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3D Position measurement of 1Hz injected flying CD beads
レーザー核融合連続投入CD固体ターゲットの3次元位置計測

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We have conducted fusion reaction experiments with highly-repetitive DPSSL-pumped laser HAMA and target injection system. In this paper, we develop two directions shadowgraph system with short pulses laser and measure the three-dimensional parget position at the moment of the irradiation of implosion laser. We show the target position distribution in target injection experiments.

1. Introduction

We have conducted fusion reaction experiments with highly-repetitive DPSSL-pumped laser HAMA [1-4]. Recently, we have -developed a target injection system and succeeded highly-repetitive fusion reaction by irradiating the laser on the flying deuterated polystyrene(CD) beads targets [5]. We observe the target position at the moment of the irradiation by shadowgraph with short pulses laser. In this paper, we develop two directions shadowgraph system with short pulses laser and measure the three-dimensional parget position at the moment of the irradiation of implosion laser. We show the target position distribution in target injection experiments at 1 Hz.

2. Experimental system

Figure 1 shows the target injection system which is installed a vacuum chamber. The target loader stores CD beads target with a diameter 1-mm. The rotating disk with holes feeds CD beads to the exit hole above the focal point of the implosion laser at 1 Hz. Falling targets pass between a

two-step photodiode array. It forecasts the target arrival time at the focal point to laser system. At the moment flying targets arrived at the laser focal point, two implosion beams with 800 nm wavelength and 0.4-ns pulse width irradiate the target from opposite directions. Following it, two heating beams with 110-fs pulse width irradiate it from same directions.

Figure 2 shows two directions shadowgraph system. It uses second harmonics of a part of the heating beam with 110-fs pulse width as a probe beam. The two probe beams illuminates target simultaneously with heating laser by adjusting the path length of probe beam. The two probe beams are perpendicularly to each other and One probe beam is perpendicular to heating beam. The other probe beam intersects with heating beam at 30 degree. From two shadowgraphs, three-dimensional parget position is estimated.

3. Results and Discussion

The distribution of target positions at the moment of heating beam irradiation is shown in fig.3. In this experiment, 400 CD beads are repetitively injected at 1 Hz. The standard deviations of parget position in x, y and z are 0.79-mm, 0.67-mm, and 0.76mm, respectively. In this time, 65.5% targets are injected, 35.9% targets are irradiated by implosion and heating beams. Neutrons are generated from 11.1% targets.

Two directions shadowgraph system can measure distribution of target positions at the moment of heating beam in fusion reaction experiments.

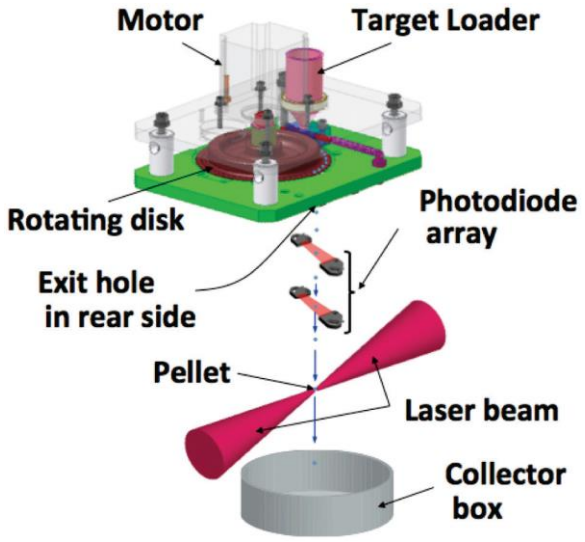

Fig.1. Target injection system

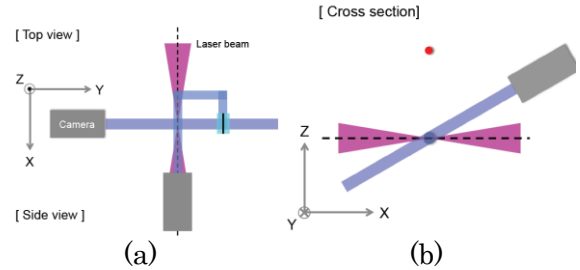

Fig.2. (a) top view and (b) side view of two directions shadowgraph system.

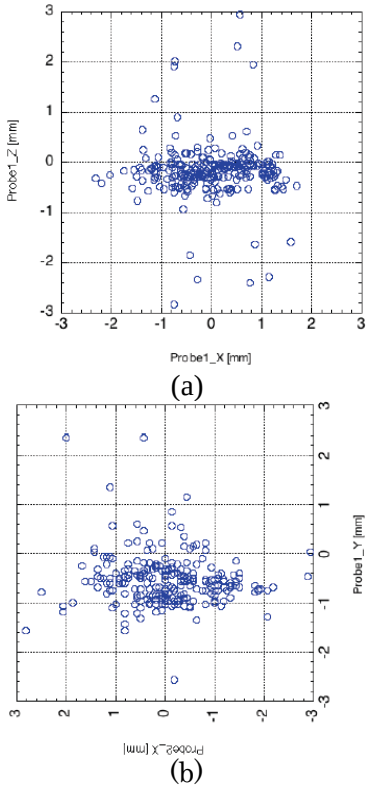

Fig.3. (a) x-z and (b) x-y distribution of target positions in the 400 targets injection.

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