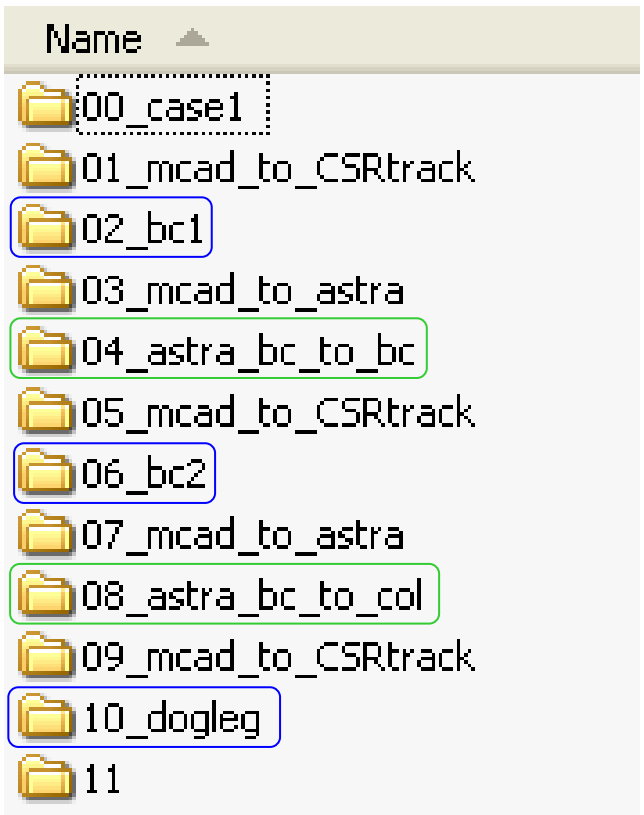
TTF2-s2e→dogleg→

ASTRA-Generator → see http://www.desy.de/xfel-beam/s2e/ttf2_v2.html

ASTRA → see http://www.desy.de/xfel-beam/s2e/ttf2_v2.html

= case 4ps gaussian laser, no 3.9 GHz cavity (E. Schneidmiller proposal)



convert to CSRtrack; add wake

CSRtrack (E_{ref} = 124.425 MeV, r_{56} = 17.29 cm)

convert to ASTRA

ASTRA

convert to CSRtrack; add wake

CSRtrack (Eref = 380 MeV, r56 = 10.0 cm)

convert to ASTRA

ASTRA

convert to CSRtrack; add wake

CSRtrack (Eref =, r56 = 0.47 mm)

European XFEL Beam Dynamics Group - Start-to-End Simulations: TTF2 S2E Files - Microsoft Internet Explorer

File Edit View Favorites Tools Help

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Address http://www.desy.de/xfel-beam/s2e/ttf2_v2.html

Case 4 ps gaussian laser, no 3.9 GHz cavity
(E. Schneidmiller proposal)

Schematic Case 1: No CSR, No Wakefields, Injector with ASTRA, Linac with ELEGANT

Injector - Linac - Undulator

Injector (up to Z=13.59)

- **Description of the Elements**
- **Input field maps for ASTRA: aperture, solenoids, rf gun, 9-cell structure, half-module, 3.9GHz cavity**
- **Input files for Poisson and Superfish : solenoids, rf gun, 9-cell structure,**

ASTRA Files	Case 1	Case 2
Input File (ASTRA)	ttf2.in	ttf2.in
Input File (Generator)	laser-100k-500pc.in	laser-100k-500pc.in
Input Laser Distribution	laser-100k-500pc.ini laserttf2.pdf	laser-100k-500pc.ini

ASTRA Injector Simulations Output Files

the particles

	Case 1	Case 2
Dump (at Z=13.59m)	ASTRA file	ASTRA file
1000 Slices	SDDS file	

Done

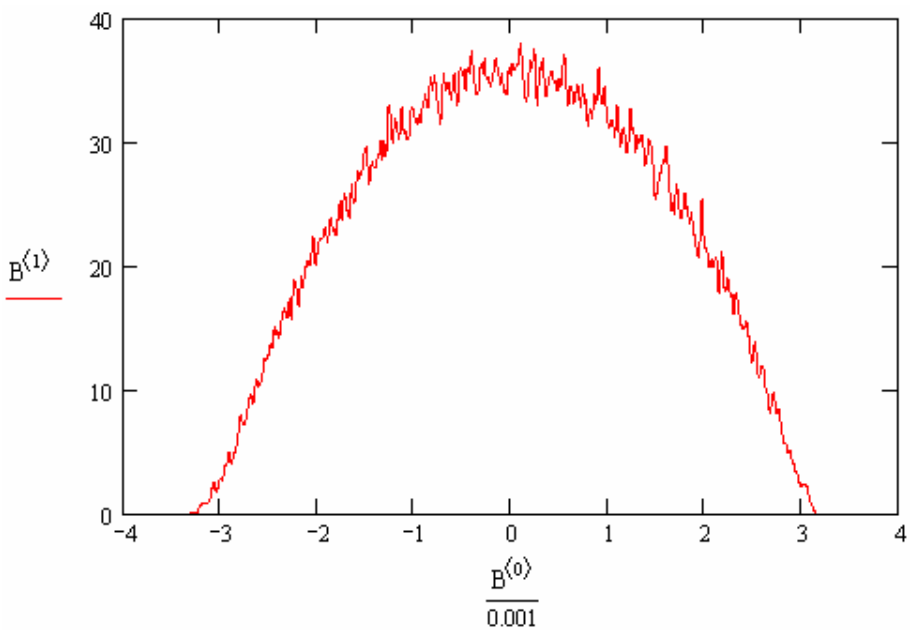
Local intranet

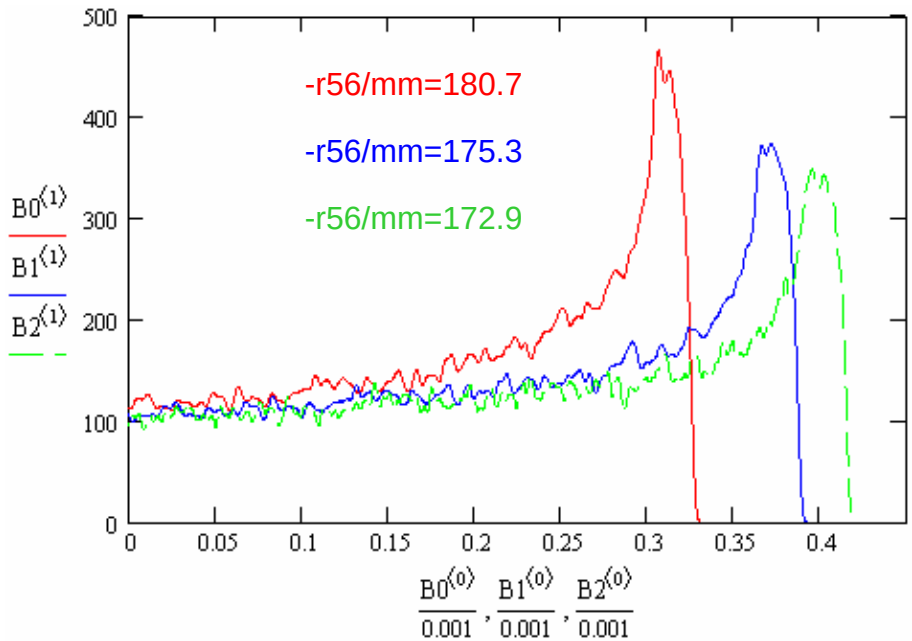
r56 of 1st BC (no CSR)

from Elegant file:

reference momentum = 124.425 MeV/c

1st BC: phi = pi/10 → r56 = -0.180717m



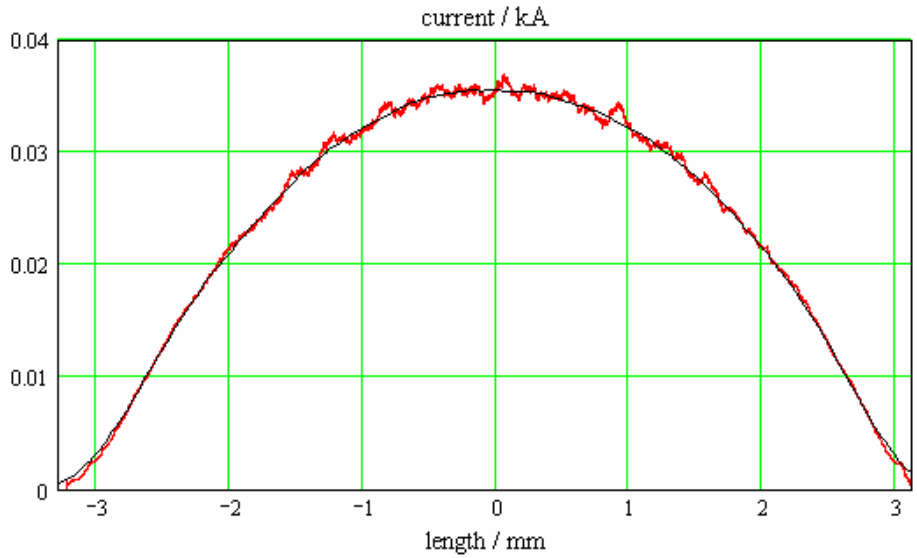


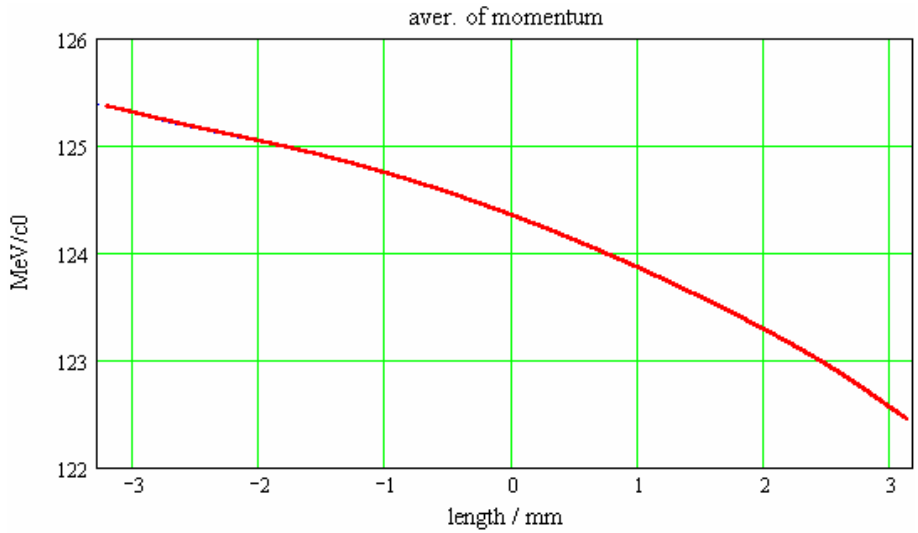
the following simualtions:

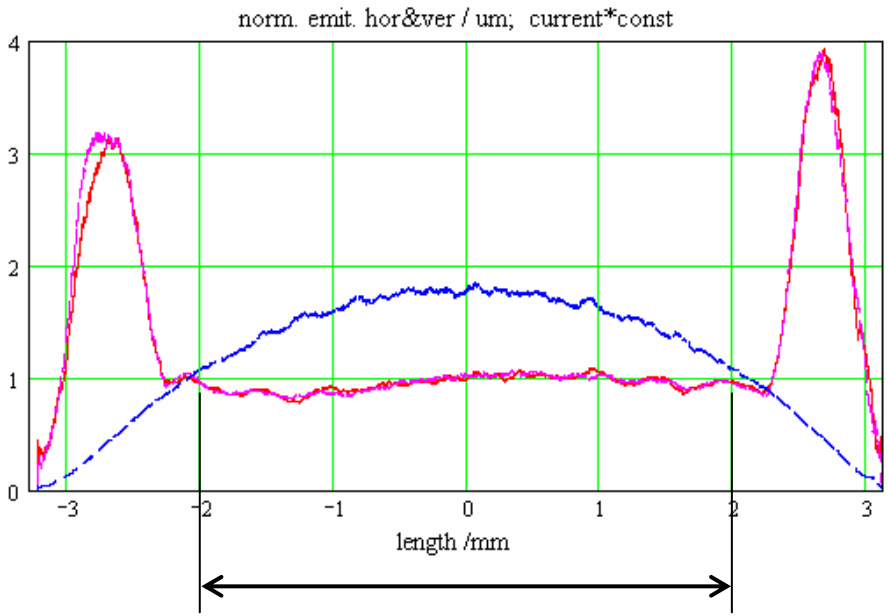
reference momentum = 124.425 MeV/c

r56 := -0.172899m

entrance 1st BC

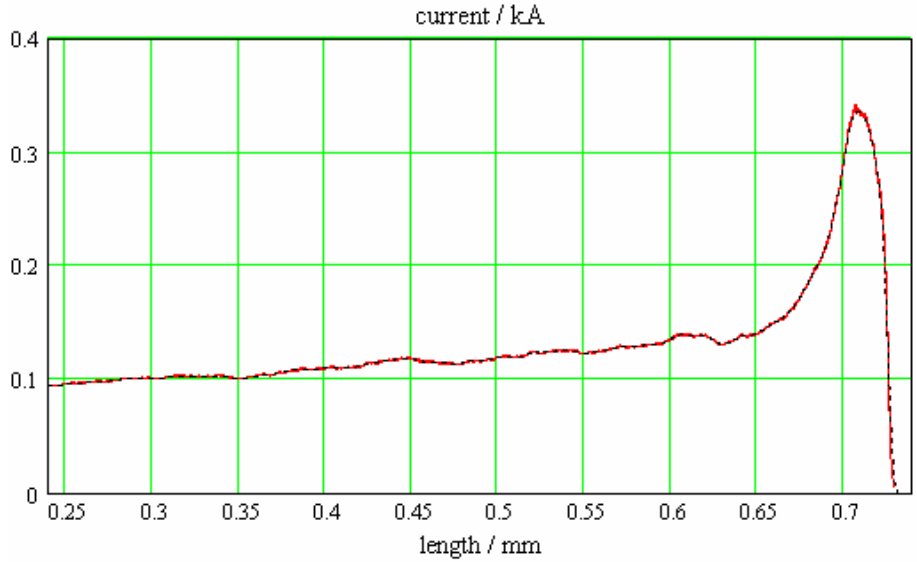


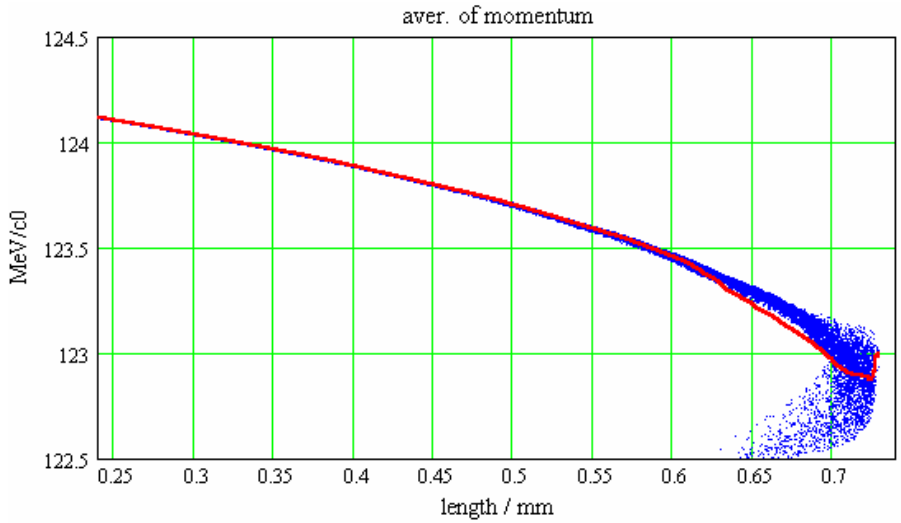


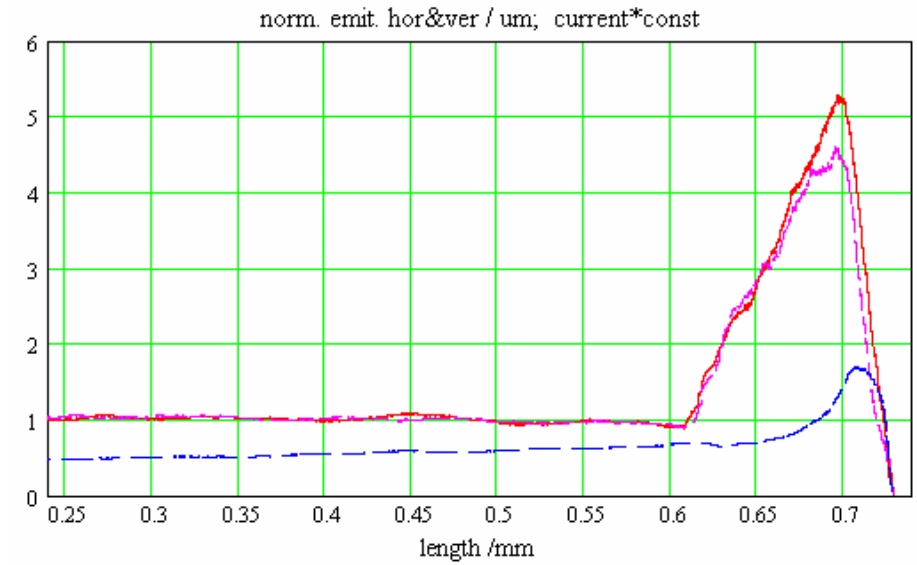


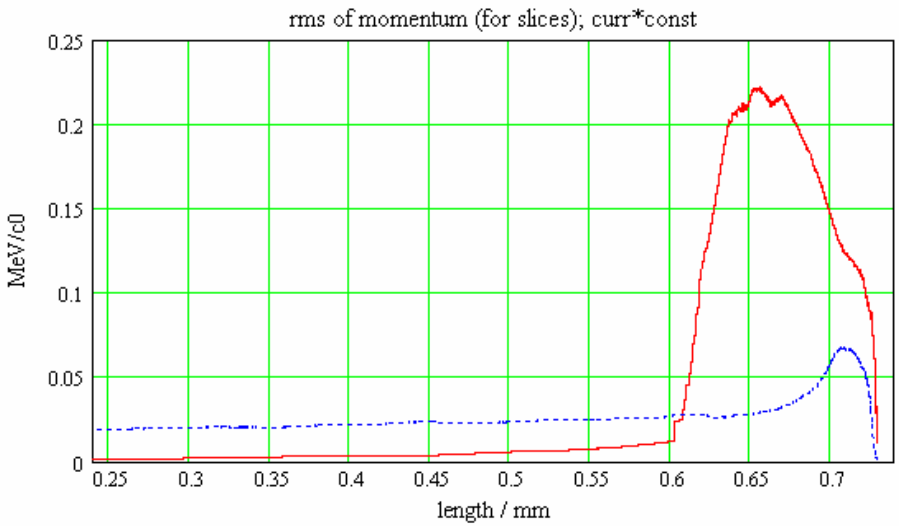
matched to nominal optics

after 1st BC (r56=-0.1729m)

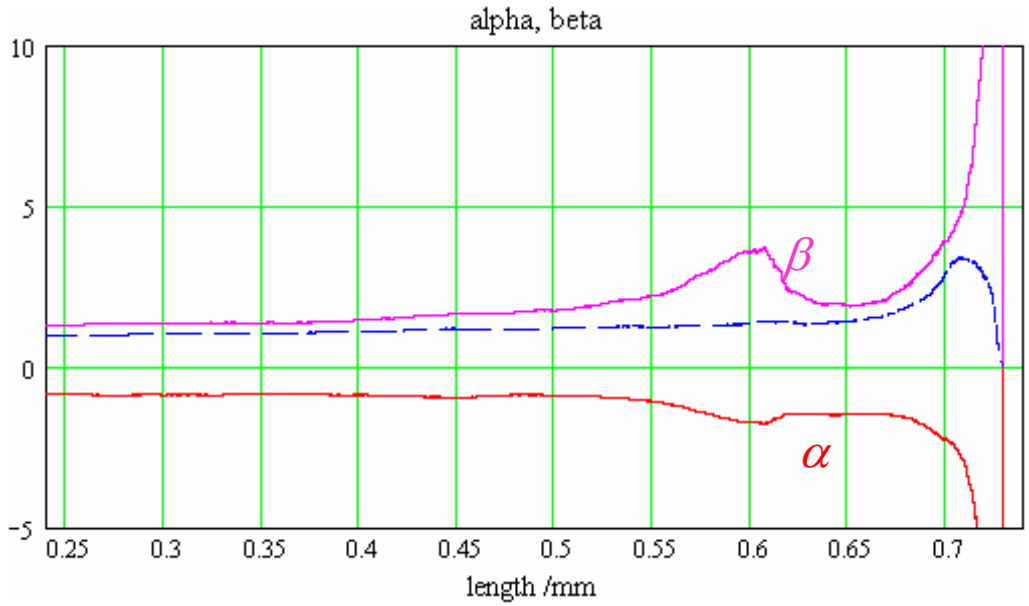






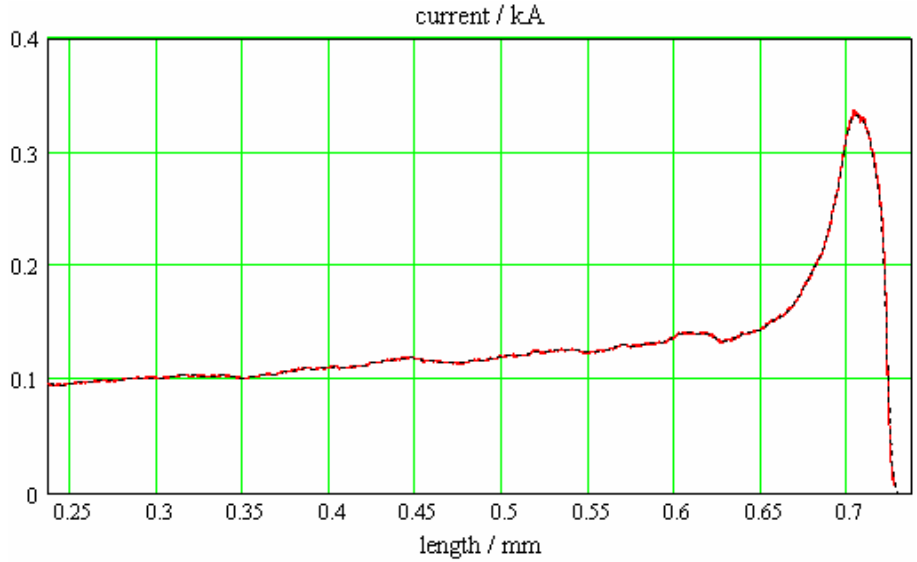


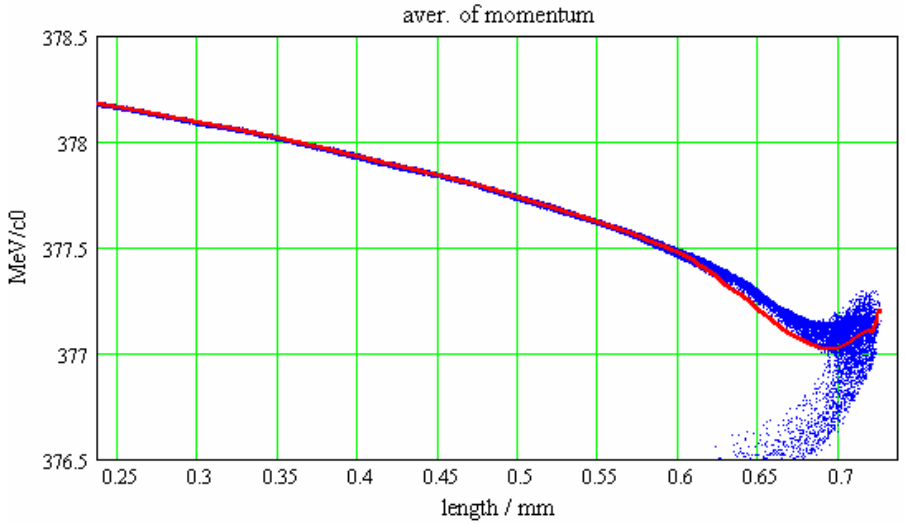
after 1st BC (r56=-0.1729m)

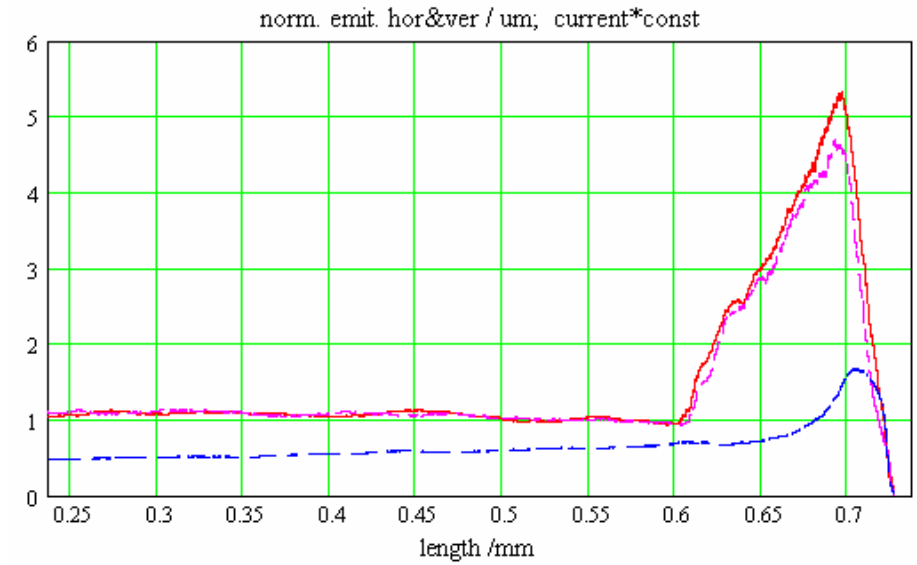


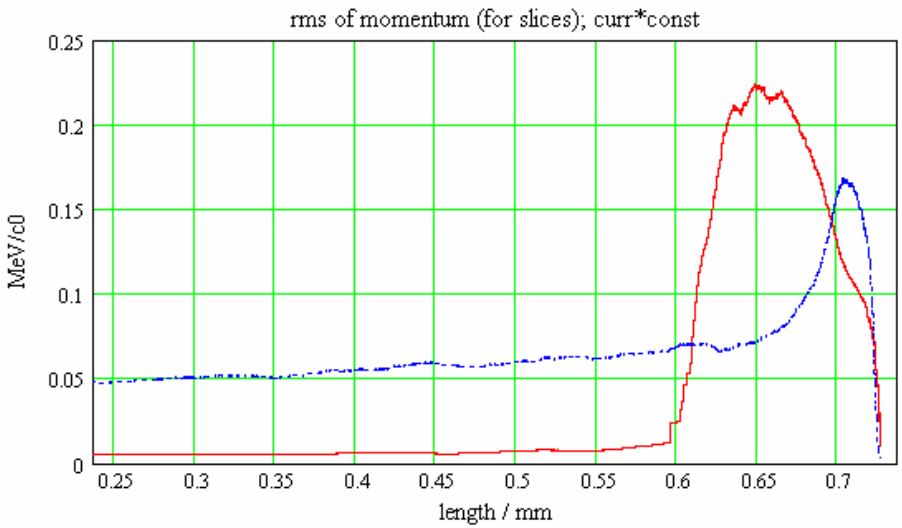
Nina; D4BC2 + 1m drift
alpha=-0.17 -1.3
beta=0.93m 2.4
(ttf2-bc2-bc3-op1)

ASTRA to 2nd BC: course mesh

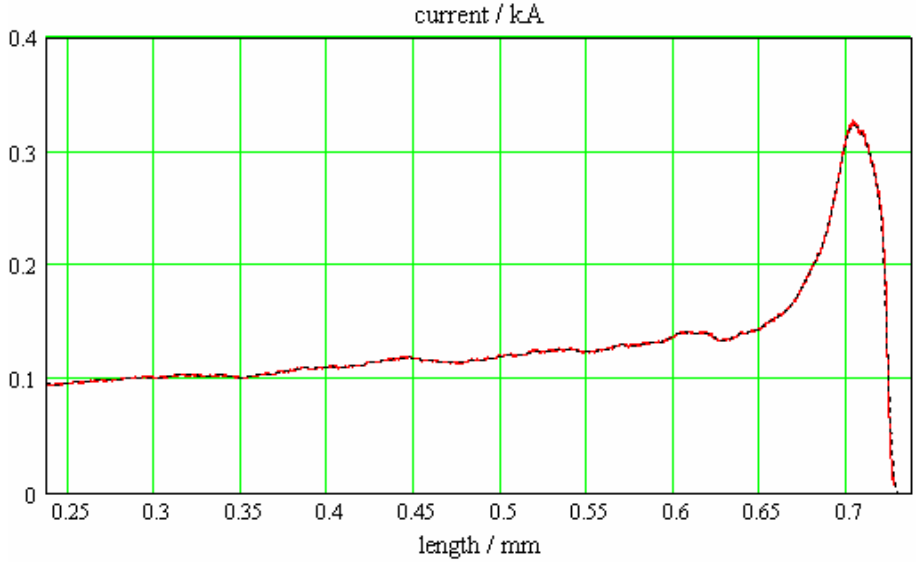


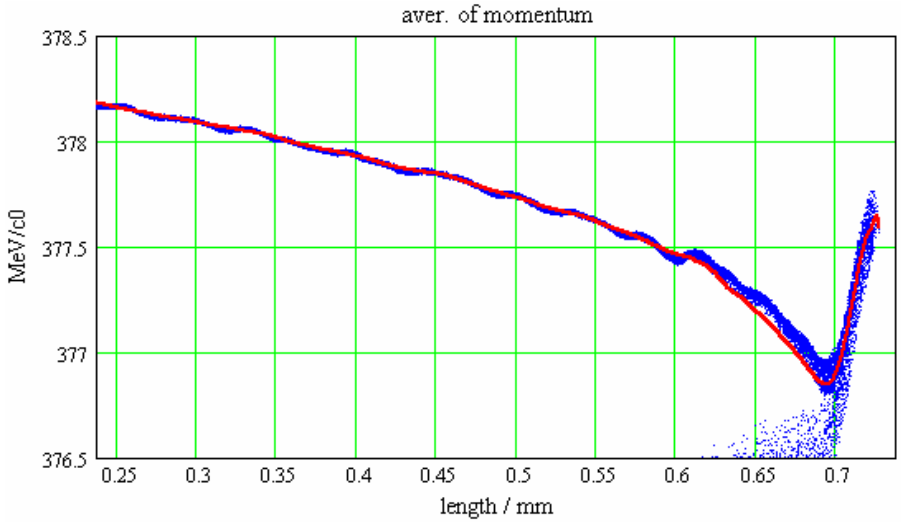


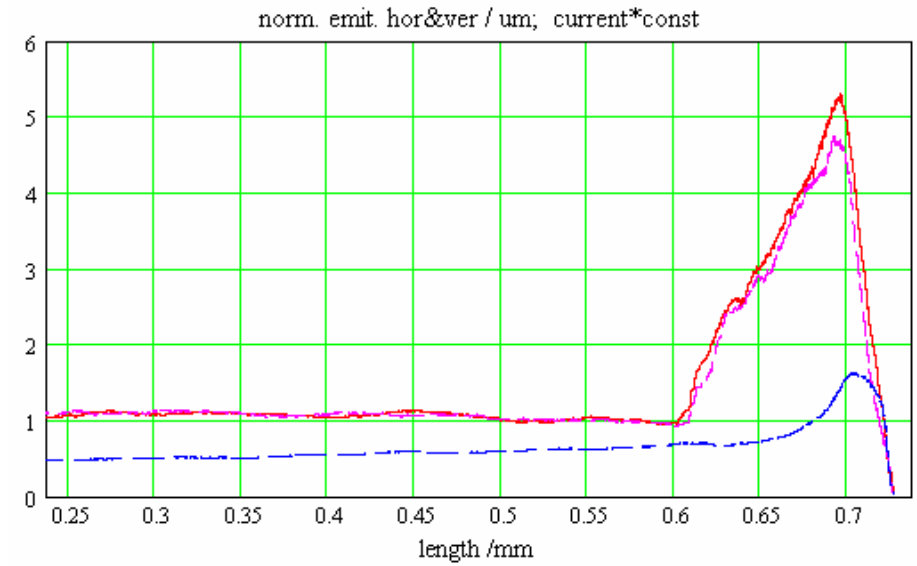


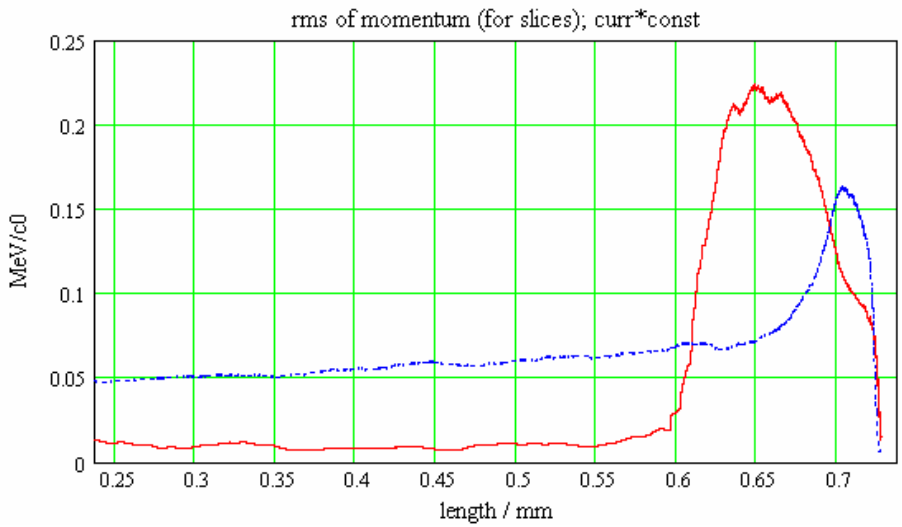


ASTRA to 2nd BC: fine mesh



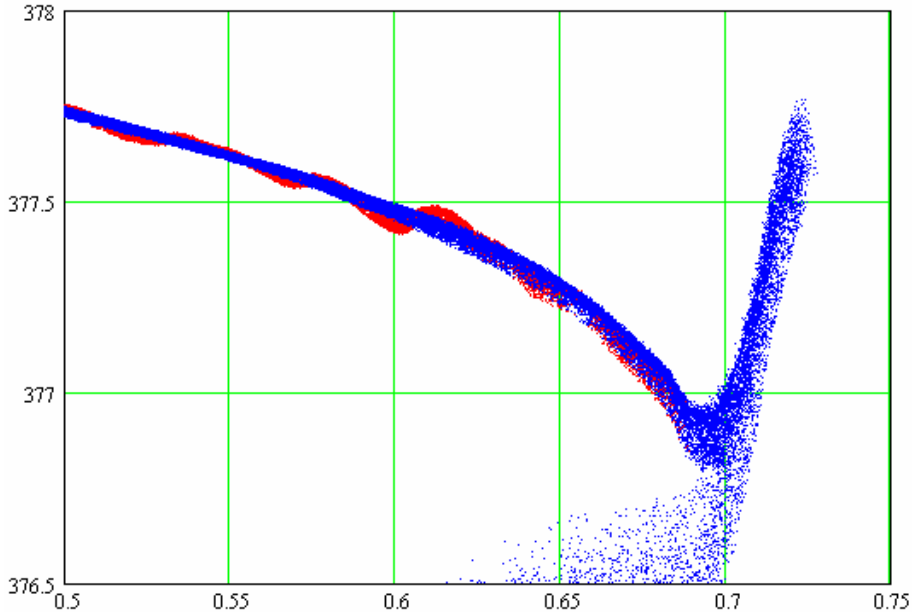




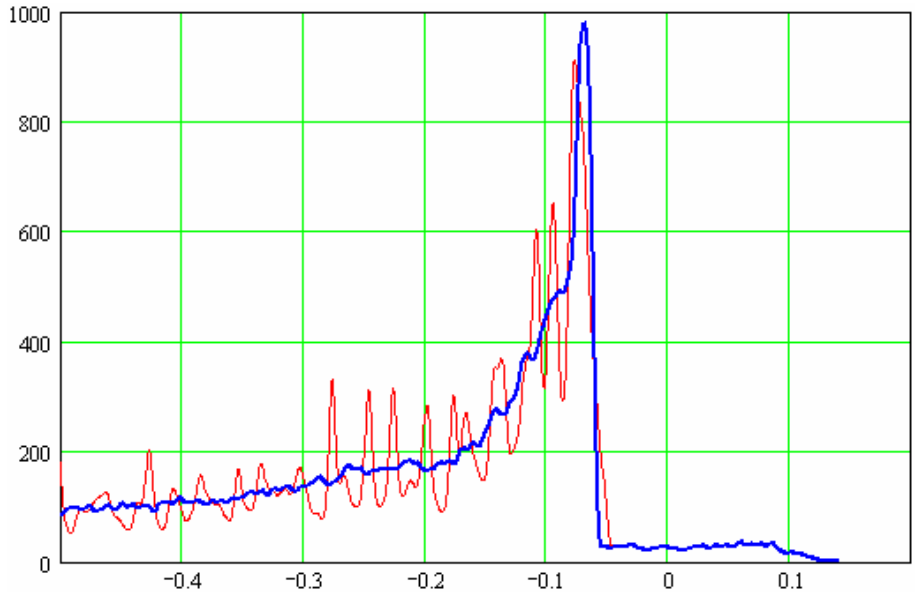


a mixture

before 2nd BC
long. phasespace



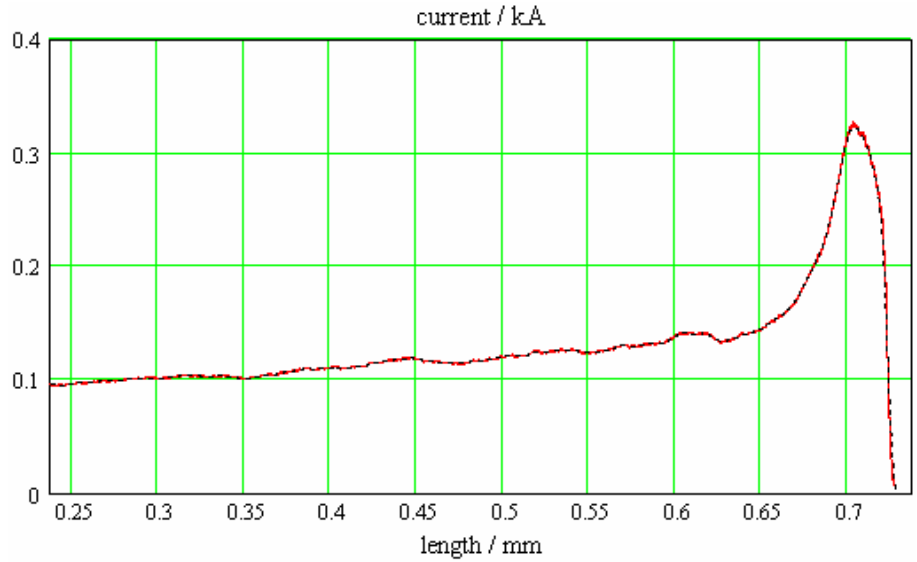
after 2nd BC
current

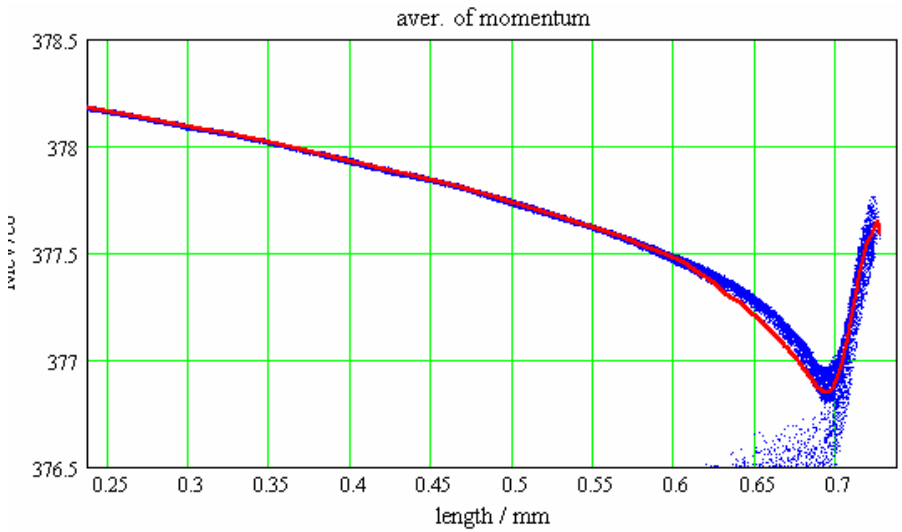


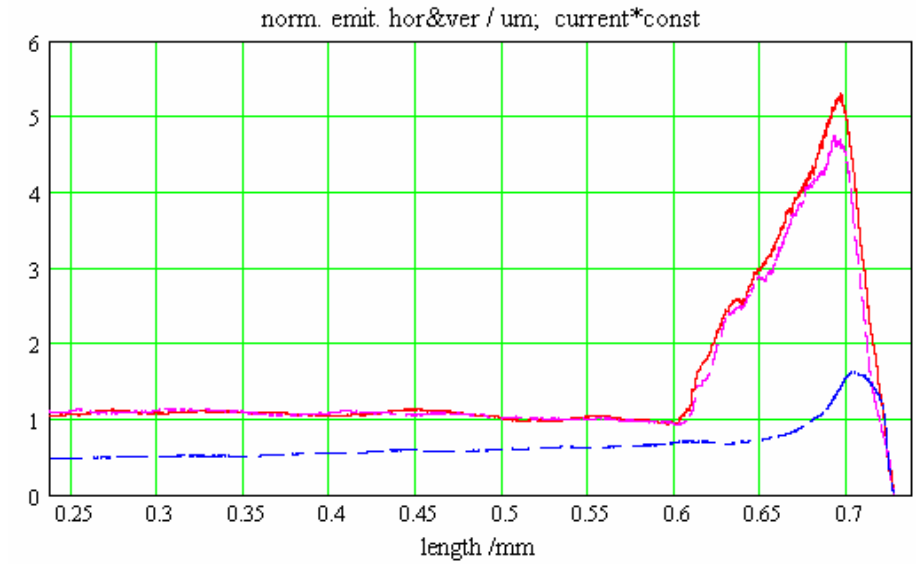
fine mesh
“mixture” course-fine mesh

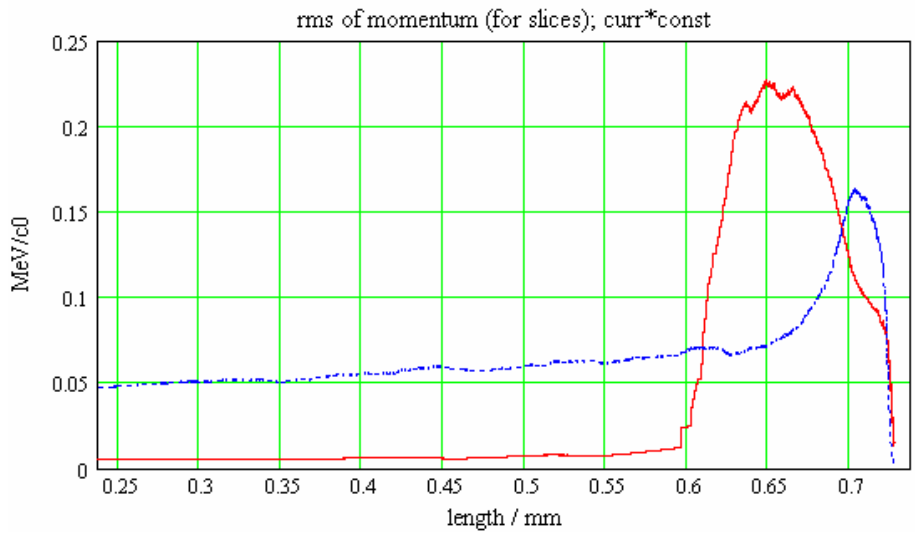
better method: ASTRA merge option , Klaus Floettmann 21. October

entrance 2nd BC (a mixture)

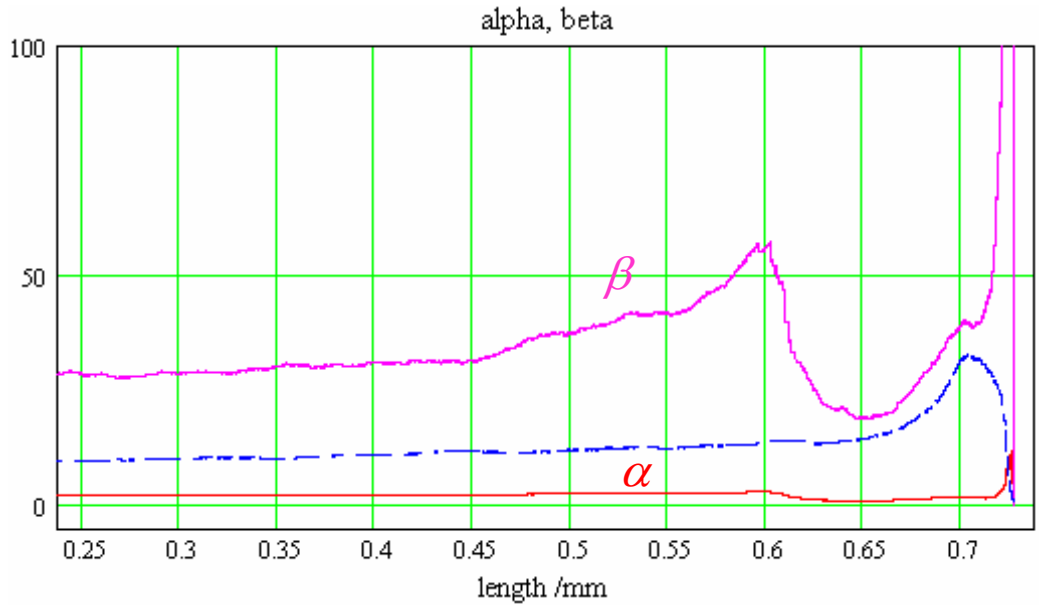






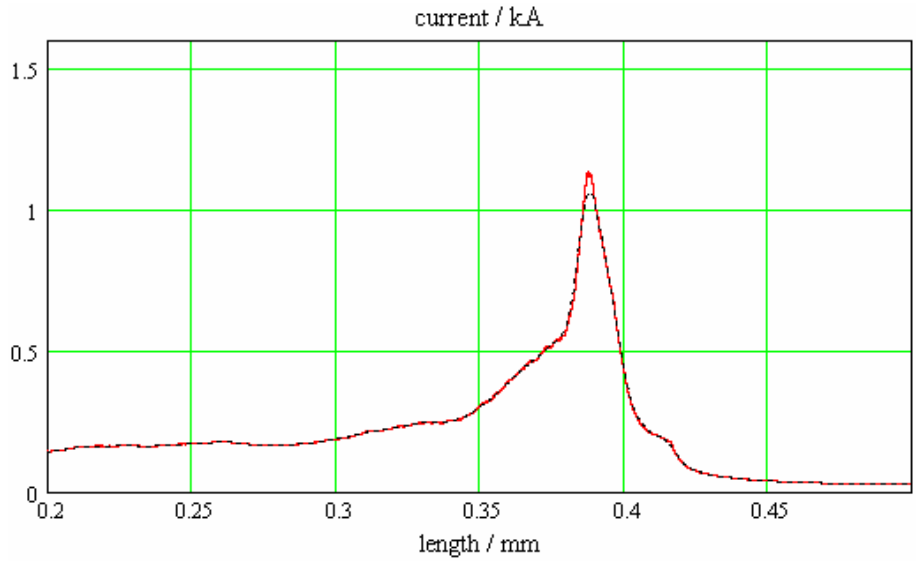


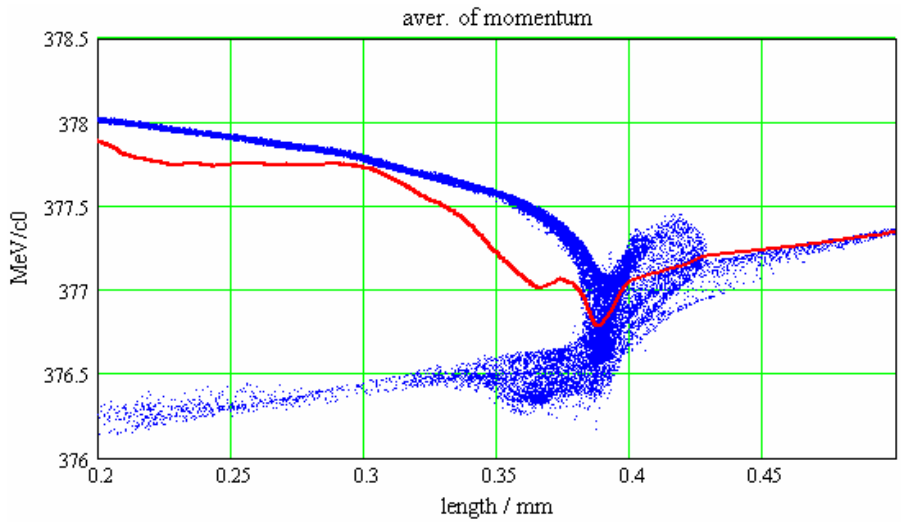
entrance 2nd BC (a mixture)

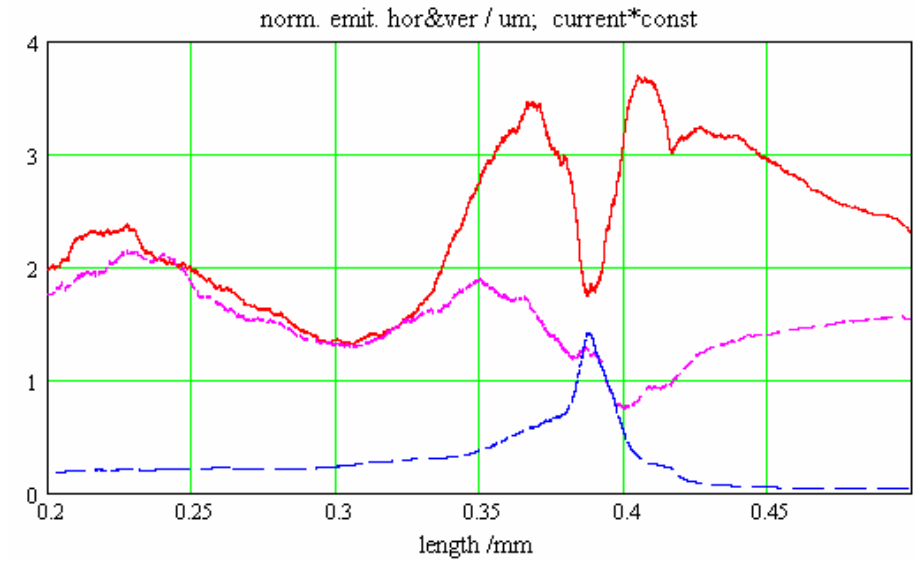


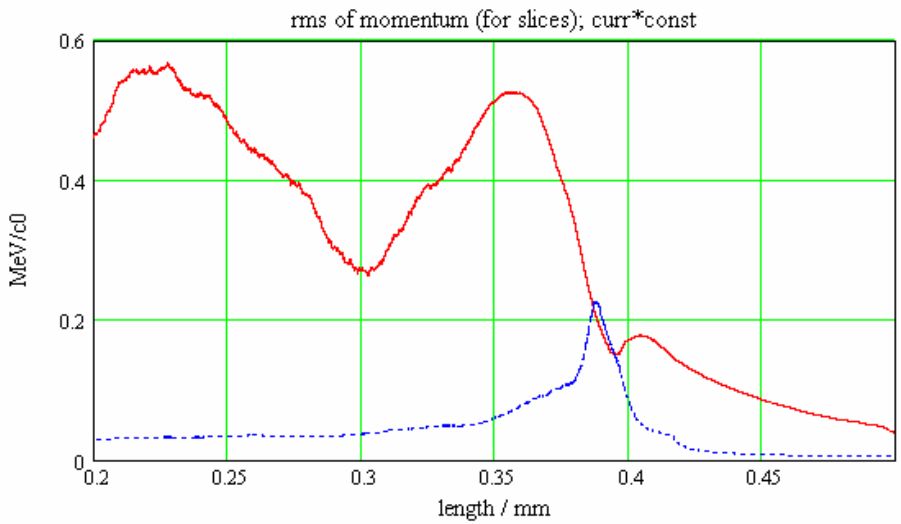
Nina; D00982
alpha=2.0
beta=30.6m
(ttf2-bc2-bc3-op1)

after 2nd BC (r56=-0.099369m)

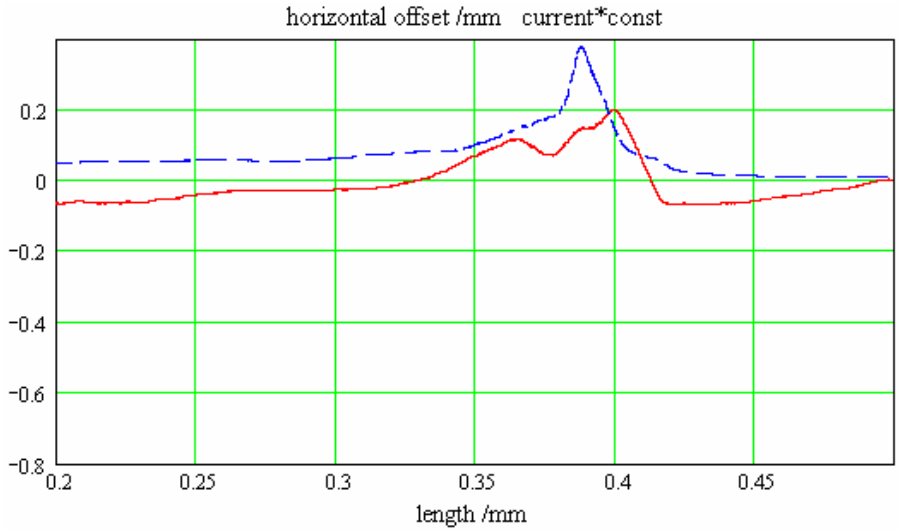


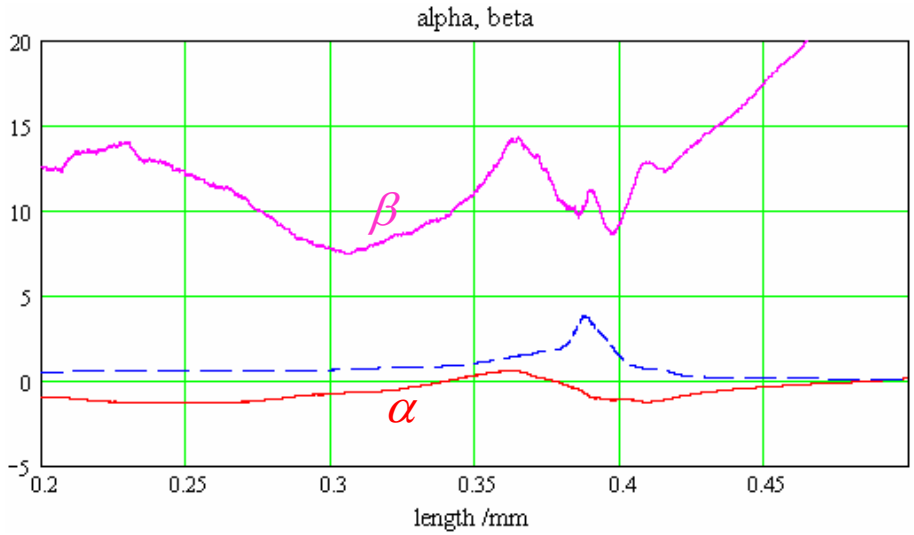


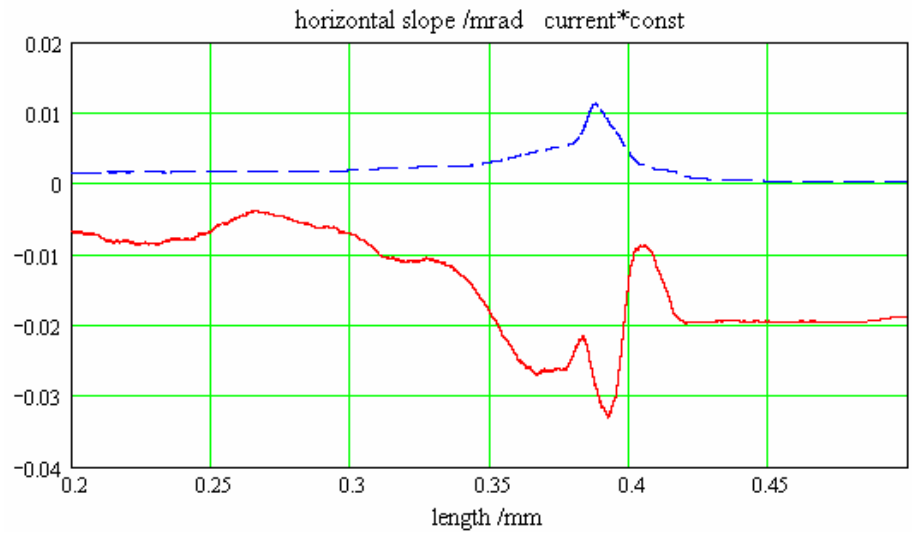




after 2nd BC (r56=-0.099369m)





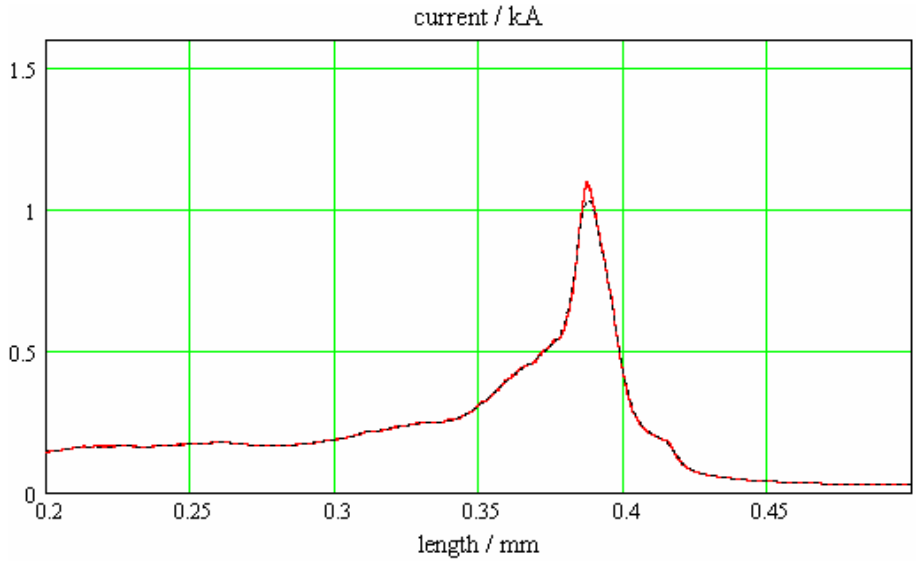


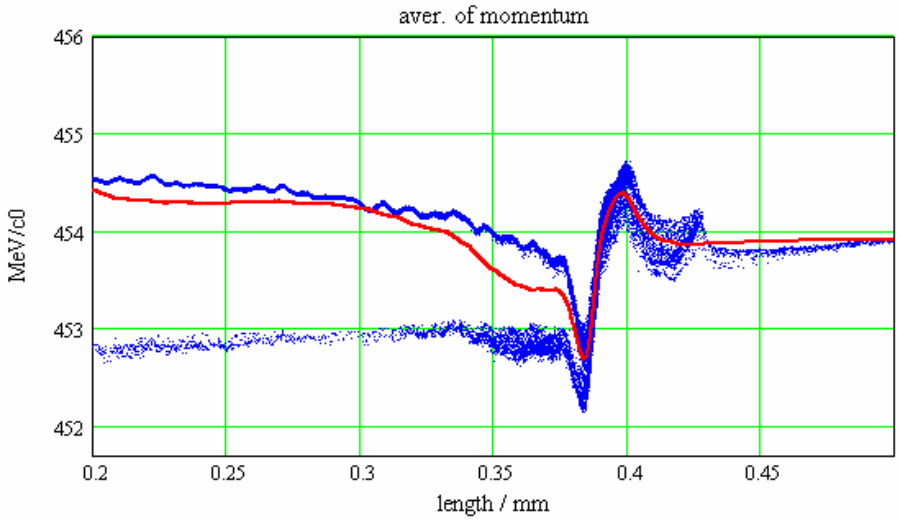
Nina; D14BC3 + 1m drift
alpha=-0.29 -0.45
beta =6.7m 7.4
(ttf2-bc2-bc3-op1)

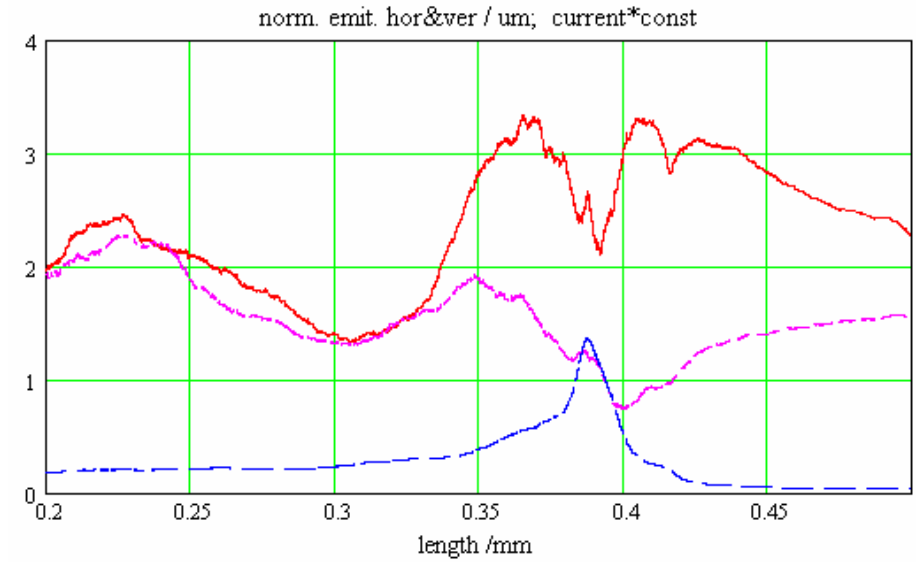
good agreement with pert. Theory
→ essentially 1st order effects

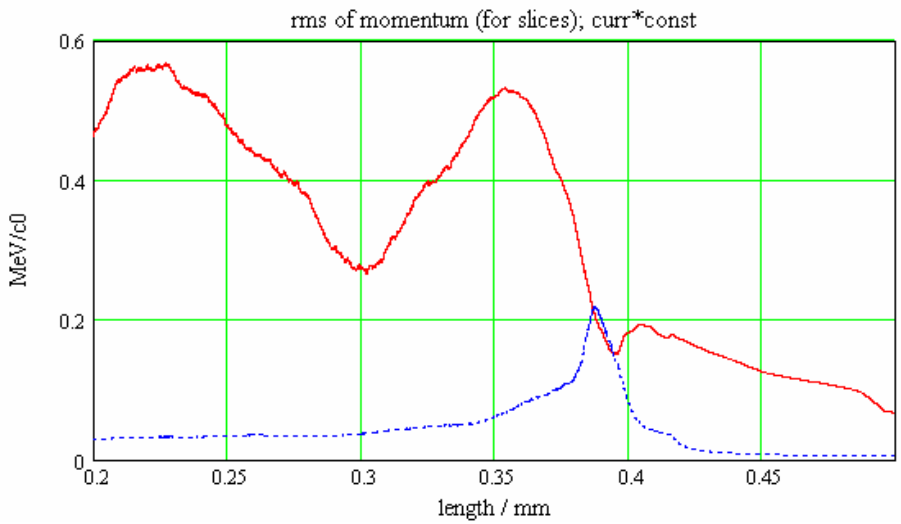
centroid offsets extracted for further calculations !

at 155m, 900 z-meshlines



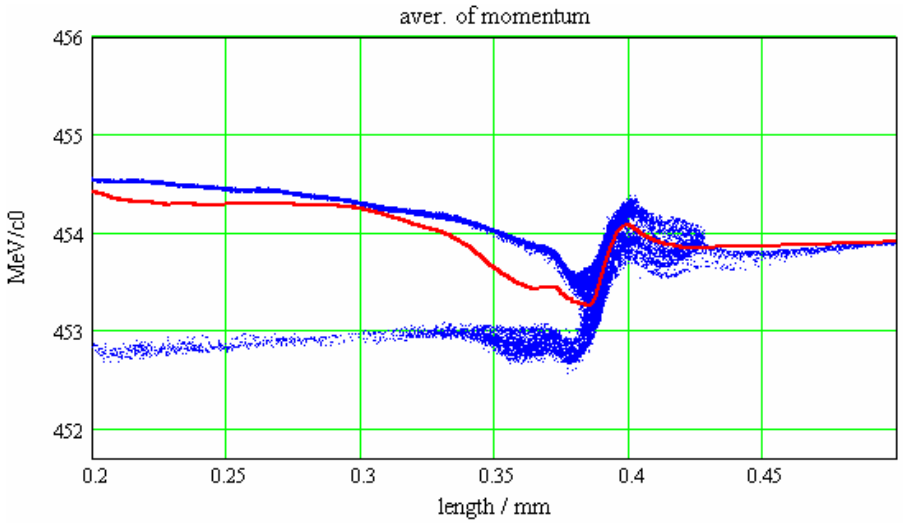




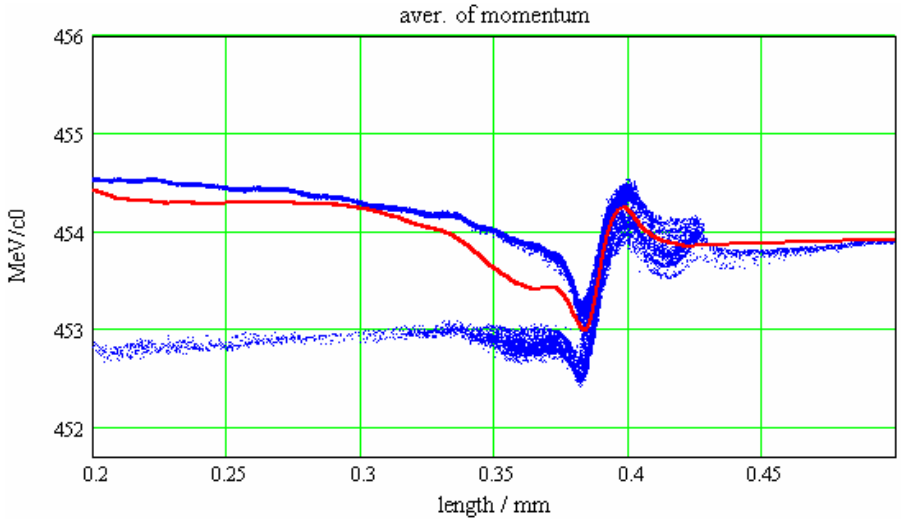


careful convergence test still missing, but:

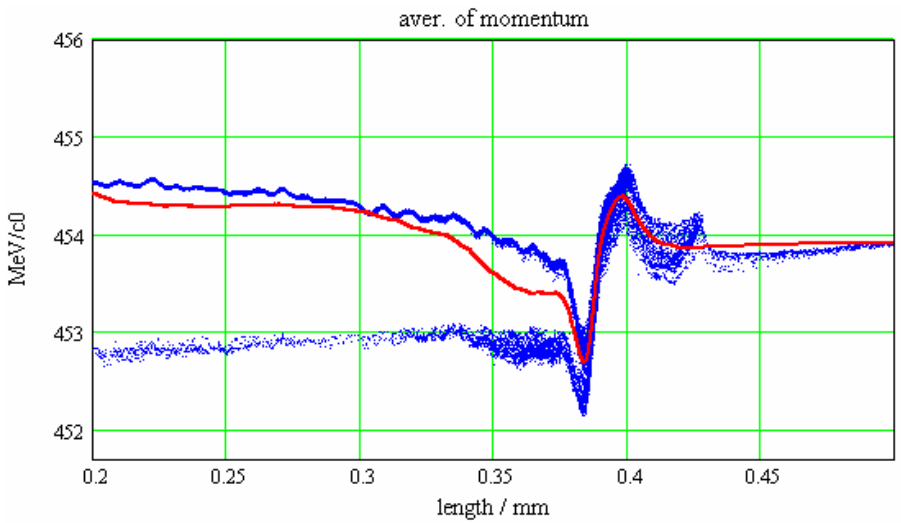
at 155m, 300 z-meshlines



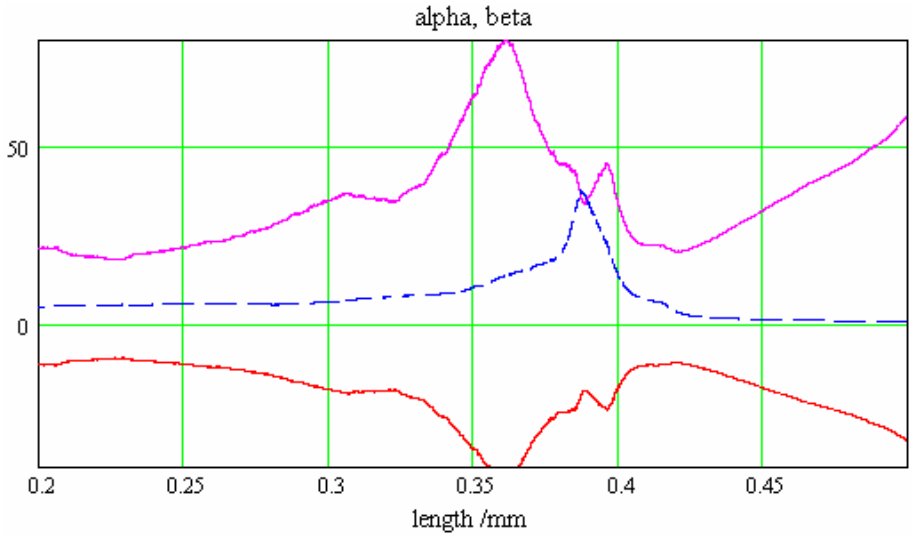
at 155m, 500 z-meshlines



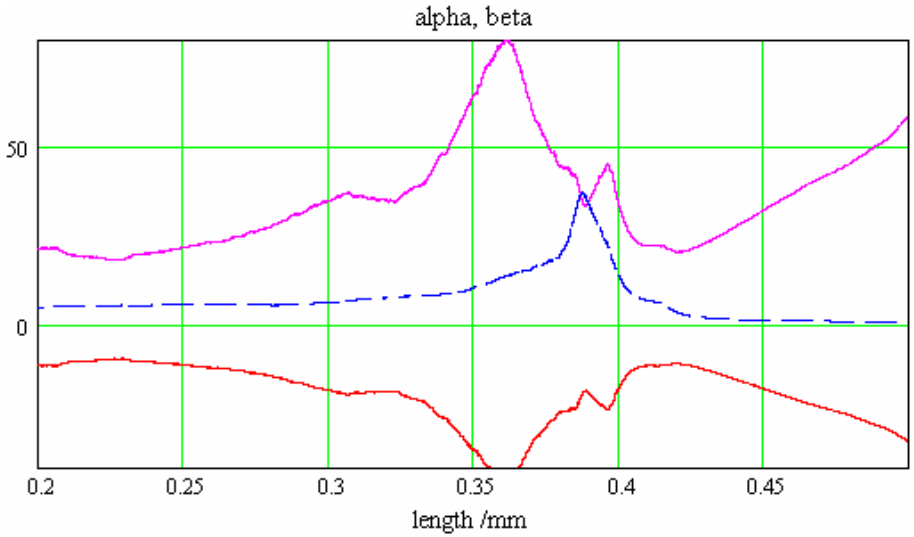
at 155m, 900 z-meshlines



at 155m, 300 z-meshlines



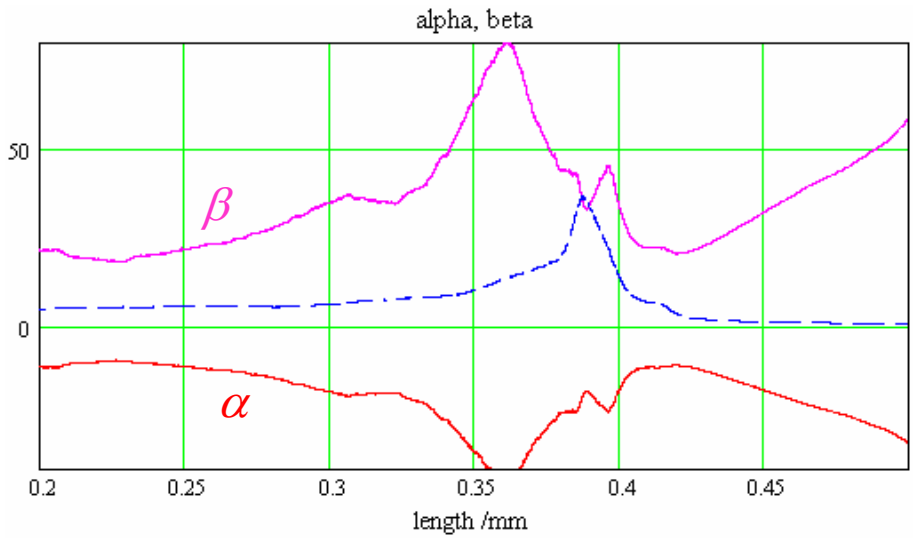
at 155m, 500 z-meshlines



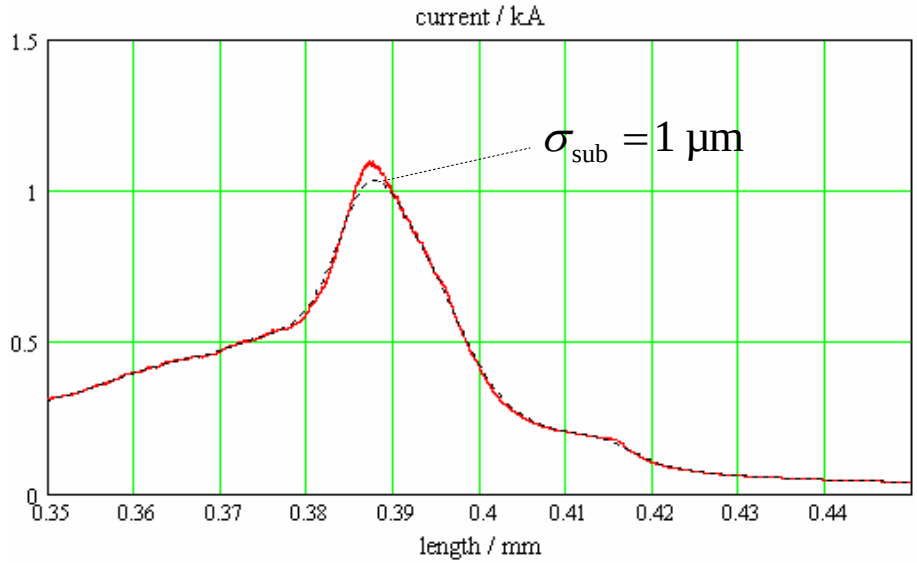
Nina; ??? (→ 141.505m)
alpha=???
beta =???m
(ttf2-bc2-bc3-op1)

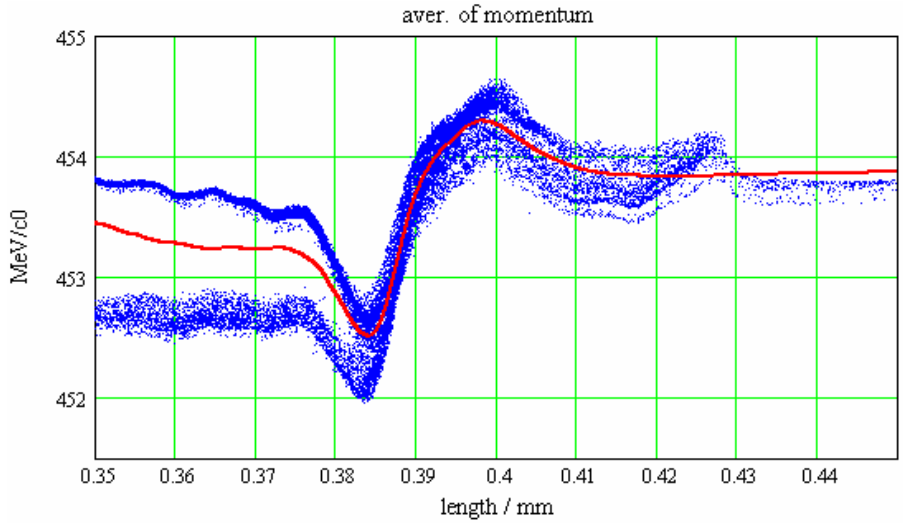
wrong optic in ASTRA file ???
→ matching to “design” values
at entrance of dogleg

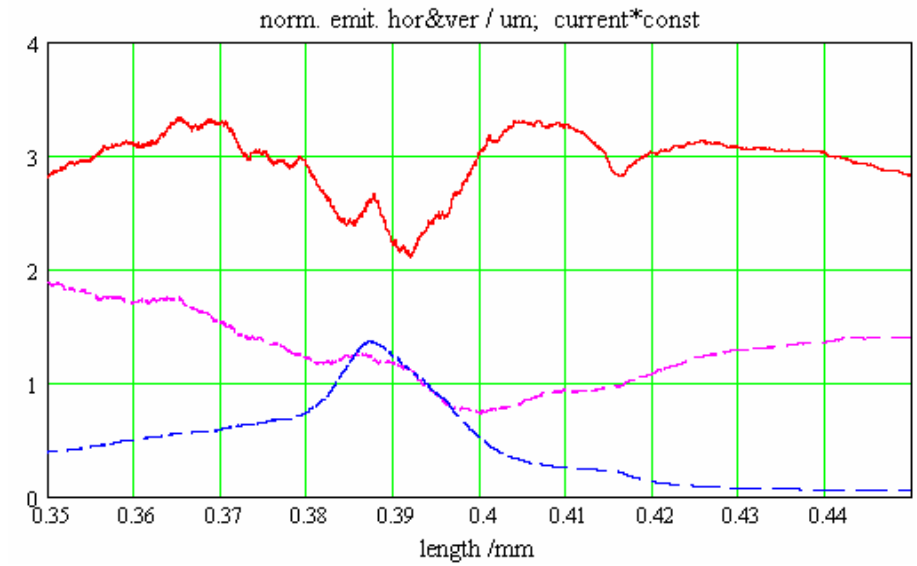
at 155m, 900 z-meshlines

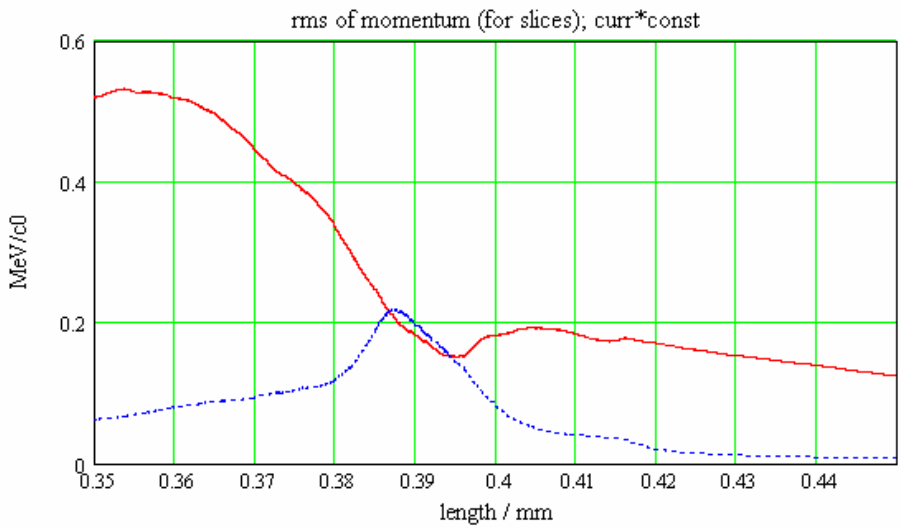


entrance of dogleg: 900 z-meshlines, + Wakes (2 x module+LOLA) + matching



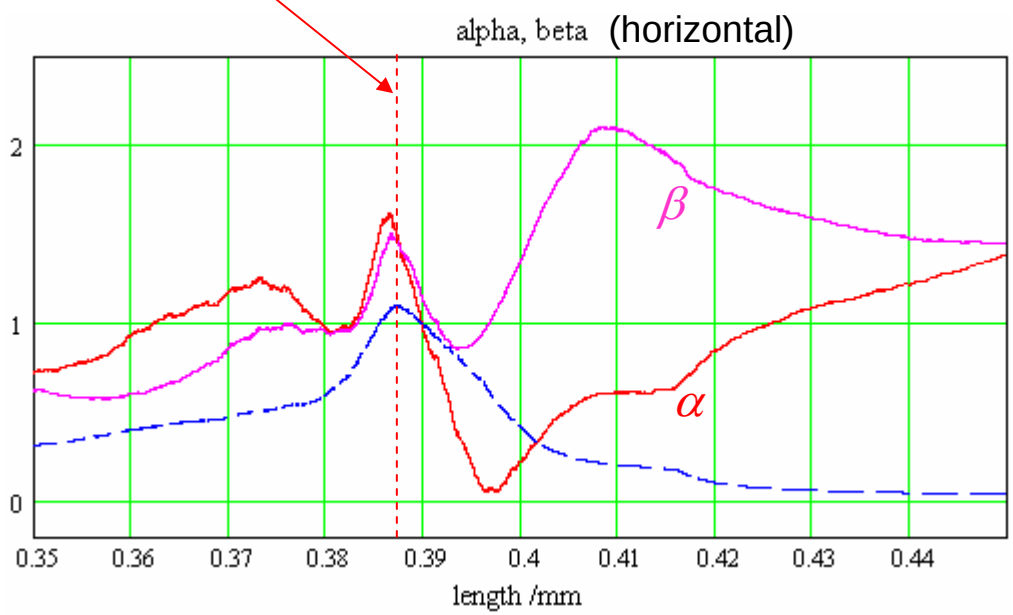




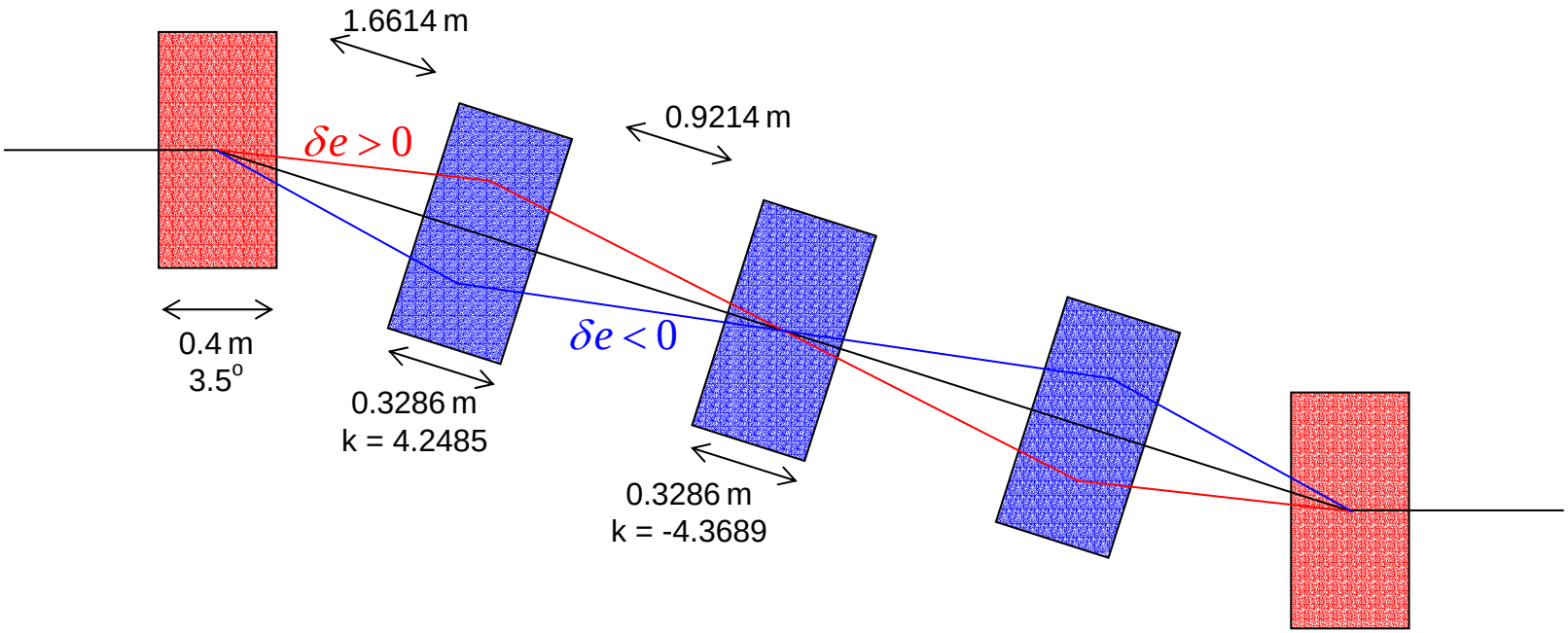


ELEMENT SEQUENCE				HORIZONTAL							VERTICAL						
pos. no.	element name	occ. no.	dist [m]	betax [m]	alfax [1]	mux [2pi]	x(co) [mm]	px(co) [.001]	Dx [m]	Dpx [1]	betay [m]	alfay [1]	muy [2pi]	y(co) [mm]	py(co) [.001]	Dy [m]	Dpy [1]
604	D0100A	18	138.529	2.695	2.204	2.208	0.0000	0.000	0.000	0.000	22.586	8.673	2.285	0.0000	0.000	0.000	0.000
end	Q9TCOL00	1	138.529	2.695	2.204	2.208	0.0000	0.000	0.000	0.000	22.586	8.673	2.285	0.0000	0.000	0.000	0.000
begin	DOGLEG	1	138.884	1.404	1.432	2.237	0.0000	0.000	0.000	0.000	16.853	7.475	2.288	0.0000	0.000	0.000	0.000
607	D1ECOL	1	139.284	0.603	0.561	2.308	0.0000	0.000	0.012	0.061	11.410	6.231	2.292	0.0000	0.000	0.000	0.000
618	D0075B	1	140.946	4.763	-3.064	2.590	0.0000	0.000	0.114	0.061	0.340	0.431	2.452	0.0000	0.000	0.000	0.000
619	Q3ECOL	1	141.274	4.546	3.620	2.600	0.0000	0.000	0.107	-0.099	0.581	-1.274	2.599	0.0000	0.000	0.000	0.000
625	D0075B	3	142.196	0.509	0.761	2.704	0.0000	0.000	0.016	-0.099	6.762	-5.434	2.676	0.0000	0.000	0.000	0.000
626	Q4ECOL	1	142.524	0.507	-0.755	2.827	0.0000	0.000	-0.016	-0.099	7.008	4.807	2.683	0.0000	0.000	0.000	0.000
634	D0075B	5	143.446	4.527	-3.607	2.931	0.0000	0.000	-0.107	-0.099	1.071	1.638	2.738	0.0000	0.000	0.000	0.000
635	Q5ECOL	1	143.774	4.745	3.050	2.941	0.0000	0.000	-0.114	0.061	0.636	-0.120	2.808	0.0000	0.000	0.000	0.000
643	D0220	1	145.436	0.604	-0.558	3.222	0.0000	0.000	-0.012	0.061	5.437	-2.769	2.984	0.0000	0.000	0.000	0.000
644	D7ECOL	1	145.837	1.401	-1.425	3.293	0.0000	0.000	0.000	0.000	7.861	-3.336	2.994	0.0000	0.000	0.000	0.000

:! matching



dogleg (without sextupoles)

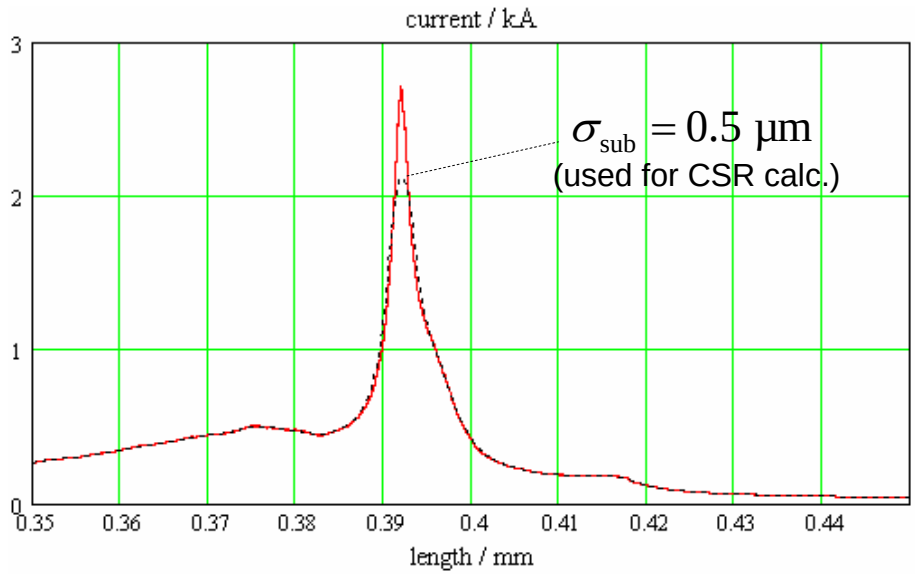


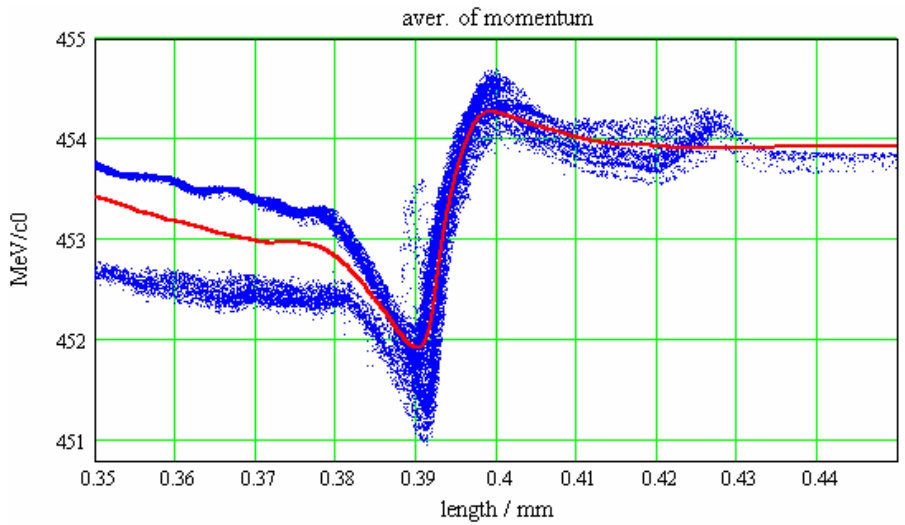
r_{56} = 0.468 mm
t_{566} = 54.8 mm

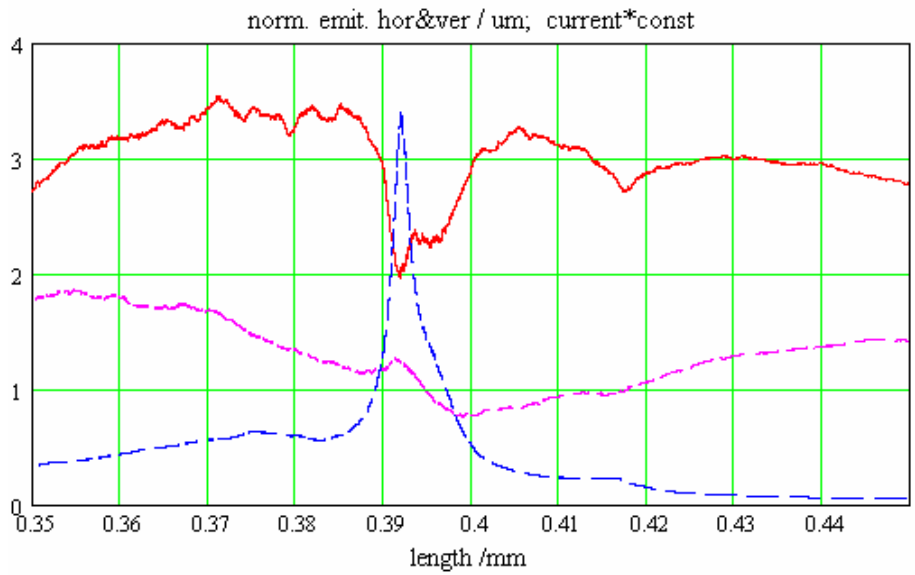
with sextupoles (not used in CSRtrack):

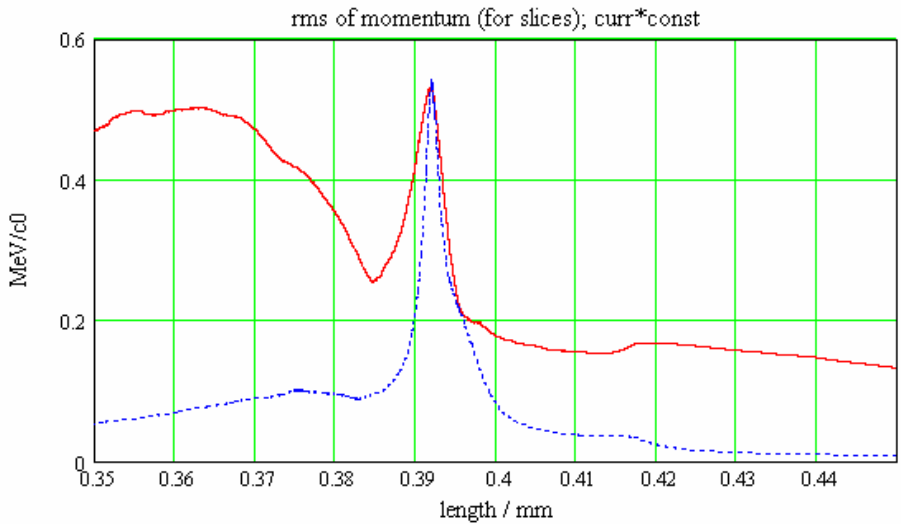
r_{56} = 0.468 mm
t_{566} = 17.8 mm

1m after dogleg







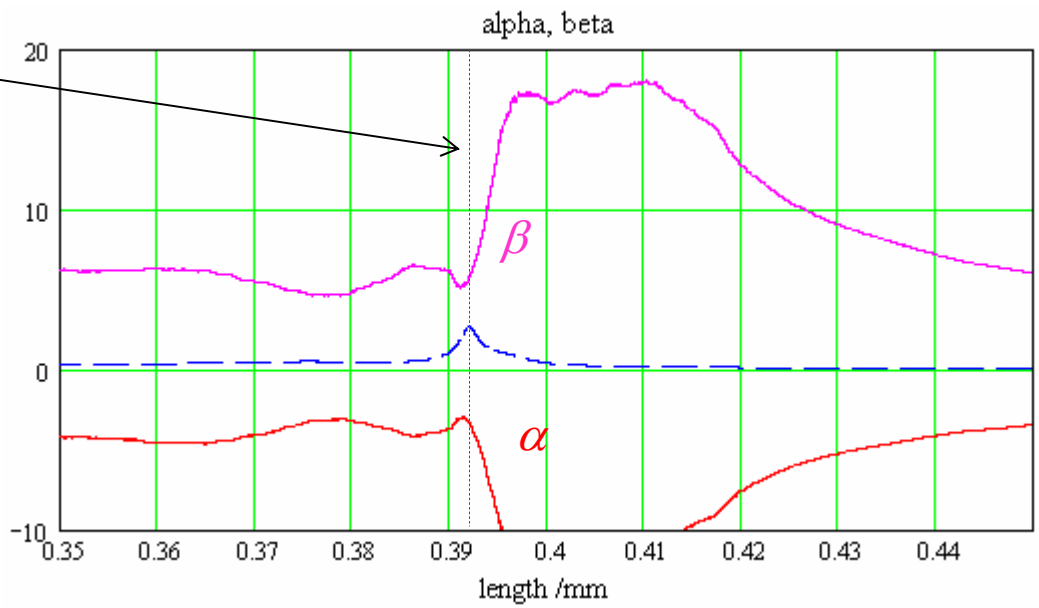


1m after dogleg

ELEMENT SEQUENCE			I	HORIZONTAL							I	VERTICAL						
pos. no.	element name	occ. no.	dist [m]	I I	betax [m]	alfax [1]	mux [2pi]	x(co) [mm]	px(co) [.001]	Dx [m]	Dpx [1]	I I	betay [m]	alfay [1]	muy [2pi]	y(co) [mm]	py(co) [.001]	Dy [m]	Dpy [1]
604	D0100A	18	138.529		2.695	2.204	2.208	0.0000	0.000	0.000	0.000		22.586	8.673	2.285	0.0000	0.000	0.000	0.000
end	Q9TCOL00	1	138.529		2.695	2.204	2.208	0.0000	0.000	0.000	0.000		22.586	8.673	2.285	0.0000	0.000	0.000	0.000
begin	DOGLEG	1	138.884		1.404	1.432	2.237	0.0000	0.000	0.000	0.000		16.853	7.475	2.288	0.0000	0.000	0.000	0.000
607	D1ECOL	1	139.284		0.603	0.561	2.308	0.0000	0.000	0.012	0.061		11.410	6.231	2.292	0.0000	0.000	0.000	0.000
618	D0075B	1	140.946		4.763	-3.064	2.590	0.0000	0.000	0.114	0.061		0.340	0.431	2.452	0.0000	0.000	0.000	0.000
619	Q3ECOL	1	141.274		4.546	3.620	2.600	0.0000	0.000	0.107	-0.099		0.581	-1.274	2.599	0.0000	0.000	0.000	0.000
625	D0075B	3	142.196		0.509	0.761	2.704	0.0000	0.000	0.016	-0.099		6.762	-5.434	2.676	0.0000	0.000	0.000	0.000
626	Q4ECOL	1	142.524		0.507	-0.755	2.827	0.0000	0.000	-0.016	-0.099		7.008	4.807	2.683	0.0000	0.000	0.000	0.000
634	D0075B	5	143.446		4.527	-3.607	2.931	0.0000	0.000	-0.107	-0.099		1.071	1.638	2.738	0.0000	0.000	0.000	0.000
635	Q5ECOL	1	143.774		4.745	3.050	2.941	0.0000	0.000	-0.114	0.061		0.636	-0.120	2.808	0.0000	0.000	0.000	0.000
643	D0220	1	145.436		0.604	-0.558	3.222	0.0000	0.000	-0.012	0.061		5.437	2.769	2.984	0.0000	0.000	0.000	0.000
644	D7ECOL	1	145.837		1.401	-1.425	3.293	0.0000	0.000	0.000	0.000		7.861	-3.336	2.994	0.0000	0.000	0.000	0.000

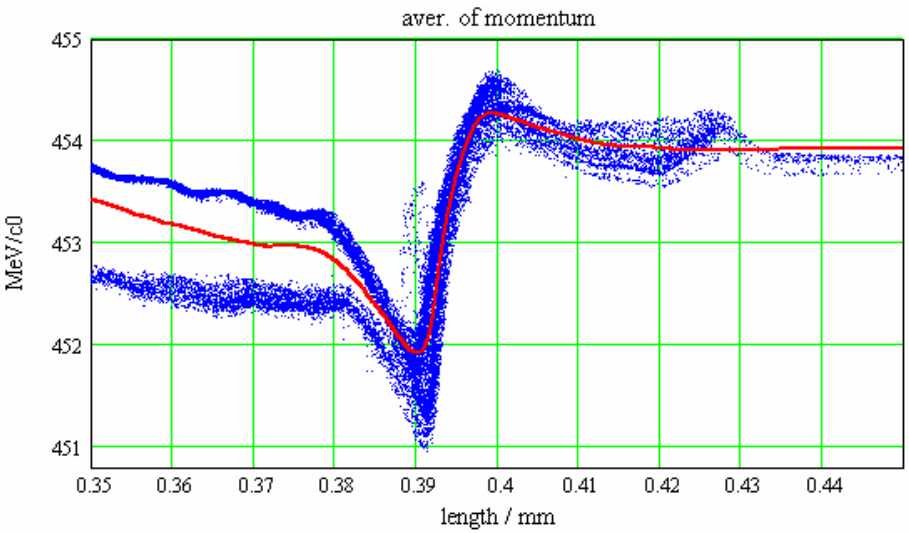
1m drift

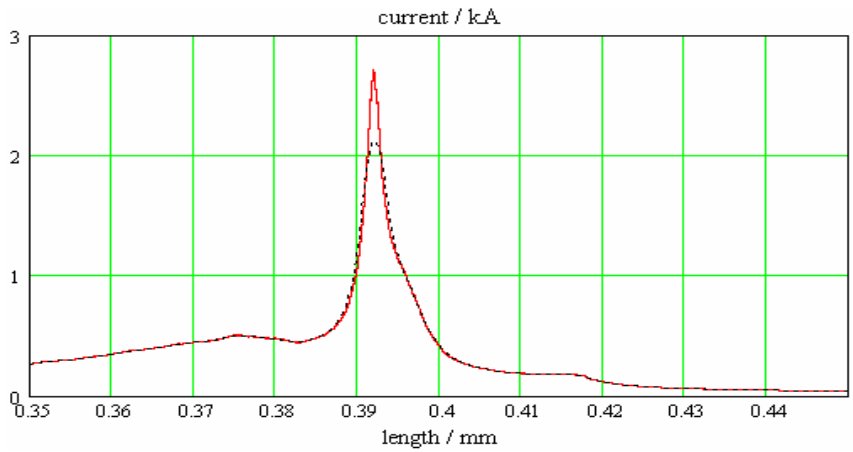
6.414 -3.588



compression in dogleg much stronger than expected by r56 !?

CSRtrack
reference energy = 450 MeV

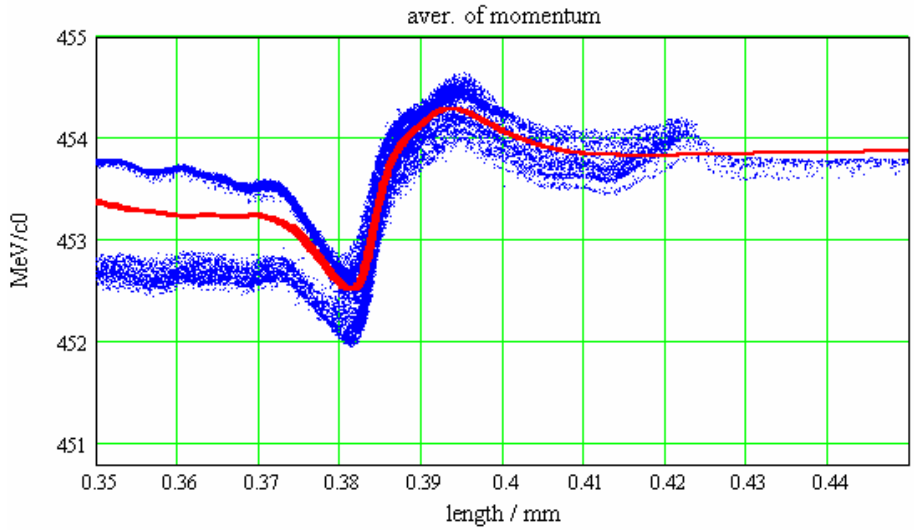


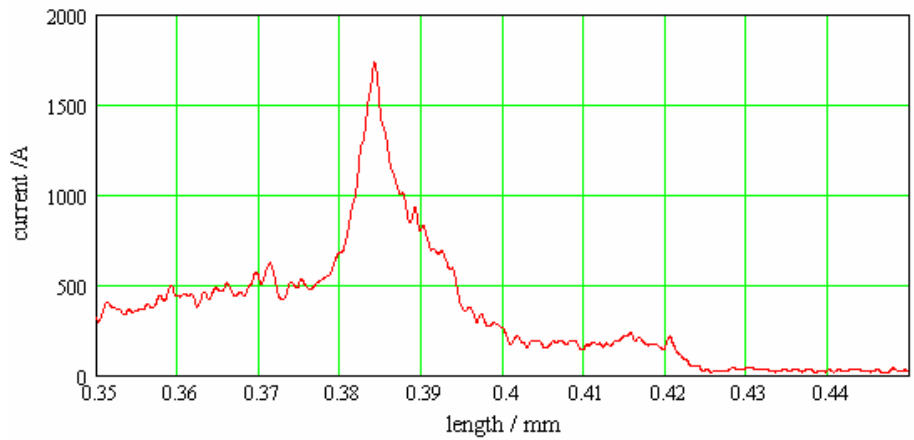


just r56:

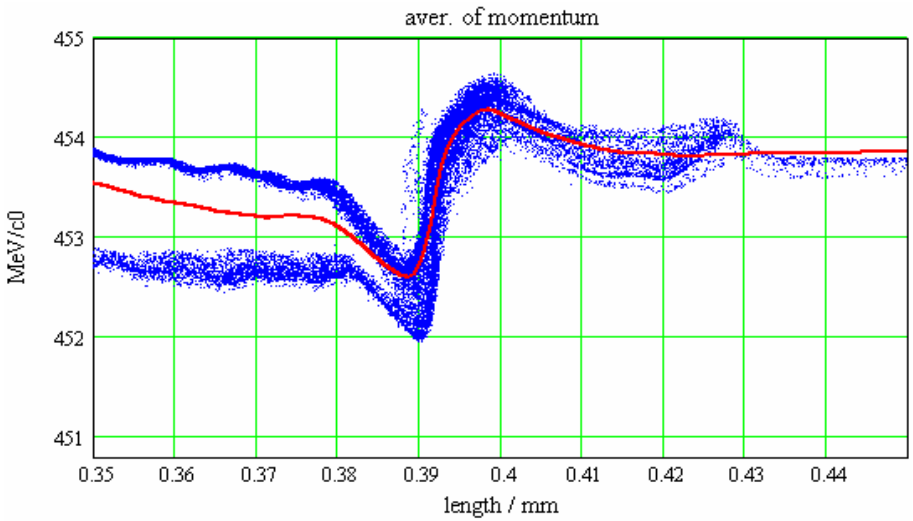
$r56 := 0.0005$ $k := 0 .. rows(xxs) - 1$ $z2_k := xxs_{k,4} - r56 \cdot xxs_{k,5}$

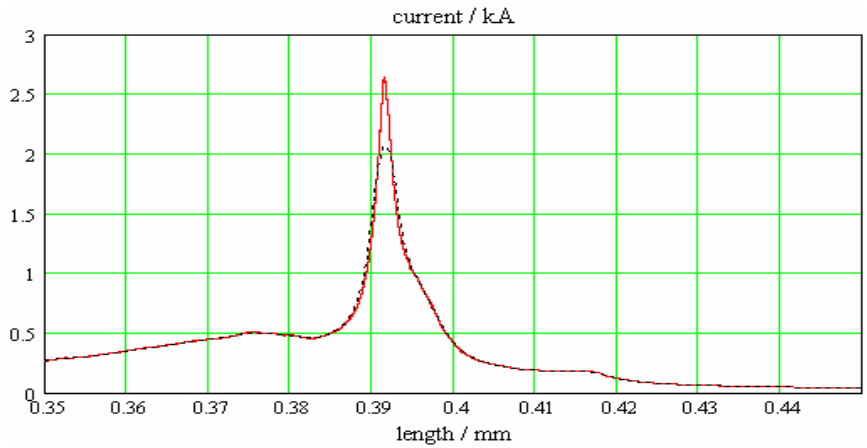
$C := s_to_cur(z2, 0.25 \cdot 10^{-6}, 0.5 \cdot 10^{-9}, 3 \cdot 10^{8})$



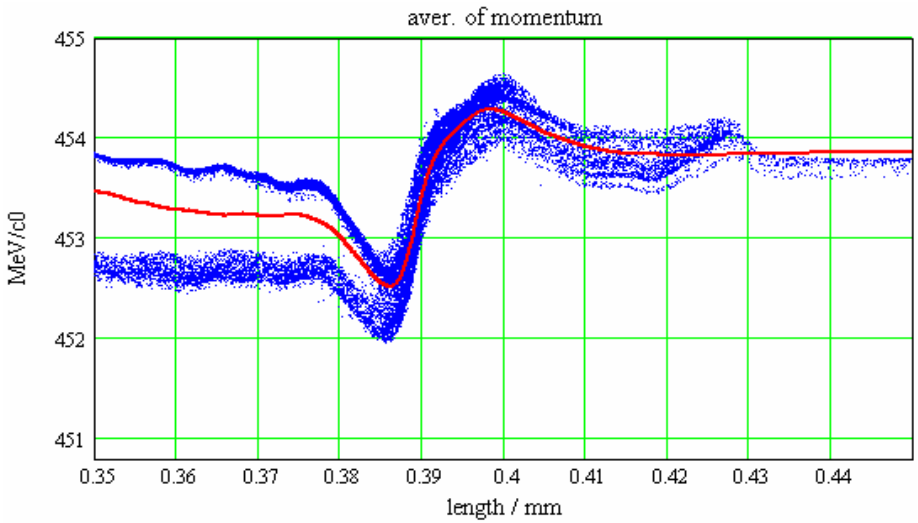


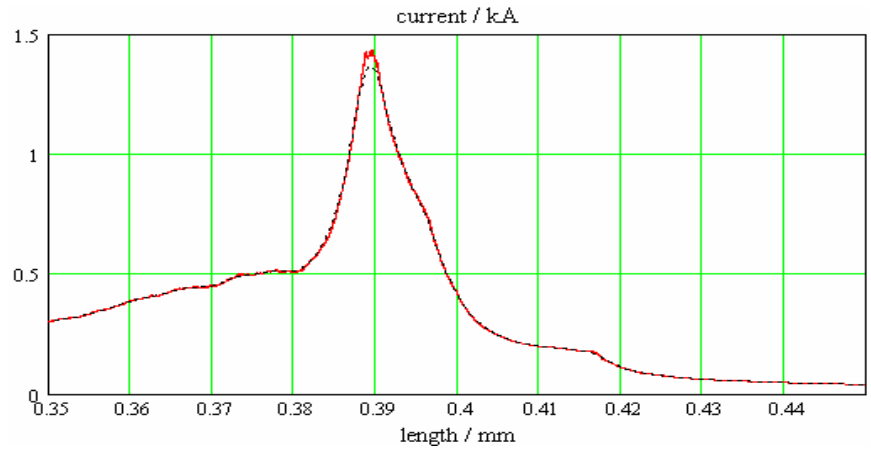
CSRtrack, without force
reference energy = 450 MeV



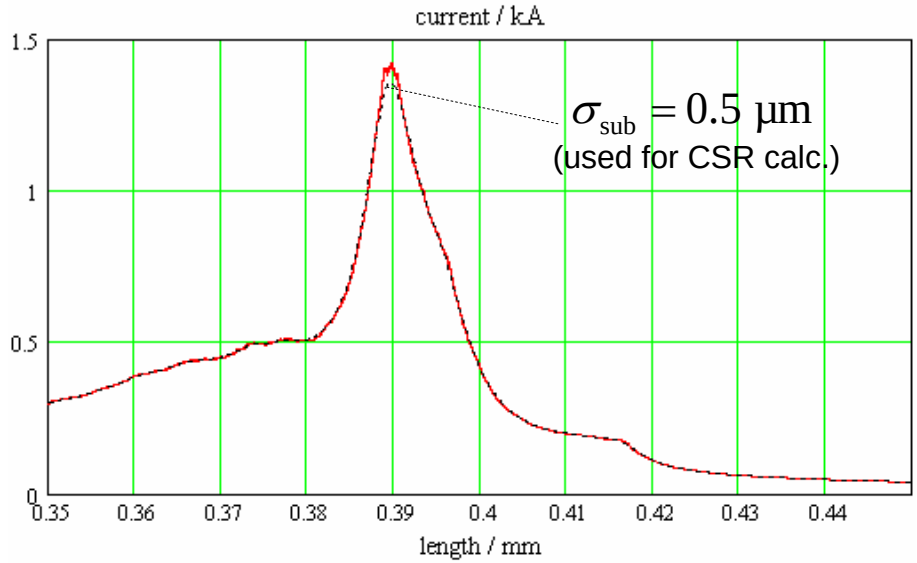


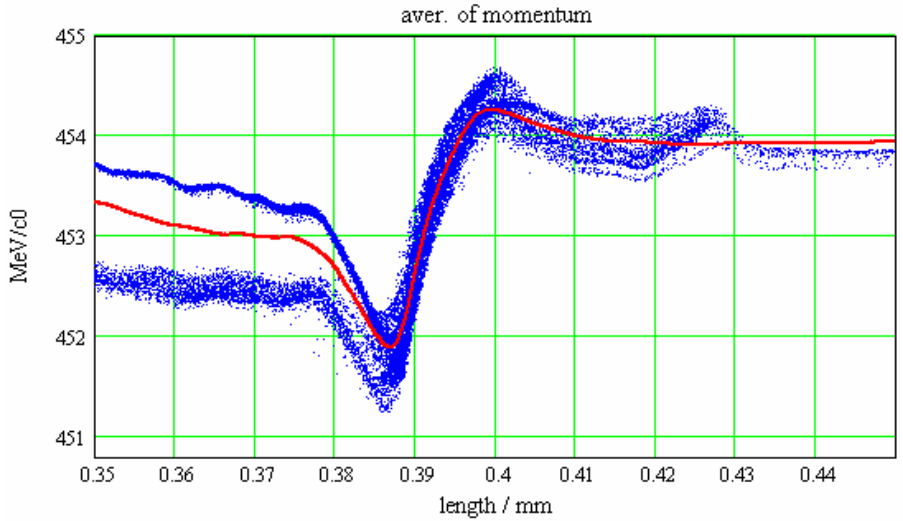
CSRtrack, without force
reference energy = 453.5 MeV

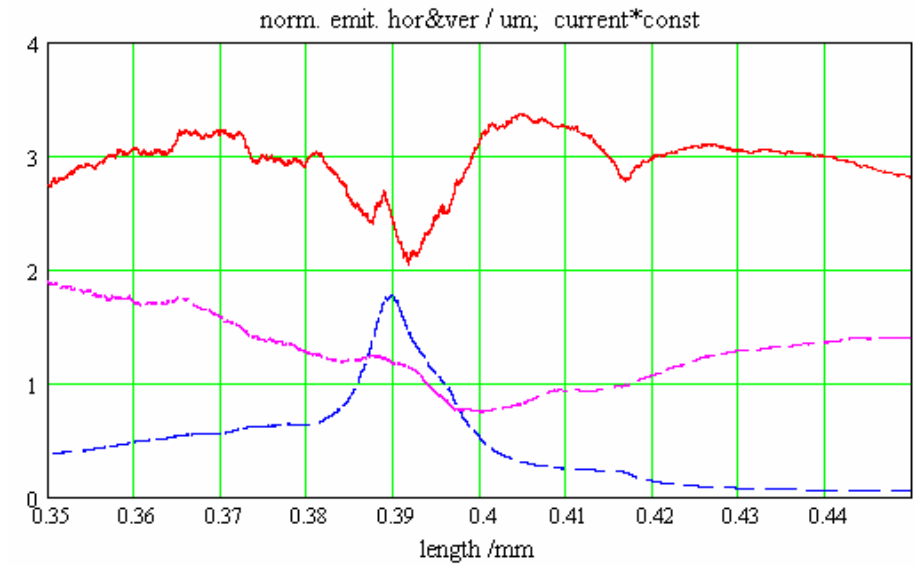


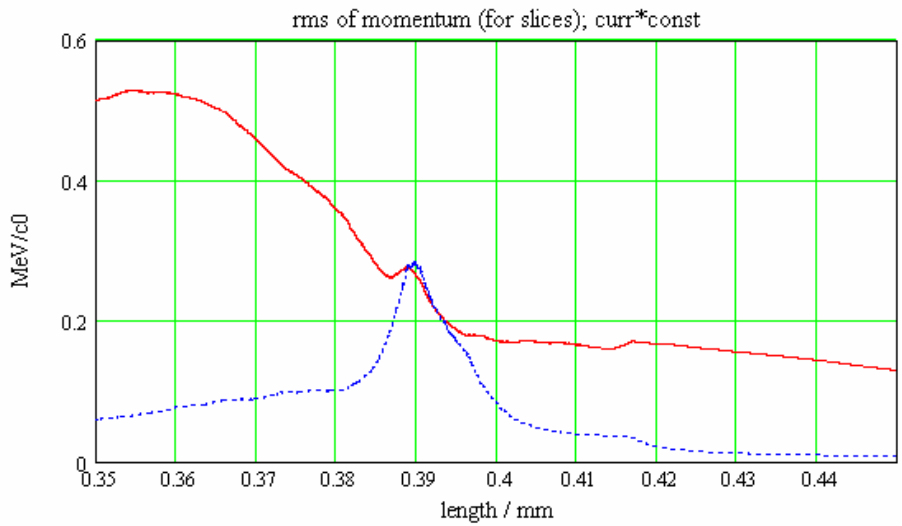


1m after dogleg, ref. energy = 453.5 MeV







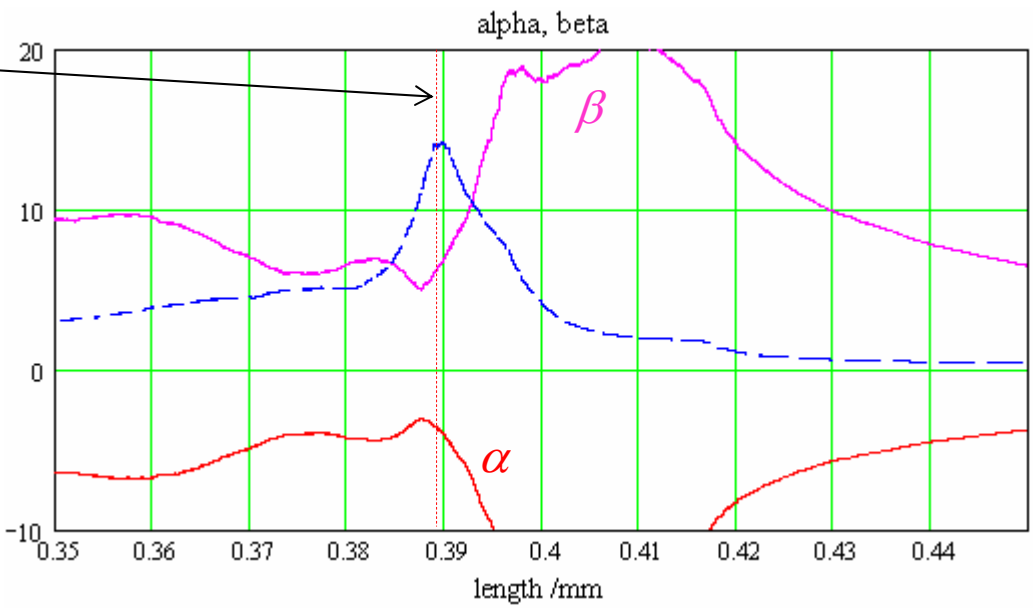


1m after dogleg

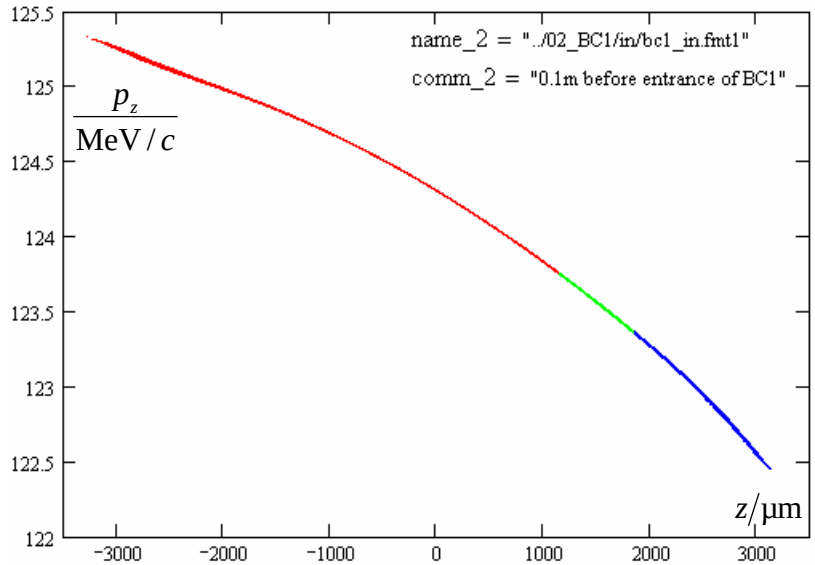
pos. no.	element name	occ. no.	dist [m]	I	betax [m]	alfax [1]	mux [2pi]	x(co) [mm]	px(co) [.001]	Dx [m]	Dpx [1]	I	betay [m]	alfay [1]	muy [2pi]	y(co) [mm]	py(co) [.001]	Dy [m]	Dpy [1]
	ELEMENT SEQUENCE			I	H O R I Z O N T A L							I	V E R T I C A L						
604	D0100A	18	138.529		2.695	2.204	2.208	0.0000	0.000	0.000	0.000		22.586	8.673	2.285	0.0000	0.000	0.000	0.000
end	Q9TCOL00	1	138.529		2.695	2.204	2.208	0.0000	0.000	0.000	0.000		22.586	8.673	2.285	0.0000	0.000	0.000	0.000
begin	DOGLEG	1	138.884		1.404	1.432	2.237	0.0000	0.000	0.000	0.000		16.853	7.475	2.288	0.0000	0.000	0.000	0.000
607	D1ECOL	1	139.284		0.603	0.561	2.308	0.0000	0.000	0.012	0.061		11.410	6.231	2.292	0.0000	0.000	0.000	0.000
618	D0075B	1	140.946		4.763	-3.064	2.590	0.0000	0.000	0.114	0.061		0.340	0.431	2.452	0.0000	0.000	0.000	0.000
619	Q3ECOL	1	141.274		4.546	3.620	2.600	0.0000	0.000	0.107	-0.099		0.581	-1.274	2.599	0.0000	0.000	0.000	0.000
625	D0075B	3	142.196		0.509	0.761	2.704	0.0000	0.000	0.016	-0.099		6.762	-5.434	2.676	0.0000	0.000	0.000	0.000
626	Q4ECOL	1	142.524		0.507	-0.755	2.827	0.0000	0.000	-0.016	-0.099		7.008	4.807	2.683	0.0000	0.000	0.000	0.000
634	D0075B	5	143.446		4.527	-3.607	2.931	0.0000	0.000	-0.107	-0.099		1.071	1.638	2.738	0.0000	0.000	0.000	0.000
635	Q5ECOL	1	143.774		4.745	3.050	2.941	0.0000	0.000	-0.114	0.061		0.636	-0.120	2.808	0.0000	0.000	0.000	0.000
643	D0220	1	145.436		0.604	-0.558	3.222	0.0000	0.000	-0.012	0.061		5.437	2.769	2.984	0.0000	0.000	0.000	0.000
644	D7ECOL	1	145.837		1.401	-1.425	3.293	0.0000	0.000	0.000	0.000		7.861	-3.336	2.994	0.0000	0.000	0.000	0.000

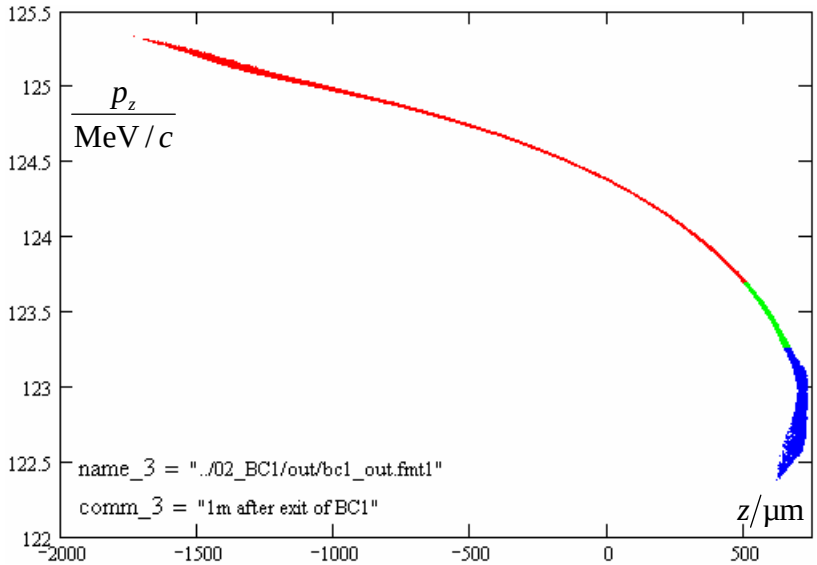
1m drift

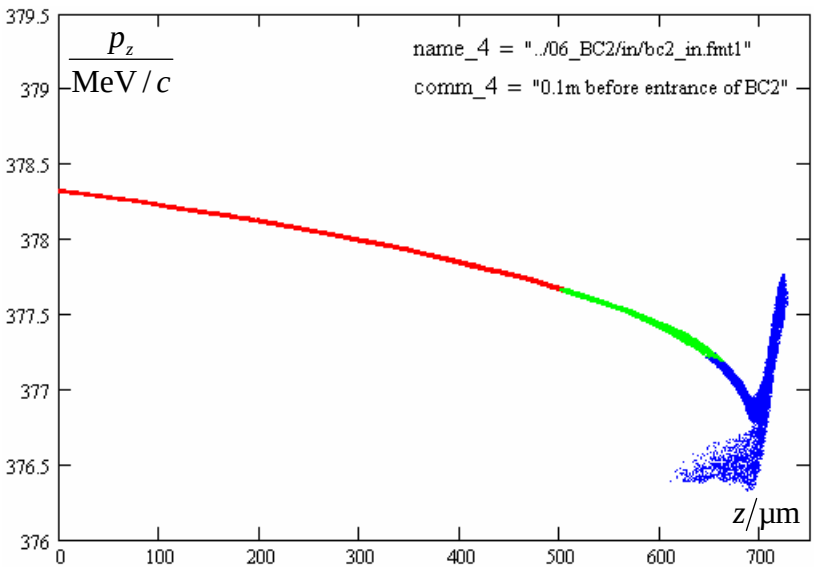
6.414 -3.588

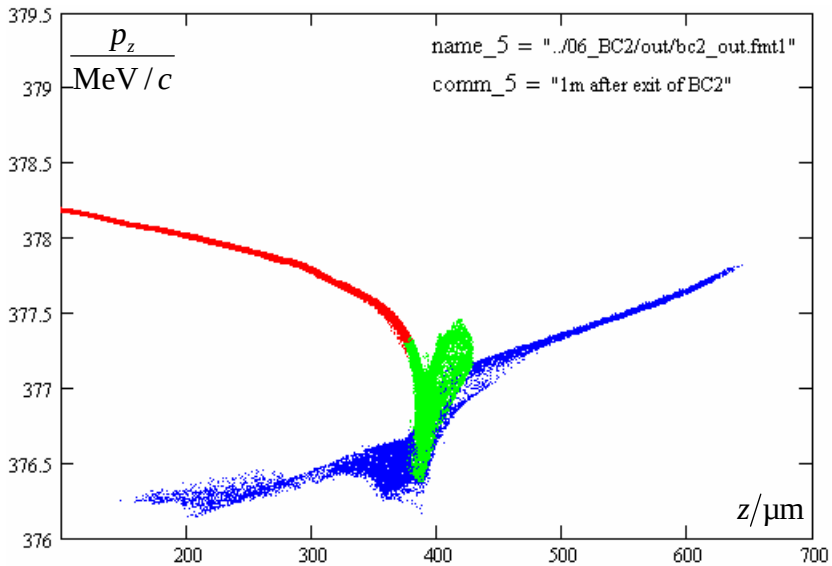


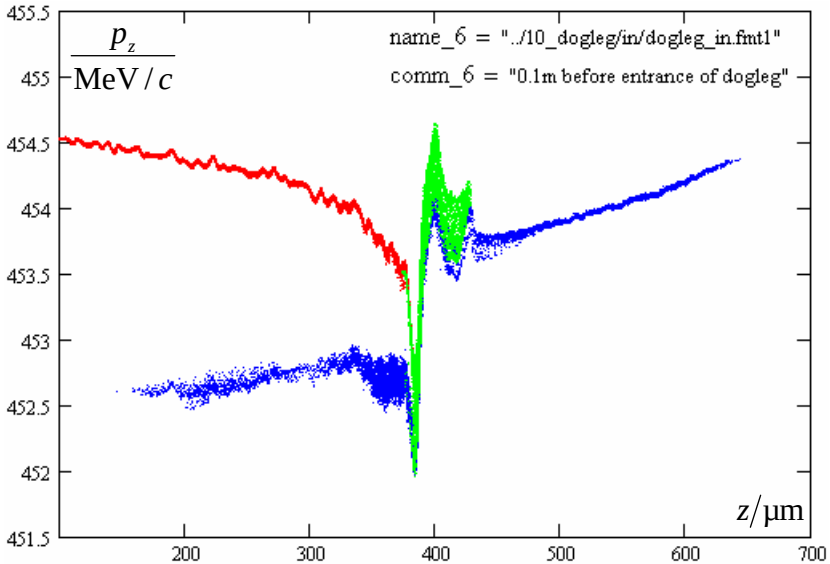
particles in color

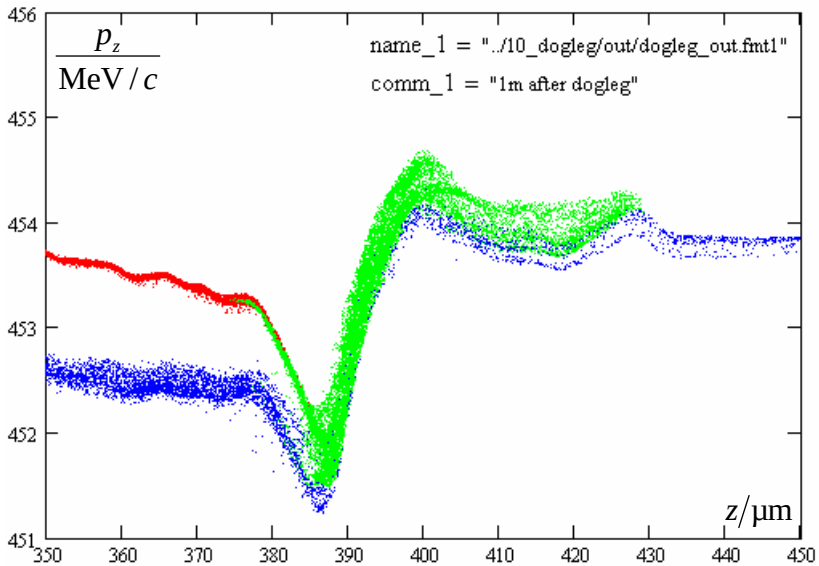


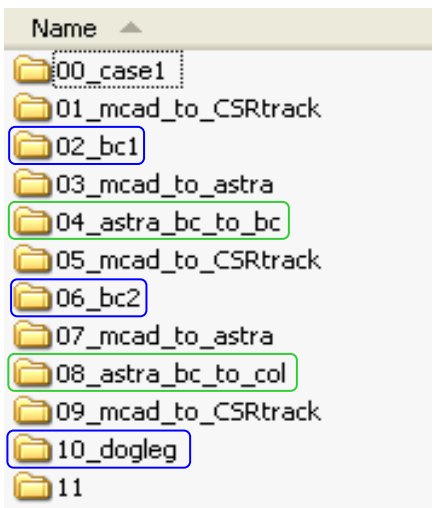
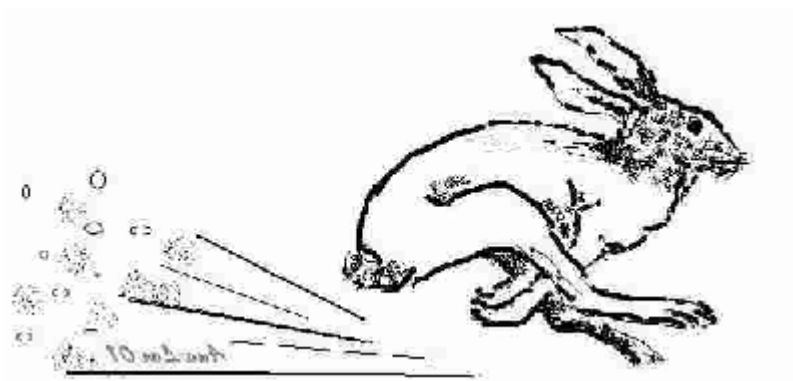







$\frac{p_z}{\mathrm{MeV}/c}$
name_6 = "../10_dogleg/in/dogleg_in.fmt1"
comm_6 = "0.1m before entrance of dogleg"
z/μm
455.5
455
454.5
454
453.5
453
452.5
452
451.5
200
300
400
500
600
700


$\frac{p_z}{\mathrm{MeV}/c}$
name_1 = "../10_dogleg/out/dogleg_out.fmt1"
comm_1 = "1m after dogleg"
z/μm
456
455
454
453
452
451
350
360
370
380
390
400
410
420
430
440
450

conclusion, experiences

- s2e is lengthy procedure: 4 x ASTRA (including GUN + after dogleg)
  3 x CSRtrack
  6 x conversion and/or wakes
- dogleg to undulator + Genesis still missing
- convergence test
- automatization
- improved ASTRA mesh; (but not user-friendly)
- low energy (450MeV): SC effects before dogleg are important
- compression in dogleg touchy; sextupoles should be considered