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Beam dynamics study of a CW L-band SRF gun for the high duty cycle EuXFEL

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The upgrade of the European XFEL to support a future high duty cycle (HDC) operation mode requires new design concepts for the photoinjector. In particular, the electron gun is crucial for achieving high quality beams at high peak currents. Among other variants, a 1.6-cell TESLA-type RF-gun is the preferable solution for the HDC EuXFEL. The SRF gun design, however, requires the application of unconventional emittance compensation schemes. One alternative is embedded RF focusing by means of a retracted cathode. Such a scheme has been previously successfully tested, e.g., at the ELBE accelerator of the HZDR. However, the beam dynamics characterization and parameter optimization for this design remains a challenge. This is primarily due to the 3D geometry of the cathode region, which cannot be easily handled by available tracking codes. In this work, we present a simulation and optimization study of the EuXFEL injector line including the geometrical and space charge effects related to a retracted-cathode SRF gun design.

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Footnotes

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