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Orbital alignment of electron beam in the CeC experiment

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During the coherent electron cooling (CeC) experiment at RHIC, we have encountered various challenges to align the electron beam both in the low energy beam transfer line and in the cooling section. For example, the electrons exit the SRF gun with an orbital angle of tens of milli-radian, which is likely caused by the misalignment of the cavity inside the cryostat and the tilted cathode. The significant orbital angle leads to transversely asymmetric beam with deteriorated emittance. In run 23, we have demonstrated that such orbital angle can be minimized by adjusting the position of the laser spot at the cathode. Another challenge is to align the orbit of the electron beam with the ion beam in the cooling section, which plays a critical role in demonstrating CeC. Over the past few years, we have developed a procedure to ensure the transverse alignment to the precision of 0.1 mm. The proper alignment has been confirmed by significant growth of the ion beam's longitudinal emittance due to its interaction with the electrons and increased signal from the recombination monitor. In this paper, we will present the techniques developed for beam alignment with experimental results.

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