Proton-diagnostic performance in laser-driven hydrodynamics experiments

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Abstract

Magnetic fields are often generated in high-energy-density experiments, and proton radiography is an important technique for detecting the effects of such fields. Target-normal sheath acceleration (TNSA) is a useful method for generating the necessary proton beams, but its performance is very sensitive to laser-chamber conditions, the exact effects of which are not completely understood. This presentation describes the behavior of the TNSA diagnostic in an experiment performed on the OMEGA-EP laser, attempting to detect self-generated magnetic fields at a blast-wave-driven, Rayleigh-Taylor(RT)-unstable interface. In the experiment, laser energy is used to create a planar blast wave in a plastic disk; the blast wave then crosses the interface between the disk and a lower-density foam, inducing the RT instability. An initial perturbation, to seed the instability, is machined at the interface. This system differ significantly from typical experiments employing the TNSA diagnostic, and it was found that some aspects of the experimental geometry, combined with the long time scale on which this hydrodynamic experiment evolves, greatly affected

the quality of the corresponding proton images. Connections between these data and relevant features of the setup will be explored.

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