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Effects of dark current in high brightness RF photoguns

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The behavior of high gradient rf cavity is improved via the reduction of RF breakdown rates by operating at cryogenic and temperatures. These studies are largely empirical but they present a new paradigm in the future of high gradient capital operation. Peak electric fields >200 MV/m are sustainable at S and C band frequencies. These fields while sustainable produce more dark current than is ideal for high brightness beam production. We present investigation into the dark current limits on high brightness beam performance, especially in the case of an RF photogun where beam dynamics is most sensitive. We also present mechanism for reducing the effects of dark current on bright low charge electron beams produced in high gradient photoguns. Specific interest is spent considering reentrant nosecone geometric for high shunt impedance cavities.

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