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An early look at laser plasma interaction in laser indirect drive designs at 10 MJ of incident energy*

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With 10 MJ of laser energy at 351 nm delivered to an indirectly-driven inertial confinement fusion target, preliminary design work suggests yields far exceeding 100 MJ are feasible. Avoiding excessive loss of drive or loss of symmetry control due to laser plasma interactions (LPIs) is a central consideration in both laser and target design. To accommodate the yield and debris of such targets, a larger chamber radius could lead to a substantial increase in the *f*-number of individual laser beams. Similarly, the targets relative to igniting designs fielded at the NIF could double in size.

In this work, the impact on LPI of increasing the *f*-number (notably, laser speckles have a length proportional to f^2) and the target scale length is explored using simulations (pF3D[1,2]). Given the nearly unbounded parameter space, we focus here on targets hydroscaled from current igniting designs at the NIF. Future work will explore other, perhaps significantly different, designs. We discuss experiments scheduled for FY26 that will sub-aperture NIF beams to assess the impact of *f*~40 laser speckles on LPI in current igniting designs.

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