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## Coherent electron cooling physics for the EIC

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In order to prevent emittance growth during long stores of the proton beam at the future Electron-Ion Collider (EIC), we need to have some mechanism to provide fast cooling of the dense proton beams. One promising method is coherent electron cooling (CeC), which uses an electron beam to both “measure” the positions of protons within the bunch and then apply energy kicks which tend to reduce their longitudinal and transverse actions. In this talk, we discuss the underlying physics of this process. We then discuss simulations which constrain the electrons to move only longitudinally in order to perform fast optimizations and long-term tracking of the bunch evolution, and benchmark these results against fully 3D codes. Finally, we will discuss practical challenges, including the necessity of a high-quality electron beam and sub-micron alignment of the electrons and protons.

### Footnotes

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**Primary author:** BERGAN, William (Brookhaven National Laboratory)

**Co-authors:** MAYES, Christopher (SLAC National Accelerator Laboratory); GULLIFORD, Colwyn (Xelera Research LLC); XU, Derong (Brookhaven National Laboratory); WANG, Erdong (Brookhaven National Laboratory); WANG, Gang (Brookhaven National Laboratory); STUPAKOV, Gennady (xLight Incorporated); QIANG, Ji (Lawrence Berkeley National Laboratory); CONWAY, Joseph (Xelera Research LLC); MA, Jun (Brookhaven National Laboratory); DEITRICK, Kirsten (Thomas Jefferson National Accelerator Facility); BLASKIEWICZ, Michael (Brookhaven National Laboratory); TAYLOR, Nicholas (Xelera Research LLC); WANG, Ningdong (Cornell University); BAXEVANIS, Panagiotis (Brookhaven National Laboratory (BNL)); BENSON, Stephen (Thomas Jefferson National Accelerator Facility)

**Presenter:** BERGAN, William (Brookhaven National Laboratory)

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