DEVELOPMENT OF A PRECSION NEUTRON TIME-OF-FLIGHT DIAGNOSTIC FOR INERTIAL FUSION AND HED EXPERIMENTS

G.P Grim[1], J. A. Caggiano[1], B. A. Davis[2], M. J. Eckart[1], C. Forrest[4], V. Glebov[4], R. Hatarik[1], E. E. Hunt[2], B. M. Jones[3], J. Knauer[4], G. L. Morgan[4], D. Sayre[1]

[1]Lawrence Livermore National Laboratory, Livermore, CA, USA
[2]National Security Technologies, Las Vegas, NV, USA
[3]Sandia National Laboratory, Albuquerque, NM, USA
[4]Laboratory for Laser Energetics, Univ. of Rochester, Rochester, NY USA
[5]Los Alamos National Laboratory, Los Alamos, NM, USA
grim3@llnl.gov

The National Ignition Facility at Lawrence Livermore National Laboratory routinely compresses deuterium and tritium (DT) filled targets to high density, ~1000 times solid density, and temperatures, 3-5 KeV, resulting in fusion yields approaching 10^{16}. The concomitant flux of neutrons from these experiments is routinely used to diagnose the apparent ion temperature of the plasma, fluid motion, as well as the density of the DT in the experiment. This flux is measured using a suite of neutron time-of-flight (nToF) diagnostics and a magnetic recoil spectrometer (MRS)[1-2], which are approaching the upper end of their designed dynamic ranges. New experiments are being planned that extend the fusion yield by another 2-3 orders of magnitude and will tax the current nToF capability at the NIF. We report on efforts to extend the NIF nToF suite dynamic range by another 2 orders of magnitude, as well as improve the sensitivity of the new nToF suite to allow measurement of the first four central moments of fusion neutron spectra with precision goals for the respective precisions of: 0.02%, 0.3%, 0.3%, and 1%. LLNL-ABS-670058

[1] M. Gatu Johnson et al., Rev. Sci. Instrum. **83** 10D308 (2012)
[2] J. A. Frenje et al., Nucl. Fusion, **53** 043014 (2013)