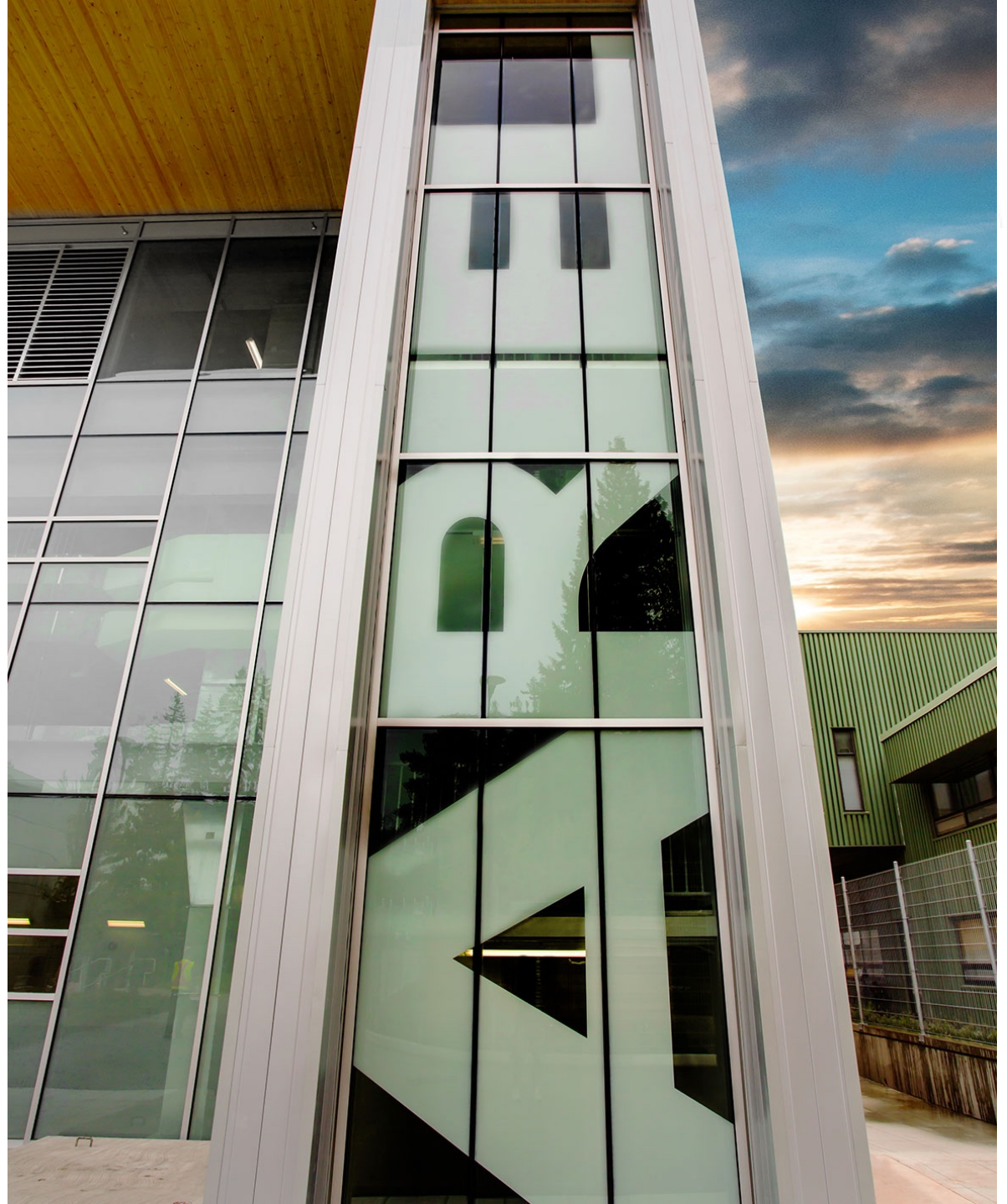
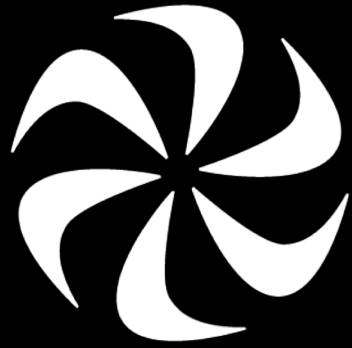


TRIUMF in the ARIEL Era

Five-Year Plan 2020-2025

Reiner Kruecken
Deputy Director, Research





TRIUMF

50 anniversary
anniversaire

Five Year Plan 2020-2025

<https://fiveyearplan.triumf.ca/>

- Articulates TRIUMF's vision and mission
- Communicates goals and priorities for 2020-2025 & beyond
- Lays out an action plan, including a high level budget
- Makes the case for core operational funding
- Ensures the continued relevance and success of TRIUMF



How did we get here?

- Internal bottom-up strategic planning process with SWOT analysis for all areas of the lab
- Internal and external consultation through Town Halls, surveys, Science Week, PPAC evaluation
- Prioritization based on risk and opportunity analysis to ensure that plan is optimal
- Strategic Plan and Implementation Plan articulate the outcome of this process
- Five-Year Plan 2020-2025 approved Board of Management



TRIUMF delivers value to Canada across three critical dimensions

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

Platforms for sustained success

ADVANCED RARE ISOTOPE LABORATORY (ARIEL)

Revolutionizing the study of isotopes
for science, medicine, and business



INSTITUTE FOR ADVANCED MEDICAL ISOTOPES (IAM)

A world-class centre
for advanced isotope
research and development



TRIUMF INNOVATIONS

Translating scientific discovery
into commercial opportunities



Science and Technology

- **Goal 1:** Make groundbreaking discoveries across TRIUMF's multidisciplinary research portfolio
 - *Why? To strengthen Canadian leadership in science and technology*
- **Goal 2:** Reinforce TRIUMF as a globally leading particle accelerator centre
 - *Why? To make Canada a destination of choice for talent, ideas, and international partnerships*

TRIUMF's research portfolio, from fundamental to applied:



Expands the boundaries
of human knowledge



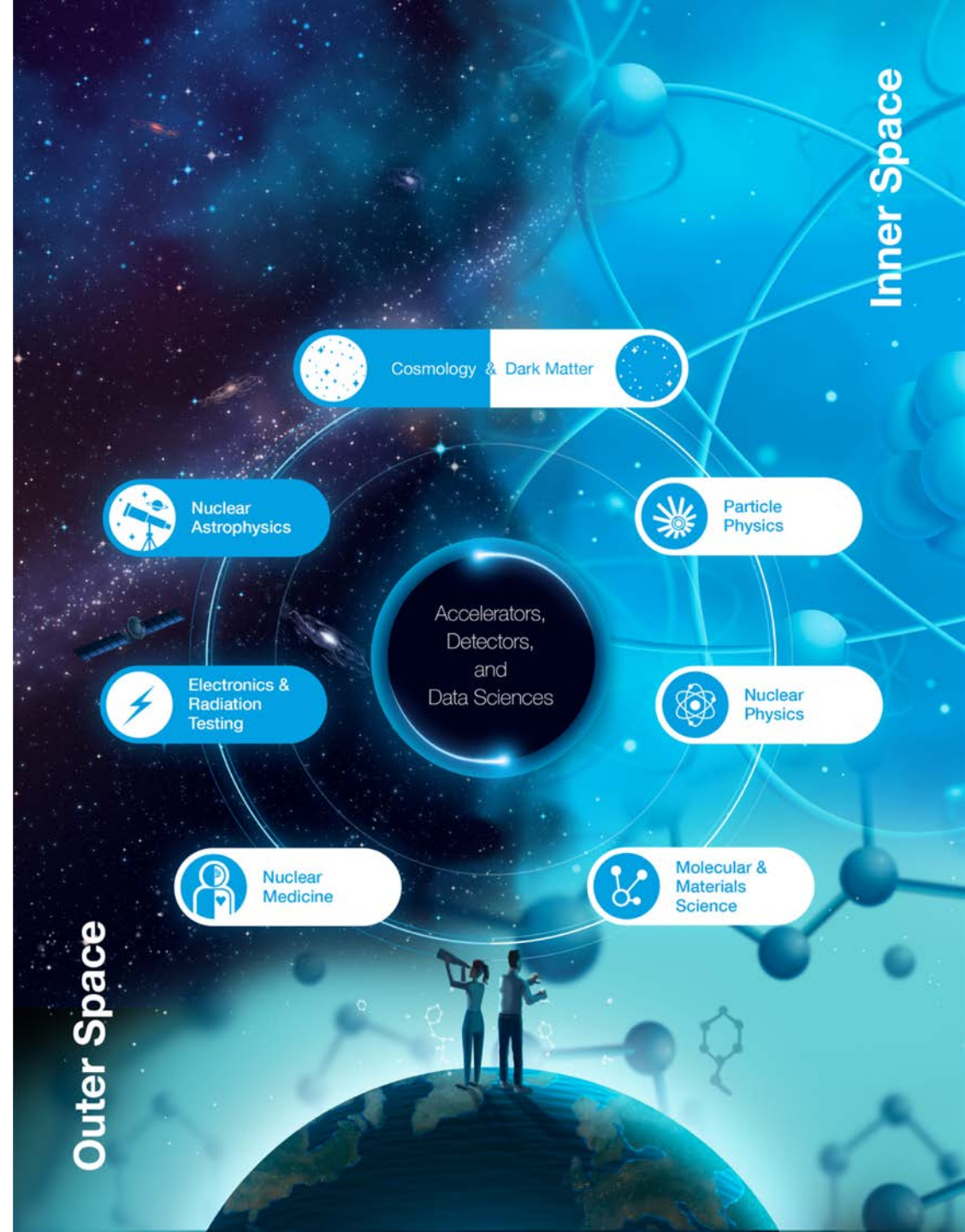
Advances the treatment
of critical diseases



Develops new technologies
and innovations



Deepens our understanding
of the natural world



Science and Technology

Unleashing the full power of our accelerator complex

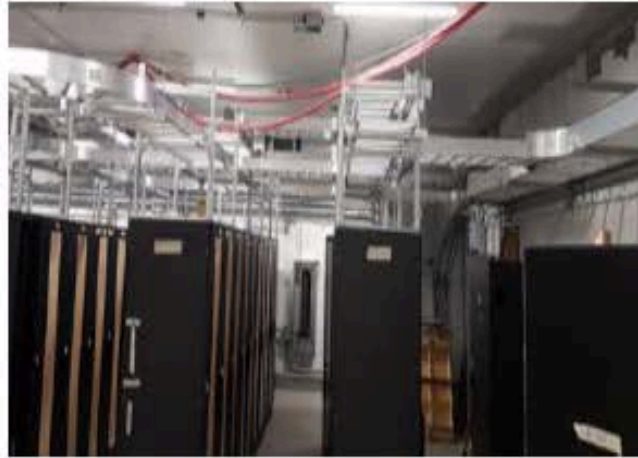
- Complete and operate ARIEL
 - Most powerful ISOL rare-isotope beam facility worldwide
 - 50 kW protons x2
 - 100 kW electrons
 - Purpose-built multi-user RIB facility
 - Cleaner beams, new beams
 - More experiments
 - Longer beamtimes
 - Triple rare isotope capabilities, enabling more science, more training and more commercial activity



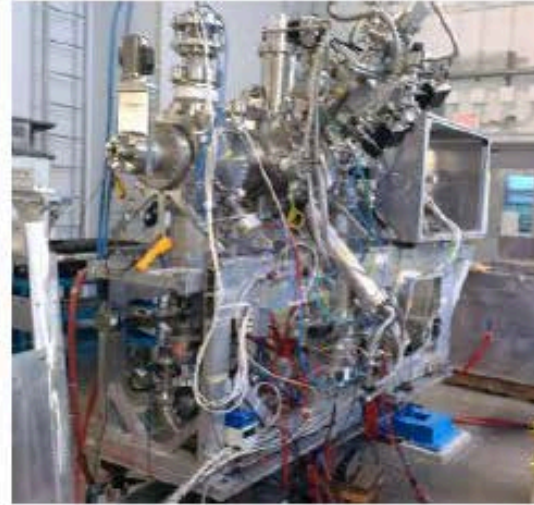
Recent Accomplishments



RFQ RF-tests



B1-Level racks completed



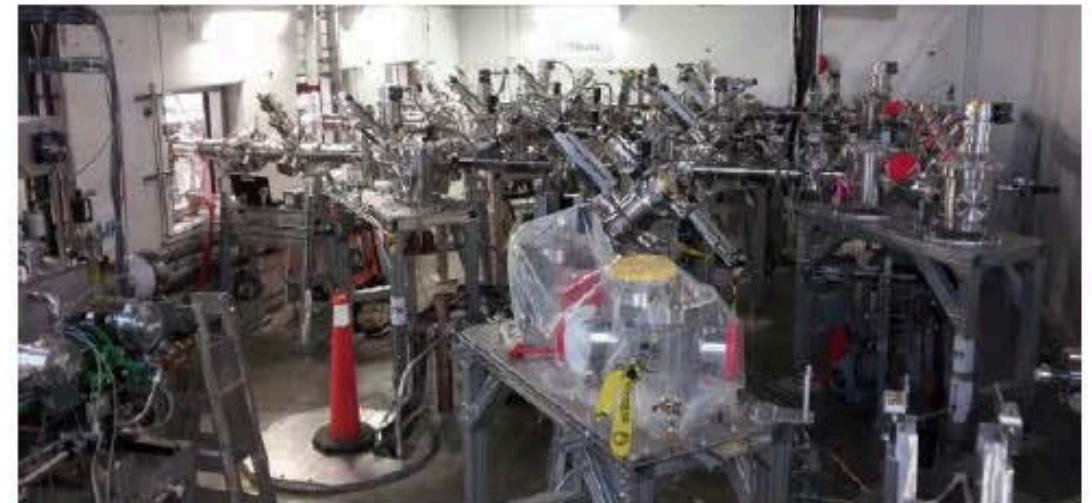
EBIS testing resumed
after collector repair



HRS mapping completed,
ready for installation



RIB beamlines,
yield station enclosure



RIB beamlines in ARIEL building

Science and Technology

Establishing TRIUMF as a global centre for nuclear medicine

- Launch IAMI – Institute for Advanced Medical Isotopes
 - Research and production facility for medical isotopes
 - TR-24 cyclotron with state-of-the-art GMP laboratories
 - Global centre for nuclear medicine research and radiopharmaceutical development





November 1, 2018

Science and Technology

Building a modern and inclusive organization

Attracting the best scientists to our world-class facilities

- Strengthen TRIUMF itself
 - Ensure equity, diversity and inclusion are central to every activity
 - Enhance programs to attract, retain, and develop talent
 - Renew site infrastructure to improve productivity
 - Develop continuous improvement culture and improve organizational structure



Operate Safely and Effectively – DDO / COO

- Anne Louise Aboud
 - McGill Engineer, McGill MBA
 - Broad range of prior experience:
 - Technical Sales, Dow Chemical
 - Product Manager, Imperial Chemical
 - Business Development, GE Canada
 - Senior Vice President, TD Ameritrade
 - Senior Vice President, Lifelabs
 - Consultant, Baxter Canada and Rogers Communications
- Started June 1





Jon Aoki

Nigel Hessey

Ania Kwiatkowski (Chair)

Hossein Rafighi

Carla Rodrigo

Monika Stachura

Maxine McKay (HR)

Operate Safely and Effectively – CDI

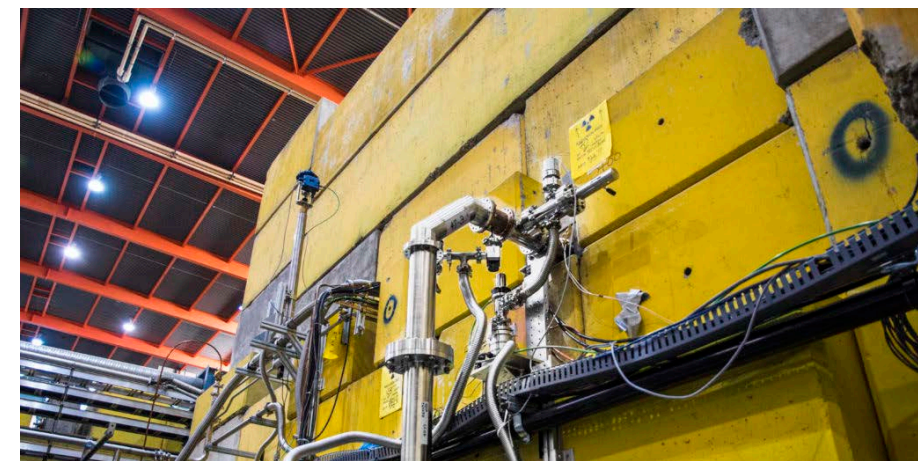
Committee on Diversity and Inclusion

- Conducted baseline demographic survey.
68% response rate
- Gender: 74% male 21% female
<1% non-binary
- Indigenous Persons: 1% yes 95% no
- Visible Minority: 25% yes 69% no
- Disabled: 2% yes 92% no

Science and Technology

Investing in state-of-the-art laboratory infrastructure

- Infrastructure Renewal – based on risk and opportunity analysis
 - Accelerator upgrades and refurbishments
 - 520MeV cyclotron (>90% reliable at 400 μ A)
 - ISAC targets & beam delivery
 - Upgrade Meson Hall infrastructure
 - MuSR beamlines and experiments
 - Robotic warm cell for BL1A beamline refurbishment & rad-waste management
 - UCN facility phase II & nEDM experiment
 - Renewal and upgrade of detector facilities



Major science & technology priorities

Leveraging our strength in accelerator science and detector technology

■ TRIUMF facilities

- ARIEL and IAMI completion and ramp up of operations (core budget)
- 520 MeV Cyclotron & ISAC targetry upgrades (core budget)
- Meson Hall upgrades and BL1A overhaul (core budget & CFI funding ~2023)
- betaNMR facility expansion (CFI funding ~2021)
- UCN source upgrade and nEDM experiment (CFI funded)
- Detector facility upgrades (CFI funding ~2021)

■ National and International Projects

- ATLAS upgrades (CFI funded)
- SuperCDMS Dark Matter (CFI funded)
- NuPRISM / HyperK (CFI funding ~2021)
- nEXO neutrinoless double-beta decay (CFI funding ~2021)
- HL-LHC cryomodules and beam dynamics (funded)

World Class Science – HL-LHC

\$10M Funding Announced: Crab Cavity Cryomodules



People and Skills

- **Goal 3:** Become a hub for interdisciplinary education and training
 - *Why? To prepare Canadians to compete in the knowledge and innovation economy*
- **Goal 4:** Inspire Canadians to discover and innovate
 - *Why? To increase access and opportunity, and strengthen Canadian society*

People and Skills



- Strengthen Canada's STEM pipeline
 - Expand TRIUMF's unique post-secondary education programs, offering a quality, hands-on, real-world experience
 - Graduate lectures on select topics, summer schools
 - Undergraduate work experiences, Engineers in Training, apprentices
- Promote diversity and inclusion, for federally designated groups and in accordance with Athena SWAN charter
 - Recruitment and retention strategies with regular review of metrics
 - Targeted recruiting and special scholarships
 - Relationship building with Indigenous communities

People and Skills

- Strengthen Canada's STEM pipeline
 - Better prepare postdocs and graduate students for careers outside academia
 - Entrepreneurship education
 - Communications training
 - Project management experience
 - Data science training
 - Leverage partnerships to attract international students and postdocs to Canada



People and Skills

- Empower future generations of discoverers and innovators
 - Take TRIUMF's outreach program nationwide
 - Establish TRIUMF as a hub for science communication and public engagement
 - Partner with like-minded organizations to carry TRIUMF's story into communities across Canada
 - Join with the BC Digital Supercluster to use VR and other digital technologies to engage urban and rural communities
 - Offer professional development experiences to teachers, science communicators, students, and postdocs



Connect to World – Outreach

Global Physics Photowalk 2018

- TRIUMF image takes **podium** in both jury and people's choice competitions in 2018 Global Physics Photowalk
- Featured in *Wired UK* and *symmetry*



See more competition photos via [#PhysPics18](#) hashtag

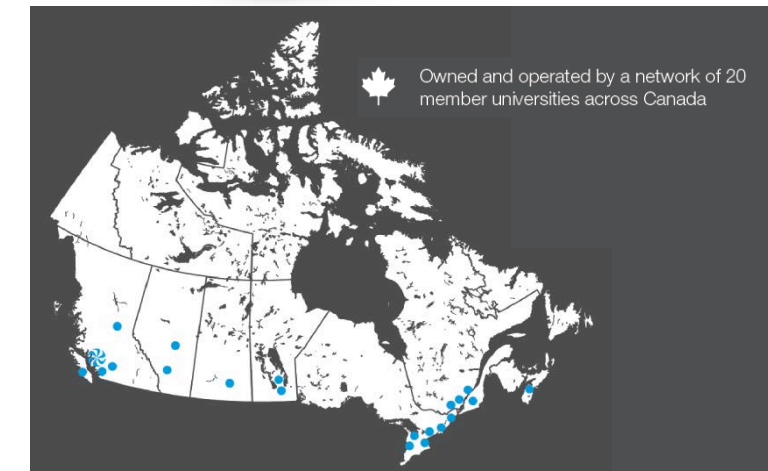
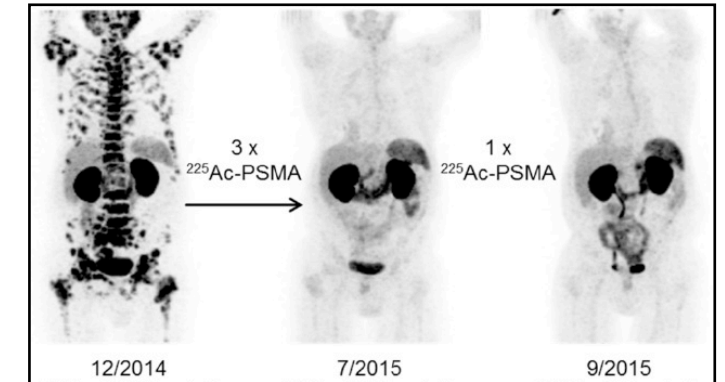
Innovation and Collaboration

- **Goal 5:** Translate knowledge and discovery into innovation
 - *Why? To develop new technologies to support business-led innovation and improve the lives of Canadians*
- **Goal 6:** Increase national and international collaboration
 - *Why? To strengthen Canadian competitiveness in global discovery and innovation*

Innovation and Collaboration



- Expand TRIUMF Innovations into a national centre for commercializing disruptive technologies
 - Medicine and drug development
 - Materials development and testing
 - Accelerator and detector technologies
 - Mining and natural resources
 - Border security
 - Oil and gas exploration
 - Data sciences
- Expand TRIUMF's national and international networks
- Leverage TRIUMF's networks to create teams to solve real-world problems and deliver tangible benefits to Canadians



The Rarest Drug on Earth



AVOCADO VIDEO


STORYHIVE
creativity connected by TELUS

Five Year Plan Summary

- Key outcomes

- Instill equity, diversity, inclusion across laboratory
- Fully operate ARIEL and IAMI, ensuring international leadership
- Expand quantum materials and data sciences programs
- Fully support Canadian university community, SNOLAB experiments and priority international projects
- Improve TRIUMF site to ensure reliable ARIEL operations
- Modernize management tools and implement process improvements
- Give special focus to talent development
- Strengthen programs in education, outreach, commercialization

Five Year Plan Budget

- Delivering the full Plan requires
 - \$353.1M core operating budget
 - Bottom-up budget guided by community priorities
 - \$320M core operation funds via NRC
 - \$5M/year increase over inflation
 - Supported by
 - \$23.1M commercial revenues & cost recoveries
 - \$10M Efficiency Savings
 - ~\$26M sponsored research funding
 - NSERC, CIHR, Mitacs, ...
 - ~\$55M capital investments (CFI + Provinces)
 - ~\$25M commercial revenues
 - ~\$10M WFO cost recoveries

CORE OPERATING BUDGET 2020-2025	M\$
Salaries and Benefits	244.1
Site Operating Costs	24.4
Electricity	24.9
Divisional MRO	26.2
Site Stewardship	11.6
Accelerator Refurbishments and Upgrades	10.7
Science and Technology Initiatives	6.1
Training, Outreach and User Support Initiatives	5.1
SUM	353.1
Commercial and WFO Revenues	23.1
Efficiency Savings	10.0
NRC ASK	320.0

TRIUMF's Five-Year Plan 2020-2025

- Is ambitious with clear goals and outcomes, delivering success across dimensions
 - Science and Technology
 - People and Skills
 - Innovation and Collaboration
- Enables Canadian scientists to continue making groundbreaking discoveries
- Reinforces TRIUMF's status as a globally leading accelerator centre
- Is the outcome of extensive strategic planning, consultation and priority setting
- Can be delivered with \$320M of core operational funding by the federal government
- Will leverage both commercial revenues (assuming modest growth) and additional competitive funding (CFI, NSERC, CIHR, etc.)
- **Ensures the continued relevance and success of TRIUMF**

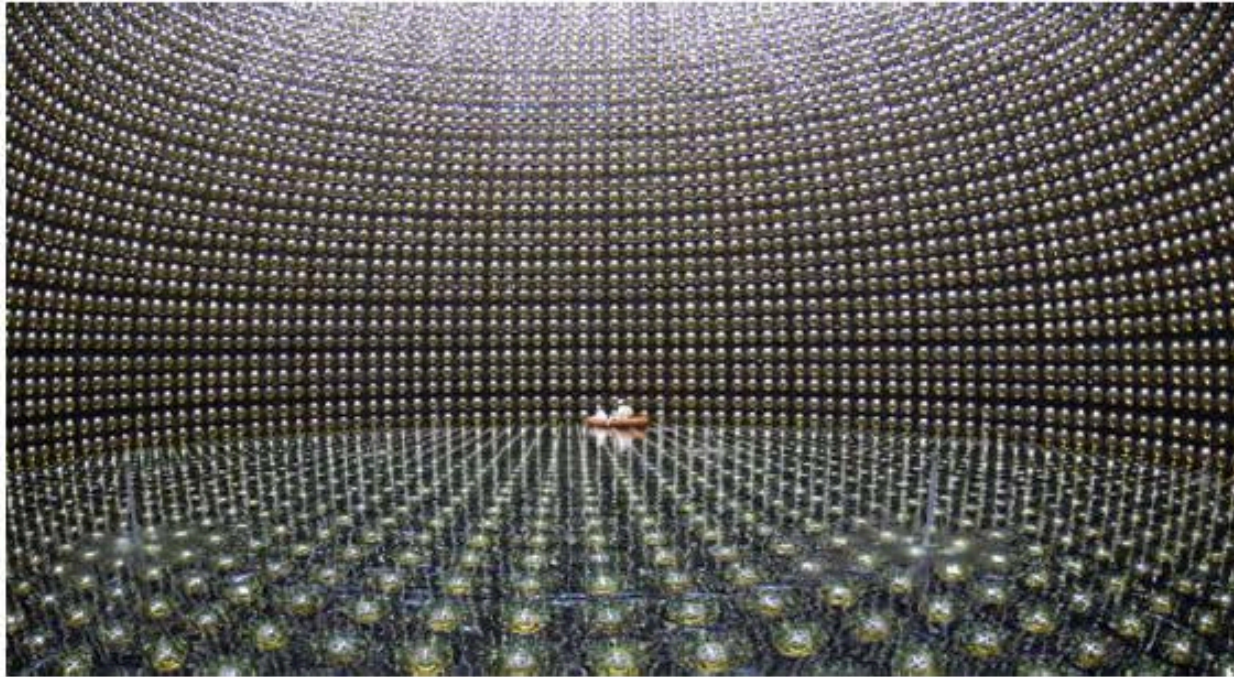
Thank you
Merci

www.triumf.ca

Follow us @TRIUMFLab



Hyper-K Seed Funding Secured



Nature: Lyman α transition observed in antihydrogen

Observation of the 1S–2P Lyman- α transition in antihydrogen

M. Ahmadi¹, B. X. R. Alves², C. J. Baker³, W. Bertsche^{4,5}, A. Capra⁶, C. Carruth⁷, C. L. Cesar⁸, M. Charlton³, S. Cohen⁹, R. Collister⁶, S. Eriksson³, A. Evans¹⁰, N. Evetts¹¹, J. Fajans⁷, T. Friesen^{2,10}, M. C. Fujiwara^{6*}, D. R. Gill⁶, J. S. Hangst^{2*}, W. N. Hardy¹¹, M. E. Hayden¹², E. D. Hunter⁷, C. A. Isaac³, M. A. Johnson^{4,5}, J. M. Jones³, S. A. Jones^{2,3}, S. Jonsell¹³, A. Khramov⁶, P. Knapp³, L. Kurchaninov⁶, N. Madsen³, D. Maxwell³, J. T. K. McKenna⁶, S. Menary¹⁴, J. M. Michan^{6,15}, T. Momose^{11,16*}, J. J. Munich¹², K. Olchanski⁶, A. Olin^{6,17}, P. Pusa¹, C. Ø. Rasmussen², F. Robicheaux¹⁸, R. L. Sacramento⁸, M. Sameed⁴, E. Sarid¹⁹, D. M. Silveira⁸, D. M. Starko¹⁴, G. Stutter², C. So¹⁰, T. D. Tharp²⁰, R. I. Thompson^{6,10}, D. P. van der Werf^{3,21} & J. S. Wurtele⁷

TRIUMF researchers

Makoto Fujiwara

David Gill

Konstantin Olchanski

Art Olin

Andrea Capra

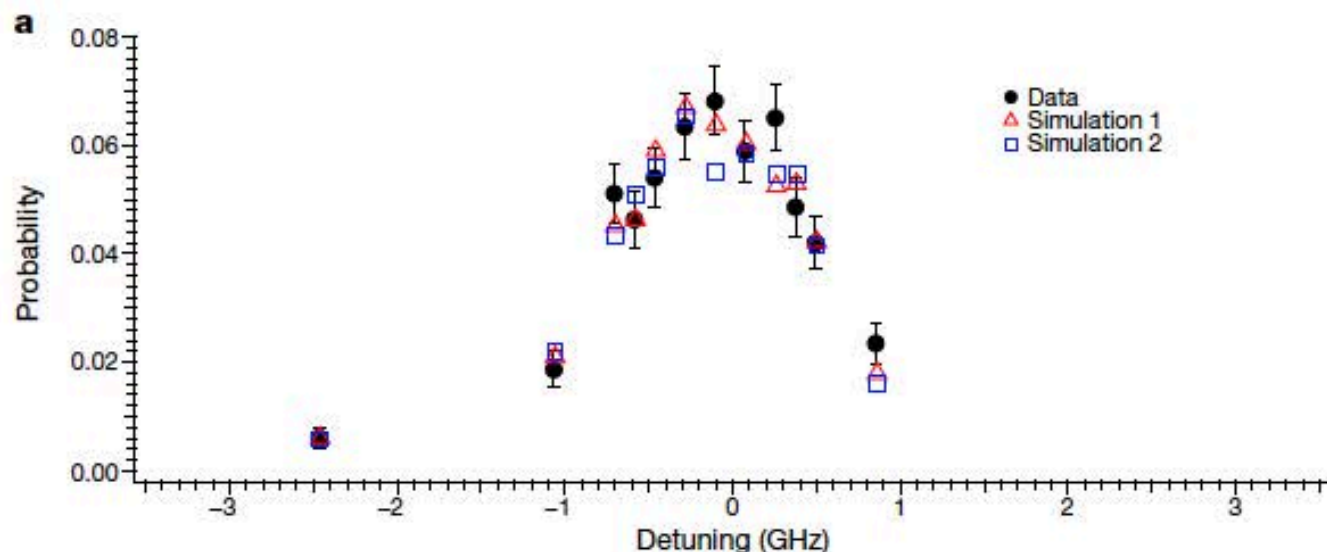
Rob Collister

Andrew Evans

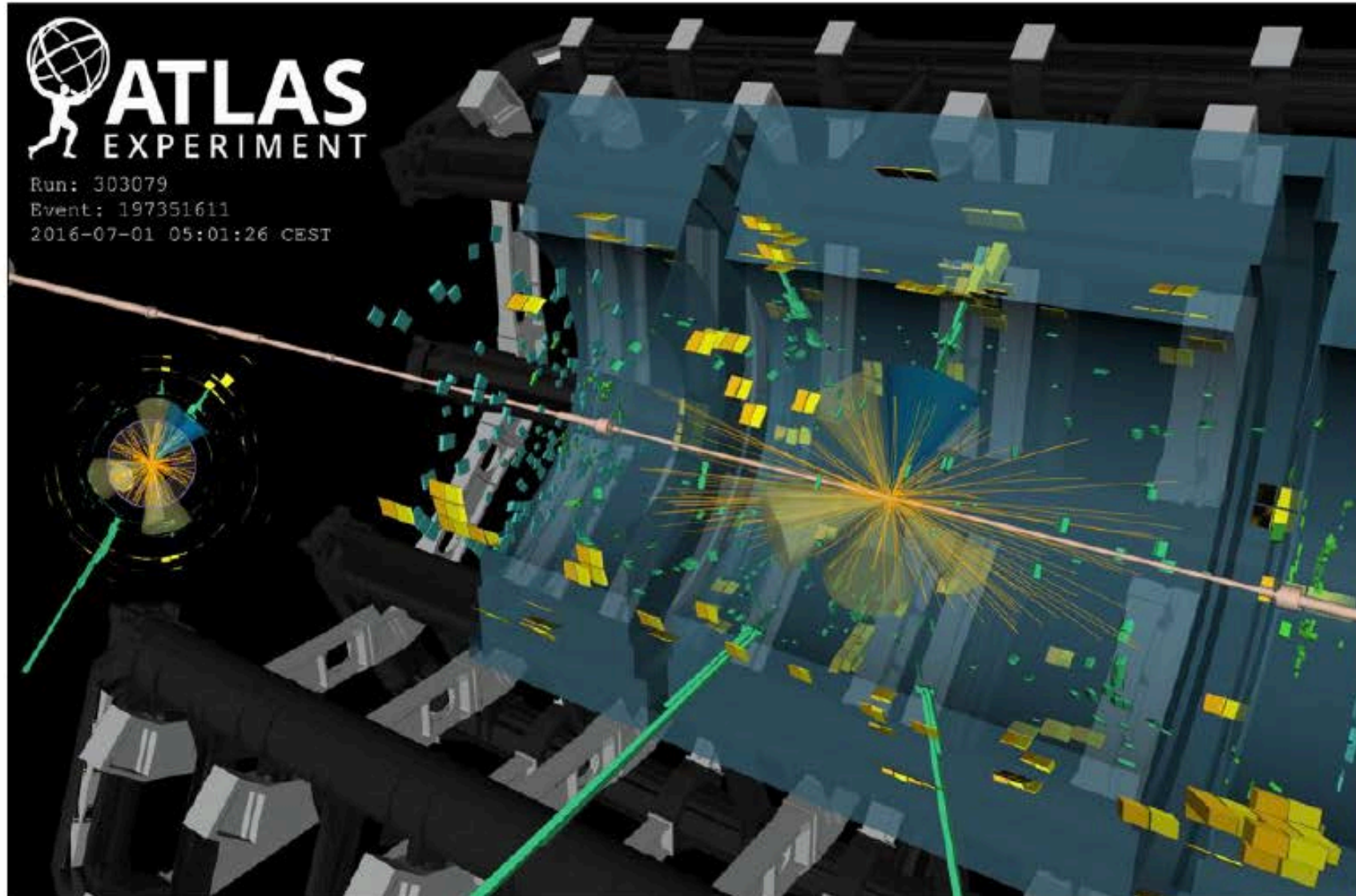
Alex Khramov

Joseph McKenna

Mario Michan



ttH coupling observed at 6.3σ



TRIUMF researchers

Alexander Held
(TRIUMF/UBC)

Jelena Jovicevic
(TRIUMF)

Oliver Stelzer-Chilton
(TRIUMF/UBC)

TRIUMF:

20 Member Universities



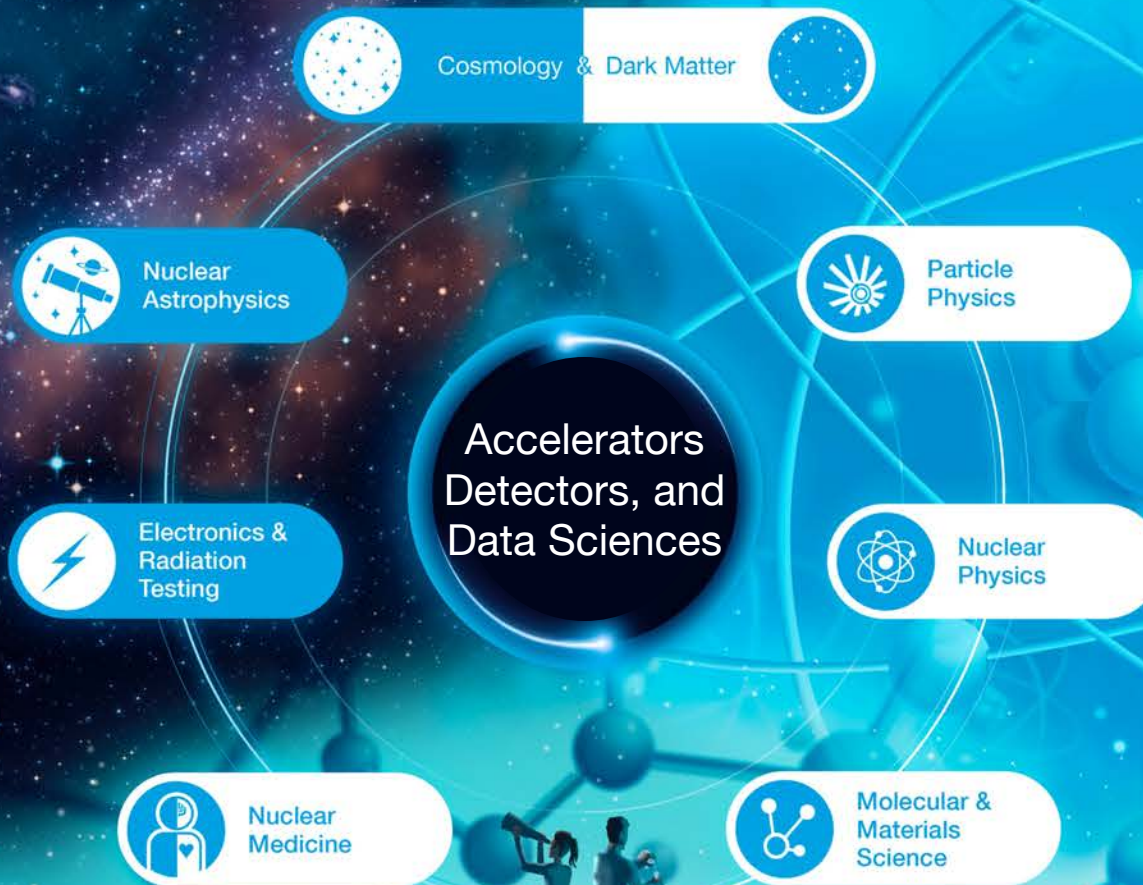
Three new since 2013. And more underway....

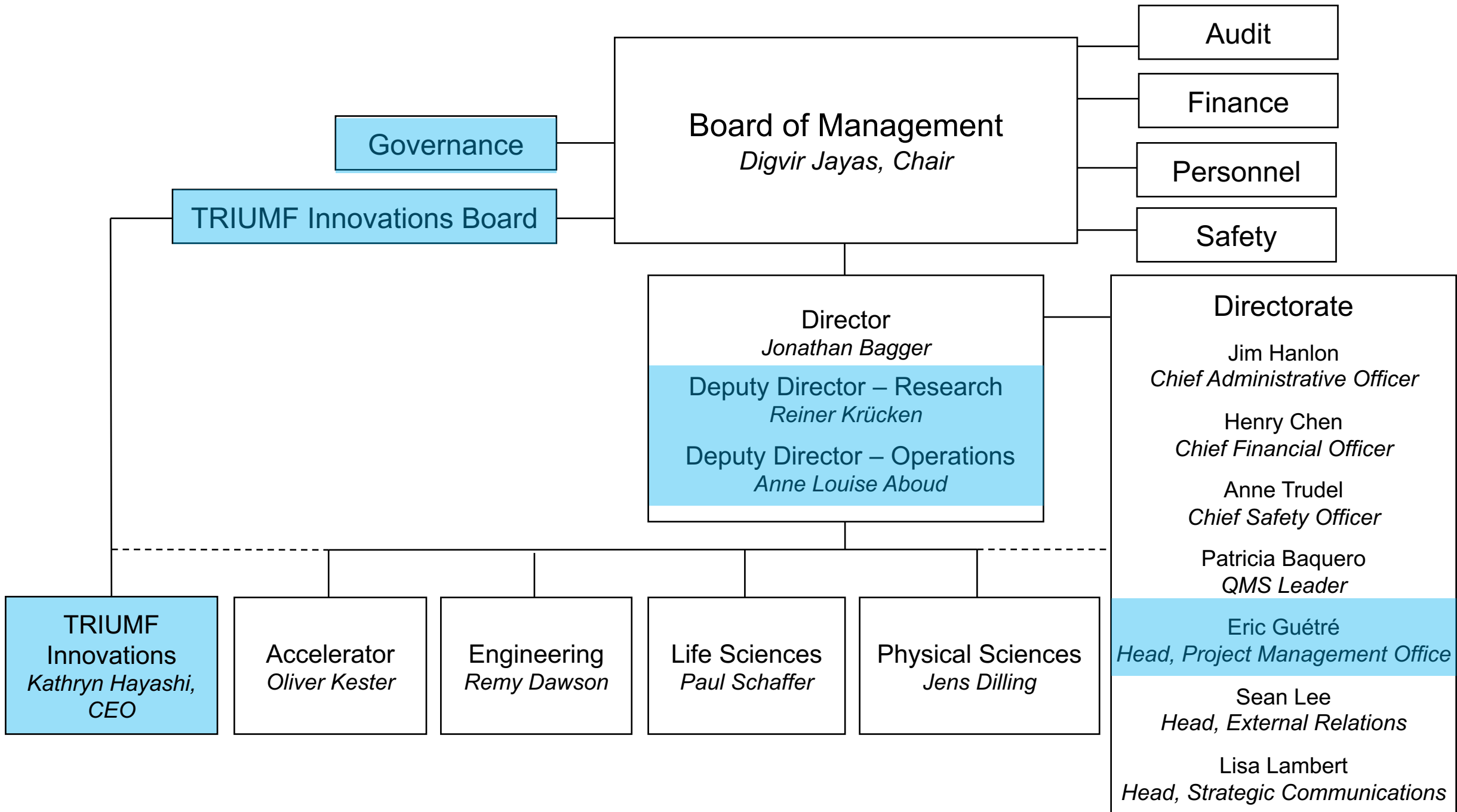


University owned and operated

Outer Space

Inner Space





Operate Safely and Effectively – Board Governance

- Board governance review progressing
 - Led by Vivek Goel, VPRI, Toronto
 - Foundational to Five-Year Plan
 - Assisted by Watson Advisors, Gowling WLG
 - Move from Joint Venture to Incorporated Non-Profit Charity
 - Still university owned and operated
 - Members' Council, Science Council, Board of Directors
 - Approved in principle at June Board of Management Meeting

