



DENSITY GRADIENTS

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MPP - TUM

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DENSITY GRADIENT PARAMETERS

Parameter	Value
Bunch σ_z	6.9 cm
Bunch σ_r	0.02 cm
Bunch populat.	3×10^{11} protons
Bunch energy	400 GeV
Plasma length	10 m
Plasma density	1.81×10^{14} electrons
Window length	22 cm

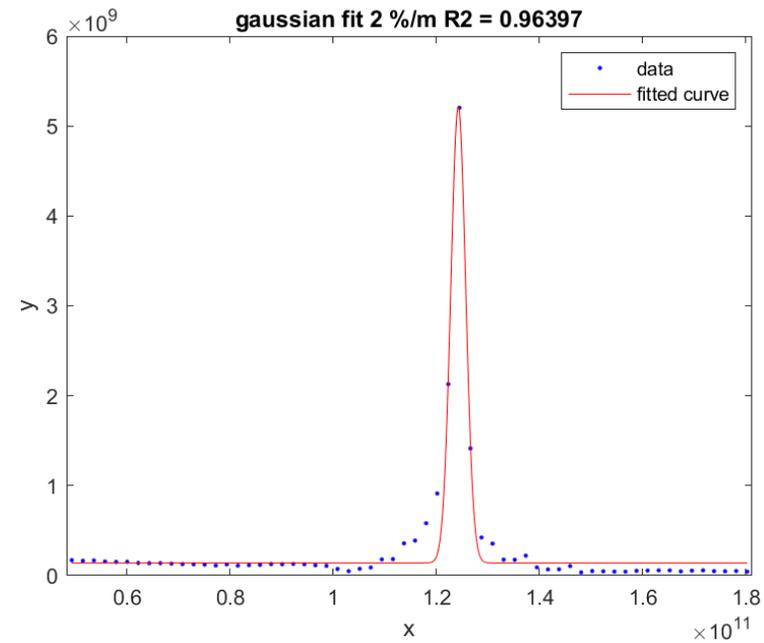
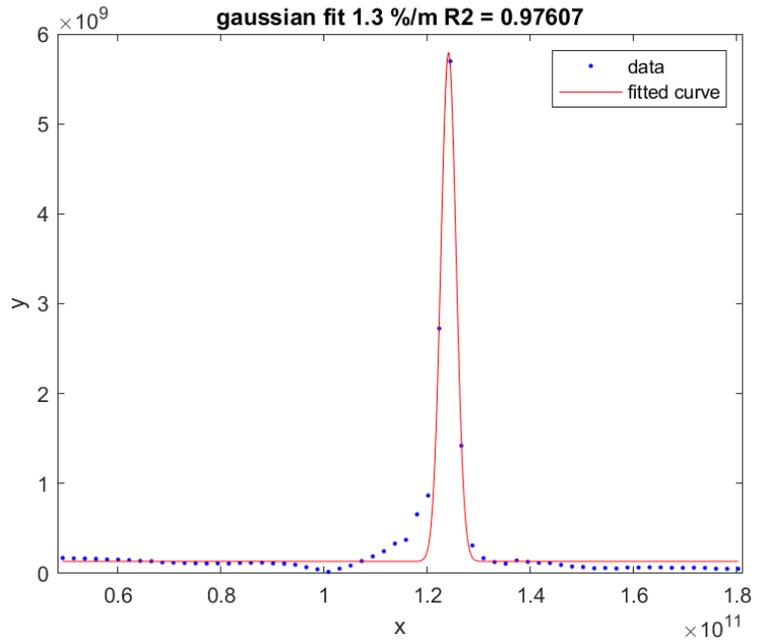
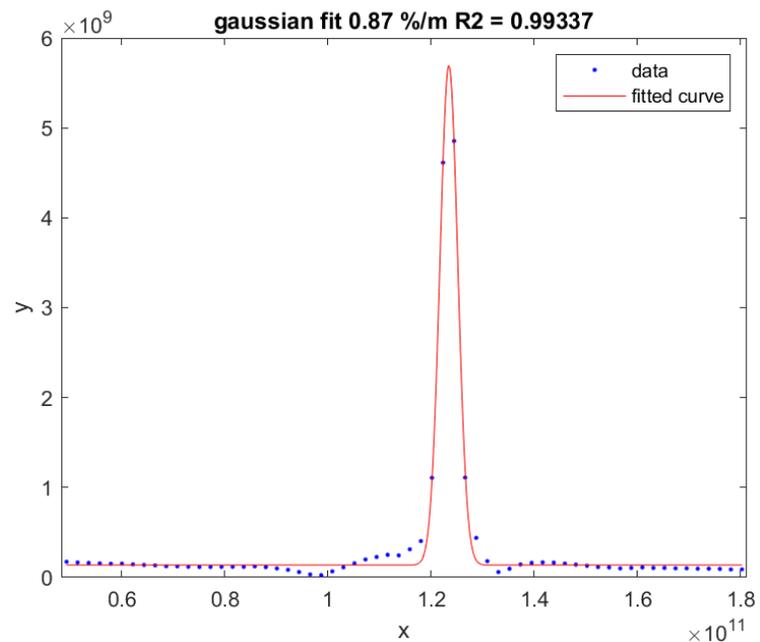
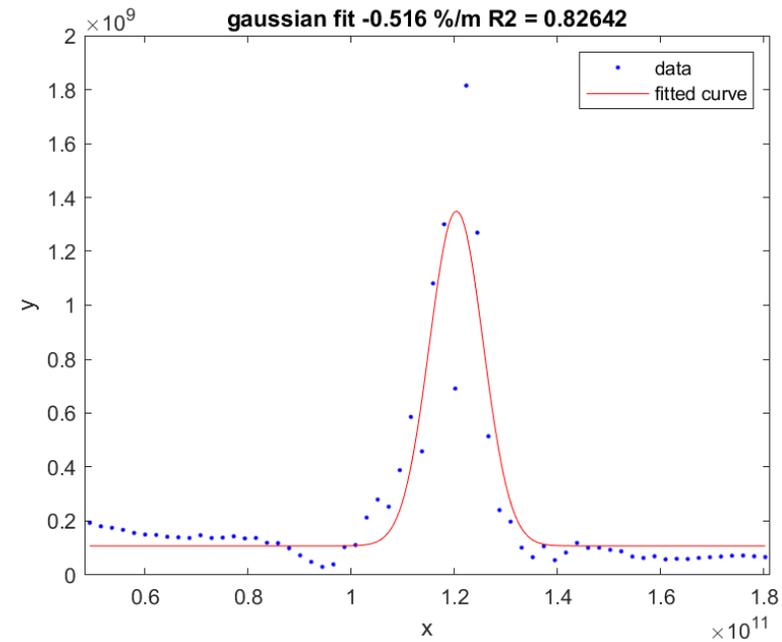
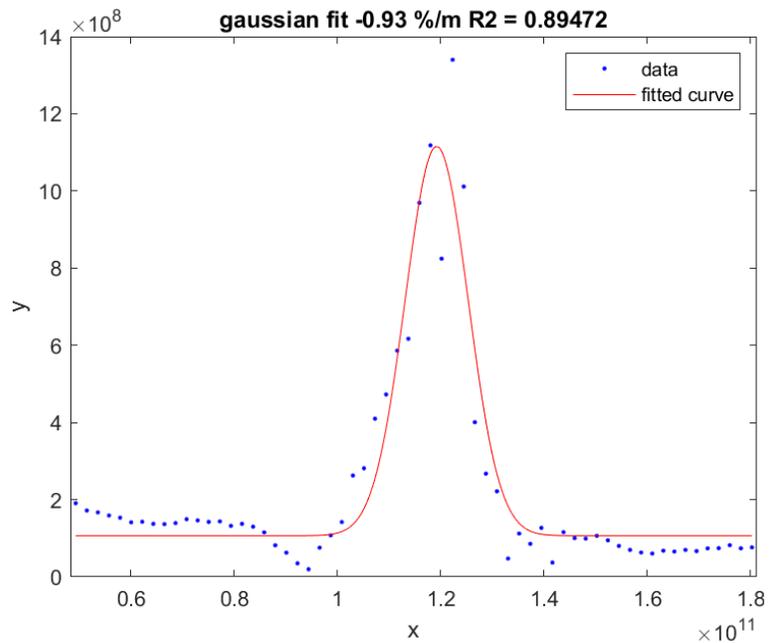
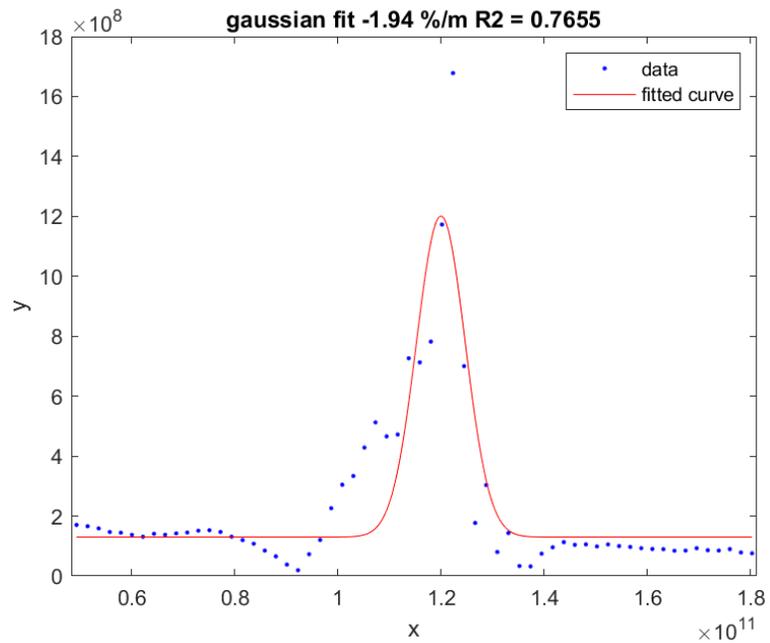
Parameter	Value
z resolution	0.0158 mm (nx1 13295)
r resolution	0.003 mm (nx2 500)

AWAKE R1
axisymmetric 2D

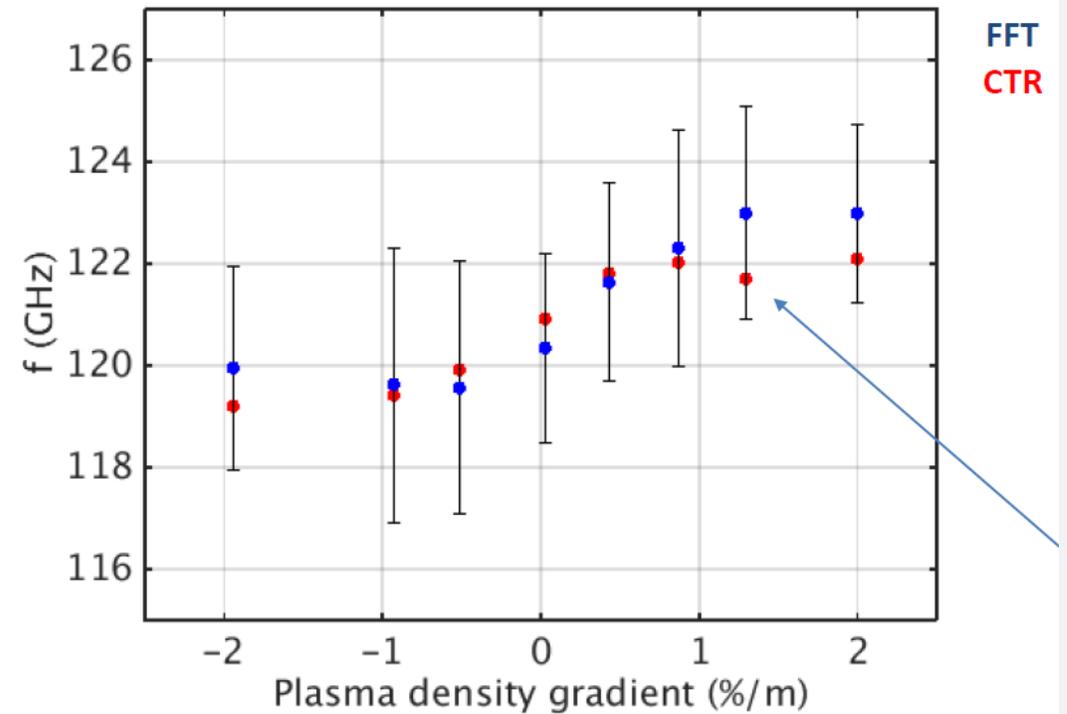
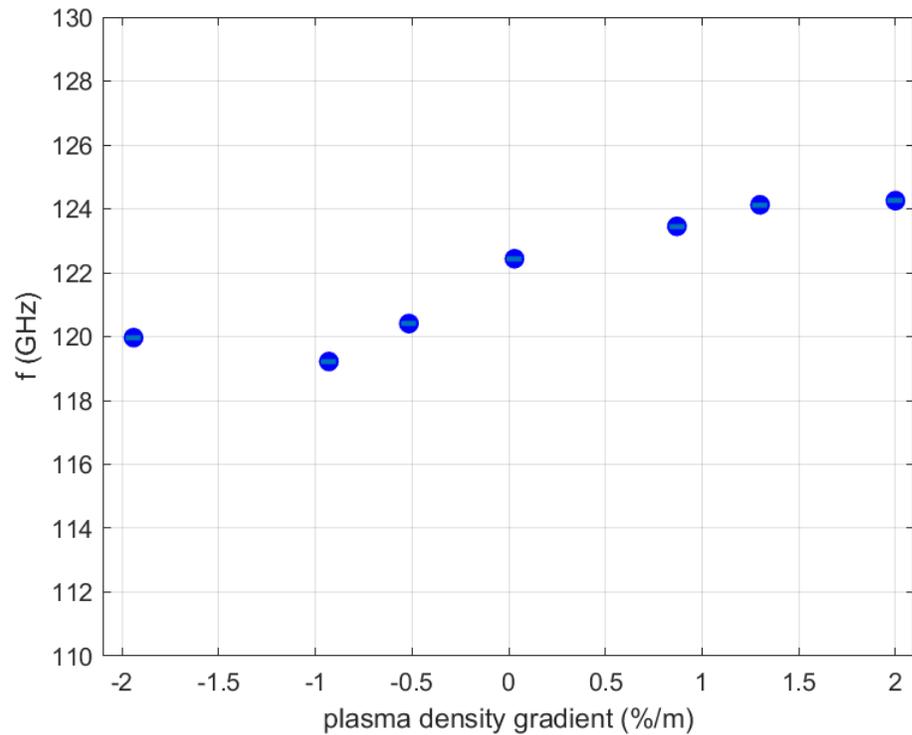
Final density change per meter

-1.94 %	-0.93 %	-0.56 %	0.03 %	0.87 %	1.3 %	2 %
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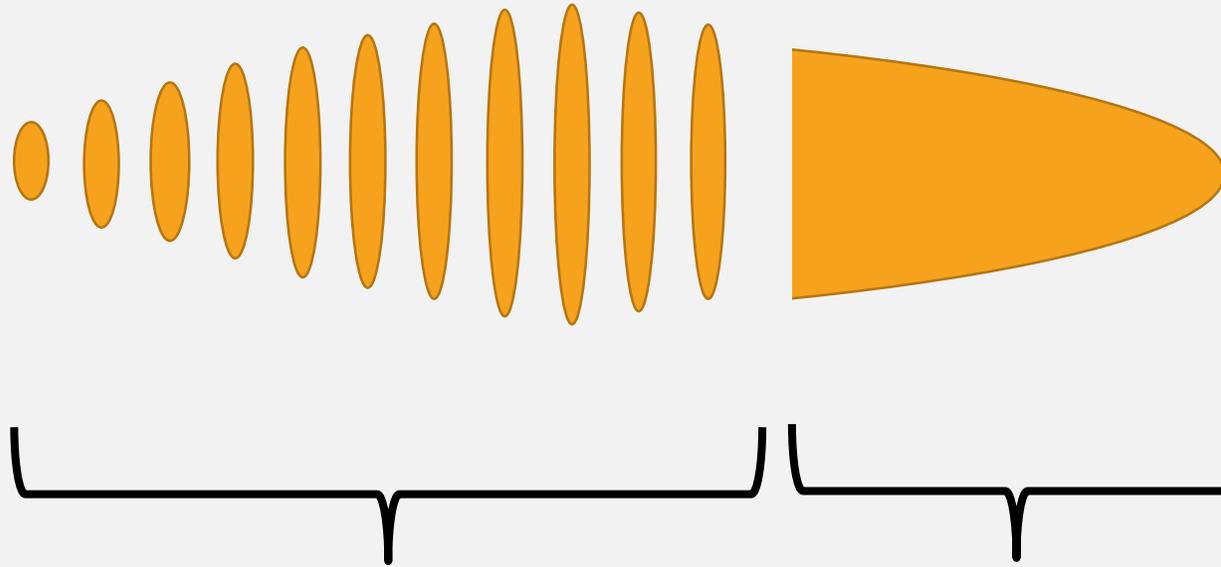
FOURIER TRANSFORM PLOTS



FOURIER TRANSFORM



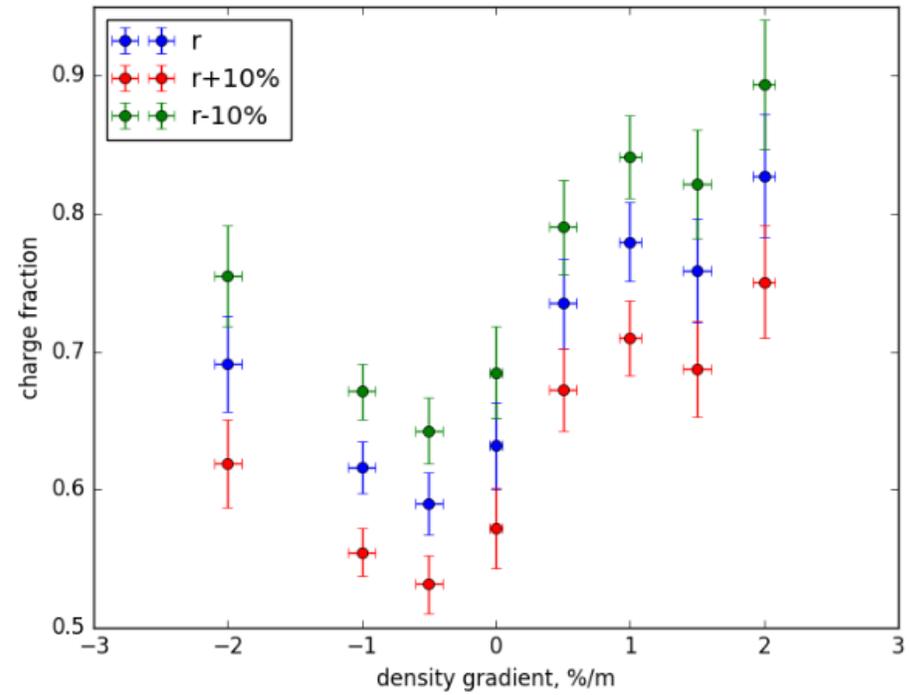
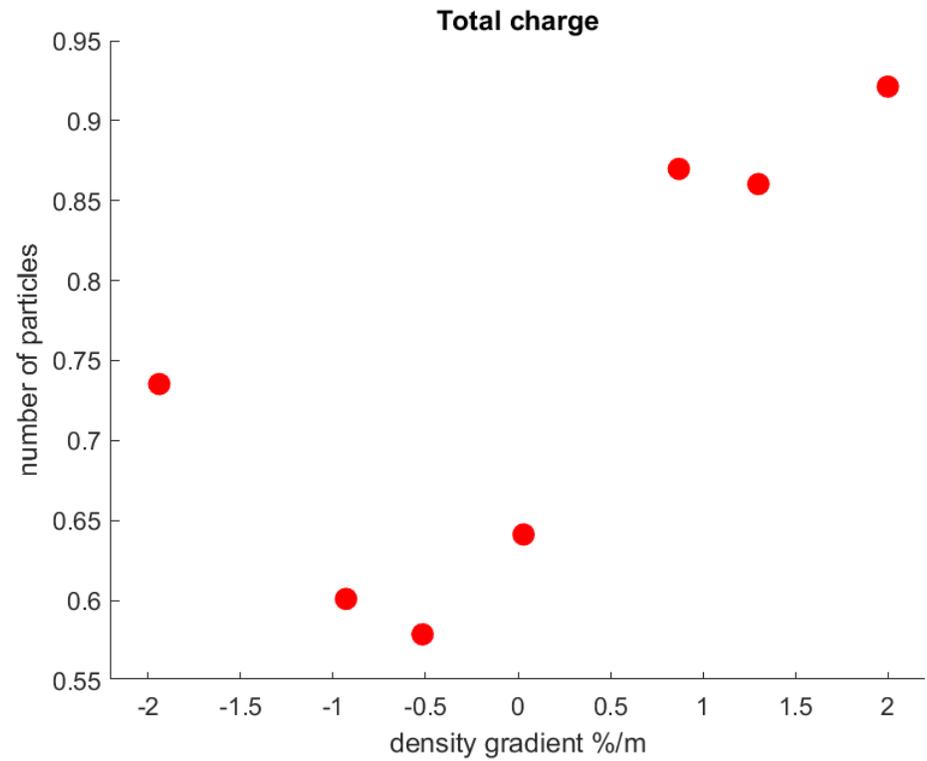
TOTAL CHARGE LEFT



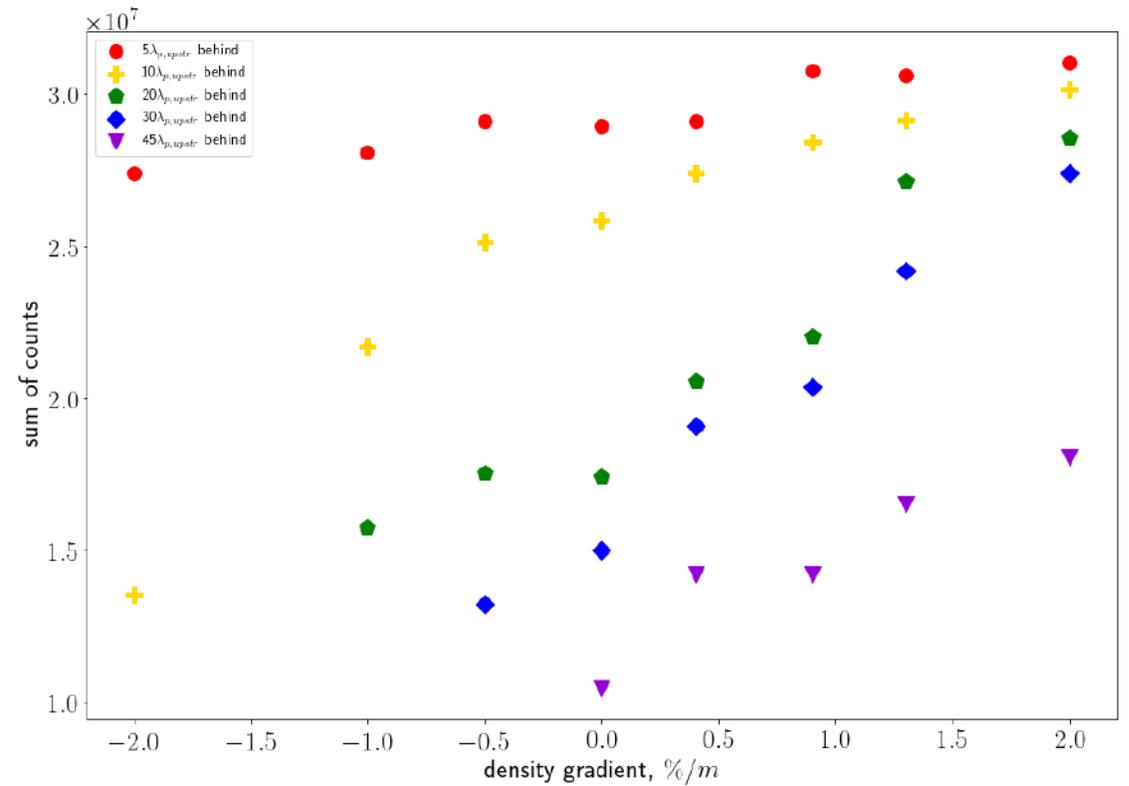
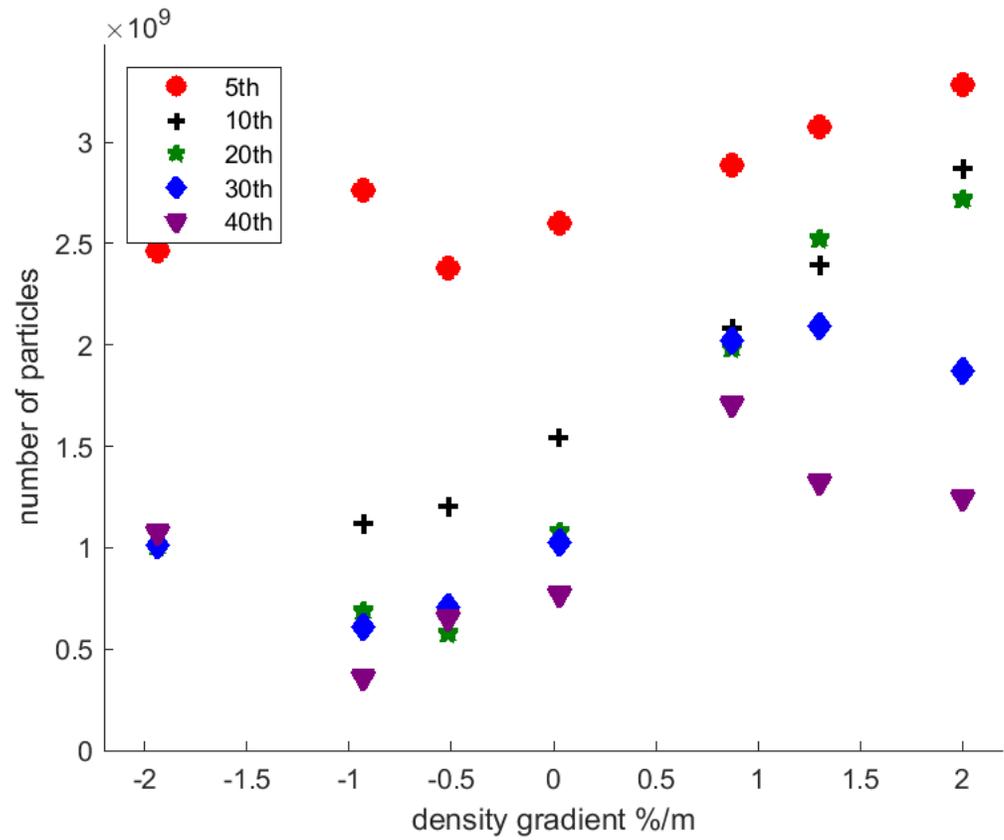
Charge in the microbunches
that I get from the simulation

I calculate the charge fraction in the front
of the Gaussian bunch and add it to the
charge from the microbunches.

TOTAL CHARGE LEFT

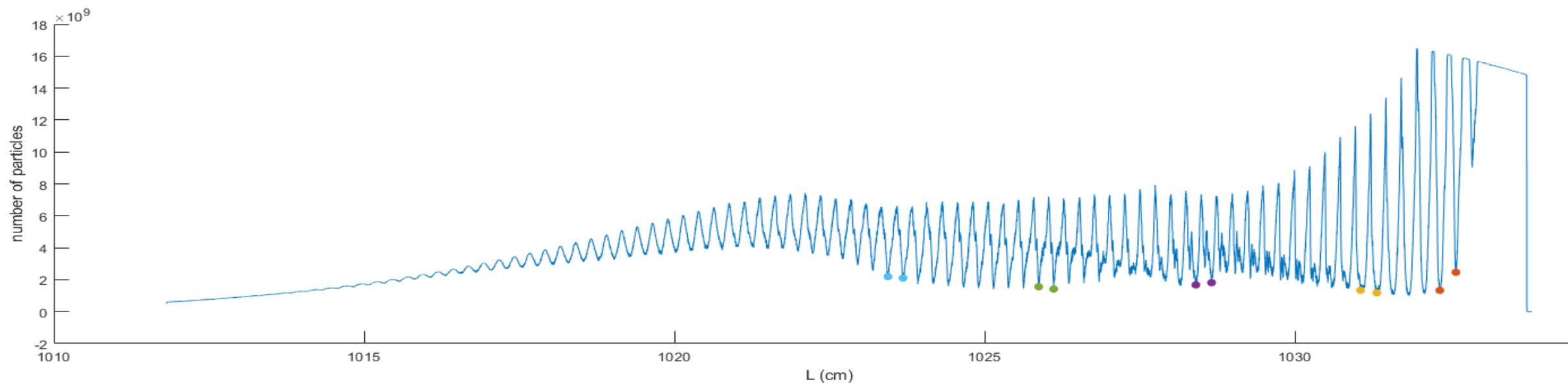
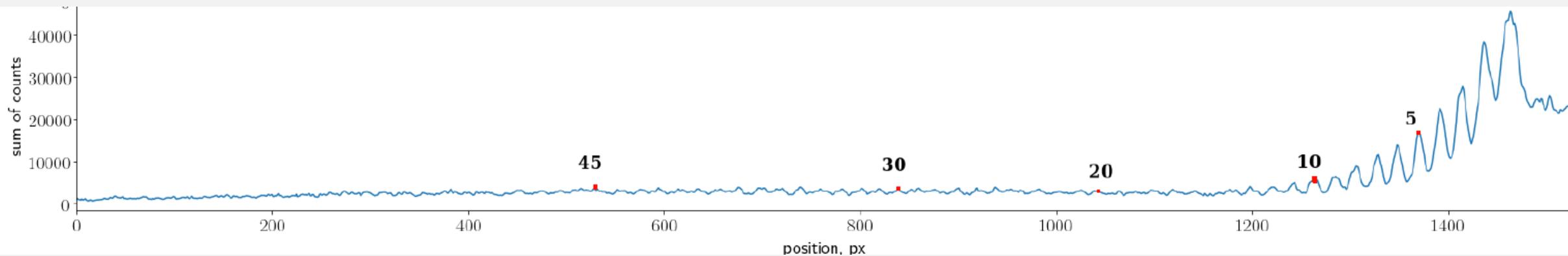


CHARGE PER MICROBUNCH



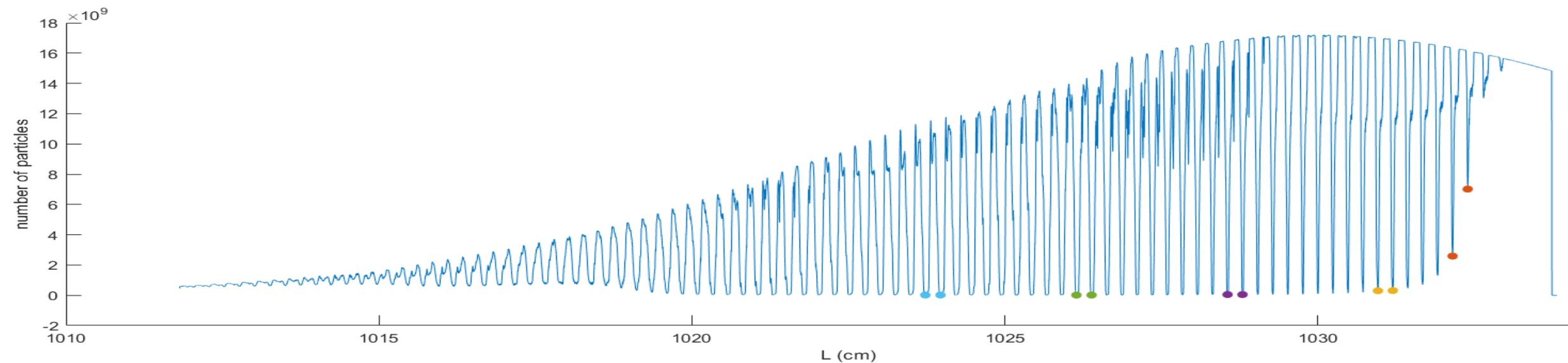
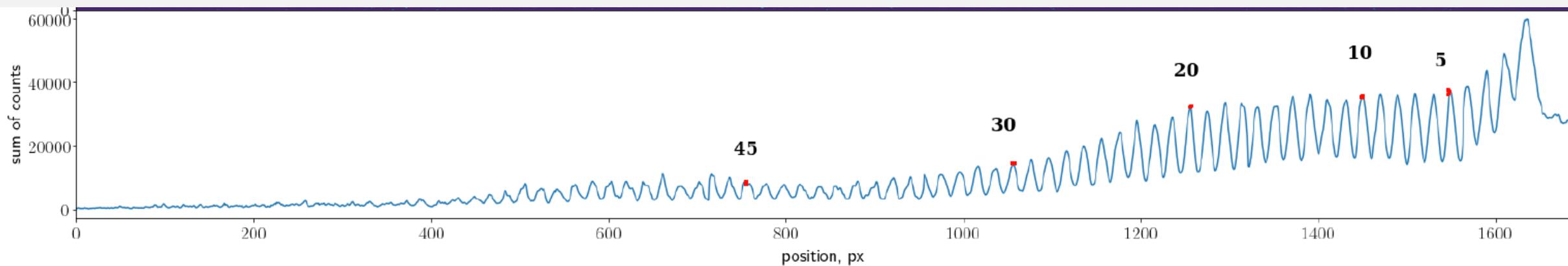
CHARGE PER MICROBUNCH

-1.93 %

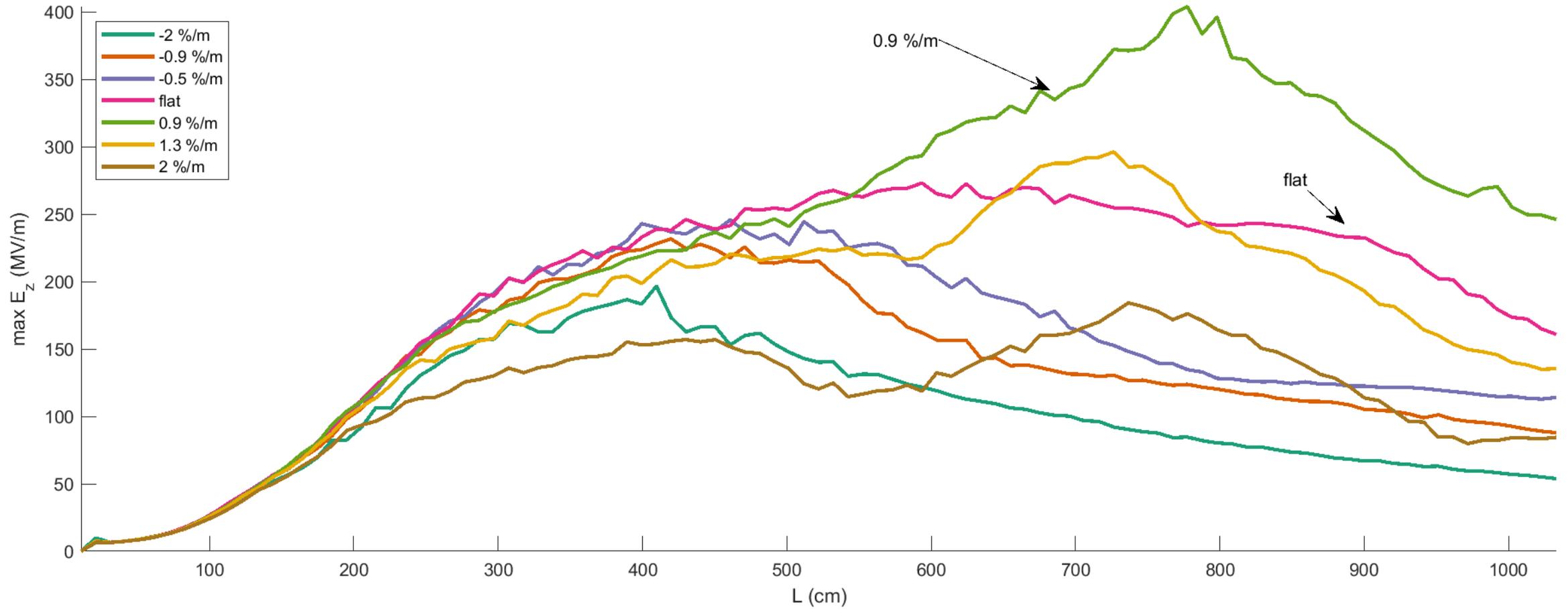


CHARGE PER MICROBUNCH

+2 %

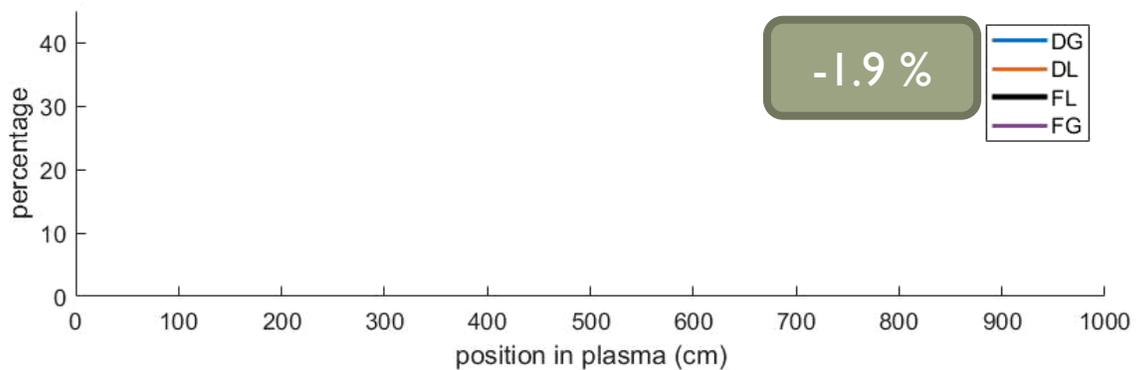
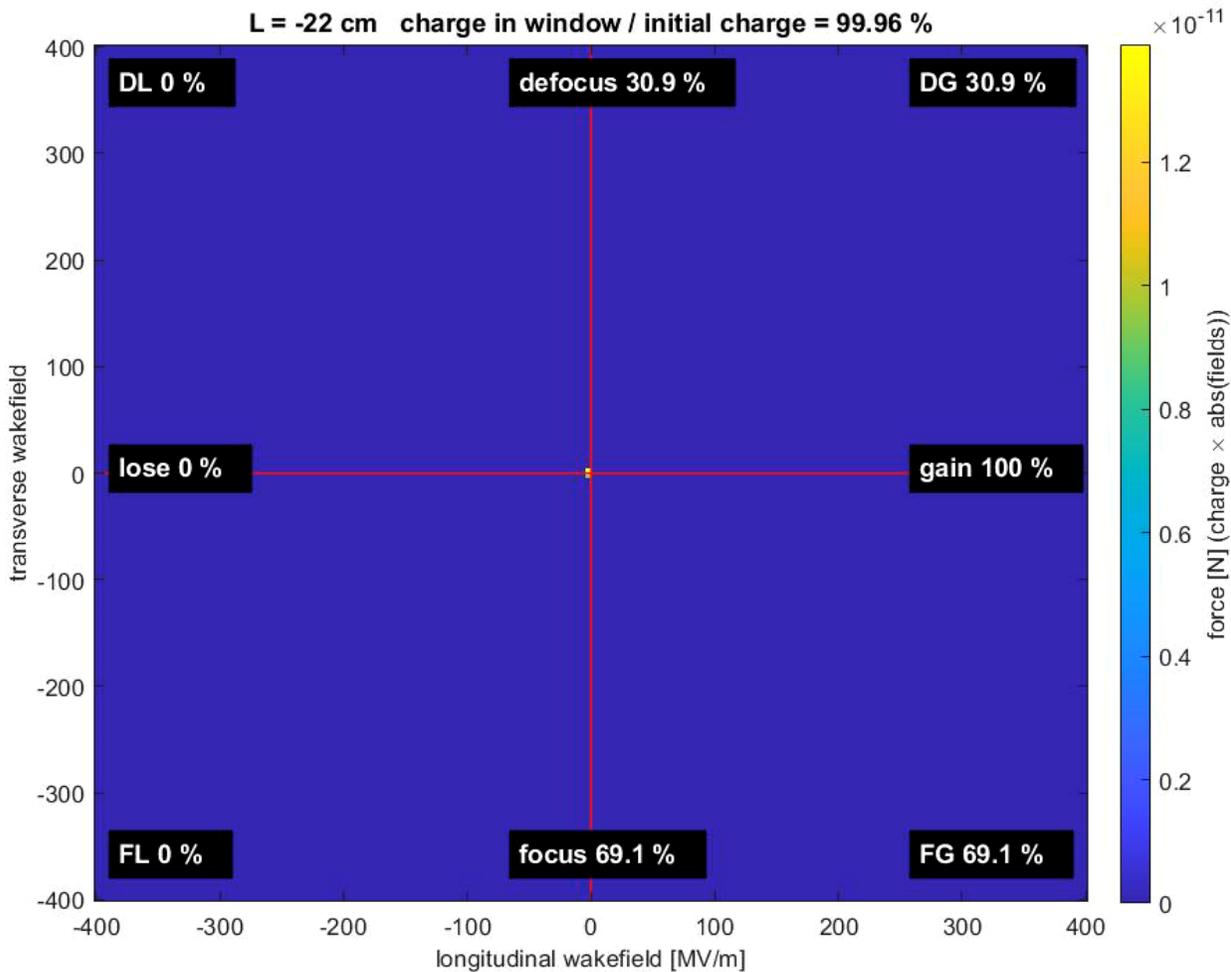


max E field

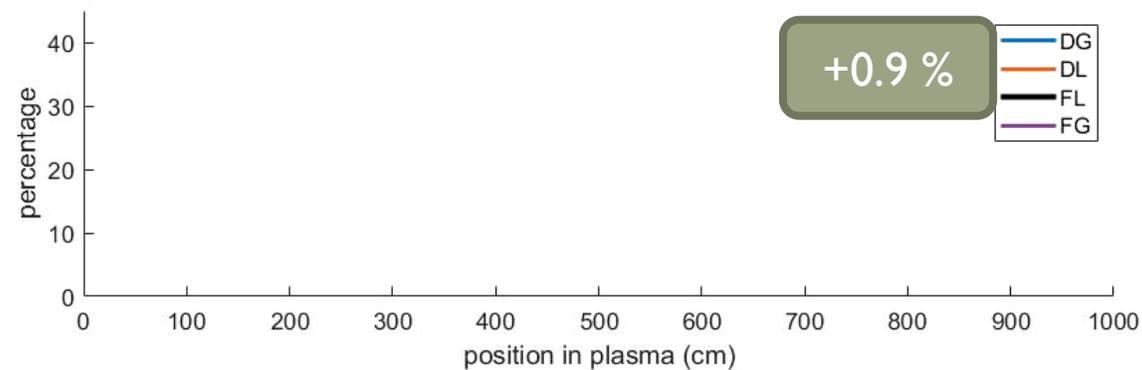
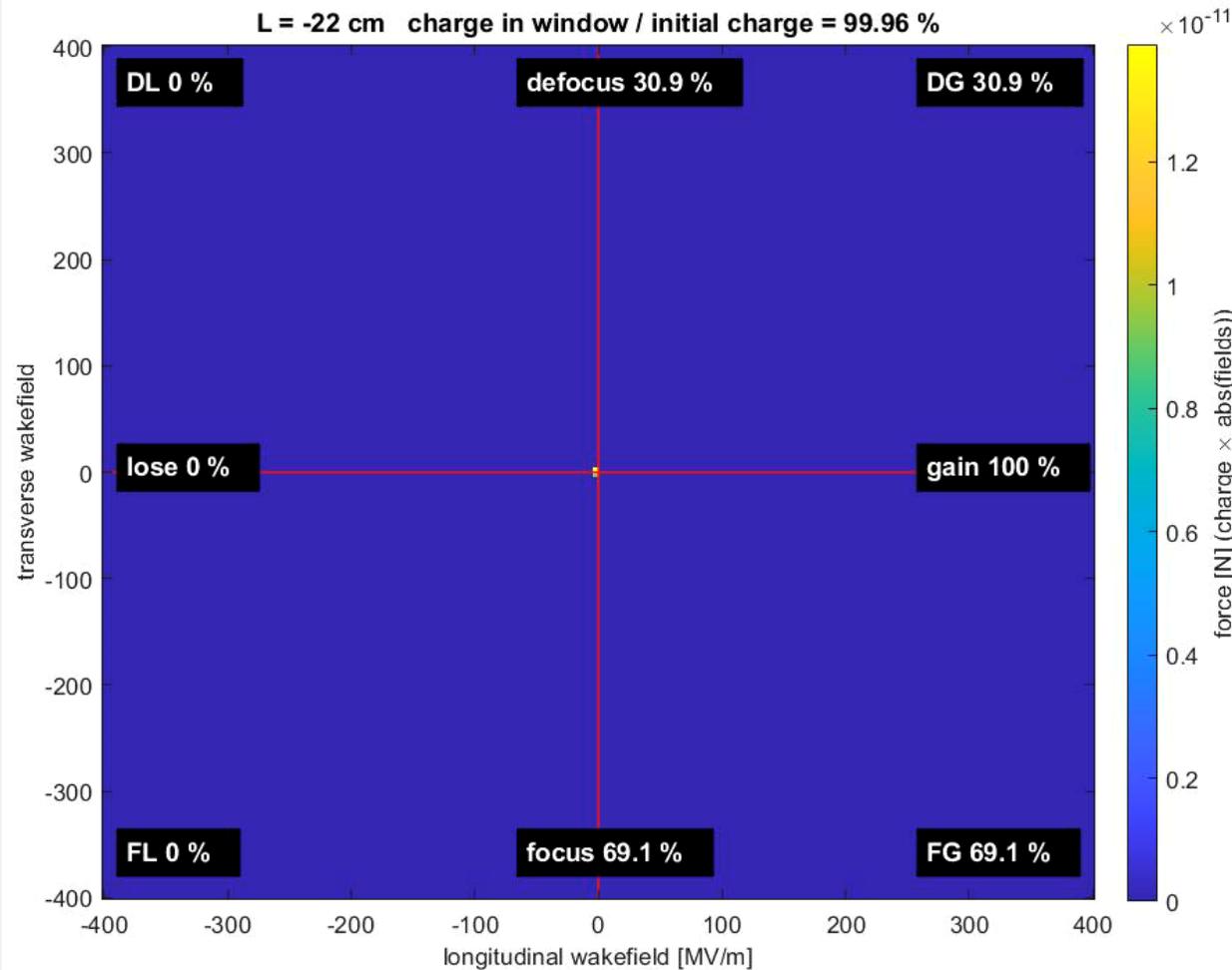


MAX. LONG. WAKEFIELD

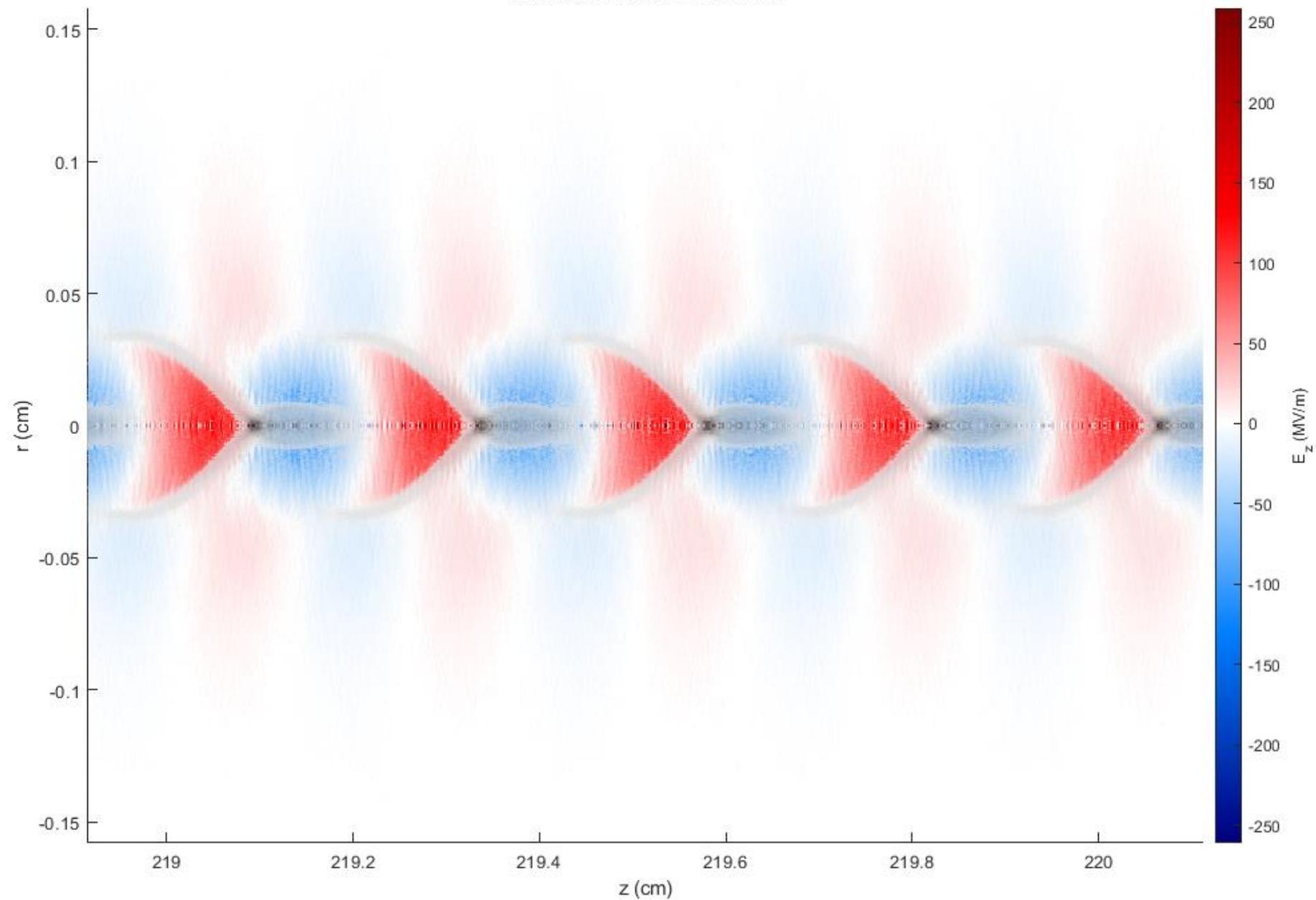
L = -22 cm charge in window / initial charge = 99.96 %



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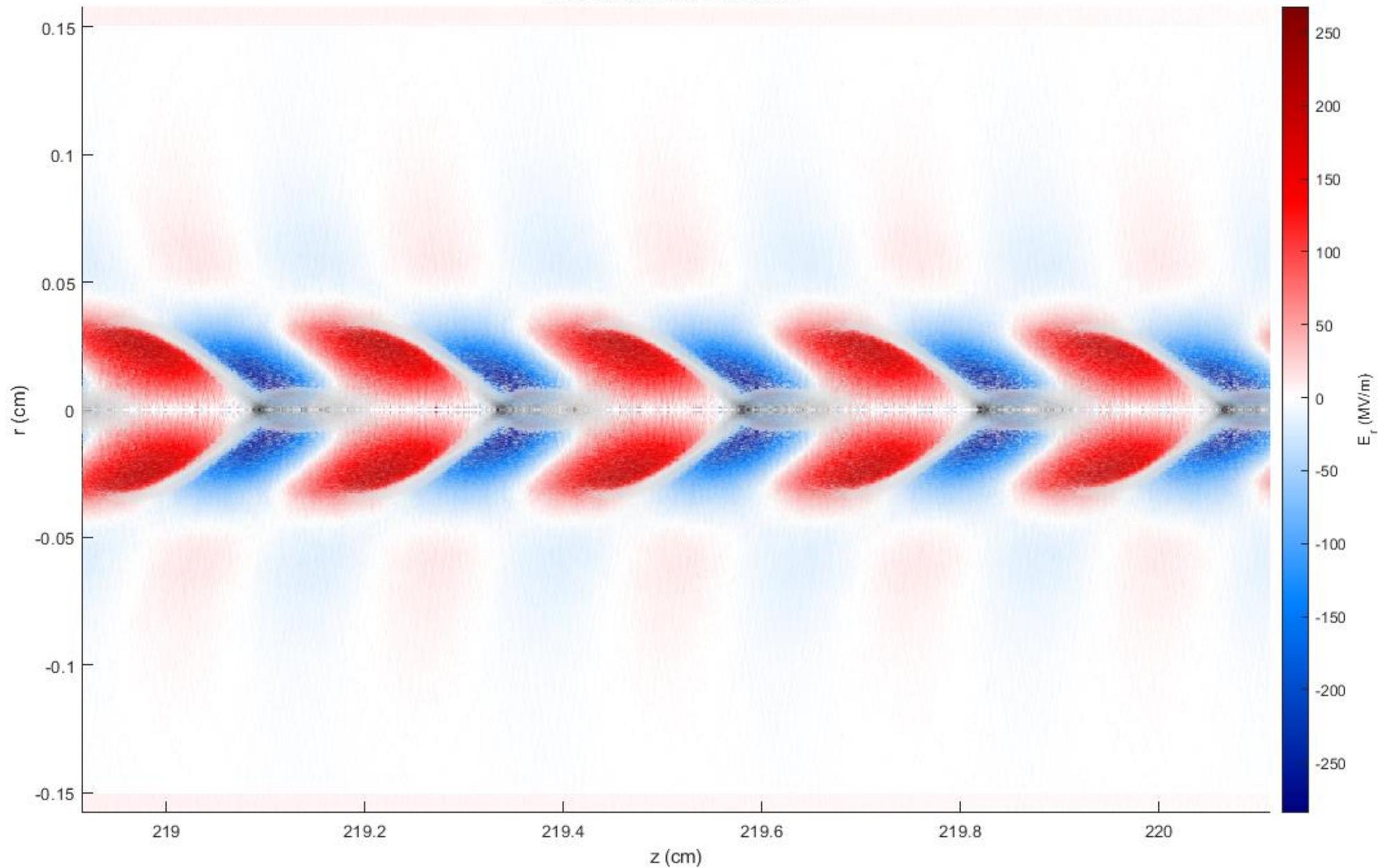


distance traveled = 219.51 cm



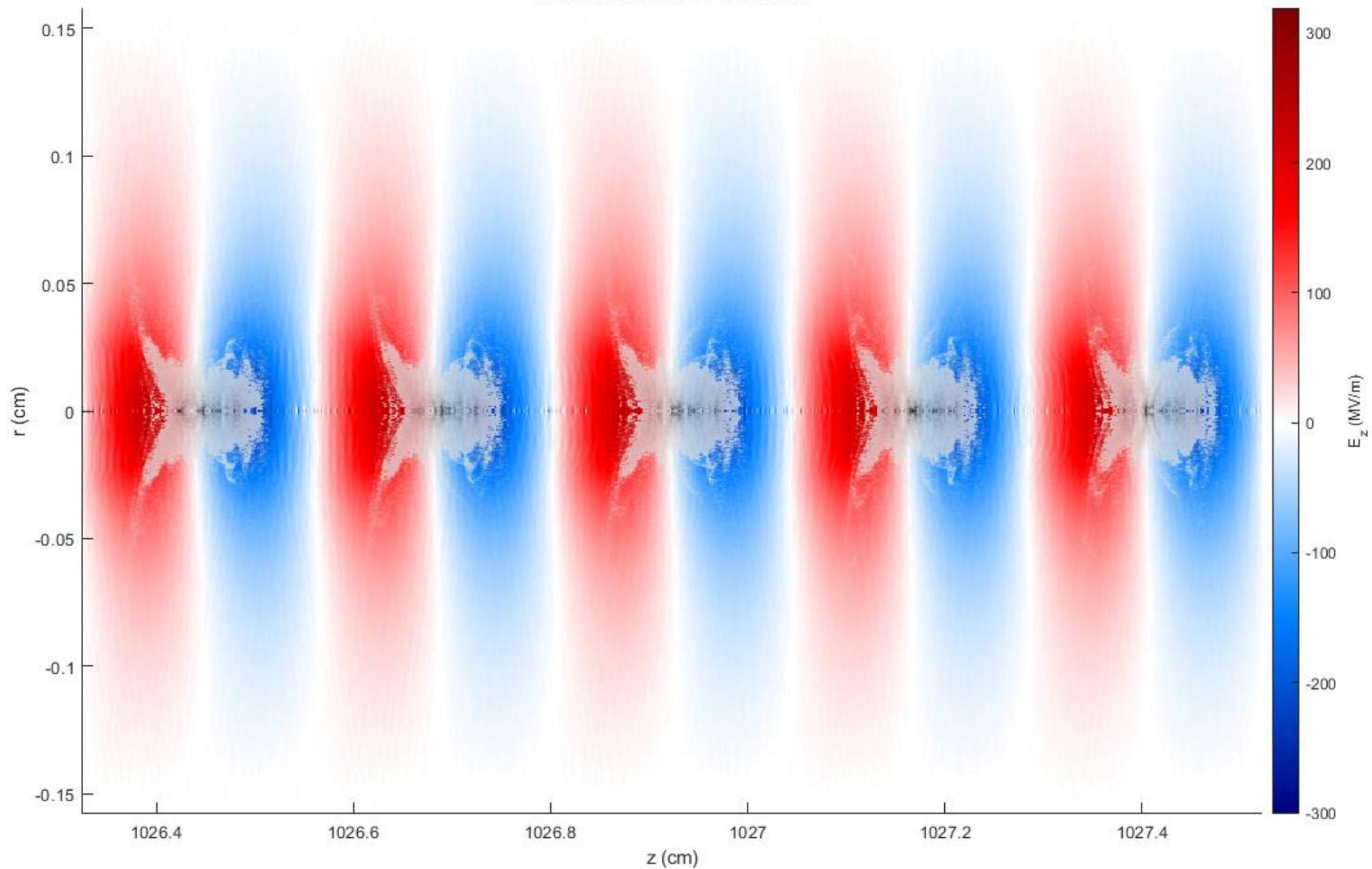
W_z

distance traveled = 219.51 cm



Wr

distance traveled = 1026.92 cm



W_z

CONCLUSIONS

- Simulation results follow experimental trends.
 - We can use the data to analyze properties not measured in the experiment.
- +9 % produces the largest wakefields (+0.43 % not tested yet)
 - Mainly due to protons being in the losing-energy phase most of the time
- Next
 - Obtain 2 more data points: +0.43 %/m and -1.5 %/m
 - For charge amount at the end, integrate until bunch radius measured by Tatiana