Demonstration Of Laser Imprint Reduction Using Underdense Foams And Its Consequences On The Hydrodynamic Instability Growth

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In the direct-drive approach, inhomogeneities in the laser beam intensity distribution may create pressure perturbations on the target surface and seed hydrodynamic instabilities. These instabilities may decrease the fuel compression and reduce the energy gain. The control of the latter is one of the crucial issues of the Inertial Confinement Fusion.

To control the laser energy distribution in the plasma, optical techniques of laser beam smoothing are implemented. Unfortunately, these techniques are not operational at early time and the instantaneous intensity fluctuations are imprinted in the solid target. We present a study on the use of a low, sub-critical density foam on the target front-side to enhance the laser beam smoothing [1]. Thanks to a chain of dedicated multi-dimensional numerical tools, the effects of the foam on the spatial and temporal coherence of the laser beam are analyzed and the consequences on the hydrodynamic instability growth are highlighted [2].

To validate this analyse, a dedicated experiment has been carried out at the Omega laser facility. The initial imprinted perturbation was imposed using specific phase plates. The development of the hydrodynamic instabilities at the ablation front of a CH foil coated with an underdense foam was measured for the 1rst time. The experiment showed a reduction of the imprint level with the foam coated targets due to the parametric instabilities, mainly the stimulated Brillouin scattering in near forward direction (FSBS). A delay in growth of the areal density modulations up to 1 ns and a reduction of imprint level by a factor of 2 or 3 were measured with the low density foam target.

References

[1] Depierreux et al, *Phys. Rev. Lett*. 102, 195005 (2009)
[2] Olazabal-Loumé et al, *New J. Phys*. 15, 085033 (2013)