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Direct density measurements of multi-Mbar shock waves for absolute equation-of-state studies T.R. BOEHLY, E. VIANELLO, J.E. MILLER, D.D. MEYERHOFER, Laboratory for Laser Energetics, U. of Rochester, D.G. HICKS, J.H. EGGERT, J.F. HANSEN, P.M. CELLIERS, G.W. COLLINS, LLNL
— Many EOS studies rely on impedance matching to a known standard but at high pressures (>5 Mbar) uncertainties in the EOS of that standard material (such as Aluminum) ultimately limit the accuracy of such a technique. Previous efforts to perform absolute EOS measurements using time-resolved x-ray radiography were limited by the extreme precision required to measure shock and particle velocities at such high compressions. We present results from experiments on the OMEGA Laser System that employ a new technique designed to achieve direct density measurements in a shock wave. Side-on radiography using point-projection imaging (∼5-keV x rays) is used to produce a snapshot of the expanding shock wave; this 2-D image is then tomographically inverted to determine the density profile behind the shock front. By simultaneously measuring the shock velocity using VISAR, absolute equation-of-state points are determined. This technique conveniently scales to measurements on higher-Z materials using harder x rays from an intense short-pulse laser. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC03-92SF19460, the U. of Rochester, and the NYSEDA.

T.R. Boehly

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