in more detail, we will find that the mean value of n slowly rises and after some time (here after taking approximately 400 frames) it returns to the original level. Most probably at that point the bubble was already not present on the ring because it burst.

From the time development of the value of n, we can conclude that the thickness of the bubble gradually decreases as the fluid continuously flows down until the bubble shrinks so much that it bursts. The point of bursting, however, cannot be in the chart determined.

3.4.18 The absorption of alpha particles in water

Clean water is transparent to gamma photons and to visible light photons, but the alpha radiation is strongly absorbed in it. We will verify this fact on the impact of radiation emitted by the ŠZZ on a drop of water.

Experiment type:	Demonstration			
Duration:	4 min			
Equipment:	MX-10 camera and computer, mounting rails, ŠZZ Alfa, food wrapping foil, water, drinking straw, rubber bands or Scotch tape			
Settings:	*Radiation source:*	241 Am	*Exp. count:*	1000
	Mode:	Spectrometer	*Exp. time:*	0.1 s
	Analysis type:	Basic	*Min. level:*	0
	Bias voltage:	20 V	*Max. level:*	50
	Continuous m.:	No	*Colormap:*	Hot
	Integral mode:	Yes		

Instructions: Mount the MX-10 detector and the and ŠZZ Alfa source on the mounting rails and fix the radiation source mounting block in such manner that the rails can be raised and turned by 90° without any risk of a fall of the source onto the detector. The detector sensor is now in horizontal position and the ŠZZ Alfa radiation source is above it (Fig. 58). Choose the short hole particle output.

Put one layer of food wrapping foil on the detector, and drop on it a small droplet of water – just a few millimeters wide (e.g. by a straw). Place the source of the radiation approximately 5 mm above the sensor and run measurement. In Fig. 59 the droplet of water appears as a black spot, which does not contain any alpha particle tracks. The alpha particles emitted by the ŠZZ are absorbed by water layer only a few tens of micrometers thick. The drop of water had a significantly greater thickness, therefore it completely blocked the alpha radiation.

Figure 58: The setup for demonstration of the absorption of radiation in a water drop. The sensor is in the horizontal position, above it is a piece of food wrapping foil with a drop of water and above the center of the sensor is the radiation source. For a better visibility of the drop is the source in this picture placed higher than in actual measurement.

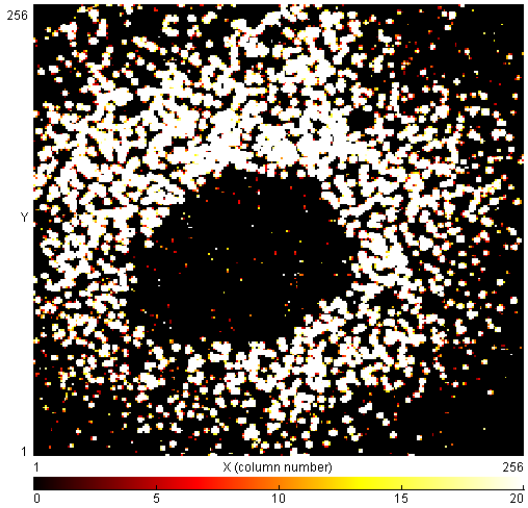

Figure 59: The projection of a water droplet on food wrapping foil.

The gamma photons are passing through the drop of water because the water layer is not too thick. A layer of water several meters thick, however, can contribute to shielding the gamma radiation, which is being used in nuclear power plants. The spent fuel is removed from the reactor and stored in a pool of water, which is used for cooling the fuel, shielding the flux of neutrons and partly shielding the gamma radiation.

3.4.19 Is aluminum foil thinner than a human hair?

In the experiments described in previous text we studied how alpha particles behave when impacting on various thin layers. We have tested that in close proximity of the source of radiation ŠZZ Alfa and the aluminum foil, the alpha particles pass through. Would it be possible to determine the thickness of the foil? Is it thinner than a human hair, whose thickness is commonly in range from 60 µm to 100 µm?

Experiment type:	Demonstration			
Duration:	7 min			
Equipment:	MX-10 camera and computer, mounting rails, ŠZZ Alfa, aluminum foil			
Settings:	*Radiation source:*	241 Am	*Exp. count:*	100
	Mode:	Spectrometer	*Exp. time:*	0.5 s
	Analysis type:	Basic	*Min. level:*	0
	Bias voltage:	20 V	*Max. level:*	1
	Continuous m.:	Yes	*Colormap:*	Gray
	Integral mode:	No		

Instructions: Mount the MX-10 detector and the ŠZZ Alfa source on the mounting rails and on the ŠZZ choose the sieve particle output. Place the source as close as possible to the detector. Insert one layer of aluminum foil between the alpha source and the detector and start measurement. We can see that alpha particles penetrate the aluminum foil (Fig. 60 a).

Remove the foil, fold in half and place it again in front of the sensor. The image is now significantly different. No alpha particles pass through the aluminum foil and we detect only gamma radiation (Fig. 60 b).

The mean linear range R_{air} of alpha particles in air is approximately given by (4) and from the value R_{air} it is possible to calculate the mean linear range $R_{\text{substance}}$ in other substances (see [8]).