Abstract Submitted
for the GEC12 Meeting of
The American Physical Society

Accuracy of the step sheath approximation MARK SOBOLEWSKI, National Institute of Standards and Technology — In modeling plasma sheaths, it is useful to approximate the electron density profile by a sharp, step-like drop between a quasineutral region and an electron-free region. This approximation allows rapid and efficient numerical calculations of sheath properties and, when combined with other assumptions, allows predictions for sheath properties to be calculated analytically. Nevertheless, the approximation must result in some loss of accuracy. Here, the accuracy of the step approximation was investigated by comparisons with exact solutions for Poisson's equation in the sheath and with experimental measurements of current and voltage waveforms and ion energy distributions. In general, the errors introduced by the step approximation are small but not negligible. The resulting errors in current and voltage are noticeable during the part of the rf cycle when the sheath is nearly collapsed. The effects on the ion energy distribution are most noticeable in the amplitude of the low-energy peak, which is sensitive to the choice of boundary conditions on the plasma side of the step. Using the exact Poisson solution in place of the step approximation results in a modest improvement in the agreement with experiment.

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Date submitted: 15 Jun 2012 Electronic form version 1.4