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A Multiple Material Velocimetry Based Current Loss Detector for Pulsed Power Systems

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Recent experiments at Sandia National Laboratories have been focused on understanding the physics of power flow in the magnetically insulated transmission lines (MITLs) at the Z Pulsed Power Facility. One outstanding question is determining time-dependent current loss for both ions and electrons in the Z inner MITLs. To answer this question, we have developed a novel velocimetry based current loss detector that is fabricated from multiple materials, e.g. aluminum and gold. Using the fact that different metals, such as Al and Au, have different charged particle stopping powers and equations-of-state, the velocity response of an Al flyer, which is located on the inside of the inner MITLs, can be different from a flyer of identical thickness that is a combined substrate of Al and Au. By analyzing the differences in the velocity responses of these flyers, which is measured using Photonic Doppler Velocimetry (PDV), one can infer time-dependent loss currents of electrons and ions in the inner MITLs. In this presentation, we describe the physics of this detector, and show recent results of this detector from Z experiments.

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