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A new electromagnetic probe array diagnostic system for analyzing electrostatic and magnetic fluctuations on EAST

H. Lan[1], T. H. Shi[2], N. Yan[2], X.Q. Li[2], S. Li[2], R. Chen[2], M.Y. Duan[2], G. H. Hu[2], L. N. Liu[2], M. Chen[2], L. X. Chen[2], Z. K. Lu[2], Y. Y. Zheng[2], Z. Yuan[2], Y. Wang[2], Z.H. Xu[2], L. Q. Xu[2], P. F. Zi[2], L. Chen[2], S. C. Liu[2], D. G. Wu[2], G. F. Ding[2], L. Y. Meng[2], Z. C. Wang[2], Q. Zang[2], L. Wang[2], G.S. Xu[2]
[1] Institute of Fusion Science, School of Physical Science and Technology, Southwest Jiaotong University, [2] Institute of Plasma Physics, Chinese Academy of Sciences
e-mail (speaker): henglan@swjtu.edu.cn

A new electromagnetic probe array (EMPA) diagnostic system has been developed on EAST [1,2]. This diagnostic system consists of two subsystems: i.e., a low-field side electromagnetic probe array (LFS-EMPA) [1] and high-field side magnetic probe array (HFS-MPA)[2]. Each magnetic probe of the EMPA diagnostic can measure three dimensional magnetic fluctuations, which provides additional toroidal magnetic fluctuation measurement ability comparing with regular magnetic probe on EAST. The LFS-EMPA diagnostic system consists of 24 magnetic probes and 20 electrostatic probes, which can resolve fluctuations with frequency lower than 700 kHz, nearly one times higher than the fluctuation frequency resolution of EAST conventional high-frequency magnetic probe; its toroidal mode number measuring range of $-112 \leq n \leq 112$ is greatly improved comparing with the conventional magnetic probe with toroidal mode number resolution of $-8 \leq n \leq 8$; the electrostatic probe array is fixed near the first wall and about 12 cm behind the limiter, which provides a new tool for studying the phenomenon of large eruption of particles and heat from plasma in a transient time. The HFS-MPA diagnostic system consists of 12 three-dimensional magnetic probes, which have the identical structure to the LFS-EMPA magnetic probe. The HFS-MPA can resolve magnetic fluctuations with frequency lower than 700 kHz, which is also higher than the HFS conventional magnetic probe; the carefully designed arrangements of the HFS-MPA can contribute to the mode structure studies on HFS. The engineering details of the EMPA diagnostic, including the mechanical system, the electrical system, the acquisition and control system, and the effective area calibration and frequency response analysis, are presented. The preliminary applications of the EMPA in EAST L-mode and H-mode discharges have demonstrated that the EMPA works well for providing information on the magnetic and electrostatic fluctuations and can contribute to deeper physical analysis in future EAST experiments.

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References

[1] H. Lan, et al., 2023 Plasma Sci. Technol. **25** 075105
[2] H. Lan, et al., New high-field side magnetic probe array system for three-dimensional magnetic fluctuation measurements on EAST (2023, to be submitted)

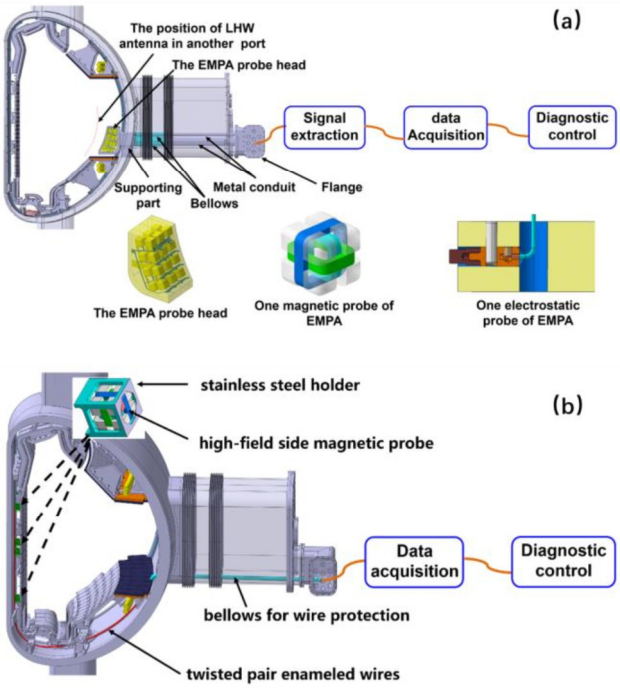

Figure 1. Schematic of the EMPA diagnostic system: (a) low-field side electromagnetic probe array (LFS-EMPA) and (b) high-field side magnetic probe array(HFS-MPA).