LASER PERFORMANCE MODELING OF THE ADVANCED RADIOGRAPHIC CAPABILITY LASER SYSTEM

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The National Ignition Facility (NIF) at Lawrence Livermore National Laboratory is the first of a kind megajoule-class laser with 192 beams capable of delivering over 1.8 MJ and 500TW of 351nm light [1]. It has been operated since 2009 to support the study of inertial confinement fusion, high energy density physics, material science, laboratory astrophysics.

Radiographic techniques will be an important aid in the diagnosis of the relatively large, dense plasmas generated during NIF experiments. For this purpose, the generation of very hard x-rays above 50 keV is necessary. Such x-rays can be efficiently generated with high intensity laser pulses above 10^{17} W/cm2. The Advanced Radiographic Capability (ARC) [2], currently commissioned on the NIF, will provide eight adjustable pulses with lengths of 1 ps to 50 ps, and with up to 1.7 kJ each, to create x-ray point sources enabling dynamic, multi-frame x-ray backlighting.

In this paper, we will describe the modeling of the laser performance results from the OPA front-end, main laser, compression stage to target chamber center (TCC). We will summarize the modeling results and compare them with previous stretched pulse measurements [3], and recent measurements that include the compressed pulse and the focal spot at TCC.

[1] C.A. Haynam, et al. Appl. Opt. 46, 3276–3303 (2007).
[2] C. P. J. Barty, et al. Nucl. Fusion 44, S266 (2004).
[3] J.M. Di Nicola, et al. Proc. SPIE 9345 (2015).

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