INTEGRATED MODELING OF HIGHFOOT EXPERIMENTS AT THE NIF
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We have developed an integrated model [1], including the hohlraum and capsule, for layered cryogenic DT implosions on the NIF in the Highfoot shots series [2-5]. We apply the radiation hydrodynamics model consistently across all shots and show a comparison of the simulations with experimental data. The model consists of a semi-empirical fit to low mode asymmetries at early times and at peak compression. In addition we apply radiation drive multipliers to match shock trajectories, 1D inflight radiography, and time of peak neutron production. This 2D model has been applied over a wide range of powers, laser energies, laser wavelengths, and target thicknesses and predicts the yield to within a factor of a few for most shots.

These simulations include low-mode perturbations that result in insufficient conversion of fuel kinetic energy to PdV work on the hot spot [6]. We assess the shape impact on yield by running 2D simulations with a smoothed radiation drive in theta. These simulations suggest that an increase in neutron yield of ~2-4 times the experimental measurement can be obtained if low-mode symmetry is improved. We show that the impact on yield due to low mode asymmetries is increasingly important as we increase the peak fuel velocity. We also show that the 2D simulations are in rough agreement with additional implosion parameters, such as the ion temperature, burnwidth, DSR, and inferred Pressure, for simulated peak fuel velocities <340 km/s. At higher fuel velocities and alpha heating, the model deviates further from the measured results, potentially due to 3D or tent effects.

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