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Ordinary and coherent bremsstrahlung at linac-ring ep colliders

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Abstract: The ordinary bremsstrahlung ep \rightarrow epγ can be used at the linac-ring ep colliders for luminosity measurement. It is known that at high energies this process has a large correction due to beam-size effect. We have calculated this effect for ep colliders of the linac-ring type. For the LHC+CLIC collider the correction exceeds 10% for E_γ < 0.95\;E_e. As a rule, the bremsstrahlung of protons in the ep scattering is not considered due to its small cross section. However, if the photon energy E_γ becomes small enough, the number of produced photons become large because in this case the radiation is determined by the interaction of a proton with the collective electromagnetic field of the electron bunch. It is coherent bremsstrahlung (CBS). We present the main characteristics of CBS calculated for linac-ring ep colliders. At the LHC+CLIC collider it should be about 1700 \; dE\gamma /E\gamma photons for a single collision of bunches at E\gamma \stackrel{<}{\sim} 0.2 MeV. It seems that CBS can be a potential tool for fast control over collisions and for measuring beam parameters. Indeed, the electron bunch length l_e can be found from the critical energy E_c \propto $1/l_e$, the transverse bunch size $\sigma_{\perp}$ is related to the photon rate dN_γ \propto $1/\sigma_{\perp}^2$. A specific dependence of dN_γ on the impact parameters between the beams allows for a fast control over beam displacement.

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