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Uncertainties in cylindrical anode current inferences on pulsed power drivers

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For over a decade, velocimetry based techniques have been used to infer the electrical current delivered to dynamic materials properties experiments on pulsed power drivers such as the Z Machine.[1] Though originally developed for planar load geometries, in recent years inferring the current delivered to cylindrical coaxial loads has become a valuable diagnostic tool for numerous platforms including Magnetic Liner Inertial Fusion (MagLIF) targets. The process for determining a load current from velocimetry data is colloquially referred to as performing an "unfold."Various uncertainties that can affect the accuracy of the unfolded current are discussed and accounted for, including errors in the velocimetry measurement itself, sensitivity of the velocimetry to low pressure fluctuations, and the influence of the computational material model chosen. A convenient error relation is developed that indicates for currents above 10 MA the uncertainty is 1-3%; this makes velocimetry determined currents the most accurate high current diagnostic known for pulsed power drivers.

[1] R. W. Lemke, M. D. Knudson, D. E. Bliss, K. Cochrane, J.-P. Davis, A. A. Giunta, H. C. Harjes, and S. A. Slutz, "Magnetically accelerated, ultrahigh velocity flyer plates for shock wave experiments,"Journal of Applied Physics 98, 073530 (2005), http://dx.doi.org/10.1063/1.2084316.

Author: PORWITZKY, Andrew (Sandia National Laboratories)

Co-author: BROWN, Justin (Sandia National Laboratories)

Presenter: PORWITZKY, Andrew (Sandia National Laboratories)

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