DAQ Developments and Commissioning for Beam and Non-beam Physics in MicroBooNE

As an Intensity Frontier Fellow, I successfully led the commissioning of the triggered mode (also known as the accelerator mode) of the MicroBooNE data acquisition (DAQ) system and achieved an uptime greater than 97% from the very start of neutrino delivery by the Booster Neutrino Beam (BNB) at Fermilab. The excellent spatial resolution of liquid-argon time-projection chamber (LArTPC), the newly developed technology MicroBooNE uses, makes the online DAQ system challenging: with a lossless data compression algorithm, the data rate is 192 MB per second. The support of the fellowship allowed me to stay on-site Fermilab and made it much easier to coordinate with experts in the detector readout system, online DAQ software, online monitoring system, slow control monitors, and data management. I have also been in charge of routine DAQ operations, including debugging, maintenance, and expert recruitment and training. Moreover, I built the online software triggering system together with the MicroBooNE trigger task force. This serves as the only self-triggering system in the experiment, reducing the amount of recorded data by a factor of 16 and consequently relaxing the pressure on data management.

A second, continuous DAQ mode (known as the supernova mode) is needed in MicroBooNE for detection of supernova neutrinos and physics unrelated to the BNB. This mode continuously writes data from readout to the disks of each sub-event PC (SEB PC), and assembles and sends events to tape only upon the arrival of an external trigger, such as a supernova early warning alert (SNEWS). With the support of the fellowship, I initiated the commissioning of the DAQ mode, and started convening the Astroparticle and Exotic Physics group in MicroBooNE. Most of the studies in the Astroparticle and Exotic Physics group, including the sensitivity of supernova neutrino detection in LArTPC, utilize the data taken from the continuous DAQ mode, and will demonstrate its capability.