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THE USE OF ANNIHILATION PHOTONS AS A METHOD FOR DOSE DISTRIBUTION CONTROL IN PHOTON BEAM RADIATION THERAPY

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Radiation therapy plays a significant role in the treatment of cancer. In recent years, radiation therapy techniques have begun to be introduced, which make it possible to control the position of the tumor directly during the irradiation process, reducing the procedure time and minimizing the negative impact on the patient. An example of combining diagnostics and radiation therapy is the "Tomotherapy" device, in which a beam of ionizing radiation is directed at a tumor with the highest accuracy, and an integrated computer tomograph determines the shape, size and position of the tumor in a matter of seconds before the start of the session.
The paper proposes a method that can become a way to assess the dose distribution in the patient's body during irradiation. The method uses the ideology on which PET tomography is based and is based on the registration of annihilation photons. The creation of electron-positron pairs is one of the processes that occurs when photons with an energy of more than 1.22 MeV interact with matter. The resulting positrons then annihilate with the formation of photons. By registering such photons, it is possible to obtain information that, after appropriate processing, will lead to a conclusion about the dose distribution.
To study the proposed method, a computer experiment was carried out using the GEANT4 package, based on the Monte Carlo method. Within the framework of the work performed, the correlation between the distribution of the absorbed dose of photon and positron radiation and the distribution of positron annihilation sites was estimated, and the energy spectra of bremsstrahlung and annihilation photons were analyzed.
As a result, the depth distributions of the absorbed dose and the number of annihilations were obtained, and a recalculation function was obtained, which makes it possible to obtain the depth distribution of the absorbed dose from the distribution of the number of annihilations.
The data obtained are discussed.

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