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Results from an Orion proton heating experiment for Warm Dense Matter studies PETER ALLAN, STEVEN JAMES, COLIN BROWN, LAUREN HOBBS, MATTHEW HILL, DAVID HOARTY, AWE plc, HUI CHEN, ANDY HAZI, LLNL, AWE TEAM, LLNL TEAM — The properties of warm dense matter covering densities and temperatures in the ranges 0.1-10x solid and 1-100eV, fall between ideal plasma and condensed matter theories. Studies have highlighted uncertainties in EoS predictions using methods based on the Thomas-Fermi and ion-cell models. In particular, such models predict large departures from ideal gas behaviour for low Z material at low densities and temperatures. In an extension of previous work, material has been isochorically heated using short-pulse laser-generated proton beams. Here, the method of Foord et al. was used toinfer isentropes oflow Z materials and provide data to validate model predictions. Earlier measurements were limited by the eV backlighterenergy to relatively low densities and pressures below 1.5Mbar, and were conducted in cylindrical geometry. More recent experiments performed at the Orion laser use a parabolic crystal imaging system in order to measure to higher pressures by probing planar expansion of aluminium foils at 1.8keV. The imaging system is described and results are presented showing a spatial resolution of 6um, which was then streaked to give temporal resolution of 10ps. Preliminary analysis of the foil expansion indicates a peak temperature of 30eV. The proton and ion spectra used to heat the sample were measured by a magnetic spectrometer and a Thomson parabola. These results are presented and the effect on the measured expansion discussed. Plans for future measurements are discussed in the light of results obtained so far.

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