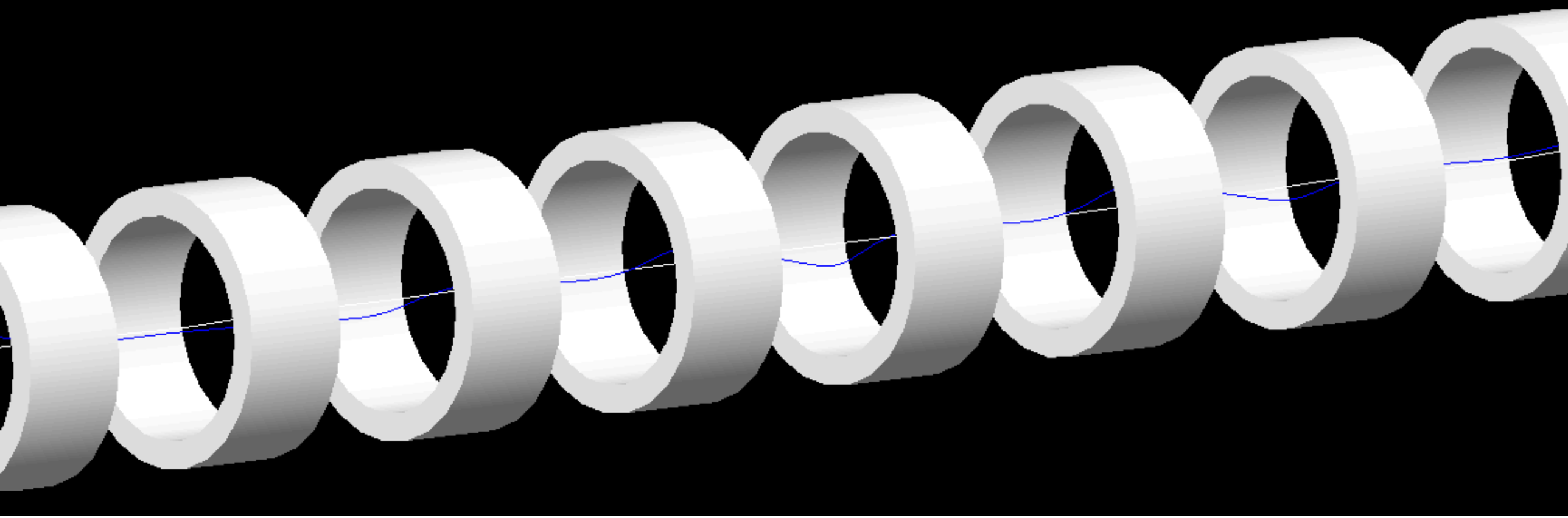
Muon Cooling Project Updates

May 30, 2025



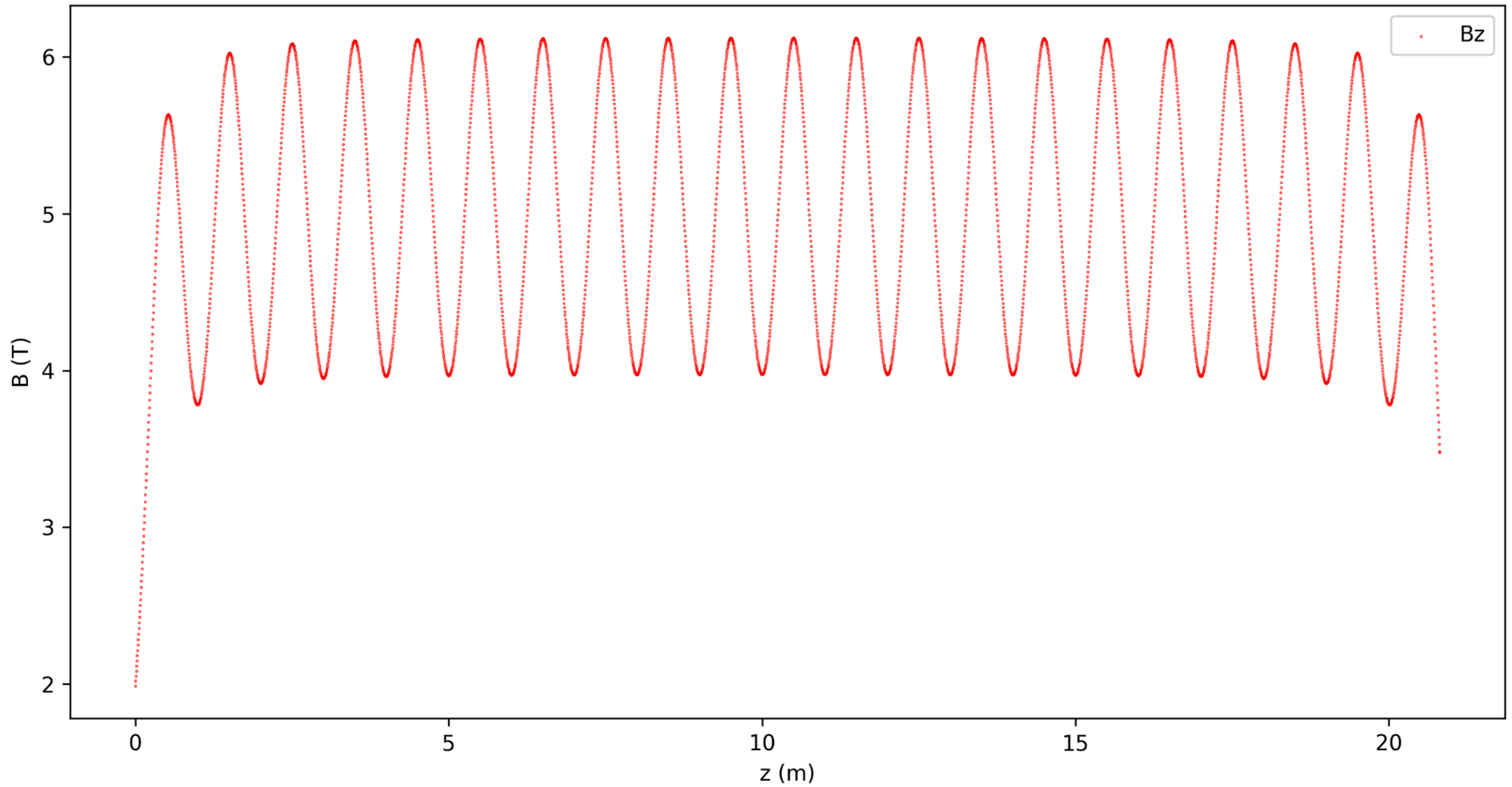
Solenoid Lattice Study

https://github.com/criggall/solenoid-study/tree/main

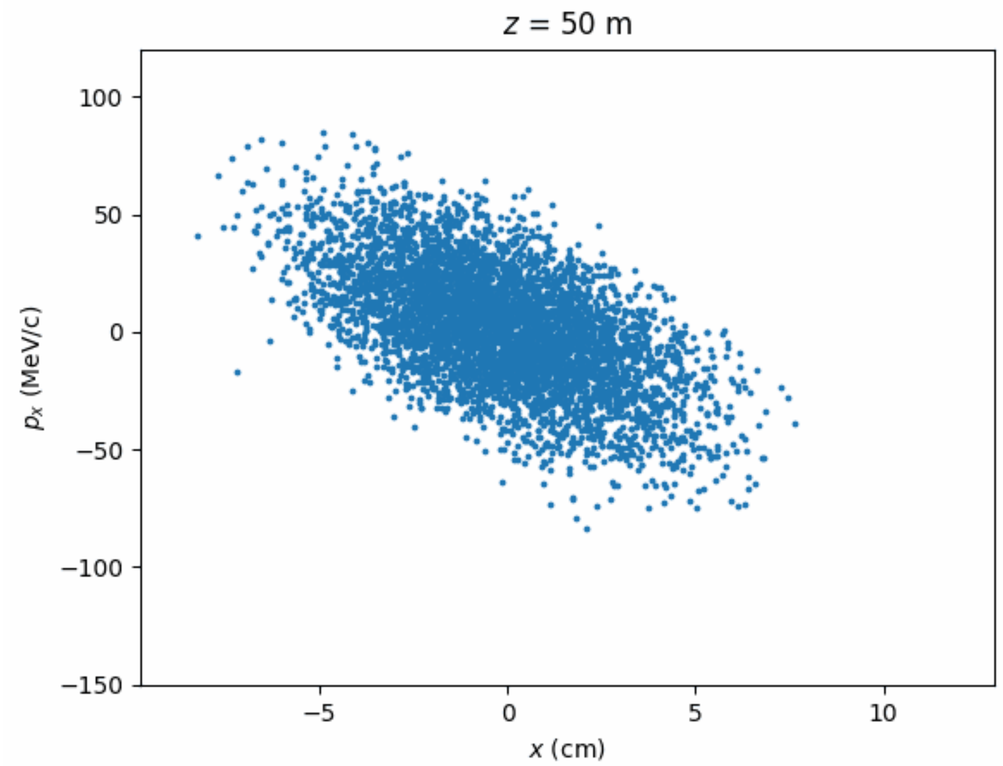
Without flipped polarity

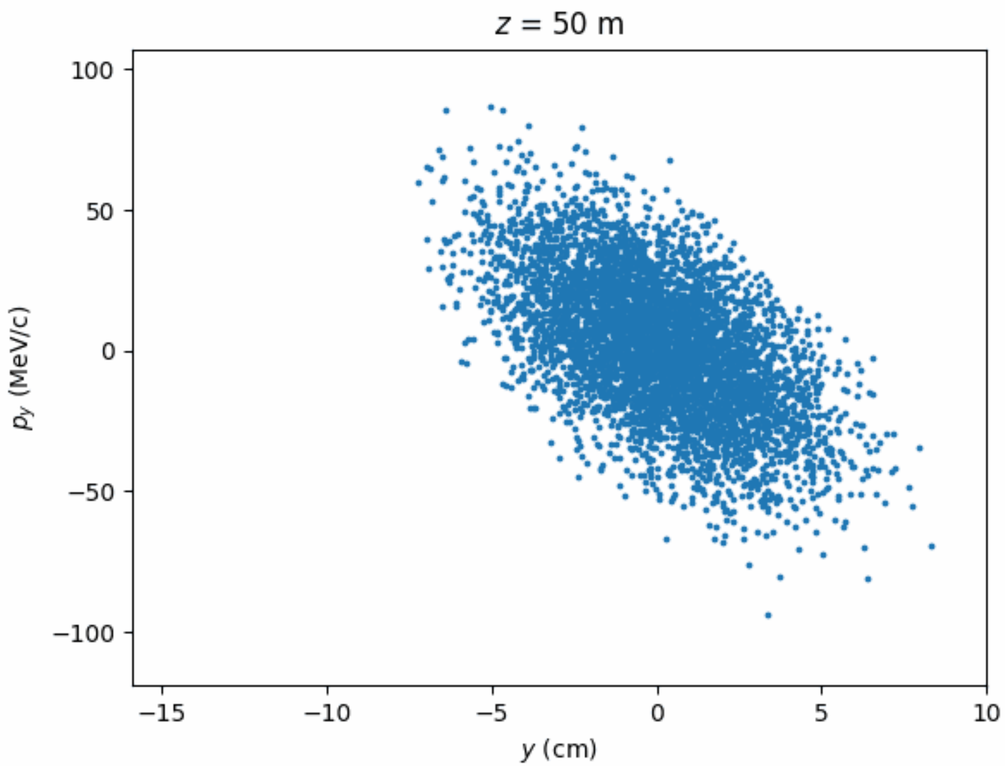
Magnetic Field

Transverse components are zero as expected



Phase Space Evolution

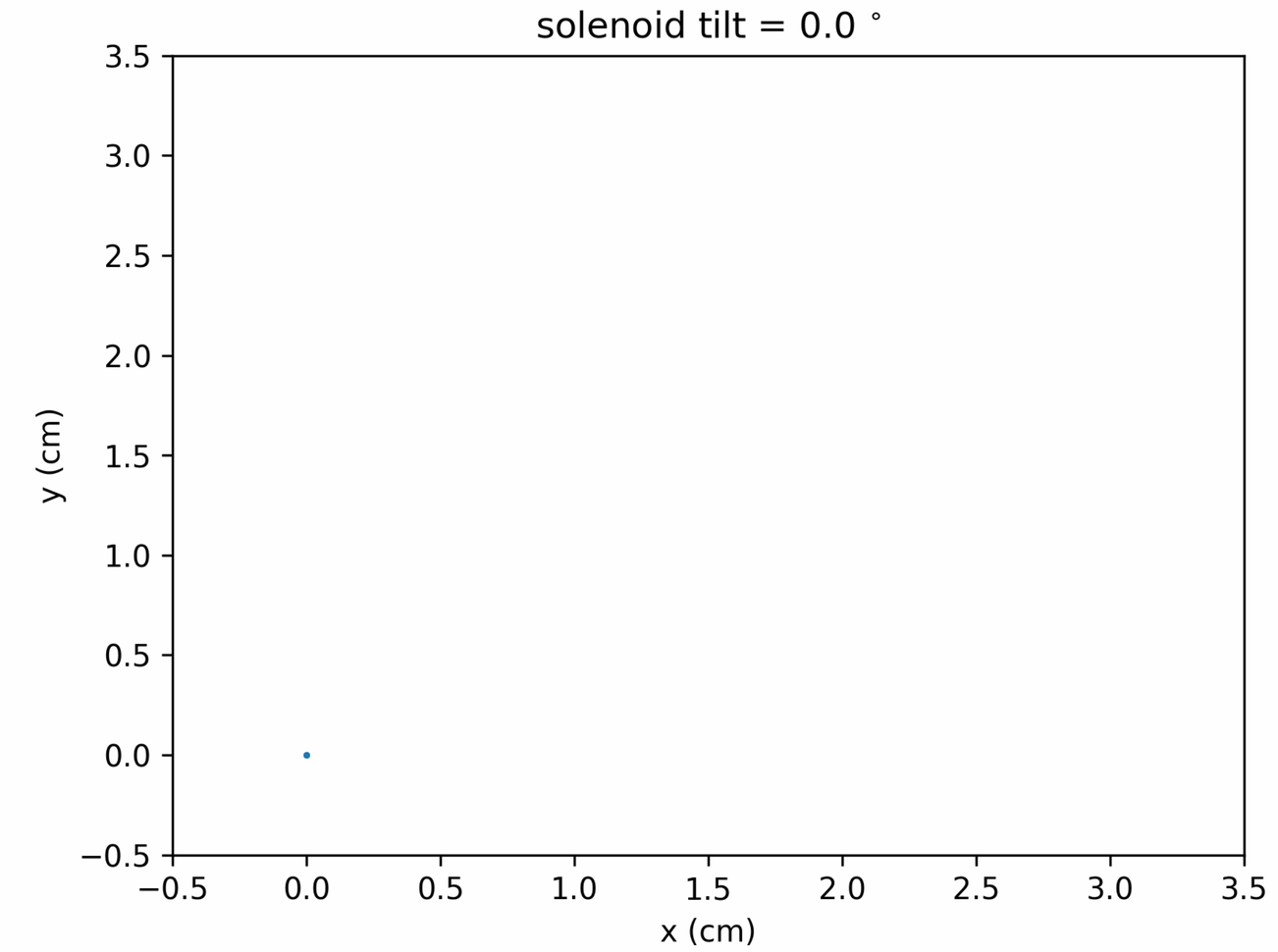




(Animation)

Adjusting Solenoid Tilt

Scan over x rotation from 0 to -2.5 mrad

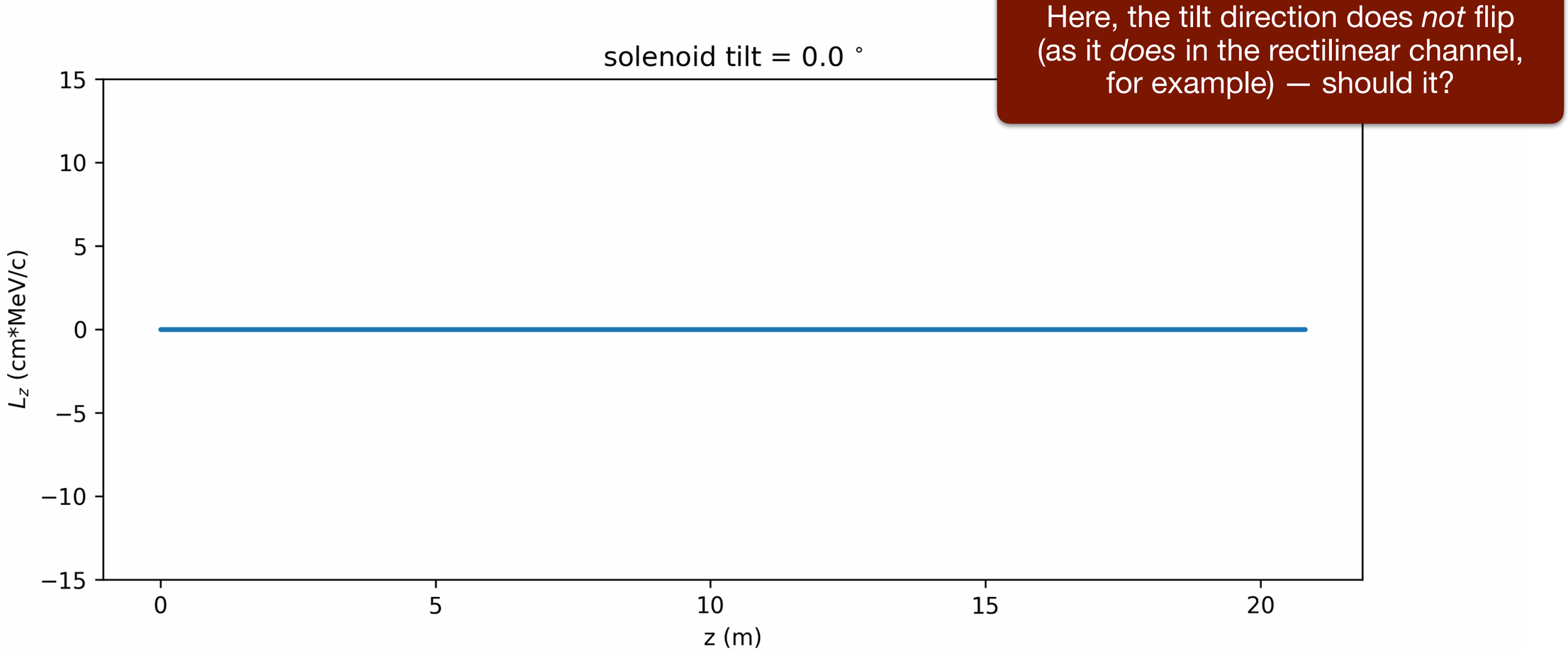


(Animation)

Adjusting Solenoid Tilt

Scan over x rotation from 0 to -2.5 mrad

Here, the tilt direction does *not* flip (as it *does* in the rectilinear channel, for example) — should it?

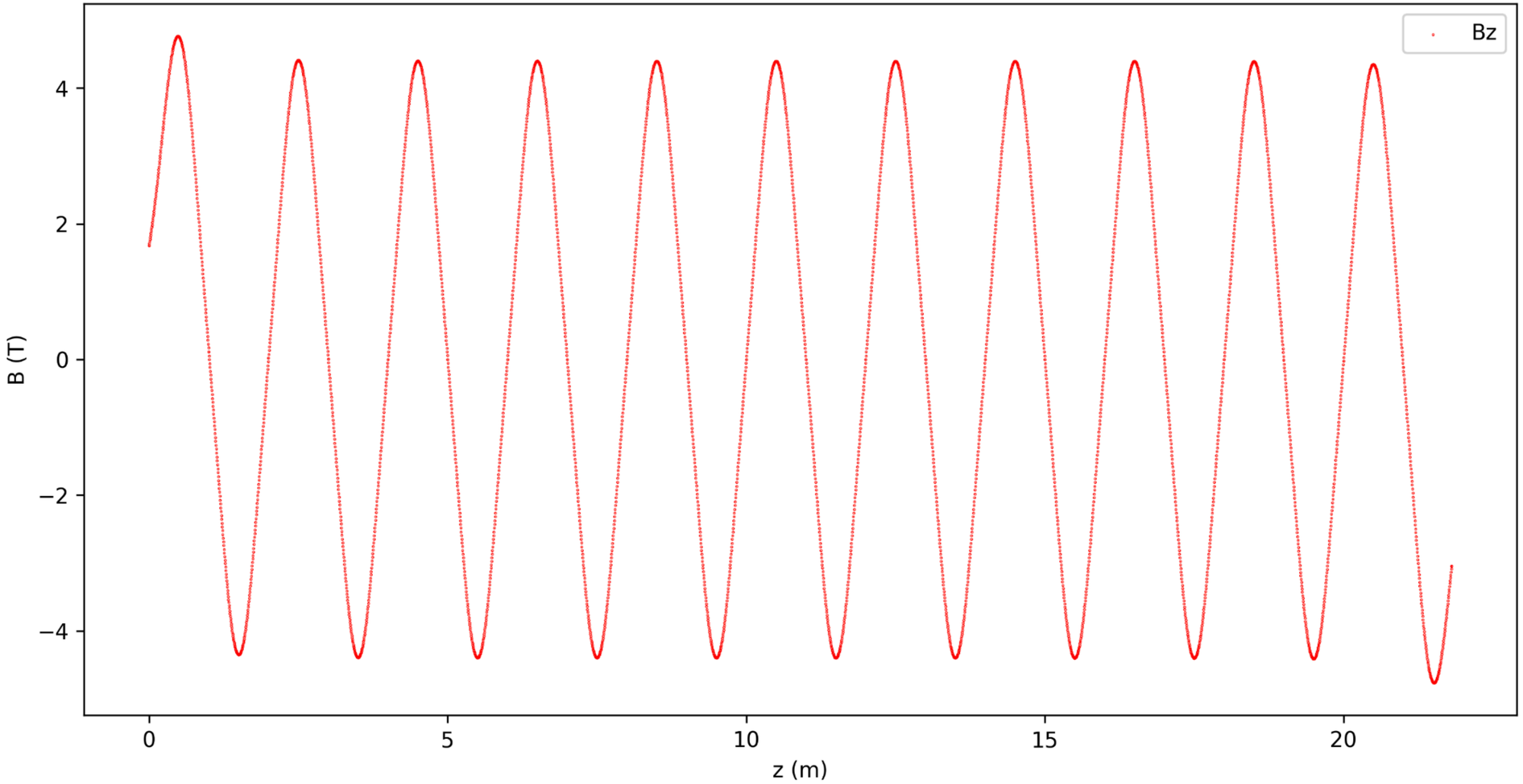


(Animation)

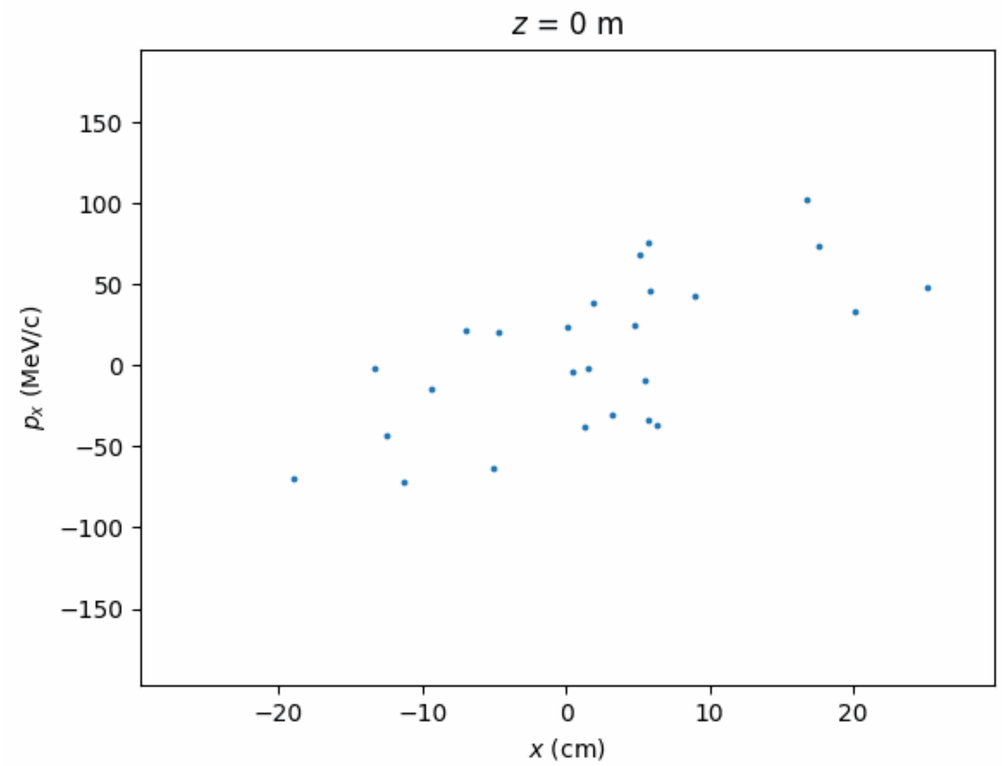
With flipped polarity

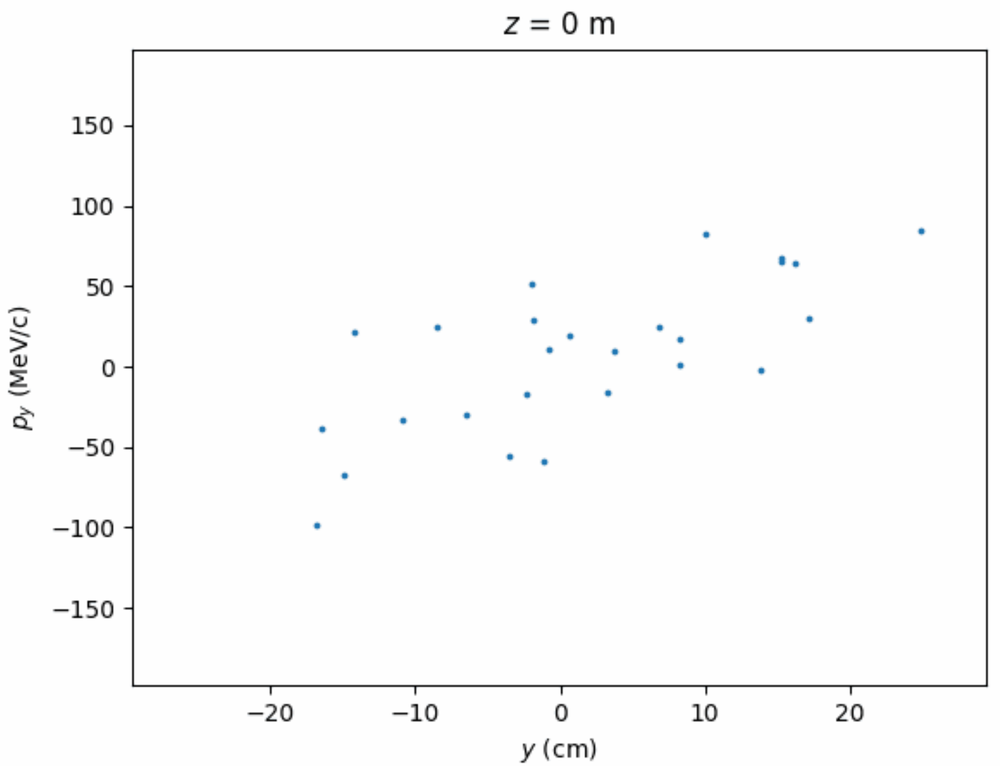
Magnetic Field

Transverse components are zero as expected



Phase Space Evolution





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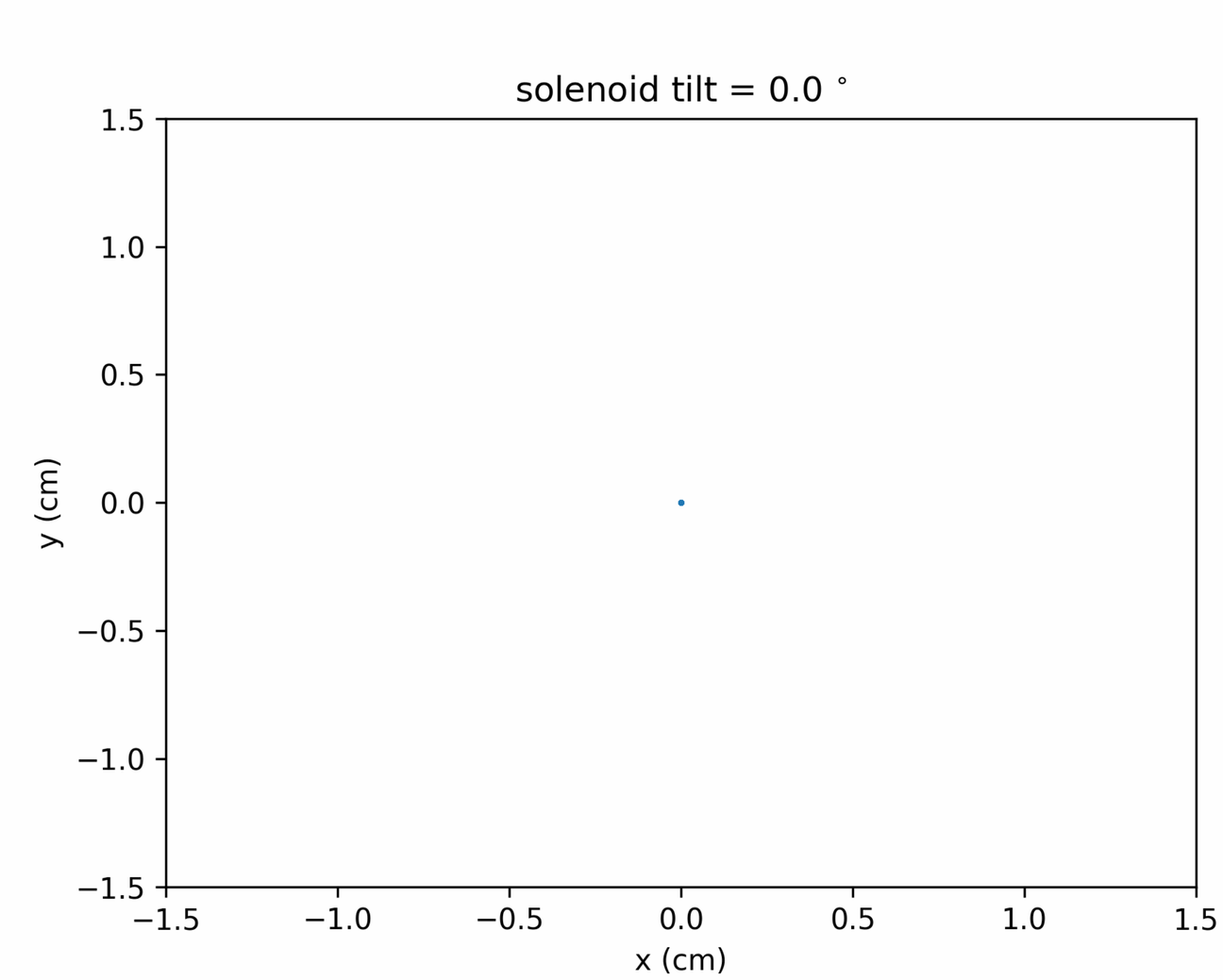

(Animation)

Adjusting Solenoid Tilt

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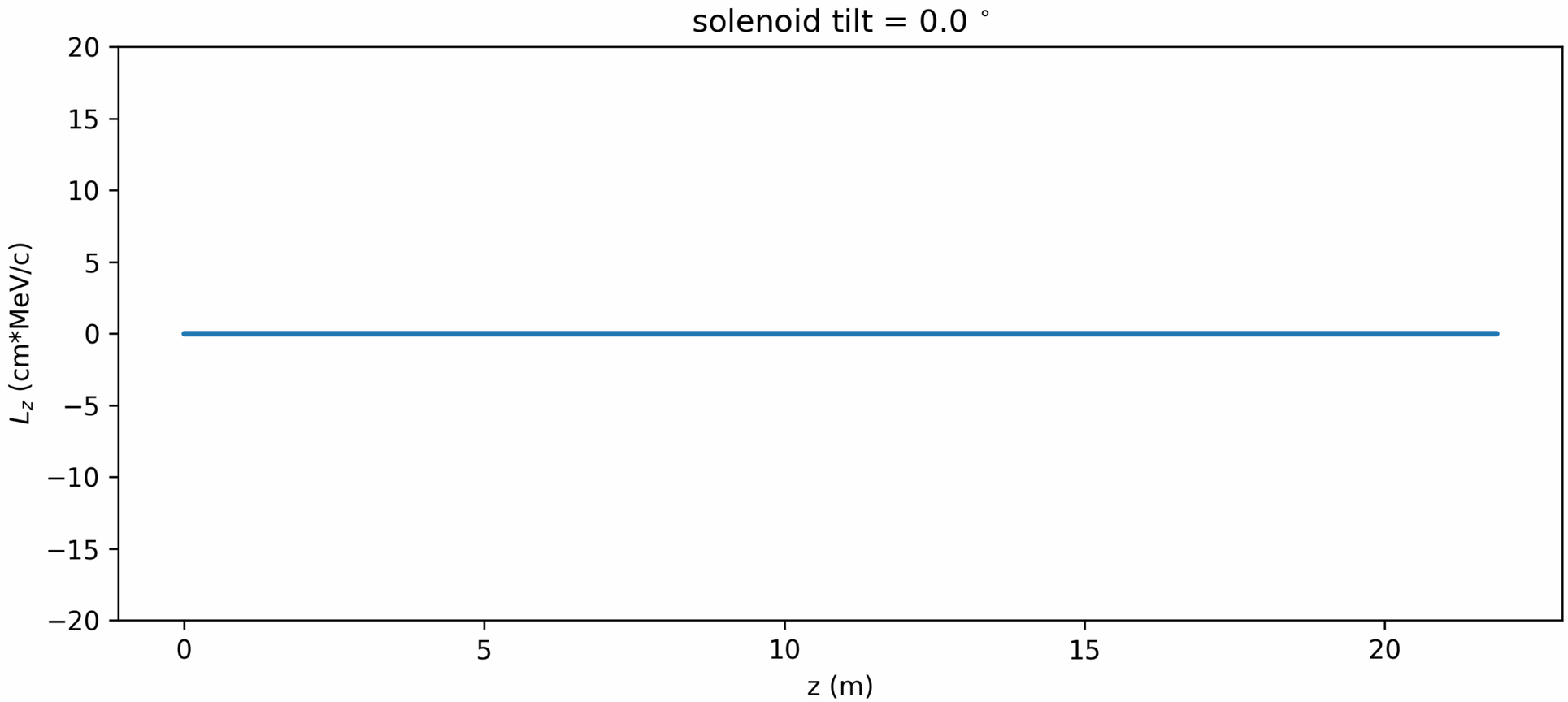
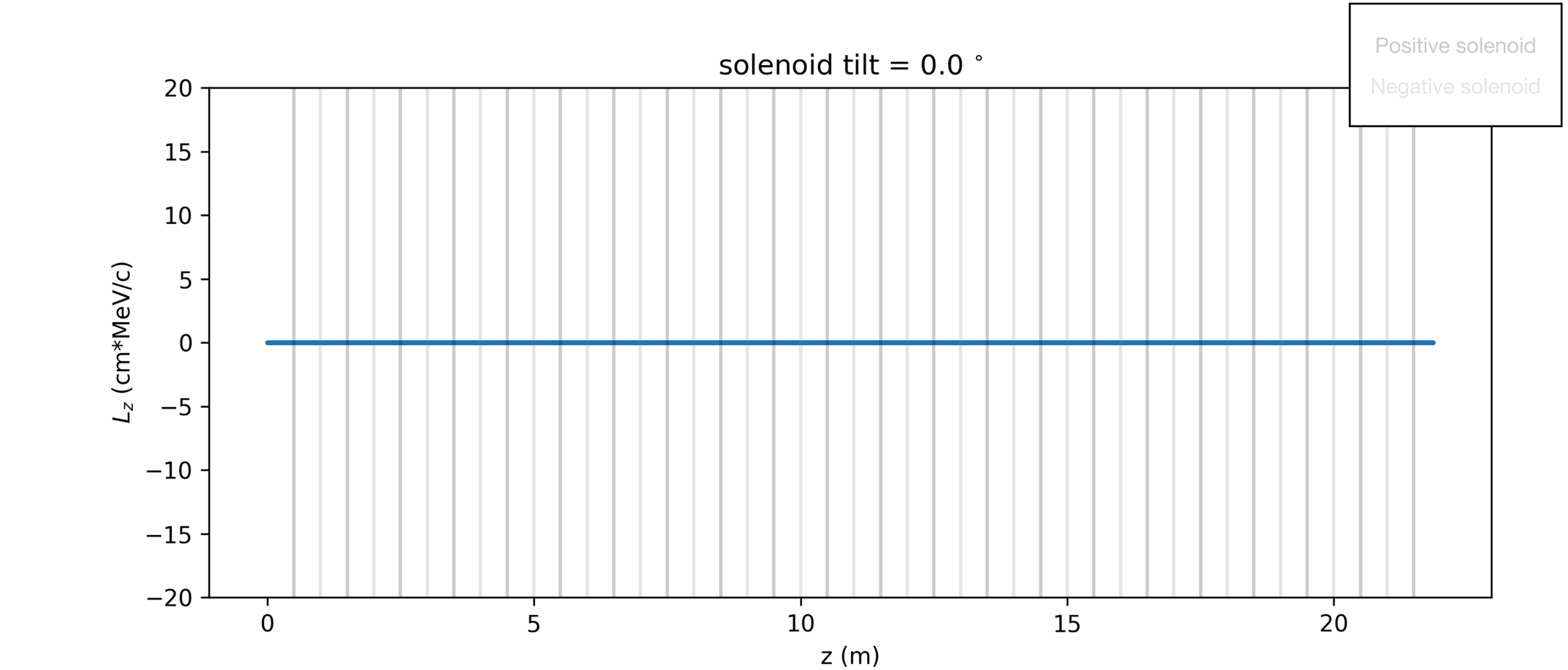


(Animation)

Adjusting Solenoid Tilt

Scan over x rotation from 0 to -2.5 mrad



(Animation)

Single solenoid coil

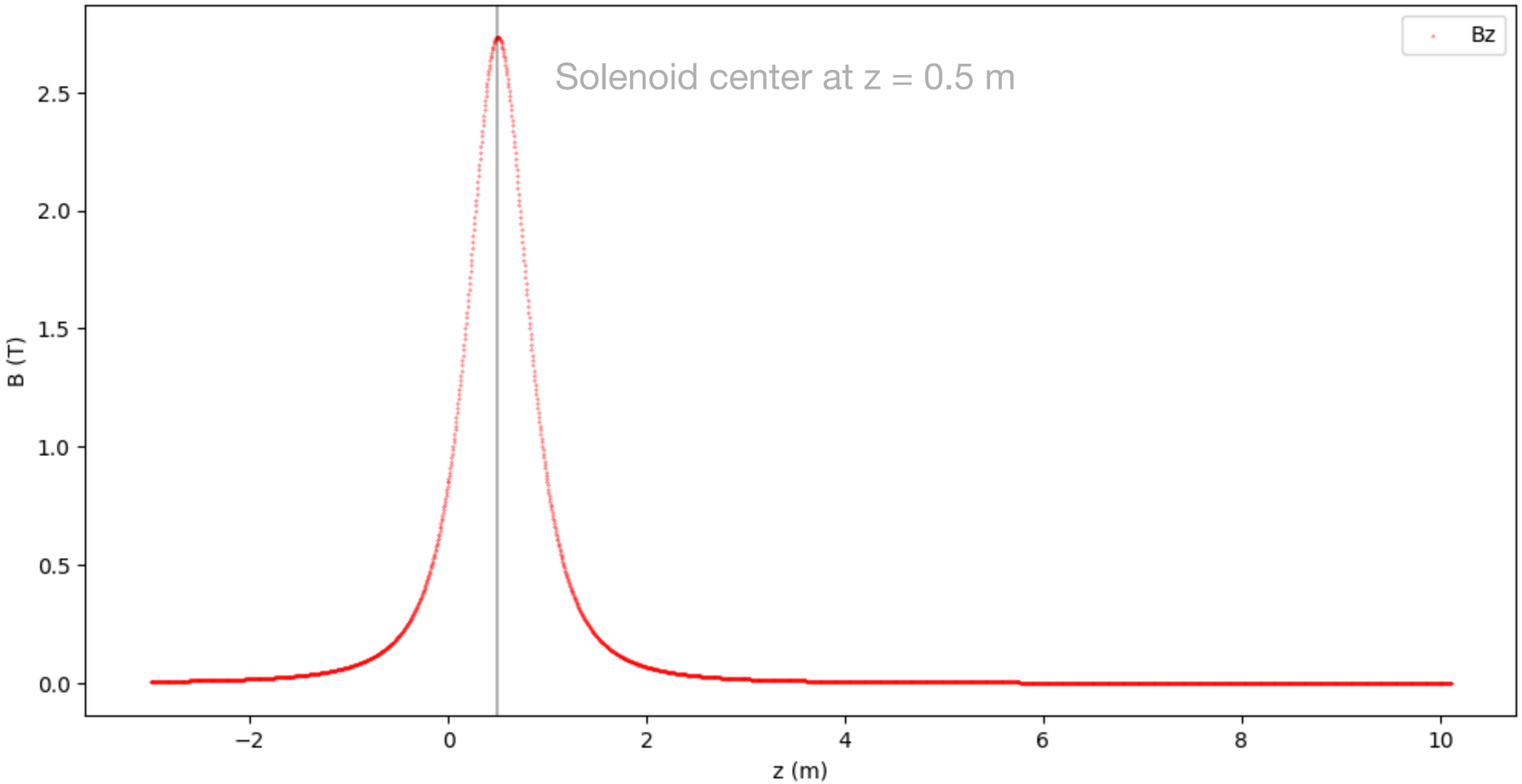
Magnetic Field

Coil length = **200** mm

Coil inner radius = 400 mm

Coil thickness = 100 mm

Current = 100 A/mm^2



Focusing Length

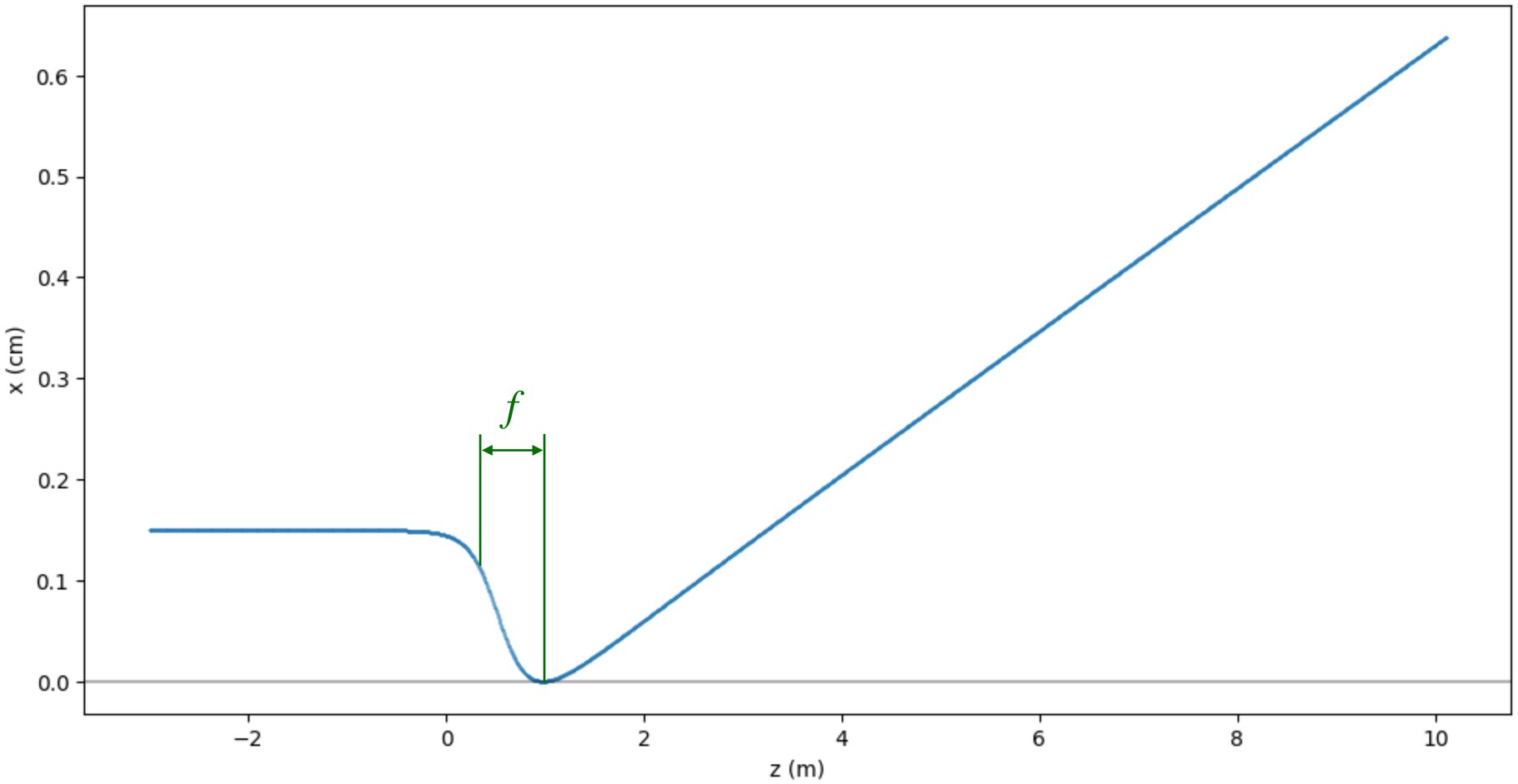
Coil length = **200** mm

Coil inner radius = 400 mm

Coil thickness = 100 mm

Current = 100 A/mm^2

$$f = \frac{2\gamma m_\mu}{eB_z}$$



Magnetic Field

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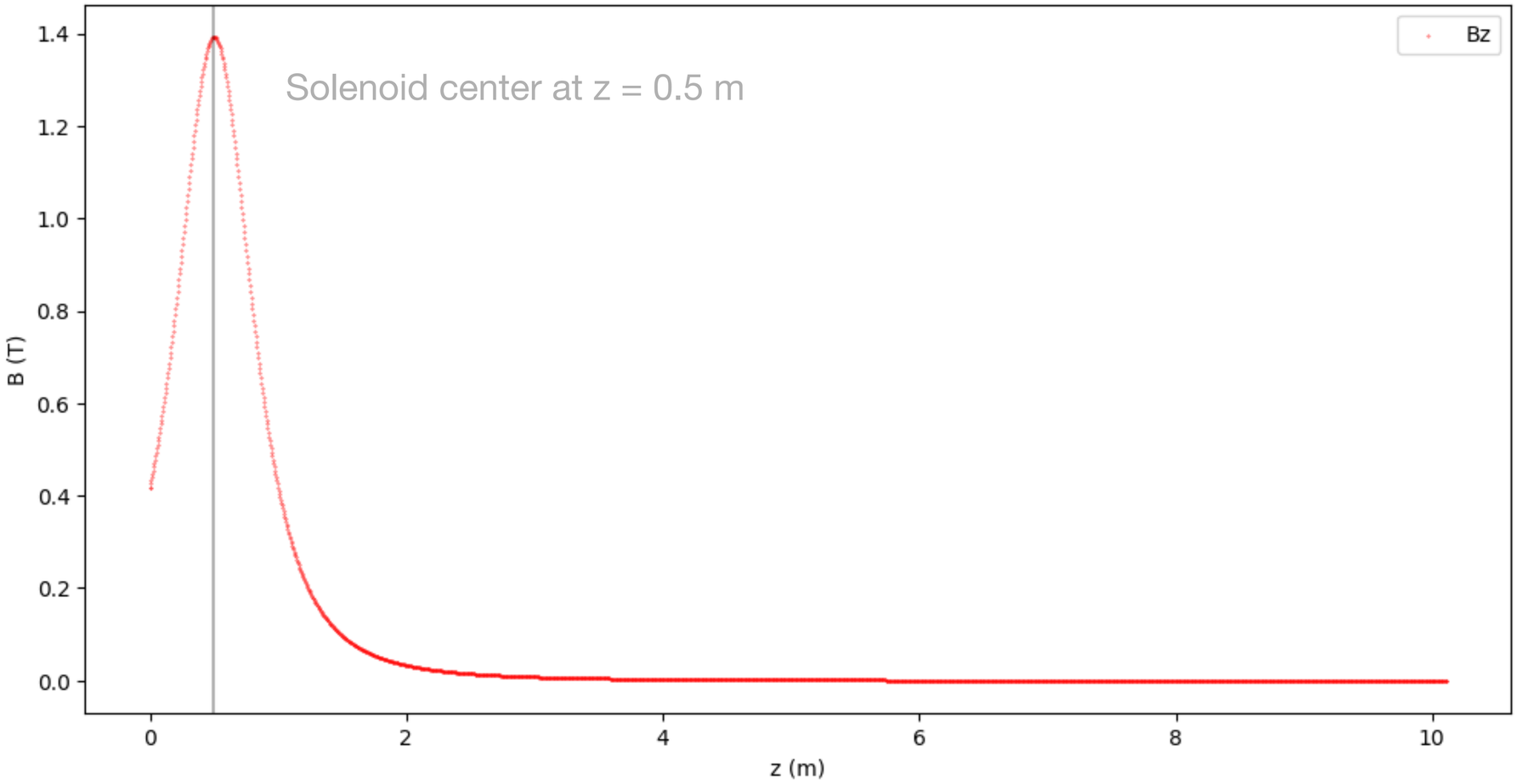
Current = 100 A/mm^2



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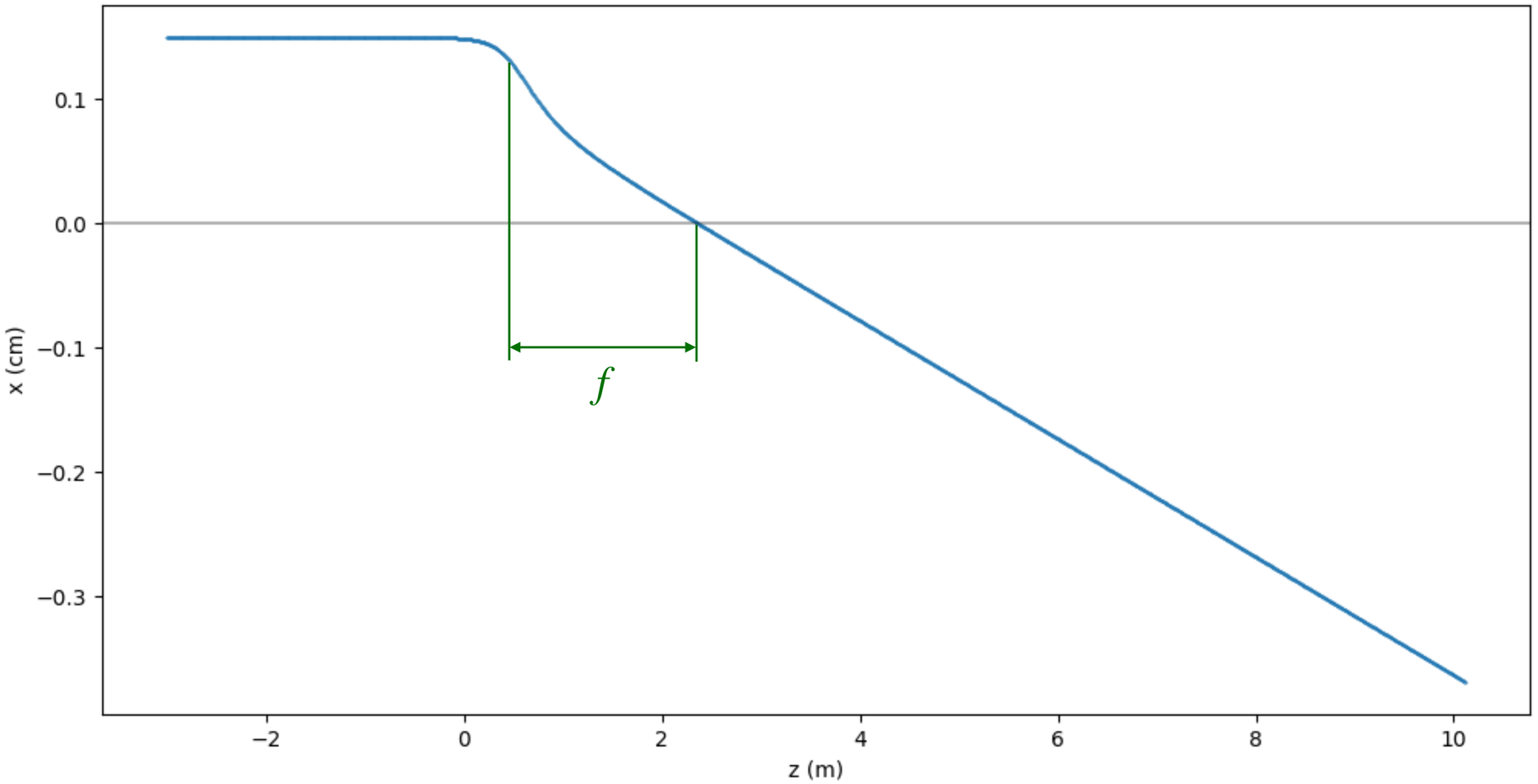
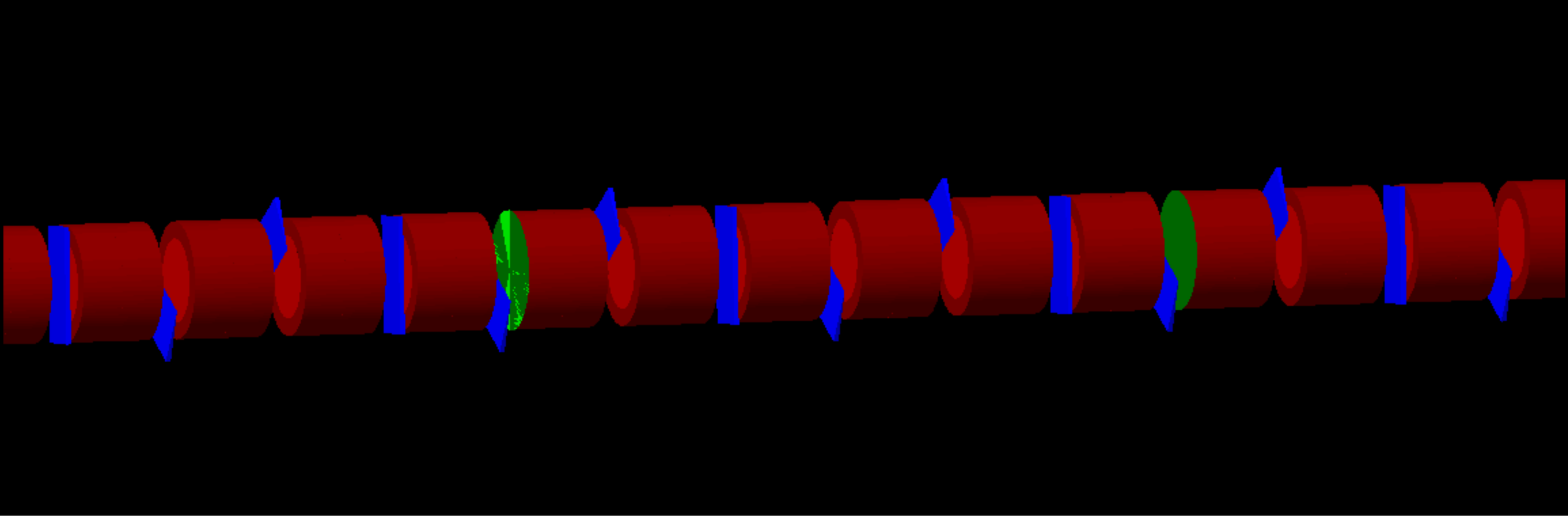




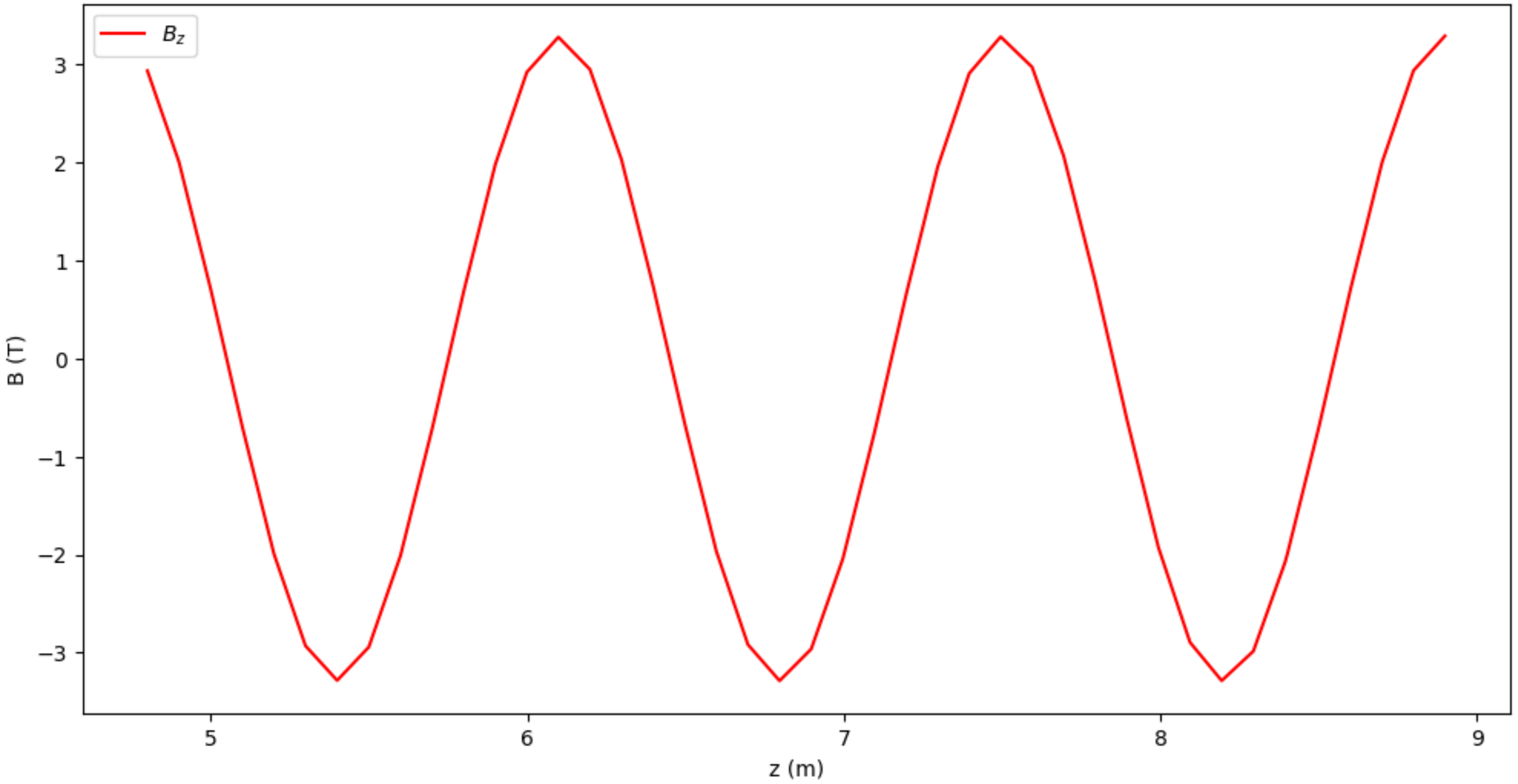
Constant-Current HFOFO Study

https://github.com/criggall/muon-cooling/tree/main/Simplified-HFOFO

Magnetic Field

Rotation about x-axis of -2.5 mrad

Periodic rotations about z-axis of $\frac{4\pi}{3}$, 0, $\frac{2\pi}{3}$, $\frac{4\pi}{3}$, 0, $\frac{2\pi}{3}$



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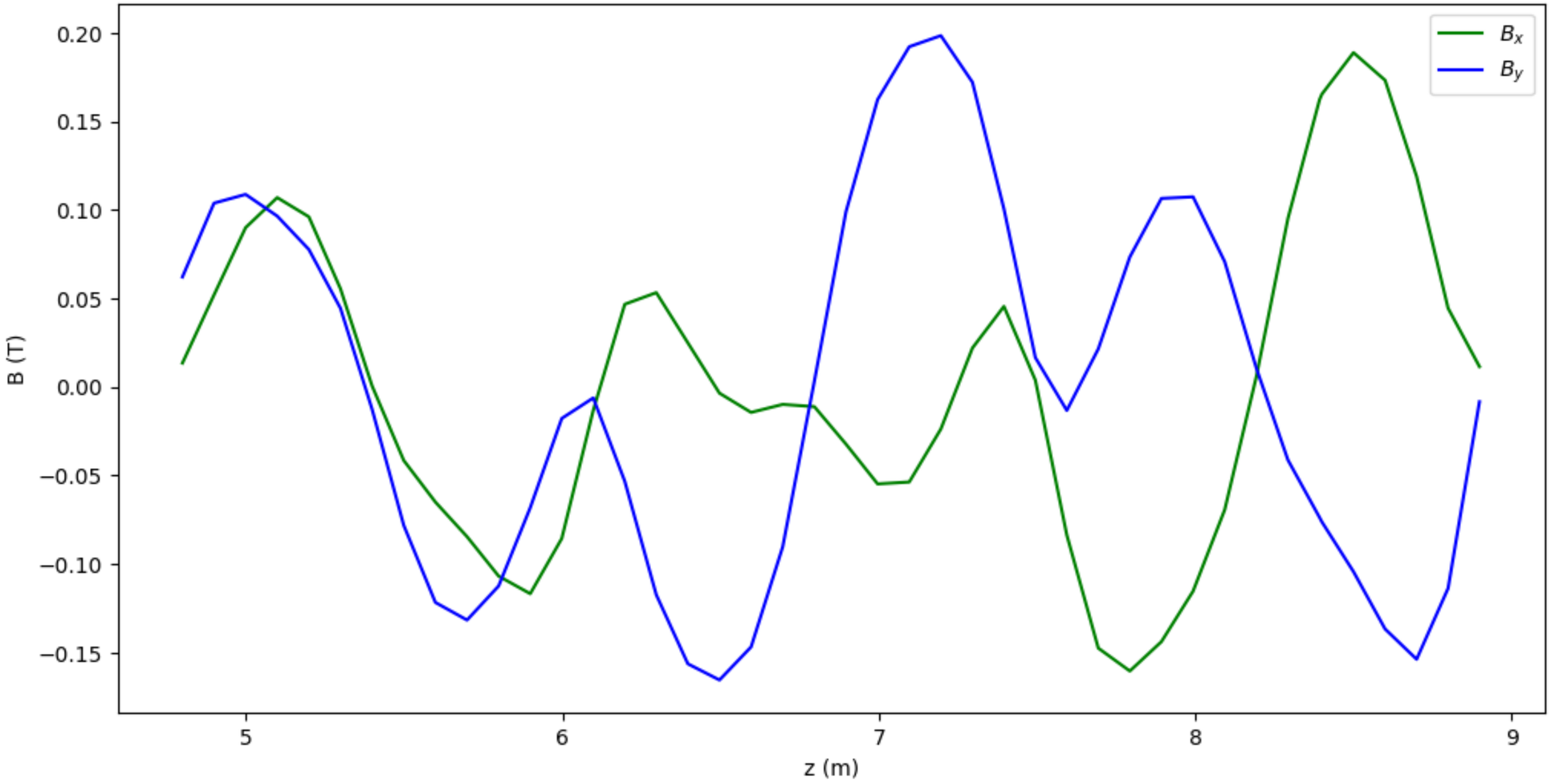

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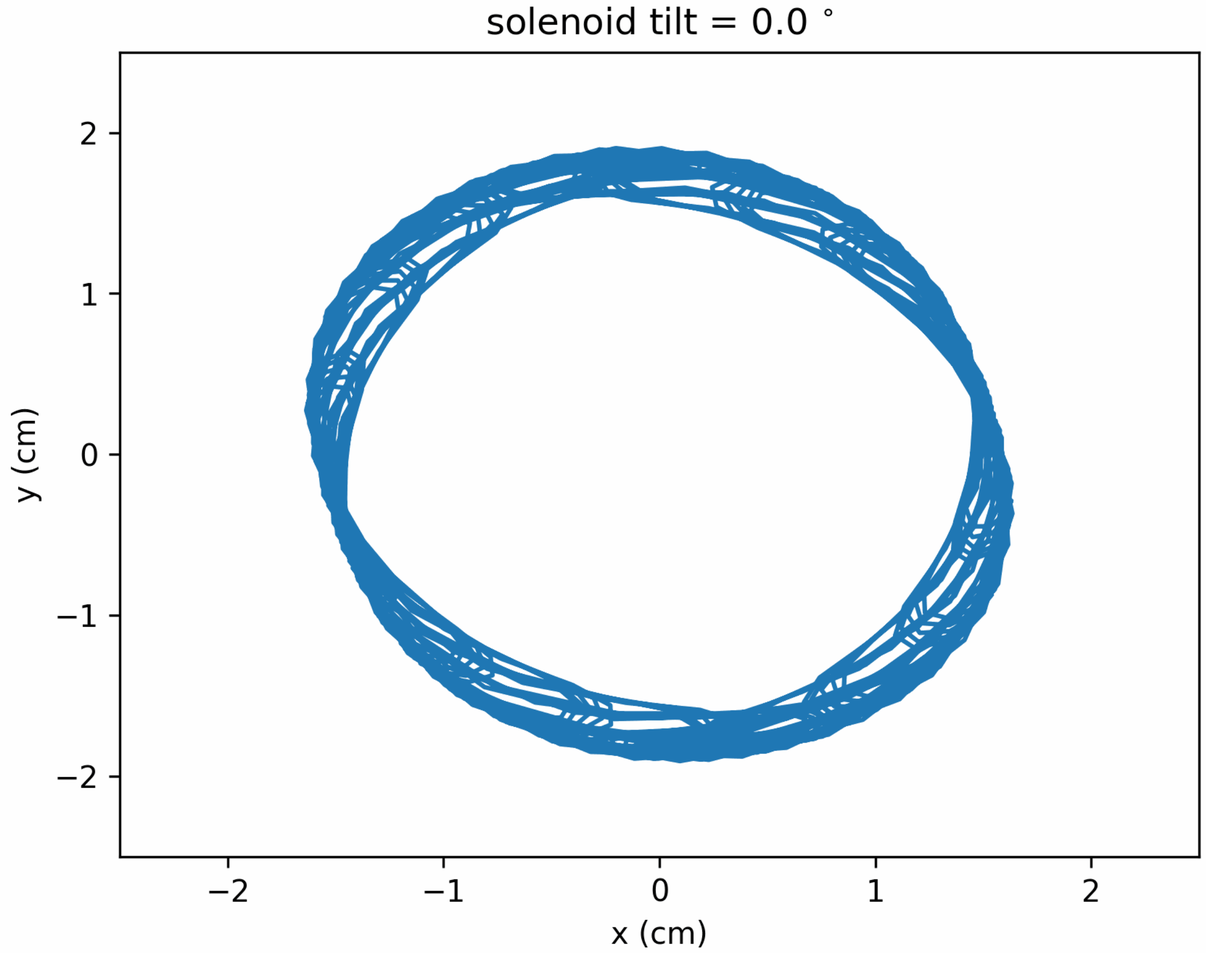
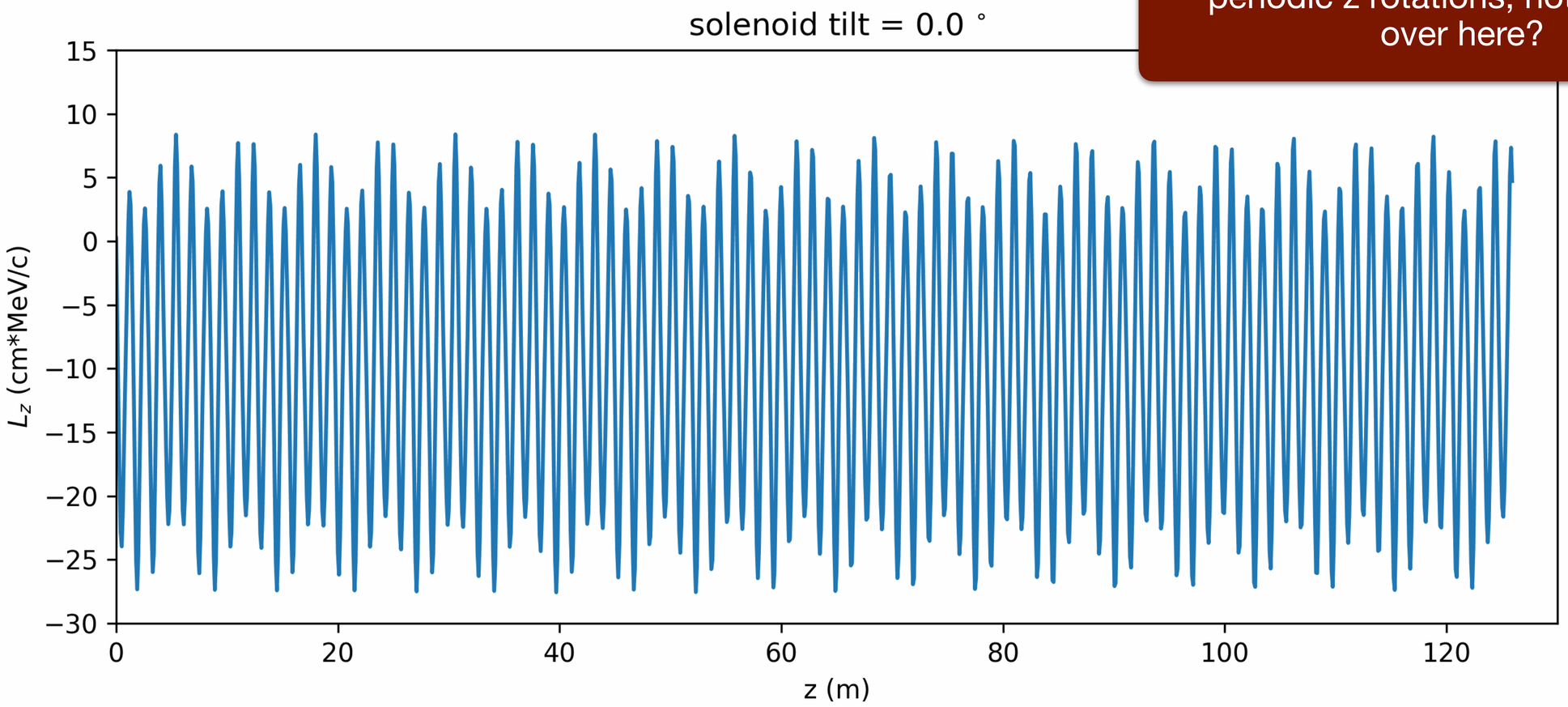


(Animation)

Adjusting Solenoid Tilt

Scan over x rotation from 0 to -2.5 mrad

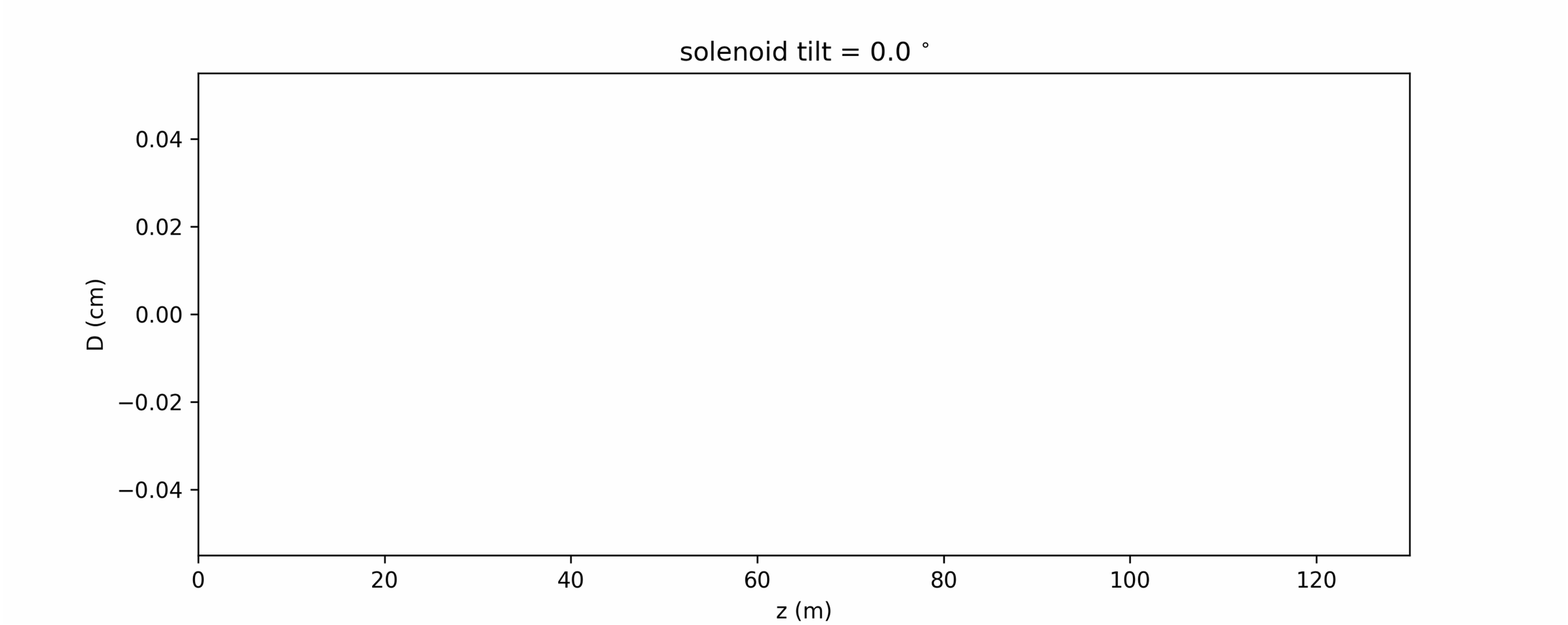
What about the effect of the periodic z rotations, not scanned over here?



(Animation)

Adjusting Solenoid Tilt

Scan over x rotation from 0 to -2.5 mrad



(Animation)