Knowledge of the dose distribution of a radiotherapy orthovoltage unit is important for treatment planning, optimisation and verification and hence for tumor control. To accurately calculate the dose in a patient geometry, the phase space needs to be quantified, which was the aim of this project. Because characteristic x-rays are produced in an angulated thick target, the phase space depends strongly on the pathlength of the photons in the target material.

The phase space of the Pantak DXT300 has been modelled using a spectrum calculated by XRAYBEAM. This spectrum, an intensity modulation, an energy shift, as well as a finite source were incorporated into a Monte Carlo user code.

Monte Carlo surface dose profile curves using the modelled phase space show agreement with experiment within 2% in the interval [-4,4] for 10×10 cm^2 fields and within 4% in the interval [-8,8] for 20×20 cm^2 fields. The edge of the Monte Carlo surface profile curves are overpredicted by a maximum of 6% for 20×20 cm^2 fields at 9 cm off axis due to only taking 90% of the field size for the intensity modulation function. The “tail” is underpredicted due to the lack of modelling scattered photons from the collimator and the x-ray tube in the Monte Carlo simulations

The Monte Carlo and experimental dose distribution agreement was deemed clinically acceptable, and the phase space has been used as input for dose calculation in patient treatment geometries.

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