On Figure 1 filtered with 1.6 mm Cu radiation spectrum of "transfer effect" depending on the temperature gradient for the crystal quartz of 9 mm thickness is shown. Energy of the first and the second order has been determined from the spectrum and its values are equal to 46.86±0.05 and 93,33±0.05 keV, FWHM is 2.2±0.1 and 3.4±0.3 keV, correspondently.

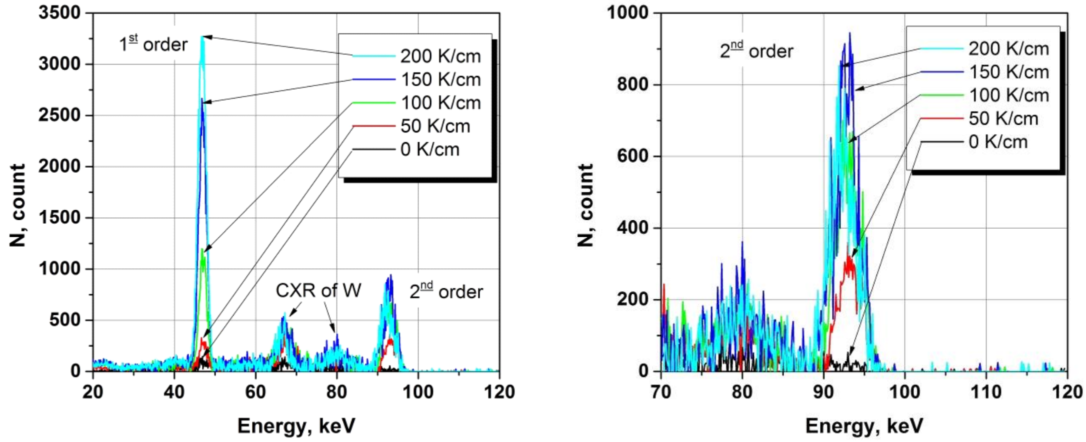

Fig. 1. The spectrum of the reflected beam (a) and zoomed part (b) for different values of the temperature gradient ΔT/Δx applied to the quartz single crystal with the thickness of 9 mm.

The spectral measurements confirm the effect of transfer from passing beam of X-ray radiation to reflecting beam and its dependency on the temperature gradient created in the crystal. Multiple increases in the intensity are caused by the phenomenon of full pumping of the X-ray from the passing direction to the reflecting direction with a big angular width, which is much bigger than the angular width of the Darwin table, and depends on the thickness of the observed mono-crystal. The intensity saturation is parallel to temperature gradients increase due to the fact that in big deformations the extinction length becomes much bigger than the effective thickness of the diffraction of each monochromatic X-ray waves.

This work was supported by The Ministry of education and science of the Russian Federation within "Nauka" Program project # 3761.

REFERENCES

1. A.S. Gogolev et al., (2011) . J. Phys. Conference Series 357 012018
2. Gogolev A, Potylitsyn A and Kube G (2012) J. Phys.: Conf. Ser. 357 012018

STRUCTURE AND OPERATING PRINCIPLES OF ELEKTA PRECISE LINEAR ACCELERATOR

Trinh Van Hien
National Research Tomsk Polytechnic University,
Russia, Tomsk, Lenin Avenue, 30, 634050
Email: trinhvanhien94@gmail.com

Radiation therapy uses controlled high-energy rays to treat tumors and other body diseases. Radiation works by damaging the DNA inside the cells making them unable to divide and reproduce. Abnormal cancer cells are more sensitive to radiation, because they divide more quickly than normal cells. There are many methods for various applications of radiation, one of the most commonly used method is an application of beam of photons emitted from the accelerator. In this paper, the structure of Elekta Precise accelerator is studied. There are some components of the precise radiation accelerator: gantry stand, gantry, electron gun, accelerating waveguide, treatment head and others.

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

I.Zh.Khassenova, E.S. Sukhikh
National Research Tomsk Polytechnic University,
Russia, Tomsk, Lenin Avenue, 30, 634050
E-mail: hasenova-indira@mail.ru

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