

Calculation of output factors for an electron accelerator (6-20 MeV) by Monte Carlo modelling.

In radiotherapy with high-energy electrons, the final element of the accelerator is the beam defining cut-out. During the commissioning stage of an accelerator, the relative output factors (ROF) for many different regular cut-outs have to be measured. Furthermore, for custom-made irregular cut-outs, additional measurements are required. The ROF for the cut-outs can, in principle, also be determined by Monte Carlo (MC) simulation of the accelerator.

In this work, we modelled a Varian V2100E accelerator with electron energies 6, 9, 12, 16 and 20 MeV, using the MC code BEAM/EGS4. The models were verified by comparing measured and calculated lateral and depth dose distributions; the agreement was within 1-2%. From the calculated dose distributions, we derived ROF for a range of rectangular, square and circular cut-outs. Good agreement (never more than 2% difference) was obtained with ROF, measured in water with NACP and Markus ion chambers.

With the MC simulations, we also studied the influence of backscattered radiation from the accelerator components on the monitor chamber response. Of these components, only the jaws were found to have an influence but for the jaw positions used in this work, no correction of the measurements was required.

In conclusion, MC simulations can be used to obtain ROF for electron cut-outs for regular fields. Ongoing research will determine if this also holds for arbitrary irregular cut-outs.