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MODELLING OF NONLINEARITY OF LIGHT COLLECTION IN LARGE-VOLUME SCINTILLATORS

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In the state of progressive extension of information technologies around the world, non-analytic methods of calculation are widely used by means of powerful computer systems. In particular, it is very effective today to use the Monte Carlo method to simulate the transport of ionizing radiations in different materials.

Keywords: Monte Carlo method, scintillation, optical photons.

The systems of radiation portal monitors are an effective way to provide homeland security on potential dangerous objects. Recently, the idea of categorization of isotopes to increase the speed and quality of inspection at customs facilities has been actualized. In RPM the large volume scintillators are usually used to achieve the maximum sensitivity at low exposure rate. This inevitably leads to the problem of nonlinearity of light collection. In other words, the amount of light detected depends on the detector point where the flash occurred. The nonlinearity of the light collection results in a deterioration of detector's resolving power and, consequently, the possibility of correct categorization of isotopes.

GEANT4 is an open-source software toolkit for simulation of the transport of different types of particles through matter [1]. It has traditionally been used in medium and generally high energy physics applications. However, there is on-going development to extend the capabilities of this toolkit beyond this traditional scope [2]. In particular, some effort has been made into applying GEANT4 in the simulation of the optics of scintillation. For example, the simulation may commence with the propagation of a charged particle and end with the registration of the ensuing optical photons on photo sensitive areas, all within the same event loop [3].

In this research capability of GEANT4 to predict the nonlinearity of light collection in large-volume scintillators was investigated.

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AUTOMATING THE MANAGEMENT OF THE PORTAL RADIATION MONITORS SYSTEM

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Modern world is filled with events that disastrously influence nature and society. Some of these events, such as acts of terror at potentially dangerous facilities or illicit trafficking of ionizing radiation sources and nuclear materials, can be prevented by usage of specialized radiation monitoring systems – radiation portal monitors. Automation of management of such systems allows to speed up and increase work quality of various security services.

Keywords: radiation control, automation, software.

Radiation portal monitor systems are the means of continuous radiation monitoring. They are designed to detect sources of gamma and neutron radiation. Usage of such systems is the effective means of securing potentially dangerous facilities and increasing speed and quality of inspections at customs.

In addition to detection elements and processing units, radiation portal monitor systems generally include also specialized software. This software allows to optimize the operation and management of such systems, in particular it allows to control system remotely, supervise it and automate processes of radiation situation data acquisition, analysis and reporting.

Usage of specialized software as the part of radiation portal monitor system the increases efficiency of the work of customs authorities in field of radiation control. It allows to receive timely information on the radiation status at control points, capture a photo or video image of alarming objects, automates the process of creating reports on the effectiveness of control over the illicit trafficking of nuclear and radioactive materials. This ensures an early warning about the possibility of radioactive contamination or terrorist act.

This study defines concept and describes the process of automating the management of the portal radiation monitors system by developing and implementing specialized software.

BIOINDICATION WITH THE USE OF TRIFOLIUM REPENS L.

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Bioindication methods are important in carrying out environmental monitoring as a result they have recently received widespread acceptance and prevalence. No matter how modern the equipment for controlling contamination and detecting harmful impurities in the environment is, it cannot be compared with a complex "live device" that reacts to various changes, reflecting the impact of the entire complex of factors, including complex compounds of various ingredients.

The aim of the work is to assess the ecological state of the districts of Minsk, Nesvizh and Volma, characterized by the most developed industry, and the main recreational zones located in them, by the method of analysis of genetic polymorphism in populations of white creeping clover according to the variety of the "gray" pattern on the leaves.

Keywords: bioindication, bioindicators, creeping white clover (Trifolium repens L.), polymorphism

Collection of material was carried out in summer, in July. In total, 25 test sites were examined. During the research, the industrial part of the city of Minsk, the city of Nesvizh and the ecological park "Volma" of the Dzerzhinsky district was covered. The collection points were at a considerable distance from each other. Observations of the change in the pattern on the leaves of the meadow clover were carried out by counting forms with different patterns and without it on trial plots. In addition, the frequency of occurrence of detected phenes (in %) was calculated. All the hairdryers we detected were checked with known forms in the literature [3], and when new forms were found they were recorded into a table.

As a result the following conclusions were drawn:

The pasture populations of the Dzerzhinsky and Nesvizh regions were investigated, where 5–7 genotypes with different leaf patterns were identified. In addition to the age of the population, the level of pollution of the growth medium is of great importance here. In this respect, Dzerzhinsky and Nesvizhsky belong to ecologically cleaner regions. On the contrary, the tendency of polymorphism increase is typical for Minsk and its territories, contaminated with exhaust gases of roads, emissions of petrochemical enterprises, 10–12 genotypes were detected. In Nesvizh, anomalous forms of clover have been found, but in general the *vv* genotype is 34,95 %, which indicates a rather favorable habitat for this plant. In the city of Minsk, the frequency of occurrence of the genotype *vv* is 34.3 %, rare genotypes are also found: V^PV^P – 0,2 % and V^BV^B – 0,1 %. There is a wide variety of genotypes on the territory of Minsk. At the total count, the share of unchanged leaves in the sample was about 30 % and varied at some points from 11 to 53 %. The total share of the changed phenotypes was about 71 %, and varied from 47 to 89 %.

The analysis of the conducted studies showed that the pattern on the clover leaf is sensitive and the number of phenotypes increases with an increase in the anthropogenic load. In Minsk, there are clear signs of a load of mutations caused by the impact of anthropogenic factors, in comparison with the points selected in Nesvizh and Volma.