IPAC '23

Contribution ID: **2775** Contribution code: **SUPM035**   Type: **Poster Presentation**

Design of a 10.156 MHz Pre-buncher for a heavy ion RFQ

Sunday, 7 May 2023 16:00 (2 hours)

LEAF (Low Energy heavy ion Accelerator Facility) is a low-energy high-intensity heavy-ion LINAC complex for multidiscipline research. At present, the beam repetition rate is the same as the LINAC frequency of 81.25 MHz. A lower frequency would be desirable for many types of experiments employing time of flight data acquisitions. A method of increasing the bunch spacing to 98 ns by combining a 10.156 MHz pre-buncher before the RFQ and an RF chopper after the RFQ has been proposed. This paper reports the design studies of such a low-frequency pre-buncher. A resonator-based buncher is the best choice since lumped circuit-based buncher cannot provide the high voltage we expect for the efficient bunching of ion beams with an A/q of 7. According to the simulation result, the bunching efficiency of a 3-harmonic buncher will merely increase by 1% compared to a 2-harmonic buncher. We decide to design a two-harmonic buncher based on the little improvement in bunching efficiency. We optimize the length of electrodes so that the utilization of the parasitic field is maximized. The beam dynamics analysis indicates that the voltage amplitude and the RF power can be lowered by 1.3 times and 2.2 times by optimizing the electrode length.

Funding Agency

Footnotes

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Session Classification: Student Poster Session