Designing a Wien Filter Model with General Particle Tracer[1]

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— The Continuous Electron Beam Accelerator Facility injector employs a beamline component called a Wien filter which is typically used to select charged particles of a certain velocity. The Wien filter is also used to rotate the polarization of a beam for parity violation experiments. The Wien filter consists of perpendicular electric and magnetic fields. The electric field changes the spin orientation, but also imposes a transverse kick which is compensated for by the magnetic field. The focus of this project was to create a simulation of the Wien filter using General Particle Tracer. The results from these simulations were vetted against machine data to analyze the accuracy of the Wien model. Due to the close agreement between simulation and experiment, the data suggest that the Wien filter model is accurate. The model allows a user to input either the desired electric or magnetic field of the Wien filter along with the beam energy as parameters, and is able to calculate the perpendicular field strength required to keep the beam on axis. The updated model will aid in future diagnostic tests of any beamline component downstream of the Wien filter, and allow users to easily calculate the electric and magnetic fields needed for the filter to function properly.

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