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**Deuterium Gas-Puff Z-Pinch Implosions on the Z accelerator**

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The generation of neutrons via current driven sources, including z-pinch driven hohlraums, deuterium gas puffs, deuterium fiber pinches, deuterium liners, and dense plasma foci, has been studied for many years. Experiments with methods other than inertial confinement fusion have produced significant neutron output (up to $\sim 10^{12}$) from experiments with current drives $< 8$ MA. In this paper, the results of experiments at the Z Accelerator to study the neutron production and implosion characteristics of a deuterium gas puff will be presented. Two current levels (12MA and 15MA) were fielded to evaluate the scaling of the neutron output; neutron outputs of 1 x $10^{13}$ and 3 x $10^{13}$ were measured. The neutron output measured was the first with a load of this type at this current level and has been demonstrated to be repeatable, with side-on time-of-flight measurements showing 2.34 MeV. While the mechanism for the neutrons has not been identified experimentally, this neutron output is 100 times more than previously observed from neutron producing experiments at Z. Comparison of the neutron output with previous experiments at 7 MA shows that the neutron output scales approximately as $I^4$. Time-of-flight measurements from multiple directions, as well as the results of activation diagnostics will be presented. The experimental results will be compared with 1D, 2D, and 3D magneto-hydrodynamic (MHD) calculations, which have shown that thermal neutron outputs from Z could be expected to be in the (0.3 to 1.0) x $10^{14}$ range. Dopant gases were added to track the implosion characteristics of the gas through x-ray yield measurements and spectroscopy. X-ray diagnostics have shown that the stagnated deuterium plasma achieved electron temperatures of 2.2 keV and ion densities of 2 x $10^{20}$ $cm^{-3}$, in agreement with the MHD calculations. **Sandia is a multi-program laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy under Contract DE-AC04-94AL85000. NRL work was supported by DTRA. **in collaboration with C. Deeney, C. Ruiz, Sandia National Labs, G. Cooper, Univ. of New Mexico, A.L. Velikovich, J. Davis, R.W. Clark, Y.K. Chong, and J.P. Apruzese, Naval Research Lab, J.Franklin, S. Chantrenne, and P.D. LePell, Ktech, J. Chittenden, Imperial College, J.Levine and J. Banister, L-3 Communications.