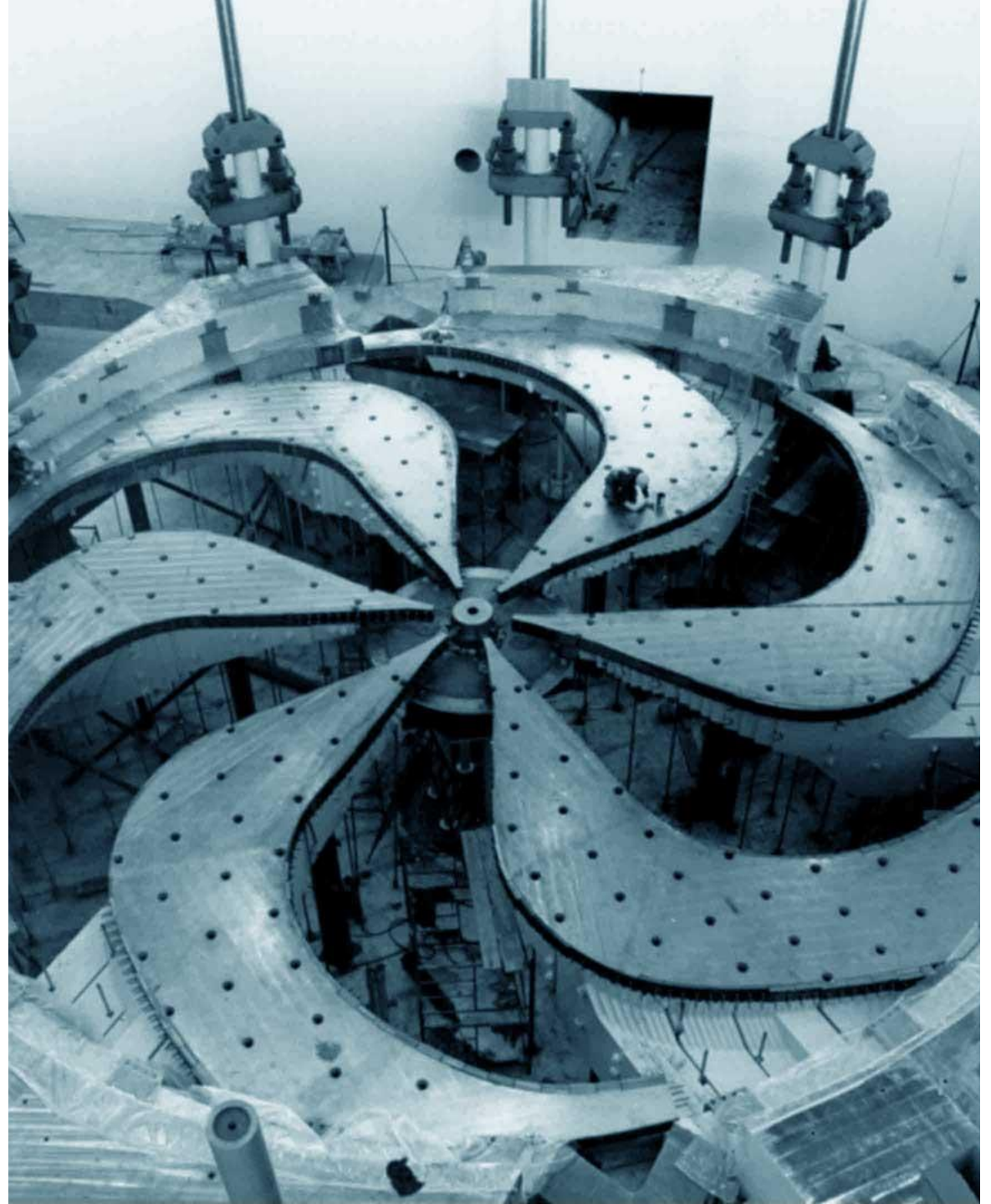


Hi-Lumi Update from TRIUMF

Bob Laxdal

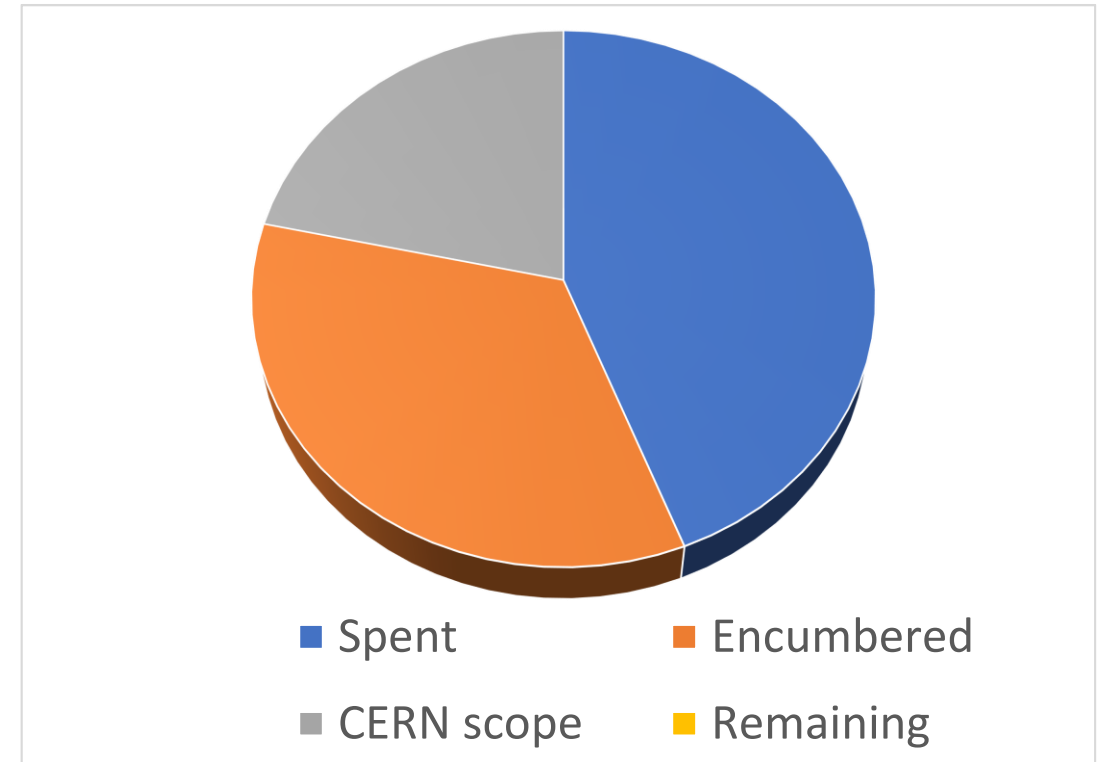
Dec 13, 2024



Funding progress and remaining risks

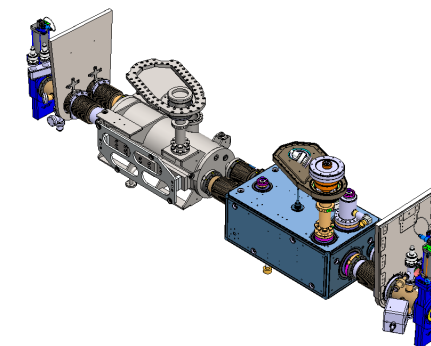
- Due to the nature of the funding agreement ALL funds for the project must be spent and all parts received before April 2025
- ✓ Over 5M\$ has been committed over the last year – TRIUMF has spent or encumbered all funds – a major milestone
- Present risks
 - Over 50% of funds are encumbered including 22% from CERN that need delivery to TRIUMF before April 2025

	Spent	Encumbered	CERN scope	Remaining
Total	\$4,458,936	\$3,473,226	\$2,182,161	-\$114,323

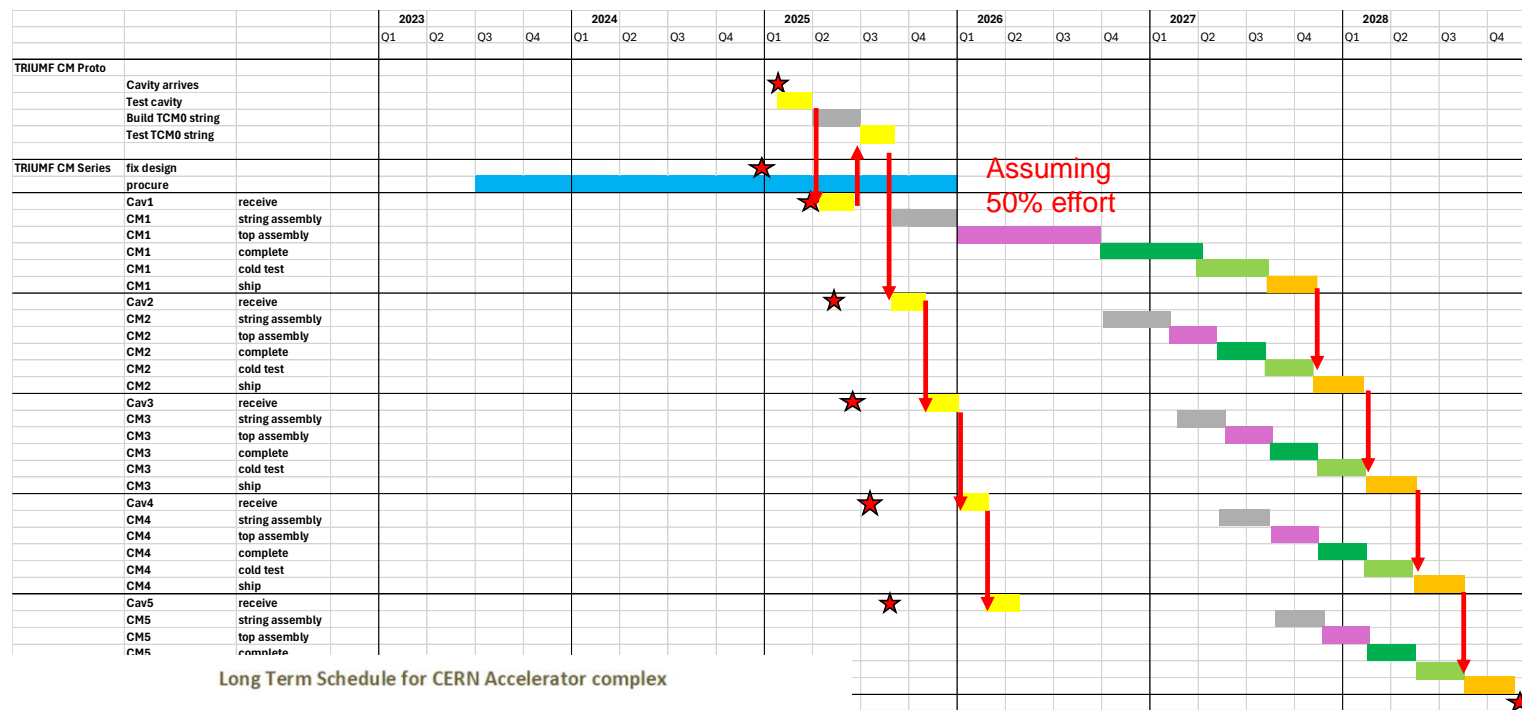


Present schedule including impact of LS26

- 2025
 - Receive and qualify cavity TC0 -> assemble TCM0 string -> requalify TC0
 - Receive cavities TC1,2, qualify and assemble TCM1 string
 - Receive other cavities and qualify them in sequence
- 2026



- Priority will be on supporting ARIEL effort
- Qualify any remaining HL cavities as part of our agreement with AUP/CERN
- Opportunistic work on TCM1 to guarantee all parts are in hand
- Project completion expected to be delayed by 6 months



Long Term Schedule for CERN Accelerator complex

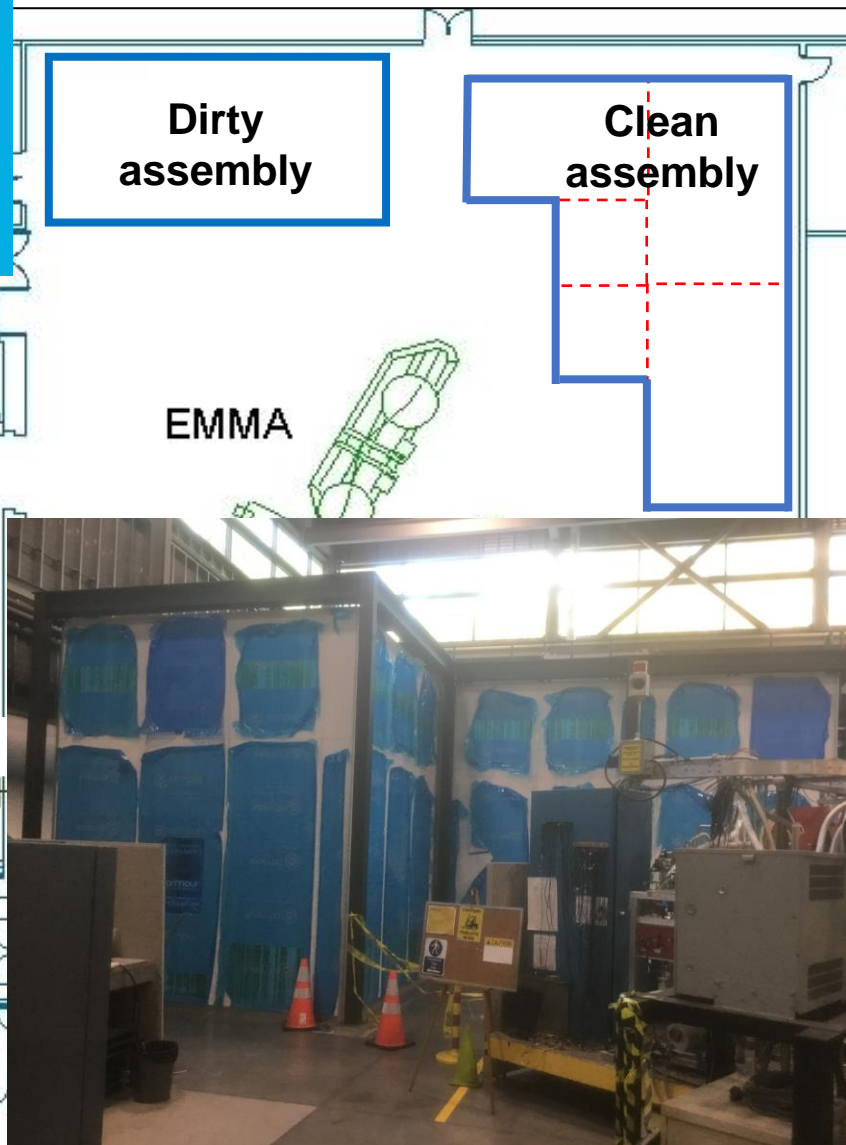
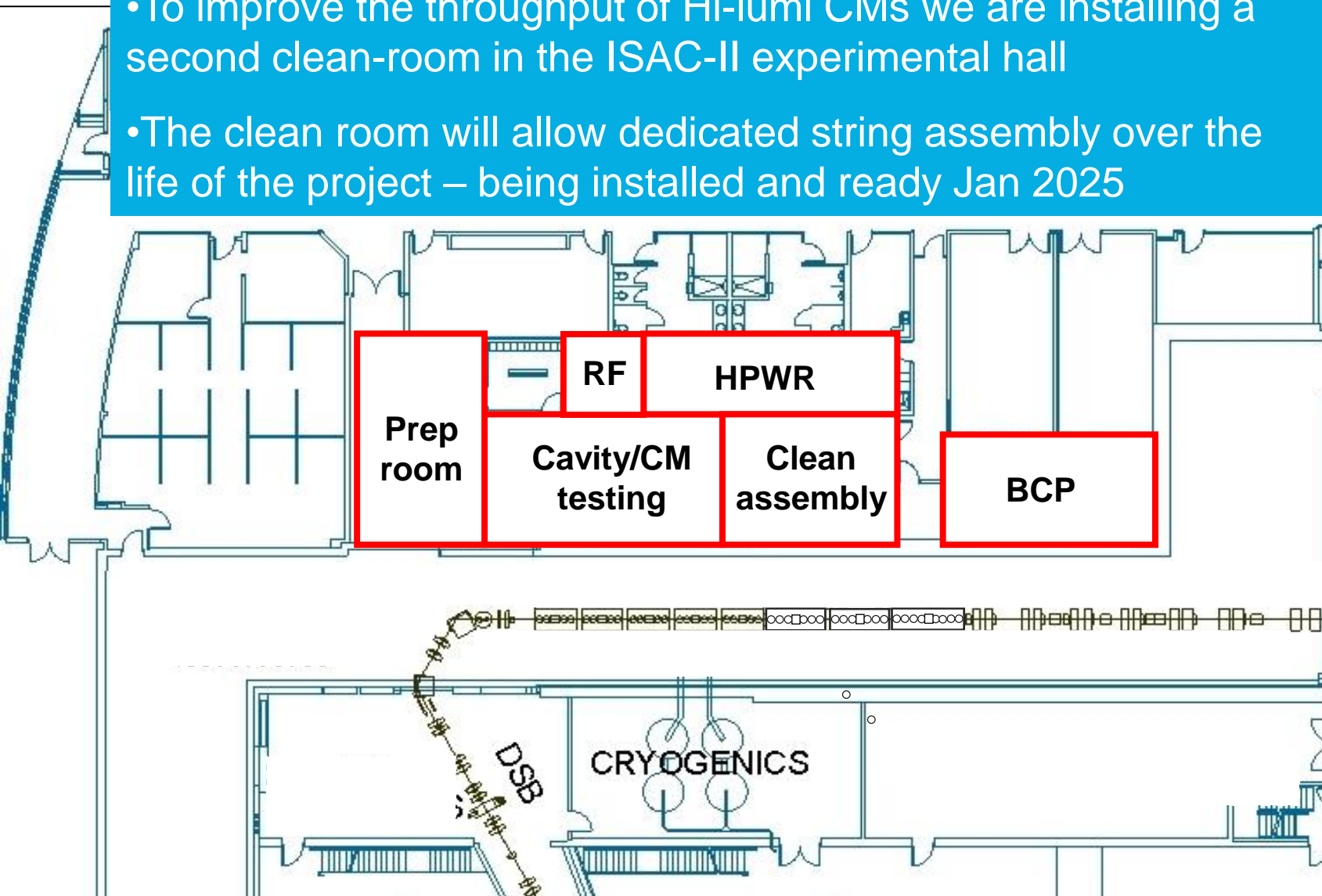


Infrastructure upgrade status

		specified	designed	ordered	received
Clean room upgrade	New clean room	✓	✓	✓	Jan 2025
	Rinse facility	✓	✓	Nov 2024	Jan 2025
	Pumping/venting	✓	✓	✓	✓
Cavity testing	4k/2k insert	✓	✓	✓	✓
	Test diagnostics	✓	✓	✓	✓
	Clean venting system	✓	✓	✓	✓
	Qualification (dummy cavity)	✓	✓	✓	Jan 2025
Assembly fixtures	Hermetic string cart	✓	✓	✓	✓
	Dummy cavity	✓	✓	✓	✓
	Cavity handling tooling	✓	✓	✓	✓
	Top down assembly stand	✓	✓	✓	✓
	Cryomodule trolley	✓	✓	✓	✓

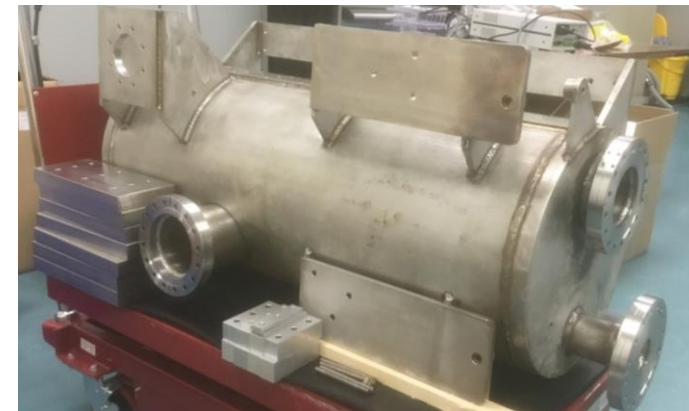
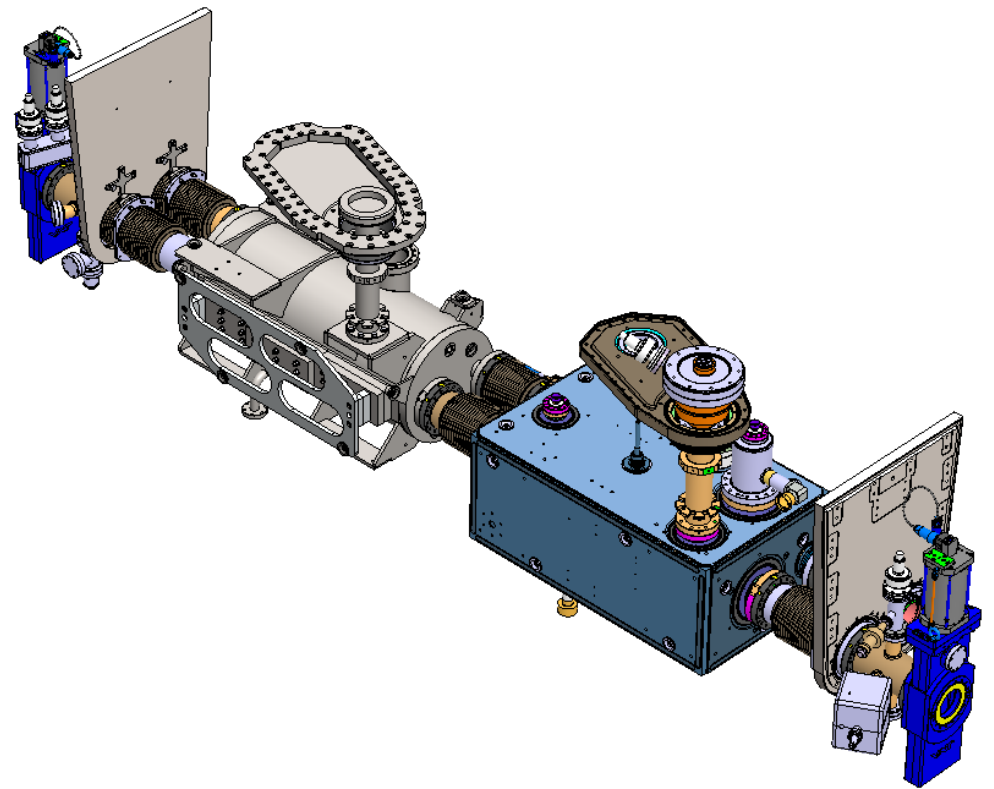
TRIUMF SRF Facilities – Hi-Lumi Upgrade

- To improve the throughput of Hi-lumi CMs we are installing a second clean-room in the ISAC-II experimental hall
- The clean room will allow dedicated string assembly over the life of the project – being installed and ready Jan 2025



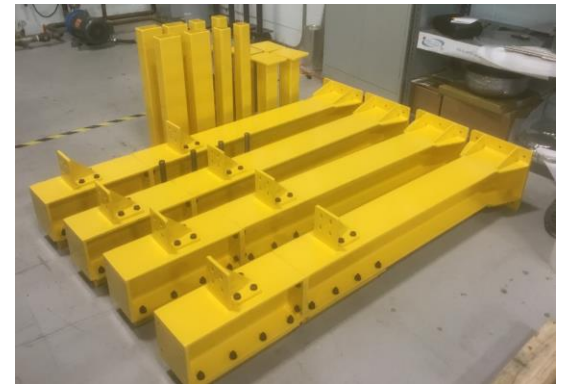
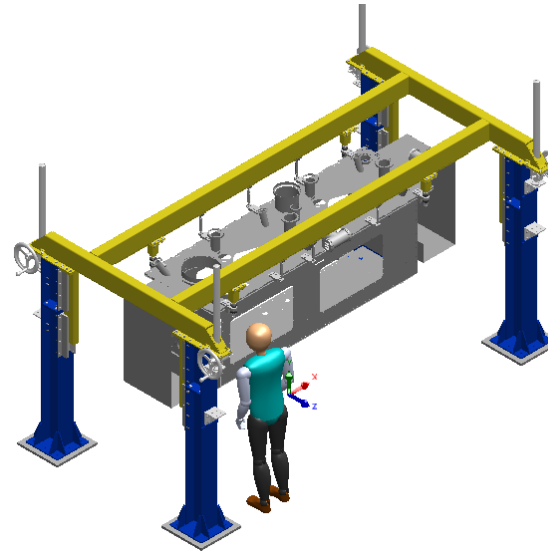
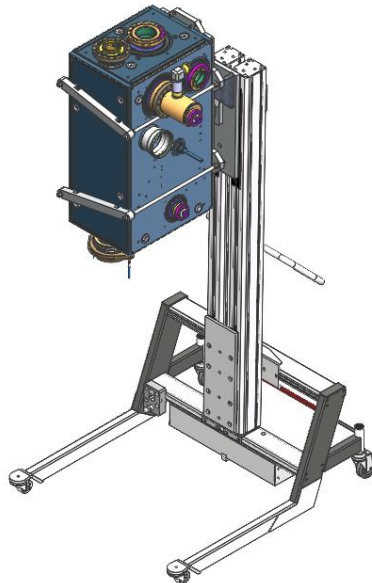
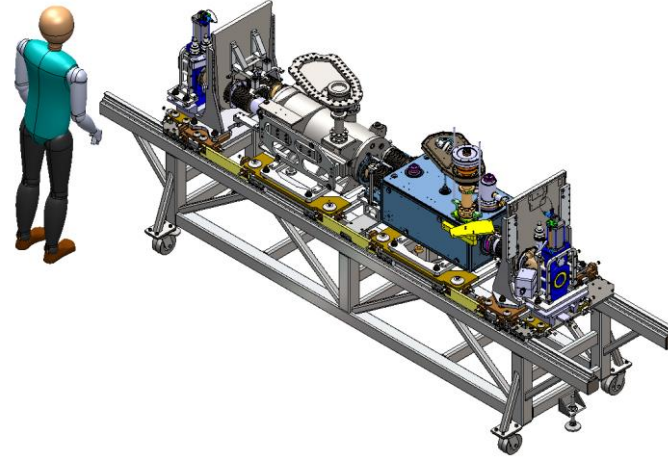
Dummy cavity for TCM0

- AUP anticipates delivery of one TCM0 cavity in Feb. 2025
- TRIUMF has designed and fabricated a dummy cavity for TCM0 string assembly
 - Identical LHe volume and mass as the actual cavity
 - Identical beam and helium interfaces as the RFD cavity
 - Identical support interfaces
- Will be used for testing prior to cavity delivery and during assembly of TCM0 cavity string



Other Infrastructure

- String assembly frame received
 - Ready for assembly
- Top assembly frame
 - Assembled and ready for TCM0
- Cavity manipulation/rinsing tooling
 - Received
- Pumping/Venting stand
 - Ready for commissioning



Recent milestones - Cryomodules

Milestone	Application	Achieved
OVC material order received	TCM1-5	Feb. 2024
OVC fabrication order launched	TCM1-5	Feb. 2024
MLI contract issued	TCM1-5	Mar. 2024
Mu-metal received	TCM1-4	Oct. 2024
Tuner frame/flexures fabrication launched	TCM1-5	Sept. 2024
Thermal shield fabrication launched	TCM1-5	Sept. 2024
Cavity support spider fabrication launched	TCM1-5	Oct. 2024
Bi-phase pipe supports ordered	TCM1-5	Oct. 2024
OVC lifting blocks ordered	TCM1-5	Oct. 2024

Cryomodule fabrication milestones

Outer vacuum chamber (OVC)

- TCM0 and Series contract issued to Axton (Vancouver)
- All material in hand

Mu-metal - series

- Four articles received with all expected by Dec. 2024

Thermal shield - series

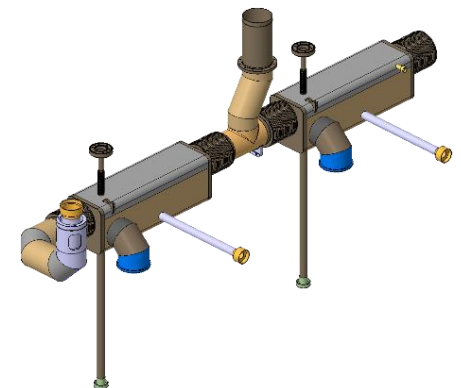
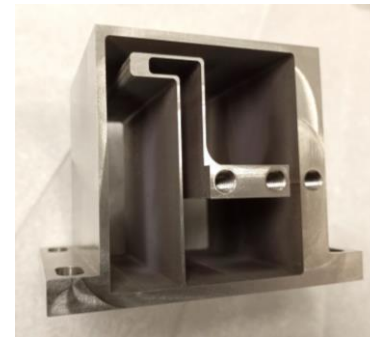
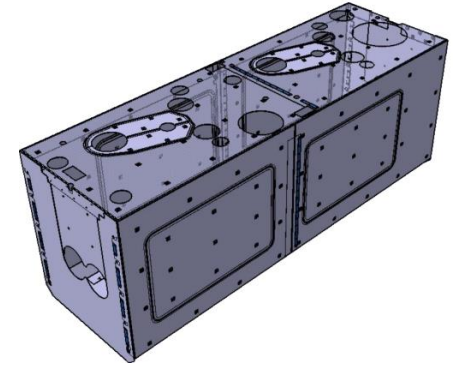
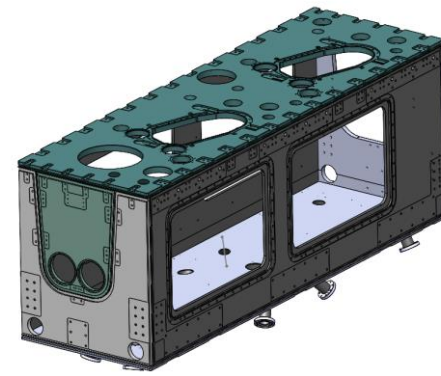
- Material in hand and major fabrication contracts launched

Tuner - series

- Tuner frame fabrication expected in Jan 2025

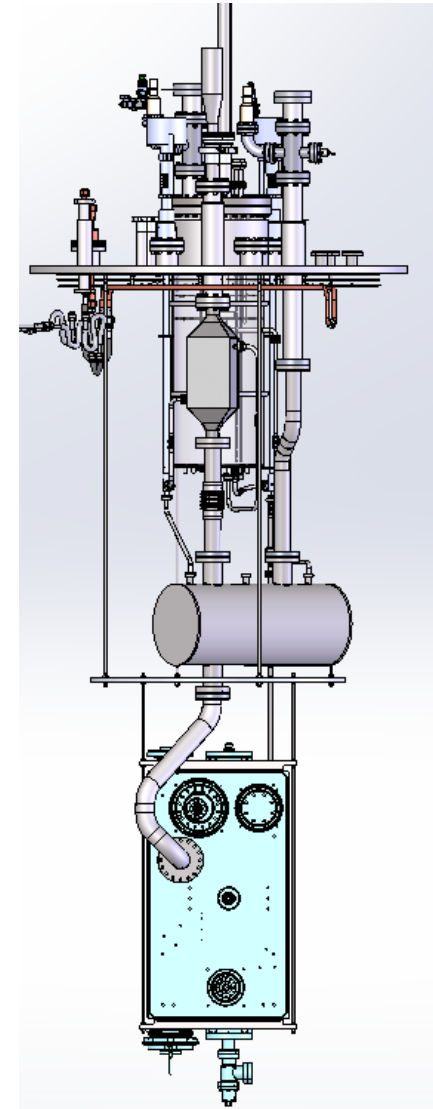
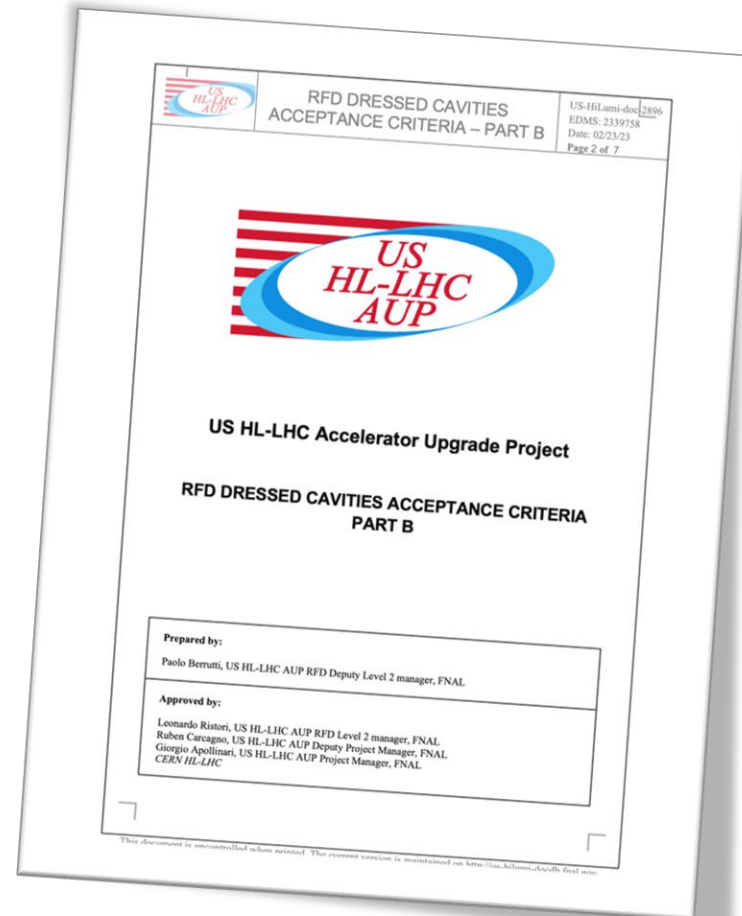
Bi-phase lines

- Production well advanced at CERN with first article for TCM1 delivered



Preparation for cavity testing

- TRIUMF will requalify the AUP cavities upon delivery from JLab
- TRIUMF has upgraded the cavity test facility
- Prepared and qualified cryo-insert for multi-purpose cryostat to test dressed cavities at 2K in jacketed mode
- **Require signed off requirements document for requalification tests**



Cryomodule Assembly Critical Path

- Remaining ‘added scope’ from CERN required by April 2025 to satisfy budget condition
- CM assembly requires cavities from AUP and CERN parts (FPCs, beamline assemblies, cryopiping, tuner parts, ...)
 - **Critical path runs through the delivery of first articles for the assembly of TCM0 string and for TCM1**
 - AUP cavities are expected in Feb 2025 with delivery of series articles highly compressed - expected to be delivered within eight months
 - **Delivery of CERN articles for TCM0 string and TCM1 full CM required in early 2025**
 - **RF adaptors for cavity testing, 3 FPCs, 1.5 sets of PIMs and other string components,**
...



AUP Delivery Projection		
Cavity Pair	Module	Delivery
Prototype TC0	TCM0	Feb 2025
TC1,2	TCM1	May 2025
TC3,4	TCM2	Jun 2025
TC5,6	TCM3	Jul 2025
TC7,8	TCM4	Aug 2025
TC9,10	TCM5	Sep 2025

Summary

- 2024 strategy addresses finite time window for available funds
 - All funds now committed
 - Requires timely delivery from vendors and CERN of agreed deliverables in order to make payments in time
- Preparing for TCM0 string and series production CMs
 - Significant progress on fabrication orders
 - First out of scope fabricated parts received from CERN
 - **Require signed off document for cavity requalification requirements**
 - Major assembly infrastructure in hand
 - New clean room being installed for commissioning in Jan 2025
 - Cavity testing infrastructure prepared for first cavities from AUP

