§83. Magnetic Measurement and Plasma Control of Long Discharge in QUEST

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Accuracy magnetic measurement with paying attention to the noise and drift at the integrator is an important issue in the shape and position control of a long plasma discharge toward steady state operation. Therefore, the magnetic sensor with low noise has being developed from original one (original AT probe) utilized in QUEST and LHD. Coupling area, which is product of cross-section and the turn number, of the newly developed magnetic sensor (new AT probe) can be increased ten times larger than original one without decrease the frequency response due to lager size. The newly developed connector for MIC (mineral insulated cable) enables the direct connection between the sensor and MIC. Therefore, the box including the sensor and the connector inside is the roughly same size of that of original. The coupling area of the newly developed magnetic sensor is much larger than that of original, therefore it is expected that the noise during low plasma current, low plasma current lamp up and steady state operation decrease. Moreover, the sensor is insusceptible to noise because the newly developed connector for MIC enables connection between sheathes of the sensor and MIC by the sheath of the connector and signal cables to be connected in the sheath of the connector. Therefore, the sensor has advantage in the measurement in the plasma with much noise such as the plasma heated with radio-frequency.

The multi-pin connector or BNC type connector is adopted as the feedthrough (Fig.1). The sensor and connector are covered by single or double sheath. By comparing the tolerance for noise between these different conditions, we can systematically provide the guideline of protection against noise.

We installed two newly developed magnetic sensors to QUEST. One with multi-pin type feedthrough and the other with BNC type feedthrough are installed at the upper and lower vacuum tube, respectively (Fig.2). We assess the soundness of the magnetic sensor and connector. We have also installed the two conventional type of magnetic probe with single or double sheath used in the JT-60U (TC probe).

Addition to the existing data acquisition system for QUEST, we have installed the new high frequency data acquisition system of YOKOGAWA DL750 and developed the program for incorporation of this new system into the experimental sequence of QUEST.

Figure 3 shows poloidal magnetic field measured by new AT probe with the connector, BNC type feedthrough and single sheath and by original TC probe with double sheath. The data of new AT probe, which was installed one year before, is consistent with that of original TC probe.

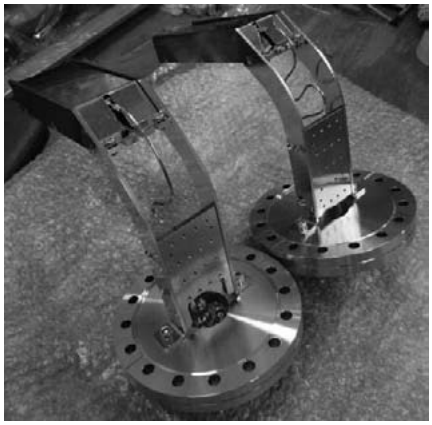

Fig. 1. Newly developed magnetic sensors, BNC type (left front) and multi-pin type (right back)

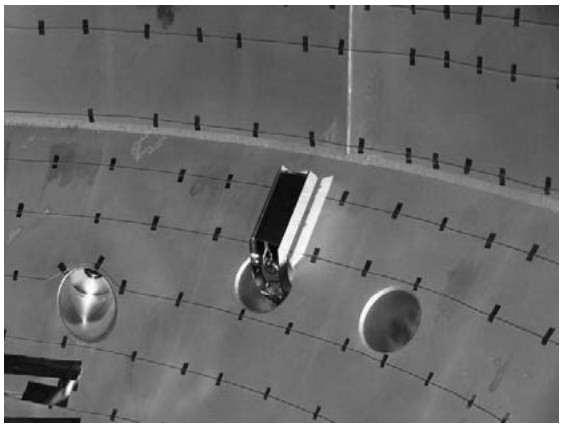

Fig. 2. Newly developed magnetic sensor in the vacuum vessel of QUEST.

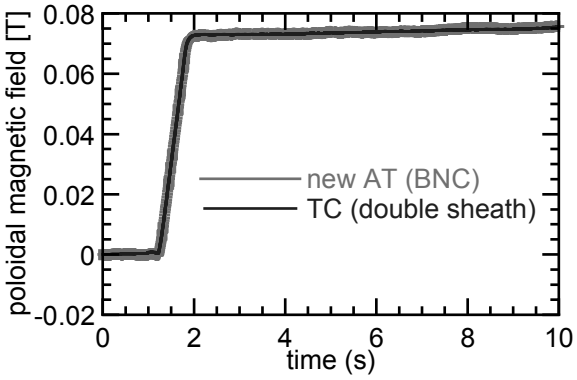

Fig. 3. Poloidal magnetic field measured by new AT probe with the connector, BNC type feedthrough (thick line) and single sheath and by original TC probe with double sheath (thin line).