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Radiation Effects Sciences (C7) Z-Pinch Source Development on the Refurbished Z Machine in FY08

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Radiation effects experiments on Z in collaboration with the Radiation Sciences Center (1300) and other customers play an essential role in certifying non-nuclear components in the enduring stockpile. Wire array and gas puff z-pinch sources in the 1-10 keV photon energy range [1,2] have been used to evaluate system and material responses to high radiation fluences, either for component testing or for code validation. We discuss here the 5-year plan for reestablishing multiple 1-13 keV K-shell x-ray sources on Z, and in particular the FY08 plans for large diameter (65 mm) nested stainless steel and copper wire arrays. The load design is determined through the use of a K-shell yield scaling model developed in collaboration with NRL and previously benchmarked to Z data [3]. Thin-shell implosion calculations over a range of array mass and radius parameter space determine the **j**x**B**-coupled energy which is used with this phenomenological model to extrapolate the K-shell yield. This treatment does not include physics associated with discrete wire effects and instability growth, and we discuss our considerations of these issues. Electrode effects causing early pinch disruption near the cathode have previously been observed to degrade the uniformity of the stagnation for large diameter wire arrays. This effect is expected to be more detrimental as even larger array diameters are explored. A technique to mitigate end effects has been tested on Saturn and has shown promising results [4]. Plans will be discussed for two shots on Z to investigate further whether it is possible to mitigate end-effects, and whether this is advantageous to the source emission. The diagnostic requirements for upcoming C7 shots will be discussed, focusing on K-shell power and yield measurements and x-ray spectroscopy.

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[3] J. W. Thornhill *et al.*, IEEE T. Plasma Sci. **34**, 2377 (2006).
[4] D. J. Ampleford *et al.*, Bull. Am. Phys. Soc. **52**, 245 (2007).