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Backscatter edge model to infer fuel layer conditions near stagnation in ICF implosions A CRILLY, B APPELBE, K MCGLINCHEY, C WALSH, J TONG, J CHITTENDEN, Centre for Inertial Fusion Studies, Imperial College London, O MANNION, C FORREST, Laboratory for Laser Energetics, University of Rochester — Observations during the stagnation of ICF implosions are primarily focused on diagnosing the hot spot. The scattered neutron spectrum also contains a wealth of information about the cold dense fuel. Previous analysis has been restricted to an inference of fuel areal density. In this work we develop a method to extract additional properties, including fluid velocity and temperature. Scattering kinematics are affected by the velocity distribution of the ions with which the neutrons interact. Neutrons which undergo a single 180^{o} scattering event from D and T ions produce sharp edges in the spectrum. The spectral shape of the backscatter edge is especially sensitive to the ion velocity distribution. Similar to the DT primary spectrum, thermal and non-thermal broadening and bulk fluid velocity shifts govern the spectral form. A model to fit the edge shape has been derived in order to infer an average scattering medium velocity, temperature and acceleration. The 1D discrete ordinates neutron transport code Minotaur is used to post-process 1D Chimera and LILAC simulations of ICF experiments to produce synthetic neutron spectra. Inferred quantities from the backscatter edge model can then be related to implosion performance metrics such as hotspot pressure. Multidimensional effects are investigated through 3D Chimera simulations with the aim of identifying failure mechanisms brought about by asynchronous stagnation of the capsule. Comparisons are made to experimental data obtained at OMEGA with observations of both the nT and nD edges.

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