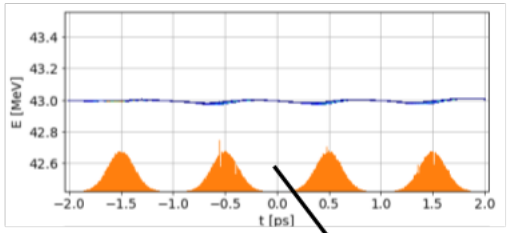
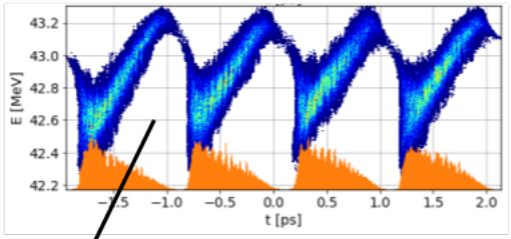
Convergence Study for Static and Full-Wave Solvers



OPAL with Full-Wave solver



1.1 m = wiggler length

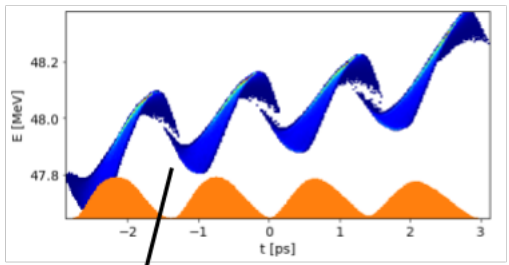
BUNCH

WIGGLER

Simulation start,
x = -10 cm

x = 0 cm

Screen,
x = 95 cm



OPAL with Static solver

Gun

Cavity

Cavity

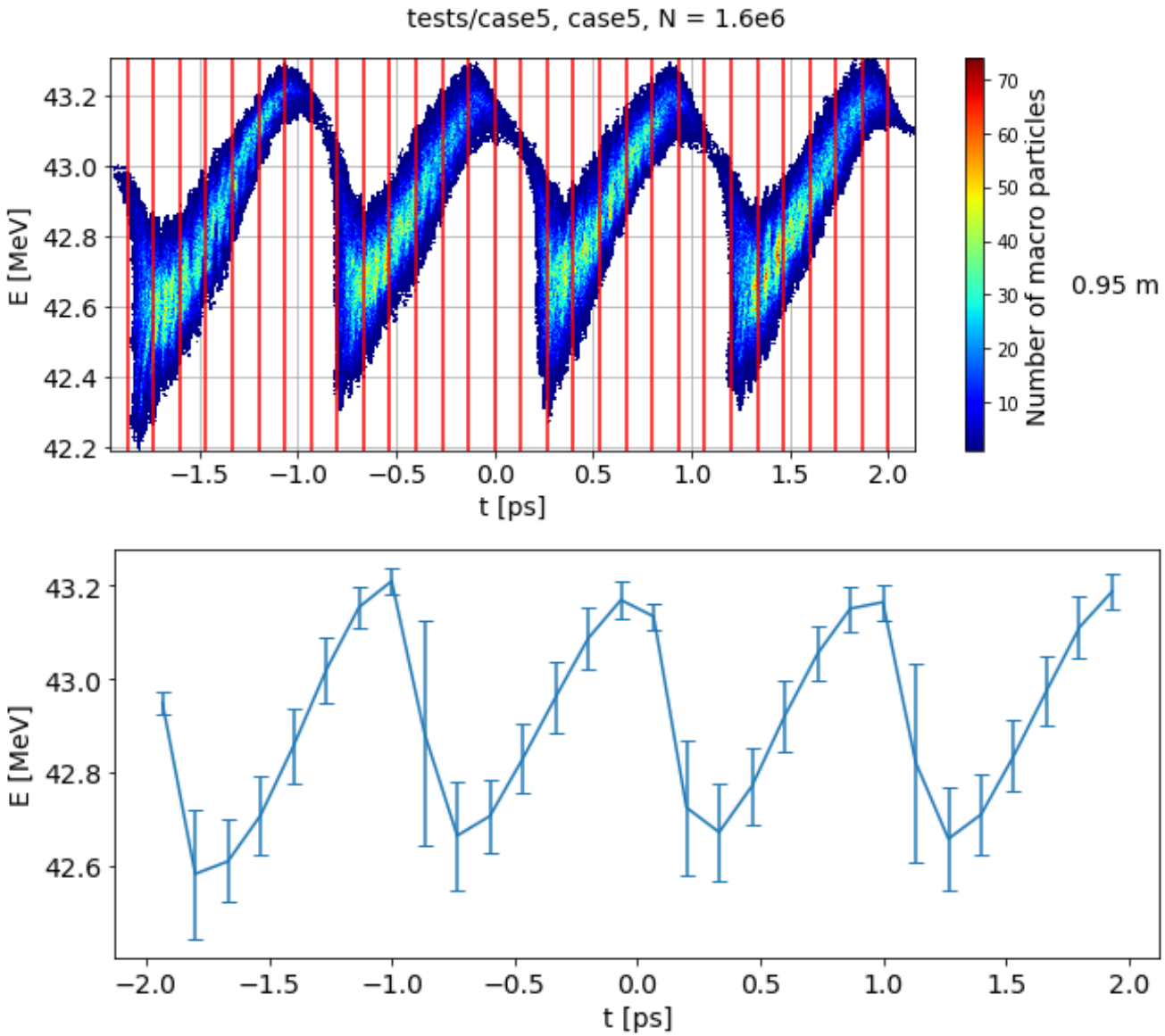
Cavity

Cavity

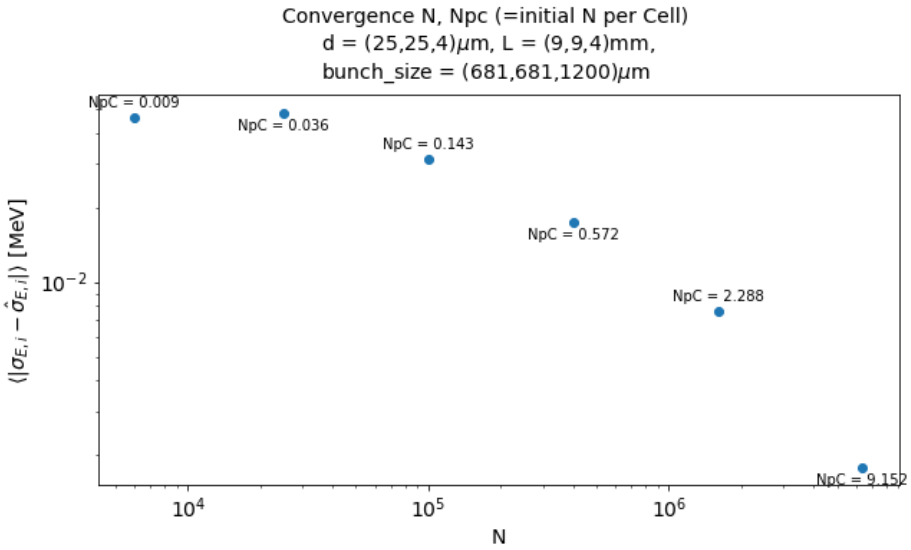
Simulation start,
x = 0 cm

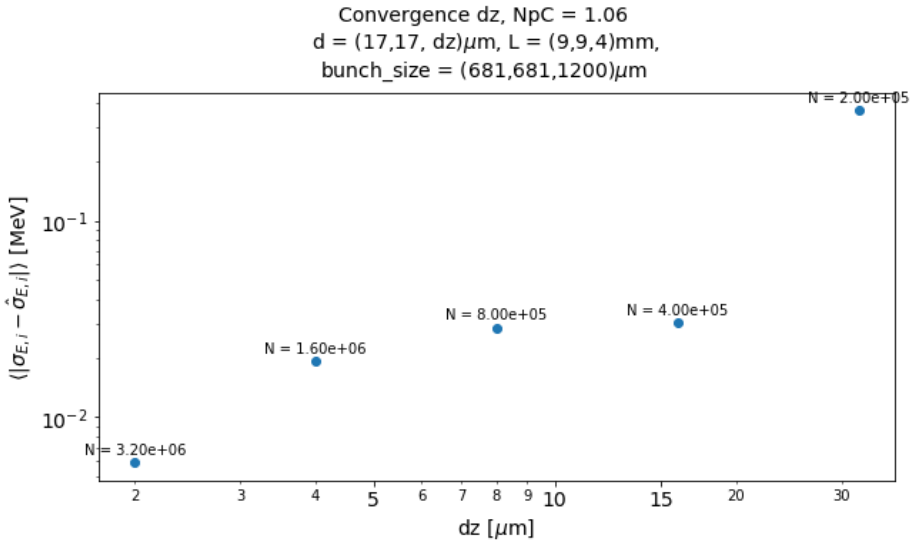
YAG 4,
x = 11.47 m

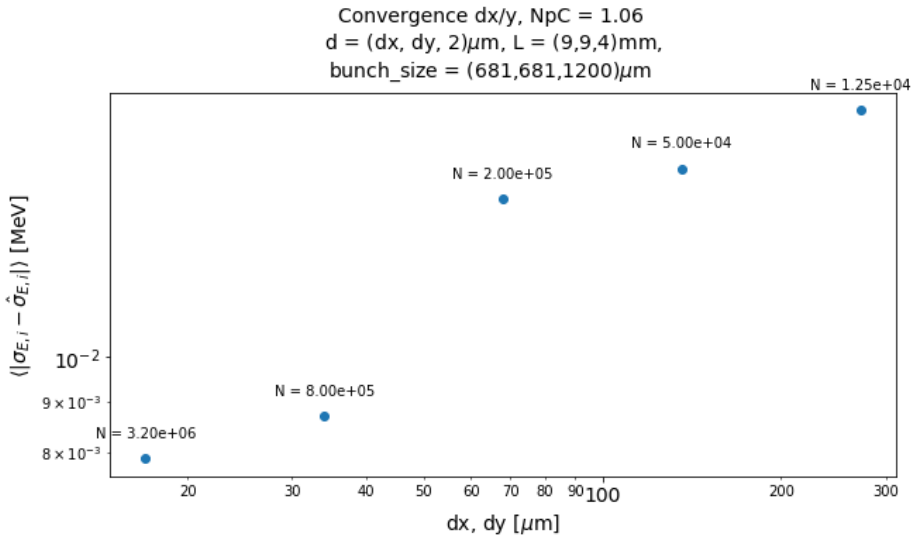
Convergence Study for Static and Full-Wave Solvers



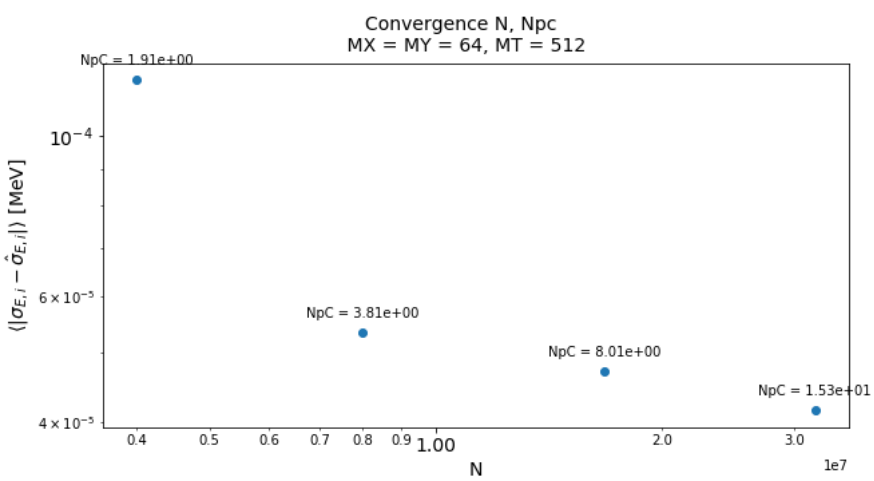
Convergence Study for Full-Wave Solver

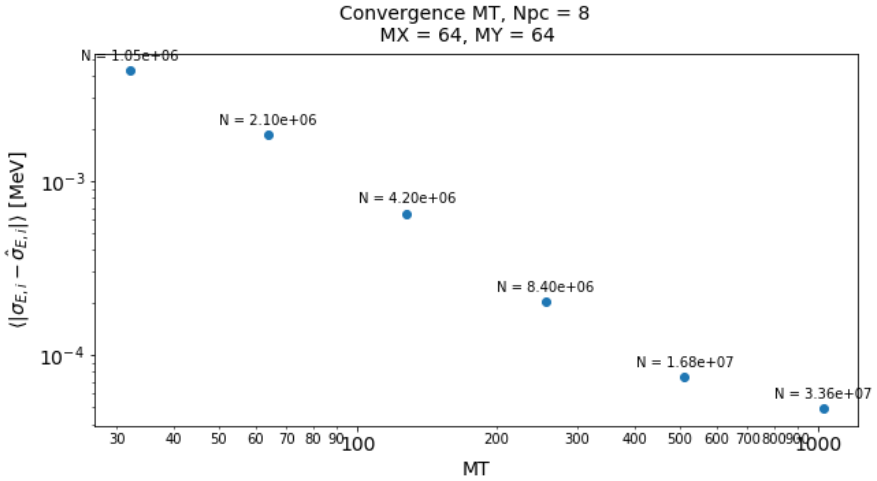


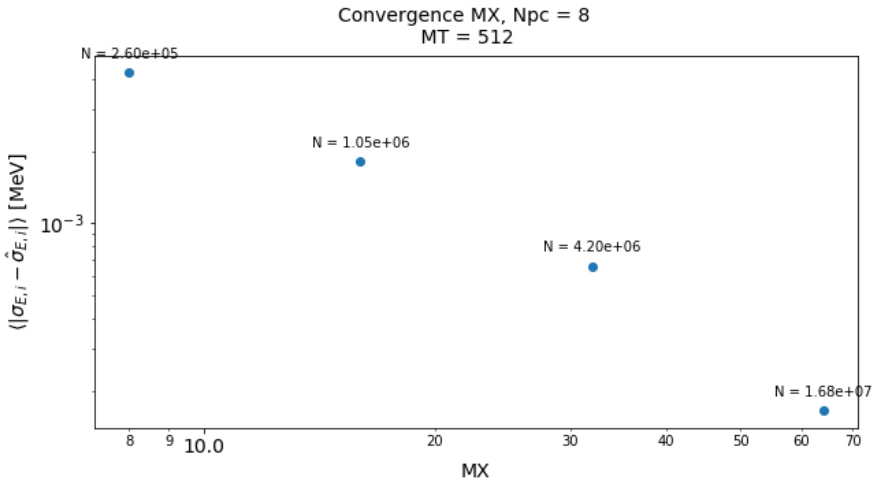




Convergence Study for Static Solver

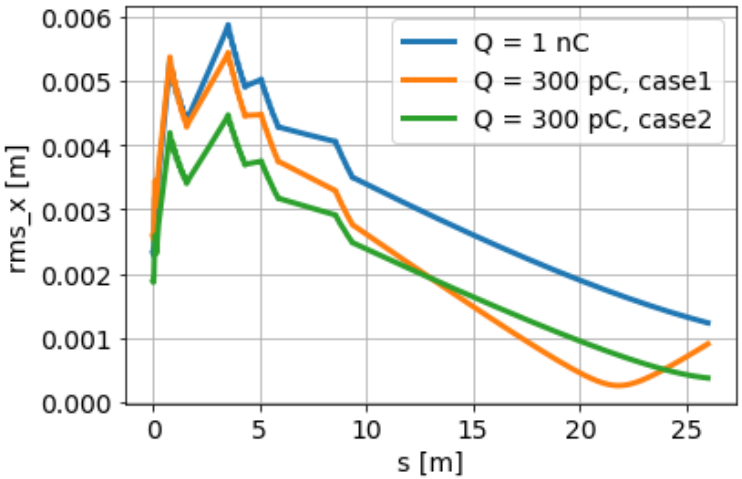


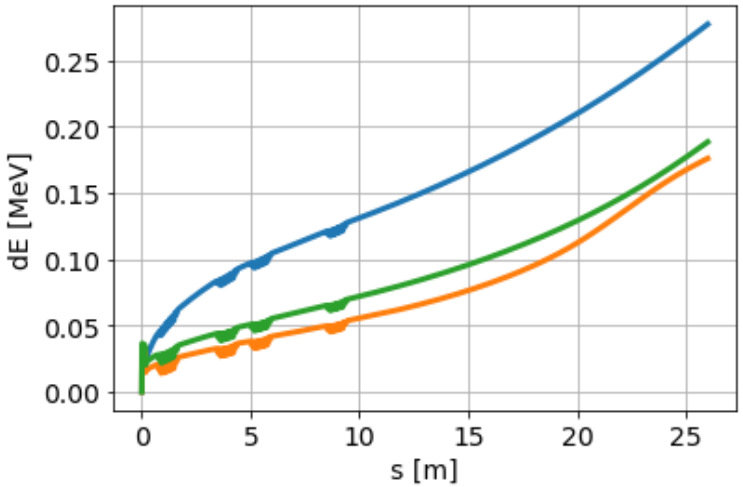


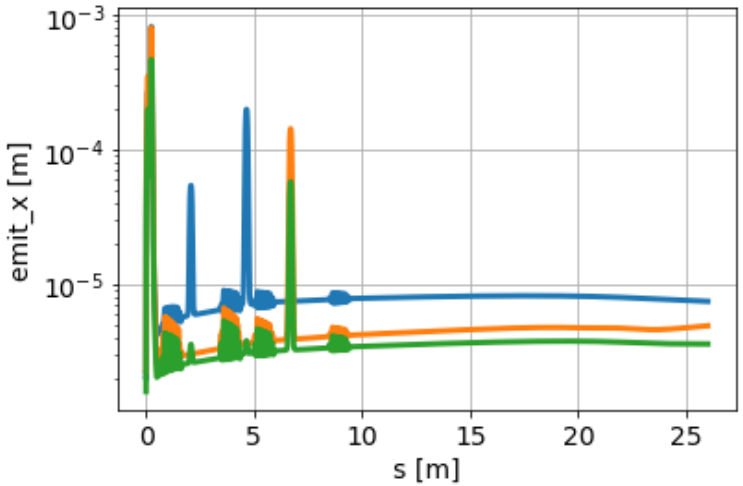


S2E Simulations which Minimise σ_E

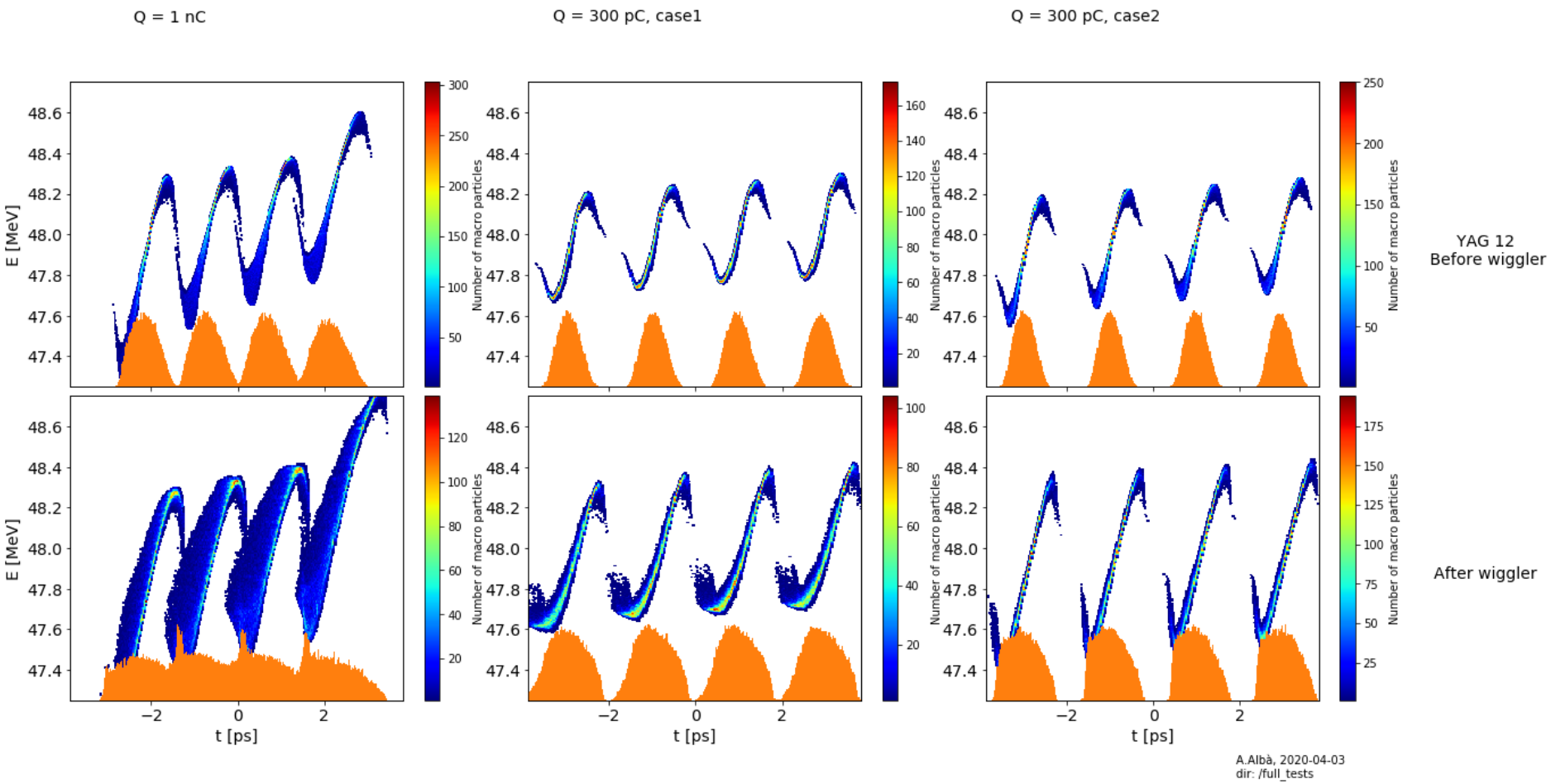
at $s = 26$ m	ϵ_x [mm mrad]	σ_E [KeV]	σ_x [mm]
1 nC	7.4	277	1.2
.3 nC, c1	4.9	176	.9
.3 nC, c2	3.6	188	.37







S2E Simulations which Minimise σ_E

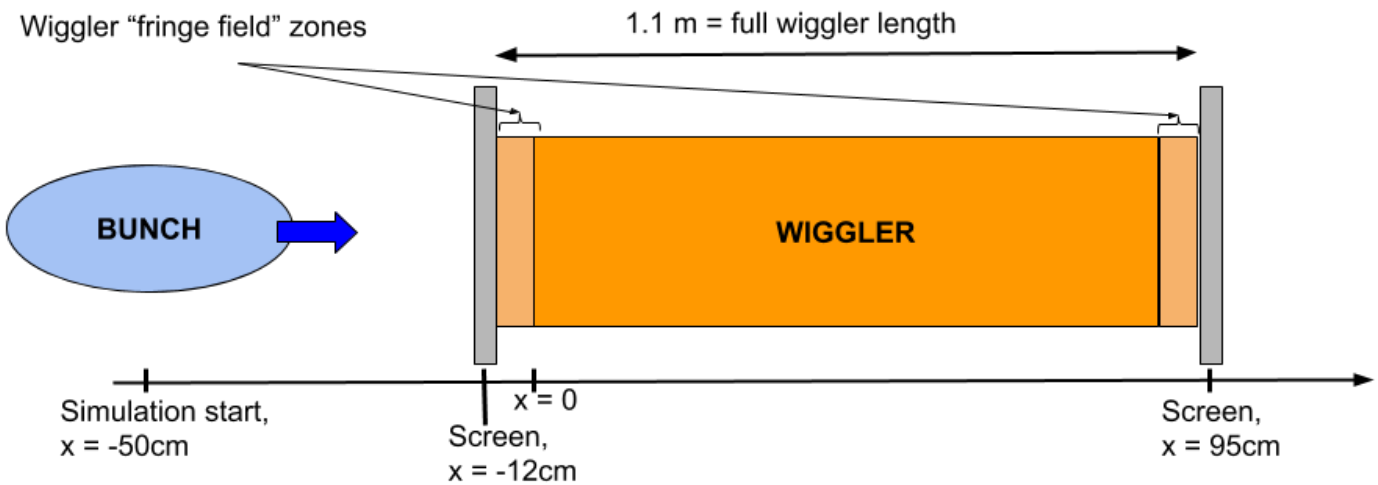


Parameters and Schematics for Wiggler Only Simulations

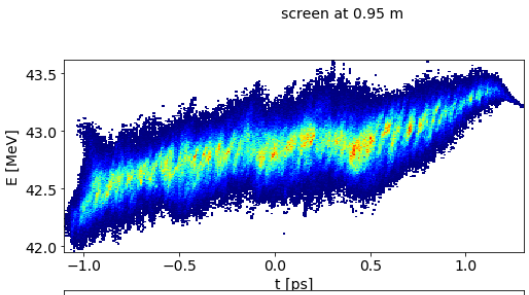
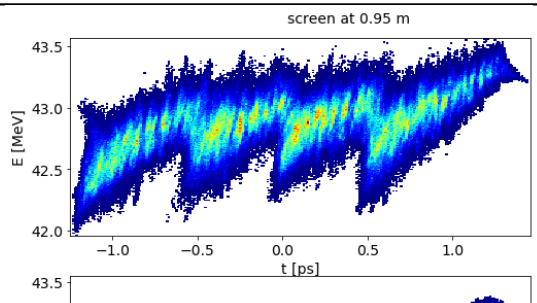
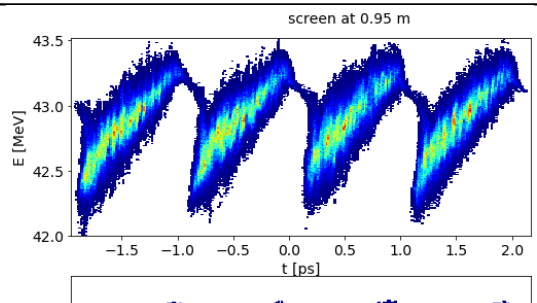
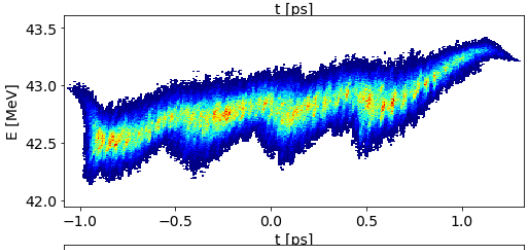
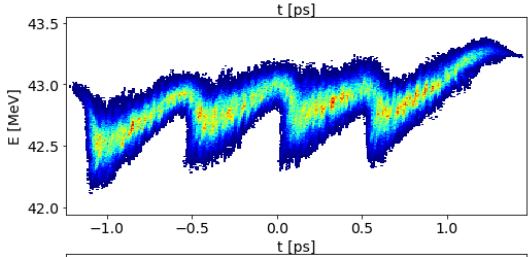
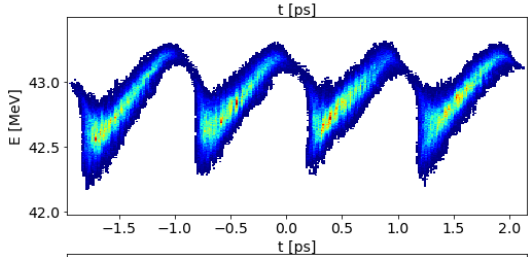
$FWHM_t = .3\text{ps}$	$\lambda = .42, .52, 1\text{ps}$	$K_w = 10.81$
$\sigma_\perp = 0.340, 0.681, 1\text{mm}$	$E = 43\text{MeV}$	$Q = .3\text{nC}$

Remarks:

- Chosen λ values correspond to density modulation $50, 75, 99\%$.
- Chosen λ values correspond to radiation diffraction limit $\sigma_{diff} = \frac{1}{2\pi}\sqrt{\lambda_w \lambda} = 521, 580, 804\mu\text{m}$. Theory says radiation becomes negligible when $\sigma_\perp > \sigma_{diff}$
- The wiggler reduces the effective γ of the bunch to $\gamma_w = \frac{\gamma}{\sqrt{1+\frac{K_w^2}{2}}} = 10.92$.



Wiggler Only Simulations

$\sigma_\perp$	$\lambda = .42$ps, $mod = 50\%$, $\sigma_{diff} = 521\mu$m	$\lambda = .52$ps, $mod = 75\%$, $\sigma_{diff} = 580\mu$m	$\lambda = 1$ps, $mod = 99\%$, $\sigma_{diff} = 804\mu$m
340µm			
681µm			
1mm