



Contribution ID: 9

Type: Talk

## Remote toggle on off of Slow Control System cabinet racks at NICA complex \*

Friday 10 November 2017 10:50 (10 minutes)

Slow Control Systems (SCS) are electronic systems that are used to setup, monitor and enable operation of complex hardware for physical experiments. Detectors MPD (Multi-Purpose Detector) and BM@N (Baryonic Matter at Nuclotron) at NICA (Nuclotron-based Ion Collider Facility) complex are some implementations of this system. For the purpose of this machinery it will be necessary to simultaneously operate on either 64 or 128 cabinet racks. It is required to design a software that controls the system remotely because of hazardous environment for humans as there will be strong radiation and electric field.

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### 1. Introduction

Both MPD and BM@N detectors are still under construction, but it is predicted to be 64 to 128 cabinet and size of one rack is 1000 x 800 x 42U. Such setup utilizes slave/master [1] configuration and is scalable which allows to create the base software before it is completed. Because of substantial size of the whole setup and SCS itself, ability to have remote access is a crucial feature.

The other aspect that plays a huge factor is reliability, in order to start the system, it is necessary to prepare the vacuum and very low temperature [2] for elements that are being used in NICA[3] complex. Doing it takes long time and is expensive. Because of it, we had to foresee how the development of the whole system may go and adjust accordingly.

\* Presented at ...

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Fig. 1. Run Panel, with lower level of security and without availability to set crucial parameters.

Fig. 2. Engineering Panel, with higher level of security and ability to adjust all parameters of the program.

The program for the purpose of turning on/off and monitoring the basic parameters is written in graphic programming environment LabVIEW. NI PXIe 8880 is the controller for master racks and NI cRIO 09039 is the controller for slave racks. The program created, turns on/off and monitor the basic parameters of the racks remotely.

For NI PXIe 8880 there are two different approaches. One is by providing specific voltage to two pins located at the rear of the device. The other one is by using windows function called WOL (Wake On Lan) [4] which sends a magic packet of 6 bytes of all 1's followed by 16 repetitions of the MAC

address for the controller you want to wake.

## 2. Results

The following program was created that allows us to turn on/off the racks remotely. In order to reduce number of external devices it was decided that WOL is better option than providing voltage. For shutting down it was decided that windows console will be used and shutdown command because of its simplicity and reliability.

The racks now, could be handled altogether or separately. The program was initially created for 4 racks but it is modifiable to add more racks.

The final program is divided into two different password protected panels.

Run Panel (1) is for simple operations with predefined configuration.

It allows easy turn on/off of those racks. After clicking check status the program simultaneously checks the state of all racks using ping function

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in windows console. For convenience and further development delay time of every ping and timeout can be both adjusted in engineering panel because

of every network different arrangement. It is arranged to be used for

non qualified worker and it also prevents user from any accidental changes.

However, engineering panel (2) allows to input and what is more important

save and load every racks data. Last but not least, for such considerate

setup size delay of turning on all the racks is unavoidable. This amount of

electrical devices needs to be turned on and off one by one. By reason of variety of options setup can be both saved and loaded from specified XML file.

## 3. Conclusions

For now prototypes of four racks are built hence it is decided to keep the programme also for this amount of racks and utilize the benefit of modularity of SCS for further development.

Both software and hardware needs to be designed thoroughly. Mainly it is

required for it to work for ten years, so all the accepted solutions can be

reapplied in the event of any change or adjustment of whole machinery.

The next step in developing this program and making the control more remote

is setting up the VPN(Virtual Private Network) which will allow to

control it outside of NICA complex and include more people to further develop

the software and also collect acquired data. Also, turning on and off

delays can be more automatized by indicating them to run after the previous

one is toggled instead of manual delay time input.

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**Session Classification:** Session 1; 10-nov 2017;

**Track Classification:** Student Program: SCS-2017 Slow Control System Dubna 2017