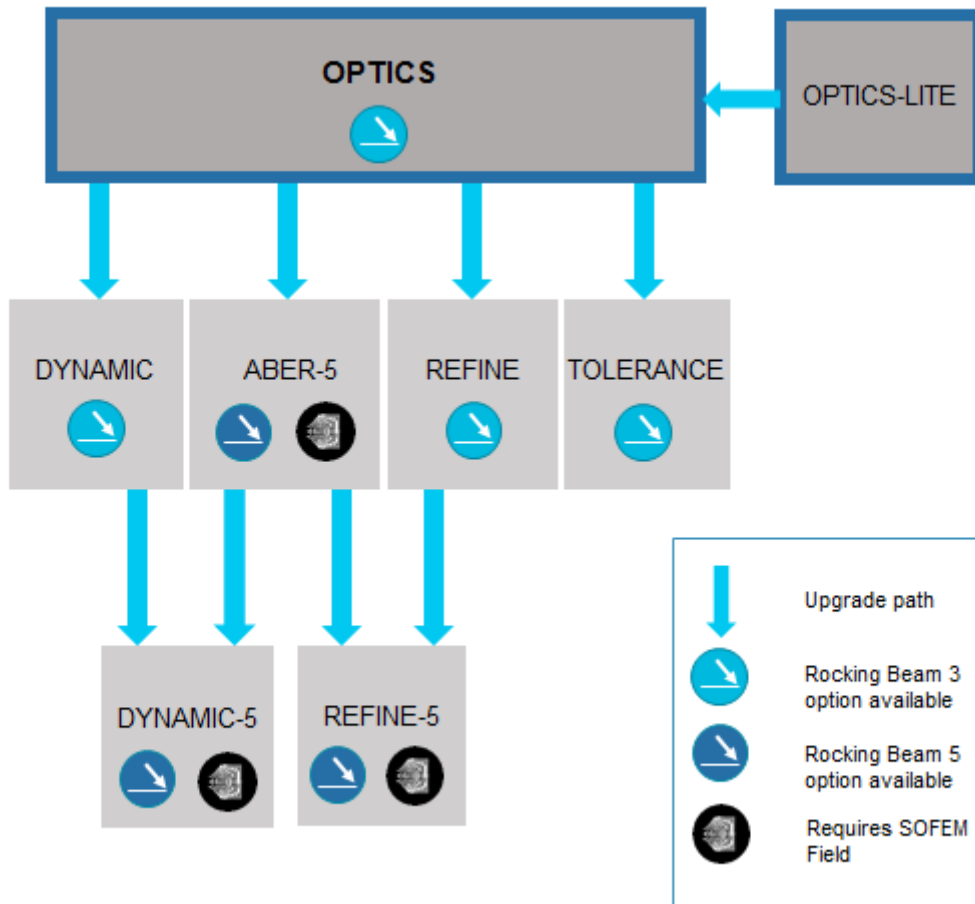




# OPTICS & OPTICS-Lite

Column Simulation



## Overview

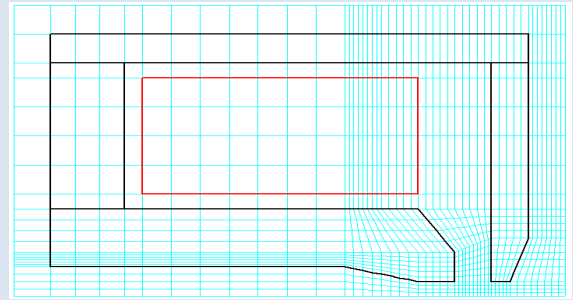
OPTICS and OPTICS-Lite are the base packages for the OPTICS software family. The OPTICS software is used for the simulation and computer aided design of columns consisting of any combination of round electron lenses and deflectors. OPTICS assists with:

- The computation of field distributions in individual round electron lenses and deflectors.
- The computation of the optical properties and aberrations of any combination of such elements.
- The graphical display of the effects of the aberrations.

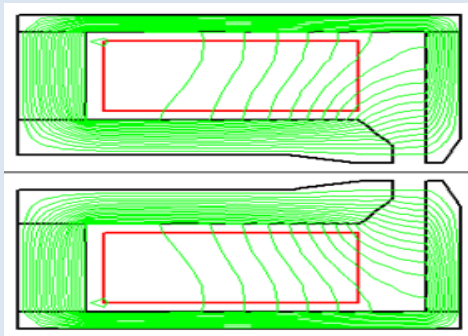
OPTICS-Lite is a reduced functionality version of the full OPTICS package. OPTICS-Lite allows the user to simulate a single electrostatic or magnetic lens only. It also has tolerancing capabilities

## Field Computation

The lens and deflector fields are computed using the first-order finite element method (FEM). For magnetic lenses, the field can be computed either in the polepiece region of the lens only, using a scalar potential, or throughout the complete lens, including the magnetic circuit and coil windings, using a vector potential. Magnetic saturation is handled with numerically specified B-H curves.



*Finite Element Mesh for a magnetic lens*



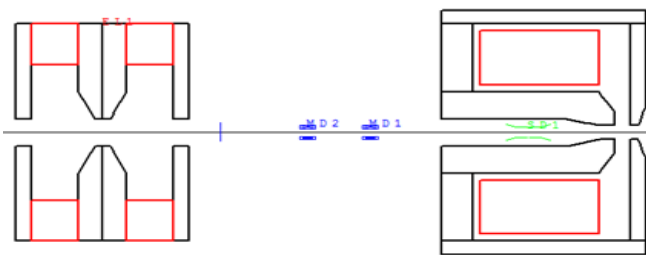
*Magnetic Field Distribution*

The software can handle deflection systems with up to three independent channels and each channel can be either electrostatic or magnetic. The deflectors are used to scan the beam over a 2D area in the image plane.

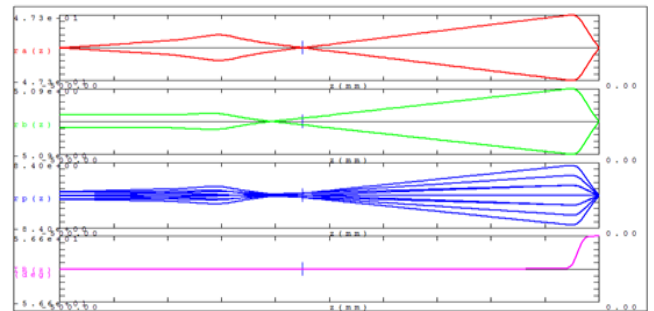
The numerical output of the field distributions, flux densities and potential distributions for the lenses and deflectors are stored in separate files.

## Column Simulation

Once the fields of the individual elements have been computed, these results can be combined in what is known as the imaging conditions file in order to simulate a complete column.



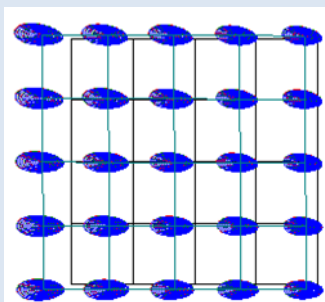
*Layout of optical column*



*Paraxial rays focused at intermediate and final image planes*

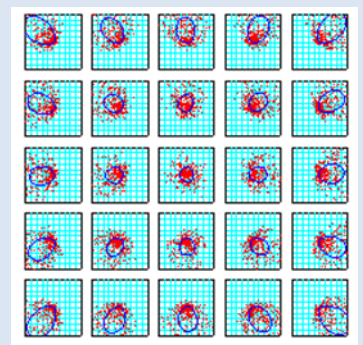
The software computes the paraxial rays and an auto focus algorithm can be used to focus the rays at predefined image planes.

## Post Processing



*Aberration spot diagram*

The software contains a powerful post-processing tool. The aberrations can be computed using specially derived aberration integrals, which enable fast and accurate computation of the required coefficients. The base OPTICS package computes third-order geometrical aberrations and first-order chromatic aberrations. The fields of all the individual elements which make up the complete column are first computed. The OPTICS environment allows all data including mesh data to be modified directly and the effects of any modifications are displayed numerically and graphically.



*Spots and contours at selected plane for a shaped beam*