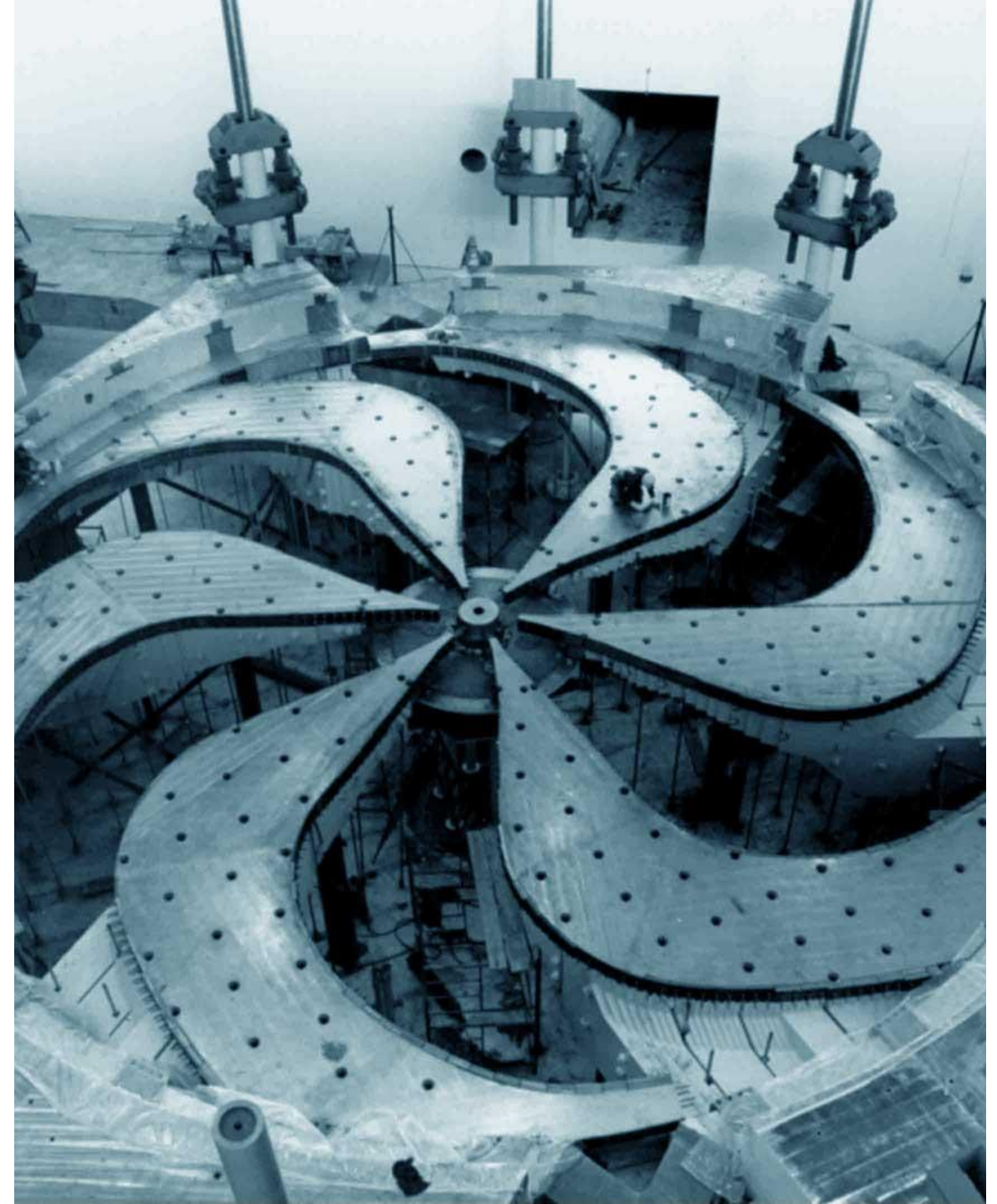


TRIUMF Capabilities and Funding Strategy

Bob. Laxdal, TRIUMF

2021-10-27



Introduction to TRIUMF

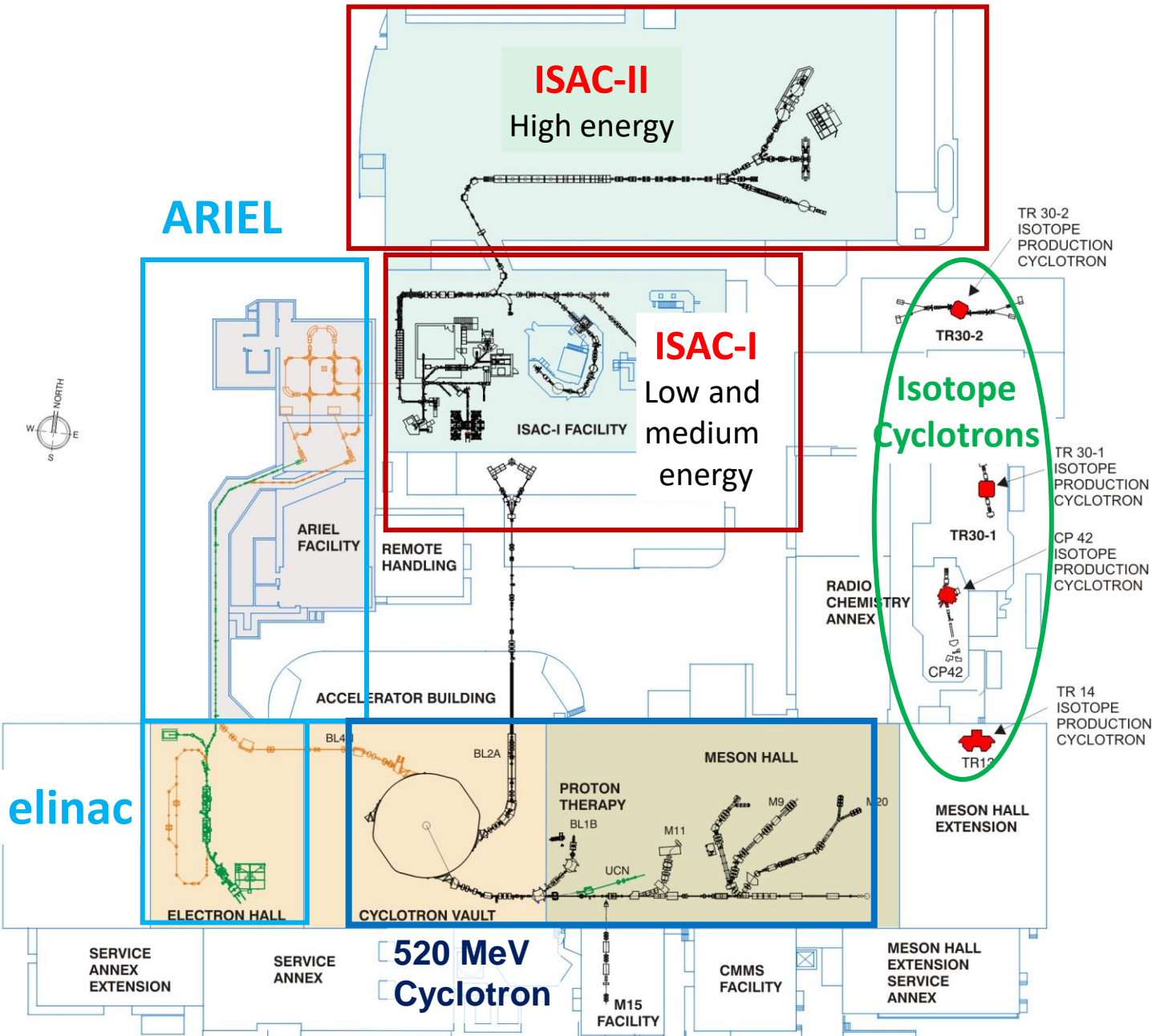


TRIUMF has five decades of experience in building a rich particle accelerator infrastructure that enables cutting-edge research while growing accelerator expertise. Our mission is to serve as Canada's particle accelerator centre.

This mission is reflected in the wide variety of accelerator technologies that populate the campus.

Our strategy is to use internal projects and external collaborations as springboards to expand core competencies or gain new ones.

Rather than import technology, we typically develop it, accumulating a broad expertise within a relatively small lab.



ISAC-II Post accelerator (2001-2010)

- Superconducting RF technology for heavy ions
- Cryomodule design and assembly
- Design and operation of cryogenic systems



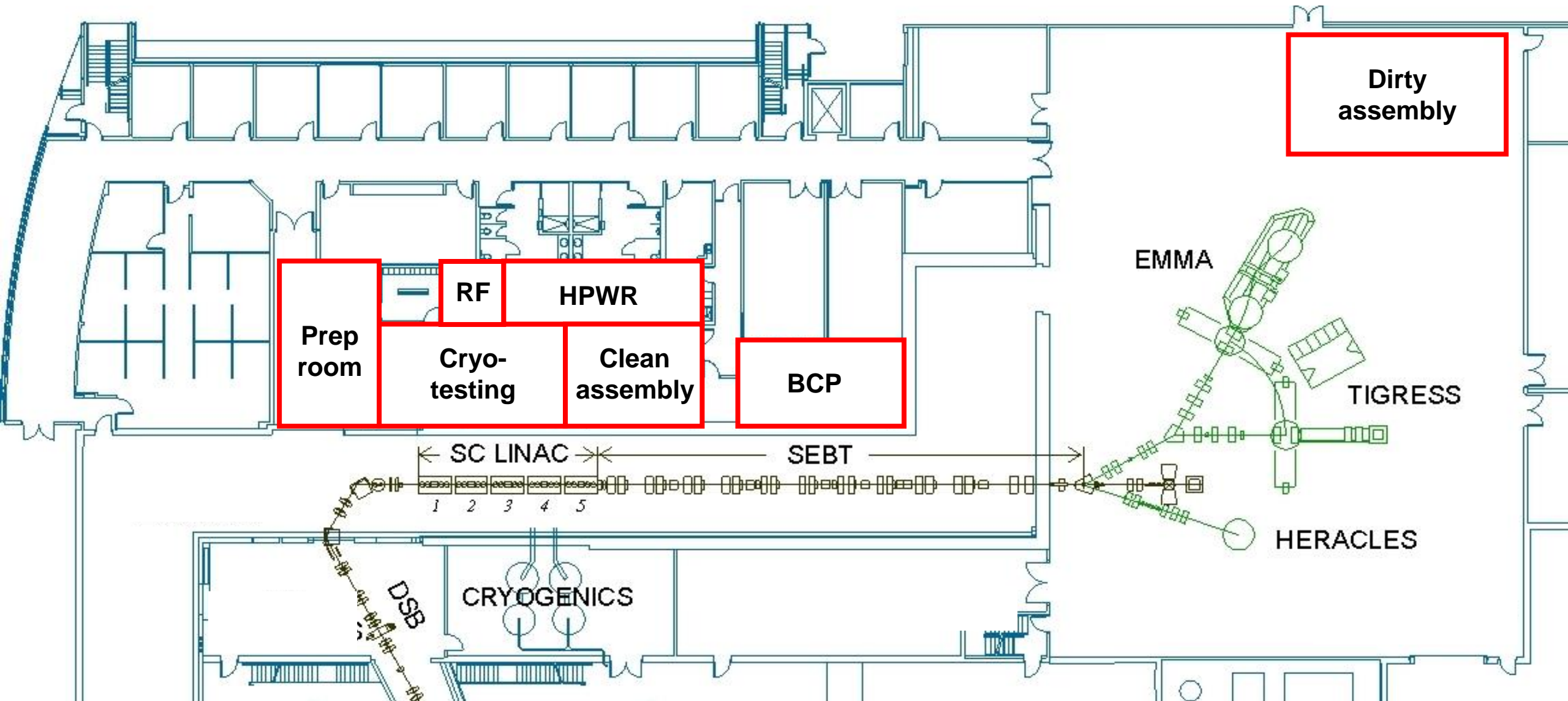
ISAC-II Cryomodule

ARIEL e-Linac (2008-2014)

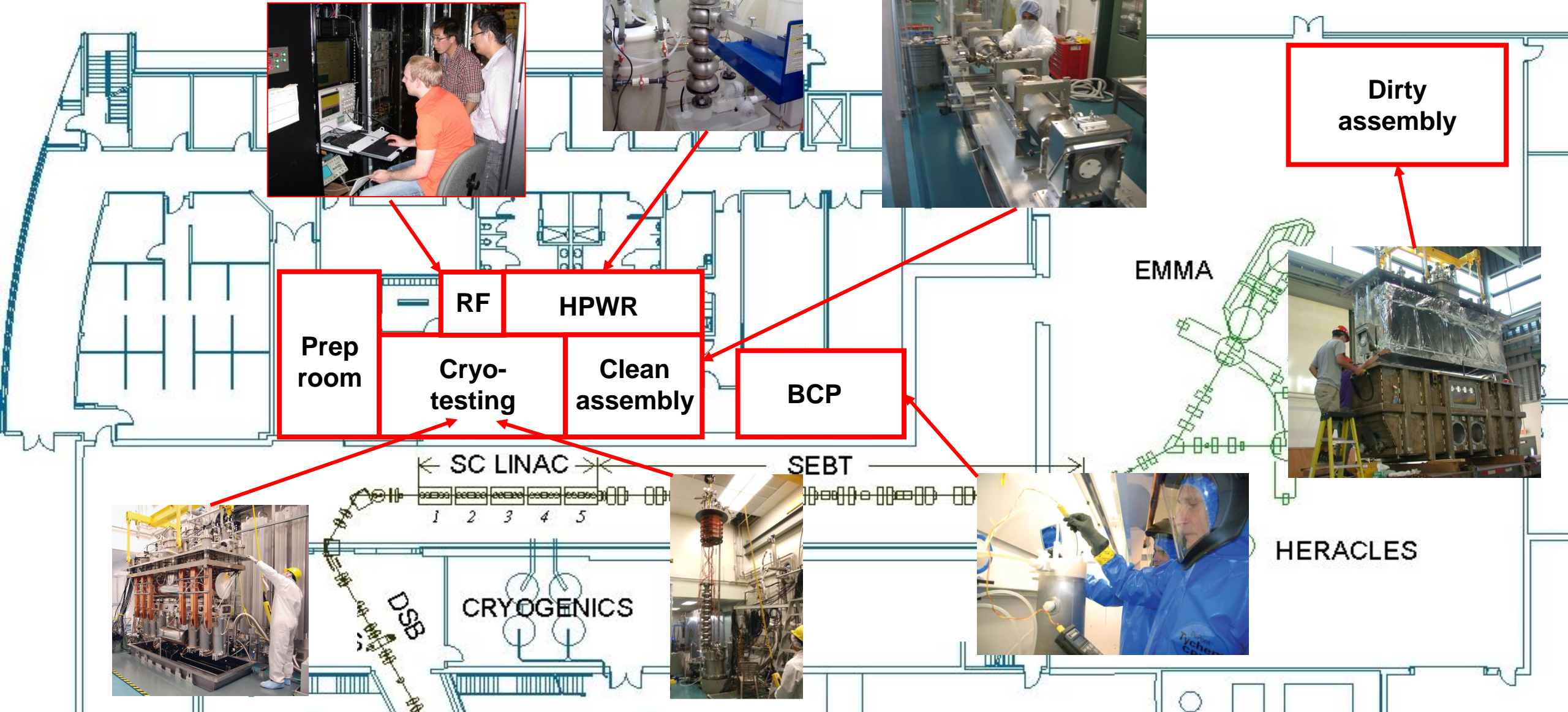
- Superconducting RF technology for electrons
- High power klystrons



SRF Facilities



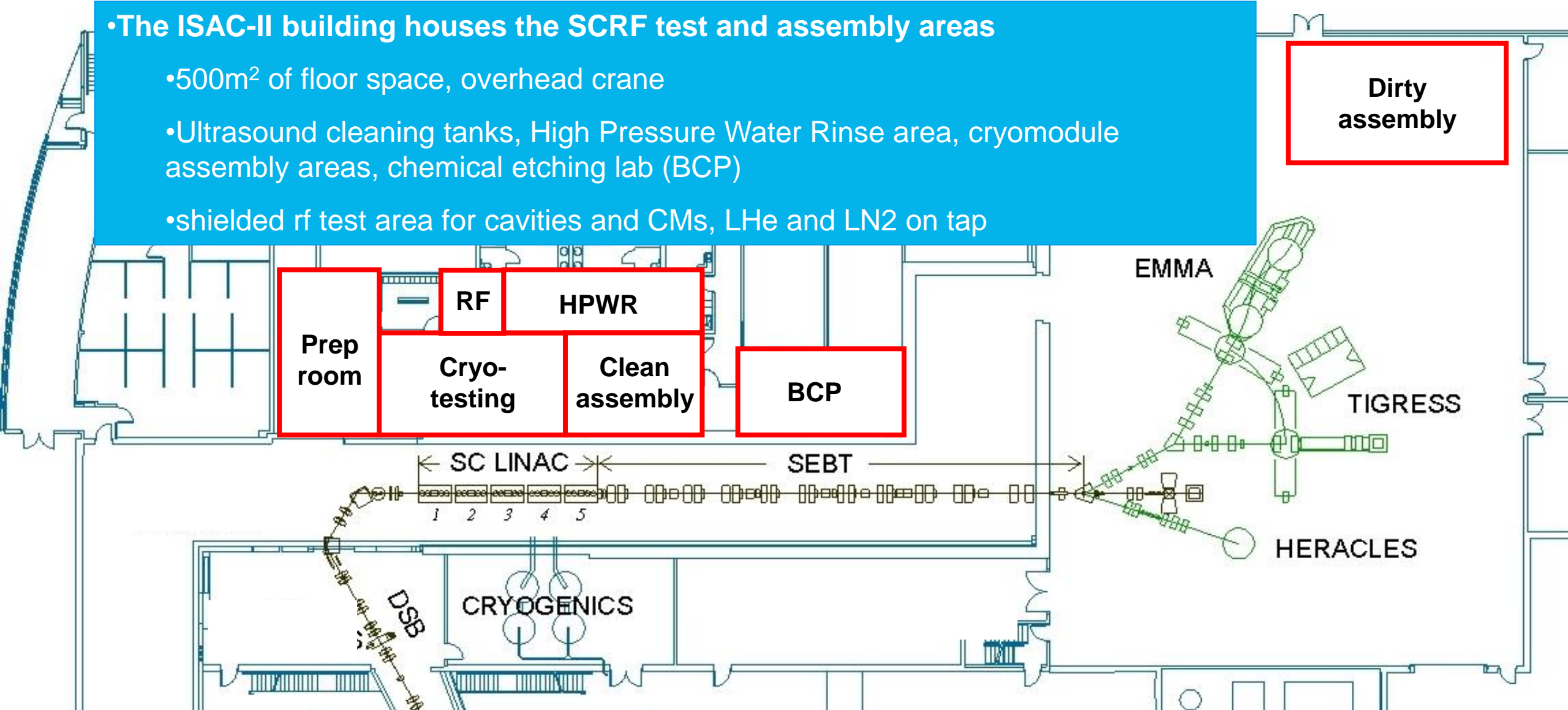
SRF Facilities



SRF Facilities

•The ISAC-II building houses the SCRF test and assembly areas

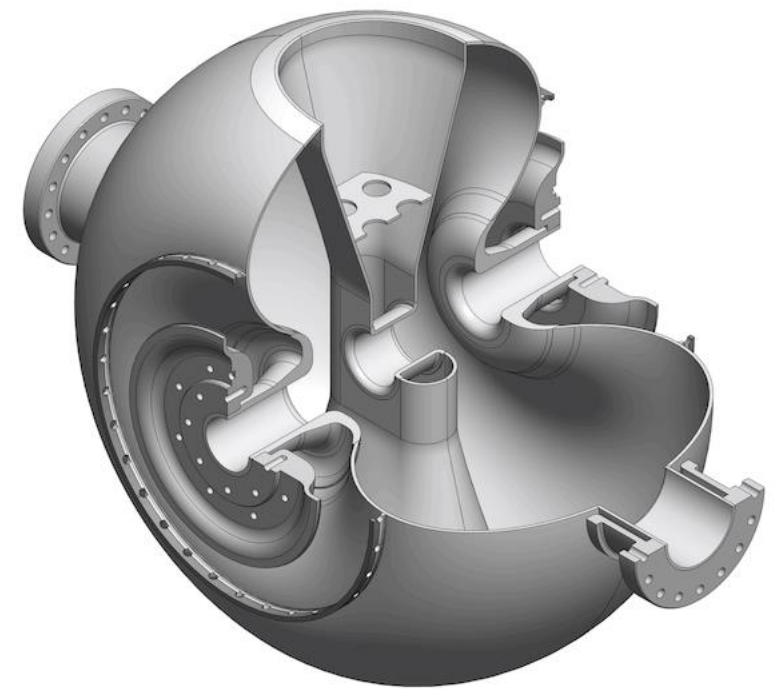
- 500m² of floor space, overhead crane
- Ultrasound cleaning tanks, High Pressure Water Rinse area, cryomodule assembly areas, chemical etching lab (BCP)
- shielded rf test area for cavities and CMs, LHe and LN2 on tap



TRIUMF and International Collaborations

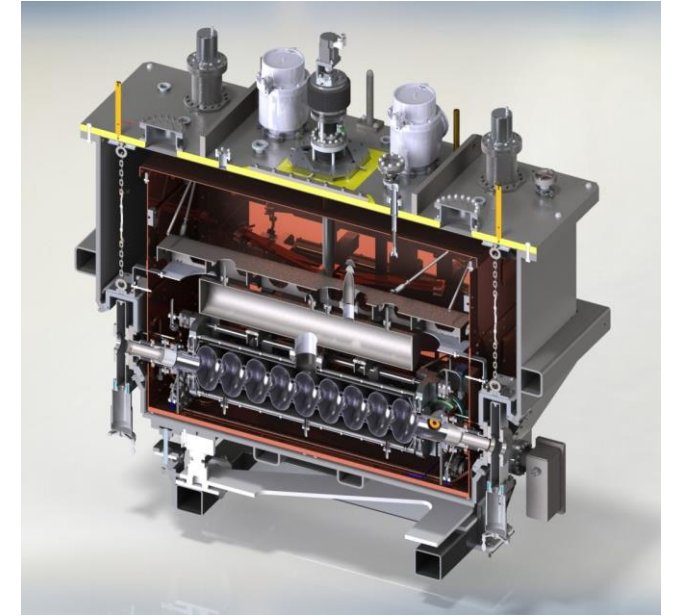
SRF Technology Development for RISP

- TRIUMF has developed and successfully tested a new variant (balloon geometry) of a single spoke resonator for Hadron acceleration
- Virtually eliminates the high level multipacting that plagues standard geometries
- The cavity design and prototyping was sponsored by RISP (Korea) and is being used in their heavy ion driver linac
- TRIUMF also designed and delivered a prototype tuner and a power coupler design

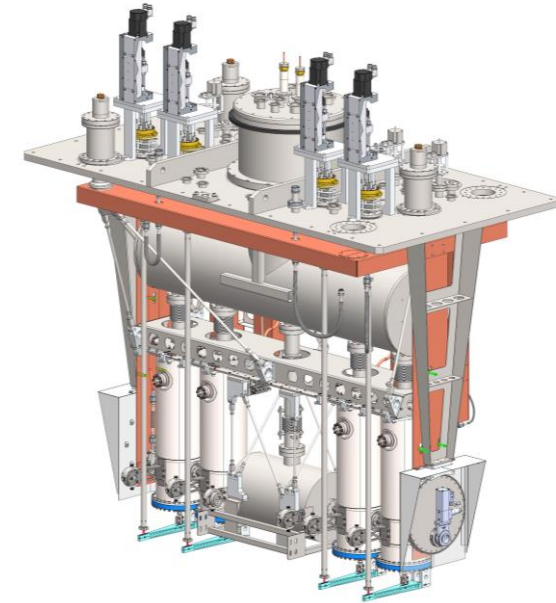
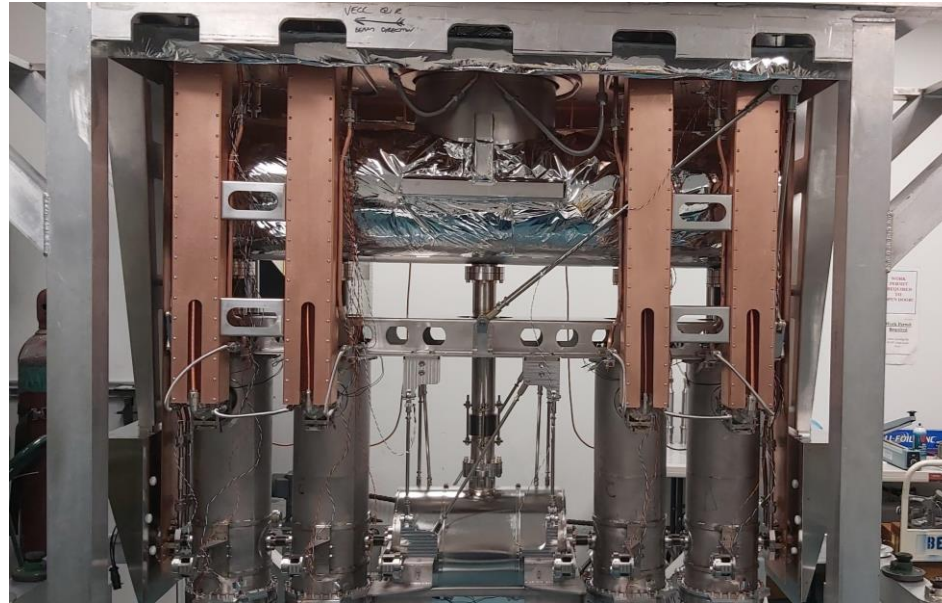


TRIUMF and VECC (Kolkata)

- TRIUMF and VECC have been collaborating on mutually aligned projects since 2008 – ANURIB in Kolkata and ARIEL in Vancouver
- An electron cryomodule has been shipped to VECC in 2018
- Future deliverables - heavy ion cryomodule to be cold test next month and shipped in early 2022

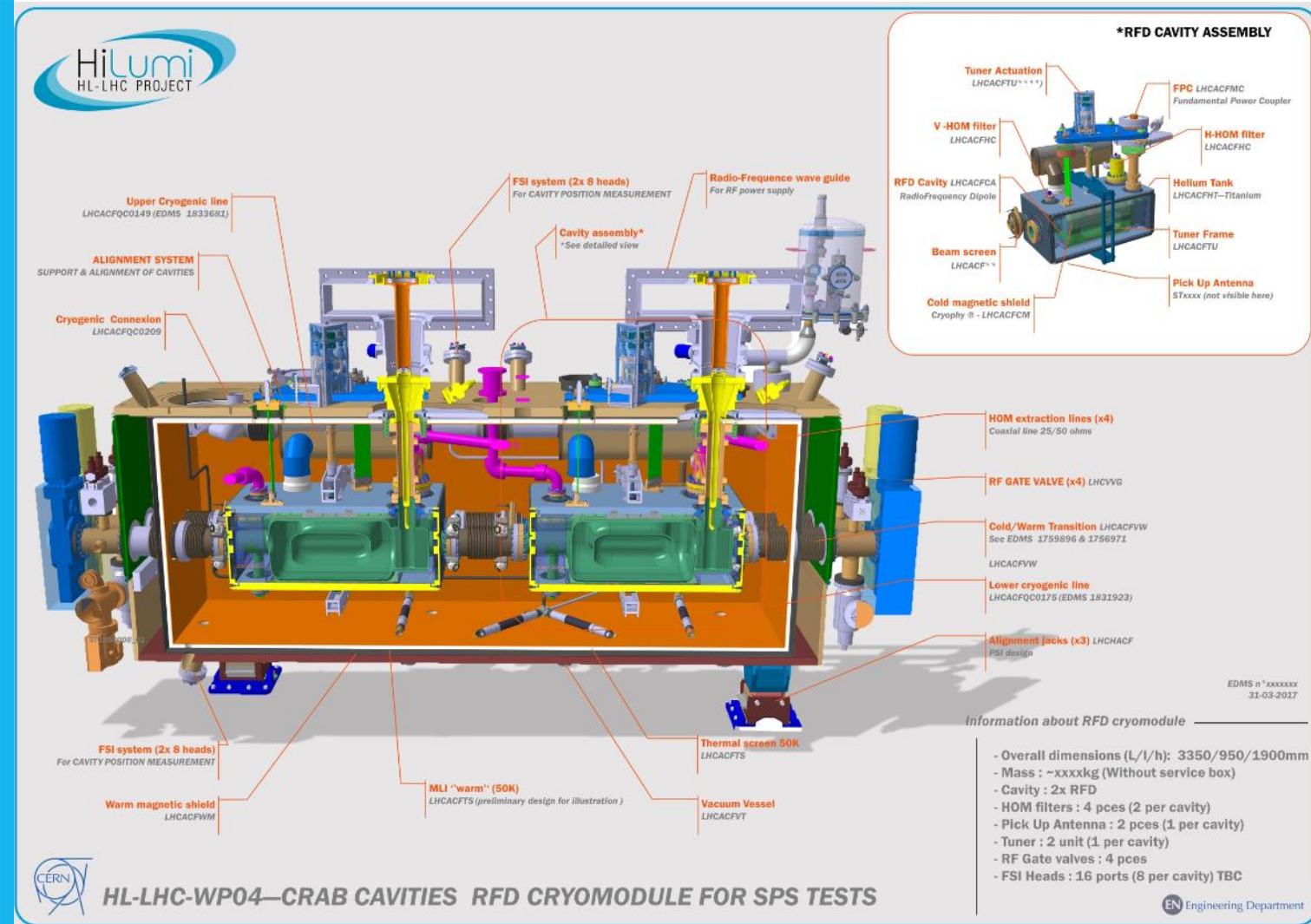


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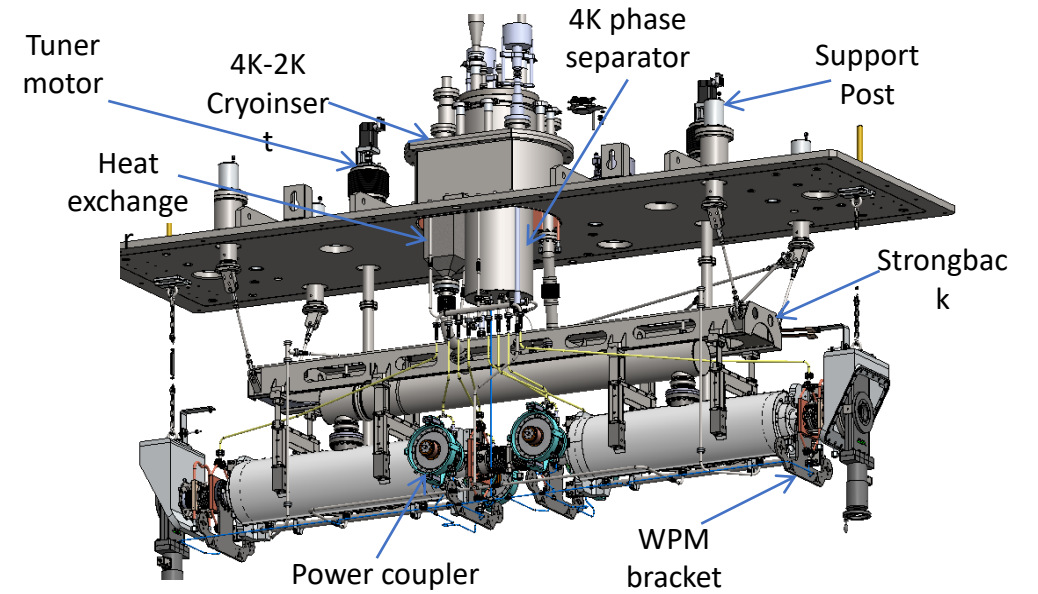
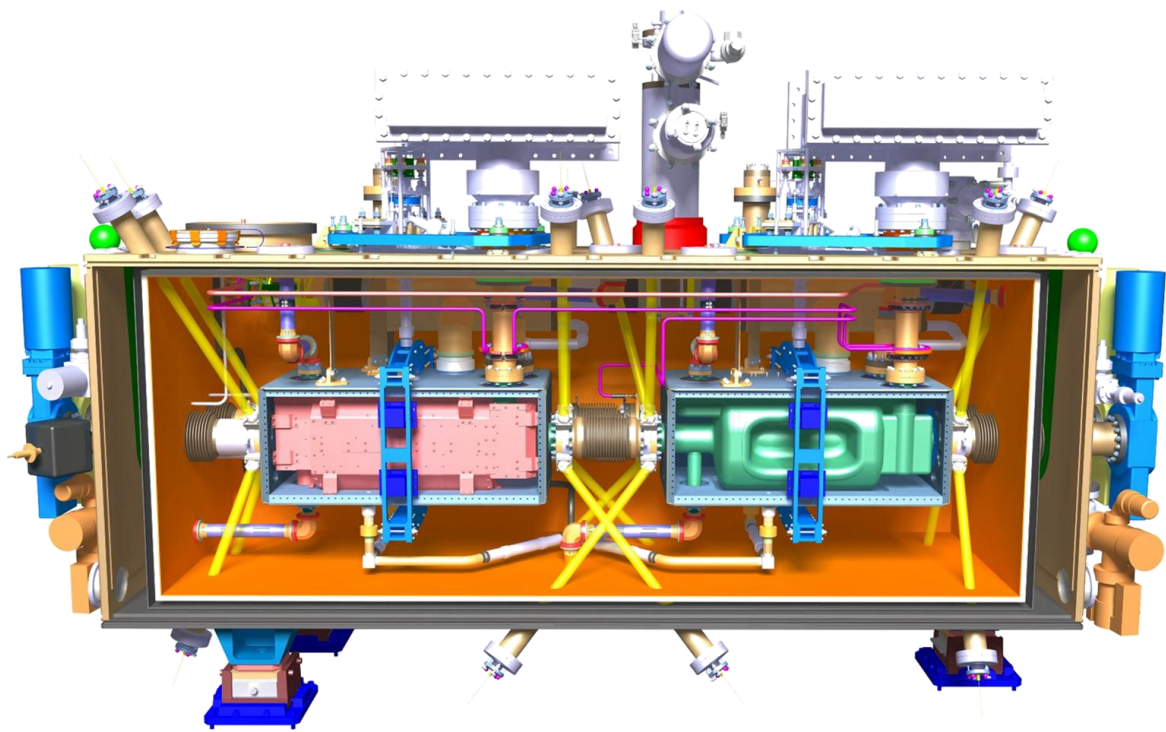


HL-LHC Crab Cavity Cryomodules

- TRIUMF to receive 10 RFD resonators produced and qualified by US DOE lab consortium (AUP), to assemble each pair of RFDs into five cryomodules
- TRIUMF to qualify the cryomodules through testing at TRIUMF before packaging and shipping to CERN
- The project supplies critical infrastructure to CERN, supporting both the HL-LHC and the Canadian IPP community



Hi-Lumi Cryomodule vs ARIEL



The Hi-Lumi cryomodule design borrows from the ARIEL e-Linac module developed and fabricated at TRIUMF.

A prototype will be assembled in 2022 and series production at TRIUMF will span 2023-25



ARIEL Cryomodule

Delivery (AUP/TRIUMF/CERN)



AUP projected delivery dates for series

- Cav1&2 June 2023
- Cav3&4 Sep 2023
- Cav5&6 Dec 2023
- Cav7&8 Feb 2024
- Cav9&10 May 2024



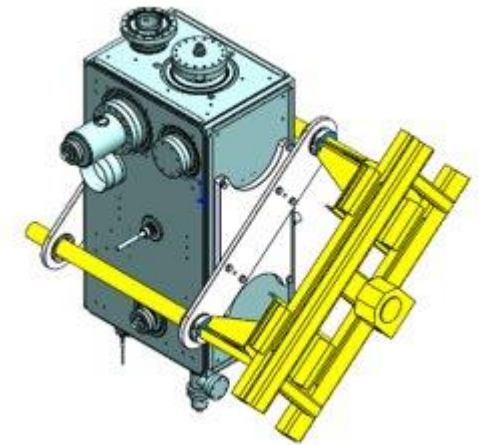
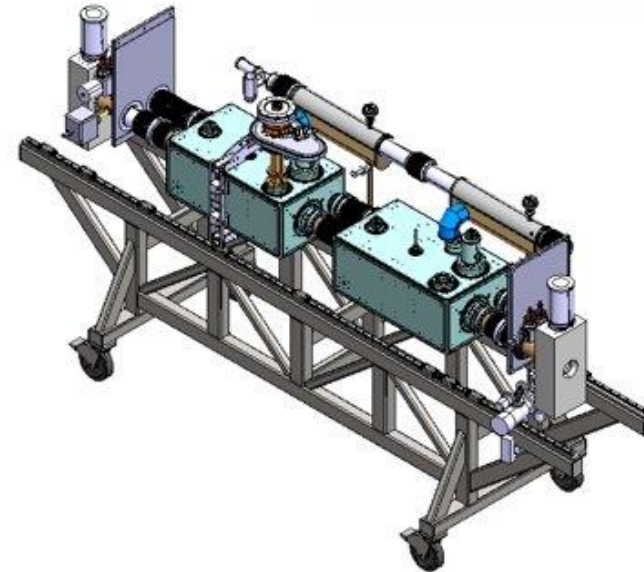
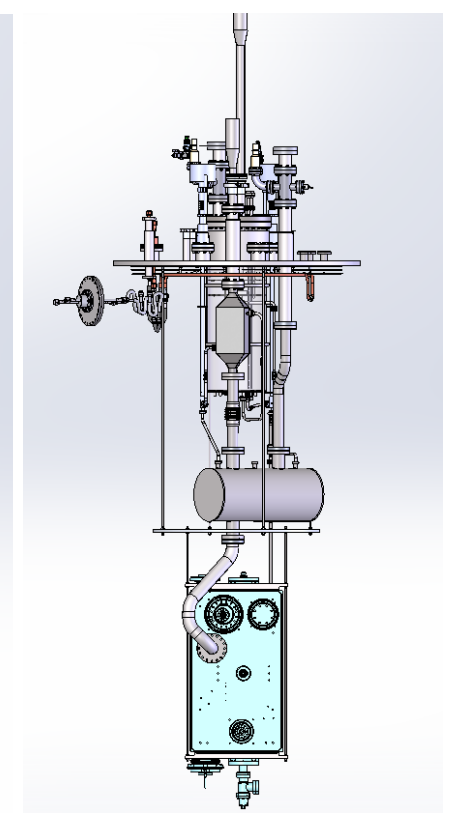
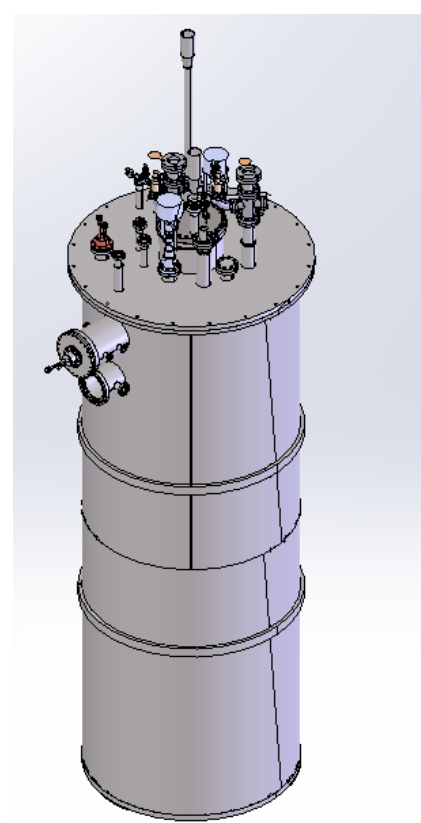
TRIUMF CM Delivery dates

- CM1 July 2024
- CM2 October 2024
- CM3 January 2025
- CM4 April 2025
- CM5 July 2025

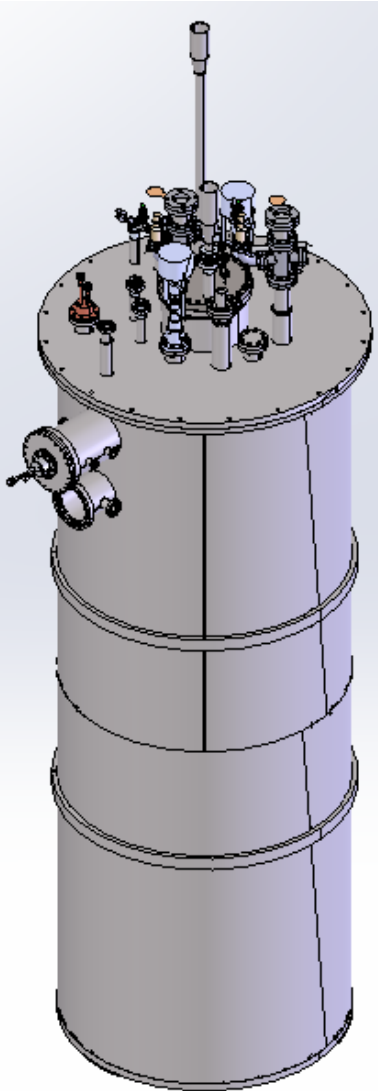
Infrastructure upgrade

SRF infrastructure is being upgraded to be compatible with Hi-Lumi scope. The improvements can be grouped into categories

- Clean room upgrades to reduce chance of particulate pollution
 - Garments upgrade
 - Particulate diagnostics upgrade
 - Vacuum equipment upgrade
- Testing infrastructure
 - Prepare 4k/2k insert for multi-purpose cryostat to allow testing dressed cavities at 2K in jacketed mode
 - Upgrade cavity test diagnostics
 - Upgrade 2K pumping capacity
- Assembly fixtures
 - Cavity handling tooling
 - Hermetic string assembly cart
 - Top down assembly fixture



Multi-purpose cryostat



Capabilities

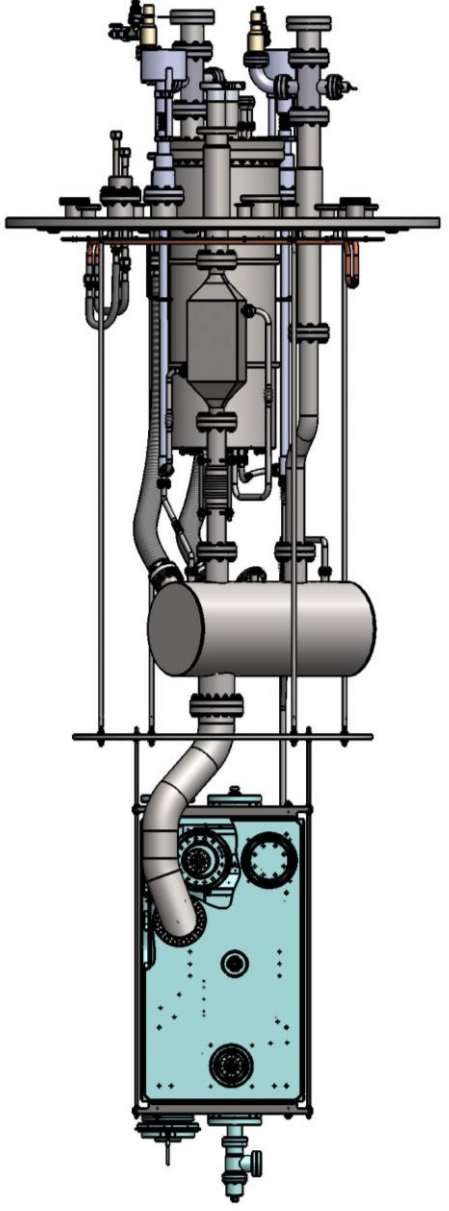
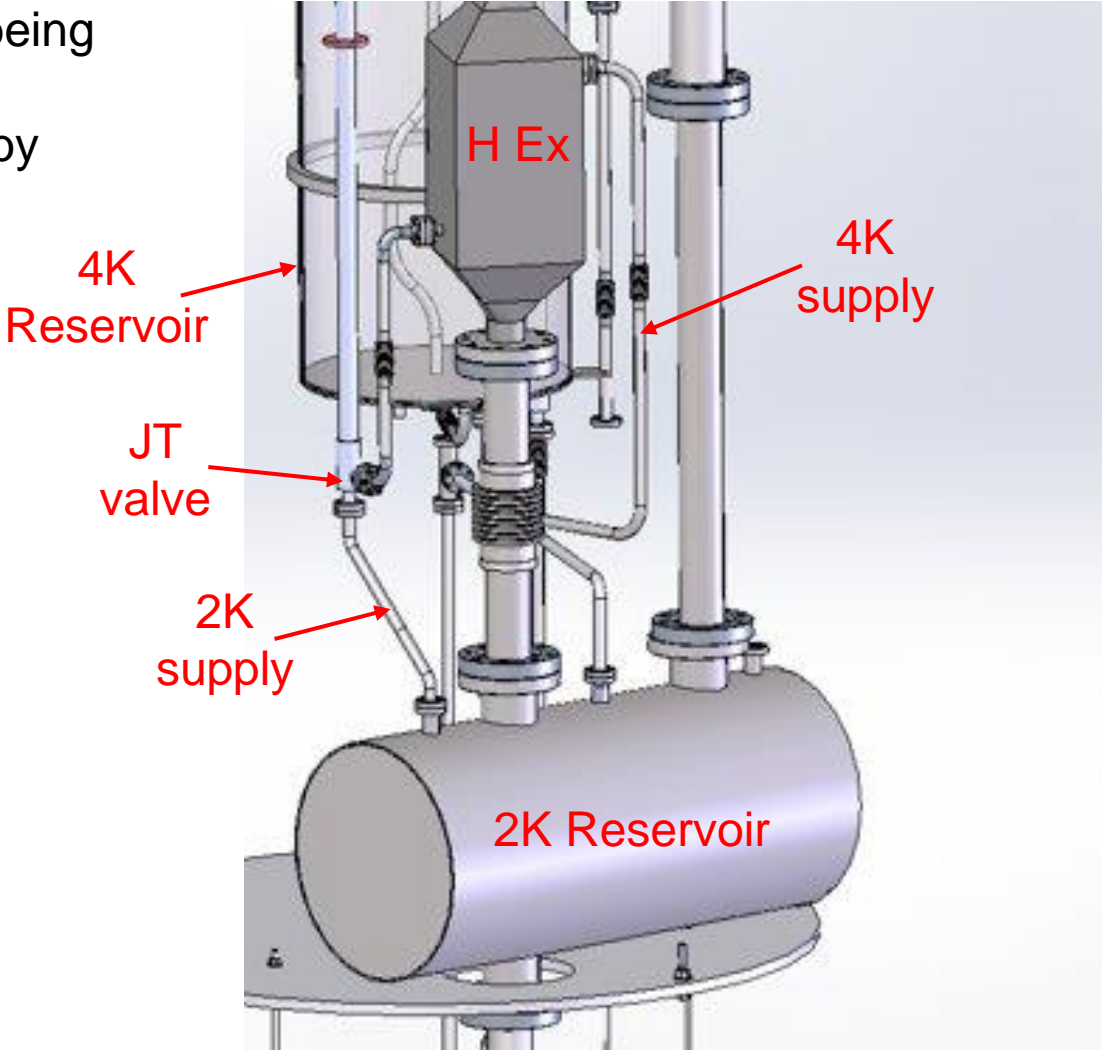
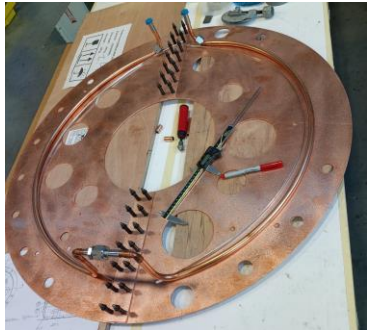
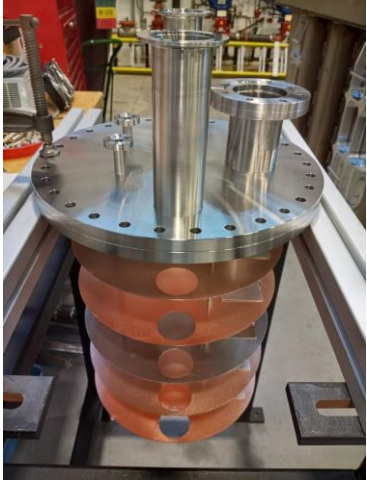
- LHe/LN2 on tap
- Testing at 4K or 2K in jacketed or bath mode

Cavity test region dimensions

- Jacketed test (diameter) – 956 mm
- Bath mode (diameter) – 850mm
- Vertical height – 2 m



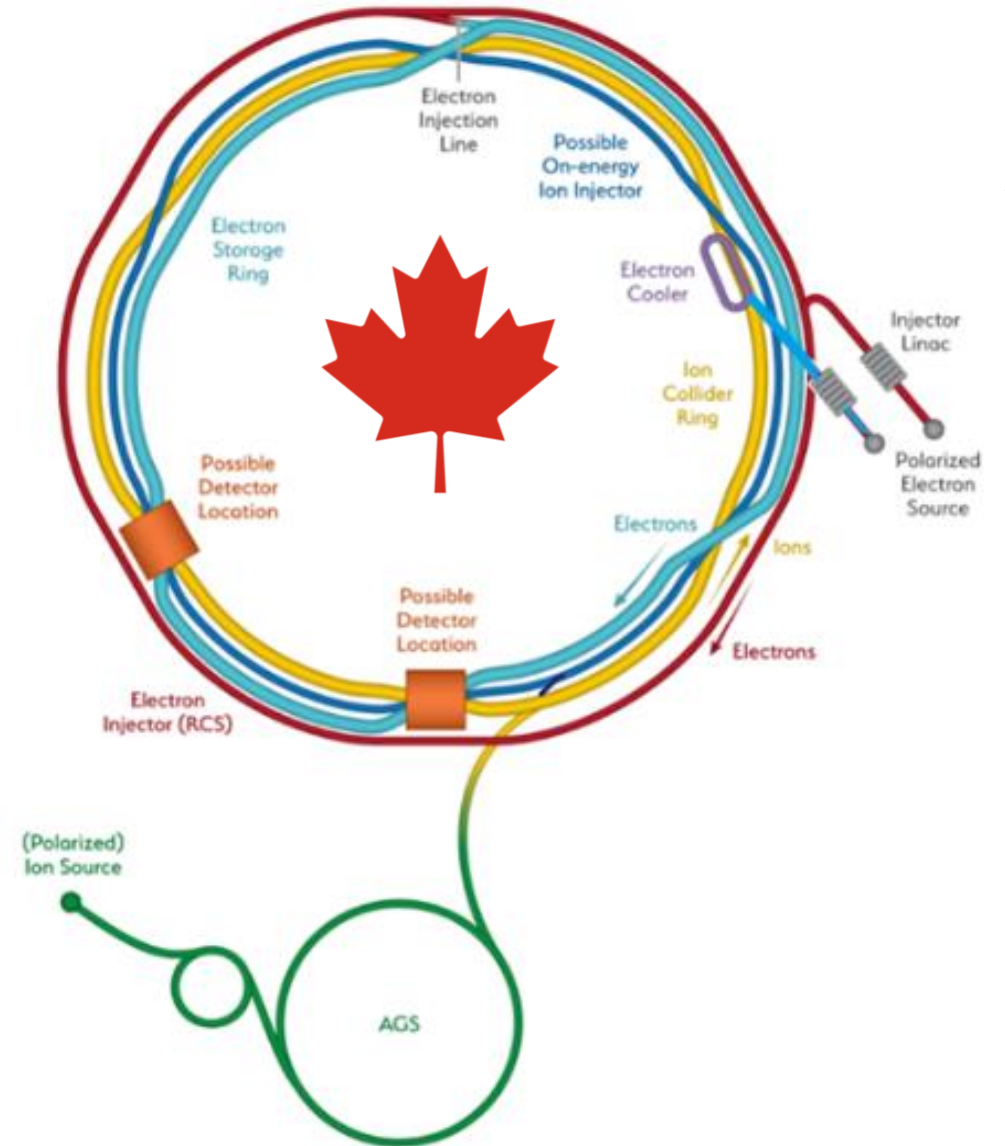
4k-2k upgrade detailed drawings released – parts being produced in TRIUMF and external shops – complete by Jan 2022



TRIUMF and EIC

EIC, Canada and TRIUMF

- Canadian contributions to international projects are typically driven by the corresponding science community within Canada
- The EIC-Canada collaboration will make the case for Canadian participation in EIC and lead funding initiatives with domestic agencies
- TRIUMF will work with EIC-Canada to help define work packages and seek funding to support in-kind contributions



Canadian Foundation for Innovation

TRIUMF, University partners and EIC Canada are applying for funds from CFI to support TRIUMF to enable Canada in large accelerator projects like the EIC

Proposal includes funds for:

- Degassing furnace
- New modular clean room
- Upgraded HPWR
- Electro-polishing facilities
- **Prototype EIC crab cavity**

If successful, funds would be available in March 2023

Funding for other contributions can be realized in future calls. New infrastructure could be used to support EIC deliverables.

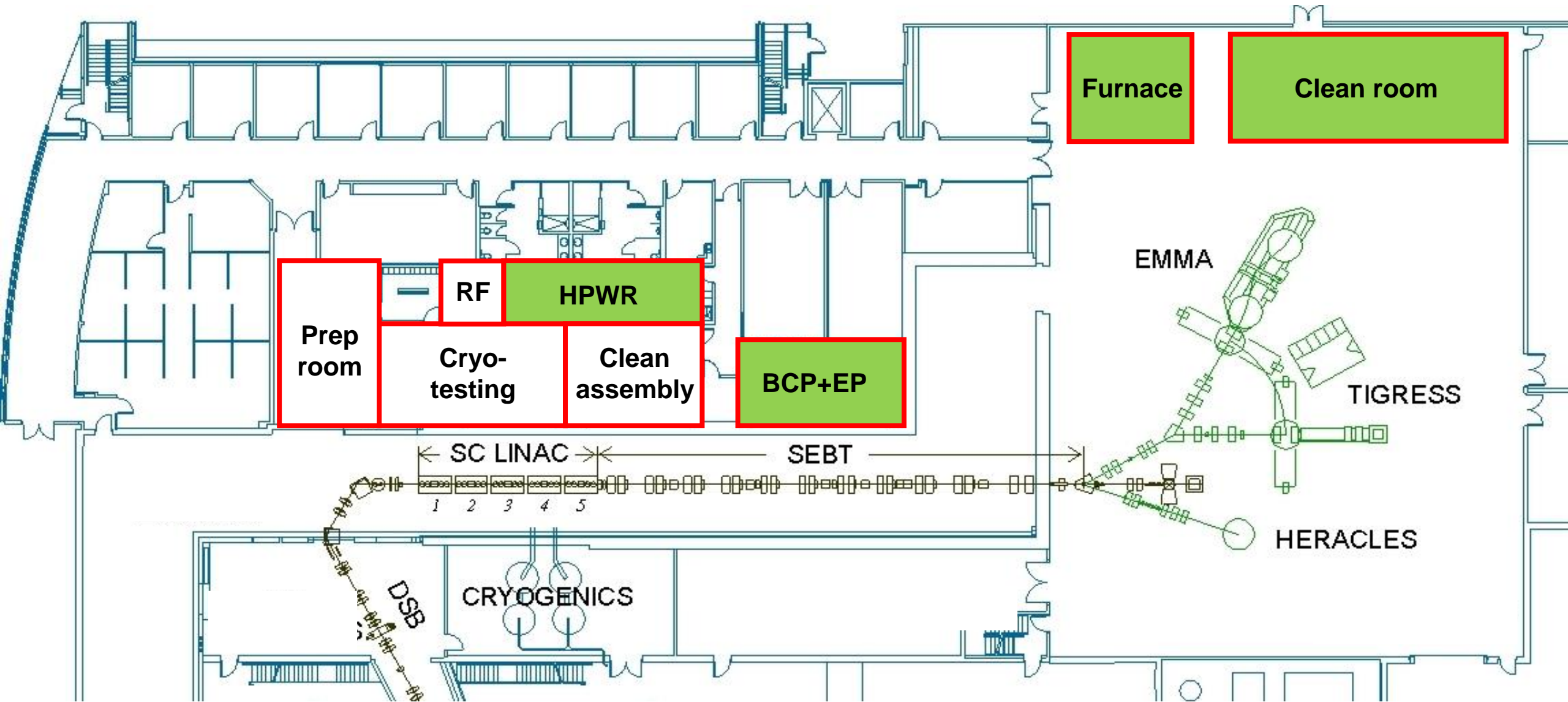


Timeline

The timeline of the 2023 Innovation Fund competition is:

CFI launches draft call for proposals	October 2021
CFI launches call for proposals	November 2021
Deadline to submit notices of intent	February 2022
Deadline to submit proposals	June 2022
Review process	June 2022 through February 2023
Decisions by CFI Board of Directors	March 2023

SRF Upgrade



TRIUMF and EIC

- TRIUMF SRF maintains an active program in International collaboration (VECC, RISP, CERN)
- TRIUMF is presently applying for funds with university partners for upgraded infrastructure and crab cavity development as an initial investment in EIC



Thank you
Merci

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