Two types of waveguide are used in linacs: radiofrequency power transmission waveguides and accelerating waveguides. The components of the treatment head are as follows: an X- ray target, scattering foil, a flattening filter, an ion chamber, a fixed and a movable collimator, and a light localizer system.

Electrons are generated by the thermal radiation from the electron gun (electron guns), which is an operating principle of the accelerator. The acceleration chamber has a transverse acceleration chamber and a chamber standing wave accelerator. Microwave radiation is provided in the form of short pulses, about a few microseconds, and is emitted as pulses of high voltage, 50 kV, from the pulse modulation to the microwave source. Electromagnetic and voltage pulses are injected into the waveguide accelerator at the same time. The energy, which the electron has from high frequency accelerator tube, depends on the amplitude of the electric field, or in other way, it depends on the constant power source of high frequency waves. The electrons are accelerated to the required energy driving past the treatment plant to be used directly by electron beam treatment. When the machine is used in playback mode X-ray photon, the electron beam (which has been accelerated to considerable energy) will be directed at a target made of materials with a greater atomic number Z (X rays target), where electrons emit braking photons and X-ray photons through braking radiation effects. This radiation is used to treat cancer.

REFERENCES:

1. Kądziołka, M. Kisielewska-Birycka, T. Surowiak, J. Barszczewski, P. F. Kukołowicz. (2006). Information about the first Elekta Precise® accelerator installed in Poland, Report Practical Oncology Radiotherapy. pp. 147-155.
2. Reference to a chapter in a book: E. B. Podgorsak, Chapter 5. (2005). Treatment machines for external beam radiotherapy. Radiation oncology physics: A handbook for Teachers and Students, International Atomic Energy Agency Vienna.
3. L Grevillot, T Frisson, D Maneval, N Zahra, J-N Badel, D Sarrut. (2011). Simulation of a 6 MV Elekta Precise Linac photon beam using GATE/GEANT4, Physics in medicine and biology, 56. pp. 903-918.
4. Faiz M. Khan, Ph.D, The Physics of Radiation Therapy, third ed, Lippincott, Williams and Wilkins, Baltimore, MD (2003).

COMPARISON AND ANALYSIS OF ALGORITHMS FOR DOSE CALCULATION IN TISSUE-EQUIVALENT ENVIRONMENT WITH A TREATMENT PLANNING SYSTEM PLUNC FOR REMOTE RADIOTHERAPY

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The past decade has seen rapid changes in the field of radiation oncology ranging from an increasing shift to evidence-based treatments to a constantly expanding technological armamentarium [1]. For this reason, modern radiation therapy utilizes computer-optimized dose distributions with beam data transferred through a computer network from treatment planning system to accelerator for automatic delivery of radiation [2]. Examples of such planning systems are as follows: XiO and Monaco (Elekta), Eclipce (Varian) software.

PlanUNC is a portable, adaptable, and extensible set of software tools for radiation treatment planning funded by the National Institutes of Health and intended for educational purposes.

The objective of this work is to select the most appropriate treatment plan for providing recommended absorbed dose of ionizing radiation to tumor volume and the minimum dose to organs at risk and normal tissues surrounding the tumor.

The treatment plan was developed for patients with rectal cancer. The simulation was performed on the basis of actual dicom - images of the tumor obtained using modern medical equipment (Computed Tomography Aquilion

Toshiba). The planning for radiation treatment was carried out for photons and high-energy (15 MeV) electrons beams with different geometry:

- “box” - 4 beam (60 Gy / 2 Gy);
- field produced by a multi - petal collimator;
- 5 fields without filters;
- 5 fields with filters;
- “box” - 4 beam (60 Gy / 3 Gy).

Evaluation of the most appropriate radiation dose distribution was carried out on the basis of DVH - histograms.

The present study demonstrates the relationship between the dose distributions and the selected treatment plan. As a result of research, the comparison and analysis of algorithms for dose calculation in tissue-equivalent environment using treatment planning system PLUNC has been conducted. A methodological guide for working with the use of the PLUNC software has been developed.

REFERENCES

1. Gregory M. M., Vassil A.D. (2012). Handbook of Treatment Planning in Radiation Oncology. – M.: Demos Medical Publishing. p.127.
2. Karlsson M., Ahnesjo A., Georg D., Nyholm T., Olofsson J. (2010). Independent Dose Calculations – Concepts and Models. – M.: Estro. p.104.

APPLICATION OF RADIOMETRIC METHODS FOR MINERALS STUDY

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Radiometry is a set of methods used for measuring ionizing activity of radiation sources. Determination and study of natural minerals and rocks radioactivity is the basis for applying radiometric methods in mining industry. They are widely used in all research, exploration and exploitation stages of mineral products to determine the natural radionuclides in the subsurface rock, ores and processed products. Also, total radioactivity in samples is determined by measuring alpha, beta and gamma radiation, or main radioactive elements are determined separately using combined radiation.

According to the type of radiation, radiometric methods are divided into α-, β-, γ-methods:

1. Alpha radiation is a stream of positively charged particles (nucleus of helium). α-method is used to measure alpha-radiation and determine the concentration of radioactive elements (U, 222Rn, 226Ra, etc.) in radioactive ores and rocks. Application of this method is a complicated task due to special features of alpha-particles.

2. Beta radiation is a flow of electrons (β^-- radiation, or, more often, simply β-radiation) or positrons (β + - radiation), which is caused by radioactive decay.

3. Gamma radiation is a stream of electromagnetic radiation of very high frequency. Although the particles are scattered and absorbed by the environment, they have a higher penetration power owing to its electrical neutrality.

Some minerals are radioactive. The examples of radioactive ores are as follows: natural uranium, cinnabar, thorium and others. Therefore, rocks radioactivity can be determined by the rock-forming mineral radioactivity and varies within very wide limits depending on the quality and quantity of minerals, formation conditions, age and