

Abstract Submitted
for the DPP20 Meeting of
The American Physical Society

Nuclear Imaging of Inertial Confinement Fusion: 3D hot spot tomography, fuel density characterization, and remaining ablator shape
NOAH BIRGE, VERENA GEPPERT-KLEINRATH, MATTHEW FREEMAN, CARL WILDE, PETR VOLEGOV, Los Alamos National Laboratory — The LANL neutron imaging team has been providing neutron images of inertial confinement fusion implosions at the National Ignition Facility (NIF) for almost 10 years. The neutron imaging system has recently evolved into a comprehensive nuclear imaging suite including multiple neutron imagers, in addition to x-ray and gamma imaging. A powerful diagnostic tool, the neutron image precisely determines the region of fusion fuel actively undergoing fusion, providing information on the fuel shape at ignition and associated performance limitations. Since the delivery of the first primary neutron images at NIF in 2011, the nuclear diagnostic has grown from one instrument to three dedicated lines of sight with comprehensive imaging power. The diagnostic suite now encompasses: three orthogonal primary images allowing for limited-view 3D hotspot tomography, two down-scattered images facilitating fuel density reconstruction, colinear x-ray imaging for direct neutron/ x-ray comparison studies, and colinear gamma imaging to provide the remaining ablator shape. We will show recent results that highlight the diagnostic power of the comprehensive nuclear imaging suite.

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Date submitted: 12 Oct 2020

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