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10.51 The X-ray Temporal Diagnostic (XTD) for time-resolved measurements of electron temperature in warm and cryogenic DT implosions at OMEGA

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The current Particle X-ray Temporal Diagnostic has been used to simultaneously measure X-ray-emission and nuclear-reaction histories in Inertial Confinement Fusion (ICF) implosions at OMEGA. Through time-resolved measurements of the X-ray continuum, the time-evolution of the electron-temperature [Te(t)] can be inferred. Obtaining this information is essential in our efforts to understand the energy balance in cryogenic DT implosions, since Te(t) is not affected by residual hot-spot kinetic energy, as is the case for ion temperature measurements. This work defines the diagnostic requirements for measurement of Te(t) in warm and cryogenic DT implosions at OMEGA. Using synthetic data, a shielded X-ray Temporal Detector (XTD) with eight spectral channels, each composed of a scintillator and distinct-thickness Ti filter, coupled to an optical relay system and Ross streak camera, Te(t) in cryogenic DT implosions can be inferred to within +/-5% during peak burn. This work was supported in part by the U.S. Department of Energy, the Laboratory of Laser Energetics, Livermore National Lab, and the NLUF

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