MonTec

Charged Particle Optics Simulation Tools

Product description:

- INTERAC Modeling Environment
- Monte Carlo Simulation Program

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MonTec Particle Optics Simulation Tools

Overview

The MonTec Particle Optics Simulation Tools package supports the design and optimization of particle optical systems in which the impact of Coulomb interactions on the system performance is significant, e.g.:

- Electron- and ion-beam lithography systems,
- Low-voltage scanning electron microscopes, and
- High brightness electron- or ion-sources.

The software provided by MonTec results from the research programs carried at out by Guus Jansen and co-workers over the past two decades for Delft University of Technology and IBMs General Technology Division in the USA. The theoretical models on which the MonTec software is based have become the standard approach in particle optics to evaluate the impact of Coulomb interactions in particle beams. The theory has been published in many articles and a review can be found in the following publications:

1) G.H. Jansen, Coulomb Interactions in Particle Beams, Advances in Electronics and Electron Physics, Supplement 21, Academic Press, Boston, 1990

2) G.H. Jansen, Trajectory displacement effect in Particle Projection Lithography Systems: Modifications to the Extended Two-Particle Theory and Monte Carlo Simulation Technique, Journal of Applied Physics, Vol.84, No 8, p. 4549 (1998)

3) P.Kruit and G.H. Jansen, Space Charge and Statistical Coulomb Effects (Handbook of Charged Particle Optics, Ed. Jon Orloff, CRC Press, New York 1997)

The particle optics simulation software provided by MonTec was first commercially released in 1990 and is used by companies and universities around the world for the design and optimization of electron- and ion-beam lithography systems and scanning electron microscopes.

Latest release features

The MonTec software has been recently (2003) upgraded into a Windows compliant integrated modeling environment with the capability to apply and compare the following complementary theoretical approaches to estimate the impact of Coulomb interactions in combination with lens aberrations:

- Monte Carlo simulation, a brute force numerical method in which a bunch of particles with randomly chosen initial coordinates, reflecting the properties of the beam in the vicinity of the source, is traced through a user defined system,
- Analytical equations from the Extended Two-Particle (ETP) model as published in references 1 and 2, and
- Slice method based on a numerical integration of the analytical equations from the ETP-model for a thin cylindrical slice of the beam.

The MonTec software provides the means to define a particle optical system, to apply the analytical models for lens aberrations and particle interactions, to run and analyze the outcome of Monte Carlo simulations and to compare the outcome of the different theoretical approaches. It provides a modeling environment that is both powerful and easy to use. The performance of particle beam systems can be evaluated with limited effort and without the need for a detailed understanding of the underlying theory.

Core software programs

The MonTec software serves to simulate electron (or ion) Gaussian beam, shaped beam and projection lithography systems, electron (or ion) scanning microscopes and similar devices. The MonTec package consists out of two separate, but tightly integrated, programs:

- **INTERAC:** An MS Excel based modeling environment to define and analyze particle optical systems. It provides an interactive user interface to specify the properties of a particle optical system consisting out of a particle source, followed by a succession of particle optical components - such as lenses, quadrupoles, deflectors and apertures – separated by drift spaces or spaces where the beam is linearly accelerated or decelerated. INTERAC provides a plot of the system as it is defined, showing the various optical components and the beam built-up from the first-order primary rays. The system plot is generated dynamically, meaning that any changes made by the user to the input data are directly reflected in the system plot. The system description defined this way is used by INTERAC to calculate first order properties of the beam, the geometrical and chromatic aberrations and the impact of Coulomb interactions. The same system description is used to execute both the analytical and slice-method calculations and to generate the input files for the corresponding MC simulation. The results of the MC simulation can be imported to allow a direct comparison of the results obtained with the analytical approach, the slice method and the MC simulation.
- **MC:** A FORTRAN based program to execute Monte Carlo simulations. It can be run as a stand-alone program or, which is more convenient, in conjunction with INTERAC. Monte Carlo simulation of particle beams is a brute force numerical method in which a bunch (or sample) of particles with randomly chosen initial coordinates, reflecting the properties of the beam in the vicinity of the source, is traced through a user defined system. The trajectories are determined by updating the positions and velocities of each particle at regular time intervals, taking the Coulomb repulsion experienced from all other particles in the sample into account. Lenses and other optical elements can be specified and are modeled in the thin-lens approximation. The ray tracing can be repeated for a number of samples, each starting with a different "seed" of initial conditions. The final coordinates, accumulated from all seeds, are processed in order to reduce the information to a limited number of characteristic quantities, such as the width of the energy distribution, the defocusing distance and the spatial broadening in the plane of best focus. The particle positions as well as their energy and spatial distribution are stored by to file for separate analysis, for which INTERAC can be used.

Design objectives of the MonTec package

The MonTec Particle Optics Simulation Tools package has been designed to meet the following objectives:

- Provide an **Integrated modeling environment**: INTERAC provides an interactive user interface to specify the properties of a particle optical system consisting out of a particle source, followed by a succession of particle optical components - such as lenses, quadrupoles, deflectors and apertures – separated by drift spaces or spaces where the beam is linearly accelerated or decelerated. INTERAC provides a plot of the system as it is defined, showing the various optical components and the beam built-up from the first-order primary rays. The system plot is generated dynamically, meaning that any changes made by the user to the input data are directly reflected in the system plot. The system description defined this way is used by INTERAC to calculate first order properties of the beam, the geometrical and chromatic aberrations and the impact of Coulomb interactions. The same system description is used to execute both the analytical and slice-method calculations and to generate the input files for the corresponding MC simulation. The results of the MC simulation can be imported to allow a direct comparison of the results obtained with the analytical approach, the slice method and the MC simulation.

Design objectives of the MonTec package- Continued

- Provide **automatic parameter selection** for analytical and Monte Carlo calculations. Given the system specification, INTERAC automatically determines the input parameters for the analytical and slice method calculations based on an analysis of the location of beam crossovers, the location of the image planes conjugated to the source and the target and the transverse magnifications from these planes to the source and target respectively. These automatically generated input parameters for the analytical and slice method can be overwritten by the user if desired. For the Monte Carlo simulations, INTERAC provides a facility to automatically set some of the key MC model parameters such as the sample size NSAM and number of seeds NSEED. For this, INTERAC evaluates the sample length relative to the lateral dimensions of the beam, assuring that some user-specified critical ratios are met. Based on the selected MC input data, INTERAC also estimates the run time of the corresponding MC simulation. These facilities provide the means to balance the run-time and the expected accuracy of the MC simulation prior to execution. The automatic parameter settings provided by INTERAC allow the users to carry out analytical calculations and MC simulations without the need to explore the details of the underlying modeling concepts.
- Provide **graphical tools to inspect Monte Carlo results**. The various output files generated by the Monte Carlo programming - containing the general output data, the energy distributions, the spatial distributions in selected reference planes, the lateral particle positions in selected reference planes and the complete phase-space co-ordinates of all particles near the target – can be imported by INTERAC for subsequent analysis. INTERAC automatically create plots of the energy and spatial distributions, the lateral particle positions in the reference planes, as well as various cross-section of the phase space co-ordinates near the target. INTERAC thereby provides the means to inspect all MC results in full detail and replaces the program MCPLOT provided in the previous release of the MonTec package.
- Provide **data management facilities** to design and administrate computer experiments: INTERAC associates each case with a unique run-number and employs series IDs to allow the user to specify groups of runs. Each run corresponds to a unique user-specified set of MC input and output file names. Various file manipulations and data storage tasks can be executed for a selected series of MC runs through a single instruction by the user. Furthermore, INTERAC has incorporated the means to compare and plot the results of different runs to investigate the dependency on system as well as model parameters.
- Provide **flexibility while assuring maintainability**: INTERAC has been designed to provide rich functionality and extensive flexibility. The user can specify various series of runs to analyze a particle optical system under different experimental conditions, apply alternative theoretical approaches, store the corresponding results and create customized plots to analyze trends. The user may also change various modeling, data-management and plotting parameters to tailor INTERAC to its specific needs. In order to assure that INTERAC can be properly maintained, default settings can be retrieved on individual basis or for all parameters as a whole. INTERAC includes various spreadsheet management functions to restore default settings and clear user data.

Typical Usage

The MonTec Particle Optics Simulation Tools package is used by industrial R&D groups, universities and research institutes around the world and is typically used to:

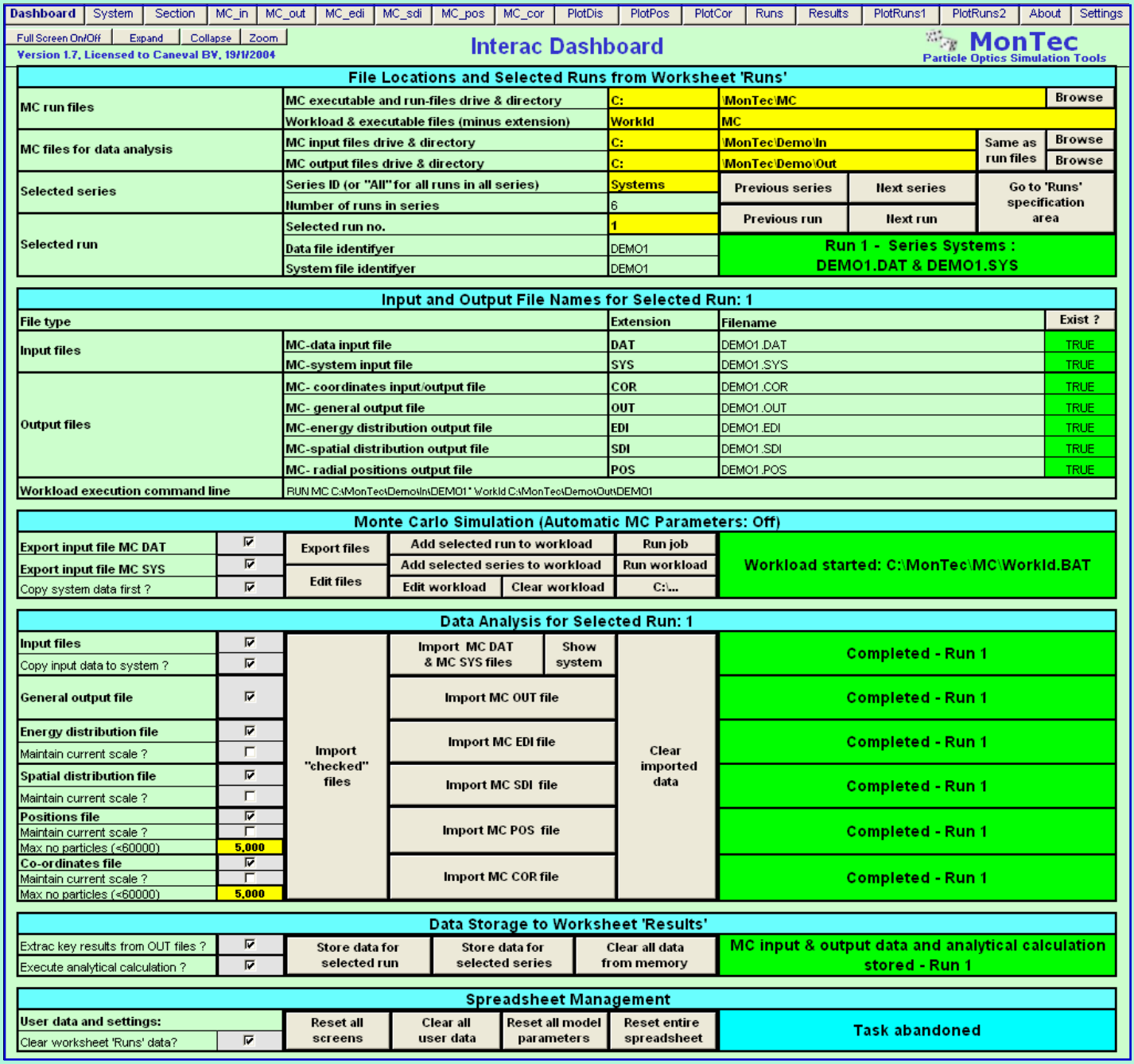
- Verify and optimize the design of high speed electron and ion lithography systems,
- Verify and optimize the design of low-voltage scanning electron microscopes,
- Verify and optimize the design of high brightness Schottky and field emission guns,
- Explore and evaluate novel particle optical concepts, such as e-beam projection systems and high resolution & high throughput mask less wafer stepper, and
- Support university courses on particle optics.

Mastering the MonTec Particle Optics Simulation Tools is straightforward for students and academic professionals alike due to its easy to use graphical interface, its interactive system definition facilities, its fully integrated capability to apply different theoretical approaches, its automatic selection of key modeling parameters, the comprehensive documentation, available electronically and in book form, and the extensive literature on the underlying theory

INTERAC user interface components

The INTERAC workbook consists of 16 user worksheets. These worksheets contain a mixture of headings, guidelines, input cells, output areas, graphs and controls (macro buttons that activate Visual Basic routines to perform certain tasks for the user), which together constitute the user interface. The cell- and font-colors are used in a systematic way, e.g. input areas are yellow, section headings are light blue, macro controls are gray etc. The sections below and on the following pages show some of the worksheets and describe the key functionality.

Dashboard: The *Dashboard* worksheet groups the key user controls and entry fields to specify the user workspace; to import and export files; to schedule MC batch jobs for background processing; to perform data analysis and calculations; to store results to memory and to execute spreadsheet management functions (such as the clearance of user data and the reset of the program to its default settings). The figure below shows the *Dashboard* screen.



Dashboard | System | Section | MC_in | MC_out | MC_edi | MC_sdi | MC_pos | MC_cor | PlotDis | PlotPos | PlotCor | Runs | Results | PlotRuns1 | PlotRuns2 | About | Settings

Full Screen On/Off | Expand | Collapse | Zoom

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Interac Dashboard

MonTec
Particle Optics Simulation Tools

File Locations and Selected Runs from Worksheet 'Runs'

MC run files	MC executable and run-files drive & directory	C:	\MonTec\MC	Browse
	Workload & executable files (minus extension)	WorkId	MC	
MC files for data analysis	MC input files drive & directory	C:	\MonTec\Demo\In	Same as run files / Browse
	MC output files drive & directory	C:	\MonTec\Demo\Out	Browse
Selected series	Series ID (or "All" for all runs in all series)	Systems	Previous series / Next series	Go to 'Runs' specification area
	Number of runs in series	6		
Selected run	Selected run no.	1	Previous run / Next run	
	Data file identifyer	DEMO1	Run 1 - Series Systems : DEMO1.DAT & DEMO1.SYS	
	System file identifyer	DEMO1		

Input and Output File Names for Selected Run: 1

File type		Extension	Filename	Exist ?
Input files	MC-data input file	DAT	DEMO1.DAT	TRUE
	MC-system input file	SYS	DEMO1.SYS	TRUE
Output files	MC- coordinates input/output file	COR	DEMO1.COR	TRUE
	MC- general output file	OUT	DEMO1.OUT	TRUE
	MC-energy distribution output file	EDI	DEMO1.EDI	TRUE
	MC-spatial distribution output file	SDI	DEMO1.SDI	TRUE
	MC- radial positions output file	POS	DEMO1.POS	TRUE
Workload execution command line	RUN MC C:\MonTec\Demo\In\DEMO1 * WorkId C:\MonTec\Demo\Out\DEMO1			

Monte Carlo Simulation (Automatic MC Parameters: Off)

Export input file MC DAT	☑	Export files	Add selected run to workload		Run job	Workload started: C:\MonTec\MC\WorkId.BAT
Export input file MC SYS	☑		Add selected series to workload		Run workload	
Copy system data first ?	☑	Edit files	Edit workload	Clear workload	C:\...	

Data Analysis for Selected Run: 1

Input files	☑	Import "checked" files	Import MC DAT & MC SYS files / Show system	Clear imported data	Completed - Run 1
Copy input data to system ?	☑				
General output file	☑		Import MC OUT file		Completed - Run 1
Energy distribution file	☑		Import MC EDI file		Completed - Run 1
Maintain current scale ?	☐				
Spatial distribution file	☑		Import MC SDI file		Completed - Run 1
Maintain current scale ?	☐				
Positions file	☑		Import MC POS file		Completed - Run 1
Maintain current scale ?	☐				
Max no particles (<60000)	5,000				
Co-ordinates file	☑		Import MC COR file		Completed - Run 1
Maintain current scale ?	☐				
Max no particles (<60000)	5,000				

Data Storage to Worksheet 'Results'

Extrac key results from OUT files ?	☑	Store data for selected run	Store data for selected series	Clear all data from memory	MC input & output data and analytical calculation stored - Run 1
Execute analytical calculation ?	☑				

Spreadsheet Management

User data and settings:		Reset all screens	Clear all user data	Reset all model parameters	Reset entire spreadsheet
Clear worksheet 'Runs' data?	☑				Task abandoned

INTERAC user interface components- Continued

System: The *System* worksheet provides an interactive environment to enter, review and modify all particle optical system variables and parameters and to specify the model parameters for the different calculation methods. An implicit ray-tracing module displays the beam envelope, the primary rays, the properties of the source, the optical components and the drift, acceleration or deceleration spaces in between the components. The optical properties such as the angular and spatial distributions, optical planes conjugated to the source and the target respectively and corresponding magnifications are estimated by the program to automate the input for the analytical and the slice method. The figure below displays the top part of the *System* screen, where the user can interactively define the system to be modeled.

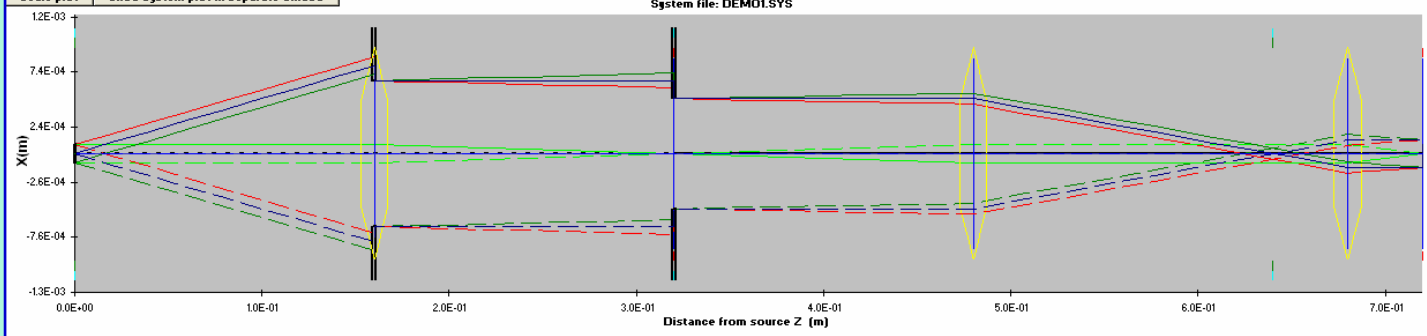
Dashboard | System | Section | MC_in | MC_out | MC_edi | MC_sdi | MC_pos | MC_cor | PlotDis | PlotPos | PlotCor | Runs | Results | PlotRuns1 | PlotRuns2 | About | Settings

Expand all areas | Collapse all areas | Full Screen On/Off | Unlockcharts | Zoom | System Definition & Calculations | Increase abs | Decrease abs | 1.0000E-02 | Increase % | Decrease % | 0.0001%

Expand | Collapse | Copy data from MC_in | Copy system data to MC_in | System plot: Principal Rays in Total System - X direction | Set-up screen for system input | Reset for new system | Load demo system

Scale plot | Show system plot in separate window

System file: DEMO1.SYS



Legend: Straightline / Dashed axis: Interaction on / off

Expand | Collapse — **Source Properties**

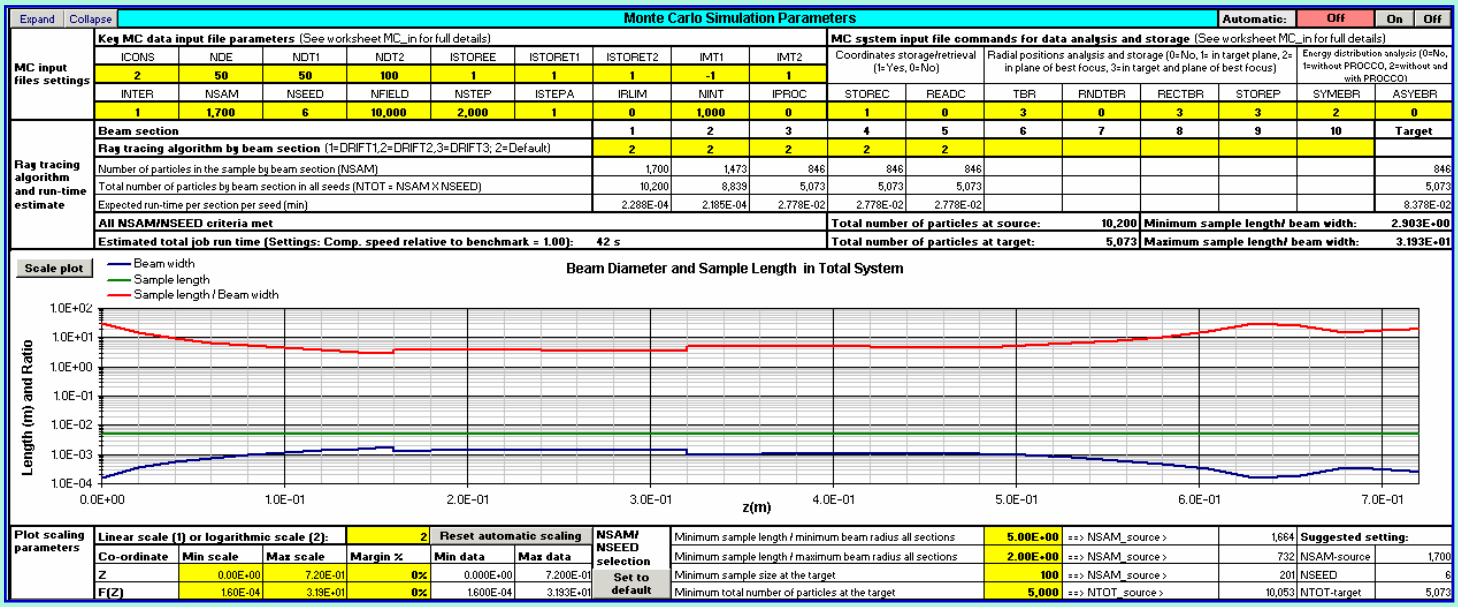
Category	Geometric properties	Identifier	Unit	Value	Beam properties	Identifier	Unit	Value
Source Properties	X-coordinate of source centre	XCTR	m	0.0000E+00	Particle mass	PMASS / PM	kg	9.1096E-31
	Y-coordinate of source centre	YCTR	m	0.0000E+00	Absolute value of particle charge in elementary charge units	NCHRG / PQ	-	1.0000E+00
	Spatial distribution type (1=Circular uniform, 2= Circular Gaussian, 3= Rectangular)	IDS	-	2	Beam current at emission	BI	A	1.0000E-05
	Source half width in X-direction (HWHM)	XHW	m	8.0000E-05	FWHM energy spread at emission	FWE	eV	1.0000E+00
	Source half width in Y-direction (HWHM)	YHW	m	8.0000E-05	Type of energy distribution (1=Uniform, 2=Gaussian, 3=Lorentzian)	IDE	-	2
	Angular distribution type (1=Circular uniform, 2= Circular Gaussian, 3= MB thermal distribution)	IDA	-	1	Cathode temperature	TCA	K	2.5000E+03
	Beam semi angle HWHM	AHW	Rad	5.0000E-03	Beam semi angle HWHM corresponding to Cathod temperature	AHW	Rad	1.728E-03

Expand | Collapse — **Optical Components and Drift Sections**

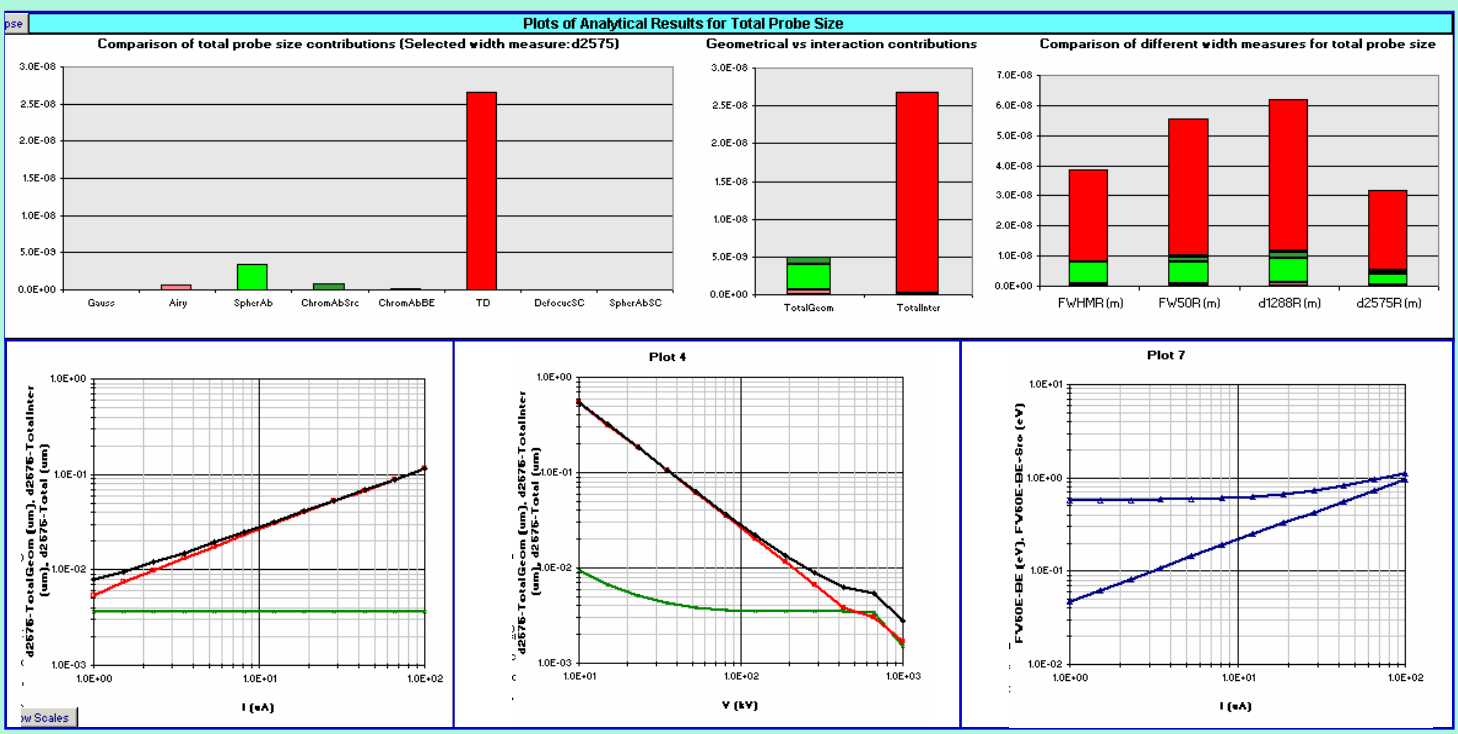
Category	Variable description	Identifier	Unit	Specification / value by beam section 1	2	3	4	5	6	7	8	9	10	Target
Beam sections	Particle interaction switch (0=Off, 1=On)	INTER	-	0	0	1	1	1						
	Axial coordinate at start of section (first = source, last = target)	Z0	m	0.0000E+00	1.6000E-01	3.2000E-01	4.8000E-01	6.8000E-01						7.2000E-01
	Beam potential at start of section (= value at end previous section)	BV0	V	1.0000E+05										
Collapse	Active (1= Yes, 0= No)	lens-switch	-		1		1	1						
Lenses (at start of beam section)	X-coordinate of lens centre	XCTR	m											
	Y-coordinate of lens centre	YCTR	m											
	Focal distance F	F	m		1.6000E-01		1.6000E-01	4.0000E-02						
	Spherical aberration coefficient (object side, infinit magnification)	CS(Obj,inf)	m		1.6000E-01		1.6000E-01	4.0000E-02						
	Chromatic aberration coefficient (object side, infinit magnification)	CC(Obj,inf)	m		8.0000E-02		8.0000E-02	2.0000E-02						
	Coefficient of rotational distorsion (magnetic lens)	RD	Rad											
	Coefficient of chromatic error in rotational distorsion (magnetic lens)	RC	Rad											
Collapse	Active (1= Yes, 0= No)	Defl.-switch	-											
Deflectors (at start of beam section)	Angular deflection in X-direction	AX	m											
	Angular deflection in Y-direction	AY	m											
	Dispersion (chromatic aberration) coefficient	DC	Rad											
Collapse	Active (1= Yes, 0= No)	Apert.-switch	-		1	1								
Apertures (at start of beam section)	X-coordinate of lens centre	XCTR	m											
	Y-coordinate of lens centre	YCTR	m											
	Half width in X-direction	XHM	m		6.6000E-04	5.0000E-04								
	Half width in Y-direction	YHM	m		6.6000E-04	5.0000E-04								
	Shape index (1=Circular aperture, 2= Square aperture)	ISHP	-		2	2								

The *System* worksheet provides the capability to advice on or automatically select the optimum MC parameters - such as the sample size and the number of seeds - based on the properties of the beam and certain criteria set by the user, such as the minimum sample length relative to the lateral dimensions of the beam. All parameters can be overwritten by the user if desired. The figure on the top of the next page shows the part of the *System* screen, where the user can verify and, if desired, overwrite the MC parameters selected by INTERAC.

INTERAC user interface components- Continued

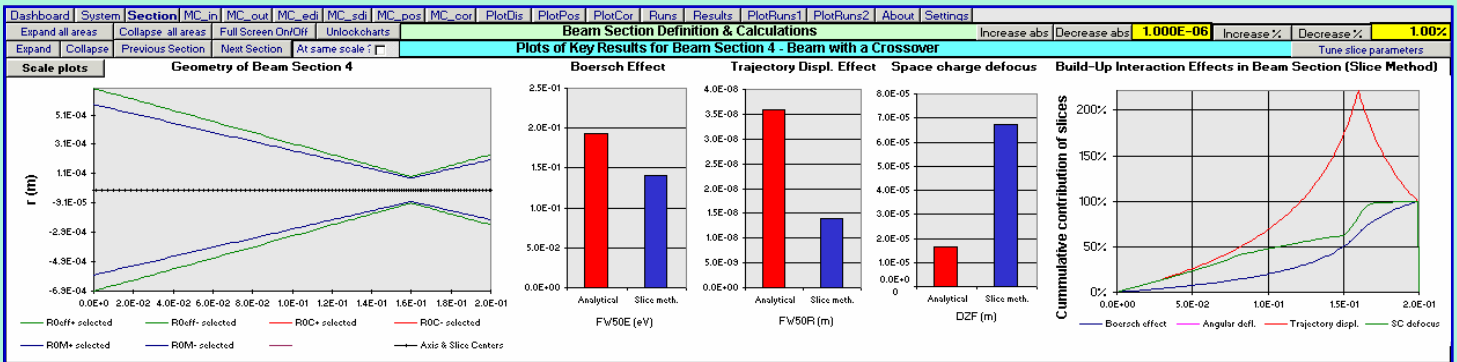


The analytical and slice method calculations are executed and stored on a per beam section basis. The total system results are derived by adding the results obtained for the different beam sections constituting the total system. Various controls are included to calculate the results for an individual beam section or for all sections in one go. The total system evaluation can be based on the analytical method only, the slice method only or a mix and match of the methods on a per beam section basis, referred to as the "selected results". In the default mode the program automatically selects the best method per beam section and the type of analytical equations used (that is the equations for a beam section with crossover or a parallel beam section). The *System* worksheet includes facilities to calculate and plot the analytical/slice method results for various user specified ranges of system input variables in order to analyze the dependency of the system performance on these parameters. The figure below shows some graphs from the *System* worksheet depicting the various contributions to the total probe size for an individual system input setting (top graphs) and as function of the beam current and beam voltage (bottom graphs).



INTERAC user interface components- Continued

Section: The *Section* worksheet provides the means to inspect the results of the analytical and slice method per beam section in more detail. The properties of the individual beam sections can be copied from the *System* worksheet. This input can be subsequently modified to analyze the dependency on the model parameters. The analytical and slice method calculations are dynamic, which means that the results are shown immediately after the input has been entered. The *Section* worksheet is used by the *System* worksheet to calculate the interaction effects in the individual beam sections. The figure below displays the top part of the *Section* worksheet with the input parameters and key results for the crossover section of the system defined in the *System* worksheet.

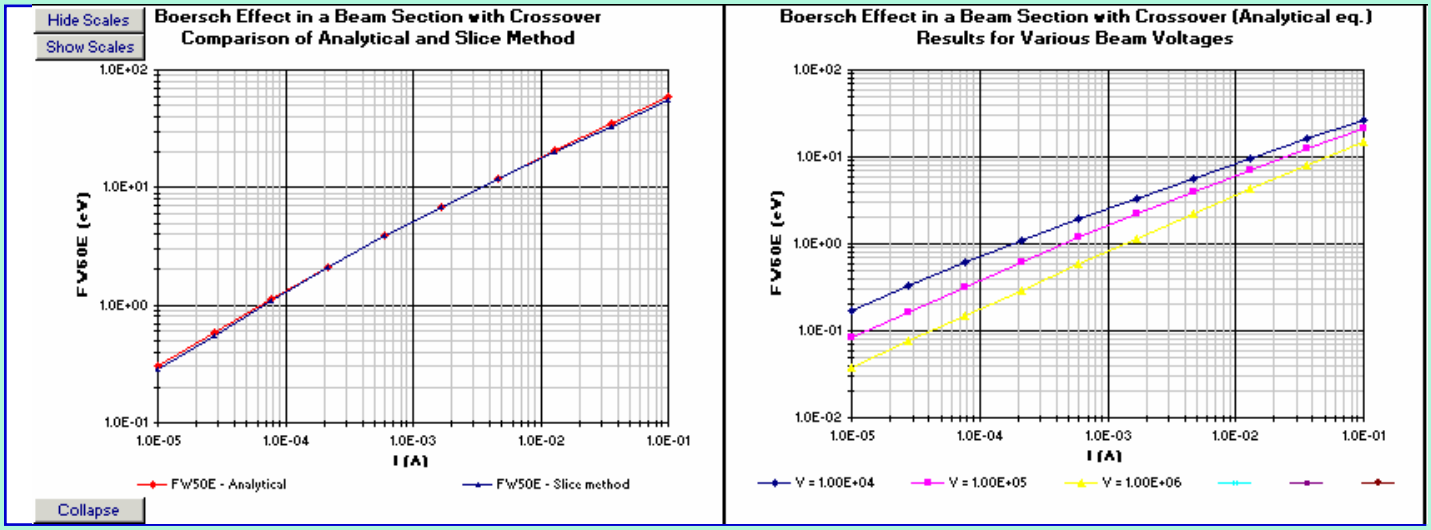


Expand | Collapse — **Plot Parameters & Key Results**

Expand | Collapse — **Beam Section 4 Input Parameters**

	Category	Description	Symbol	Unit	Input Value	Minimum	Maximum	Remarks on selected input value
Input parameters for beam section	**General beam section properties**	Beam current	I	A	4.974E-06	1.000E-15		
		Beam potential at start of section (non-relativistic)	VNR	V	1.000E+05	1.000E-15		
		Acceleration ratio Vend/Vstart (Slice method only)	VRAT	-	1.000E+00	1.000E-15		
		Beam section length	L	m	2.000E-01	1.000E-15		
		Transverse magnification from physical image plane to reference plane	TMP	-	1.000E+00	1.000E-15		
		Transverse magnification from optical image plane to reference plane	TMO	-	4.000E-12	1.000E-15		
		Beam type: (1) section with crossover, (2) parallel section	IBT	-	1	1	2	Beam section with crossover
	Input for beam section with a crossover (Input required when IBT=1)	Crossover position	SC	-	8.000E-01	-1.000E+03	1.000E+03	
		Physical image plane position	SIP	-	1.200E+00			
		Optical image plane position	SIO	-	-5.000E+10			
		Angular distribution type (1=Uniform, 2=Gauss, 3=Trunc.Gauss, 4=Square.U	IDA0	-	4	1	4	Square uniform angular distribution in crossover
		Characteristic beam semi-angle (HWHM)	A0C	Rad	3.125E-03	1.000E-15		
		Maximum beam semi-angle (HWHM, used when IDA0=3)	A0M	Rad	3.125E-03	1.000E-15		
		Spatial distribution type (1=Uniform, 2=Gauss, 3=Trunc.Gauss, 4=Square.U	IDRC	-	2	1	4	Gaussian spatial distribution in crossover
		Characteristic crossover radius (HWHM)	RCC	m	8.000E-05	1.000E-15		
		Maximum crossover radius (HWHM, used when IDRC=3)	RCM	m	8.000E-05	1.000E-15		
	Input for parallel beam section (Input required when IBT=2)	Spatial distribution type (1=Uniform, 2=Gauss, 3=Trunc.Gauss, 4=Square.U	IDR0	-		1	4	
		Characteristic beam radius (HWHM)	R0C	m		1.000E-15		
		Maximum beam radius (HWHM, used when IDR0=3)	R0M	m		1.000E-15		
		Physical distance to image plane (Focal length)	FLP	m		0.000E+00		
		Optical distance to image plane (Focal length)	FLO	m		0.000E+00		
	Relation between beam section and total system specification	Beam section number	ISEC	-	4	1	10	
		Include interaction effects in total system evaluation (1=Yes, 0=No)	INT	-	1	0	1	Interaction effects included in system calculation
		Interactions correlated to next beam section (1=Yes, 0=No)	ICOR	-	0	0	1	Interactions independent from other sections
	Model selection	(1) Use analytical formulae; (2) Use slice method	IMETH	-	1	1	2	Use analytical formulae

Ranges of results, denoted as *user curves* can be generated to assess the dependency of the Coulomb interactions effects on the beam current and beam voltage. These curves are calculated be means of control buttons and stored to the output areas on this worksheet. The data is plotted in various graphs. The figure shows some user curves depicting the the FW_{50E} energy spread generated in the crossover section as function of the beam current for different beam voltages.



INTERAC user interface components- Continued

Runs: The worksheet *Runs* facilitates the file management of all user specified MC runs. The file ID's (that is the file names minus the standard extensions) corresponding to each run are listed on this sheet and associated with a unique run-number. The top part of the *Runs* worksheet is displayed in the figure below.

Full Screen On/Off — **MC Run Jobs Specification**

MC run & series specification				System Input					MC program parameter setting			
Run no.	Series ID	DAT file minus ext. (max 10 char.)	SYS file minus ext. (max 10 char.)	I (uA)	V (10 kV)				NSAM	NSEED	DRIFTX	
1	Default	DEMO1	DEMO1	10	100				Automatic		DRIFT2	
2	D1-test	DEMO1T1	DEMO1	100	100				200	100	DRIFT2	
3	D1-test	DEMO1T2	DEMO1	100	100				500	40	DRIFT2	
4	D1-test	DEMO1T3	DEMO1	100	100				1000	20	DRIFT2	
5	D1-test	DEMO1T4	DEMO1	100	100				2000	10	DRIFT2	
6	D1-test	DEMO1T5	DEMO1	100	100				5000	4	DRIFT2	
7	D1-test	DEMO1T6	DEMO1	100	100				10000	2	DRIFT2	
8	D1-test	DEMO1T7	DEMO1	100	100				20000	1	DRIFT2	
9	D1-IS	DEMO1I1	DEMO1	1	100				Automatic		DRIFT2	
10	D1-IS	DEMO1I2	DEMO1	2	100				Automatic		DRIFT2	
11	D1-IS	DEMO1I5	DEMO1	5	100				Automatic		DRIFT2	
12	D1-IS	DEMO1I10	DEMO1	10	100				Automatic		DRIFT2	
13	D1-IS	DEMO1I20	DEMO1	20	100				Automatic		DRIFT2	
14	D1-IS	DEMO1I50	DEMO1	50	100				Automatic		DRIFT2	
15	D1-IS	DEMO1I100	DEMO1	100	100				Automatic		DRIFT2	
16	D1-VS	DEMO1V5	DEMO1	10	5				Automatic		DRIFT2	
17	D1-VS	DEMO1V10	DEMO1	10	10				Automatic		DRIFT2	
18	D1-VS	DEMO1V20	DEMO1	10	20				Automatic		DRIFT2	
19	D1-VS	DEMO1V50	DEMO1	10	50				Automatic		DRIFT2	
20	D1-VS	DEMO1V100	DEMO1	10	100				Automatic		DRIFT2	
21	D1-VS	DEMO1V200	DEMO1	10	200				Automatic		DRIFT2	
22	D1-IS-D1	DEMO1I1D	DEMO1D1	1	100				Automatic		DRIFT1	
23	D1-IS-D1	DEMO1I10D	DEMO1D1	10	100				Automatic		DRIFT1	
24	D1-IS-D1	DEMO1I100D	DEMO1D1	100	100				Automatic		DRIFT1	

MC-out: The data read from the various MC input and output files can be imported by INTERAC and is stored in the worksheets *MC_in* (*'.DAT'* and *'.SYS'* files containing the system and MC parameters input data), *MC_out* (*'.OUT'* file containing the general output data), *MC_edi* (*'.EDI'* file containing the energy distributions at the target), *MC_sdi* (*'.SDI'* file containing the spatial distributions in the selected reference planes), *MC_pos* (*'.POS'* file containing the lateral particle positions in the selected reference planes) and *MC_cor* (*'.COR'* file containing the complete phase-space co-ordinates of all particles near the target). The figure below shows a selection of the data stored in the *MC_out* worksheet. This worksheet provides the main results from an individual MC run and compares it to the corresponding results obtained from the selected analytical method.

Full Screen On/Off | Expand | Collapse — **Data from MC OUT General Output File: DEMO1.OUT and Comparison with Analytical Results**

Data extracted from MC OUT Input file: DEMO1.OUT					Selected analytical results	
Category	Variable description	Identifier	Unit	Value	Value	Rel.dif: (MC-A)/MC
Beam properties	Source type (1=Round, 2=Rectangular, 3=Multi, 4= Multi test)	ISRC	-	1		
	Final spot shape (1=round, 2= rectangular, 3=both RNDTBR and RECTBR us	IFSSHP	-	2		
	Final energy dis. shape (1=sym, 2= asy, 3=both SYMEBR and ASYEBR used	IFESHP	-	1		
	Axial coordinate of source	Z0	m	0.000E+00	0.000E+00	
	Axial coordinate end of last DRIFT section	ZT	m	7.200E-01	7.200E-01	0.0%
	Beam curren at source	ISOURCE	A	1.000E-05	1.000E-05	0.0%
	Beam curren through last aperture	ITARGET	A	5.000E-06	4.974E-06	0.5%
	Beam voltage at source	VSOURCE	V	1.000E+05	1.000E+05	0.0%
	Beam voltage in last DRIFT section	VTARGET	V	1.000E+05	1.000E+05	0.0%
MONTEC parameters	No particles in the sample at the source	NSAM-source	-	1,700		
	No particles in the sample at the target	NSAM-target	-	850		
	Total no. particles at the target	NTOT-target	-	5,101		
	Relative statistical error in FW50R - TBR	SE-FW50R	-	6.52%		
	Relative statistical error in FW50E - EBR	SE-FW50E	-	6.24%		
	PROCCO used (1=Yes,0=No)	IPROCCO	-	1		
	Reduction in FW50E through PROCCO	FSEFW50E	-	0.84%		
Energy broadening (Boersch effect and	FWHM energy distribution	FWHME	eV	1.087E+00	1.057E+00	2.9%
	FW50 energy distribution	FW50E	eV	6.286E-01	6.161E-01	2.0%
Spatial broadening (Trajectory displacement effect)	FWHM displacement distribution	FWHMR	m	3.015E-08	3.051E-08	-1.2%
	Average FWHM displ. Distr. in X and Y direction	(FWHMX+FWHMY)/2	m	3.561E-08		
	FW50 displacement distribution	FW50R	m	3.868E-08	4.568E-08	-15.3%
Space charge effects	Axial coordinate of reference plane used in TBR/RNDTBR/RECTBR	ZREF	m	7.200E-01	7.200E-01	0.0%
	Axial defocus	DZF	m	1.833E-05	2.079E-05	-11.8%
Total spot resolution	FWHM of final spot	FWHMR	m		3.404E-08	
	Average FWHM of final spot in X and Y direction	(FWHMX+FWHMY)/2	m	2.437E-04		
	FW50 of final spot	FW50R	m		4.881E-08	
	D1288 edge width	d1288R	m	0.000E+00	5.409E-08	-100.0%
	D2575 edge width	d2575R	m	1.881E-06	2.809E-08	6596.3%

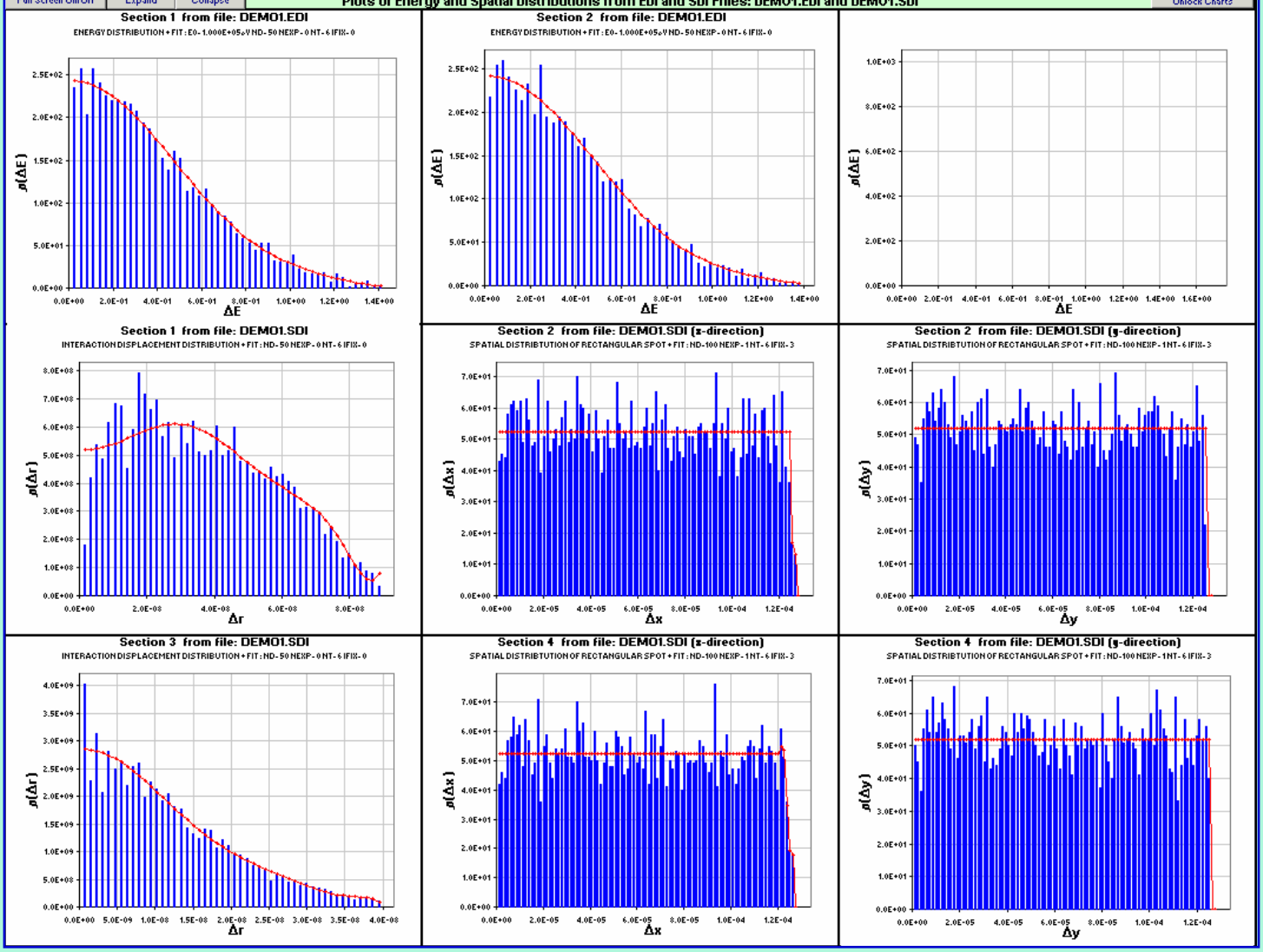
INTERAC user interface components- Continued

MC_edi, MC_sdi and PlotDis: The energy and spatial distributions evaluated by Monte Carlo simulation can be imported by INTERAC and are stored in the worksheets *MC_edi* and *MC_sdi*. These results are plotted in the worksheet *PlotDis.* The figures below show a part of the data listed in the *MC_edi* worksheet and the graphical representation of the distributions from the worksheet *PlotDis* respectively.

Full Screen On/Off | Expand | Collapse | **Data from MC EDI Energy Distribution File: DEMO1.EDI**

Section 1			Section 2		
ΔE	ρ(ΔE)	$\rho(\Delta E)^{fit}$	ΔE	ρ(ΔE)	$\rho(\Delta E)^{fit}$
2.8237E-02	2.3500E+02	2.4298E+02	2.7603E-02	2.1800E+02	2.4176E+02
5.6474E-02	2.5700E+02	2.4211E+02	5.5207E-02	2.5400E+02	2.4092E+02
8.4711E-02	2.0400E+02	2.4037E+02	8.2810E-02	2.5900E+02	2.3925E+02
1.1295E-01	2.5700E+02	2.3779E+02	1.1041E-01	2.4100E+02	2.3675E+02
1.4119E-01	2.4100E+02	2.3439E+02	1.3802E-01	2.2600E+02	2.3346E+02
1.6942E-01	2.2600E+02	2.3020E+02	1.6562E-01	2.1400E+02	2.2941E+02
1.9766E-01	2.2000E+02	2.2527E+02	1.9322E-01	2.3200E+02	2.2463E+02
2.2590E-01	2.2100E+02	2.1964E+02	2.2083E-01	1.9700E+02	2.1917E+02
2.5413E-01	2.1900E+02	2.1336E+02	2.4843E-01	2.5400E+02	2.1308E+02
2.8237E-01	2.1600E+02	2.0650E+02	2.7603E-01	1.9500E+02	2.0641E+02
3.1061E-01	2.0700E+02	1.9913E+02	3.0364E-01	1.8700E+02	1.9923E+02
3.3884E-01	1.9300E+02	1.9130E+02	3.3124E-01	1.9500E+02	1.9160E+02
3.6708E-01	1.8700E+02	1.8310E+02	3.5884E-01	1.8900E+02	1.8359E+02
3.9532E-01	1.7600E+02	1.7459E+02	3.8645E-01	1.7400E+02	1.7526E+02
4.2356E-01	1.5200E+02	1.6585E+02	4.1405E-01	1.6000E+02	1.6669E+02
4.5179E-01	1.3900E+02	1.5696E+02	4.4165E-01	1.7000E+02	1.5795E+02
4.8003E-01	1.6000E+02	1.4799E+02	4.6926E-01	1.5000E+02	1.4910E+02
5.0827E-01	1.5200E+02	1.3901E+02	4.9686E-01	1.4300E+02	1.4022E+02
5.3650E-01	1.1400E+02	1.3010E+02	5.2446E-01	1.1900E+02	1.3137E+02
5.6474E-01	1.1800E+02	1.2131E+02	5.5207E-01	1.2100E+02	1.2261E+02
5.9298E-01	1.0800E+02	1.1271E+02	5.7967E-01	1.1900E+02	1.1401E+02
6.2121E-01	1.1600E+02	1.0435E+02	6.0727E-01	1.2200E+02	1.0561E+02
6.4945E-01	9.7000E+01	9.6286E+01	6.3488E-01	8.8000E+01	9.7475E+01
6.7769E-01	9.0000E+01	8.8555E+01	6.6248E-01	8.1000E+01	8.9639E+01
7.0592E-01	8.5000E+01	8.1192E+01	6.9008E-01	6.8000E+01	8.2142E+01
7.3416E-01	7.7000E+01	7.4227E+01	7.1769E-01	7.8000E+01	7.5012E+01
7.6240E-01	6.3000E+01	6.7678E+01	7.4529E-01	6.9000E+01	6.8276E+01

Full Screen On/Off | Expand | Collapse | **Plots of Energy and Spatial Distributions from EDI and SDI Files: DEMO1.EDI and DEMO1.SDI** | Unlock Charts



INTERAC user interface components- Continued

MC_pos and PlotPos: The data from the MC *'.POS'* output file containing the lateral particle positions in selected reference planes near the target can be imported by INTERAC and is stored in the worksheet *MC_pos*. This data is plotted in the worksheet *PlotPos.* The figures below show a part of the data listed in the *MC_pos* worksheet and the corresponding plots in the worksheet *PlotPos* respectively. The blue dots refer to the unperturbed particle positions (without Coulomb interactions) and the red dots to the perturbed particle positions (with Coulomb interactions). The figure on the right hand side shows the displacements from the unperturbed positions and the figure on the left hand side and in the middle represent the actual spot without and with Coulomb interactions respectively.

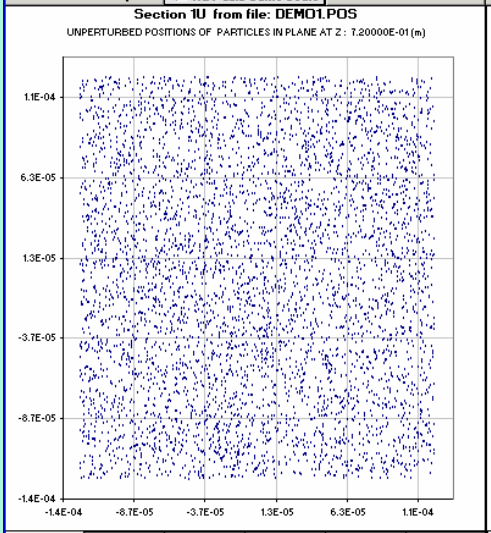
Full Screen On/Off | Expand | Collapse | **Data from MC POS (X,Y) Positions File: DEMO1.POS**

Storage							
Section 1				Section 2			
Xperturbed	Yperturbed	Xunperturbed	Yunperturbed	Xperturbed	Yperturbed	Xunperturbed	Yunperturbed
-3.0772E-05	-1.0260E-04	-3.0739E-05	-1.0263E-04	-3.0767E-05	-1.0261E-04	-3.0735E-05	-1.0264E-04
-1.7141E-05	3.2083E-05	-1.7160E-05	3.2089E-05	-1.7156E-05	3.2079E-05	-1.7174E-05	3.2084E-05
-1.0573E-04	-6.1540E-05	-1.0571E-04	-6.1556E-05	-1.0569E-04	-6.1555E-05	-1.0567E-04	-6.1571E-05
1.4170E-05	-5.7728E-05	1.4177E-05	-5.7767E-05	1.4176E-05	-5.7764E-05	1.4183E-05	-5.7802E-05
-9.6991E-05	1.0032E-04	-9.7039E-05	1.0031E-04	-9.7045E-05	1.0030E-04	-9.7093E-05	1.0028E-04
-1.2491E-04	-4.9495E-05	-1.2491E-04	-4.9540E-05	-1.2487E-04	-4.9569E-05	-1.2487E-04	-4.9615E-05
-2.1453E-05	-5.1536E-05	-2.1507E-05	-5.1527E-05	-2.1494E-05	-5.1517E-05	-2.1548E-05	-5.1508E-05
-2.9503E-06	3.4079E-05	-2.9415E-06	3.4153E-05	-2.9498E-06	3.4149E-05	-2.9411E-06	3.4223E-05
-1.2236E-04	1.1835E-04	-1.2235E-04	1.1838E-04	-1.2233E-04	1.1834E-04	-1.2232E-04	1.1837E-04
-1.1918E-04	-4.4966E-05	-1.1924E-04	-4.5003E-05	-1.1921E-04	-4.4988E-05	-1.1927E-04	-4.5025E-05
-1.2474E-04	-7.4467E-05	-1.2474E-04	-7.4461E-05	-1.2472E-04	-7.4458E-05	-1.2472E-04	-7.4452E-05
-2.4053E-05	6.4314E-06	-2.4099E-05	6.4948E-06	-2.4059E-05	6.4545E-06	-2.4105E-05	6.5178E-06
-1.0436E-04	-1.7194E-05	-1.0435E-04	-1.7179E-05	-1.0435E-04	-1.7180E-05	-1.0434E-04	-1.7165E-05
-8.4723E-05	6.1992E-06	-8.4755E-05	6.2094E-06	-8.4734E-05	6.2085E-06	-8.4766E-05	6.2187E-06
-2.3663E-05	7.4008E-05	-2.3660E-05	7.3977E-05	-2.3660E-05	7.3968E-05	-2.3657E-05	7.3936E-05
-1.0418E-04	-1.0998E-04	-1.0423E-04	-1.1000E-04	-1.0421E-04	-1.0998E-04	-1.0426E-04	-1.1001E-04
-7.5938E-05	5.2869E-05	-7.5948E-05	5.2871E-05	-7.5948E-05	5.2879E-05	-7.5958E-05	5.2881E-05
-8.6323E-05	-1.1276E-04	-8.6307E-05	-1.1278E-04	-8.6305E-05	-1.1275E-04	-8.6289E-05	-1.1277E-04
-4.8225E-05	-1.9788E-05	-4.8152E-05	-1.9832E-05	-4.8199E-05	-1.9811E-05	-4.8126E-05	-1.9856E-05
-4.0554E-05	1.2161E-04	-4.0586E-05	1.2169E-04	-4.0563E-05	1.2163E-04	-4.0594E-05	1.2171E-04
5.7642E-05	4.1443E-05	5.7615E-05	4.1488E-05	5.7607E-05	4.1489E-05	5.7580E-05	4.1534E-05
6.0562E-05	3.1672E-05	6.0582E-05	3.1640E-05	6.0557E-05	3.1641E-05	6.0577E-05	3.1609E-05
-1.2942E-05	-1.0677E-04	-1.2941E-05	-1.0681E-04	-1.2934E-05	-1.0679E-04	-1.2933E-05	-1.0682E-04
-3.1120E-05	-7.5754E-05	-3.1086E-05	-7.5823E-05	-3.1095E-05	-7.5797E-05	-3.1061E-05	-7.5866E-05
-1.2263E-04	1.2025E-04	-1.2266E-04	1.2023E-04	-1.2263E-04	1.2019E-04	-1.2266E-04	1.2017E-04
2.8074E-05	9.7785E-05	2.8078E-05	9.7837E-05	2.8064E-05	9.7742E-05	2.8068E-05	9.7795E-05
6.2724E-06	7.7633E-05	6.2587E-06	7.7610E-05	6.2604E-06	7.7623E-05	6.2466E-06	7.7599E-05
-4.9097E-05	1.1033E-04	-4.9041E-05	1.1038E-04	-4.9064E-05	1.1036E-04	-4.9008E-05	1.1041E-04
-1.1007E-06	-5.1197E-05	-1.0620E-06	-5.1251E-05	-1.0815E-06	-5.1226E-05	-1.0428E-06	-5.1281E-05
1.3668E-05	1.1240E-04	1.3616E-05	1.1241E-04	1.3601E-05	1.1239E-04	1.3549E-05	1.1240E-04
9.9566E-05	9.0930E-05	9.9613E-05	9.0938E-05	9.9579E-05	9.0916E-05	9.9626E-05	9.0924E-05
-9.7673E-05	-5.8757E-06	-9.7679E-05	-5.8900E-06	-9.7665E-05	-5.8926E-06	-9.7671E-05	-5.9068E-06
7.8001E-05	-1.0205E-04	7.8044E-05	-1.0210E-04	7.8040E-05	-1.0205E-04	7.8083E-05	-1.0210E-04

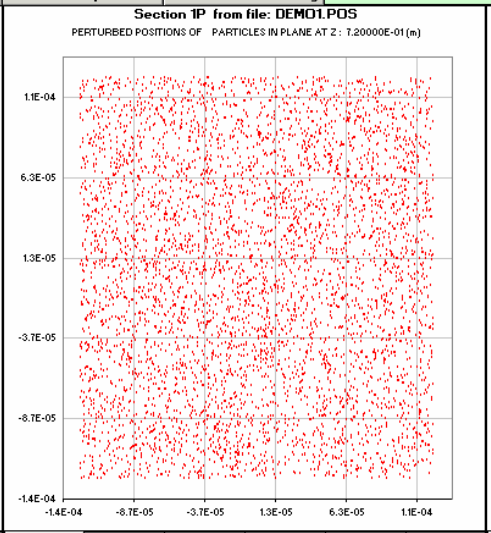
Dashboard | System | Section | MC_in | MC_out | MC_edi | MC_sdi | MC_pos | MC_cor | PlotDis | **PlotPos** | PlotCor | Runs | Results | PlotRuns1 | PlotRuns2 | About | Settings

Full Screen On/Off | Expand | Collapse | **Plots of Positions from POS File: DEMO1.POS** | Unlock Charts

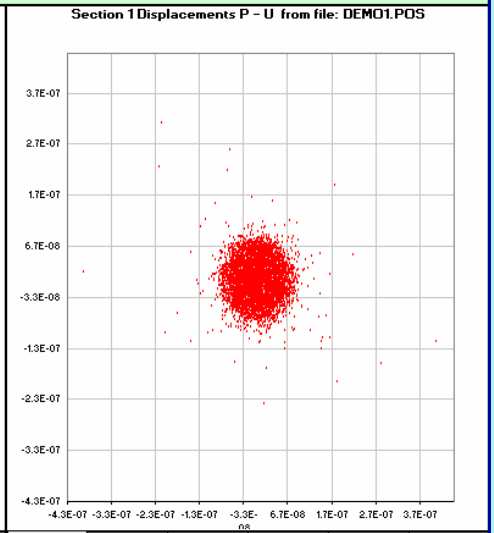
Same scale similar plots: ☑ X&Y axis same scale | Fix current scale | Scale all plots | Reset automatic scaling



Scale plot	Min scale	Max scale	Margin %	Min data	Max data
X	-1.37E-04	1.37E-04	5%	-1.250E-04	1.250E-04
Y	-1.37E-04	1.37E-04	5%	-1.250E-04	1.247E-04



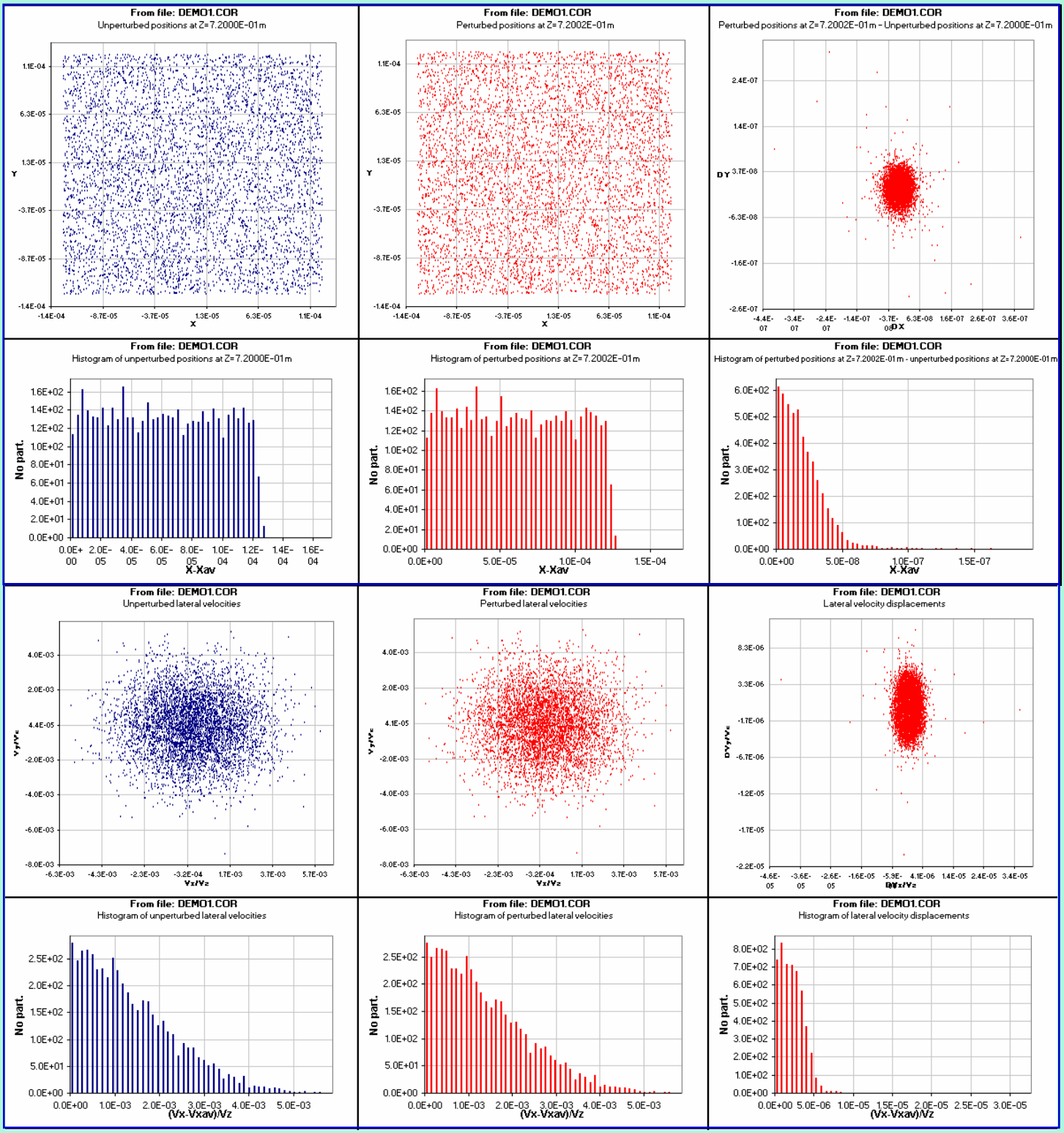
Scale plot	Min scale	Max scale	Margin %	Min data	Max data
X	-1.37E-04	1.37E-04	5%	-1.249E-04	1.250E-04
Y	-1.37E-04	1.37E-04	5%	-1.249E-04	1.248E-04



Scale plot	Min scale	Max scale	Margin %	Min data	Max data
X	-4.33E-07	4.45E-07	5%	-3.929E-07	4.054E-07
Y	-4.33E-07	4.45E-07	5%	-2.419E-07	3.094E-07

INTERAC user interface components- Continued

MC_cor and PlotCor: The data from the MC '*.COR*' output file containing the complete phase-space co-ordinates of all particles near the target can be imported by INTERAC and is stored in the worksheet *MC_cor*. This data is plotted in the worksheet *PlotCor.* The figures below show some of the graphs from the worksheet *PlotCor*. The blue dots and lines refer to the unperturbed particle co-ordinates (without Coulomb interactions) and the red dots an lines to the perturbed particle co-ordinates (with Coulomb interactions). The figures in the third column represent the displacements from the unperturbed co-ordinates, whereas the figures in the first and second column pertain to the actual co-ordinates without and with Coulomb interactions respectively.



INTERAC user interface components- Continued

Results: The results of the various MC and analytical calculations are stored in the worksheet *Results* using the run-number as the primary key. Some of the data stored in the *Results* worksheet is displayed in the figure below. This data can be selected to generate the graphs in the *PlotRuns1* and *PlotRuns2,* which are shown on the next page.

Dashboard | System | Section | MC_in | MC_out | MC_edi | MC_sdi | MC_pos | MC_cor | PlotDis | PlotPos | PlotCor | Runs | **Results** | PlotRuns1 | PlotRuns2 | About | Settings

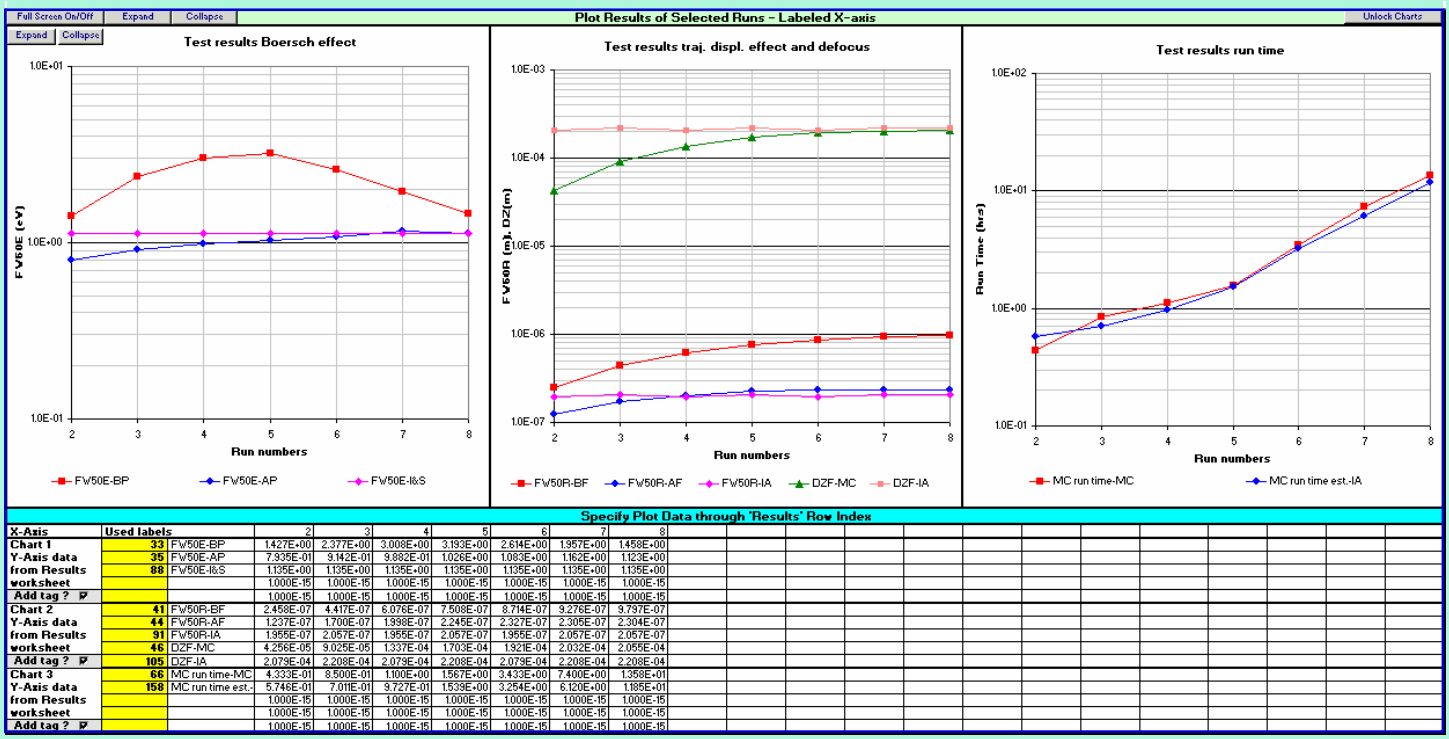
Full Screen | Expand | Collapse | Zoom | **MC Run Output Storage**

Parameter specification				Selected run on dashboard	Selected memory entry	Results Storage (Memory entries 1 - 200) ==========>		
						1	2	3
Specification		Selected run	1	Run: 1	Memory entry: 30	Run: 1	Run: 2	Run: 3
	Y	Selected memory	30	Series: Default	Series: Systems	Series: Default	Series: D1-test	Series: D1-test
		First memory entry	1	DEMO1.DAT	JEOL.DAT	DEMO1.DAT	DEMO1T1.DAT	DEMO1T2.DAT
	Y	Last memory entry	30	DEMO1.SYS	JEOL.SYS	DEMO1.SYS	DEMO1.SYS	DEMO1.SYS

Results read from	Row	Symbol	Tag	Unit					
Beam properties	1	ISRC	-MC	-	1	1	1	1	1
	2	IFSSHP	-MC	-	2	1	2	2	2
	3	IFESHP	-MC	-	1	1	1	1	1
	4	Z0	-MC	m	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	5	ZT	-MC	m	7.200E-01	3.810E-01	7.200E-01	7.200E-01	7.200E-01
	6	ISOURCE	-MC	A	1.000E-05	1.000E-05	1.000E-05	1.000E-04	1.000E-04
	7	ITARGET	-MC	A	5.000E-06	1.620E-09	5.000E-06	5.000E-05	5.000E-05
	8	VSOURCE	-MC	V	1.000E+05	5.000E+03	1.000E+05	1.000E+05	1.000E+05
	9	VTARGET	-MC	V	1.000E+05	5.000E+04	1.000E+05	1.000E+05	1.000E+05
MONTEC parameters	10	NSAM-source	-MC	-	1,700	500,000	1,700	200	500
	11	NSAM-target	-MC	-	850	81	850	100	250
	12	NTOT-target	-MC	-	5,101	1,056	5,101	9,995	9,990
	26	SE-FW50R	-MC	-	6.52%	26.54%	6.52%	2.71%	2.83%
	27	SE-FW50E	-MC	-	6.24%	12.83%	6.24%	4.56%	3.58%
	28	IPROCCO	-MC	-	1	1	1	1	1
	29	FSEFW50E	-MC	-	0.84%	0.19%	0.84%	44.41%	61.55%
MONTEC Interaction	30	FWHME	-MC	eV	1.087E+00	3.953E-01	1.087E+00	1.360E+00	1.568E+00
	31	FW50E	-MC	eV	6.286E-01	3.518E-01	6.286E-01	7.935E-01	9.142E-01
	36	FWHMR	-MC	m	3.015E-08	8.431E-10	3.015E-08	1.057E-07	1.415E-07
	37	(FWHMX+FWHMY)/2	-MC	m	3.561E-08	1.429E-09	3.561E-08	1.128E-07	1.602E-07
	38	FW50R	-MC	m	3.868E-08	2.471E-09	3.868E-08	1.237E-07	1.700E-07
	45	ZREF	-MC	m	7.200E-01	3.810E-01	7.200E-01	7.200E-01	7.200E-01
	46	DZF	-MC	m	1.833E-05	-5.059E-09	1.833E-05	4.256E-05	9.025E-05
	47	TM-1	-MC	-					
	48	CS	-MC	m	N.A.	N.A.	N.A.	N.A.	N.A.
MONTEC total spot resolution	49	FWHMR	-MC	m		5.101E-06			
	50	(FWHMX+FWHMY)/2	-MC	m	2.497E-04	5.701E-06	2.497E-04	0.000E+00	0.000E+00
	51	FW50R	-MC	m		1.034E-05			
	52	d1288R	-MC	m	0.000E+00		0.000E+00	0.000E+00	0.000E+00
	53	d2575R	-MC	m	1.881E-06		1.881E-06	0.000E+00	0.000E+00
	54	FWHMR	-BF	m		5.102E-06			
MONTEC calculation time	64	Start time	-MC	date and time	11:52:31 ON 27/ 1/2004	15: 4:58 ON 27/ 1/2004	11:52:31 ON 27/ 1/2004	16:26: 5 ON 26/ 1/2004	16:26:13 ON 26/ 1/2004
	65	End time	-MC	date and time	11:52:47 ON 27/ 1/2004	18:18:59 ON 27/ 1/2004	11:52:47 ON 27/ 1/2004	16:26:13 ON 26/ 1/2004	16:26:28 ON 26/ 1/2004
	66	MC run time	-MC	min	2.667E-01	1.940E+02	2.667E-01	1.333E-01	2.500E-01
Results from anal	**Row**	**Symbol**	**Tag**	**Unit**					
INTERAC beam properties at the target	68	Itarget	-IA	A	4.974E-06	1.603E-09	4.974E-06	4.974E-05	4.974E-05
	69	Vtarget	-IA	V	1.000E+05	5.000E+04	1.000E+05	1.000E+05	1.000E+05
	70	Lsystem	-IA	m	7.200E-01	3.810E-01	7.200E-01	7.200E-01	7.200E-01
INTERAC Interaction effects	78	FWHME	-IA	eV	3.238E-01	1.995E-02	3.238E-01	1.448E+00	1.448E+00
	79	FW50E	-IA	eV	2.169E-01	1.620E-02	2.169E-01	9.536E-01	9.536E-01
	80	GamEffE	-IA	-	1.530E+00	1.239E+00	1.530E+00	1.605E+00	1.605E+00
	87	FWHME	-I&S	eV	1.057E+00	3.938E-01	1.057E+00	1.804E+00	1.804E+00
	88	FW50E	-I&S	eV	6.161E-01	3.898E-01	6.161E-01	1.135E+00	1.135E+00
	89	GamEffE	-I&S	-	1.847E+00	1.011E+00	1.847E+00	1.730E+00	1.730E+00
	90	FWHMR	-IA	m	3.051E-08	4.740E-11	3.051E-08	1.605E-07	1.605E-07
	91	FW50R	-IA	m	4.568E-08	6.500E-11	4.568E-08	1.955E-07	1.955E-07
	92	d1288R	-IA	m	5.041E-08	7.244E-11	5.041E-08	2.102E-07	2.102E-07
	93	d2575R	-IA	m	2.659E-08	3.790E-11	2.659E-08	1.135E-07	1.135E-07
	94	GamEffT	-IA	-	1.222E+00	9.739E-01	1.222E+00	1.283E+00	1.283E+00
	105	DZF	-IA	m	2.079E-05	6.309E-10	2.079E-05	2.079E-04	2.079E-04
	106	M-1	-IA	-	-6.150E-05	-1.886E-06	-6.150E-05	-6.189E-04	-6.189E-04
	107	CS	-IA	m/Rad^3	0.000E+00	1.855E-21	0.000E+00	0.000E+00	0.000E+00
INTERAC total spot resolution	114	FWHM-Gauss	-IA	m	0.000E+00	5.633E-07	0.000E+00	0.000E+00	0.000E+00
	115	FWHM-Airy	-IA	m	9.372E-10	4.521E-11	9.372E-10	9.372E-10	9.372E-10
	116	FWHM-SpherAb	-IA	m	7.099E-09	5.260E-05	7.099E-09	7.099E-09	7.099E-09
	117	FWHM-ChromAbSrc	-IA	m	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	118	FWHM-ChromAbBE	-IA	m	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	119	FWHM-TD	-IA	m	3.051E-08	4.740E-11	3.051E-08	1.605E-07	1.605E-07
	120	FWHM-DefocucSC	-IA	m	1.000E-15	7.876E-11	1.000E-15	1.000E-15	1.000E-15
	121	FWHM-SpherAbSC	-IA	m	0.000E+00	1.396E-25	0.000E+00	0.000E+00	0.000E+00
	122	FWHM-TotalGeom	-IA	m	7.288E-09	5.271E-05	7.288E-09	7.288E-09	7.288E-09
	123	FWHM-TotalInter	-IA	m	3.052E-08	7.663E-10	3.052E-08	1.605E-07	1.605E-07
	124	FWHM-Total	-IA	m	3.404E-08	5.271E-05	3.404E-08	1.627E-07	1.627E-07
	125	FW50-Gauss	-IA	m	0.000E+00	3.983E-07	0.000E+00	0.000E+00	0.000E+00
	126	FW50-Airy	-IA	m	9.743E-10	4.699E-11	9.743E-10	9.743E-10	9.743E-10
	127	FW50-SpherAb	-IA	m	7.099E-09	5.260E-05	7.099E-09	7.099E-09	7.099E-09

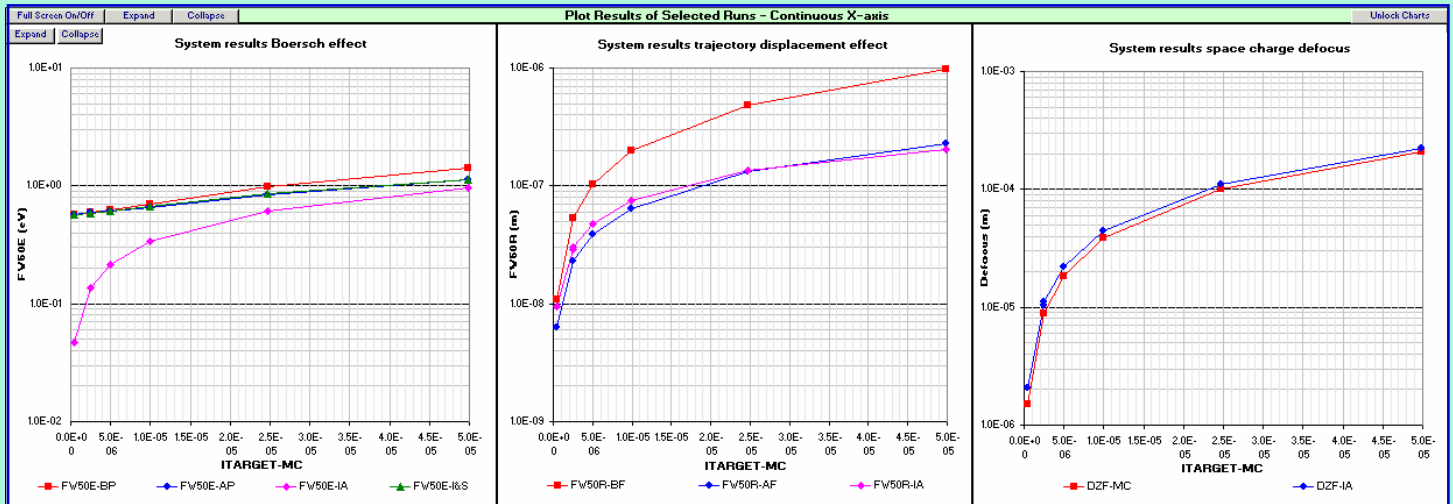
INTERAC user interface components- Continued

PlotRuns1 and PlotRuns2: The results of the various MC and analytical calculations are stored in the worksheet *Results* using the run-number as the primary key. The worksheets *PlotRuns1* and *PlotRuns2* provide the capability to compare selected results from different runs, as shown in the figures below.



Specify Plot Data through 'Results' Row Index

X-Axis	Used labels								
Chart 1	33	FW50E-BP	1.427E+00	2.377E+00	3.008E+00	3.193E+00	2.614E+00	1.957E+00	1.458E+00
Y-Axis data	35	FW50E-AP	7.935E-01	9.142E-01	9.882E-01	1.026E+00	1.083E+00	1.162E+00	1.123E+00
from Results	88	FW50E-I&S	1.135E+00	1.135E+00	1.135E+00	1.135E+00	1.135E+00	1.135E+00	1.135E+00
worksheet			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Add tag ?			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Chart 2	41	FW50R-BF	2.458E-07	4.417E-07	6.076E-07	7.508E-07	8.714E-07	9.276E-07	9.797E-07
Y-Axis data	44	FW50R-AF	1.237E-07	1.700E-07	1.998E-07	2.245E-07	2.327E-07	2.305E-07	2.304E-07
from Results	91	FW50R-IA	1.955E-07	2.057E-07	1.955E-07	2.057E-07	1.955E-07	2.057E-07	2.057E-07
worksheet	46	DZF-MC	4.256E-05	9.025E-05	1.337E-04	1.703E-04	1.921E-04	2.032E-04	2.055E-04
Add tag ?	105	DZF-IA	2.079E-04	2.208E-04	2.079E-04	2.208E-04	2.079E-04	2.208E-04	2.208E-04
Chart 3	66	MC run time-MC	4.333E-01	8.500E-01	1.100E+00	1.567E+00	3.432E+00	7.400E+00	1.359E+01
Y-Axis data	158	MC run time est.-	5.746E-01	7.011E-01	9.727E-01	1.539E+00	3.254E+00	6.120E+00	1.185E+01
from Results			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
worksheet			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Add tag ?			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15



Specify Plot Data through 'Results' Row Index

X-Axis	Used:	ITARGET-MC	5.000E-07	2.500E-06	2.500E-06	4.988E-06	9.973E-06	2.465E-05	4.989E-05
Chart 1	33	FW50E-BP	5.692E-01	5.931E-01	5.931E-01	6.242E-01	6.950E-01	9.908E-01	1.421E+00
Y-Axis data	35	FW50E-AP	5.684E-01	5.927E-01	5.927E-01	6.127E-01	6.598E-01	8.483E-01	1.120E+00
from Results	79	FW50E-IA	4.738E-02	1.376E-01	1.376E-01	2.169E-01	3.408E-01	6.145E-01	9.536E-01
worksheet	88	FW50E-I&S	5.748E-01	5.901E-01	5.901E-01	6.161E-01	6.755E-01	8.588E-01	1.135E+00
Add tag ?			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Chart 2	41	FW50R-BF	1.093E-08	5.337E-08	5.337E-08	1.033E-07	2.008E-07	4.879E-07	9.821E-07
Y-Axis data	44	FW50R-AF	6.321E-09	2.298E-08	2.298E-08	3.860E-08	6.442E-08	1.309E-07	2.300E-07
from Results	91	FW50R-IA	9.401E-09	2.894E-08	3.051E-08	4.807E-08	7.509E-08	1.339E-07	2.057E-07
worksheet			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Add tag ?			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Chart 3	46	DZF-MC	1.515E-06	8.870E-06	8.870E-06	1.836E-05	3.884E-05	1.001E-04	2.101E-04
Y-Axis data	105	DZF-IA	2.079E-06	1.040E-05	1.104E-05	2.208E-05	4.416E-05	1.104E-04	2.208E-04
from Results			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
worksheet			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15
Add tag ?			1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15	1.000E-15

Prices

The MonTec Particle Optics Simulation Tools package is brought to the market by Caneval BV. The complete package includes the INTERAC and MC run time program versions. For users who want to run the MC program as a stand-alone application, the MC run time version can be ordered separately. The FORTRAN source code of the MC program is not included in the standard licenses, but can be ordered at an additional charge.

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The table below gives the prices for the different licenses.

All prices in Euro	MonTec complete package: INTERAC and MC run time version	Monte Carlo Simulation program MC run time version	Additional charge for Monte Carlo Simulation program MC source code
Commercial license	**7,000**	**5,000**	**10,000**
Educational license	**3,500**	**2,500**	**5,000**

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See the MonTec License Agreement for additional terms and conditions

Further information

For further information on the software provided by MonTec or for ordering the software, please send an email to montec@caneval.com