

FLASH Beam Dynamics Simulation for 250 pC

Igor Zagorodnov

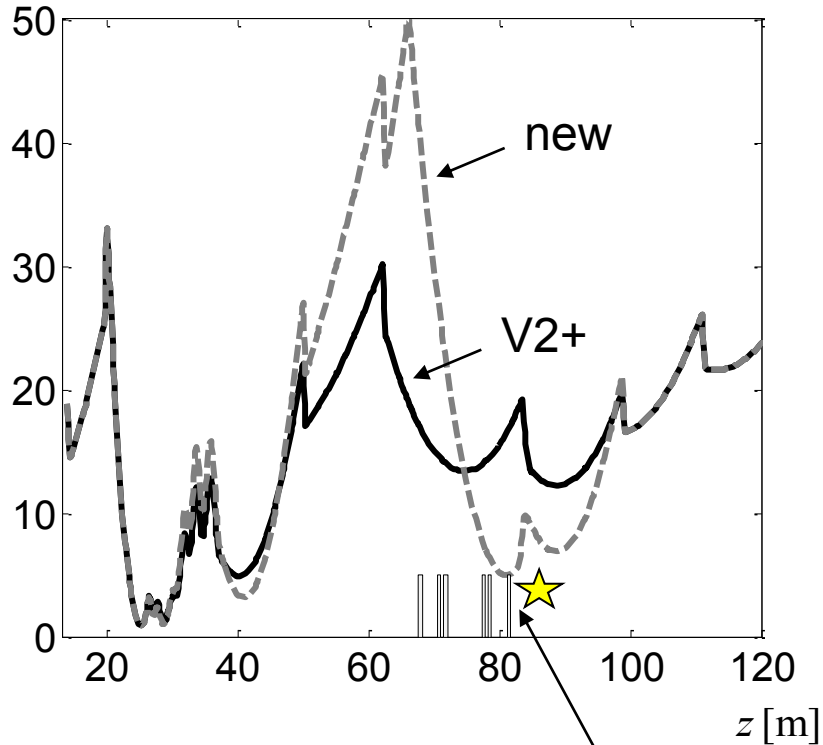
DESY, Hamburg, Germany

02.04.2013

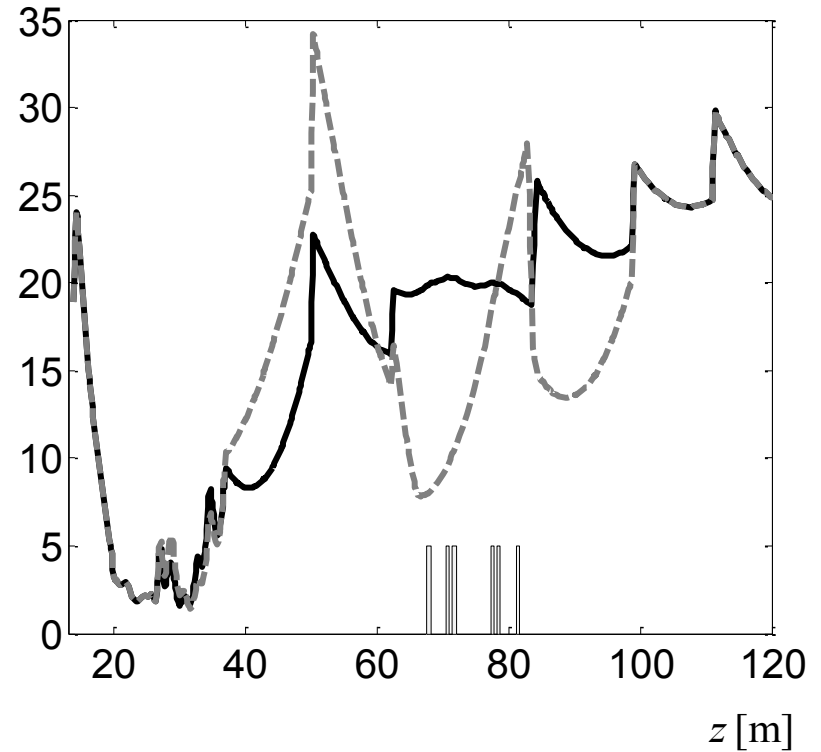
Technical constraints and choosing of machine parameters

Optics correction

β_x [m]



β_y [m]

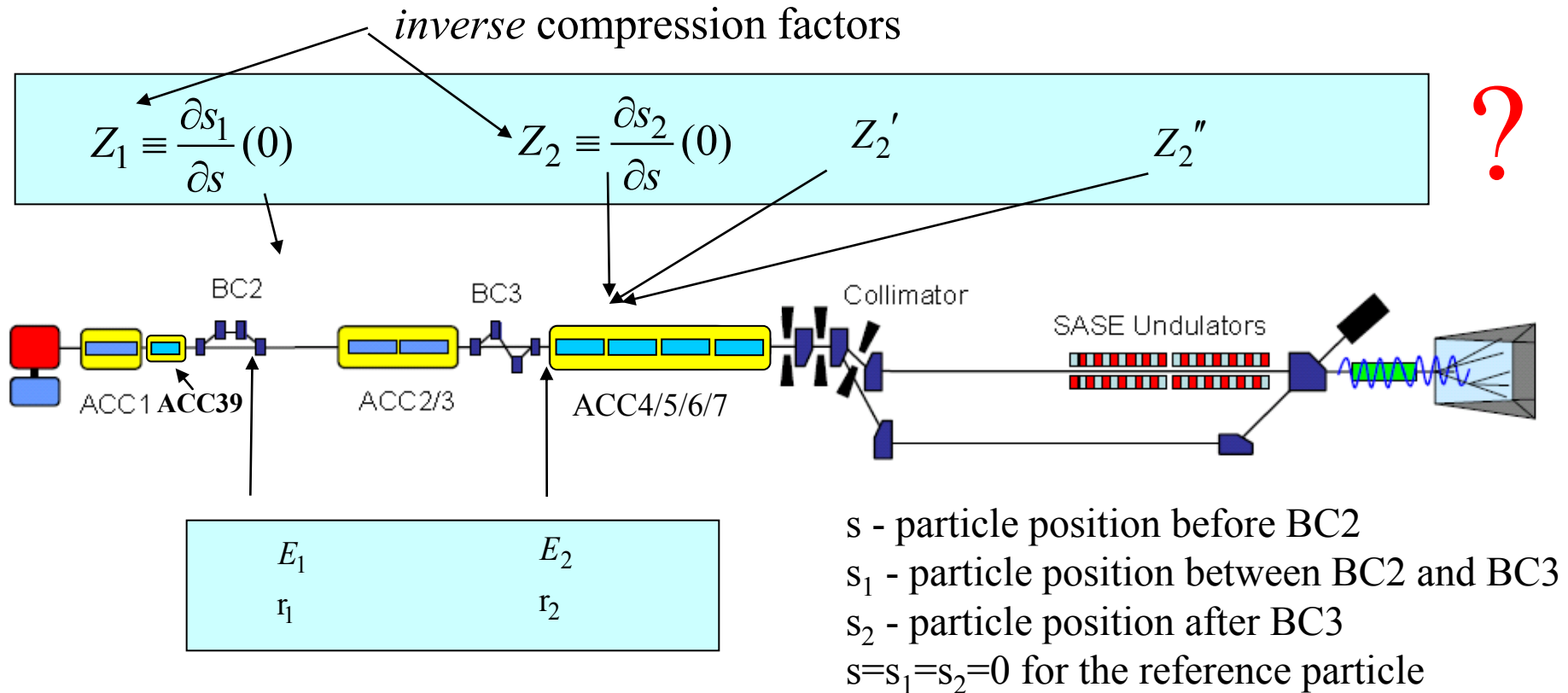


a small transverse bunch size before the last dipole

M.Dohlus, T. Limberg, *Impact of optics on CSR-related emittance growth in bunch compressor chicanes*, PAC 05, 2005

Technical constraints and choosing of machine parameters

Working points (8 macroparameters)



What is the optimal choice?

$$E_1 = 130\text{MeV}, \quad E_2 = 450\text{MeV}, \quad r_1 = 1.93\text{m}, \quad r_2 = 6\text{m},$$

$$Z_2^{-1} = 48, \quad Z_1^{-1} = ?, \quad Z_2' = ?, \quad Z_2'' = ?$$

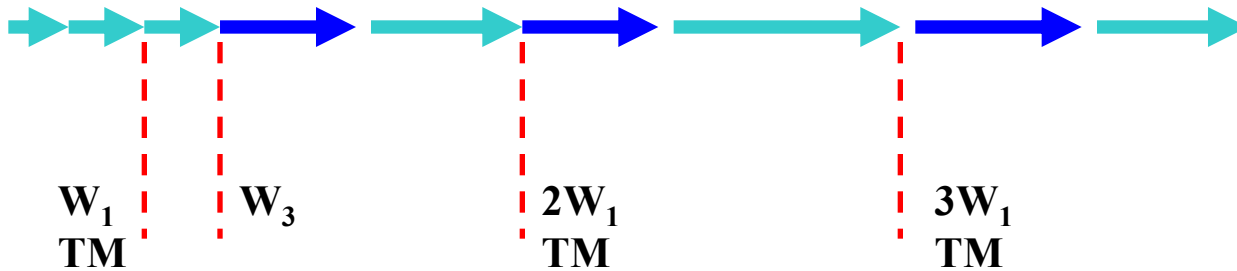
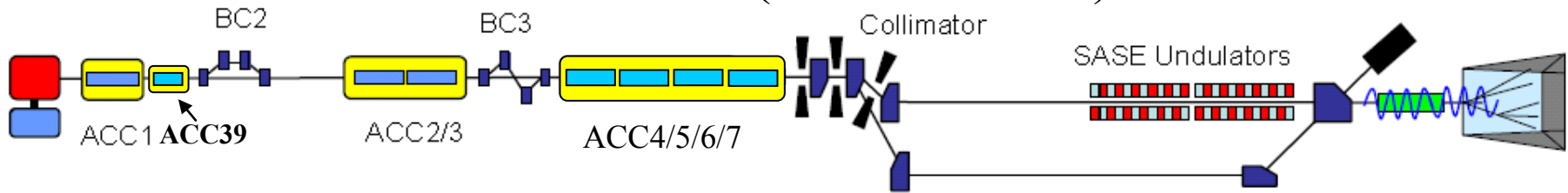
Technical constraints and choosing of machine parameters

Working points (8 macroparameters)

Charge Q , nC	Energy in BC2 E_1 , [MeV]	Energy in BC3 E_2 , [MeV]	Deflecting radius in BC2 r_1 , [m]	Deflecting radius in BC3 r_2 , [m]	Compression in BC2 C_1	Total compression C	First derivative Z_2' , [m ⁻¹]	Second derivative Z_2'' , [m ⁻²]
0.25	130	450	1.93	7.8	6.57	150	0.7	4e3

FLASH beam dynamic simulations setup

3d simulation method (self-consistent)



 **ASTRA** (tracking with space charge, DESY, K. Flötman)

 **CSRtrack** (tracking through dipoles, DESY, M. Dohlus, T. Limberg)

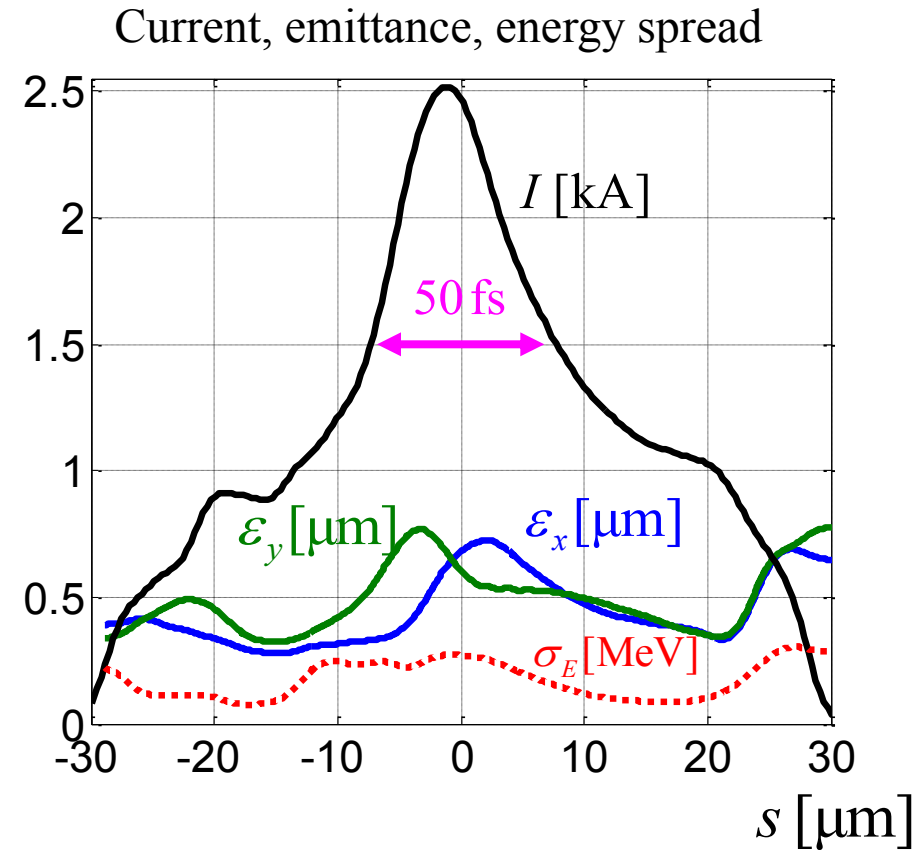
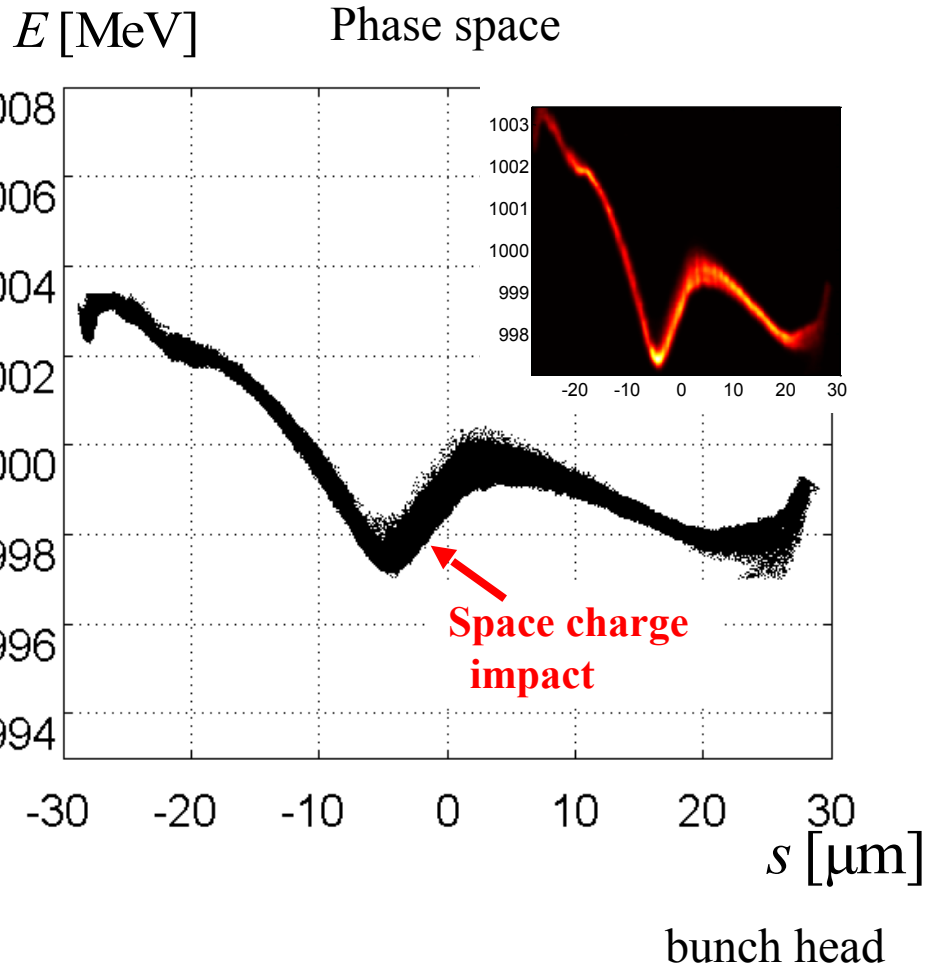
W1 -TESLA cryomodule wake (TESLA Report 2003-19, DESY, 2003)

W3 - ACC39 wake (TESLA Report 2004-01, DESY, 2004)

TM - transverse matching to the design optics

FLASH beam dynamic simulations for 1000 MeV

$Q=0.25$ nC (only 94 % in analysis)



$$\varepsilon_x^{proj} = 2.1 [\mu\text{m}]$$

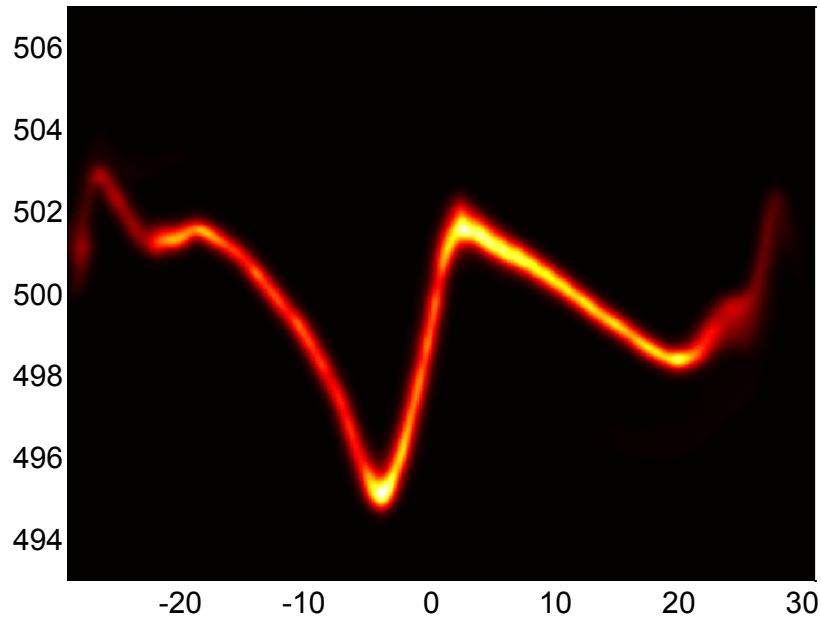
$$\varepsilon_y^{proj} = 0.65 [\mu\text{m}]$$

FLASH beam dynamic simulations for 500 MeV

$Q=0.25$ nC (only 94 % in analysis)

E [MeV]

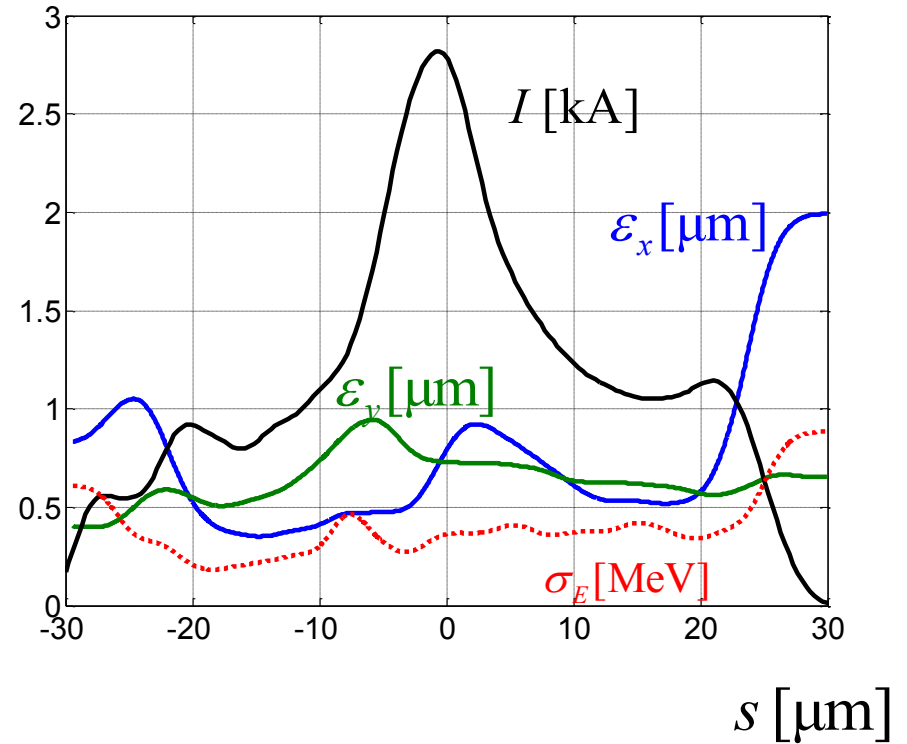
Phase space



s [μm]

bunch head

Current, emittance, energy spread



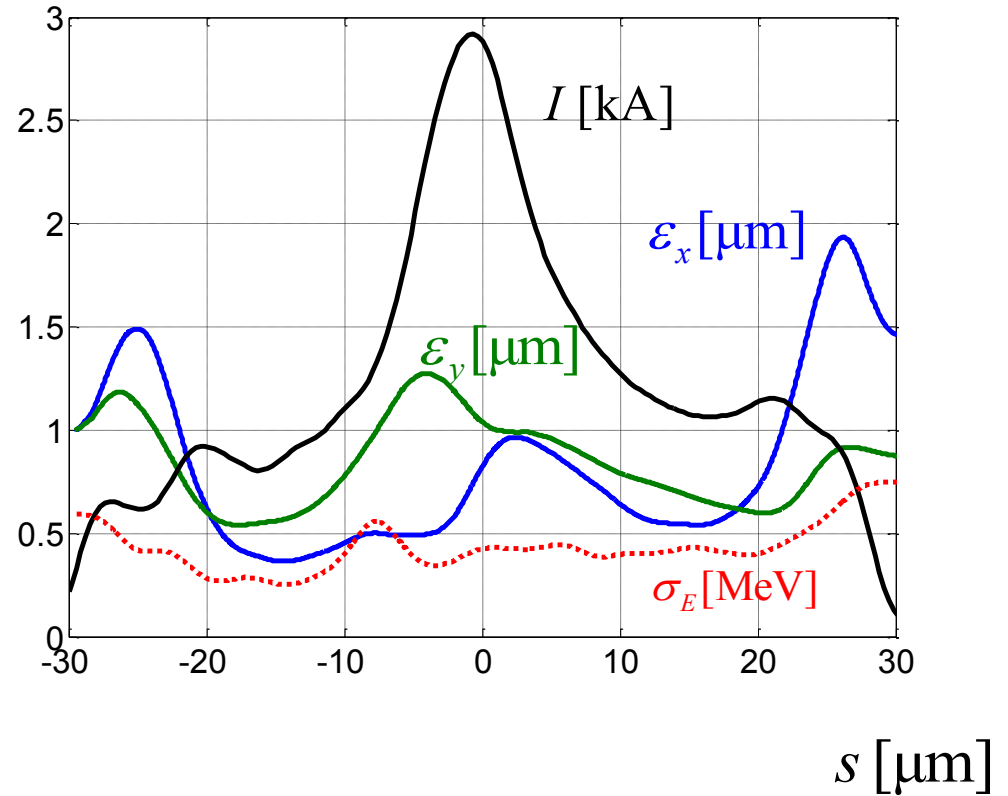
$$\varepsilon_x^{proj} = 2.6 [\mu\text{m}]$$

$$\varepsilon_y^{proj} = 0.9 [\mu\text{m}]$$

FLASH beam dynamic simulations for 500 MeV

Q=0.25 nC (100% particles in analysis)

Current, emittance, energy spread



$$\epsilon_x^{proj} = 3.23 [\mu\text{m}]$$

$$\epsilon_y^{proj} = 1.17 [\mu\text{m}]$$