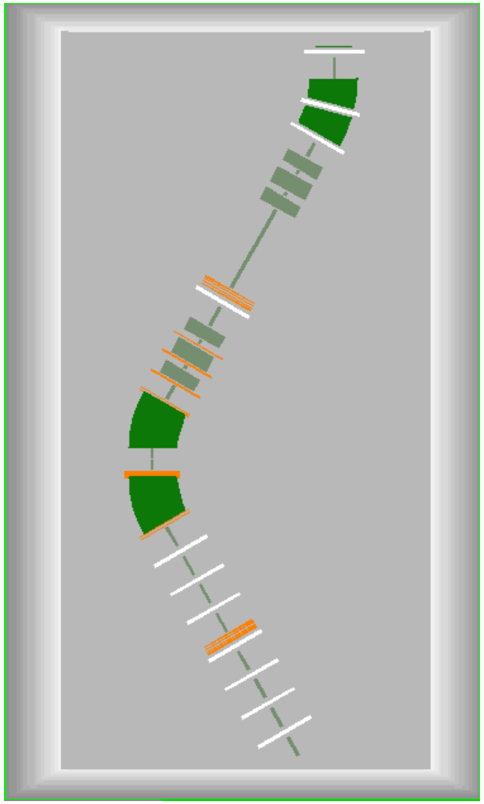
LISE++ v.9.10.280



HRS Preconcept #25 from May 2014

http://lise.nscl.msu.edu/9_10/HRS/HRS_v3.lpp

http://hrs.lbl.gov/

HRS design

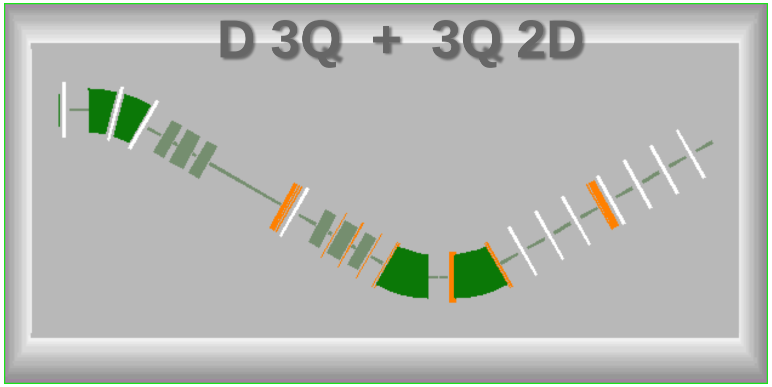
http://hrs.lbl.gov/design :

As input to the first HRS workshop, pre-conceptual, first-order ion-optical design studies were performed to provide a basis for discussion of the technical needs and boundary conditions, as well as scientific opportunities. Please refer to this document as a first guide for the properties of the HRS.

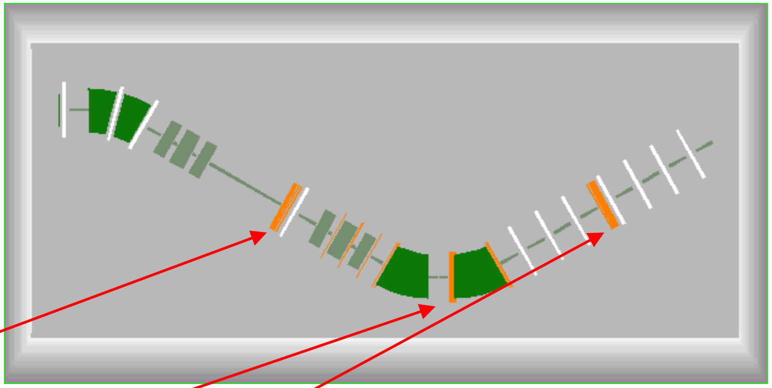
http://lise.nscl.msu.edu/9_10/HRS/HRS_v3.lpp

The HRS configuration in the LISE^{++} code has been created based on the "HRS Preconcept May 2014 #25" TRANSPORT file kindly presented by Th.Baumann.

Discussions with Th.Baumann are very appreciated.



1st order optimization



Optics fit

Blocks with parameters to vary
#01-q Position@011: 2QA
#02-q Position@013: 2QB
#03-q Position@015: 2QC
#04-q Position@023: 3QA
#05-q Position@026: 3QB
#06-q Position@029: 3QC

Active Constraint blocks			
#01	@017:	R12 = 0	FocX
#02	@018:	R34 = 0	FocY
#03	@019:	sX < 300	F2_sX
#04	@020:	sY < 400	F2_sY
#05	@025:	sY < 250	3QBY
#06	@027:	sX < 150	3QBX
#07	@030:	sX < 200	3QCX
#08	@032:	sX < 300	D2X1
#09	@033:	sY < 100	D2Y1
#10	@037:	R22 = 0	F_D2A
#11	@039:	sY < 50	F_D2Y
#12	@040:	R44 = 0	F_D2B
#13	@042:	sX < 300	F_D2X2
#14	@043:	sY < 100	F_D2Y2
#15	@051:	R12 = 0	F_FocX
#16	@052:	R44 = 0	F_BB
#17	@053:	R11 < 1	F_uX

N iter = 100

FIT | Restore previuos values | Optics Settings (fast editting) | Fit Settings | Browse output file | Show initial conditions | Matrix Plot | Exit | Help | Beam Sigma Edit [#2] | Beam Sgma Plot [#2]

HRS_v3.fit

c:\program files (x86)\lise\results\HRS_v3.fit_init

```
chi2: Initial    0.494243  LISE fit reduced values
chi1: Initial     2.95852  LISE fit reduced values

Parameters:           LeftBound      Initial      RightBound   |
#01-q:  2QA           +0.0e+00  <  +1.900e+01  <  +3.0e+01    |
#02-q:  2QB           -3.0e+01  <  -2.883e+01  <  +0.0e+00    |
#03-q:  2QC           +0.0e+00  <  +2.427e+01  <  +3.0e+01    |
#04-q:  3QA           +0.0e+00  <  +2.005e+01  <  +2.5e+01    |
#05-q:  3QB           -3.0e+01  <  -2.905e+01  <  +0.0e+00    |
#06-q:  3QC           +0.0e+00  <  +1.712e+01  <  +3.0e+01    |

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Constraint values:     Initial       Y-value      Precision  (Init-Des)/P     Desired
#01:  FocX           +2.987e-08   +2.987e-08    1.0e-04   +2.987e-04 |  = 0
#02:  FocY           +5.885e-06   +5.885e-06    1.0e-03   +5.885e-03 |  = 0
#03:  F2_sX          +3.972e+01   +3.000e+02    1.0e-02    0         |  < 300
#04:  F2_sY          +1.209e+00   +4.000e+02    1.0e-01    0         |  < 400
#05:  3QBY           +7.932e+01   +2.500e+02    1.0e-01    0         |  < 250
#06:  3QBX           +1.226e+02   +1.500e+02    1.0e-02    0         |  < 150
#07:  3QCX           +2.000e+02   +2.000e+02    1.0e-01   +1.164e-02 |  < 200
#08:  D2X1           +2.152e+02   +3.000e+02    1.0e-01    0         |  < 300
#09:  D2Y1           +6.002e+01   +1.000e+02    1.0e-01    0         |  < 100
#10:  F_D2A          +3.122e-01   +3.122e-01    1.0e+01   +3.122e-02 |  = 0
#11:  F_D2Y          +4.868e+01   +5.000e+01    1.0e-0    +2.671e-01 |  < 50
#12:  F_D2B          +8.955e-02   +8.955e-02    1.0e-01   +8.955e-01 |  = 0
#13:  F_D2X2         +2.519e+02   +3.000e+02    1.0e+00    0         |  < 300
#14:  F_D2Y2         +4.215e+01   +1.000e+02    1.0e-01    0         |  < 100
#15:  F_FocX         -2.254e-06   -2.254e-06    1.0e-03   +2.254e-03 |  = 0
#16:  F_BB           +7.649e-02   +7.649e-02    1.0e-01   +7.649e-01 |  = 0
#17:  F_uX           +1.097e+00   +1.098e+00    1.0e-01   +9.785e-01 |  < 1
#18:  F_dX           +1.097e+00   -1.000e+00    1.0e-01   +1.228e-03 |  > -1

----------------------------------------------------------------------------------------

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

                                                      Format [mm-mrad]
===================== G L O B A L ====  matrix ===================  | Beam(sigma) |
  +1.097e+00  -2.254e-06   0            0            0   -6.655e+01  |    3.33e+02 |
  +2.886e-01  +9.117e-01   0            0            0   -6.367e+00  |    4.84e+01 |
   0           0          +5.728e+00  -7.456e-01    0    0           |    3.04e+01 |
   0           0          +7.536e-01  +7.649e-02    0    0           |    3.15e+00 |
  -1.222e+00  -6.067e+00   0            0           1.0  -2.829e+01  |    2.81e+02 |
   0           0           0            0            0   +1.000e+00  |    5.00e+00 |
```
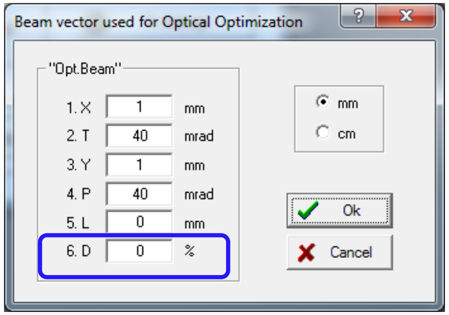
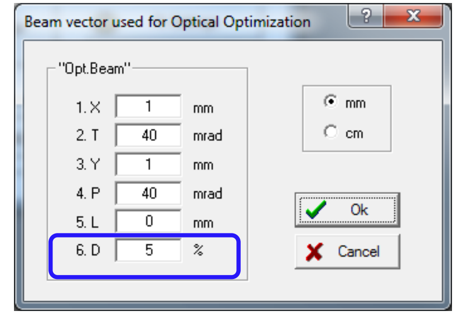
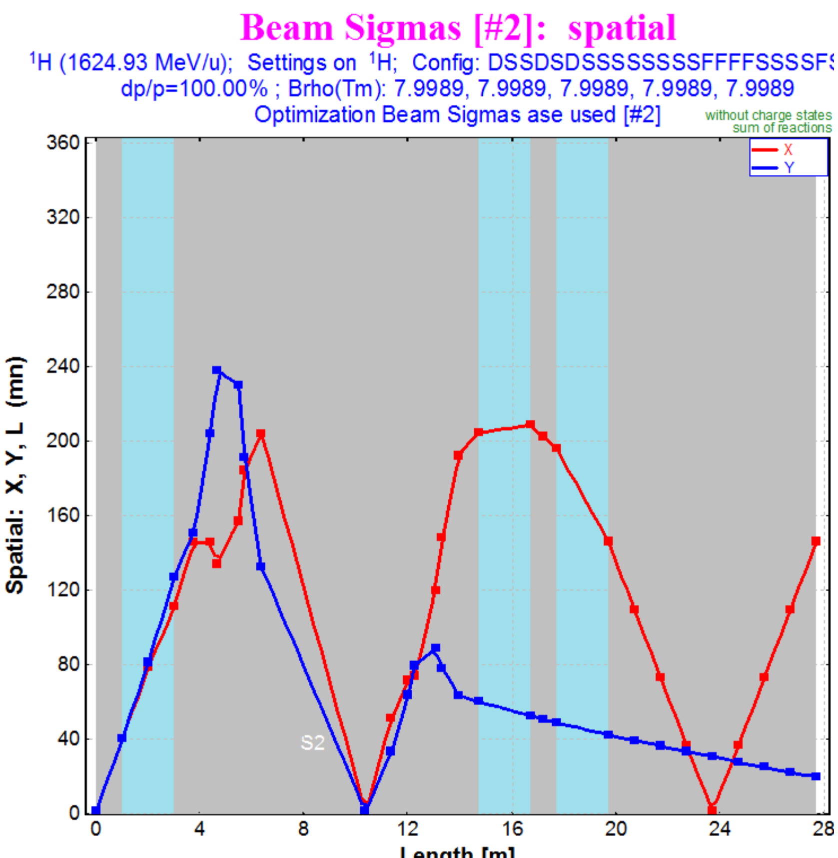
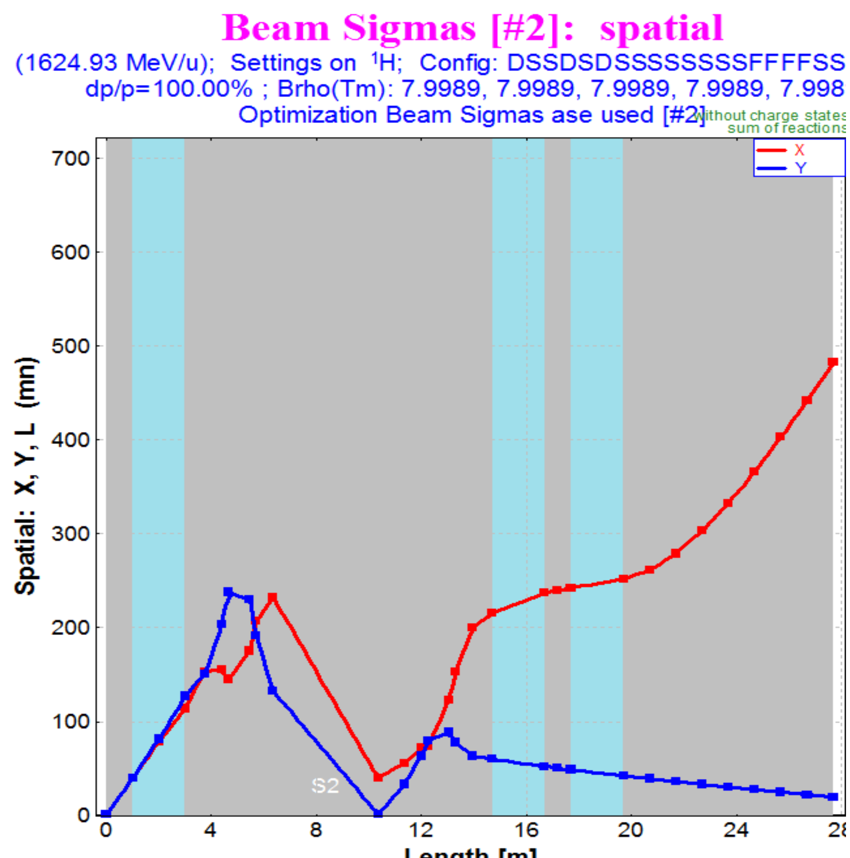

1st order optimization







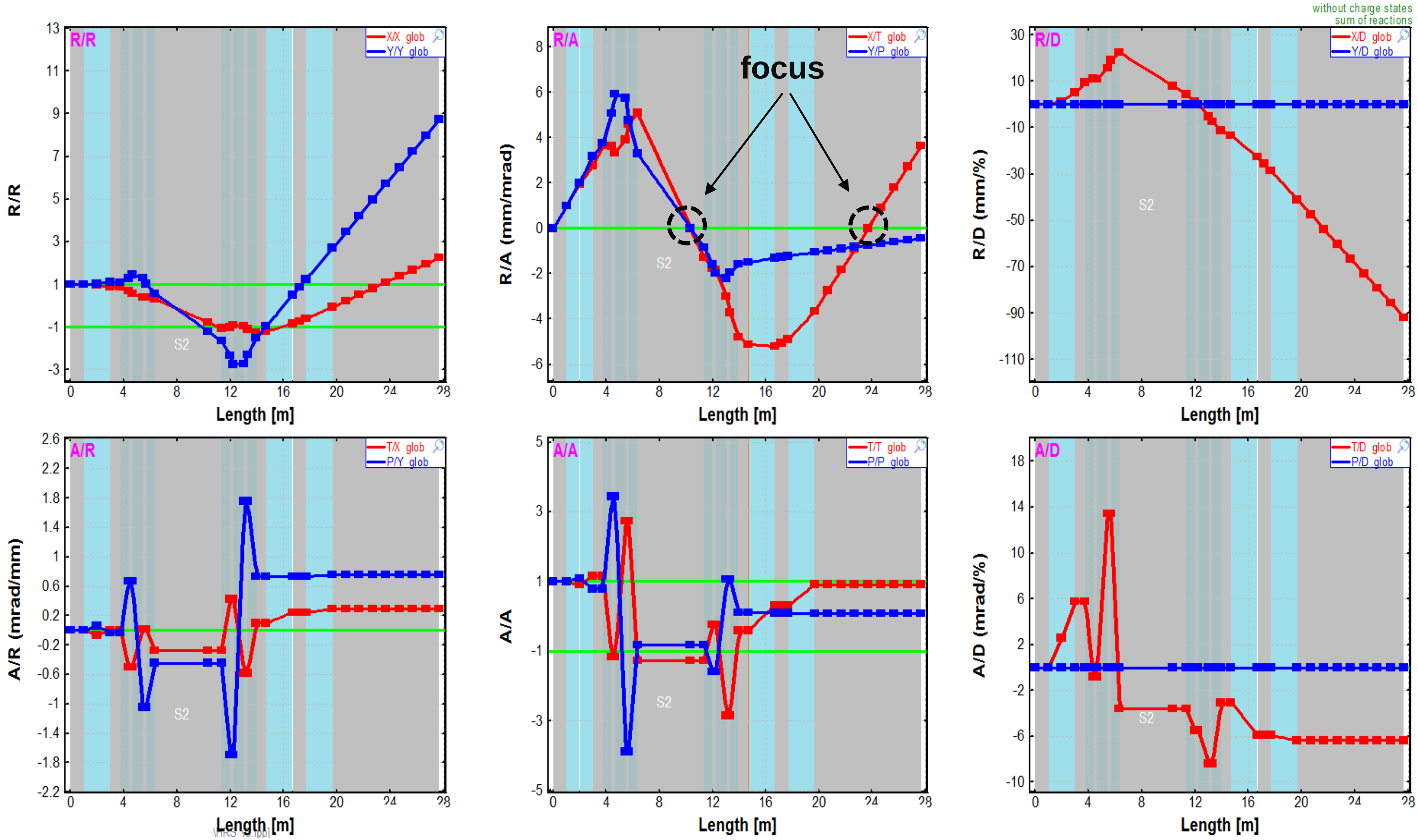


1st order matrices

First order matrix elements

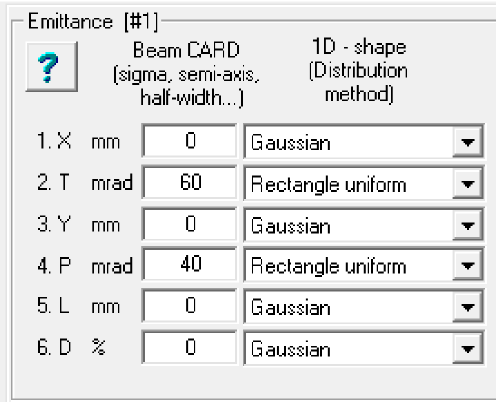
^{1}H (1624.93 MeV/u); Settings on ^{1}H; Config: DSSDSDSSSSSSSSFFFFSSSSFSFS...

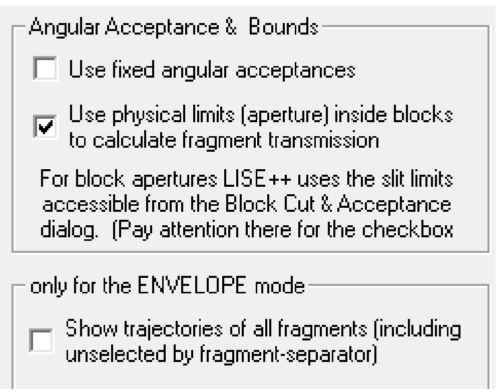
dp/p=100.00% ; Brho(Tm): 7.9989, 7.9989, 7.9989, 7.9989, 7.9989

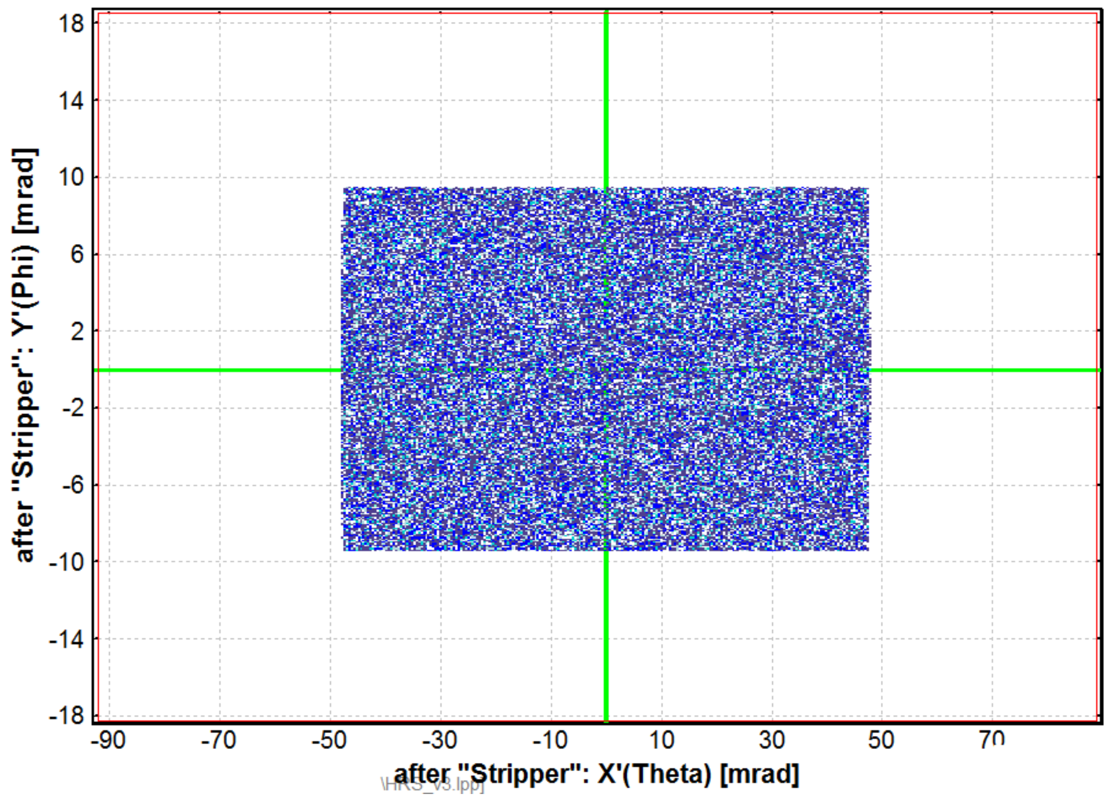


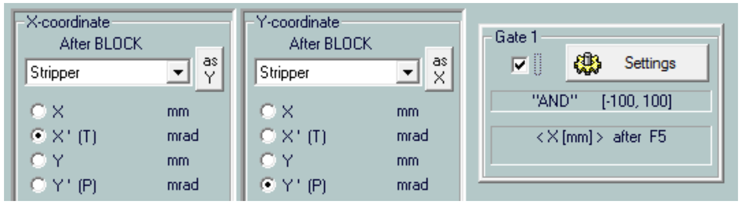
Angular Acceptance (1^{st} order)

Initial emittance

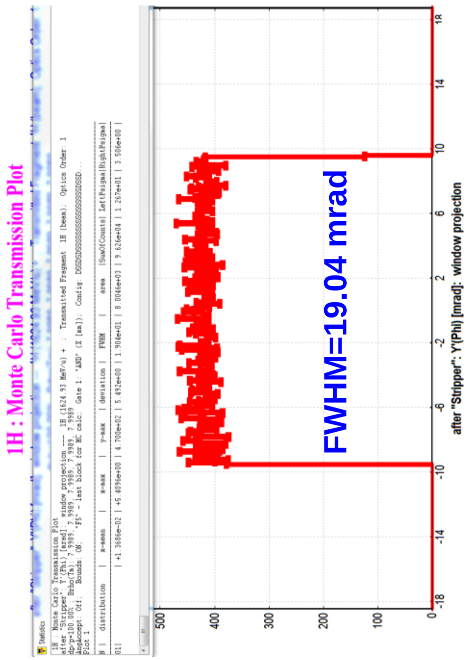


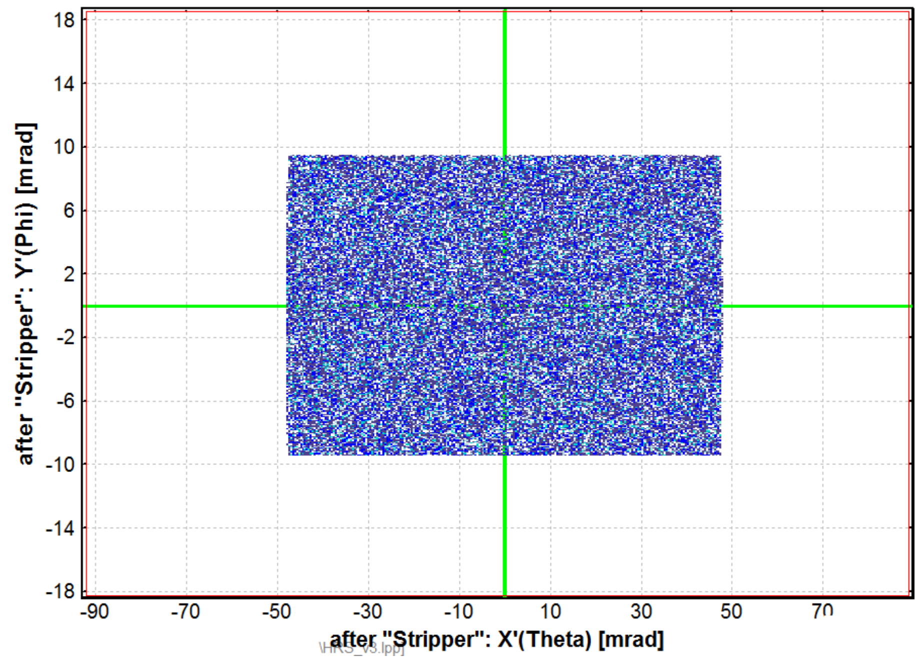


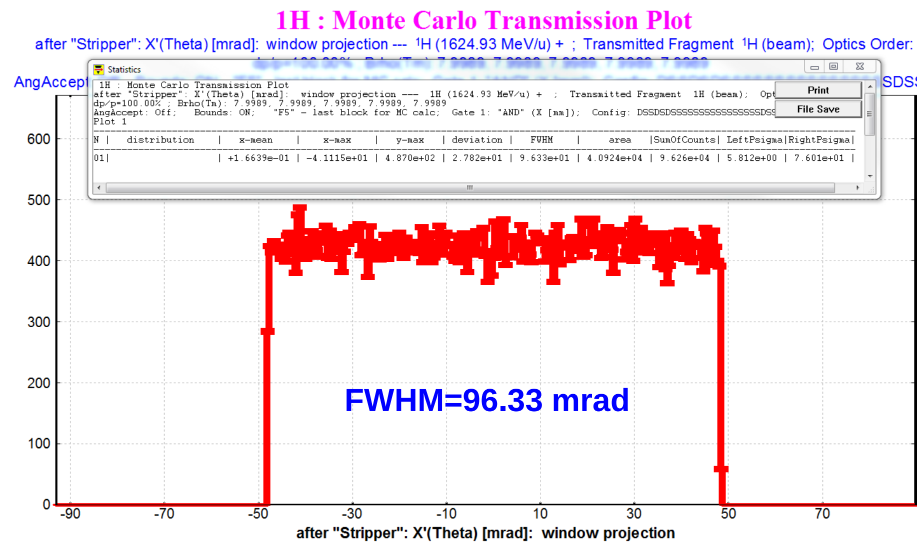




Angular Acceptance (1st order)





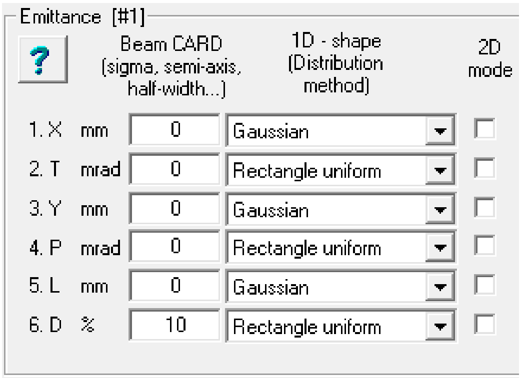


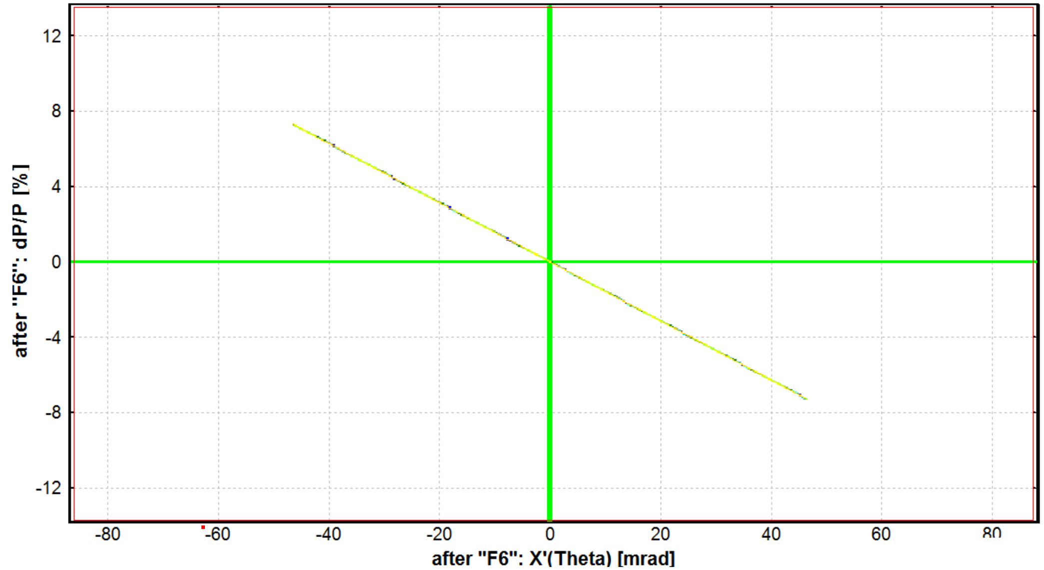
Angular acceptance:

Horizontal = ± 48.2 mrad (rectangle)
Vertical = ± 9.5 mrad (rectangle)

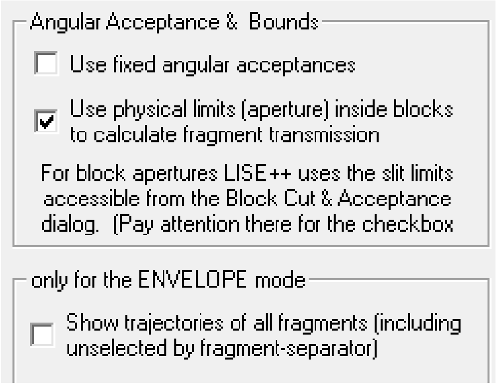
Momentum Acceptance (1st order)

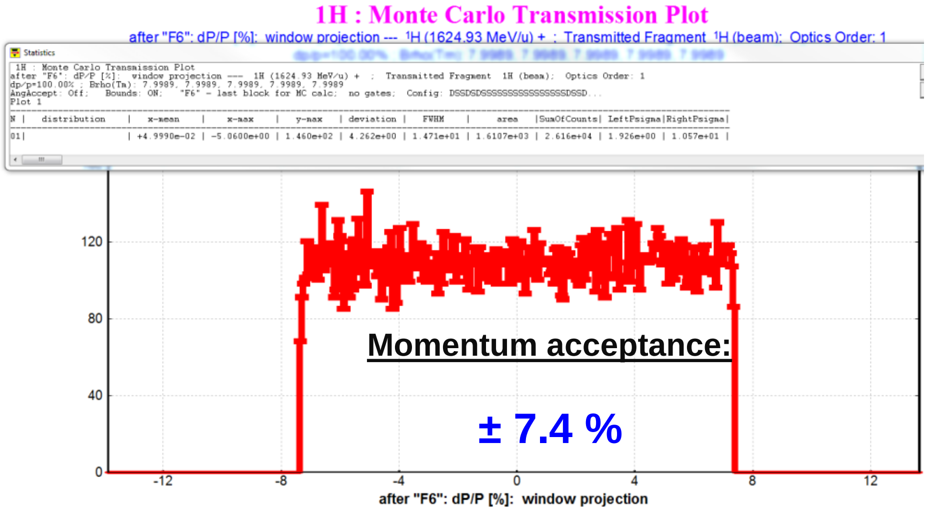
Initial emittance

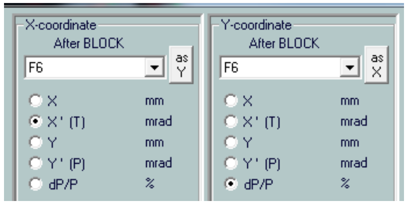




In the current concept it is limited by apertures of the last quadrupoles





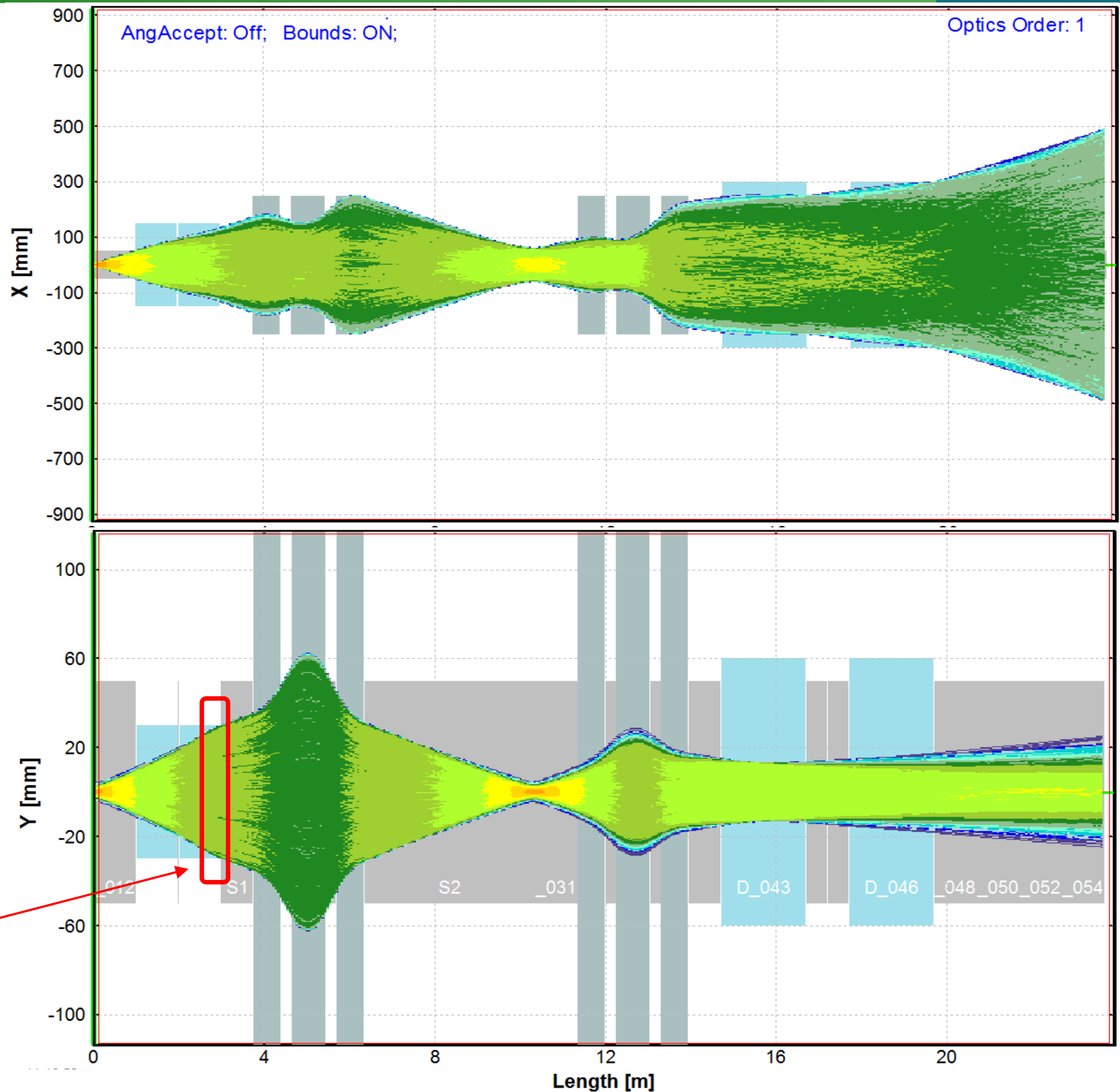


1^{st} order envelopes, dP/P=±7.4%

Initial emittance

Emittance [#1]

		Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm	1	Gaussian
2. T	mrad	48.2	Rectangle uniform
3. Y	mm	1	Gaussian
4. P	mrad	9.5	Rectangle uniform
5. L	mm	0	Gaussian
6. D	%	7.4	Rectangle uniform



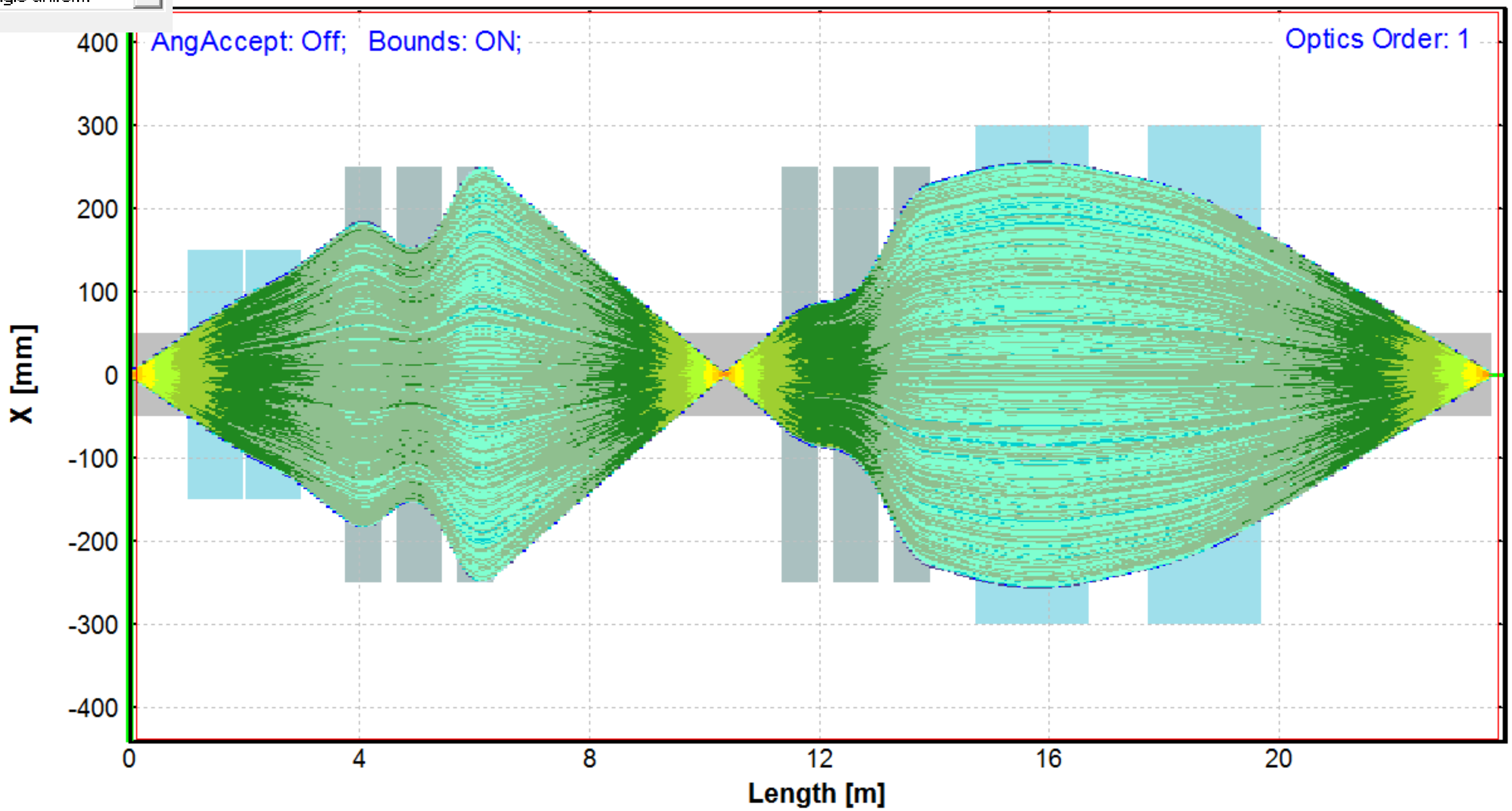
Limitation of vertical acceptance

1st order envelope, dP/P=0

Initial emittance

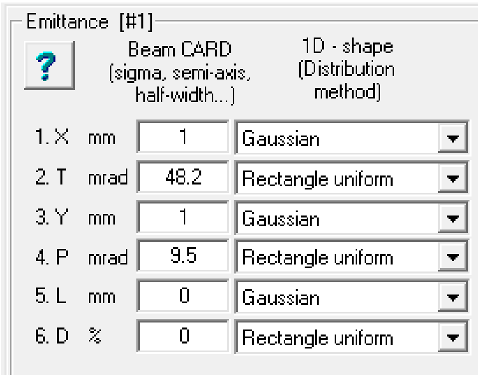
Emittance [#1]

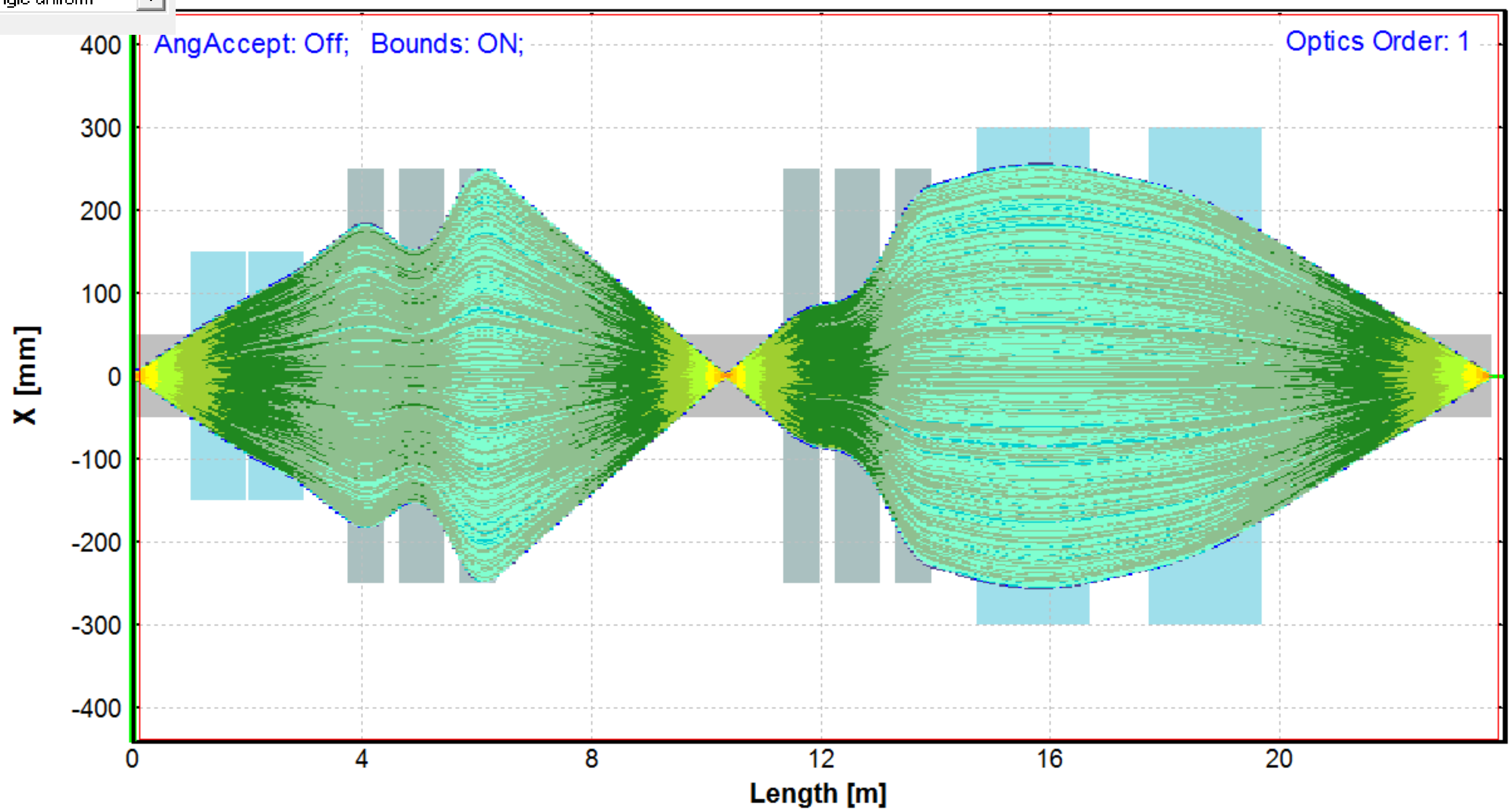
		Beam CARD (sigma, semi-axis, half-width...)	1D - shape (Distribution method)
1. X	mm	1	Gaussian
2. T	mrad	48.2	Rectangle uniform
3. Y	mm	1	Gaussian
4. P	mrad	9.5	Rectangle uniform
5. L	mm	0	Gaussian
6. D	%	0	Rectangle uniform



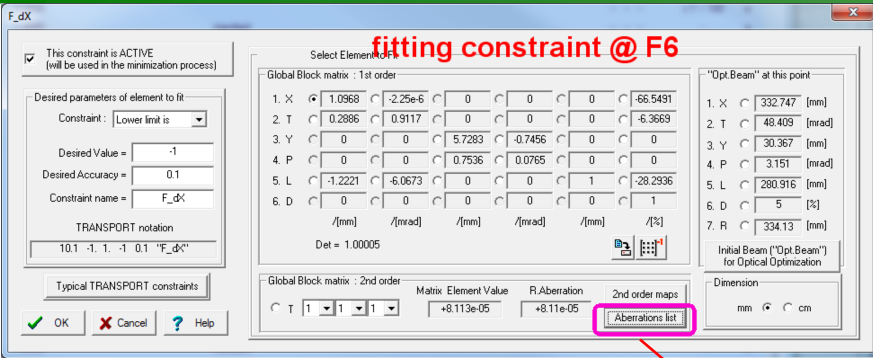
1st order envelope, dP/P=0

Initial emittance





2^{nd} order effects



Block: "F_dX" Aberrations (Elements normalized on Phase Space)

Block: "F_dX" Aberrations (Elements normalized on Phase Space)
1st order : (a/b)*beam(b); 2nd order: (a/b/c)*beam(b)*beam(c)

transport format [mm-mrad]

* TRANSFORM 1 *

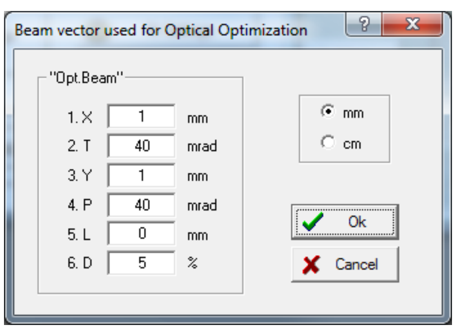
1 [X]:	+1.0968e+00	-9.0000e-05	0	0	0	-3.3275e+02
2 [T]:	+2.8860e-01	+3.6468e+01	0	0	0	-3.1835e+01
3 [Y]:	0	0	+5.7283e+00	-2.9824e+01	0	0
4 [F]:	0	0	+7.5360e-01	+3.0600e+00	0	0
5 [L]:	-1.2221e+00	-2.4269e+02	0	0	0	-1.4147e+02
6 [D]:	0	0	0	0	0	+5.0000e+00

* TRANSFORM 2 *

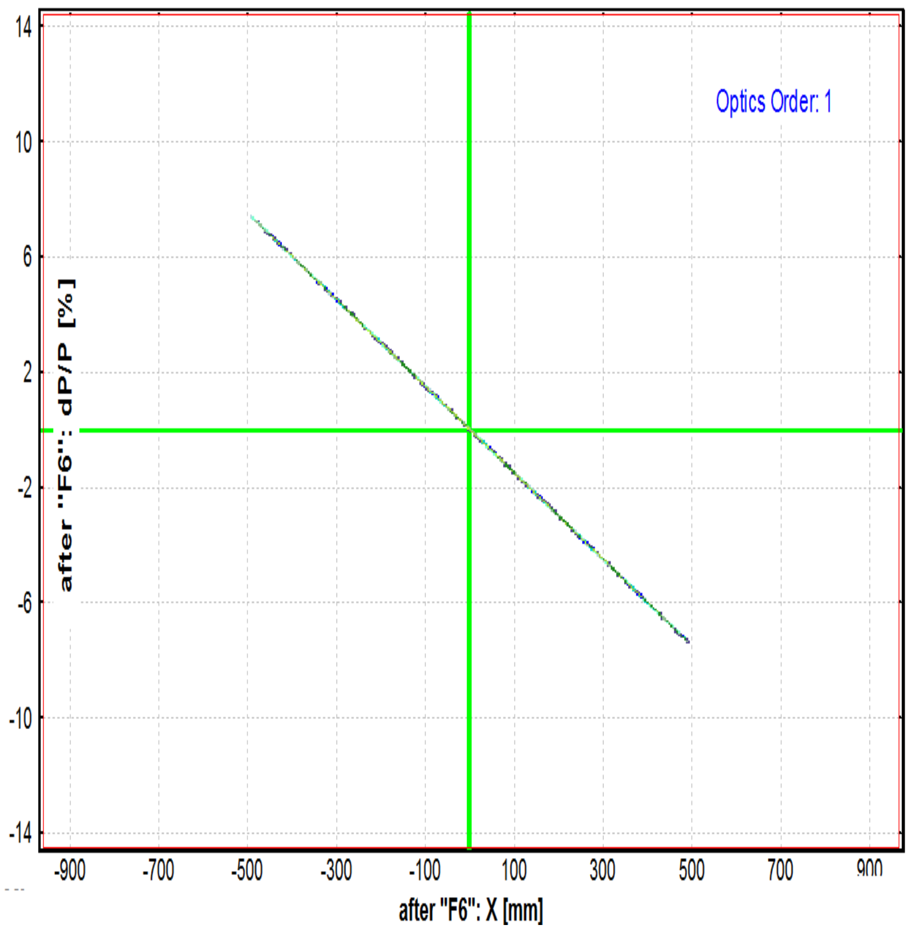
x/θ^2 x/δ^2 $y/\theta\varphi$

1	1:	+8.1128e-05					
1	2:	+6.7662e-03	+5.5691e+00				
1	3:	0	0	-2.4687e-04			
1	4:	0	0	-3.5419e-02	+3.0735e+00		
1	5:	0	0	0	0	0	
1	6:	+3.3002e-02	+1.2150e+00	0	0	0	+1.6707e+01
2	1:	+3.5658e-06					
2	2:	+9.1623e-03	+8.9118e-01				
2	3:	0	0	-4.7798e-05			
2	4:	0	0	-3.0191e-03	+3.8031e-01		
2	5:	0	0	0	0	0	
2	6:	-1.8941e-03	-9.8444e-01	0	0	0	+1.6078e+00
3	1:	0					
3	2:	0	0				
3	3:	-9.6944e-04	-2.8725e-01	0			
3	4:	-2.3619e-02	-1.0214e+01	0	0		
3	5:	0	0	0	0	0	
3	6:	0	0	-4.0531e-02	-7.3020e+00	0	0
4	1:	0					
4	2:	0	0				
4	3:	-1.4465e-04	-3.2199e-02	0			
4	4:	+8.4874e-04	-5.2316e-01	0	0		
4	5:	0	0	0	0	0	
4	6:	0	0	-7.8027e-03	-6.1984e-01	0	0
5	1:	+4.8844e-06					
5	2:	-2.5269e-02	+1.0208e+00				
5	3:	0	0	+1.0680e-04			
5	4:	0	0	+9.6359e-04	+2.1641e+00		
5	5:	0	0	0	0	0	
5	6:	+3.8043e-02	+5.6963e+00	0	0	0	+6.6427e+00

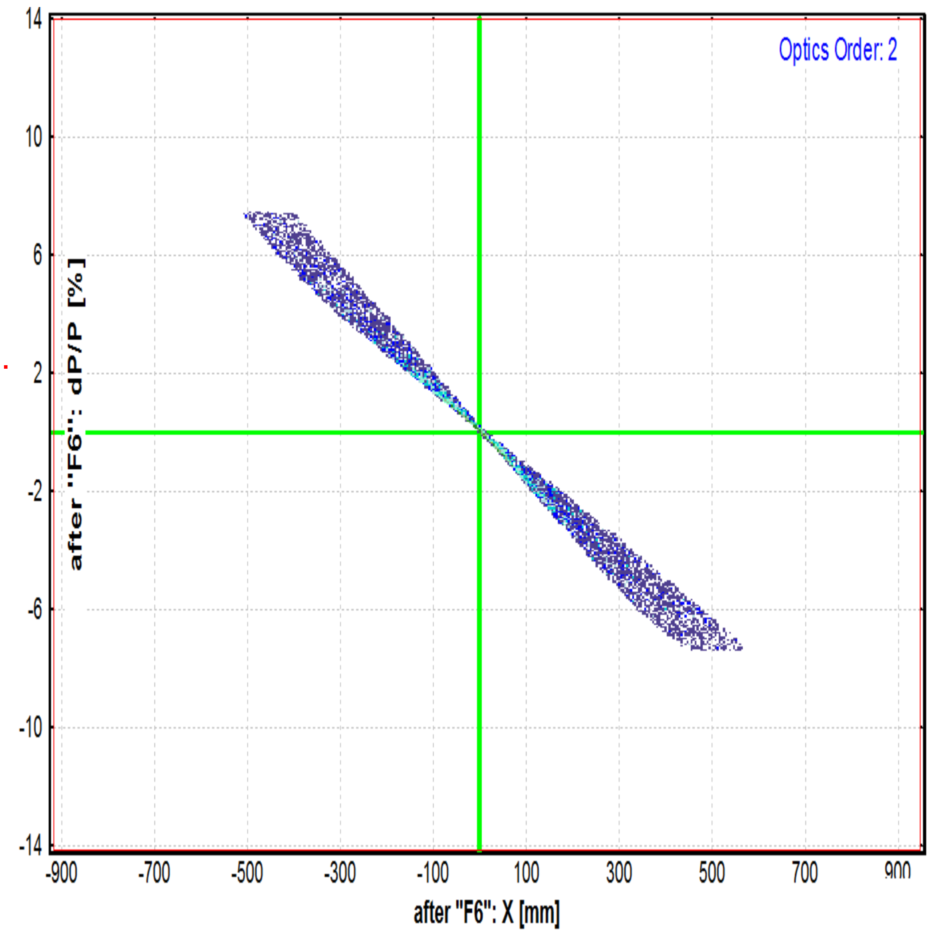
Beam sigma vector used for aberrations



2nd order effects : X vs dP



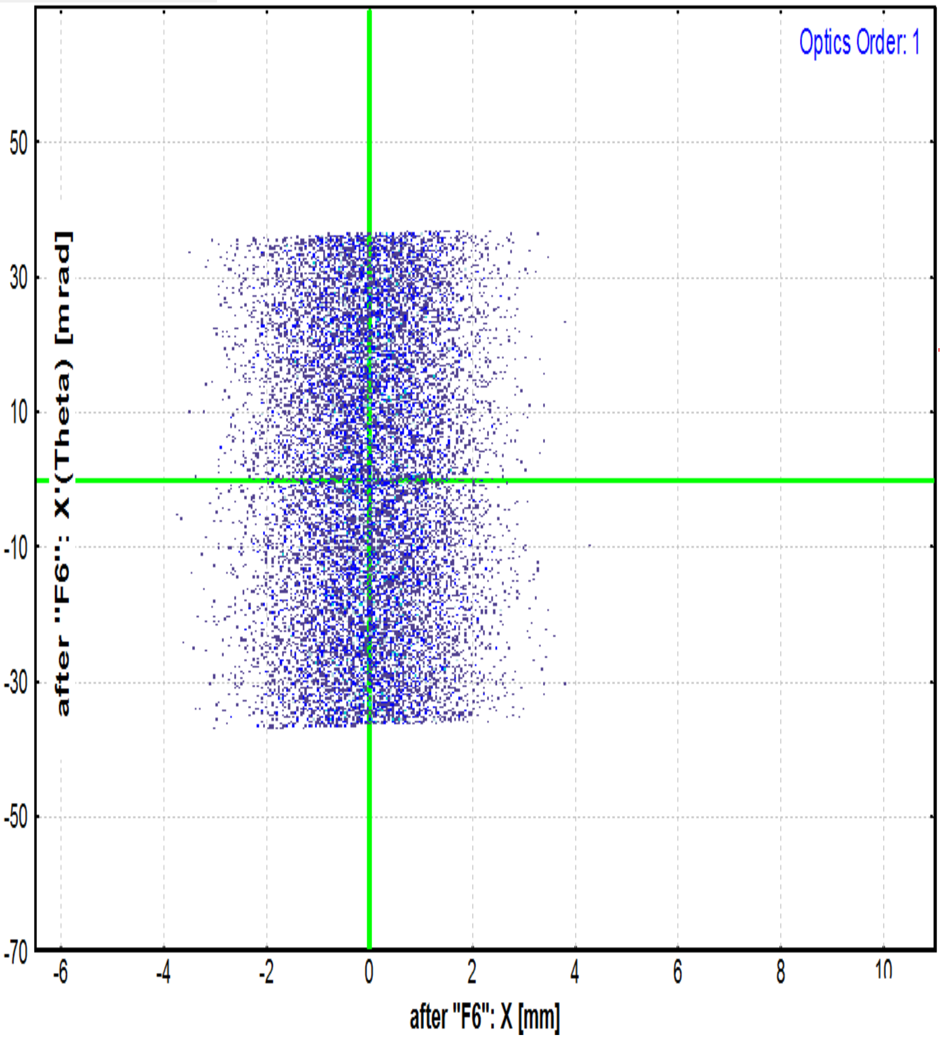
x/δ^2

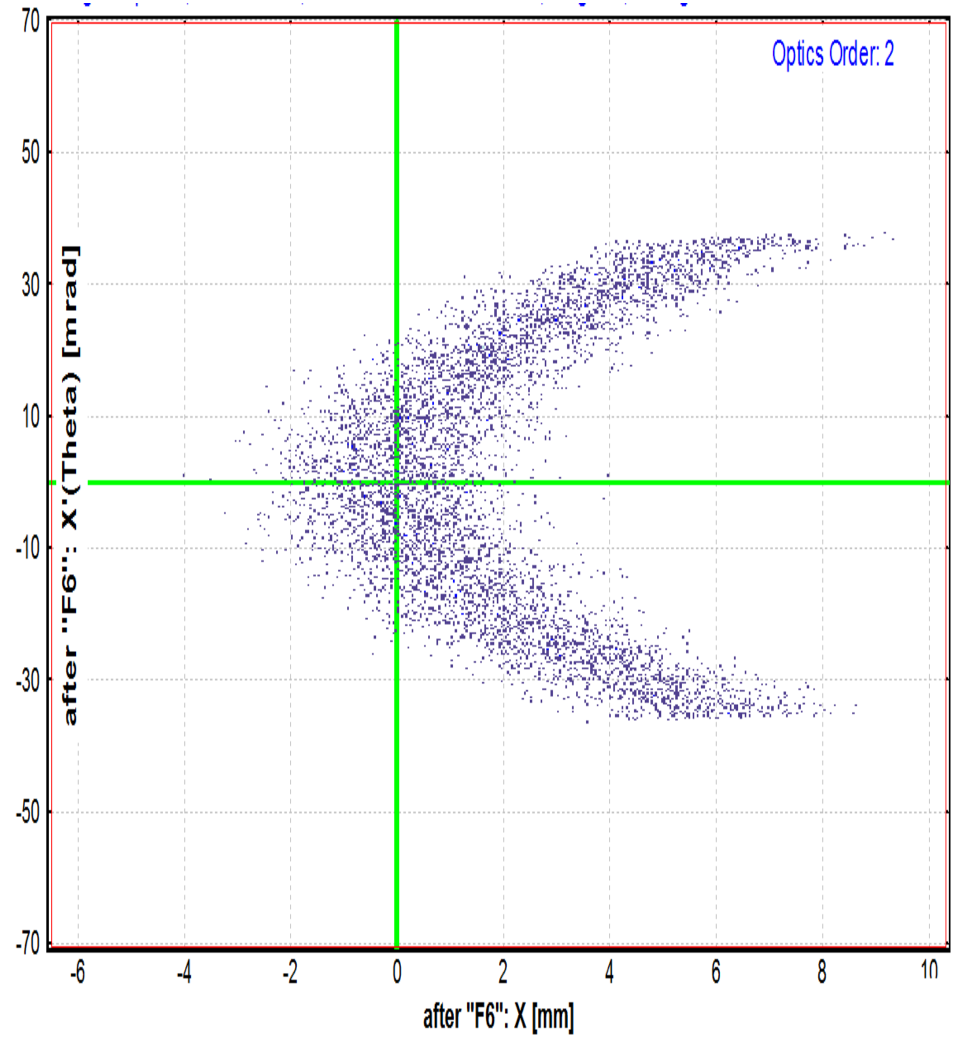


2^{nd} order effects : X vs θ for dP=0

1. X	mm	1
2. T	mrad	40
3. Y	mm	1
4. P	mrad	40
5. L	mm	0
6. D	%	0

x/θ^2





2^{nd} order effects : Y vs θ

1. X	mm	1
2. T	mrad	40
3. Y	mm	1
4. P	mrad	40
5. L	mm	0
6. D	%	0

y/θφ