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Dark current in the LCLS-II Injector: characterization and mitigation strategies

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In addition to the desired electron beam, RF photoinjectors such as the one in LCLS-II produce dark current via field emission. Left unchecked, the dark current can cause various operational issues in the accelerator, such as increased radiation, damage to accelerator components and diagnostics, and desorption of gases from vacuum chamber surfaces. In this contribution, we present measurements of the dark current in the LCLS-II injector, including imaging, current, and energy distributions of the observed dark current emitters. These measurements allow us to characterize each emitter in terms of the Fowler-Nordheim model of field emission, which in turn enables us to more accurately model the behavior of the dark current in the accelerator. Taking these results into account, we also present potential active and passive mitigation strategies.

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