Abstract Submitted
for the DPP19 Meeting of
The American Physical Society

Learning the Link Between MagLIF Performance and Stagnation Morphology[1] WILLIAM LEWIS, THOMAS MOORE, MICHAEL GLINSKY, MATTHEW WEIS, CHRISTOPHER JENNINGS, DAVID AMPLEFORD, ERIC HARDING, PATRICK KNAPP, MATTHEW GOMEZ, JEFFREY FEIN, Sandia National Laboratories — Magnetized Liner Inertial Fusion (MagLIF) performance (measured by neutron yield) for nominally identical shots may differ by as much as an order of magnitude. This must mean that experimentally tuned parameters are not effectively controlling one or more important underlying physical quantities. In order to investigate this, we utilize a machine learning based approach to uncover the relationship between stagnation morphology and neutron yield. The morphology of a stagnated plasma produced in MagLIF is imaged using self-emission x-rays from the multi-keV plasma. By utilizing a linear regression based on the Mallat Scattering Transform of the stagnation image, we have successfully extracted morphological parameters with uncertainty at stagnation. The inferred morphological parameters and associated uncertainties are utilized to augment sparse MagLIF shot data in order to aid in learning the relationship between stagnation morphology and shot performance (neutron yield). This relationship is successfully learned using a generalized regression neural network to within an error of less than 10%. By investigating this relationship, we search for latent physical quantities which if better controlled would yield greater repeatability.

[1]Sandia National Labs is managed and operated by NTESS under DOE NNSA contract DE-NA0003525. SAND2019-7469 A

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Date submitted: 01 Jul 2019 Electronic form version 1.4