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Ripple-induced fast-ion loss in SPARC due to misaligned TF Coils[1] S. SCOTT, CFS, G. KRAMER, PPPL, E. TOLMAN, J. WRIGHT, P. RODRIGUEZ, PSFC, A. SNICKER, J. VARJE, Department of Applied Physics, Aalto U., K. SARKIMAKI, Chalmers University of technology — The expected loss of fusion alpha power due to ripple-induced transport is computed for the SPARC tokamak design by the ASCOT and SPIRAL orbit-simulation codes to assess the expected surface heating of plasma-facing components. We find good agreement between the ASCOT and SPIRAL simulation results in integrated quantities such as fraction alpha power loss and also in the spatial, temporal, and pitch-angle dependence of the losses. The SPARC edge ripple is small (0.15 - 0.30%) when the toroidal field (TF) coils are perfectly aligned, the associated computed ripple-induced alpha power loss is small (˜0.25%), and the corresponding peak surface power density is acceptable (244 kW/m^2). However, the ripple and ripple-induced losses increase strongly if the toroidal field coils are assumed to suffer increasing magnitudes of misalignment. Surface heat loads may become problematic if the TF coil misalignment approaches the centimeter level, which exceeds expected assembly tolerances. Recessing the plasma-facing surface of the RF antennas by one centimeter behind adjacent protective limiters is found to be sufficient to reduce the lost-alpha power load onto the antennas to safe levels. Ripple-induced losses of the energetic ion tail driven by ICRF heating are not expected to generate significant wall or limiter heating in the nominal SPARC plasma scenario.

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