MIRROR

Software for Modelling Electron Mirrors

• Software for analysing aberrations and Coulomb interactions in mirror systems

• Aberrations Package (MIRROR-DA)
  • Compute focusing conditions for mirrored beam
  • Auto-adjust focusing potentials
  • First-order optical properties – magnification, angular magnification
  • Aberrations computed by differential algebra method

• Coulomb Interactions Package (MIRROR-IMAGE):
  • Compute focusing conditions for mirrored beam
  • Auto-adjust focusing potentials
  • First-order optical properties – magnification, angular magnification
  • Combined effects of aberrations and Coulomb interactions by direct raytrace

• System Requirements:
  • Runs under Microsoft Operating System (Windows 7, Vista or XP)
MIRROR FAMILY OVERVIEW

Electron mirrors are becoming increasingly important in electron optics. Mirrors generate aberrations of negative sign which compensate round-lens aberrations, as well as being useful in systems such as cathode lens columns. We have two packages for mirror systems: MIRROR-IMAGE and MIRROR-DA.

MIRROR-IMAGE

The MIRROR-IMAGE software package is a set of programs for simulating the optical properties of electron mirrors by direct ray-tracing. The software handles electron mirrors containing any combination of rotationally symmetric electrostatic and magnetic fields. The software can handle combinations of electron mirrors and electron lenses.

MIRROR-IMAGE is based on the MEBS software package IMAGE. It uses the same fundamental methods as IMAGE, including representation of the fields by Hermite series, direct ray-tracing using a fifth-order Runge-Kutta method with adaptive step size, and calculation of the discrete Coulomb interaction effects by Monte Carlo simulation with many discrete bunches of charged particles.

The MIRROR-IMAGE package includes a main program for computing the paths of charged particles through the mirror by direct ray-tracing, and post-processing programs for plotting spot diagrams of the aberrations at the image plane and for plotting the trajectories. The main program allows initial conditions to be specified, to enable spot diagrams of the overall beam shape at the image plane to be computed and plotted. It also allows random initial conditions to be assigned to bunches of particles, to enable the discrete Coulomb interaction effects in the beam to be computed. It should be noted that the Coulomb interaction calculation does not take into account the interaction between the forward and reflected beams.

MIRROR_IMAGE Plot showing incident and reflected electrons in a mirror system
MIRROR-DA

The MIRROR-DA software package is a set of programs for simulating the optical properties of electron mirrors, including the aberration coefficients, by the differential algebra method. The software handles electron mirrors containing any combination of rotationally symmetric electrostatic and magnetic fields. The software can handle combinations of electron mirrors and electron lenses.

MIRROR-DA is based on the MEBS software package MIRROR-IMAGE. It uses a lot of the fundamental ideas as MIRROR-IMAGE, including representation of the fields by Hermite series and direct ray-tracing using a fifth-order Runge-Kutta method with adaptive step size, but also introduces some new principles to compute the aberration coefficients. The data format for MIRROR-DA is very similar to that used in MIRROR-IMAGE, so the same data can be used to compute the aberration coefficients (using MIRROR-DA) and the overall spot size, including aberrations and coulomb interactions (using MIRROR-IMAGE).

The MIRROR-DA package includes a main program for computing optical properties in the mirror by differential algebra method, and a post-processing program for plotting spot diagrams of the aberrations at the mirror screen plane.

MIRROR-DA Plots showing fields and paraxial rays in a mirror system