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An astigmatic method for target pre-alignment at high-repetition rate

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After the interaction between an intense laser pulse and a solid target, the target is usually destroyed. Due to this damage, a target delivery technique must be implemented to renew the target with the required repetition rate and precision. This process must be done carefully to maintain the target in focus at high repetition rate (1 kHz), since an online measurement of the target position is difficult to achieve [1,2]. A solution to this problem is to measure the target position for each programmed sequence before the experiment and use this map to correct the position when shooting the target. In this work, we present the results of a surface target mapping implementing an astigmatic method.
The astigmatic focusing method is a well-known technique used in microscope objective focusing [3,4]. We use this focusing system to characterize the surface by mapping a solid target in a confocal setup at normal incidence, respect the target. We tested our astigmatic focusing method using the L2A2 laser system (Universidad de Santiago de Compostela, 25 GW, 1mJ, 35 fs, 1kHz, Ti:Sapph amplified system). A fraction of a 2-inches target (1/8) was mapped in less than 15 minutes with an accuracy of ± 10 μm. A full target mapping could be performed in 120 minutes or less. The information of the surface calibration can be loaded to a programmed sequence of the target delivery to run the experiment. This remote technique, to characterize the deviations of the target with respect to focus, will enable a microfocus laser-plasma X-ray source with high average power and stability, which is essential for some applications.

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