Engineering Update

KLF Collaboration Meeting

5 May 2026

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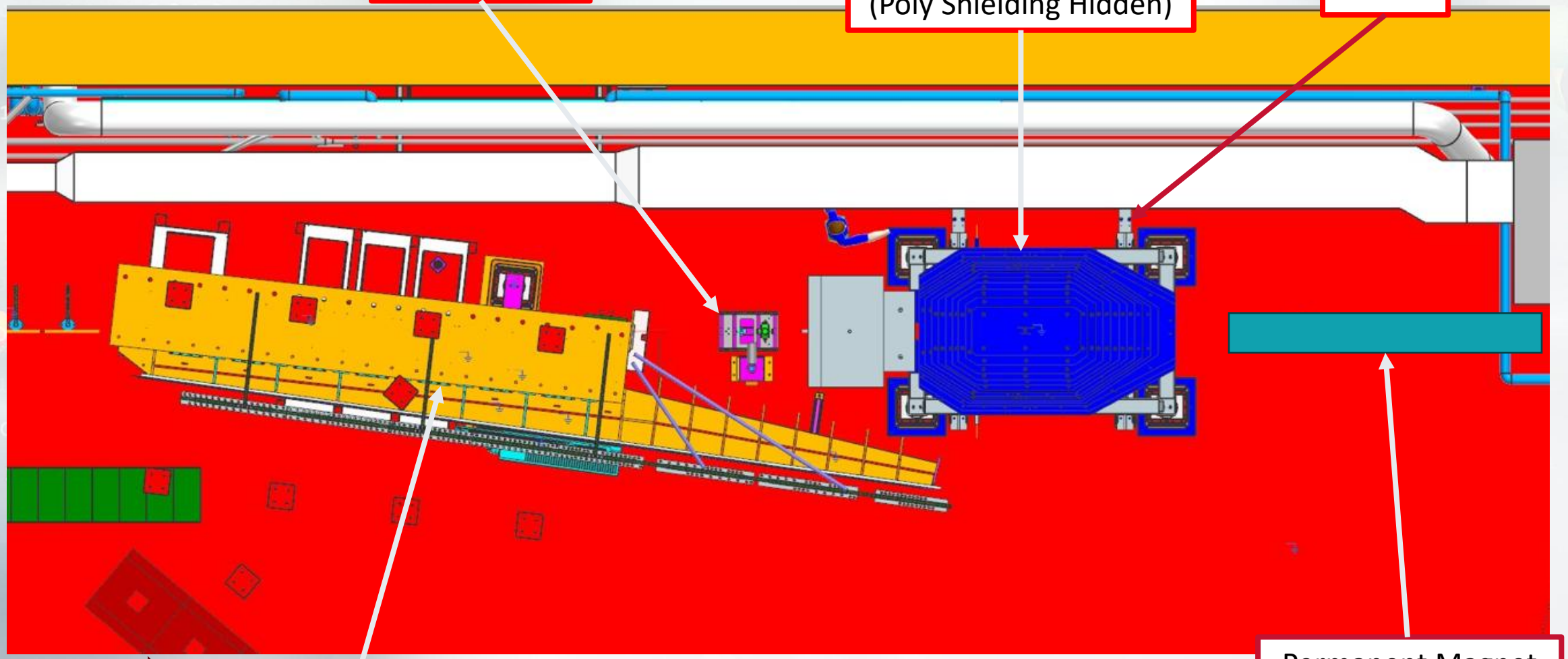
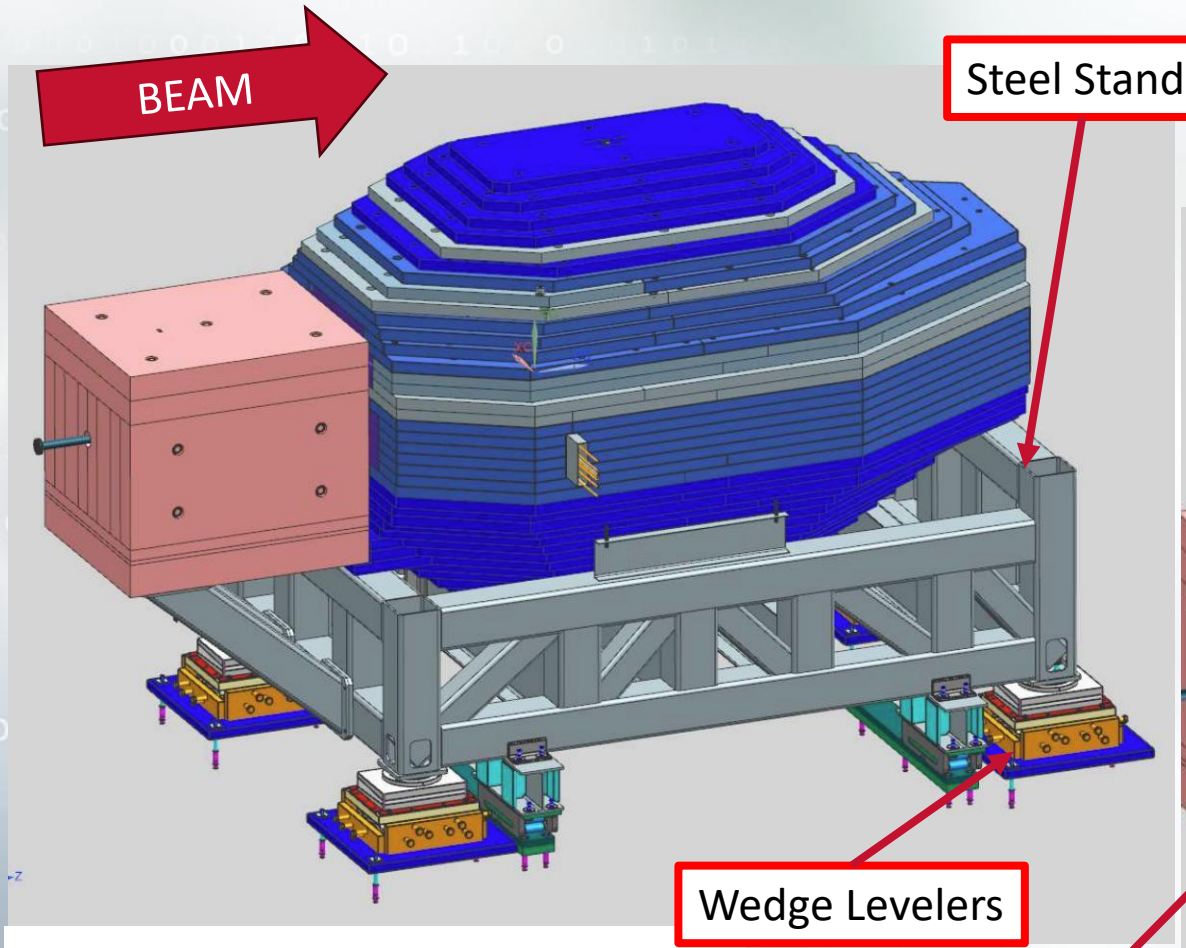
Jefferson Lab

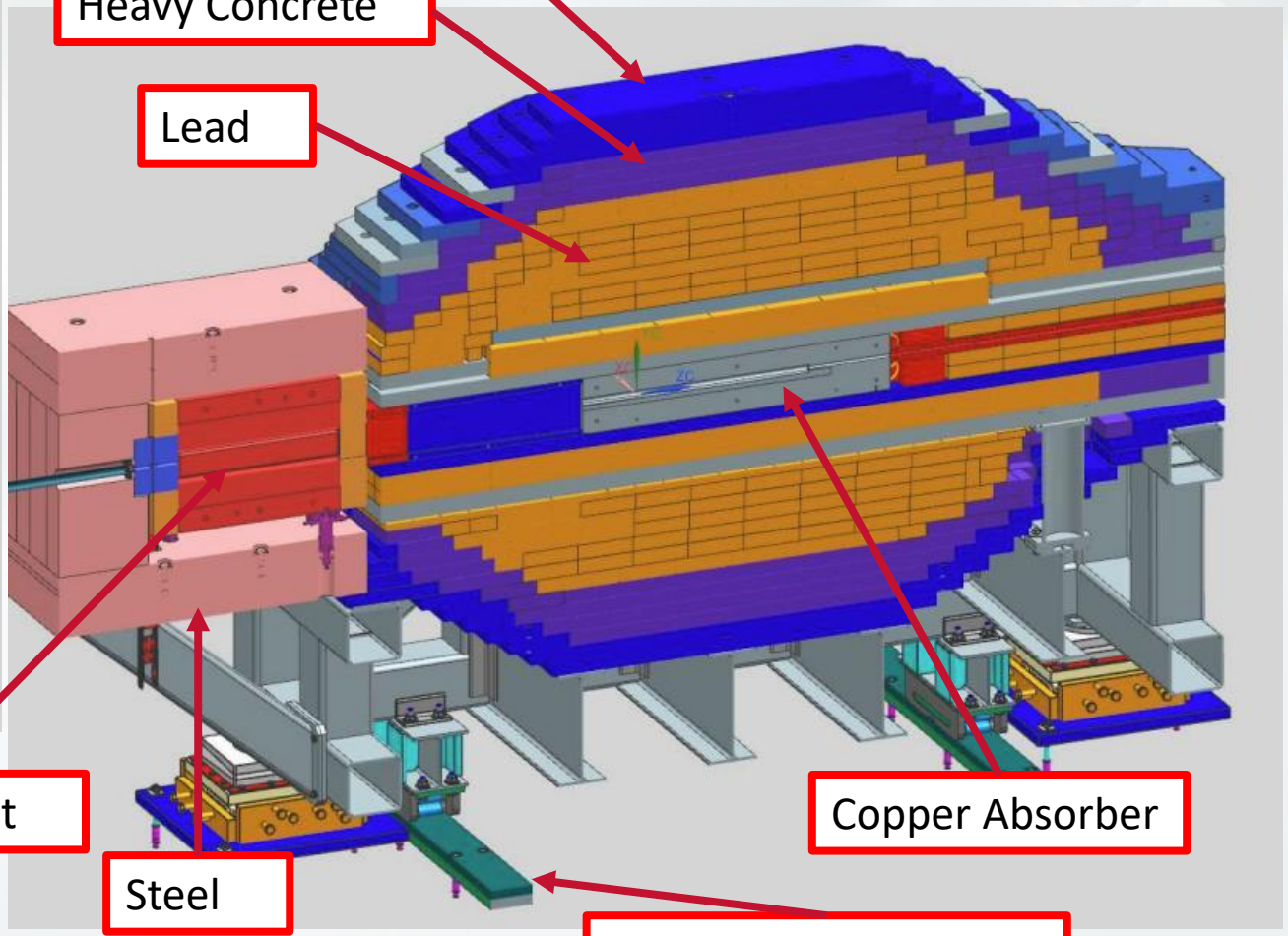
U.S. DEPARTMENT of ENERGY

CPS Design


BPM Girder
CPS
(Poly Shielding Hidden)
Rails
BEAM
Tagger Magnet
Permanent Magnet
(existing)

CPS Design

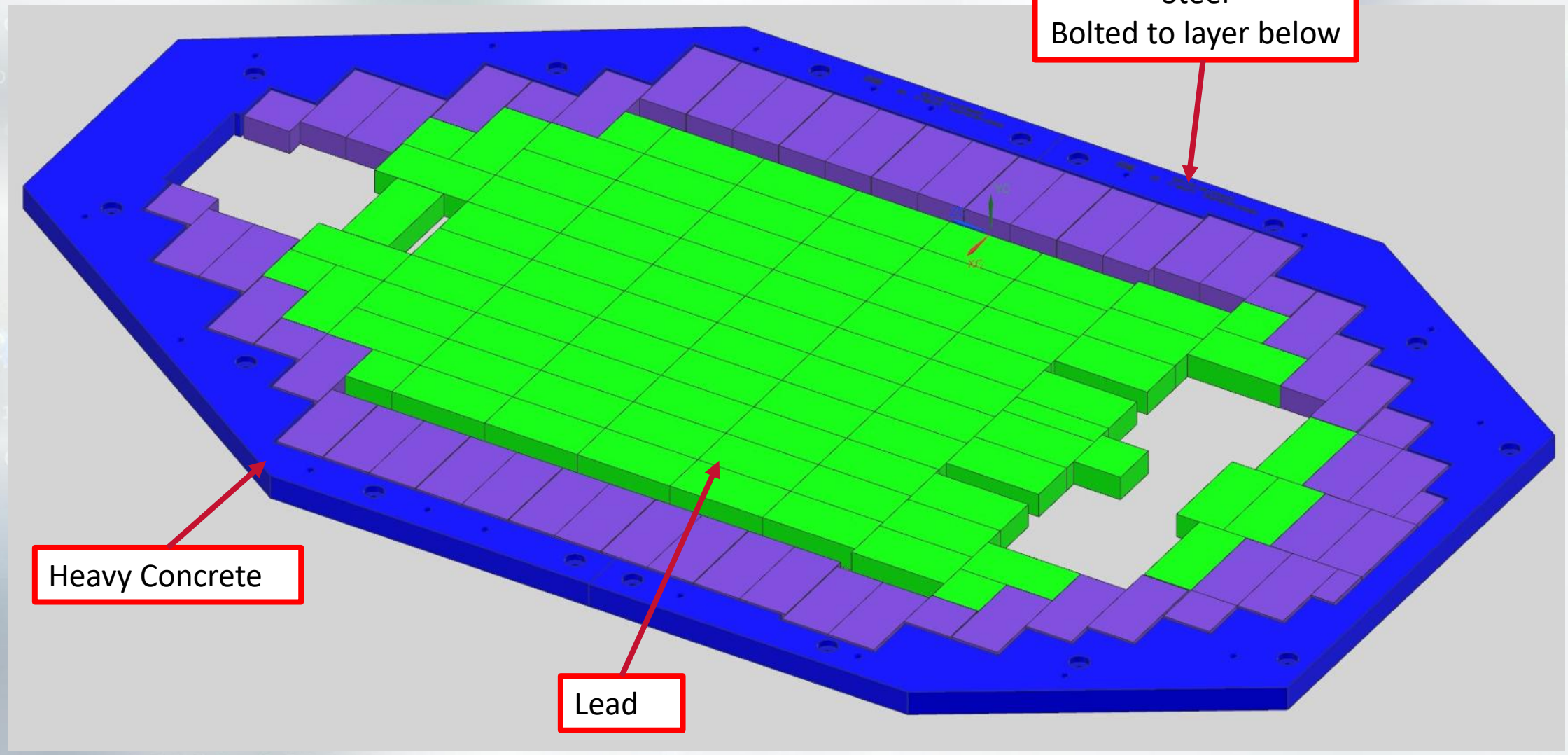




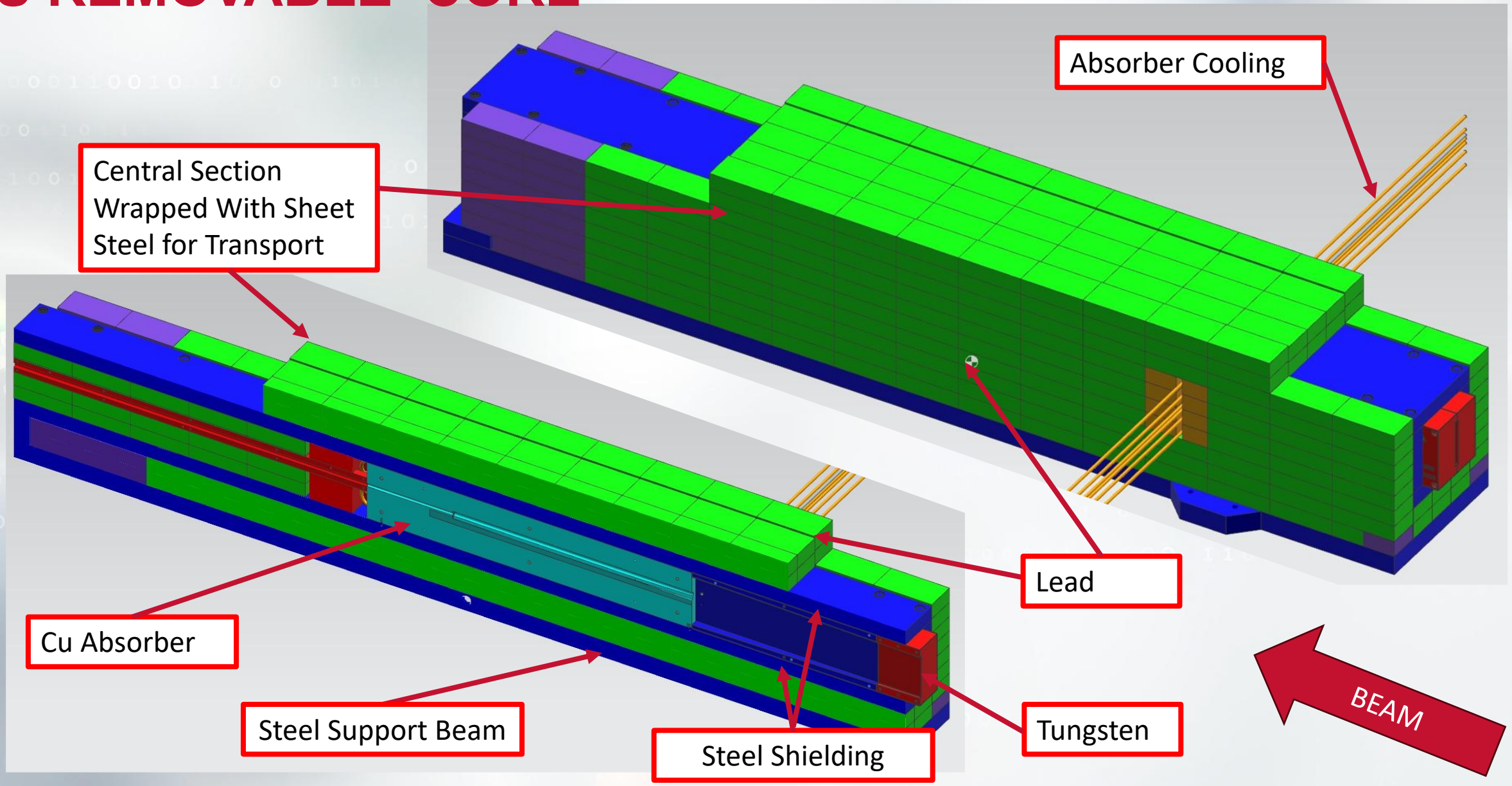
Poly Shielding (12 inch thick)
Not Shown

Total Weight: ~ 160,000 lb
Total Layers: 39
Lead Bricks : ~2265
Concrete Bricks: ~1180

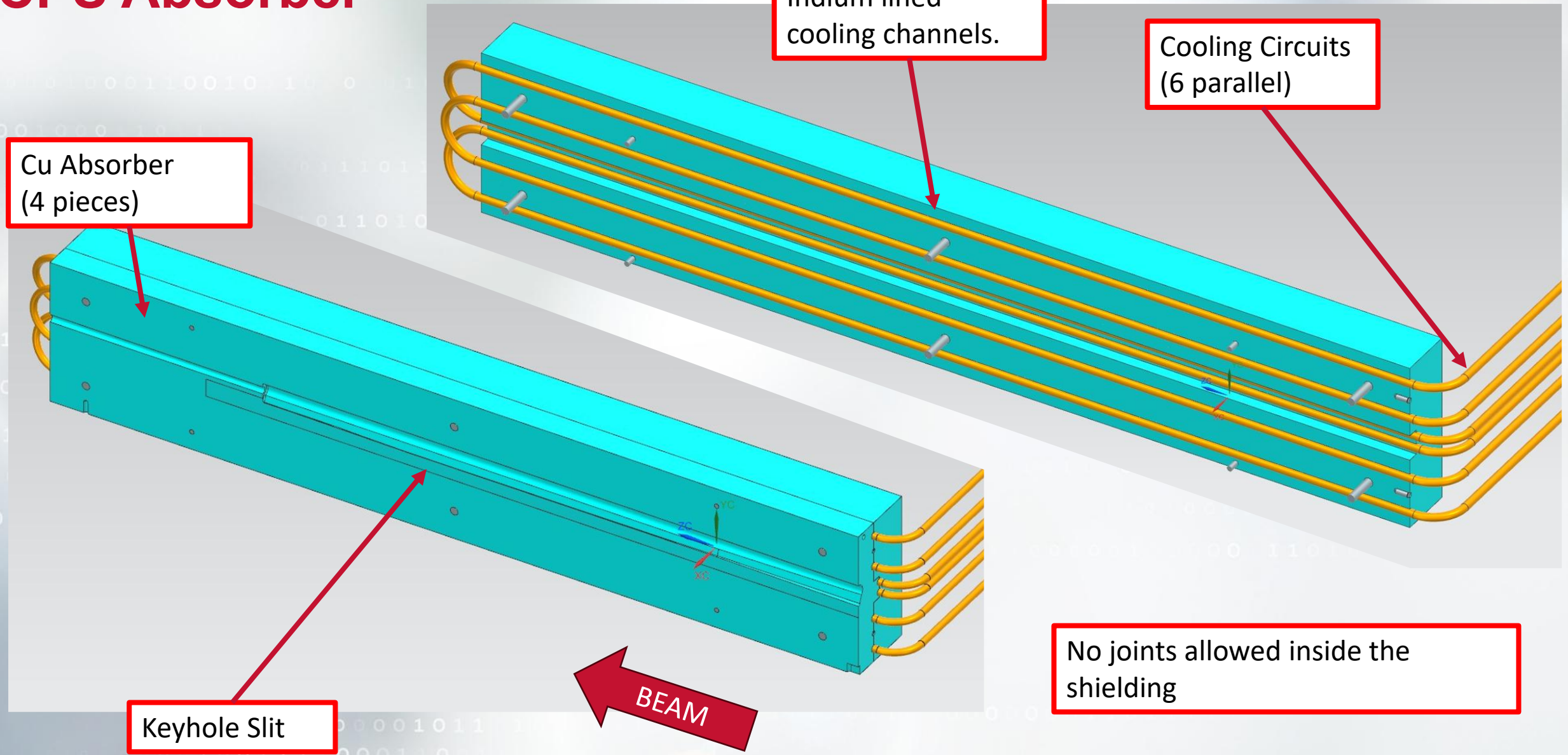
CPS Shielding Typical Layer



CPS REMOVABLE ‘CORE’

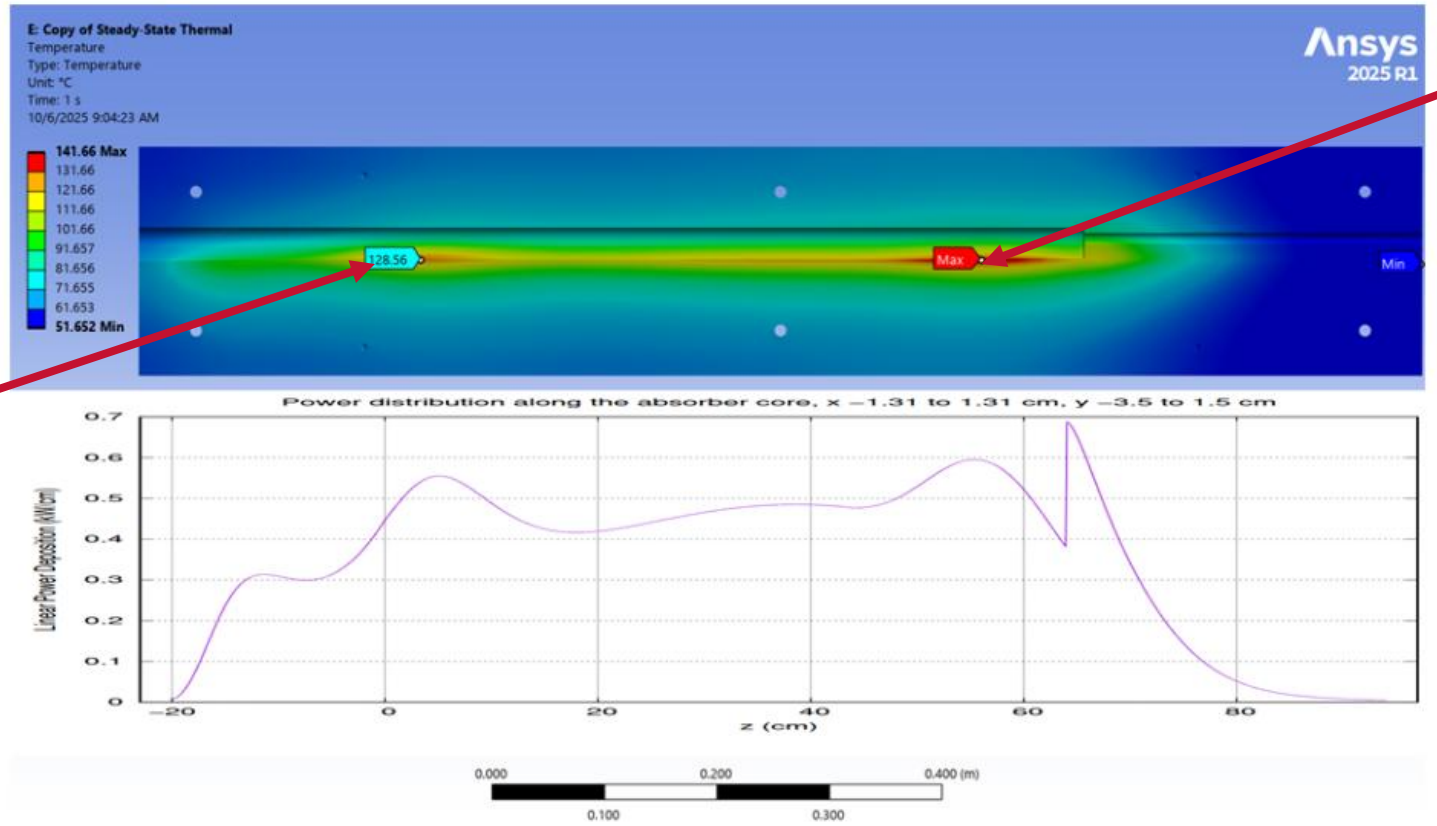


CPS Absorber



CPS Absorber

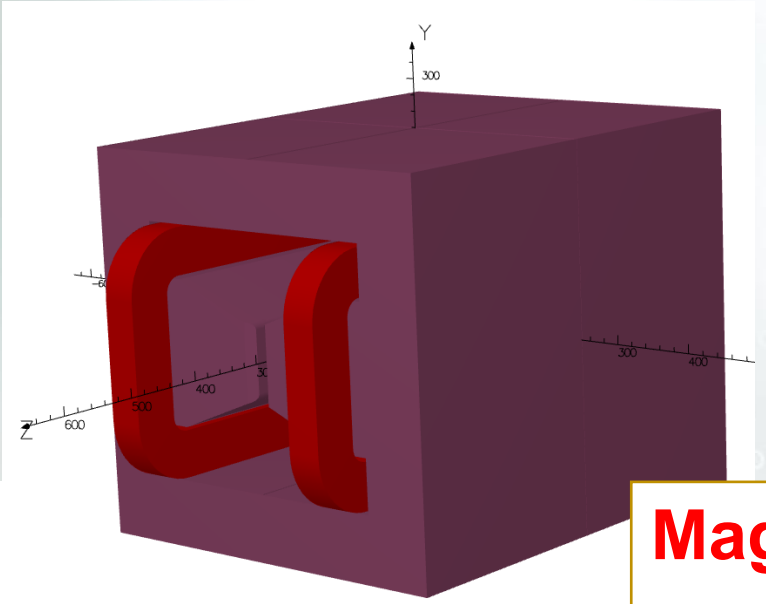
Pavel 81, 20% Radiator, 48.1KW,1200 um beam, 2.4% field bias, 0mm x offset, 1mm mesh on bottom radii and 2.5 mm throughout, no slit, water cooling 50°C, h=9000 for static thermal

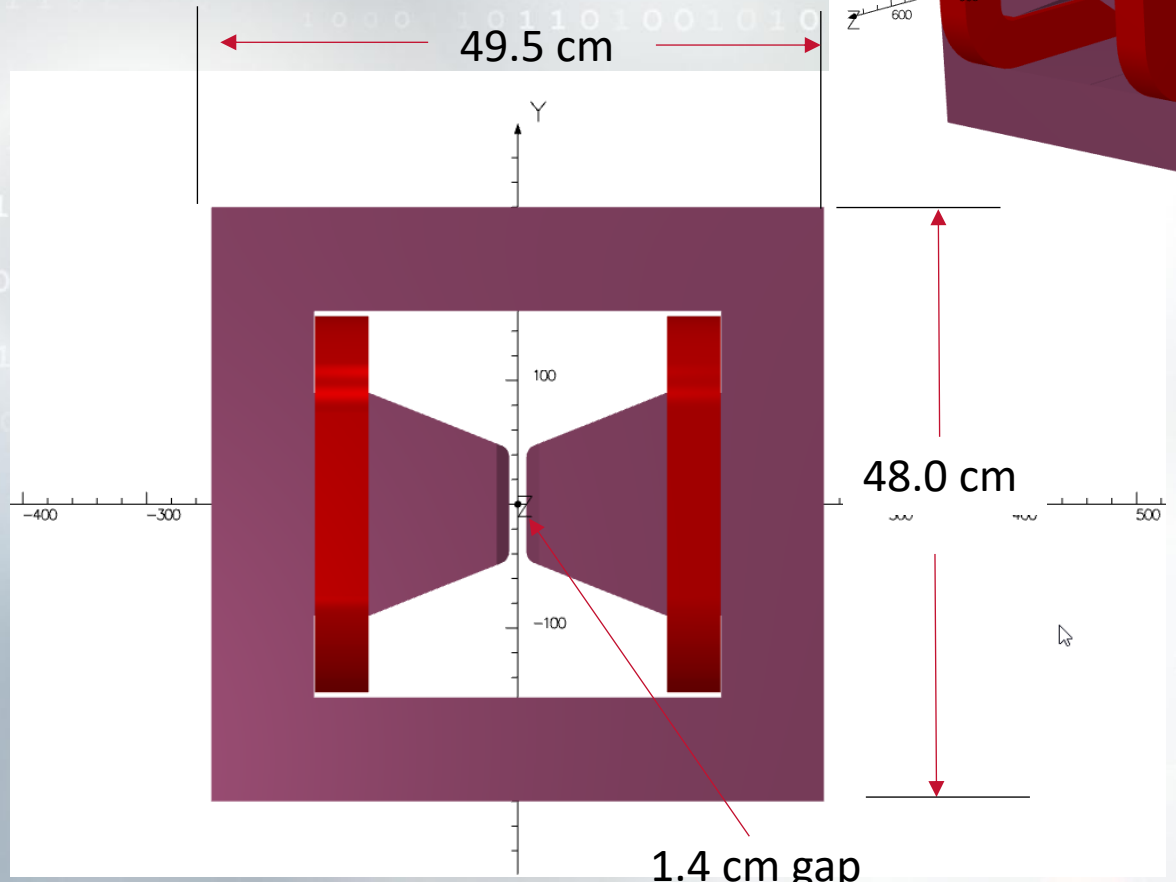


Max Temp 141 C

126 C

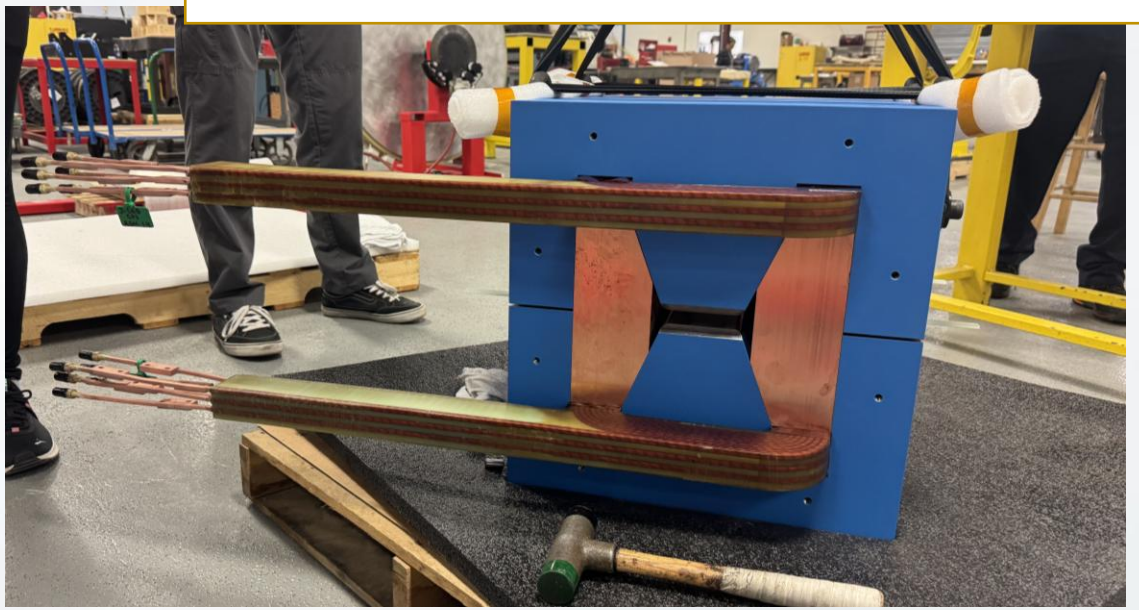
CPS Magnet





Magnet Received 2025

TODO: Mapping (late 2026)



CPS Design Status

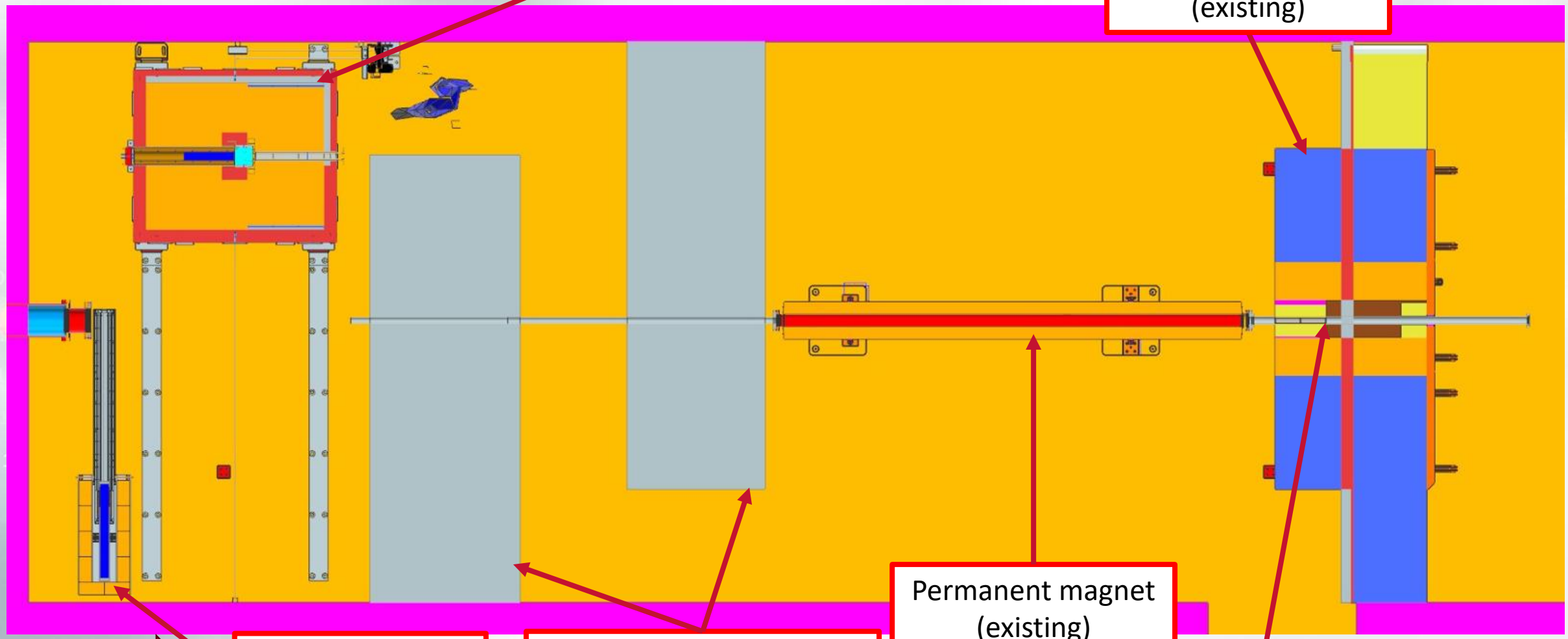
Done:

- CPS Magnet design & procurement
  - QA check performed by JLab Magnet Test Group
- Reversing power supply procured, installed, tested (and in use)
- De-gauss procedure for Tagger Magnet developed and verified
- CPS Absorber & Shielding preliminary design
- CPS Shielding support structure preliminary design
- Water system P&ID (make use of existing electron dump infrastructure)

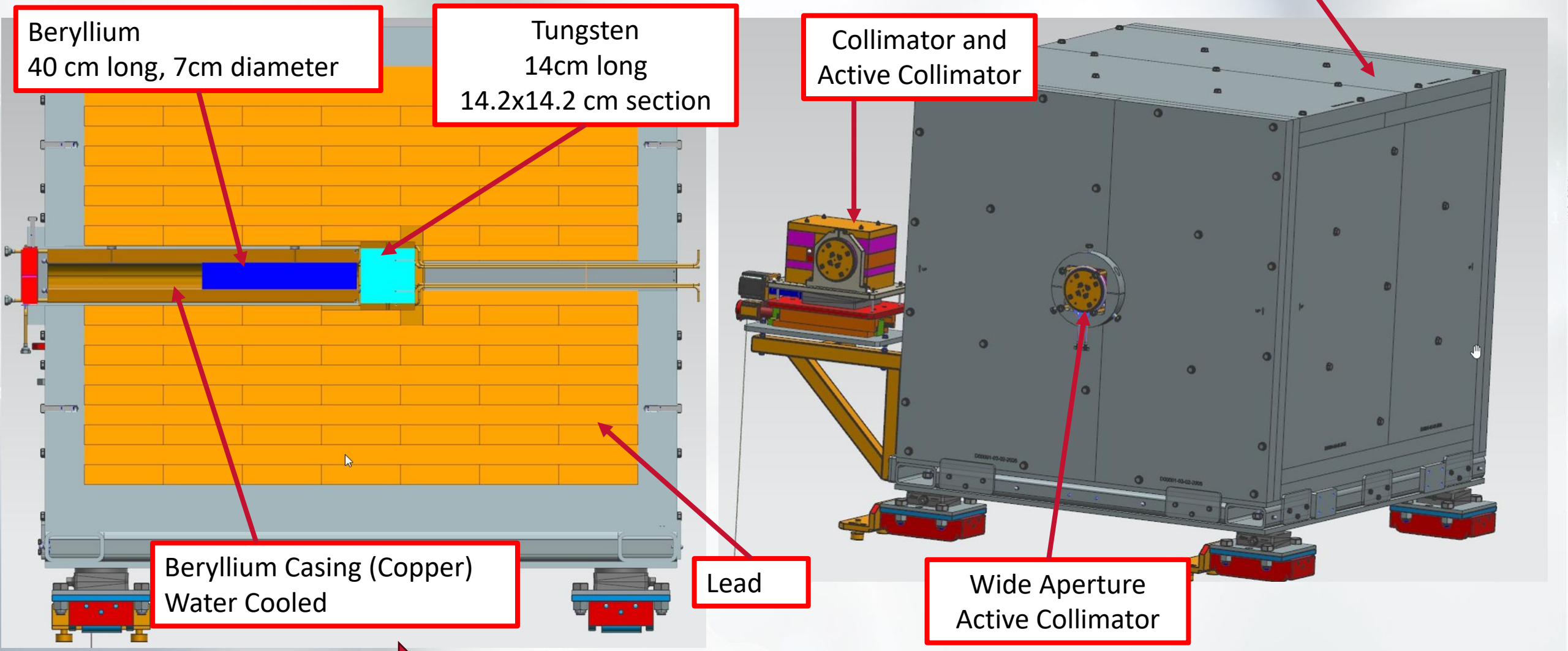
To Do:

- Pressure and structural analysis documents
- Fabrication, assembly, and layout drawings
- Cooling water piping and instrumentation detail design
- Radiator insertion ladder design
- Beamline and downstream shielding design
- Magnet lead connections and buswork
- Control & monitoring system definition and design
- Decommissioning design
- Installation & De-installation procedures
- CPS Magnet Mapping

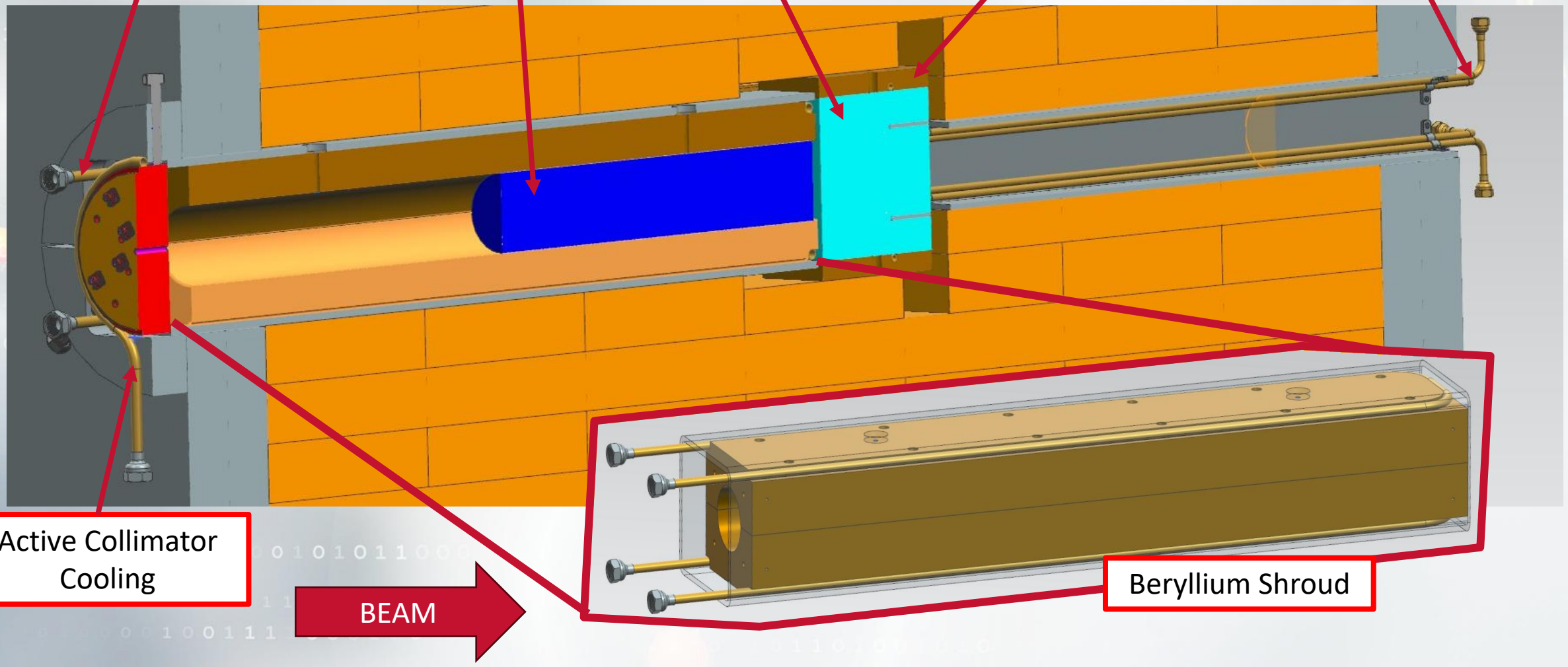
KPT Design


KPT in Storage Position
Lead/Concrete Shield Wall (existing)
Permanent magnet (existing)
Concrete Shield Walls
Beam Profiler (stowed position)
Beam pipe to hall
BEAM

KPT Design

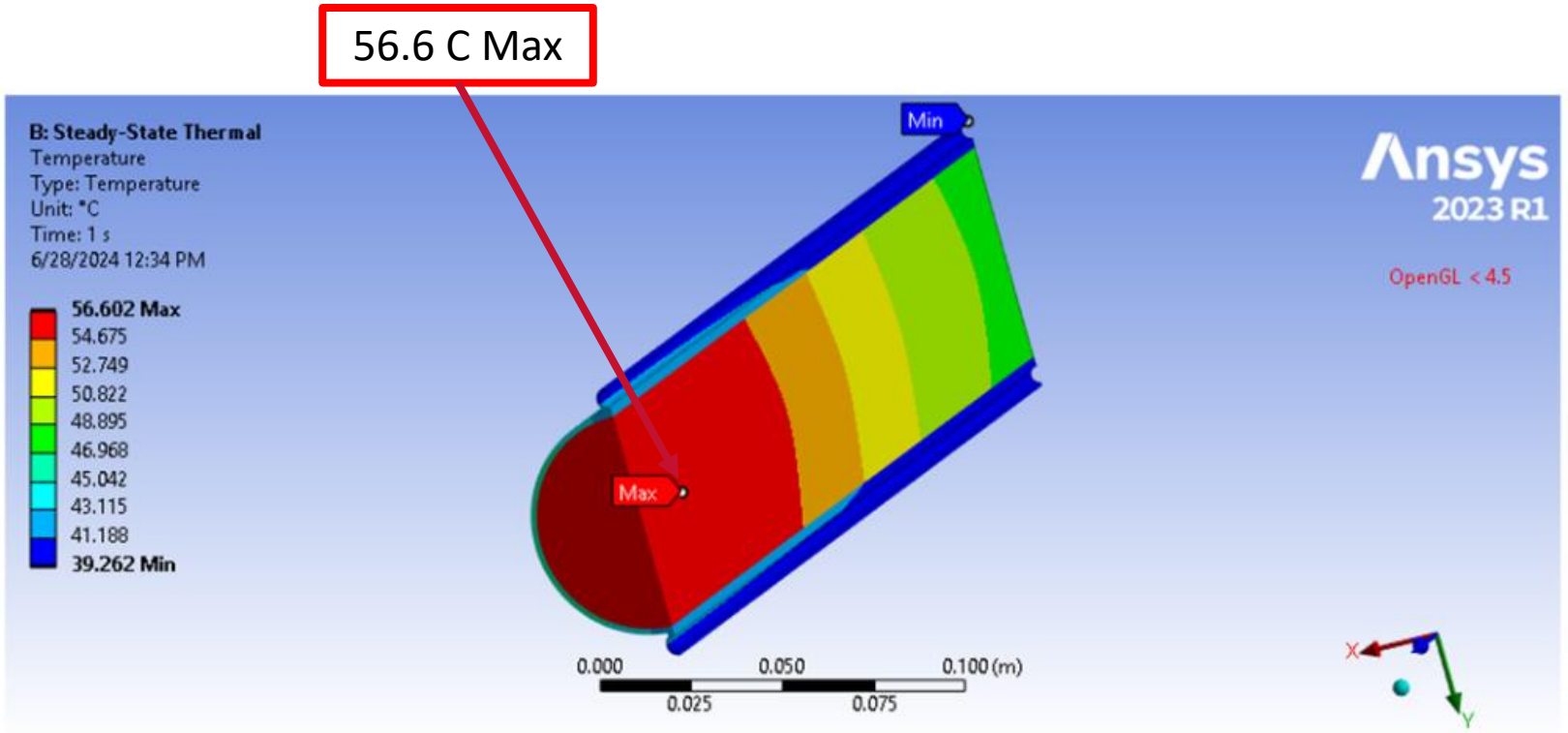

Beryllium
40 cm long, 7cm diameter
Tungsten
14cm long
14.2x14.2 cm section
Collimator and
Active Collimator
Poly Shielding
Beryllium Casing (Copper)
Water Cooled
Lead
Wide Aperture
Active Collimator
BEAM

KPT Cooling


Beryllium Cooling
Beryllium
Tungsten
Copper Cooling Plates
Tungsten Cooling Tubes
Active Collimator Cooling
BEAM
Beryllium Shroud

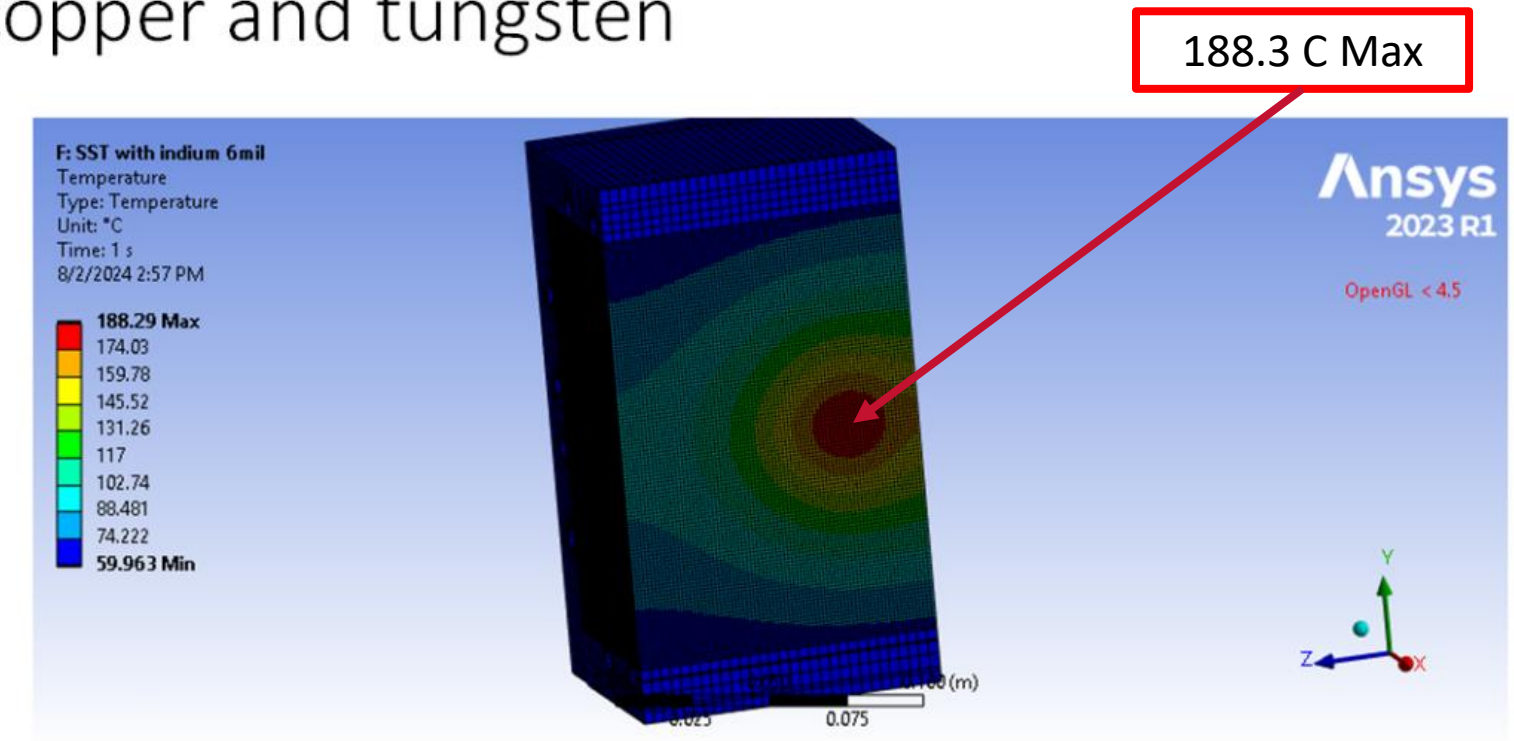
KPT Cooling (Beryllium)

204 W from Hovanes file, 100 micron air gap between Be and Cu sheet wrap



KPT Cooling (Tungsten)

w/Cu cooling plates (bonded) , ¼" tube, 4 holes per plate, h=5000 w/m^2, 5.57 kW absorbed, Indium layer (150um) between copper and tungsten



KPT Status

Done:

- Preliminary design of KPT with fixed length Tungsten plug (14 cm)
- Conceptual design of collimator stowage system

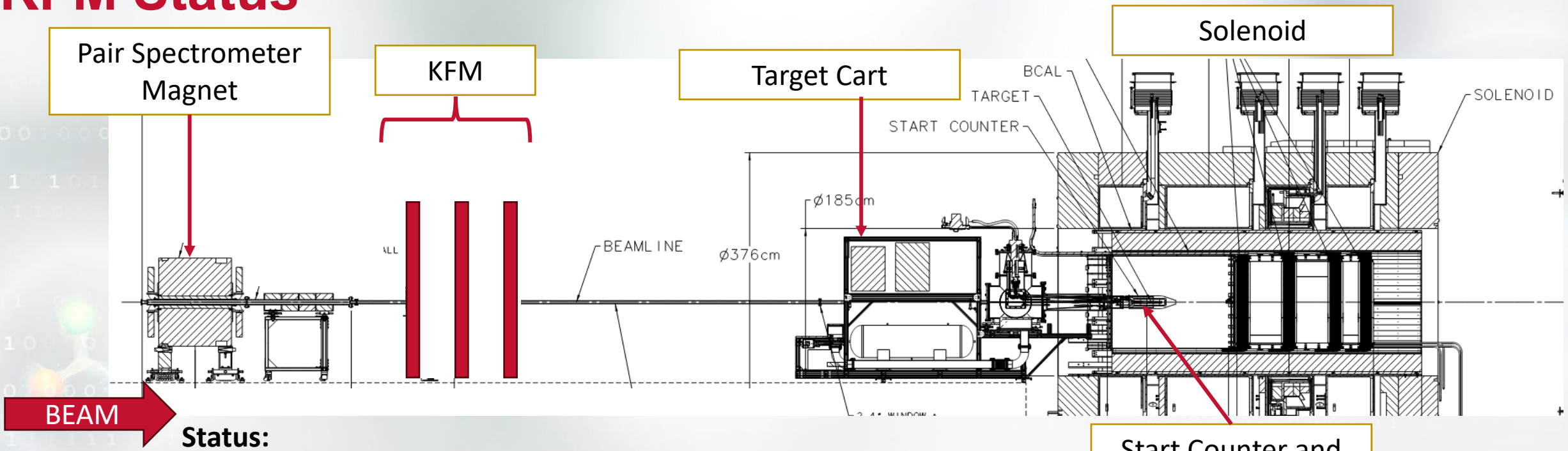
To Do:

- Design closed-loop cooling water system
- Control and monitoring system definition and design
- Design beamline and shielding downstream of KPT
- Final fabrication, assembly, and layout drawings
- De-commissioning hardware design
- Installation, de-installation, and decommissioning procedures
- Pressure and structural analysis documentation

Needed:

- Final requirements for KPT Tungsten absorber thickness (adjustable?)
- Downstream beamline requirements (sizes, wall thicknesses)
- Final shielding requirements

KFM Status



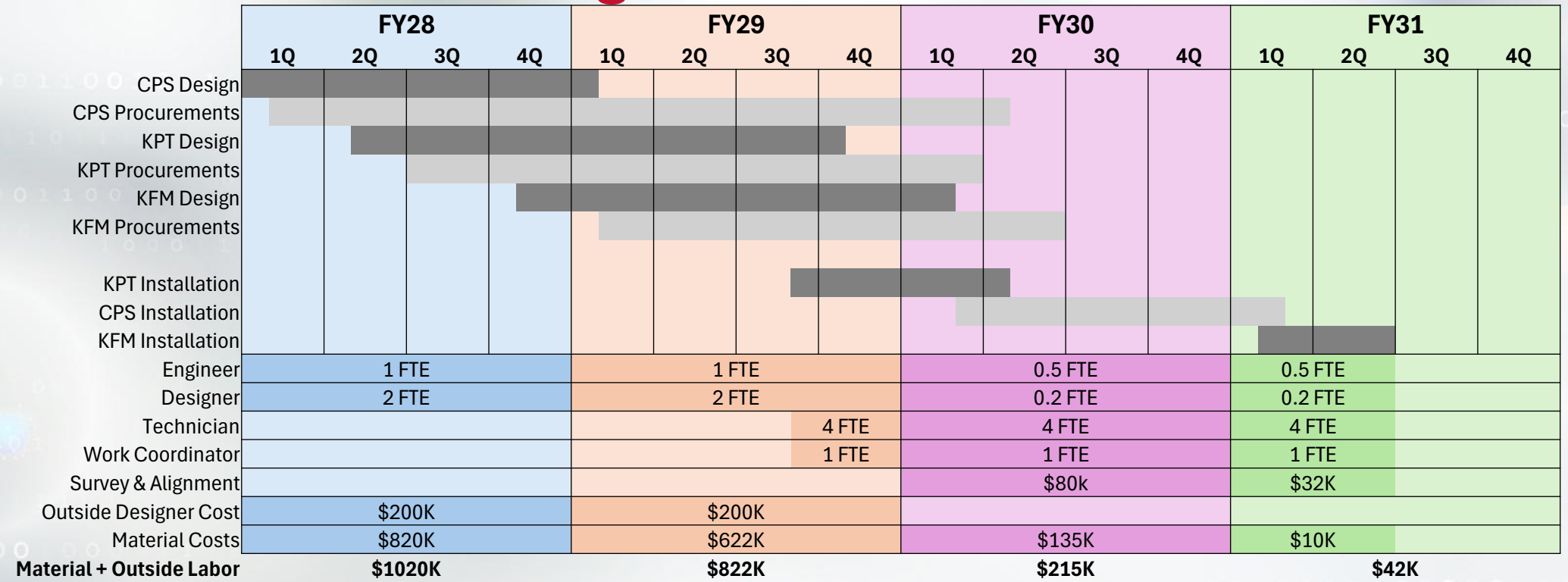
Status:

- Awaiting arrival of detectors at JLab
- ESB available for inspection and testing of detectors after arrival
- Detector frames require modification to lower beamline to match Hall D

Needed:

- Set up detectors in ESB to design height modification and make changes
- Detector arrangement (location, spacing)
- Beamline requirements (size, wall thickness, shielding)
- Gas system requirements

Overall Schedule & Budget



	FY28				FY29				FY30				FY31			
	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q
Engineer	1 FTE				1 FTE				0.5 FTE				0.5 FTE			
Designer	2 FTE				2 FTE				0.2 FTE				0.2 FTE			
Technician								4 FTE	4 FTE				4 FTE			
Work Coordinator								1 FTE	1 FTE				1 FTE			
Survey & Alignment									$80k				$32K			
Outside Designer Cost	$200K				$200K											
Material Costs	$820K				$622K				$135K				$10K			
Material + Outside Labor	**$1020K**				**$822K**				**$215K**				**$42K**			

Schedule Assumptions:

- Serial Installation: KPT -> CPS -> KFM -> (Hypernuclear*)
- 1 Engineer, 1 Designer, 4 Technicians, Work Coordinator charge DOPS
- Funding available Starting October 2027 on the order of $750k/year
- KFM, Beamline, and KPT decisions arrive in time

Total Costs:

- $1.6M for parts & materials
- $512K non-operations labor

*Hypernuclear (not shown) adds ~$40k material costs, ~4 months design, ~3 months installation

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QUESTIONS?

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BACKUP SLIDES

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