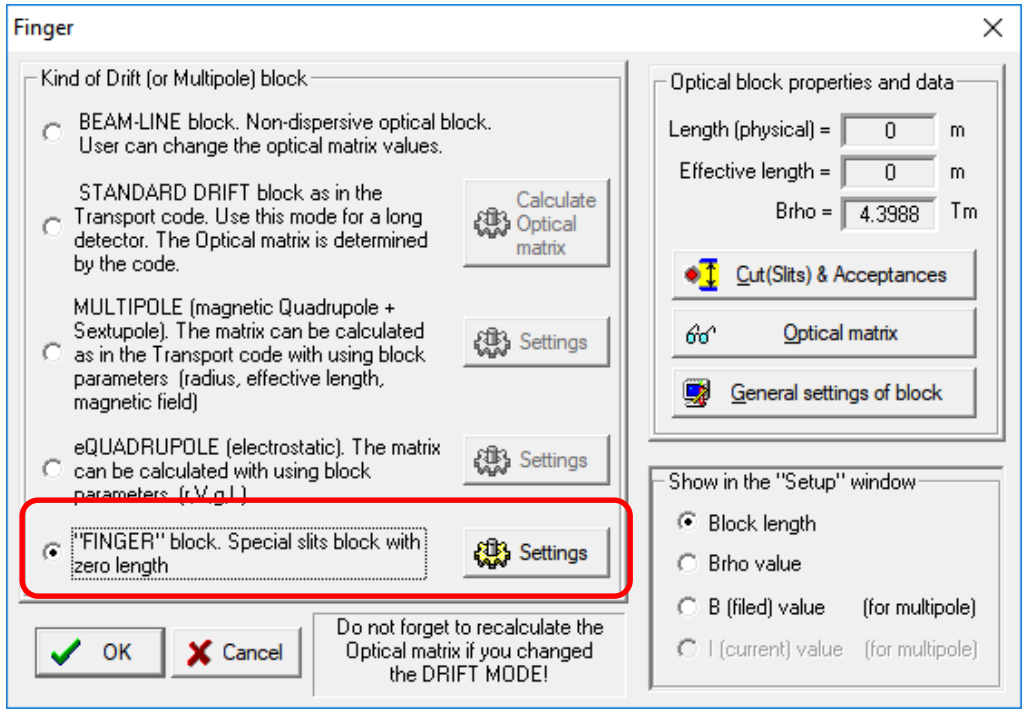
“Finger” block

v.13.4.4
02/24/12

- The new drift mode “Finger” has been designed to simulate transmissions with use of bars to stop primary beam charge states
- General settings, properties
- “Finger” block settings
- Selection with “Finger” block: analytical solution
- “Finger” block vs. different transmission and plotting methods
- Next steps

- Correction for transmission calculations in the case of zero-length blocks

New mode of “Drift” block

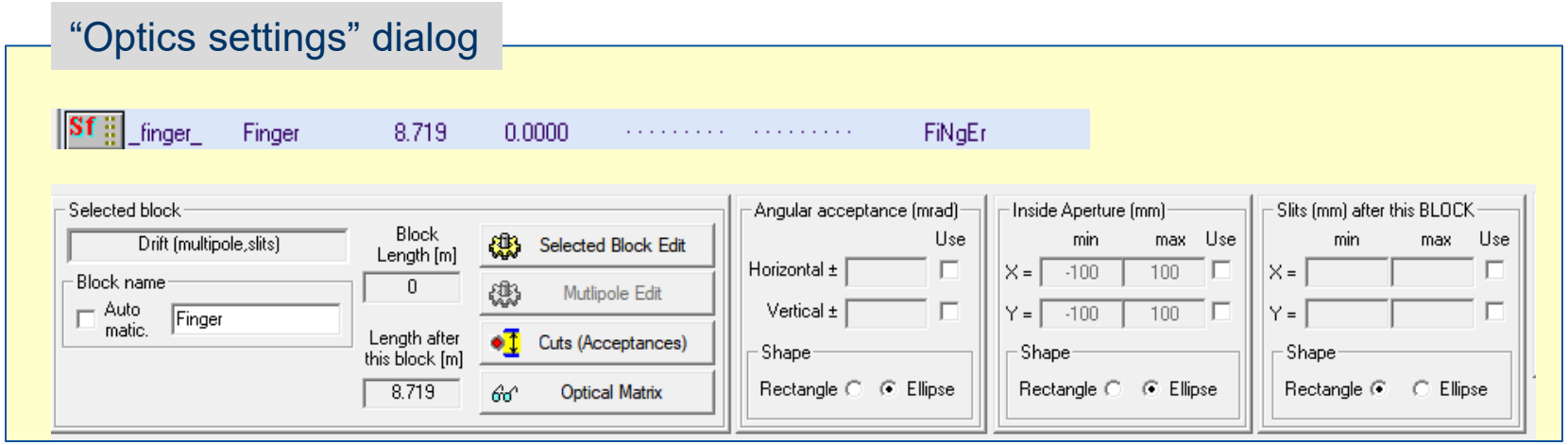


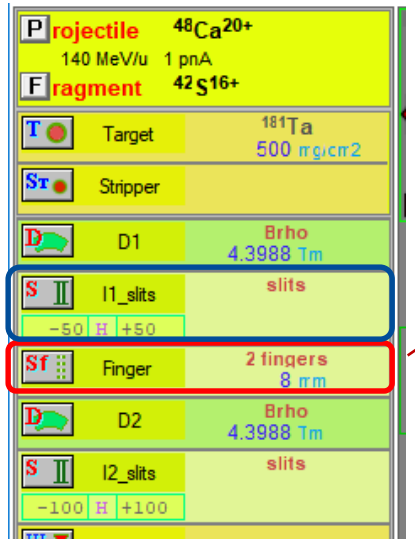
Finger block : general settings

- Block length = 0
- No apertures
- Angular acceptance disabled
- No ‘regular” slits

- Recommendations
  - use an optical block with working slits before a “Finger” block
  - use NP=64 or higher

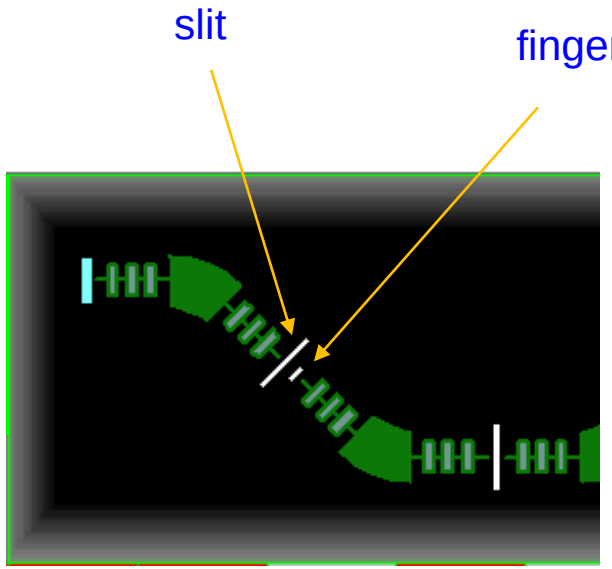
“Optics settings” dialog





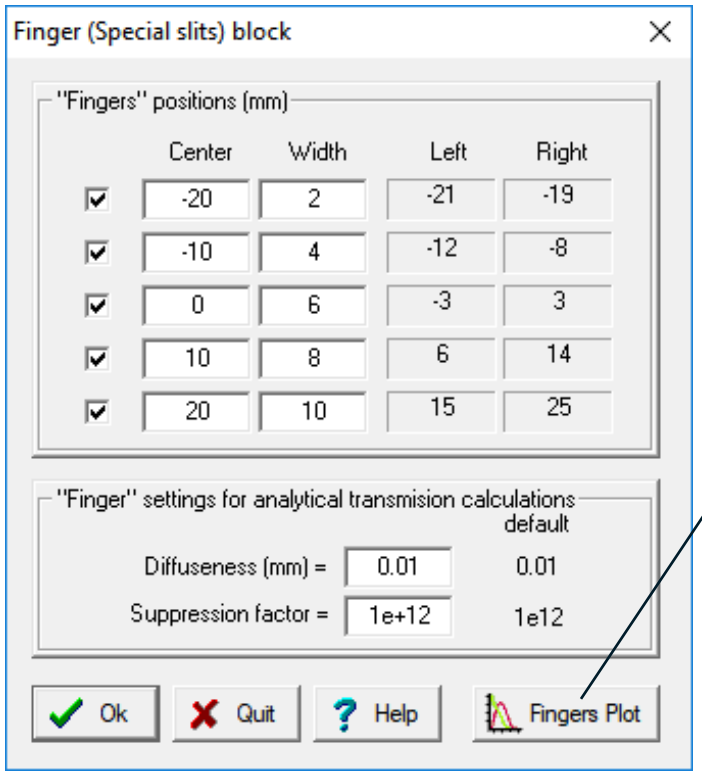
Total number of acting fingers

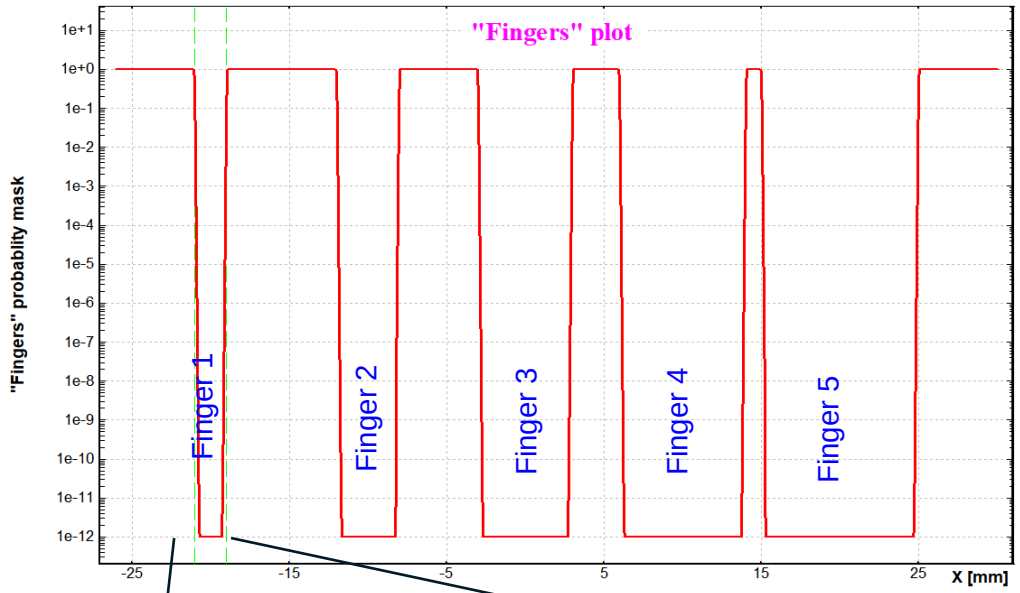
Sum of acting fingers widths

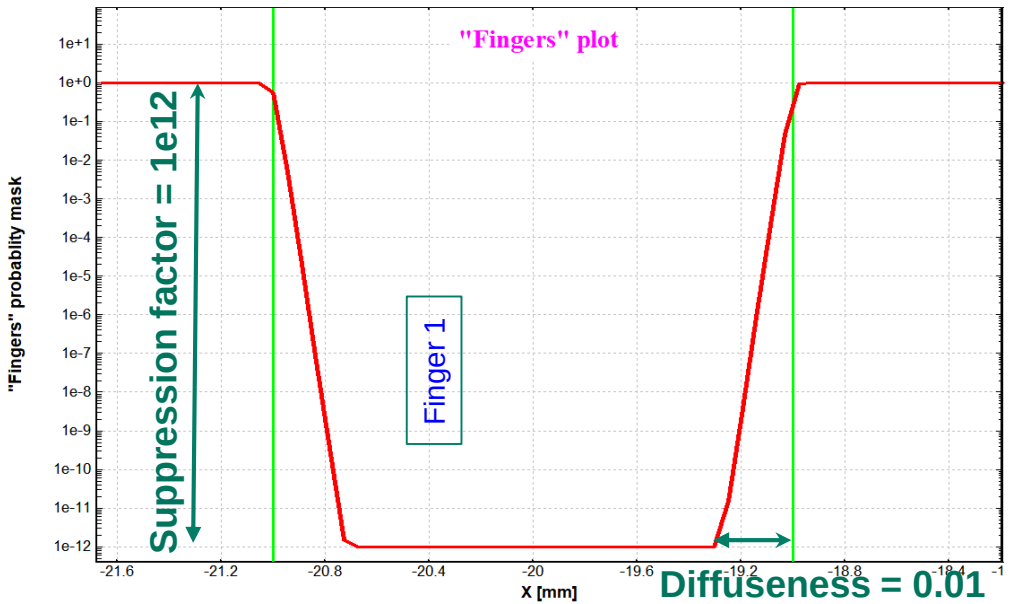


Finger block setting

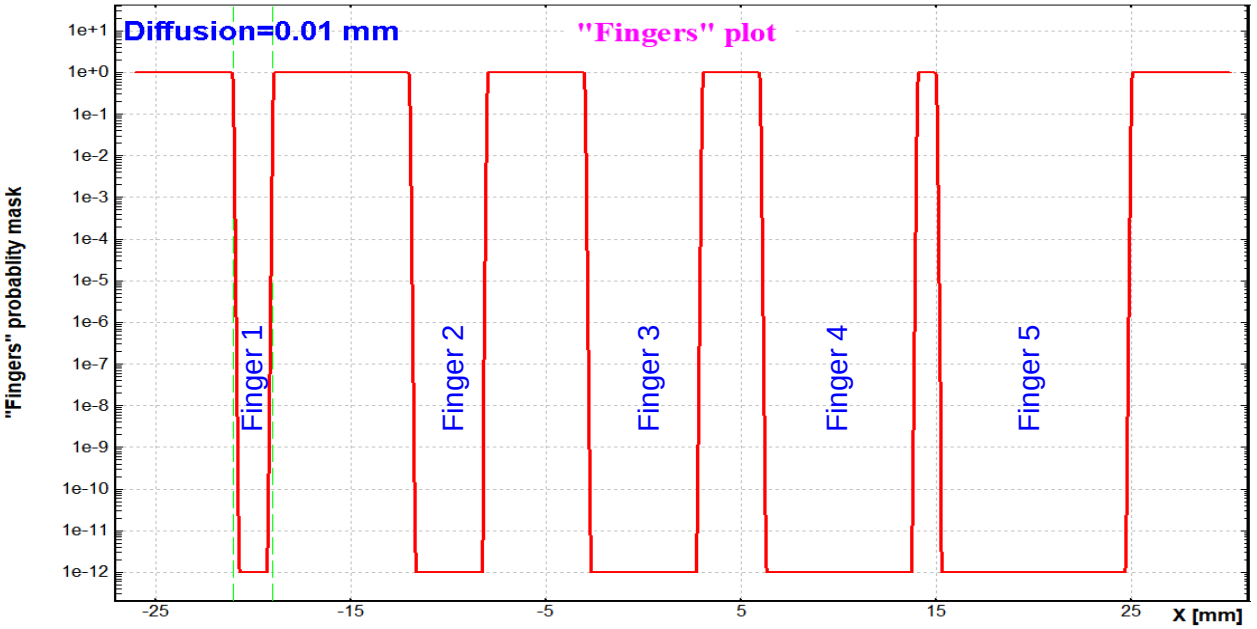
- Maximum 5 fingers per block
- Fingers can be entered in free order
- “Suppression” and “Diffuseness” parameters are used in analytical transmission calculations, and they are property of the configuration. So, they are the same for all finger blocks in configuration



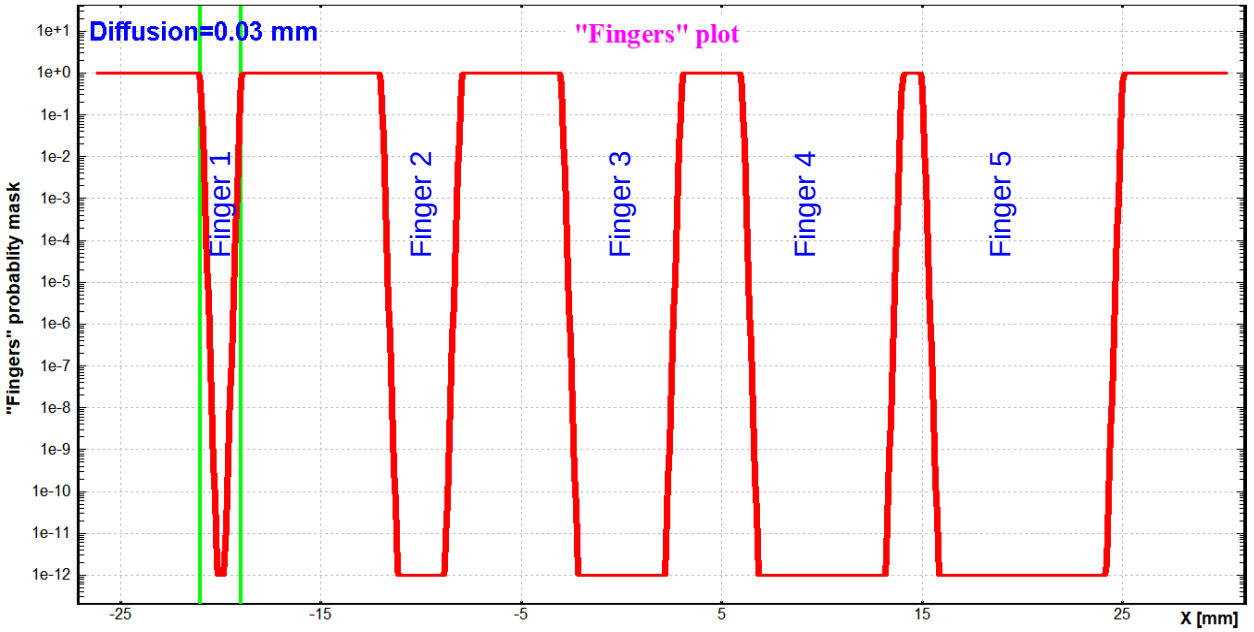


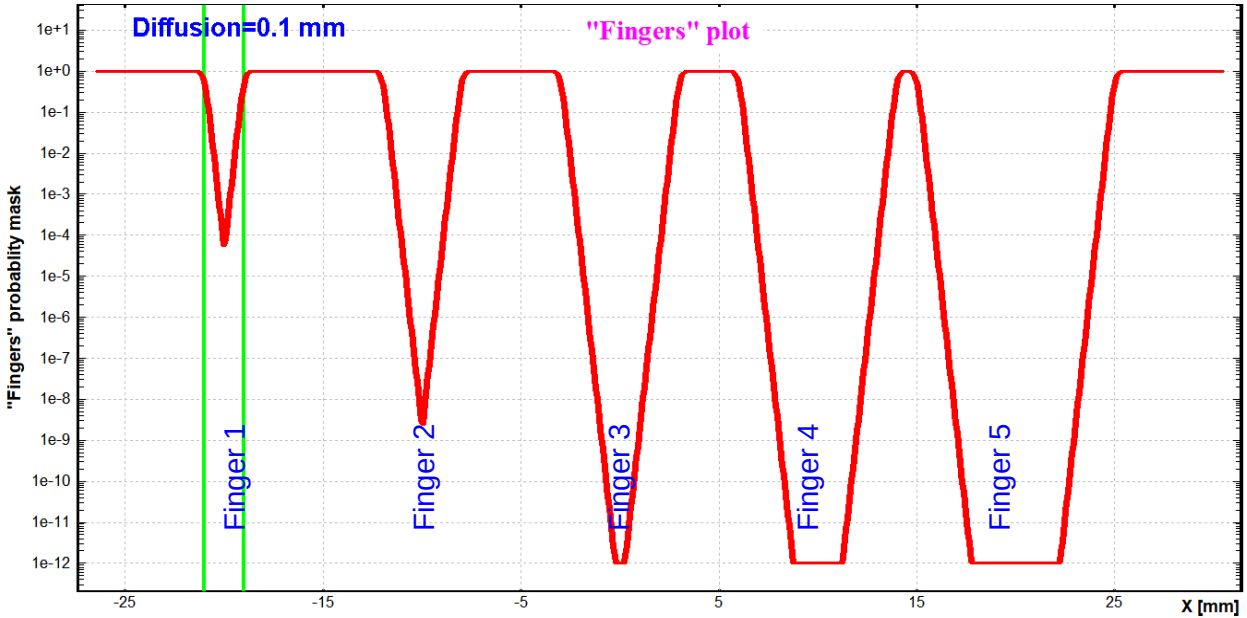


Finger block : how it works?

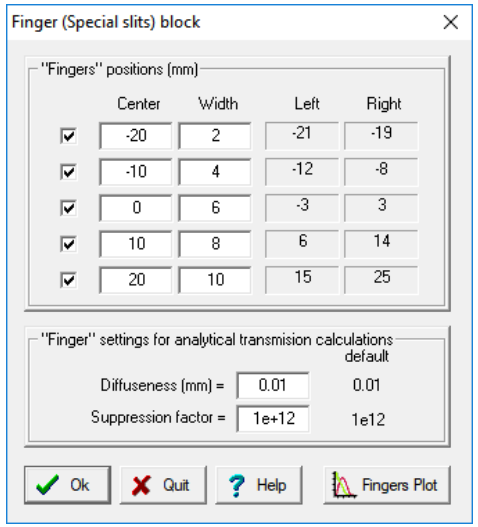


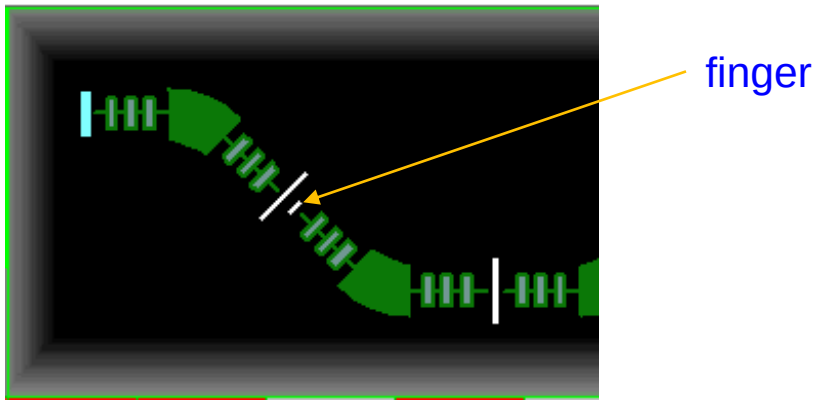
- Monte Carlo mode : diffuseness and suppression values are not used. Rectangular well with an infinite depth is used
- "Distribution" (analytical) solution :
  - The Diffuseness parameter is needed since "Distribution" technique does not act properly in convolution with sharp wells
  - Can be manually used to reproduce high-order effects
  - The Diffuseness parameter default value is 0.01 mm (minimum 0.001 mm)
  - Suppression factor is used to avoid zero values in intensity distributions
  - Do not use small suppression values. Should be enough to suppress primary beam charge states
  - Default value is 1e12. Larger factor is not recommended when plotting distributions





Selection with Finger block

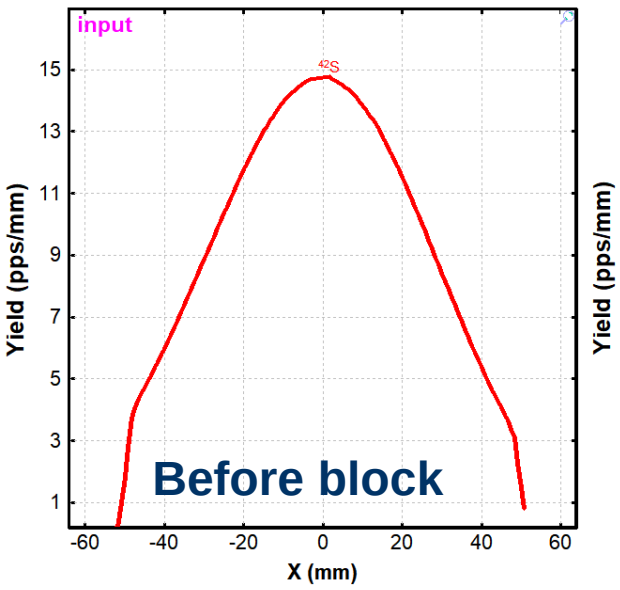


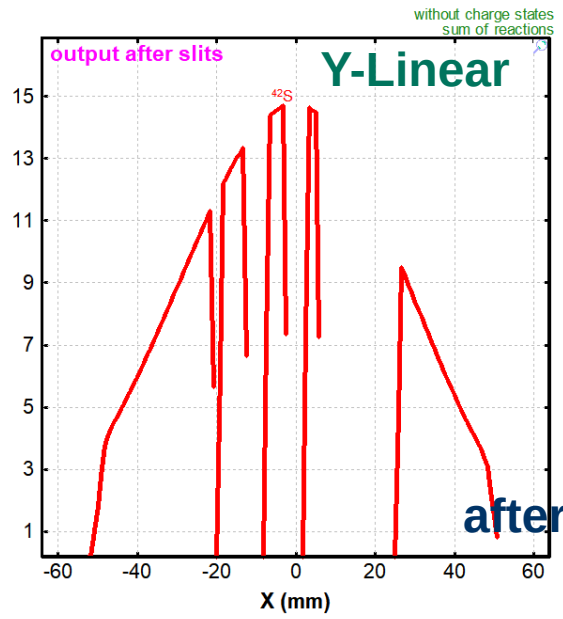


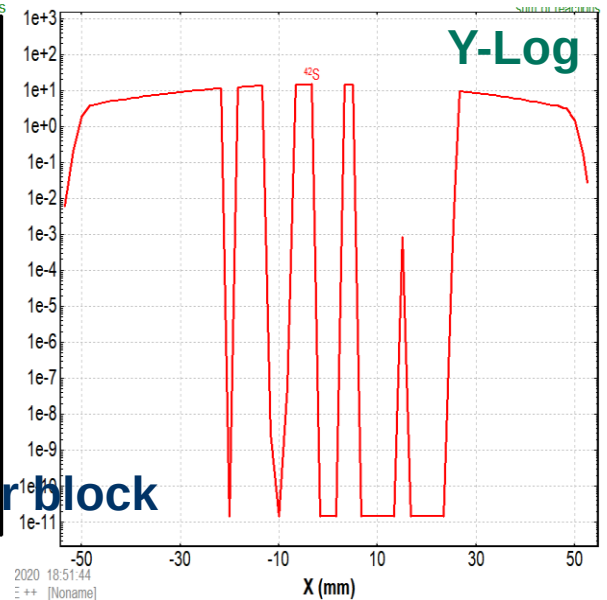
Reaction		ProjFrag
Ion Production Rate	(pps)	4.92e+2
Total ion transmission	(%)	44.809
Total: All reactions	(pps)	4.92e+2
X-Section in target	(mb)	1.06e-1
Target	(%)	99.15
Unreacted in material	(%)	99.15
Unstopped in material	(%)	100
D1	(%)	98.49
X angular transmission	(%)	100
Y angular transmission	(%)	98.49
I1_slits	(%)	91.51
X space transmission	(%)	91.51
Finger	(%)	57.17
D2	(%)	100
X angular transmission	(%)	100
Y angular transmission	(%)	100

Finger => Xspace

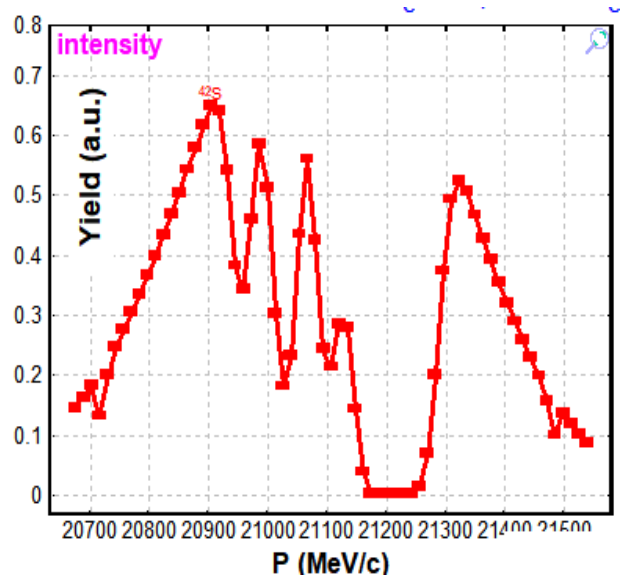
^{48}Ca (140 MeV/u) + Ta (500 mg/cm^2); Settings on ^{42}S; Config: DSSDSWDDMMSMM
dp/p=3.38% ; Wedges: 0; Brho(Tm): 4.3988, 4.3988, 4.3988, 4.3988







"Intensity" D4 distribution



Selection with Finger block: what is cut?

A

Emittance [#1]

Beam CARD (sigma, semi-axis, half-width...)

1. X	mm	1	Gaussian
2. T	mrad	6	Gaussian
3. Y	mm	1	Gaussian
4. P	mrad	8	Gaussian
5. L	mm	0	Gaussian
6. D	%	0.07	Gaussian

Pay attention that 3 left fingers did not make significant cuts in the intensity distribution (left case).
It is due to a relatively larger 1 mm initial beam spot on target.

Transmissions in both cases are close the same,
but.. See difference in the next page

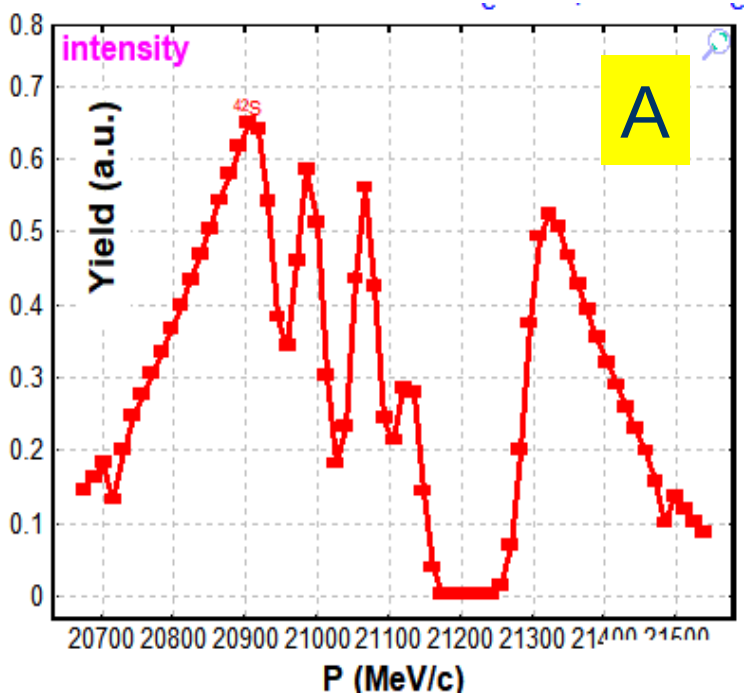
B

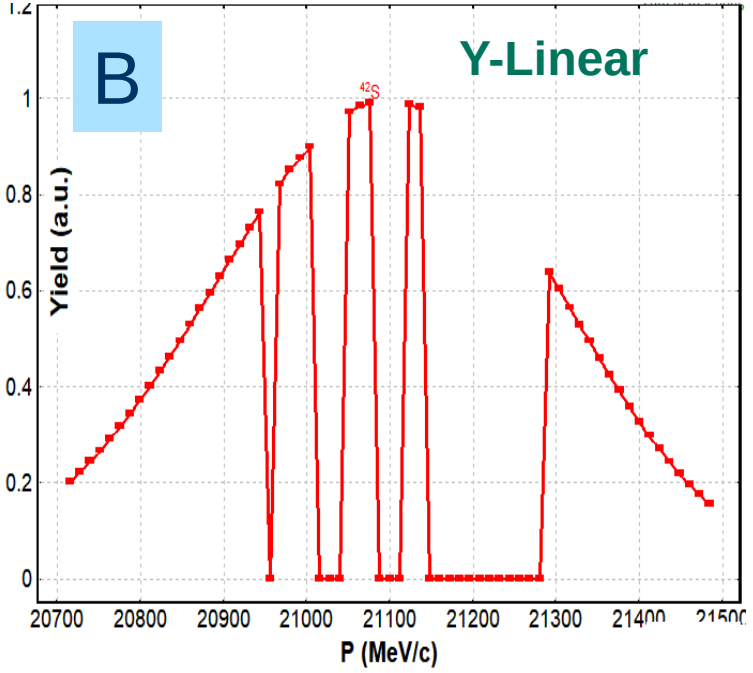
Emittance [#1]

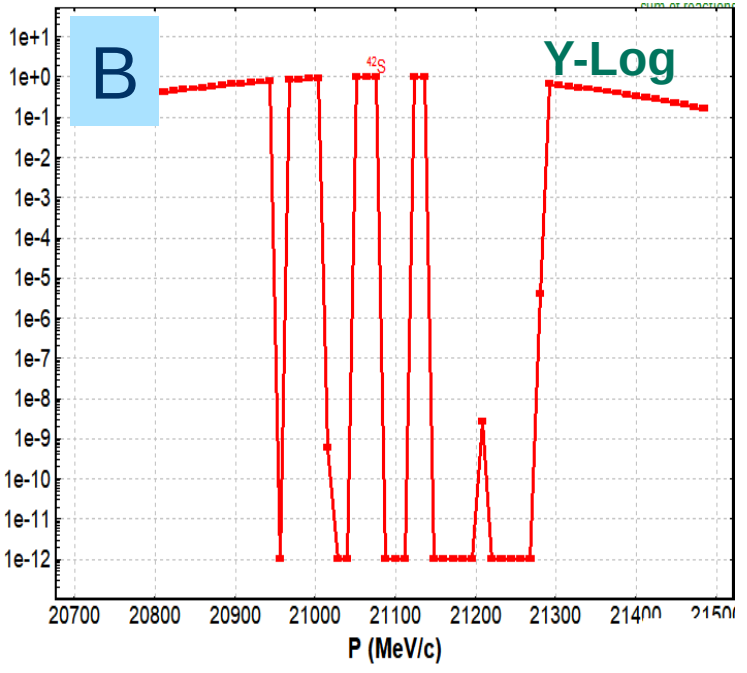
Beam CARD (sigma, semi-axis, half-width...)

1. X	mm	0.2	Gaussian
2. T	mrad	6	Gaussian
3. Y	mm	1	Gaussian
4. P	mrad	8	Gaussian
5. L	mm	0	Gaussian
6. D	%	0.07	Gaussian

"Intensity" D4 distribution



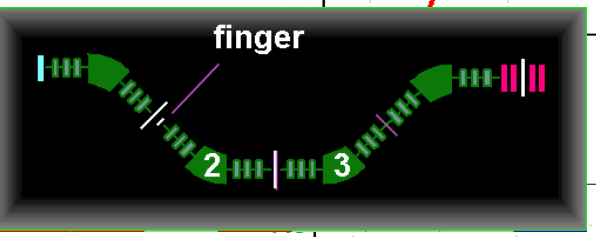


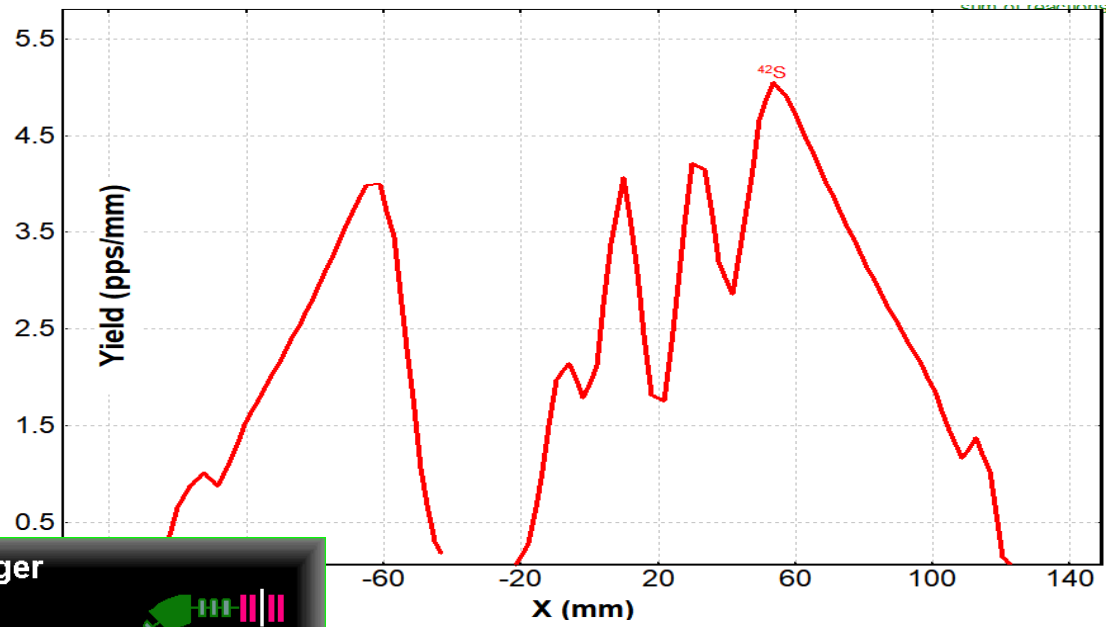


Distribution → Selection with Finger block

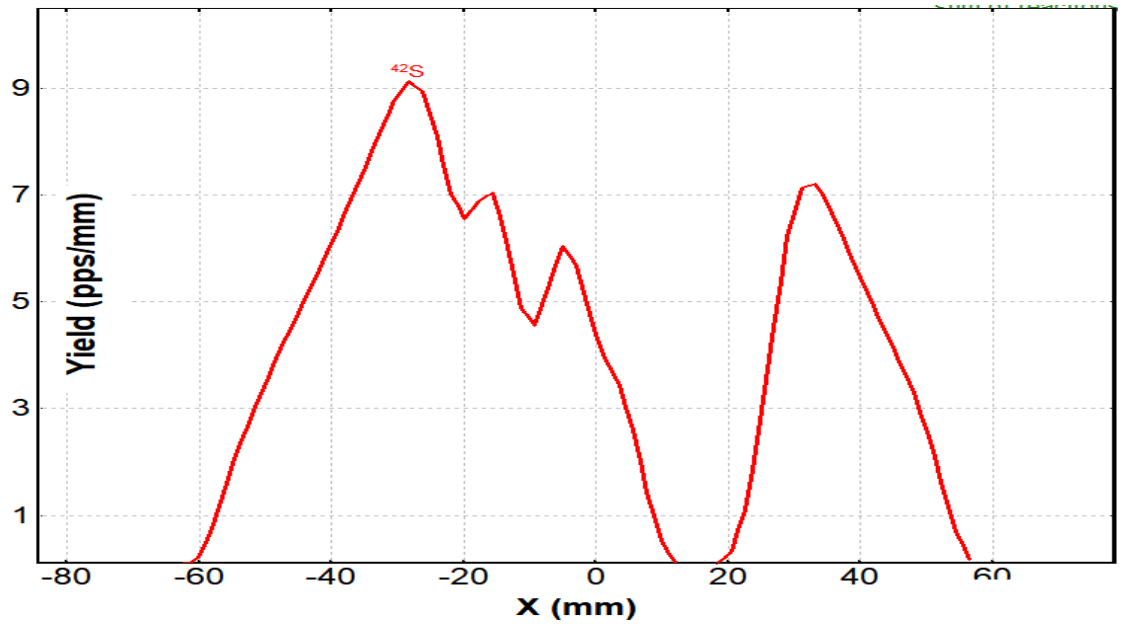
A

X=1.0





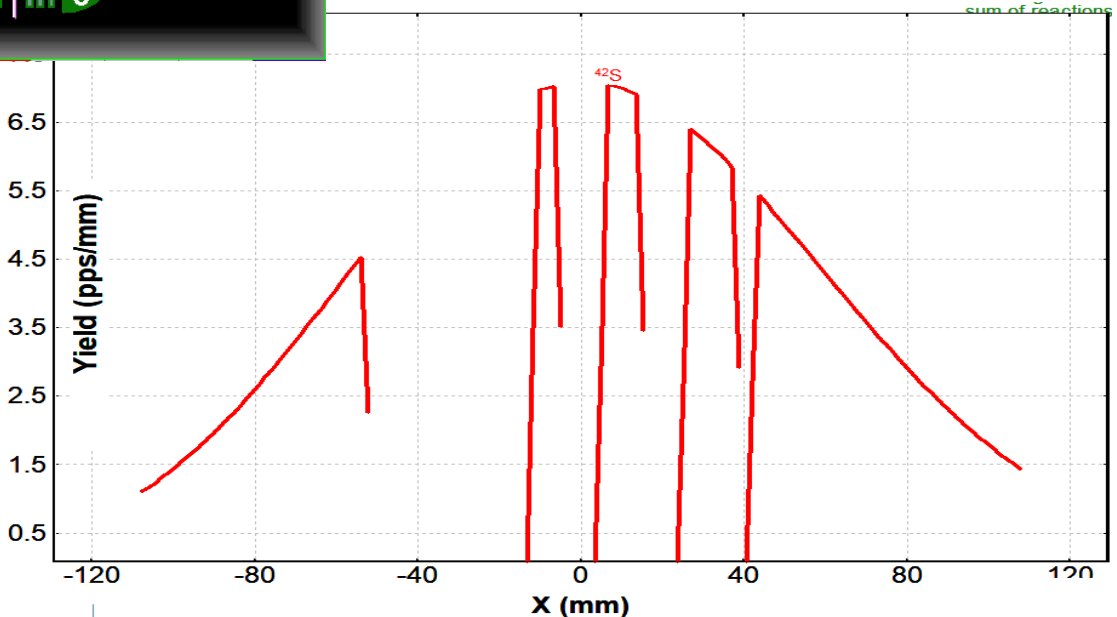
After the 2nd dipole

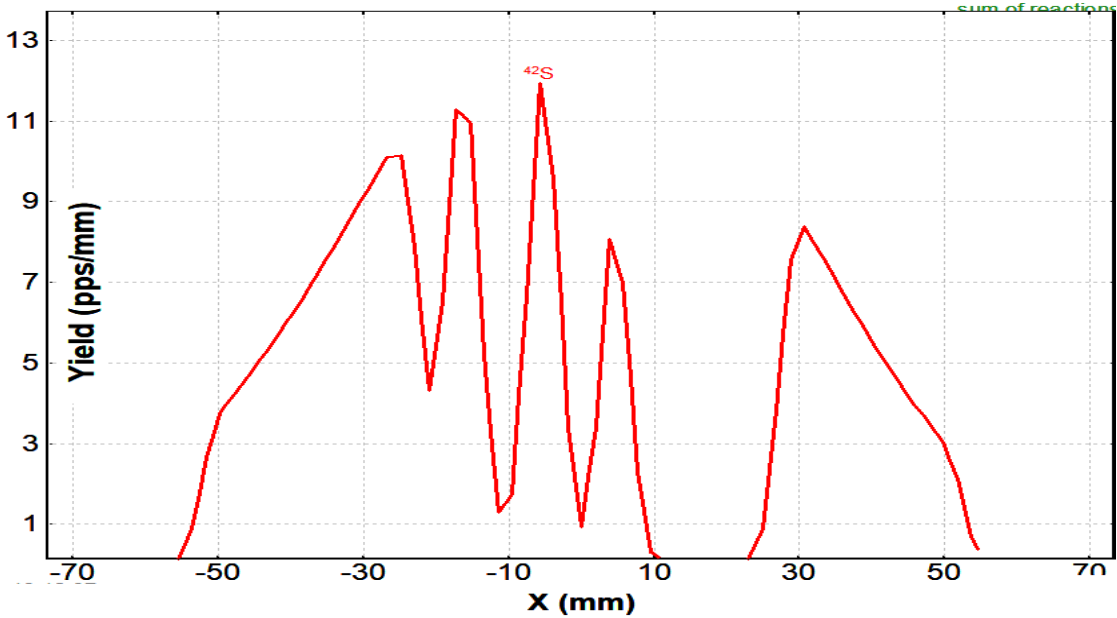


After the 3rd dipole

B

X=0.2

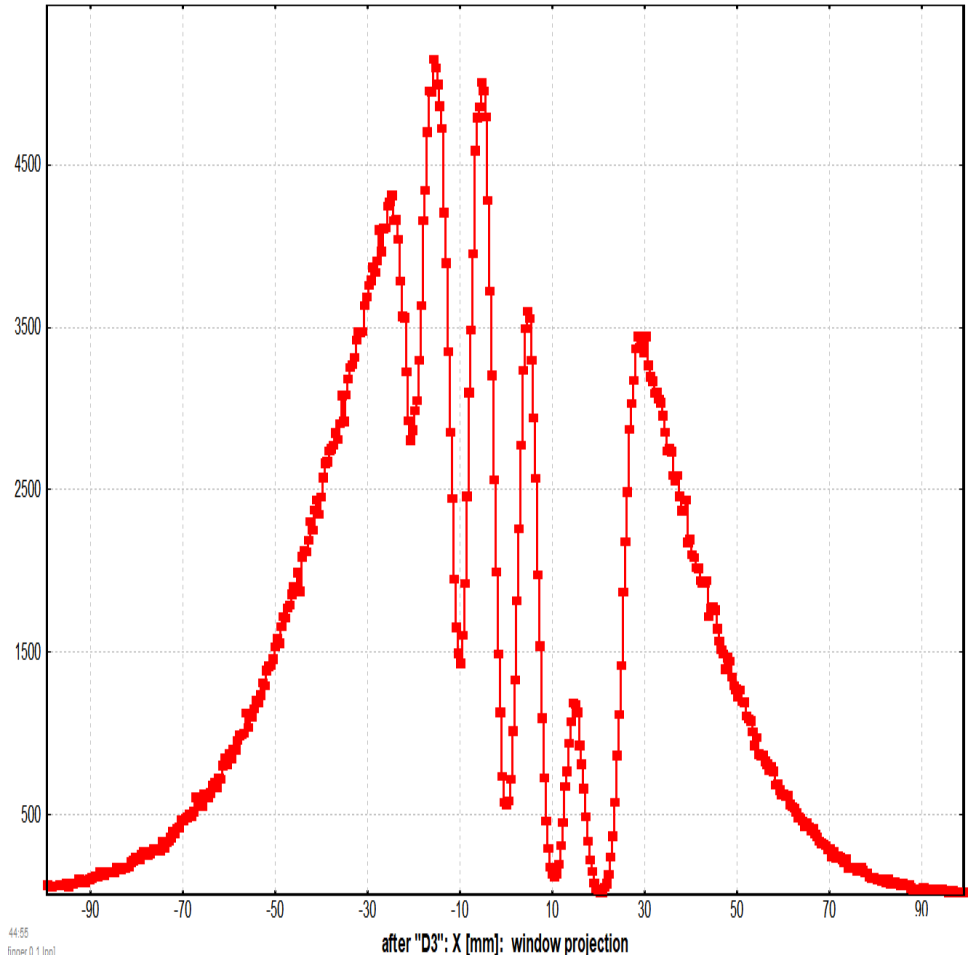


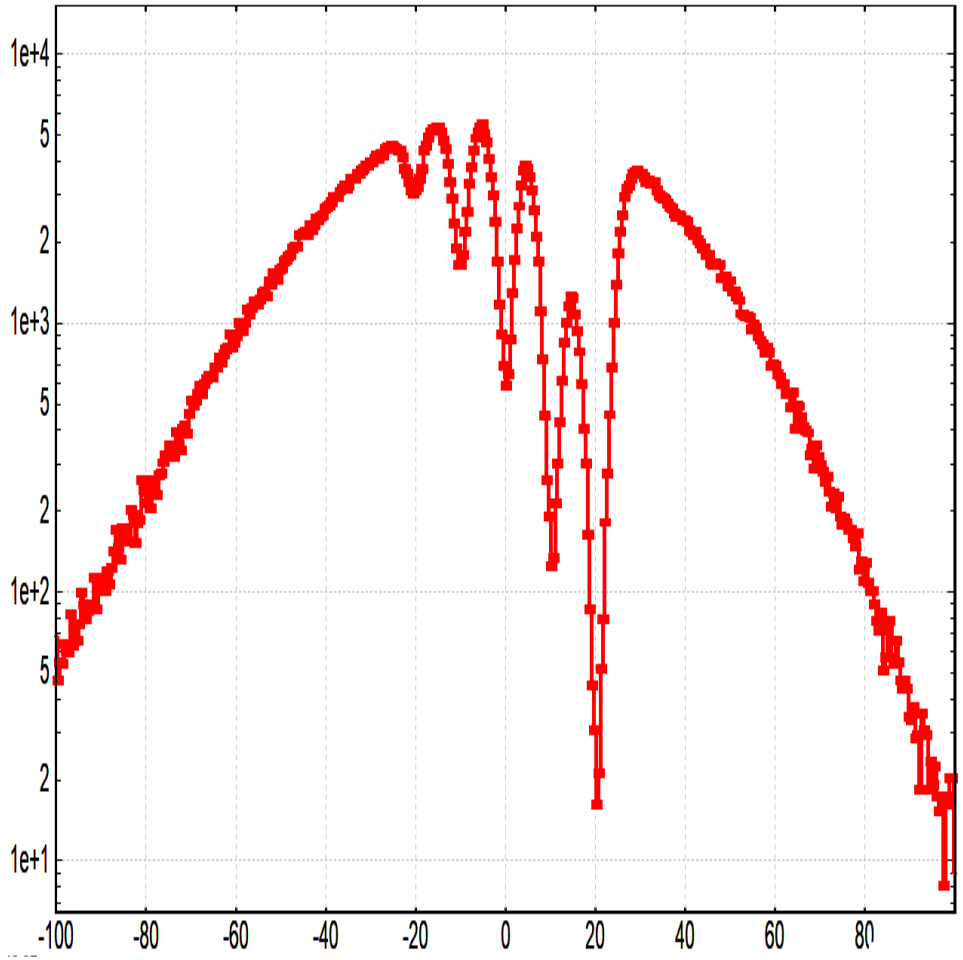


Monte Carlo → Selection with Finger block

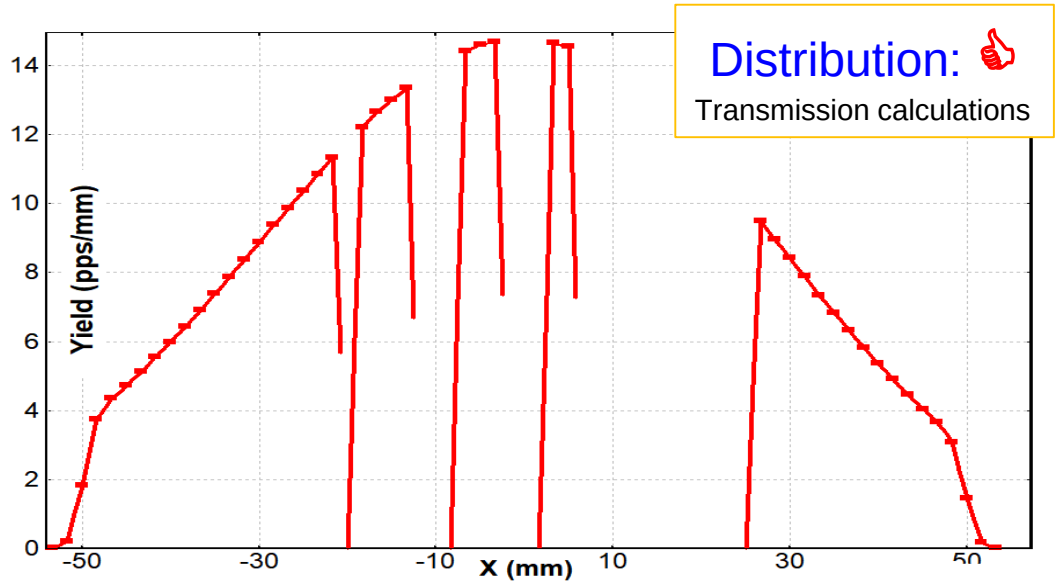
No significant difference was observed between A & B cases in Monte Carlo Mode

After the 3rd dipole

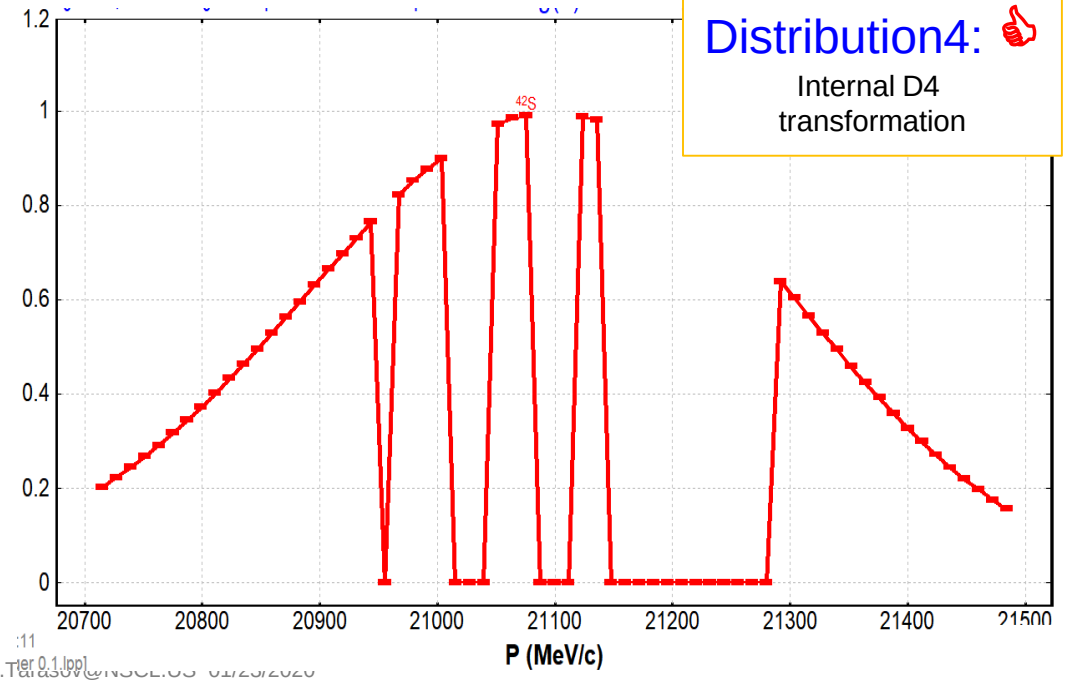




Finger block selection : transmission



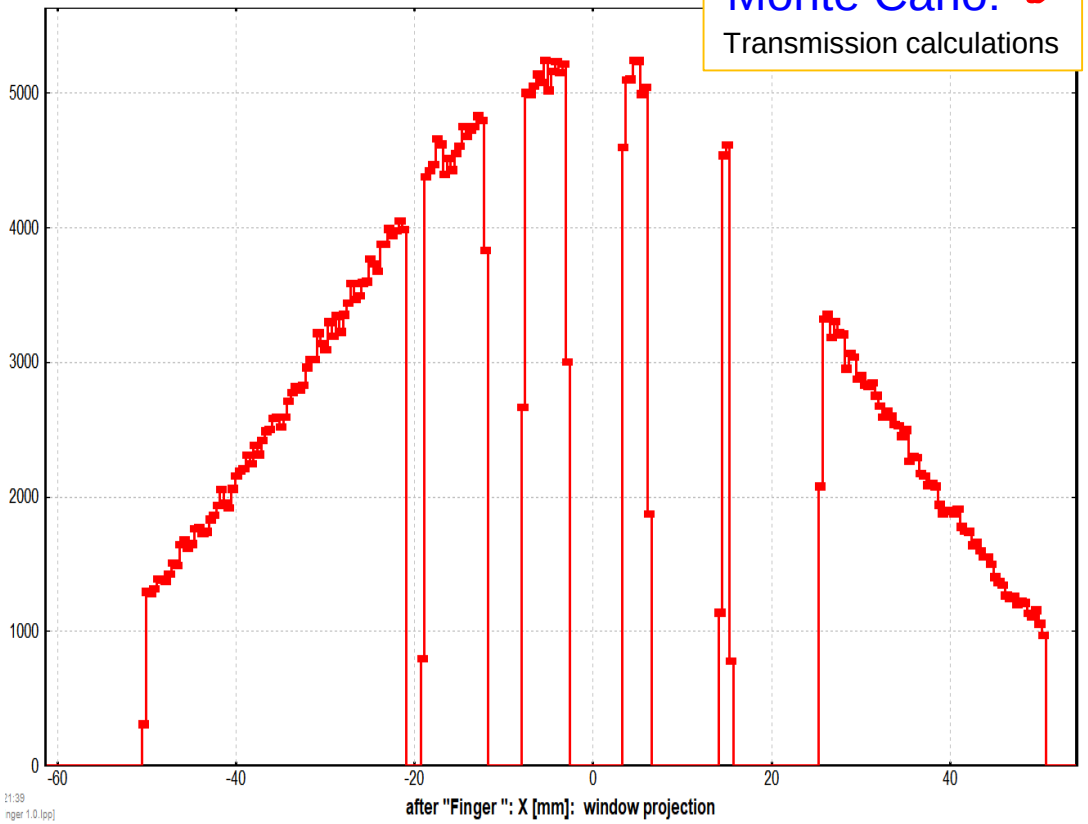
Distribution:
Transmission calculations



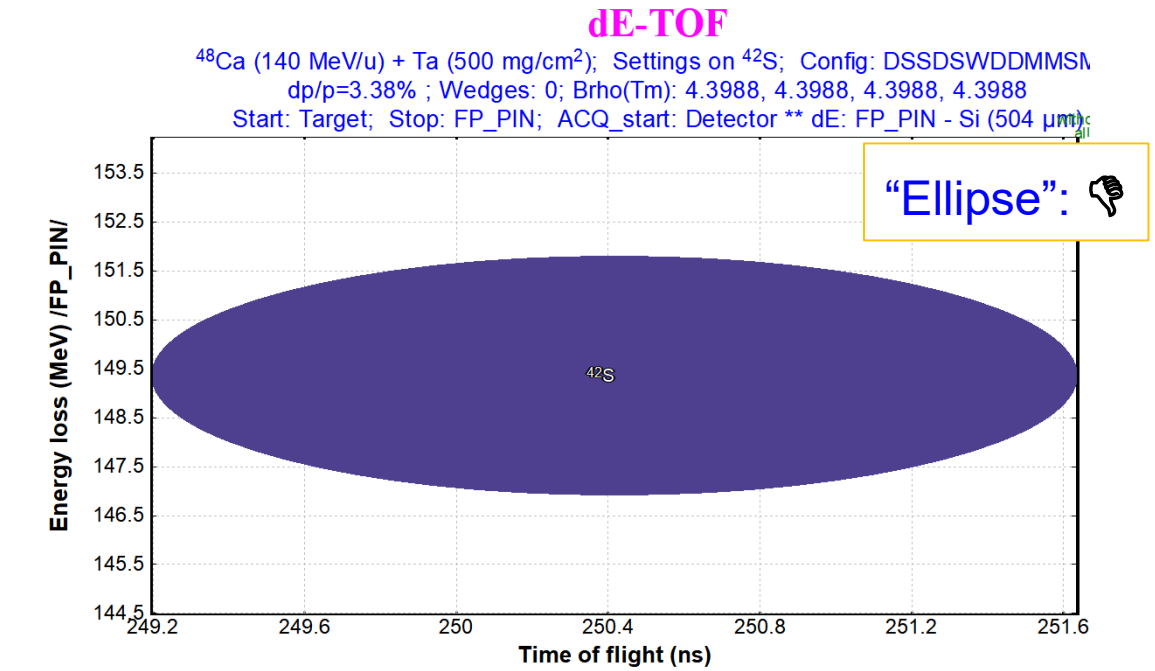
Distribution4:
Internal D4 transformation

Just after the Finger block

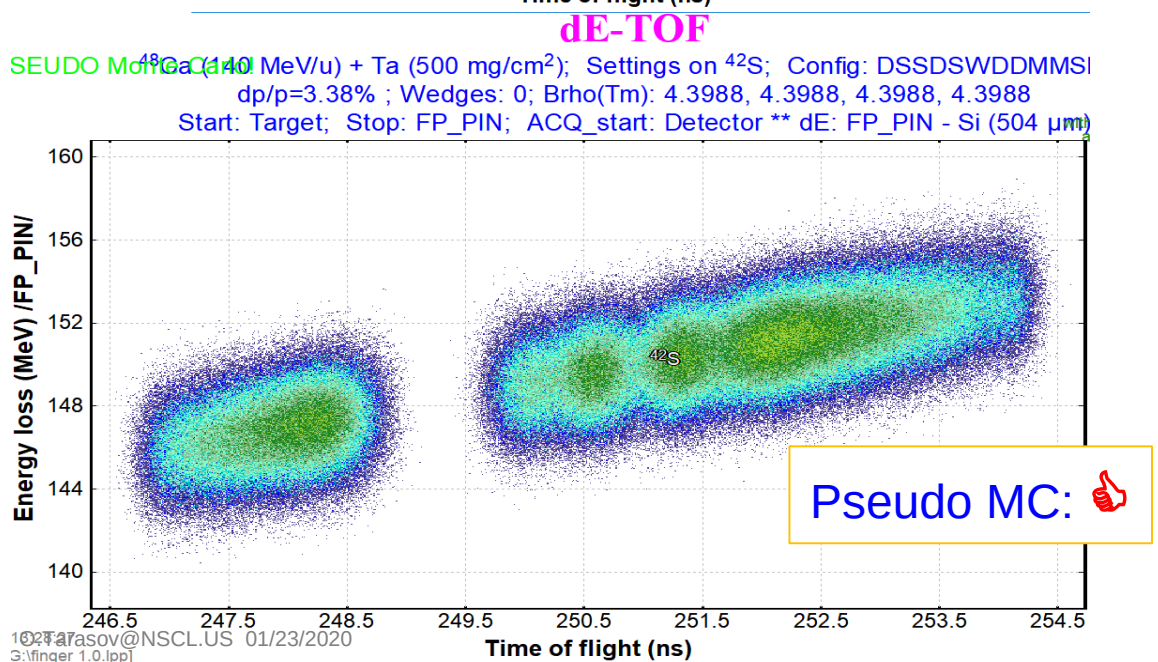
Monte Carlo:
Transmission calculations



Finger block selection : 2D-plot

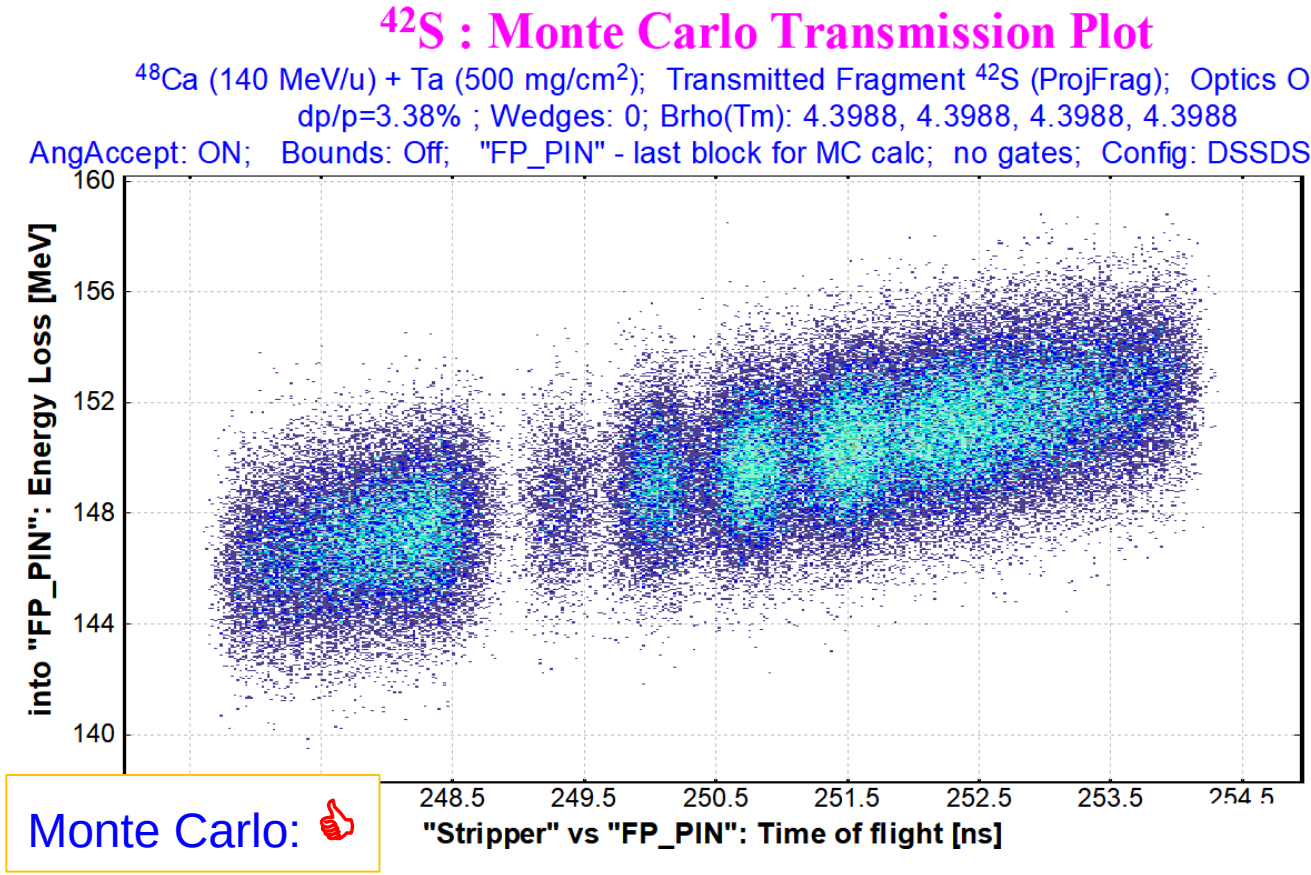


"Ellipse": 👎



Pseudo MC: 👍

ToF : target-FP



Monte Carlo: 👍

Finger block next steps

- Make benchmarks with higher-order optics
- Primary beam suppression (perform analysis effects of “Moyal straggling” and Coulomb scattering tails)
- Determinate Suppression and diffuseness values comparing to MC high order analysis

Correction for transmission calculations in the case of zero-length blocks

v.12.1

42S Beta- decay (Z=16, N=26)

Q1(D1) Reaction		16 ProjFrag
Ion Production Rate	(pps)	2.56e+2
Total ion transmission	(%)	11.677
Total: All reactions	(pps)	2.56e+2
X-Section in target	(mb)	1.06e-1
Target	(%)	98.3
Unreacted in material	(%)	98.3
Unstopped in material	(%)	100
D1	(%)	100
I1_slits	(%)	16.91
X space transmission	(%)	53.43
Y space transmission	(%)	31.65
I2_slits	(%)	70.24
X space transmission	(%)	80.02
Y space transmission	(%)	87.78

Should be 100%

Two identical slits

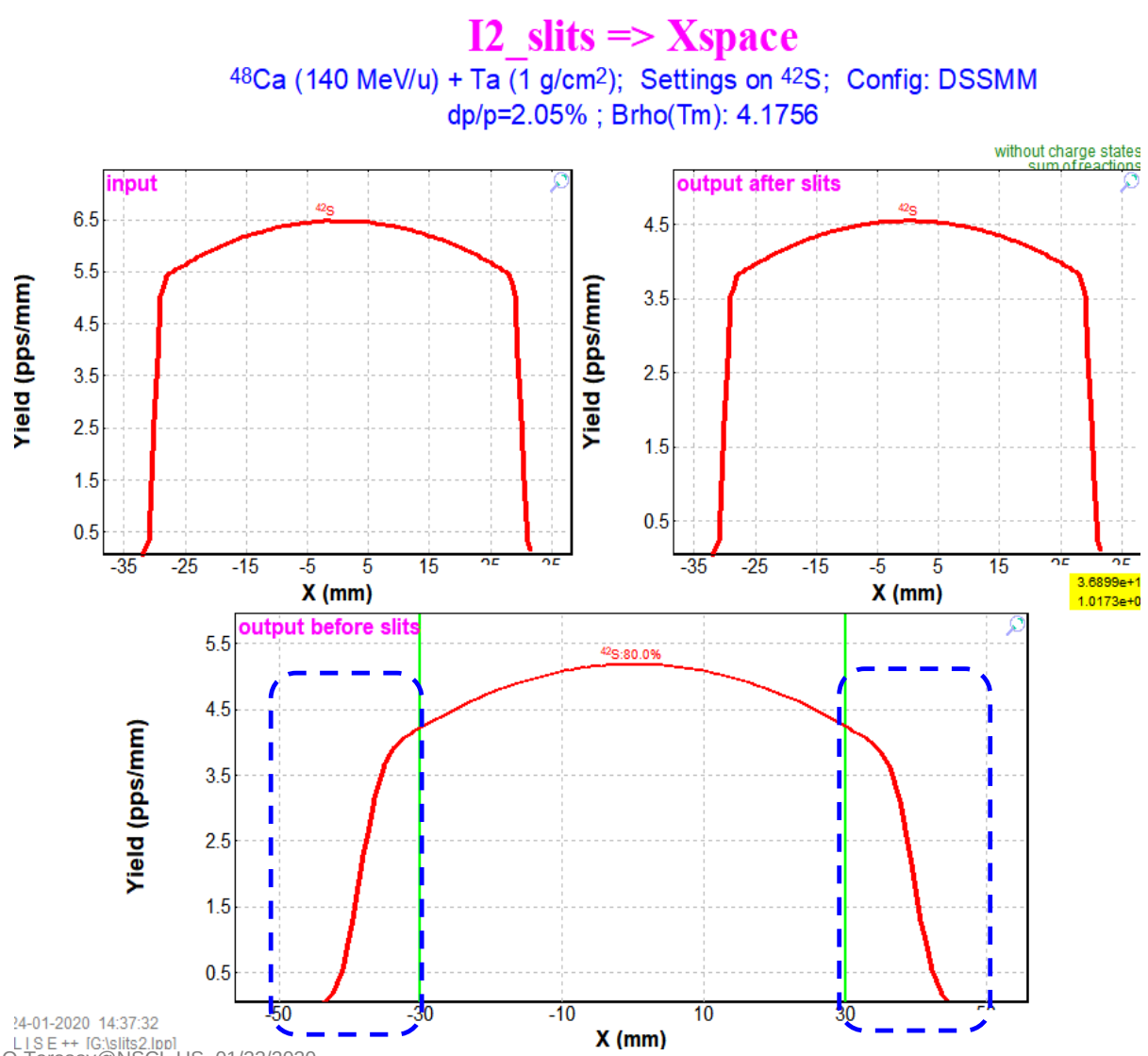
Fixed at v.13.4

42S Beta- decay (Z=16, N=26)

Q1(D1) Reaction		16 ProjFrag
Ion Production Rate	(pps)	3.59e+2
Total ion transmission	(%)	16.351
Total: All reactions	(pps)	3.59e+2
X-Section in target	(mb)	1.06e-1
Target	(%)	98.3
Unreacted in material	(%)	98.3
Unstopped in material	(%)	100
D1	(%)	100
I1_slits	(%)	16.91
X space transmission	(%)	53.43
Y space transmission	(%)	31.65
I2_slits	(%)	98.35
X space transmission	(%)	99.21
Y space transmission	(%)	99.14
FP_PIN	(%)	99.45
Unreacted in material	(%)	99.45

Correction for transmission calculations in the case of zero-length blocks

v.12.1



O.Tarasov@NSCL.US 01/23/2020

v.13.4