Theremino Geiger & Teviso RD2014 Sensor

Teviso RD2014 Sensor Characteristics

Detector type : **RD2014**
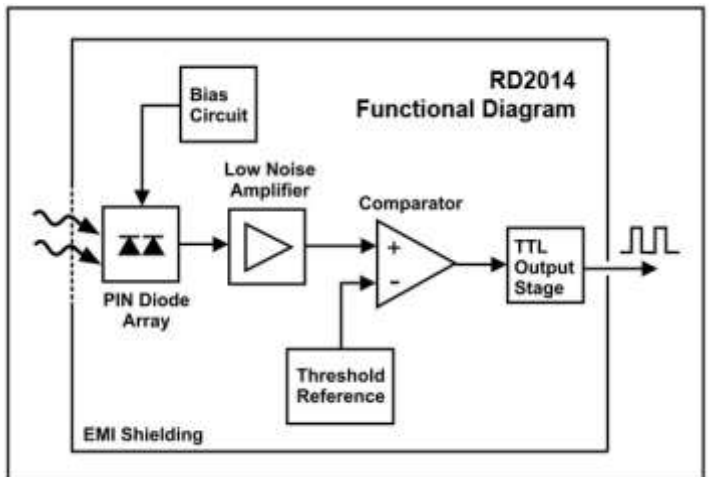Detector Sensitivity : 1 CPS/mR/h (or 5.8 CPM/µSv/h)
Radiations : Beta+Gamma

Supply voltage range : VCC 3.0 V to 5.0 V
Supply current : 400 µA TYP, 450 µA MAX

Output pulse level Equal to supply voltage (positive going)
Output pulse width 40 µsec to 150 µsec

Theremino Geiger

Based on a simple and reliable hardware, this tool has a sophisticated software (open source) that turns it into a professional equipment, similar to a "Rate-Meter", with characteristics unattainable from the "usual" Geiger counters. The possibility of making averages over long times allows to perform accurate measurements with the most various sensors. This tool is great in education and experimenting and it gives schools and technical institutes the opportunity to carry out professional analysis, such as the determination of the natural radioactivity of ceramics and building materials.

Connection with PC

The PC has to be connected, through USB cable, to a "Master" module that can be purchased on site http://www.theremino.com/ or built "do-it-yourself" following the instructions on the same site.

Connection of Sensor RD2014
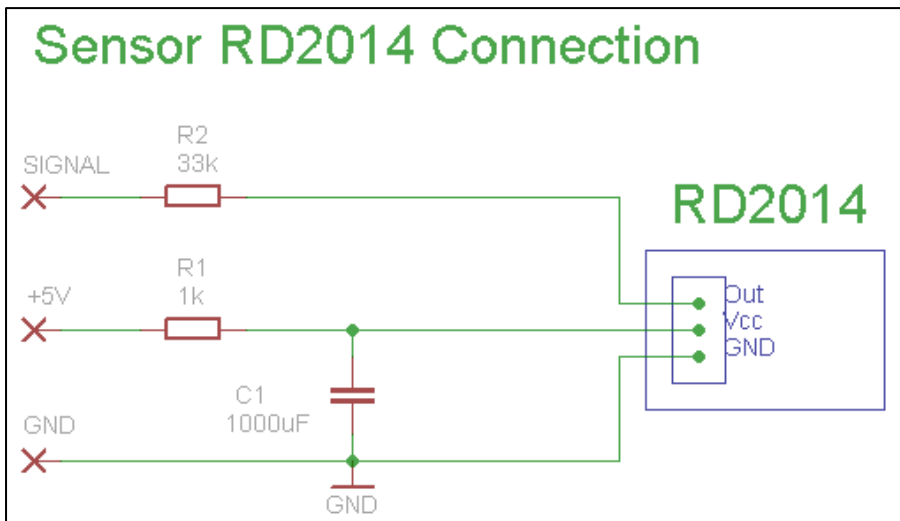
In the scheme and picture shown above you can see the connection of the sensor RD2014. The power supply line of +5V comes from the connector present on the Master (see the picture below) and must be filtered with an RC filter. The TTL signal that comes from the sensor has to be connected to an input of the Theremino Master through a 33k resistor in order to limit the current, this is because the input "high level" voltage has a value of 3.3V instead of 5V.

Meauserement Software
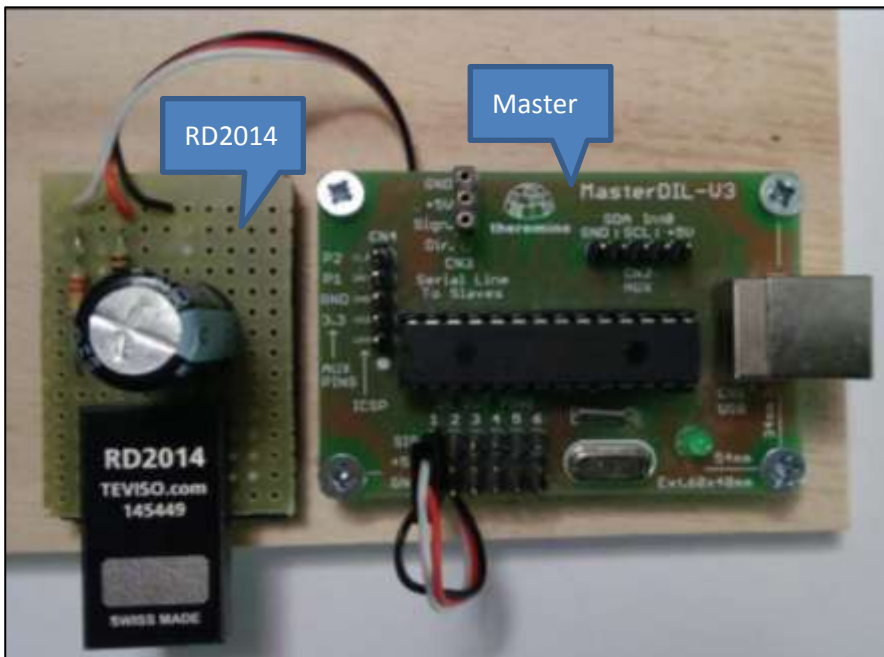
Background radiation
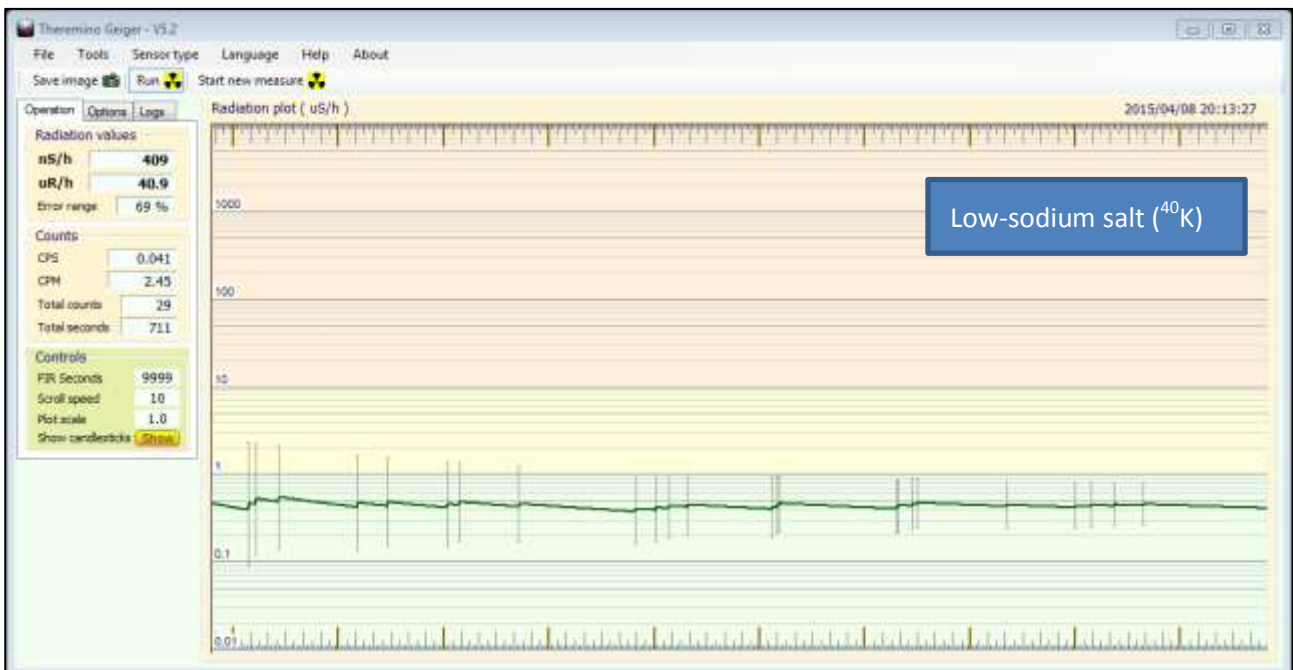
Low-sodium salt (^{40}K)

In the above images you can see, in the first screenshot, the measure of the background radiation level, and in the second one the radiation level of the low-sodium salt, which contains potassium with the radio-isotope ^{40}K. This is a "difficult" analysis that needs long time to be performed. The measure stabilizes and trust lines converge towards the value of **100 nS/h** which is the normal background radiation level present in the laboratory and towards the value of **400 nS/h** when the potassium salt is put near the detector.

This is the analog instrument window, useful for those who are more comfortable with the old Geiger counters and measurement units such as CPS and CPM. This instrument is less accurate than the main window of the application, but it has a faster response.

The analog instrument window can be placed alongside the main window, which is instead used for measurements over long periods and it also acts as a "scaler" and as a "ratemeter" thus you can perform measures of very low levels of radioactivity with great accuracy.

By means of moving averages, "Finite Response" averages and other mathematical techniques for noise reduction, you can achieve a useful and accurate measurement even with low levels of radiation and sensors with low sensitivity.

The application (Open Source with source code) could be downloaded at:
http://www.theremino.com/downloads/radioactivity

Software Features

- Integration time adjustable from 1 to 9999 seconds (almost three hours)
- Integration of type "finite response" based on FIFO followed by a moving average
- Readout of radiation level in micro-Sievert and milli-Roentgen
- Continuous updating of the measurement accuracy based on the amount of events
- Continuous updating of counts per second, per minute, and the total elapsed time
- Scale in uS/h with candle-sticks of Min-Max (trust lines)
- Analog display calibrated in uS/h, mR/h, CPS and CPM, useful for fast" analysis
- Chart with speed control
- Chart with memory with "zoom"
- Calibration of "sensitivity", "background" e "dead time" for each sensor
- Modularity and full integration with the Theremino system through SLOT
- Ability to transmit data via SLOT, IP, local network and the Internet
- Adjustable sounds in order to realistically reproduces the "click" of Geiger
- Typical sounds for alarm and event reporting
- Detailed LOG
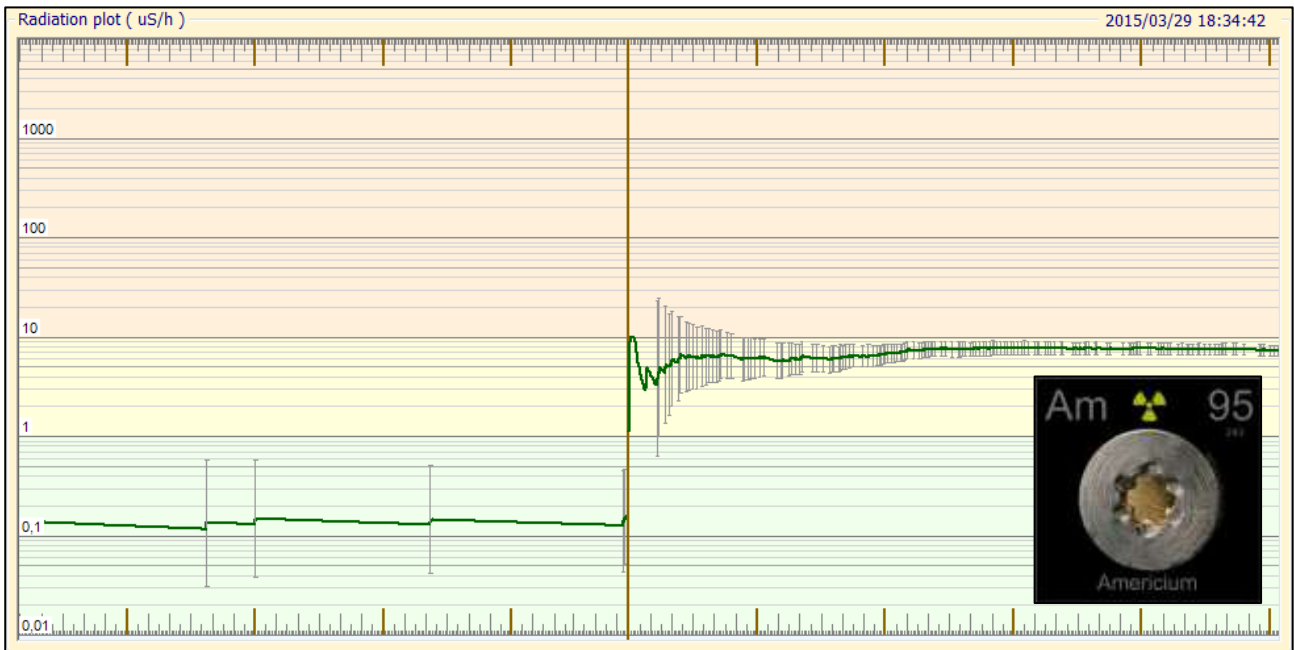- Availability of different languages

Configuration Parameters for Teviso RD2014

Sensitivity : 1 CPS/mR/h
Background : 0 CPS
Dead time : 0 us

Americium Cap (^{241}Am)

Sensor : RD2014
Background : 0,1 µSv/h
Result : 7 µSv/h

Caesium Spark Gap (^{137}Ce)

Sensor : RD2014
Background : 0,1 µSv/h
Result : 5 µSv/h

Autunite (uranyl phosphate)
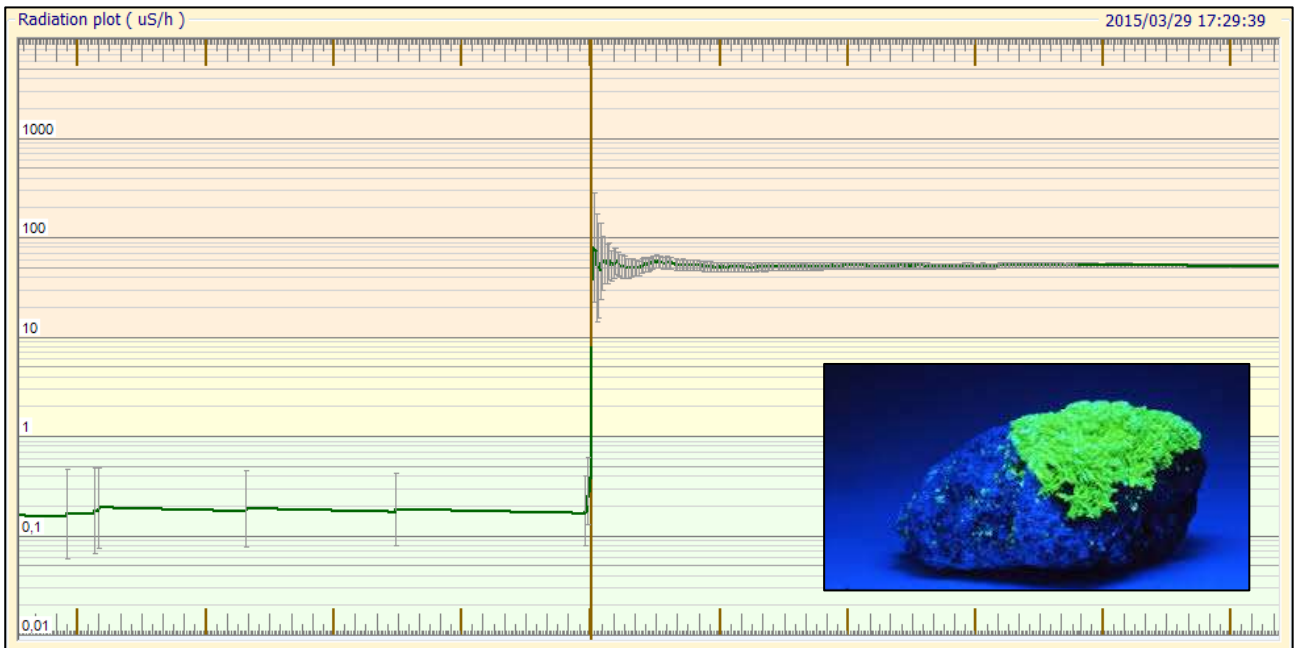
Sensor : RD2014
Background : 0,1 µSv/h
Result : 50 µSv/h

Uraninite (or Pitchblende)
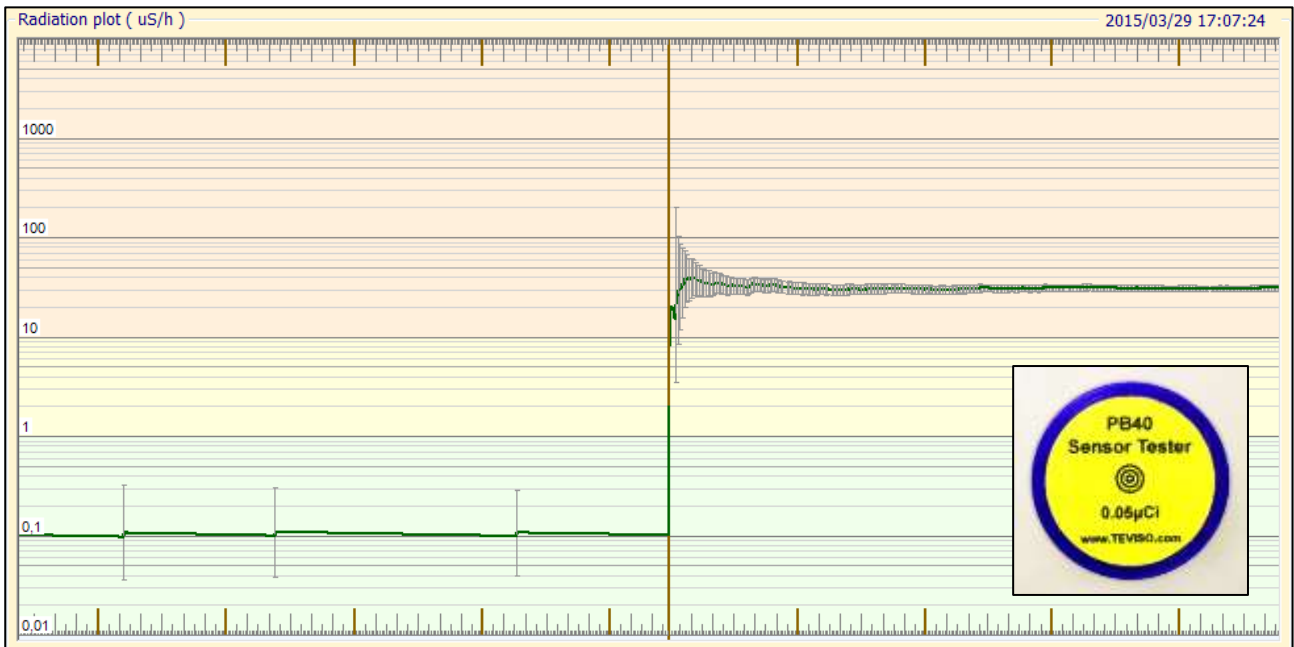
Sensor : RD2014
Background : 0,1 µSv/h
Result : 30 µSv/h

"Fiestaware" Uranium Glaze
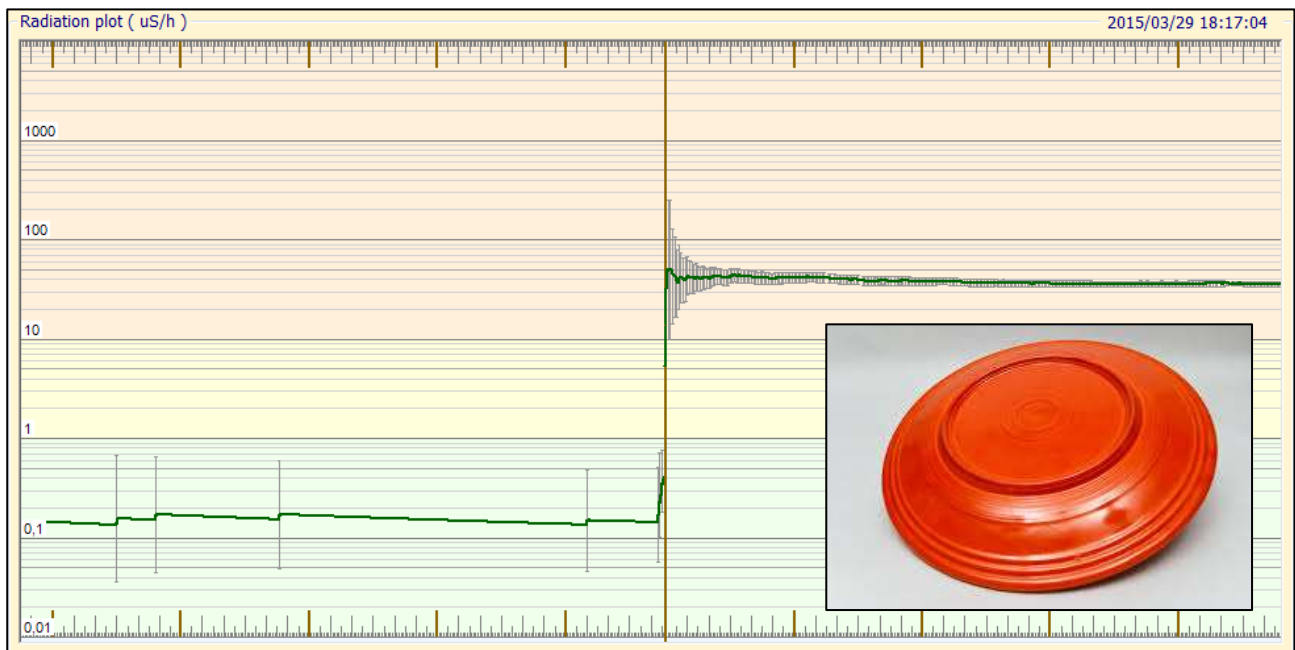
Sensor : RD2014
Background : 0,1 µSv/h
Result : 35 µSv/h

Thorium Gas Mantle (^{232}Th)
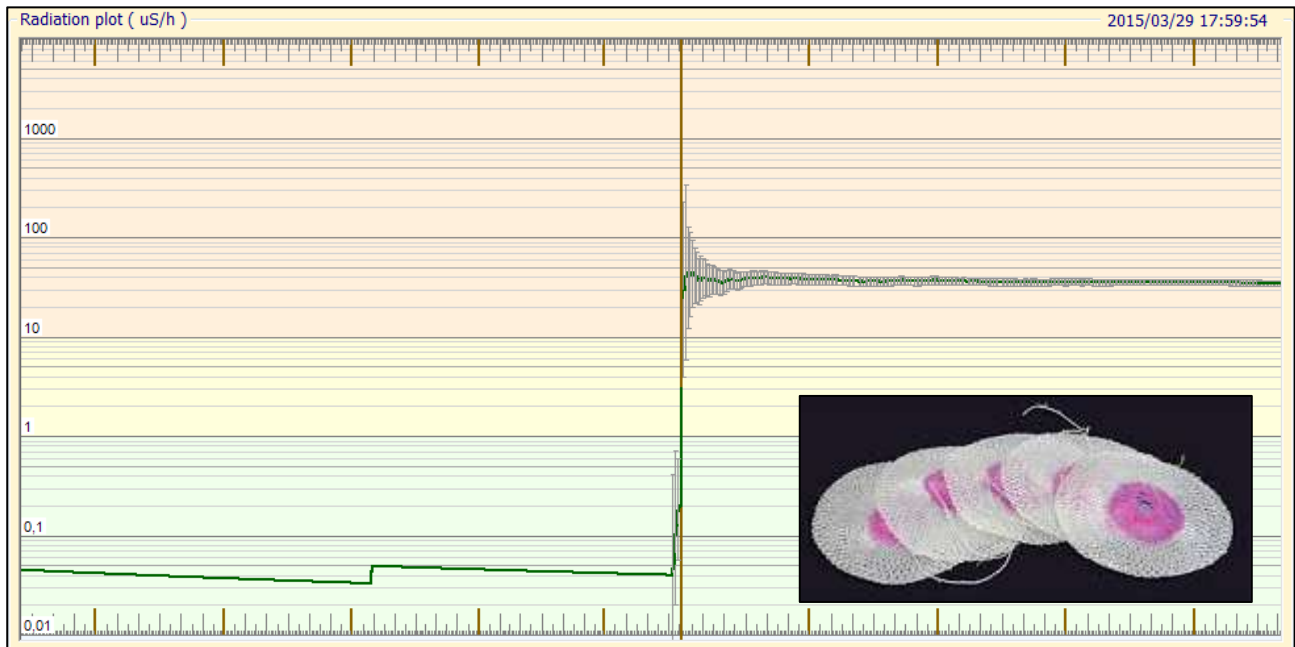
Sensor : RD2014
Background : 0,1 µSv/h
Result : 35 µSv/h

Radium Watch Hands

Sensor : RD2014
Background : 0,1 µSv/h
Result : 3 µSv/h