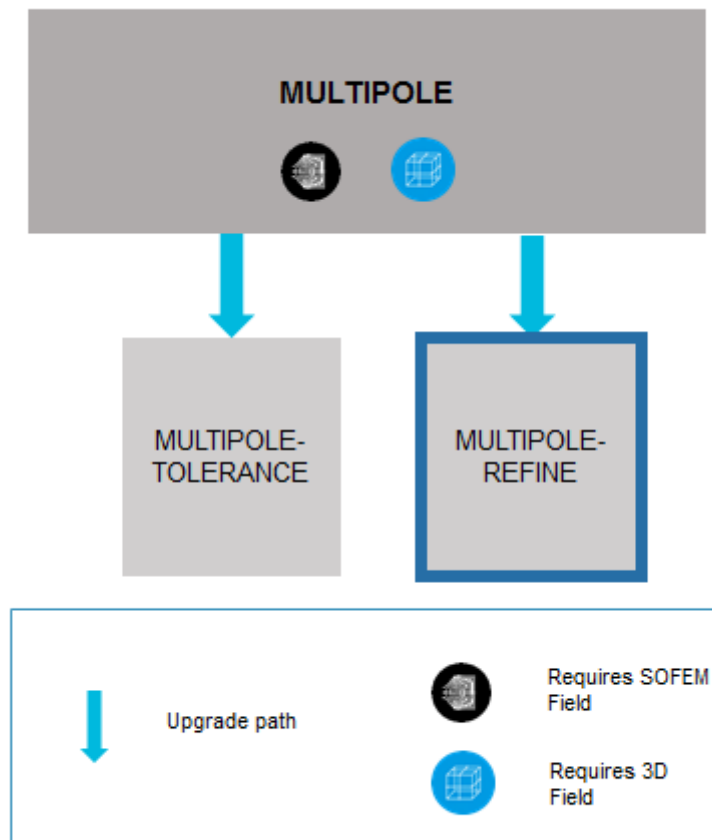




# MULTIPOLE REFINE

Multipole column design



## Overview

The MULTIPOLE-REFINE module takes the initial design of the column, and interactively refines it to optimise the performance. An electron beam column contains many design parameters that can be varied and there are numerous aberrations which each depend on the variable parameters.

MULTIPOLE-REFINE allows the user to choose which design parameter to vary and which aberration to target. The program then runs several optimisation cycles and generally yields designs with better properties than those obtained through trial and error.

MULTIPOLE-REFINE computes and optimises the third-order geometrical aberrations and first-order chromatic aberrations for systems that do not include hexapole lenses; for systems with hexapoles lenses, the program additionally computes the second-order geometrical aberrations. Intermediate images do not need to be stigmatic, however the computed aberration coefficients are meaningful only if the beam is stigmatically focused at the final image plane.

Because of the complicated nature of multipole columns, the optimisation of the system is often crucial to the successful design of the system. It also requires the visualisation and control of many parameters and MULTIPOLE-REFINE uses a graphical interface to assist with entering and controlling the system parameters and the optimisation procedure.

**Optimization Process**

**BEFORE Optimization**

**1st order properties**

	x direction	y direction
Column Magnification	0.935526	1.068917
Image Rotation (degree)	0.000000	0.000000

**Spot Diagram @ Axis:**

**2nd order aberration (microns)**

Dependency	AP	BA	DI
Aper. Angle			
Shaped Beam			

Overall beam blur due to 2nd order aberration caused by HEXAPOLE lenses =  (microns)

**3rd order geometrical and 1st order chromatic aberrations (microns)**

Dependency	AP	CO	FC	AS	DI	CA	LA
Aper. Angle	0.350176					1.362387	
Shaped Beam		0.318881	0.703973	0.375865	0.075976	0.401740	0.010464

Overall beam blur due to 3rd order geometrical and 1st order chromatic aberrations = 1.648412 (microns)

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**AFTER Optimization Cycle 0**

**1st order properties**

	x direction	y direction
Column Magnification	0.935526	1.068917
Image Rotation (degree)	0.000000	0.000000

**Spot Diagram @ Axis:**

**2nd order aberration (microns)**

Dependency	AP	BA	DI
Aper. Angle			
Shaped Beam			

Overall beam blur due to 2nd order aberration caused by HEXAPOLE lenses =  (microns)

**3rd order geometrical and 1st order chromatic aberrations (microns)**

Dependency	AP	CO	FC	AS	DI	CA	LA
Aper. Angle	0.350176					1.362387	
Shaped Beam		0.318881	0.703973	0.375865	0.075976	0.401740	0.010464

Overall beam blur due to 3rd order geometrical and 1st order chromatic aberrations = 1.648412 (microns)

To Do Refine Cycle 1      OK

Screen shot showing the form for controlling the optimisation process