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Benchmarking Intrabeam Scattering with RF-Track

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Intra-beam scattering (IBS) has recently gained significant interest in the community of free electron lasers (FELs), as it is believed to produce an increment in the sliced energy spread (SES), which is detrimental to FEL performance. To control and contain this phenomenon, it is important to include IBS in the design phase of an FEL through appropriate numerical simulation. Most existing codes that simulate IBS were developed for long-term tracking in circular lattices, assuming Gaussian bunches. Unfortunately, this assumption doesn' t capture the rapid bunch evolution of electron bunches in photoinjectors. To address this limitation, the tracking code RF-Track has recently been updated to include IBS, using a novel hybrid-kinetic Monte Carlo method.
This paper presents benchmarks performed to verify the implementation. The predicted SES increment in the beam due to IBS using RF-Track has been compared against a kinetic approach used in a different tracking code and, secondly, against a semi-analytical model. The results showed a good agreement, setting RF-Track as a tool to understand and control the SES growth in photoinjectors and, in particular, in FEL.

Footnotes

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