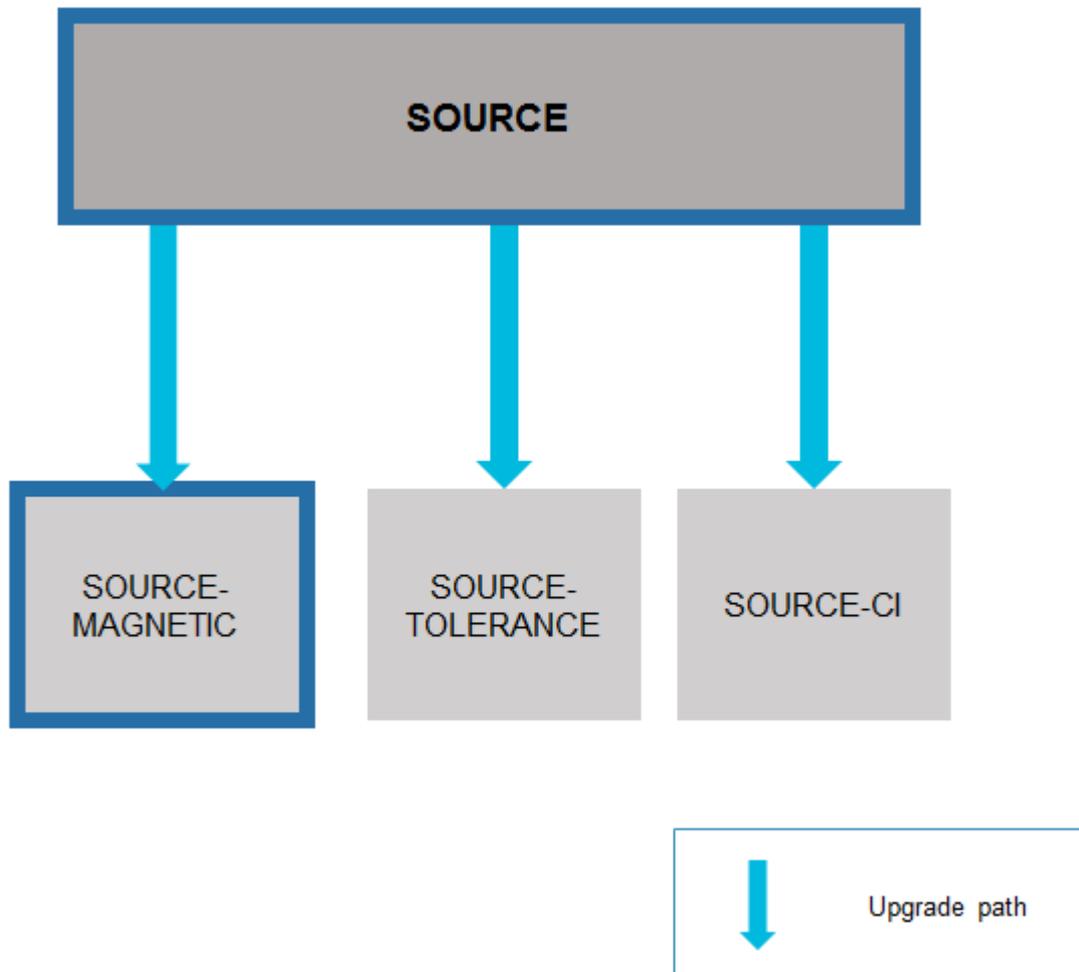


SOURCE & SOURCE-MAGNETIC

Electron Source Design



Overview

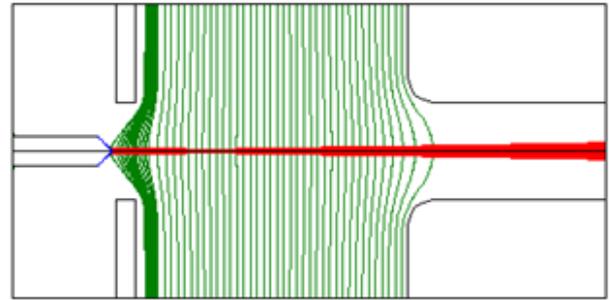
The SOURCE software is used for the analysis and design of all types of electron sources, ranging from point cathode field emission guns to high current Pierce type guns, taking into account the effects of volumetric space charge. SOURCE handles electrostatic sources only, however, by using the SOURCE-MAGNETIC optional upgrade package, the capabilities of the software can be extended to allow the handling of electron sources with magnetic fields generated by magnetic lenses.

The software uses the second-order finite element method for both the electrostatic and magnetic field computation, providing greater accuracy than the first order method. This allows very accurate modelling of curved cathodes, electrodes and magnetic pole-pieces. SOURCE and SOURCE-MAGNETIC can handle only rotationally symmetric or planar symmetric structures.

The software computes the space charge distribution by iterative solution of Poisson's equation and the electron trajectories through the combined electrostatic and magnetic fields are computed by direct ray tracing.

Thermionic emission, Schottky emission and field emission are all handled in a unified way.

The software can also compute the aberrations of the source, and the brightness as a function of the beam half-angle.



Plot of the equipotentials and trajectories in a LaB6 gun

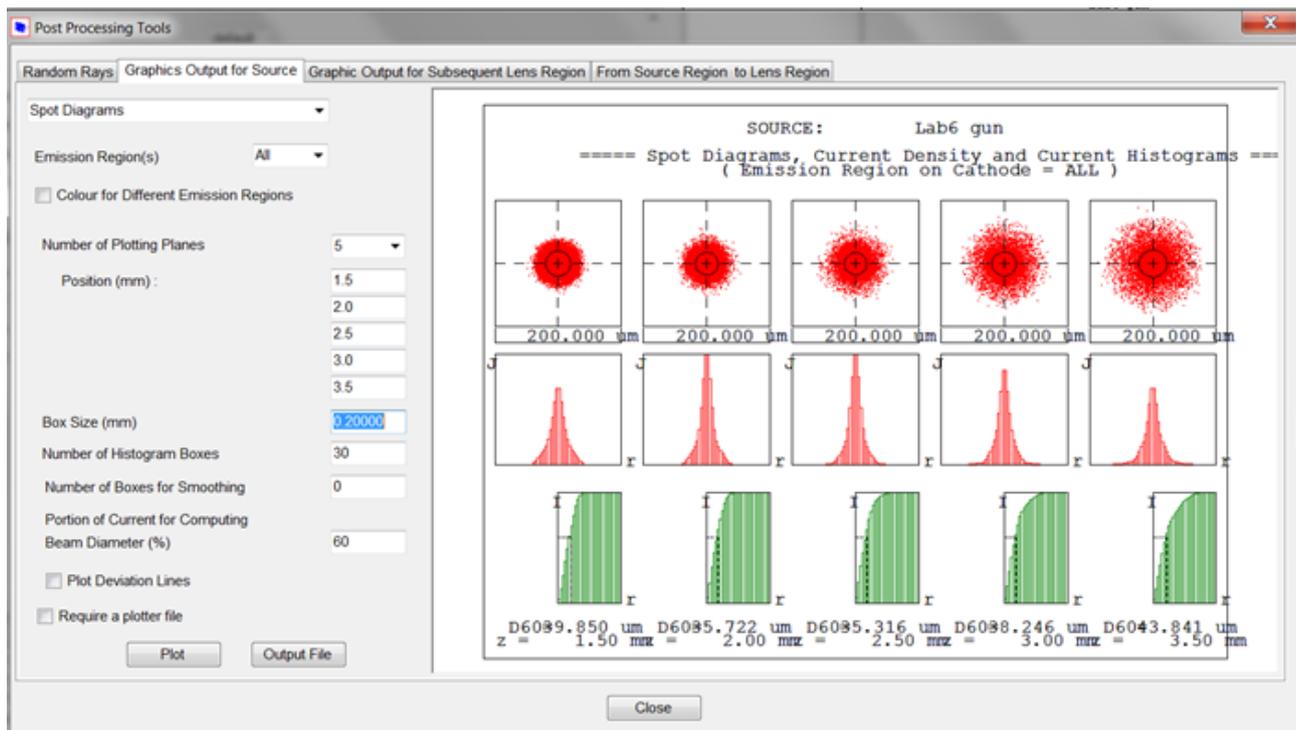
Post Processing

The SOURCE and SOURCE-MAGNETIC packages also provide the following post processing functions for analysing electron sources:

The paths of several rays with randomly generated initial ray conditions on the cathode surface in the source region, are computed. The positions and slopes of rays at the source exit plane are stored in an output file.

Spot diagrams, current density and current histograms, current distributions through the knife-edge and emittances of the source can then be plotted from the computed positions and slopes of rays at the source exit plane.

The positions and slopes of the rays from the source exit plane can be transferred to any plane in the subsequent lens, and then spot diagrams, current density and current histograms, current distributions through knife-edge, and emittances in the lens region can be plotted.



Spot diagrams, current density and current histograms