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## Surface plasmon enhanced photocathode R&D at DESY for CW photoinjector for future CW and high-duty-cycle European XFEL\*

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The future upgrades of the European XFEL (EuXFEL) foresees continuous wave (CW) and High-Duty-Cycle (HDC) operation requiring a CW electron photoinjector. Motivated by this, a 1.6-cell superconducting radio frequency (SRF) electron gun cavity is under development at DESY. Recently, the DESY CW SRF gun cavities out of niobium with a copper cathode screwed directly to the cavity's back wall demonstrated a peak electric on an axis field of up to 55 MV/m. The design of the DESY gun cavity requires air-stable photocathodes, limiting the choice of photocathode materials to metals. Presently, copper is the baseline photocathode material. However, photoinjector operation at high repetition rates using a copper photocathode is challenging due to laser power limitations in the UV range. Therefore, we are exploring methods to enhance the quantum efficiency (QE) of metallic photocathodes to allow higher repetition rates. In this work, we report our current progress on numerical and experimental efforts towards metal cathodes with enhanced photoemissive properties.

### Footnotes

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