Construction and Preliminary Results of Huazhong Field Reversed Configuration Device

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Field reversed configuration (FRC), first been discovered in theta pinch plasma researches in 1960s, has now gained more and more attention for its several advantages [1-3]. In the past two or three decades, many people begin to explore new methods to obtain nuclear fusion energy in a simpler and cheaper way. Because FRC has a very high beta (ratio of plasma thermal pressure and magnetic pressure), and relatively good plasma confinement performance, it is usually considered as a steady plasma carrier or a target for compression. FRC is taken as basic magnetic configuration and driven by neutral beams, and has set new record of plasma lifetime and reached 30ms in C-2 series devices [4-5]. FRC is also adopted as initial target for solid liner compression (known as magnetized target fusion (MTF) [6] or magneto-inertia fusion [7]), magnetic compression [8], and plasma jet compression (known as plasma jet magnetic inertia fusion (PJMIF) [9]). FRC is now even being considered as initial target plasma in Z pinch [10].

A large field reversed configuration (FRC) research device named as HFRC has been constructed in Huazhong University of Science and Technology (HUST) in Wuhan. In HFRC, on optimization of FRC formation methods and magnetic compression will be mainly focused. Multi-coil field reversed theta pinch is usually adopted to form and accelerate the FRC [5]. In this method, proper and accurate sequential coordination is a crucial issue for a high performance FRC. On HFRC, an axial multi-channel optical fiber interferometer has been equipped in the formation region to measure the electron density evolution during the fast FRC formation process. Besides, a photodiode array for detecting 200nm ~ 400nm ultra-violet emission from core region is also used to optimize the time coordination of the pulsed power supply. Preliminary results of the density evolution during

the dynamic formation and its impacts on formed FRC will be given in the conference.

Compression is thought very useful to improve plasma temperature and density substantially. Among typical plasma compression methods, magnetic compression has several advantages. The compression magnetic field is generated by external coils and current, which can easily be controlled accurately, and make magnetic compression more repeatable and controllable. The limited strength and rising rate of the compression field and interchange instabilities are main challenges. On HFRC, new method of controlling instabilities will be investigated.

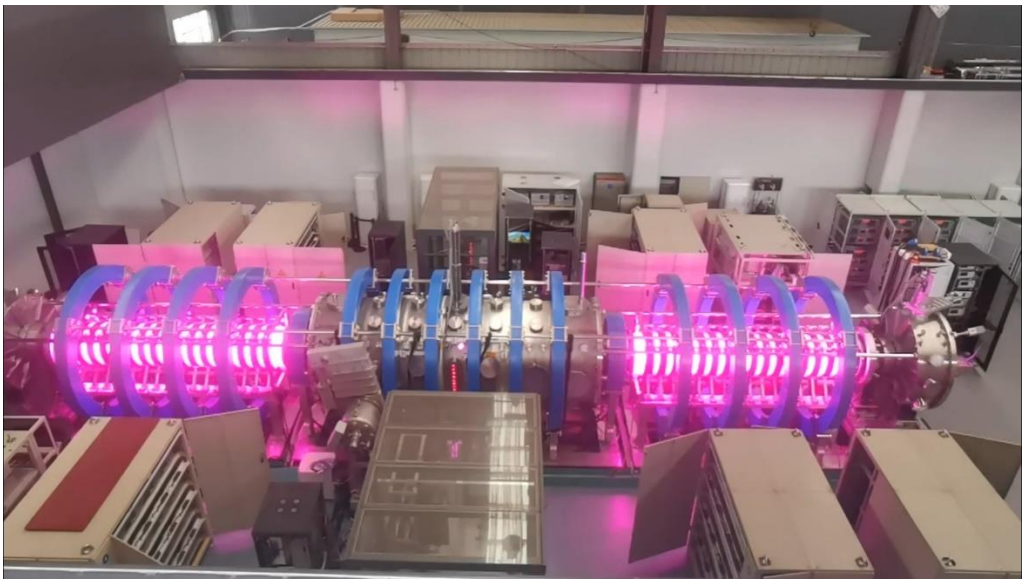

Figure 1 Photo of a HFRC discharge

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