§2. Present Status of Gas-Puff System on LHD

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After the initial set-up of gas-puff system for the first experimental campaign,[1] gas-puff system has been gradually improved. Other than the initial gas injection manifold at 3.5L port, two piezo-valves (100 and 5 Pa·m^3/s for hydrogen) was installed on 9.5L port before the second cycle and one piezo valve of 100 Pa·m^3/s for hydrogen was installed on 5.5L port before the third cycle (Fig. 1). Especially, the fuel gas injected from 5.5L gas-puff port is fed through three stainless tubes of about 4 m long and 7 mm of inner diameter, and puffed to LHD plasma at the so-called non-private region. Therefore, we often use a terminology of "local-puff-port" to call this 5.5L port (see picture in Fig. 1). Taking into account the conductance of these slender pipes, 5.5L port has 20 Pa·m^3/s of flow rate for hydrogen. Reservoir tanks (0.04 m^3 of volume) that store the purified fuel gases of hydrogen and helium for 3.5L gas-puff system supply the gases with these new gas-puff ports. Since the third cycle, a gas cylinder stand has been set near the 0.04 m^3 reservoir tanks to store the impurity gas cylinder such as neon. The impurity gas cylinder can be connected to any of the three gas injection ports.

After the third cycle, we found the most reliable method to calibrate the flow-rate of piezo valves. In the method, the pressure of 0.002 m^3 reservoir tank connected to the piezo-valve is measured before and after gas injection while the gas supply into the reservoir tank is stopped. Decreased pressure times the volume of reservoir tank divided by the pulse length of gas injection gives the flow rate of the piezo-valve at the control voltage used. The volume of 0.002 m^3 reservoir tanks are measured by the pressure decrease after gas injection from the calibrated mass-flow controller, which is prepared for glow discharge cleaning (see ref. 1).

Feedback control by electron density measured by microwave or far infrared ray has been successfully carried out since the third cycle, and manual feedback control was effectively used for long pulse discharges. Although the pulse length of the density feedback control was restricted to 17 seconds during the third cycle, it will be extended to 10,000 seconds in the next fourth cycle.

Reference

1) Miyazawa, J., Yasui, K., Kato, S., and Yamada, H., Ann. Rep. NIFS (1997-1998) 30.

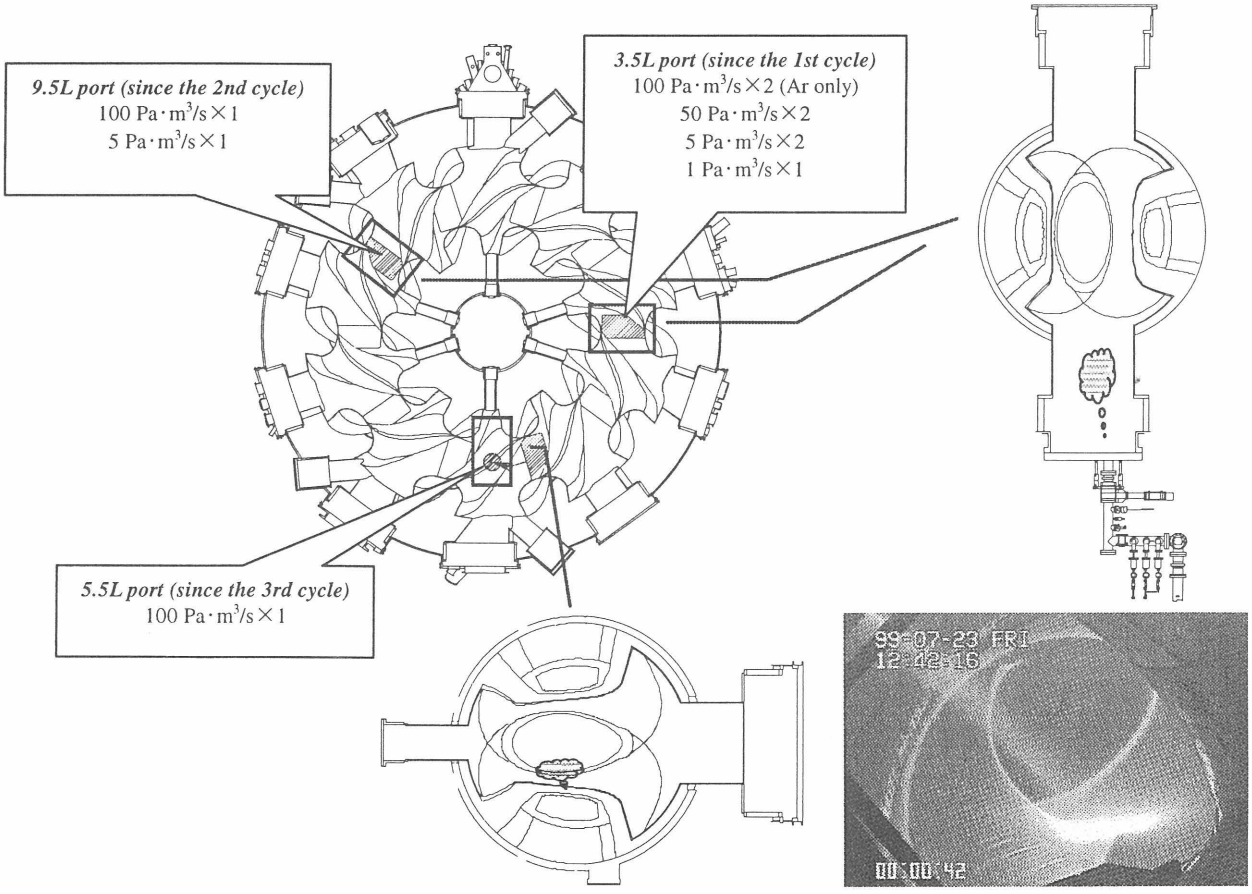

Fig. 1. The schematic of gas-puff configuration on LHD and the picture of LHD plasma with local puff.