

High Order extended and segmented configurations

Version 9.8.169
from 12/12/2014

[Link: Fragment Separator “BigRIPS”](#)

- ❑ New BigRIPS configurations in LISE⁺⁺
 - Details of the Extended configuration
 - Comparison of calculations with high order segmented and extended configurations

- ❑ Angular Acceptances

- ❑ Momentum Acceptances

- ❑ Beam dump fixed @ D1

Segmented configuration with
COSY maps (3rd order) by
Hiro Takeda & Hiro Suzuki
from 03-Dec-2014

Configuration files

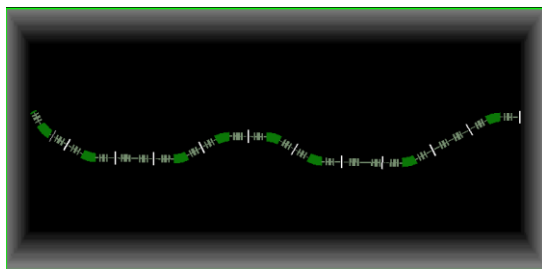
Path /config/RIKEN/

Vise\config\RIKEN*			
↑Name	Ext	Size	Date
[.]		<DIR>	12/13/2014
BigRIPS_ZD_3rd	lcn	334,767	12/13/2014
BigRIPS-F0F3-PAC0702	lcn	30,473	12/09/2006
BigRIPS-F0F7-PAC0702	lcn	58,205	12/09/2006
BigRIPS-F0F8-PAC0702	lcn	62,140	12/09/2006
BigRIPS-ZeroDegree-PAC0702	lcn	82,224	12/09/2006
e_BigRIPS	lcn	925,436	12/13/2014
RIPS	lcn	24,974	10/10/2003

LISE++ files

Path /files/examples/RIKEN/

Vise\files\examples\RIKEN*			
↑Name	Ext	Size	Date
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BigRIPS_ZD_3rd 34Ne	lpp	356,187	12/13/2014
e_BigRIPS	lpp	945,669	12/13/2014

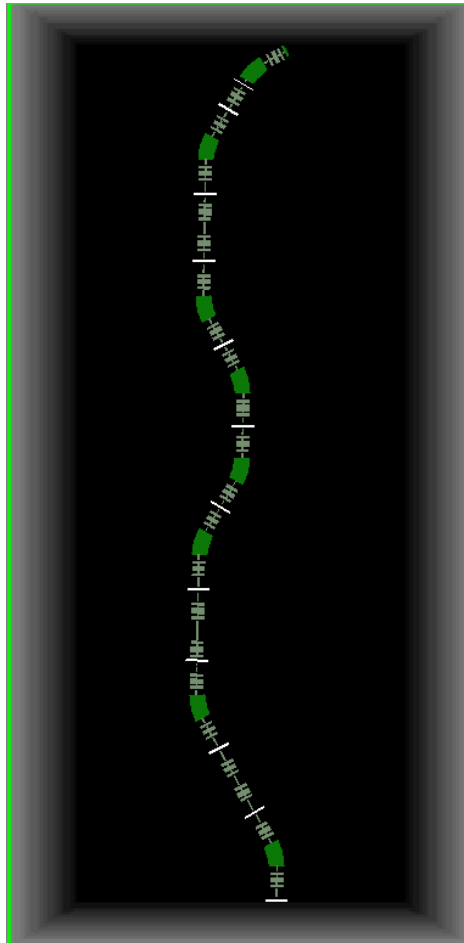


Note: It's an extended configuration! For details on extended configuration approach please use the next link

http://lise.nsci.msu.edu/9_8/LISE3/Extended%20configurations%20at%20LISE++.pdf

Optics blocks and Sextupole fields by courtesy of Takeda-san

sextupoles



Quadrupoles and dipoles fast editing

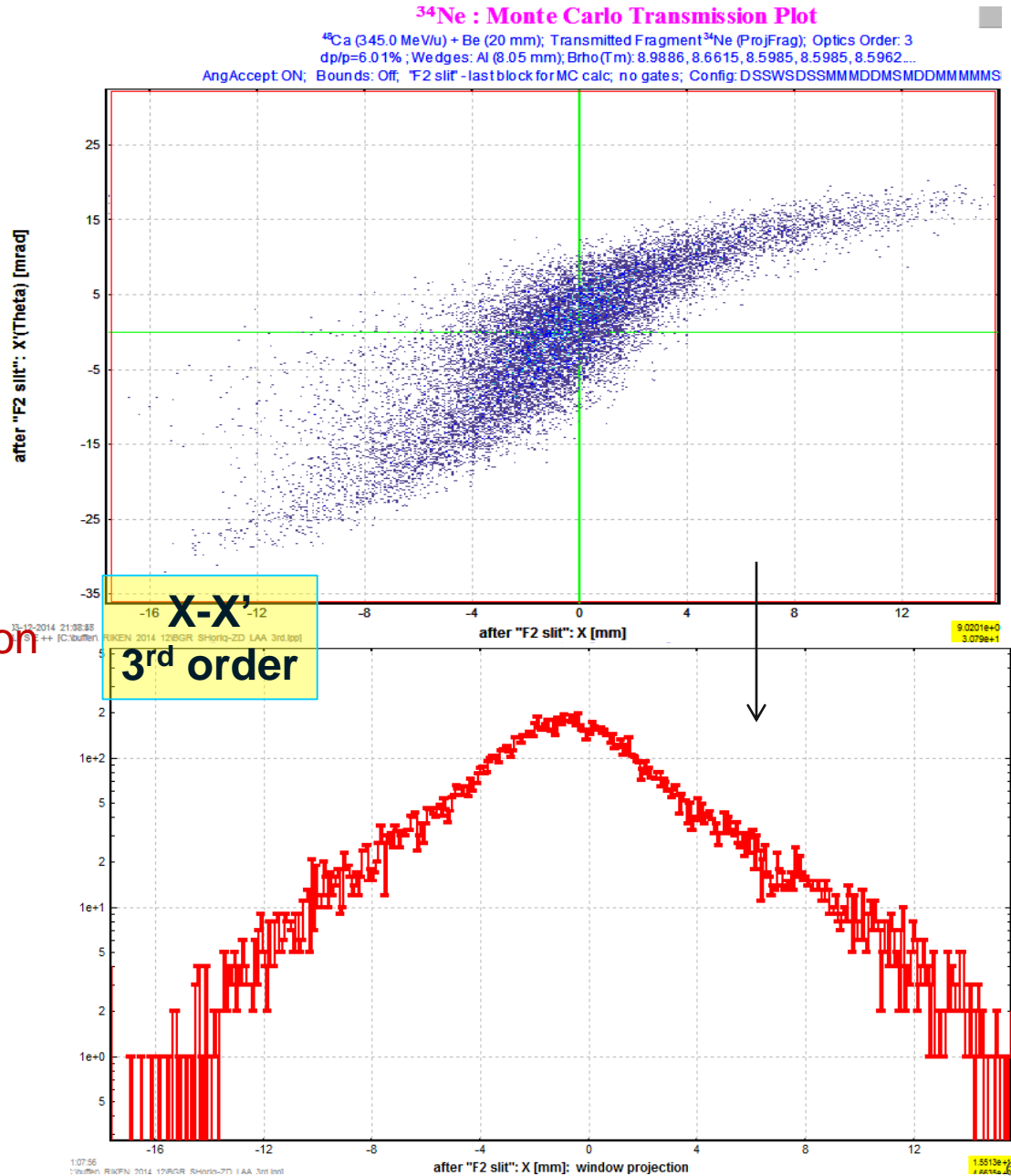
Block	Given Name	Start(m)	Length(m)	B0(kG)	Br(Tm)cor/*real	DriftM/*Angle	F
Dipole	tuning	0.000	0.0000	+29.4259	* 8.8278	* +0.0	
S	Drift	_010	0.000	0.5000		standard	
Q	Drift	STQ1	0.500	0.5000	+18.2571	8.8278	QUAD
S	Drift	_012	1.000	0.2000		standard	
Q	Drift	_013	1.200	0.8000	-22.2775	8.8278	QUAD
S	Drift	_014	2.000	0.2000		standard	
Q	Drift	STQ1-c	2.200	0.5000	+18.4664	8.8278	MULT
S	Drift	_016	2.700	1.0000		standard	
Dipole	D1	3.700	3.1416	-14.7134	* 8.8278	* -30.0	
S	Drift	beamdump	6.842	0.4670		standard	
S	Drift	_021	7.309	0.0000		SLITS	
S	Drift	_022	7.309	0.5330		standard	
Q	Drift	STQ2-a	7.842	0.5000	+11.3626	8.8278	MULT
S	Drift	_024	8.342	0.2000		standard	
Q	Drift	STQ2-b	8.542	0.8000	-12.4320	8.8278	QUAD
S	Drift	_026	9.342	0.2000		standard	
Q	Drift	STQ2-c	9.542	0.5000	+11.6817	8.8278	QUAD
S	Drift	_028	10.042	0.7500		standard	
S	Drift	F1	10.792	0.0000		SLITS	

Almost 176 optical blocks

Segmented configuration with COSY maps (3rd order)

P rojectile	⁴⁸ Ca ²⁰⁺
	345 MeV/u 1 pA
F ragment	³⁴ Ne ¹⁰⁺
T arget	Be 20 mm
S tripper	
D 1	Brho 8.9886 Tm

F2 position



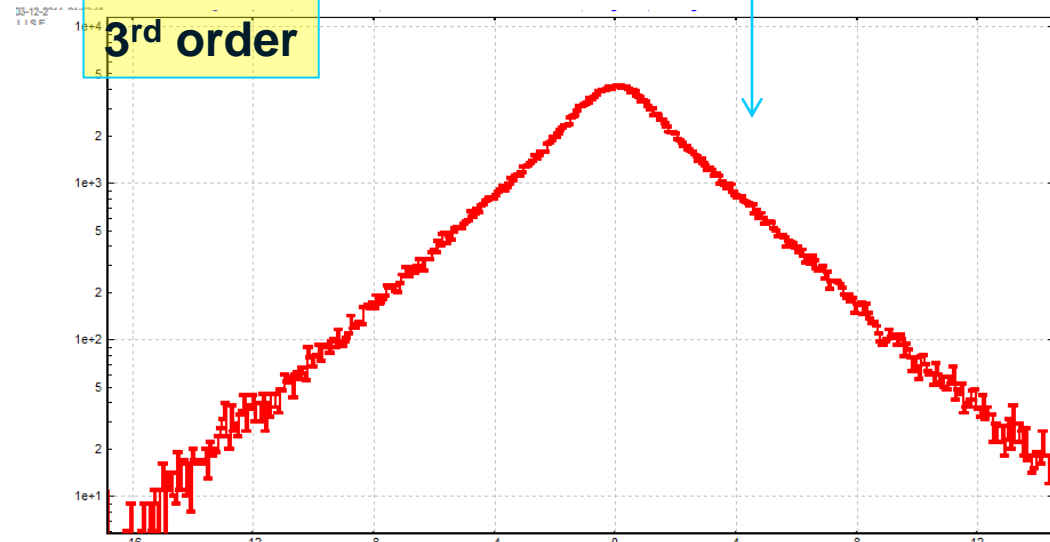
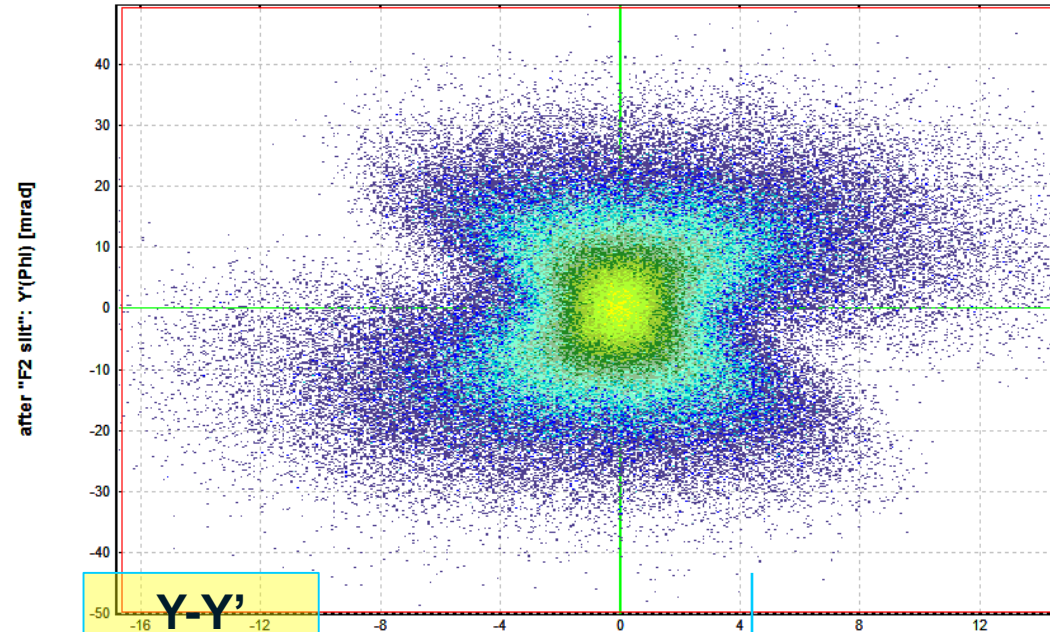
Segmented configuration with
COSY maps (3rd order)

F2 position

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T arget	Be 20 mm
S tripper	
D 1	Brho 8.9886 Tm

³⁴Ne : Monte Carlo Transmission Plot

⁴⁸Ca (345.0 MeV/u) + Be (20 mm); Transmitted Fragment ³⁴Ne (ProjFrag). Optics Order: 3
dp/p=6.01% ; Wedges: Al (8.05 mm); Brho(Tm): 8.9886, 8.6616, 8.5985, 8.5985, 8.5962...
AngAccept: ON; Bounds: Off; *F2 slit* - last block for MC calc; no gates; Config: DSSWSDSSMMDDMSMDDMMMMMS



More details in the file : [BigRIPS_AngularAcceptance.pdf](#)

BigRIPS Angular Acceptances

- Angular acceptance study
 - F0-F1 file : [e_BigRIP_AngAccept.lpp](#)
 - F0-F2
 - F0-F7
 - F1-F2 file : [e_BigRIP_AngAccept_F1-F2.lpp](#)
 - F5-F7 file : [e_BigRIP_AngAccept_F5-F7.lpp](#)
- Benchmarks with angular acceptances
- Angular acceptances settings in the BigRIPS configurations
- High order optics @ F7

See the next links for LISE++ details for
[Configurations](#)
[Angular acceptance](#)

Angular acceptance study results

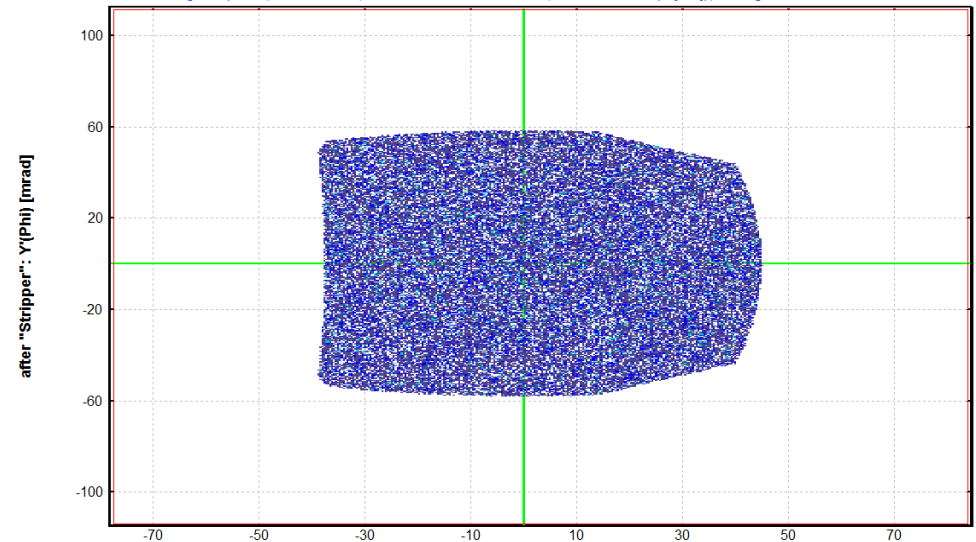
New analysis with use of the extended configuration						Previous default BigRIPS settings				
position		order	angular acceptance		shape	position		angular acceptance		shape
start	stop		X	Y		start	stop	X	Y	
target	F1	1	42.3	55.8	rect					
target	F1	2	42.8	56.4	rect					
target	F1	final	42.3	55.8	rect	target	F1	40.0	50.0	ellipse
soild anlge			7.41	msr		soild anlge		6.28	msr	
target	F2	1	42.9	55.8	rect					
target	F2	2	40.2	55.5	rect					
target	F2	final	40.2	55.5	rect					
target	F7	1	42.3	54.7	rect					
target	F7	2	40.3	55.1	rect					
target	F2	final	40.3	54.7	rect					
soild anlge			6.92	msr						
F1	F2	1	26.9	13.5	rect					
F1	F2	2	27.9	13.0	rect					
F1	F2	final	26.9	13.0	rect	F1	F2	40.0	50.0	ellipse
F5	F7	1	31.5	33.3	rect					
F5	F7	2	30.8	31.1	rect					
F5	F7	final	30.8	31.1	rect	F5	F7	absent	absent	

- Angular acceptance of the separator is defined by 1-st dipole segment
- It looks like the angular acceptances is a little bit higher, then was set in the BigRIPS previous default configurations.
- It seems that better to use the rectangle shape instead ellipse.

¹H : Monte Carlo Transmission Plot

¹H (1350.7 MeV/u) + ; Transmitted Fragment ¹H (beam); Optics Order: 2
 dp/p=6.13% ; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000, 7.0000, ...

AngAccept: ON; Bounds: ON; "F7" - last block for MC calc; Gate 1: "AND" (X [mm]); Config: DSSSSSSSDSSSSSSSSSSSSSSSS



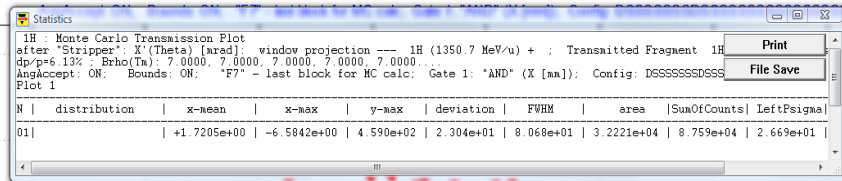
07-12-2014 19:37:14

LISE++ [C:\buffer_RIKEN_2014_12\HighOrderOptical_BigRIP_SEXT_up_to_F7_accept.lpp]

after "Stripper": X(Theta) [mrad]

¹H : Monte Carlo Transmission Plot

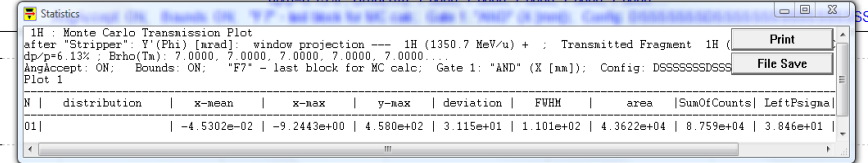
after "Stripper": X(Theta) [mrad]: window projection --- ¹H (1350.7 MeV/u) + ; Transmitted Fragment ¹H (beam); Optics Order: 2
 dp/p=6.13% ; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000, 7.0000, ...



after "Stripper": X(Theta) [mrad]: window projection

¹H : Monte Carlo Transmission Plot

after "Stripper": Y(Phi) [mrad]: window projection --- ¹H (1350.7 MeV/u) + ; Transmitted Fragment ¹H (beam); Optics Order: 2
 dp/p=6.13% ; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000, 7.0000, ...



after "Stripper": Y(Phi) [mrad]: window projection

Quadrupoles and dipoles fast editing

Block	Given Name	Start(m)	Length(m)	B0(kG)	Br(Tm)cor/*real	DriftM/*Angle	Rapp(cm)/*R(...)	Leff(m)/*Ldip(m)	2 nd order	CalcMatr/*Z-Q	AngAcc.Apps.Slits	COSY_link	SE
Dipole	D1	0.000	7.1410	-15.6450	* 9.3870	* -30.0	* 6.0000	* 3.1416	-	* 0	HV -- --	-	S
Drift	ExitBeamD...	7.141	0.0000			SLITS					-- -- H-	-	s
Drift	Drift 2	7.141	3.6500			beam-line					-- --	-	s
Drift	F1 slit	10.791	0.0000			SLITS					-- -- H-	-	s
Dipole	D2	10.791	12.0420	-15.5096	* 9.3057	* -30.0	* 6.0000	* 3.1416	-	* 0	HV -- --	-	S
Drift	F2 slit	22.833	0.0000			SLITS					-- -- HV	-	e
Drift	F2-F3 drift	22.833	8.8000			beam-line					-- --	-	s
Dipole	D3	31.633	11.7916	-15.4993	* 9.2996	* -30.0	* 6.0000	* 3.1416	-	* 0	-- --	-	S
Dipole	D4	43.425	11.4920	+15.4993	* 9.2996	* +30.0	* 6.0000	* 3.1416	-	* 0	-- --	-	S
Drift	F5 slit	54.917	0.0000			SLITS					-- -- H-	-	s
Dipole	D5	54.917	11.4920	+15.3925	* 9.2355	* +30.0	* 6.0000	* 3.1416	-	* 0	-- --	-	S
Dipole	D6	66.409	11.7920	-15.3925	* 9.2355	* -30.0	* 6.0000	* 3.1416	-	* 0	-- --	-	S
Drift	F7 slit	78.201	0.0000			SLITS					-- -- HV	-	s

D1

ANGULAR ACCEPTANCE

Shape: Rectangle Ellipse

mrad <-> deg

Horizontal ± 40 mrad
Vertical ± 50 mrad
Solid angle 6.28 msr

Horizontal plane
 Use in Calculations
dispersion [mrad/%] -5.01
x' -momentum[%] (accept./disp.) 100

Vertical plane
 Use in Calculations
dispersion [mrad/%] 0
y' -momentum[%] (accept./disp.) 100

D2

ANGULAR ACCEPTANCE

Shape: Rectangle Ellipse

mrad <-> deg

Horizontal ± 40 mrad
Vertical ± 50 mrad
Solid angle 6.28 msr

Horizontal plane
 Use in Calculations
dispersion [mrad/%] 0
x' -momentum[%] (accept./disp.) 100

Vertical plane
 Use in Calculations
dispersion [mrad/%] 0
y' -momentum[%] (accept./disp.) 100

D5

ANGULAR ACCEPTANCE

Shape: Rectangle Ellipse

mrad <-> deg

Horizontal ± 30 mrad
Vertical ± 37.5 mrad
Solid angle 3.53 msr

Horizontal plane
 Use in Calculations
dispersion [mrad/%] 0
x' -momentum[%] (accept./disp.) 100

Vertical plane
 Use in Calculations
dispersion [mrad/%] 0
y' -momentum[%] (accept./disp.) 100

Recommended

position	start	target	F1	F5
	stop	F1	F2	F7
angular acceptance	X	42.3	26.9	30.8
	Y	55.8	13.0	31.1
shape		rect	rect	rect

More details in the file : [BigRIPS_MomentumAcceptance.pdf](#)

BigRIPS: Momentum Acceptances

The momentum acceptance of BigRIPS @ F1 slits is ~11.5%

File:
[e_BigRIP_momentum.lpp](#)

"F1" block : Apertures (throughout), Slits (after)

Left limit (aperture) -120 mm Right limit (aperture) 120 mm
L slit: -120 R slit: 120

horizontal

APERTURES

Shape (see *)

Rectangle

Ellipse

Use in Calculations

Horizontal

Vertical

SLITS

Slits shape (see *)

Rectangle Ellipse

Horizontal Slit

Set

conjointly Use in Calculations

separately Show in schematics

Vertical Slit

Set

conjointly Use in Calculations

separately Show in schematics

Horizontal plane

dispersion (mm/%)

-20.89

x-momentum[%]
(slit/dispersion)

total 11.49

Vertical plane

dispersion (mm/%)

0

y-momentum[%]
(slit/dispersion)

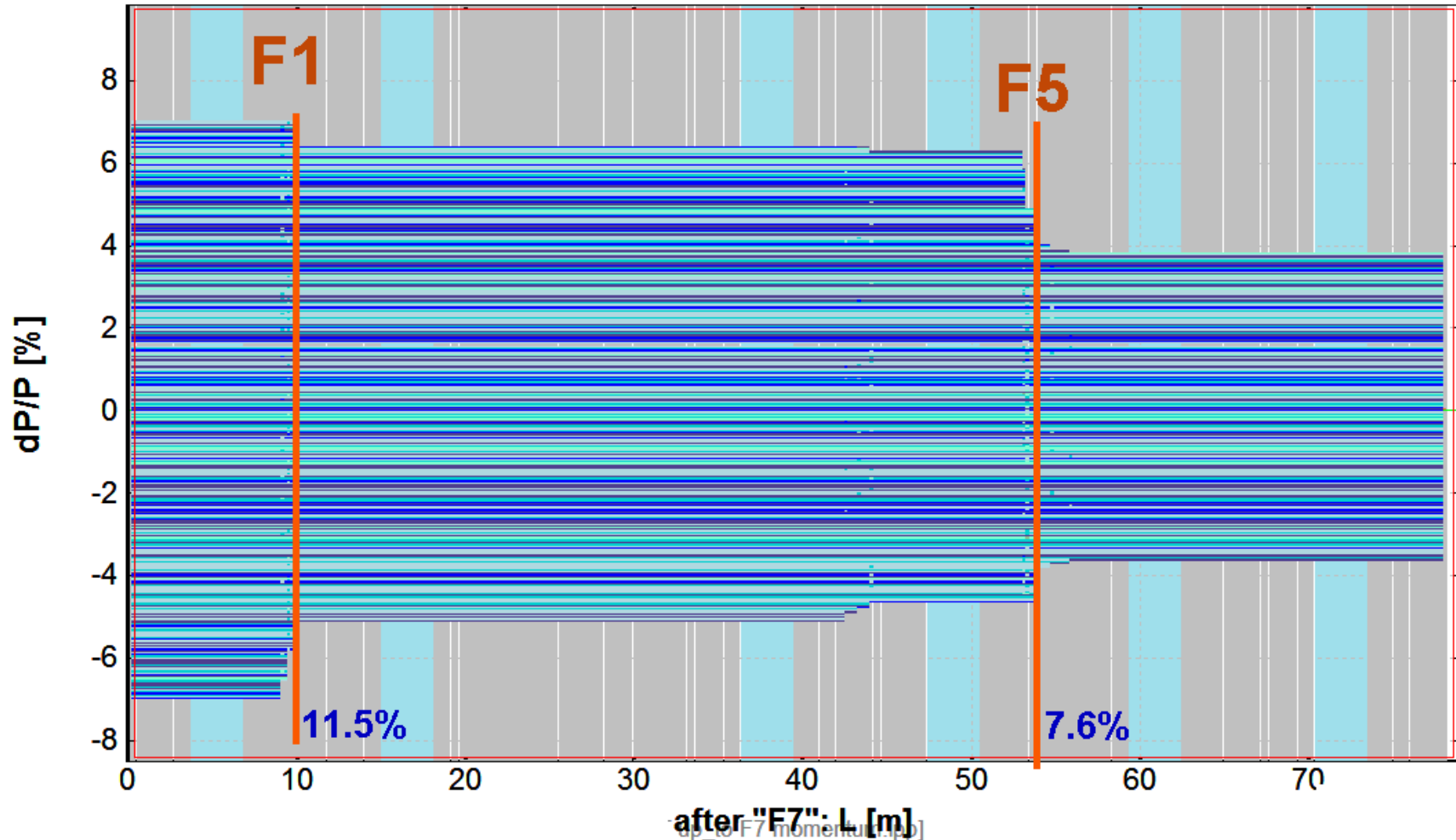
total 100

* Only the Monte Carlo mode uses "Ellipse" Shapes and Aperture settings.
The Distribution method uses only "Rectangle" shape slits.

^1H : MC Transmission Plot - Envelope (all)

^1H (1350.7 MeV/u) + ; Transmitted Fragment ^1H (beam); Optics Order: 2
 $dp/p=11.49\%$; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000, 7.0000....

Bounds: ON; "F7" - last block for MC calc; no gates; Config: DSSSSSSSDSSSS

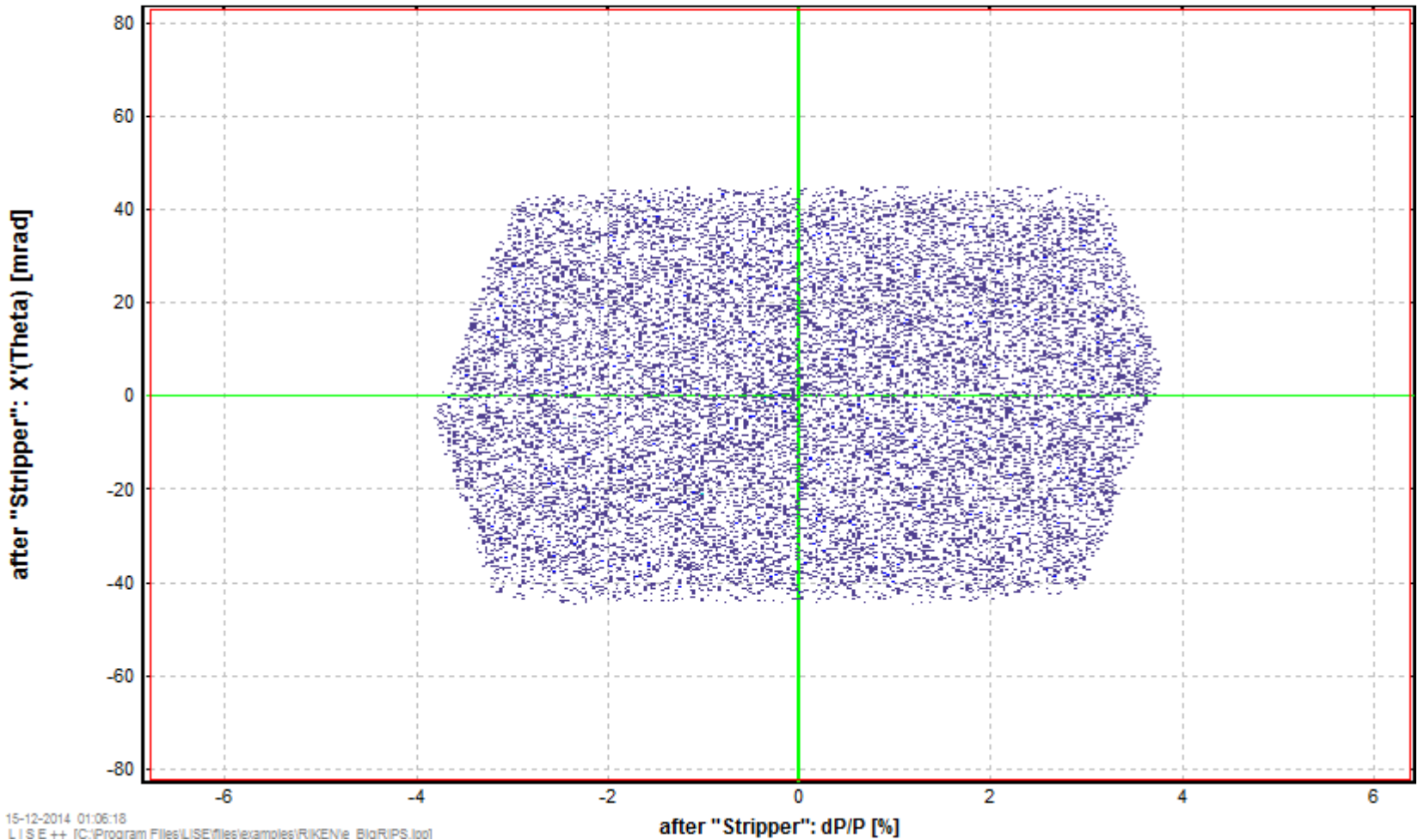


Gate on F7

¹H : Monte Carlo Transmission Plot

¹H (1350.7 MeV/u)+ ; Transmitted Fragment ¹H (beam); Optics Order: 1
dp/p=11.49% ; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000....

AngAccept: Off, Bounds: ON; "F7"- last block for MC calc; Gate 1: "AND" (X [mm]); Config: DSSSSSSSDSSSSSSSSSSSSS



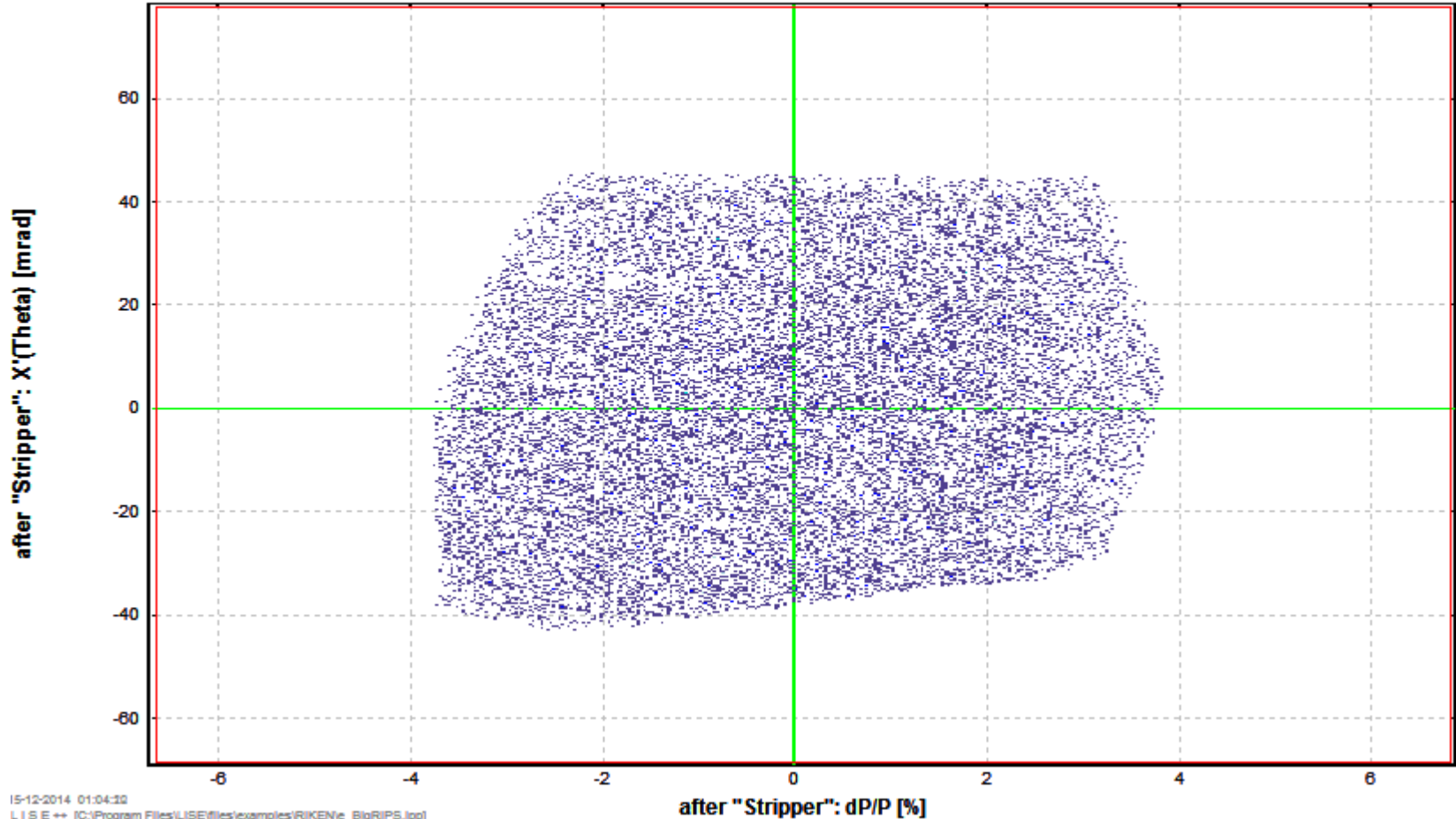
Gate on F7

¹H : Monte Carlo Transmission Plot

¹H (1350.7 MeV/u)+ ; Transmitted Fragment ¹H (beam); Optics Order: 2

dp/p=11.49% ; Brho(Tm): 7.0000, 7.0000, 7.0000, 7.0000, 7.0000....

AngAccept Off; Bounds: ON; "F7" - last block for MC calc; Gate 1: "AND" (X [mm]); Config: DSSSSSSSDSSSSSSSSSSSSSSSSSSSS



15-12-2014 01:04:32
L I S E ++ [C:\Program Files\LISE\files\examples\RIKENe_BigRIPS.lpp]

Fixed Beam Dump @ D1 : ^{34}Ne settings (Be 20 mm)

^{48}Ca : MC Transmission Plot - Envelope (all)

^{48}Ca (345.0 MeV/u) + Be (20 mm); Transmitted Fragment ^{48}Ca (beam); Optics Order: 2
 dp/p=6.22% ; Brho(Tm): 8.8278, 8.8278, 8.8278, 8.8278, 8.8278....

AngAccept: ON; Bounds: ON; "F2" - last block for MC calc; no gates; Config: DSSSSSSSDSSSSSSSSSSSSSSSSSS

