Deep brain stimulation (DBS) of the subthalamic nucleus (STN) has rapidly emerged as an effective treatment in medically refractory Parkinson’s disease; however, scientific understanding of DBS is limited. The fundamental goal of this project is to quantify the volume of tissue activated by STN DBS on a patient-specific basis and couple these results to clinical analysis and interactive 3D visualization. Our models merge anatomical and electrical representations of the electrode and surrounding tissue medium, customized to the individual patient, based on magnetic resonance imaging data using SCIRun BioPSE. We evaluate the tissue structures activated with therapeutic and non-therapeutic STN DBS to enhance our understanding of the mechanisms of DBS, and provide 3D visualization software to clinicians to improve their ability to cite the stimulation.