Proposal for TRIUMF Commitment (5YP 2015-2020)

Date:
September 17, 2012

PROJECT/COMMITMENT TITLE: Canadian participation in a future e+e- linear collider

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PRINCIPAL COLLABORATORS: Alain Bellerive, Madhu Dixit, Francois Corriveau

PROJECT DESCRIPTION:

For more than a decade, Canadian researchers have participated in the worldwide effort to understand the physics potential and to demonstrate the feasibility of an e+e- linear collider as the next major facility in experimental particle physics. Present Canadian detector efforts have focused on precision tracking systems based on a time projection chamber with micropattern gas detectors and calorimeter systems with unprecedented granularity to achieve exceptional jet energy resolution. Superconducting accelerator technology developed for the International Linear Collider (ILC) is being built in Canada and deployed at TRIUMF in the ARIEL elinac.

The ILC Steering Committee has directed the Global Design Effort, led by Barry Barish, to complete the ILC Technical Design Report by June 2013. An advanced draft is to be complete in late 2012, and will undergo significant review prior to submitting the final report to ICFA at the 2013 Lepton Photon conference. The design for a higher energy linear collider, known as CLIC, continues to progress, primarily at CERN. The two detector system designs approved for inclusion in the ILC TDR are also used to understand the capabilities of CLIC.

Governments around the world will decide if a linear collider project goes forward. As such, it is impossible to predict the timeline. Should the project go ahead during the period 2015-2020, it is proposed that TRIUMF participate, as Canada's national particle physics laboratory, thus allowing Canadian physicists to take part in the exciting science and technology program that this entails.

SCIENTIFIC JUSTIFICATION:

The scientific justification for an e+e- linear collider has been documented in numerous documents:

- A comprehensive report was written for the ILC reference design report in 2007 and is available here: http://ilcdoc.linearcollider.org/record/6321/files/ILC_RDR_Volume_2-Physics_at_the_ILC.pdf?version=4

- A summary of the physics and detector studies was prepared in late 2011 and is available here: http://ilcdoc.linearcollider.org/record/35024/files/ilc_detector_report_2011_lores.pdf

Highlights of the physics program include detailed investigation of the Higgs, the top quark, and possibly new particles, including new stable neutral particles that may be responsible for the so-called dark matter.

With the strong evidence for a Higgs-like particle announced by the LHC experiments, the rich program of precision Higgs studies at a linear collider is confirmed.

RELATIONSHIP TO BROADER CANADIAN RESEARCH COMMUNITY:

Participation in a future linear collider has been highlighted as a priority in the last three long range plans of the Canadian subatomic physics community (since 2001). Researchers at several Canadian Universities have contributed to both theoretical and technical advancements, including Victoria, British Columbia, Carleton,

Montreal, and McGill. Should the project be approved, it is expected that a large number of Canadian researchers will participate, following up on the tremendous success of the LEP physics program.

The linear collider appeared as an important future project in the 2010-2015 TRIUMF five year plan.

TRIUMF resources would be called upon for accelerator and detector design and construction. The 2010-2015 TRIUMF 5YP proposed that the TRIUMF resources required after project approval would be roughly 5 mechanical engineers, 2.5 mechanical technicians, 2.5 electrical technicians, 4 designers, and 2 accelerator physicists.

BROADER IMPACTS:

Canadian participation in a future linear collider could provide significant economic impact, as Canadian industry is developing the necessary experience with superconducting cavity technology through the ARIEL elinac project.

This project would represent a major scientific undertaking, and participation by Canada would be essential to maintain Canada's reputation for excellence in fundamental research.

MAJOR MILESTONES:

Description	Date
LC project approval	Unknown – assumed in
	year 3 for illustration below

RESOURCE REQUIRMENTS:

CASH FLOW REQUIREMENTS						
\YEAR SOURCE \	ONE	TWO	THREE	FOUR	FIVE	TOTAL
TRIUMF						
EXTERNAL						
TOTAL						
TRIUMF NON-CASH RESOURCES						
\YEAR RESOURCE\	ONE	TWO	THREE	FOUR	FIVE	TOTAL
Engineering						
- Mechanical			2 FTE	3 FTE	5 FTE	
Physics						
- Accelerator			1 FTE	2 FTE	2 FTE	
Technical						
- Mechanical			1 FTE	2 FTE	2.5 FTE	
- Electrical			1 FTE	2 FTE	2.5 FTE	
- Designer			1 FTE	3 FTE	4 FTE	

EXTERNAL FUNDING INFORMATION:

Existing NSERC grants support detector R&D. Funding for design/construction phase unknown.

ONGOING OPERATIONAL REQUIREMENTS:

DECOMMISSIONING REQUIREMENT:

Accepted: Date: