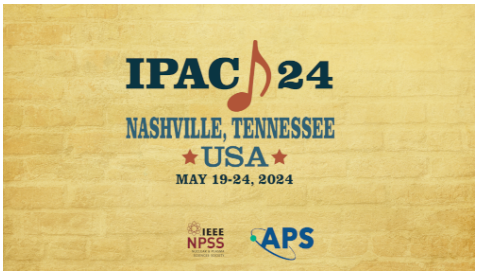

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Transmission characteristics of dark current in a 1.4-cell RF photocathode gun

Thursday, 23 May 2024 16:00 (2 hours)

One effective method to improve the brightness of an RF electron gun is to increase the acceleration gradient of the photocathode to suppress space charge effects. However, this increases the risk of field emission from the metal surface, which becomes a significant factor limiting the further improvement of the electron gun performance. The dark current formed by field emission electrons leaving the electron gun can affect downstream accelerator structures. This paper thoroughly analyzes the critical characteristics of dark currents from various possible emission positions. By constructing a transmission matrix from the cathode to the fluorescent screen, we simulate the image of dark currents on the fluorescent screen and obtain the magnification factor. Based on this, we determine the position of the field emission source. Additionally, we consider the manipulation of the dark currents by the electron gun and solenoid and construct a 4×4 transmission matrix to track the behavior of dark current imaging on the fluorescent screen and analyze their distribution characteristics. The results show a good agreement between the calculated and simulated results.

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