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Functional design of a wideband RF cavity for HeLICS synchrotron

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Within the framework of the NIMMS (Next Ion Medical Machine Study) initiative at CERN, a comprehensive design study is taking place for the Helium Light Ion Compact Synchrotron (HeLICS), a compact accelerator for hadron therapy. A key component of this facility is the radiofrequency (RF) cavity. Its proposed design is based on the FINEMET technology successfully implemented in the CERN PS Booster. It comprises four FINEMET cells that enable the acceleration of protons and $^4He^{2+}$ over a broad energy range. The cavity, designed to deliver a peak voltage of up to 2 kV within a frequency range up to 10 MHz, features a compact design to meet the stringent requirements of a compact medical accelerator, and operates in double-harmonic mode, to effectively reduce longitudinal line density and mitigate space-charge effects at injection. The combination of compactness, operational flexibility, and innovative features positions this RF cavity as an optimal solution for compact synchrotrons, enabling more efficient, precise, and accessible hadron therapy for cancer treatment.

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