Muon Cooling Project Updates

April 11, 2025

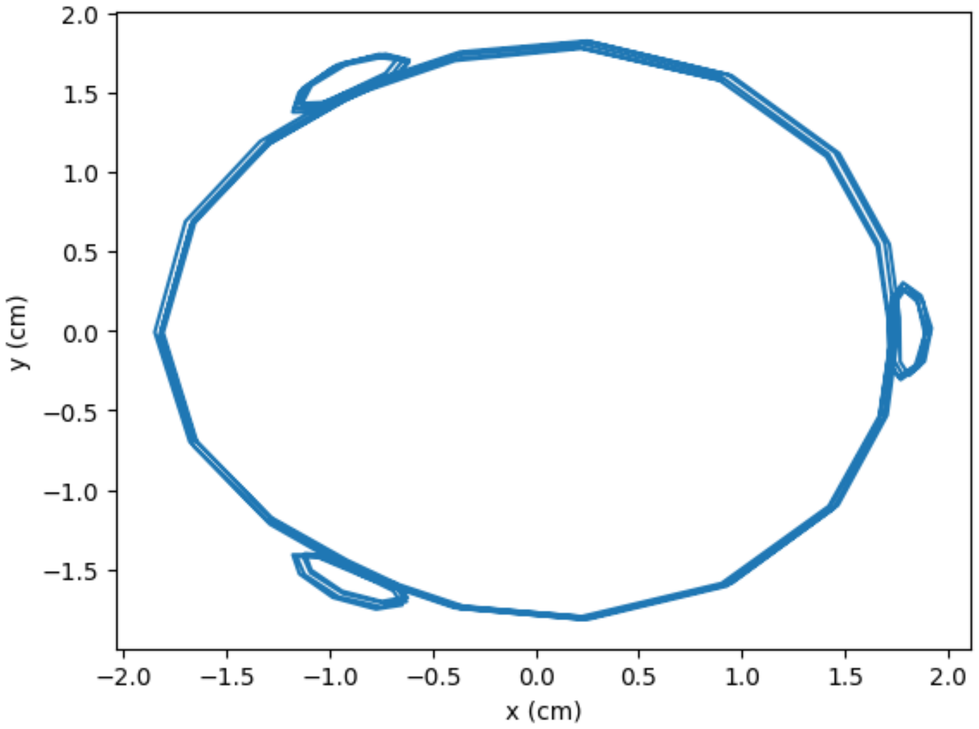
https://github.com/criggall/muon-cooling

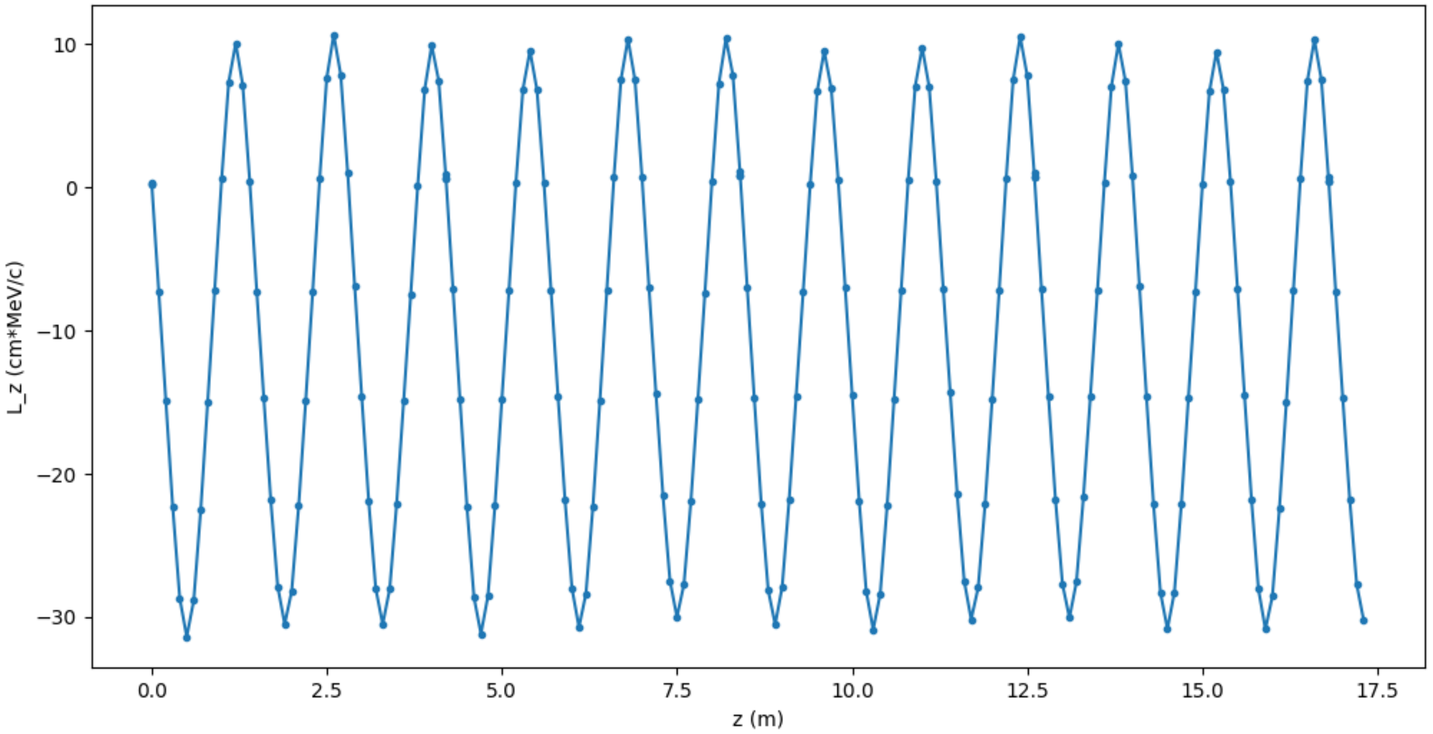
Progress from this week

- Found matching reference particle momentum for original solenoid current value
- Then instead fixed reference momentum to be 200 MeV/c and scanned to find matching solenoid current value
- Investigated effect of setting solenoid tilt to zero
  - With intentions of finding a simplified Hamiltonian for the system
  - …But the results were rather unexpected
- Started simulating offset particle to characterize the lattice

Improved reference orbit

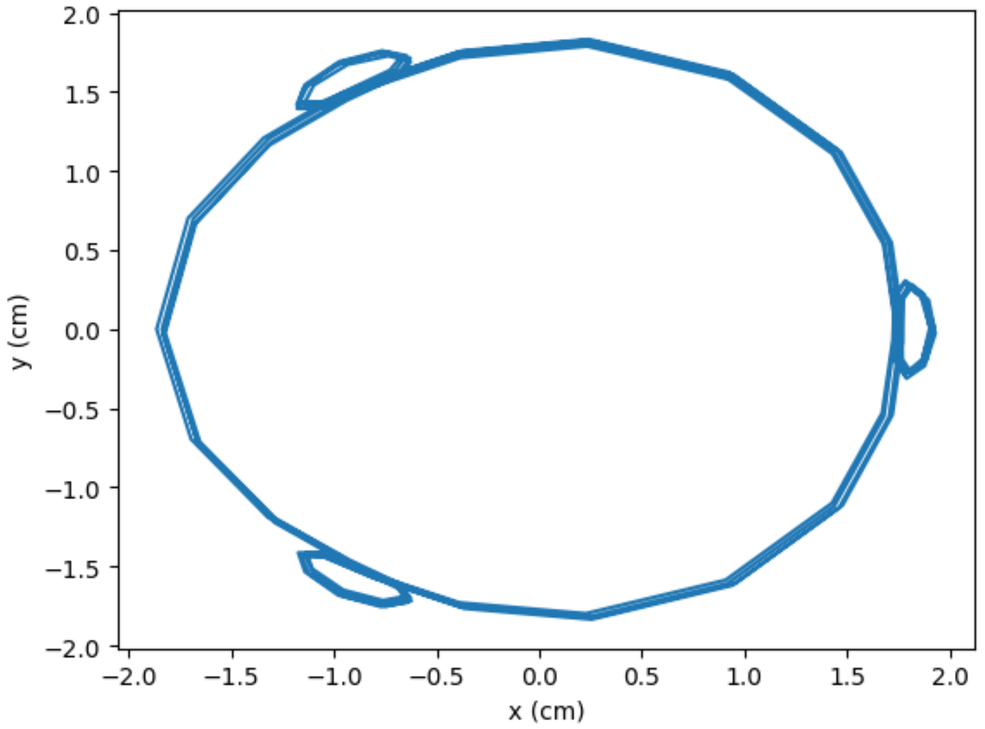
- 227.5 MeV/c

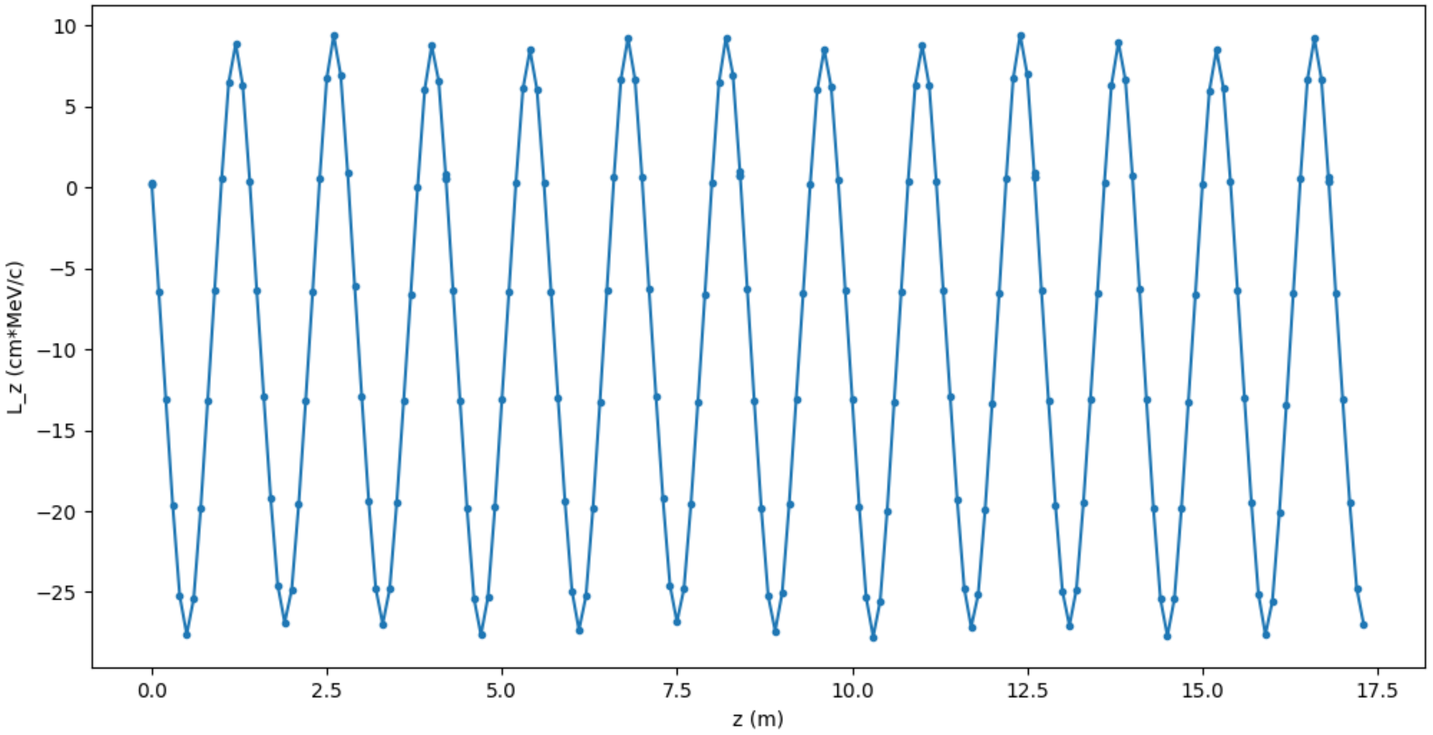




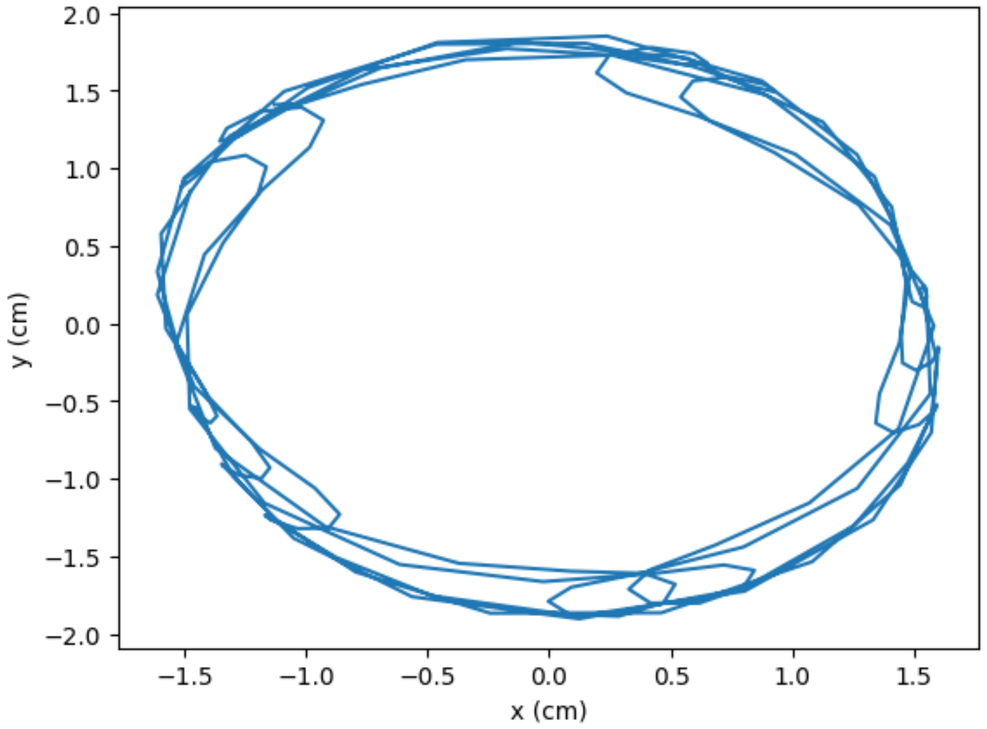
200 MeV/c reference particle

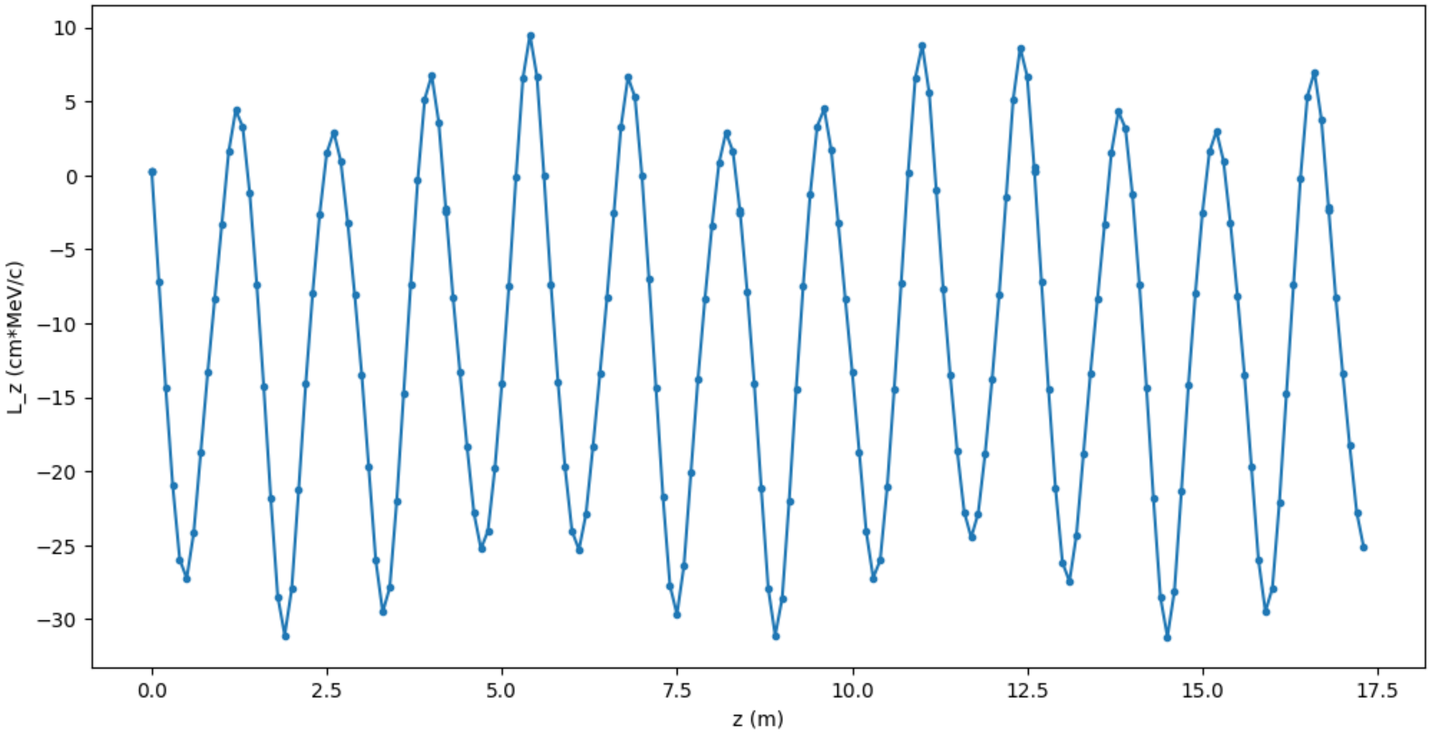
- Found best agreement with solenoid current set to -80.46 amps





Setting solenoid tilt to zero





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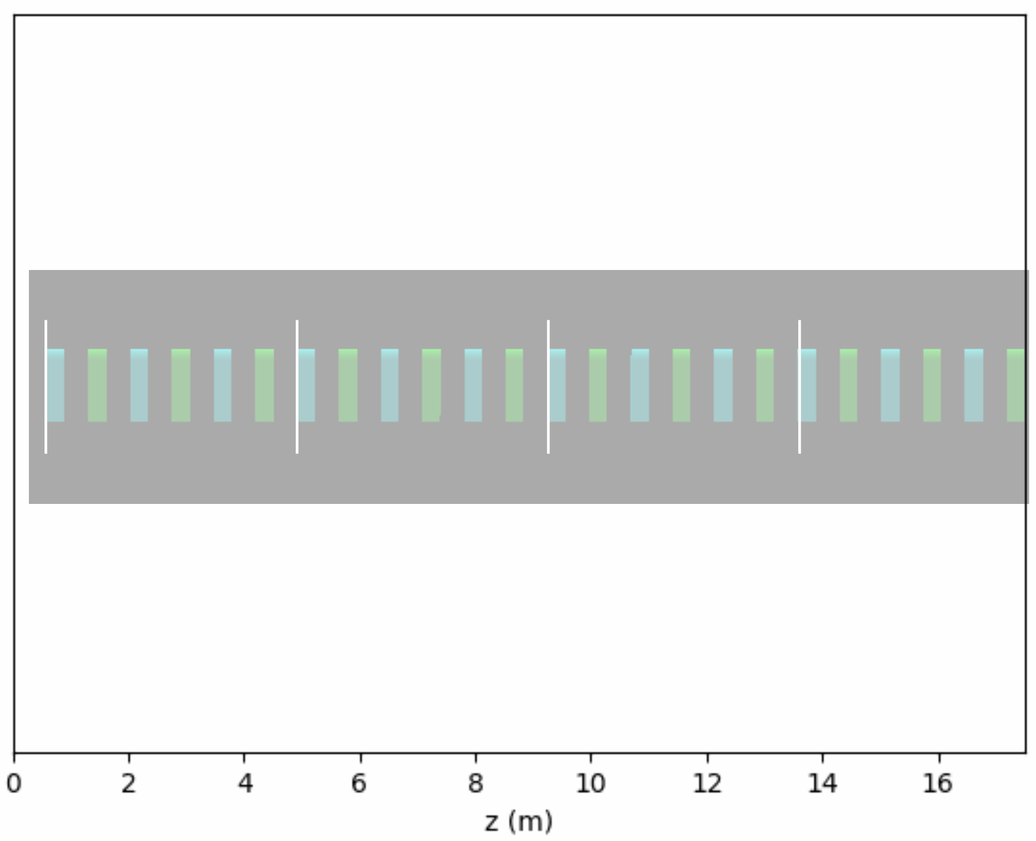
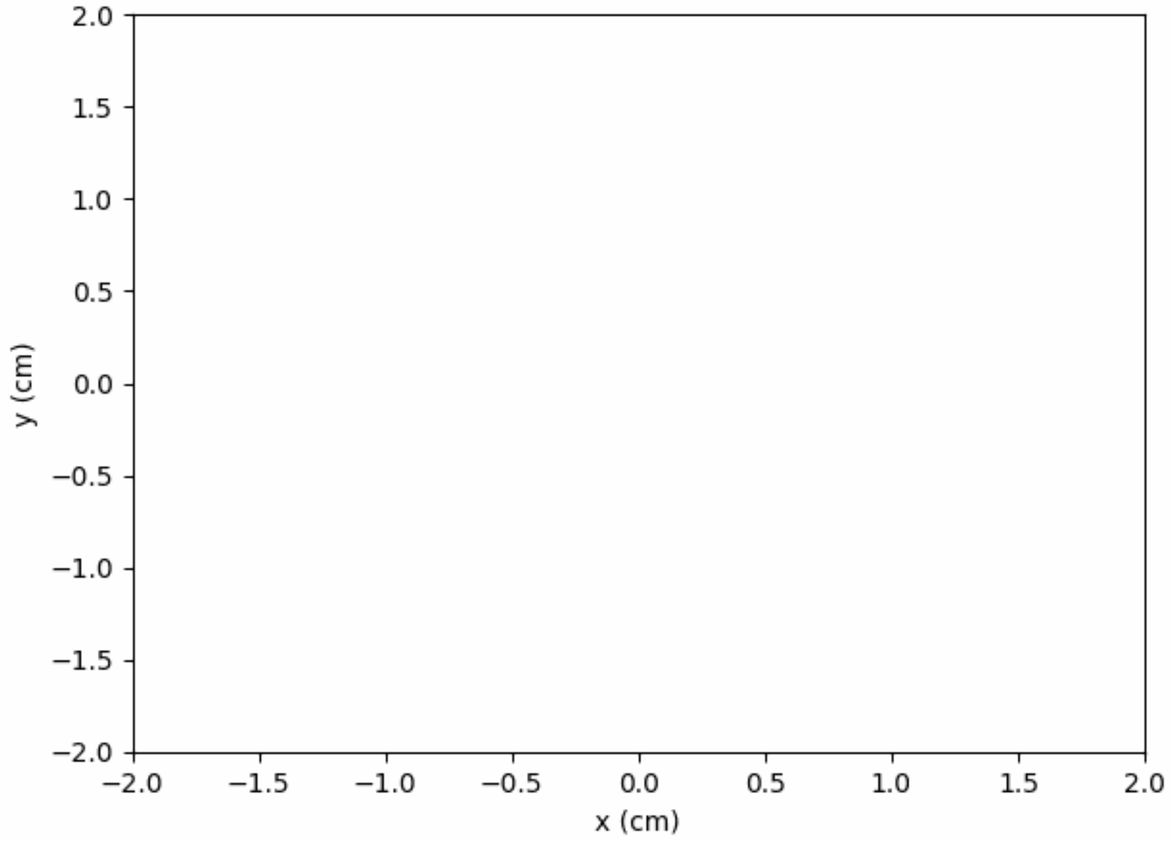
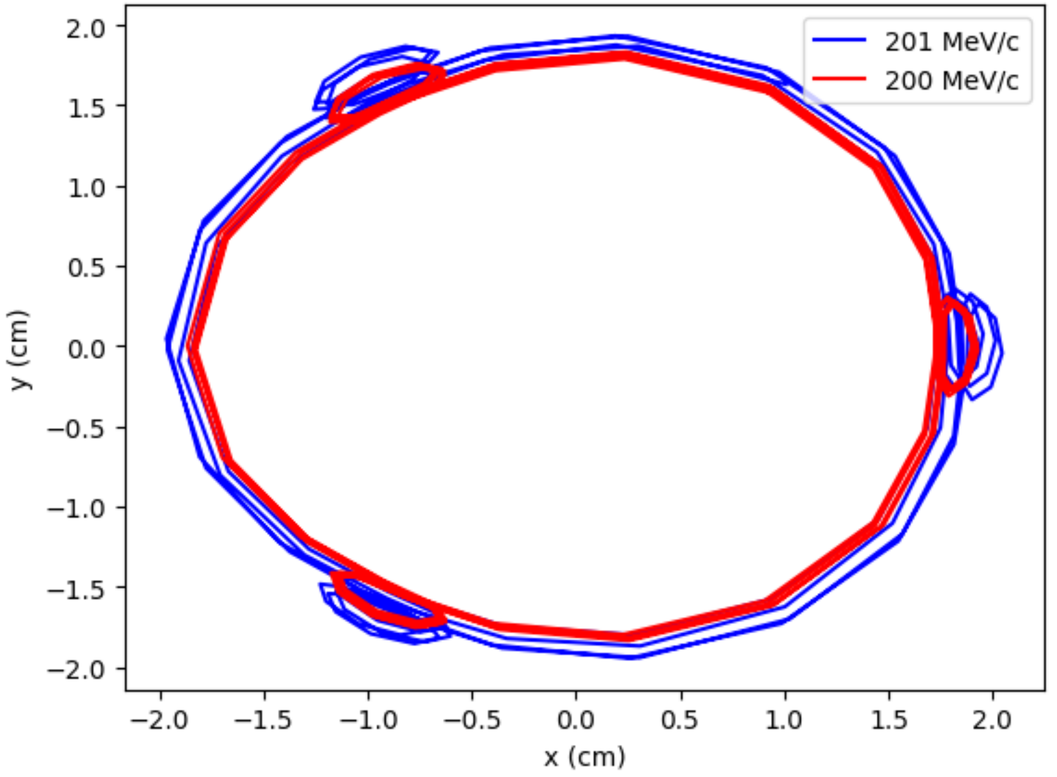


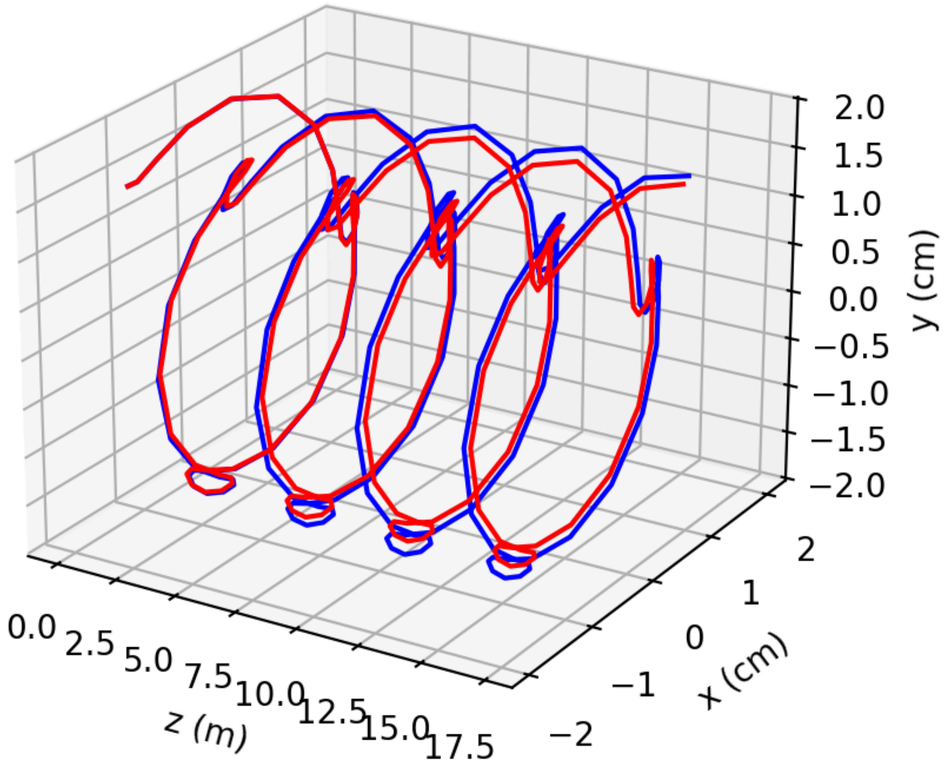


Next steps: investigating the lattice

1. Send reference particle with slight offset from the nominal one
    - Separately run offset x, y, z, px, py, and pz
2. Find phase space coordinates for each offset particle along the channel
3. Compute covariance matrix from phase space distributions
4. Translate to measurements of dispersion and beta function

Momentum offset





Momentum offset