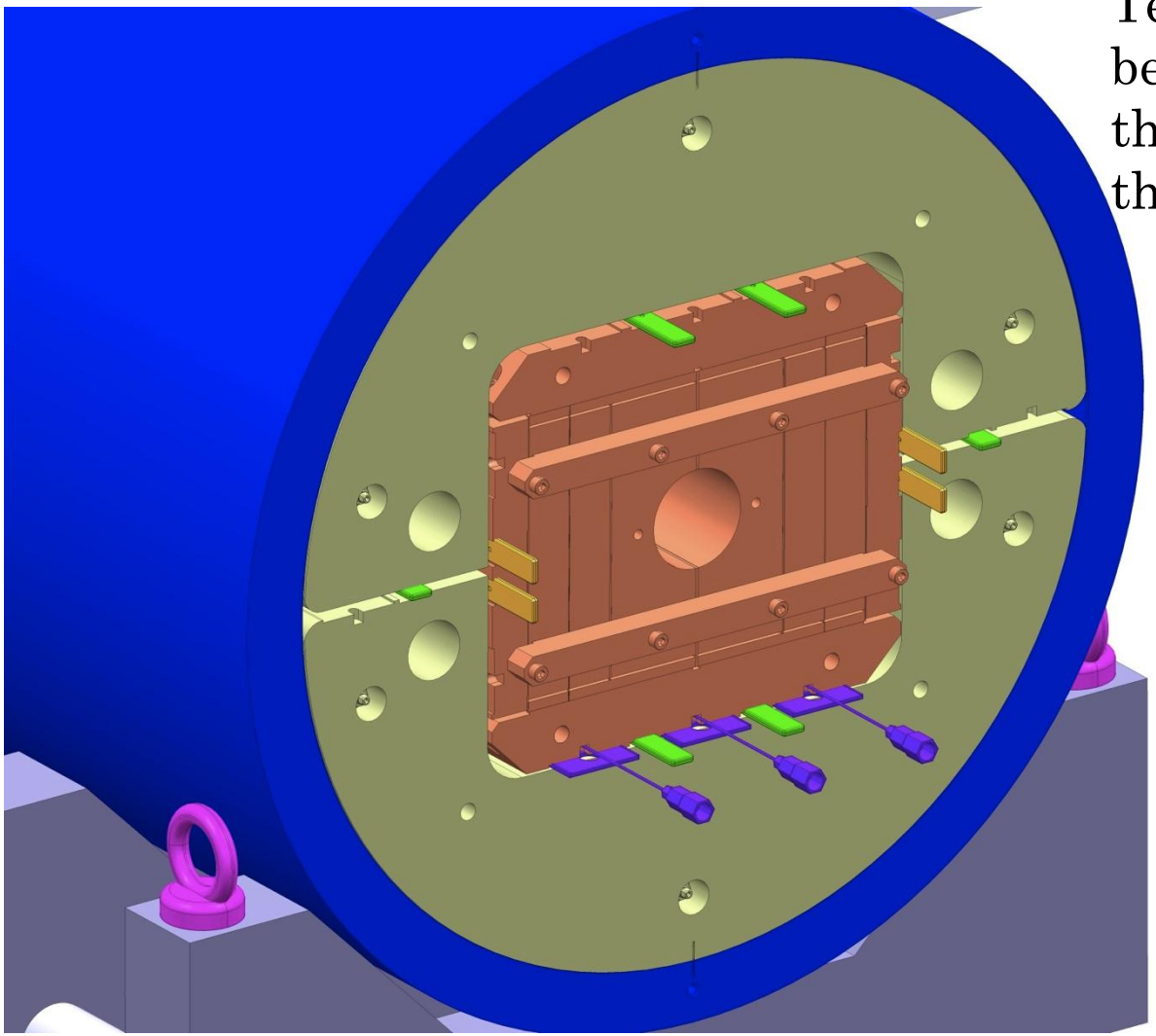


Detailed view of the coil-pack inserted in the yoke



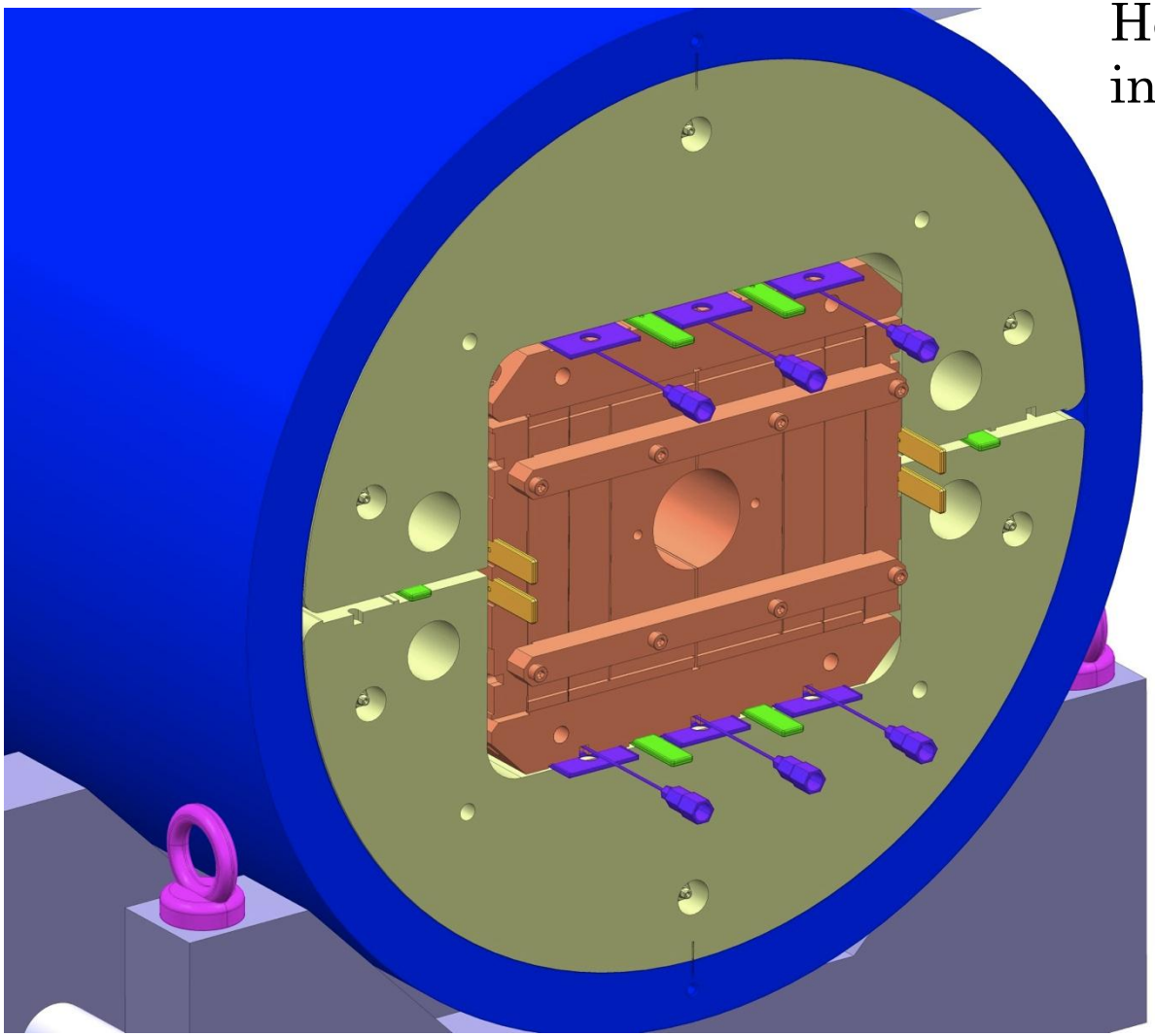
3 vertical bladders will be used to lift the coil-pack and remove the rollers

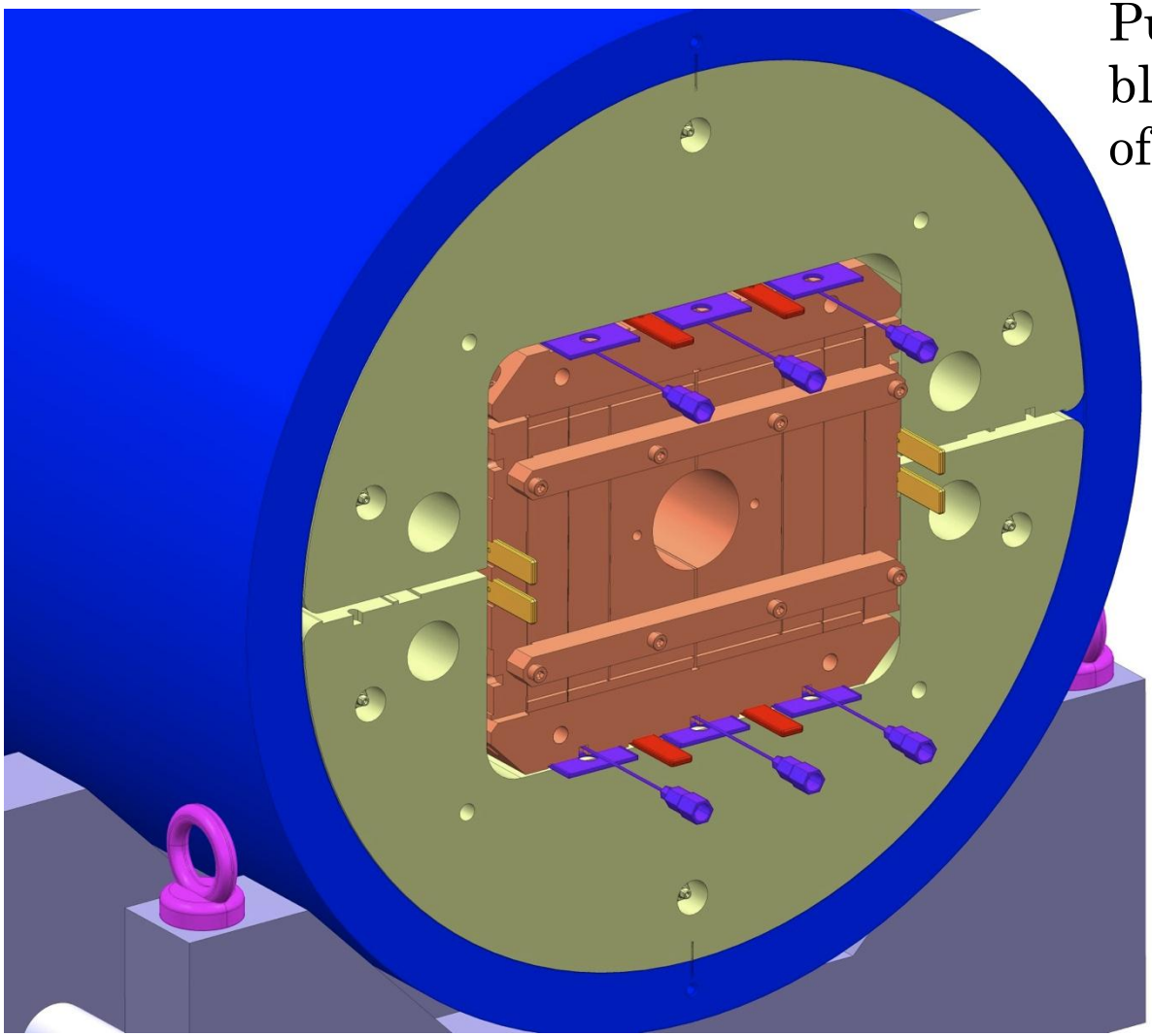
COILS LOADING OPERATION



Temporary keys will be inserted to center the coil –pack into the yoke aperture

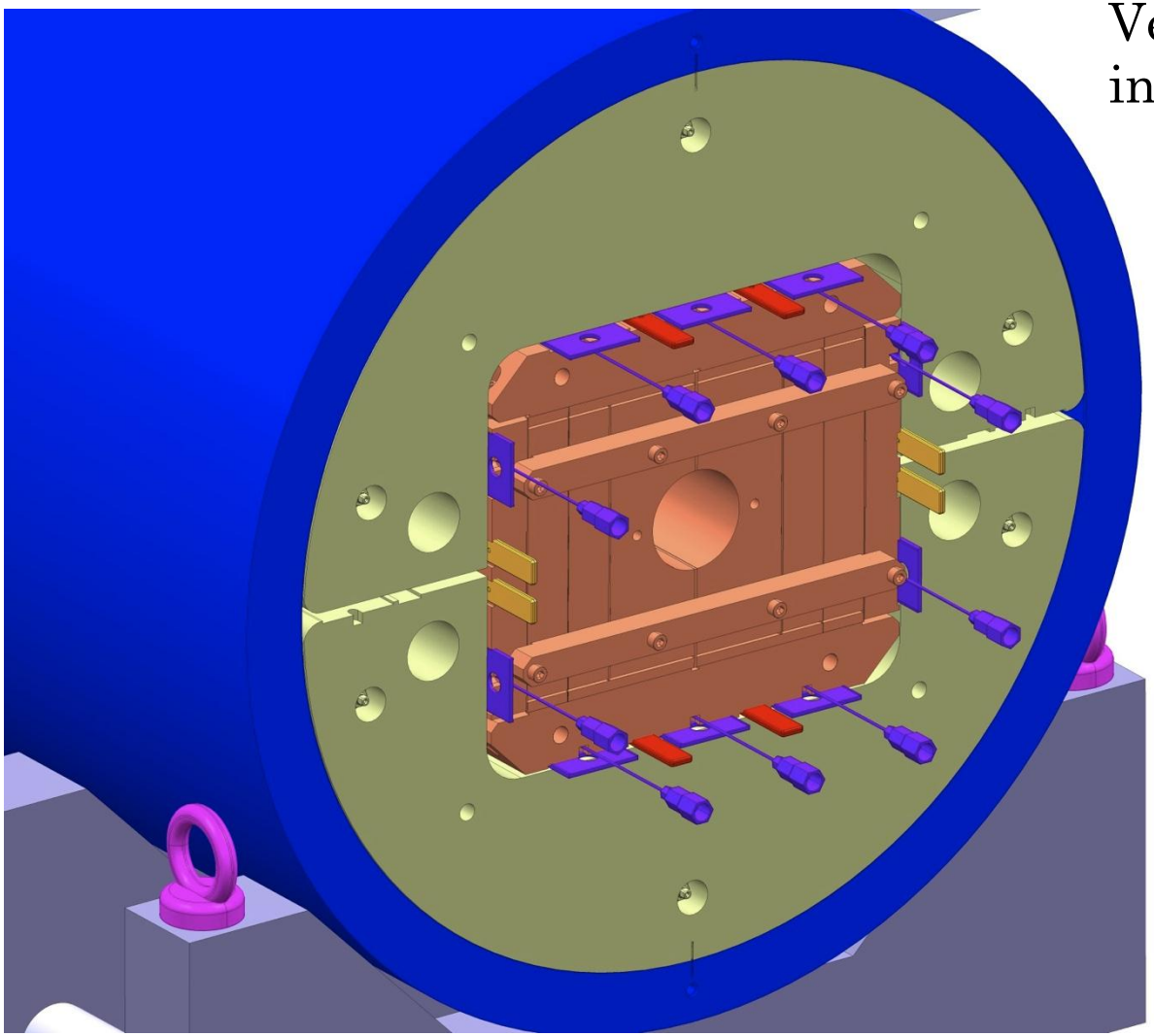
Horizontal bladders insertion

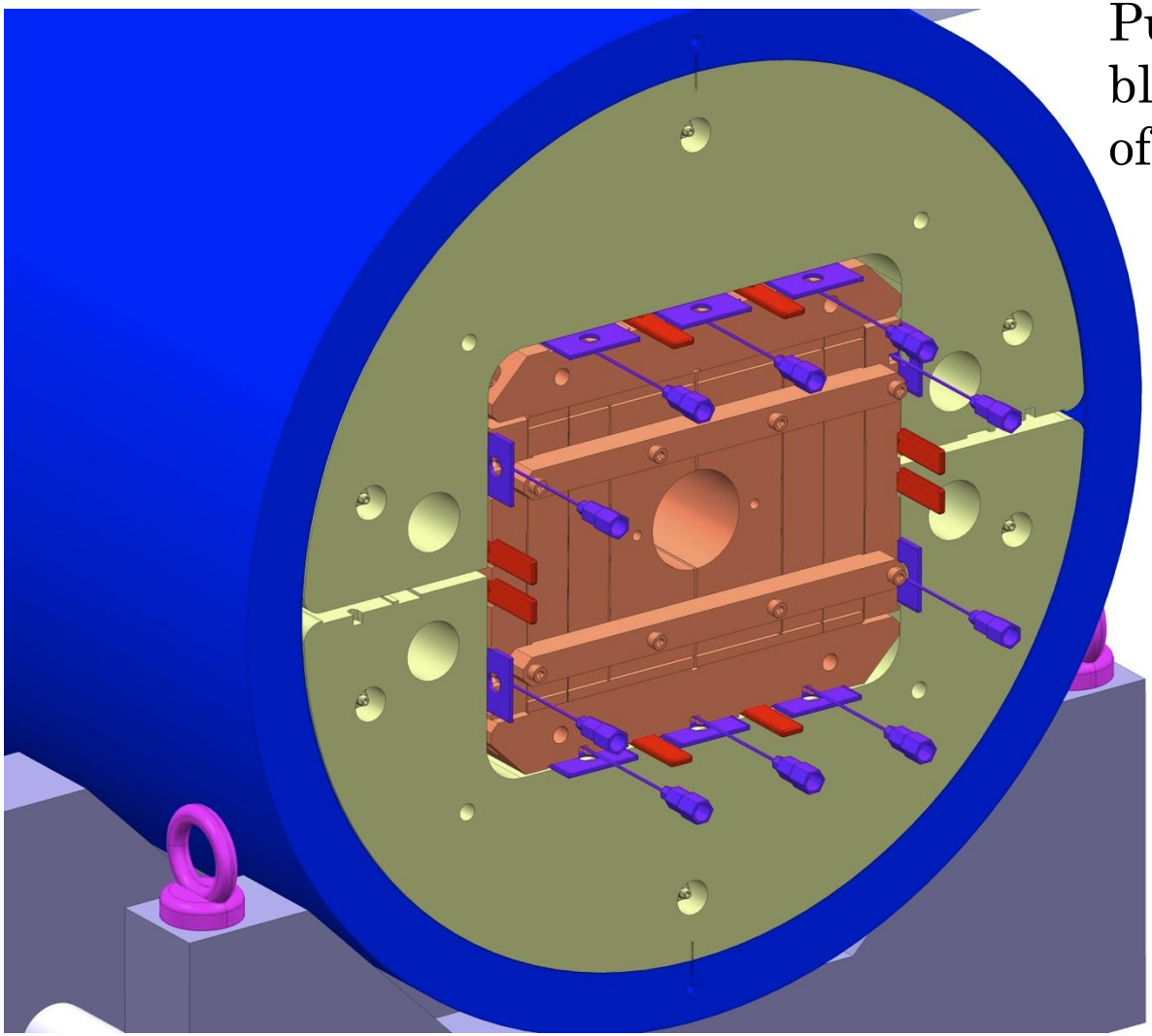




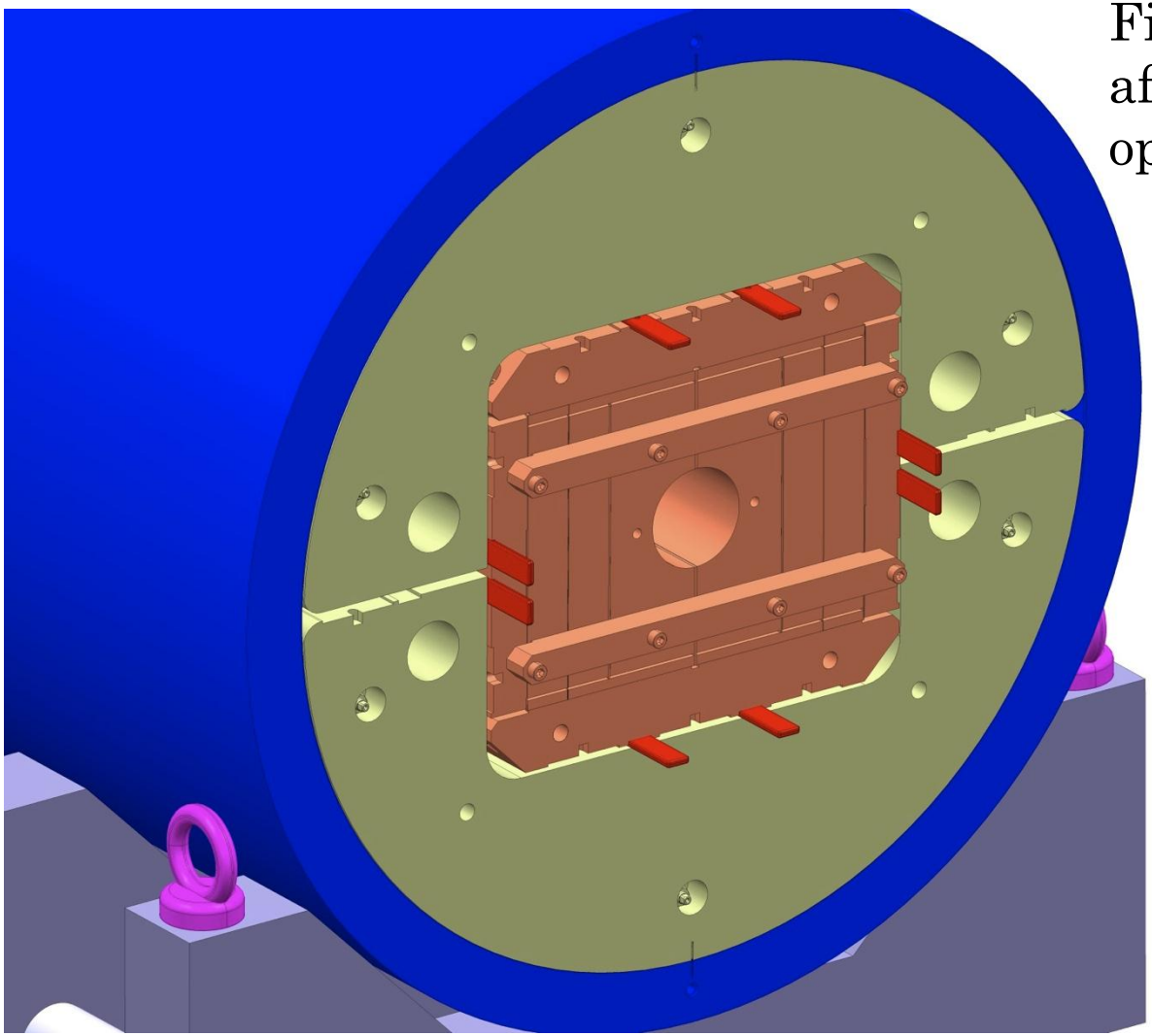
Pumping horizontal bladders & insertion of horizontal keys

Vertical bladders insertion



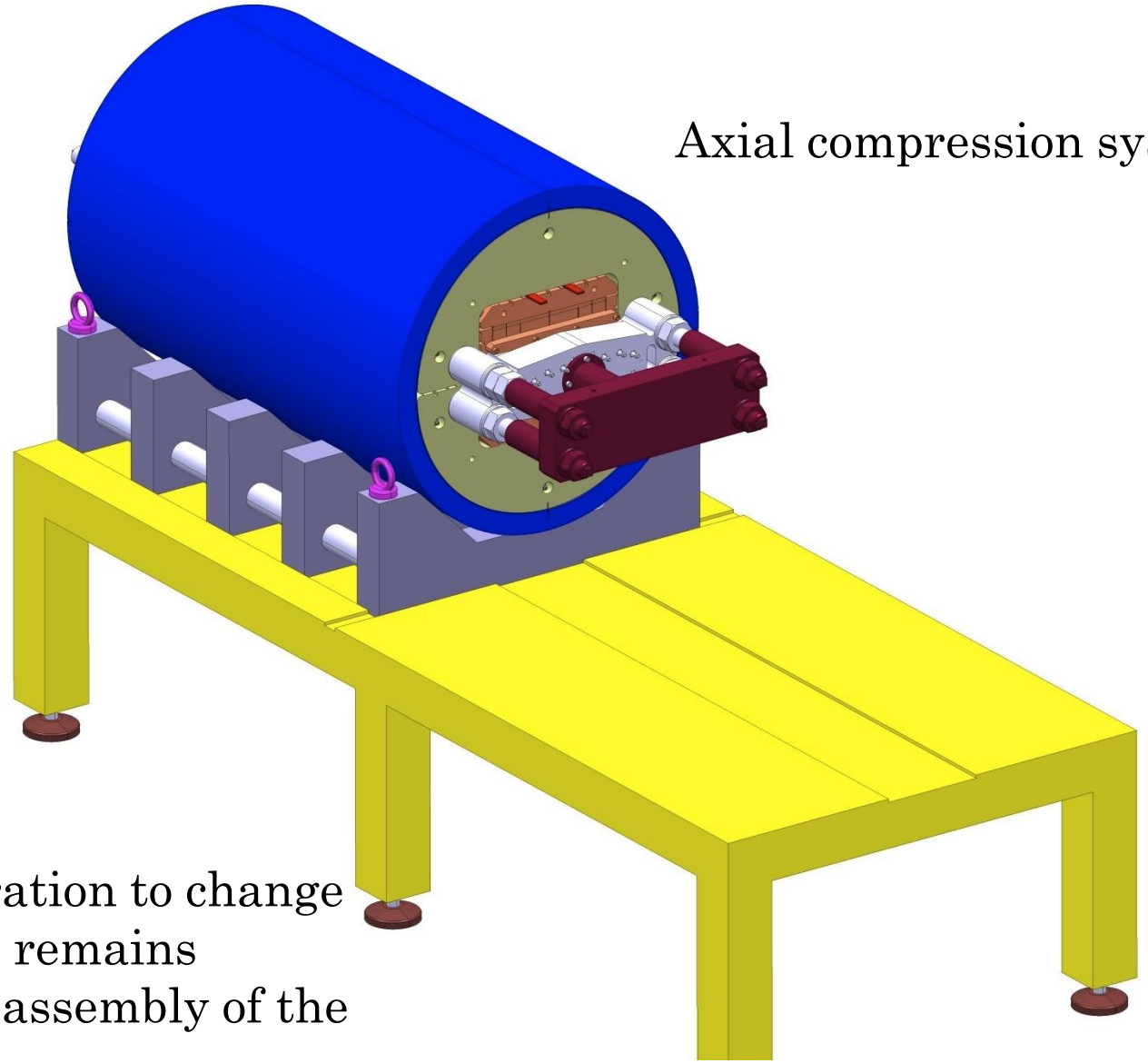


Pumping vertical bladders & insertion of vertical keys



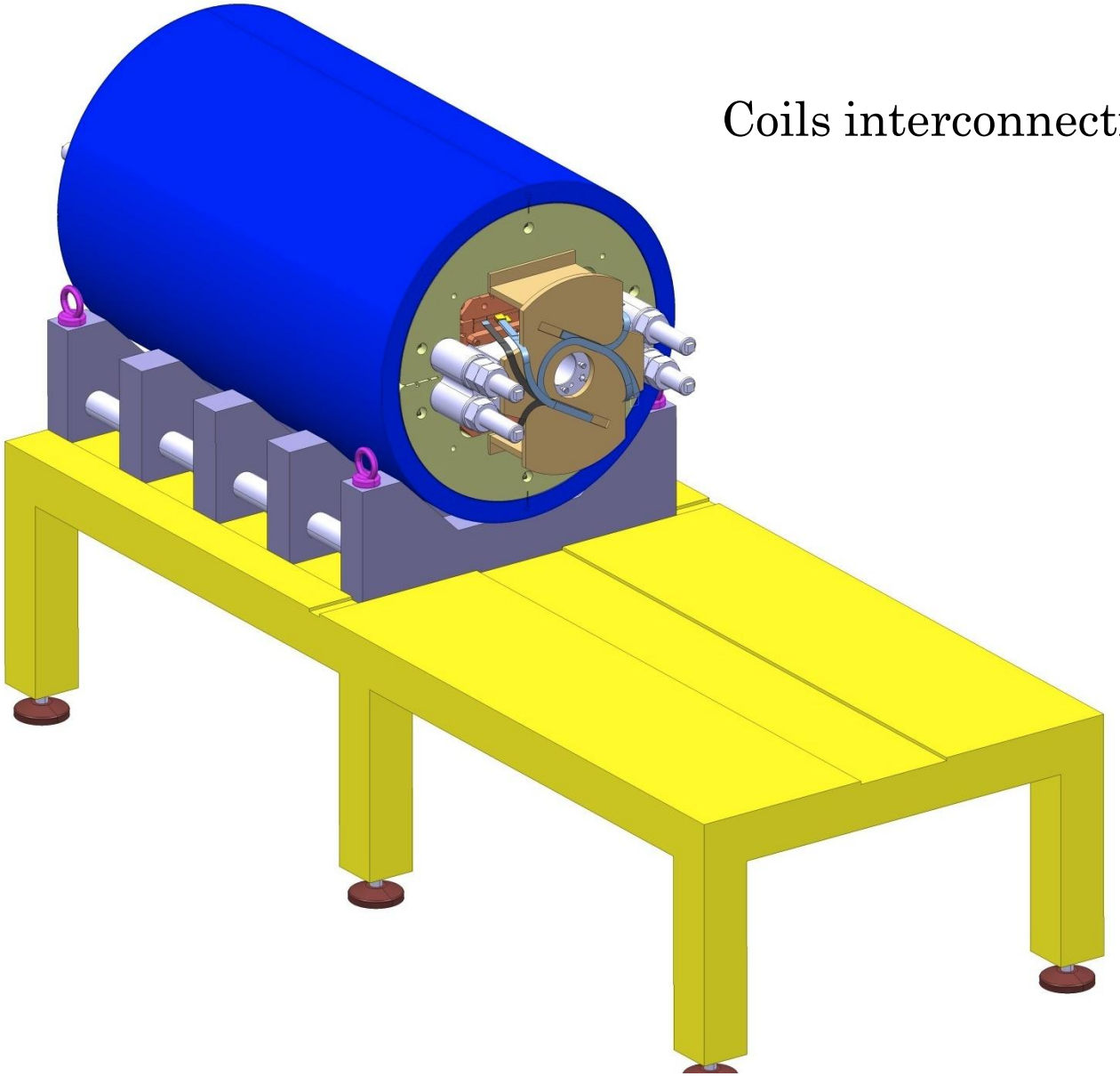
Final configuration after loading operation

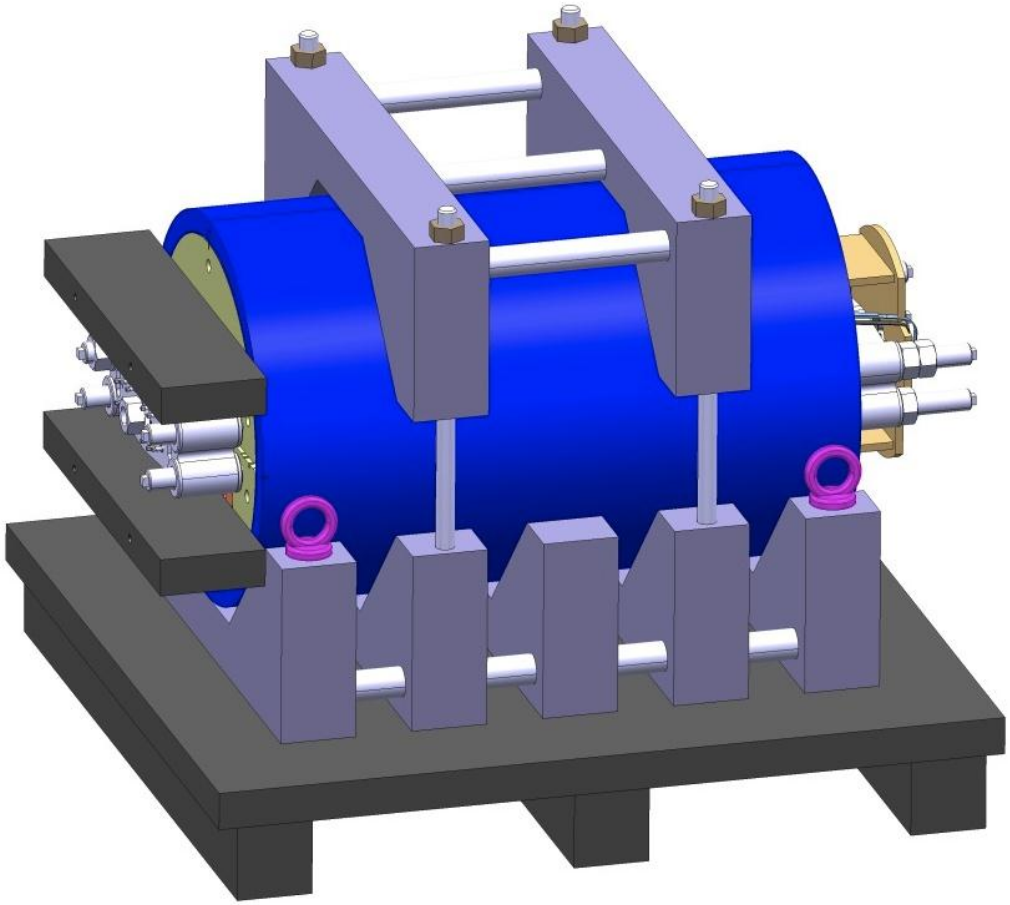
Axial compression system



Bladders operation to change coil pre-stress remains possible after assembly of the end plates

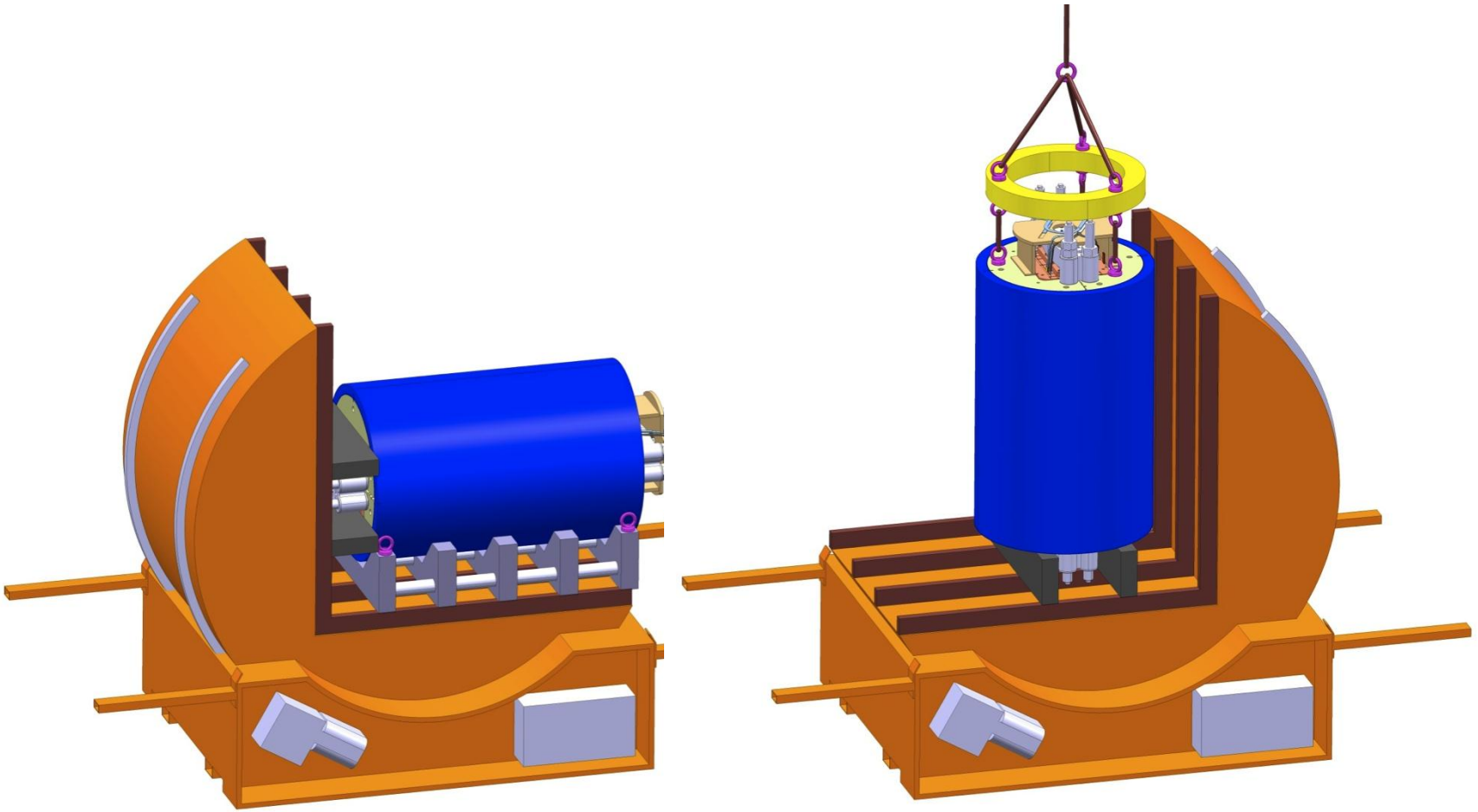
Coils interconnection

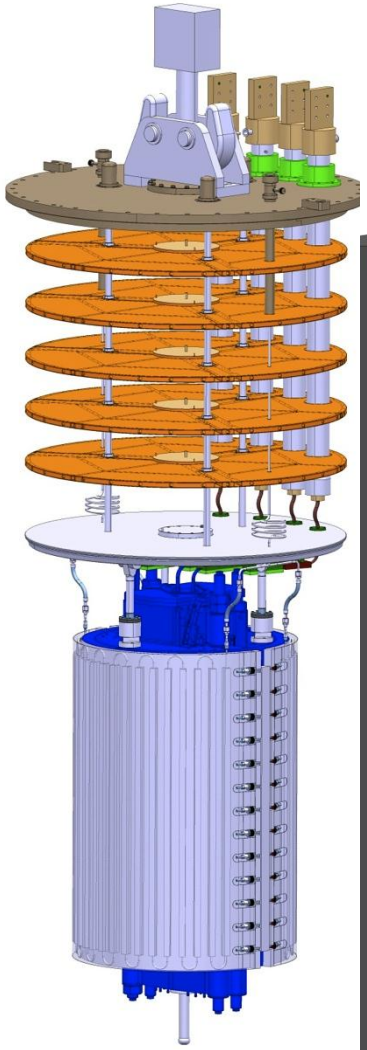


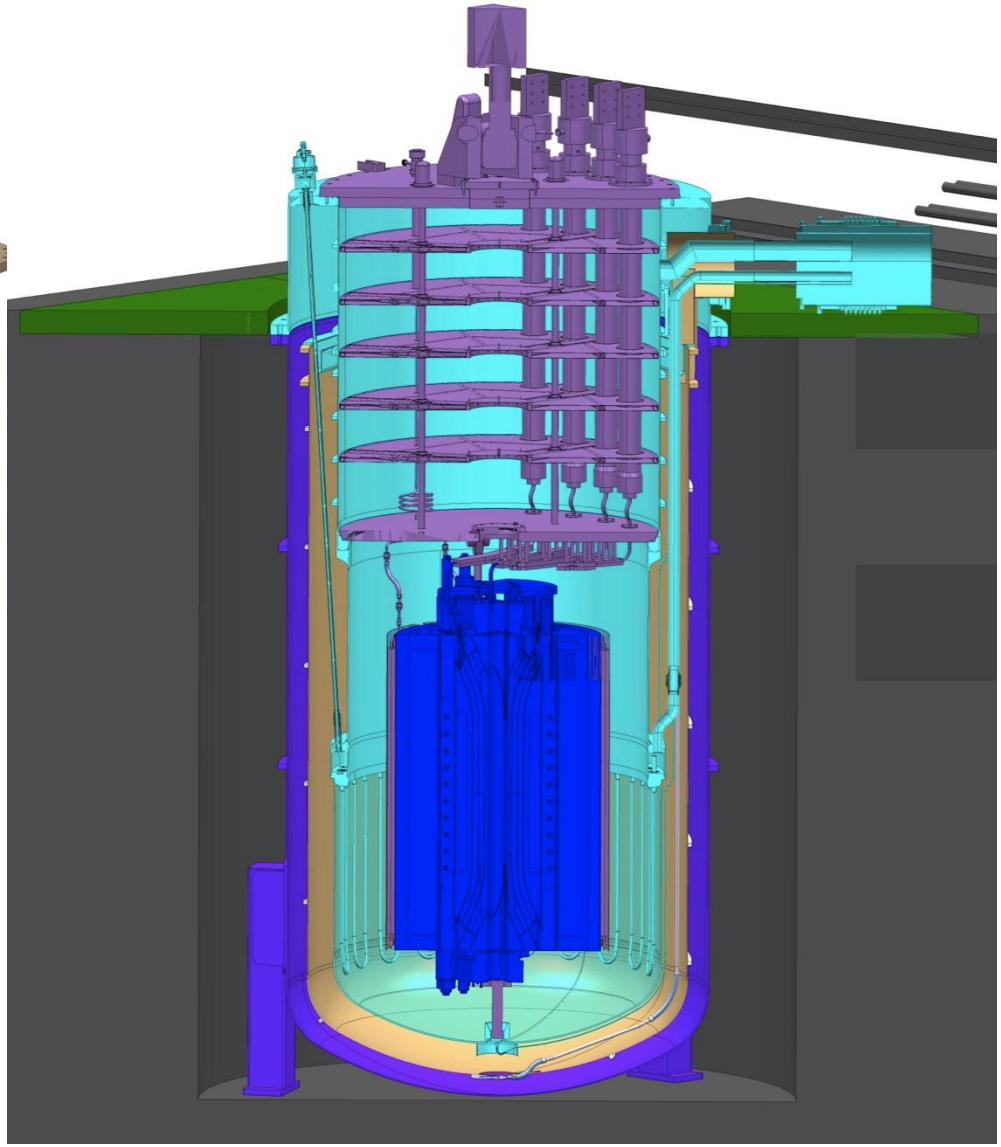


Magnet ready to be transported

From horizontal to vertical position in SM18



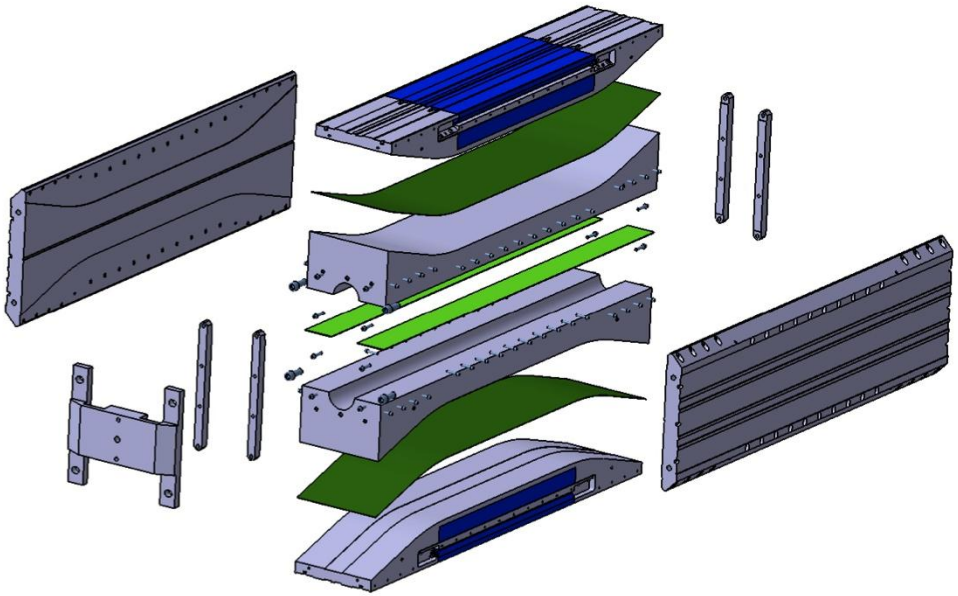




Magnet in the cryostat

ALUMINUM DUMMY COIL ASSEMBLY

- The first mechanical assembly will be performed using aluminum blocks replacing the real coils
- This will qualify the support structure, the assembly and loading procedure and validate the FEM
- The aluminum dummy coils will be instrumented with strain gauges in the aperture
- The way to cool-down the structure to 77 K in LN2 is under investigation



Acknowledgements

- CEA/Saclay:

  M. Durante, P. Manil, J.F. Millot, J.M. Rifflet, F. Rondeaux,

- CERN:

  P. Ferracin, E. Fornassiere, J. Humbert, A. Milanese,
  L. Oberli, M. Timmins, G. Villiger,,

- Fresca2 collaboration team

Thanks for your attention