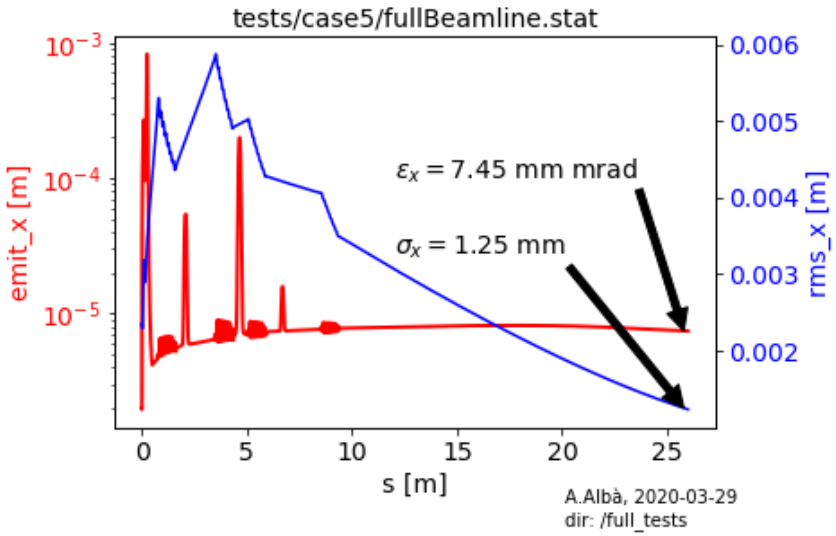
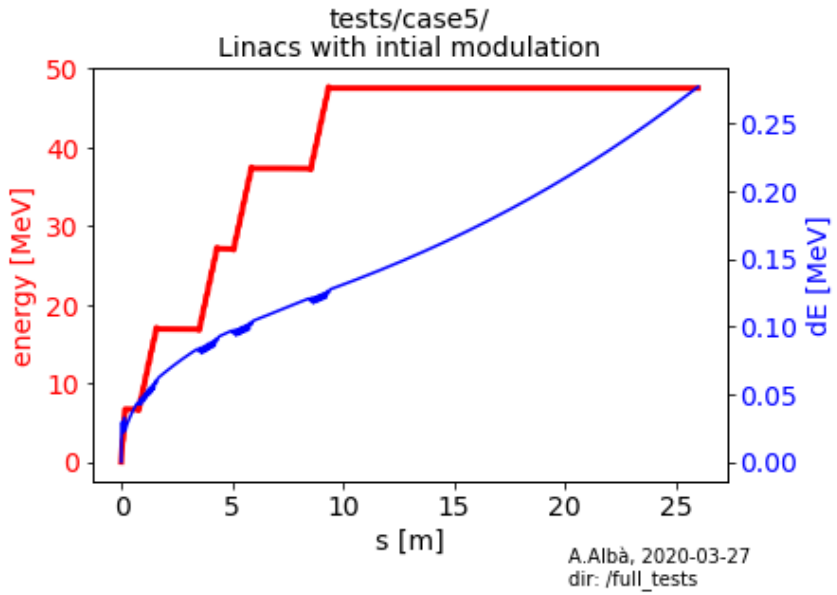
S2E simulation

The DVAR configs for minimum energy spread are:

IBF	IM	GPHASE	ILS1	ILS2	ILS3	bunchCharge	lambda	SIGXY
467.898673	165.977247	1.929788	5.792116	19.182973	1.867927	1.00329	1.306454	4.712957

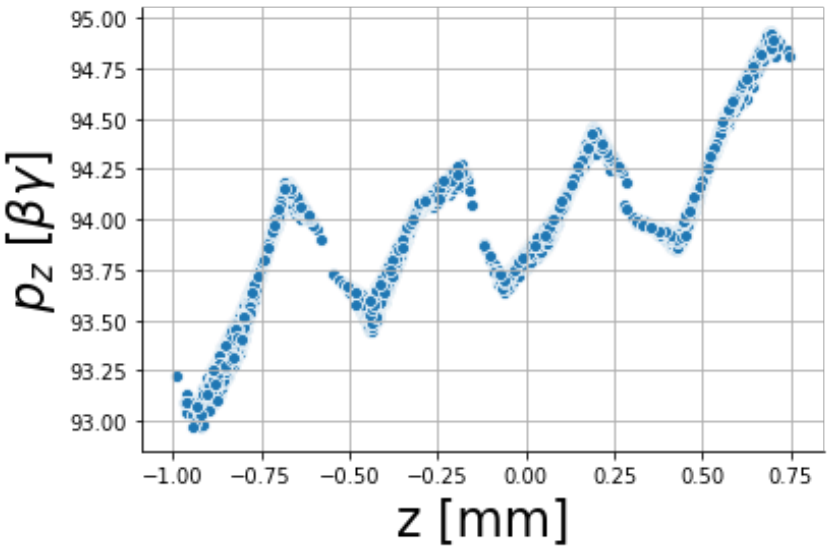
$\Rightarrow \sigma_{diff} = 930\,\mu m < \sigma_{\perp} = 1.25\,mm$. Hence radiation might be negligible. Can reduce $\sigma_{\perp}$ with quadrupoles.



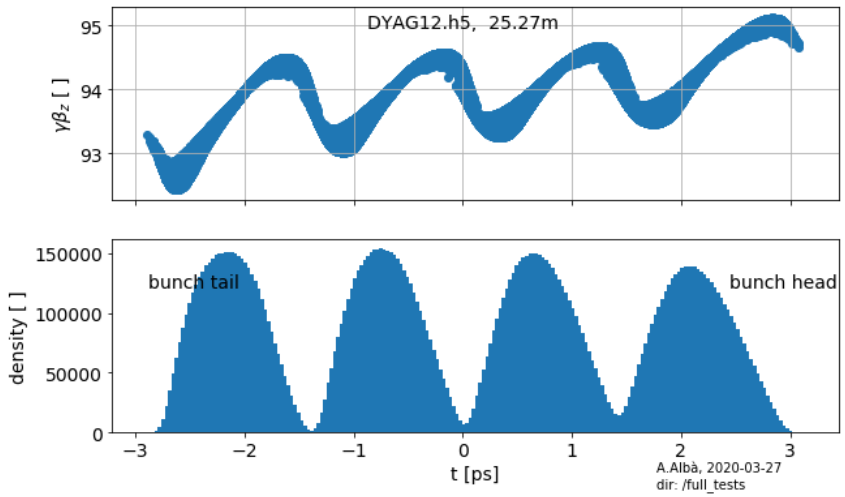


YAG 12, Computational Parameters

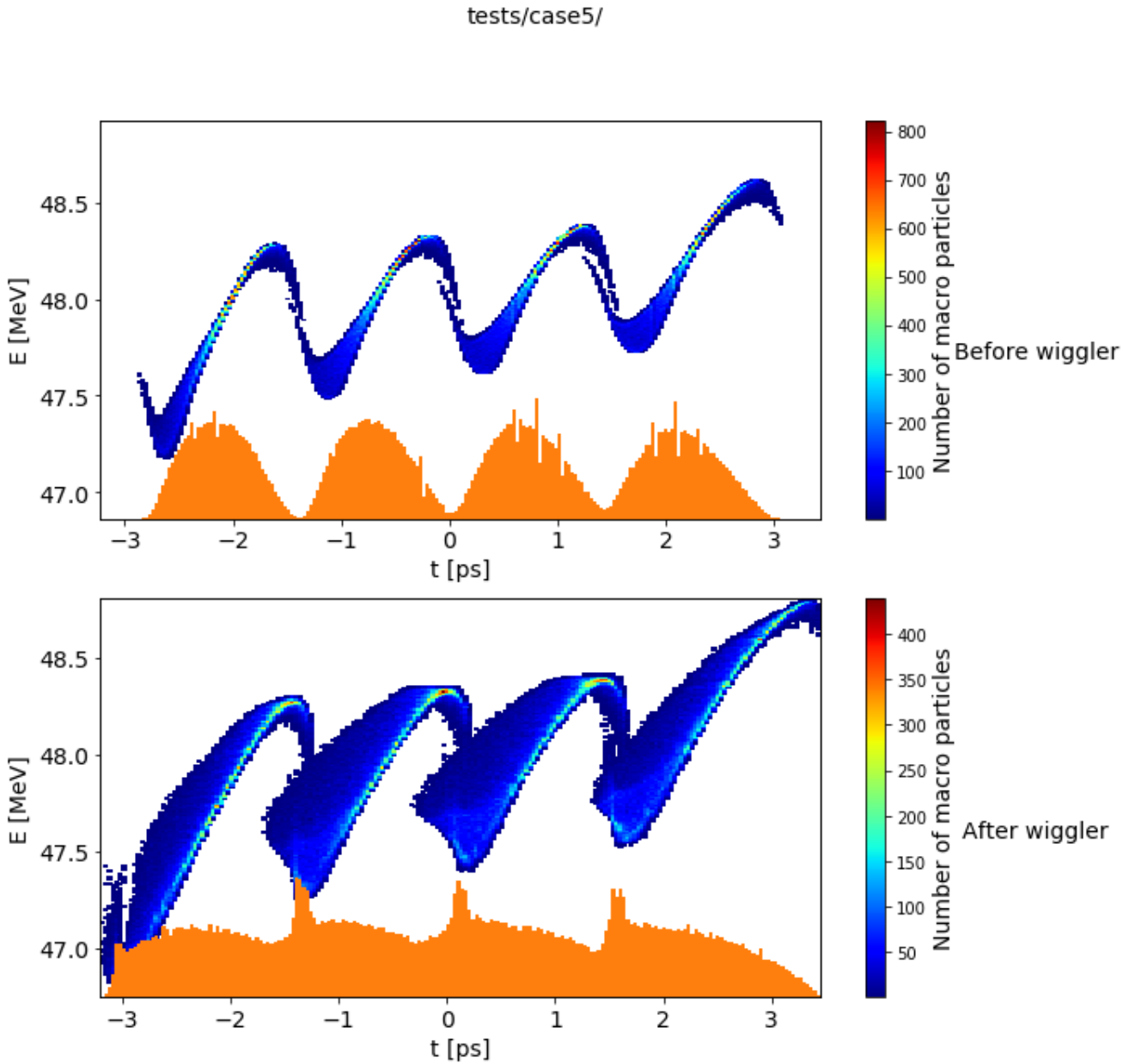
$MX = MY = MT = 16, N = 2e4 \Rightarrow NpC = 5$



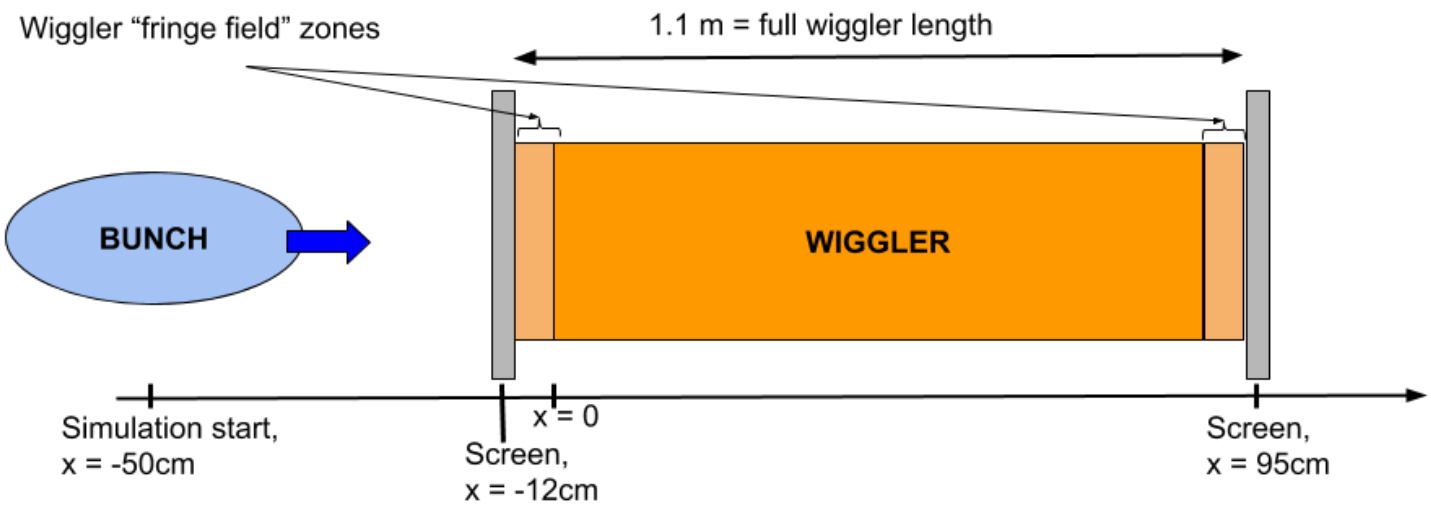
$MX = MY = 64, MT = 512, N = 17e6 \Rightarrow NpC = 8$



S2E, Wiggler Part



Convergence Study: Full-Wave Solver



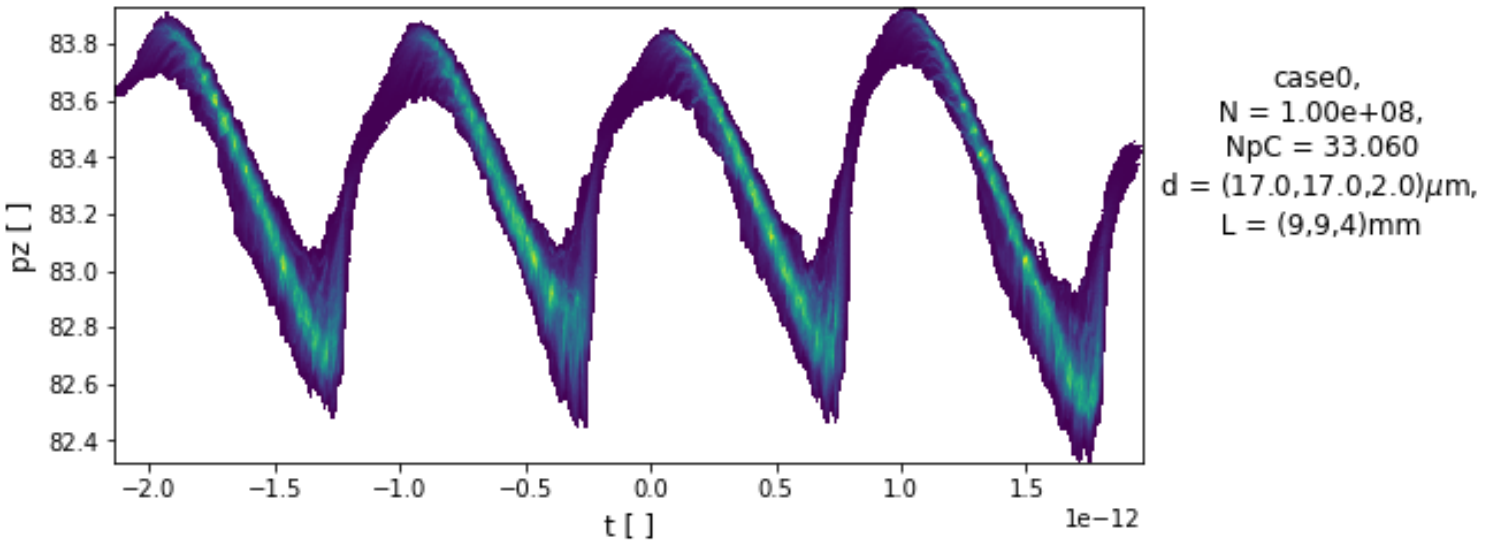
Convergence tested by comparing longitudinal phase-space density $\rho(t, E)$ at the last screen. Quantities of interest:

- Number of particles N
- Number of particles per cell at the start of the simulation NpC
- Mesh discretisation size dx, dy, dz
- Size of computational domain Lx, Ly, Lz

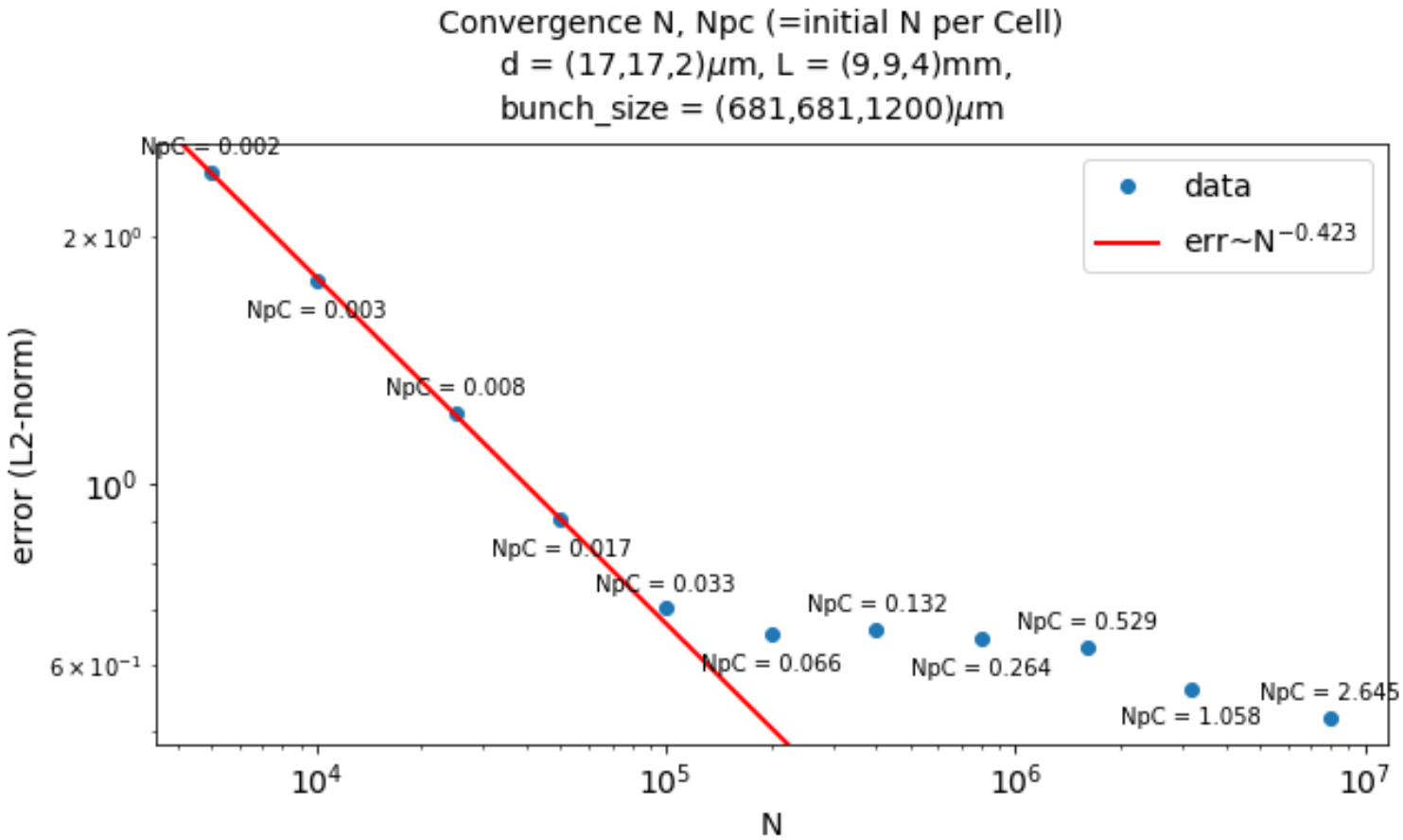
Convergence Study: Full-Wave Solver

$$error = \frac{\sqrt{\sum_i (\rho_i - \hat{\rho}_i)^2}}{\sqrt{\sum_i \hat{\rho}_i^2}}, \tag{1}$$

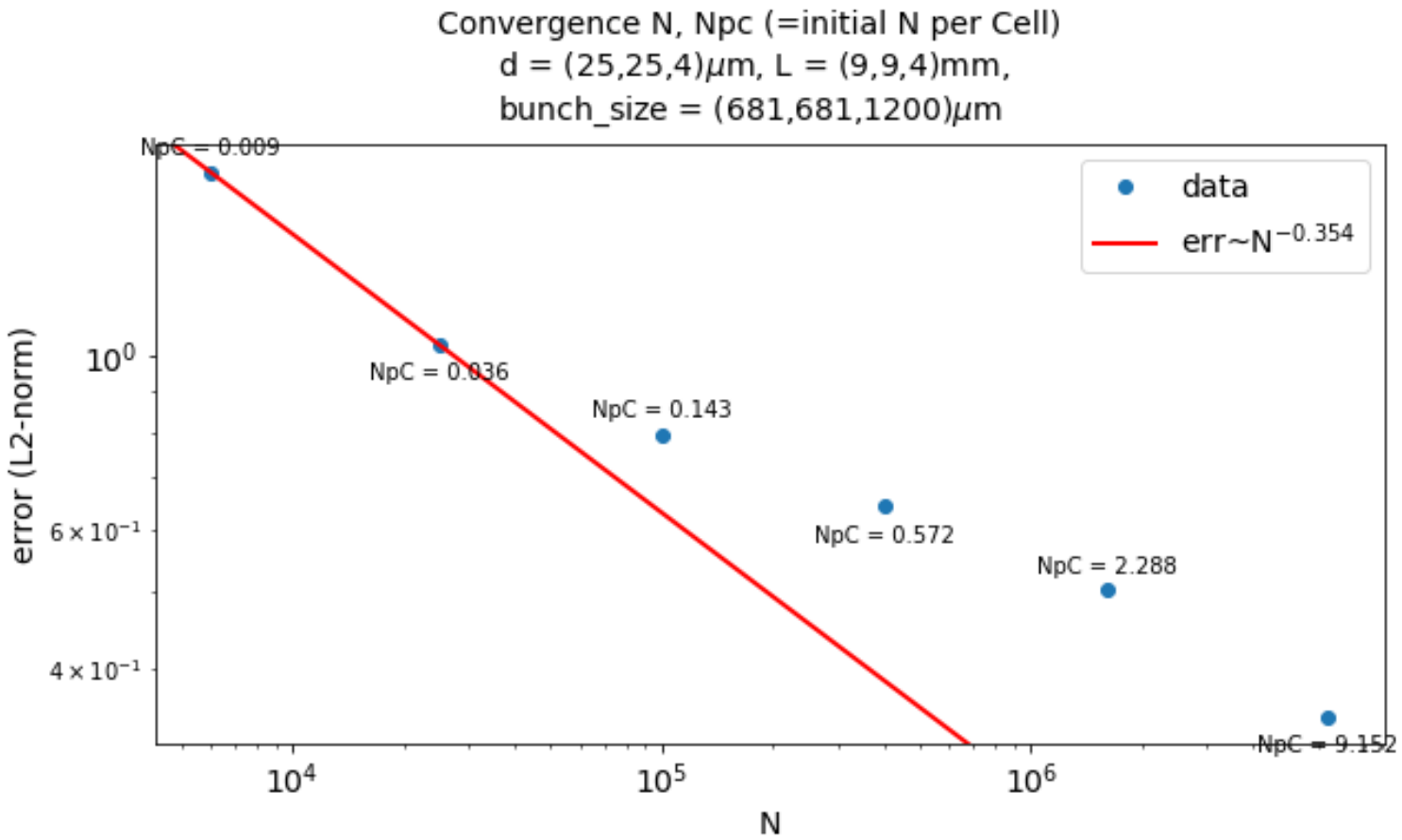
where $\hat{\rho}_i$ is the simulation with the largest number of particles and smallest grid spacing. An example of phase-space density ρ:



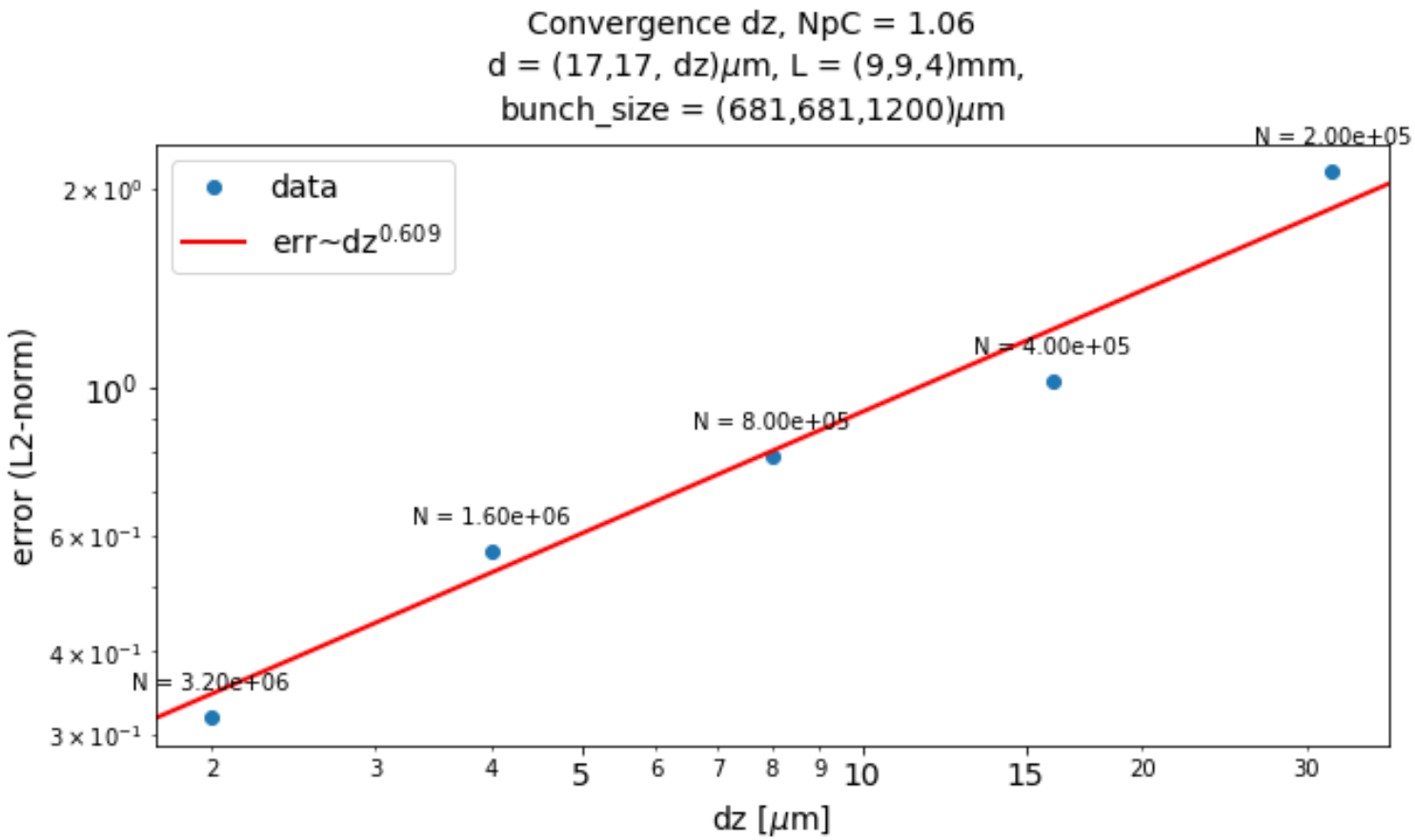
Full-Wave Solver: Convergence N



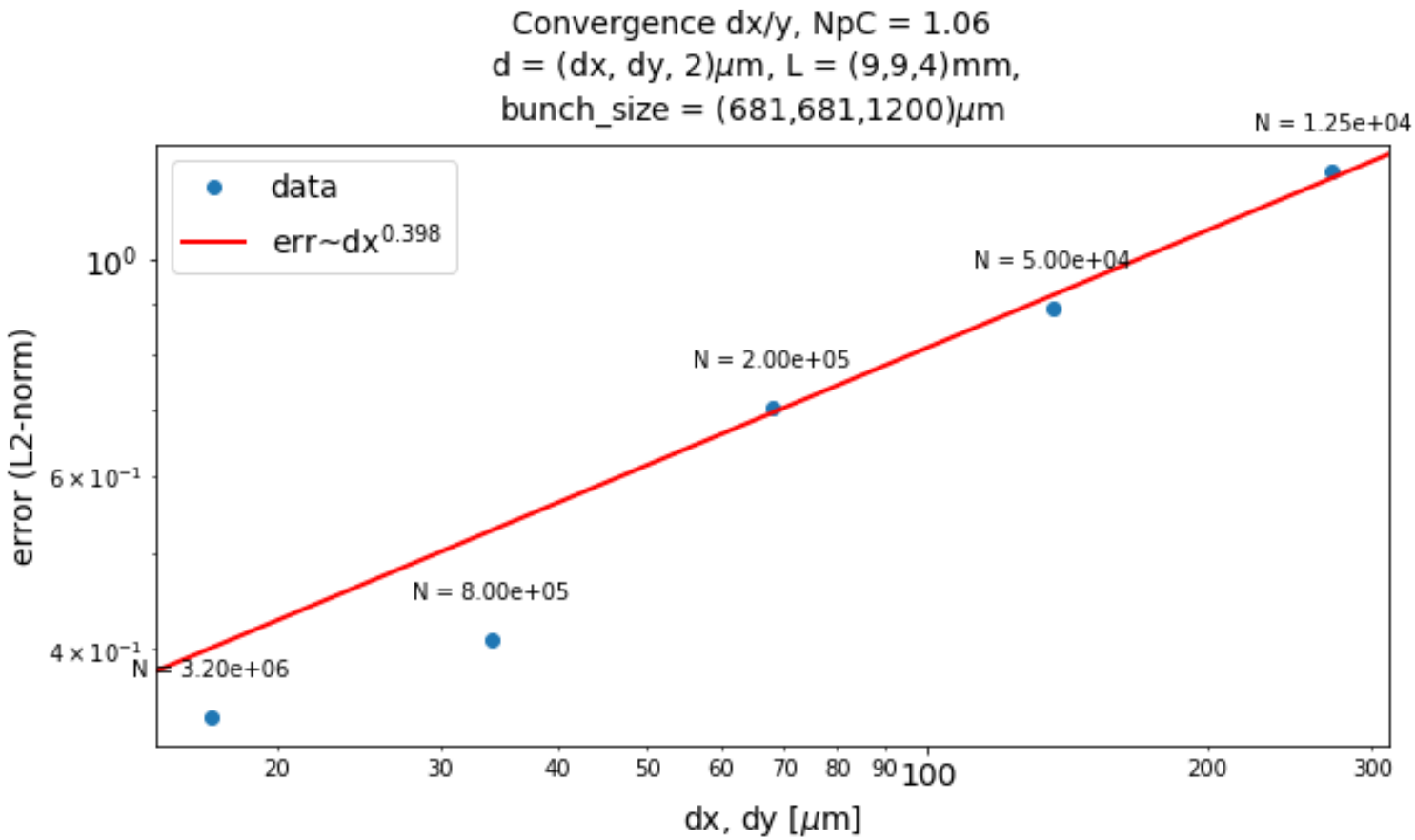
Full-Wave Solver: Convergence N, different mesh size



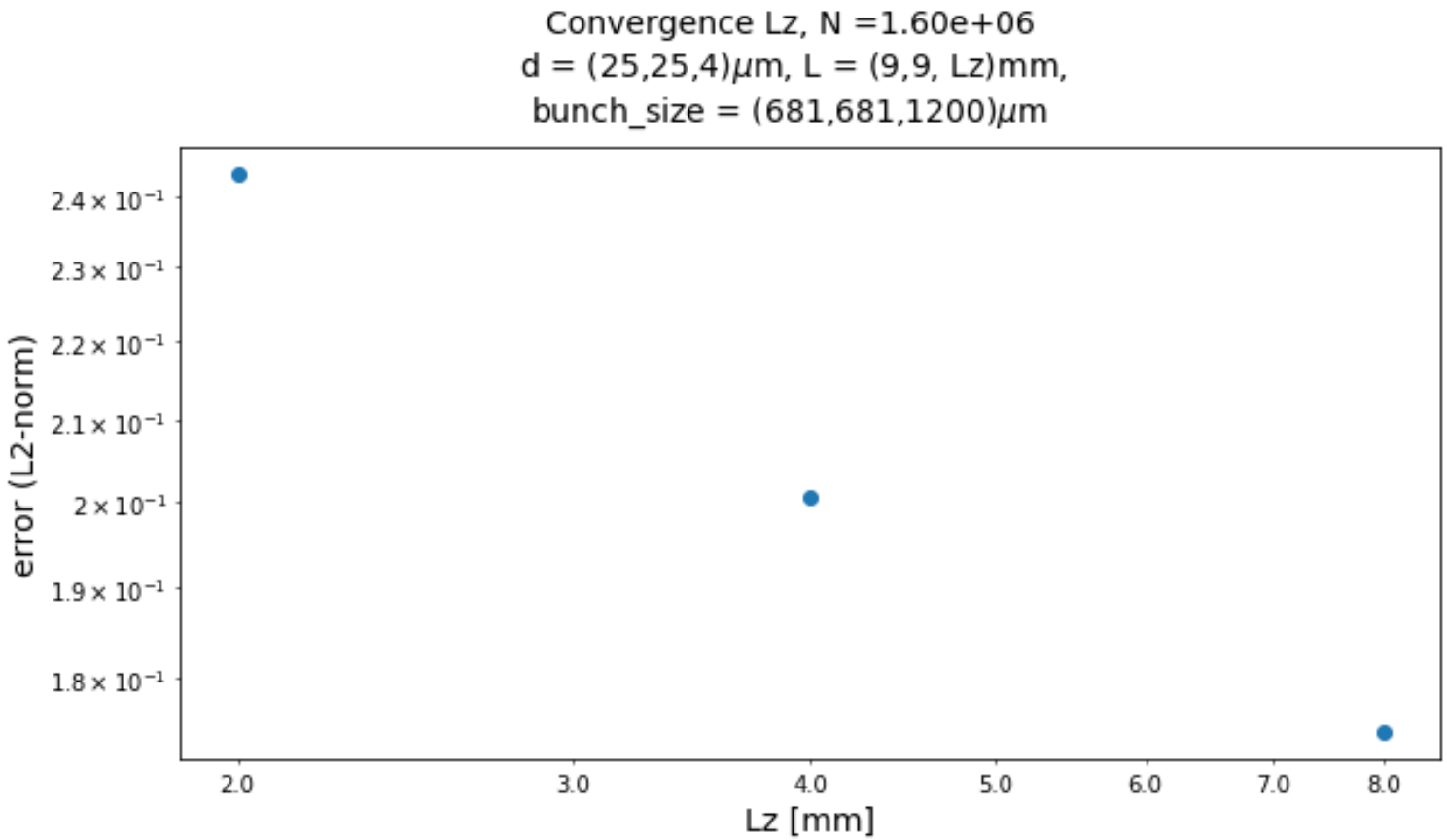
Full-Wave Solver: Convergence dz



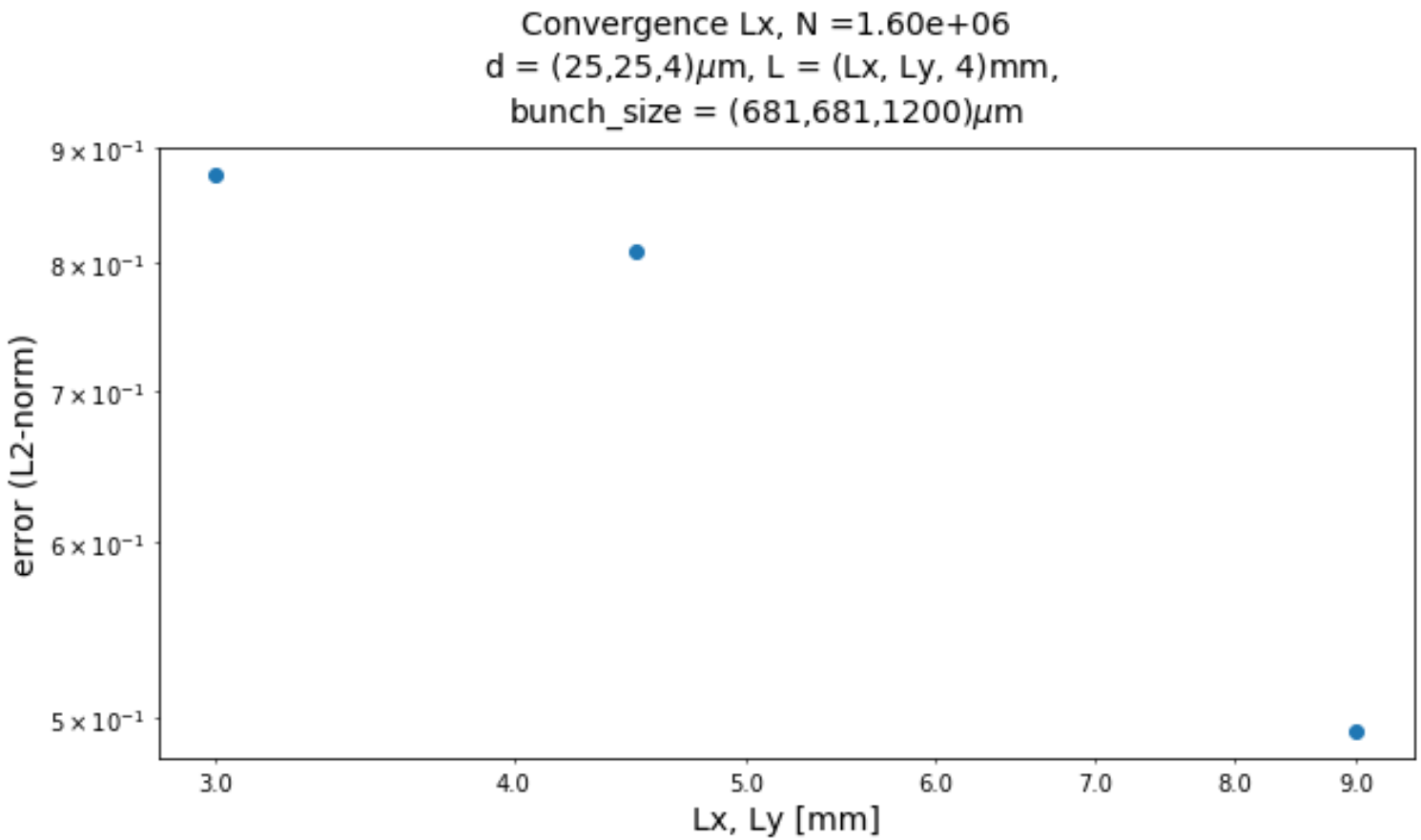
Full-Wave Solver: Convergence dx



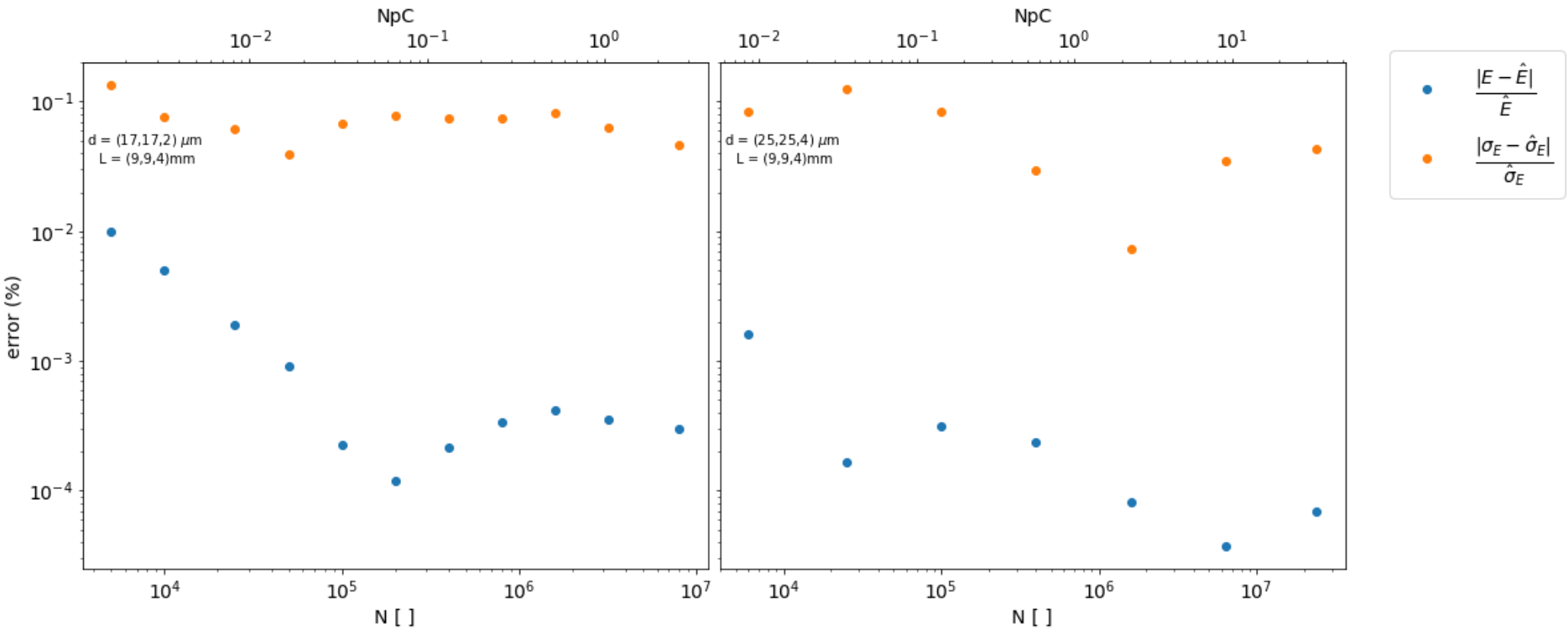
Full-Wave Solver: Convergence Lz



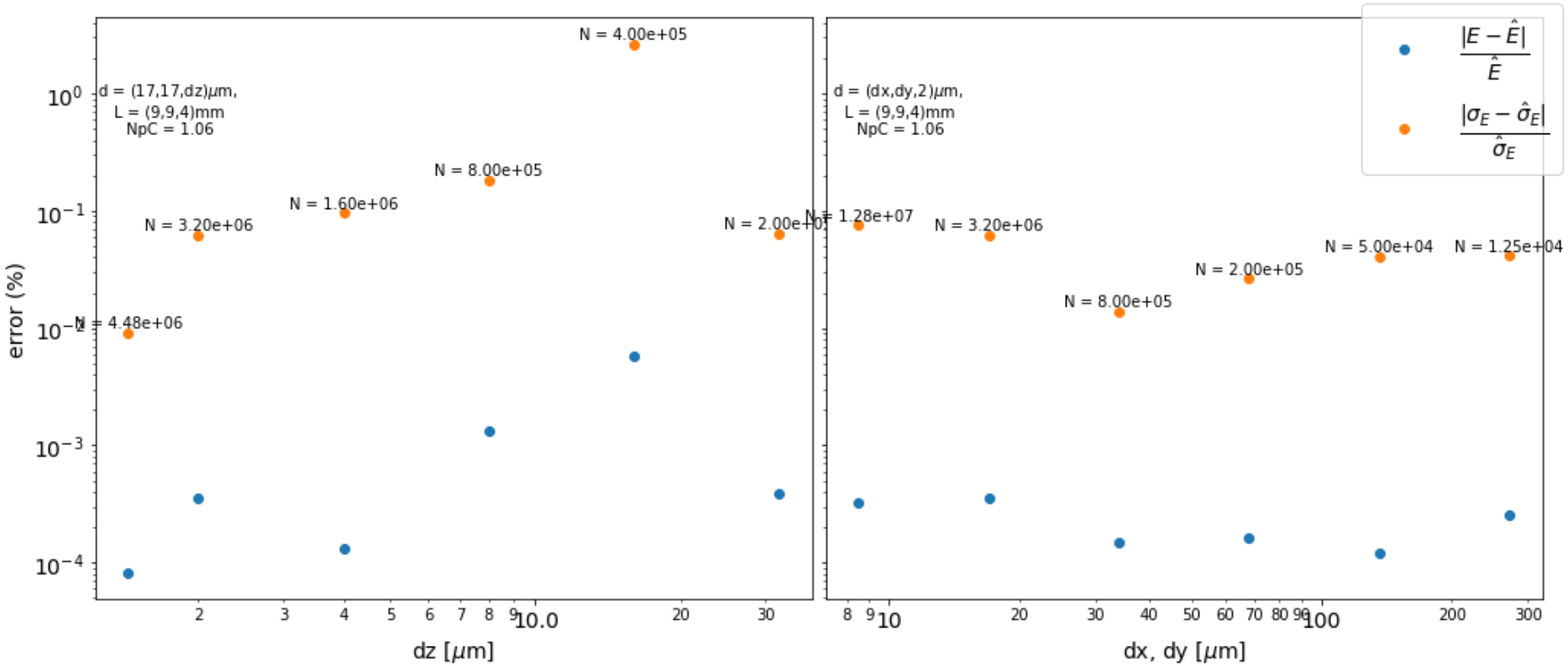
Full-Wave Solver: Convergence Lx, Ly



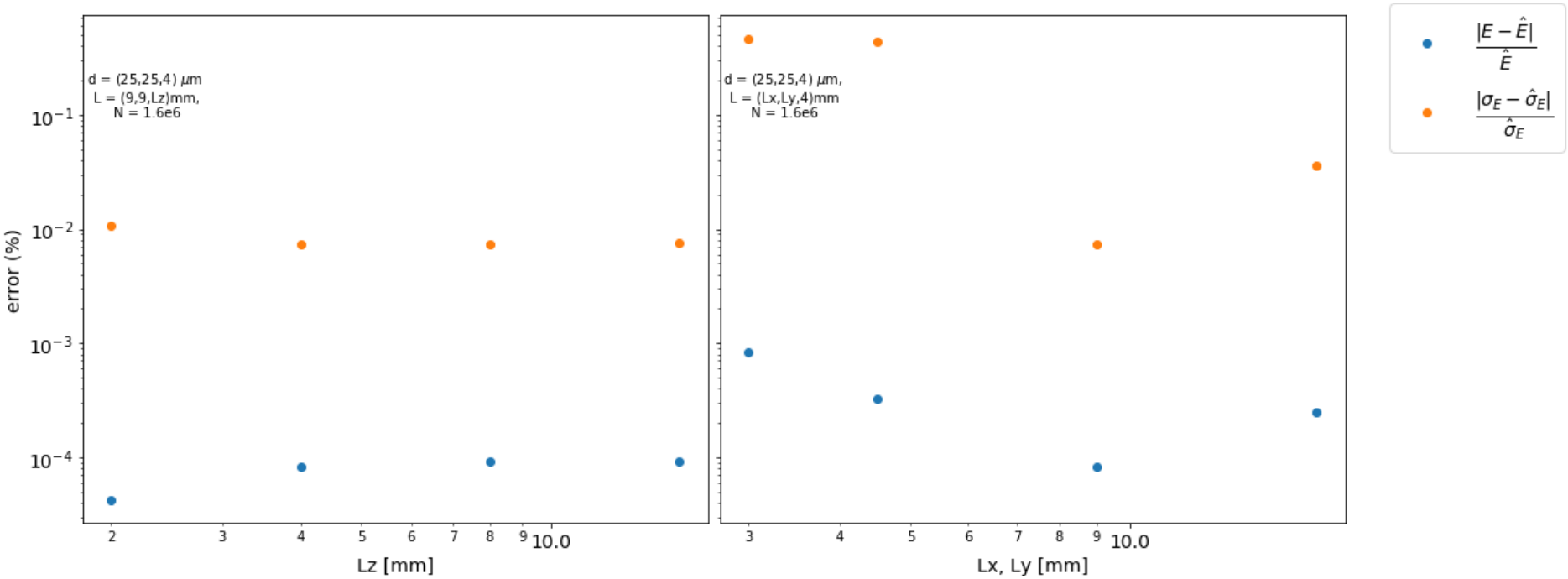
Full-Wave Solver: Convergence $\bar{E}$ and σ_E



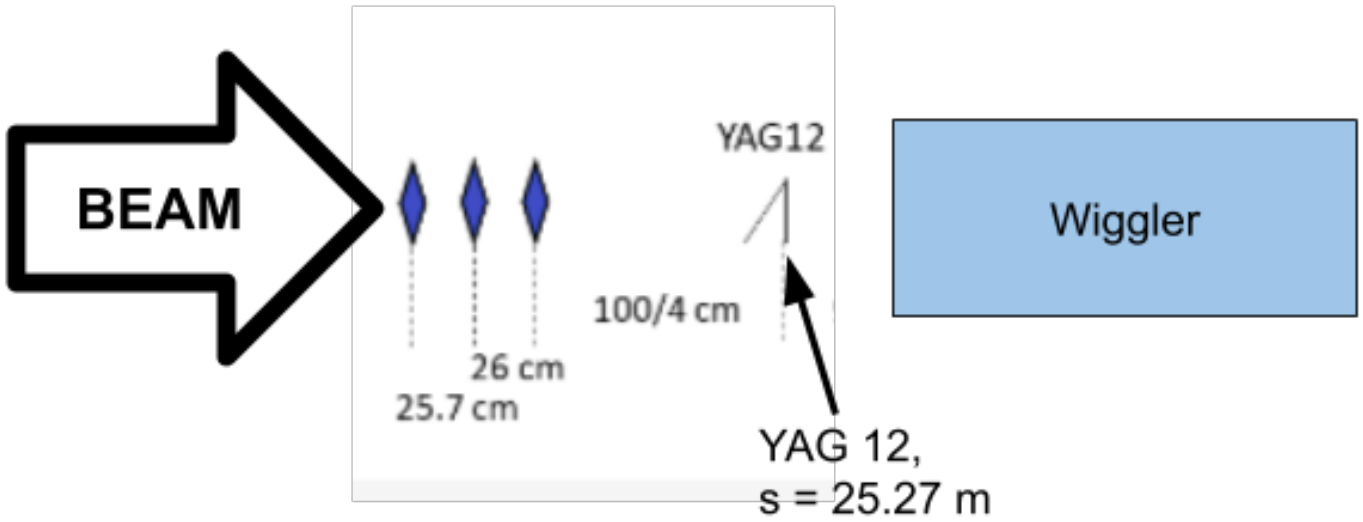
Full-Wave Solver: Convergence $\bar{E}$ and σ_E



Full-Wave Solver: Convergence $\bar{E}$ and σ_E



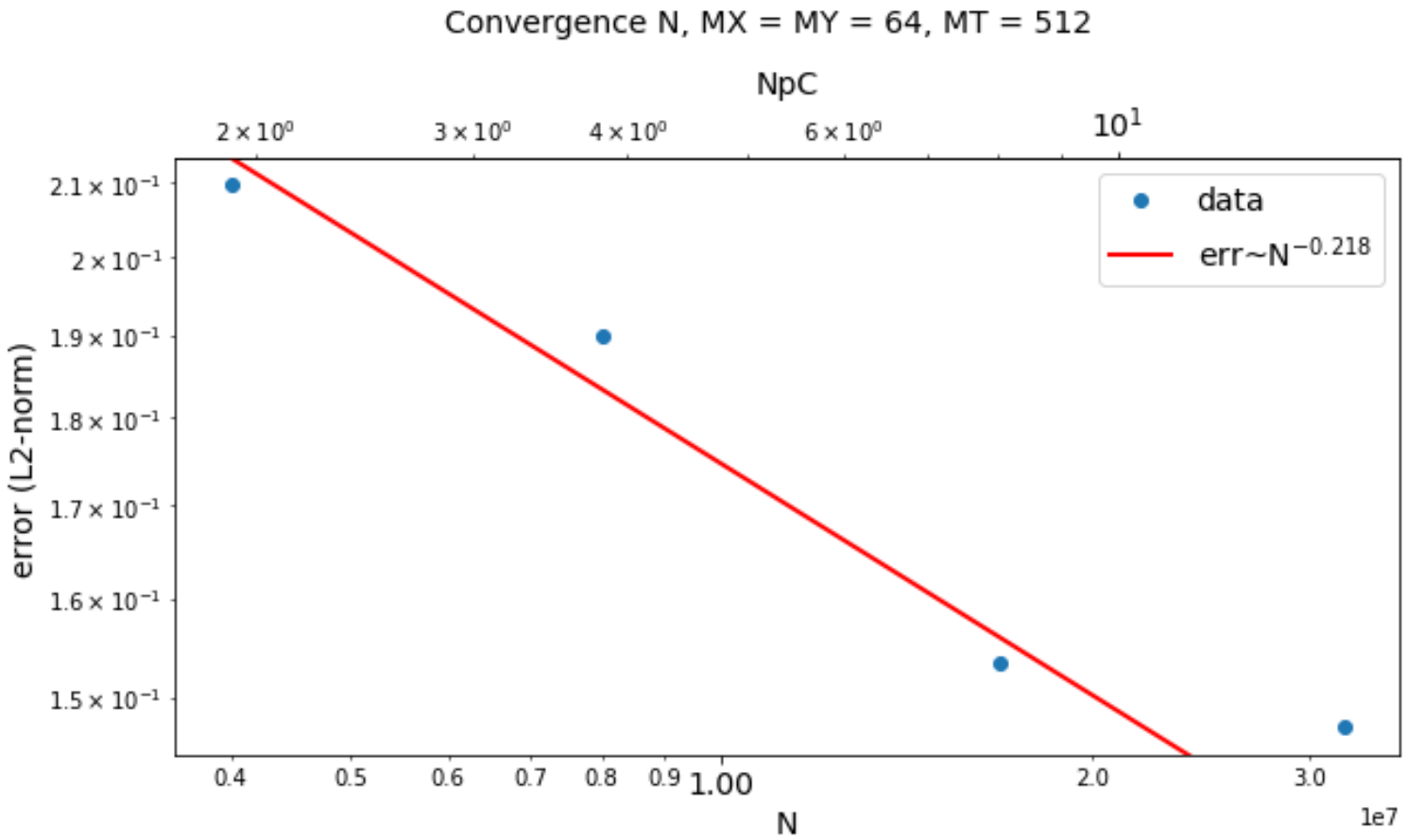
Convergence Study: Static Solver



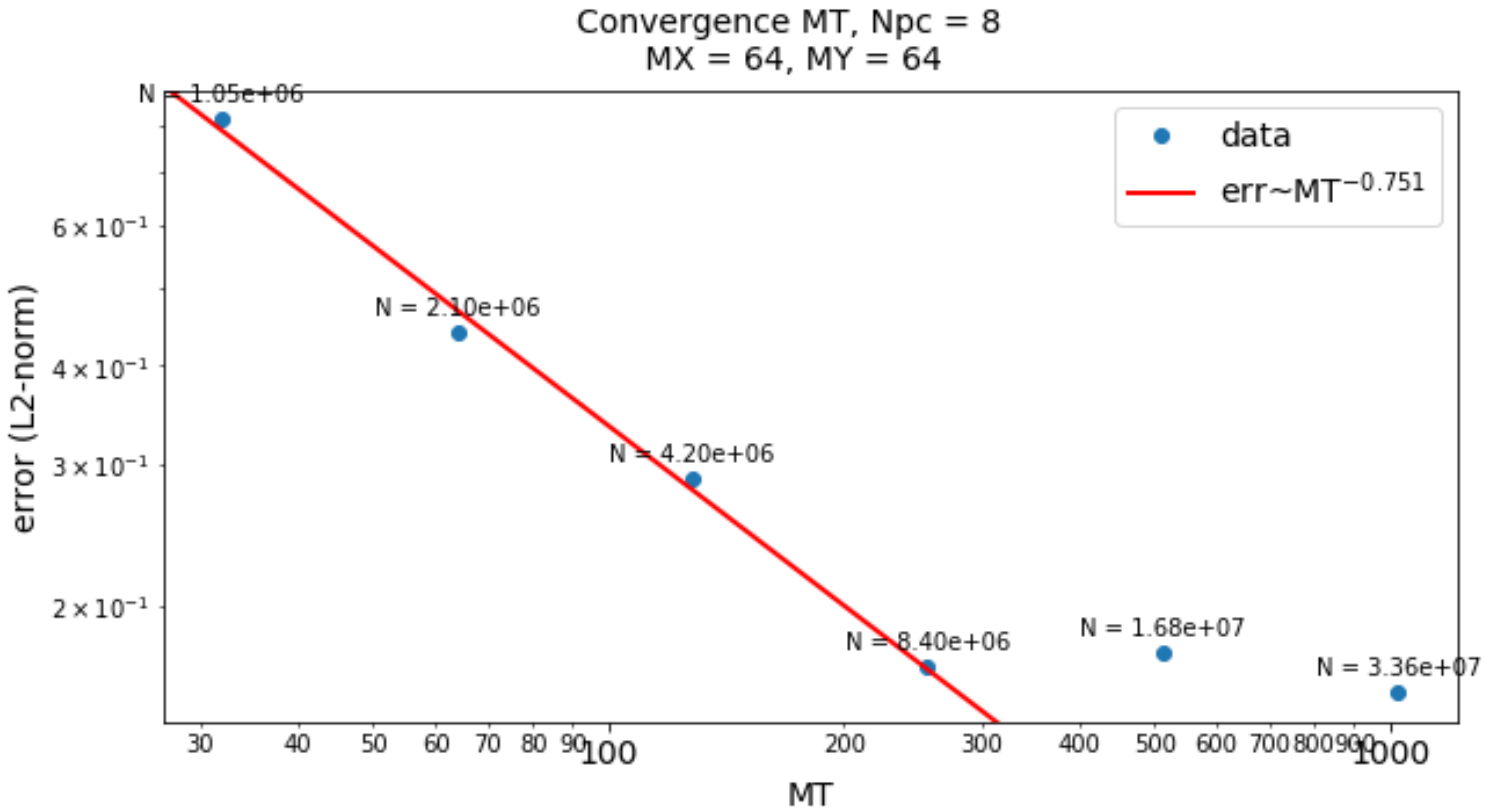
Simulation **from gun to wiggler**. Convergence tested by comparing longitudinal phase-space density $\rho(t, E)$ at YAG12. Quantities of interest:

- Number of particles N
- Number of particles per cell at the start of the simulation NpC
- Number of cells MX, MY, MT

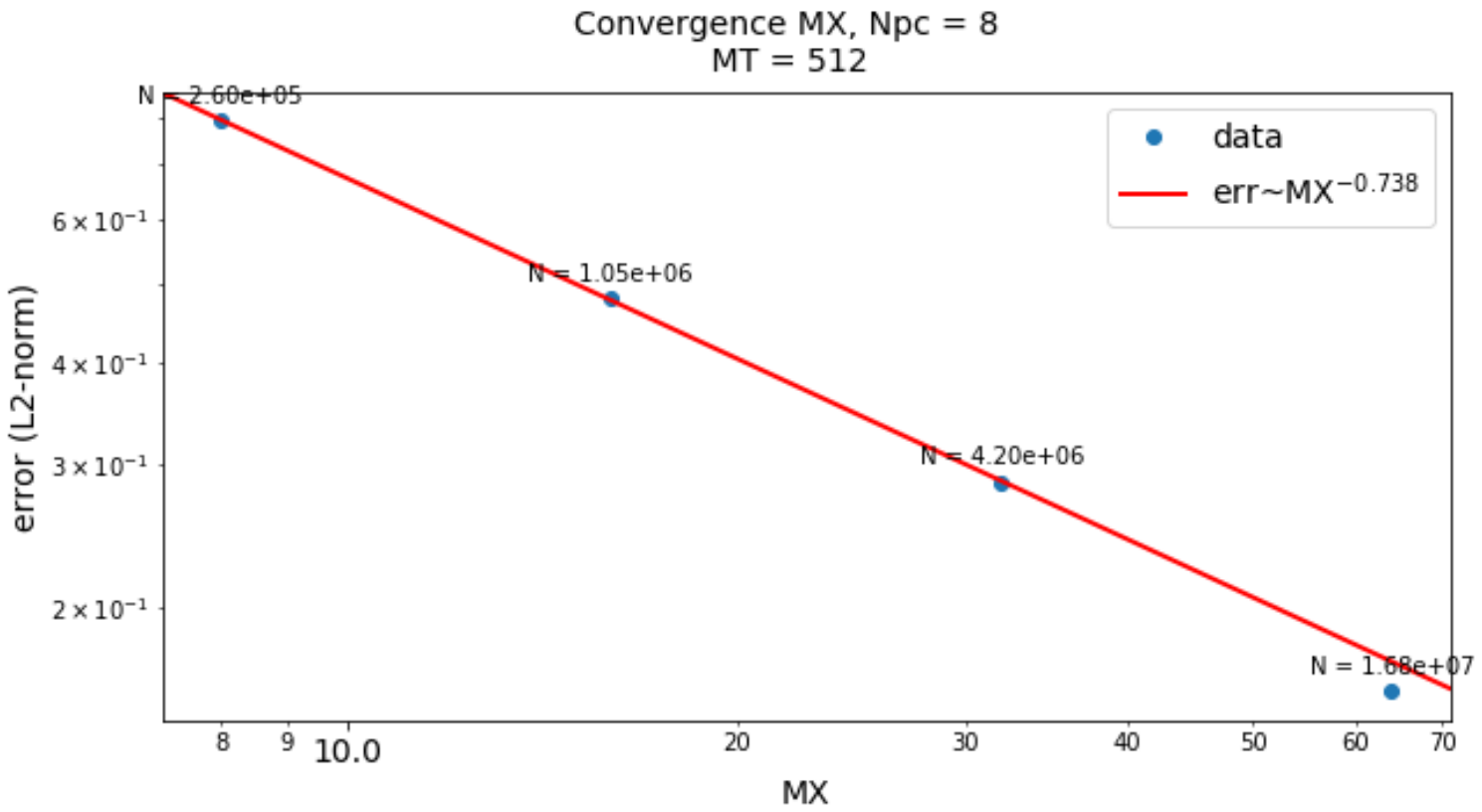
Static Solver: Convergence N



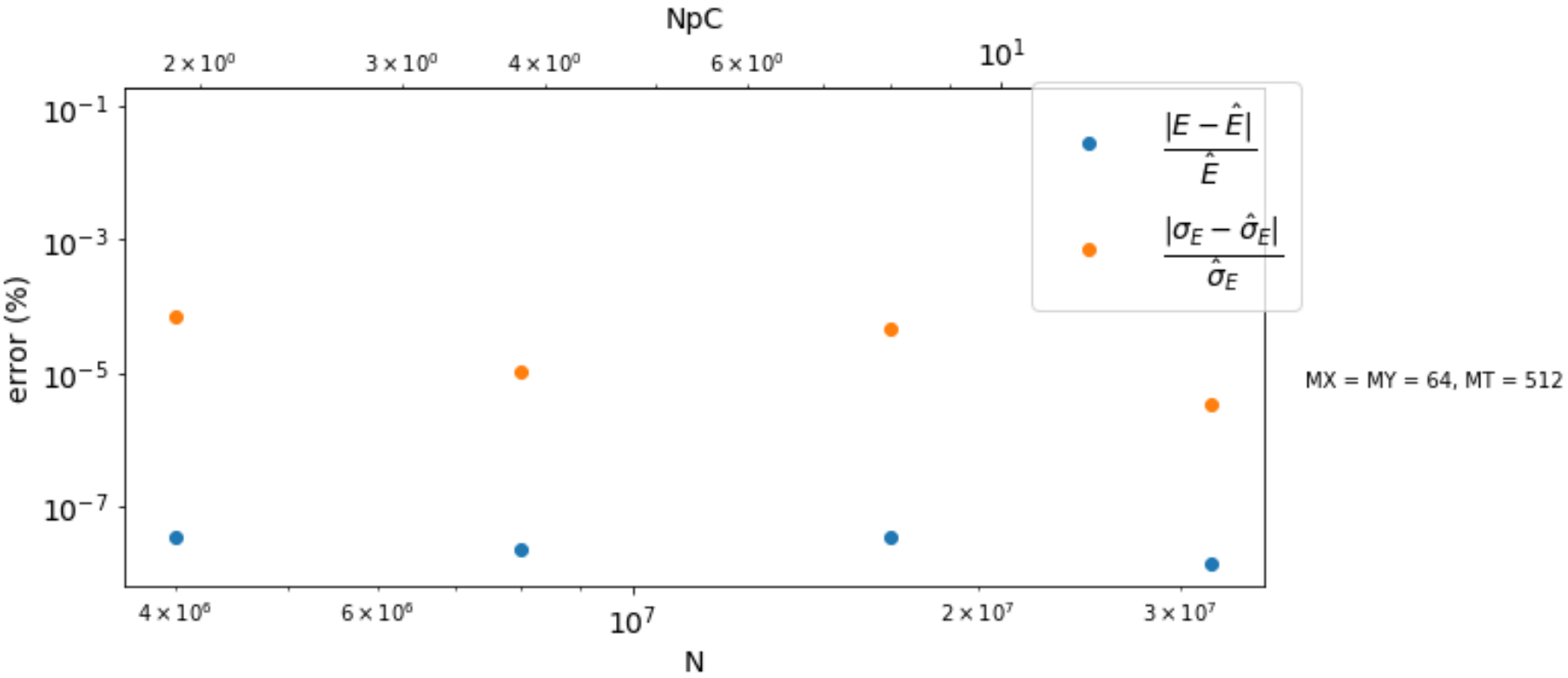
Static Solver: Convergence MT



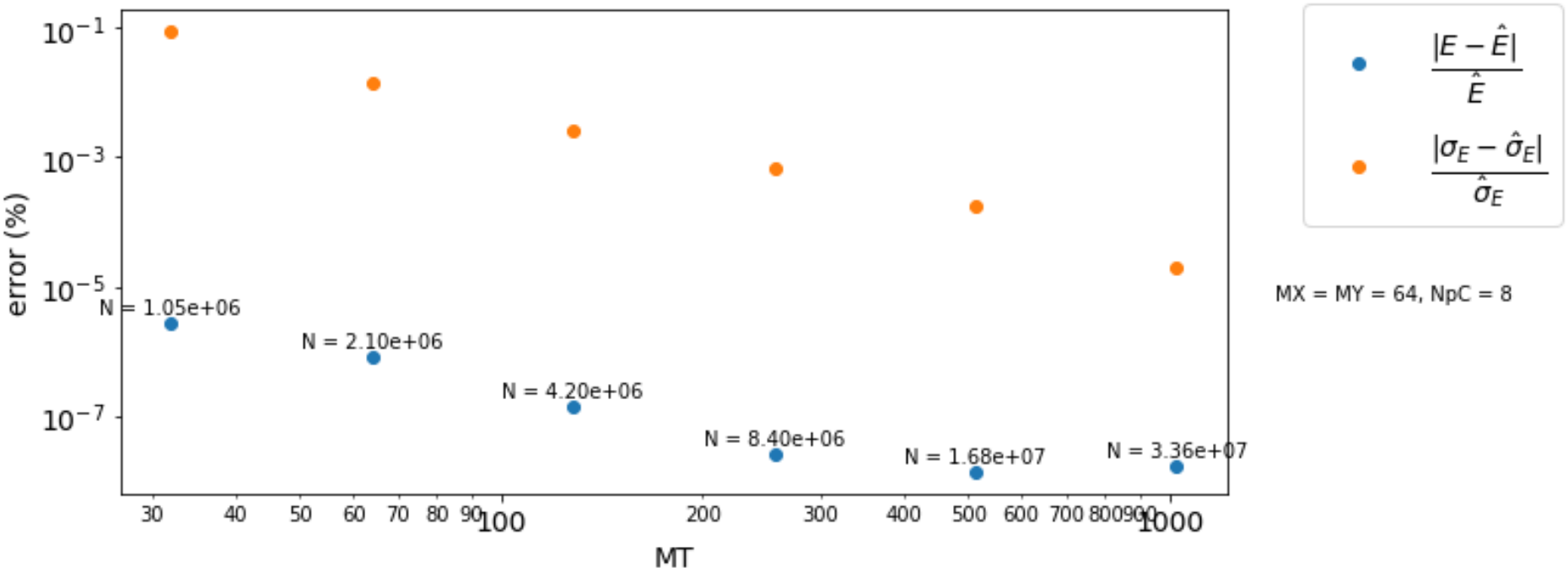
Static Solver: Convergence MX



Static Solver: Convergence $\bar{E}$ and σ_E



Static Solver: Convergence $\bar{E}$ and σ_E



Static Solver: Convergence $\bar{E}$ and σ_E