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

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Magnetic sensors with heat and radiation resistance are necessary for future DEMO and reactor. Therefore, the magnetic sensor is improved in JAEA based on one with tungsten metalized ceramic plate co-developed by Dr. Takahashi, NIFS and Kyocera. Large coupling area decreases the problem of noise and drift of integration in a long discharge, therefore, the coupling areas of the new AT probe are increased about ten times larger than those of original one by decreasing the channel from six to three and increasing the size. A severe test of the magnetic sensor can be done with the long and relatively low plasma current discharge in QUEST. Therefore, we installed new AT probe in QUEST. The soundness of the new AT probe is confirmed after more than three years installation in QUEST. Original AT probes and the probes made of winded MI cable had been already installed and comparison between them is possible. We also installed the same type of the magnetic sensor installed in JT-60U (TC probe) for comparison. The coupling area of the new AT probe is same as that of the TC probe (0.3 m^{-2}). The location of the magnetic sensors with poloidal cross-section of the vacuum vessel of QUEST is shown in Fig.1. New two AT probes and two TC probes are installed at the same poloidal position of the other same types of probes. MP#3, #4, #5 and #6 are original AT probes and PR#1, #2, #3 and #4 are the probes made of winded MI cable. One AT probe has twist pair cable and multi-pin type connector for feed-through, the other has coaxial cable and BNC type connector. One TC probe has double sheath structure and double sheath MIC, the other has single sheath ones.

The noise characteristics of the magnetic sensor signals are investigated. The noises of new AT probes and TC probes are much smaller than those of signals from original AT probes. Figure 2 shows the power spectral density of the magnetic sensor signals in 8.2 GHz RF heated plasmas. The plasma current is 30kA. Compared between Fig.2 (a) and (b), the amplitude and frequency characteristics of the noise are similar between TC probe with double sheath and TC probe with single sheath. Compared between Fig.2 (c) and (d), they are also similar between new AT probe with multi-pin feed through and new AT probe with BNC feed-through. However the signals of AT probes have 60 Hz noise and its higher harmonics. The noise is not observed in the signals of TC probes. We will look for the souse of the noise and try to suppress the noise.

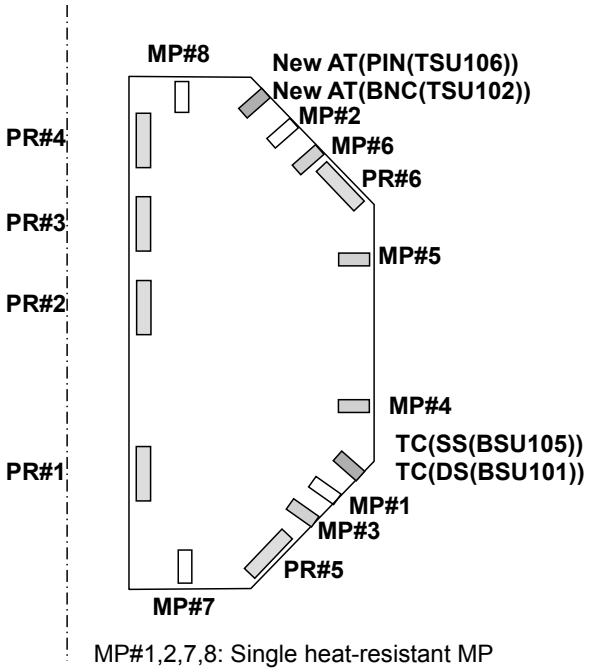

Fig. 1. The location of the magnetic sensors with poloidal cross-section of the vacuum vessel of QUEST. New AT probes and TC probes are installed at the same poloidal position of the other same types of probes. MP#3, #4, #5 and #6 are original AT probes.

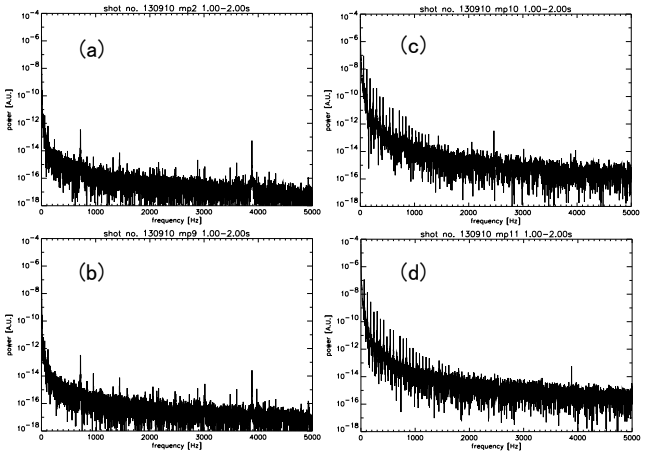

Fig. 2. Power spectral density of the magnetic sensor signals in 8.2 GHz RF heated plasmas. (a) TC probe with double sheath, (b) TC probe with single sheath, (c) New AT probe with multi-pin feed through (d) New AT probr with BNC feed-through.