ABLATION PLASMA TRANSPORT USING MULTICUSP MAGNETIC FIELD FOR LASER ION SOURCE

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Heavy ion inertial fusion (HIF) is considered as a candidate to realize the power generation by nuclear fusion. The HIF requires heavy ion beams with high current to deposit sufficient energy to the fuel. A laser ion source (LIS) is expected to be the injector for providing the high current ion beam. The LIS provides ion beams with a pulse due to using a pulse laser and the ion current waveform indicates shifted-Maxwellian distributions [1]. The width of the beam pulse can be varied by changing the plasma drifting distance between the surface of the target and the ion beam extraction point. However, an ion beam current density decreases significantly due to the three-dimensional expansion of the plasma [2]. To suppress the decrease of plasma density, applying magnetic fields have been investigated for LIS from the view point of increasing the ion current [3-5].

In this study, we propose a plasma guiding method using multicusp magnetic field to transport the ablation plasma with keeping the density. To investigate the effect of guiding using magnetic field on the ablation plasma, we demonstrated the transport of the laser ablation plasma in the multicusp magnetic field. The magnetic field was formed with eight permanent magnets and arranged to limit the plasma expansion to radial direction. The plasma was transported over 300 mm in the magnetic field. A Nd:YAG laser (wavelength: 532 nm) was focused on the metal target to generate plasmas. The pulse width and energy of the laser were 16 ns and 400 mJ, respectively. The plasma ion current was measured with a Faraday cup as a function of the plasma drifting distance from the laser target. We investigated the variation of current density and pulse width w/wo the magnetic field. The result implied that the plasma was confined in the transverse direction during the transport in the multicusp magnetic field.

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