3D ELECTROMAGNETIC AND TRANSMISSIONLINE MODELS OF A 1-MA LINEAR TRANSFORMER DRIVER CAVITY FOR HIGH-CURRENT Z PINCH ACCELERATORS*

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A three-dimensional, fully electromagnetic (EM) model of the principal pulsed-power components of a new high-current linear transformer driver (LTD) z-pinch accelerator has been developed. LTD systems are a relatively new modular compact pulsed-power technology based on high energy density capacitors and low-inductance switches packed around a parallel-plate disk feed. We model 1-MA, 100-kV, 100-ns rise-time LTD cavities developed for driving z-pinch loads[1]. The simulation model tracks the generation and propagation of electromagnetic power from individual capacitors through triggered gas switches driving a radially symmetric output line. Multiple cavities are combined for power multiplication that drives a water-filled coaxial transmission line. A fully EM 3D model of a single 1-MA 100-kV LTD cavity driving a simple resistive load is presented and compared to electrical measurements. A new model of the current loss through the ferromagnetic cores is developed for use both in circuit representations of an LTD cavity and in the 3D EM simulations. Good agreement between the measured core current, a simple circuit model, and the 3D simulation model is obtained. A 3D EM model of a 10 cavity LTD accelerator, presently under construction at Sandia National Laboratories, is also developed. The model results demonstrate efficient voltage addition when driving a matched impedance load, in good agreement with an idealized circuit model.

1. A. A. Kim, M. G. Mazarakis, V. A. Sinebryukhov, B. M. Kovalchuk, *et al*., Phys. Rev. ST Accel. Beams **12**, 0504002 (2009).

* Work supported by Sandia National Laboratories through the US DOE. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed-Martin company, for the United States Department of Energy's National Nuclear Security Administration, under contract DE-AC04-94AL85000.