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Optimization of cooling distribution of the EIC cooler ERL

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The Electron-Ion Collider (EIC) Hadron Storage Ring (HSR) will use strong hadron cooling to maintain the beam brightness and high luminosity during long collision experiments. An Energy Recovery Linac is used to deliver the high-current high-brightness electron beam for cooling. For the best cooling effect, the electron beam requires low emittance, small energy spread, and uniform longitudinal distribution. In this work, we simulate and optimize the longitudinal laser-beam distribution shaping at the photo-cathode, modeling space charge forces accurately. Machine parameters such as RF cavity phases are optimized in conjunction with the beam distribution using a genetic optimizer. We demonstrate the improvement to the cooling distribution in key parameters.

Footnotes

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Primary author: WANG, Ningdong (Cornell University)

Co-authors: GULLIFORD, Colwyn (Xelera Research LLC); WANG, Erdong (Brookhaven National Laboratory); HOFFSTAETTER, Georg (Cornell University (CLASSE))

Presenter: WANG, Ningdong (Cornell University)

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