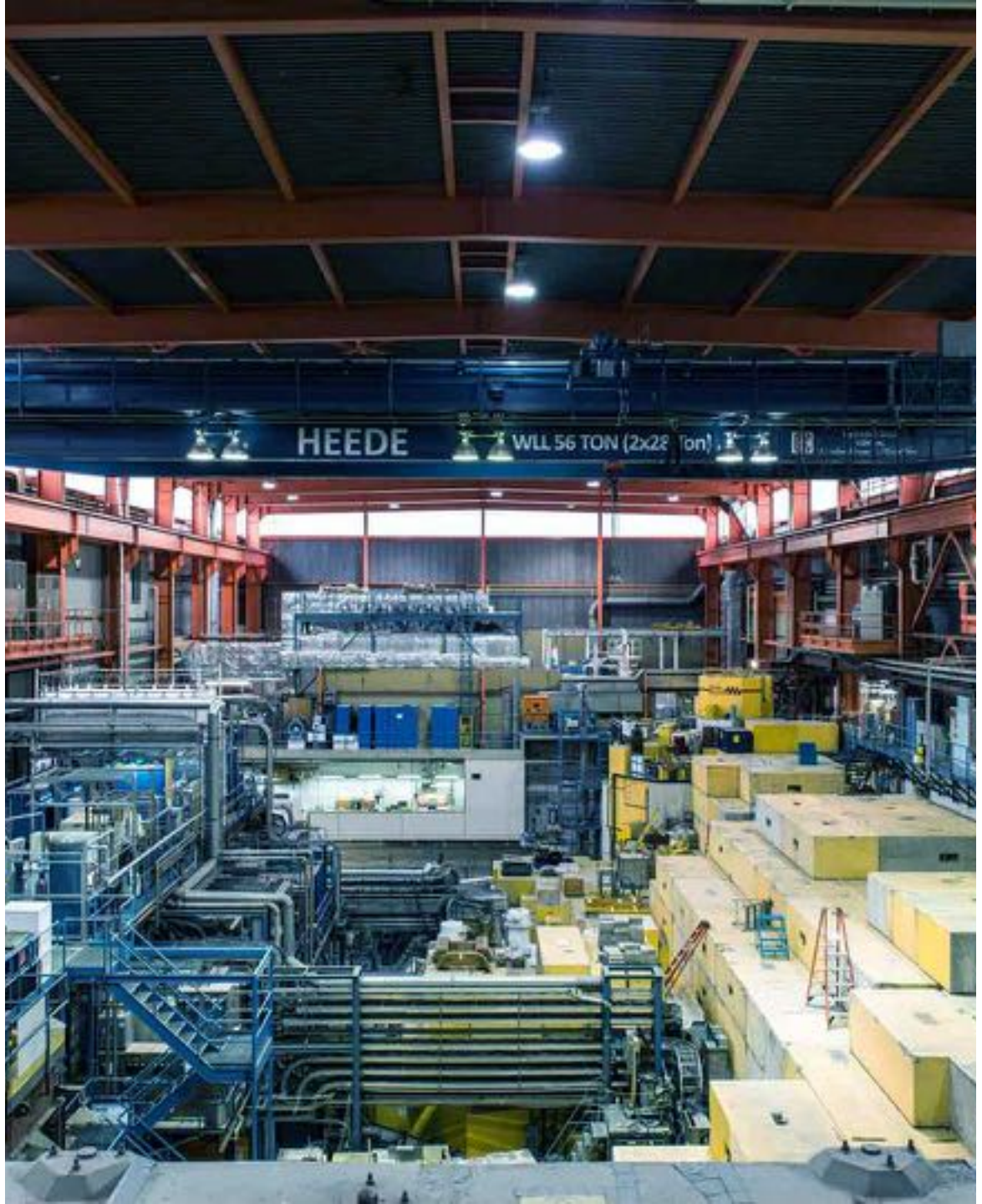
TRIUMF

CINP-IPP Meeting
TRIUMF Update

Nigel Smith

TRIUMF Executive Director

2022-06-05



Discovery, accelerated


TRIUMF

It has been a major period of transition for TRIUMF over the last year

- Incorporation as a not-for-profit occurred on June 1st 2021
  - Two weeks after a new Director joined
- A new governance model has been introduced, with a new Board structure and processes, including a skills based approach to Board membership
  - New Board chair and vice-chair have been appointed (very engaged!)
- Major organisational structure changes, personnel changes and major transitions occurring in enterprise systems - introduced WorkDay last fall
- We have faced a rapidly changing environment and risks - CNSC reviews and relicensing, geopolitical shifts, increased focus on security and IP from governments and stakeholders
  - … and a pandemic which has stressed everything, including supply chains and resource availability
- Thanks to TRIUMF staff and community for successfully navigating a turbulent year

TRIUMF KPIs

	Target	2018	2019	2020	2021
published scientific papers	285	325	356	317	285
highly qualified personnel trained	156	254	243	223	301
Canadian scientists & students using TRIUMF	206	396	471	127	90
Canadian scientists & students participating in research abroad through TRIUMF	195	227	227	224	224
international visiting scientists & students	392	606	715	48	97
informal science experiences to the public	15,000	15,367	16,503	8,375	10,327
commercial revenues	$3.0M (net)	$4.7M ($3.7M net)	$4.4M ($2.6M net)	$5.4M* ($3.3M net)	$7.4M** ($5.4M net)

* Revised final audited figures (adjusted from $5.2M; $2.9M net)
** Preliminary figures

TRIUMF's Research

Both fundamental and applied, focus on discovery-driven research

- Expanding the boundaries of human knowledge
- Advancing the treatment of critical diseases
- Developing new technologies and innovations
- Deepening our understanding of the natural world

Particle Physics Highlights

ALPHA

physicsworld TOP 10 BREAKTHROUGH 2021

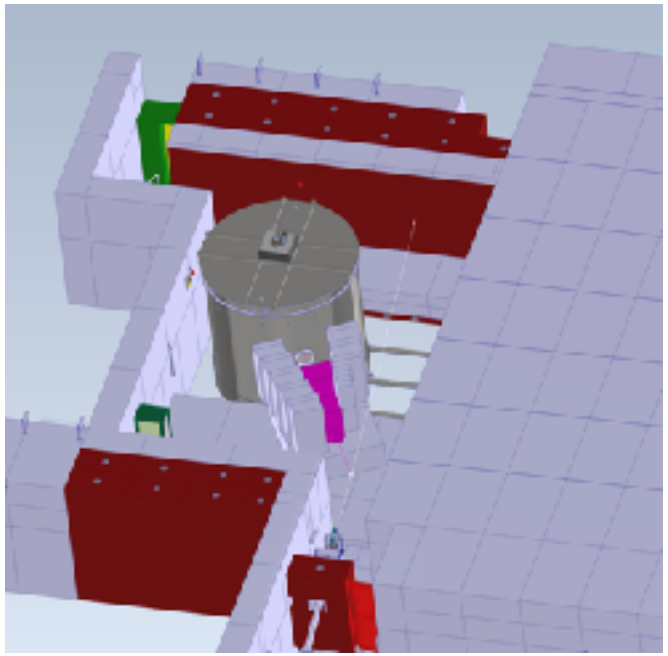
The ALPHA collaboration demonstrated laser-cooling of antihydrogen atoms for the first time!

Walter Hardy (UBC), appointed Member of the Order of Canada

Hyper-K

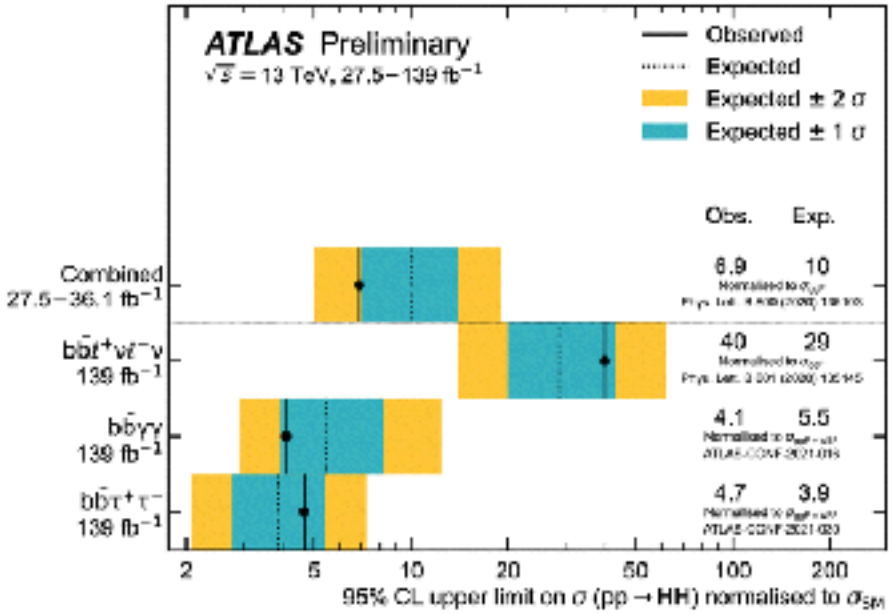
Water Cherenkov prototype (WCTE) approved by CERN Research Board

Development and testing of prototypes for multi-PMT proceeding well

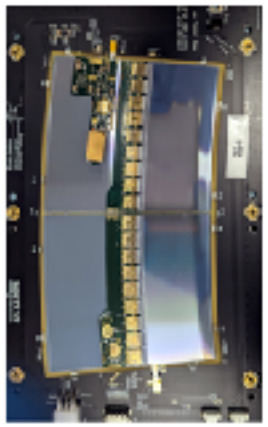


ATLAS

Probing Higgs-self coupling through HH production



Completed proto-typing for ATLAS ITK modules
The first end-cap module site to enter pre-production


R5 module


R4 module

R3 module to be built in Toronto


R2 module


R1 module

R0 module to be built in Toronto

ATLAS Outstanding Achievement award to Estel Perez Codina, Alam Toro (TRIUMF) et.al.

*for outstanding contributions to the completion of the NSW integration and surface commissioning within the LS2 schedule

Discovery, accelerated

TUCAN
TRIUMF Ultra Cold Advanced Neutron source

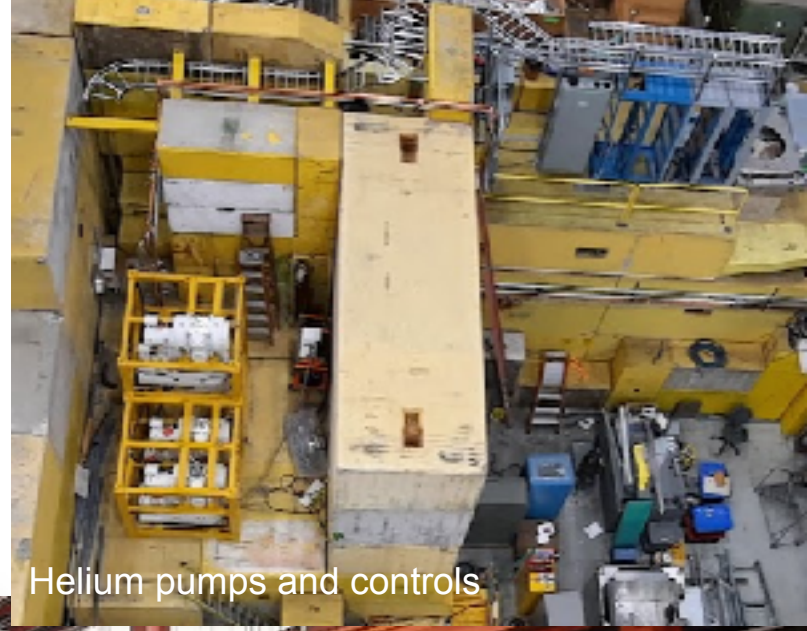
UCN

Milestones towards the highest density neutron source

Crucial UCN testing for tail section successfully completed at LANL

Support structure for liquid He transfer & return lines installed
Large He pumps tested

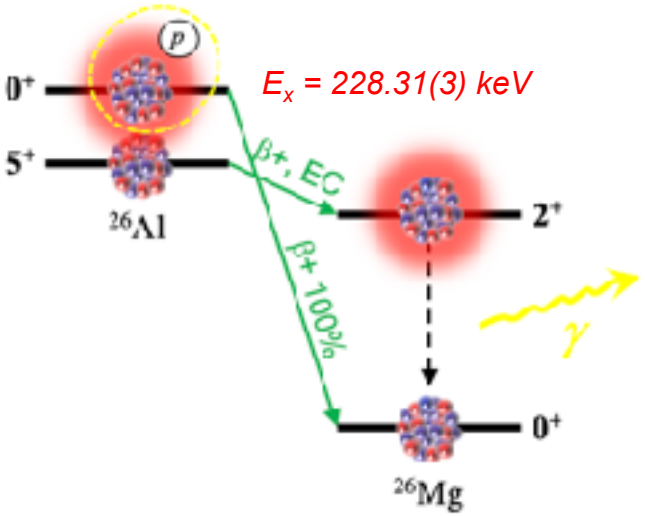
Preparing for UCN beamtime at J-PARC to test
UCN storage cell for EDM experiment


Helium pumps and controls

Liquid helium transfer line

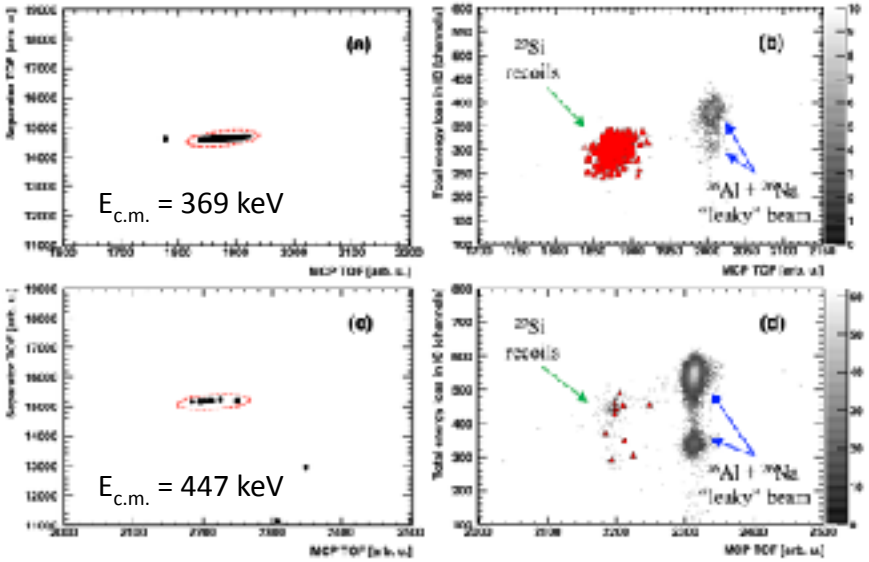
Radiative capture on nuclear isomers – Direct measurement of ^{26m}Al(p,γ) at DRAGON

- The **radioisotope** ^{26}Al provides insight into the nature of nuclear processes in stars in the Milky Way.



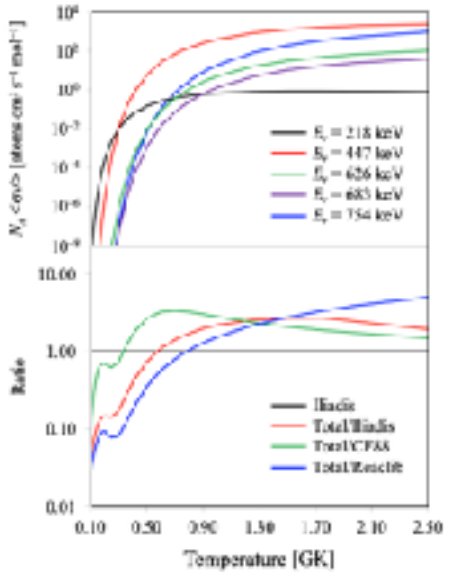
Nucleosynthesis of ^{26}Al is complicated by the presence of an isomer!

Isomers can act as entirely separate nuclei and **strongly influence the formation of chemical elements**



- Studying these reactions on earth poses a significant **experimental challenge!**

- Performed the **first ever direct study of an excited state proton capture** at TRIUMF



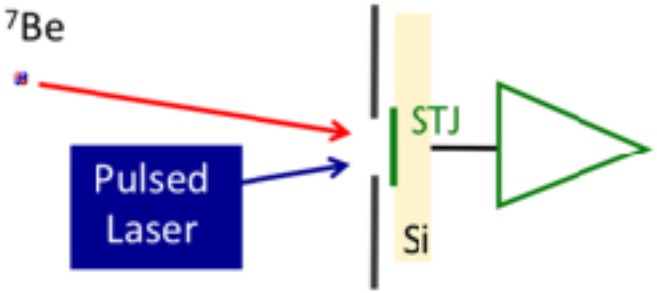
➔ *With our present result the* **447 keV resonance governs the entire ^{26m}Al(p,γ) stellar reaction rate** over the peak temperature range of classical novae & supernovae!

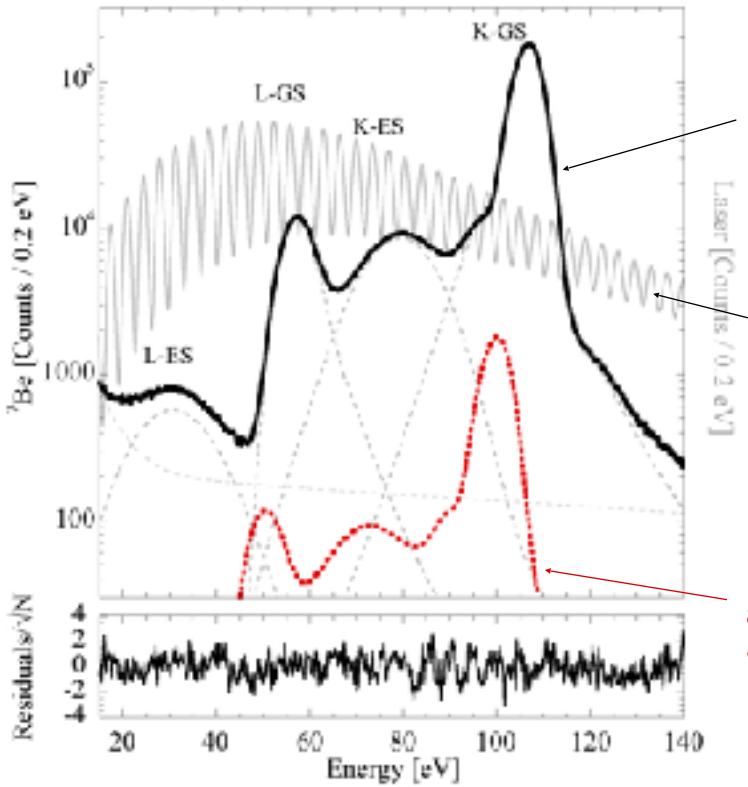
G. Lotay, A. Lennarz, C. Ruiz et. al., Phys. Rev. Lett. 128, 042701 (2022)

The BeEST Experiment

Beryllium Electron capture in Superconducting Tunnel junctions

Rare-isotope implantation at TRIUMF-ISAC

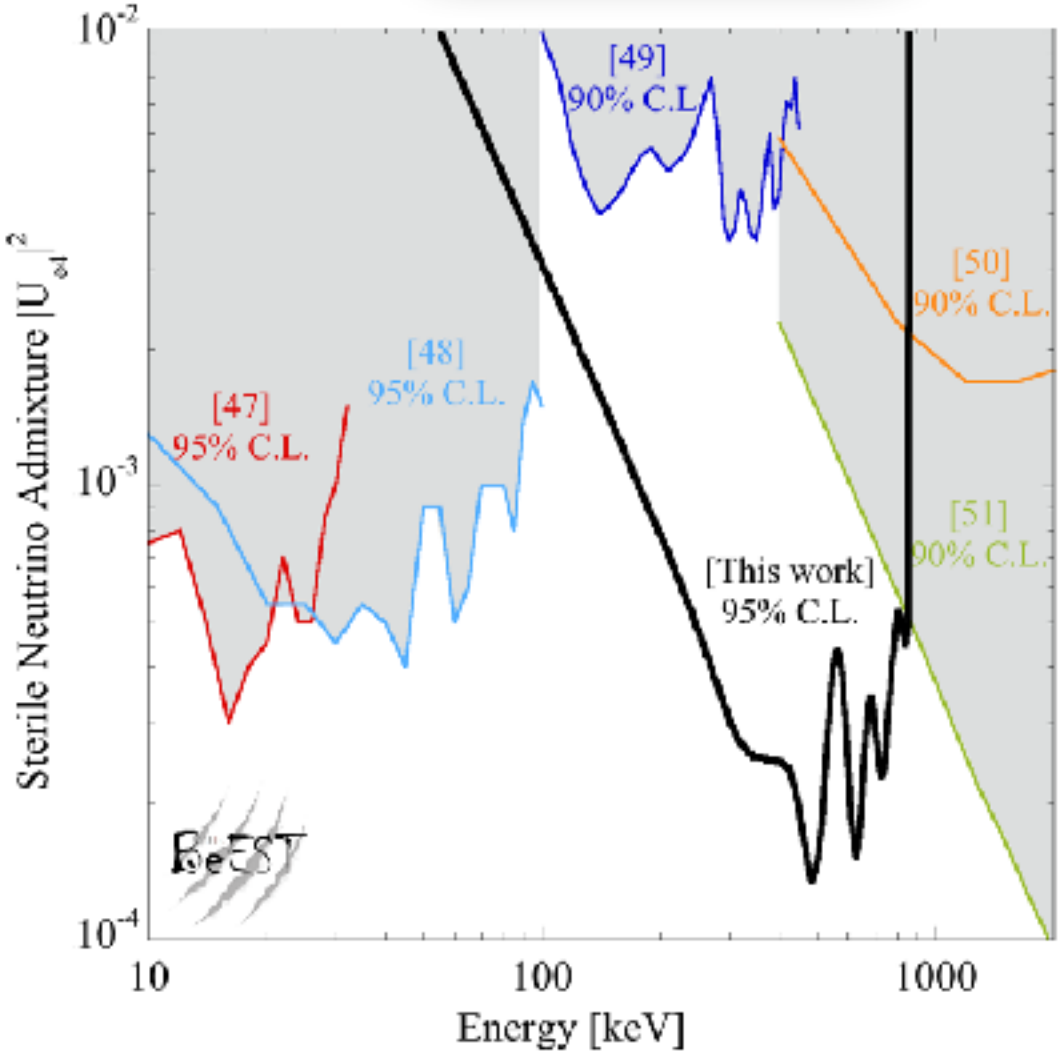




^{7}Li recoil spectrum generated by pseudo-degenerate mass states from ~28 days of counting

Simultaneously acquired laser calibration spectrum

Example of signal that would be generated by 300 keV neutrino with 1% mixing



- Up to an order of magnitude improvement for limits on heavy neutrino admixtures to ν_e for masses of 100 – 850 keV

COLORADO SCHOOL OF MINES EARTH • ENERGY • ENVIRONMENT

TRIUMF

Lawrence Livermore National Laboratory

S. Friedrich *et al.*, Phys. Rev. Lett. **126**, 021803 (2021)

Research highlights - nuclear theory

- *Ab initio* calculations for heavy nuclei
  - Challenge: Convergence with respect to the number of three-nucleon (3N) force matrix elements
  - Breakthrough in storage achieved
  - Opens possibilities for calculations of ^{132}Sn, ^{208}Pb, … superheavy isotopes?!?

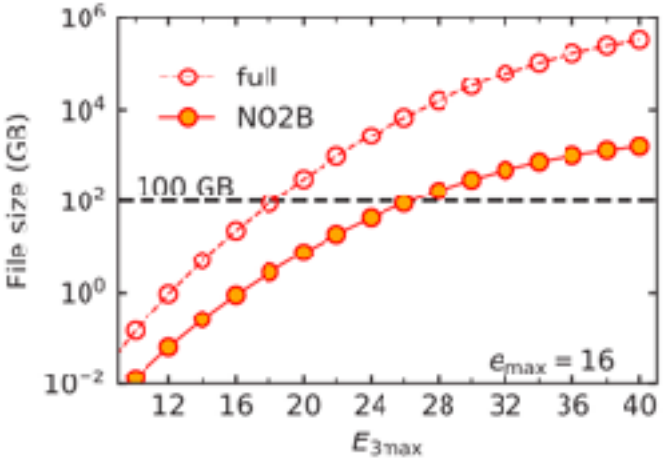
PHYSICAL REVIEW C 105, 014302 (2022)

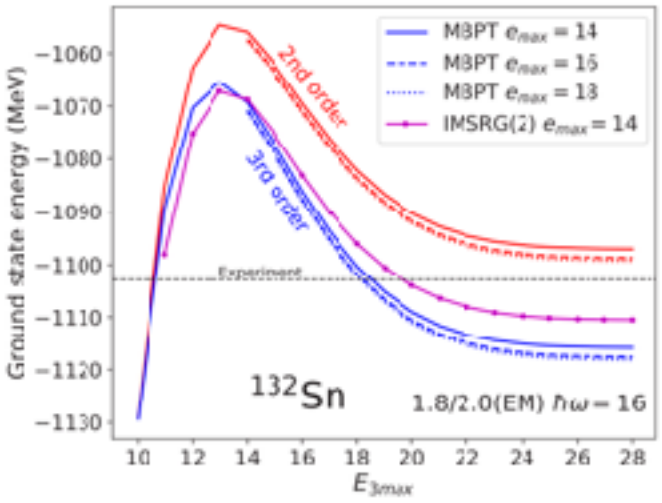
Converged *ab initio* calculations of heavy nuclei

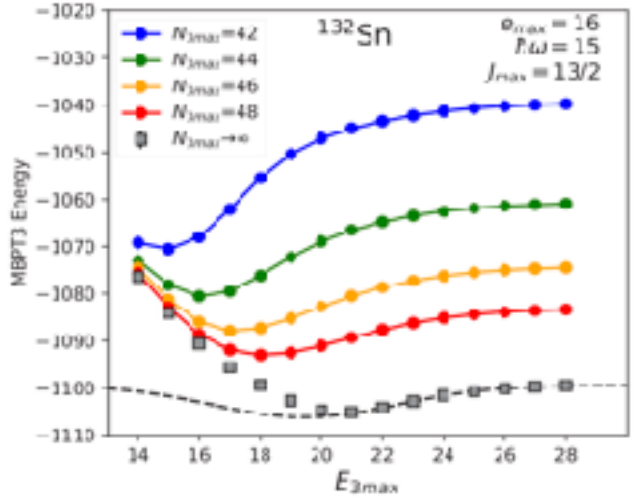
T. Miyagi, S. R. Stroberg, P. Navrátil, K. Hebeler, and J. D. Holt

(Received 15 April 2021; revised 3 November 2021; accepted 7 December 2021; published 3 January 2022)

Ground-state energy of ^{132}Sn with chiral NN+3N 1.8/2.0 (EM) & NN N^{3}LO+3N$_{\text{lnl}}$







Ground state energy of ^{132}Sn reproduced by *ab initio* calculations with nuclear forces determined in *A*=2,3 systems

The ARIEL Target and Ion source Acceptance test-stand (TISA)

- The TISA test stand is in principle a copy of the core elements of the ARIEL target stations, intended to replicate some of their sections.
- It is crucial to validate the design and performance of systems and components before going online at the AETE and APTW stations
  - Thermal Tests
  - Mechanical Tests
  - High Voltage Tests
- Target and ion-source were heated up to > 2000 °C
- Temperature of components were monitored in real-time to ensure the stability of the system and to avoid overheating!

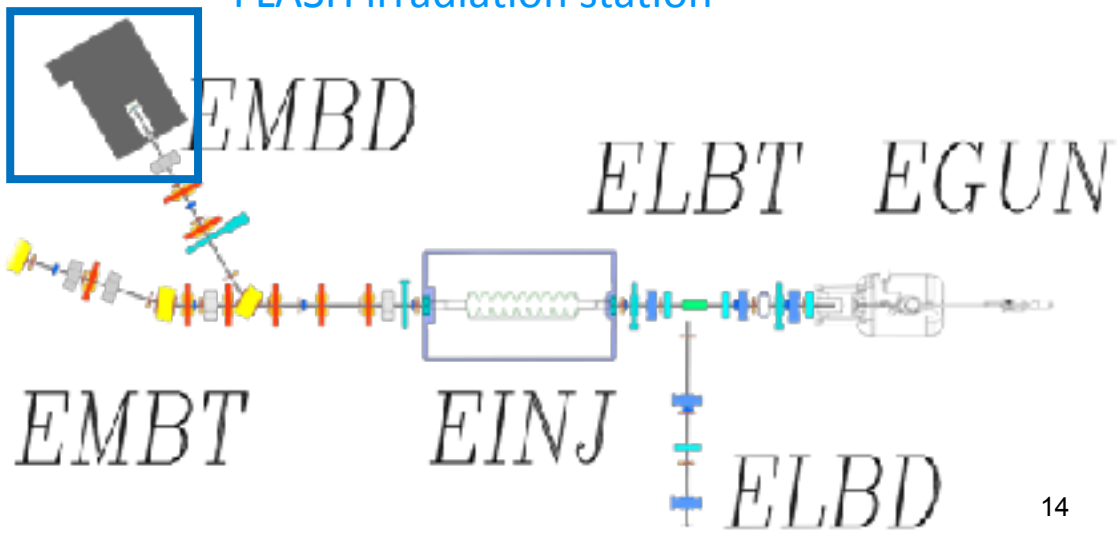
The ARIEL Hot Cell at TRIUMF

- The ARIEL hot cell#1 is required for
  - service at target modules (like to retrieve a stuck target assembly)
  - service at RIB and the convertor module
  - disassemble front end and packaging for disposal
- Despite setbacks due to global supply chain issues, the hot cell assembly is in progress and will be completed in August 2022.

γ-ray-FLASH at the ARIEL electron linac

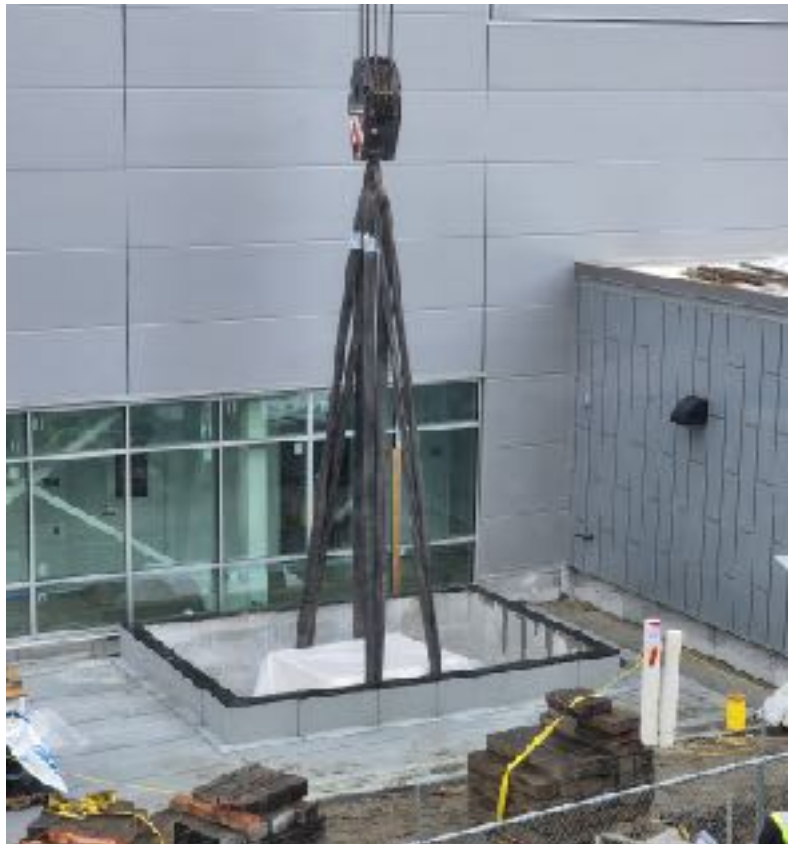
- TRIUMF commissioned the unique station for FLASH irradiation at the ARIEL superconducting electron linac.
- This new type of radiotherapy being explored for cancer treatment is using a γ-FLASH produced by a unique electron convertor target developed for ARIEL
- Beam delivered for **FLASH dose rates (~100 Gy/s)**
- Studies comparing response to identical dose deposited at FLASH and conventional rates in situ and on DNA samples.

FLASH irradiation station

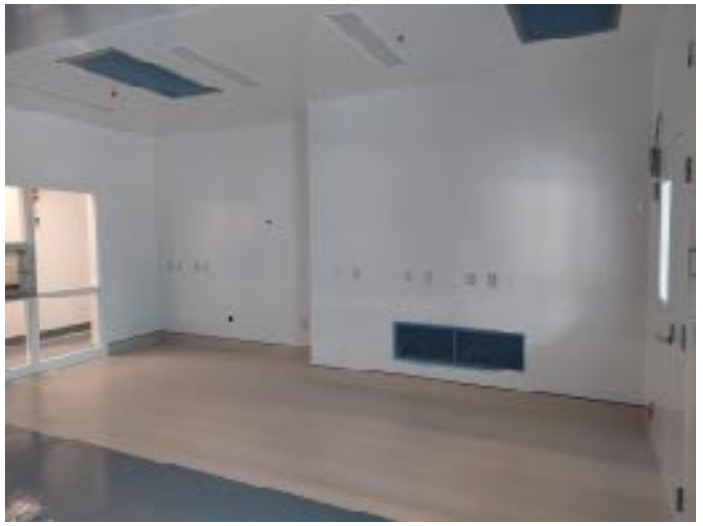


Institute for Advanced Medical Isotopes - IAMI

- Building construction nearly completed
- Building commissioning underway



- TR24 installed
- beamlines and ancillary systems installation underway
- TRIUMF-designed solid target station design/build effort underway



- GMP labs ready for hot cell installation

BC CANCER

a place of mind

UBC

TRIUMF

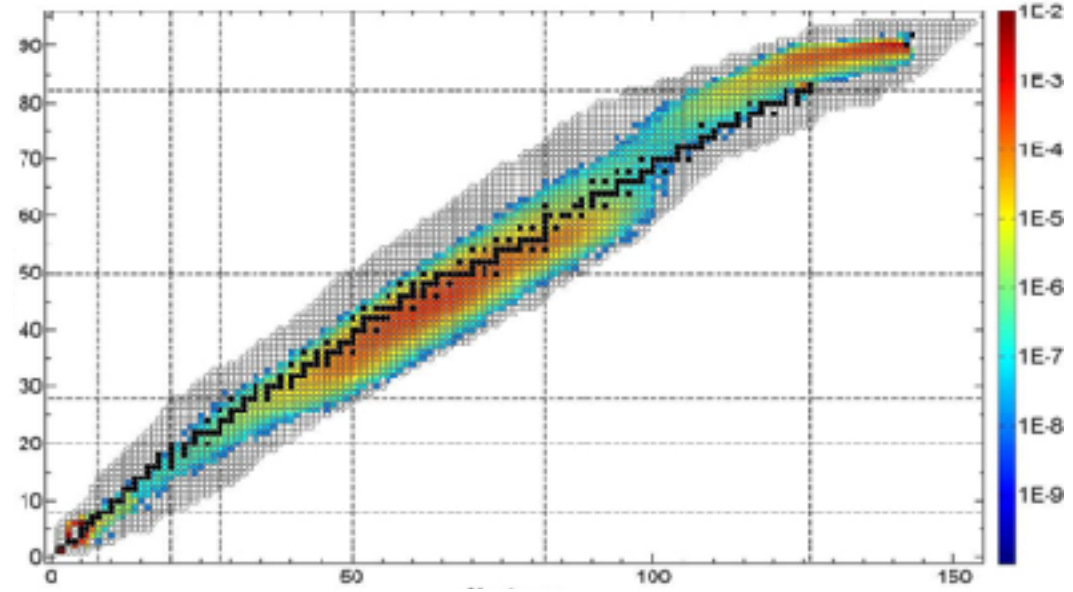
Therapeutic Isotope Production

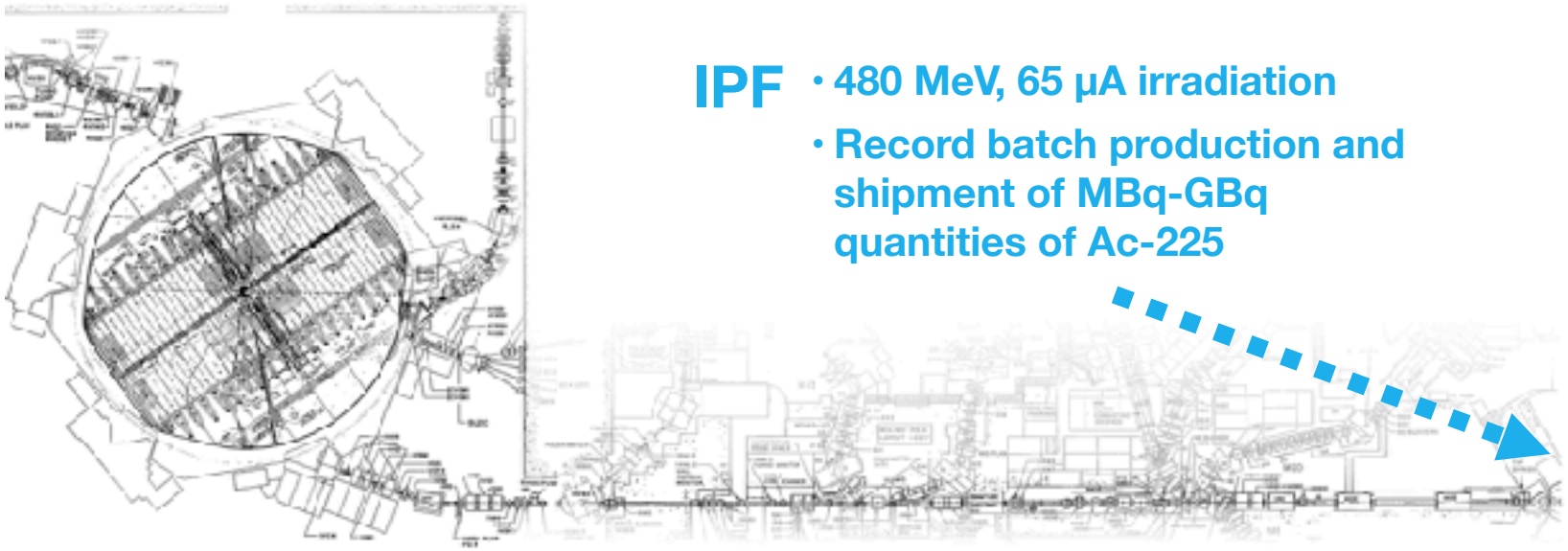
89

Ac

actinium

$[Rn]6d^{1}7s^{2}$





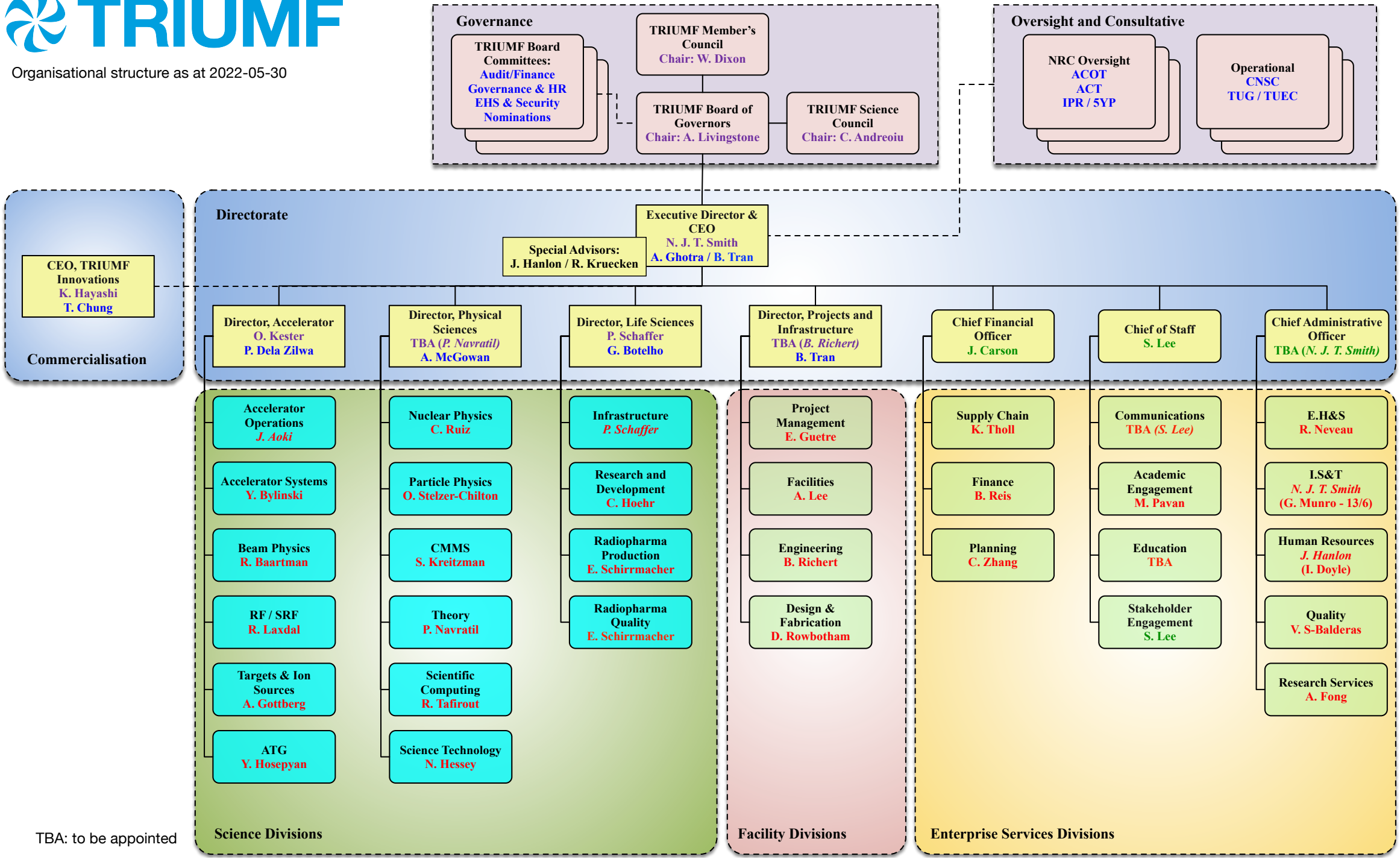
IPF

- 480 MeV, 65 µA irradiation
- Record batch production and shipment of MBq-GBq quantities of Ac-225

TRIUMF

Organisational structure as at 2022-05-30

People and Skills



TBA: to be appointed

People & Skills

TRIUMF's Ombudsperson (ombudsperson@triumf.ca)

- Dr. Grace Wong-Sneddon has been appointed into the new role of ombudsperson;
  - an advisory role reports to the Executive Director
- This role is specifically in place to support students and postdoctoral fellows whose involvement with TRIUMF is connected to their academic pursuits, regardless of whether they have a formal agreement with TRIUMF

Bullying & Harassment

- TRIUMF released a new policy in February 2022; this represents a major update over the legacy policy. Key changes include:
  - Alignment with the latest legislation and best practices, including integrating "duty to report"
  - Reframes equity/inclusion as a core TRIUMF value and is present across many different polices

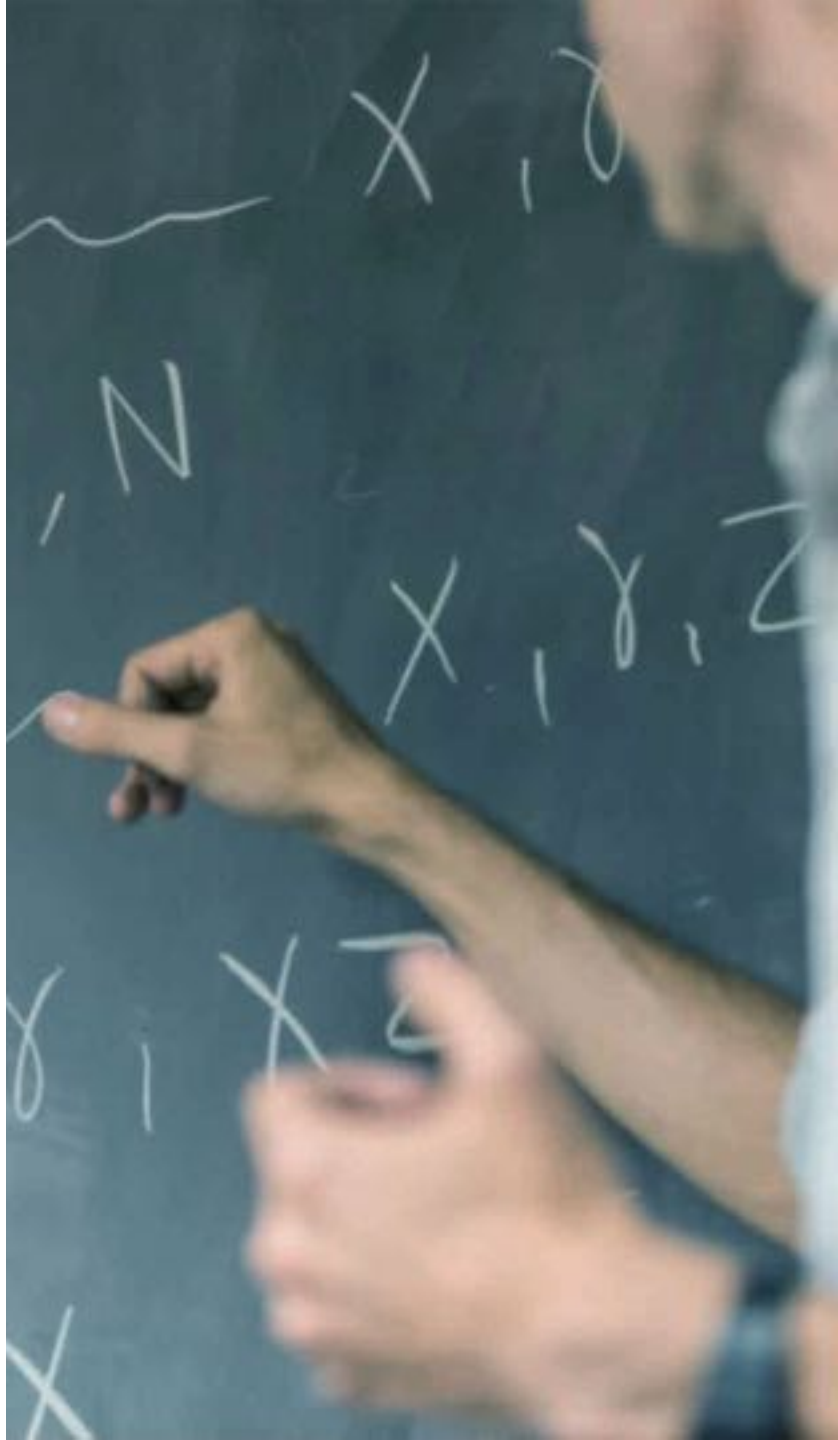
Towards a 20-year Vision for TRIUMF

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
- **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)

20-Year Vision Steering Committee

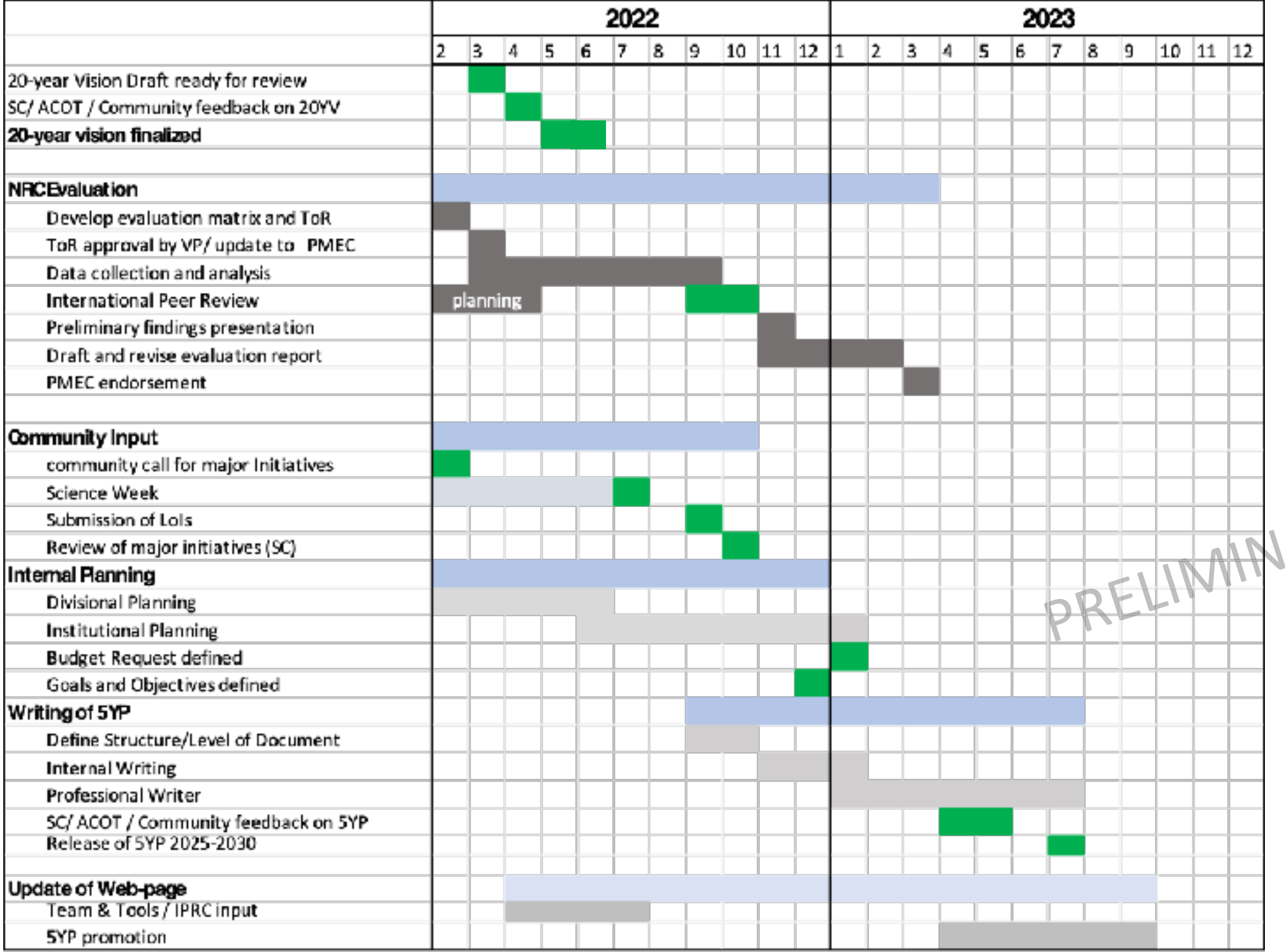
• Alan Bernstein	President & CEO CIFAR
• Rob Dunlop	Former ADM ISED
• Danika Goosney	VP Grants, NSERC
• Digvir Jayas	VPRI University of Manitoba, TRIUMF Board
• Dermot Kellerher	Dean, Faculty of Medicine, VP Health UBC
• Bob Kowalewski	University of Victoria, Former PPAC Chair
• Ania Kwiatkowski	TRIUMF, EDI Committee chair
• Sylvain Lévesque	CFO, DBC Group, TRIUMF & 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	US National Science Board, Former IPRC Chair
• Caterina Ramogida	SFU/TRIUMF, TUEC past chair
• Nigel Smith (chair)	TRIUMF Director & CEO
• Geneviève Tanguay	VP Emerging Technologies, NRC



Phase 3 (now): Final draft overarching statements

- **A global leader in discovery science, delivering breakthroughs that unlock the deepest mysteries of the universe:** strengthening Canada's leadership in groundbreaking frontier particle & nuclear physics
- **A world-class accelerator centre driving use-inspired research—from the life sciences to quantum and green technologies:** leveraging our unique infrastructure to pursue research in Canada that will change the world
- **An inclusive multidisciplinary talent incubator, attracting and developing the best people from around the world:** producing Canada's future science leaders and innovators
- **A leader in a flourishing national Big Science ecosystem:** catalyzing the success and growth of Canada's network of major research facilities
- **A national innovation hub translating discovery science into health and sustainability solutions:** responding nimbly to complex societal challenges for the benefit of Canadians

Five year plan timeline



PRELIMINARY

TRIUMF Science Week: 18th - 22nd July

- https://meetings.triumf.ca/event/289/
- Packed and innovative programme put together
  - **Monday**: Science highlights
  - **Tuesday:** Science highlights / VR poster session
  - **Wednesday**: 5-year plan / 20 year vision / ICAP link / Lets Talk Science student competition
  - **Thursday**: IAS link / EDI panel / networking events
  - **Friday**: Town Hall / TUG AGM
- Thanks to the organisers!

Awesome video from the website ->

TRIUMF

Thank You!

Merci!

www.triumf.ca
@TRIUMFLab