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**Measurement and mitigation of X-ray shadow imprint of hydrodynamic instabilities on the surface of Inertial Confinement Fusion capsules due to the fill tube**

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Indirectly-driven Inertial Confinement Fusion (ICF) implosions on the National Ignition Facility (NIF) employ a small diameter (10$\mu$m) fill tube to supply the cryogenic deuterium-tritium (DT) fuel to the capsule. Recent experimental observations characterizing the perturbation produced by this fill tube have revealed an unexpected shadow imprinted instability mechanism [1], whereby several of the x-ray spots formed on the inside wall of the hohlraum cast directional shadows of the fill tube onto the surface of the capsule. Reduced ablation in the corresponding umbrae of these shadows leads to a pattern of radial ridges of excess ablator material measuring ˜100 nm above the surrounding capsule surface. By the time the capsule has converged ˜2x from its original radius, the areal density ($\rho$R) perturbation of these spoke-like features becomes comparable to that of central hole due to the fill tube itself. We report both quantitative radiographic measurements of this newly observed perturbation (for several ablator materials) as well as the results of two strategies for mitigating against such shadow imprinted instabilities: 1.) reducing the fill tube diameter and wall thickness to produce a smaller perturbation that blows down to low density more quickly, and 2.) modifying the driving laser pulse for the lower-intensity inner beams to allow more time for the fill tube to blow down to low density prior to the onset of shadow imprint, which is produced by the more-intense outer beams during the later part of the drive. Results and analysis from both focused radiographic experiments as well as the impact on the performance of layered DT ignition implosions will be discussed. [1] A. G. MacPhee et al., Phys. Rev. E 95, 031204(R) (2017) *Work performed under the auspices of the U.S. D.O.E. by Lawrence Livermore National Laboratory under Contract No. DE-AC52-07NA27344.