

A Continuous, In-Chamber Target Tracking and Engagement Approach for Laser Fusion

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Direct-drive targets must be hit by driver beams with an accuracy of $\pm 20 \mu\text{m}$. Target engagement is the process of measuring the target trajectory and directing the driver beams to hit the target at a position that is predicted based on these measurements. New target engagement concepts have been proposed and developed in the last few years to continuously track the targets and to verify that the tracking system is aligned with the driver beams for each shot.

For transverse position measurements, a laser beam continuously backlights the target and we measure the position of the Poisson spot in the center of the target's shadow. Axial target displacement is measured using a laser interferometer and counting interference fringes as the target moves away from the laser source. Final steering corrections use a "glint" reflected off the target ~ 1 ms prior to firing the laser beams and collected in a separate PSD for each driver beamlet. The position of the glint on the PSD is compared to the position of an alignment beam that travels essentially the same optical path as a laser beamlet. Steering corrections are then made based on the difference in position of the two spots reaching the PSD at different times.

Work supported by NRL Contract N00173-06-C-6005.
