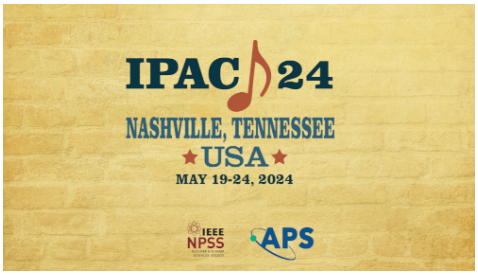

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Two slit emittance measurement with thermal emittance isolation for an SRF injector

Sunday 19 May 2024 14:00 (4 hours)

This study focuses on the beam source for the LCLS-II-HE Low Emittance Injector (LEI) design: a state-of-the-art superconducting radiofrequency (SRF) gun. The LEI is intended to enable extending the LCLS-II-HE' s useful photon energy to 20 keV without additional cryomodules. We consider a robust two-slit emittance measurement optimized for the LEI SRF gun, compatible with the current LEI gun-to-linac beamline design, and extensible to measuring photocathode mean transverse energy (MTE) with the cathode at or below 4 K. In-situ measurement of photocathode MTE, and evolution thereof, could help optimize the overall performance of the LEI.

A two-slit method enables determination of the detailed phase-space distribution of the electron bunch, beyond the normal Twiss parameters and emittance provided by methods such as solenoid scans. Additionally, we investigate the RF emittance by recessing the cathode. This allows us to study the influence of the RF field on the bunch phase space.

In summary, our work introduces a cutting-edge two-slit emittance measurement methodology that combines different emittance-dampening techniques to isolate intrinsic emittance from the photocathode. Detailed results will be presented at the workshop to highlight established trends, dependencies, and a summary/concept of the future photocathode characterization beamline implementation.

Footnotes

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