DEVICE CONCEPT FOR MEASURING THE TRANSVERSE DISTRIBUTION OF ELECTRONS IN THE BEAM ACCELERATOR

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Electron beams are widely used in medicine and other applied sciences. Every day there are more devices based on the use of electron beams [1]. Electron accelerators are used for quality control of materials, intermediates and products of high thickness in order to detect defects in their structure, in nuclear medicine - in the diagnosis and therapy of various fields of scientific and practical medicine (oncology, cardiology, etc.).

There are various methods for determining the spatial characteristics of the electron beam which are necessary to overall understand of the electron flux density in a beam cross-section. The existing methods for measuring these characteristics have a number of drawbacks. Methods based on the use of space-distributed ionization chambers have a low resolution; based on the use of dosimetric films and luminescent detectors, limited by dose beam characteristics. Thus, a need exists to develop new methods for measuring the distribution of the electron flux density in a beam cross-section.

The present work reveals the research of such a system implementation. The proposed method is based on the cross-section scanning beam with a thin strip at different angles. It should be taken into consideration that the number of scanning lines determines the accuracy of the measurement. The cross-section distribution of the electron flux density is reverted by Radon inverted transformation depending from a beam current on the position of the scanning element.

Thus, to measure the electron flux density in the cross-section the following results have been obtained in this paper, which make it possible to provide a device having a resolution of less than 1 mm, weakly dependent on the electron energy.

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HARD X-RAY LAUE MONOCHROMATOR

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Experimental studies of X–ray diffraction from reflecting atomic planes of X–cut quartz single crystal in Laue geometry influenced by the temperature gradient have been carried out. It has been shown that it is possible to reflect a hard X–ray beam with photon energy near the 100 keV with high efficiency by using the temperature gradient. It has been experimentally proved that the intensity of the reflected beam can be increased by more than order depending on the value of the temperature gradient.

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.

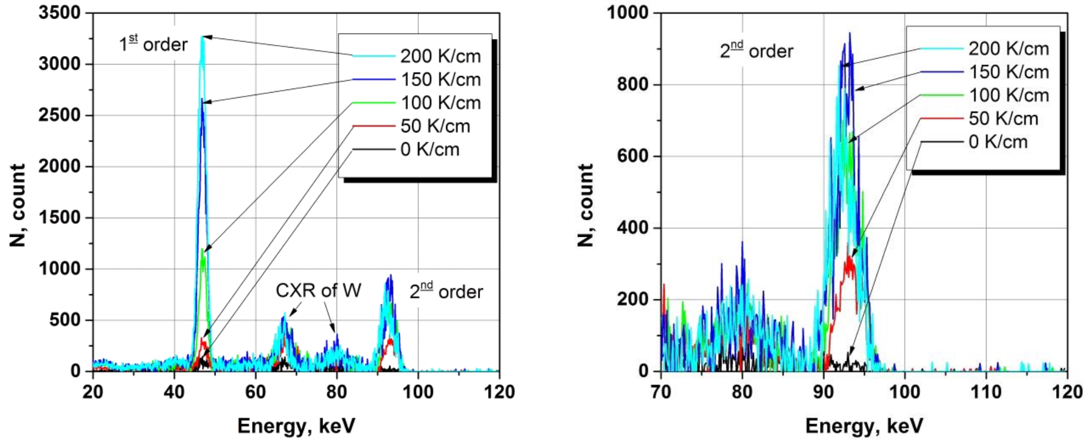

Fig. 1. The spectrum of the reflected beam (a) and zoomed part (b) for different values of the temperature gradient ΔT/Δx applied to the quartz single crystal with the thickness of 9 mm.

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.

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STRUCTURE AND OPERATING PRINCIPLES OF ELEKTA PRECISE LINEAR ACCELERATOR

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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.