Beam quality specification and absorbed dose beam quality correction factors k_Q for high energy photons

Selection of the parameter to specify radiation quality of clinical photon beams plays an essential role in the final accuracy of protocols based on absorbed dose calibrations such as the AAPM-TG51 or IAEA codes of practice. We compared the adequacy of two beam quality specifiers i.e. TPR and $\%dd(10)_x$ in their ability to specify experimental k_Q factors for cylindrical chambers in high energy photon beams of different types. We base our assessment on our water calorimeter based k_Q data as well as high quality experimental k_Q factors and beam quality data available from other laboratories. For the NE2571 chambers investigated, there is a systematic improvement in the specification of the beam when using $\%dd(10)_x$, i.e. the maximum range of differences between various measured values of k_Q amount to 0.4% over $58 < \%dd(10)_x < 88$, whereas differences are up to 1.2% when using TPR. Similarly over the same range, for the NE2611 or NE2561 chamber, differences are up to 0.4% when using $\%dd(10)_x$ and up to 0.7% when using TPR. For the PR06C chamber, the improvement is less obvious but less experimental k_Q data are available. In addition, the agreement between measured and calculated k_Q factors is slightly better when beam quality specification is with $\%dd(10)_x$: For the NE2571 the maximum difference reduces from 1.2% to 0.8%, for the NE2611 from 1.2% to 1.0% whereas we see no significant improvement for the PR06C chamber.