

# Time-Resolved Measurements of the Hot Spot Density and Temperature on the National Ignition Facility

L. Gao<sup>1</sup>, B. Kraus<sup>1</sup>, K. W. Hill<sup>1</sup>, P. C. Efthimion<sup>1</sup>, M. B. Schneider<sup>2</sup>, D. B. Thorn<sup>2</sup>, H. A. Scott<sup>2</sup>, M. J. MacDonald, A. G. MacPhee<sup>2</sup>, M. Bitter<sup>1</sup>, C. Thomas<sup>2</sup>, R. L. Kauffman<sup>2</sup>, D. A. Liedahl<sup>2</sup>

<sup>1</sup>Princeton Plasma Physics Laboratory, Princeton, NJ 08543, USA

<sup>2</sup>Lawrence Livermore National Laboratory, Livermore, CA 94550, USA

The electron density and temperature and their evolution in the hot spot of a Kr-doped, big-foot implosion target were measured for the first time using an absolutely calibrated, streaked, high-resolution x-ray spectrometer DHIRES on the National Ignition Facility (NIF) [1]. Kr He $\alpha$  and He $\beta$  complexes near stagnation were recorded on a streak camera with a temporal resolution of  $\sim 30$  ps, with signal levels provided by a simultaneous time-integrated measurement on the image plate. The electron density was inferred through stark-broadened line shapes and the temperature was derived from the relative intensities of dielectronic satellites. This presentation will present first experimental measurements of Kr spectra for big-foot implosions [2], with and without W dopant in the ablator. The measurements are compared with hydrodynamic simulations using Lasnex [3], as well as collisional-radiative calculations for line intensities and shapes using Cretin [4].

## References:

[1] L. Gao *et al.*, RSI 89, 10F125 (2018)

[2] C. A. Thomas, Bull. Am. Phys. Soc. 61, 18 (2016)

[3] H G. B. Zimmerman and W. L. Kruer, Comments Plasma Phys. Control. Fusion 2, 51 (1975)

[4] H. A. Scott, J. Quant. Spect. Rad. Transf. 71, 689 (2001)

Work performed under the auspices of the U.S. Department of Energy by Princeton Plasma Physics Laboratory under contract DE-AC02-09CH11466 and by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344