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P5.2012 Using the Bayes Inference Engine to study the deceleration-phase of Rayleigh-Taylor growth rates in laser-driven cylindrical implosions

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Hydrodynamic instabilities, such as the Rayleigh-Taylor (R.-T.) instability develop in high energy density, inertial confinement fusion (ICF) experiments. These instabilities degrade the implosion due to mixing of the fuel. We study R.-T. modes in ICF implosions in order to better understand how they evolve in time. To improve our data analysis, we use the Bayes Inference Engine (BIE). The BIE is a computational framework that takes an iterative forward modeling approach to perform statistical inference.
We use the BIE to create a parameterized model of these 2D implosions. This model accounts for blur, alignment and illumination. The parameters are optimized to obtain maximum likelihood estimates for the time-dependent amplitude of the R.-T. modes, the returned solution considers weighted statistical likelihood and prior information.
This technique has helped improve our ability to quantify uncertainties, establish sensible error bars and guide the refinement of our experimental techniques. When applied to our data analysis the BIE can be used to confirm the symmetry of the implosion and understand all asymmetries to be a result of parallax, as well as, improve our error bars and establish a more statistically significant model moving forward.

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1. 1 K.M. Hanson and G.S. Cunningham, Maximum Entropy and Bayesian Methods, Springer, Dordrecht, pp. 125-134 (1996)

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