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Harmonic Ratcheting for Ferrite Tuned RF Acceleration of Charged Particles[1] NATHAN COOK, Stony Brook University, MIKE BRENNAN, Brookhaven National Laboratory — One of the most persistent difficulties in the design of RF cavities for acceleration of charged particles is the rapid and efficient acceleration of particles over a large range of frequencies. From medical synchrotrons to accelerator driven systems, there is a strong need for fast acceleration of protons and light ions over hundreds of MeV. Conventionally, this is a costly undertaking, requiring specially designed ferrite loaded cavities to be tuned over a large range of frequencies. Ferromagnetic materials allow for the precise adjustment of cavity resonant frequency, but rapid changes in the frequency as well as operation outside material specific frequency ranges result in significant Q-loss to the cavity. This leads to a considerable increase in power required and is thus undesirable for regular operation. We introduce an acceleration scheme known as harmonic ratcheting which can be used to reduce the cavity frequency range needed for accelerating an ion beam in a synchrotron. In particular, this scheme addresses the need for high rep. rate machines for applications such as radiation therapy in which low beam intensity is needed. We demonstrate with simulations the type of ramps achievable using this technique and consider its advantages over h=1 acceleration schemes.

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