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A calculation study of H⁺ recapture in a synchrocyclotron using the IBA phase_motion code

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One of the important concerns in the development of a synchrocyclotron for clinical use is the predictability and accuracy of the beam pulse. During studies of the longitudinal motion in the S2C2 we have observed that protons falling out of the RF bucket but not lost, may regain stable oscillations around a subsequent synchronous particle and hence be recaptured in a later beam pulse. Such a behavior must be quantified and suppressed in the stages of machine design to deliver a high quality treatment beam.

It has been the purpose of this study to extend the 1-D phase_motion code for longitudinal motion to describe the case of particles recaptured after multiple turns without acceleration in a synchrocyclotron. The strong advantages of this 1-D approximation are i) rapid study of large numbers of particles over many thousands of turns and ii) associated optimization of the RF-frequency and voltage curves during the full acceleration up to the maximum radius in the cyclotron.

In this communication the extensions to the phase_motion program are explained and the problem of H⁺ recapture in the S2C2 is studied.

Please indicate preferred presentation (poster or talk?)

poster

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