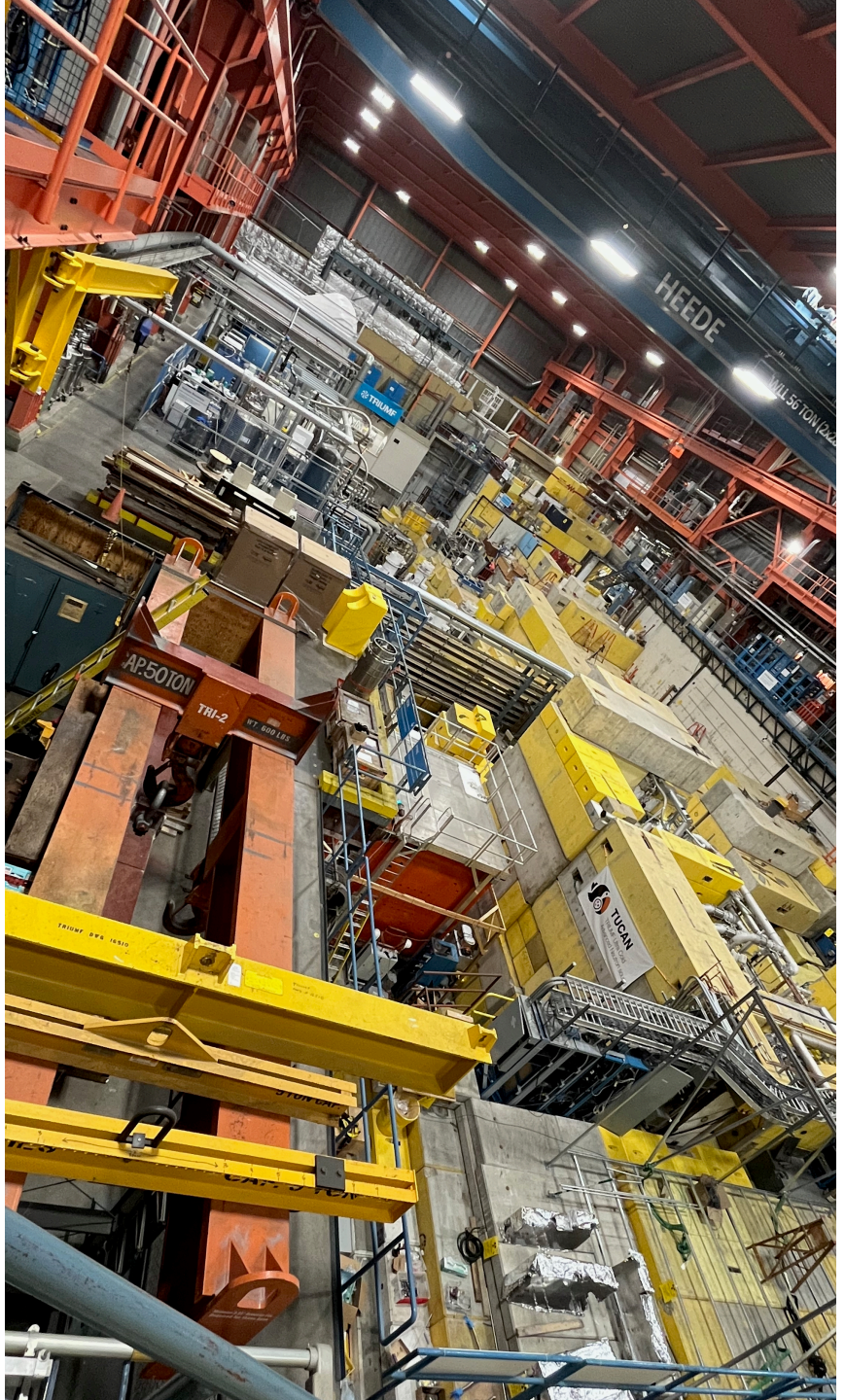
CLC Project Management Workshop - TRIUMF Plenary

“Communication of programme priorities in an evolving environment”

- or -

“If priorities are clear, every ‘no’ becomes a step towards what is actually important”

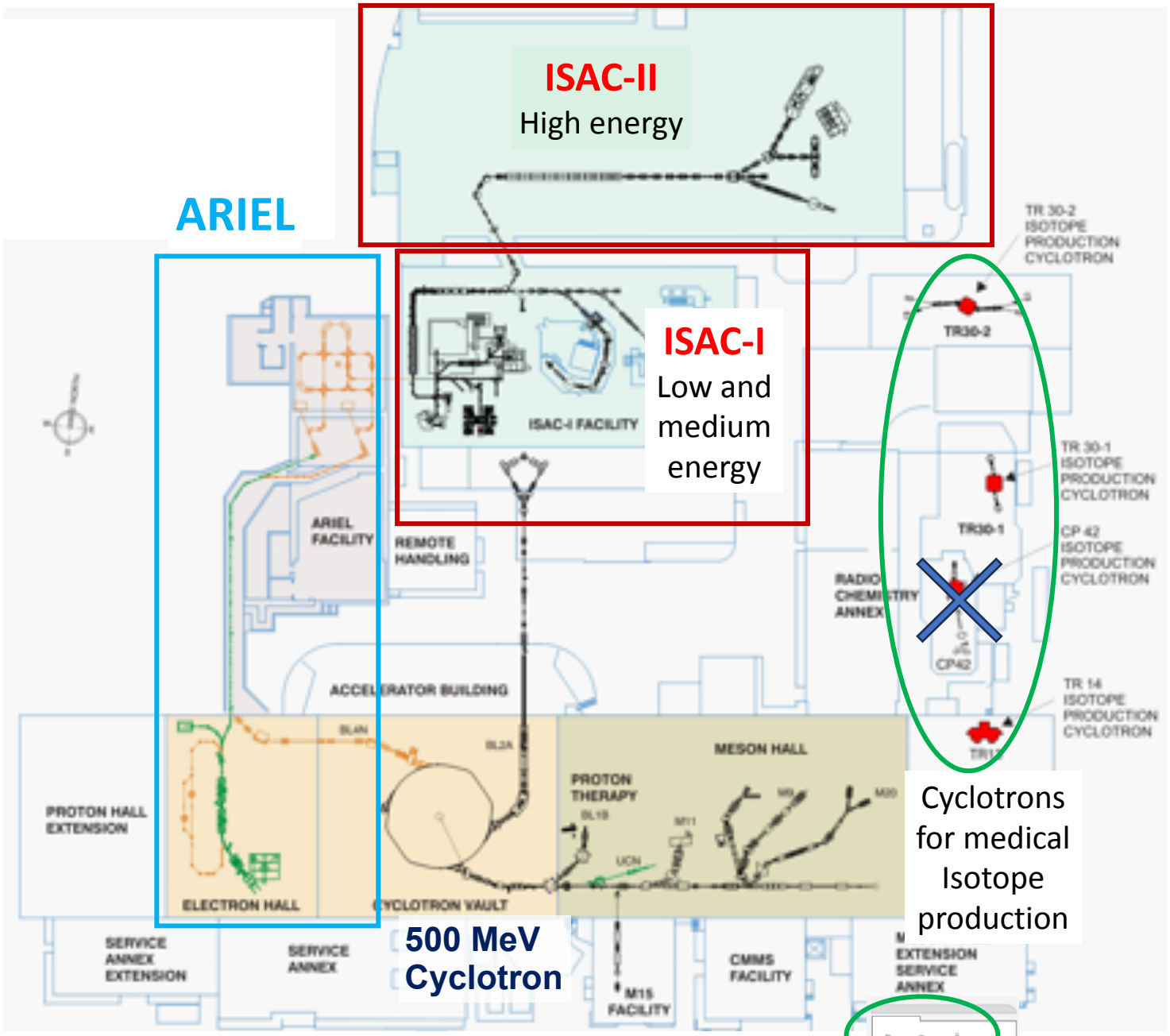
May 13th, 2025



Discovery, accelerated

TRIUMF is located on the traditional, ancestral, and unceded territory of the Musqueam people, who for millennia have passed on their culture, history, and traditions from one generation to the next on this site.

TRIUMF’s home has always been a seat of learning.



TRIUMF accelerator complex

Primary beam driver:

Cyclotron, 500 MeV, H^-

Produces rare isotopes, neutrons and muons!

Isotope Separator and Accelerator facility - ISAC

Isotope Separator Online (ISOL) facility

ISAC-I: Normal conducting-linac, 0.15-1.5 MeV/u

ISAC-II: Superconducting-linac, 5-15 MeV/u

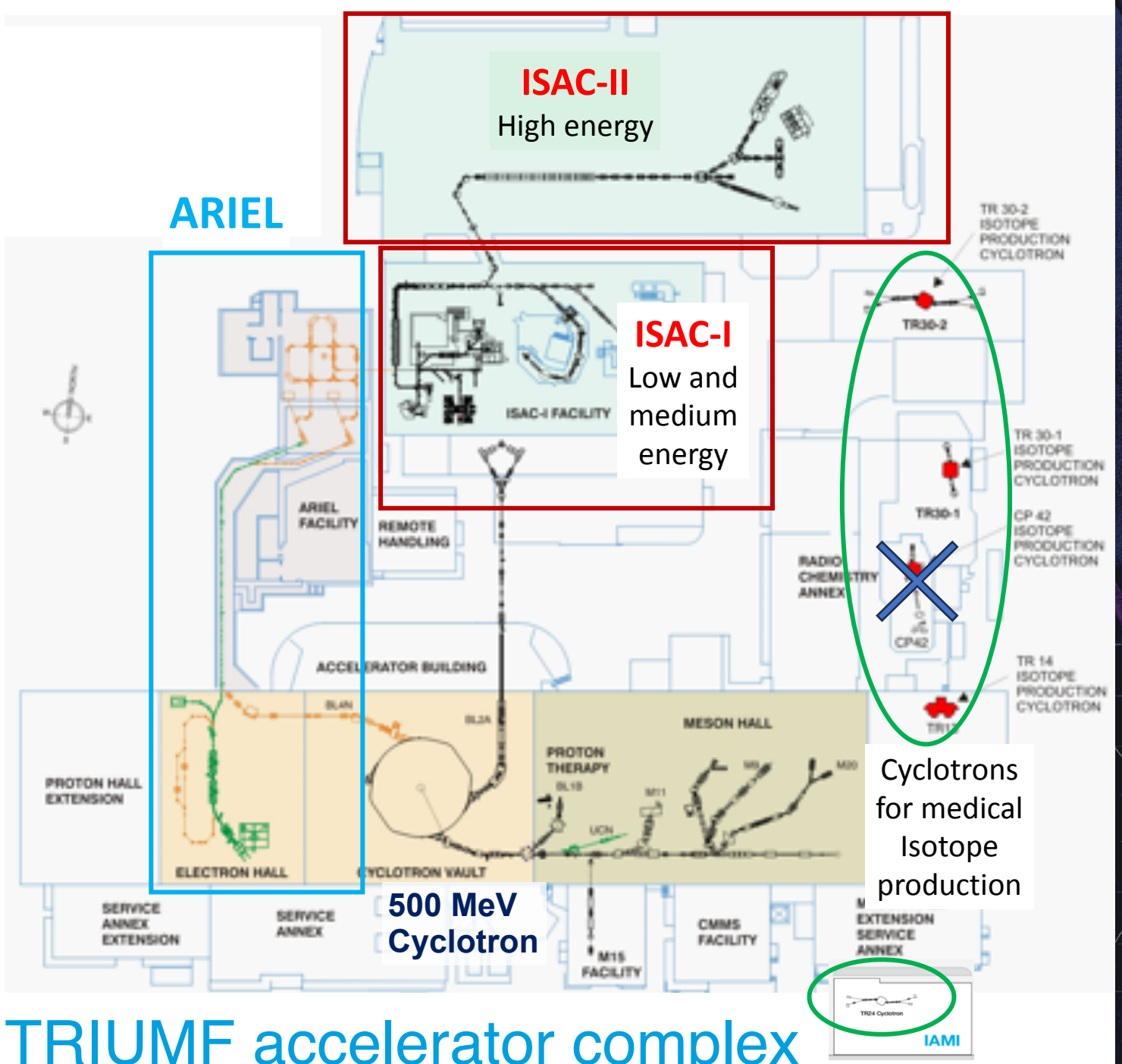
Advanced Rare Isotope Laboratory - ARIEL

Superconducting electron linac

30 MeV, 10 mA, cw

4 Cyclotrons for medical isotope production

(Including a TR24 in the Institute for advanced Medical Isotope – IAMI)



TRIUMF accelerator complex

TRIUMF Strategic Planning Cycle

- The introduction of a 20-year Vision process allows TRIUMF to move to a new model for strategic planning, which provides clarity on a funded programme of work
- The 20-Year Vision provides governance, community and laboratory engagement to discuss potential options for the future TRIUMF direction. Refreshed quinquennially.
- The 5-Year Request for Support builds a detailed proposal for federal operational support which will allow the first steps in the 20-Year Vision. One-off document.
- Following funding being awarded, the 5-Year Implementation Plan builds a funded programme of work, aligned with the 20-year Vision and the 5-year request for Support. This allows clarity of objectives given the funding available.
- The objectives within this 5-year Implementation Plan have been encoded into the Contribution Agreement in this cycle.

TRIUMF Strategic Planning Cycle

20-Year Vision (inaugural)
- Winter/Spring 2021 – Process begins
- September 2022 – Release

22/23 – NRC Evaluation

Request for Support (2025-2030)
- Spring/Summer 2023 – Process begins
- Fall 2023 - Approved & Release

Five-Year Implementation Plan (2025-2030)
- Spring 2024 – Process begins
- Fall 2024 - Approved
- Spring 2025 - Released

March 2025 – Contribution Agreement Signed

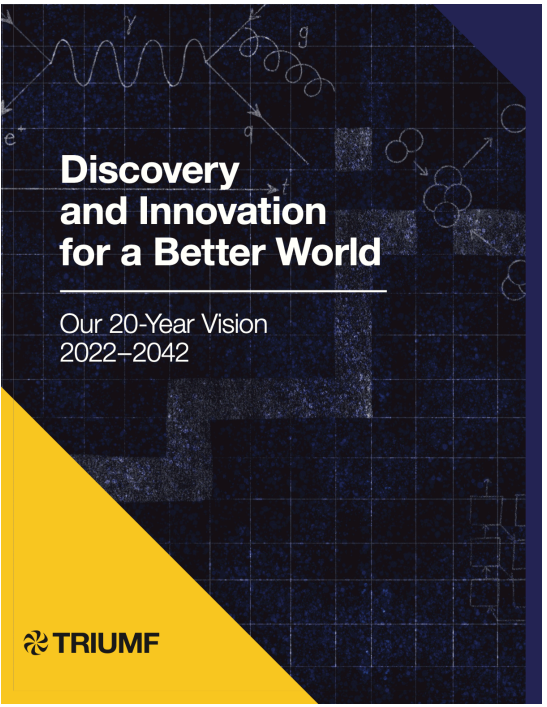
20-Year Vision Update
- Spring 2026 – Process begins
- Summer 2027 – Release

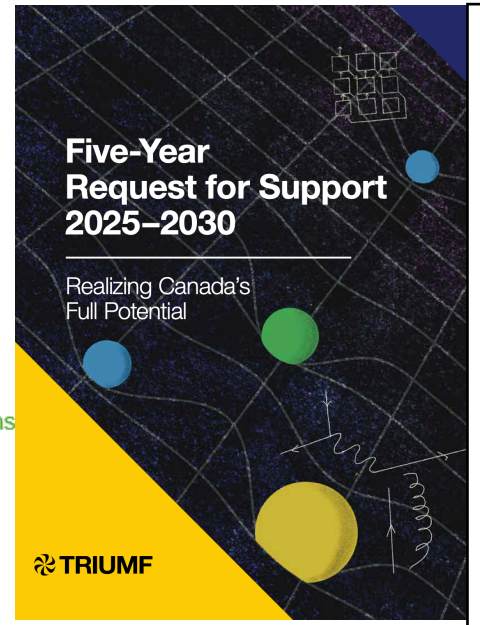
27/28 – NRC Evaluation

Request for Support (2030-2035)
- Winter/Spring 2028 – Process
- Fall 2028 – Release

The 2030-2035 Implementation Plan or other document will be dependant on the outcome of the MRF process

March 2030 – Funding Secured

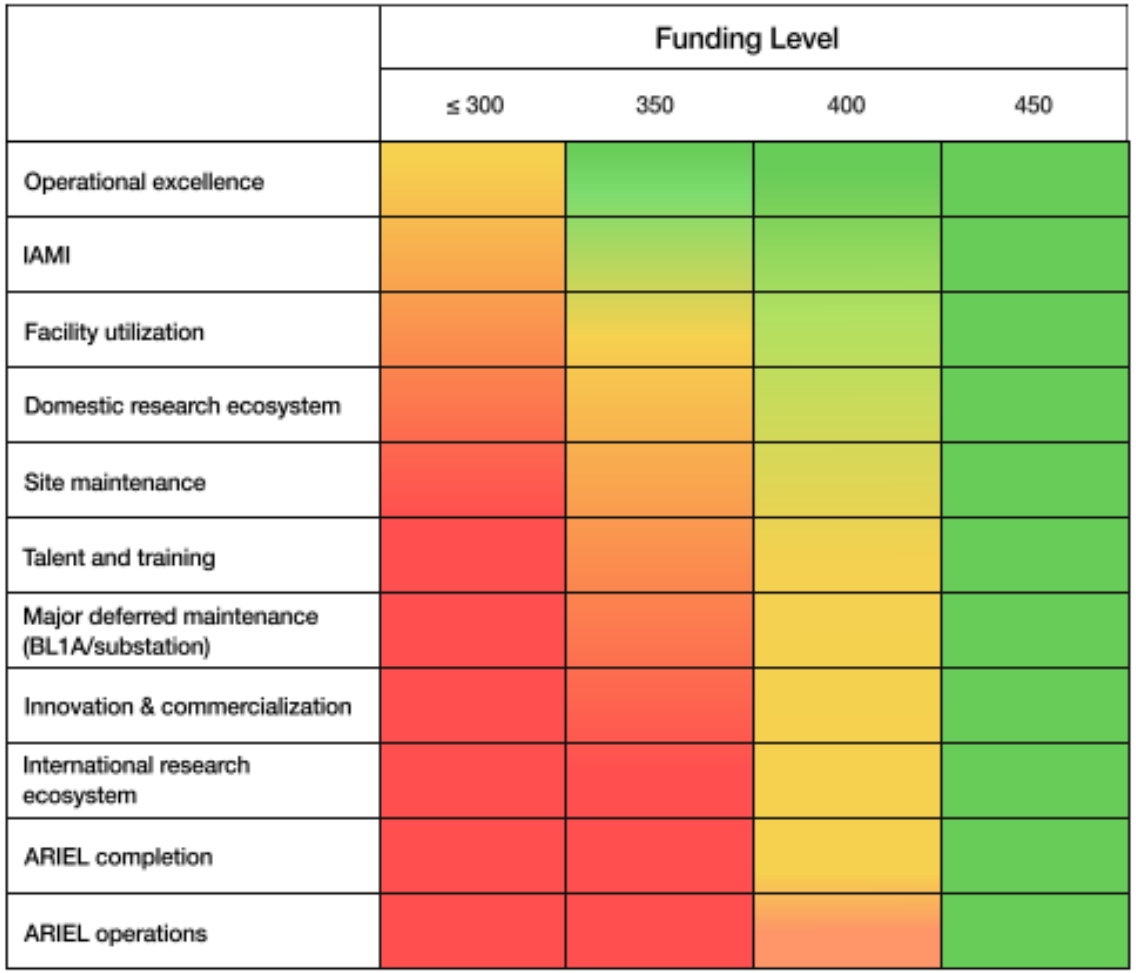




Priority Definition

Budget 2024 Outcome

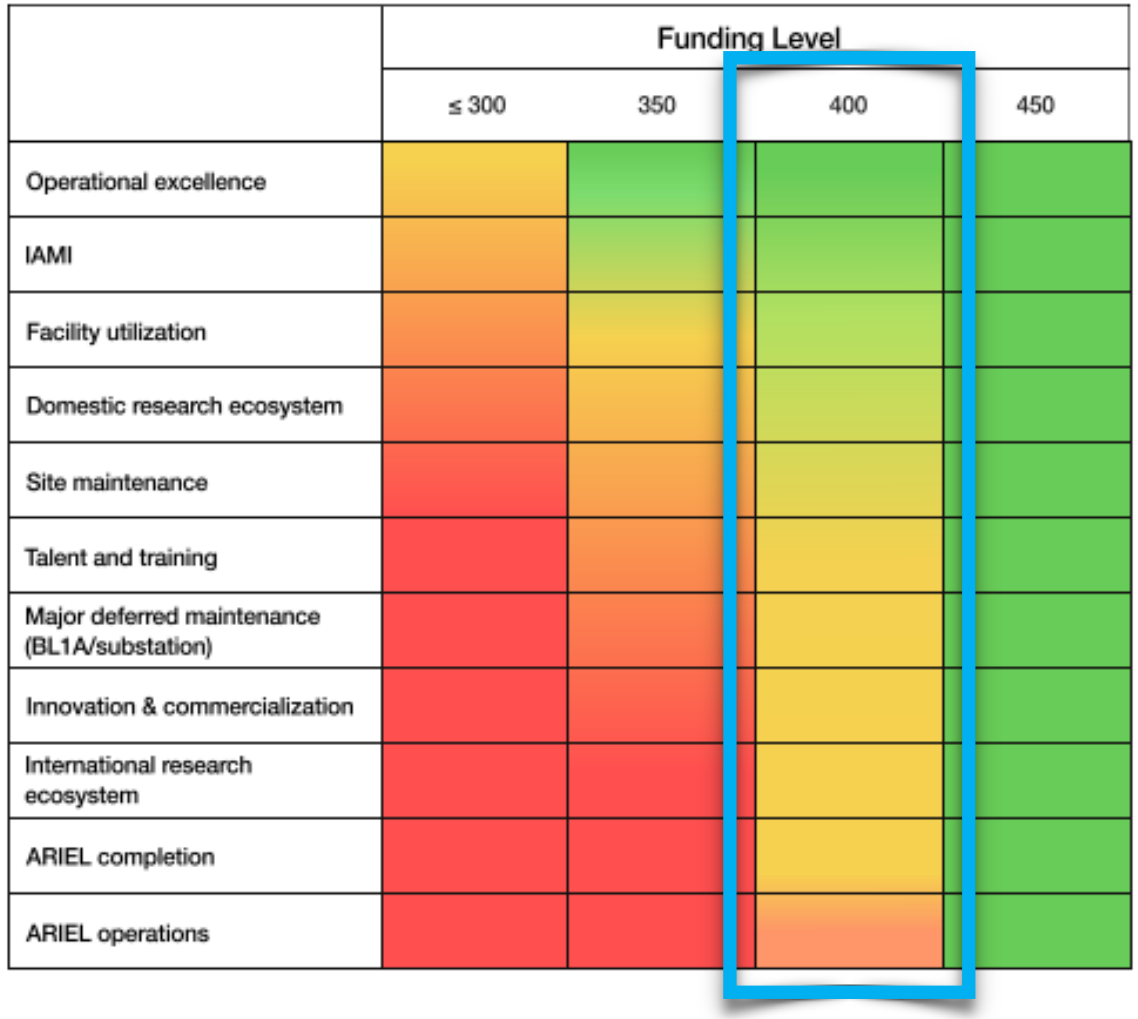
- TRIUMF did not receive the requested funding to fulfil the programme outlined in the Request for Support (request was $450M over five years)
    - With constraints from Board on use of commercial revenue due to risk profile, $70M needed to be trimmed from the plan
- This requires a reworking of the planned programme, trying to maximise the impact of the award
- Consultation with ACOT, Board, government and community indicate completion of ARIEL and IAMI remains our highest priority
- This has consequence on what we can achieve, and the sequencing of that work to maximise impact



Heat map visualizing various funding-level scenarios, including those of reduced funding from the $450M request

Budget 2024 Outcome

- TRIUMF did not receive the requested funding to fulfil the programme outlined in the Request for Support (request was $450M over five years)
    - With constraints from Board on use of commercial revenue due to risk profile, $70M needed to be trimmed from the plan
- This requires a reworking of the planned programme, trying to maximise the impact of the award
- Consultation with ACOT, Board, government and community indicate completion of ARIEL and IAMI remains our highest priority
- This has consequence on what we can achieve, and the sequencing of that work to maximise impact



Heat map visualizing various funding-level scenarios, including those of reduced funding from the $450M request

5-year Implementation Plan Scenarios

- Three scenarios identified to fit within budget - each with negative impacts cf original plans:

    1. Returning to an eight-month operational cycle for ISAC, delaying operations of IAMI into the next five-year period (2030 - 2035) and effectively deferring ARIEL construction and operations well beyond 2030

    2. A single extended shutdown of the main accelerator for a year in 2026 to complete ARIEL construction as defined by the CFI criteria. Allows focus on ARIEL during that period without distraction, with impacts on ISAC, CMMS, and medical isotope production

    3. The status quo of longer shutdowns over the next five years to provide some spare capacity for ARIEL construction. This implies continued six month shutdowns, which impacts science and medical isotope production

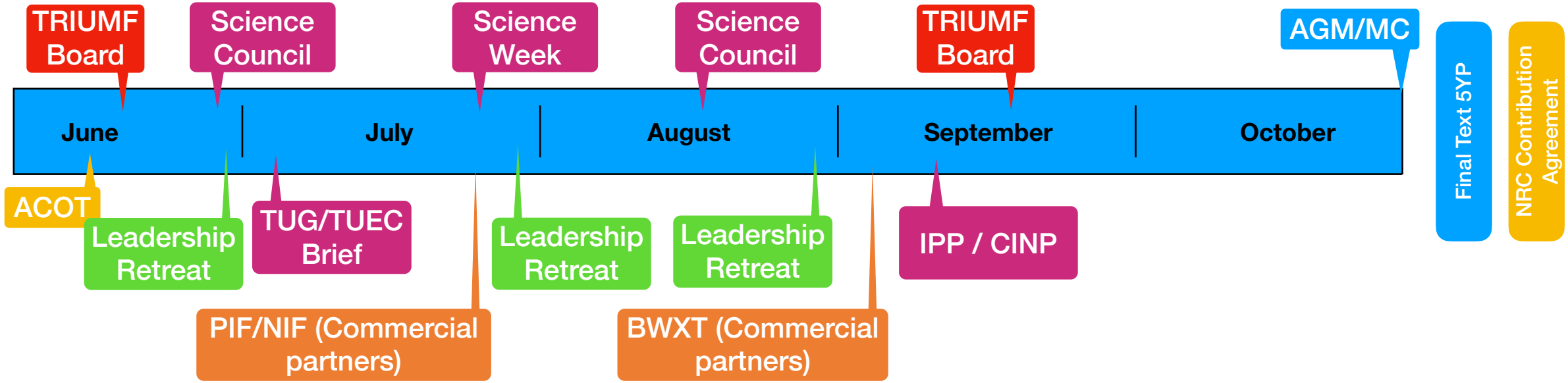
- (Fourth scenario of securing an additional $50M operation funds viewed as unachievable)

5-year plan scenario considerations

More +ve
Less +ve
Less -ve
More -ve

	Scenarios		
	1 (Defer ARIEL/IAMI; 8-month cycle)	2 (Extended Shutdown)	3 (Delay ARIEL/IAMI; 6-month cycle)
Non-negotiable elements			
Compensation	✔	✔	✔
Deferred Maintenance	✔	✔	✔
Operational Excellence	✔	✔	✔
Considerations			
Position TRIUMF for next 5YP			
Maintain domestic scientific userbase / excellence			
Maintain international scientific userbase / excellence			
Talent Development (also 'compensation' above)			
Complete and operate ARIEL			
Complete and operate IAMI			
Complete BL1A Refurbishment			
Financially secure - operations & capacity			
Medical isotope production			
Manage reputation with users			
Maintain reputation with international collaborators			
Manage reputation with government			
Manage reputation with business partners			

Consultations on the path forwards (2024)



Pathway to completion - governance perspective

- Leadership Team Retreat (Plan Development) – May 13
- Leadership Team Retreat (Plan Development)– May 31
- NRC – Advisory Committee on TRIUMF – June 10-12
- Board of Governors Meeting – June 18
- Science Council Meeting – June 27
- Leadership Team Retreat (Plan Development) – June 28
- TRIUMF User Group Pre-Science Week Briefing – July 5
- TRIUMF Science Week - July 22-26
- Science Council Meeting [Unanimous plan endorsement from voting members] – August 15
- Board of Governors Meeting [Unanimous approval to recommend 5YIP deliverables] – September 17
- Members' Council Annual General Meeting [Implementation Plan Approved] – October 28 & 29
- NRC Contribution Agreement - April 2025

Five-year Plan Objectives

- Some of the areas that we have viewed as essential components of the next five-year planning (the “rocks”) have been agreed with the Board
- **Compensation plans:** we aim to deliver the market median as a target salary for all staff during the next five-year plan, with evaluations against market every three years.
- **Deferred maintenance:** an essential component of the request and discussions with government. We have an aging core infrastructure and need to invest heavily in securing future operations
    - Looked to use CFI IF process (new “core facilities” stream) to augment budget
- **Operational Excellence** is a cornerstone of the request. Funding Weft and Warp as a response to CNSC/WAG, developing research security, safety, programme management, …
- These components form the basis of the award, as re-affirmed in the budget language

Implementation Plan Core Deliverables

- **Deliver science from the Advanced Rare Isotope Laboratory (ARIEL)**

  1. Deliver 5000 hours of radioactive isotope beam to ISAC by the 2029 operational year

  2. Ensure ARIEL is ready for Gate-4A in the TRIUMF project management process by 2027

- **Complete and operate the Institute for Advanced Medical Isotopes (IAMI)**

  3. Initial operations of the IAMI facility in 2026

- **Refurbish key infrastructure and systems**

  4. Replacement of key components of Beamline 1A, supporting material sciences and isotope production, during planned shutdown periods

Contribution Agreement Schedule B

SCHEDULE B

Funded Activities

The following activities shall be undertaken by TRIUMF or its controlled entities, in alignment with the financial information in Schedule C.

Core deliverables now threaded through CA, 5YIP, governance groups, community discussions

1. TRIUMF commits to following core deliverables:

(a) Ensuring ARIEL is ready for Gate-4A in the TRIUMF project management process in 2027

(b) Delivery of 5000 hours of radioactive isotope beam to ISAC in the 2029 operational year

(c) Initial operations of the IAMI facility in 2026

(d) Replacement of key components of Beamline 1A, supporting material sciences and isotope production, during planned shutdown periods

2. TRIUMF will support the Canadian scientific community by providing access to its experimental facilities as well as technical and scientific support. TRIUMF will provide support for:

(a) On-site science: RIB nuclear physics; quantum materials & technologies; life sciences; theoretical subatomic physics; UCN/nEDM.

(b) Off-site collaborative research, and science projects (ATLAS; HL-LHC; ALPHA; Hyper-K; DBD)

(c) Science operations undertaken as part of the Institute for Advanced Medical Isotopes (IAMI)

(d) Other on- or off-site science initiatives undertaken using resources provided under this Contribution Agreement.

3. TRIUMF or its Controlled entities or Affiliates, will undertake activities to commercialize TRIUMF's research and technology activities for the benefit of Canada, in alignment with the provisions of the Contribution Agreement and in particular with the provisions set out in Article 5 regarding Security, Article 9 regarding Intellectual property and Article 10 regarding Traceable Economic Benefit.

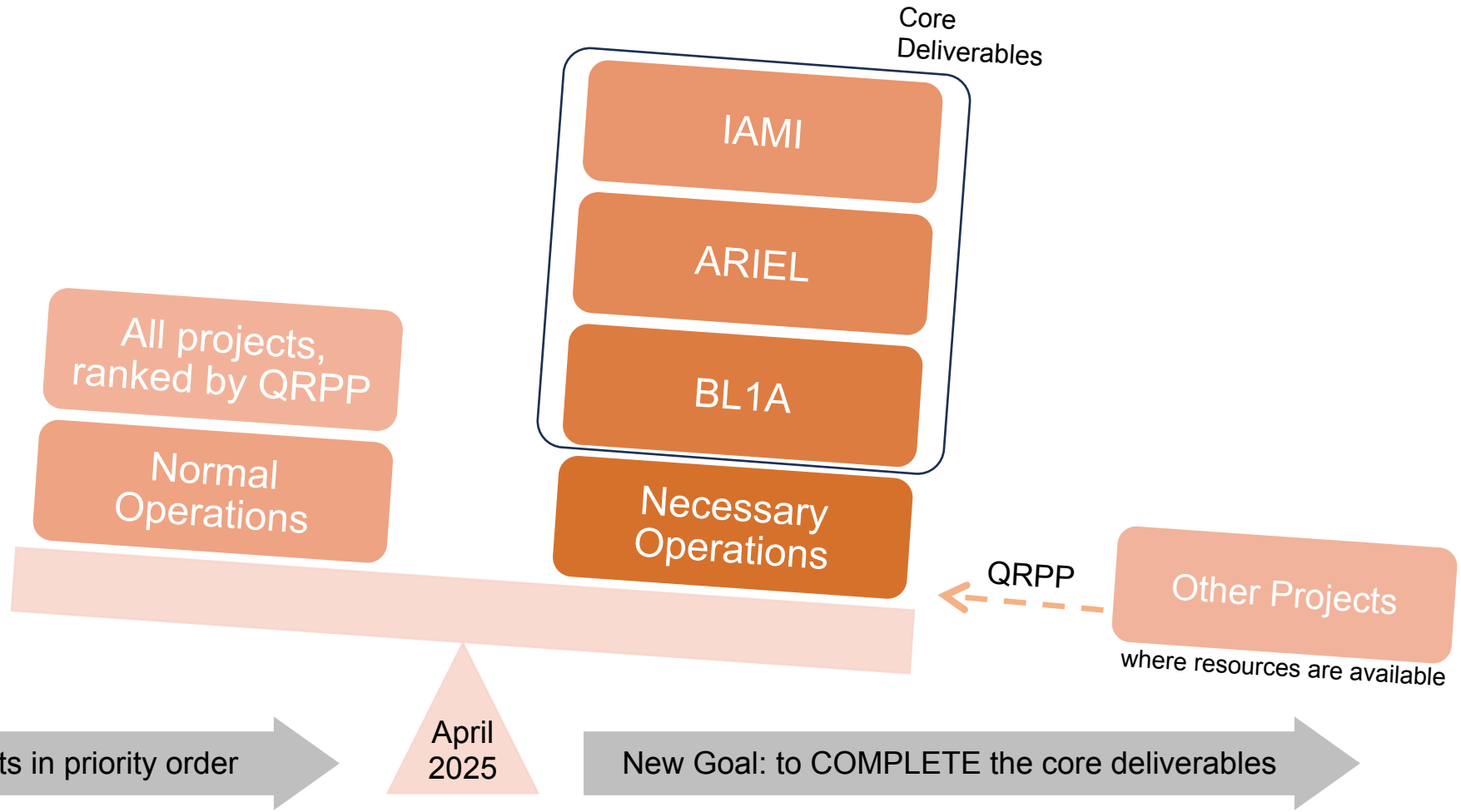
Delivery Mechanism

Pivoting to 2025-30 5YR Plan

From April 1st, the new NRC contribution agreement commits TRIUMF to the 4 core deliverables

Existing QRPP Process

New QRPP Process



QRPP Reset (Quarterly Review of Project Priorities)

Project ID	Project Name	September Ranking
Ops	Non-Project Work (Training, MRO, Vacation, etc.)	1*
PRJ_342	ARIEL-II Program Management, Licensing and Documentation	1
PRJ_353	ARIEL-II Target stations	2
PRJ_179	ARIEL-II BL4N	3
PRJ_424	ARIEL-II Target Hall Infrastructure	4
PRJ_405	Cancer Treatment with Therapeutic Radionuclides	5
PRJ_363	ARIEL 1.5	6
PRJ_354	ARIEL-II Separator & front end	7
PRJ_358	ARIEL-II CFS	8
PRJ_487	ARIEL-II Hot Cells	9
PRJ_374	e-Linac Development	10
PRJ_355	ARIEL-II Laboratories	11
PRJ_310	CANREB Studies	12
PRJ_442_construction	IAMI Construction	13
PRJ_527	IAMI – BCC Build-out	14
PRJ_550	IAMI Phase 2	15
PRJ_553	UCN Source	16
PRJ_407	UCN project management	17
PRJ_555	nEDM Experiment	18
PRJ_481	Replacement of ISIS horizontal beam line	19
PRJ_372	On-Line Ion Source I2	20
PRJ_552	HAICU	21
PRJ_492	Upgrade and refurbishment of the Cyclotron RF System	22
PRJ_455	CERN HI-LUMI CMs Fabrication and Assembly	23
PRJ_476	Routine 225Actarget processing capabilities and product development	24
PRJ_457	Infrastructure Upgrades for Alpha Emitter Production	25
PRJ_416	Target Module 3 Refurbishing	26
PRJ_499	M15 Revitalization	27
PRJ_557	TRIUMF Cyclotron Control System	28
PRJ_406	Expanding Muon Beam Facilities at TRIUMF	29
PRJ_526	225 Ac Production via 226 Ra(p,2n)	30
PRJ_497	Rare Isotope Beam Delivery Development	31
PRJ_538	DarkLight at ARIEL e-linac	32
PRJ_470	Search for neutrinoless double-beta decays in Xe-136 with nEXO	33
PRJ_401	ATLAS ITk Upgrade	34
PRJ_456	Multi-PMT Development and Prototyping for NuPRISM and Hyper-K	35
PRJ_517	Asset and Workflow Management System	36
PRJ_545	STF Station Upgrade	37
PRJ_453	ATLAS Phase-2 Upgrade LAr FE	38
PRJ_461	IWCD	39
PRJ_462	DarkSide-20K	40
PRJ_463	MOLLER	41
PRJ_496	ISAC Target Hall Consolidation	42
PRJ_507	Replacement for DG1 and ATS	43
PRJ_513	ME141 Replacement	44
PRJ_494	ISAC TRILIS upgrade	45
PRJ_412	Upgrade of TRIUMF Radiochemistry for brain imaging at the DM Center for Health and acquisition of a Hybrid PET/MR	46
PRJ_87	M9 upgrade	47
PRJ_493	ISAC LINAC RF System Refurbishing	48
PRJ_502	Portable Versatile Remote Manipulator Unit	49
PRJ_464	POLARIS	50
PRJ_473	E-linac test bed for high intensity THz radiation	51
PRJ_150	BT Spectrometer	52
PRJ_522	Si Pixel Testing	53
PRJ_537	Photosensor for Hyper-K	54
PRJ_562	Ultra fast detector for neutron spectroscopy	55
PRJ_495	Cyclotron refurbishment	56
PRJ_549	Detectors for environmental monitoring	57
PRJ_569	PENeLOPE Cryogenic Commissioning	58
PRJ_532	PONE	59
PRJ_534	Laboratory for fundamental symmetries and radioactive molecules	60
PRJ_567	PIONEER next generation pion decay	61
PRJ_488	TRIUMF future dosimetry	62
PRJ_558	Copper Active LCW Corrosion Project	63
PRJ_471	TR24 Targets and Transfer System	64
PRJ_559	IPF High Power Upgrade	65
PRJ_344	ALPHA - Measurement of Antimatter Gravity	66
PRJ_483	New CRM System	67
PRJ_514	Production of radioactive molecules in an RFQ gas-reaction cell	68
PRJ_528	Separation methods for medical isotopes from thorium carbide targets	69
PRJ_480	Replacement of cooling tower units	70
PRJ_408	Ultra-violet photo-detector development infrastructure	71
PRJ_535	nEXO	72
PRJ_541	ARGO	73
PRJ_468	Radioactive Cell Culture Lab	74
PRJ_509	Rabbit Line Replacement	75
PRJ_539	Compact accelerator based neutron sources	76
PRJ_508	Site Card Access System Replacement	77
PRJ_560	BL1A Beamlines and Remote Handling	78
PRJ_568	BL1A Contribution to Site-Wide Waste Management	79
PRJ_482	RCA1 Nuclear Ventilation Upgrade	80
PRJ_540	BL1A Refurbishment	81

Count: > 80

Project Category	# Projects
NRC Contribution agreement priorities IAMI, **ARIEL**, BL1A	3, **12**, 2
Other approved QRPP projects Can request resources. Allocated **after** core priorities	16
Non-conflicting projects No resource conflicts with “green”	19
Hibernated projects	23

QRPP redesign for resource simplicity

QRPP Project Rankings April-June 2025

NRC Contribution Agreement Priorities

Core priorities
Take precedence for resources

Core Priority	PRJ #	Description
1	PRJ_442_cor	IAMI Construction
1	PRJ_527	IAMI – BCC Build-out
1	PRJ_550	IAMI Phase 2
2	PRJ_342	ARIEL-II Program Management, Licensing and Documentation
2	PRJ_353	ARIEL-II Target stations
2	PRJ_179	ARIEL-II BL4N
2	PRJ_424	ARIEL-II Target Hall Infrastructure
2	PRJ_405	Cancer Treatment with Therapeutic Radionuclides
2	PRJ_363	ARIEL 1.5
2	PRJ_354	ARIEL-II Separator & front end
2	PRJ_358	ARIEL-II CFS
2	PRJ_487	ARIEL-II Hot Cells
2	PRJ_374	e-Linac Development
2	PRJ_355	ARIEL-II Laboratories
2	PRJ_310	CANREB Studies
3	PRJ_568	BL1A Contribution to Site-Wide Waste Management
3	PRJ_560	BL1A Refurbishment

Other Projects Approved for QRPP

Can request resources at QRPP.
Resources allocated AFTER core priorities

Strategic Priority	PRJ #	Description
1	PRJ_481	Replacement of ISIS horizontal beam line
2	PRJ_406	Expanding Muon Beam Facilities at TRIUMF (M9H)
3	PRJ_538	Darklight
4	PRJ_517	Asset and Workflow Management System
5	PRJ_557	TRIUMF Cyclotron Control System
6	PRJ_412	Upgrade of TRIUMF Radiochemistry for brain imaging at the DM C
7	PRJ_526	225 Ac Production via 226 Ra(p,2n)
8	PRJ_407	UCN project management
9	PRJ_553	UCN Source
10	PRJ_555	nEDM Experiment
11	PRJ_455	CERN HI-LUMI CMs Fabrication and Assembly
12	PRJ_573	Radmol Lab Renovation (NRC funded portion)
13	PRJ_372	On-Line Ion Source I2
14	PRJ_473	E-linac test bed for high intensity THz radiation
15	PRJ_552	HAICU
16	PRJ_483	New CRM System

Non-Conflicting Projects

Can Proceed - no conflicts with P&I (including Engineering), ACC, and limitted resources from Core Service
Report status at QRPP, can't request resources

PRJ #	Description
PRJ_579	Weft and Warp
PRJ_495	Cyclotron refurbishment
PRJ_539	Compact accelerator based neutron sources
PRJ_582	Digital Ecosystem Rebuild
PRJ_508	Site Card Access System Replacement
PRJ_461	IWCD
PRJ_462	DarkSide-20K
PRJ_532	PONE
PRJ_562	Ultra fast detector for neutron spectroscopy
PRJ_87	M9 upgrade
PRJ_150	3T Spectrometer
PRJ_453	ATLAS Phase-2 Upgrade LAr FE
PRJ_537	Photosensor for Hyper-K
PRJ_401	ATLAS ITk Upgrade
PRJ_569	PENeLOPE Cryogenic Commissioning
PRJ_567	PIONEER next generation pion decay
PRJ_549	Detectors for environmental monitoring
PRJ_580	TIIGR, Therapeutic Isotope Imager with Gamma Rays
new	SEAQR, Sensor for Environment Analysis with single Quanta Reso

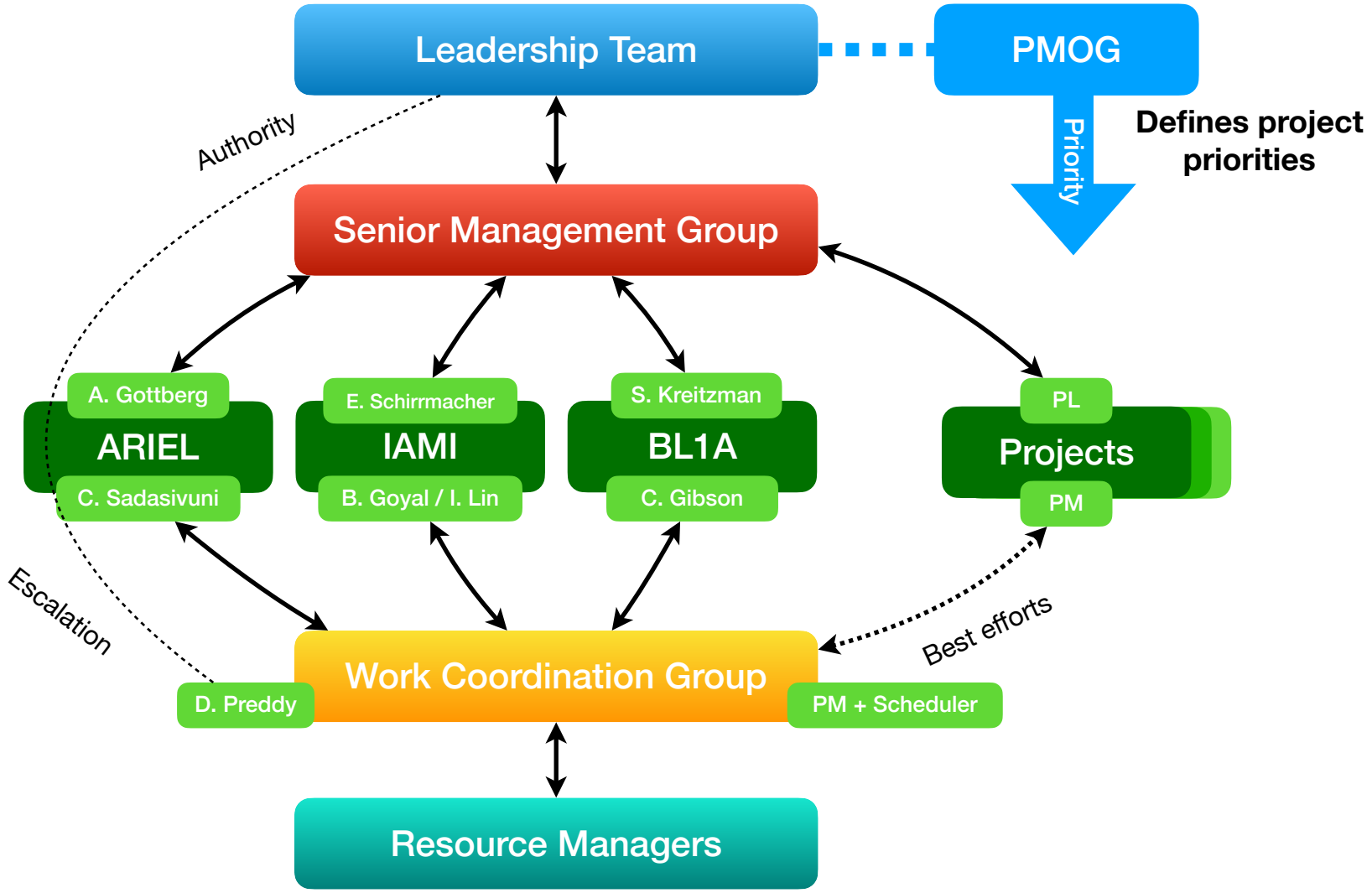
Hibernated Projects (on hold)

PRJ_535	nEXO	
PRJ_502	Target Waste Packaging System	
PRJ_492	Upgrade and refurbishment of the Cyclotron RF System	
PRJ_416	Target Module 3 Refurbishing	
PRJ_497	Rare Isotope Beam Delivery Development	
PRJ_496	ISAC Target Hall Consolidation	
PRJ_494	ISAC TRILIS upgrade	
PRJ_493	ISAC LINAC RF System Refurbishing	
PRJ_545	STF Station Upgrade	
PRJ_559	IPF High Power Upgrade	
PRJ_514	Production of radioactive molecules in an RFQ gas-reaction cell	
PRJ_528	Separation methods for medical isotopes from thorium carbide ta	
PRJ_482	RCA1 Nuclear Ventilation Upgrade	
PRJ_575	T2 Leak Repair in BL1A	
PRJ_509	Rabbit Line Replacement	
PRJ_540	BL1A Refurbishment	
PRJ_476	Routine 225Ac target processing capabilities and product develop	
PRJ_457	Infrastructure Upgrades for Alpha Emitter Production	
PRJ_513	ME141 Replacement	
PRJ_480	Replacement of cooling tower units	
PRJ_558	Copper Active LCW Corrosion Project	
PRJ_572	Capacity Management in Workday	
PRJ_534	Laboratory for fundamental symmetries and radioactive molecul	
PRJ_464	POLARIS	
PRJ_488	TRIUMF future dosimetry	

RESOURCE MANAGEMENT & PRIORITIZATION							
TSOP-15 PROJECTS				**OPERATIONS**			
QRPP Ranking	**Request Work?**	**Resource Escalation**	**Work Coordination**	**Operations**	**Notification**	**Escalation**
			Resource Owner	Life Safety / Emergency Response	DCR	DCR ➔ LT
NRC Contribution agreement priorities IAMI, ARIEL, BL1A	QRPP	1. Negotiate at WCG 2. WCG ➔ SMM 3. WCG ➔ LT	WCG Resource Owner	Break/fix urgent response (beam down/experiment fail)	DCR, RIB Ops, resource owner	Division ➔ LT
Other approved QRPP projects request resources. allocated after core priorities	QRPP		WCG	Routine maintenance & planned work	SMM (if disruptive)	1. Negotiate at WCG 2. WCG ➔ SMM 3. WCG ➔ LT
Non-conflicting projects No resource conflicts with "green" or "yellow"	WCG	Division ➔ PMOG (Update QRPP priority?)	WCG	Operational "projects" (below TSOP 15 size) Non-urgent experiment work (e.g. staging)	WCG	Division ➔ LT
Hibernated Projects	Division Head	Division ➔ PMOG (Update QRPP priority?)	N/A	Maintenance not required/not approved	N/A	Division

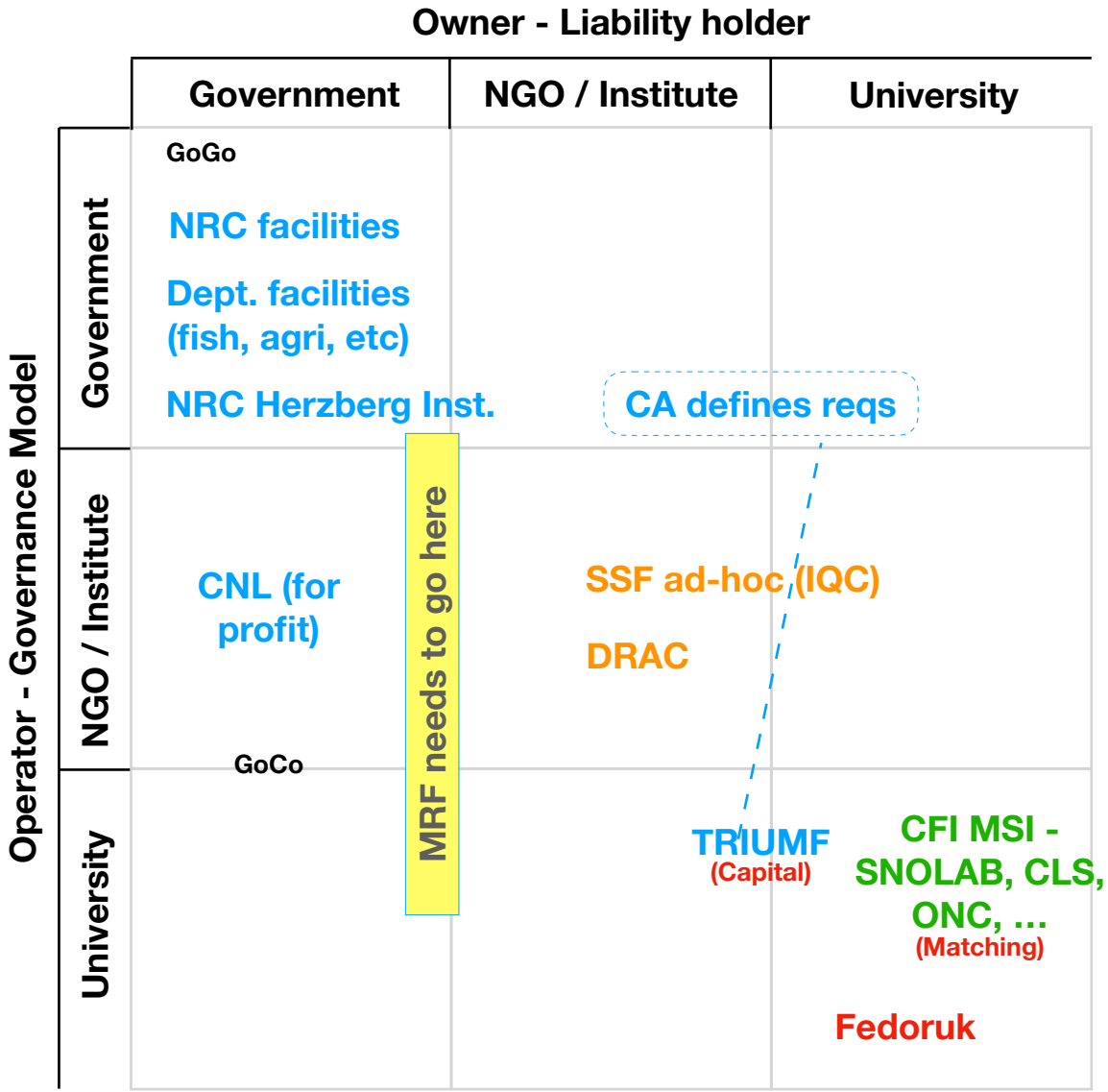
WCG = Work Coordination Group, **LT** = Leadership Team i.e. Division Director, **SMM** = Senior Management i.e.. LT + Department Heads, **DCR** = Driver Control Room,

LS26 Delivery and Oversight



Future Strategy & MRF

National Research Facilities Models



- GoCo (US DOE, NSF) e.g. Battelle
- GoGo (EU) e.g. STFC RAL
  - German model includes Helmholtz / Max Plank
- Canada model historical
  - NRC supporting mission driven research
  - CNL grown from Manhattan programme
  - TRIUMF - first ‘academic’ MRF
  - MSI similarly ‘bottom-up’ derived

Key to colour coding

Federal support direct

Provincial support

Federal support through CFI (Foundation)

Federal support through ad-hoc / ISED

Future Strategy Positioning

- Proposal for development of MRF submitted at end of April to ISED
- Latest concept shown at MSI workshop in February, no substantive changes at that time from enhanced MSI - the proposed programme design precludes TRIUMF joining
- There is an opportunity to maximise the benefit to Canada of its MRF assets
- Opportunities exist in
    - Mission-driven (mission derived from community and government)
    - International programmes (“who speaks for Canada”)
    - Interdisciplinary programmes
    - Innovation and commercial work
    - Academic engagement

G7 Large Research Infrastructures: Synergies and impact on science and society

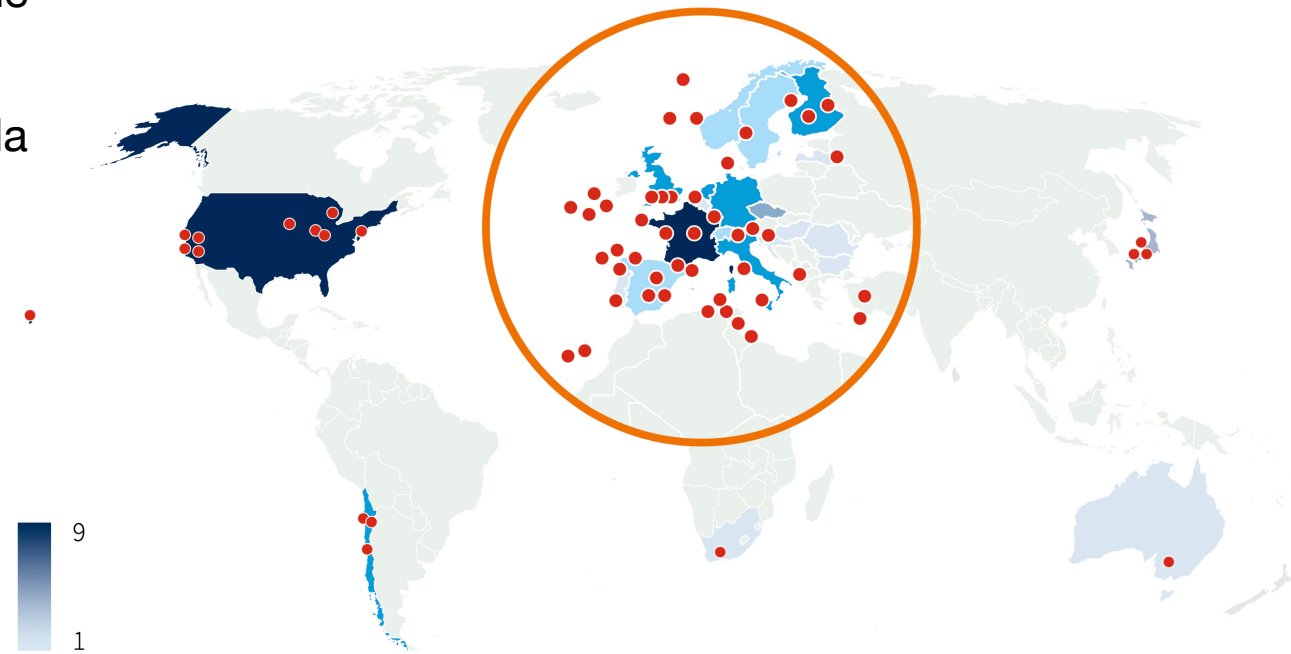


FIGURE 1. Geographical distribution of the 32 ground-based LRIs.
Note: The mapping is based on the physical location of each LRI’s primary assets.
Source: TEHA Group elaboration on various sources, 2024

TRIUMF

Thank You
Merci
Hay ce:p ḑə

www.triumf.ca
@TRIUMFLab