Design of the T962 Cryostat

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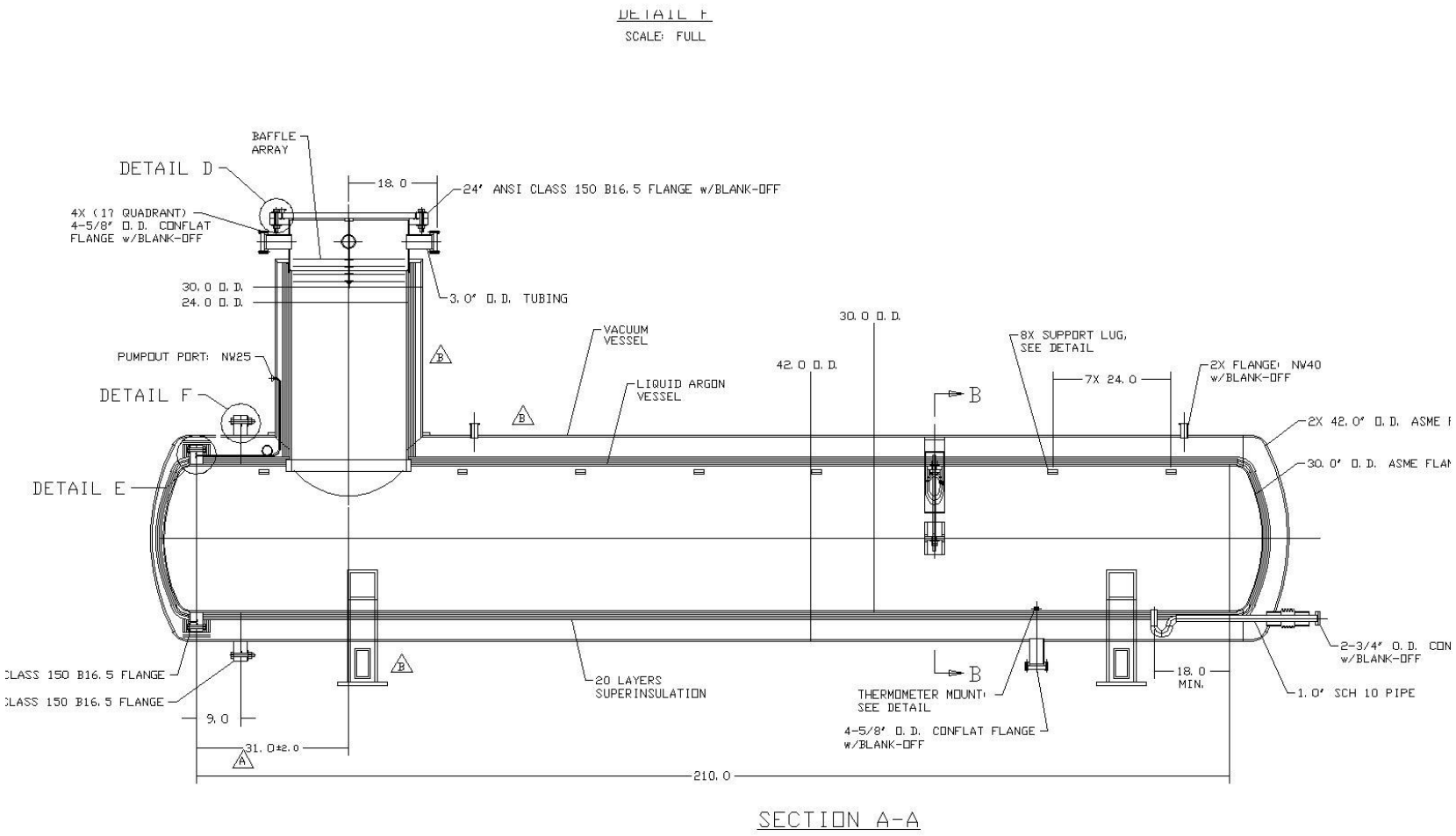
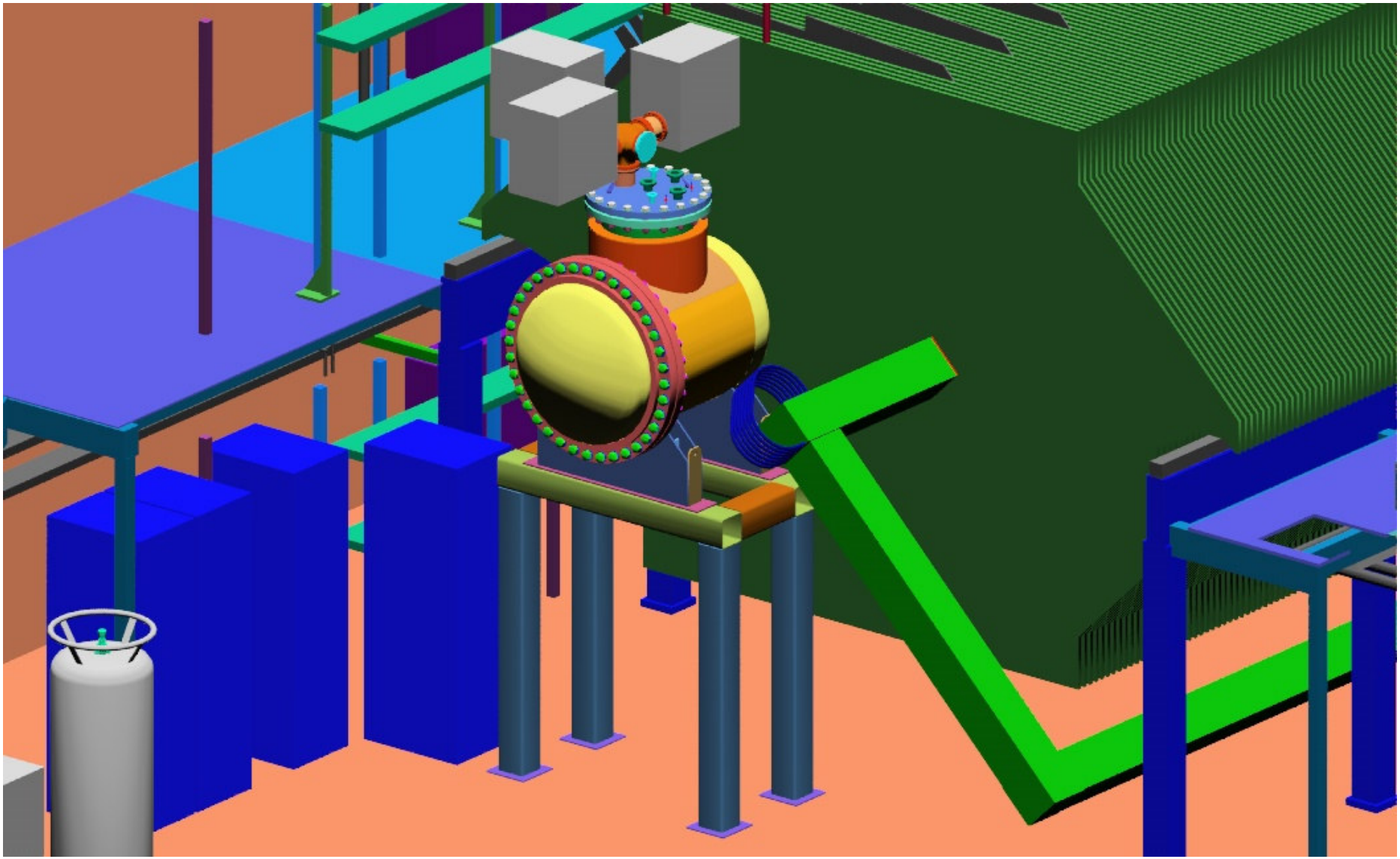
Introduction

- The T962 cryostat is directly based on the 5 meter LAr cryostat designed at FNAL
- It is made up of an inner vessel supported from an outer vacuum jacket vessel
- Total liquid argon volume is currently 524 liters
- Vessel is supported at nominal beam center just upstream of the MINOS near detector

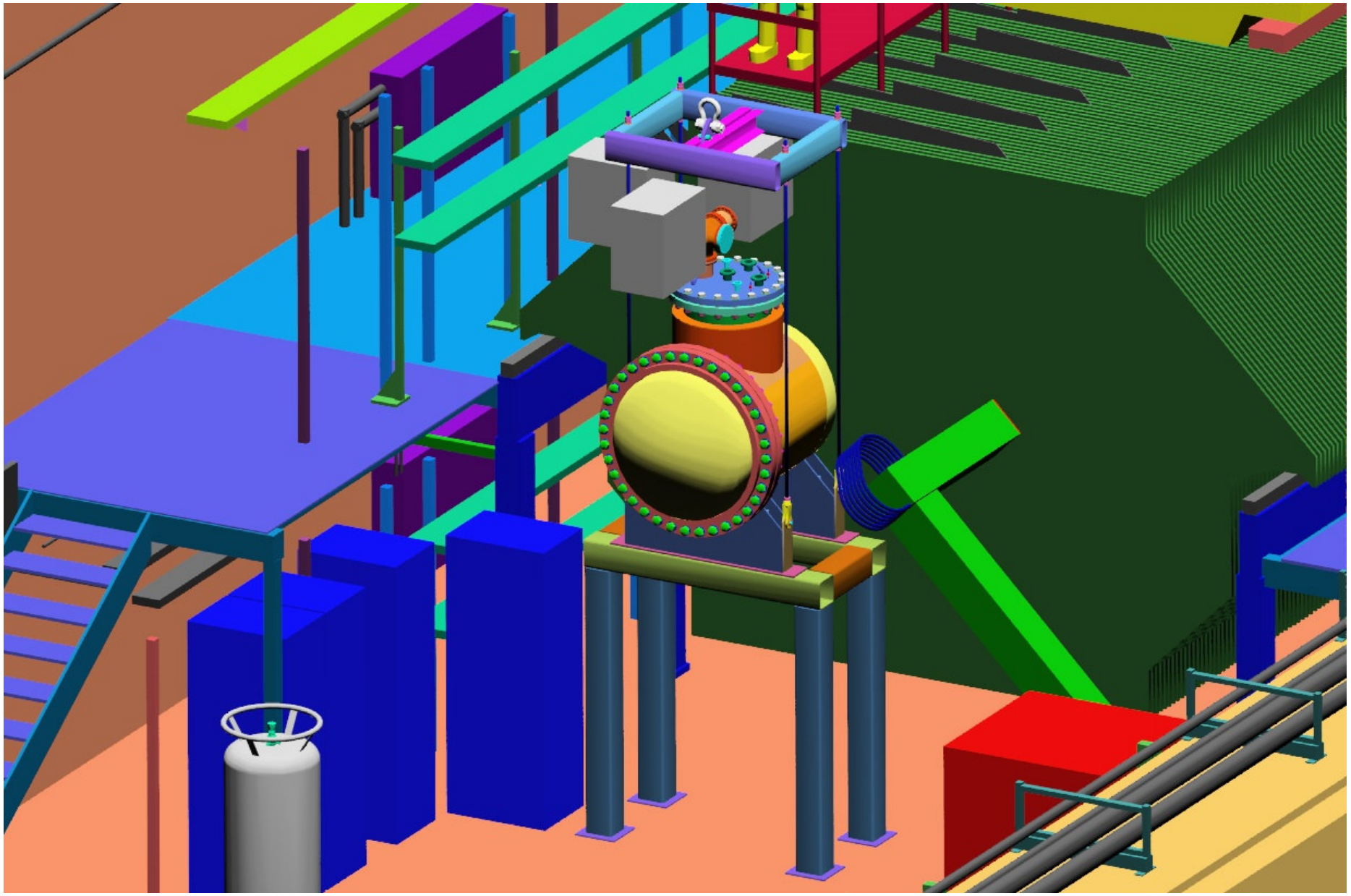
The 5 meter cryostat



VESSEL IS FURTHER SPECIFIED IN DOCUMENT,

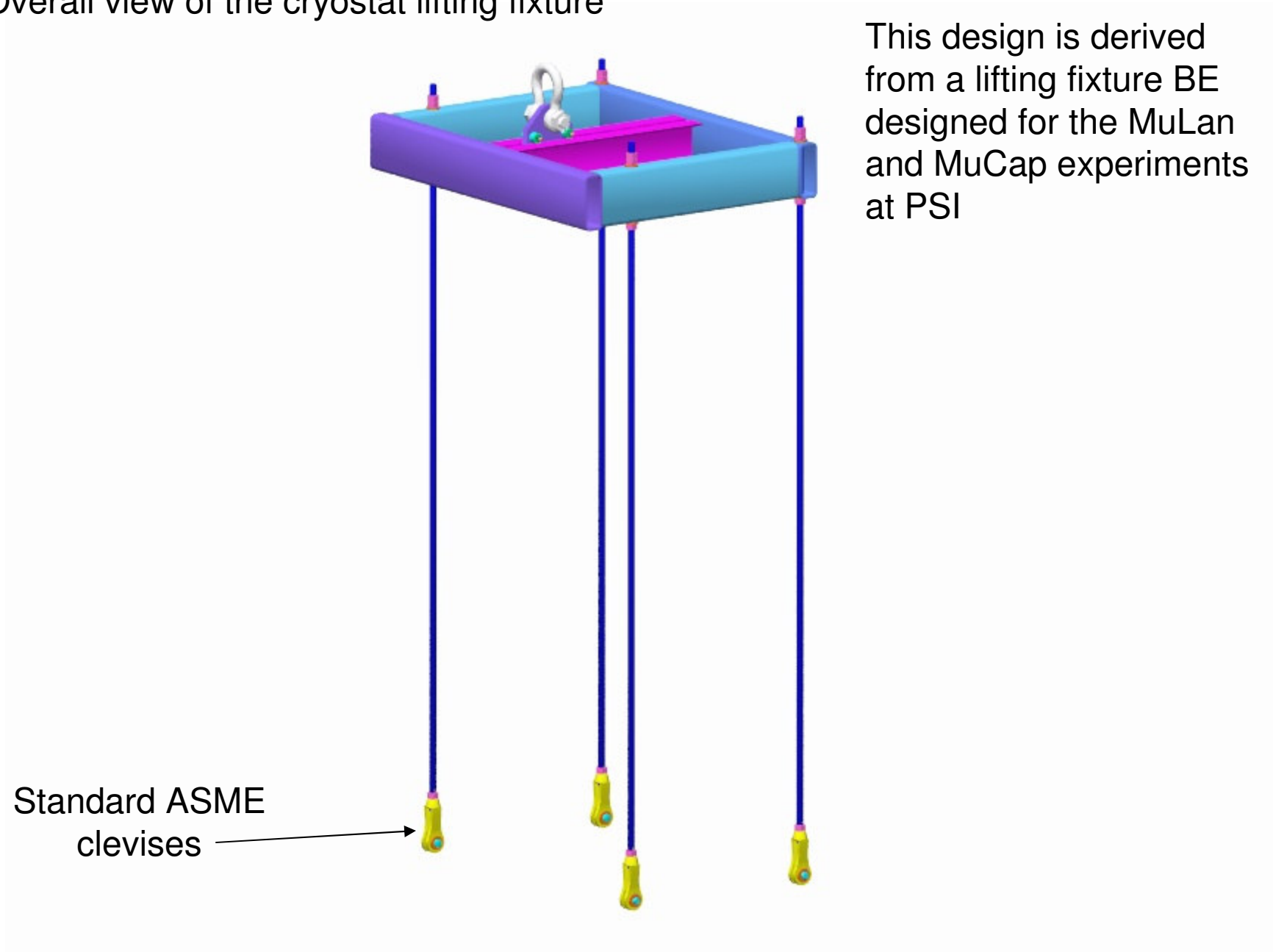


View of the T962 cryostat installed upstream of the MINOS near detector at FNAL

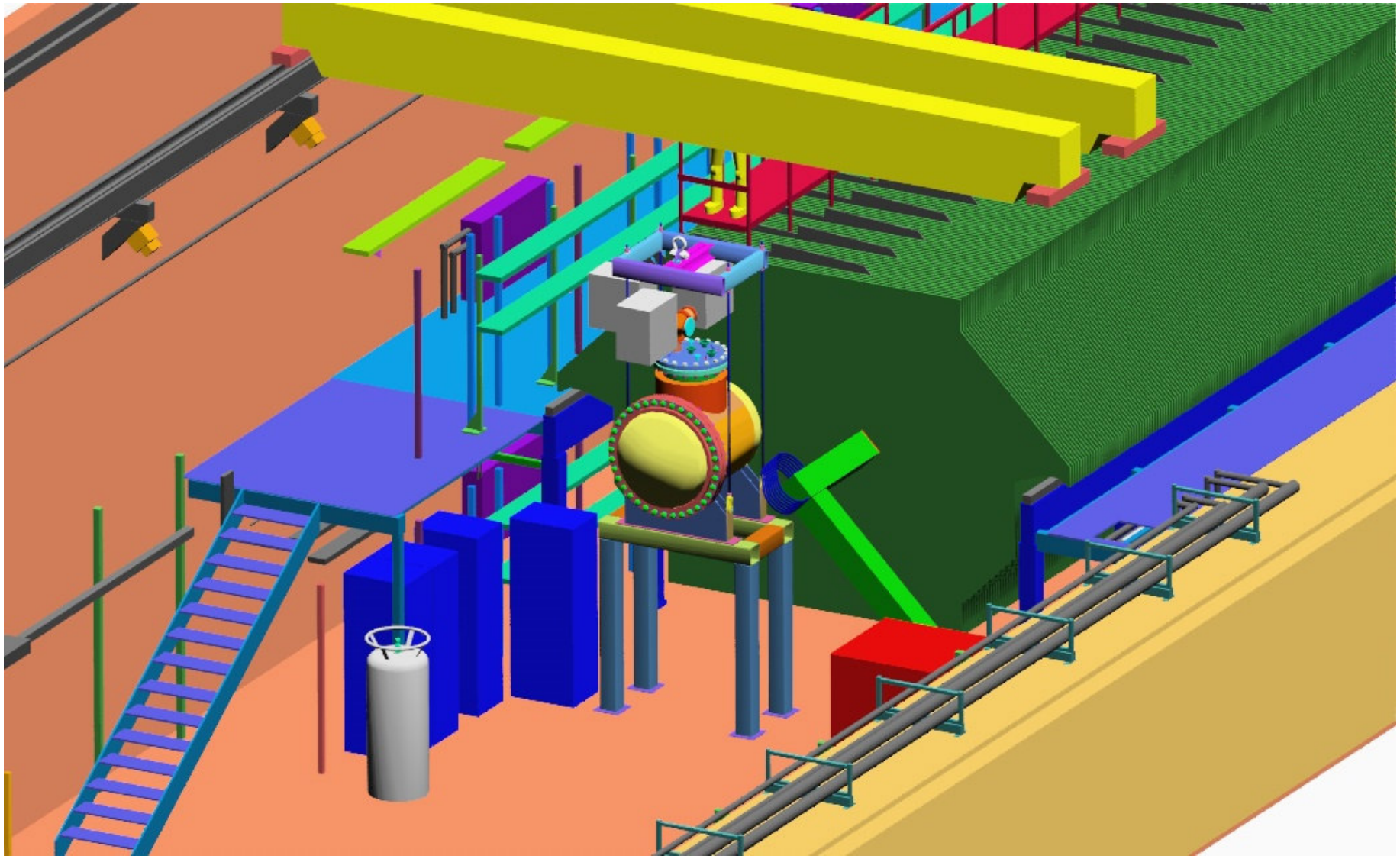


The lifting fixture that allows us to move the cryostat with its electronics

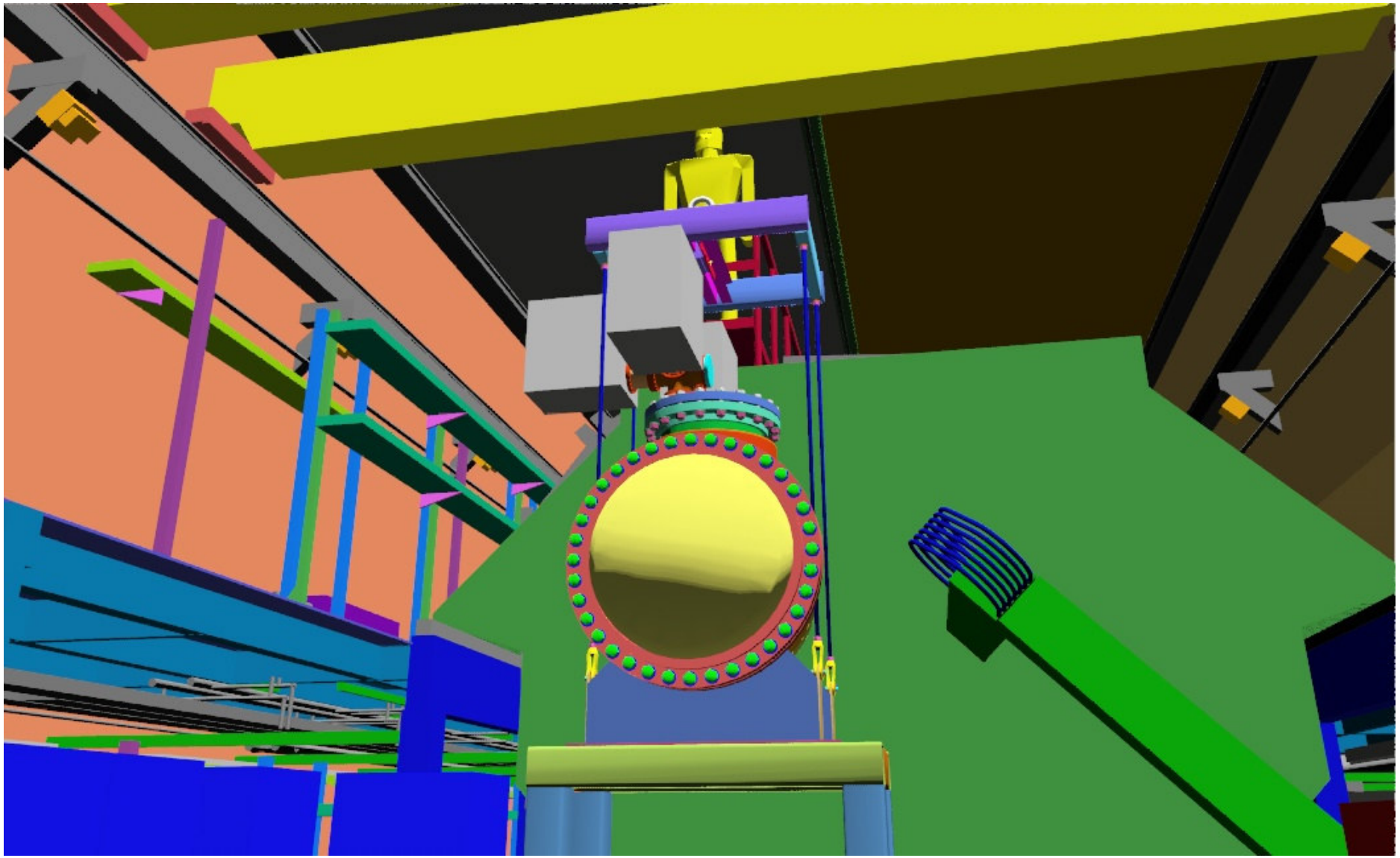
Overall view of the cryostat lifting fixture



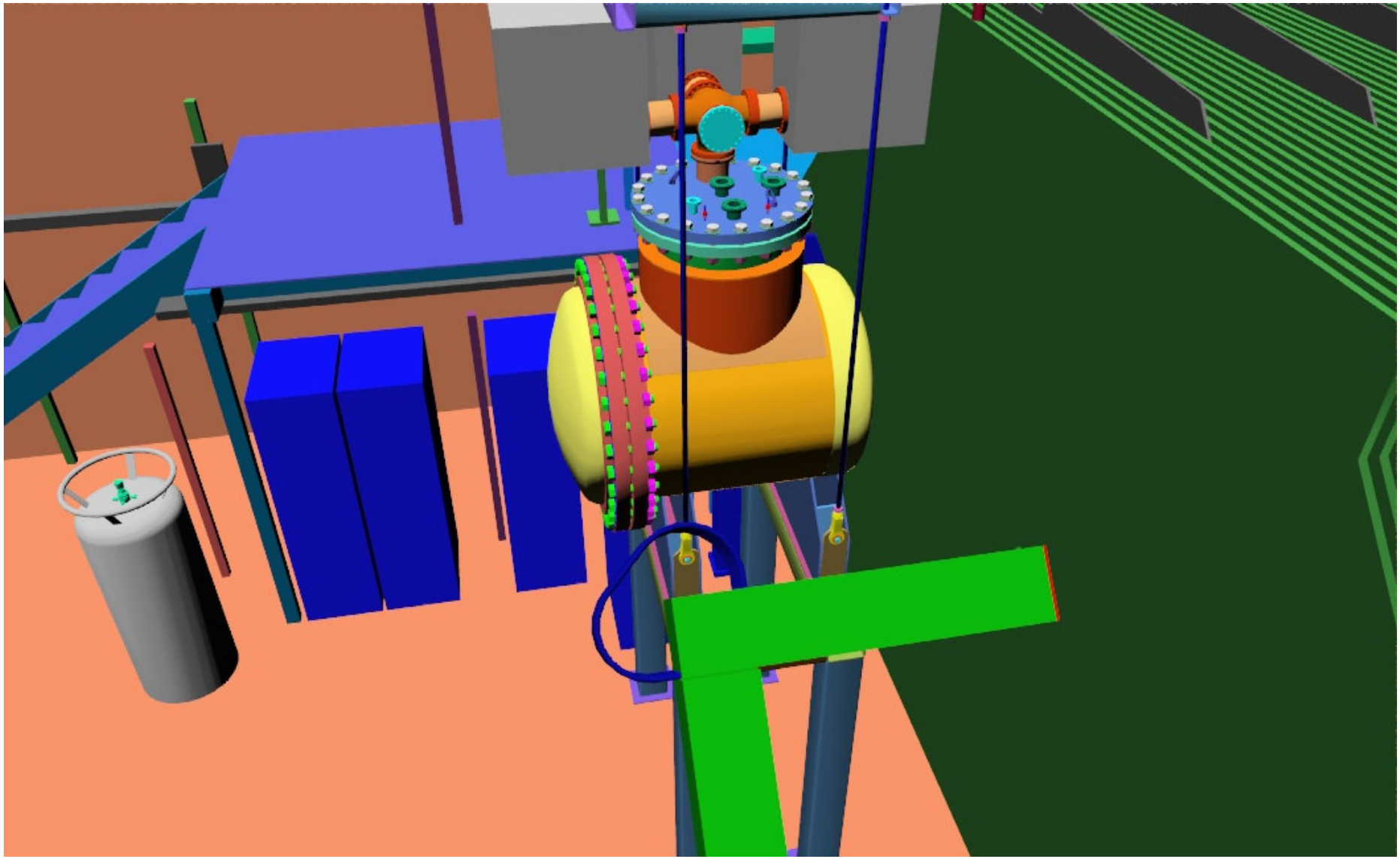
This design is derived from a lifting fixture BE designed for the MuLan and MuCap experiments at PSI



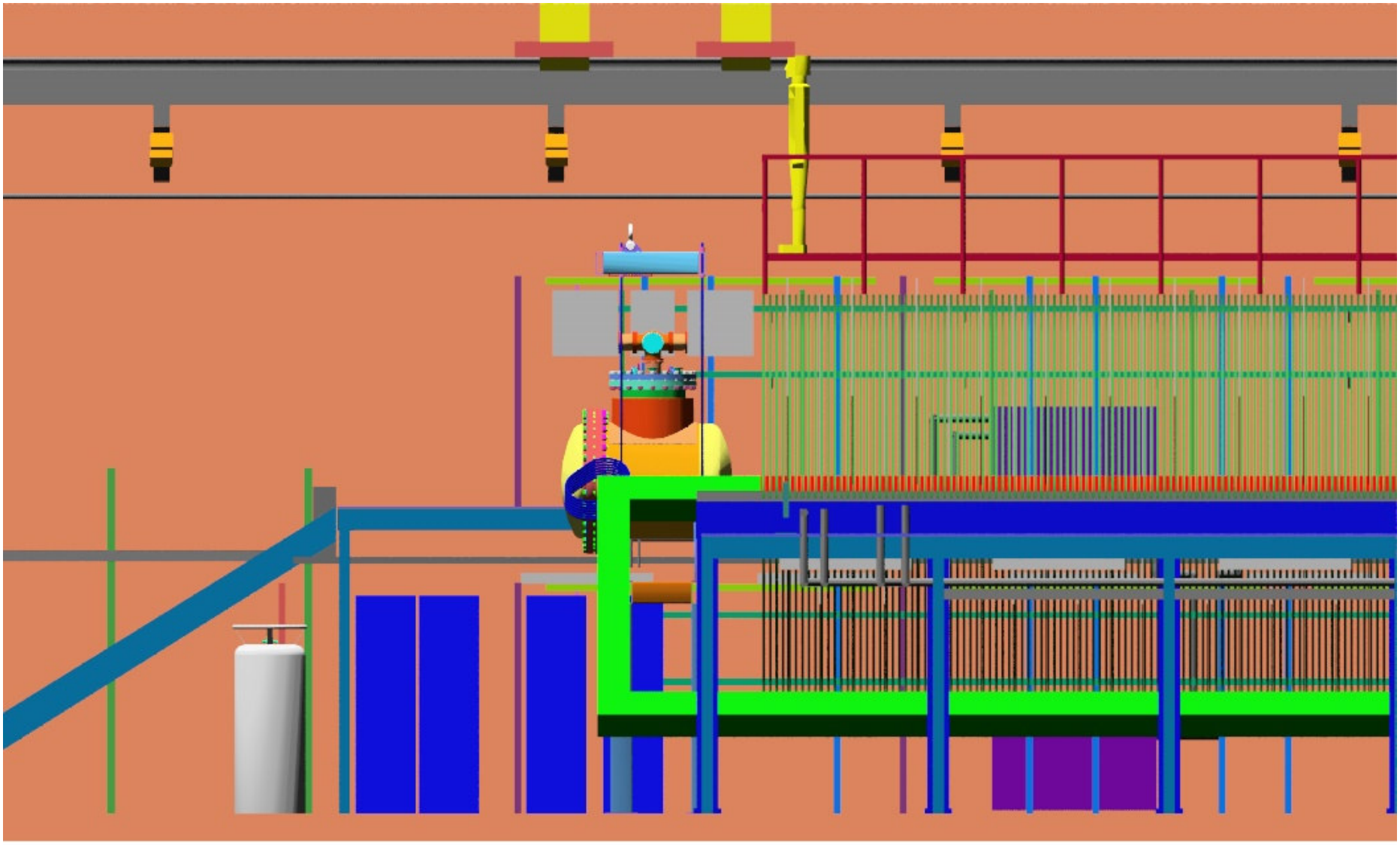
Another view of the T962 area showing possible rack locations and a dewar of LAr



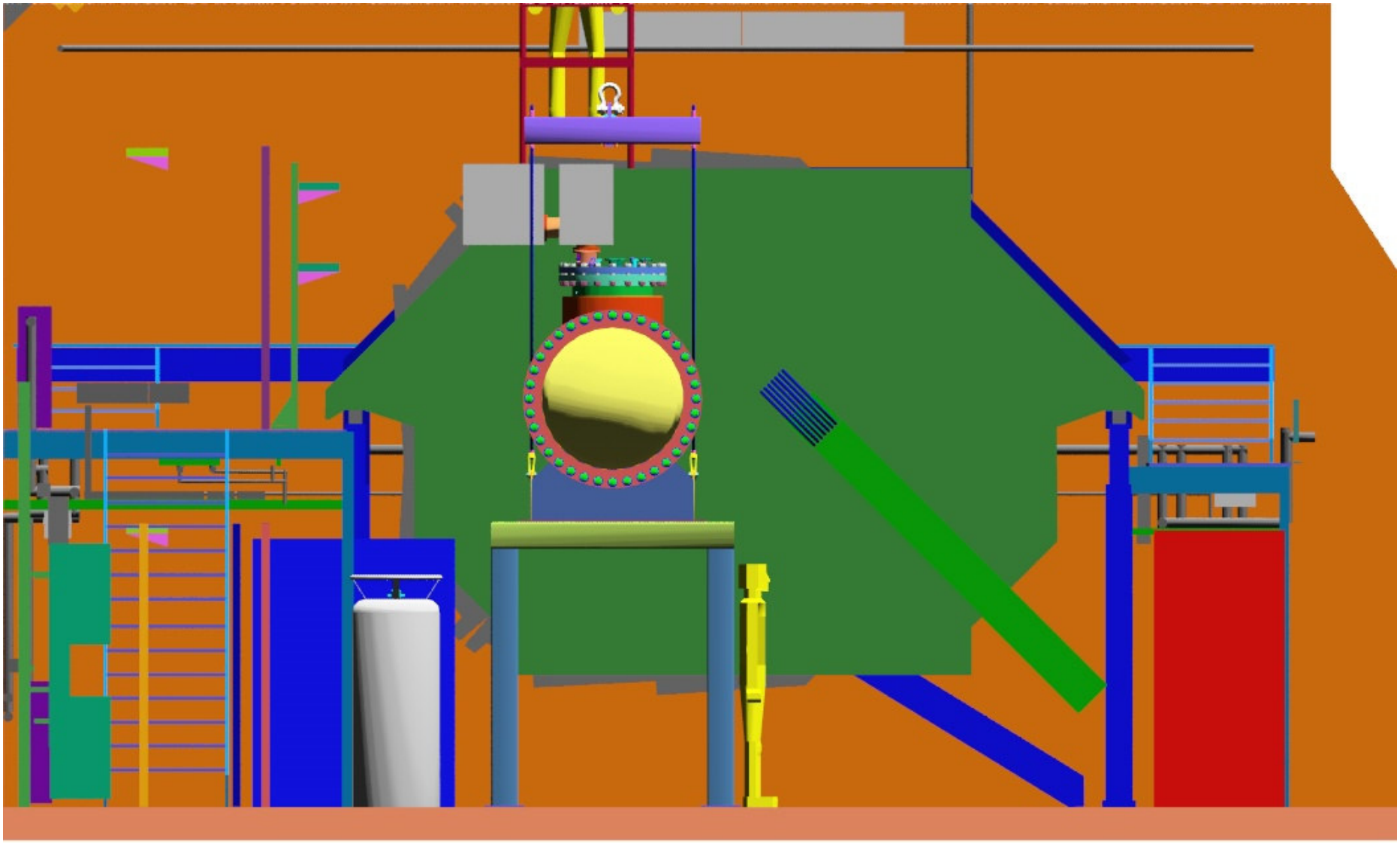
View from eye level upstream of T962. It may be possible to work on the electronics from the catwalk above the MINOS detector



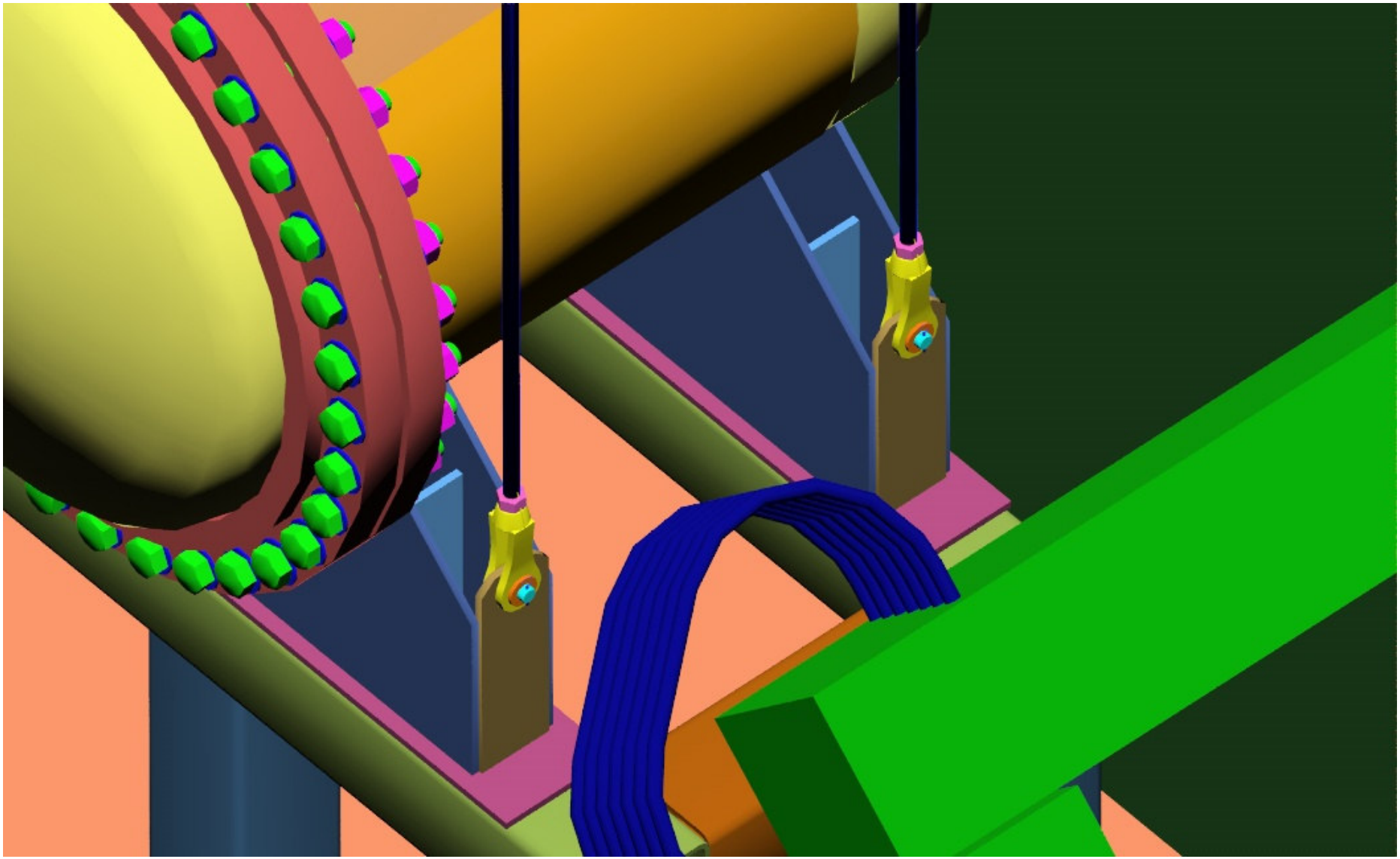
The detector fits within 2 meters of the upstream plate of MINOS. Temporary scaffolding is imagined during installation (similar to PEANUT), but it won't fit with Minerva installed



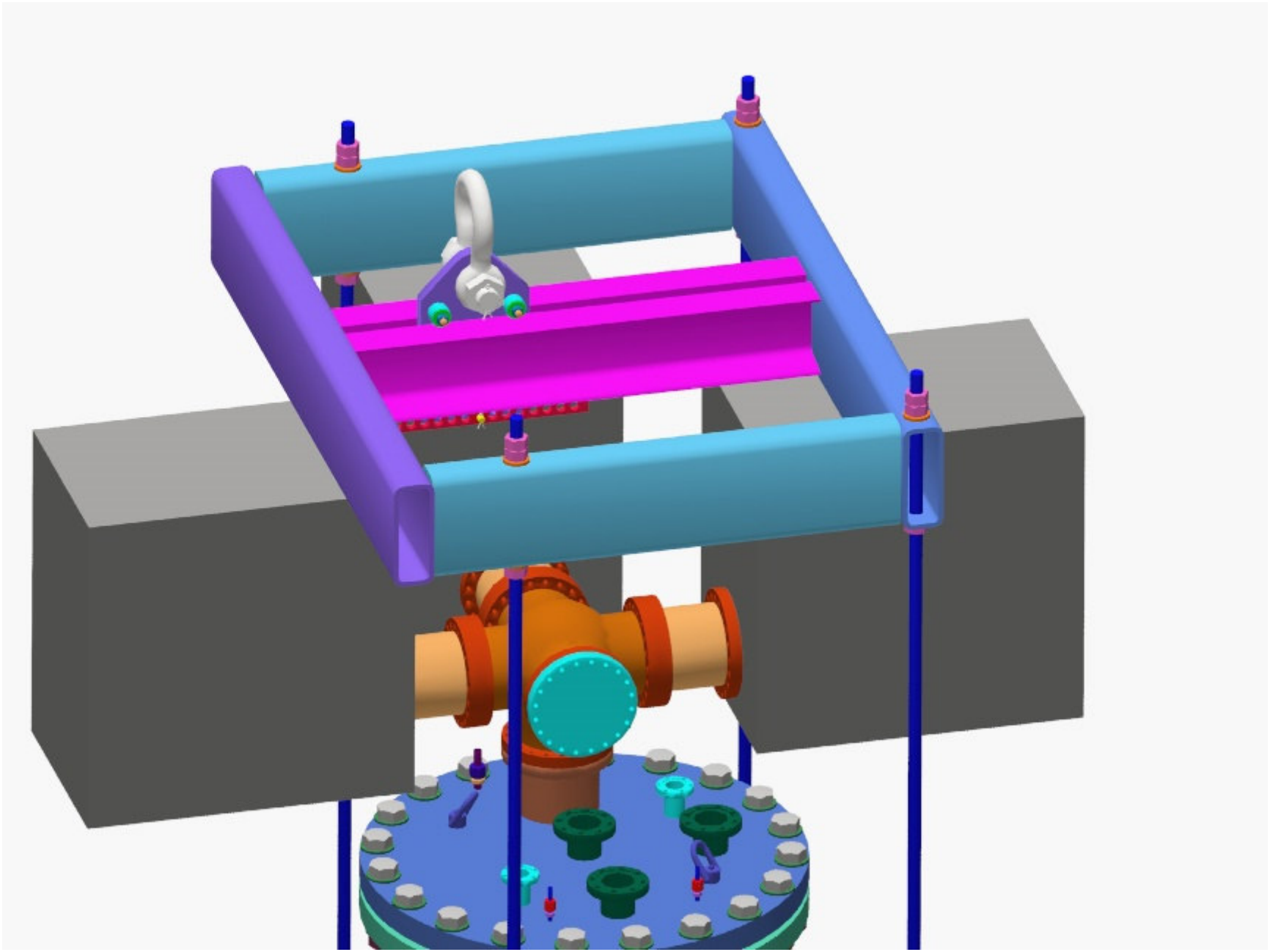
Orthographic elevation view showing plenty of clearance above the cryostat to the crane. This may be necessary to remove the cryostat for service after Minerva installation.

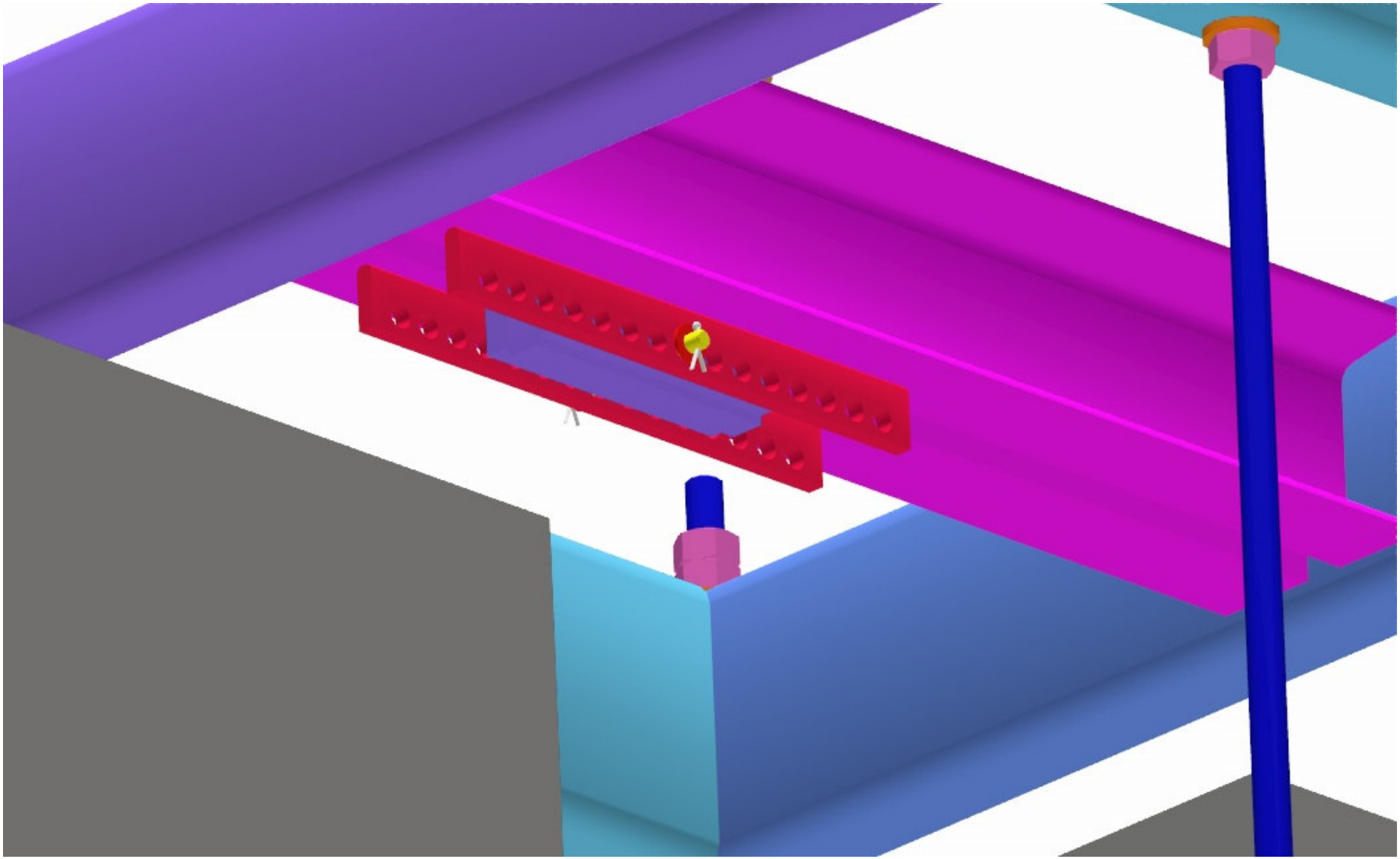


Upstream elevation view of the cryostat on its support. The stand shown has not been analyzed structurally yet and may change.



Close-up of the clevises connecting the lifting fixture to the cryostat

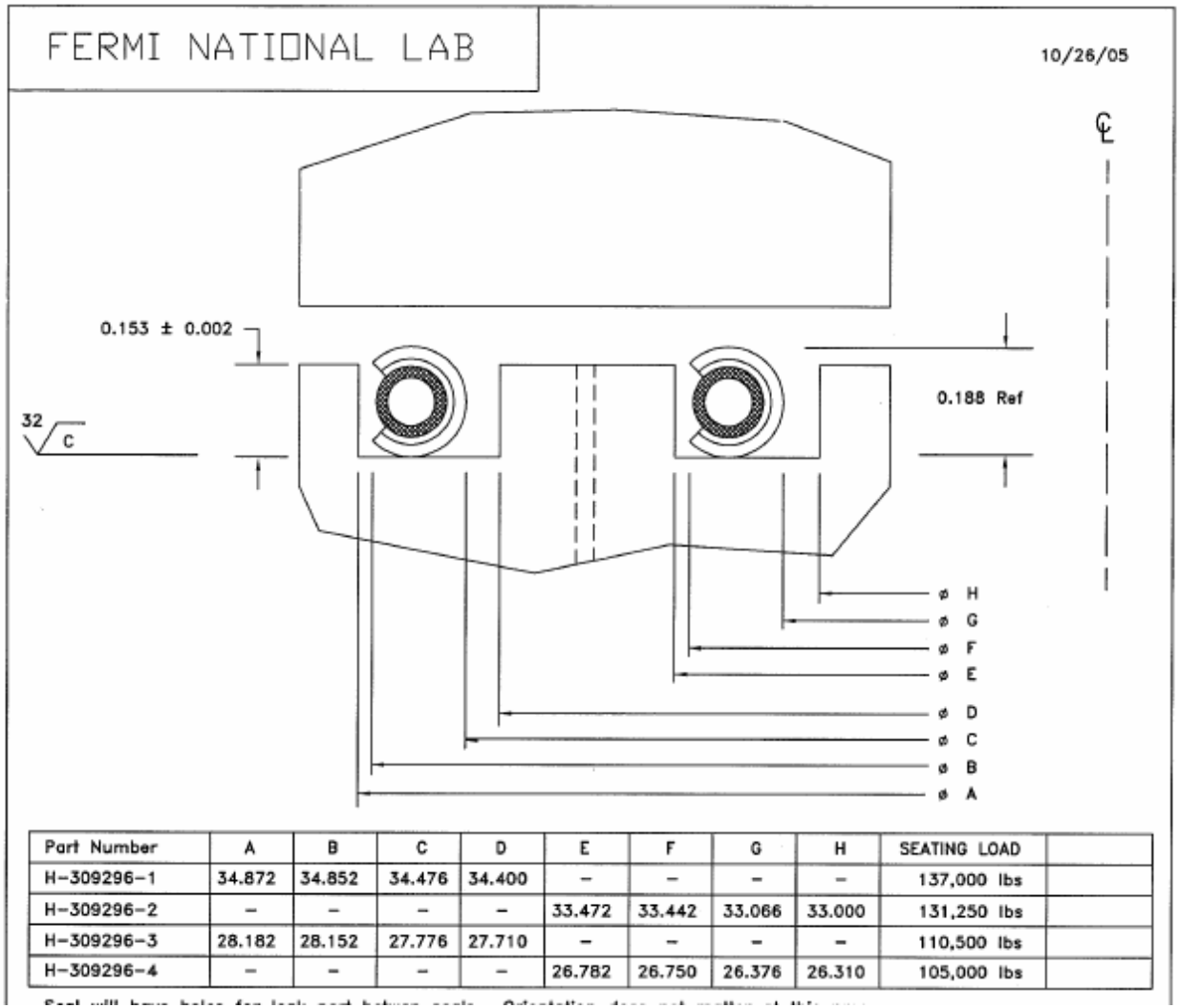




The lift point of the lifting fixture can be adjusted upstream and downstream to level the cryostat during lifting. Left-Right offset is not currently designed in.

Seals

- Helicoflex quoted on seals for the 5 meter cryostat
- Since our flanges are the same size, we should be able to use these
- I've drawn the grooves from the Helicoflex quote and they don't match sizes in the 5 meter cryostat drawing
- If we use raised flanges we'll have to get new quotes on the seals from Helicoflex



Part Number	A	B	C	D	E	F	G	H	SEATING LOAD	
H-309296-1	34.872	34.852	34.476	34.400	–	–	–	–	137,000 lbs	
H-309296-2	–	–	–	–	33.472	33.442	33.066	33.000	131,250 lbs	
H-309296-3	28.182	28.152	27.776	27.710	–	–	–	–	110,500 lbs	
H-309296-4	–	–	–	–	26.782	26.750	26.376	26.310	105,000 lbs	

Drawing and dimensions of the Helicoflex seals

The inner vessel will have two metal o-rings differentially pumped to assure cleanliness

Scaffolding and catwalks

- Access around the cryostat in the beam position is envisaged to be from temporary scaffolding that could look like PEANUT's
- It will have to be removed when Minerva gets installed

PEANUT scaffolding for person access

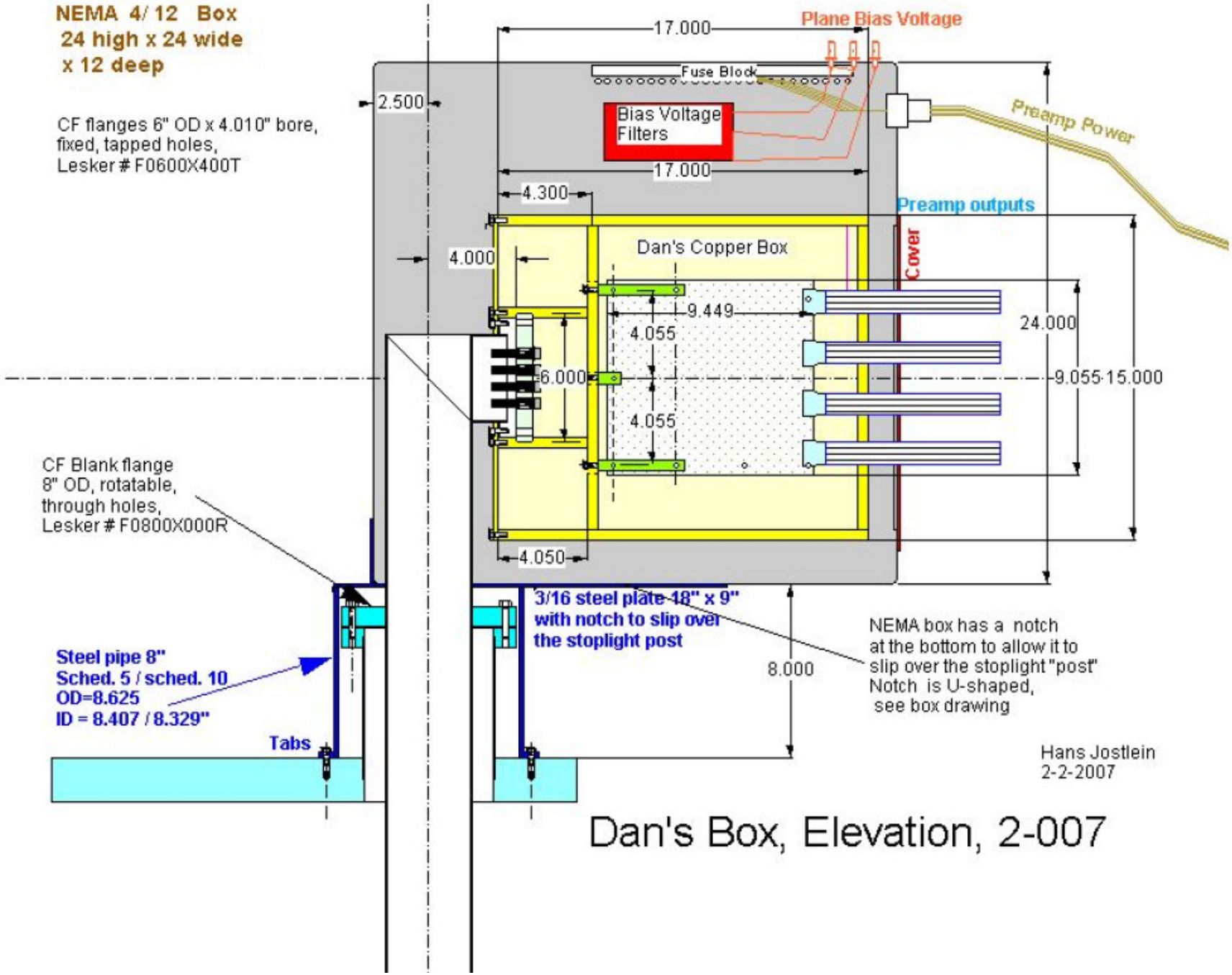
Working on the TPC inside

- There isn't enough room around the cryostat when it is in the beam line to remove the TPC or exchange any internal components
- We need some space in the hall upstream of MINOS to work on the TPC

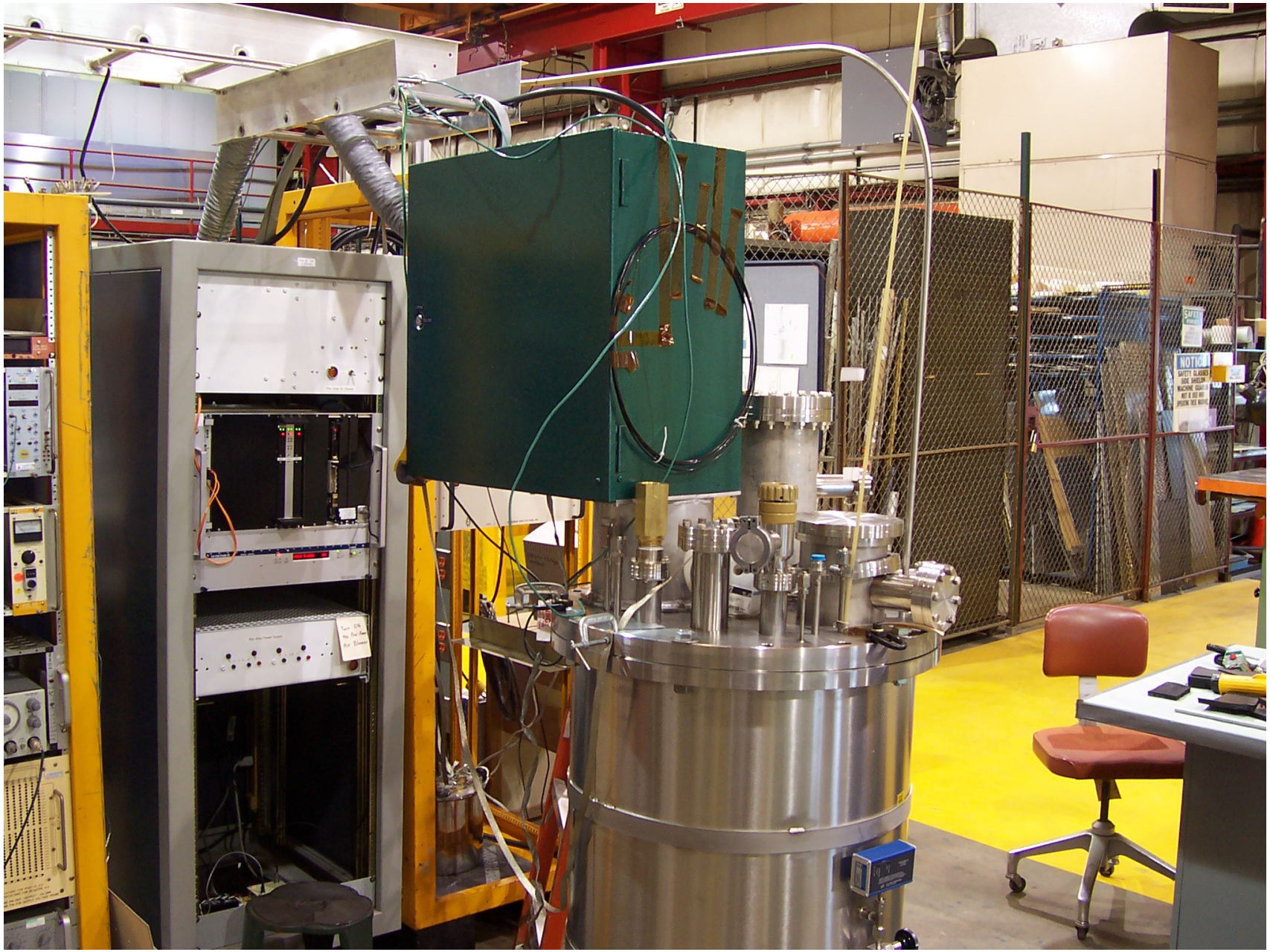
We will need some space on the floor upstream of MINOS for work on the TPC. Tooling for this is not shown.

Electronics boxes

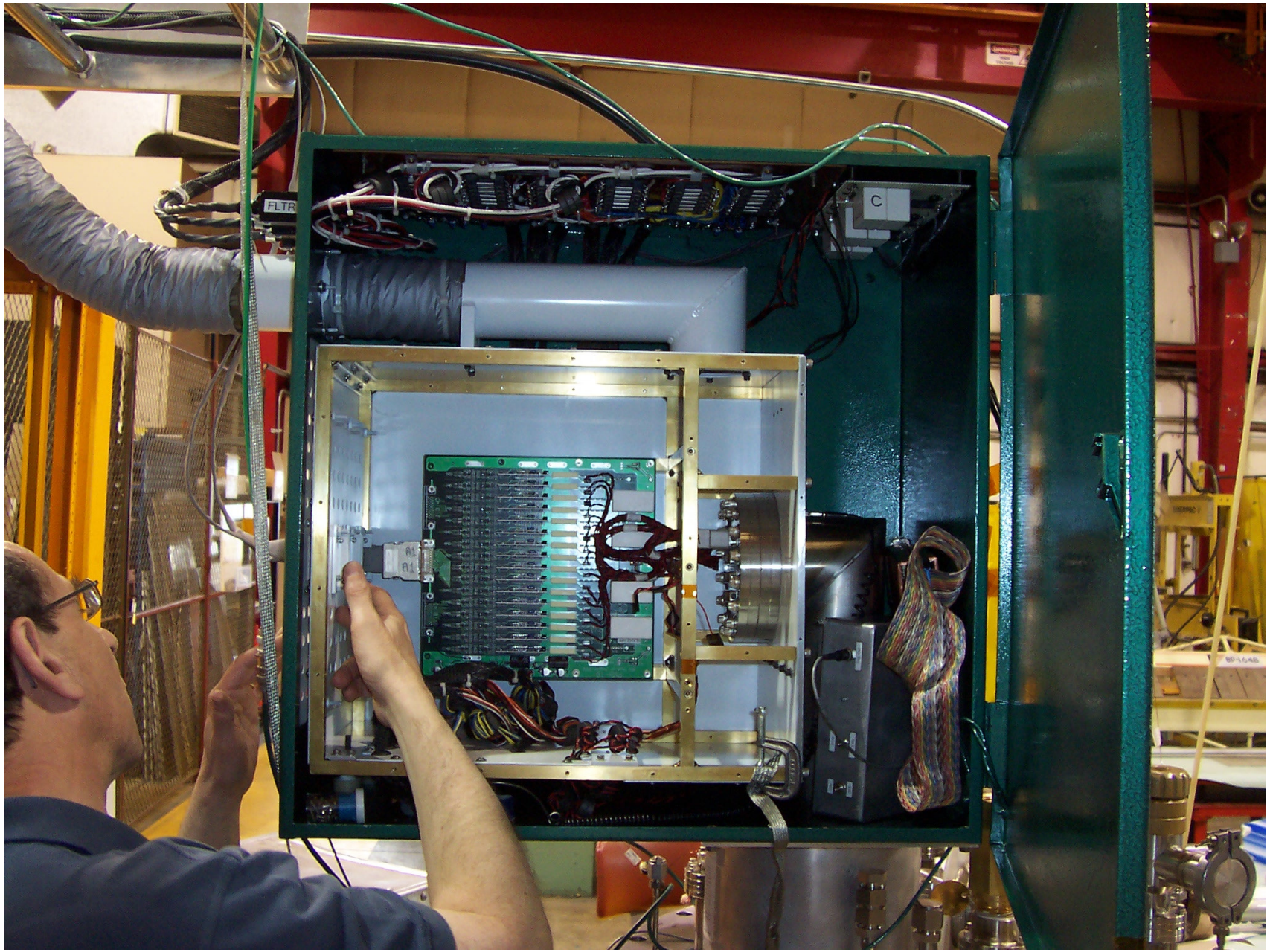
- The boxes on top of the cryostat are NEMA 4/12 24” x 24” x 16”
  - They are based on the Bo cryostat design of Hans Jostlein and Dan Edmunds at PAB
- Bo boxes hold 6 cards, T962 boxes have to hold 10
- Bo has one box, T962 needs 3

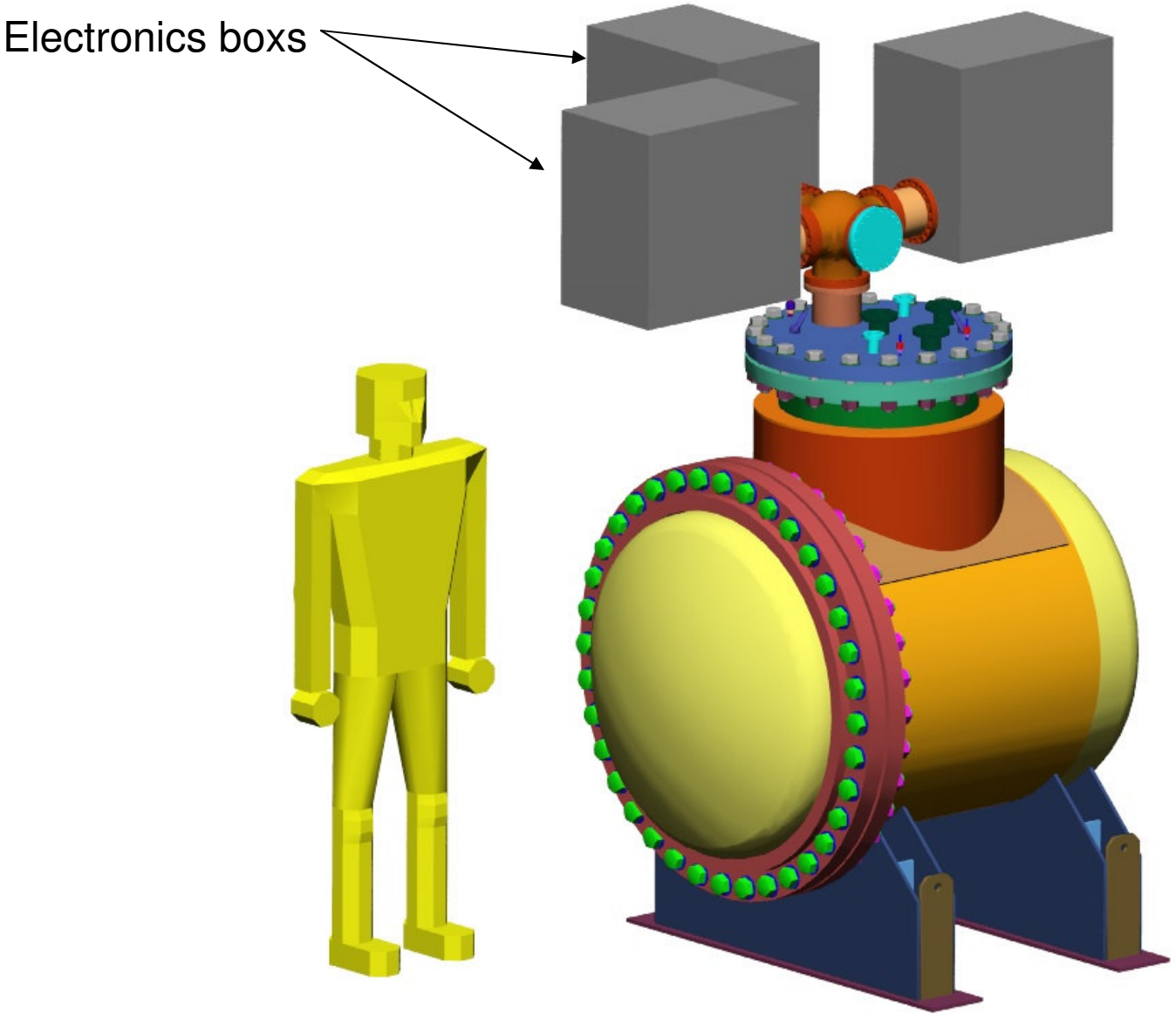

NEMA 4/ 12 Box
24 high x 24 wide
x 12 deep
CF flanges 6" OD x 4.010" bore,
fixed, tapped holes,
Lesker # F0600X400T
17.000
Plane Bias Voltage
Fuse Block
2.500
Bias Voltage
Filters
Preamp Power
17.000
4.300
Preamp outputs
4.000
Dan's Copper Box
Cover
9.449
4.055
24.000
6.000
9.055
15.000
4.055
CF Blank flange
8" OD, rotatable,
through holes,
Lesker # F0800X000R
4.050
3/16 steel plate 48" x 9"
with notch to slip over
the stoplight post
NEMA box has a notch
at the bottom to allow it to
slip over the stoplight "post"
Notch is U-shaped,
see box drawing
8.000
Steel pipe 8"
Sched. 5 / sched. 10
OD=8.625
ID = 8.407 / 8.329"
Tabs
Hans Jostlein
2-2-2007
Dan's Box, Elevation, 2-007

Electronic box mounted on top of Bo cryostat



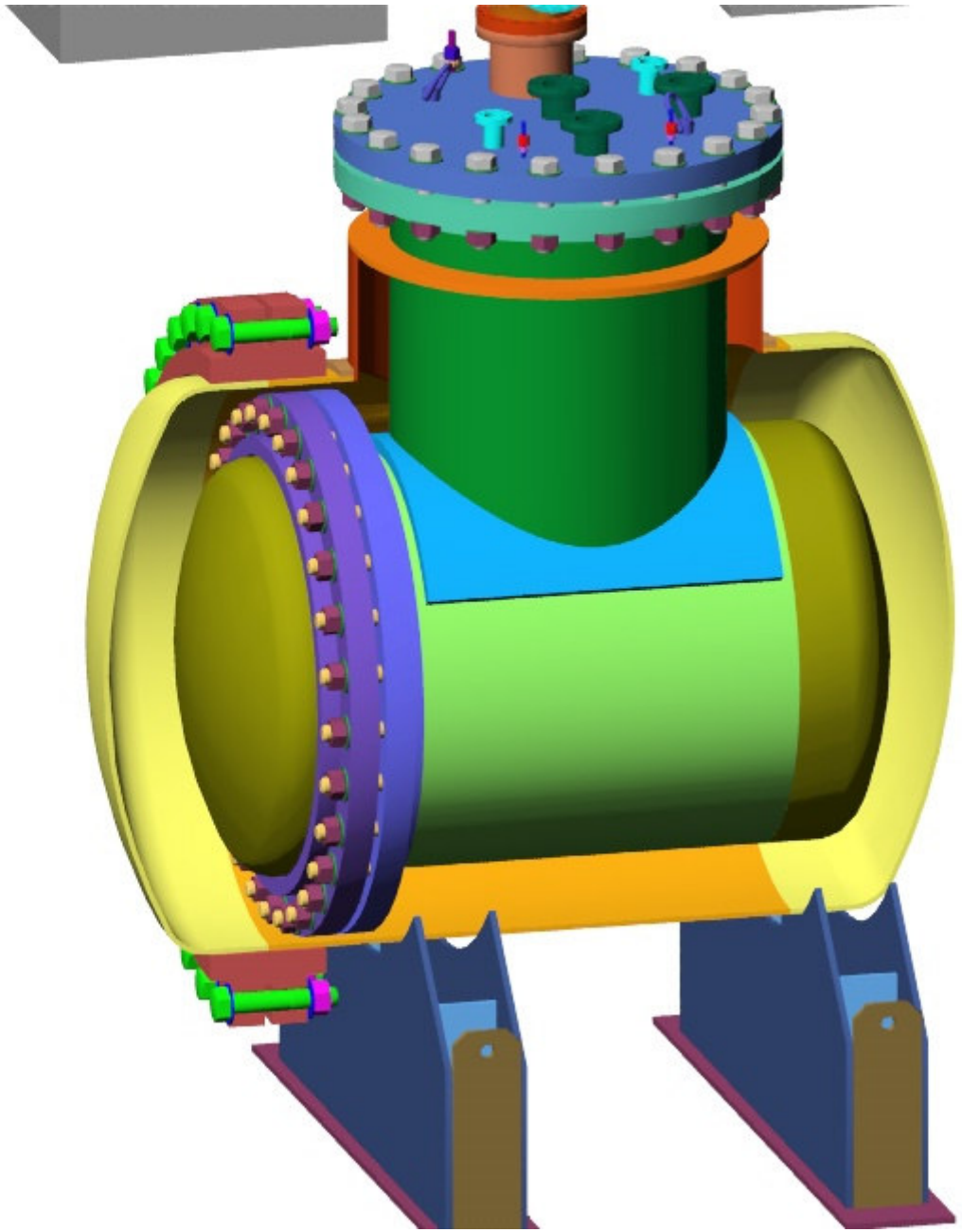
Internals of Bo electronics box




Electronics boxs

Cryostat design and construction

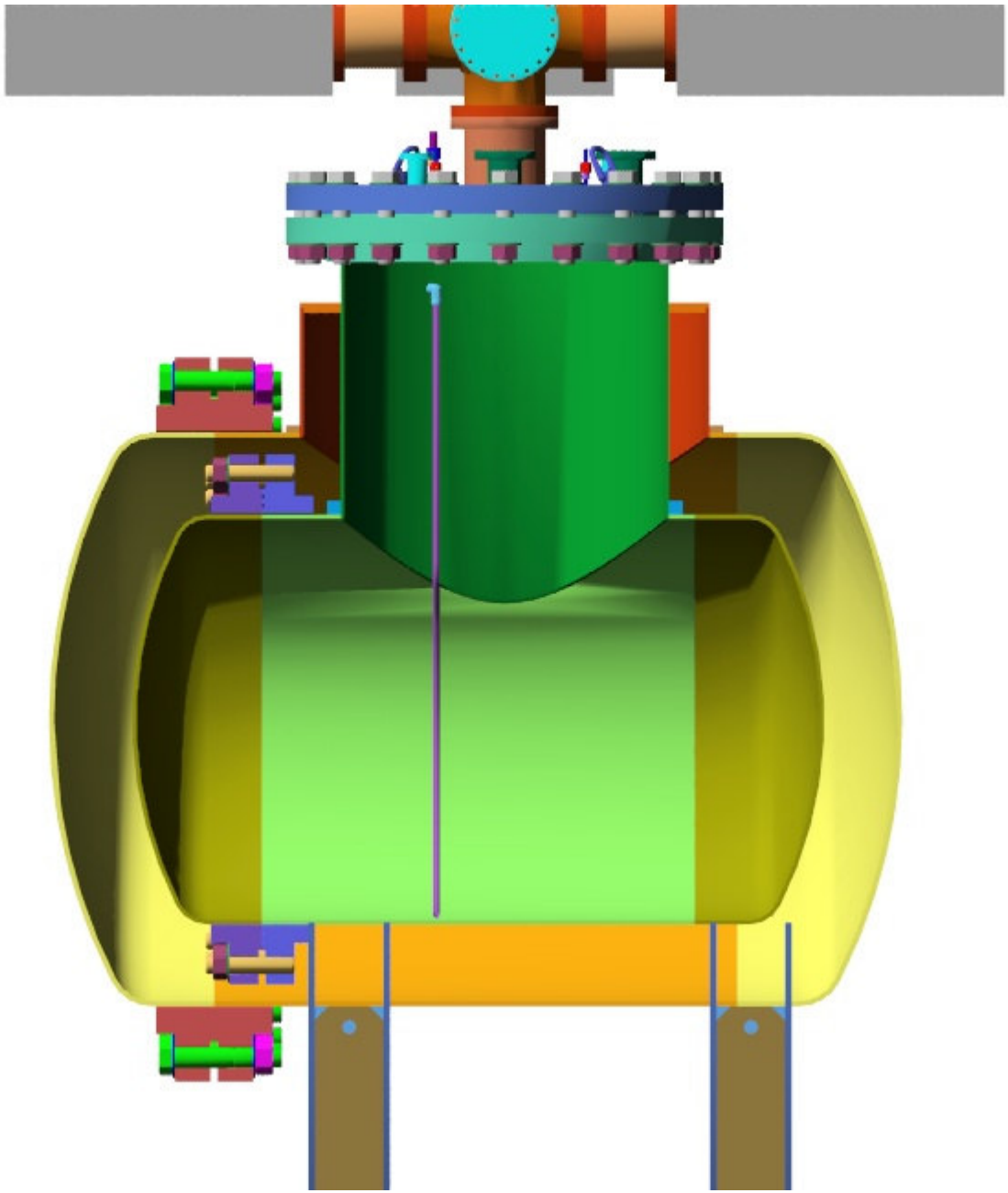
- We are planning to send out a proposal to cryostat machine shops shortly after this review
- The shops will do the detailed design and satisfy the ASME B&PV Code requirements



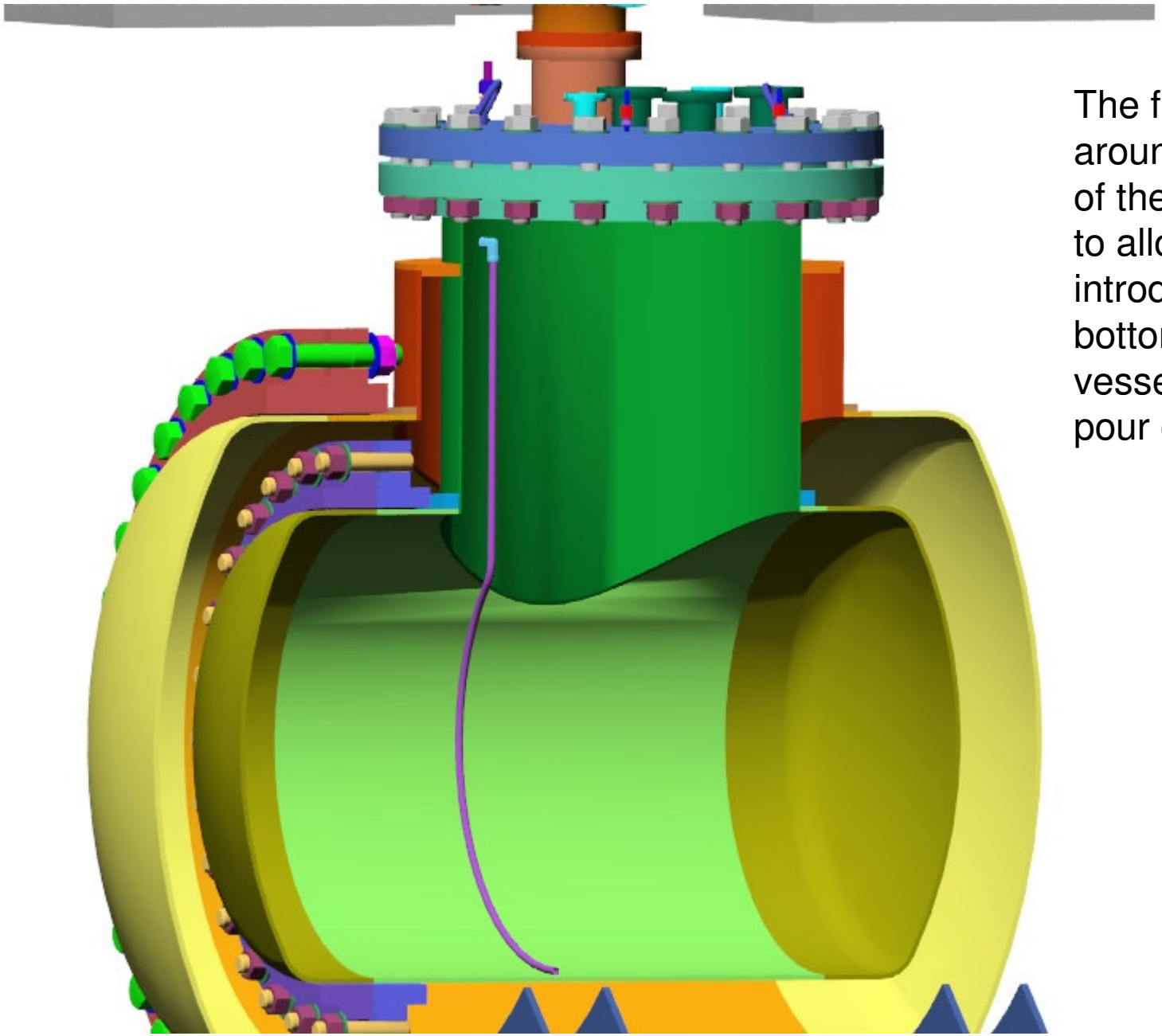
Cutaway of external vessel showing the inner vessel.

The inner vessel is suspended from the outer.

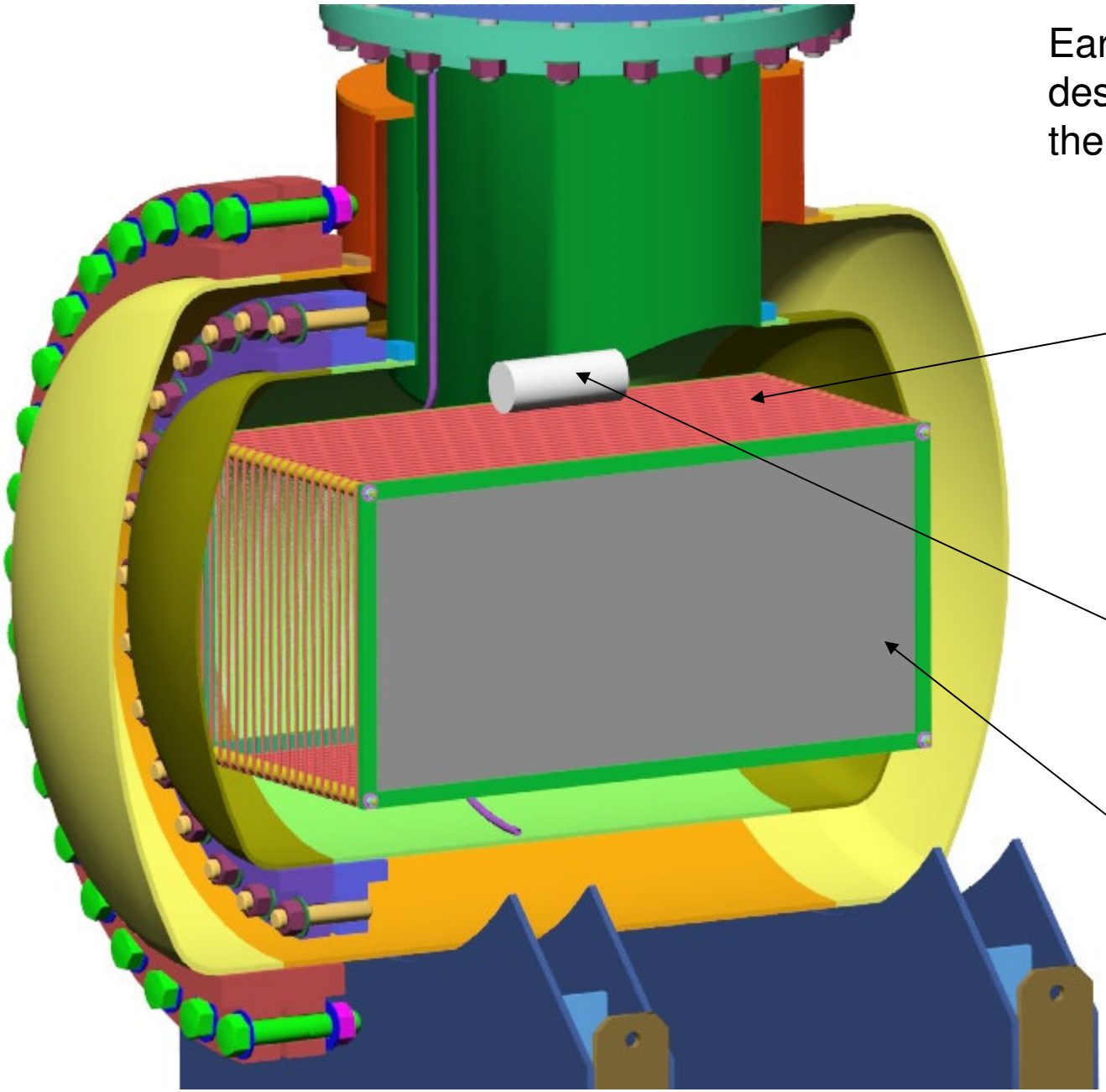
A counter-weighted lifting fixture will be needed to remove the flange from the inner vessel.

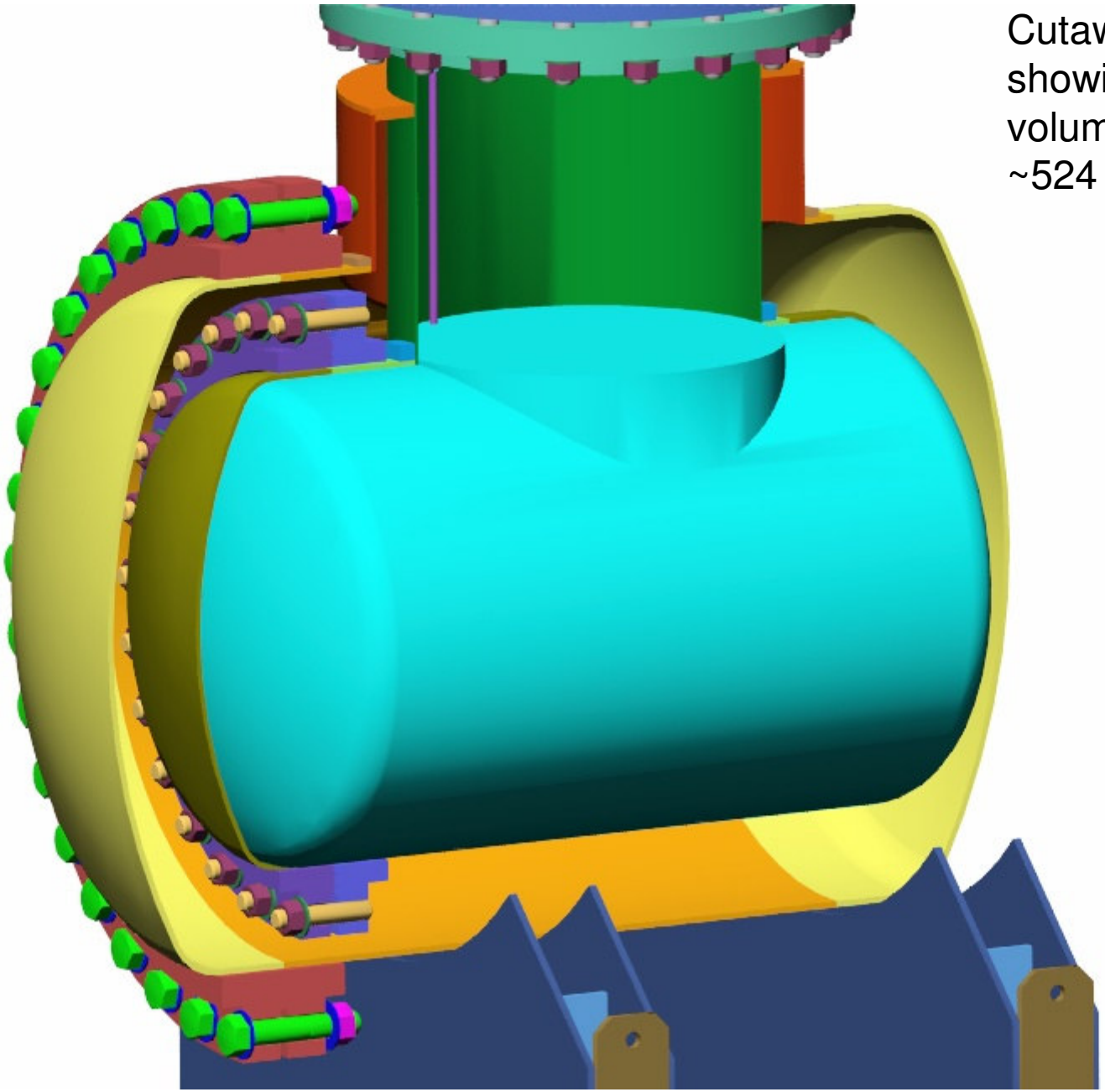


Cutaway view of the inner and outer vessels showing the fill line for LAr

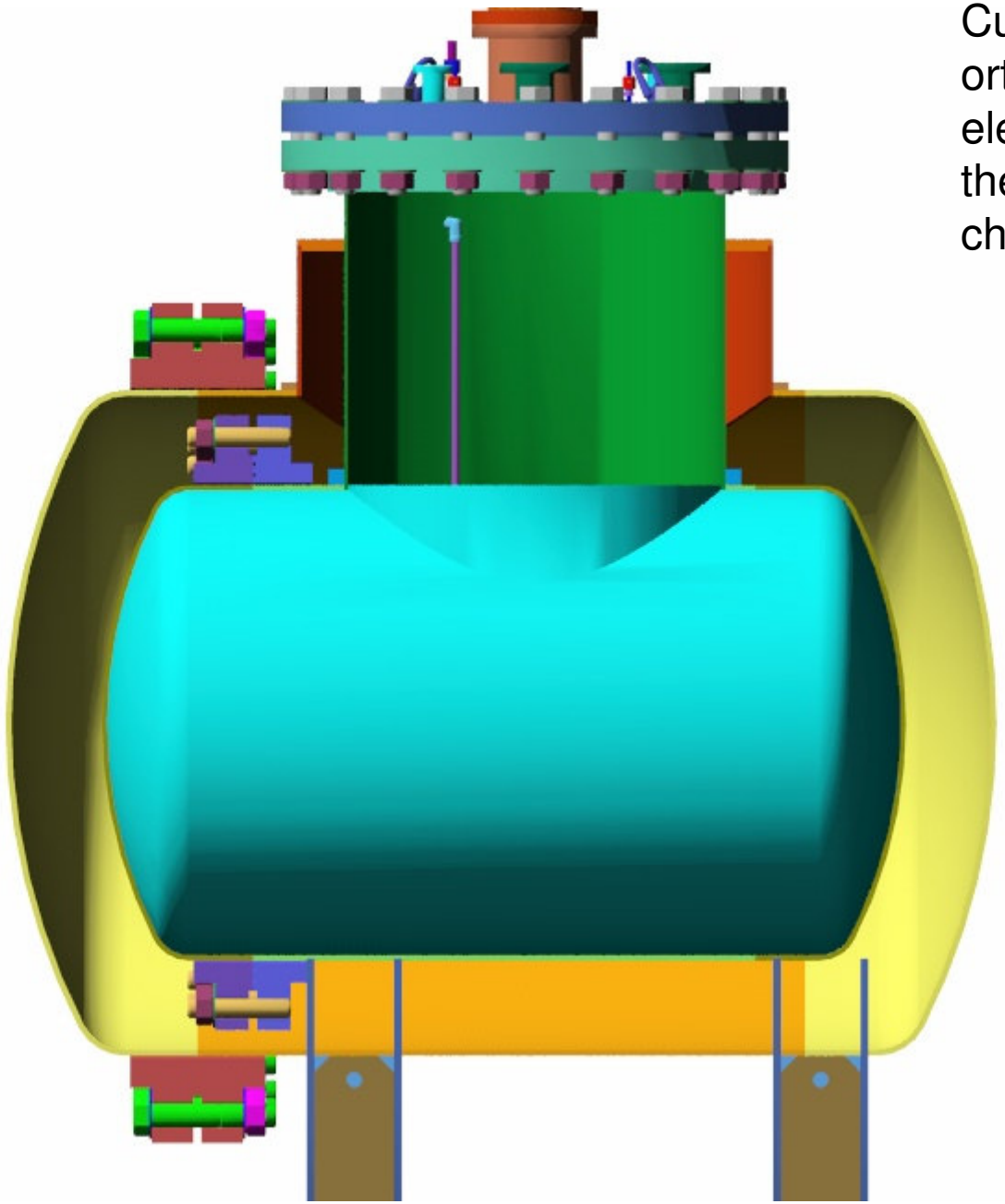


The fill line curves around the inside of the inner vessel to allow LAr to be introduced to the bottom of the vessel, but not pour on the TPC.

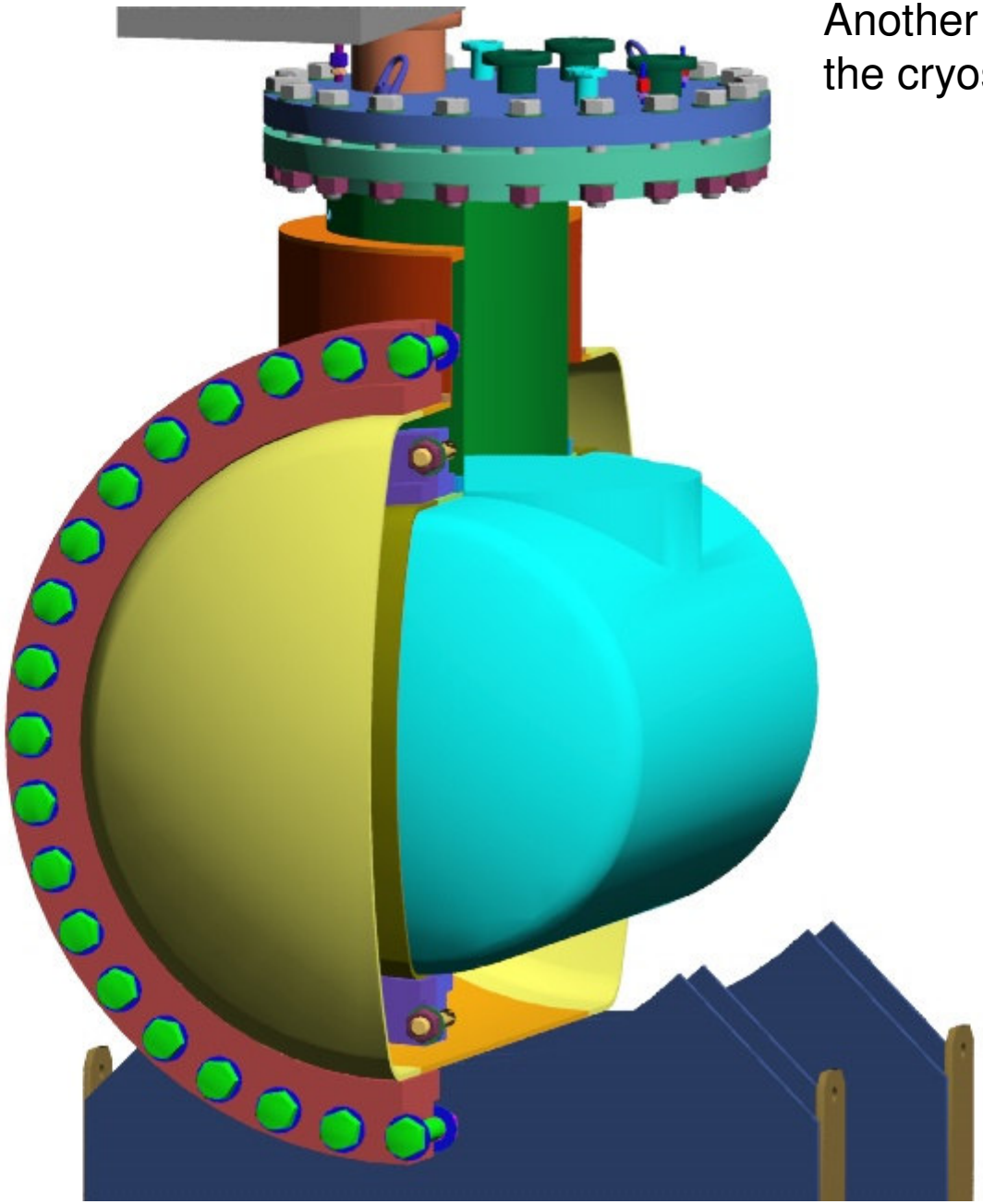

Early conceptual
design of a TPC inside
the inner vessel
Electrode cage
Purity monitor
cathode



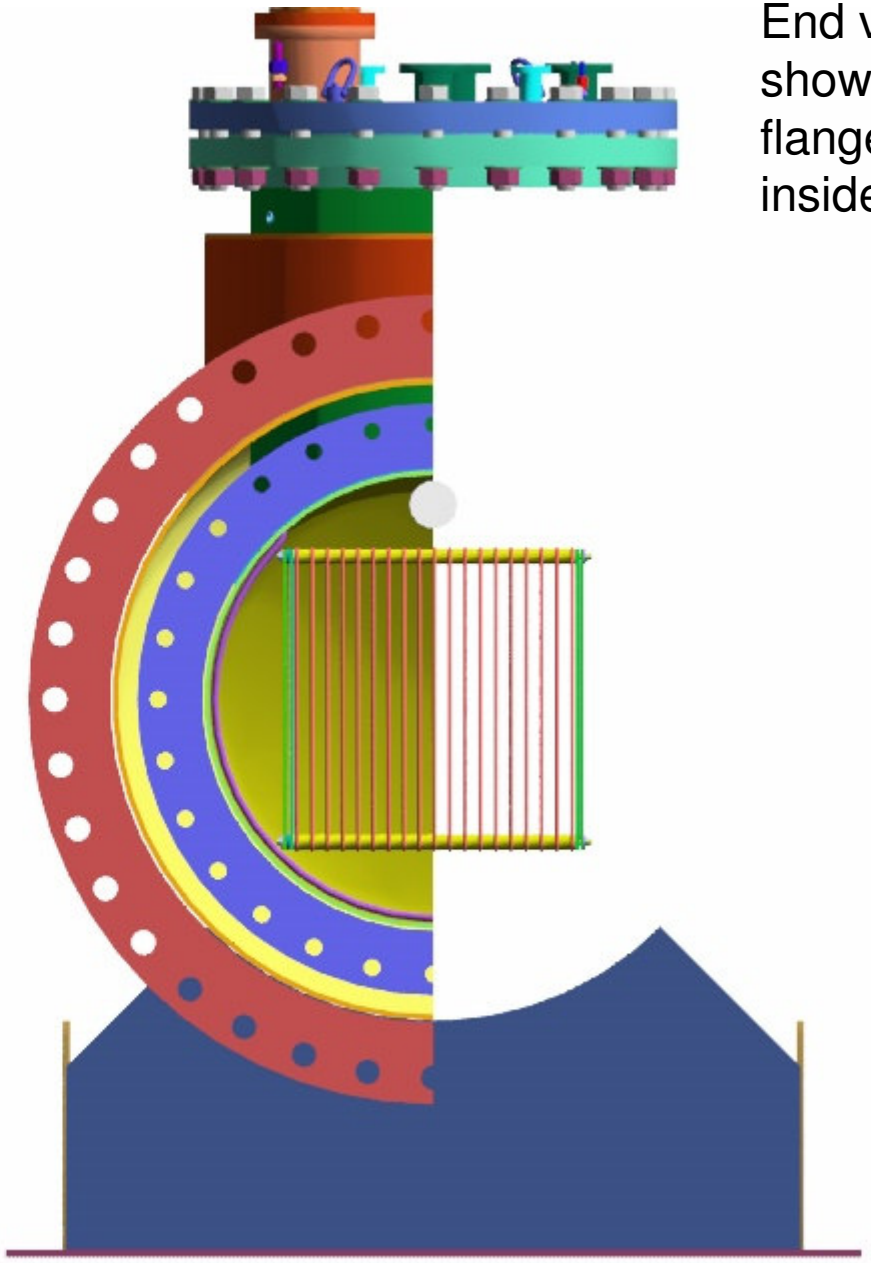
Cutaway view showing the volume of LAr, ~524 liters



Cutaway orthographic elevation showing the LAr level in the chimney



Another cutaway view of the cryostat

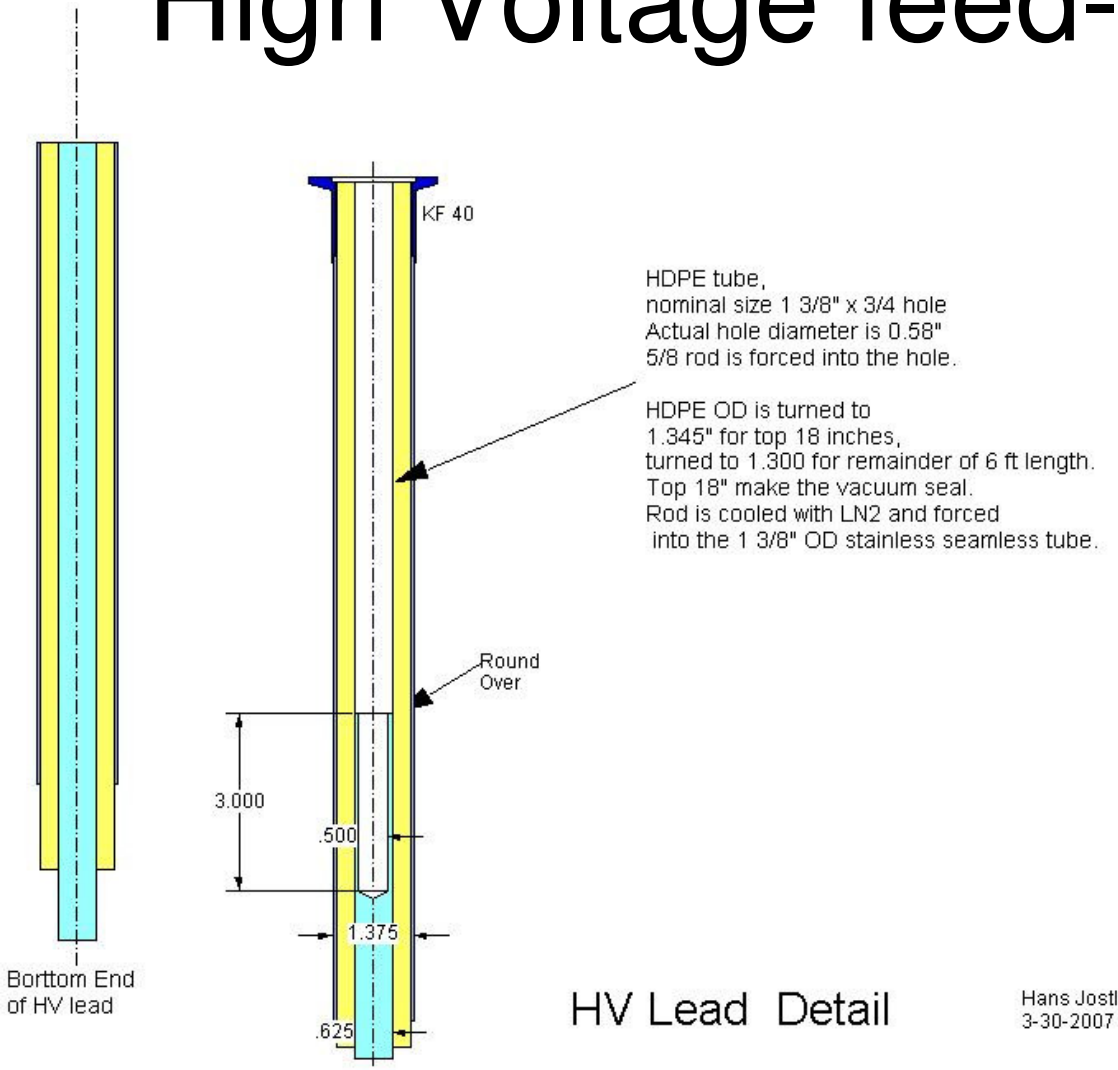


End view elevation cutaway showing the inner and outer flanges removed and the TPC inside the inner vessel

Cryostat Feed-throughs

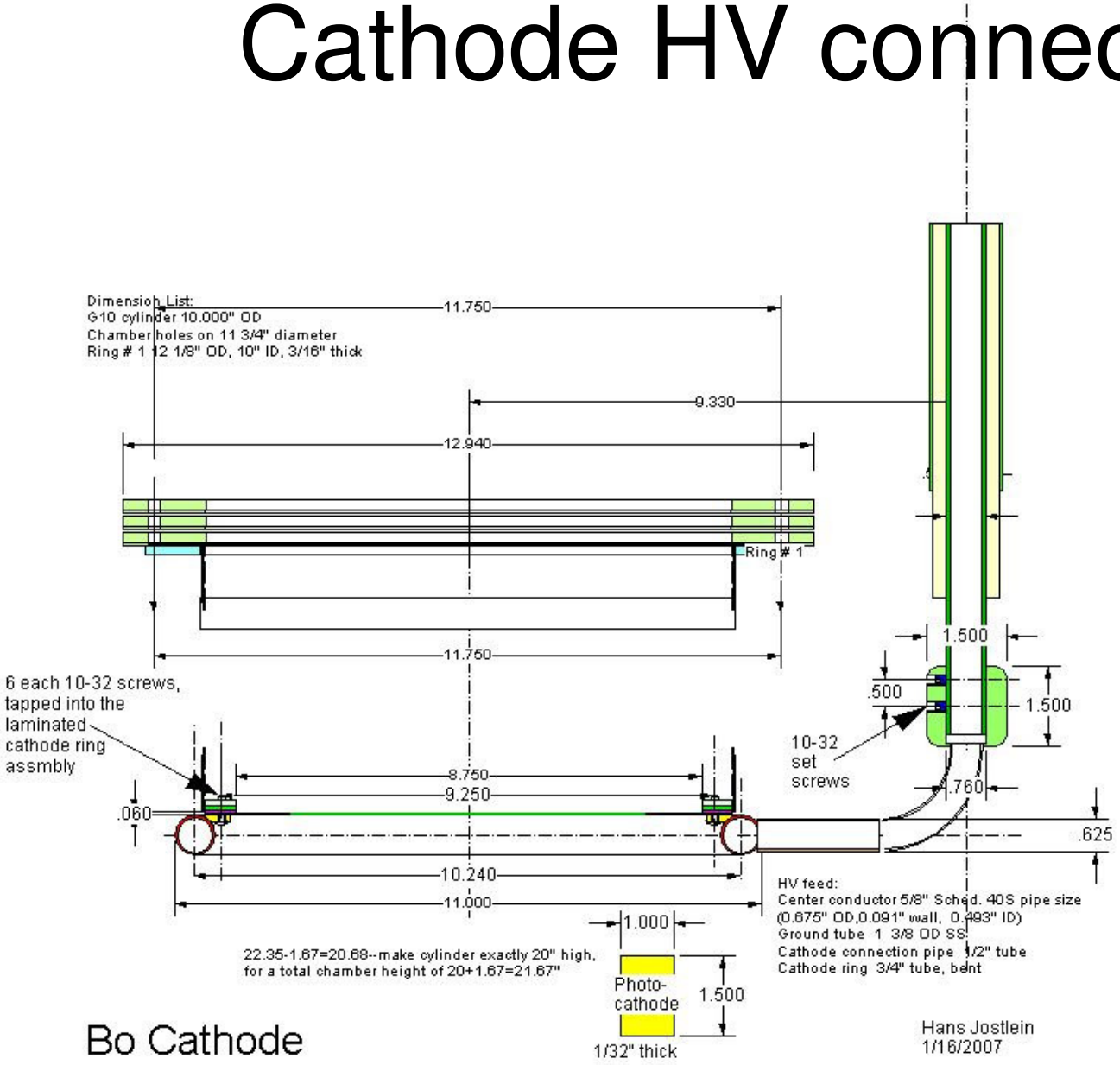
Description	Quantity	Size/type port
Signal	1	10" CF
HV	1	4.5" CF
Level meter	1	2.75" CF or less
Pressure transmitters/gauges	TBD	1/4" VCR
Cryocooler recirculation in	1	2.75" CF
Cryocooler recirculation out	1	2.75" CF
filling connection	1	1/2" VCR
vacuum connection	1	4.5" CF
safety valve connection	1	4.5" CF
heater power feedthrough	1	2.75" CF or less
spare	TBD	4.5" CF
Purity Monitor	1	2.75" CF
Fiber Optic for PM	1	1/2" VCR
Port for pressure transducer on bottom	1	1/4" VCR

High Voltage feed-through



We are planning to use the design experience from the Bo cryostat at PAB. This design comes courtesy of Hans Jostlein.

Cathode HV connection



The T962 cryostat may use this design, also from Hans Jostlein, to make the connection between the HV and the cathode

Conclusion

- We have a lot to do, but have a solid start on the design because of all the previous work done at FNAL and Yale
  - Many thanks to everyone who has shared their drawings and design concepts