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高機動型LIFシステムを用いた
発散磁場領域におけるプラズマ流れ構造の可視化

Measurement of a plasma flow structure in a diverging magnetic field region with an LIF spectroscopy system including high-mobility performance

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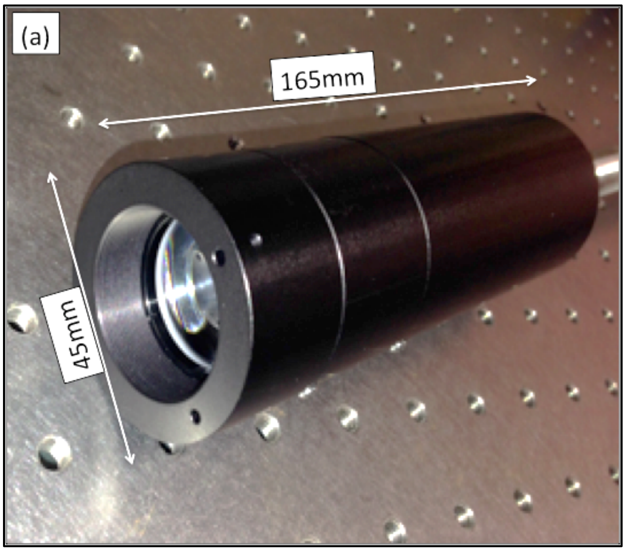
Recently, the ion stream line detachment in a diverging-weak magnetic field was observed in the HYPER-I device at the National Institute for Fusion Science [1]. In the detachment region, an E×B rotation is driven by the radial electric field, and the characteristic of plasma flow in this region is clearly different with that in the magnetized region. This indicates that studying the flow structure in a weaker magnetic field region is important.

To measure the distribution of the ion flow field accurately, we have developed a laser induced fluorescence (LIF) spectroscopy system including high-mobility light collection optics (Fig.1). Since the diameter of vacuum chamber is large, the LIF collection system should be introduced inside the chamber to ensure sufficient signal-to-noise ratio (SNR). The part of the light collection optics is 45 mm diameter, 165 mm long, made of duralumin alumited in black. A biconvex lens (f = 31.7 mm) is used, and the collected lights inject into a fused silica collection fiber (NA = 0.22). Between the lens and the fiber cable, the light baffles are also appropriated to prevent the noises from injecting into the fiber. It is expected that this can contribute to improvement of SNR.

The part of light collecting system is connected to the stainless shaft with an inner diameter of 12 mm and an outer diameter of 16 mm. The optical fiber cable is isolated from the plasma by the shaft, and the LIF signal is brought from vacuum to air. In addition, the shaft is movable in its axial direction, and thus, the spatial distribution of ion flow field can be measured.

The obtained LIF signal is analyzed utilizing a lock-in detection method. We are optimizing the LIF measurement system by changing the setting of lock-in detection using an RF discharge argon plasma (test plasma).

We will present the results using a newly developed LIF collection system in the poster session.



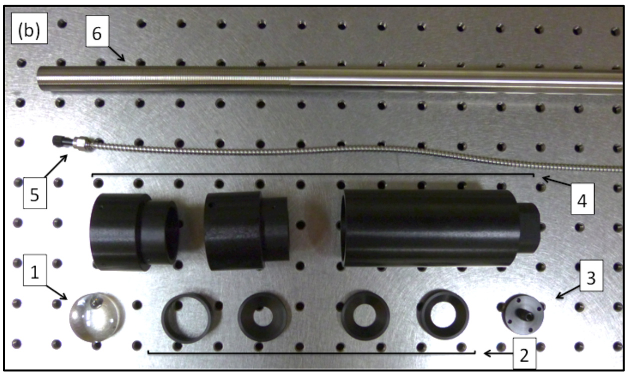


Fig.1. (a) A picture of new LIF measurement tool: (b) 1- a biconvex lens, 2- light baffles, 3- a SMA fiber connector, 4- light collection optics, 5- a fused silica collection fiber, 6- a stainless shaft.

Reference.
[1] K. Terasaka et. al, Phys. Plasmas; 17(7): 072106