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Abstract. The implementation of the high voltage power supply control system (HVPSCS) for experimental setup FODS (FOcusing Doublearmed Spectrometer) at accelerator U-70 of the Federal State Budgetary Institution State Research Center Of Russia Institute for High Energy Physics of the National Research Centre "Kurchatov Institute" (hereinafter referred to as IHEP) or for the test bench of the detector components is considered. The required set of hardware is defined and the appropriate software to operate HVPSCS is written in C/C++ codes. The date acquisition (DAQ) system [1] makes automatic control on HVPSCS for data taking run. It allows to get the dependence of appropriate detector parameters on the high voltage supply values and choose its optimal values for FODS detectors. The test run results of HVPSCS are presented.

1. Introduction

In modern experimental installations in high energy physics, the number high voltage (HV) channels can be hundreds or thousands. That's why there is a problem of managing a large number HV channels and their control, minimize manual work and reduce the time for tuning - for example choosing of operating HV value. Earlier, similar tasks, providing automatic control of HV of detectors, has been solved [2], but only for one channel of HV and application software was a highly specialized.

This article describes the necessary elements of hardware and scheme of their use, as well as software designed for automated management of HVPSCS. The code is on C / C ++ languages. The using of the open-source operating system allows to solve the problem of the computer-assisted management for HV power supplies of any experimental setups by making the appropriate changes in it.

The test results on dependences of the detected event numbers from the HV voltages for limited number of elements obtained by using the created HVPSCS are presented.

2. Main elements of the system

As HV sources for FODS detectors was chosen the production of ISEG Spezialelektronik GmbH company [3].

The modules are placed in crate which provides service, control and management of the modules with a controller connected to the computer with PCAN-PCI Dual Channel interface [4] by CAN protocol (Controller Area Network) [5].

Figure 1 shows the general scheme of the elements connection of HV system with CAN protocol.

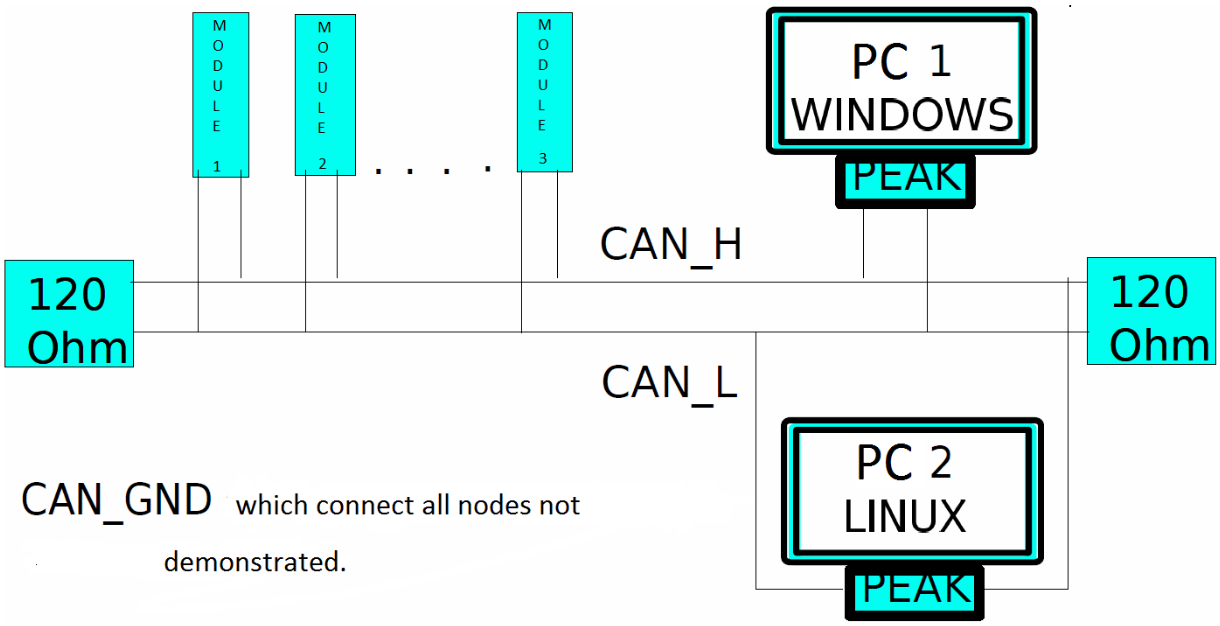

Figure 1. HV hardware connection by CAN protocol.

3. Software

Management and control of HV realized from the personal computer under LINUX operating system [6] in the version Debian Wheezy. Advanced versions of LINUX already have HV management software within the CAN protocol (driver and a set of tools to test it work).

There are several software packages, allowing to work with CAN protocol on LINUX operating system. We used the software package SocketCAN, using application programming interface (API) made at Berkeley, the so-called Berkeley sockets interface [7]. This package is made in the image of TCP / IP protocol. Exchange of information on the CAN-network is carried out in frames, which are received by all nodes on the network.

Created software has set of programs for managing HV system in automatic mode - HVPSCS referred to FODS DAQ.

4. DAQ and HVPSCS

A data acquisition system (DAQ) of FODS based on free software MIDAS (Maximum Integrated Data Acquisition System) v2.1 [8]. To collect the information used by the distributed system from several client programs connected independently to the same database (DB) on the host PC-server.

For each crate of electronics parallel runs its own client program (in the terminology of MIDAS - frontendMISS), capable to receive and transmit the data to a computer running a server program (in the terminology of MIDAS - mserver).

One of such programs is the client program of HVPSCS (frontend-HV) (see figure 2), which is connected to the shared program server DAQ and loads, when it is run, the configuration file with an array of HV values for all HV channels of ISEG in the database.

During data collection frontend-HV follows the control signals from the MIDAS-server program transmitted through the database and, in particular, for the signal to change the voltage of HV ISEG channels. When a command to change the HV appears, frontend-HV reads the entire array of new values of HV generated by MIDAS server program, and sends ISEG controllers signals to change the HV values, generates an array of data to write to the database. Then registers in the database information about the command to change the HV. Information regarding these exposed HV values recorded at the end of each accelerator spill in the information box "end of discharge" for further processing during analysis of physical experimental data.

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For automated data acquisition and voltage changes in the next data acquisition cycle built-in MIDAS interpreter is used (MIDAS in terminology - Sequencer). For automatic control and monitoring system of HV on FODS the interpreter has commands to start and stop the data set, the command to change the values of variables in the array of new HV. Stop the current data collecting can be set in both time and the number of received events.

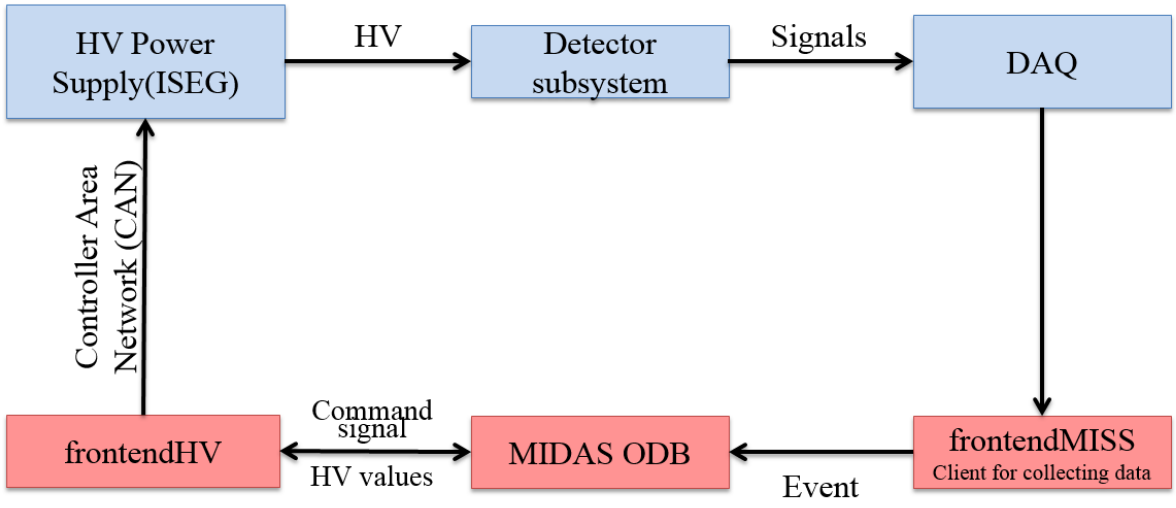

Figure 2. Scheme of DAQ and HVPSCS connection.

Processing the received data occurs in two stages. For each value of HV received data are processed with the built-in MIDAS program (in the terminology of MIDAS - analyzer), the output of which is a file with histograms in the root package file [9]. In the second phase the program is used in the language root, created by the system operator to read an array of files with histograms and to analyze of characteristics that interests the experimentator.

5. Test results

For testing of HVPSCS FODS for 4 photomultiplier tubes (PMT) XP2212, used in trigger scintillation counter, were measured counting characteristics depending on HV with monitor system LED signal with a frequency of 1 kHz (see figure 3) in the case where all the detected signals coming from counters, i.e. and noise from the LEDs, and where the signals correspond with the same LED signal detected by a scintillation counter, and if there is no signal from the LED, i.e. only noise.

XP2212 photomultipliers in the production are subject to strict selection quality and therefore have similar characteristics parameters in the operating values of high voltage. Nevertheless, the figure clearly shows the difference in their countable characteristics for noise signals. These results demonstrates HVPSCS FODS “health”. Selection of the parameters and method for determining operating HV, as measured from the HV behavior depends on the type of detector and method of its use, and is beyond this article subject. We only note that we have not found, depending on the measurement data channel with PMT information pick and differences in behavior are completely determined by the PMT.

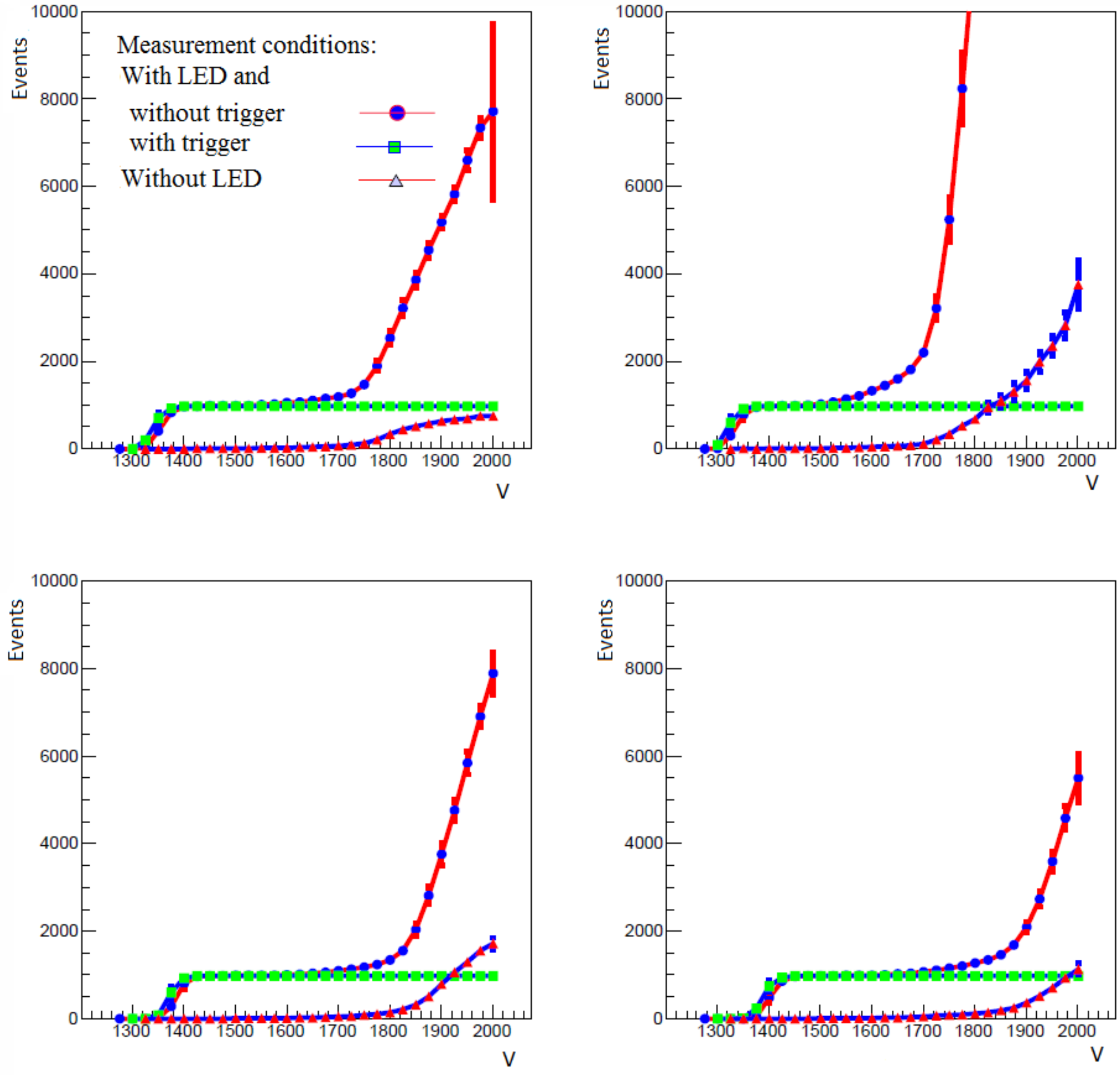

Figure 3. Dependence the number of events from voltage in 4 PMTs.

6. Conclusion

HVPSCS FODS automates basic operations with HV. Efficiently and with minimal time to conduct proper preparatory of work for tuning the equipment and in the operating voltage on the HV. This HVPSCS can also be used on test stands for the elements of the detection equipment, or testing prototypes of detectors with a wide range of characteristics depending on the HV and for a large number of HV channels. The work was done by IHEP employees with Russian Foundation of Basic Research support.

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