Collisional merging process of field-reversed configuration plasmas in the FAT-CM device

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A field-reversed configuration (FRC) is a concept of magnetically confined plasma for a nuclear fusion reactor that realizes a highly efficient reactor core with an averaged beta value of near unity [1]. Since additional heating and current drive methods have not been established on an FRC, most FRCs have been operated in a pulsed fashion. Recently, the C-2/C-2U device at Tri Alpha Energy has successfully demonstrated quasi-static sustainment of merged two FRCs by fast ions, which are introduced via ~10 MW neutral beam injection [2]. However, the collisional merging process itself, at relative translation velocity of up to 600 km/s, and its effect on FRC performance have not yet been investigated in detail.

We have upgraded the FAT (FRC Amplification via Translation) device to have two FRTP (field-reversed theta-pinch) formation regions, like the C-2/C-2U device, to investigate the merging and relaxation processes of FRCs. The dependency of FRC performance on translation velocity has been investigated experimentally. In the FAT-CM project, a set of internal coils has been installed to excite low frequency (< 100 kHz) waves for additional heating of FRCs. The processes of FRC formation, translation and merging including the effect of internal coils to the translated FRC have all been computed by the 2D MHD Lamy Ridge code [3]. The simulation results are compared with the experimental results, especially to verify the rethermalization mechanism through the collisional merging process of FRCs.

* This work was partially supported by JSPS KAKENHI Grant Number 16K06939.

[1] M. Tuszewski, Nucl. Fusion **28** (11), (1988) 2033.

[2] H. Gota *et al.*, Nucl. Fusion **57**, (2017) 116021.

[3] Y. Mok *et al.*, http://meeting.s.aps.org/link/BAPS.2010.DPP.GP9.97, (2010).