

TAS removal study

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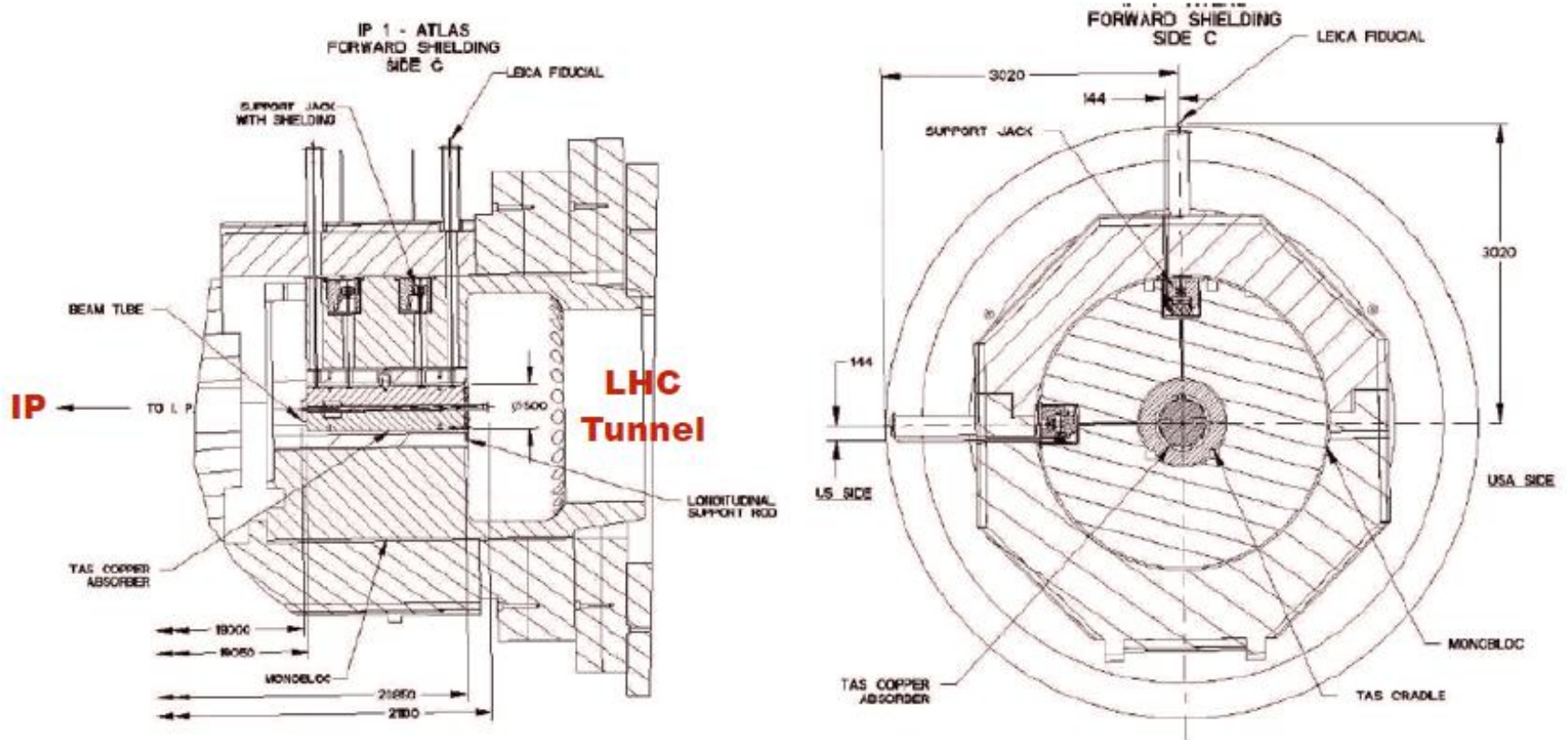
EN-EA, 23.08.2016

Agenda

- TAS installation @ Atlas
- TAS removal study from Atlas
 - From Experiment side
 - From machine tunnel side
- TAS installation @ CMS
- TAS removal study from CMS
 - From Experiment side
 - From machine tunnel side
- ❖ *Mainly based on “Scenarios for the removal of IR1 and IR5 TAS” by F. Butin, EDMS 1254919*

TAS location @ Atlas

- ▶ The TAS is embedded in the forward shielding of the experiment, at the wall separating the Experimental Cavern with the LHC tunnel



TAS installation @Atlas

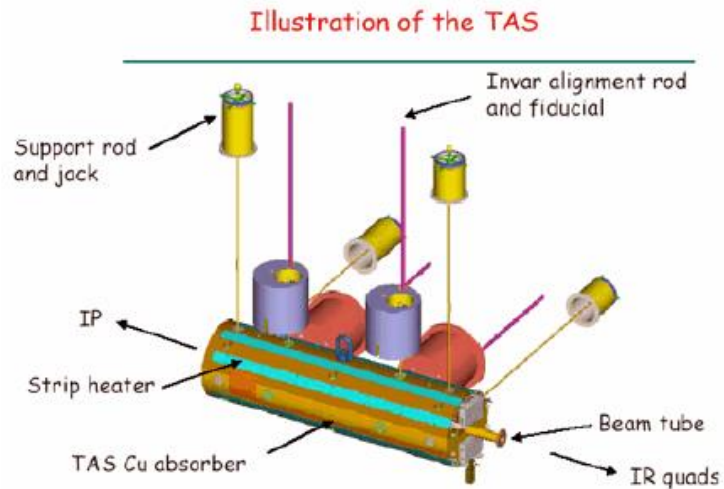


TAS inserted in its cradle then in TX1S shielding at the surface.

TAS installation @Atlas



TAS installation @Atlas



TAS installation @Atlas



TAS installation @Atlas



Lowering of the whole (TAS + cradle+ TX1S) and installation

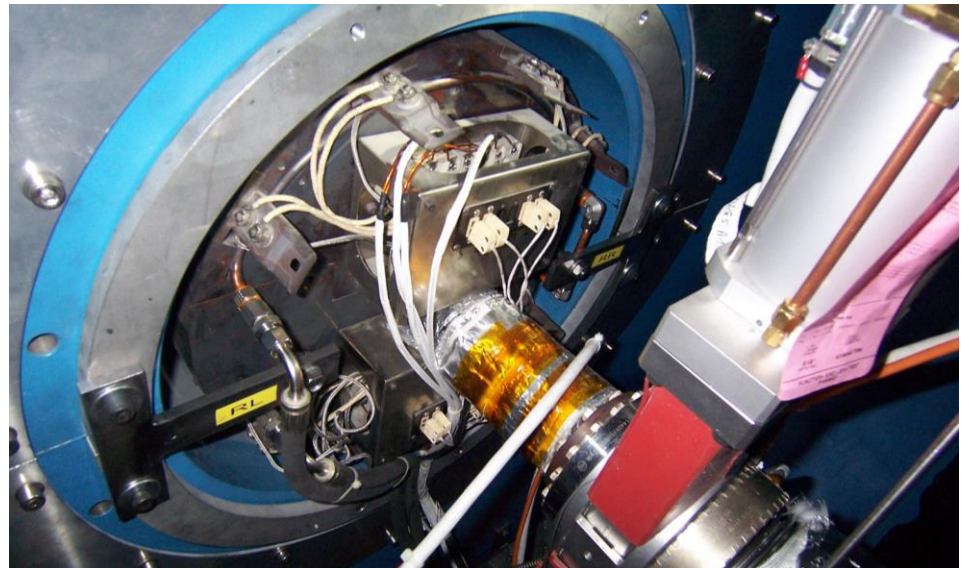
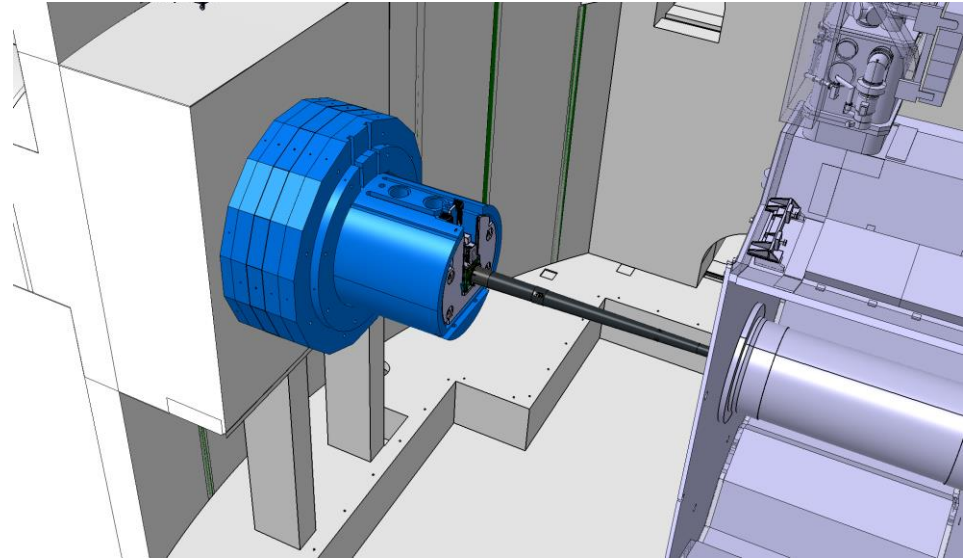
Removal of TAS operating from the UX15 cavern side

- The easiest way to remove the TAS would be to extract it together with its cradle from inside the TX1S Monobloc to have sufficient shielding. → need estimates of the expected activation in this configuration — RP?



Preparatory operations

- In order to access the front face of the TAS shield, the ATLAS detector must be in the long opening configuration, i.e. the big wheels in garage position, the endcap toroids in garage position off the beam line (see EDMS 969888)
- The beam pipe sections VT and VJ must have been removed
- The alignment plate must have been removed as well.
- On the machine side, the beam vacuum equipment must have been disconnected from the TAS beam pipe as well as cooling hoses and mechanical stops.



Preparatory operations

Additional plate on JN



From the TAS installation time, an additional plate has been added.

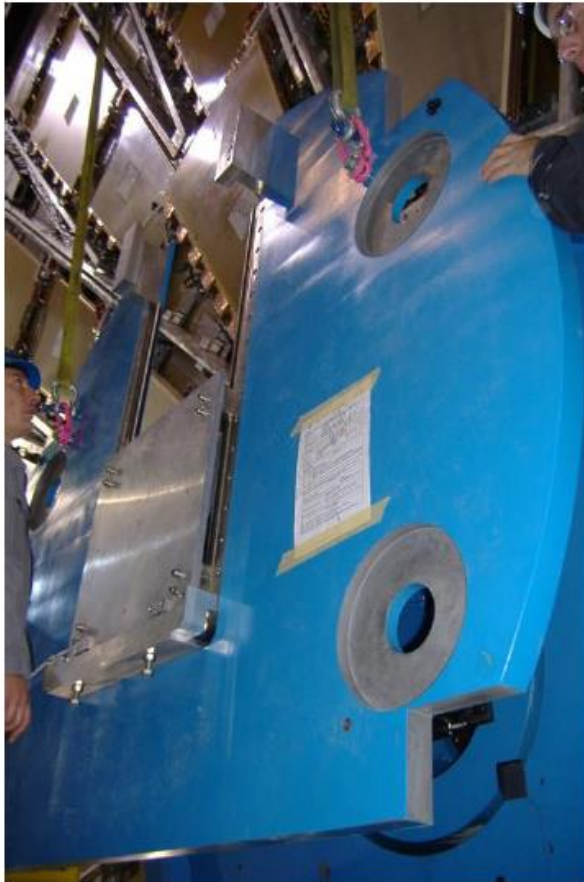
The purpose is to be interfaced with the vacuum pipe : see drawing LHCVC1J_0010

From the picture, it does not look possible to remove TAS from ATLAS side without removing this large plate



Preparatory operations

Additional plate on JN

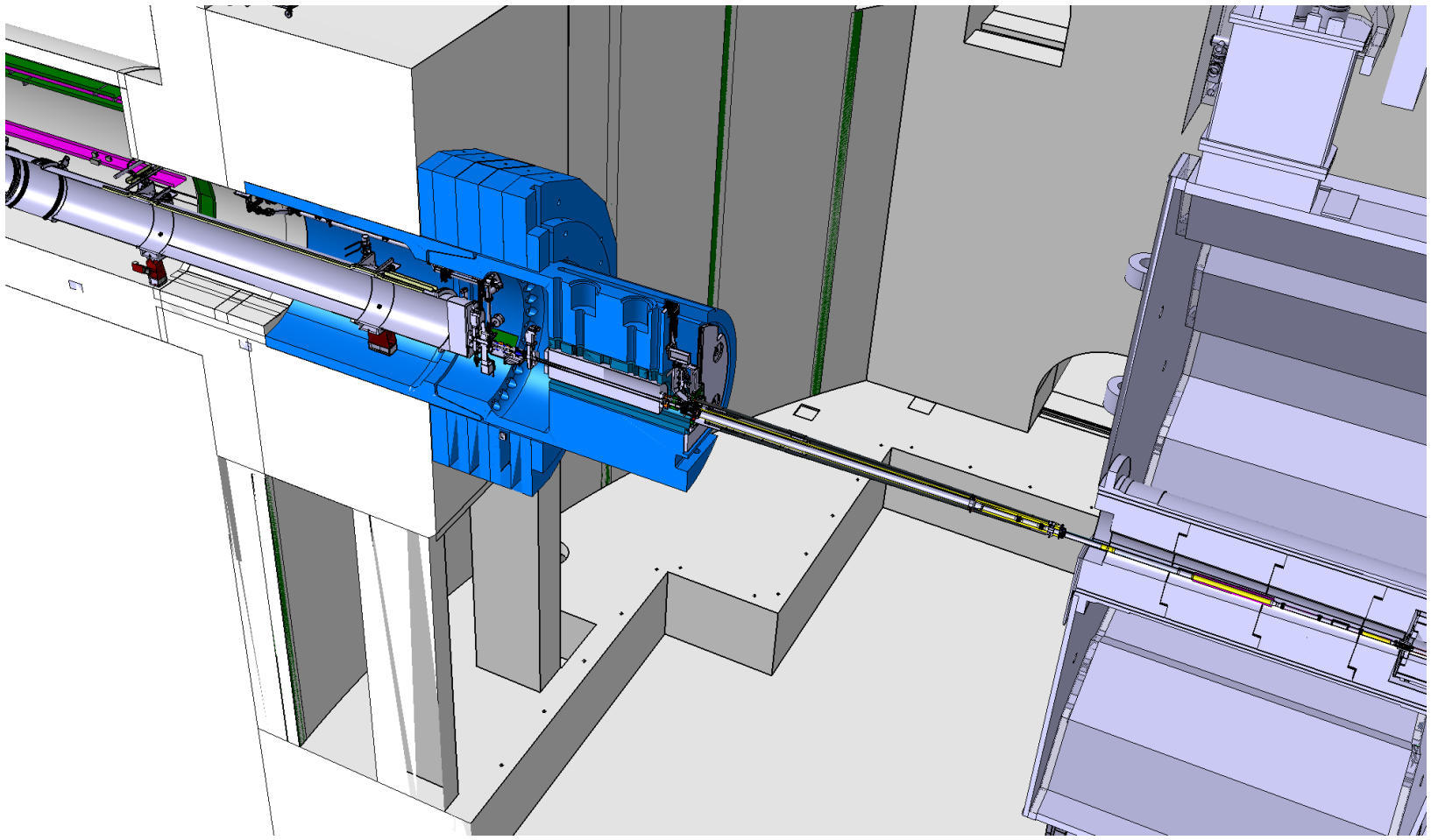


The full assembly as it can see here is detailed is drawing LHCVC1J_0045

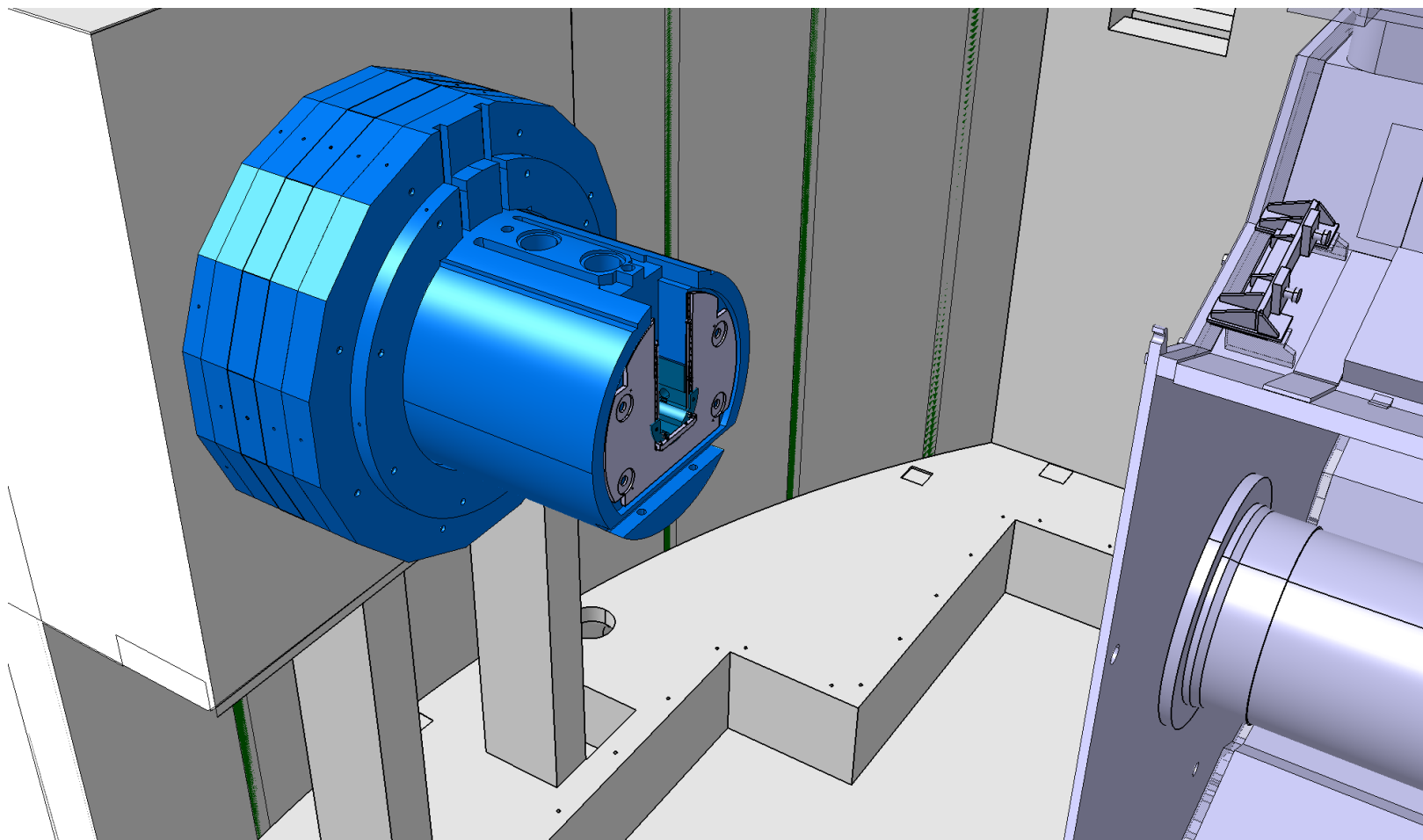
Does a 3D model exist on Catia ???
→ Investigation on going

In any case, its removing should be foreseen

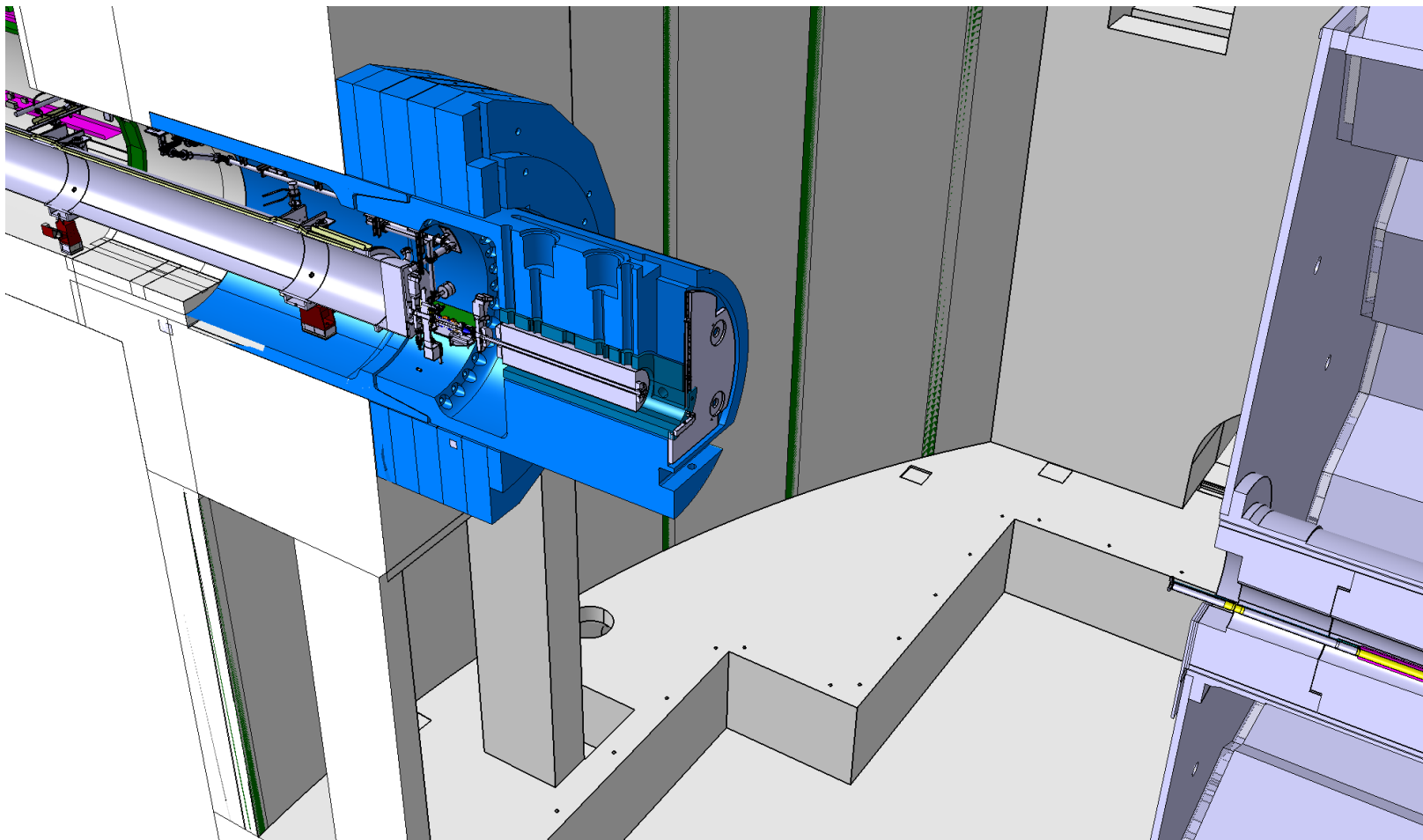
Removal of surrounding shieldings



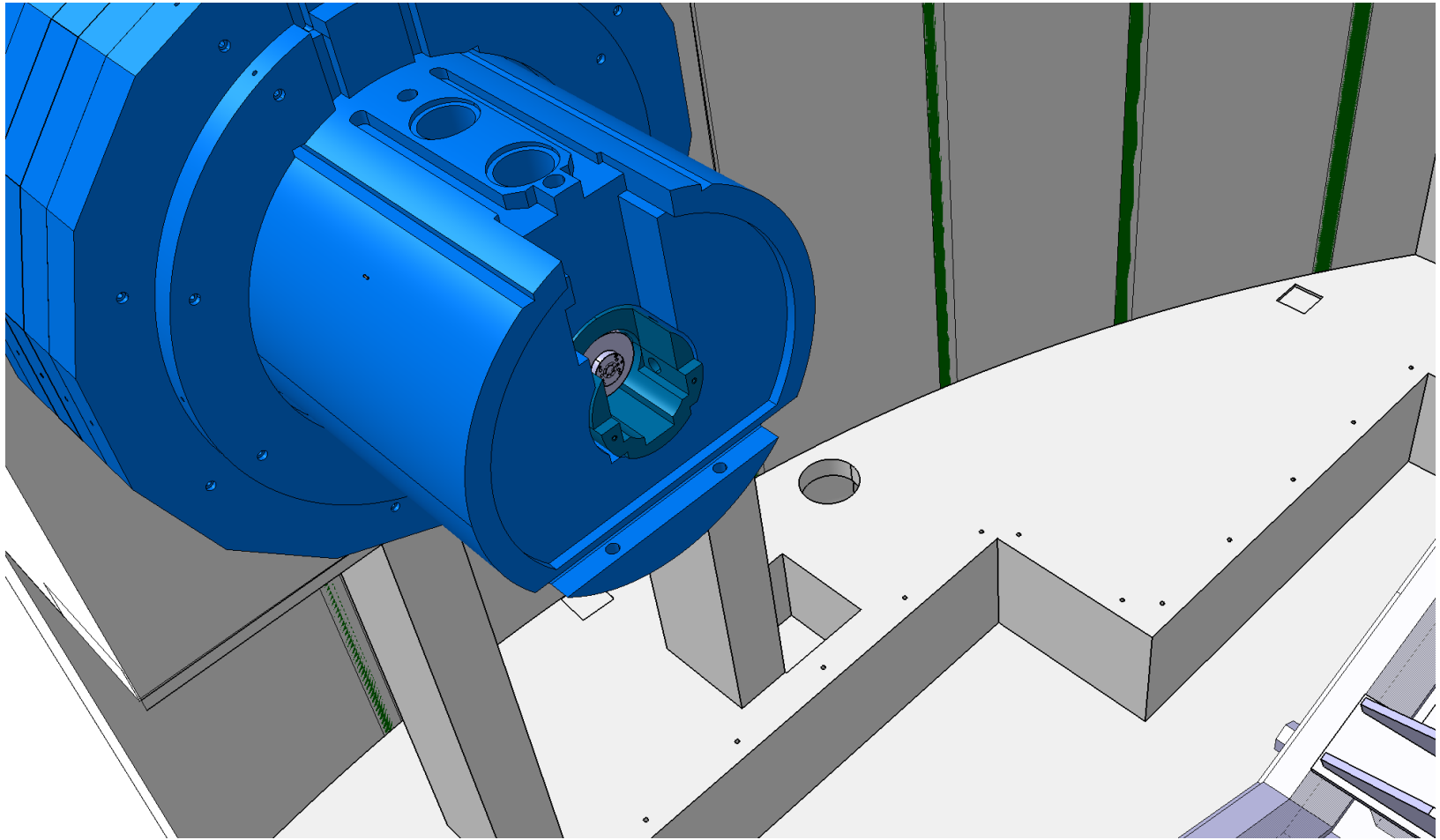
Removal of VT and VJ beam pipe sections



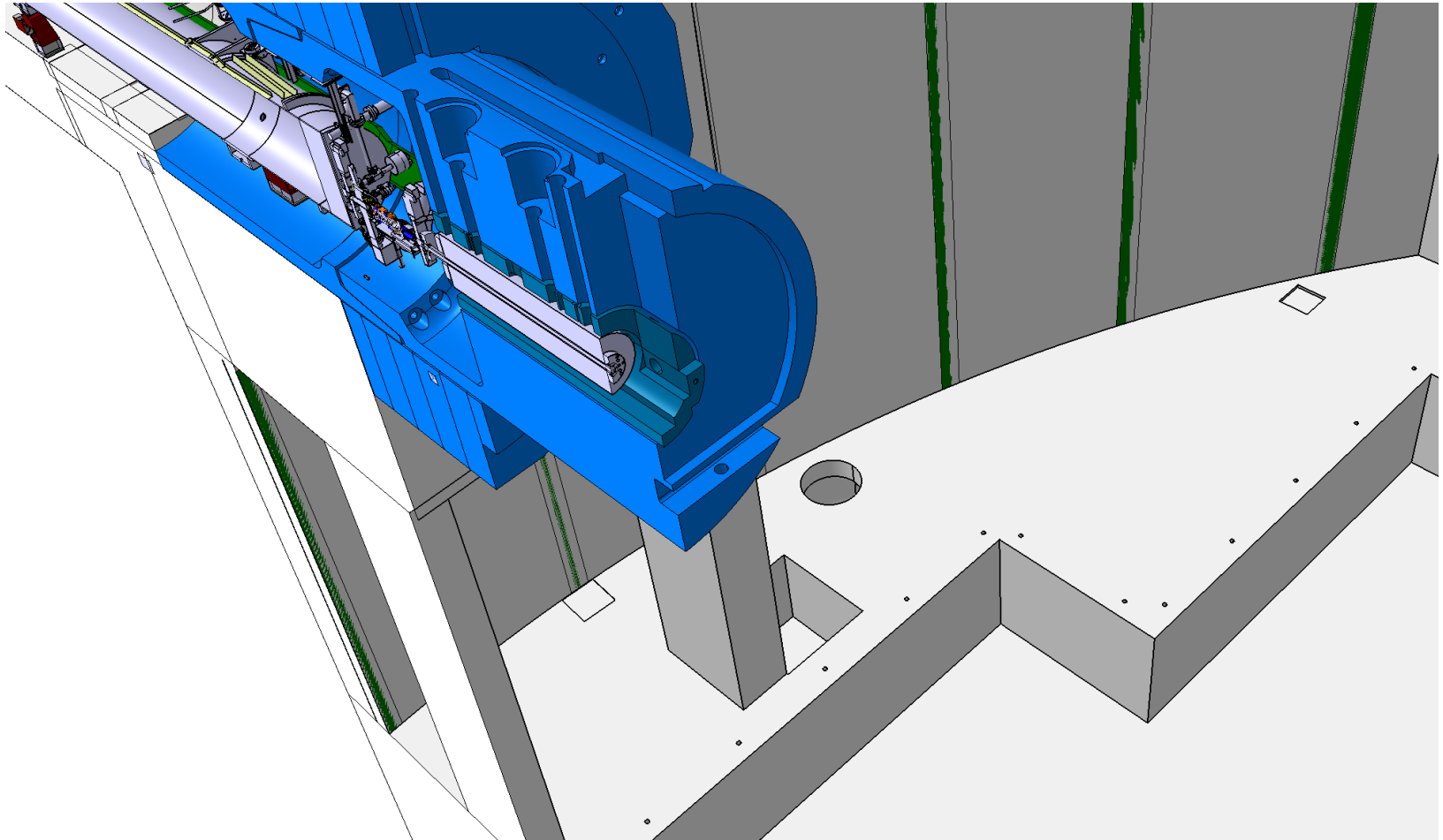
Removal of VT and VJ beam pipe sections



Removal of alignment plate



Removal of alignment plate



Operation sequence

1. *Disconnection of services at the back of TAS and installation of a longitudinal stop*

- Prior to extracting the TAS, the heating and cooling equipment at the back of the TAS must be disconnected. A blocking bar must be put in place to prevent the TAS to slide inside the cradle during the transport later on.

2. *Installation of wood supports and longitudinal stops*

- When the support rods are disconnected, the TAS must rest on some wooden supports that were designed for this purpose. They need to be inserted between the TAS and its cradle, possibly using long metal rods.

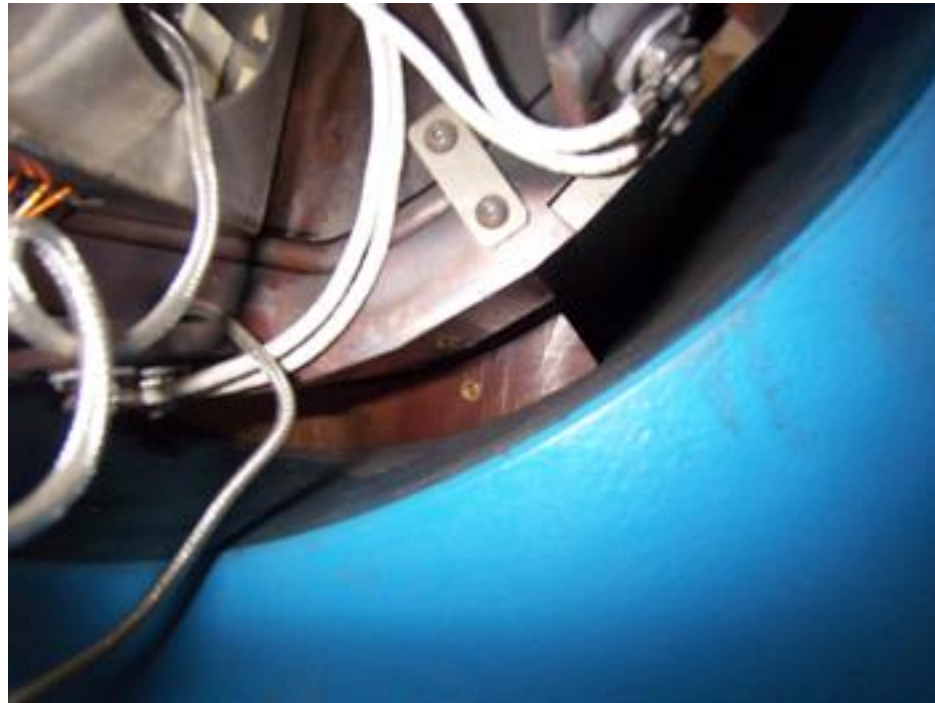
3. *Disconnection of supports and survey equipment*

- In order to be able to extract the TAS and its cradle, the supporting rods must be disconnected and the survey bars removed (shielding plugs in Monobloc possibly to be removed beforehand). Starting by horizontal ones, than vertical ones.

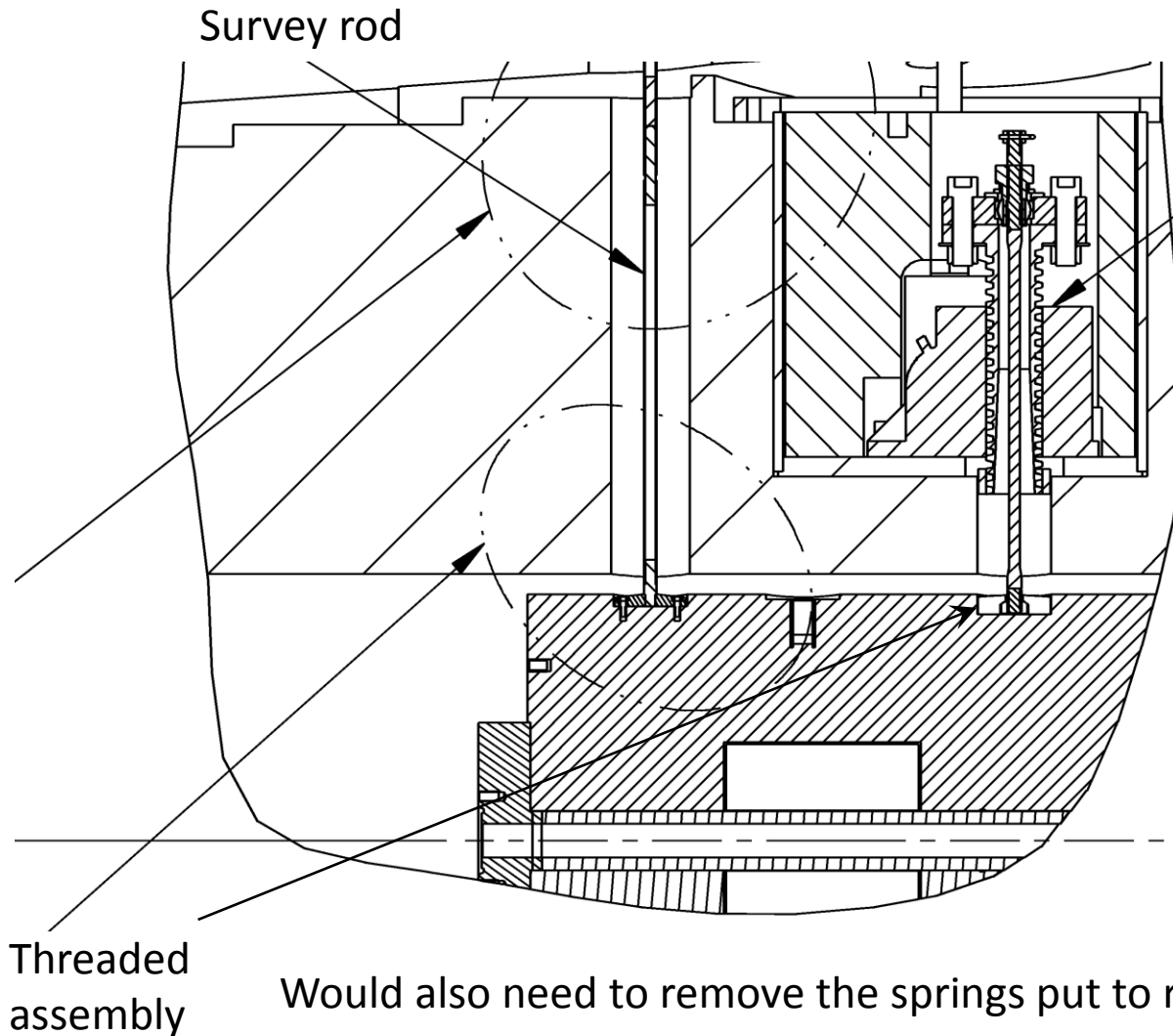
4. *Installation of the console*

- The same console as used for the insertion of the TAS and its sarcophagus into the TX1S monobloc shall be re-used for the extraction. This steel frame shall be lowered into the UX15 cavern, then suspended from the 5t underground crane and taken to the front face of the TX1S monobloc, onto which it will be bolted.

Installation of wood supports and longitudinal stops



Disconnection of supports and survey equipment

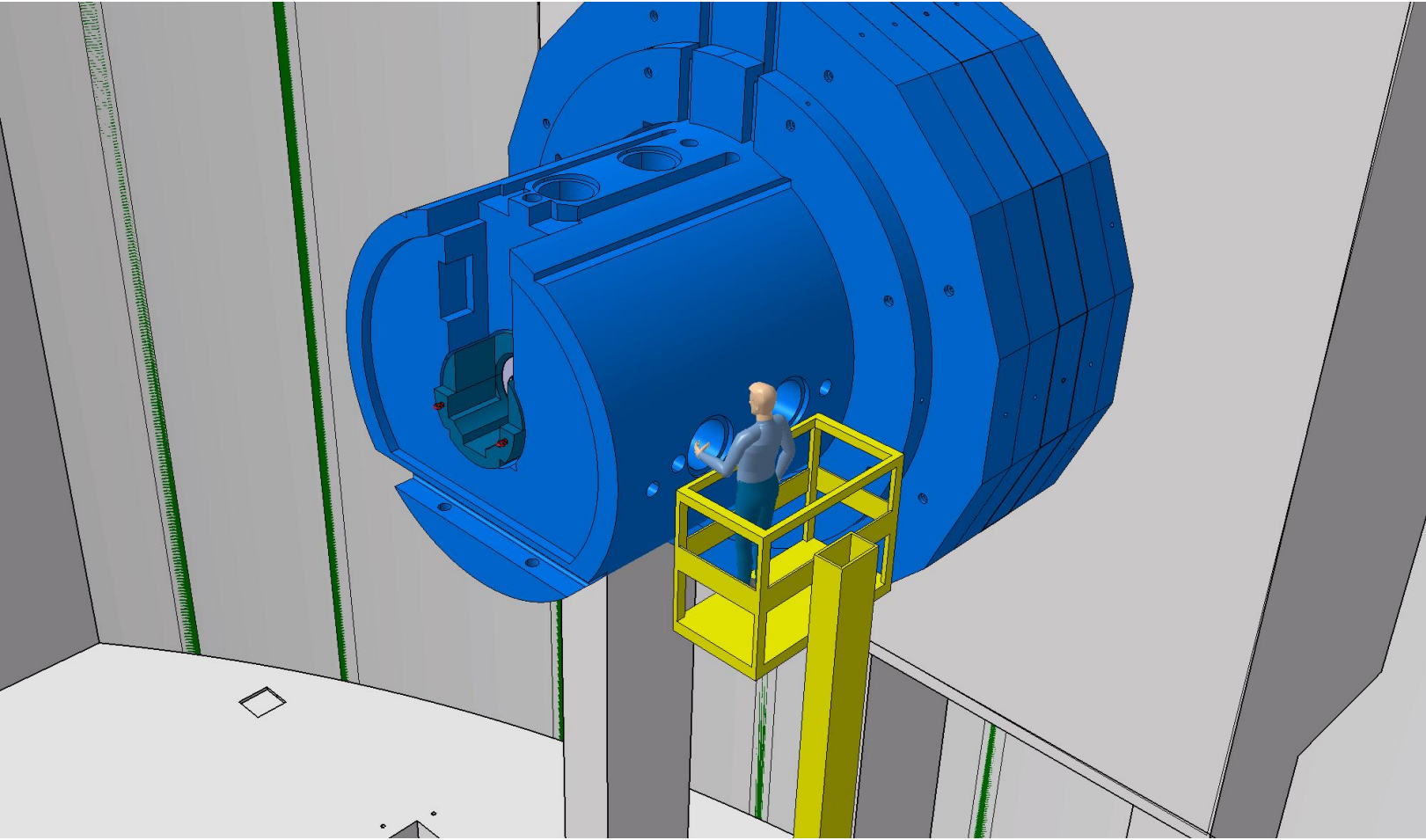


SUPPORT JACK ASSEMBLY

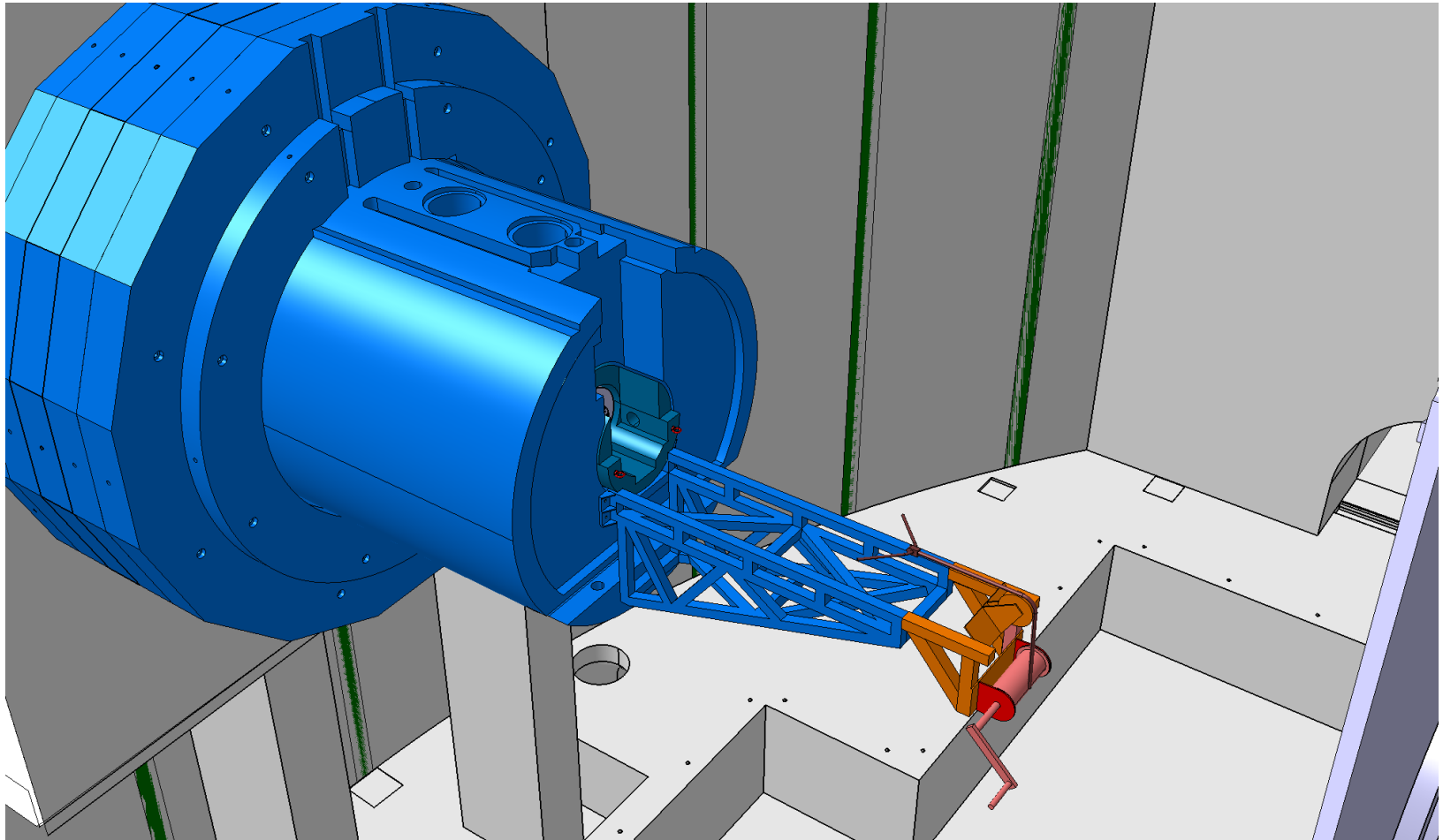
- 4 alignment rods to unbolt
- 4 support rods to dismount
- See lhctas_0071-vAB and lhctas_0075-vAA for details
- **Manual operations with access around and front/back of the TAS at close vicinity of monobloc** → safety and RP assessment needed.
- 4 screw jacks remain in monobloc. To be reused with TAXS ?

Would also need to remove the springs put to rigidify the TAS movements ?

Disconnection of supports and survey equipment



Installation of the console



Operation sequence

5. *Installation of traction equipment on sarcophagus*

- In order to extract the TAS with its sarcophagus, the following equipment has to be installed on the front of the sarcophagus: 2 x M20 eyebolts bolted onto the sarcophagus, 2 x shackles, 2 x 12m slings.

6. *Extraction of the sarcophagus and TAS onto the console*

- The TAS and its sarcophagus shall be extracted from inside the TX1S by pulling horizontally on the slings, using a “Pullift” or similar attached to the console extension (to be detailed).

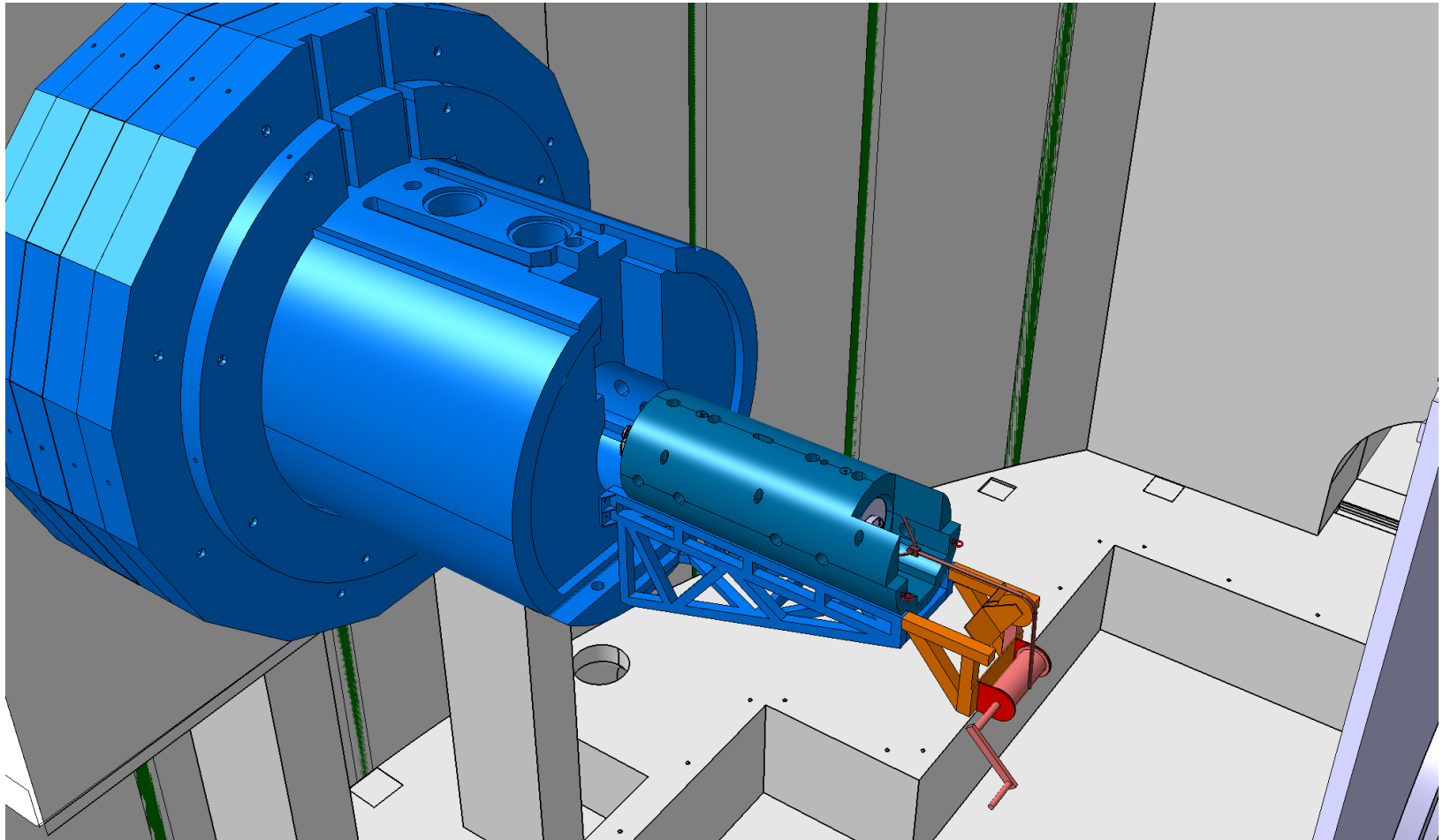
7. *Slinging the sarcophagus and lifting to the surface hall*

- For the lifting to the surface, 2x M30 eyebolts, 2 shackles and 2x 5m slings have to be installed on top of the sarcophagus. The TAS and its sarcophagus shall then be hooked to the SX1 surface crane and lifted into a container waiting in the SX1 buffer area for further transport.

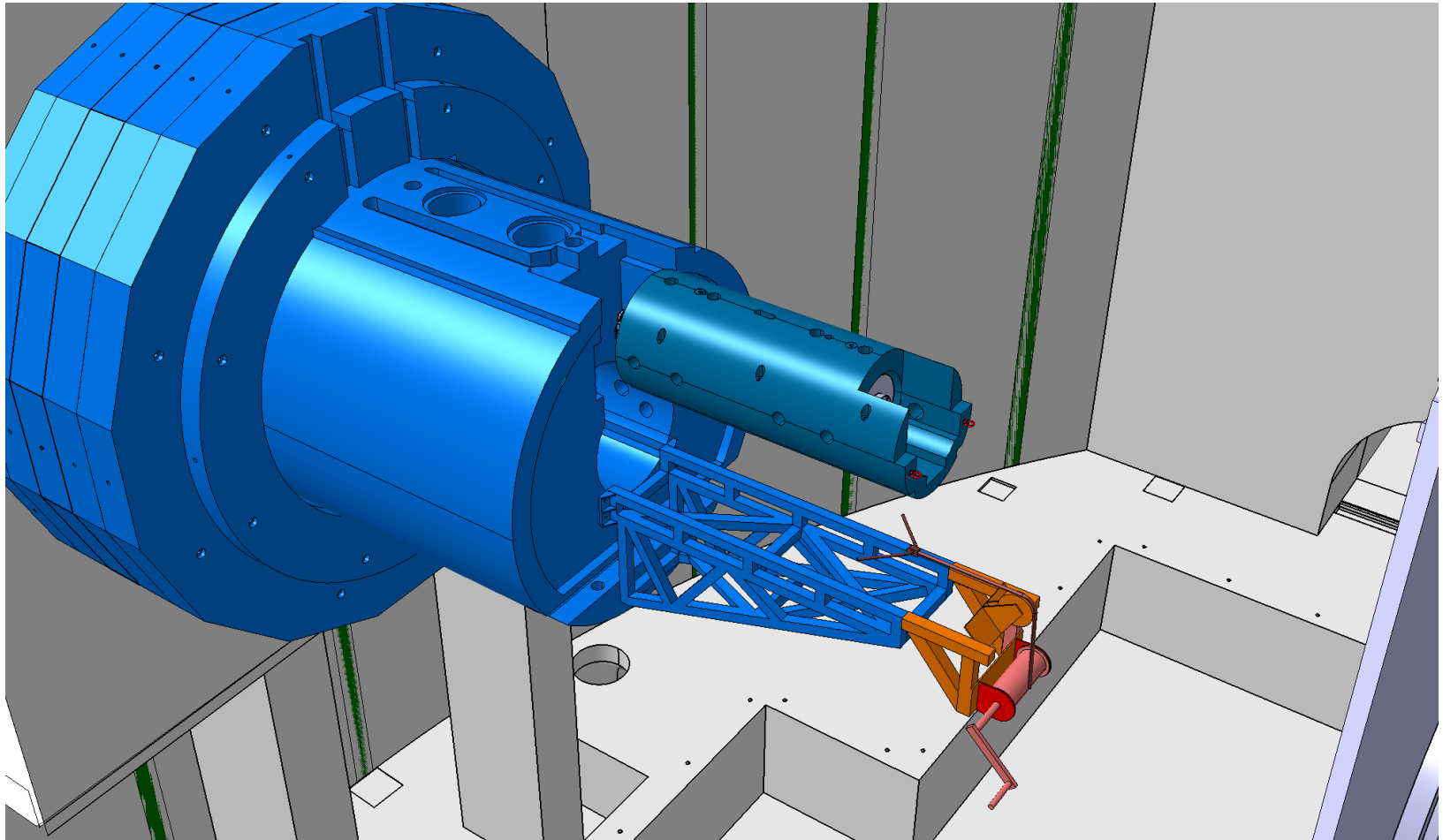
8. *De-slinging the sarcophagus in the surface hall*

- The slings have to be released from the hook once in the SX1 buffer zone.

Extraction of the sarcophagus and TAS onto the console



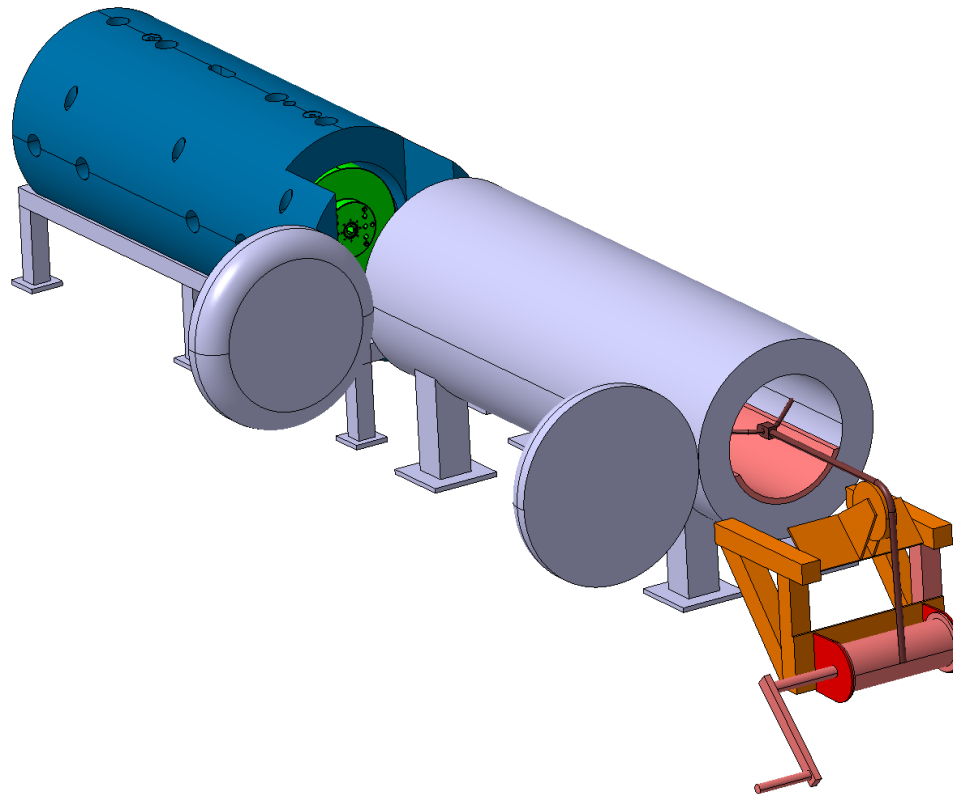
Slinging the sarcophagus and lifting to the surface hall



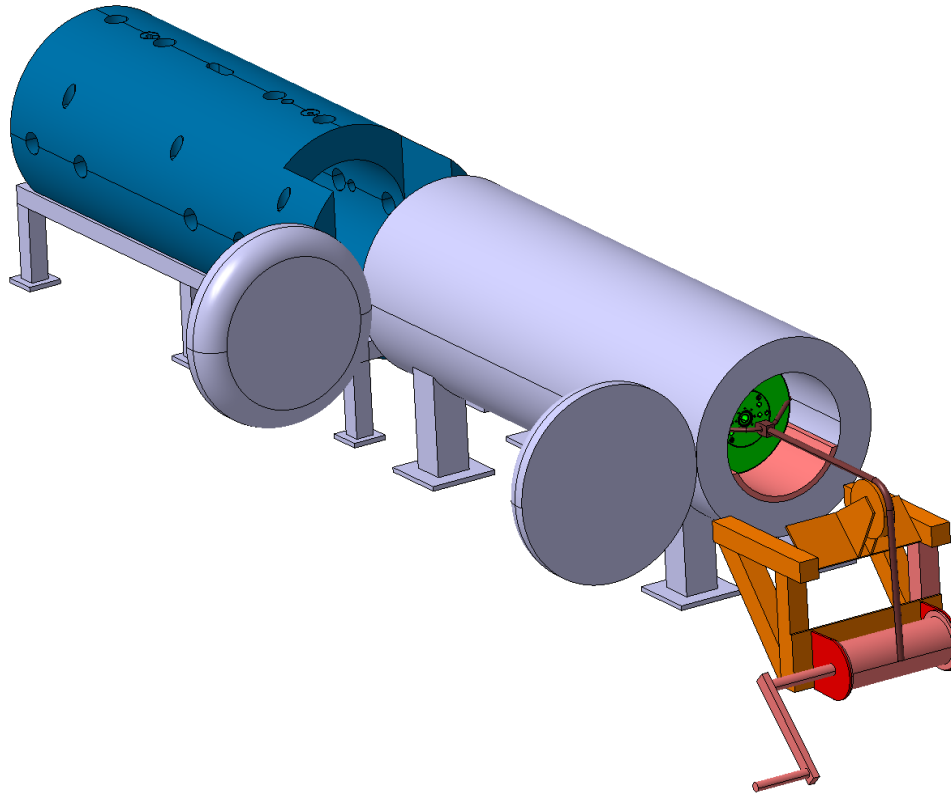
Operation sequence

- 8. *Installation of a sarcophagus in front of cradle and TAS***
 - In order to extract the TAS from its cradle and insert it in a long-term shielding, dedicated sarcophagus are going to be designed and built and fitted with internal rails.
- 9. *Extraction of the TAS and insertion into its sarcophagus***
 - The TAS shall be extracted from inside the cradle by pulling horizontally on the slings, using a “Pullift” or similar attached to the sarcophagus end. (to be detailed). Additional shielding blocks to protect operators.
- 10. *Transport decommissioned TAS to ISR for long term disposal***

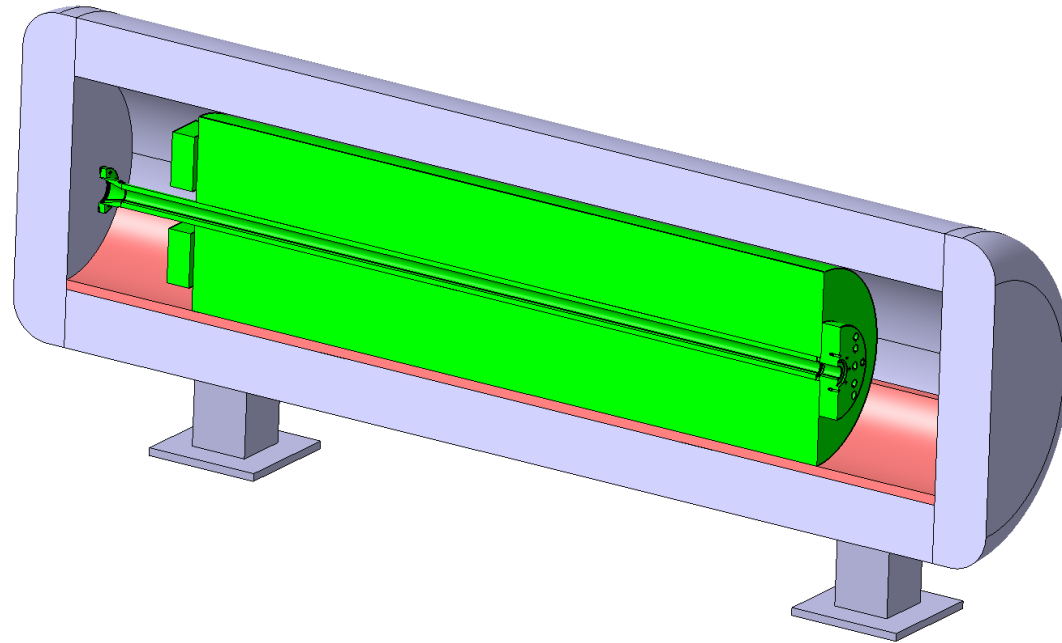
Présentation du principe de sarcophage de surface



Extraction du TAS



Fermeture du sarcophage

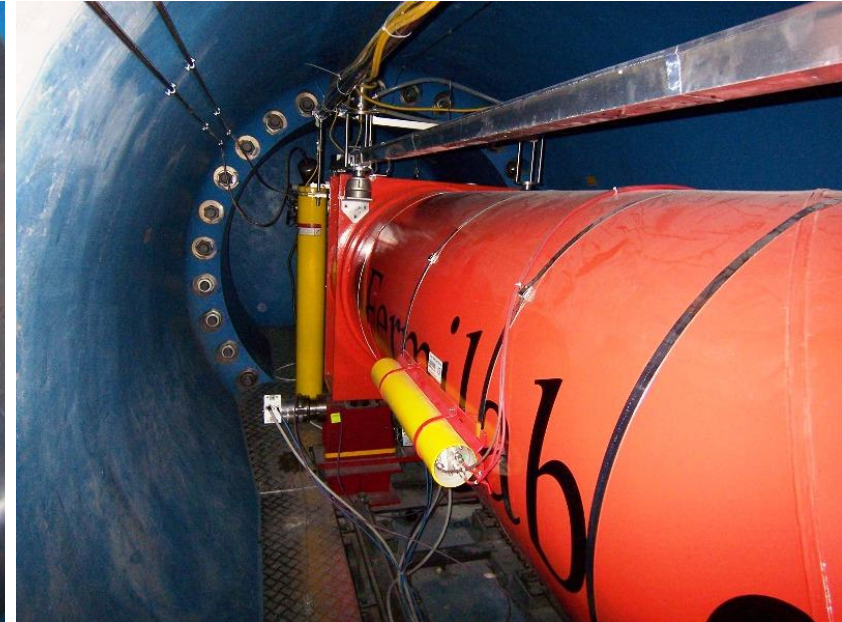
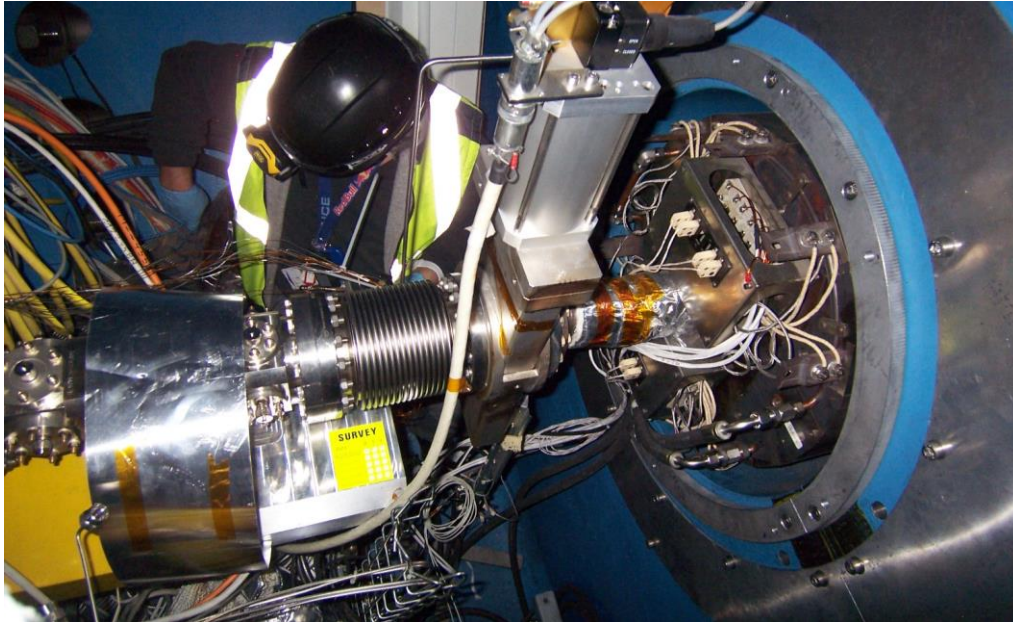


Additional points to consider

- Should we prepare a dummy shielding for ATLAS until the new TAXS is installed?
RP/access/ventilation sectorisation?
- Are we going to re-use/modify the cradle?
- Additional shielding plugs in JF shielding: it would be rather challenging to correctly align the TAXS in face with the holes for the jacks and to the alignment rods: if not, we must build new ones, probably better adopted to the HL-LHC operation?

Removal of TAS operating from the LHC tunnel side

- In order to access the back face of the TAS shield in an easier way and in any case to extract it from the machine tunnel side, the inner triplet must have been removed



Preparatory operations

- The inner triplet must have been removed from the tunnel, together with the beam vacuum equipment on the back face of the TAS. The ATLAS detector must be in the long opening configuration, i.e. the big wheels in garage position, the endcap toroids in garage position off the beam line, the beam pipe section VJ must have been disconnected from the TAS beam pipe

Operation sequence

1. *Disconnection of services at the back of TAS and installation of a longitudinal stop*

- Prior to extracting the TAS, the heating and cooling equipment at the back of the TAS must be disconnected. A blocking bar must be put in place to prevent the TAS to slide inside the cradle during the transport later on.

2. *Installation of wood supports and longitudinal stops*

- When the support rods are disconnected, the TAS must rest on some wooden supports that were designed for this purpose. They need to be inserted between the TAS and its cradle, possibly using long metal rods.

3. *Disconnection of supports and survey equipment*

- In order to be able to extract the TAS and its cradle, the supporting rods must be disconnected and the survey bars removed.

4. *Installation of the transport trailer*

- The TAS and its cradle shall be transferred onto a transport trailer in order to be transported to an access shaft where it will be evacuated to the surface. The same bogies as used for the installation / removal of the inner triplet may be re-used. They will need to be adapted to allow a direct transfer of the TAS onto their platform. More design is needed on this point.

Operation sequence

5. Installation of traction equipment on sarcophagus

- In order to extract the TAS with its sarcophagus, the following equipment has to be installed on the front of the sarcophagus: 2 x M20 eyebolts bolted onto the sarcophagus, 2 x shackles, 2 x 6 m slings.

6. Extraction of the sarcophagus and TAS onto the transport trailer

- The TAS and its sarcophagus shall be extracted from inside the TX1S by pulling horizontally on the slings, using a “Pullift” or similar attached to the transport trailer (to be detailed). A shielding may have been installed on the trailer so as to limit the radiation received by the personnel from this stage on. The nature of this shielding remains to be detailed.

7. Horizontal transport of the sarcophagus to the pit

- The TAS in its sarcophagus once installed on the trailer will be towed to the nearest pit where they can be transported to the surface.

8. Slinging the sarcophagus and lifting to the surface hall

- For the lifting to the surface, 2x M30 eyebolts, 2 shackles and 2x 5m slings have to be installed on top of the sarcophagus. The TAS and its sarcophagus shall then be hooked to the surface crane and lifted into a container waiting in a surface buffer area for further transport.

9. De-slinging the sarcophagus in the surface hall

- The slings have to be released from the hook once in the surface buffer zone.

Decision making process

- decision will have to be made taking into account:
 - the optimal phasing,
 - the doses involved in the work in both scenarios,
 - the work on surrounding elements (in particular the inner triplet) that may be impacted by the presence or the absence of the TAS, as it will be a major source of radiation in this environment

TAS installation @ CMS



The TAS collimators were installed at IR5 together with the surrounding FIN shielding and the covering plug using the surface crane.

Removal of TAS operating from the UX55 cavern side

- The TAS can be lifted together with its covering plug (acting as shielding) for removal, but this can only be done with the underground crane as the surface crane does not reach that far.
- The TAS with its covering plug will then be put inside a shielded container (to be defined) below the PX55 shaft and the whole shall be brought to the surface and evacuated to a long term storage place.

Preparatory operations

- In order to reach the TAS and its covering plug, the CMS detector has to be in long access scenario, with the rotating shielding in open position, the beam pipe sections connected to the TAS must have been removed.
- On the machine side, the beam vacuum equipment must have been disconnected from the TAS beam pipe as well as cooling hoses.

1. *Disconnection of services at the back of TAS*

- Prior to extracting the TAS, the heating and cooling equipment at the back of the TAS must be disconnected.

2. *Disconnection of adjustment and survey rods*

- In order to be able to extract the TAS and its covering plug, the horizontal adjustment rods must be disconnected and the survey bars removed.

3. *Installation of eyebolts on the covering plug*

- In order to extract the TAS with its covering plug, 4 eyebolts have to be bolted onto the top of the covering plug.

4. *Slinging the TAS and covering plug and lifting into the shielded container in UX55*

- For the lifting to the floor of UX55 into the shielded container, 4 shackles and 4x 5m slings have to be installed on top of the covering plug. The TAS and its covering plug shall then be hooked to the UX55 underground crane and lifted into a container waiting on the UX55 floor.

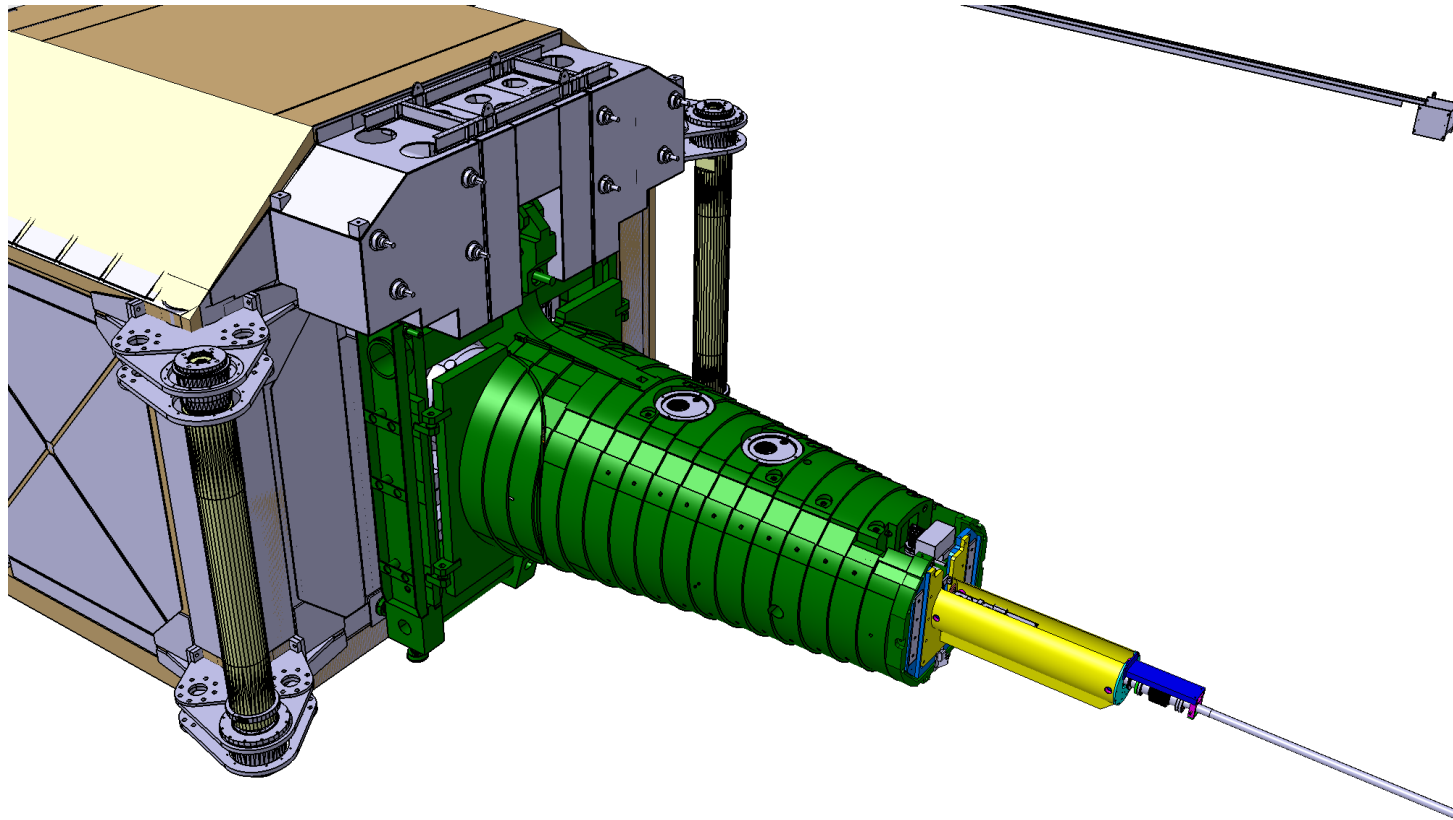
5. *De-slinging the covering plug once in the shielded container in UX55*

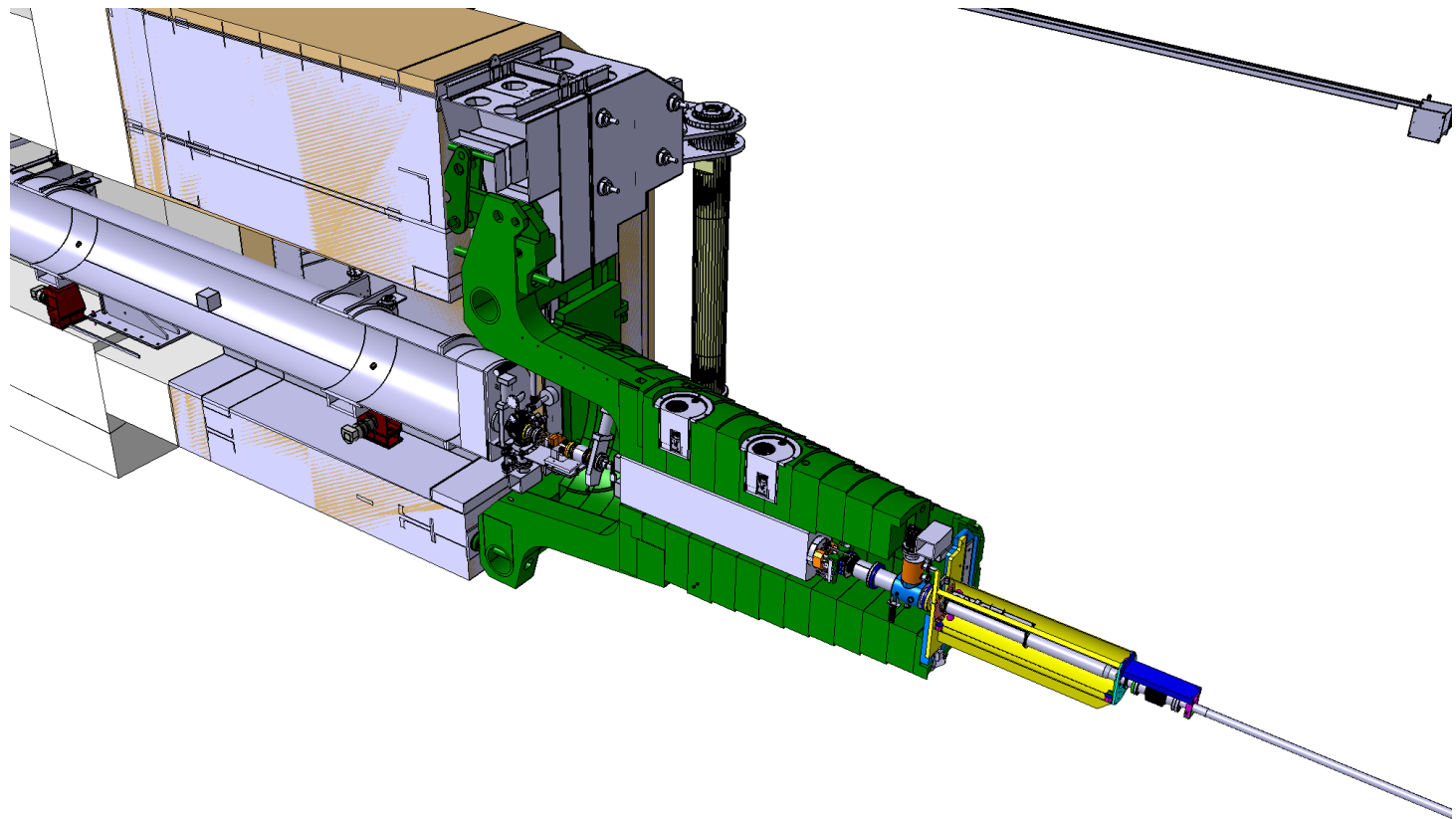
- This operation shall in principle not present particular radiological issues as the shielded container should constitute an adequate protection.

6. *Vertical transport of the shielded container with the TAS and its covering plug into the buffer zone in SX5 surface hall*

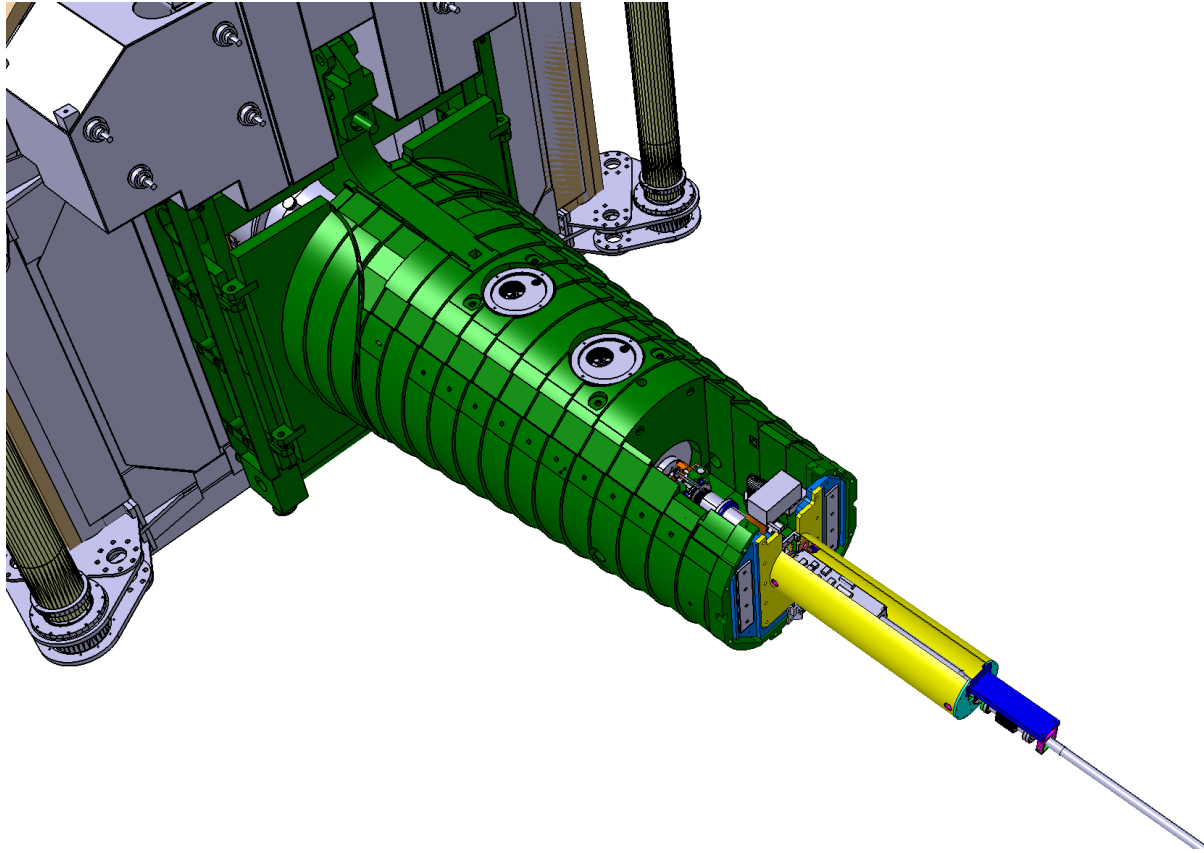
- This operation shall in principle not present particular radiological issues as the shielded container should constitute an adequate protection.

Vue après ouverture du blindage

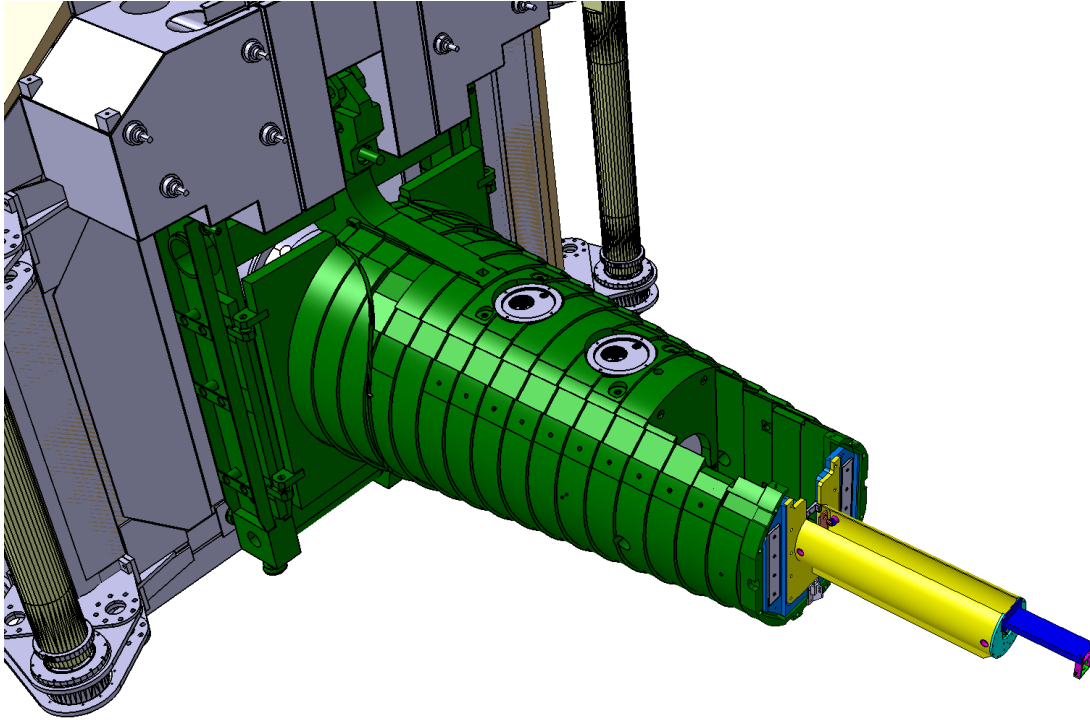


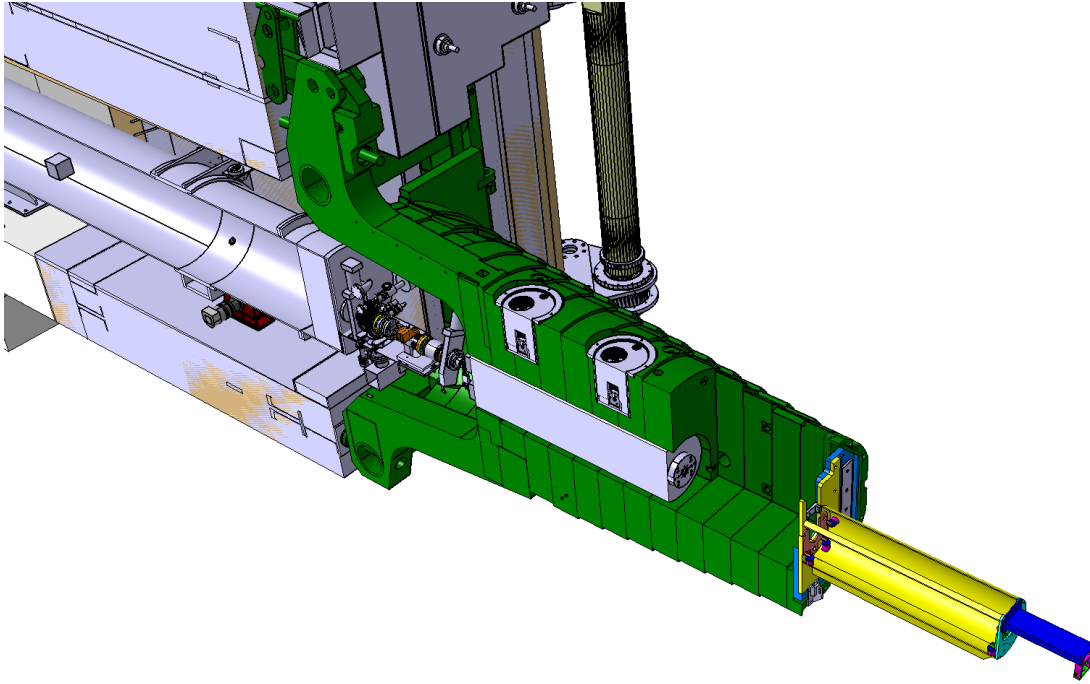


Démontage du "bouchon" du blindage

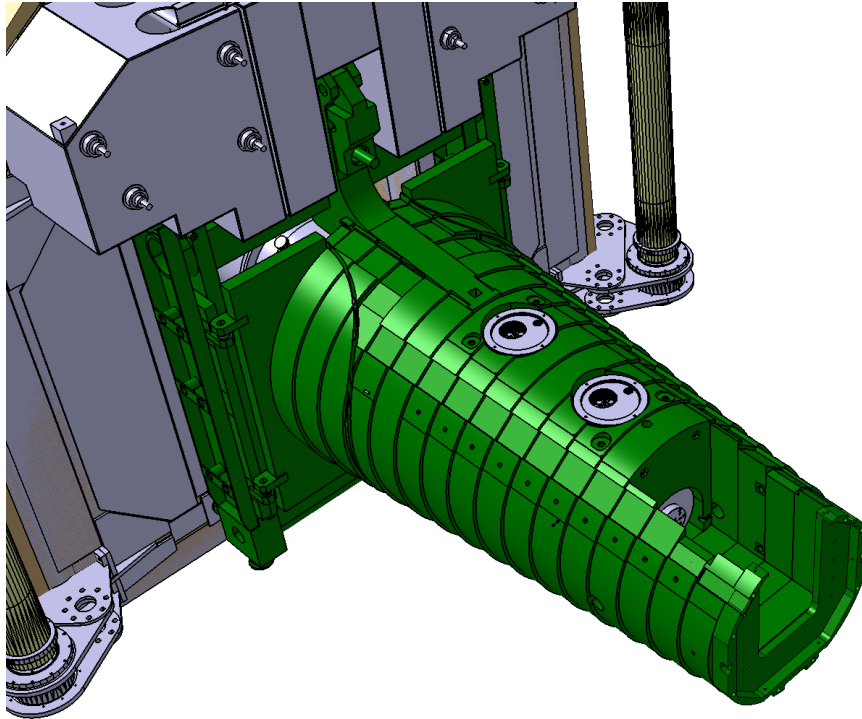


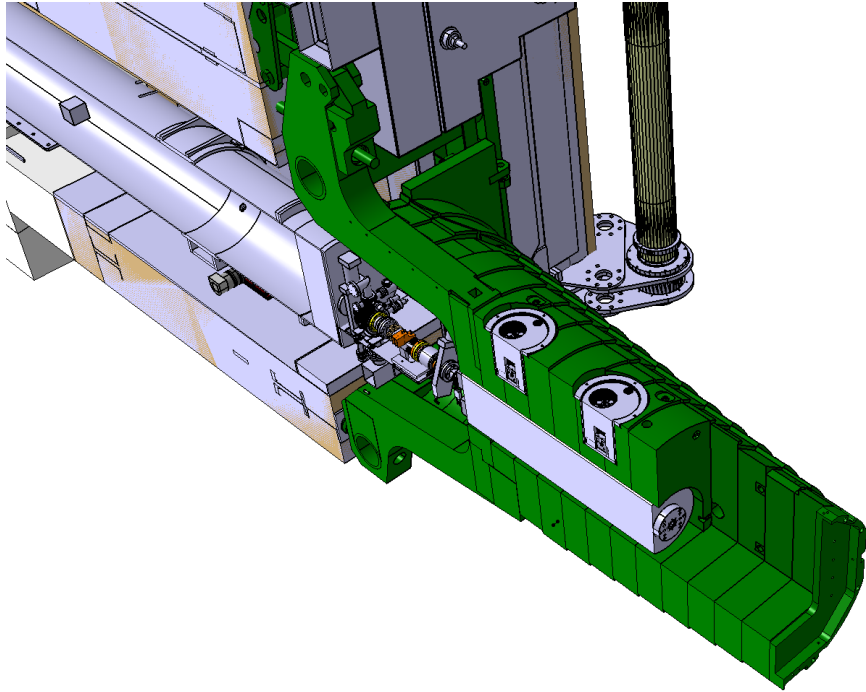
Démontage de tout le système de vide



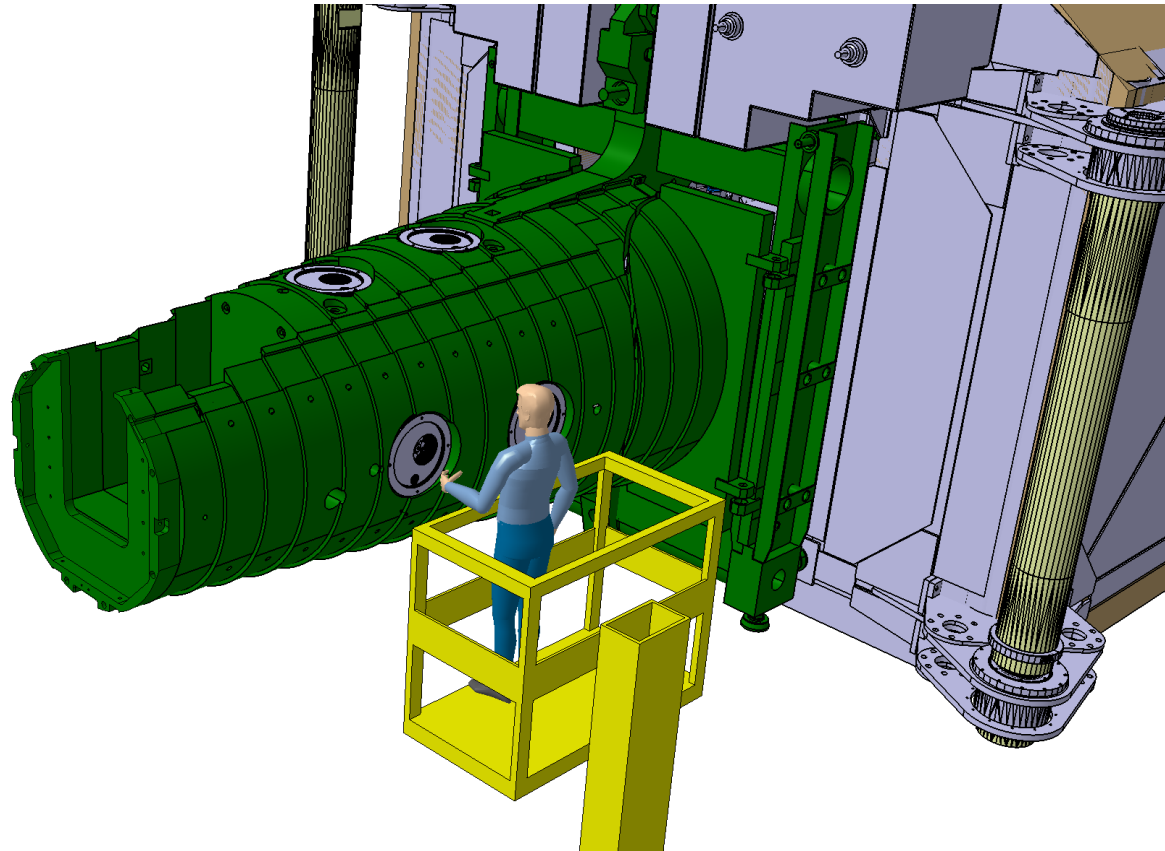


Démontage du supportage du vide

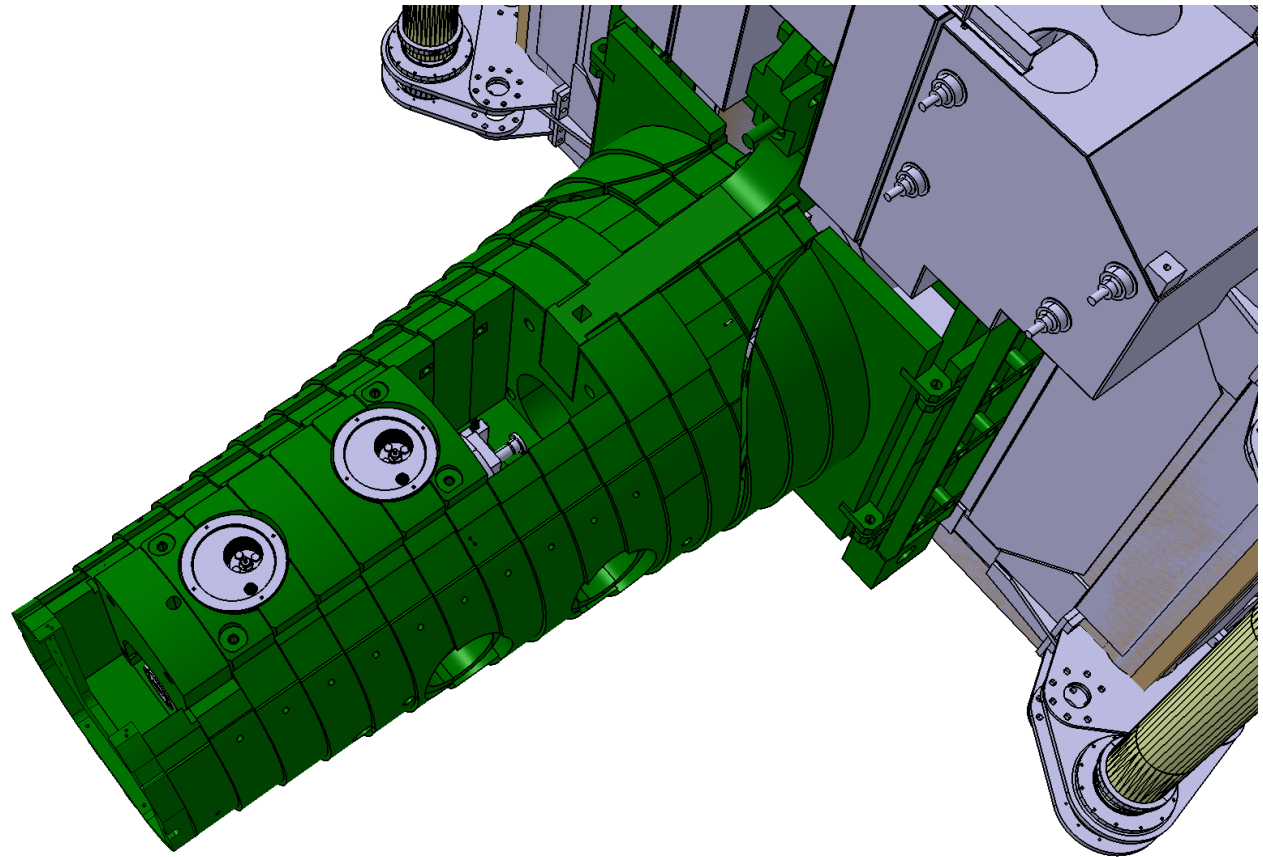




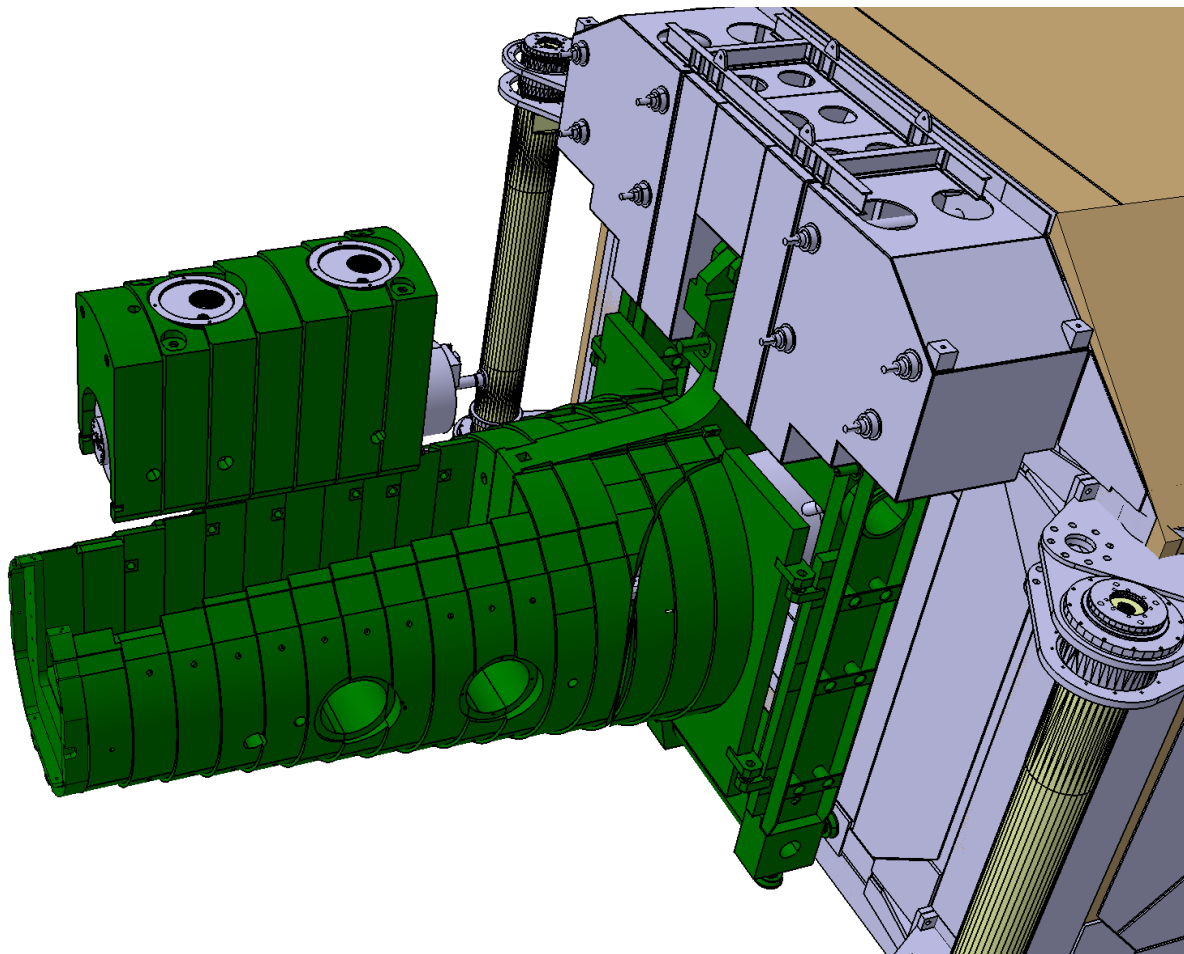
Démontage des 2 supports et 2 tiges de mesures horizontales



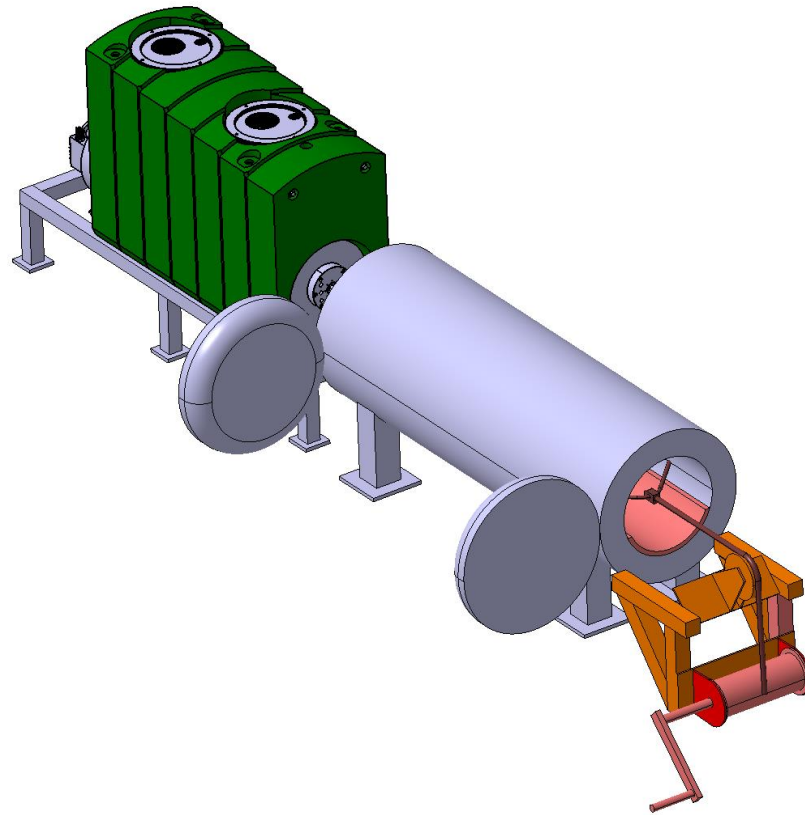
Tirer le TAS et son blindage d'environ 700mm pour dégager la chambre à vide



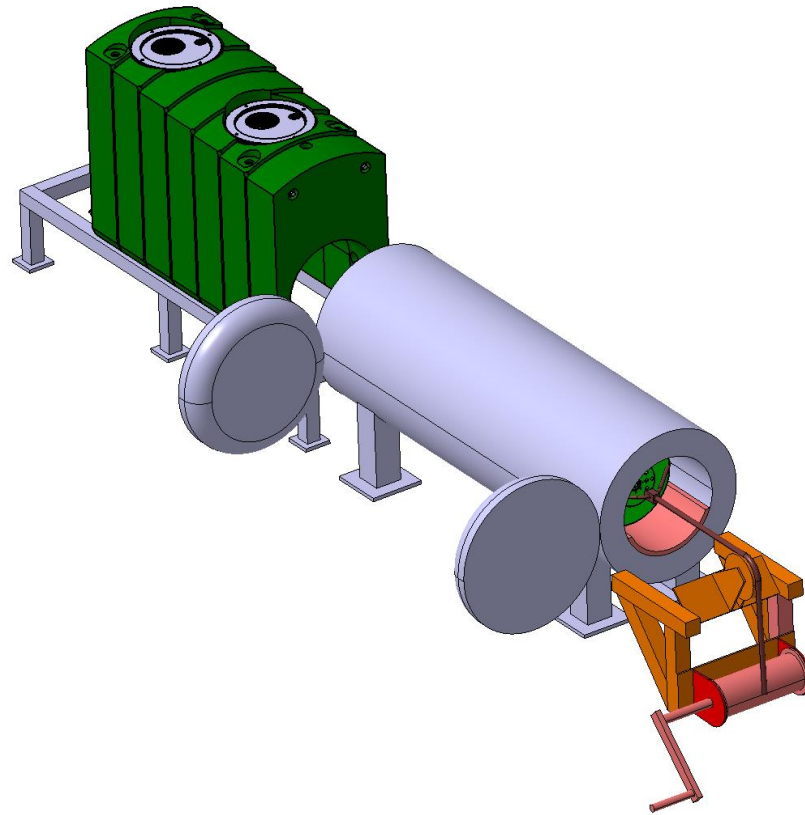
Remonter à la surface le TAS et son blindage à l'aide du pont roulant



Présentation du principe de sarcophage de surface



Extraction du TAS



Removal of TAS operating from the LHC tunnel side

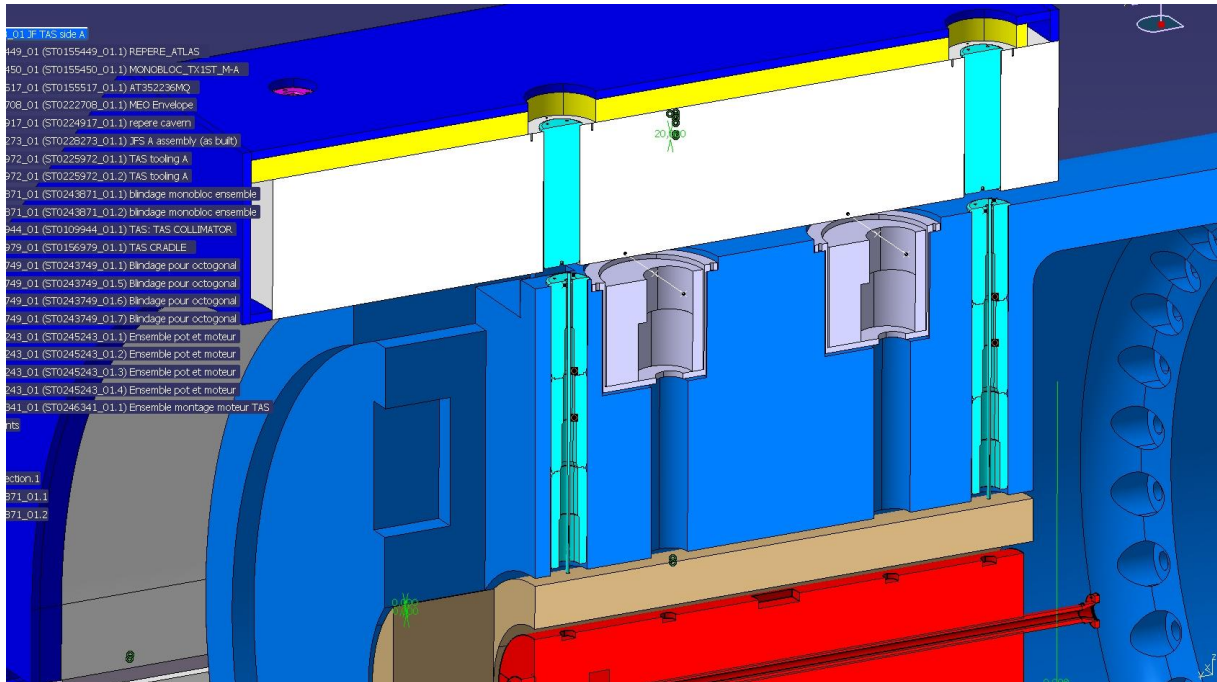
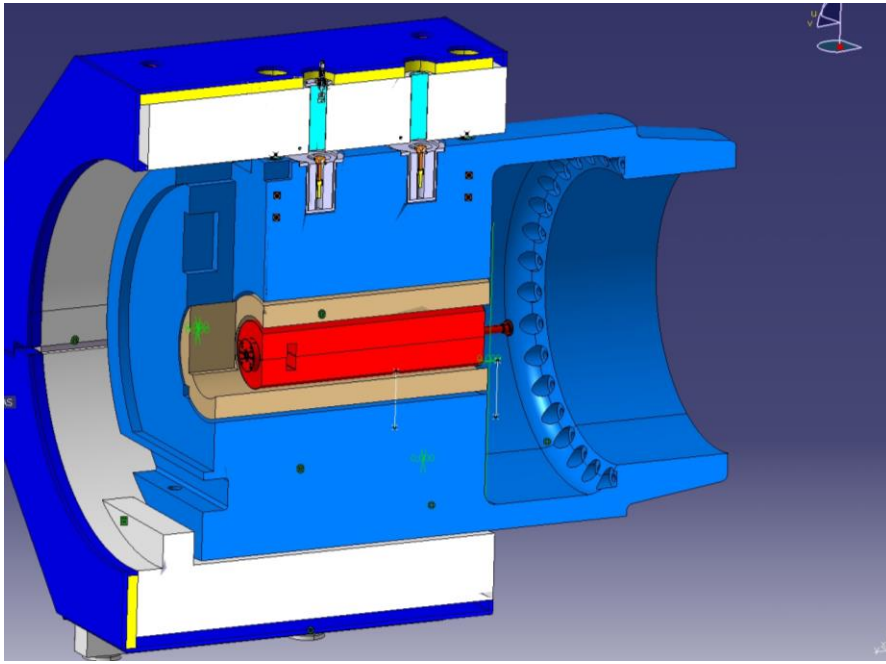
- At this point, it is not considered removing the IR5 TAS operating from the LHC tunnel side as there would apparently be only drawbacks in comparison to the above scenario from the experimental cavern side. It would involve work in the vicinity of the highly activated back face of the TAS, and would imply that the inner triplet has to be removed with the TAS still in place.

Summary and next steps

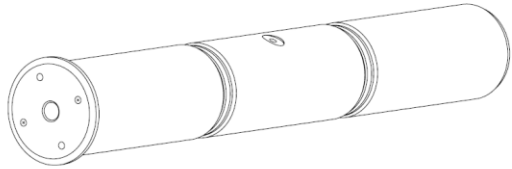
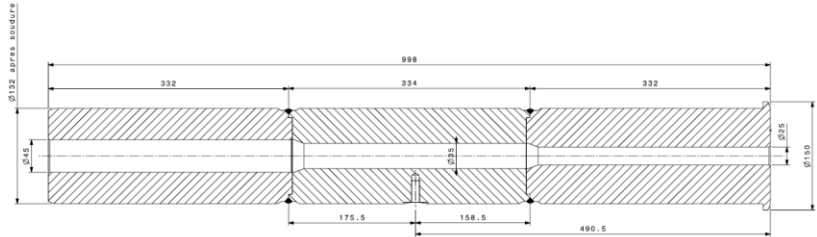
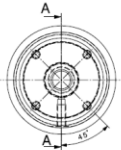
- A first look at the sequence of operations for the ATLAS/CMS TAS removal was presented → Decision on removal scenario.
- Several points in the sequence require close manual contact with the nearby TAS. → Fine tune removal procedure and establish an initial Work Dose Planning
- Some technical solutions must be found and tools must be developed to optimise the process according to ALARA
- Prepare TAXS removal procedure and accommodate TAXS design accordingly

BACK-UP SLIDES

Shielding plugs in JF shielding & monobloc



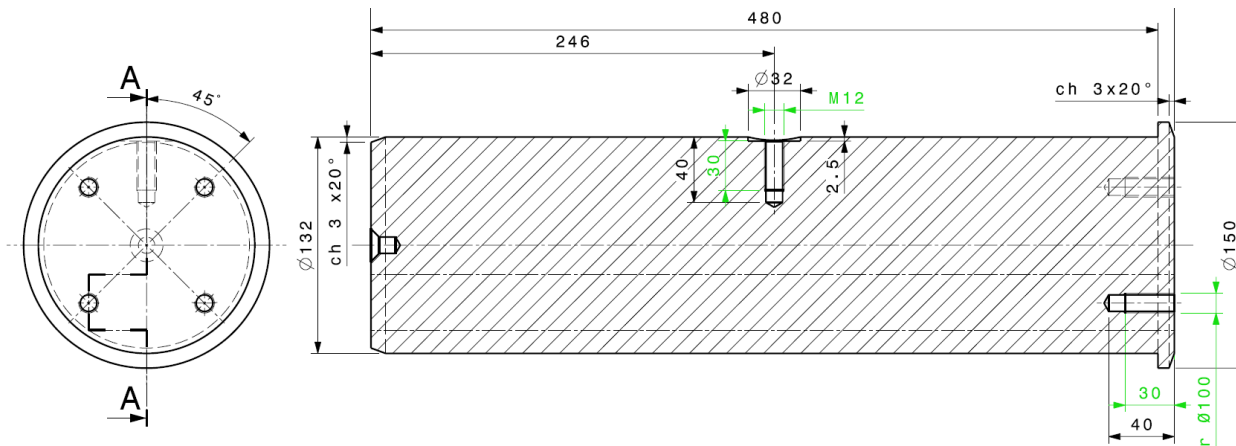
Shielding plugs in monobloc



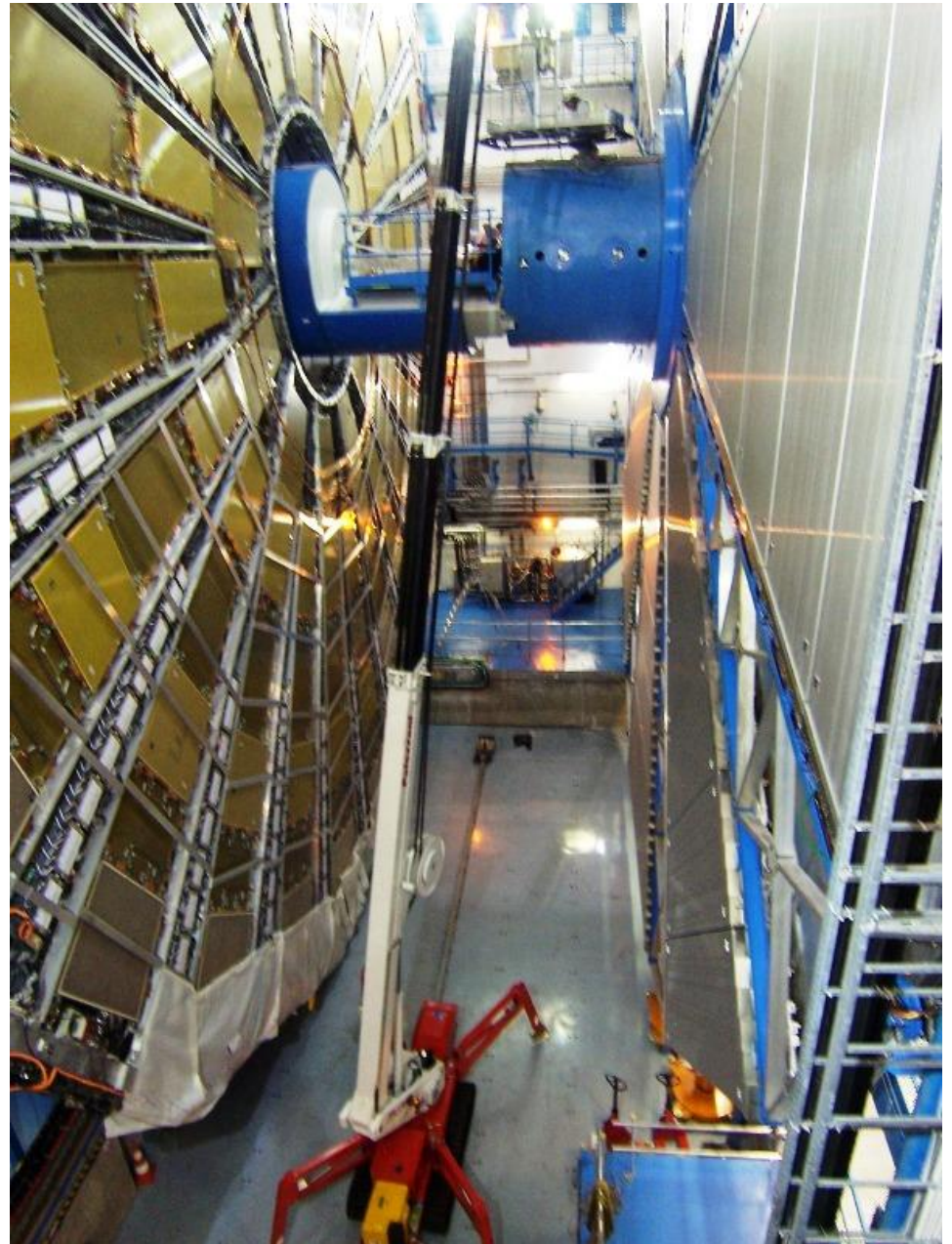
Mass: 100 kg
Masse:

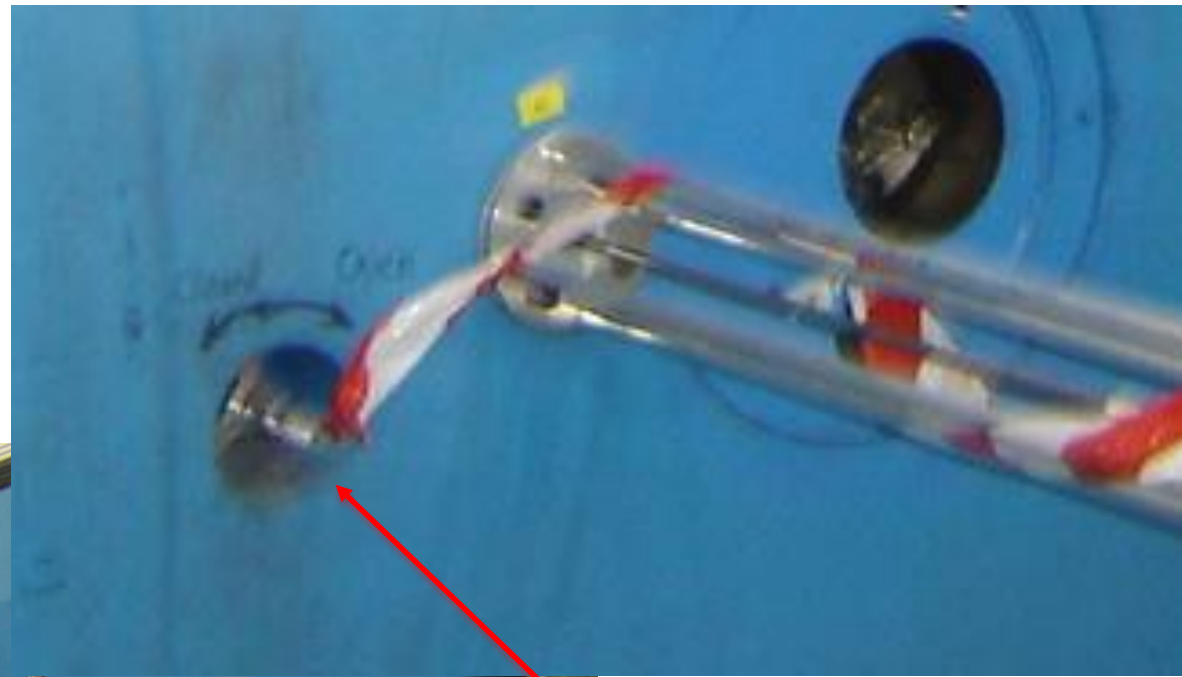
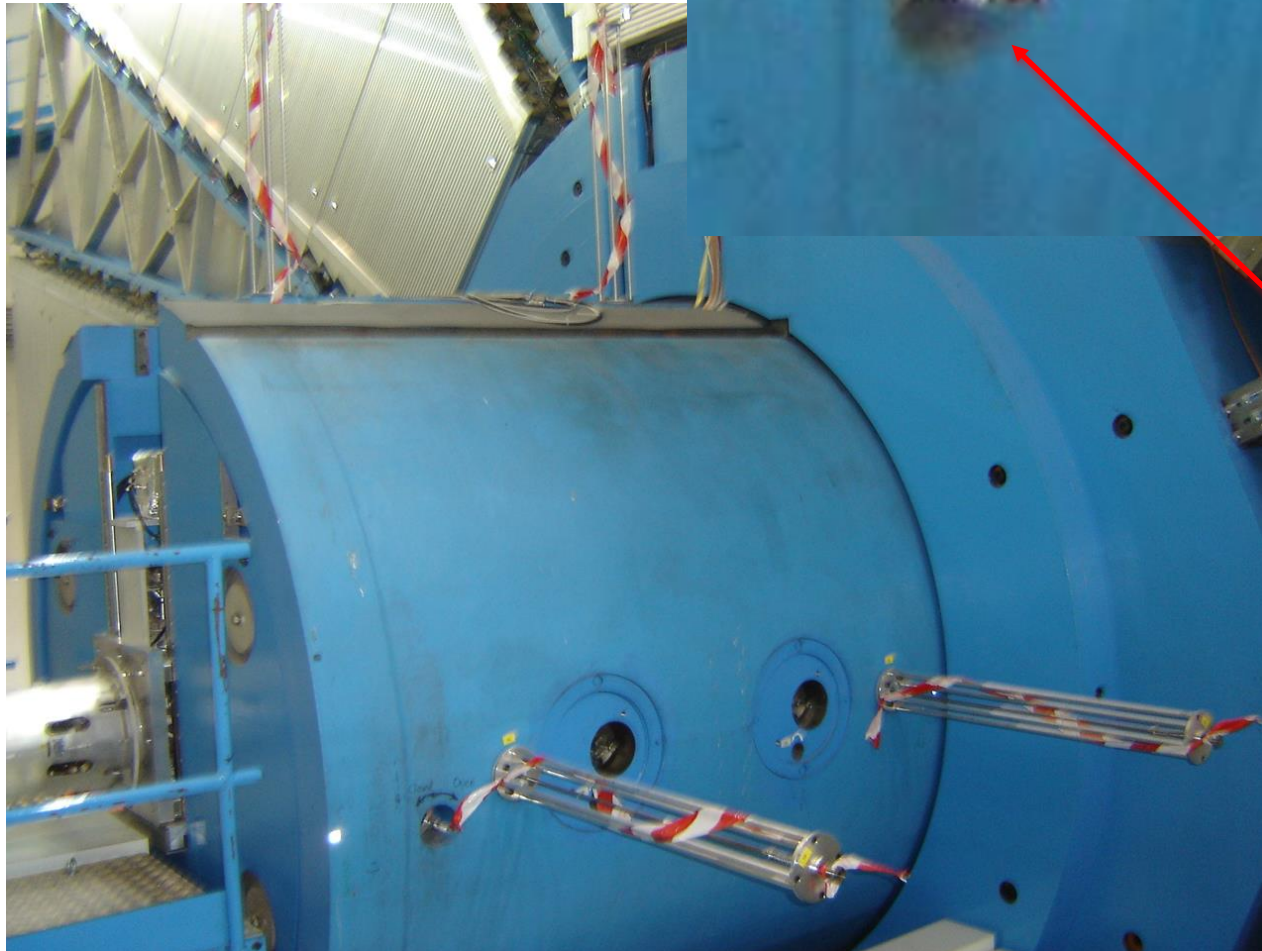


Shielding plugs in JF shielding



Access to Monobloc





What's that ?