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Beam Dynamic Simulation of the Thermionic RF Electron Gun with Self-generated Cathode Emission

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A thermionic RF-gun is an essential component in electron injector for producing a quality electron beam for a THz radiation source at Plasma and Beam Physics Research Facility, Chiang Mai University. The RF gun consists of one and a half normal conducting resonant cavities and a side-coupling cavity which operates in pi/2-mode at frequency of 2856 MHz. In 2014, the gun design was improved by changing the position of a RF input port from horizontal coupling plane to the vertical plane in order to obtain symmetry beam at the gun exit. In this work, geometry of each main accelerating cell as well as the position of the side-coupling cavity are modified to have more symmetric electromagnetic field simulated by using the CST Microwave Studio. Beam dynamic study is performed by using PARMELA. In addition, we created the initial thermionic particle distribution obeying Maxwell-Boltzmann distribution for PARMELA simulation instead of the built-in distribution. The transverse and longitudinal profiles of the beam at cathode and gun exit are compared with the case of the built-in distribution. Furthermore, this self-generated distribution can be used as an initial thermionic emission distribution for the charged particle tracking code, ASTRA. The comparison of beam profiles at gun exit which simulated by PARMELA and ASTRA is presented and discussed in this paper.

Primary authors: SAISA-ARD, Chaipattana (Chiang Mai University); RIMJAEM, Sakhorn (Chiang Mai University)

Presenter: SAISA-ARD, Chaipattana (Chiang Mai University)

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