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P1.4008 Optimizing injection of positrons into a magnetic dipole trap

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In a pair plasma, the two oppositely charged particle species have a mass ratio of one. This property is predicted to have significant influence on the behavior of such a plasma including extraordinary stability characteristics [1]. APEX (A Positron-Electron Experiment) aims to create this kind of plasma in a magnetic dipole trap. Because the number of available positrons is the limiting factor to reach plasma densities, it is essential to be able to inject positrons as efficiently as possible into the confinement volume. Unfortunately, the physics that confines charged particles in the dipole also makes their injection from the outside challenging. Recently, lossless injection [2] of the steady positron beam of NEPOMUC [3] into the confinement volume of the magnetic field of a supported permanent magnet was achieved by utilizing the E◊B guiding-center drift and optimizing the electrostatic potentials of the surrounding electrodes. Moreover, confinement times exceeding 1s were observed [4]. These findings were accompanied and reproduced by single-particle simulations. On this basis, numerical studies for the next-generation experiments were carried out. The results promise improved confinement times and suggest that the accumulation of positrons from multiple pulses is potentially feasible in the dipole.

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