

# NEUTRON SPECTRA AND DOSIMETRIC FEATURES AROUND AN 18 MV LINAC ACCELERATOR

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Paper

## Abstract Author Information Authors Article Metrics Metrics

Using the difference between responses to neutrons of TLD-600 and TLD-700, three experimental devices were constructed and arranged to measure thermal neutron fluences, neutron spectra, and neutron doses inside the treatment room of a radiotherapy 18 MV Linear electron accelerator (Linac). Thermal neutron fluences were measured with TLD-600/TLD-700 pairs arranged in both a bare and a cadmium (Cd) foil covered methacrylate box. Neutron spectra were measured in 26 energy bins by introducing pairs of TLD-600/TLD-700 in air and into the middle of five polyethylene spheres with diameters of 3, 5, 8, 10, and 12 inches. A PC version of the BUNKI code was used to unfold the six measurements in each sphere to obtain the 26 energy bins. Neutron and photon doses were measured by introducing pairs of TLD-600/TLD-700 into the middle of a single 25-cm-diameter paraffin sphere. The three required neutron calibrations were carried out at the Nuclear Technology Laboratory of the Polytechnique University of Madrid (UPM), using an <sup>241</sup>Am-Be neutron source with an alpha activity of 111 GBq and a yield of  $6.6 \times 10^6$  neutrons  $s^{-1}$ . Three devices were needed for the necessary calibrations: a BF<sub>3</sub> counter for the thermal neutron fluence calibration, a LUDLUM 42-5 Bonner spectrometer with five 0.95 g  $cm^{-3}$  polyethylene spheres with a LiI(Eu)  $4 \times 4$  mm<sup>2</sup> scintillation counter for the neutron spectrometer calibration and a NEMO 9140 remmeter for the paraffin remmeter calibration. The Monte Carlo code MCNP 4C has been used in two ways: to calculate the neutron kerma contribution to two TLDs (type 600 and 700) both in air and inside the paraffin sphere, and to determine the neutron spectra at those Linac room zones where the neutron spectra were measured. Thermal neutron fluences of  $2.9 \times 10^4 \pm 8.6 \times 10^3$   $cm^{-2} s^{-1}$ , measured around the Linac head plane, and  $2.3 \times 10^4 \pm 2.3 \times 10^3$   $cm^{-2} s^{-1}$ , measured at the patient couch plane, are in agreement with previous independent measurements from other authors. The calculated and measured neutron spectra obtained in the treatment room showed three distinct regions: a peak around 0.1 MeV, a flat epithermal region and a thermal region with values similar to those mentioned above. Patient dose equivalents of 0.5 mSv and 5 mSv from neutrons and photons, respectively, were obtained per treatment Gray.

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