Muon Cooling Project Updates

February 14, 2025

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

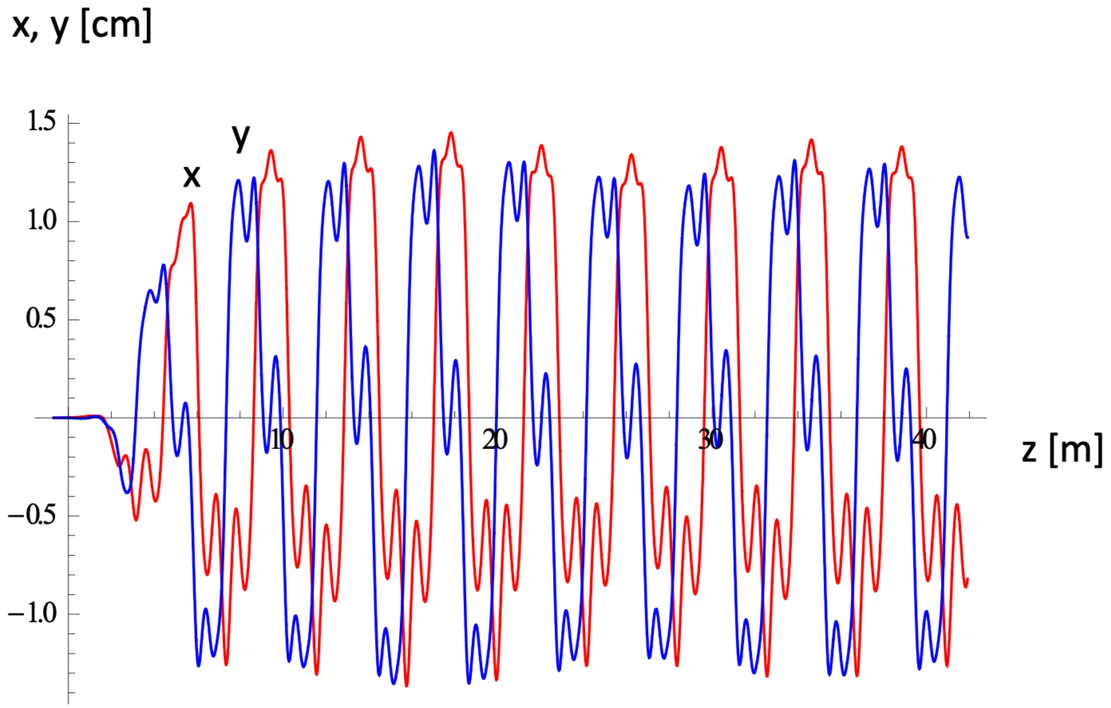
Overview

- At our last meeting, we discussed some preliminary scans of the BLS parameter (see supplementary for these plots)
  - Found that reference particle only made it to end of channel for limited range of BLS values not including the nominal
- To better compare to the original G4bl input we have, presented here are more plots of the behavior with the original BLS value, particularly focusing on the periodic region
- Also presented are preliminary scans over adjustments to the initial z placement of the beam to investigate the effect of this z offset on the periodicity

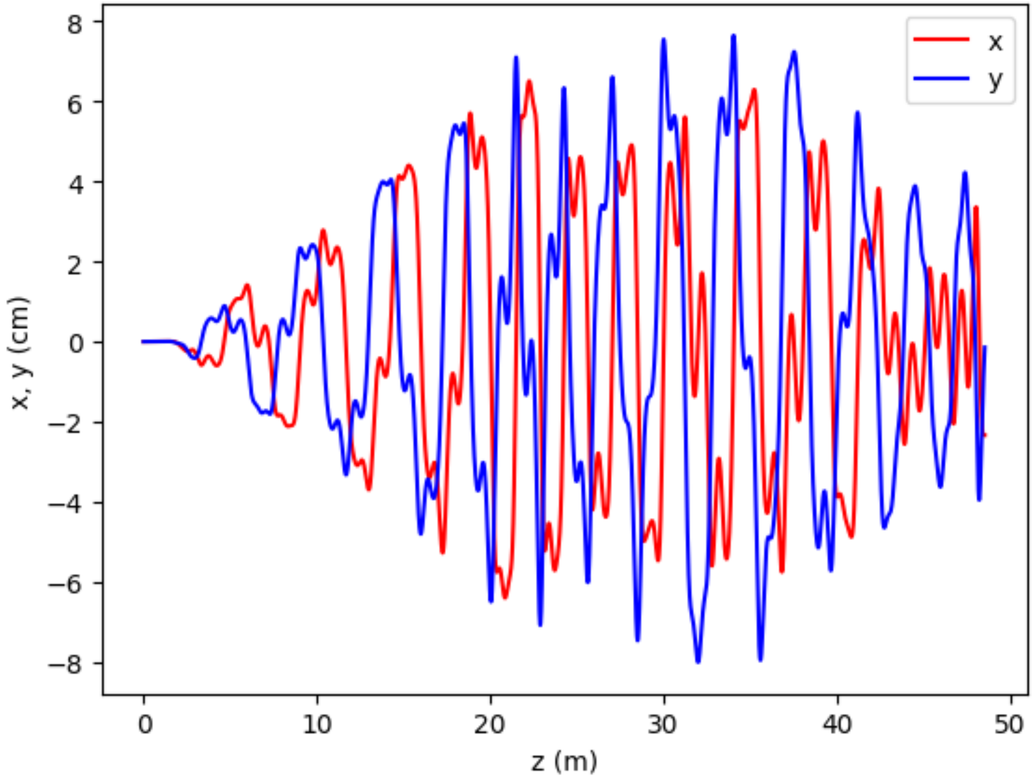
Original BLS value

BLS = 21.4 (original) — full channel

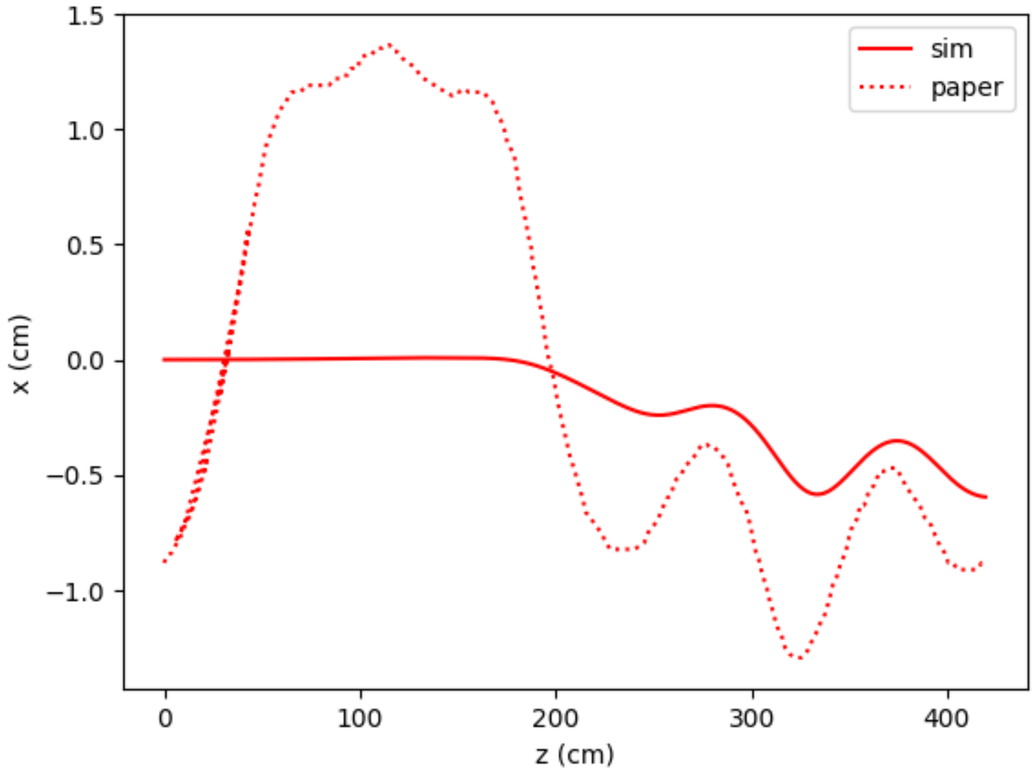
Yuri's slides

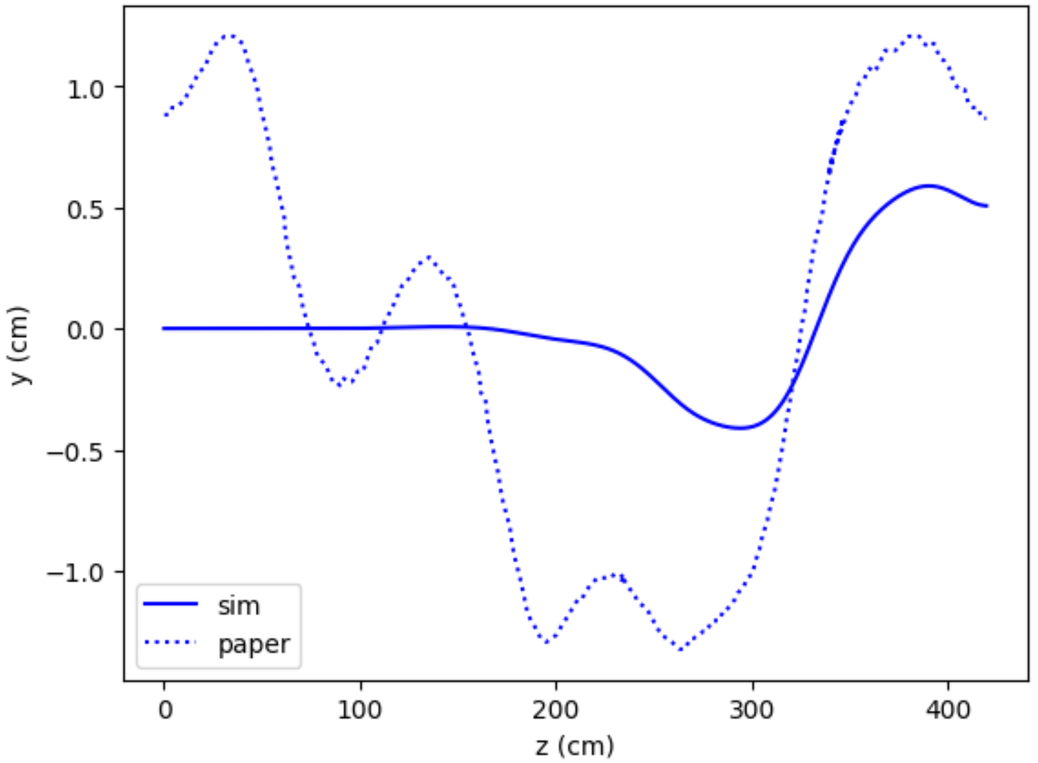


Simulation

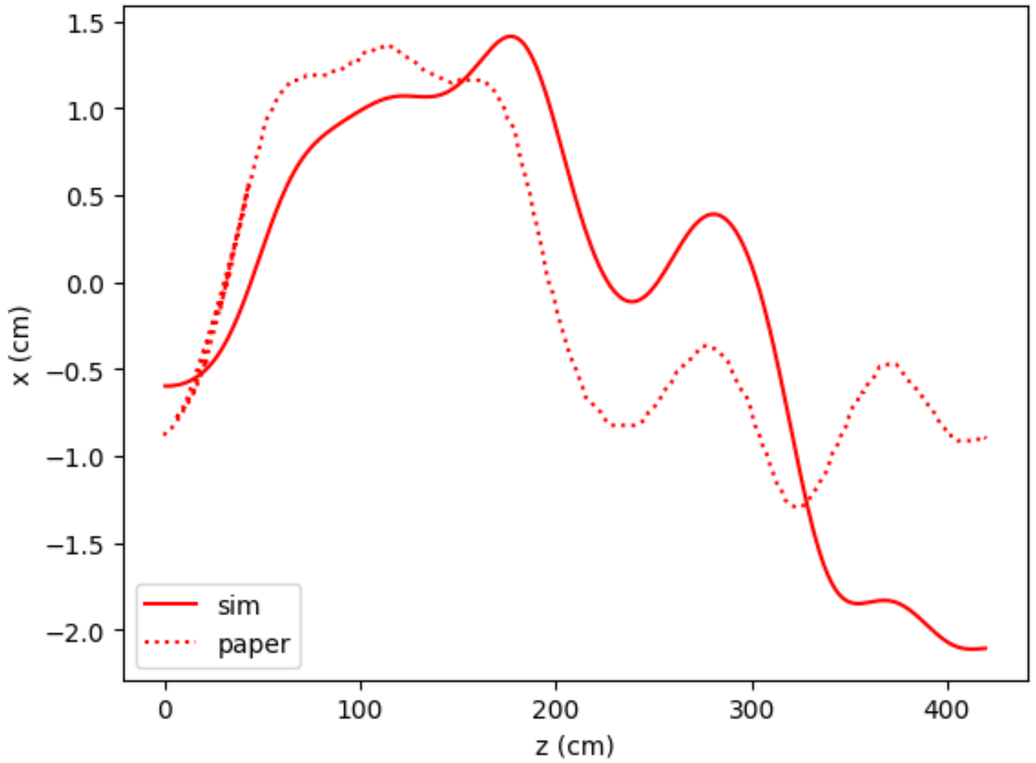


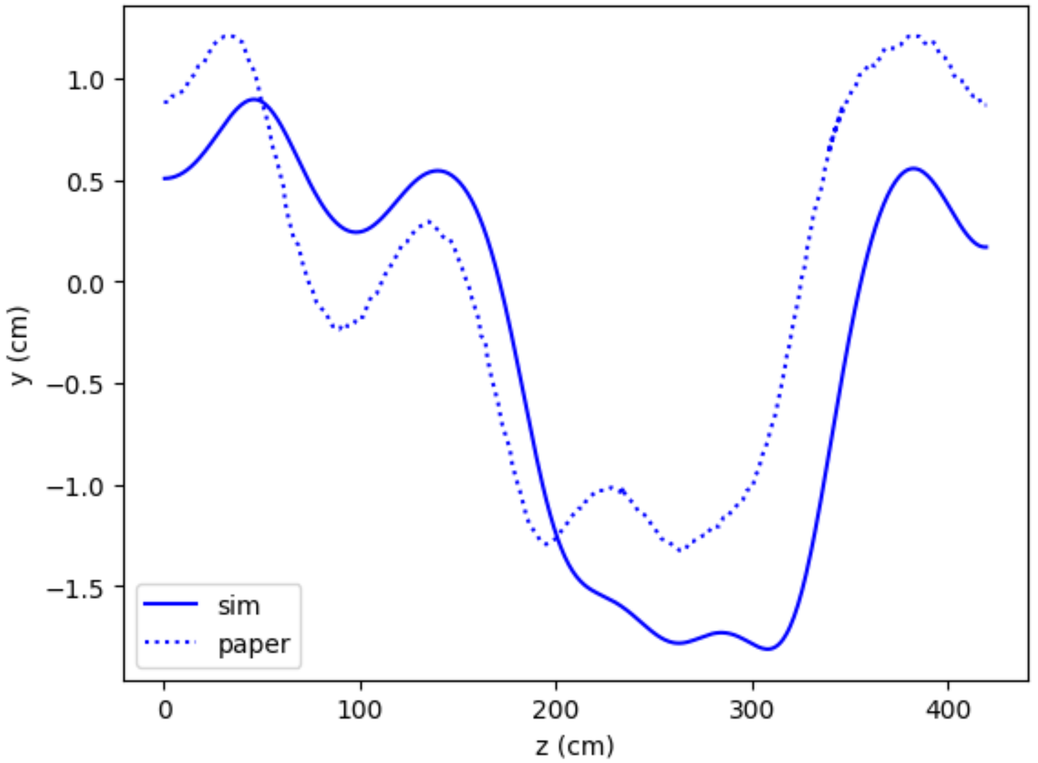
BLS = 21.4 (original) — first period





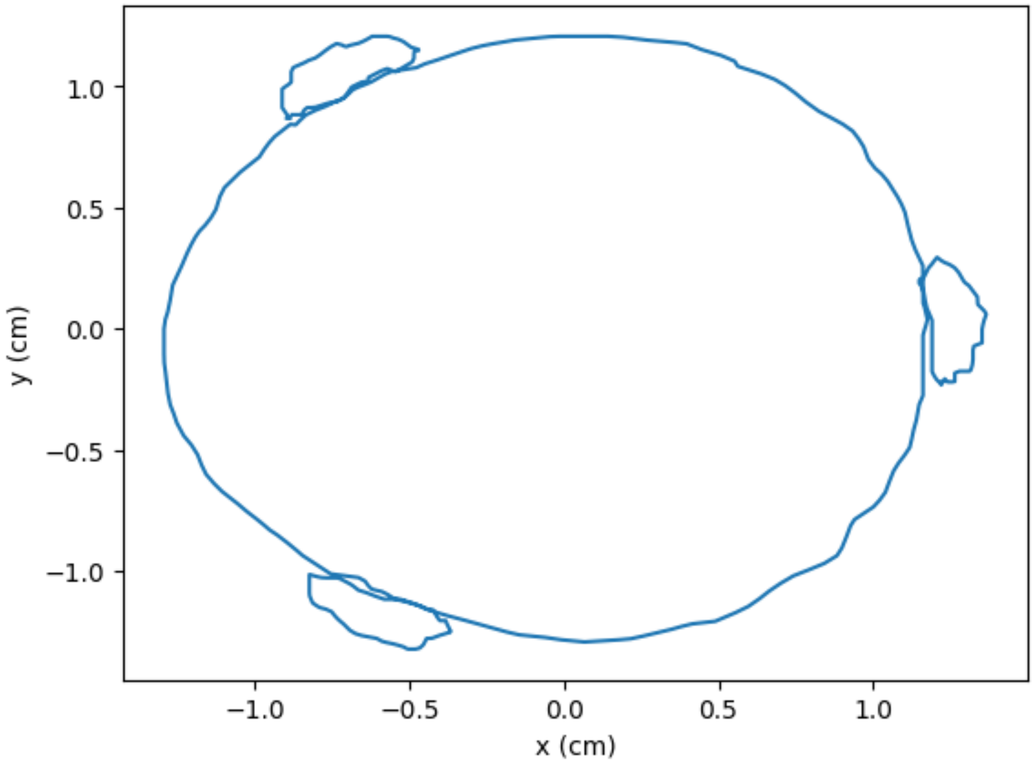
BLS = 21.4 (original) — second period



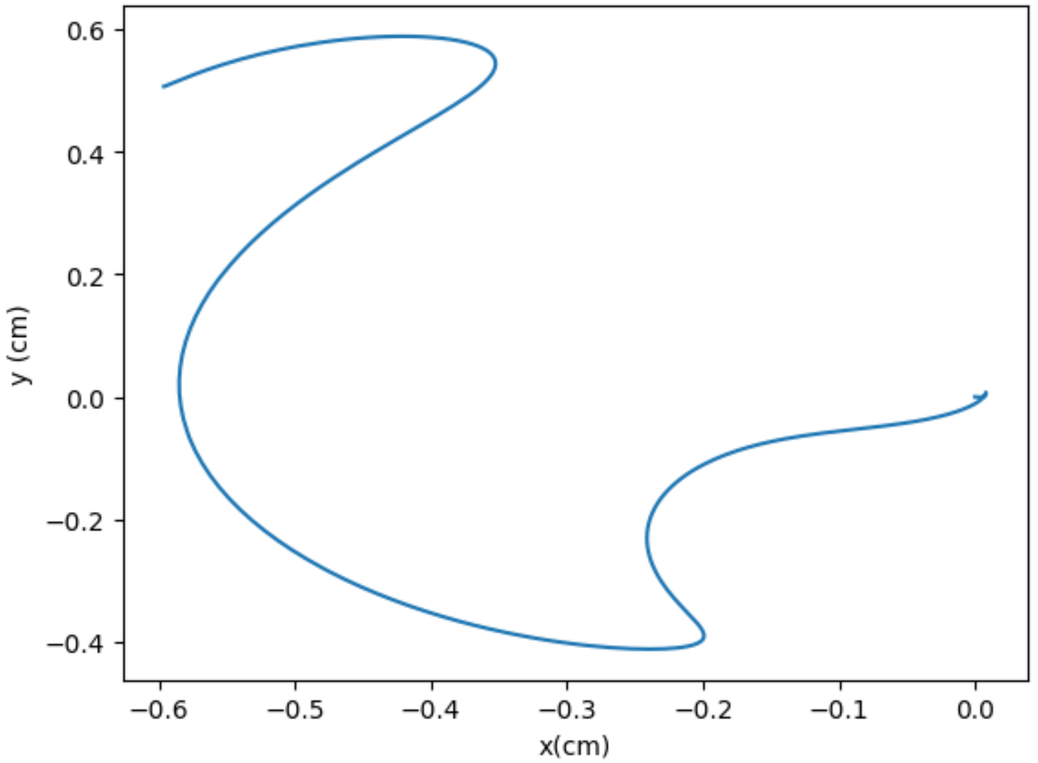


BLS = 21.4 (original) — first period

Paper

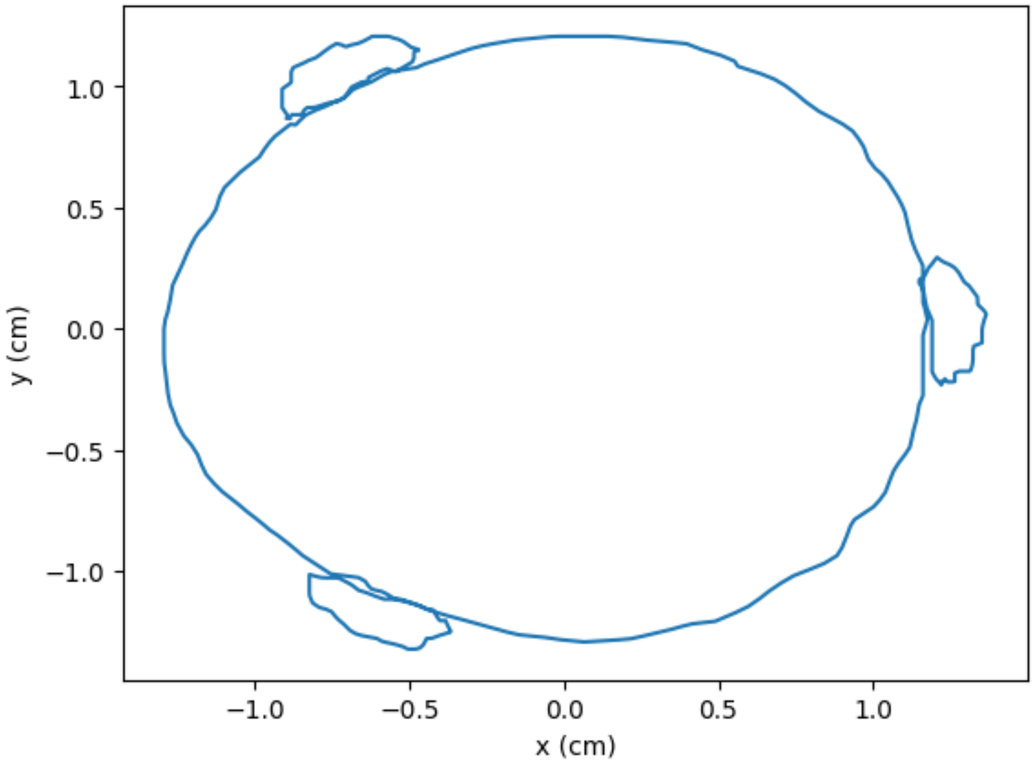


Simulation

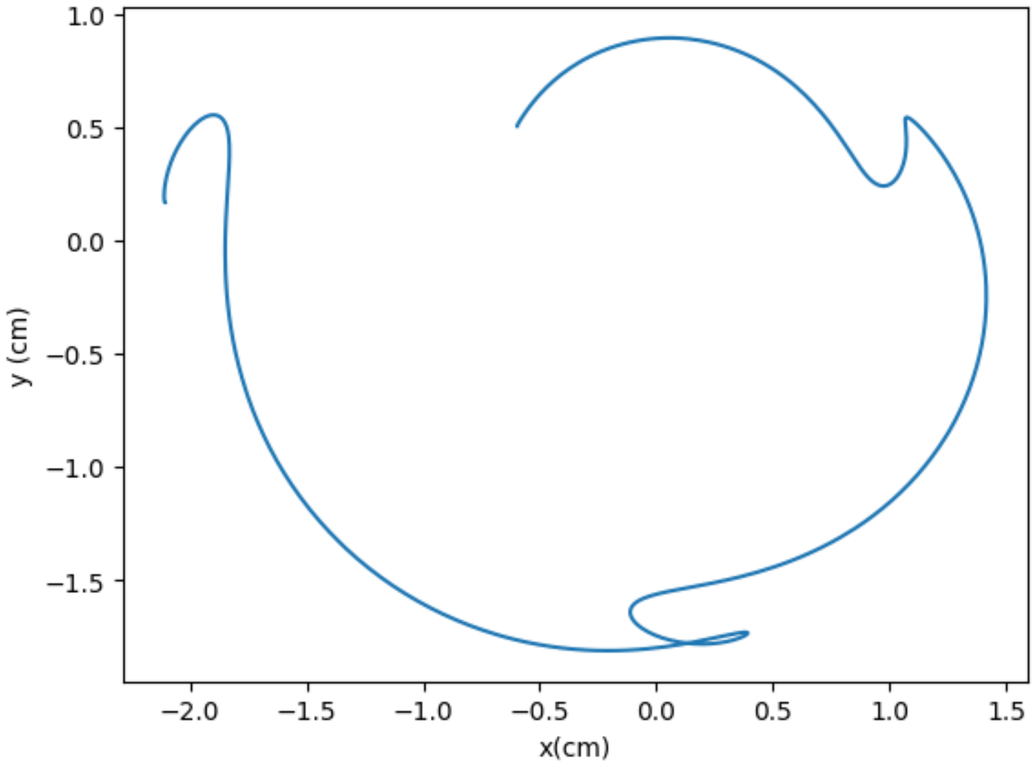


BLS = 21.4 (original) — second period

Paper

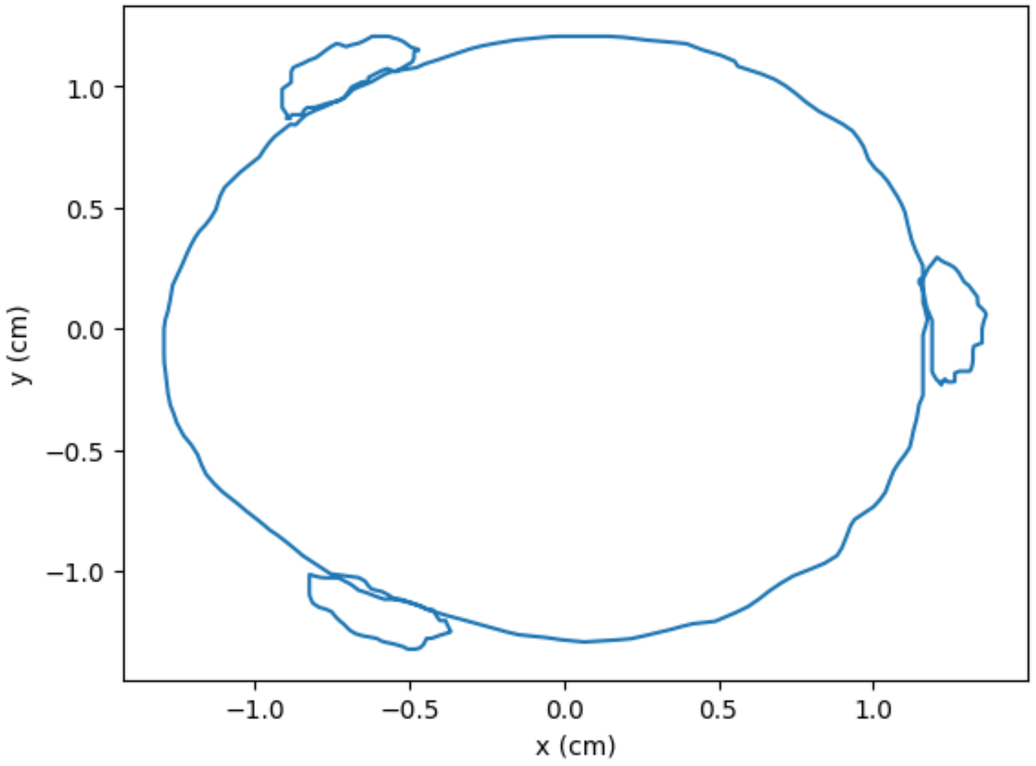


Simulation

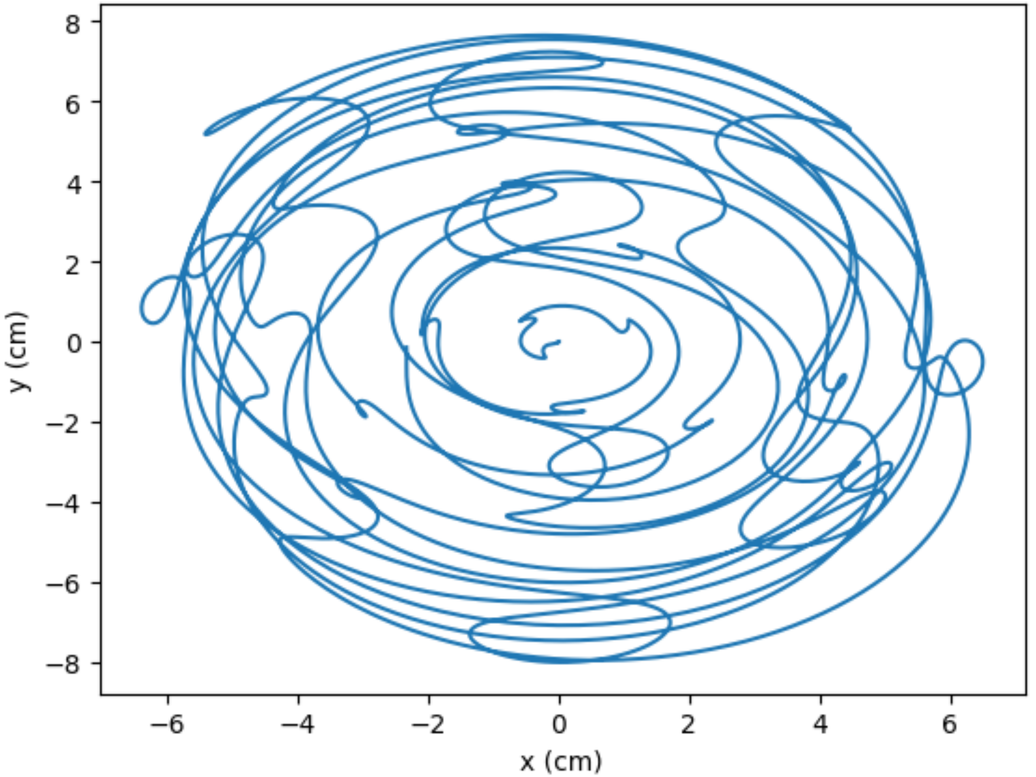


BLS = 21.4 (original) — full channel

(single period only)
Paper

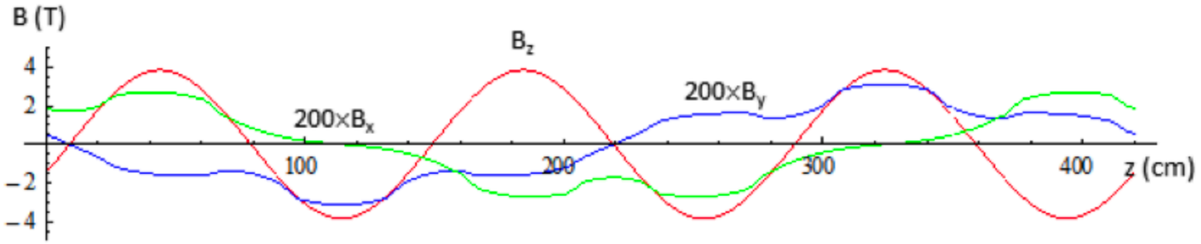


(full channel)
Simulation

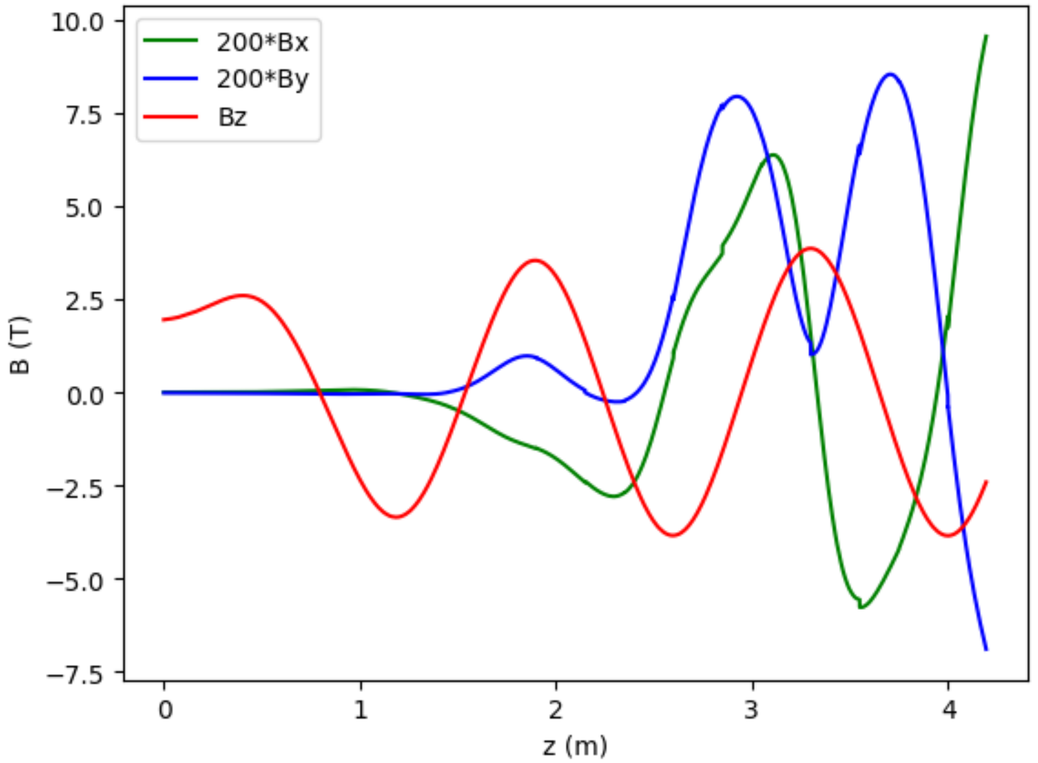


BLS = 21.4 (original) — first period

Paper

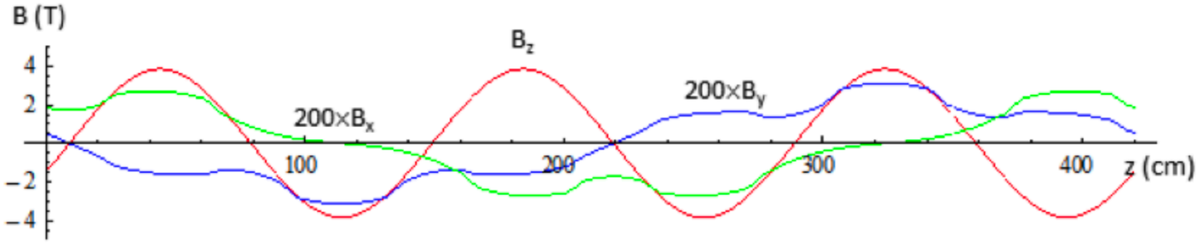


Simulation

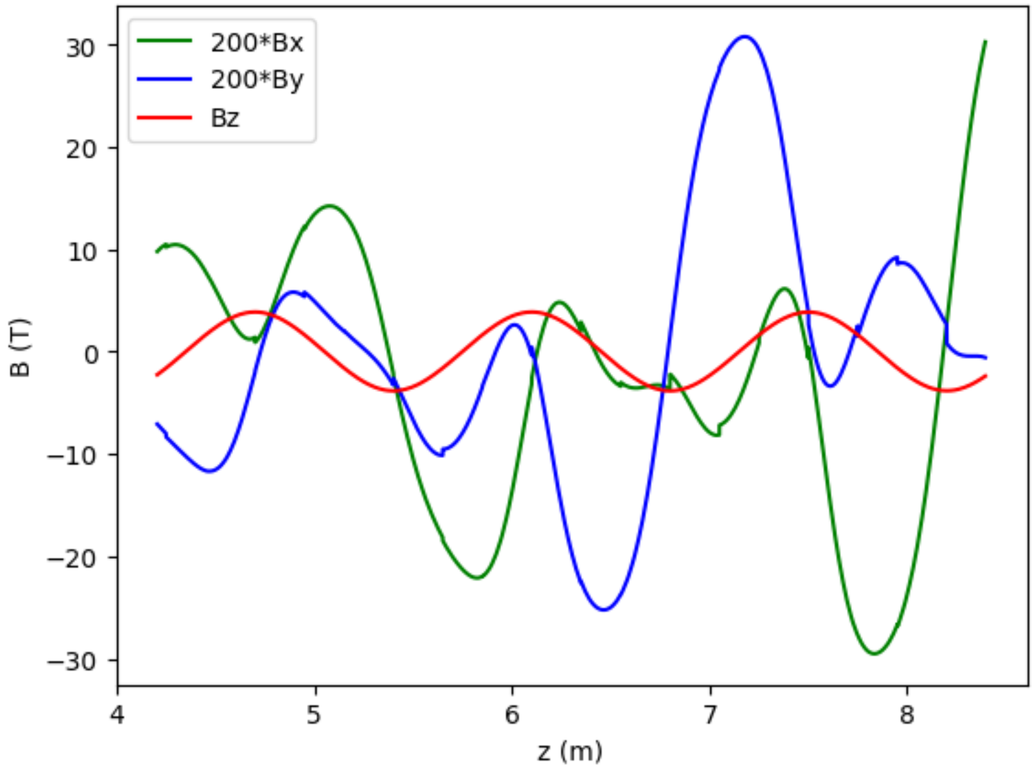


BLS = 21.4 (original) — second period

Paper



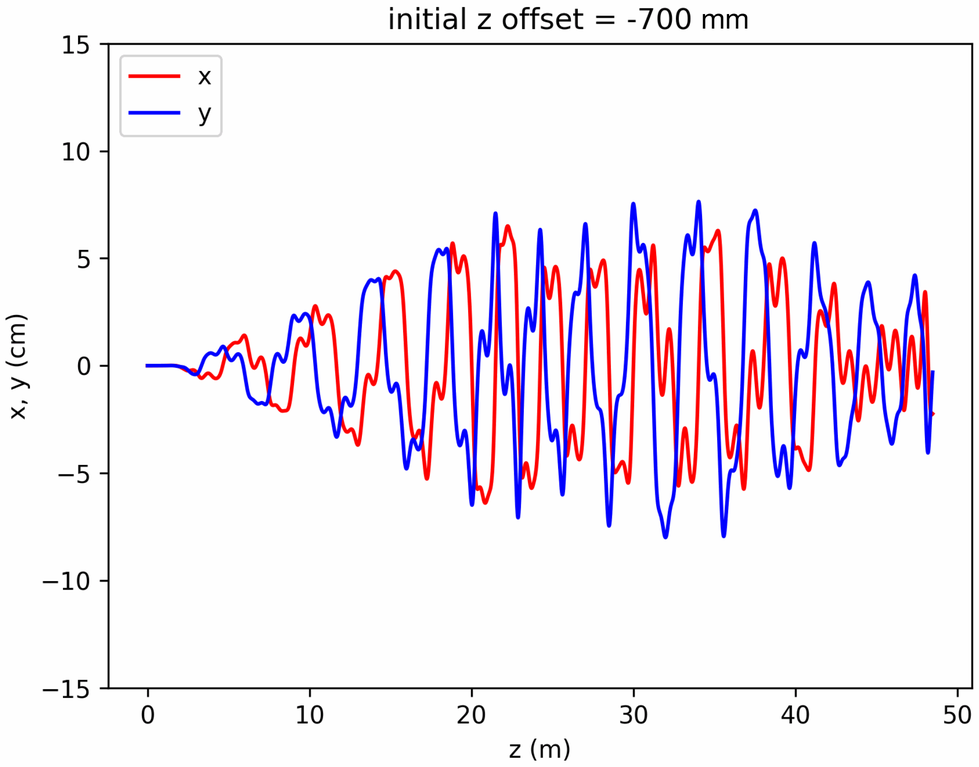
Simulation

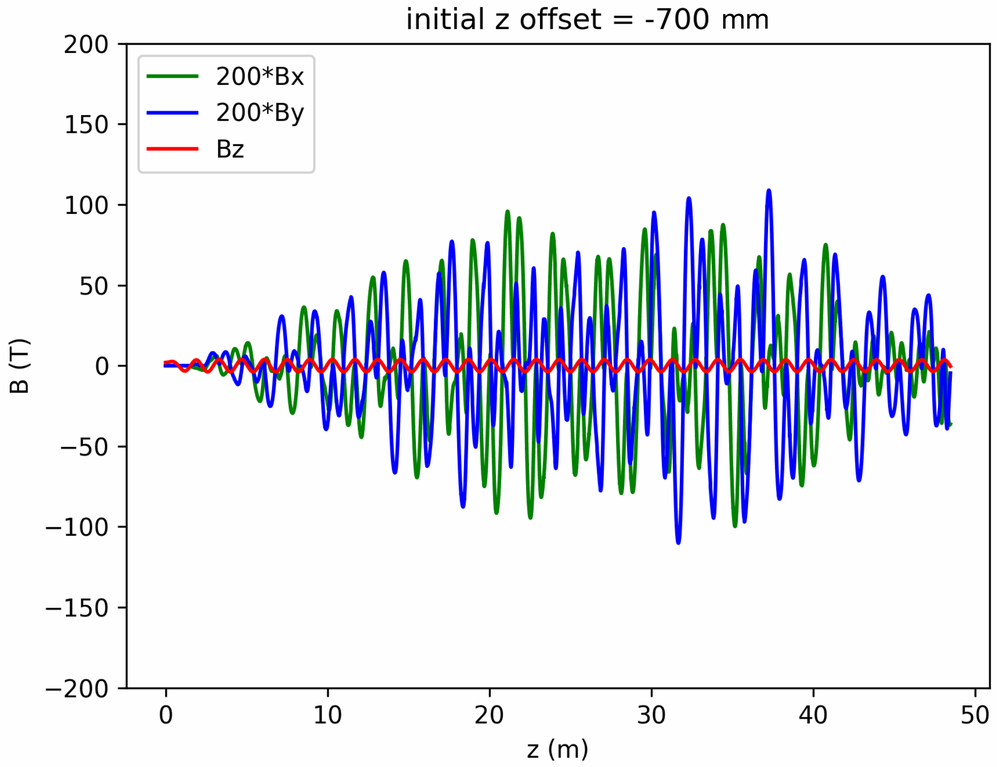


Coarse scan over z offset

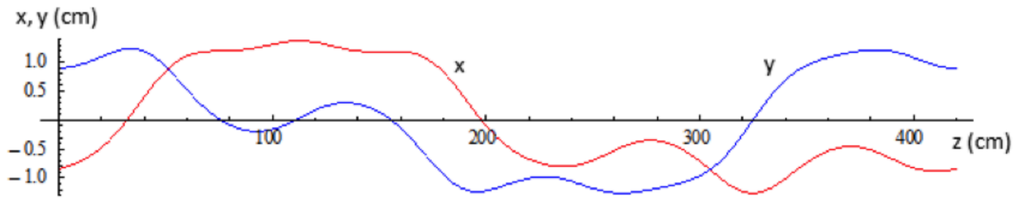
Initial beam z offset = -700mm (original) to 0mm in steps of 100mm (with BLS fixed at 21.4)

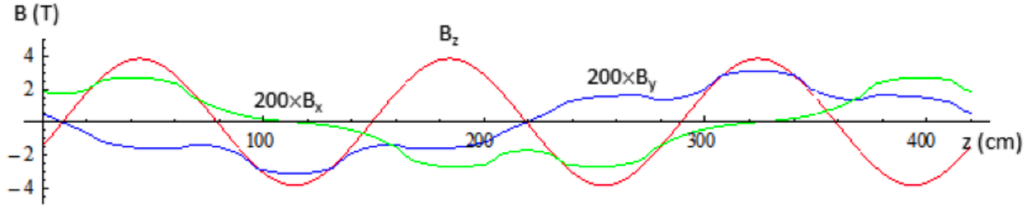
Beam initial z offset coarse scan — full channel

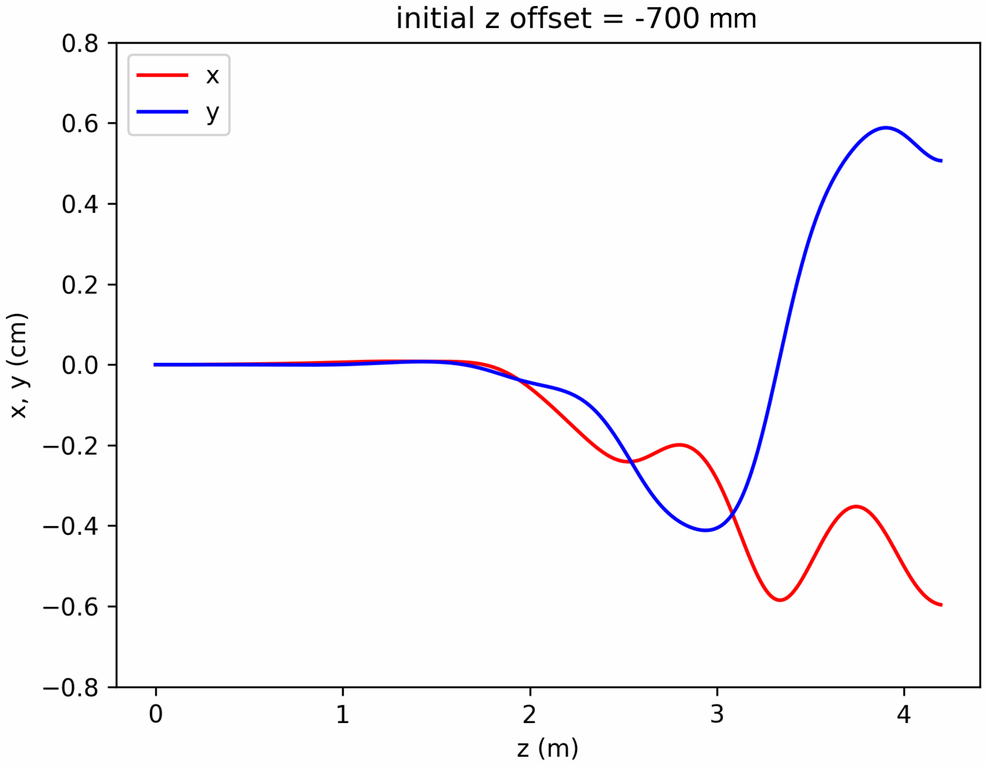


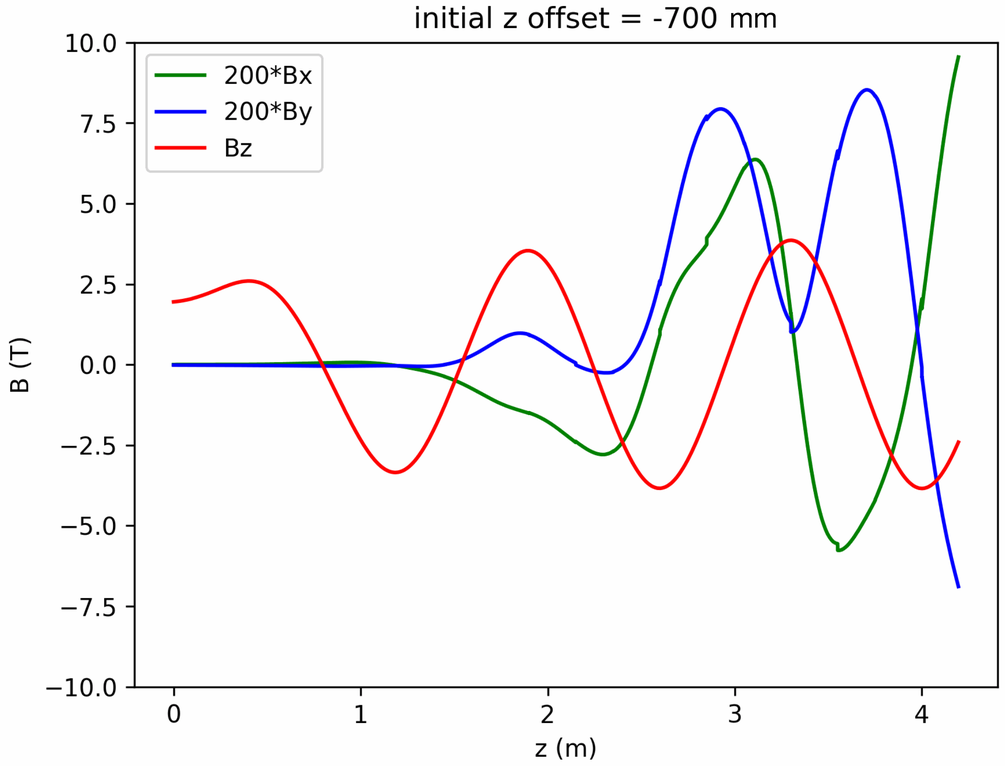


Beam initial z offset coarse scan — first period

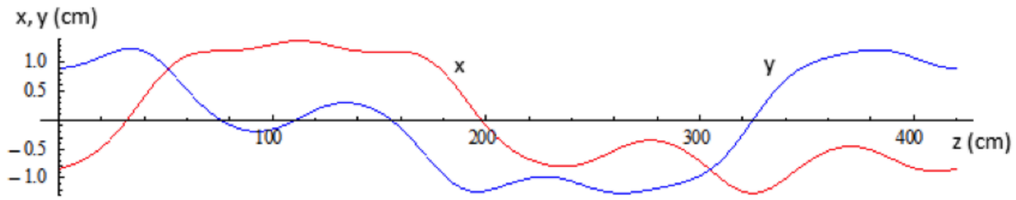


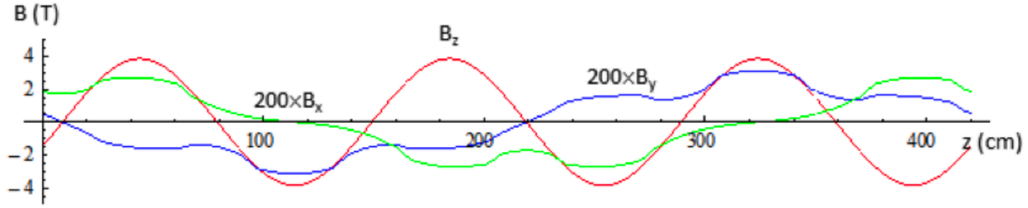


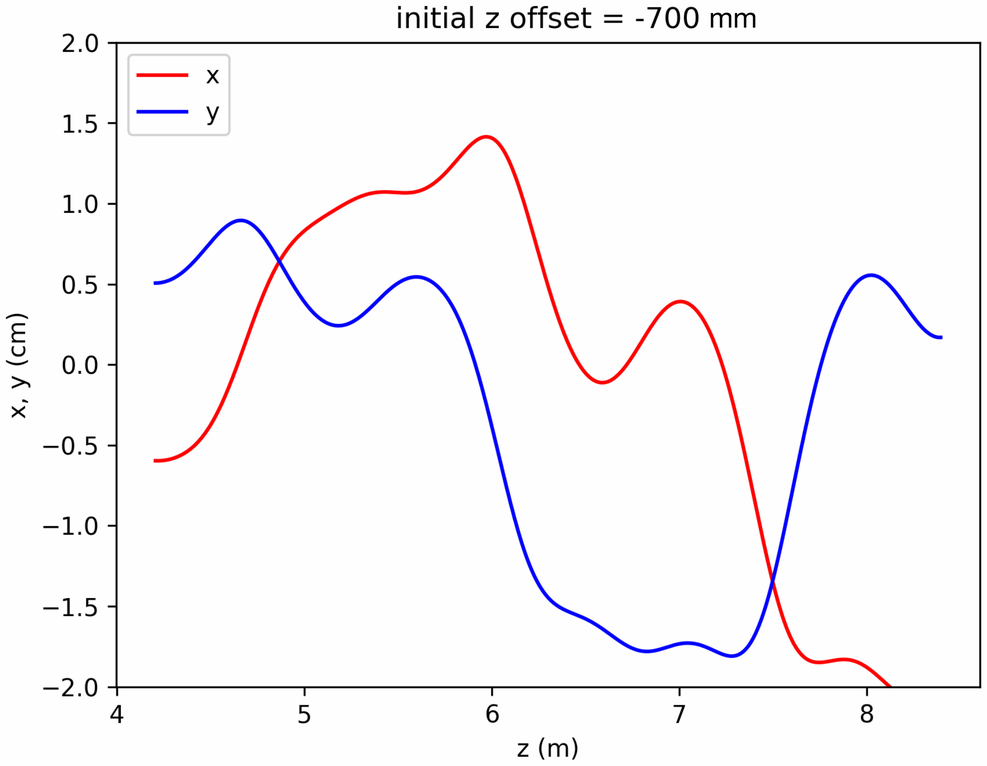


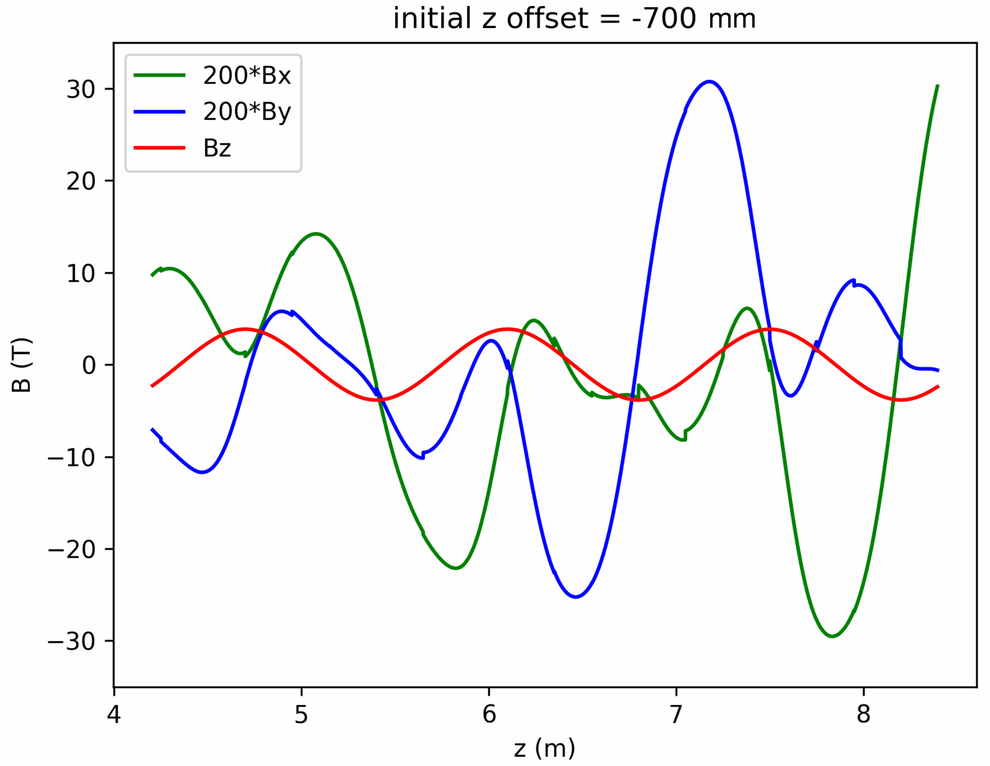


Beam initial z offset coarse scan — second period





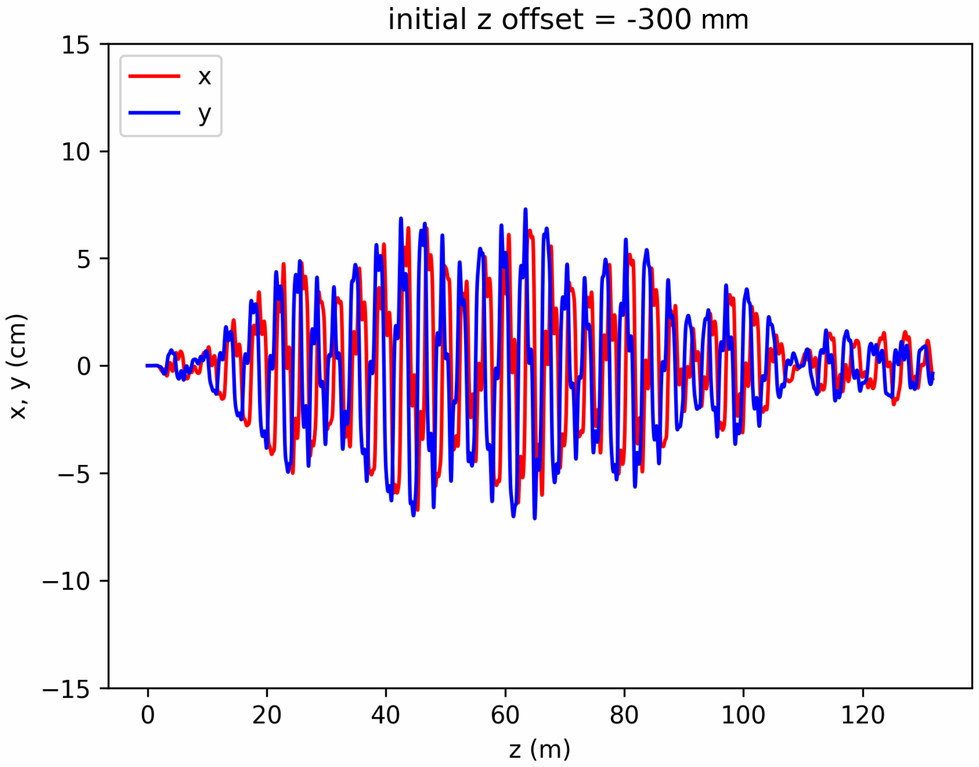


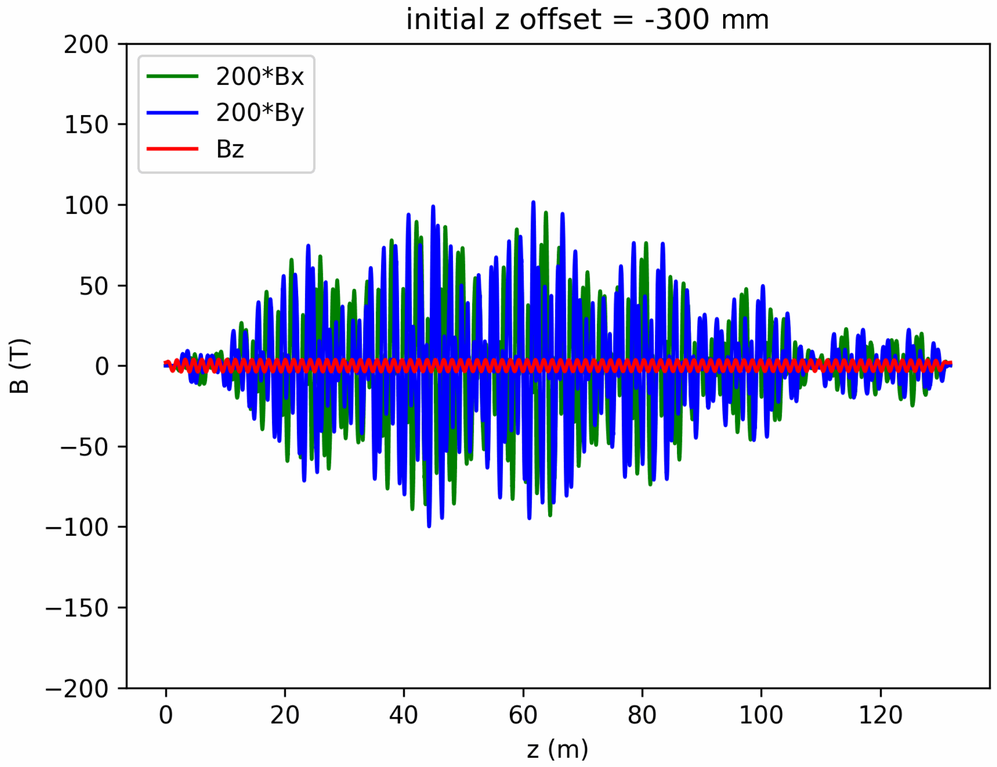


Fine scan over z offset

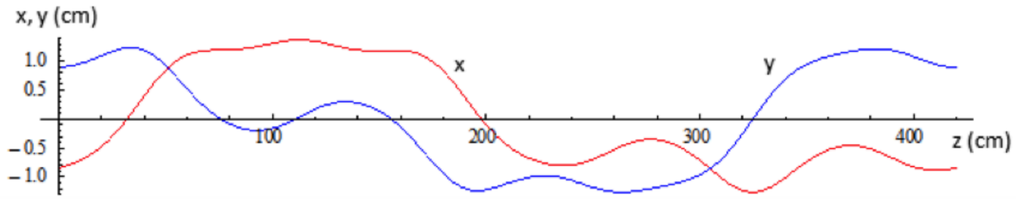
Initial beam z offset = -300mm to 0mm in steps of 10mm (with BLS fixed at 21.4)

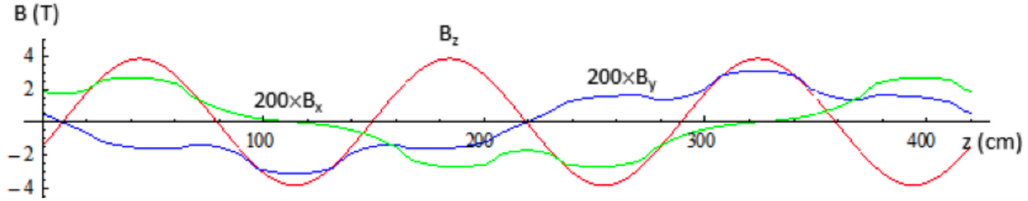
Beam initial z offset fine scan — full channel

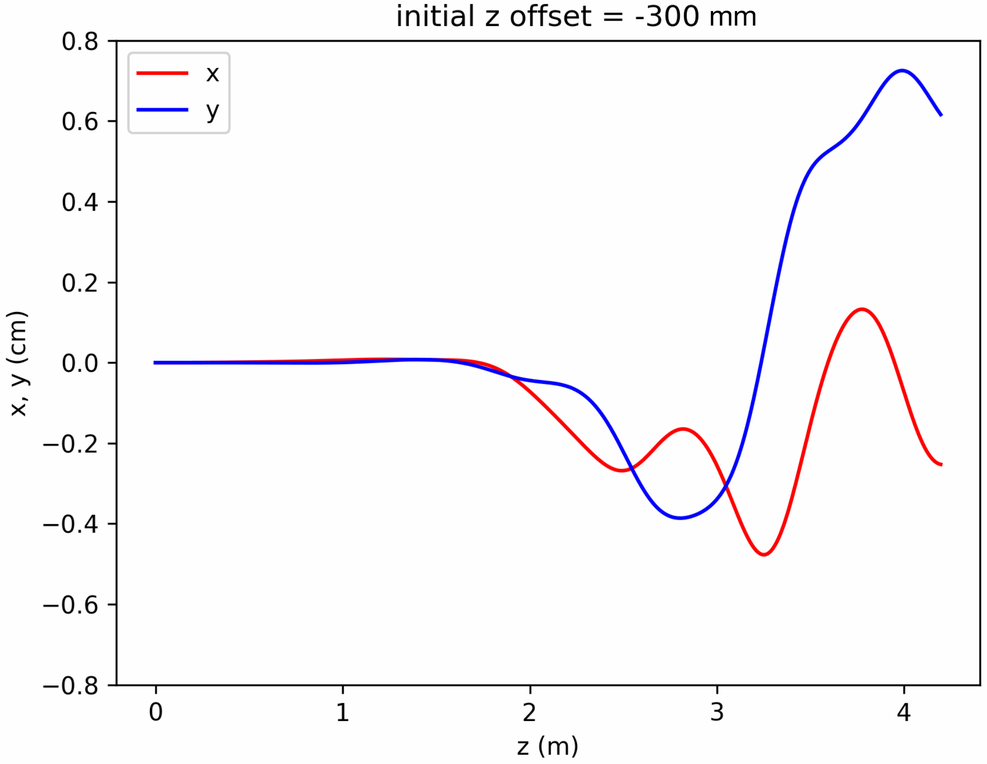


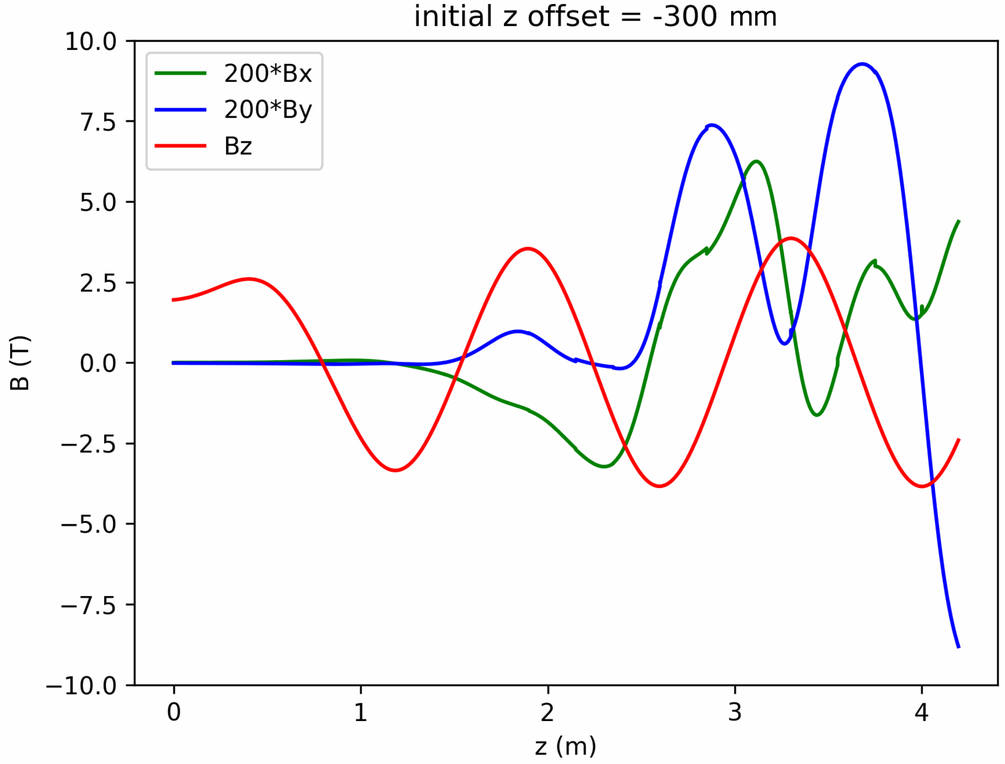


Beam initial z offset fine scan — first period

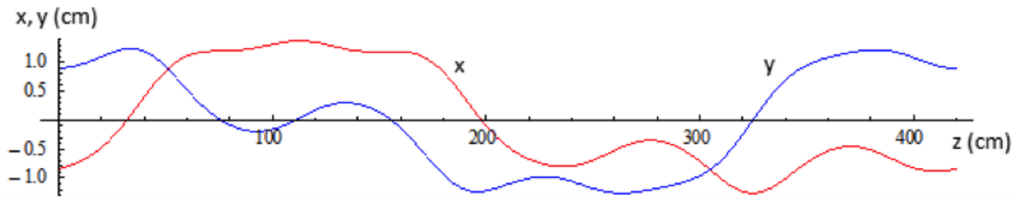


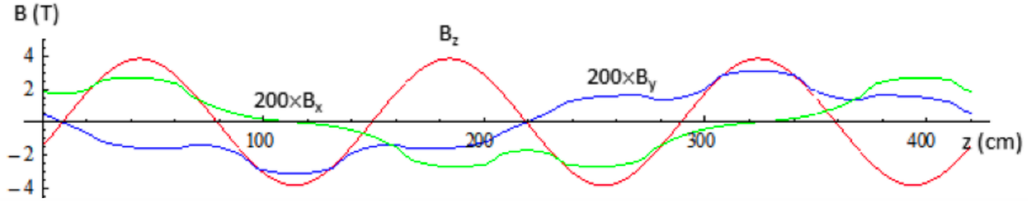


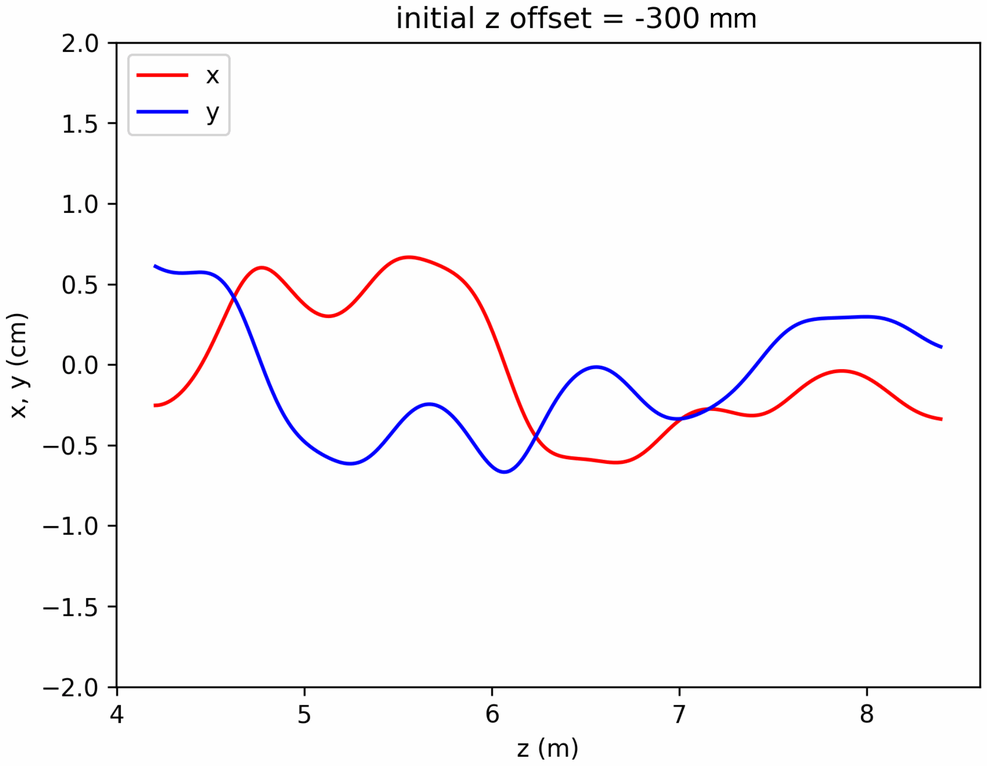


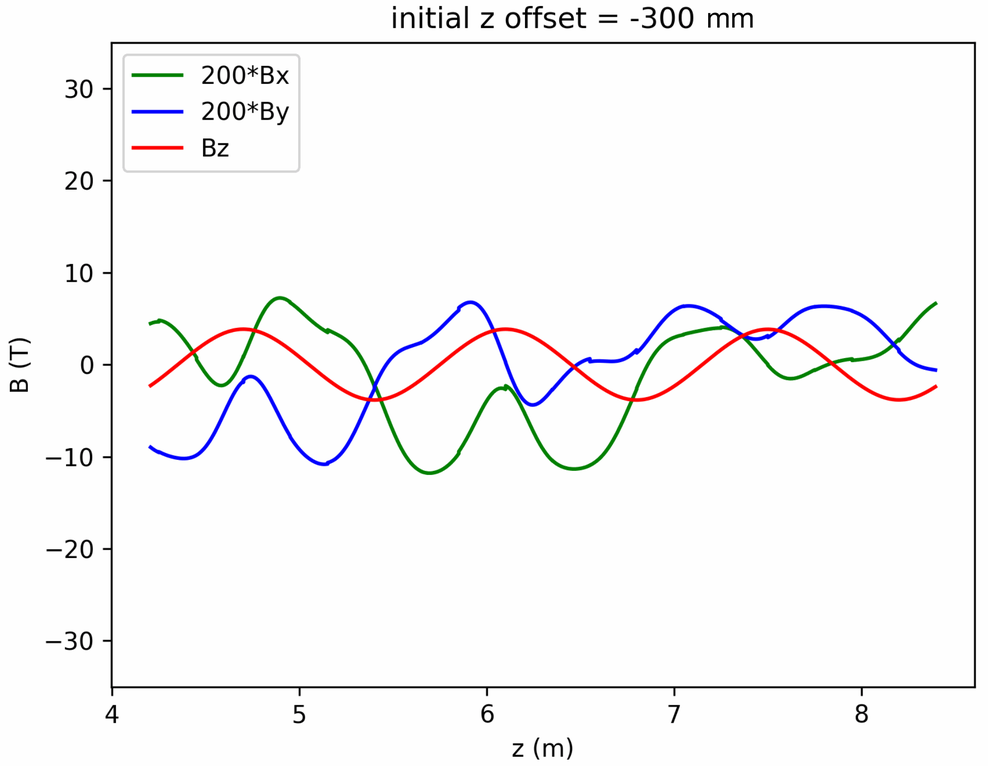


Beam initial z offset fine scan — second period









Next steps

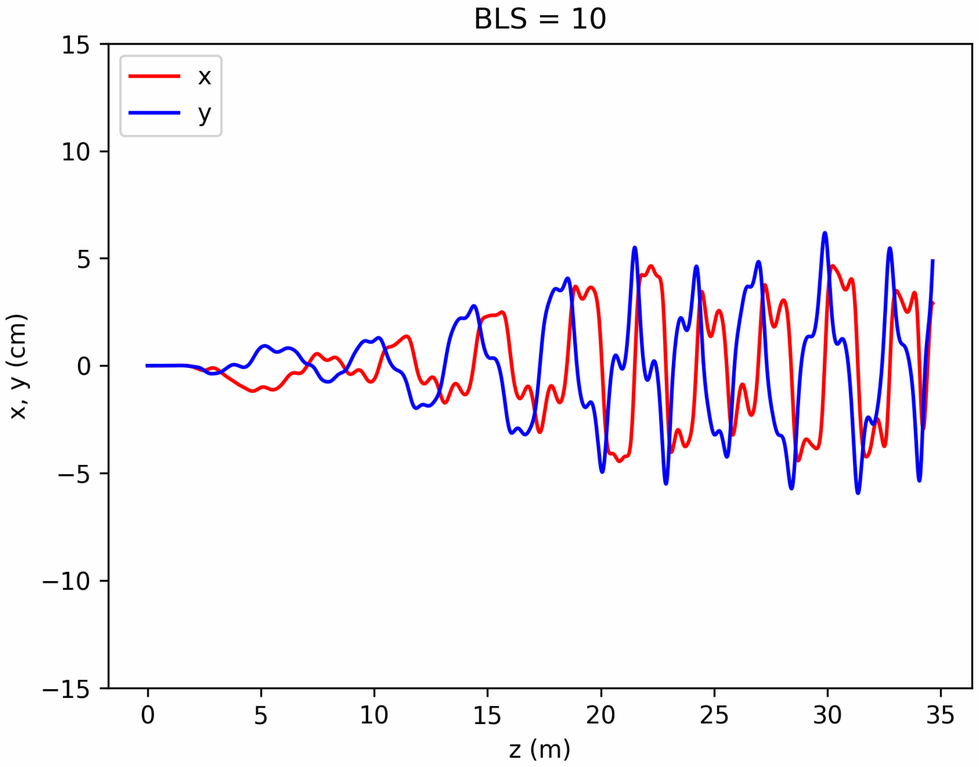
- Further simulations over z offset parameter space are required to cover limited range in several orders of magnitude finer steps
- Based on these preliminary plots, **we have yet to find a configuration that yields periodic behavior**
  - However, plotting phase space trajectory might be more insightful
- Simulating a reference neutron would allow us to better visualize the magnetic field components

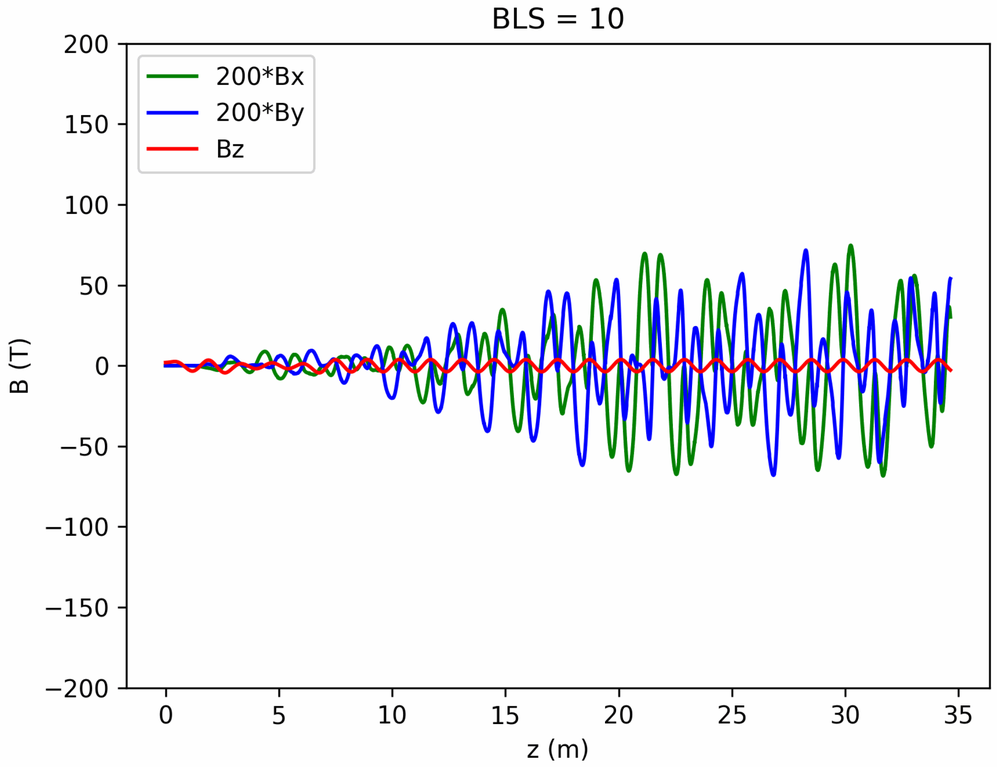
Supplementary

Coarse scan over BLS values

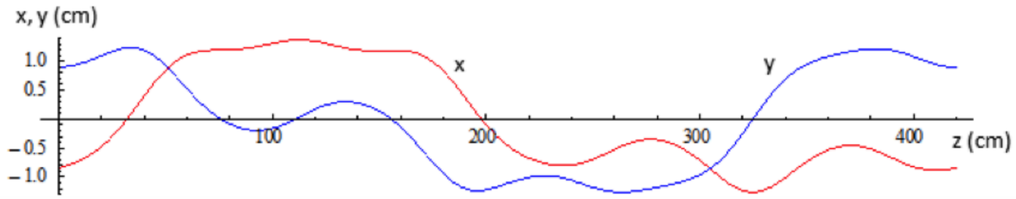
BLS = 10 to 30 in steps of 1

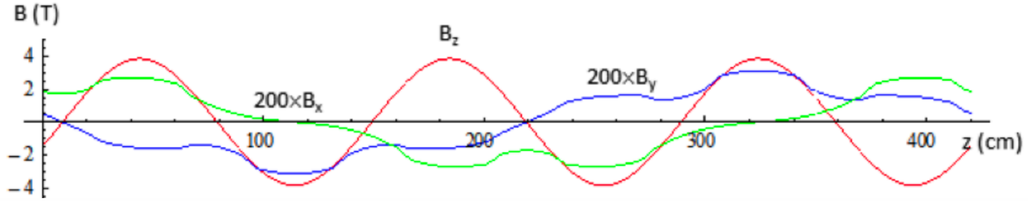
BLS coarse scan — full channel

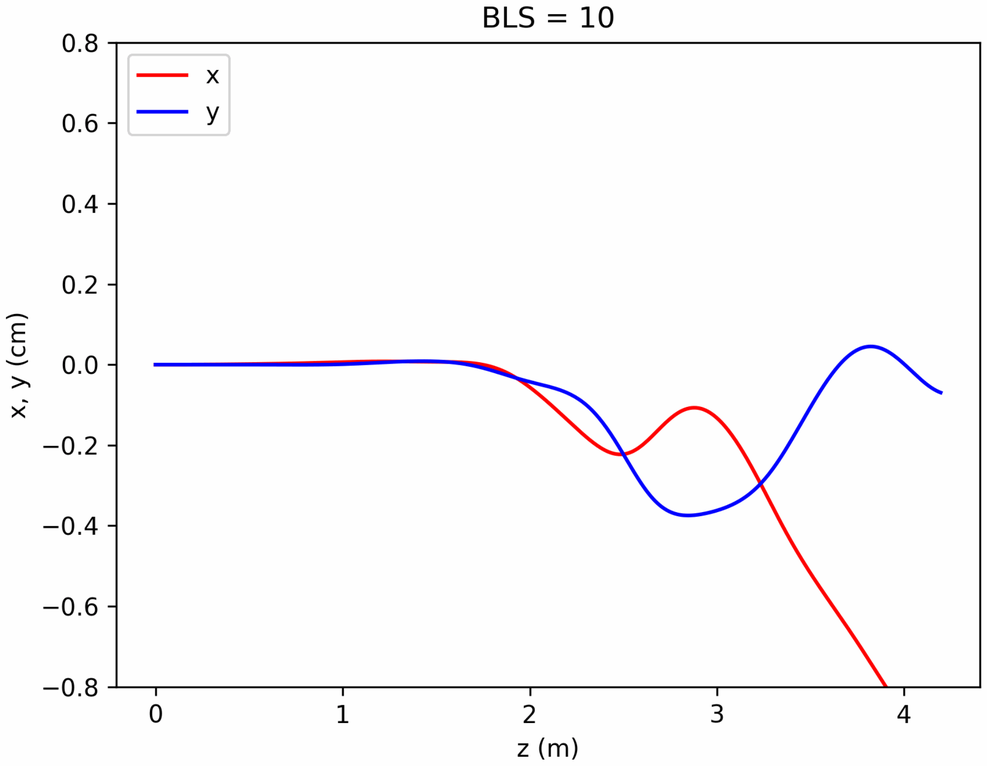


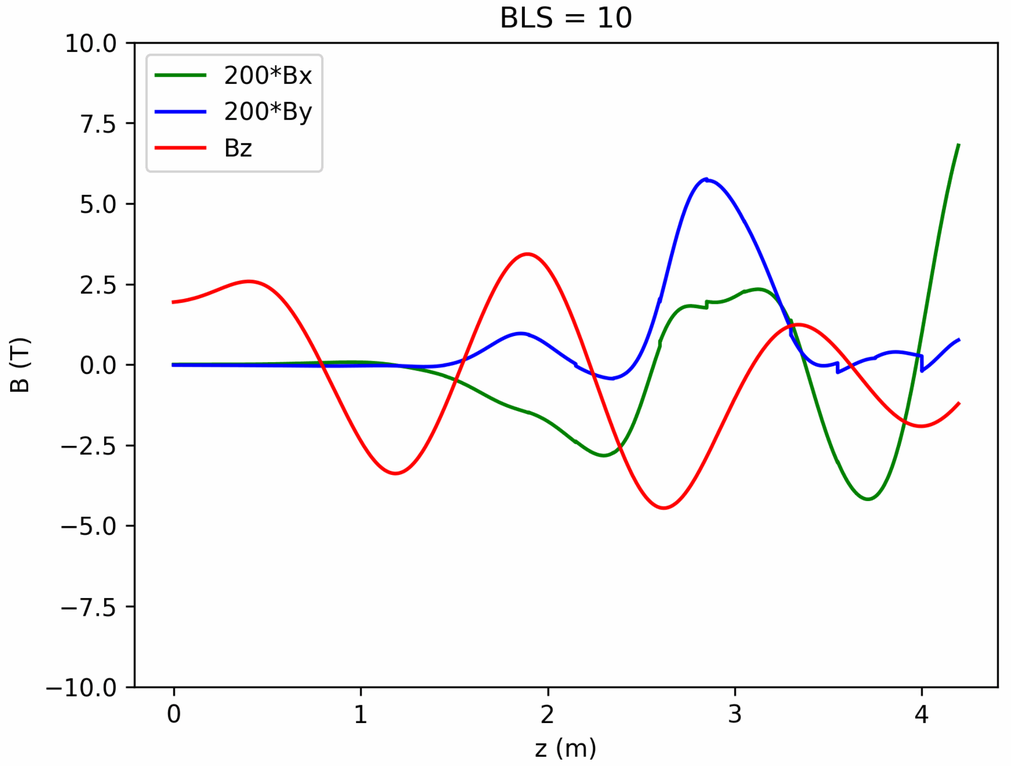


BLS coarse scan — first period

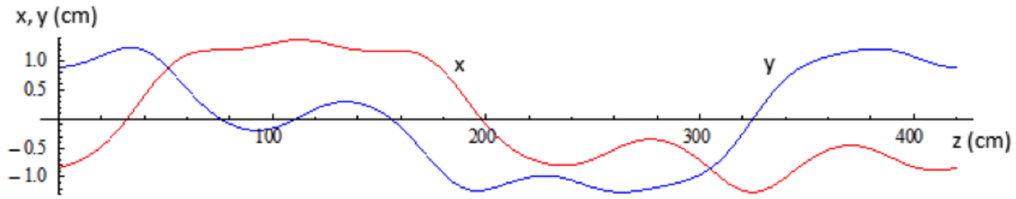


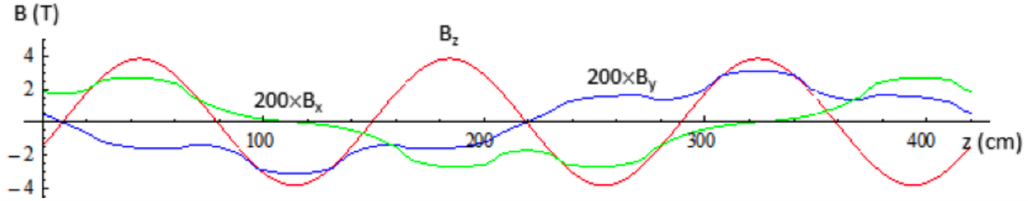


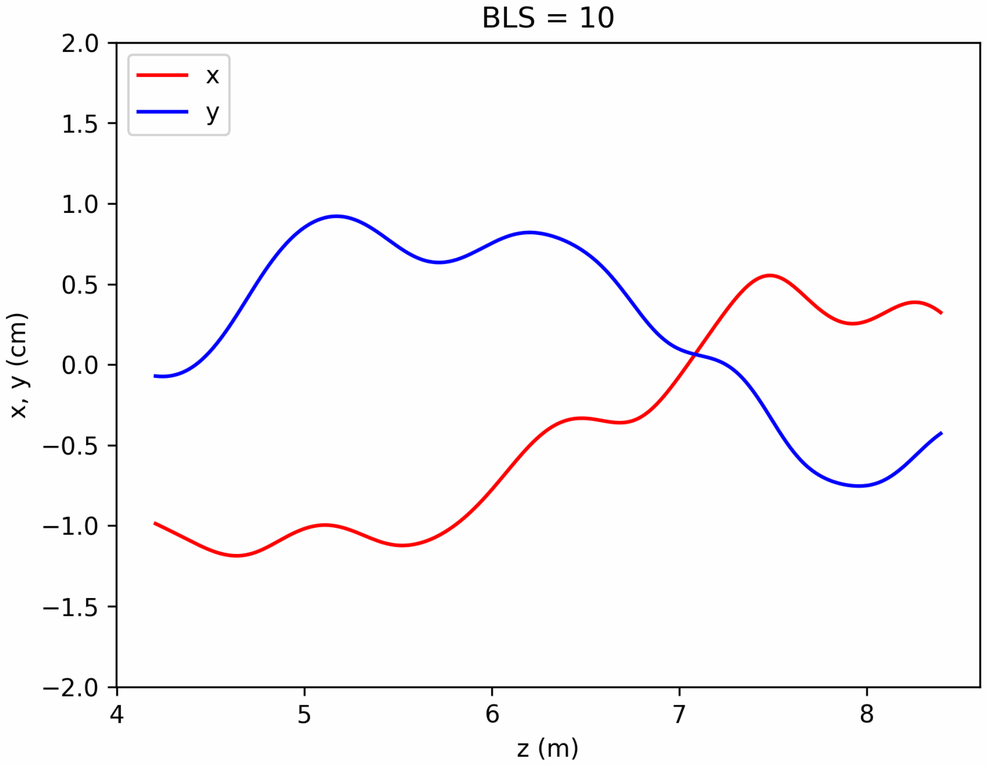


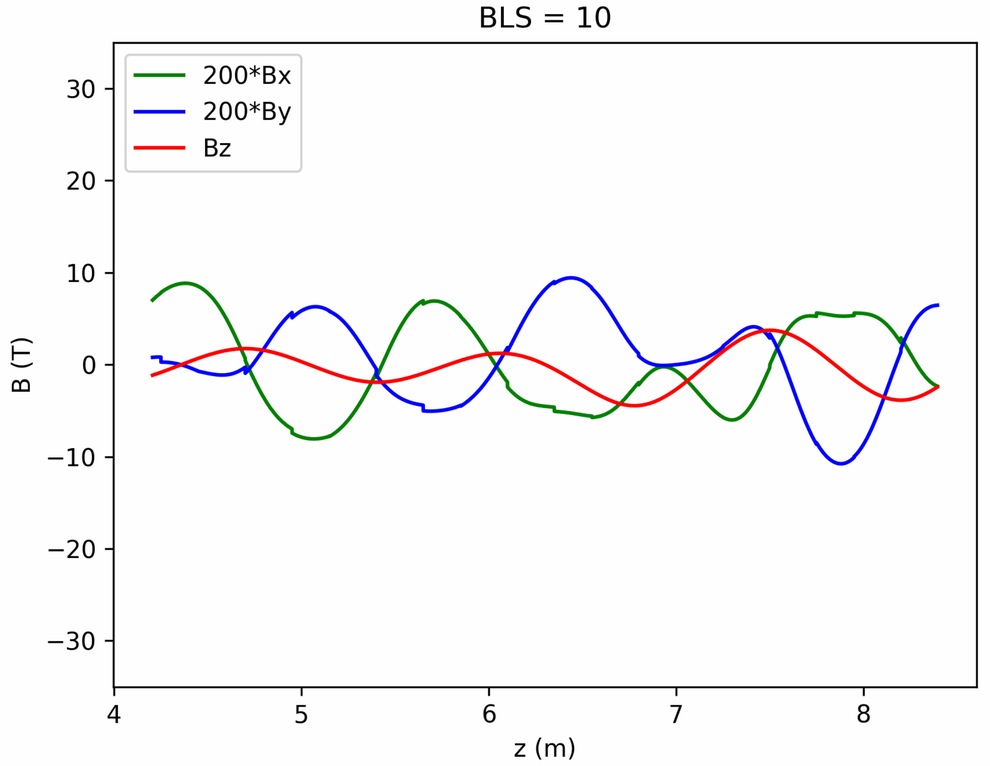


BLS coarse scan — second period





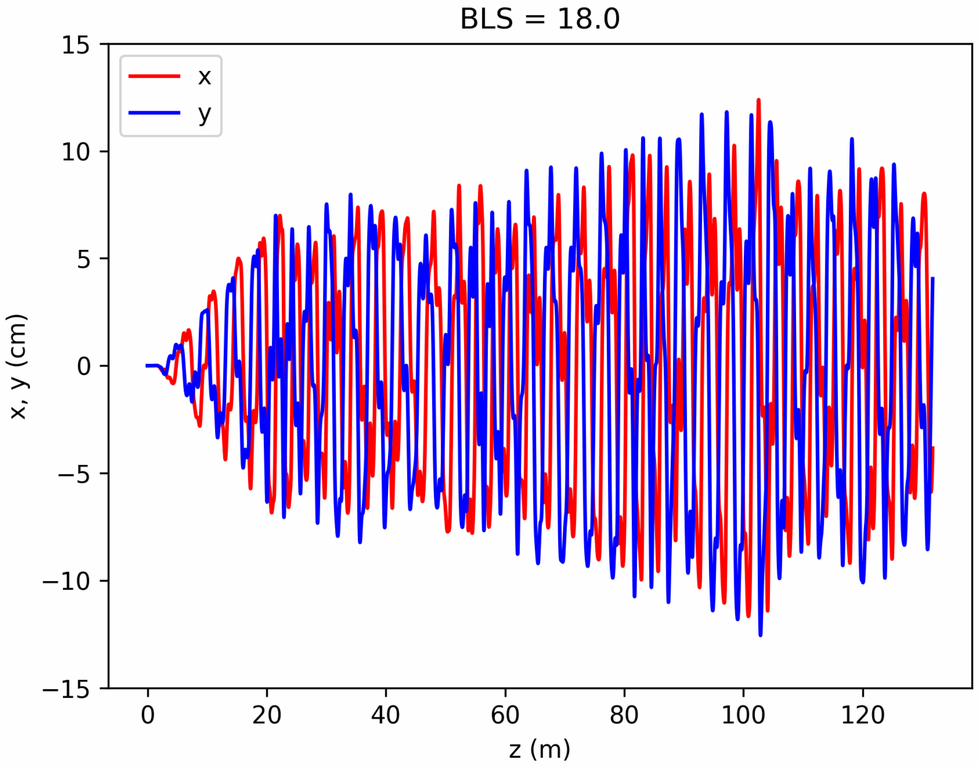


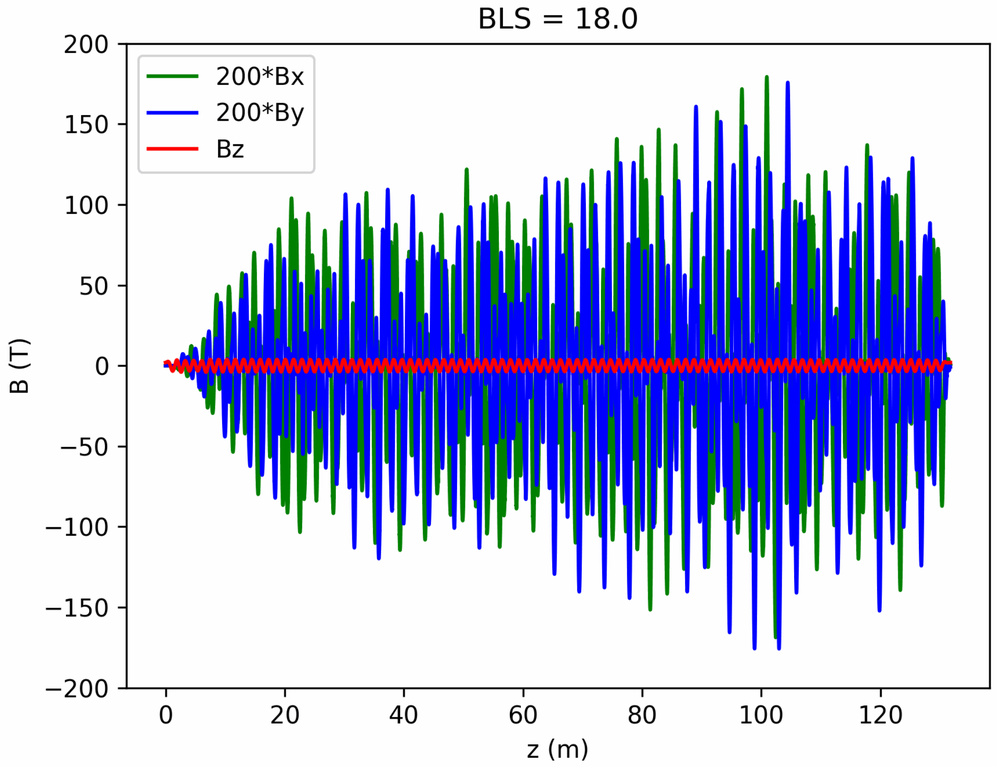


Fine scan over BLS values

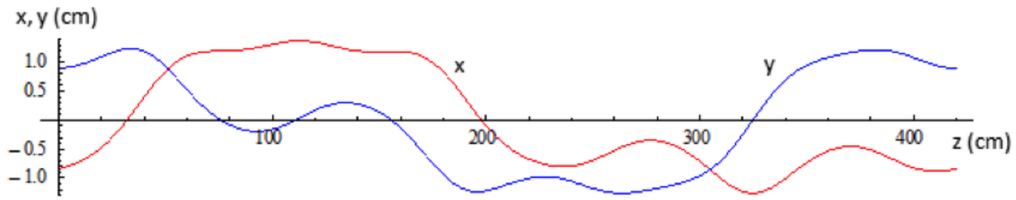
BLS = 18 to 20 in steps of 0.1

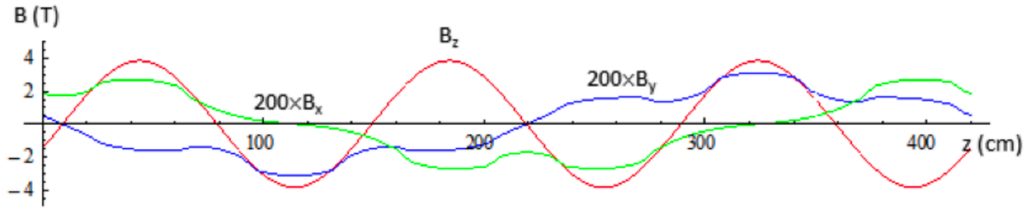
BLS fine scan — full channel

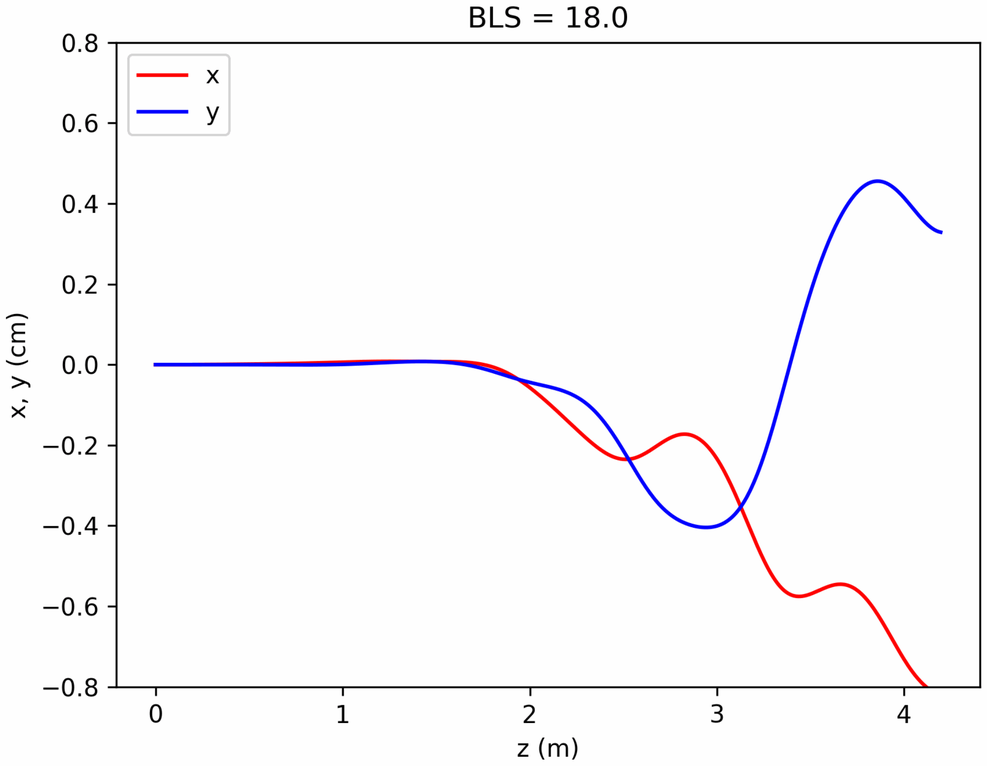


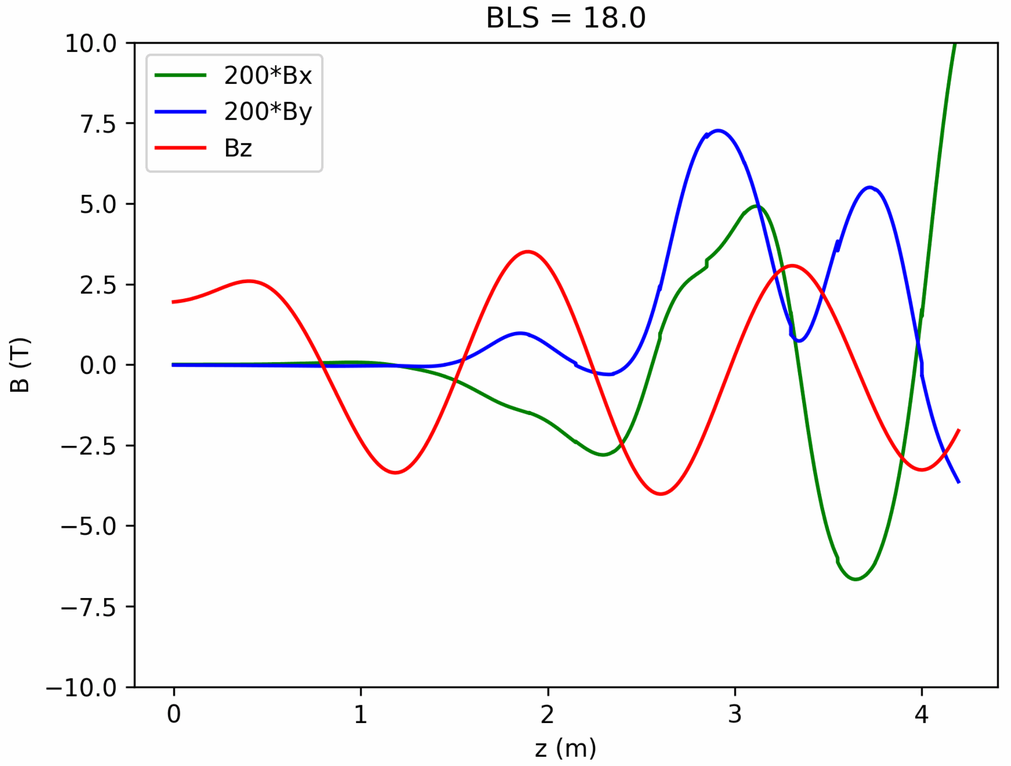


BLS fine scan — first period









BLS fine scan — second period