Study on laser ablation plasma traveling in solenoidal magnetic field

Kazumasa Takahashi\textsuperscript{a}, Shunsuke Ikeda\textsuperscript{b}, Mitsuo Nakajima\textsuperscript{b}, Jun Hasegawa\textsuperscript{b}, and Kazuhiko Horioka\textsuperscript{b}

\textsuperscript{a} Nagaoka University of Technology, Niigata 940-2188, Japan
\textsuperscript{b} Tokyo Institute of Technology, Yokohama 226-8502, Japan

kazumasa@vos.nagaokaut.ac.jp

Laser ion source is a pulse ion provider, which can supply a high current and/or highly charged ion beam from a solid target irradiated by a laser. Since a short-pulse (\~{}10 ns) laser is used for an ion source, a pulse plasma expands toward the direction perpendicular to the laser target surface. An ion source for accelerators is required to provide a reproducible waveform with a certain pulse length appropriate to the application for practical use. Although the pulse length can be extended with a plasma drifting distance, a density of the plasma decreases by a three-dimensional expansion during the drift.

Applying a solenoidal magnetic field to the laser ablation plasma has been attempted in order to guide the expanding plasma and increasing the plasma ion current. The researches indicated that enhancements of the current with the magnetic field were observed [1, 2]. However, the current does not increase monotonically with the field strength and the current waveform is not reproducible in some range of the field strengths [3].

To investigate the behavior of the laser ablation plasma traveling in a solenoidal magnetic field, the current was measured with a Faraday cup as a function of the field strength. Results showed that the current was increased and an onset point of the increasing current shifted to the upper stream with the field strength.

