



DIRECTOR'S ADDRESS

TRIUMF Alumni and
Retirees Association
Annual General
Meeting

November 9, 2021



A little about me...

- Grew up in Nottingham (Robin Hood, lace, cycling, Nottingham Forest, coal mining)
- Degrees at Leeds University
 - PhD in cosmic ray/VHE gamma ray studies
 - Winter-over placement at South Pole, via Bartol
- Returned to lecture at Leeds
- Shifted focus to dark matter at Imperial & R.A.L.
 - Initially as post-doc at Imperial 1992
 - Dark matter group leader at RAL 1998
 - (one of U.K.'s national labs)
- Came to Canada in 2009 as Director of SNOLAB
 - Reappointed a couple of times
 - Canadian citizenship in 2019
- Hold visiting chair at Imperial, adjunct at Queen's, CIFAR fellowship in Earth 4D



Previous experience

- PhD: PeV gamma-ray astronomy (South Pole, +3km, -71°C)
- ICL/RAL: Dark matter searches, Boulby salt/potash mine (UK, -1.1km, $+25^{\circ}\text{C}$)
- Executive Director: SNOLAB deep underground facility (Canada, -2.1km, $\pm 40^{\circ}\text{C}$)

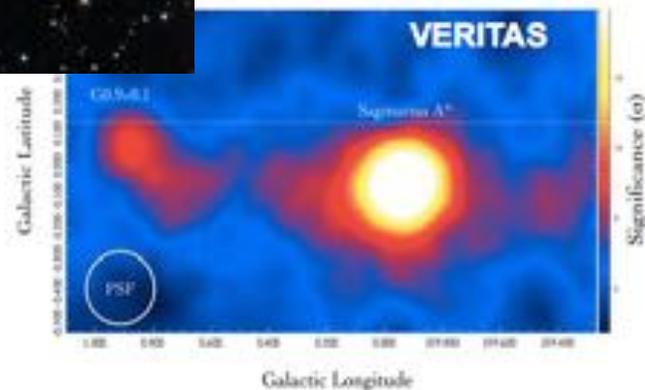


Antarctic astronomy at 10^{15} eV

- Looking for sources of PeV cosmic rays
 - South Pole Air Shower Experiment
 - Built as part of small team in 1987/88 (“wintered”)
 - Ran 1988 - 1994
- Results Inconclusive



A possible source:
SN1987A



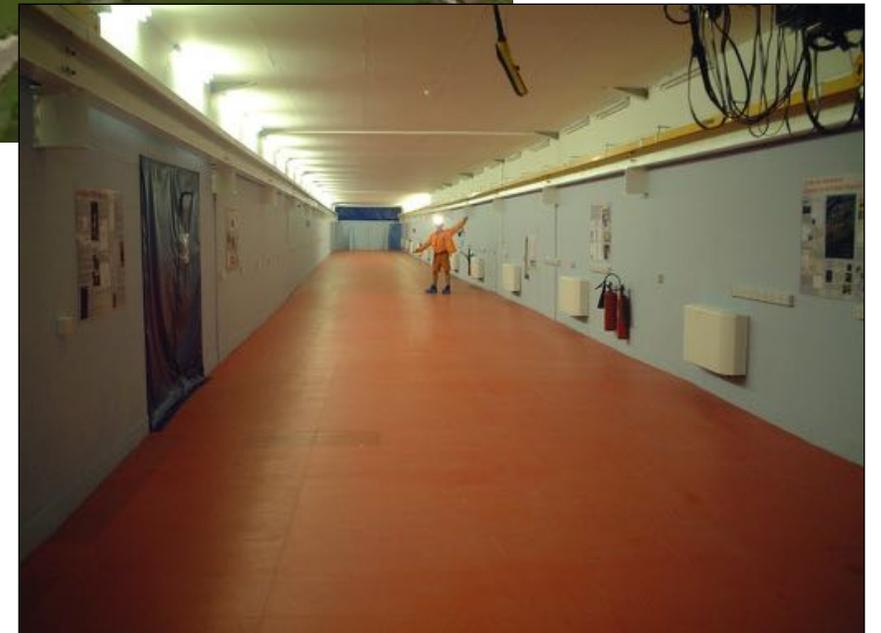
State of the field now
(image of Galactic Centre)



Boulby Dark Matter laboratory

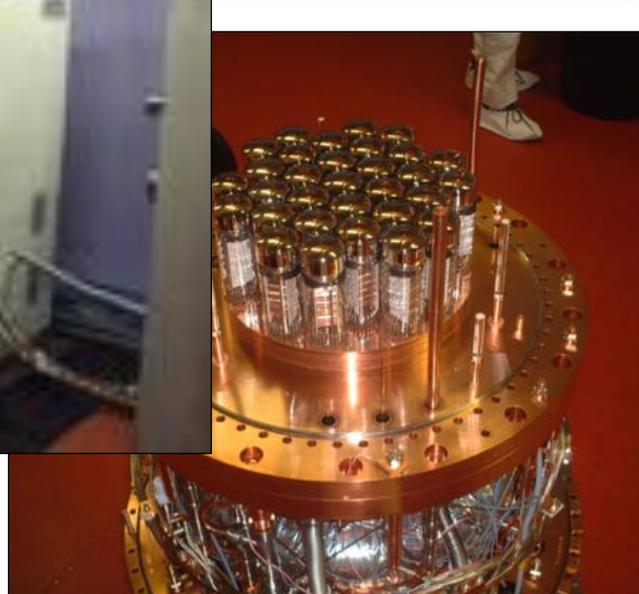
- Working salt/potash mine @1100m
- Low activity rock-salt environment
- Initial 'lab' built 1990
- Upgrade to facility 2001

Early Infrastructure 1993 (and early NJTS)



Dark Matter Experiments

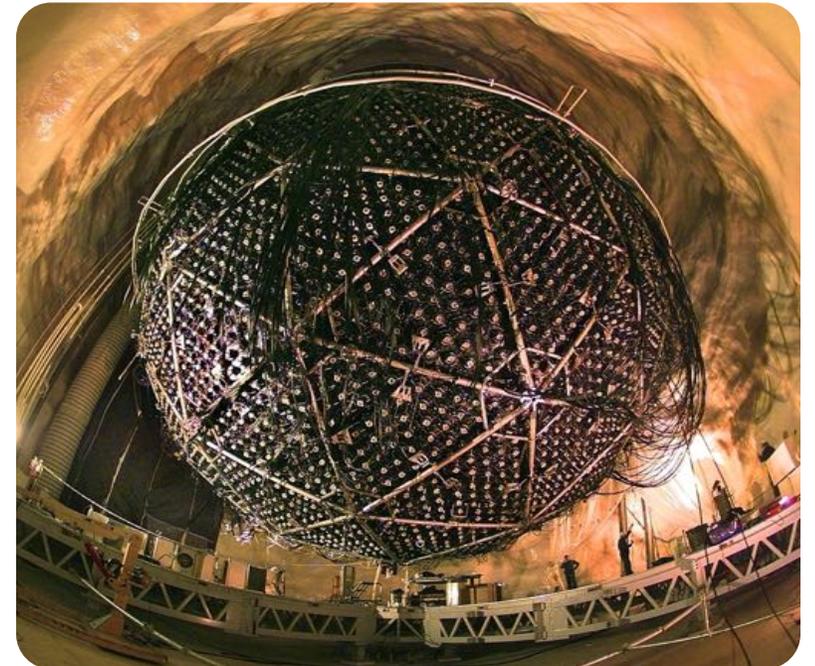
- Specialised in liquid xenon as a dark matter target
- Three generations of ZEPLIN detector
- First to show xenon works as a dark matter target
- First to show two phase technique works for dark matter searches, still the leading technology

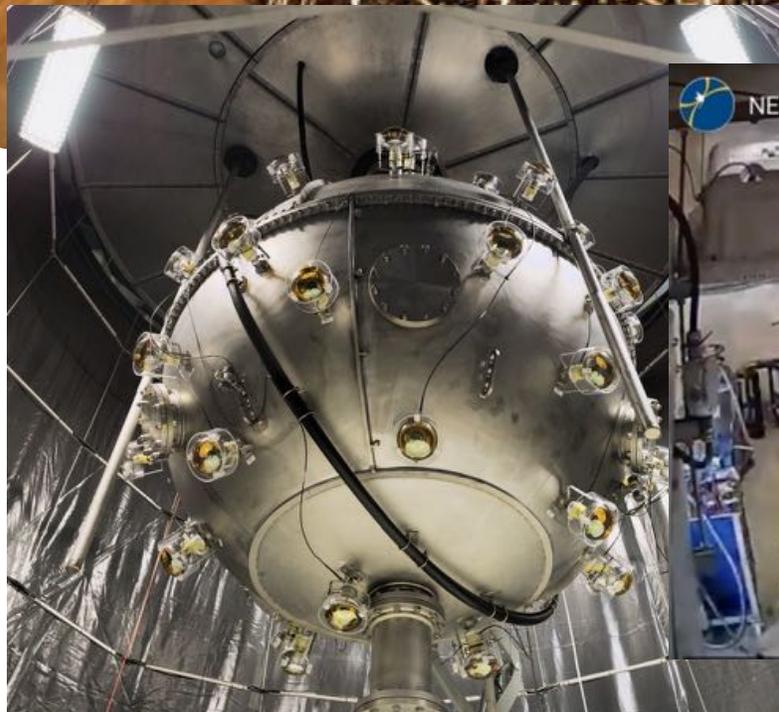
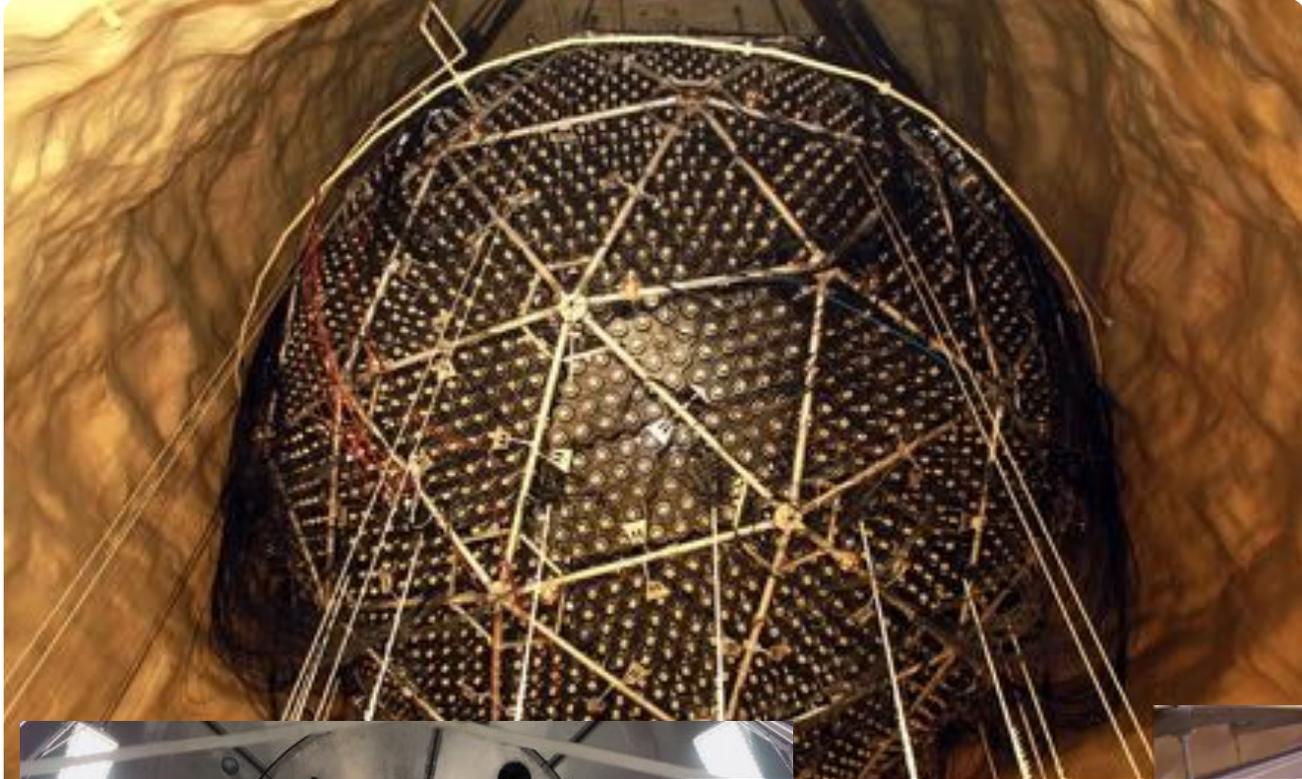


ZEPLIN-III now in a museum

The SNOLAB Facility

- Deep underground science addresses some of the most fundamental and high scientific priority questions in contemporary physics:
 - What is the **dark matter** that pervades and shapes our universe?
 - How have **neutrinos** shaped the evolution of the universe and the synthesis of heavy elements? What is the intrinsic physics and nature of these particles?
 - How did the Universe begin and what caused the asymmetry that led to a matter dominated universe?
- Developed from the original SNO detector to develop Canadian international facilities
- Managed as a joint venture between five Canadian Universities (Alberta, Carleton, Queen's, Laurentian, Montréal)
- Funded through CFI MSI programme and Province
- Operated in the Creighton nickel mine, near Sudbury, Ontario, hosted by Vale Ltd.





NEWS-G installation at SNOLAB (2020 timelapse)



Seismic platform installation

TRIUMF Plans and Priorities

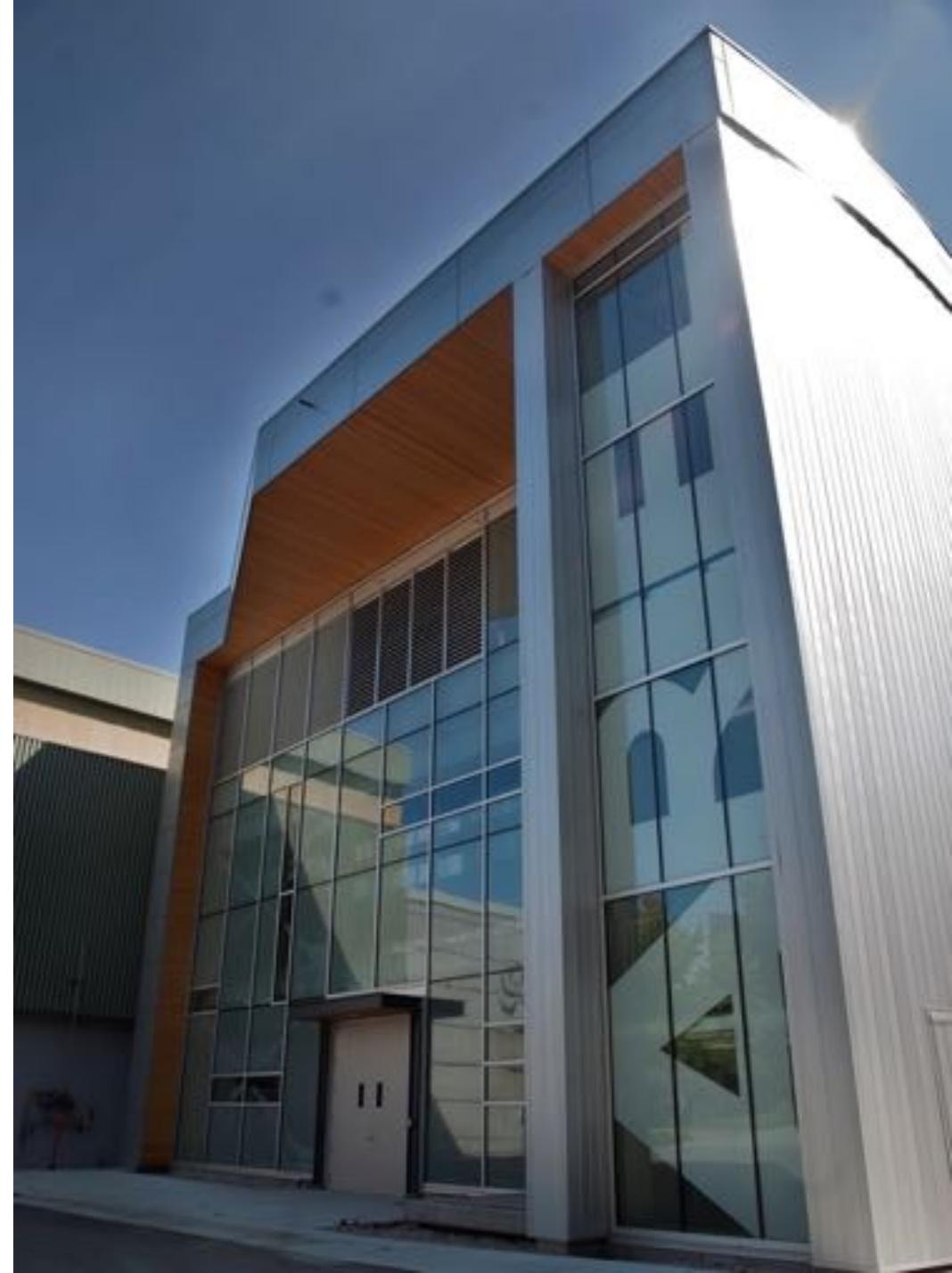
TRIUMF's Five-Year Plan 2020-2025 is based around three core dimensions:

- Science and Technology
- People and Skills
- Innovation and Collaboration



Science and Technology – ARIEL

- Leveraging made-in-Canada super-conducting RF accelerator technology, the Advanced Rare Isotope Laboratory (ARIEL) will triple TRIUMF's rare isotope production capacity – enabling more science, more training, and more commercial activity
- Represents > \$100 million investment by federal and provincial governments
- Supported by 21 universities from across Canada
- New science capacity began coming online in 2020 and will continue until work concludes in 2026



Science & Technology - IAMI

- The Institute for Advanced Medical Isotopes (IAMIs) is a >\$50M research and production facility
- IAMIs will enable BC research into next-generation medical isotopes and radiopharmaceuticals. Located on the TRIUMF campus, IAMIs will:
 - Provide provincial isotope security
 - Unlock development of next-generation cancer therapies
 - Enable clinical trials and cutting-edge medical research
 - Advance technological innovation and skills training
- Funding for IAMIs was announced by Prime Minister Trudeau in Nov. 2018
- IAMIs is currently under construction; commissioning is expected to take place in 2022



People and Skills – Skills Training

- TRIUMF is developing Canada's next-generation workforce in a wide range of fields
- We provide unique interdisciplinary opportunities to train people at all levels – from high school to postdoctoral researchers
- The TRIUMF undergraduate co-op program is one of the most high-demand placements in the country, with the January 2021 intake receiving nearly 4000 applicants for 24 positions – ~0.6% acceptance rate
- TRIUMF is also working closely with BCIT and technical colleges to support more work integrated learning opportunities



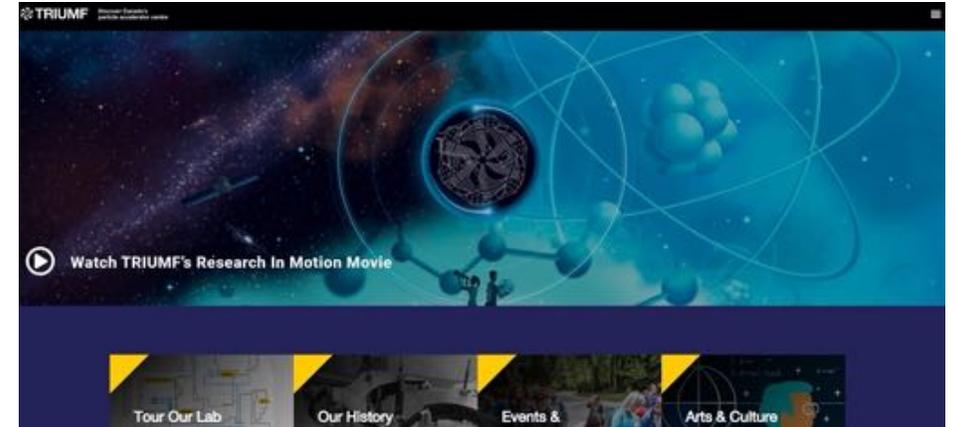
TRIUMF hosted 223 students & postdocs in 2020

People and Skills

TRIUMF has launched [a new interactive website](#); features include:

- [Interactive Map](#)
- [Interactive timeline](#)
- [ARIEL Infographic](#)

Additional enhancements and improvements are underway, as this will be a major platform for TRIUMF's public engagement going forward. TRIUMF will leverage this new platform to broaden our reach to new groups and communities.



Innovation and Collaboration

The real-world impact of TRIUMF's reach spans well beyond its expertise in physics, with application in:

- Medicine and drug development
- Materials development and testing
- Accelerator and detector technologies
- Mining and natural resources
- Border security
- Oil and gas exploration
- Data sciences



TRIUMF
INNOVATIONS



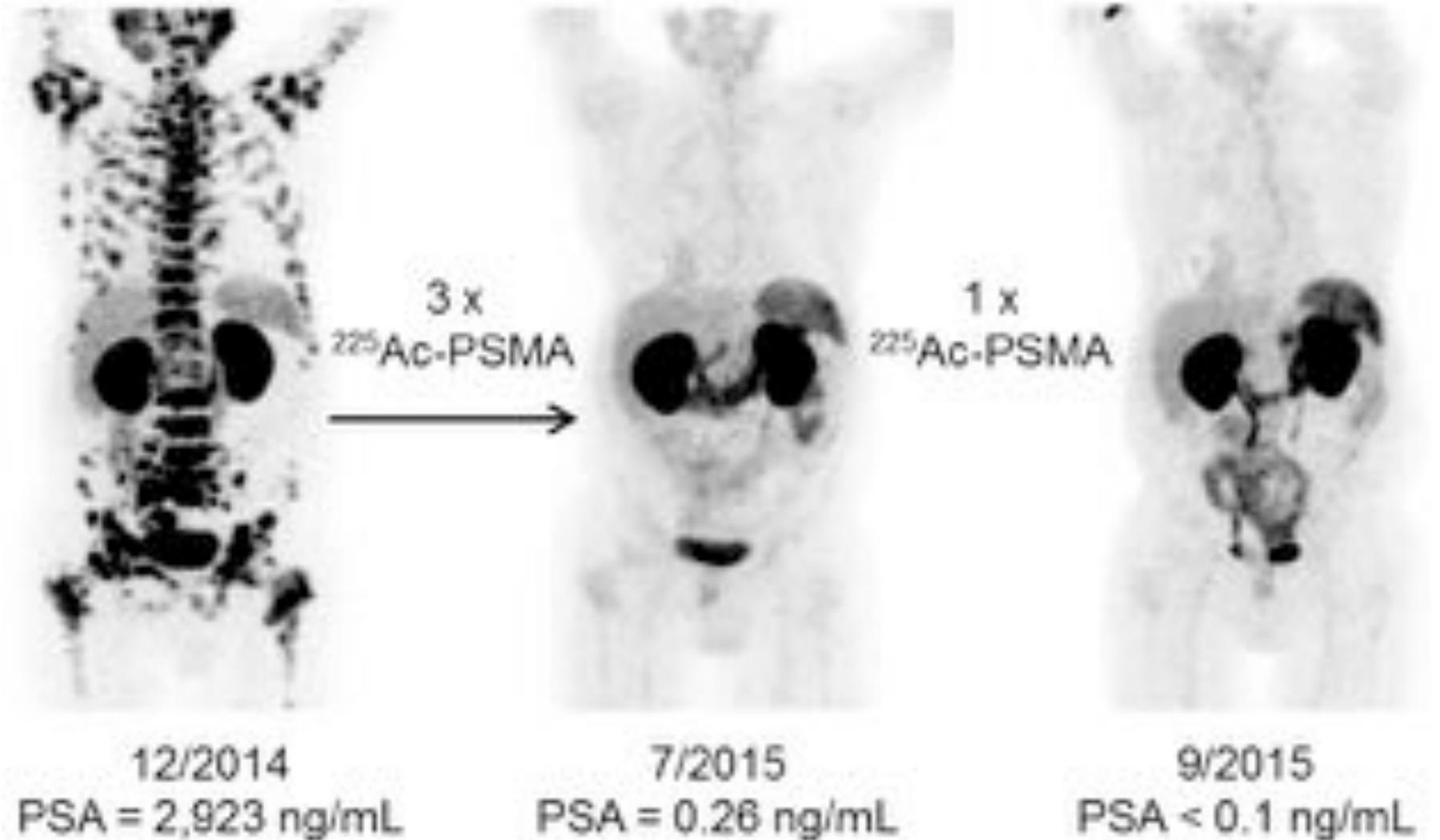
Innovation and Collaboration

Emerging Opportunities: Targeted α Therapy

Prostate cancer patient before and after treatment with ^{225}Ac -PSMA

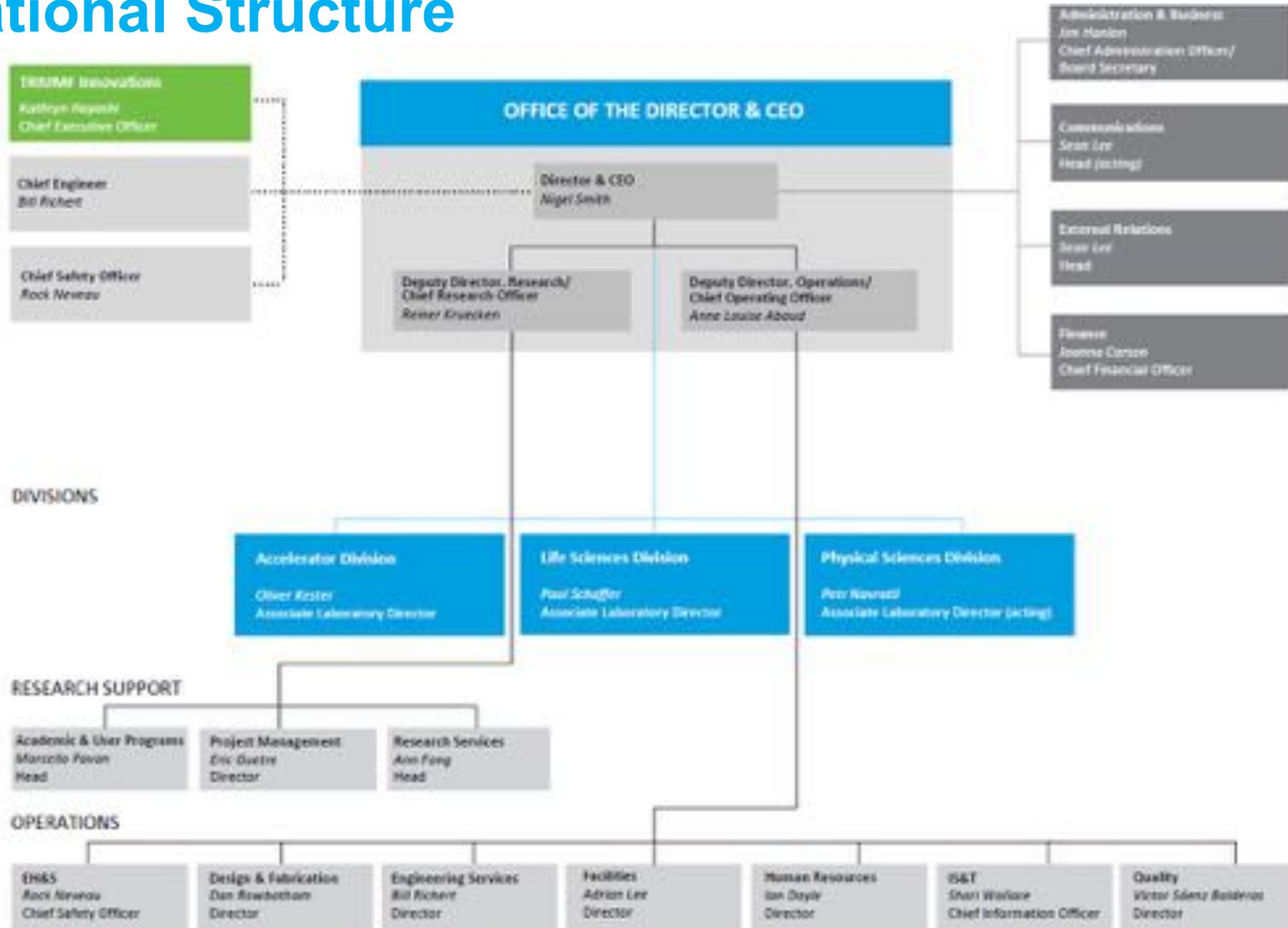
Canada's entry into this promising area of research will be enabled by TRIUMF and IAMI

See rarestdrug.com



Structure & Governance

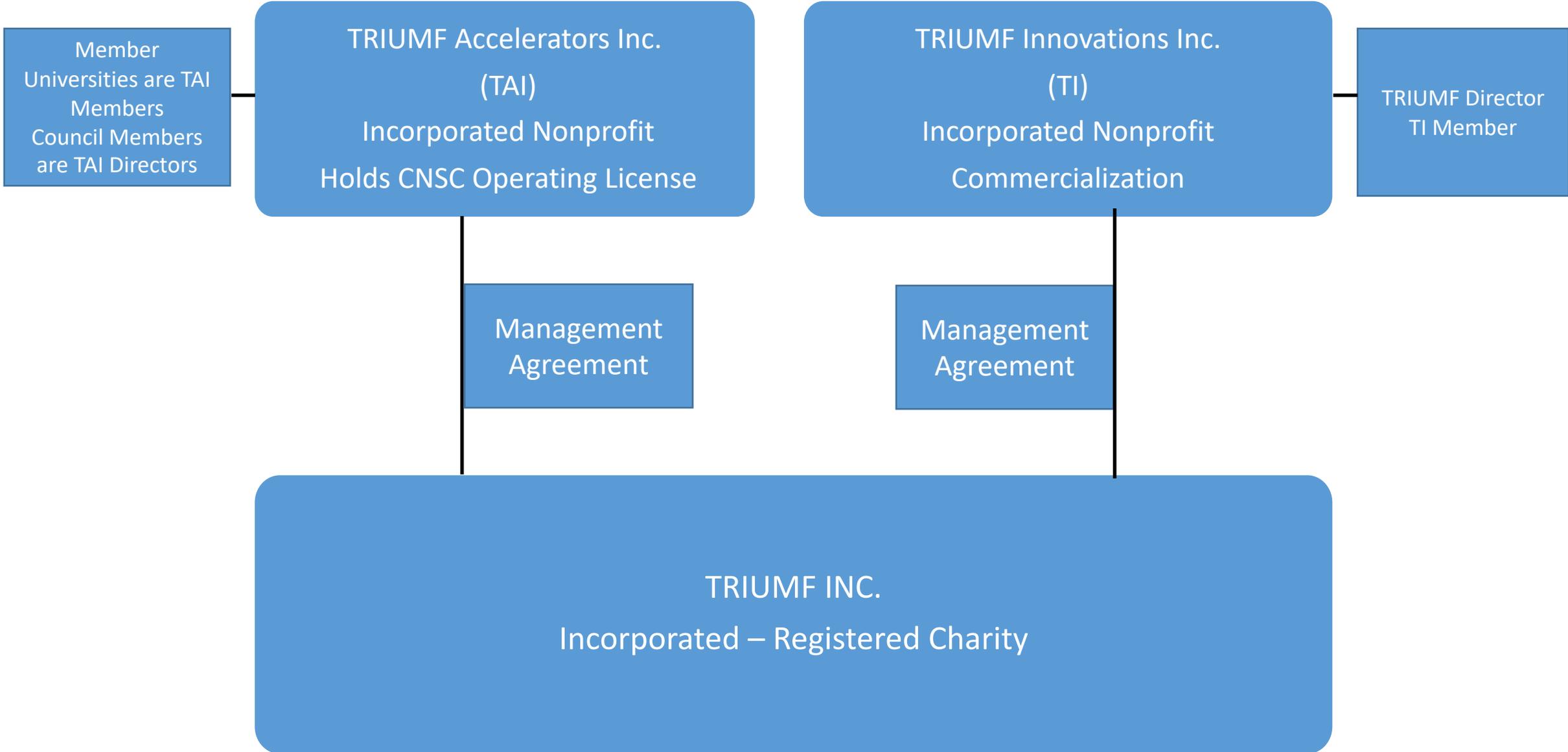
Organizational Structure



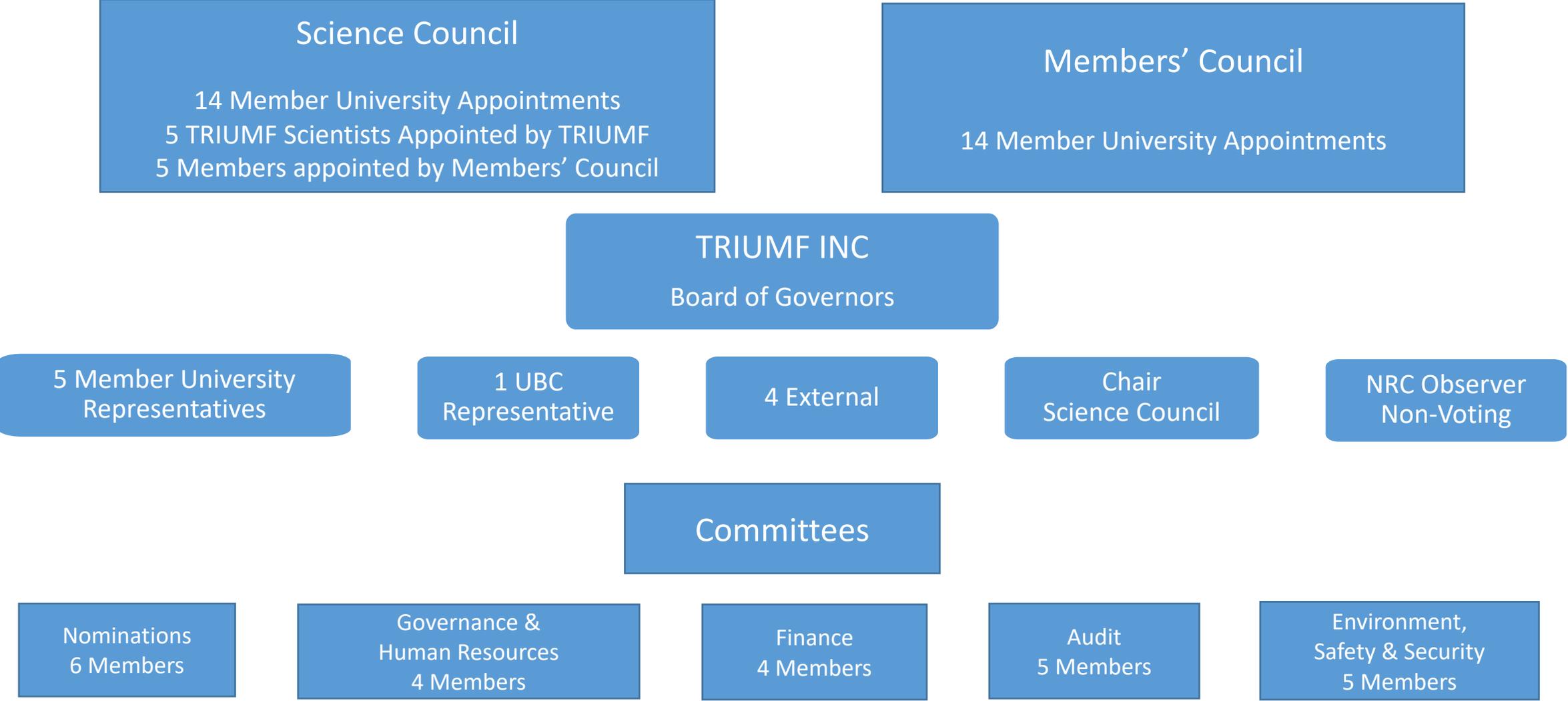
TRIUMF's Governance Has Changed

- Effective June 1, 2021, TRIUMF began operating as an incorporated non-profit with charitable status
- This new governance model includes a streamlined, skill-based Board of Governors, which was pursued to deliver more proactive decision-making, greater accountability, and a renewed focus on the science and stewardship of TRIUMF. Crucially, these changes will not alter TRIUMF's relationship with its Member Universities, who will continue to own the laboratory
- The change does not affect existing relationships with funders and government partners, including the National Research Council (NRC) and the Natural Sciences and Engineering Research Council (NSERC)

TRIUMF Governance (Pre-incorporation)



TRIUMF Governance (Post-incorporation)



Members' and Science Councils

The Members' Council is the forum for the Member Universities to:

- Discuss and determine fundamental strategic, operational, and governance matters for TRIUMF, as identified in the bylaws
- Exercise and discharge their rights and responsibilities as members of TRIUMF
- Discuss matters submitted by the Board for consideration and approval

The Science Council is intended to be an advisory body to the Board of Governors for the purpose of providing advice and input to the Board on:

- The scientific direction of TRIUMF under the Five-Year Plan
- TRIUMF's engagement strategy with the scientific community and major funders of TRIUMF
- TRIUMF's scientific risk appetite statement and major scientific risks
- Such other matters requiring input of the Science Council, as may be determined by the Board

Board of Governors

The Board of Governors is responsible for managing or supervising the management of the activities and affairs of TRIUMF. The Board is accountable to the Members' Council, and, as prescribed in TRIUMF's Bylaws; certain fundamental strategic, operational, and governance matters may only be approved by the Members' Council.

Composition: (11)

- Five Member university representatives
- One UBC representative
- Four external representatives
- Science Council Chair

Observer (1)

- National Research Council - Non-voting

20-Year Vision

Towards a 20-year Vision for TRIUMF

Launching from the priorities of Five-Year Plan 2020-25 and guided by our Vision, Mission and Core Values we project ~20 years into the future

Output: High-level 20-year Vision Document in spring 2022

Purpose:

- To articulate TRIUMF's purpose and ambitions for future accomplishments
- To position TRIUMF in the Canadian and international science ecosystems
- To guide the development of the next 5-Year Plan(s)

Target audience:

- University Presidents, NRC, Tri-Agency & CFI Presidents
- Federal & Provincial Governments, Chief Science Advisor
- General Public (at least in communications strategy)



Phases of the TRIUMF 20-year Vision development

Phase 1: Visioning and listening (Fall 2020 – Summer 2021)

A broad spectrum of stakeholders was be engaged through various means to capture the full diversity of ideas and perspectives of our community

Phase 2: Convergence on vision framework (Summer – Fall 2021)

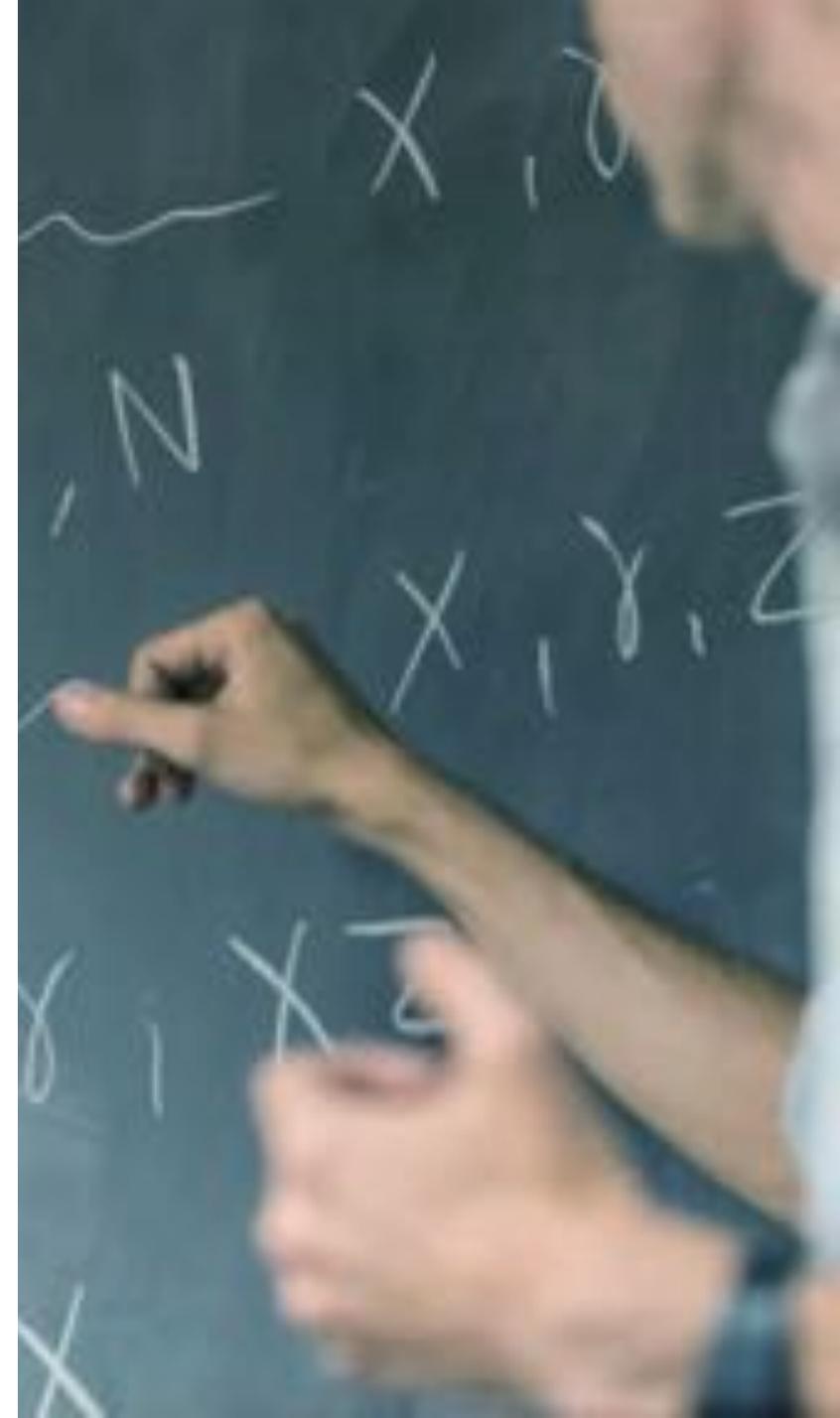
Based on the input received, the high-level pillars of the vision and supporting elements will be developed and refined through consultations

Phase 3: Finalization (Winter 2022)

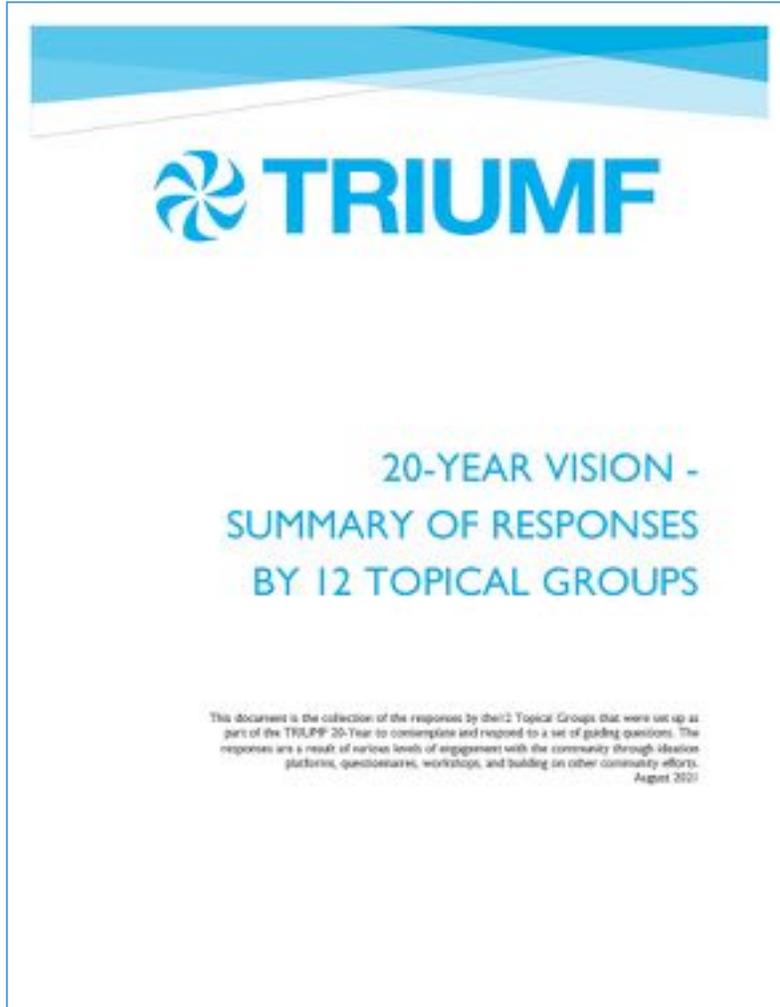
The 20-year Vision document will be drafted, refined, and the final version approved by the TRIUMF Board

20-Year Vision Steering Committee

- Alan Bernstein
President & CEO CIFAR
- Rob Dunlop
Former ADM ISED
- Danika Goosney
VP Grants, NSERC
- Digvir Jayas
Board
VPRI University of Manitoba, TRIUMF
- Dermot Kellerher
Dean, Faculty of Medicine, VP Health UBC
- Bob Kowalewski
University of Victoria, Former PPAC Chair
- Ania Kwiatkowski
TRIUMF, EDI Committee chair
- Sylvain Lévesque
CFO, DBC Group, TI Board
- David MacFarlane
SLAC, Former ACOT Chair
- Julie Moskalyk
Science Director, Science North
- Karen Mossman
VPR McMaster University, TRIUMF Board
- Gilles Patry
CEO, U15
- Julia Philips
Chair
US National Science Board, Former IPRC
- Caterina Ramogida
SFU/TRIUMF, TUEC past chair
- Nigel Smith (chair)
TRIUMF Director & CEO
- Geneviève Tanguay
VP Emerging Technologies, NRC



Phase 1 Summaries



[Collection](#) of responses to the Guiding Questions
[Collection](#) of topical Vision Summary slides

Guiding Questions

- What is TRIUMF today?
- What trends and changes will shape TRIUMF's future?
- What will TRIUMF be?
- What will TRIUMF have accomplished?
- What will TRIUMF be doing and what will TRIUMF not be doing anymore?
- What will TRIUMF look like?



Phase 1 – Science Week

At Science Week 2021 we presented

- assumptions about the broader environment in 20 years
- assumptions about TRIUMF in 20 years
- high-level statements sketching the outlines of the full picture of TRIUMF's 20-year vision
- each high-level statement is supported by several supporting statements

Full Science Week Slide Deck: <https://www.triumf.ca/sites/default/files/20-year%20Vision%20Science%20Week2021.pdf>



Phase 2 – Convergence

Our vision for the next 20 years must be ambitious and credible.



Phase 2 – Convergence



Overarching Direction

In 20 years, we see TRIUMF delivering world-class fundamental and convergence research, being instrumental in Canada's efforts towards sustainability that leverage multi-disciplinary, multi-sector collaboration, and its strategic Big Science assets.

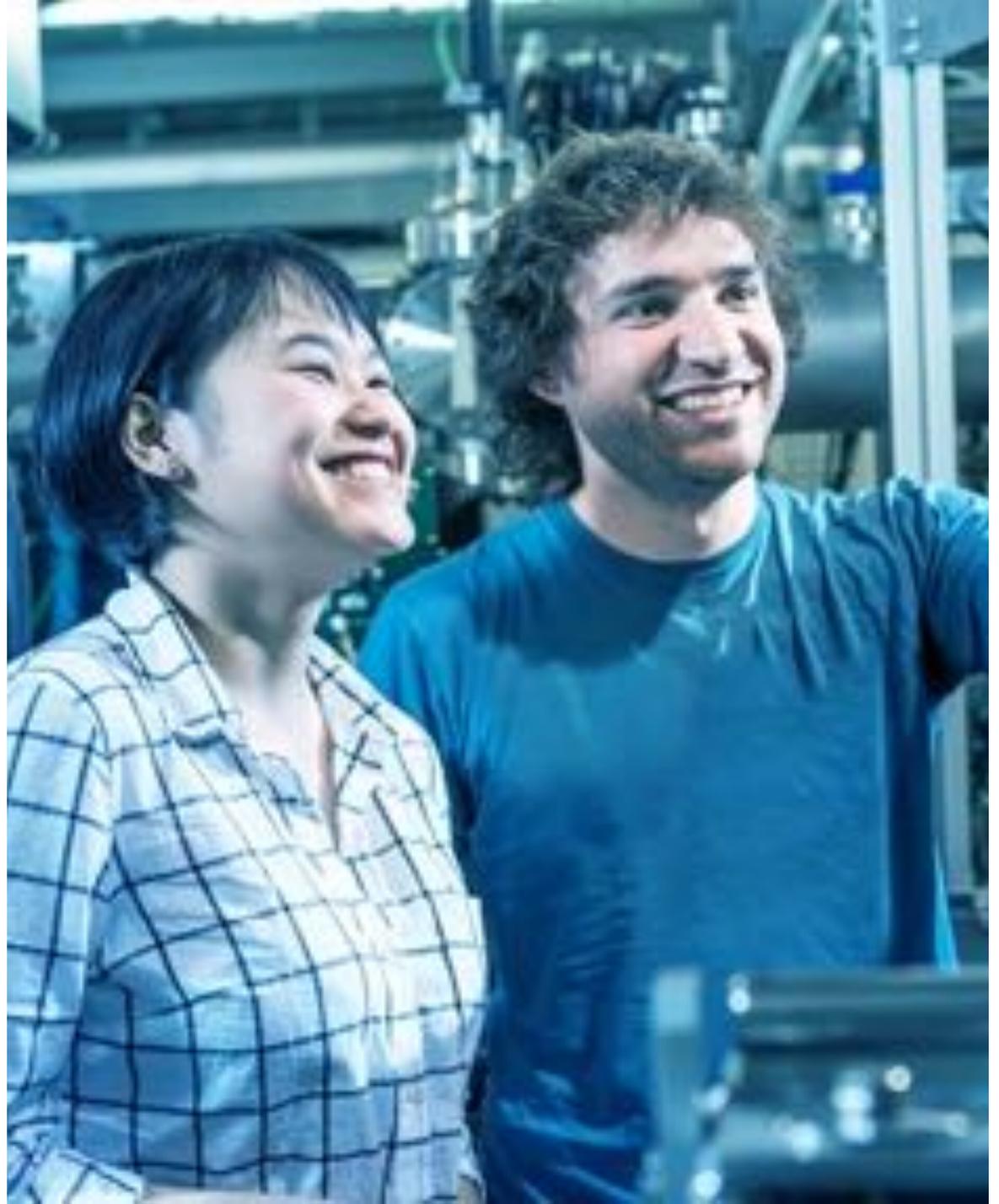
Phase 2 – Convergence

High-level Positioning Statements

1. As Canada's particle accelerator centre and radioisotope hub for science, medicine, and industry, TRIUMF delivers world-class fundamental and use-inspired research for societal benefit.
2. TRIUMF is recognized and leveraged as a strategic Canadian asset with unique infrastructure, expertise, and capabilities, to not only answer the biggest scientific questions, but also to address global societal challenges through convergence research, and enable Canada to react rapidly to emerging national needs.
3. TRIUMF is a catalyst for and a key player in Canada's coordinated Big Science enterprise that delivers world-class science and innovation through large scale infrastructure and secures our domestic capability to address complex challenges.

Phase 3 – Finalization

- 20-Year Vision document
 - Will be drafted by professional writer (Clare Walker)
 - Guidance from Steering Committee
- Document structure confirmed in November
- High-level draft ready end of 2021
- Full draft ready in early 2022
- Final draft presented to ACOT in spring 2022
- Release in spring 2022 with Board approval



Physics in Canada

The Bulletin of the Canadian Association of Physicists
Bulletin de l'Association Canadienne des Physiciens

Vol. 20, No. 2, June 1964

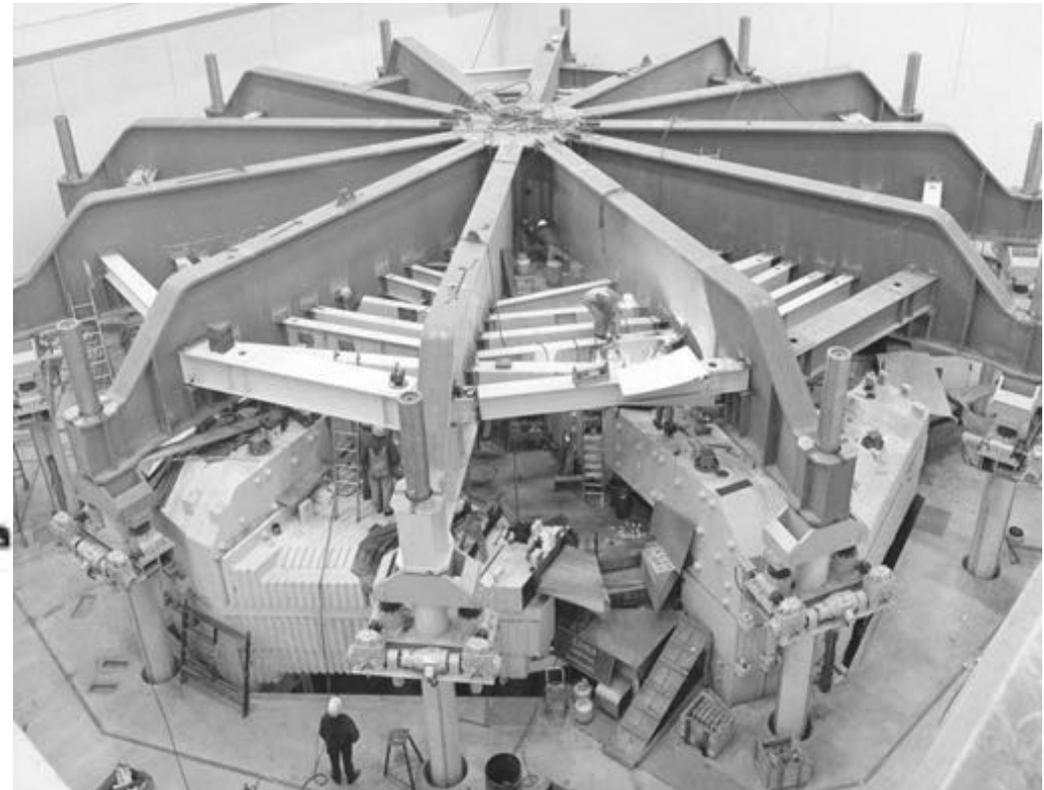
ANNUAL CONGRESS, JUNE 10-13

THURSDAY, June 11, 9:00 a.m.

Session 1. INVITED PAPERS ON PHYSICS IN CANADA
Paul Lorrain, Chairman

- 1.1 THE ROLE OF FUNDAMENTAL PHYSICS IN CANADA
by G. Laurence, President, Atomic Energy Control Board
(45 minutes)
- 1.2 WHITHER CANADIAN PHYSICS?
by L. E. Howlett
(45 minutes)

TRIUMF founded 4 years later...





Thank You!

www.triumf.ca

@TRIUMFLab



Supplemental Slides

Large Scale

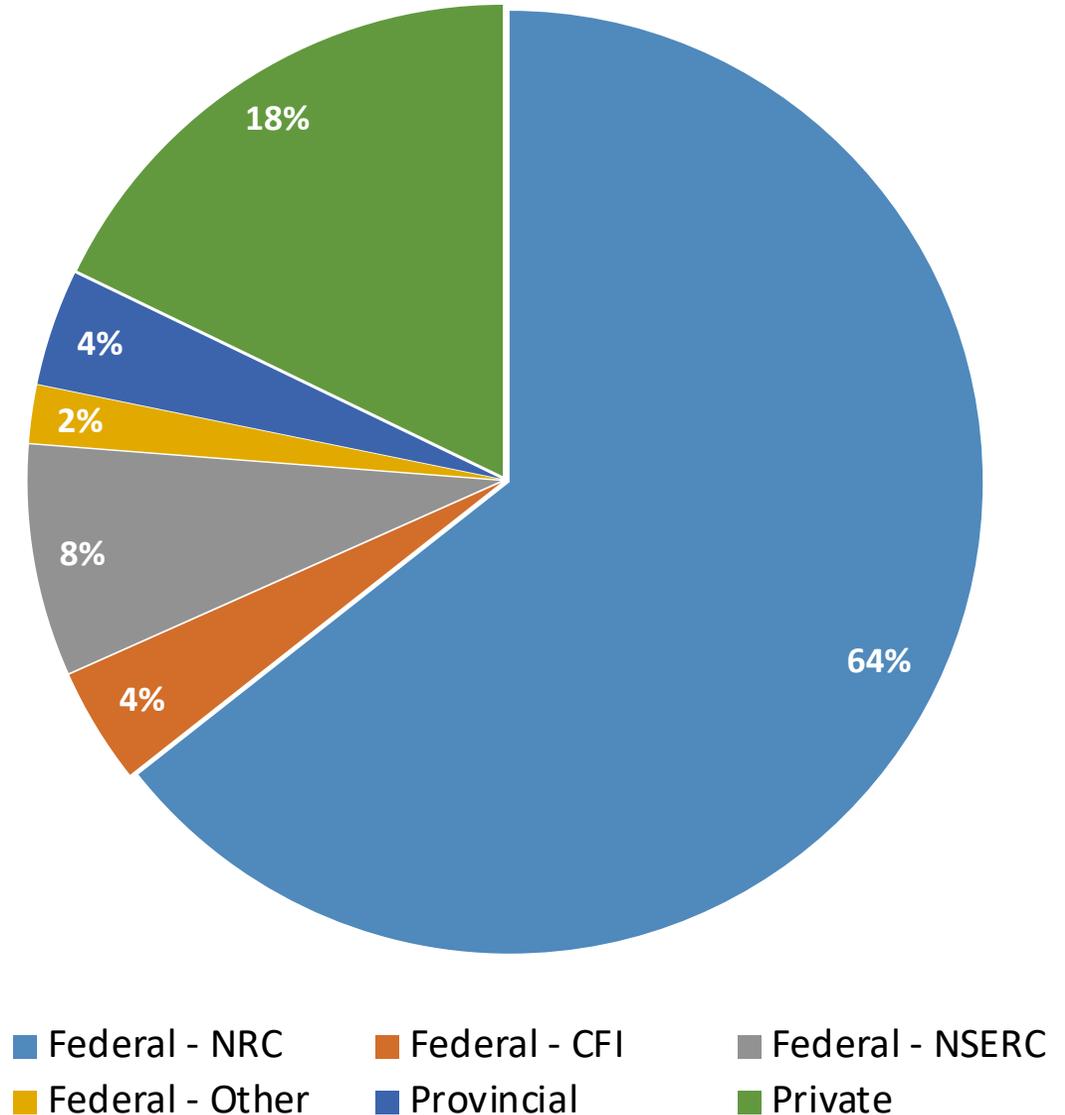
FY20/21:

\$89.1 M Total Revenues

~560 Employees

Budget 2019: \$292.7M
allocated for core operations (via NRC) for 2020-25!

Revenue Sources (2020-2025)



Operations

- Federal government:¹ \$303.1M

Capital Expenses

- Federal government:² \$26.5M
- Provincial government: \$18.3M
- Other:³ \$3.4M

Sponsored Research

- Federal funders:⁴ \$37.0M
- International collaborations:⁵ \$8.6M
- Canadian collaborations: \$6.2M

Private Sector

- Industrial partnerships:⁶ \$27.8M
- Royalties, commercial revenue & interest:⁷ \$36.7M

Total: \$467.6M

1 – Comprised of National Research Council support (including the \$25M infrastructure funding + \$10M HL-LHC support), as well as initial operation funds tied to Canada Foundation for Innovation projects

2 – Comprised of funding from the Canada Foundation for Innovation, Infrastructure Canada, Western Economic Diversification

3 – Comprised of funding from research partners for the Institute for Advanced Medical Isotopes

4 – Comprised of funding from the Tri-Council agencies (NSERC, CIHR, and SSHRC) and Natural Resources Canada

5 – This includes funding that flows to TRIUMF from international partners (i.e.: VECC partnership with TRIUMF for ARIEL)

6 – Includes funds received from BWXT and TRIUMF Innovations

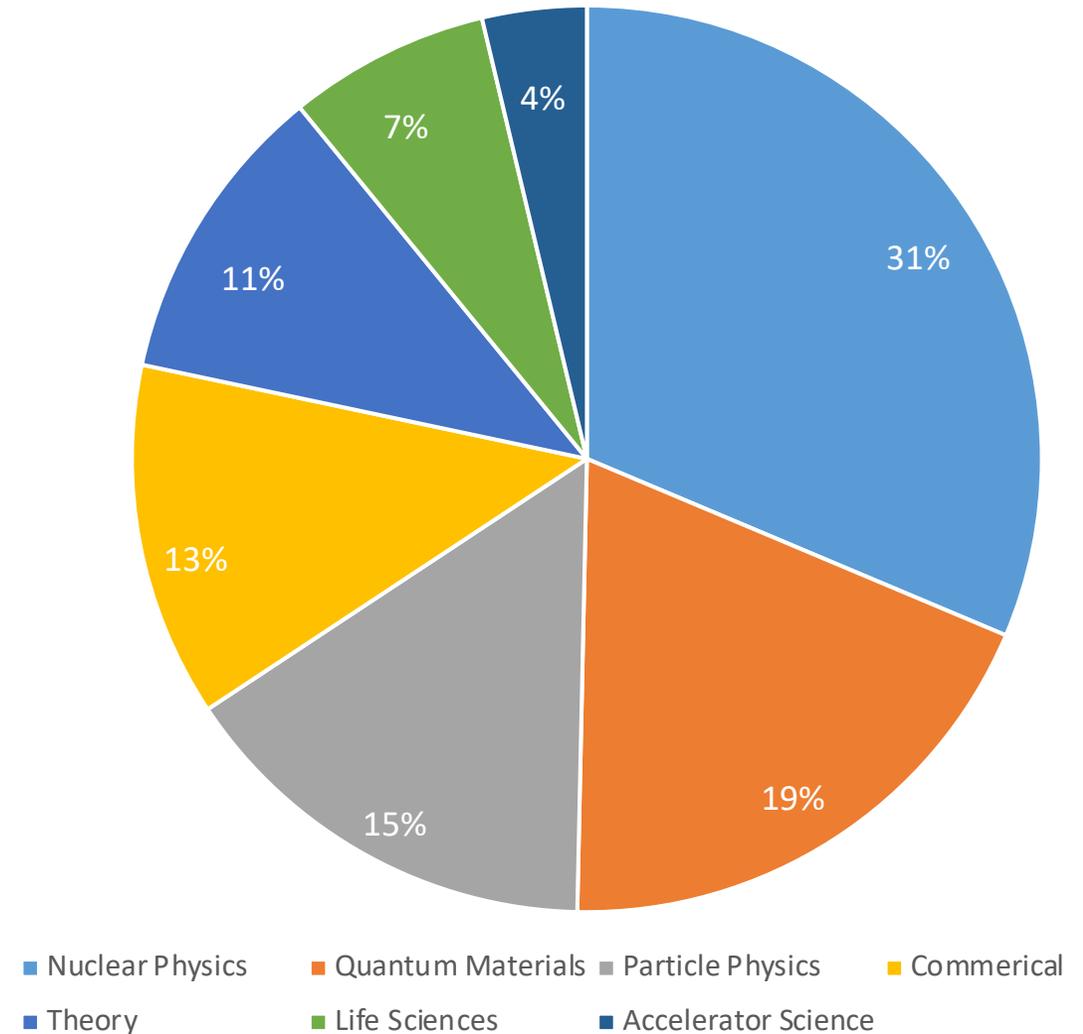
7 – All income is reinvested in TRIUMF

Multidisciplinary

1186 Scientific Users
and Visitors

* As the last full year before the outbreak of the COVID-19 pandemic, these values are most representative of TRIUMF's community

Scientific Users and Visitors by Field (2019*)





TRIUMF users come from over 40 Countries