Numerical study of Coulomb scattering effects on electron beam from a nano-tip

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Nano-tips with high acceleration gradient around the emission surface have been proposed to generate high brightness beams. However, due to the small size of the tip, the charge density near the tip is very high even for a small number of electrons. The Coulomb scattering near the tip can significantly degrade the beam quality and cause extra emittance growth and energy spread. In the paper, we present a numerical study of these effects using a direct relativistic N-body model. We found that emittance growth and energy spread, due to Coulomb scattering, can be significantly enhanced with respect to mean-field space-charge calculations in different parameter regimes.

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