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## Dark current study of a normal conducting VHF band RF gun

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The room temperature VHF RF gun which can provide high brightness beams with MHz repetition rate is one of the candidates for the electron source of a high-repetition-rate FELs. The VHF RF gun operates at continuous wave (CW) mode with high cathode gradient and high accelerating voltage. The dark current is critical to the performance of the downstream SRF cavities, undulators and beam line electronic equipments. In this paper, we will introduce the efforts to reduce dark current, including the dimension optimizations of plug vicinity and cavity inner surface treatment techniques. Besides, we adopted stainless steel instead of oxygen free copper as the material of cathode plug hole trying to decrease the field emission strength. The trajectories of the field emissions from high electric field regions were tracked. The dark current energy depositions on anode and cathode nose were calculated. The dark current transmission ratio from the gun to the downstream faraday cup was simulated. We also analyzed the plug insertion depth effect on the dark current transmission. Plugs with different insertion depth were fabricated. The dark current measurements will be reported in this paper.

### Footnotes

### Funding Agency

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