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Assessment of RE transport induced by the DIII-D REMC with ASCOT5

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The inboard-wall runaway electron mitigation coil (REMC) designed for DIII-D was optimized based on vacuum island overlap width (VIOW) [1] and subsequently modeled with the linear MHD code MARS-F [1] and the non-linear MHD code NIMROD [2]. Both the linear and non-linear MHD modeling tracked the confinement of an initial RE test population, with the total loss fraction for the nonlinear model exceeding that of the linear model. Because in reality REs are continuously produced during the CQ by the avalanche mechanism, the single initial test population can not capture the true dynamics of RE generation and loss as a function of space, energy and time. For the SPARC tokamak, the ASCOT5 code [3] was used to evaluate RE transport coefficients based on NIMROD 3D fields [2], and these coefficients were incorporated into DREAM [4] simulations of RE generation and evolution [2]. Here, ASCOT5 modeling is applied for the first time to DIII-D REMC simulations with NIMROD to determine transport coefficients as a function of space and energy. In the simplest model, competition between these transport coefficients and an avalanching population in free-fall can be calculated with an assumed seed to give an estimate of the growth of the RE population. Eventually, the transport results can be incorporated in a more complete RE evolution model like DREAM to predict the expected performance of the DIII-D coil.

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