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INVESTIGATION OF SPATIAL-TIME CHARACTERISTICS OF RADIATION DETECTORS BACKSCATTERING FROM THE MULTICHANNEL COLLIMATOR

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Computer tomography using back-scattering is increasingly used for nondestructive testing and diagnostics. Often the problem occurs when accessing an object of control and there is need for one-way access, related to its size, the impossibility of disconnecting and removing a particular node of the production cycle. In such cases it is advisable to use the method of imaging based on inverse Compton scattering. Among the objects of control, a study which is only possible with the use of imaging in the scattered radiation can be classified as follows: The control of multilayer shells of torpedo boats, searching for the body or under the deck beams, stiffeners, the study of the dynamics of external influence on the protective shell in aviation, shipbuilding, case of many products in the rocket-space technology, and more.

Unlike transmission tomography, is characterized by the universality of hardware and software, constructive and algorithmic features tomography backscattering determined by the specific appearance of the object and the tasks of reconstruction.

The problem of reconstruction is reflections photons scattered from a particular voxel, and compensation for the influence of the density distribution in the ways of propagation of radiation to weaken it. Selection is made either by using special systems kolllimation source and the scintillator, or by use of coordinate-sensitive detectors. Compensation ease - only programmatically.

As collimators used slotted, cylindrical, cell collimators, Pinhole. Collimator provides an unambiguous transfer point on the object of control to a point in space observations. In the simplest case, he performed as a lead plate with a hole corresponding to the size of the input window of the detector. Figure 1 shows a schematic ray using a slit collimator of the radiation source and Pinhole input window detector.

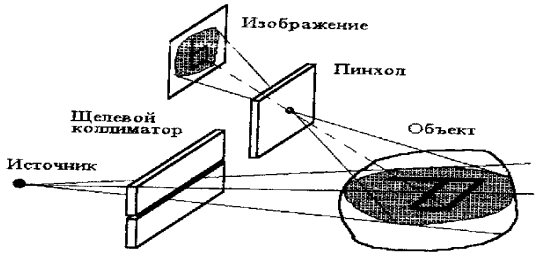

Figure 2 - Scheme ray systems using collimation

Collimator device is shown in Figure 2 is a collection of absorbing and impermeable rods. Quanta pass only along the rods, and across completely absorbed. First, long rods stick together, then cut into pieces and going to the device. This device became the basis for designing collimation device

Lying parallel plate absorber installed in the slab, so that between them there was an air gap, figure 3. Then are covered from the top of another plate. On the face side closed Teflon plate and filled air gap with epoxy resin on the opposite side, which also rose after the plate. When the resin hardens cleaned plates and plates.

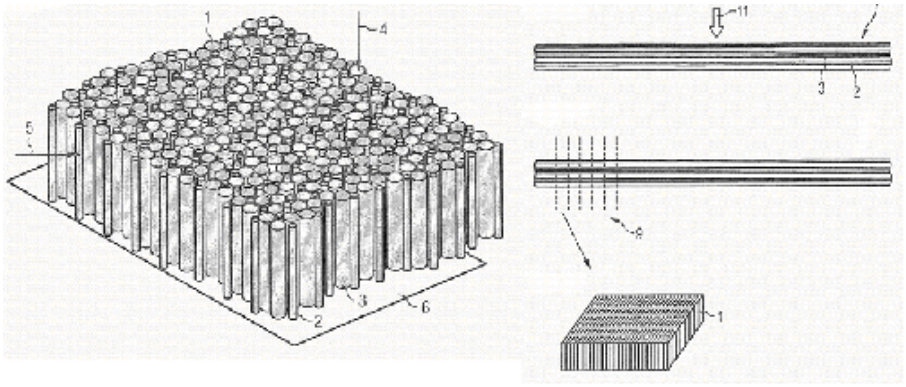

Figure 2 - The technology builds collimator

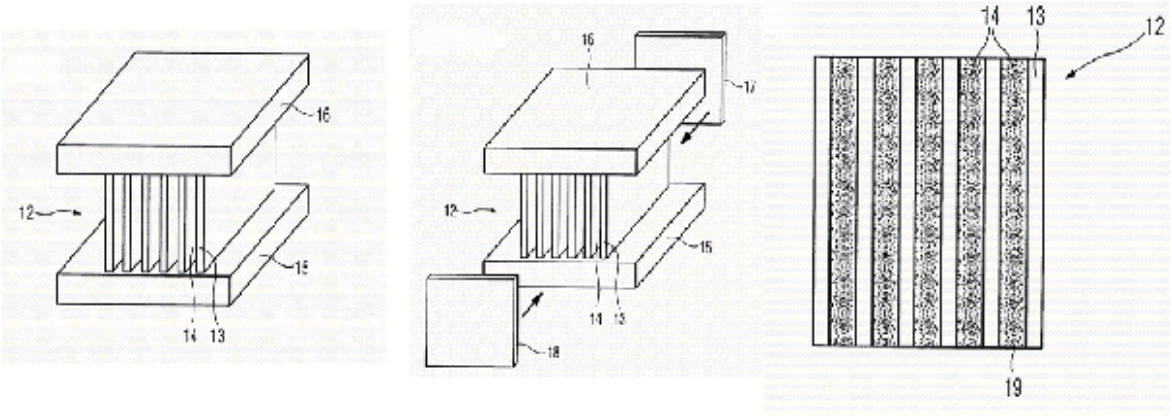

Figure 3 - Technology collimator assembly

In Figure 4, A and B shows one element of the collimator cell (a set of alternating absorbing and allow the plates (channels) with a diameter 0.1 mm) and the geometry of radiation passing through the plate.

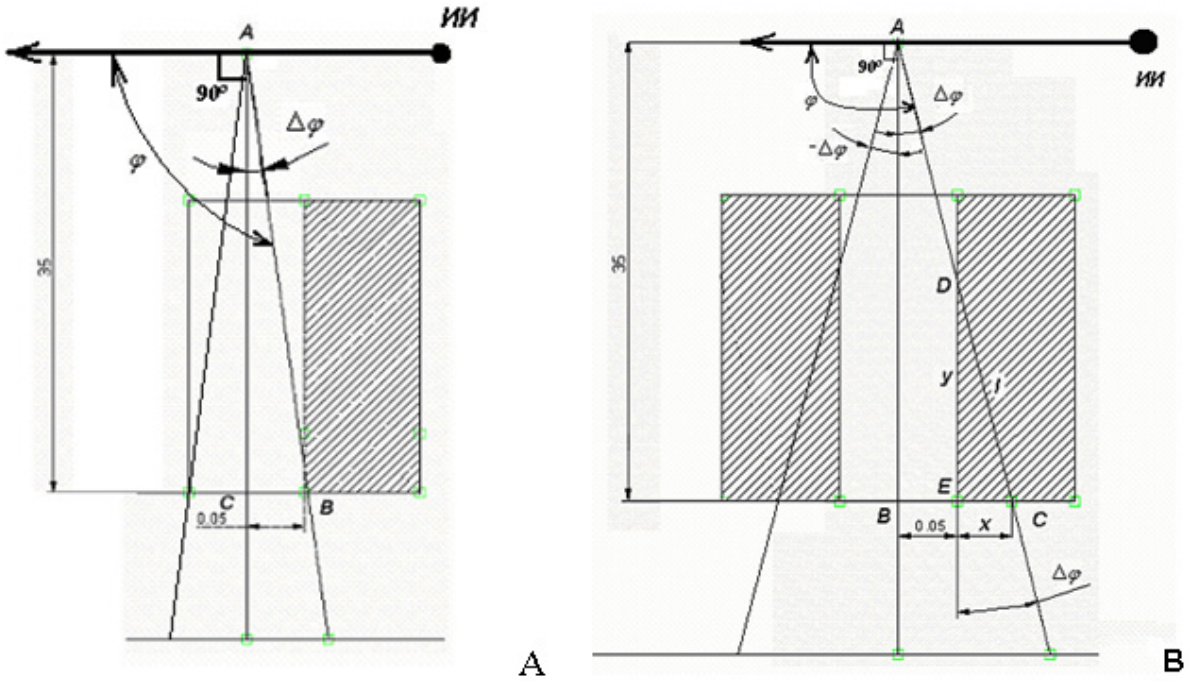

Figure 4 - Geometry of radiation passing through the collimator

The resolution of scanners with different collimation systems (cylindrical, cone cell collimators, circular and slotted Pinhole) is determined by the aperture function, which is the response of the system for resolution of the thin plate moving in zone "visibility" of the detector.

Aperture function is numerically equal to the normalized number of photons registered by the detector scanner, when finding a thin scattering plate in the x-coordinate. Theoretically, the aperture function is defined on the whole range of x. However, the range of meaningful values, which determines the resolving power, can take a finite (0; xr). The value of xr and defines aperture resolution imager.

Based on the considered geometry and the calculations has been built aperture function, shown in Figure 5.

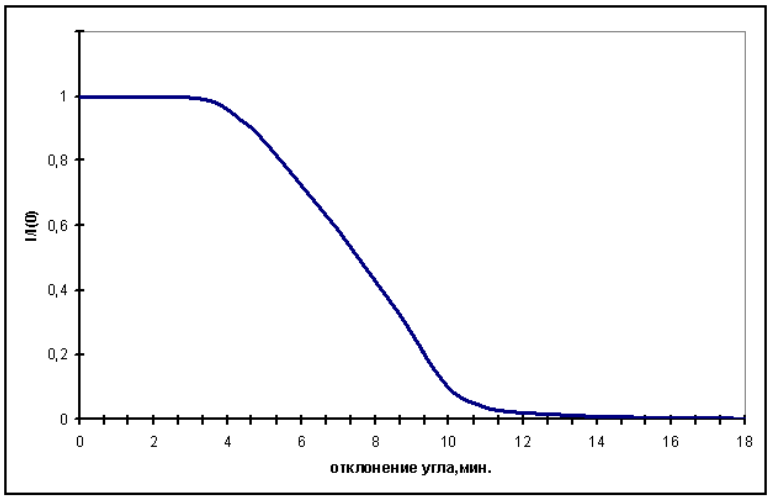

Figure 5 - aperture function

Result of this work was the development of new technologies for the collection device multichannel collimator for spatial selection of the scattered radiation. The collimator is a set of plates made of impermeable material and impermeable quanta. As impermeable materials used monofilament diameter of 0.5 mm, and as a material absorber copper wire with a diameter of 0.5 mm. Intuitively, the device and its components are shown in Figure 6

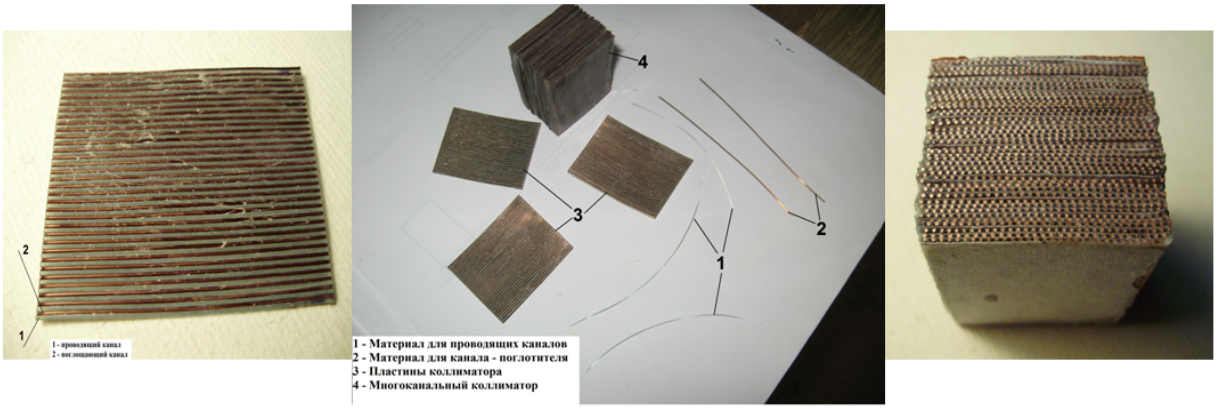

Figure 6 - multichannel collimator device and its components

The developed technology has allowed the sample to produce a multichannel collimator with a view to investigating the possibilities of its application in systems of Compton tomography.

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