



Contribution ID: 2250 Contribution code: SUPC025

Type: **Poster Presentation**

Optimization of cooling distribution of the EIC cooler ERL

Sunday, 19 May 2024 16:00 (2 hours)

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

Funding Agency

Work supported by Brookhaven Science Associates, LLC under Contract No. DE-SC0012704 with the U.S. Department of Energy and the Office of Science Graduate Student Research (SCGSR) Program.

Paper preparation format

LaTeX

Region represented

North America

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Session Classification: Student Poster Session

Track Classification: MC1: Colliders and other Particle and Nuclear and Physics Accelerators: MC1.A18 Energy Recovery Linacs (ERLs)