Effect of synchrotron radiation and chamber properties on LHC electron-cloud heat load

Effects of the sawtooth and its orientation

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Section 1

Synrad3D
Key parameters

- Vacuum chamber
  - Material - 10 nm C over Cu
  - Surface roughness - $\sigma = 50$ nm
- Lattice - Taken from http://lhc-optics.web.cern.ch/
- Geometry
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Geometry

Green is a beam seeing a correct orientation.
Red is a beam seeing an inverted orientation.
Normalized photon absorption functions

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Normalized absorption at top and bottom of the chamber

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Section 2

PyECLoud
Key parameters

- SEY values from 1.0 to 1.7 in 0.1 steps.
- Proton Beam Energy of 6.5 TeV
- Vacuum chamber used is rectellipse
- Filling pattern, repeated 4 times
  - 72 particle-filled bunches
  - 8 empty bunches
- Bunch spacing of 25 ns
Linear Density

Electron linear density for a SEY = 1.3

- Correct Sawtooth Pattern
- Inverted Sawtooth Pattern
- Smooth Surface

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Linear Density

Electron linear density for a SEY = 1.4

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Linear Density

Average linear density as a function of SEY

- Correct Sawtooth Pattern
- Inverted Sawtooth Pattern
- Smooth Surface

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Heat Load

Average heat load as a function of secondary emission yield (SEY)

- Correct Sawtooth Pattern
- Inverted Sawtooth Pattern
- Smooth Surface

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Future Work
Future Work

- Use a more realistic model of the sawtooth pattern
- Use different values of the surface aspect ratio and surface roughness to determine the importance of these values.
- Use filling patterns from 2017 and 2018
- Work on the quadrupoles
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