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Collisionless and Kinetic Phenomena of Interpenetrating Plasma Streams via Neutron Self-Emission J.S. ROSS, D.P. HIGGINSON, R. HATARIK, A. LINK, H.-S. PARK, D.D. RYUTOV, S.V. WEBER, S.C. WILKS, LLNL, F. FIUZA, SLAC, C.K. LI, H. SIO, MIT, A.B. ZYLSTRA, LANL — Recent NIF experiments focus on the generation and diagnosis of collisionless shocks relevant to astrophysical phenomena such as supernova remnants and gamma ray bursts. In the experiments, two opposing CD laser-generated plasmas flow into each other at high velocity (˜1000 km/s). As the ion-ion collisional mean-free-path is near to or greater than the system size, the flows interpenetrate and neutrons are generated via beam-beam deuteron interactions. We model this system using the hybrid particle-in-cell code LSP with electric and magnetic fields suppressed to capture the full temporal and spatial size of the experiment. These simulations show good agreement with the yield, spectrum and spatial/temporal profiles of the neutrons observed in the experiment. When one CD foil is replaced with CH an asymmetry develops in the neutron spectrum that is caused by the Doppler shift related to the flow velocity. Additionally, in this case the neutron yield is found to be lower in the simulations than is observed experimentally, which indicates that the deuterons thermalize more efficiently in the experiment. This suggests that another mechanism is responsible for this yield enhancement other than small angle scattering since it is included in the simulations. Possible mechanisms such as scattering across Weibel-mediated magnetic filaments and large-angle Coulomb scattering will be evaluated and discussed. Prepared by LLNL under Contract DE-AC52-07NA27344.

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