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Data driven models of the performance and repeatability of NIF high foot implosions¹ JIM GAFFNEY, DAN CASEY, DEBBIE CALLAHAN, ED HARTOUNI, TAMMY MA, BRIAN SPEARS, Lawrence Livermore National Laboratory — Recent high foot (HF) inertial confinement fusion (ICF) experiments performed at the national ignition facility (NIF) have consisted of enough laser shots that a data-driven analysis of capsule performance is feasible. In this work we use 20-30 individual implosions of similar design, spanning laser drive energies from 1.2 to 1.8 MJ, to quantify our current understanding of the behavior of HF ICF implosions. We develop a probabilistic model for the projected performance of a given implosion and use it to quantify uncertainties in predicted performance including shot-shot variations and observation uncertainties. We investigate the statistical significance of the observed performance differences between different laser pulse shapes, ablator materials, and capsule designs. Finally, using a cross-validation technique, we demonstrate that 5-10 repeated shots of a similar design are required before real trends in the data can be distinguished from shot-shot variations.

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