§39. Stability of Fast Ignition Target after Release from Sabot

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1. Introduction

In a fast ignition laser fusion reactor, targets must be injected to the firing position accurately. The velocity of injected target is 100m/s to allow sufficient time for steering laser beams. The deviation from the designated position must be less than 5mm and tumbling of the target is expected to be less than 2 degree. The reproducibility of injection is also critical issue in the laser fusion power plant. These technical issues can only be discussed with actual size experimental system. We are going to construct a single-shot-base injection-system for actual size taget for the power plant to demonstrate the injection, tracking and beam steering.

A concept of the target injector for commercial reactor and the target for reactor are illustrated in Fig. 1 and Fig 2, respectively.

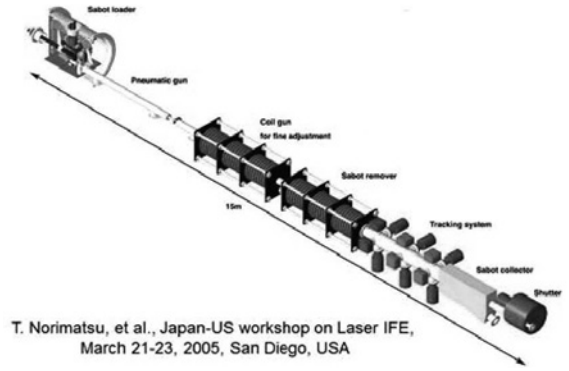

Fig 1 Concept of target injector for KOYO-F.

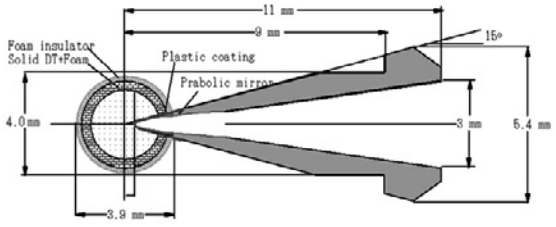

Fig. 2. Cross sectional view of a fast ignition target for commercial reactor

The target has a thermal insulator to protect a cryogenic solid DT layer. The total mass is 53 mg.

2. Experimental equipment

Figure 3 shows the test equipment that consists of a gas gun, a acceleration tube, and a flight chamber. This system was originally developed at Hiroshima University and moved to ILE in 2011, Osaka University to make integrated system. This gun is capable of injecting a sabot into the view chamber at the left end of the line with the velocity of 100m/s. A magnetic dis-acceleration unit for sabot separation was designed at the Gifu University and installed to this line. Demonstrate of stability of the target after sabot separation will be carried out in 2012.

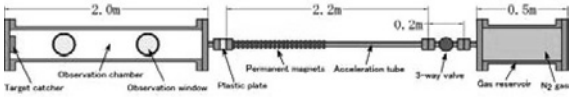

Fig. 3 Experimental setup for stability test of fast ignirion target after sabot separation.

In this experiment a dummy target made with aluminum (shown in Fig. 4) was used to demonstrate the stability of the target after separation. Outer size is almost the same with actual target but the mass is 3 times larger than actual target. To discuss the influence of Lorentz force induced by the external magnetic field on the stability of target after separation, the ratios of conductivity to the mass of the actual target and dummy target are designed to be the same.

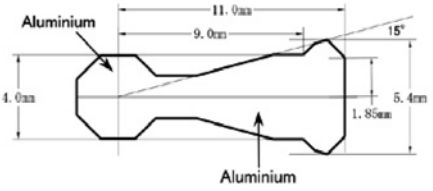

Fig 4 Dummy target for stability experiment.

In April 2012, the first shot after assembling was successfully operated. We are now improving observation section to obtain accurate data on tumbling of target during flight.