
Target Studies for Pion Production

Simulation setup



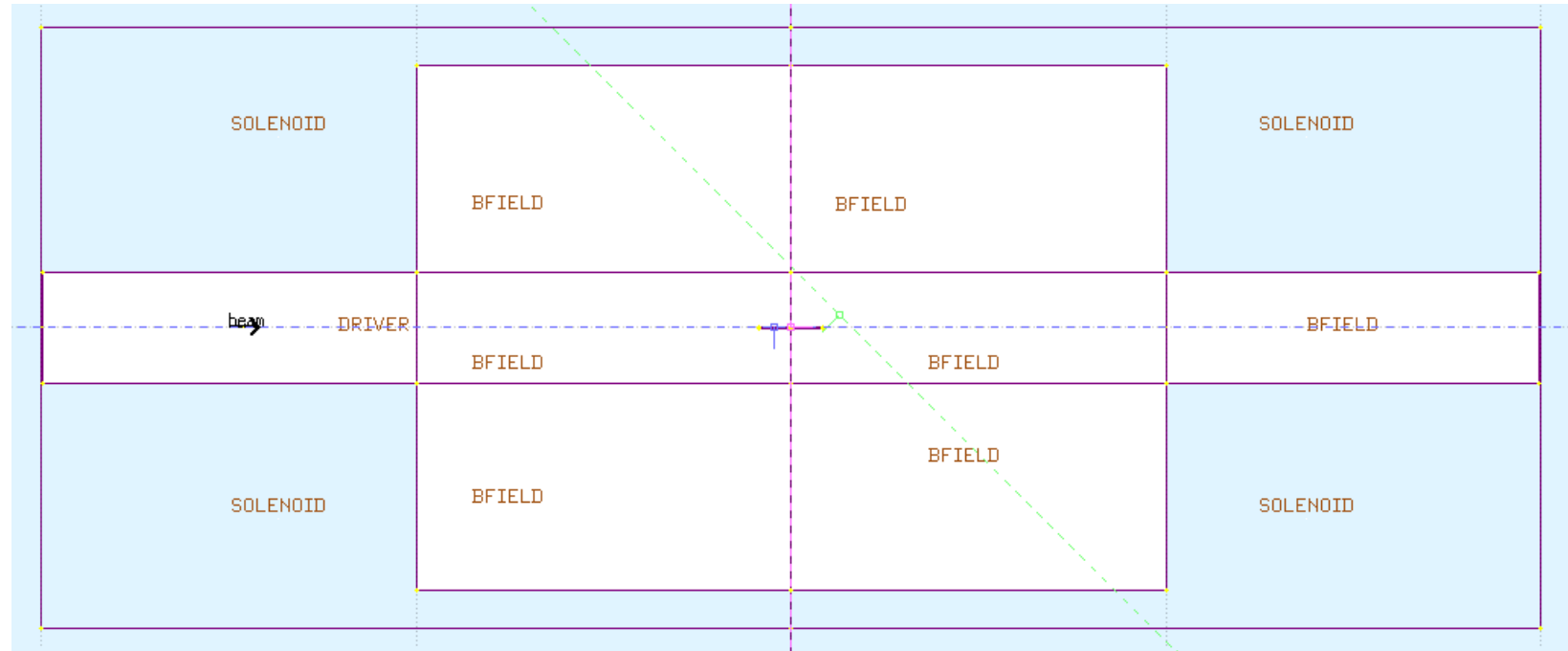
7/27/2026

Ruaa Alharthy

Shielding Module.
Target heads

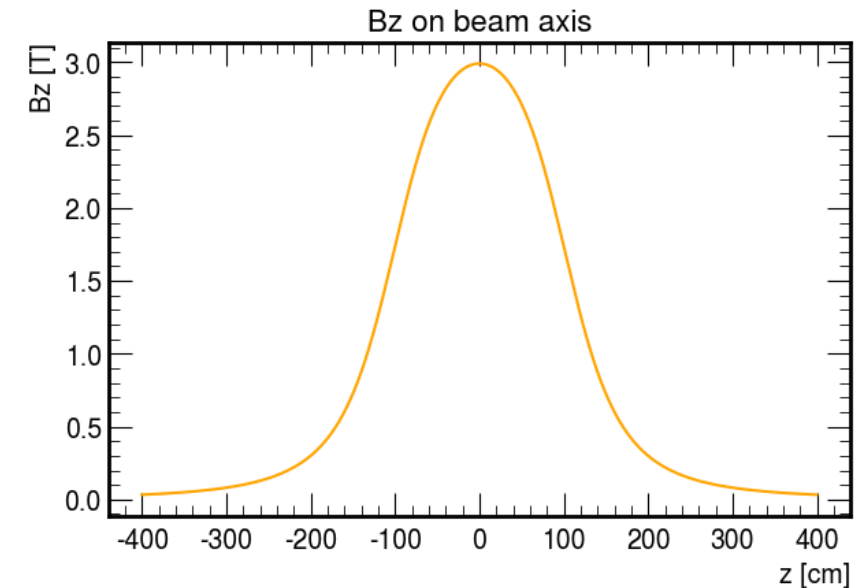
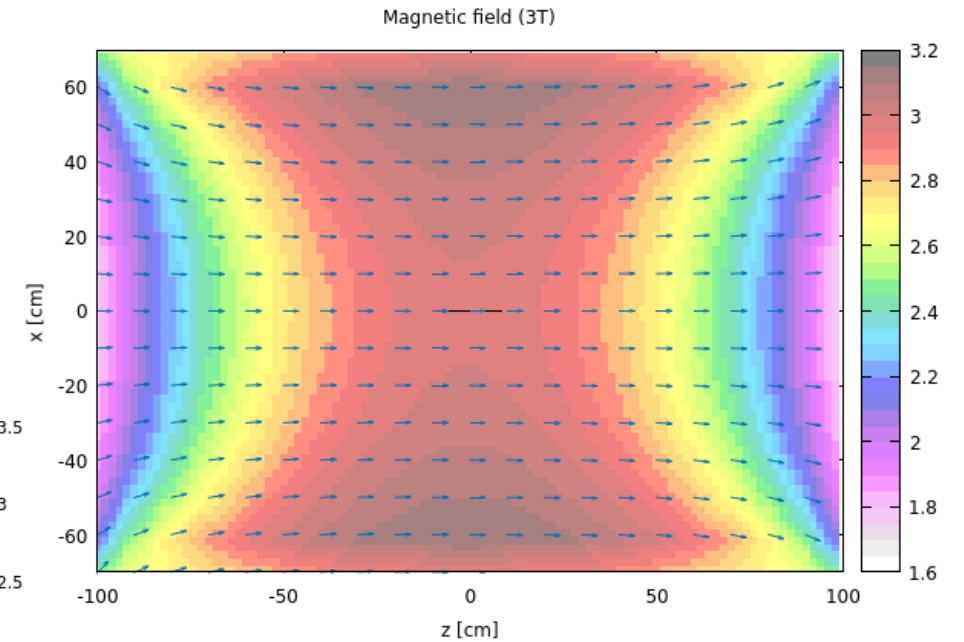
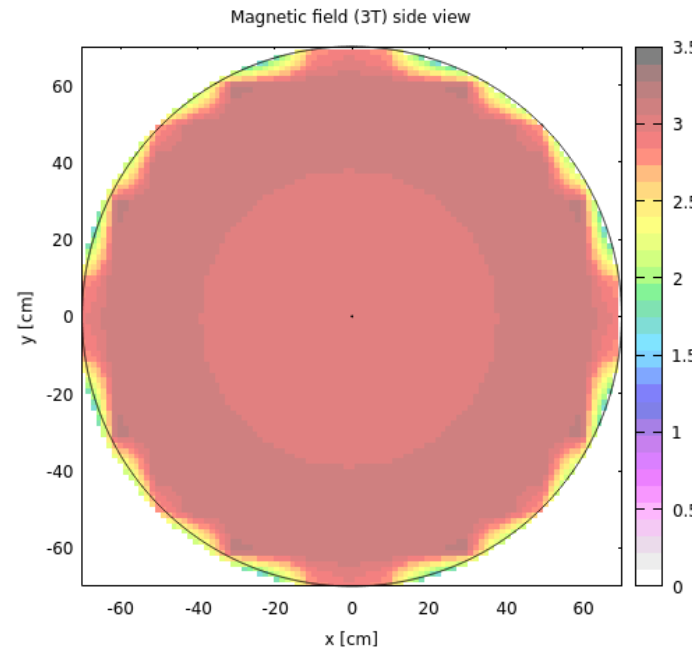
Geometry Setup

- The solenoid is 2m wide and has a radius of 70cm.
- The target is located at the center of the solenoid.
- For now, I chose the transport system to have an aperture that is 60cm wide.
- The driver section does not have magnetic field (to ensure the protons move in a straight line)
- Used 100,000 8GeV protons.



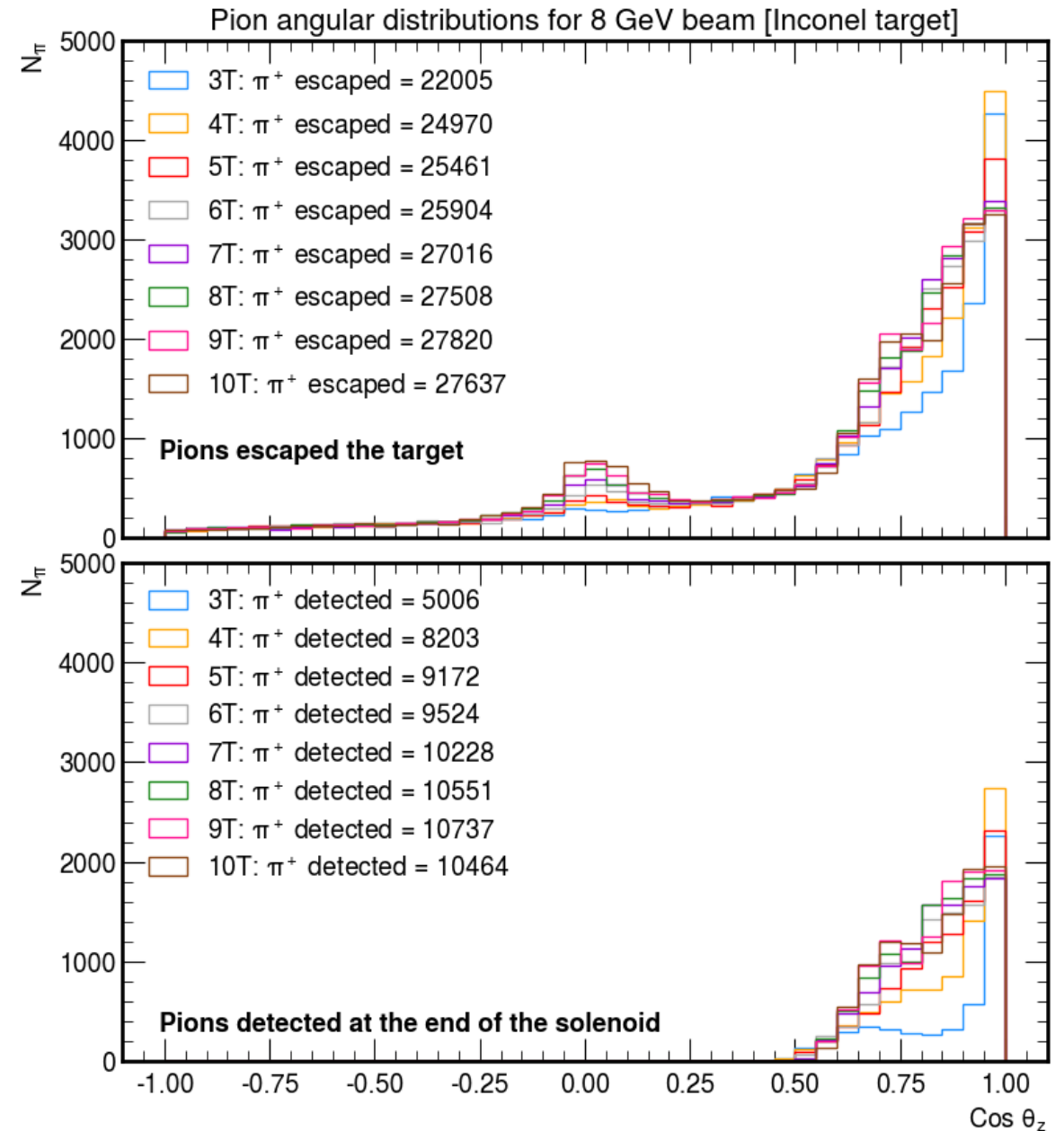
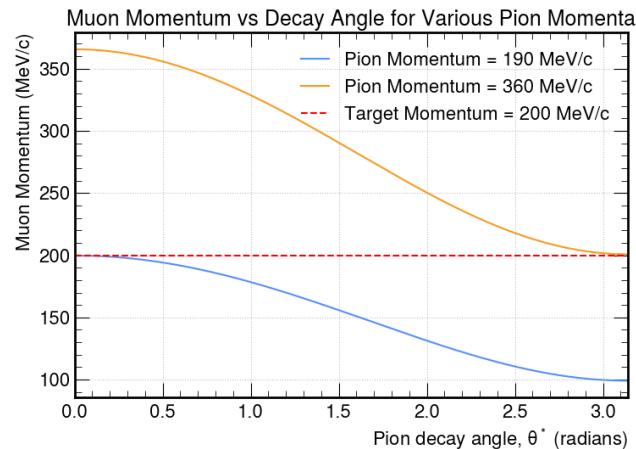
Magnetic field topology

- I created magnetic fieldmaps for 3T – 10T.
- Initially, I am planning to make a simple comparison of the performance of the different magnetic field strengths.
- I also made sure to include fringe fields that span 100cm outwards.

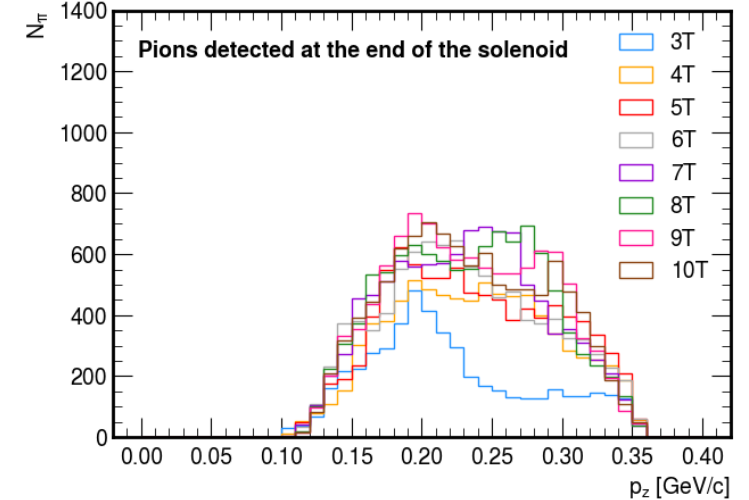
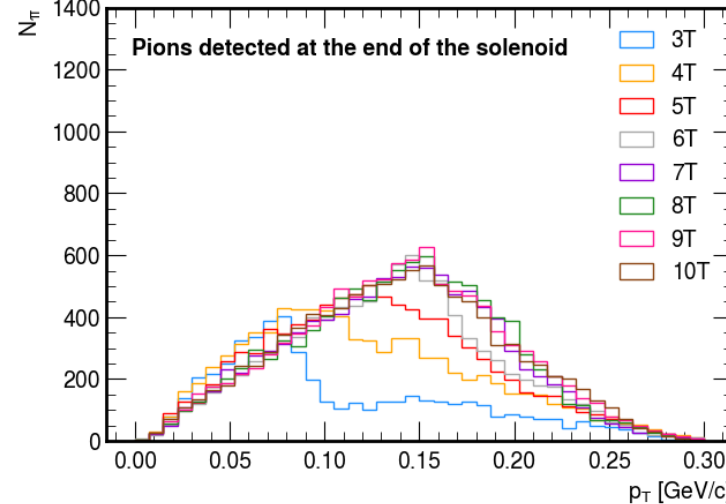
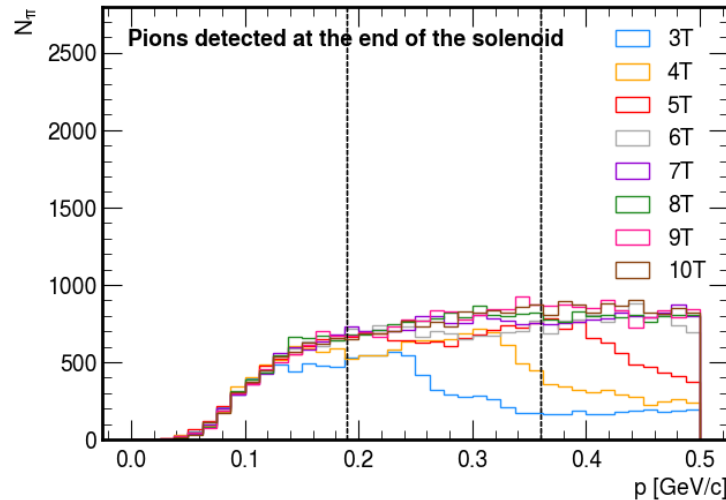
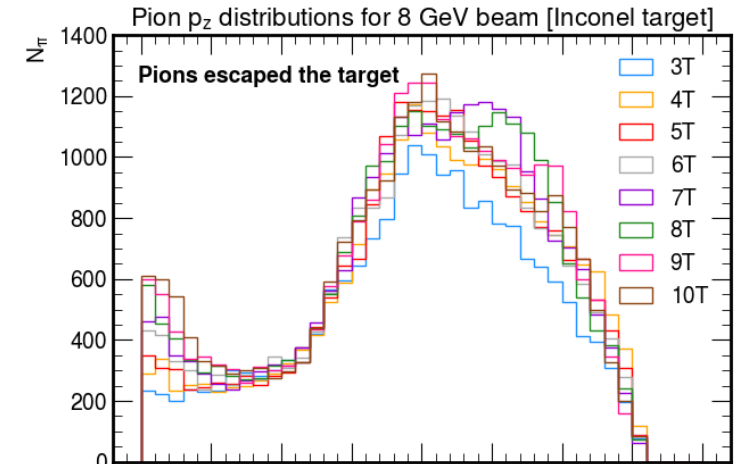
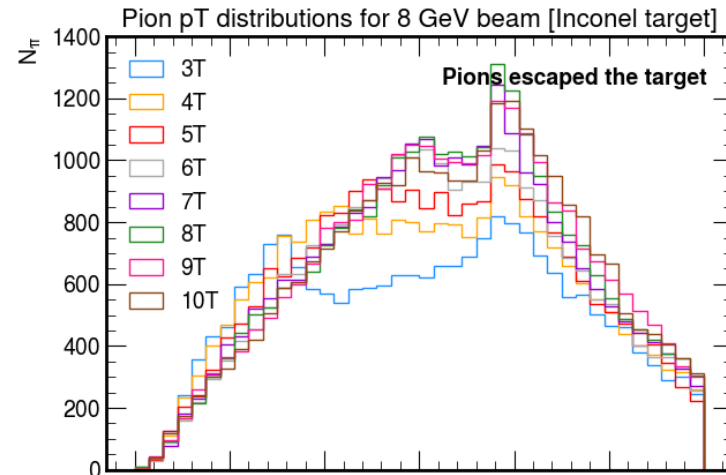
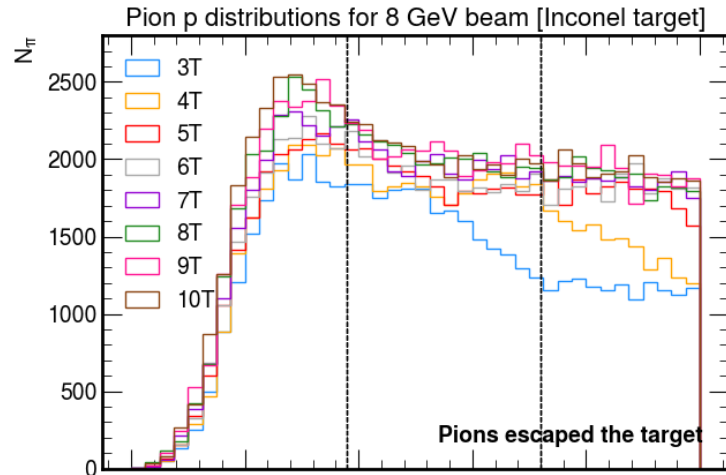


Angular distribution (select $0.19 < p < 0.36 \text{ GeV/c}$)

- Here I applied the momentum selection of 190-360 MeV/c for pions.
- Now we see an interesting shift in the pion angular distribution.
- Pions produced in 3T, 4T, and 5T solenoid tend to have higher $\text{Cos } \theta_z$ values than those produced in stronger magnetic fields.



Momentum distribution (select $0.15 < p < 0.25$ GeV/c)



Next steps

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- This is my first week at Fermilab and I will be staying here until the end of September.
 - I will have a meeting with Sergo and Katsuya to discuss and set goals for my summer project.