Abstract Submitted
for the SHOCK13 Meeting of
The American Physical Society

Simultaneous unfolding of compression and opacity from time-resolved radiography[1] D.C. SWIFT, J.A. HAWRELIAK, Lawrence Livermore National Laboratory, S.D. ROTHMAN, AWE Aldermaston, A. KRITCHER, T. DOEPPNER, G.W. COLLINS, Lawrence Livermore National Laboratory, J. GAFFNEY, S. ROSE, Imperial College — Radiographs of symmetric objects can be analyzed to give the spatial variation of attenuation, as in the Abel inversion of an axisymmetric object. If the opacity is known, the mass density can be derived from the attenuation. The space- and time-variation of density is needed to make equation of state (EOS) measurements by radiography, e.g. by measuring the speed and compression of a shock. However, in our experiments using hohlraum drive at the National Ignition Facility (NIF) to perform EOS measurements at gigabar pressures with spherically-converging shocks, the opacity may vary by an order of magnitude because of ionization. We have developed a new algorithm to simultaneously deduce the compression and opacity of the sample given time-resolved radiographs with a Lagrangian location behind the shock, such as the edge of the sample. This approach relies on spatial integration to deduce the opacity in the region just behind the shock from the difference between the known and apparent mass. We assume that the change in opacity is dominated by shock-heating, so that subsequent variations, as shocked material is either released or compressed further, are negligible or can be accounted for by a model. We used this algorithm to analyze our NIF data on the Hugoniot of CH at 10-40 TPa.

[1]This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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Date submitted: 22 Feb 2013 Electronic form version 1.4