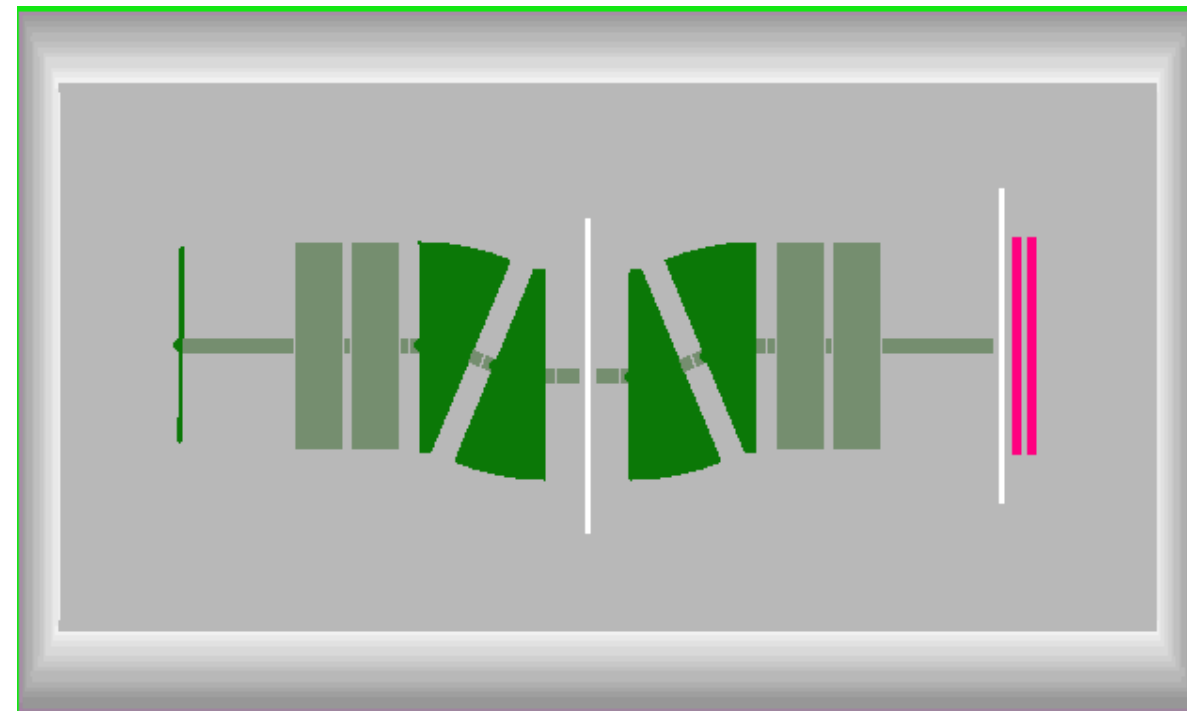


AIRIS: <https://www.phy.anl.gov/airis/>

## Version 4:

Quad Pole-radii 4 cm instead 3.5 cm,  
Dipole vertical half-gaps 4 cm instead 3.5 cm.

Now agreement between LISE<sup>++</sup> and  
COSY in quad-fields



<u>Topic</u>	<u>: configuration</u>	<u>URL address</u>
Optics with beam	: <i>extended</i>	<a href="http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS_v4_beam.lpp">http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS_v4_beam.lpp</a>
Experiment	: <i>extended</i>	<a href="http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS_v4_experiment.lpp">http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS_v4_experiment.lpp</a>
Experiment	: <i>segmented</i>	<a href="http://lise.nsl.msu.edu/10_1/AIRIS/s_AIRIS_v4_experiment.lpp">http://lise.nsl.msu.edu/10_1/AIRIS/s_AIRIS_v4_experiment.lpp</a>
AIRIS2 Bis-version	: <i>extended</i>	<a href="http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS2_bis.lpp">http://lise.nsl.msu.edu/10_1/AIRIS/e_AIRIS2_bis.lpp</a>

RF kicker



F11



Block with parameters to vary

Constraints

Final matrix

```

c:\program files (x86)\Vise\results\AIRIS v4 beam.fit_init
chi2: Initial 0.0152462 LISE fit reduced values
chi1: Initial 0.506632 LISE fit reduced values

Parameters:      LeftBound      Initial      RightBound
#01-q: Q1        -1.0e+99 < -4.644e+00 < +1.0e+99
#02-q: Q2        -1.0e+99 < +4.182e+00 < +1.0e+99
#03-q: Q3        +3.0e+00 < +4.182e+00 < +4.5e+00
#04-q: Q4        -5.0e+00 < -4.643e+00 < -3.5e+00

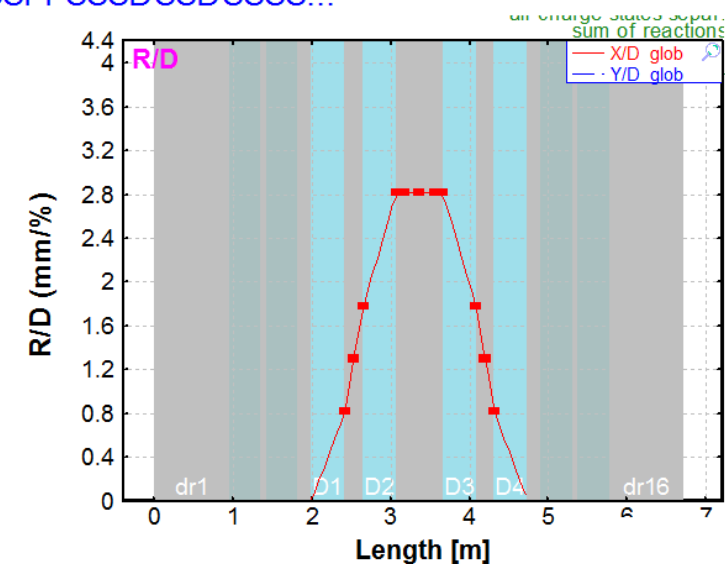
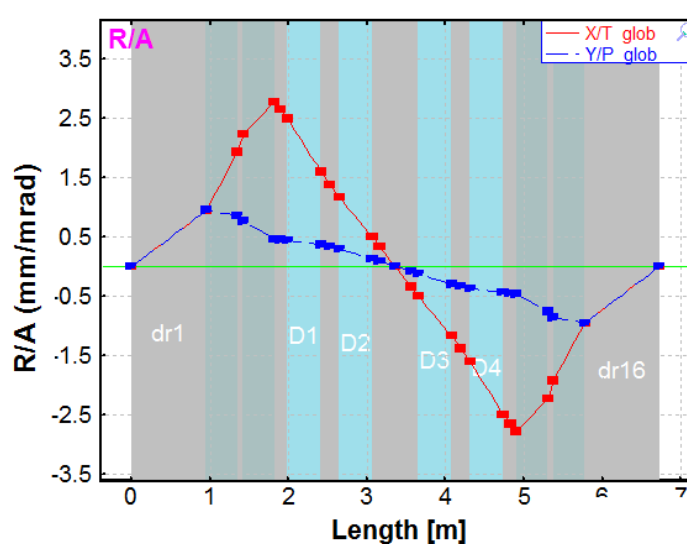
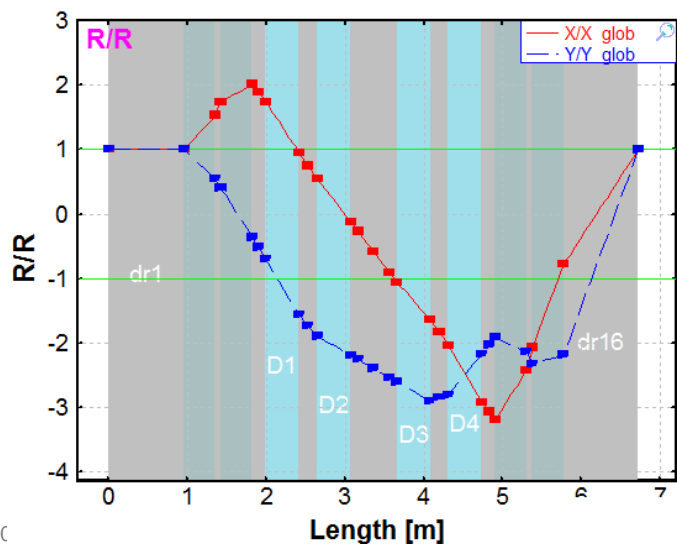
Constraint values:  Initial      Y-value      Precision  (Init-Des)/P  Desired
#01: FocX          -6.454e-06   -6.454e-06   1.0e-03      +6.454e-03    = 0
#02: FocY          -2.210e-06   -2.210e-06   1.0e-02      +2.210e-04    = 0
#03: FP FocX       +4.762e-04   +4.762e-04   1.0e-03      +4.762e-01    = 0
#04: FP FocY       -2.377e-04   -2.377e-04   1.0e-02      +2.377e-02    = 0
#05: FP dipX       +1.894e-16   +1.894e-16   1.0e-02      0              = 0

==> "FP dipX" : last fitting block global optical matrix and sigma vector

===== G L O B A L =====
Format [mm-mrad]
----- matrix -----
+1.000e+00 +4.762e-04 0 0 0 +1.894e-16 1.00e+00
+1.871e+00 +1.000e+00 0 0 0 +1.772e-16 4.01e+01
0 0 +9.994e-01 -2.377e-04 0 0 9.99e-01
0 0 +3.349e+00 +9.998e-01 0 0 4.01e+01
-1.110e-16 -1.110e-16 0 0 1.0 +1.724e+00 1.72e+00
0 0 0 0 0 +1.000e+00 1.00e+00
    
```

## First order matrix elements

$^{14}\text{O}$  (14 MeV/u); Settings on  $^{14}\text{O}^{8+..8+}$ ; Config: DSSSSSDSSDSSFFSSSDSSDSSSS...

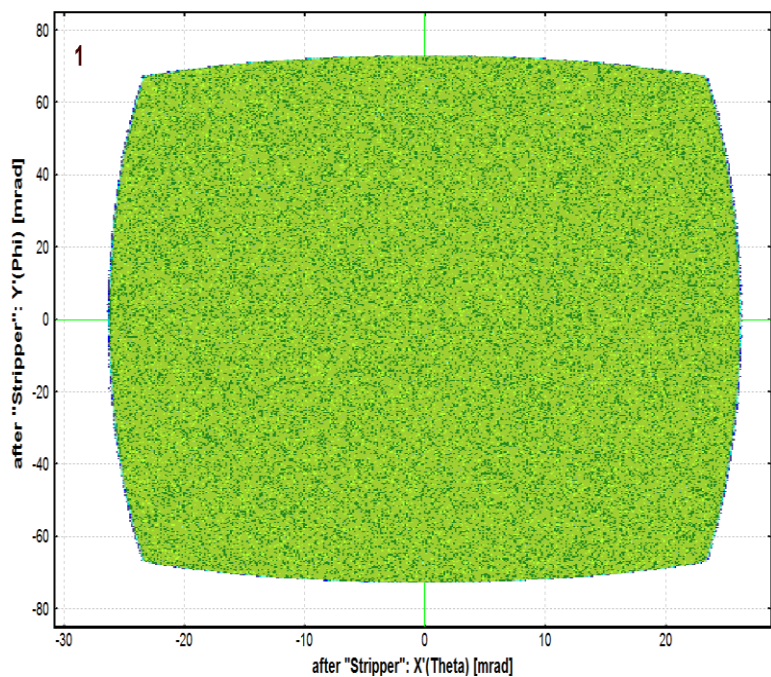


	LISE <sup>++</sup>		COSY																																																																																				
Calculated fields	Mass=A*amu  $B\rho = 0.94612 \text{ Tm}$ $Q1 = -4.6349 \text{ kG}$ $Q2 = +4.1821 \text{ kG}$	$^{14}\text{O}^{8+}$ $E = 196 \text{ MeV}$	$B\rho = 0.94626 \text{ Tm}$ $Q1 = -4.6483 \text{ kG}$ $Q2 = +4.1899 \text{ kG}$																																																																																				
1st half	Global matrix <table border="1"> <tr><td>-0.58611</td><td>-6.454e-7</td><td>0</td><td>0</td><td>0</td><td>0.28157</td><td>[cm]</td></tr> <tr><td>-15.95854</td><td>-1.70619</td><td>0</td><td>0</td><td>0</td><td>0</td><td>[mrad]</td></tr> <tr><td>0</td><td>0</td><td>-2.39548</td><td>-2.21e-7</td><td>0</td><td>0</td><td>[cm]</td></tr> <tr><td>0</td><td>0</td><td>-6.99108</td><td>-0.41745</td><td>0</td><td>0</td><td>[mrad]</td></tr> <tr><td>-0.44934</td><td>-0.04804</td><td>0</td><td>0</td><td>1</td><td>0.08619</td><td>[cm]</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>[%]</td></tr> <tr><td>/[cm]</td><td>/[mrad]</td><td>/[cm]</td><td>/[mrad]</td><td>/[cm]</td><td>/[%]</td><td></td></tr> </table>	-0.58611	-6.454e-7	0	0	0	0.28157	[cm]	-15.95854	-1.70619	0	0	0	0	[mrad]	0	0	-2.39548	-2.21e-7	0	0	[cm]	0	0	-6.99108	-0.41745	0	0	[mrad]	-0.44934	-0.04804	0	0	1	0.08619	[cm]	0	0	0	0	0	1	[%]	/[cm]	/[mrad]	/[cm]	/[mrad]	/[cm]	/[%]		6 1 <table border="1"> <tr><td>-0.58320E+00</td><td>-0.95784E-06</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.27835E+00</td></tr> <tr><td>-0.16022E+02</td><td>-0.17147E+01</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>-0.23918E+01</td><td>-0.14729E-06</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>-0.70355E+01</td><td>-0.41810E+00</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>-0.44597E+00</td><td>-0.47729E-01</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.10000E+01</td><td>0.84958E-01</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.10000E+01</td></tr> </table>	-0.58320E+00	-0.95784E-06	0.00000E+00	0.00000E+00	0.00000E+00	0.27835E+00	-0.16022E+02	-0.17147E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	-0.23918E+01	-0.14729E-06	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	-0.70355E+01	-0.41810E+00	0.00000E+00	0.00000E+00	-0.44597E+00	-0.47729E-01	0.00000E+00	0.00000E+00	0.10000E+01	0.84958E-01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01
-0.58611	-6.454e-7	0	0	0	0.28157	[cm]																																																																																	
-15.95854	-1.70619	0	0	0	0	[mrad]																																																																																	
0	0	-2.39548	-2.21e-7	0	0	[cm]																																																																																	
0	0	-6.99108	-0.41745	0	0	[mrad]																																																																																	
-0.44934	-0.04804	0	0	1	0.08619	[cm]																																																																																	
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/[cm]	/[mrad]	/[cm]	/[mrad]	/[cm]	/[%]																																																																																		
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0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01																																																																																		
Both halves	Global matrix <table border="1"> <tr><td>1.00048</td><td>4.762e-5</td><td>0</td><td>0</td><td>0</td><td>0</td><td>[cm]</td></tr> <tr><td>18.71078</td><td>1.00041</td><td>0</td><td>0</td><td>0</td><td>0</td><td>[mrad]</td></tr> <tr><td>0</td><td>0</td><td>0.99941</td><td>-2.377e-5</td><td>0</td><td>0</td><td>[cm]</td></tr> <tr><td>0</td><td>0</td><td>33.48892</td><td>0.9998</td><td>0</td><td>0</td><td>[mrad]</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0.17238</td><td>[cm]</td></tr> <tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>[%]</td></tr> <tr><td>/[cm]</td><td>/[mrad]</td><td>/[cm]</td><td>/[mrad]</td><td>/[cm]</td><td>/[%]</td><td></td></tr> </table>	1.00048	4.762e-5	0	0	0	0	[cm]	18.71078	1.00041	0	0	0	0	[mrad]	0	0	0.99941	-2.377e-5	0	0	[cm]	0	0	33.48892	0.9998	0	0	[mrad]	0	0	0	0	1	0.17238	[cm]	0	0	0	0	0	1	[%]	/[cm]	/[mrad]	/[cm]	/[mrad]	/[cm]	/[%]		6 1 <table border="1"> <tr><td>0.10000E+01</td><td>0.32849E-05</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.18688E+02</td><td>0.10000E+01</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>0.10000E+01</td><td>0.12316E-06</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>0.33655E+02</td><td>0.10000E+01</td><td>0.00000E+00</td><td>0.00000E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.10000E+01</td><td>0.16992E+00</td></tr> <tr><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.00000E+00</td><td>0.10000E+01</td></tr> </table>	0.10000E+01	0.32849E-05	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.18688E+02	0.10000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01	0.12316E-06	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.33655E+02	0.10000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01	0.16992E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01
1.00048	4.762e-5	0	0	0	0	[cm]																																																																																	
18.71078	1.00041	0	0	0	0	[mrad]																																																																																	
0	0	0.99941	-2.377e-5	0	0	[cm]																																																																																	
0	0	33.48892	0.9998	0	0	[mrad]																																																																																	
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0.10000E+01	0.32849E-05	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00																																																																																		
0.18688E+02	0.10000E+01	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00																																																																																		
0.00000E+00	0.00000E+00	0.10000E+01	0.12316E-06	0.00000E+00	0.00000E+00																																																																																		
0.00000E+00	0.00000E+00	0.33655E+02	0.10000E+01	0.00000E+00	0.00000E+00																																																																																		
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0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0.10000E+01																																																																																		

## 1<sup>st</sup> half

rectangle  
 $X' = \pm 26$  mrad  
 $Y' = \pm 72$  mrad

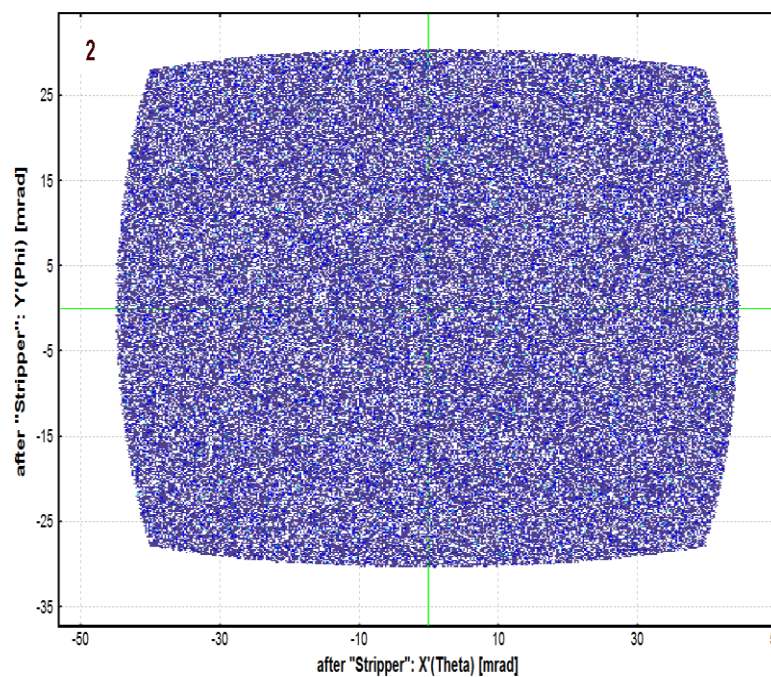
Solid angle 7.49 msr



## 2<sup>nd</sup> half

rectangle  
 $X' = \pm 43$  mrad  
 $Y' = \pm 30$  mrad

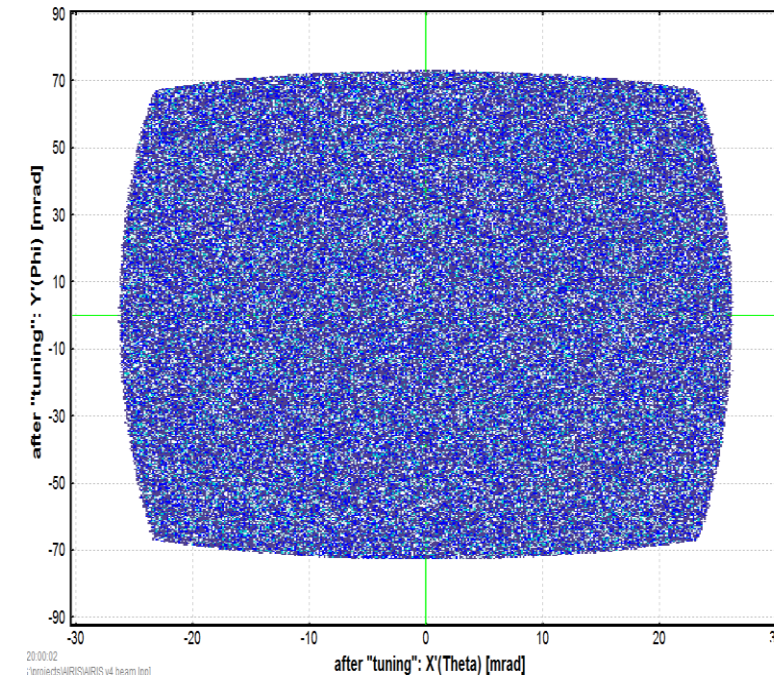
Solid angle 5.16 msr



## Total

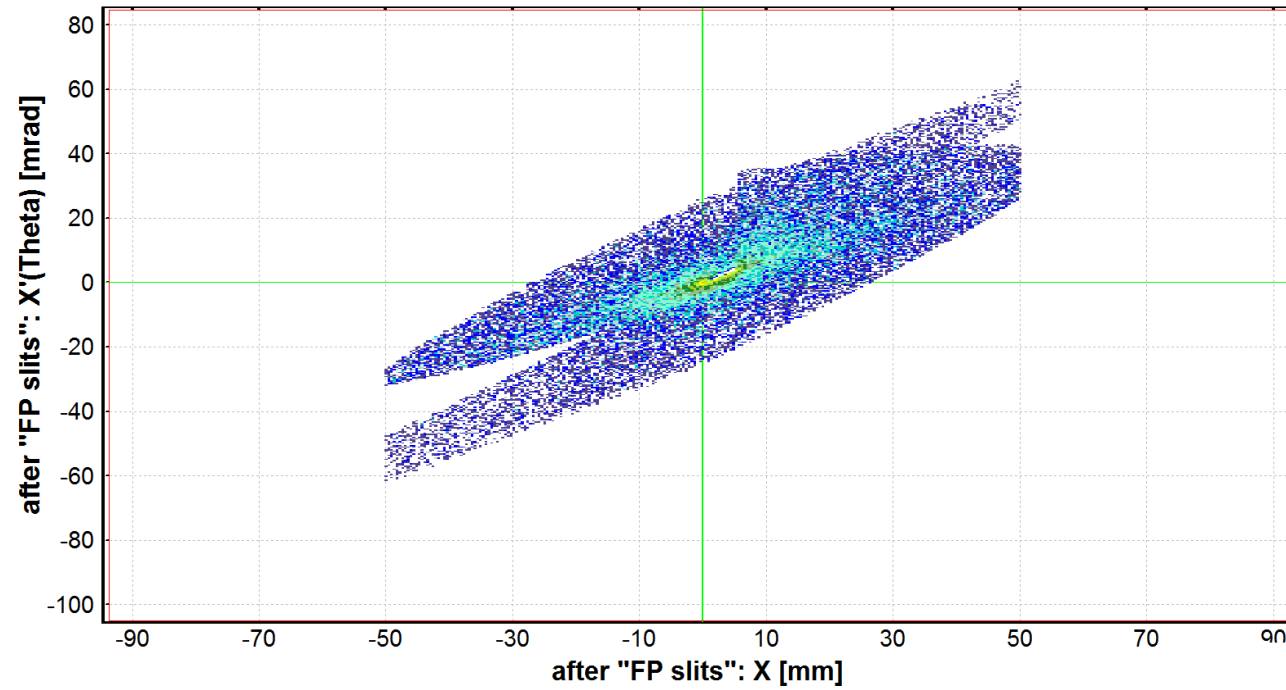
rectangle  
 $X' = \pm 25$  mrad  
 $Y' = \pm 72$  mrad

Solid angle 7.2 msr



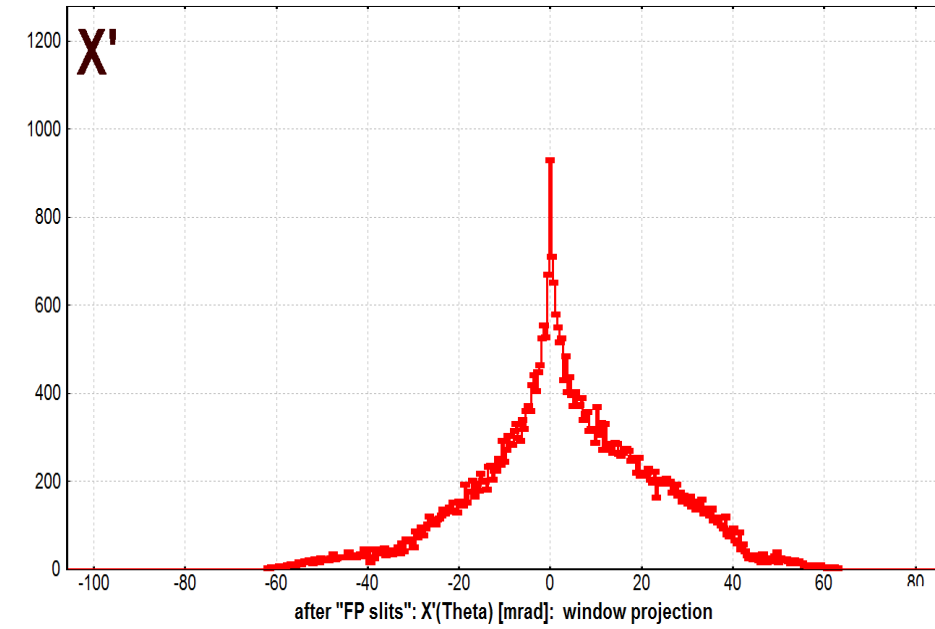
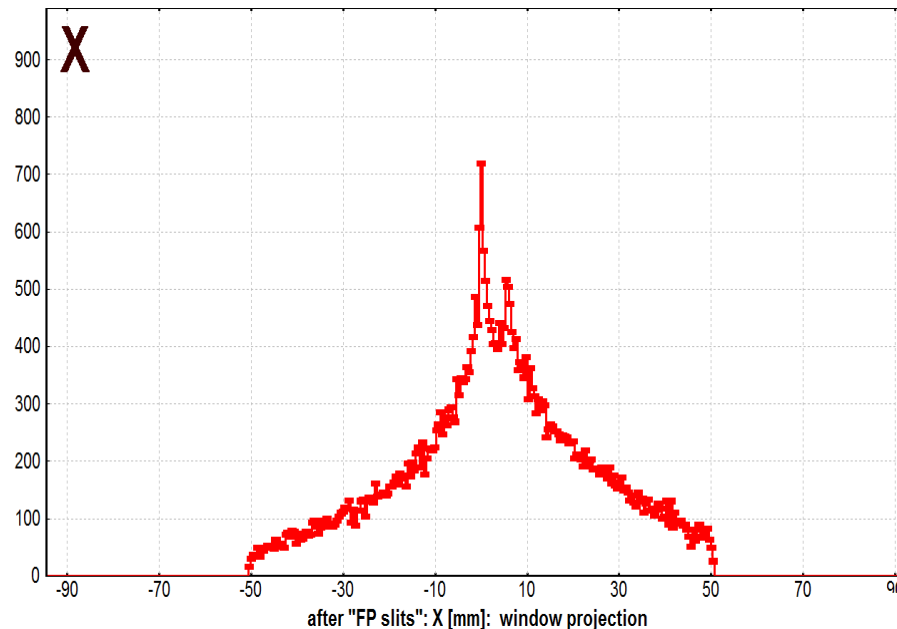


Emittance [#1]		
	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm 0	Gaussian
2. T	mrاد 26	Rectangle uniform
3. Y	mm 0	Gaussian
4. P	mrاد 72	Rectangle uniform
5. L	mm 0	Gaussian
6. D	% 50	Rectangle uniform



## Transmission

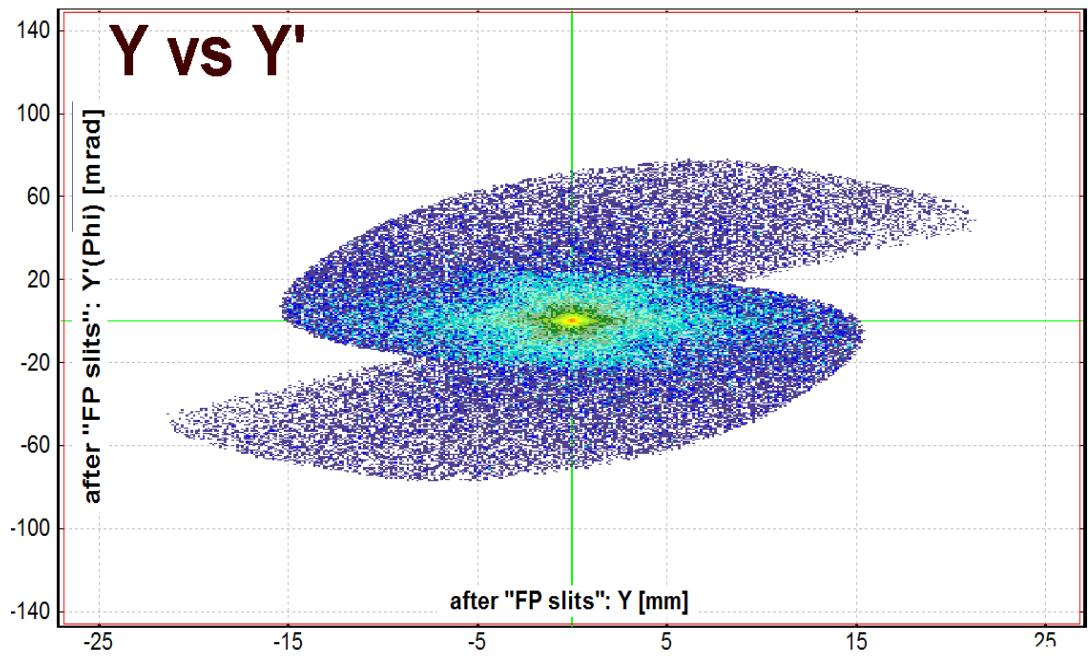
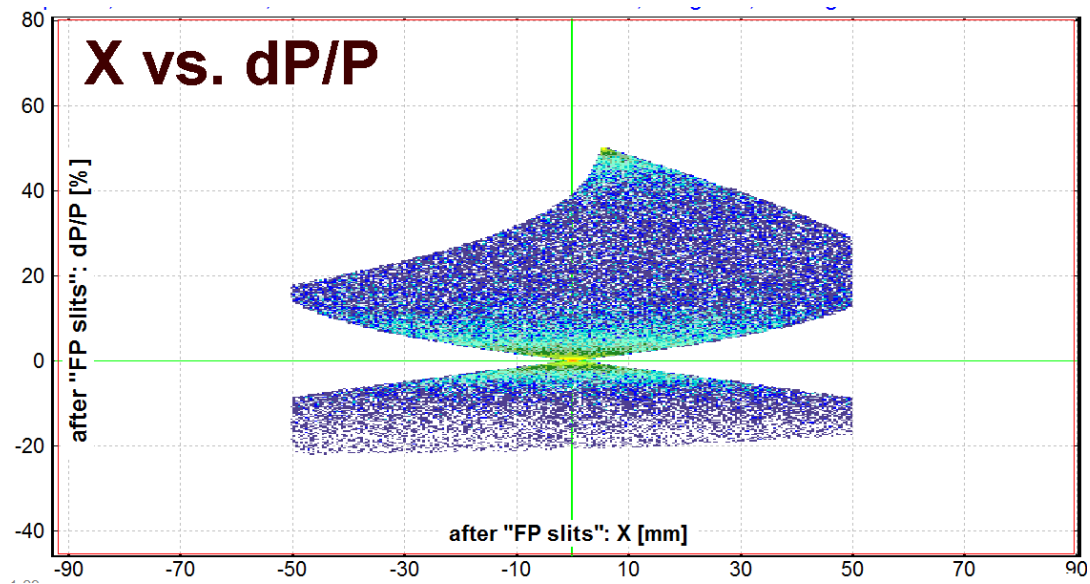
1<sup>st</sup> order : 45.6%  
2<sup>nd</sup> order: 30.0%



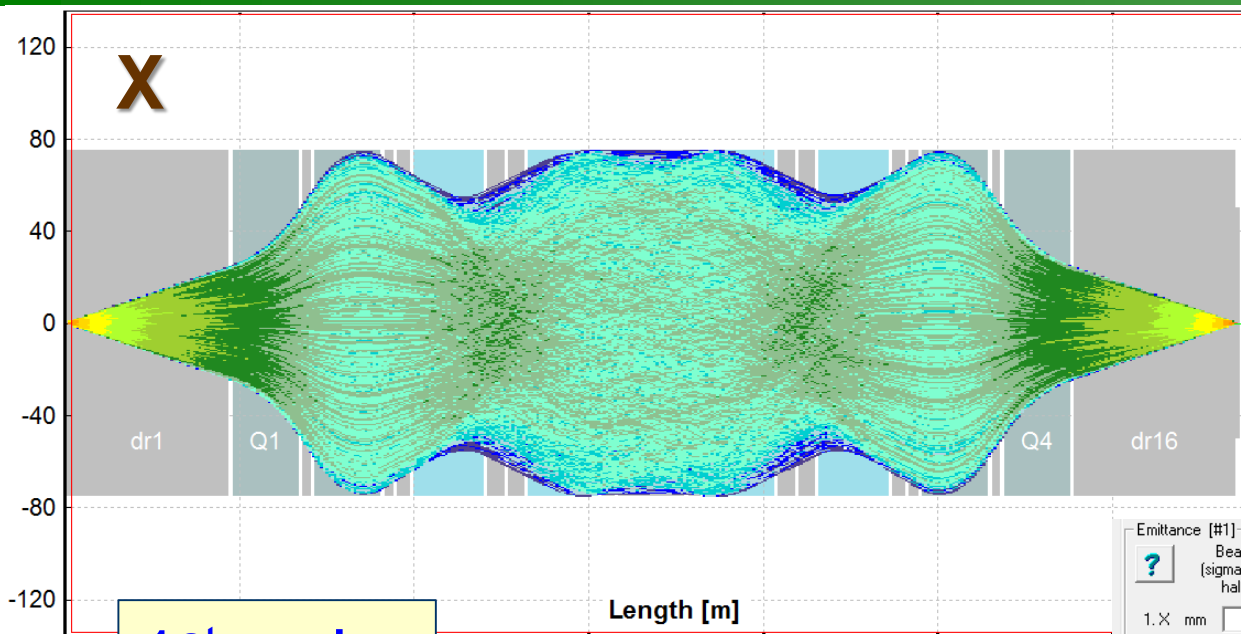
# Second order aberrations

Emittance [#1]

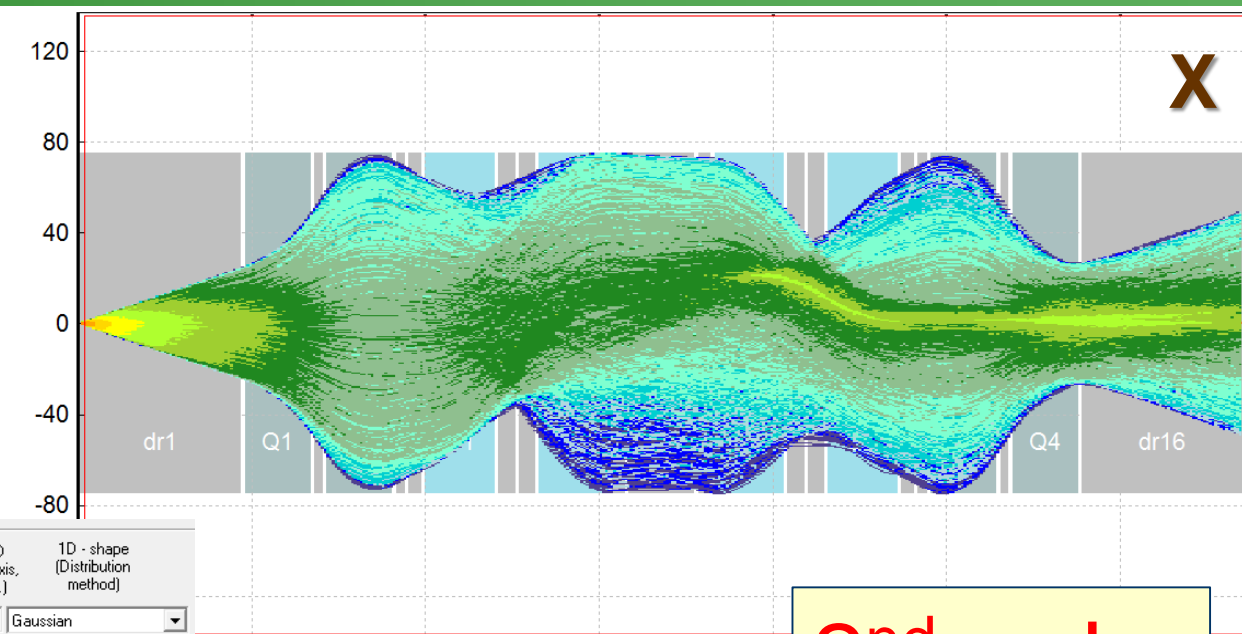
	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0	Gaussian
2. T mrad	26	Rectangle uniform
3. Y mm	0	Gaussian
4. P mrad	72	Rectangle uniform
5. L mm	0	Gaussian
6. D %	50	Rectangle uniform



# Second order aberrations

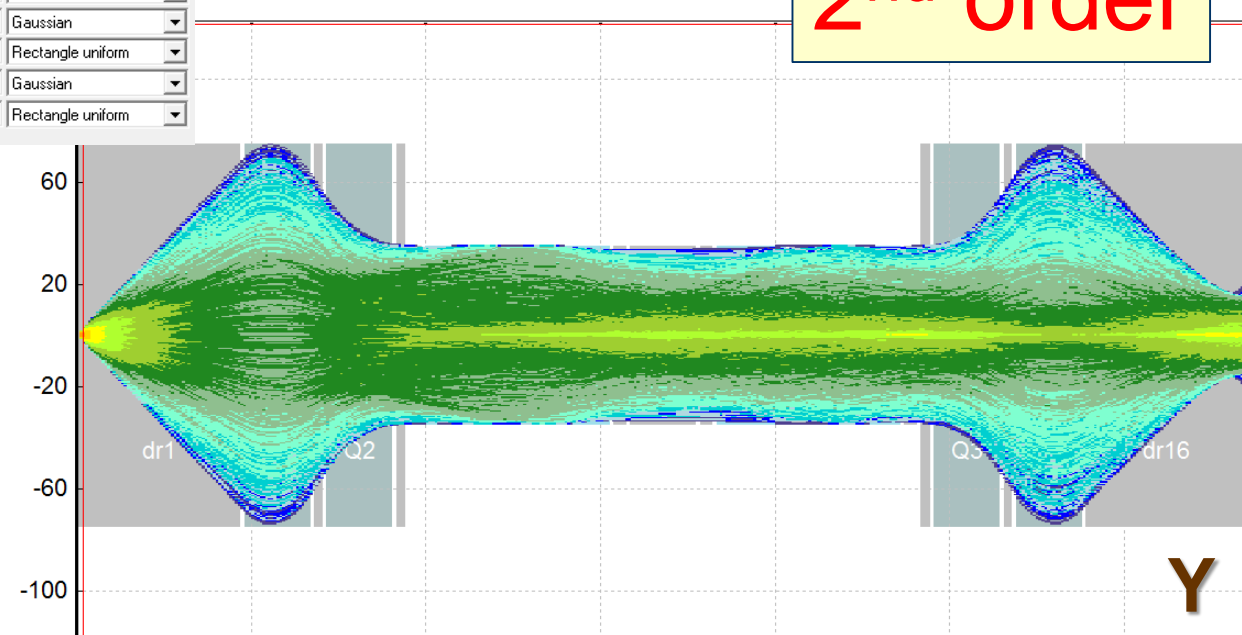
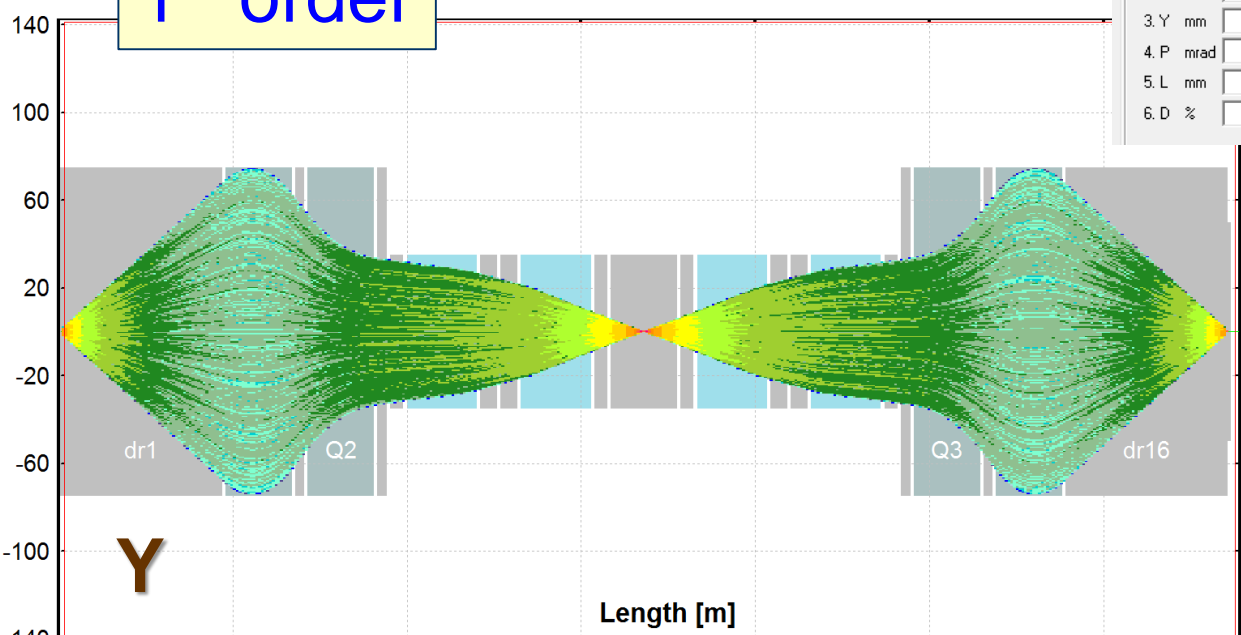


1<sup>st</sup> order



2<sup>nd</sup> order

Emittance [#1]		1D - shape (Distribution method)	
?	Beam CARD (sigma, semi-axis, half-width...)		
1. X mm	0	Gaussian	
2. T mrad	26	Rectangle uniform	
3. Y mm	0	Gaussian	
4. P mrad	72	Rectangle uniform	
5. L mm	0	Gaussian	
6. D %	50	Rectangle uniform	



**Projectile**  $^{14}\text{N}^{7+}$   
 15 MeV/u 1 pA  
**Fragment**  $^{14}\text{O}^{8+..8+}$   
**Target**  $^1\text{H}$   
 2 mg/cm<sup>2</sup>  
**Stripper**  
**tuning** Brho  
 0.9265 Tm

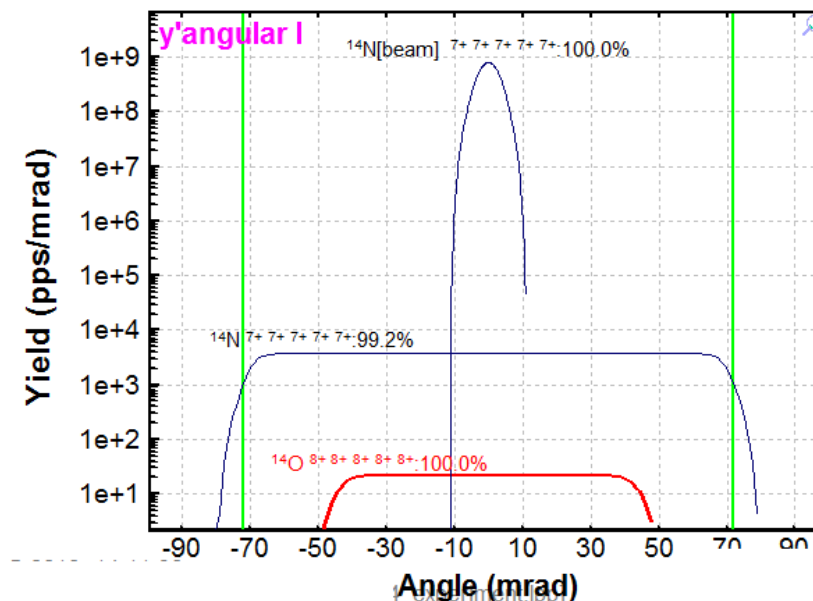
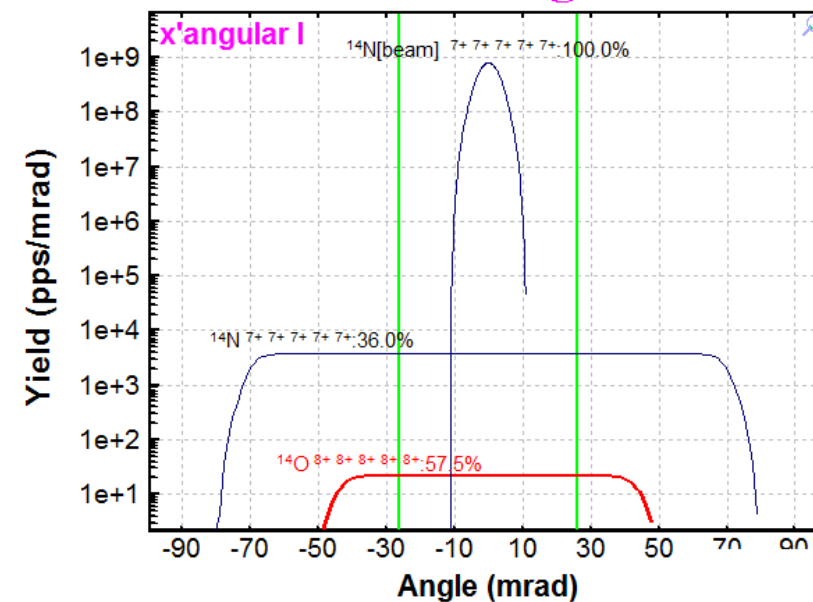
statistics: 140

140 Beta+ decay (Z=8, N=6)

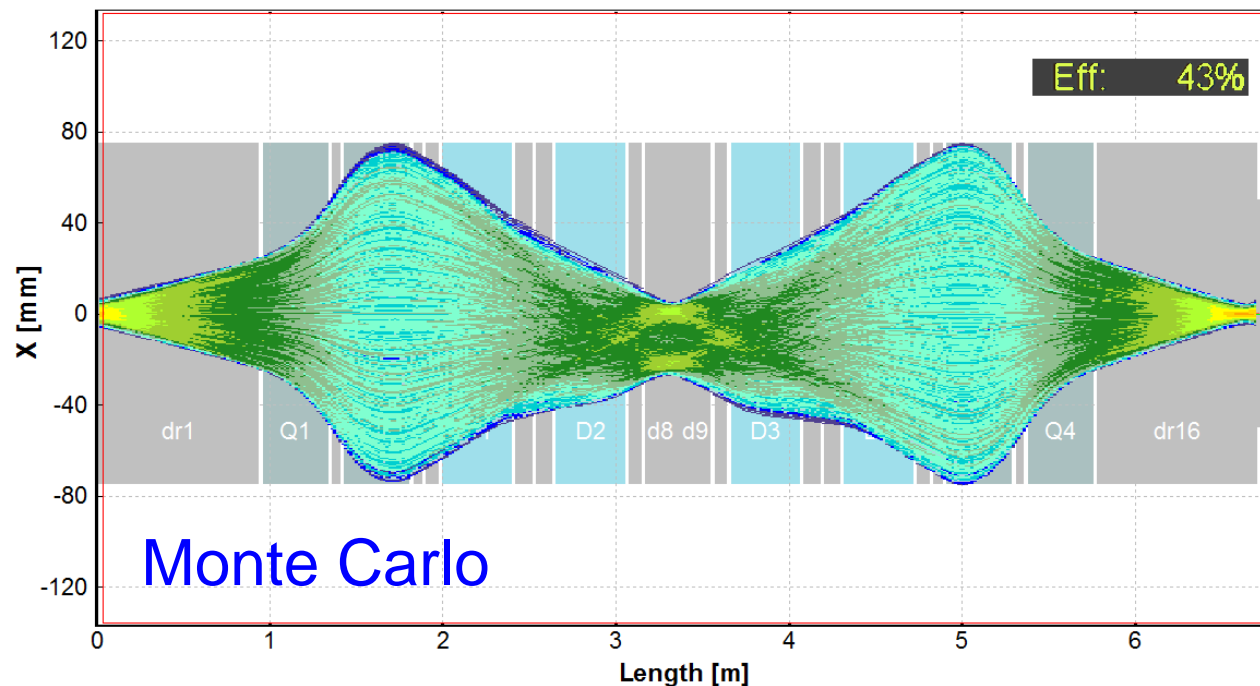
Q1 (tuning)	8
Q2 (D1)	8
Q3 (D2)	8
Q4 (D3)	8
Q5 (D4)	8
Reaction	TwoBody
Ion Production Rate (pps)	1.05e+3
<b>Total ion transmission (%)</b>	<b>55.563</b>
Total: this reaction (pps)	1.05e+3
Total: All reactions (pps)	1.05e+3
X-Section in target (mb)	2.53e-1
Target (%)	100
Unreacted in material (%)	100
Q (Charge) ratio (%)	100
Unstopped in material (%)	100
tuning (%)	57.53
X angular transmission (%)	57.53
Y angular transmission (%)	100

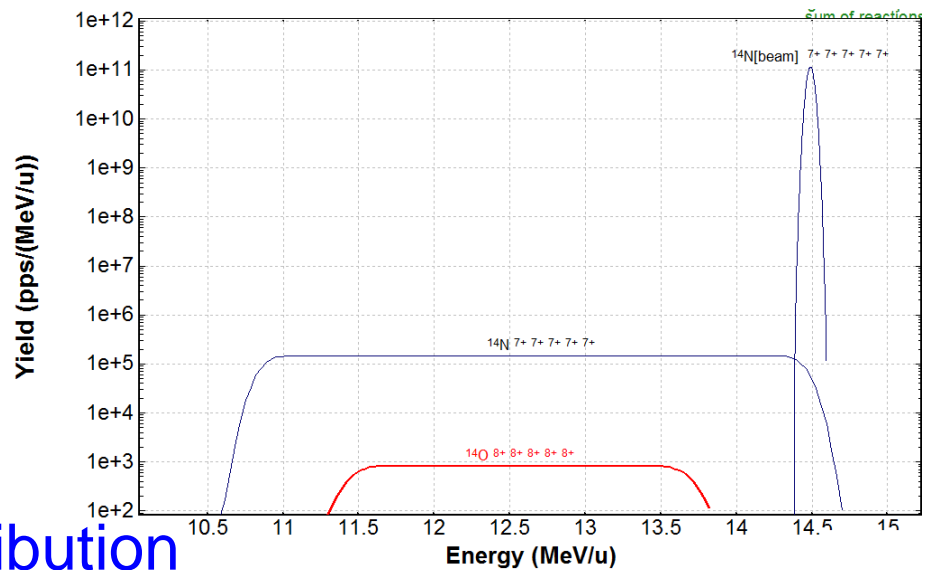
## Distribution

## tuning



Pay attention for cross sections!  
By default is EPAX

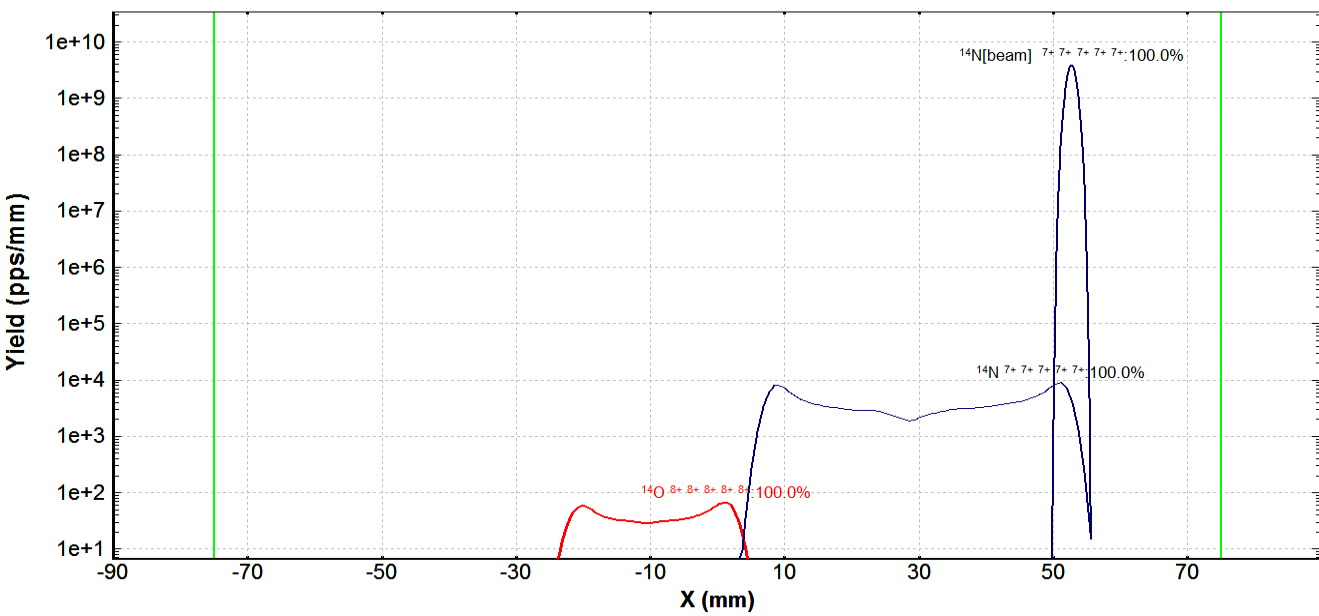




Distribution

Slits => Xspace: output before slits

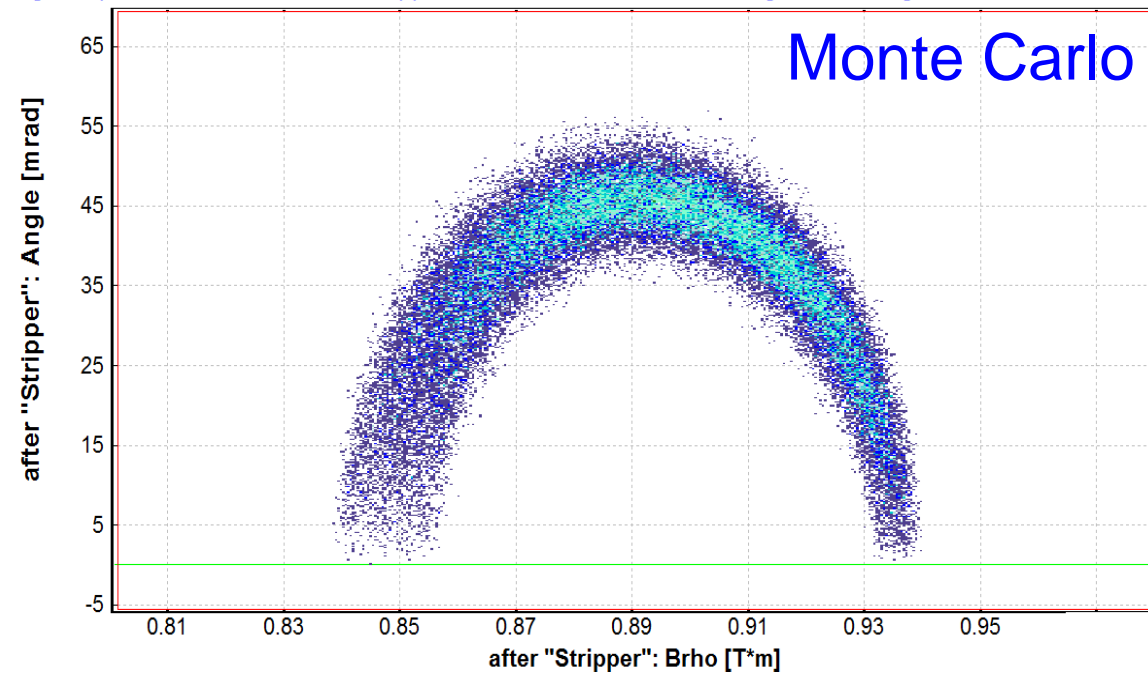
$^{14}\text{N}$  (15 MeV/u) + H<sub>2</sub> (2 mg/cm<sup>2</sup>); Settings on  $^{14}\text{O}^{8+..8+}$ ; Config: DSSSSSDSSDSSFFSSSDSSDSSSS...  
dp/p=53.27% ; Brho(Tm): 0.9265, 0.9265, 0.9265, 0.9265, 0.9265



$^{14}\text{O}$  : Monte Carlo Transmission Plot

$^{14}\text{N}$  (15 MeV/u) + H<sub>2</sub> (2 mg/cm<sup>2</sup>); Transmitted Fragment  $^{14}\text{O}^{8+..8+}$  (TwoBody); Optics Order  
dp/p=53.27% ; Brho(Tm): 0.9265, 0.9265, 0.9265, 0.9265, 0.9265

AngAccept: Off; Bounds: ON; "Stripper" - last block for MC calc; no gates; Config: DSSSSSDSSDSSS

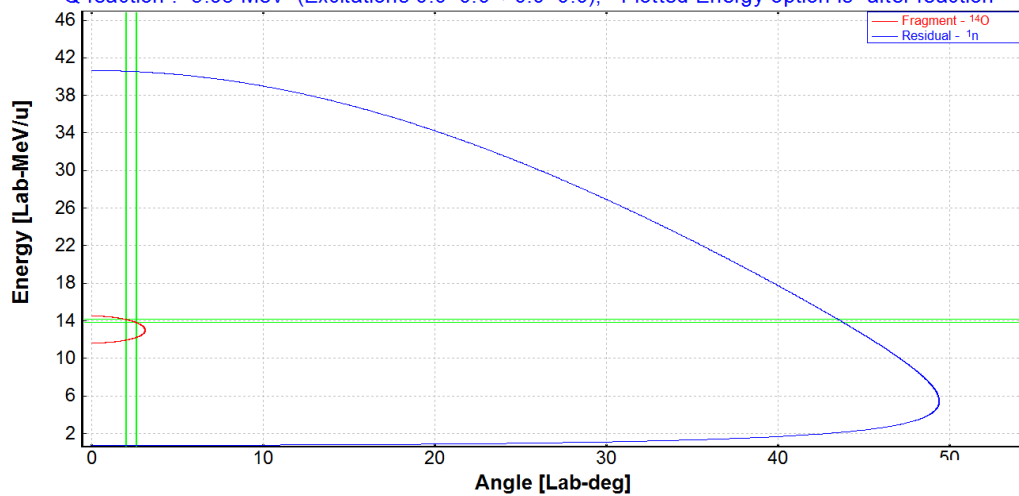


## Kinematic calculator

### Reaction's Kinematics: $A_{lab}$ & $E_{lab}$

$^{14}\text{N} + ^1\text{H} \Rightarrow ^{14}\text{O} + ^1\text{n}$   $^1\text{H}(^{14}\text{N}, ^{14}\text{O})^1\text{n}$ ; Reaction at the "middle" of the target

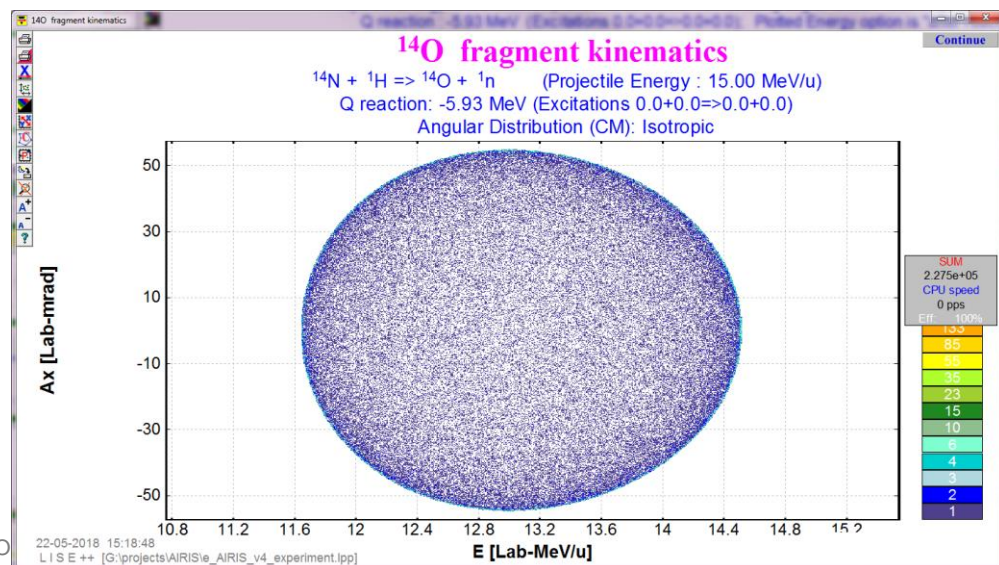
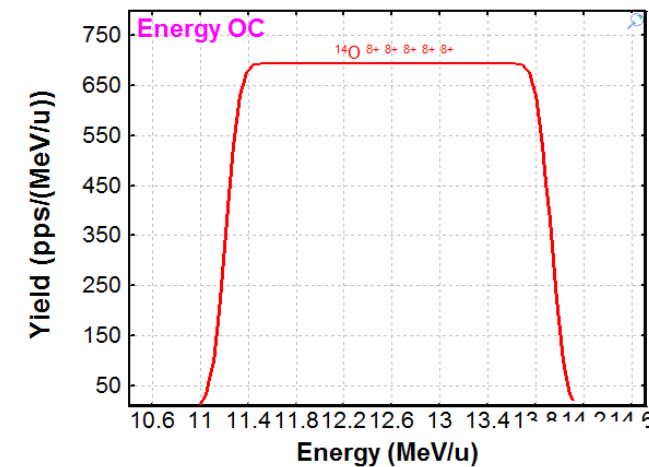
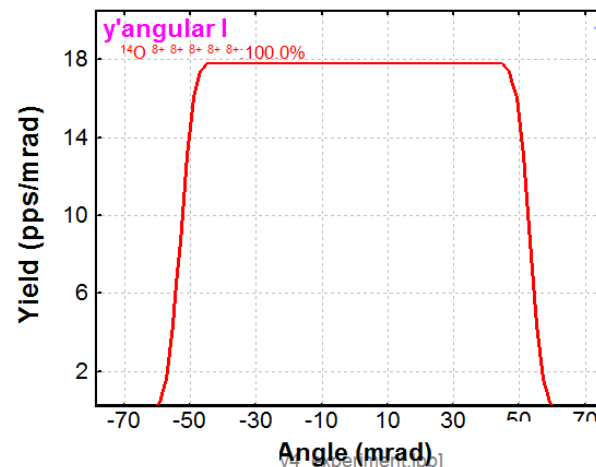
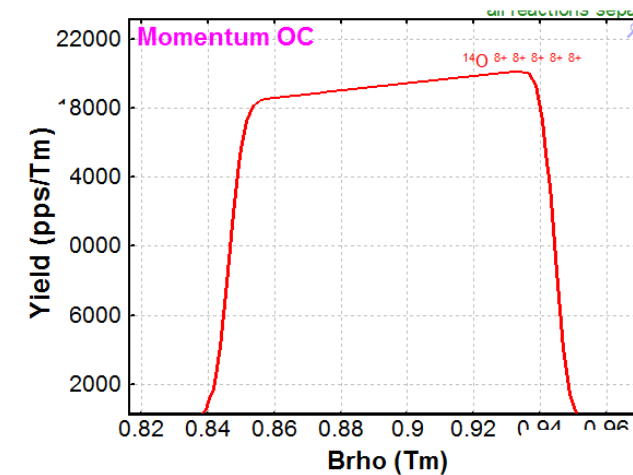
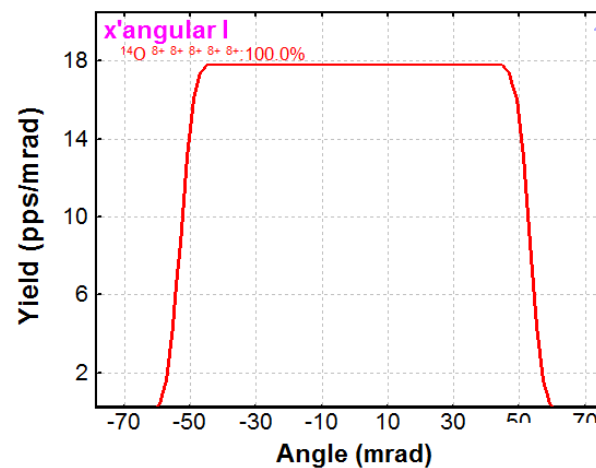
Projectile Energy at the reaction place: 15.00 MeV/u    Grazing angle: CMS = 6.28 deg; Lab = 0.32 deg  
 Q reaction : -5.93 MeV (Excitations 0.0+0.0=>0.0+0.0); Plotted Energy option is "after reaction"



## Distribution method

### Stripper

$^{14}\text{N}$  (15 MeV/u) +  $\text{H}_2$  (2 mg/cm<sup>2</sup>); Settings on  $^{14}\text{O}^{8+}$ ; Config: DSSSSSDSSDSSFFSW  
 dp/p=17.76% ; Wedges: 0; Brho(Tm): 0.8972, 0.8972, 0.8972, 0.8972, 0.8972



Should be updated

*Examples:*

**LISE++ files:**

$d + {}^{18}\text{O} \rightarrow p + {}^{19}\text{O}$

[http://lise.nsl.msu.edu/9\\_6/DifCS/d\\_18O.lpp](http://lise.nsl.msu.edu/9_6/DifCS/d_18O.lpp)

${}^3\text{He} + d \rightarrow p + \alpha$

[http://lise.nsl.msu.edu/9\\_6/DifCS/d\\_3He.lpp](http://lise.nsl.msu.edu/9_6/DifCS/d_3He.lpp)

**DiffCS Files:**

Ground State :

[http://lise.nsl.msu.edu/9\\_6/DifCS/19O\\_gs.txt](http://lise.nsl.msu.edu/9_6/DifCS/19O_gs.txt)

At 0.96 MeV :

[http://lise.nsl.msu.edu/9\\_6/DifCS/19O\\_L0.96.txt](http://lise.nsl.msu.edu/9_6/DifCS/19O_L0.96.txt)

Isotropical distribution:

[http://lise.nsl.msu.edu/9\\_6/DifCS/19O\\_isotropic.txt](http://lise.nsl.msu.edu/9_6/DifCS/19O_isotropic.txt)

[http://lise.nsl.msu.edu/9\\_6/DifCS/9\\_6\\_44\\_DifCS.pdf](http://lise.nsl.msu.edu/9_6/DifCS/9_6_44_DifCS.pdf)

Should be updated

Reactions

Settings

Projectile Fragmentation

Fusion -> Residual

Fusion -> Fission

Coulomb fission

Abrasion-Fission

Two Body Reactions

ISOL mode

additionally calculate yields for the next reactions

S II Slits slits

-30 H +10

$^{14}\text{O}$  : 1.7% (purity)

Reactions

Settings

Projectile Fragmentation

Fusion -> Residual

Fusion -> Fission

Coulomb fission

Abrasion-Fission

Two Body Reactions

ISOL mode

additionally calculate yields for the next reactions

S II Slits slits

-21 H +3

$^{14}\text{O}$  : 3.0%

Reactions

Settings

Projectile Fragmentation

Fusion -> Residual

Fusion -> Fission

Coulomb fission

Abrasion-Fission

Two Body Reactions

ISOL mode

additionally calculate yields for the next reactions

S II Slits slits

-21 H +3

$^{14}\text{O}$  : 5.8%

Reactions

Settings

Projectile Fragmentation

Fusion -> Residual

Fusion -> Fission

Coulomb fission

Abrasion-Fission

Two Body Reactions

ISOL mode

additionally calculate yields for the next reactions

S II Slits slits

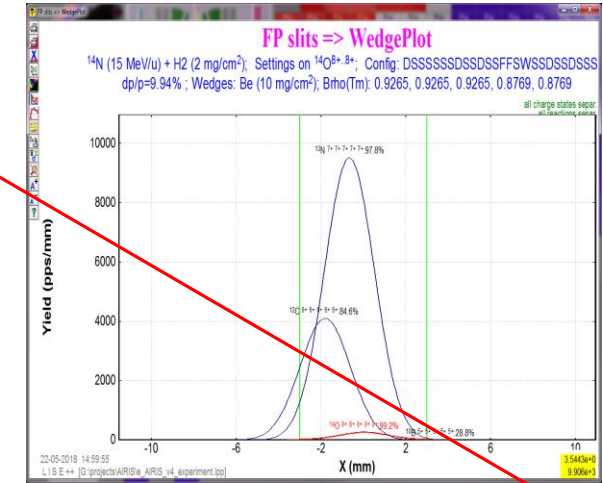
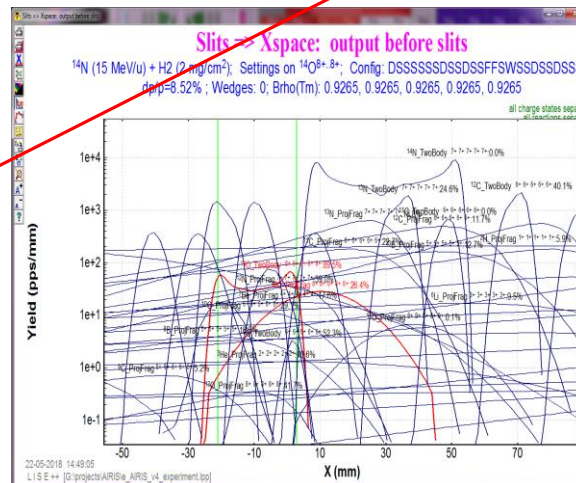
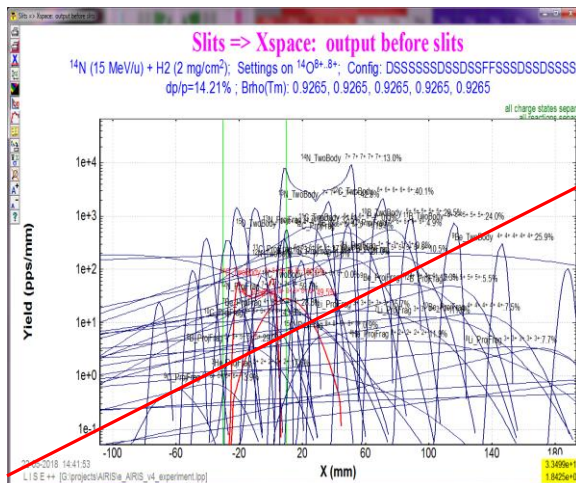
-25 H +3

W Wedge 1 Be 5 mg/cm<sup>2</sup>

S II FP slits slits

-4 H +4

$^{14}\text{O}$  : ---



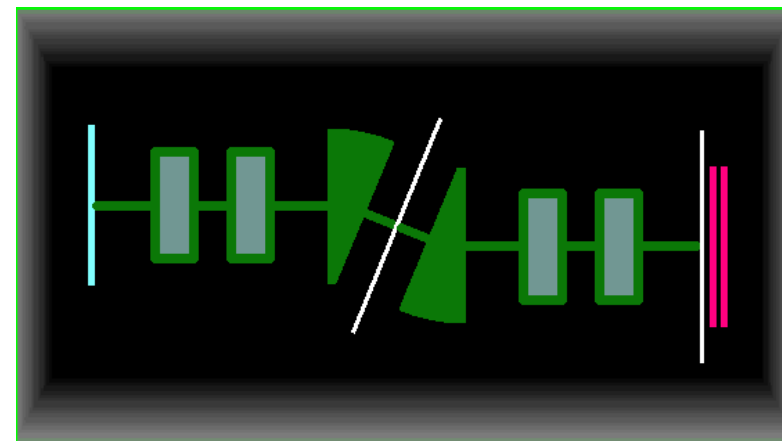
## Simple configuration with two dispersive segments

<b>P</b> rojectile	$^{14}\text{N}^{7+}$
15 MeV/u 1 pA	
<b>F</b> ragment	$^{14}\text{O}^{8+8+}$
<b>T</b> arget	$^1\text{H}$ 2 mg/cm <sup>2</sup>
<b>Str</b> ipper	
<b>D</b> 1	Brho 0.8972 Tm
<b>S</b> lits	slits -25 H +25
<b>D</b> 2	Brho 0.8972 Tm
<b>S</b> lits	FP slits -5 H +5
<b>M</b> wind PPAC	Al 0.2 mg/cm <sup>2</sup>
<b>M</b> Row 1	CH4 250 mm
config: s_AIRIS cp:p	

statistics: 140

140 Beta+ decay (Z=8, N=6)

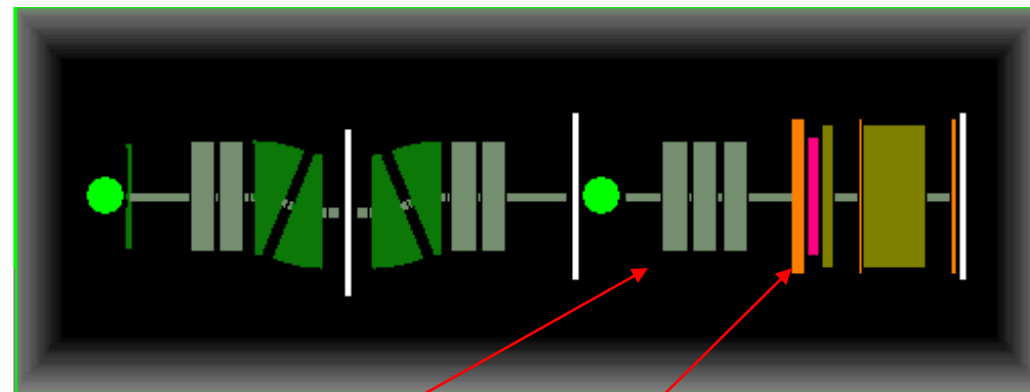
Q1 (D1)	8
Q2 (D2)	8
Reaction	TwoBody
Ion Production Rate (pps)	8.77e+2
<b>Total ion transmission (%)</b>	<b>46.449</b>
Total: this reaction (pps)	8.77e+2
Total: All reactions (pps)	8.77e+2
X-Section in target (mb)	2.53e-1
Target (%)	100
Unreacted in material (%)	100
Q (Charge) ratio (%)	100
Unstopped in material (%)	100
D1 (%)	48.18
X angular transmission (%)	48.18
Y angular transmission (%)	100
Slits (%)	100
X space transmission (%)	100
D2 (%)	96.45
X angular transmission (%)	96.45
Y angular transmission (%)	100
FP slits (%)	100
X space transmission (%)	100
wind PPAC (%)	100
Unreacted in material (%)	100
Unstopped in material (%)	100
Row 1 (%)	100
Unreacted in material (%)	100
Unstopped in material (%)	100



Preliminary!

## Second half

d	da1	standard	60 cm
Q	QA1	QUAD	4.5894 kG
d	da2	standard	7 cm
Q	QA2	QUAD	-4.6453 kG
d	da3	standard	7 cm
Q	QA3	QUAD	1.9415 kG
d	da4	standard	70 cm
M	Material	Si	0.01 micron
B	RFbuncher	U 750 kV Ph 340.4 deg	
d	da5	standard	40 cm
K	RFsepar	U 70 kV Ph 257.2 deg	
		-25 H +25 -100 V +100	
d	da6	standard	40 cm



Optics fit

Blocks with parameters to vary		Active Constraint blocks	
#01-q	Position@038: QA1	#01	@044: R22 = 0    Fit TT
#02-q	Position@040: QA2	#02	@045: R44 = 0    Fit PP
#03-q	Position@042: QA3	#03	@046: s R < 65    Fit R
		#04	@050: s X < 22.5    Fit X-kicker
		#05	@053: s R < 60    Fit R2

N iter = 1000

**FIT**    Restore previous values    Optics Settings (fast editing)    Fit Options

Show initial conditions    Browse output file

Beam Sigma Edit [#2]    Matrix Plot

Beam Sigma Plot [#2]

Exit    Help

e\_AIRIS2\_bis.fit

**Beam**

A Element q+  
 14 0 8  
 8  
 Z  
 Beta+ decay  
 Table of Nuclides  
 Z N  
 Ok Cancel

**Beam energy**  
 Energy 14 MeV/u  
 TKE 196.0589 MeV  
 Brho 0.946548 Tm  
 P 2.27014 GeV/c  
 U 24507 KV

**Beam intensity**  
 8 enA  
 1 pnA  
 6.24151e+9 pps  
 0.000196 kW

**Emittance [#1]**  
 Beam CARD (sigma, semi-axis, half-width...)  
 1D - shape (Distribution method)  
 2D mode  
 2D - shape (Monte Carlo method)  
 Correlated with  
 mm cm  
 beam respect to spectrometer  
 dX 0 mm  
 dT 0 mrad  
 dY 0 mm  
 dP 0 mrad  
 dT 0 degrees  
 dP 0 degrees

1. X mm 0.1 Gaussian  
 2. T mrad 25 Rectangle uniform  
 3. Y mm 0.1 Gaussian  
 4. P mrad 70 Rectangle uniform  
 5. L mm 0 Gaussian  
 6. D % 2 Rectangle uniform

Energy Loss in the target box 0 KW  
 Primary beam Brho-value after target (stripper) for q= 8+ 0.94655 Tm  
 RF frequency 6.062 MHz  
 Bunch length 1 ns  
 Beam Sigma Vector [#2] used for Optics Optimization ("Opt.Beam")

**RFbuncher**

**RF buncher settings**  
 Select method  
 Electric field E = 3750 KV/m  
 Voltage U = 750 KV

**RF buncher plots:**  
 $E = f(\text{phase } x), V = f(x), dE = f(\text{phase})$

**Geometry**  
 La = 0 m  
 L (gap) = 0.2 m  
 Lb = 0 m

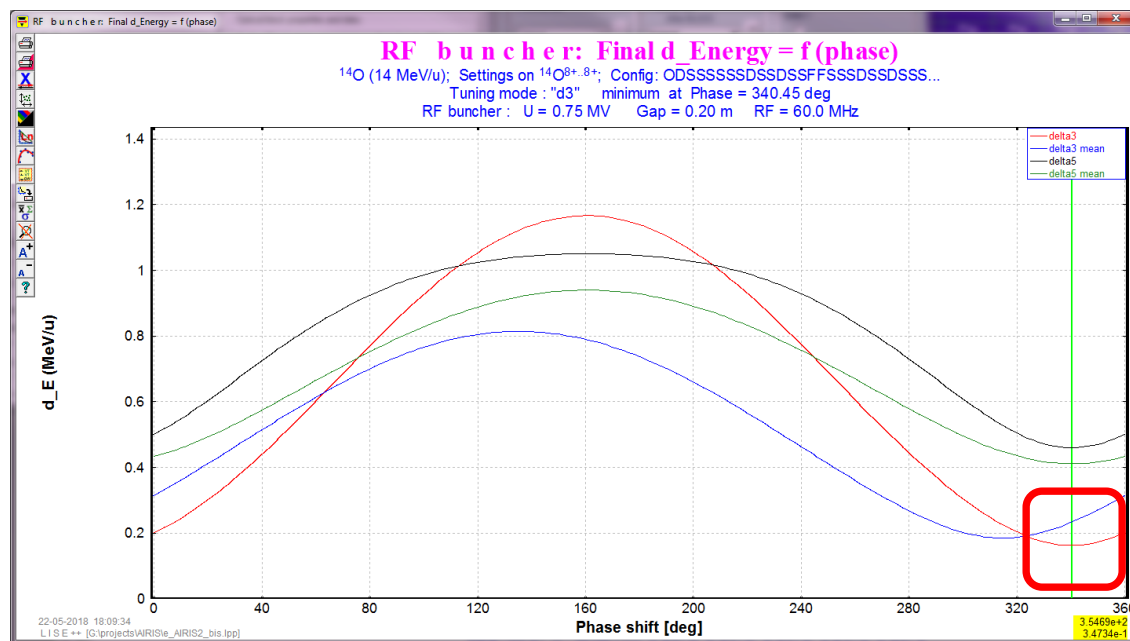
**RF settings**  
 use Beam settings RF (MHz) 6.06  
 manually 60  
 Phase shift 340.44 [deg]

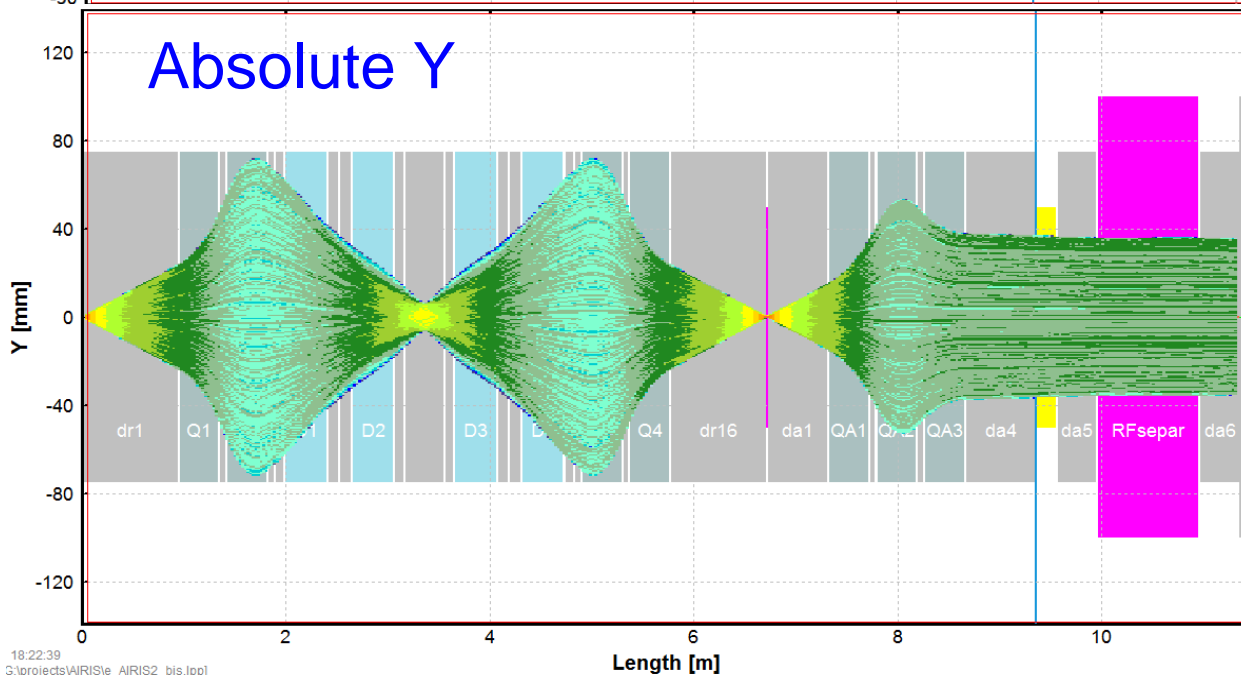
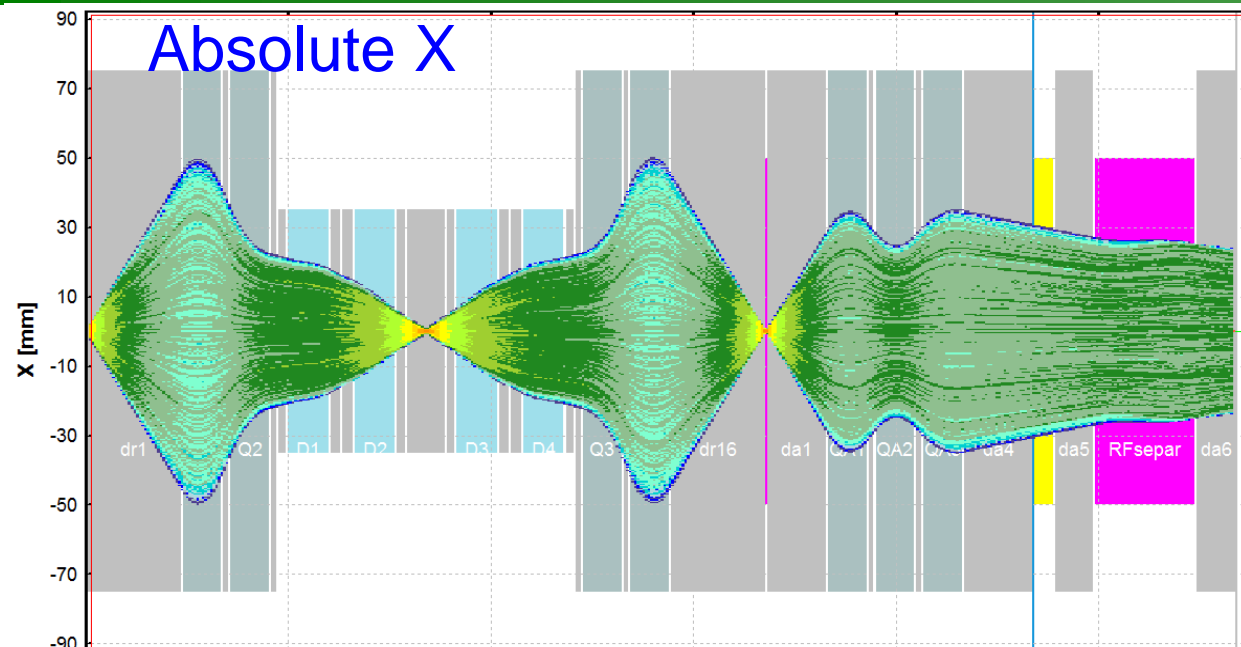
**tft (transit time factor)**  
 $V(t) = V_0 * tft * \sin(\omega t + \text{phase\_shift})$   
 parameterization 0.668  
 manually 1  
 tuning chose d-mode d3

**Optical block properties and data**  
 Setting Charge state for the Block (Z-Q) 0  
 Calculate the RF buncher using the Setting fragment  
 Cut(Slits) & Acceptances  
 Optical matrix  
 General setting of block Tweak 3 %

**Calculations for the setting fragment**  
 Before the buncher gap <E> <dE> <E> <E>+dE  
 Energy [MeV/u] 13.08 14.02 14.96  
 Values corresponding to Energy in middle of the gap  
 Time of flight [ns] 190.3 184.2 178.2  
 Phase [deg] 130.5 0.0 229.7  
 After the RF buncher  
 Energy [MeV/u] 13.38 14.02 14.66

OK Cancel Help Optimization utility Local : Phase & V

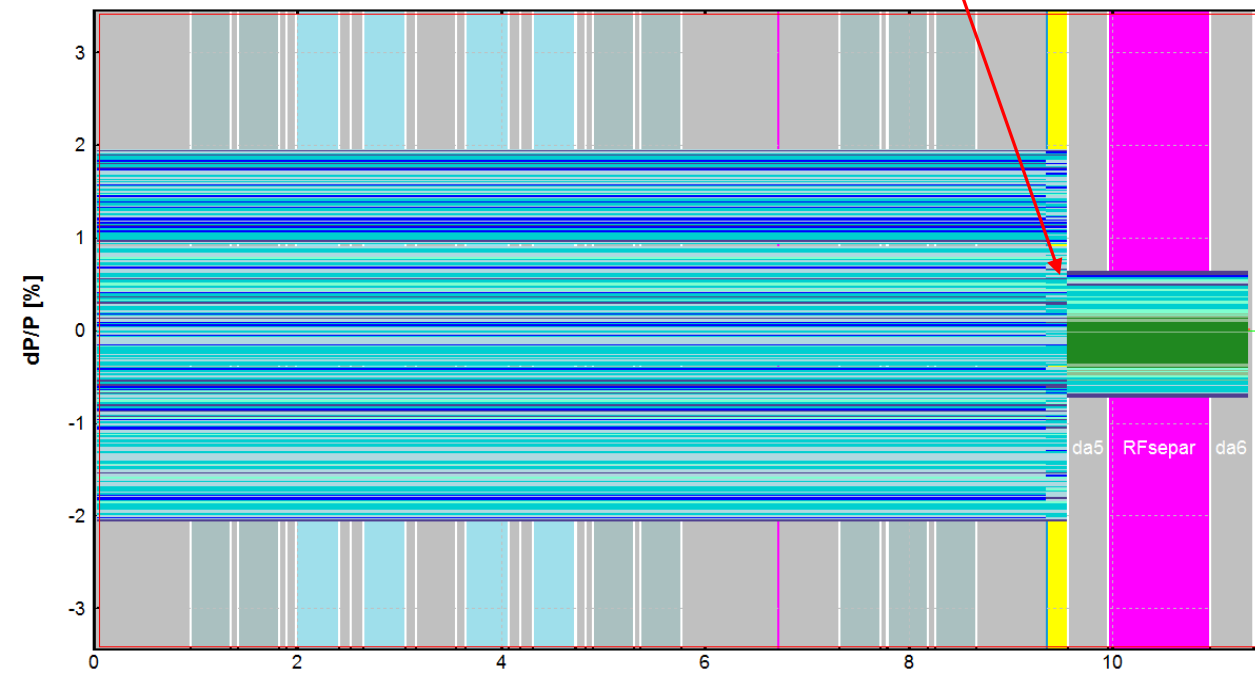




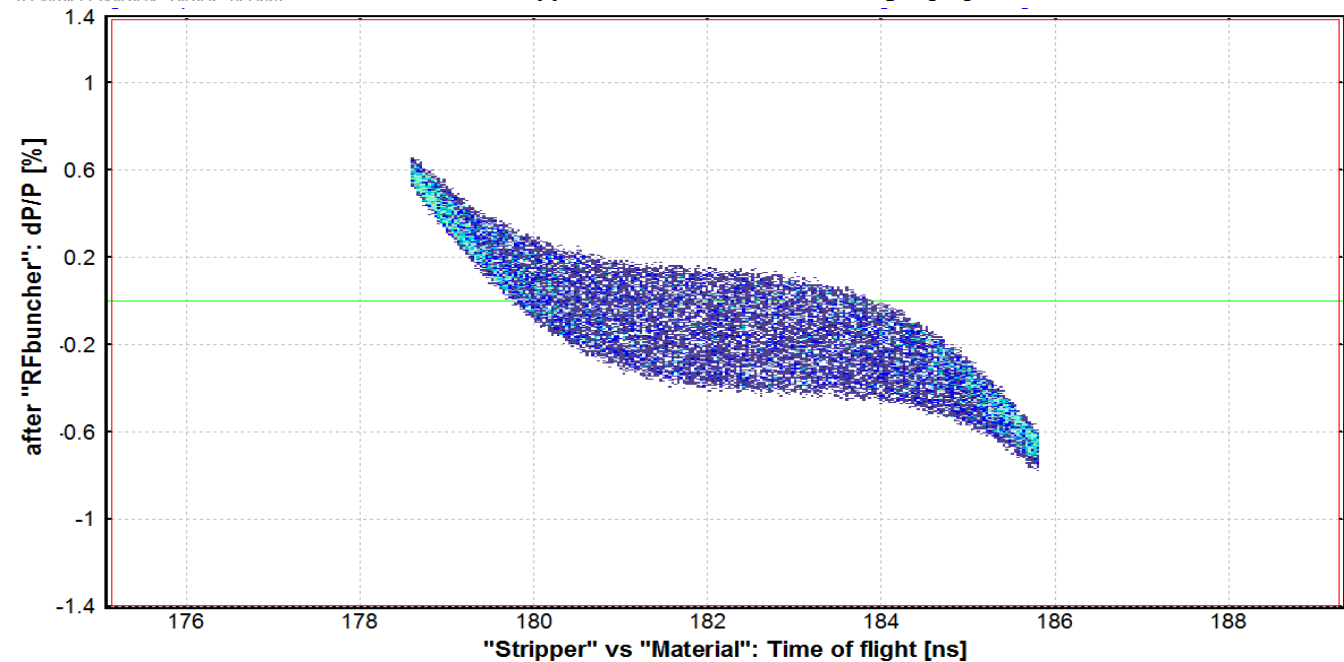
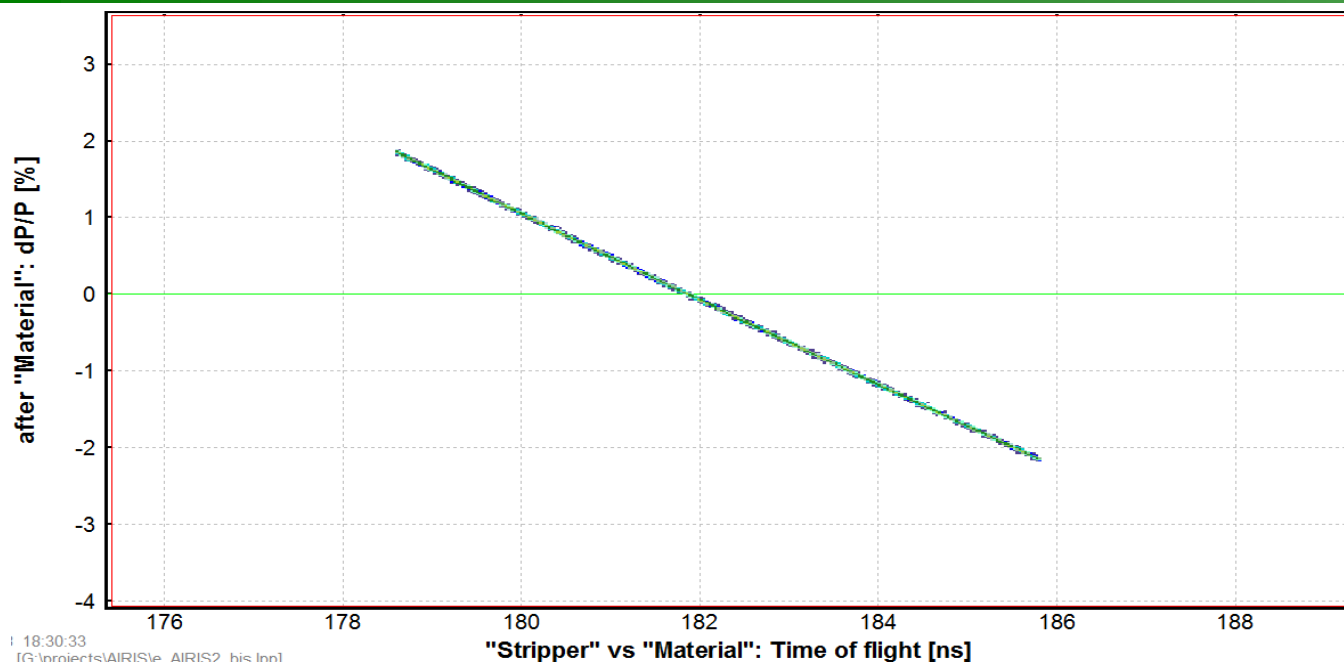
- Emittance [#1]

	Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X mm	0.1	Gaussian
2. T mrad	25	Rectangle uniform
3. Y mm	0.1	Gaussian
4. P mrad	70	Rectangle uniform
5. L mm	0	Gaussian
6. D %	2	Rectangle uniform

Compression  
by RF-buncher



# Before and After the RF-Buncher



Monte Carlo calculation of fragment transmission

What isotope transmission to calculate?  
 One fragment of interest. Chose manually here  
 Group of isotopes already calculated by the Distribution method (Ncalc = 0)  
 List of isotopes from file to produce inside target  
 Input ions rays from file emitted from target

Chose fragment of interest:  

A	Element	Z
14	O	8

  
 Charge states:    
 Reaction mechanism:

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

X-coordinate  
 Stripper:  as Y  
 X mm  
 X' (T) mrad  
 Y mm  
 Y' (P) mrad  
 dP/P %  
 Radial [f(X,Y)] mm  
 Angle [f(X',Y')] mrad  
 Energy MeV/u  
 TKE MeV  
 Momentum MeV/c  
 Biho T/m  
 Erho MJ/C  
 Energy Loss MeV  
 Range mm  
 Envelope m  
 Energy Deposition MeV/mm /particle

Y-coordinate  
 After BLOCK  
 RFbuncher:  as X  
 X mm  
 X' (T) mrad  
 Y mm  
 Y' (P) mrad  
 dP/P %  
 Radial [f(X,Y)] mm  
 Angle [f(X',Y')] mrad  
 Energy MeV/u  
 TKE MeV  
 Momentum MeV/c  
 Biho T/m  
 Erho MJ/C  
 Energy Loss MeV  
 Range mm  
 Envelope m  
 Energy Deposition MeV/mm /particle

Gate 1  
 "AND" (1000,1000)  
  
 Gate 2  
 no gate  
 Gate 3  
 no gate  
 Gate 4  
 no gate

Time of flight:  ns  m  
 Length:  ns  m  
 Stripper:  <- Start ->   
 Material:  <- Stop ->   
 Cyclotron RF-signal

Velocity  
 Velocity\_Z [cm/ns]  
 Velocity [cm/ns]

Ion parameters [M,Z,q...]  
 A (mass number)  
 Z-q