TRIUMF
Canada's National Laboratory for Particle and Nuclear Physics
STUDENT JOB PROGRAM
Summer 2018 job posting
Job number TR18-2-21

Student job title:
   E61 R&D Analyst

Name of project:
   Development and simulation of the E61 multi-PMT photosensor

Overview:
   Neutrino oscillations are the only experimentally verified observation of a process not described by the Standard Model (SM) of particle physics. Since their discovery in 1998 we have learnt a lot about the parameters that govern these oscillations, but there are still many questions remaining. Perhaps the most exciting of these is to determine whether neutrino oscillations violate the charge-parity (CP) symmetry of the SM, and so could potentially explain why we live in a matter-dominated universe.

E61 is the proposed intermediate detector for the Hyper-Kamiokande (HK) project, the next generation neutrino oscillation experiment in Japan. HK is the planned successor to the current Super-Kamiokande and T2K experiments and is expected to start taking data in 2026. It will be a powerful tool for exploring neutrino oscillations, as well as other phenomenon such as proton decay and supernovae neutrinos.

The Canadian T2K group is working on a number of interesting R&D efforts aimed towards E61 and HK.

The goal of this project is to assist in the development of the E61 multi-PMT photosensor (mPMT). The mPMT is composed of a series of 3" photo-multiplier tubes placed inside a transparent pressure vessel along with their readout electronics. For this project you will
Duties:
The main responsibility of the student would be to assist in the commissioning of the existing mPMT prototype. This will involve testing the response of the mPMT, and potentially the 3" PMTs it contains, to laser light. This will provide data on the light collection and angular efficiency of the mPMT which will then be implemented in the E61 simulation. The second responsibility will be to use this simulation to understand the impact of the mPMT on the E61 event selections, in particular measuring the intrinsic electron-like background at NuPRISM, which will provide an important constraint for the HK CPV analysis.

Skills learned during this work experience:
The student will gain experience in many aspects of a complicated physics problem. This will range from low level work on PMT hardware through to the development of event selection algorithms and physics studies with water Cherenkov neutrino detectors.

Qualifications:
We are looking for a motivated physics student to work on a exciting high energy physics project. The core skills that we are looking for include:
- C++ programming experience
- Aptitude for mechanical assembly
- Good communication skills
- Comfortable with scientific computing and data analysis

Beneficial skills would include

- Experience with using Linux OS would be very beneficial
- Experience in large scale data analysis
- Experience with standard HEP software packages, in particular GEANT4 and ROOT
- Understanding of the basics of a particle physics detector, particularly of photo-multiplier tubes

Shiftwork required: No

Period of Work: May – Aug 2018, with possible 4-month extension