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Investigation of parameter space for fully detached long-legged divertor operation[1] M. V. UMANSKY, LLNL, B. LABOMBARD, MIT PSFC, M.E. RENSINK, T.D. ROGNLIEN, LLNL — Recently it was found in numerical modeling that passively-stable fully detached divertor regimes exist in a broad range of input power from the core, for divertor configurations with radially or vertically extended, tightly baffled, outer divertor legs, with or without a secondary X-point in the leg volume [1]. This report presents a comparative computational study of detached divertor operation carried out for a variety of divertor configurations, expanding on the initial work reported in Ref. [1]. The parameters are based on those of the ADX tokamak design [2], and the simulations are carried out with the tokamak edge transport code UEDGE [3]. The simulations show that long-legged divertors have a large increase of the peak power handling capability, by up to an order of magnitude, compared to conventional divertors. For the detached divertor regime in these simulations, important physics combines interplay of strong convective plasma transport to the outer wall, confinement of neutral gas in the divertor volume, geometric effects including secondary X-point, and atomic radiation. As the power from the core is varied, the detachment front merely shifts up or down in the leg but remains stable. The present work addresses sensitivity of the detached divertor regime to various parameters used in the model, including the anomalous plasma transport, neutral transport, impurity radiation, and geometry of plasma-facing material surfaces. [1] Umansky et al., Phys. Plasmas 24, 056112 (2017); [2] LaBombard et al., Nucl. Fusion 55, 053020 (2015); [3] Rognlien et al., J. Nuc. Mat. 196, 347–123 (1992).

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