Abstract Submitted
for the APR15 Meeting of
The American Physical Society

Optimization of the LBNF Beamline LAURA FIELDS, Northwestern University, LONG-BASELINE NEUTRINO FACILITY (LBNF) COLLABORATION — Conventional neutrino beams are created by directing a high energy proton beam onto a target, focusing the resulting pions and kaons through one or more magnetized focusing horns, and allowing the focused hadrons to decay to produce neutrinos. This type of beam has many configurable parameters, such as horn shapes and positions, that can be changed to create a wide variety of neutrino energy spectra. Historically, beams designed for neutrino oscillation measurements have been configured to maximize the signal neutrino spectrum in the region where oscillations are expected. Recent advances in computing power coupled with the development of complex optimization algorithms enable identification of improved beam designs that are precisely tuned to physics observables. We present an example beam optimization wherein the LBNF (Long-Baseline Neutrino Facility) beam is tuned to maximize sensitivity to neutrino CP violation. Simulations indicate that the beam configuration identified by this optimization improve LBNF's sensitivity to CP violation by more than 40%.

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Date submitted: 09 Jan 2015 Electronic form version 1.4