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Examining the radiation drive asymmetries present in implosion experiments at the National Ignition Facility[1]

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Understanding the origin, interplay, and mitigation of time dependent radiation drive asymmetries is critical to improving the performance of indirectly driven implosion experiments. Recent work has successfully modeled many aspects of the observed symmetry in implosions using the so-called high foot radiation drive [1] by applying a semi-empirical fit to the low mode time dependent flux asymmetries that the capsule experiences [2]. In these experiments, laser plasma interactions, including cross beam energy transfer, inverse Bremsstrahlung absorption, and stimulated Raman and Brillouin scattering, make controlling the symmetry of the radiation flux that drives the implosion challenging. More recently, control of implosion symmetry without the use of cross beam energy transfer, in hohlraums with lower gas fill densities using both plastic and high density carbon ablators, have been explored [3-4]. The aim of these experiments was to reduce the amount of highly non-linear laser plasma interactions and develop implosions in which the radiation flux symmetry could be more easily understood and controlled. This work describes the experimental reemission, shock timing, radiography, and x-ray self emission measurements that inform our understanding of time dependent radiation drive asymmetries. This data indicates that in the high foot series of implosion experiments, the drive asymmetry initialized during the first shock of the implosion was enhanced by the asymmetry that develops during the peak of the radiation drive. In contrast, in lower gas filled hohlraum experiments, a reduction in the magnitude of time dependent radiation asymmetries has been observed. Incorporating additional data and modeling, this work seeks to further our understanding of the physical mechanisms that currently limit symmetry control in implosion experiments.

[1] T. R. Dittrich, et al. "Design of a high-foot high-adiabat icf capsule for the national ignition facility," Phys. Rev. Lett. **112**, 055002 (2014). [2] A. Kritcher, et al. "Integrated modeling of cryogenic layered Highfoot experiments at the NIF", Physics of Plasmas, **23**, 05709 (2016) [3] D. Turnbull, et al. "Symmetry control in subscale near-vacuum hohlraums", Physics of Plasmas, **23**, 052710 (2016) [4] D. Hinkel, et al. "Development of improved radiation drive environment for High Foot implosions at National Ignition Facility", submitted 2016.

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