***X-Ray Thomson Scattering from Spherically Imploded ICF Ablators*[1]:** The first x-ray Thomson scattering measurements from spherically imploded inertial fusion-type targets were recorded at the Omega Laser Facility in June 2009 and January 2010. The goal is to characterize the properties of compressed ICF ablators. In these experiments, the noncollective, or microscopic behavior, of imploding CH and Be shells was probed using a Zn He$_\alpha$ x-ray source. For these degenerate plasmas, the width of the inelastic scattering peak is proportional to the Fermi energy and, therefore, the electron density. The electron temperature is obtained from the intensities of the elastic and inelastic features. Measurement of the temperature and density allows the capsule adiabat to be inferred, and can be used to test low-adiabat pulse-shaping methods designed for optimum compressibility and stability. These experiments demonstrate the viability of this technique to study the properties of implosion targets at the National Ignition Facility (NIF). A schematic of the experimental setup is shown in Fig. 1(a). In these experiments, 40-μm-thick CH and Be shells (860-μm outer diameter) were compressed and heated using 36 shaped drive beams [pulse shapes LA2201 and LA370901p (see Fig. 1(b)] in a hemispherical geometry. To characterize the compressed shells, an intense laser-produced zinc He$_\alpha$ x-ray source was scattered from the targets at an angle of 113°, accessing the noncollective behavior of the plasma. The Zn He$_\alpha$ x-ray source was created using six additional shaped laser beams that irradiated 10-μm-thick Zn foils, mounted onto a CH plug (650 μm in diameter, 125 μm thick) placed inside a gold cone. The scattered x rays were recorded with high-energy resolution using a highly oriented pyrolytic graphite crystal (HOPG) Bragg spectrometer coupled to an x-ray framing camera and CCD detector. Gold cones (6-mm long, 60 μm thick, 60° opening) mounted to the hollow CH shells restricted the view of the incident-probe x rays to the spectrometer. A Ni shield restricted the scattering volume and shield against scattering from uncompressed material. Figure (2) shows in-flight scattering measurements, including an elastically scattered peak and a Compton downshifted peak, yielding electron densities of ~0.8 × 10^{24} cm^{-3}, temperatures of ~11 eV, and an ionization state of C(+3) H(+1). High-quality data for CH and Be ablators and for two laser pulse shapes (LA2201 and LA370901p) were obtained in these experiments.

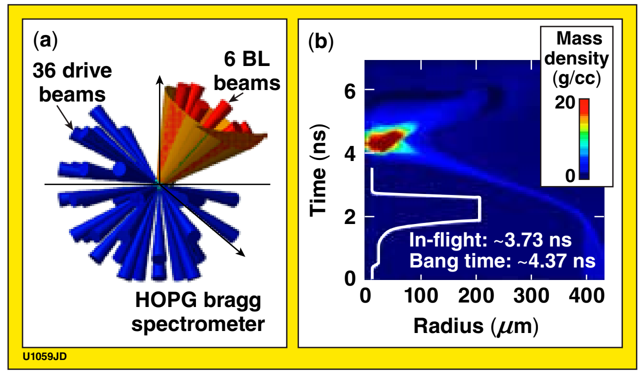

Figure 1. (a) Schematic of the experimental setup. Here, 36 drive beams compress CH and Be ablators and 6 beams create the x-ray scattering source inside the gold cone. The scattered x-ray spectra from the ablator are collected using a highly oriented pyrolytic graphite Bragg spectrometer. (b) Radiation hydrodynamic simulations of the mass density of imploding CH shells as a function of radius and time since the start of the compression beams. Also plotted (in arbitrary units) is the laser-intensity profile (white) as a function of time.

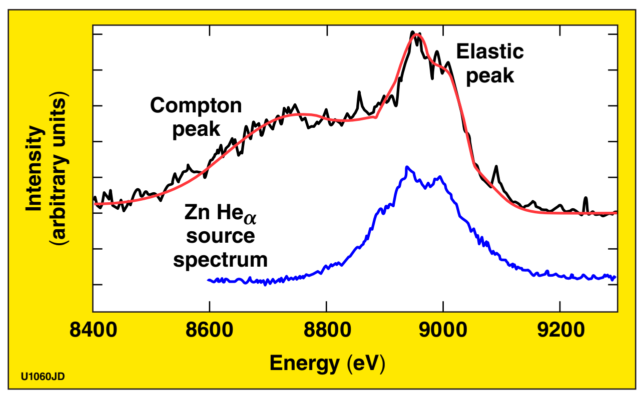

Figure 2. In-flight x-ray scattering spectrum from laser-compressed CH cone-in-shell targets, including an elastic feature and a Compton downscattered peak. Theoretical fits to the experimental data yield temperature, densities, and ionization states of about 0.8 × 10^{24} cm^{-3}, 11 eV, and C(+3)H(+1). Also plotted is the Zn He$_\alpha$ probe source spectrum (blue).

OMEGA Operations Summary: The Omega Laser Facility conducted 118 target shots in January. One hundred eight of these shots were conducted on OMEGA with an experimental effectiveness of 94% and 10 shots were carried out on OMEGA EP with an experimental effectiveness of 65%. Thirty-nine of the shots were taken for the NIC program by teams from LLE and LLNL; 34 shots were carried out by LLE and LANL teams for the HED program; 11 shots were taken for an NLUF project led by the University of Washington; and 34 shots were conducted for LBS projects led by LLE and LLNL.

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