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Performance of the high-brightness SRF CW photo-electron gun

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Next generation X-ray FELs (XFELs) are rapidly moving towards CW operation, which brings the new requirements on high quality of the CW electron sources. such as a superconducting RF (SRF) electron gun. While operation in SRF environment can be quite challenging, the quality of the generated beams is rather rewarding [1-4].

We report on our unique experience with the record performing SRF electron gun equipped with warm CsK2Sb photocathode. The gun is generating high charge electron bunches (up to 20 nC/bunch) and extremely low transverse emittances suitabel for X-ray FELs. We present study of the transverse beam emittance from the gun, including our experimental results and numerical simulations. We also presnt initial results of operating the gun with GaAs photocathode. In addition, we disucss accelerating scheme based on our photoinjector, which can satisfy the high requirements for the new generation FELs.

We report on our unique experiences with the only operational low emittance photo-electron SRF CW gun: we report the challenges, problems but also our breakthroughs in this challenging technology

Footnotes

[1] Physical Review Accelerators and Beams 21, 082001, 2018
[2] Phys. Rev. Lett. 124, 244801 (2020) -
[3] Scientific Reports 11, 4477 (2021)
[4] Phys. Rev. Accel. Beams 25, 092001 (2022)

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