Abstract Submitted
for the DPP10 Meeting of
The American Physical Society

Kinetic effects of nuclear reactions in deuterium gas puffs BRIAN APPELBE, SIMON VICKERS, JEREMY CHITTENDEN, Imperial College —
Deuterium gas puffs are the largest source of laboratory neutrons producing more than 10^{13} neutrons on the Z machine at Sandia National Laboratories. However, the mechanisms producing these neutrons are poorly understood. In particular, the extent of non-thermal neutron production is an important issue for determining the scalability of the results to higher currents. In this work we present the results of a computational study of the nuclear reactions in a deuterium gas puff. We investigate this by simulating the gas puff implosion using the 3D MHD GORGON code. The data is post-processed with the addition of a kinetic species to model the non-thermal neutron production. Results show that non-thermal neutron production accounts for only a small fraction of total neutron production. The number of 14.1MeV neutrons produced by secondary DT reactions is also calculated. The ratio of secondary to primary neutrons is approximately 0.0001. Finally, the shape of the neutron spectra for both thermal and non-thermal plasmas are derived theoretically and compared with the composite neutron spectra produced by the code. The results show the sensitivity of the spectra to conditions of the deuterium plasma.

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Date submitted: 16 Jul 2010 Electronic form version 1.4