

SLOW CONTROL OF POSITRON POLARISATION SYSTEM'S POWER SUPPLY*

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(Received July 23, 2018)

The purpose of this project is to develop a control system for positron polarisation system's power supply unit. To solve this problem, a proper hardware is chosen. In order to control hardware, the software, divided into two separate programs, is developed. Article explains what features software deliver, why LabVIEW was used and why programs are divided.

DOI:10.5506/APhysPolBSupp.11.825

1. Introduction

The experiments conducted in the Dzhelepov Laboratory of Nuclear Problems by P. Horodek require beam of polarized positrons. Polarization system requires adjustable voltage in the range from 0 to 70 kV. SPELLMAN PCM SERIES HVPSU is used to generate voltage. While it is possible to adjust voltage manually, it is not feasible. This power supply unit provides bidirectional analog interface that may be used to control and measure its working parameters [1].

2. Physical layer

In order to adjust power supply's voltage, it requires input of voltage in the range from 0 to 10 V. Output voltage is linearly proportional to input voltage. Power supply unit's interface provides feedback with voltage linearly proportional to output voltage.

* Presented at the II NICA Days 2017 Conference associated with the II Slow Control Warsaw 2017, Warsaw, Poland, November 6–10, 2017.

Those features of power supply unit’s interface match the analog interface of National Instruments myDAQ. NI myDAQ provides 16 bit digital to analog and analog to digital converters, both of which operate within the voltage range of power supply unit’s interface [2]. The digital to analog converter with 16 bit resolution may control output voltage with a precision of *circa* 1.07 V, which is more precise than required.

3. Programming

Chosen device (myDAQ) input and output may be controlled with a PC, if computer is supplied with NI LabVIEW runtime and proper drivers. This leads to usage of LabVIEW language as it is the most suitable for this task. LabVIEW allows the programmer to create a legible user interface and easily operate with myDAQ.

For user’s convenience, we decided that the best solution would be to use separate programs to prepare experiment procedure and to supervise it. This way, while authorized personnel may prepare the plan of experiment, designated operator could supervise it, but could not interfere with experiment parameters (while still being able to stop it in case of emergency).

3.1. Engineer’s Input Panel

The Engineer’s Input Panel (Fig. 1) allows the user to prepare a script that will be realised by runtime. The user may set desired voltage change (in a single step) and delay between changes. Saved steps may be browsed and removed if are unnecessary or wrong.

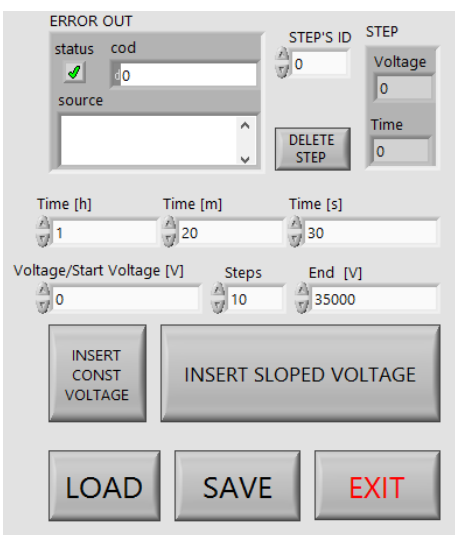


Fig. 1. Engineer’s Input Panel.

The user may save the script at any moment. If it is required, an older script may be loaded and then modified.

For user's convenience, there is provided a feature of sloped voltage change emulation. It is realised by automatically inserting the user defined number of steps, which are equally distributed at the scheduled time.

In the case of any error, the user would receive a feedback in the ERROR OUT field.

3.2. The Operator's Runtime Panel

The Operator's Runtime Panel (Fig. 2) allows the user to load scripts created with the Engineer's Input Panel. After the script was loaded, it is immediately executed. The user may choose the desired device (as there may be more than one device connected to PC).

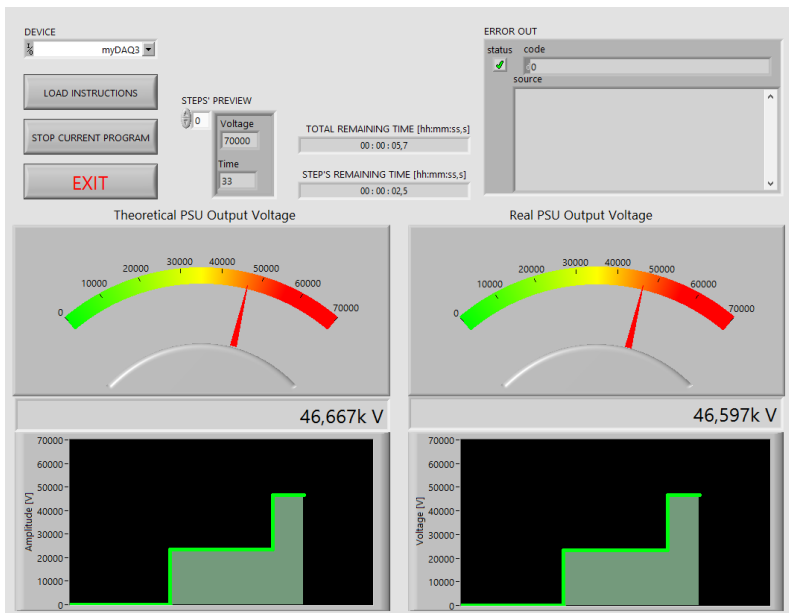


Fig. 2. Operator's Runtime Panel.

The panel provides the user with two sets of indicators for both theoretical (desired) output voltage and for real (measured at Supply Unit's feedback output and scaled to proper range) one. Both sets of indicators consist of analog meter, digital display and chart. The analog meter is more natural representation of data, reading from it is more convenient when approximate value is sufficient. The digital display shows

the user the exact value of voltage (theoretical and read from feedback). The chart shows data gathered during the experiment, the user may use it to monitor sudden changes and tendencies.

The user is informed about remaining time of both the whole experiment and a current step. It is possible to preview each steps voltage and duration (if the user wants to check the remaining steps).

The operator may stop script execution in any time by either clicking STOP CURRENT PROGRAM button or EXIT button. Both buttons would set voltage to zero volts and stop executing script. In the case of EXIT button, the Operator's Runtime Panel is terminated afterwards.

4. Conclusion

National Instruments myDAQ controlled by LabVIEW software may be used to easily develop automatization systems. While myDAQ provides universal hardware (both digital and analog inputs and outputs) and may be conveniently controlled with a PC, the LabVIEW language may be used to quickly develop functional interface. By separation of functionalities between different programs, stability of their operation is increased (as simpler programs are easier to debug) and access to certain features may easily be restricted.

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