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30/11/2021

Development of Mech. Moving Systems for WCTE

WCTE Collaboration Meeting @ CERN

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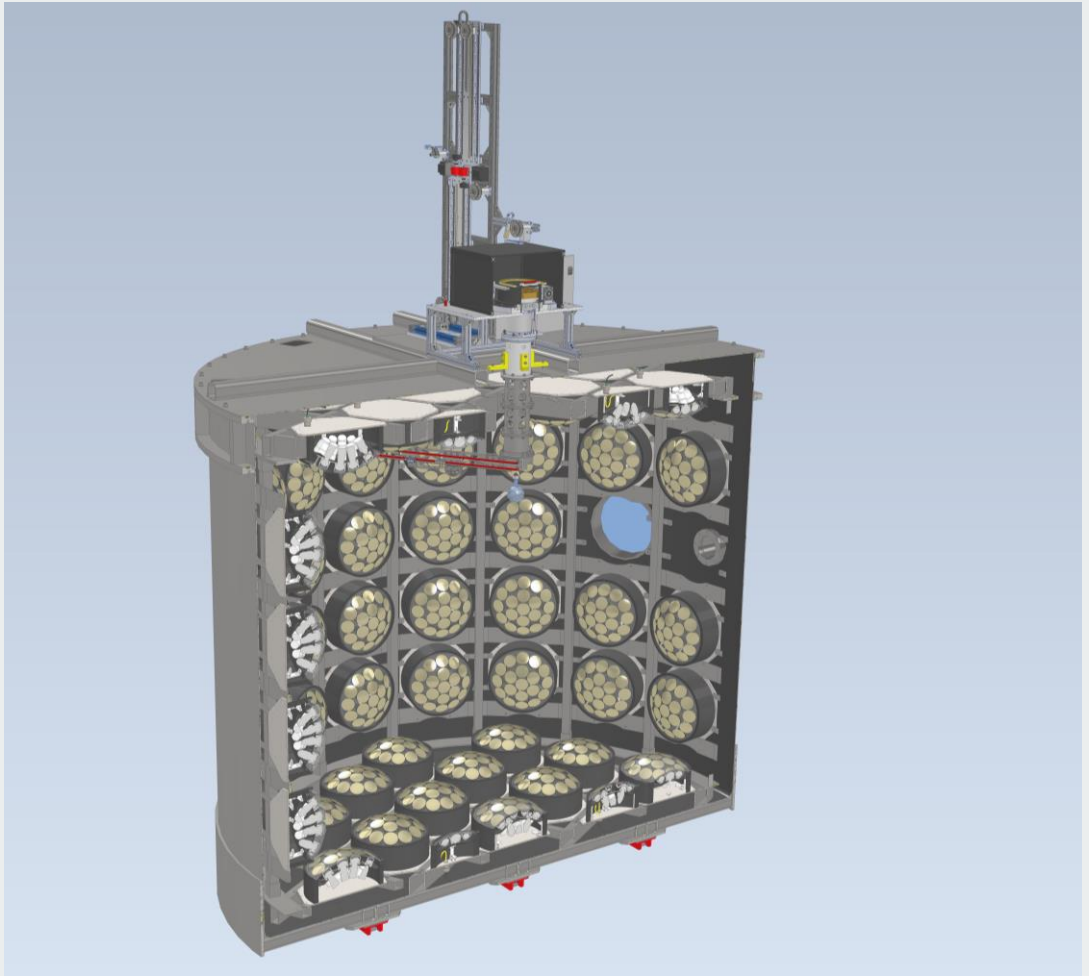
Topics

- Moving the Detector into T9
- Moving Between Beamlines
- Central Deployment System



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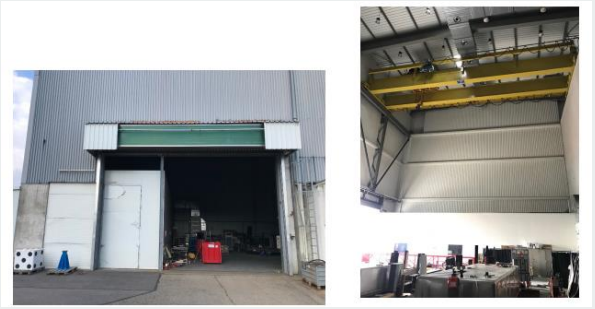
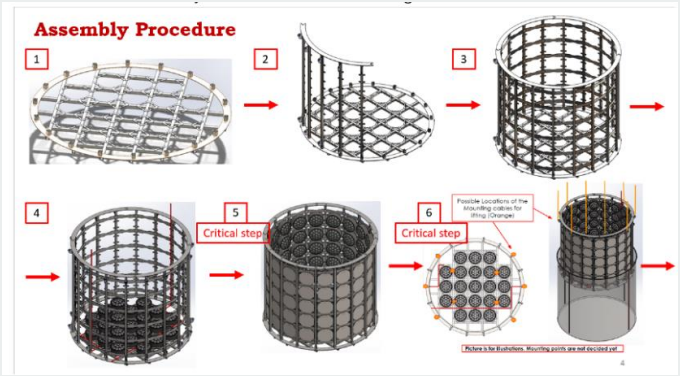


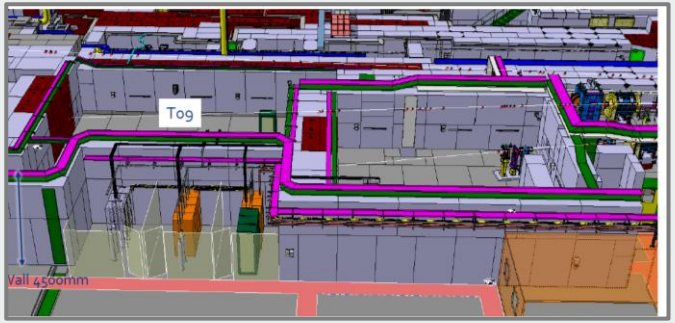
Gargamelle Hall Assembly Area?



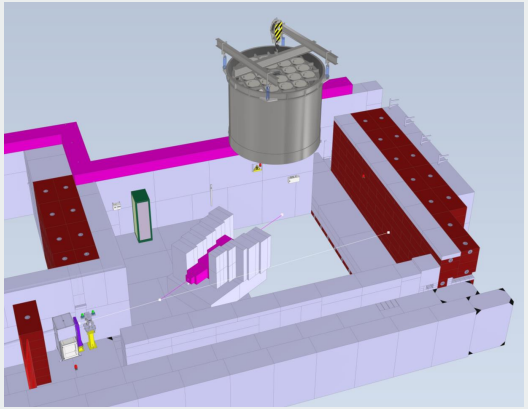
Assembly procedure by S. Garode

Example of Universal Lifting Beam

Transport to T9



T9 Experimental Area



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4 Row Version

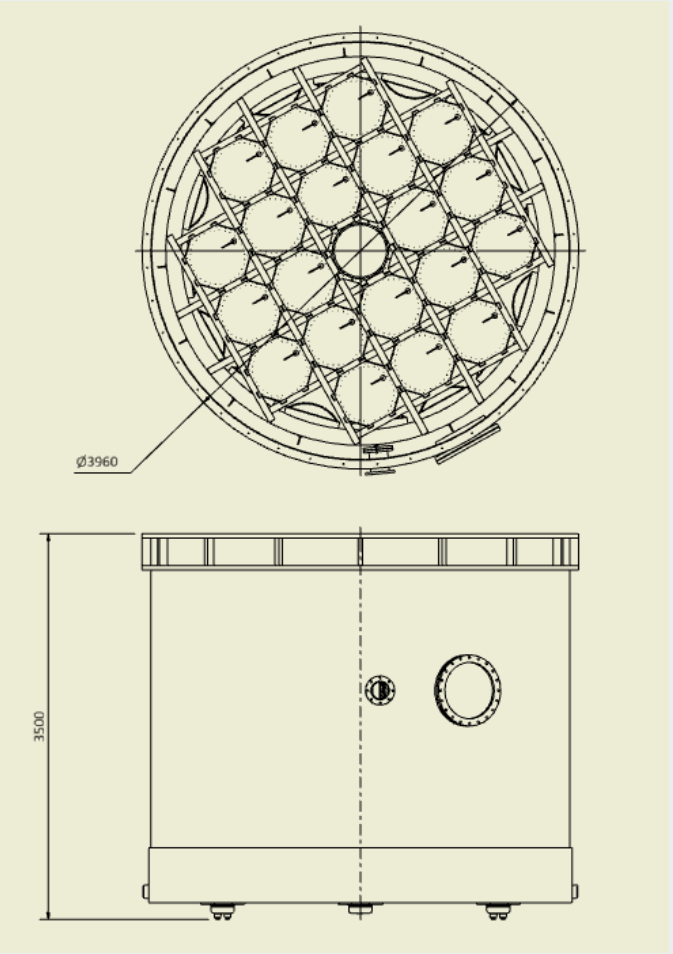
WCTE detector lifting requirements:

Ø3960 mm

3500 mm high

Mass ~12,000 Kg (TBC)

(for this instance, we are lifting without lid)



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Hook heights and shielding of T9&T10

A reminder of the T9 space and wall restriction:

Wall + Cable Tray = 4500mm

Hook Height = 9200mm (45t) PR-39

Hook Height = 9000mm (25t)

- PR-39:
  - Loads max: 45t
  - Hook height from the ground: 9200mm
- PR-67:
  - Loads max: 25t
  - Hook height from the ground: 9000mm

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Adjustable spreader beam

Can be used for detector / mPMT structure / lid / etc

https://www.pfeifer.info/out/assets/PFEIFER_LIFTING-TURNING-DEVICES_PPEN.PDF

1 Adjustable spreader beam with low construction height
Cross beams on top for low heights, cross beams can be used individually. Carrying capacity 15,000 kgs.

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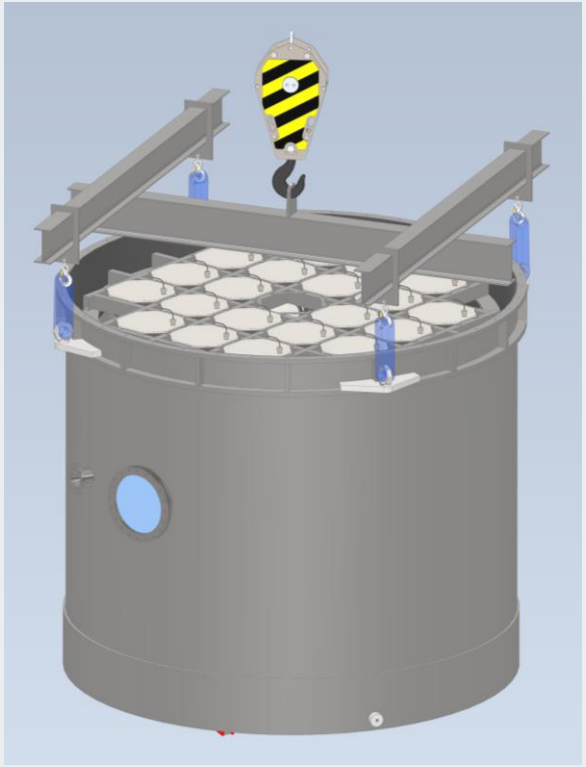

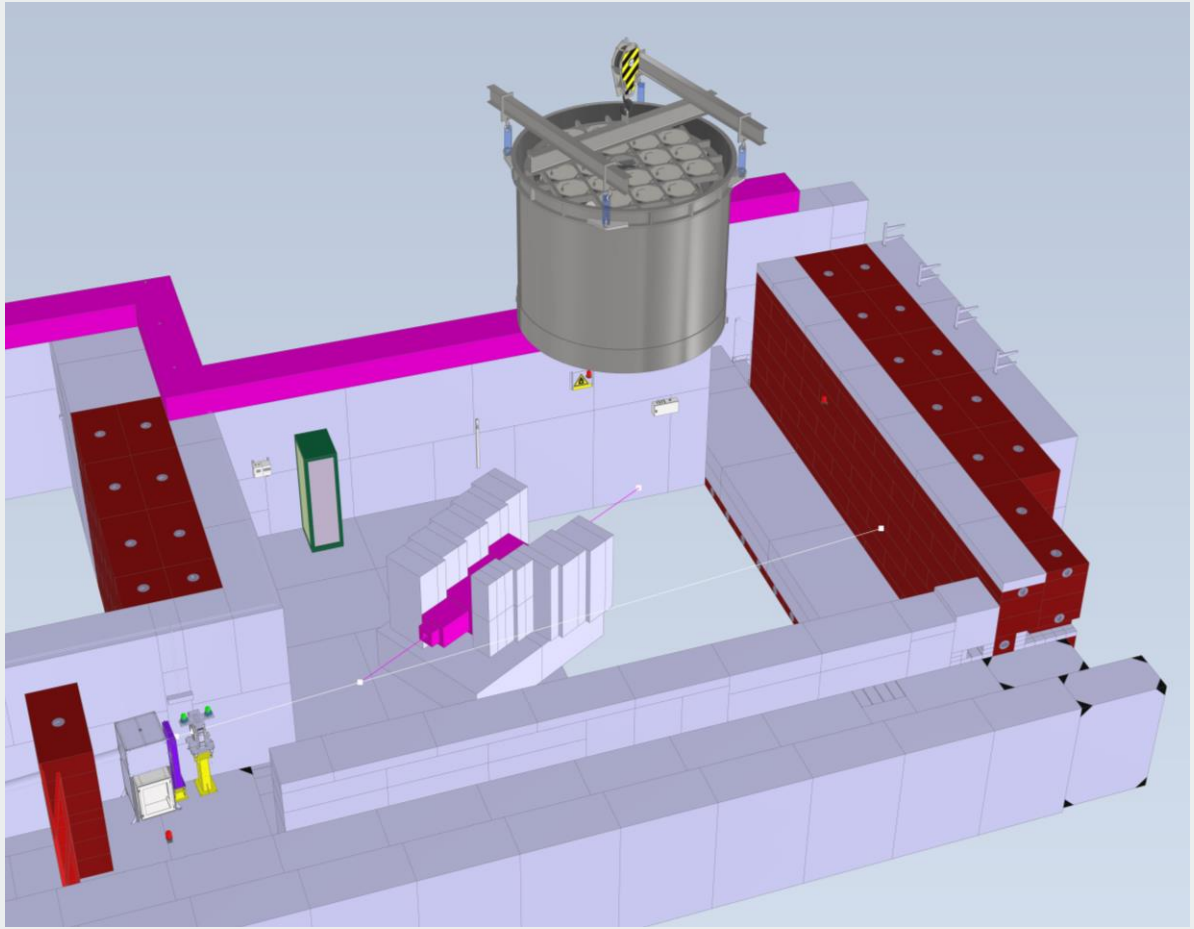

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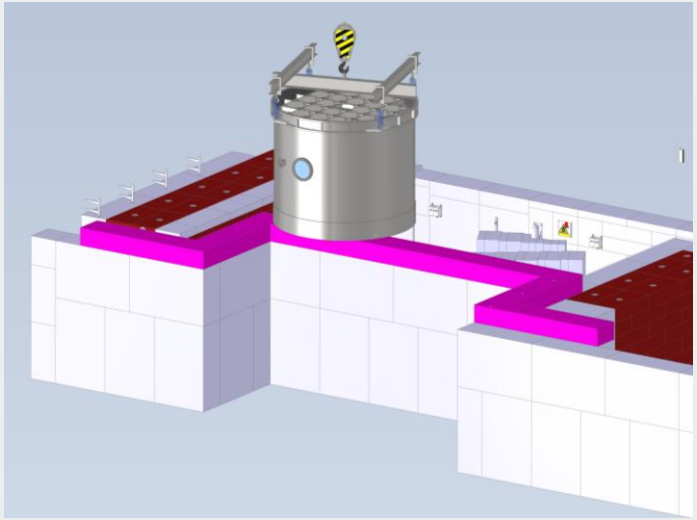

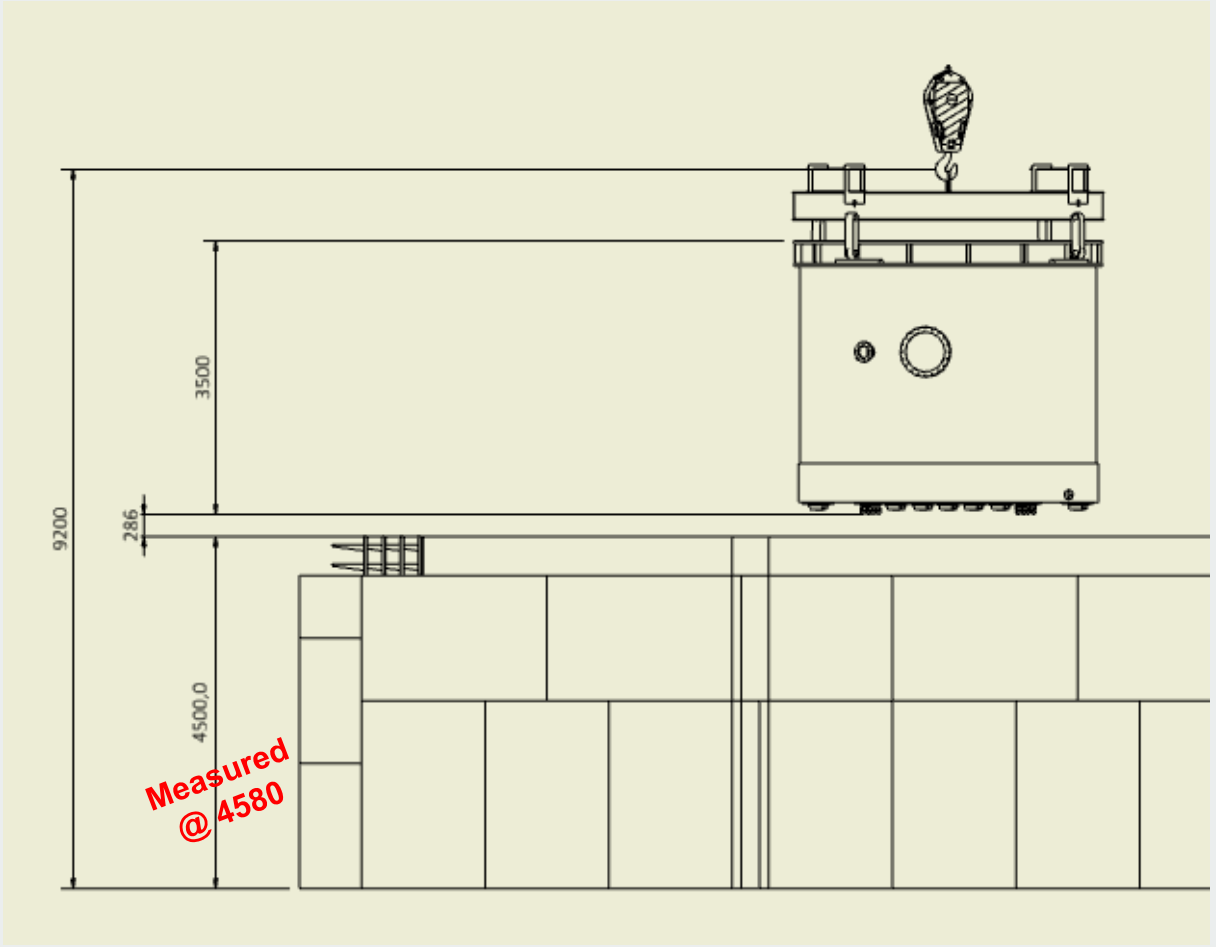

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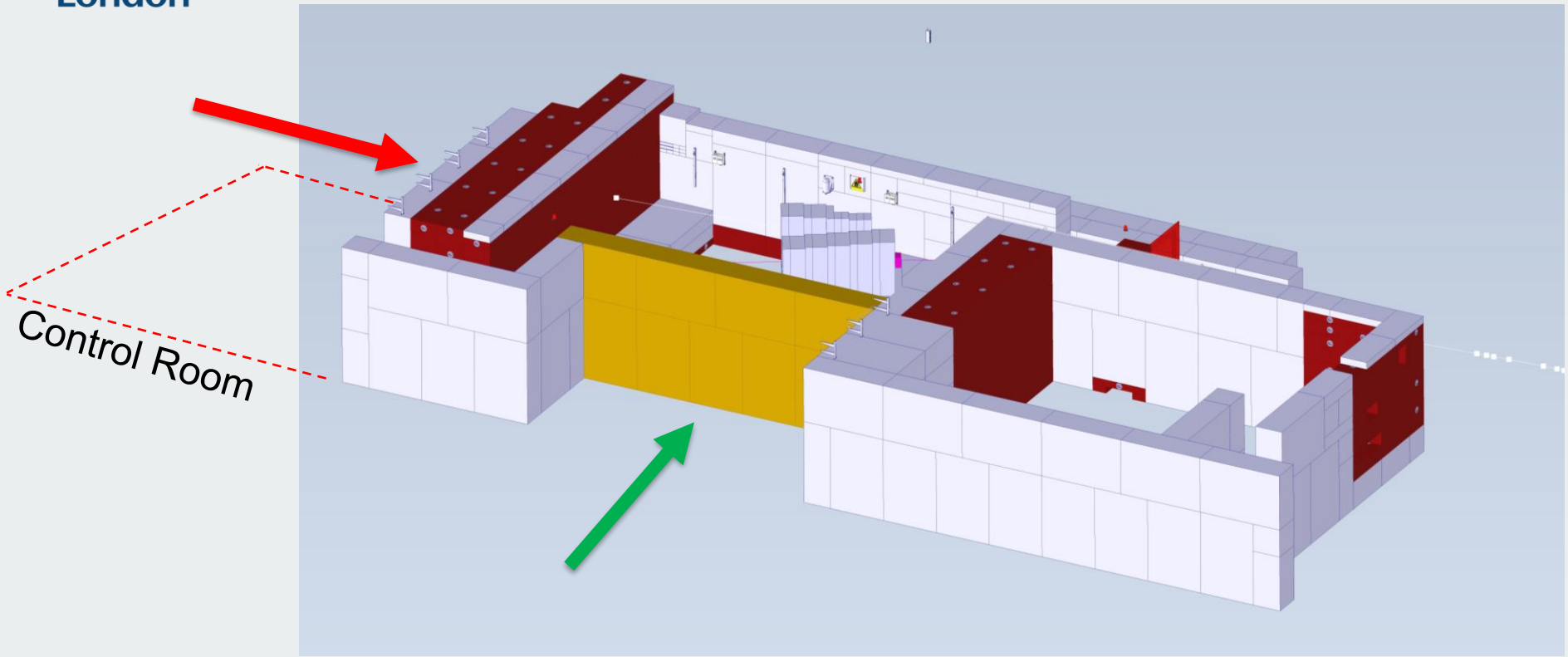

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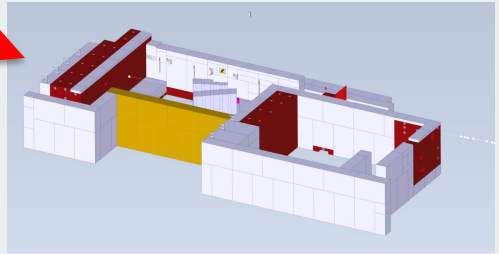
Alternative lift into T9?



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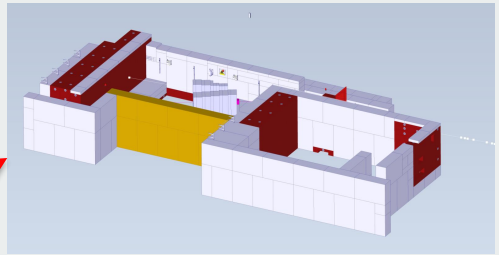

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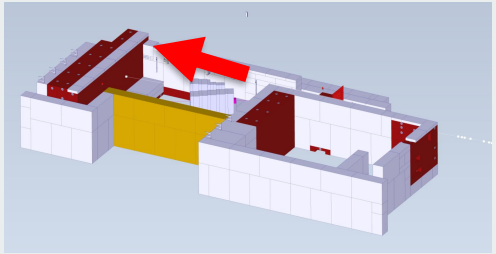

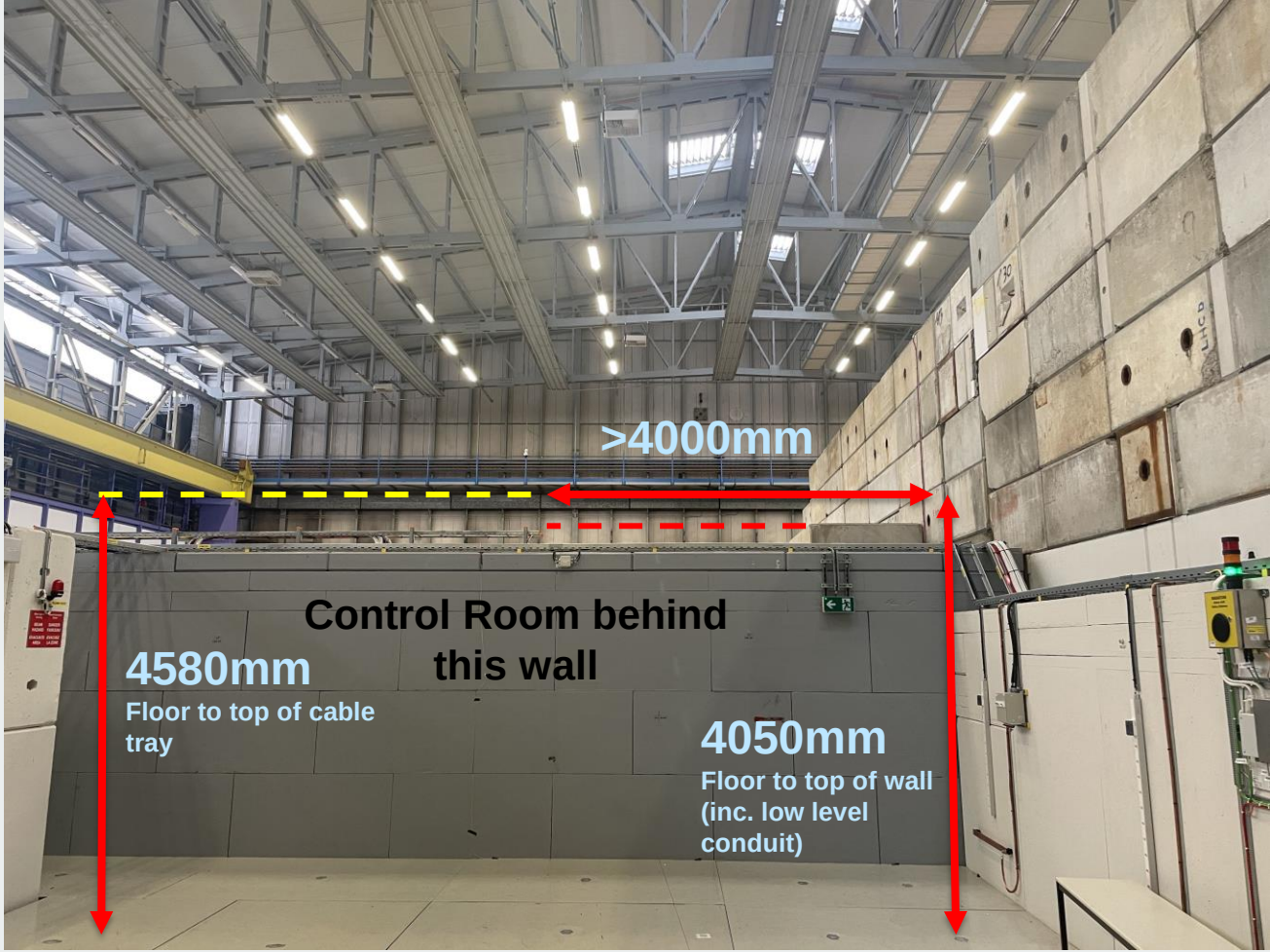

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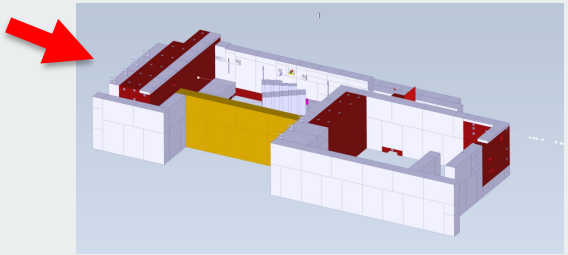
Possibly remove x4 blocks



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Summary of lifting:

- Possible gap in cable tray meaning a 4050mm wall to clear, lifting over the control room
- Custom lifting frame needs to be designed and manufactured
- CERN crane drawings to be investigated and models to be produced
- The findings from today to be discussed with transport group, Abubakar / Catarina in coming weeks

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Topics

- ~~Moving the detector into T9~~
- Moving between beamlines
- CDS

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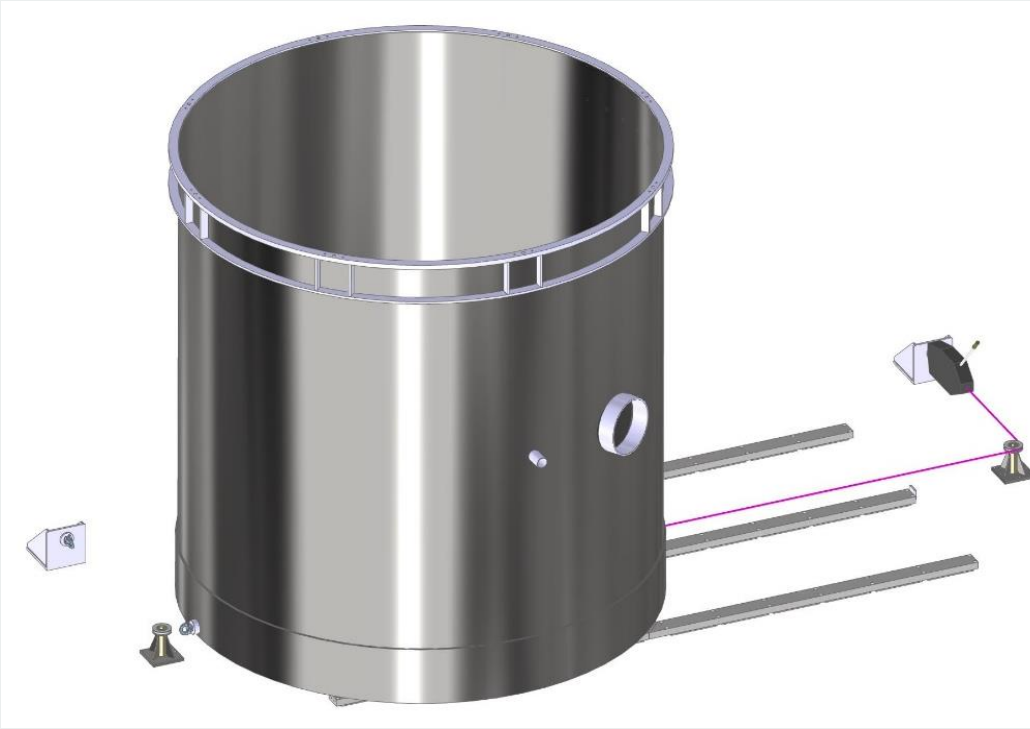
The transition of the detector from tertiary to secondary beam position is to be done by a set of mechanical rollers moving along a rail system

The force to move the ~51,000Kg is to be generated by a manual ‘wire rope puller’,

The detector mounted on 3 rails, shown in the tertiary position. At either end of the rails are a pulley and anchor point



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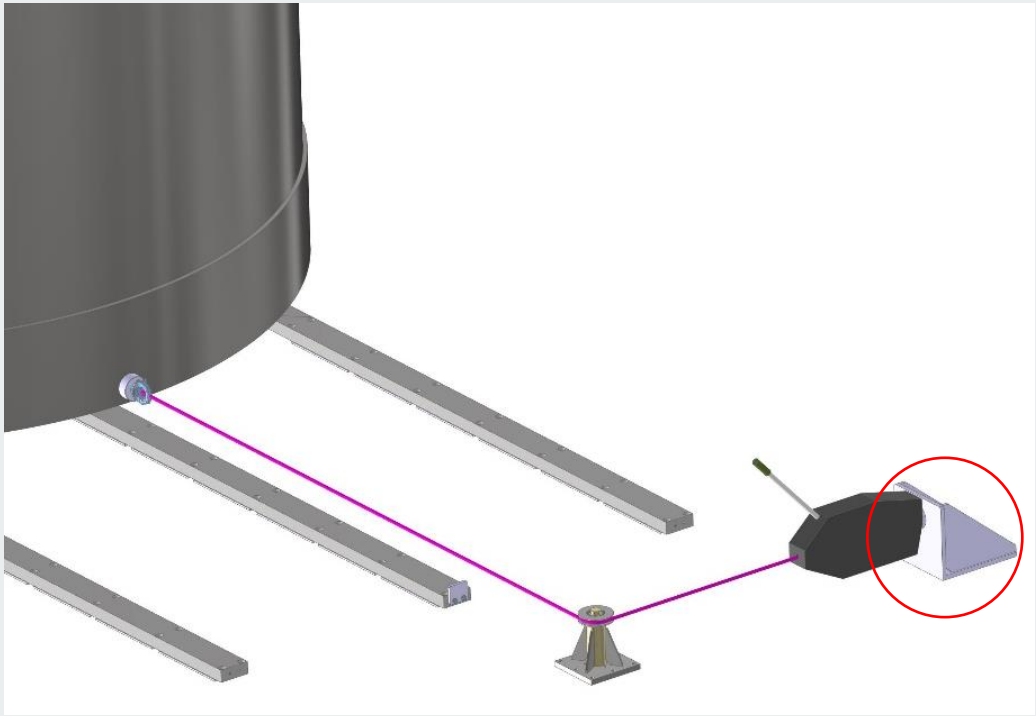
- A floor mounted bracket that is fastened to the concrete foundation by specialist bolts
- This provides the position to which one end of the wire rope is attached



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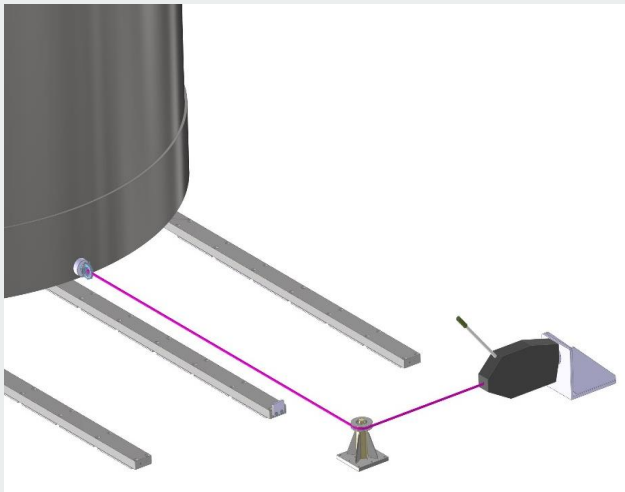
- A hand operated wire rope puller, a telescopic leaver is used to mechanically pull the wire rope through the device
- Keeping a tension on the rope and pulling the detector along the rails

TRPA (Aluminium)



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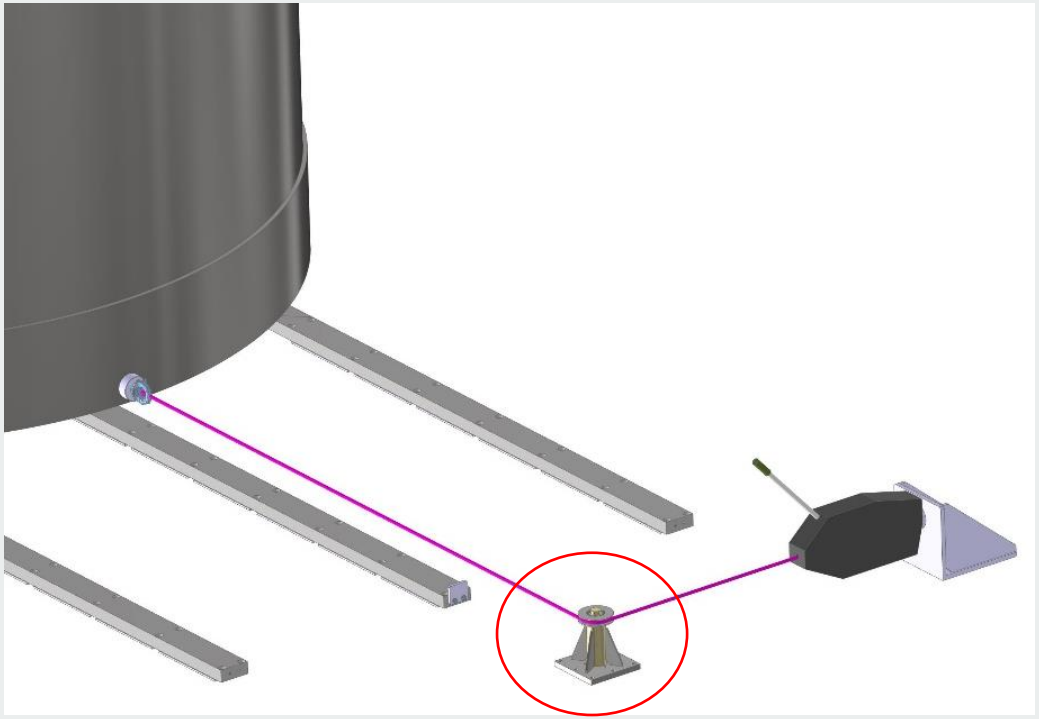
- This allows the wire rope to be directed through 90 degrees, allowing the system to fit inside T9 experimental area
- Again, fastened to the floor with bolts



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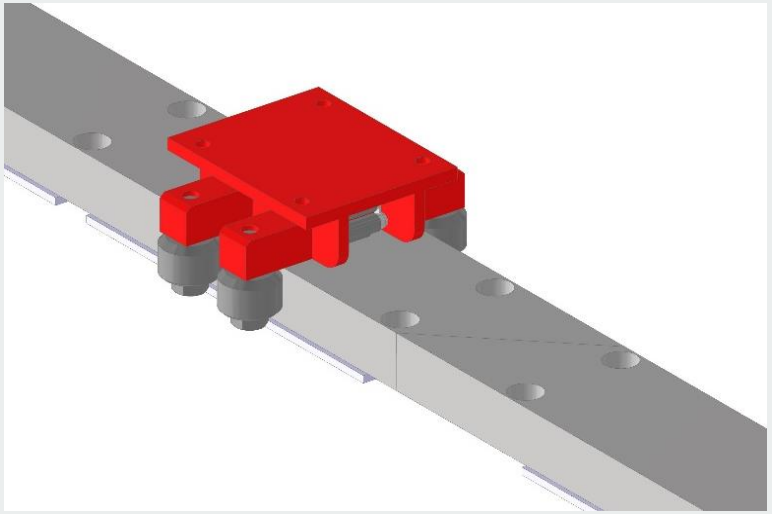
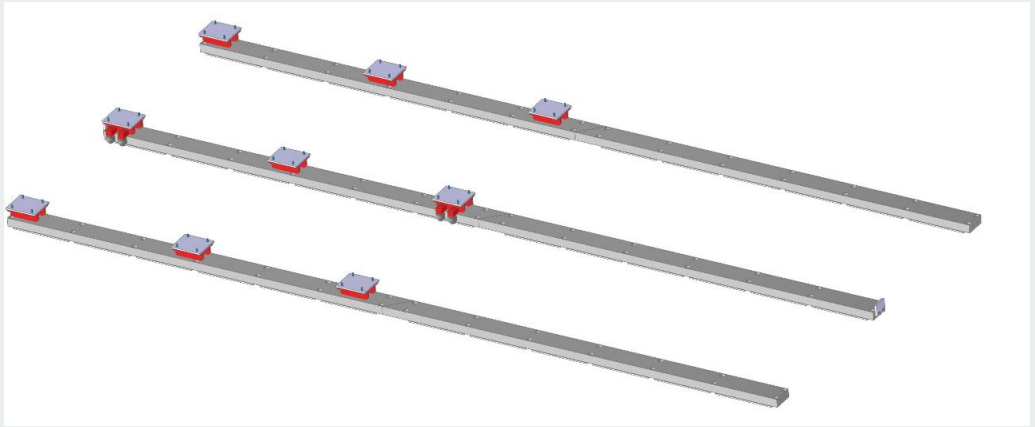
- X3 steel rails 150mm wide by 60mm thick bolted to the floor of T9, manufactured from steel, along which x9 skates will move.
- Each skate has cylindrical rollers that move over the rail
- Rails fastened to floor with multiple bolts
- Final length of rail TBD





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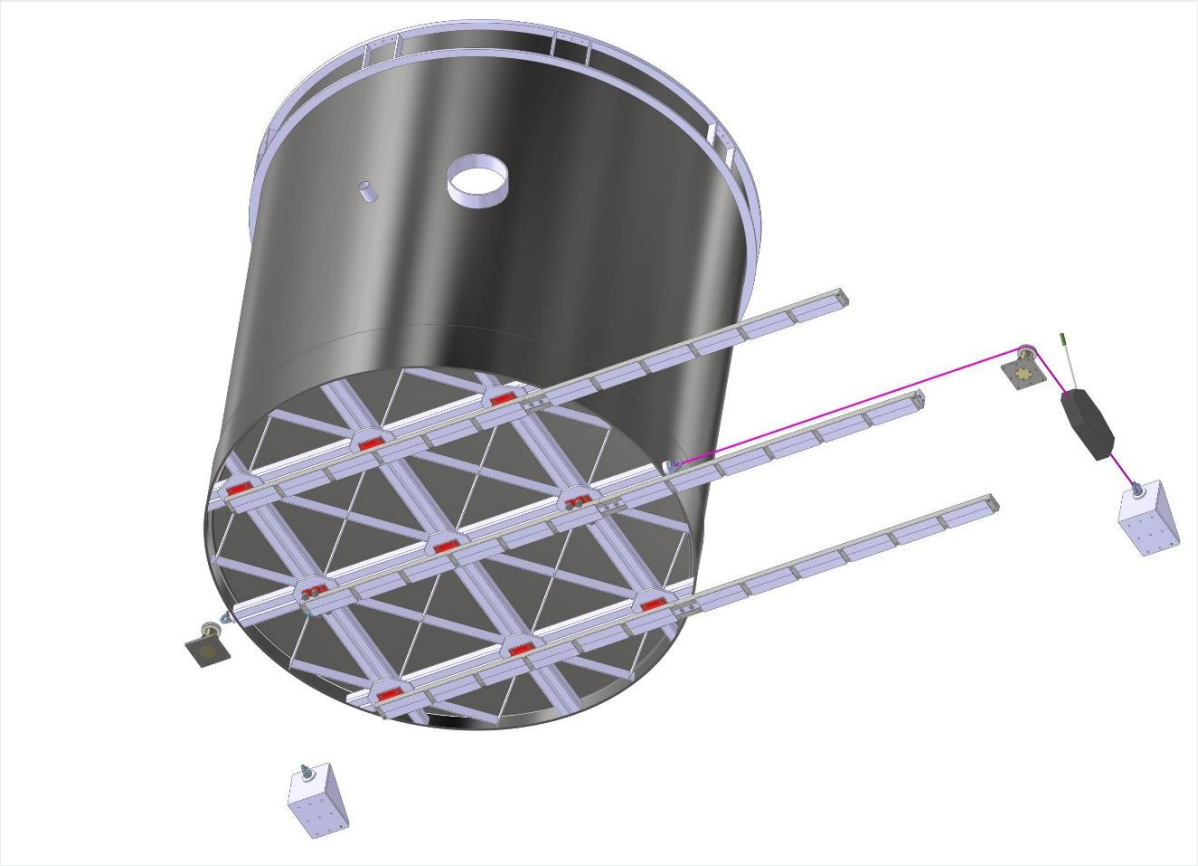
- Figure, right, shows the underside of the detector
- The x9 skate positions can be seen affixed to the detector vessel by means of a reinforce steel fabricated structure,
- With cross beams to strengthen the underside of the vessel.



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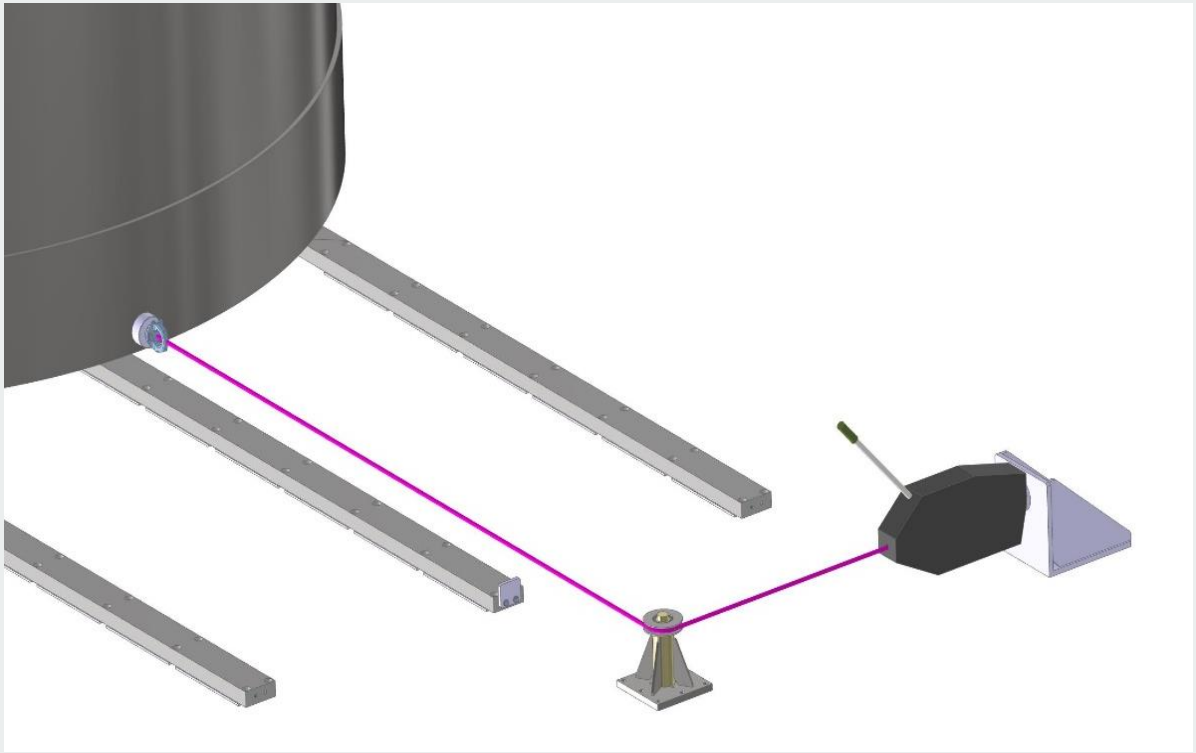
- There is a fixed point on the base of the detector and a 16mm diameter wire rope is connected at this point as shown

- The wire rope passes around the pully and into the rope pulling machine, which is in turn connected to the anchor point.

- When the lever on the rope puller is operated the wire is pulled through the system and thus the detector vessel moves along the rail.



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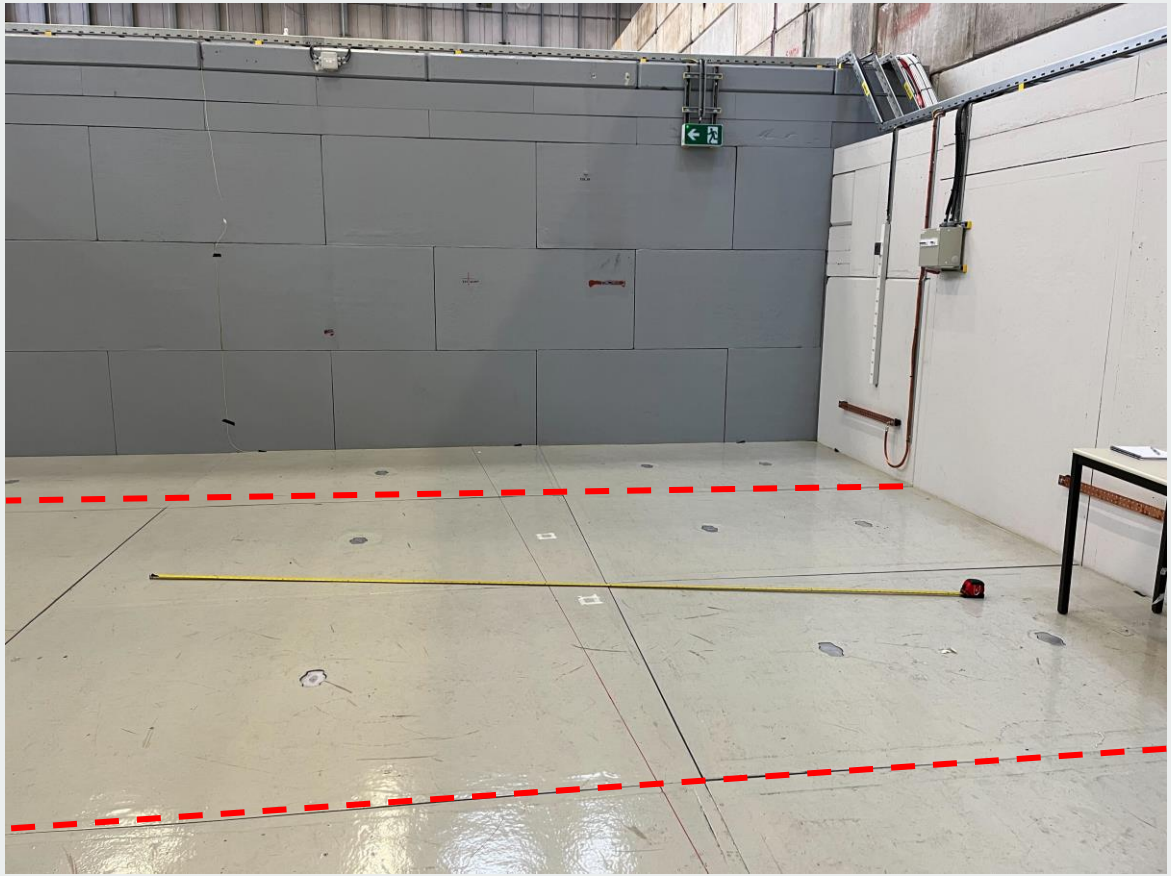
- Removal of floor blocks as shown in diagram
- X2 layer of concrete and x1 of iron shielding
- Floor to be assesses and bolts type to be identified
- Floor loading to be checked
- Room measured at 8045mm



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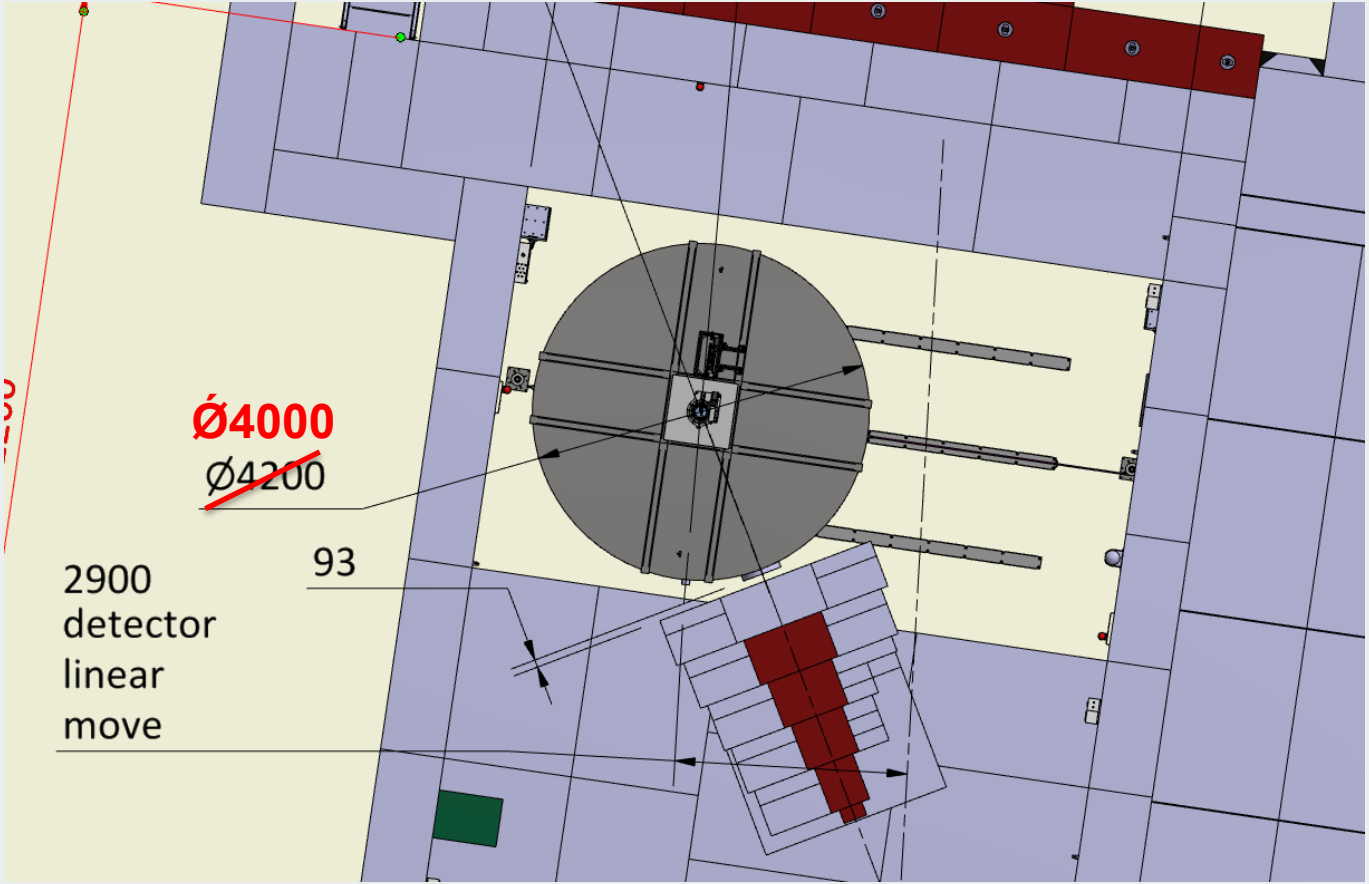
Summary of Moving:

- Work needs to be done to fit, <8000 wide to fit T9
- 3D model of collimator / Tof / other apparatus to be updated
- From this the linear distance can be determined
- Work alongside CERN engineers to complete system
- CERN have recently moved a similar mass along rails



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Topics

- ~~Moving the detector into T9~~
- ~~Moving between beamlines~~
- CDS

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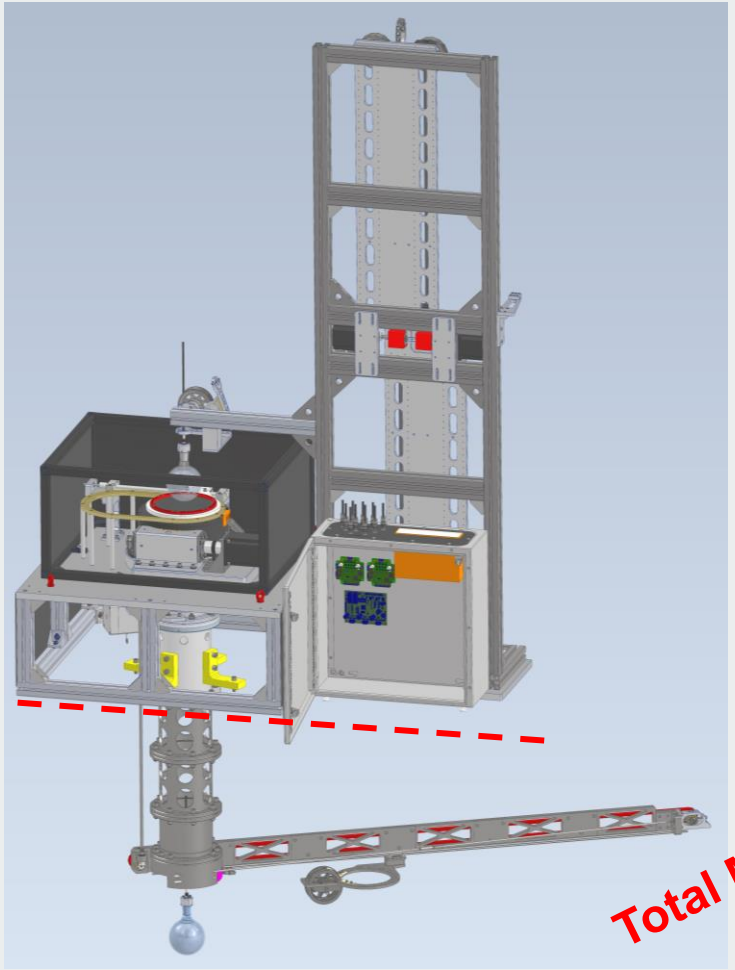
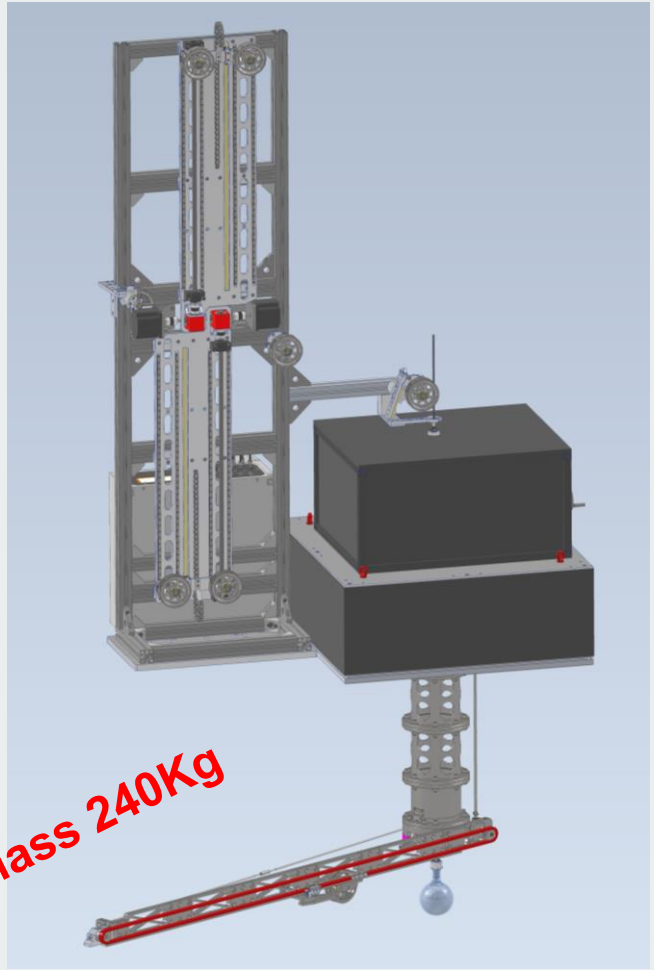
Design around 85% complete

Prototype around 60% complete

Testing and evaluation in Q1 2022

Manuf. Final version Q2 2022





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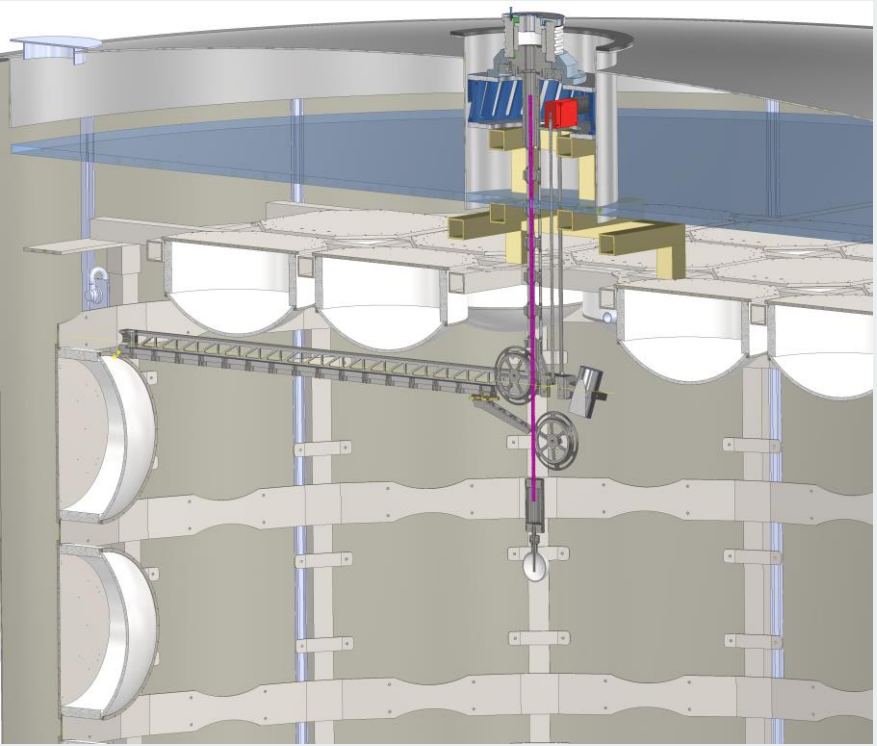

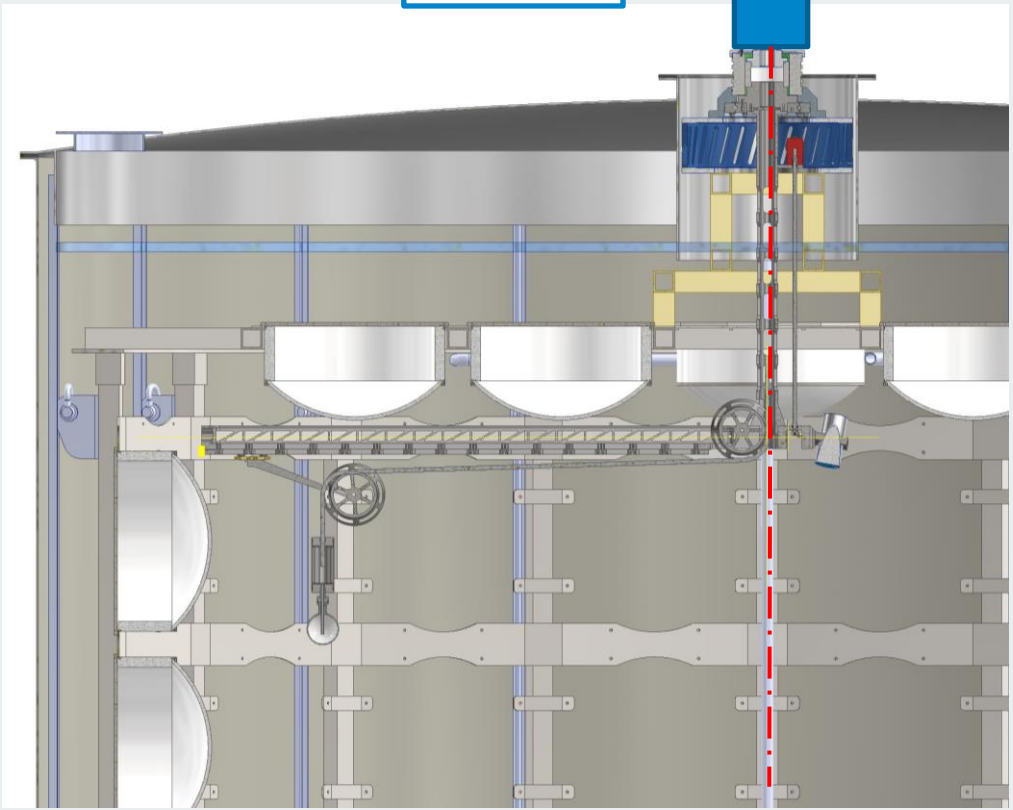

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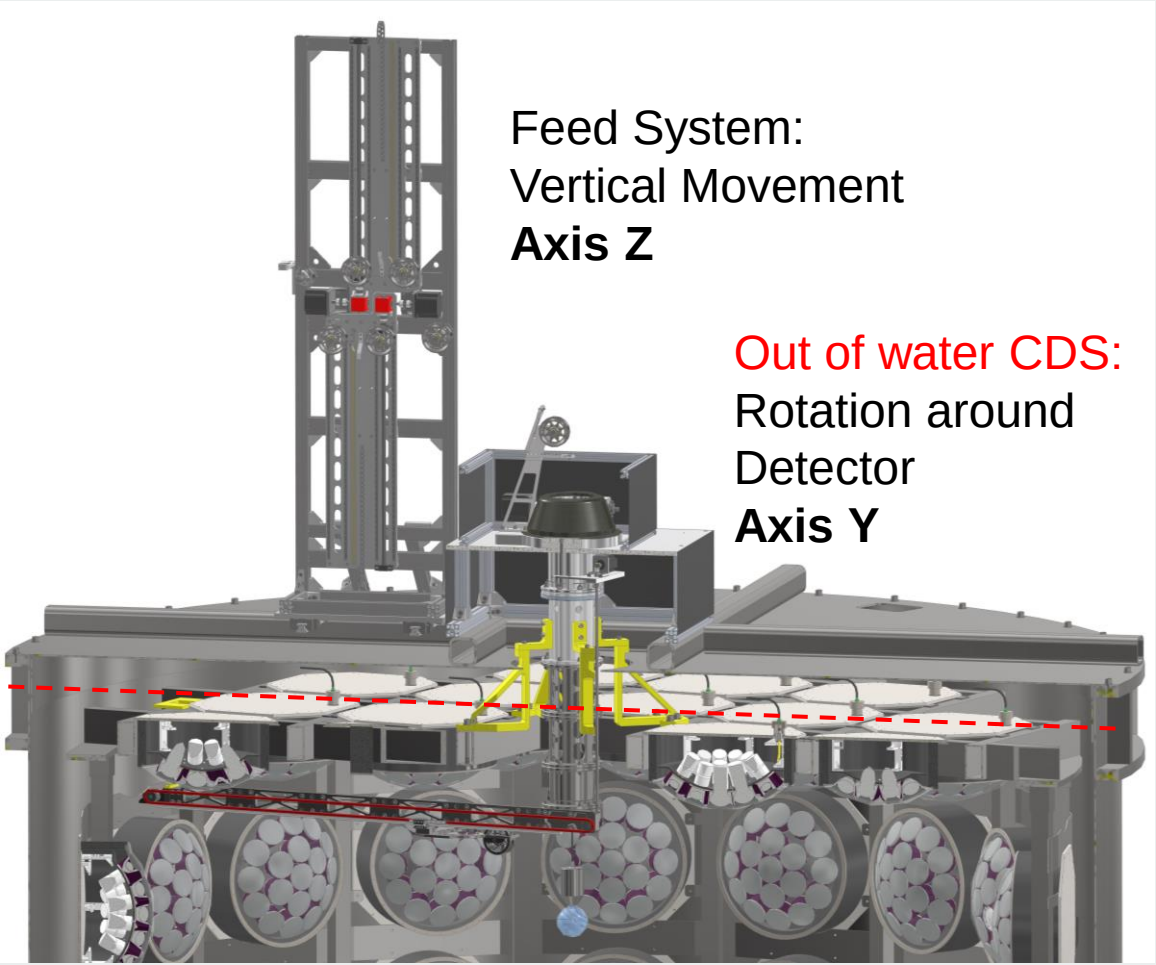
3 Axis System

- X – Laser ball from vertical center line, radially to edge
- Y – Rotation around tank +/- 180 degree
- Z – Laser Ball vertical +/- in tank

In Water part of CDS:
From CL radially out
Axis X



Feed System:
Vertical Movement
Axis Z

Out of water CDS:
Rotation around Detector
Axis Y

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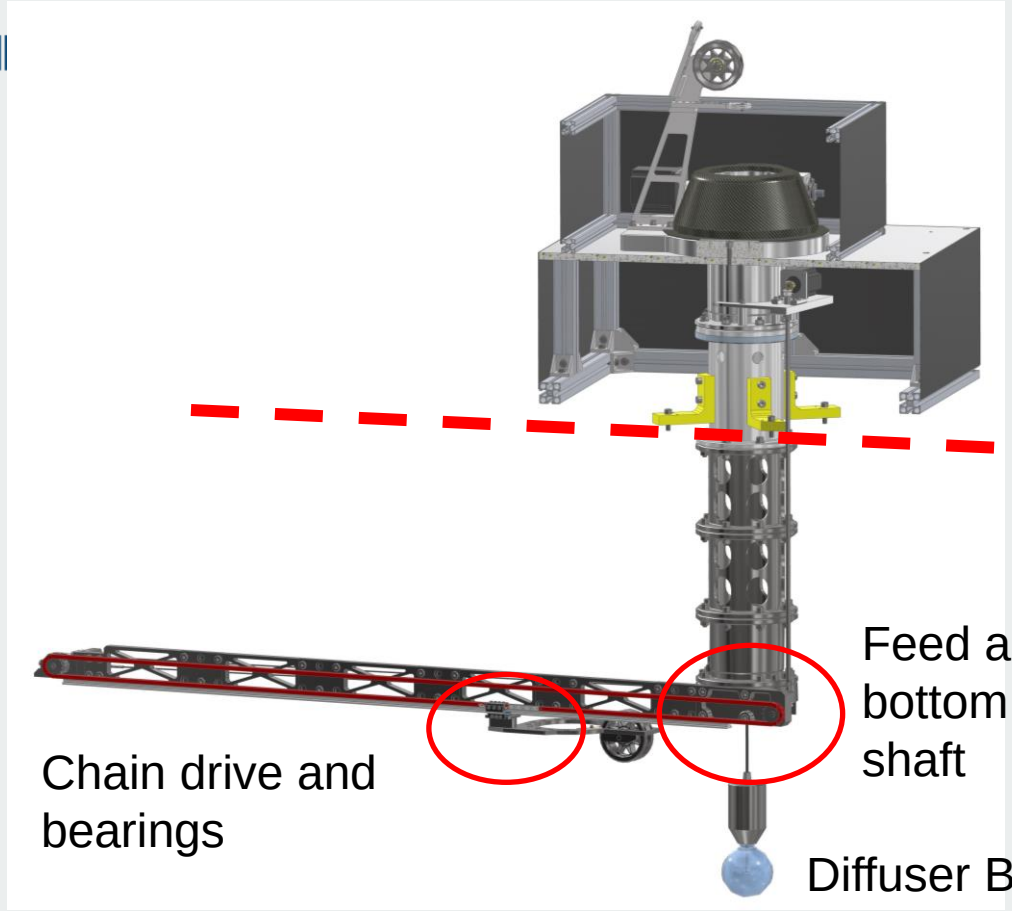

Design and development of Y Axis to be detailed in future meetings

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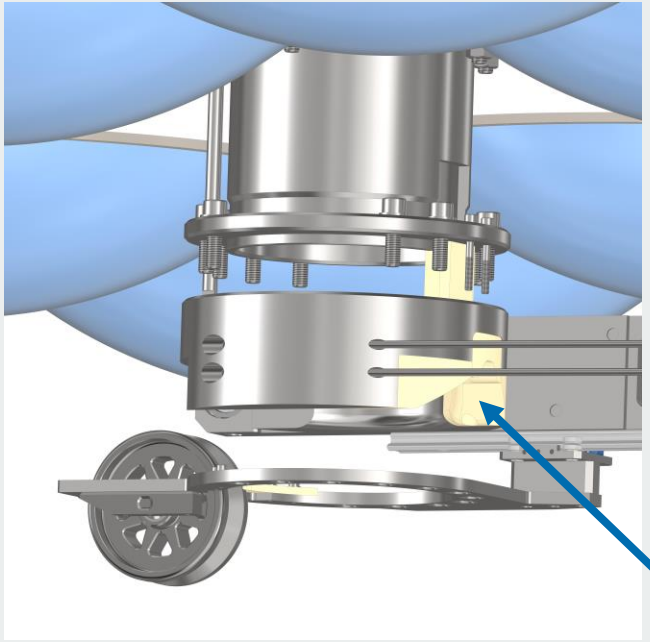
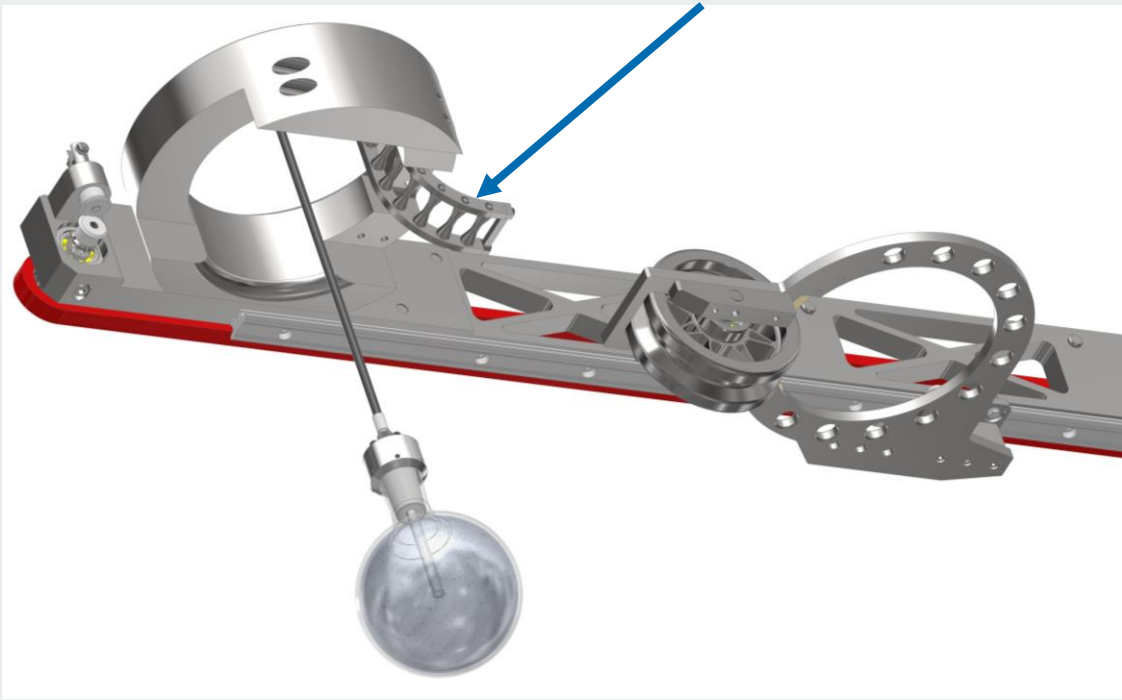


Delrin Umbilical Plain Guide

SS Curved Rollers



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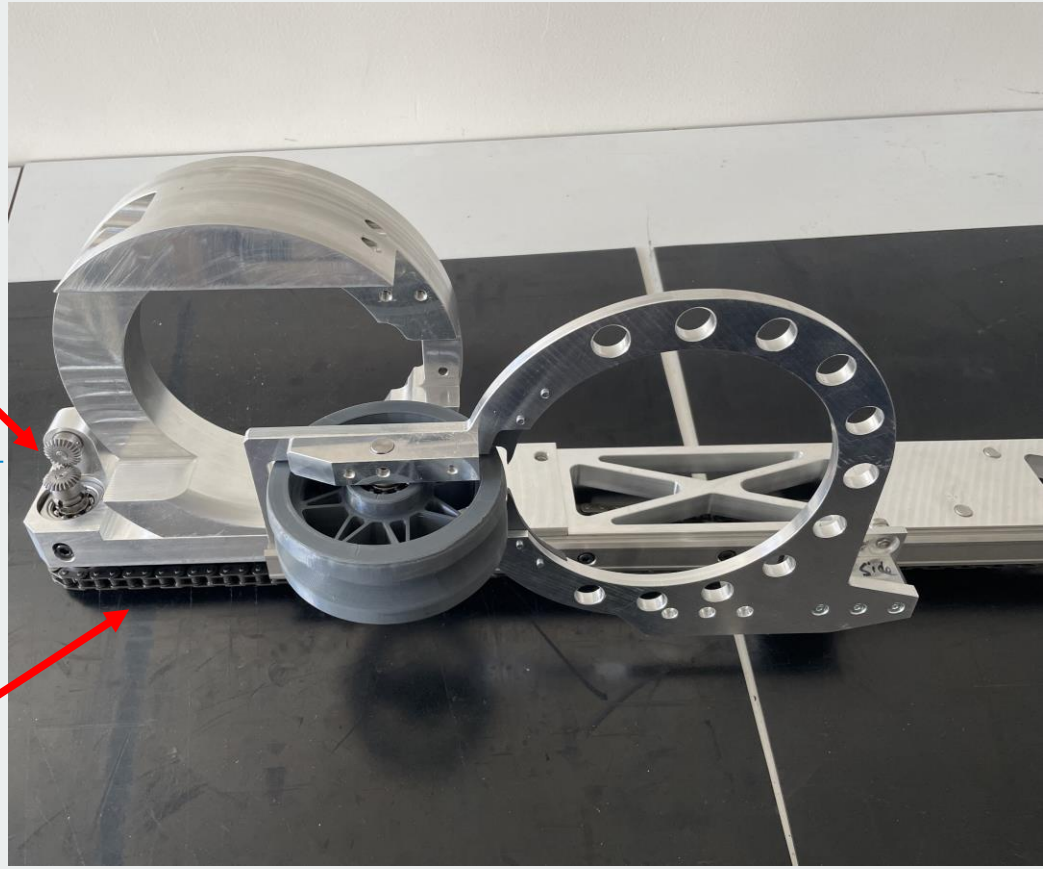
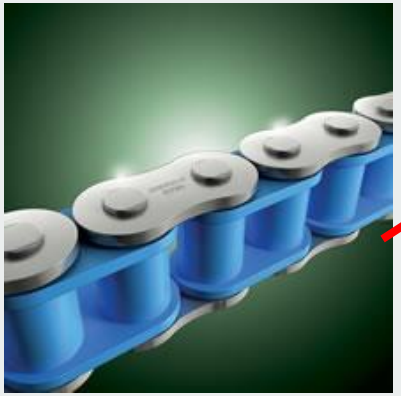


- Bearing Material: SS Deep groove Ball BRG or Polymer Plain Bearing
- Gears SS

Currently we have a regular steel chain, for WCTE we could:

- A custom made 316 chain
- Polymer / SS Chain



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Soak testing underway

A further x5 tests have been added

And more to follow

Details of test setup and equipment used to be reviewed in further meetings, but suitable equipment has been sourced

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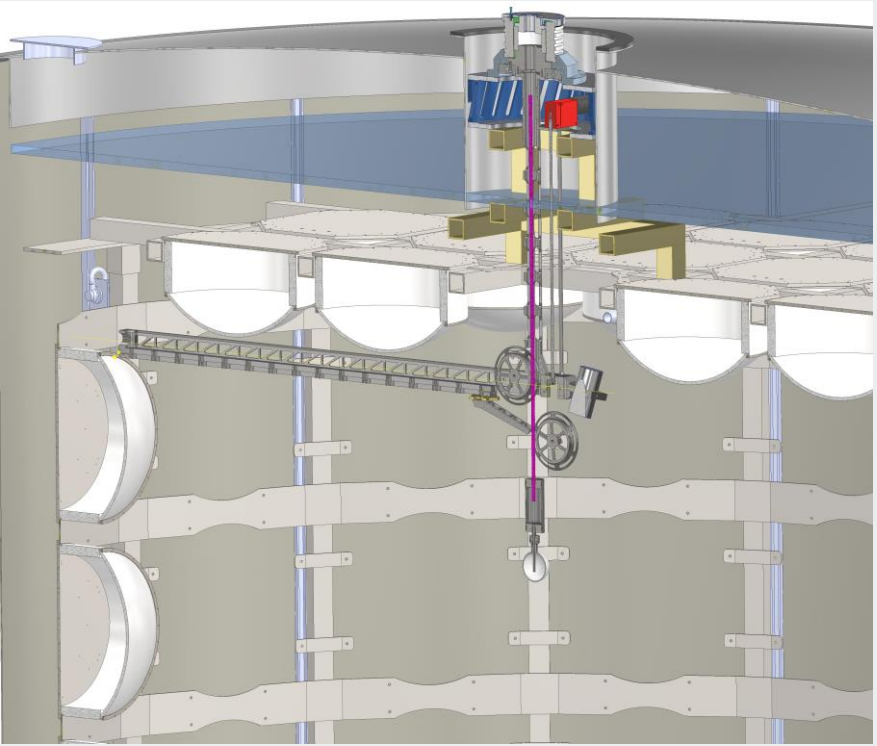

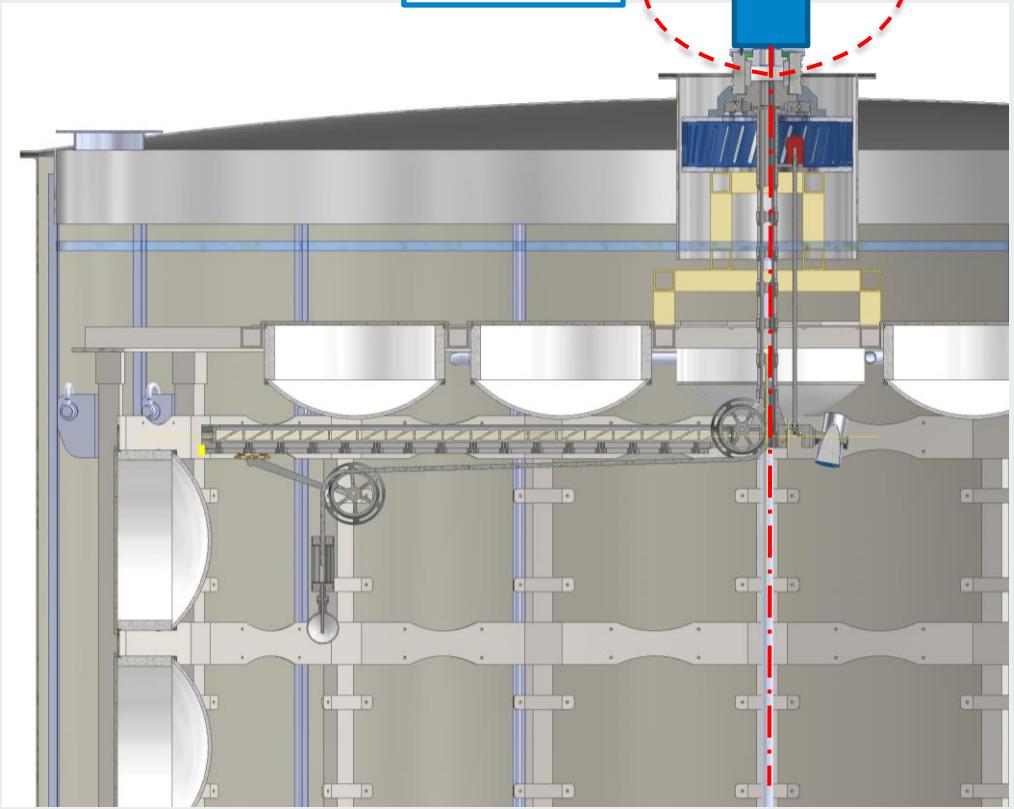

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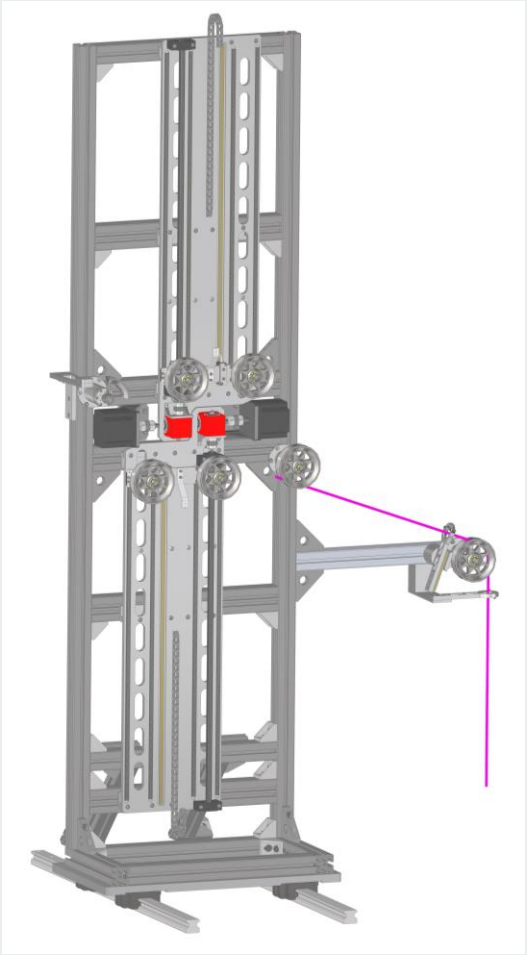

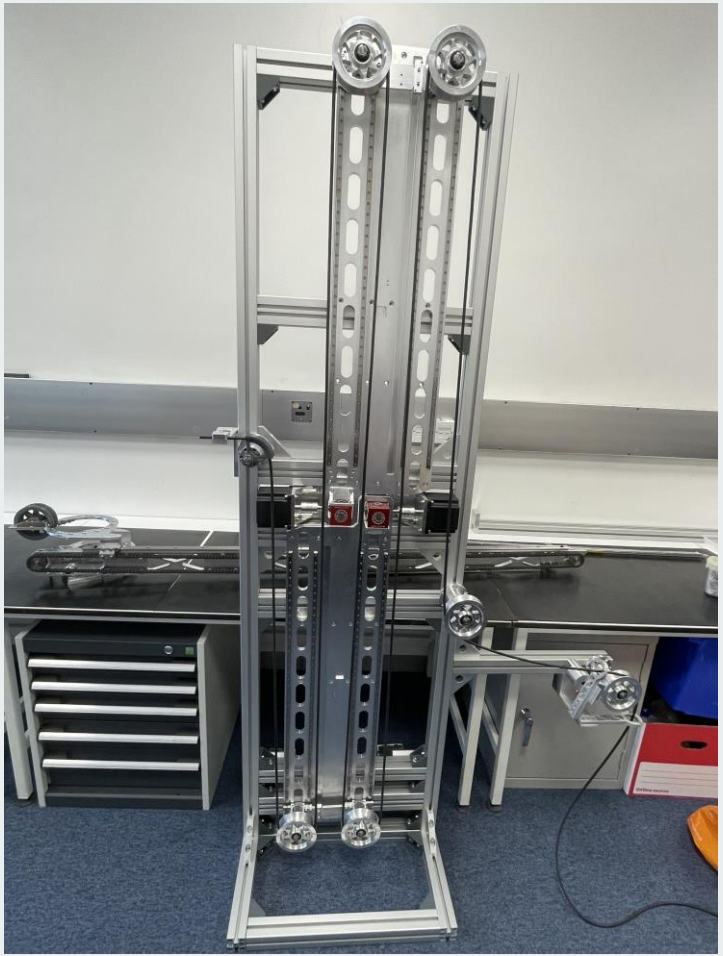

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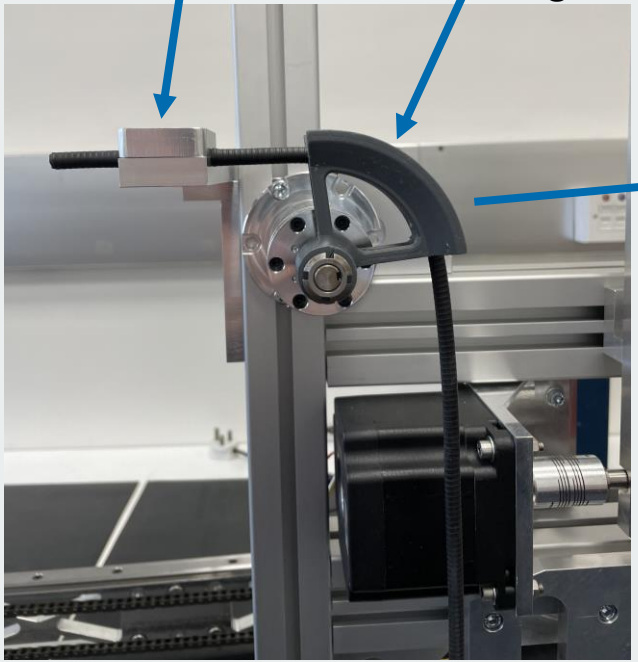
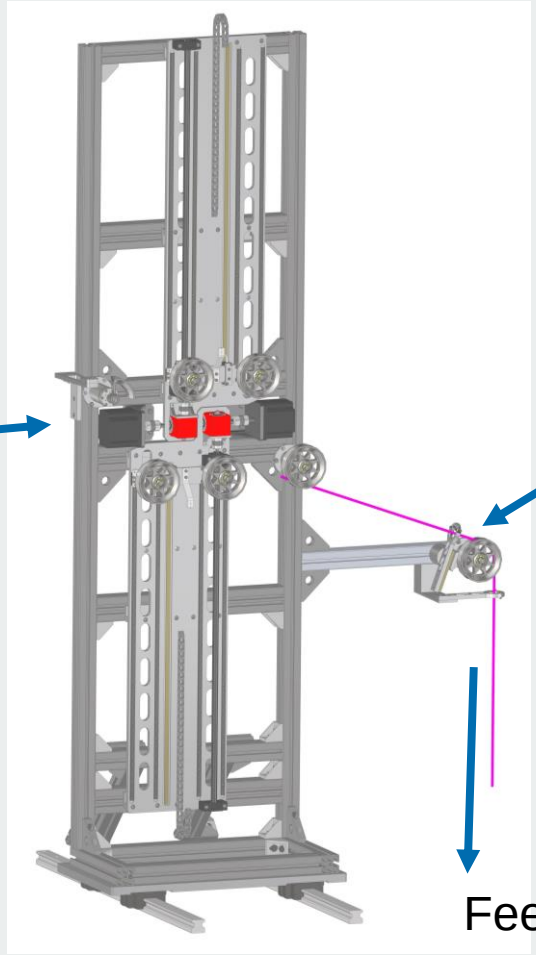
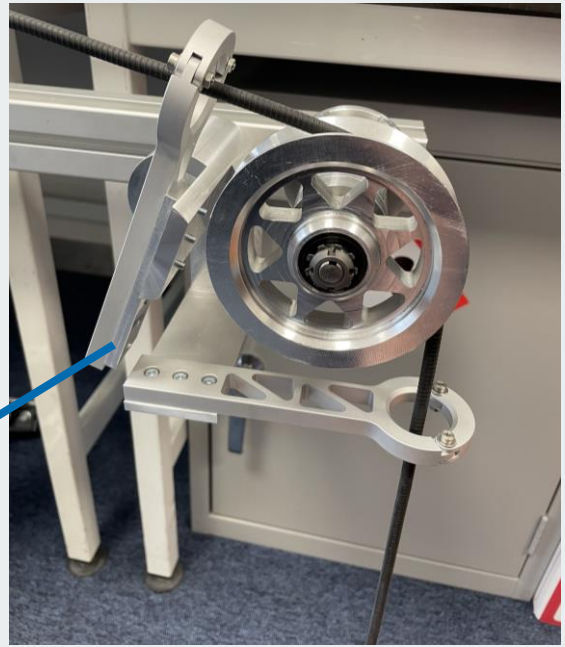
Umbilical Clamp

Feed in arc segment







Roller and Guides into Detector

Feed into Detector

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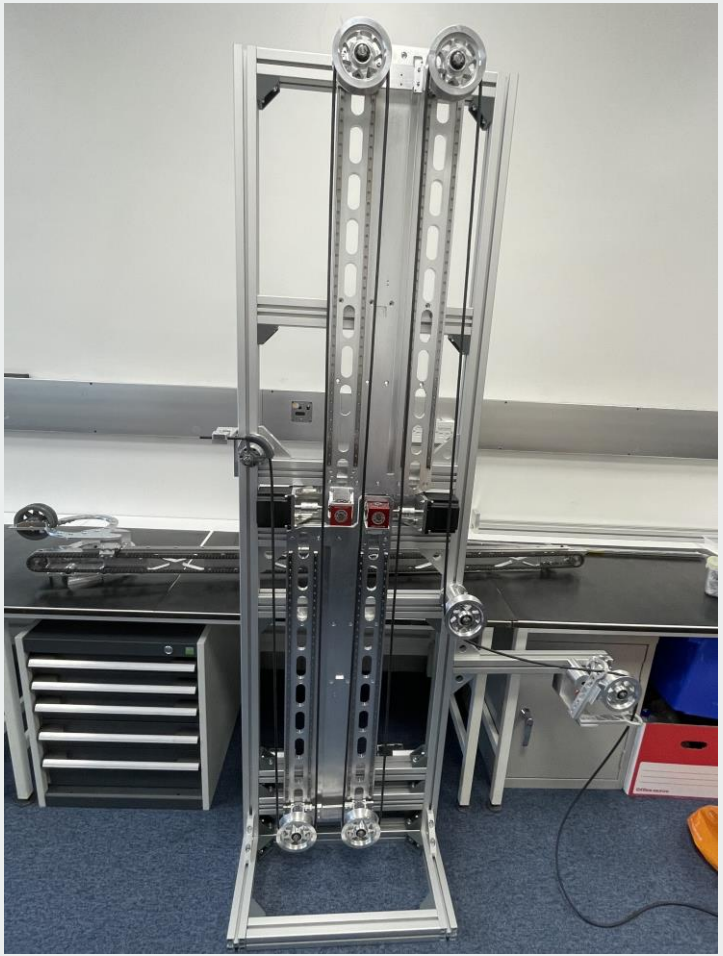

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- Trialing Thor Labs FT061PS Furcation tubing for umbilical
    - Coating still needs to be verified by soak test **(ON TEST)**
    - Ø6.1 mm Stainless Steel Tubing inside
    - Dynamic bend R19 mm (empty tube)
    - Dynamic bend of fibre ~R40 mm

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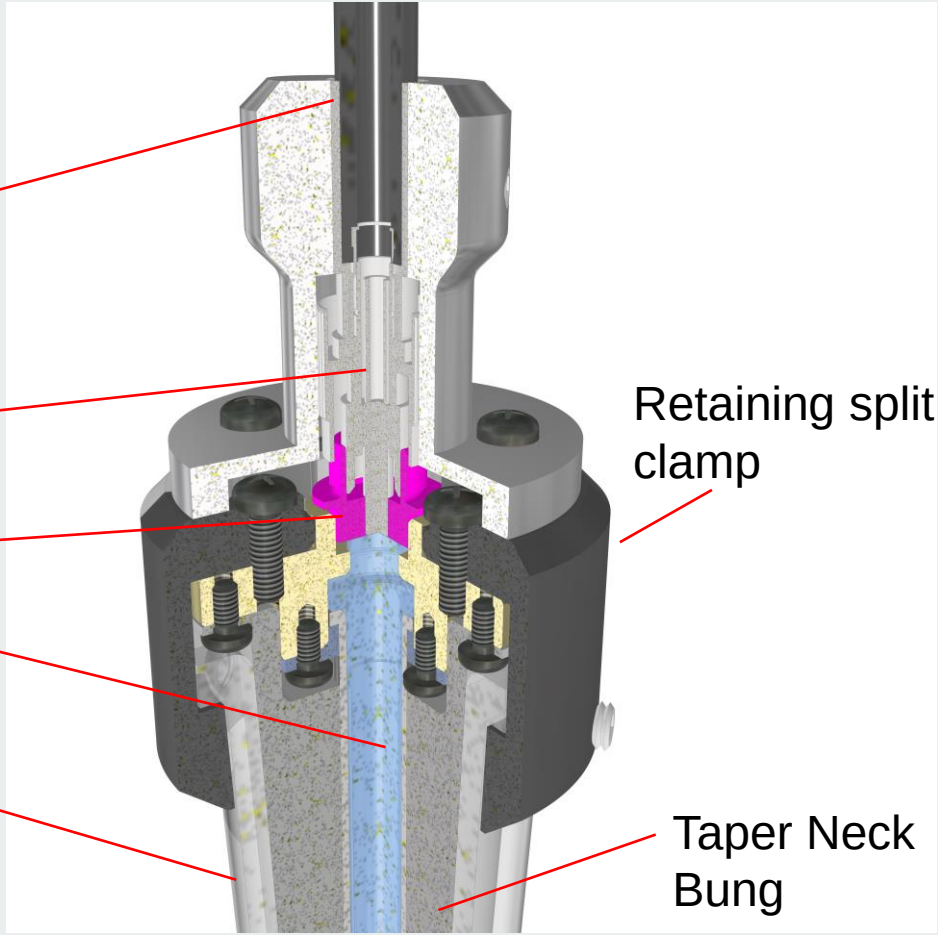
Thor Labs Umbilical Tube

Fibre Connector

Thor HAFC Bulkhead Connector

Quarts / Acrylic Light Guide (with SS sleeve)

Quarts Flask (109 dia. shown*)



Retaining split clamp

Taper Neck Bung

* Can be up to 140 dia.

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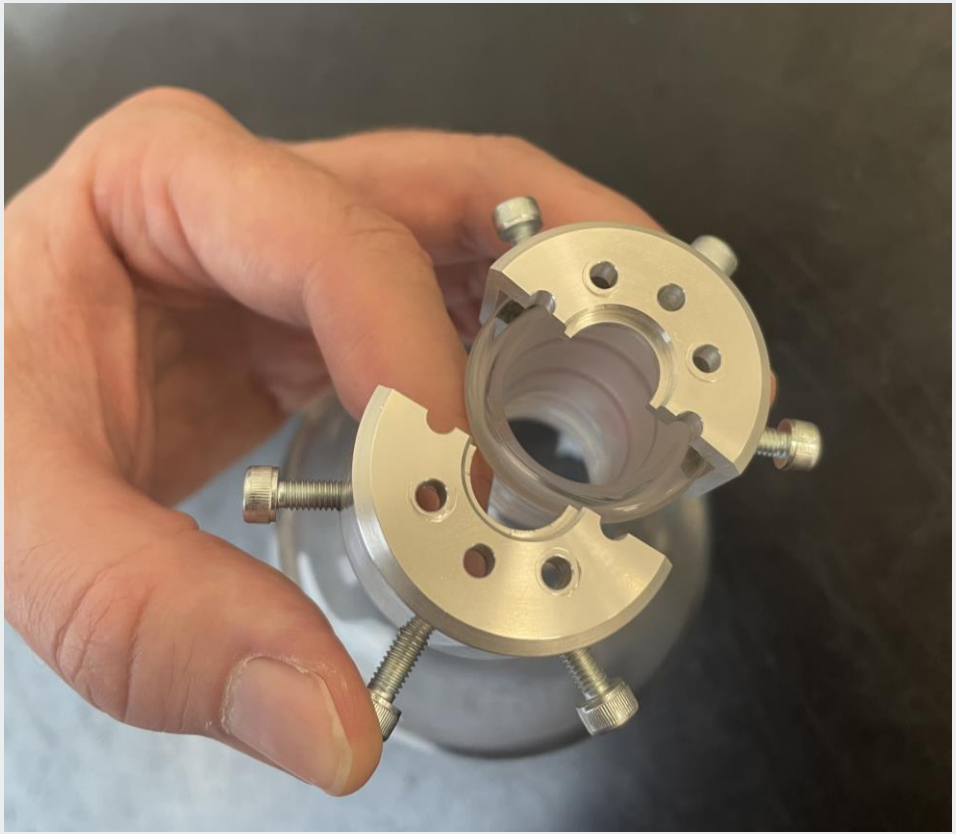

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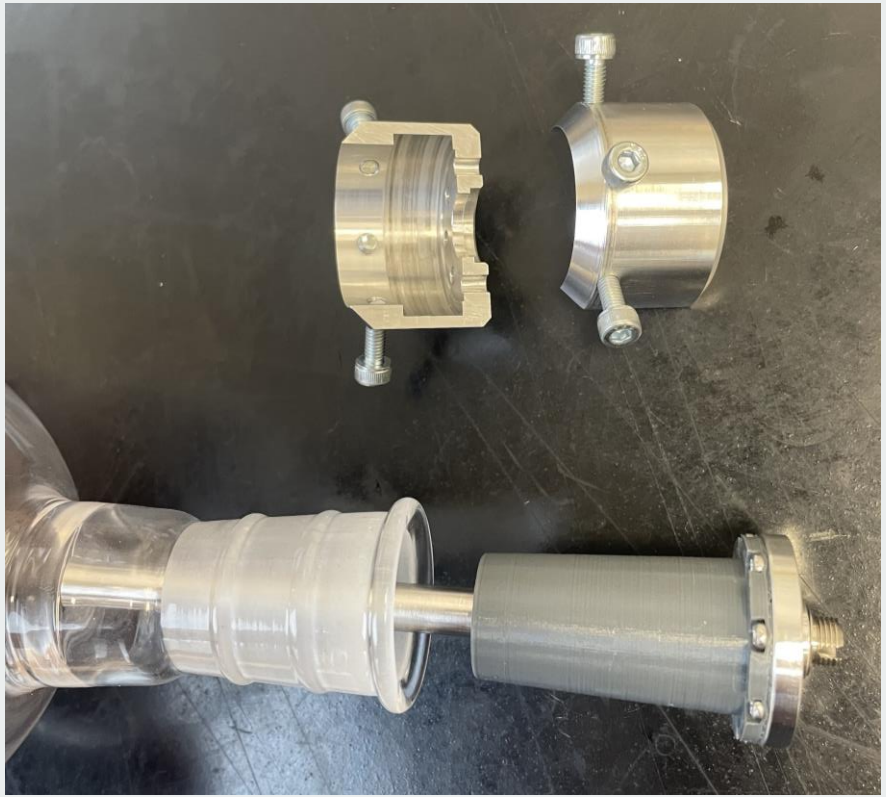

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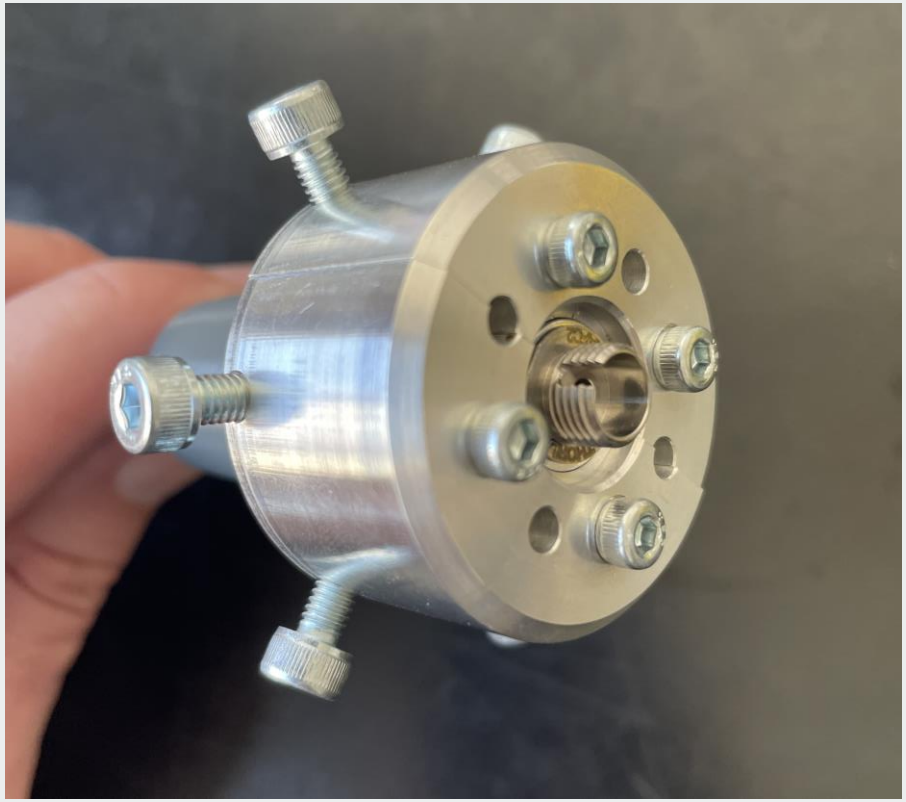

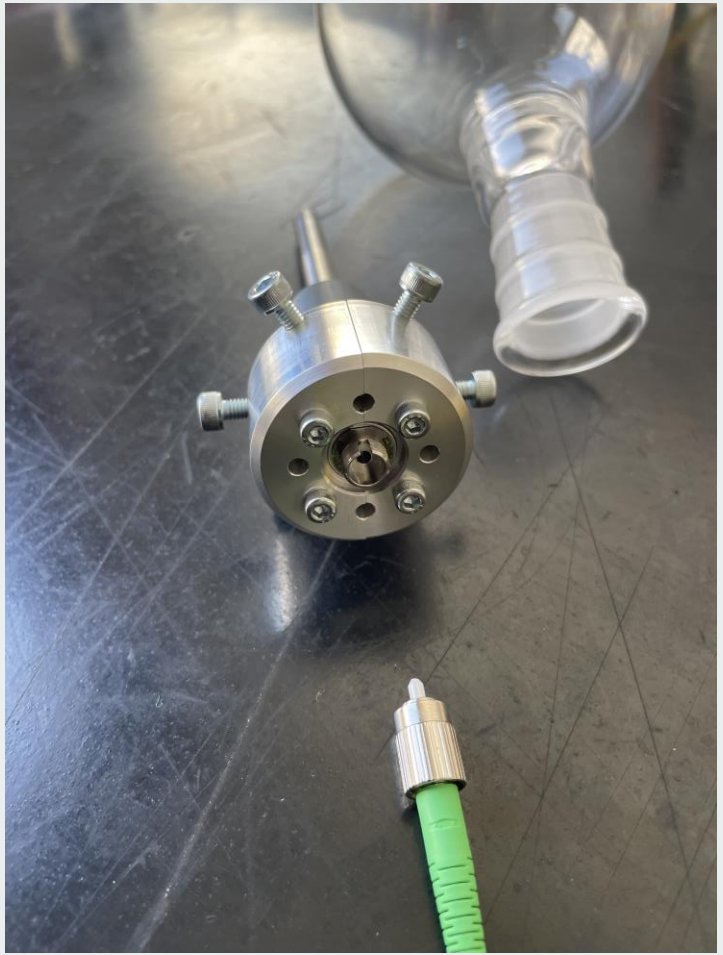

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CDS prototype setup near completion

Waiting for delivery of gearbox to begin arm axis testing

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Summary of CDS

- Axis X and Z to be tested ASAP
- Y axis currently being manufactured
- Encoders are awaiting delivery (IC shortages holding these up)
- Make cables to enable us to connect to the lab PC