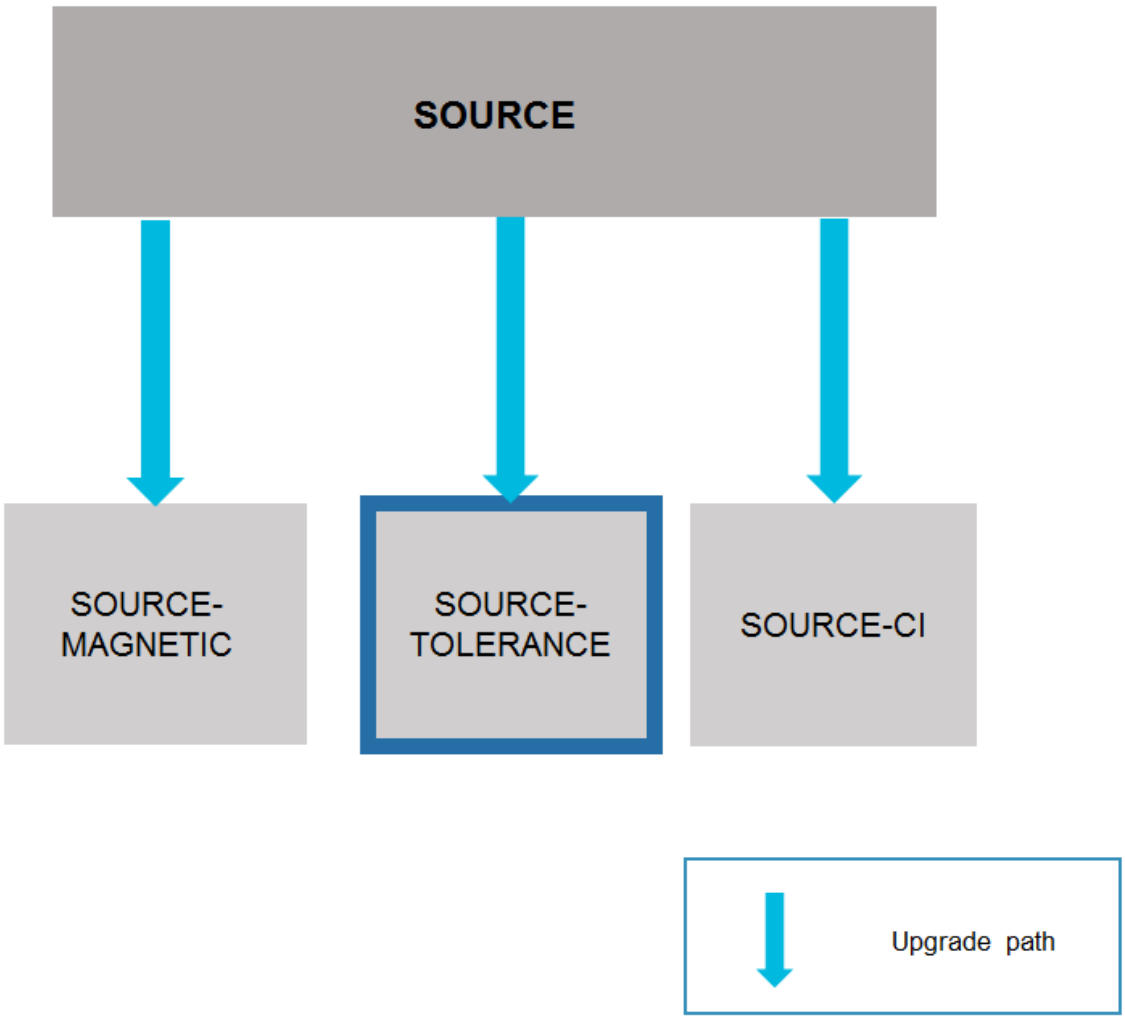
# SOURCE-TOLERANCE

## Electron Source Tolerancing




## Overview

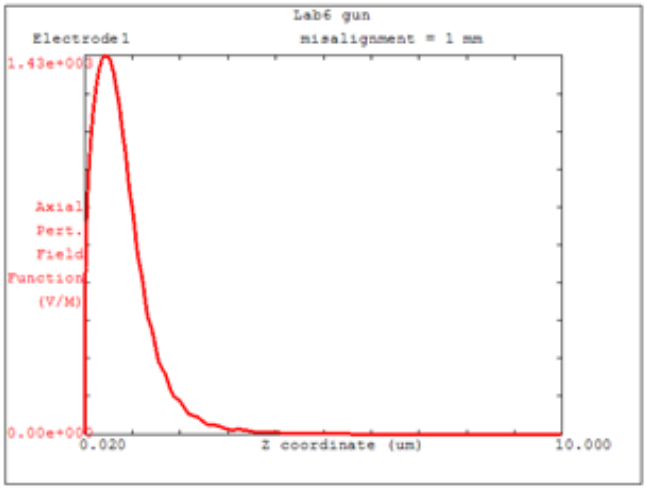
Real columns suffer from asymmetry errors caused by small mechanical imperfections during construction and alignment. Using the SOURCE-TOLERANCE software, the user can compute the perturbation field distributions due to tilts, misalignments and ellipticities in the electrodes or cathodes, to ensure that the system will perform in accordance with its design specifications. The corresponding beam displacements and asymmetry aberrations can also be computed.

The SOURCE-TOLERANCE module can only be used for systems which contain electron or ion sources with rotationally symmetrical electrostatic structures, not with planar symmetrical structures or magnetic lenses.

The potential field distribution of the source must first be computed using the SOURCE software, before computing the perturbation field functions using the SOURCE-TOLERANCE software.

The tilt centres of each electrode can then be set and then the SOURCE-TOLERANCE module can be used to compute the perturbation field functions of the source.

SOURCE-TOLERANCE uses the first-order FEM, rather than the second-order FEM, to compute the perturbation fields. It is accurate enough to use the first-order FEM for computing the perturbation fields, even though the rotationally symmetrical potentials are computed with the second-order FEM.

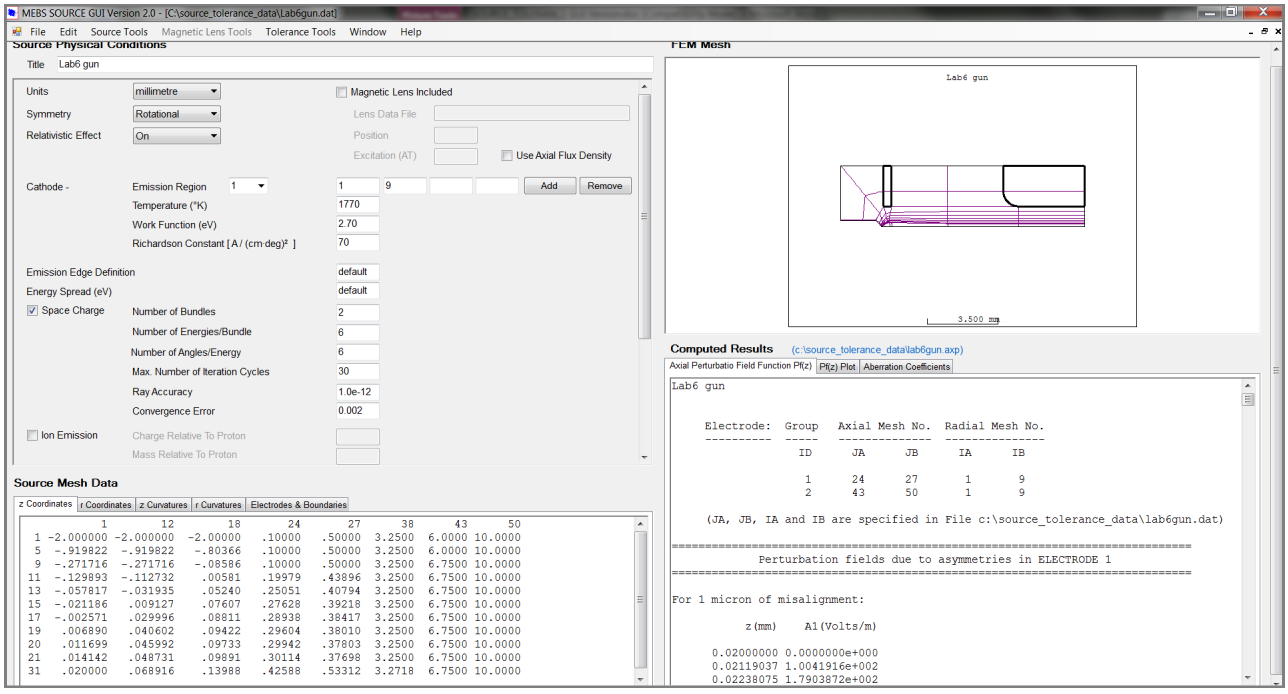



*Graph of perturbation field*

After the normal potential distributions and the perturbation field functions are computed , the user can then compute the asymmetry aberrations.

The program computes the beam displacement and aberrations due to misalignment, tilt and ellipticity errors by solving the equations of motion, with the asymmetric perturbation fields as well as the rotationally symmetric electrostatic axial potential distribution.

A bunch of rays are computed from the cathode to the exit plane of the source, which should be in a field-free region; then all these rays are projected back to the virtual crossover plane. This is similar to the computation of the chromatic aberration in the SOURCE software. The position and slope of the central ray at the virtual crossover give the shift and slope of the displacement. The beam confusion disc at the virtual crossover gives the aberration due to the asymmetry error. In this program, only the third-order aberrations are taken into account.




*Electron source simulation with the computed beam displacement and asymmetry aberrations displayed numerically in the lower part of the screen*