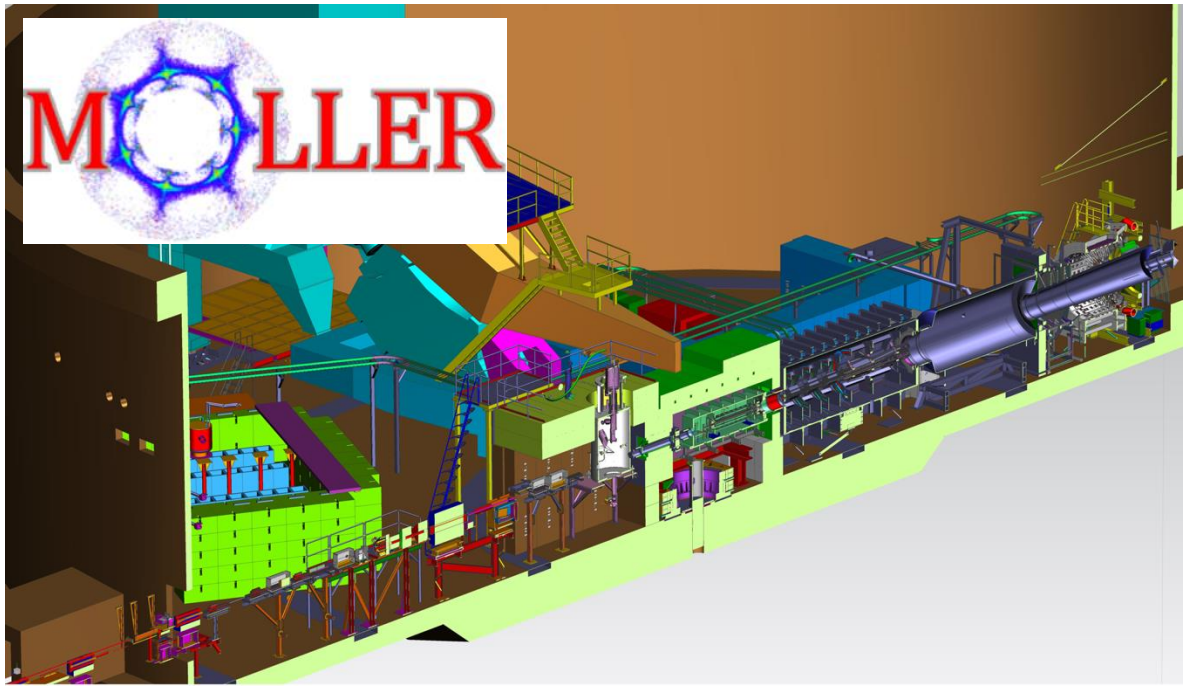
MOLLER Project update

2025 Summer Hall A/C Collaboration Meeting

Jun 18 2025

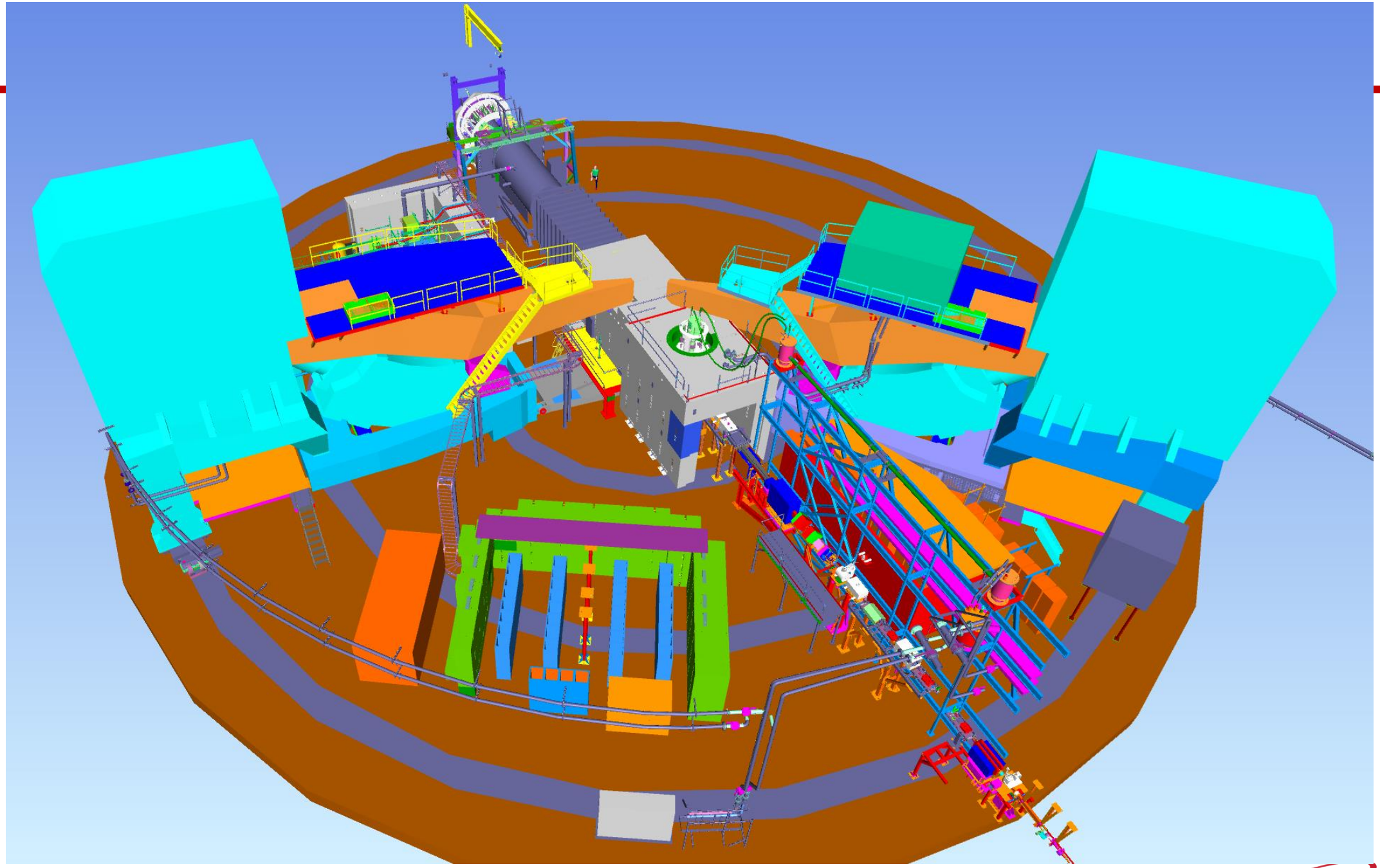


Vladimir V. Berdnikov (Level 2 manager)

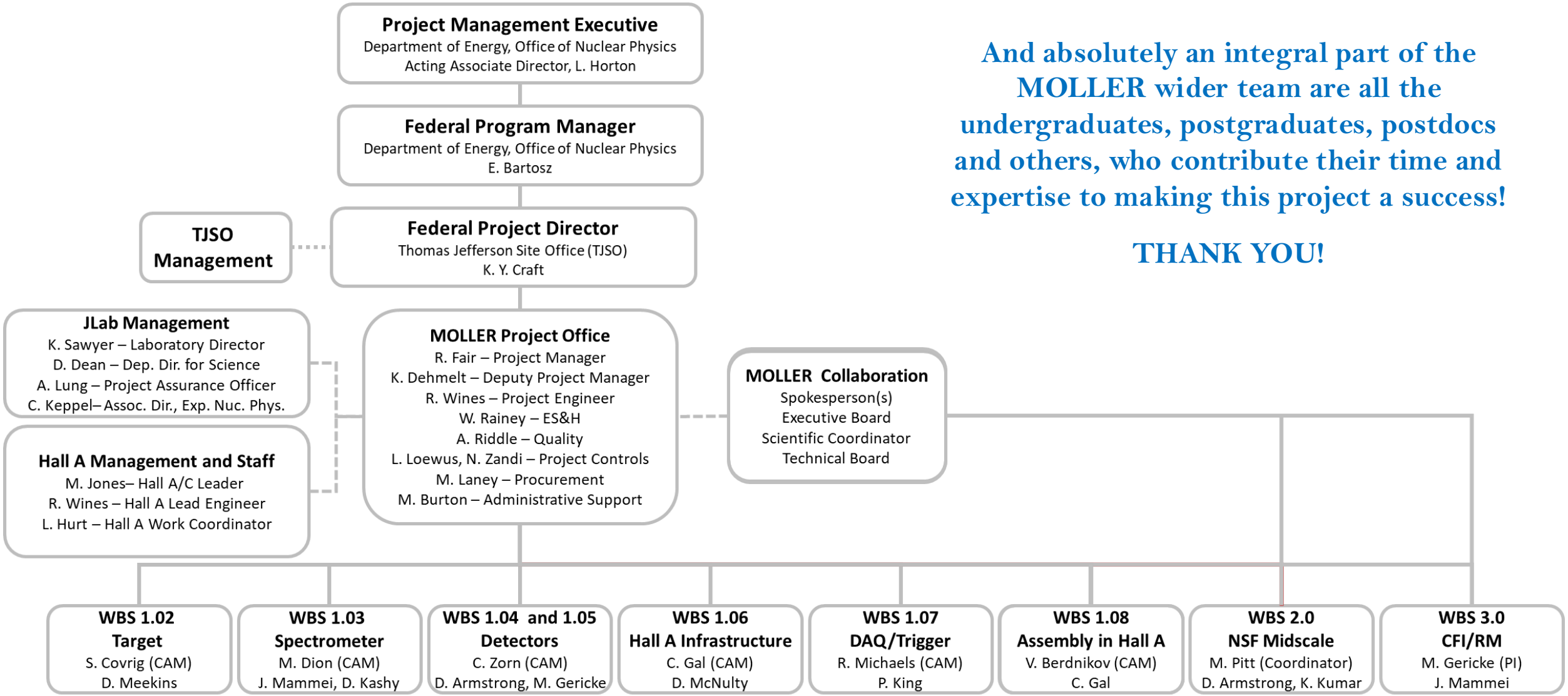
Jefferson Lab

U.S. DEPARTMENT OF ENERGY | Office of Science

JSA



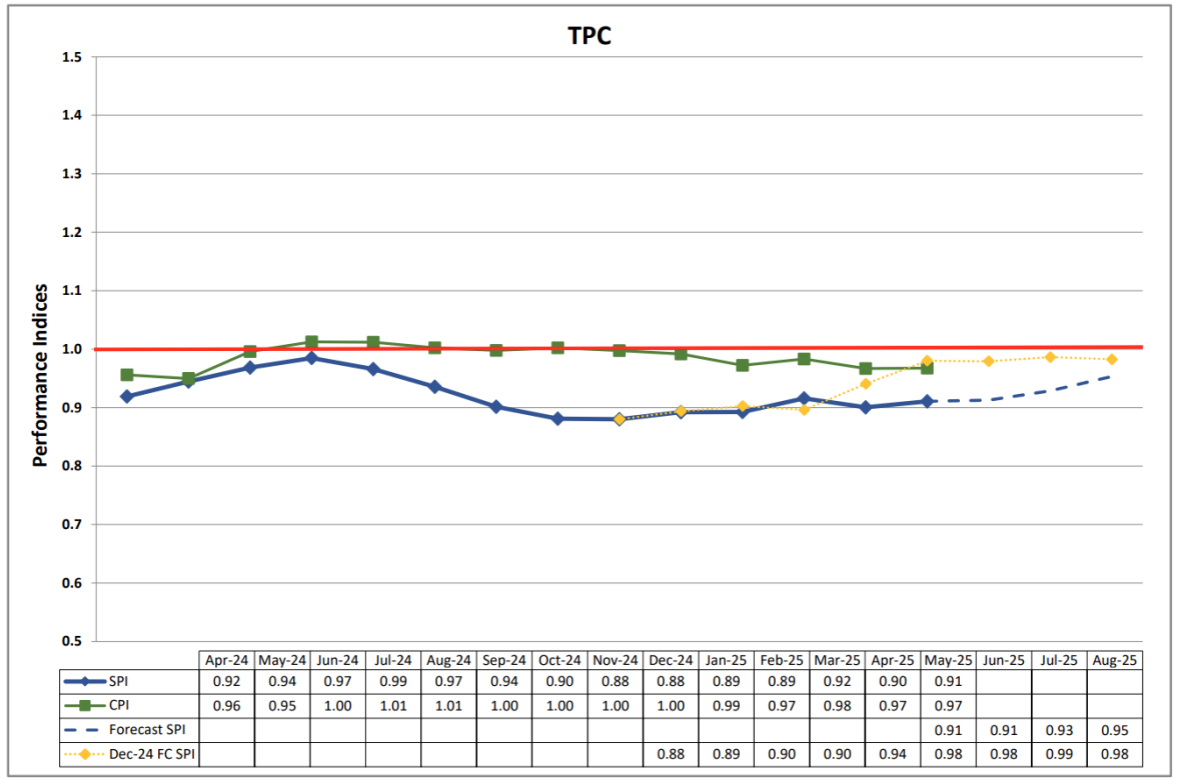
The MOLLER Team



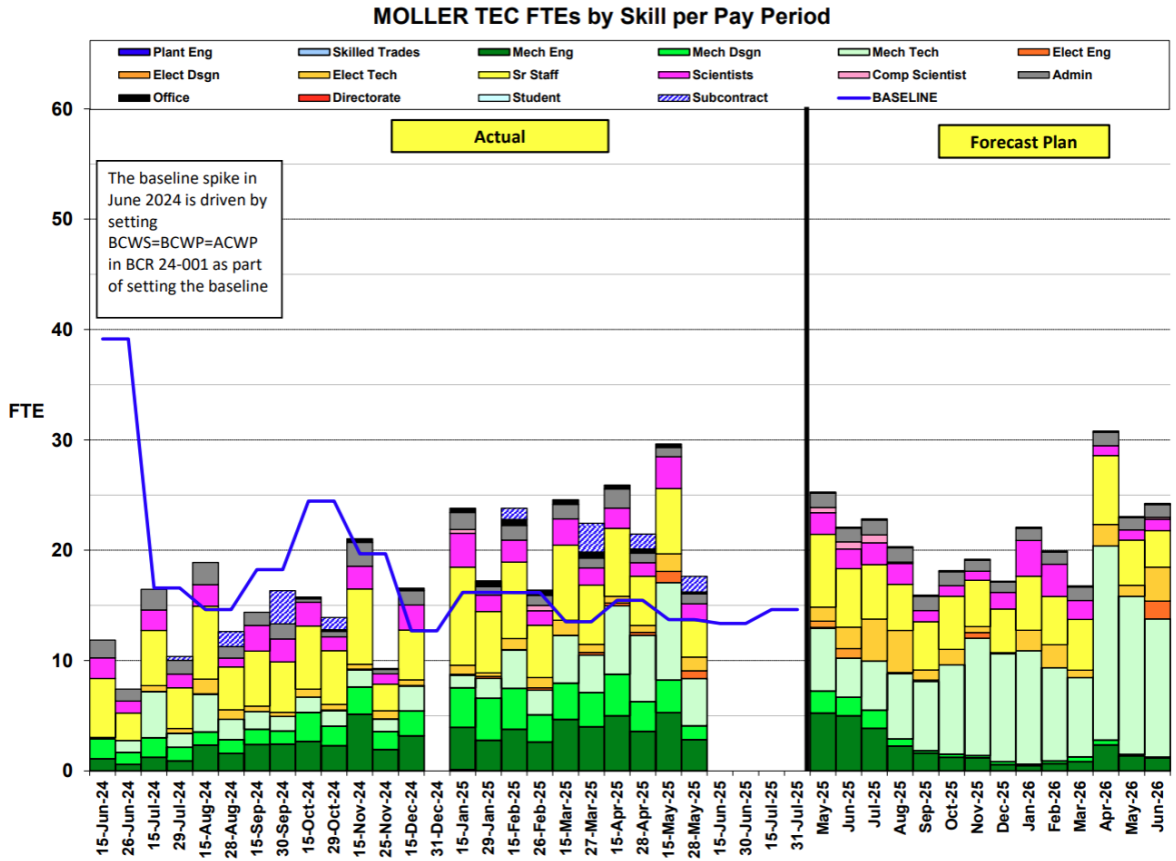
And absolutely an integral part of the MOLLER wider team are all the undergraduates, postgraduates, postdocs and others, who contribute their time and expertise to making this project a success!

THANK YOU!

EVMS



	Apr-24	May-24	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25	Jun-25	Jul-25	Aug-25
SPI	0.92	0.94	0.97	0.99	0.97	0.94	0.90	0.88	0.88	0.89	0.89	0.92	0.90	0.91			
CPI	0.96	0.95	1.00	1.01	1.01	1.00	1.00	1.00	1.00	0.99	0.97	0.98	0.97	0.97			
Forecast SPI														0.91	0.91	0.93	0.95
Dec-24 FC SPI									0.88	0.89	0.90	0.90	0.94	0.98	0.98	0.99	0.98

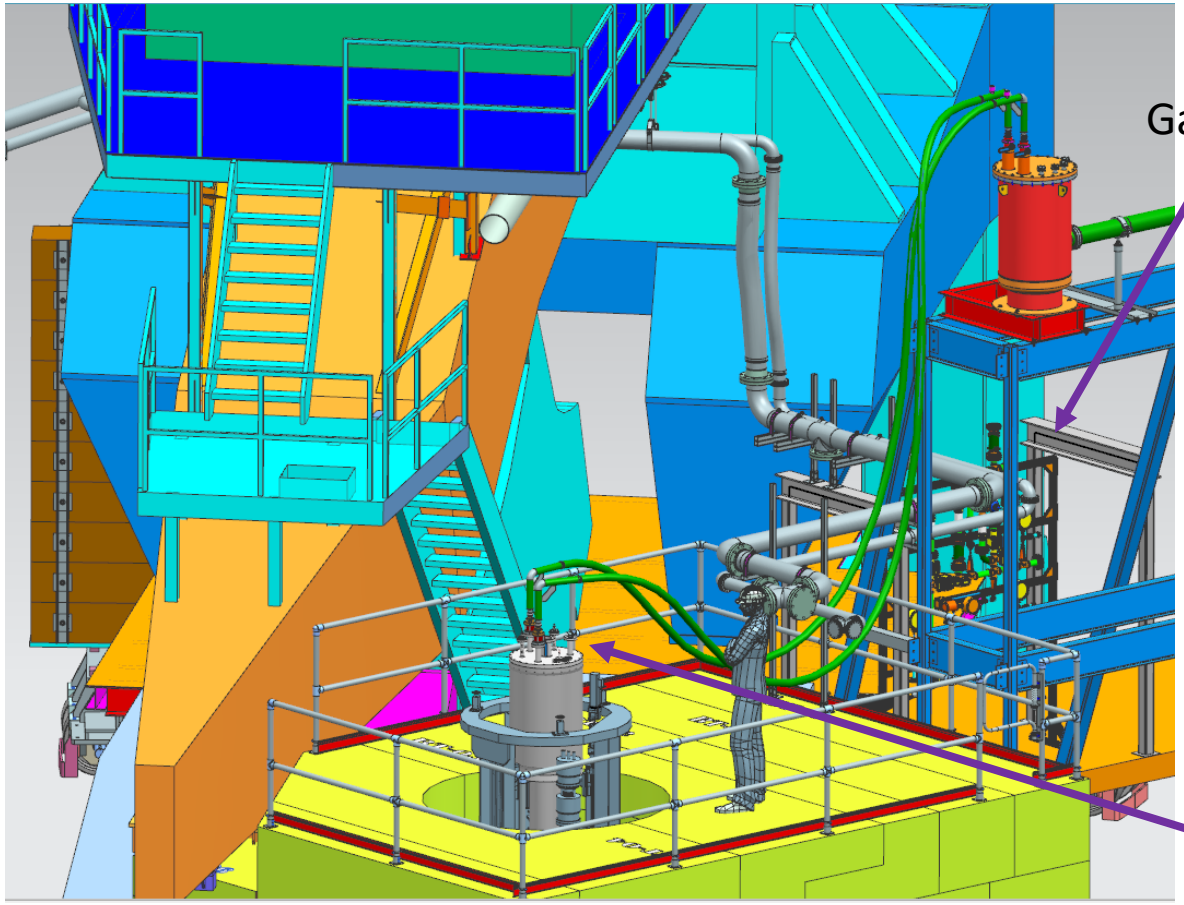


M:\MOLLER\PMO\Workforce\Skills Mix Charts\FY25\08.May-25\MOLLER Semi-Monthly FTEs Skill Mix Charts 31-May-2025 6/12/2025

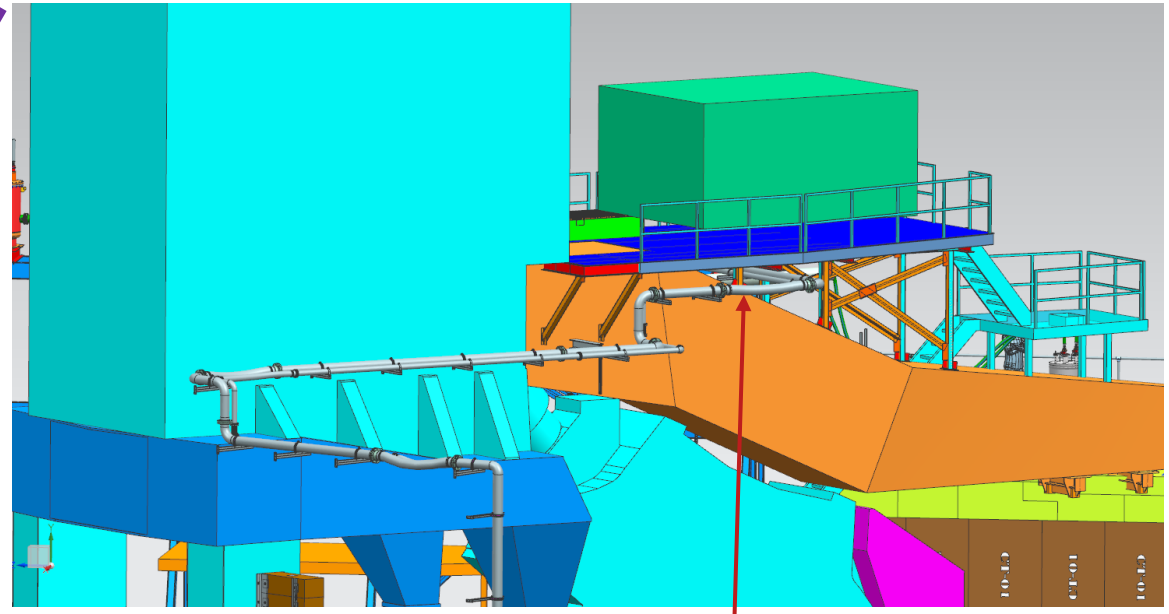
WBS 1.02.02 Chamber Test Assembly

Scattering chamber test fit completed early January
Components have been re-crated for storage in Physics facility

WBS 1.02.03 Hydrogen Gas Service



Final design is complete but piping sections will need to be field fit during assembly

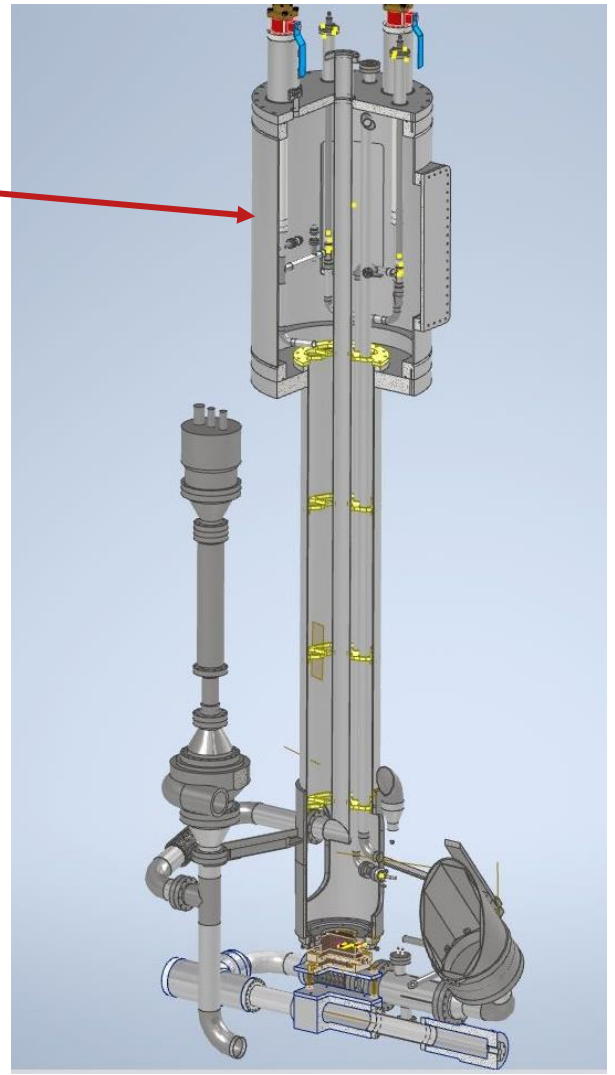


MORE details above ground; storage tanks, piping, etc.

WBS 1.02.04 Helium Gas Service

Cryostat

- Interfaces between helium service piping and target HX and bypass
- Control Valves (JT valves)
- Provides warm to cold transition for the H2 service and loop
- Feedthroughs for instrumentation
- Status
  - Fabrication is complete
  - Leak testing is complete



Completed Cryostat Components

Components have been test fit. Disassembled for fit-up with lifter components.

Spectrometer Major Components – Bellows

SS Bellows 1 (and 2)

Bellows 3 (SS)

Bellows 5 (Inconel)

Bellows 7 (Inconel)

Spectrometer Major Components

Pion Donut (w/ lead) and stand

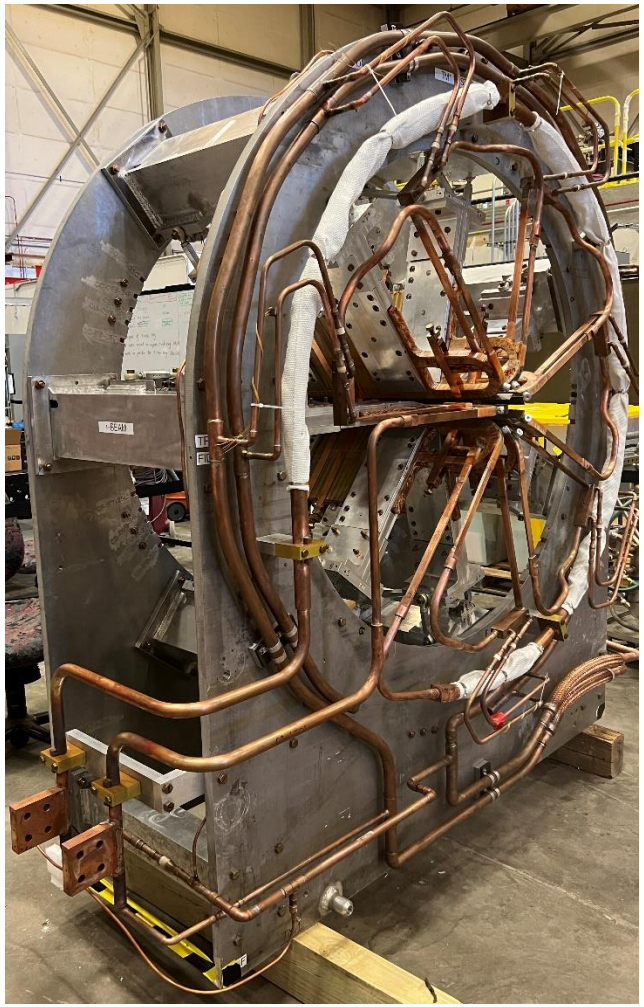
Detector Window machining completed 2/5/2025

Detector Pipe/Pion Donut Stand

Spectrometer Major Components – Drift Pipe & Detector Pipe

- Large aluminum vacuum components; drift pipe ~ 110” OD

Spectrometer Major Components – Magnets ASSEMBLED!

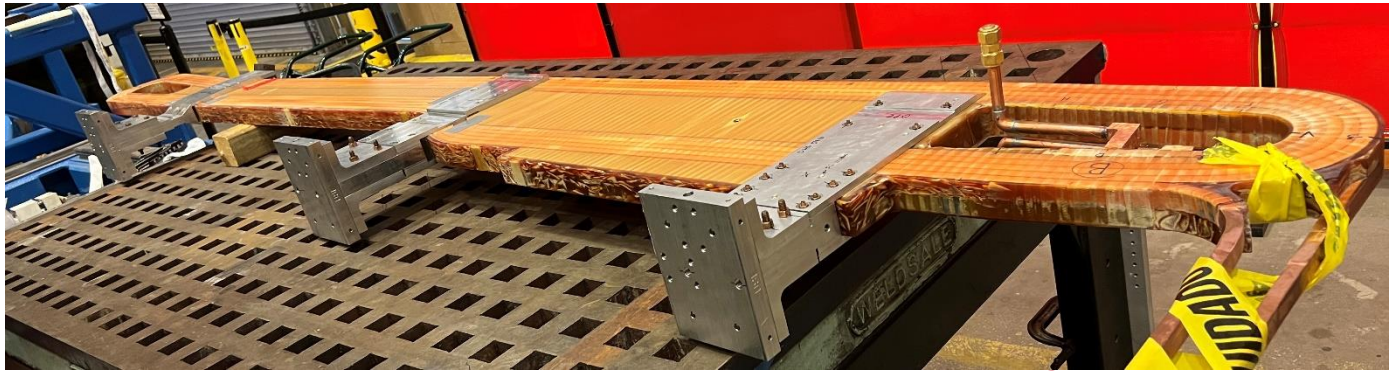


TM-1 complete…

TM-2

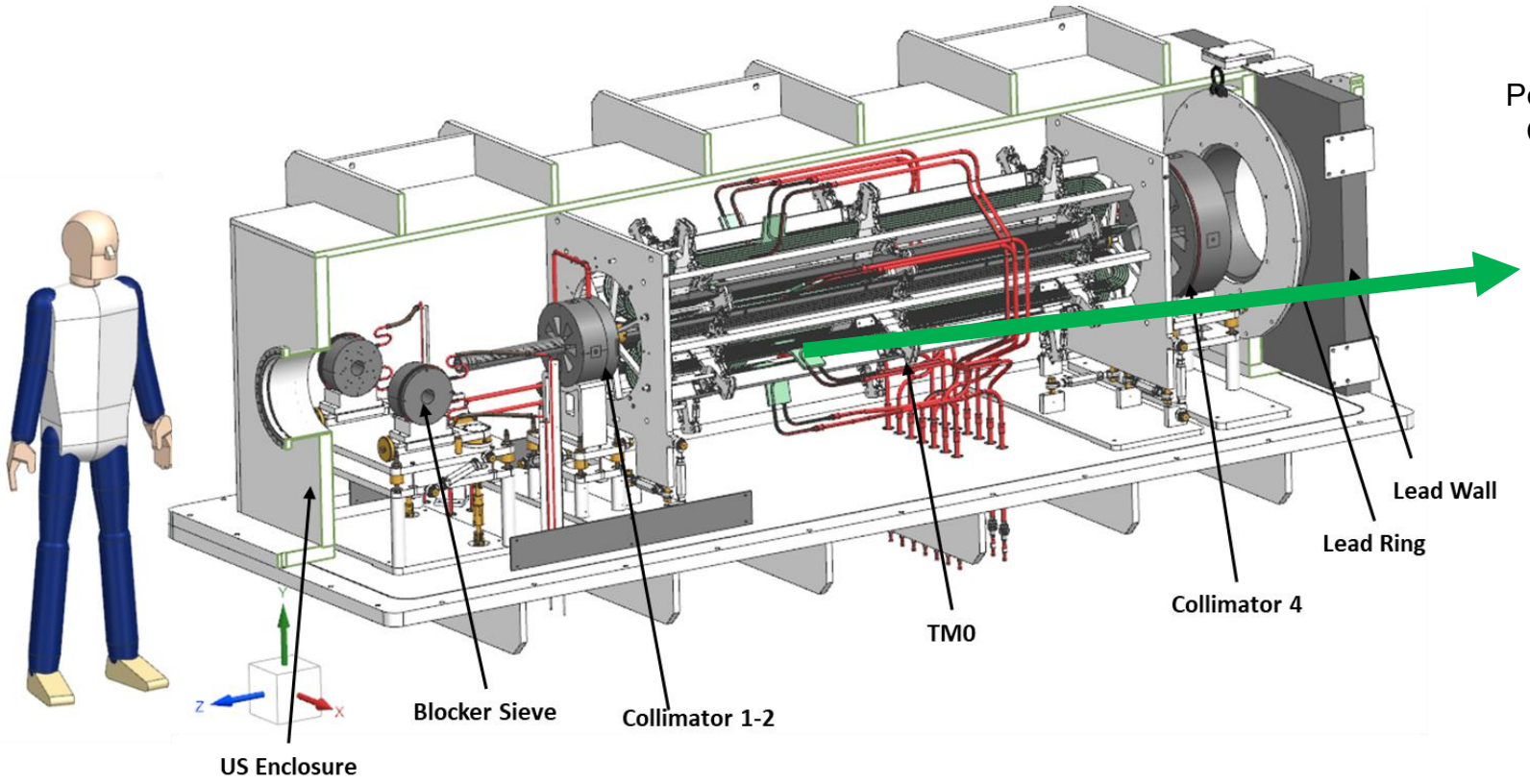
Magnet operating parameters at 110% of nominal current				
	Maximum Magnet Current (A)	Maximum Magnet Power (kW)	Current Density (A/mm^2)	Total Flow (gpm)
TM0	1178.7	84	21.6	9.59
TM1	2451.6	50	20.6	9.94
TM2	2682.3	103	17.2	14.21
TM3	3709.6	185	20.0	22.67
TM4	3688.7	751	18.5	113.8

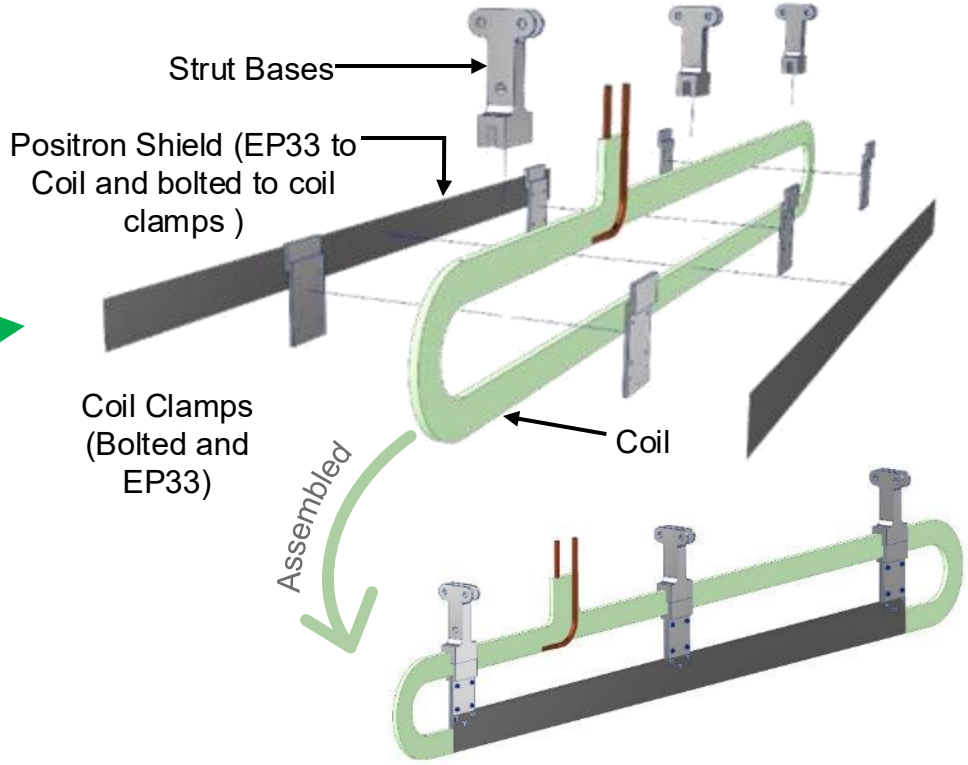
SC-4 coil



US Spectrometer Design

- Collaborative effort between JLab, MIT-Bates, and Bartoszek Engineering

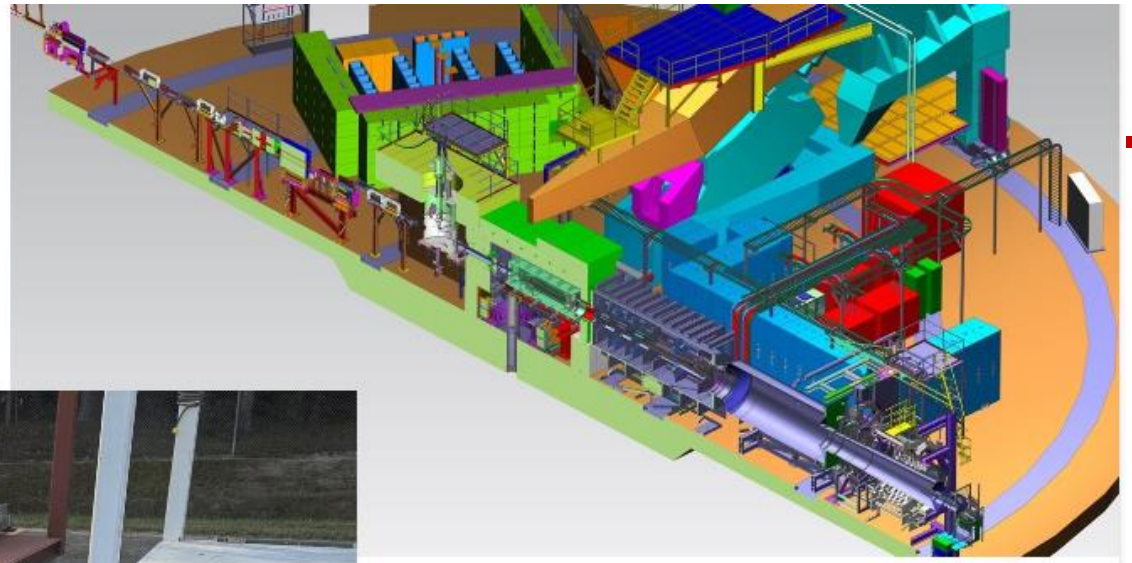




Assembled Coil Assembly

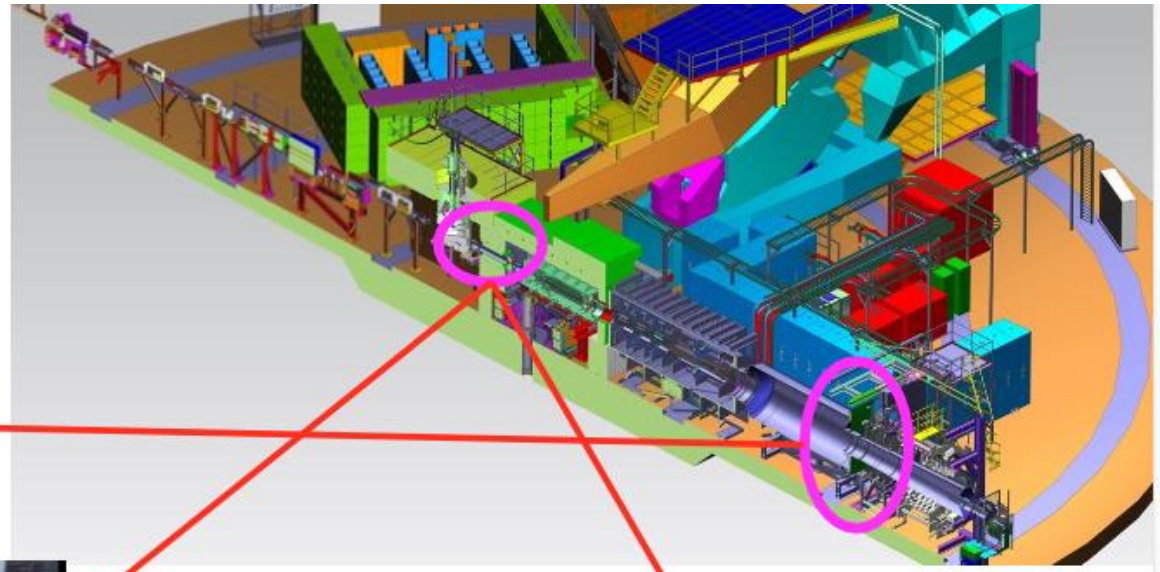
Jefferson Lab

Supports



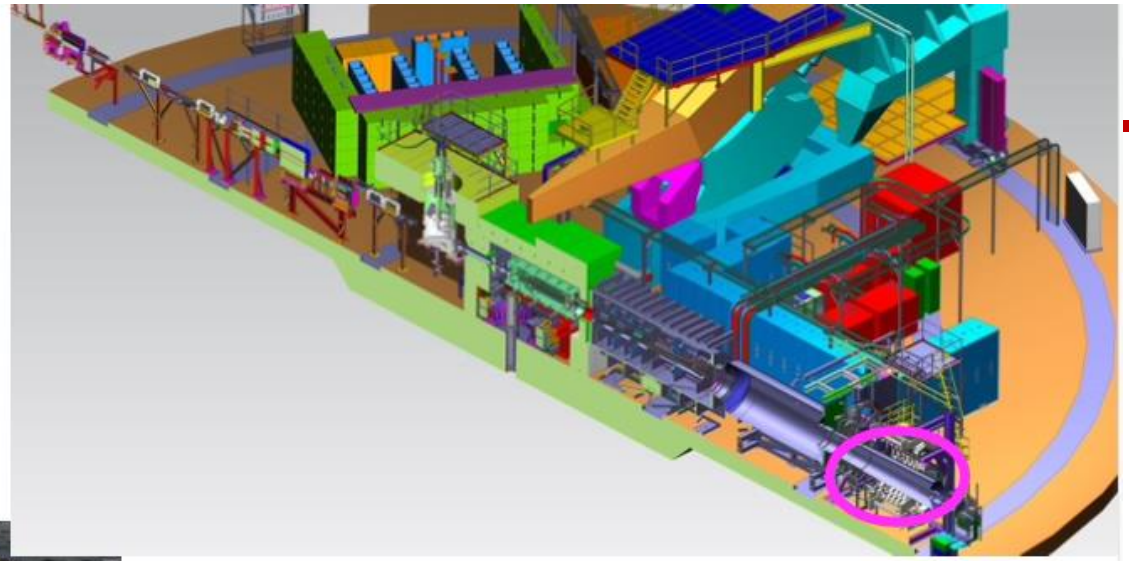
- All the supports and auxiliary structures are on track
  - Some are already on site

Shielding

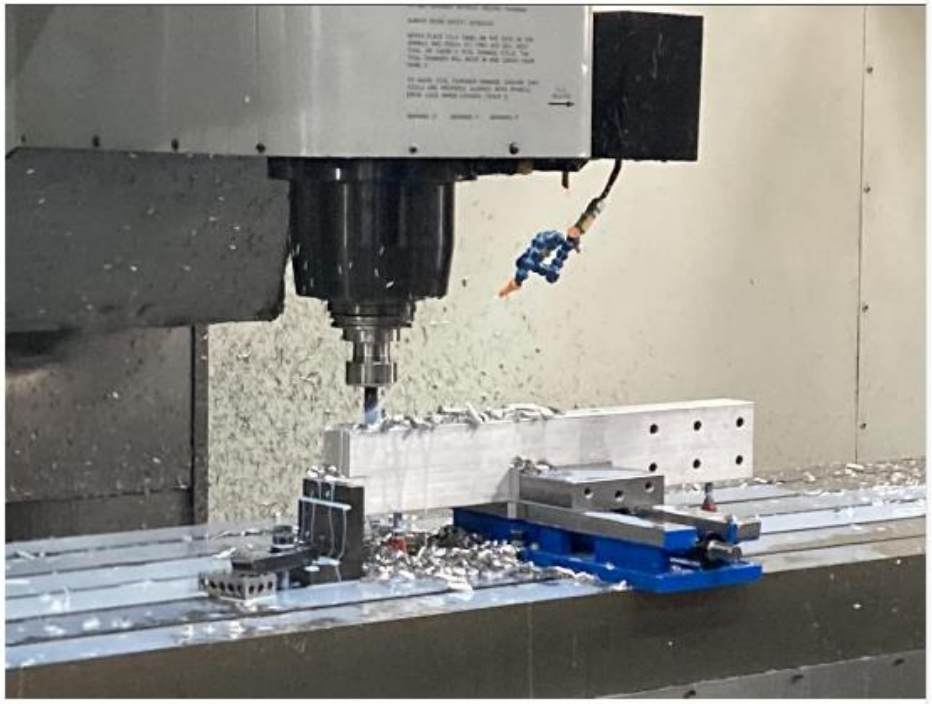


- Most shielding is being worked on by the vendors
  - some are late
  - some are already here
  - all are expected to not delay the assembly

MD stand

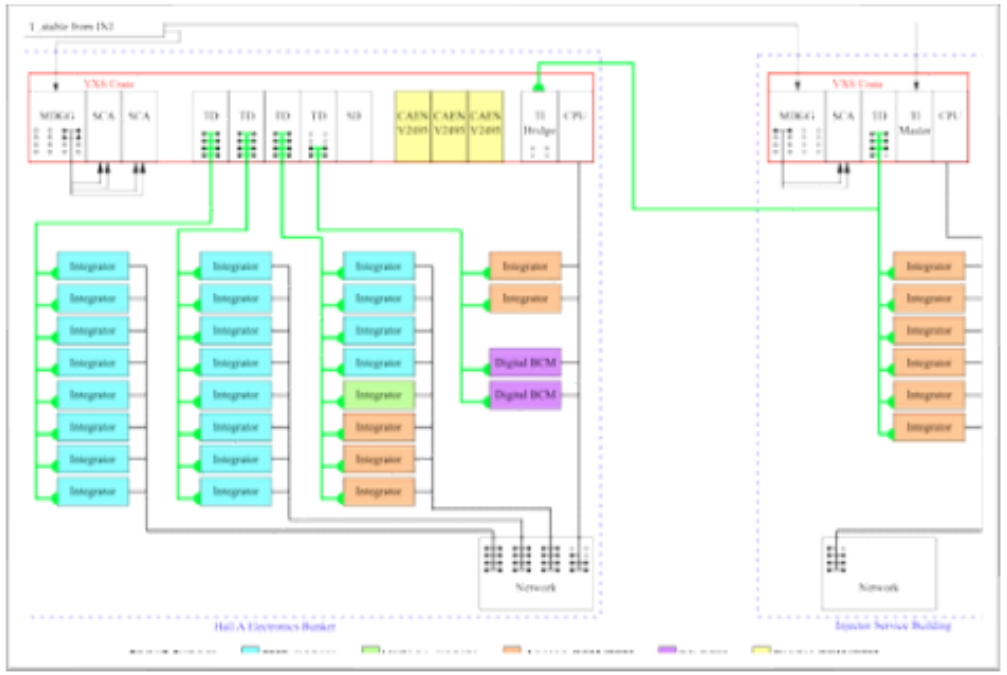


- The main detector stand is on track to be delivered mid Aug
- Most of the materials already ordered by the vendor and machine has commenced
- Control system is still being worked out

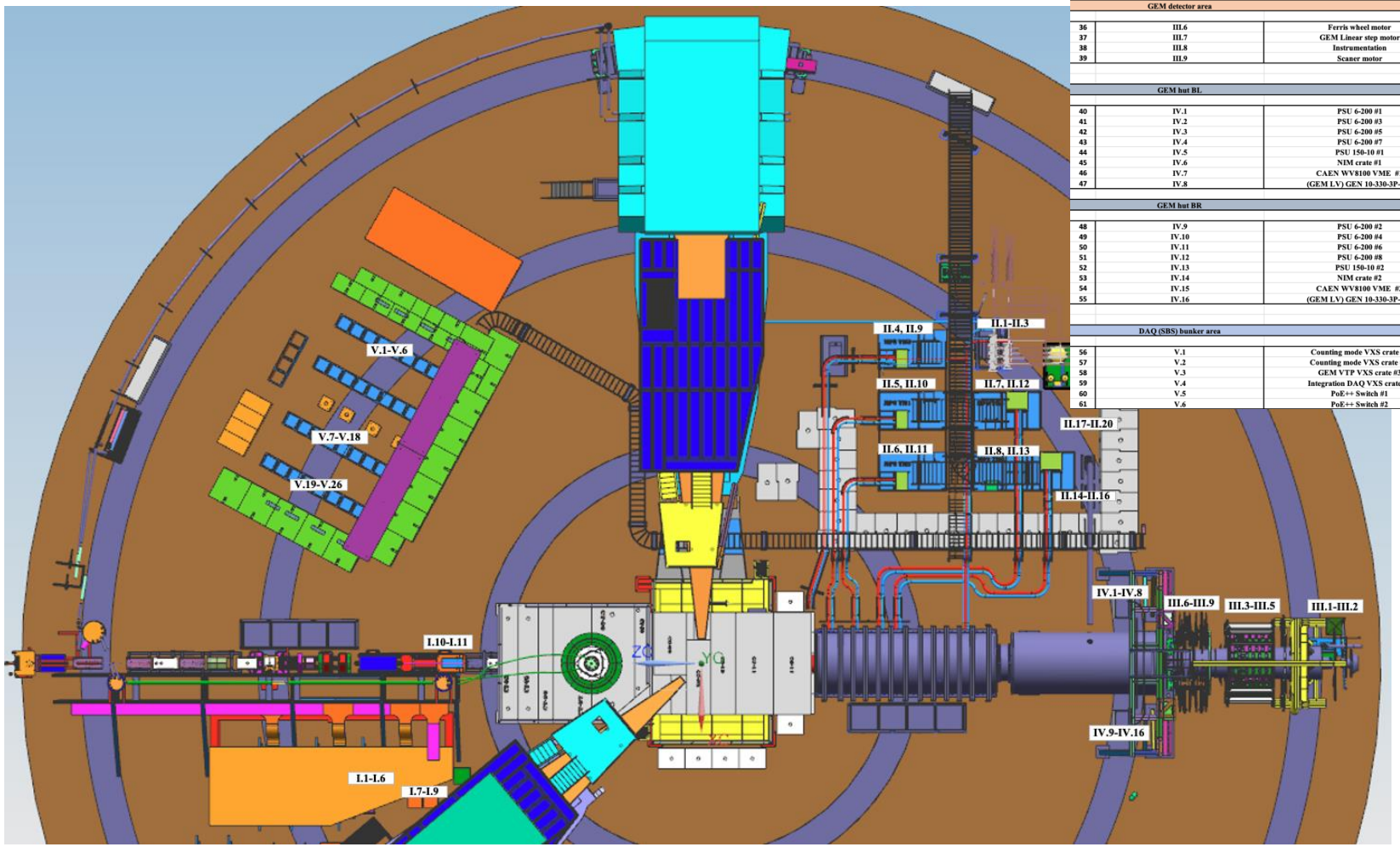


DAQ

- Nearly all DAQ hardware is at JLab (some is still at OhioU)
  - Computing procurements and interconnection cables are in process
- Firmware development for the integrating ADCs had been slowed in part due to the tariff-related delays in shipping the rev2 boards to JLab
  - Rev2 ADCs are expected at JLab imminently
- Multiple test stands of both systems in use, allowing build up for the assembly in early fall



Electrical infrastructure



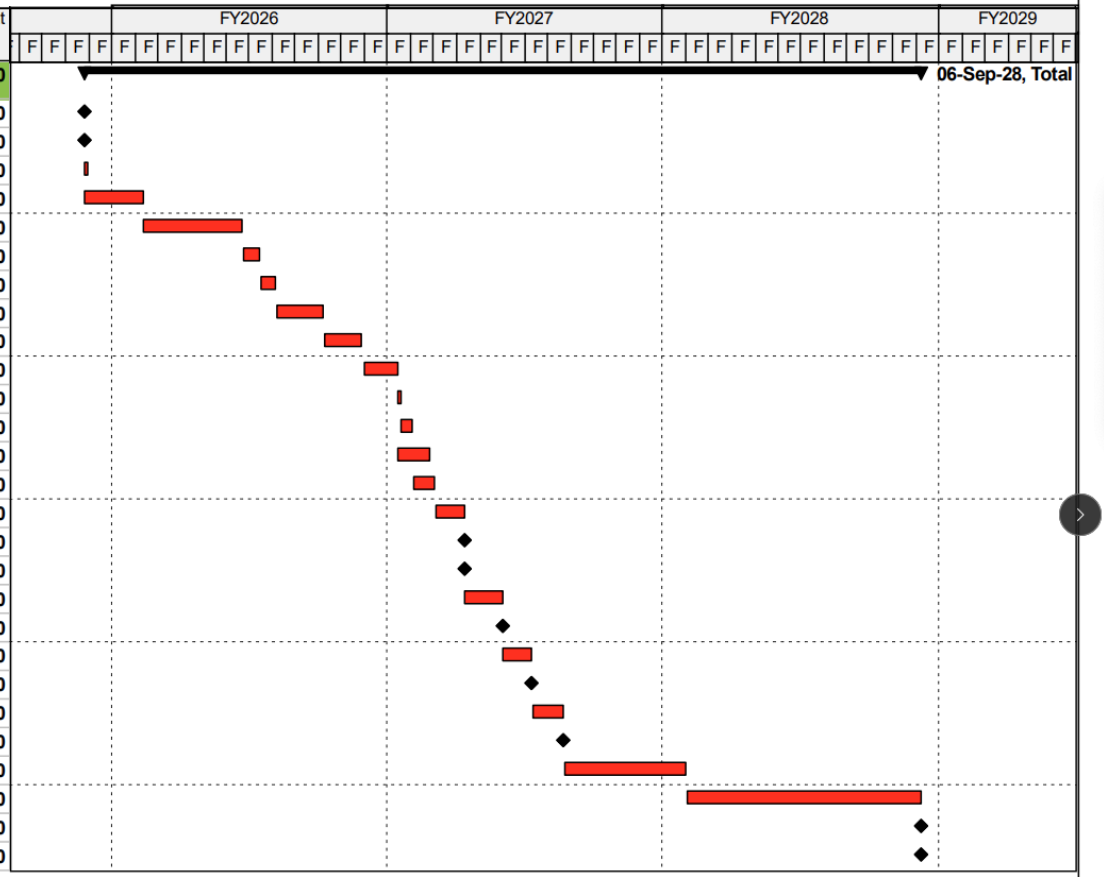
#	ITEM NO.	Description	Volts	Phase	Clean power	Max Amps	Expected Amps	Operating Temp	Cooling	WBS	Exist or new
35	III.5	Instrumentation	110	1		15	<15			1.08.04	
	GEM detector area										
36	III.6	Ferris wheel motor	208	3	No	20	<20	< 30 C	ambient	1.08.04	New
37	III.7	GEM Linear step motor	110	1		10	<10				
38	III.8	Instrumentation	110	1		15	<15				
39	III.9	Scaner motor	110	1		10	<10				
	GEM hut BL										
40	IV.1	PSU 6-200 #1	208	3	Yes	20	<20	< 30 C	Ambient	1.08.04	New
41	IV.2	PSU 6-200 #3									
42	IV.3	PSU 6-200 #5									
43	IV.4	PSU 6-200 #7									
44	IV.5	PSU 150-10 #1									
45	IV.6	NIM crate #1									
46	IV.7	CAEN WV8100 VME #1									
47	IV.8	(GEM LV) GEN 10-330-3P-480	408								
	GEM hut BR										
48	IV.9	PSU 6-200 #2	208	3	Yes	20	<20	< 30 C	Ambient	1.08.04	New
49	IV.10	PSU 6-200 #4									
50	IV.11	PSU 6-200 #6									
51	IV.12	PSU 6-200 #8									
52	IV.13	PSU 150-10 #2									
53	IV.14	NIM crate #2									
54	IV.15	CAEN WV8100 VME #2									
55	IV.16	(GEM LV) GEN 10-330-3P-480	408								
	DAQ (SBS) bunker area										
56	V.1	Counting mode VXS crate #1	208	3	Yes	20	<20	< 30 C	ambient	1.08.07	New
57	V.2	Counting mode VXS crate #2									
58	V.3	GEM VTP VXS crate #3									
59	V.4	Integration DAQ VXS crate #4									
60	V.5	PoE++ Switch #1				15	10				
61	V.6	PoE++ Switch #2									

Project ID: MOLLER_BL25-014
Project Name: MOLLER Schedule CD2/3 Baseline for May-25 BL-25-014

MOLLER Critical Paths - Total Float < or = 0 (All WBS)
sorted by finish date

Data Date: 16-Aug-19
Print Date: 12-Jun-25

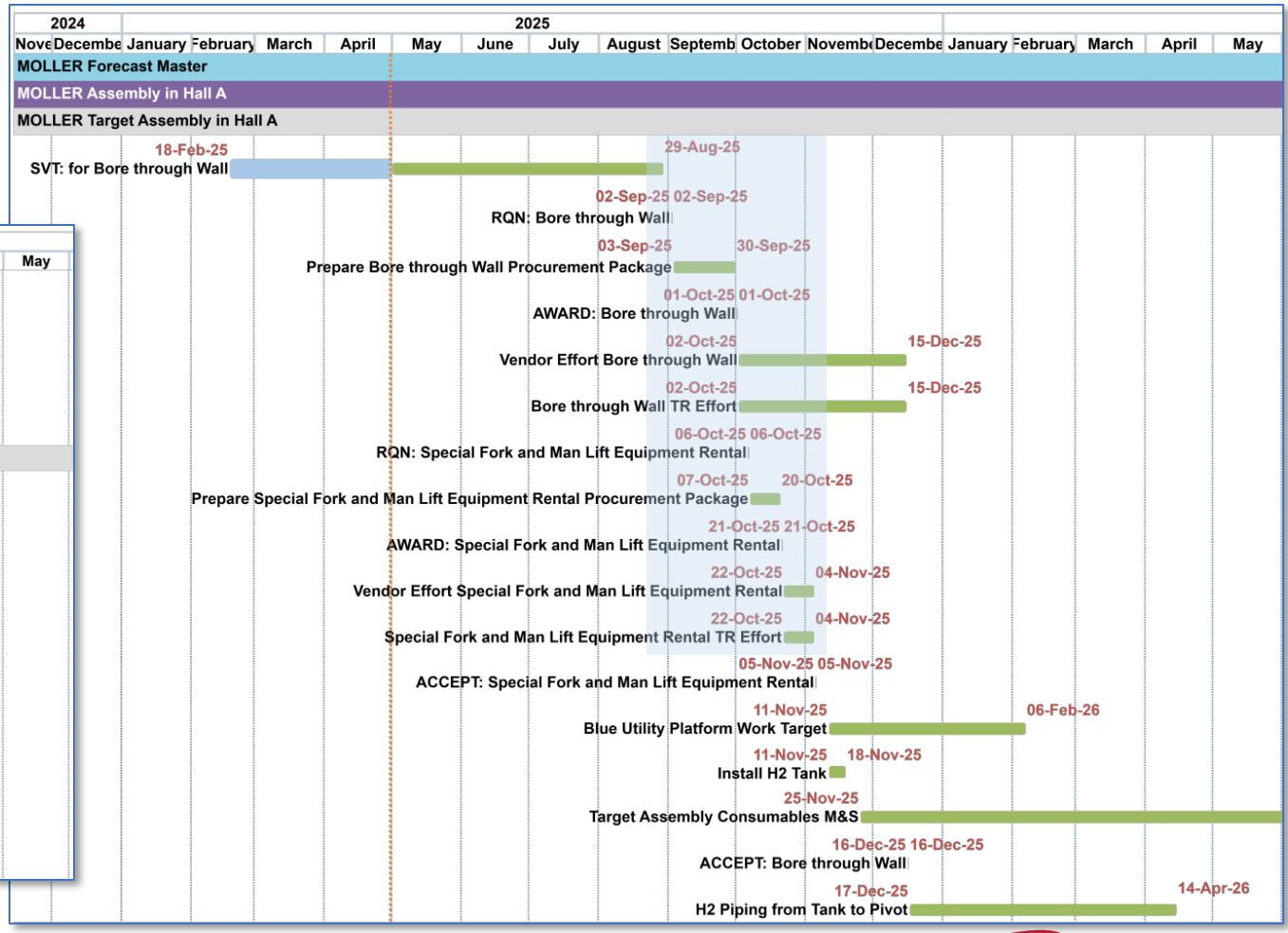
Activity ID	Activity Name	Start	Finish	Original Duration	Total Float	Free Float
Total Float: 0 to 5		25-Aug-25	06-Sep-28	750	0	0
3-15090M	MOLLER Ready for End of SBS Run		25-Aug-25	0	0	0
3-02040M	End of Experiment Running before MOLLER		25-Aug-25	0	0	0
10806010	Radiological Survey and Release of Hall to MOLLER	26-Aug-25	29-Aug-25	4	0	0
10806030	SBS Equipment Removal	26-Aug-25	11-Nov-25	55	0	0
10806060	Utilities Removal and Platform Modifications	12-Nov-25	23-Mar-26	84	0	0
10806055	Assemble Detector Infrastructure	24-Mar-26	15-Apr-26	17	0	0
10804020	Main Detector Frame and Ring Assembly	16-Apr-26	06-May-26	15	0	0
10804045	Main Detector Segments Installation	07-May-26	08-Jul-26	42	0	0
10804050	Main Detector Cabling and Testing	09-Jul-26	28-Aug-26	37	0	0
10804030	GEMs Detector Assembly	31-Aug-26	15-Oct-26	33	0	0
10804071	SVT: Start Pion Detector 2 days after GEMs Cabled	16-Oct-26	19-Oct-26	2	0	0
10804035	Pion Detector Assembly	20-Oct-26	03-Nov-26	11	0	0
10804070	GEMs Cabling and Detector Tests	16-Oct-26	25-Nov-26	29	0	0
10804040	Pion Detectors Cabling and Testing	04-Nov-26	03-Dec-26	20	0	0
10804085	Detectors KPP validations	04-Dec-26	11-Jan-27	20	0	0
3-03130M	MOLLER Assembly in Hall A Complete		11-Jan-27	0	0	0
3-01080M	Ready for CD-4		11-Jan-27	0	0	0
3-01085	Prepare Documentation for CD-4 Director's Review	12-Jan-27	02-Mar-27	35	0	0
3-01090M	CD-4 Director's Review		02-Mar-27	0	0	0
3-01095	Prepare Documentation for CD-4 OPA Review	03-Mar-27	09-Apr-27	28	0	0
3-01100M	CD-4 OPA Review		09-Apr-27	0	0	0
3-01105	CD-4 DOE Approval Process	12-Apr-27	21-May-27	30	0	0
3-01110M	CD-4 ESAAB Approval		21-May-27	0	0	0
2-01050	SVT - From 3-01110M (CD-4 Approval) JLAB MR	24-May-27	01-Nov-27	112	0	0
2-01050D	SVT - DOE SVT for CD-4 Approval	02-Nov-27	06-Sep-28	209	0	0
2-01056M	CD-4 Late Finish (Approve Project Completion and Start of Operations)		06-Sep-28	0	0	0
1-6M	CD-4 (Approve Project Completion and Start of Operations)		06-Sep-28*	0	0	0



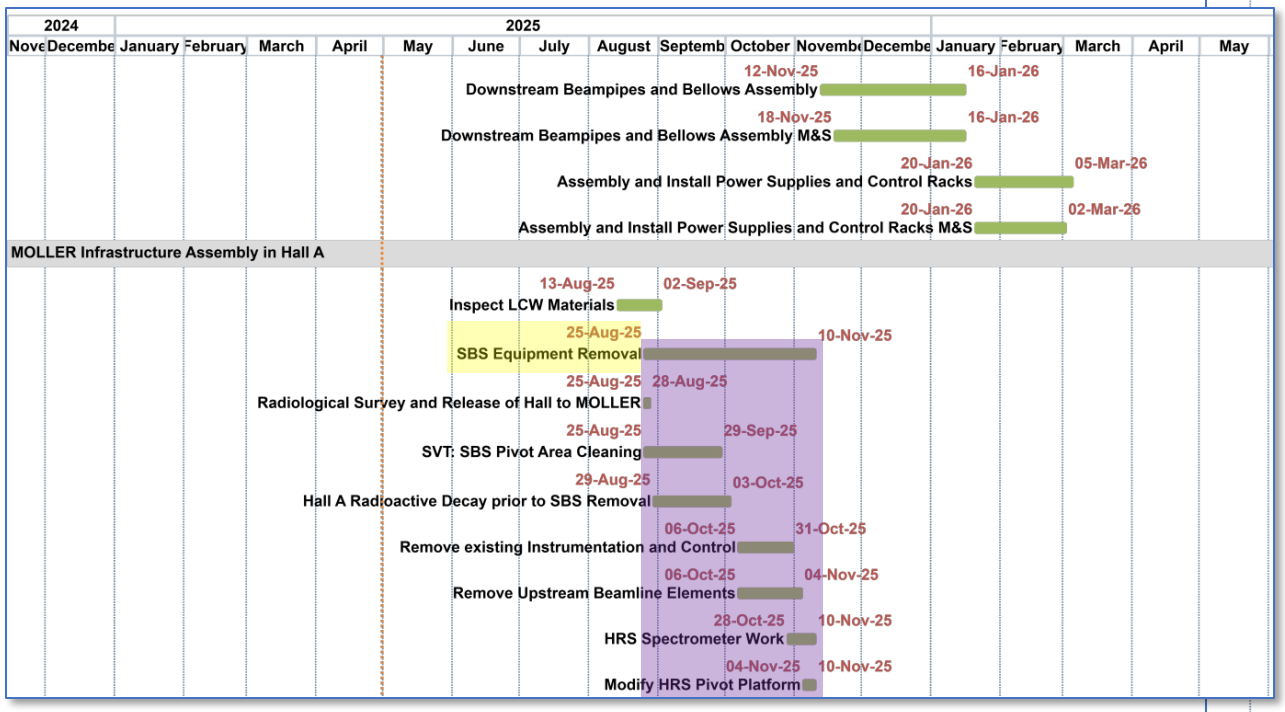
Cost and Schedule Contingency

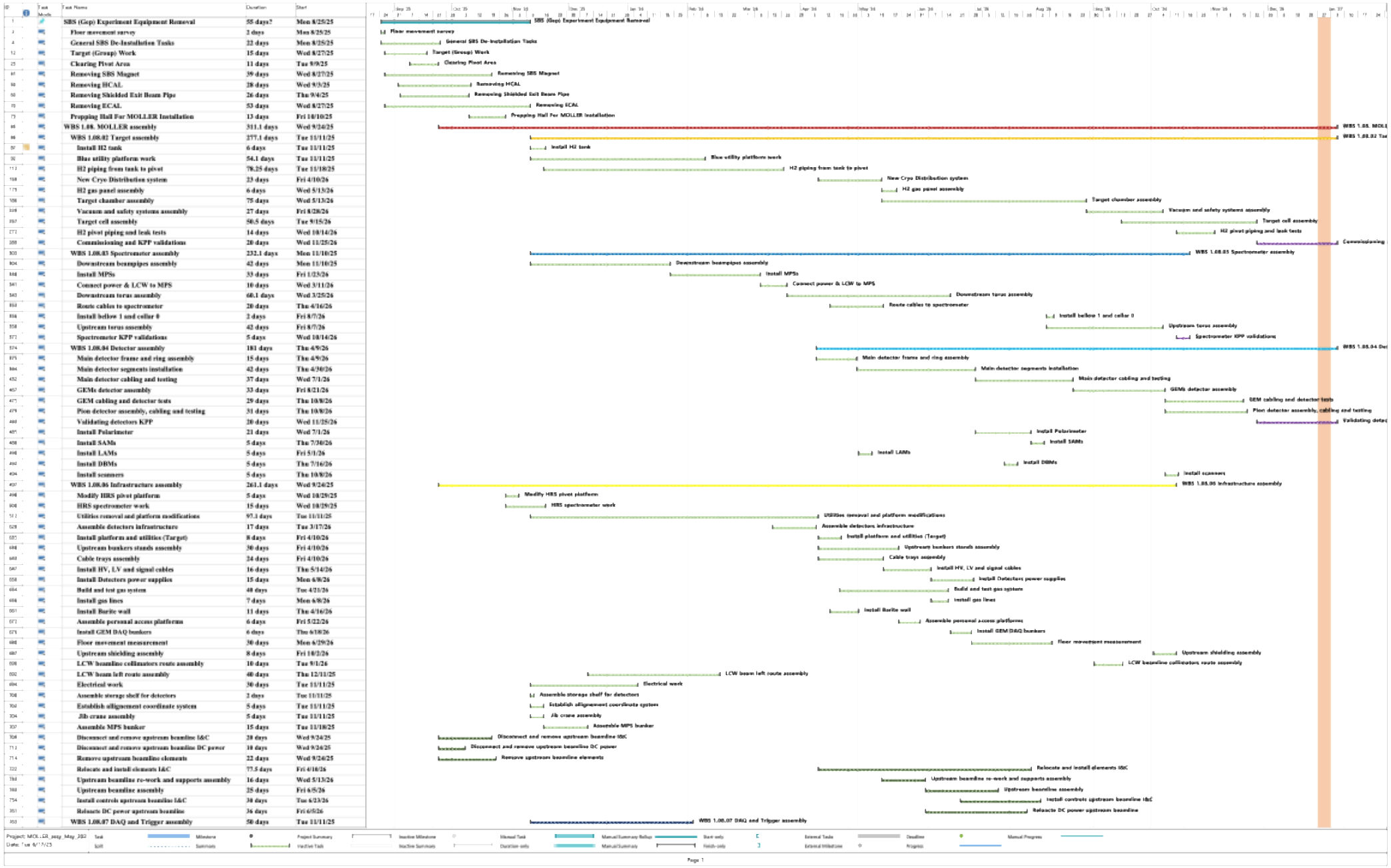
MOLLER activities running concurrently with SBS De-Installation

Outside the hall



In the hall





ID	Task Mode	Task Name	Duration	Start
1		SBS (Gep) Experiment Equipment Removal	55 days?	Mon 8/25/25
2		Floor movement survey	2 days	Mon 8/25/25
4		General SBS De-Installation Tasks	22 days	Mon 8/25/25
12		Target (Group) Work	15 days	Wed 8/27/25
25		Clearing Pivot Area	11 days	Tue 9/9/25
45		Removing SBS Magnet	39 days	Wed 8/27/25
59		Removing HCAL	28 days	Wed 9/3/25
60		Removing Shielded Exit Beam Pipe	26 days	Thu 9/4/25
70		Removing ECAL	53 days	Wed 8/27/25
73		Prepping Hall For MOLLER Installation	13 days	Fri 10/10/25
86		WBS 1.08. MOLLER assembly	311.1 days	Wed 9/24/25
86		WBS 1.08.02 Target assembly	277.1 days	Tue 11/11/25
87		Install H2 tank	6 days	Tue 11/11/25
92		Blue utility platform work	54.1 days	Tue 11/11/25
113		H2 piping from tank to pivot	78.25 days	Tue 11/18/25
168		New Cryo Distribution system	23 days	Fri 4/10/26
179		H2 gas panel assembly	6 days	Wed 5/13/26
188		Target chamber assembly	75 days	Wed 5/13/26
228		Vacuum and safety systems assembly	27 days	Fri 8/28/26
257		Target cell assembly	50.5 days	Tue 9/15/26
272		H2 pivot piping and leak tests	14 days	Wed 10/14/26
288		Commissioning and KPP validations	20 days	Wed 11/25/26
303		WBS 1.08.03 Spectrometer assembly	232.1 days	Mon 11/10/25
304		Downstream beampipes assembly	42 days	Mon 11/10/25
344		Install MPSs	33 days	Fri 1/23/26
341		Connect power & LCW to MPS	10 days	Wed 3/11/26
343		Downstream torus assembly	68.1 days	Wed 3/25/26
353		Route cables to spectrometer	20 days	Thu 4/16/26
354		Install bellow 1 and collar 0	2 days	Fri 8/7/26
358		Upstream torus assembly	42 days	Fri 8/7/26
371		Spectrometer KPP validations	5 days	Wed 10/14/26
374		WBS 1.08.04 Detector assembly	181 days	Thu 4/9/26
375		Main detector frame and ring assembly	15 days	Thu 4/9/26
384		Main detector segments installation	42 days	Thu 4/30/26
432		Main detector cabling and testing	37 days	Wed 7/1/26
457		GEMs detector assembly	33 days	Fri 8/21/26
471		GEM cabling and detector tests	29 days	Thu 10/8/26
479		Pion detector assembly, cabling and testing	31 days	Thu 10/8/26
480		Validating detectors KPP	20 days	Wed 11/25/26
485		Install Polarimeter	21 days	Wed 7/1/26
488		Install SAMs	5 days	Thu 7/30/26
490		Install LAMs	5 days	Fri 5/1/26
492		Install DBMs	5 days	Thu 7/16/26
494		Install scanners	5 days	Thu 10/8/26
497		WBS 1.08.06 Infrastructure assembly	261.1 days	Wed 9/24/25
498		Modify HRS pivot platform	5 days	Wed 10/29/25
508		HRS spectrometer work	15 days	Wed 10/29/25
512		Utilities removal and platform modifications	97.1 days	Tue 11/11/25
528		Assemble detectors infrastructure	17 days	Tue 3/17/26
535		Install platform and utilities (Target)	8 days	Fri 4/10/26
538		Upstream bunkers stands assembly	30 days	Fri 4/10/26
543		Cable trays assembly	24 days	Fri 4/10/26
547		Install HV, LV and signal cables	16 days	Thu 5/14/26
558		Install Detectors power supplies	15 days	Mon 6/8/26
564		Build and test gas system	48 days	Tue 4/21/26
606		Install gas lines	7 days	Mon 6/8/26
561		Install Berlin wall	11 days	Thu 4/16/26
572		Assemble personal access platforms	6 days	Fri 5/22/26
579		Install GEM DAQ bunkers	6 days	Thu 6/18/26
588		Floor movement measurement	30 days	Mon 6/29/26
587		Upstream shielding assembly	8 days	Fri 10/2/26
598		LCW beamline collimators route assembly	10 days	Tue 9/1/26
592		LCW beam left route assembly	40 days	Thu 12/11/25
604		Electrical work	30 days	Tue 11/11/25
708		Assemble storage shelf for detectors	2 days	Tue 11/11/25
702		Establish alignement coordinate system	5 days	Tue 11/11/25
704		Jib crane assembly	5 days	Tue 11/11/25
707		Assemble MPS bunker	15 days	Tue 11/18/25
708		Disconnect and remove upstream beamline I&C	28 days	Wed 9/24/25
713		Disconnect and remove upstream beamline DC power	18 days	Wed 9/24/25
714		Remove upstream beamline elements	22 days	Wed 9/24/25
722		Relocate and install elements I&C	77.5 days	Fri 4/10/26
750		Upstream beamline re-work and supports assembly	16 days	Wed 5/13/26
760		Upstream beamline assembly	25 days	Fri 6/5/26
754		Install controls upstream beamline I&C	30 days	Tue 6/23/26
351		Relocate DC power upstream beamline	36 days	Fri 6/5/26
353		WBS 1.08.07 DAQ and Trigger assembly	50 days	Tue 11/11/25

M

on Lab

Summary

- MOLLER is Order 413.3B DOE MIE project
- The project is in full swing, and 68.92% is completed
- The majority of procurements are either awarded, in process, or have been received.
- Assembly and fabrication are in process
- We are addressing issues case by case and actively mitigating risks
- Installation starts in the upcoming SAM
- Estimated time for completion: mid-winter 2027

Backup