Contribution ID: **163** Type: **Contributed Talk**

Results from Prototypes of Some Environmental and Health Alarm Devices Based on Gaseous Detectors Operating in Air in Counting Mode

Saturday 20 February 2010 09:50 (25 minutes)

There exist some commercial environmental alarm /monitoring and health safety related devices operating in the ionization mode, for example smoke detectors, medical x-rays and charged particles dosimeters and so on. Based on our recent studies, conditions were found for the stable operation of some micropattern and wire type gaseous detectors in air with high gas gains. This enables to operate them in pulse counting modes and gaining orders of magnitude in sensitivity with respect to ionization chambers. We will shortly review our earlier achievements in this direction; however, the main focus will be given on new designs and results. In particular we will present the latest design of a Rn detector for applications in possible earthquake prediction and a novel detector of tracing of dangerous gases in air (toxic, flammable, combustive). The Rn detector is more sensitive than the best commercial detectors, but much simpler and cheaper. In the design of the dangerous gases detector a few new features were implemented, for example simultaneous gas ionization and absorption measurements and utilization of UV radiation with a wavelength shorter than the cut off of the air transmission and as a result it has much superior sensitivity with characteristics comparable to any commercial device. We believe that due to their high sensitivity, simplicity and low cost such new detectors will find massive applications.

Summary (Additional text describing your work. Can be pasted here or give an URL to a PDF document):

Results from Prototypes of Some Environmental and Health Related Alarm Devices Based on Gaseous Detectors Operating in Air in Counting Mode
G. Charpak, P. Benaben, P. Breuil, P. Martinengo, E. Nappi, V. Peskov

The main requirements for some environmental and public health alarm and monitoring devices, especially those meant to be massively applied (for example monitoring of Rn concentration in air or early detection of the appearance in air of dangerous gases) are high sensitivity, simplicity and low cost. In the attempt to meet these requirements, our group developed prototypes of several devices based on micropattern or wire-type detectors operating in air in pulse counting mode. It must to be noticed that several commercial detectors operating in air in ionization chamber mode (gas gain =1) already exist, i.e. smoke detectors, various medical dosimeters, etc. The novelty which we have introduced is to exploit such devices in pulse counting mode enabling considerably, in some cases orders of magnitude, to increase of their sensitivity, at the same time preserving the simplicity and low production cost. Based on our studies we have found conditions at which micropattern and wire-type detectors can operate stably in air at high gas gains despite of natural changes in the atmospheric pressure and humidity level. Several prototypes were built and successfully tested; descriptions of some of our earlier prototypes and results obtained are reported in literature [1-3].
In this report we will present our latest yet unpublished results obtained in this direction.
. The main focus was on the development of cheap and robust Rn detectors designed for early predicting earthquakes and detecting dangerous gases in the environment.
It is generally accepted that Rn accumulated in buildings, especially in the basements, may cause a significant risk to the human health. Nowadays, most of the massively used Rn detectors are accumulative types which are acquired after some time interval (up to 90 days). In our work, however, we focus not only on developing fast online Rn monitors for the healthy safety, but mainly on another subject also related to Rn and which requires massive use of fast detectors operating in online mode. In the last decade or so, some researches have looked at elevated soil gas Rn concentration or rapid changes in soil or groundwater Rn concentration as a predictor of earthquakes To verify these early observations of the correlation between the earthquake and the Rn appearance on a more solid statistical ground one has to create a wide networks of cheap, compact, fast and high sensitivity Rn monitors. The existing commercial Rn detectors do not fulfil these requirements. The new design developed by us recently has sensitivity a few times higher than the best commercial detectors, but at the same time much simpler and cheaper in production. Note that it is very different from the earlier

version described in [1, 3] and not only more sensitive, but also is capable to operate in 100% humid air.
The detector of dangerous gases combines the basic principle of a standard PID [4] (gas photoionization) enforced with several new features: for example with simultaneous gas absorption measurements and with the utilization of UV radiation with a wavelength shorter than the cut off of the air transmission. In combination with the counting mode (our earlier version [2] operated with some gas gain, but in current mode) of the operation this allows an increase of the sensitivity up to 1000 times (and even more for some particular gases). Obtained results let us believe that due to the exceptionally high sensitivity, simplicity, robustness and low cost, such new devices will find massive applications. We will report our current affords on establishing contacts with industry in attempt to commercialize these detectors.
References:
[1] G Charpak et al., JINST 3 P02006, 2008
[2]G. Charpak et al., IEEE Trans. on Nucl. Sci, 55, 2008, 1657
[3] G Charpak et al ., arXiv:0909.2480, 2009
[4] http://www.shsu.edu/˜chemistry/PID/PID.html

Primary author: PESKOV, Vladimir (CERN)

Co-authors: Prof. NAPPI, Eugenio (INFN, Bari, Italy); Prof. CHARPAK, Georges (Ecole des Mines Supperor, St Etienne, France); Dr MARTINENGO, Paolo (CERN); Prof. BENABEN, Patrick (Ecole des Mines Supperor, St Etienne, France); Dr BREUIL, Philippe (Ecole des Mines Supperor, St Etienne, France); Prof. PESKOV, Vladimir (CERN)

Presenter: PESKOV, Vladimir (CERN)

Session Classification: Applications 1