

## Disruption-induced kink instability in the leptonic beam collision driven by QED effects

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The kink instability can occur in collisions of leptonic beams due to the disruption effects when the colliding beams are not fully aligned [1]. The kink instability can perturb the profile of the beams significantly when the disruption effect [2, 3] is strong. In addition, this instability is shown to be capable of compensating the luminosity loss due to the offset between the beams. This phenomenon is critical for the performance and design of large particle colliders. Here, we show that QED effects, i.e., photon emission and pair production, become significant when the collision of dense beams is considered. The QED effects are shown to be coupled with the beam disruption, as well as the corresponding kink instability, since the beam energy is depleted through the QED effects. This depletion results in a dynamically increasing disruption effect during collision. Therefore, more oscillations of the beams are observed in the kink instability when QED effects are considered. These discoveries are verified by particle-in-cell (PIC) simulations with OSIRIS [4], and also by the numerical solution to the equation of motion of the beam centroids.

### References

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