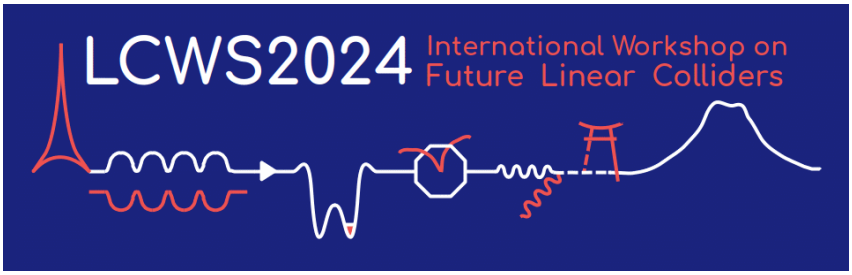

Contribution ID: **79** Type: **Oral presentation (in person)**

Luminosity Studies for the Cool Copper Collider

Wednesday 10 July 2024 09:20 (20 minutes)

Achieving high instantaneous luminosity while managing the beam-induced background (BIB) is critical for the successful operation of any future electron-positron (e^+e^-) collider. In this talk, we will present the first extensive luminosity studies for a proposed linear e^+e^- collider, the Cool Copper Collider (C^3), as discussed in arXiv:2403.07093. We begin with a theoretical overview of luminosity at e^+e^- colliders and its interplay with Beamstrahlung –the leading source of BIB –and we motivate the importance of simulations for the accurate evaluation of the effect of beam-beam interactions on the attainable luminosity. Through simulations in Guinea-Pig, we then evaluate the impact of key beam parameters, such as emittance, bunch length, beta function and waist shift, on the luminosity of C^3, and tune these parameters with the objective of optimizing the luminosity, without a commensurate increase in the accompanying BIB. We then propose a new beam parameter set for C^3 which achieves a ~40% luminosity increase while maintaining BIB levels at similar levels. Additional luminosity-enhancing scenarios through modifications in the time-structure of the beam are presented, and their sustainability implications are discussed. Finally, using a common simulation framework, we perform a comparative analysis of the luminosity and BIB characteristics of C^3 with those for ILC and CLIC. Our results indicate that C^3 achieves competitive luminosities with a narrower luminosity spectrum than CLIC and lower background rates than ILC, placing C^3 as an attractive option for realizing a compact, high-performance Higgs factory. We close our talk by showing how the developed luminosity optimization methodology can be extended to other collider proposals and by presenting preliminary results towards an automatized luminosity optimization scheme.

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