§12. Progress in Construction of 6 MeV Heavy Ion Beam Probe for LHD

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The construction of an accelerator and the beam transport system for 6 MeV heavy ion beam probe (HIBP) for LHD is continuously performed.
The operation of the tandem accelerator was improved to stable operation. We performed experiments on the extracting beam to obtain fundamental conditions of accelerated beams and X-ray emission from the accelerator tank before the accelerator is removed for the LHD experiment building. We used a Cu minus ion source in the experiments. As shown in Fig. 1, the ratio of the beam current of charge states is depended on the Ar charge stripping gas pressure. The charge separating is performed by an electrostatic cylindrical deflector at the out put of the accelerator. The primary beam becomes maximum when the gas pressure is 1x10E-4 Pa.

In this condition, X-ray emissivity from the tank is small, and the required off limit area at the LHD room is setting on 1.5m line from the tank surface. Additionally, the sealing to X-ray at the limit line for human is not required in the range of a law on the X-ray.

The transmission test of a mounted 4.8m deflector and transport system at the beam line in LHD room was performed by using a hand made 100kV accelerator. The experimental results was shown that beam transport by the 4.8m cylindrical deflector is enough for the LHD experiments in the future.

The tandem energy analyzer was designed in detail for the error in the potential measurement due to small incidence angle. The error can be compensated by adjusting the tandem applied voltages and a detector position.

In the fiscal year 2000, we will dogging entrance beam line and secondary beam detection system to ports of LHD, and construct remaining part of the total system such as an analyzer and a primary beam monitor. At first, in plasma phase, we must observe that the strong radiation from the plasma to a octupole sweeper for sweeping the sample volume in the LHD creates the secondary electron on the surface of the sweeper electrode and the sweeper voltage drops down if the power is not supplied enough. Next, we will calibrate trajectory of the primary and secondary beam with gas scattering by using the 100kV accelerator, because the permit to the operating 6MeV accelerator from the administrator can not be got soon.

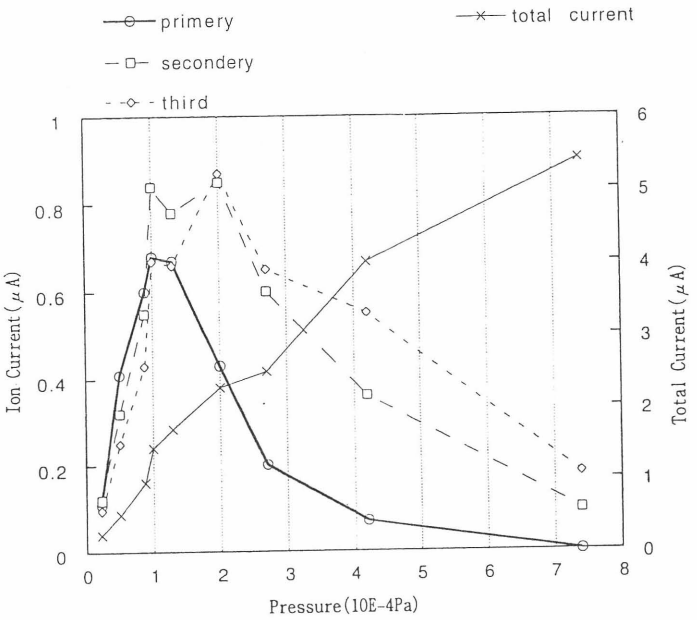

Fig. 1 Charcterristics of total current and each current of charge states to the stripping gas pressure.

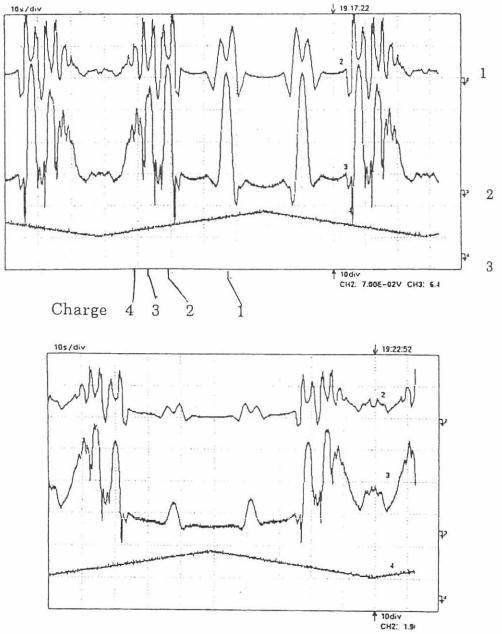

Fig. 2 Charge separated current measurements depended on the stripping gas pressure
accelerator voltage: 3MV, injection minus ion current: 2.3 μA, distance from the exit of the charge separator: 6m, detector: 15 φ Faraday cup, upper trace: Faraday sealing signal (0.5V/div), middle trace: target signal (0.2V/div), bottom trace: 7.8° charge separator swept voltage (5V/div; 45kV ± 20kV) . Upper and lower data are 1.0x10E-4Pa and 2.7x10E-4Pa in Ar gas pressure, respectively.