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Studies of the Twin Helix Parametric-Resonance Ionization Cooling Channel with COSY INFINITY

A primary technical challenge to the design of a high luminosity muon collider is an effective beam cooling system. An epicyclic twin-helix channel utilizing parametric-resonance ionization cooling (EPIC) has been proposed for the final 6D cooling stage. A proposed design of this twin-helix channel is presented that utilizes correlated optics between the horizontal and vertical betatron periods to simultaneously focus transverse motion of the beam in both planes. Parametric resonance is induced in both planes via a system of helical quadrupole harmonics. Ionization cooling is achieved via periodically placed wedges of absorbing material, with bi-periodic rf cavities restoring longitudinal momentum necessary to maintain stable orbit of the beam. COSY INFINITY is utilized to simulate the theory at first order. The motion of particles around a hyperbolic fixed point is tracked. Comparison is made between the EPIC cooling channel and standard ionization cooling effects. Cooling effects are measured, after including stochastic effects, for both a single particle and a distribution of particles.

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