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Modeling Cold-Fuel Distributions Inferred from Elastically Scattered Neutrons in Layered Cryogenic-DT Direct-Drive Implosions C. FORREST, V.YU. GLEBOV, J.P. KNAUER, T.C. SANGSTER, C. STOECKL, K.S. ANDERSON, P.B. RADHA, V.N. GONCHAROV, D.D. MEYEHOFER, Laboratory for Laser Energetics, U. of Rochester, S. GARDNER, Constellation Energy Nuclear Group, D. BALDWIN, SUNY Geneseo — High-resolution neutron spectroscopy has been used to probe the areal density of a compressed shell from a cryogenic-DT direct-drive implosion in inertial confinement fusion (ICF) experiments. The two-body kinematics of (n,T) and (n,D) elastic scattering suggest that there should be a correlation between the energy of the neutron and the region of the DT shell probed when using a single line of sight with time-of-flight (TOF) techniques. A finite-source distribution and/or asymmetric compressed-fuel distribution is expected to modify the correlation in the TOF signal significantly. Low-mode perturbation of the DT source/shell have been simulated in a transport code (MCNP) to track neutrons that elastically scatter into a TOF detector. A 3-D plot of the dense-DT-shell scatter locations of the "detected" neutrons show that a realistic extended-source distribution probes a much larger region of the fuel shell than a simple point-source distribution. Simulations illustrate that higher ρR implosions increase multiple scatterings that further mask the correlation between neutron energy and the sampling area of the dense shell distribution. This work was supported by the U.S. Department of Energy Office of Inertial Confinement Fusion under Cooperative Agreement No. DE-FC52-08NA28302.

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