

Recent Improvements in MARS Models and Radiation Effects in Superconducting Magnets for Mu2e and High-Luminosity LHC

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Abstract

Aimed at accurate prediction of radiation effects in superconducting magnet materials, recent improvements to the MARS15 physics models are described. These include nuclear interaction models at low and intermediate energies, electromagnetic interactions at low energies, Displacement-Per-Atom (DPA) in crystalline lattices, highly-precise particle tracking in complex geometries in presence of magnetic fields, and adequate histogramming. The impact of the improvements on the predicted critical values in superconducting magnets of the Mu2e experiment and LHC collider is discussed. Results of detailed MARS and FLUKA studies of radiation quantities in the Nb₃Sn inner triplet magnets for the High-Luminosity LHC upgrade are presented and compared to the established radiation damage limits.