

Mitigation of longitudinal beam losses in the FRIB linac

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The linear accelerator at the Facility for Rare Isotope Beams (FRIB) at Michigan State University uses a thin liquid Lithium film for charge stripping of high-intensity heavy ion beams. Energy straggling of the beam in the non-uniform Lithium film affects the energy distribution in the beam. This can lead to non-linear “tails” in the longitudinal phase-space beam distribution after bunching at the two 161 MHz Multi-Gap Bunchers (MGBs) between the stripper and the next accelerating segment. Some particles in these “tails” are lost in the downstream accelerator cryomodules. To mitigate these losses, we have designed a room-temperature IH-type buncher cavity with a resonant frequency of 322 MHz. The new harmonic cavities will be installed next to each MGB, linearizing the waveform of the effective bunching voltage and eliminating the formation of non-linear “tails.” The increase in the energy acceptance of the post-stripper part of the accelerator reached over 50% according to our simulations. We present the electromagnetic design of this cavity along with beam dynamics simulations that demonstrate how the losses are mitigated. The construction and installation of the cavity are being pursued as an accelerator improvement project.

Footnotes

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