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Round-to-flat and flat-to-round beam transformations at the Argonne Wakefield Accelerator Facility

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In this paper, we present a study of the transformation of a magnetized electron beam from round to flat and back to round using a skew quadrupole triplet. Electron cooling of hadron beams requires a magnetized electron beam, which can be generated from an RF photoinjector. However, such a beam is coupled in four-dimensional phase space, making it difficult to transport through beamlines. To address this challenge, we use a skew quadrupole triplet to remove the coupling and form a flat beam with different emittance in the horizontal and vertical planes and a high aspect ratio. Likewise, we use an additional skew quadrupole triplet to restore the correlation to the beam. We use particle tracking simulations to identify the optimal positions and strengths of the skew quadrupole magnets for the beam transformation. Finally, we present experimental demonstrations of the beam transformation at the Argonne Wakefield Accelerator Facility.

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Footnotes

I have read and accept the Privacy Policy Statement

Yes

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