§1. A Five-Barrel Pneumatic Pellet Injector for LHD

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A single barrel pneumatic pipe-gun type pellet injector has been installed for LHD in the second experimental campaign of LHD (1998) [1]. For the third experimental campaign (1999), four barrels were added to the injector, so that five sequent injections were enabled. More than 1500 pellets were successfully injected to LHD plasmas during third experimental campaign.

Fig. 1 shows the schematic drawing (top view) of the pellet injector and vacuum vessel of LHD. The pellet injector is installed on the B-stage and connected to the 3-O port of LHD. The injector equips one 2.4 mm inner diameter barrel and four 3.0 mm inner diameter barrels. 3.0 mmϕ pellets include $0.8 - 1.0\times10^{21}$ atoms per pellet, and 2.4 mmϕ pellet is half the mass of 3 mmϕ pellet. Velocity of the pellets is the range of 850 – 1200 m/s. Pellet mass was measured by a microwave cavity mass detector, and pellet velocity was measured by time of flight method. The injected pellet was checked by shadow graph, which consists of fast flash lamp (pulse width; 70 ns) and CCD camera, at an exit of the injector. Timings of the injection are controlled independently with time resolution of 1 ms.

In regard to effect on the performance deterioration of the pellet injector by addition of four barrels, two major problems were given in advance. One of the problems is refrigeration capacity. Heat load increase with the barrel addition causes the 1 K temperature rise (9.5 K to 10.5 K) of cryogenic parts in comparison with the single barrel case. Consequently, operational region of pellet formation become narrow. However, this matter was not major problem. 5 pellets can be formed and injected every 3 minute. The other problem is hydrogen gas supply system for pellet formation. Hydrogen gas flow control is performed collectively by a pair of mass flow meter and pressure switch. This method cannot optimize simultaneously the forming condition of all barrels. Consequently, about 10 % dispersion in pellet mass is observed.

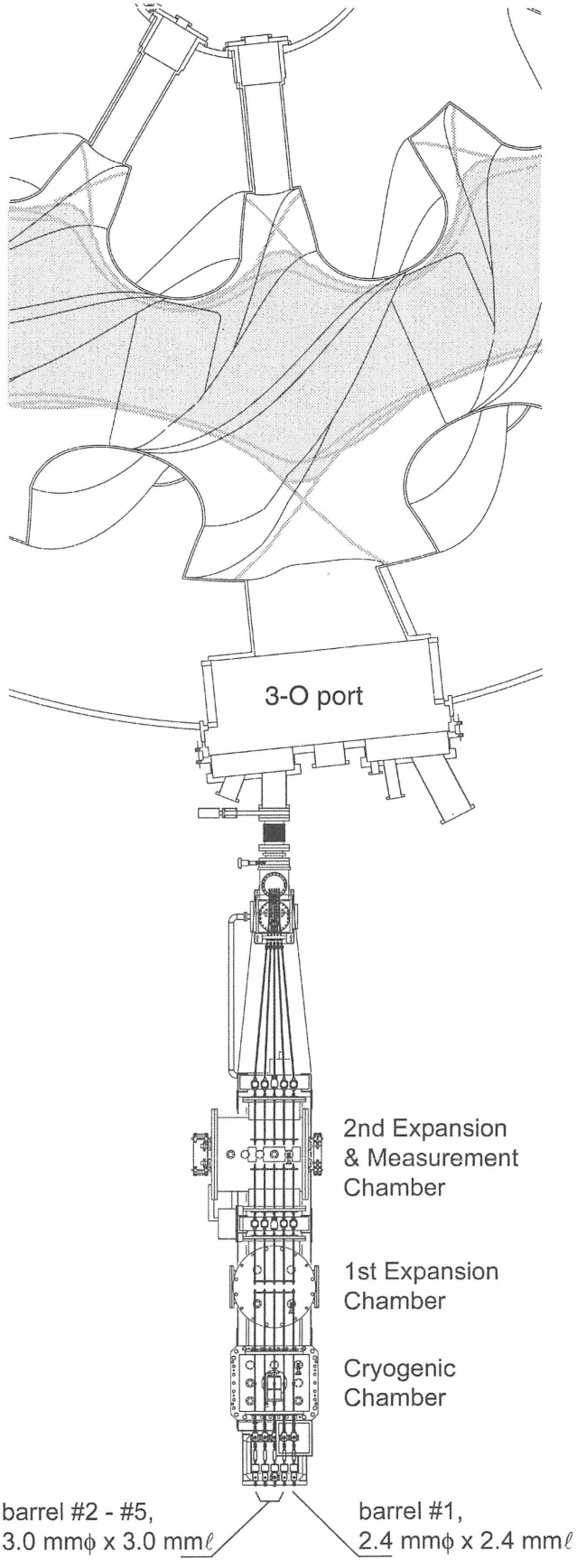

Fig. 1 schematic drawing of the pellet injector. (Top view)

[1] Sakamoto, R. *et al.*, Annual Report of NIFS, April 1998- March 1999, 76(1999).