Proposal for TRIUMF Commitment (5YP 2015-2020)

Date:
September 17th, 2012

PROJECT/COMMITMENT TITLE: DEAP

PROPONENT: F. Retiere **TRIUMF CONTACT:** F. Retiere

PRINCIPAL COLLABORATORS: D. Grant, A. Hallin (U. Alberta), K. Graham (Carleton), M. Boulay, A. McDonald, T. Noble, W. Rau (Queens), F. Duncan, C. Jillings (SNOLAB)

PROJECT DESCRIPTION:

DEAP is a Dark matter search Experiment based on liquid Argon Pulse shaping discrimination. It is located at SNOLAB. It is scheduled to start operation in 2013. The construction and commissioning of the experiment will be completed before 2015. It will operate for a yet unknown number of years, but certainly until 2017. It is likely to go through 2 phases: normal argon, with 1000 Bq of radioactive ^{39}Ar isotope per tonne of normal argon and then depleted argon with about a factor of 100 less ^{39}Ar.
TRIUMF is responsible for DEAP readout electronics. Support from the electronics development group and data acquisition group will be required throughout the life time of the experiment. Furthermore, when switching to depleted argon the trigger condition will have to be updated. This will be mostly addressed by physicists but may also involve engineers. In general, the trigger was designed to be very flexible. Trigger optimization is expected to be one of the main tasks that DEAP group at TRIUMF will tackle. In addition, we will ensure accurate simulation of the electronics and we will be directly involved in the dark matter search analysis.

SCIENTIFIC JUSTIFICATION:

DEAP is a competitive dark matter search experiment. Its sensitivity is expected to be better than the LUX experiment currently running. It should be the most sensitive spin-independent dark matter search experiment until the XENON-100 comes online. If dark matter was to be discovered by DEAP, it would be a very significant achievement for the Canadian research community.

RELATIONSHIP TO BROADER CANADIAN RESEARCH COMMUNITY:

DEAP is a collaboration between 6 Canadian institutions, University of Alberta, Carleton University, Queens University, Laurentian University, TRIUMF and SNOLAB and 3 British institutions.

BROADER IMPACTS:

TRIUMF contribution to DEAP electronics is already finding other applications. The mother board of DEAP Digitizer and Trigger Module will be used for GRIFFIN. It is foreseen to be used in multiple applications at TRIUMF. The DEAP trigger architecture with 2 trigger levels in firmware and then software is likely to prove popular in other applications because it is highly customizable. Maintaining the DEAP electronics through the life of the experiment will enable TRIUMF to gain useful expertise in long term operation of such a system. Several graduate students are expected to work within the DEAP group at TRIUMF. In addition, undergraduate students will also be involved in the data analysis and electronics operation.

MAJOR MILESTONES:

Description	Date
First dark matter search paper (normal argon)	2015
Depleted argon fill	2016
Second dark matter search paper with depleted argon	2017

RESOURCE REQUIRMENTS:

CASH FLOW REQUIREMENTS						
\YEAR SOURCE \	ONE	TWO	THREE	FOUR	FIVE	TOTAL
TRIUMF						
EXTERNAL	100,000	100,000	100,000	100,000	100,000	500,000
TOTAL						
TRIUMF NON-CASH RESOURCES						
\YEAR RESOURCE\	ONE	TWO	THREE	FOUR	FIVE	TOTAL
Electronics dev.	3	5				8
DAQ	3	5	3	2	2	15

EXTERNAL FUNDING INFORMATION:
The external funds are expected to be obtained from NSERC. The amount only includes the fraction of the grant going to TRIUMF (about 15% of the total).

ONGOING OPERATIONAL REQUIREMENTS:
TRIUMF will be responsible for maintaining DEAP electronics. The system is being designed to allow most operations to be performed from Vancouver.

DECOMMISSIONING REQUIREMENT:
None. The equipment will remain at SNOLAB.

Accepted: Date: