CO_2 laser collective Thomson scattering for alpha-particle diagnostics

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In order to understand the behavior of alpha-particles which are the dominant heat source in a burning plasma, it is necessary to measure energy spectrum of the alpha-particles and their spatial distribution. A technique based on the collective Thomson scattering (CTS) is being developed using CO_2 lasers and gyrotrons. The CTS based on the CO_2 laser has an advantage of a small plasma refraction, simplifying the tracking of the scattered radiation. On the other hand, the scattering angle must be small (~0.5 deg.) to obtain large ion contribution on the scattered spectrum.

In JT-60U, the CTS based on the CO_2 laser is being developed[1]. A schematic view of the CTS system is shown in Fig. 1. The energy of the pulsed CO_2 laser is 15 J and the nominal pulse length is about 1 μs. Measurement of the scattered signal from the JT-60U plasma has been performed, however, scattered light has not been observed because of the stray signal. It is thought that the stray signal is generated by multi-longitudinal mode components of the laser. To improve the spectral purity of the laser, cavity length will be feedback-controlled and a spectral filter will be installed to the output of the laser. Numerical calculation shows that ion temperature will be evaluated from the scattered spectrum after the stray signal reduction. This work is partly supported by Grant-in-Aid for Scientific Research Scientific Research on Priority Areas No. 16082210.

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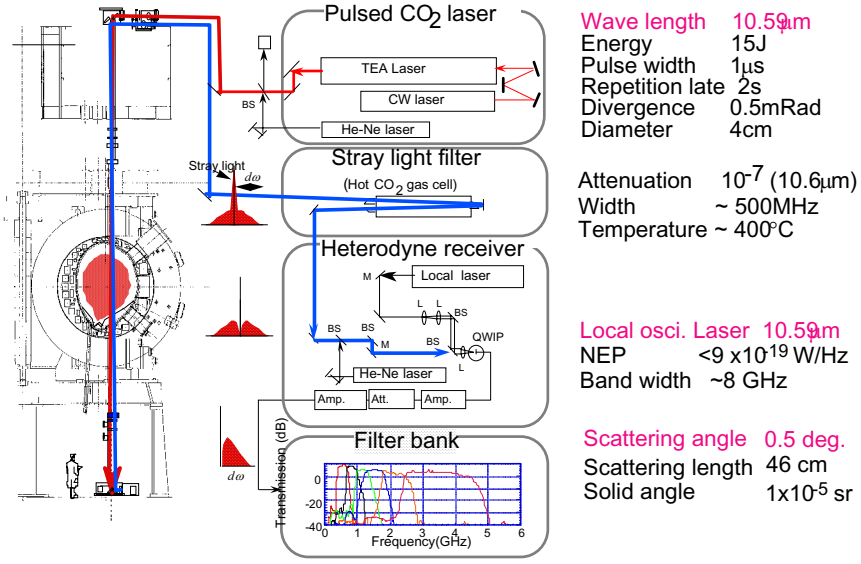

Fig. 1 Collective Thomson scattering system in JT-60U