

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

Marian Lückhof



Universität Hamburg

FCC-ee MDI Meeting April 3, 2017

Scope of the Project - Where we're heading?

Studying FCC-ee MDI, PhD, started on 01/03/2017



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

MDISIM and Output

First results with details on magnets and SR [Boscolo et al., 2017]

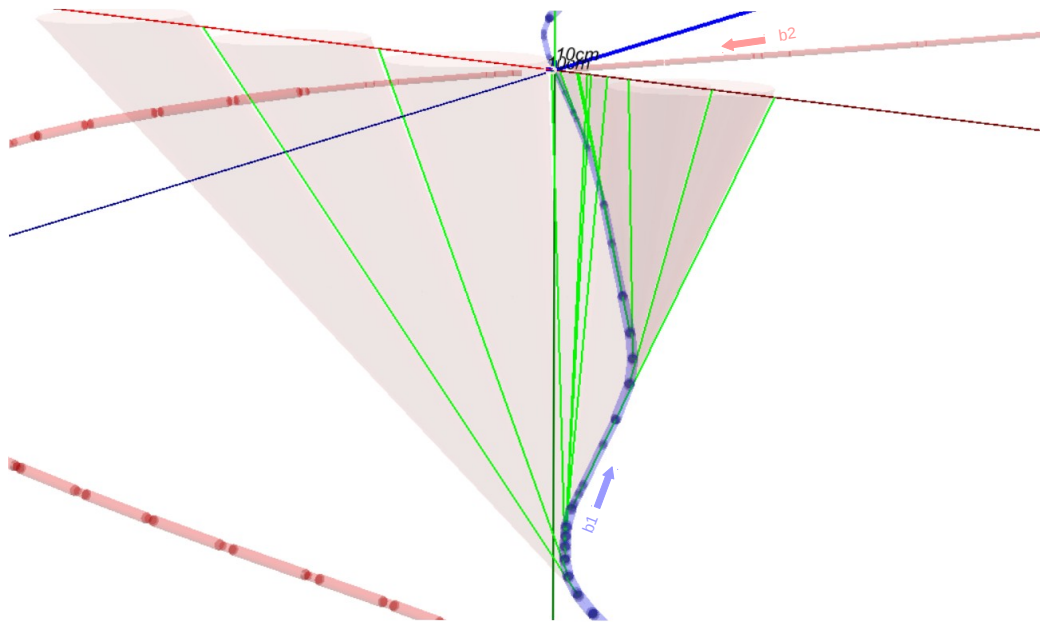


Figure: Upstream view of b1. Last couple of magnets with estimated SR cones. Note: optics version 85

- ▶ E_c
- ▶ n_γ
- ▶ SR power P_S

- ▶ Location (distance)
- ▶ Bending radius
- ▶ Field

Details on Lattice Elements

Example I: SR cones on last 600 m



This stage already allows basic understanding of the layout

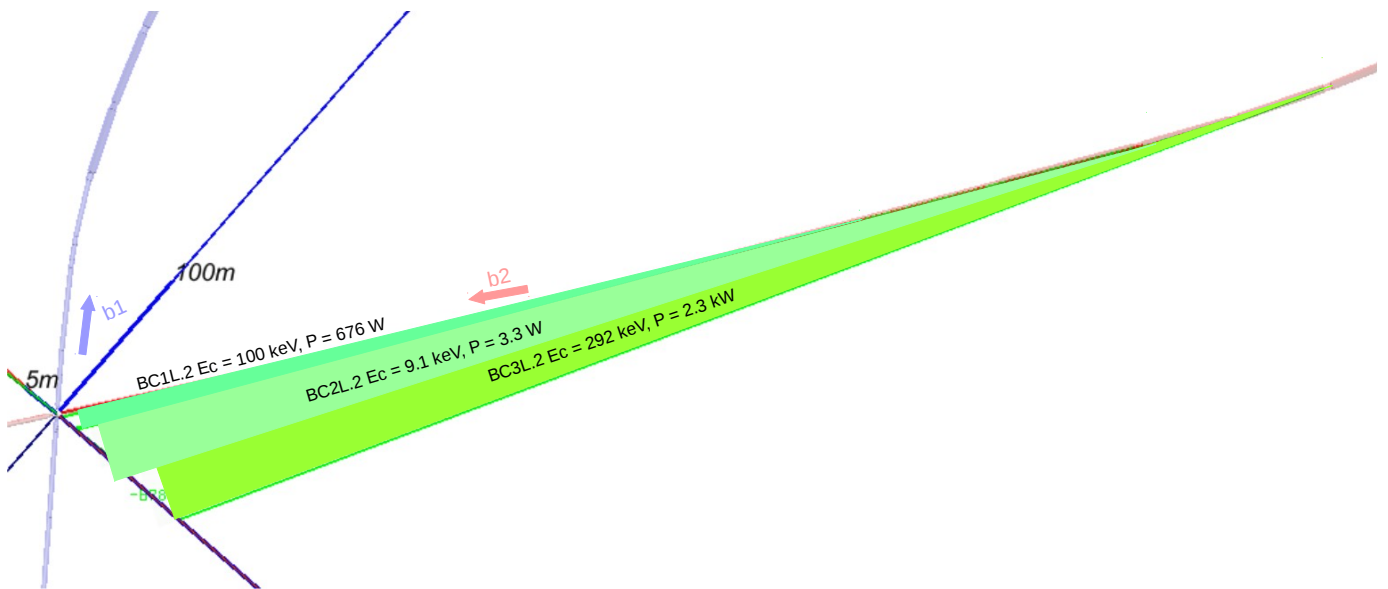


Figure: SR fans of BC3L.2, BC2L.2 and BC1L.2 upstream of b2.

- ▶ SR fans and affected areas
- ▶ Estimating E_c and P_s

Details on Lattice Elements

Example II: top view on last 270 m

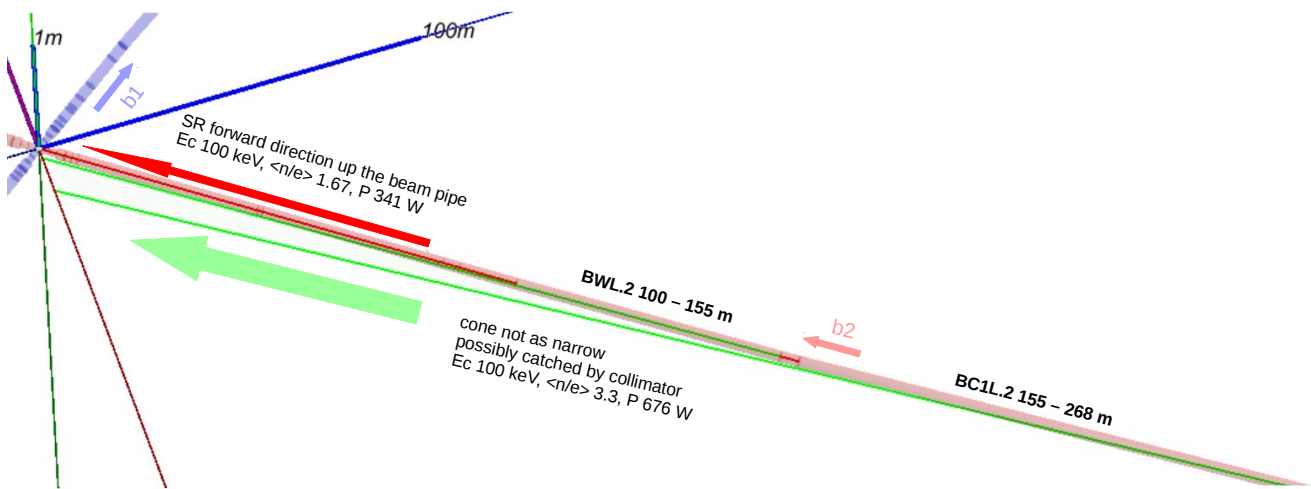


Figure: Magnets BC1L.2 and BWL.2 upstream of b2.

- ▶ 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

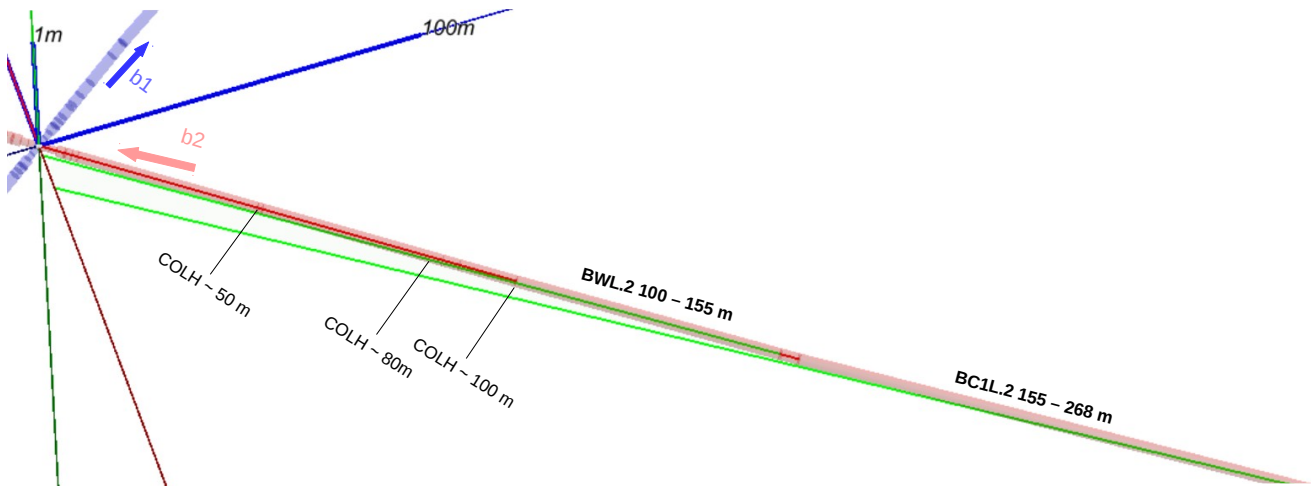


Figure: Possible collimator positions upstream of b2.

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)

References



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).