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Multi-Variable Sensitivity Studies of NIF Ignition Targets[1]

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Performance of indirect drive ignition targets planned for the National Ignition Facility has been studied with multi-variable sensitivity studies. Large numbers of simulations are run, in each of which a number of parameters are set from statistical ensembles intended to represent expected variations in the variables describing the target. Parameters varied include target dimensions, compositions, densities, laser pulse variations, variations in the hohlraum parameters as they determine pulse shaping and symmetry variations, surface roughness, intrinsic hohlraum asymmetry, beam-to-beam power imbalance, and pointing errors. Statistical samples are very large (10,000) for variations of the 1D spherical implosion, and large enough for meaningful statistics (a few hundred runs) for the 2D variations. The overall performance trends can be quite well predicted from a model that uses second order Taylor series to calculate the implosion velocity and DT fuel entropy, as functions of the target variables. The statistical variations allow us to address quantitatively questions such as "What is the distribution function describing the probability of ignition, given expected shot-to-shot variations in the parameters describing the experiment?"

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