A SURVEY OF THE EFFECT OF CONVERGENCE RATIO WITH LOW-MODE DRIVE ASYMMETRY ON ICF IMPLOSIONS

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We investigate the impacts of low-mode drive asymmetry on ICF implosions. This asymmetry produces distortions and residual flows that sap internal energy from the hot spot, making ignition more difficult. We find in simulation that the effects of asymmetry are amplified by increased convergence ratio. Moreover, fully 3D asymmetry produces poorer stagnation and is more harmful than equivalent axisymmetric perturbations. We explore the effects of convergence ratio, 2D or 3D perturbations, and the time dependence of the perturbation using ensembles of 2D and 3D HYDRA radiation hydrodynamics simulations. Our ensemble strategy calls for many dozens of full 3D, many hundreds of 2D, and a vast number of hybrid approximate models. We believe our survey will extend previous work[1,2] and provide the most detailed and comprehensive look at this issue to date.

Our analysis of each simulation focuses on a set of standardized output, including instrumental output — simulated X-ray images, neutron images, neutron spectra, among others — as well as performance metrics from the simulated fields — burn-weighted pressures, velocity moments, cold shell shape moments, and ignition criteria. This amounts to thousands of images and hundreds of scalars for each implosion. The detailed simulated diagnostics and the size of this dataset (tens of petabytes) pose several new challenges. We have developed a new, flexible, fully parallel post-processing suite to produce our final output. The suite provides standardized measures that allow meaningful comparison between simulations that have very different structure. We discuss the strategies that we have adopted in building this platform as well as the resultant physics insight into low mode asymmetries.

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