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Stix Award Talk: Hot spot mix in ICF implosions on the NIF

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In the quest to achieve ignition through the inertial confinement fusion scheme, one of the critical challenges is to drive a symmetric implosion at high velocity without hydrodynamic instabilities becoming detrimental. These instabilities, primarily at the ablation front and the fuel-ablator interface, can cause mix of the higher-Z shell into the hot spot, resulting in increased radiation loss and thus reduced temperature and neutron yield. To quantify the level of mix, we developed a model that infers the level of hot spot contamination using the ratio of the enhanced x-ray production relative to the neutron yield. Applying this methodology to the full ensemble of indirect-drive National Ignition Facility (NIF) cryogenically layered DT implosions provides insight on the sensitivity of performance to the level of ablator-hot spot mix. In particular, the improvement seen with the High Foot design can be primarily attributed to a reduction in ablation-front instability mix that enabled the implosions to be pushed to higher velocity and performance.

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