Remote Handling of ILC Target

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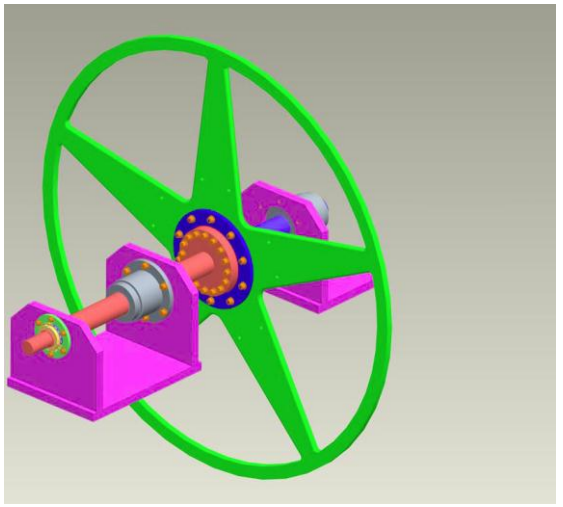
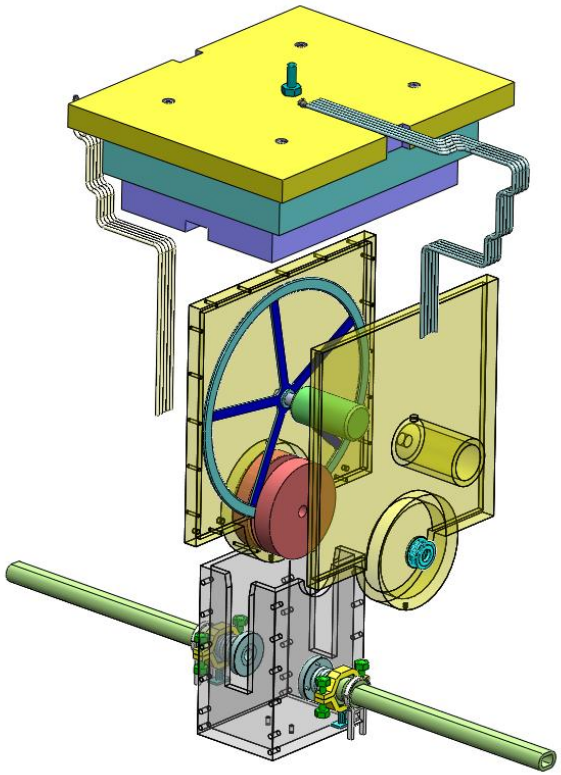
Target Wheel



Titanium Alloy

Rotates at 100m/s at rim

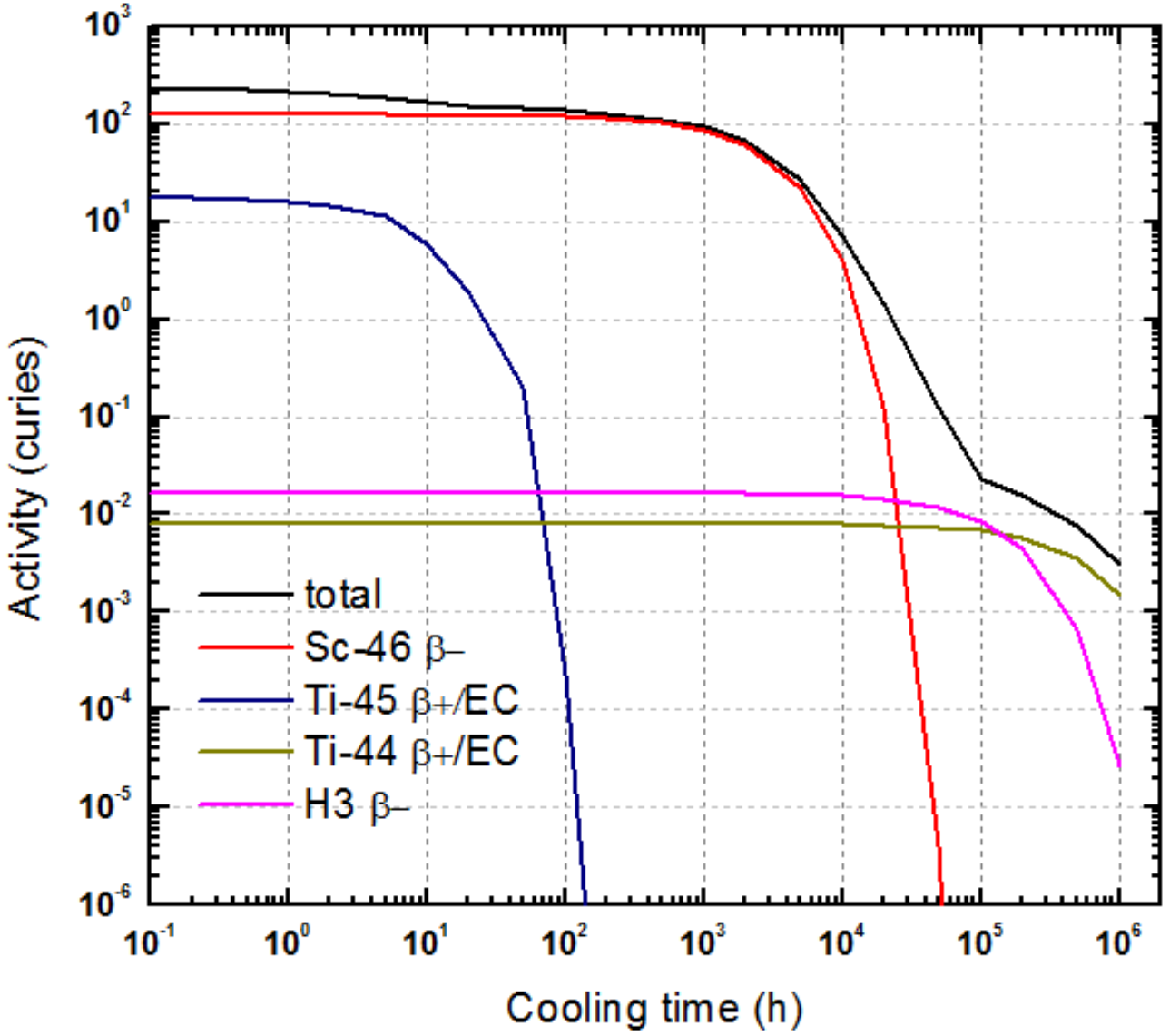
Cryo-cooler, cryostat and vacuum pump



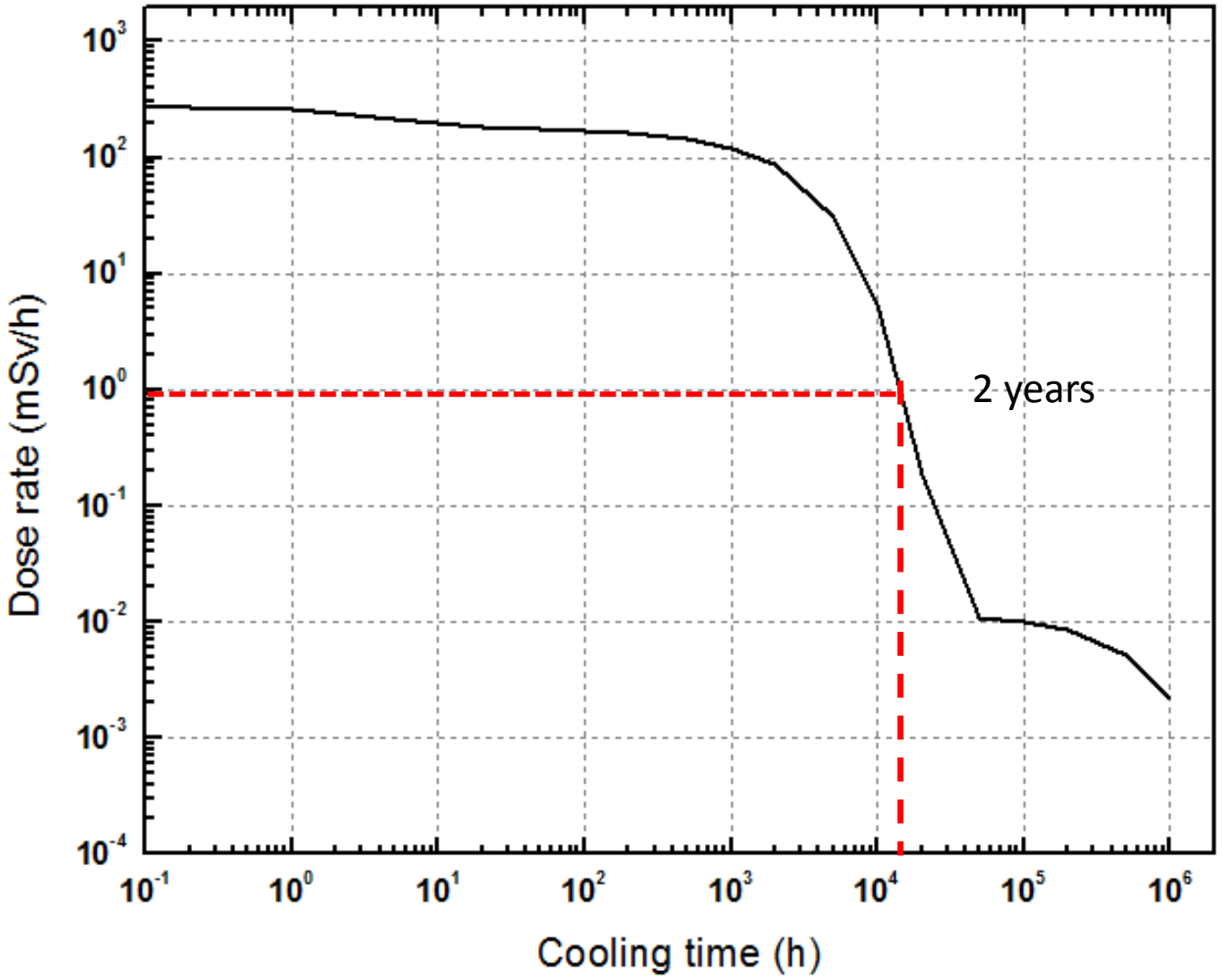
If can be immersed in strong magnetic field then capture more positrons

Strong Eddy current effects

Target Activity (150kW, 5000h)

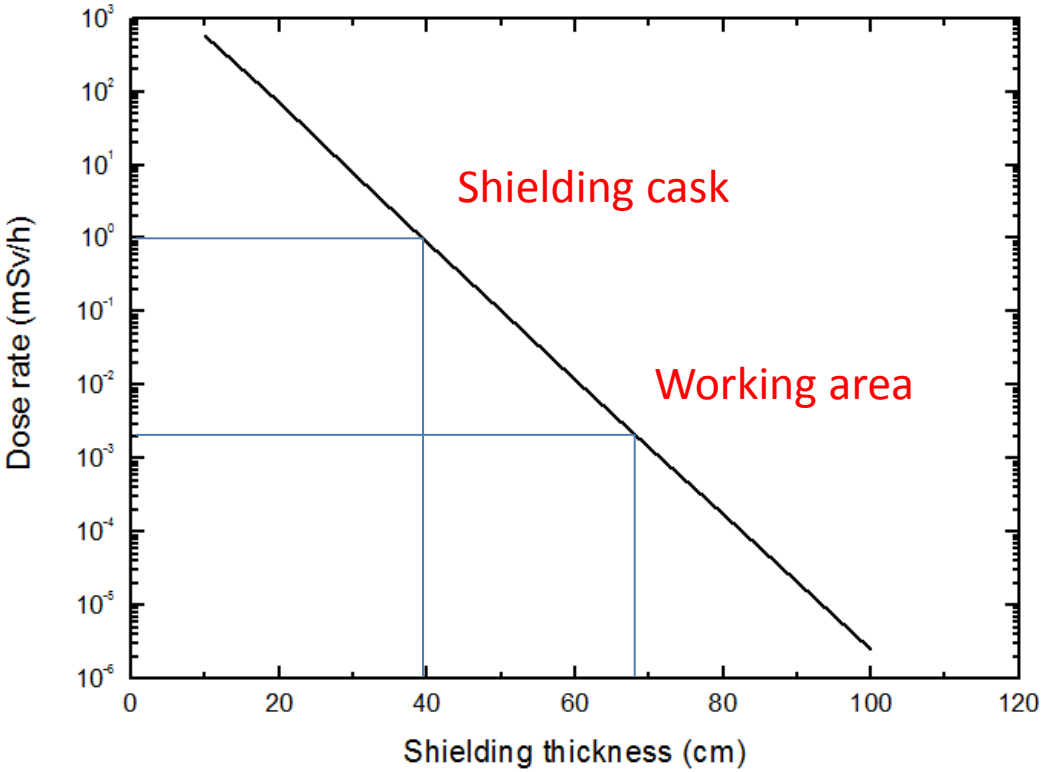


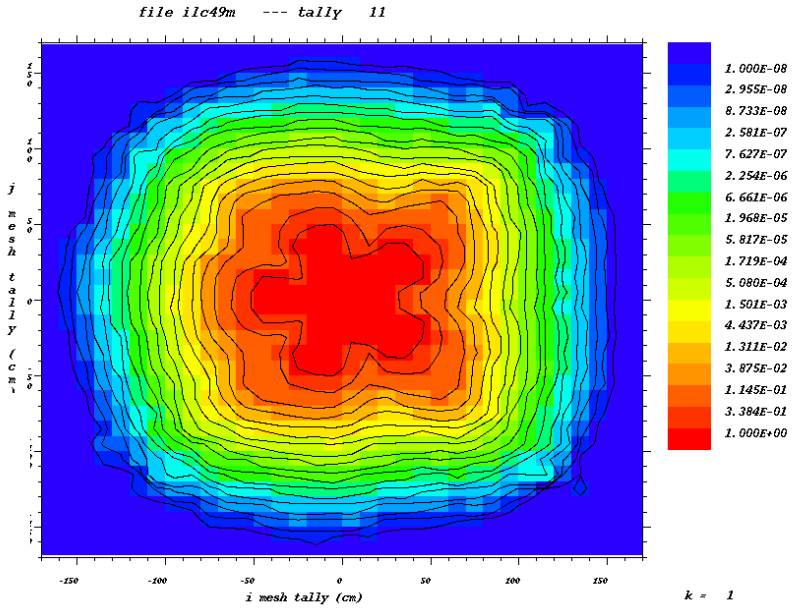
Dose rate of used Target (mSv/h@1m)

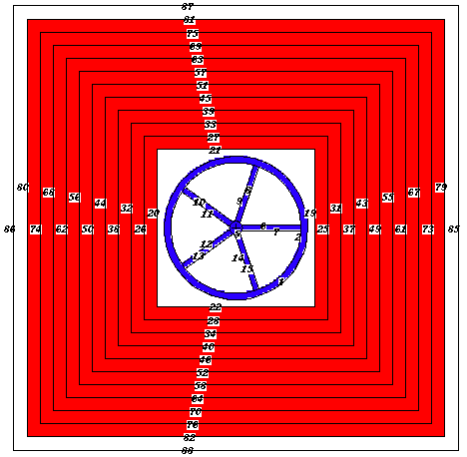


Shielding calculation

Codes and libraries
MCNPX2.5.0, CINDER90,
libraries:mcplib04, e103, endf60
Target: Ti-6%wtAl-4%wtV, density 4.5g/cc
Magnetite concrete: density 3.53 g/cc

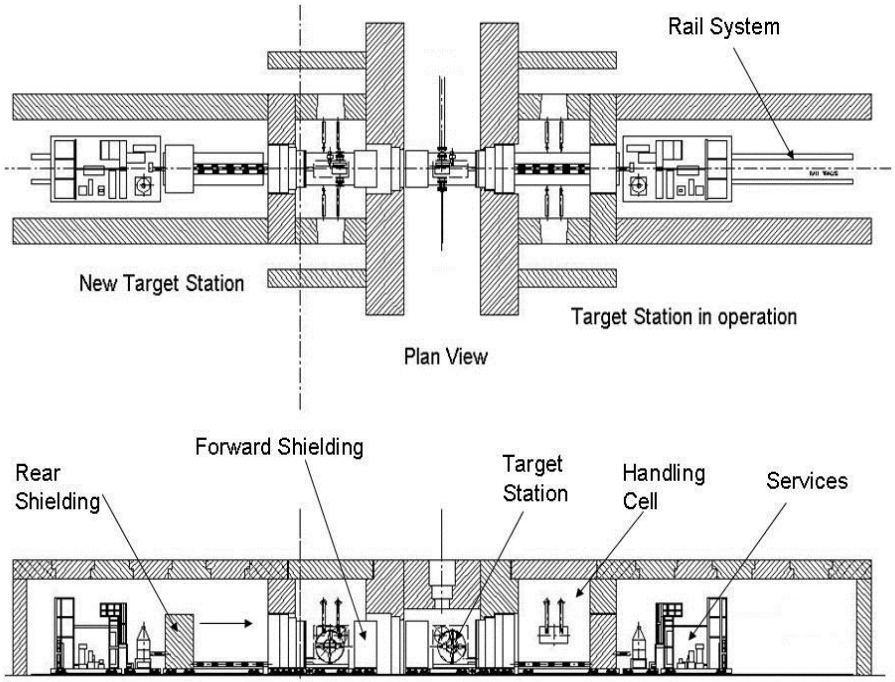


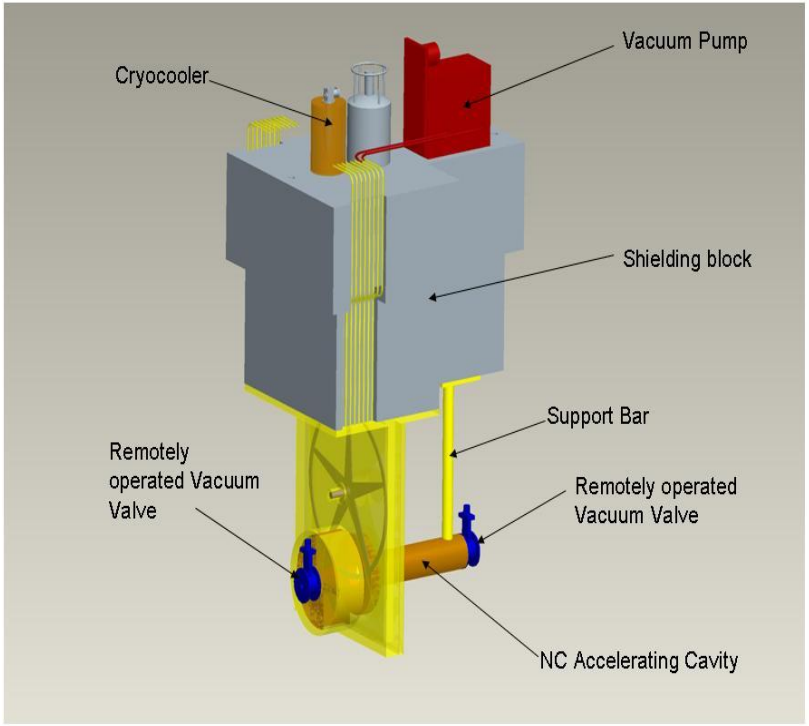




Remote handling concept

Horizontal or vertical?





Horizontal

ISIS target concept

Hot-cell Very Expensive

Complicated hydraulics, interlock systems

Long period requirement

Difficult to engineer

vertical

Whole plug replacement

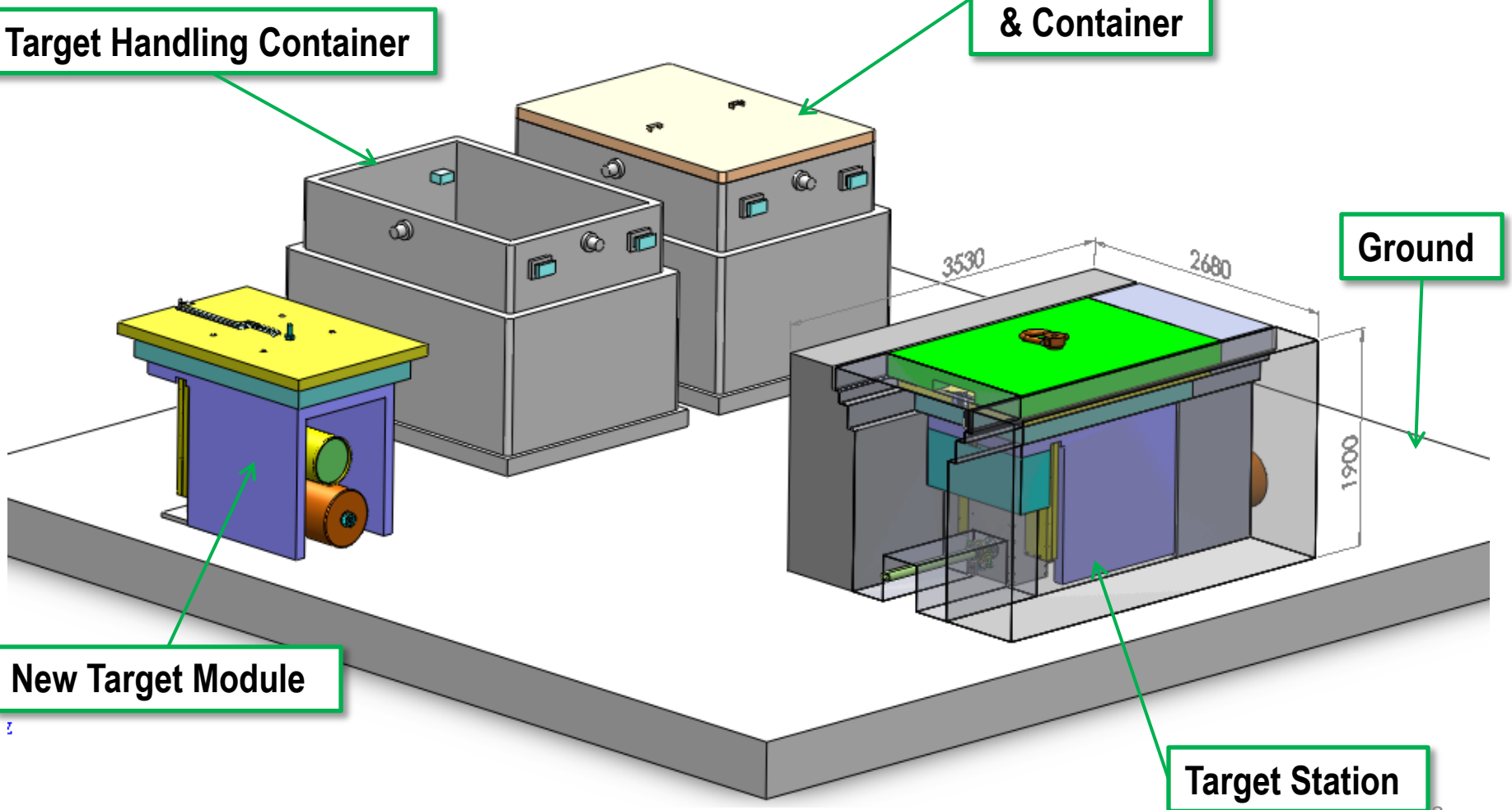
Not hot-cell, but plug storage pit (or area)

Short period requirement

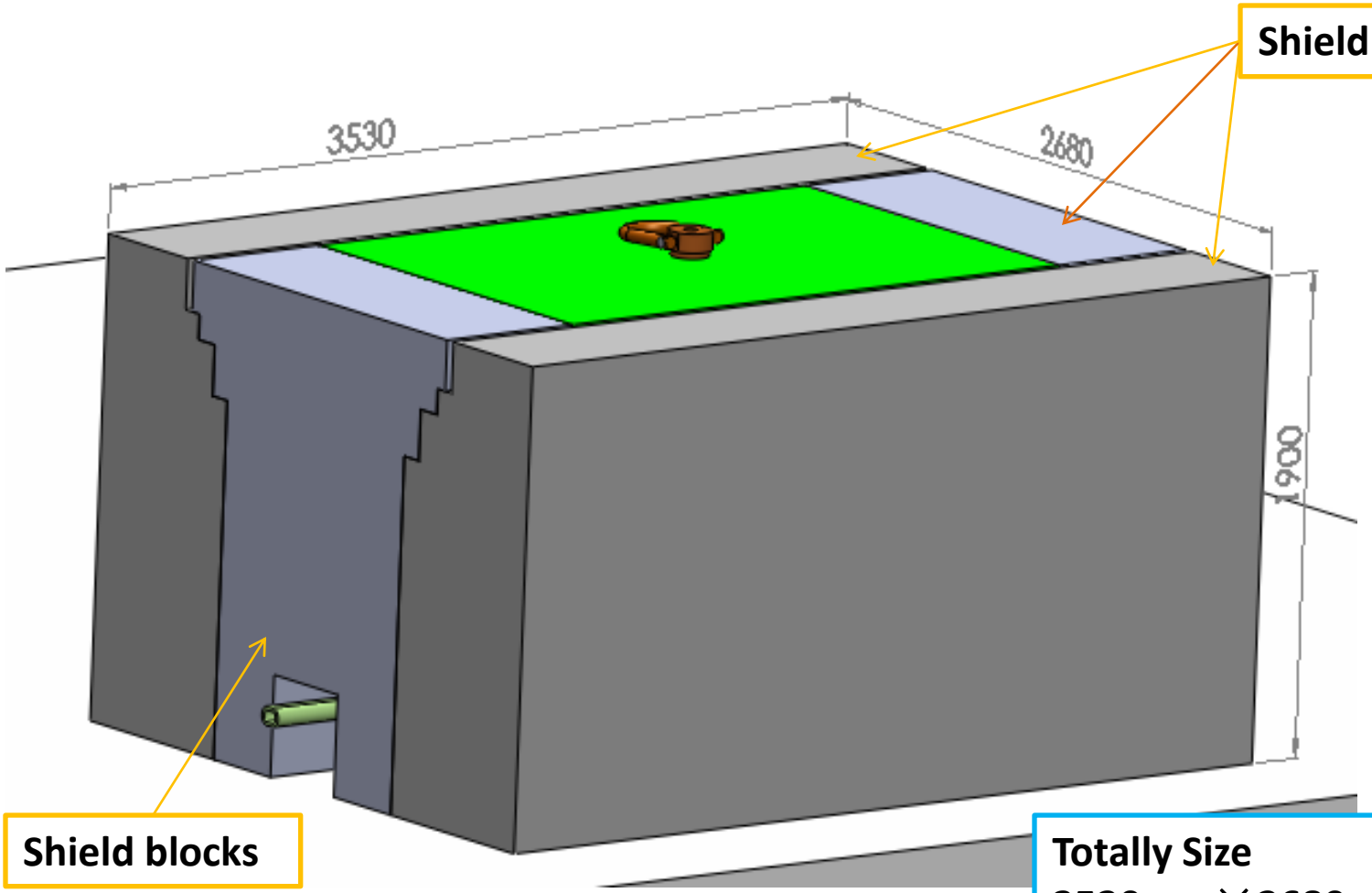
Less shielding, less tunnelling

All connections hands-on

1. General Layout



2. Components of the Target Station Assembly



Totally Size
3530mm × 2680mm × 1900mm

Size of the Target Station

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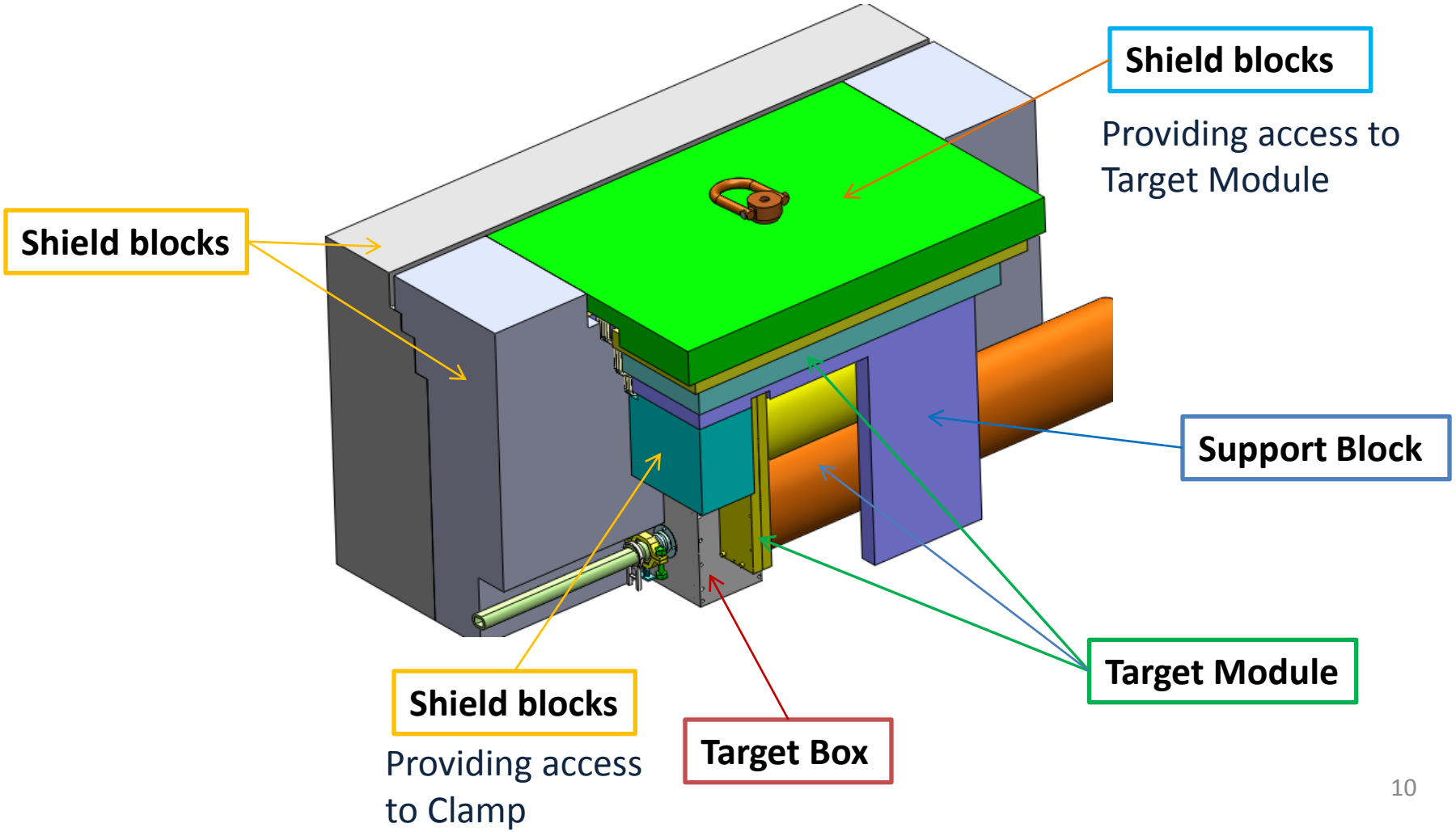

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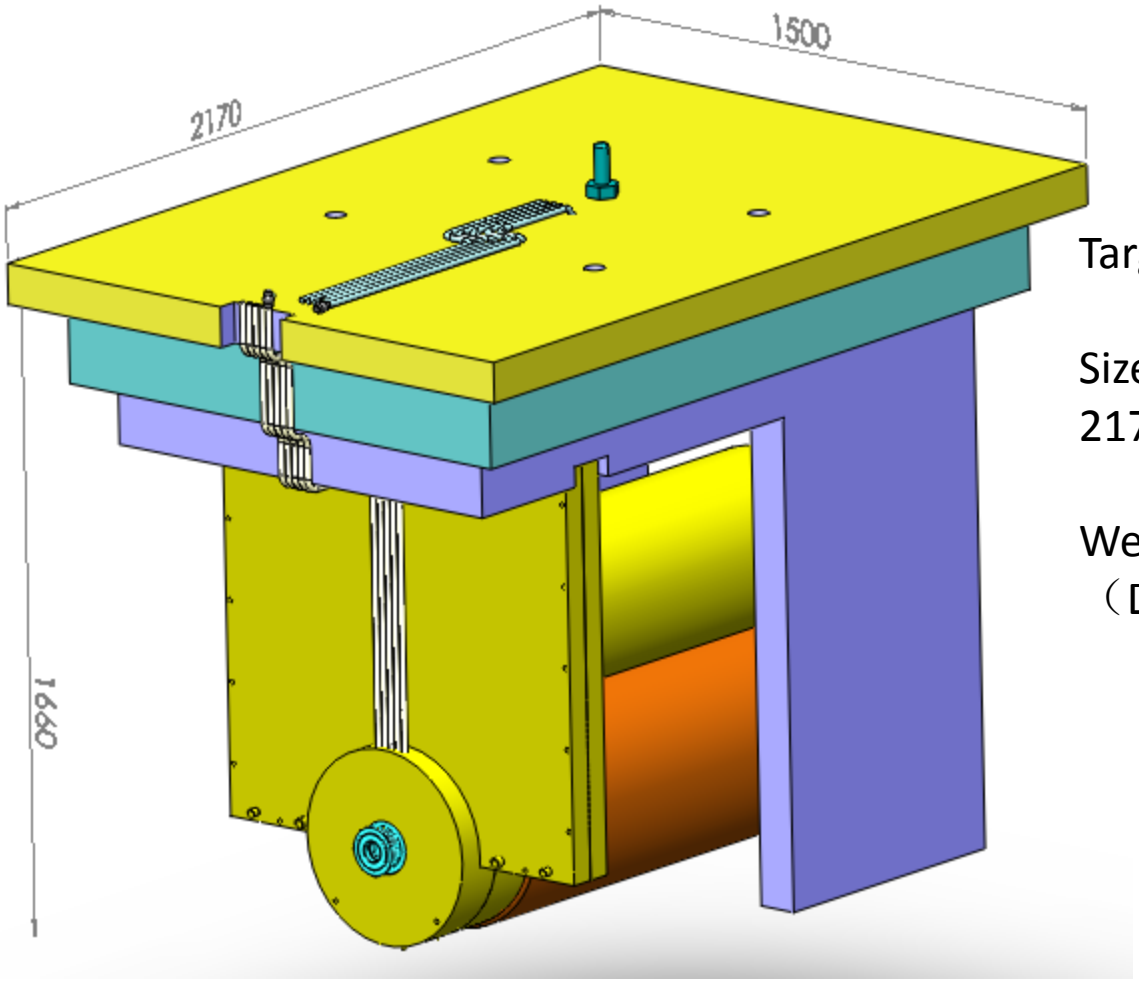

Target Module

Size:
2170mm×1500mm×1660mm

Weight: 12943 Kg
（Density choose $7.9\times10^{3}Kg/m^{3}$）

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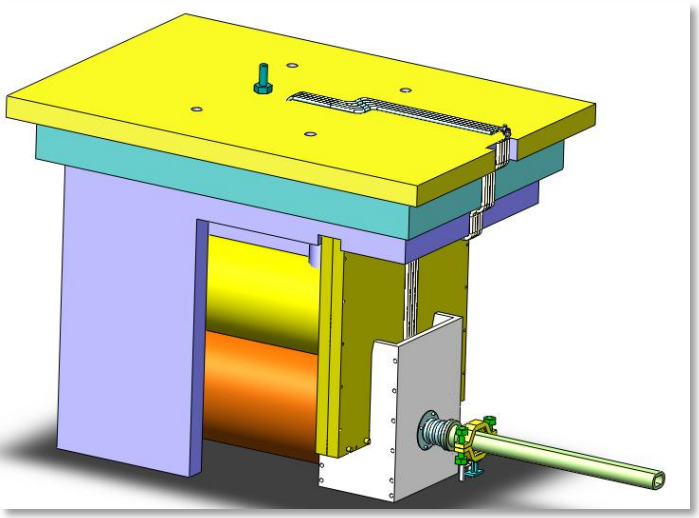

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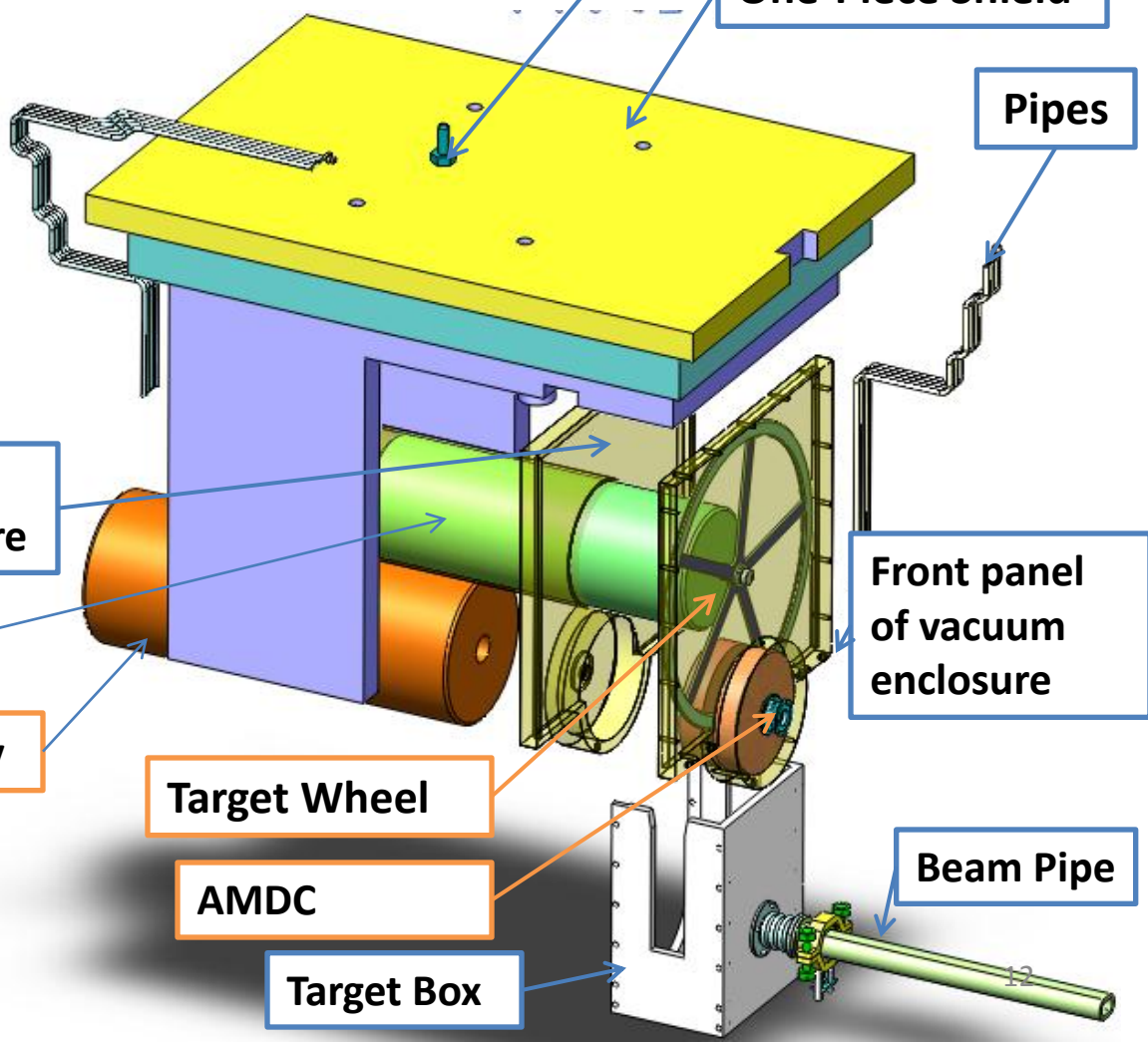

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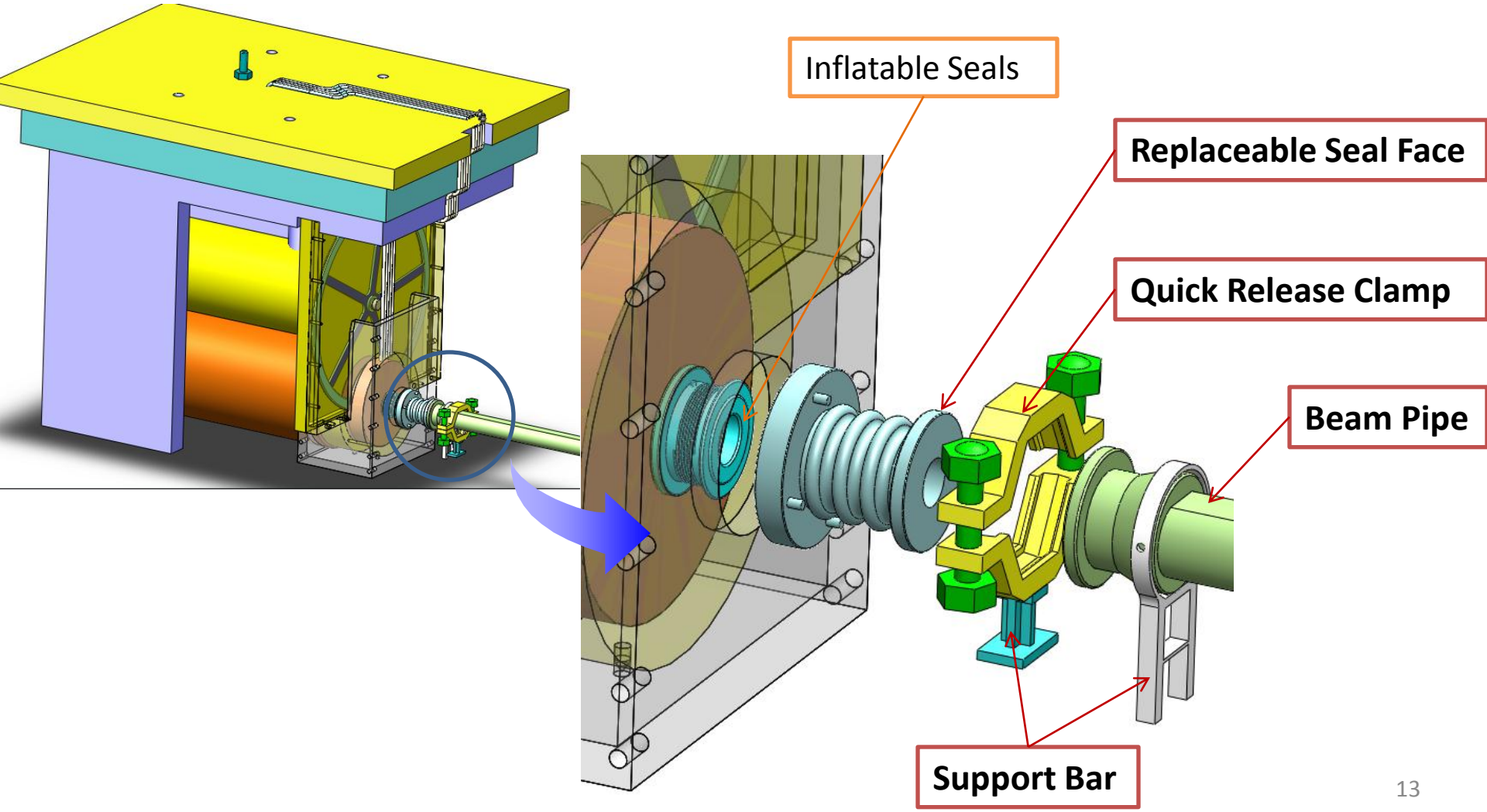
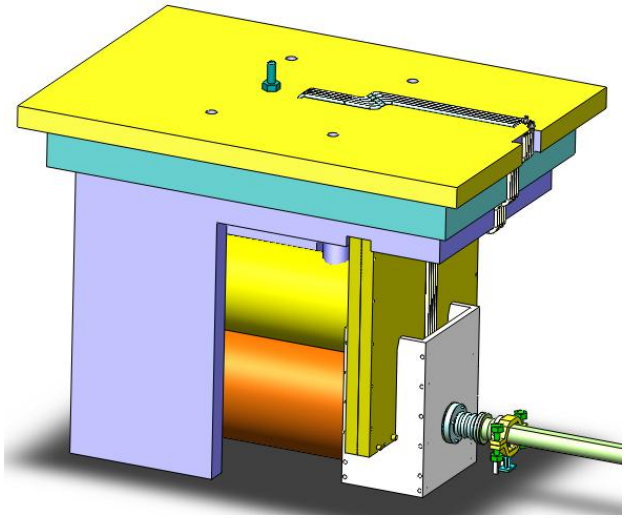
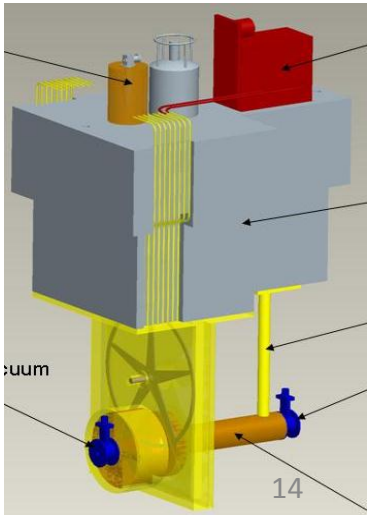


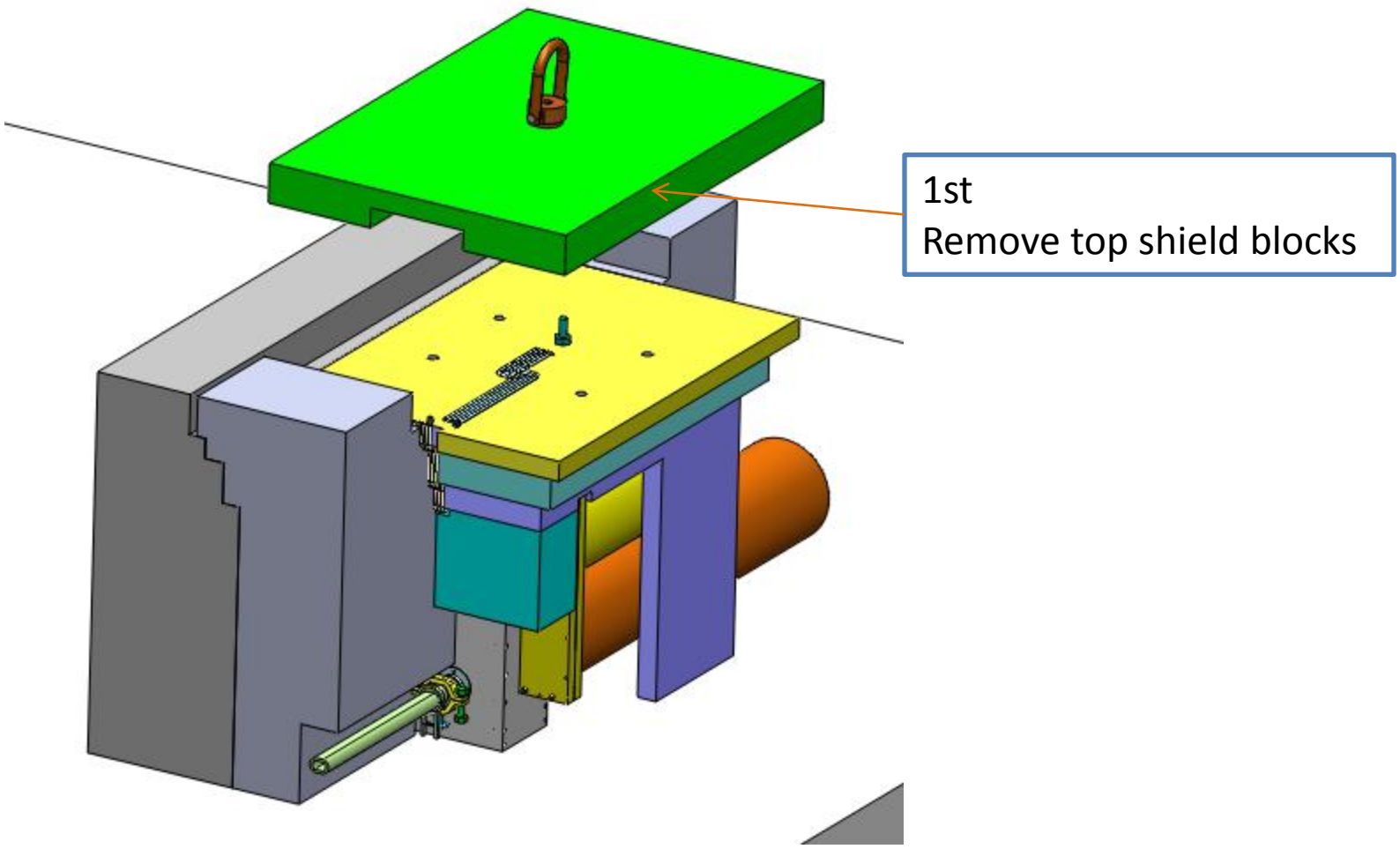
Differences between the new Target Station Assembly and the former

- Rearrange the service pipes and equipments.
- Add a target box to help the location and fixed of the target.
- Apply the replaceable seal face and quick release clamp to instead of the remotely operated vacuum valve, which reduce the pipes and simplify the target module structure.





3. Replacement of Target Module



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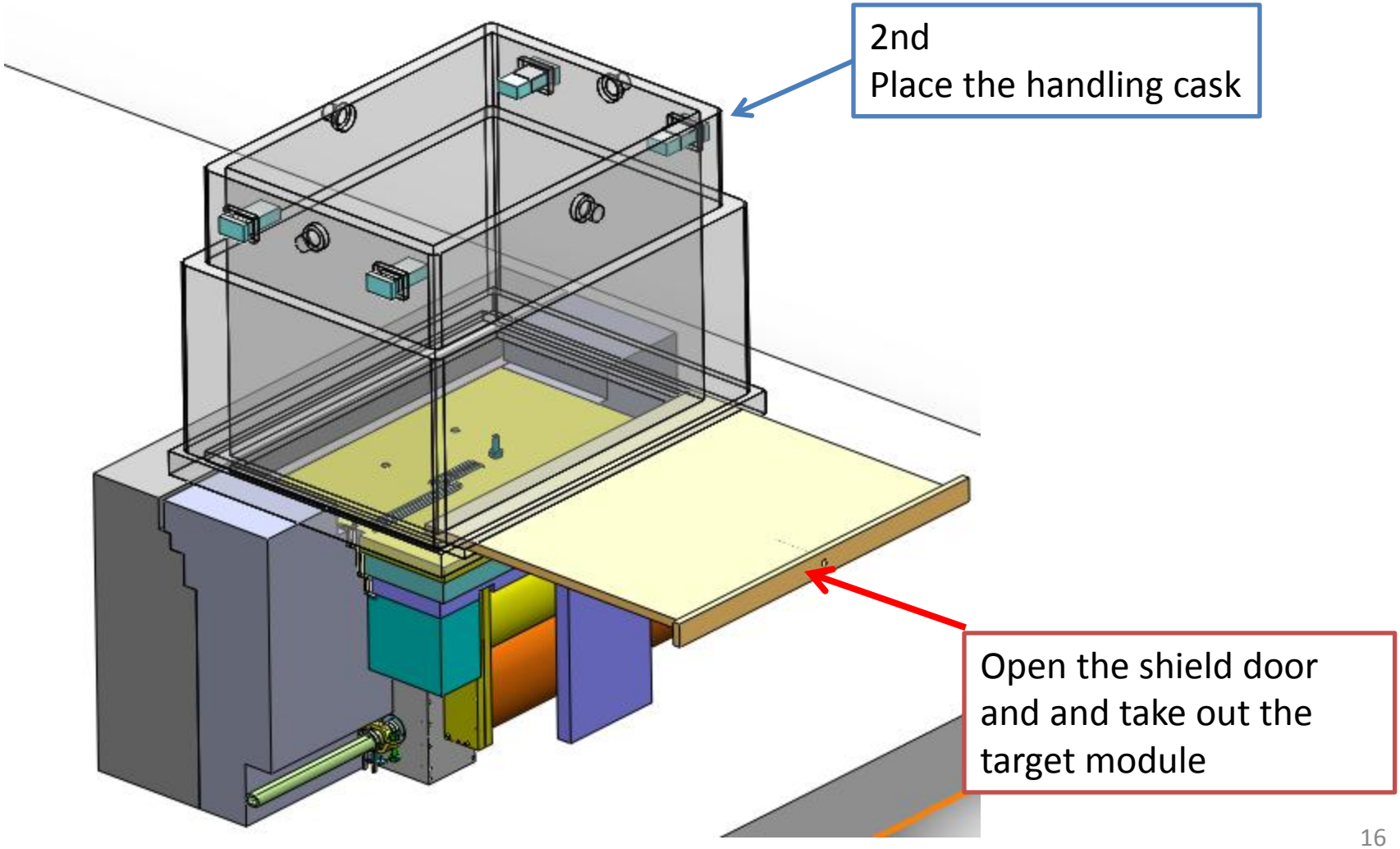

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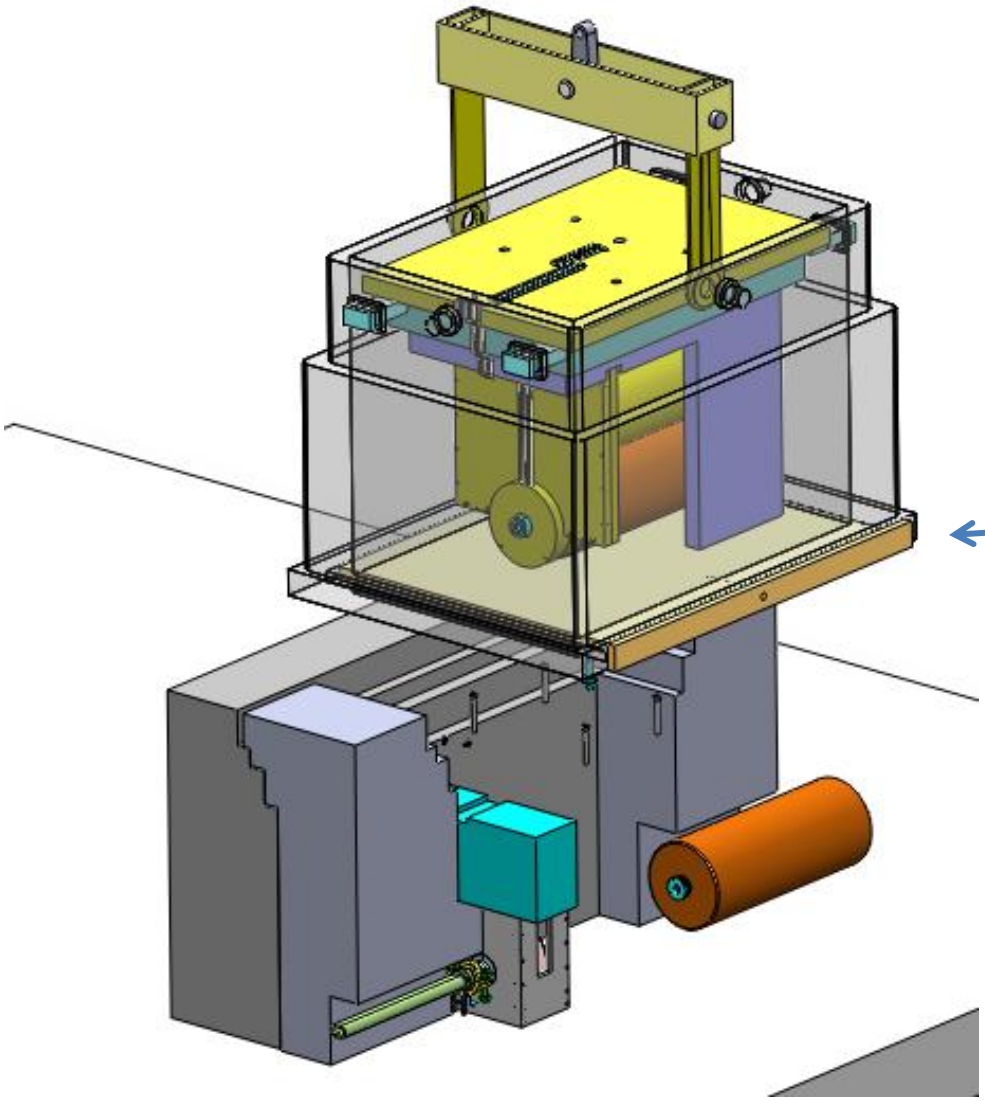
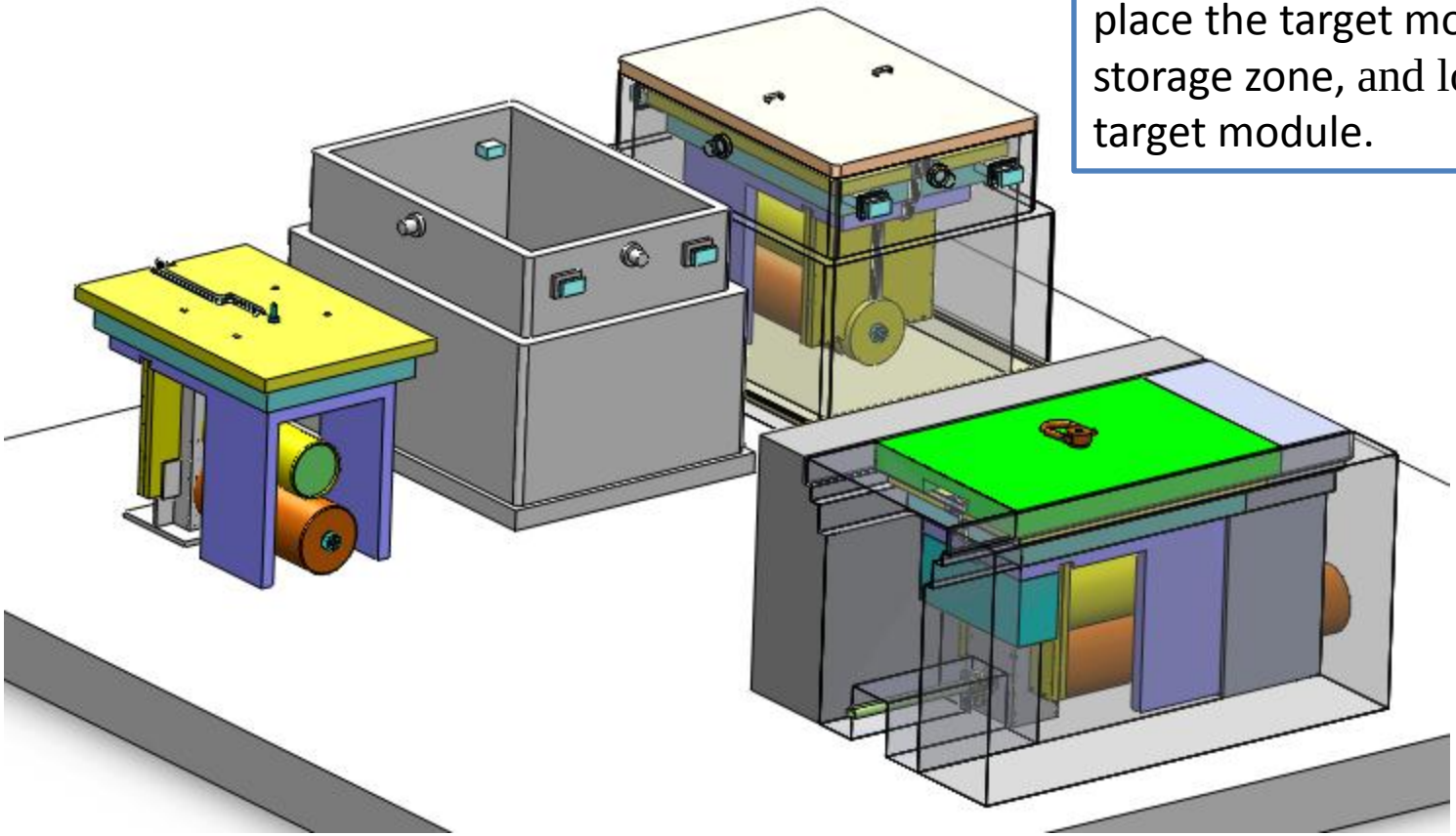
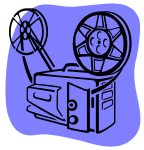


3nd
Close the shield door and place the target module to storage zone.

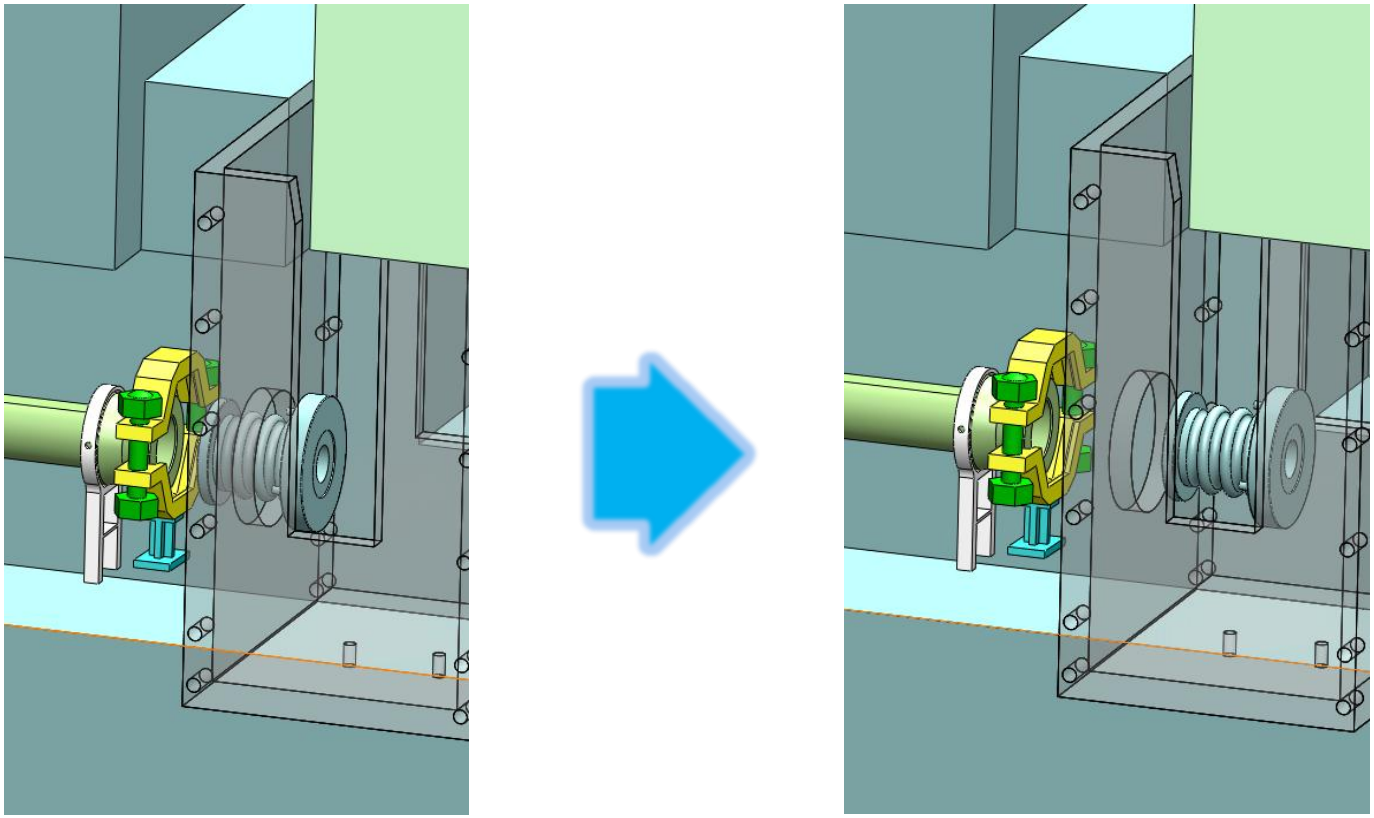
3. Replacement of Target Module



3rd
place the target module to storage zone, and load a new target module.



4. Removal of Replaceable Seal Face (If got weard)



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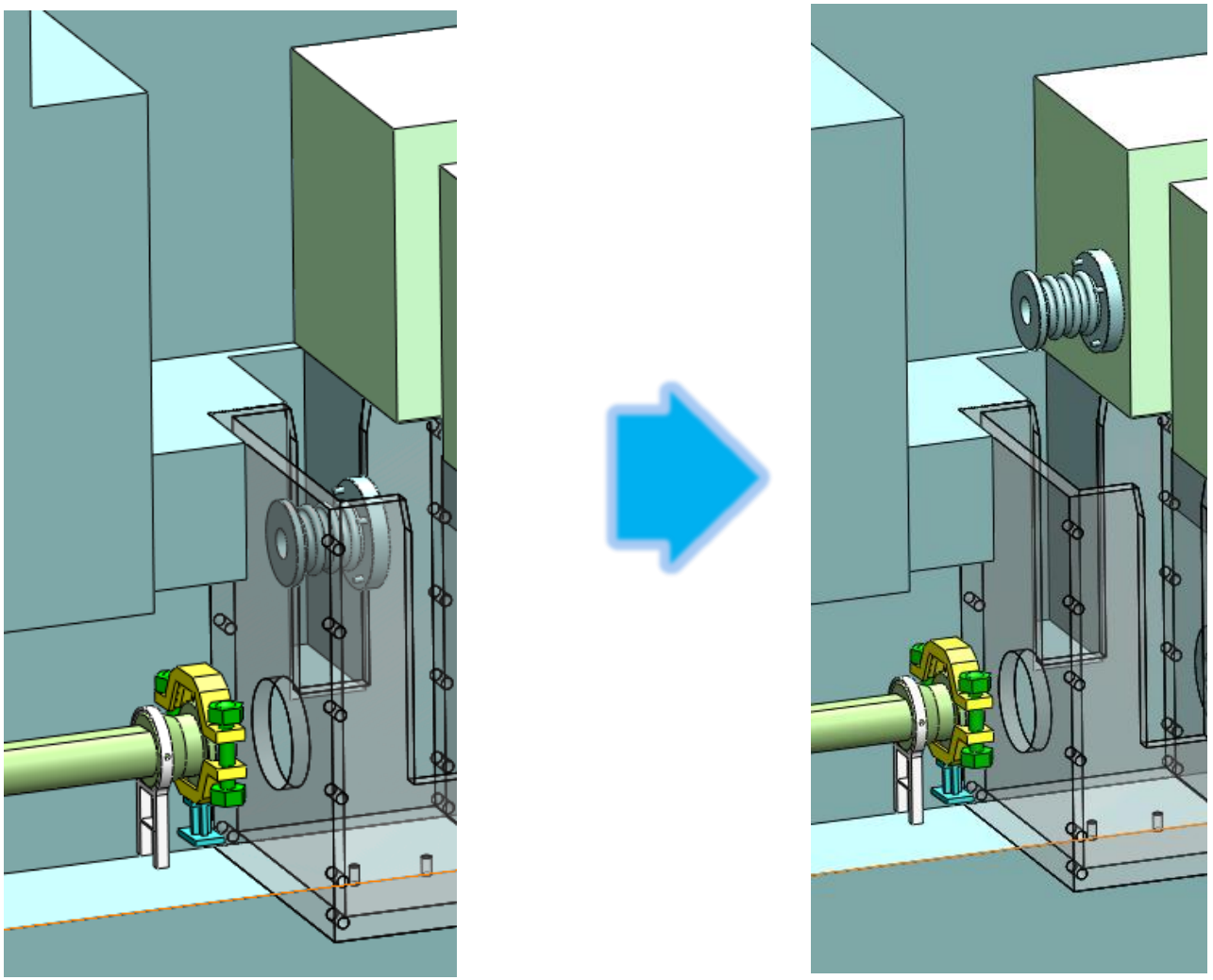
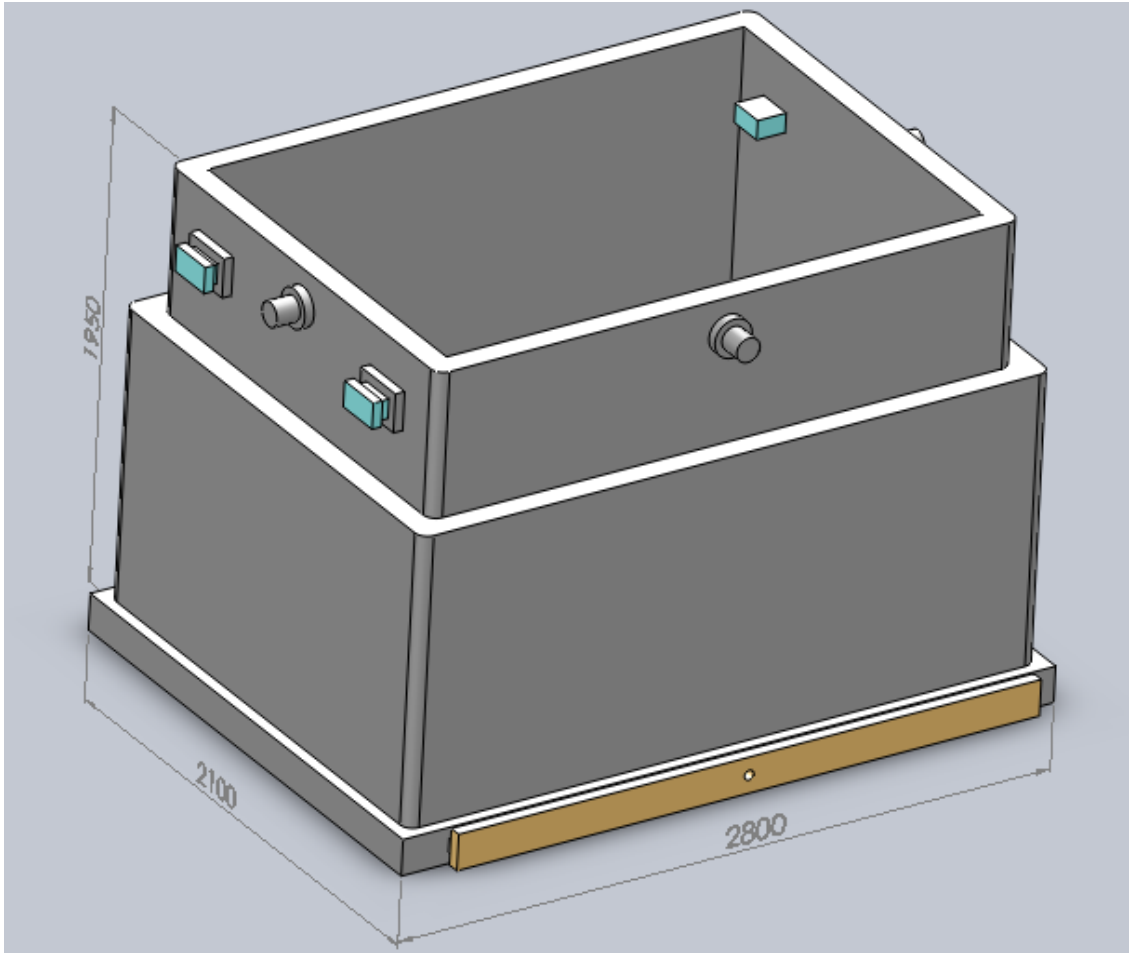


5. Important parameters of remote handling



Size:
2800mm × 2100mm × 1950mm

Weight: 34305 Kg
（Density choose $11.3 \times 10^3 Kg/m^3$）

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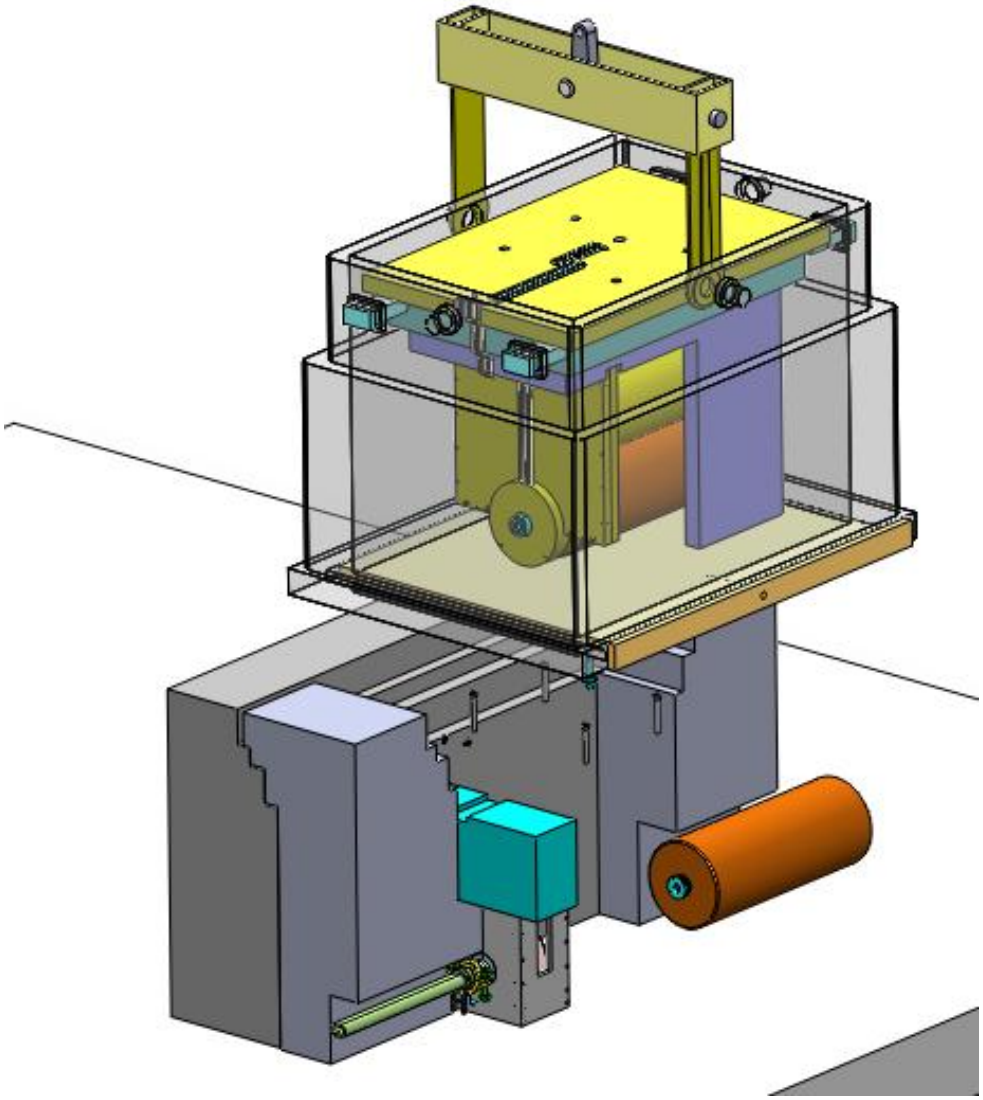


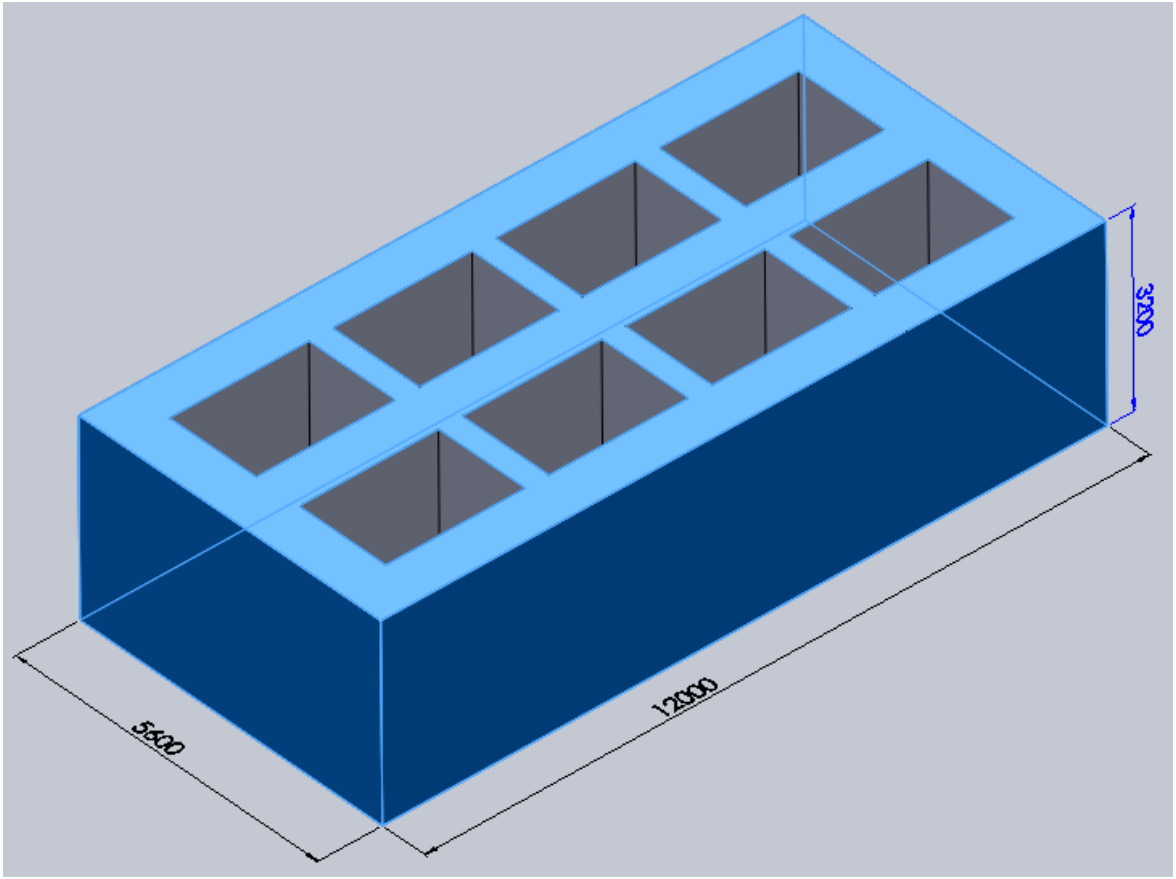
1. The minimum lift weight (Target Mould + Handling Cask) 47248KG

2. The remote handling height above 6000mm

3. The waste Target Moulds need to place into shielding casks or special waste room with shielding (above 800mm thickness concrete)

Suggestion:
If the Motor and Accelerating Cavity can separate with the target module, the tool will become much smaller.

5. Important parameters of remote handling



Waste room(For example)

Size:
12000mm×5600mm×2500mm

Store 8 waste target.

5.Target Remote Handling Scenario

Step	Operation	Time - hrs
Remove		
1.	Switch off and isolate electric power to magnets (overhead cable system)	3
2.	Switch off and isolate power to Target Wheel motor	
3.	Stop Target Wheel coolant pump	1
4.	Remove/disconnect water supply	
5.	Close actuated vac valves on beam line each side of target station.	2
6.	Close actuated vac valve on AMD side of target station	
7.	Close actuated vac valve on NC Accelerating Cavity side of target station.	
8.	De-pressurise both inflatable seal units and close vac valve on top of target mould	1
9.	Attach lifting rods	2
10.	Attach lifting beam	
11.	Blow out top shield block	0.5
12.	Lift target station complete with shield container and vac valve closed.	2
13.	Place into parking enclosure	
14.	Disconnect from crane	1

5.Target Remote Handling Scenario

Replacement		
15.	Connect lifting rods and beam to new unit with vac valve closed (already under vacuum)	4
16.	Lower into position – locate	
17.	Replace/reconnect water and gas pipes	2
18.	Pressurise and activate both inflatable seal units	
19	Open actuated vac valve on NC Accelerating cavity side of target station	3
20.	Open actuated vac valve on AMD side of target station	
21.	Test target station vacuum for leaks	
22.	Open actuated vac valves on beam line each side of target station	
23.	Reconnect power to target wheel motor	2
24.	Test wheel motor. Test water flow through target wheel	
25.	Connect electric power supply to magnets	4
26.	Replacement the top shield block	0.5
	TOTAL	28

Estimated cost

- Pillow seal: 2X150k
- Supporting structure, alignment : 300k
- Replaceable seal : 2X 80k
- Zip-lift, Remote handling tools: 300k
- Transfer cask and supporting : 300k
- Utilities: 150k (?)
- Crane : 100k (20tons)
- Required storage area : ≈ 60 m^2

Many Thanks!