SEED MAGNETO-RAYLEIGH-TAYLOR INSTABILITY EXPERIMENTS ON A 1-MA LTD

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Recent research on the 1-MA Michigan Linear Transformer Driver, MAIZE, has focused on the Magneto Rayleigh-Taylor (MRT) instability and validation of analytic theory, developed at UM [1,2]. MRT is a concern to all forms of magnetically imploding experiments, most recently with the imploding liners anticipated in the MagLIF geometry [3]. Eliminating or mitigating MRT is crucial to success of these programs.

MAIZE is a nominal 1-MA, 100 ns, 100 kV driver, capable of driving 0.1 Ω matched loads. We present here the results of our recent campaign on planar foils with periodic perturbations to seed MRT at specific wavelengths.

These experiments were conducted on 400-nm thick, 1-cm wide aluminum foils placed between two planar current return posts. The driver charge was limited to ±70 kV, giving ~700 kA with a risetime of ~180 ns. Experiments were performed employing two ex-situ methods to seed the MRT instability on the foil. For the first technique a 150 femtosecond laser was used to micro-machine a pattern of 40µm holes, imposing a mass perturbation on the foil. The second technique involved imposing a periodic ripple in the foil at the seed wavelength. These seeding techniques allowed a preferred wavelength of MRT to be extracted and analyzed. Analysis of MRT was derived from laser shadowgraphic images, obtained using a 150-femtosecond Ti:Sapphire laser operating at 775 nm.


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