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Diagnosing Pulsed Power Produced Plasmas with X-ray Thomson Scattering at the Nevada Terawatt Facility[1] J.C. VALENZUELA, C. KRAULAND, D. MARISCAL, I. KRASHENINNIKOV, F.N. BEG, University of California, San Diego, P. WIEWIOR, A. COVINGTON, University of Nevada, Reno, R. PRESURA, Voss Scientific, Llc, T. MA, Lawrence Livermore National Laboratory, C. NIEMANN, University of California, Los Angeles, P. MABEY, G. GREGORI, University of Oxford — We present experimental results on X-ray Thomson scattering (XRTS) at the Nevada Terawatt Facility (NTF) to study current driven plasmas. Using the Leopard laser, $\sim$ 30 J and pulse width of 0.8 ns, we generated He-α emission (4.75 keV) from a thin Ti foil. Initial parameter scans showed that the optimum intensity is $\sim 10^{15}$W/cm^2 with a foil thickness of 2 μm for forward X-ray production. Bandwidth measurements of the source, using a HAPG crystal in the Von Hamos configuration, were found to be ΔE/E $\approx$ 0.01. Giving the scattering angle of our experimental setup of 129 degrees and X-ray probing energy, the non-collective regime was accessed. The ZEBRA load was a 3 mm wide, 500 μm thick, and 10 mm long graphite foil, placed at one of the six current return posts. Estimates of the plasma temperature, density and ionization state were made by fitting the scattering spectra with dynamic structure factor calculations based on the random phase approximation for the treatment of charged particle coupling.

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