Muon Cooling Project Updates

February 21, 2025

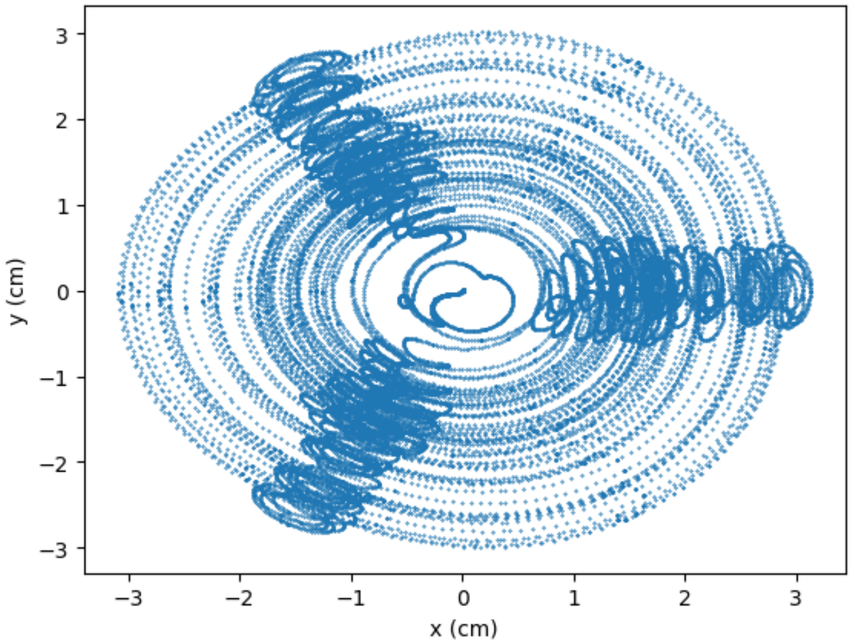
https://github.com/criggall/muon-cooling

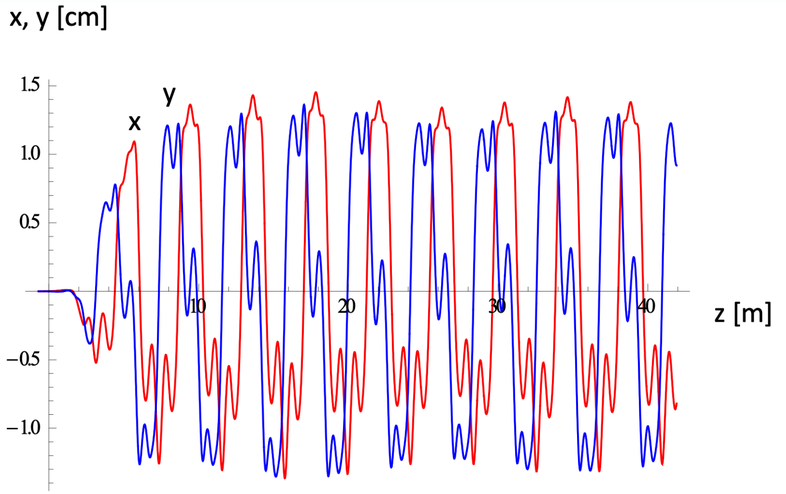
Adjusted .in file

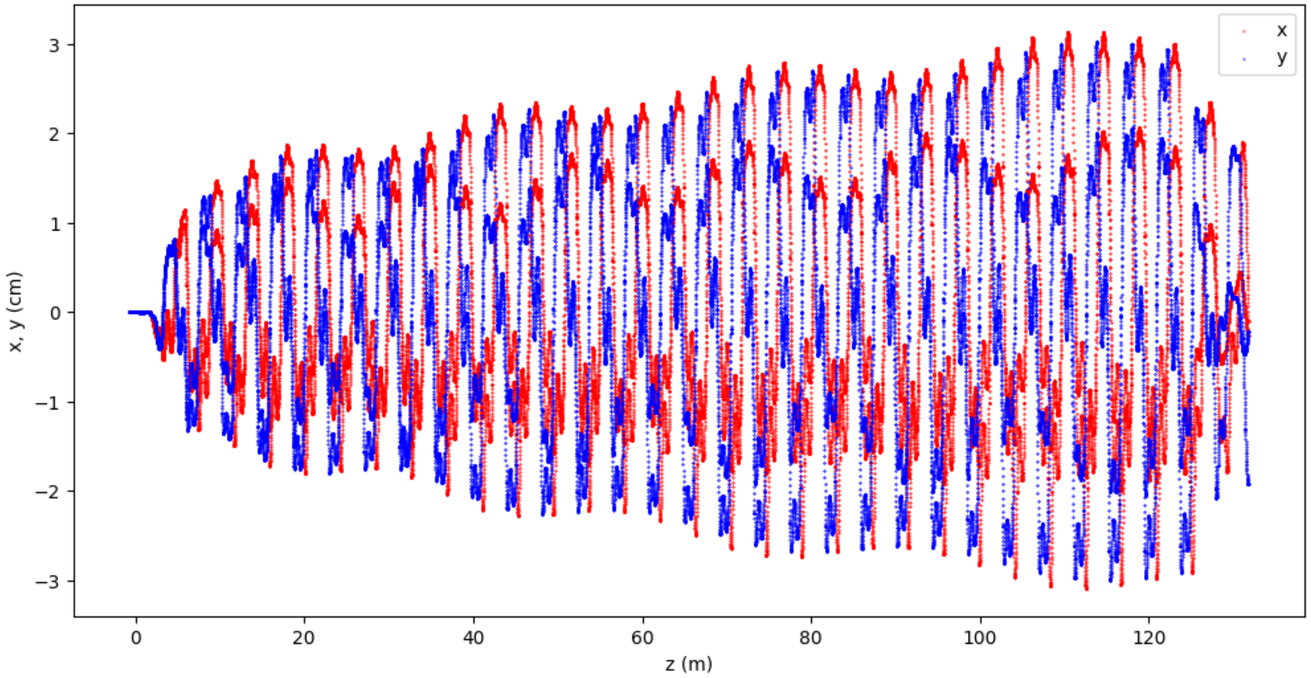
- Turn off all materials
- Turn off RF gradient
- Turn off stochastic processes

Reference particle

```
reference referenceMomentum=250 particle=mu+ beamZ=0.0
```







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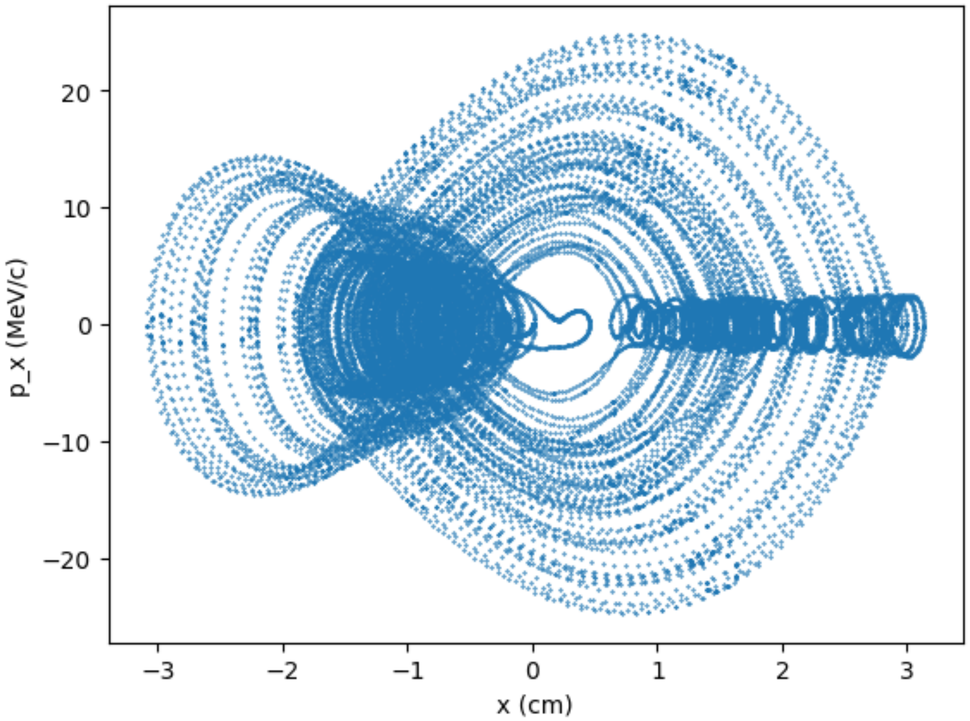

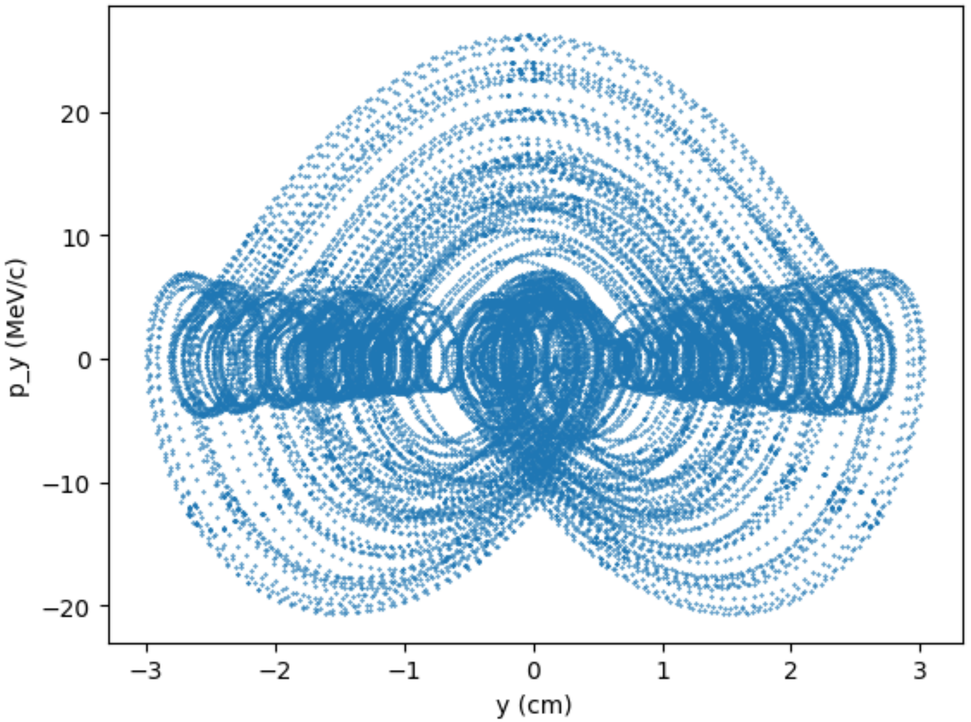

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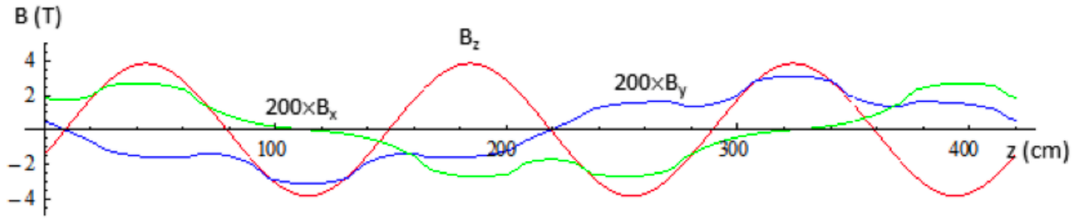

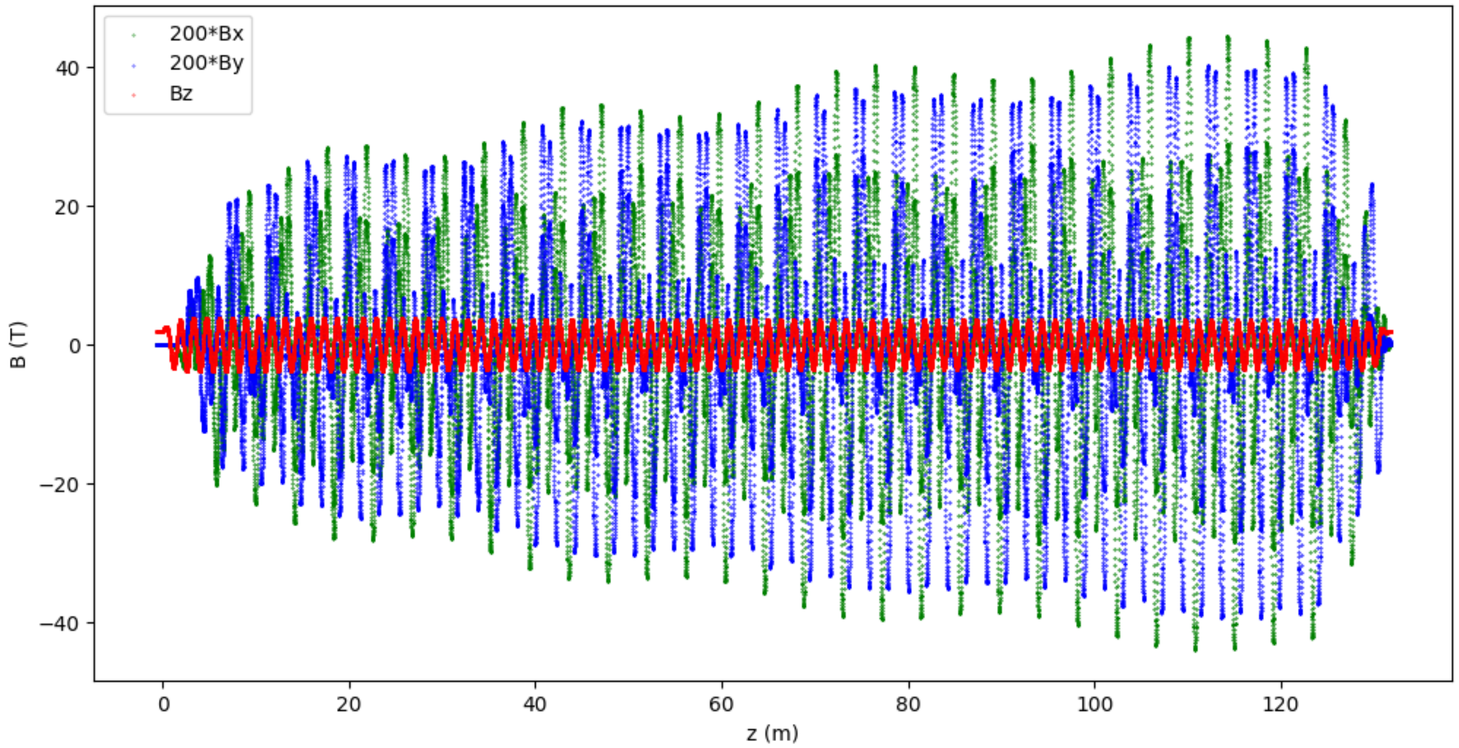

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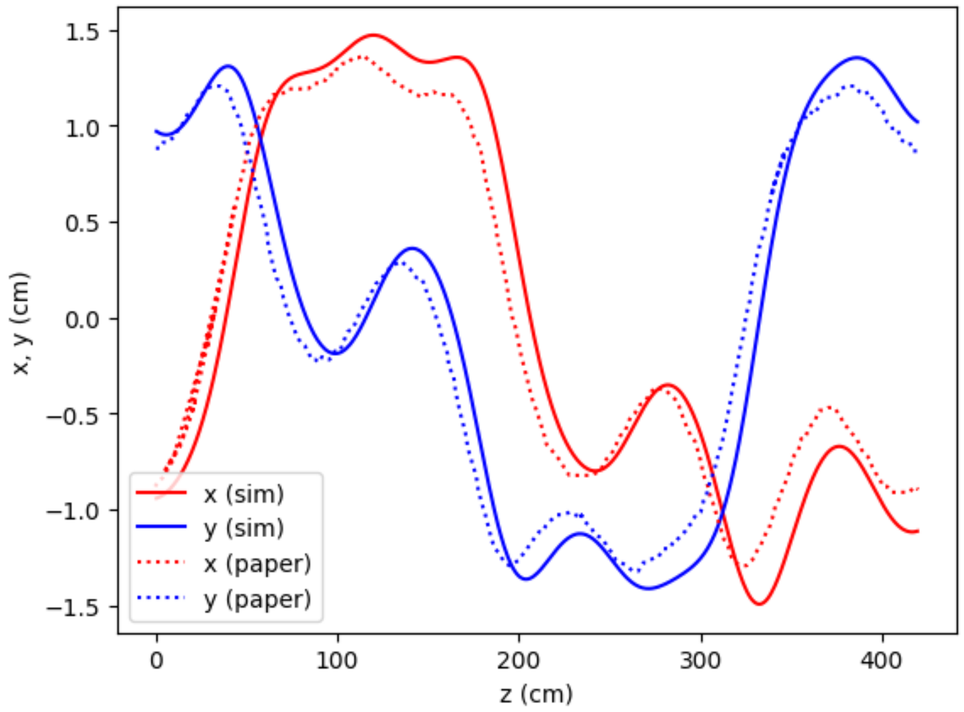
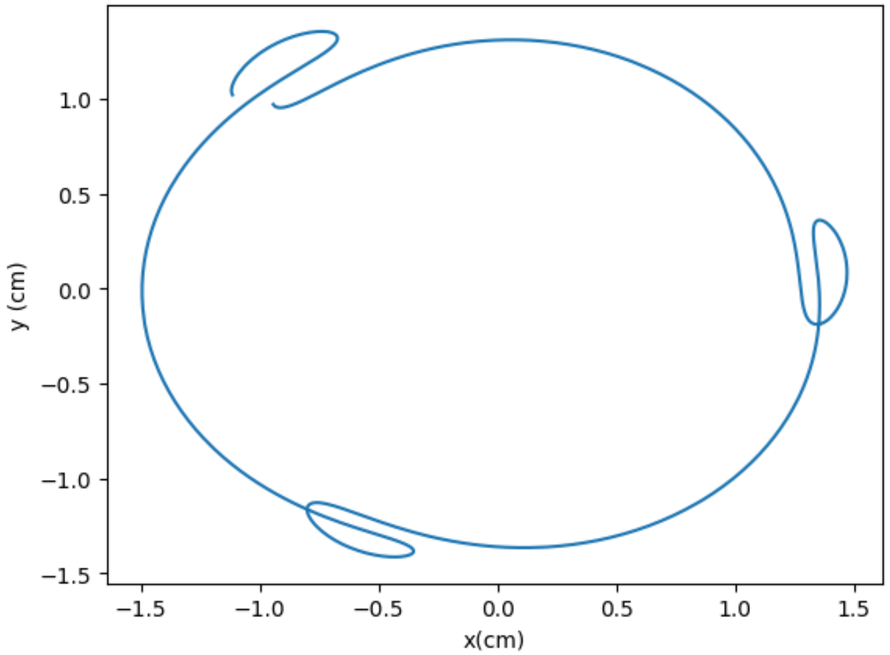
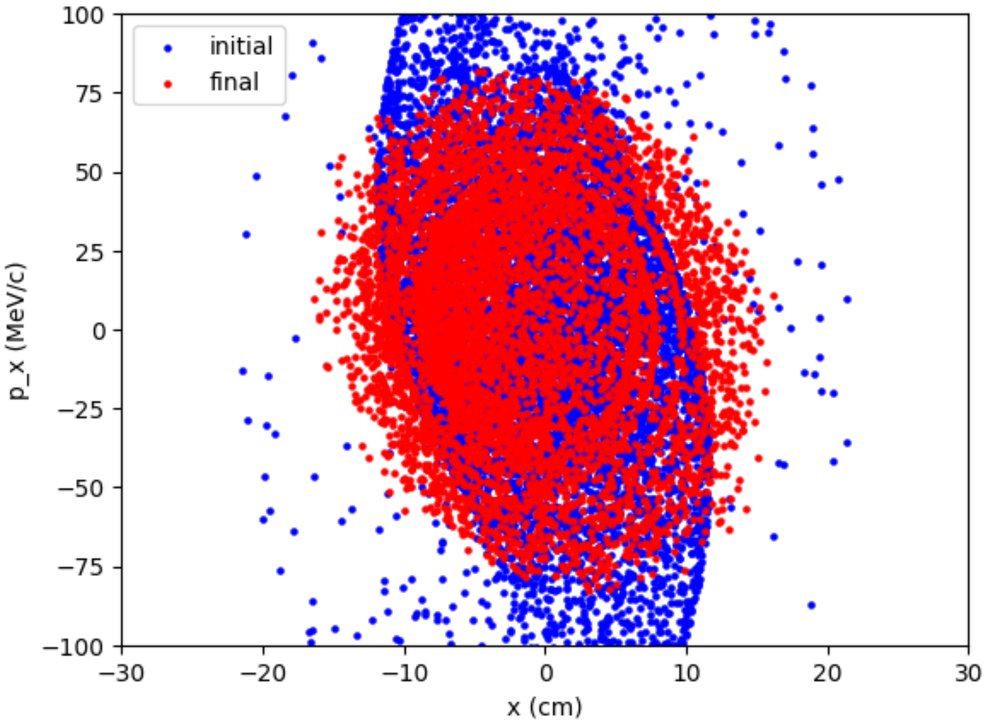
Isolated 3rd period of channel

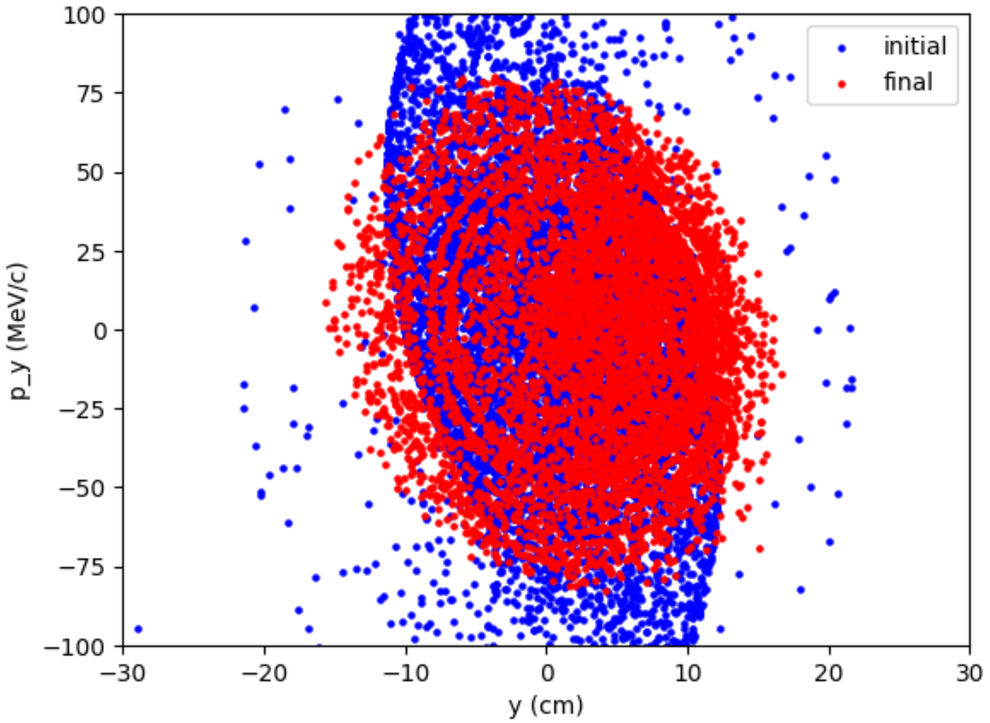




Gaussian beam

```
beam gaussian particle=mu+ nEvents=10000 beamZ=-700.0 \
    sigmaX=100.0 sigmaY=100.0 sigmaXp=0.00 sigmaYp=0.00 \
    meanMomentum=250.0 sigmaP=0.0 meanT=0.0 sigmaT=0.0
```





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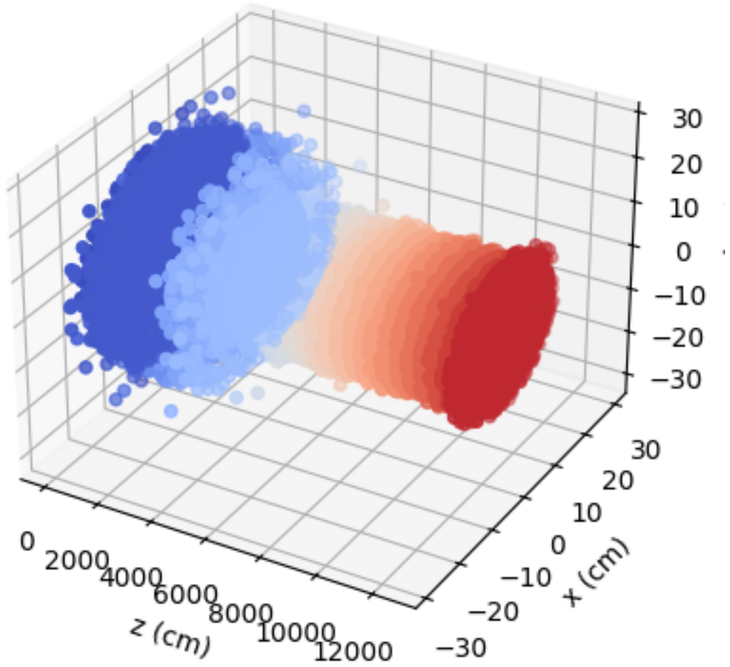

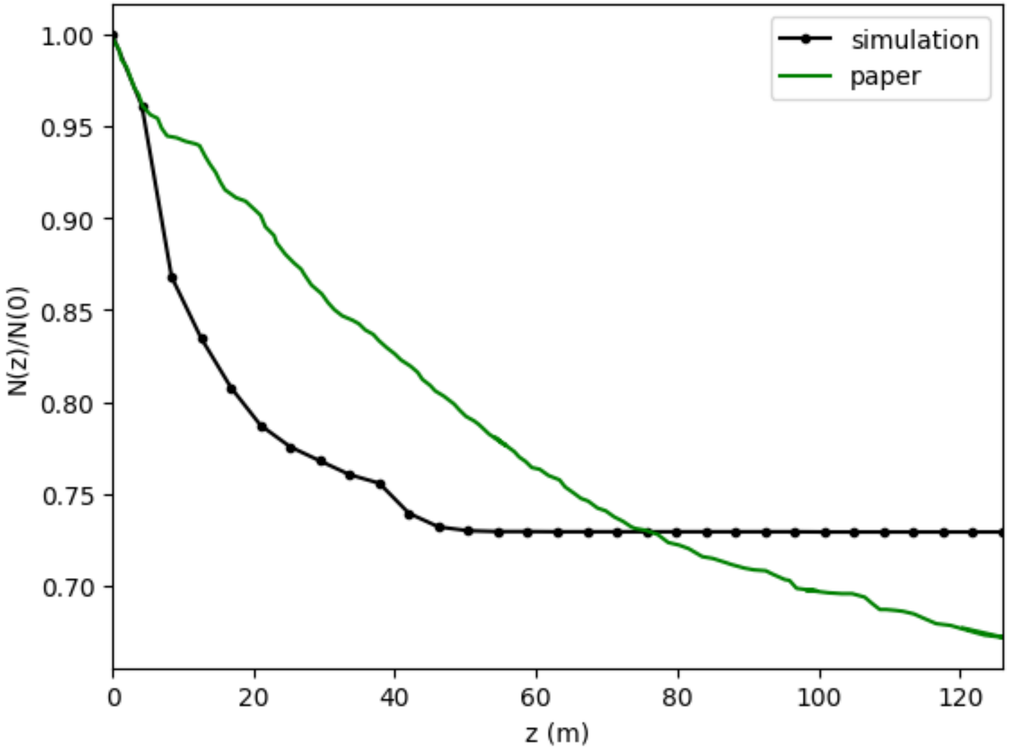

Next steps

- Further investigate periodicity by plotting one point in phase space per period (**Poincaré section**)
- Scan over initial time placement of Gaussian beam (with time spread = RF period) to find matching with RF phase (**RF offset**)
- Try calculating emittance from reference particle
  - And cooling efficiency factor from simulated beam