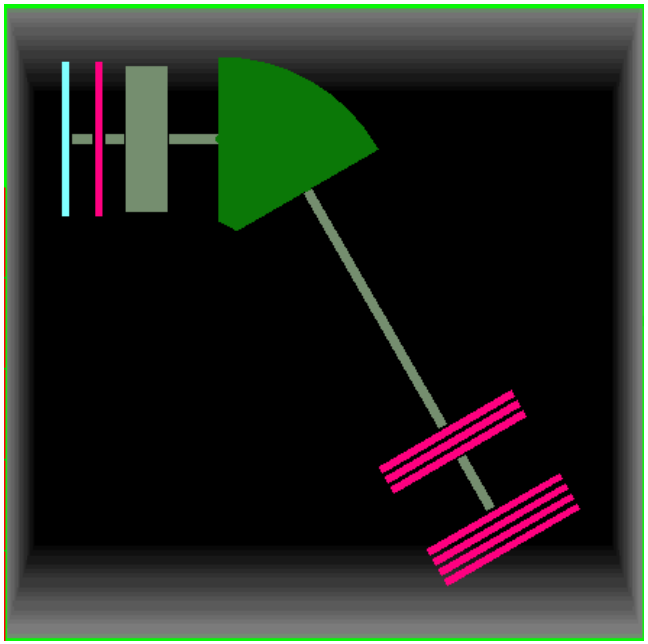
Spectrometer "PRISMA" : extended configuration

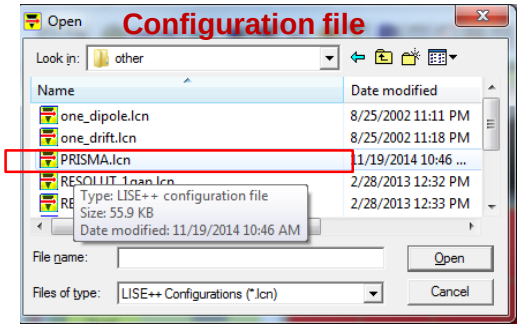
Version 9.8.160
from 11/14/2014

Request of Yu.I. and G.K

Spectrometer "PRISMA" http://www.lnl.infn.it/~prisma/it/index.html

Thesis of Andrea Latina "Study of Heavy-Ion Reactions with the Magnetic Spectrometer PRISMA: On-line and Off-line Data Analysis" to create the PRISMA configuration





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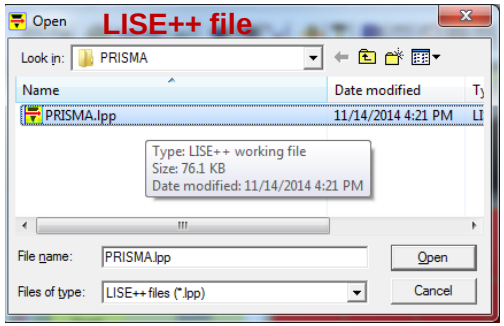
/files/examples/



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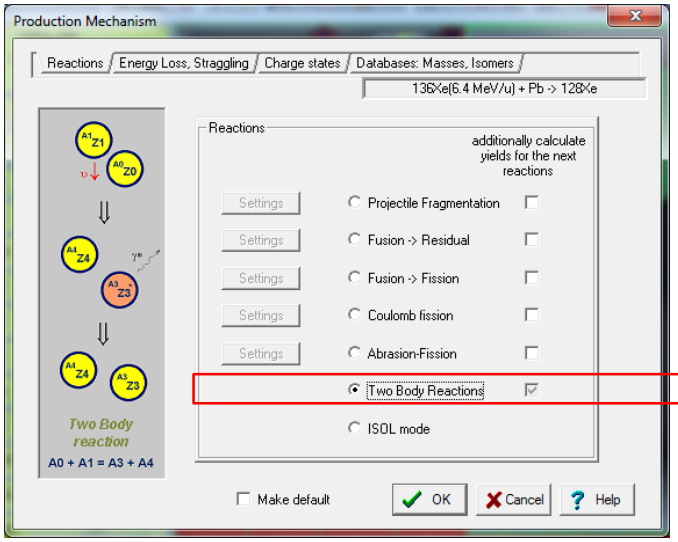
Note: It's an extended configuration! For details on extended configuration approach please use the next link
http://lise.nscl.msu.edu/9_8/LISE3/Extended%20configurations%20at%20LISE++.pdf

Reaction example used to create the configuration

Projectile	$^{136}Xe^{54+}$ 6.4 MeV/u 1 pnA	
Fragment	$^{128}Xe^{40+40+}$	
Target	Pb	0.1 mg/cm2
Stripper		
tuning	Brho	1.1600 Tm
Drift 1	standard	25 cm
MCP foil	C	0.0212132 mg/cm2
Drift 2	standard	25 cm
Quad	QUAD	-8.4849 kG
Drift 4	standard	60 cm
Dipole	Brho	1.1589 Tm
Drift 5	standard	3.23 m
wind PPAC	Al	0.2 mg/cm2
gas PPAC	C4H10	20 mm
wind PPAC	Al	0.2 mg/cm2
Drift 6	standard	72 cm
Row 1	CH4	250 mm
Row 2	CH4	250 mm
Row 3	CH4	250 mm
Row 4	CH4	250 mm
config: PRISMA	dp/p	
option: A1900_2013_myopt	28.26%	



Distributions of ^{128}Xe ions are shown in the next slides

128Xe Stable (Z=54, N=74) Xenon

All reactions total isotope rate 1.55e-1 pps
and Overall isotope transmission 0.339 %

Q1(tuning)		45	44	43	42	41	40	39	38	37	36	35	34
Q2(Dipole)		45	44	43	42	41	40	39	38	37	36	35	34
Reaction		TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody
Ion Production Rate	(pps)	5.29e-4	2.2e-3	6.78e-3	1.55e-2	2.65e-2	3.35e-2	3.15e-2	2.2e-2	1.14e-2	4.4e-3	6.61e-4	5.21e-8
Total ion transmission	(%)	0.001	0.005	0.015	0.034	0.058	0.073	0.069	0.048	0.025	0.01	0.001	1.14e-7
Total: this reaction	(pps)	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1
X-Section in target	(mb)	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1
Target	(%)	0.28	1.16	3.59	8.23	14.03	17.75	16.69	11.66	6.05	2.33	0.669	0.142
X space transmission	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Y space transmission	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unreacted in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Q (Charge) ratio	(%)	0.339	1.41	4.35	9.96	16.97	21.47	20.19	14.1	7.32	2.82	0.809	0.172
Unstopped in material	(%)	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67
tuning	(%)	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
X angular transmission	(%)	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05
Y angular transmission	(%)	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47
Drift 1	(%)	100	100	100	100	100	100	100	100	100	100	100	100
MCP foil	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unreacted in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unstopped in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 2	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Quad	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 4	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Dipole	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 5	(%)	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	12.94	0.005
X space transmission	(%)	100	100	100	100	100	100	100	100	100	100	52.38	0.019
Y space transmission	(%)	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71
wind PPAC	(%)	100	100	100	100	100	100	100	100	100	100	100	100

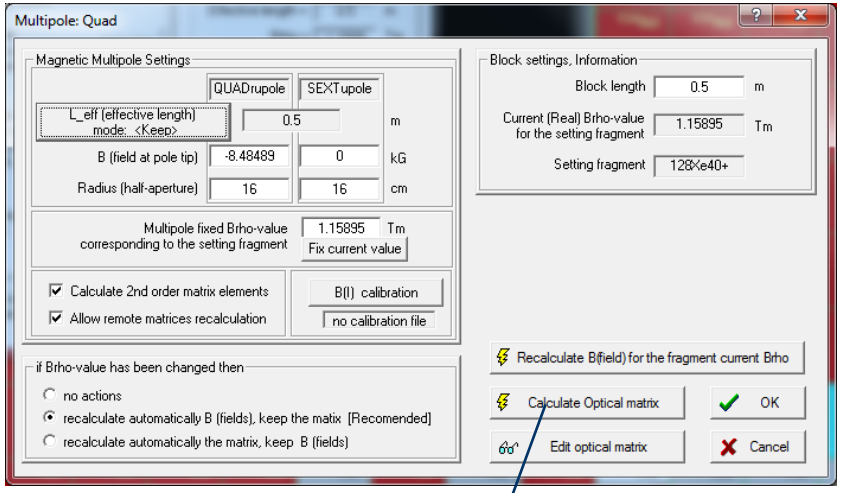
Quad

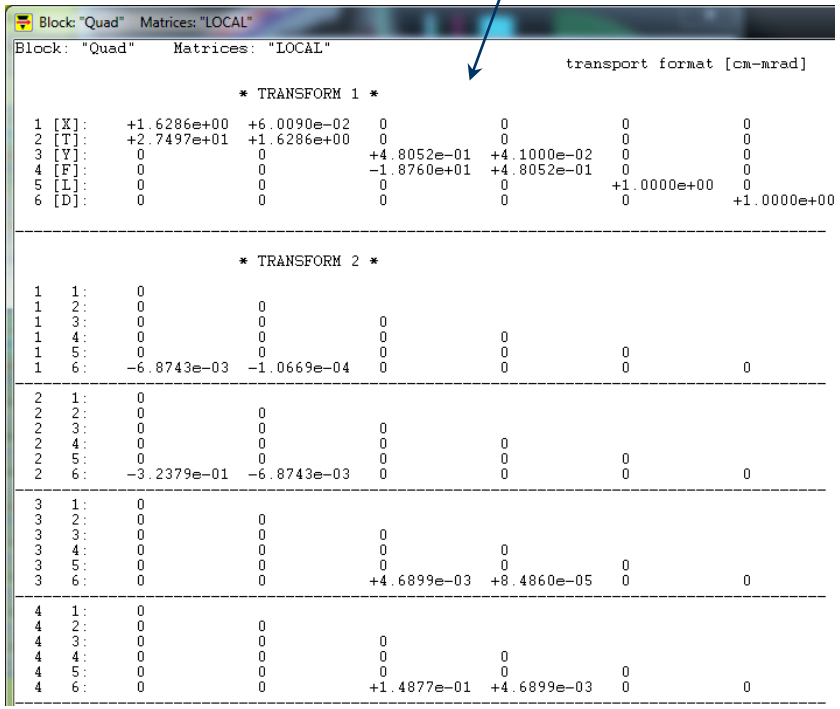
Thesis

QUADRUPOLE		
Max. field gradient	G	5.3 T/m
Max. pole tip field	B_0	0.848 T
Effective length	l_{eff}	500 mm
Aperture diameter	d	320 mm
Pole profile		Multi-faceted
Yoke shape		Square

Table 2.2: *Characteristics of the PRISMA Quadrupole Magnet.*

LISE++



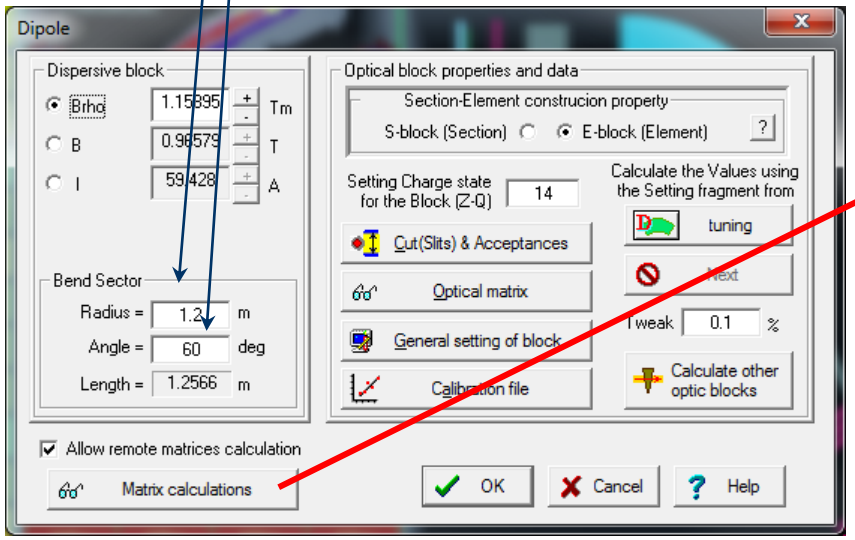


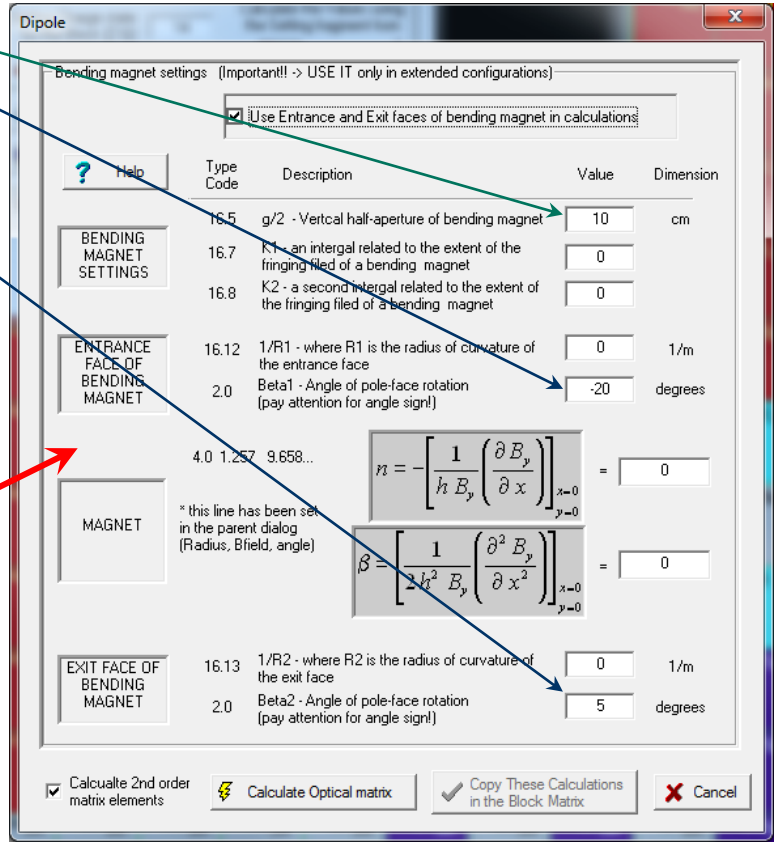
Dipole

DIPOLE		Thesis
Maximum field	B	1.0 T
Bending radius	R_0	1200 mm
Bending angle	ϕ	60°
Entrance angle	ϵ_1	-20°
Exit angle	ϵ_2	+5°
Pole gap	d	200 mm
Homogeneity at the Center		1×10^{-3} over +500/ − 400 mm

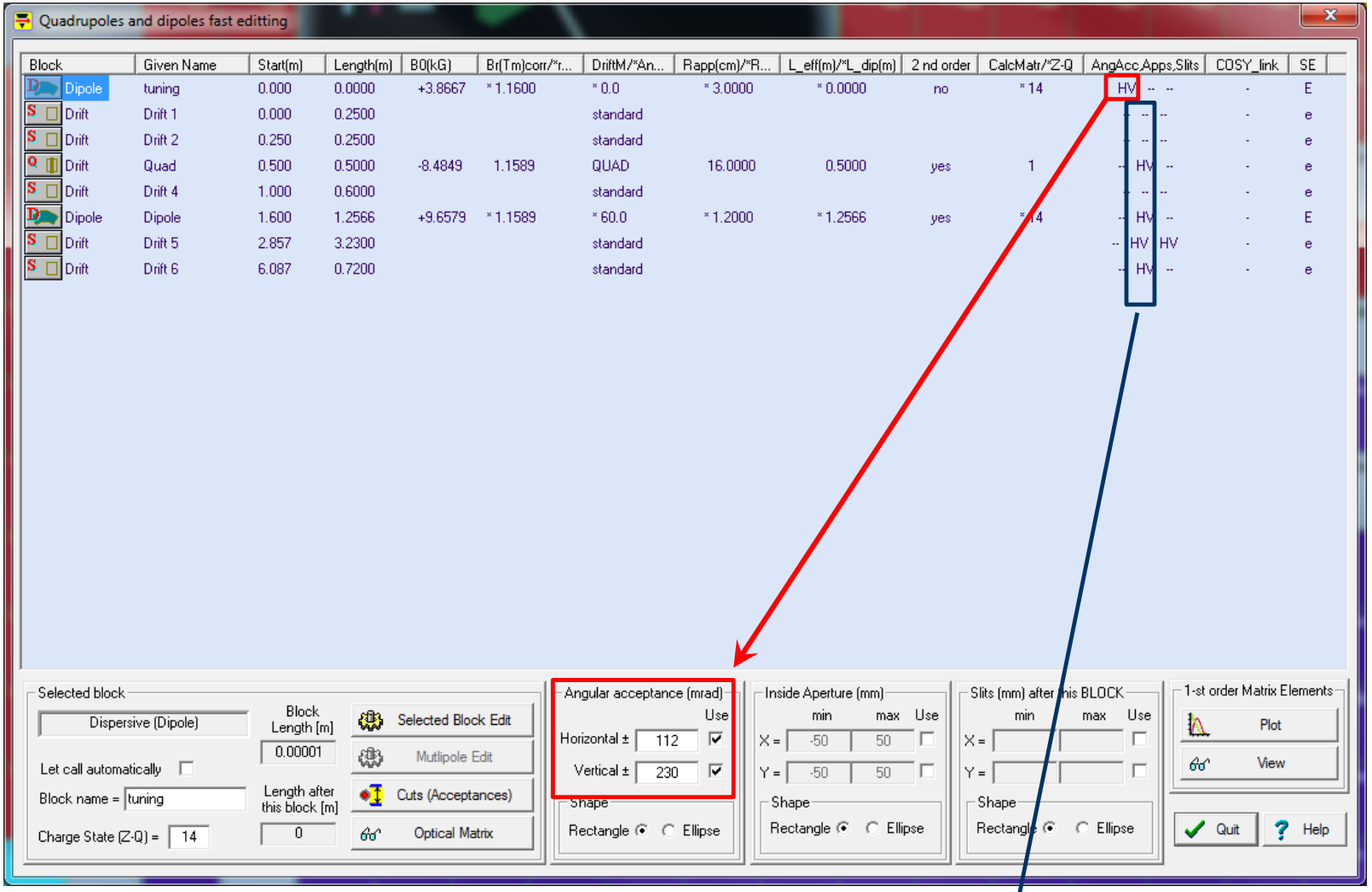
Table 2.3: *Characteristics of the PRISMA Dipole Magnet.*

LISE++





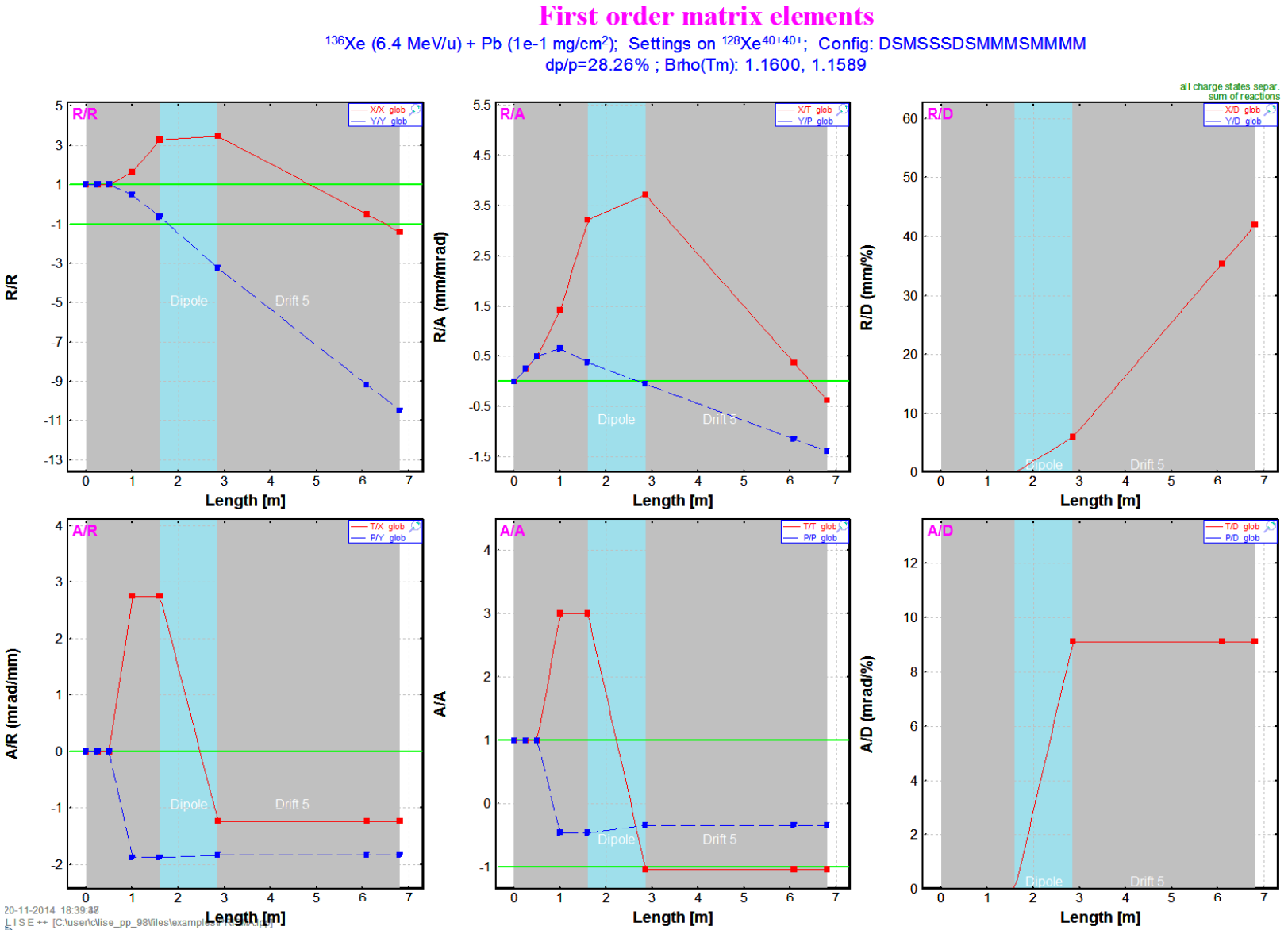
Optical blocks summary



Apertures should be set

Then the Angular acceptance has to be verified

First order matrix elements calculated by LISE^{++}

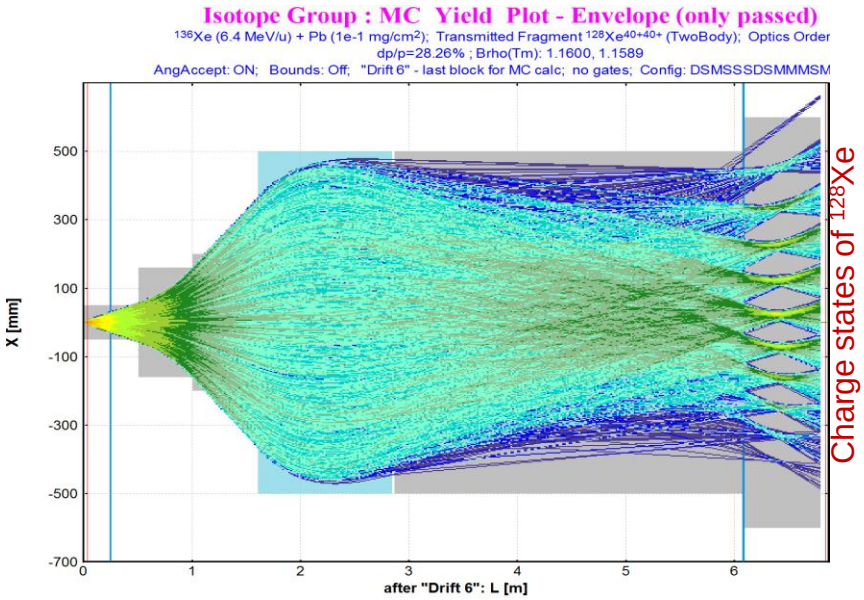


LISE^{++} Monte Carlo envelopes vs. Thesis

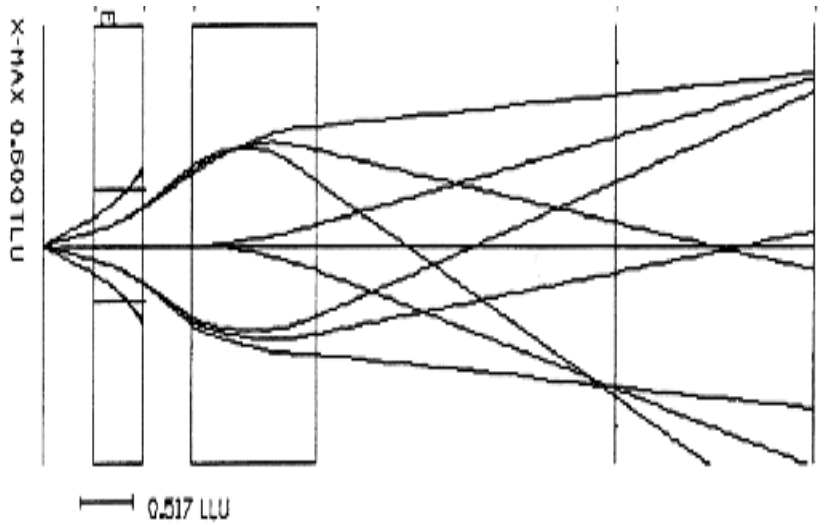
LISE^{++}

Thesis

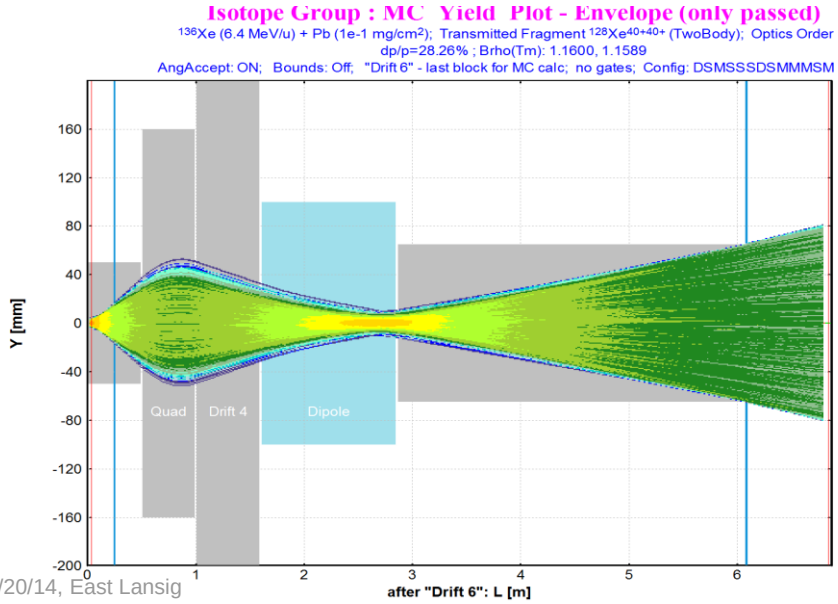
X

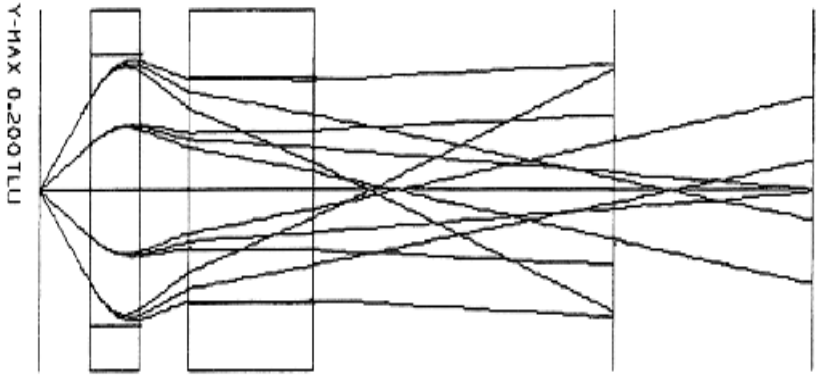


Charge states of ^{128}Xe



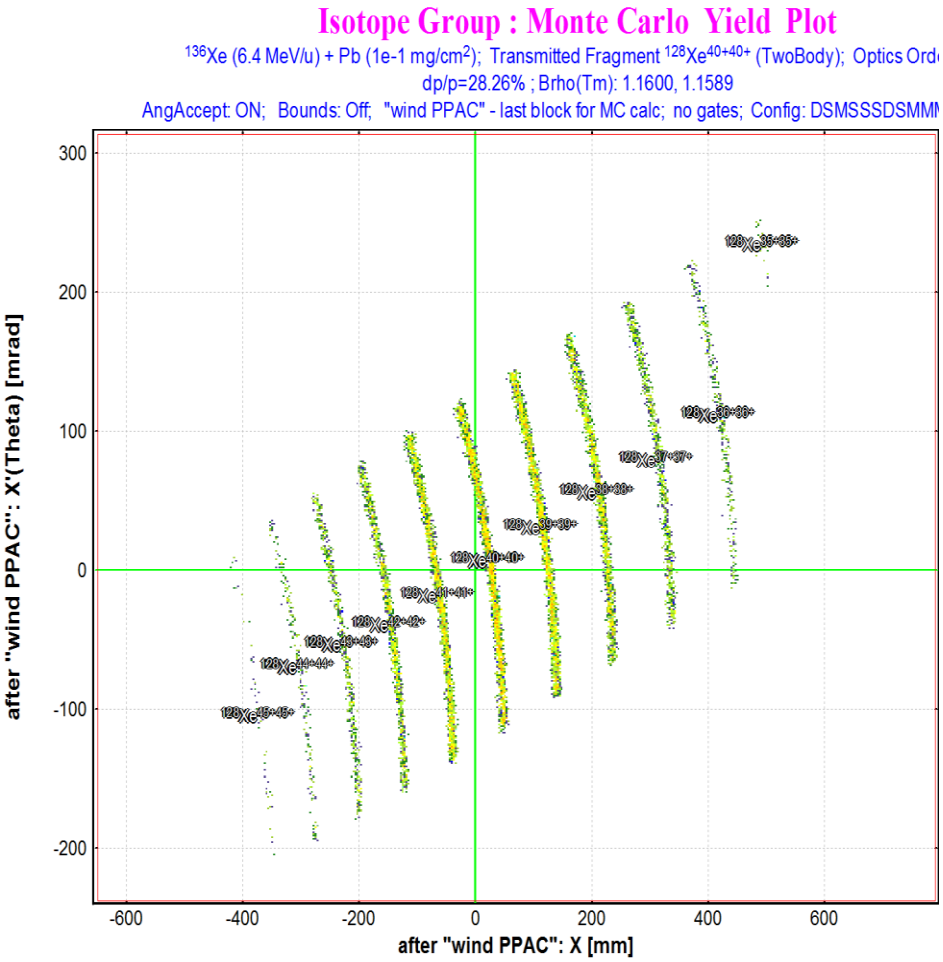
Y



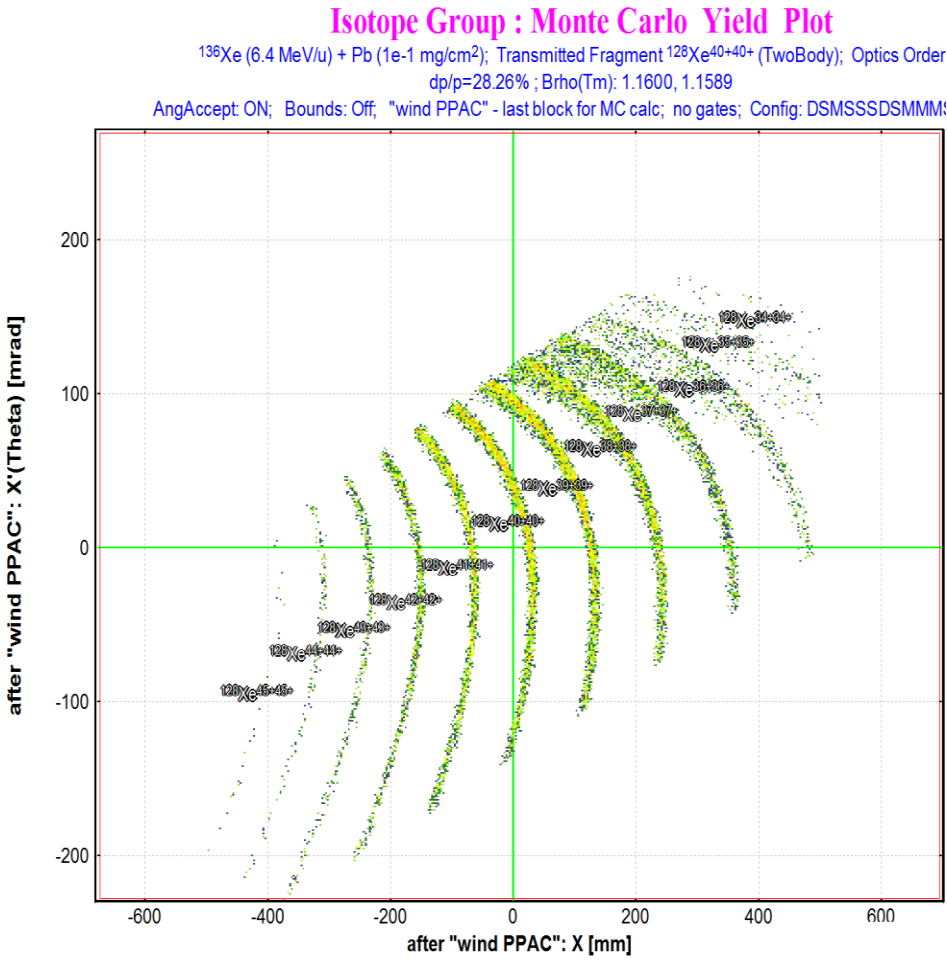


Using high orders optics with Monte Carlo method

1st order



2nd order



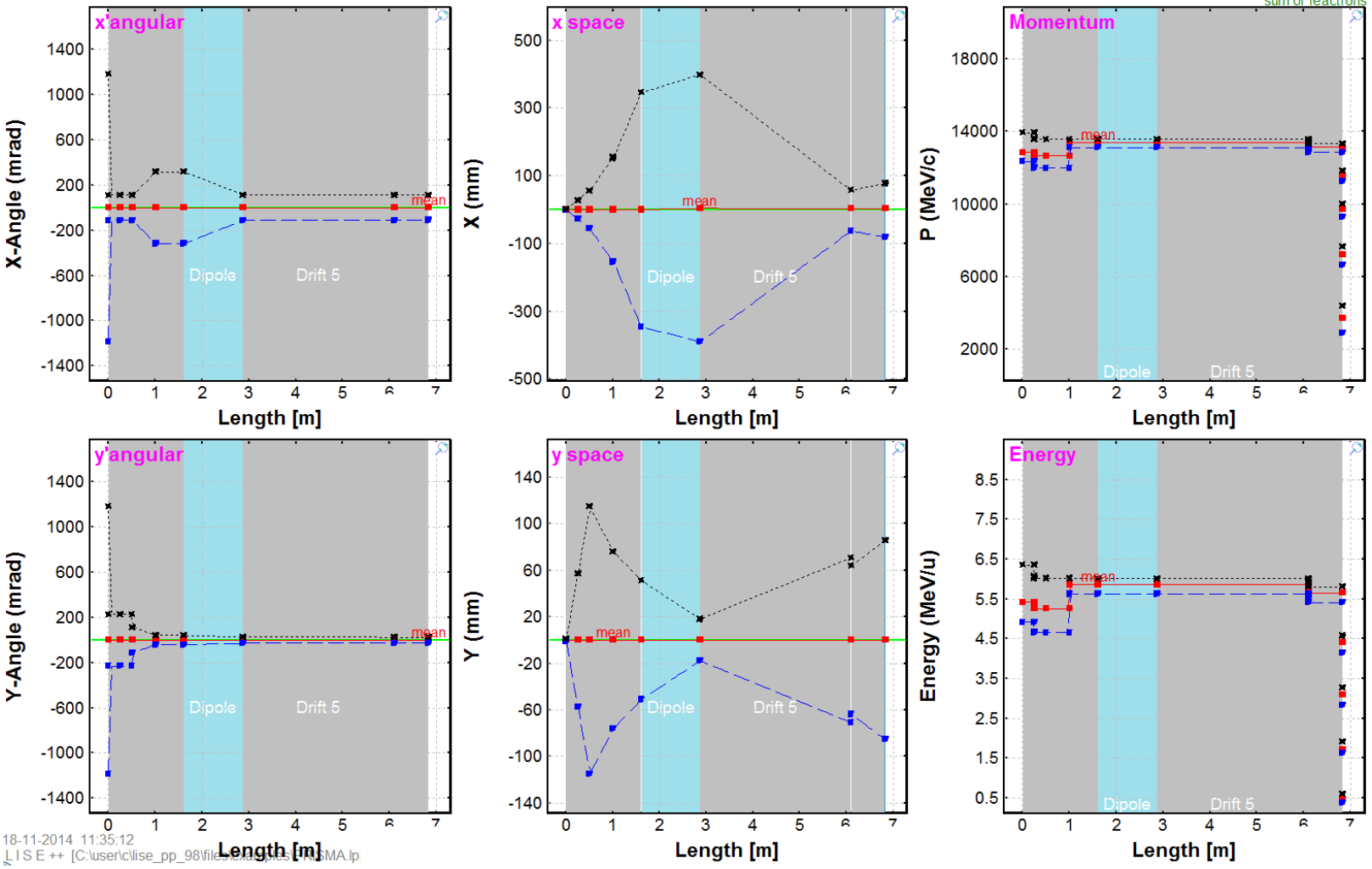
Charge states of ^{128}Xe at PPAC location: X-Angle vs. X-position

"Distribution" (analytical) method: envelope plots

Envelope for ^{128}Xe_TwoBody $^{40+}$

^{136}Xe (6.4 MeV/u) + Pb (1e-1 mg/cm^2); Settings on ^{128}Xe^{40+}; Config: SMSSSDSMMMSMMMM
dp/p=28.26% ; Brho(Tm): 1.1152

all charge states separ.
sum of reactions



"Distribution" (analytical) method: transmission calculation

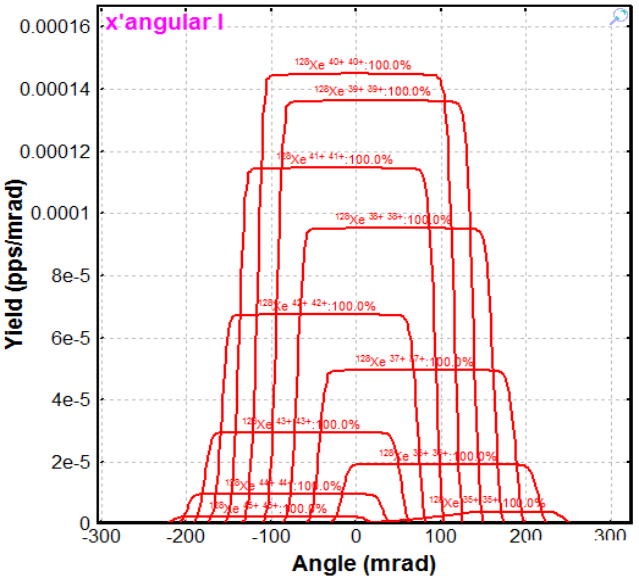
128Xe Stable (Z=54, N=74) Xenon

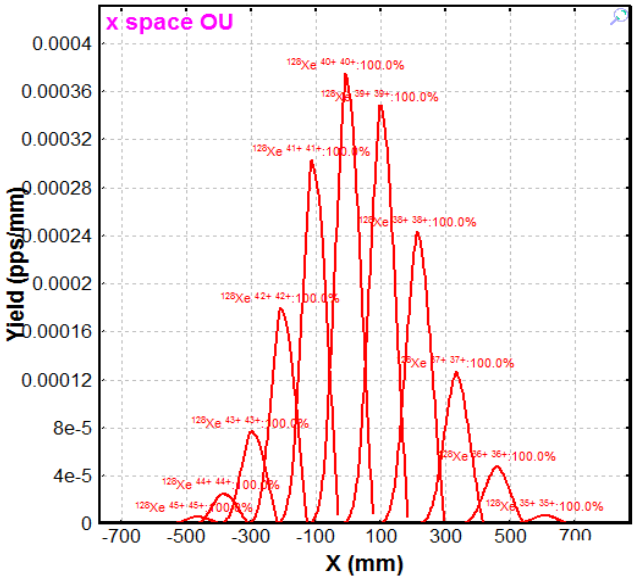
All reactions total isotope rate		1.55e-1	pps										
and Overall isotope transmission		0.339	%										
Q1(tuning)		45	44	43	42	41	40	39	38	37	36	35	34
Q2(Dipole)		45	44	43	42	41	40	39	38	37	36	35	34
Reaction		TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody	TwoBody
Ion Production Rate	(pps)	5.29e-4	2.2e-3	6.78e-3	1.55e-2	2.65e-2	3.35e-2	3.15e-2	2.2e-2	1.14e-2	4.4e-3	6.61e-4	5.21e-8
Total ion transmission	(%)	0.001	0.005	0.015	0.034	0.058	0.073	0.069	0.048	0.025	0.01	0.001	1.14e-7
Total: this reaction	(pps)	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1	1.55e-1
X-Section in target	(mb)	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1	2.51e+1
Target	(%)	0.28	1.16	3.59	8.23	14.03	17.75	16.69	11.66	6.05	2.33	0.669	0.142
X space transmission	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Y space transmission	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unreacted in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Q (Charge) ratio	(%)	0.339	1.41	4.35	9.96	16.97	21.47	20.19	14.1	7.32	2.82	0.809	0.172
Unstopped in material	(%)	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67	82.67
tuning	(%)	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.67
X angular transmission	(%)	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05
Y angular transmission	(%)	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47	18.47
Drift 1	(%)	100	100	100	100	100	100	100	100	100	100	100	100
MCP foil	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unreacted in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Unstopped in material	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 2	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Quad	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 4	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Dipole	(%)	100	100	100	100	100	100	100	100	100	100	100	100
Drift 5	(%)	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	12.94	0.005
X space transmission	(%)	100	100	100	100	100	100	100	100	100	100	52.38	0.019
Y space transmission	(%)	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71	24.71
wind PPAC	(%)	100	100	100	100	100	100	100	100	100	100	100	100

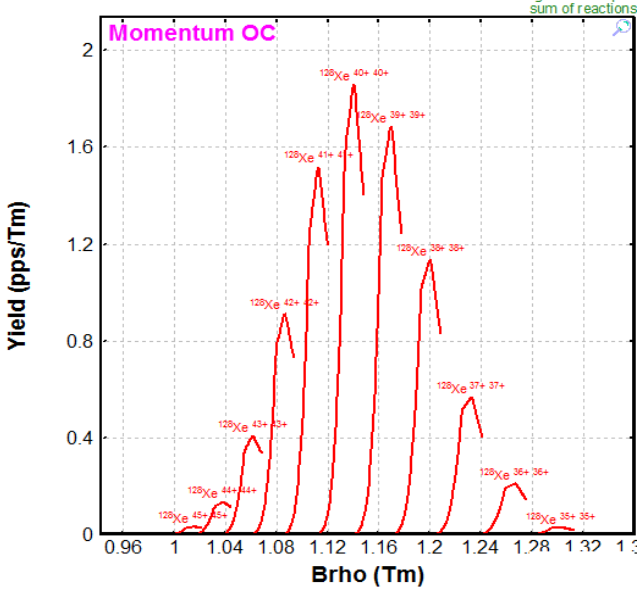
Drift 6

^{136}Xe (6.4 MeV/u) + Pb (1e-1 mg/cm^2); Settings on ^{128}Xe^{40+40+}; Config: DSMSSSDSMMMSMMMM
dp/p=28.26% ; Brho(Tm): 1.1600, 1.1589

all charge states separ.
sum of reactions







Should be done

- The Configuration test
- Quad and Dipole calibration B=f(I)
- Apertures settings
- Angular acceptance settings