BRIEF 1-2 PARAGRAPH SUMMARY OF PROPOSAL

Proposal Title and Abstract

Thermal Load Optimization of "Spherical" Targets in Neutrino Oscillation Experiment

The Long Baseline Neutrino Facility (LBNF, formerly the Long Baseline Neutrino Experiment) is a next generation neutrino oscillation experiment, with primary objectives to search for CP violation in the leptonic sector, to determine the neutrino mass hierarchy and to provide a precise measurement of θ_{23}. The facility will generate a neutrino beam at Fermilab by the interaction of a proton beam with a target material, which must dissipate the c.20 kW heat load that will be deposited at the ultimate anticipated proton beam power of 2.3 MW. Currently various cooling schemes are implemented to alleviate these thermal loads and to ensure the health of the target. The proposed work is a parametric study of the cooling schemes associated with neutrino beam targets. This investigation will use the novel target concept based on an array of spheres evolved from a cylindrical monolithic target that currently operates at the T2K facility. Early simulation results show that array of spheres offers a more efficient cooling and lower stresses whilst delivering the equivalent neutrino production of a conventional solid cylindrical target. This work be broken up into two phases a computational and an experimental phase.

The first phase will use the ANSYS computational fluid dynamics suite to investigate the effect of varying relevant boundary conditions on target thermal load. During this phase fluid boundary conditions (i.e freestream temperature, velocity, density, etc) and target geometry (shape, material properties, etc) will be the metric in a parametric study. The goal of this phase is to final an optimal target and cooling configuration. The second phase will be development of a scaled optimal target and cooling configuration for validation of computational model. During this phase a benchtop model of the target and cooling scheme will be created and tested under various heating load to simulate the target when it is installed in the LBNF facility.

Experimental Team

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Directly-relevant previous work
High-Power Targetry 2012-present
Long Baseline Neutrino Facility (LBNF) 2009-present

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