PEREGRINE is a Monte Carlo dose calculation system developed specifically for radiation therapy treatment planning. It obtains its speed without sacrificing accuracy because of methods developed for the efficient geometrical description of the transport medium (the patient), optimization of photon and electron transport methods, and variance reduction. PEREGRINE uses the patient's CT scan to construct a rectilinear transport mesh with simply-defined boundaries that facilitate rapid particle tracking. Photon transport is done in an analog manner, sampling the important physical processes from accurate databases. The application of Woodcock tracking enhances speed by allowing rapid tracking across voxel boundaries and material interfaces. Electron transport is accomplished using a class II Goudsmitt-Saunderson-based condensed history method. PEREGRINE accumulates dose on a user-defined dose collection array that is decoupled from the transport mesh. Knowledge of the size and location of this mesh enables PEREGRINE to apply some simple variance reduction techniques in tracking secondary photons, electrons and positrons. Comparisons between PEREGRINE, other Monte Carlo codes and measurements in both homogeneous and heterogeneous media for photon and electron beams demonstrates the validity of the code and its underlying techniques.

This work was performed under the auspices of the United States Department of Energy by Lawrence Livermore National Laboratory under contract W-7405-ENG-48.