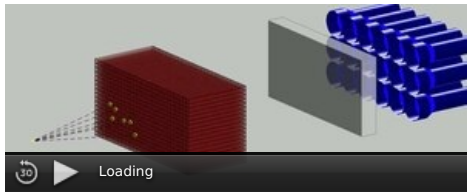
Collimator

The collimator is a lead (sometimes also tungsten), several cm high device in front of the scintillation crystal, filtering and focusing the impact of γ-ray photons on the scintillation crystal. It absorbs all photons flying in a direction, which is different than perpendicular, to the device. This ensures optimal image sharpness. Resolution and sensitivity of collimator deteriorate rapidly with increasing distance from the monitored object. This is the reason, why it must be as close as possible to patient´s body.



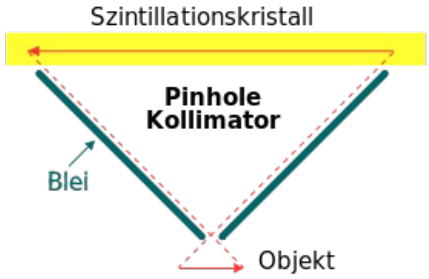
Animation of the parallel collimator

Distribution of collimators

Collimators are divided according to shape, energy, spatial resolution and sensitivity of collimator. This is determined by the thickness of collimator, hole density, thickness of partitions.

By shape[1][2]

- **multi-hole collimator with parallel holes** - collimator with thousands of holes, which are in a parallel axis with detector. Detector image has the same size. This is the most often used collimator.
- **divergent collimator** - collimator with holes diverging towards the radiation source. It allows to gain bigger picture than surface of crystal, but it is smaller sensitivity and spatial resolution-It takes up an area larger than the area of the detector.
- **convergent collimator** - collimator with holes converging to radiation source. That´s what we get enlarged picture of little organ with an increased sensitivity and a spatilal resolution-It spreads a small area of the object over a larger area of the detector.
- **Pinhole collimator** - funnel-shaped collimator with diametr hole 3-5 mm. It provides enlarged picture wit the highest positional resolution, but there is low sensitivity (extends examination time). It is extended time of examination. It is inteded for observation of small organs (for example, thyroid gland, testicles).
- **fan beam collimator**[2] - this type has focus in transversal direction while it is paralel in axial direction. Thanks to this, it has more than 50% higher spatial resolution than paralel typ. It is used in cerebral computer tomography.



Pinhole

By energy[2]

This distribution is important for thickness of collimator´s partition. If a high energy emitter were used for collimator for the low energy, partitions would leak photons and they caused blurriness of the whole image.

- for emitters with low energies to 160 keV(e.g. ^{99m}Tc, ^{201}Tl, ^{123}I)
- for emitters with midium energies to 300 keV(e.g. ^{111}In, ^{67} Ga)
- for emitters with high energies to 400 keV(e.g. ^{131}I, ^{18}F)

Links

Related articles

- SPECT
- Scintigraphy
- Gamma camera

Bibliography

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- KUPKA, Karel – KUINYI, Josef – ŠÁMAL, Martin et al.. *Nukleární medicína.* 1. edition. 2007. ISBN 978-80-903584-9-2.

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2. KUPKA, Karel – KUBINYI, Jozef – ŠÁMAL, Martin, et al. *Nukleární medicína.* 1.

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