

RF tuning analysis of a 750 MHz carbon RFQ for medical applications

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This work is part of the development study of a linac injector for hadron therapy with carbon ion beams. The initial cavities of the future injector consist of two 750 MHz Radio Frequency Quadrupoles (RFQ), which are based on the compact CERN High-Frequency RFQ. These RFQs are designed to accelerate the ions from 15 KeV/u to 5 MeV/u. Each RFQ, with a length of more of 2 meters, comprises four individual modules and 32 tuners, 8 per module.

Certain design choices, manufacturing imperfections, and misalignments lead to local variations in the frequency and field distribution within the RFQs. The tuning procedure corrects these perturbations in the TE210 operating mode using a bead pull system and movable tuners.

The aim of this article is to determine the maximum field correction achieved through this tuning without affecting the beam dynamics. For this purpose, a set of electromagnetic deviations that introduces significant dipole components to the cavity is simulated, using CST Studio. Using the tuning algorithm, this EM deviation is corrected in a realistic way.

Footnotes

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