# Full penetration of odd-parity rotating magnetic field antenna driven Field-Reversed Configuration

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As a potential magnetic fusion system candidate, the rotating magnetic field (RMF), which operates under the frequency conditions $\omega_{ci} << \omega << \omega_{ce}$ (where $\omega_{ci}$ and $\omega_{ce}$ are the ion and electron cyclotron frequency corresponding to the RMF intensity, $\omega$ is the RMF frequency), has been employed to generate and sustain a field reversed configuration (FRC) with high-β value compact toroid [1-3]. Further, by employing an odd-parity RMF (RMFo) antenna [4], based on the Princeton Field-Reversed Configuration (PFRC-2) experiment [5], S.A. Cohen et al found that compared to the even-parity RMF (RMFe) antenna [6], the ions and electrons can be significantly heated due to its closed magnetic field topology [7-9]. By employing X-Ray spectra method, C. Swanson et al found that [10, 11] the electron temperature can be heated up to several hundreds of electron volts in in the PFRC-2 hydrogen plasma.

In this paper, by employing the two-fluid model, based on a RMFo driven FRC model, under given parameters: plasma column radius $r_p = 5$ cm, axial static magnetic field $B_a = 300$ G, perpendicular RMF magnetic field $B_0 = 12$ G, RMF frequency $f_{RMF} = 4$ MHz, radially uniform plasma density $n_0 = 10^{13}\,\mathrm{cm}^{-3}$, electron temperature $T_e = 200\,\mathrm{eV}$, ion temperature $T_i = 1\,\mathrm{eV}$, the RMF penetrate criterion, $\gamma_c > 1.12\lambda\left(1+0.12\left(\lambda-6.5\right)^{0.4}\right), \lambda > 6.5$ (where $\gamma_c$ and $\lambda$ are the RMF drive parameter and penetration parameter, respectively) [12], is satisfied, simulation results as shown in Fig.1 and 2 show that under this condition the RMF eventually fully penetrated into the core plasma region after a few RMF periods and a FRC is formed.

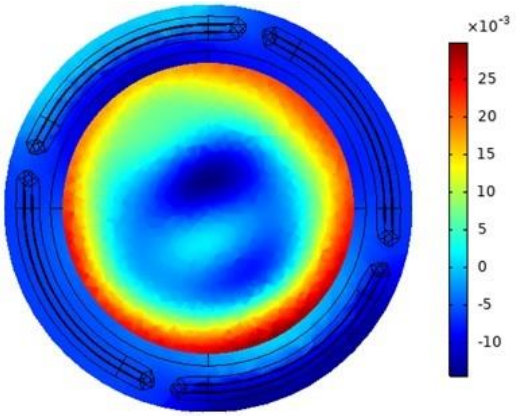


Fig.1 Axial component magnetic field at the midplane

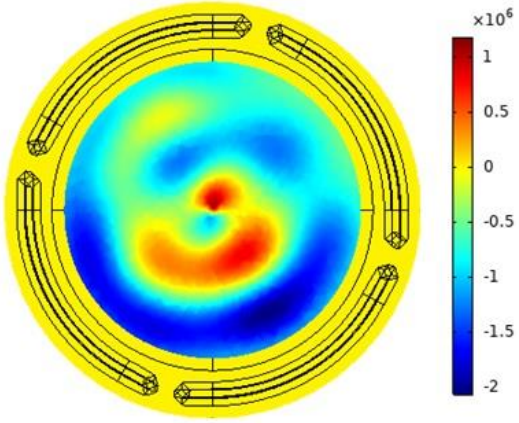


Fig.2 Toroidal plasma current at the midplane

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