§ 16. Development of Supersonic Molecular Beam Source for Fueling

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The prototype of the supersonic beam source has been installed in LHD and operating as a "direct gas puff" (DGP) system. Figure 1 shows the insertion system of the DGP. One of the upper ports of LHD is used. The vertical position of the valve is adjustable so as to inject the pulsed gas plume from both private and non-private regions. The present system is based on the inertial cooling and is unable to be used a series of plasma shots at the inserted condition. The water-cooling system will be added next year.

The inner structure of the Piezo-electric valve used in the DGP is shown in Fig. 2. When the Piezo-electric element is charged, the element pushes one end of a lever, which results in opening the valve at the other end of the lever. The rough sketch of the orifice of the valve is shown in Fig. 3. The diameter and the length of the orifice are about 2 mm and 14 mm, respectively. The maximum gas flow rate of the valve is 100Pa·m^3 and is determined by the small gap between the valve and the orifice. This means that the gas expands mainly at the seal and hits the inner wall of the orifice and then is transferred in the orifice and exits to the open space with the speed corresponding to the wall temperature, not with supersonic speed. Though with sound speed, the DGP still has superior characteristics; the valve is faced to the plasma and the gas plume reaches the plasma directly without the interaction to the inner wall of the vacuum vessel. In addition, the movable system of the valve enhances the flexibility of the experiments on plasma fueling.

Revised version of the valve is now under investigation.

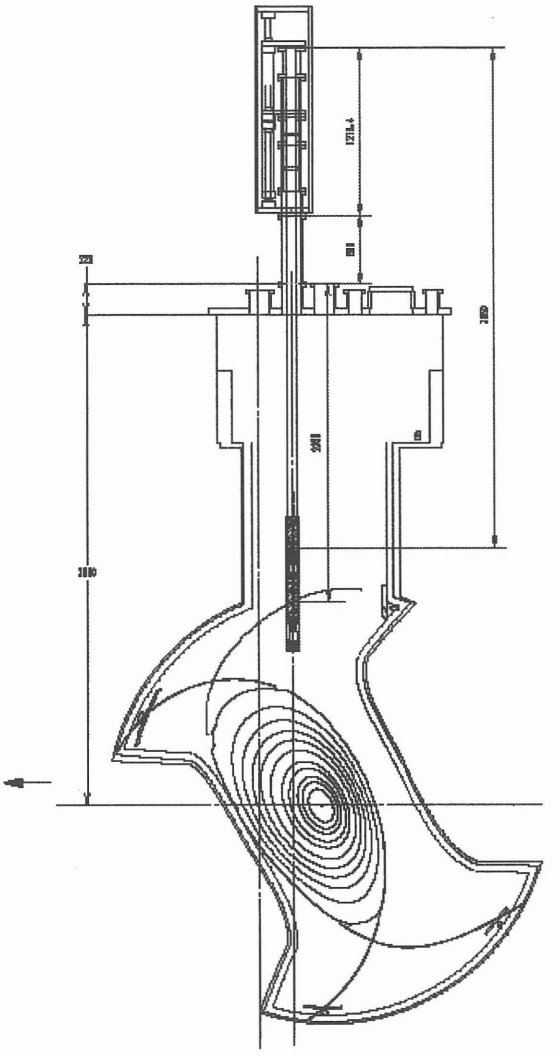

Fig. 1 Insertion system of the valve.

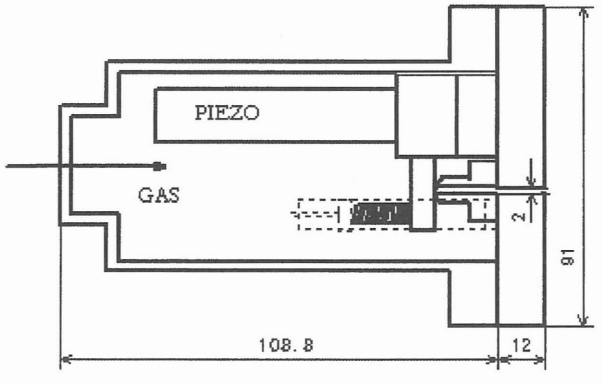

Fig. 2 Structure of the Piezo valve.

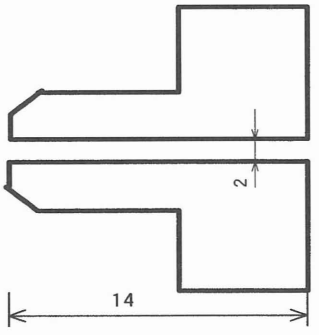

Fig. 3 Structure of the orifice