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Inertial Confinement Fusion at the NIF - What we learn from imaging of neutrons coming from the burn region[1]

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Inertial Confinement Fusion experiments at the National Ignition Facility (NIF) are designed to understand and test the basic principles of self-sustaining fusion reactions by laser driven compression of deuterium-tritium (DT) filled cryogenic plastic (CH) capsules. The experimental campaign is ongoing to tune the implosions and characterization of burning plasma conditions. Nuclear diagnostics play an important role in measuring the characteristics of these burning plasmas, providing feedback to improve the implosion dynamics. I will present the data collected with the recently commissioned Neutron Imaging (NI) diagnostic that provides vital information on the distribution of the central fusion reaction region and the surrounding DT fuel. These fuel distributions are measured through neutron images collected at two different energy bands for primary (13-17 MeV) and downscattered (6-12 MeV) neutrons. From these distributions, the final shape and size of the compressed capsule can be estimated and the symmetry of the compression can be inferred. In addition, the spatially averaged density of the nuclear fuel, another important parameter for optimizing and understanding the ignition conditions, can be calculated from these images during the peak neutron emission time.

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