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DFCSR: A Fast Calculation of 2D/3D Coherent Synchrotron Radiation in Relativistic Beams

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Coherent Synchrotron Radiation (CSR) is regarded as one of the most important reasons that limits beam brightness in modern accelerators. Current numerical packages containing CSR wake fields generally use 1D models, which can become invalid in extreme compression regime. On the other hand, the existing 2D or 3D codes are often slow. Here we report a novel particle tracking codes — DFCSR — which can simulate 2D/3D CSR and space charge wakes in relativistic electron beams 2 or 3 order of magnitude faster than conventional models like CSRtrack. We performed benchmark simulations based on FACET-II beams, where electron beams are compressed to reach 300kA peak current. The tracking code is written in Python and C programming languages with human-friendly input styles and is open-sourced on Github. It can serve as a powerful simulation tool for the design of next-generation accelerators.

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Footnotes

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Yes

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