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Energy deposition studies for the LBNE beam absorber*

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The Long-Baseline Neutrino Experiment (LBNE) at Fermilab is supposed to provide the world's highest-intensity neutrino beam for the US program in neutrino physics. The corresponding incoming proton beam power can ultimately be as high as 2.3 MW, and the underground beam absorber at the end of the decay channel with related infrastructure is supposed to operate with little or no maintenance for about 20 years. Such a combination of long operation time and high deposited power imposes strict limitations on design of the absorber.

In this paper, we describe results of detailed Monte Carlo energy deposition studies performed for the absorber core and the surrounding shielding with the MARS15 code. The model of the entire facility, that includes the pion-production target, focusing horns, target chase, decay channel, hadron absorber system – all with corresponding radiation shielding – was developed using the recently implemented ROOT-based geometry option in the MARS15 code. This option provides substantial flexibility and automation when developing complex geometry models. Both normal operation and accidental conditions were studied. Various design options were considered, in particular the following: (i) filling the decay pipe with air or helium; (ii) the absorber mask material and shape; (iii) the beam spoiler material and size. Results of detailed thermal calculations with the ANSYS code helped to select the most viable absorber design options.

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Summary

Energy deposition studies with the MARS15 code for the Long-Baseline Neutrino Experiment at Fermilab are presented.

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