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Compton Radiography of Imploded Capsule Shells[1]

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In Inertial Confinement Fusion (ICF), a number of concurrent processes can contribute to degrading the degree and uniformity of compression of the imploding shell and fuel and hence the yield, namely hydro-instabilities, increase in entropy and residual asymmetries in the drive or target. Obtaining images at stagnation time of the compressed and relatively cold deuterium-tritium fuel surrounding the hot-spot is therefore fundamental to distinguishing between the degradation mechanisms so they may be mitigated on later shots. Here we report on the development and first demonstration of hard x-ray radiography of implosions obtained at photon energies around and above 100keV, where the Compton effect is the dominant contributor to the opacity. The radiographs of plastic shell implosions were obtained at the OMEGA/EP laser facility using gold micro wires in a point projection geometry and have a spatial resolution of $\sim$10μm and a temporal resolution of $\sim$10ps. This novel "Compton" radiography technique is an invaluable diagnostic tool for ICF targets and will be deployed at the National Ignition Facility (NIF).

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