Abstract Submitted
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Extracting the 'thermal' ion temperature from inertial fusion neutron time-of-flight measurements.[1] ALASTAIR MOORE, DAVID SCHLOSSBERG, EDWARD HARTOUNI, SHAUN KERR, MARK ECKART, GARY GRIM, Lawrence Livermore Natl Lab — Inertial Confinement Fusion (ICF) experiments implode deuterium-tritium fuel at velocities approaching 400 km/s to densities of 1g/cc and temperatures of 5 keV. Any implosion asymmetry results in reduced compression, yield, and motion of the fusing hot-spot. Models of the hot-spot plasma show that the shift in the mean of the neutron energy distribution away from the rest frame DT birth energy (14.028 MeV) is a result of hot-spot motion and the distribution of thermal ions undergoing fusion in the Gamov peak. On the National Ignition Facility (NIF) hot-spot velocity is measured using Fused-Silica Cherenkov detectors deployed on five lines of sight which is necessary to test the model, and derive the ion temperature of the fusing plasma. Ion temperatures derived from the width of the neutron spectrum are affected by flows and can deviate from the thermal temperature. Electron temperature measurements are often complicated by x-ray opacity and may not reflect the ion distribution in the Gamov peak. High-precision neutron time-of-flight measurements of the hot-spot velocity represent a new tool in diagnosing in implosion drive asymmetry and in understanding the ion distribution in the hot-spot. Measurements from DT-layered implosions on NIF are presented and the inference of thermal ion temperature compared with simulation.

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