”Detektory dla Szkół”
a pilot detector-lending programme for Polish schools

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We present an idea of a teaching programme with the use of a low-cost detector set. The project entitled ”Detektory dla Szkół” – “Detector Lending Programme” provides schools with sets of two types of detectors. These detectors are to be used in research projects. The main goal is to bring innovation to science education by developing new methods and tools to make the field more attractive, especially for the younger generation and female students. The programme also aims at decreasing inequalities in access to knowledge and increasing public engagement in education.

Background of the project

The best way to inform the public about the uses and risks of ionizing radiation as well as the radiological protection is through the education system.
The general objective of the teaching curriculum in primary and high schools is to stimulate students' interest, but we are aware that teaching physics in Polish schools is concentrated on theory. Pupils very rarely prepare, perform, analyse, or present experiments. It is also very rare for teachers to conduct experiments in front of the class. The main reason for this is the lack of time and experimental equipment in schools. The programme designed by NCBJ solves these problems.

The concept of the programme

The basic idea of the programme is quite simple: “your project—our detectors”. Students prepare and send in their projects and once they are accepted, their authors are lent tools for collecting and analysing data. The data is then used as an educational tool to illustrate various nuclear, particle or astrophysics phenomena. Or for more advanced students, the tool gives them further opportunities to build their own programs, enabling them to record and analyse their own data and then extract physics from the data. Thanks to the provided detectors, physics classes are taken to a whole new level, as the vast majority of students can actively participate in them.

Experimental setup

The detectors were designed to be as accessible as possible, and therefore widely available components were used to reduce the cost of the detectors. They are capable of exploring various physical phenomena of nature and have already been used to investigate various phenomena associated with the geomagnetic field, atmospheric conditions, cosmic-ray shower composition, attenuation of particles in matter, radioactivity, and statistical properties of the Poisson process.
In addition, the setup allows you to develop constructions skills, as well as programming.

The experimental box contains:

- **didactic Geiger–Müller counter (GM)**

GM counter, built by NCBJ's staff, is a device based on GM tube STS 6 (old device made in the former USSR). This tube is sensitive to x-ray, high energy beta, muon and (with reduced sensitivity) gamma radiation, while (due to the metal walls) is blind to standard-energy alpha radiation.

- **two Cosmic Watch (CW) detectors**

Designed in a collaboration between MIT and NCBJ, the CosmicWatch Desktop Muon Detector consists of a 5x5x1cm^3 slab of extruded plastic scintillator instrumented with a silicon photomultiplier (SiPM) and accompanying electronics, controlled by programmable Arduino Nano.
The detector allows the measure of gamma radiation and charged particles like the muons.

Conlcusions

Our programme allows teachers to produce more creative and innovative lessons. It will let their pupils investigate (through research) the radiation physics phenomena. The shift from the teacher-centred traditional approach towards pupil-centred active learning attracts most pupils helping them improve their learning process and outcome.
The methodologies and activities proposed in the programme should contribute to increasing the number of technically oriented students, enhance the general interest in science and scientific methods, and also raise the common understanding of physical processes.