3-DIMENSIONAL MODELING OF LARGE DIAMETER WIRE ARRAY HIGH INTENSITY K-SHELL RADIATION SOURCES*

C.A.Jennings, D. J. Ampleford, S.B.Hansen, E.P.Yu, M. E. Cuneo, C.A.Coverdale, B.M. Jones, E.M. Waisman, W.A. Stygar, M.E. Savage, K. LeChien
Sandia National Laboratories, Albuquerque

J. P. Chittenden
Blackett Laboratory, Imperial College, London

J. L. Giuliani, J. W. Thornhill
Plasma Physics Division, NRL

Large diameter nested wire array z-pinches imploded on the Z-generator at Sandia National Laboratories have been used extensively to generate high intensity K-shell radiation. Large initial radii are required to obtain the high implosion velocities needed to efficiently radiate in the K-shell. This necessitates low wire numbers and large inter-wire gaps which introduce large azimuthal non-uniformities. Furthermore, the development of magneto-Rayleigh-Taylor instabilities during the implosion are known to generate large axial non-uniformity. These effects motivate the complete, full circumference 3-dimensional modeling of these systems. Such high velocity implosions also generate large voltages, which increase current losses in the power feed and limit the current delivery to these loads. Accurate representation of the generator coupling is therefore required to reliably represent the energy delivered to, and the power radiated from these sources.

We present 3D-resistive MHD calculations of the implosion and stagnation of a variety of large diameter stainless steel wire arrays (hν ~ 6.7keV), imploded on the Z-generator both before and after its refurbishment. Use of a tabulated K-shell emission model allows us to compare total and K-shell radiated powers to available experimental measurements. Further comparison to electrical voltage and current measurements allows us to accurately assess the power delivered to these loads. These data allow us to begin to constrain and validate our 3D MHD calculations, providing insight into ways in which these sources may be further optimized.

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