MHD and Hybrid Simulation Study of FRC Plasmas

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Field-reversed configuration (FRC) plasmas are extremely high-beta torus plasmas and those exhibit strong MHD activities. Experimental results of FRC plasmas sometimes are inconsistent with an MHD prediction for such as tilt mode stability; it implies that particle effects dominate FRC stability properties. Therefore, MHD and non-MHD natures can probably coexist in high-beta self-organized plasmas. Here, we will present simulation results for FRC plasmas of 1) translation and subsequent collision process, 2) poloidal flux amplification by neutral beam injection, and 3) spontaneous toroidal spin-up.

In the present abstract, we will show the MHD simulation result for collision process of two FRC plasmas. The obtained axial forces in the reconnection region are presented in Fig. 1, where the 2D profile is plotted on the top and the 1D axial profile on the field-null surface is shown on the bottom. We found from the bottom figure that an attracting force is acting on the plasma core and a repulsive force however is acting on the colliding front surface. Therefore, this repulsive force inhibits a merging process. Resultantly, we never observed the complete merging that unifies the two field-null points. We are now developing a 3D hybrid simulation code and plan to complete until next fiscal year to compare the results from different calculation models.

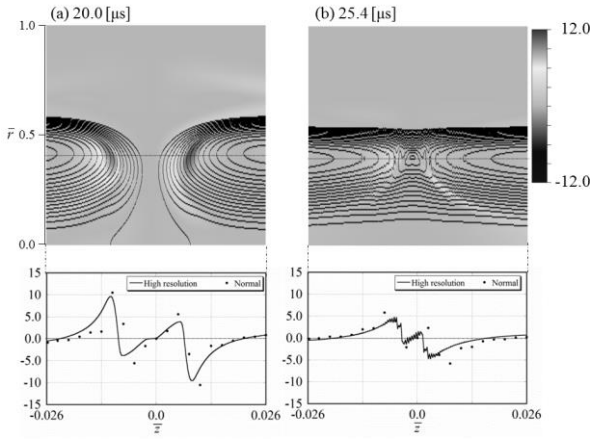

Fig. 1. (Top) 2D axial force profile in refined mesh region, (bottom) 1D axial force profile on a surface having the field-null points.