

## LBNF Beamline

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The Long Baseline Neutrino Facility (LBNF) will utilize a beamline located at Fermilab to provide and aim a neutrino beam of sufficient intensity and appropriate energy range toward DUNE detectors, placed deep underground at the Sanford Underground Research Facility (SURF) in South Dakota. LBNF is designed for approximately twenty years of operation, to provide adequate exposure for the DUNE experiment. During its lifetime, the facility must be able to accommodate various target and focusing configurations to enable tuning of the neutrino energy spectrum.

The primary proton beam (60-120 GeV) will be extracted from the MI-10 section of Fermilab's Main Injector. Neutrinos are produced after the protons hit a solid target and produce mesons, which are subsequently focused by magnetic horns into a 194m long decay pipe where they decay into muons and neutrinos. The parameters of the facility were determined by taking into account the physics goals, spatial and radiological constraints and the experience gained by operating the NuMI facility at Fermilab. The Beamline facility is designed for initial operation at a proton-beam power of 1.2 MW, with the capability to support an upgrade to about 2.4 MW. LBNF/DUNE obtained CD-1 approval in November 2015. We discuss here the design status and the associated challenges as well as the R&D and plans for improvements before baselining the facility, and we will present results of a beam optimization algorithm developed to maximize DUNE's sensitivity to neutrino CP violation, yielding substantial improvements to the neutrino flux and physics sensitivities.

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