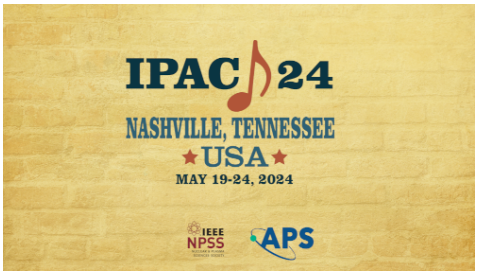

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Advancing electron injection dynamics and mitigation approaches in the Electron-Ion Collider's swap-out injection scheme

Monday, 20 May 2024 16:00 (2 hours)

The Electron-Ion Collider (EIC) will use swap-out injection scheme for the Electron Storage Ring (ESR) to overcome limitations in polarization lifetime. However, the pursuit of highest luminosity with the required 28 nC electron bunches encounters stability challenges in the Rapid Cycling Synchrotron (RCS). Consequently, multiple RCS bunches will be accumulated in the ESR.
A pivotal aspect lies in optimizing the injected and stored bunch separation for efficient injection. However, maximizing this separation introduces intricate challenges, notably electron emittance blowup and proton emittance growth because of beam-beam interaction. This delicate balance between injection facilitation and mitigating electron emittance blowup is further constrained within a small dynamic aperture.
This paper conducts simulation studies investigating proton emittance growth and electron emittance blowup in transverse and longitudinal injection schemes. Mitigation strategies are explored, including: (1) Employing a secondary kicker to manipulate beam separation at the injection point by offsetting the stored beam negatively and the injected beam positively; (2) Exploring electron working point optimization, etc.
These findings promise enhanced EIC stability and performance, shaping potential future operational improvements.

Footnotes

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