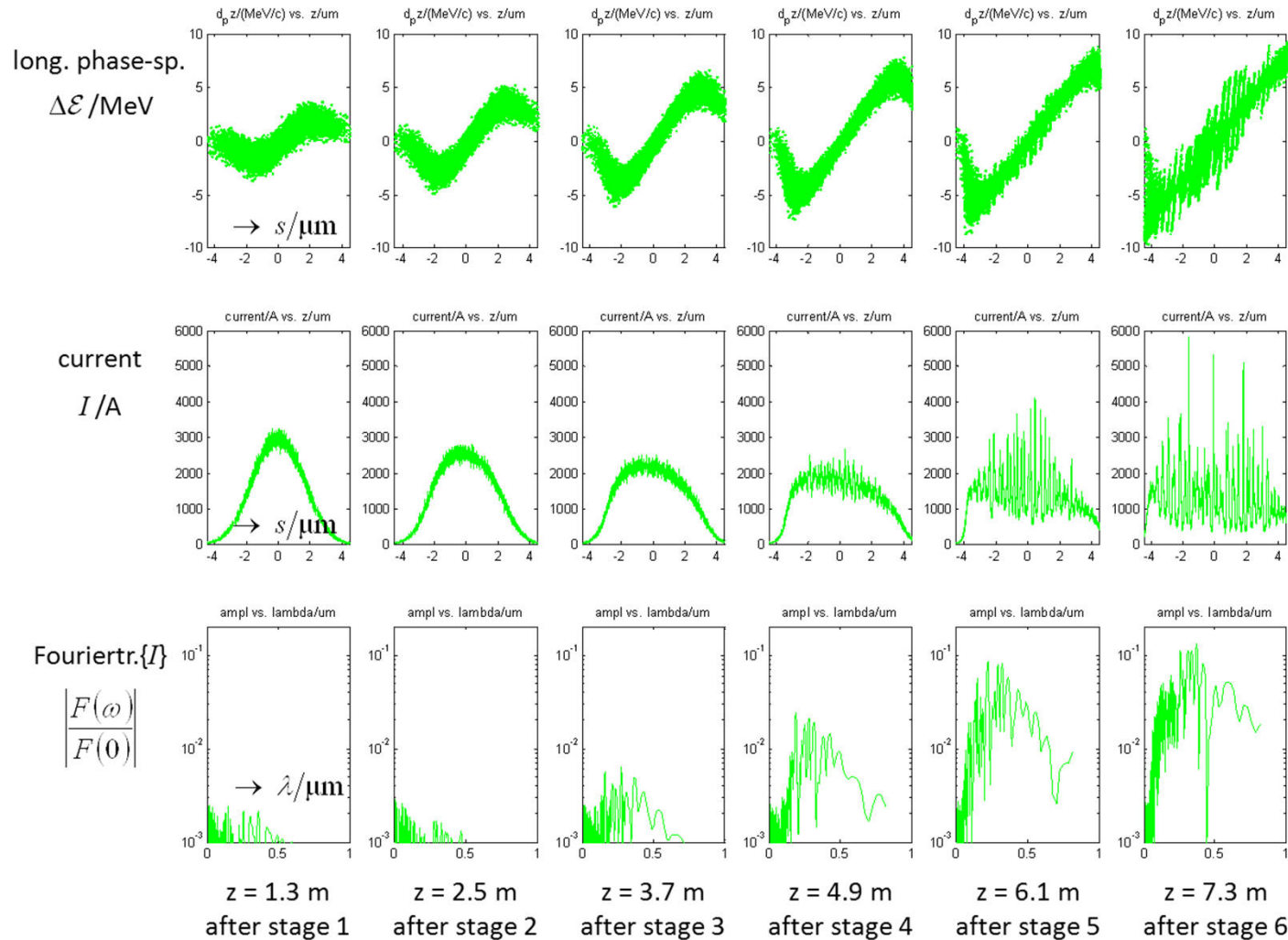
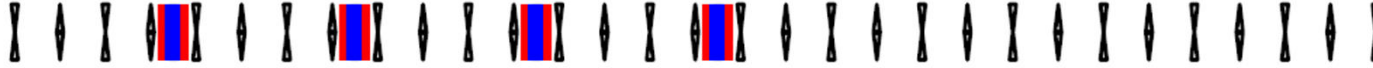
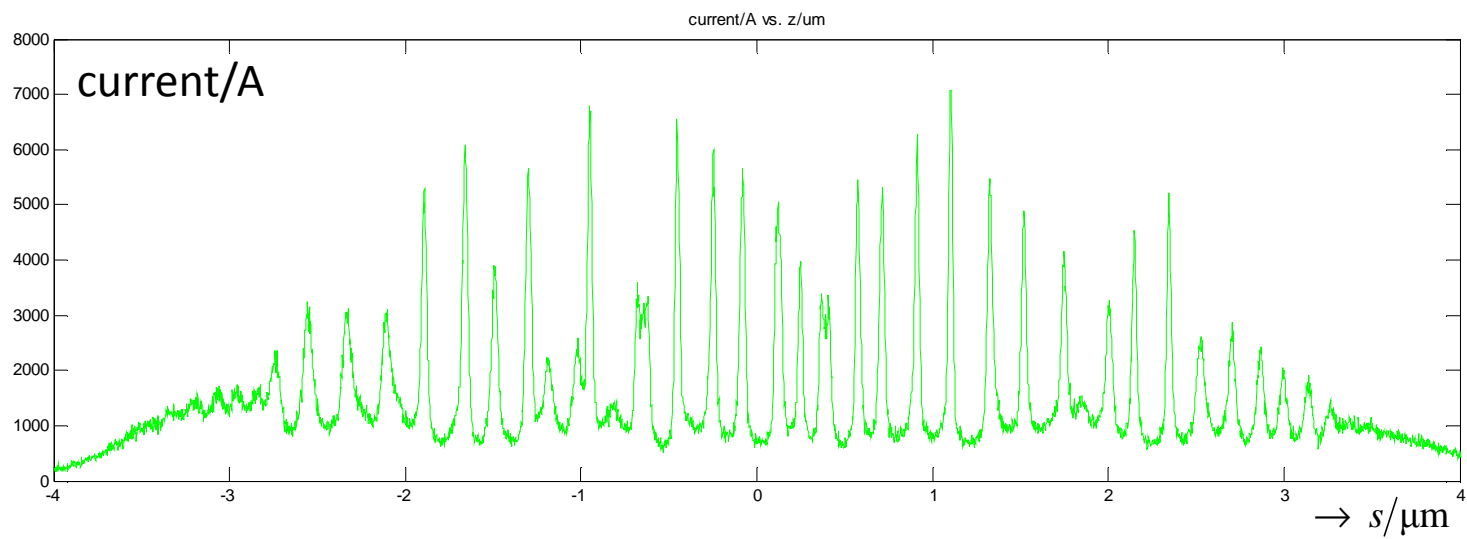
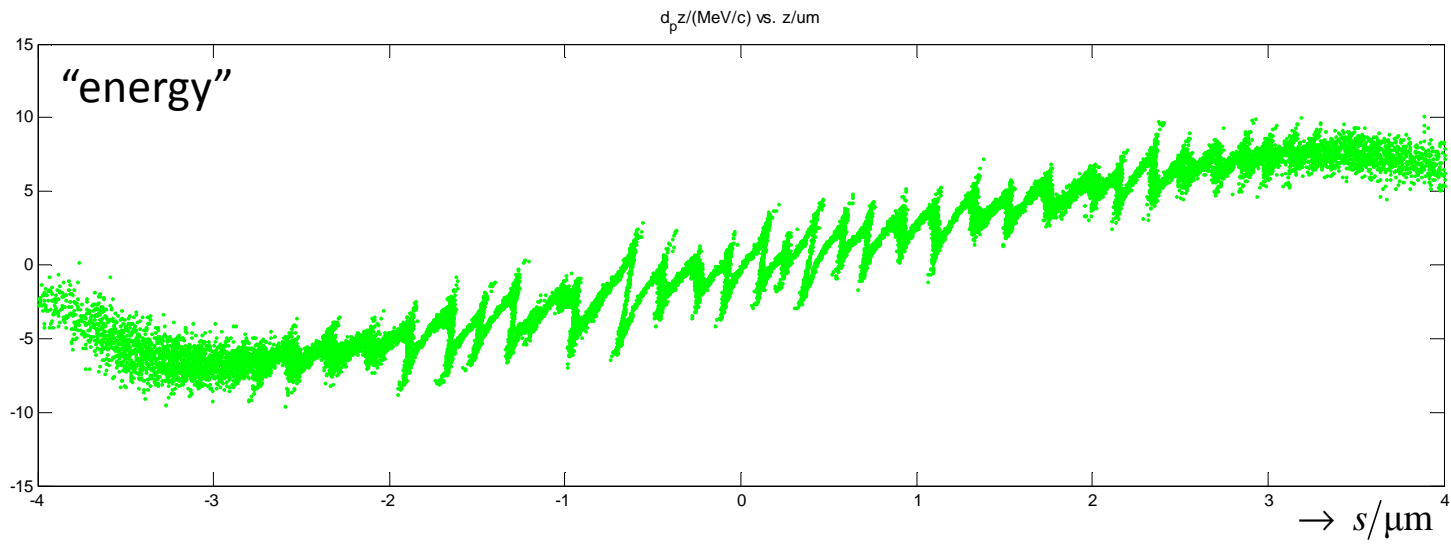


Longitudinal SC Amplifier

s2e seminar, NOV. 2012: still not on homepage

BC-chicanes in FODO structure





Parameters

(after discussion with Florian Grüner)

particles: $q = 40 \text{ pC}$

$$\sigma_{\parallel} = 1.5 \text{ } \mu\text{m}$$

$$\mathcal{E}_{\text{av}} = 300 \text{ MeV}$$

$$\mathcal{E}_{\text{rms}} = 0.6 \text{ MeV}$$

$$\varepsilon_n = 0.2 \text{ } \mu\text{m}$$

$$\sigma_x = \sigma_y \approx 0.5 \text{ } \mu\text{m}$$

$$\left. \begin{array}{l} \mathbf{250E6 \text{ electrons}} \\ \end{array} \right\} \hat{I} = 3.2 \text{ kA}$$

slice energy spread

correlated spread is neglected in the following
(small compared to SC induced correlation)

waist $\rightarrow \alpha = 0, \beta = 0.7 \text{ mm}$

matching to FODO:

to be investigated !!!

example (without SC):

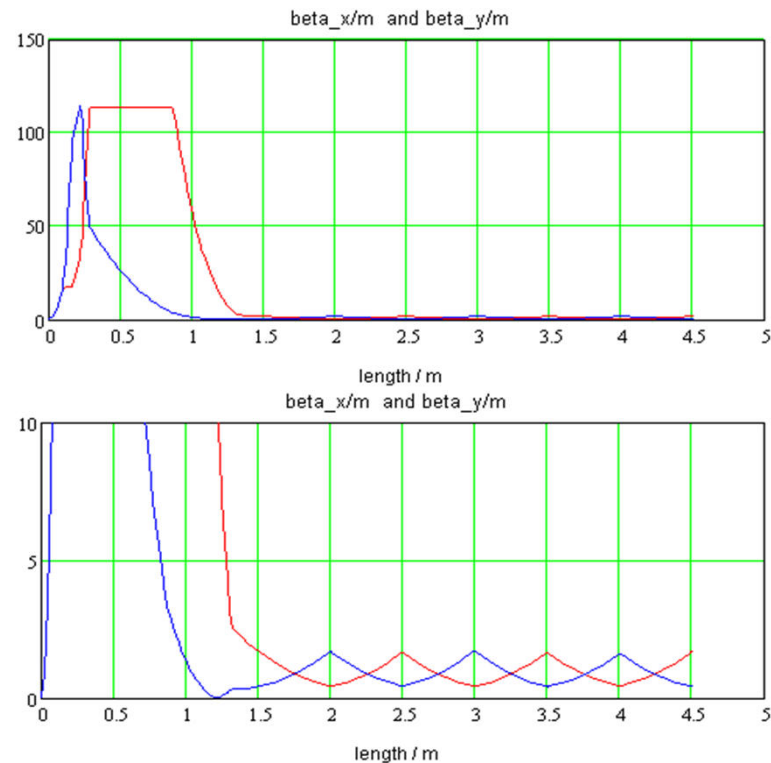
$$\alpha_x = \alpha_y = 0$$

$$\beta_x = \beta_y = 0.7 \text{ mm}$$

to FODO lattice with

$$L_p = 1 \text{ m}$$

$$\varphi = 71 \text{ deg}$$

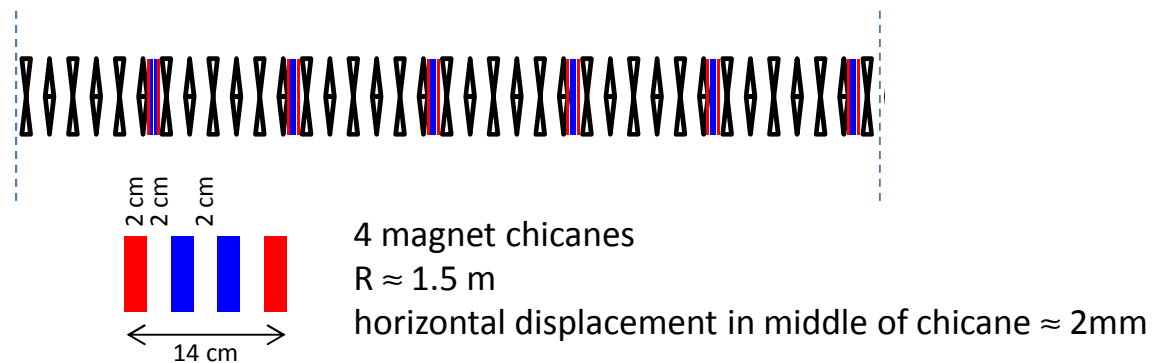


3d simulation with many particles

calculation with 100E6 particles for 40 pC

first test run; 3D SC solver; resolution 5.8 μm transverse, 10 nm longitudinal (= cell size);

lattice: FODO, period = 60 cm, phase advance 90 deg; BC 4 magnet chicane, $r_{56} = 10.8 \mu\text{m}$
total length = 11.05 m

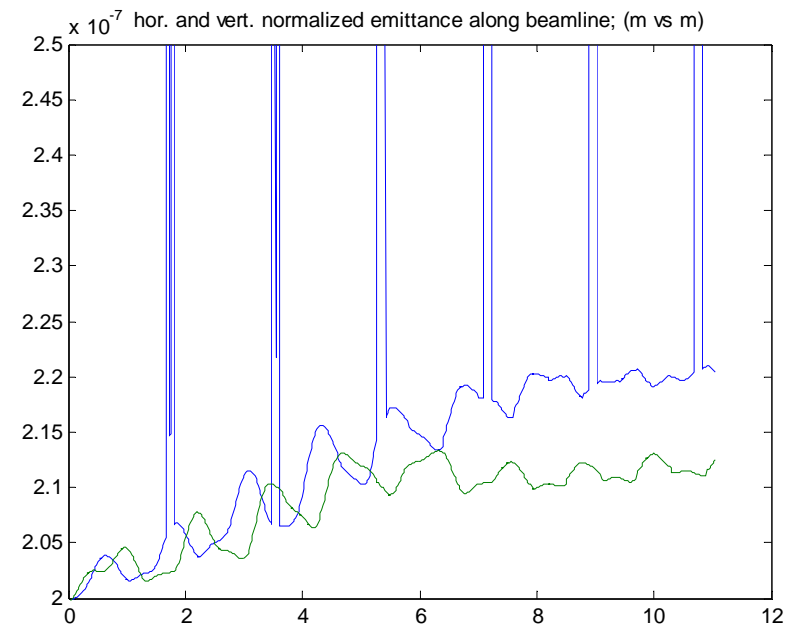
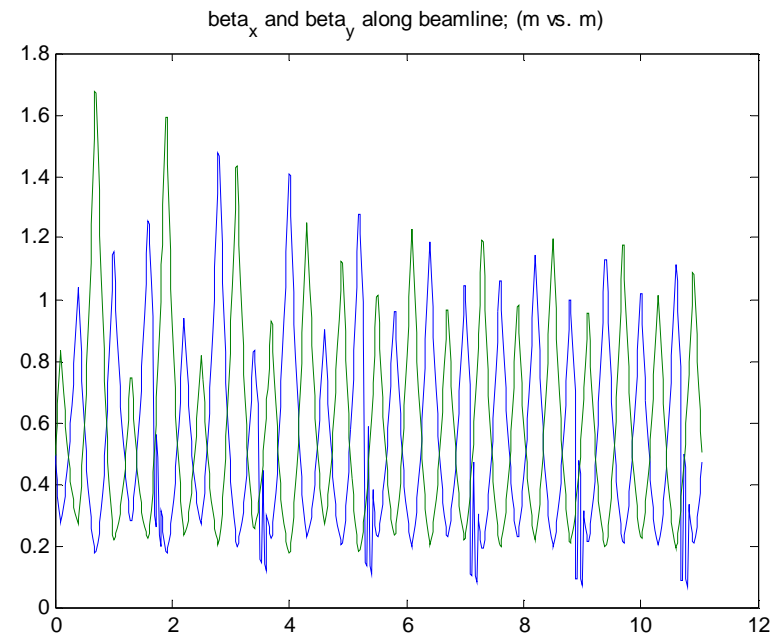
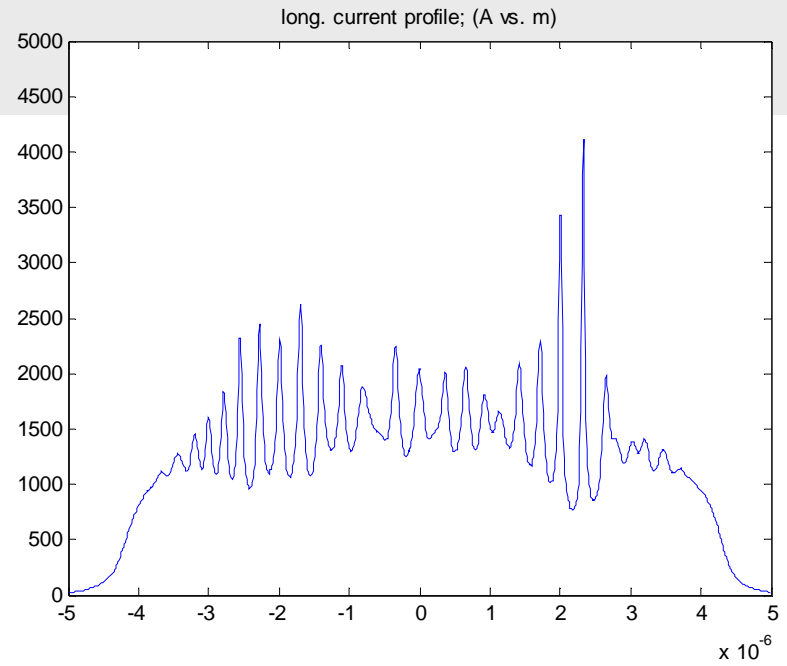
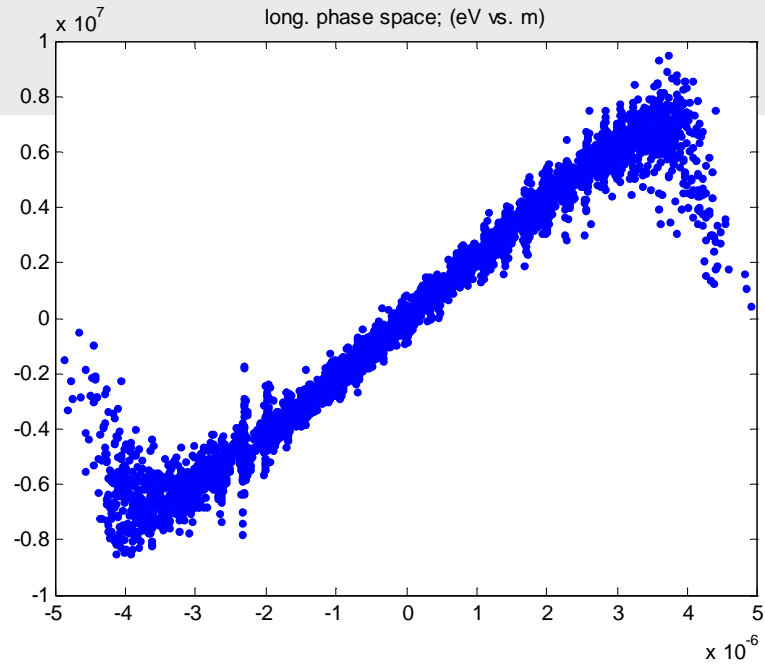


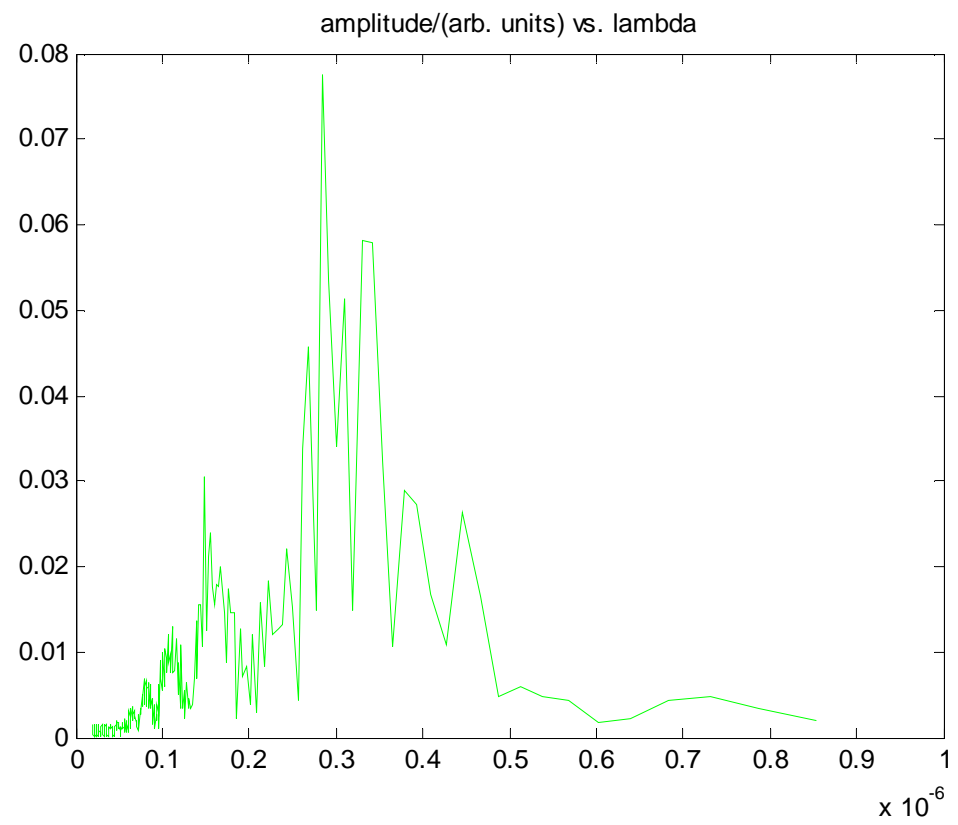
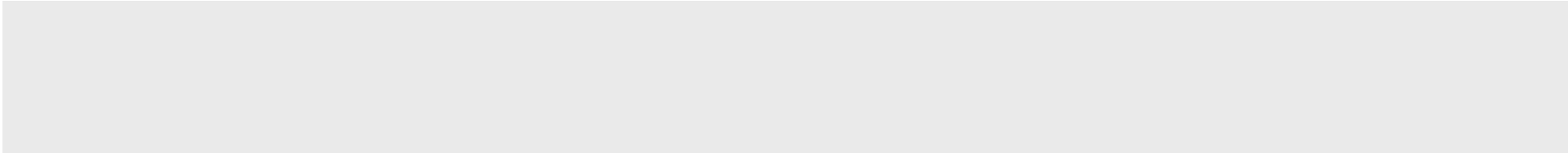
bunch: normalized emittance 0.2 μm ; approximately matched to lattice (with s.c.)

calculation: step width 2cm (or smaller); no self effects in bending magnets;

total cpu time 150 000 sec; sc-step 250 sec; on MPY28MAFIA4



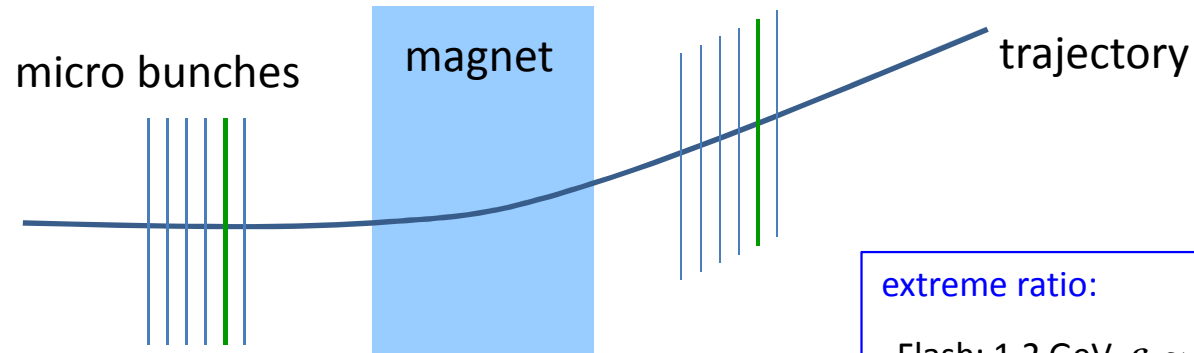




EM Field for some (predefined) Source Fields

field 2d object: solve 2d integral

a) stiff 2d object f.i. disc



extreme ratio:

Flash: 1.2 GeV, $\varepsilon_n \approx 1 \mu\text{m}$, $\beta \approx 5 \text{ m}$
 $\rightarrow \sigma_r \approx 50 \mu\text{m}$, $\lambda_{\text{ph}} \approx 5 \text{ nm}$
ratio 1E4 : 1

XFEL: 15 GeV, $\varepsilon_n \approx 1 \mu\text{m}$, $\beta \approx 5 \text{ m}$
 $\rightarrow \sigma_r \approx 10 \mu\text{m}$, $\lambda_{\text{ph}} \approx 0.1 \text{ nm}$
ratio 1E5 : 1

SC ampl.: 300 MeV, $\varepsilon_n \approx 0.2 \mu\text{m}$, $\beta \approx 0.5 \text{ m}$
 $\rightarrow \sigma_r \approx 10 \mu\text{m}$, $\lambda_{\text{ph}} \approx 100 \text{ nm}$
ratio 100 : 1

b) time dependent 2d object

