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14.21 Validation of the foil-on-hohlraum technique for the Magnetic Recoil Spectrometer for time-resolved neutron measurements at the National Ignition Facility

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The next-generation Magnetic Recoil Spectrometer, called MRSt, will provide time-resolved measurements of the DT-neutron spectrum from Inertial Confinement Fusion (ICF) implosions at the National Ignition Facility (NIF). These measurements will provide critical information about the time evolution of the fuel assembly, hot-spot formation, and nuclear burn. The absolute neutron spectrum in the energy range of 12-16 MeV will be measured with high accuracy (˜5%), unprecedented energy resolution (˜100 keV) and, for the first time ever, time resolution (˜20 ps). Crucial to the design of the system is a CD (or CH) conversion foil for the production of recoil deuterons (or protons) as close to the implosion as possible to provide a small source for the ion-optics of the MRSt magnet system. The foil-on-hohlraum technique has been demonstrated by placing a 1-mm-diameter, 40-μm-thick CD foil on the hohlraum diagnostic band along the line-of-sight of the current time-integrating MRS system, which measured the recoil deuterons. In addition to providing validation of the foil-on-hohlraum technique for the MRSt design, substantial improvement of the MRS energy resolution has been demonstrated.
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