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FEgen v.1: Fowler-Nordheim Equation Based Initial Particle Distribution Freeware for Advanced Beam Dynamics Simulations

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As field emission effects play critical role in the physics of breakdown, modelling these effects is a critical aspect to better understand and mitigate breakdown. Proposed here is an initial particle distribution generator called FEgen version 1 (based on the time dependent Fowler-Nordheim equation), a part of the FEmaster platform which is a comprehensive toolkit for field emission diagnostics, modeling and analysis [1,2,3]. FEgen is an open-source python code that creates initial field emission distributions both in the pulsed dc and rf power environments. For further tracking, generated files can be directly imported into beam dynamics software such as IMPACT-T [4] and GPT [5] which currently do not have any built-in field emission modeling capabilities. Compared to costly PIC codes like Michelle [6] and VSim [7], demonstrated combination FEgen and GPT is ease to use and can be customized for a variety of different scenarios which cannot be done with proprietary commercial PIC codes. FEgen allows for the modeling of not only uniform geometries but also grid and custom pattern of emission which is been shown to match recent experimental measurements [1]. Work is being done to extend FEgen toward newer version, where non-planar/asperity geometry, temperature and semiconductor effects can be taken into account to build realistic energy and momenta particle distributions.

References:

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