Preliminary Simulation Study for Doppler Reflectometry

Y. Ishii, H. Hojo, Y. Haraguchi, and A. Mase[a]

Plasma Research Center, University of Tsukuba, Tsukuba 305-8577, Japan
[a]Art, Science and Technology Center for Cooperative Research, Kyushu University, Kasuga 816-8580, Japan

Corresponding author's e-mail: hojo@prc.tsukuba.ac.jp

Doppler reflectometry is considered to be a hopeful diagnostic to measure flow velocity or radial electrostatic field in magnetically confined turbulent plasmas. Detecting the Doppler frequency shift in reflected wave signals satisfying the Bragg resonance condition, we can measure plasma flow velocity and thus observe a radial electrostatic field which is the origin of producing an ExB drift.

In this paper, we study simulations on Doppler reflectometry. The simulations solve Maxwell equations with use of finite difference time domain (FDTD) method in two dimensions (x, z). We first perform the simulations of Doppler reflectometry by using a moving corrugated metal target in place of plasma to study the basic features of Doppler reflectometry, and examine the effects of the magnitude and wavelength of the metal-target corrugation on reflected wave signals for different probing-beam widths. We observe that the Doppler frequency shift is just proportional to the speed of the moving target. We next perform the simulations for magnetically confined non-uniform plasmas, in which a moving layer with density fluctuations is formed. The simulations are done for different plasma configurations to analyze the details of reflected wave signals.