A preliminary look at Rastered Beam for HDice in UITF using g4Beamline

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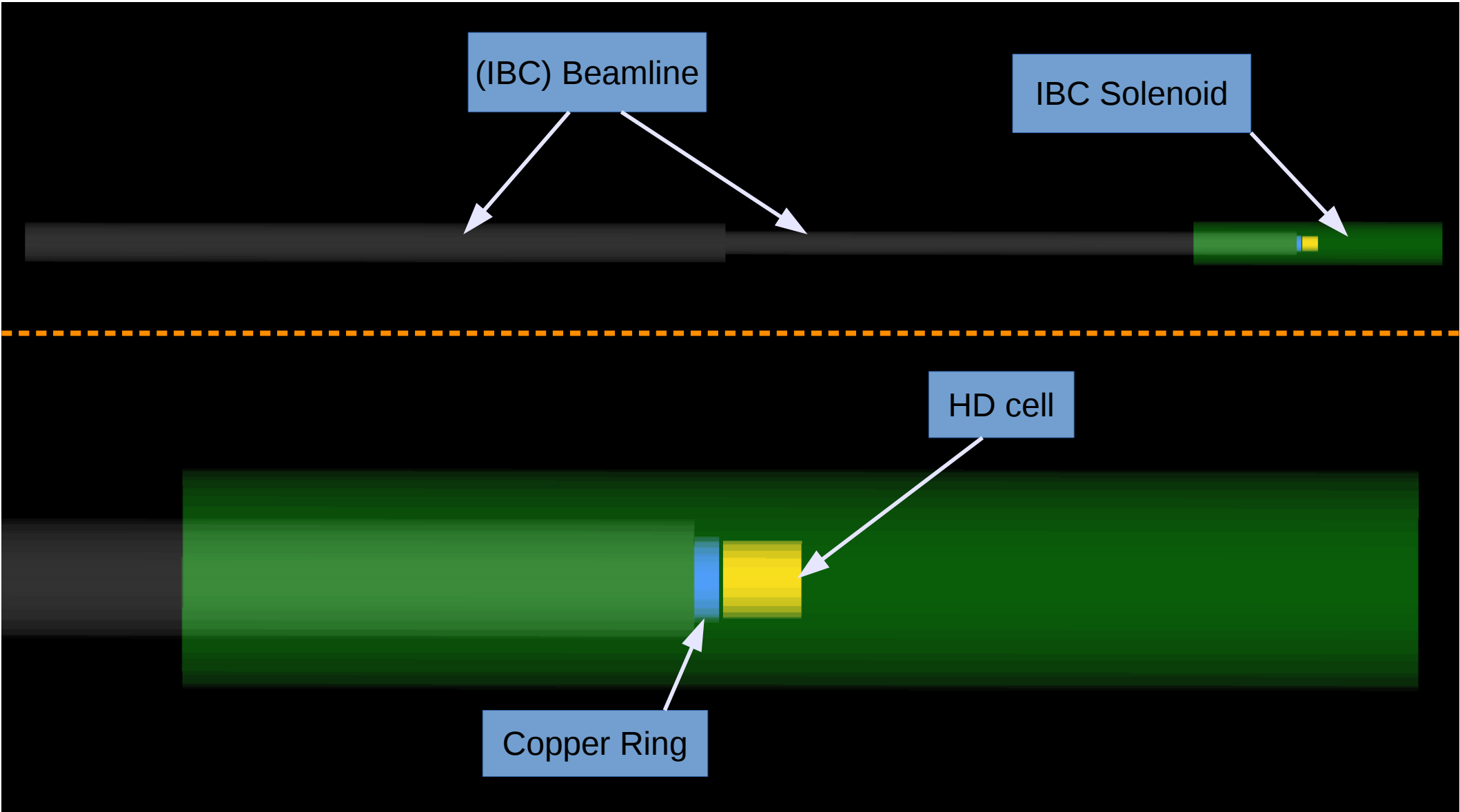
What was looked at?

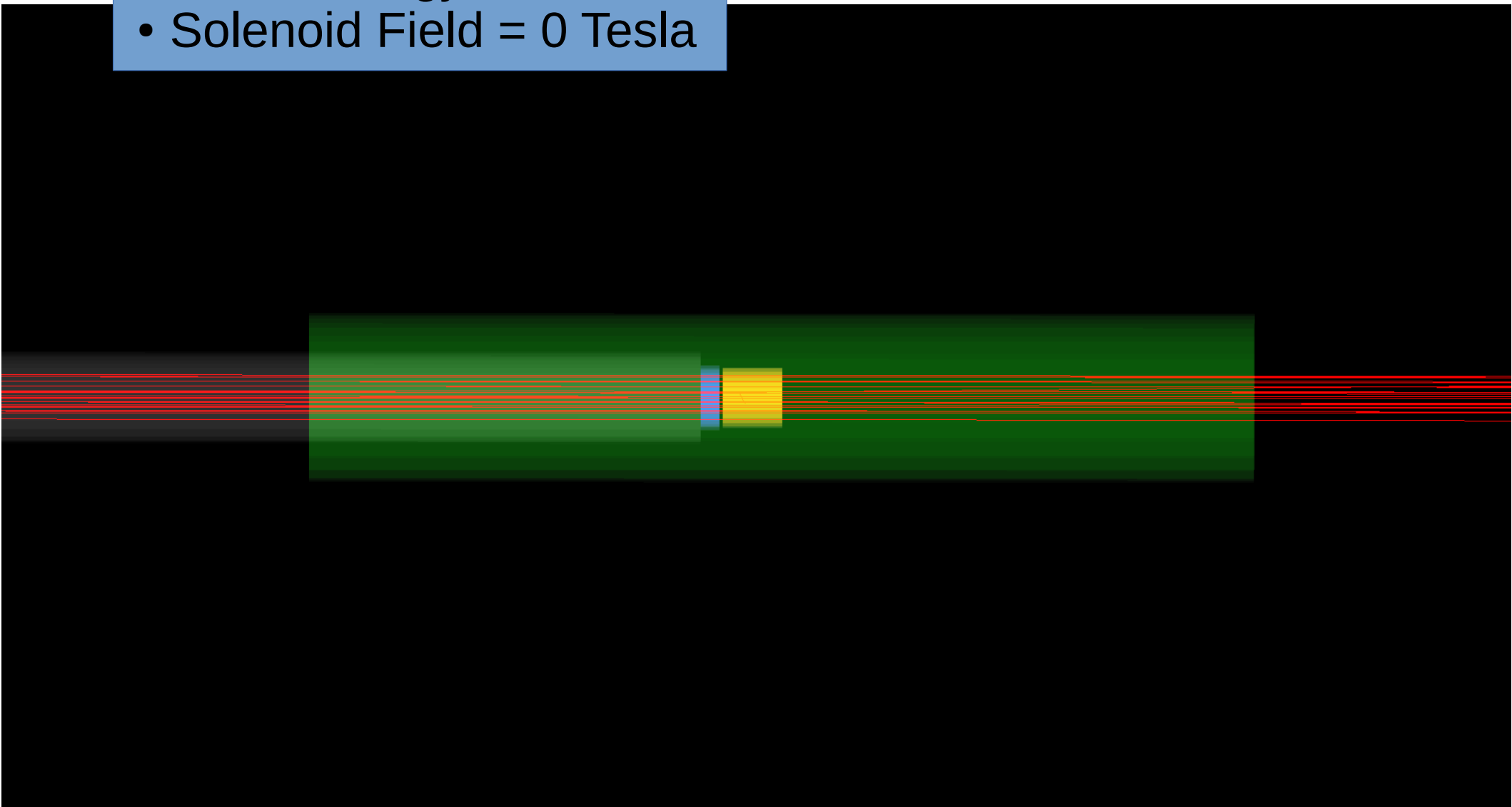
- Effects of IBC solenoid on:
  - beam (focusing and defocusing)
  - spiral pattern of rastered beam
  - kick provided by the Raster

What HDice hardware was modeled?



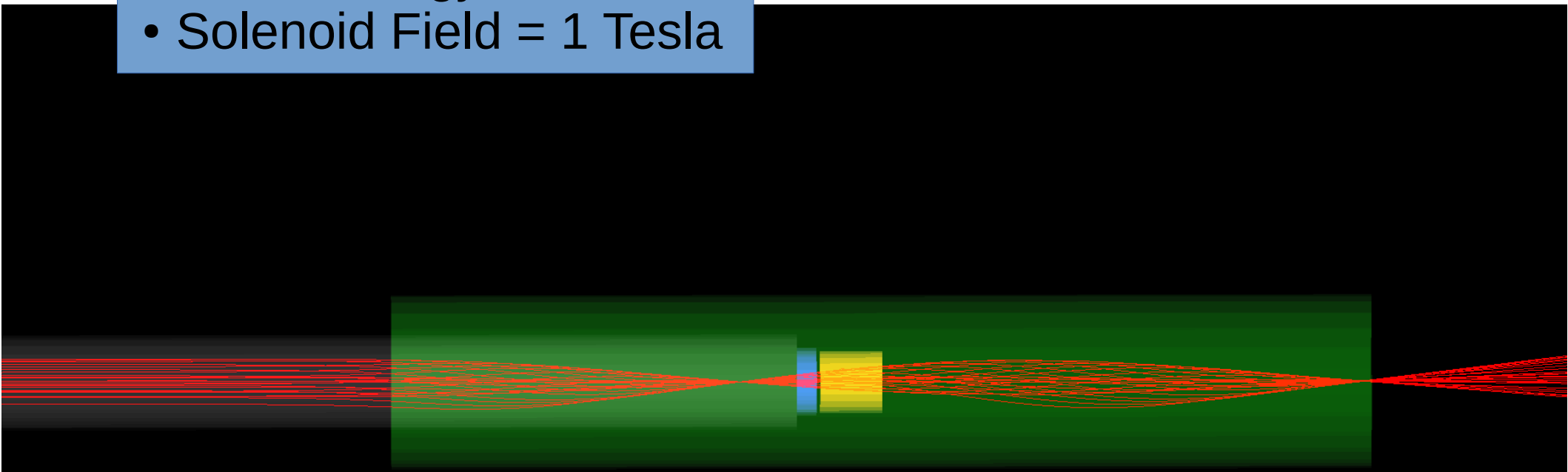
Beam focusing and defocusing

- Beam energy = 10 MeV
- Solenoid Field = 0 Tesla



Beam focusing and defocusing

- Beam energy = 10 MeV
- Solenoid Field = 1 Tesla



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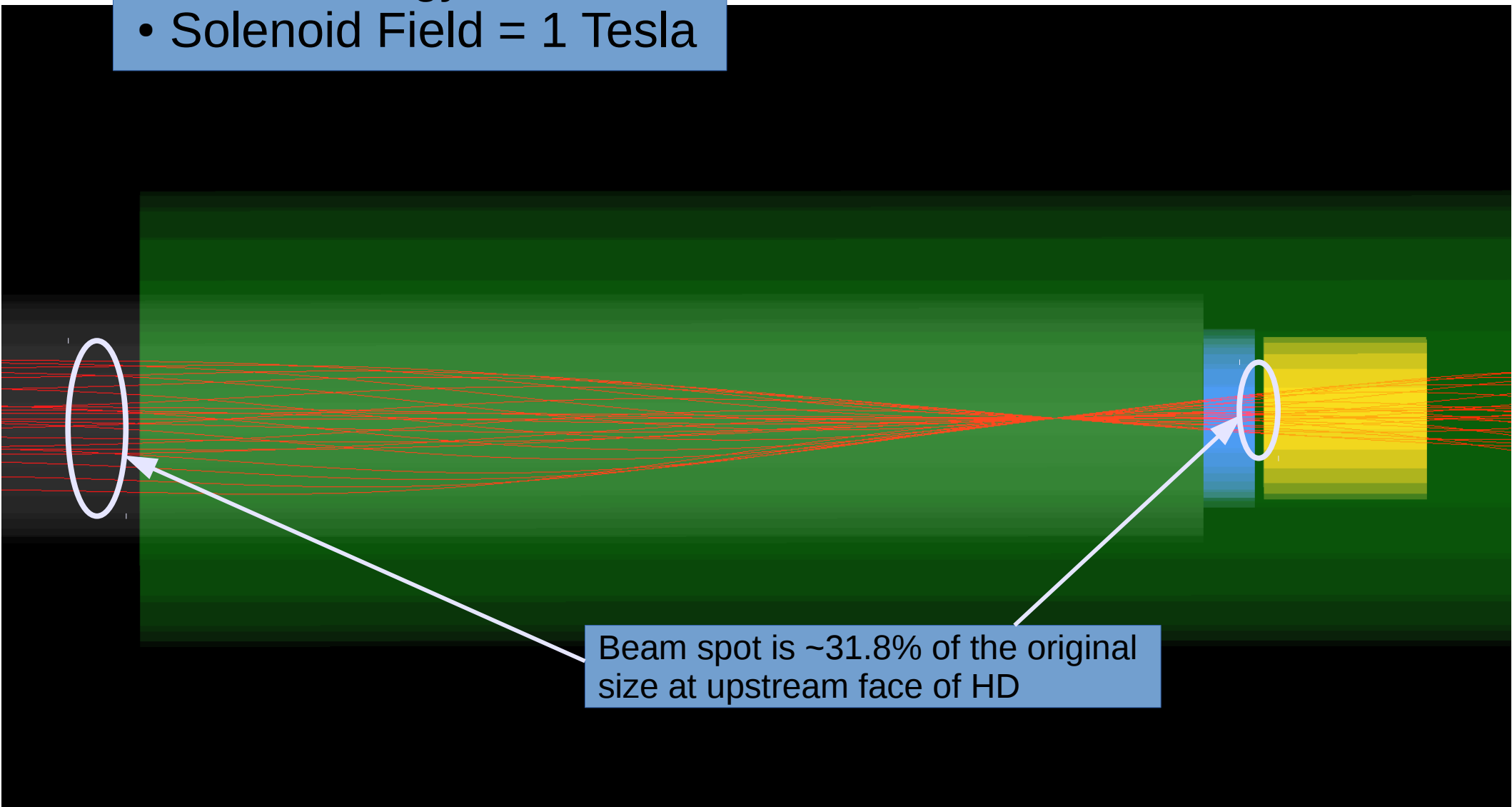
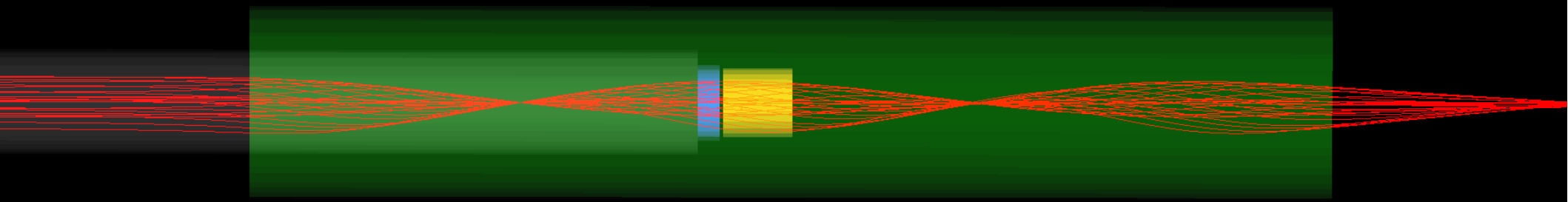


Beam focusing and defocusing

- The IBC Solenoid has a consequential effect on the beam size due to focusing.
- The first focal point occurs upstream of the target but beam spot is smaller at the upstream face of the HD than it was before the solenoid (~31.8% the original size).
- The location of the focal points (and therefore beam size at the target) may be altered via a small reduction in beam energy.

Effect of lower beam energy

- Beam energy = **6.8** MeV
- Solenoid Field = 1 Tesla



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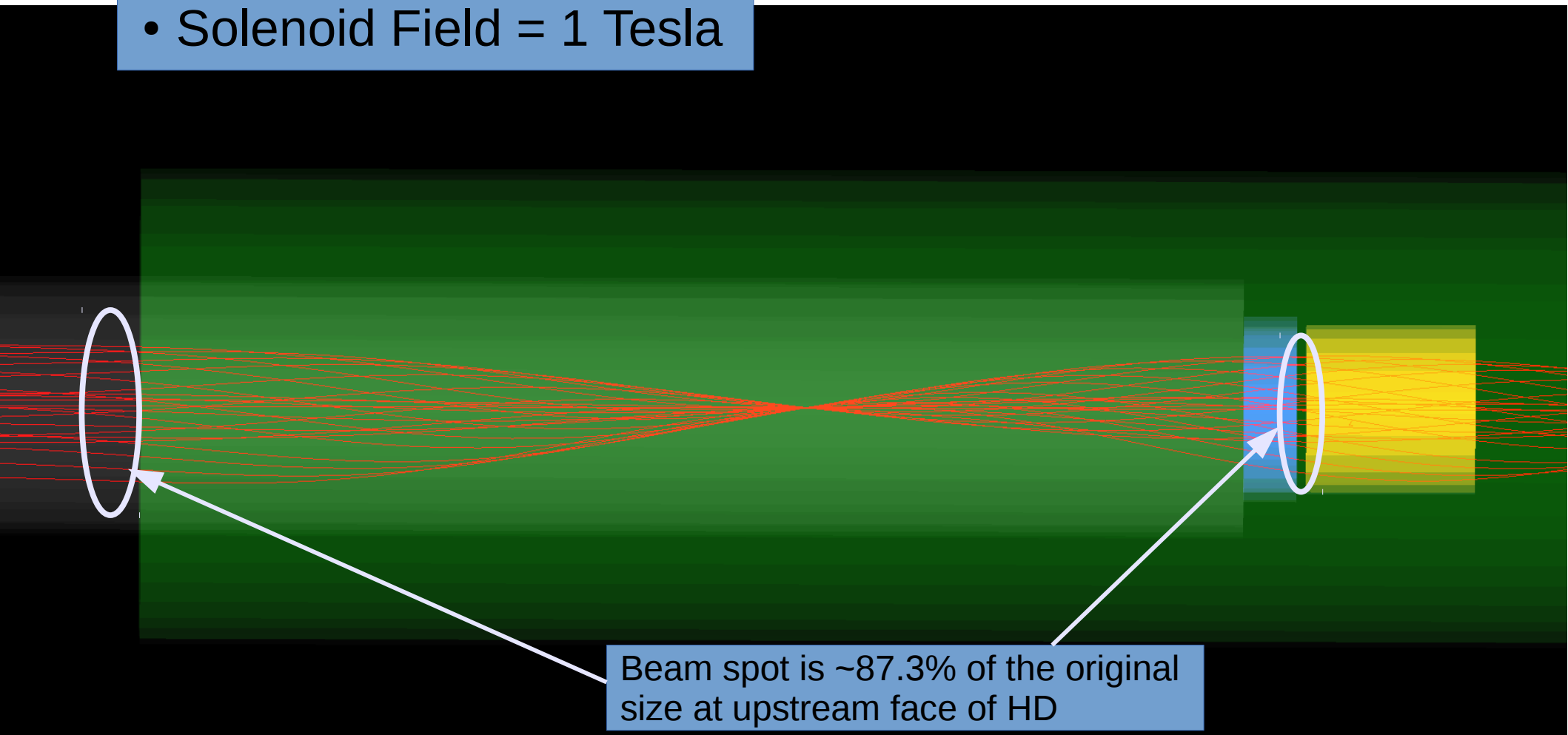
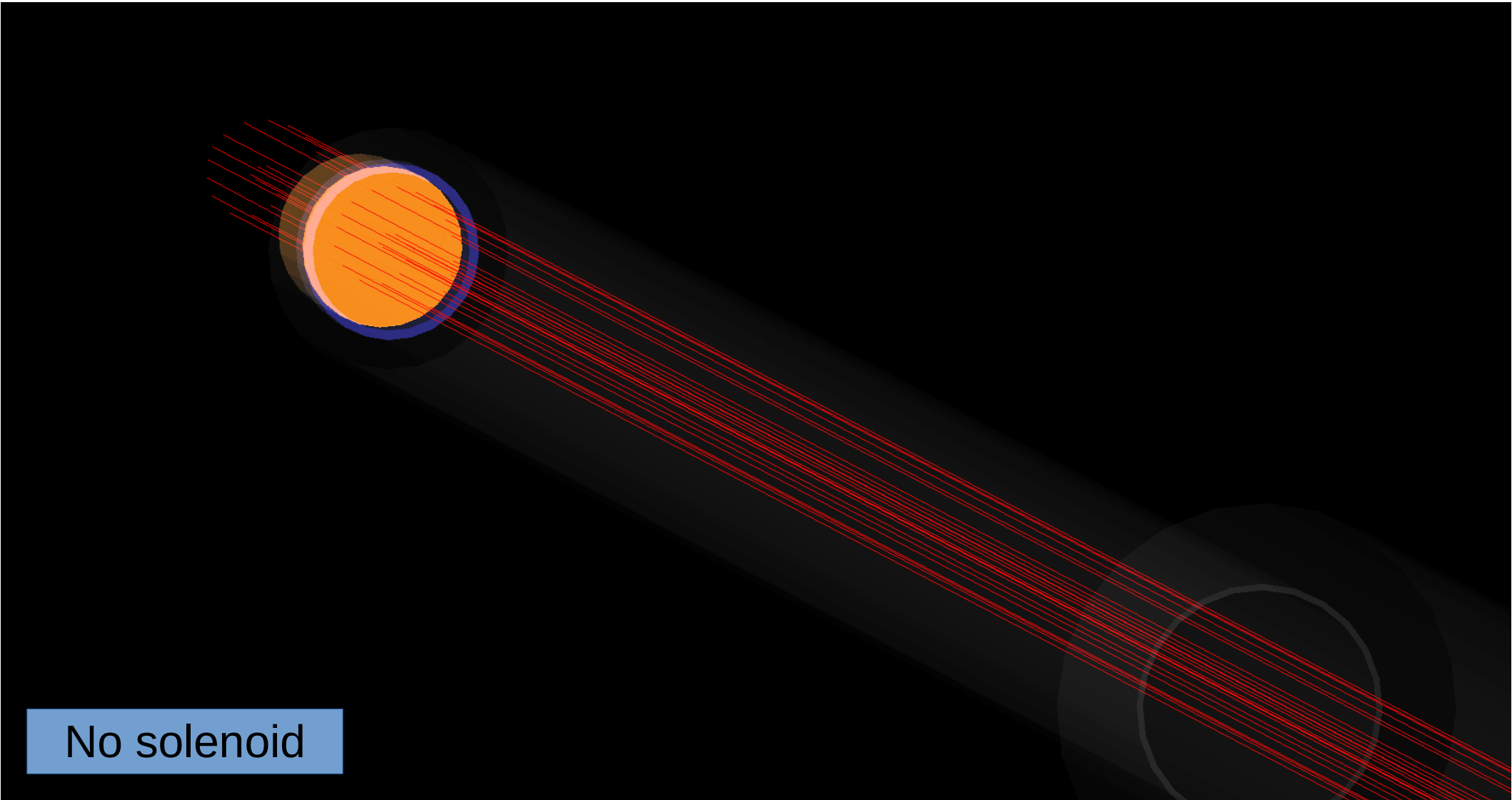


Effect on spiral pattern

- Used 24 individual (and parallel) 10 MeV beams with no divergence, forming a spiral.



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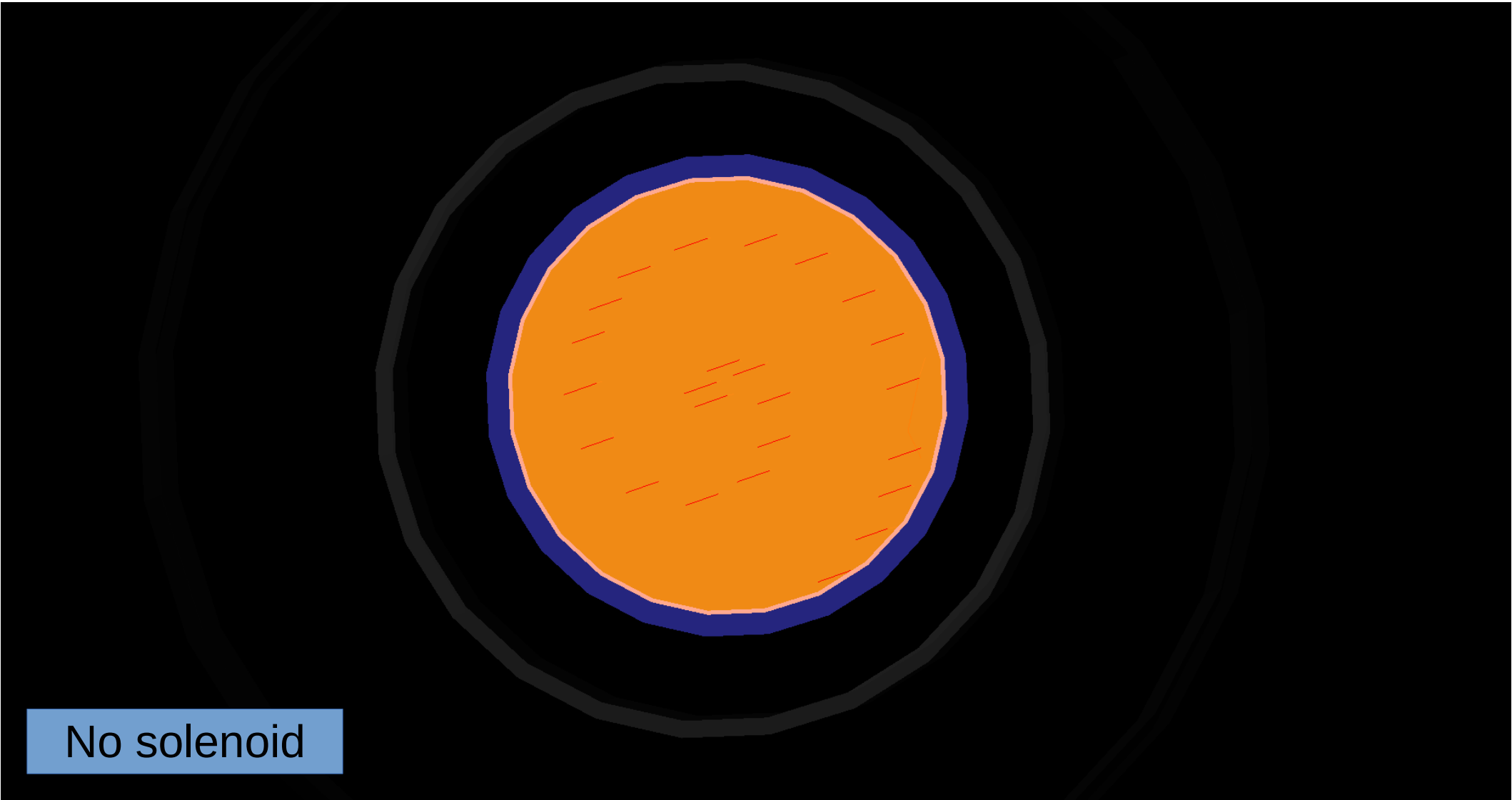

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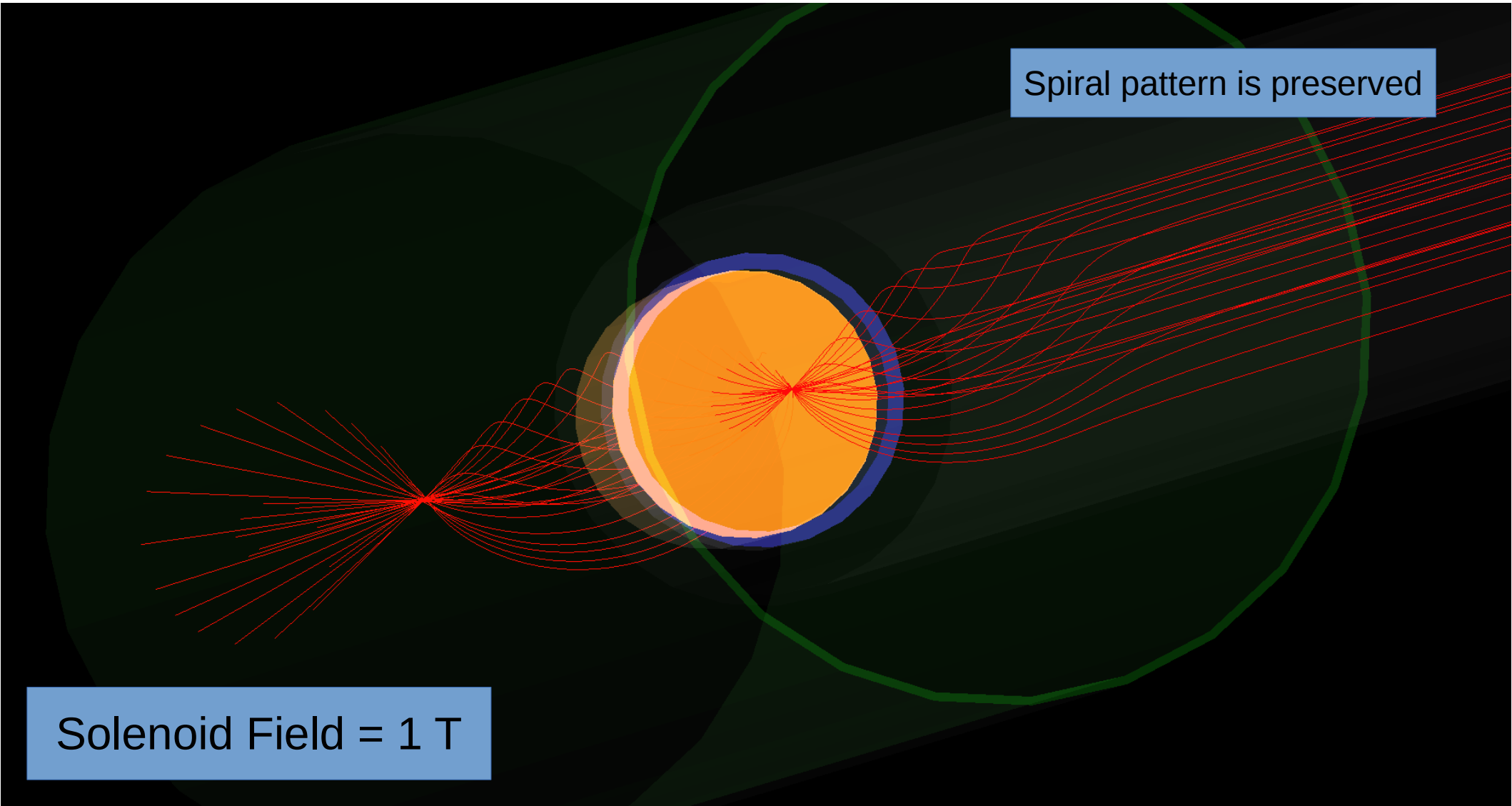

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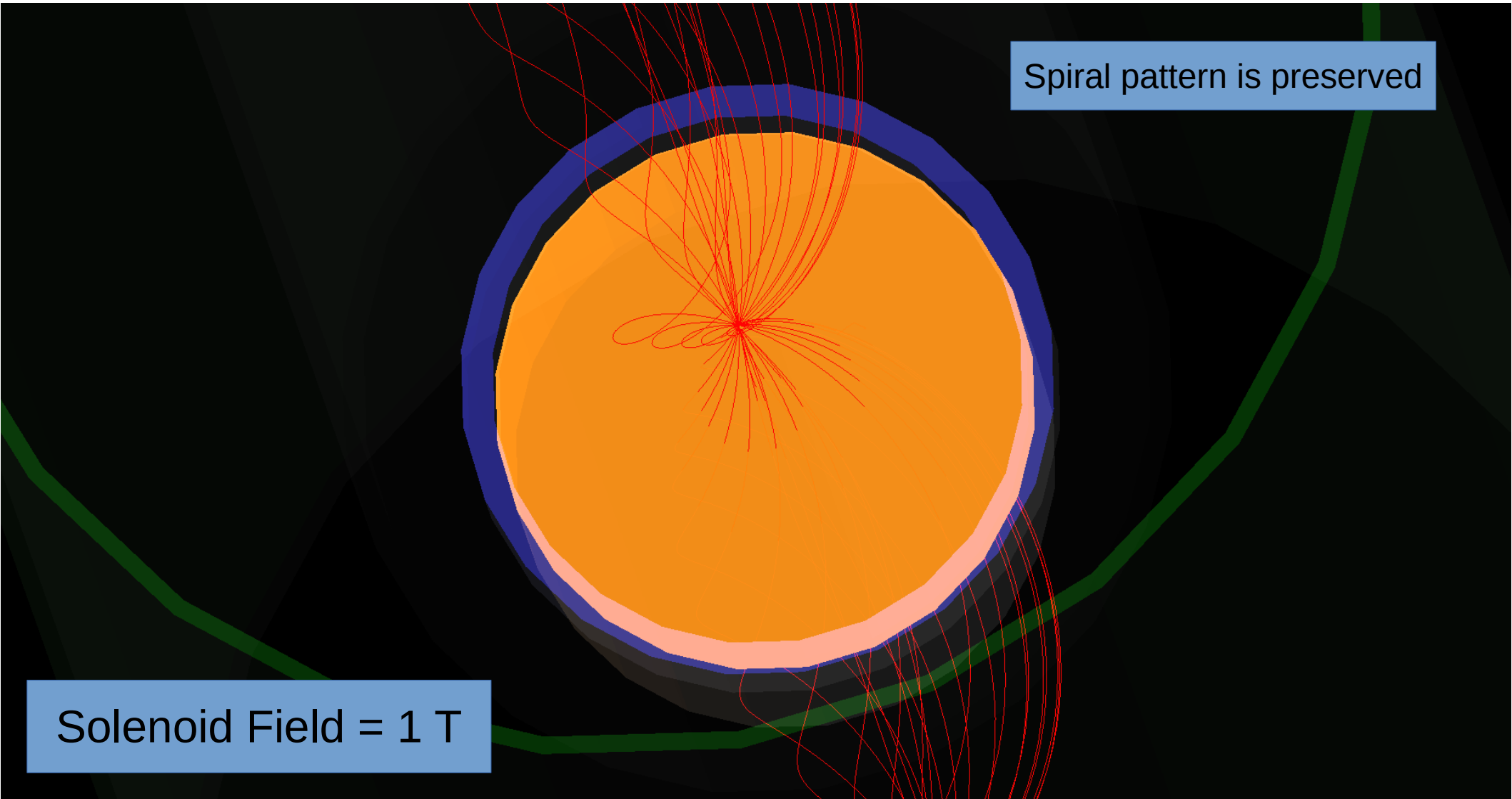

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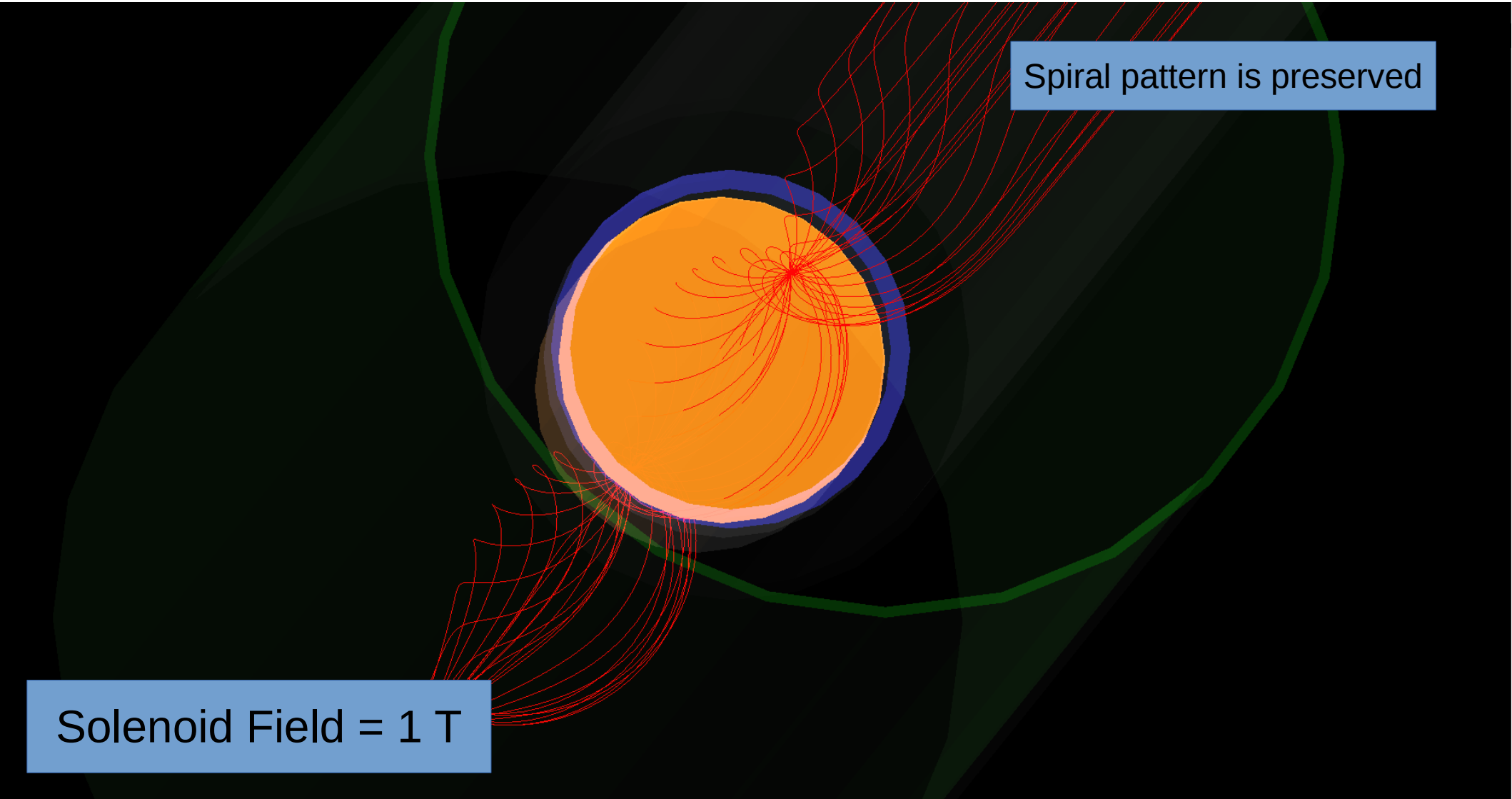
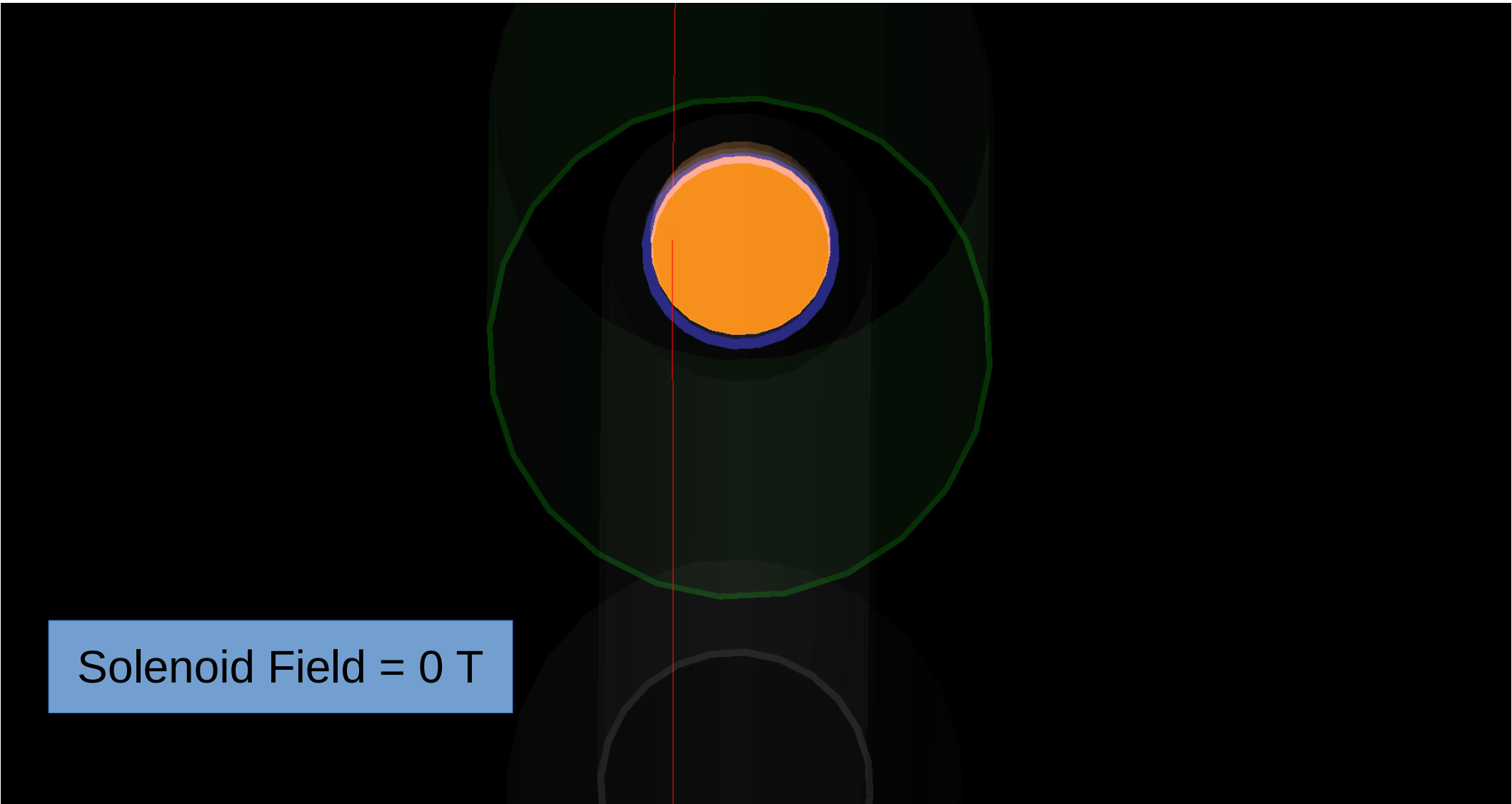


Effect on rastered beam

- As we've seen, the size of the beam spot on the target may be increased by moving the focal points further upstream.
- We could also kick the beam a little harder with the Raster.
- But how does the IBC Solenoid affect the rastered beam?

Effect on rastered beam

- A 10 MeV beam given a “soft” kick (8.6 m upstream of IBC entrance using 2.5% of full field).



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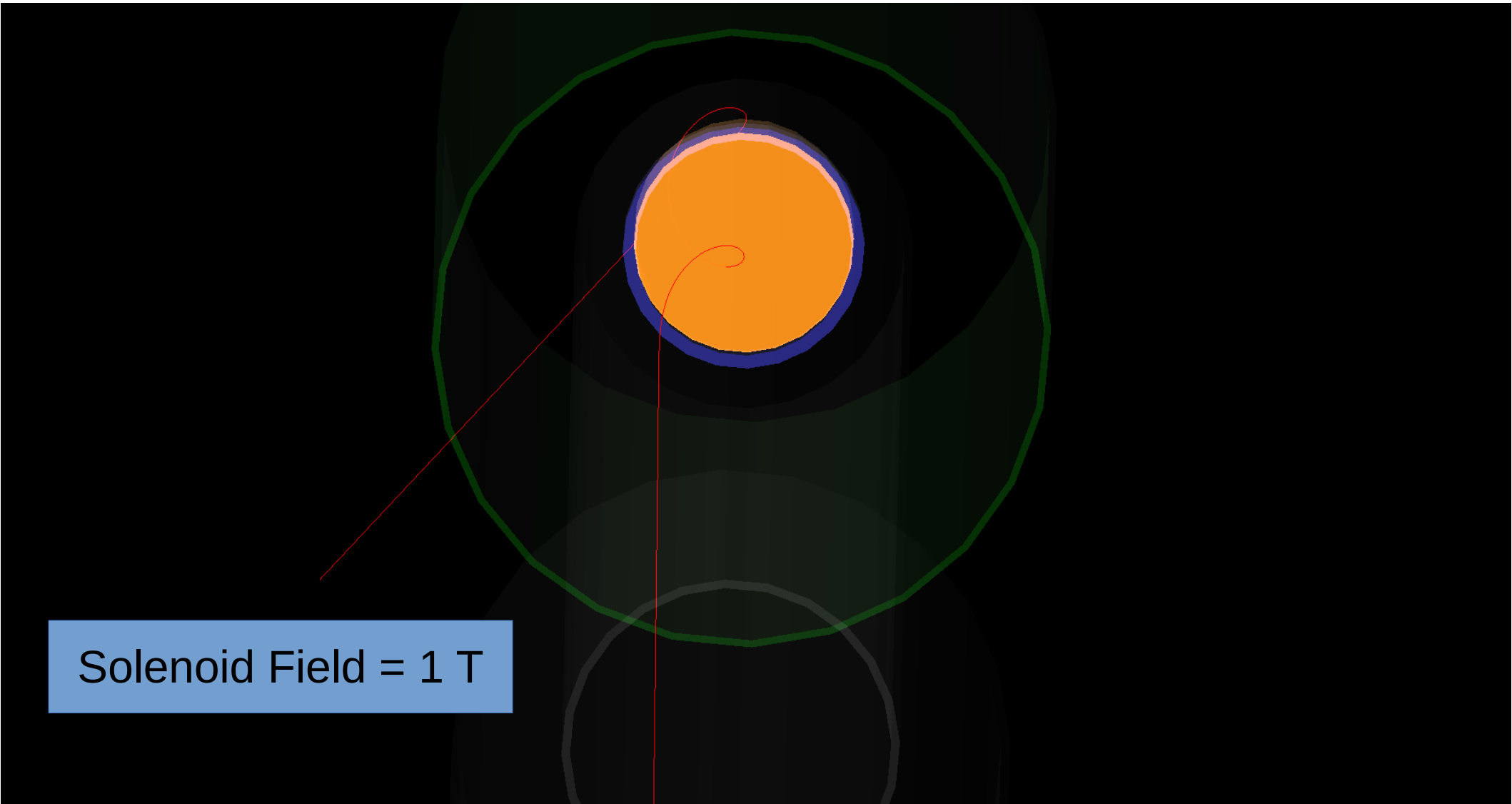
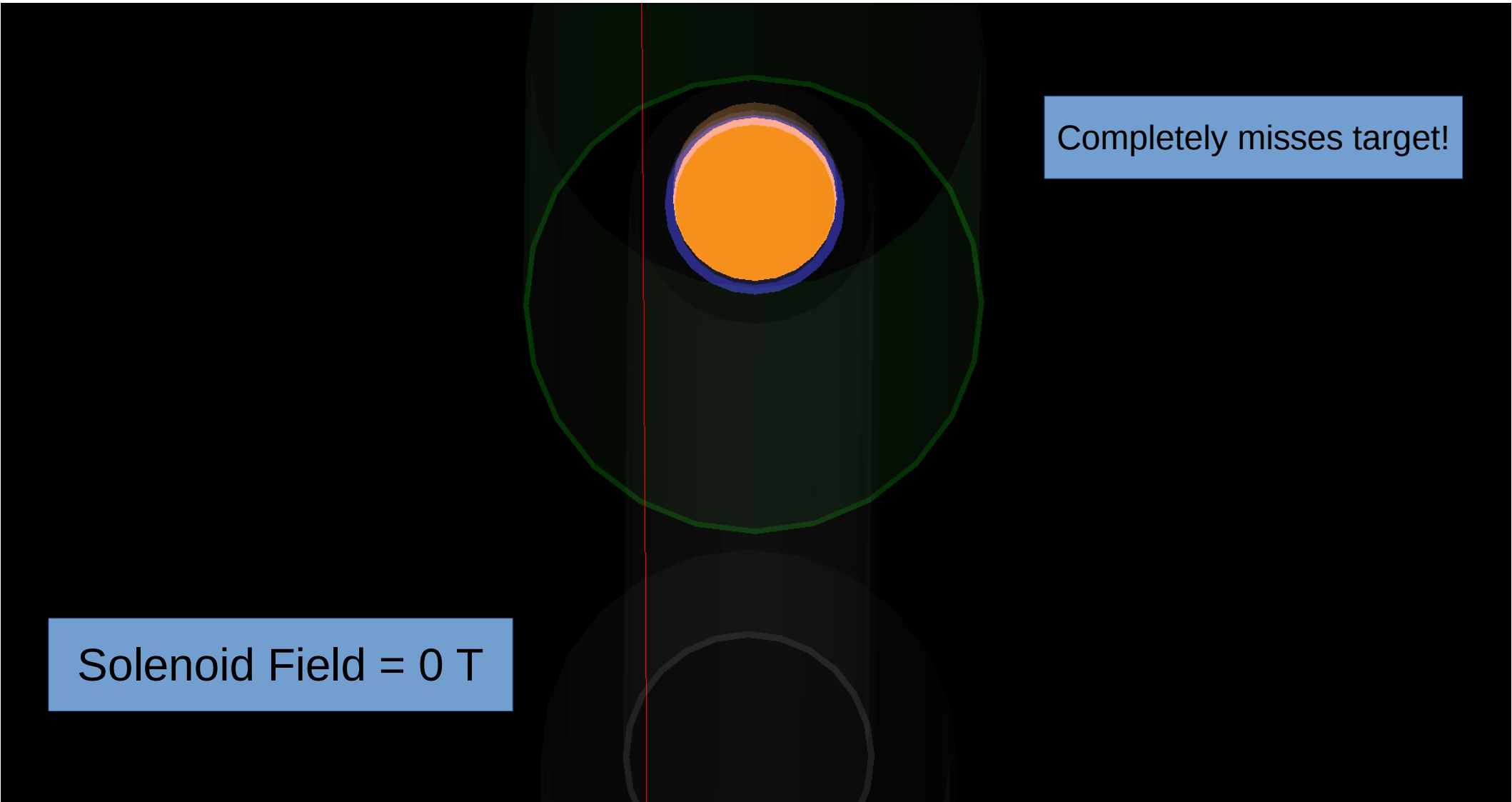


Effect on rastered beam

- A 10 MeV beam given a harder kick (8.6 m upstream of IBC entrance using 4.5% of full field).



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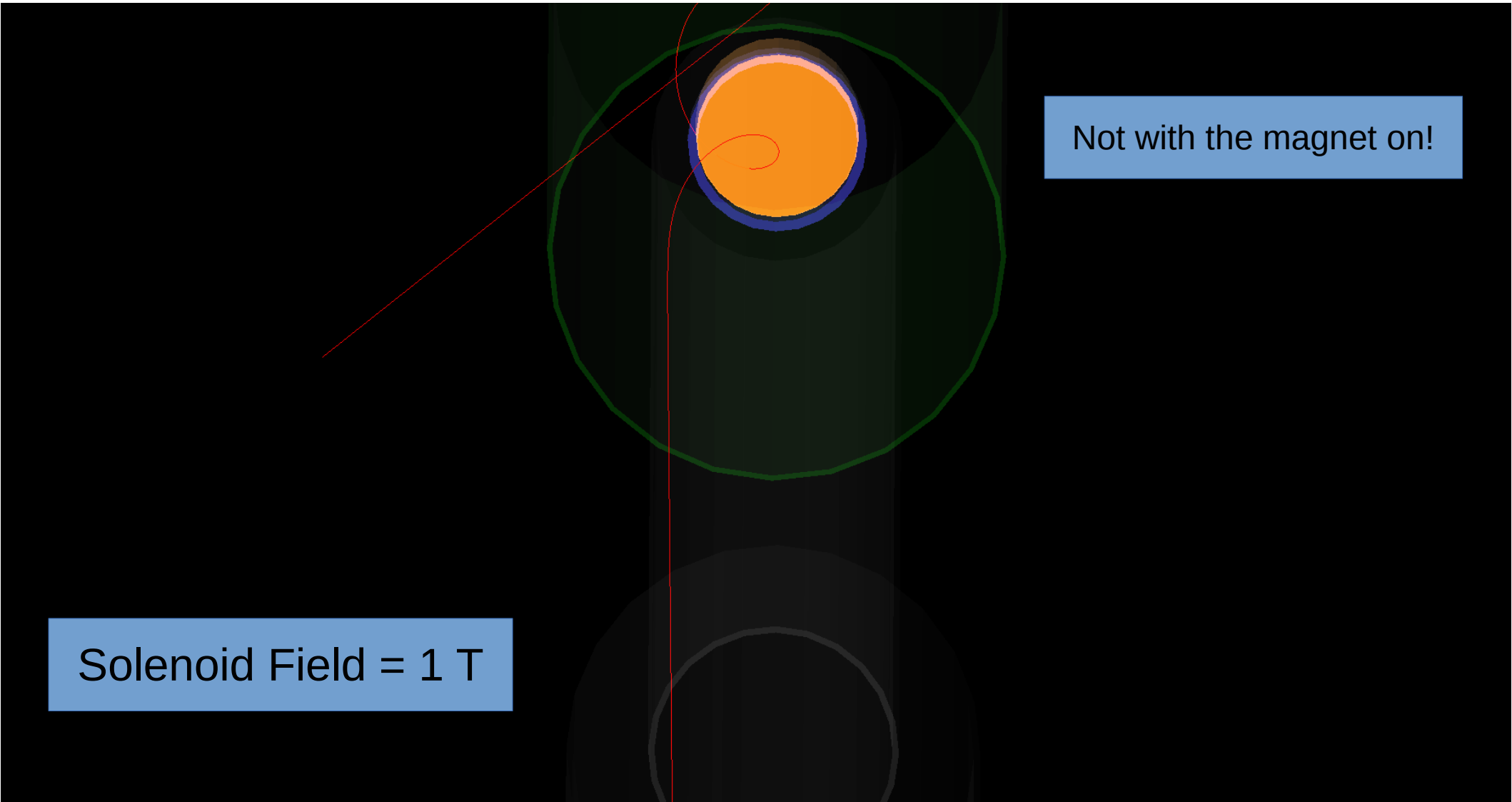
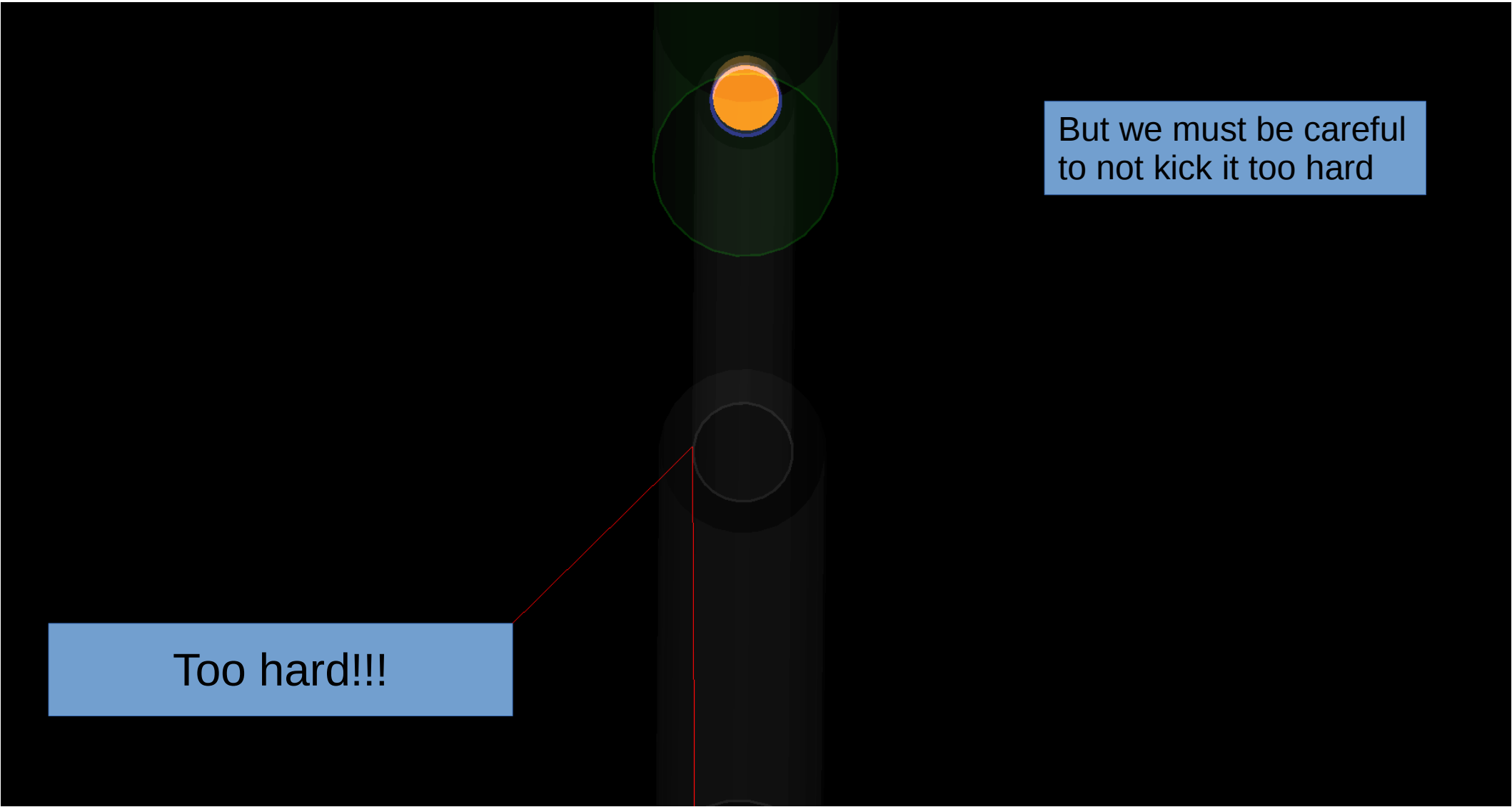


Effect on rastered beam

- A 10 MeV beam given an even harder kick (8.6 m upstream of IBC entrance using 5.5% of full field).



What we've learned so far:

- The IBC Solenoid has a consequential effect on the size of the beam in the target region of the IBC. However, a first look indicates that this effect may be countered through an adjustment (reduction) of the beam energy.
- A simple modeling of a spiral beam indicates that this beam shape is not destroyed by the field of the solenoid.
- An early look at the effect of the IBC Solenoid on the rastered beam indicates that the Raster should be run at a central field value that is higher than a simple calculation would suggest.

To do:

- Model a spiral beam NOT using a set of perfect, parallel beams.
- Make a more complete model of the raster coils (currently just using a single dipole magnet).
- A more rigorous examination of proper raster power and beam energy.

Bonus Slide: Beam at Dump