Simulation study of current drive efficiency for KSTAR 5 GHz LHCD

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Theoretical 5 GHz lower hybrid current drive (LHCD) efficiency using power spectrum given by 0-D Brambilla code [1] and Lower hybrid simulation code (LSC) [2] have been studied for KSTAR. In LSC simulation, RF-driven current and current drive efficiency has been found to be deeply dependent on the profiles of the plasma density and temperature as well as on current profile in order to obtain hollow current profile favorable for advance tokamak operation mode and steady state operation [3]. The peaked density and broad temperature profile control has been found to be efficient in current drive with maximum RF-driven current larger than 400 kA/MW with very high efficiency when the peak plasma density is ranged from 0.2 to 2.0 × 10^{20} m^{-3}, and the peak electron temperature range of 2 – 20 keV together with toroidal field 2 – 3.5 T and I_p = 0.5 – 2 MA. The on-/off-axis current profile controllability is also investigated through parametric scan, and small negative magnetic shear is seen at the narrow region of the off-axis for very high temperature regime and for high B_t and I_p. In order to achieve the same for lower temperature regime I_p has to be lower and also for higher LH-power compromising with CD efficiency in this case.

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[2] D.W. Ignat et al., Nucl. Fusion **34,** 837 (1994).
[3] T. Fujita, Nucl. Fusion **50**, 113001 (2010).