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DIAGNOSTICS FOR NEAR TERM WDM EXPERIMENTS *

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We are assessing possible near term heavy-ion beam-driven warm dense matter experiments. The experiments are at low beam velocity, below the Bragg peak (NDCX-1), increasing toward the Bragg peak in subsequent versions of the accelerator (NDCX-2). The WDM conditions are envisioned to be achieved by combined longitudinal and transverse neutralized drift compression to provide a hot spot on the target with a beam spot size of about 1 mm, and pulse length about 2 ns. The range of the beams in solid matter targets is about 1 micron, which can be lengthened by using metallic foams at reduced density.

Initial candidate experiments include a transient darkening experiment to study the “black glass” phenomenon in WDM regime; and a thin target dE/dx experiment to study beam energy and charge state distribution in a heated target. Further experiments will explore target temperature and other properties such as electrical conductivity to investigate conditions such as phase transitions in targets of interest.

Initial diagnostics will be relatively simple or extensions of existing capabilities. These include electrical resistivity and optical absorption measurements to provide information on target temperature and phase transitions. Beam energy and charge state after passing through thin targets can be measured using time of flight and the existing electrostatic energy analyzer. Ion beam current and profile diagnostics will be improved to diagnose the small spot sizes to be achieved in these experiments. Other diagnostics of interest monitor optical emission (e.g. fast optical pyrometer, streak cameras), utilize laser reflectometry and polarimetry, or flash x-ray (that could be driven by laser, x-pinch or electron beam) shadowgraphy.

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