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Passive 3D Coil Design to Protect Tokamaks from the Threat of Runaway Electrons[1] COLLIN DUNN, Georgia Institute of Technology, DAVID WEISBERG, General Atomics — A passive 3D helical coil was modeled and optimized to passively de-confine runaway electrons (RE) in the DIII-D tokamak. RE are created during tokamak disruptions when the rapid plasma current drop induces an electric field that accelerates plasma electrons to relativistic speeds. A beam of REs can cause significant damage to plasma facing components. In order to prevent this threat, the helical coil would create a 3D magnetic field to enhance the radial drift and deconfinement of the REs. The coil is inherently passive in that no external power is needed; the disruption itself would provide the required current to create the needed 3D field due to the changing magnetic flux causing an emf within the coil. An in-house electromagnetic code (BSharm) was developed and used to create various coil designs and calculate the 3D field induced by each design. The inductive coupling between the DIII-D tokamak and the various coil designs were calculated using the TokSys simulation suite. The coil designs were then tested for their efficacy by comparing vacuum field harmonic amplitudes, and an optimized design for the 3D coil was selected. Finally, this optimized coil was tested using MARS to model the complete plasma response to the 3D fields induced by the coil.

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