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PIC SIMULATIONS OF POWER FLOW IN A LINEAR TRANSFORMER DRIVER FOR RADIOGRAPHIC APPLICATIONS*

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The linear transformer driver (LTD) is a promising technology for building a compact, high-voltage driver for radiographic applications. Prototype 1 MV LTDs have been built at several sites for proof-of-principle experiments, but radiographic applications require higher voltage, V > 2 MV, and preferably at least 7 MV. At the higher voltage, there will be substantially greater electron flow current in the central magnetically insulated transmission line (MITL). The existing 1 MV LTD at Sandia National Laboratories has recently been upgraded to 21 series cavities with an output voltage of 2.5 MV. This system provides the first opportunity to evaluate the effects of substantial electron flow in a multi-cavity driver at the low end of the voltage needed for radiography.

We have been developing a 2-D, r-z PIC simulation model of the entire system. Each of the 21 cavities is driven with its own external RLC circuit that can be independently triggered. Thus, the model can address various timing issues, such as optimizing time delays between cavities and the effect of jitter. It also provides an opportunity to evaluate circuit models of the system. Electrons are emitted from the central cathode with a conventional space-charge-limited emission model. The code computes the local energy deposition of electrons hitting the anode structures, including the dielectric insulator for each cavity. Electron impact on the insulators is of particular interest. Results from simulations will be presented.

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