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Development of new platforms for hydrodynamic instability and asymmetry measurements in deceleration phase of indirectly-driven implosions on NIF

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Hydrodynamic instabilities and asymmetries are a major obstacle in the quest to achieve ignition as they cause pre-existing capsule perturbations to grow and ultimately quench the fusion burn in experiments at the National Ignition Facility (NIF). This talk will review recent developments of the experimental platforms and techniques to measure high-mode instabilities and low-mode asymmetries in the deceleration phase of implosions. These new platforms provide a natural link between the acceleration-phase experiments and neutron performance of layered deuterium-tritium implosions. In one innovative technique, self-emission from the hot spot was enhanced with argon dopant to "self-backlight" the shell in-flight around peak compression. Experiments with pre-imposed 2-D perturbations measured instability growth factors [1], while experiments with 3-D, "native-roughness" perturbations measured shell integrity in the deceleration phase of implosions. In a complimentary technique, the inner surface of the shell, along with its low-mode asymmetries and high-mode perturbations were visualized in implosions using x-ray emission of a high-Z dopant added to the inner surface of the capsule. These new measurements were instrumental in revealing unexpected surprises and providing improved understanding of the role of instabilities and asymmetries on implosion performance. This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. [1] L. A. Pickworth *et al.,* Phys. Rev. Lett. **117**, 035001 (2016).