APPLICATION OF MONTE CARLO METHOD TO THE DOSIMETRY *X*-RAY EXAMINATIONS

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Application of Monte Carlo method in ionizing radiation dosimetry allows to carry out a virtual experiment to evaluate the absorbed dose distribution in the human body exposed to external irradiation.

The MCNP code was used to implement the Monte Carlo method [1]. The package is designed to simulate transport of neutron, gamma and electron radiation through matter using Monte Carlo methods.

Simulation of *X*-ray examination of the human body consists of several tasks: modeling of *X*-ray source, simulation *X*-ray radiation transport and modeling of anatomy of the human body. The semi-empirical model TASMIP for the *X*-ray tube radiation source is used as the *X*-ray source [2]. This model is most suitable for the calculation of radiation doses for typical *X*-ray diagnostic procedures.

Voxel phantom of the human body was created by using computer tomograms of an Alderson-Rando-like physical anthropomorphic phantom of an adult. The phantom consists of three types of tissue (lung, soft, bone) [3]. A special technique to accelerate the MCNP calculations is used to calculate the spatial distribution of the absorbed dose [4].

The absorbed dose distributions for different age groups were calculated for different exposure conditions. A comparison between the calculated and experimental distributions of the absorbed dose was carried out in an Alderson-Rando-like physical phantom. The experiment was performed by use of thermoluminescent detectors. Irradiation of different parts of phantom was carried out for different modes of *X*-ray operations. Calculated and measured data matched well.

1. MCNP- A general Monte Carlo N-particle transport code, Version 4A. Report LA-12625-M. / Briestmeister J. F., Ed. Los Alamos: LANL. 1993. 736 p.
2. J.M. Boone *et al.*// Med. Phys. 1997. V.24. №1. P.1661.
3. V.Minenko *et al.* // Int. J. Low Radiation. 2010. V.7. No.2. P.140.
4. T.Goorley MCNP5 Tally Enhancement for Lattices. Research Notes, X-5-RN(U)04-20. Los Alamos: LANL. 2004.