

## TRIUMF PPAC 5yr plan summary

Summary of the very 1<sup>st</sup> Policy and Planning  
Committee Meeting

### Introduction

- This talk represents the summary of the first PPAC (TRIUMF Policy and Planning Advisory Committee) meeting
- The charge for the first meeting was simple: Evaluate all proposals for the next 5yr plan, and give advice on their relative merits
- As we all know from condensed matter, complex behaviour can arise from very simple rules
  - I'd like to thank the committee for working so hard under extreme pressure, high temperatures (just missing high B-fields to round out the list)
  - They put up with a 15 hour day, late night phone meetings and a very short time to work during a busy time of year to participate
  - Everyone is highly motivated to see TRIUMF continue to thrive and grow during the period covered by the next 5yr plan

## PPAC Committee

- PPAC is a large committee that combines a broad representation from the TRIUMF-associated universities and an expertise in the wide range of physics performed at the lab.

•Mauricio Barbi, Univ of Regina	•Graeme Luke, McMaster Univ
•Sampa Bhadra, York Univ	•Shelley Page, Univ of Manitoba
•Mark Boulay, Queens Univ	•Maxim Pospelov, Univ of Victoria
•Colin Gay, Univ of British Columbia	•Michael Roney, Univ of Victoria
•Stephen Godfrey, Carleton Univ	•Pierre Savard, Univ of Toronto
•Aksel Hallin, Univ of Alberta	•Vesna Sossi, Univ of British Columbia
•Michael Hayden, Simon Fraser Univ	•Carl Svensson, Univ of Guelph
•Ritu Kanungo, Saint Mary's Univ	•Brigitte Vachon, McGill Univ
•Rob Kiefl, Univ of British Columbia	•Michel Vetterli, Simon Fraser Univ / TRIUMF
	•Viktor Zacek, Univ de Montreal

- The suite of proposals for inclusion into the next 5yr plan is very strong, and was forwarded to the committee in the form of 43 “1-pagers” on each option
- I doubled checked with my 6-year old daughter this morning to make sure, and I’m now fairly confident that  $43 \times 1 \neq 112$ , so our first recommendation is that all senior management at TRIUMF be provided with pocket calculators

## PPAC

- We were charged with providing a recommendation of priorities of the projects. The projects were divided roughly into major categories. With some adjustment, our major categories were:
  - Accelerators On Site
  - Accelerators Off Site
  - Life Sciences
  - Generalized Infrastructure
  - Molecular and Materials Science
  - Subatomic Physics On Site
  - Subatomic Physics Off site
  - Theory
- For the CFI proposals, we considered them within their appropriate category above

## What we did

- The criteria we used to evaluate proposals included
  - Scientific Merit
  - Interest within the Canadian Research Community
  - International impact/connections/visibility
  - Benefit to Canada, spinoffs etc
  - Impact on TRIUMF
- We did not try to build a plan that had a detailed weighting of projects based on fitting into a total budget
  - Resource envelope is not set
  - Resource needs for each project are not understood at the same level
  - Several of the larger projects will have more detailed resource needs developed over the coming weeks, so it is premature for this committee to guess the outcome of that work

## Guiding principles

- There is broad support for
  - Having the most compelling science program
  - Continuing to increase our connection with the larger International research and technical community is critical
  - Expanding the Life Science and Materials programs, which have large potential benefits to Canadian society, increase the lab visibility, and have clear technology spinoff capabilities
  - Continued support for University-driven projects in which unique TRIUMF resources can have a major impact
  - Ensuring there remains some flexibility for reacting to interesting new ideas that arise during the coming 5 years (i.e. keep some resources in hand to deploy as needs evolve and arise)
- The lab plan should be consistent with the NSERC Long Range Plan for SAP, though new developments are not excluded

## Accelerators On-site

*Increasing the number of simultaneous experiments in ISAC and providing the new beams using actinide targets is a top priority for TRIUMF*

All items in this category therefore have high priority

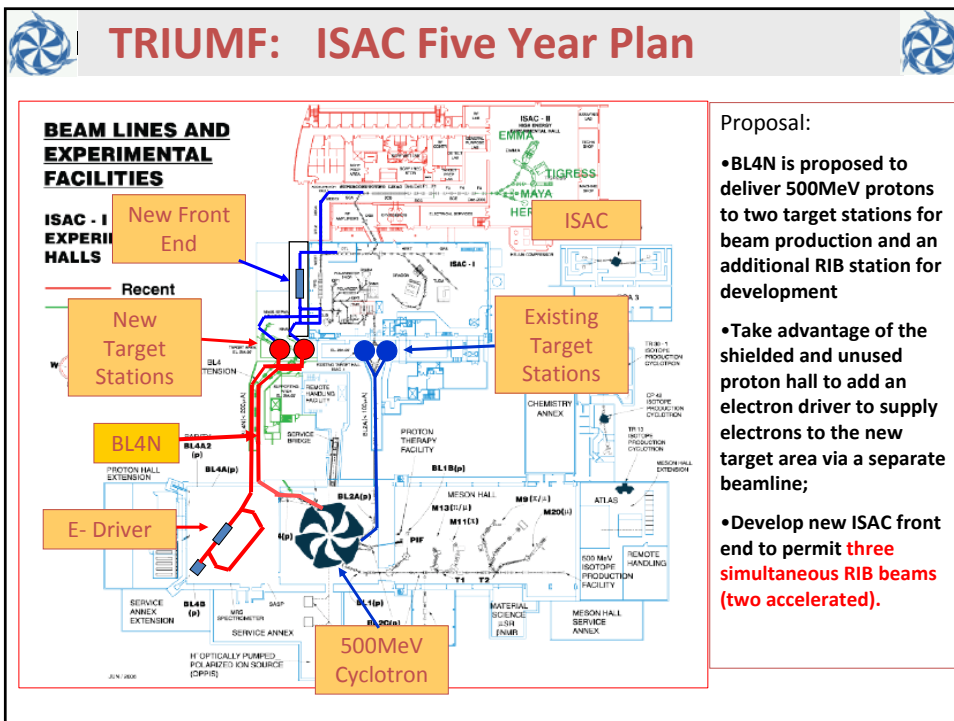
In order to achieve this goal as quickly as possible, a staged approach to the upgrades is the correct strategy.

## Accelerators On-site

The following order is optimal to increase the # of beams ASAP:

- New beam line from the cyclotron (BL4Np)
- Two new target stations, including the actinide targets and the beamline elements (LEBT, CSB) necessary to provide two simultaneous beams to ISAC-1
- Upgrading the cyclotron to 300  $\mu$ A and improving the stability of the beam (increased intensity needed for new target stations)
- New e-linac driver  
(the committee identified this as the top priority for CFI funding)
- Transport lines (MEBT) and accelerators (RFQ, DTL, SC-linac) to provide a third beam to ISAC1 and ISAC-2
- Increase cyclotron output to 400  $\mu$ A

All of the items above, except last one, are considered URGENT!



## Accelerator On-site

- The proposed facility, with two new production beams, provides a wide variety of new beams to ISAC and will solidify TRIUMF's position as a world-leader in Radioactive Beam Physics.

The proton and electron beams, in combination with the actinide targets, will give access to a complementary set of beam species.

TRIUMF can then follow through on the numerous high-priority experiments currently on the EEC list and dramatically increase the scientific output of the lab.

- All fields of research in the TRIUMF program will benefit:
  - new beams to astro/nuclear physics
  - beams required for top-priority fundamental symmetries experiments
  - much more beam for  $\beta$ -NMR
  - radionuclide mining for medical applications
  - accelerator physics & tech transfer

## Accelerators On-site

- It should be possible to build the proton beamline earlier because the driver already exists.
- The e-linac is an excellent solution that addresses many issues at once.
  - Photofission on U will give ISAC physicists access to important new beams.
  - The accelerator technology developed will allow TRIUMF to contribute to several new facilities (ILC, SLHC, light source,...).
  - The superconducting RF technology can be transferred to Canadian industry, opening new opportunities on the international stage.

## Accelerators Offsite

- **1<sup>st</sup> Rank ILC/SRF Machine Contribution**
  - scientific impact: future of HEP; broad physics program
  - benefit to univ. community: high - broad user base for ILC detector
  - benefit to Canadian society: high - maintains accelerator expertise in Canada; high potential for tech transfer (e.g. Pavac)
  - other comments: potential future for TRIUMF
- **1<sup>st</sup> Rank sLHC Accelerator**
  - scientific impact: future of HEP; discovery machine
  - benefit to univ. community: high - broad user base for ATLAS upgrade
  - benefit to Canadian society: high - maintains accelerator expertise in Canada (such expertise required in diverse areas of Canadian society); provides Canadian contribution to CERN
  - other comments: PS2 maintains/develops unique TRIUMF expertise; Significant capital contribution to sLHC should be considered separately from this R&D. (more comments on discussion of relations between categories)

## Accelerators Offsite

- **2<sup>nd</sup> Rank J-PARC**
  - scientific impact: premier facility for neutrino physics
  - benefit to univ. community: high - broad user base for T2K
  - benefit to Canadian society: medium - continues to maintain accelerator expertise in Canada
  - other comments: draws on specialized TRIUMF expertise
- **3<sup>rd</sup> Rank ELENA**
  - scientific impact: increases number of low energy antiprotons several orders of magnitude
  - benefit to univ. community: user base in ATRAP & ALPHA
  - benefit to Canadian society: has educational value

**Molecular and Materials Research****TRIUMF Center for Molecular and Materials Research in 2010-2015**

- The committee was impressed with the high scientific productivity and quality of this program. The center has received significant external funding to expand their program, increasing the number of muon endstations (from 3 to 5) with new capabilities. In addition, the  $\beta$ NMR program has evolved from a proof of principle to a valuable technique for the study of nanostructures and interfaces and is poised to make significant discoveries.
- The committee notes that the facility already receives significantly less support from the laboratory in comparison with similar facilities worldwide. In order to capitalize on the new facilities and capabilities, a significant increase in the number of TRIUMF supported personnel and operating resources is essential.

**Molecular and Materials Research**

- The committee also recommends that a second driver for  $\beta$ NMR be developed as soon as possible. This adds to the scientific case that a new ISAC driver be developed as a high priority for the laboratory.
- A reliable and clean supply of liquid helium is essential for the operation of the TCMMS. Therefore the committee wholeheartedly supports plans for the acquisition of a new helium liquifier as part of the general infrastructure of the laboratory.



## Subatomic Physics On Site (Priorities)

## 1. ISAC:

- The highest priority of the on-site subatomic physics program must be the continued, and enhanced, support and exploitation of the ISAC-I and ISAC-II facilities for radioactive ion beam production, including strong programs in **Fundamental Symmetries** and **Nuclear Structure and Astrophysics**.
- The committee strongly endorses a major new interdisciplinary thrust in fundamental symmetry tests utilizing laser technology and actinide beams, including high discovery-potential searches for CP-violation through precision electric dipole moment measurements.
- The new high-intensity proton beamline, actinide target stations, and low-energy beam transport to ISAC are essential to pursue this program and are therefore ranked as the highest priority for onsite accelerator development.

## Subatomic Physics On Site (Priorities)

## 1. ISAC (continued):

- Together with the new electron-linac driver, the provision of 2, then 3, simultaneous radioactive beams to ISAC will enable the full exploitation of the ISAC facility for fundamental symmetry, nuclear astrophysics, and nuclear structure research, identified as one of the highest priorities of the Canadian subatomic physics community.
- The full exploitation of ISAC beams also requires the continued development of advanced detectors and the committee strongly endorses CFI proposals to bring this infrastructure to TRIUMF. The lab should carefully evaluate the resource implications of each proposal.
  - **GRIFFIN** (CFI, Ontario MRI) will increase the  $\gamma$ - $\gamma$  efficiency of the  $8\pi$  Spectrometer at ISAC-I by a factor of 400 with only a modest increase in demand on TRIUMF resources and should be pursued vigorously.
  - **IRIS** (CFI, Nova Scotia) will provide a unique cryogenic target capability for reaction studies at ISAC-II and should be pursued. A matching contribution from vendor discounts should be explored.

## 2. Ultracold Neutrons (CFI):

- The committee endorses the development of the world's highest density ultracold neutron source at TRIUMF in close collaboration with groups from Japan and the United States.
- The UCN facility will represent a major new fundamental symmetry and nuclear physics capability at TRIUMF.
- We recommend TRIUMF pursue a more detailed engineering study to define the TRIUMF and CFI resource requirements, as well as implications of the UCN installation for CMMS and other users.

## 3. Particle Physics On-Site ( $\pi \rightarrow e\nu$ ):

- The pienu experiment is scheduled to begin 2008 and will improve the  $\pi^+ \rightarrow e^+\nu$  branching ratio by an order of magnitude, providing a sensitive probe of model-dependent new physics to very high mass scales.
- The committee recommends completion of the experiment by 2012 as scheduled.

- We were asked to rank the projects based on the quality of the science, Canadian community interest, benefits to society, international partnerships, and value to TRIUMF
- In its evaluation of the subatomic offsite projects, the committee was also guided by the report of the NSERC Long-Range Planning committee.
  - The top priority projects identified by the LRP report were ATLAS, SNOLAB, and T2K.
  - The LRP report also recommended that “a broad program of smaller efforts be maintained to provide breadth and diversity to the Canadian physics community, and to allow for novel and emerging initiatives”

## Subatomic Offsite (2)

- We identified the highest priority projects as:
  - ATLAS Tier-1 and physics centre at TRIUMF
  - Continued support for T2K
  - SNOLAB

## Subatomic Offsite

- The concept of supporting smaller efforts that provide breadth and diversity was considered to be very important to the Canadian university community.
- TRIUMF as a national laboratory has outstanding technical capabilities that are generally not available at universities. By applying a modest fraction of these resources to support high-quality smaller projects, TRIUMF can leverage a large scientific impact with a relatively minor investment.

## Subatomic Offsite (3)

After ATLAS, SNOLAB, and T2K, the ranking of the presented projects is

Notes:

- LHC results will influence plans and priorities during the 5-year plan period
- Some of the projects that have a lower ranking require very modest resources from TRIUMF and might be easily accommodated

Project	Priority
ILC detectors	high
SLHC detectors	high
JLAB experiments	medium
Super B detector	medium
Cold Neutrons at SNS	low
ALPHA	low
Detector Simulation	low
Rare Decays	lowest

## Life Science

**Life Sciences**

The Committee enthusiastically endorses an expansion of the TRIUMF Life Science program.

It is important that this expansion be carried out with a view to building a cohesive thrust based on existing and core strengths of the larger effort at TRIUMF.

**Support and enhancement of existing programs (high priority)**

- **Proton therapy** – benefit to the larger community

- **Use of radiotracers for medical imaging** (long standing relation with PPRC and newly established relation with BCCA)- very successful research programs.

New infrastructure needs to be put in place to ensure continued success of this program. Increase in personnel is recommended.

**Main thrust of expansion (high priority)**

**Triumf should take a strong international leadership role in radiotracer developments, which requires expertise and development in cyclotron/targetry/radiochemistry, all areas where Triumf has unique knowledge .**

There is national interest for this effort in the form of a preparation of a National CFI application.

Testing of the newly developed radiotracers *would be complemented by small animal imaging capabilities and chemistry space.*

New positions would have to be created and new infrastructure would be required. Collaborations with industrial partners should be fully exploited.

## Life Science

**Other areas of expansion (in no particular order)**

- Microfluidics (moderate investment, high risk, high potential return)
- Mining radionuclides (feasibility not fully investigated, but natural fit for Triumf, high potential return)
- Instrumentation development (natural and obvious fit for Triumf, area of research not unique to Triumf)

The committee recommends that the LS community further assesses the merit of these projects with a view to capitalizing on the core strengths of the community.

The committee also recommends increasing the number of Life Science experts on Triumf committees.

## Theory Group

A world-class lab requires a world-class theory group

- that is a resource to the Canadian subatomic physics community, both theory and experiment,
  - a centre that people wish to visit because it is an exciting environment, running workshops, conferences, and schools.
- 
- Increase of theory support would increase science return of experimental program
  - Strong theory group would raise national and international profile of TRIUMF

## Recommendations

To foster a world class theory group that is a resource to TRIUMF and the Canadian Subatomic physics community TRIUMF should:

1. Take steps to increase the impact of the Theory Group by:
  - Increasing its size to be more in line with the size of theory groups at national laboratories of similar size
  - Focusing on the physics priorities of TRIUMF. Hiring people with overlapping research interests will result in collaboration, synergies, and complementarity.
2. Take initiatives to raise the national and international profile of the Theory Group and TRIUMF by:
  - Funding a workshop/conference program. (Workshops in the style of CERN to produce “yellow reports” on TRIUMF physics topics could be especially valuable)
  - Funding and actively promoting a visitor program that is broadly accessible (sabbatical and summer visits)
  - Increasing the interactions with the universities (eg collaborations and give seminars & colloquia)

Additional comments:

- The theory group will need additional office space to accommodate this increase
- Bridging university faculty positions could be explored as a possible means of strengthening the TRIUMF Theory Group and connections with the Universities.

## Generalized Infrastructure

The committee takes note of the issues related to generalized laboratory infrastructure and is confident that lab management will take the appropriate actions.

- We recognize that helium retention and recycling will become of prime importance in the future operation of TRIUMF. Current helium suppliers are often contaminated resulting in significant loss of beam. In addition to the economical aspects, the Helium Liquefaction Plant project will provide the necessary quality of liquid helium essential for several projects at TRIUMF.

## Generalized Infrastructure

- The committee recognizes the value of LADD as a resource for detector development that can effectively serve the needs of TRIUMF and the Canadian university community, as for example by contributions of LADD to medical imaging and to SNOLAB projects.
- A transparent process should be developed to enable the research community to access LADD resources under TRIUMF management.
- We support additional resources commensurate with the needs of the Canadian research community. Research such as *Curiosity-Driven Detector Research* projects could be carried out in the context of LADD.



## Summary

- I'd like to thank the committee again for working so well together
- We'd like to thank Nigel for giving us the opportunity to be a part of this important process
- Thanks to Tim and the 5yr planning committee for their quick response to all our questions