Triumph of a Dream

The Canadian research centre, TRIUMF, is now 50+ years old and seeks new challenges in dealing with big data

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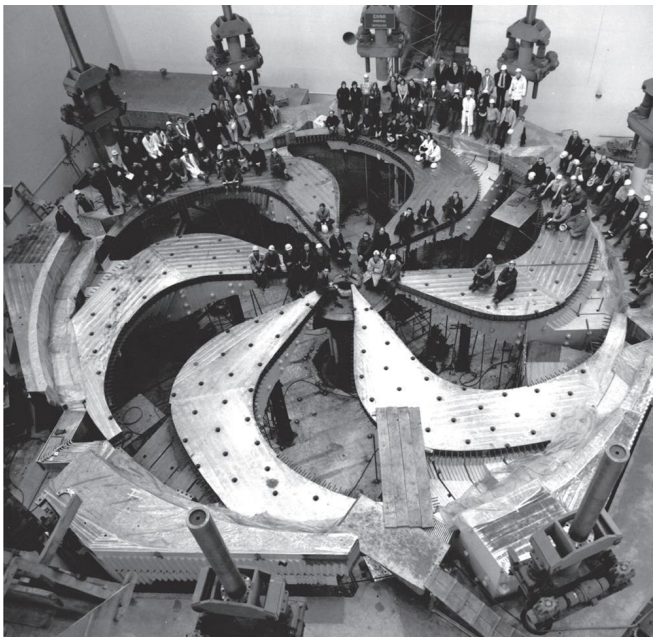
N.Ed.: The contributions of the Tri-university Meson Facility (TRIUMF) to many branches of science have been recognized through an IEEE Milestone. Dedicated in December 2010, the Milestone plaque notes that the first 500-MeV proton beam was extracted from the facility in November 1974. Revolutionary computer-related technologies were needed to achieve its design. The IEEE Vancouver Section prepared the Milestone nomination, led by Prof. Dave Michelson of the University of British Columbia. See https://ethw.org/Milestones:First_500_MeV_Proton_Beam_from_the_TRIUMF_Cyclotron,_1974.

This article was prepared in early 2019. Readers are encouraged to explore the latest information using the links provided.

The campus of the University of British Columbia is located on a picturesque peninsula in the western part of Vancouver. About 50 years ago, three universities had a dream here: Simon Fraser University, the University of British Columbia, and the University of Victoria joined in 1968 to build the world's largest cyclotron accelerator. The goal of the facility, doing research on mesons, is still reflected in the name of the centre, TRIUMF, which is an acronym for Tri-university Meson Facility (www.triumf.ca). Today, 20 universities are participating as the members or associated partners of TRIUMF, and research is ongoing based on this goal, which includes investigating nuclear and particle physics, nuclear medicine, and materials science and biosciences.

The heart of the facility is a 520-MeV cyclotron. The accelerator, still the largest of its kind in the world. with an 18-m-diameter magnet, makes four beam lines of protons available at the same time. Using this, experiments with different secondary radiations, such as neutrons, pions, and muons, take place in parallel. Especially using the ISOL method developed at the end of the 1980s, many radioactive isotopes are produced. Using these, many nuclear reactions can be investigated that play important roles in the synthesis of elements and formation of stars. In addition, the decaying characteristics of unstable isotopes offer the possibility of performing high-precision tests for the standard model [of particle physics].



Members of the TRIUMF community pose on the lower six sectors of the cyclotron magnet during construction (January 1972). (Source: TRIUMF.)

Since its beginning, German universities and research institutes kept a close relationship with TRIUMF, particularly to experiment at the world-renowned unique facilities as external users and benefit from the developments there. At the same time, the research centre attracts high-calibre talent from Germany to the west coast of Canada. For example, Jens Dilling, who has worked there for 17 years as the associate director of the institute and leads the division of natural sciences, says, "Doing research with top-notch scientists from all over the world brings new inspiration every day here." He became familiar with the experimental facilities of TRIUMF during his thesis research, and, after completing his postdoctoral in Heidelberg, he moved to Canada permanently.

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The most recent example of German–Canadian collaboration is the agreement to process a large amount of data (big data) using machine learning as well as perform research on future quantum computers. On the German side, the Jülich Research Centre and DESY are collaborating as members of Helmholtz Association; in addition to TRIUMF, Canadian companies, such as D-Wave Systems Inc. and 1Qbit,

Different events were held through the year to celebrate the laboratory's birthday.

work together with TRIUMF Innovations. "An early start to researching the scientific applications of this field establishes totally new pillars for TRIUMF," says Dilling. "That helps us to push the forefronts of science for another 50 years together with Canadian and international partners" (see "Translator's Note").

Different events were held through the year to celebrate the laboratory's birthday (www.triumf50.com). Anja Karliczek, federal research minister [of Germany], found the jubilee a reason to visit TRIUMF to learn about Canadian–German collaborations as part of her first non-European visit. Canadian Prime Minister Justin Trudeau visited the research institute at the beginning of November [2018] and pledged a gift: to finance founding the Institute for Advanced Isotopes, where the production of future radiopharmaceuticals for cancer therapy and urgent production of the Tc-99m isotope for medical imaging will take place.

Trudeau was delighted to receive a special present: the TRIUMF director, Jonathan A. Bagger, presented him with a framed picture showing Trudeau's father, Pierre, during the opening ceremony of the cyclotron in February 1976. During the ceremony, Pierre Trudeau, the then Canadian prime minister, said these frequently quoted words: "I don't know really what a Cyclotron is, but I am very glad that there is one in Canada." ■

Prime Minister Justin Trudeau pays TRIUMF research institute a visit in celebration of its 50th birthday (1 November 2018). (Source: TRIUMF/CC BY-NC-SA 2.0.)

Translator's note

An example of these partnerships is the ALPHA-g detector, built by TRIUMF and shipped to CERN in Switzerland. This sensitive detector is built to see if antimatter (antihydrogen atom) defies gravity and moves up instead of falling when released from a magnetic trap. The ALPHA team tries to shed light on the process through which all of the antimatter produced from the Big Bang was eliminated from the universe, such that all that is left for us to see is matter. It is believed that equal amounts of matter and antimatter were initially created.

For a more detailed account of this intriguing experiment, see "New ALPHA-g Detector Poised to Search for Signs of Antigravity," by Michelle Hampson in *IEEE Spectrum*. https://spectrum. ieee.org/tech-talk/aerospace/astrophysics/new-alphag-detector-poised-to-search-for-signs-of-antigravity. Since the publication of this article, the ALPHA team successfully completed a test run before CERN shut down for maintenance and upgrading. The soonest the actual experiment will be conducted will be early to mid 2021, when antihydrogen will again be available. ■

Scientists at TRIUMF position the ALPHA-g detector in preparation for testing. The instrument was shipped in July 2018 to CERN, which is the only facility that can produce antimatter in sufficient quantity for the experiment. (Source: Stu Shepherd/TRIUMF.)