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High resolution imaging of inertially confined fusion implosions using Compton radiography[1]

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Inertial Confinement Fusion experiments aim to impose the highest possible temperatures and pressures on the fusing ions by compressing a spherical ablator and layer of cryogenic deuterium-tritium fuel with the maximum degree of uniformity. Direct and multiple imaging of the ablator and fusing fuel as they go through maximum compression is fundamental to understand the dynamics of the asymmetries and the amount by which they degrade the implosion efficiency. Here we report on the first radiographs of cryogenic indirect drive implosions. We have used pairs of laser-generated, point-projection, backlighters to generate X-rays with energies exceeding 50keV and record two radiographs, spaced in time, of the fuel near stagnation in implosions experiments at the National Ignition Facility. The radiographs, with a spatial and temporal resolution of ˜10m and ˜30ps, respectively, allow measurements of areal mass densities and the reconstruction of the fuel density profiles. We will discuss the direct measurements of fuel non-uniformities resulting from drive asymmetries and hydro-instabilities, peak and areal densities, and kinetic energy, with emphasis on the impact of these parameters on performance.

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