Improvement on Faraday rotation measurement affected by the stray lights on HL-2A tokamak

Z. H. Wang[1], Y. G. Li[1], H. X. Wang[1], Y. Li[1], J. Yi[1] and Z B Shi[1]
[1]Southwestern Institute of Physics
e-mail (speaker): wangzaihong@swip.ac.cn

The accurate Faraday rotation measurement remains a long-standing challenging issue.[1] It was established experimentally that, the value of Faraday rotation angle is much smaller and easily contaminated by the stray lights produced in the optical system.

Formic-acid (HCOOH, λ = 432.5 μm) laser Polarimeter-Interferometer has been developed on HL-2A tokamak, which provides 4-channels line-integrated electron densities and 4-channels Faraday rotation angles. Affected by the stray lights arising from the reflection of the probe waves in the optical system, the Faraday rotation angle was dramatically contaminated during the HL-2A experiments, which shows an obvious oscillation modulation during the electron density ramp-up/down.[2,3] This paper introduces an effective correction approach used to improve the accuracy of the Faraday rotation measurement on HL-2A tokamak. Based on the method, the deviation term originating from the stray lights can be effectively subtracted from the contaminated Faraday rotation measurement. The preliminary result indicates the interference amplitude on Faraday rotation angle is reduced by about 80 percent, and the corrected data is consistent with the experimental measurement by using the optical isolator that consists of a λ/4 wave-plate and polarizer under the similar discharges. This work was supported by the National magnetic Confinement Fusion Science Programme of China: No. 2019YFE03020004.

References

[1] Angioni C, Peeters A G, Pereverzev G V and Ryter F 2003 *Phys. Rev. Lett.* **90** 205003
[2] Li Y G *et al* 2018 *Fusion Eng. Des.* **137** 137
[3] Zou Z Y *et al* 2018 *Rev. Sci. Instrum.* **89** 01351

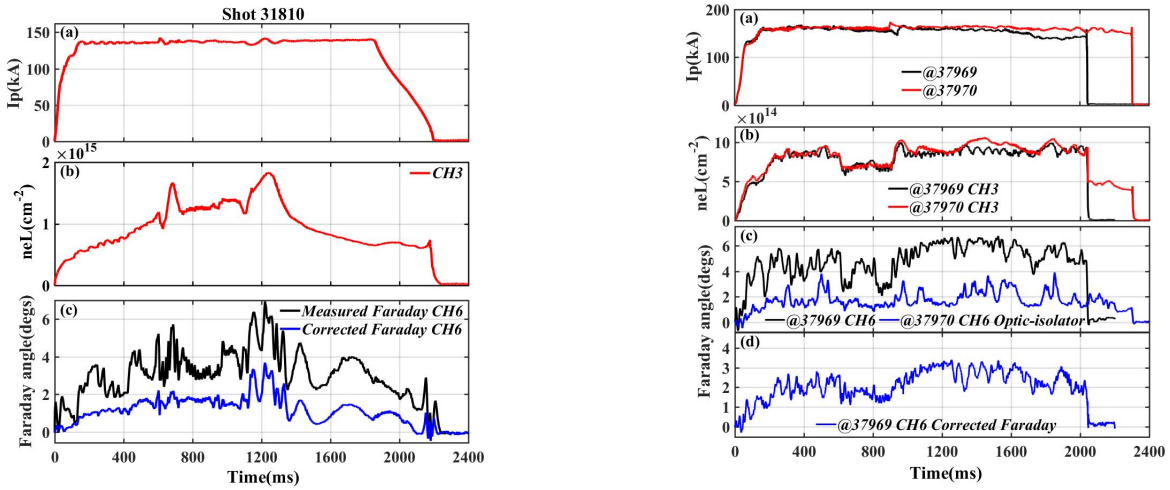

Figure 1. The comparison between the measured and corrected Faraday rotation angle for shot 31810# (left), and the results of the data-processing method and the optical isolator application on HL-2A Faraday rotation measurements (right). The Faraday rotation angle measured by the optical isolator is well consistent with the corrected data calculated by using the data-processing method.