

NDnano Undergraduate Research Fellowship (NURF) 2011 Project Summary

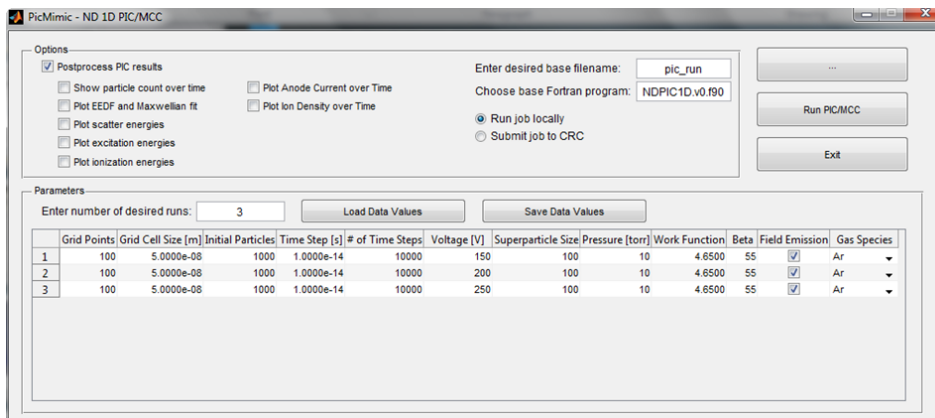
Student Name: Ben Rollin

Faculty Mentor Name: David Go

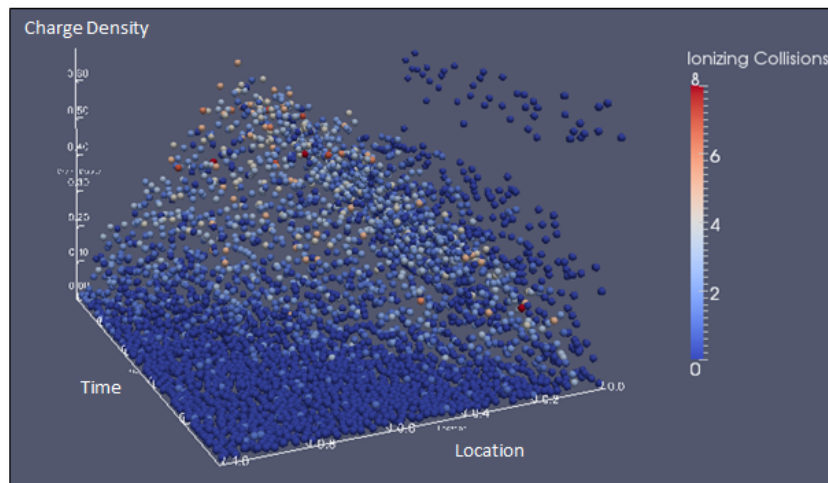
Project Title: Visualization of DC Microplasma Particle-in-Cell Monte Carlo Collision Simulations

The fundamental behavior of DC low-temperature plasmas when scaled down to the micro-scale remains not fully understood. When anode-cathode gap sizes in a parallel plate setup approach microns with a sufficient voltage, a phenomenon known as field electron emission occurs. How field emission plays a role in the characteristics of the resulting plasma is of interest, in that harnessing this technology will allow for the generation of plasmas with specific parameters. These plasmas may be used in plasma TV screens, nanomaterial synthesis, killing bacteria, or contaminant detection, for example.

In order to study microplasmas, I used a simulation method known as particle-in-cell, Monte Carlo collisions (PIC-MCC). My work involved first developing my own microplasma simulation code to understand plasma simulation techniques, and then adopting the lab's code and generating results. I developed a GUI that allows for more ready use of the thousand-line FORTRAN code used by the lab, as well as began to visualize some results. For example, the cascading effect of electrons in a microplasma was visualized in 3D with ParaView.



Matlab GUI developed for use by Go Group in plasma simulation



Visualization of electron cascade through time, with ionizing collision locations

Presented poster entitled "Visualization of microplasma particle-in-cell Monte Carlo collision simulations" at Undergraduate Research Symposium August 5th, 2011.