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Design of a helium ion linear accelerator for injection in a particle therapy synchrotron and parallel production of radioisotopes

Monday 26 August 2024 16:00 (2 hours)

Interest in helium ions for cancer therapy is growing, motivated by their superior conformability as compared to protons or carbon. Clinical trials are starting, using beams produced by large carbon synchrotrons. To exploit the potential of this new ion, a compact synchrotron is being designed to accelerate helium and protons at treatment energies, for about half the size of a carbon machine. The helium LINAC is designed to operate at higher duty cycle than required for synchrotron injection. Beam pulses can be sent to a target producing radioisotopes, in particular alpha emitters to be used for targeted alpha therapy of cancer. The 352 MHz LINAC is made of 3 sections. To increase the efficiency with respect to a standard Drift Tube LINAC (DTL), the first section from 1 to 5 MeV/u is made of a Quasi-Alvarez DTL, a structure combining high efficiency and smooth beam optics. Only this section is powered when injecting helium ions into the synchrotron. The second and third sections of DTL type have energies of 7 MeV/u, the threshold for production of 211At, the most widely used alpha emitter, and 10 MeV/u, for injection of protons and production of other radioisotopes.

Footnotes

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