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Validation and Verification of Two Particle-In-Cells Codes for a Glow Discharge ALEXANDER KHRABROV, JOHAN CARLSSON, IGOR KAGANOVICH, Princeton Plasma Physics Laboratory, TIMOTHY SOMMERER, GE Global Research — Two PIC codes, a research code EDIPIC and a commercial LSP, were benchmarked and validated for a parallel-plate glow discharge in helium, in which the axial electric field profile had been carefully mapped in experiment [1]. Both codes reproduce very well the cathode fall and the negative glow regions of the discharge, including formation of high density plasma with very low-energy (0.1 eV) electrons in the negative glow. A detailed comparison was performed for several synthetic cases of electron-beam injection into helium gas and showed that the codes are in excellent agreement for ionization rate, as well as for collisional transport if isotropic scattering was assumed. However, the electron velocity distribution is anisotropic in the cathode fall; hence an adequate model of anisotropic scattering in elastic/inelastic collisions needs to be adopted. Because of the experimental uncertainty for the emission yield, it is tuned to make the cathode current computed by each code match the experimental values. The resulting computed electric fields are in excellent agreement with each other and within about 10% of the experimental value. In the process of validation, several issues with each of the codes were noted and addressed, including the necessity to use quality random number generators, and, for the commercial code, updating the field solver, the secondary electron emission, and the external circuit algorithms. [1] E A den Hartog, D A Doughty and J E Lawler, Physical Review A **38**, 2471 (1988).

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