New features of LISE^{++} Monte Carlo calculations

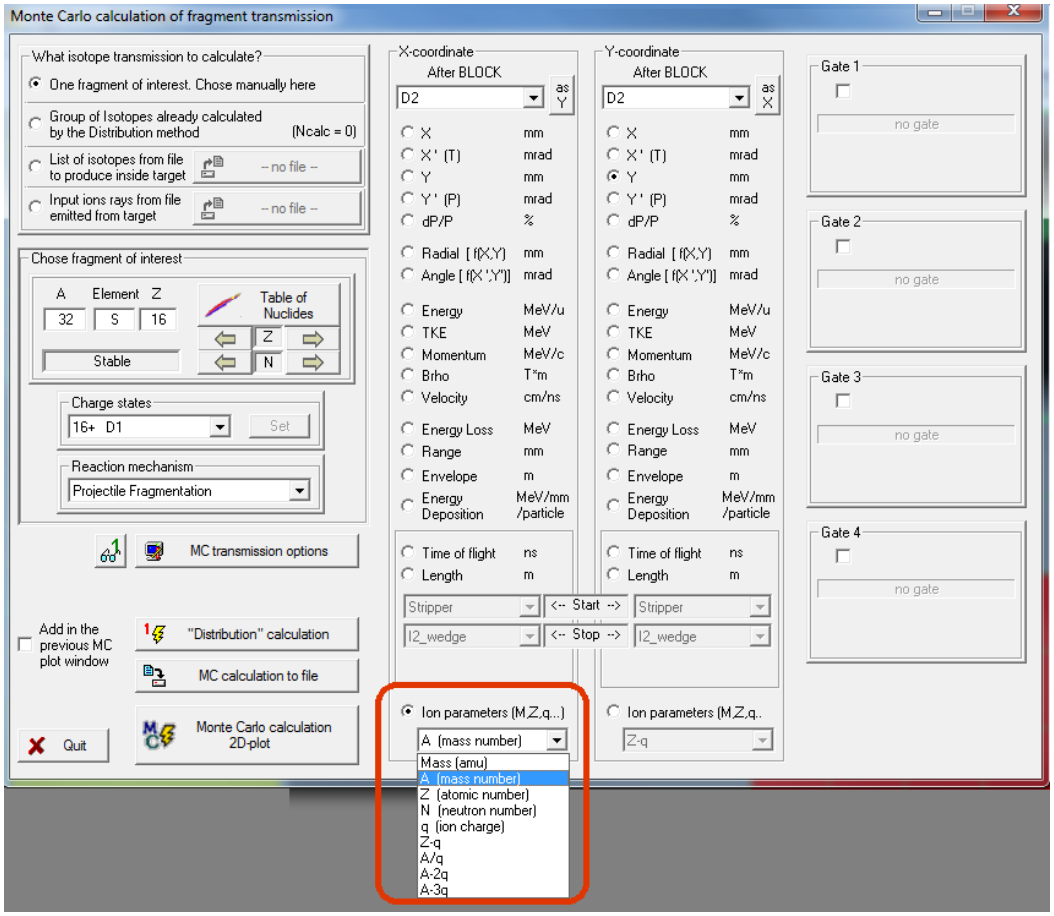
v.9.6.25
from 04/17/13

- **9.6.19 04/09/13 New A, Z, q, A/q, … fields and filters in MC**
- **9.6.20 04/10/13 MC gate optimization; creation of local checkpoints filters**
- **9.6.21 04/11/13 Several locations for output MC file**
- **9.6.23 04/16/13 Input ions rays from file emitted from target in MC mode**

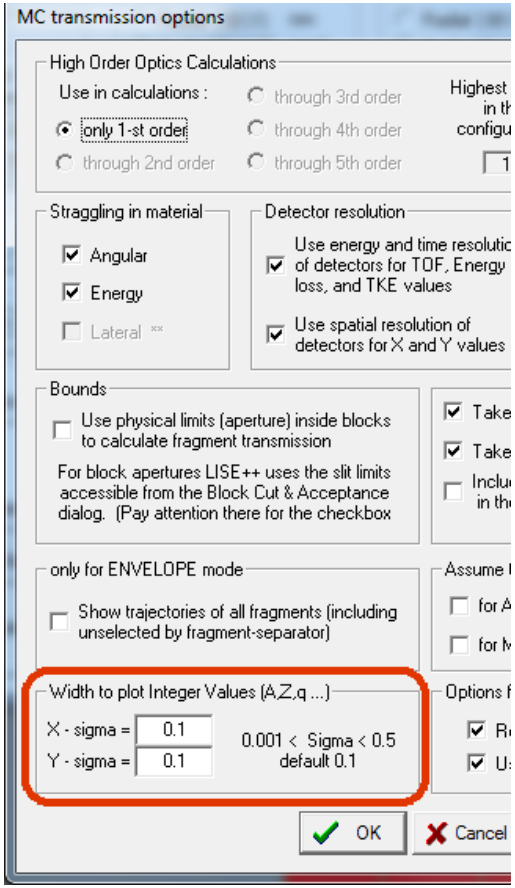
- **Easy way to change the charge state option**
- **LISE for Excel – Mas OC version**
- **Recommendations for 9.6 beta version use @ NSCL**
- **LISE++ perspectives: current status**

New A, Z, q, A/q, … fields and filters in MC (1)

MC dialog

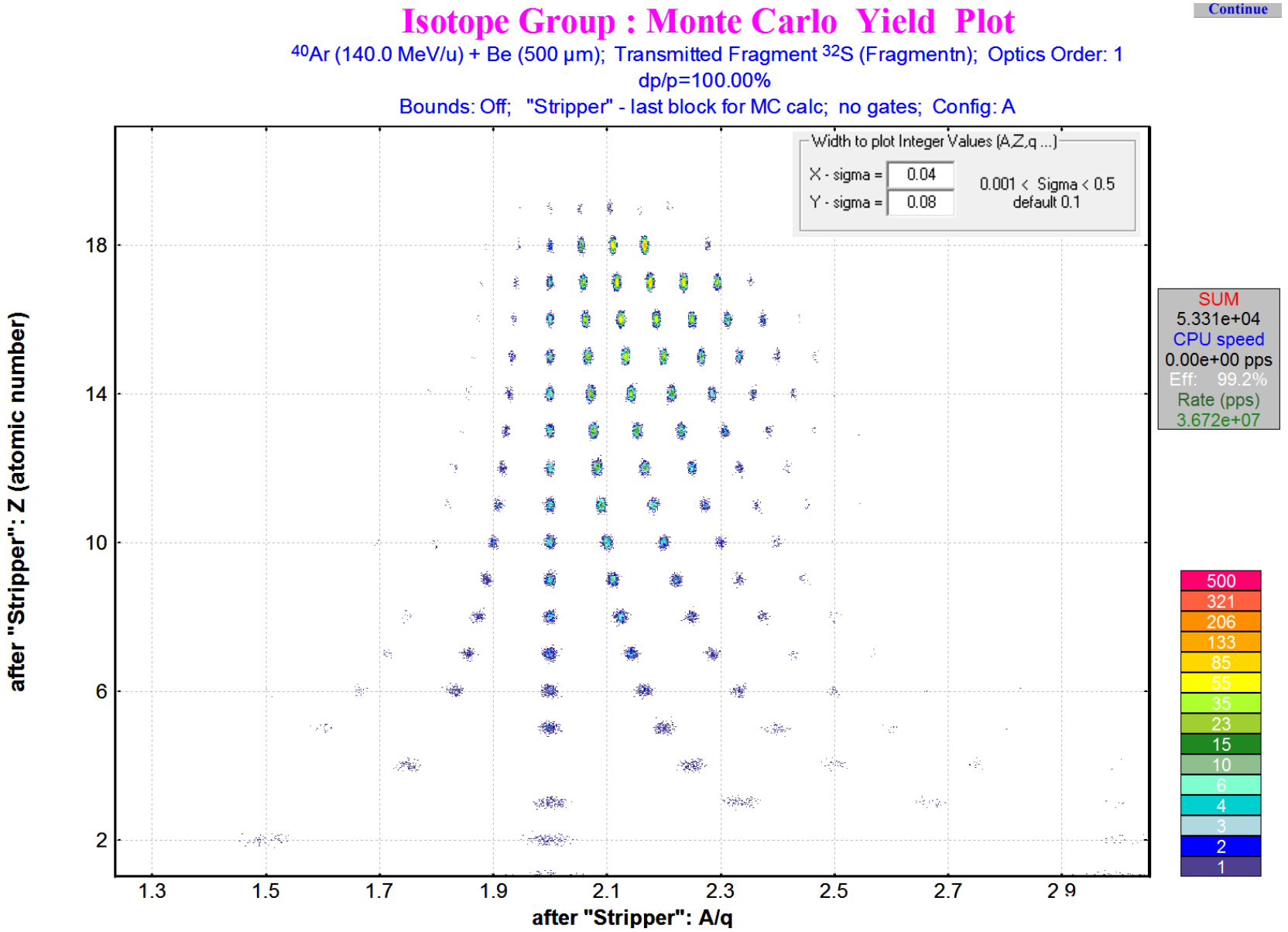


MC option dialog



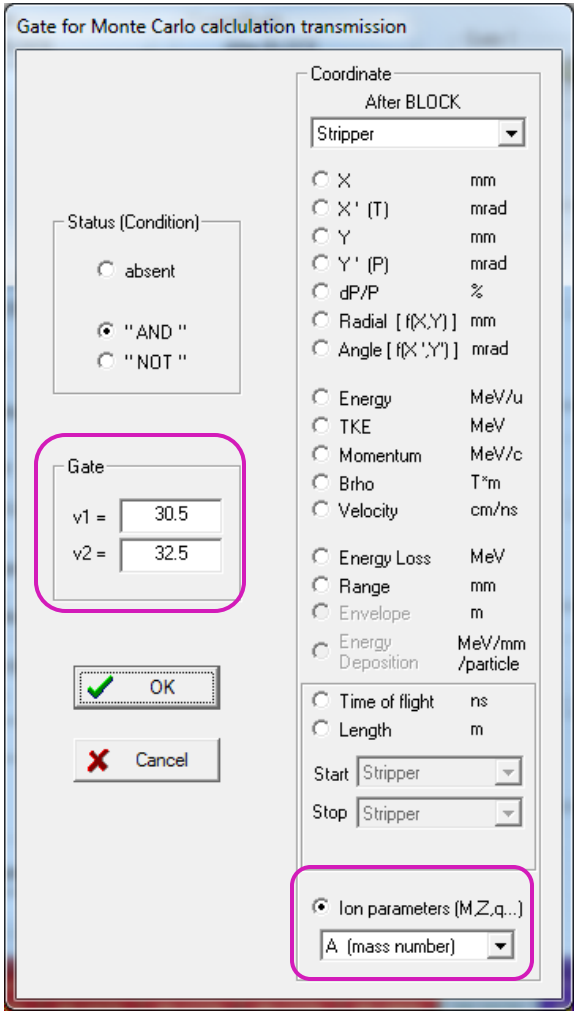
New A, Z, q, A/q, … fields and filters in MC (2)

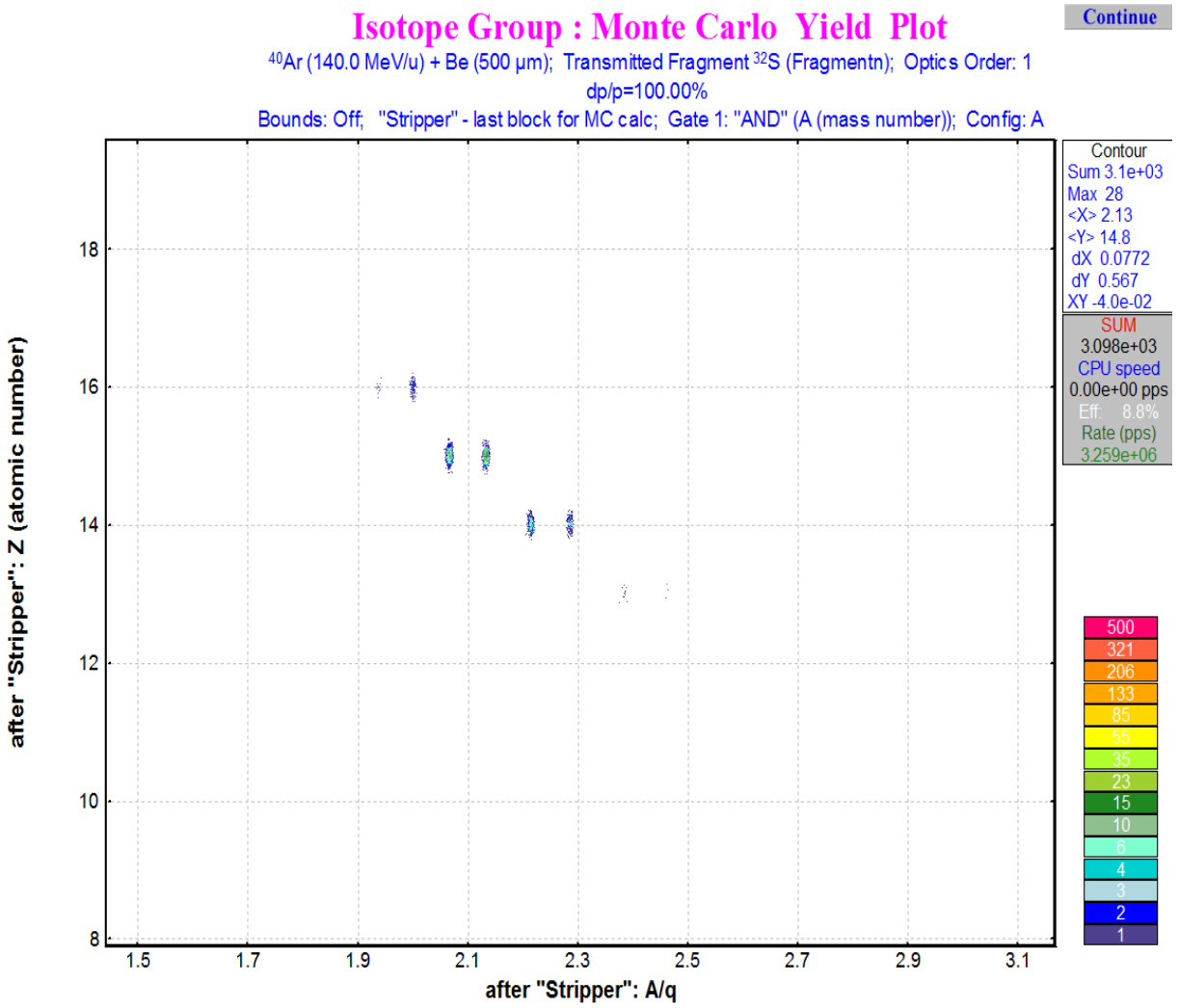
Example: After target without beam



New A, Z, q, A/q, … fields and filters in MC (3)

Example: After target without beam with A-gate





MC gate optimization; creation of local checkpoints filter (1)

In previous versions the gate has been applied to filter then rays reached the last block for MC calculation.

So, even the gate was set after stripper, the code calculates all blocks.

In this version the gate is checked immediately after passing its associated block.

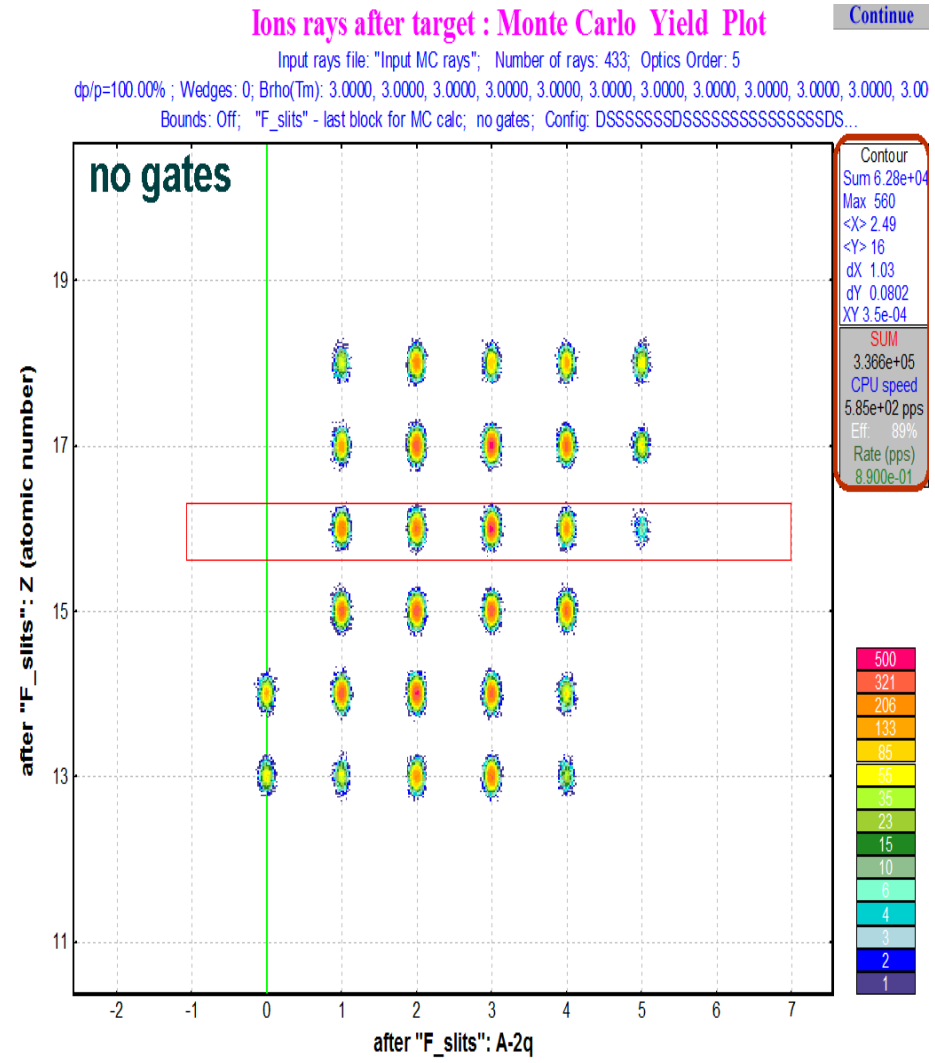
The main factors slowing down the speed of MC calculations:

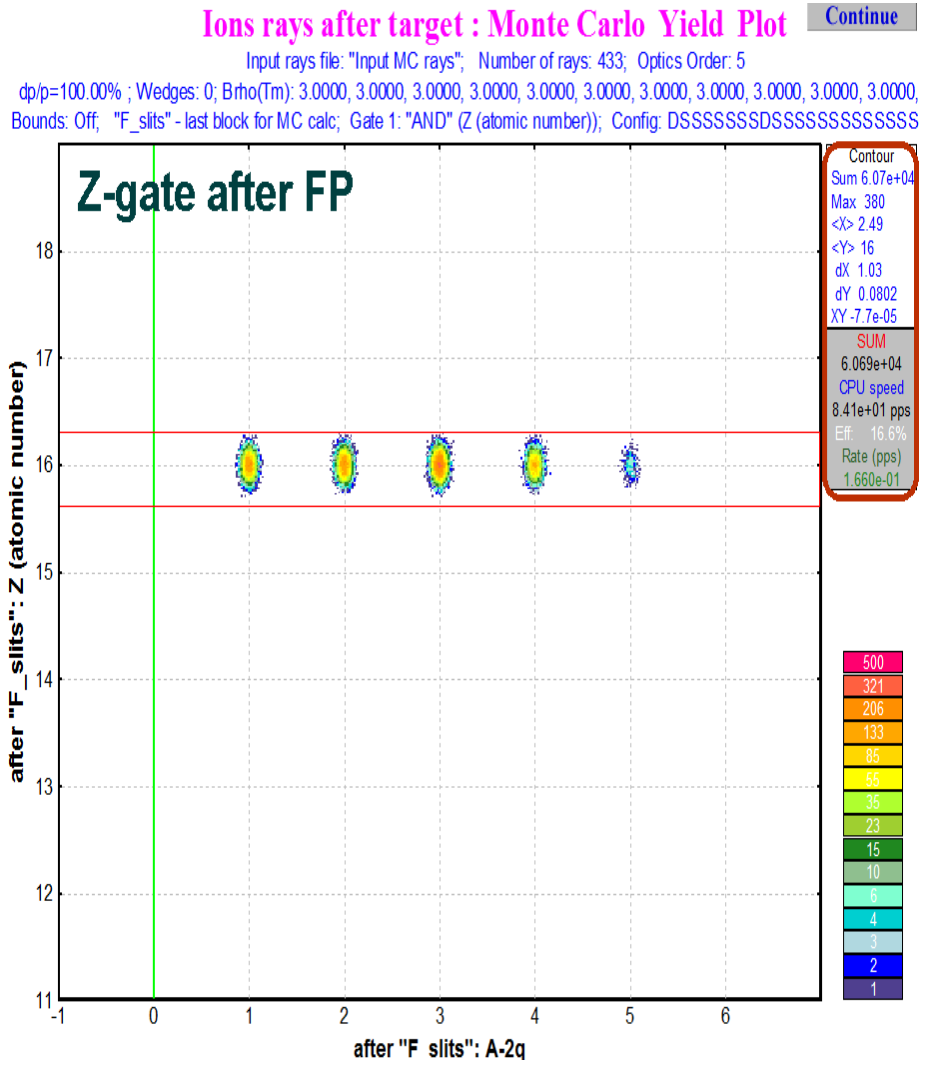
- **Target**
  - **Charge state calculations using the "Global" library**
  - **Reactions**
- **Fragment separator**
  - **High order optics**
  - **Extended configurations**
  - **Non-equilibrium charge state calculations using the "Global" library**

MC gate optimization; creation of local checkpoints filter (2)

Example:

- **input ion rays from file emitted from target**
- **Extended configuration**
- **5-th order optics**





MC gate optimization; creation of local checkpoints filter (3)

Example:
- input ion rays from file emitted from target
- Extended configuration
- 5-th order optics

- gate for Z=16 after FP and gate for Z=16 after stripper

	no gates	gate after stripper	gate after FP
SUM (events in spectrum)	3.34E+05	3.20E+05	6.07E+04
events Z=16 (contour)	6.22E+04	3.20E+05	6.07E+04
CPU speed (pps)	431	415	84
Eff	89%	16.60%	16.60%
Rate (pps)	0.89	0.166	0.166

the same efficiency and Rate (pps) for both gates

CPU speed Factor for gates Stripper/FP **4.940**

CPU speed (pps) = events in the spectrum per second

Eff = the spectrum sum and produced nuclei ratio

Rate (pps) = real experimental rate based on CS, beam, intensity …

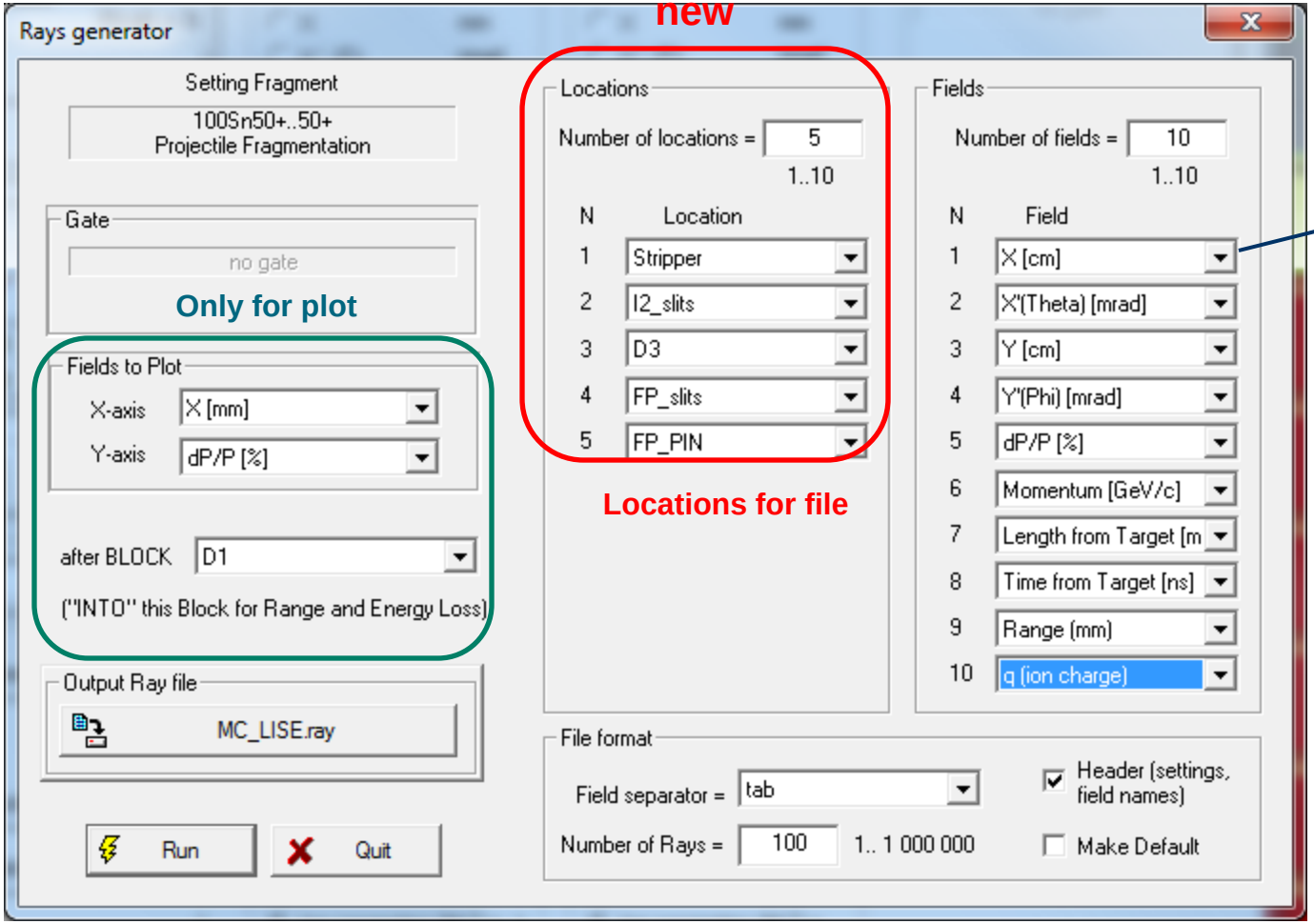
Several locations for output MC file (1)

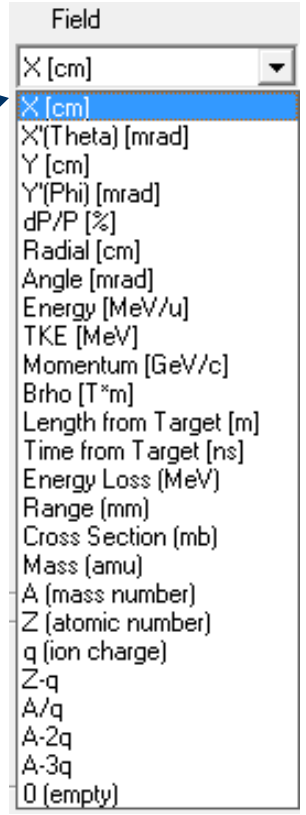
MH's request

1 ≤ Number of locations ≤ 10
1 ≤ Number of fields ≤ 10

In previous version:
Number of locations =1

"last" block" (most downstream) is defined from gate locations, location for file, location for plot





Several locations for output MC file (2)

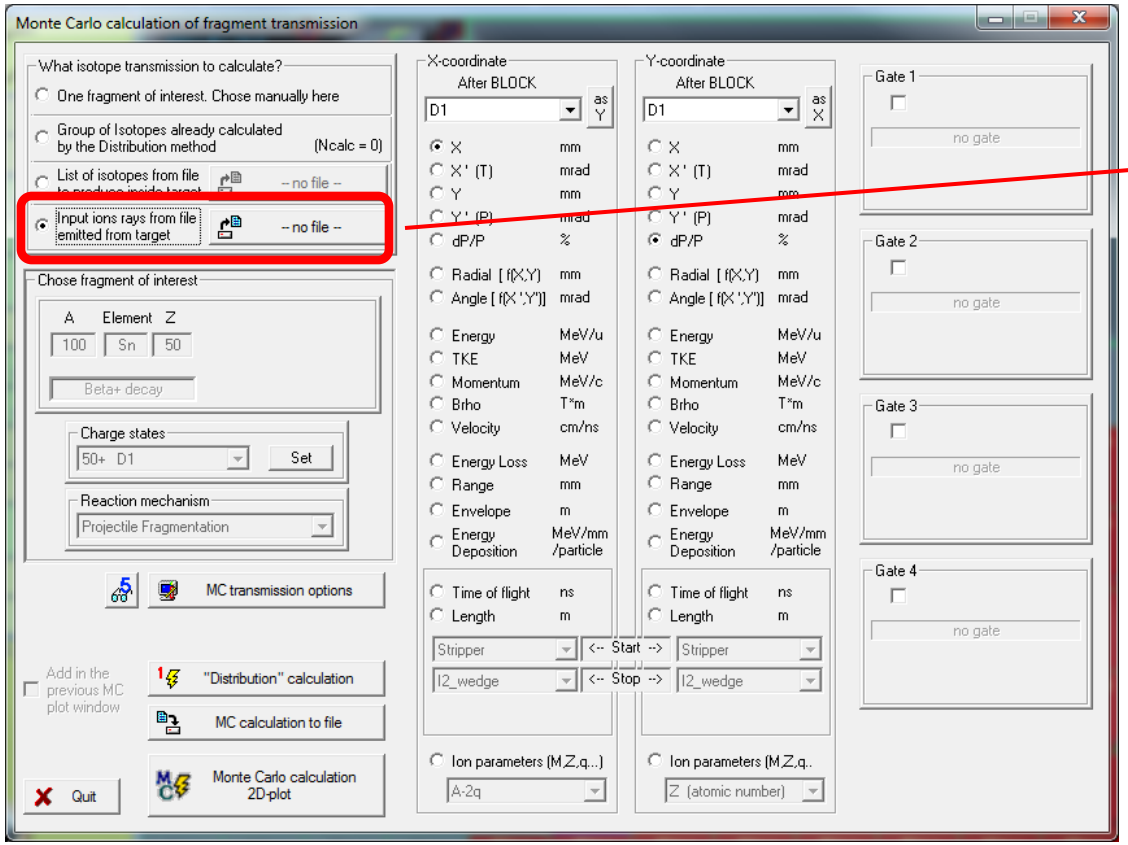
Column name: "Location position (0,1,2..) – Field Name"

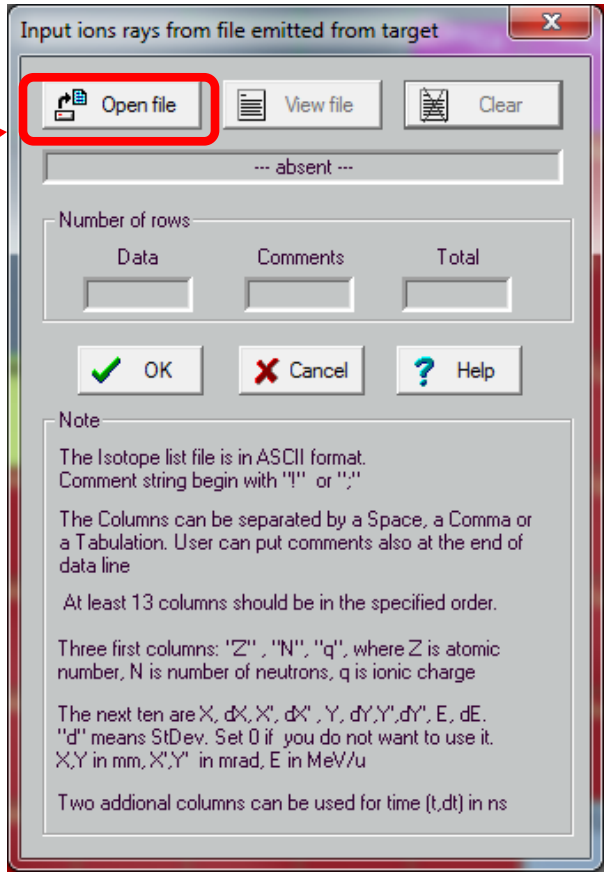
! Last block "FP_PIN", setting fragment: 100Sn50+..50+ (Projectile Fragmentation); N_Locations=5; N_fields=10; N_Rays=100
! location #01 : Stripper
! location #02 : I2_slits
! location #03 : D3
! location #04 : FP_slits
! location #05 : FP_PIN

! N	01-X [cm]	01-X'(Theta) [mrad]	01-Y [cm]	01-Y'(Phi) [mrad]	01-dP/P [%]	01-Momentum [GeV/c]	01-q (ion charge)	02-X [cm]	02-X'(Theta) [mrad]	02-Y [cm]	02-Y'(Phi) [mrad]	02-dP/P [%]	02-Momentum [GeV/c]	02-Length from Target [m]	02-Time from Target [ns]	02-Range (mm)	02-q (ion charge)	03-X [cm]	03-X'(Theta) [mrad]
1	-0.1129	7.1959	-0.08535	15.994	0.55118	60.997	50	-3.4593	4.9788	-0.0412	15.21	0.55118	60.997	17.521	106.64	0	50	1.7004	-5.371
2	-0.1034	-11.708	-0.18591	-13.868	-0.4247	60.404	50	2.3029	-2.3776	-0.1548	-27.278	-0.4247	60.404	17.472	107.07	0	50	-1.1027	1.071
3	-0.0763	10.787	1.58E-05	2.1415	0.14412	60.75	50	-1.0236	5.5121	0.01037	3.0404	0.14412	60.75	17.521	106.94	0	50	0.51187	-5.770
4	-0.2455	16.445	-0.07911	16.538	0.01029	60.668	50	-0.5326	11.026	0.04611	20.454	0.01029	60.668	17.553	107.24	0	50	0.12823	-12.49
5	0.03839	-8.1885	0.11778	6.0167	0.36481	60.883	50	-2.0458	-3.5871	0.08634	13.784	0.36481	60.883	17.468	106.46	0	50	0.90589	3.372
6	-0.1524	4.346	-0.13551	0.96609	-0.6603	60.262	50	3.5747	3.2643	-0.1306	-7.3991	-0.6603	60.262	17.504	107.45	0	50	-1.6265	-3.407
7	-0.0803	16.51	-0.21527	5.5061	0.67223	61.07	50	-4.1487	7.9158	-0.1736	-7.1395	0.67223	61.07	17.539	106.66	0	50	1.9576	-8.359
8	0.10658	30.736	0.024456	-4.2877	-0.0938	60.605	50	0.79488	12.473	-0.0018	-4.8769	-0.0938	60.605	17.561	107.36	0	50	-0.8	-13.22
9	-0.0447	-16.965	0.08971	-4.7103	-0.3342	60.459	50	1.8671	-6.5517	0.07398	-0.1478	-0.3342	60.459	17.447	106.85	0	50	-0.9158	6.707
10	0.03292	-2.2843	0.19896	-20.981	-0.5731	60.314	50	3.557	-0.4255	0.16668	-13.721	-0.5731	60.314	17.484	107.25	0	50	-1.8213	0.4869
11	-0.0066	1.9967	-0.1925	6.2534	0.49975	60.965	50	-2.9596	0.78228	-0.1613	-4.9283	0.49975	60.965	17.495	106.52	0	50	1.4361	-0.8354
12	-0.0745	16.087	0.010426	2.5637	-0.8187	60.165	50	4.7286	7.3007	0.03743	4.8563	-0.8187	60.165	17.528	107.72	0	50	-2.3646	-7.379
13	0.01758	11.048	0.11291	2.412	-0.5771	60.312	50	3.4812	4.4142	0.1192	10.614	-0.5771	60.312	17.511	107.43	0	50	-1.7954	-4.7
14	-0.0596	-2.5842	-0.01268	-9.1291	-0.092	60.606	50	0.4208	-0.0777	-0.0308	-12.41	-0.092	60.606	17.486	106.91	0	50	-0.1648	-0.1801
15	-0.0878	-3.9601	-0.00054	-10.435	-0.1519	60.57	50	0.71231	-0.2775	-0.0265	-13.431	-0.1519	60.57	17.485	106.94	0	50	-0.2788	-0.0082
16	0.03588	-7.0353	-0.13446	-4.0601	-0.1641	60.563	50	1.0604	-3.0864	-0.1162	-12.988	-0.1641	60.563	17.468	106.85	0	50	-0.5912	2.820
17	0.07869	8.0604	-0.10436	3.5092	-0.0457	60.634	50	0.45453	2.6144	-0.0839	-2.0557	-0.0457	60.634	17.502	106.97	0	50	-0.3286	-2.732

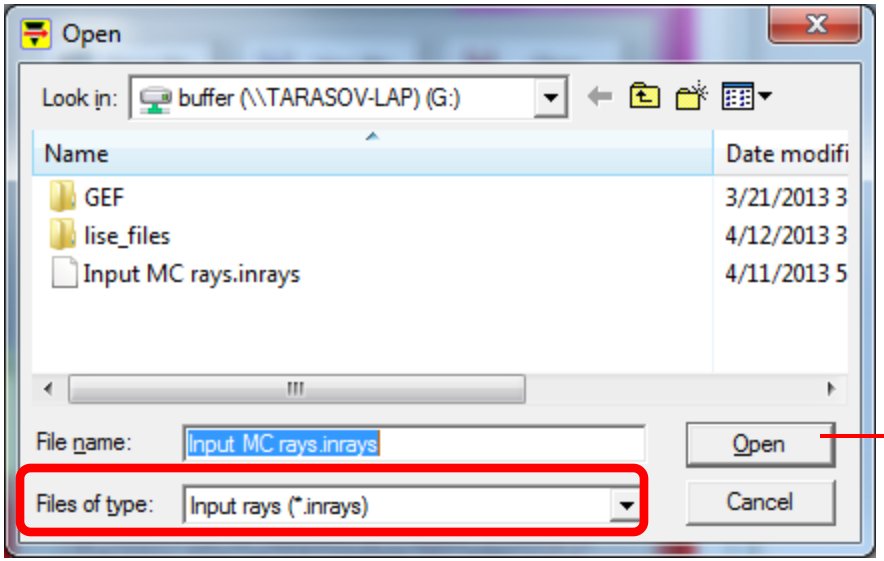
Input ions rays from file emitted from target in MC mode (1)

DJM's request

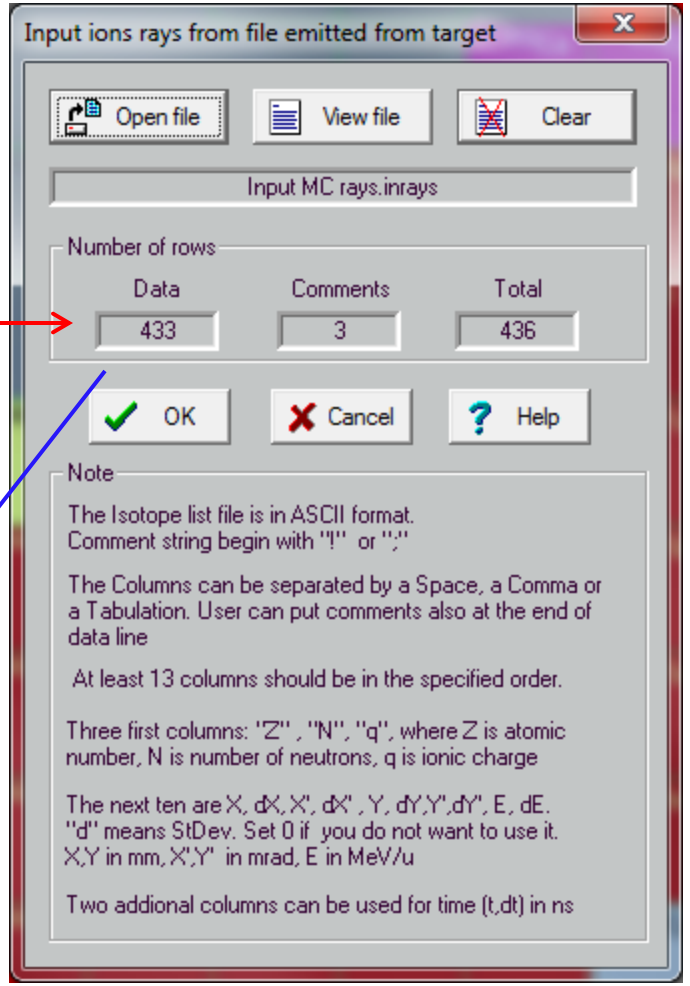




Input ions rays from file emitted from target in MC mode (2)



Specified file format



Analysis of data line structure for correct order, size, and Z,N,q - contents

Input ions rays from file emitted from target in MC mode (3)

Data line structure

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	! 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
2	! Z	N	q	X	d(X)	X'	d(X')	Y	d(Y)	Y'	d(Y')	E	d(E)	t	d(t)
3	!			mm	mm	mrad	mrad	mm	mm	mrad	mrad	MeV/u	MeV/u	ns	ns
4	18	20	18	-0.549	1	-0.409	4	-1.521	0.8	-4.046	5	95.20	1	-0.891	2
5	18	23	18	-0.509	1	6.557	4	0.120	0.8	7.029	5	102.66	1	-0.463	2
6	16	19	16	-1.603	1	-1.041	4	-1.435	0.8	8.051	5	97.17	1	0.869	2
7	15	19	15	-2.177	1	4.244	4	1.317	0.8	-0.575	5	104.09	1	0.683	2
8	15	19	15	0.209	1	-2.225	4	1.561	0.8	1.710	5	98.53	1	0.004	2
9	14	15	14	2.412	1	-4.756	4	-1.051	0.8	0.530	5	102.42	1	-0.095	2
10	14	17	14	2.288	1	0.295	4	0.992	0.8	4.415	5	95.77	1	-0.173	2
11	14	15	14	1.495	1	1.112	4	0.580	0.8	-0.943	5	102.13	1	0.455	2
12	17	20	17	1.533	1	4.954	4	0.863	0.8	6.794	5	98.28	1	-0.404	2
13	16	17	16	2.462	1	-5.620	4	1.109	0.8	-1.494	5	104.95	1	0.424	2
14	13	15	13	1.185	1	-4.911	4	1.873	0.8	-1.027	5	99.03	1	-0.504	2
15	18	22	18	1.373	1	7.311	4	0.105	0.8	-9.834	5	98.95	1	0.191	2
16	16	19	16	0.710	1	5.501	4	-0.534	0.8	-6.920	5	98.37	1	-0.057	2
17	15	19	15	1.785	1	5.563	4	1.699	0.8	8.535	5	104.78	1	-0.263	2
18	18	20	18	0.117	1	-2.653	4	0.445	0.8	9.797	5	98.79	1	0.593	2
19	17	19	17	0.203	1	1.481	4	0.955	0.8	-9.887	5	95.41	1	-0.557	2
20	17	18	17	-1.885	1	-7.375	4	-0.024	0.8	-7.897	5	99.34	1	0.995	2
21	15	16	15	-0.357	1	-0.539	4	0.392	0.8	-6.350	5	98.54	1	0.800	2
22	18	22	18	-1.197	1	7.231	4	-1.778	0.8	-2.706	5	99.27	1	-0.911	2
23	16	20	16	-2.477	1	1.283	4	-0.446	0.8	-5.652	5	96.69	1	-0.120	2
24	16	19	16	0.857	1	5.091	4	0.604	0.8	5.536	5	104.44	1	-0.002	2
25	15	17	15	0.849	1	2.037	4	-1.268	0.8	-8.649	5	98.56	1	0.614	2
26	17	22	17	2.320	1	2.574	4	1.015	0.8	-2.753	5	95.23	1	0.680	2
27	14	15	14	0.974	1	-6.327	4	-1.404	0.8	9.402	5	99.26	1	-0.119	2
28	18	20	18	-0.816	1	4.964	4	-0.116	0.8	5.200	5	97.26	1	0.200	2
29	16	17	16	-0.543	1	-6.363	4	1.384	0.8	-0.102	5	101.26	1	0.429	2
30	14	15	14	-1.535	1	-1.722	4	0.291	0.8	-0.900	5	97.06	1	0.120	2
31	15	19	15	-2.164	1	4.317	4	1.030	0.8	5.206	5	102.23	1	-0.493	2
32	16	19	16	0.135	1	5.462	4	1.926	0.8	9.343	5	100.70	1	-0.119	2
33	18	22	18	-1.250	1	6.402	4	1.069	0.8	-3.461	5	98.95	1	0.736	2
34	14	18	14	-1.402	1	2.364	4	1.405	0.8	-7.775	5	97.24	1	0.716	2
35	16	17	16	-0.948	1	-7.159	4	0.966	0.8	1.677	5	97.07	1	-0.595	2
36	15	17	15	-1.916	1	-1.048	4	-1.879	0.8	1.071	5	103.65	1	-0.446	2

The Isotope list file is in ASCII format.
Comment string begin with "!" or ";"

The Columns can be separated by a Space, a Comma or a Tabulation. User can put comments also at the end of data line

At least 13 columns should be in the specified order.

Three first columns: "Z" , "N", "q", where Z is atomic number, N is number of neutrons, q is ionic charge

The next ten are X, dX, X', dX' , Y, dY,Y',dY', E, dE.
"d" means StDev. Set 0 if you do not want to use it.
X,Y in mm, X',Y' in mrad, E in MeV/u

Two addional columns can be used for time (t,dt) in ns

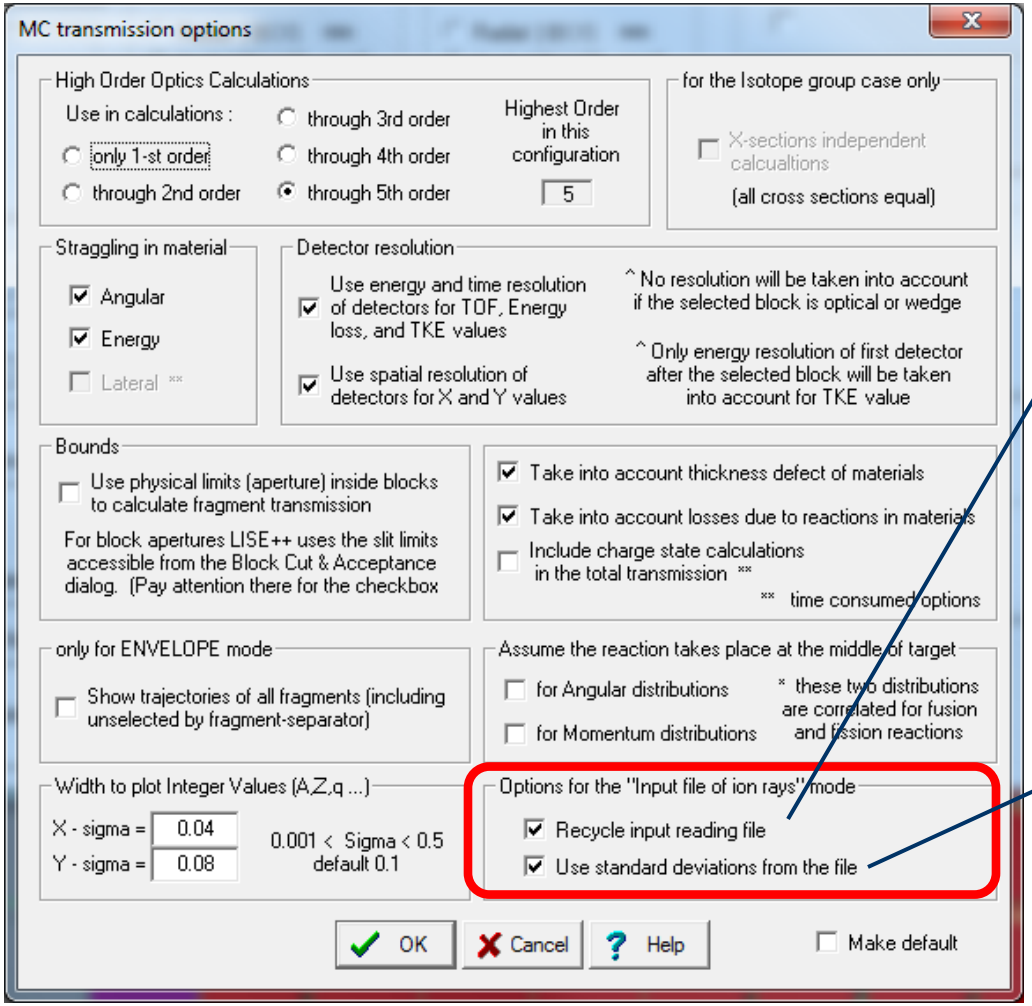
Example of Input ion rays file is located in LISE++ package:

\Files\examples\ Input MC rays.inrays

This Excel example with random generator values is located at

http://lise.nscl.msu.edu/9_6/Input MC rays.xlsx

Options:

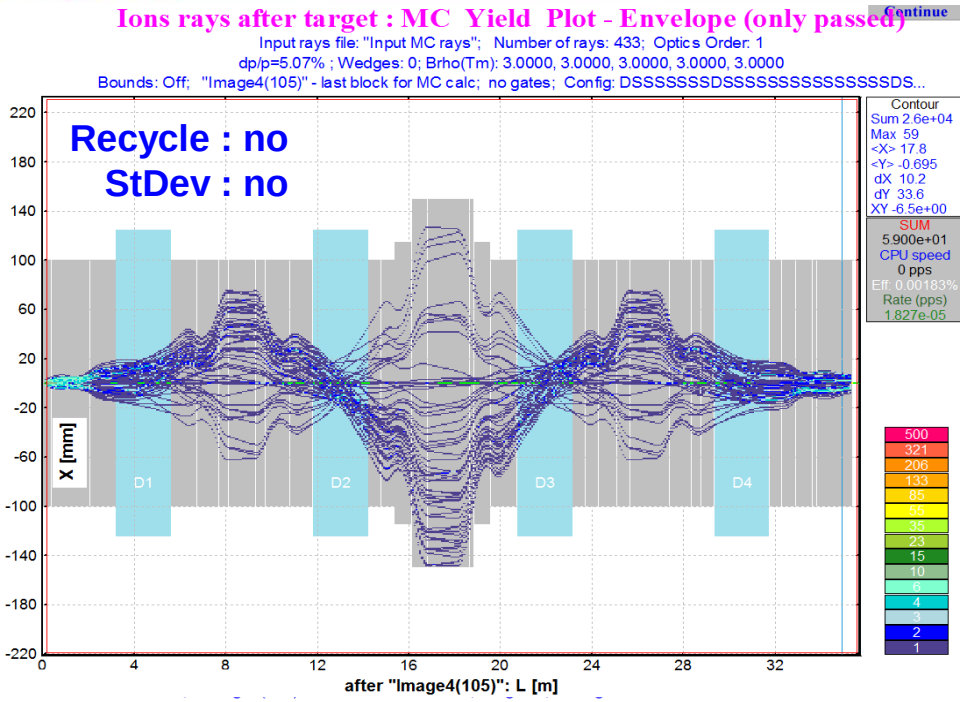


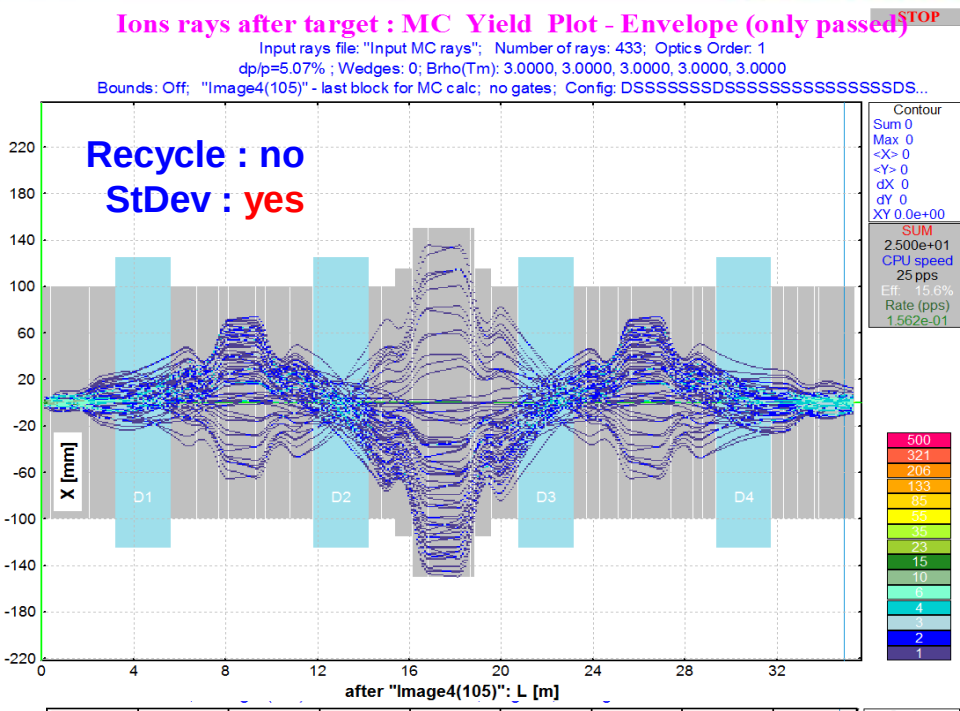
If this option is set, then after MC reaches the end of file, MC starts to read file from beginning

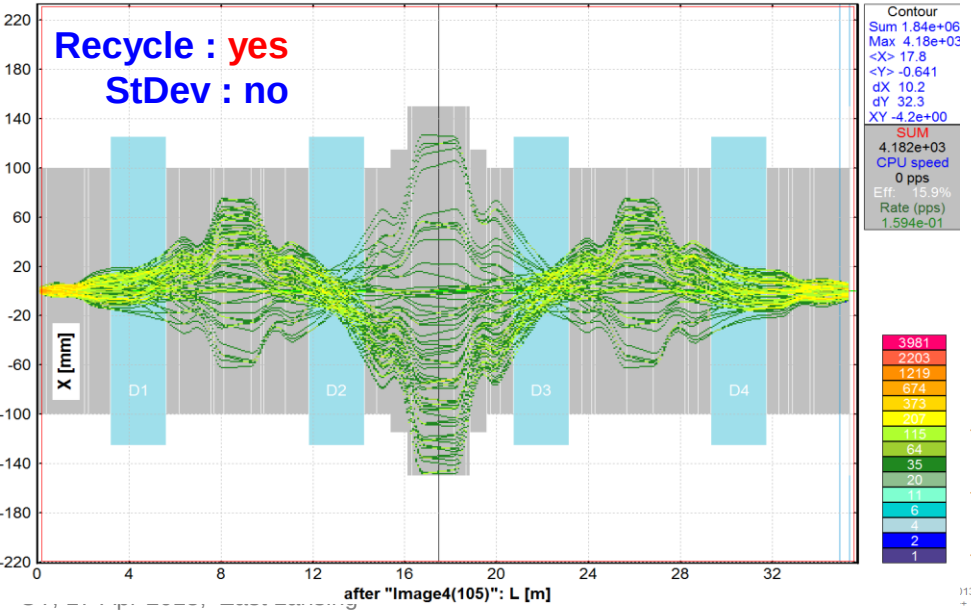
If this option is set, MC uses St.Dev. values from file to randomize output values.

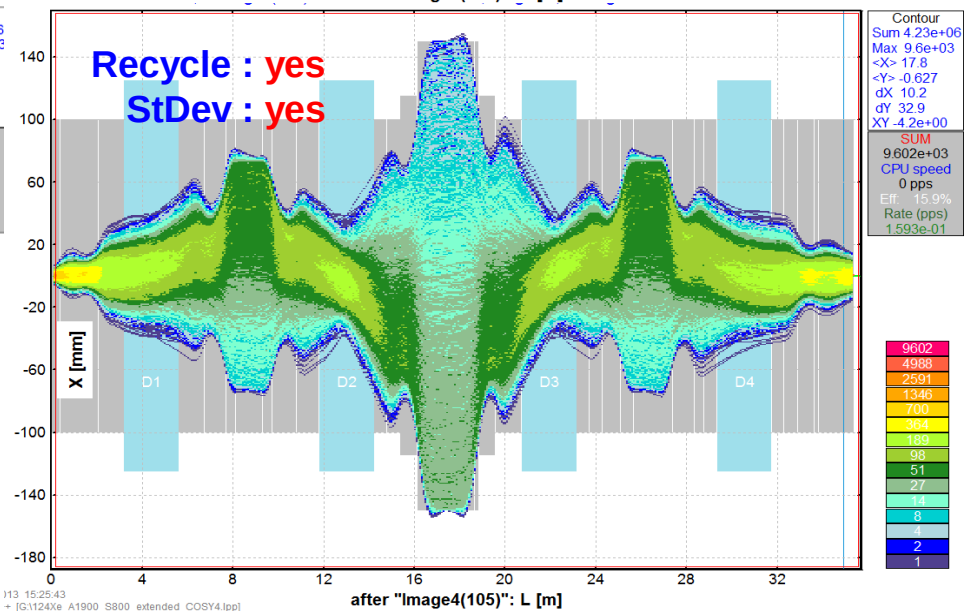
If this option is not set, then it is equivalent to all of St.Dev values are zero

Input ions rays from file emitted from target in MC mode (5)



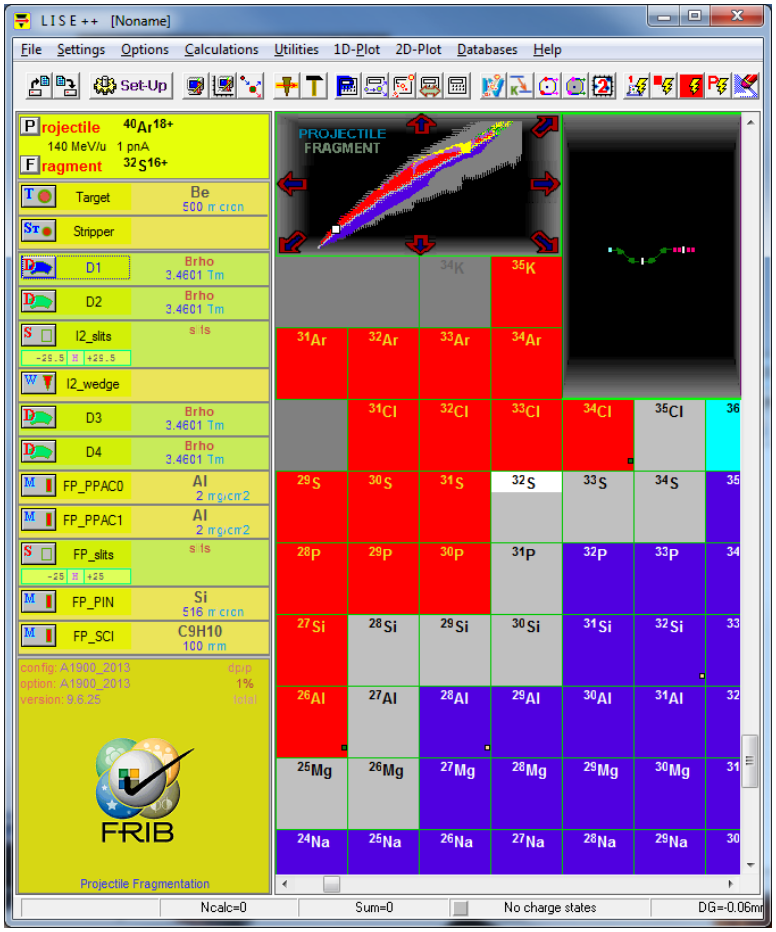


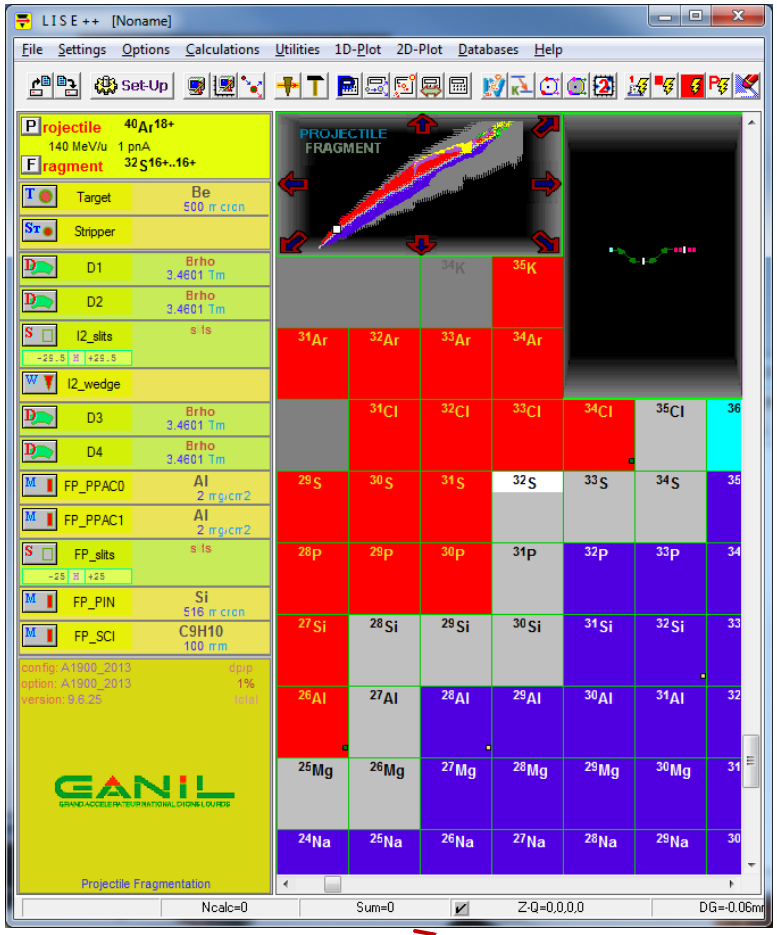




Easy way to change the charge state option

TB's request





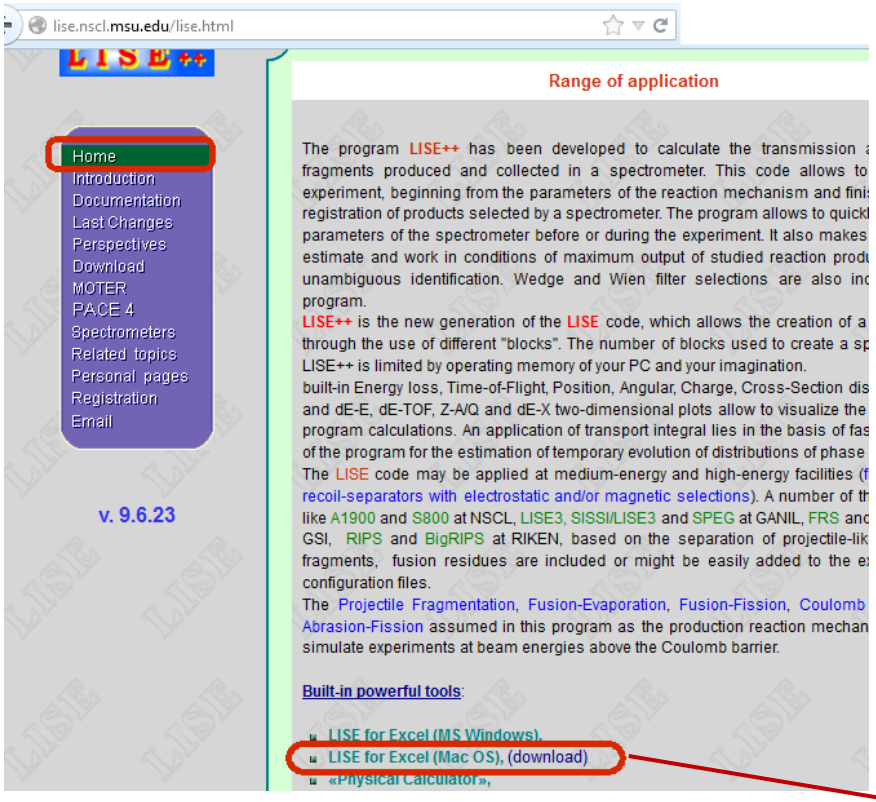
Use this CheckButton to change the change state option

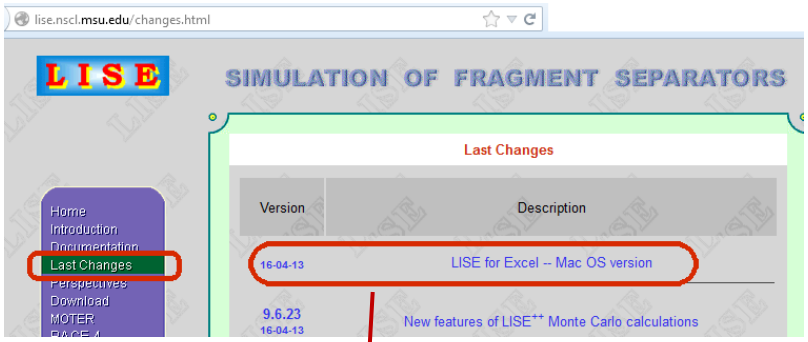
LISE for Excel – Mas OC version

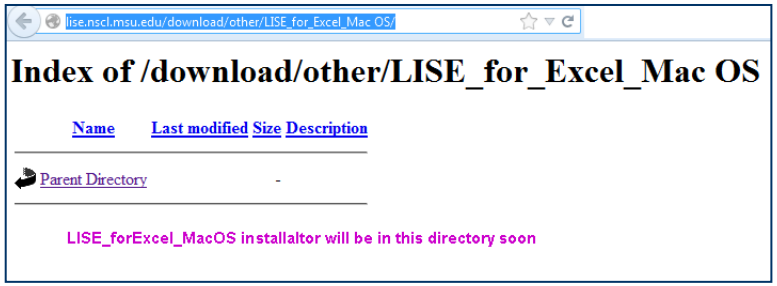
**Daniel has transported some LISE++ libraries to Mac OS,
and modified the LISE-Excell shell and its macros to operate under MaC OS.
It is a beta-version. Please, submit your remarks to Daniel** (bazin@nscl.msu.edu)

http://lise.nscl.msu.edu/download/other/LISE_for_Excel_Mac OS/

Links to download the installer of "LISE_for_Excel" version for Mac OS from the LISE++ site







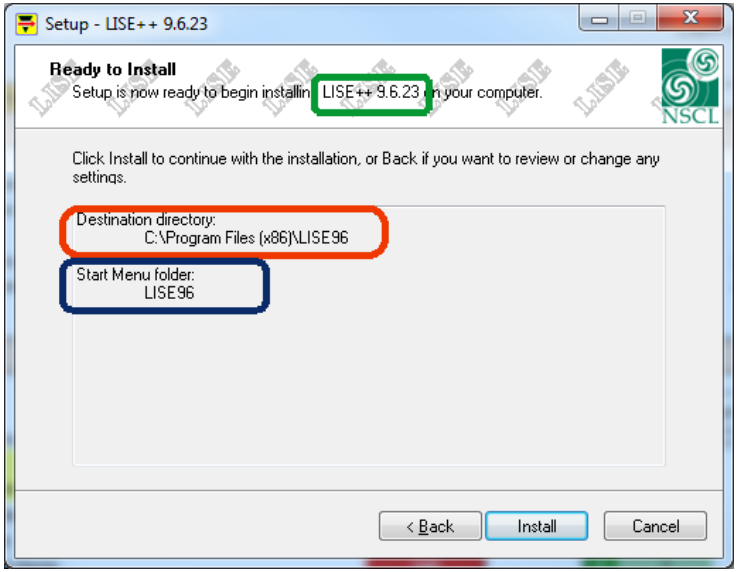
Recommendations for 9.6 beta version use @ NSCL

Most PC computers at the NSCL are set for automatic software update.
This update for some computers includes LISE^{++} installation.
Nowadays the official version is 9.5.3.
It means, that if you install another version in the “Program Files/LISE” directory,
then later this update restore LISE^{++} official version back.

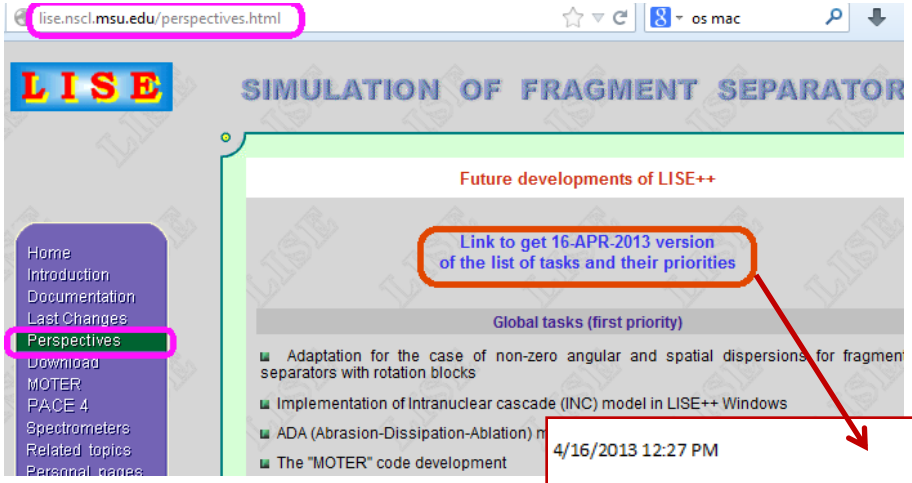
Therefore, if you would like to work, for example, with the new beta-version 9.6.23,
then you need to install this version in another directory and create new Start menu folder.
Example is shown below. So

Directory : Program Files (x86)\LISE96
Start Menu Folder: LISE96

Note: remember, that LISE^{++} files are associated to the LISE^{++} version, which was installed last



LISE++ perspectives: current status (04/16/2013)



4/16/2013 12:27 PM — LISE++ development

Subject	Priority	Status	new	Order	Time
LongTerm					
~~LISE for Mac EXCEL~~	high	done	X	1	1.5 weeks
Evaporation cascade: improvement, create Monte Carlo version	high				1 month
Abrasion-Ablation: improvement, create Monte Carlo version	high				2 weeks
Abrasion-Fission: create Monte Carlo version	high				2 weeks
Time in the distribution4 class (RF-buncher, RF-kicker)	medium		X	8	1-2 weeks
Custom shape degrader optimization in MC mode for high order optics	medium				< 2 weeks
ShortTerm					
~~Help links from dialogs on the LISE++ site~~	high	done	X	2	2 days
~~Two or more locations for the MC output file~~	high	done	X	3.2	2 days
~~Input source of ions @ MC (A,Z,q,E,E*,dt,x,x',y,y')~~	high	done	X	3.3	2 days
Two-body reactions : user angular distribution	high	in process	X	5.1	4 days
Two-body reactions : manually set excitation energy of fragment	high	in process	X	5.2	3 days
Develop a subroutine to calculate a reduced dispersion for large values of dP/P	high			6.1	< 3 days
Improvement of existent blocks : Electric dipole	high		X	6.2	< 3 days
Improvement of existent blocks : Compensating dipole	high		X	7	< 3 days
~~MC Gates : A,Z,Q, A/q~~	medium	done		3.1	< 2 days
~~MC gates procedure optimization for speed~~	medium	done	X	3.4	1 day
Gates for analytical solutions (like done for MC)	medium		X	4	< 2 days
Cross section for stripper	medium				< 2 days
Create possibility to Insert a material before the target	medium		X		2 days