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Preliminary Heating & Current Drive design on EHL-2 spherical torus

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In 2023, ENN introduced the spherical torus EHL-2, which is a next-generation large Mega-Ampere (MA) device. The main target of EHL-2 is to resolve the key physics issues of p-11B fusion, including hot-ion mode with high ion temperature and non-inductive current drive with high density. The design parameters of EHL-2 is: T_{i0} > 20keV, $T_i/T_e > 2$, $n_{e0} \sim 1.3 \times 10^{20} m^{-3}$, $I_p \sim$ 3MA, $B_t \sim$ 3T, R=1.05m. Nevertheless, heating and current drive (H&CD) system is one of the most important factors to achieve EHL-2's physics goals. To meet the requirements of the EHL-2 development roadmap, various auxiliary heating and current drive systems have been considered. The NBI heating system provides 15 MW of energy with a planned beam energy about 200 keV. The ECCD system operates at frequencies of 105/140 GHz and delivers a power of 5 MW. The ICRH system has an output power of 10 MW, while the LHCD and HHFW systems contribute 2 MW of power each. In total, these systems have a combined power of 34 MW. The preliminary design of H&CD system for EHL-2 will be presented in this report. The initial numerical simulation results for the general auxiliary heating and current drive methods (NNBI&PNBI, ECCD, LHCD, ICRH&FWCD) will also be presented.

Key words: heating and current drive; p-B; EHL-2; ST;

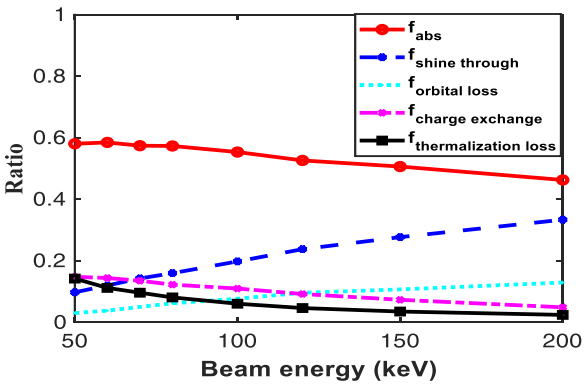

Figure1: NBI beam energy simulation.

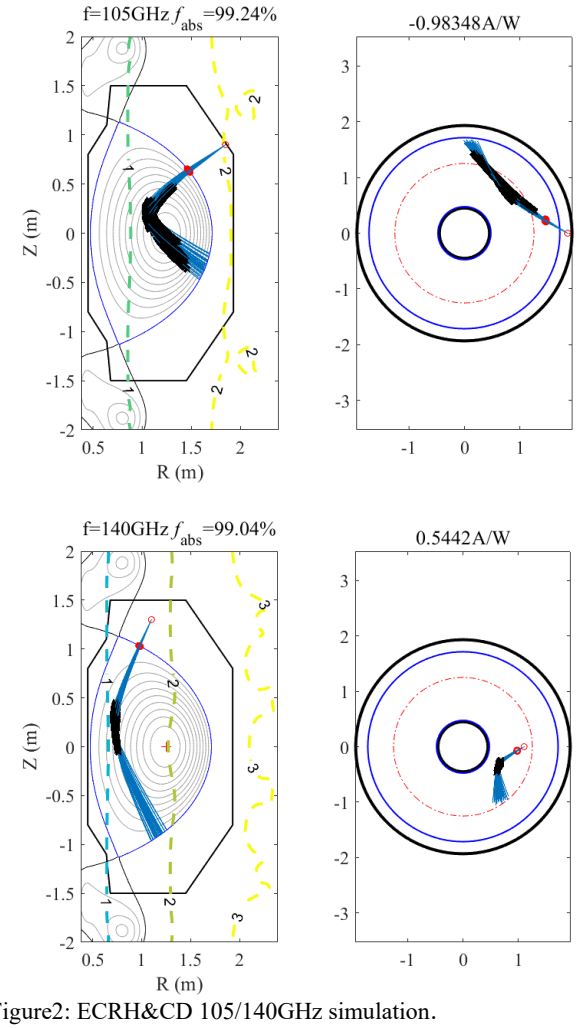

Figure2: ECRH&CD 105/140GHz simulation.