WIRE ARRAY Z-PINCH LENGTH VARIATIONS FOR K-SHELL X-RAY GENERATION ON Z*

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Large diameter (50-70 mm) wire array z pinches are fielded on the refurbished Z machine to generate 1-10 keV K-shell x-ray radiation. Imploding with velocities approaching 100 cm/μs, these loads create large dL/dt which generates a high voltage, stresses the convolute, and leads to current loss. High velocities are required to reach the few-keV electron temperatures required to strip moderate-atomic-number plasmas to the K shell, thus there is an inherent trade-off between achieving high velocity and stressing the pulsed power driver via the large dL/dt.

Here, we present experiments in which the length of stagnated Cu and stainless steel z pinches was varied from 12-24 mm. The motivation in reducing the pinch height is to lower the final inductance and improve coupling to the generator. Shortening a Cu pinch from 20 to 12 mm by angling the anode glide plane reduced the final L and dL/dt, enhancing the feed current by 1.4 MA, nearly doubling the K-shell power per unit length, and increasing the net K-shell yield by 20%. X-ray spectroscopy is employed to assess differences in plasma conditions between the loads. Lengthening the pinch could lead to yield enhancements by increasing the mass participating in the implosion, provided the increased inductance is not overly detrimental to the current coupling. In addition to the experimental results, these scenarios are studied via thin-shell 0D and also magneto-hydrodynamic modeling with a coupled driver circuit model.

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