COMPARISON OF MONTE CARLO CODES FOR SMALL-FIELD DOSE CALCULATIONS IN EXTERNAL BEAM RADIOTHERAPY

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Small treatment fields are increasingly used in modern radiotherapy (RT) techniques, such as in stereotactic radiotherapy. Small fields enable more precise treatment, but with the cost of increased uncertainty in dosimetry as the reference conditions based on conventional Codes of Practice cannot be fully established [1]. Monte Carlo (MC) calculation methods provide efficient way to investigate dosimetry in RT and they are considered to be the most accurate methods [2].

In this study, the dose calculations with two user codes of MC software package EGSnrc [3], *DOSRZnrc* and *egs_chamber*, were compared through single volume, percentage depth dose (PDD), and profile calculations. Calculations were performed with small 6 MV photon fields ranging from 4 to 40 mm in large cylindrical water phantom. All calculations were performed with both user codes. In order to verify the accuracy of MC calculations, PDD and profile calculation results were also compared with measurements performed by micro-ionization chamber.

In single volume calculations the maximum difference of 0.2% was found. The largest and mean statistical uncertainties were 0.2% and 0.1%, respectively. Profile and PDD calculations were in good agreement, with maximal difference of 0.5 % and distance-to-agreement (DTA) of 0.6 mm. In the measurements the broadening of the penumbra in dose profile was recognized. The clinical consequence of this is the greater exposure to the surrounding healthy tissues in the region of targeted tumour than estimated by pure measurement based dose calculations.

The results of dose calculations computed with two user codes were in good agreement. This encourages the use of *egs_chamber* over more traditional *DOSRZnrc*, as it enables more realistic geometry models, which are not restricted to a cylindrical geometry only.

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