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Unwanted beam studies for the SRF photoelectron gun at SEALab

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The desired electron beam from the Superconducting Radio-Frequency photoelectron gun (SRF gun) at SEALab has tailored properties for its specific application. There are, however, sources of unwanted electrons from field emission and other processes, that may lead to beam losses and limit the performance of the SRF guns. This paper studies potential unwanted beam generation and transport mechanisms. Using the electromagnetic field profile of the SRF gun, the Fowler-Nordheim model is applied to calculate the spatiotemporal emission distribution of electrons from the SRF cavity walls and the photocathode. These electrons are then tracked through the complete SRF gun beamline to locate potential loss sites and to predict power deposition in the electron beamline. Additionally, the properties of the unwanted beam are studied in contrast to the main beam to understand the optics and characteristics of the former and tackle mitigation strategies.

Footnotes

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