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A study for emittance growth compensation by space charge effects at the injector of KEK-STF after dry ice cleaning of the RF gun

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The International Linear collider (ILC) is an electron-positron linear collider with a center-of-mass energy up to 1 TeV. At the interaction point, the beam shape must be flat in the transverse space to maximize the luminosity and minimize the energy spread by Beamstrahlung. The flat beam is obtained by asymmetric emittance in x and y made up by radiation damping with a 3 km damping ring. We propose a new method to make asymmetric emittance based on emittance exchange techniques known as Round to Flat beam transformation (RFBT) and Transverse to Longitudinal Emittance Exchange (TLEX). We use ASTRA simulations to understand the transverse motion along the beamline of KEK Superconducting Test Facility (STF) with the goal of minimizing the emittance growth due to space charge effects. In the KEK STF facility the RFBT experiment was performed. In December 2023, to investigate the cause of unexpected emittance growth in previous experimental runs, we performed a detailed study of the STF injector with the cryomodules detuned. Here we report the results of this study and plans to achieve emittance compensation.

Footnotes

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