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Electrical and X-ray diagnostics on the NSTec 2-MA dense plasma focus system

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National Security Technologies (NSTec) is developing dense plasma focus systems as intense pulsed neutron sources. Sandia National Laboratories participated in a limited number of experiments on an NSTec plasma focus. In collaboration with NSTec, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory, we implemented additional electrical and X-ray image measurements in parallel with normal operation of the system.

Dense plasma focus neutron sources have been studied for decades, but much of the experimental interest has been on neutron and X-ray yield. The primary goal for the present work was to deliver high-fidelity and traceably-calibrated current and voltage measurements for comparison to computer simulations. The secondary goals were to utilize the current and voltage measurements to add general understanding of vacuum insulator behavior and current sheet dynamics, and conduct initial scoping of soft X-ray diagnostics. We will show the electrical diagnostics and the techniques used to acquire high-fidelity signals in the difficult environment of the 2 MA, 6 μ s plasma focus drive pulse. We will show how we measure accreted plasma mass non-invasively, and the sensitivity to background fill density. We will also show initial results from filtered X-ray pinhole images and spectroscopic data from the pinch region.

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