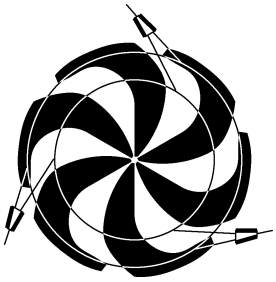
# TRIUMF



# ANNUAL REPORT
# SCIENTIFIC ACTIVITIES
# 1997


CANADA'S NATIONAL MESON FACILITY
OPERATED AS A JOINT VENTURE BY:

UNIVERSITY OF ALBERTA
SIMON FRASER UNIVERSITY
UNIVERSITY OF VICTORIA
UNIVERSITY OF BRITISH COLUMBIA

ASSOCIATE MEMBERS:

UNIVERSITY OF MANITOBA
UNIVERSITÉ DE MONTRÉAL
UNIVERSITY OF REGINA
UNIVERSITY OF TORONTO



UNDER A CONTRIBUTION FROM THE
NATIONAL RESEARCH COUNCIL OF CANADA

APRIL 1998

*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.*

# ADMINISTRATION DIVISION

## INTRODUCTION

The major divisional project for 1997 was the production of a safety analysis report to support an application to the Atomic Energy Control Board for an operating license amendment for the ISAC extension. The design is complete and most of the equipment components are in hand for the access control and radiation monitoring systems to allow the commissioning of beam line 2A in 1998. The design has begun for a system to monitor the $\gamma$-radiation fields from the deposition of secondary radioactive beams from ISAC. Some measurements of the releases of volatile $\alpha$-emitters from thorium targets in TISOL are being analyzed for the information they contain for guiding the ISAC containment system.

Improvements were made during the year in both the hardware and software of the Administrative Computing System. Most, but not all, of the applications and original data base software were updated during the year to avoid any year-2000 anomalies.

## ISAC RADIOLOGICAL SAFETY

### General

During the first part of the year most of the effort on radiological safety for ISAC went into calculating the radioactivity production and distribution and the details of the shielding design. A number of computing tools were installed or updated to help complete these calculations. In February Alberto Fasso at SLAC installed the latest version of the multipurpose, multiparticle transport code FLUKA on alph04. This code has been very useful in verifying some of the shielding estimates and in solving the geometrically more complicated shielding problems.

A review of these first estimates was presented at the Annual Meeting of the Canadian Radiation Protection Association held in May at Victoria, B.C. A number of issues remained outstanding and the second half of the year was devoted to resolving these and filling in many of the details. In October Shiori Furihata joined the Safety group on sabbatical from the Mitsubishi Company. She installed the LAHET Code System on lin01 and has used this to calculate production cross sections for a number of radiologically significant isotopes. The design and construction of the access control and radiation monitoring systems also gathered momentum during the fall. By the end of the year an updated and expanded ISAC Safety Analysis Report was submitted to the Atomic Energy Control Board in support of an application for an operating licence.

### Licensing

The first draft of the ISAC Safety Analysis Report (ISAC SAR) was submitted to the Atomic Energy Control Board (AECB) in December, 1996 as supporting documentation for an application for a licence to construct ISAC. After review by AECB staff this report was revised and expanded and then re-submitted in February, 1997. The report summarized the analysis of the radiological aspects of the ISAC extension to TRIUMF. TRIUMF made a presentation to the Board at their meeting in Ottawa on April 3, 1997 and was subsequently granted a licence to construct.

The ISAC SAR was further expanded with new sections on commissioning and accident analysis. The estimates of radioactivity production were refined and the requirements for a possible internal dosimetry program were worked out with the help of a consultant. To obtain some assurance that no major issues had been overlooked, TRIUMF convened a panel of international experts from some of the major accelerator centres in Europe and North America to review the report. The panel met at TRIUMF for three days early in November. In addition to the ISAC SAR and the supporting documentation the panel was given two days of oral presentations by the ISAC designers and a tour of the nearly complete ISAC building. The review panel submitted a written assessment which was generally favourable but recommended that because of the largely unpredictable extent of the contamination problems we are likely to encounter that the progress towards full beam power on high-$Z$ targets be gradual, with an assessment at each incremental increase. This was in any case the approach that had been planned.

The revised ISAC SAR was then submitted to the AECB with a request for an operating licence.

### Interlocks

The design of the interlocks for access control follow very closely the approach that has become standard at TRIUMF. In this case there is, however, a distinction between those areas which need to be controlled because of the proton beam and therefore need to be integrated into the existing 500 MeV cyclotron Access Control System and those that need to be controlled because of the presence of radioactive ion beams. The design of the former was completed by the end of the year and the aim is to have the installation finished in time for the first proton beam test in April, 1998.

The design of the ion beam access control including that for the system of linear accelerators was still very

much in the conceptual stage by the end of the year.

### Radiation monitoring

Here also there is a conceptual difference between the monitoring which is needed for the radiation originating from the proton beam and that originating from the radioactive ion beams. The former needed to be integrated into the 500 MeV cyclotron radiation monitoring and logging system and most of the monitors had been procured by the end of the year with installation of cabling well under way. However, the existing system cannot be expanded to include the large number of monitors that will be needed to properly diagnose beam losses and x-ray sources in the experimental hall. For this task a new system is being designed which will take advantage of the EPICS control system tool kit. The new radiation monitoring and logging system will be designed so that it can eventually be expanded to read and interpret all the monitors in the existing system as well.

## OPERATIONAL SAFETY

### AECB licensing

Normal licensing activities such as routine Operating Licence amendments were delayed due to the considerable amount of time spent by the AECB preparing for the TRIUMF ISAC Extension Safety Report and its subsequent review. A long-awaited 'Policy on Safety in the Workplace' document was written and submitted to the AECB in the spring. The document will be referred to in the next licence amendment.

The AECB designated TRIUMF as an approved agency for survey meter calibration and calibration source leak testing. The approved agency status was granted after an on-site review of facilities and procedures.

A TR30 Upgrade Report was submitted to the AECB in August and the request to increase routine currents from 250 $\mu$A to 350 $\mu$A on Cd-112, Tl-203 and Zn-68 targets was approved late in the year.

### Site security

Site security became an issue after the theft of a significant amount of copper stock in early April. A private security firm was immediately contracted to provide a patrol during hours of darkness. TRIUMF is documenting a thrice-weekly check of the entire perimeter fence to complement the on-going patrol service.

Late November saw the perimeter of the TRIUMF site security fence expanded to encompass the new ISAC building. Repairs and improvements were made to the original sections of the security fence to bring them up to the same standard as the new ones.

### Site environmental

TSG's Industrial Safety Officer continued to reduce TRIUMF's inventory of waste chemicals. Twelve 45 gallon drums of solvents, coolants and oil were disposed of by the UBC Waste Management Department during the summer. The chemicals left in the abandoned Bio-Medical Annex were also declared waste products during 1997. They, too, were disposed of after several days of packaging and labelling.

TRIUMF's inventory of radioactive waste has also been reduced considerably. Several large waste shielding blocks in various stages of deterioration were shipped for disposal as low specific activity material.

### Interlocks and monitoring

Three new beamspill monitors were installed in the 500 MeV cyclotron vault. The monitors were placed along the east wall and are intended to monitor the vault section of the new beam line 2A.

An alpha cell monitor was installed on the TISOL exhaust stack prior to Expt. 714's spring run with a thorium target. Data from the monitor were used to calculate Rn-220 releases from the target and to form a basis for further studies on the detection of alpha emitting isotopes at TRIUMF. The detected releases were well within TRIUMF's derived release limits for this isotope.

Interlocks that allow the south CP42 cyclotron P5 cave to be accessed while running beam to the north P13 cave were finally commissioned. The interlock logic has been in place since the facility was built, however, signals from the appropriate beam control devices had only recently become available.

### Personnel dosimetry

Several changes were made to TRIUMF's internal system of dose guidelines. The old 3 mSv per shutdown guideline has been changed to a 3 mSv per sliding month guideline. This allows the guideline to be applied to the Applied Technology group which does not schedule major shutdowns and will also be more appropriate for the lengthy four month shutdown planned for early 1998. A 5 mSv per sliding quarter guideline has been retained. A 'Dose Status Report' will be used to communicate information on those who exceed the various guidelines to Group Leaders and Division Heads.

A 10 mSv per calendar year dose, determined by a best estimate of TLD and direct reading dosimeter dose totals, is still recognized as the significant policy limit at TRIUMF.

Changes were also made to the reporting capabilities of the 500 MeV facility's direct reading dosimeter

service program itself. The program can list all personnel who exceed each individual dose guideline, allowing the state of dose management at TRIUMF to be reviewed and reported.

The collective dose as measured by the TRIUMF direct reading dosimeter service was 424 mSv for 1997. Table XIV shows the breakdown of the collective dose by various groups:

Table XIV. Collective DRD dose.

| Group | Dose (mSv) | Fraction of Total (%) | Median (mSv) |
|---|---|---|---|
| Applied Program | 90.6 | 21.4 | 3.3 |
| Beam Lines/Probes | 18.0 | 4.2 | 4.6 |
| Experimenters | 11.4 | 2.7 | 0.1 |
| 500 MeV Operations | 36.0 | 8.5 | 1.8 |
| Life Sciences | 25.7 | 6.1 | 0.4 |
| Mech. Engineering | 15.6 | 3.7 | 1.6 |
| Outside Contractors | 10.7 | 2.5 | 0.2 |
| Plant Group | 19.5 | 4.6 | 0.4 |
| RF Group | 22.2 | 5.2 | 1.0 |
| Remote Handling | 41.3 | 9.7 | 4.8 |
| Safety Group | 17.6 | 4.2 | 0.6 |
| Tech Support | 30.3 | 7.1 | 1.9 |
| Vacuum Group | 14.1 | 3.3 | 2.4 |
| Others | 71.2 | 16.8 | — |
| Total | 424.2 | 100.0 | 0.5 |

## ADMINISTRATIVE COMPUTING

### Data processing

The IBM AS/400 computer system that is used for administration data processing was upgraded substantially during the 1997 calendar year. Near the start of the year, the 48-bit CISC-based processor was replaced with a faster, 64-bit RISC-based processor and all application software was converted to run on the new system. Near the end of the year, the operating system was upgraded to Version 4, Release 1, which resulted in additional performance improvements and improved system utilities. During the year, half of the old IBM System/38-era data-entry terminals were replaced with network stations; it is expected that the remaining data-entry terminals will be replaced in the new year.

This year also saw a move towards using the internet, and particularly the World Wide Web, as a means of distributing information. The AS/400 hardware upgrades allowed us to start developing data inquiry applications for Web browsers, including supplier lookups by name and commodity and a prototype stores catalogue. The operating system upgrade at year-end included implementation of a secure Web server, which now allows more control over who can see information we publish on the Web. This will allow many more Web-based applications, including some that would offer end-users a paperless alternative to the reports now distributed monthly.

Preparation for the year 2000 also went into high gear this year. All hardware and operating system software was already year-2000 compliant, as were all applications written in-house in the past few years, but many applications and much of the administration database design that was originally purchased and written on the System/38 were not. By year-end, all Personnel, Stores, Cost-Centre, Purchasing, and Receiving applications were made year-2000 compliant; it is expected that the remaining applications will be compliant by the end of 1998.

### Word processing

The word processing systems saw only incremental changes in 1997, including application software upgrades, memory upgrades, and a couple of additional networked PC stations. During the year, most older business office PCs were moved onto the same server as used by the word processing PCs, resulting in a common environment in both areas.

### Telephones and telecommunications

The most significant change made in the site telephone system in 1997 was the implementation of a two-step direct access to all 6xxx locals by dialing 221-3200 from off site. The telephone system did suffer major damage due to a lightning strike this summer. Unfortunately, aside from the cost of replacing damaged hardware, the failure exposed problems in the telephone system's configuration-file back-up software as well. As a result, it took much longer than necessary to get service back to the pre-lightning state. New procedures have been implemented to ensure that the backed-up configuration-file is now current.