Abstract Submitted
for the DPP11 Meeting of
The American Physical Society

NIF Neutron Image Reconstruction Techniques PETR VOLEGOV, GARY GRIM, FRANK MERRILL, DOUGLAS WILSON, LANL — Neutron imaging is an important diagnostic tool for inertial fusion studies at the National Ignition Facility (NIF) for measuring asymmetries in the burn region during the ignition stage of implosions. The technique for imaging of the spatial distribution of deuterium-tritium (DT) fusion neutrons utilizes an aperture - placed between the neutron source and a spatially sensitive neutron detector - which blocks the neutron flux and produces a shadow image of the neutron source at the detector. The recorded image is related to the 2D projection of the neutron source through a convolution with some, in general case spatially dependent, point spread function. The neutron source is reconstructed from the recorded image by solving a Fredholm-type integral equation of the first kind before we can estimate the shape and the size of the source. This inverse problem is notoriously ill-posed and presents certain difficulties in the context of NIF neutron imaging. Due to relatively low yield of neutrons the recorded images are expected to be noisy, so a special attention should be paid to the regularization of the equations to avoid the unacceptable amplification of the noise. We will present an overview of the developed techniques for reconstruction of source image from detector images and the results of reconstruction of the first neutron images obtained at NIF.

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Date submitted: 29 Jul 2011 Electronic form version 1.4