

T2K Target Remote Handling

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and TRIUMF: C Mark, C Fisher



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Target Station (Tada 21 April)

Damaged!! (; ° Д °) !
Not dealt yet Σ (; ° Д °) !!

- **Facilities**

Around the building
: caved in!

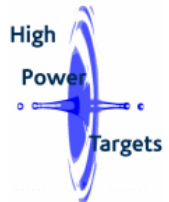
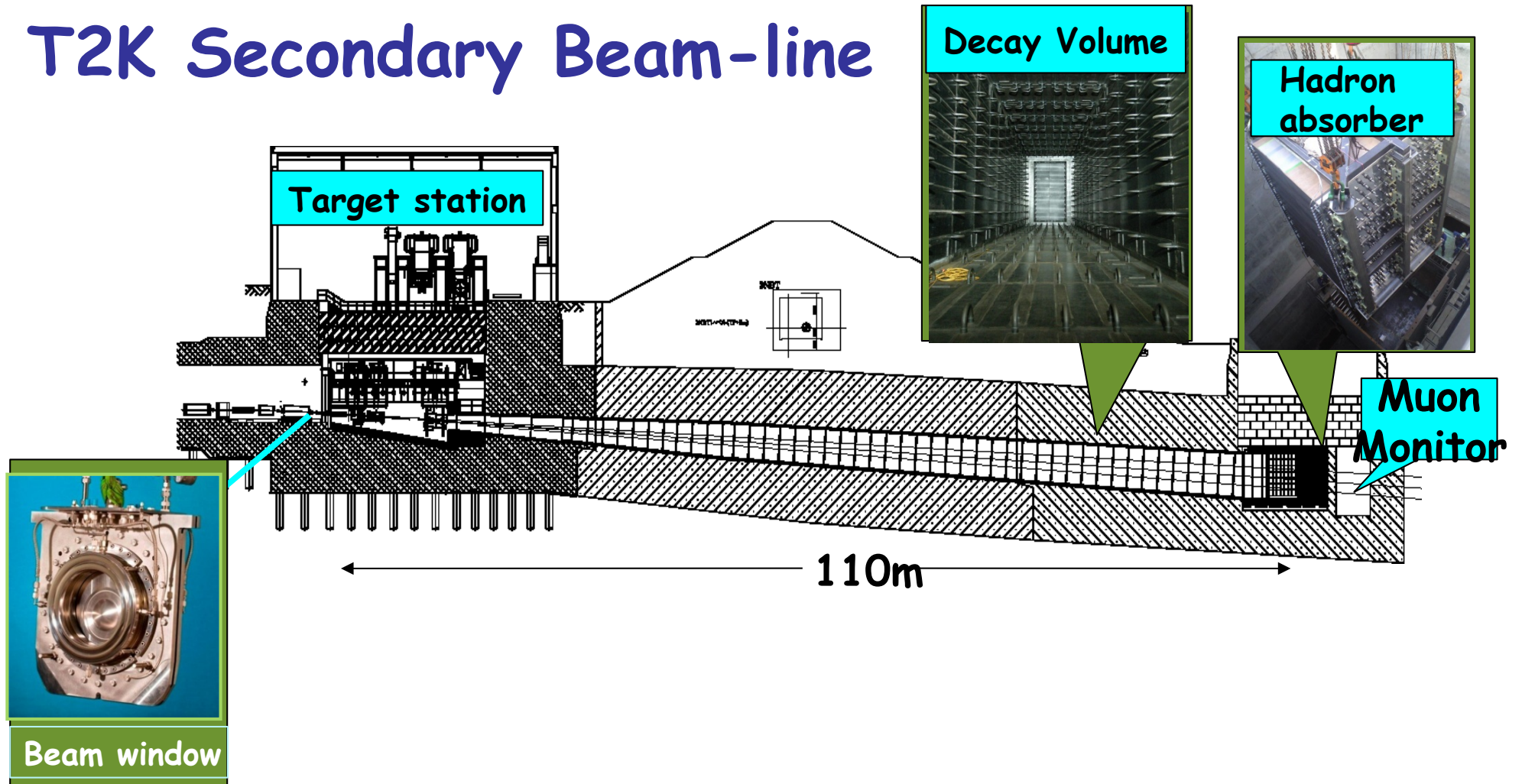


Unknown!!

- **Equipment**

Equipment inside of helium vessel :
will be checked from June to September

T2K Secondary Beam-line

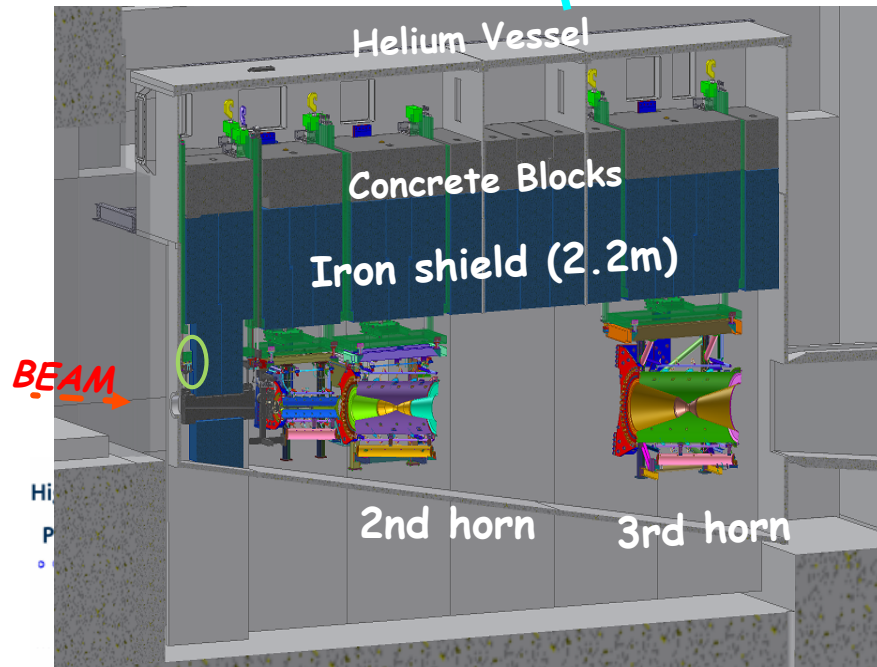
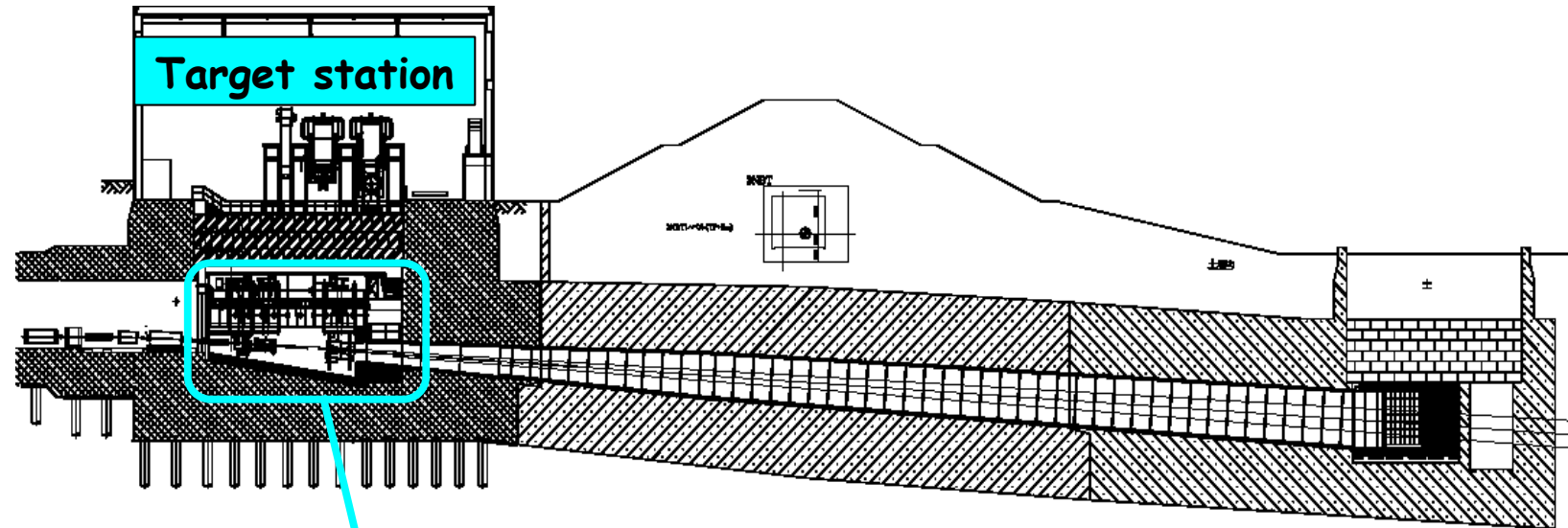


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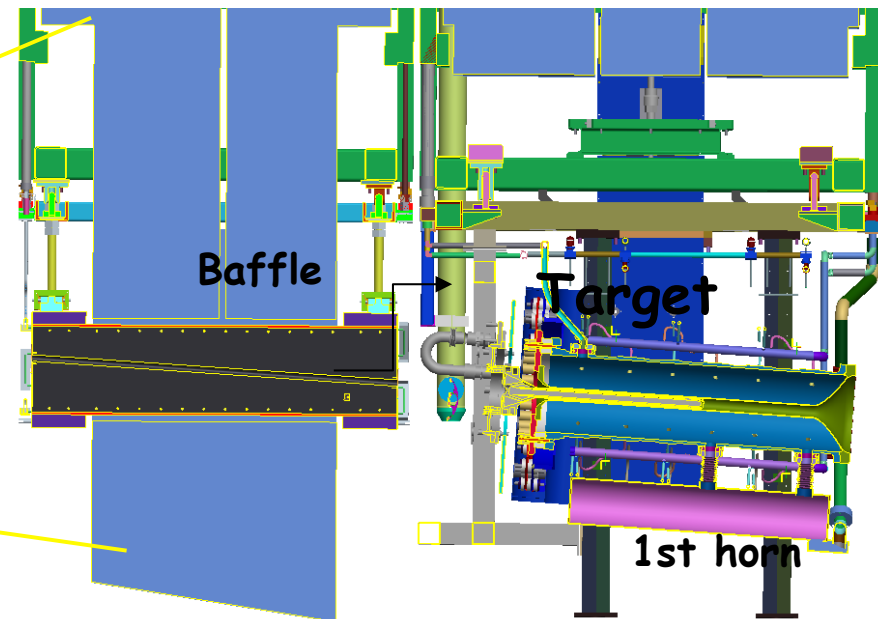
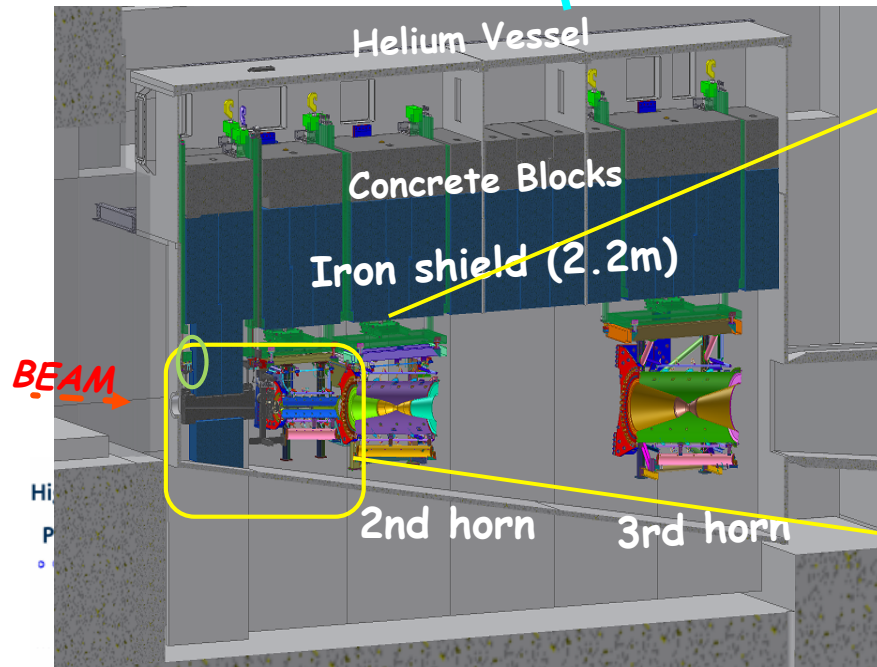
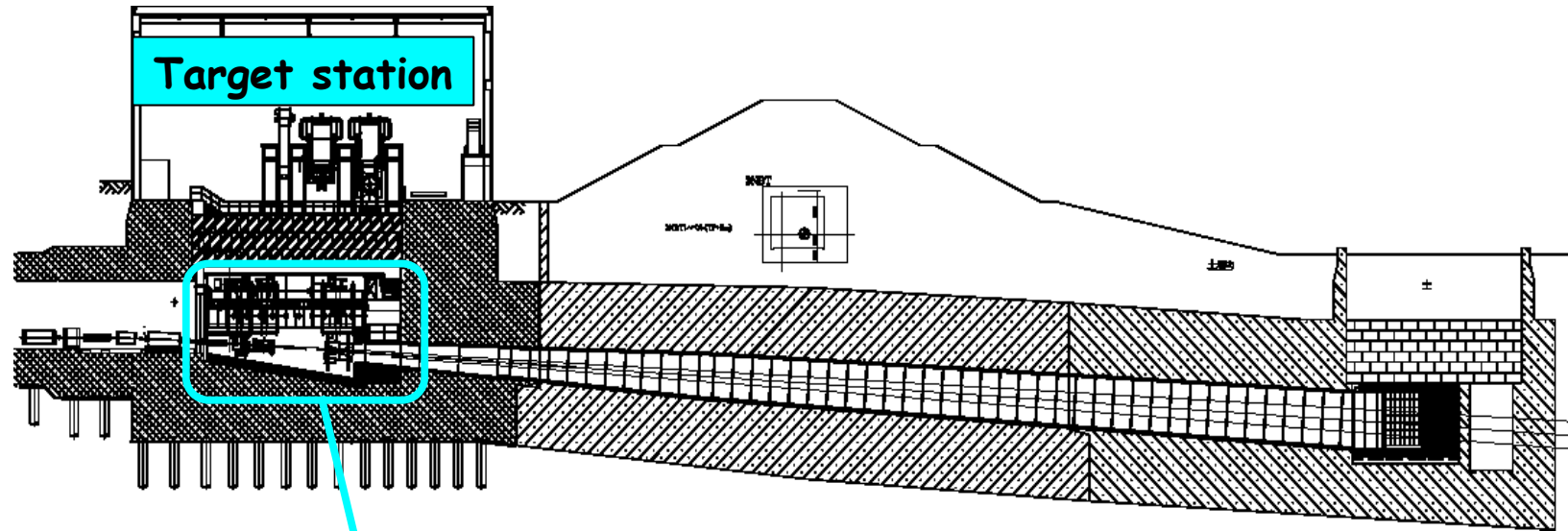


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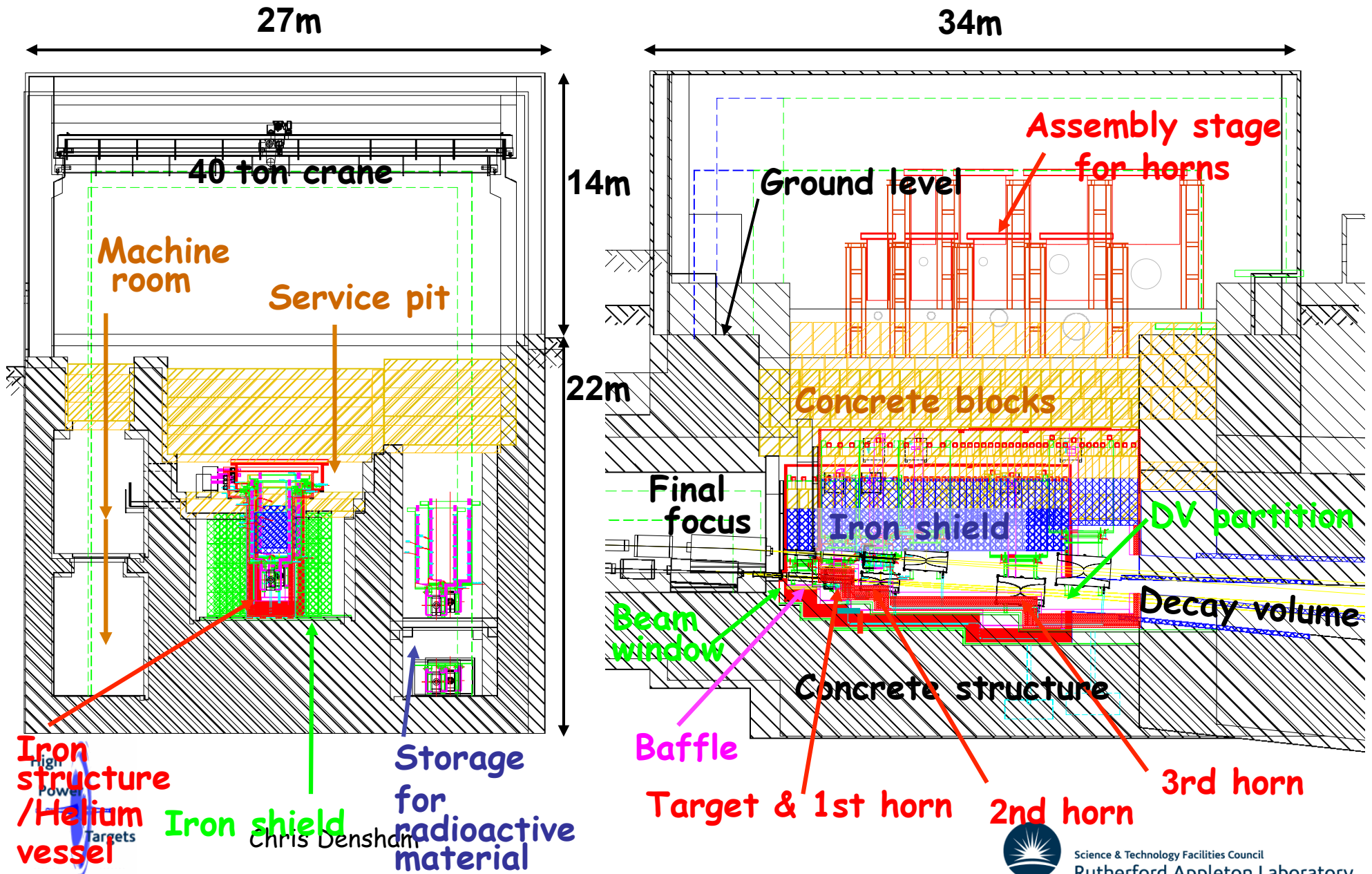
T2K Secondary Beam-line



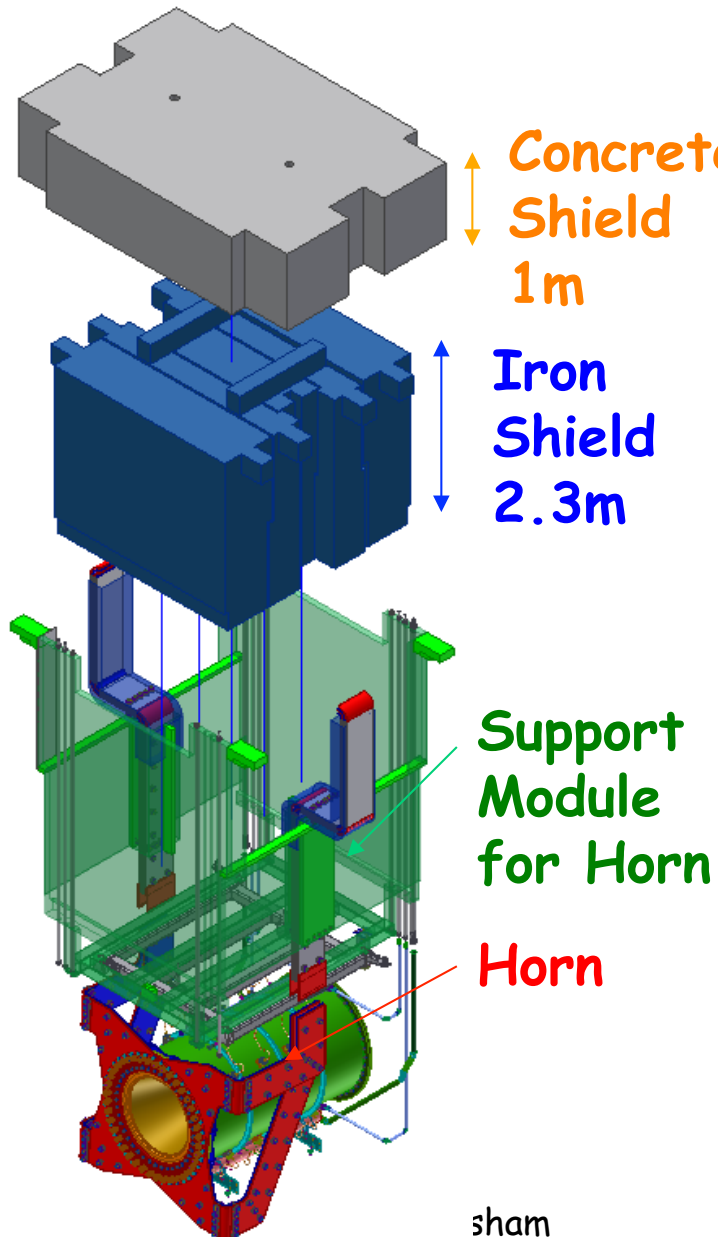
T2K Secondary Beam-line



Target Station



Remote Maintenance of Horns



Concrete Shield
1m

Iron Shield
2.3m

Support Module
for Horn

Horn

Horns are shielded by iron and concrete shields and workers only have access above these shields.



Concrete shield

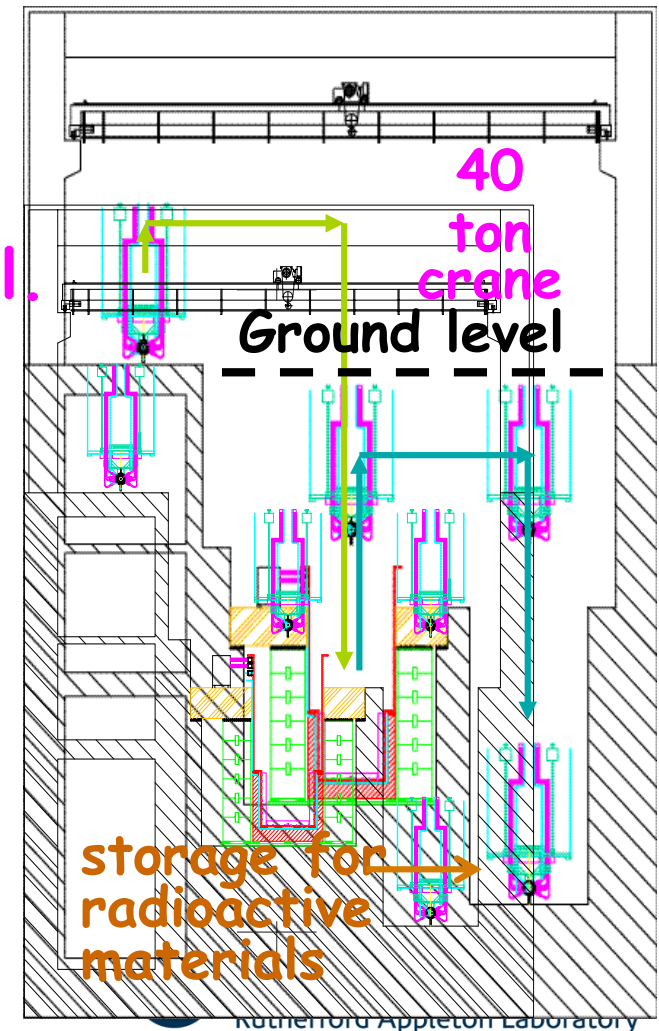
Horns and shields are handled by remote controlled crane.

sham



Remote maintenance of horns

- Radioactive (>1Sv/h) horn is moved below ground-level and kept in the storage for radioactive materials for several years.
- New horn is installed.
- All work done remotely with 40 ton crane & remote sling tool.

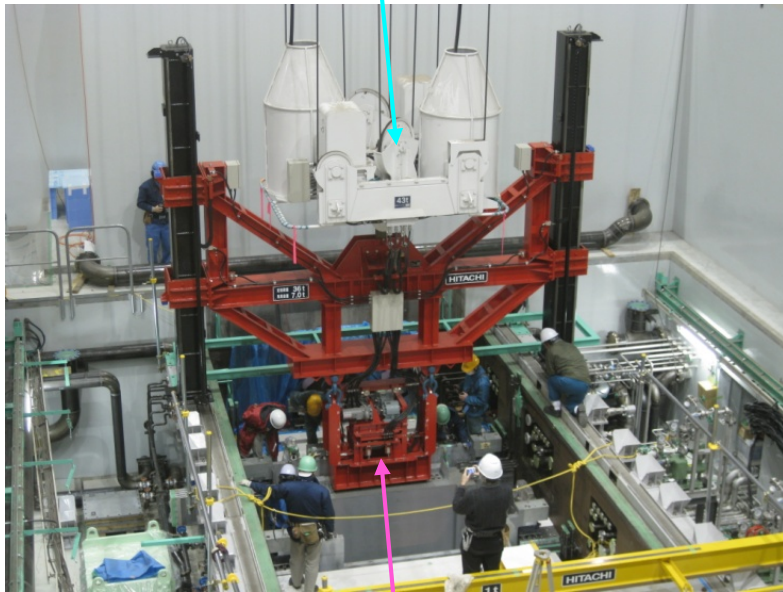


Remote Controlled Crane for TS

A numerical controlled crane is used in the TS.

A remote handling machine is attached to this crane.

Crane



Handling machine for the shields

We need a few mm in x, y, z direction and 0.5 degree in rotation for the position accuracy when horn exchange.

To secure such accuracies, we use **this numerical controlled crane in a few cm region** and **the mechanical guide in a few mm region**.

(Finally, it is possible to fine-tune the horn position in the beam line manually.)

This crane has a spare system.

If the crane stops while at work (for example, while it suspends an radioactive device), the main system is cut off, and the spare one runs and keeps on the work.

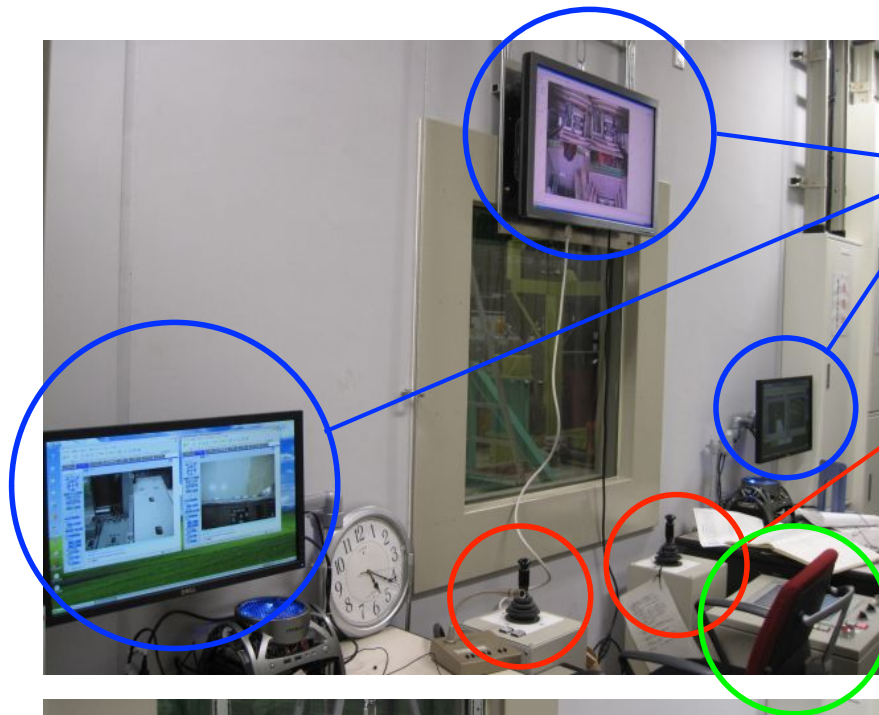


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Crane control room



Display for the camera

Control stick
(for the manual operation mode)

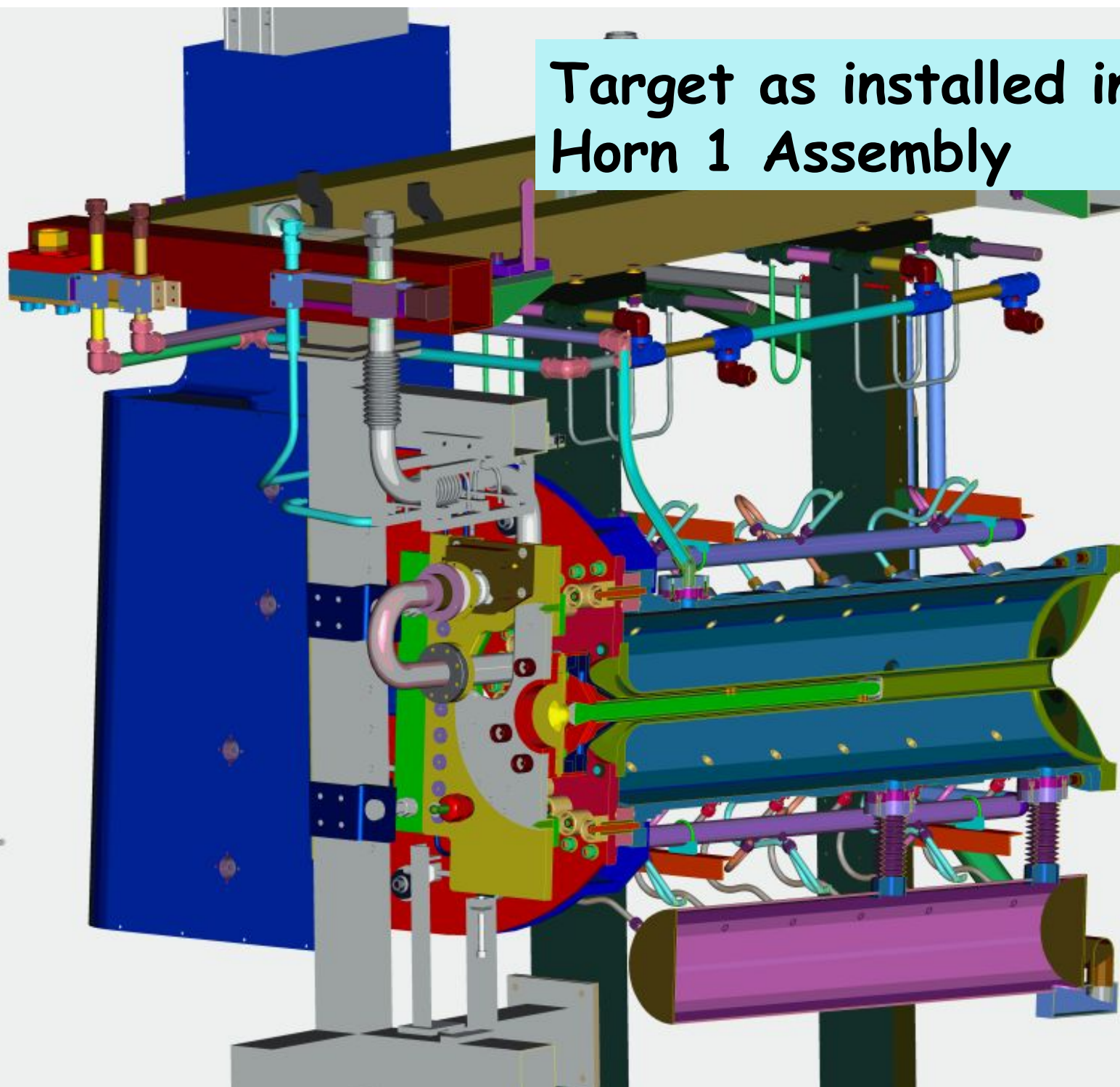
Control panel



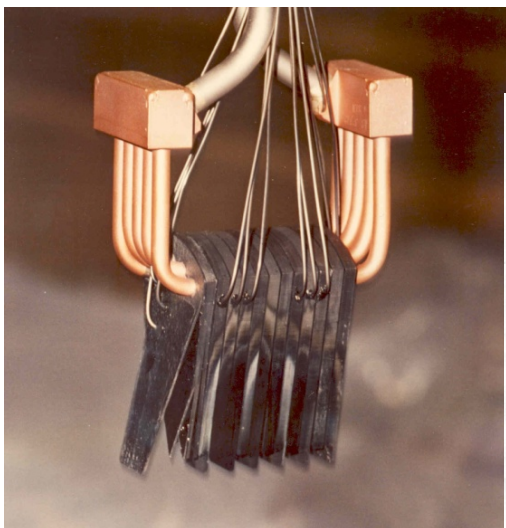
High
Power



Target as installed in Horn 1 Assembly



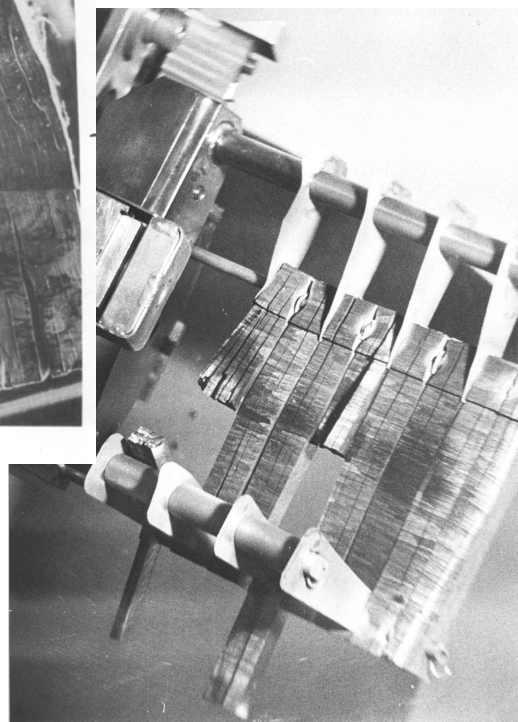
Broken graphite targets / samples from existing accelerator facilities



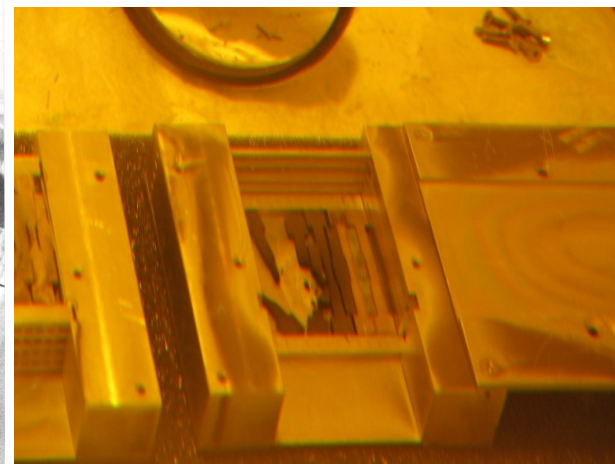
LAMPF



PSI

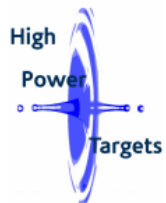


BNL tests

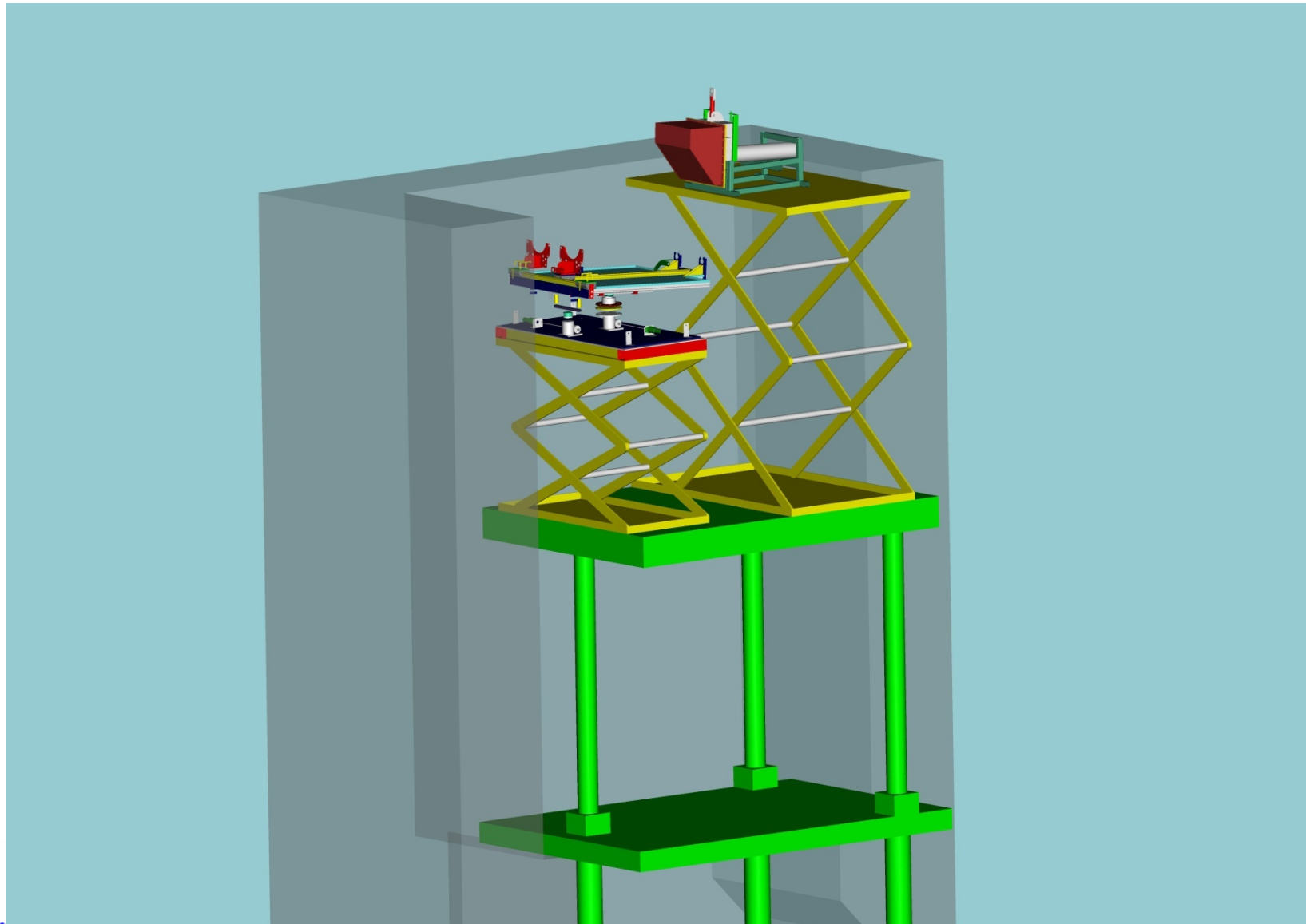


Target Remote Handling requirements

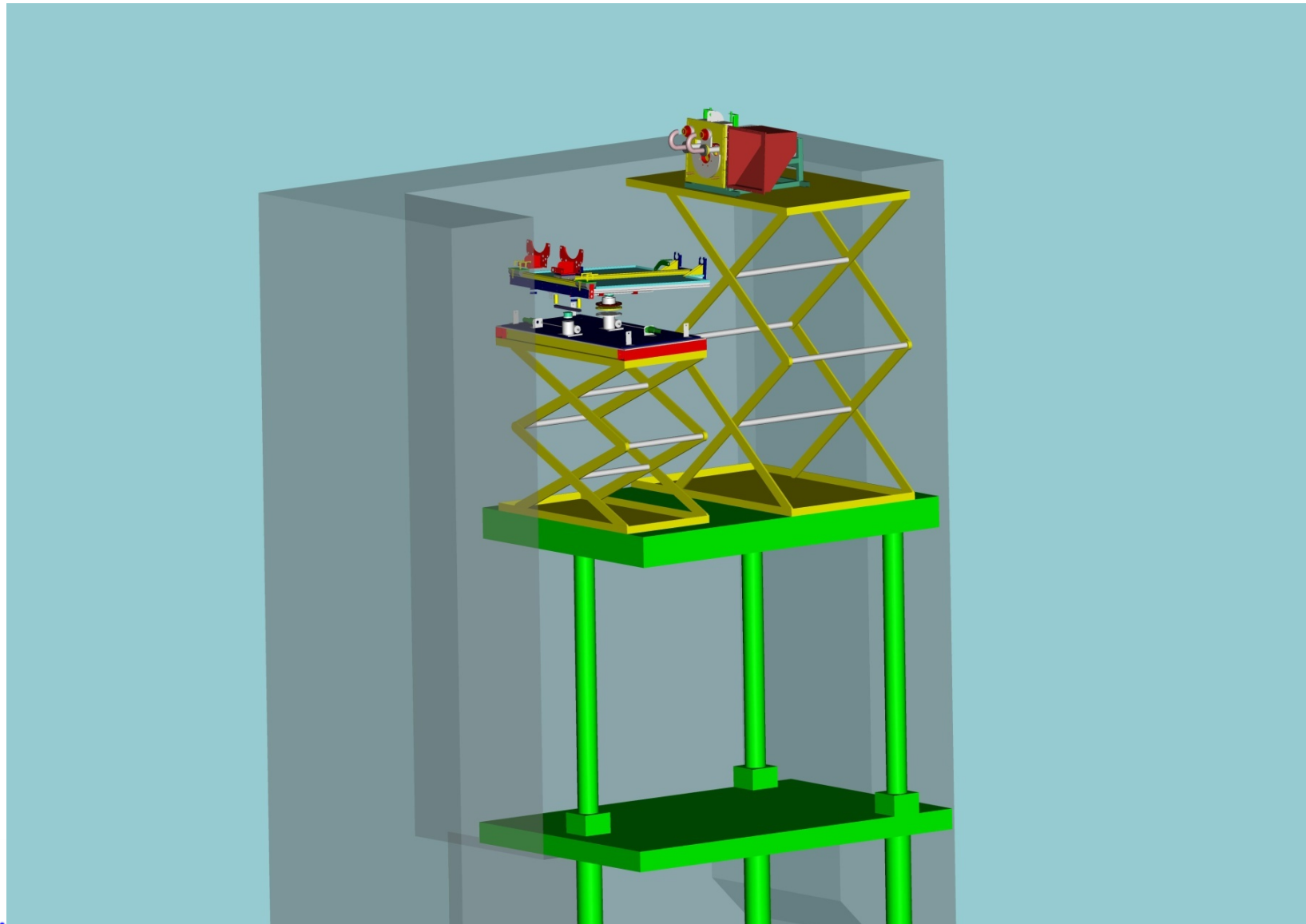
- Want to be able to replace a failed target and re-use Horn 1.
 - 1 month cool down required (at 750 kW operation)
 - Horn 1 with failed target to be lifted from beamline and installed in Remote Maintenance Area
 - Failed target to be removed, new target installed, and Horn 1 assembly re-installed in beamline.
 - Failed target to be placed inside disposal flask
- Many limitations within Remote Maintenance Area
 - Very limited space
 - No crane access - lift tables only
 - Horn can only be installed in RMA with reproducibility of ± 10 mm but target needs to be installed within horn to accuracy of ≈ 0.1 mm.



Procedure for installing new target in hot cell



Procedure for installing new target in hot cell

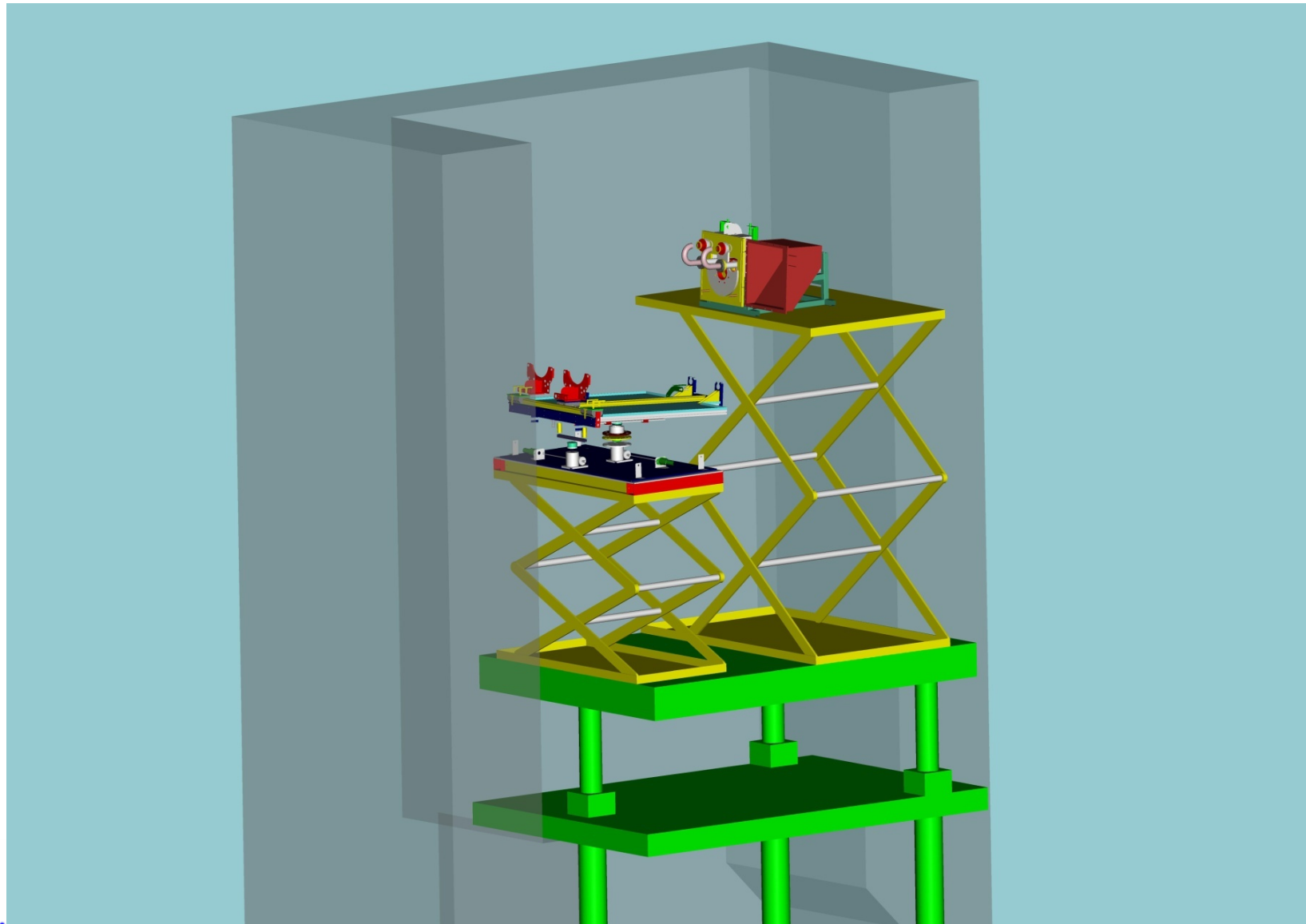


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Procedure for installing new target in hot cell

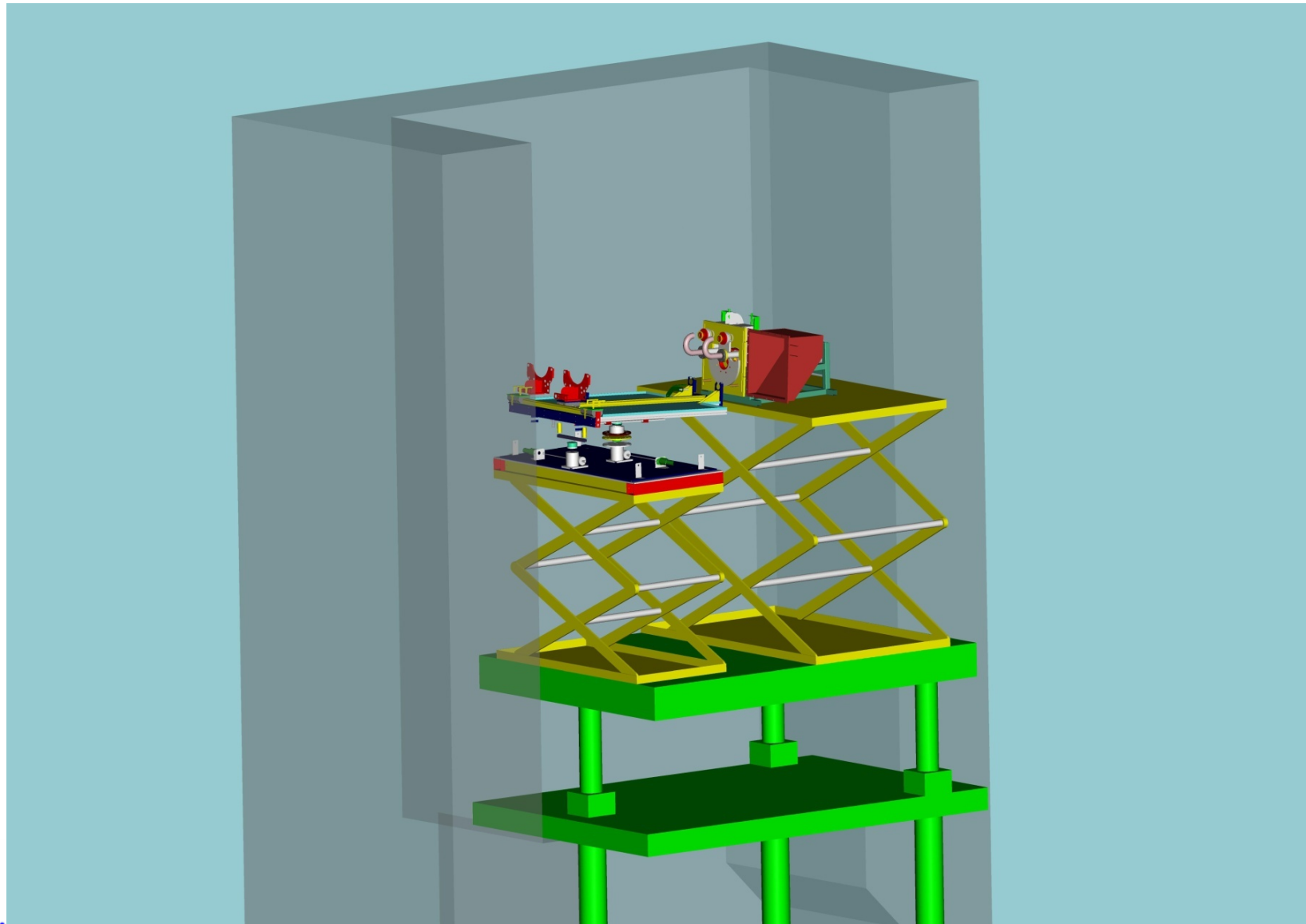


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Procedure for installing new target in hot cell

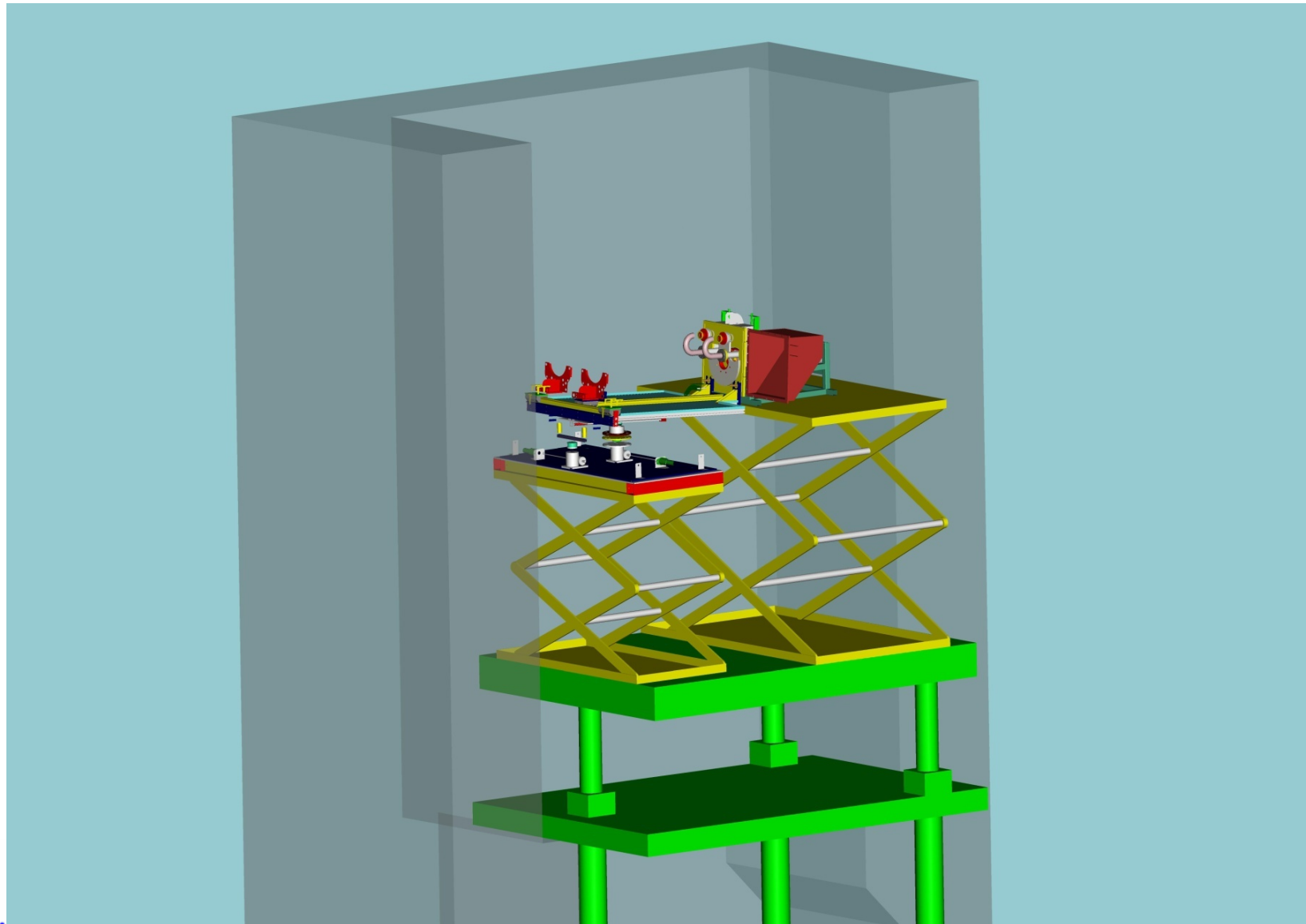


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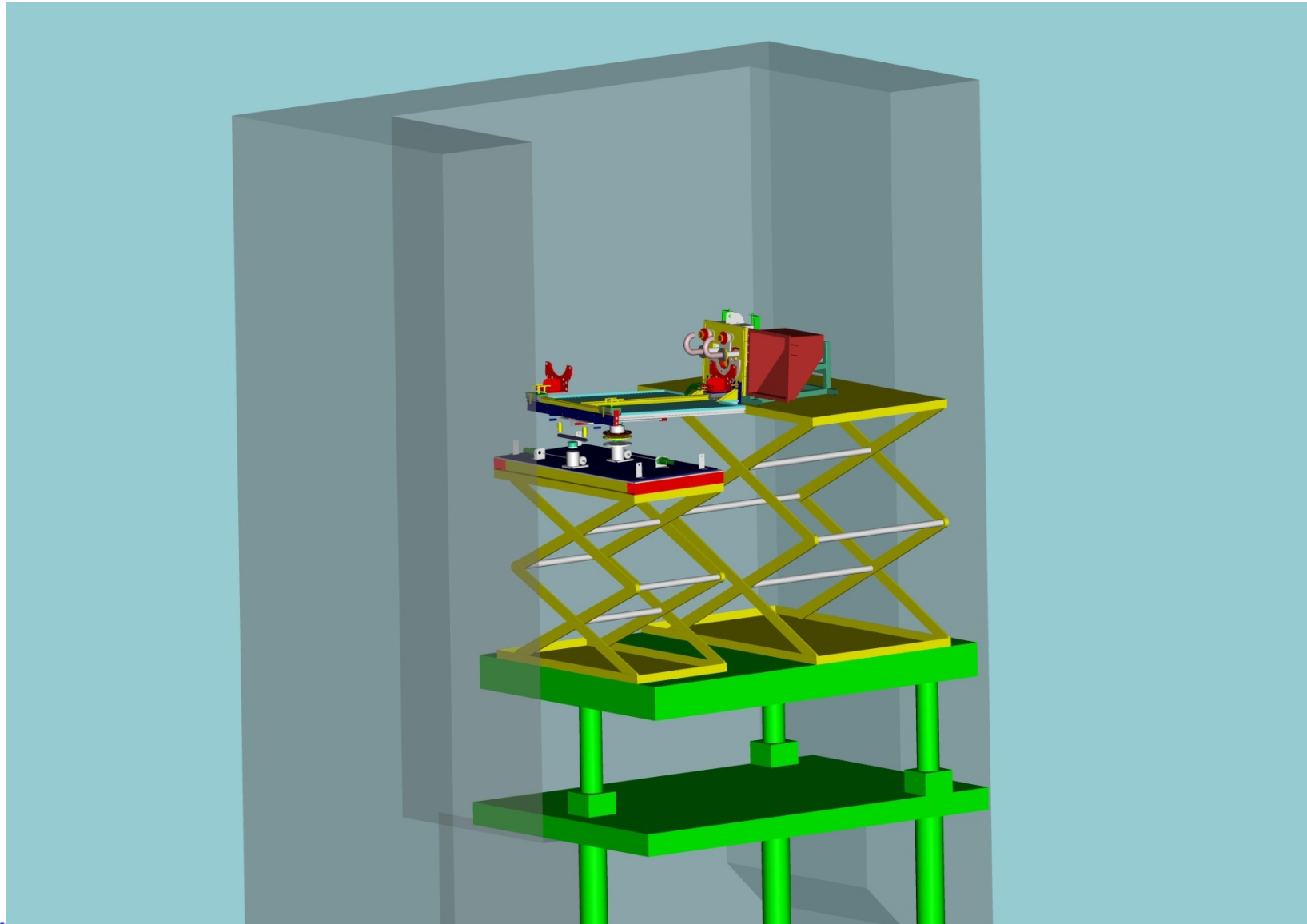


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Procedure for installing new target in hot cell

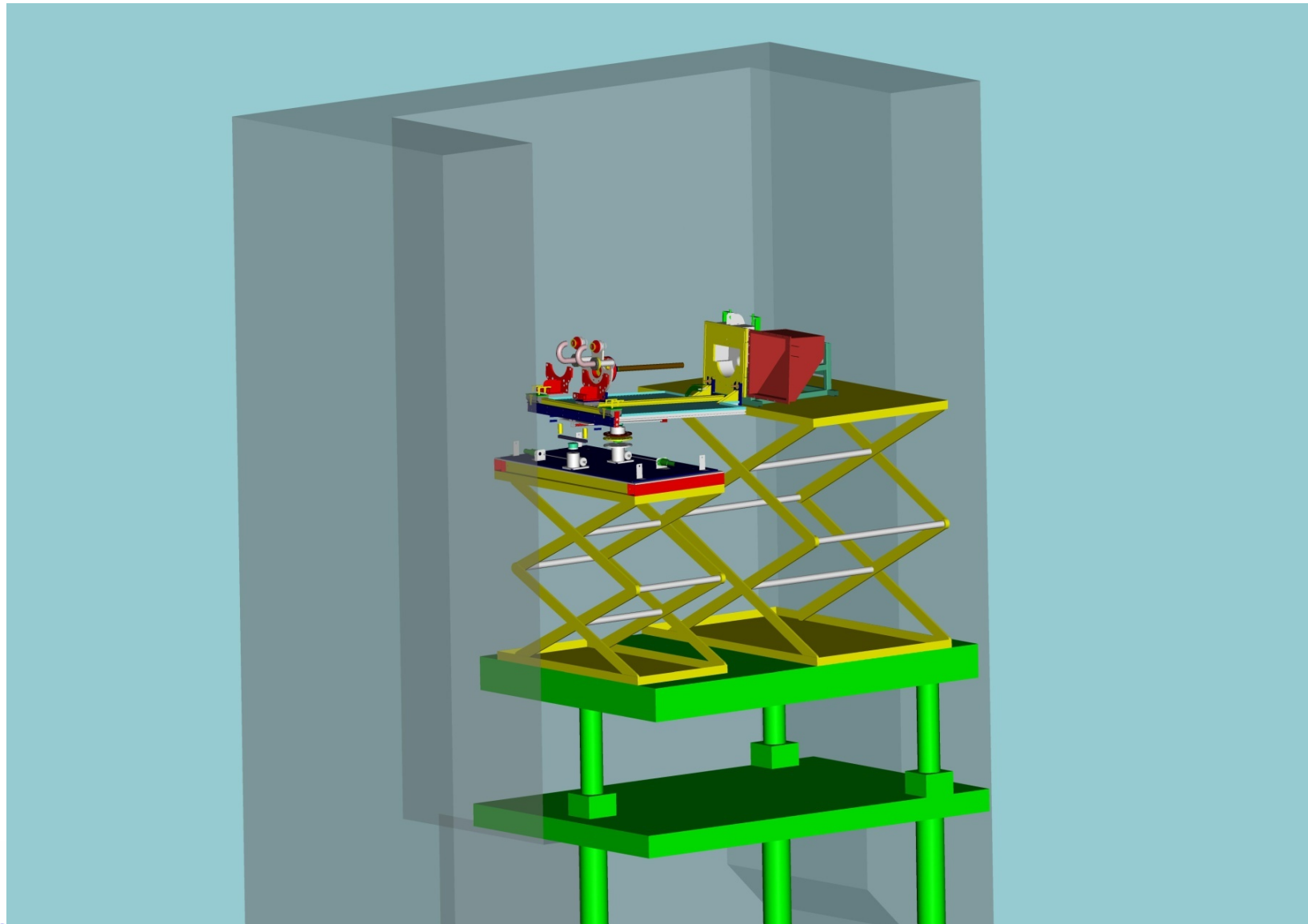


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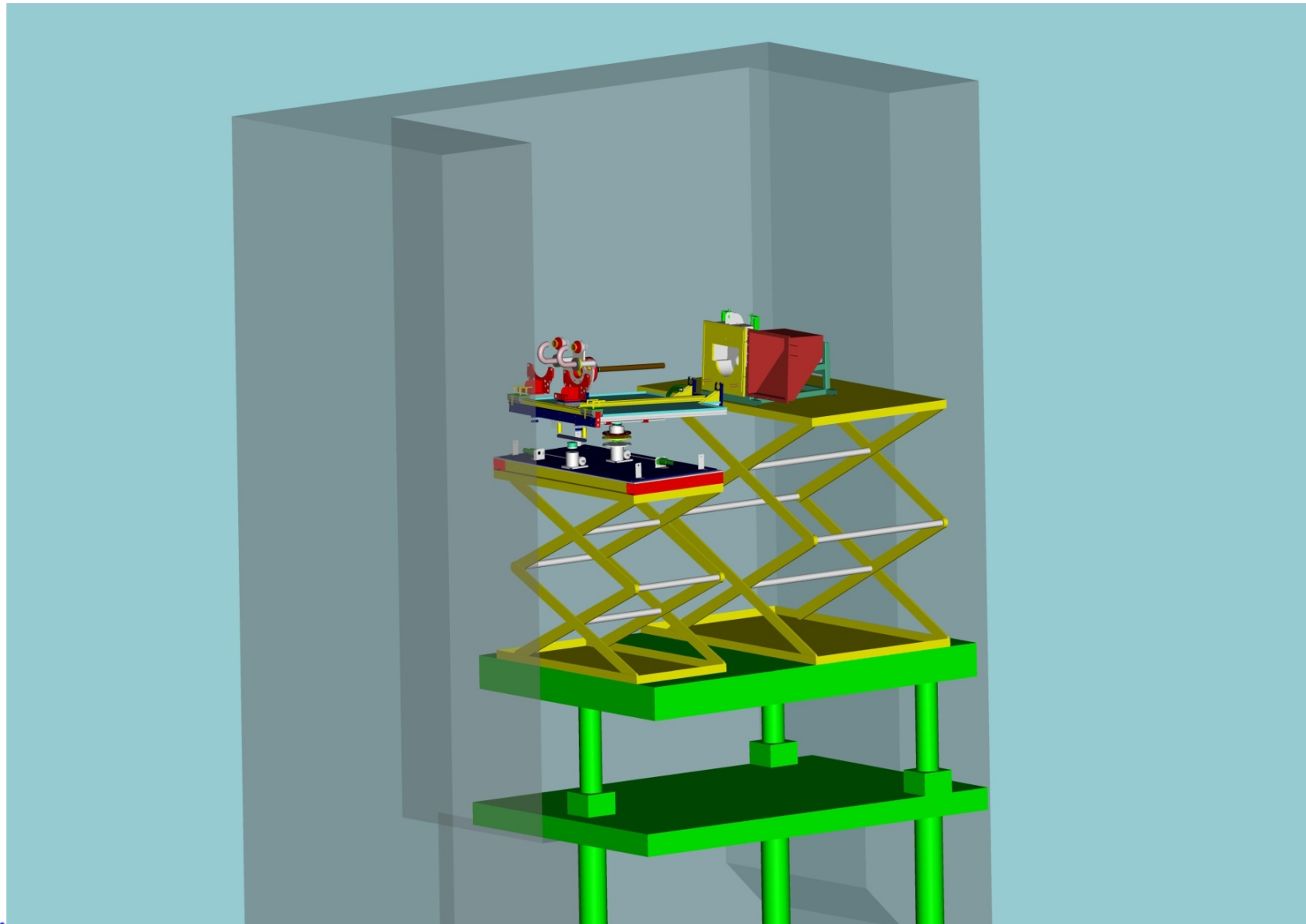


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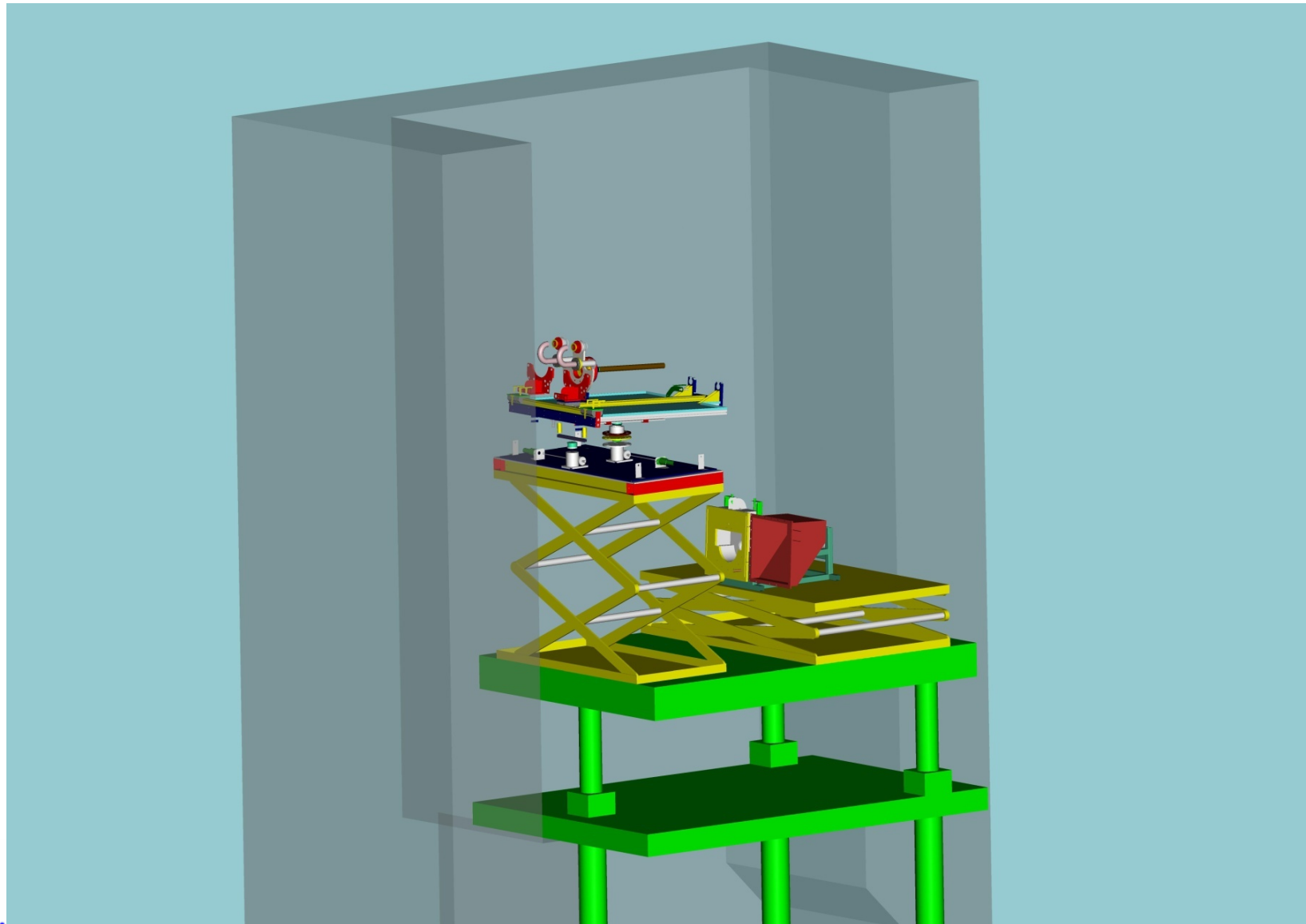


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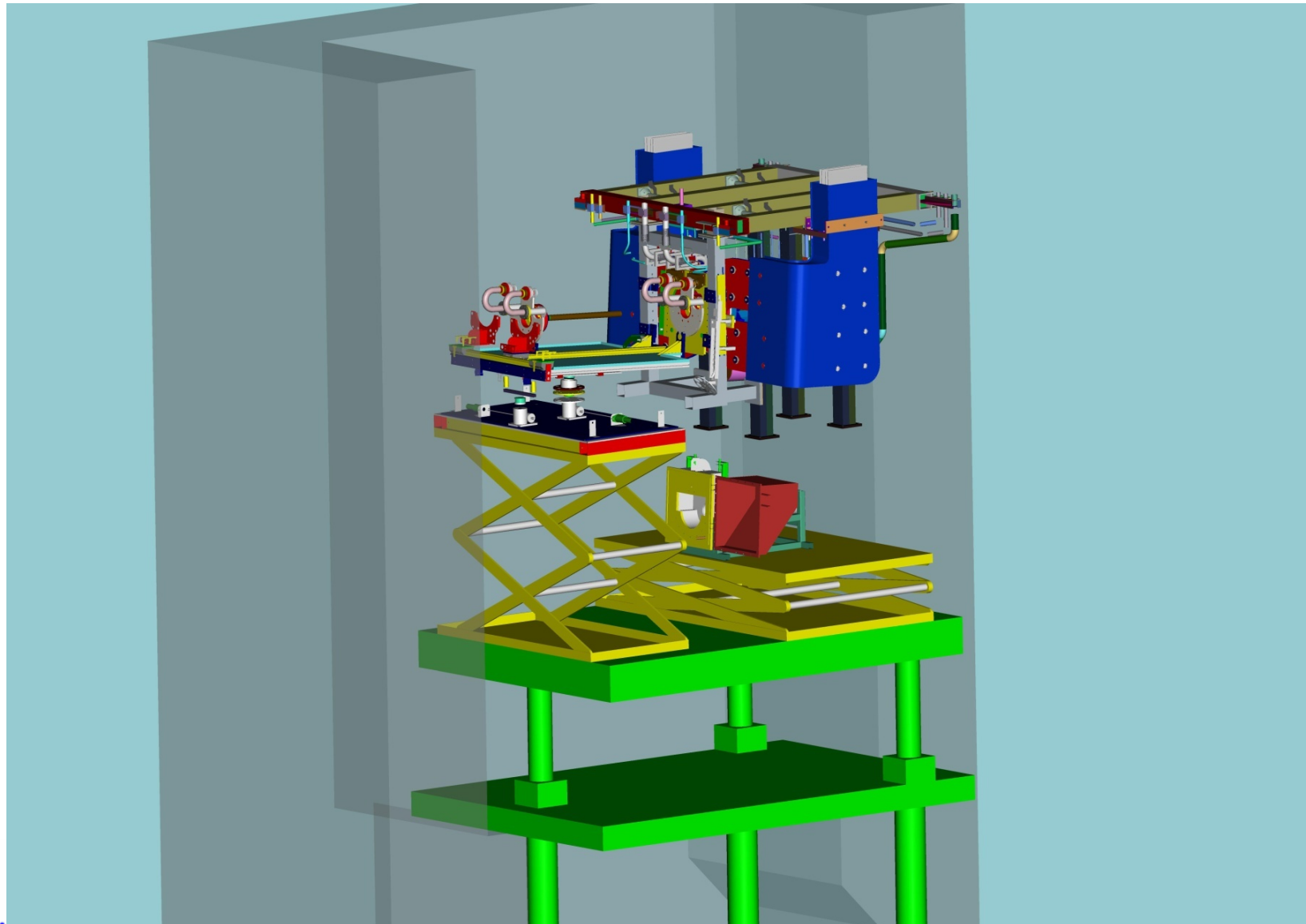


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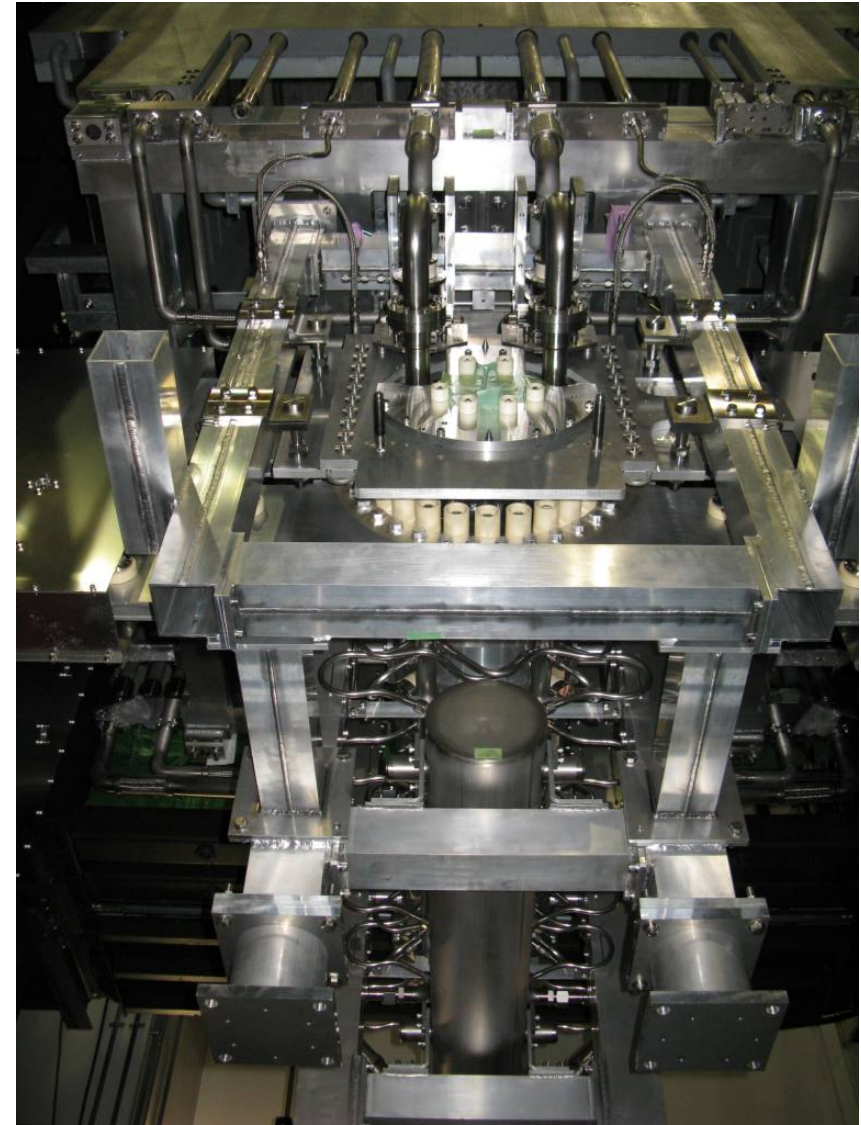


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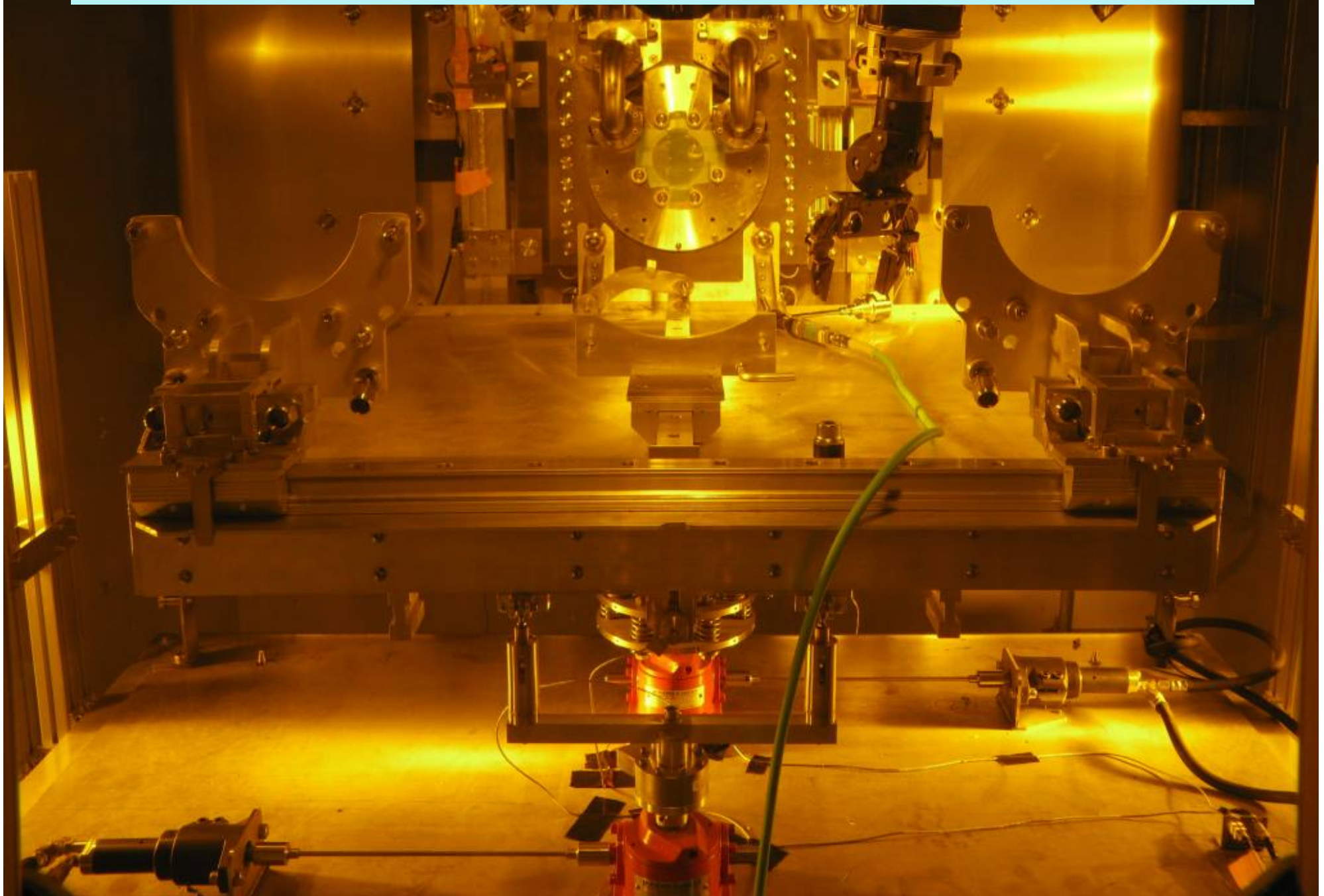


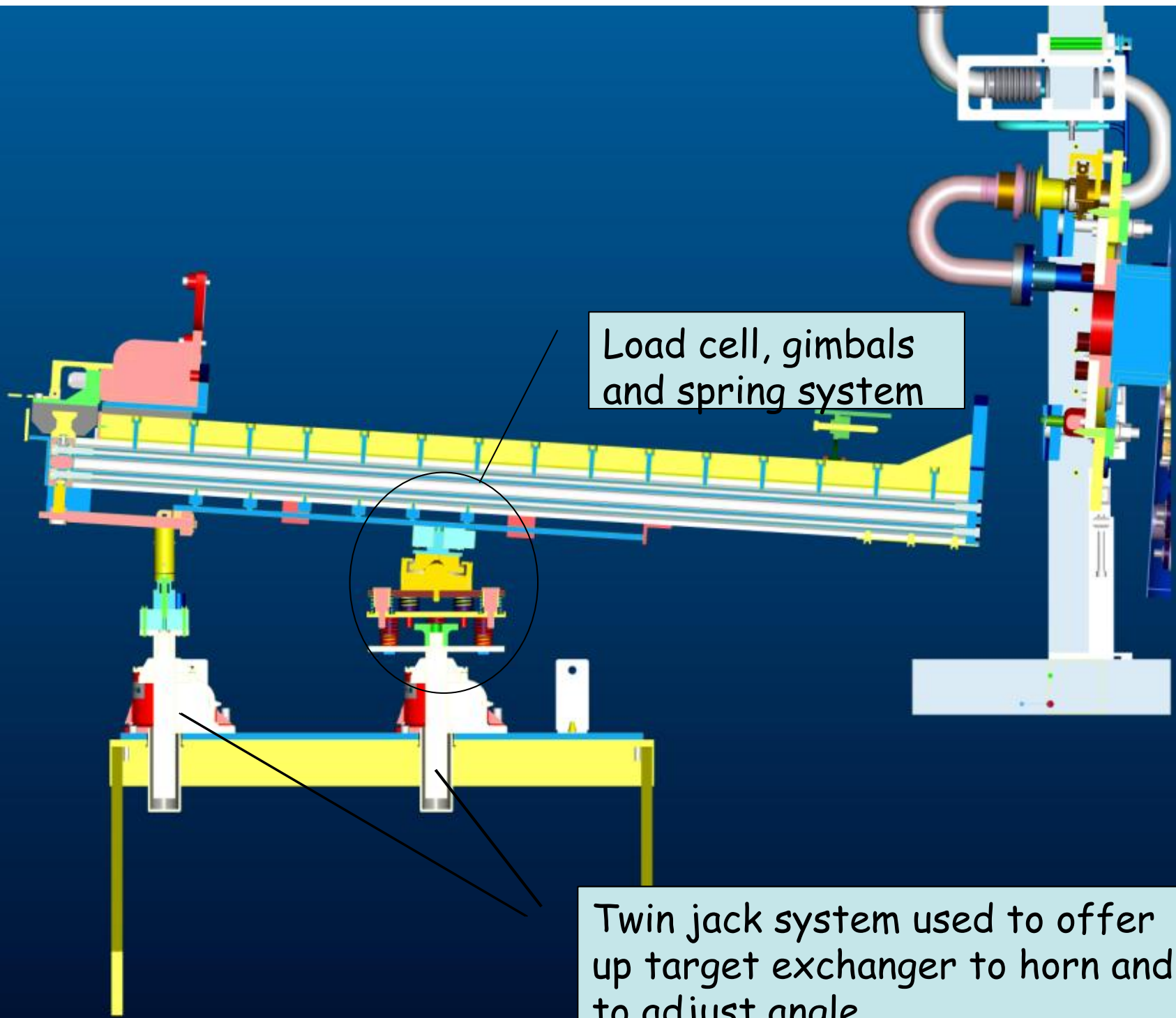
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Installing horn 1 in the hot cell



View of target / horn in hot cell





Load cell, gimbals and spring system

Twin jack system used to offer up target exchanger to horn and to adjust angle

Gimbals + spring protection system

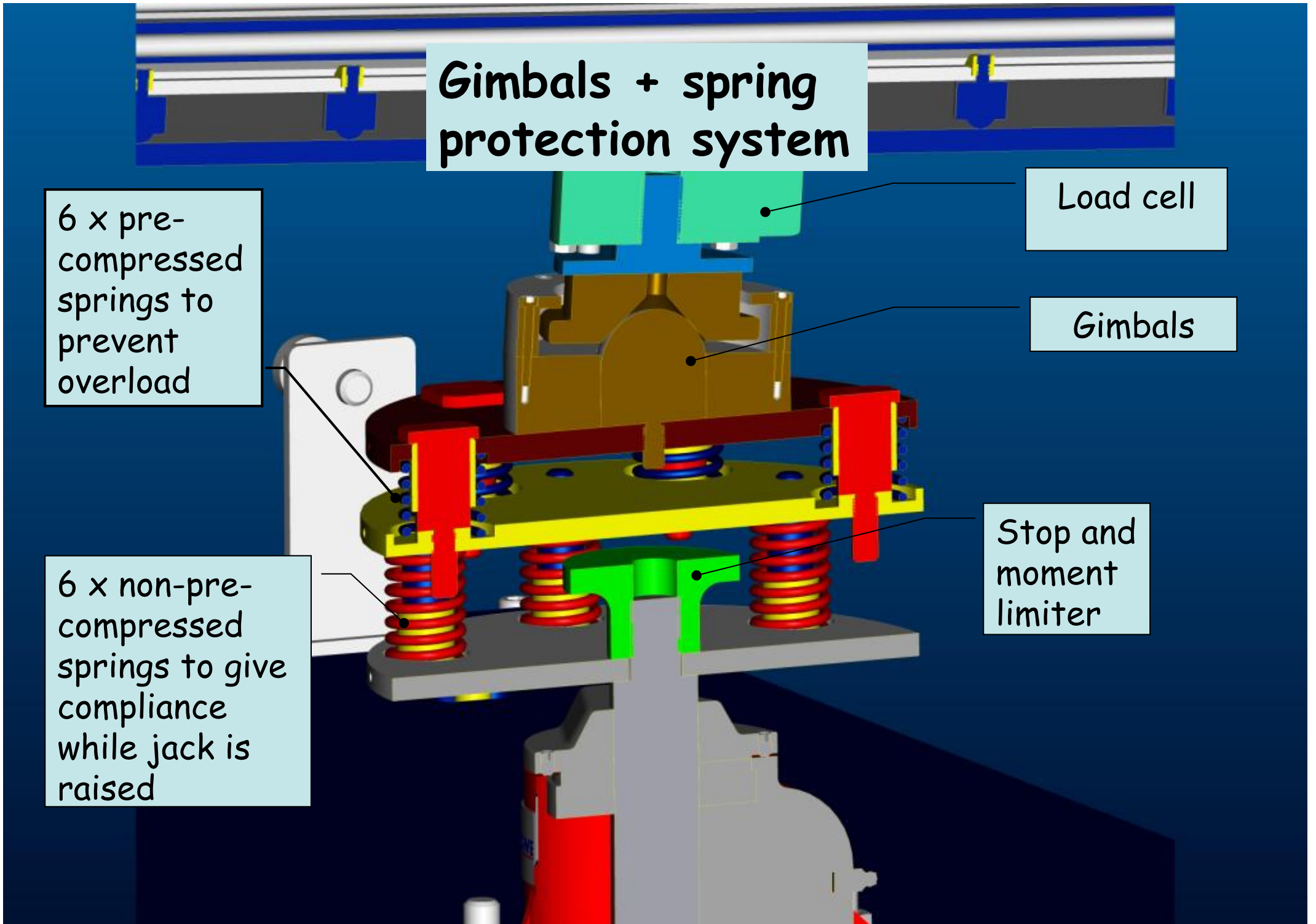
Load cell

Gimbals

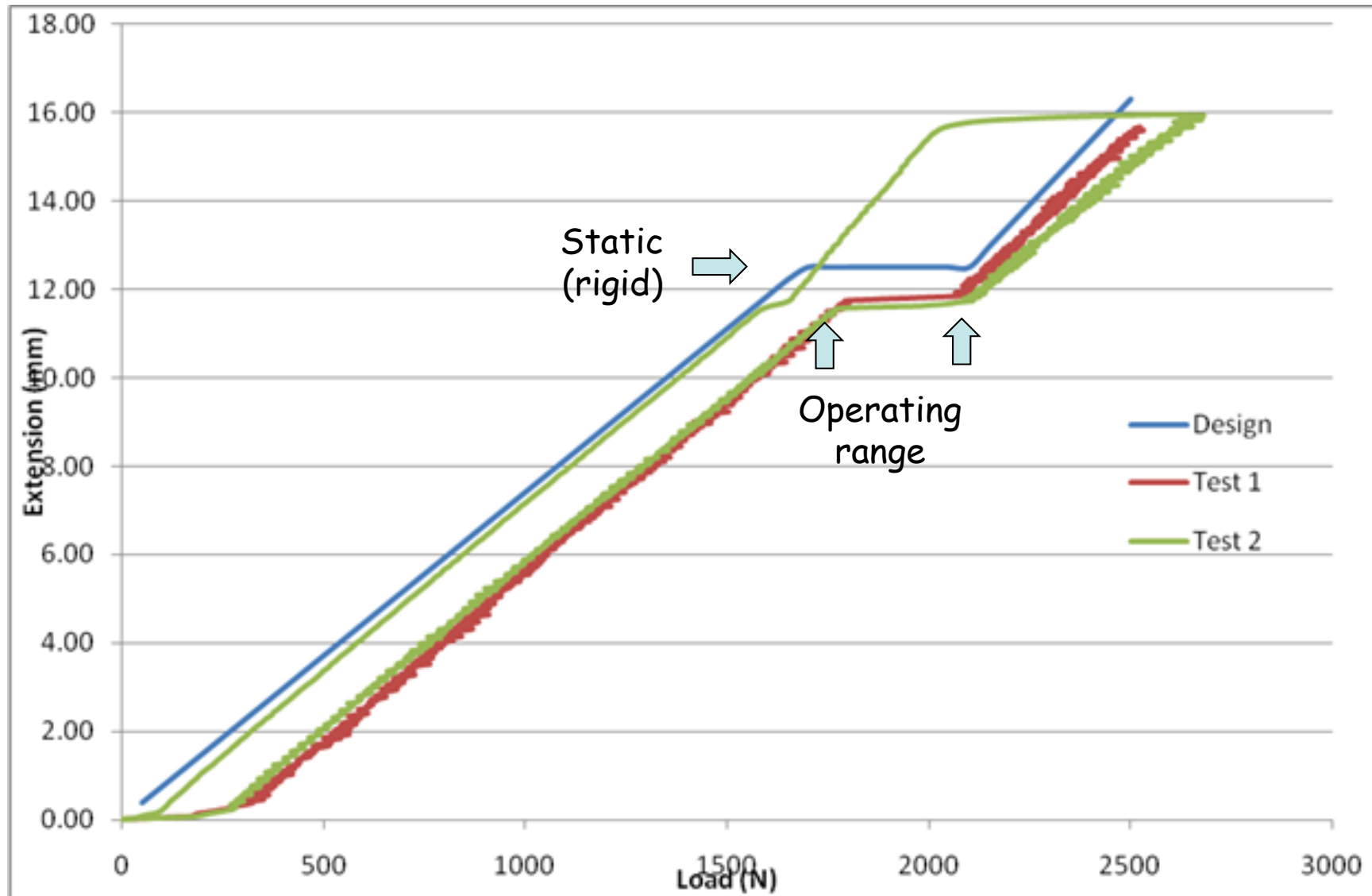
6 x pre-compressed springs to prevent overload

6 x non-pre-compressed springs to give compliance while jack is raised

Stop and moment limiter



Operation of spring protection system

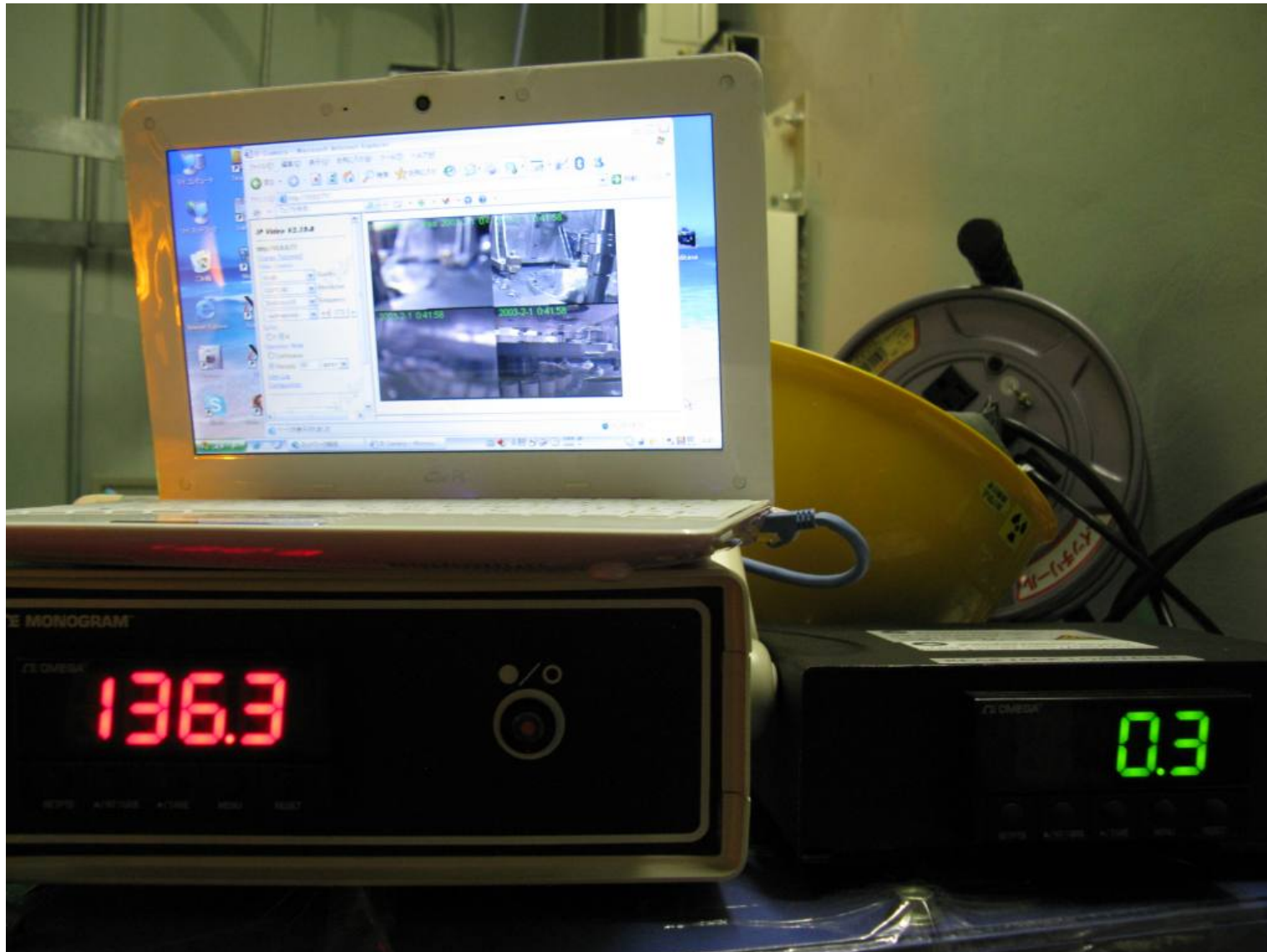


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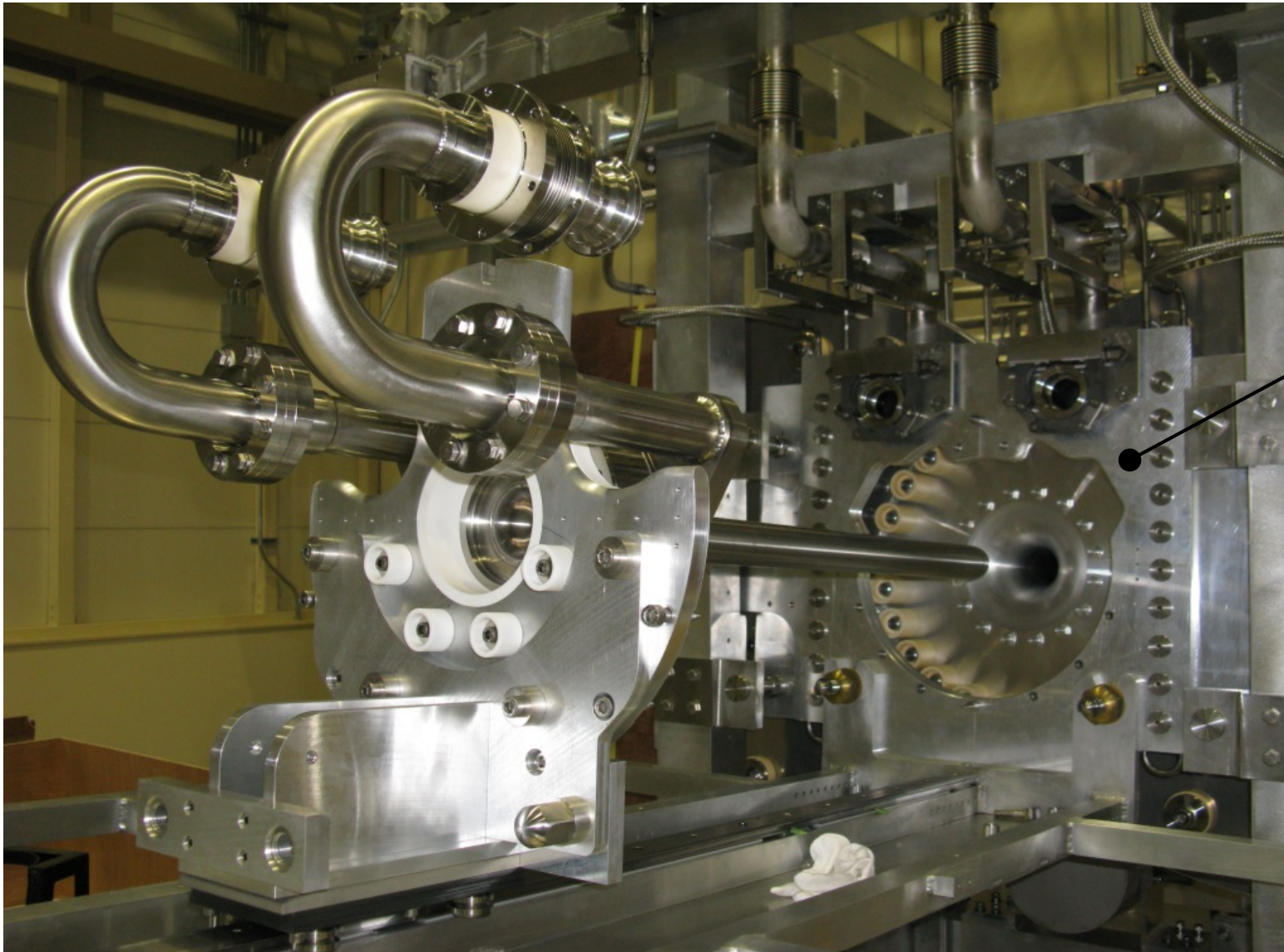


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Load cell readouts from jacks crucial for docking exchanger to horn - more important than visual



Integration of target with 1st Horn - August 2008

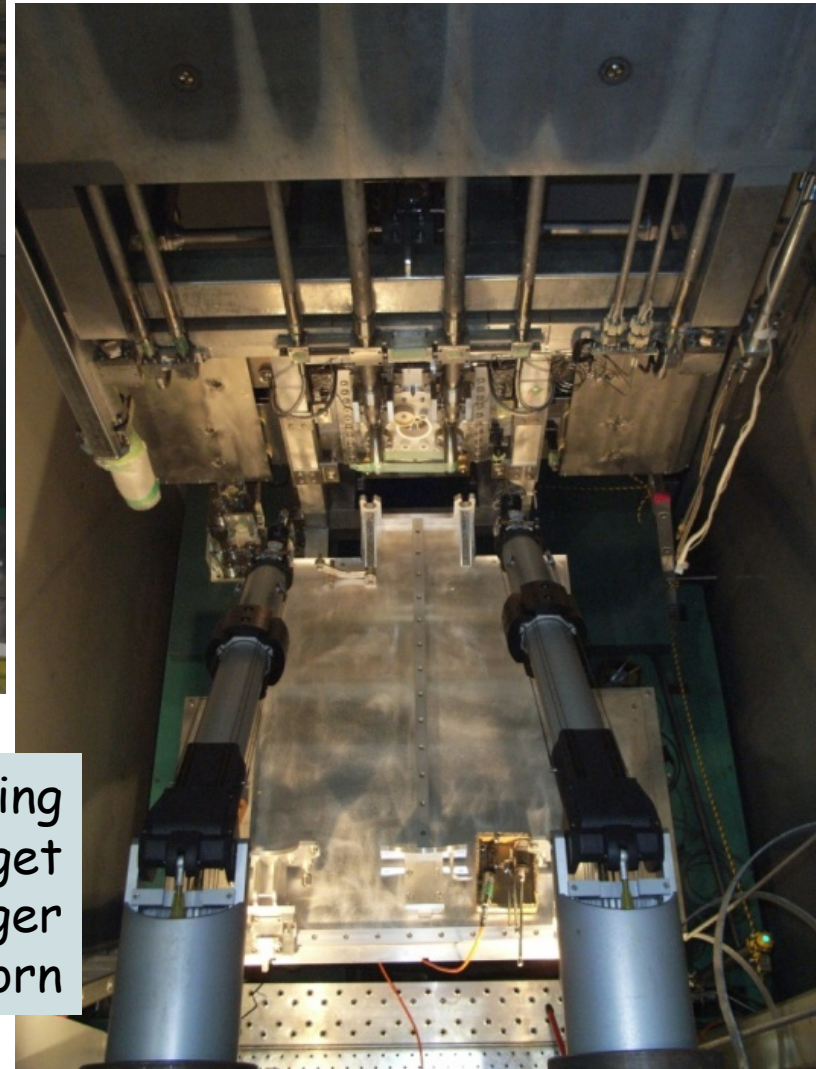


Target support plate & pins accurately aligned to horn centreline using a jig

Remote Maintenance Area Commissioning (Nov 2008)

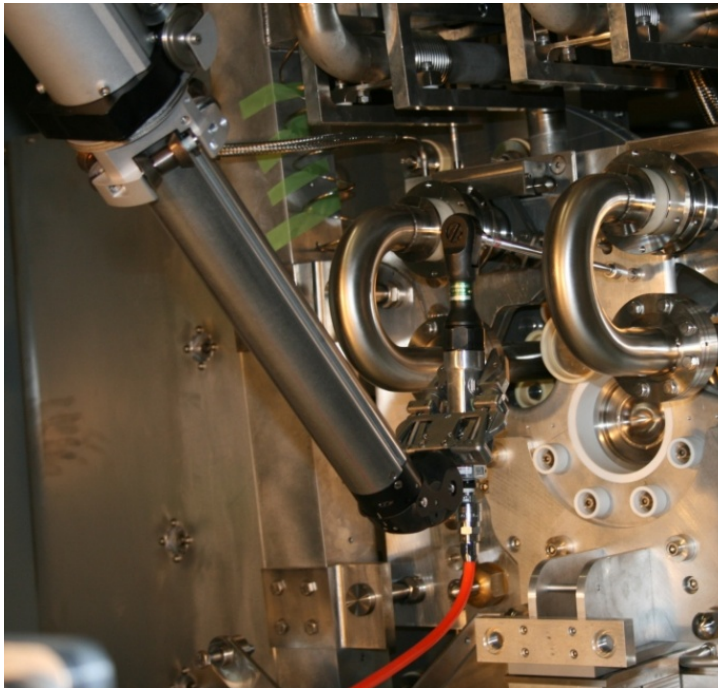


Installation of shielding window and manipulators supplied by TRIUMF into Remote Maintenance Area

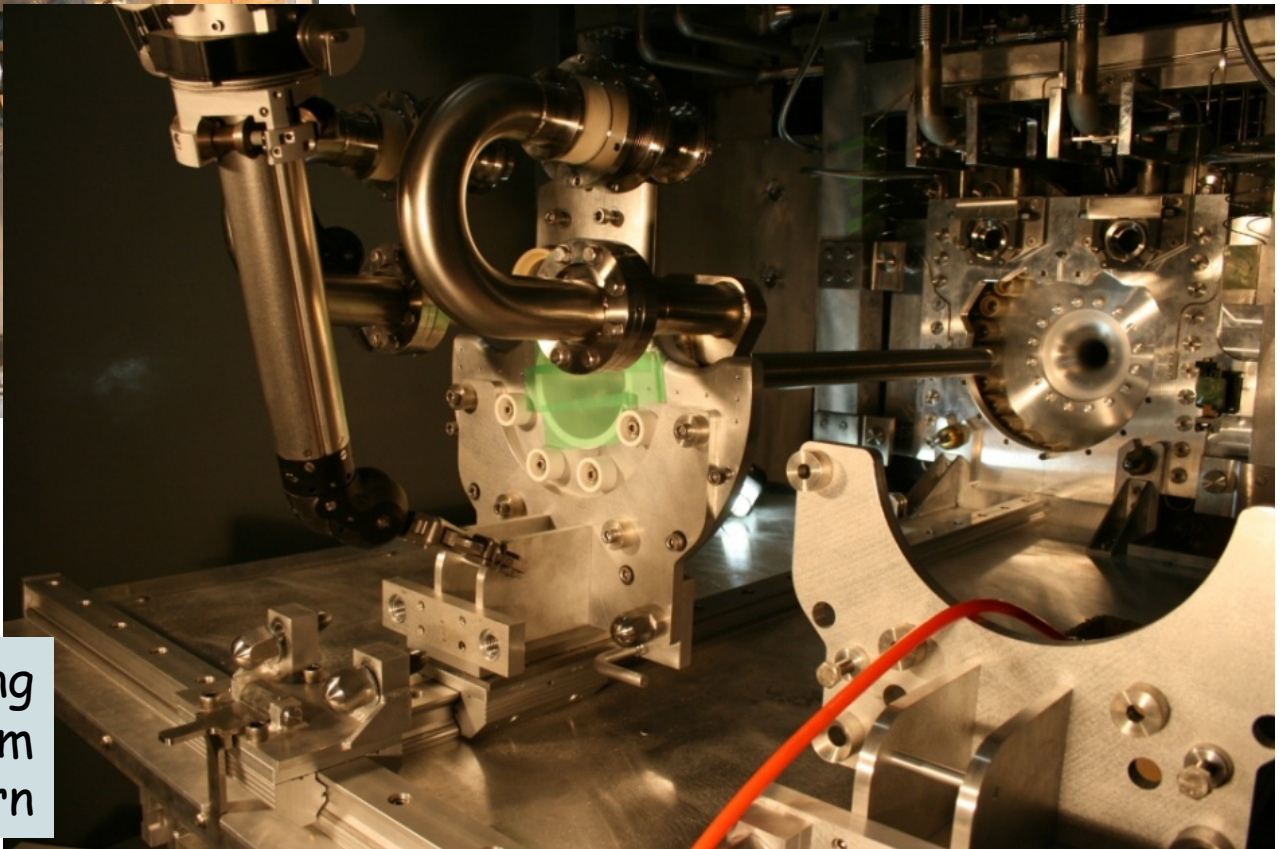


Offering up Target Exchanger to horn

Target Remote Replacement Commissioning using Target Exchanger Mk 2 (Nov 2008)

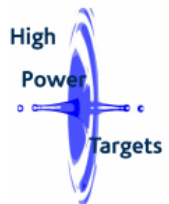
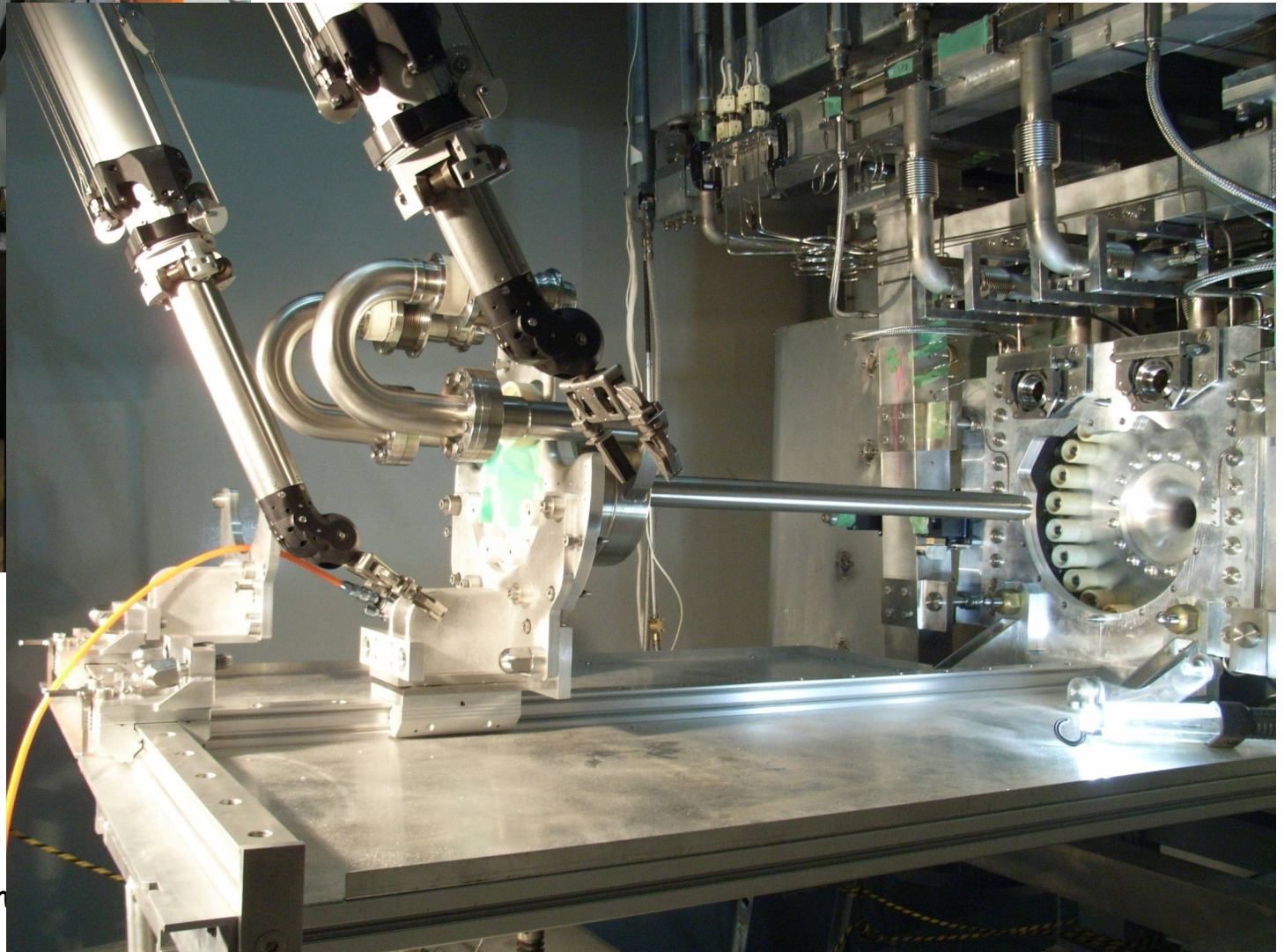


Disconnecting
target from
horn



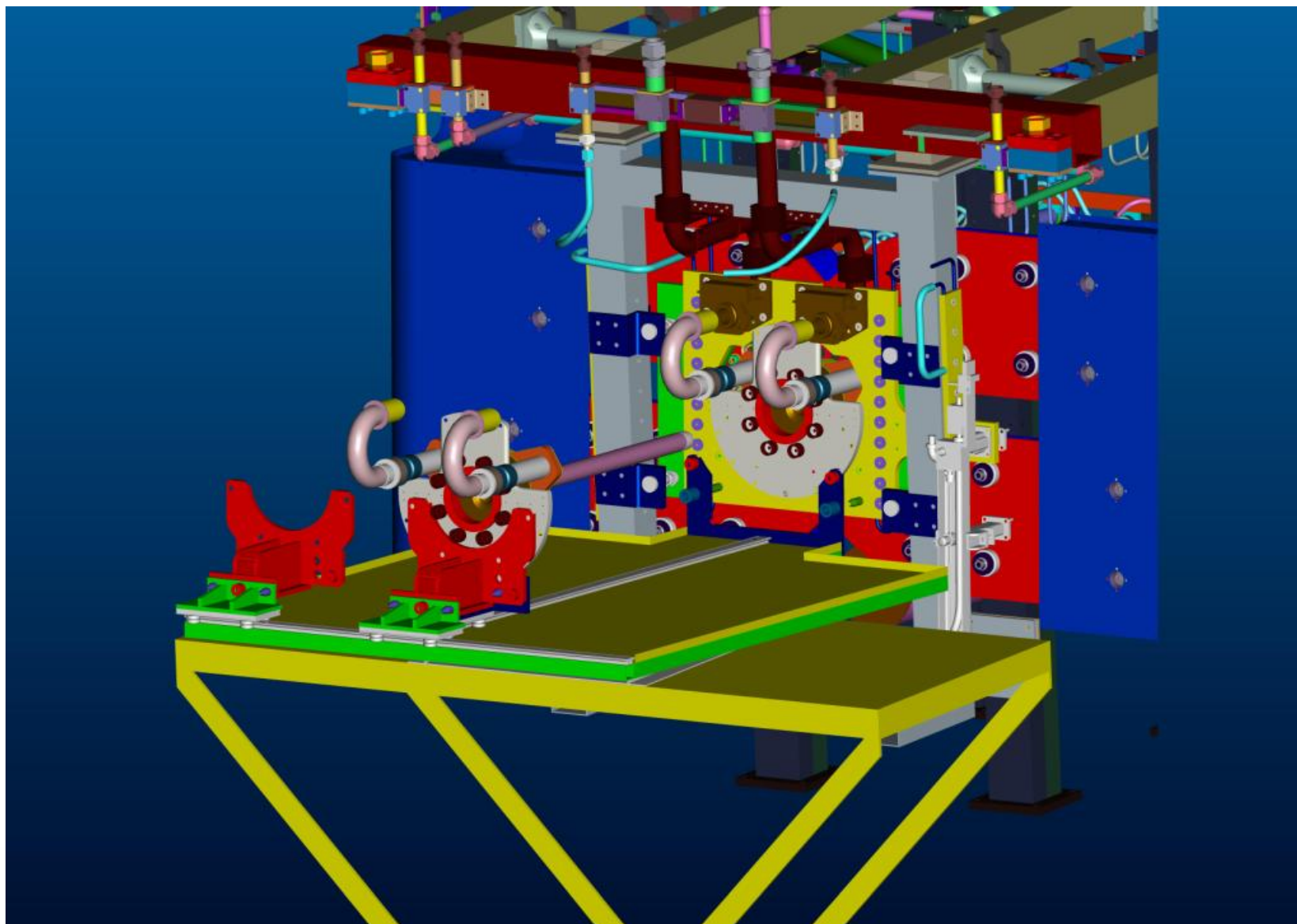
Withdrawing
target from
horn

Chad Fisher - master manipulator operator at work

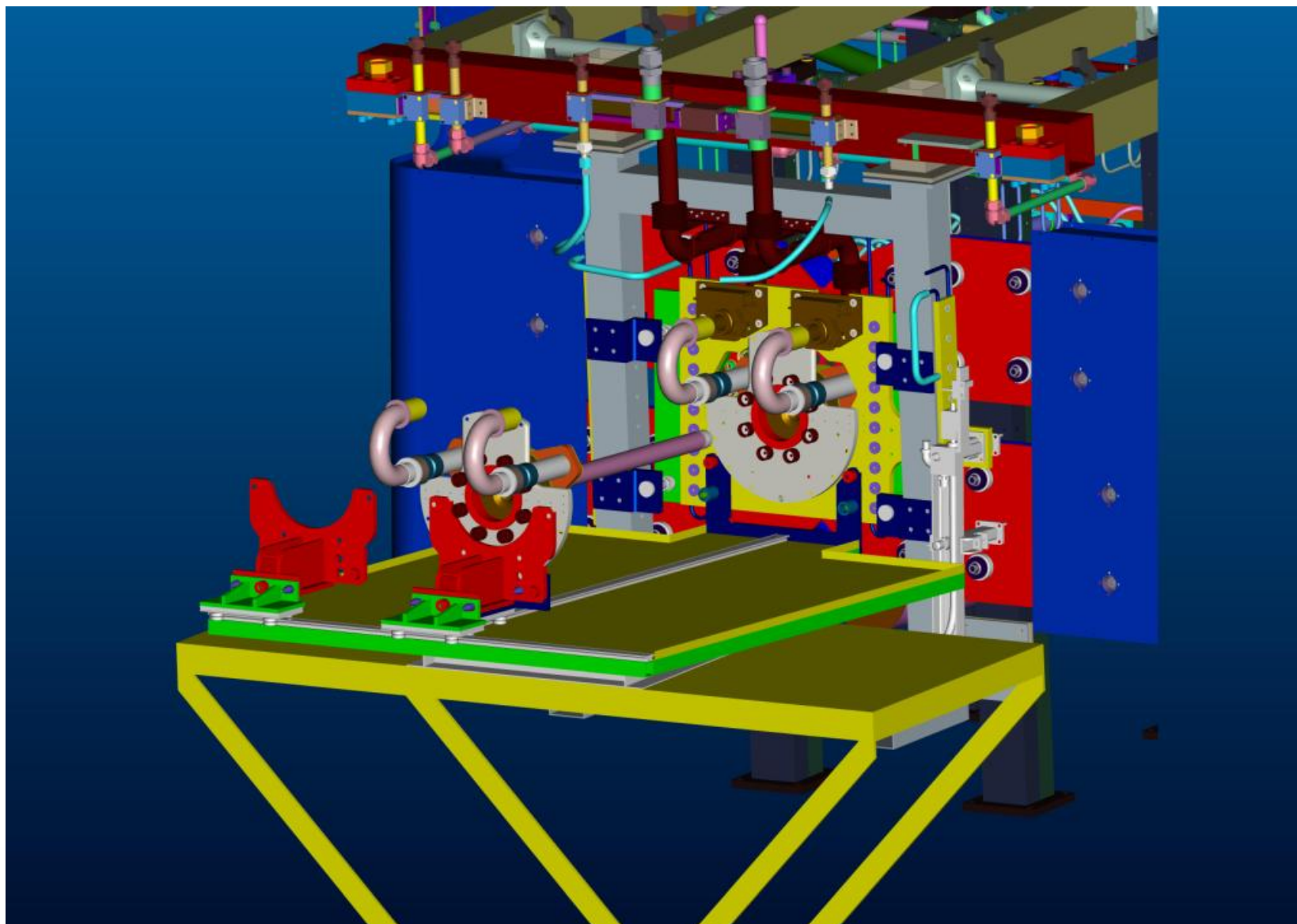


Chris Den

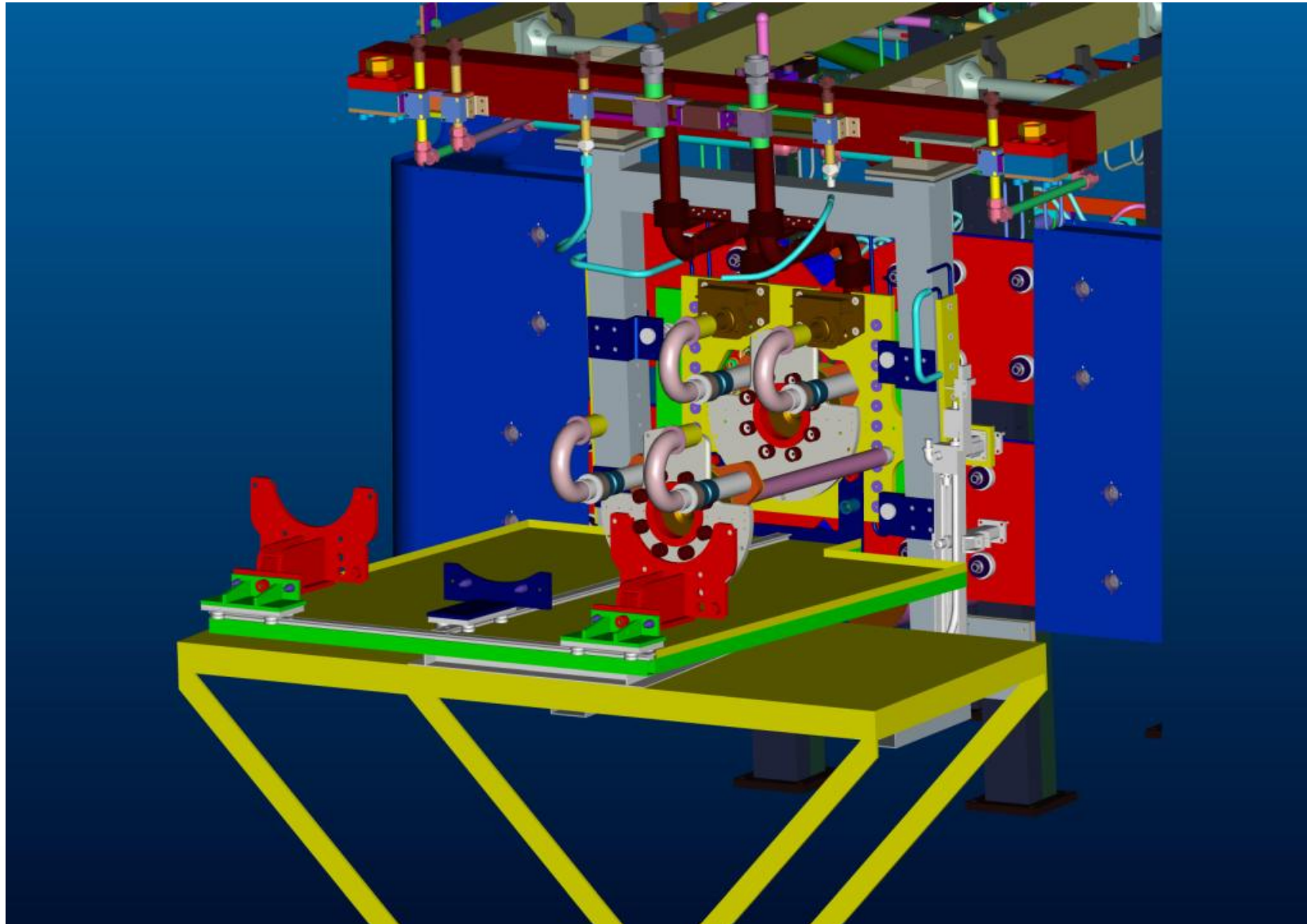
Changing a target



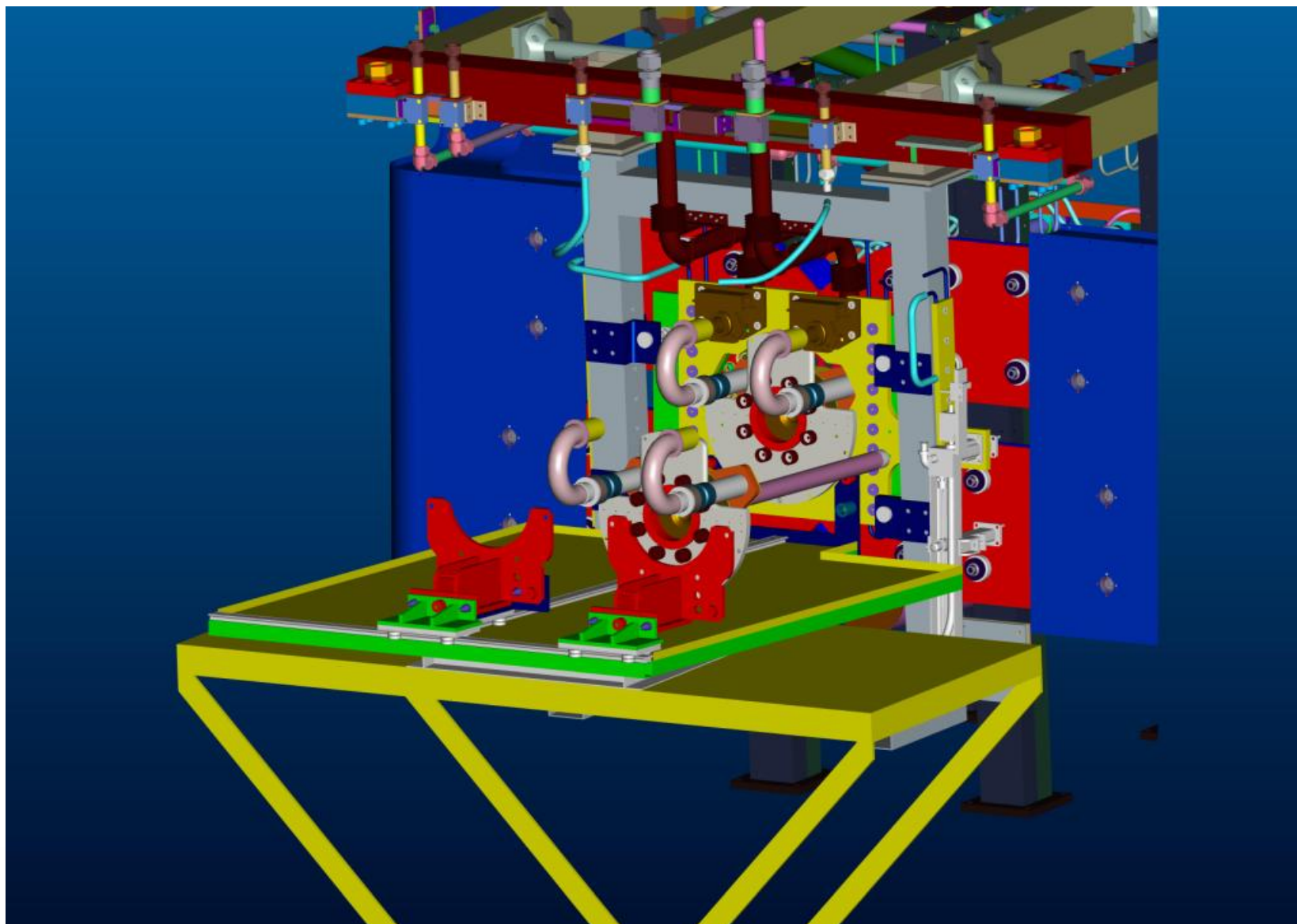
Changing a target



Changing a target



Changing a target

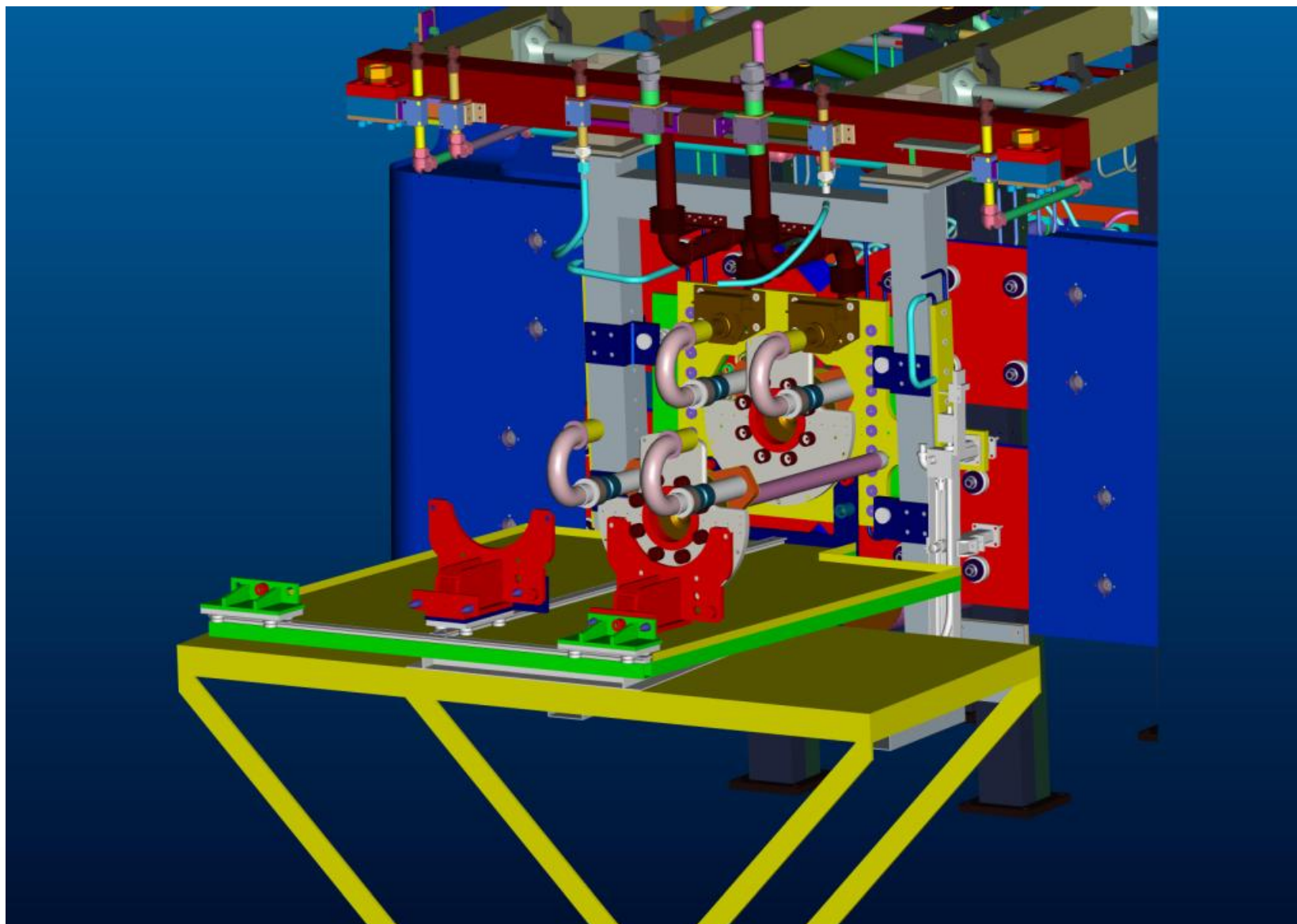


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Changing a target

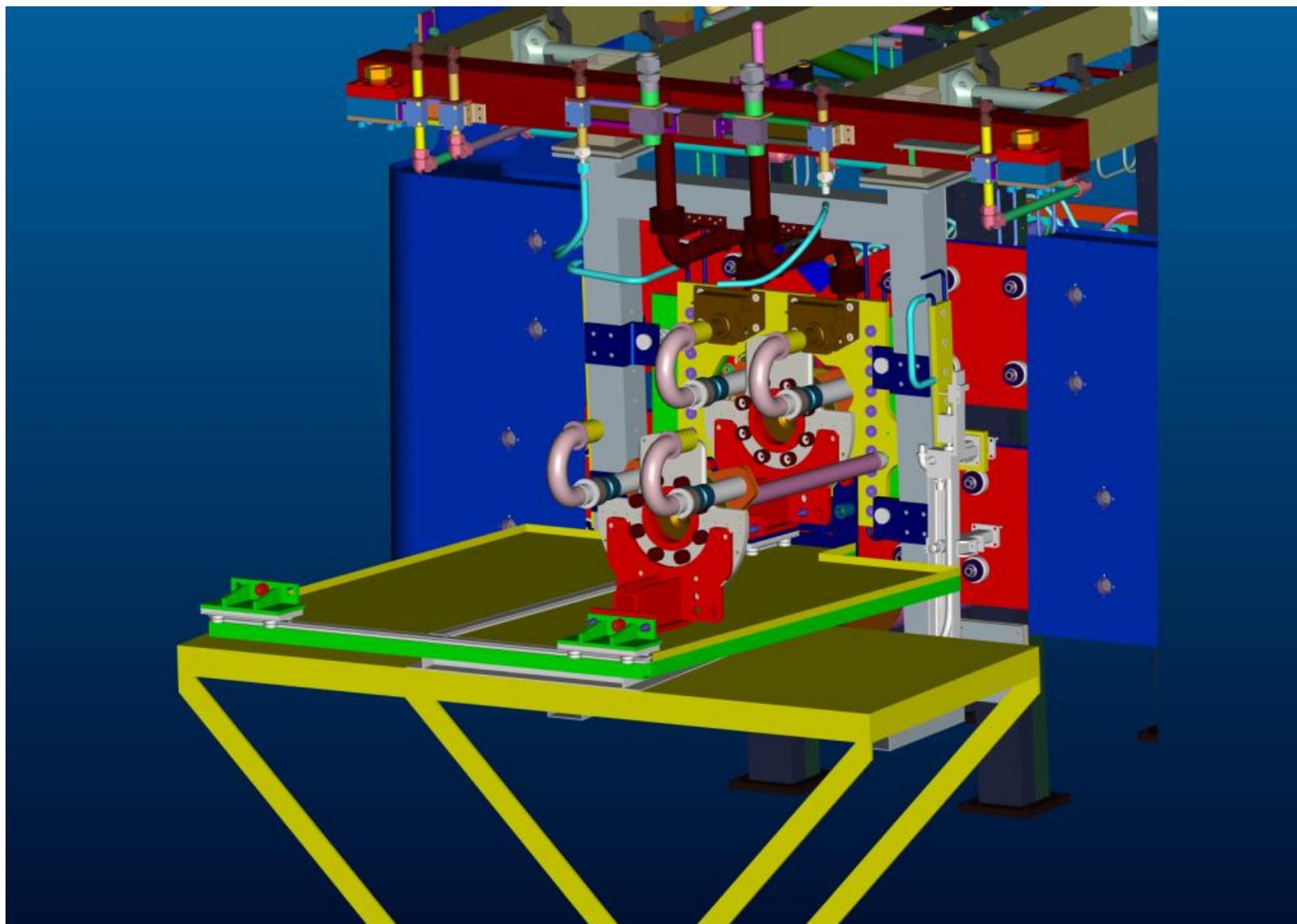


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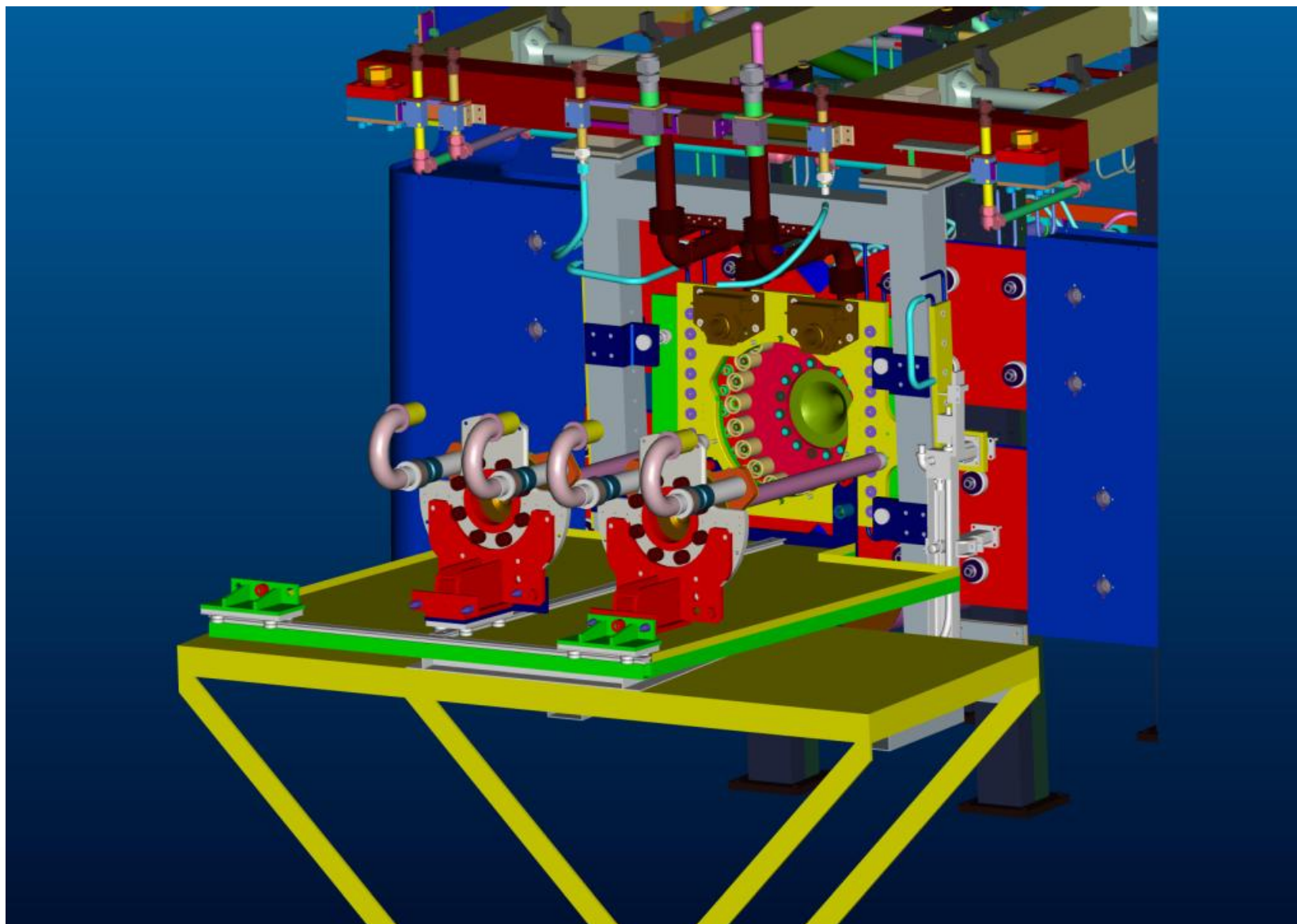


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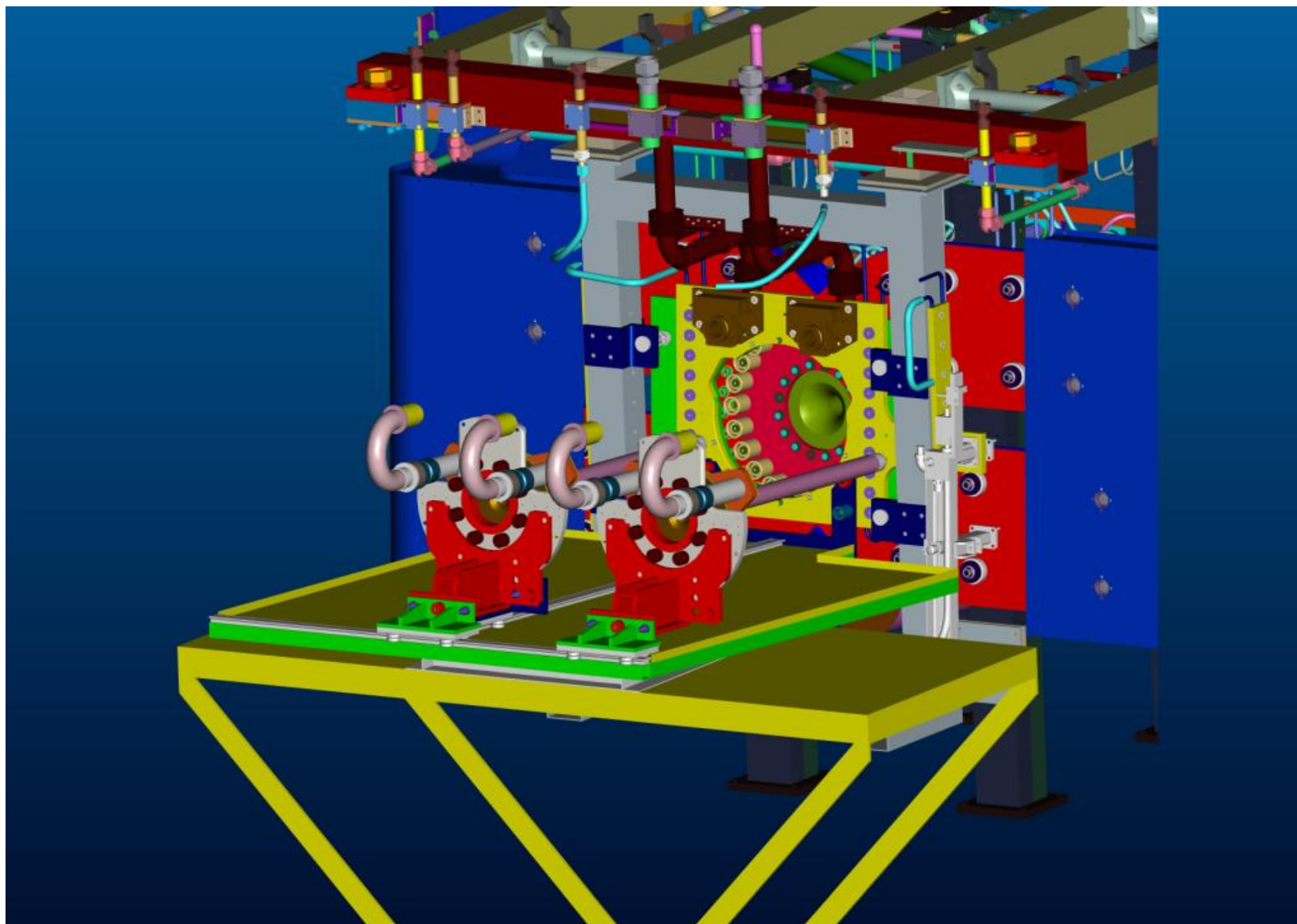
Changing a target



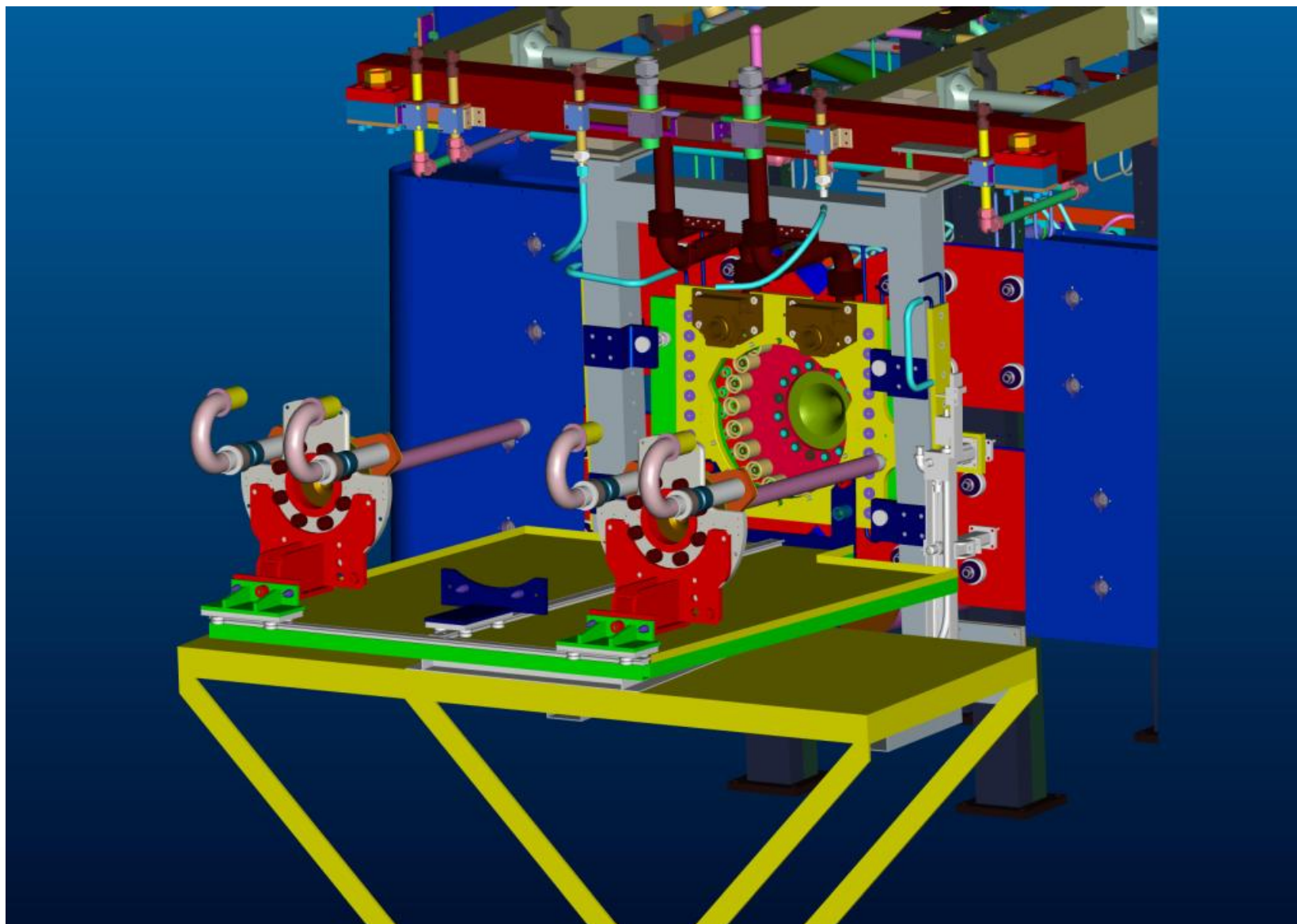
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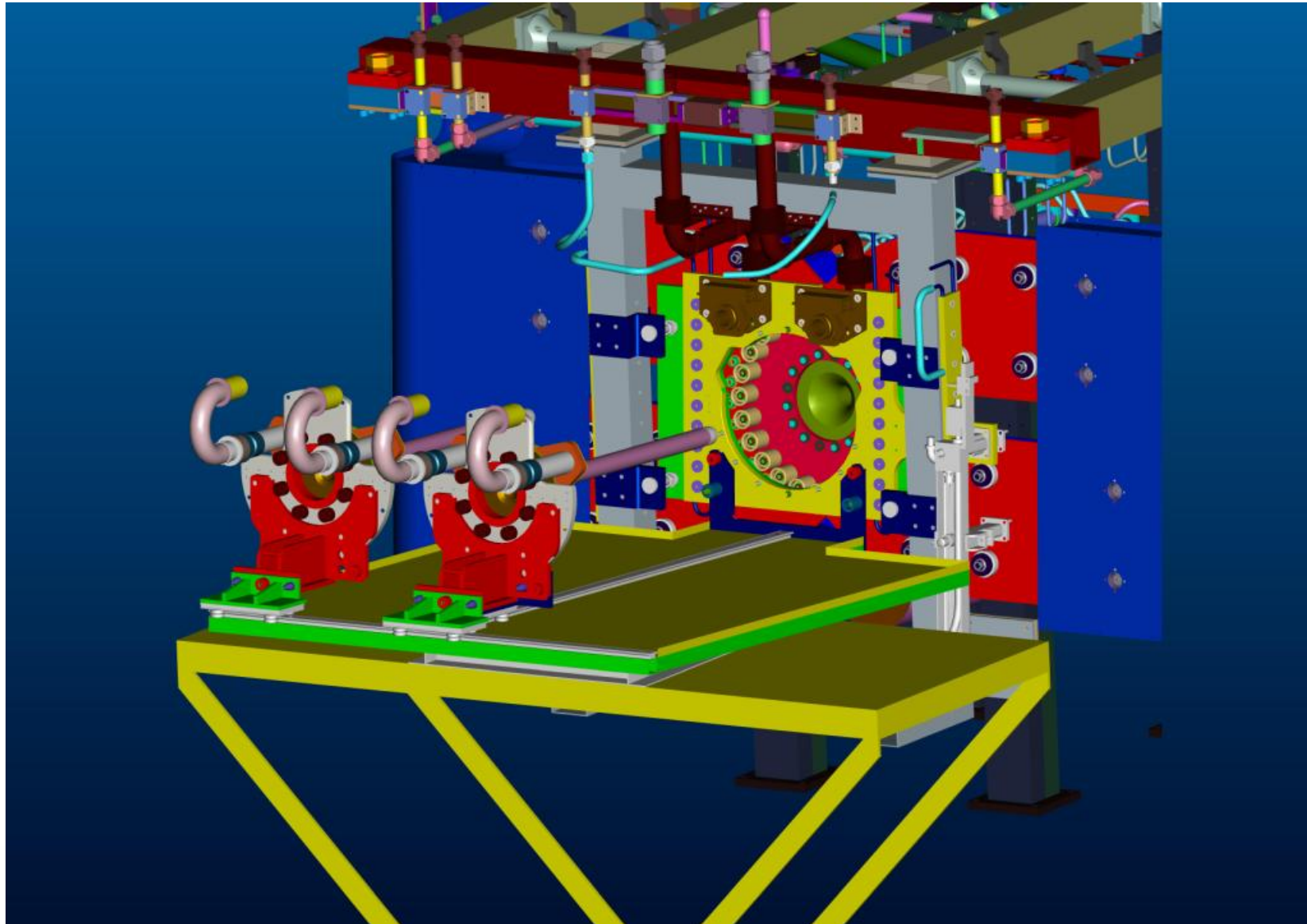
Changing a target



Changing a target



Changing a target

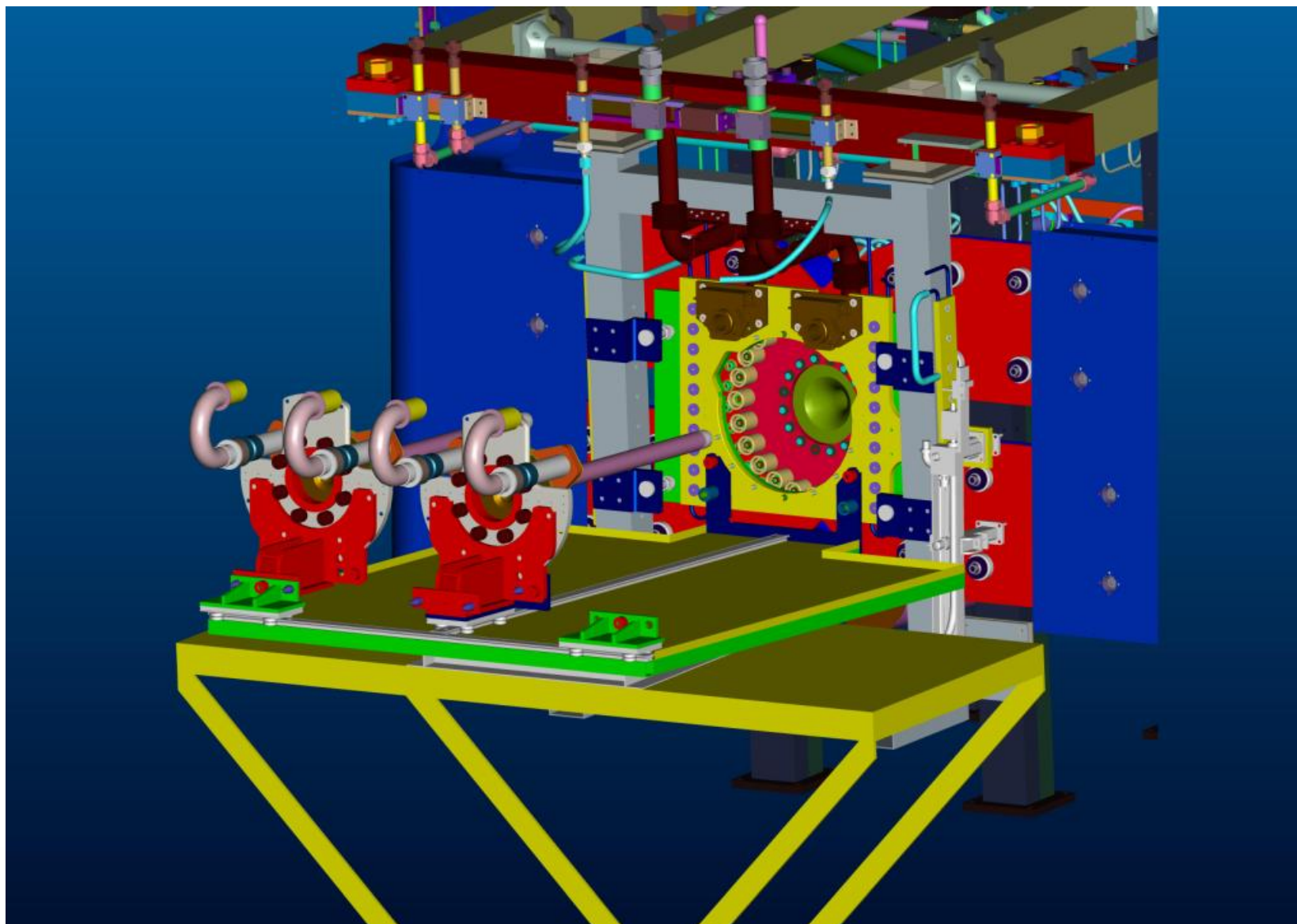


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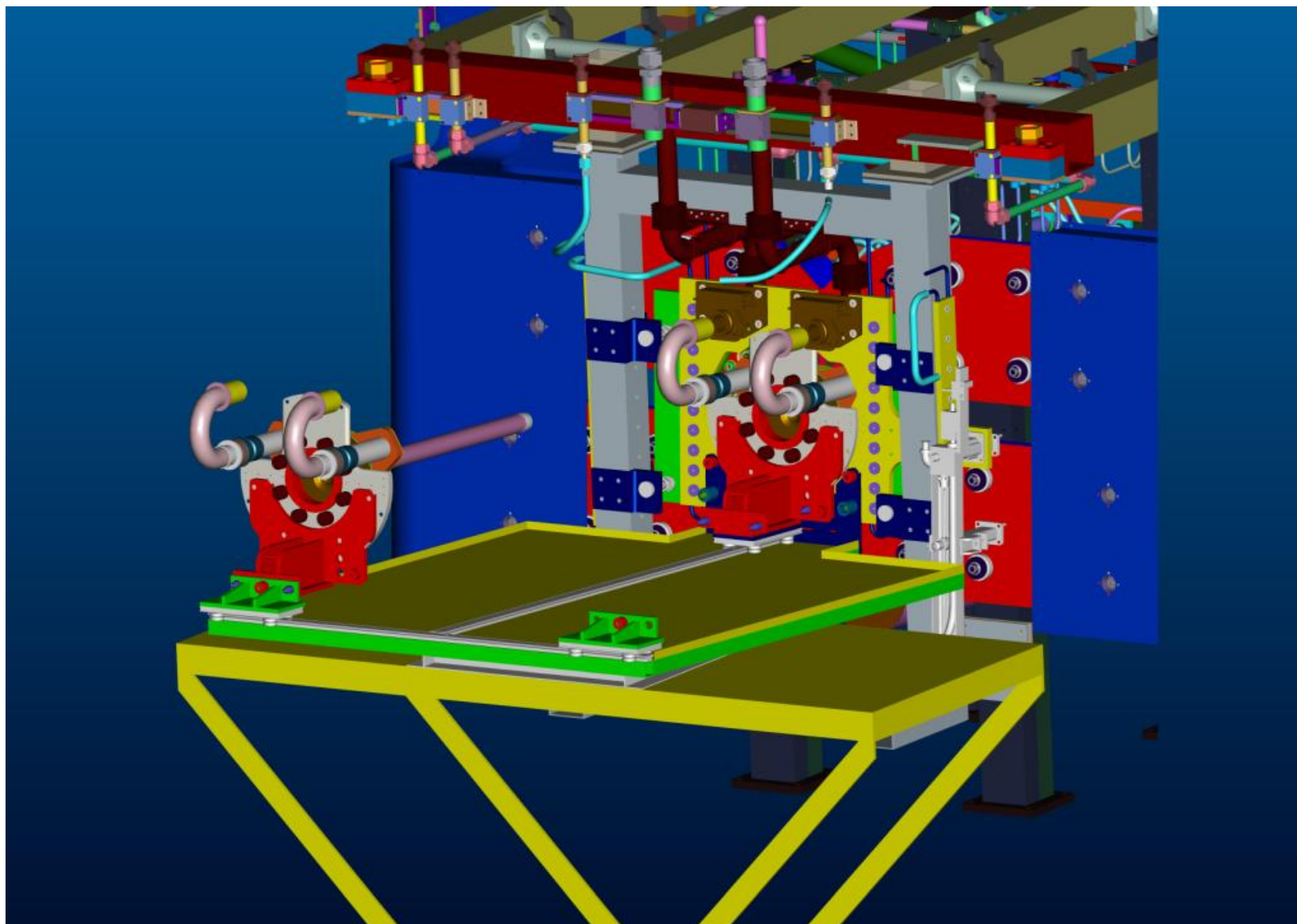


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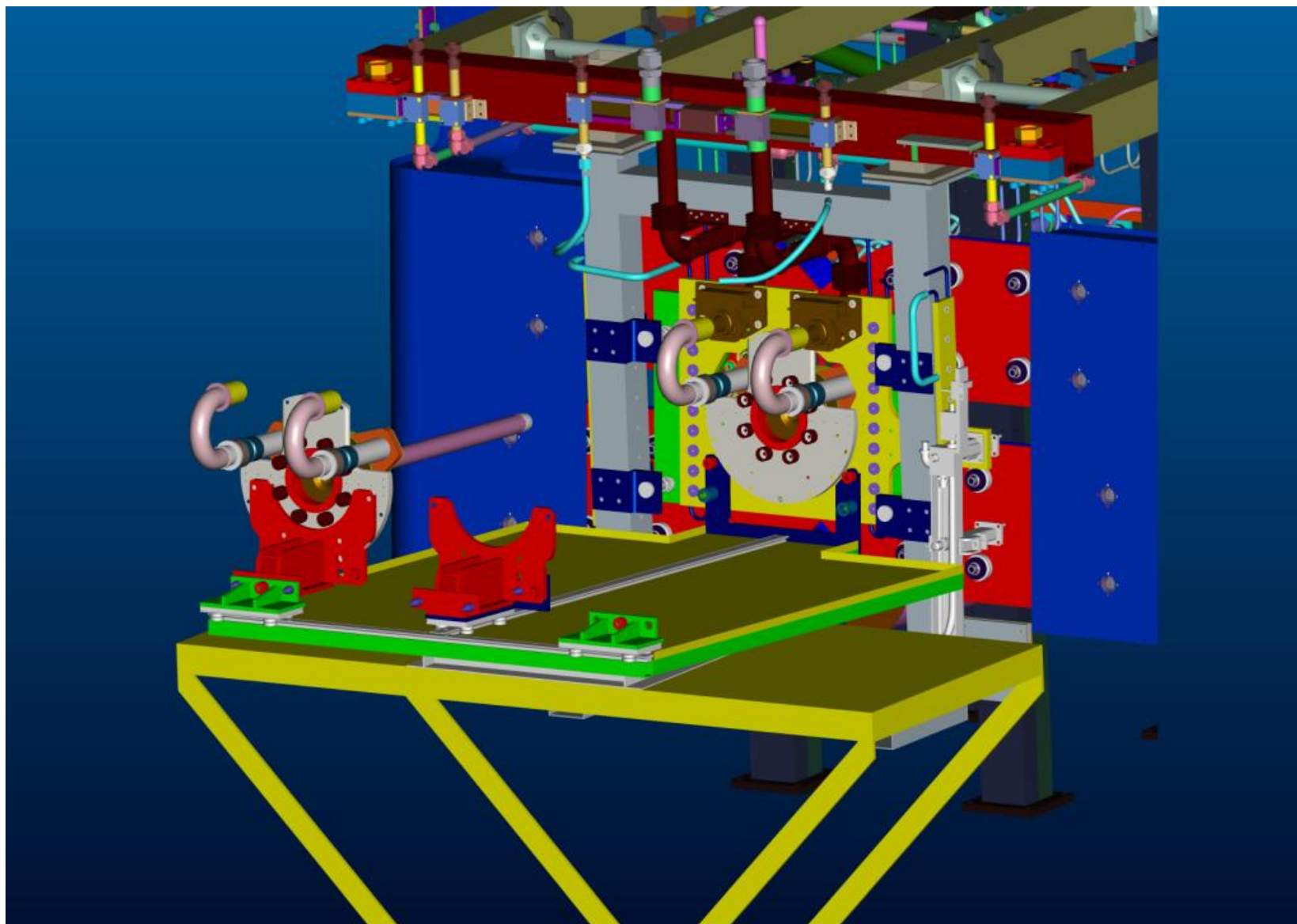
Changing a target



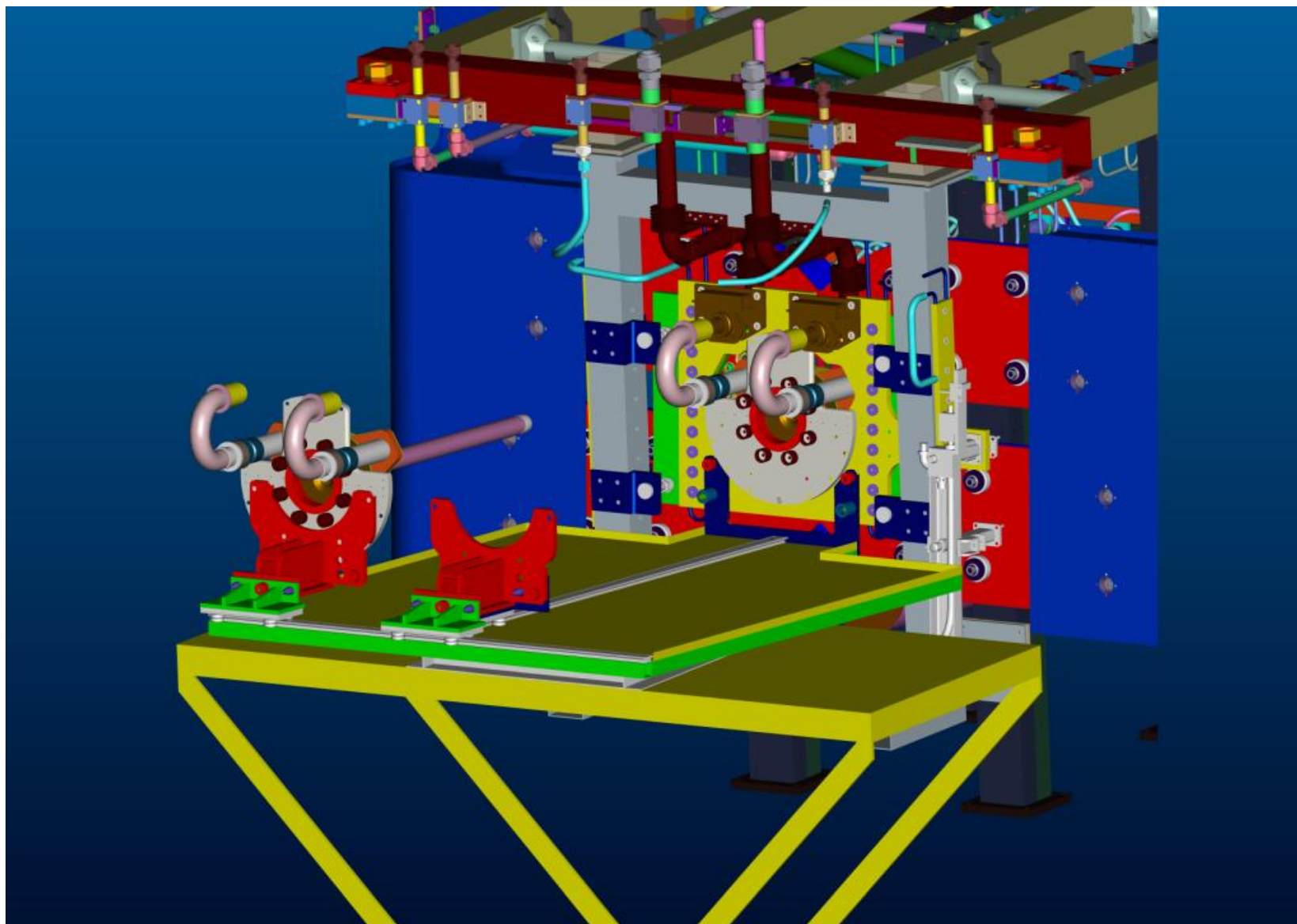
Changing a target



Changing a target



Changing a target

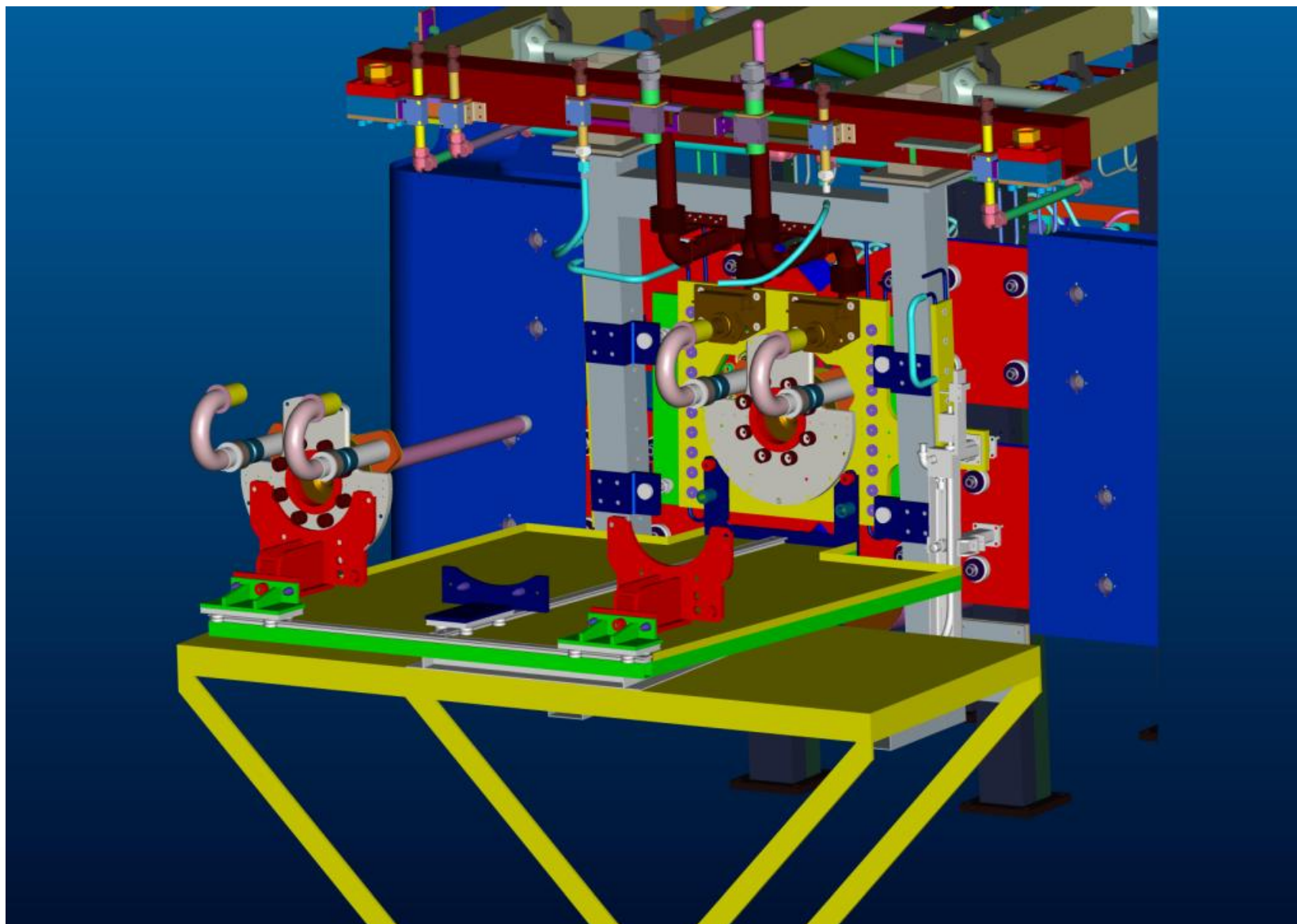


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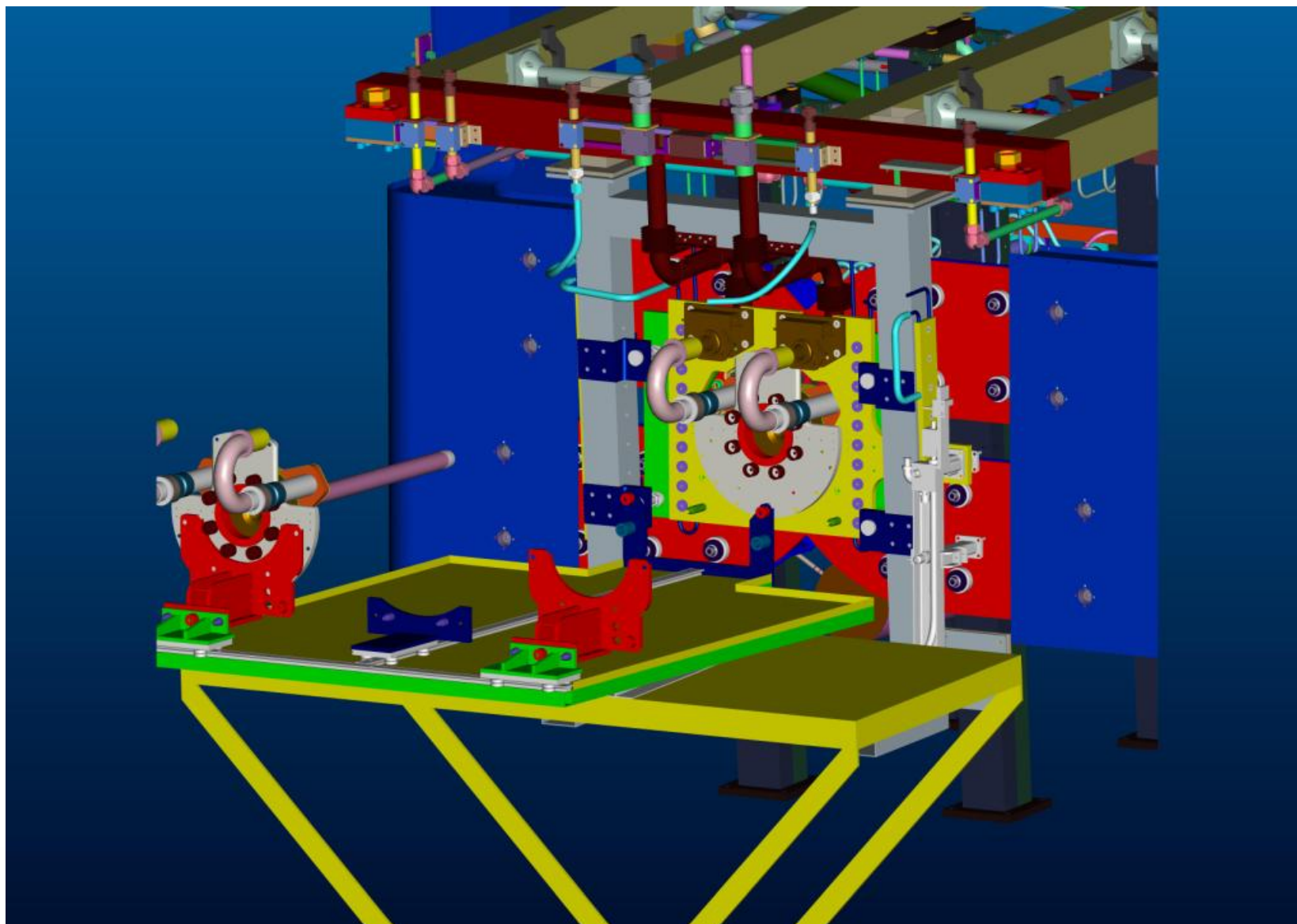


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Changing a target



Changing a target



Post-earthquake secondary beamline summary

- No significant damage of buildings or facilities reported
- Subsidence around buildings leading to damage of services
- Inspection inside helium vessel to begin in June
- Preparations now underway for complete replacement of 1st horn and target assembly with spare as a precautionary measure
- Replacement of target within horn 1 is possible if necessary



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