Exploration of the laser spectrum parameters to improve laser smoothing performance

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In the context of inertial confinement fusion large energetic facilities require optical smoothing techniques. For this purpose, many focal spots have to be added incoherently which may be performed in the time domain by changing rapidly the focal spot. This is the purpose of optical smoothing by spectral dispersion (SSD). It consists in broadening the initial laser field by using a periodic phase modulation and then to decorrelate the induced additional frequencies with a dispersive grating. Four major parameters may be considered: the total bandwidth, the inter- frequency shift, the spectrum shape and the time delay imposed by the dispersive grating. It is well known that a short laser coherence time mitigates laser plasma instabilities (LPI). However, the generation of a high energetic laser with a short coherence time, shorter than the LPI growth rates, is still a major issue.

Considering the Laser Mégajoule optical system framework, we study different smoothing techniques: multiple phase modulations [1], modification of the time delay and synchronization of the phase modulation between beams. We assess their efficiency by looking at a better mitigation of the stimulated Brillouin scattering [2]. The most important result is that an increase of the modulation frequency with the same bandwidth improves smoothing performance.

References:

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