DYNAMICS OF PLASMA CHANNELS FOR CHAMBER TRANSPORT

J. Hasegawa, T. Mawatari, Y. Oguri, M. Ogawa, RLNR, Tokyo Tech, 2-12-1 Ookayama, Meguro-ku, Tokyo, 152-8550, Japan

K. Horioka, Department of Energy Sciences, Tokyo Tech, 4259 Nagatsuta-cho, Midori-ku, Yokohama, 226-8503, Japan

Plasma-channel-based transport is one of the attractive schemes for delivering space-charge-dominated beams to a fuel target in a reactor chamber. It relaxes the requirements for beam quality and may decrease the cost of driver accelerators. Recently, a final focusing scheme using Z-pinch plasma channels has been proposed with a combination of adiabatic plasma lenses [1] and a proof-of-principle experiment also has been performed [2]. The discharge parameters of the plasma channels, however, were limited because those analyses and experiments were based on the specific reactor designs. Particularly the dynamics of the plasma channel strongly depends on the background gas pressure and the required discharge current for beam confinement and it also determines the design of the discharge circuit. To discuss the applicability of plasma channels for chamber transport, the dynamics of the channel must be examined in a wide range of discharge parameters. Thus, we performed numerical analyses of the plasma channel using a one-dimensional magneto-hydrodynamic (MHD) code. This report discusses the realistic parameter range of the channel discharge and shows the results from the numerical calculations. We also show the results on the beam trajectory obtained by a two-dimensional particle code.

1. S. Yu et al., Nucl. Instr. and Meth. A 415 (1998) 174.

2. C. Niemann et al., J. Appl. Phys., 93 (2003) 9470.