In radiotherapy Monte Carlo methods can be used for benchmarking or even for routine dose calculations. The MC simulations normally start at a predefined level (phase space) downstream of the beam defining system.

The present work investigates four photon beam characterization models, namely phase space data obtained from full MC simulations of the treatment head (model 1), a photon point source with a mean energy spectrum and a constant fluence (model 2), a photon point source with a mean energy spectrum and a fluence distribution (model 3), and a photon point source with full energy but mean fluence distribution (model 4). Energy spectra and fluence distributions for all models were sampled from the phase space data. To investigate the performance of these models, measured and calculated depth dose curves, dose profiles and output factors in water for different square fields were compared.

Comparison of the depth dose curves normalized per incident fluence showed no larger deviations than 2% at the depth of 10 cm for small field sizes. The dose profiles calculated for models 1 to 3 showed good agreement with the measurements. On condition to achieve the same statistical accuracy in the calculations, the efficiency of the single point source is increased about 100 times compared to the full head calculation. In summary, we think that the single source model 3 is a useful and fast tool for Monte Carlo dose calculations at least for small field sizes.