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High-Speed Diamond Detectors for nTOF Plasma Diagnostics at the NIF[1] STEPHAN FRIEDRICH, TODD J. CLANCY, RICHARD A. ZACHARIAS, MARK J. ECKART, LLNL, JOE KILKENNY, GA, VLADIMIR Y. GLEBOV, LLE, THOMAS BUCZEK, MILTON J. SHOUP III, LLE — Neutron time-of-flight (nTOF) spectrometers are integral diagnostics at the National Ignition Facility (NIF) to extract neutron yield, ion temperature and bang time of the implosion. For measurements of the fuel areal density (ρR), one of these nTOF diagnostics will be operated with low shielding at a comparably close distance of 3.9 m to the hohlraum target to minimize the scattering contribution of the intense 14 MeV neutron signal to the spectral background. This nTOF spectrometer uses CVD diamond semiconductor detectors with sub-ns decay times and without the long tails that often affect the response of fast scintillators. It will measure the fraction of down-scattered neutrons that arrives only ∼10 ns after the large pulse of 14 MeV DT neutrons and that provides a measure of the areal density ρR and thus the ignition threshold function. We discuss the instrument design, Monte Carlo simulations of its response function, and measurements of the detector response to X-ray and neutron signals at the Laboratory for Laser Energetics (LLE). Special emphasis will be placed on discussing the contributions to the background for the neutrons down-scattered in the fuel into the spectral range of ∼10 to ∼12 MeV.

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