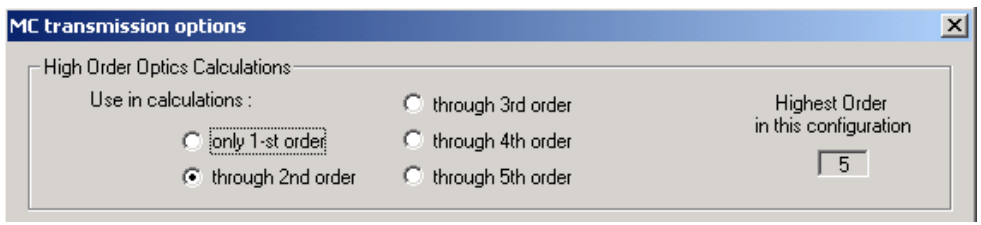
High order optics in LISE^{++}

The code operates under MS Windows environment and provides a highly user-friendly interface.
It can be freely downloaded from the following internet addresses:
http://www.nscl.msu/edu/lise

See "**a1900_FifthOrder.lpp**" in the Installation package

version 8.3.158

- up to 5th order calculations in MC mode
- for this Friday this presentation was planned 2nd, but…
- The code can be used for transmission calculations with high order aberrations, deduce angular acceptances, check other codes (as MOTER), user-friendly interface for introduction in high-order optics
- MOCADI A1900 file for LISE^{++}, as well as translator from MOCADI to LISE^{++}
- The Optics dialog should be commissioned, as well Local <-> Global transformation.
- New utility for MC mode (Envelope plot to see transmission loss)



Importing high-order matrices

- LISE++ uses for transmission calculations **only** LOCAL matrices for both (Distribution and MC) methods
- Global matrices (1st order) were more convenient to import from TRANSPORT
- Now with import of the **LOCAL** matrices up to 5th order.
- Second order matrices can be entered manually using matrix dialog, for higher orders import of COSY map file, or editing LISE++ file.

COSY file

```
PRIAMRY_BEAM ;

   CR ; INITIALIZE_RAYS ;   SR 0 0        0 0       0 0      0 0   1  ;
   BP ;
UM ;
    FR 0 ;
    DL S1L1 ;
      M5 T1LA    ZO17TA*SCLB 0*SCLB 0*SCLB 0 0    0.133 ;
    DL S1L2 ;
      M5 T1LB    ZO19TB*SCLB 0*SCLB 0*SCLB 0 0    0.133 ;
    DL S1L3 ;
      M5 T1LC    ZO21TC*SCLB ZO21SX*SCLB ZO21MC*SCLB 0 0    0.15  ;
    DL S1L4;

      DI 3.094   45.0  0.045     0 0   0 0 ;

    DL S1L5 ;
      M5 T2LA    ZO31TA*SCLB ZO31SX*SCLB ZO31MC*SCLB 0 0    0.15  ;
    DL S1L6 ;
      M5 T2LB    ZO33TB*SCLB ZO33SX*SCLB ZO33MC*SCLB 0 0    0.15  ;
    DL S1L7 ;
      M5 T2LC    ZO35TC*SCLB ZO35SX*SCLB ZO35MC*SCLB 0 0    0.15  ;
    DL S1L8;

    PM_LISE 'IMG1_COSY.TXT' ;
UM ;
    DL S2L1 ;
      M5 T3LA    ZO39TA*SCLB ZO39SX*SCLB ZO39MC*SCLB 0 0    0.15  ;
    DL S2L2 ;
      M5 T3LB    ZO41TB*SCLB ZO41SX*SCLB ZO41MC*SCLB 0 0    0.15  ;
    DL S2L3 ;
      M5 T3LC    ZO43TC*SCLB ZO43SX*SCLB ZO43MC*SCLB 0 0    0.15  ;
    DL S2L4 ;

      CB ; DI 3.094   45.0  0.045     0 0   0 0 ; CB ;

    DL S2L5 ;
      M5 T4LA    ZO53TA*SCLB ZO53SX*SCLB ZO53MC*SCLB 0 0    0.15  ;
    DL S2L6 ;
      M5 T4LB    ZO55TB*SCLB 0*SCLB 0*SCLB 0 0    0.15  ;
    DL S2L7 ;
      M5 T4LC    ZO57TC*SCLB 0*SCLB 0*SCLB 0 0    0.21  ;
    DL S2L8 ;

    PM_LISE 'IMG2_COSY.TXT' ;
```

Importing high-order matrices. COSY Map

Lister - [c:\user\c\lise_pp_83\files\cosy\FifthOrder\IMG1_COSY.TXT]

File Edit Options Help

```
 6 1
 -.23036E+01   .90815E-03   .00000E+00   .00000E+00   .00000E+00   .28887E+01
  .10757E+02  -.43835E+00   .00000E+00   .00000E+00   .00000E+00  -.96289E-04
  .00000E+00   .00000E+00   .75082E+00   .11788E-02   .00000E+00   .00000E+00
  .00000E+00   .00000E+00   .37351E+02   .13905E+01   .00000E+00   .00000E+00
  .31073E+01  -.12662E+00   .00000E+00   .00000E+00   .10000E+01  -.24223E+00
  .00000E+00   .00000E+00   .00000E+00   .00000E+00   .00000E+00   .10000E+01
------------------ MAP IN TRANSPORT UNITS, COSY FORMAT, PM
  .1495016E-12  .0000000      .0000000      .0000000      .0000000     000000
 -2.303570      10.75695      .0000000      .0000000     3.107285      100000
  .9081494E-03 -.4383496      .0000000      .0000000     -.1266239     010000
  .0000000      .0000000      .7508238     37.35126      .0000000     001000
  .0000000      .0000000      .1178834E-02  1.390514     .0000000     000100
  .0000000      .0000000      .0000000      .0000000     1.000000     000010
  2.888651     -.9628933E-04  .0000000      .0000000     -.2422335    000001
 -.2790306     -.2719936      .0000000      .0000000     -.8022218E-01 200000
  .1814153E-01  .2169344E-01  .0000000      .0000000      .4590367E-02 110000
 -.2924729E-03 -.3646087E-03  .0000000      .0000000     -.1233354E-03 020000
  .0000000      .0000000     -.2875726     -3.395282     .0000000     101000
  .0000000      .0000000      .5194432E-02  .7699961E-01  .0000000     011000
 -.1531596     -1.062890      .0000000      .0000000     -.2369491    002000
  .0000000      .0000000     -.1385900E-01 -.1621949     .0000000     100100
  .0000000      .0000000      .2685810E-03  .3861999E-02  .0000000     010100
 -.1606992E-01 -.9680975E-01  .0000000      .0000000     -.2464215E-01 001100
  .3864437E-01 -.3023526      .0000000      .0000000     -.1508210E-01 100001
  .8540427E-03 -.1122261E-01  .0000000      .0000000     -.2573938E-02 010001
  .0000000      .0000000      .2329722E-01 -1.081405     .0000000     001001
 -.4162447E-03 -.2197651E-02  .0000000      .0000000     -.7913614E-03 000200
  .0000000      .0000000     -.2377957E-02 -.1631402     .0000000     000101
 -.2246381E-01  .1942907      .0000000      .0000000     -.1588118E-01 000002
  .2496851E-02  .6822664E-02  .0000000      .0000000      .1717573E-02 300000
 -.3669691E-03 -.7664941E-03  .0000000      .0000000     -.2277991E-03 210000
  .1397706E-04  .2719766E-04  .0000000      .0000000      .1044545E-04 120000
 -.2248783E-06  .2572266E-06  .0000000      .0000000      .2452711E-08 030000
  .0000000      .0000000      .4421901E-01  .3752077     .0000000     201000
  .0000000      .0000000     -.1857340E-02 -.1583853E-01  .0000000     111000
  .0000000      .0000000      .1932137E-04  .1769933E-03  .0000000     021000
  .9622497E-01  .3748885      .0000000      .0000000      .2362062E-01 102000
 -.2494744E-02 -.9068004E-02  .0000000      .0000000     -.6440559E-03 012000
```

- LISE++ is looking for strings ended on 6 chars (0-5) in row
- Other lines are omitted
- COSY command

`PTWT UI;  or PT UI;`
`TRANSPORT dimensions(cm-mrad)`

- if you have COSY and LISE^{++} (1st order) files, then only 5 minutes to create high order matrices and implement them in the LISE^{++} file

Importing high-order matrices. COSY Map. P.2

Added 09/15/09

```
0.00000E+00  0.00000E+00  0.37427E+02  0.13653E+01  0.00000E+00  0.00000E+00
0.31074E+01 -0.12927E+00  0.00000E+00  0.00000E+00  0.10000E+01  0.57769E+00
0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.00000E+00  0.10000E+01
------------------ MAP IN TRANSPORT UNITS, COSY FORMAT, PM
0.2359988E-12-0.1174798E-11  0.000000    0.000000   -0.3108624E-12 000000
-2.284592    [illegible]     0.000000    0.000000    3.107380      100000
0.8986714E-03-0.4418942      0.000000    0.000000   -0.1292682     010000
 0.000000     0.000000       0.7385298   37.42714    0.000000      001000
 0.000000     0.000000       0.2212702E-03 1.365255  0.000000      000100
 0.000000     0.000000       0.000000    0.000000    1.000000      000010
 2.925327    -0.2825546E-02  0.000000    0.000000    0.5776943     000001
-0.7919284E-02-0.4093931E-01 0.000000    0.000000   -0.7889948E-01 200000
0.3007172E-03 0.1697271E-02  0.000000    0.000000    0.4661546E-02 110000
```

pay attention for COSY9 problems with output.
complaint was sent. In process

```
------------------ MAP IN TRANSPORT UNITS, COSY FORMAT, PM
 .1495016E-12  .0000000      .0000000      .0000000      .0000000      00000000
-2.303570      10.75695      .0000000      .0000000      3.107285      10000000
 .9081494E-03 -.4383496      .0000000      .0000000     -.1266239      01000000
 .0000000      .0000000      .7508238      37.35126      .0000000      00100000
 .0000000      .0000000      .1178834E-02  1.390514      .0000000      00010000
 .0000000      .0000000      .0000000      .0000000      1.000000      00001000
 2.888651     -.9628933E-04  .0000000      .0000000     -.2422335      00000100
 120.8617     [illegible]    [illegible]   [illegible]   [illegible]   00000010
-.2790306     -.2719936      .0000000      .0000000     -.8022218E-01  20000000
 .1814153E-01  .2169344E-01  .0000000      .0000000      .4590367E-02  11000000
-.2924729E-03 -.3646087E-03  .0000000      .0000000     -.1233354E-03  02000000
 .0000000      .0000000     -.2875726     -3.395282      .0000000      10100000
 .0000000      .0000000      .5194432E-02  .7699961E-01  .0000000      01100000
-.1531596     -1.062890      .0000000      .0000000     -.2369491      00200000
 .0000000      .0000000     -.1385900E-01 -.1621949      .0000000      10010000
 .0000000      .0000000      .2685810E-03  .3861999E-02  .0000000      01010000
-.1606992E-01 -.9680975E-01  .0000000      .0000000     -.2464215E-01  00110000
-.4162447E-03 -.2197651E-02  .0000000      .0000000     -.7913614E-03  00020000
 .3864437E-01 -.3023526      .0000000      .0000000     -.1508210E-01  10000100
 .8540427E-03 -.1122261E-01  .0000000      .0000000     -.2573938E-02  01000100
 .0000000      .0000000      .2329722E-01 -1.081405      .0000000      00100100
 .0000000      .0000000     -.2377957E-02 -.1631402      .0000000      00010100
 5.533966     -1.756564      .0000000      .0000000      1.543158      10000010
-.1920568     [illegible]    .0000000      .0000000     -.2011607E-01  01000010
 .0000000      .0000000      7.809142      65.54887      .0000000      00100010
 .0000000      .0000000      [illegible]   [illegible]   .0000000      00010010
-.2246381E-01  .1942907      .0000000      .0000000     -.1588118E-01  00000200
```

first SIX digits will be used

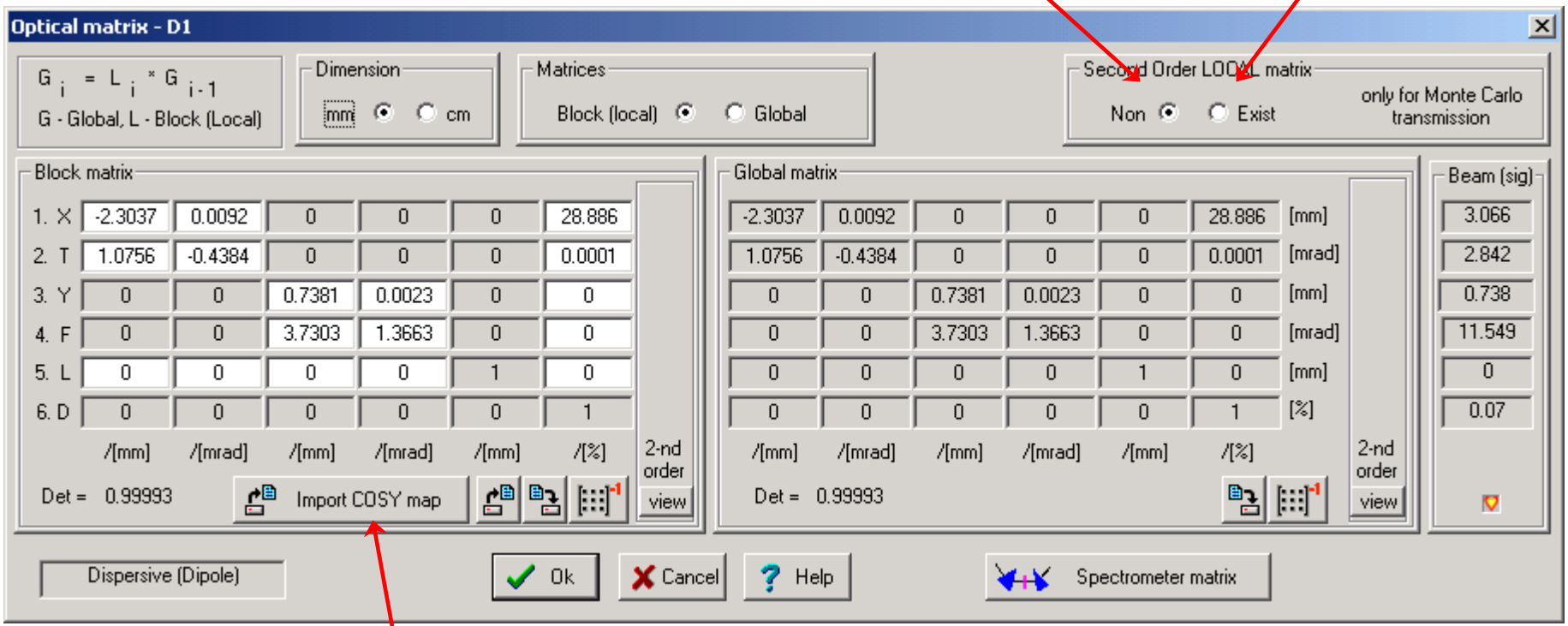
Lines with non-zero 7-10 columns will be omitted

- LISE++ is looking for strings ended on ***6-10*** chars (0-5) in row

LISE++ optics dialog (1st order)

clicking NON in the case of already existing non-zero second and higher order matrices you erase high order information for this block

to input manually

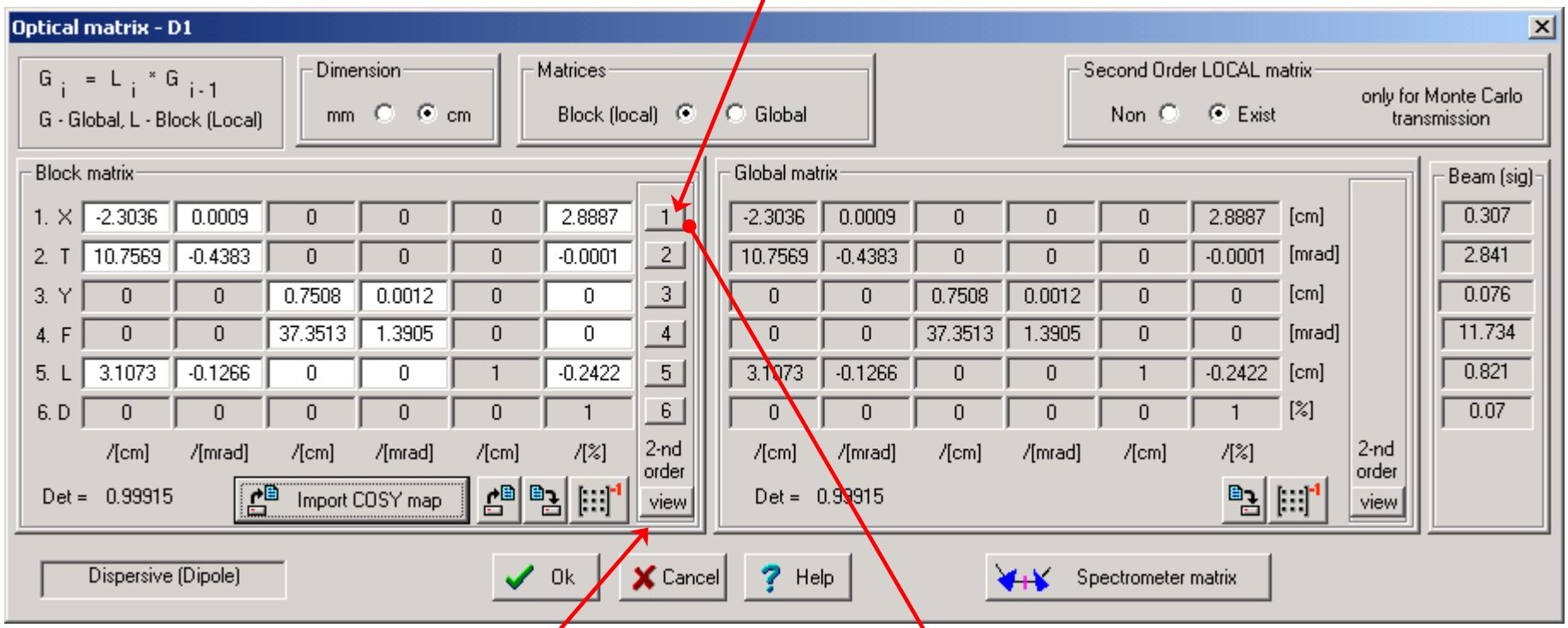


Second and Higher orders flags will be done automatically after COSY map import

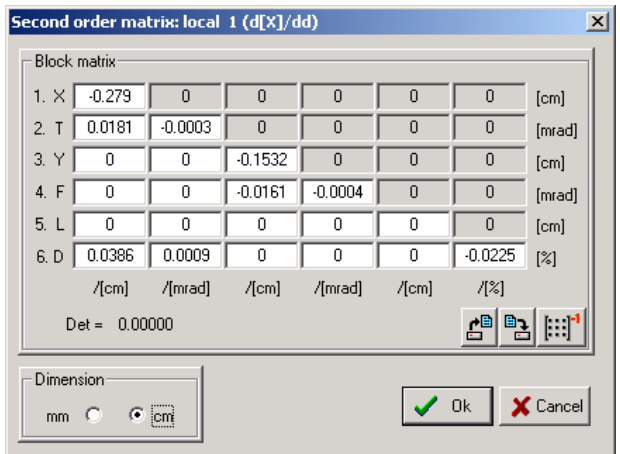
LISE++ optics dialog (2nd order)

after COSY map import

to edit second order matrices



to list information about all orders



List of all orders

Block: "D1" Matrices: "LOCAL"

Block: "D1" Matrices: "LOCAL"

transport format [cm-mrad]

* TRANSFORM 1 *

1	[X]:	-2.3036e+00	+9.0000e-04	0	0	0	+2.8887e+00
2	[T]:	+1.0757e+01	-4.3830e-01	0	0	0	-1.0000e-04
3	[Y]:	0	0	+7.5080e-01	+1.2000e-03	0	0
4	[F]:	0	0	+3.7351e+01	+1.3905e+00	0	0
5	[L]:	+3.1073e+00	-1.2660e-01	0	0	+1.0000e+00	-2.4220e-01
6	[D]:	0	0	0	0	0	+1.0000e+00

* TRANSFORM 2 *

1	1:	-2.7903e-01					
1	2:	+1.8142e-02	-2.9247e-04				
1	3:	0	0	-1.5316e-01			
1	4:	0	0	-1.6070e-02	-4.1624e-04		
1	5:	0	0	0	0	0	
1	6:	+3.8644e-02	+8.5404e-04	0	0	0	-2.2464e-02
2	1:	-2.7199e-01					
2	2:	+2.1693e-02	-3.6461e-04				
2	3:	0	0	-1.0629e+00			
2	4:	0	0	-9.6810e-02	-2.1977e-03		
2	5:	0	0	0	0	0	
2	6:	-3.0235e-01	-1.1223e-02	0	0	0	+1.9429e-01
3	1:	0					
3	2:	0	0				
3	3:	-2.8757e-01	+5.1944e-03	0			
3	4:	-1.3859e-02	+2.6858e-04	0	0		
3	5:	0	0	0	0	0	
3	6:	0	0	+2.3297e-02	-2.3780e-03	0	0
4	1:	0					
4	2:	0	0				
4	3:	-3.3953e+00	+7.7000e-02	0			
4	4:	-1.6219e-01	+3.8620e-03	0	0		
4	5:	0	0	0	0	0	
4	6:	0	0	-1.0814e+00	-1.6314e-01	0	0
5	1:	-8.0222e-02					
5	2:	+4.5904e-03	-1.2334e-04				
5	3:	0	0	-2.3695e-01			
5	4:	0	0	-2.4642e-02	-7.9136e-04		
5	5:	0	0	0	0	0	
5	6:	-1.5082e-02	-2.5739e-03	0	0	0	-1.5881e-02
6	1:	0					
6	2:	0	0				
6	3:	0	0	0			
6	4:	0	0	0	0		
6	5:	0	0	0	0	0	
6	6:	0	0	0	0	0	0

* TRANSFORM 3 and higher *

N	Order	Parameter	COSY	value
1	3	X / XXX	1-300000	+2.4969e-03
2	3	T / XXX	2-300000	+6.8227e-03
3	3	L / XXX	5-300000	+1.7176e-03
4	3	X / XXT	1-210000	-3.6697e-04
5	3	T / XXT	2-210000	-7.6649e-04
6	3	L / XXT	5-210000	-2.2780e-04
7	3	X / XTT	1-120000	+1.3977e-05
8	3	T / XTT	2-120000	+2.7198e-05

Block: "D1" Matrices: "LOCAL"

Block: "D1" Matrices: "LOCAL"

transport format [mm-mrad]

* TRANSFORM 1 *

1	[X]:	-2.3036e+00	+9.0000e-03	0	0	0	+2.8887e+01
2	[T]:	+1.0757e+00	-4.3830e-01	0	0	0	-1.0000e-04
3	[Y]:	0	0	+7.5080e-01	+1.2000e-02	0	0
4	[F]:	0	0	+3.7351e+00	+1.3905e+00	0	0
5	[L]:	+3.1073e+00	-1.2660e+00	0	0	+1.0000e+00	-2.4220e+00
6	[D]:	0	0	0	0	0	+1.0000e+00

* TRANSFORM 2 *

1	1:	-2.7903e-02					
1	2:	+1.8142e-02	-2.9247e-03				
1	3:	0	0	-1.5316e-02			
1	4:	0	0	-1.6070e-02	-4.1624e-03		
1	5:	0	0	0	0	0	
1	6:	+3.8644e-02	+8.5404e-03	0	0	0	-2.2464e-01
2	1:	-2.7199e-03					
2	2:	+2.1693e-03	-3.6461e-04				
2	3:	0	0	-1.0629e-02			
2	4:	0	0	-9.6810e-03	-2.1977e-03		
2	5:	0	0	0	0	0	
2	6:	-3.0235e-02	-1.1223e-02	0	0	0	+1.9429e-01
3	1:	0					
3	2:	0	0				
3	3:	-2.8757e-02	+5.1944e-03	0			
3	4:	-1.3859e-02	+2.6858e-03	0	0		
3	5:	0	0	0	0	0	
3	6:	0	0	+2.3297e-02	-2.3780e-02	0	0
4	1:	0					
4	2:	0	0				
4	3:	-3.3953e-02	+7.7000e-03	0			
4	4:	-1.6219e-02	+3.8620e-03	0	0		
4	5:	0	0	0	0	0	
4	6:	0	0	-1.0814e-01	-1.6314e-01	0	0
5	1:	-8.0222e-03					
5	2:	+4.5904e-03	-1.2334e-03				
5	3:	0	0	-2.3695e-02			
5	4:	0	0	-2.4642e-02	-7.9136e-03		
5	5:	0	0	0	0	0	
5	6:	-1.5082e-02	-2.5739e-02	0	0	0	-1.5881e-01
6	1:	0					
6	2:	0	0				
6	3:	0	0	0			
6	4:	0	0	0	0		
6	5:	0	0	0	0	0	
6	6:	0	0	0	0	0	0

* TRANSFORM 3 and higher *

N	Order	Parameter	COSY	value
1	3	X / XXX	1-300000	+2.4969e-05
2	3	T / XXX	2-300000	+6.8227e-06
3	3	L / XXX	5-300000	+1.7176e-05
4	3	X / XXT	1-210000	-3.6697e-05
5	3	T / XXT	2-210000	-7.6649e-06
6	3	L / XXT	5-210000	-2.2780e-05
7	3	X / XTT	1-120000	+1.3977e-05
8	3	T / XTT	2-120000	+2.7198e-06

LISE++ file and high orders

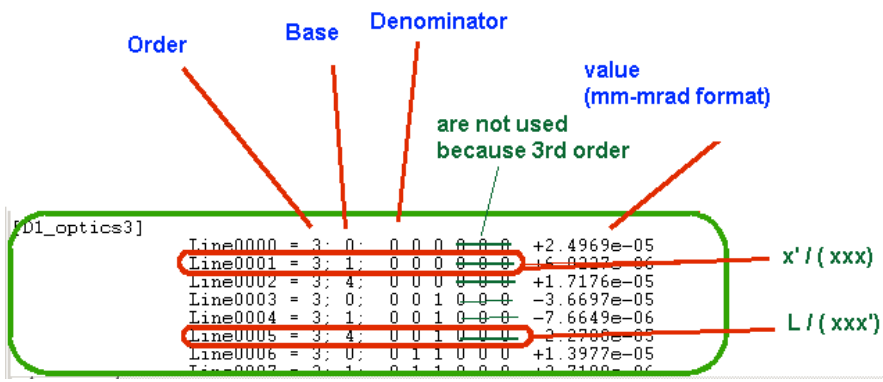
C:\user\c\lise_pp_83\files\a1900_FifthOrder_open.lpp

```
              Highest = 39Ar                                  ; Mass ElementName Charge+ Beam


{============================ BLOCK D1 - Dipole ======================================}

[D1_General]
                 Name = D1,1                                  ; Name of Block, Constant name 1/0
            Available = 1                                     ; Use 1/0
               Length = 8.719000              m               ; Length block for optical blocks
          SecondOrder = 1                                     ; Exist - 1  Non - 0
           ThirdOrder = 584                                   ; Number of lines
         Before_Quad = 3                                      ; number of quadrupoles before optic devic
          After_Quad = 3                                      ; number of quadrupoles after  optic devic
         QB_DontDraw = 0
         QA_DontDraw = 0
                 ZmQ = 0                                      ;  Z - Q  = charge state settings
    Calibration file = A1900\A1900_D1-Z026.cal

[D1_slits]
               Shape = 0                                      ; 0-slits, 1-ellipse
            X_action = 1,0                                    ; Use 1/0, Show 1/0
              X_size = 1,-100.00,-150.0,100.00,150.0          ; joint,Left,L-limit,Right,R-limit
            Y_action = 1,0                                    ; Use 1/0, Show 1/0
              Y_size = 1,-100.00,-150.0,100.00,150.0          ; joint,Bottom,B-limit,Top,T-limit

[D1_optics]
                row1 = -2.3036e+00,+9.0000e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+2.8887e+01
                row2 = +1.0757e+00,-4.3830e-01,+0.0000e+00,+0.0000e+00,+0.0000e+00,-1.0000e-04
                row3 = +0.0000e+00,+0.0000e+00,+7.5080e-01,+1.2000e-02,+0.0000e+00,+0.0000e+00
                row4 = +0.0000e+00,+0.0000e+00,+3.7351e+00,+1.3905e+00,+0.0000e+00,+0.0000e+00
                row5 = +3.1073e+00,-1.2660e+00,+0.0000e+00,+0.0000e+00,+1.0000e+00,-2.4220e+00
                row6 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+1.0000e+00

[D1_optics2]
               row11 = -2.7903e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row12 = +1.8142e-02,-2.9247e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row13 = +0.0000e+00,+0.0000e+00,-1.5316e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row14 = +0.0000e+00,+0.0000e+00,-1.6070e-02,-4.1624e-03,+0.0000e+00,+0.0000e+00
               row15 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row16 = +3.8644e-02,+8.5404e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,-2.2464e-01
               row21 = -2.7199e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row22 = +2.1693e-03,-3.6461e-04,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row23 = +0.0000e+00,+0.0000e+00,-1.0629e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row24 = +0.0000e+00,+0.0000e+00,-9.6810e-03,-2.1977e-03,+0.0000e+00,+0.0000e+00
               row25 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row26 = -3.0235e-02,-1.1223e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00,+1.9429e-01
               row31 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row32 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row33 = -2.8757e-02,+5.1944e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row34 = -1.3859e-02,+2.6858e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row35 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row36 = +0.0000e+00,+0.0000e+00,+2.3297e-02,-2.3780e-02,+0.0000e+00,+0.0000e+00
               row41 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row42 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row43 = -3.3953e-02,+7.7000e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row44 = -1.6219e-02,+3.8620e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row45 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row46 = +0.0000e+00,+0.0000e+00,-1.0814e-01,-1.6314e-01,+0.0000e+00,+0.0000e+00
               row51 = -8.0222e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row52 = +4.5904e-03,-1.2334e-03,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row53 = +0.0000e+00,+0.0000e+00,-2.3695e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row54 = +0.0000e+00,+0.0000e+00,-2.4642e-02,-7.9136e-03,+0.0000e+00,+0.0000e+00
               row55 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row56 = -1.5082e-02,-2.5739e-02,+0.0000e+00,+0.0000e+00,+0.0000e+00,-1.5881e-01
               row61 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row62 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row63 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row64 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row65 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00
               row66 = +0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00,+0.0000e+00

[D1_optics3]
           Line0000 = 3; 0;  0 0 0 0 0 0  +2.4969e-05
           Line0001 = 3; 1;  0 0 0 0 0 0  +6.8227e-06
           Line0002 = 3; 4;  0 0 0 0 0 0  +1.7176e-05
           Line0003 = 3; 0;  0 0 1 0 0 0  -3.6697e-05
           Line0004 = 3; 1;  0 0 1 0 0 0  -7.6649e-06
           Line0005 = 3; 4;  0 0 1 0 0 0  -2.2780e-05
           Line0006 = 3; 0;  0 1 1 0 0 0  +1.3977e-05
```

LISE++ keeps all information in files, as well as all calculates in **mm-mrad** format!

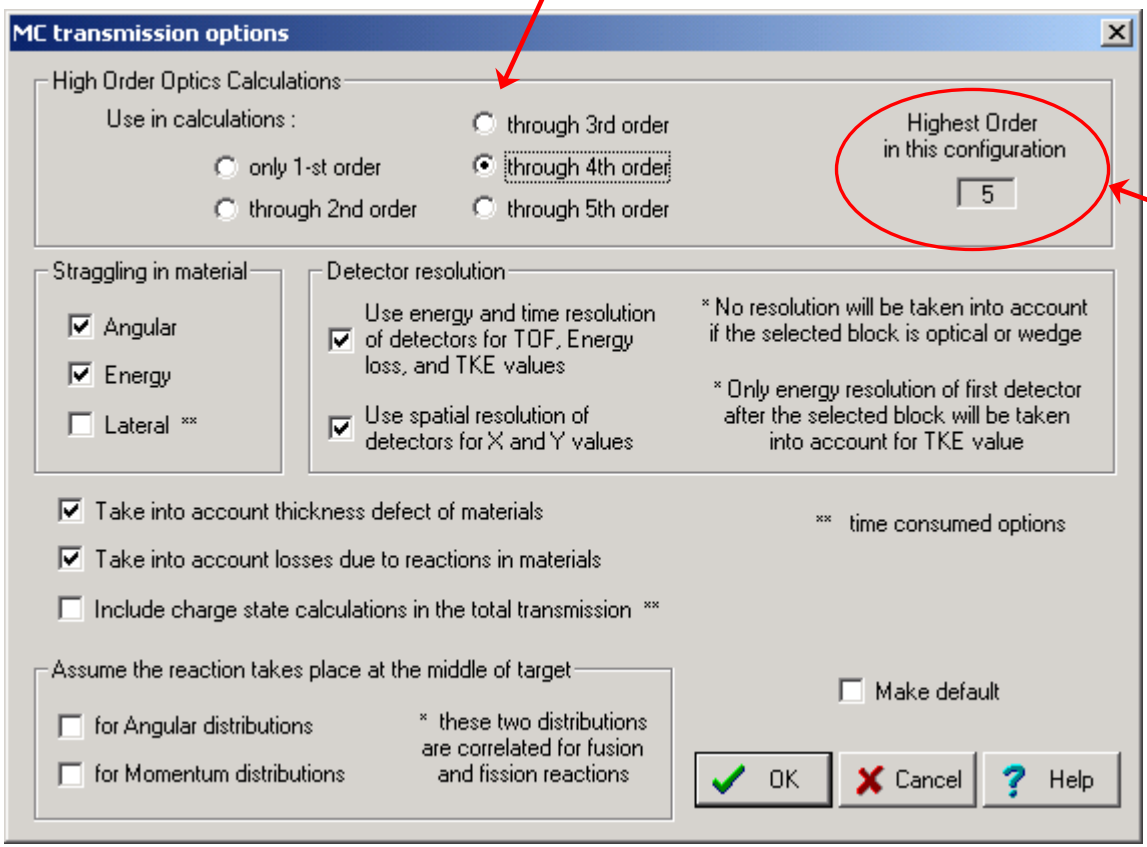
LISE++ A1900 files

1st order ~ 59 kB
3rd order ~ 112 kB
5th order ~ 231 kB



Monte Carlo options dialog

The user can manipulate with order to plot MC results

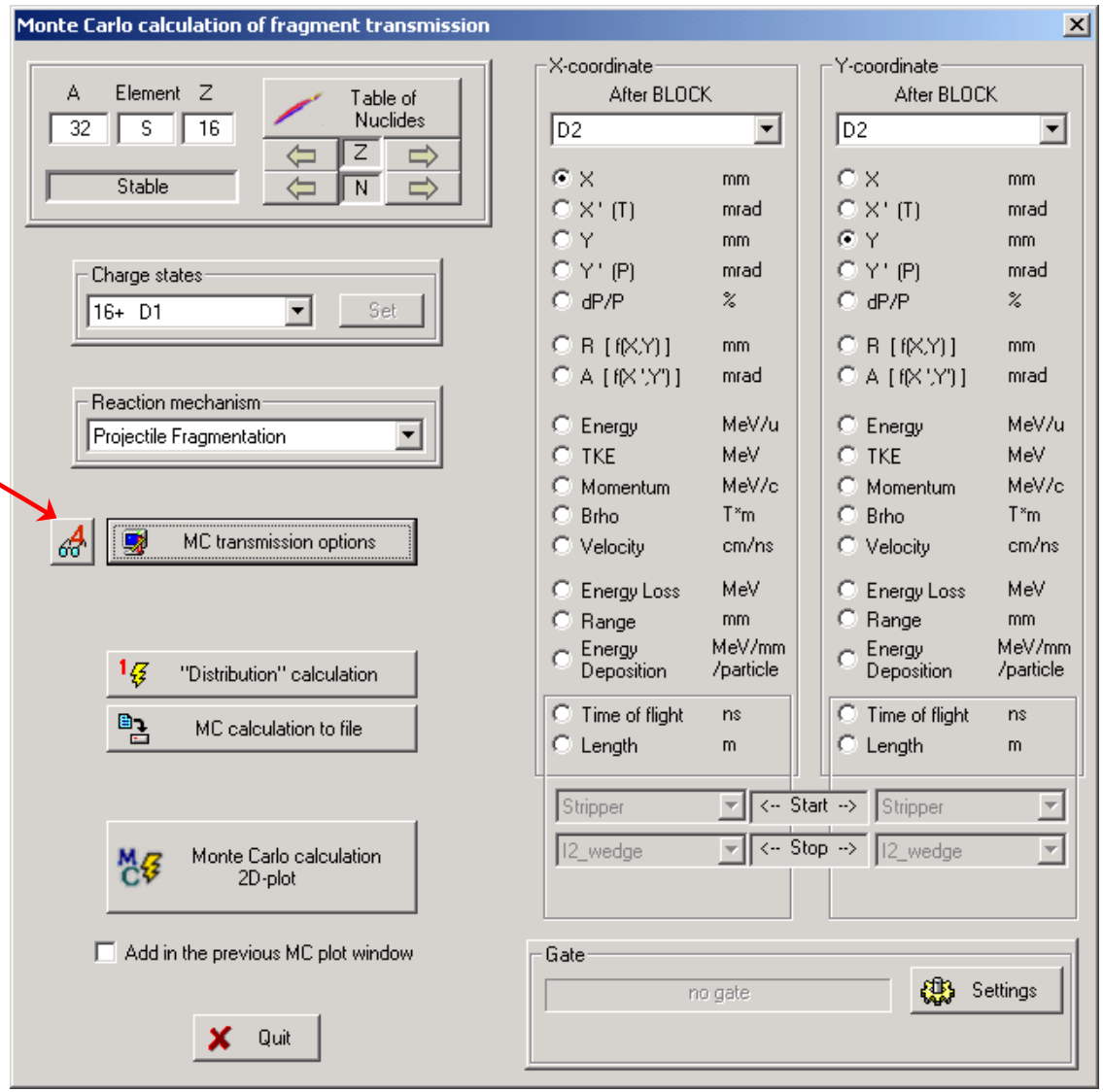


LISE++ defines automatically the highest order and make buttons enable/disable

Monte Carlo dialog

Information about the set order,

Clicking on this icon you can cyclically change order



Calculation Speed

(A1900 configuration)

1st order ~ 3600 cps

2nd order ~ 3400 cps

3rd order ~ 2500 cps

4th order ~ 1900 cps

5th order ~ 1200 cps

Example 1 - stripper

Emittance

Beam CARD (sigma)

1. X	3	mm
2. T	6	mrad
3. Y	3	mm
4. P	6	mrad
5. L	0	mm
6. D	0.07	%

Gate for Monte Carlo calclulation transmission

Coordinate

After BLOCK: Stripper

X	mm
X' (T)	mrad
Y	mm
Y' (P)	mrad
dP/P	%
R [f(X,Y)]	mm
A [f(X',Y')]	mrad
Energy	MeV/u
TKE	MeV
Momentum	MeV/c
Brho	T*m
Velocity	cm/ns
Energy Loss	MeV
Range	mm
Energy Deposition	MeV/mm /particle
Time of flight	ns
Length	m

Status (Condition)

- absent
- "AND"
- "NOT"

Gate

v1 = -2

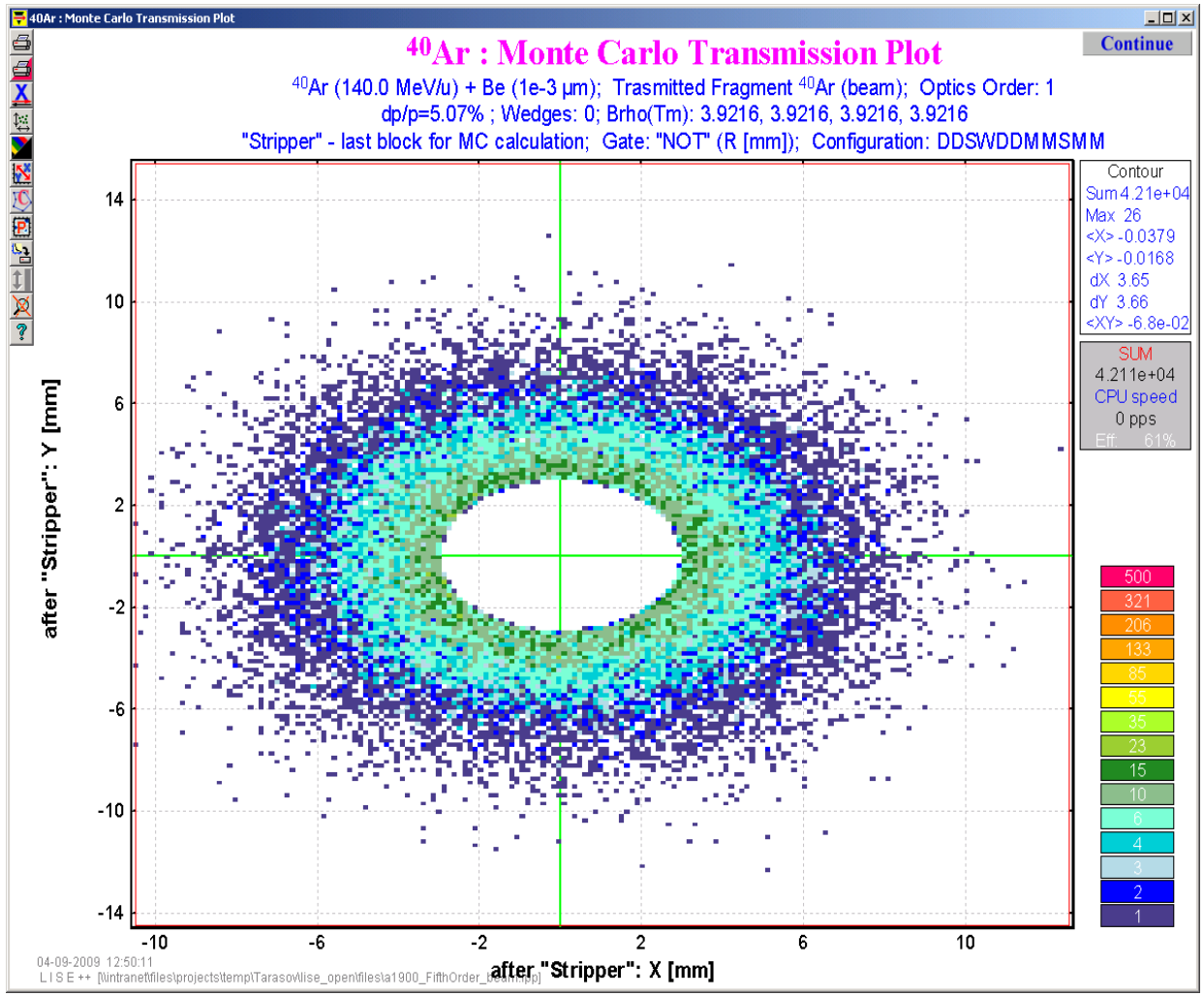
v2 = 2

OK

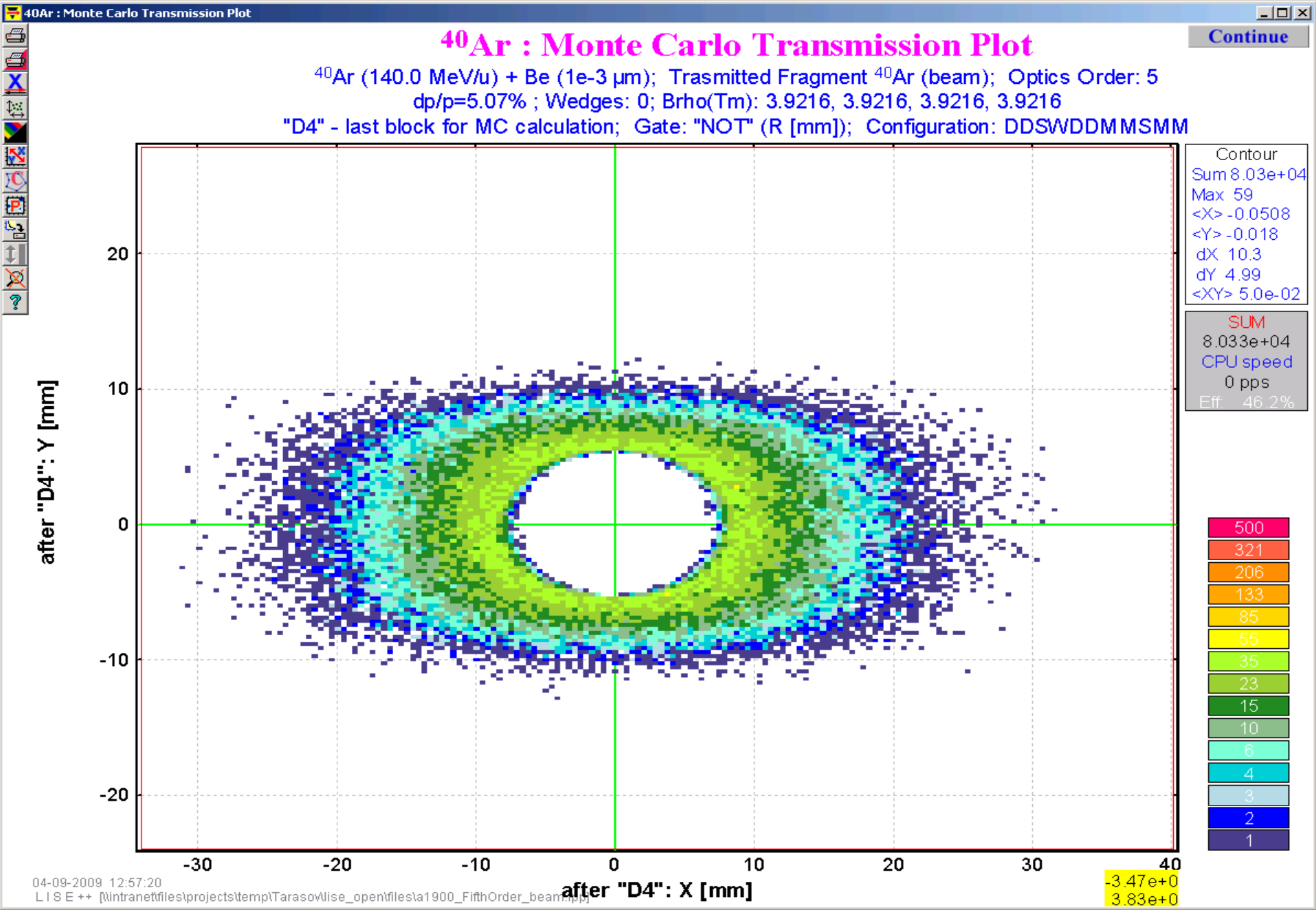
Cancel

Start: Stripper

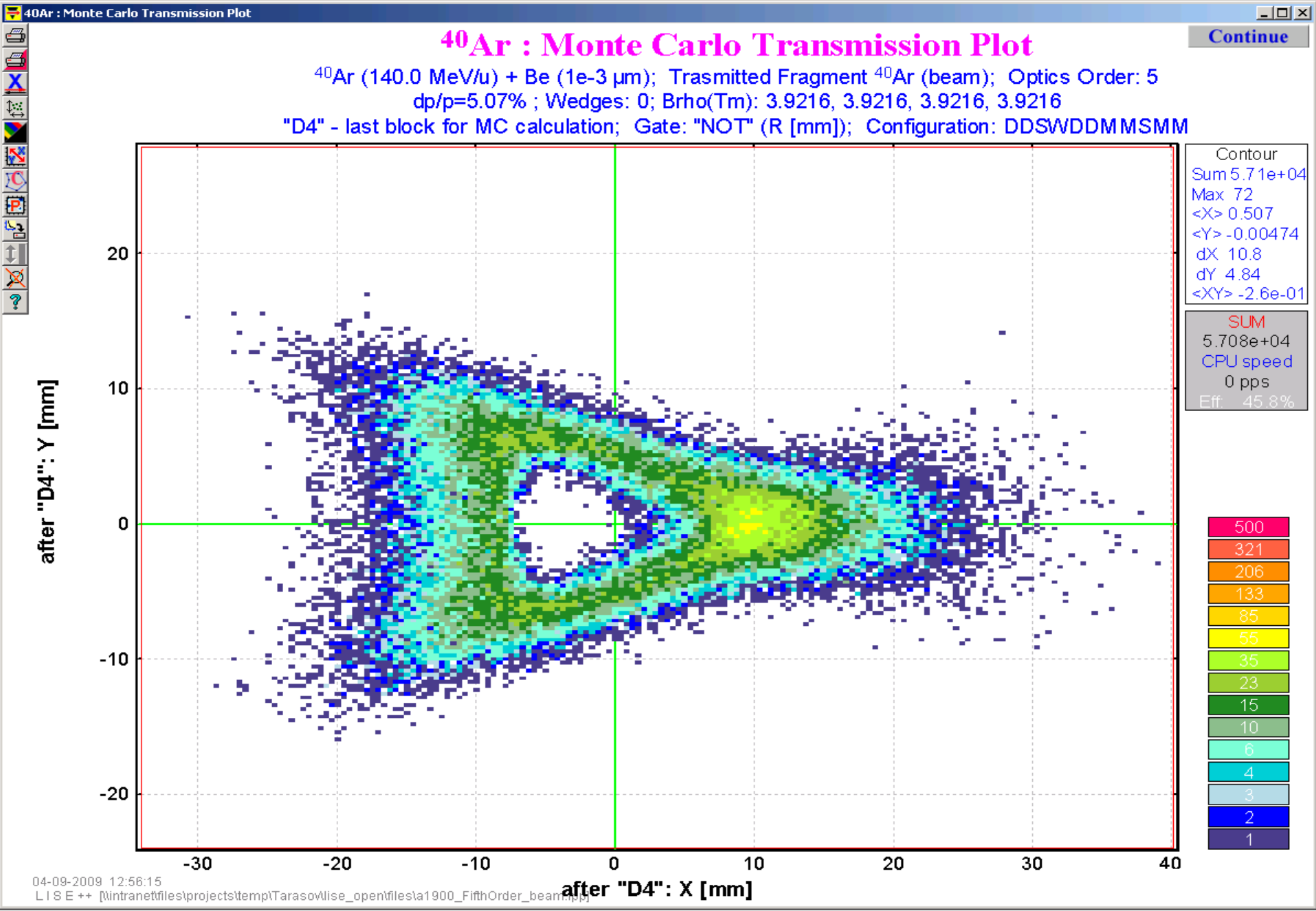
Stop: Stripper



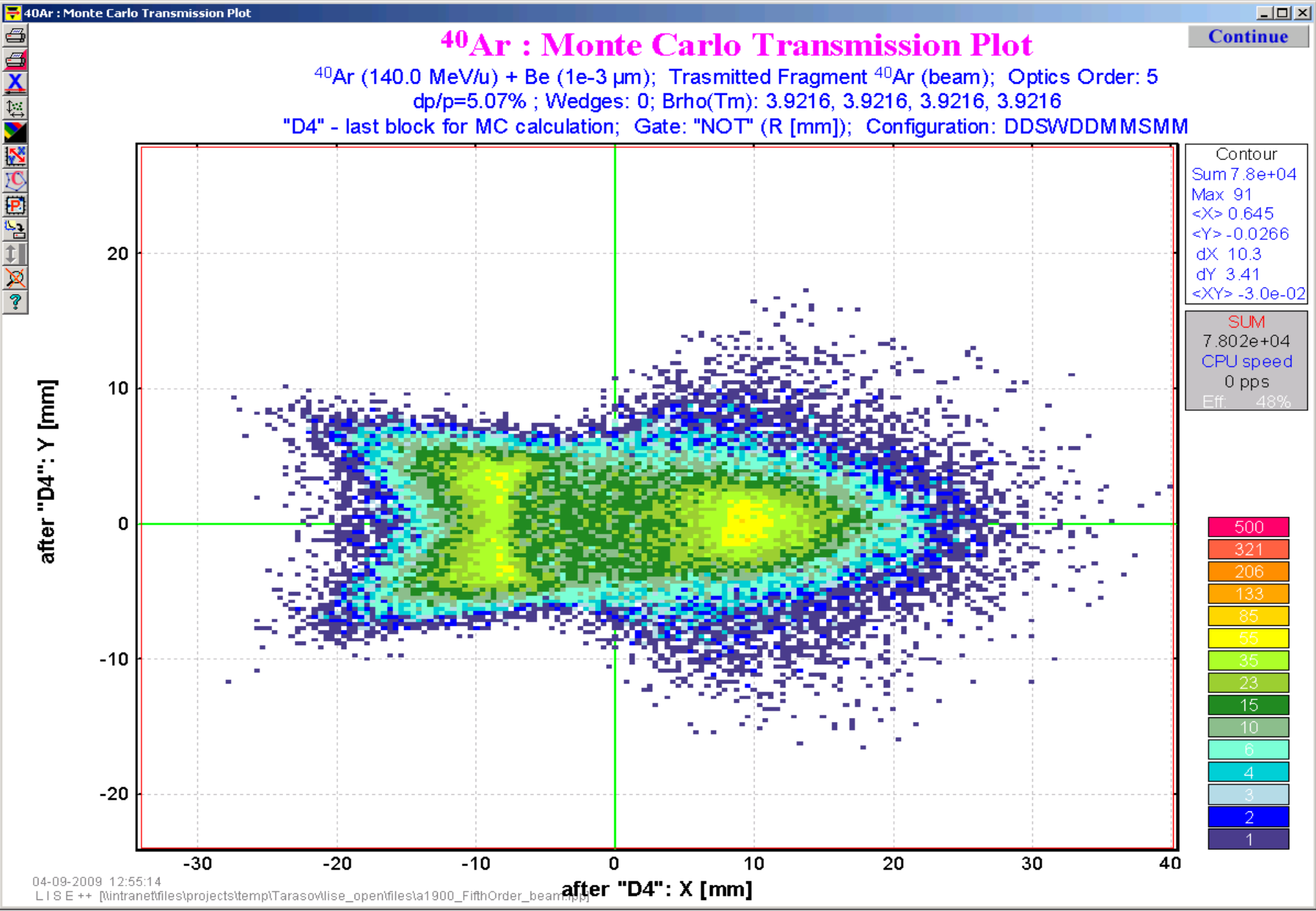
Example 1 – Image4 : order 1



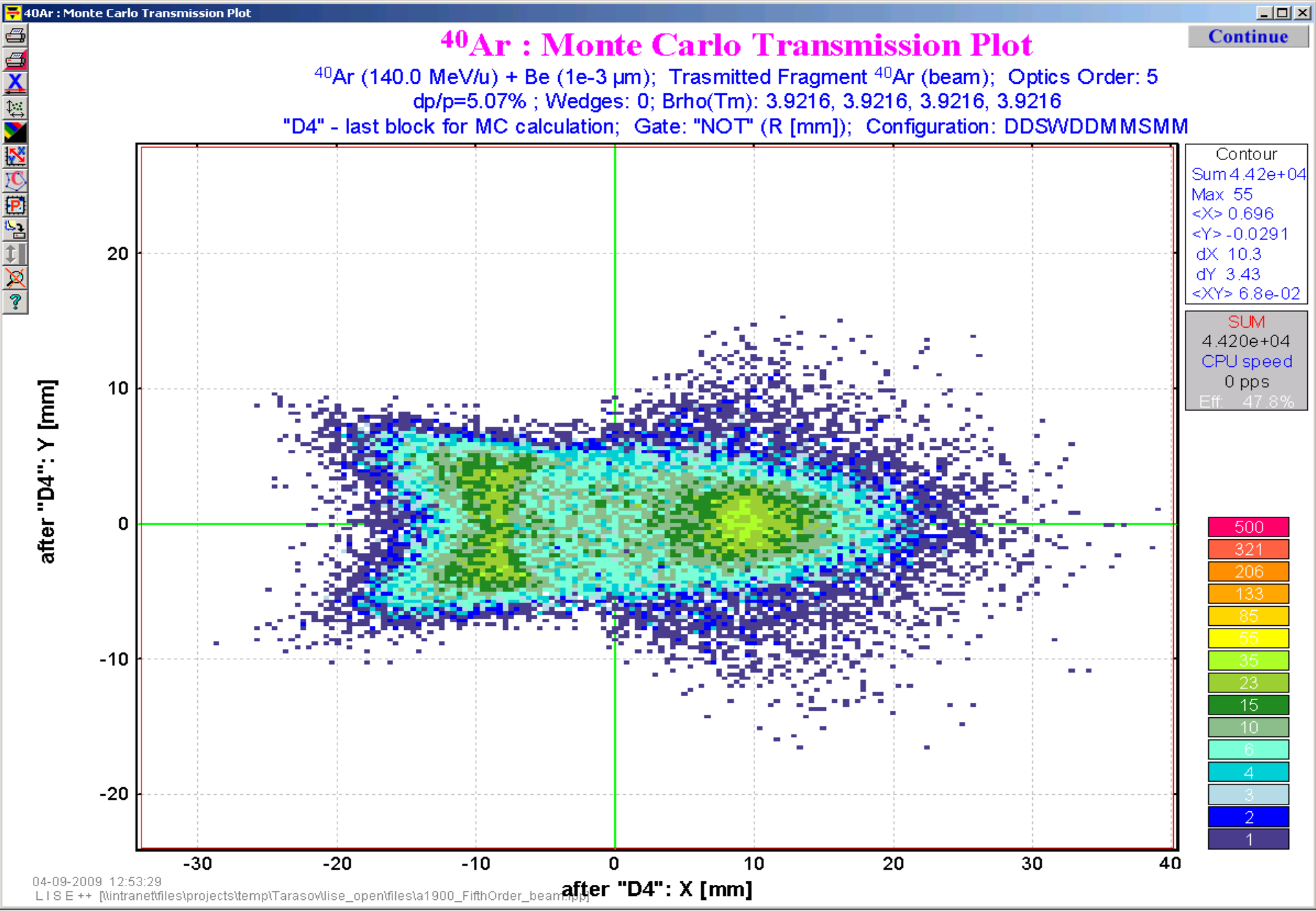
Example 1 – Image4 : order 2



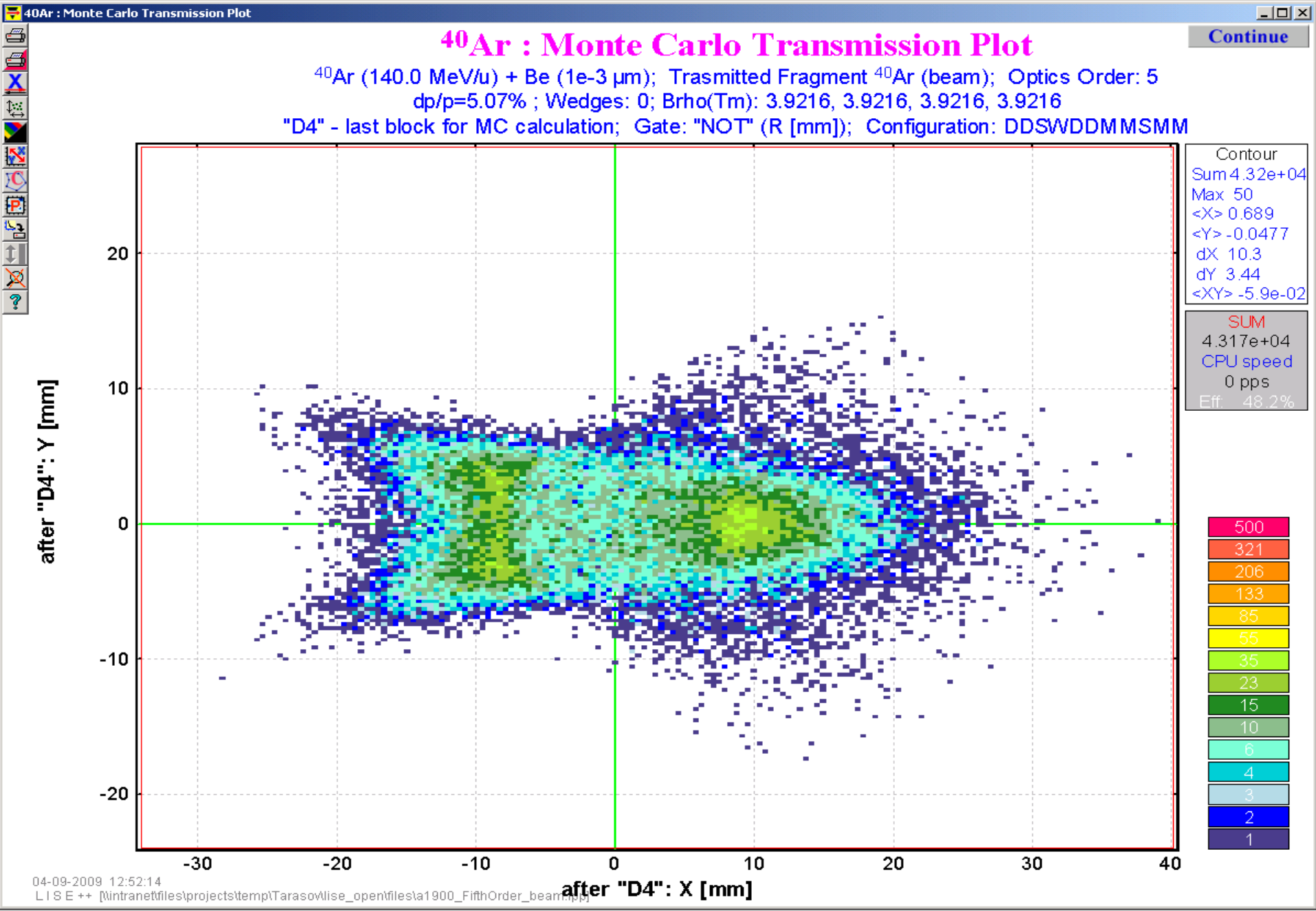
Example 1 – Image4 : order 3



Example 1 – Image4 : order 4



Example 1 – Image4 : order 5



Example 2 – Image4 : order 5, Y' vs. X'

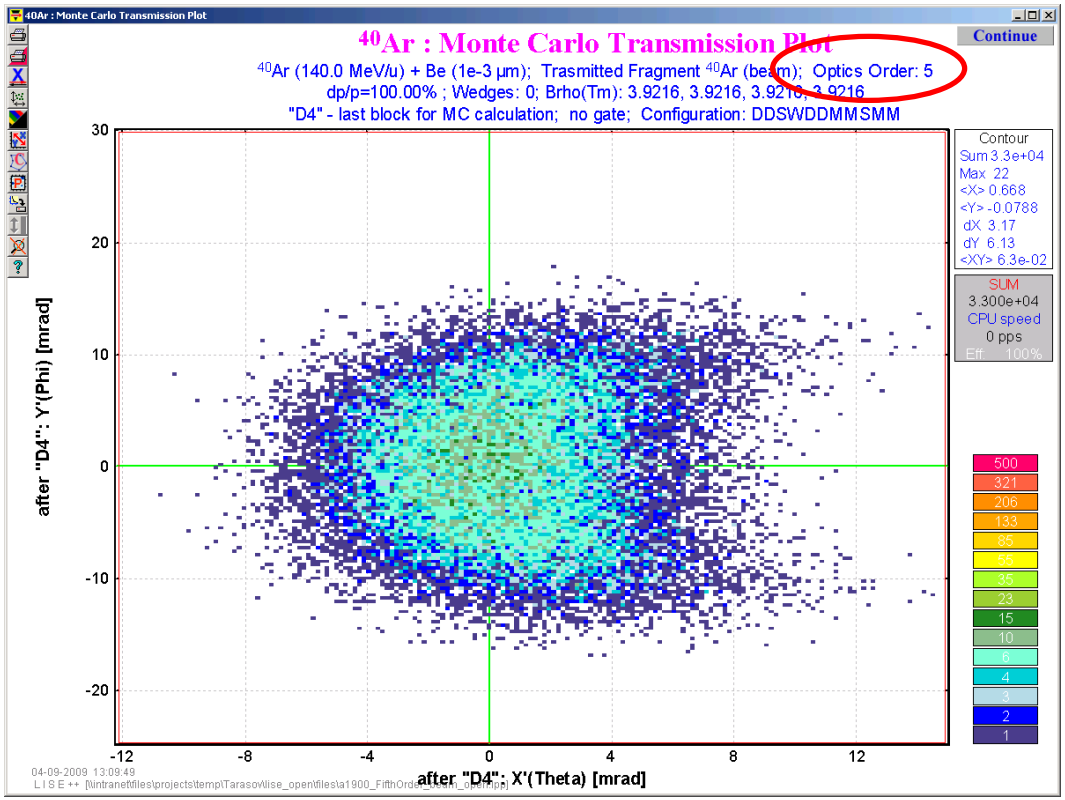
Emittance

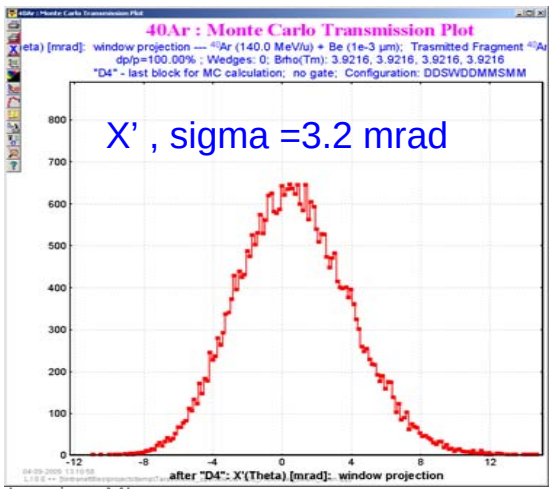
Beam CARD (sigma)

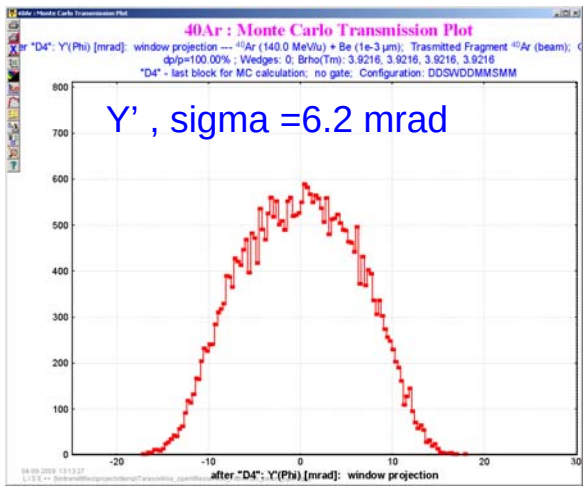
1. X	1	mm
2. T	7	mrad
3. Y	1	mm
4. P	7	mrad
5. L	0	mm
6. D	0.07	%

Global matrix

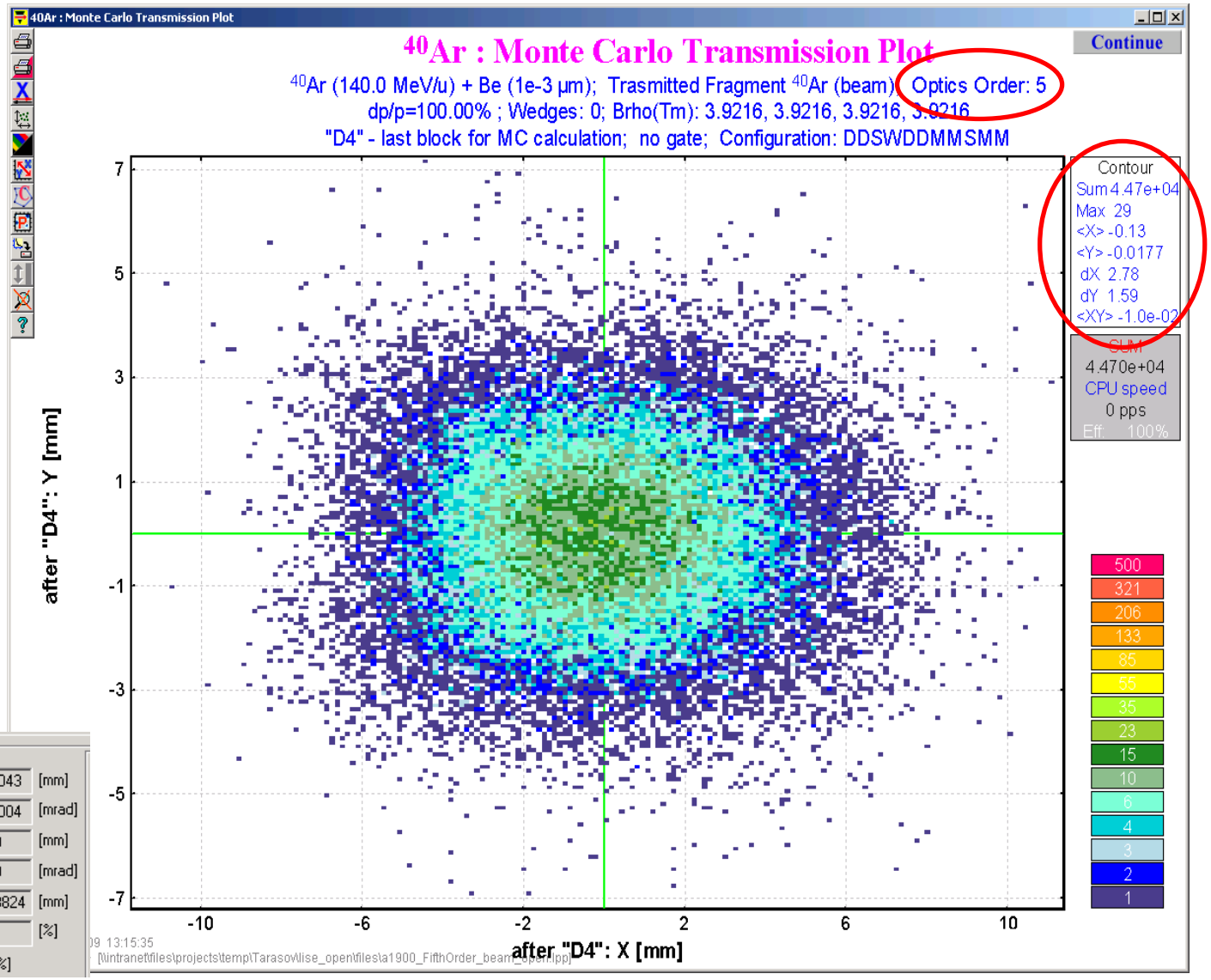
2.6917	-0.0722	0	0	0	-0.0043	[mm]
-1.0586	0.3999	0	0	0	-0.0004	[mrad]
0	0	1.8167	0.0052	0	0	[mm]
0	0	6.4009	0.5695	0	0	[mrad]
0	0.0001	0	0	1	-10.8824	[mm]
0	0	0	0	0	1	[%]
/[mm]	/[mrad]	/[mm]	/[mrad]	/[mm]	/[%]	







Example 2 – Image4 : order 5, Y vs. X



Emittance

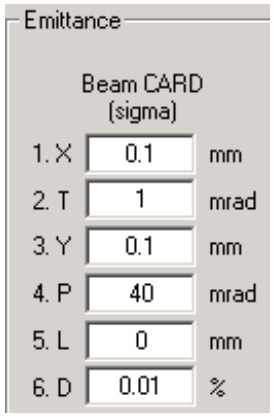
Beam CARD (sigma)

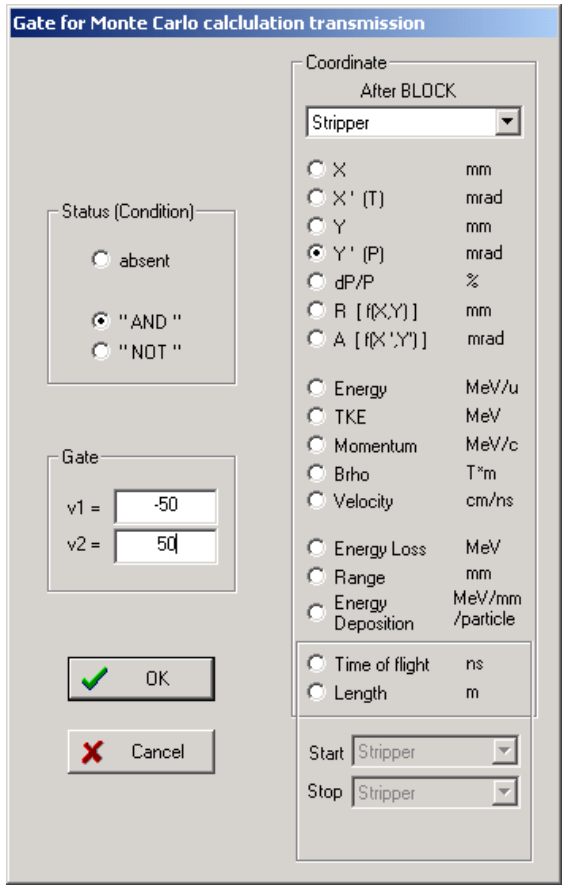
1. X	1	mm
2. T	7	mrad
3. Y	1	mm
4. P	7	mrad
5. L	0	mm
6. D	0.07	%

Global matrix

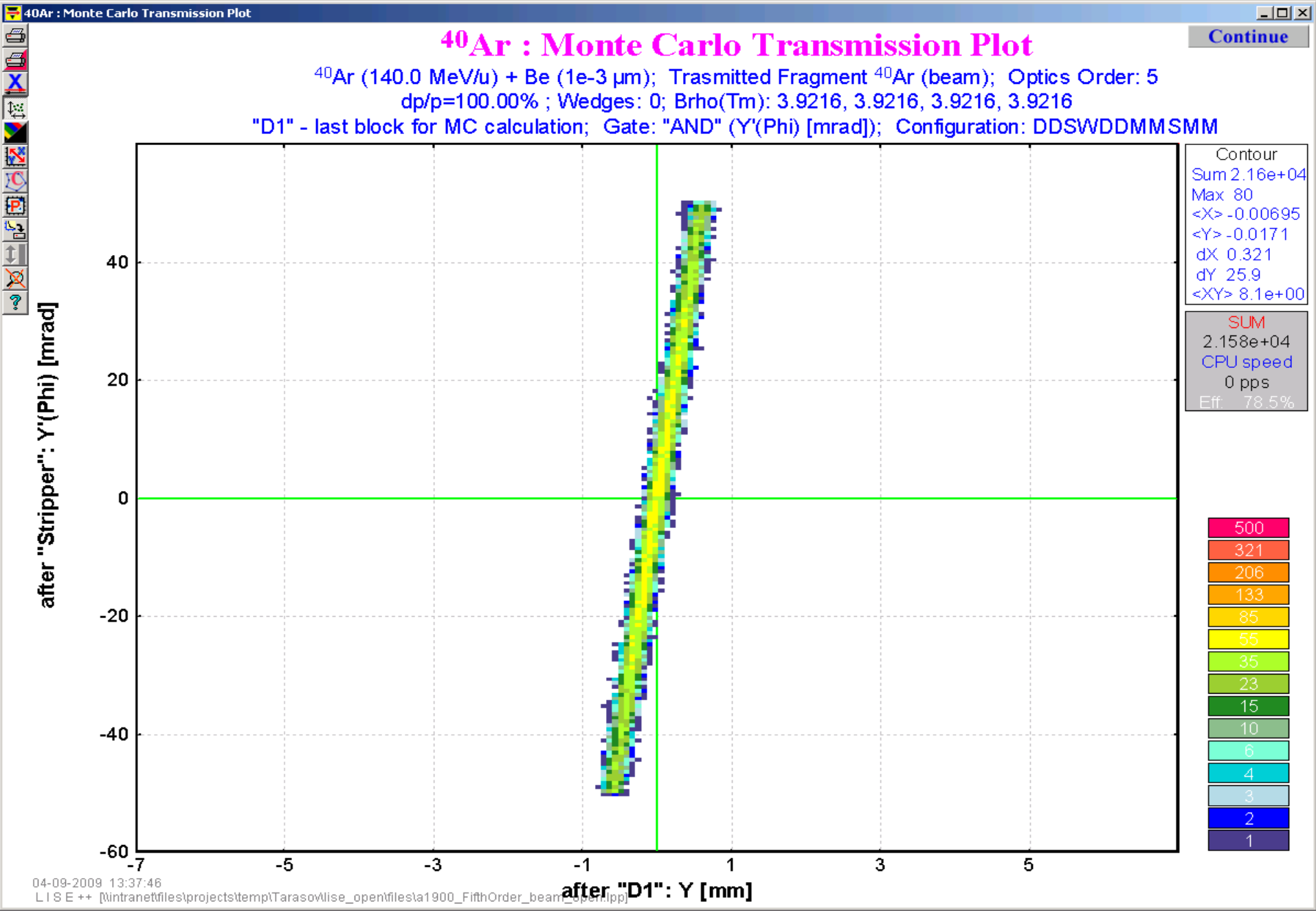
2.6917	-0.0722	0	0	0	-0.0043	[mm]
-1.0586	0.3999	0	0	0	-0.0004	[mrad]
0	0	1.8167	0.0052	0	0	[mm]
0	0	6.4009	0.5695	0	0	[mrad]
0	0.0001	0	0	1	-10.8824	[mm]
0	0	0	0	0	1	[%]
/[mm]	/[mrad]	/[mm]	/[mrad]	/[mm]	/[%]	

Example 3

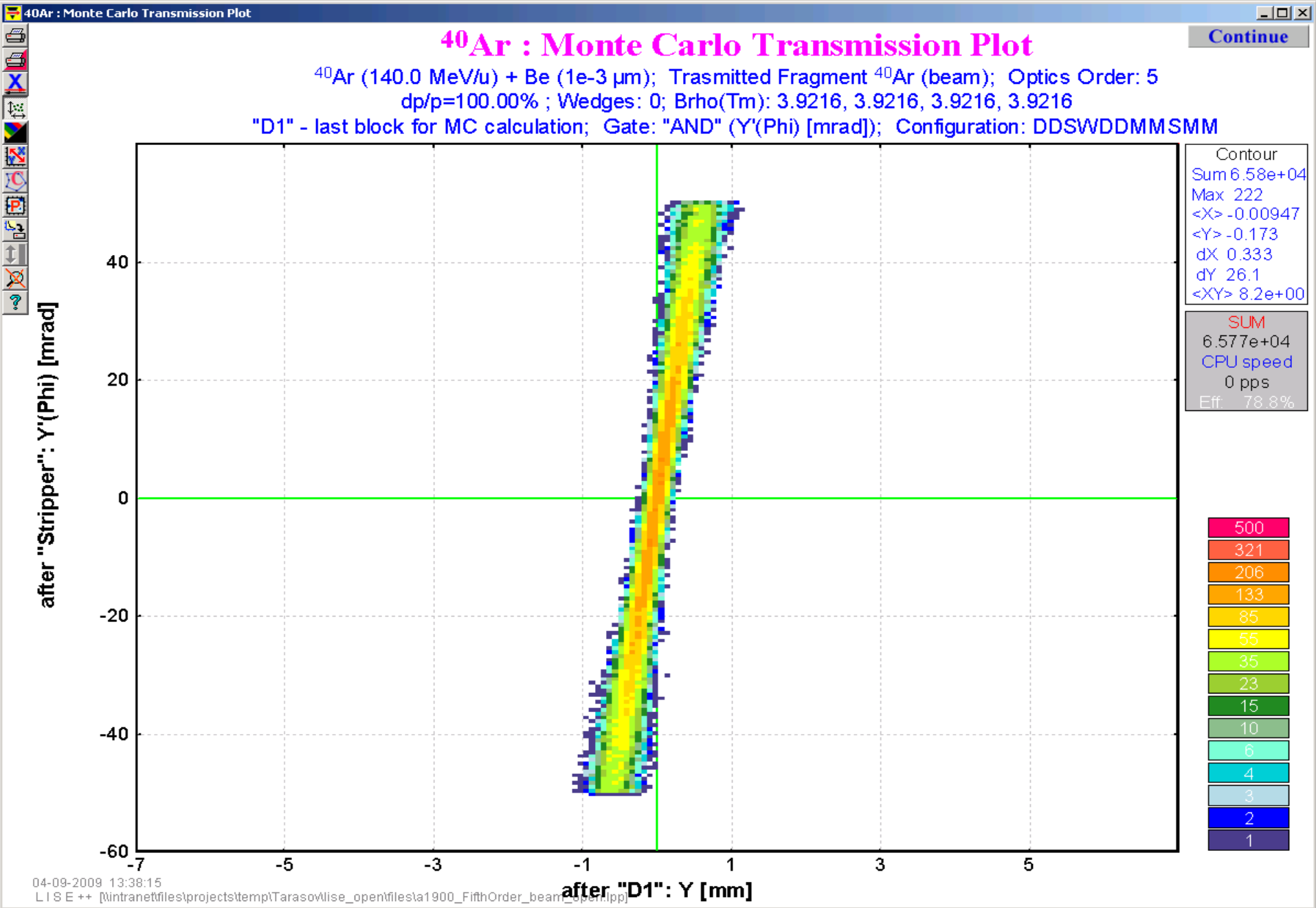

Emittance
Beam CARD
(sigma)
1. X 0.1 mm
2. T 1 mrad
3. Y 0.1 mm
4. P 40 mrad
5. L 0 mm
6. D 0.01 %


Gate for Monte Carlo calclulation transmission
Coordinate
After BLOCK
Stripper
X mm
X' (T) mrad
Y mm
Y' (P) mrad
dP/P %
R [f(X,Y)] mm
A [f(X',Y')] mrad
Energy MeV/u
TKE MeV
Momentum MeV/c
Brho T*m
Velocity cm/ns
Energy Loss MeV
Range mm
Energy Deposition MeV/mm /particle
Time of flight ns
Length m
Status (Condition)
absent
"AND"
"NOT"
Gate
v1 = -50
v2 = 50
OK
Cancel
Start Stripper
Stop Stripper

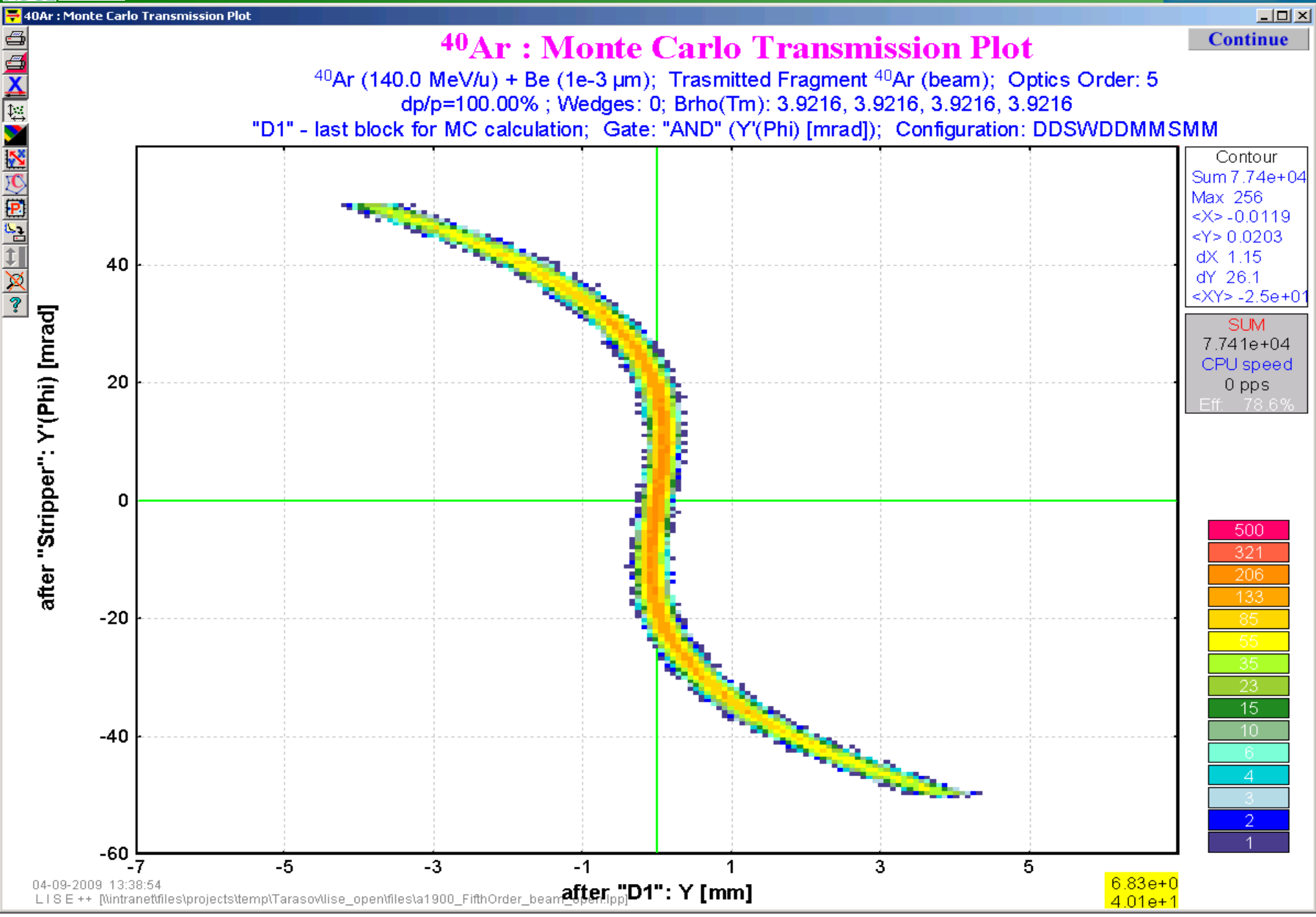
Example 3 – Image1 : order 1



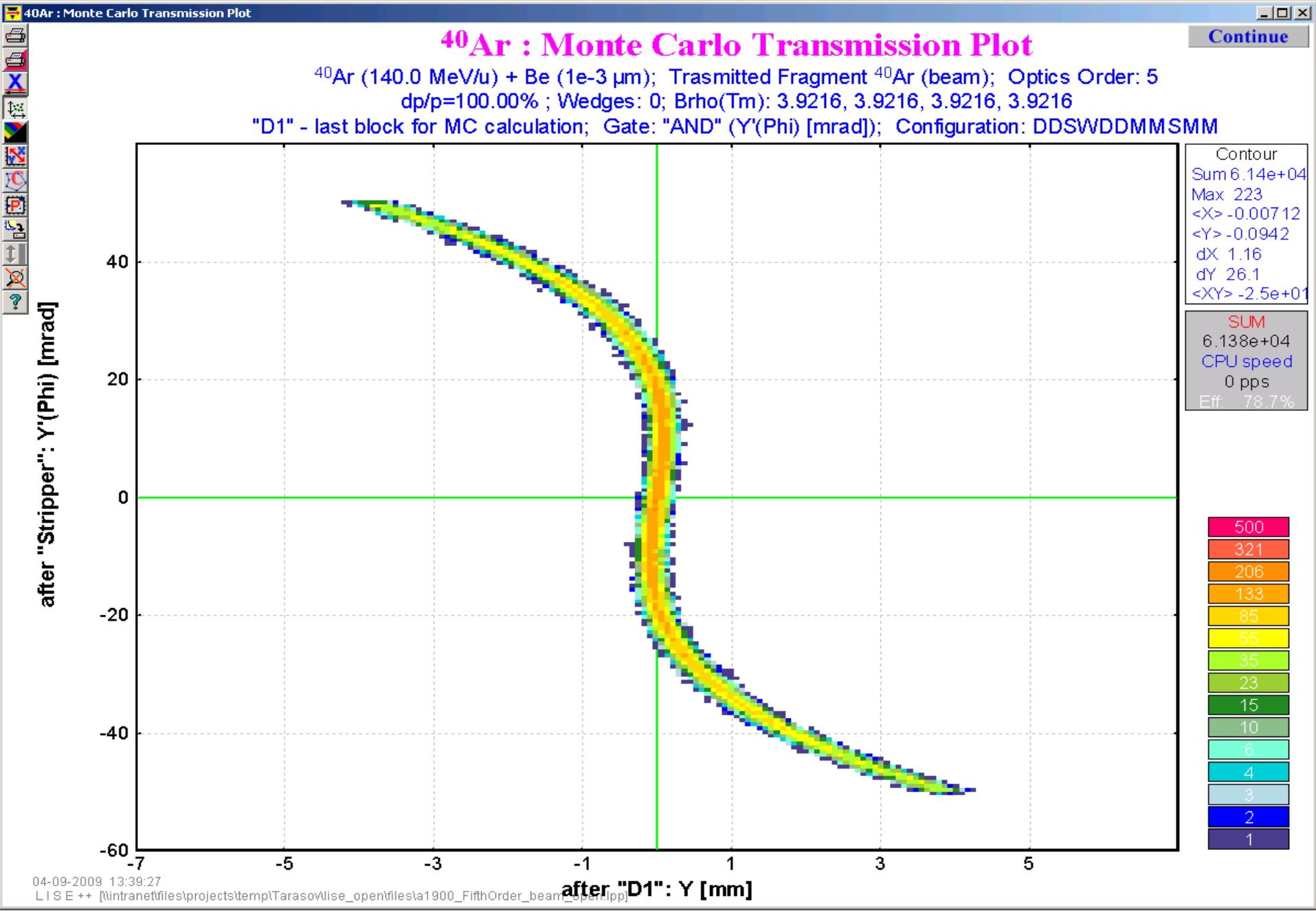
Example 3 – Image1 : order 2



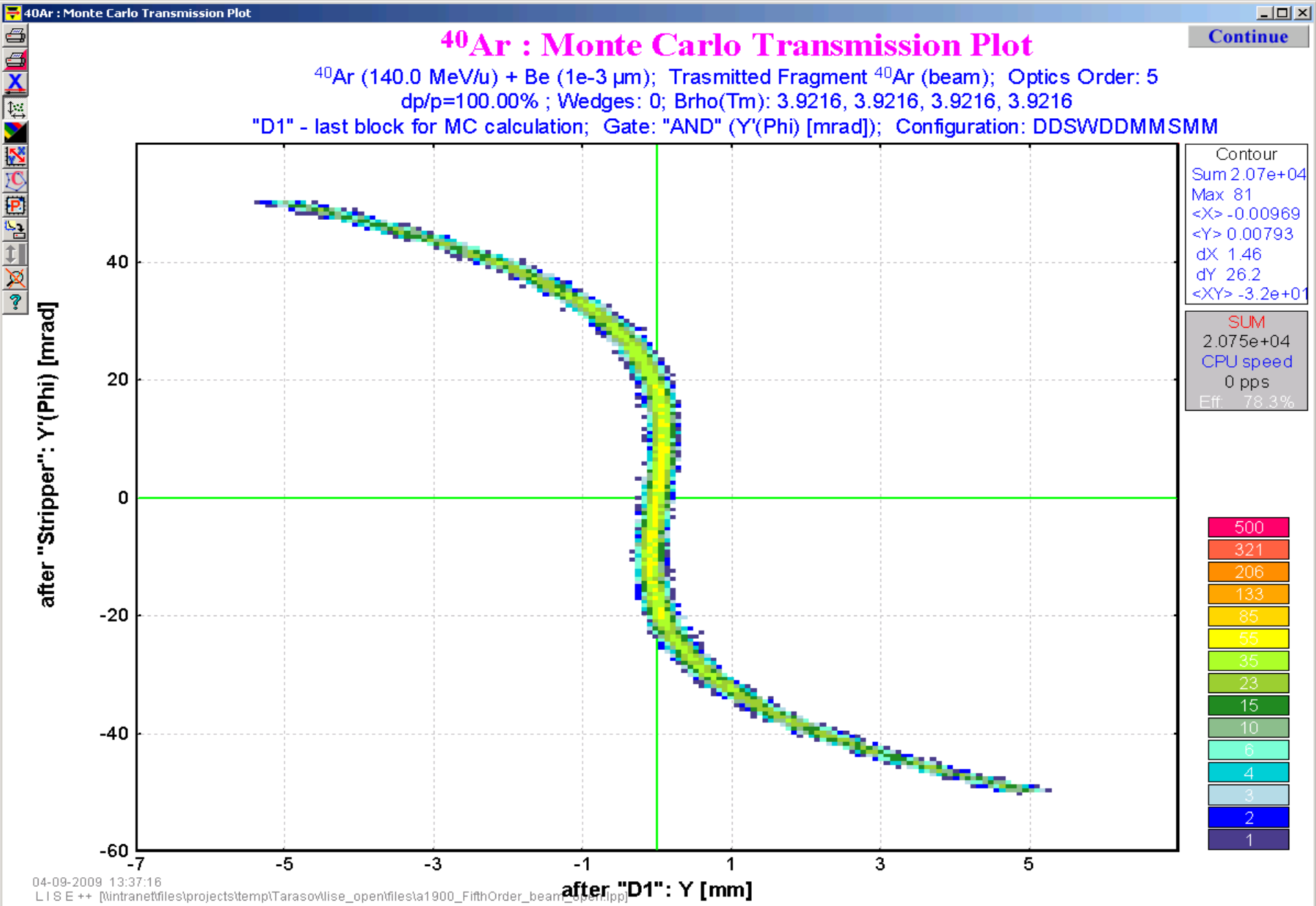
Example 3 – Image1 : order 3



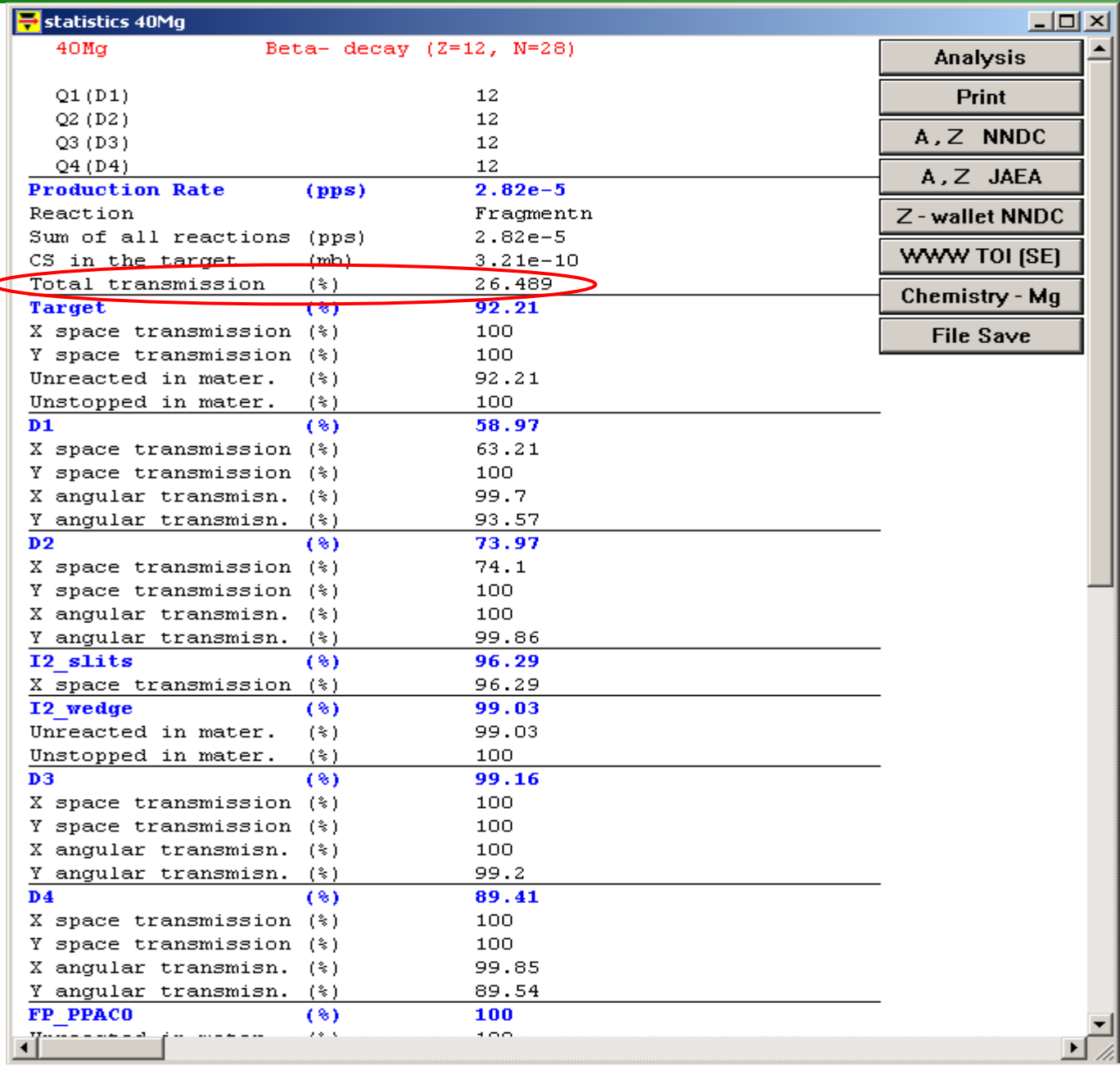
Example 3 – Image1 : order 4



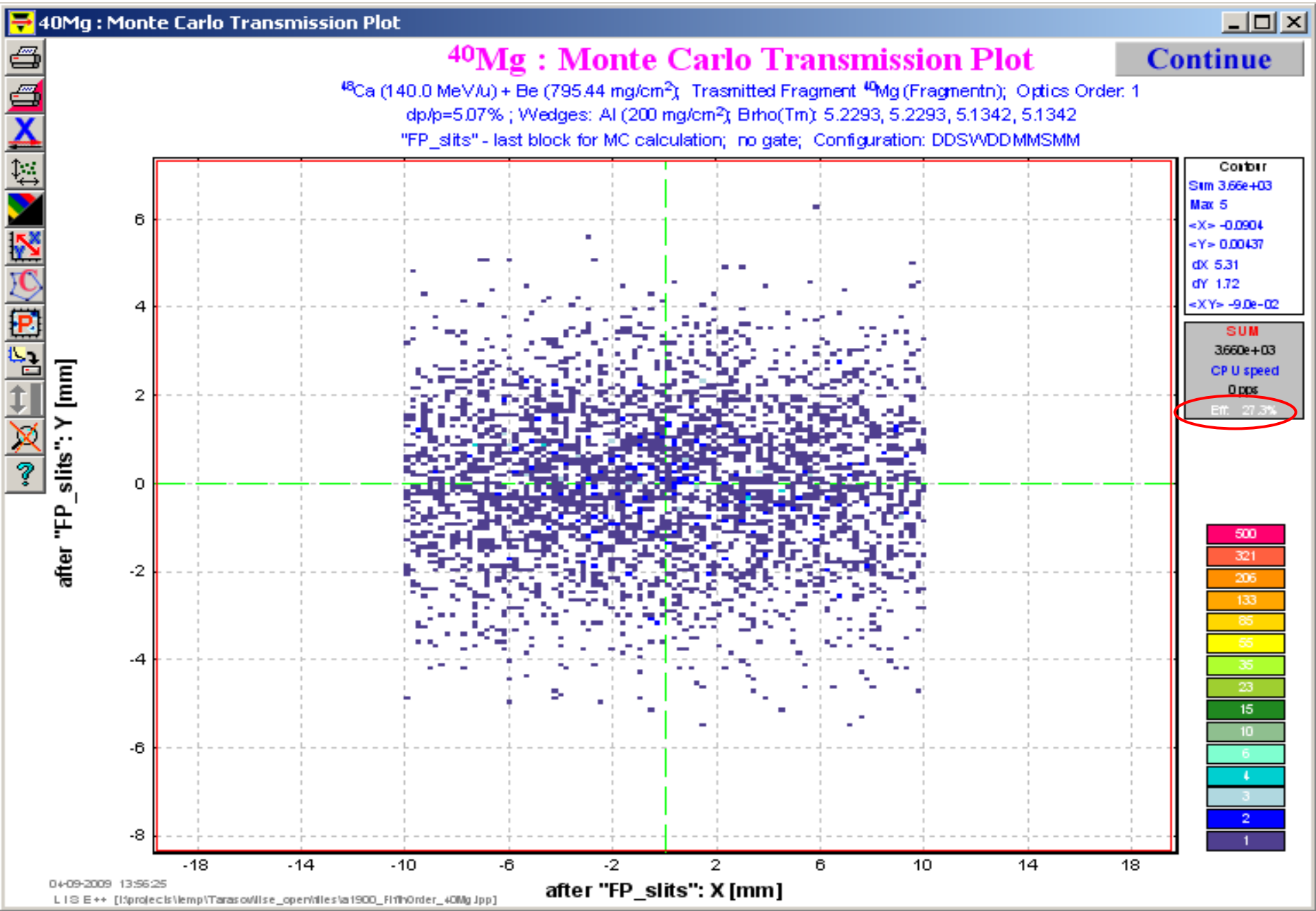
Example 3 – Image1 : order 5



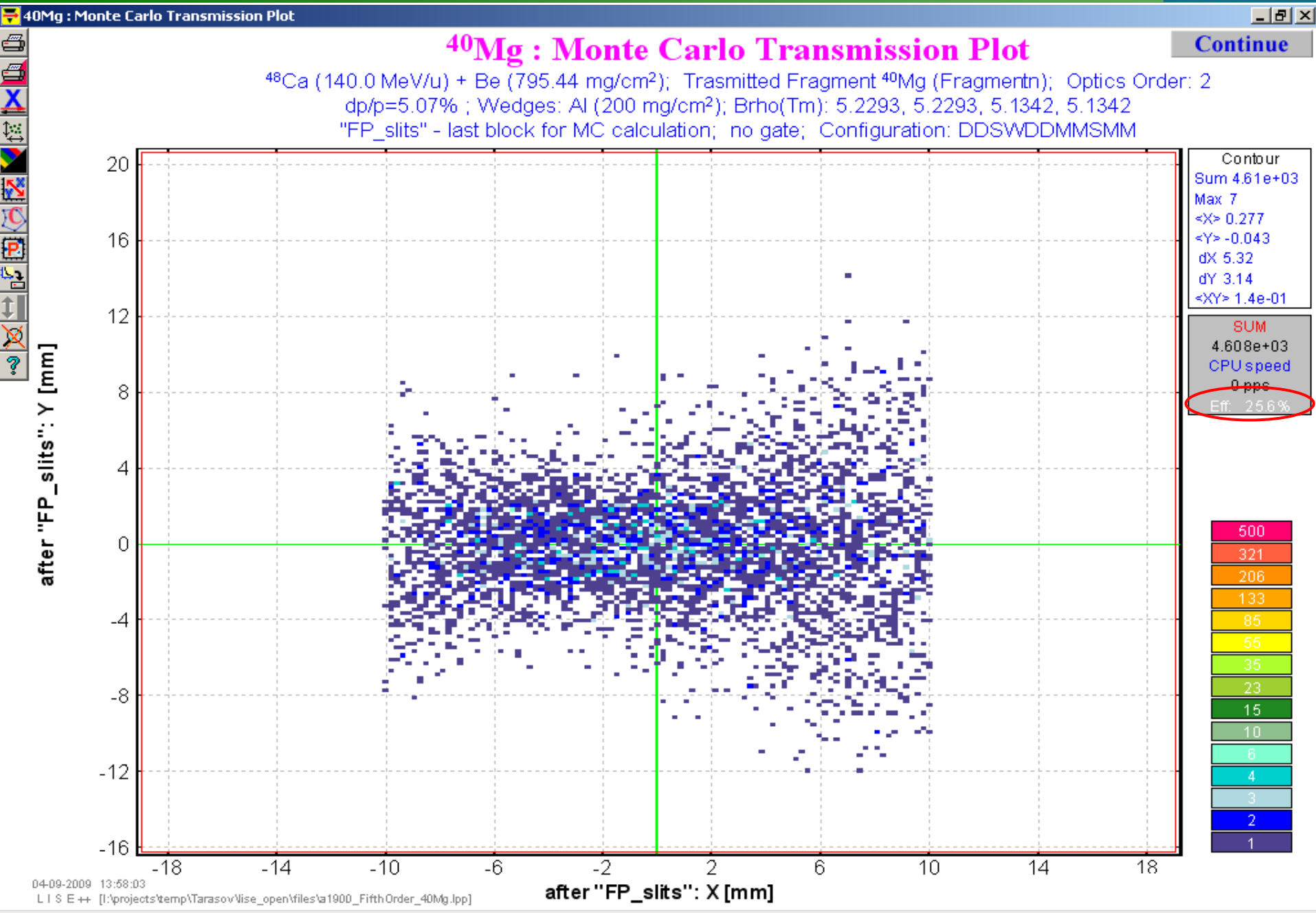
Example 4 – transmission: Distribution method



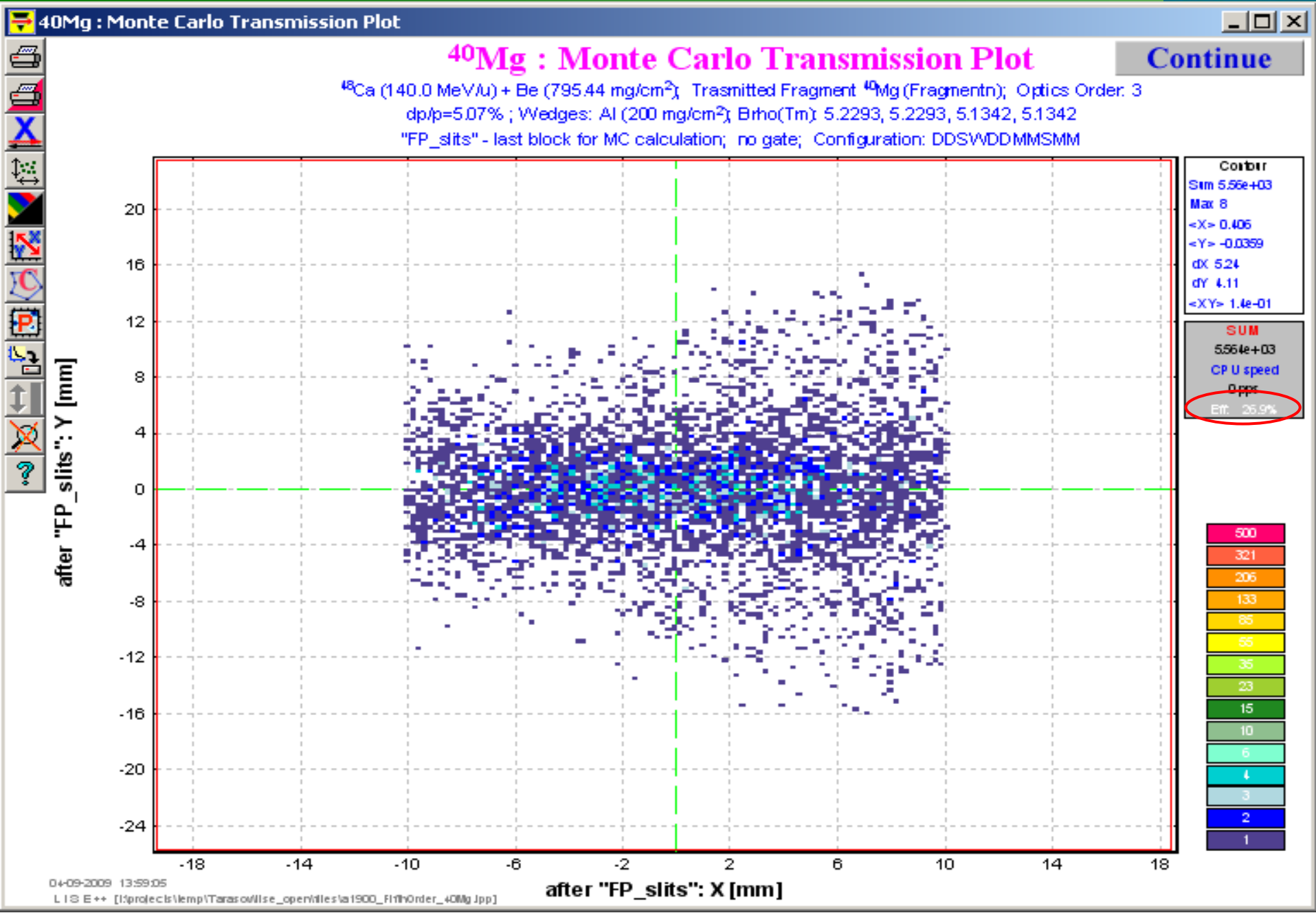
Example 4 – transmission: 1st order



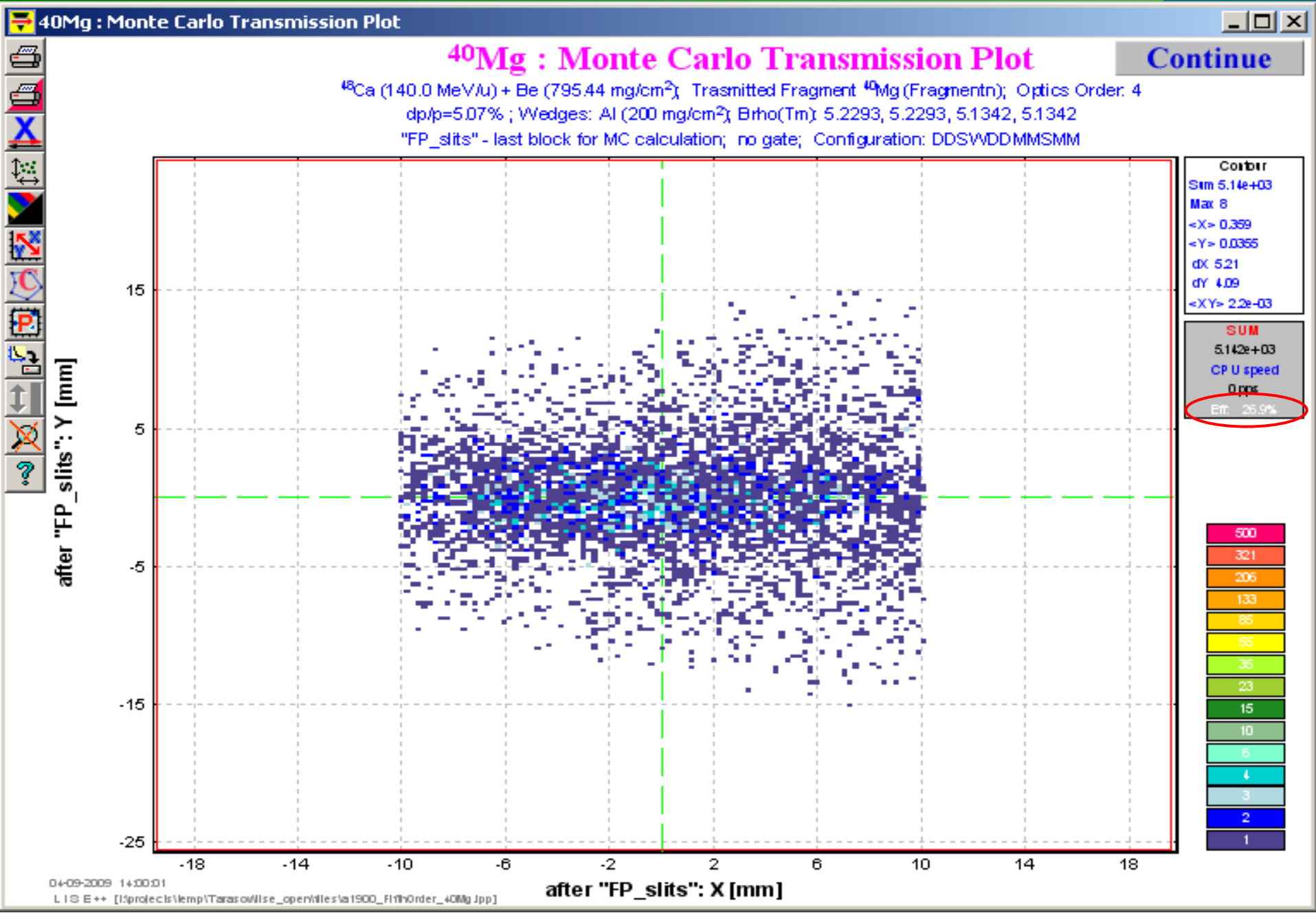
Example 4 – transmission: 2nd order



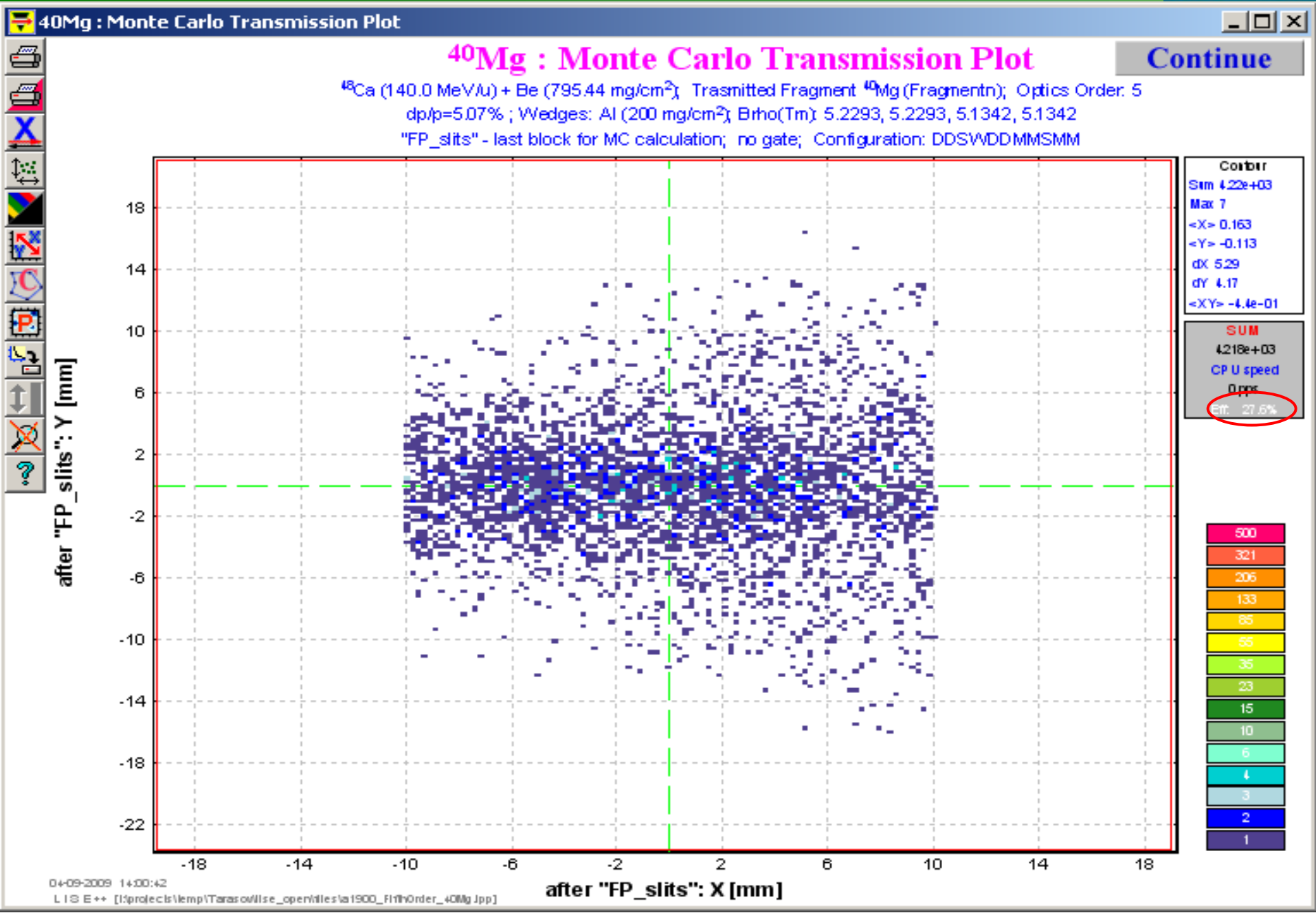
Example 4 – transmission: 3rd order



Example 4 – transmission



Example 4 – transmission: 5th order



Next…

High order optics

- MOCADI A1900 file for LISE^{++}, as well as translator from MOCADI to LISE^{++}
- The Optics dialog should be commissioned, as well Local <-> Global transformation.
- New utility for MC mode (Envelope plot to see transmission loss)
- New official LISE^{++} version 8.4. Include High orders.

General

- Abrasion-Dissipation-Ablation (ADA)
- 64-bit operational system & LISE++
- MOTER
- Monte Carlo evaporation cascade to track “parents”
- Brho-method to measure half-lives

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