HIGH ENERGY PHOTON REFERENCE FOR RADIATION PROTECTION: MONOENERGETIC CONVERSION COEFFICIENTS AND TECHNICAL DESIGN OF THE LINAC BEAM

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In this work we present the results of the first part of a research project aimed at offering a complete response to dosimeters fabricants' and nuclear physicists' demand for high energy (6 – 9 MeV) photon radiation beams for radiation protection purposes. Classical facilities allowing for the production of high energy photonic radiation (proton accelerators, nuclear reactors) are very rare and need large investment for development and use. We thus propose a novel solution, consisting in the use of a linear accelerator, allowing for a significant decrease of all costs.

Using Monte Carlo simulations (MCNP5 and PENELOPE codes), we have calculated conversion coefficients for dosimetric quantities (air kerma and dose equivalents) in the range between 10 keV and 22.4 MeV, in specific geometrical set-ups. These coefficients have then been extrapolated from radiotherapy spectra. A specifically designed (by Monte Carlo simulations) electron-photon conversion target allows for obtaining a high energy photon beam (with an average energy weighted by fluence of 6.17 MeV) for radiation protection purposes. Due to the specific design of the target, this "realistic" radiation protection high energy photon beam presents a uniform distribution of air kerma at a distance of 1 m, over a 30 × 30 cm^2 surface.