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Monte Carlo Investigation of chamber cap material and thickness for head-scatter measurement

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The purpose of this work is to investigate the chamber cap material and thickness for head-scatter measurement using Monte Carlo simulations. Accelerator head-scatter factor can be measured in air using an ionization chamber with a build-up cap. The measurement accuracy is important to high energy photon beam dosimetry, especially for the small field sizes with the IMRT technique. The question is what material and thickness for the build-up cap is more accurate for head-scatter measurement. Monte Carlo simulations of ionization chambers and build-up caps were carried out in this study. The EGSnrc based Monte Carlo code DOSIMETER was used in the calculation. The code simulated an ion-chamber with a build-up cap in different materials and thicknesses irradiated in a clinical photon beam. Based on the definition of the head-scatter factor, we also calculated kerma in a tiny water voxel in air with different field sizes. The ratios of relative dose in the chamber with different cap materials and thicknesses were calculated. According to calculated ratios, several build-up cap materials and thickness for head-scatter factor measurement were compared and discussed.