§6. Polarization State of 77 GHz Millimetre Wave for the Large Helical Device

Takahashi, H., Kubo, S., Shimozuma, T., Kobayashi, S., Ito, S., Yoshimura, Y., Igami, H., Mizuno, Y., Takita, Y.,
Kariya, T., Minami, R., Imai, T. (Plasma Research Center, Univ. of Tsukuba)

For a 1 MW-77 GHz gyrotron newly installed in the 11th LHD experimental campaign, we constructed the transmission line and evaluated the polarization state of the transmitted millimetre wave.

Figure 1 illustrates the transmission line of 77 GHz-ECRH in the heat equipment room. Output power from the gyrotron was directed to LHD through the evacuated corrugated waveguides of ~90 m in total length. Two power monitors and a pair of polarizer are set at the miter bends. The horizontal electric field component of transmitted power is monitored by the Schottky diode detector. First one is located upstream of the polarizers and the second one is at downstream. The output from the second monitor corresponds to the vertical component, so to check the polarization controllability. The polarization state of the transmitted millimetre wave is controlled by the set of the mechanical rotation angles of two polarizers with the grating depth of $\lambda/4$ and $\lambda/8$.[1, 2] The arrows in Fig.1 indicate the polarization components of transmitted millimetre wave.

Figure 2 shows the contour plot of (a) the power of the electric field component monitored by second monitor and (b) the calculated polarization efficiency η_p^2 with the desired polarization state (α_{opt}, β_{opt}) on the rotation angle of polarizers ϕ_1 and ϕ_2. Here $\eta_p = \cos^2(\alpha-\alpha_{opt})\cos^2(\beta-\beta_{opt}) + \sin^2(\alpha-\alpha_{opt})\sin^2(\beta+\beta_{opt})$ is the normalized power of the transmitted millimetre wave with (α_{opt}, β_{opt}) for arbitrary polarization state (α, β), α is the angle of the long axis, β is the ellipticity of the polarization, ϕ_1 and ϕ_2 denote the mechanical rotation angle of upstream ($\lambda/8$) and downstream ($\lambda/4$) polarizer, respectively. As can be seen from these figures, the observed polarization state shows good agreement with the calculation indicating high controllability of polarization state. This result also implies high accuracy of the alignment of the transmission line and high purity of HE_{11} mode.

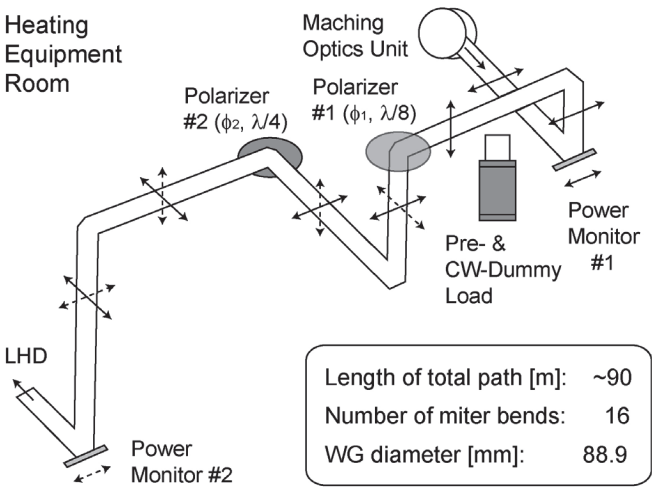

Fig. 1. The transmission line of 77 GHz-ECRH to LHD hall.

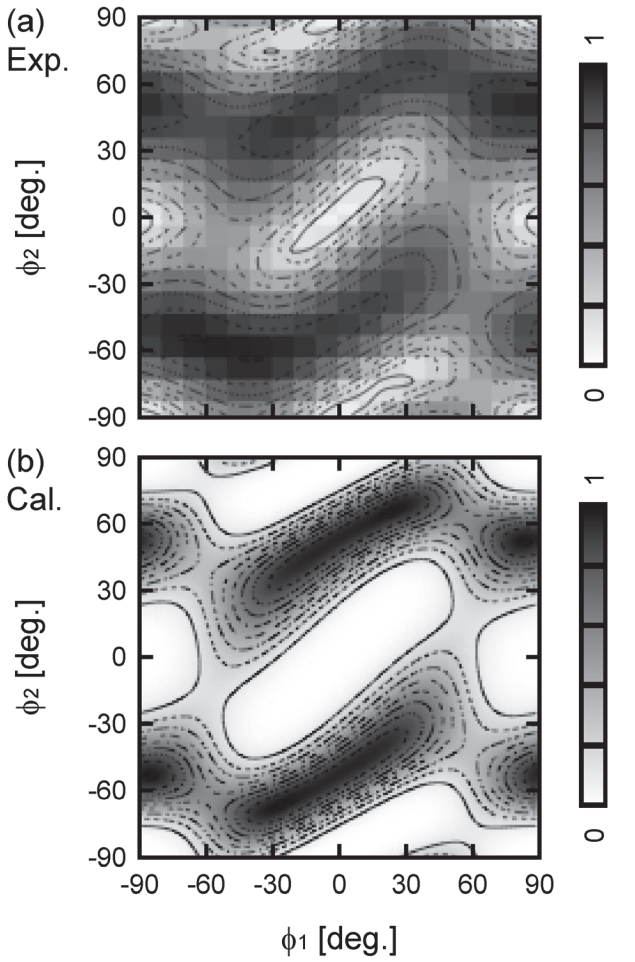

Fig. 2. The contour plot of (a) horizontal component at the second power monitor and (b) the calculated polarization efficiency η_p^2 with the desired polarization state on the rotation angle of polarizers ϕ_1 and ϕ_2.

1) T. Notake *et al.*, Plasma Phys. Control. Fusion **47**, (2005) 531
2) S. Kubo *et al.*, Fusion Eng. Des. **83**, (2008) 256