

Experimental Target Injection and Tracking System Construction and Single Shot Testing*

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Targets must be injected into an inertial fusion energy (IFE) power plant at a rate of 5 to 10 each second. Targets must be tracked very accurately to allow driver beams to be aligned with defined points on the targets with accuracy of $\pm 200\text{ }\mu\text{m}$ for indirect drive and $\pm 20\text{ }\mu\text{m}$ for direct drive. An experimental target injection and tracking system has been constructed at General Atomics to investigate injection and tracking of both direct drive and indirect drive targets. The injector system will be used as a tool for testing the survivability of various target designs and providing feedback to the target designers. This 30 m long system will be the centerpiece of a Facility for developing IFE target fabrication and injection technologies.

Helium gas propels the targets down an 8 m gun barrel that was built to achieve 400 m/s target speed while not exceeding $10,000\text{ m/s}^2$ acceleration. Direct-drive targets are protected in the barrel by sabots that are spring loaded to separate into two halves after acceleration. A sabot deflector directs the sabot halves away from the target injection path. Targets will be optically tracked with laser beams and line scan cameras. Target position and arrival time to a plane in the reaction chamber center will be predicted in real-time based on early target position measurements. Shots with this injector ending at the first detector chamber were first carried out in February 2003. The system installation will be described. Results of single shot testing with sabot separation, target tracking, single axis position prediction, and position verification will be presented.

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