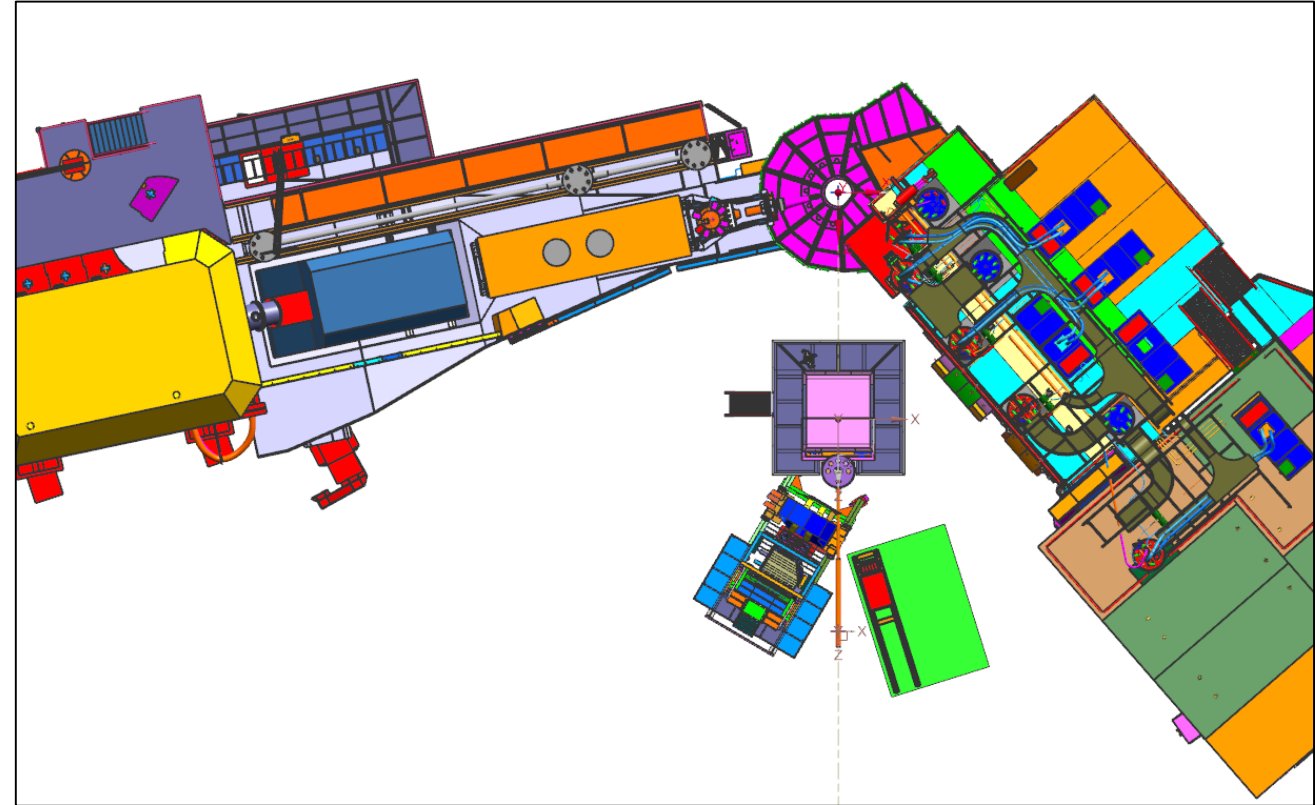


CPS Update 2024

NPS Collaboration Meeting

Steven Lassiter

Wednesday July 17, 2024



U.S. DEPARTMENT OF
ENERGY

Office of
Science



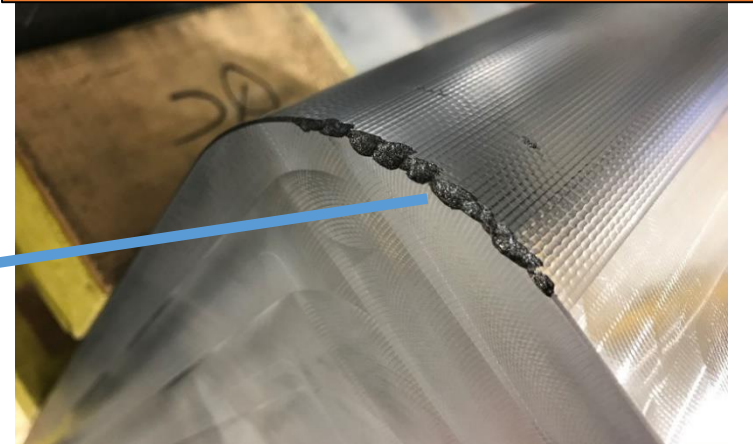
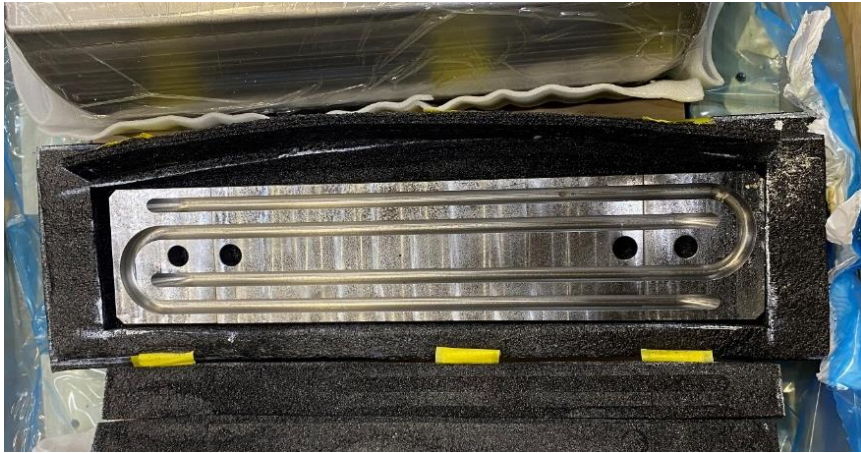
Current status 2024

- Engineering work has been paused since mid-2023
- In the process of hiring two engineers for Hall C – one candidate has a good background in thermo-hydraulic analysis on ITER cryogenics and heat exchangers
- Magnet yoke, poles pieces, coils and raw Cu absorber blocks have arrived at JLAB
- Prototype Cu absorber testing – was just getting started when paused
- CAD Modeling updates will be shown

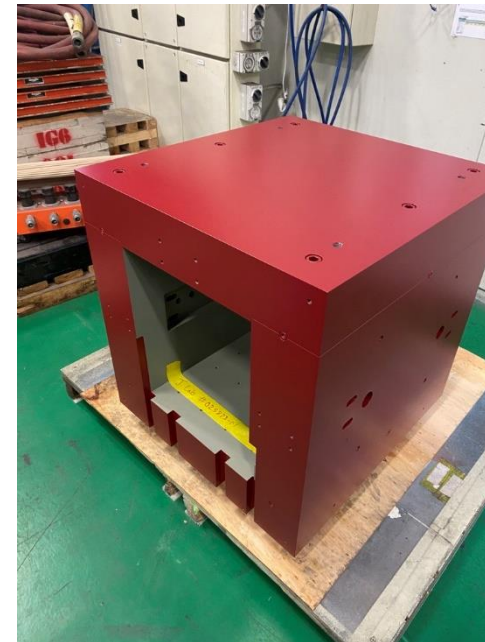
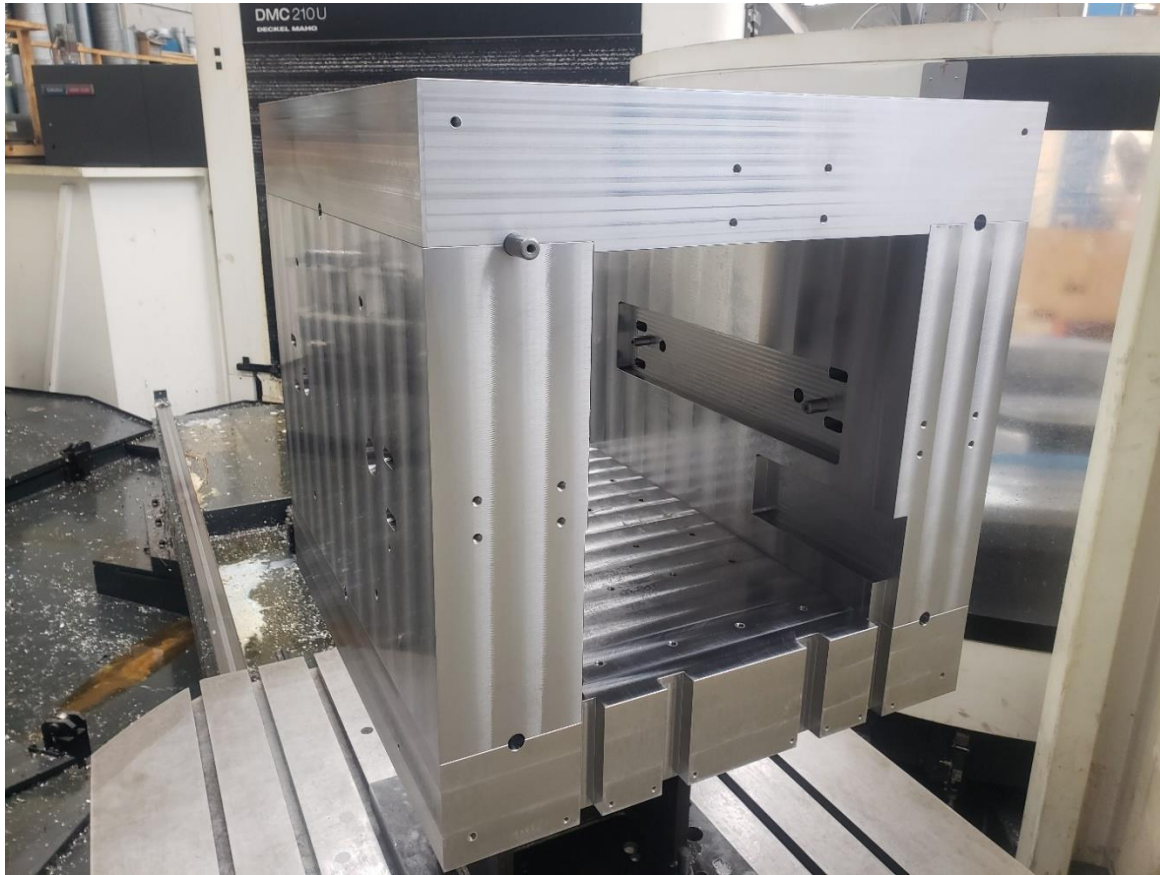
Magnet Pole and Cooling Plate Pieces Buckley Systems



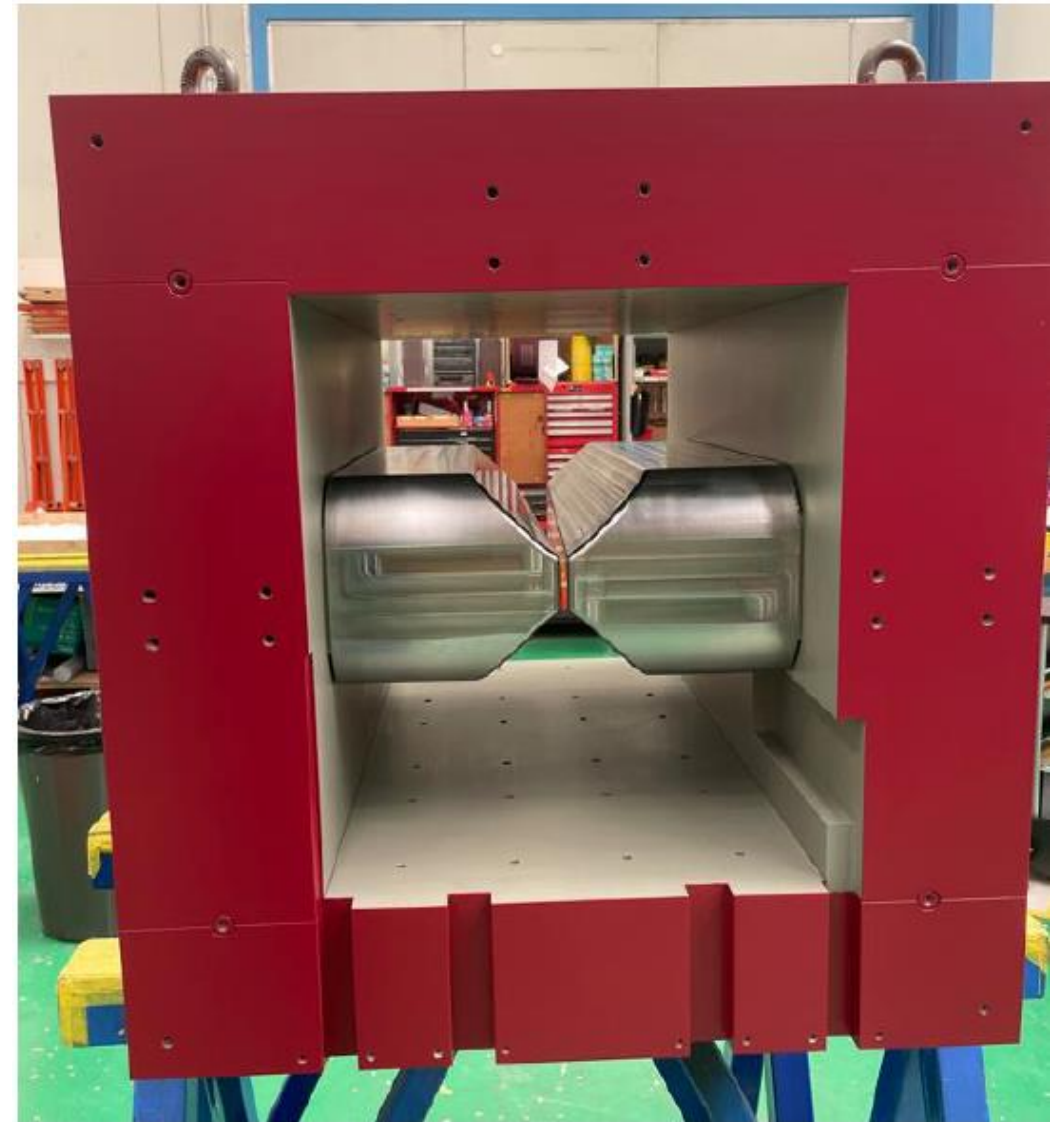
Q/A and surface defects on pole edge - accepted



Yoke



CPS Magnet Assembled at Factor

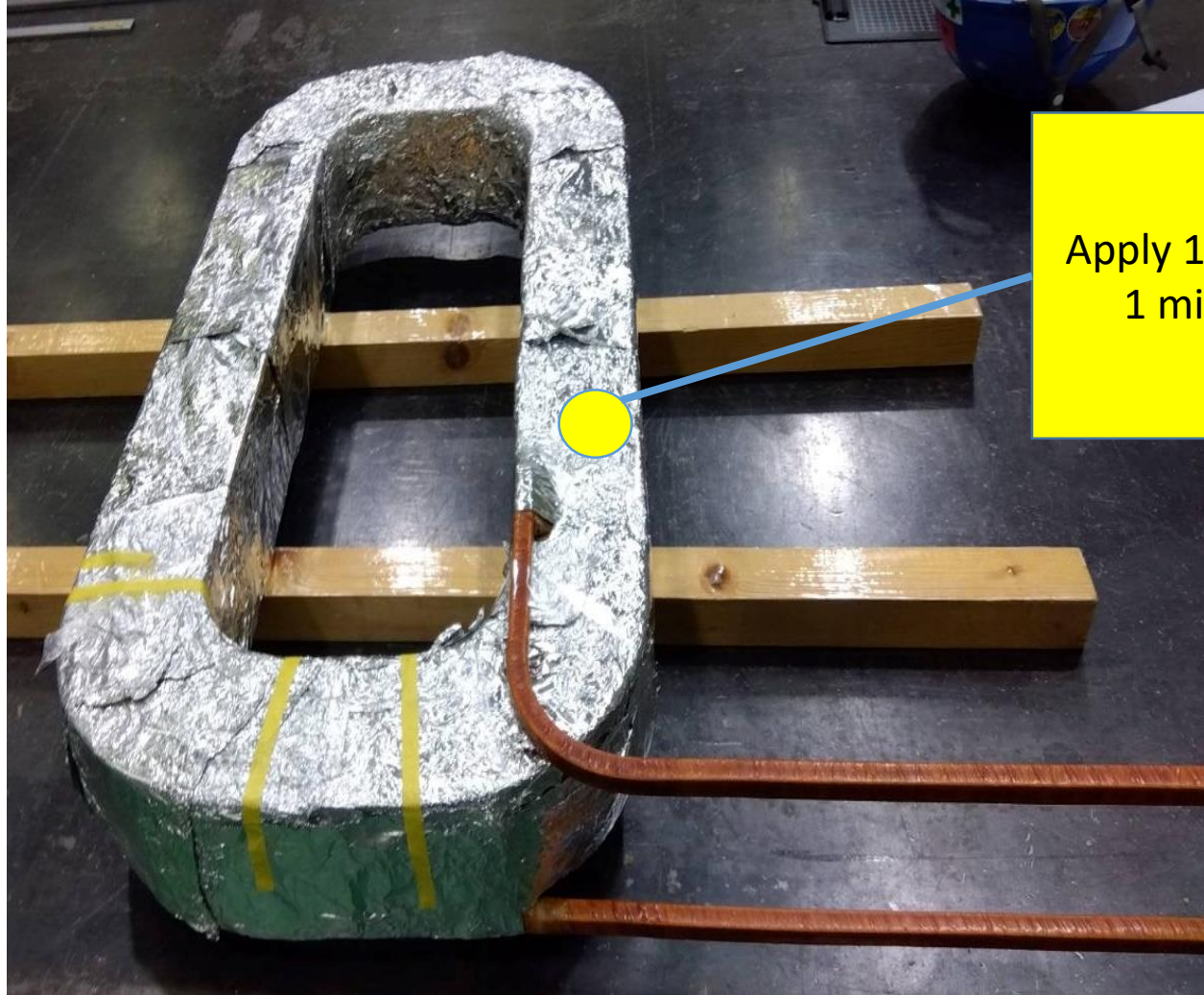


COILS - Tokin Corp

Factor testing included Dimensional checks, Hi-pot test, Cleaning checks, Water flow & Pressure



Token Electrical and Factory testing



Apply 1.5kV AC
1 minute

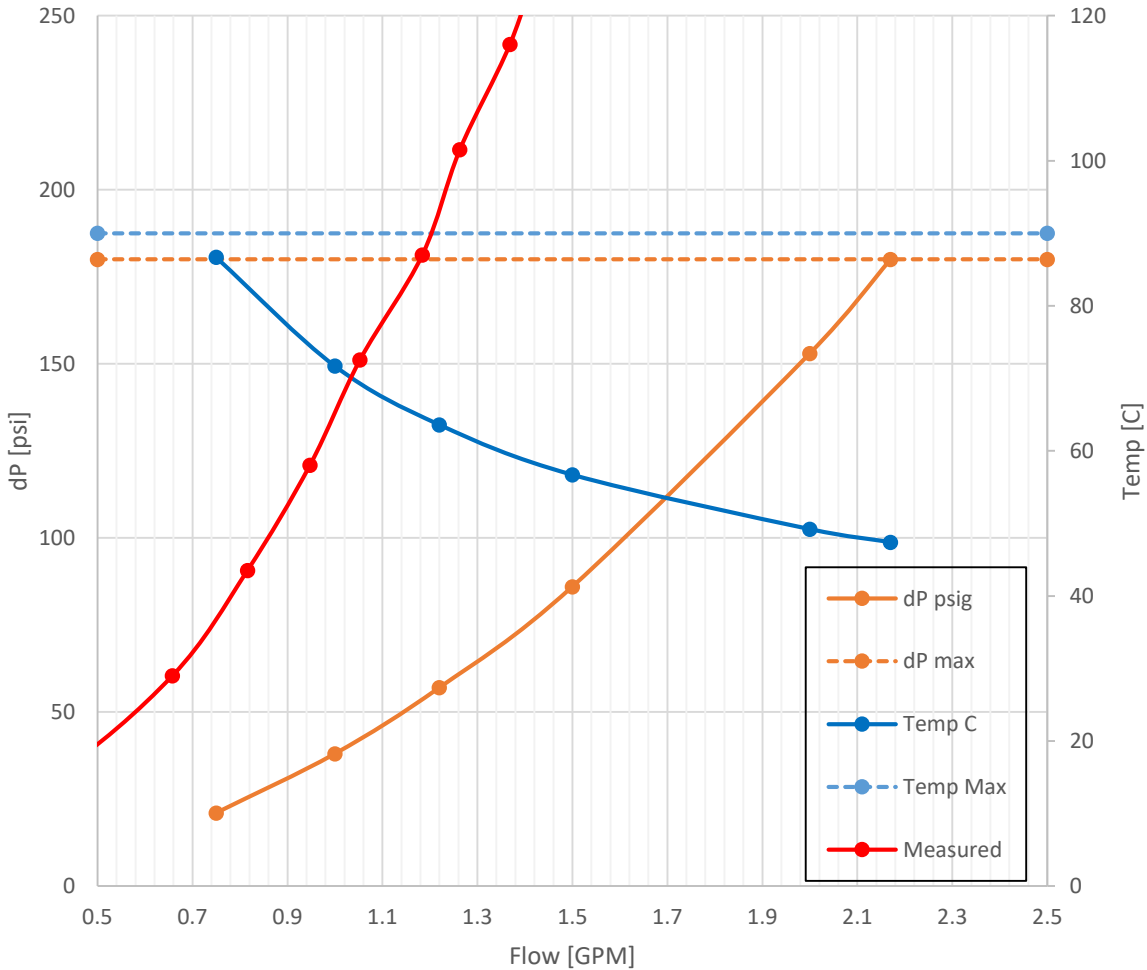
Both Coils passed

No.	Inspection	Method (Specification Value)	Criterion	Result
1	Appearance Inspection	Perform visually on specification and assembly drawing.	Appearance is clean and parts are securely fastened.	<u>Pass</u> · Fail
2	Dimensions Inspection	Measure the dimensions of each specified in the assembly drawing. See inspection drawing 4950-1200-01	Must be less than or equal to the dimensional tolerances entered in the drawing. Dimension without tolerance are for reference values.	<u>Pass</u> · Fail
3	DC Resistance	Measure the DC resistance at the coil terminal.	17.6 ± 10% m Ω /coil (20°C)	<u>Pass</u> · Fail 17.23 m Ω
4	Insulation Resistance	The following lists are measured with a 1kV DC megger. Coil conductor to ground The ground conductor is wound with aluminum foil on the part corresponding to the yoke.	100M Ω or more when cold.	<u>Pass</u> · Fail ≥ 2000 M Ω
5	Impulse Test	A single 1000Vp full-wave pulse is applied between coil terminals to check insulation turns. Waveforms are photographed.	No abnormalities.	<u>Pass</u> · Fail See Fig-2
6	AC Hipot Test	Apply 1.5kV AC (Commercial frequency) to the coil for 1 minute. Coil conductor to ground The ground conductor is wound with aluminum foil on the part corresponding to the yoke. Record leakage current at 30s and 60s after energization.	No abnormalities.	<u>Pass</u> · Fail Leakage current 30s 3.22 mA 60s 3.23 mA
7	Inductance Test	Measure inductance at the coil terminals. (Measured at 120Hz, 1kHz)	Reference values.	120Hz 1.7823mH 1kHz 1.4909mH
8	Water Circuit Test	Attach the filter to the outlet of the water channel and let the water flow at 0.3 MPa for 1 minute.	No dirt accumulates in the filter	<u>Pass</u> · Fail See Fig-3
9	Flow/ Pressure Tests	The coolant circuits shall be pressurized 2.7 MPa for 30 minutes. Measure cooling water flow rate and pressure drop at water temperature of 25 ± 2°C. Measurement from 0 to 1.5 MPa in 0.1 MPa steps.	Reference values. Record pressure drop at 5.2L/min/coil	0.8 MPa See Fig-1

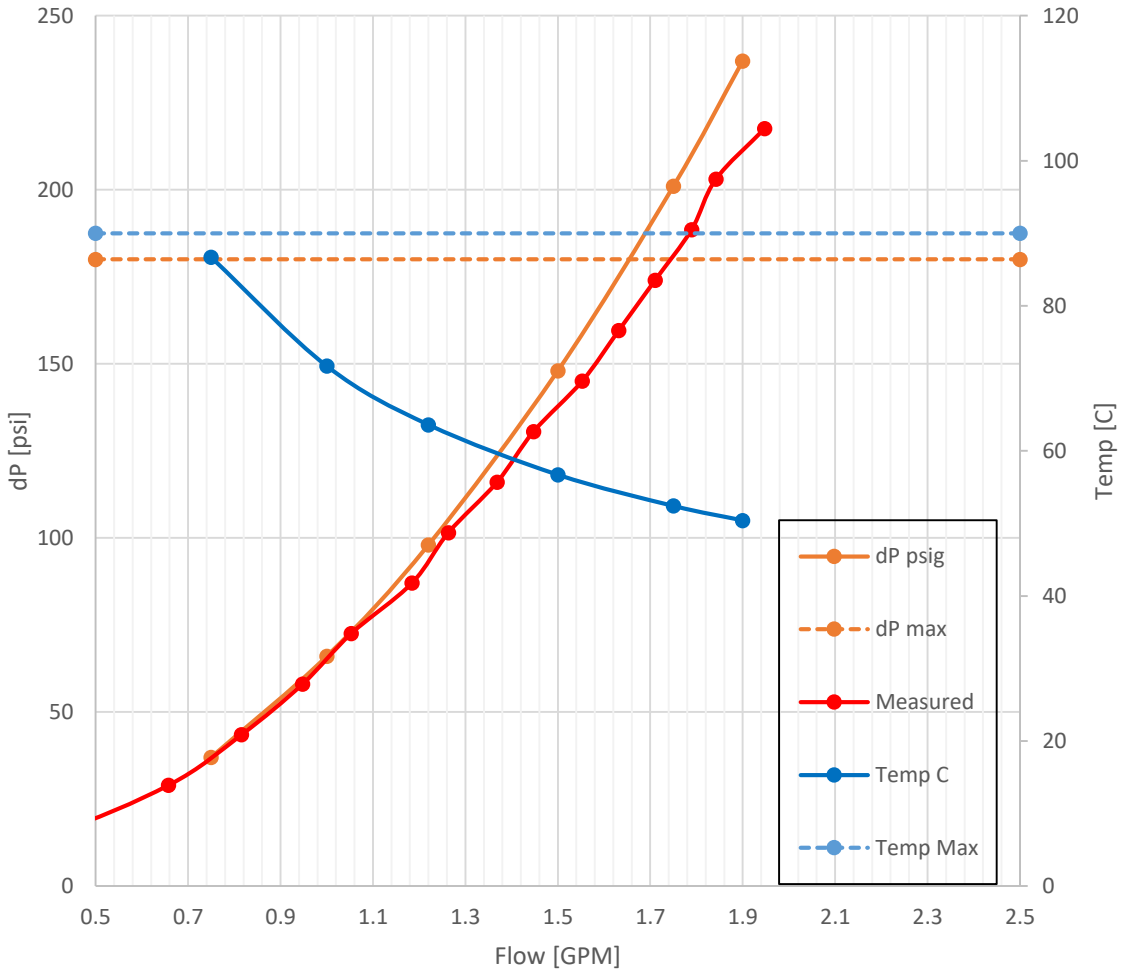


Calculations vs Measured

Original estimate of $f = 1.36E-02$

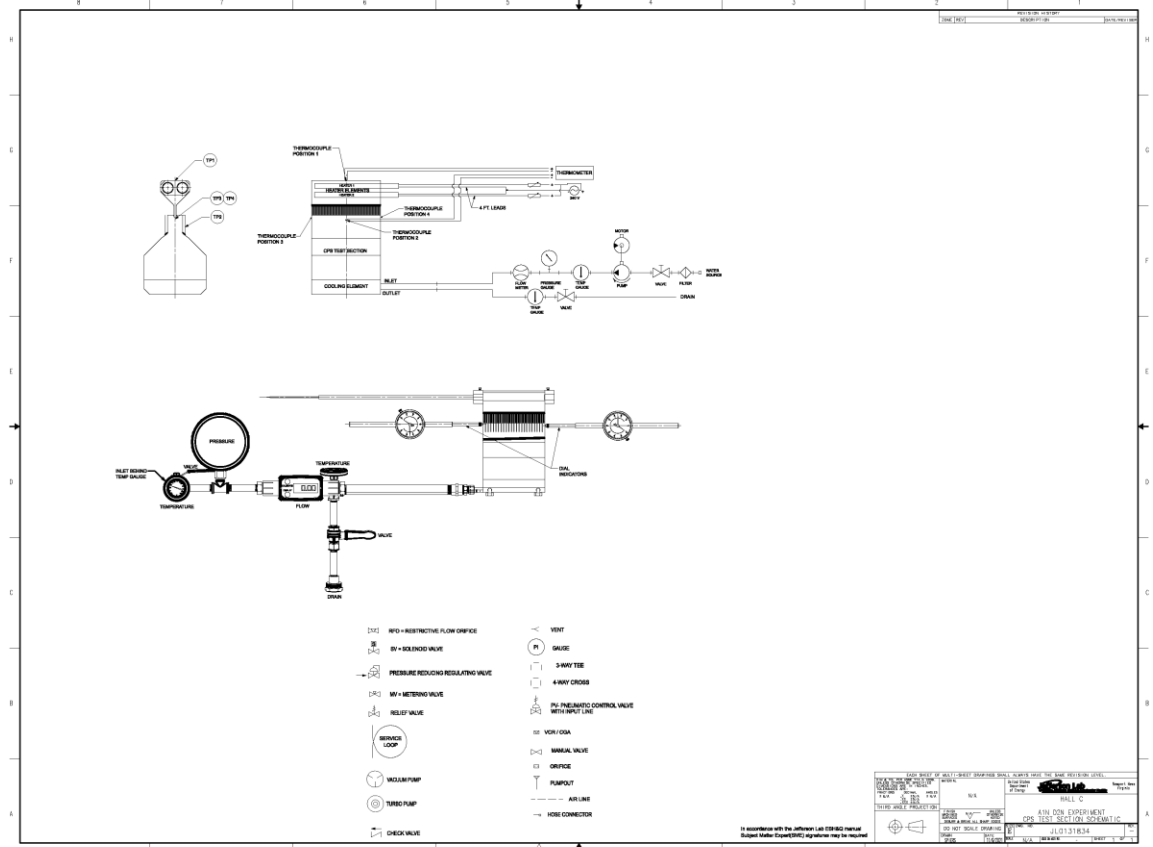
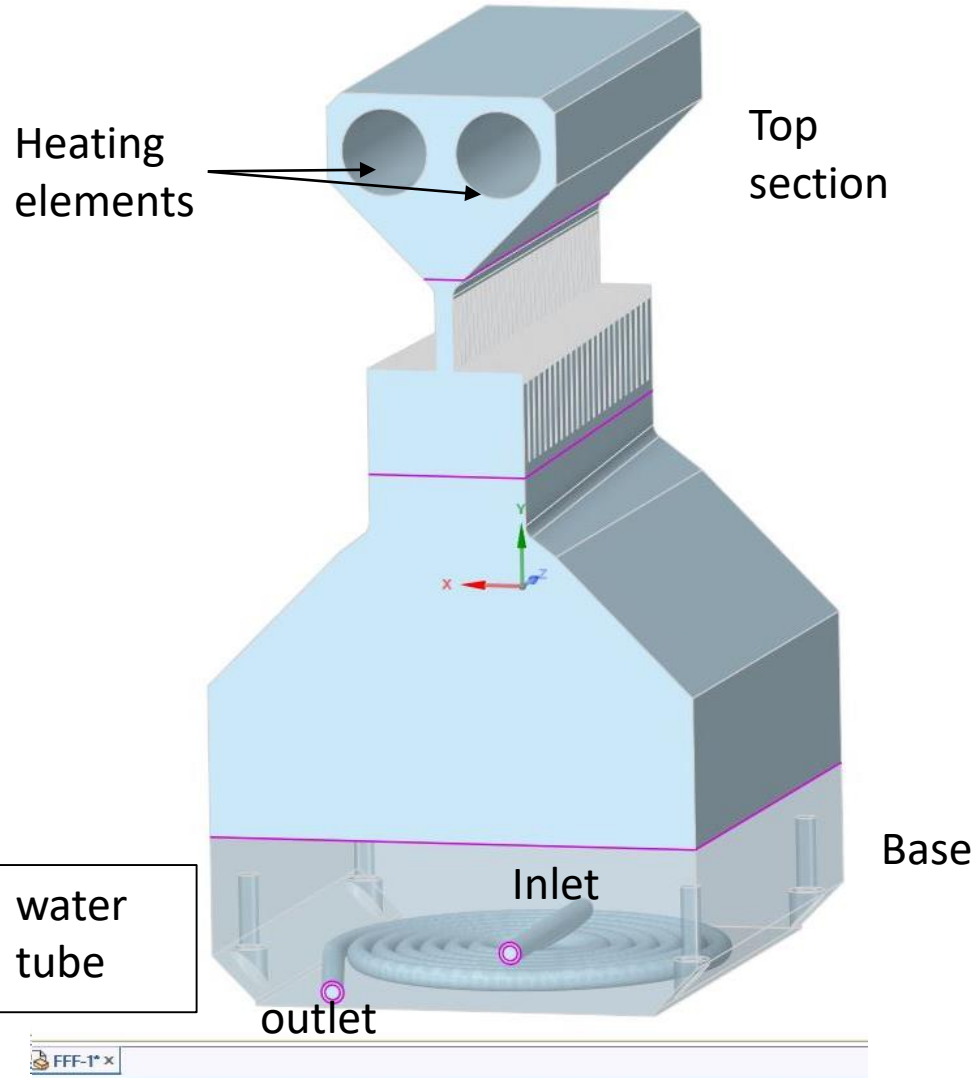


Refined estimate of $f = 2.34E-02$



Cu Absorber Prototype

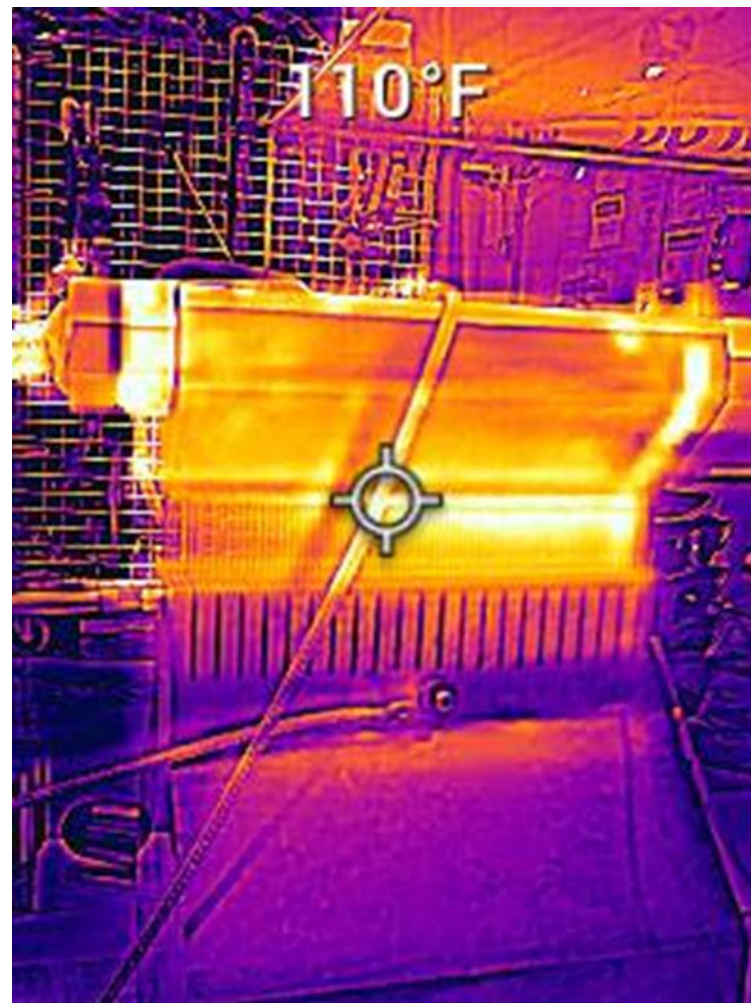
Click an object. Double-click to select an edge loop. Triple-click to select a solid.



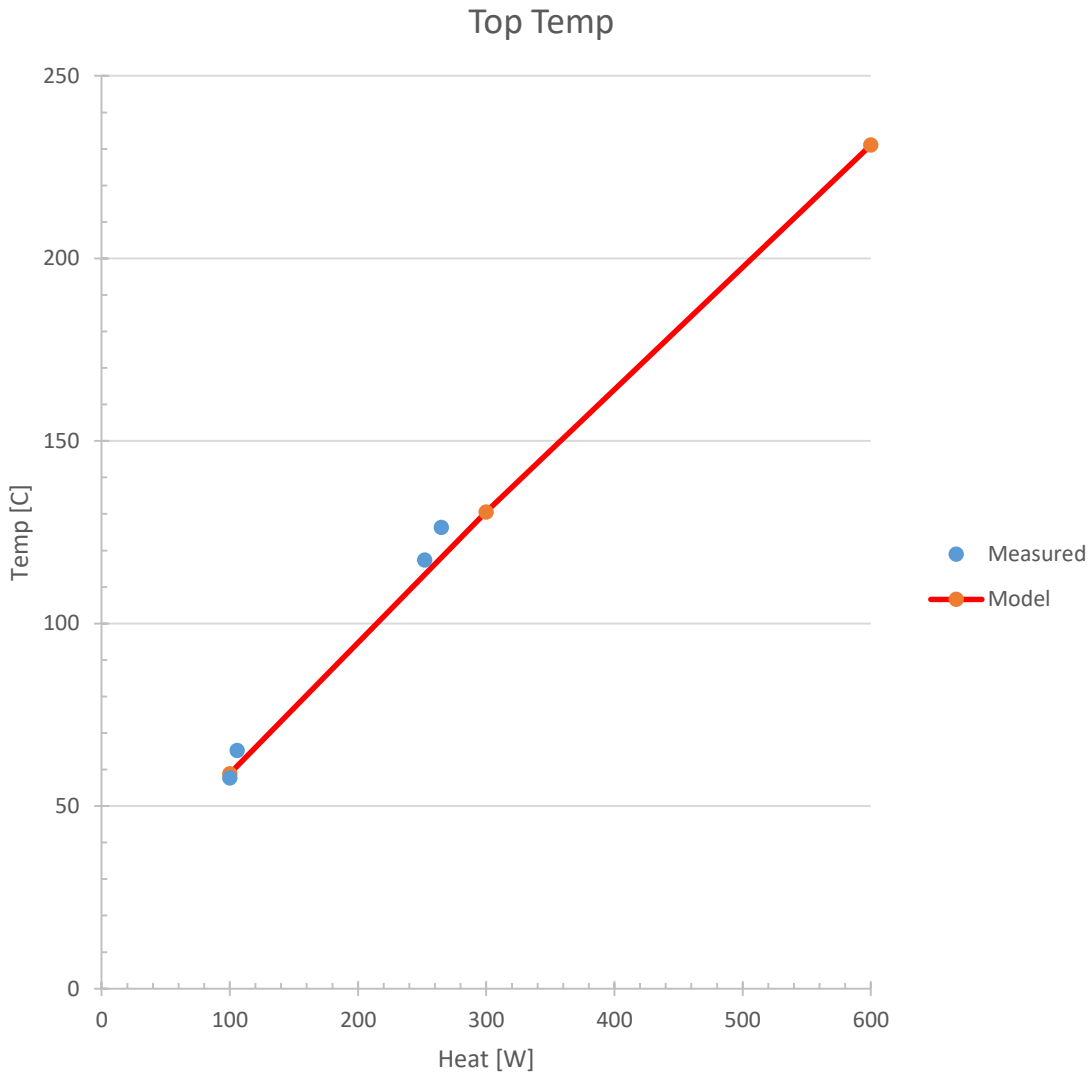
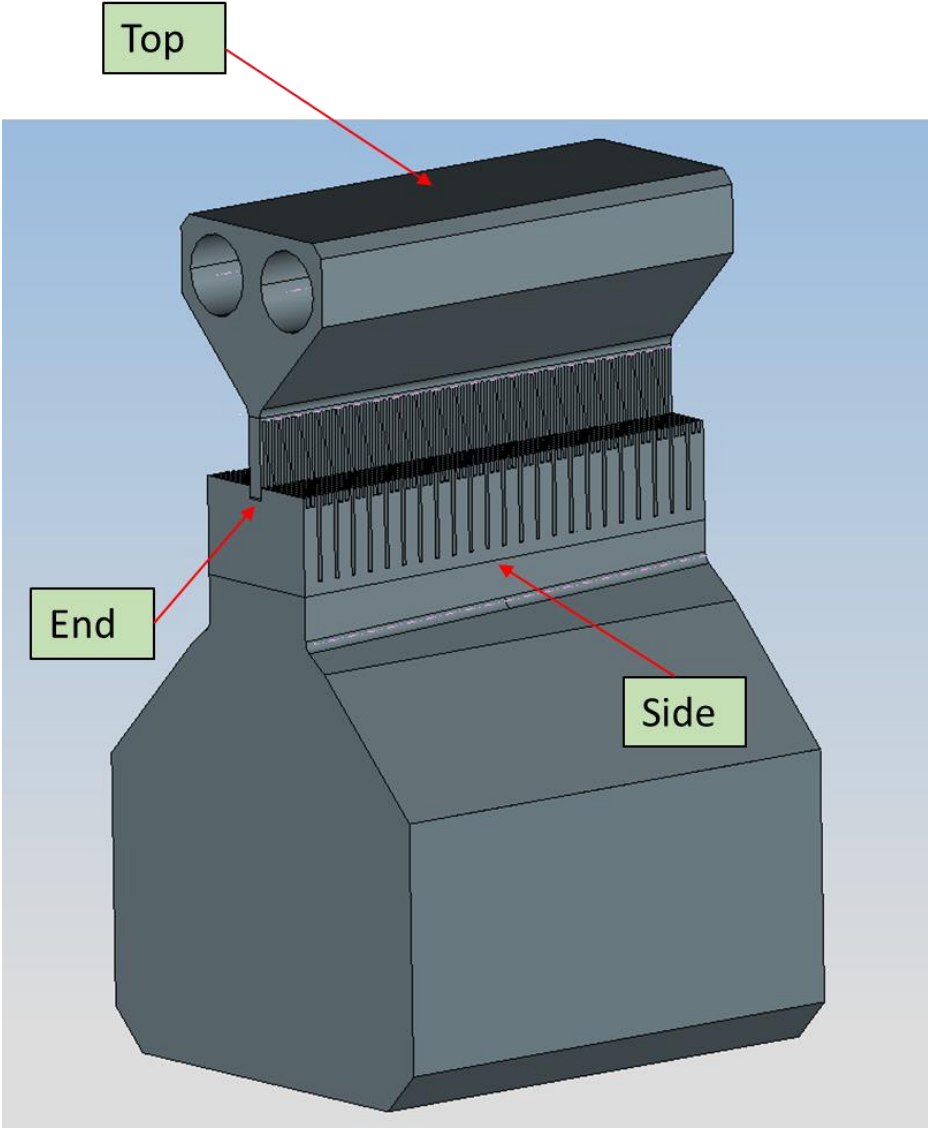
Cu Absorber Prototype Testing Setup



Thermal Camera Captures

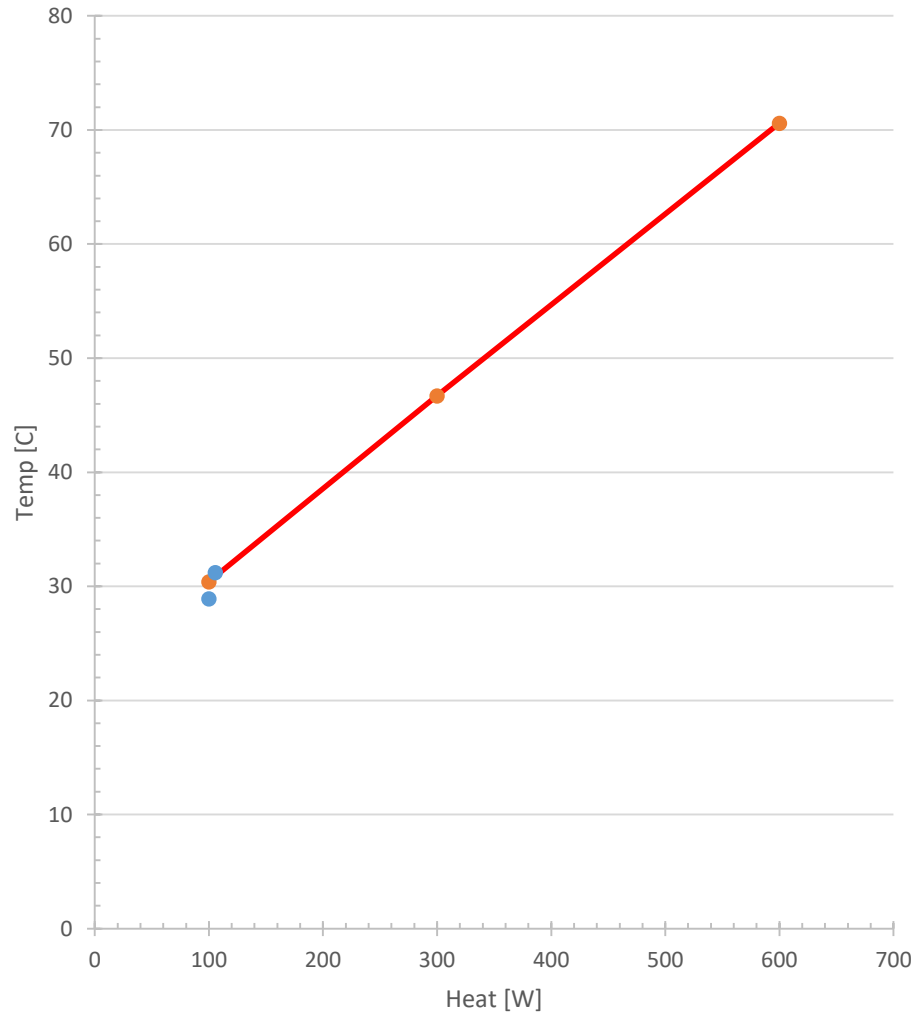


Temperatures Measured vs Model

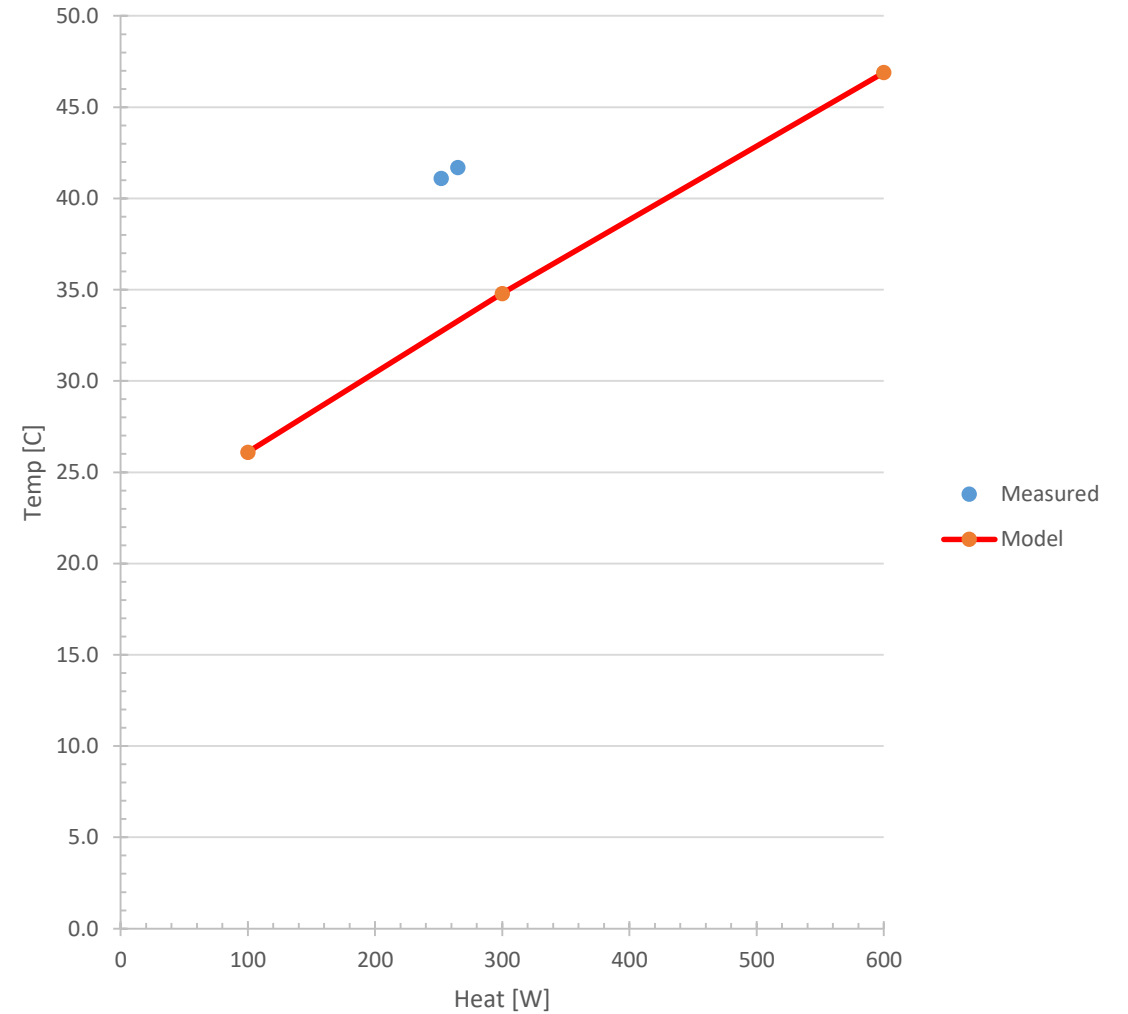


Prototype Temperatures Measured vs Model

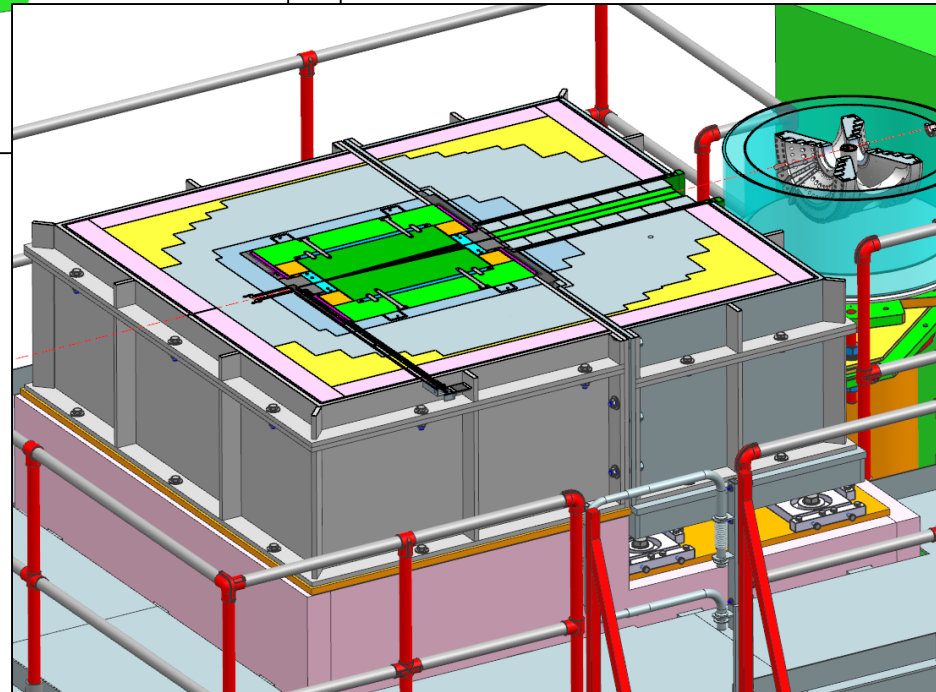
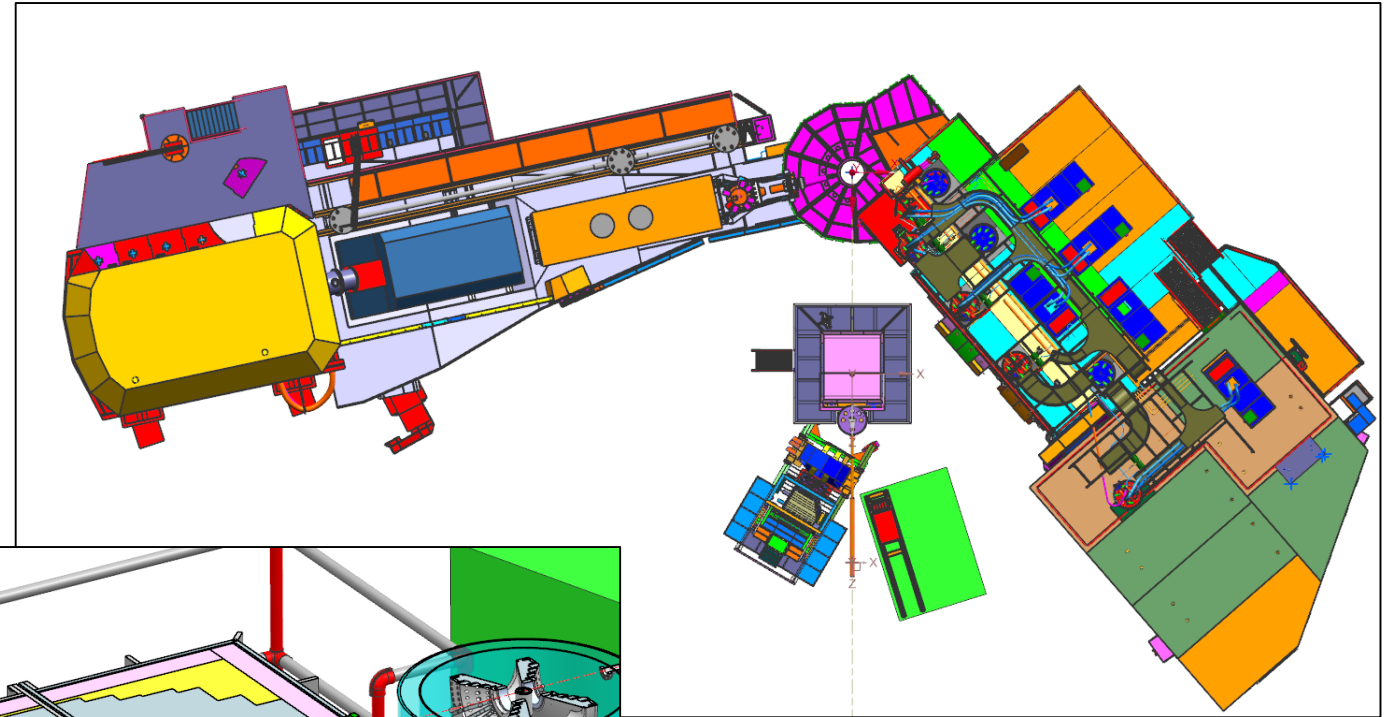
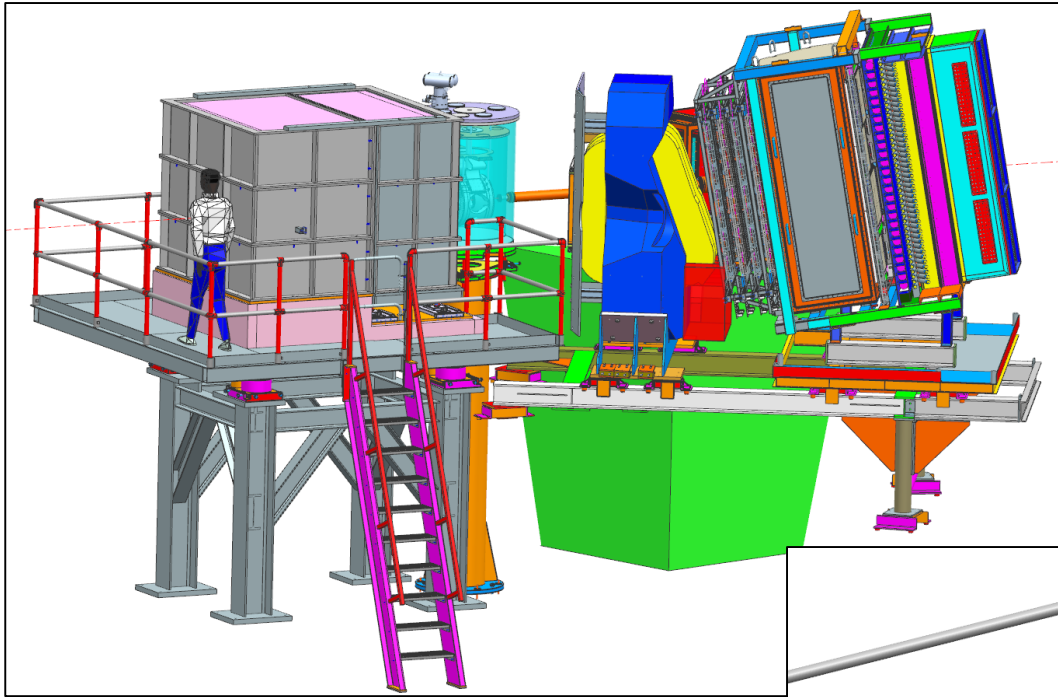
End Temp

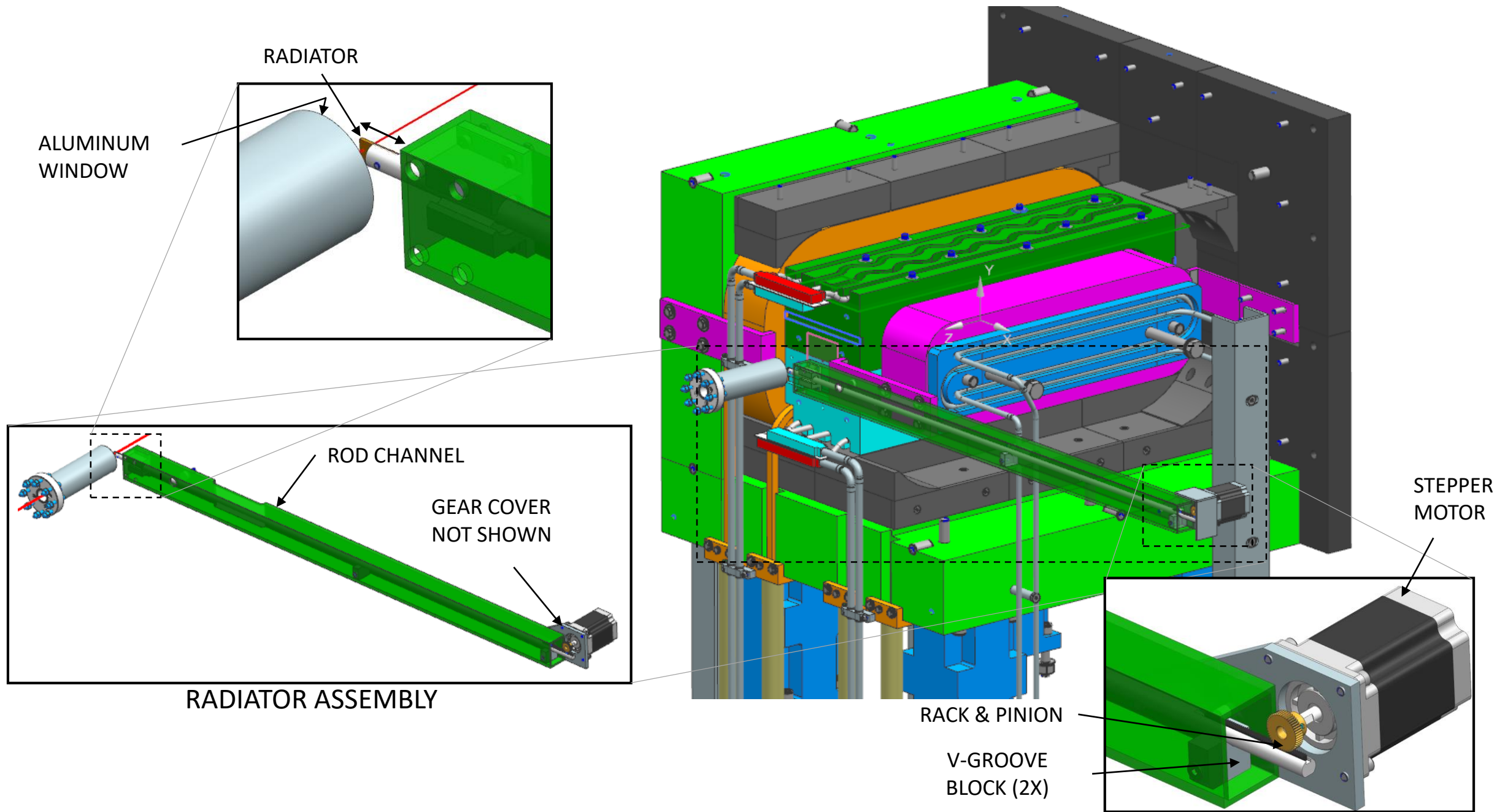


Side Temp



CAD Modeling Layout



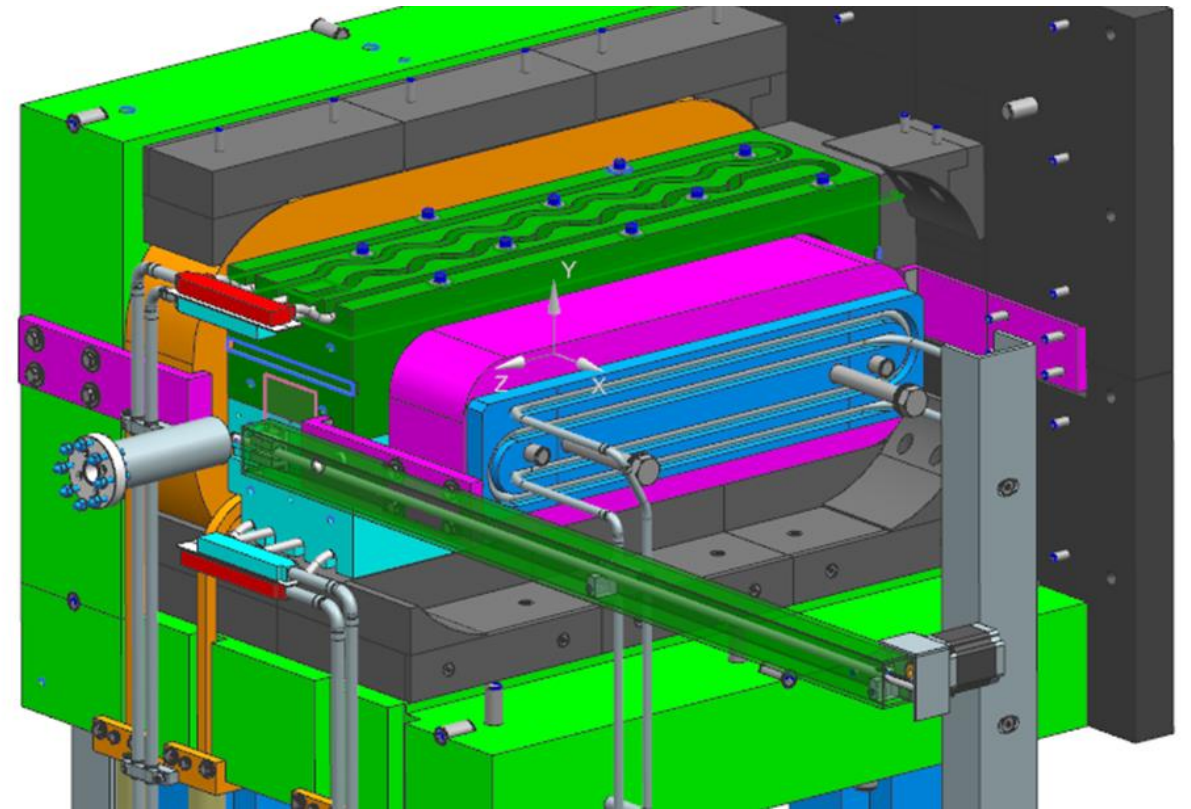


CPS Items Remaining

- Finish testing of Cu absorber prototype and finalize design
- Brazing of Cooling plate water lines and final machining
- Cu Absorber cooling plates (finish design, fabricate & test)
- Machining / brazing of Cu absorber halves.
- Beam line finalize and procured
- Procurement of water chillers and containment chambers
- Support Frames for CPS, Target, NPS Calorimeter and Big Byte
- Layout of PSU and cooling lines
- Assemble of magnet and field mapping

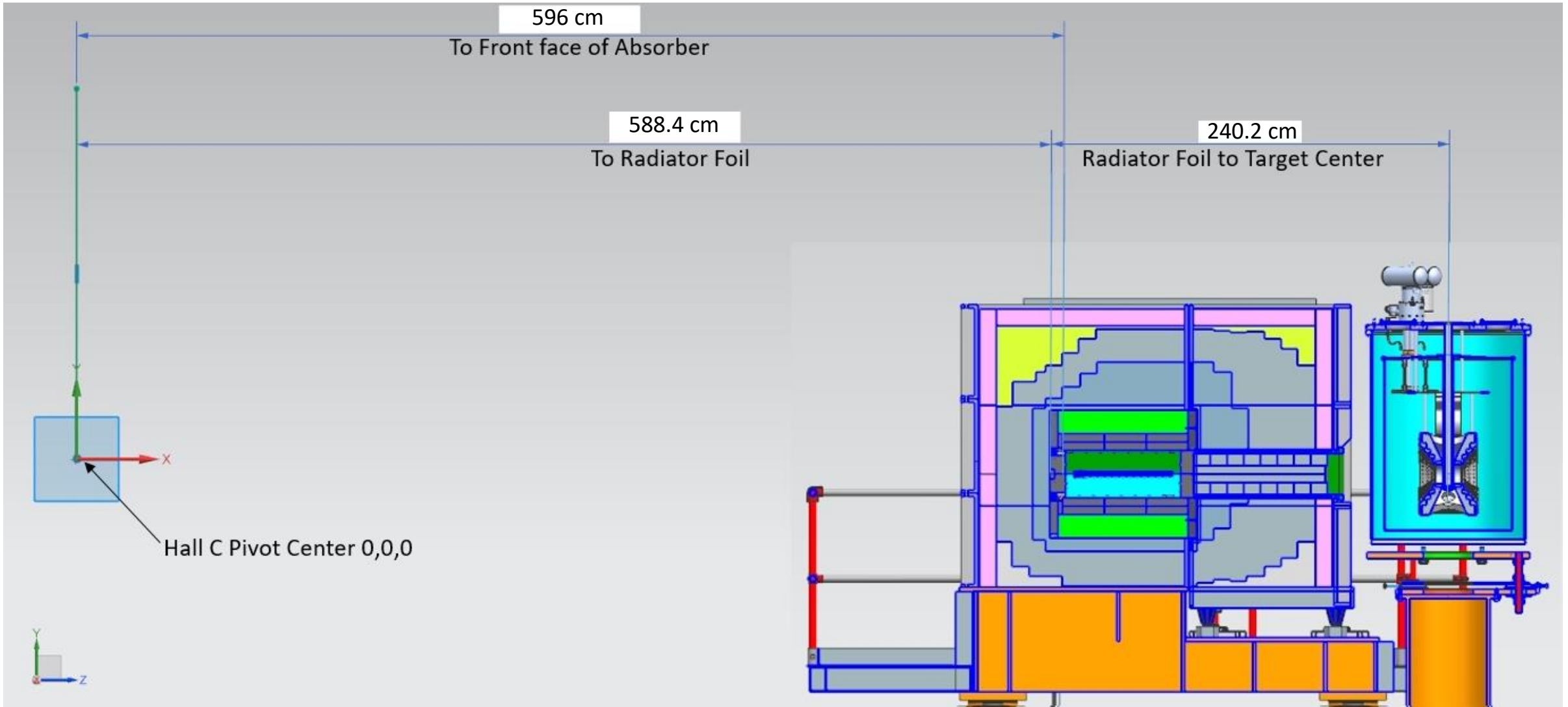
CPS Remaining Items/Task/Studies

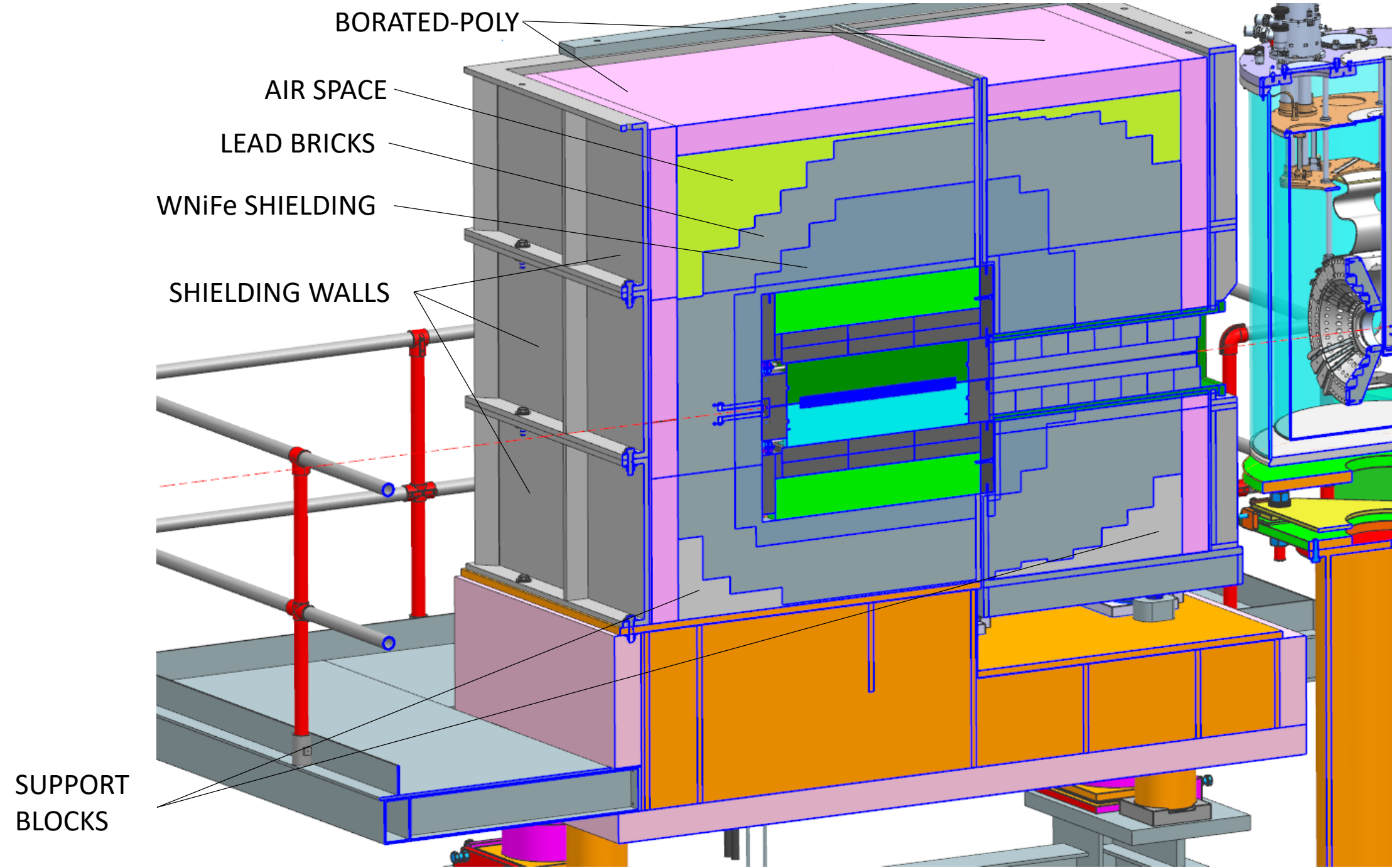
- Finish testing of Cu absorber prototype and finalize design of cooling
- Brazing & Machining of Pole's Cooling plate
- Cu Absorber cooling plates (finish design, fabricate & test)
- Support Frames for CPS, Target, NPS Calorimeter and Big Byte
- Machining of Cu absorber halves.
- Machining of Shield blocks
- Beam line finalize and procured
- Procurement of water chillers and containment chambers
- Layout of PSU and Cooling lines for magnet, absorber & PSU
- Assemble of magnet and field mapping



Backup Slides

CPS Magnet Distances





BORATED-POLY

AIR SPACE

LEAD BRICKS

WNiFe SHIELDING

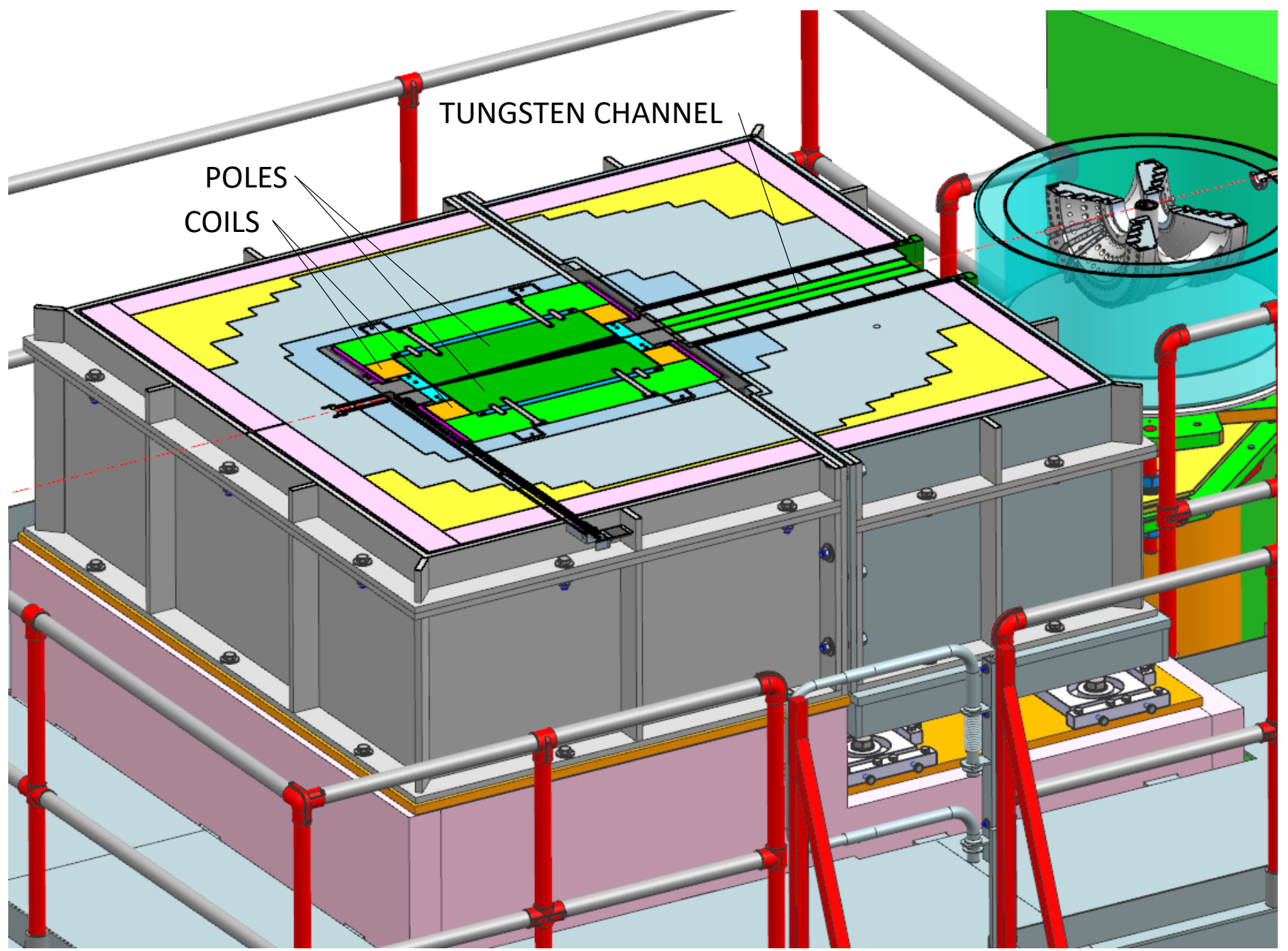
SHIELDING WALLS

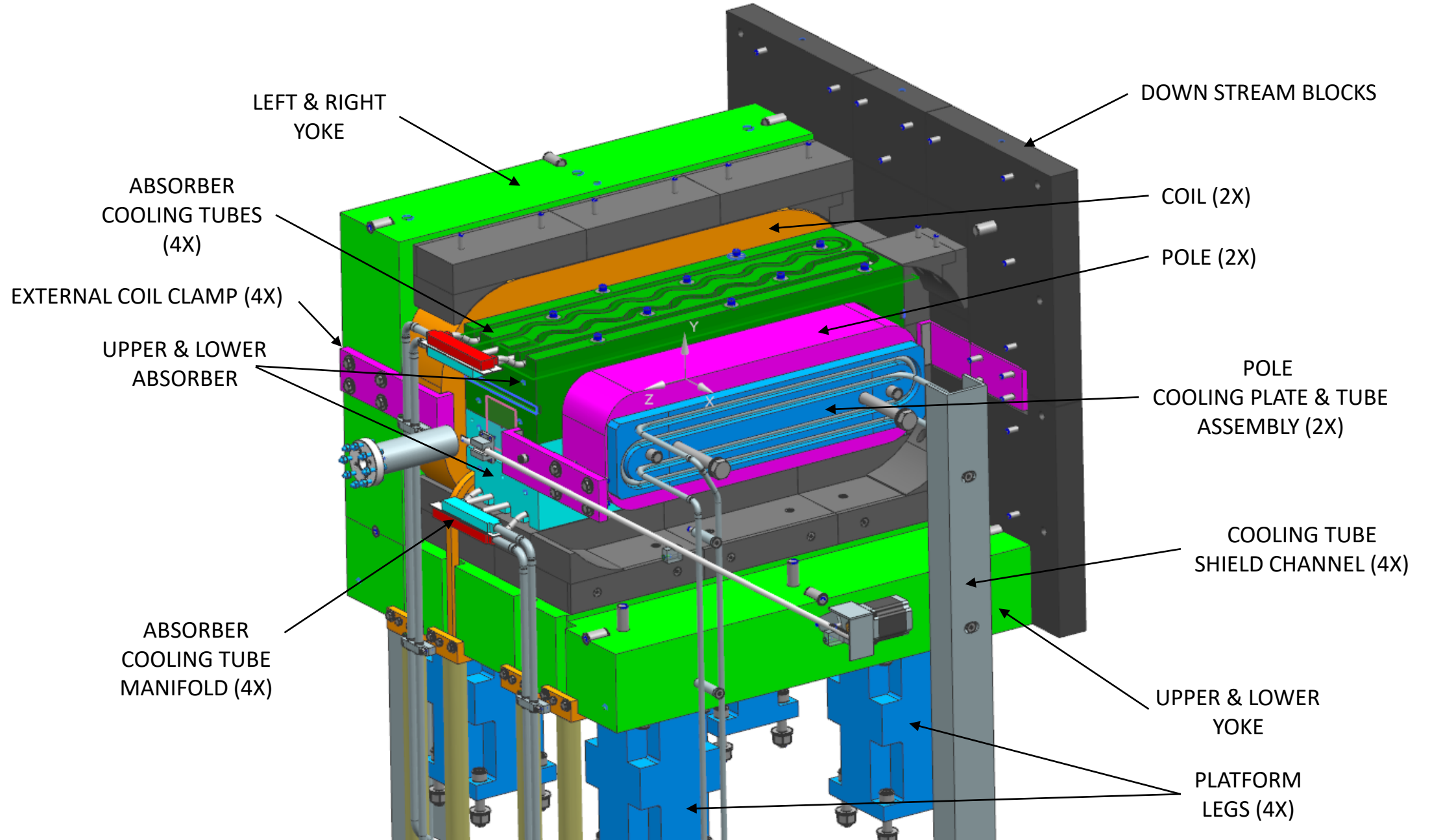
SUPPORT
BLOCKS

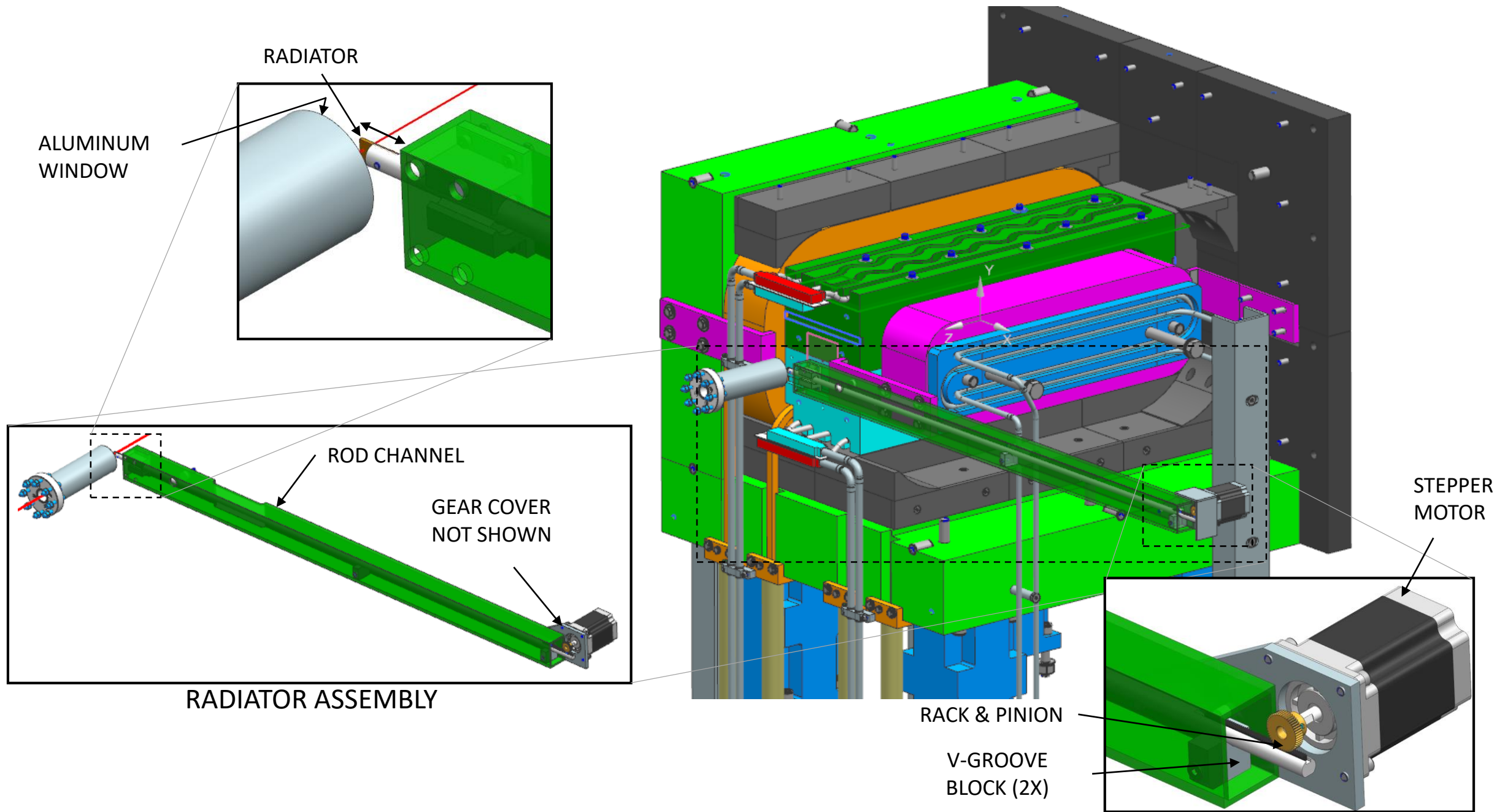
BEAM
DIRECTION +Z

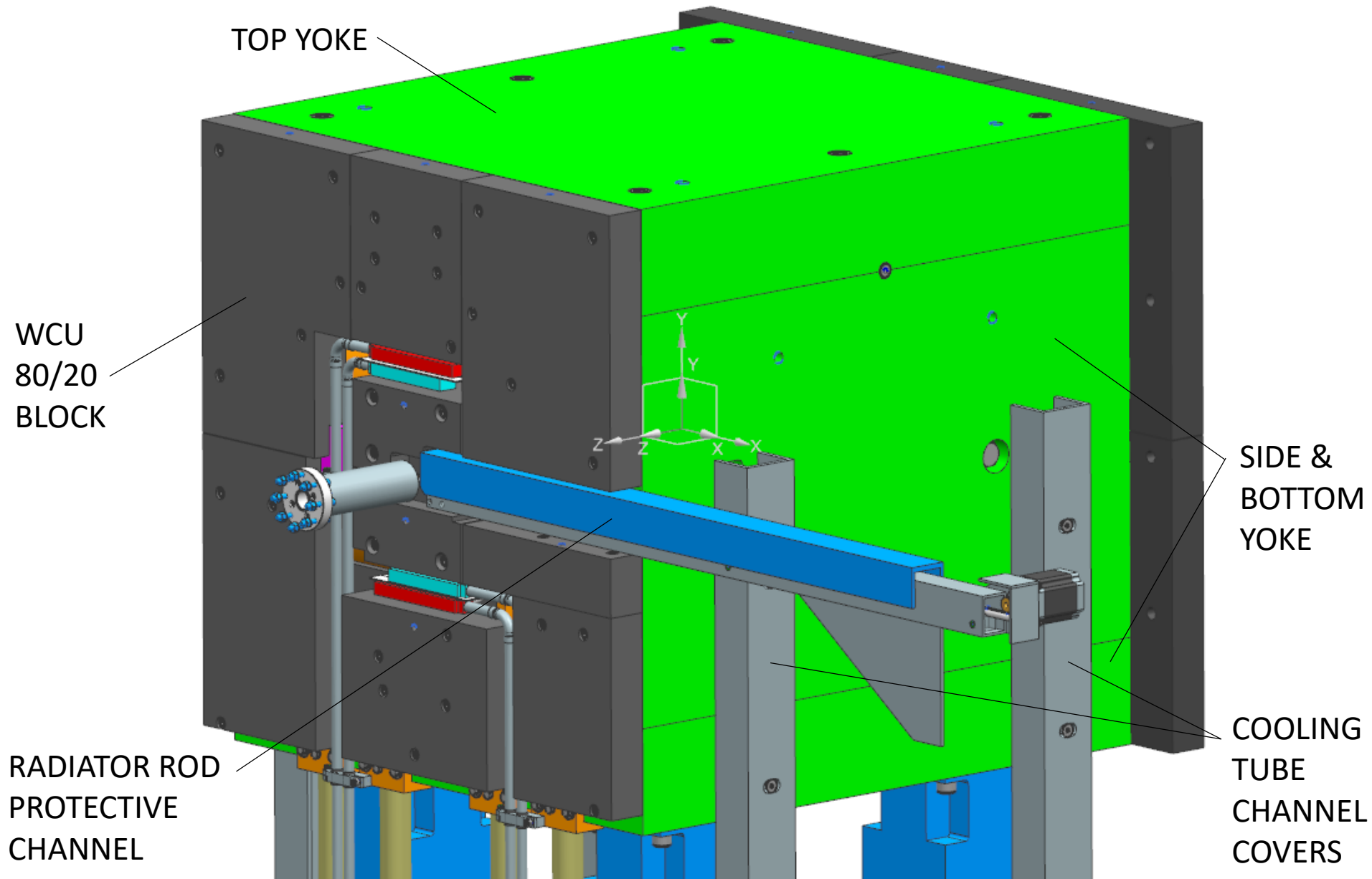
POLES
COILS

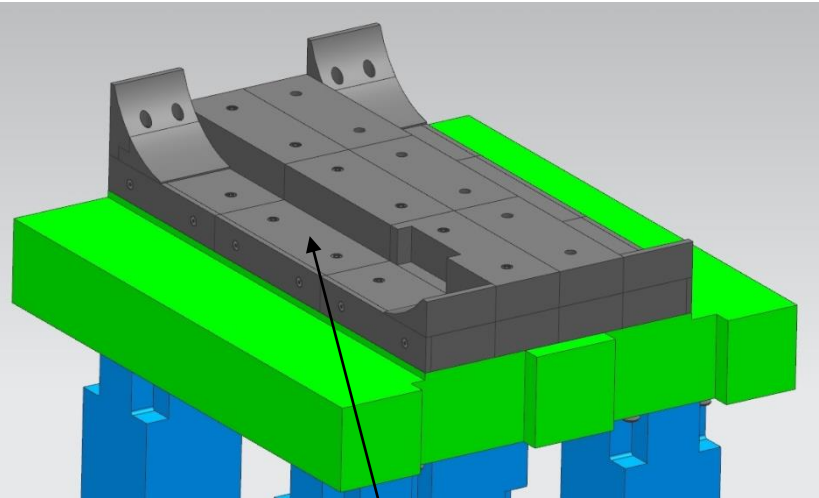
TUNGSTEN CHANNEL



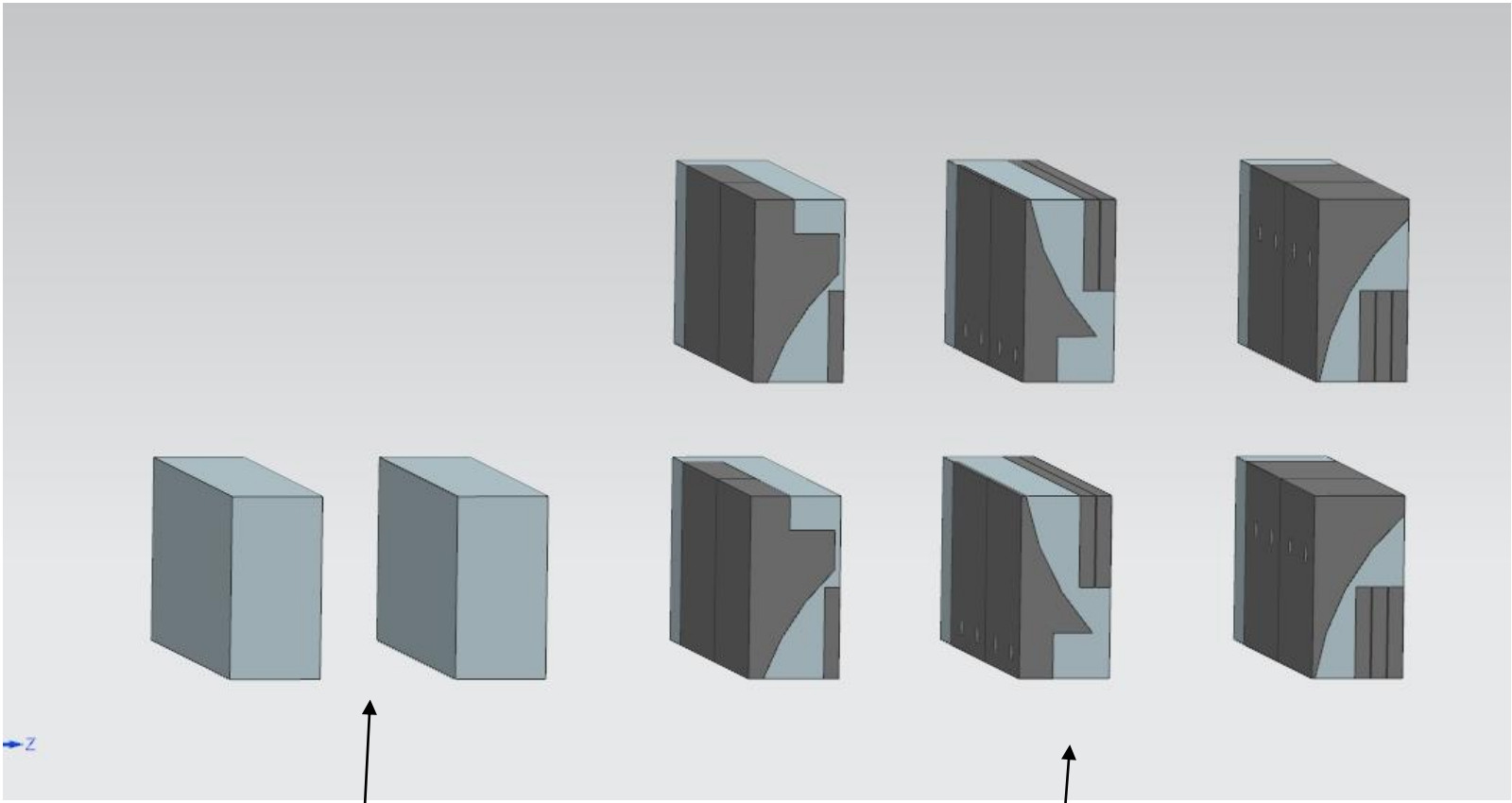








18 W80Cu20 Lower Yoke shield blocks shown
(36 total Lower, Upper)



2 extra W80Cu20 blocks

6 blocks Cut out shapes
W80Cu20 blocks

44 W80Cu20 blocks total

2" x 10.712" x 15.263" &
1.027" x 4.306" x 4.515"

2" x 8.092" x 14.263"

2" x 7.953" x 10.496" &
1.027" x 3.315" x 6.471"

2" x 10.712" x 13.498" &
1.027" x 4.306" x 4.515"

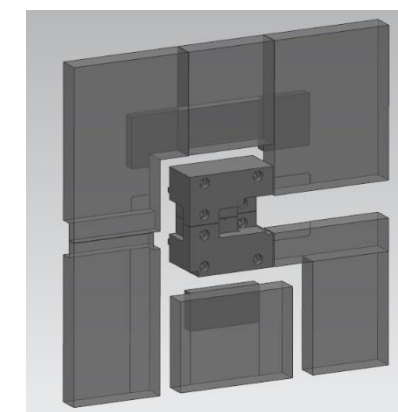
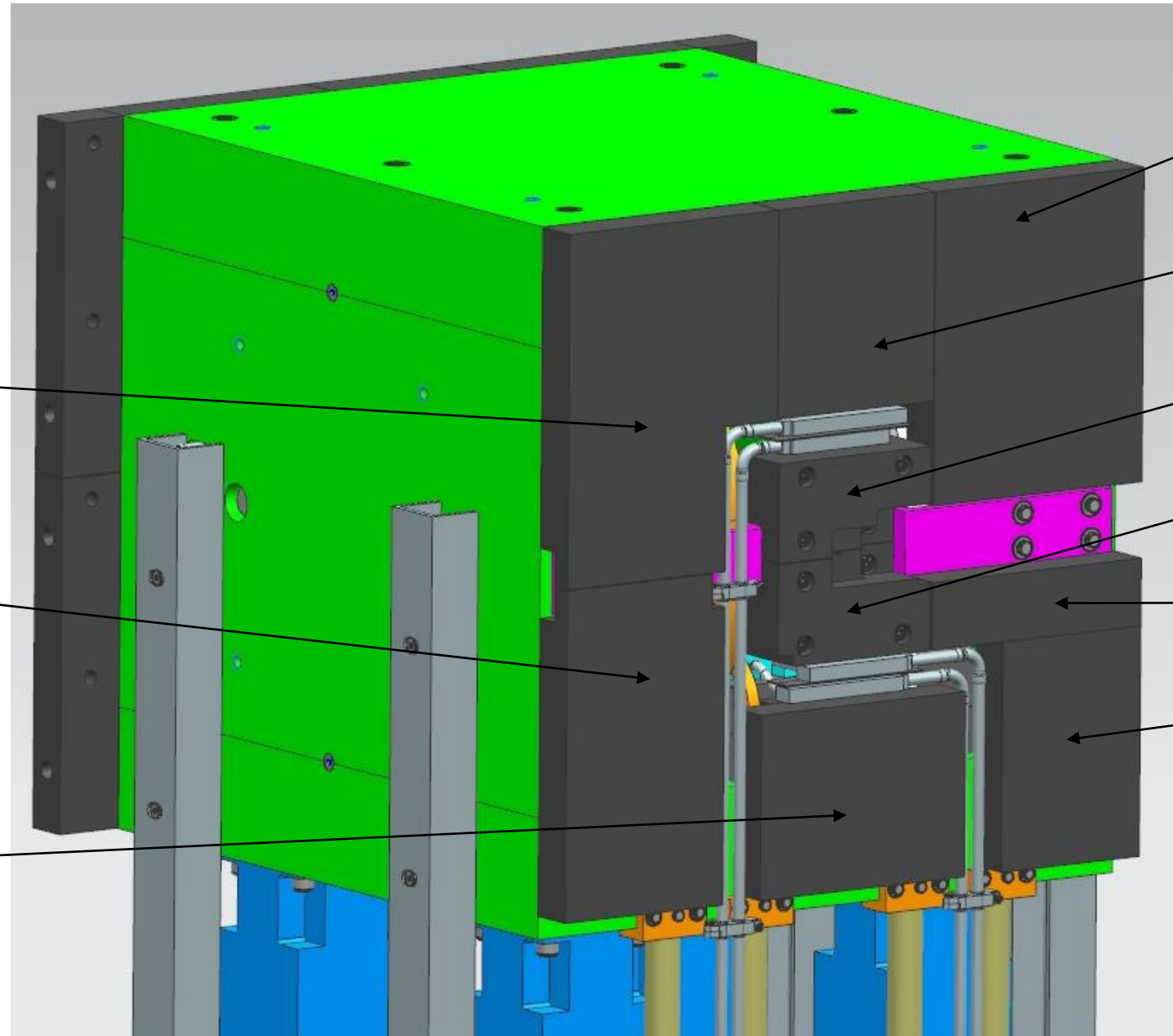
2" x 8" x 8.983" &
1.027" x 3.365" x 8"

4.021" x 4.286" x 7.802"

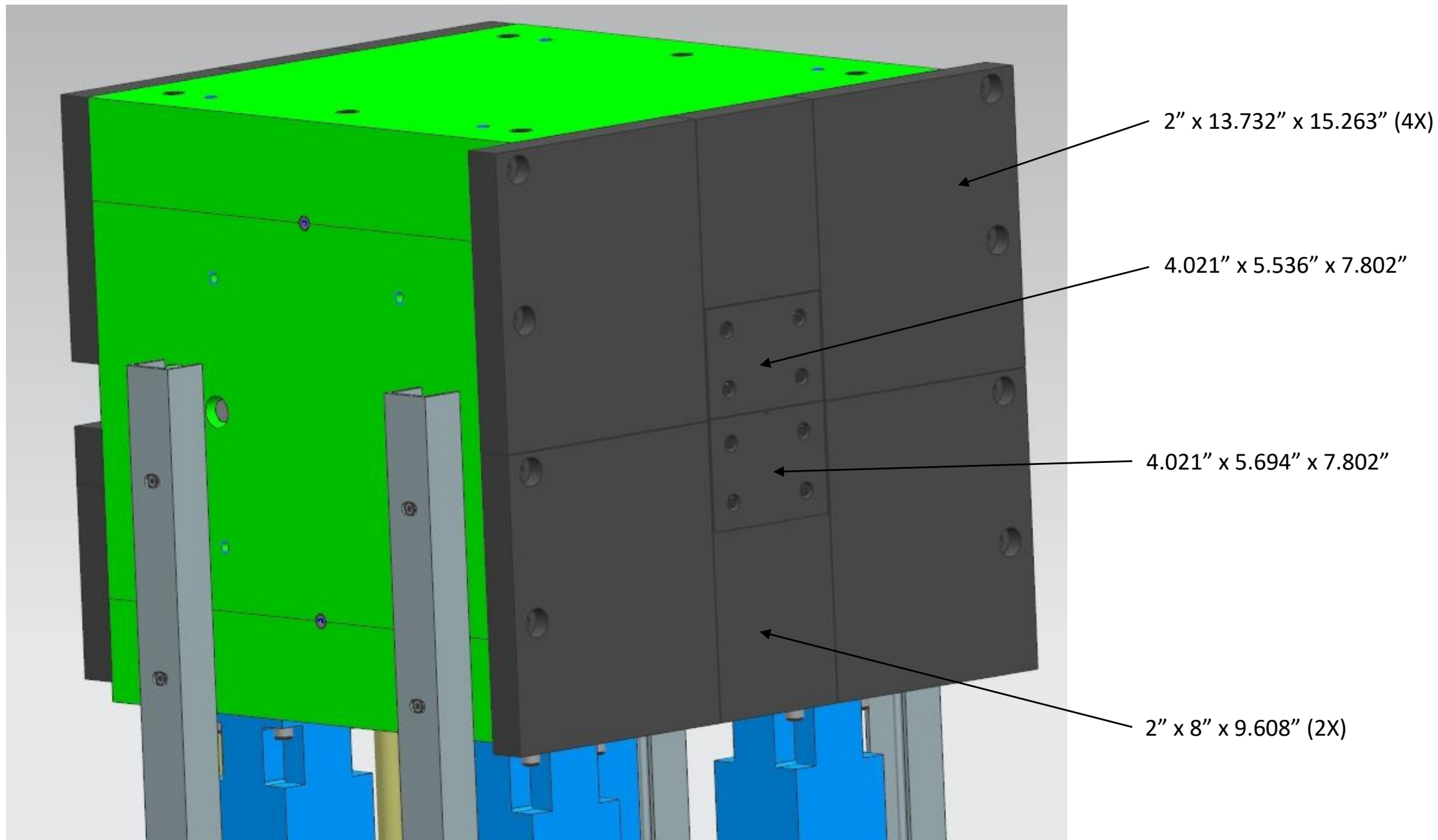
4.021" x 4.444" x 7.802"

2" x 2.905" x 10.717"

2" x 7.086" x 9.898"



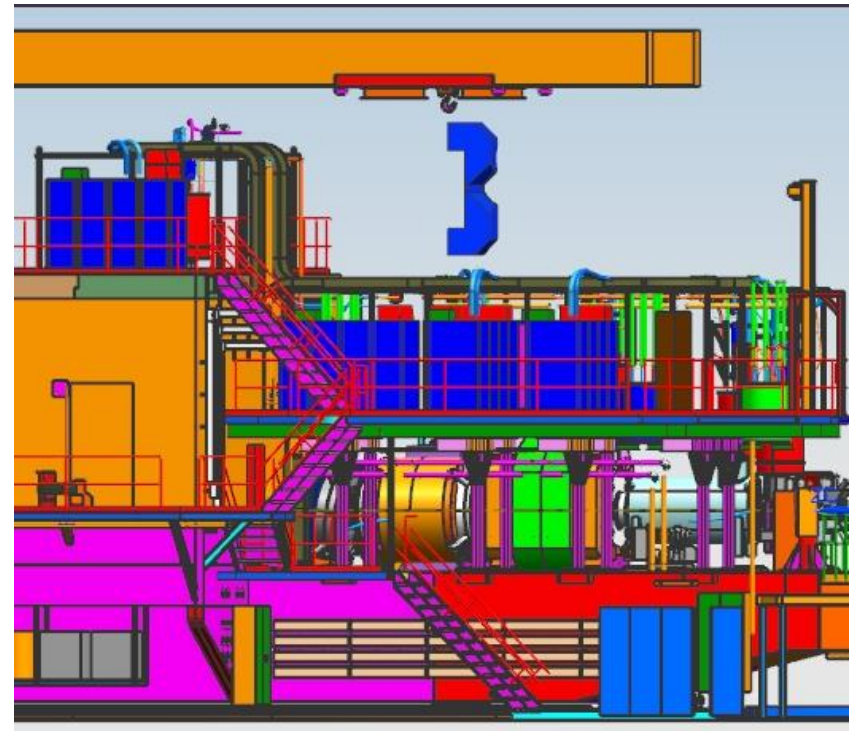
CPS Upstream W80Cu20 blocks



CPS Downstream WCu(80/20) blocks

Getting Big Bite Magnet over SHMS

Big Bite Magnet can be disassembled and lifted over the SHMS with Hall C standard crane



Optional for Big Bite Magnet to be lifted with a mobile crane

