SYNCHROTRON RADIATION OUTLET OF UVSOR

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In UVSOR storage ring, two outlets of synchrotron radiation, which accept 80 mrad of arc, are attached to each bending section. The outlet can prevent breakdowns of vacuum in the storage ring caused by accidental leakage of air at beam lines and chambers for measurements. It is composed of a water-cooled shutter, a slow closing valve, a fast closing valve with finite conductance and a acoustic delay line, which decreases speeds of shock front of leaked air. In some cases, it includes premirrors. In this report, model study of the acoustic delay line, ADL, is presented.

A shock wave in a smooth pipe resulting from a sudden breakdown of vacuum propagates approximately with a speed of sound. In many cases in UVSOR, the distance between the fast closing valve and an entrance slit of a monochromator is less than 2 m. Accordingly the propagation time is less than 6 ms without ADL. On the other hand, the closing time of available fast closing valve at present is about 10 ms. Therefore, to protect the storage ring vacuum from accidental leakage, ADL is installed to delay the propagation time sufficiently larger than 10 ms before the fast closing valve shuts. ADL is a pipe with several diaphragms in it as already reported [1~6].

Measuring system of the propagation time in ADL is shown in Fig. 1. A 1 m and a 2 m ADL's with 300 mm inner diameter were studied. They contain coned diaphragms with rectangular orifices(80 mm x 27 mm). The pressure in a reservoir was set at 1 Torr, 10 Torr, 100 Torr, and 1 atm. Air in the reservoir was suddenly introduced in ADL through a magnetic valve, and pressures at the entrance and the exit of ADL were measured by two Schulz gauges G1 and G2 with fast response(less than 5 ms) [5], and an oscilloscope.

Measured propagation times are shown in Fig. 2. The ordinate represents the propagation time defined as the difference between the times when G1 and G2 indicated 1 x 10^{-3} Torr. The abscissa represents the pressure in the reservoir. Propagation times at 1 Torr and 1 atm are 350 ms and 50 ms in the 2 m ADL with 8 diaphragms, while 150 ms and 17 ms in the 1 m ADL with 8 diaphragms. Propagation times at 1 Torr and 1 atm in the 1 m ADL with 15 diaphragms are 240 ms and 25 ms. Even with a 1 m ADL, it is sufficient to delay propagation time larger than the closing time of 10 ms. Another ADL with a smaller diameter will be studied in near future. After this study we will design a final ADL.

References

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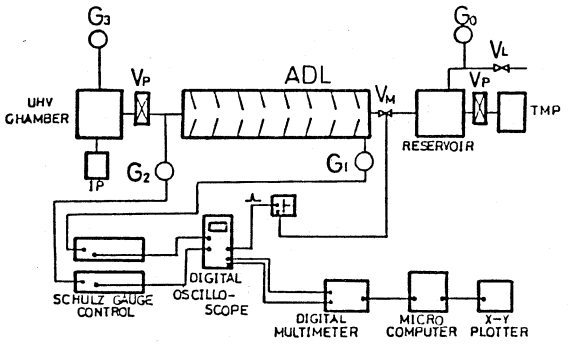

Fig. 1 Measuring system of the propagation time in acoustic delay line (ADL).
G_0: pirani gauge, G_1,G_2: Schulz gauges,
G_3: ionization gauge, V_L: leak valve,
V_M: magnetic valve, V_P: pneumatic valve,
IP: ion pump, and TMP: turbo molecular pump.

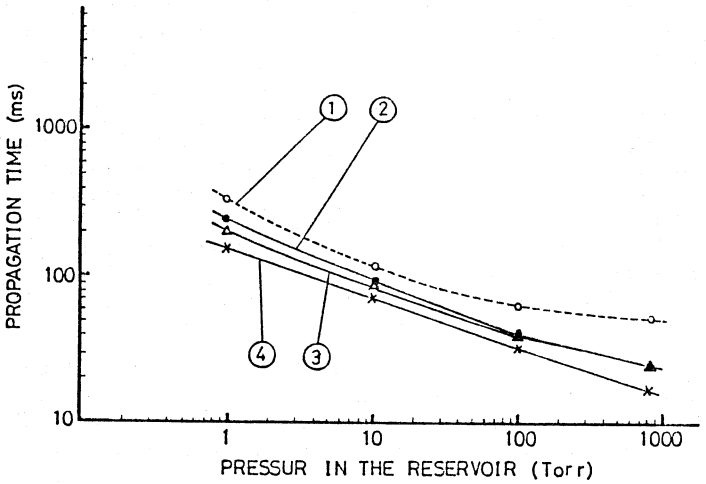

Fig. 2 Dependence of propagation times on pressures in the reservoir.
1: 2 m ADL with 8 diaphragms, 2: 1 m ADL with 15 diaphragms, 3: 1 m ADL with 10 diaphragms,
4: 1 m ADL with 8 diaphragms.