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The Best Possible Prediction: statistical inference and uncertainty quantification in predictions for ICF experiments[1] NM HOFFMAN, DA OSTHUS, SA VANDER WIEL, FJ WYSOCKI, Los Alamos National Laboratory — To make the best possible prediction, we must combine models and data optimally. As an example, we apply a method for inference on large data sets to the problem of "predicting" the unknown results, with uncertainties, of 16 direct-drive implosion experiments, using glass and plastic capsules, shot at OMEGA. The method uses the GPM/SA (Gaussian Process Models for Simulation Analysis) code to construct an emulator, based on a rad-hydro code and constrained by data from 22 other ICF implosions carried out under different conditions from the unknown set. Comparing the extrapolative "predictions" to the actual observations lets us evaluate the validity of various assumptions and the reliability of the predictions and uncertainty bounds [Osthus et al., SIAM/ASA J. Uncert. Quant. 7, 604 (2019)]. The predictions turn out to be quite reliable: 94% of the predictions agreed with the actual observations to within the 95% uncertainty bounds. This approach will likely also be useful for model calibration and validation, hypothesis testing, and experiment design.

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