§62. Optimization of Sabot for Target Injection Accuracy - Development of Sabot Remover of Target Injector for IFE -

Yoshida, H. (Gifu Univ.),
Norimatsu, T. (Osaka Univ.)

A target for First Ignition for Inertial Fusion Energy is protected from thermal radiation by a container sabot. The target is separated from the sabot before entering to the reactor chamber. We have been developed magnetic sabot-remover applying Lorentz force generated by permanent magnet array (PMA)[1-6]. The force acts on only sabot for removal it. In order to improve injection accuracy, improvement of machining accuracy of sabot and introduction of sabot rotation are carried out[5].

Fig. 1 shows the experimental injector system. A poly-styrene form target (4.0 ± 0.05mmϕ, 0.8mg) was inserted in an aluminum sabot (9.35mmϕx40mm, 5.07g) with machining accuracy of 50 μm. A solenoid valve releases 10^6 Pa N_2 gas to accelerate the sabot up to 40 m/s with the target. Forty donut shape permanent magnets (OD30mm、ID14mm、5mmt) of PMA are set outside of the barrel. The sabot passing through the PMA is selectively decelated down to 20 m/s. Fig. 2 shows injection accuracy of ~13 mrad measured at the end of vaccum chamber.

Fig. 3 shows preliminary testing sabot rotation apparatus. The pieces of neodymium magnets (232mT) are spirally set on the vertically fixed transparent acrylic barrel. A free fallen sabot passed through it was rotated at the angular velocity of 30 π rad/s. Its slip was estimated s=0.95. The slip can be decreased by rearrangement of neodymium magnets. We are introducing the tested rotating magnetic field to newly designed target injector.

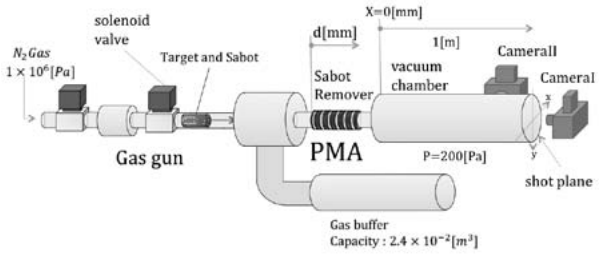

Fig.1 Experimental injector system

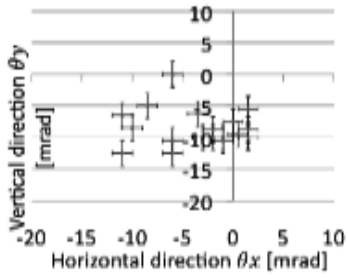

Fig. 2 Target injection accuracy

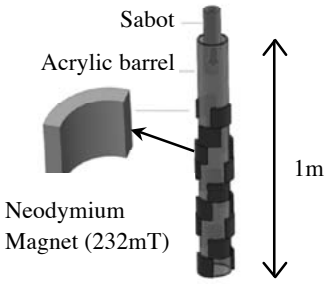

Fig. 3 Preliminary tested sabot rotation apparatus.

We are constructing the new injector system shown in Fig. 4. The effect of sabot rotation for target injection accuracy will be evaluated

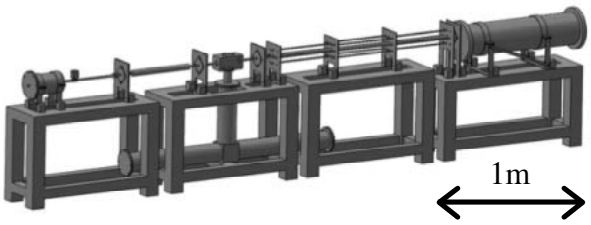

Fig. 4 Newly designed target injector

1) H. Yoshida, R. Makino, T. Niwa, Tokai-Section Joint Conference on Electrical and Related Engineering (2010) Pol-19.
2) H. Yoshida, R. Makino, T. Niwa, Tokai-Section Joint Conference on Electrical and
Related Engineering (2011) O3-8.
3) H. Yoshida, N. Kameyama, Conference on Inertial Fusion Energy '12 (2012) CIFE5-5.
4) Kameyama N and Yoshida H 2013 Plasma Fusion Res.8, 3404045(2013).
5) Kojima K, Kameyama N and Yoshida H, C521pIII04 (2014).
6) Kameyama N, Kojima K and Yoshida H, C521pIII05 (2014).