

## Beamline Monitors for LBNF

The proposed Deep Underground Neutrino Experiment (DUNE) will rely on a new intense neutrino beam at Fermilab as part of the Long Baseline Neutrino Facility (LBNF). To make precise measurements of the neutrino oscillation parameters will require a very precise knowledge of the fluxes of neutrinos produced in LBNF. The present model predictions for the neutrino production in the beam are uncertain at the level of 10-20% at some energies. In situ detectors to verify the flux behavior provide a valuable validation. This project will focus on muon detectors.

Muons are produced inside the decay pipe from the same pion decays that produce the muon neutrinos, and therefore are correlated with the neutrino flux. Measurements of the muons exiting the absorber would be used to monitor the beam profile and stability, and a determination of the absolute flux and energy spectrum of these muons would place a constraint on the absolute neutrino flux at energies above 3 GeV that is independent of the uncertainties on neutrino interaction cross sections. A prototype gas Cherenkov detector for LBNF is currently deployed in the muon alcoves of the NuMI neutrino beamline. I plan use the time at Fermilab to analyze this prototype data, assist in the maintenance and calibration of the detectors, install additional small detectors, and facilitate getting the data from these prototypes better integrated into current DAQ framework.