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Evaluation and analysis of the factors influencing the electron beam dynamics through the buncher of LINAC

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Abstract

In this paper, the importance of the buncher in linear electron accelerators is discussed and two types of bunchers, velocity-modulation and disk-loaded, are introduced. Higher bunching factor, larger initial phase range, and smaller final phase range are favorable in the disk-loaded buncher. Our investigations showed that the aforementioned situations can be met by appropriate changes in the field strength and the phase velocity. In this study, factors affecting the bunching of electrons have been surveyed using the equations of electron motion. The dynamics of the electron movement through the buncher has been simulated. The results of simulation and calculations revealed that: (1) in order to deliver the maximum energy to the electrons, phase velocity should vary so that a phase of -90 degrees is achieved by the electrons after the bunching, (2) reducing the initial field strength also increases the initial phase range. If the field strength is large from the beginning, the phase velocity variations will be large and rapidly reach a value of 1. In this case, the initial phase range will become small, (3) the electron gun voltage changes the initial phase; the larger the value of the gun voltage, the wider the initial phase range, and vice versa. The result of this study is going to be applied for design and fabrication of the first Iranian linear accelerator that is under construction.

Keywords: electron beam dynamic, LINAC, buncher design

For full article, refer to the Persian section