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Optimization of the LBNF Beamline

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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, which can be changed to create a wide variety of neutrino energy spectra. Recent advances in computing power coupled with the development of complex optimization algorithms enable identification of parameters that are precisely tuned to optimize physics parameter sensitivity. We present results of a beam optimization algorithm developed for the LBNF (Long-Baseline Neutrino Facility) beam and designed to maximize DUNE's sensitivity to neutrino CP violation. We find that several modifications to the target and horns of the beamline will yield substantial improvements to the neutrino flux and physics sensitivities. We also discuss efforts to incorporate these modifications into the LBNF design.

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