

DOSIMETRY SETUP PROTOTYPE FOR THE SLOW CONTROL SYSTEM OF THE MPD-TOF*

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The purpose of the considered project is to create an information tool for effective control of Gamma-Scout Geiger counters. The main goal of the system for nuclear and radiation safety is to protect health and life of people and to preserve the electronic equipment. Features of the proposed software are the following: (i) Real-time dose-rate measuring; (ii) Support for previous revisions of Gamma-Scout devices; (iii) Data logging and remote display of dose-rate for smartphones. However, it is impossible to record two charged particles in one Geiger tube at the same time [C. Grupen, B. Shwartz, «Particle Detectors Second Edition», *Cambridge Monographs on Particle Physics, Nuclear Physics and Cosmology*, 2008]. It is important to know, there are limitations in measuring high radiation rates and the energy of incident radiation.

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1. System description

The Gamma-Scout (all types, include “Standard”, “Alert”, “Online”, “Rechargeable”) work with the LND 712 detector made in the USA (Fig. 1).

At the anode of the tube, there are coming pulses. The Gamma-Scout algorithm collects the pulses at the anode parallel to a quartz and builds a pulse rate of pulses per two seconds. In the next step, the algorithm is flattening the rate by a certain logic (over the last 30 intervals, two seconds each, roughly, by higher inputs, it is dynamically shortening the number of intervals). In the third step, the algorithm assigns a dose rate ($\mu\text{Sv/h}$) using the table of dose rate to pulse rate, built with a gauged Cs-137 source (quite complex, not a polynomial relation). The Gamma-Scout is a Geiger counter that measures alpha, beta, gamma and X-ray radiation.

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Fig. 1. Front panels of Gamma-Scout detectors.

The detector has a few aspects [1]:

1. The tube accepts ALL inputs alfa, beta, and gamma (different to the Russian SBM 20, which does not detect alfa).
2. The tube is NOT energy compensated and accepts all rays from isotopes, from a pointed source and its environment.
3. The Gamma-Scout displays the $\mu\text{Sv/h}$ exactly (and is able to be calibrated, if wanted repeatedly) for Cs-137 and similar Co-60, due to a similar energy chart — but not identical for all other isotopes.
4. If the user works with other isotopes than Cs-137, he gets a reasonable dose rate, but not the precise dose rate; GS has the option to display pulses which the user can convert with his own tables.

2. Software description

In this project, we used the development environment LabVIEW 2016 with preinstalled drivers for RS-485/232 and VISA library. At first, the VISA functions are initialized with COM-port parameters. Next, the user chooses an option like “Read log-file”, “Current dose-rate”, “Switch to Acquisition mode”, “Switch to PC-mode”, “Clear log-file” by sending the following codes through a virtual com-port (Fig. 2):

- ‘P’ (in ASCII) switches to PC mode (the same as pressing PC button);
- ‘O’ (in ASCII) switches to “classic” online mode (only for online devices);
- ‘R’ (in ASCII) switches to dose-rate online mode (only for online devices);
- ‘D’ (in ASCII) switches to dose online mode (only for online devices);
- ‘X’ (in ASCII) exits online mode;

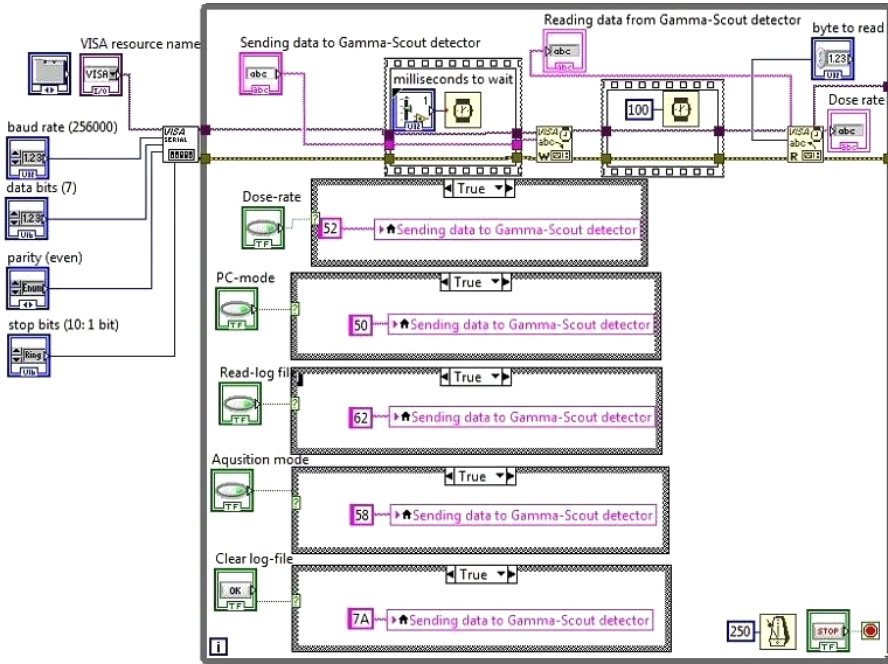


Fig. 2. Block diagram of software designed for Gamma-Scout detector.

- ‘b’ (in ASCII) dumps protocol memory;
- ‘z’ (in ASCII) resets protocol pointer to beginning of memory (Fig. 3);
- ‘N’ (in ASCII) warm start [2].

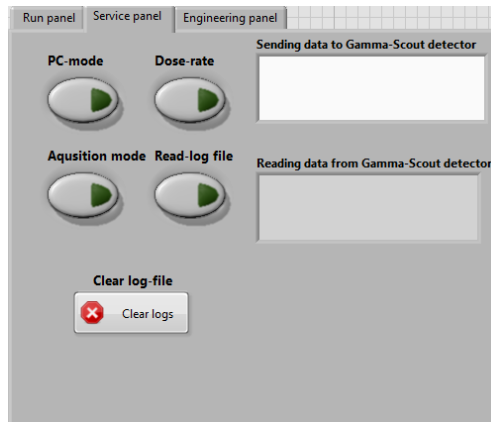


Fig. 3. User interface for configuration and service panel.

At the final step, the VISA-read function reads all data in the buffer, and the software saves all data into log-file including data such as current time, current dose, month, day, current year.

3. Summary

The permissible error of Gamma-Scout is ± 5 percent. The input varies between 0.08 and 0.25 $\mu\text{Sv/h}$ and partially more under normal environmental conditions. A contamination should be above 1.0 $\mu\text{Sv/h}$ [1].

As a result, the software of the nuclear and radiation system was designed to read the current dose-rate (Fig. 4), display it remotely and save it in log-file. To prevent the MPD platform from malfunctioning, when the determined level of radiation is reached, a software should be triggered and special procedures should take place to stop electronic equipment, PLC's and physical facilities.

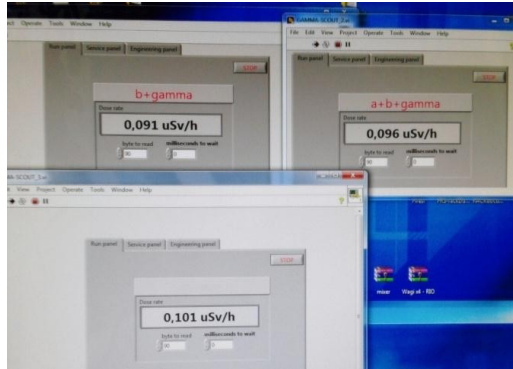


Fig. 4. User interface for run panel.

REFERENCES

- [1] Gamma-Scout GmbH & CO. KG, «Gamma Scout English manual», 2017, available at: <https://gamma-scout.com>
- [2] Reverse engineering of Gamma-Scout detector available at: <https://johannes-bauer.com/linux/gammascout/>