Student's Zone 2020 of the NICA Project

Report of Contributions

Contribution ID: **1** Type: **not specified**

Heat transfer simulation of the cooling system for NICA-MPD-Platform RACK cabinet.

Heat transfer simulation of the cooling system for NICA-MPD-Platform RACK cabinet

Contact to the supervisor: czarnynoga@jinr.ru

Description of topic:
The main goal of this internship topic is to conduct heat transfer simulation for the NICA-MPD-Platform RACK cabinet which using a new cooling system. Exactly for a set of two RACKs and one cooling cabinet. During the practice, student get skills of preparing the simply 3D model and conduct heat transfer simulation for it. Moreover, the student gets an overview of the whole NICA-MPD-Platform project and the issue of temperature stability.

Student internship goals: (estimated time of work)
• Get acquainted with basic technical documentation of NICA-MPD-Platform (3 days)
• Prepare geometry model of typical RACK equipment (3 days)
• Conduct heart transfer simulation for model of typical RACK equipment (3 days)
• Compare simulation results with measured values (2 days)
• Prepare geometry model of RACK with equipment (3 days)
• Prepare geometry model of cooling cabinet (2 days)
• Prepare geometry model of set two RACK and cooling cabinet (1day)
• Conduct heart transfer simulation for set two RACK and cooling cabinet (5 days)
• Prepare analysis of results (5 days)
• Prepare final report (5 days)
• Prepare final presentation (2 days) (34)

Total time of work: 34 days + preliminary consultation and lectures

Student Learning Outcomes:
• Interpret of technical documentation (of NICA-MPD-Platform)
• Use Autodesk Inventor Pro to create simply 3D geometry
• Use Autodesk CFD to conduct heat transfer and gas flow simulation
• Produce a formal technical documentation
• Produce a simply engineering drawing

Author: CZARNYNOGA, Maciej (WUT)

Co-author: Mr ROSLON, Krystian (WUT, JINR)

Presenter: CZARNYNOGA, Maciej (WUT)

Contribution ID: **2** Type: **not specified**

Thermal optimization of the "Intelligent Power Distributor" using CFD method.

Thermal optimization of the "Intelligent Power Distributor" using the CFD method.

Contact to the supervisor: czarnynoga@jinr.ru

Description of topic:
The main goal of this internship topic is to conduct heat transfer simulation for Intelligent Power Distributor (IPD) in a few variants of the construction. Base on the simulation optimal variant of construction will be chosen. During the practice, student get skills of preparing the simply 3D model and conduct heat transfer simulation for it. Moreover, the student gets an overview of the whole NICA-MPD-Platform project and the issue of temperature stability.

Student internship goals: (estimated time of work)
• Get acquainted with basic technical documentation of the IPD (3 days)
• Prepare geometry model of the IPD in current variant (5 days)
• Conduct heart transfer simulation for model IPD (3 days)
• Prepare analysis of results (2 days)
• Propose upgrade of construction (2 days)
• Prepare upgraded geometry model of the IPD (2 days)
• Conduct heart transfer simulation for model upgraded IPD (3 days)
• Prepare analysis of results (5 days)
• Prepare final report (5 days)
• Prepare final presentation (2 days)

Total time of work: 32 days + preliminary consultation and lectures

Student Learning Outcomes:
• Interpret of technical documentation (of the IPD)
• Use Autodesk Inventor Pro to create simply 3D geometry
• Use Autodesk CFD to conduct heat transfer and gas flow simulation
• Produce a formal technical documentation
• Produce a simply engineering drawing

Author: CZARNYNOGA, Maciej (WUT)

Co-author: ROSLON, Krystian (WUT, JINR)

Presenter: CZARNYNOGA, Maciej (WUT)

Contribution ID: **3** Type: **not specified**

EqDb manual preparation

During this practice, student will learn what is Equipment Database, what is its role in the NICA project and how it works. It will be hands-on experience and a chance to improve the existing database structure. Result of this practice will be a manual for new users on how to use the database and where to find which data. Manual will be written in LaTeX so basic knowledge will be useful, however not crucial. Required skill: English at least at B2 level.

Contact to the supervisor: milevich@jinr.ru

Author: Mrs MILEWICZ-ZALEWSKA, Michalina (Warsaw University of Technology)

Presenter: Mrs MILEWICZ-ZALEWSKA, Michalina (Warsaw University of Technology)

Contribution ID: **4** Type: **not specified**

Cosmic ray measurements in automation cycle using Python programming

Laboratory of High Energy Physics (LHEP)
Engineering Support

PhD Marcin Bielewicz Laboratory: VBLHE Dubna and NCBJ-Świerk Poland
Msc. Arkadiusz Chłopik Laboratory: VBLHE Dubna and NCBJ-Świerk Poland

Contact: marcin.bielewicz@ncbj.gov.pl; arkadiusz.chlopik@ncbj.gov.pl

The topic of the exercise:

"Cosmic ray measurements in automation cycle using Python programming."

Goal:
Large detectors like ALICE at CERN and NICA at Dubna are often equipped with additional cosmic ray detectors. These detectors are used to obtain information about which tracks inside the detector came from the passage of a particle coming from an atmospheric cascade (eg: muons), and are not as a product of an internal collisions. They are also very useful for calibrating detectors such as TOF or TPC. The nature of radiation changes in relation to the direction in the sky which we observe as well as the influence of the very thick walls or ground. The purpose of this exercise is to automate the measurement cycle by writing software in the Python Environment. For preliminary measurements we use small, ready-to-use "CosmicWatch"detectors based on small scintillator. Until now, the measurement results have been manually transferred using an SD micro card to a computer. Our goal is to create a program that automatically reads on line measurements via a USB cable and virtual COM port, from CosicWatch detectors. Next data will be saves in a usable form on a computer and performs possibility of results visualization. The program will be written on the apprentice's computer and then tested by a supervisor on a real device. If it is possible, a student's visit to the laboratory in Świerk is planned in order to conduct practical tests, or the CosmicWatch detector will be lent to the student home.

To do: To create a program that automatically reads on line measurements via a USB cable and virtual COM port, from CosmicWatch detectors, in Python language.

Description of the exercise:
1. Discussion of the issue of wide atmospheric showers and cosmic irradiation.
2. Carrying out measurements of cosmic radiation at LHEP
3. Understanding the CosmicWatch control system and its programming (technical documentation).
4. Writing software that reads data in a Python environment.
5. Preparation the own speech at the end of the student practice and for the conference after that, and preparation the publication together with the practice supervisor based on the obtained results.

Requirements for the students:
The subject is addressed to students interested: Python practical programming, measurement systems, astrophysics, and electronics.
Knowledge about programming and basic skills in Python.
Basic skills in using Excel program.

Exercise for up to 2 students

Author: BIELEWICZ, Marcin (NCBJ / JINR)

Co-author: Mr CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Presenter: BIELEWICZ, Marcin (NCBJ / JINR)

Contribution ID: **5** Type: **not specified**

Modification of the existing LabVIEW™ code for Dosimetry System using Finite State Machin architecture

Laboratory of High Energy Physics (LHEP) Engineering Support

Supervisor: MSc. Arkadiusz Chłopik, LHEP Dubna and NCBJ-Świerk Poland
Contact: a.chlopik@ncbj.gov.pl, chlopik@jinr.ru

The topic of the exercise
"Modification of the existing LabVIEW™ code for Dosimetry System using the Finite State Machine architecture"

Goal
During nearly two years of work on the project "The prototype dosimetry system to protect NICA Slow Control electronic equipment" in cooperation with JINR, Dubna was created a program that supports 3 dosimetry probes. It was written in the graphic programming language LabVIEW™. The probes are serviced by sending commands over the RS-485 bus (for command descriptions, see the user manual for each probe). The connection of the RS-485 measurement bus with the computer on which the LabVIEW™ environment is installed is currently carried out via a USB-RS485 converter and a virtual serial COM port created on a PC computer (e.g. laptop). However, the program itself was written using a combinatorial programming technique that allows for quick programming and easy testing. Each collected data series are displayed on a monitor screen and saved to the Coma Separated Value (CSV) file. The aim of the exercise would be to modify the code in such a way that the combinatorial of programming (asynchronous) would be replaced with the architecture of the Finite State Machines (synchronous). This would eliminate such undesirable phenomena occurring in combinatorial programming as races, hazards or the occurrence of spikes. The resulting code should be run and tested with the existing Dosimetry System setup.

To Do: Write and test the program for Dosimetry System.

Description of the exercise
1. Getting familiar with the existing LabVIEW™ code written with use of the combinatorial technique.
2. Learning the remote control and data acquisition of the probes EKO-C and EGM-104 with the use of the USB-RS485 converter.
3. Learning the Finite State Machine architecture (one of the main architectures of the LabVIEW™ programming). Explanation of the difference and advantage comparing to the combinatorial programming technics.
4. Converting the code to the one with the Finite State Machine architecture.
5. The software tests with real hardware setup located in JINR, using the video conference room to track by the students the results of running the program.
6. Writing project documentation.
7. Preparation of the own speech at the end of the student practice and for the conference after that, and preparation the publication together with the practice supervisor based on the obtained results.

Requirements for the students
The subject is addressed to students interested in serial measurement systems, data acquisition, electronics, LabVIEW™ programming and dosimetry. The basic knowledge of the digital electronics and basic skills in LabVIEW™ programming will be helpful.

Exercise for maximum up to 3 students

Author: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Co-author: BIELEWICZ, Marcin (NCBJ / JINR)

Presenter: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Contribution ID: **6** Type: **not specified**

Automatic handler of the dosimetry detector with use of the FHT 6020 display and communication unit, RS-485 bus and the LabVIEW™ language

Laboratory of High Energy Physics (LHEP) Engineering Support

Supervisor: MSc. Arkadiusz Chłopik, LHEP Dubna and NCBJ-Świerk Poland
Contact: a.chlopik@ncbj.gov.pl, chlopik@jinr.ru

The topic of the exercise
“Automatic handler of the FHT 192-10 dosimetry detector with use of the FHT 6020 display and communication unit, RS-485 bus and the LabVIEW™ language”

Goal
The display and communication unit FHT 6020 is the most recent product belonging to the well-know, tried and tested family of measuring gauges developed by Thermo Fisher Scientific Messtechnik GmbH. It may be operated in a network, it offers a wide variety of probes to be connected, features a reduced response time in the „transparent mode“as well as a compact structural shape. When being used in a network, the FHT 6020 –together with the intelligent probes may be remote controlled and evaluated via a RS-485 bus. This configuration enables a central PC to access to the connected probes (e.g. gamma, neutron) right through the FHT 6020 unit itself. The purpose of the exercise is to write a handler program for the detector connected to the FHT 6020 in the LabVIEW™ language for setting up the device and the data collecting. The data should be displayed on the computer monitor and saved to the Comma Separated Value (CSV) file. If it will be possible it is planned at the end of the student’s internships the visit to the laboratory in NCBJ, Świerk to observe the work of the written software with the real hardware setup. The students will learn three main stages of the measured data collecting process: data logging, data presenting and data archiving.

To Do: Make the design, write code in LabVIEW™ graphical programming language and test the program.

Description of the exercise
1. Learning about the RS-485 remote control and data acquisition of a probe connected to the FHT 6020 unit from the user manual.
2. Designing of the Graphical User Interface (GUI) of the program.
3. Defining the program modules (software modularity).
4. LabVIEW™ coding of the control and data acquisition with the use of the Finite State Machine architecture (one of the main architectures of the LabVIEW™ programming) and the modularity.
5. Planned the software tests with real hardware setup located in the laboratory of the National Centre for Nuclear Research (NCBJ), Świerk and the results will be observed online in the meeting room.
6. At the end of the student’s internships the visit to the laboratory in NCBJ, Świerk to observe the work of the written software with the real hardware setup.
7. Writing project documentation.
8. Preparation the own speech at the end of the student practice and for the conference after that, and preparation the publication together with the practice supervisor based on the obtained results.

Requirements for the students
The subject is addressed to students interested in serial measurement systems, data acquisition, electronics, LabVIEW™ programming and dosimetry. Basic knowledge of the digital electronics, serial interfaces and basic skills in LabVIEW™ programming will be helpful.

Exercise for maximum up to 3 students

Author: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Co-author: BIELEWICZ, Marcin (NCBJ / JINR)

Presenter: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Contribution ID: **7** Type: **not specified**

The LabVIEW™ program modules Record Generator and Transmitter/Receiver for the Input Output Device Simulator project

Laboratory of High Energy Physics (LHEP) Engineering Support

Supervisor: MSc. Arkadiusz Chłopik, LHEP Dubna and NCBJ-Świerk Poland
Contact: a.chlopik@ncbj.gov.pl, chlopik@jinr.ru

The topic of the exercise
"The LabVIEW™ program modules Record Generator and Transmitter/Receiver for the Input Output Device Simulator project of the NICA-MPD-PLATFORM"

Goal
The Engineering Support Group working in the High Energy Physics Laboratory at the Joint Institute for Nuclear Research in Dubna is involved in the construction of NICA-MPD-PLATFORM. It is a set of devices controlling and monitoring the work of the MPD (Multipurpose Detector) included in the NICA complex. Part of the data generated by these devices will have to be saved to the database. Equipment Database (EqDb) was established especially for this purpose at the Faculty of Physics of the Warsaw University of Technology. Since the devices will be built only after some time, it was decided to launch a project called Input Output Device Simulator (IODS). Its task is to create a VPN connection between JINR and WUT and automatically write to the EqDb a record that will be simulated by the IODS. On the other hand, it should also be possible to read data from the EqDb and write it to this record. As a result, a two-way communication channel will be established between the two centers and a way of saving and reading data on the fly from/to the EqDb will be developed and tested. The project is fully a software written with use of the LabVIEW™ environment. Students will be required to write a program that generates a IODS Simulated Record and sends it in both directions between two computers connected with Ethernet cable.
To do: Design, write and test a LabVIEW™ program to transfer the IODS Simulated Record between two computers connected with Ethernet cable.

Description of the exercise
1. Learning the project of the Input Output Device Simulator (IODS) from the Conceptual Design Report documentation.
2. The development of the Simulated Data Record for the IODS in LabVIEW™ environment.
3. LabVIEW™ coding of the Record Generator Module.
4. Learning Client Server Architecture.
5. Getting to know the terms such as LAN, WAN, Web Server, Web Services, REST and SOAP web services APIs, XML, JASON, UDP, TCP, IP, TCP/IP.
6. Getting familiar with popular Web Services.
7. Learning the TCP/IP implementation in LabVIEW™.
8. LabVIEW™ coding of the module which transmits and receives the Simulated Record via Ethernet applying the Finite State Machine architecture (one of the fundamental architectures in LabVIEW™).
9. Installing written software on two computers connected together with the Ethernet cable (LAN connection).
10. Testing the Simulated Record sending over the LAN in both directions.
11. Writing project documentation.
12. Preparation of the own speech at the end of the student practice and for the conference after that, and preparation the publication together with the practice supervisor based on the obtained results.

Requirements for the students
The subject is addressed to students interested in LabVIEW™ programming. Basic programming skills in the LabVIEW™ graphical language are required.

Exercise for maximum up to 3 students

Author: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Co-author: BIELEWICZ, Marcin (NCBJ / JINR)

Presenter: CHŁOPIK, Arkadiusz (NCBJ-Swierk/JINR)

Contribution ID: **8** Type: **not specified**

MPD detector performance

Analysis of large-scale datasets (Big Data), produced with Monte-Carlo models of heavy ion collisions at NICA. Determination of basic detector performance characteristics (efficiency, momentum resolution, tracking, particle identification). Determination of Data Quality monitoring tools for large scale datasets.
Work involves usage of the MPDRoot software - C++ programming and physics data analysis.

Author: KISIEL, Adam (Warsaw University of Technology)

Presenter: KISIEL, Adam (Warsaw University of Technology)

Contribution ID: **9** Type: **not specified**

Monitoring and management of large-scale physics simulations

MPD experiment requires running a massively parallel computing tasks (hundreds of thousands of jobs) for the simulation of physics processes and MPD detector response. The advanced management, monitoring and reporting for such large-scale tasks is required. The task involves development and/or application of proper management, monitoring and reporting tools for routine operation of the Monte-Carlo simulations for MPD. Tasks will be run on large-scale computing clusters - LIT and NICA Cluster (>5k CPU cores each).
Work requires good knowledge of Linux, cluster management software (job schedulers) and web technologies for on-line reporting of computing resources status.

Author: KISIEL, Adam (Warsaw University of Technology)

Presenter: KISIEL, Adam (Warsaw University of Technology)

Contribution ID: **10** Type: **not specified**

Cooling System Control using PLC Siemenst S7-1200 simulator

The cooling system for RACKs cabinets has been already proposed, however it works using LUMEL SM4 modules. It is going to be updated and replaced with Siemens S7-1200/1500. To do it, the first step is preparing the simulation withe the exact code that can be uploaded to the PLC. The effect of the work will be exchanging the control device for the cooling system.

Requirements: English B2, Laptop with Windows, a basic knowladge of programing PLC.

To do:
1. Tag the variables,
2. Prepare the automatic configuration of PLC,
3. Prepare the code for switching fans,
4. Rewrite the control from LabVIEW to PLC,
5. Prepare the documentation,
6. Prepare the presentation,
7. Prepare the article.

Author: ROSLON, Krystian (WUT, JINR)

Presenter: ROSLON, Krystian (WUT, JINR)

Contribution ID: **11** Type: **not specified**

Modeling of K+K- fermtoscopic correlations in p+Pb collision using the Therminator2 model.

It is believed that up to a few milliseconds after the Big Bang, the Universe was in the state called Quark-Gluon Plasma (QGP). Moreover, this unique state should be available in the cores of neutron stars. What is QGP really? The matter that exists everywhere is built with quarks and gluons. In the ordinary matter quarks are confined in hadrons (baryons (example: protons), mesons (example: kaons)) but⋯if the matter reaches very high energy or very high baryon density, quarks and gluons can behave as free particles. This state is called as Quark Gluon Plasma.

To do:
Students will work with the Therminator 2 model. The main tasks are:
a. Install the Therminator 2 environment;
b. Generate events for pPb collisions;
c. Analyze the generated data;
d. Obtain the correlation function for the particles specified before.

Preliminary schedule by topics/tasks
The project duration is 4 weeks.

Required skills
a. Computer with Linux or OS operating system
b. Programming skills in C++ and ROOT languages
c. Basic English skills

Acquired skills and experience
Other programming skills

Recommended literature

a) Introduction to relativistic heavy ion physics, J. Bartke, World Scientific, 2009
b) 2. K+K− femtoscopic correlations in Pb–Pb collisions at √sNN = 2.76 TeV in the ALICE experiment at LHC, B.V. Batyunya, L.V. Malinina, K.R. Mikhaylov, E.P. Rogochaya, 2017
c) 3. Femtoscopic Correlations and Final State Resonance Formation, R. Lednicky, 2011
d) https://therminator2.ifj.edu.pl Therminator generator main page

Author: ROSLON, Krystian (WUT, JINR)

Presenter: ROSLON, Krystian (WUT, JINR)

Contribution ID: **12** Type: **not specified**

Designing of cooling system for MPD-ITS Detector

MPD-ITS is one of the subdetector of MPD. It based of silicon detectors and produce a huge amount of heat. Also, it is located very close to MPD-TPC which is very sensitive to the temperature gradient. Due to this fact, the gradient of the temperature on the MPD-ITS has to be minimalized. To do that, cooling plans and cooling RACKs have to be located somewhere in the area of MPD. The task is to propose the cables and pipes routes and find the solution for locating cooling plans. Later on the work on cooling plans also can be developed.

Author: ROSLON, Krystian (WUT, JINR)

Presenter: ROSLON, Krystian (WUT, JINR)

Contribution ID: **13** Type: **not specified**

Configuration of the SIEMENS S7-1200 Simulator

Simulator of SIEMENS S7-1200 that can be used for a various engineering tasks for NICA-MPD-PLATFORM. Student should doenwload the simulator of PLC S7-1200 and the STEP7 software for preparing the code that can be uploaded to the PLC. The first step is to preapre the configuration (naming the I/O and so on according to the device that are available in the laboratory) for S7-1200 that can be upload to the PLC. Later on the student should prepare the code that will be physicaly sent to the device and test it remotely. Software should work acording to the request of supervisor.

To do:

1. Tag the variables,
2. Prepare the detailed configuration of PLC,
3. Check if the configuration is compatible with PLCs located in V&BLHEP,
4. Prepare the test code for the simulator,
5. Prepare the documentation,
6. Prepare the presentation,
7. Prepare the article.

Author: ROSLON, Krystian (WUT, JINR)

Presenter: ROSLON, Krystian (WUT, JINR)

Contribution ID: **14** Type: **not specified**

Configuration of the SIEMENS S7-1500 Simulator

Simulator of SIEMENS S7-1500 that can be used for a various engineering tasks for NICA-MPD-PLATFORM. Student should doenwload the simulator of PLC S7-1500 and the STEP7 software for preparing the code that can be uploaded to the PLC. The first step is to preapre the configuration (naming the I/O and so on according to the device that are available in the laboratory) for S7-1200 that can be upload to the PLC. Later on the student should prepare the code that will be physicaly sent to the device and test it remotely. Software should work acording to the request of supervisor.

To do:

1. Tag the variables,
2. Prepare the detailed configuration of PLC,
3. Check if the configuration is compatible with PLCs located in V&BLHEP,
4. Prepare the test code for the simulator,
5. Prepare the documentation,
6. Prepare the presentation,
7. Prepare the article.

Author: ROSLON, Krystian (WUT, JINR)

Presenter: ROSLON, Krystian (WUT, JINR)

Contribution ID: **15** Type: **not specified**

Automatic face detection

The task is to prepare the software for an automatic face recognition. The task should be done in the C++ programming language with use of the OpenCV library.
Required basic C++ knowledge. General knowledge of digital image processing algorithms can be helpful as well as knowledge of the OpenCV library, however it is not necessary. The task at the initial stage will be realised by utilizing the camera connected to the computer. It can be builtin laptop camera. Also, for better results tests can be performed on a recorded video of higher quality.
The task can be separated to few parts:
1. Installing the OpenCV library
2. Preprocessing the acquired image
3. Face detection
4. Storing the detected face
5. Recognizing the face by comparing with the saved examples with use of neural networks

Such software can be utilized in variety of safety systems which can store and/or recognize faces of the people entering the crucial areas.
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Presenter: PROTOKLITOW, Filip (Warsaw University of technology, Faculty of Mechatronics)

Contribution ID: **16** Type: **not specified**

Pressure control algorithm improvements in the Gas System Control Software for TOF/MPD

The currently used pressure control algorithm inside the TOF / MPD detector chambers has been prepared for testing only one module at a time. Currently, one to four modules are used, therefore it is necessary to adapt the control algorithm to the new conditions. At first, PID controller settings should be tuned to the optimum values, for all the four corresponding setups - from one to four detector modules connected simultaneously. New, improved algorithm should have implemented chosen settings of the PID controllers in the software code. Additionally, User Interface of the Gas System Control Software should be expanded of the possibility to choose number of connected modules.

Author: DĄBROWSKI, Daniel (Warsaw University of Technology)

Presenter: DĄBROWSKI, Daniel (Warsaw University of Technology)

Contribution ID: **17** Type: **not specified**

Simulator for Fire Protection System (FPS)

Developing of the software that simulates the algorithms of Fire Protection System (FPS) based on LabVIEW.

The set of input signals forms the general state of the system, according to which the fire extinguishing algorithm starts and the alarm signals are turned on.

GUI should have these features:

1) RUN Panel:
- Input modules states (Sensors, Push Button, Door and etc.) –Normal/Malfunction/Fire/Block
- System State –Normal/Pre-Alarm/Alarm/Extinguishing/Malfunction
- Output Signals –Normal/Pre-Alarm/Alarm/Extinguishing/Malfunction

2) Service Panel:
- Manual setup of output relay signals –Normal/Pre-Alarm/Alarm/Extinguishing/Malfunction

3) Engineering Panel:
- Timings
- Sensors algorithm (1 or 2 paired sensors for Alarm System state)
- Output Relay settings (delaying, inversion etc.)

To do:
- Tag the fire alarm inputs (sensors, modules) and their states, system internal devices, system general states and output signals,
- Prepare general states formation from input conditions,
- Prepare fire extinguishing algorithm and output signals formation,
- Prepare the code,
- Prepare the documentation,
- Prepare the presentation,
- Prepare the article.

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Presenter: SHMYREV, Ilya (JINR)