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Feasibility of using Orbit Tomography to infer the Runaway Electron Distribution Function from Bremsstrahlung Measurements

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During a disruption event a strong electric field is generated, causing supra thermal electrons to reach relativistic speeds. Due to the severe damage the runaway electrons can inflict upon ITER's plasma facing components and cooling systems, developing strategies to both prevent the formation of and to safely dissipate the runaways is critically important to ITER's success. However, development of mitigation strategies is hindered by the difficulty of measuring the runaway electron's distribution function as most runaway-electron diagnostics can only provide partial information about the runaway-electron phase-space. Fortunately, using Orbit Tomography, a technique developed in the fast-ion community, multiple measurements can be combined to infer the runaway electron distribution function to unprecedented dimensionality.

DIII-D's Gamma Ray Imager (GRI) provides multiple spatially and energy resolved bremsstrahlung measurements of the runaway electron distribution. Calculations of the GRI's orbit weight functions i.e. phase-space sensitivities shows favorable conditions for doing Orbit Tomography. In this work we will explore the feasibility of doing Orbit Tomography with GRI measurements. Orbit weight functions for the GRI calculated by the SOFT code will be presented along with reconstructions of the runaway electron distribution function from synthetic measurements.

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