PW-P007

A Simulation Study of a Chopping System for Extracting a Pulsed Beam from a Cyclotron

김재홍, 홍성광, 김미정, 김성준, 김명진, 김도균, 윤종철, 김종원

중이온가속기구축사업단, 기초과학연구원

Cyclotron-accelerated ion beams are used for various researches, such as nuclear physics, nuclear chemistry, biotechnology, and material sciences including radio-isotope production. Recently considerable applications are asked to the cyclotron development undertaken to meet user requirements of various ions'energies, intensities, and their pulsed beams. For instance, a cocktail beam acceleration technique rapidly changing the ion species and energies was developed to irradiating integrated circuit chips. Also a chopping system in a cyclotron injection line is considered for producing a pulsed ion beam with a relatively long period compared with that generated by the resonance frequency. For the research in neutron time-of-flight measurement, a single-pulsed beam with a repetition interval of the order of mili-seconds or longer is necessary to have a good resolution and to remove background events. In this paper a feasibility of pulsed beam with an external ion source is simulated by adopting a combination system of a chopper accompanying with a bunching stage in the injection line and an additional chopper after the exit of the cyclotron in order to produce beam pulses with a range of 1 μs～1 ms periods from a resonance RF cycle. The pulseperiod will be adjusted by chopping the number of beam bunches from the injected pulses in the injection line. However, the longer pulses will have reduced number of beam pulses and sacrificed beam currents. Because the beam users need an intense single pulsed beam, a careful tuning of the acceleration phase and a high-intense external ion source are necessary to achieve an intense single-pulsed beam from the cyclotron. It is essential to strictly match the acceleration phase of injected beams in the central region of the cyclotron to improve its efficiency. An effect of space charge at each pulse from the ion source will be also considered.

Keywords: Pulsed beam, Cyclotron, Simulation, Bunching, Chopper