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Influence of Asymmetric Electromagnetic Field Distributions in an RF-gun on Electron Beam Properties

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The electron source of the linear accelerator system at the Plasma and Beam Physics Research Facility, Chiang Mai University, is a thermionic cathode radio-frequency (RF) electron gun. The gun is a pi/2-mode standing wave structure composing of two S-band RF accelerating cells and a side-coupling cavity. The 2856 MHz RF wave is transmitted from the klystron to the RF-gun through a rectangular waveguide input-port. The RF input-port and the side-coupling cavity are the cause of asymmetric electromagnetic (EM) field distributions inside the gun. This leads to an asymmetric beam transverse shape and the increase of the beam emittance at the gun exit. The problems can be enlarged when the beams are transported from the RF-gun through the whole accelerator system, which consists of an alpha magnet, a travelling wave linear accelerator, magnet elements and related beam diagnostic components. To investigate the influence of the asymmetric EM fields on the electron beam properties at the experimental station, beam dynamic simulations are performed by using the computer code PARMELA. The input 2D and 3D EM field distributions are obtained from the RF modeling programs SUPERFISH 7.19 and CST Microwave Studio 2012. Simulation results by using both 2D and 3D field distributions are compared and reported in this contribution. This work has been supported by the CMU Junior Research Fellowship Program, the Development and Promotion of Science and Technology talents project (DPST), and the Department of Physics and Materials Science, Faculty of Science, Chiang Mai University.

Summary

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