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BESSY III intra-beam scattering and touschek lifetime calculations

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The 4th generation synchrotron light source, BESSY III, is expected to enable high-impact applications for users in life science, material science, energy and catalysis materials, and more. Currently in its Conceptual Design Report (CDR) phase, the feasibility of BESSY III's ambitious parameter range necessitates a thorough assessment of "collective effects". These phenomena can either compromise beam stability or degrade beam quality, potentially hindering the expected performance. In this work, we present recent estimations of the Intra Beam Scattering (IBS) and Touschek lifetime for the BESSY III lattice. The IBS leads to an increase in longitudinal and transverse emittances, it is described through the IBS growth rates and equilibrium emittances. Both quantities were computed with the ibsEmittance module from elegant and a newly implemented module in Xsuite. The Touschek effect induces beam losses along the storage ring resulting in a shorter beam lifetime. Its effect was computed using pyAT. Finally, the impact of different emittance coupling factors is studied to mitigate both effects, laying the first stone for future studies with higher-harmonic cavities.

Footnotes

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