MEASUREMENT OF THE HOT SPOT ELECTRON TEMPERATURE IN AN ICF IMPLOSION BY HIGH-Z DOPANT X-RAY SPECTROSCOPY

H. Chen, T. Ma, P. K. Patel, M. B. Schneider, M. A. Barrios, B. Hammel, H. Scott, A. Pak, D. Casey, B. Spears
Lawrence Livermore National Laboratory, Livermore, CA 94551, USA
chen33@llnl.gov

The temperature of the hot spot in an ICF implosion is a fundamental parameter that describes the level of heating achieved in the reacting fusion plasma. To date on the NIF, work has been focused on inferring the ion temperatures (Tion) using the width of the energy distribution of fusion neutrons as measured by the Neutron Time of Flight (NTOF) detectors [1]. However, these neutron spectral widths (and thus the inferred Tion) have shown to be sensitive to bulk motion and mass flows within the reacting plasma region, resulting in overestimates of the real thermal temperature of the hot spot [2]. This complication can be overcome by measuring the electron temperature (Te), which directly describes the dense x-ray emitting hot spot. In this presentation, we report on the design of ICF implosion experiments where a trace amount of high-Z dopant has been added to the fuel in Symcap [3] capsules to allow for simultaneous Te and Tion measurements. The Tion is inferred by the typical NTOF measurements, while the Te is inferred from x-ray spectroscopic methods. The considerations for applying x-ray spectroscopy in such a dense, hot, optically thick, integrated implosion will be discussed. We will also present the results from the first dedicated hot spot Te experiments.

[1] V. Y. Glebov et al., RSI **77**, 10E715 (2006).
[2] T. J. Murphy, PoP **21**, 072701 (2014).
[3] G. A. Kyrala, et al., PoP **18**, 056307 (2011).

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