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An Integrated Simulation Tool for Dark Current Radiation Effects using ACE3P and Geant4

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A simulation workflow is under development to interface particle data transfer and matching of geometry interface between the electromagnetic (EM) cavity simulation code ACE3P and radiation code Geant4. The target is to simulate dark current (DC) radiation effects for the KEK 56-cell S-band accelerating structure using ACE3P and Geant4, and benchmark against KEK experiment data. As a first step, ACE3P DC simulations using a 7-cell structure have been performed by first calculating the operating mode in the structure and then tracking field-emitted electrons under the influence of the EM fields of the mode. The ACE3P simulation results agree well with the EM software CST for an accelerating gradient of 21.8 MV/m. The reader/writer I/O in ACE3P and the transfer of particle data from Track3P to Geant4 for DC radiation effects studies have been implemented. The simulation workflow between the two codes will be demonstrated with the goal of performing large-scale simulations for the KEK 56-cell structure. In addition to modeling DC effects in linacs, the integrated simulation workflow will be applicable to studying positron source and capture structure for future lepton colliders.

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