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Simulation of ion beam cooling with a pulsed electron beam

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Abstract

All operational electron cooling systems employ a DC electron beam that generated by an electrostatic electron gun. This paper is devoted to the simulation of the electron cooling process with a pulsed electron beam, in which the electron cooling, Intra Beam Scattering and the space-charge field of the pulsed electron beam are included. A simulation of coasting ion beam cooling with a pulsed electron beam showed that the ion beam is cooled down to a small momentum spread, and all ions are captured by the bucket created by the pulsed electron beam space-charge field simultaneously. Finally, a cold pulsed ion beam with length the same as the electron pulse is obtained. In this article, the structure of the particle tracking simulation code is described and the simulation results of coasting and bunched ion beam cooling with a pulsed electron beam are presented and analysed. Moreover, the preliminary experiment on CSRm is introduced and the result shows an agreement with the simulation.

Keywords: Electron cooling; Pulsed electron beam; Beam dynamic

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1. Introduction

2 Electron cooling, a well-established method proposed by G. I. Budker to in-
3 crease the phase space density of stored ion beams, had been applied successfully
4 in many proton, antiproton and ion storage rings [1]. The first electron cooling

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