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**A Two Frequency Thermionic Cathode Electron Gun** JON EDELEN, SANDRA BIEDRON, JOHN HARRIS, Colorado State Univ, JOHN LEWELLEN, Los Alamos National Lab, STEPHEN MILTON, Colorado State Univ — When an un-gated thermionic cathode is operated in an RF gun, some fraction of the emitted electrons will return to the cathode due to the change in sign of the electric field in the gun. This back-bombardment current causes heating of the cathode, and this reduces the ability of the cathode heater to control the bunch charge. In this paper, we investigate the use of a two frequency  $TM_{010}/TM_{020}$  electron gun to mitigate this effect. Simulations revealed that for a 100-pC bunch charge operating at 10MV/m gradient the harmonic field produced a 63% reduction in the back-bombardment power.

Jon Edelen  
Colorado State Univ

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