PLACET Simulations of Intensity-dependent effects at ATF2

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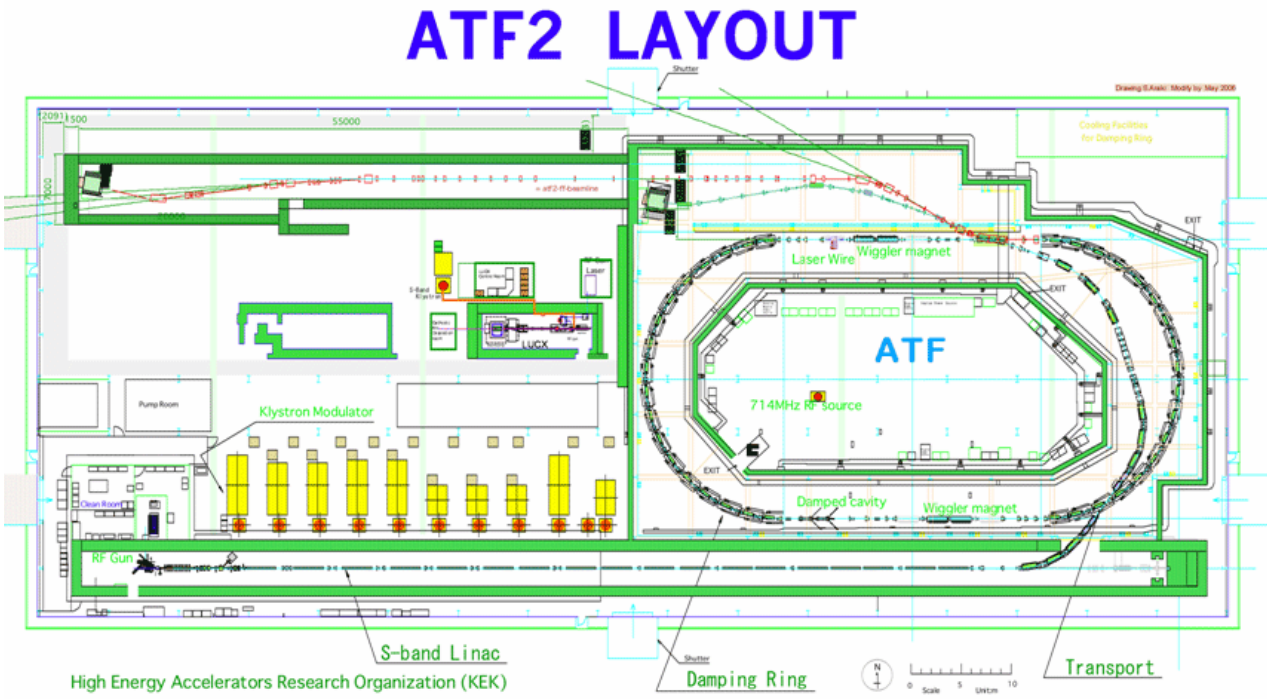
Outline

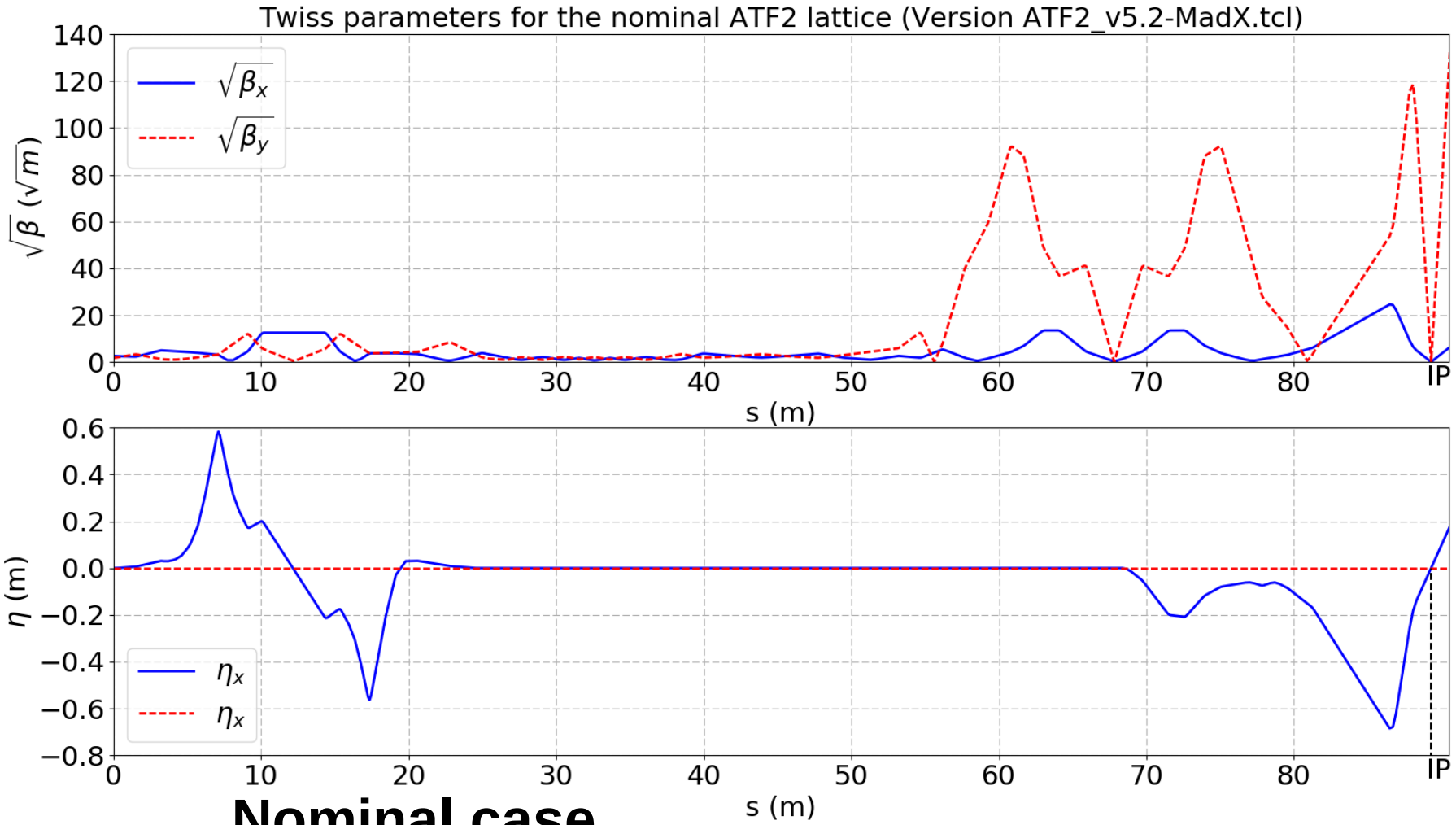
- **Pursue the studies on the intensity-dependent effects**
- **Start comprehensive simulations of ATF2 using Placet**
- **Preparatory studies are presented here**

Parameters for the simulations

E	1.3 GeV
Energy spread	0.08 %
Charge	1e10
εx	5200 nm.rad
εy	30 nm.rad
Bunch length	7 mm



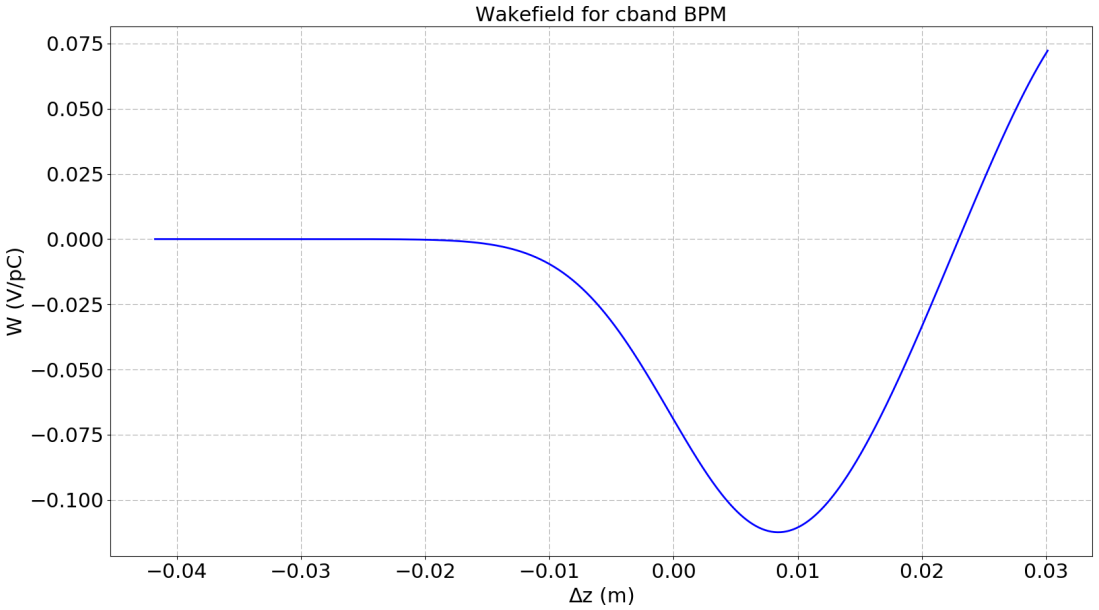
ATF2 twiss parameters with Placet

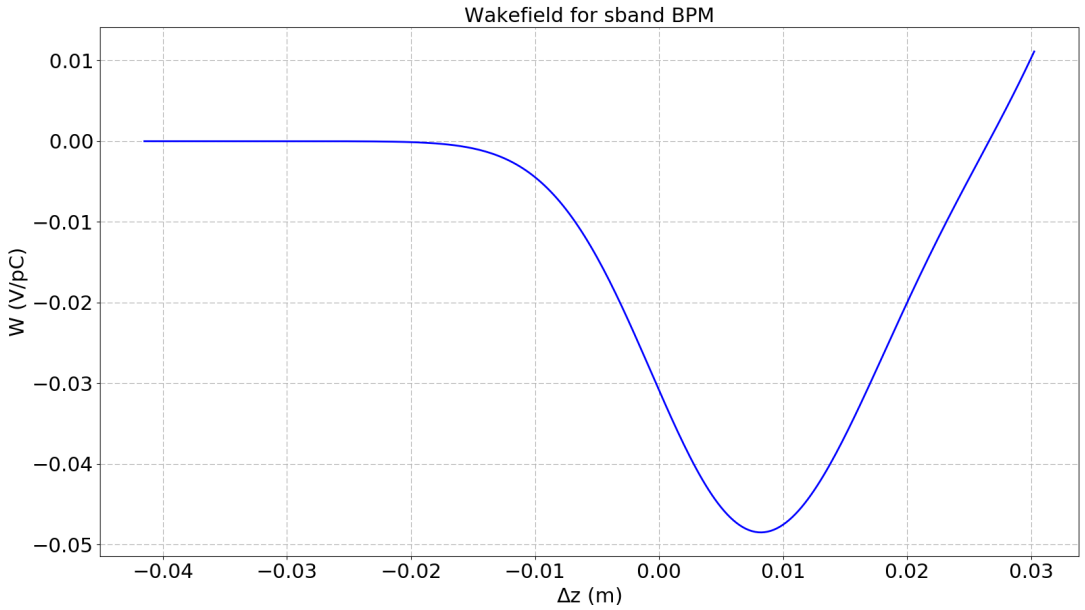


Nominal case

At IP σ_y = 37.19 nm **β_y* = 0.10 mm**

Wakepotentials for C-band and S-band BPMs





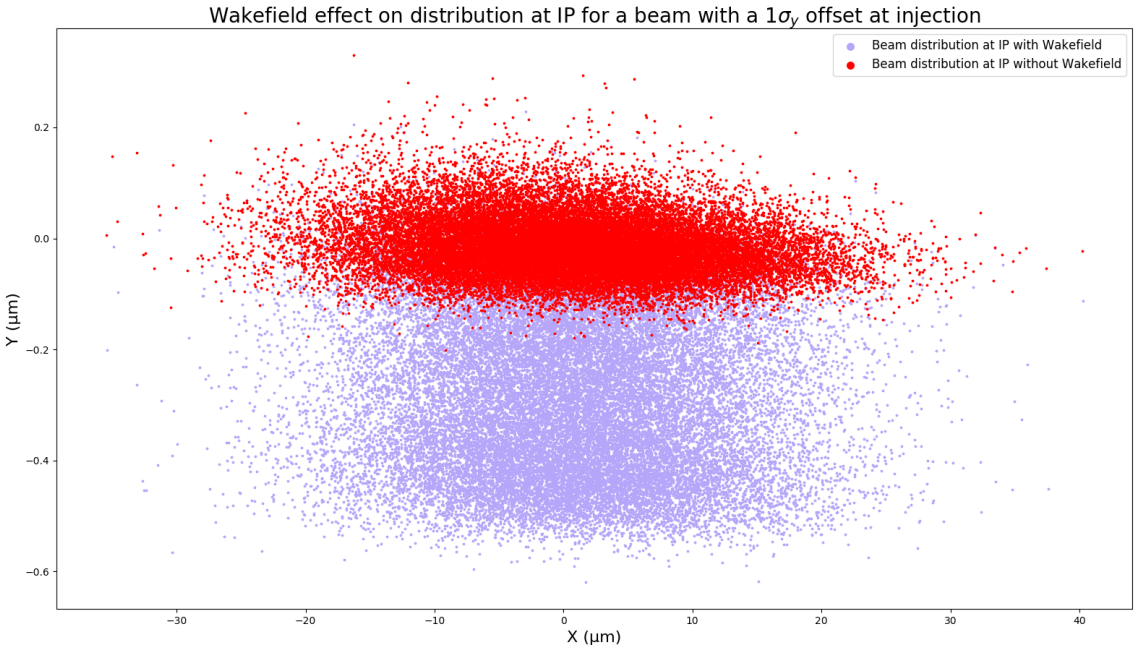
Wakepotentials used for simulations created with GdfidL by A. Lyapin. These wakepotentials were computed for a 7mm long bunch and for an offset of 1mm in the transverse direction.

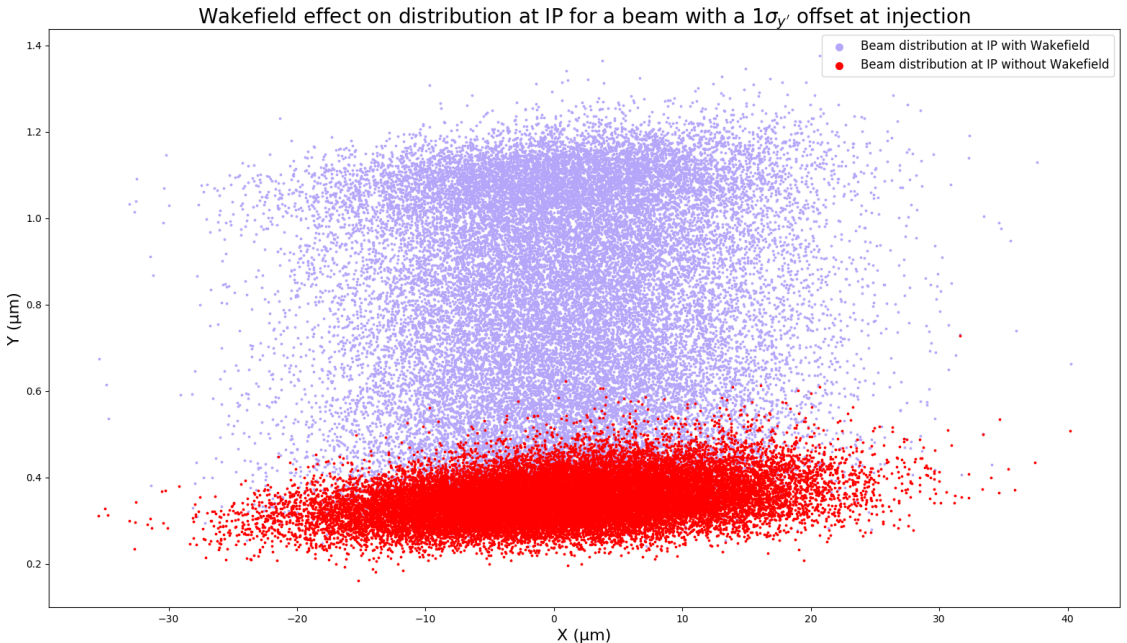
Like the ones which can be found on ATF2 wiki (link).

In simulations:

- **34 C-bend BPMs**
- **2 S-bend BPMs (MSF0FF, MSF1FF)**

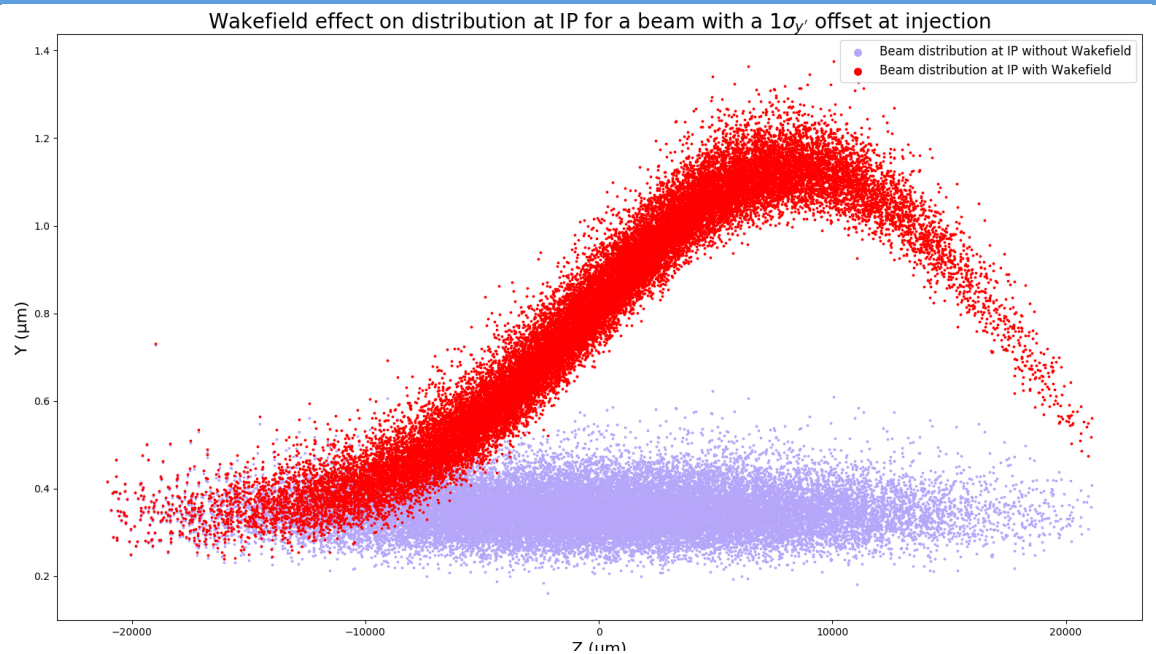
Wakefield effect on distribution at IP

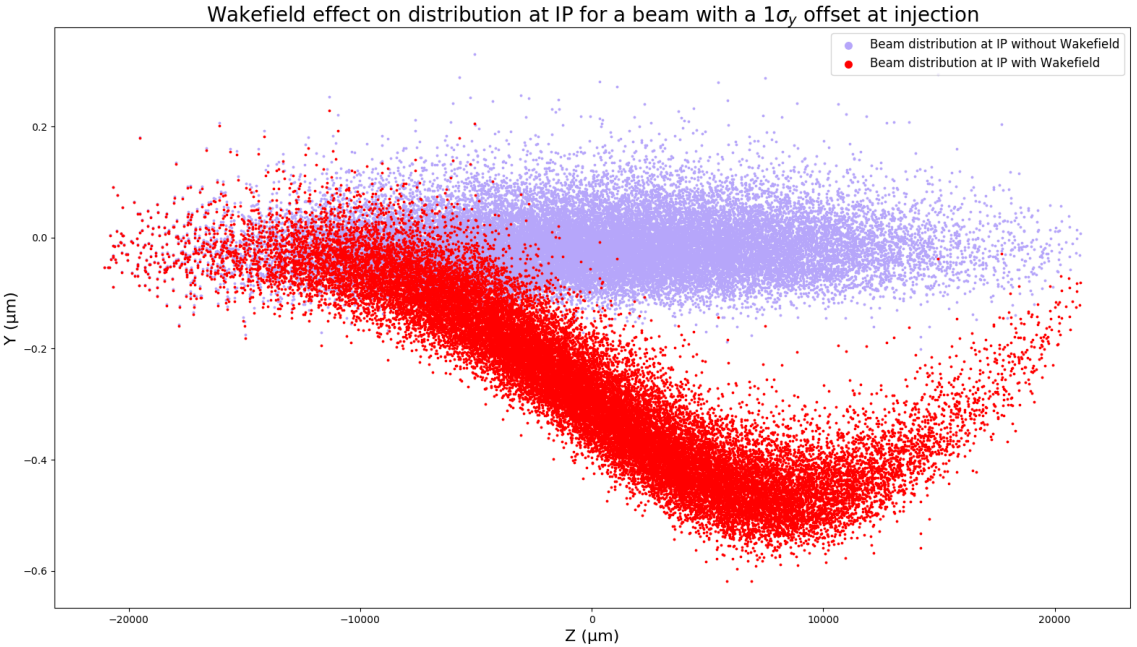




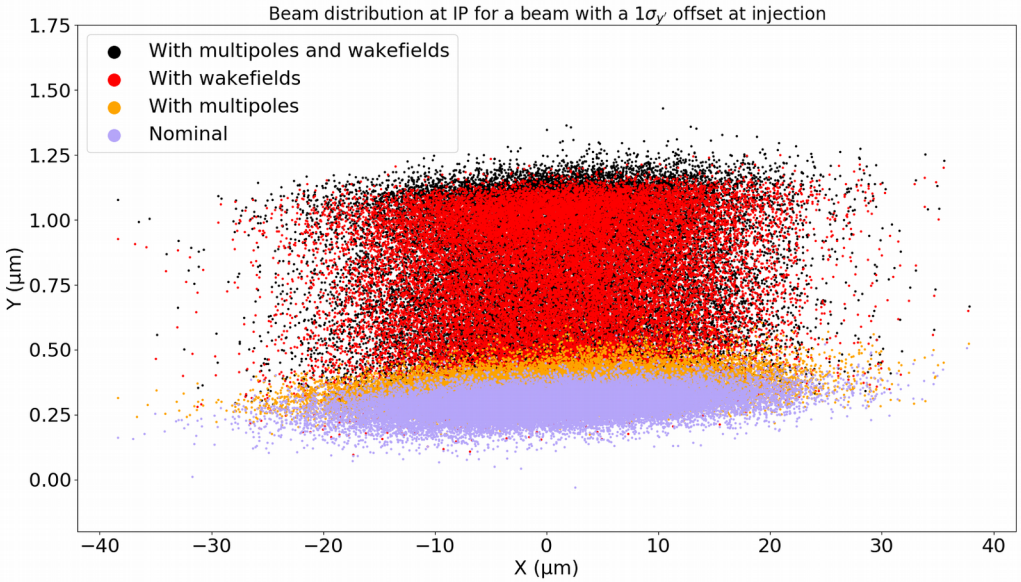
	σ_y (nm) Wakefield OFF	σy (nm) Wakefield ON
No offset	37.5893	37.5933
σy offset	52.2165	149.9093
σy' offset	50.3186	251.7890

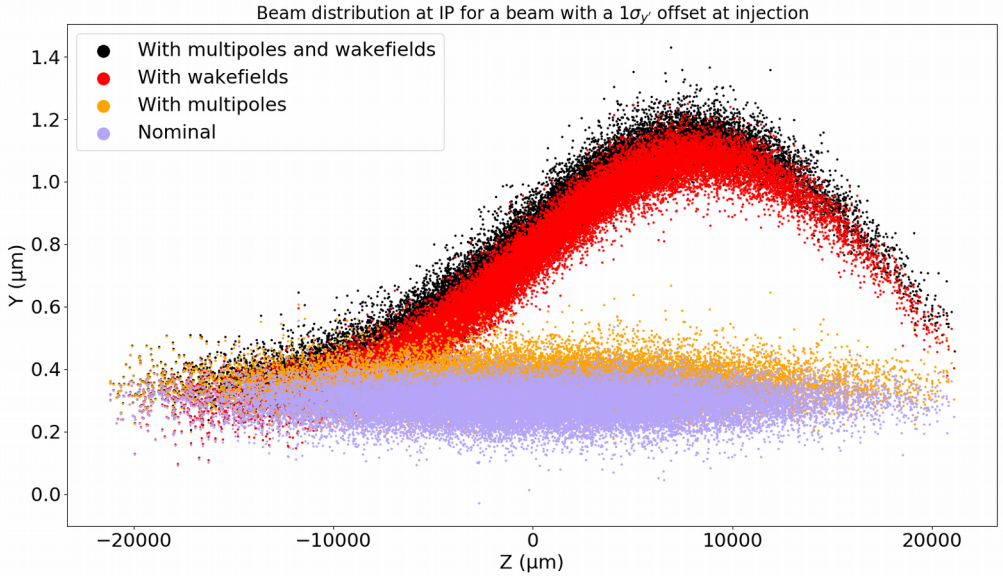
Wakefield effect on distribution at IP





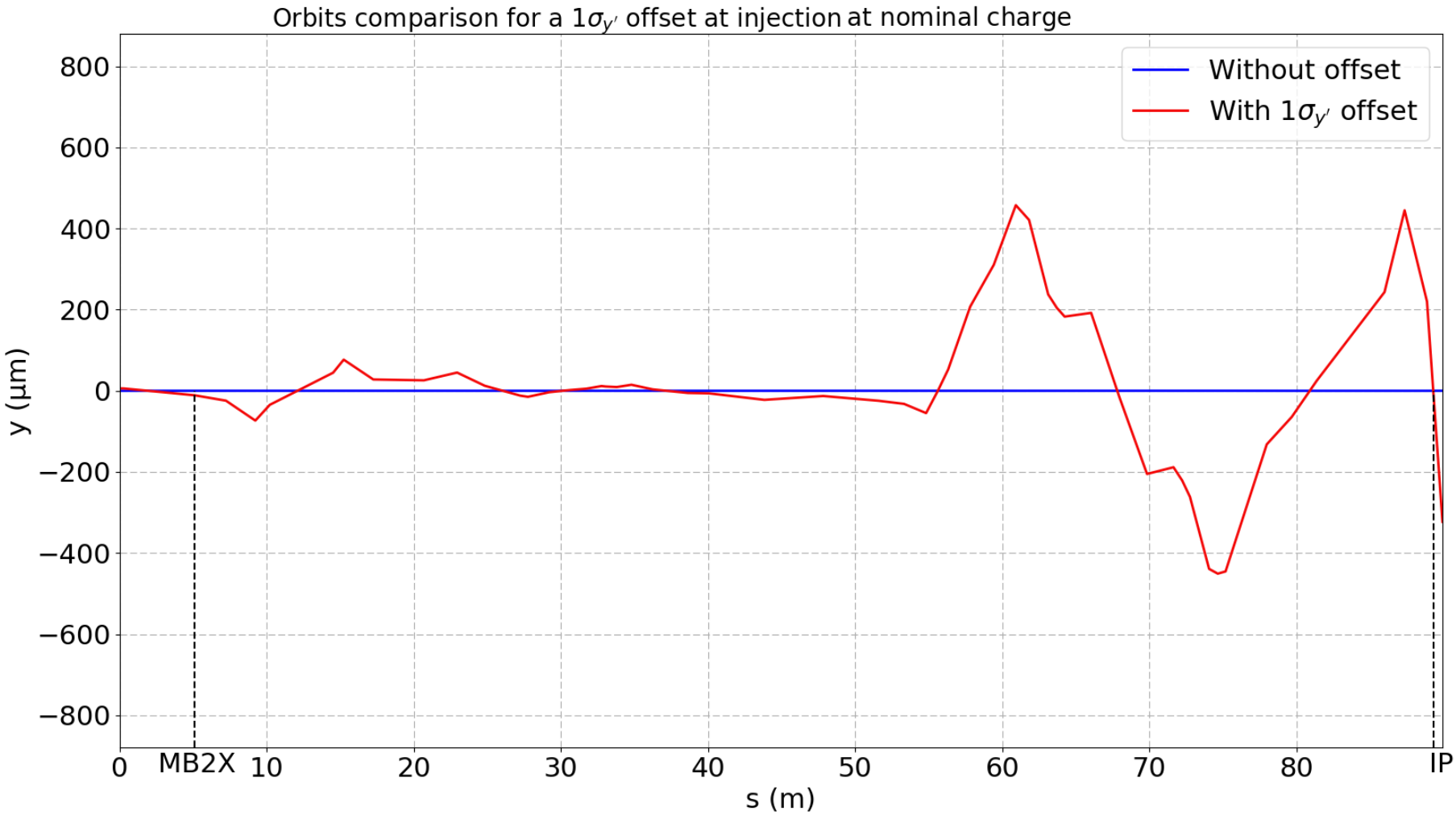
Comparison cases multipoles/wakefields for a 1$\sigma_{y'}$ offset





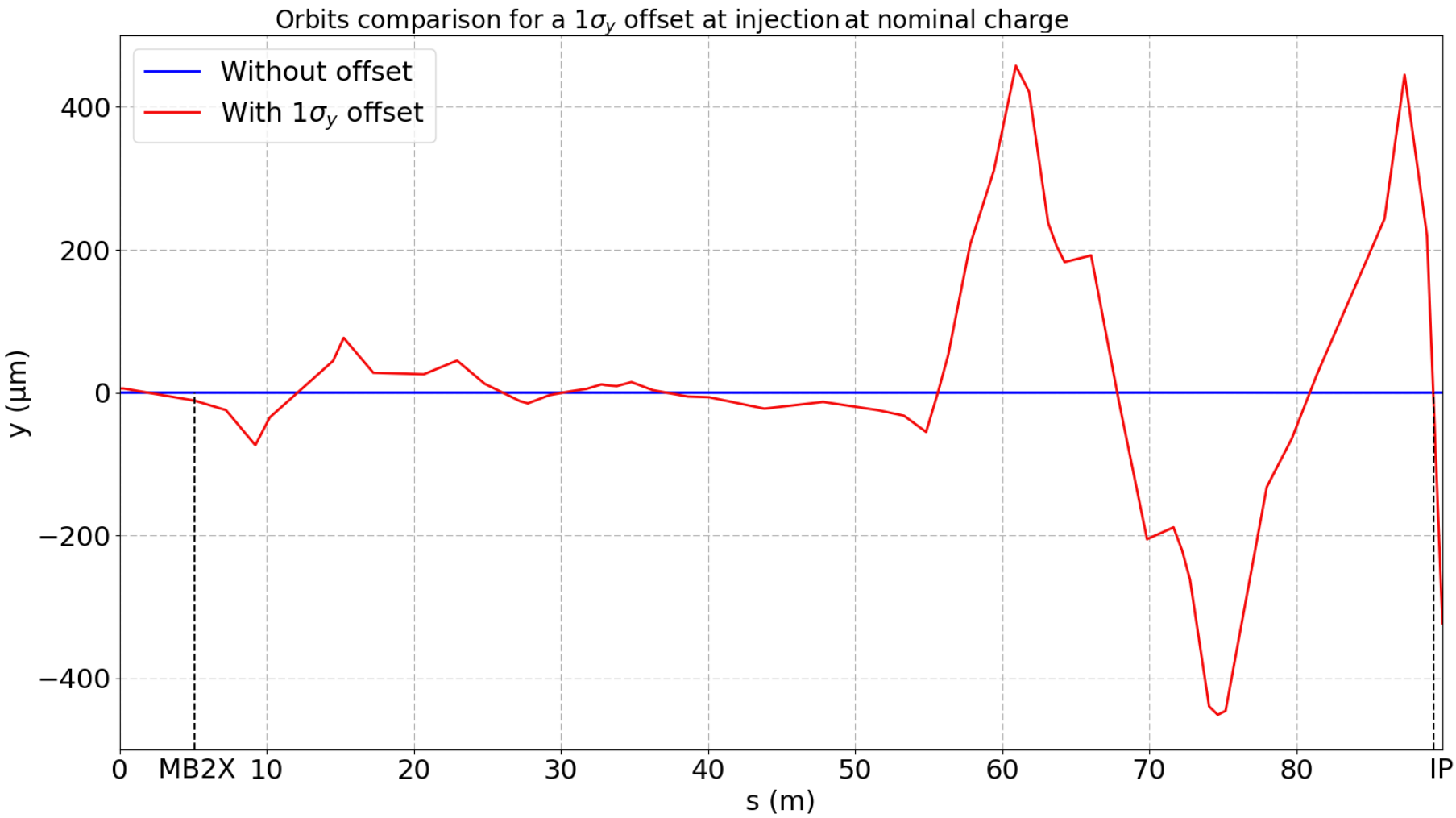
Case	Beam size σ_y (nm)
Nominal	48.6218
With multipoles	50.3186
With wakefields	251.7907
With multipoles and wakfields	251.7890

Effect of a 1σy' offset on the orbit



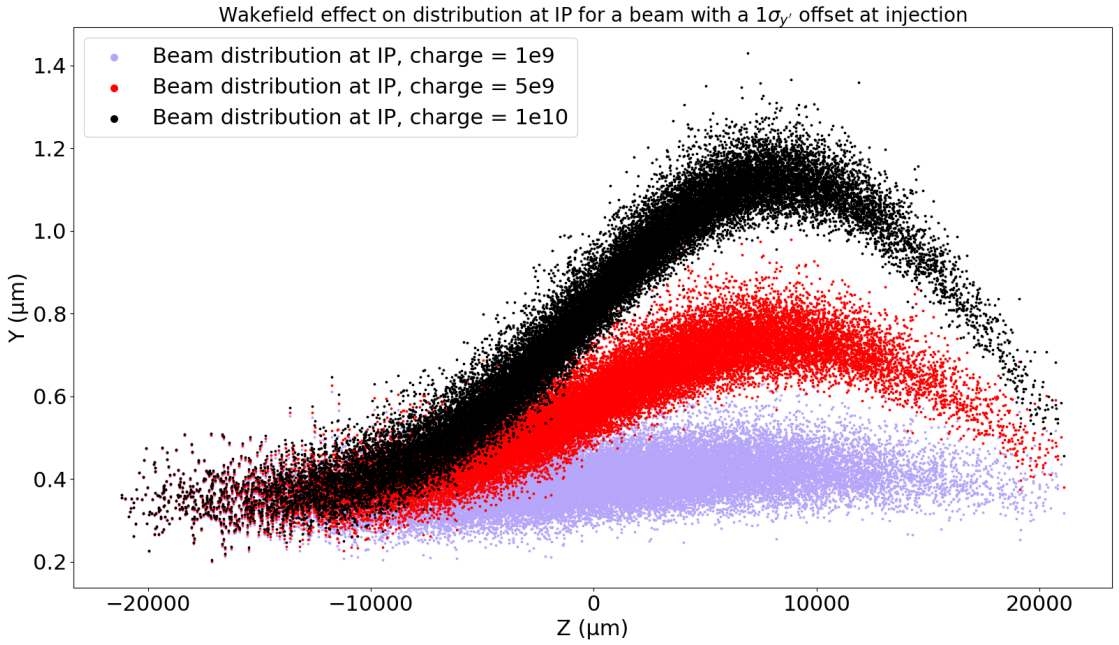
At IP σ_y = 251.79 nm **β_y^* = 0.652 mm**

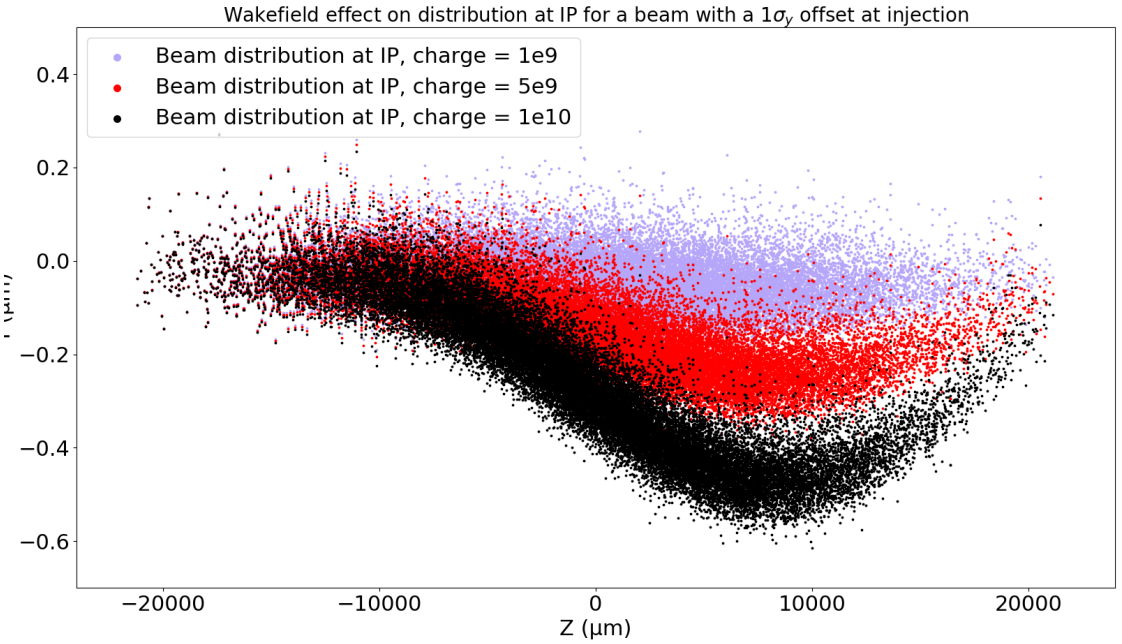
Effect of a 1σy offset on the orbit



At IP σ_y = 149.91 nm **β_y^* = 0.430 mm**

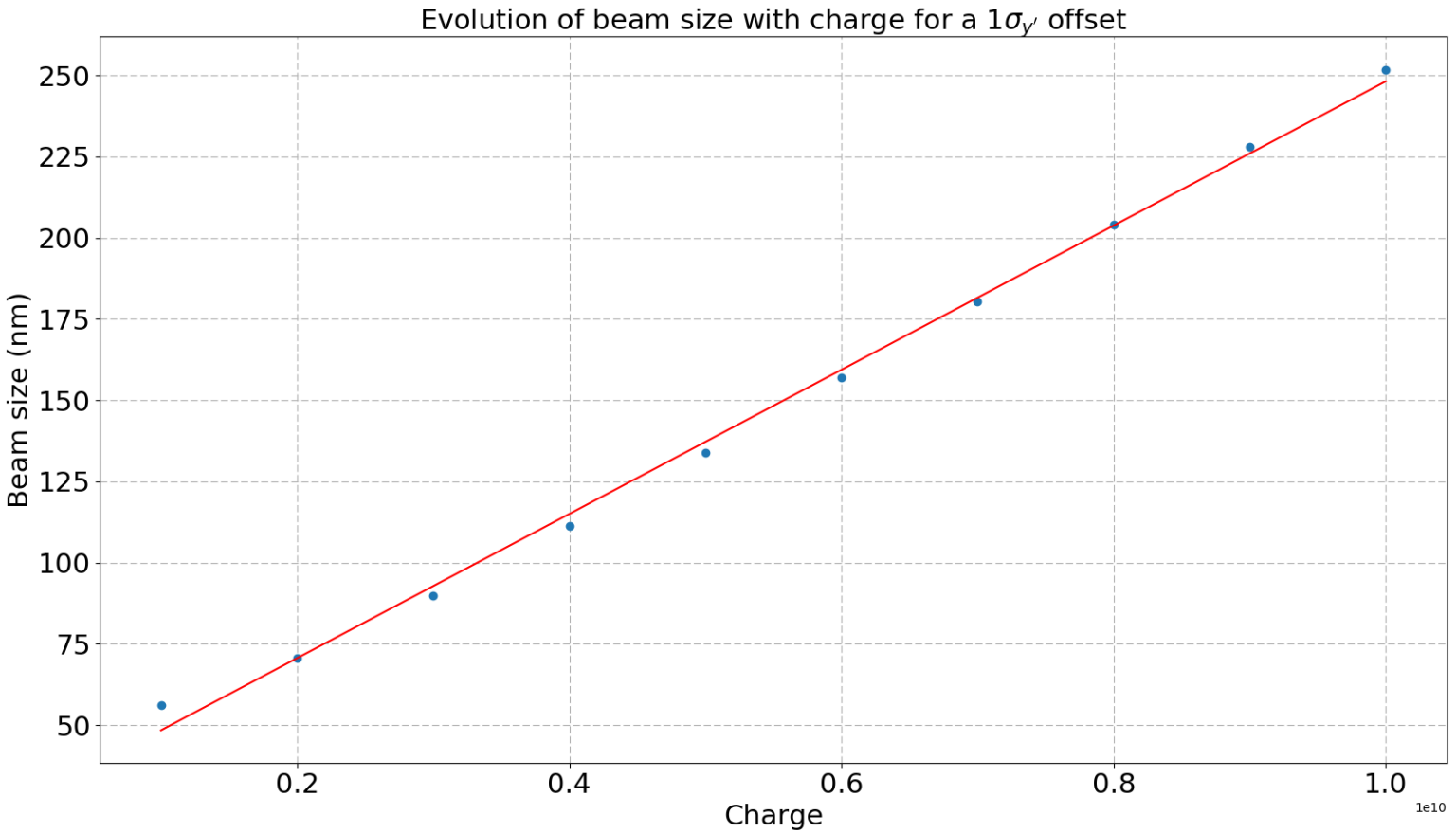
Intensity-dependent effects on bunch distribution at IP





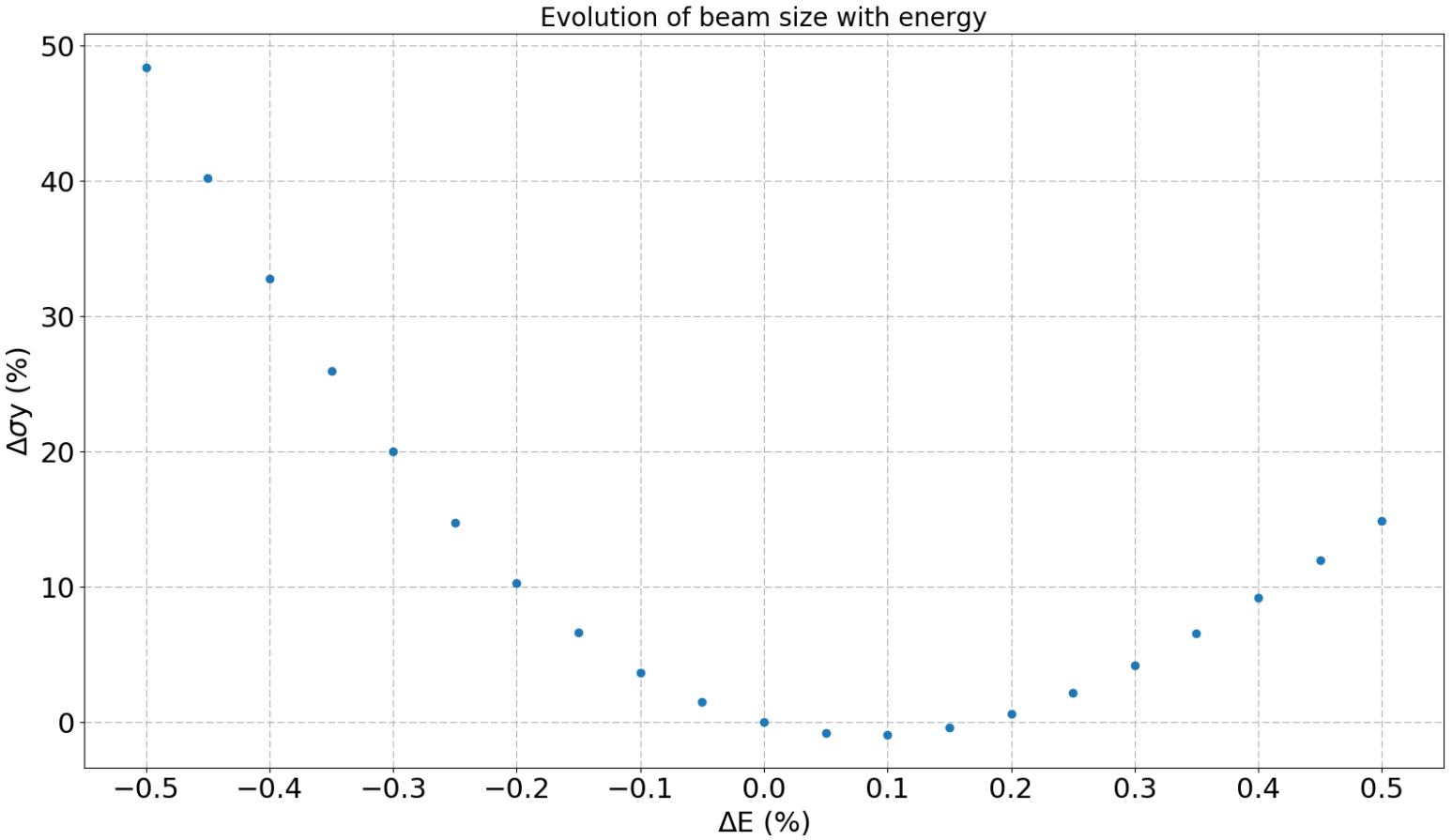
	Charge 1e9	Charge 5e9	Charge 1e10
Case	σy (nm)	σy (nm)	σy (nm)
No offset	37.59	37.59	37.59
1σy offset	53.95	70.00	149.90
1σy' offset	56.15	133.80	251.79

Intensity dependent effects



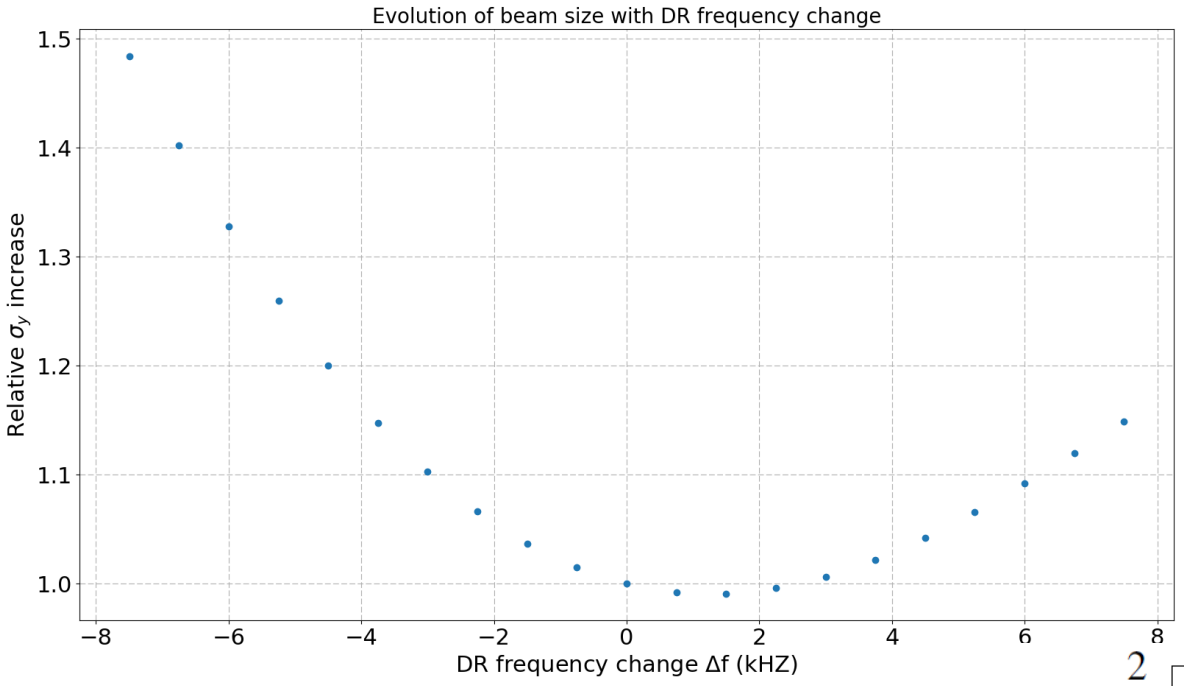
Charge (x10^{10})	Beam size (nm)
0.1	56.15
0.2	70.76
0.3	89.94
0.4	111.31
0.5	133.80
0.6	156.91
0.7	180.38
0.8	204.06
0.9	227.89
1.0	251.79

Evolution of beam size with energy

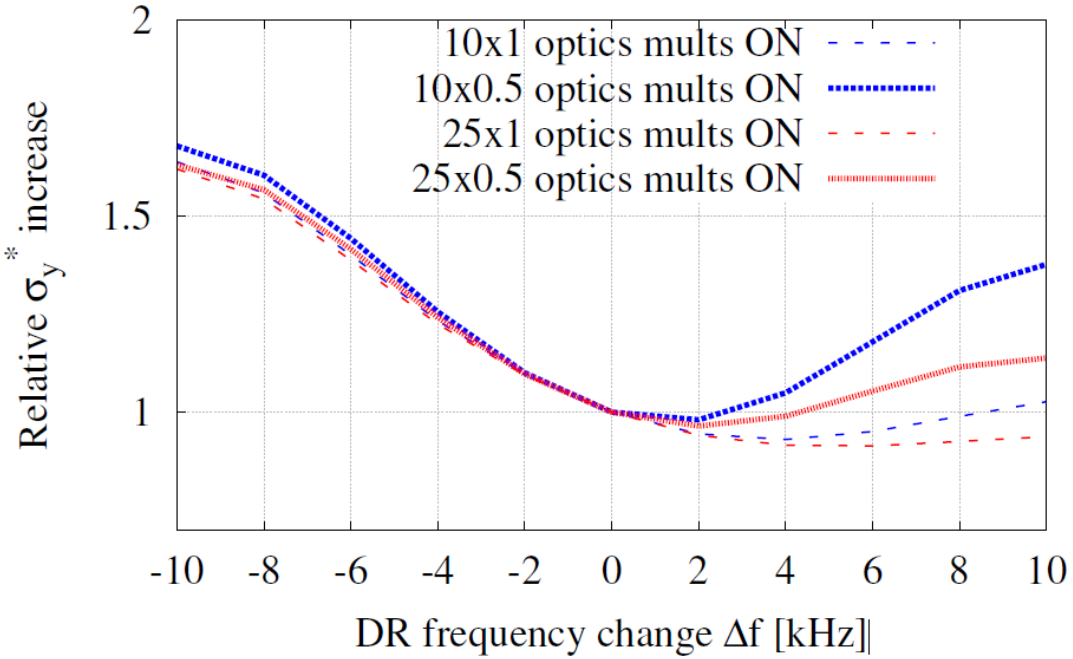


ΔE (%)	Δσy (%)
-0.50	48.40
-0.45	40.23
-0.40	32.74
-0.35	25.99
-0.30	19.99
-0.25	14.76
-0.20	10.31
-0.15	6.62
-0.10	3.68
-0.05	1.48
0.00	0.00
0.05	-0.79
0.10	-0.92
0.15	-0.42
0.20	0.64
0.25	2.21
0.30	4.21
0.35	6.56
0.40	9.18
0.45	11.99
0.50	14.91

Evolution of beam size with energy



10x1 optics
Multipoles ON



Outlook

- **Integrate static and dynamics imperfections in the simulation, e.g.:**
  - **Incoming beam jitter**
  - **Misalignment of components**
  - **Diagnostics systematics**
  - **Stray fields**

- **Assess incoming beam jitter from experimental data**

- **Try to reproduce in simulation the measured intensity dependence plot**

- **Long term goal: explore potential strategies to mitigate these effects**

- **Extrapolate the results for CLIC and ILC**