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Imaging X-ray Thomson Scattering Development at Trident D.S. MONTGOMERY, J.L. KLINE, D.T. OFFERMAN, M.S. MURILLO, LANL, T.E. LOCKARD, I.M. HALL, S.A. GAILLARD, Univ. Nevada, Reno — X-ray Thomson scattering is a powerful technique to accurately measure conditions such as density, temperature, and ionization state in near-solid density plasmas. Such measurements are required to assess equation of state variables, for example, in the warm dense matter regime. Experiments using x-ray Thomson scattering reported by other research groups utilized high-collection-efficiency x-ray spectrometers with high spectral resolution, but very poor spatial resolution. Thus, those experiments required fairly uniform conditions within the volume of dense plasma being probed. In this present research, we report the development of a high-collection-efficiency toroidally curved imaging spectrometer, with high spectral and spatial resolution (2 eV, 20 μm) for x-ray photon energies in the 4 to 5 keV region. In principle, it can be used as part of an imaging x-ray Thomson scattering experiment whereby spatial gradients in dense plasma conditions can be measured. The spectrometer was fielded on Trident to demonstrate its resolution characteristics, and to demonstrate a proof-of-principle use of imaging x-ray Thomson scattering by nonuniformly heating a solid-density target. We report preliminary results from these experiments, and future prospects for this diagnostic capability.

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