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T-CHI current start up by a simple configuration electrode in QUEST

Transient Coaxial Helicity Injection (T-CHI) current start-up by using a simple configuration electrode installed in QUEST has been tested on a collaborative research project between University of Washington, Princeton Plasma Physics Laboratory (PPPL) and Kyushu University [1]. T-CHI has been developed as a solenoid-free plasma start-up method in HIT-II and NSTX [2,3]. The conventional T-CHI electrode in the both devices consists of inner and outer of the vessel walls which are insulated by ceramic breaks inserted in upper and lower parts of the vessel wall. The QUEST electrode is designed to be easier to introduce T-CHI to a fusion reactor, in which a bias electrode located on the lower divertor is insulated by a sandwiched ceramic break. We have examined the T-CHI discharge in two cases in which the injector region is different. When the injector flux is formed between the bias electrode and outer vessel wall, the injector current flowing from electrode is very high but the toroidal current is comparable to the injector current. The flux evolves but its footprint becomes wide. When the injector flux is formed between the bias electrode and inner vessel wall, the injector current is substantially reduced, and the plasma evolves with a narrow footprint configuration to fill the entire height of the vessel (figure 1). In addition, the plasma current pulse duration increases by several times that in the other configuration and the outer leg of the current channel is much clearly defined. The latter result has many similarities to the discharges generated by the conventional electrode on HIT-II and NSTX.

References [1] Kuroda K et al 2018 Plasma Phys. Contr. Fusion 60 115001. [2] Raman R et al 2004 Phys. Plasmas 11 2565. [3] Raman R et al 2011 Phys. Plasmas 18 092504

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