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SFQED - Disruption Interplay in Leptonic Beam Interaction for Future Colliders

Friday 22 March 2024 09:00 (30 minutes)

High-luminosity collisions between dense and high-energy beams (100s GeV to a few TeV) planned for future colliders, including utilizing advanced collider concepts through high-gradient plasma-based accelerators, will push beamstrahlung into the quantum regime. The typical beam parameters at the final focus will necessitate the disruption parameter to be $\langle D < 1 \rangle$. However, the bunch length will remain on the micron scale, indicating that several hard photons per beam particle will be emitted during the collisions. This phenomenon has already been estimated to lead to severe energy loss in colliding beams.

In this talk, we will demonstrate that two unintuitive effects can emerge due to SFQED - disruption interplay. First, in the collision of electron-positron beams with $\langle D < 1 \rangle$, luminosity enhancement effects from beam disruption are typically weak. Recent QED-PIC simulations have revealed that disruption, in the presence of SFQED effects, transforms into a dynamical parameter that can be significantly increased during the interaction. Second, electron-electron collisions are usually not considered viable due to the tendency of the two beams to repel each other. However, we will present findings that for special beam parameters, pair production enables the anomalous pinching of the beam tail.

Available for oral presentation in a session

Yes

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