§29. Development of Gas Gun for Target Injection in Laser-Fusion Reactor

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The prototype of a gas gun for target injection in laser-fusion reactor has been being developed at Hiroshima University. Figure 1 schematically shows the gas gun under development. The gas gun is composed of a high-pressure gas reservoir, an acceleration tube with guide-pin-type rifling (2195 mm in length and 9.8 mm in inner diameter), a shooting stabilizer, which consists of a pressure reducing device and a fine flight-direction adjuster, at the end of the acceleration tube, a diagnostic chamber, a vacuum pump, and some pipes and valves. A projectile we are now using is a cylinder, which was 28 mm in length and 9.7 mm in diameter, with a tilted groove for the guide-pin-type rifling, and made of Duracon acetal copolymer (a kind of polyoxymethylene resin). In experiments, the speed, attitude, and direction of each flying projectile are measured. The most important issue is now to stabilize the flight attitude of the projectiles.

In FY 2006, we made the initial pressure of the diagnostic chamber lower and the initial pressure of the high-pressure gas reservoir higher, and their influences on the flight attitude and direction of the projectiles were investigated.

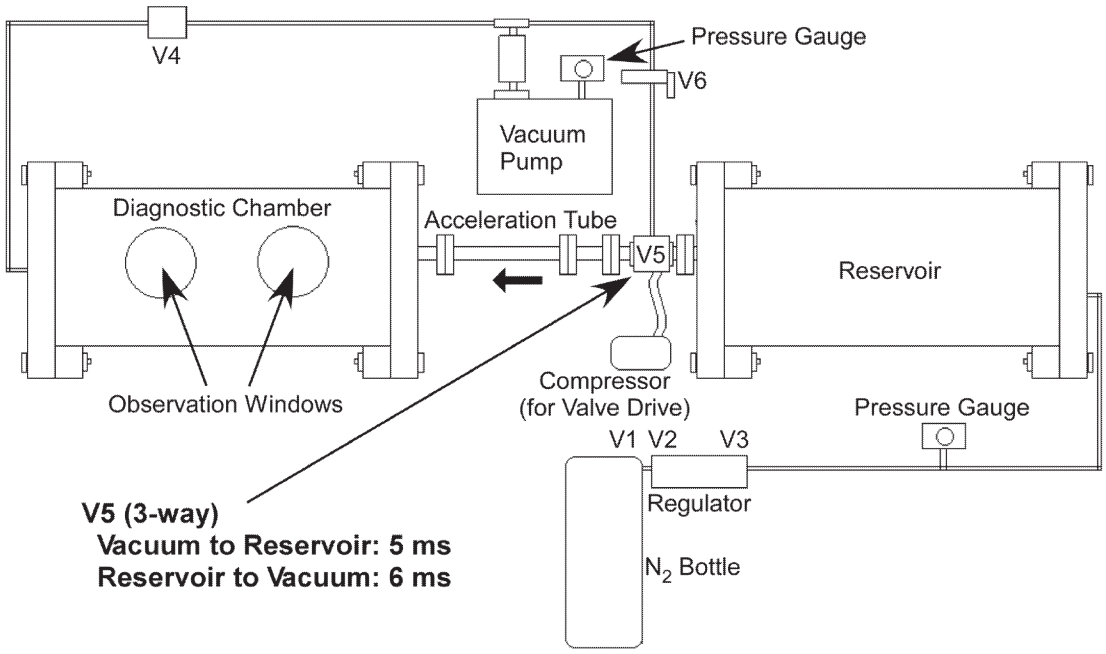

Fig. 1 Gas gun under development at Hiroshima University.

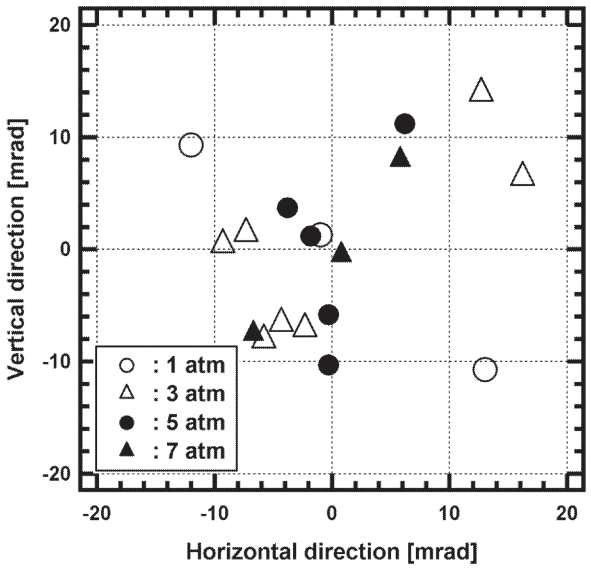

Fig. 2 Influence of the initial pressure of the high-pressure gas reservoir on the flight direction.

Figure 2 shows the influence of the initial pressure of the high-pressure gas reservoir on the flight direction. The origin of Fig. 2 is the average flight direction at each experimental condition. The higher the initial pressure of the high-pressure gas reservoir was, the higher the flight speed was. This means that the higher initial pressure of the high-pressure gas reservoir induced the higher rotation speed of the projectile. However, we did not recognize any substantial improvement in the flight direction or in the flight attitude.

Our present understanding is that the preciseness of the dimensions and axial symmetry of the projectile and the reduction of the disturbance by the accelerating gas are key issues to stabilize the flight attitude and direction. These issues will be addressed in the next year.