Intensity Frontier Fellowship Closeout Report

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I would like to start out by saying that I am very grateful to the IF fellowship support which has greatly benefitted my career in many ways. My presence at Fermilab has immensely benefitted both me and the collaborations I am participating in. My Intensity Frontier fellowship proposal outlined the work to be done on the MicroBooNE experiment. The main goals of my proposal were Low-energy neutrino cross-section measurement in Argon and Cosmogenic background studies at MicroBooNE. MicroBooNE is a short-baseline 170 ton Liquid Argon Time Projection Chamber that is currently taking data on Fermilab's Booster Neutrino Beam-line (BNB). Two major physics goals of the MicroBooNE experiment are to address the low energy excess observed by the MiniBooNE experiment and make precision cross-section measurements of ~1 GeV neutrino interactions on liquid argon.

My continuous presence at Fermilab during the fellowship period has been vital in making rapid progress on all of my research projects. I highlight some of my most significant achievements below:

1). In my role as the co-convener for the MicroBooNE neutirno cross-section physics group, I have been leading the cross-section efforts for MicroBooNE. I have also been significantly contributing to the the charged-current (CC) inclusive muon neutrino cross-section analysis which is one of the first cross-section measurements that will come out of MicroBooNE. An end-to-end Monte Carlo study was recently performed to demonstrate the sensitivity of MicroBooNE for this measurement assuming three months of Booster Neutrino Beam (BNB) data [1] and a basic set of reconstruction tools. This study showed that MicroBooNE will be able to deliver interesting results to the neutrino cross-section community with only a few months of BNB data.

2). In my role as the convener of the MicroBooNE Cosmogenics Physics group, I successfully led a team of postdocs and students to study the impact of various cosmogenic backgrounds on the MicroBooNE flagship physics analysis and recommended that MicroBooNE install a concrete overburden to reliably control the electron-like background induced by non-muon cosmic particles. These studies greatly benefitted not only MicroBooNE but the entire surface-based Short-Baseline Neutrino (SBN) program and later became part of the SBN proposal [2]. A MicroBooNE public note summarizing the cosmic shielding analysis at MicroBooNE is available [3].

3). In my role as the leader of the MicroBooNE Detector Controls and Monitoring system, I successfully installed and commissioned this sub-system which played a critical role in the overall commissioning of the MicroBooNE experiment. As this is a project which involved a lot of hands-on activity and required my presence at Fermilab, I would like to emphasize that this would not have been possible without the support of the IF fellowship.

4). Additionally, in close collaboration with Fermilab Physicist Dr. Yang, I successfully developed data-driven techniques to measure some of the important detector properties such as electron lifetime and longitudinal diffusion of the electron signal.

All of this work would not have been possible if not for the invaluable support provided by the IF fellowship.

Through the Intensity Frontier travel support, I also had the opportunity to attend various workshops and conferences during the fellowship period resulting in two conference proceedings [4, 5]:

1. *Accelerator-based Short-Baseline Neutrino Oscillation Experiments*, Invited talk, Twelfth Conference on the Intersection of Particle and Nuclear Physics (CIPANP 2015), Vail Colorado, May 19 – 24, 2015.
2. *Prospects of making low-energy neutrino cross-section measurements at MicroBooNE*, Invited talk, Ninth International Workshop on Neutrino-Nucleus Interactions in the few- GeV region (NuInt14), London, May 19 – 24, 2014.

References:

[1]. The MicroBooNE Collaboration, *MC performance study for an early νμ CC inclusive analysis with MicroBooNE, November 2015.*
url: *http://www-microboone.fnal.gov/publications/publicnotes/index.html*

[2]. R. Acciarri *et al., A Proposal for a Three Detector Short-Baseline Neutrino Oscillation Program in the Fermilab Booster Neutrino Beam,* arXiv:1503.01520, March 2015.

[3]. The MicroBooNE Collaboration, *Cosmic Shielding studies at MicroBooNE,* MicroBooNE Public note # 1005, May 2016.
url: http://www-microboone.fnal.gov/publications/publicnotes/index.html

[4]. The MicroBooNE Collaboration, *Accelerator-based Short-baseline Neutrino Oscillation Experiments,* arXiv:1510.04412, October 15, 2015.

[5]. Sowjanya Gollapinni, *Neutrino Cross section Future,* arXiv:1602.05299v1 [hep-ex], February 17, 2016.