Target Injection Placement Accuracy Improvement with Electrostatic Steering

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To achieve high gain in an Inertial Fusion Energy (IFE) power plant, driver beams must hit direct drive targets with ±20 μm accuracy. For driver beams to arrive at the target with sufficient simultaneity, the targets must be placed to ±5 mm from chamber center. Better placement accuracy simplifies driver beam steering by reducing the distance that steering mirrors must reposition the beam aim point in the last few ms. Current best target placement experimental accuracy is 0.22 mrad standard deviation which corresponds to 3 mm at 13 m. A factor of two improvement is required to achieve 3 σ accuracy in ±5 mm, and even greater accuracy is desired.

General Atomics has recently embarked on a program to improve target placement accuracy through electrostatic steering. Preliminary experiments have improved accuracy of falling charged spheres. We optically track the motion, and feed back appropriate voltage to steering electrodes. A steering algorithm was prepared to steer targets with placement accuracy limited primarily by rate and accuracy of target tracking. Substantial accuracy improvement is expected with higher-frequency tracking and voltage amplification equipment. The results will be reported.

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