

MACH2 Simulations of Nested Wire Array Flux Compression on Decade Quad

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Magnetic flux compression has been suggested as a means to achieve power amplification on Decade Quad at Arnold Engineering Development Center. This paper presents numerical simulations that were conducted to investigate plasma dynamics of titanium Z-pinch loads and potential pitfalls for efficient K-shell radiation production. The 2D MACH2 resistive magnetohydrodynamic code was chosen for this study. The code was adapted to incorporate a new circuit model that considers resistive and inductive computational domain impedance in multiple current paths. Inductive impedance is calculated by tracking isolated regions of magnetic flux while resistive impedance is calculated by partitioning joule heating in various materials. Results of the simulations show Rayleigh-Taylor instabilities significantly affect the flux compression implosion dynamics and the current distribution in the titanium plasma shell. While the simulations demonstrate excellent flux compression, the nature of the current distribution, in the design studied, limits energy transfer and leads to inefficient K-shell radiation production.