

# Unlocking our Potential

Ensuring Canada's Place  
as a World Leader in Big Science

2024 Pre-Budget Submission by TRIUMF

**Discovery,  
accelerated**



## **RECOMMENDATION**

The Government of Canada allocate \$450M in operational funding for TRIUMF from 2025 – 2030 to ensure Canada remains a world leader and partner of choice in international Big Science research

## EXECUTIVE SUMMARY

TRIUMF is a national asset for science and research that is host to over \$1.5B in large-scale scientific infrastructure. Founded in 1968 as Canada's particle accelerator centre, and its preeminent Big Science laboratory, we enable the country to collaborate and compete with other major international facilities in the delivery of world-leading science and innovation, and the attraction of top global talent. From developing new medical isotopes and life-saving cancer treatments to exploring new theories of fundamental science and expanding our understanding of the processes which create the heavy elements in the universe, TRIUMF is the leading component of the Canadian Big Science ecosystem.

TRIUMF's operations are supported in five-year tranches via direct allocations in the federal budget that flow through the National Research Council Canada (NRC). This funding stream is the only

mechanism available to support laboratory maintenance and operations. TRIUMF's current allocation was included in Budget 2019, necessitating a renewal in Budget 2024. A strong investment in TRIUMF's operations is required to safeguard the competitive advantages resulting from decades of investment into the laboratory, ensuring these are effectively stewarded and deployed to deliver maximum benefit to Canada. Fully realized, TRIUMF not only provides world-leading science capacity to Canada, but also attracts and develops critical talent and expertise to address national priorities and provide resilience against emergent risks.

**To ensure Canada remains among the leaders in international Big Science, TRIUMF is requesting \$450M in operational funding to support operations over the next five-year cycle.**



## THE CONTEXT

TRIUMF's competitive advantage rests on our state-of-the-art accelerator complex – featuring the largest proton cyclotron of its kind and the most powerful purpose-built superconducting electron linear accelerator in the world. Over the last five decades, substantial public investment in the laboratory's core infrastructure in Vancouver has enabled a proven track record of world-class science. Owned by a consortium of 21 Canadian universities, TRIUMF is the only research centre operating at this scope and scale in Canada, tackling problems too large and complex for any single researcher or institution; with our unique capabilities, we connect Canada to a global community of leading scientists, researchers, organizations, and governments. We enable Canada to compete in the global science and innovation enterprise, driving contributions which extend the boundaries of knowledge, principally in accelerator science, nuclear and particle physics, and the life and materials sciences.

Funding at the requested level of \$450M will ensure that TRIUMF can continue to deliver world-leading science and innovation; strengthen and secure the organization's talent pool; modernize and achieve operational excellence across the laboratory; complete and operate two major research infrastructure projects; support critical deferred maintenance that cannot be funded by other mechanisms; and consolidate research efforts in the pursuit of mission-driven objectives. Over the last two decades, TRIUMF's operational funding has come in below requested levels, thereby compounding pressures related to operational capacity and deferred maintenance.

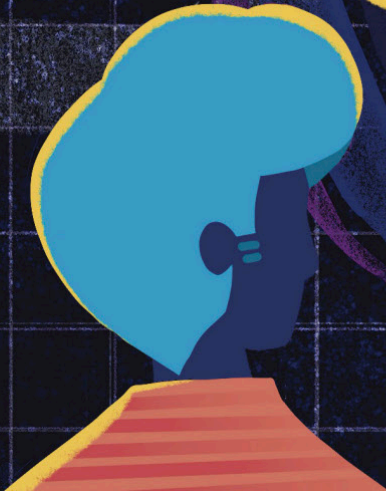
Released in October 2022, TRIUMF's 20-Year Vision ([triumf.ca/20-year-vision](https://triumf.ca/20-year-vision)) articulates our future potential and that of the community we support. It signals our ability to undertake world-leading research and translate our capabilities for societal benefit and commercial opportunities. This vision was developed over 18 months in conversation with our research community. The collective vision is for TRIUMF to be:

- A global leader in discovery science, delivering breakthroughs that unlock the deepest mysteries of the universe
- A world-class accelerator centre driving use-inspired research – from the life sciences to quantum and green technologies
- An inclusive multidisciplinary talent incubator, attracting and developing the best people from around the world
- A leader in a flourishing national Big Science ecosystem
- A national innovation hub translating discovery science into health and sustainability solutions

This funding request is the first step in realizing this bold and innovative vision.



# TRIUMF's evolving research activities





## THE OPPORTUNITY

The requested operating funds will enable TRIUMF to continue delivering world-class science (including through two new world-leading infrastructure projects more than a decade in development), train the next generation of leaders and innovators, and maintain Canada's leadership position in major international research collaborations—including shepherding Canada's contributions to the CERN and major US Department of Energy projects. The added socioeconomic benefits that TRIUMF delivers through many of its programs are not possible without strong and stable facility operations. TRIUMF is at a pivotal moment in its life cycle as a major research facility; the lab faces a critical inflection point as it balances the demands of aging legacy infrastructure while seeking to complete and operate new world-class facilities. It is on this basis that TRIUMF requests \$450M in Budget 2024 to support laboratory operations from 2025 to 2030.

Building from a recent government evaluation that noted the laboratory's strong performance in delivering both significant science and socioeconomic benefits, TRIUMF intends to continue driving Big Science research in Canada. Over the next five-year period TRIUMF will continue pursuit of Nobel-calibre scientific discovery. We will drive world-leading efforts to deliver breakthroughs beyond the current paradigm of particle physics using experiments that exploit our unique capabilities, potentially extending the Standard Model and opening new and uncharted frontiers of discovery. In another thread of research leveraging new accelerator infrastructure, TRIUMF will pull back the curtain on the origins of the heavier elements in the universe which form the world around us, experimentally probing these processes in ways never before possible. Finally, at the human scale, the next five-year plan will see TRIUMF on the frontlines of research, development, and production of a new class of isotope-based precision therapies with curative potential for currently untreatable cancers.

The level of federal support provided in the next five-year cycle will dramatically impact the future trajectory of Canada's position in international Big Science research. In the face of growing global competition, the lack of a coordinated support system for our domestic major research facilities, which considers the unique needs of these facilities and programs, puts Canada at a distinct disadvantage. Without reliable life-cycle funding, a stable and structure funding process, and a framework for long-term planning and stewardship, Canada risks falling behind; however, this proposal – in conjunction with efforts undertaken by others – seeks to bring the stability needed to keep Canada as a top-tier scientific nation.

# TRIUMF Societal Contributions

## Isotope Resilience

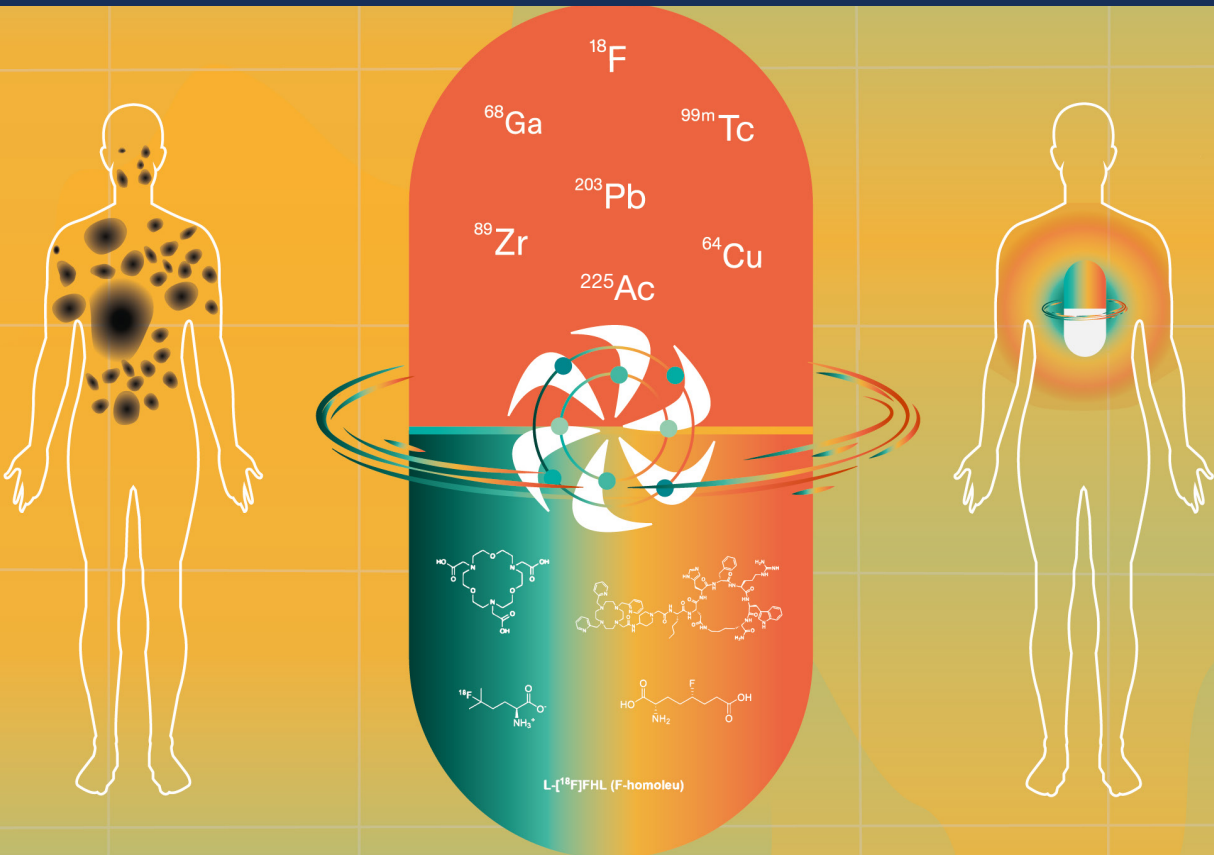
Addressing critical medical shortages resulting from the shutdown of the Chalk River reactor, with TRIUMF leading a consortium to develop a new production process for technetium-99m. This has been licensed to a start-up (ARTMS) and is now commercially available.

## Low-Cost Ventilators

Leveraging expertise in gas exchange systems (used for dark matter experiments) to design and build a low-cost ventilator in response to the COVID-19 pandemic with a consortium of Canadian institutes.

## Next-Gen Cancer Fighting

Working with partners to advance the development of new cancer fighting isotopes, putting Canada at the forefront of promising next-generation treatments including actinium-225 which shows great promise in the treatment of aggressive metastatic cancers. The world's supply of Ac-225 is limited – only enough for a few thousand treatments. TRIUMF has the potential to produce Ac-225 at dramatically larger quantities than currently possible.



## Greener Critical Minerals

One spin-off of TRIUMF, Ideon Technologies Inc., is a world pioneer in the application of cosmic-ray muon tomography. Ideon has developed a discovery platform that integrates proprietary detectors, imaging systems,

inversion technologies, and artificial intelligence techniques to provide x-ray-like visibility up to 1 km beneath the Earth's surface. By detecting subsurface muons and transforming the data into reliable geophysical surveys and 3D density maps, Ideon helps geologists identify new mineral and metal

deposits with precision and confidence. They drill less and discover more with Ideon – reducing cost and risk, saving time, and minimizing environmental impact. Ideon is also expanding the application of muon tomography to use-cases in oil and gas, critical infrastructure and national security.



## TRIUMF'S KEY OPERATIONAL THEMES (2025 – 2030)

### Delivering new infrastructure for scientific impact:

Together, the Advanced Rare Isotope Laboratory (ARIEL), a transformative facility that will triple the production of rare isotope beams at TRIUMF, and the Institute for Advanced Medical Isotopes (IAMI), a cutting-edge life sciences centre and incubator for new medical isotope development, represent the culmination of Canada's vision to lead the world in accelerator technology and rare isotope science. These new large-scale facilities, valued at approximately \$250M, ensure Canada remains at the very forefront of this highly competitive branch of global research, with potential outcomes ranging from Nobel-winning fundamental science breakthroughs to the possible curing of a range of terminal illnesses, including several types of cancer.

### Ensuring operational excellence:

As a high-profile national asset, it is imperative that TRIUMF maintain compliance and operational excellence across its spectrum of programs. Since TRIUMF's operational funding was last committed in 2019, tightening regulatory requirements and geopolitical considerations – including research security – have led to an increase in compliance and oversight requirements that have strained the laboratory's operational capacity.

### Training the diverse talent of tomorrow:

A major objective of the next 5-year proposal is to ensure TRIUMF has the staff complement to operate the laboratory effectively and efficiently. The proposal envisions an increase of approximately 55 FTEs, equal to ~12% growth to core operations against current staffing levels. Increased staffing levels, in conjunction with market-competitive compensation, will not only ensure TRIUMF is able to deliver on its infrastructure and science objectives, but also enhances the laboratory's ability to develop a pipeline of talent both for internal needs, as well as opportunities elsewhere in Canada's growing innovation ecosystem.

### Refurbishing legacy facilities:

Commissioned in 1976, many TRIUMF facilities are approaching fifty years in operation. As such, there is a critical need for deferred maintenance that is beyond what can be supported as part of regular operations and repairs. Furthermore, recent funding competition results have demonstrated that there exists no viable way to address these needs in the current system. Of note, it is also not viable to decommission this older infrastructure, as much of it is still in active use and is required for the operation of TRIUMF's newest facilities, such as ARIEL. This work was not previously possible due to lack of funding in previous funding cycles, but investing now will mitigate major risks for the long-term operations.

### Evolving TRIUMF's program towards the future:

This new proposal will see TRIUMF take the first concerted steps towards achieving the goals in its 20-Year Vision. Resources will be directed towards reconfiguring existing program areas to better align with stated national objectives and priority areas. Complementing the new frontiers of science that will be unlocked with ARIEL and IAMI, the pivot towards mission-driven centres of excellence in areas, such as quantum, green technologies, detectors, and data / artificial intelligence, will position Canada to quickly and effectively respond to emergent challenges.

## CONCLUSION

TRIUMF is at a critical stage and ensuring it receives adequate and stable operational funding allows Canada to maximize its potential as a national asset to help build the science and knowledge ecosystem necessary for Canada's long-term growth and prosperity. Strong support for TRIUMF in Budget 2024 solidifies Canada's standing as a global leader in Big Science, builds vital national resilience in sectors of critical importance, and reaffirms Canada's place as a partner of choice at the forefront of research.

To fulfil this objective, TRIUMF requests \$450M in operational funding in Budget 2024 to support our next five-year cycle from 2025 to 2030.







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