The most simple solution: The „Mini-Geigerle" – a Detector for Radioactivity based on the PC-Soundcard

Bernd Laquai, 12.6.2012

The most simple and cost effective way to detect radioactivity is to just assemble the TIA measurement amplifier of the „Stuttgarter Geigerle" and to connect its output via a large capacitor to the microphone input of a more or less well performing PC sound card (circuit diagram see end of the text). The amplifier however should be arranged in a light protected metal box in which the sample fits in too (or to use the specially prepared alpha sensor, see separate article). This box also acts as a shielding against interference from other electrical fields or electromagnetic radiation.

The pulses generated from the decay of the sample can hardly be heard, since they occur with a typical pulse width of about 50us. The activity can be recognized as a weak high frequency sizzling noise. However, even a medium quality soundcard is able to sample an input signal with 44000Hz (CD quality), what is just sufficient to visualize the recorded pulses with an audio editor program.

A further advantage of this method is that even though the pulses are hardly audible, an audio editor is able to visualize the energy of the pulses in terms of the impulse heights, provided the audio amplifier is connected to the input of the soundcard without a comparator in between. It should be taken into account however, that most of the soundcards change the shape of the pulses quite dramatically due to a more or less non-constant frequency characteristic. Despite the distortion, the pulse heights are proportional to the energy of the detected radiation quants. This can be recognized pretty clearly when using the alpha sensitive detector put immediately in front of an alpha source. In such a case the difference to weaker beta and gamma pulses become clearly visible. The strong alpha pulses can be distinguished well from the lower beta/gamma pulses in terms of their height.

When storing the audio data in a .wav audio format, a post-processing with math software like Scilab or Matlab is possible in addition to do further analysis like sorting the pulses with respect to their height in a histogram. This yields a coarse energy spectrum and in turn allows a conclusion on the type of radiation source.

Fig. 1: The „Mini-Geigerle“, the amplifier connected directly to the PC-Soundcard, external 12V power supply

Fig. 2: The interior of the „Mini-Geigerle“ using the S1223 alpha sensitive detector (see separate article)

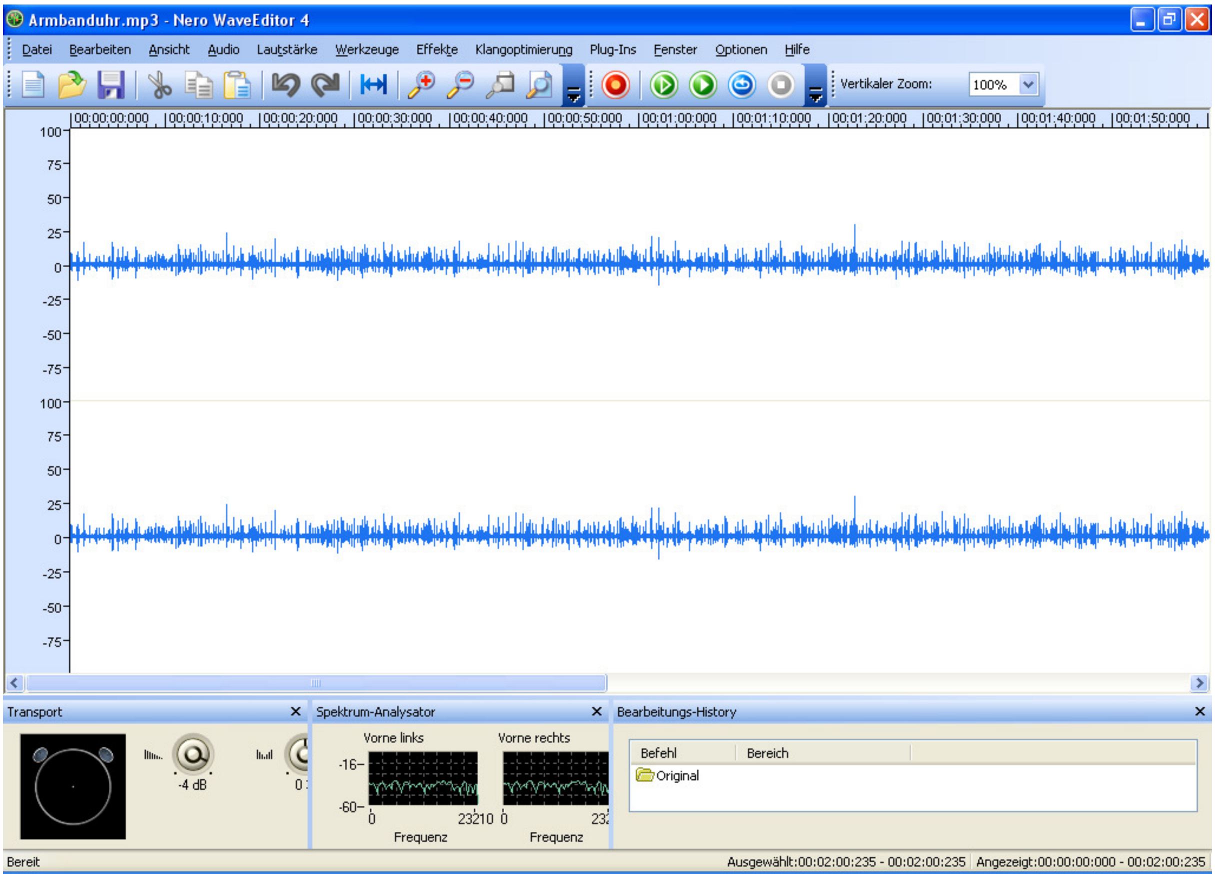

Fig. 3: Soundcard recording of pulses generated from an old wrist watch

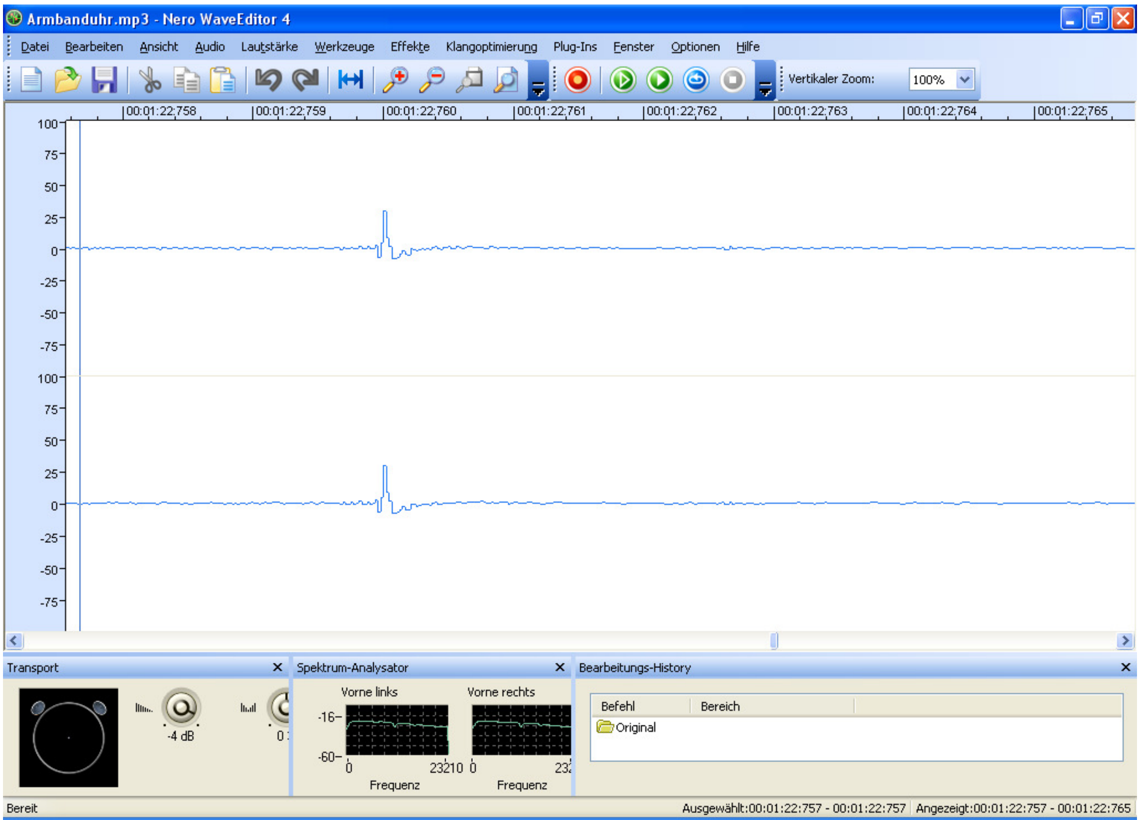

Fig: 4: Close up to a single pulse of the wrist watch sample (beta or gamma quantum)

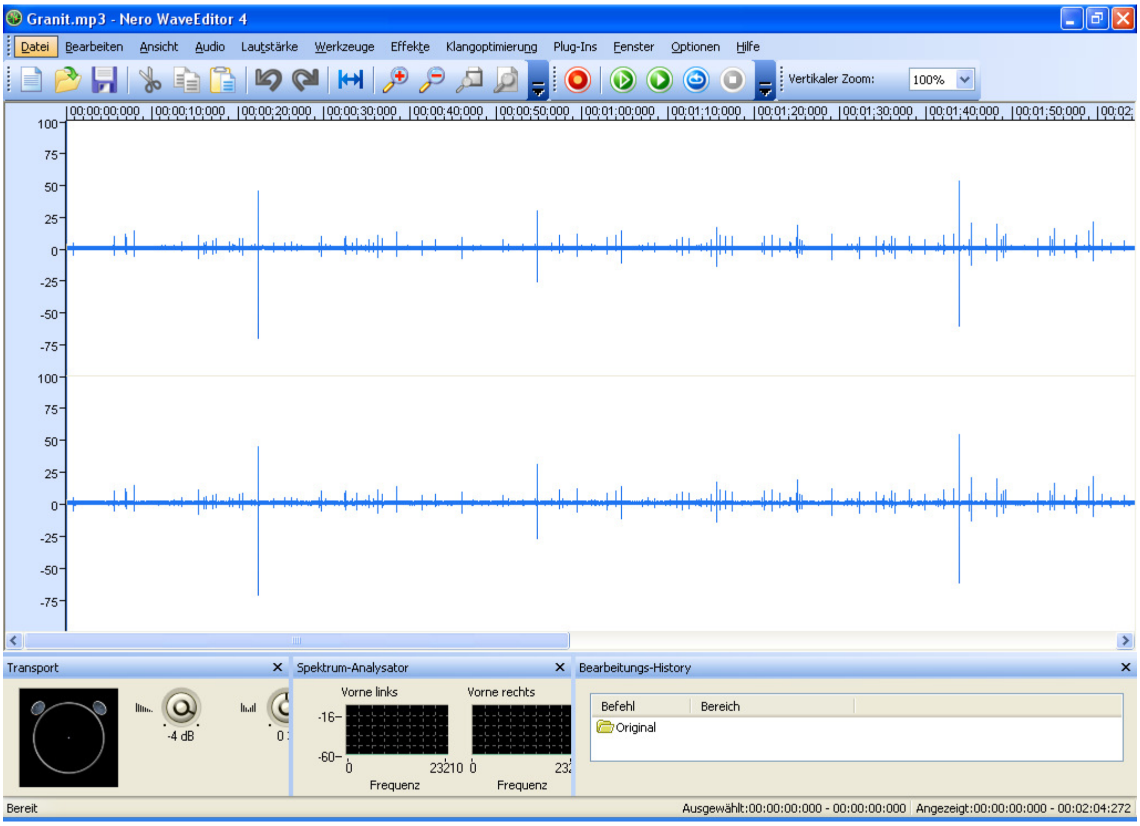

Fig. 5: Granite stone from the black forest area recorded with the alpha sensitive detector. The very strong alpha pulses show up pretty clearly but the activity is not very high.

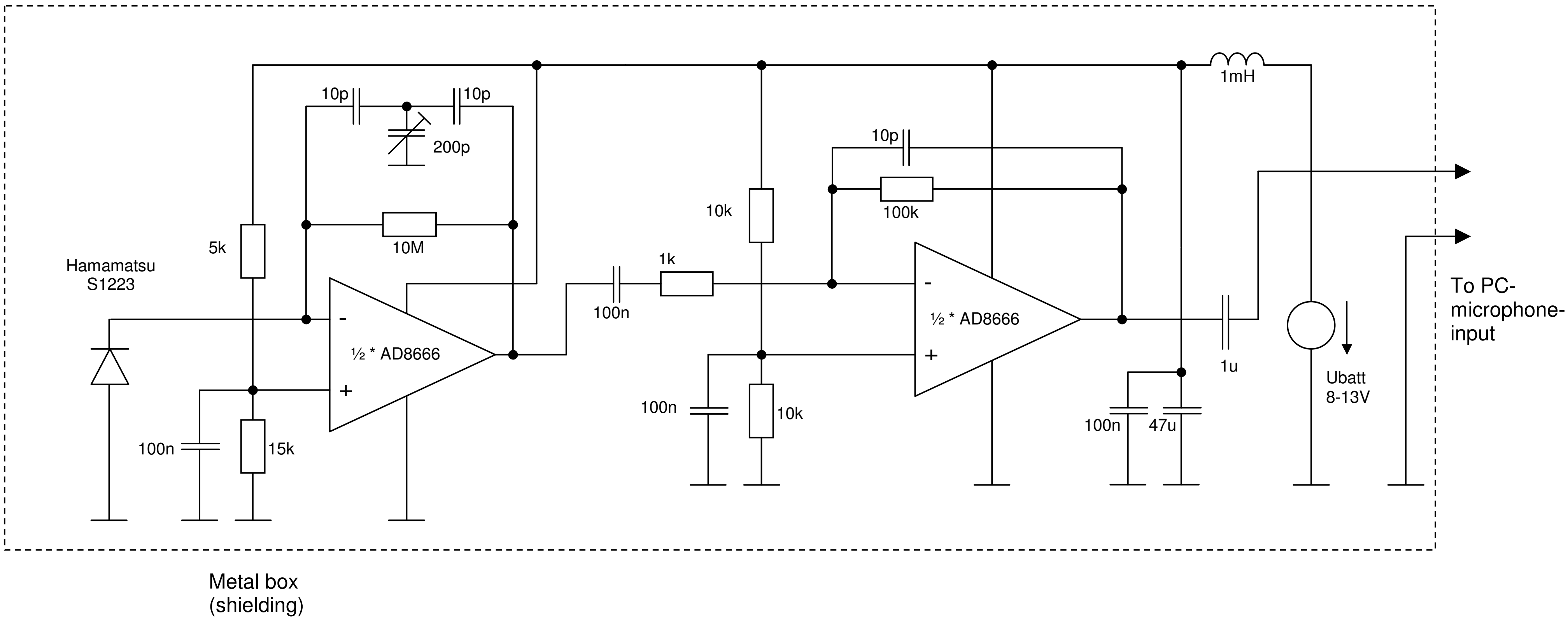

Fig. 6: Measurement amplifier from the „Stuttgarter Geigerle“ with connection to the soundcard of a PC. I named this reduced lowest cost version “Mini Geigerle”.