

Synchrotron Radiation in the Machine-Detector Interface

- Background Studies at FCC-ee & SuperKEKB -

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Overview: Belle II Solenoid & Magnetic Field

Reminder: 0 - Order Approximation

Improvements

Changes in Geant4 & Effects on the beam

Outlook

Detector Solenoid - General layout

Basic Properties

- superconducting coil provides 1.5 T
- antisolenoid
- volume of 1.8 m and 3.92 m (diameter & length)
- asymmetry w.r.t IP

Detector Solenoid - General layout

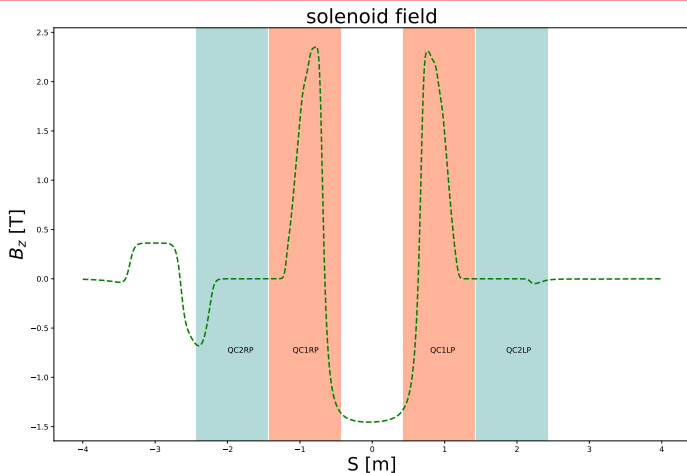


Figure: longitudinal field profile along LER, B_z , with detector components (s1er_phase2.1.sad).

Tilted Solenoid for LER - First steps in MDISim

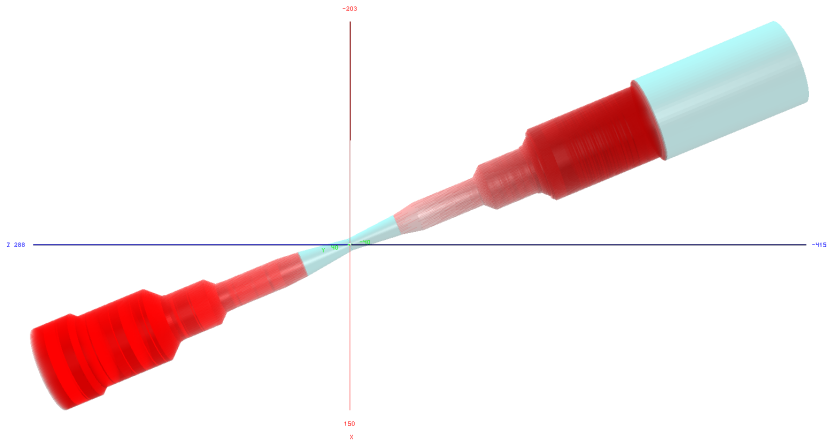


Figure: Field free drift in central region.

Tilted Solenoid for LER - First steps in MDISim

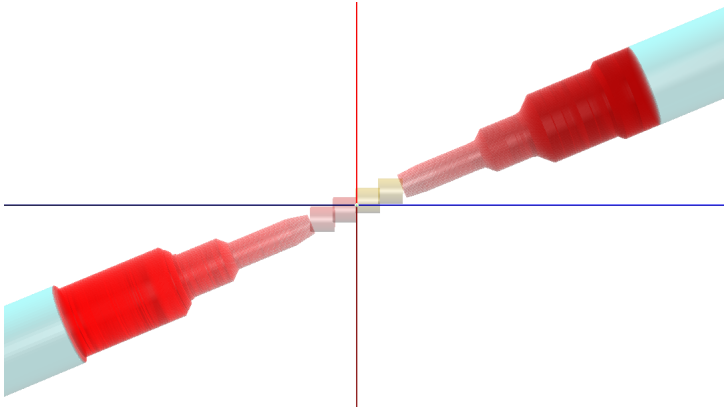


Figure: Replacing the drift with single solenoid elements, not rotated.

Tilted Solenoid for LER - First steps in MDISim

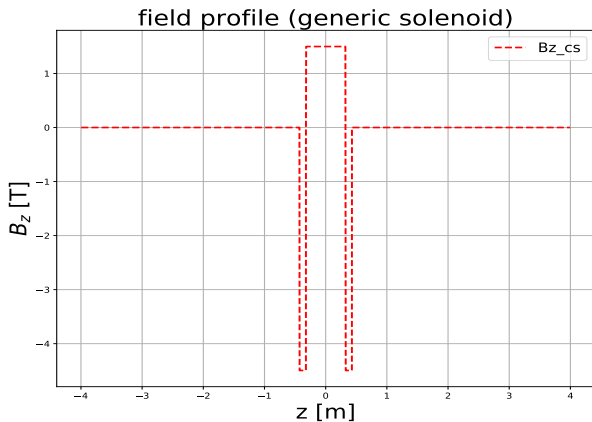


Figure: Magnetic field along particle path as returned by Geant4.

Tilted Solenoid for LER - First steps in MDISim

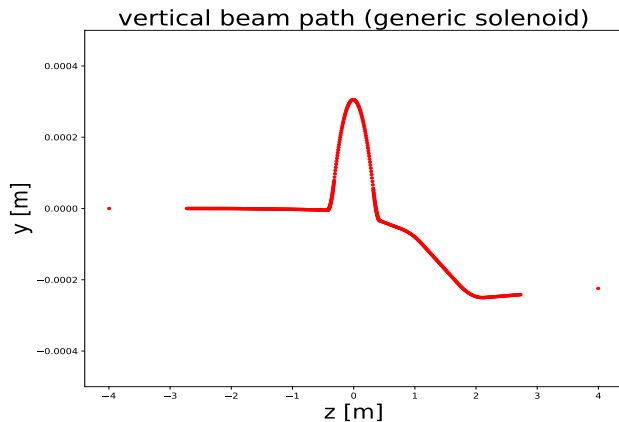


Figure: Deviation of the particle trajectory induced by solenoid field.

New/improved features

Geometry Changes

- working on Sad to Mad-X translator (K. Oide)
- detailed slicing still integral feature
- sequence now includes solenoid slices
- $L \neq 0$ outside final focus, $L = 0$ inbetween ($LRAD \neq 0$)
- detailed aperture information
- deriving fieldmap from `sler_phase2.1.sad`: SOL, QUAD
- modifying MDISim: `Fields_from_tfs` imports additional information (user choice)

New/improved features

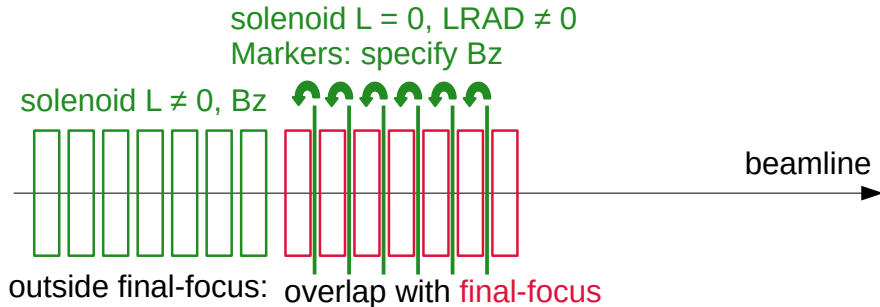


Figure: Principle of realizing field superposition.

New/improved features

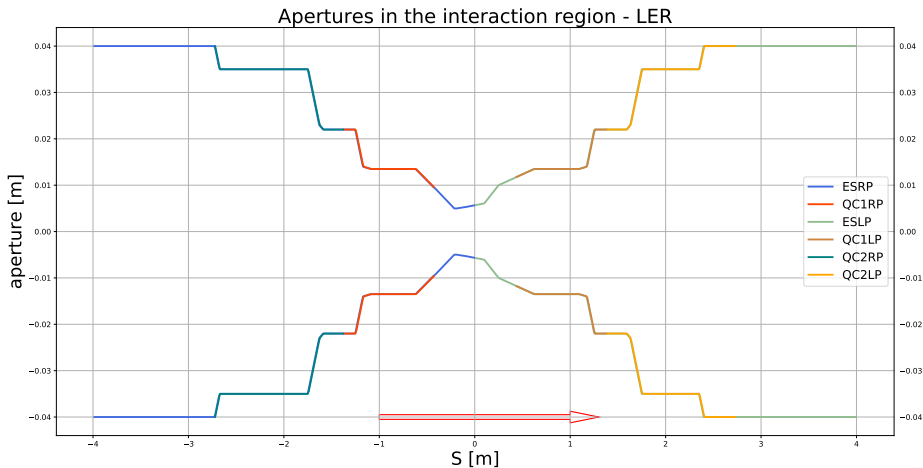


Figure: Aperture plot of the LER in the interaction region.

New/improved features

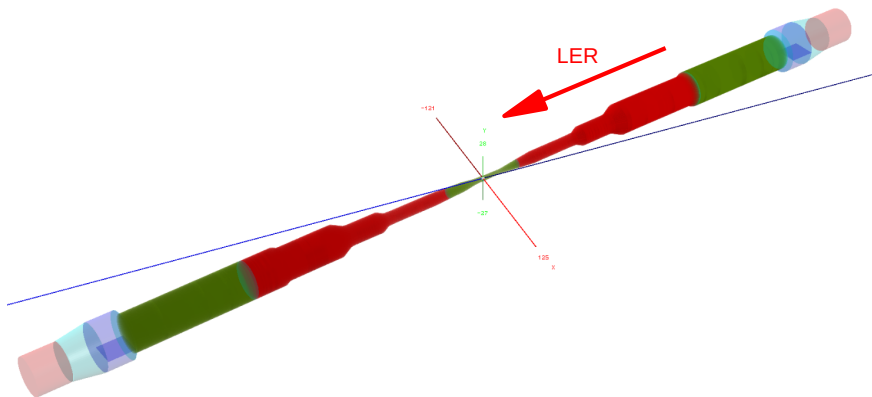


Figure: Geometry in Root Eve manager. Elements in green: pure solenoids, red: quadrupoles

Modifying the Geant4 quadrupole

- additional change to MDISim
- enable to accept another contribution
- global fieldmap vs local volumes
- use B_z from solenoid slices as 'on-top' component

Effects on the beam path

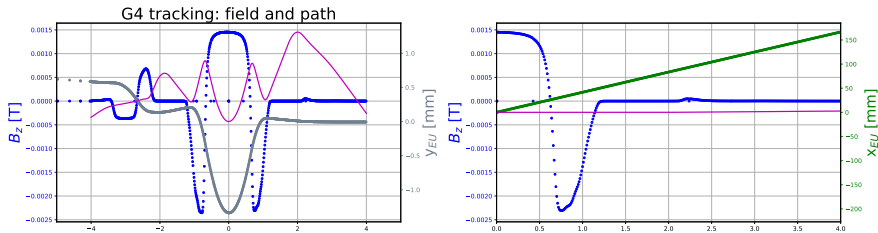


Figure: Results from tracking with realistic field map.

- reference path (sler_phase2.1.sad)
- z component magnetic field
- Geant4 beam path

Summary & Outlook

Towards more accurate IR field model

- solenoid representation more realistic
- overlap with final focus magnets
- no hard edge model
- further estimates possible (beam dynamics; SR)

Summary & Outlook

Continue SR study

- beam displacement and beam halo
- P_{SR} from solenoid and FFQ's
- P_{SR} deposition
- Visit to KEK in April \Rightarrow **finalize the model; possible benchmark**
- **Application on FCC-ee**