NTech
Lehrstuhl für
Nukleartechnik

Monte-Carlo-based Radiation Transport Simulations for Advanced Radiotherapies

The goal of radiation therapy is to maximize probability of tumor control and at the same time spare normal tissue structures. To face this difficult task, Monte-Carlo-based radiation transport simulations are used. This probabilistic approach is considered currently to be the best available method to adress the complex physics of radiotherapy applications.

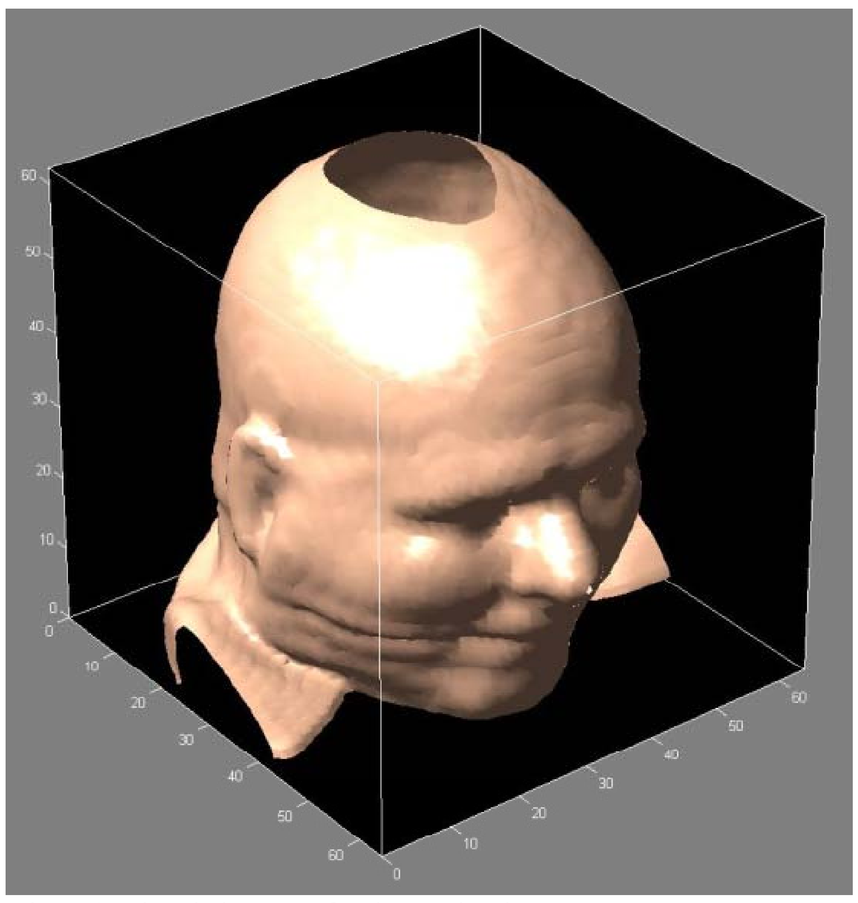

Figure 2. Virtual phantom of an human head

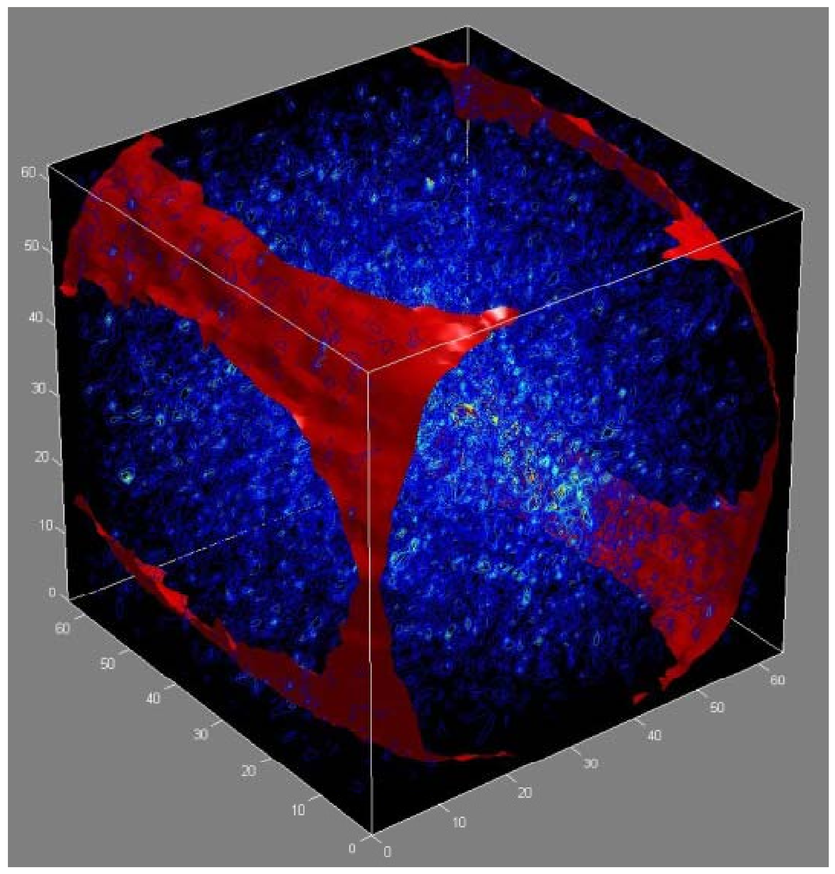

Figure 1. Secondary particle production in water phantom

COMPUTATIONAL MODEL

The development of computational models includes
– treatment heads of medical electron accelerators
– phantoms representing the patients body (figure 2)
– different operation modes of the accelerators
– different γ- energy spectra
– various multi-leaf-collimator positions

SECONDARY PARTICLE PRODUCTION

To enhance performance and reliability of dosimetry calculations not only incident γ-rays are considered (figure 3). Secondary particles such as electrons, positrons and photonuclear reaction products (figure 1) also contribute significantly to total dose.

This kind of particles are produced in the accelerator head as well as in the surrounding air and the patient himself. So, advanced computer models have to take into account this effects.

Furthermore, the influence of irradiation energy on secondary particle production has to be investigated.

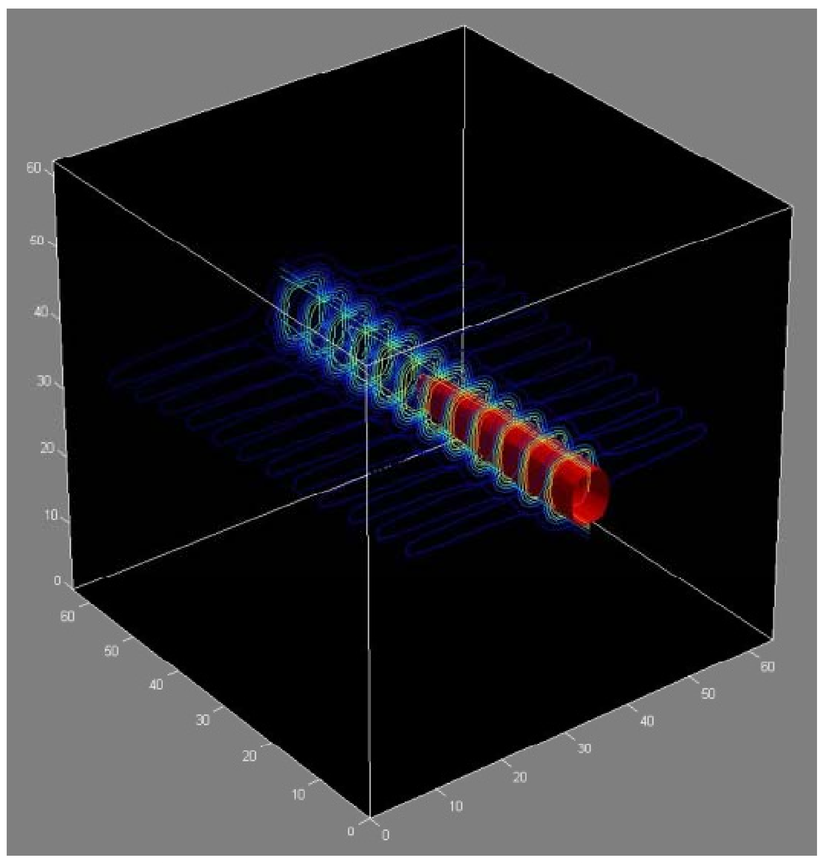

Figure 3. Incident γ-beam (red) and cross-sectional isodose lines

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