Background Studies in the FCC-ee MDI
First steps with MDISim
Synchrotron Radiation from Bending Magnets

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FCC-ee MDI Meeting April 3, 2017

Goals of this study I - Software

- ▶ Understanding the programs
- ▶ Working on personal setup

Combined programs in toolset MDISIM :

1. Machine Lattice Description, generate twiss, survey files: MAD-X

2. Visualization. Visualize geometry and analytic estimates like SR: ROOT

3. Detailed particle tracking. Simulate passage of particles through Matter: GEANT4

Goals of this study II - FCC-ee MDI

- ▶ IR, especially transition beam pipe - detector
- ▶ Focus on background processes (tbc):
    - ▶ Synchrotron radiation
    - ▶ Beam-gas
    - ▶ Beam-Beam
- ▶ Using GEANT4 to:
    - ▶ do detailed simulation of last 20 m
    - ▶ include basic detector models
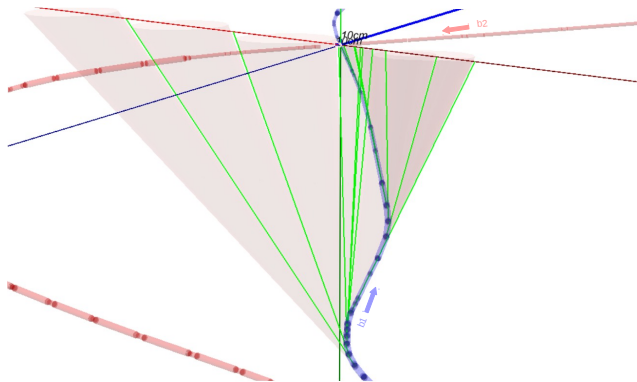- ▶ Possibly extend/improve MDISIM

Figure: Upstream view of b1. Last couple of magnets with estimated SR cones. Note: optics version 85

- E_c
- n_γ
- SR power P_S

- Location (distance)
- Bending radius
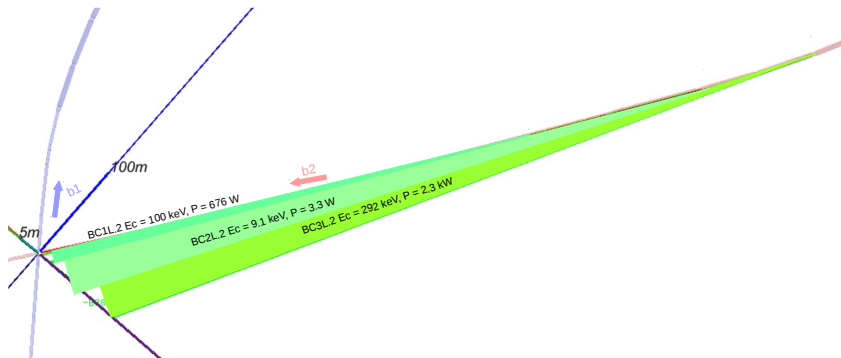- Field

This stage already allows basic understanding of the layout

Figure: SR fans of BC3L.2, BC2L.2 and BC1L.2 upstream of b2.

- ▶ SR fans and affected areas
- ▶ Estimating E_c and P_S
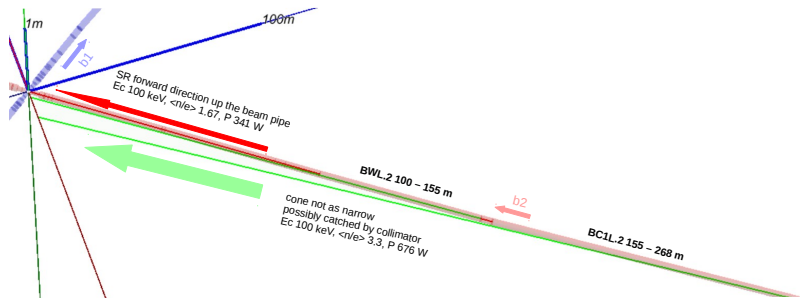
Figure: Magnets BC1L.2 and BWL.2 upstream of b2.

- E_c about 100 keV or slightly below
- Narrow and straightforward cones
- Protection of IP challenging?

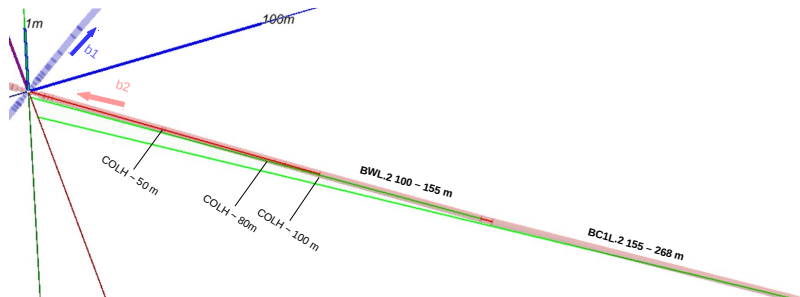# First Outlook on Next Step
Things to be investigated in more detail

Figure: Possible collimator positions upstream of b2.

Collimator locations?

- Far off vs. closer to the IP
- Material and geometry
- Interaction with the beam/ beam dimensions

Program chain

- Further setting up toolchain
- Combine ROOT with GEANT4
- Detailed particle tracking (SR γ)

Boscolo, M., Burkhardt, H., and Sullivan, M. (2017).
Machine detector interface studies: Layout and synchrotron radiation estimate in the future circular collider interaction region.
Physical Review Accelerators and Beams, 20(1).