

This update can be used to create **DRAGON, FMA, S<sup>3</sup>** and others extended configurations, where E-quads and E-dipoles are used

V. 9.6.117  
from 08/06/13

## 1. Electrostatic quadrupole

*\* matrix calculation*

## 2. Electrostatic bender (dipole) update

*\* matrix calculation*

*\*  $E\rho$  selection for analytical and MC calculations*

*\* E & B bends example*

*\* D-line : extended configuration*

## 3. New optical block : “Shift”

*\* example with 5 mm 1st triplet misalignment*

## 4. Others (July-August 2013)

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://lise.nsci.msu.edu>

# 1. Electrostatic quadrupole

Block	Given Name	Start(m)	Length(m)	B0(kG)	Br(Tm)corr./real	DriftM/*Angle	Rapp(cm)/*R(m)	L_eff(m)/*L_dip(m)	2 nd order	CalcMatr/*Z-Q	AngAcc.Apps.Slits	COSY_link
Drift	B01_D958	0.528	0.1000	+4.006kV	Er0.120	e-quadrupole	3.0000	0.1000	no	1	-- HV --	-



**B01\_D957**

Kind of Drift (or Multipole) block

- BEAM-LINE block. Non-dispersive optical block. User can change the optical matrix values.
- STANDARD DRIFT block as in the Transport code. Use this mode for a long detector. The Optical matrix is determined by the code.
- QUADRUPOLE (magnetic). The matrix can be calculated as in the Transport code with using block parameters (radius, effective length, magnetic field)
- SEXTUPOLE (magnetic). The matrix can be calculated as in the Transport code with using block parameters (radius, effective length, magnetic field)
- eQUADRUPOLE (electrostatic). The matrix can be calculated with using block parameters (r,V,g,L)**

Buttons: Calculate Optical matrix, Settings, Settings

Optical block properties and data

Length = 0.1 m  
Brho = 0.3523 Tm

Buttons: Cut (Slits) & Acceptances, Optical matrix, General setting of block

Show in the "Setup" window

- Block length
- Brho value

Do not forget to recalculate the Optical matrix if you changed the DRIFT MODE!

Buttons: OK, Cancel, Help

**Electrostatic Quadrupole**

Settings

L\_eff (effective length) = 0.1 m  
U (voltage) = -5.50491 kV  
Radius (half-aperture) = 3 cm  
Quad fixed Erho-value corresponding to the setting fragment: 0.12004 MJ/C  
Buttons: Fix current value, calculate 2nd order matrix elements

Information

Block length: 0.1 m  
Current (Real) Erho-value for the setting fragment: 0.12004 MJ/C  
Setting fragment: 100Ru1+

Do not forget to recalculate the Optical matrix if you changed cell contents in the Manual mode!

Buttons: Recalculate Voltage for the fragment current Erho, Calculate Optical matrix, Edit optical matrix, OK, Cancel

if Erho-value has been changed then

- no actions
- recalculate automatically U (voltage), keep the matrix [Recommended]
- recalculate automatically the matrix, keep U (voltage)

Optical matrix - B01\_D957

$G_i = L_i \cdot G_{i-1}$   
G - Global, L - Block (Local)

Dimension: mm, cm  
Matrices: Block (local), Global  
Second Order LOCAL matrix: Non, Exit (only for Monte Carlo transmission)

Block matrix	Global matrix	Beam (sig)
1. X: 1.55431, 0.01179, 0, 0, 0, 0, 0	1.55431, 0.07518, 0, 0, 0, 0, 0 [cm]	3.0086
2. T: 1.201e+2, 1.55431, 0, 0, 0, 0, 0	1.201e+2, 6.45228, 0, 0, 0, 0, 0 [mrad]	258.1916
3. Y: 0, 0, 0.53228, 0.00839, 0, 0, 0	0, 0, 0.53228, 0.0301, 0, 0, 0 [cm]	1.2043
4. F: 0, 0, -85.46067, 0.53228, 0, 0, 0	0, 0, -85.46067, -2.95301, 0, 0, 0 [mrad]	118.2317
5. L: 0, 0, 0, 0, 0, 1, 0	0, 0, 0, 0, 0, 1, 0 [cm]	0
6. D: 0, 0, 0, 0, 0, 0, 1	0, 0, 0, 0, 0, 0, 1 [%]	0.01

Det = 1.00024

Buttons: Import/Link COSY map, Spectrometer matrix, OK, Cancel, Help

Right now it is only 1-st order calculations

E-quad -- options : matrix keeping & automatic U recalculation, and U-keeping & automatic matrix recalculation

## LISE<sup>++</sup>

Beam

A	Element	q+
12	C	6
Z		
Stable		
Table of Nuclides		

Beam energy:

Energy	0.03	MeV/u
TKE	0.36	MeV
Brho	0.0499	Tm
P	0.09	GeV/c
U	60	KV

Electrostatic Quadrupole

Settings:

L<sub>eff</sub> (effective length) = 1 m

U (voltage) = 8 kV

Radius (half-aperture) = 10 cm

Quad fixed E<sub>tho</sub>-value corresponding to the setting fragment: 0.12016 MJ/C

calculate 2nd order matrix elements

Information:

Block length = 1 m

Current (Real) E<sub>tho</sub>-value for the setting fragment: 0.12016 MJ/C

Setting fragment: 12C6+

Do not forget to recalculate the Optical matrix if you changed cell contents in the Manual model!

Recalculate Voltage for the fragment current E<sub>tho</sub>

If E<sub>tho</sub>-value has been changed then:

no actions

recalculate automatically U (voltage), keep the matrix [Recommended]

recalculate automatically the matrix, keep U (voltage)

$G_i = L_i * G_{i-1}$

G - Global, L - Block (Local)

Dimension: mm  cm

Matrices: Block (local)

Block matrix:

1. X	-0.87398	-0.01332	0	0	0	0
2. T	17.73287	-0.87398	0	0	0	0
3. Y	0	0	19.23211	0.52633	0	0
4. F	0	0	7.008e+2	19.23211	0	0
5. L	0	0	0	0	1	0
6. D	0	0	0	0	0	1

/[cm] /[mrad] /[cm] /[mrad] /[cm] /[%]

Det = 1.02203

## COSY

EQ <length> <voltage at pole tip> <aperture> ;

A := 12 ;  
 Q := 6 ;  
 VACC\_0 := 0.060 ; {Acceleration energy 60 KV}  
 UM ;  
 EQ 1.00 8.0 0.1 ;  
 PM LISE 'EQ\_COSY.TXT' ;

Lister - [c:\user\cosy\LISE\_COSY\_App\EQ\_COSY2.TXT]

File Edit Options Help

6	1	-0.87278E+00	-0.13367E-01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
		0.17823E+02	-0.87278E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00
		0.00000E+00	0.00000E+00	-0.19279E+02	-0.52727E+00	0.00000E+00	0.00000E+00
		0.00000E+00	0.00000E+00	0.70304E+03	-0.19279E+02	0.00000E+00	0.00000E+00
		0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	-0.10000E+01	0.00000E+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

		-0.8727833	17.82332	0.0000000	0.0000000	0.0000000	1.0000000
		-0.1336728E-01	-0.8727833	0.0000000	0.0000000	0.0000000	0.0000000
		0.0000000	0.0000000	19.27944	703.0436	0.0000000	0.0000000
		0.0000000	0.0000000	-0.5272742	19.27944	0.0000000	0.0000000
		0.0000000	0.0000000	0.0000000	0.0000000	1.0000000	0.0000000





**ElecDip 1**

Electrostatic Dipole Settings

Separation plane  
 Horizontal  Vertical

E (electric field) 133.51 KV/m  
 U (voltage) 13.351 KV  
 Electric rigidity 0.40053 MJ/C  
 Magnetic rigidity 0.09106 Tm  
 (corresponds to the setting fragment)

Electrostatic Dipole Constants

Distance between plates (gap) = 0.1 m

Bend Sector

Radius (r0) = 3 m  
 Angle = 45 deg  
 Length = 2.3562 m

Optical block properties and data

Setting Charge state for the Block [Z-Q] 0

Calculate the Values using the Setting fragment from

Target  
 D1

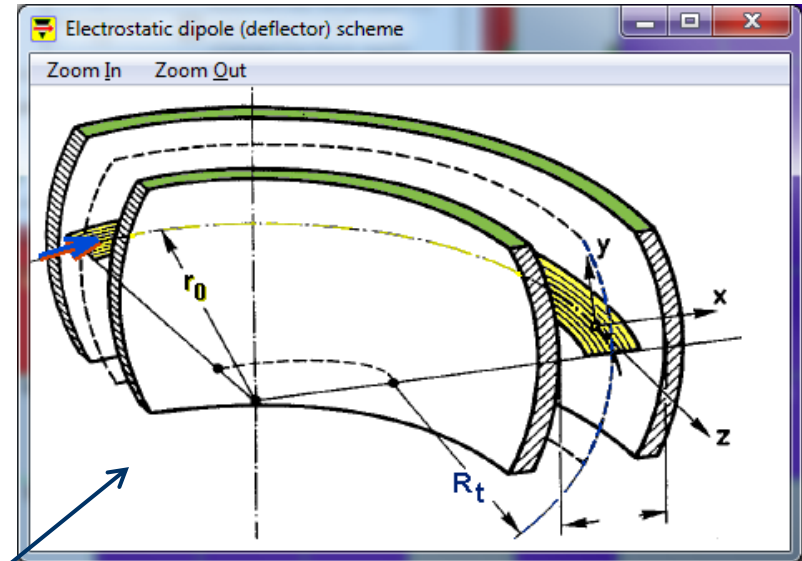
Advanced Elec.Dipole settings for extended configurations

Bend type: Rt (m)

Cylindrical INF  
 Spherical 3  
 Toroidal 10

Matrix calculations  
Automatically recalculate the matrix, when LISE++ has changed the block rigidity.

Important: Selection [X/D] in this block by Electric rigidity, where  $D = d(Erho)/(Erho)$



This checkbox is available after matrix calculations done

## LISE<sup>++</sup>

**Projectile** 12C6+  
 100 KeV/u 1 pA  
**Fragment** 12C6+ =beam=  
**Target**  
**Stripper**  
**ElecDip 1** E 133.5 KV/m  
 U 13.4 KV  
 Er 0.4 MJ/C

**ElecDip 1**

Electrostatic Dipole Settings

Separation plane  
 Horizontal  Vertical

E (electric field) 1334.4 KV/m  
 U (voltage) 133.44 KV  
 Electric rigidity 1.3344 MJ/C  
 Magnetic rigidity 0.16623 Tm  
 (corresponds to the setting fragment)

Electrostatic Dipole Constants

Distance between plates (gap) = 0.1 m

Bend Sector

Radius (R) = 1 m  
 Angle = 45 deg  
 Length = 0.7854 m

Optical block properties and data

Setting Charge state for the Block (Z-Q) 0

Cut(Slits) & Acceptances  
 Target  
 D1  
 Tweak: 0.1 %  
 Calculate other optic blocks

Advanced Elec.Dipole settings for extended configurations

Bend type: Rt (m) Show ED Scheme

Cylindrical INF  Matrix calculations  
 Spherical 1  
 Toroidal 10  
 Automatically recalculate the matrix, when LISE++ has changed the block rigidity

Important: Selection [X] in this block by Electric rigidity, where  $\Gamma = d(E\rho_0)/(E\rho_0)$

OK Cancel Help

Utility: Electrostatic deflector

Electrostatic dipole mode = Cylindrical

```

direct = X
radius = 1 m
angle = 45 deg
length = 0.7854 m
n = 0
beta = 0.02674
e_xi = 1.414
n_eta = 0
nk = 0.99982
Nm = 0.00017876
k2x = 2 m^(-2)
k2y = 0 m^(-2)
  
```

transport format [cm-mrad]

\* TRANSFORM 1 \*

[D] -- Momentum transfer matrix (Important!)

it is used for calculation of the Global matrix

```

1 [X] : +4.4419e-01 +6.3363e-02 0 0 0 +5.5581e-01
2 [T] : -1.2668e+01 +4.4419e-01 0 0 0 +1.2668e+01
3 [Y] : 0 0 1 0 +7.8540e-02 0
4 [F] : 0 0 0 0 1 0
5 [L] : -1.2668e+00 -5.5581e-02 0 0 0 -3.0342e-01
6 [D] : 0 0 0 0 0 1
  
```

transport format [cm-mrad]

\* TRANSFORM 1 \*

[D] -- Electrostatic rigidity selection (Important!)

it is used for transmission calculations, which are based on ERHO selection for E-static benders

```

1 [X] : +4.4419e-01 +6.3363e-02 0 0 0 +2.7800e-01
2 [T] : -1.2668e+01 +4.4419e-01 0 0 0 +6.3363e+00
3 [Y] : 0 0 1 0 +7.8540e-02 0
4 [F] : 0 0 0 0 1 0
5 [L] : -6.3363e-01 -2.7800e-02 0 0 1 -7.5910e-02
6 [D] : 0 0 0 0 0 1
  
```

## COSY

ES <radius> <angle> <aperture>  
 <n1 >< n2 >< n3 >< n4 >< n5 >;

A\_0 := 12;  
 Q\_0 := 6;  
 RP 12. A\_0 Q\_0;

UM;  
 ES 0.1 45.0 0.05 1 -1 1 -1 1;  
 PM LISE 'DIPO\_COSY2.TXT';

Lister - [c:\user\cosy\LISE\_COSY\_App\DIPO\_COSY2.TXT]

File Edit Options Help

```

6 1
.44455E+00 .63373E-02 .00000E+00 .00000E+00 .00000E+00 .55545E-01
-1.2661E+03 .44455E+00 .00000E+00 .00000E+00 .00000E+00 -1.2661E+02
.00000E+00 .00000E+00 .10000E+01 .78540E-02 .00000E+00 .00000E+00
.00000E+00 .00000E+00 .00000E+00 .10000E+01 .00000E+00 .00000E+00
-1.2661E+01 -.55545E-02 .00000E+00 .00000E+00 .10000E+01 -.30300E-01
.00000E+00 .00000E+00 .00000E+00 .00000E+00 .00000E+00 .10000E+01

--- MAP IN TRANSPORT UNITS, COSY FORMAT, PM
-1.851015E-13 -.4219252E-11 .00000000 .00000000 .1009747E-13 00000000
.4445492 -126.6109 .00000000 .00000000 -1.266109 10000000
.6337337E-02 .4445492 .00000000 .00000000 -.5554507E-02 01000000
.00000000 .00000000 1.00000000 .00000000 .00000000 00100000
.00000000 .00000000 .7853982E-02 1.00000000 .00000000 00010000
.00000000 .00000000 .00000000 .00000000 1.00000000 00001000
-.5554507E-01 12.66109 .00000000 .00000000 -.3030038E-01 00000100
-2.774274 -.632.3752 .00000000 .00000000 1.513393 00000010
  
```

LISE++

$B\rho(E\rho)$  Analyzer

**Projectile** 12C6+  
 100 KeV/u 1 pA  
**Fragment** 12C6+ =beam=  
 Target  
 Stripper  
 ElecDip 1 E 133.5 KV/m  
 U 13.4 KV  
 Er 0.4 MJ/C

**ElecDip 1**

Electrostatic Dipole Settings

Separation plane: Horizontal (selected) / Vertical

E (electric field) 1334.4 KV/m  
 U (voltage) 133.44 KV  
 Electric rigidity 1.3344 MJ/C  
 Magnetic rigidity 0.16623 Tm

Electrostatic Dipole Constants

Distance between plates (gap) = 0.1 m

Bend Sector

Radius (R) = 1 m  
 Angle = 45 deg  
 Length = 0.7854 m

Optical block properties and data

Setting Charge state for the Block (Z-Q) 0

Target  
 D1  
 Tweak: 0.1 %  
 Calculate other optic blocks

Advanced Elec. Dipole settings for extended configurations

Bend type: Rt (m) Show ED Scheme

Cylindrical INF  Matrix calculations  
 Spherical 1  
 Toroidal 10

Important: Selection [X] in this block by Electric rigidity, where  $X = d(Erho)/Erho$

OK Cancel Help

Utility: Electrostatic deflector

```

Electrostatic dipole
mode = Cylindrical

direct = X
radius = 1 m
angle = 45 deg
length = 0.7854 m
n = 0
beta = 0.02674
e_x1 = 1.414
n_eta = 0
Nk = 0.99982
Nm = 0.00017876
k2x = 2 m^(-2)
k2y = 0 m^(-2)
  
```

---

transport format [cm-mrad]

\* TRANSFORM 1 \*

[D] -- Momentum transfer matrix (Important!) *it is used for calculation of the Global matrix*

1 [X]:	+4.4419e-01	+6.3363e-02	0	0	0	+5.5581e-01
2 [T]:	-1.2668e+01	+4.4419e-01	0	0	0	+1.2668e+01
3 [Y]:	0	0	1	+7.8540e-02	0	0
4 [F]:	0	0	0	0	1	0
5 [L]:	-1.2668e+00	-5.5581e-02	0	0	1	-0.0342e-01
6 [D]:	0	0	0	0	0	1

---

transport format [cm-mrad]

\* TRANSFORM 1 \*

[D] -- Electrostatic rigidity selection (Important!) *it is used for transmission calculations, which are based on ERHO selection for E-static benders*

1 [X]:	+4.4419e-01	+6.3363e-02	0	0	0	+2.7800e-01
2 [T]:	-1.2668e+01	+4.4419e-01	0	0	0	+6.3363e+00
3 [Y]:	0	0	1	+7.8540e-02	0	0
4 [F]:	0	0	0	1	0	0
5 [L]:	-6.3363e-01	-2.7800e-02	0	0	1	-7.5910e-02
6 [D]:	0	0	0	0	0	1

**Brho(Erho) Analyzer**

Dipole

Magnetic

Brho\_0 0.28801 Tm  
 B\_0 0.28801 T

Electrostatic

Erho\_0 4.003 MJ/C  
 E\_0 4e+3 KV/m

Radius 1 m  
 d Radius (for Plot only) 0.1 m  
 Angle 45 deg

Drift block after the dipole

Use the drift block

Length 1 m

Local\* -- at the beam position;  
 For dispersion calculation:  
 X corresponds to V (Brho, Erho),  
 position 0 mm to V\_0 (Brho\_0, Erho\_0)

Beam

Projectile 12C6+  
 Energy 1 MeV/u  
 dP / P 1 (+/-) %  
 dErho / Erho +2.0 & -2 %  
 dX 1 (+/-) mm  
 Brho 0.2880 Tm  
 Erho 4.003 MJ/C

ELECTROSTATIC

Shift(mm) from central axis at the end of DIPOLE

-dX	0	+dX	
-dP / P	-5.2	-5.9	-6.6
0	0.729	0.0224	-0.685
+dP / P	6.52	5.8	5.09
Local* Brho dispersion	5.85	mm/%	
Local* Erho dispersion	2.93	mm/%	

Calculate Plot

## Initial conditions

<b>P</b> Projectile	$^{40}\text{Ar}^{10+}$	1 MeV/u	1 pA
<b>F</b> Fragment	$^{40}\text{Ar}^{10+10+}$	=beam=	
<b>T</b> Target	Au	0.001 m.c.m	
<b>Str</b> Stripper			
<b>ElecDip 1</b>	E	1798.1 KV/m	
	U	179.8 KV	
	Er	5.39 MJ/C	

Emittance		
	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm 0.001	Rectangle uniform
2. T	mrاد 0.001	Rectangle uniform
3. Y	mm 0.001	Gaussian
4. P	mrاد 0.001	Gaussian
5. L	mm 0	Gaussian
6. D	% 5	Gaussian

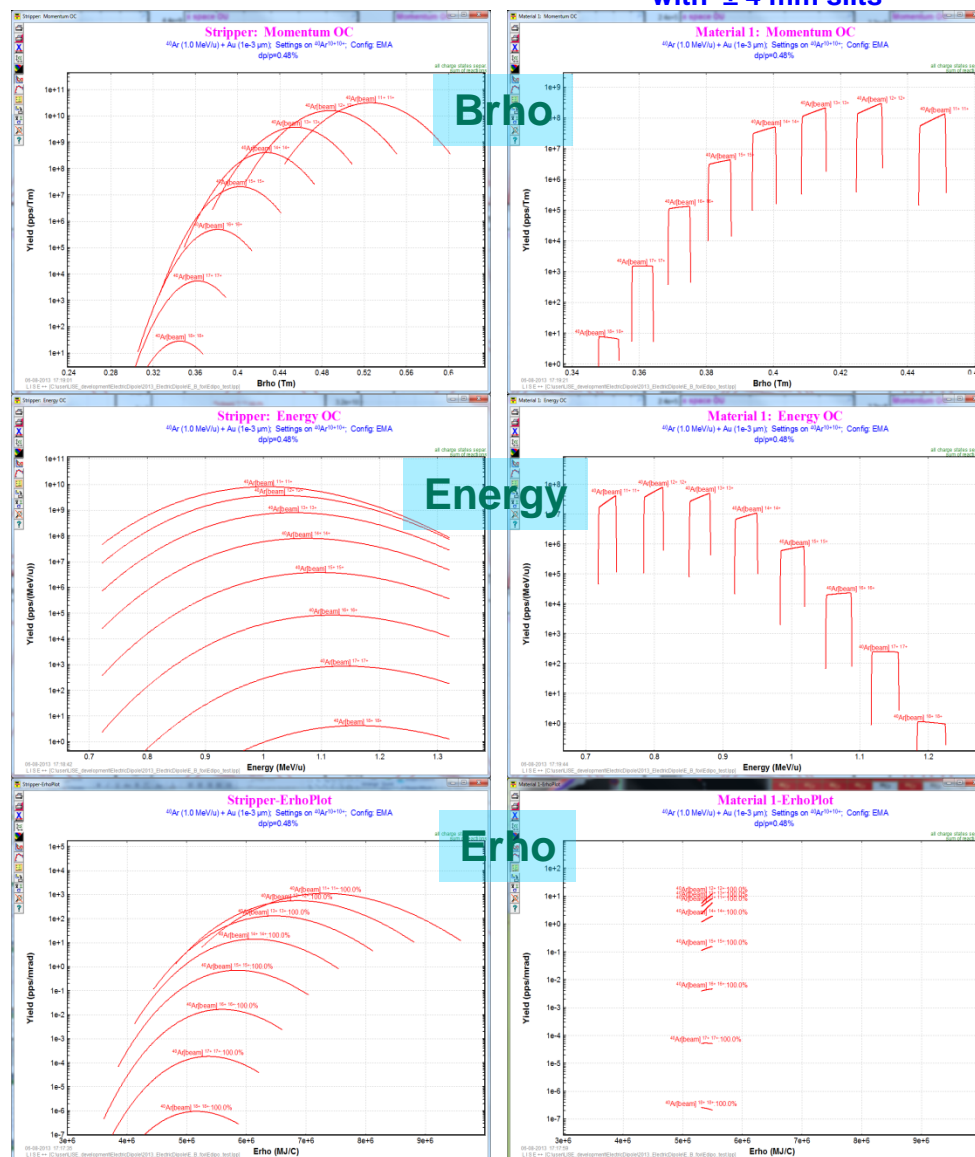
1D-Plot 2D-Plot Databases Help

- Block selection distributions
- Angular distributions
- Horizontal (X) space distributions
- Vertical (Y) space distributions
- Momentum distributions
- Energy distribution
- Total Kinetic Energy distributions
- Electrostatic rigidity distributions**
- Beam and Setting fragment charge state distributions
- Debug distributions
- Debug information
- Brho selection plot
- Wedge selection plot
- Isomeric Gamma spectrum
- Transmission characteristics
- Range distributions
- Charge distributions
- Average Ionic charge plot
- Cross Section distributions
- Q-gg distributions
- Velocity after reaction
- Velocity after reaction / TKE(for fission)
- Plot Options

## "Distribution" solution

after target

after the E-dipole  
with  $\pm 4$  mm slits



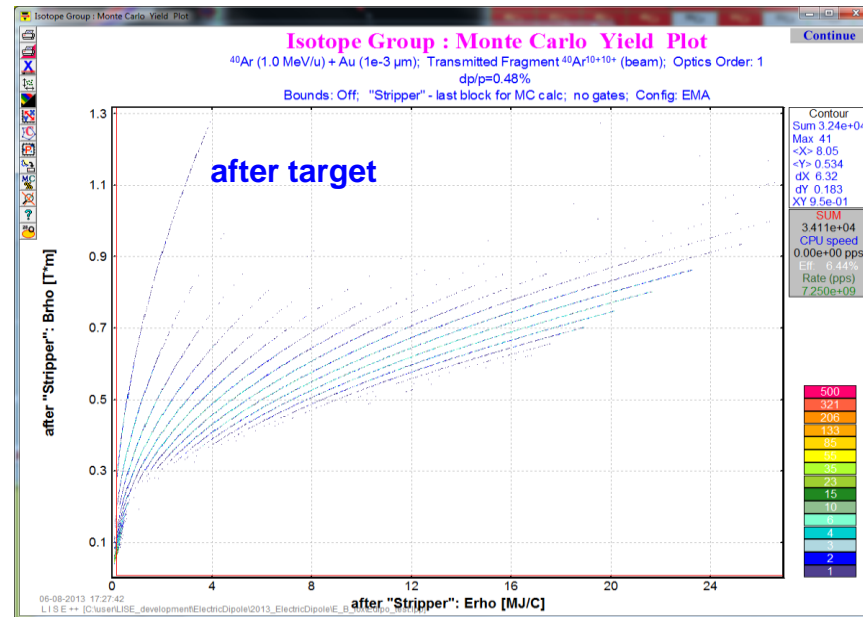
## Initial conditions

**Projectile**  $^{40}\text{Ar}^{10+}$   
 1 MeV/u 1 pnA  
**Fragment**  $^{40}\text{Ar}^{10+10+}$  =beam=  
**Target** Au  
 0.001 m.c.m.  
**Stripper**  
**ElecDip 1** E 1798.1 KV/m  
 U 179.8 KV  
 Er 5.39 MJ/C

Emittance  
 Beam CARD (sigma, semi-axis, half-width...)  
 1D - shape (Distribution method)

1. X mm	0.001	Rectangle uniform
2. T mrad	0.001	Rectangle uniform
3. Y mm	0.001	Rectangle uniform
4. P mrad	0.001	Gaussian
5. L mm	0	Gaussian
6. D %	90	Rectangle uniform

## MC solution



Monte Carlo calculation of fragment transmission  
 What isotope transmission to calculate?  
 One fragment of interest. Choose manually here  
 Group of isotopes already calculated by the Distribution method [Ncalc = 18]  
 List of isotopes from file to produce inside target  
 Input ions rays from file emitted from target

Choose fragment of interest  
 A Element Z Table of Nuclides  
 40 Ar 18  
 Stable  
 Charge states: 14+ ElecDip 1 Set  
 Reaction mechanism: Projectile Fragmentation

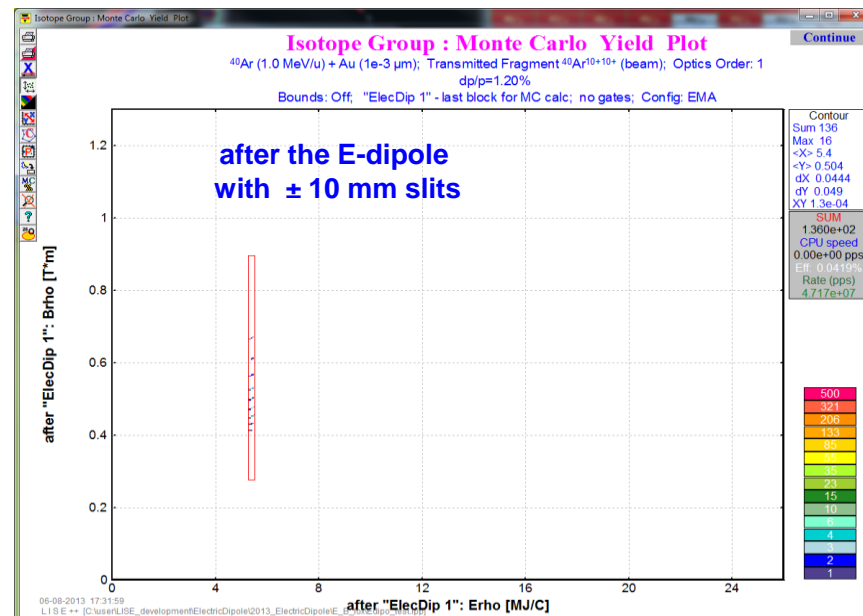
X-coordinate After BLOCK ElecDip 1 as Y  
 X mm  
 X' (T) mrad  
 Y mm  
 Y' (P) mrad  
 dP/P %  
 Radial [(X,Y) mm  
 Angle [(X',Y') mrad  
 Energy MeV/u  
 TKE MeV  
 Momentum MeV/c  
 Brho T\*m  
 Erho MJ/C  
 Energy Loss MeV  
 Range mm  
 Envelope m  
 Energy Deposition MeV/mm /particle  
 Time of flight ns  
 Length m  
 Stripper Start -> Stripper Stop -> FaradayCup 1

Y-coordinate After BLOCK ElecDip 1 as X  
 X mm  
 X' (T) mrad  
 Y mm  
 Y' (P) mrad  
 dP/P %  
 Radial [(X,Y) mm  
 Angle [(X',Y') mrad  
 Energy MeV/u  
 TKE MeV  
 Momentum MeV/c  
 Brho T\*m  
 Erho MJ/C  
 Energy Loss MeV  
 Range mm  
 Envelope m  
 Energy Deposition MeV/mm /particle  
 Time of flight ns  
 Length m  
 FaradayCup 1 Start -> Stripper Stop -> FaradayCup 1

Velocity Velocity\_Z [cm/ns]  
 Ion parameters (M,Z,q...)  
 A (mass number)  
 Z-q

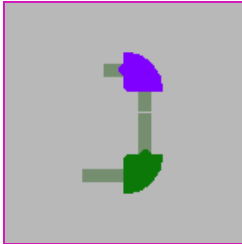
Gate 1 no gate  
 Gate 2 no gate  
 Gate 3 no gate  
 Gate 4 no gate

MC transmission options  
 "Distribution" calculation  
 MC calculation to file  
 Monte Carlo calculation 2D-plot  
 Quit





LISE++



## Purpose

- Create an energy achromat system
  - Using double focusing
  - E-dipole
    - » Bend of 90deg at R=0.2 m spherical electrodes for equal x- and y-focus strength
    - » Drift before and after bend = R
  - B-dipole
    - » Bend of 90deg at R=0.2 m
    - » 26.56deg entranc & exit edge angles for equal x- and y-focus strength
    - » Drift before and after bend = 2R

COSY

Dimension: mm  cm

Global matrix:

-1	0	0	0	0	0.8	[cm]
-50	-1	0	0	0	20	[mrad]
0	0	-1	0	0	0	[cm]
0	0	-50	-1	0	0	[mrad]
-2	-0.08	0	0	1	-0.45664	[cm]
0	0	0	0	0	1	[%]

/[cm] /[mrad] /[cm] /[mrad] /[cm] /[%]

Det = 1.00000

E bend focus

Lister - [c:\user\cosy\LISE\_COSY\_App\EB\_focus1.TXT]

-1.0000E+01	-.55116E-07	.00000E+00	.00000E+00	.00000E+00	.80000E+00
-.50000E+02	-1.0000E+01	.00000E+00	.00000E+00	.00000E+00	.20000E+02
.00000E+00	.00000E+00	-1.0000E+01	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+02	-1.0000E+01	.00000E+00	.00000E+00
-2.0000E+01	-.80000E-01	.00000E+00	.00000E+00	-1.0000E+01	-.45664E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	-1.0000E+01

MAP IN TRANSPORT UNITS, COSY FORMAT, PM

-.2945573E-08	-.7363969E-07	.0000000	.0000000	.1681321E-08	00000000
-.9999986	-.49.99997	.0000000	.0000000	-2.000000	10000000
-.5511577E-07	-.9999986	.0000000	.0000000	-.7999999E-01	01000000
.0000000	.0000000	-1.000000	-50.00000	.0000000	00100000
.0000000	.0000000	.0000000	-1.000000	.0000000	00010000
.0000000	.0000000	.0000000	.0000000	1.000000	00001000
.7999999	20.00000	.0000000	.0000000	-.4566366	00000100
-.39.99997	-.999.9994	.0000000	.0000000	22.83182	00000010
-40.00002	-1000.001	.0000000	.0000000	22.83184	00000001

Dimension: mm  cm

Matrices: Block (local)  Global

Global matrix:

1.00121	0.00002	0	0	0	-0.00066	[cm]
87.52197	1.00033	0	0	0	-35.0121	[mrad]
0	0	0.99885	-0.00002	0	0	[cm]
0	0	80.34935	0.99973	0	0	[mrad]
3.49967	0	0	0	1	-3.37062	[cm]
0	0	0	0	0	1	[%]

/[cm] /[mrad] /[cm] /[mrad] /[cm] /[%]

Det = 0.99998

E + B bend focus

Lister - [c:\user\cosy\LISE\_COSY\_App\EB\_focus2.TXT]

1.0000E+01	-.61419E-06	.00000E+00	.00000E+00	.00000E+00	-.24965E-04
.87501E+02	-1.0000E+01	.00000E+00	.00000E+00	.00000E+00	-.35000E+02
.00000E+00	.00000E+00	.99996E+00	-.66931E-06	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.80364E+02	.99999E+00	.00000E+00	.00000E+00
.35000E+01	-.34741E-06	.00000E+00	.00000E+00	-1.0000E+01	-.33708E+01
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	-1.0000E+01

MAP IN TRANSPORT UNITS, COSY FORMAT, PM

-.1061954E-12	-.1288709E-06	.0000000	.0000000	.1241115E-07	00000000
1.000045	87.50076	.0000000	.0000000	3.499983	10000000
-.6141881E-06	1.000009	.0000000	.0000000	-.3474118E-06	01000000
.0000000	.0000000	.9999564	80.36445	.0000000	00100000
.0000000	.0000000	-.6693090E-06	.9999898	.0000000	00010000
.0000000	.0000000	.0000000	.0000000	1.000000	00001000
-.2496493E-04	-.35.00045	.0000000	.0000000	-3.370789	00000100
40.00114	2500.019	.0000000	.0000000	162.8314	00000010
-.39.99865	1000.026	.0000000	.0000000	174.2475	00000001

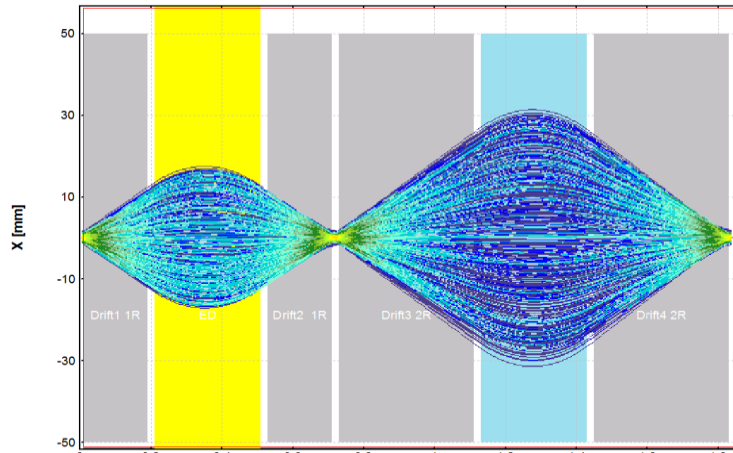
M.Portillo's example,  
and COSY calculations

## COSY

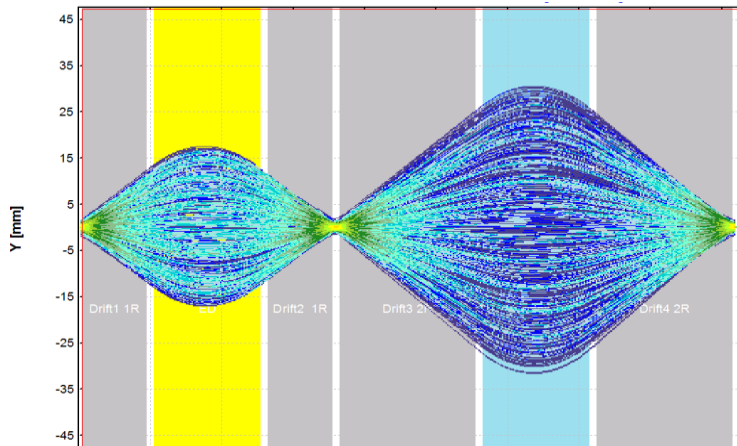
[http://lise.nsl.msui.edu/9\\_6/Edipole/EB\\_case.lpp](http://lise.nsl.msui.edu/9_6/Edipole/EB_case.lpp)

## LISE++

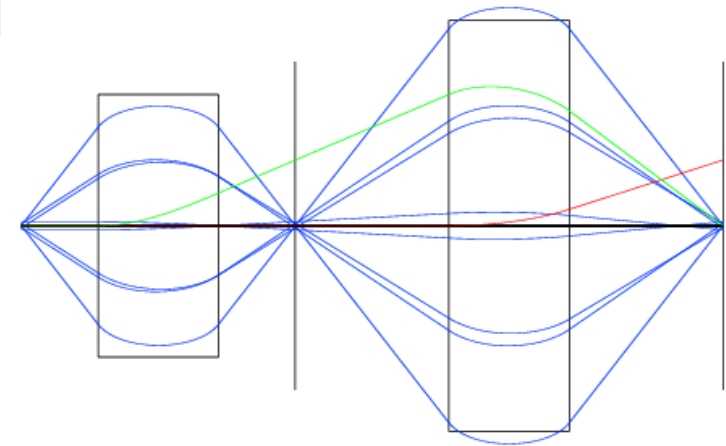
Emittance		
?	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm 0.5	Gaussian
2. T	mmrad 60	Rectangle uniform
3. Y	mm 0.5	Gaussian
4. P	mmrad 60	Rectangle uniform
5. L	mm 0	Gaussian
6. D	% 0.01	Gaussian



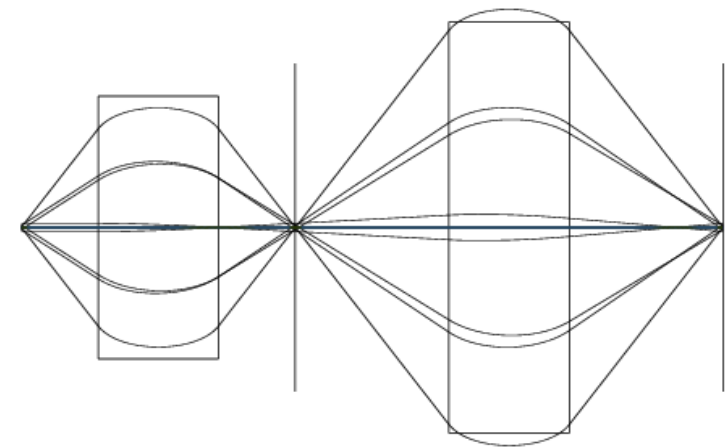
06-08-2013 18:01:05  
LISE++ - C:\user\LISE\_development\ElectricDipole2013\_ElectricDipoleEB\_case.lpp  
after "Drift4 2R": L [m]



06-08-2013 18:01:16  
LISE++ - C:\user\LISE\_development\ElectricDipole2013\_ElectricDipoleEB\_case.lpp  
after "Drift4 2R": L [m]



X-motion



Y-motion

[http://lise.nsci.msu.edu/9\\_6/Edipole/EB\\_case.lpp](http://lise.nsci.msu.edu/9_6/Edipole/EB_case.lpp)

LISE++

M.Portillo's example,  
and COSY calculations

Emittance

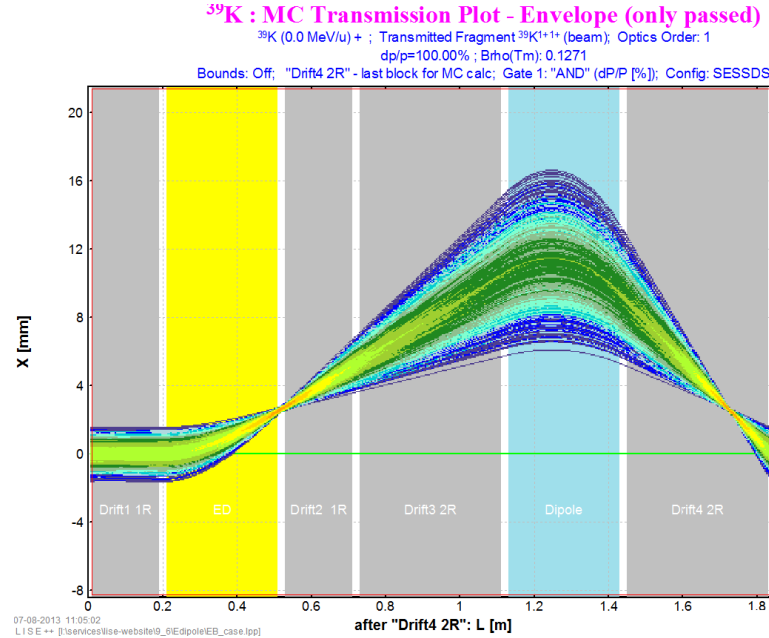
	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0.5	Gaussian
2. T mrad	0.5	Rectangle uniform
3. Y mm	0.5	Gaussian
4. P mrad	0.5	Rectangle uniform
5. L mm	0	Gaussian
6. D %	1	Gaussian

Gate 1

Settings

"AND" [0.95, 1]

< dP/P [%] > after Stripper



Emittance

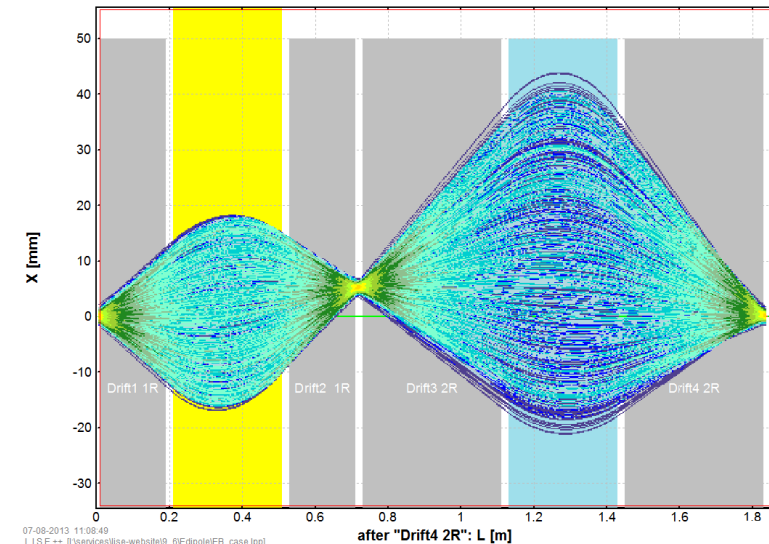
	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0.5	Gaussian
2. T mrad	60	Rectangle uniform
3. Y mm	0.5	Gaussian
4. P mrad	60	Rectangle uniform
5. L mm	0	Gaussian
6. D %	1	Gaussian

Gate 1

Settings

"AND" [0.95, 1]

< dP/P [%] > after Stripper



# 2.4 E & B bends example : TKE-dispersion

LISE++ file:

[http://lise.nsci.msu.edu/9\\_6/Edipole/EB\\_case2.lpp](http://lise.nsci.msu.edu/9_6/Edipole/EB_case2.lpp)

Input rays file:

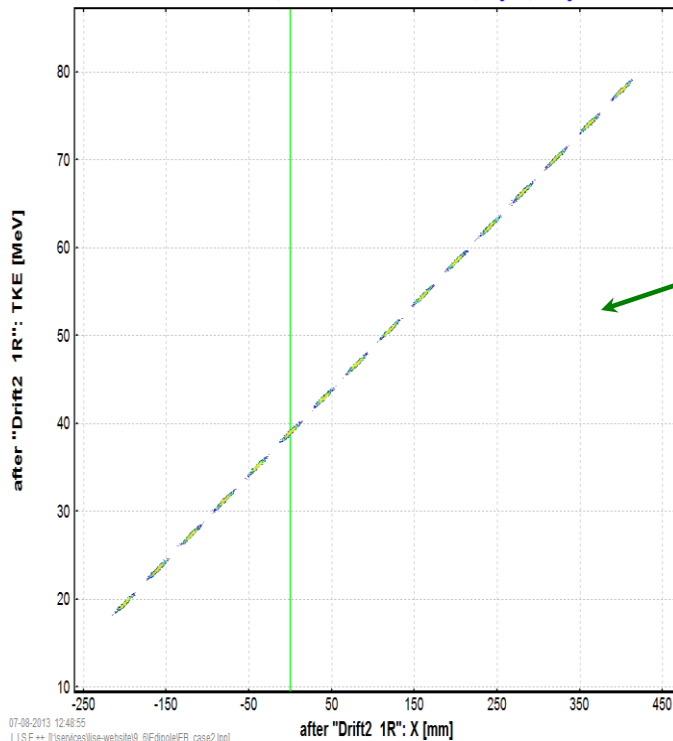
[http://lise.nsci.msu.edu/9\\_6/Edipole/39K\\_q9\\_energy.inrays](http://lise.nsci.msu.edu/9_6/Edipole/39K_q9_energy.inrays)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
! Z	N	q	X	d(X)	X'	d(X')	Y	d(Y)	Y'	d(Y')	E	d(E)	t	d(t)
!			mm	mm	mrads	mrads	mm	mm	mrads	mrads	MeV/u	MeV/u	ns	ns
19	20	9	0	1	0	60	0	1	0	60	0.5	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	0.6	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	0.7	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	0.8	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	0.9	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.1	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.2	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.3	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.4	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.5	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.6	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.7	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.8	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	1.9	0.01	0	1
19	20	9	0	1	0	60	0	1	0	60	2	0.01	0	1

LISE++

Ions rays after target : Monte Carlo Yield Plot

Input rays file: "39K\_q9\_energy"; Number of rays: 16; Optics Order: 1  
 dp/p=100.00%; Brho(Tm): 0.6229  
 Bounds: Off; "Drift4 1R" - last block for MC calc; no gates; Config: SESSDS



COSY

**E-B BEND FOCUS**

```

-0.9999986
0.5661256E-06
0.000000
0.000000
0.000000
(x,dE)1 -> 0.4000000
(x,dM)1 -> 0.1101071E-06
(x,dQ)1 -> -0.4000002
    
```

---

**E+B BEND FOCUS**

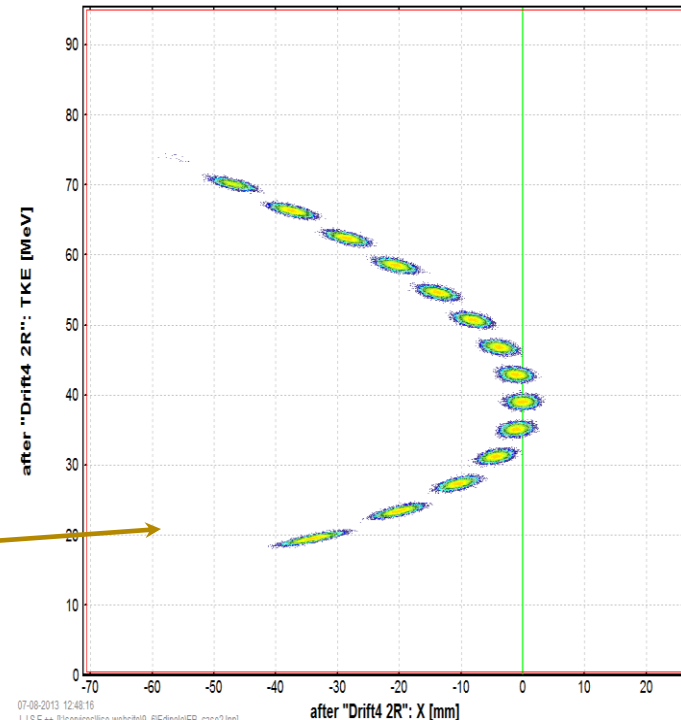
```

1.000045
0.6126912E-05
0.000000
0.000000
0.000000
(x,dE)2 -> -0.1248663E-04
(x,dM)2 -> 0.3999989
(x,dQ)2 -> -0.3999865
    
```

$(x,dM)_2 = (x,dE)_1$   
 $(x,dE)_2 = 0$

Ions rays after target : Monte Carlo Yield Plot

Input rays file: "39K\_q9\_energy"; Number of rays: 16; Optics Order: 1  
 dp/p=100.00%; Brho(Tm): 0.6229  
 Bounds: Off; "Drift4 2R" - last block for MC calc; no gates; Config: SESSDS



# 2.4 E & B bends example : M-dispersion

LISE++ file:

[http://lise.nsci.msu.edu/9\\_6/Edipole/EB\\_case2.lpp](http://lise.nsci.msu.edu/9_6/Edipole/EB_case2.lpp)

Input rays file:

[http://lise.nsci.msu.edu/9\\_6/Edipole/K\\_isotopes.inrays](http://lise.nsci.msu.edu/9_6/Edipole/K_isotopes.inrays)

	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	19	10	9	0	1	0	60	0	1	0	60	1.3448	0.05	0	1	
5	19	11	9	0	1	0	60	0	1	0	60	1.3000	0.05	0	1	
6	19	12	9	0	1	0	60	0	1	0	60	1.2581	0.05	0	1	
7	19	13	9	0	1	0	60	0	1	0	60	1.2188	0.05	0	1	
8	19	14	9	0	1	0	60	0	1	0	60	1.1818	0.05	0	1	
9	19	15	9	0	1	0	60	0	1	0	60	1.1471	0.05	0	1	
10	19	16	9	0	1	0	60	0	1	0	60	1.1143	0.05	0	1	
11	19	17	9	0	1	0	60	0	1	0	60	1.0833	0.05	0	1	
12	19	18	9	0	1	0	60	0	1	0	60	1.0541	0.05	0	1	
13	19	19	9	0	1	0	60	0	1	0	60	1.0263	0.05	0	1	
14	19	20	9	0	1	0	60	0	1	0	60	1.0000	0.05	0	1	
15	19	21	9	0	1	0	60	0	1	0	60	0.9750	0.05	0	1	
16	19	22	9	0	1	0	60	0	1	0	60	0.9512	0.05	0	1	
17	19	23	9	0	1	0	60	0	1	0	60	0.9286	0.05	0	1	
18	19	24	9	0	1	0	60	0	1	0	60	0.9070	0.05	0	1	
19	19	25	9	0	1	0	60	0	1	0	60	0.8864	0.05	0	1	
20	19	26	9	0	1	0	60	0	1	0	60	0.8667	0.05	0	1	
21	19	27	9	0	1	0	60	0	1	0	60	0.8478	0.05	0	1	
22	19	28	9	0	1	0	60	0	1	0	60	0.8298	0.05	0	1	
23	19	29	9	0	1	0	60	0	1	0	60	0.8125	0.05	0	1	

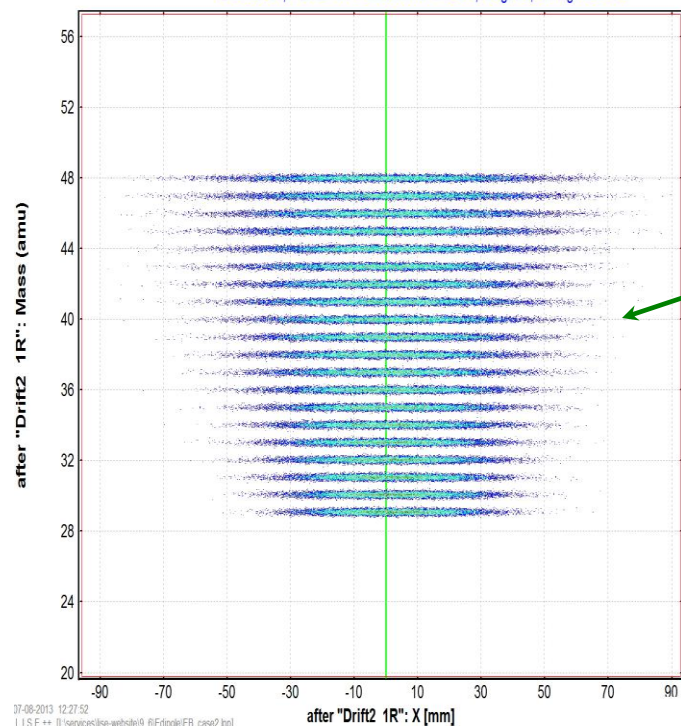
Ions rays after target : Monte Carlo Yield Plot

Input rays file: "K\_isotopes"; Number of rays: 20; Optics Order: 1

dpip=100.00%; Brho(Tm): 0.6229

Bounds: Off; "Drift2 1R" - last block for MC calc; no gates; Config: SESSDS

LISE++



COSY

**E-BEND FOCUS**

0.000000  
0.000000  
0.000000  
0.000000  
0.000000  
 $(x, dE)_1 \rightarrow 0.4000000$   
 $(x, dM)_1 \rightarrow 0.1101071E-06$   
 $(x, dQ)_1 \rightarrow -0.4000002$

---

**E+B BEND FOCUS**

1.000045  
0.6126912E-05  
0.000000  
0.000000  
0.000000  
 $(x, dE)_2 \rightarrow -0.1248663E-04$   
 $(x, dM)_2 \rightarrow 0.3999989$   
 $(x, dQ)_2 \rightarrow -0.3999865$

---

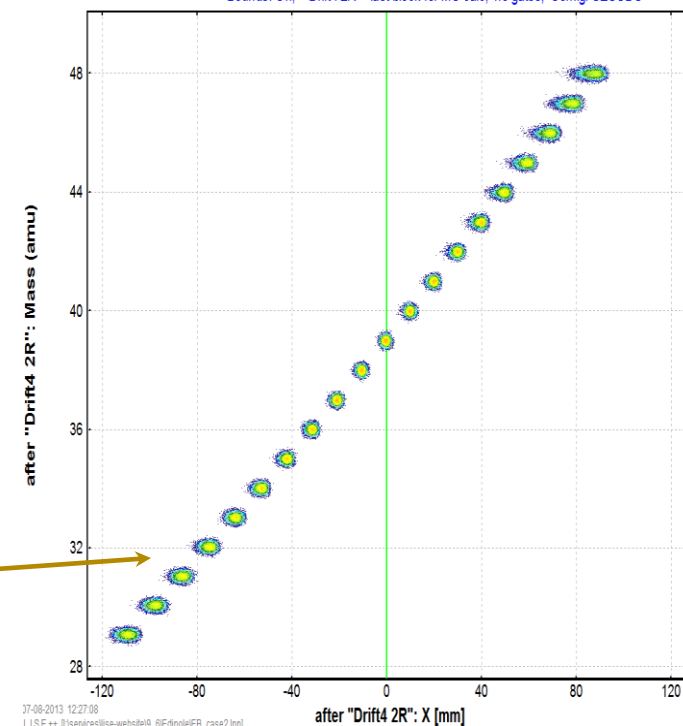
$(x, dM)_2 = (x, dE)_1$   
 $(x, dE)_2 = 0$

Ions rays after target : Monte Carlo Yield Plot

Input rays file: "K\_isotopes"; Number of rays: 20; Optics Order: 1

dpip=100.00%; Brho(Tm): 0.6229

Bounds: Off; "Drift4 2R" - last block for MC calc; no gates; Config: SESSDS



LISE++ file:

[http://lise.nsl.msui.edu/9\\_6/Edipole/EB\\_case2.lpp](http://lise.nsl.msui.edu/9_6/Edipole/EB_case2.lpp)

Input rays file:

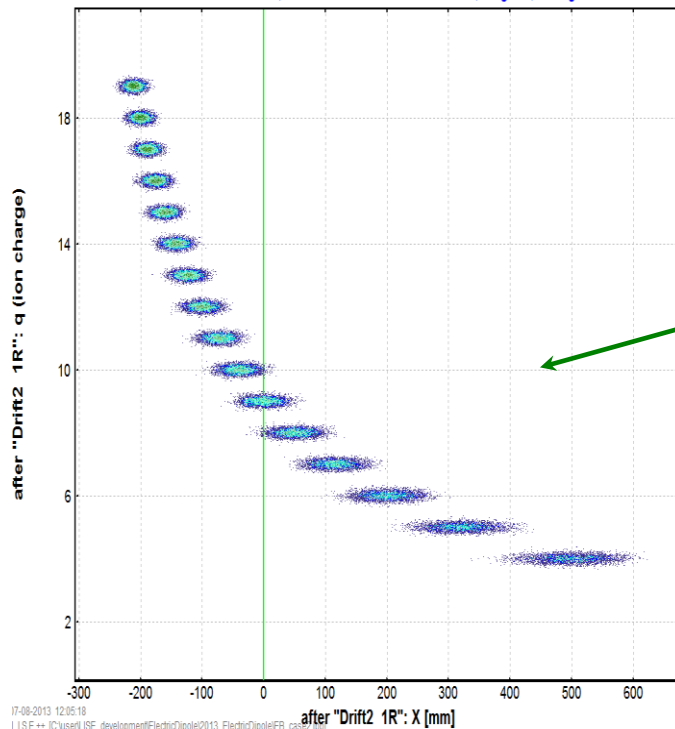
[http://lise.nsl.msui.edu/9\\_6/Edipole/39K\\_charge\\_states.inrays](http://lise.nsl.msui.edu/9_6/Edipole/39K_charge_states.inrays)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
!	Z	N	q	X	d(X)	X'	Y	d(Y)	Y'	d(Y')	E	d(E)/u	t	d(t)
!	mm	mm	nrad	mm	mm	nrad	mm	mm	nrad	nrad	MeV/u	MeV/u	ns	ns
19	20	1	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	2	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	3	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	4	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	5	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	6	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	7	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	8	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	9	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	10	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	11	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	12	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	13	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	14	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	15	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	16	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	17	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	18	0	1	0	60	0	1	0	60	1	0.05	0	1
19	20	19	0	1	0	60	0	1	0	60	1	0.05	0	1

## LISE++ MC

Ions rays after target : Monte Carlo Yield Plot

Input rays file: "39K\_charge\_states"; Number of rays: 19; Optics Order: 1  
 dp/p=100.00%; Brho(Tm): 0.6229  
 Bounds: Off; "Drift2 1R" - last block for MC calc; no gates; Config: SESSDS



## COSY

**E-BEND FOCUS**

0.000000  
 0.000000  
 0.000000  
 0.000000  
 (x,dE)<sub>1</sub> → 0.4000000  
 (x,dM)<sub>1</sub> → 0.1101071E-06  
 (x,dQ)<sub>1</sub> → -0.4000002

---

**E+B BEND FOCUS**

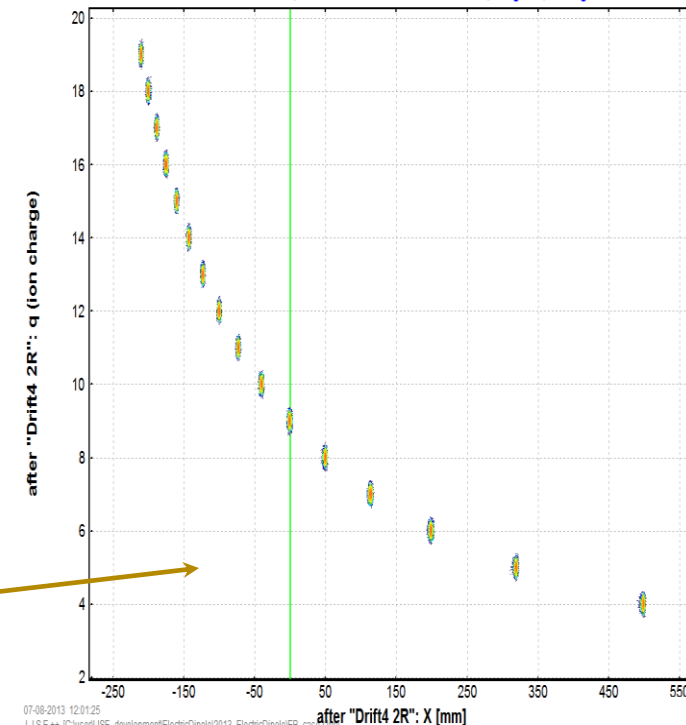
1.000045  
 0.6126912E-05  
 0.000000  
 0.000000  
 0.000000  
 (x,dE)<sub>2</sub> → -0.1248663E-04  
 (x,dM)<sub>2</sub> → 0.3999989  
 (x,dQ)<sub>2</sub> → -0.3999865

---

(x,dM)<sub>2</sub> = (x,dE)<sub>1</sub>  
 (x,dE)<sub>2</sub> = 0

Ions rays after target : Monte Carlo Yield Plot

Input rays file: "39K\_charge\_states"; Number of rays: 19; Optics Order: 1  
 dp/p=100.00%; Brho(Tm): 0.6229  
 Bounds: Off; "Drift4 2R" - last block for MC calc; no gates; Config: SESSDS



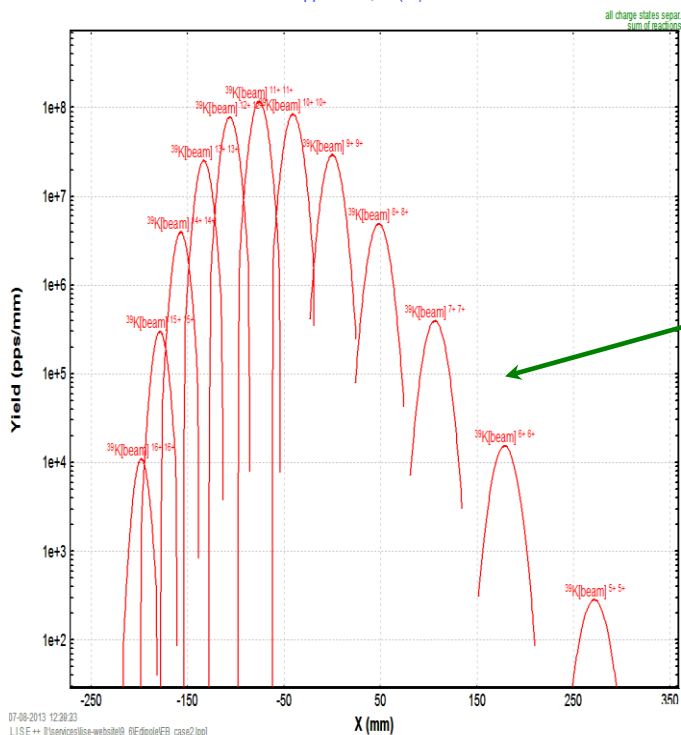
LISE++ file:

[http://lise.nsci.msu.edu/9\\_6/Edipole/EB\\_case2.lpp](http://lise.nsci.msu.edu/9_6/Edipole/EB_case2.lpp)

## LISE++ “Distribution” method

Drift2 1R-Xspace: output after slits

<sup>39</sup>K (1.0 MeV/u) + Au (1e-3 mg/cm<sup>2</sup>); Settings on <sup>39</sup>K<sup>4+</sup>; Config: SESSDS  
d/p=100.00%; Brho(Tm): 0.6229



### COSY

E-B BEND FOCUS

```

-0.9999986
0.5661256E-06
0.000000
0.000000
0.000000
(x,dE)1 → 0.4000000
(x,dM)1 → 0.1101071E-06
(x,dQ)1 → -0.4000002
    
```

E+B BEND FOCUS

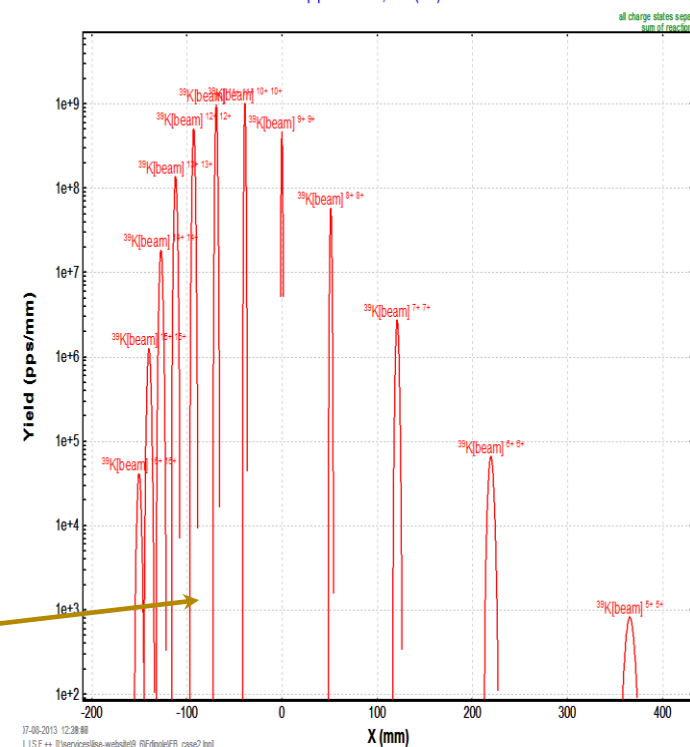
```

1.000045
0.6126912E-05
0.000000
0.000000
0.000000
(x,dE)2 → -0.1248663E-04
(x,dM)2 → 0.3999989
(x,dQ)2 → -0.3999865
    
```

$(x,dM)_2 = (x,dE)_1$   
 $(x,dE)_2 = 0$

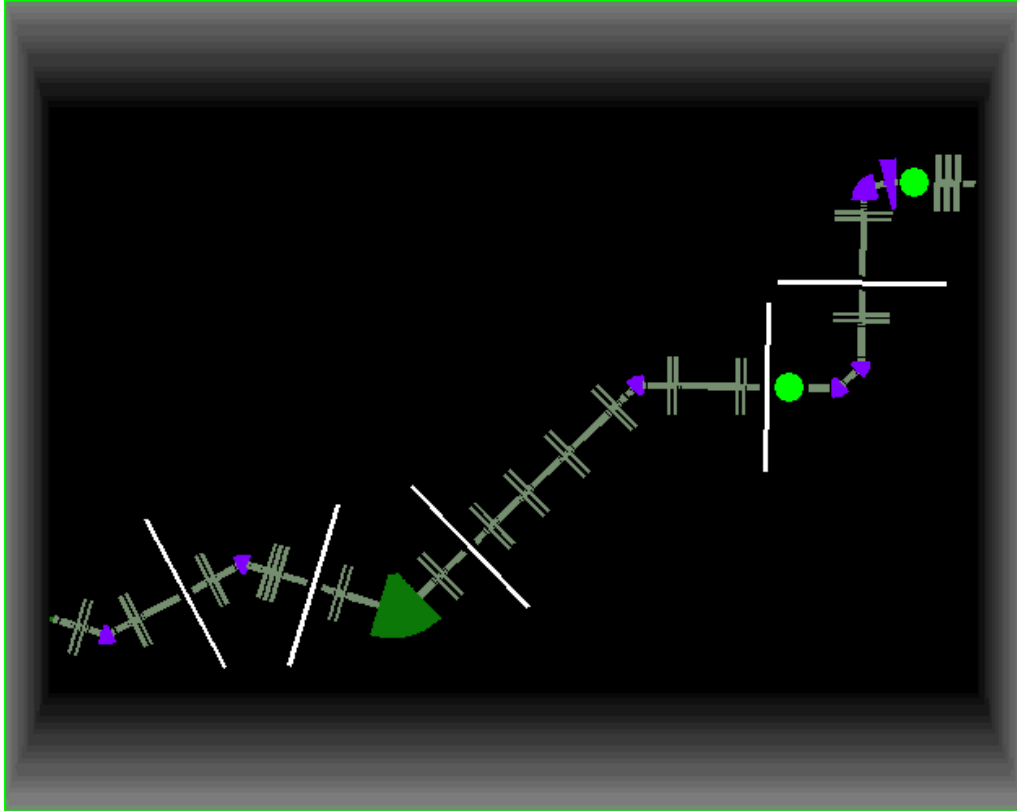
Drift4 2R-Xspace: output after slits

<sup>39</sup>K (1.0 MeV/u) + Au (1e-3 mg/cm<sup>2</sup>); Settings on <sup>39</sup>K<sup>4+</sup>; Config: SESSDS  
d/p=100.00%; Brho(Tm): 0.6229

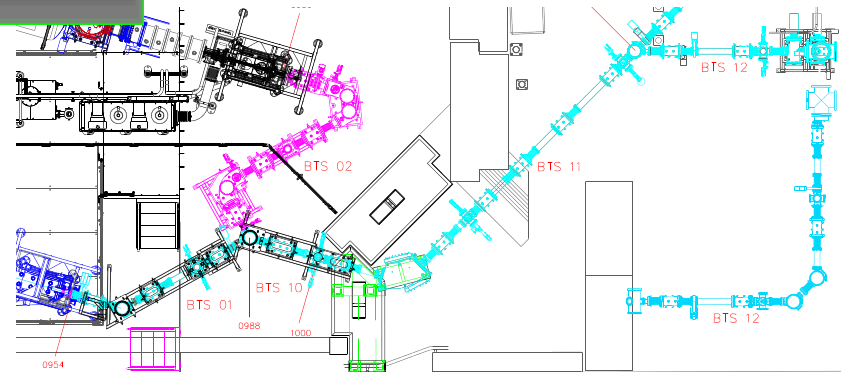


LISE++ file:

[http://lise.nsci.msu.edu/9\\_6/Edipole/D-line\\_BTS01-12%20with%20rotation.lpp](http://lise.nsci.msu.edu/9_6/Edipole/D-line_BTS01-12%20with%20rotation.lpp)



Almost 137 blocks,  
where  
*M-dipole* : 1  
*E-dipole* : 7  
*E-quad* : 32

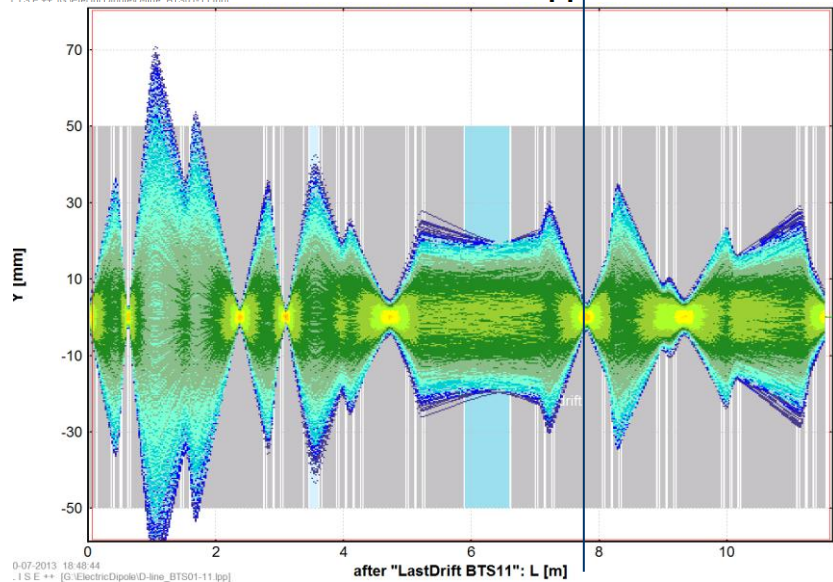
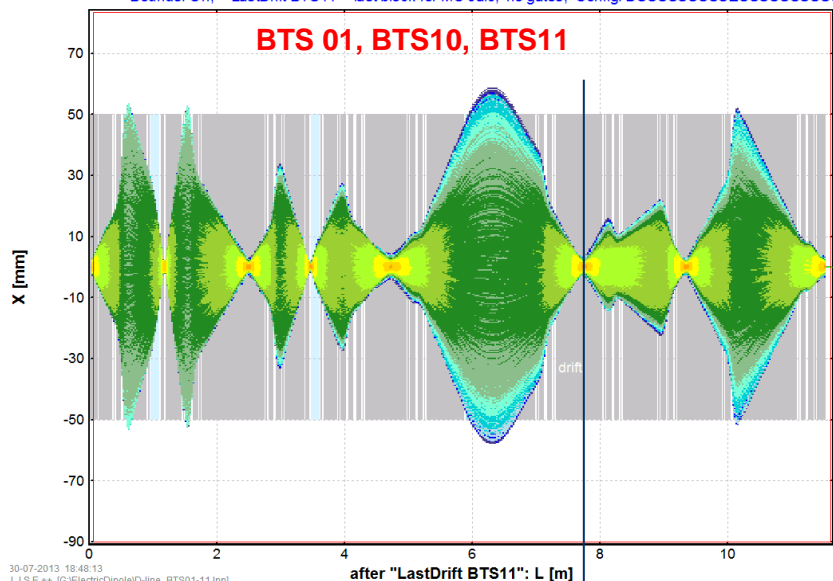




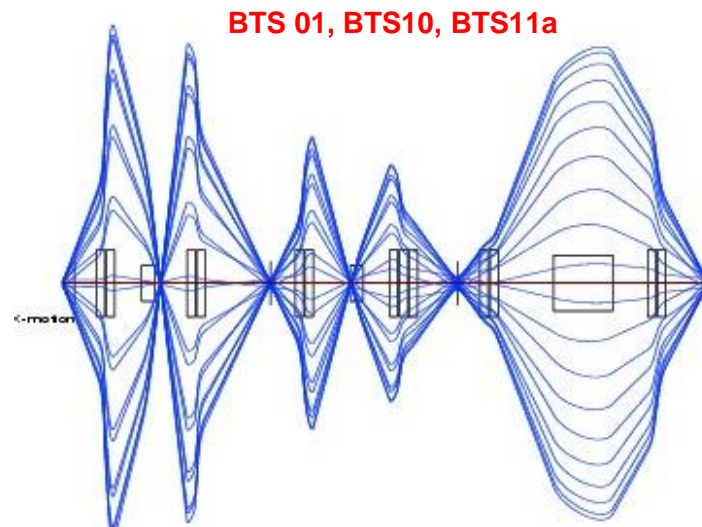
LISE++ file: [http://lise.nsci.msu.edu/9\\_6/Edipole/D-line\\_BTS01-12%20with%20rotation.lpp](http://lise.nsci.msu.edu/9_6/Edipole/D-line_BTS01-12%20with%20rotation.lpp)

From "Report on recalculation of Low-E beam lines" by M.Portillo

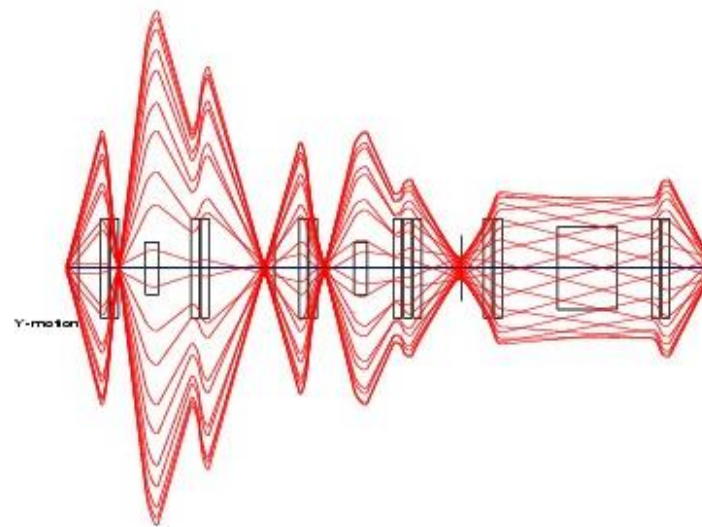
$^{100}\text{Ru}$  (0.0 MeV/u) + ; Transmitted Fragment  $^{100}\text{Ru}^{1+}$  (beam); Optics Order: 1  
 $dp/p=0.76\%$ ;  $\text{Brho}(Tm)$ : 0.3523, 0.3523  
 Bounds: Off; "LastDrift BTS11" - last block for MC calc; no gates; Config: DSSSSSSSSSESSSSSSSSSS



X



Y



LISE++ file: [http://lise.nsci.msu.edu/9\\_6/Edipole/D-line\\_BTS01-12%20with%20rotation.lpp](http://lise.nsci.msu.edu/9_6/Edipole/D-line_BTS01-12%20with%20rotation.lpp)

From "Report on recalculation of Low-E beam lines" by M.Portillo

From BTS 01 up to BTS11 (11.557 m)

LISE++

Dimension

mm  cm

Matrices

Block (local)  Global

-1.4935	0.00031	0	0	0	-2.91438	[cm]
-99.5517E	-0.64903	0	0	0	-63.6277E	[mrad]
0	0	-2.58371	0.00201	0	0	[cm]
0	0	51.03785	-0.42698	0	0	[mrad]
19.5267	0.19121	0	0	1	12.23006	[cm]
0	0	0	0	0	1	[%]
/[cm]	/[mrad]	/[cm]	/[mrad]	/[cm]	/[%]	

Det = 1.00079

COSY

Lister - [c:\user\cosy\LISE\_COSY\_App\BTS11.TXT]

File Edit Options Help

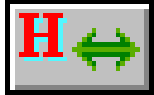
6 1

- .15079E+01	.16189E-03	.00000E+00	.00000E+00	.00000E+00	-.29255E+01
-.99674E+02	-.65248E+00	.00000E+00	.00000E+00	.00000E+00	-.63654E+02
.00000E+00	.00000E+00	-.27137E+01	-.10732E-03	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.56317E+02	-.36628E+00	.00000E+00	.00000E+00
.19561E+02	.19191E+00	.00000E+00	.00000E+00	.10000E+01	.12250E+02
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.10000E+01

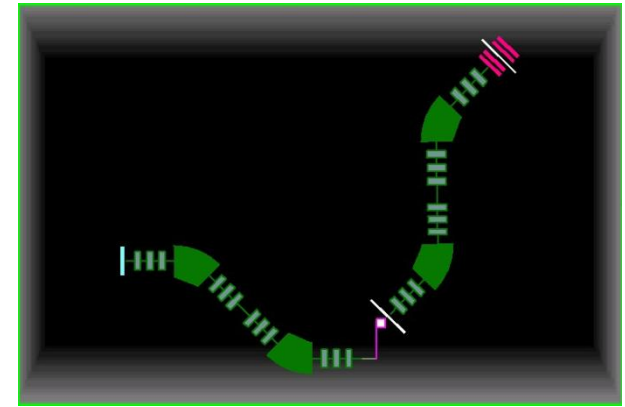
----- MAP IN TRANSPORT UNITS, COSY FORMAT, PM -----

.2798727E-07	.6089625E-06	.0000000	.0000000	-.1171928E-06	000000
-1.507879	-99.67437	.0000000	.0000000	19.56116	100000
.1618946E-03	-.6524815	.0000000	.0000000	.1919118	010000
.0000000	.0000000	-2.713679	56.31713	.0000000	001000
.0000000	.0000000	-.1073191E-03	-.3662762	.0000000	000100
.0000000	.0000000	.0000000	.0000000	1.000000	000010
-2.925466	-63.65392	.0000000	.0000000	12.24998	000001

# 3. New optical block : "Shift"



Allows to simulate misalignment, projectile scattering and so on.



Spectrometer designing

Block	Given Name	Z-Q	Length,m	Enable
Target	Target			+
Stripper	Stripper			+
Dipole	D1	0	8.719	+
Drift	I1_slits	0		NO
Wedge	I1_wedge			NO
Dipole	D2	0	8.767	+
Material	I2_PPAC0			NO
Drift	I2_slits	0		NO
Wedge	I2_wedge			+
Material	I2_PPAC1			NO
Material	I2_SCI			NO
Dipole	D3	0	8.767	+
Drift	I3_slits	0		NO
Wedge	I3_wedge			NO
Dipole	D4	0	9.39	+
Material	FP_PPAC0			+
Material	FP_PPAC1			+
Drift	FP_slits	0		+
Material	XF_SCI			NO

Insert Mode: before / after

Move element: Up / Down

Edit / Delete / OK / Help

Total: Number of Blocks: 26, Length [m]: 35.643

Insert block:

- Target
- Stripper after Target
- Wedge
- Material(Detector)
- Faraday cup
- Dispersive (Dipole)
- Wien velocity filter
- Drift (multiple.slits)
- Beam Rotation
- Shift of Optical Axis**
- Electrostatic dipole
- Gas filled separator
- Compensating Dipole
- RF separator
- RF buncher
- Solenoid
- Delay (efficiency) block

Selected block: Dispersive (Dipole)

Block Length [m]: 8.719

Block name = D1

Charge State (Z-Q) = 0

Shift

mm / cm

Optical matrix

General setting of block

Optical Axis Shifts:

dX: 2000 mm

dT: -800 mrad

dY: 0 mm

dP: 0 mrad

dT: -45.84 degrees

dP: 0 degrees

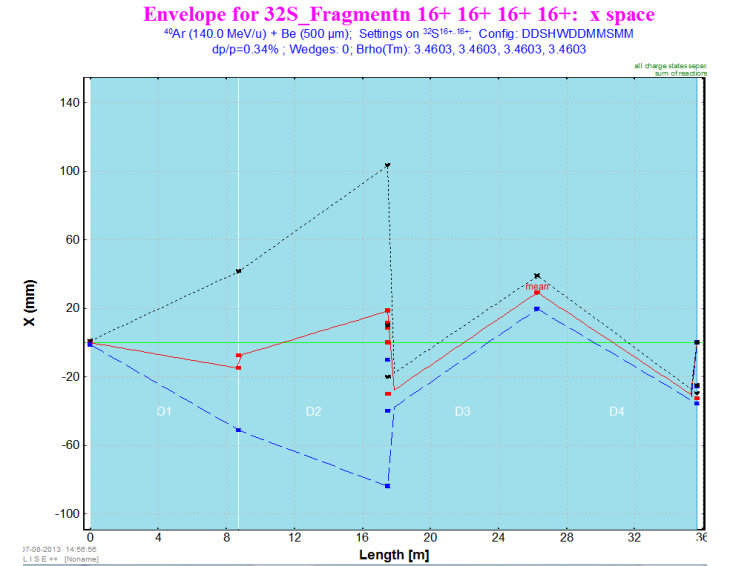
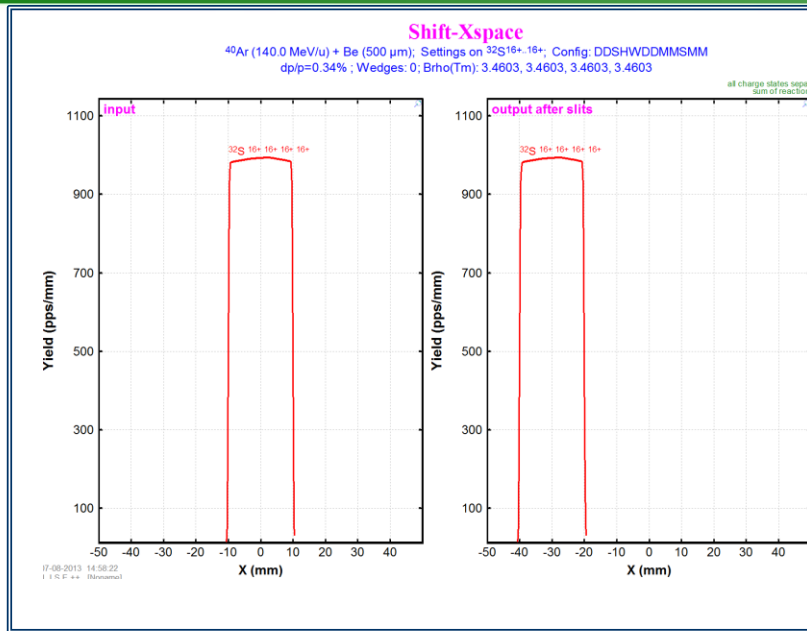
Ok / Help / Cancel

- Property : optical block
- Always Identity matrix
- Length block = 0

H ↔	Shift	d X = +2000.0 mm
S	I2_slits	d T = -800.0 mrad

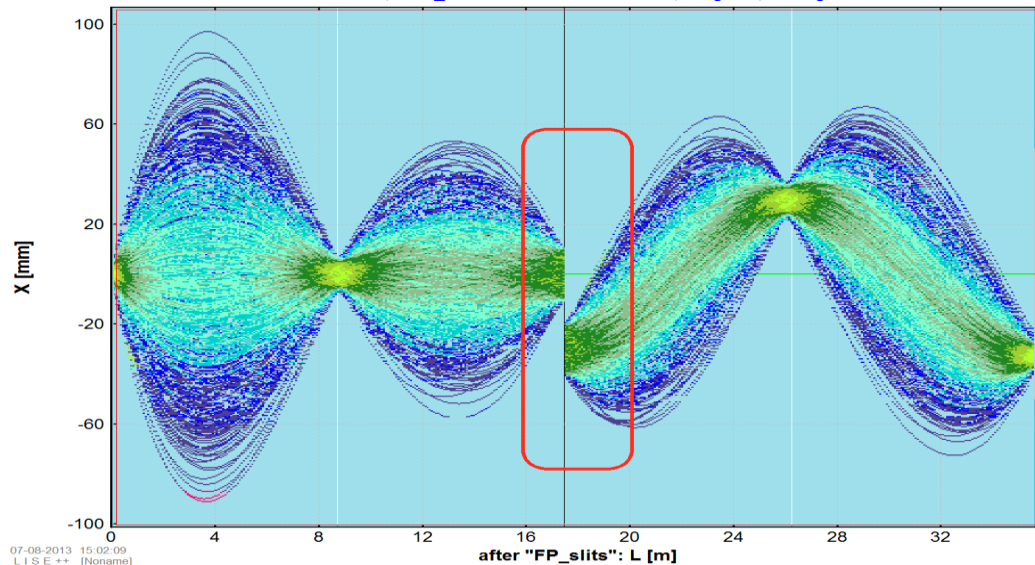
# 3. New optical block : "Shift"

**Example**  
X-shift of axis:  
**+30 mm**



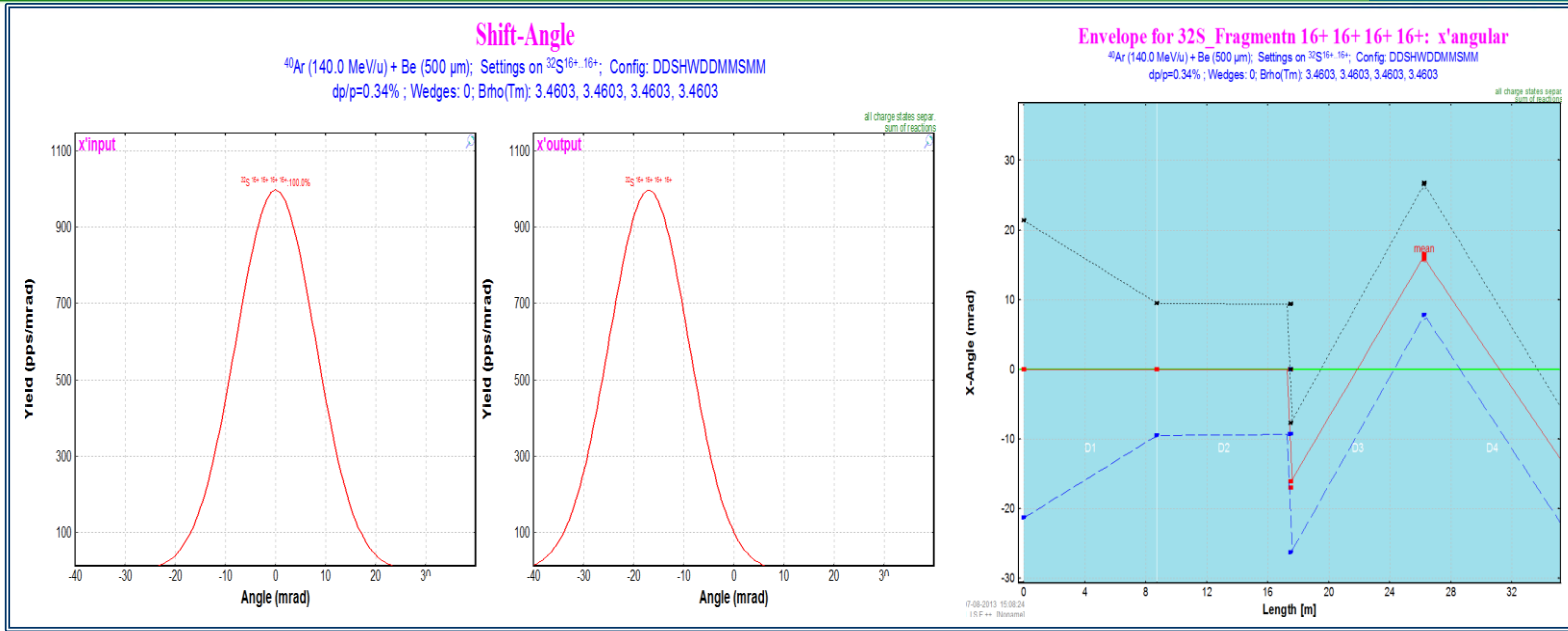
<b>P</b> rojectile	<b>40Ar<sup>18+</sup></b>
	140 MeV/u 1 pA
<b>F</b> ragment	<b>32S<sup>16+..16+</sup></b>
<b>T</b> arget	Be 500 μm cren
<b>S</b> tripper	
<b>D</b> 1	Brho 3.4603 Tm
<b>D</b> 2	Brho 3.4603 Tm
<b>S</b> lits	s ls
	-10   +10
<b>H</b> ift	d X = +30.0 mm
<b>W</b> edge	
<b>D</b> 3	Brho 3.4603 Tm
<b>D</b> 4	Brho 3.4603 Tm
<b>M</b> FP_PPAC0	A1 2 πg/cr2
<b>M</b> FP_PPAC1	A1 2 πg/cr2
<b>S</b> lits	s ls
	-50   +50

**<sup>32</sup>S : MC Transmission Plot - Envelope (only passed)**  
<sup>40</sup>Ar (140.0 MeV/u) + Be (500 μm); Transmitted Fragment <sup>32</sup>S<sup>16+..16+</sup> (Fragmentn); Optics Order: 1  
 dp/p=0.34%; Wedges: 0; Brho(Tm): 3.4603, 3.4603, 3.4603, 3.4603  
 Bounds: Off; "FP\_slits" - last block for MC calc; no gates; Config: DDSHWDDMSMM



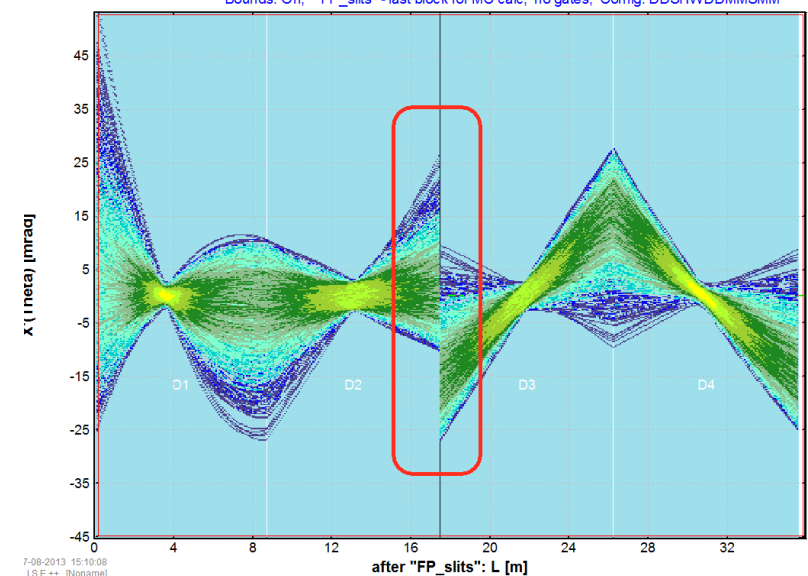
# 3. New optical block : "Shift"

**Example**  
**X'-shift of axis:**  
**+17 mrad**



<b>P</b>	Projectile	<sup>40</sup> Ar <sup>18+</sup>
		140 MeV/u 1 pnA
<b>F</b>	Fragment	<sup>32</sup> S <sup>16+</sup> .. <sup>16+</sup>
<b>T</b>	Target	Be 500 μm cich
<b>Sr</b>	Stripper	
<b>D</b>	D1	Brho 3.4603 Tm
<b>D</b>	D2	Brho 3.4603 Tm
<b>S</b>	I2_slits	s ls
<b>H</b>	Shift	d T = +17.0 mrad
<b>W</b>	I2_wedge	
<b>D</b>	D3	Brho 3.4603 Tm
<b>D</b>	D4	Brho 3.4603 Tm
<b>M</b>	FP_PPAC0	Al 2 π g/cm <sup>2</sup>
<b>M</b>	FP_PPAC1	Al 2 π g/cm <sup>2</sup>
<b>S</b>	FP_slits	s ls

**<sup>32</sup>S : MC Transmission Plot - Envelope (only passed)**  
<sup>40</sup>Ar (140.0 MeV/u) + Be (500 μm); Transmitted Fragment <sup>32</sup>S<sup>16+</sup>-<sup>16+</sup> (Fragmentn); Optics Order: 1  
 dp/p=0.34% ; Wedges: 0; Brho(Tm): 3.4603, 3.4603, 3.4603, 3.4603  
 Bounds: Off; "FP\_slits" - last block for MC calc; no gates; Config: DDSHWDDMMSSMM



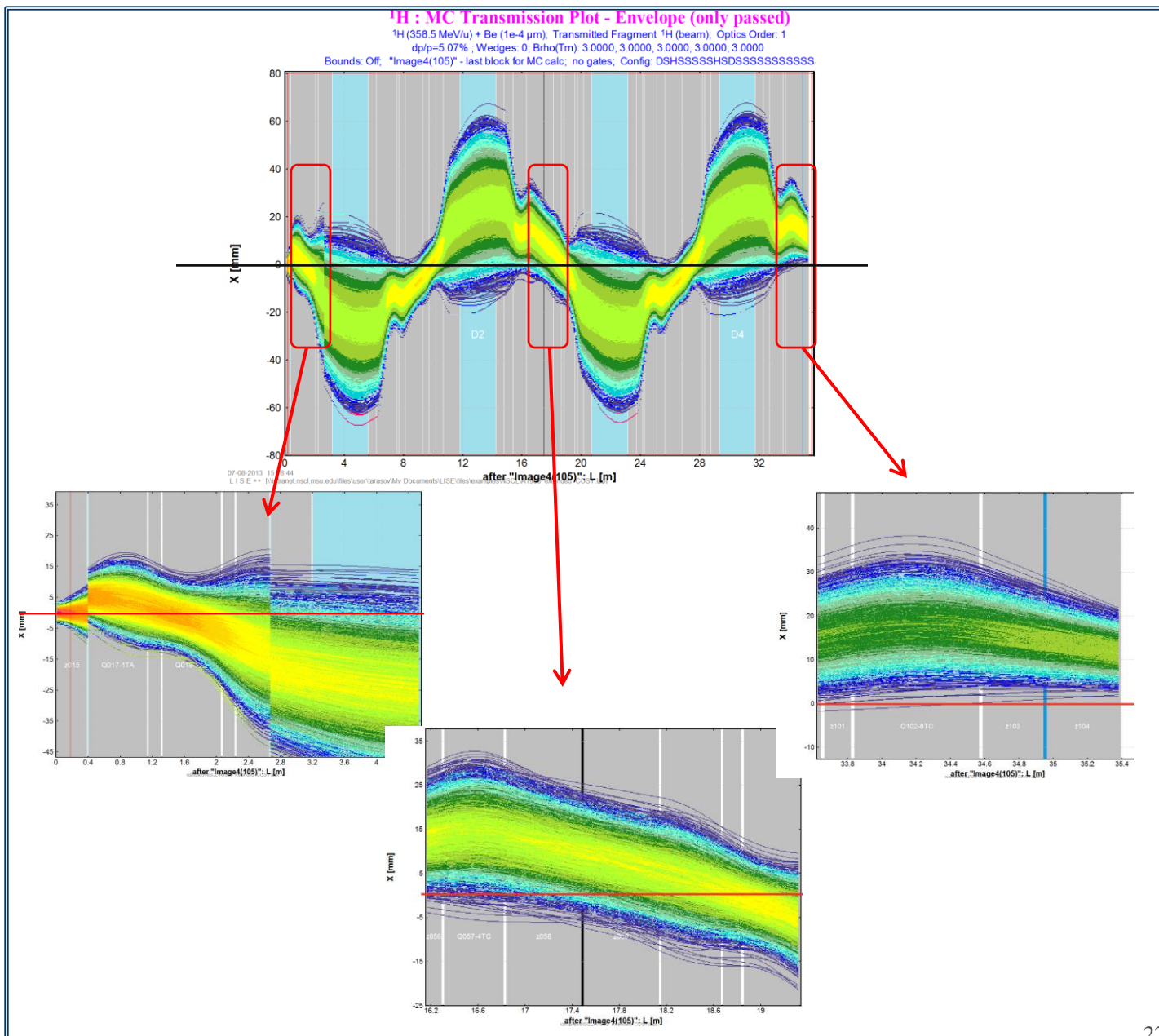
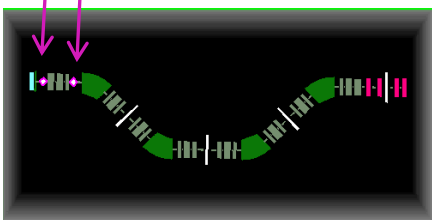
LISE++ file: [http://lise.nsci.msu.edu/9\\_6/Edipole/misalignemnt\\_A1900\\_extended\\_COSY.lpp](http://lise.nsci.msu.edu/9_6/Edipole/misalignemnt_A1900_extended_COSY.lpp)

Example:

1<sup>st</sup> triplet 5 mm

All dipoles set to 3.0 Tm

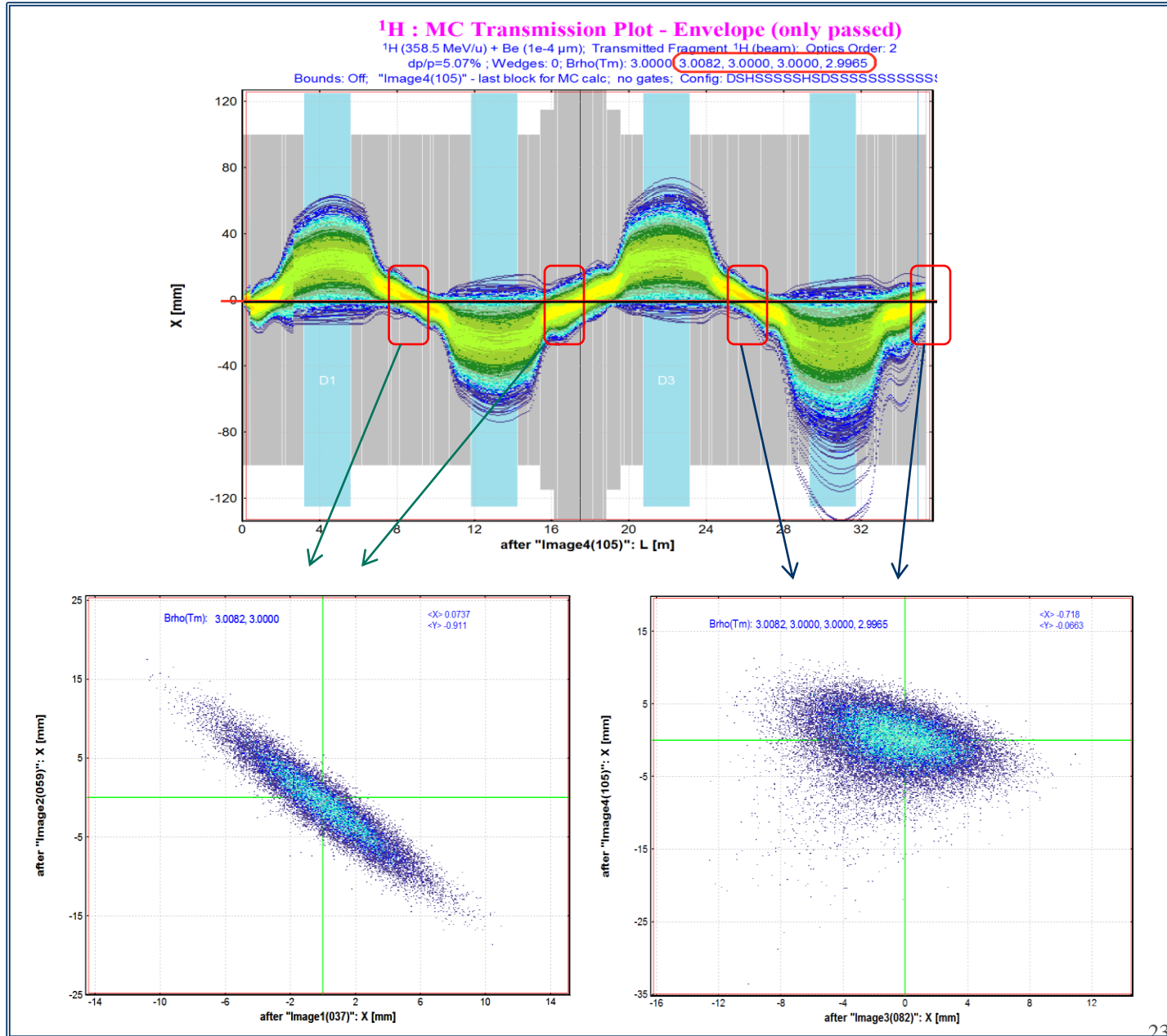
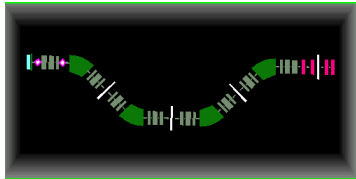
<b>P</b>	Projectile	<sup>1</sup> H <sup>1+</sup>
		358.49 MeV/u 1 pnA
<b>F</b>	Fragment	<sup>1</sup> H <sup>1+</sup> =beam=
<b>T</b>	Target	Be 0.0001 π circ
<b>Sr</b>	Stripper	
<b>D</b>	tuning	Brho 3.0000 Tm
<b>S</b>	z015	standard 3 Tm
<b>H</b>	Shift 1	Δ X = +5.0 mm
<b>Q</b>	Q017-1TA	quadrupole 3 Tm
<b>S</b>	z018	standard 3 Tm
<b>Q</b>	Q019-1TB	quadrupole 3 Tm
<b>S</b>	z020	standard 3 Tm
<b>Q</b>	Q021-1TC	quadrupole 3 Tm
<b>H</b>	Shift 2	Δ X = -5.0 mm
<b>S</b>	z022	standard 3 Tm
<b>D</b>	D1	Brho 3.0082 Tm
<b>S</b>	z030	standard 56.4 cm
<b>Q</b>	Q031-2TA	quadrupole 43 cm



LISE++ file: [http://lise.nsci.msu.edu/9\\_6/Edipole/misalignemnt\\_A1900\\_extended\\_COSY.lpp](http://lise.nsci.msu.edu/9_6/Edipole/misalignemnt_A1900_extended_COSY.lpp)

Example:  
1<sup>st</sup> triplet 5 mm

Playing with Dipoles  
to be for Images  
at the central axis



	Brho, Tm		
	Initial	Set	Set/Init
Beam	3	3	-
Dipole 1	3	3.0082	0.27%
Dipole 2	3	3	-
Dipole 3	3	3	-
Dipole 4	3	2.9965	-0.12%

## 9.6.116 08/01/13

- Update in block selection at the Spectrometer Scheme
- Subtitles Correction in W\_Graph

## 9.6.112 07/31/13

- Increase of precision in the Setup dialog for length, fields, and in LPP-files

## 9.6.108 07/29/13

- \* ShowSetup -- Energy beam format modification

## 9.6.102 07/25/13

- \* Brho-alayzer modification for dispersion
- \* Equilibrium thickness from SRIM
- \* Modification Dim & Unit in distributions
- \* Global revision Beta, Gamma, Brho, Erho functions

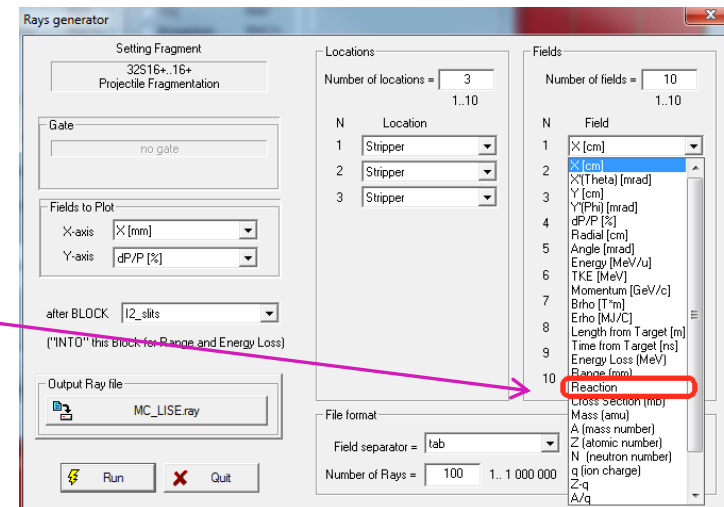
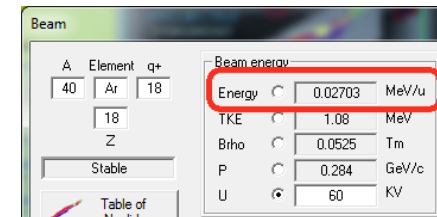
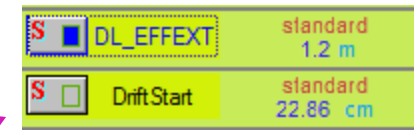
## 9.6.95 07/22/13

- \* Window Message in the case of error in MC\_trans\_init\_array (for debug)
- \* Modification WGauge for MC and creation TStatusBar for MC initialization
- \* Scroller revision in TWindowList

- \* The Reaction parameter in MC output file

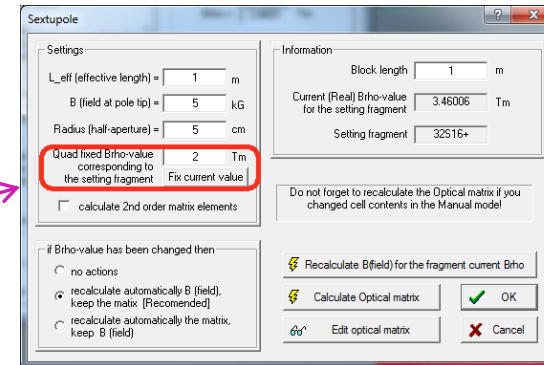
- \* New address for dynamical menu. New indexation!!!
- Due to that :

- \* new threshold: 30 000 ions for Monte Carlo transmission calculations
- \* new threshold: 30 000 ions for analytical transmission calculations
- \* new threshold: 300 blocks available in LISE++



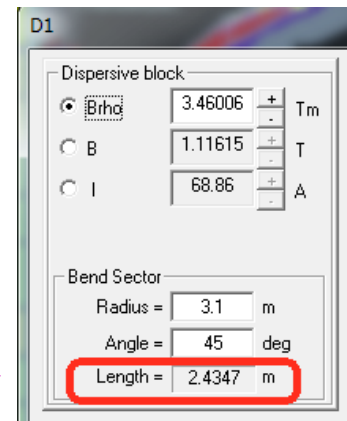


- Corrections for the "Analytical Calculation" button @ MC transmission dialog
- Correction for the "Beam-Fragment charge states" plot in the case of Stripper
- Remember the last input mode (Brho or B) in Optical block dialogs
- New button Fix Brho (Erho) value in the quadrupole dialogs
- Glyph button correction in the case of change of Drift type
- \* The "Ideal magnet" dialog revision



## 9.6.75 07/11/13

- \* Correction in Multiple Reactions use (when AF and PF together, and AF is the first)
- \* Correction in Multiple Reactions use settings at loading the code with lpp.argument
- Correction for the message of IsoMode in the Rays Output generator dialog
- Bend length cell in all Dipole dialogs (D6, Dip, ED, GFS)



## 9.6.68 07/08/13

- Correction in MC transmission to avoid a crash (sigma-per & NCALC\_MC)
- \* Gauges in MC transmission & checking or memory for case of several isotopes
- Calculation of backward transmission (realistic)
- \* Modifications in Matrix Kinematics (Fission, Two-body reactions)