

# TRIUMF



## ANNUAL REPORT SCIENTIFIC ACTIVITIES 2002

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**CANADA'S NATIONAL LABORATORY  
FOR PARTICLE AND NUCLEAR PHYSICS**

OPERATED AS A JOINT VENTURE

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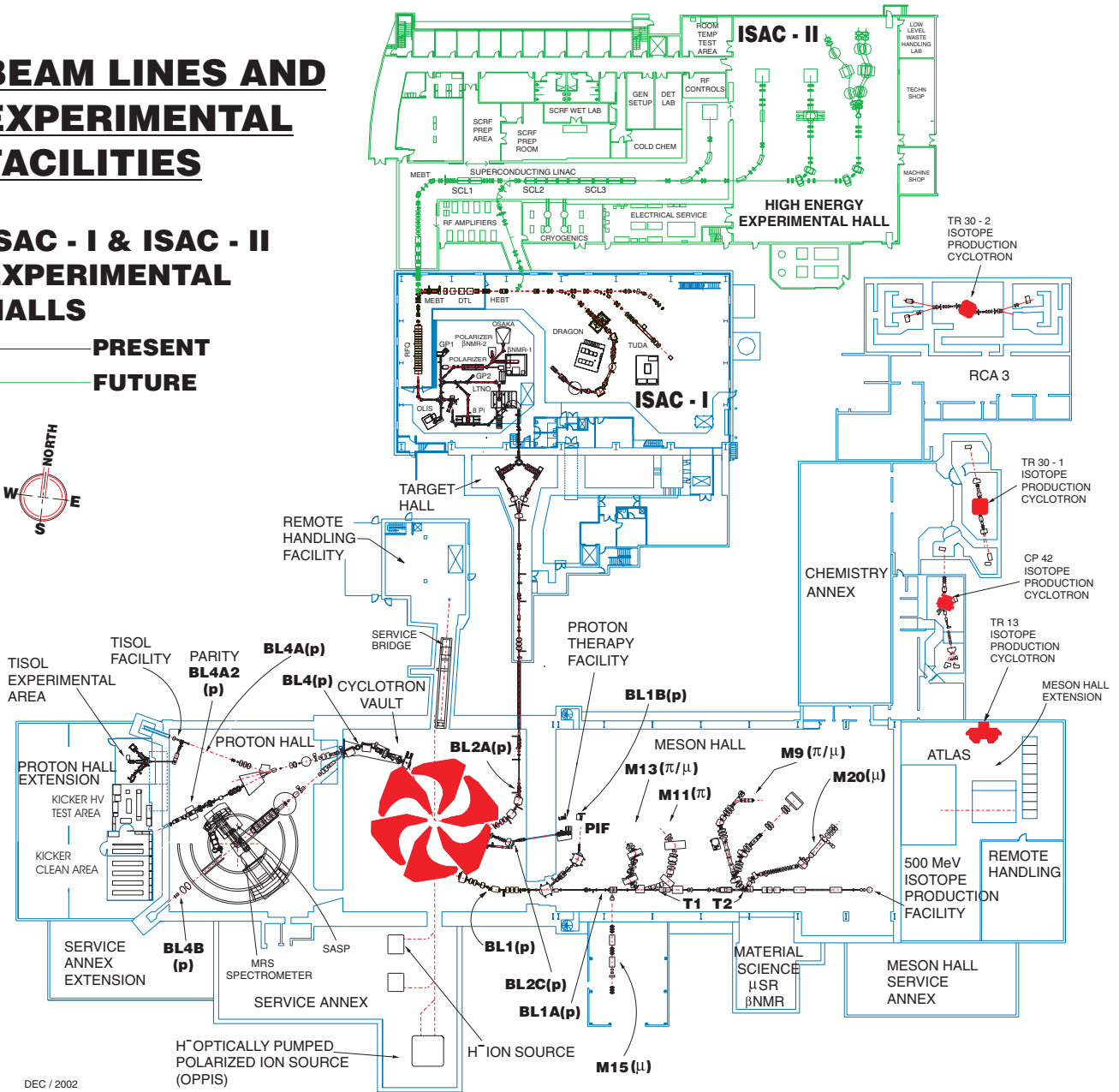
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# BEAM LINES AND EXPERIMENTAL FACILITIES

## ISAC - I & ISAC - II EXPERIMENTAL HALLS

— PRESENT  
 — FUTURE



*The contributions on individual experiments in this report are outlines intended to demonstrate the extent of scientific activity at TRIUMF during the past year. The outlines are not publications and often contain preliminary results not intended, or not yet ready, for publication. Material from these reports should not be reproduced or quoted without permission from the authors.*

## FOREWORD

On behalf of the TRIUMF Board of Management I am pleased to have the opportunity to comment on another very successful year for TRIUMF. Members of the Board are proud of the achievements of the many scientists from Canada and abroad who are making such good use of the facilities TRIUMF provides. These facilities support a truly exciting program of science in nuclear and astrophysics, precision tests of fundamental processes, medical physics, condensed matter physics, and nuclear chemistry. The scientific output of the lab is impressive for its breadth and scope, but especially for the high quality of the research that is accomplished. That quality has been recognized again by excellent support from the Natural Sciences and Engineering Research Council (NSERC). TRIUMF was also a key participant in the successful proposal to build WESTGRID, a computing facility that will, among other things, provide vital support for Canada's particle physics program.

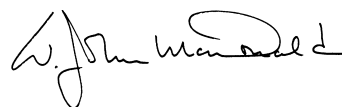
As part of their continuing support of the Canadian and international particle physics community, TRIUMF staff have continued to live up to their reputation for producing state of the art components as part of Canada's contribution to CERN. The ATLAS detector hadronic end-cap calorimeter components and the quadrupole magnets for the LHC continue to be assembled on time and on budget.

Equally important for TRIUMF's success is the professional and competent way the facilities are operated. Equipment has to be maintained and refurbished to meet ever-increasing demands for additional capability. This is particularly important in the case of the original  $H^-$  cyclotron that is the driver for multiple proton beams used for everything from medical treatment to the proton, meson, and radioactive beam programs. Staff members of the Cyclotron division are to be congratulated for their outstanding work in rebuilding and replacing key components of the cyclotron to ensure that it can continue to meet the demands placed on it. It is a tribute to their abilities that the cyclotron is operating at higher than ever efficiency despite the fact that it is now over 30 years old.

As in the past, the Board has been regularly considering matters brought to it from its standing committees: Finance, Human Resources and Safety. In addition, technology transfer was the focus of much discussion this year and the Board decided to establish a fourth committee specifically to consider how to best enhance and promote TRIUMF's existing strengths and future potential in this area. While it is the excitement of the unknown that drives all scientists and the support of good science will continue to be the first priority at TRIUMF, it is also the case that good science frequently leads to developments that can benefit society. The Board recognizes the need to encourage the transfer of ideas developed through the science activity to the wider community. Another matter that received Board attention this year is the search for resources for the replacement of TRIUMF House. The Board is seeking support from the universities to assist TRIUMF in maintaining this vital component to the success of the laboratory.

Finally, work has begun on preparing a new TRIUMF Five-Year Plan for 2005-2010. This exercise will involve considerable work by staff, the user community, administration and the Board to ensure the best possible plan for the future of TRIUMF results.

In closing, I would like to thank all members of the Board who give so generously of their time to assist TRIUMF in its important and exciting work. I would also like to acknowledge, on behalf of the Board, the core funding support of the Government of Canada through the National Research Council and the Government of British Columbia for its contribution to the ISAC-II building. Finally, I wish to personally thank President Arthur Carty of the National Research Council and his staff for their helpful advice and support.



W.J. McDonald  
Chair, Board of Management

TRIUMF was established in 1968 as a laboratory operated by the University of Alberta, the University of British Columbia, Simon Fraser University and the University of Victoria under a contribution agreement from the National Research Council of Canada. The initial consortium has been expanded to include Carleton University as a full member, and the University of Manitoba, McMaster University, the Université de Montréal, Queen's University, the University of Regina and the University of Toronto as associate members. The facility is operated for all Canadian as well as foreign users.

The experimental program is based on a cyclotron which is capable of producing four simultaneous beams of protons, two of which are individually variable in energy from 180–520 MeV, the third from 472–510 MeV, and the fourth between 70 and 110 MeV. The potential for high beam currents – 100  $\mu\text{A}$  at 500 MeV to 300  $\mu\text{A}$  at 400 MeV – qualified this machine as a “meson factory”. The third high intensity beam line feeds the new isotope production facility, ISAC, which started operation in 1998 and qualifies as a second generation radioactive beam facility.

Fields of research include basic science, such as particle physics, nuclear physics, nuclear astrophysics, and condensed matter research, as well as life sciences based primarily on isotope research. There is also a biomedical research facility which uses protons for treatment of ocular melanomae. TRIUMF is providing the Canadian contribution to the Large Hadron Collider at CERN and TRIUMF resources are also available to support the Canadian subatomic program at other laboratories.

The ground for the main facility, located on the UBC campus, was broken in 1970. Assembly of the cyclotron started in 1971. The machine produced its first full-energy beam in 1974 and its full current in 1977.

The laboratory employs approximately 325 staff at the main site in Vancouver and 19 based at the participating universities. The number of university scientists, graduate students and support staff associated with the present scientific program is about 625.