



1nC/10kA for XFEL

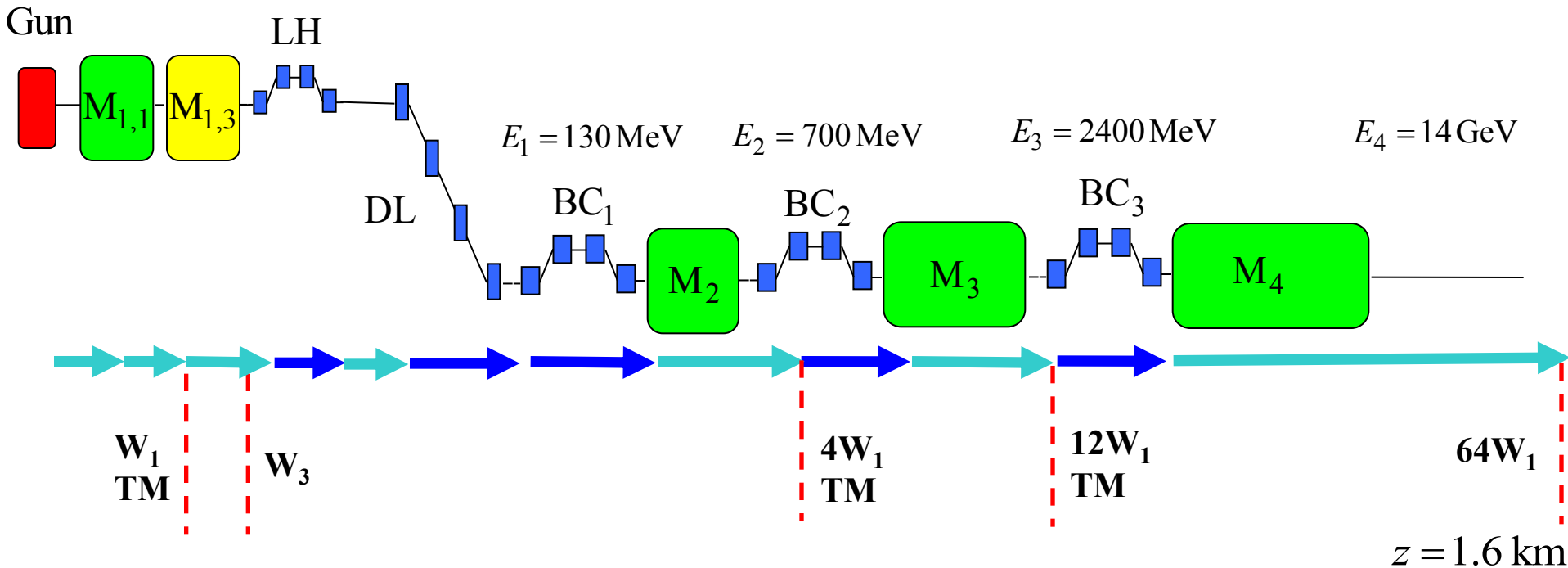
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DESY

Beam dynamics simulations for the European XFEL

Full 3D simulation method (200 CPU, ~10 hours)



 **ASTRA** (tracking with **3D 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

Choosing of machine parameters

Macro-parameters

$$E_1 = 130 \text{ MeV}$$

$$E_2 = 700 \text{ MeV}$$

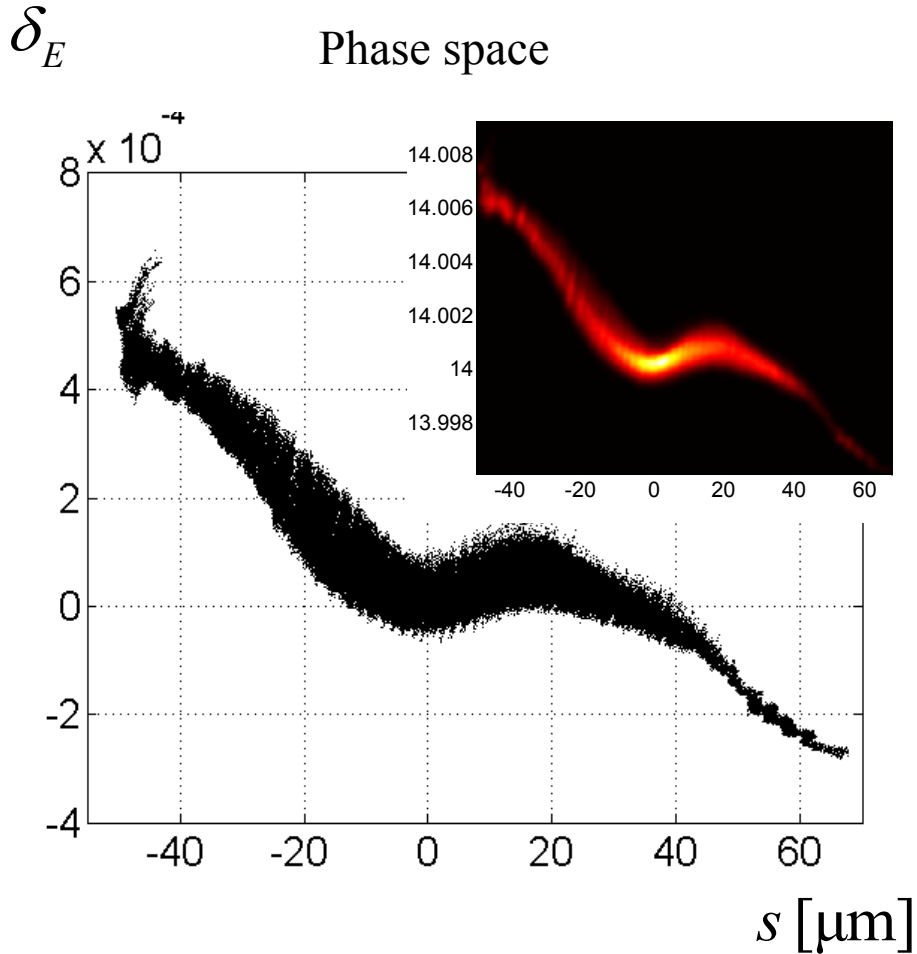
$$E_3 = 2400 \text{ MeV}$$

Charge Q , nC	Momentum compaction factor in BC_1 $R_{56,1}$, [mm]	Compr. in BC_1 C_1	Momentum compaction factor in BC_2 $R_{56,2}$, [mm]	Compr. in BC_2 C_2	Momentum compaction factor in BC_3 $R_{56,3}$, [mm]	Total compr. C	First derivative Z' , [m ⁻¹]	Second derivative Z'' , [m ⁻²]
1	-100	3.5	-54	8	-20	121	0	2000
1	-86	3.5	-54	8	-20	242	0	1500

Chicane	Minimum R56 [mm]	Maximum R56 [mm]
BC0	0, 30	90
BC1	20	80
BC2	10	60

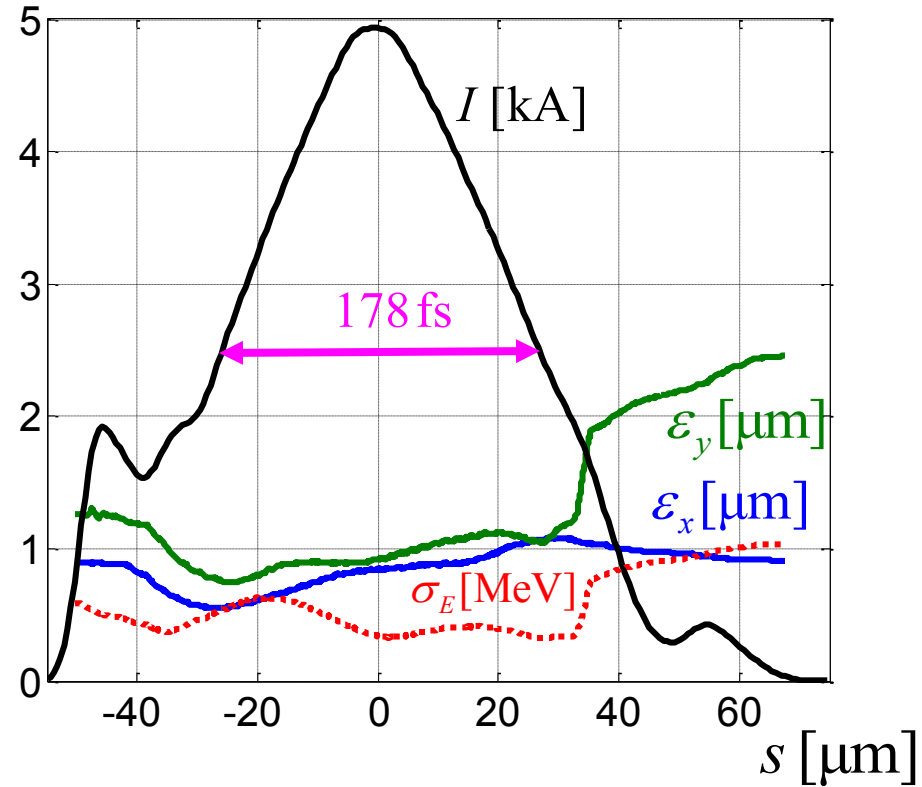
Table 1: R56 requirements for XFEL magnet compressor chicanes

Q=1 nC, I=5kA



bunch head

Current, emittance, energy spread



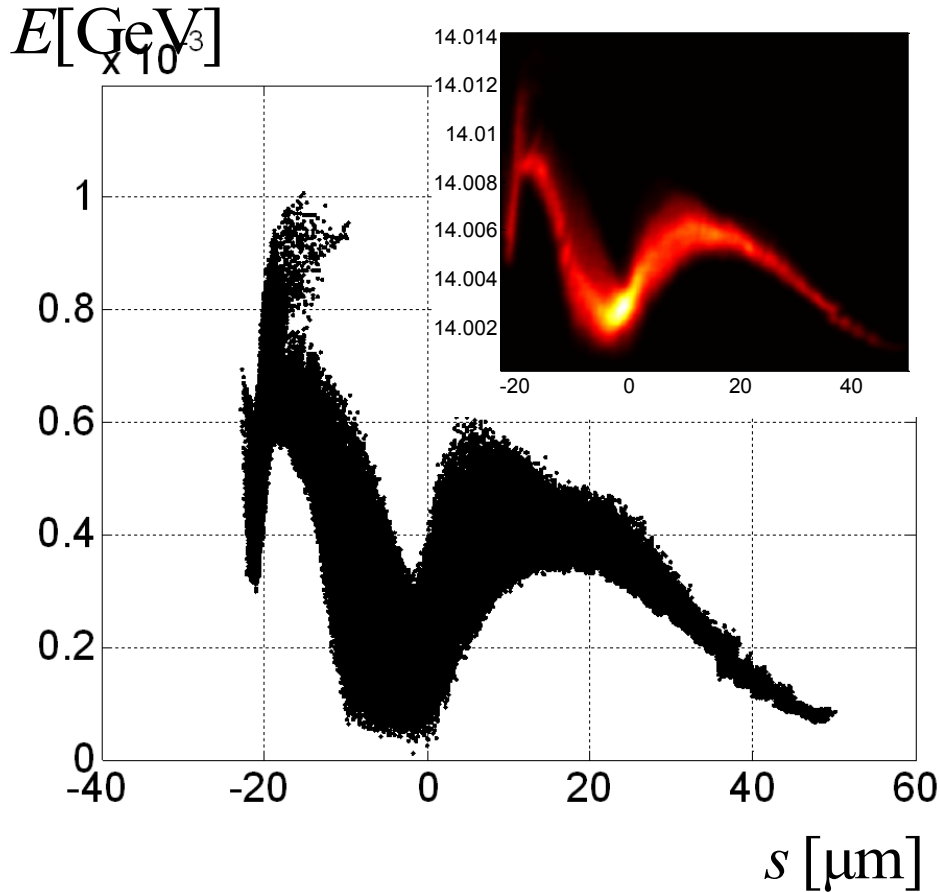
$$\epsilon_x^{proj} = 0.9 [\mu\text{m}]$$

$$\epsilon_y^{proj} = 3.5 [\mu\text{m}]$$

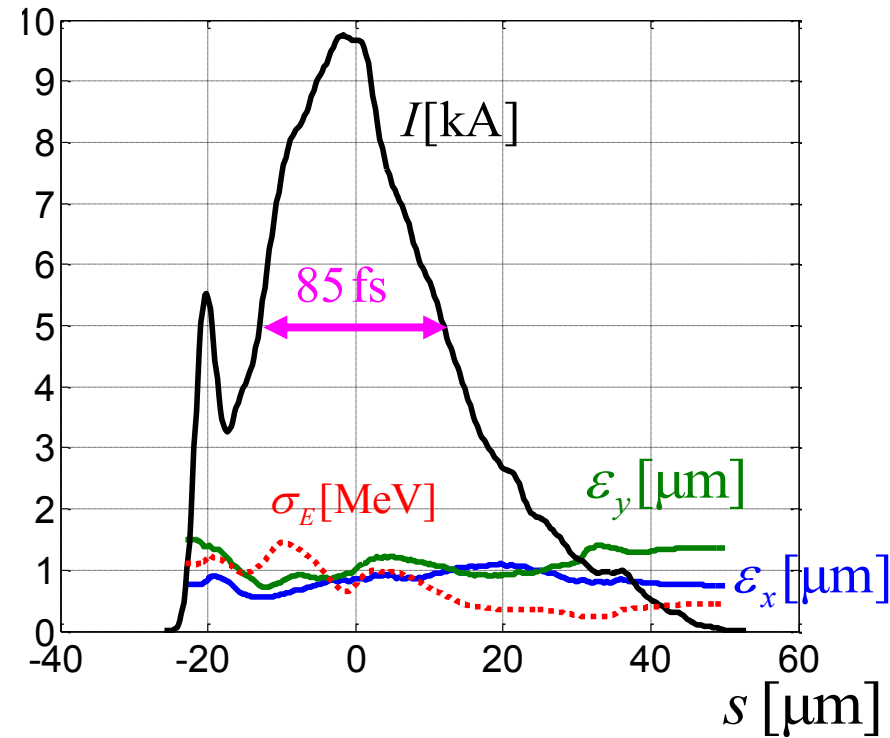
We have removed 6% of bad particles in the analysis

Q=1 nC, I=10kA

Phase space



Current, emittance, energy spread



bunch head

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

$$\epsilon_y^{proj} = 8 [\mu\text{m}]$$

We have removed 2% of bad particles in the analysis

Mismatch and undulator wake.

