POLAR-DIRECT-DRIVE EXPERIMENTS AT THE NATIONAL IGNITION FACILITY

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Polar direct drive (PDD) at the National Ignition Facility (NIF) offers a platform to study direct-drive physics, including implosion energetics, long-wavelength asymmetry from beam geometry, laser imprint, and preheat at the coronal density scale lengths characteristic of the NIF. Ongoing NIF direct-drive experiments include PDD implosions, cone-in-shell targets to study laser imprint, and planar-foil experiments to study the effect of fast-electron preheat. These platforms will also be used to demonstrate mitigation strategies for laser plasma interactions (LPI's) that are potentially detrimental to direct-drive ignition. Initial results indicate that trajectories from the backlit imploding shell driven in polar-direct-drive (PDD) geometry on the NIF are in good agreement with *DRACO* simulations, indicating that models devised using OMEGA experiments have predictive capability. The overall change in the phase of the $\ell = 2$ Legendre mode is consistent with models of cross-beam energy transfer (CBET), lending confidence to the modeling. However, some differences exist between simulation and experiment. Trajectories from gated self-emission x-ray images indicate that the imploding shell is decompressed relative to simulations. Possible reasons for this difference including shock mistiming, laser imprint, and fast-electron and radiative preheat will be discussed. Experiments to address these issues will be presented. Since these experiments use existing NIF hardware including x-ray-drive phase plates and smoothing, high-convergence implosion experiments are currently not possible. Plans for high-convergence PDD implosion experiments, including custom phase plates and multi-FM beam smoothing will be discussed. PDD cryogenic designs with pre-ignition custom phase plates will be presented. A possible path toward NIF PDD ignition will be discussed.

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