Determination of two parameters of a liquid filled ionisation chamber to predict portal dose images of dynamically modulated treatment beams.

IMRT treatments have triggered a growing interest in the verification of intensity-modulated beams with electronic portal imaging systems (EPIDs), such as scanning-liquid-ionisation chambers (SLICs).

The ion concentration in the liquid of a SLIC-EPID and therefore the absorbed dose rate in the chamber is determined by two constants describing the creation and recombination rates of the ions. These two parameters were determined for an incident open 6 MV photon beam.

The creation rate of the ions is proportional to the incoming photon fluence rate and the chamber electron yield. The latter was computed with Monte Carlo calculations. In order to obtain an absolute photon fluence value, an absolute dose was measured in a water phantom and related to a Monte Carlo computed dose. The recombination constant was determined from the ion transit time.

The parameter values were tested for simple beam intensity modulations generated by switching the beam on and off. The parameters reproduced the measured temporal behavior of the ion concentration in the liquid to within a few percent for the beam switch-on experiment. The decrease of the ion concentration in the beam-switch off experiment, however, was too slow, indicating, that the measured transit time may be inaccurate. However, the ratio between calculated and measured ion concentration was nearly constant. Therefore, the results are promising to predict portal dose images for more complicated cases, such as dynamically collimated treatment beams.