EN Engineering Department

EN STI

PSB Upgrade
LIU Project

REPLACEMENT OF PSB DUMP: ALARA

Alba Sarrió

Thanks to: Antonio Perillo-Marcone, Frédéric Loprete, Caterina Bertone, Frédéric Delsaux, Robert Froeschl and Gerald Dumont.

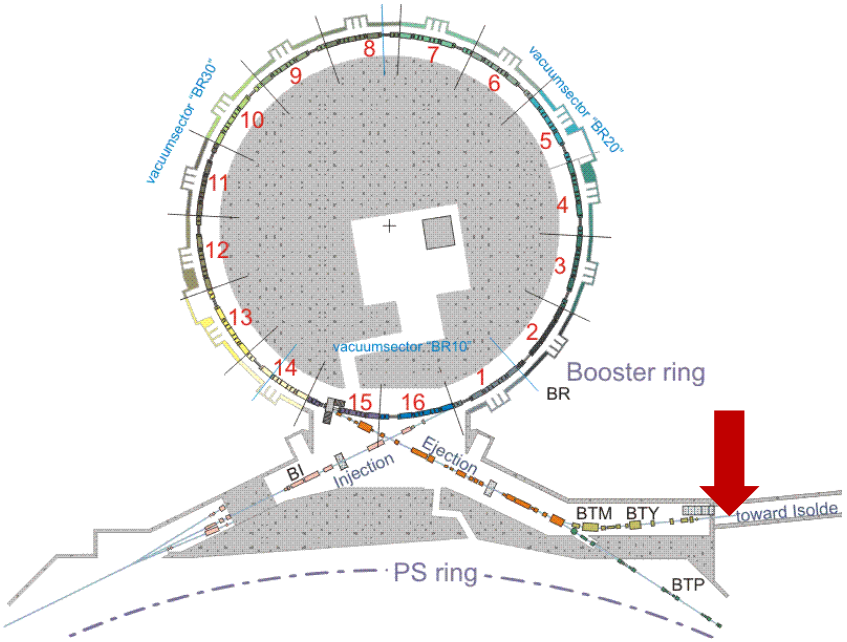
EN-STI

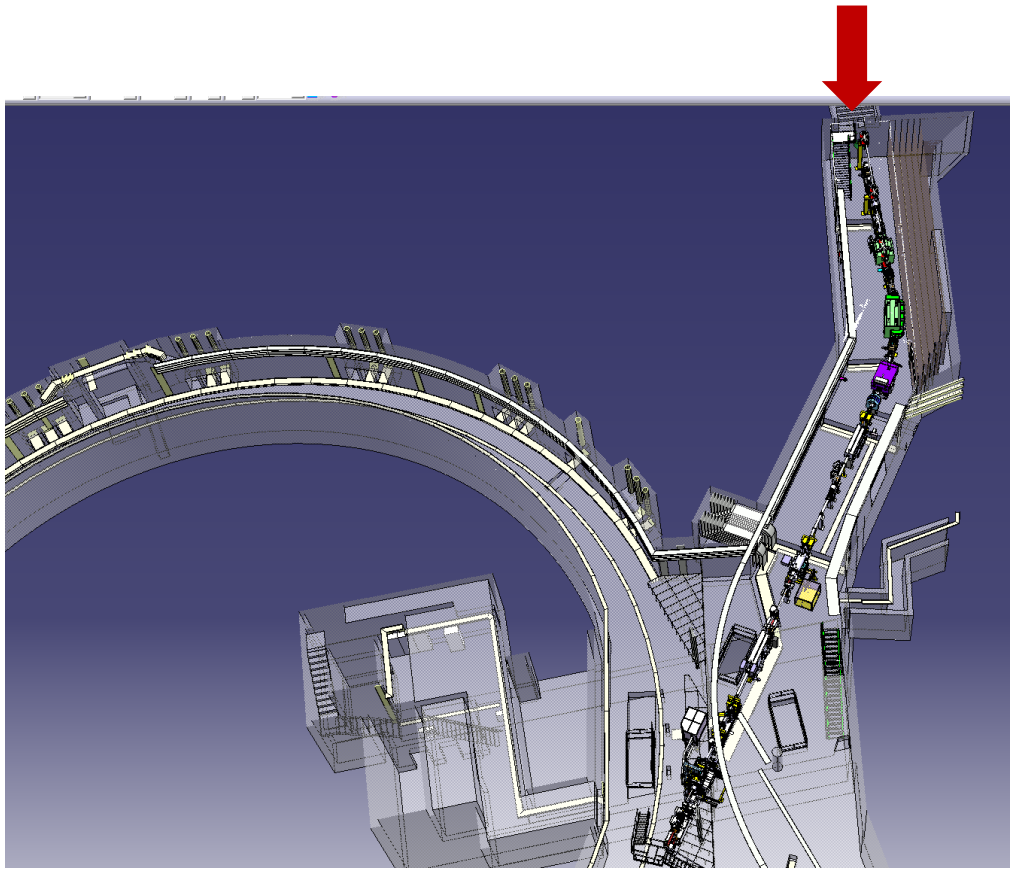
11 April 2013

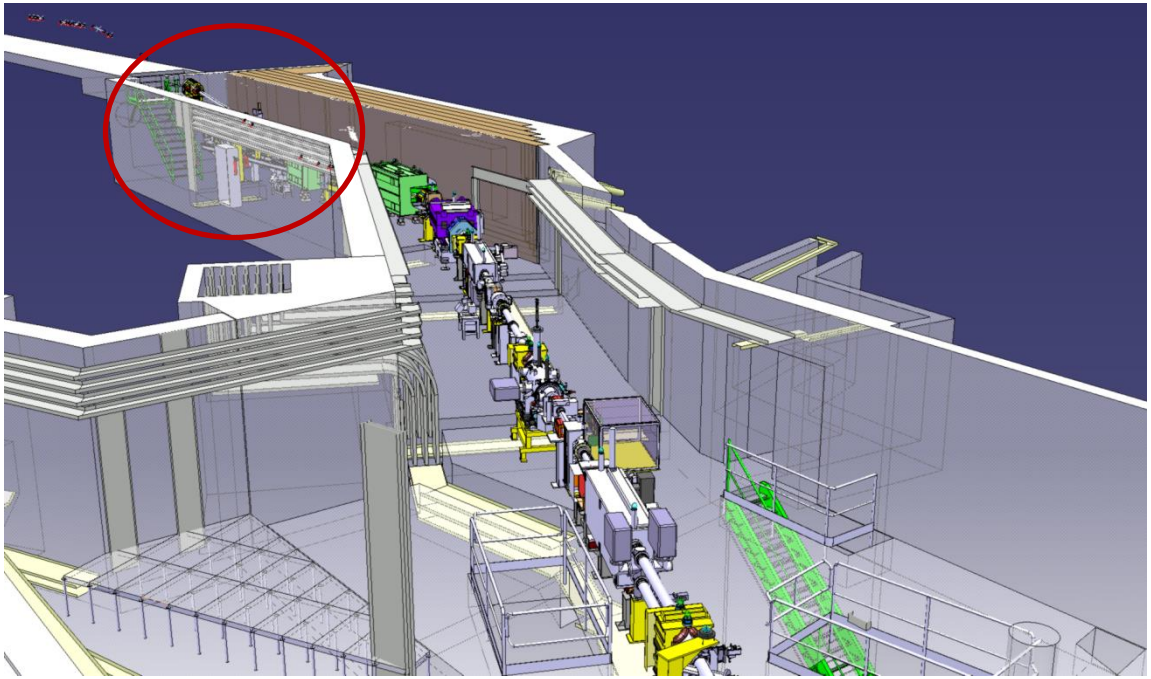
PRESENTATION LAYOUT

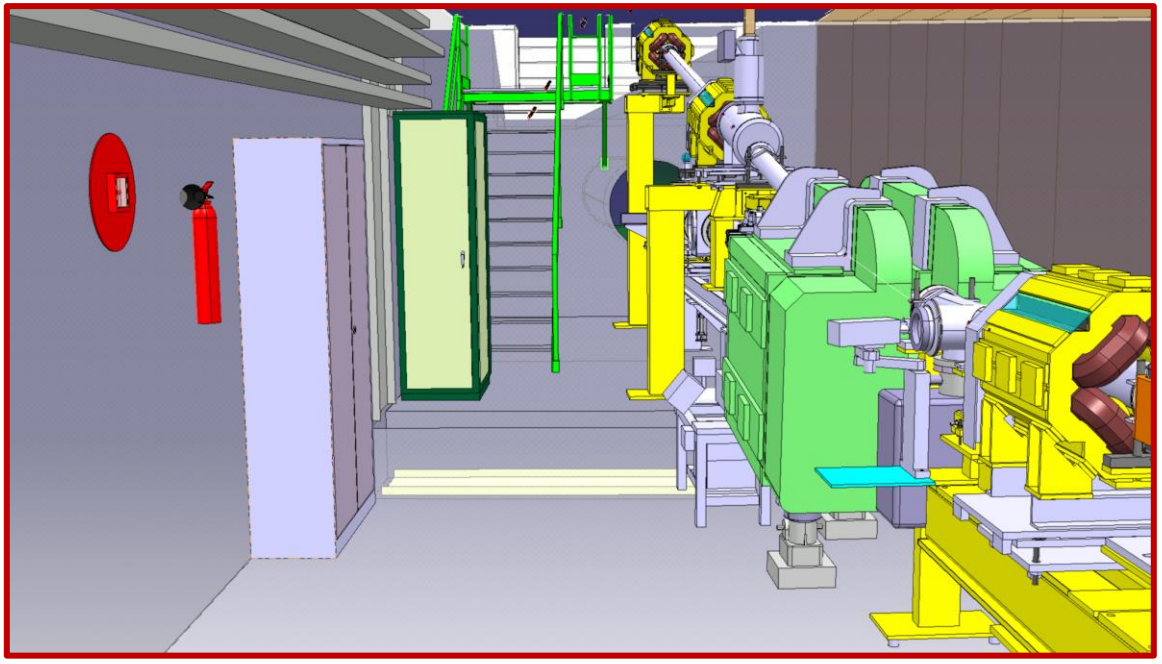
- Type of intervention
- Justification
- Work Planning
- Technical solutions adopted to reduce collective dose

TYPE OF INTERVENTION



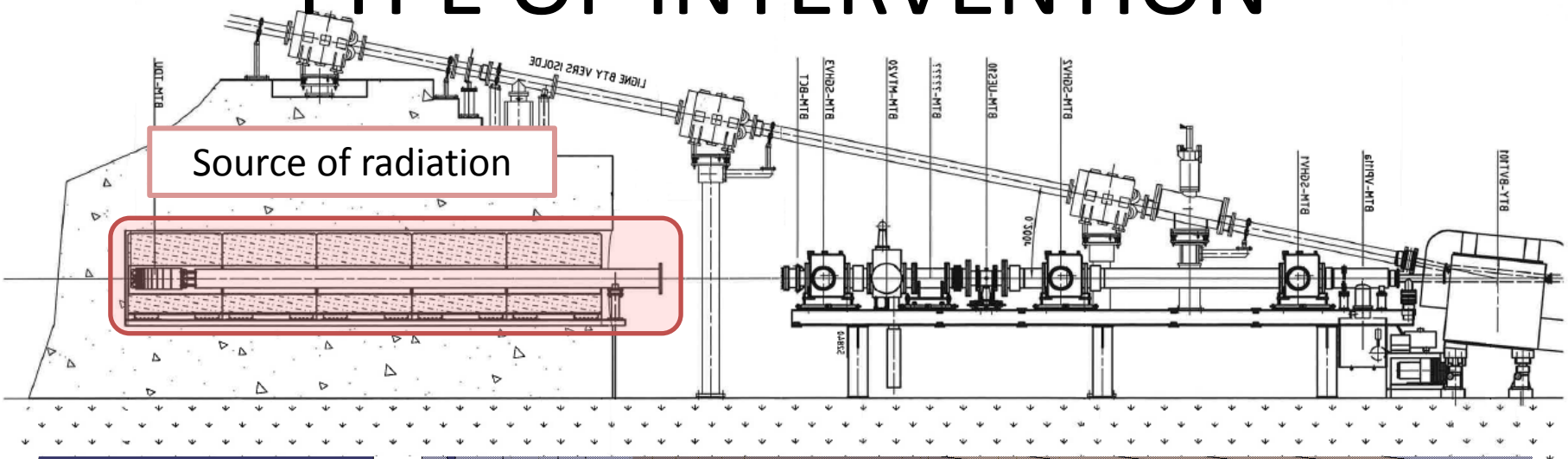


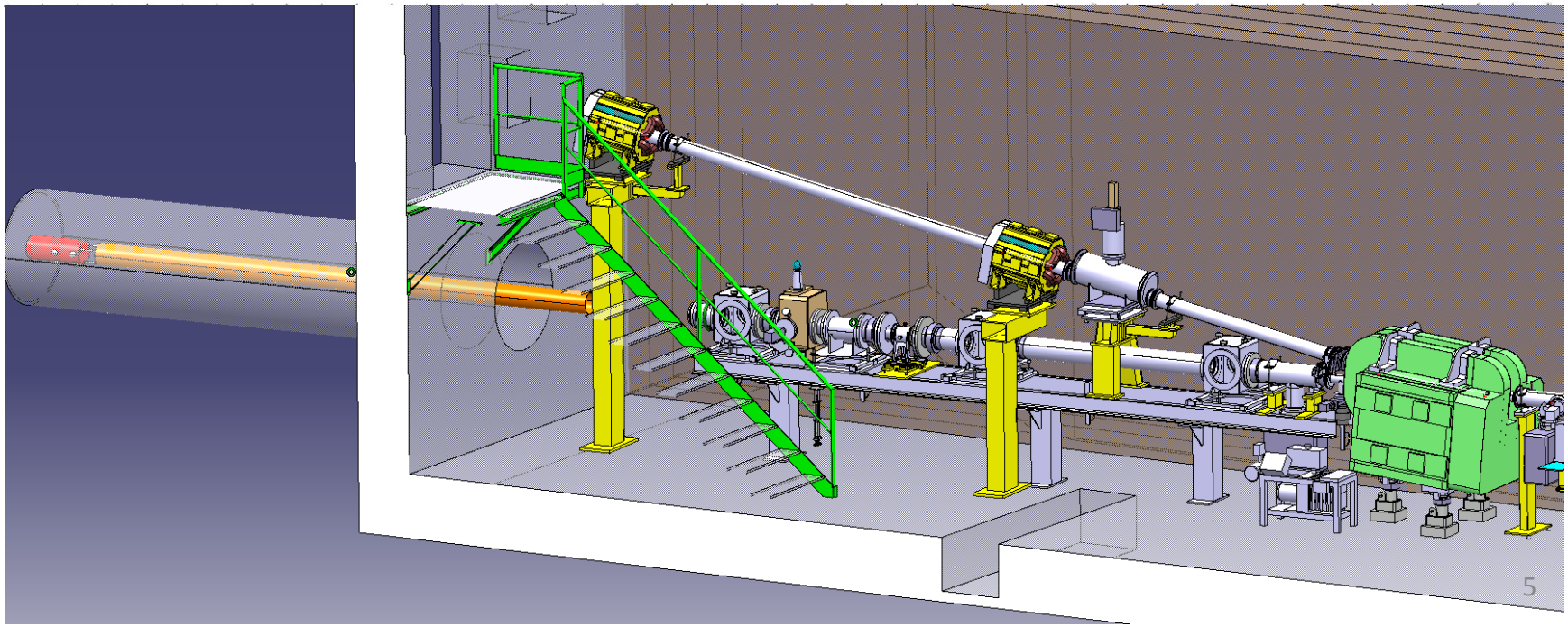





05/12/2011

TYPE OF INTERVENTION





JUSTIFICATION

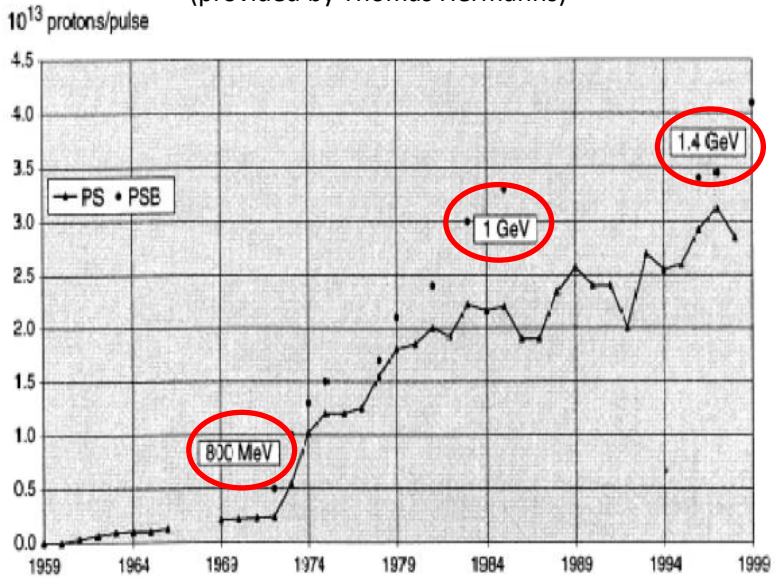
1. The PSB dump was designed in the early 1970's to cope with beam energies reaching 800 MeV and intensities of 10^{13} protons per pulse in each ring*
2. Over the past years, the dump encountered some problems, i.e. vacuum and water leaks

* G. Gelato et al., IEEE Particle Accelerator Conference, Washington D.C. 1987

JUSTIFICATION

3. Beam energy and intensity have been gradually increased during the last upgrades (1 GeV in 1988 and 1.4 GeV in 1999)

Historical diagram of peak beam intensities
(provided by Thomas Hermanns)



JUSTIFICATION

4. A new upgrade in beam energy (2 GeV) and beam intensity (10^{14} particles per pulse) is foreseen for the near future (after LS2)
5. Consequently: a new dump is needed to cope with this last upgrade.

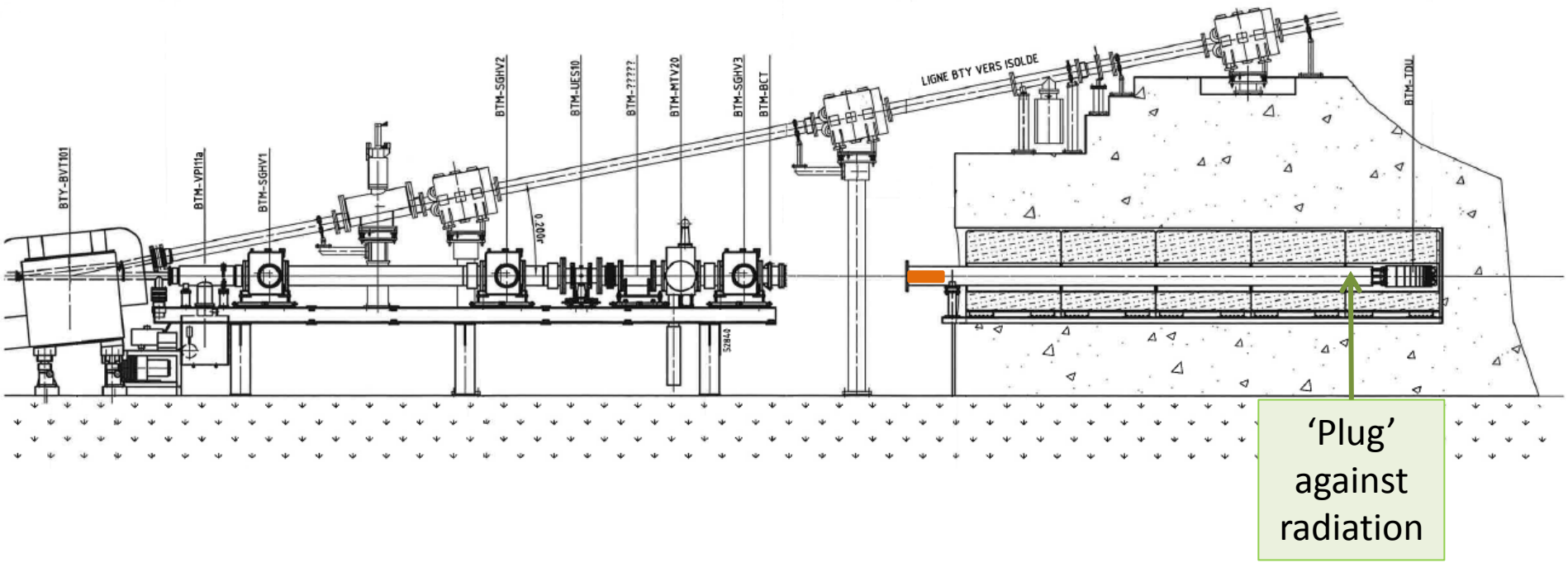
WORK PLANNING

1. Disconnect services
2. Pre-shielding
3. Temporary dismantling of equipment in BT, BTM and BTY lines
4. Dismantling and disposal operations (including transport to ISR)
5. Assembly and placement of the new dump
6. Re-assembly of equipment in BT, BTM and BTY lines. Connect services
7. Survey
8. Start vacuum
9. Ready for commissioning

1. DISCONNECT SERVICES

Disconnect vacuum and water connections from equipment in BTY and BTM lines

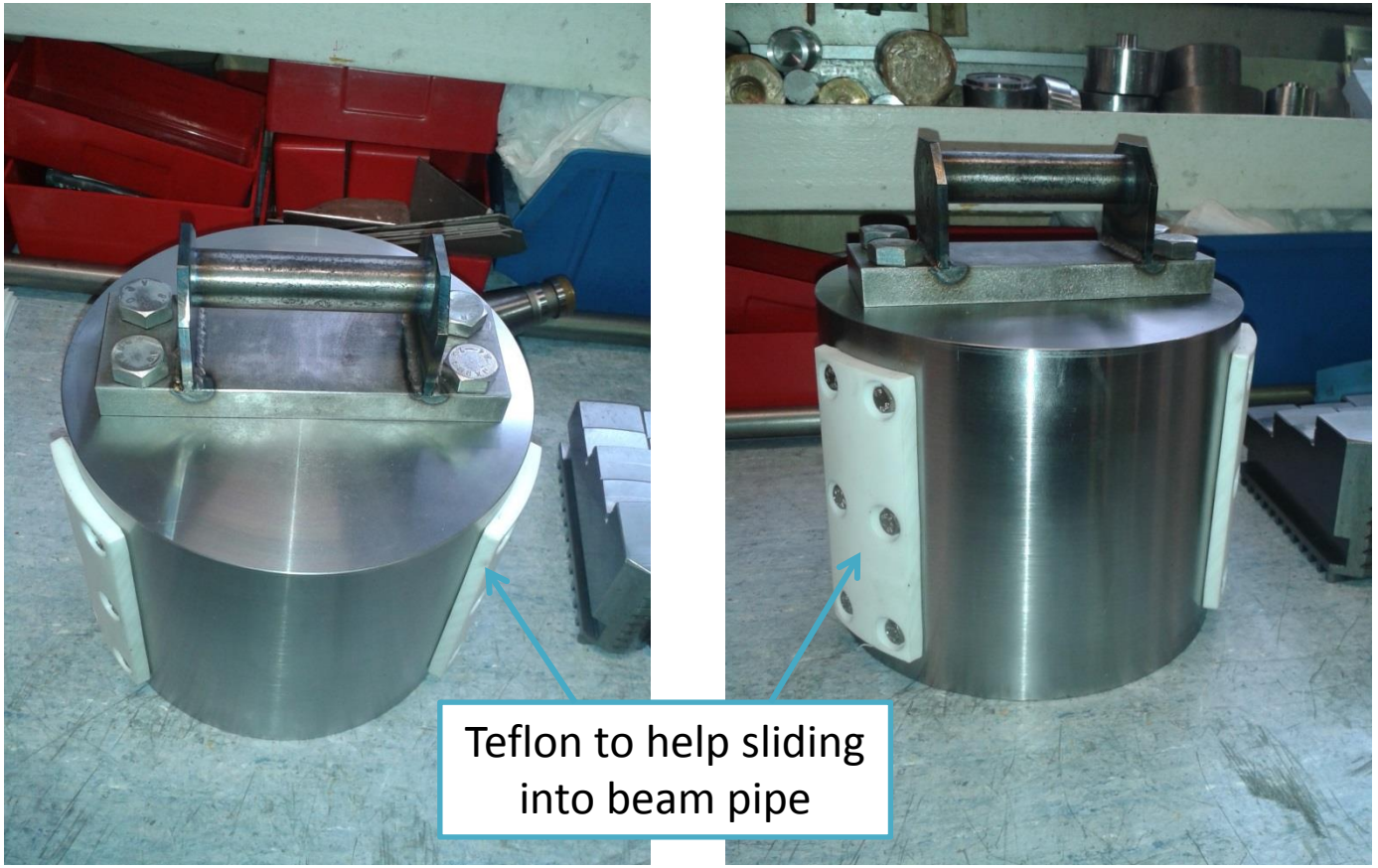
2. PRE-SHIELDING



2. PRE-SHIELDING

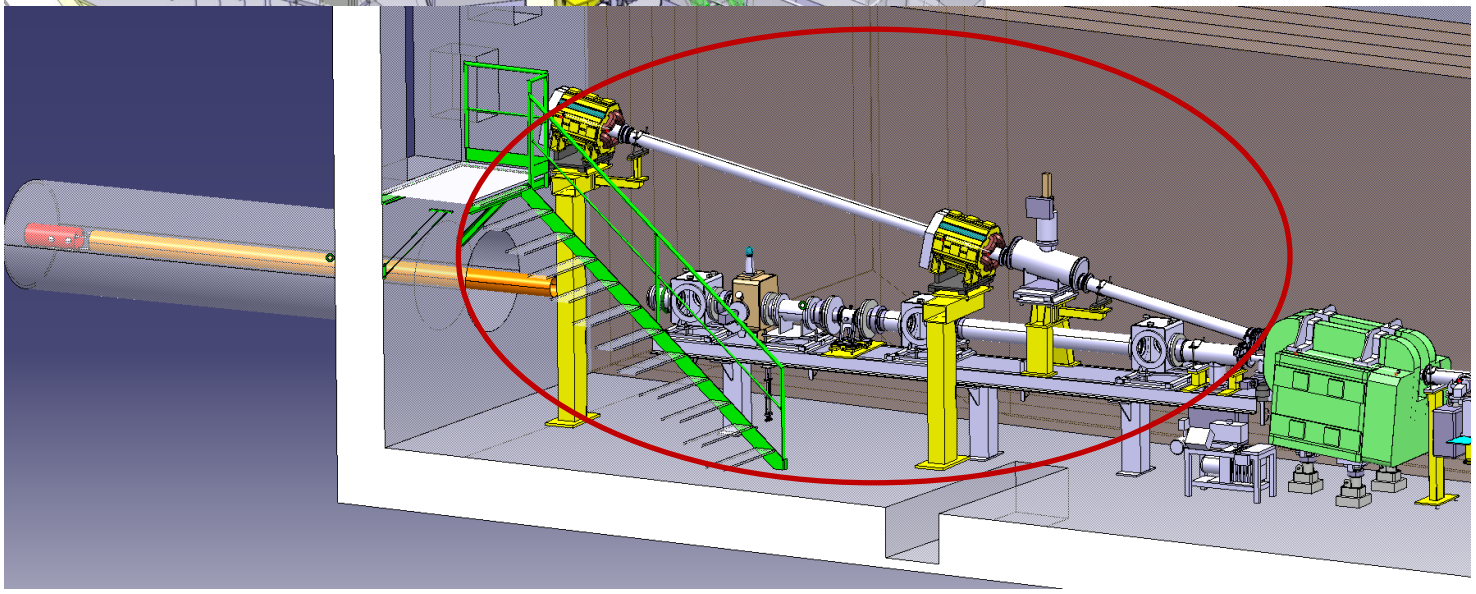
- Install a ‘plug against radiation’ at the beginning of LS1 (18 April 2013)
- This ‘plug’ will also be useful for the people (cabling, survey…) working in the PSB dump area before the dump removal tasks.

Plug against radiation

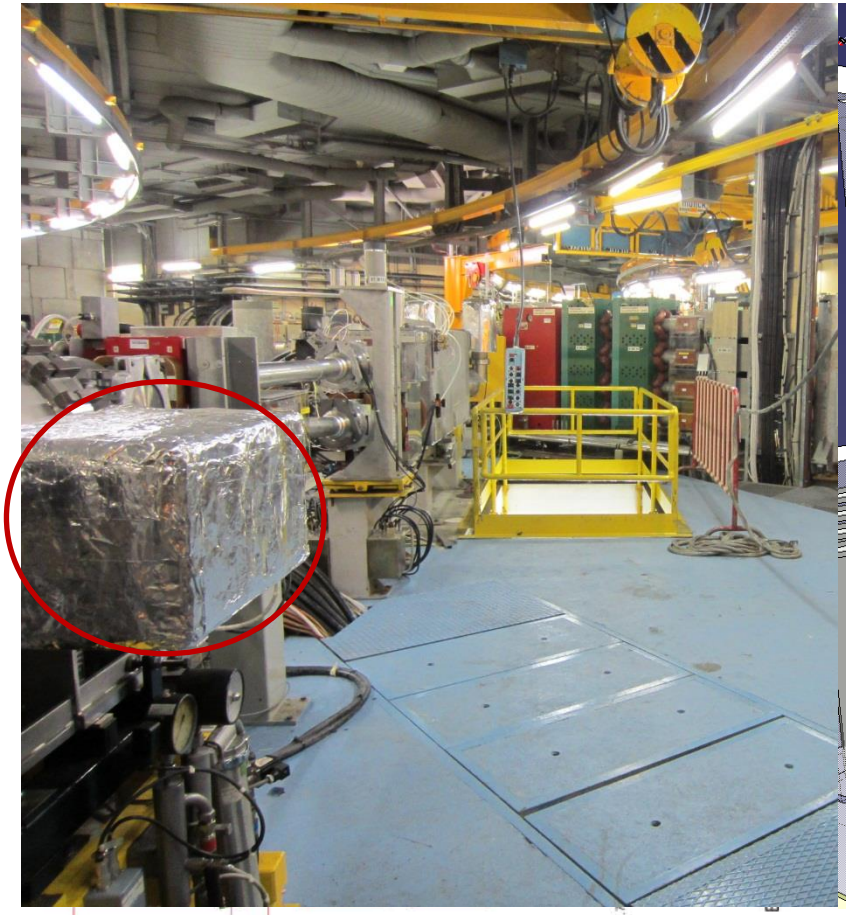


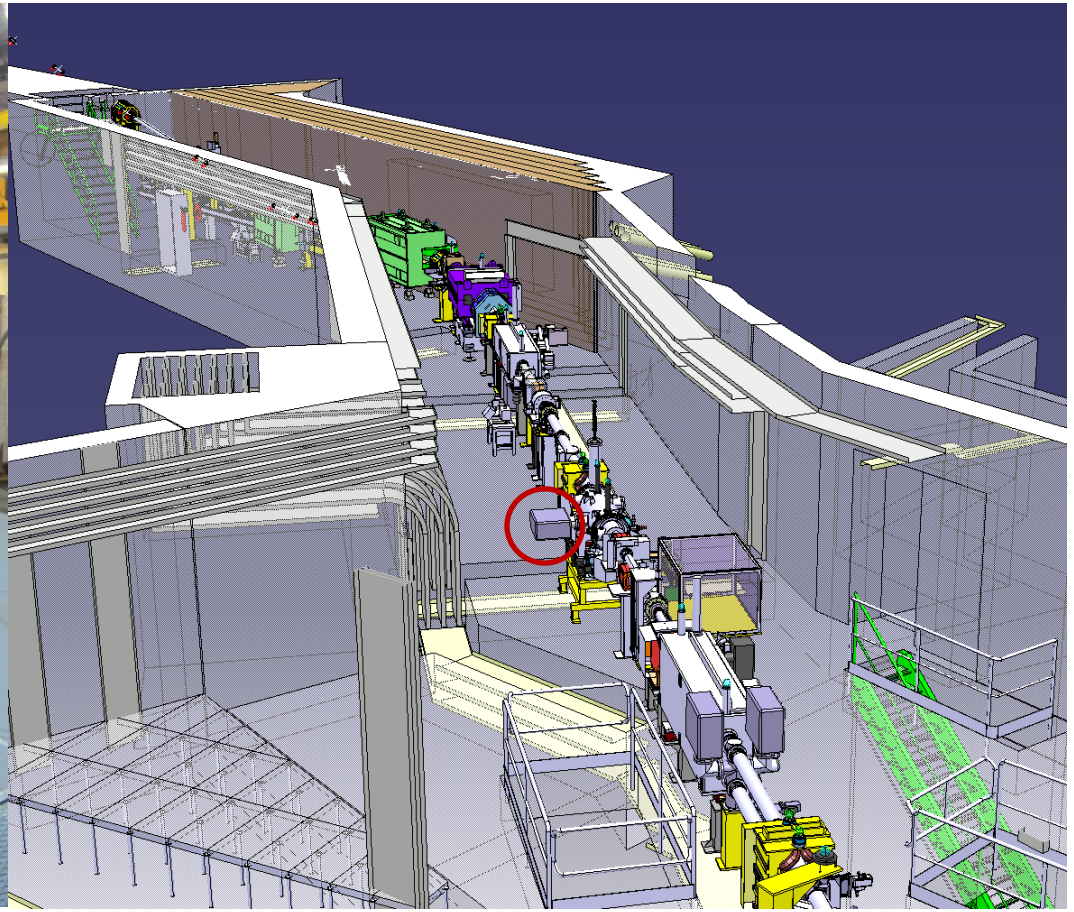
Carbon steel block: ∅ 180 mm x L 150 mm

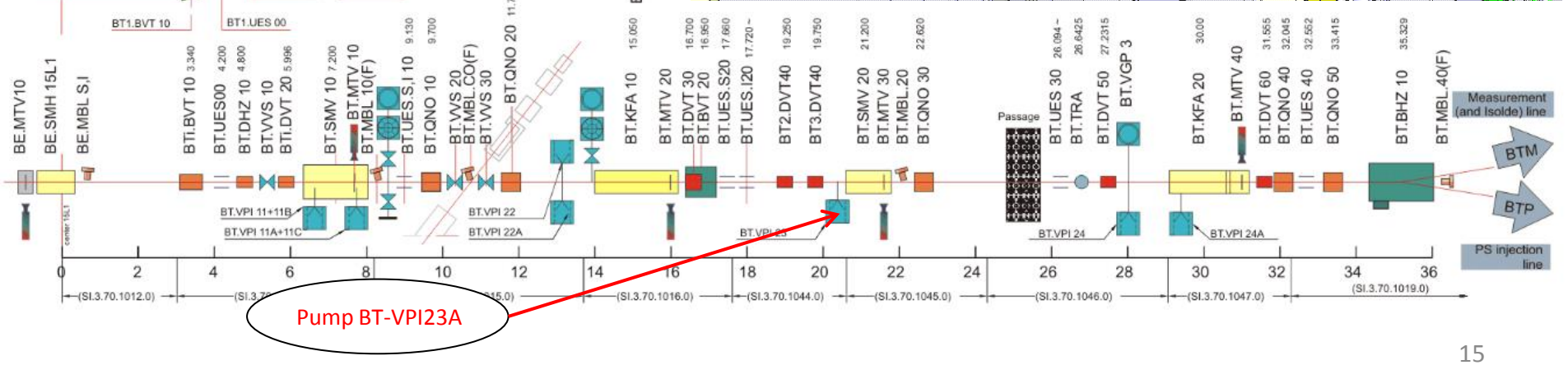
3. TEMPORARY DISMANTLING OF EQUIPMENT IN BT, BTM AND BTY LINES



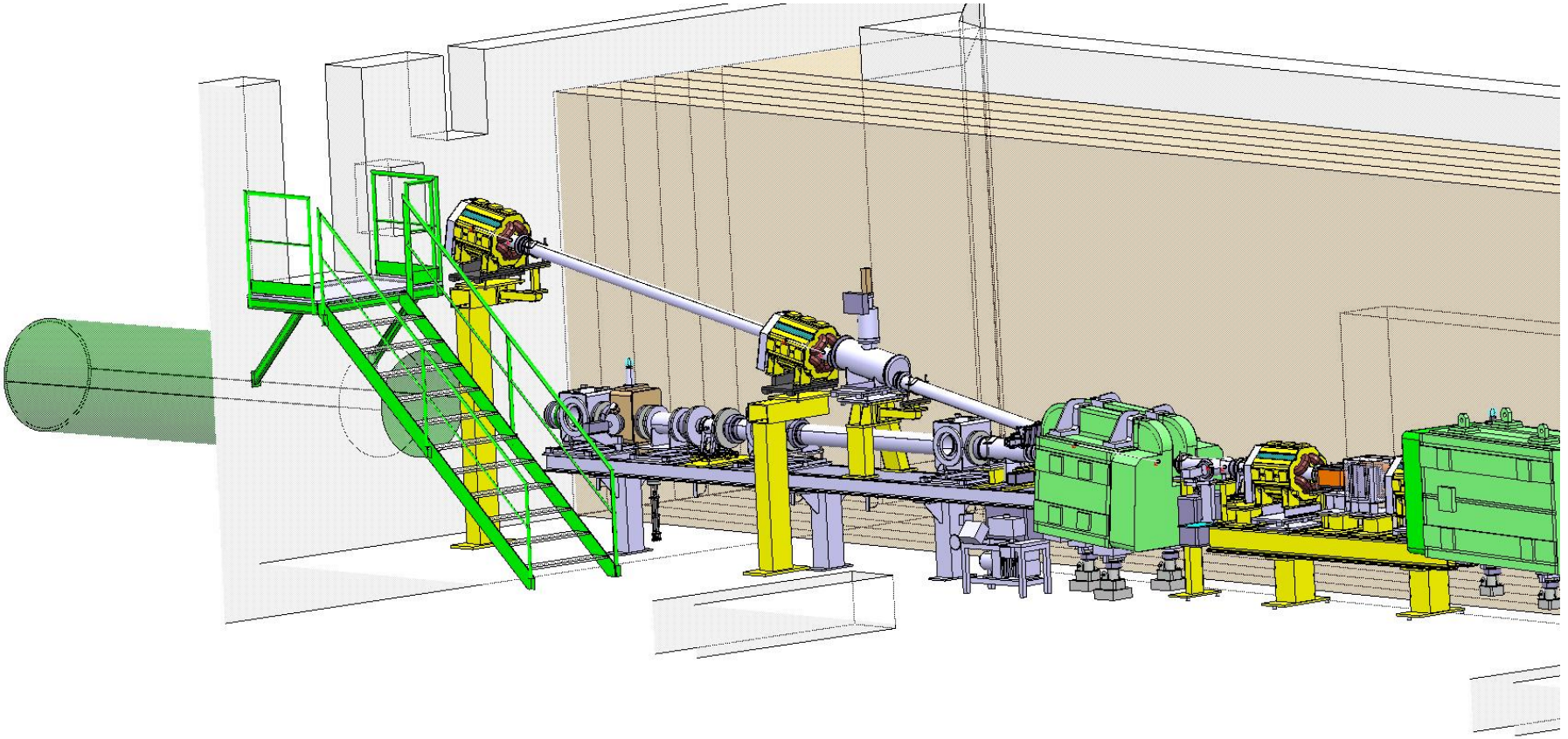
- Dismantling of equipment in BTY line
- Survey of BTM line
- Dismantling of equipment in BTM line






BT1.BVT 10
BT1.UES 00
BE.MTV10
BE.SMH 15L1
BE.MBL S,I
BTi.BVT 10
BT.UES00
BT.DHZ 10
BT.VVS 10
BTi.DVT 20
BT.SMV 10
BT.MTV 10
BT.MBL 10(F)
BT.UES.S,I 10
BT.QNO 10
BT.VVS 20
BT.MBL.CO(F)
BT.VVS 30
BT.QNO 20
BT.KFA 10
BT.MTV 20
BT.DVT 30
BT.BVT 20
BT.UES.S20
BT.UES.I20
BT2.DVT40
BT3.DVT40
BT.SMV 20
BT.MTV 30
BT.MBL.20
BT.QNO 30
Passage
BT.UES 30
BT.TRA
BT.DVT 50
BT.VGP 3
BT.KFA 20
BT.MTV 40
BT.DVT 60
BT.QNO 40
BT.UES 40
BT.QNO 50
BT.BHZ 10
BT.MBL.40(F)
Measurement (and Isolde) line
BTM
BTP
PS injection line
BT.VPI 11+11B
BT.VPI 11A+11C
BT.VPI 22
BT.VPI 22A
BT.VPI 24
BT.VPI 24A
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
(SI.3.70.1012.0)
(SI.3.70.1016.0)
(SI.3.70.1044.0)
(SI.3.70.1045.0)
(SI.3.70.1046.0)
(SI.3.70.1047.0)
(SI.3.70.1019.0)
Pump BT-VPI23A

3. TEMPORARY DISMANTLING OF EQUIPMENT IN BT, BTM AND BTY LINES



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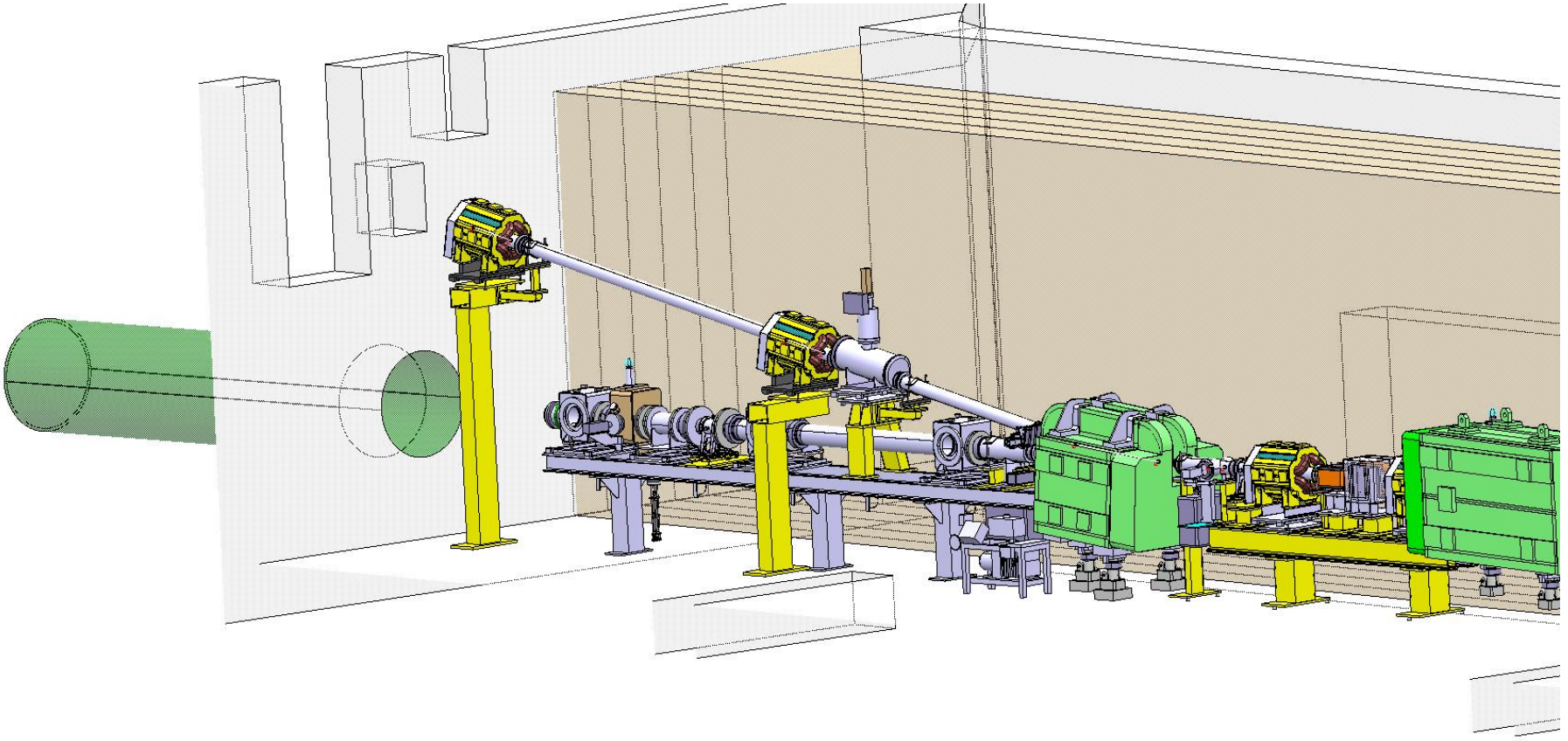

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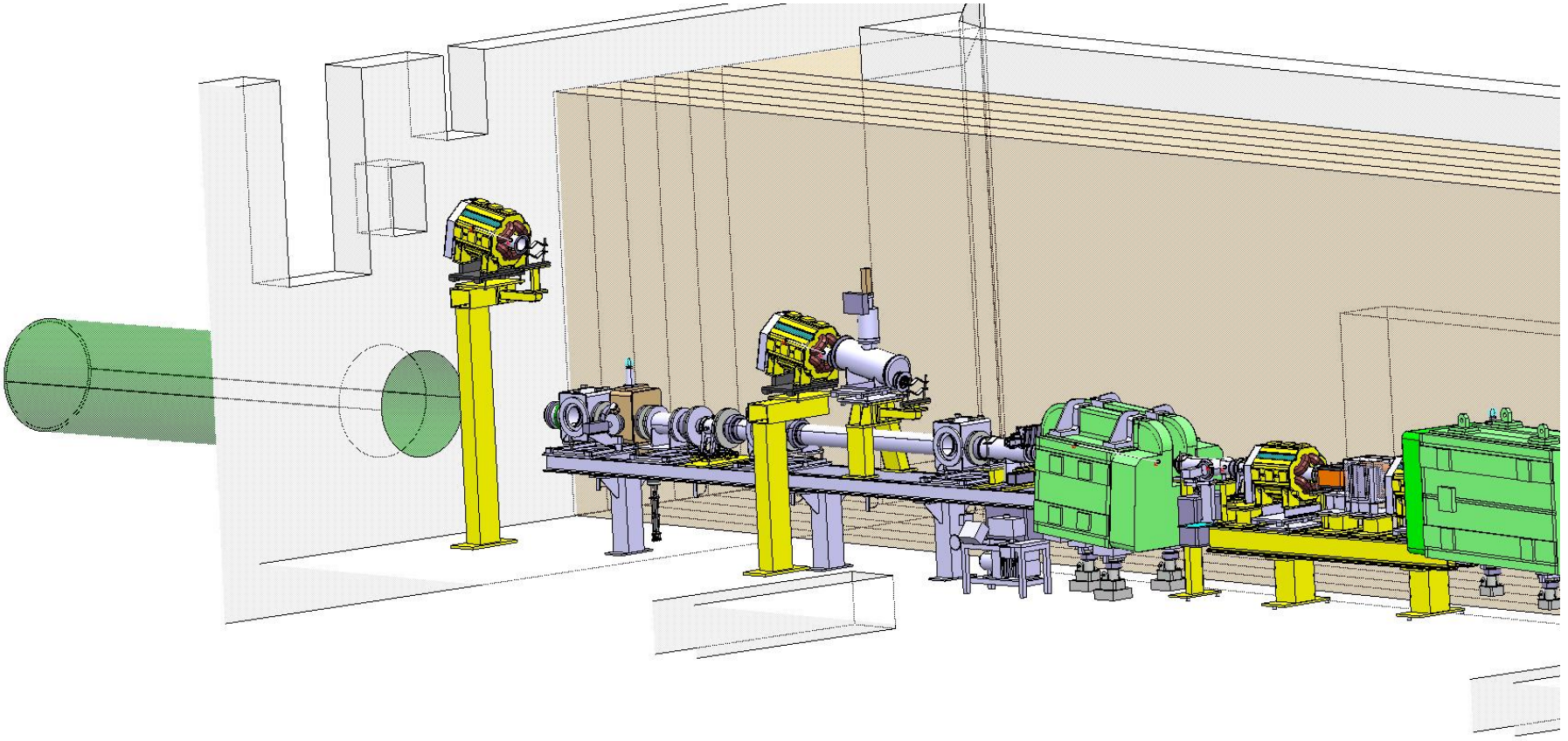

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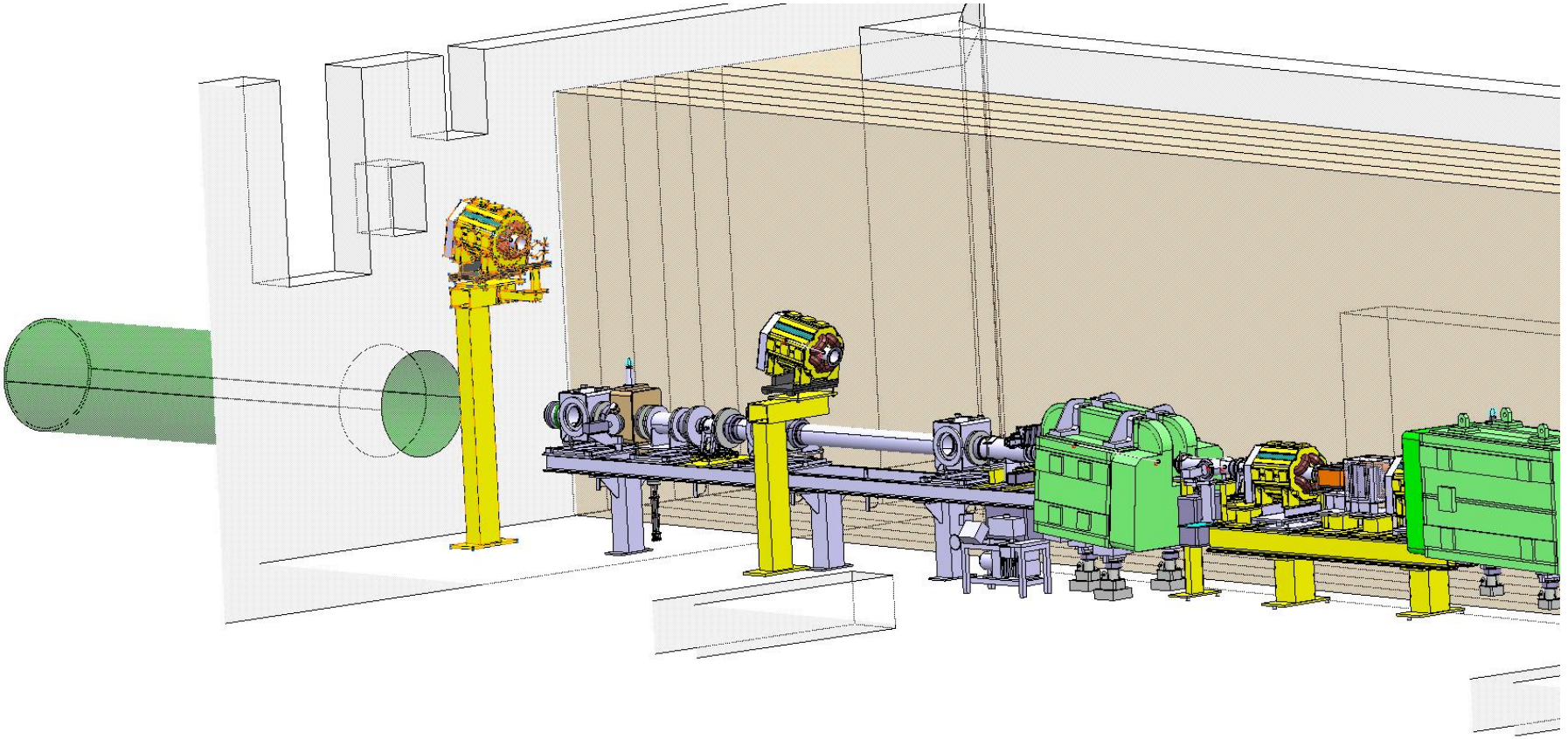

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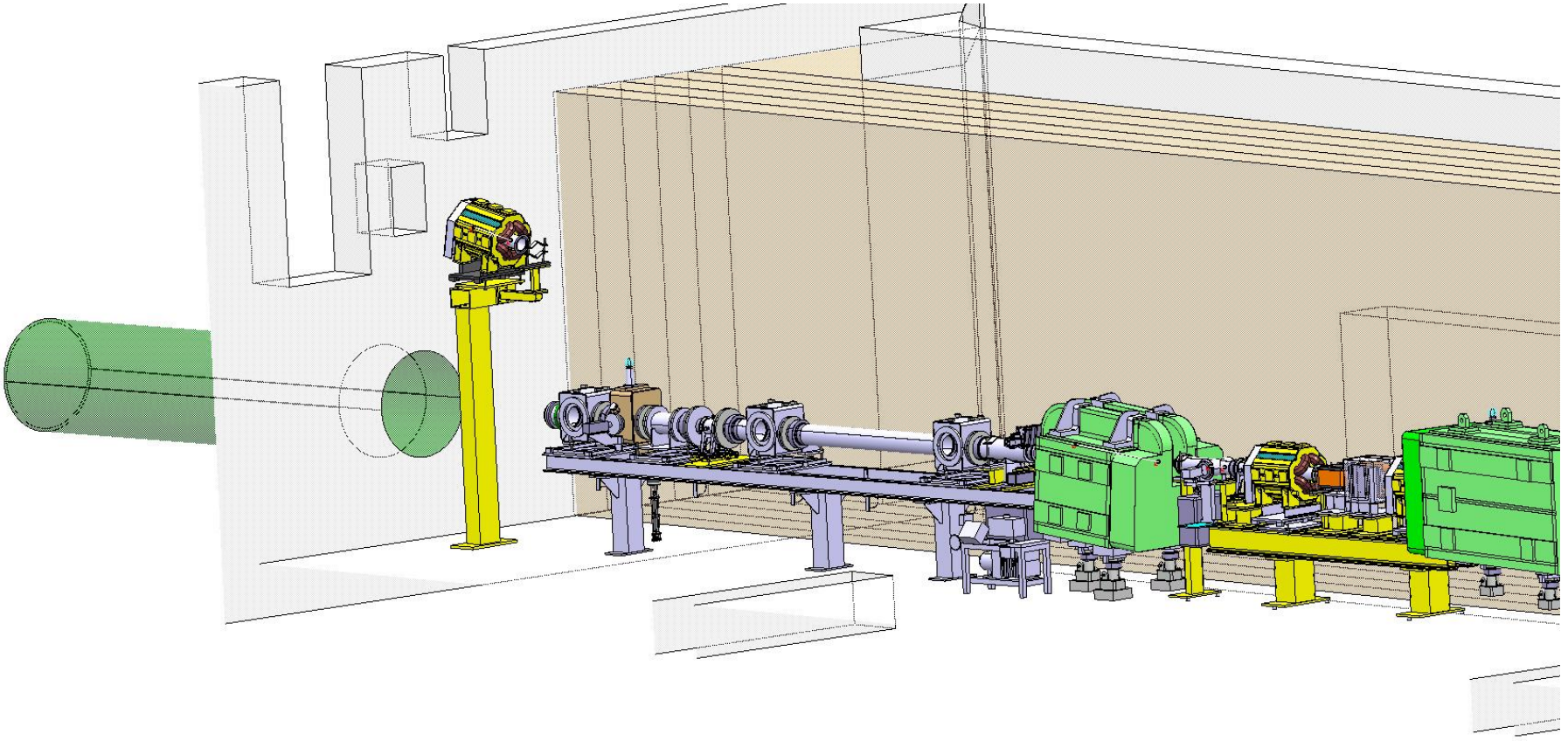

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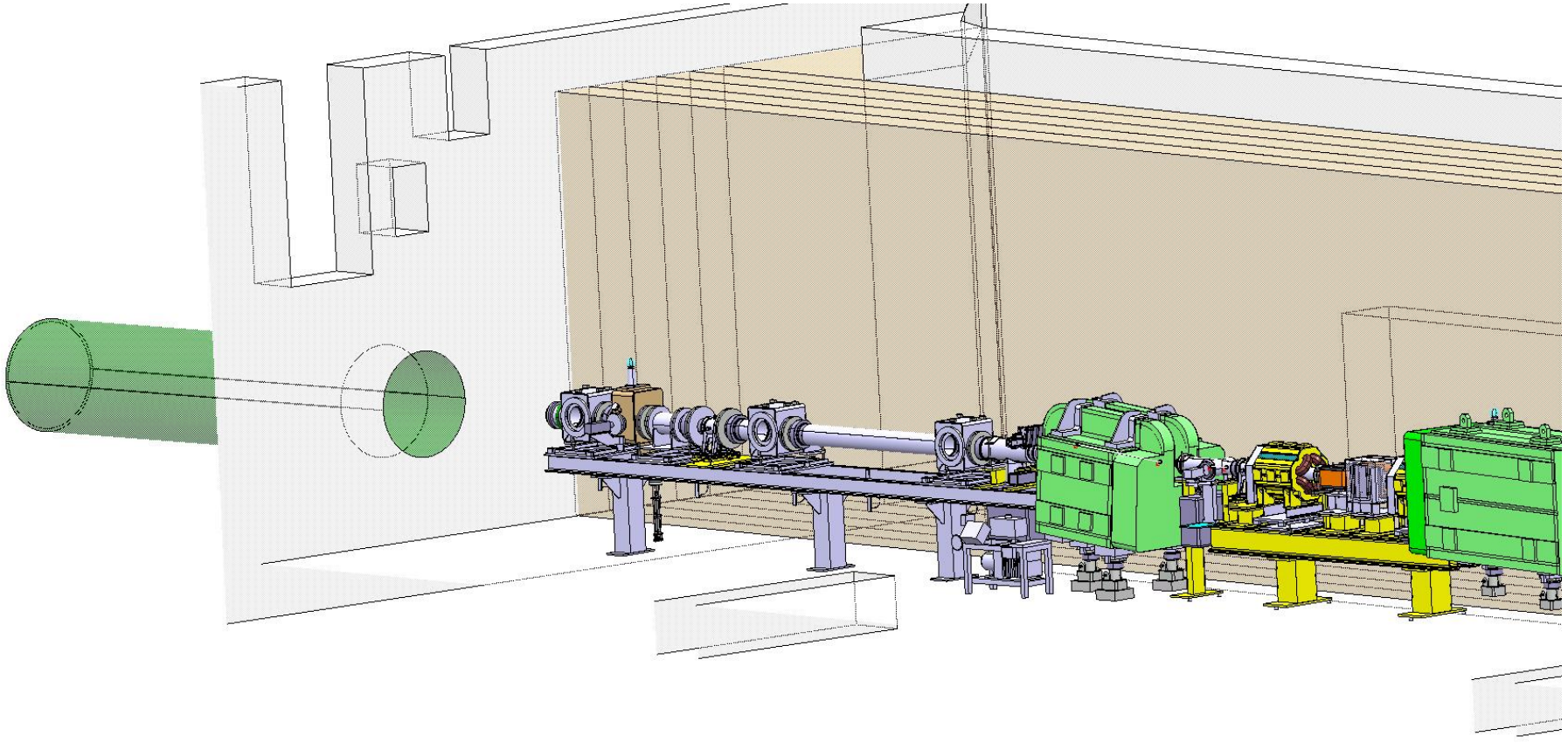

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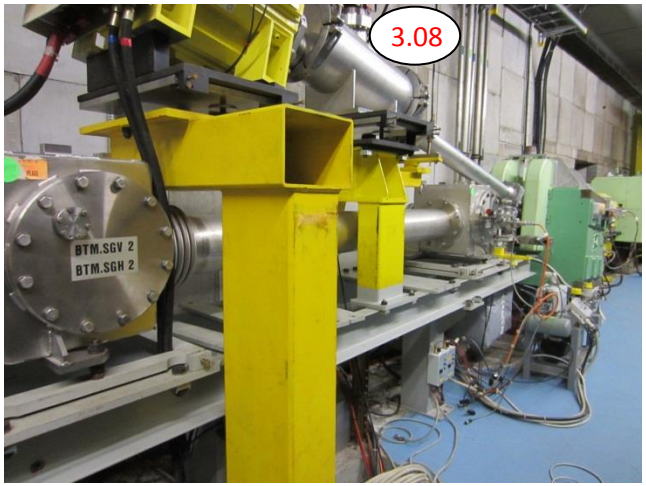

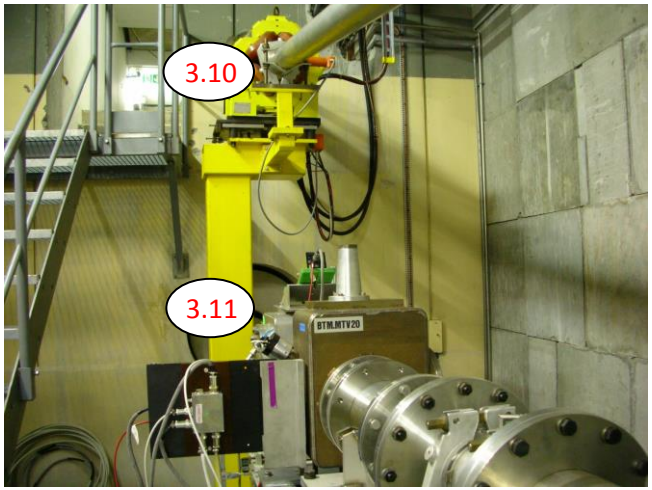

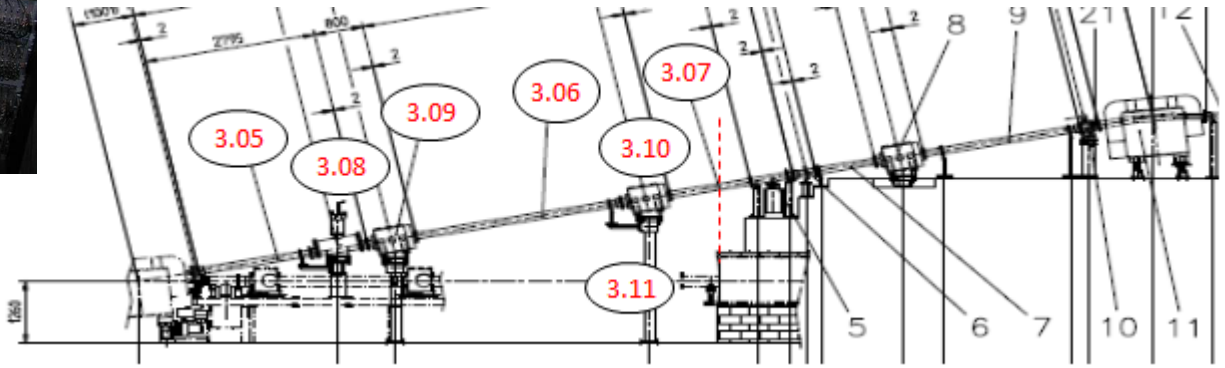

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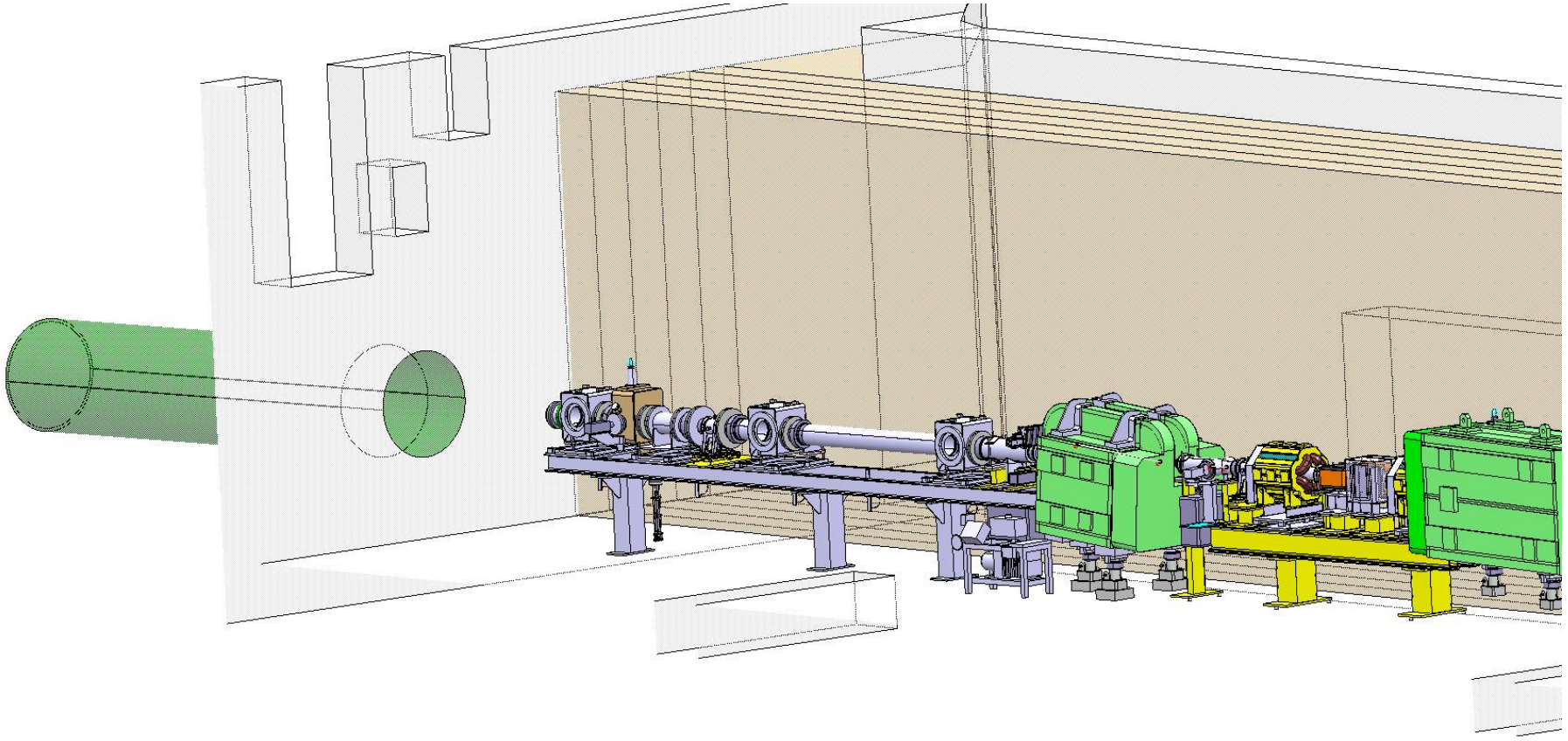

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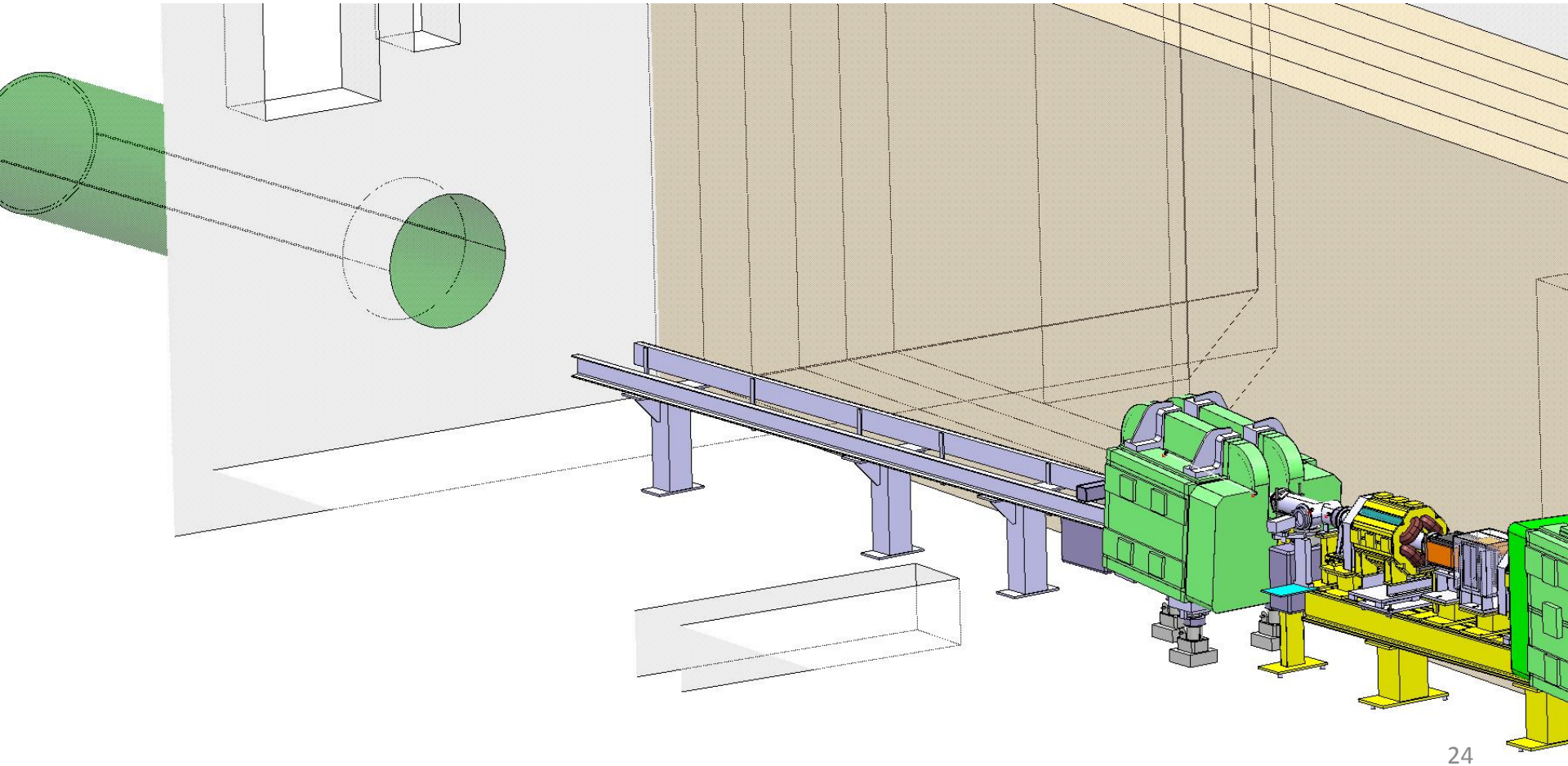

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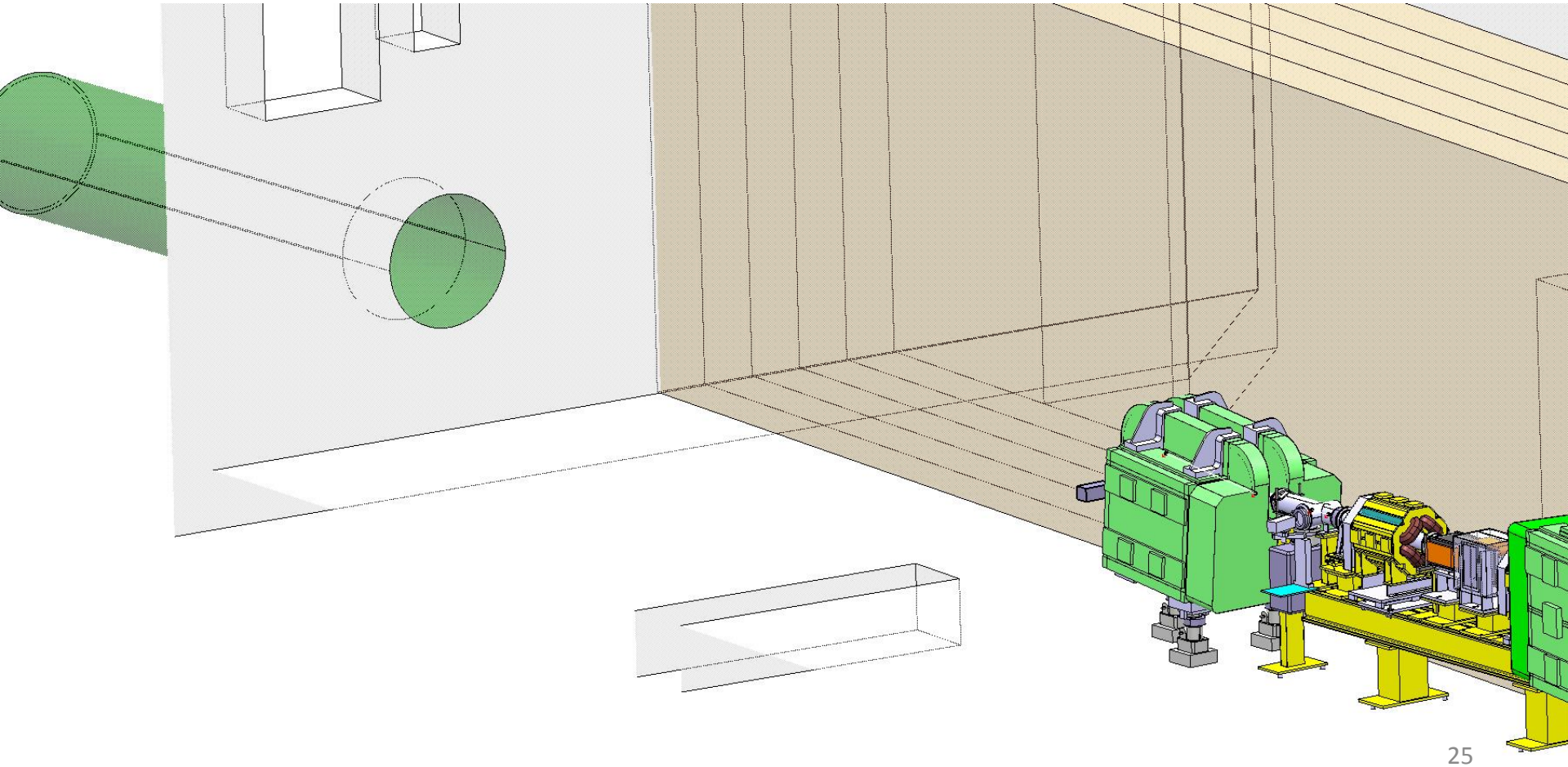

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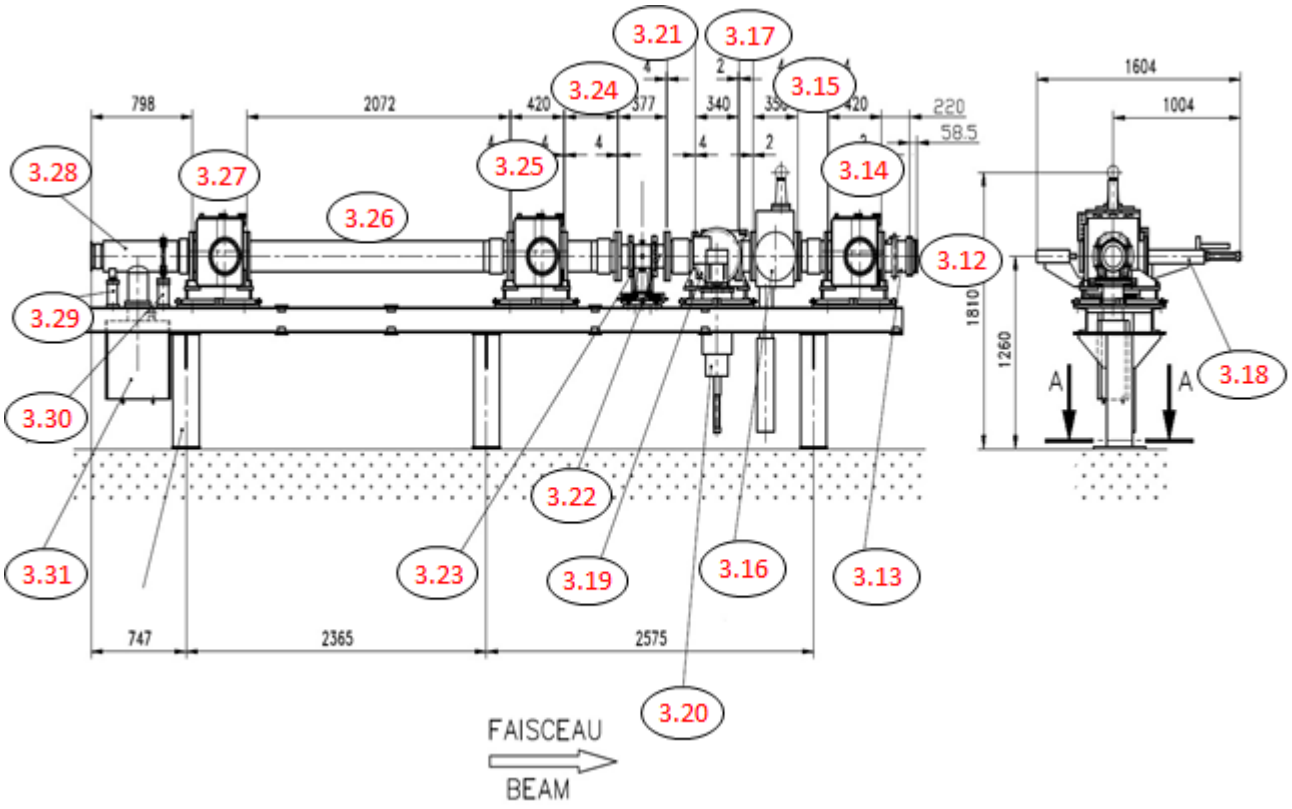
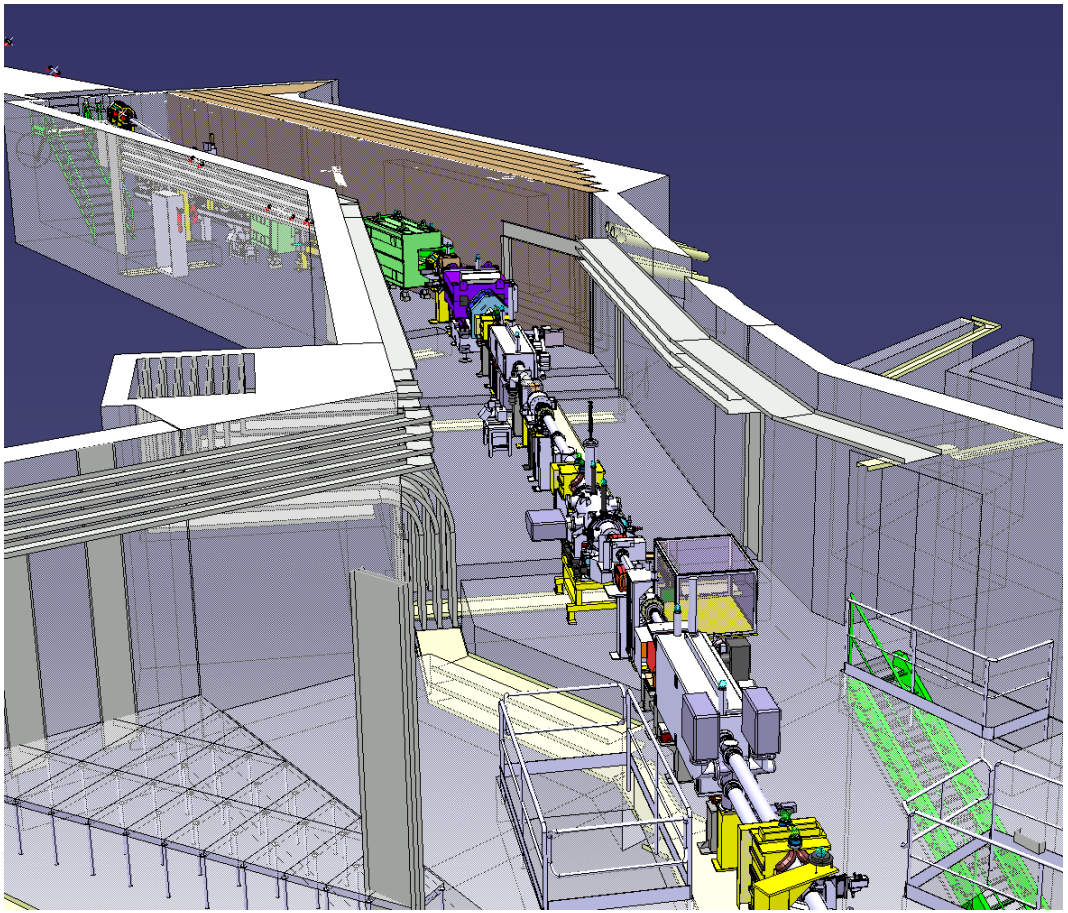


BTM beam line equipment

3.12	Window BTM-SGHV3
3.13	BTM-BCT
3.14	Semfil Tank
3.15	Vacuum Tube
3.16	TV Station
3.17	Vacuum Tube
3.18	Big Split Plate
3.19	Tank Split Plates
3.20	Split Plate
3.21	Vacuum Tube
3.22	Vacuum Chamber
3.23	Pick-Up
3.24	Vacuum Tube
3.25	Semfil Tank
3.26	Vacuum Tube
3.27	Semfil Tank
3.28	Vacuum Chamber
3.29	Upper Chamber support
3.30	Lower Chamber support
3.31	Varian Ion Pump

STORAGE OF BEAM LINE ELEMENTS

The best option is: 361/S-001 (to be confirmed)

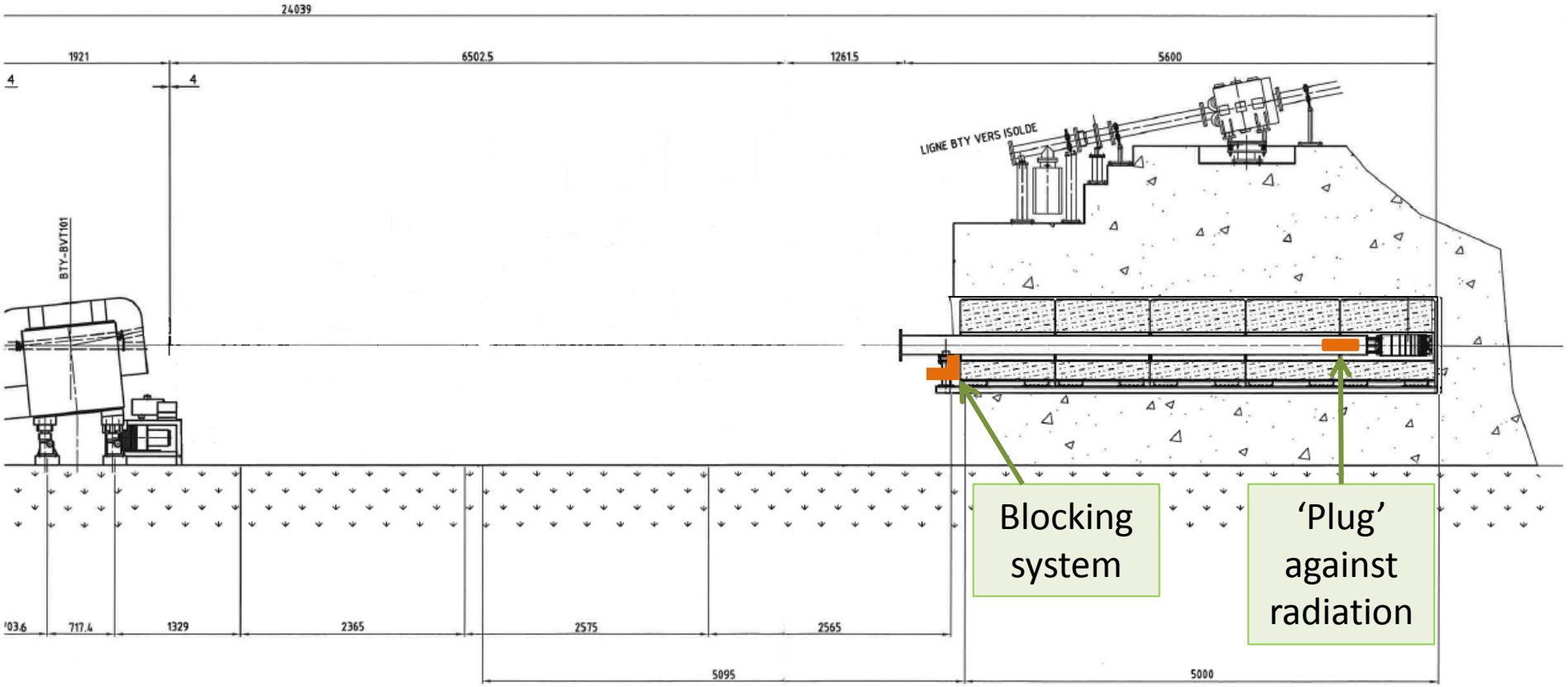


STORAGE OF BEAM LINE ELEMENTS: 361/S-001

4. DISMANTLING AND DISPOSAL OPERATIONS (INCLUDING TRANSPORT TO ISR)

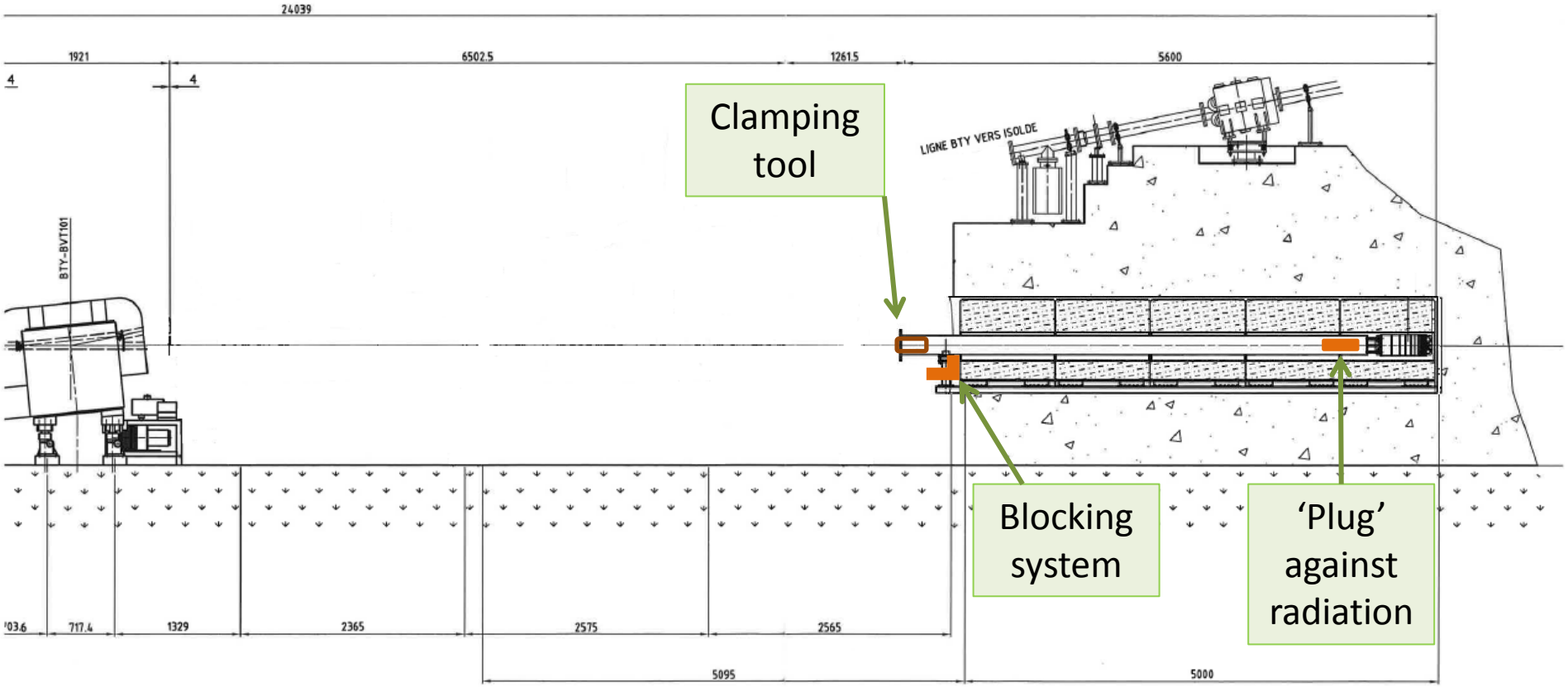
- Disposal of beam pipe-dump core assembly
- Transport of dump core + beam pipe to ISR
- Disposal of concrete blocks
- Transport of concrete blocks one by one to ISR

4. DISMANTLING AND DISPOSAL OPERATIONS

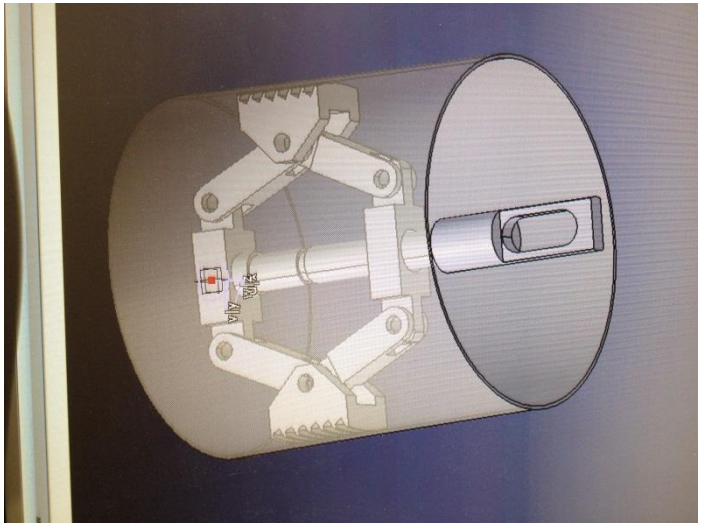


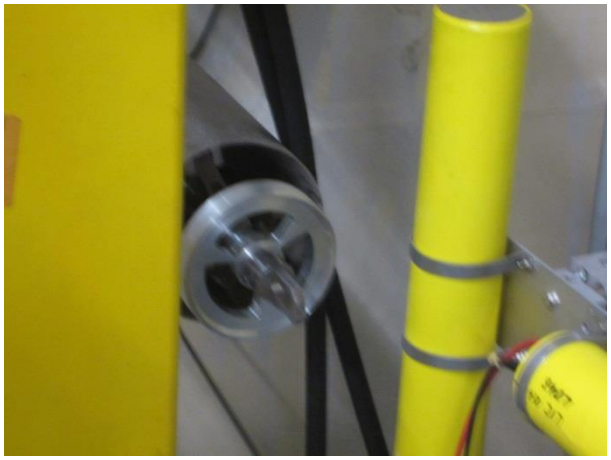
Outermost shielding block must be blocked

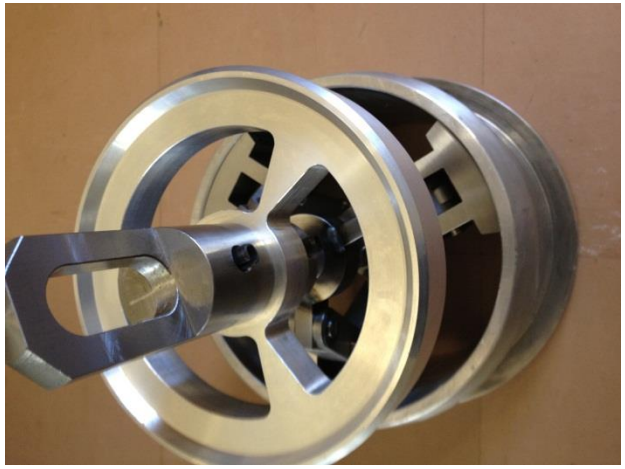
4. DISMANTLING AND DISPOSAL OPERATIONS

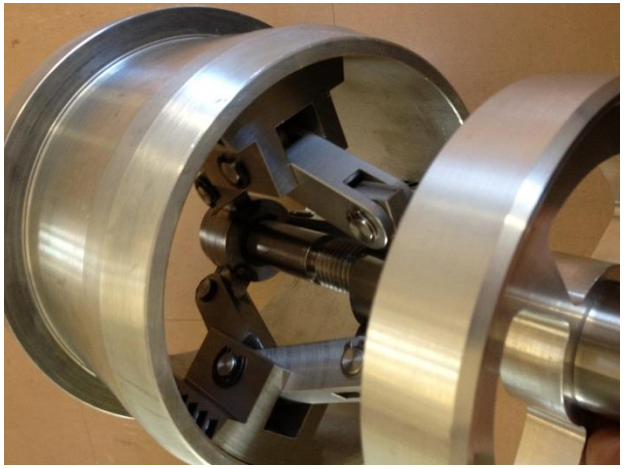


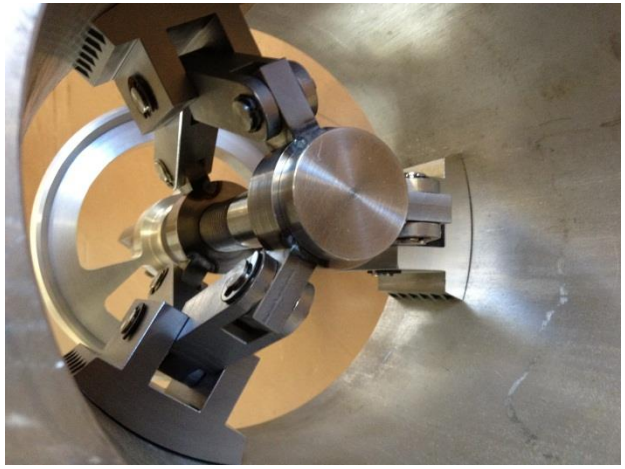
Clamping system to pull the old beam pipe + dump core











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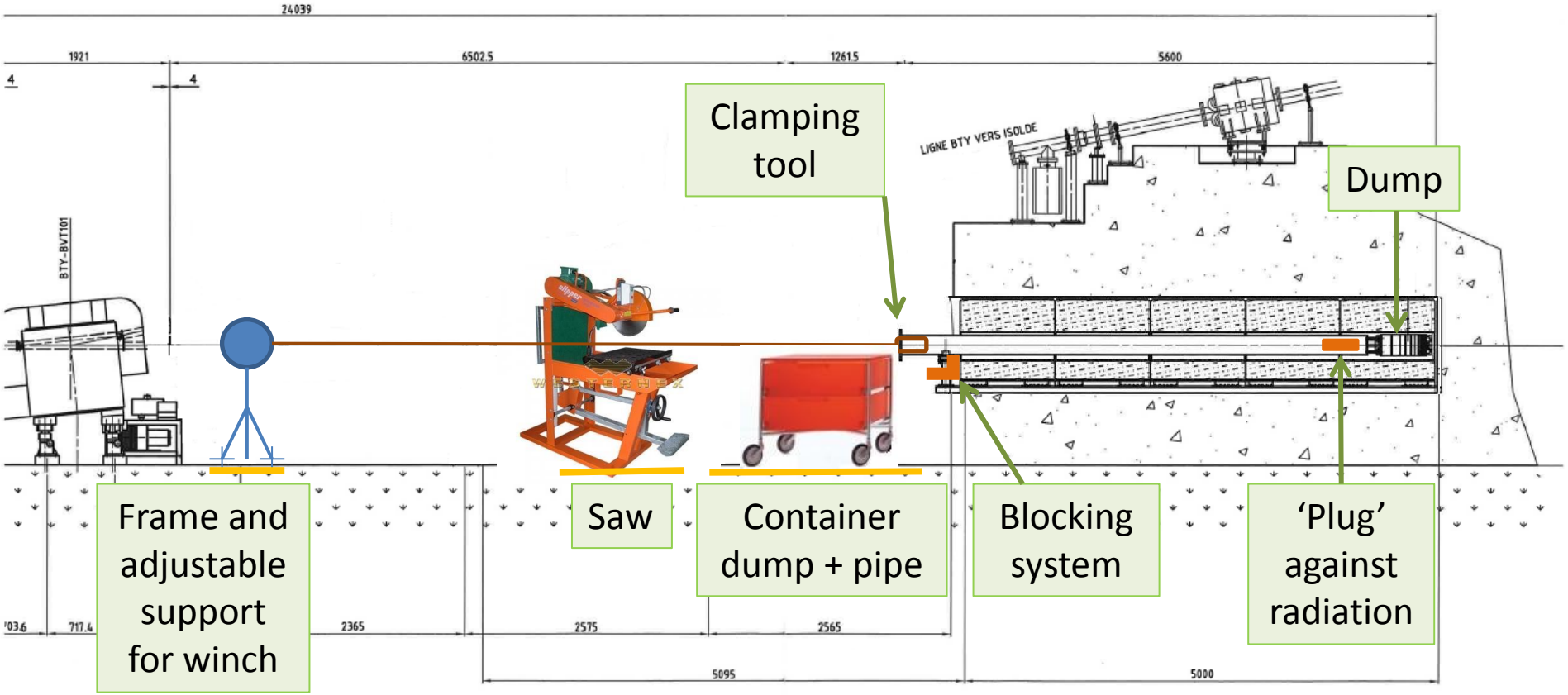
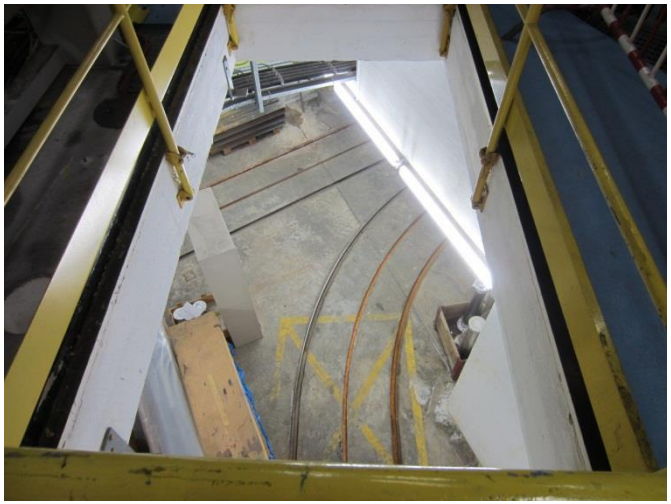


Installation extension of rail

The necessary equipment will be brought through the shaft by crane

Length: 2.6m to 2.9m
Width: 1.3m
SWL PR: 10t



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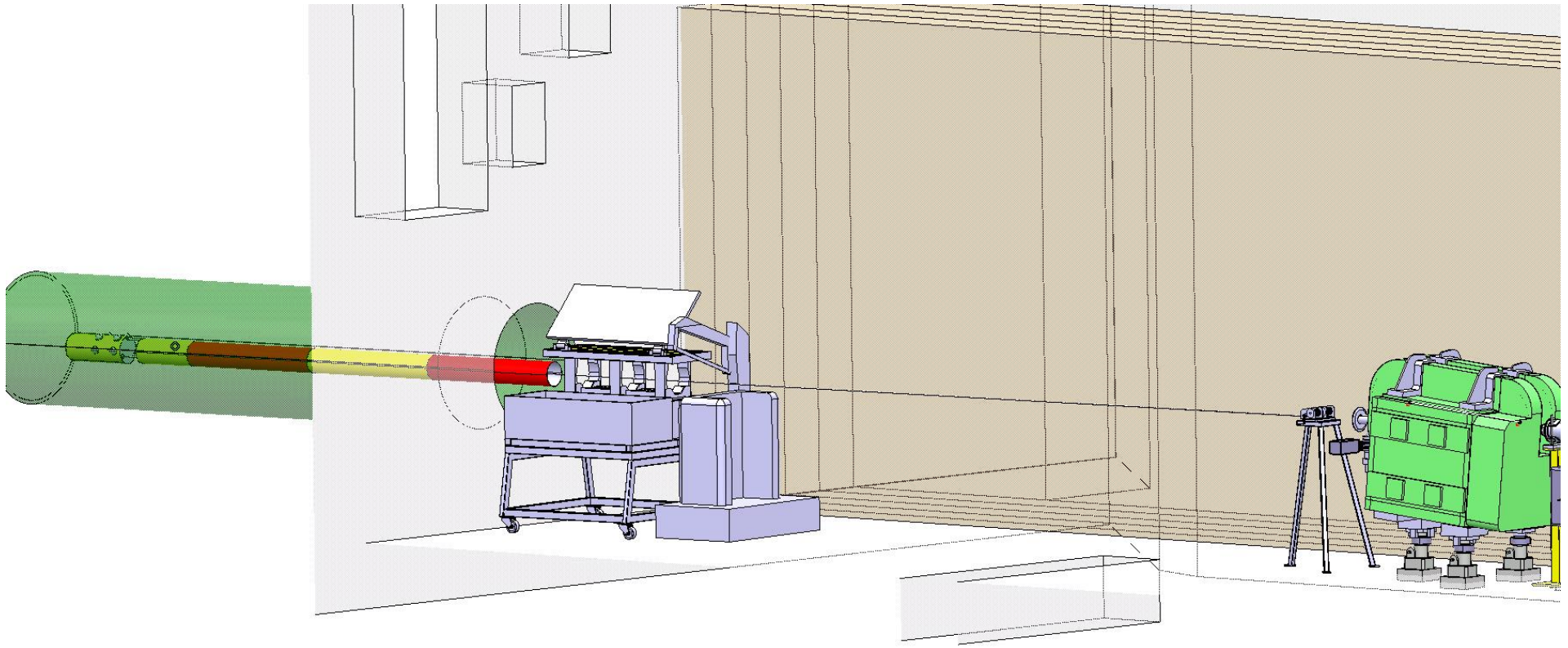

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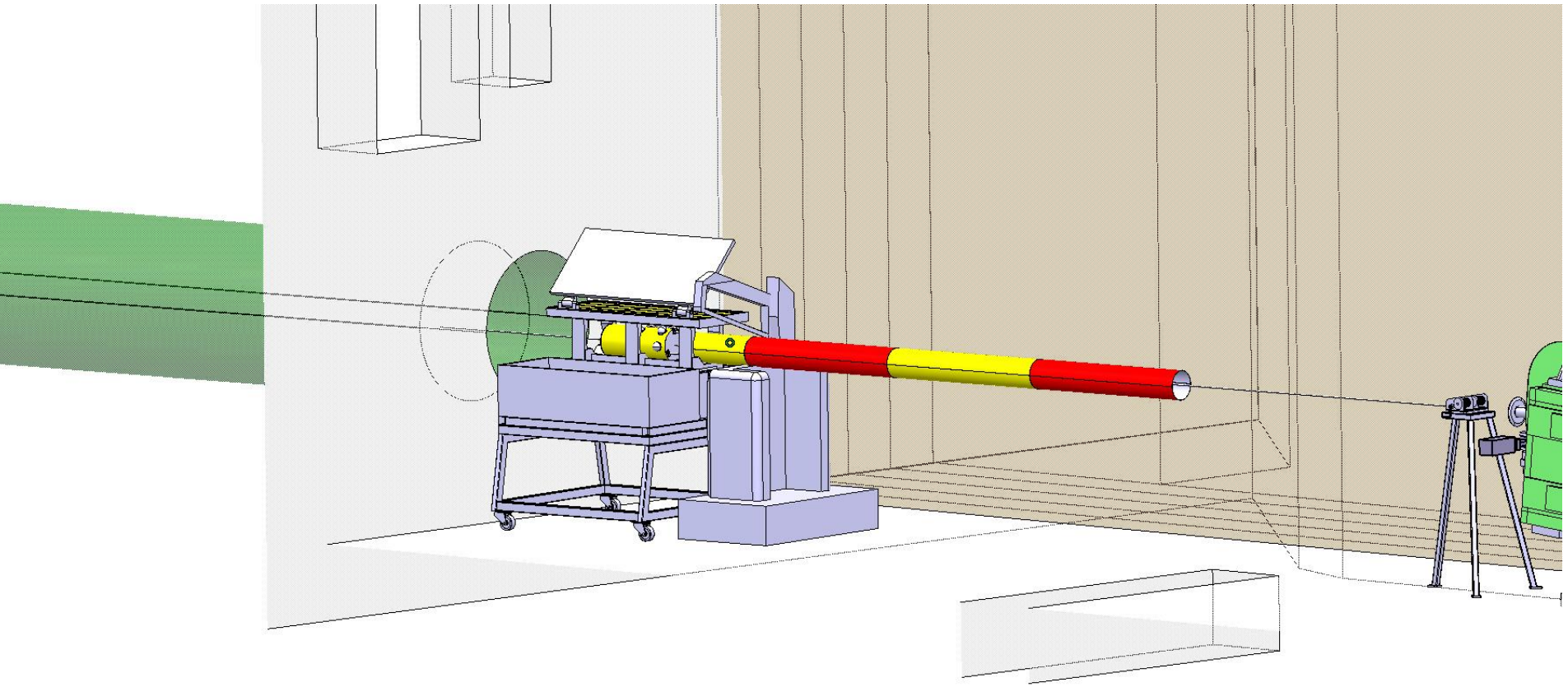

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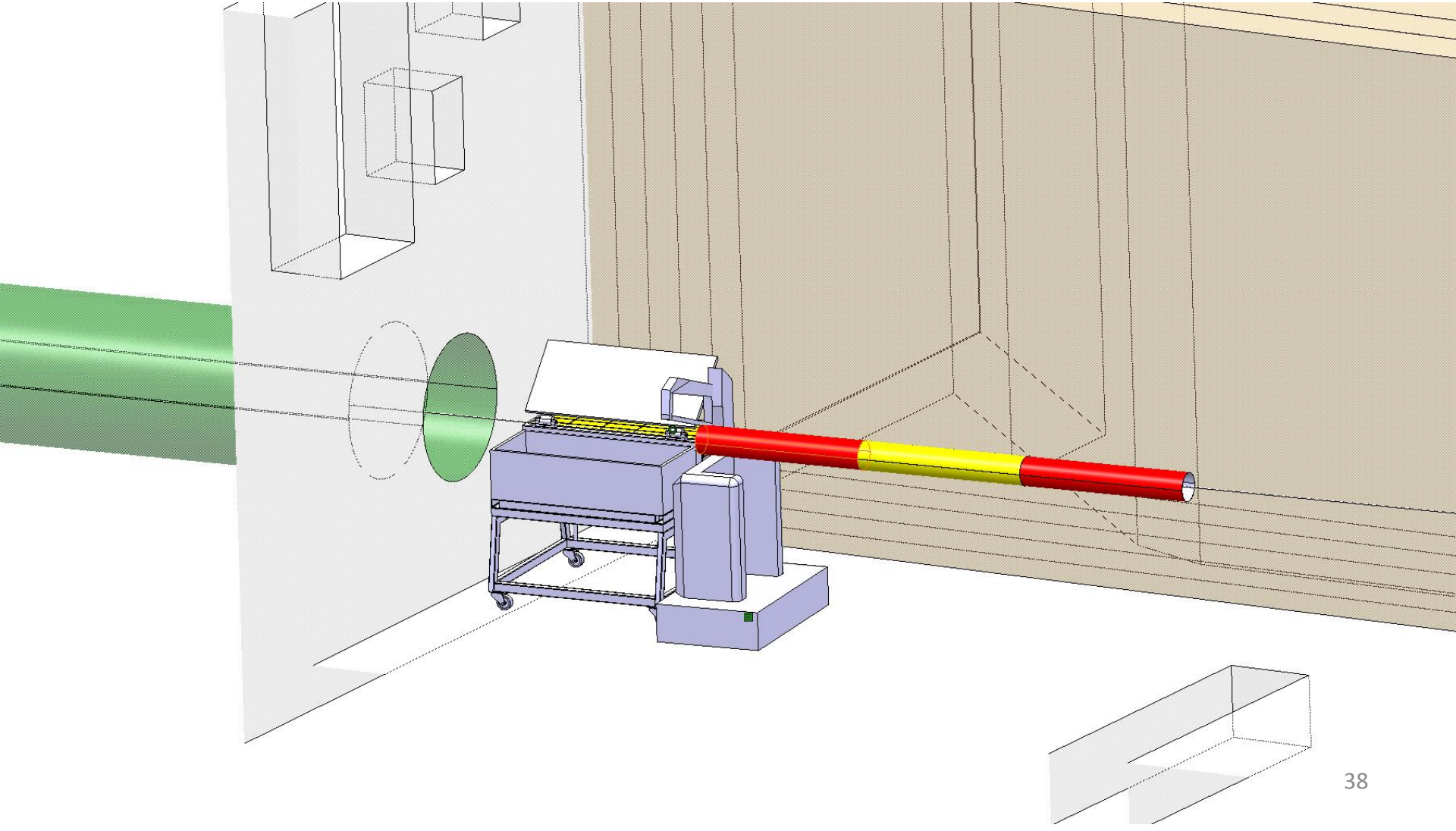

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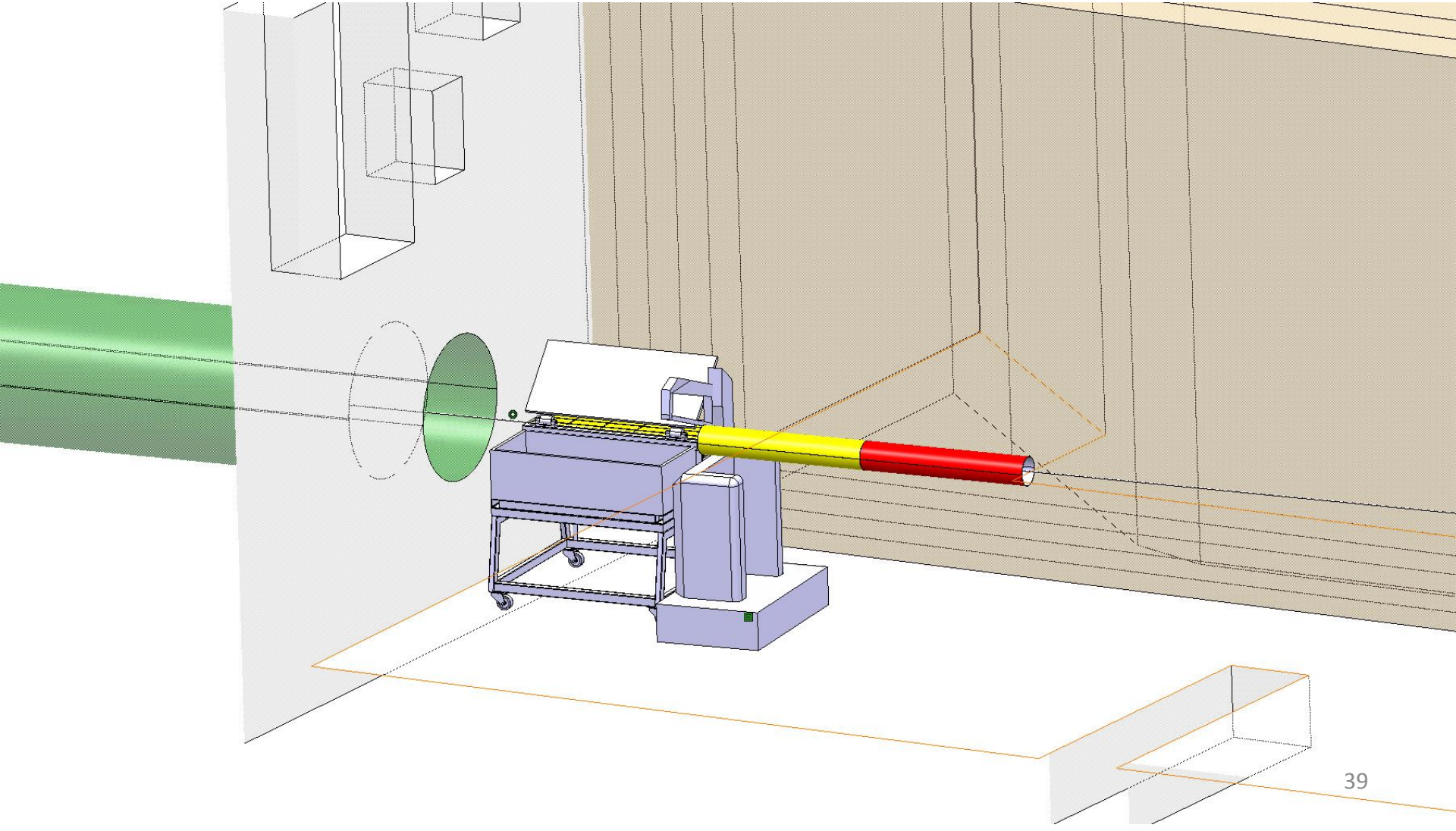

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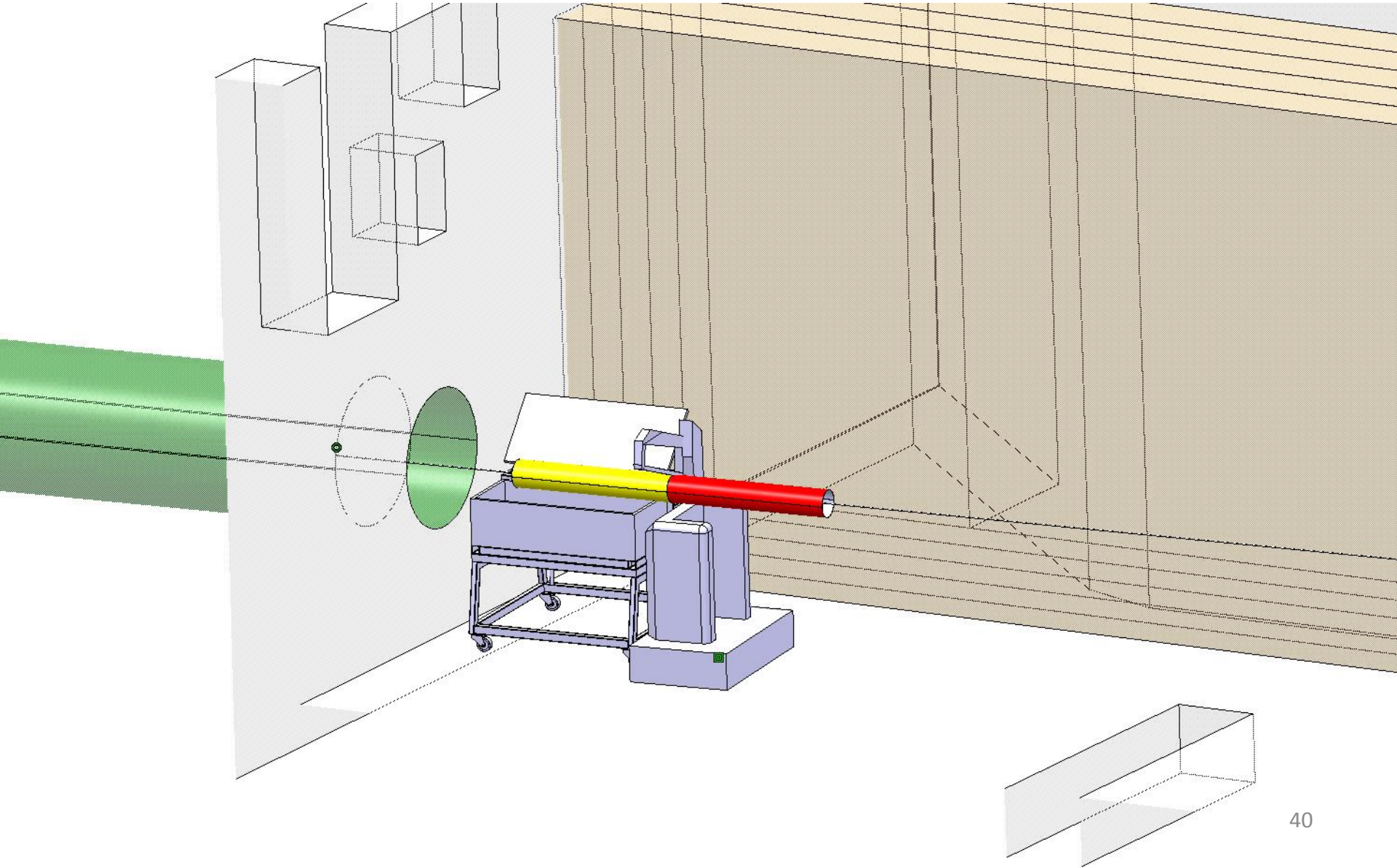

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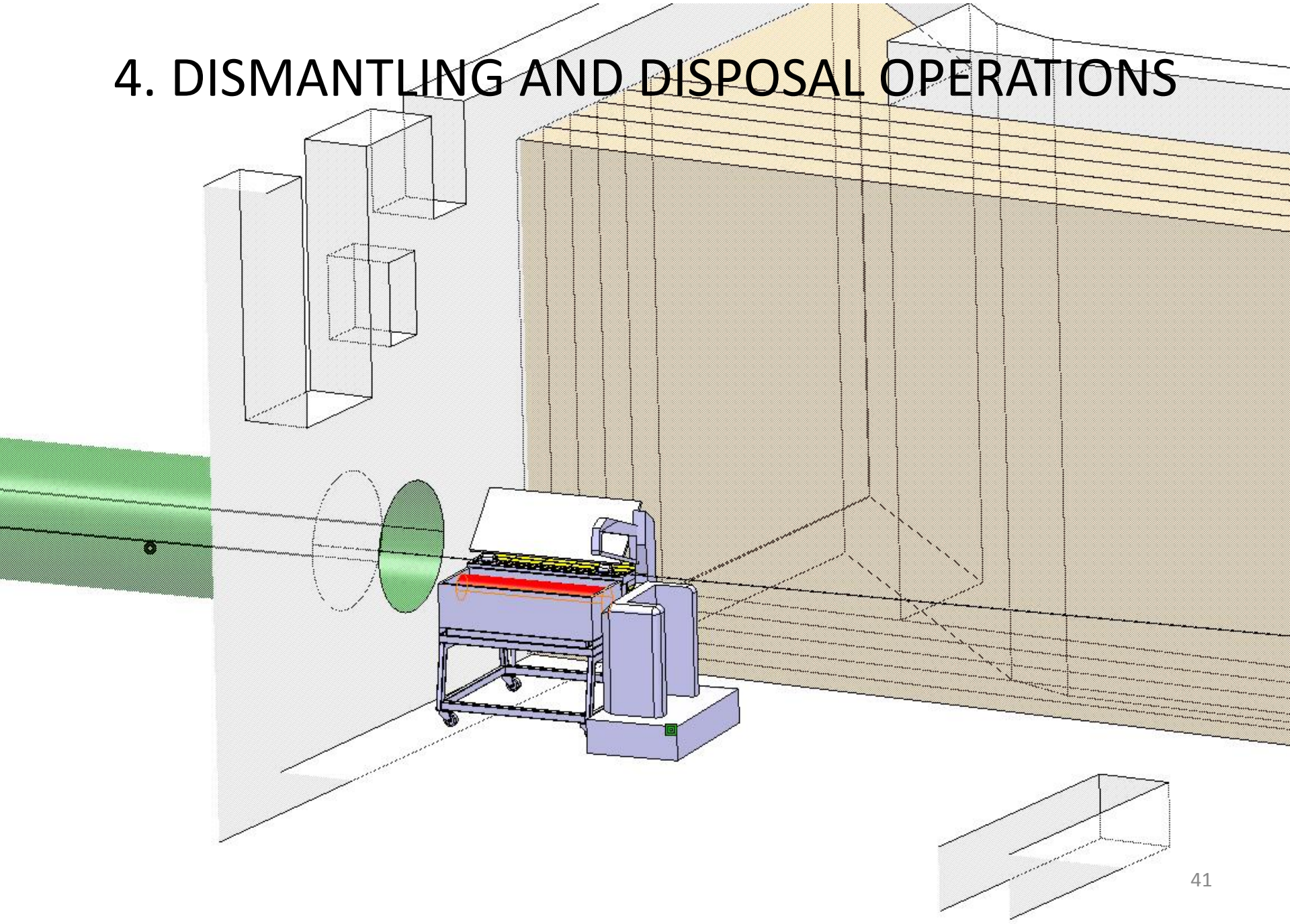

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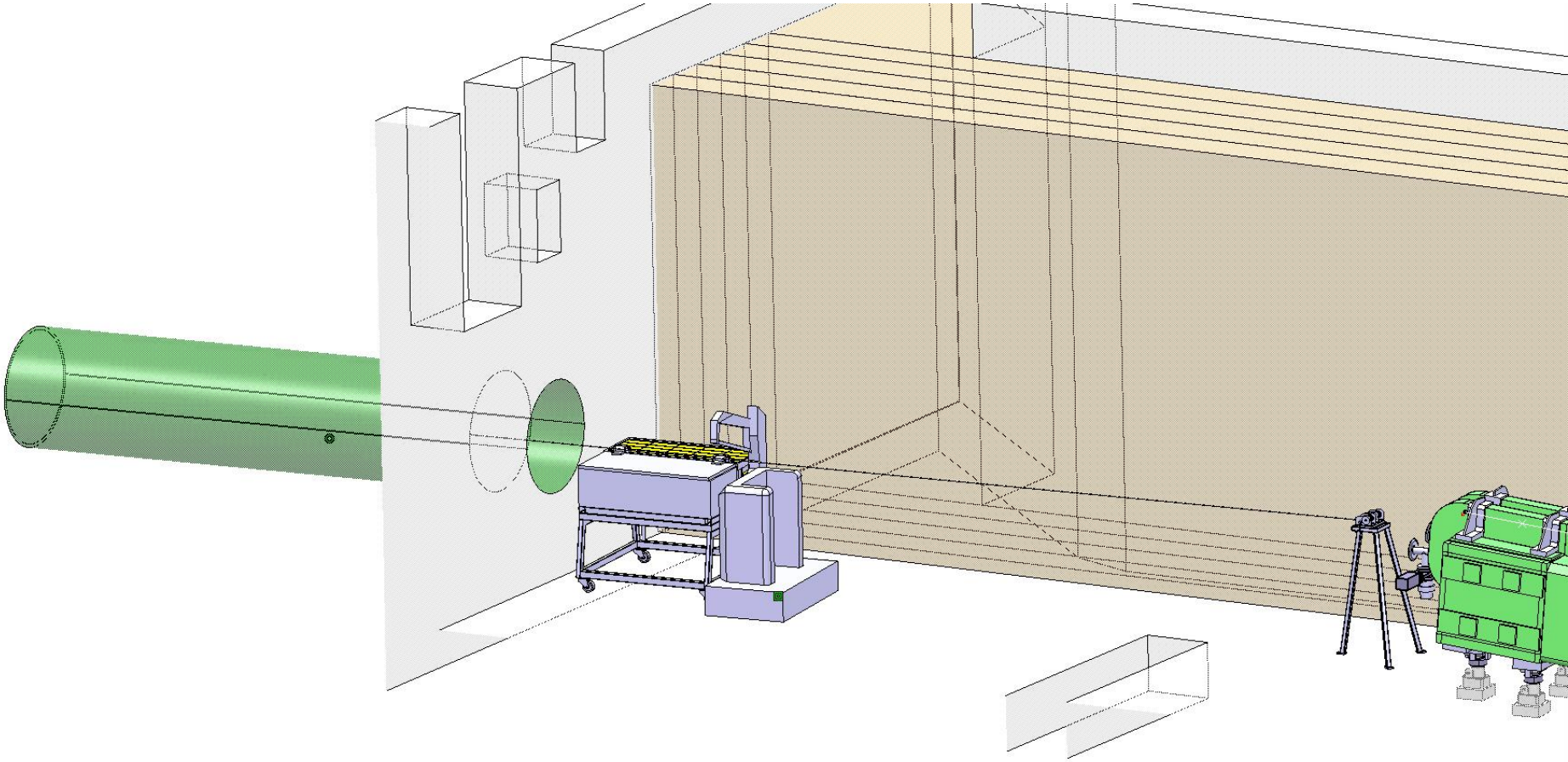

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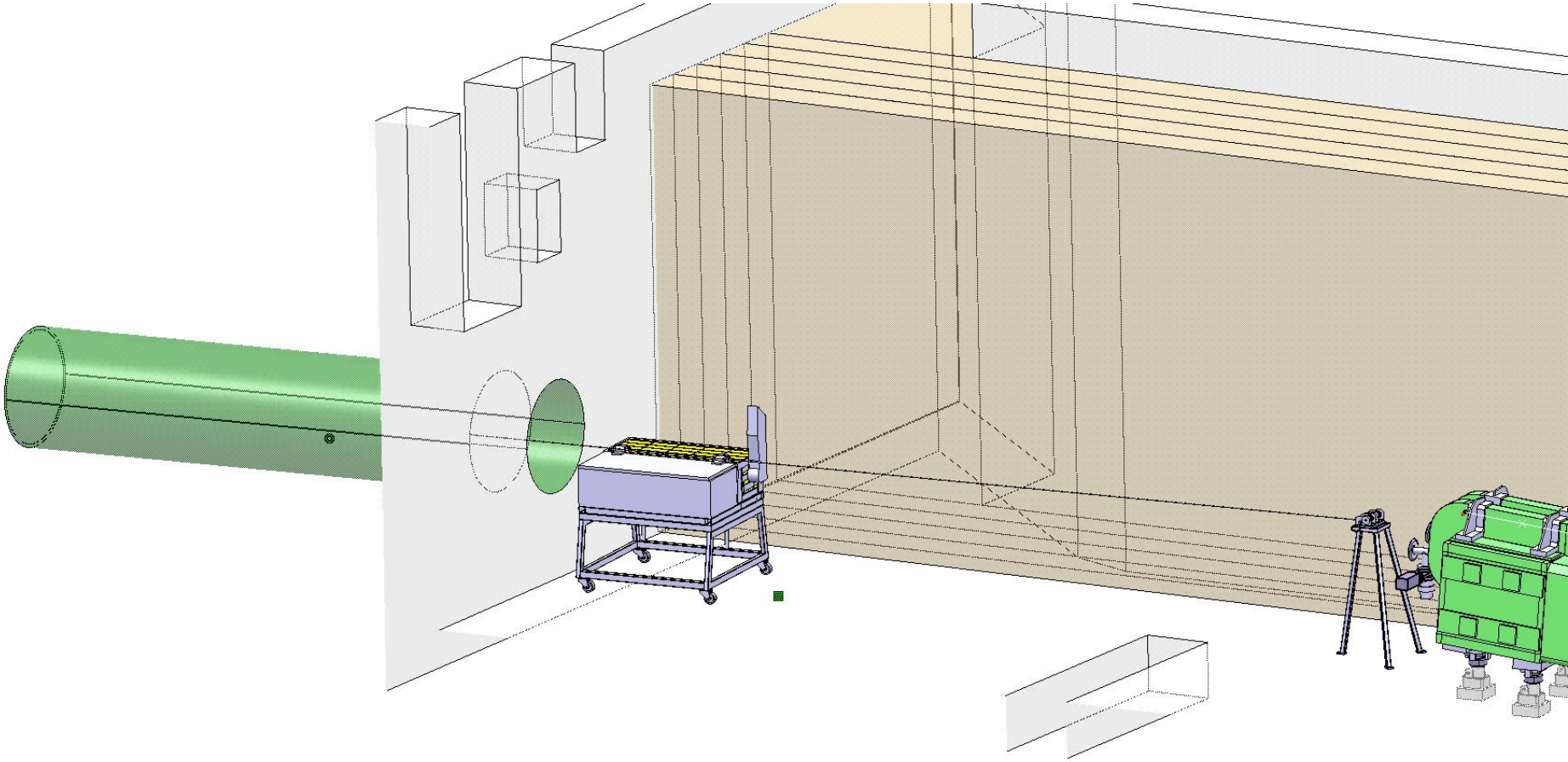

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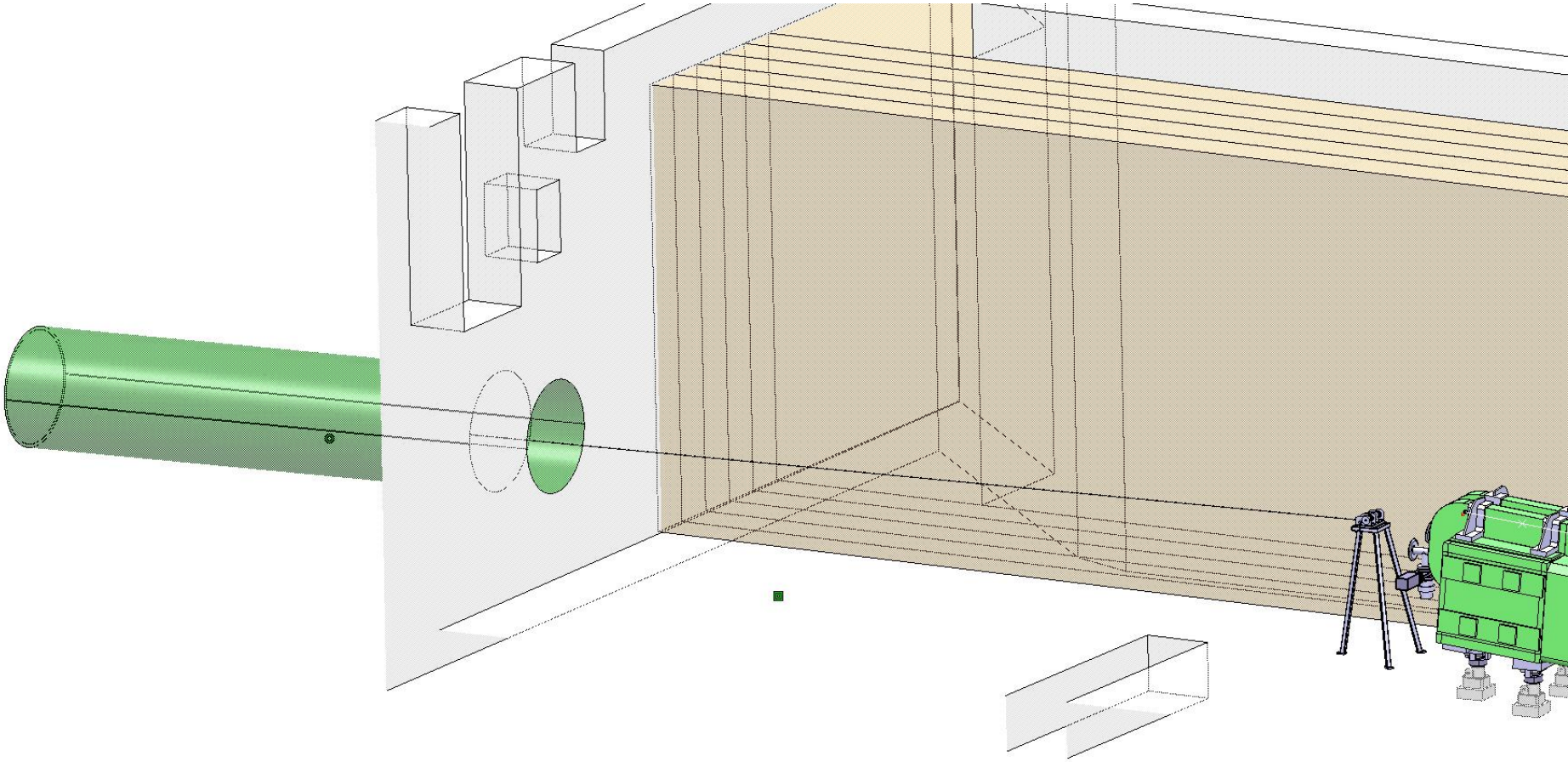


4. DISMANTLING AND DISPOSAL OPERATIONS

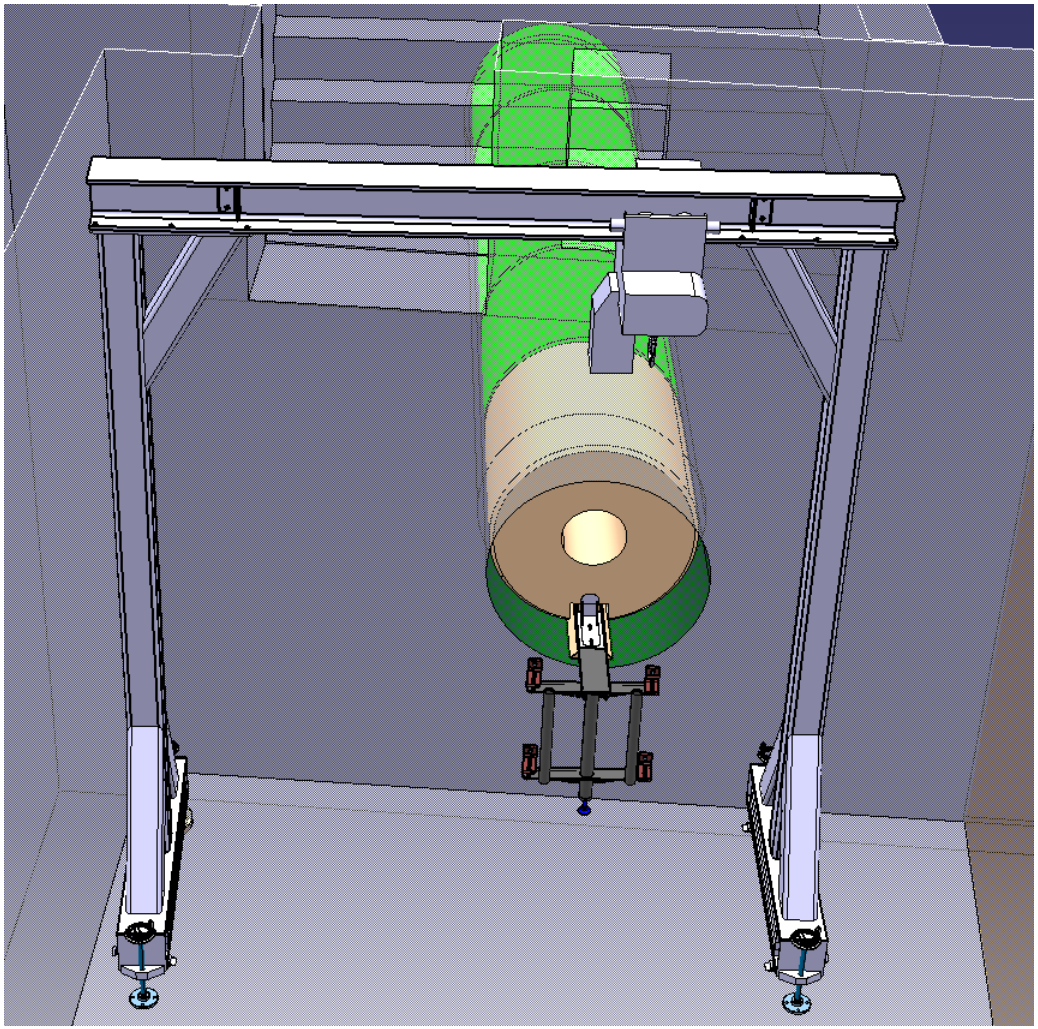
Trolley to transport shielded container with RW

Saw

Supports to clamp beam pipe

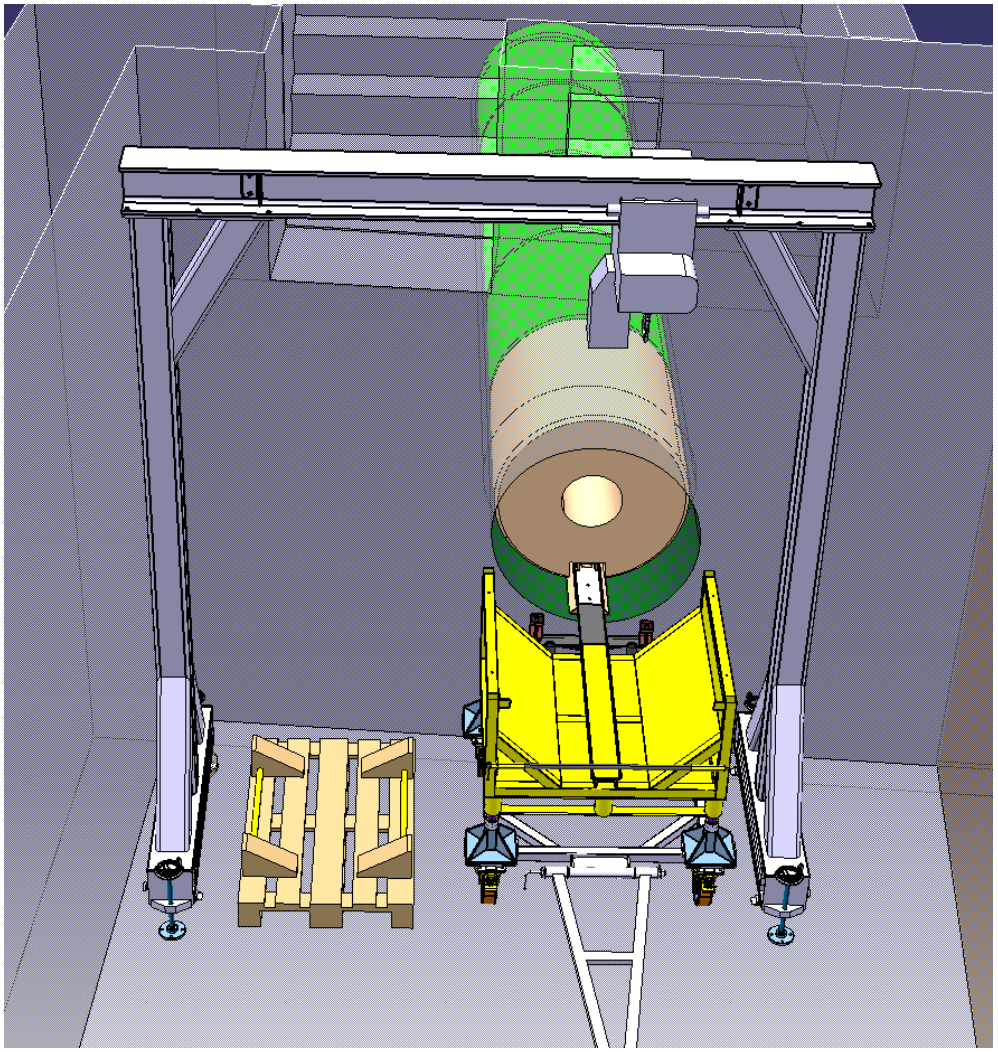
Beam pipe mock-up

4. DISMANTLING AND DISPOSAL OPERATIONS



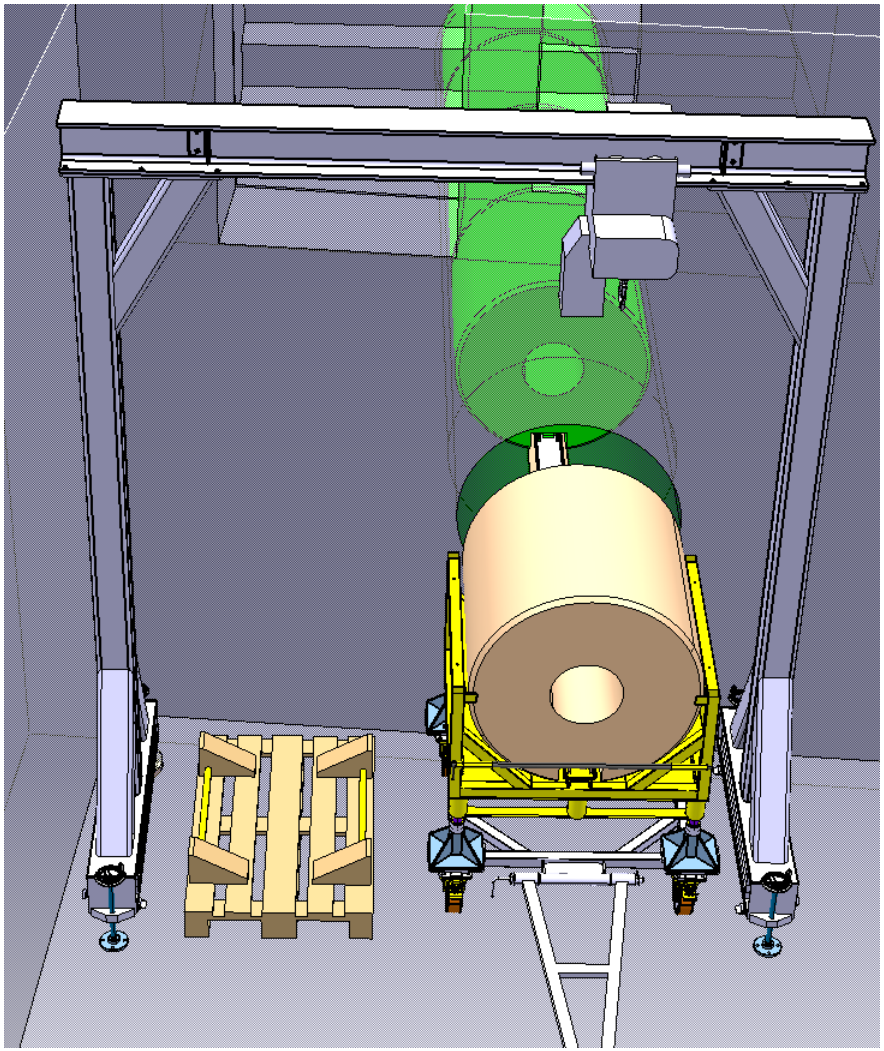
- Extension of rail
- Erection of a movable crane on site (custom made for this operation)

4. DISMANTLING AND DISPOSAL OPERATIONS



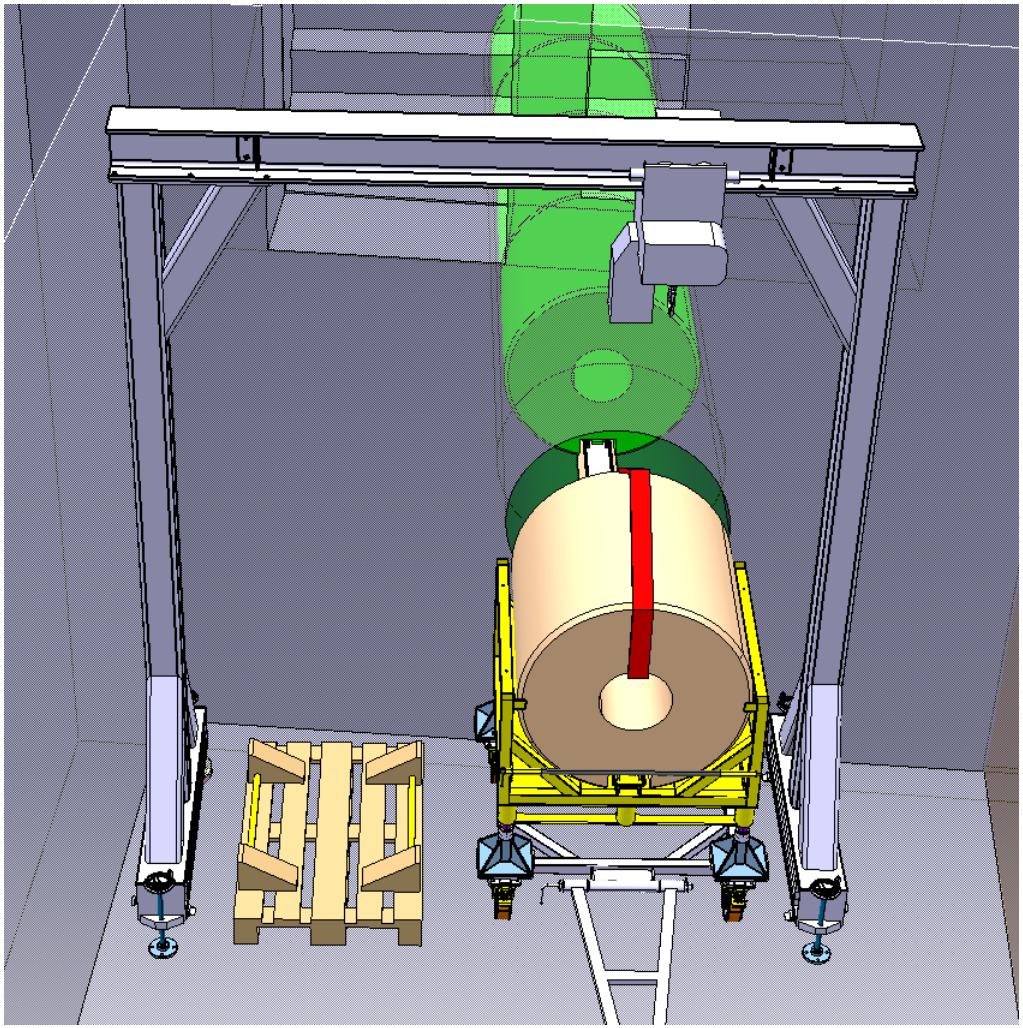
- Ad-hoc trailer in front of the dump
- Alignment and fixation to the rail extension
- Installation of a pallet beside the trailer to receive the block

4. DISMANTLING AND DISPOSAL OPERATIONS



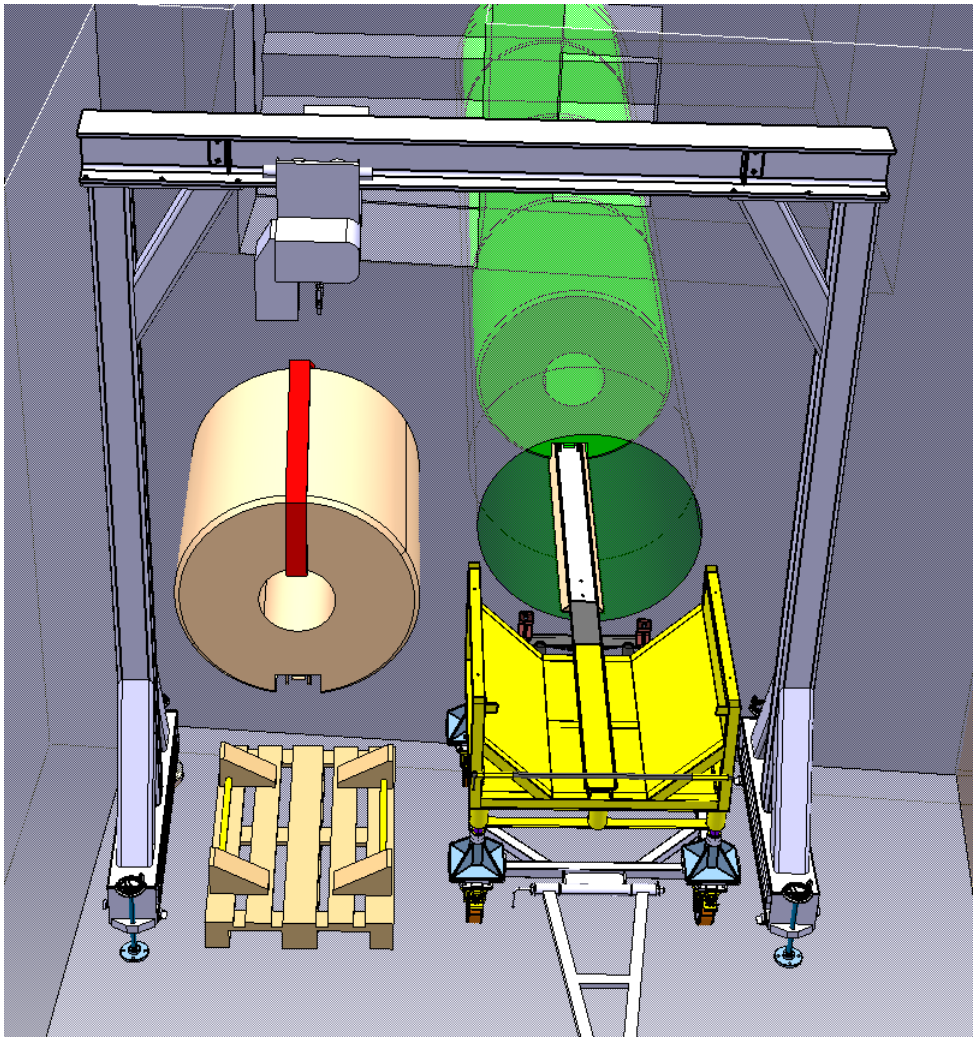
- Extraction of block

4. DISMANTLING AND DISPOSAL OPERATIONS



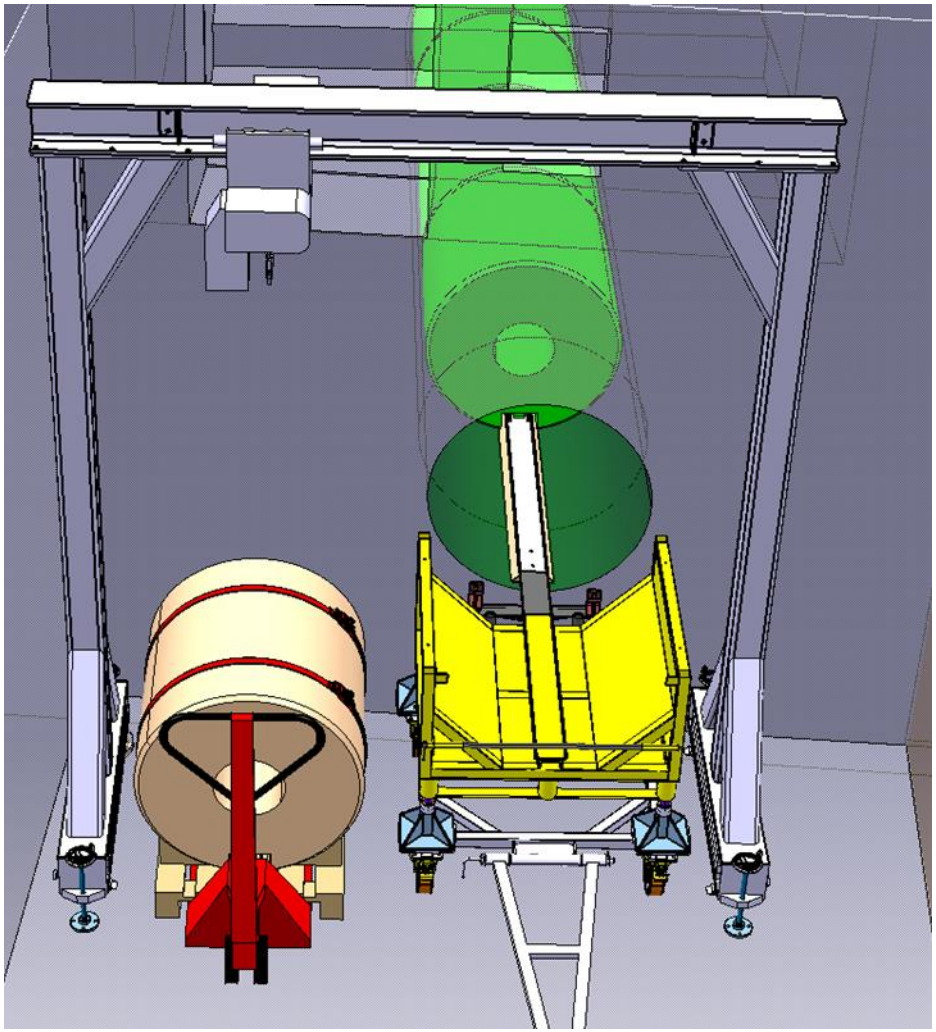
- Sling prepared on a bar
- Hoist pre-aligned
- Hook lowered before the extraction

4. DISMANTLING AND DISPOSAL OPERATIONS



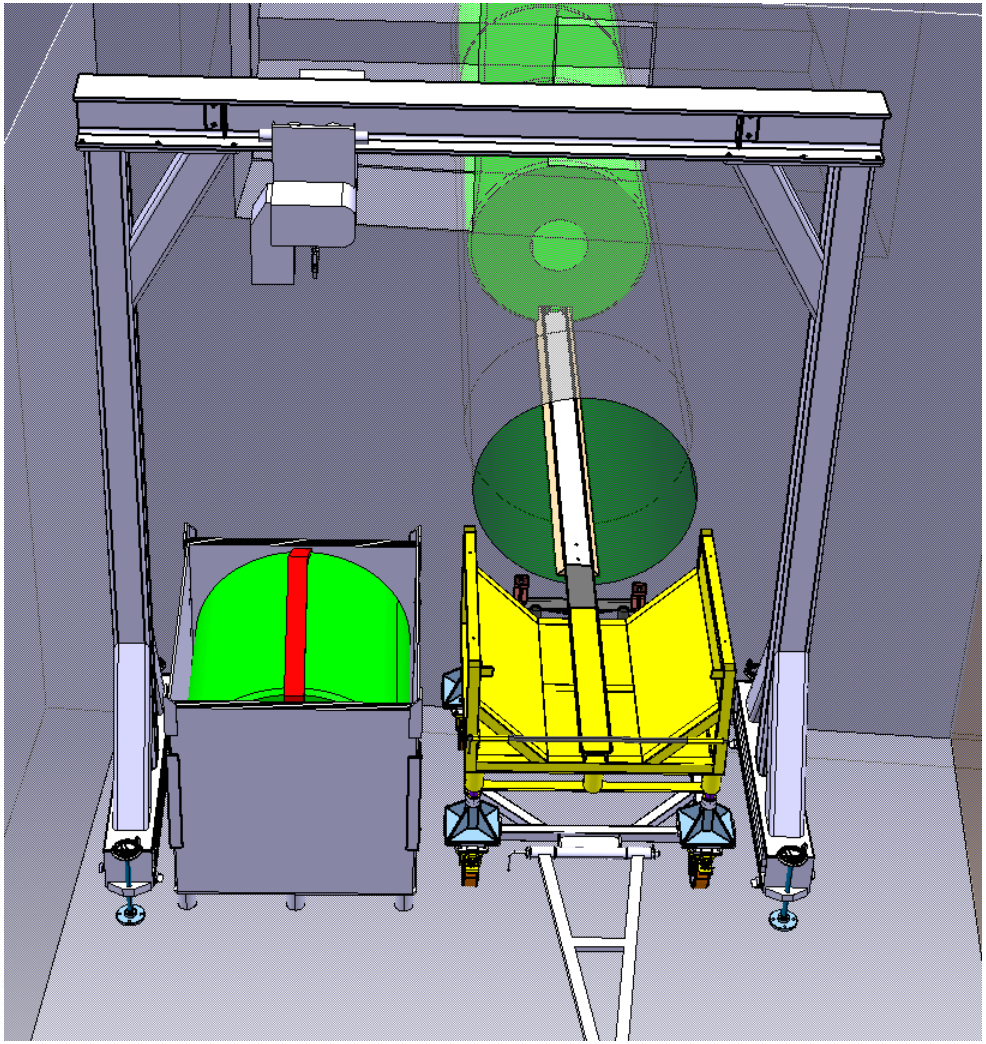
- The operator steps back and with the radio command (5m away) lifts the block and transfers it on the pallet

4. DISMANTLING AND DISPOSAL OPERATIONS

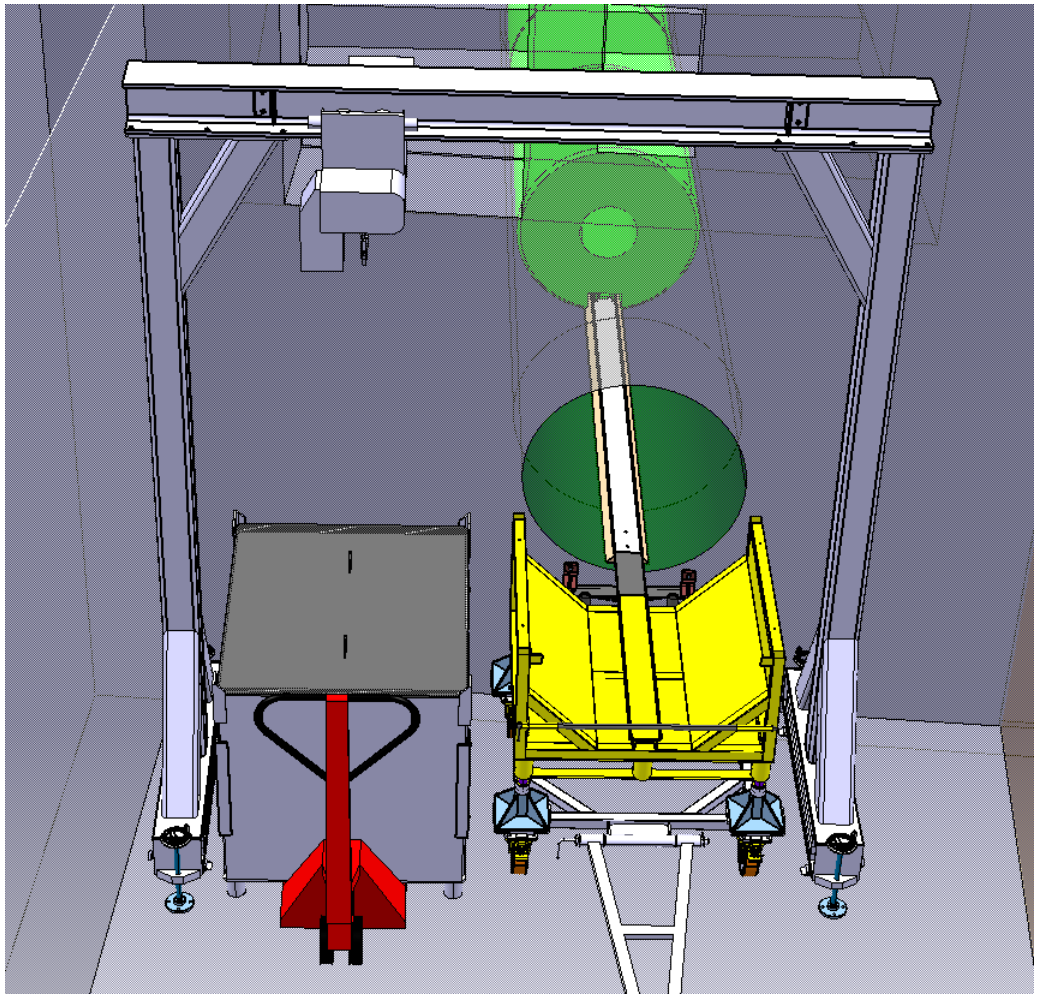


- Hook removed
- Block fixed to the pallet by 2 straps that were already in place
- The lifting slings are left in place for further transfer

4. DISMANTLING AND DISPOSAL OPERATIONS



4. DISMANTLING AND DISPOSAL OPERATIONS



4. DISMANTLING AND DISPOSAL OPERATIONS

Transport to ISR by Container Type A

5. ASSEMBLY AND PLACEMENT OF THE NEW DUMP

- Installation of new shielding
- Installation of new dump
- Installation of ventilation equipment, cabling and ductwork

6. RE-ASSEMBLY OF EQUIPMENT IN BT, BTM AND BTY LINES. CONNECT SERVICES

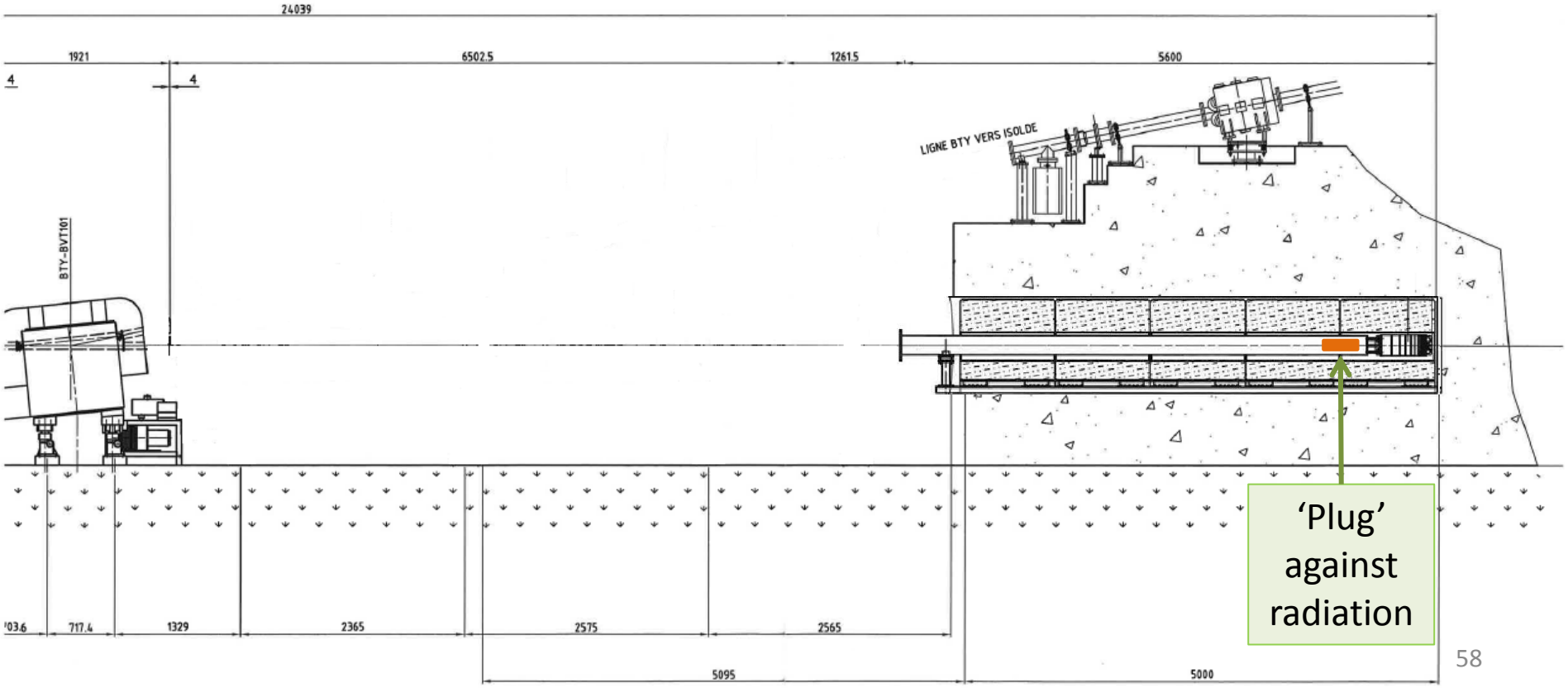
- Re-assembly of equipment in BTM line
- Re-assembly of equipment in BTY line
- Final reconstruction and Connect Services

WORK PLANNING

7. Survey
8. Start vacuum
9. Ready for commissioning

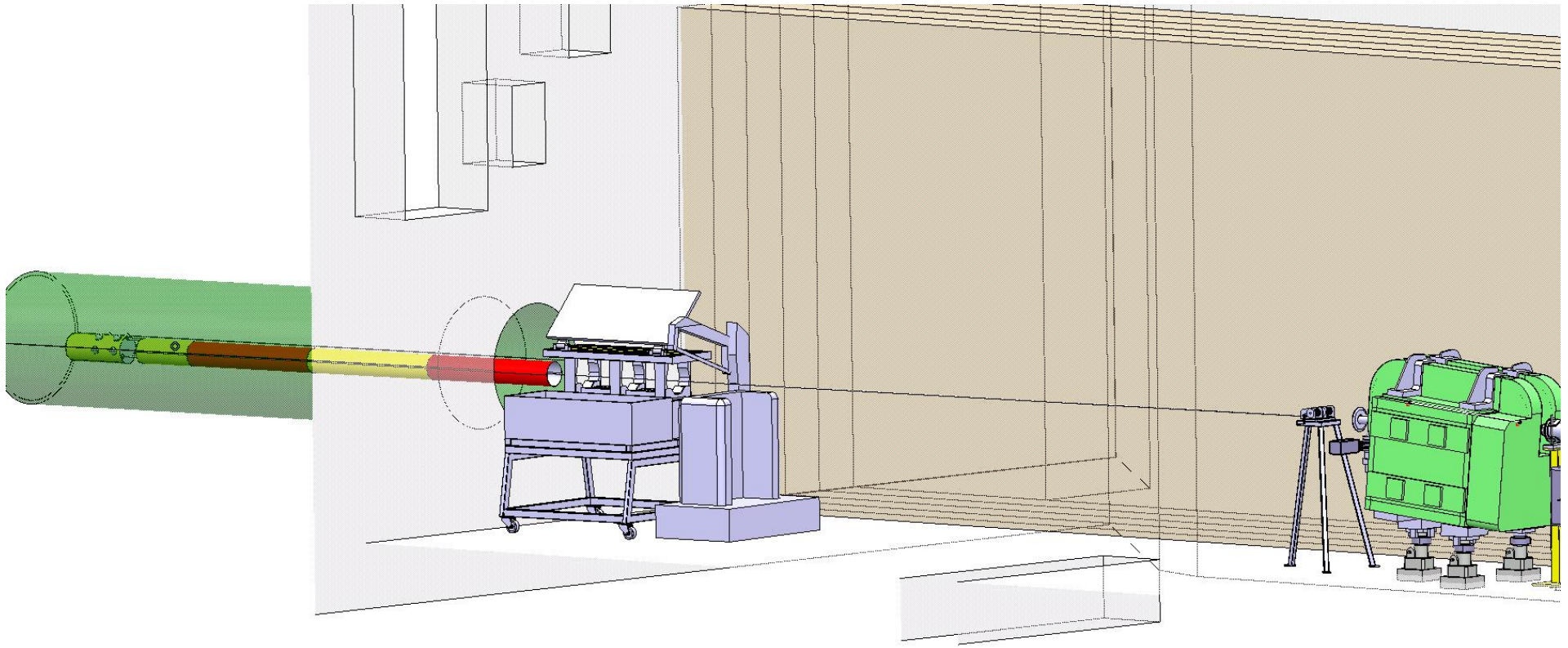
TECHNICAL SOLUTIONS ADOPTED TO REDUCE COLLECTIVE DOSE

1. Plug against radiation: installed at the beginning of LS1, in order to protect any worker in the area.



TECHNICAL SOLUTIONS ADOPTED TO REDUCE COLLECTIVE DOSE

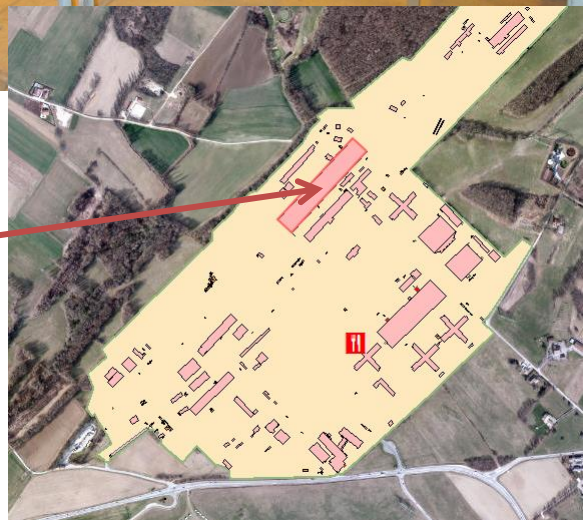
2. Winch used to extract radioactive elements placed far (~7 m)



TECHNICAL SOLUTIONS ADOPTED TO REDUCE COLLECTIVE DOSE

3. Mock-up in Building EHN1: to get familiar with the operations to perform, learn from the mistakes made, improve the strategy and last but not least reduce the time spent

Area for mock-up operations

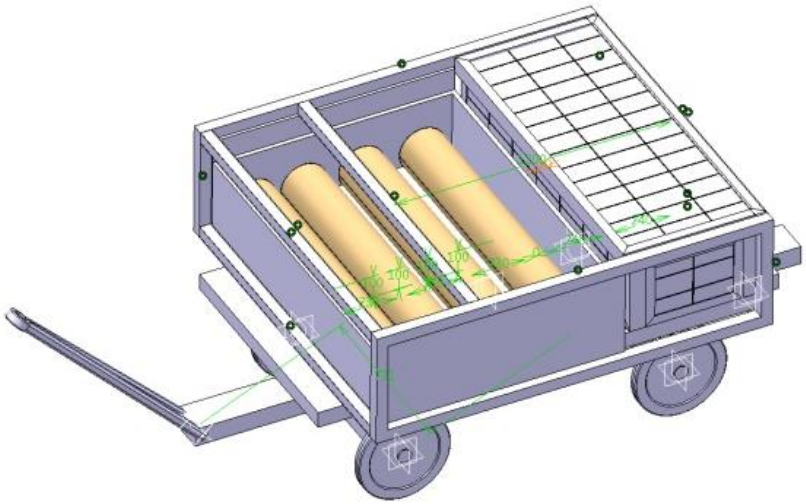


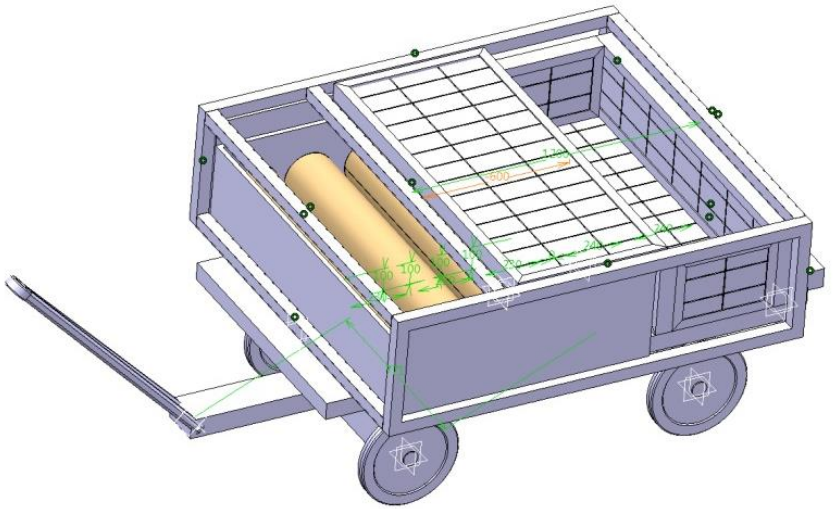
Building EHN1 (Prevessin site)

TECHNICAL SOLUTIONS ADOPTED TO REDUCE COLLECTIVE DOSE

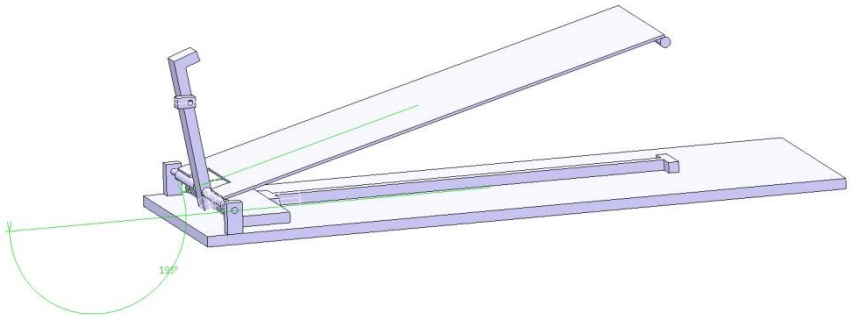
4. Custom made shielded container for dump core and beam pipe: extra layers of shielding can be added in case dose rate at contact is too high
5. Controlled fall of dump core safely inside shielded container (no need for manipulation)

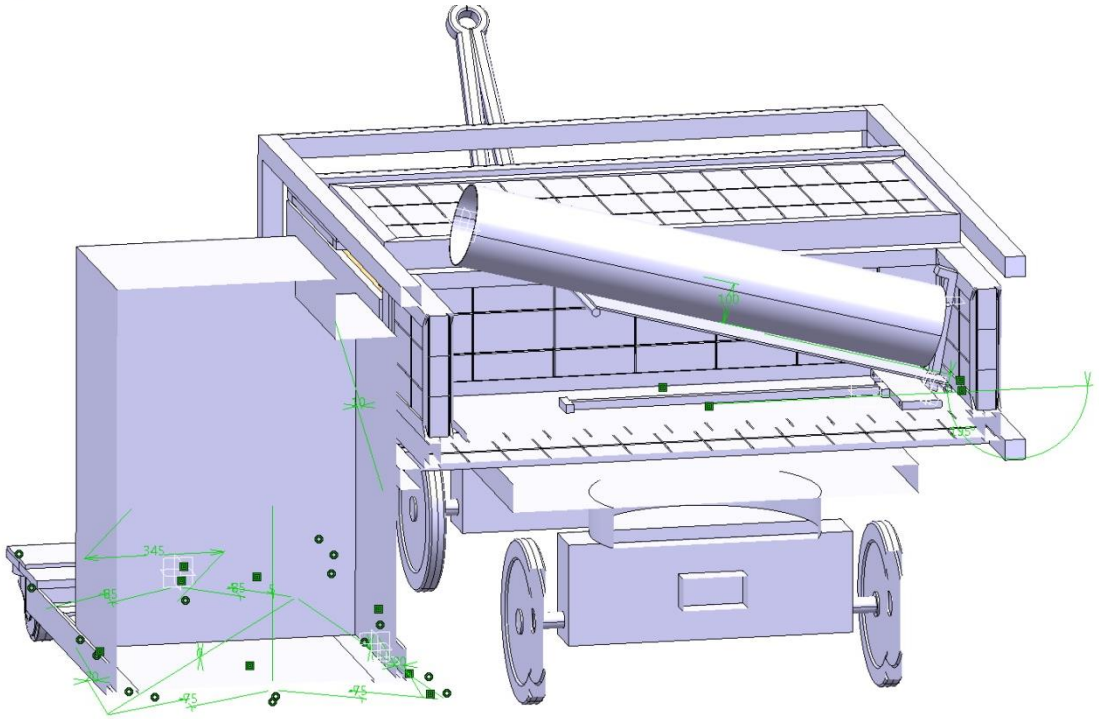
Custom made shielded container for dump core and beam pipe





Custom made shielded container for dump core and beam pipe





TECHNICAL SOLUTIONS ADOPTED TO REDUCE COLLECTIVE DOSE

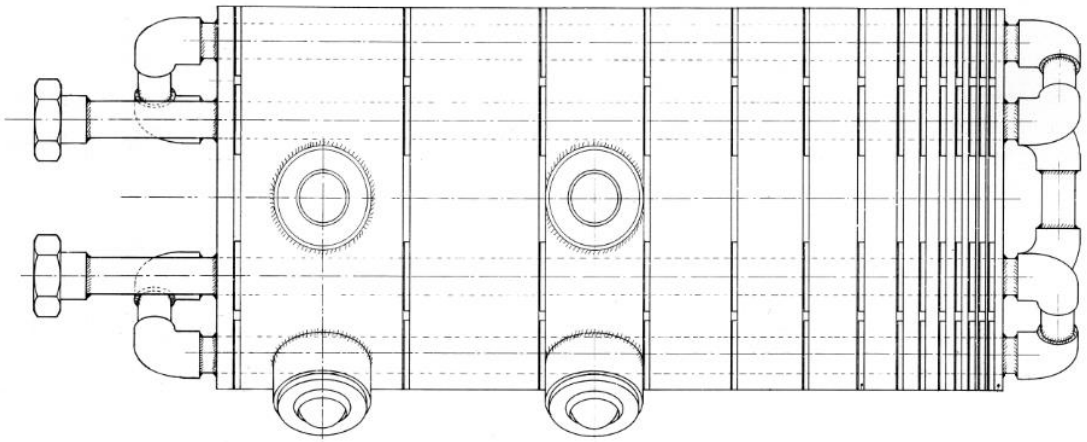
6. Cutting of beam pipe-dump core assembly done remotely (workers exposure reduced)
7. Proposition to HH to simulate the displacement of a concrete block from the dump area all the way to the lorry outside on the street

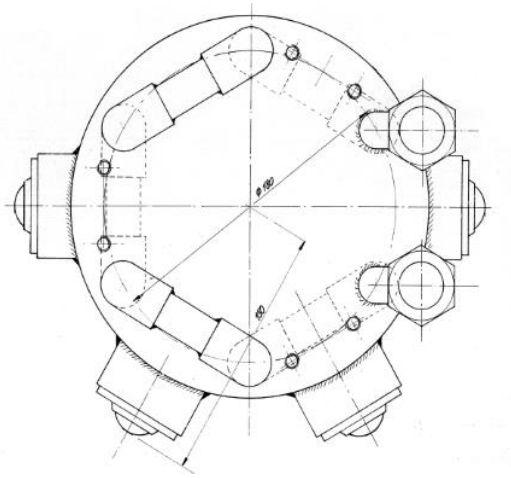
Thanks for your attention

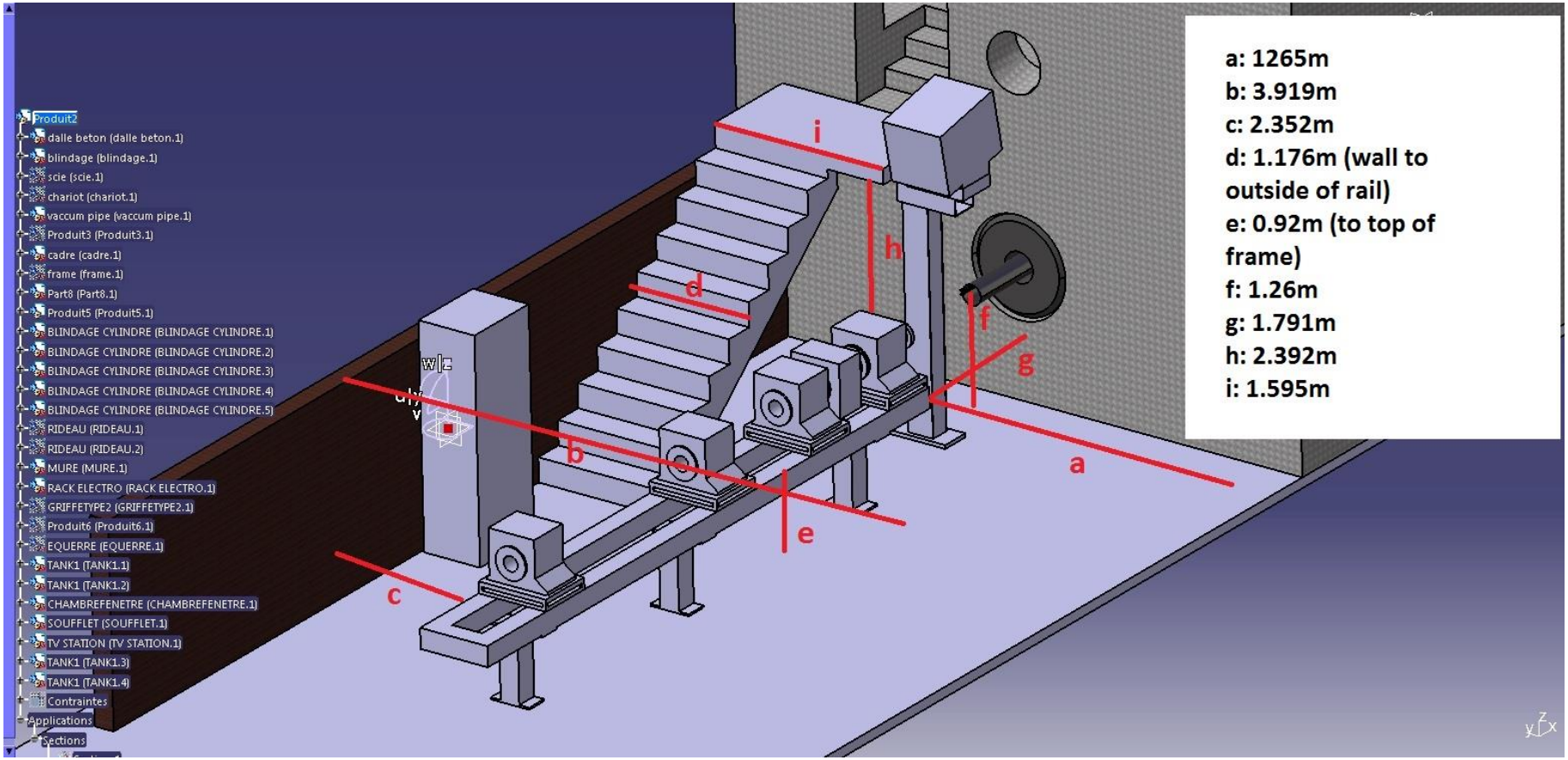
Q & A?

BACK-UP

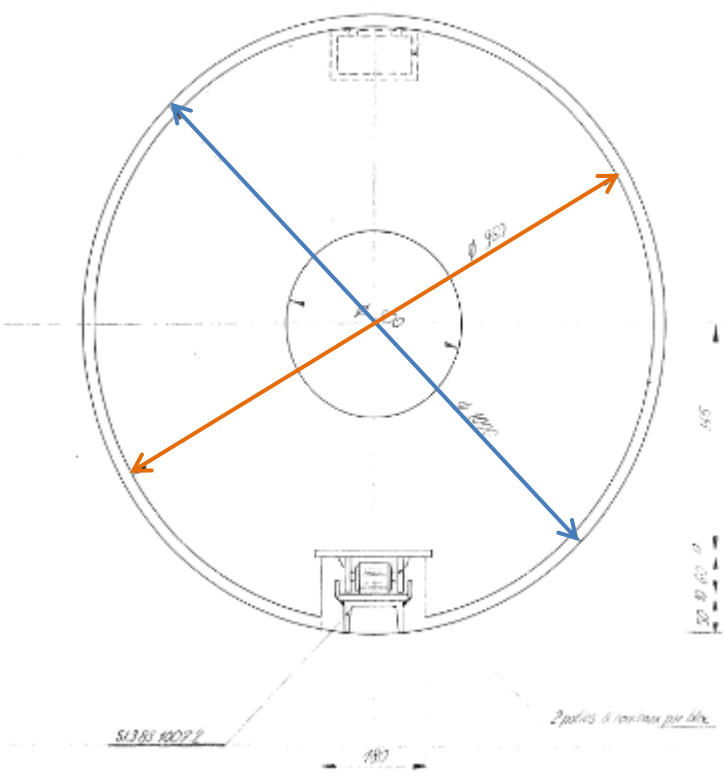
OLD PSB DUMP





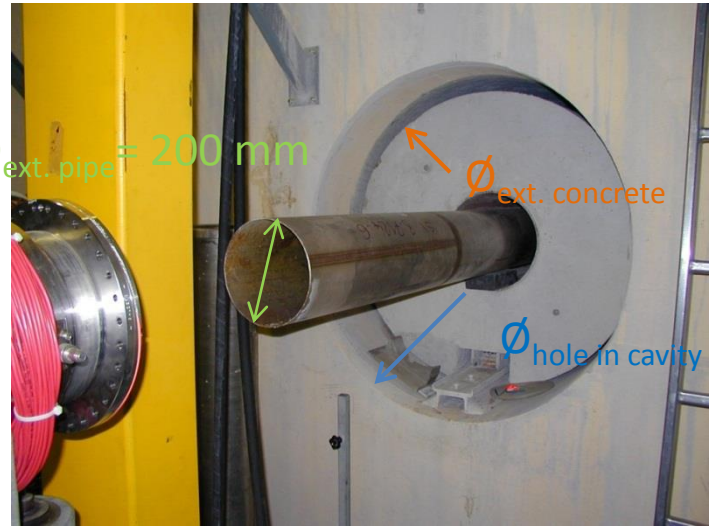

Produit2
dalle beton (dalle beton.1)
blindage (blindage.1)
scie (scie.1)
chariot (chariot.1)
vaccum pipe (vaccum pipe.1)
Produit3 (Produit3.1)
cadre (cadre.1)
frame (frame.1)
Part8 (Part8.1)
Produit5 (Produit5.1)
BLINDAGE CYLINDRE (BLINDAGE CYLINDRE.1)
BLINDAGE CYLINDRE (BLINDAGE CYLINDRE.2)
BLINDAGE CYLINDRE (BLINDAGE CYLINDRE.3)
BLINDAGE CYLINDRE (BLINDAGE CYLINDRE.4)
BLINDAGE CYLINDRE (BLINDAGE CYLINDRE.5)
RIDEAU (RIDEAU.1)
RIDEAU (RIDEAU.2)
MURE (MURE.1)
RACK ELECTRO (RACK ELECTRO.1)
GRIFFETYPE2 (GRIFFETYPE2.1)
Produit6 (Produit6.1)
EQUERRE (EQUERRE.1)
TANK1 (TANK1.1)
TANK1 (TANK1.2)
CHAMBREFENETRE (CHAMBREFENETRE.1)
SOUFFLET (SOUFFLET.1)
TV STATION (TV STATION.1)
TANK1 (TANK1.3)
TANK1 (TANK1.4)
Contraintes
Applications
Sections
a
b
c
d
e
f
g
h
i
a: 1265m
b: 3.919m
c: 2.352m
d: 1.176m (wall to outside of rail)
e: 0.92m (to top of frame)
f: 1.26m
g: 1.791m
h: 2.392m
i: 1.595m

CONCRETE BLOCKS



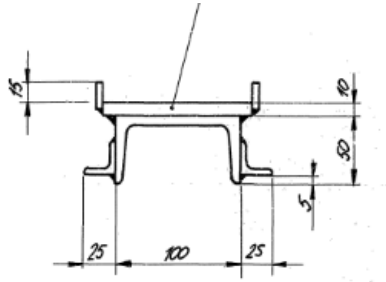
$Ø_{hole\ in\ cavity}$ = ~1000 mm

$Ø_{ext.\ concrete}$ = ~960 mm



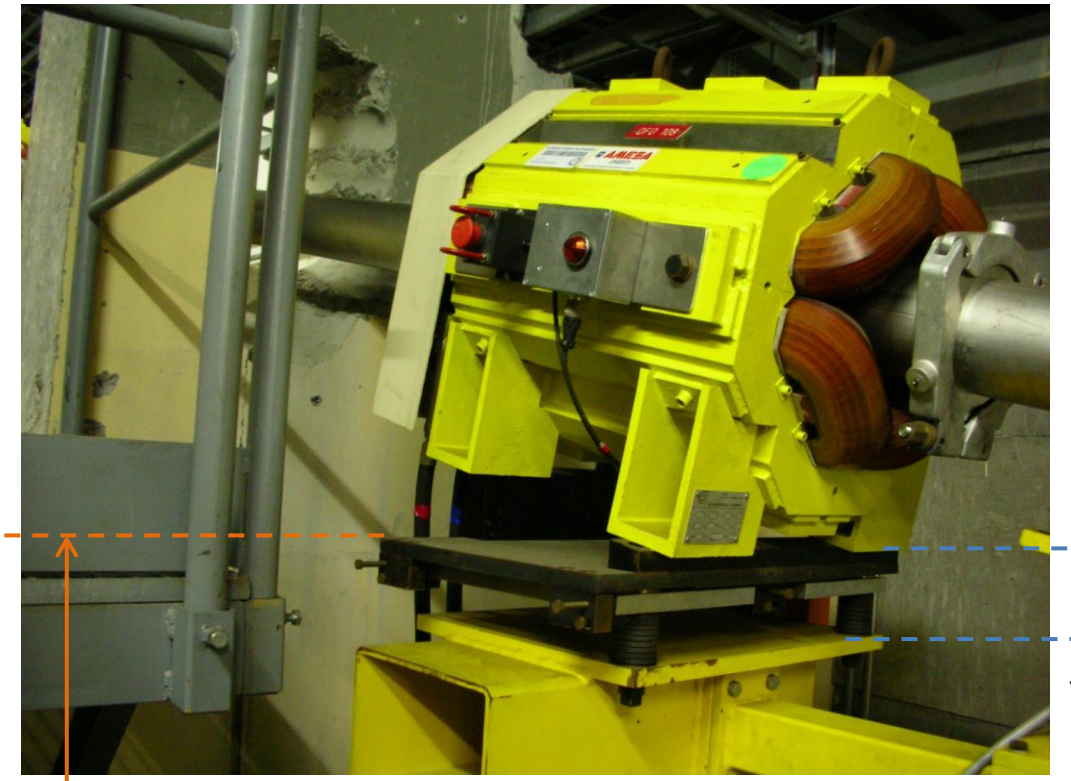
RAIL IN CAVITY

d = 62 mm *(60 mm according to old drawings)*



Old drawings

MAGNET BTY-QFO 108



Black plate's top surface

Black plate's top surface

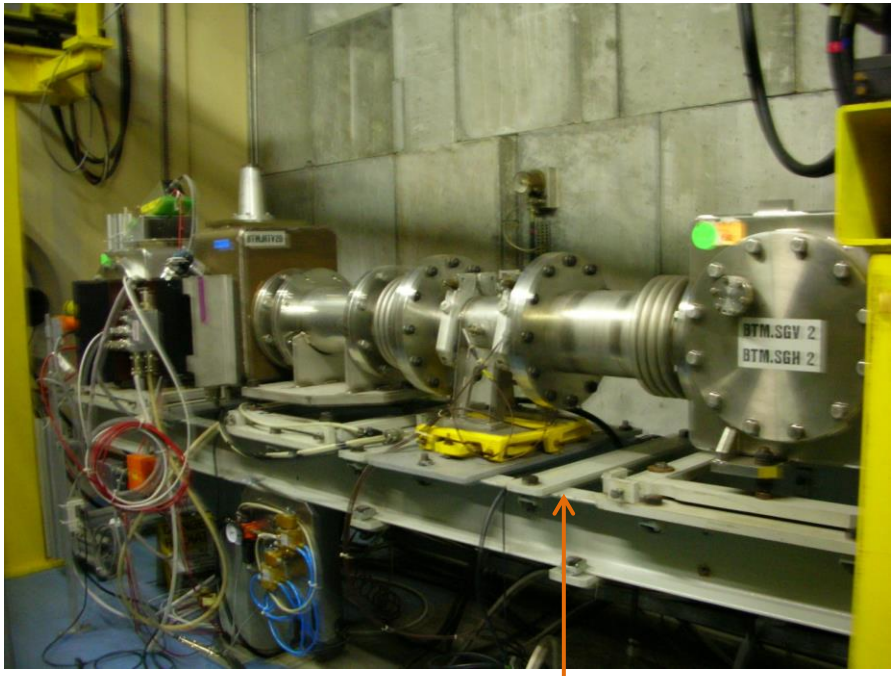
d ~ 100 mm

Yellow plate's top surface

d = 2560 mm

floor

GIRDER vs RAIL INSIDE CAVITY



Girder's top surface

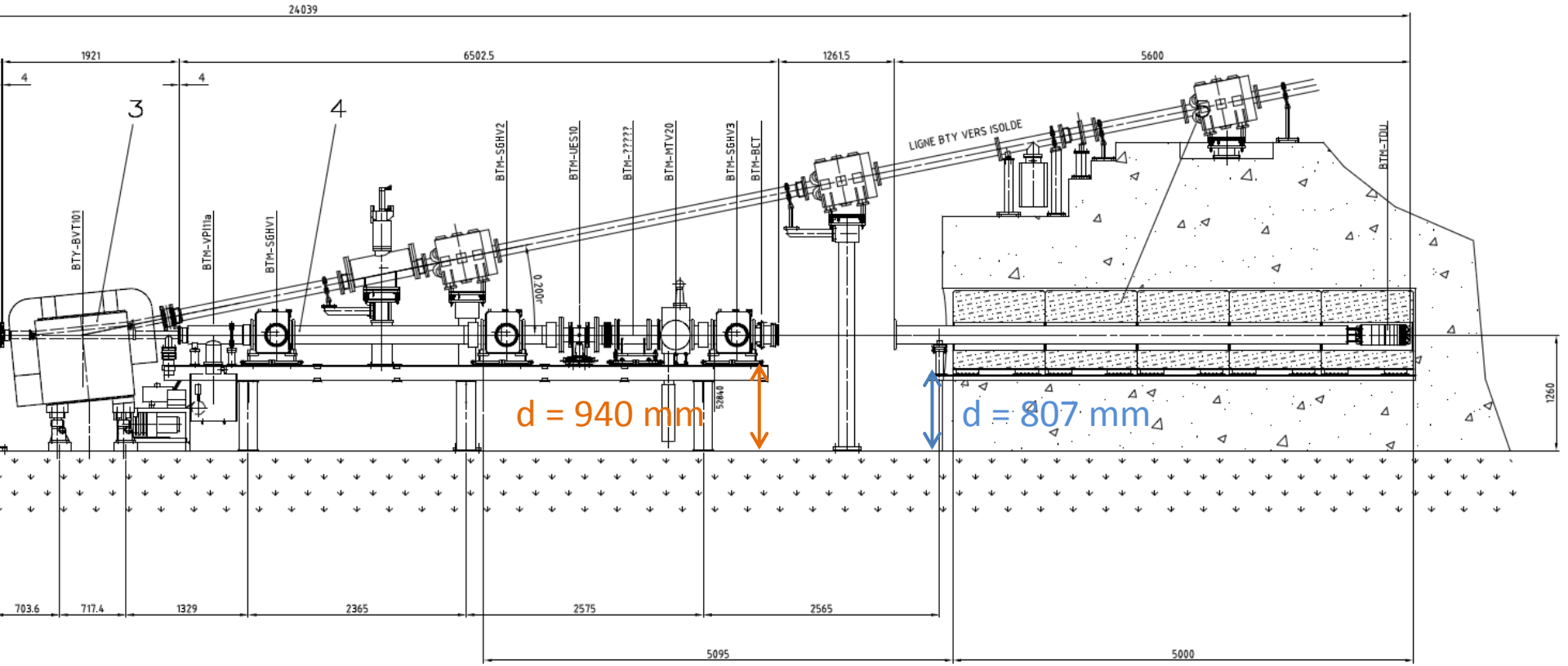
d = 940 mm

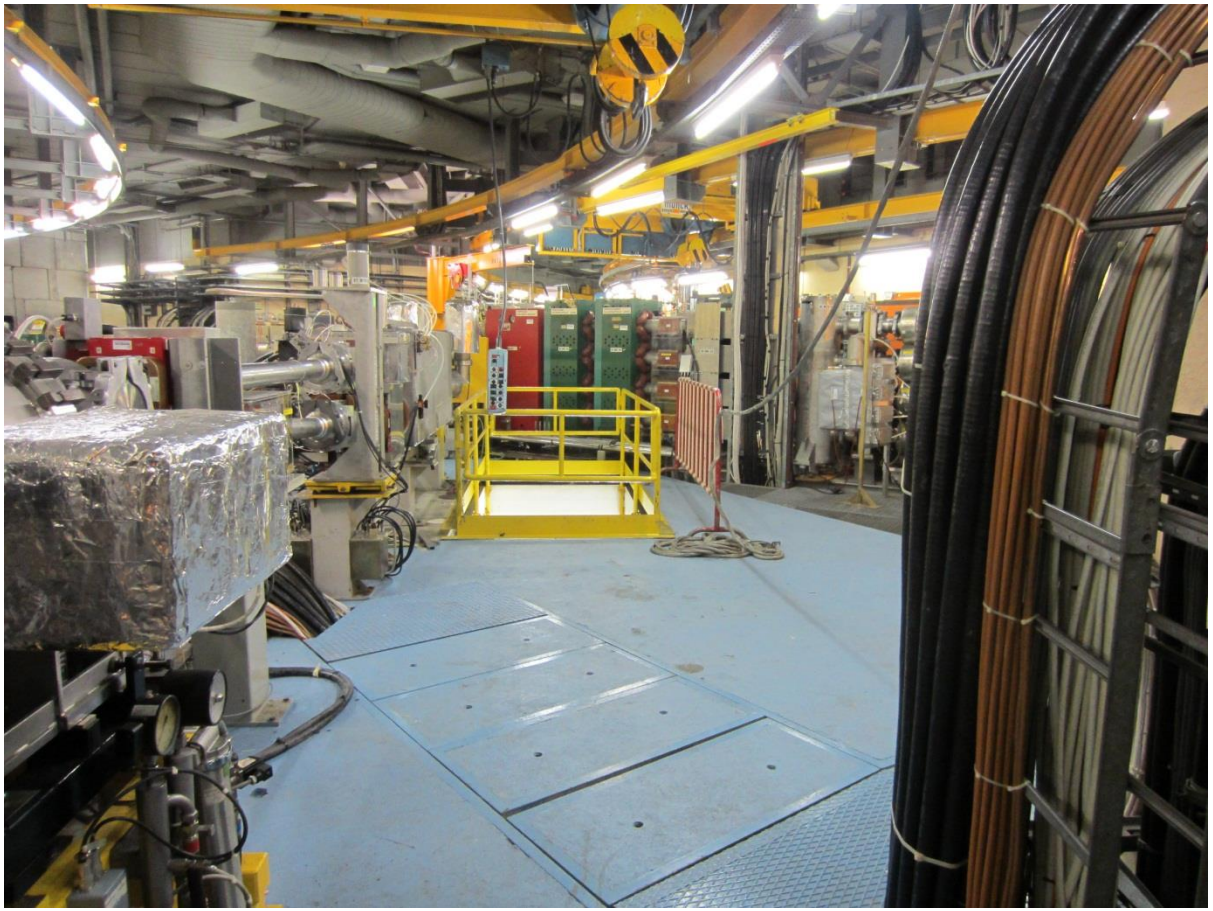
Rail's surface where the concrete blocks roll

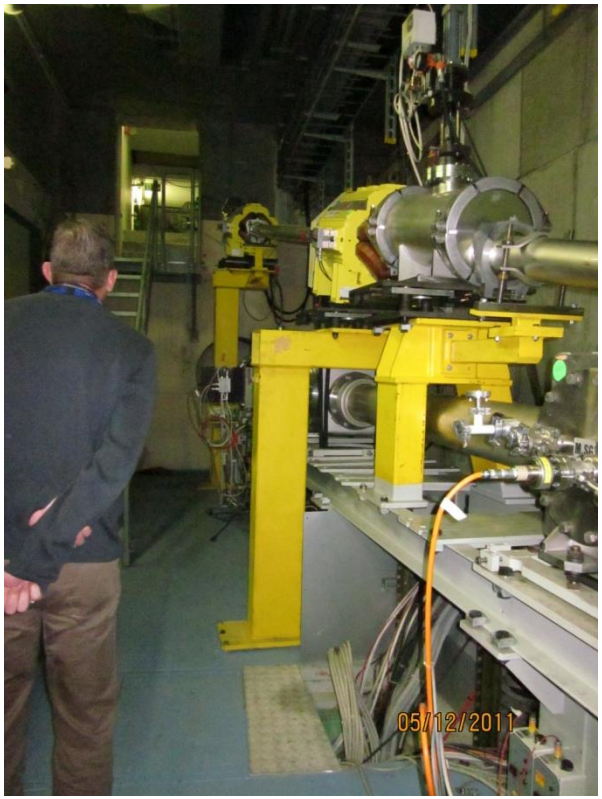
d = 807 mm

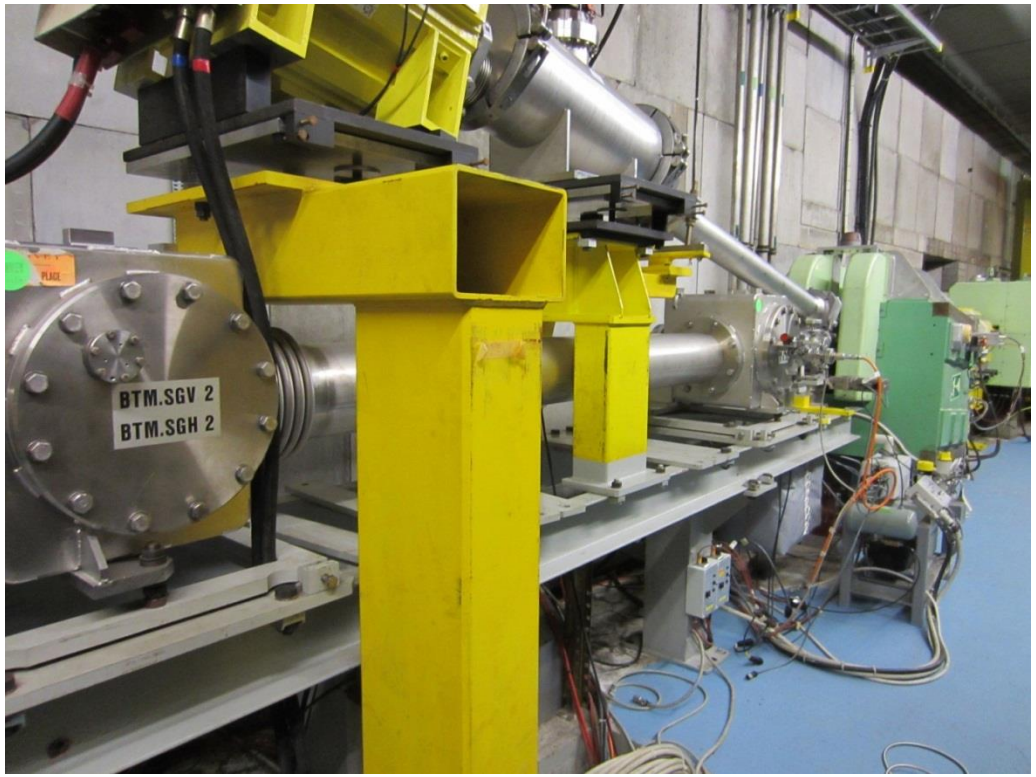
floor

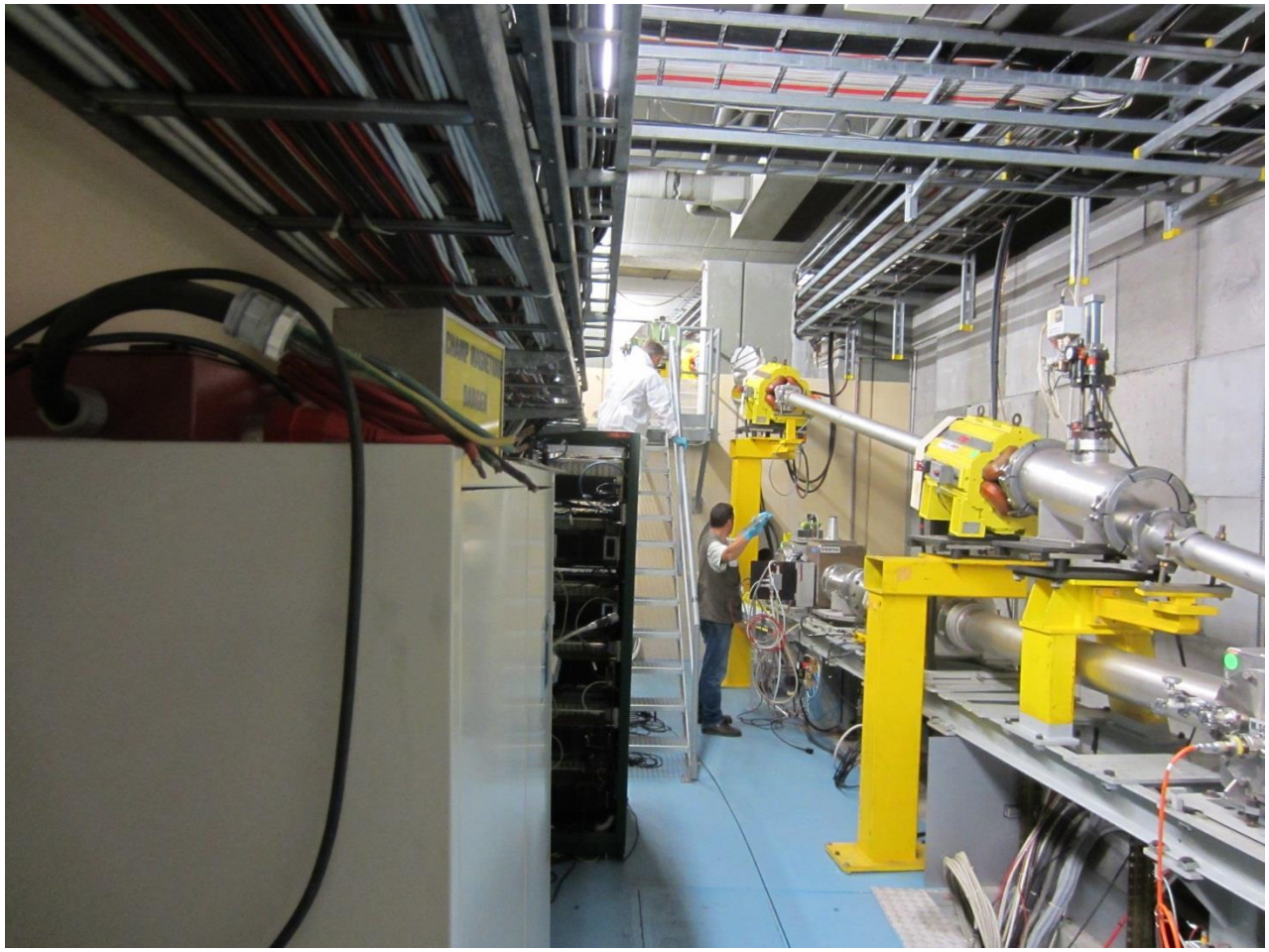
GIRDER vs RAIL INSIDE CAVITY

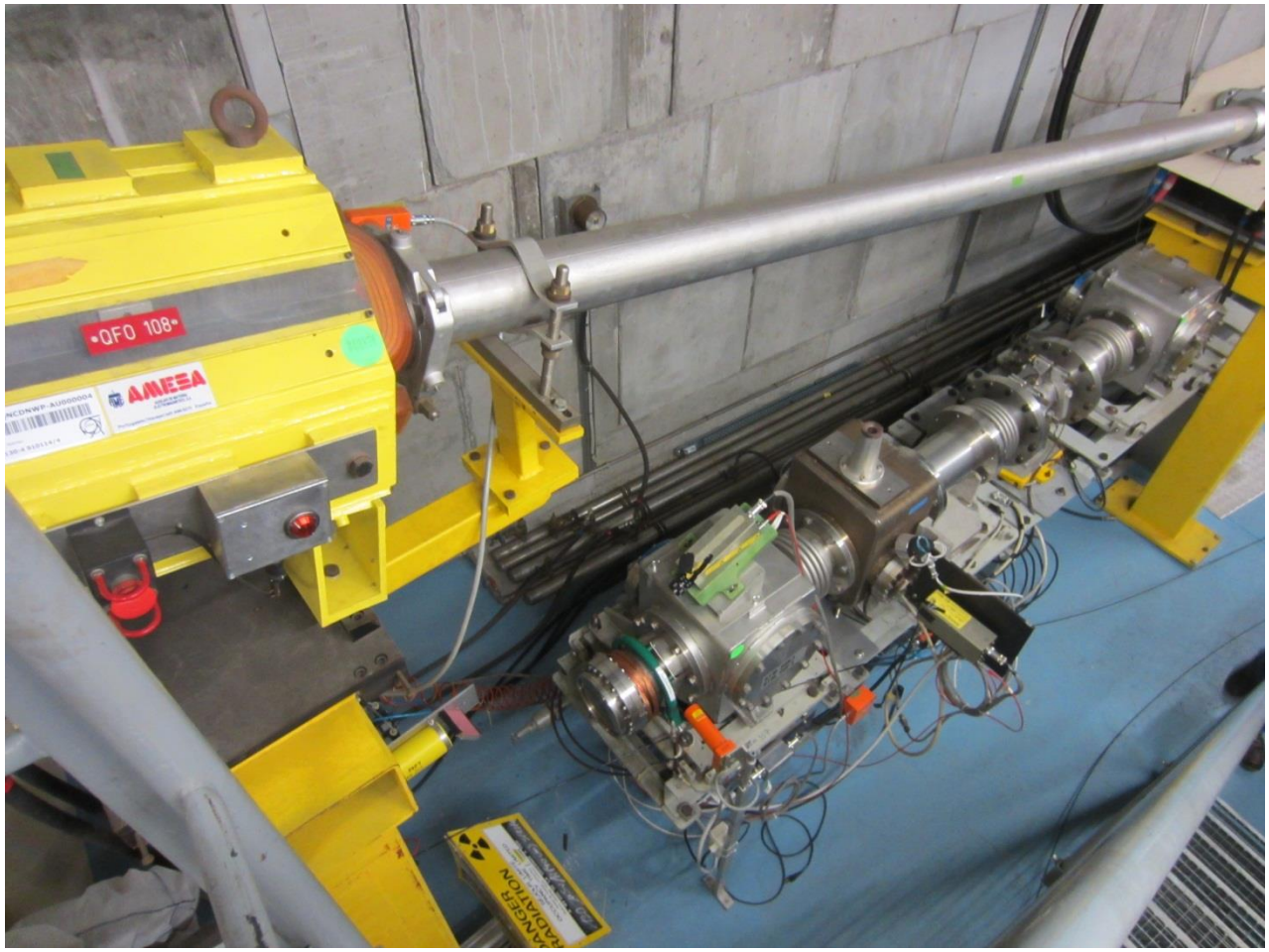


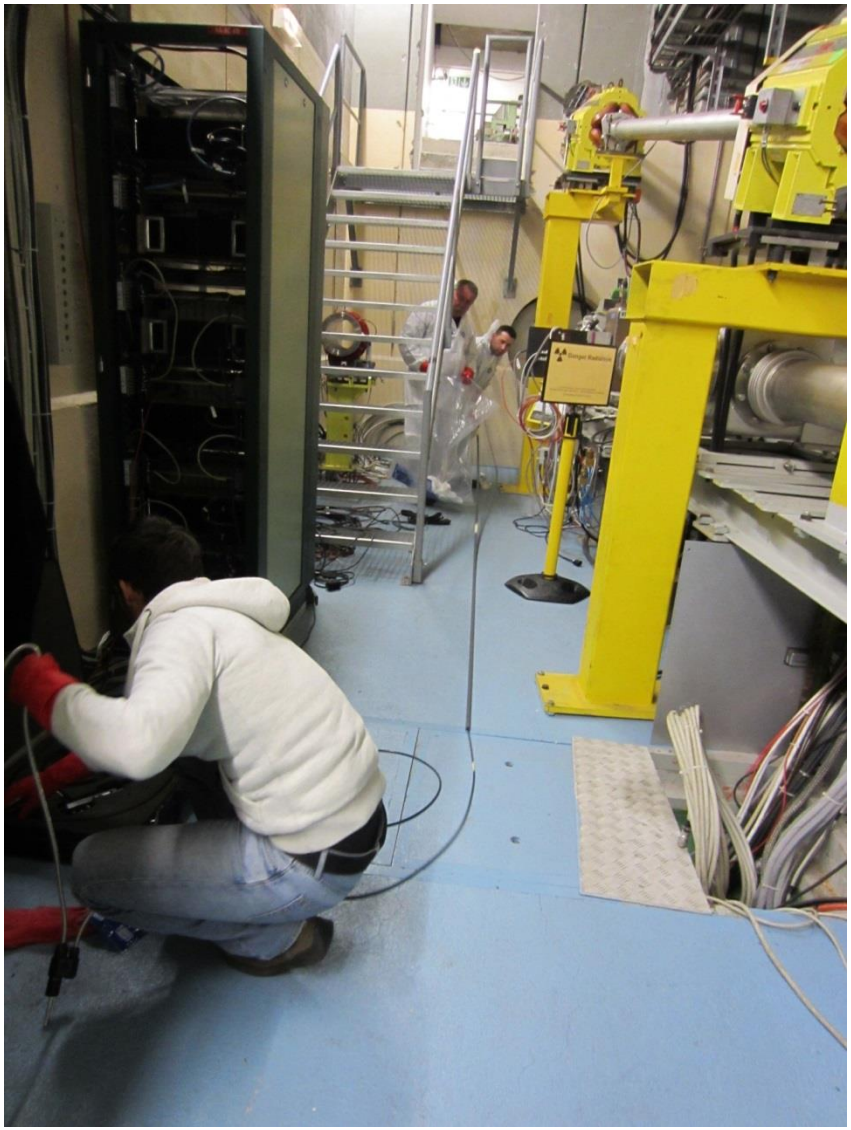



05/12/2011


BTM.SGV 2
BTM.SGH 2



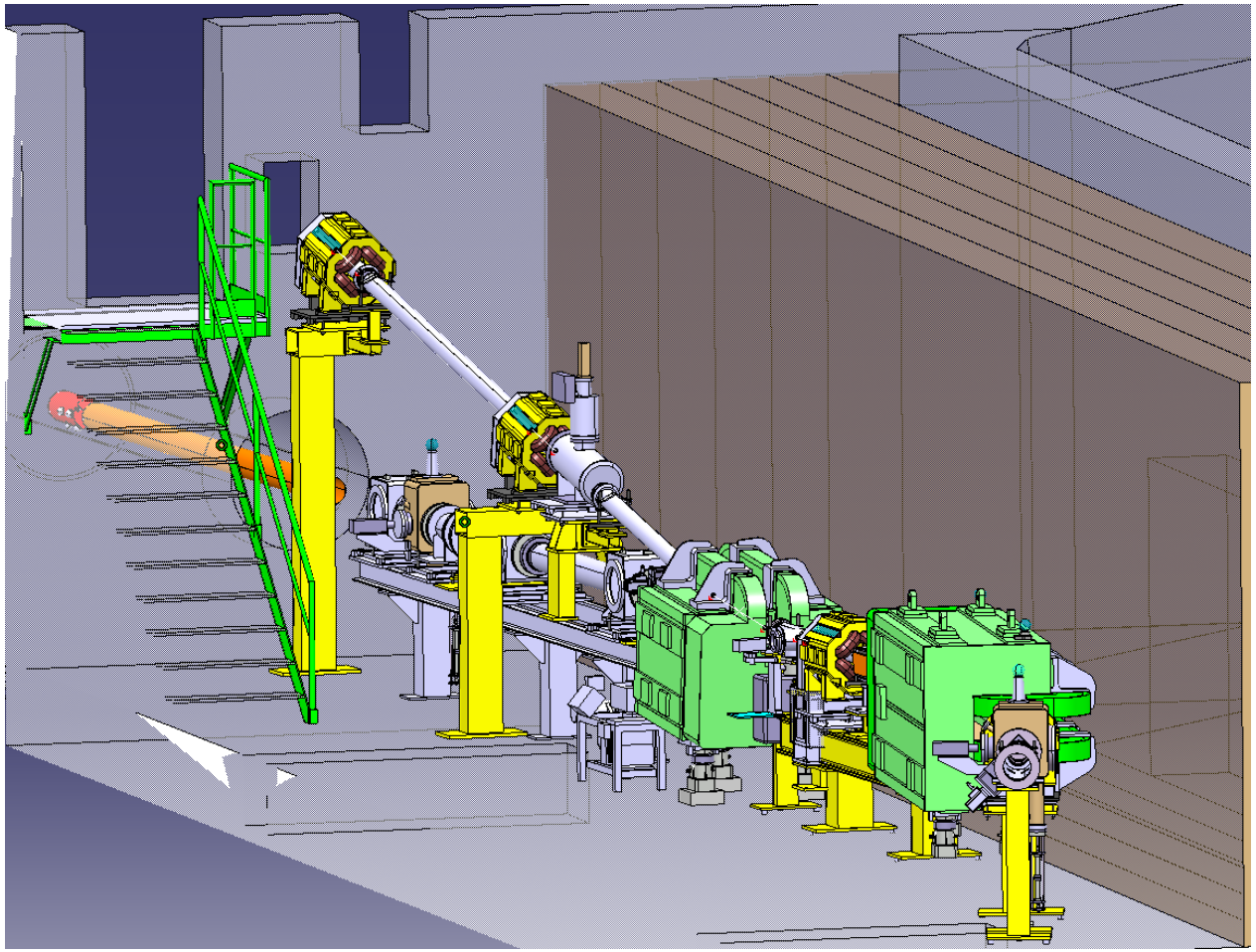

•QFO 108•
ANESA




Danger Radiation


BTM.MTV20

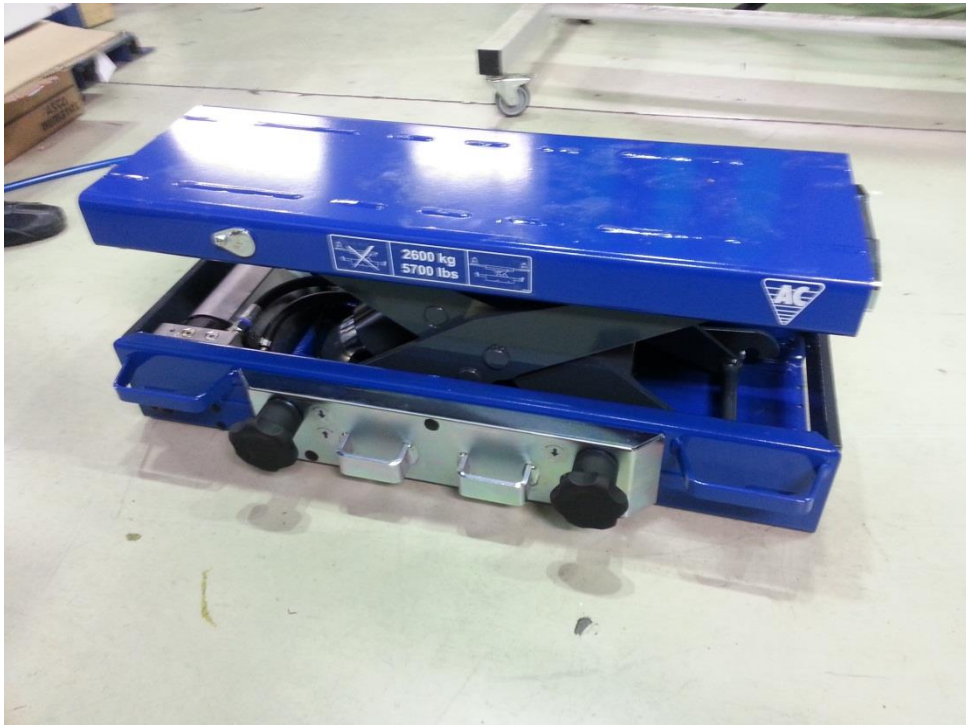

BTM.MTV20
15/12/2011



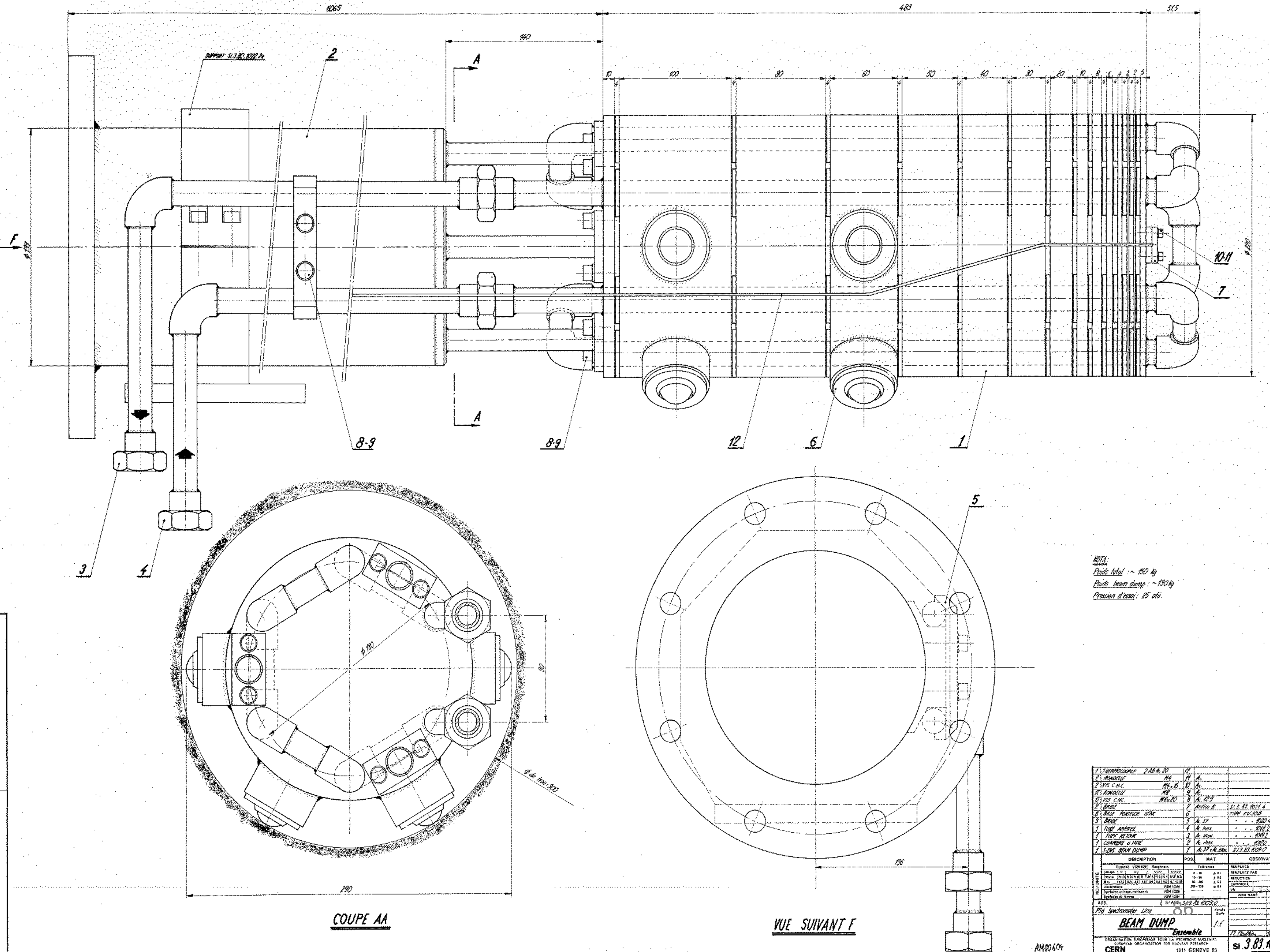
RADIOACTIVE WASTE ESTIMATED

- DUMP CORE + BEAM PIPE + 'PLUG AGAINST RADIATION'
  - Weight: ~190 kg (~130 kg dump + ~25 kg pipe + ~35 kg plug)
  - Container:
    - Frame made of steel, walls made of lead.
    - weight: ~2 t
    - Size: 1300 x 1000 x 350 mm
    - 5 cm lead for dump, 2.5 cm steel for pipe
  - Total weight: ~ 2.2 t
- CONCRETE BLOCKS (X5)
  - Weight: 1850 kg each block
  - 5 containers made of steel
  - Every block has different levels of activation, being the last one the most active one.

Lifting support



ENDOSCOPY



NO./UNITE	DESCRIPTION		POS.	MAT.	OBSERVAT
1	THERMOCOUPLE	2 AB Ac. 20	12		
2	RONDELLE	M4	11	Ac.	
2	VIS C.H.C.	M4 x 15	10	Ac.	
12	RONDELLE	M8	9	Ac.	
12	VIS C.H.C.	M8 x 20	8	Ac. 12.9	
2	BRIDE		7	Antico B	SI.3.83.1021.4
8	BASE PORTEUSE STAR		6		TYPE KV 30B
9	BRIDE		5	Ac. 37	" " " 1020.4
1	TUBE ARRIVEE		4	Ac. inox.	" " " 1018.2
1	TUBE RETOUR		3	Ac. inox.	" " " 1019.2
1	CHAMBRE à VIDE		2	Ac. inox.	" " " 1017.0
1	S.ENS. BEAM DUMP		1	Ac. 37 + Ac. inox.	SI.3.83.1029.0

ASS. S/ASS. SI.3.83.1005.0

PSB Spectrometer Line

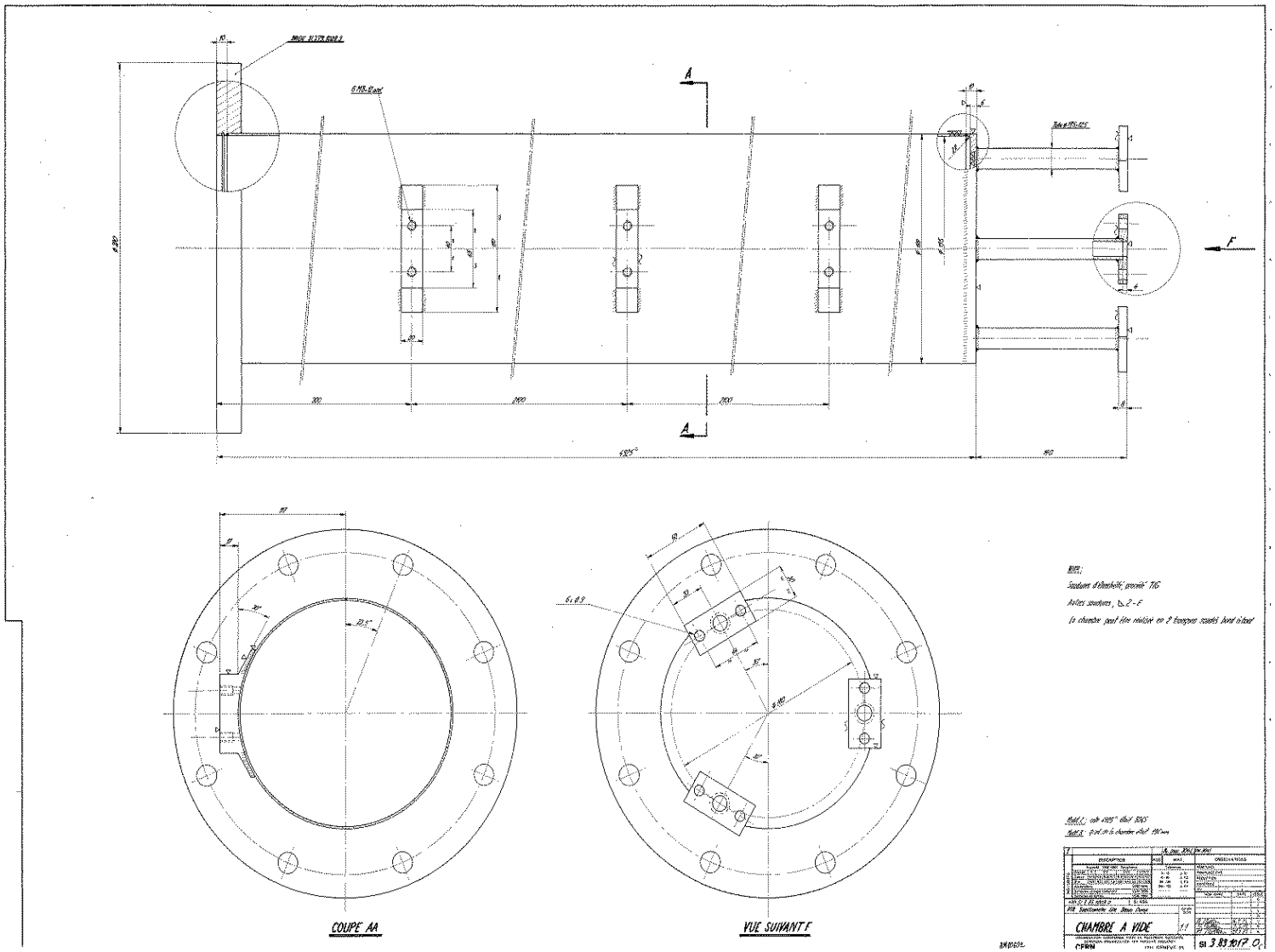
BEAM DUMP
Ensemble

Echelle Scale 1:1

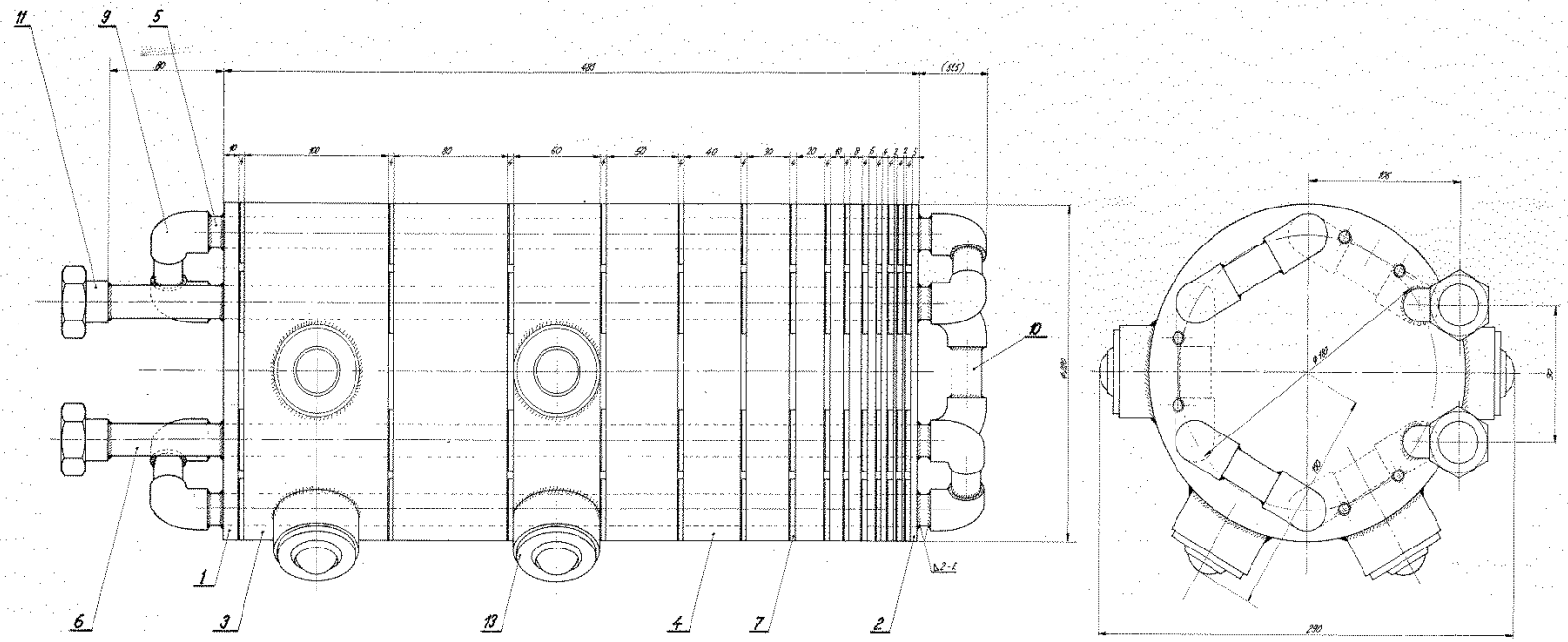
ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH
CERN 1211 GENEVE 23

SI. 3.83.1

Vacuum Pipe



Dump core



Note :
Tous les raccords de tuyauterie seront montés à sec et soudés ensuite pour assurer l'étanchéité

S-ENS. BEAM DUMP

CERN
1211 GENEVE 23

SI 3.83 1009.0

05/12/2011


15/12/2011


15/12/2011


05/12/2011

NEW INTEGRATION MODEL