Contribution ID: **34** Type: **(b) Poster abstract only (one author must be in person)**

Operational Considerations for Laser Control of the FCC Bunch Intensity

Thursday 13 June 2024 18:51 (1 minute)

The charge imbalance between colliding bunches in the FCC-ee ring must be less than 3-5% in order to avoid the beamstrahlung-induced flip-flop instability [1]. The charge of the colliding bunches is leveled through top-up injection, but this is a slow process. Laser Compton back scattering (CBS) has been proposed as a mechanism to quickly level the charge of colliding bunches between top-ups [2]. This scheme has been shown to be effective through simulations of the Compton interaction and turn-by-turn modeling of the FCC [3]. In this work, we seek opportunities to improve performance and reliability of the CBS system. We explore strategies for reducing the required energy in the laser pulse by reducing the pulse spot size. To prevent radiation damage to the laser optics, we introduce a finite angle of incidence between the laser and e+/e- beams. We study the interplay between angle of incidence and laser pulse length in this scenario. We investigate novel concepts, such as using short pulse lasers for quenched photon emission in the strong-field regime [4,5]. Finally, we discuss opportunities for experimental tests using the E320 infrastructure at FACET-II.

[1] D. Shatilov, "BEAM-BEAM EFFECTS AT HIGH ENERGY e+e–COLLIDERS,"TUYBA02, eeFACT2018, Hong Kong, China
[2] F. Zimmerman, T. Raubenheimer, "CONTROLLING e+/e– CIRCULAR COLLIDER BUNCH INTENSITY BY LASER COMPTON SCATTERING,"WEPOST010, IPAC2022, Bangkok, Thailand.
[3] I. Drebot et al., "OPTIMIZING THE BEAM INTENSITY CONTROL BY COMPTON BACK-SCATTERING IN e+/e- FUTURE CIRCULAR COLLIDER,"MOPA074, IPAC2023, Venice, Italy.
[4] C. N. Harvey et al. "Quantum Quenching of Radiation Losses in Short Laser Pulses"Phys. Rev. Lett. 118, 105004 (2017)
[5] M. Tamburini and S. Meuren, "Efficient high-energy photon production in the supercritical QED regime" Phys. Rev. D 104, L091903 (2021)

Primary authors: KNETSCH, Alexander (DESY); O'SHEA, Brendan (SLAC); ZIMMERMANN, Frank (CERN); DREBOT, Illya; KEINTZEL, Jacqueline (CERN); HOGAN, Mark; MEUREN, Sebastian (Ecole Polytechnique); GESSNER, Spencer (SLAC); RAUBENHEIMER, Tor (SLAC National Accelerator Laboratory (US)); REIS, david (Stanford University)

Presenter: GESSNER, Spencer (SLAC)

Session Classification: Poster session

Track Classification: FCC accelerators: Accelerator technical design