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Title: Progress Towards the Development and Testing of Source Reconstruction Methods for Neutron Imaging of ICF Implosions

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Progress Towards the Development and Testing of Source Reconstruction Methods for Neutron Imaging of ICF Implosions

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Development of analysis techniques for neutron imaging at the National Ignition Facility (NIF) is an important and difficult task for the detailed understanding of high neutron yield inertial confinement fusion (ICF) implosions. These methods, once developed, must provide accurate images of the hot and cold fuel so that information about the implosion, such as symmetry and areal density, can be extracted. We are currently considering multiple analysis pathways for obtaining this source distribution of neutrons given a measured pinhole image with a scintillator and camera system. One method under development involves the numerical inversion of the pinhole image using knowledge of neutron transport through the pinhole aperture from Monte Carlo simulations [E. Loomis et al. IFSA 2009]. Here we show that the technique is robust to the type and geometry of imaging aperture based on simulated neutron sources. We are currently striving to apply the technique to real data by applying a series of realistic effects that will be present for experimental images. These include various sources of noise, misalignment uncertainties at both the source and image planes, as well as scintillator and camera blurring. Some tests on the quality of image reconstructions have also been performed based on point resolution and Legendre mode improvement of recorded images. So far, the method has proven sufficient to overcome most of these experimental effects with continued devlopment.