Laser Thomson scattering system for anisotropic electron temperature measurement in NUMBER

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The laser Thomson scattering is a powerful measurement tool for electron energy distribution. Injecting a laser with an oblique angle to the external magnetic field and detecting scattering photon from a line of sight along another oblique angle enable us to obtain parallel and perpendicular components of electron temperature [1]. In order to clarify the effect of electron temperature anisotropy on volumetric recombination process [2] and intermittent bursting events [3], we have developed a laser Thomson scattering system in the Nagoya University Magnetoplasma Basic Experiment (NUMBER) device. Optics layout is shown in Fig. 1. A 2nd harmonics of Nd:YAG laser is injected into an observation volume, which is located in 0.2 m downstream from the electron cyclotron resonance (ECR) point in a diverging magnetic field configuration. Backward (165°) scattering spectrum corresponds to quasi perpendicular velocity distribution, while that for forward (15°) scattering; quasi parallel. Collecting lenses are set in vacuum to maximize solid angle in a limited space of port, where the laser path and collecting optics share an ICF152 flange. A standard imaging spectrometer is used to evaluate stray light level. Rayleigh scattering intensity is measured as a function of argon gas pressure. An initial result on residual stray light intensity is equivalent to the argon Rayleigh scattering intensity under ≤ 1 kPa of filled pressure. In order to obtain Thomson scattering spectra, a notch filter type stray light rejection optics is proposed. Collected light transferred through an optical fiber is collimated and passes a reflective type volume holographic grating. Then the stray light is reflected, while Doppler shifted Thomson spectrum passes through the grating.

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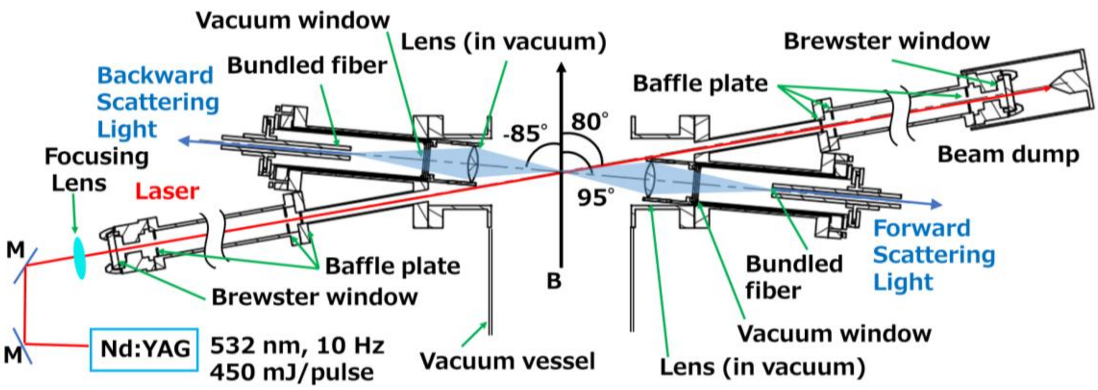

Figure 1. Schematic of Thomson scattering optics installed in NUMBER.

[1] M.D. Bowden, *et al.,* J. Appl. Phys. **73** (1993) 2732.
[2] K. Yagasaki, *et al.,* Plasma Fusion Res. **18** (2023) *in press.*
[3] A. Okamoto, *et al.,* Jpn. J. Appl. Phys. **62** (2023) *in press.*

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