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**Measurements of the down-scattered and TT-neutron spectrum using the Magnetic Recoil Spectrometer**  
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Proper assembly of capsule mass, as manifested through evolution of fuel areal density ( $\rho R$ ), is fundamentally important for achieving hot-spot ignition planned at the National Ignition Facility (NIF). Experimental information about  $\rho R$  and  $\rho R$  asymmetries,  $T_i$  and yield is therefore absolutely essential for understanding how assembly occurs. To obtain this information, we have built and activated, at OMEGA, a Magnetic-Recoil Spectrometer (MRS) whose objective is to measure the absolute neutron spectrum in the range 5 to 30 MeV, from which  $\rho R$ ,  $T_i$  and yield can be directly inferred for energy-scaled cryogenic DT implosions. This allows for experimental validation of the direct-drive ignition-capsule design prior to the first experiments on the NIF. Another MRS is currently being built for the NIF. In this talk, we present the first ever measurements of the down-scattered neutron spectrum, from which  $\rho R$  was accurately inferred for both CH and cryogenic DT implosions. As much of the OMEGA-MRS R&D is directly applicable to the NIF-MRS, the MRS activities on the NIF are presented as well. In addition, high-resolution measurements of the DT and TT-neutron spectrum have recently been performed to address, for the first time, important science questions regarding non-thermal components in the DT-neutron spectrum, as well as the possible existence of the TT-two-body reaction, at low energies, producing a neutron peak at about 9 MeV. This work was supported in part by the U.S. Department of Energy (Grant No. DE-FG03-03SF22691), LLE (subcontract Grant No. 412160-001G), LLNL (subcontract Grant No. B504974). Contributors: D.Casey, C.Li, F.Séguin, N.Sinenian, R.Petrasso, MIT, V.Glebov, T.Sangster, D.Meyerhofer, LLE-UR, S.Hatchett, S.Haan, C.Cerjan, M.Eckart, H.Kather, O.Landen, M.Moran, LLNL, K. Fletcher, *Suny Geneseo*, and R. Leeper, SNL.