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X-ray Thomson scattering as a temperature probe for gigabar shock experiments[1] T. DOEPPNER, A. KRITCHER, S. GLENZER, Lawrence Livermore National Laboratory, D. CHAPMAN, AWE Aldermaston, R. FALCONE, University of California - Berkeley, P. NEUMAYER, GSI Darmstadt — In X-ray Thomson scattering (XRTS), high-resolution spectrometry of probe x-rays scattered from matter gives an elastic (ionic) and an inelastic (electronic) feature, whose location, width, and amplitude can be analyzed for the temperature and density of the electrons. This diagnostic is complementary to traditional, mechanical EOS measurements which do not directly constrain temperature. XRTS has been demonstrated on planar dynamic-loading experiments at the Omega laser, and a spectrometer has been constructed for use at the National Ignition Facility (NIF). We plan to obtain XRTS measurements into the gigabar regime using hohlraum-driven converging shocks at NIF. In these experiments, the radial profile through the sample at any instant of time varies greatly, though the XRTS signal is dominated by the hottest region, which is at the shock front where simultaneous radiography obtains an equation of state measurement. However, the shock signal is potentially obscured by scattering from the preheat shield, comprising a higher-Z dopant than the sample. Thus we are developing an imaging spectrometer, which should enable a spatial unfold of XRTS spectrum, providing a more precise temperature measurement at the shock front and potentially in the converging flow behind the shock.

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