

Accurate, rapid Monte Carlo transport of primary and scattered photons and electrons through treatment-specific beam modifiers (collimator jaws, trays, wedges, blocks, compensators, multileaf collimators and air columns) is critical for implementing clinically useful Monte Carlo treatment planning calculations. We present methods used in PEREGRINE to track photons and generate/track contaminant electrons from their place of creation from within the accelerator head and any patient-dependent modifiers to the patient surface. Full photon transport including scattering and daughter photon tracking is used for all beam modifiers (including the air column) except for the jaws where we use ray tracing and attenuation methods. Full electron transport including production of secondary electrons (delta rays) and bremsstrahlung and annihilation photons is used for all beam modifiers (including the air column) except for the collimator jaws where all electrons are absorbed locally. Tracking electrons allows accurate calculation of dose at the surface (skin dose) and in the buildup region for all modifier configurations. Comparisons with measurements show that this treatment of beam modifiers supports accurate dose calculations for a wide variety of beam energies, modifier configurations and phantom geometries.

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