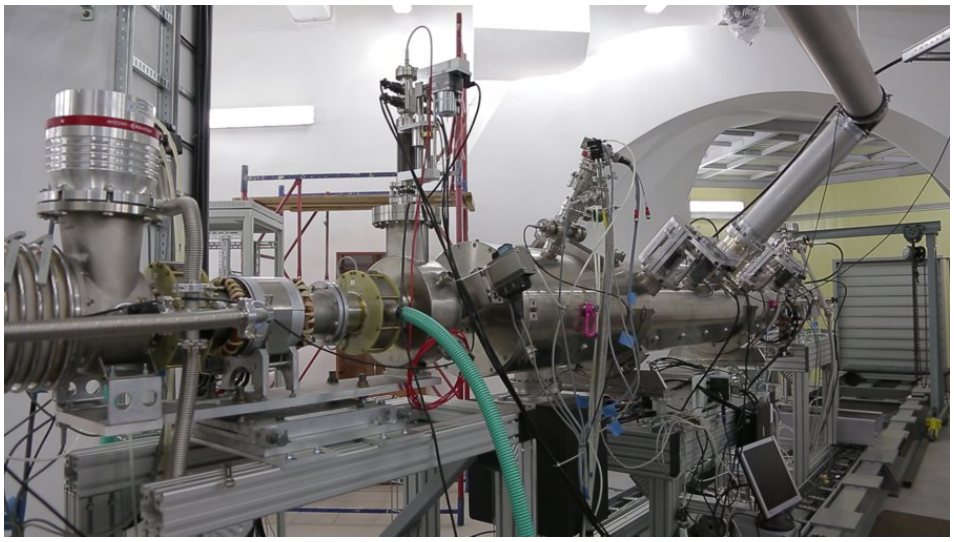
Welcome to NICA days 2017 in Warsaw

Monday 06 November 2017 - Friday 10 November 2017

CZiITT



Book of Abstracts

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α clusters in ultra-relativistic light-ion + Pb collisions

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We explore possible observable signatures of α clustering of light nuclei in ultra-relativistic nuclear collisions involving ^{7,9}Be, ^{12}C, and ^{16}O.
The clustering leads to specific spatial correlations of the nucleon distributions in the ground state, which are manifest in the earliest stage of the ultra-high energy reaction.
The formed initial state of the fireball is sensitive to these correlations, and the effect influences, after the collective evolution of the system, the hadron production in the final stage. Specifically, we study effects on the harmonic flow in collisions of light clustered nuclei with a heavy target (^{208}Pb), showing that measures of the elliptic flow are sensitive to clusterization in ^{7,9}Be, whereas triangular flow is sensitive to clusterization in ^{12}C and ^{16}O.
Specific predictions are made for model collisions at the NICA energies.

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A walk in the gardens of Queen Marysienki ...

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Adaptation of the THERMINATOR model to BES program

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THERMINATOR model is dedicated to heavy-ion collisions. Its current description allows one to work with data for the highest collision energies achieved by LHC and RHIC colliders. However it is possible to adapt THERMINATOR model to the lower energy spectrum as is used in Beam Energy Scan (BES) program at RHIC.
Femtoscopy of two particles investigates the properties of matter produced in heavy-ion collisions. It allows one to study the space- time characteristics of the medium.
We present single- and two-particle momentum distributions of particles generated for the energy spectrum for BES program. To verify how model preditions agree with experimental results, we present the correlation functions obtained for identical pions in Au+Au collisions at sqrt{s_{NN}} = 7.7 - 39 GeV.

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Assigning quality labels in the high-energy physics experiment ALICE using machine learning algorithms

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Data Quality Assurance plays an important role in many high-energy physics experiments, e.g. the ALICE experiment at Large Hadron Collider (LHC) in CERN. Currently employed quality assurance methods rely heavily on manual labour and human expert judgments. This is also true for the Time Projection Chamber (TPC), one of the detectors employed by the ALICE experiment. To ease the burden of human quality label assignment, we investigated several state-of-the-art machine learning methods that can automate this process. The selection of the machine learning methods evaluated include artificial neural networks, support vector machines (with linear and non-linear kernels), as well as random forests and logistic regression. Our results for the TPC detector indicate, that over 30% of all data points classified as correct by human experts, i.e. without errors, can be correctly evaluated without any human interaction using random forest classifier with over 98% certainty.

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BM@N slow control system: background, status and plans

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Big modern physics experiments represent a collaboration of workgroups and require wide variety of different electronic equipment. Besides trigger electronics or Data acquisition system (DAQ), there is a hardware that is not time-critical, and can be run at a low priority. Slow Control system are used for setup and monitoring such hardware.

Slow Control systems in a typical experiment are often used to setup and/or monitor components such as high voltage modules, temperature sensors, pressure gauges, leak detectors, RF generators, PID controllers etc. often from a large number of hardware vendors.

Slow Control system also has to archive revieved data for further analysis and handling by physicists and to warn personnel about critical situations and contingency.

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Baryon-(anti-)baryon interaction measurement with femtoscopy

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Interaction cross-sections for baryon pairs are of fundamental interest and they are actively investigated theoretically. They are known well for pairs of common (anti-)baryons, however there is a lack of precise data for heavier baryons, including the ones carrying strangeness. The two-particle correlation formalism (femtoscopy) is sensitive to the

interaction kernel for a pair of particles, which is related to the pair interaction cross-section [1]. The formalism is extensively used to measure two-particle correlations in heavy-ion collisions. In particular the collisions at RHIC and LHC produce simultaneously large number of baryons and anti-baryons. We show how this formalism can be used to extract the cross-sections from the femtoscopic baryon-(anti-)baryon correlation functions [2]. The analysis is complicated by the presence of the so-called "residual correlations" arising from weak decay products in the measured sample. We show how this effect can be exploited to gain further insight into the cross-sections of even heavier baryons. We discuss the limitations of the measurement technique and estimate the discovery potential of currently available and soon-to-be-collected heavy-ion collision datasets at RHIC and at the LHC.

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Brief introduction to error analysis

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Estimation of uncertainties is very important part of measurements. Without them we have problems with comparison of results. We also don't know anything about the confidence of our measurements.
In this presentation I would like to briefly introduce into basic rules used to get uncertainty. I will present most important methods used to estimate uncertainty with some simple examples.

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Control and readout electronics of the time-of-flight system of the MPD

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This report devotes to the control and readout electronics for the time-of-flight system of the MPD. The examples of methodological studies of Resistive Plate Chambers are given and the stand for research and mass testing of detectors for the MPD experiment at the NICA collider is described. The investigation has been carried out at the Veksler and Baldin Laboratory of High Energy Physics, JINR.

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Correlations in ALICE

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Activities of WUT group in ALICE.

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DAQ system for the Silicon Tracking System of the BM@N experiment

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Baryonic Matter at Nuclotron is a fixed-target heavy ion experiment which is currently under construction at JINR LHEP (Dubna, Russia) and is scheduled for launch in 2019. "Stage 1" tracking system will be based on 8 GEM planes. CBM groups from Germany and Russia are interested in installation and commissioning of 4 additional CBM-like Silicon Tracking Stations in BM@N by the year 2020, which will become a part of the tracking system for the "stage 2". By doing so, CBM gains an opportunity to test their detectors and the experiment improves its track reconstruction efficiency for particles with low Pt. In addition, keeping the DAQ and DCS systems identical would keep synergy between these two experiments and allow scientists for fast and easy integration of front-end hardware into any of them.

However, there are challenges ahead to overcome, and one of them is unavailability of ASICs that are used in the readout chain. Those radiation hardened ASICs (GBTx) are restricted for supplying to Russia and a number of other countries, therefore it has to be substituted by some other solution in BM@N. Currently proposed solution to address this problem is emulation of the GBTx functionality in FPGA with fully compatible data connections. Another challenge lies in integration of CBM-STS readout chain with the existing DAQ infrastructure used in BM@N which is yet to be done, so this is being actively discussed and contemplated.

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Development of GEM-based detector system for plasma diagnostics application

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The proposed work refers to the development of gaseous detectors for application at tokamak plasma radiation monitoring. Such a diagnostics is of high importance for future and current fusion reactors as measurement of Soft X-ray Radiation (SXR) in 0.1-20 keV photon energy range accesses a valuable information on particle transport and magnetic configuration of magnetic fusion plasmas. A successful monitoring system should be able to discriminate energy of the incident absorbed photons and to have good spatial resolution (i.e., localization of their position on the detector readout pads) while operating in the required region. Nevertheless, as of today many physical, technical and technological aspects are still needed to be taken into consideration in order to develop the photon conversion and signal processing part of such monitoring system.
The work will cover the experience in developing Gas Electron Multiplier (GEM) detectors for different plasma fusion facilities and the results of previously designed detecting systems will be presented. Different geometries of the detecting chamber as well as data acquisition and processing electronics were elaborated in order to study X-ray emission of extremely intense plasma radiation in SXR region. It will also highlight the latest conceptual design and preparation of GEM based SXR detecting system for plasma impurities tomography, which is under development by our group. The information gathered from the metal impurities monitoring is especially crucial for future ITER-like machines. The experience in the elaborating of plasma imaging technology and the results of preliminary tests will be also shown.
The work will present main elaborations of research and development phases together with the results of experiments. The gathered experience of many years could be applied for the development of gaseous detectors aimed at different applications.

This work has been carried out within the framework of the EUROfusion Consortium and has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 633053. The views and opinions expressed herein do not necessarily reflect those of the European Commission.
This scientific work was partly supported by Polish Ministry of Science and Higher Education within the framework of the scientific financial resources in the years 2014-2017 allocated for the realization of the international co-financed project.

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Electric power distribution system – RACK's power supply

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Electric power distribution system comes with a set of features that allow user to control RACK's power supply. It consists of several work modes:

- AUTO mode
- MANUAL mode
- PHASE ANALYER mode
- CALIBRATION mode

Each mode can be accesed invidually from Main Control Panel. “Auto mode” provides automatic phases load balancer while “Manual mode” allow user to manually switch phases that power each device. “Phase analyzer” mode is a tool which return a full set of data about each phase parameters, like: voltage, current, power or frequency. “Calibration mode” is used to optimize load on each phase combined with “Auto mode”.

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Event reconstruction in the inner tracking system of the BM@N experiment

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The BM@N (Baryonic Matter at Nuclotron) is the first experiment to be realized at the accelerator complex of NICA-Nuclotron at JINR (Dubna, Russia). The aim of the experiment is to study interactions of relativistic heavy ion beams with a kinetic energy from 1 to 4.5
AGeV with fixed targets. A reconstruction chain for the BM@N experiment is being developed in software department of the Laboratory of High Energy Physics of JINR. The chain includes stages of event reconstruction from binary RAW data into high-level event information (hits, tracks, etc). The main stages of event reconstruction for the BM@N experiment are described in report. Some of experimental results are shown.

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Examination of heavy-ion collisions using EPOS model

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Collisions of heavy-ions are major method used to study properties of matter. Such studies are performed with comparison of experimental data and model simulations.

One of theoretical description is Parton-Based Gribov-Regge theory included in the phenomenological model EPOS. It was originally created to explain the processes at the highest energies obtained with LHC complex. EPOS gives possibility to study different observables what helps to understand better processes present during not only as proton-proton collisions but also as during much more complex reactions with heavy-ions. Various collision energy scans are considered as well.

So far the EPOS model have been used to describe higher collision energies obtained with RHIC complexes and LHC data. However, there is another interesting program currently under investigation at RHIC: Beam Energy Scan (BES), conducted at Brookhaven National Laboratory. Main goals of this project are to examine the Phase Diagram, study the characteristics of the first-order phase transition between Hadron Gas and Quark Gluon Plasma phases of nuclear matter. The search of Critical Point between first-order phase transition and transition of “cross-over” is another absorbing topic. RHIC, one of the biggest accelerators in the world, collides beams of Au nuclei at selected

energies as: $\sqrt{s_{NN}} - 7.7, 11.5, 19.6, 27, 39$, and 62.4 GeV. The variety of initial conditions provides covering as widest part of Phase Diagram of nuclear matter as possible.

Simulated with EPOS data will be verified using two-particles femtoscopic correlations, which allow one to measure the size of sources determined by newly created particles. The studies of elliptic flow will be performed as well.

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Femtoscopic measurements at MPD

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Correlation femtoscopy is a tool to study the spatio-temporal structure of particle emission. Preparation for such measurements at MPD detector require few things.
First task is finding good theoretical models to find out how much data is needed and what measurements precision is required. Second task is measuring detector capabilities. We have to find out what are the detector limitations. Those two requirements require software for analysis and reconstruction, this software should be also used for analysis of data that will be taken in near future.
In this talk we shortly present current activity of our group by presenting current status of work on those tasks.

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Femtoscopic measurements in the frame of theoretical models.

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Heavy-ion collision experiments are developed to study the properties of strongly interacting matter at high energies. The main aim is to investigate the Quark-Gluon Plasma (QGP), which consist of free quarks and gluons. Using the femtoscopic methods, the information about the space-time characteristics of the particle emitting source, like the radii of such source, is obtained. For needs of high energy physics, phenomenological models like UrQMD and EPOS are used.

In this talk there are presented the theoretical proton-proton and antiproton-antiproton correlation functions in Au+Au collisions at √sNN of 7.7 GeV, 11.5 GeV, 39 GeV and 62.4 GeV from STAR experiment program - Beam Energy Scan.

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From Maria Skłodowska-Curie to next generation environmental friendly antibiotics

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Abstract is being prepared!

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Gas system for Time-of-Flight detector in the MPD experiment

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The Time-of-Flight (TOF) will be one of the detectors used for particle identification in nascent Multi-Purpose Detector (MPD) at NICA (Nuclotron-based Ion Collider fAcility) complex. To work properly it needs system which provides gas under the correct pressure and with specific properties, like mixture composition and purity. Requirements, construction, properties and operation principles of this system will be discussed in this presentation.

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High-Energy Ion Irradiation in Material Science at Flerov Laboratory of Nuclear Reactions on the example of Single-Walled Carbon Nanotubes

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From research purposes to space programmes - variety of materials is exposed to radiation. While here, on Earth, amount of high-energy ions irradiation might remain at low doses, spaceships electronics are in a much greater danger. And so it is crucial to test radiation resistance before sending millions of dollars into cold cosmos. But how to do it? Effects of high-energy ion irradiation on the single-walled carbon nanotubes (SWCNTs) will be presented as an exemplar studies. A variety of commercially available SWCNTs samples were prepared and irradiated with 167 MeV Xe ions at the IC-100 cyclotron (FLNR JINR, Dubna). To disclose the structural changes occurring upon irradiation the samples were thoroughly analyzed by Raman spectroscopy (EL = 473 nm and EL = 785 nm). Based on the measured data the dependence between radiation dose and the extent of the damage induced in the material is derived and compared between individual specimen of SWCNTs.

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High-speed concentration of sorted data streams for HEP experiments

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Presented paper describes the data stream sorting and merging architecture, fitting triggerless HEP experiments.

The presented architecture is implemented in FPGA and is expected to merge multiple streams of coarsely sorted data with single output stream throughput of up to 320 Mwords/s.

In triggerless HEP experiments multiple detectors record "continuous" stream of small (i.e., 32 bit) data samples and send them in a sequence to hardware data concentrator, which conveys them over high-speed links to software data processing units. To allow efficient splitting the data into sets containing events from the required time period, the concentrated data streams should be sorted.

The paper starts with the presentation of stream merging principles and description of FPGA implementation based on binary mergers. The binary merger picks single (older) data sample from two input FIFOs, used as stream buffers. The binary merger requires strictly sorted input streams, while certain detectors may provide only coarsely sorted data stream, (meaning that some samples are out of order, but generally the sample timestamp is increasing). Therefore, the initial sorting is needed. Additionally, binary mergers require the clock frequency equal or higher than the expected data throughput. That creates the hardware-dependent, unavoidable limitation of their usability for very high data rates.The output data rate limitation may be increased by a factor of two, by the newly proposed parallelized binary merger.

The introduced merger picks two oldest data samples from two double-width FIFOs and stores them in the output double-width FIFO, reducing the required clock frequency to a half of the data throughput.

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Island of Super Heavy Elements

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When D.I. Mendeleev published the first Periodic Table with the 63 chemical elements, the charming Maria Sklodowska was only two years old. 29 years later she, with Pierre Curie, will discover two new elements: radium and polonium. The Curies, with Henri Becquerel got the Nobel Prize in physics (1903) "for outstanding achievements in the joint research of the phenomena of radiation". Only eight years later Ernest Rutherford (1911) proposes his planetary model of atom, and after two years "Bohr's atom" will puzzle all the educated physicists with his postulates, but explain the emission spectrum of a hydrogen atom. Further on, George Gamow proposes to consider the nucleus as a drop of nuclear liquid (1928). On the basis of this model, Niels Bohr and John Archibald Wheeler will develop the theory of nuclear fission (1939). From this theory it followed that probability of the process of spontaneous fission that is rare for uranium, will grow progressively with increasing number of protons in the nucleus, resulting in complete loss of stability for nuclei with $Z \geq 100$. However, the predictions greatly vary due to the presence of the internal structure of nuclear matter. One of the unexpected and fundamental outcomes of the new microscopic theory (1969) was the existence of a hypothetical "Island of Stability" in the area of very heavy (superheavy) nuclei, where, within the former concepts, the nuclei and elements cannot exist. Verification of these unusual predictions appeared to be complex and difficult.

The talk is devoted to the 30-year long Odyssey that led to this mystical Island. Here are summarized various attempts of search in nature and of artificial synthesis of superheavy elements before these resulted in the discovery of the five new chemical elements (2000-2012). Elements with atomic numbers 114, 115, 116, 117, and 118 with their names and symbols fill today the seventh period in Mendeleev's Periodic Table. Isotopes of the new elements and products of their radioactive decay have added 52-two new neutron-rich nuclides up to the mass A=294 to the nuclear map.
As we move away from the latest stable Pb-208 into the region of heavier nuclei, we observe their amazing survivability. At the verge of their existence, in the domain of large Coulomb forces, there appears an extra bonding of nucleons due to the structural properties of nuclei that enables the existence of islands of stability of very heavy elements. The fundamental predictions of the microscopic nuclear theory have got experimental confirmation in full.
The relatively long lifetimes of the new elements make it possible to investigate their chemical properties. To what extent do the superheavy elements follow their lighter homologues in their chemical behavior? The theoretical expectations, along with the results of the first chemical experiments, are discussed now in terms of determining the boundaries of the Periodic Table of elements.
Experimental studies of production and decay properties of the superheavy elements were carried out in Dubna, in Laboratory of Nuclear Reactions of JINR, in extensive cooperation with the national laboratories and universities of the USA, Germany, France, Switzerland, Japan, and Institutes of the JINR Member States.

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JINR-WUT cooperation in high-energy physics - a personal view

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I'm preparing...

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K* probe of hadron matter created in A+A collisions.

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The production of the K*(892) strange resonance in A+A collisions is analyzed within the integrated hydrokinetic model (iHKM) at different equations of state of superdense matter. A modification of experimental K*(892)-identification is studied for different centralities in view of possible re-scattering of the decay products in the hot hadronic medium at the afterburner stage of the fireball evolution. We see quite intensive rescattering of the decay products as well as recombination processes for these resonances. In addition, the production of the much longer-long-lived phi(1020) resonance with hidden strange quark content is investigated. The main idea for using such resonances as a probe of hot hadronic matter is the intermediate life time of them, especially of the K*(892), that is compared with duration of hot hadron phase in A+A collisions.

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Looking for the elixir of life

Benedykt Konowalski[1]

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Looking for the elixir of life - a Symphony for Maria Skłodowska - Curie
Premiere

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Maria Skłodowska-Curie

Maria Skłodowska-Curie in a Multimedia Dance Show

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Maria Skłodowska-Curie Museum in Warsaw and 150th birthday anniversary celebrations MSC2017 “Medicine-Science-Culture”

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ABSTRACT
The short story of the 50-years of the Maria Skłodowska-Curie Museum in Warsaw 1 will be presented together with the outline of the Polish Chemical Society 1 mission.

Figure 1: Opening ceremony of the Maria Skłodowska Curie Museum in 1967 with maria’s daughter, Eva.cs

Opening ceremony of the MSC Museum in 1967 with Marias's daughter, Eva.

Figure 2: enter image description here

Aquarelle showing the Museum, Freta 16 St. in Warsaw - the Maria's birth place

The current status of the Museum and its new, modern exhibition plans will be shown to the public. It is worth mentioning here that the project is by famous Polish museums' designers Nizio Design International [3].
In the second part of the talk the planned events aiming to celebrate 150th birthday anniversary of Maria Skłodowska-Curie will be presented. Throughout 2017 a series of events will take place under the motto "Medicine-Science-Culture". The celebrations will be concentrated in Warsaw, the place of Marias' birth, but through the Polish Chemical Society branches it will spread all over Poland, and further to Europe and other continents thanks to various institutions, including Embassies and... Polish-U.S. Fulbright Commission.

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http://nizio.com.pl/en/

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Material studies with positron annihilation spectroscopy

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Positron annihilation spectroscopy (PAS) is a method dedicated to detection of open-volume defects such as vacancies and their clusters in structures. Nowadays, this technique is of a great interest due to the practical character of obtained results. It is successively applied in the field of material science, surface engineering and ion modification.
Recently PAS studies have been provided at JINR. Researches using positrons emitted directly from the radioactive source and from slow positron beam are possible. In this way defects located on the depths from unit nanometers up to micrometers can be simply found. In the frame of presentation the basics of PAS, current status of facility, examples of application as well as directions of development will be discussed.

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Mathematical modeling of experiments at the Nuclotron.

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The aim of this work is to present shortly the Monte Carlo Models: LAQGSM, FRITIOF and a MCNPX code for calculations of experiments at the NUCLOTRON. The examples of experiments at the Synchrophasotron/Nuclotron complex with reactions p(1.5 GeV)+Pb and d (4 GeV) +U were presented. Spectra of protons and π mesons in p+Pb interactions were calculated and compared with experimental data in momentum range from 3 to 15 GeV/c. Possible applications of the LAQGSM and FRITIOF models in relativistic nuclear physics were discussed. The perspectives of using of MCNPX (LAQGSM) code and Geant4 (FRITIOF) code for calculations of construction of Nuclotron-based Ion Collider and detectors were analyzed. The hadron productions (multiplicity, Pt etc.) for different ions from p to Pb or Au by scanning in b and energy in the range from 3 to 11A GeV were evaluated.

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Measurements of angular correlation function in the STAR BES data

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Abstrakt:

The angular correlation function (CF) refers to the correlation of particles in the relative pseudo-rapidity and relative azimuthal angle. It is used to study strongly interacting matter properties at relativistic energies. Recent results from the ALICE experiment at LHC show unexpected structures of CF in the proton-proton and antiproton-antiproton correlations. These observations are suggesting that study of CF of identified particles can provide more detailed insight into nuclear matter properties, in comparison with measurements of unidentified particles.
The STAR capability of identifying particles at mid-rapidity, paired with the data from broad energy range of Au+Au collisions in the Beam Energy Scan program, provide unique opportunity to investigate the phase diagram of strongly interacting matter through the CF analysis. In this talk recent STAR experimental results from the Au+Au collisions at \sqrt(s_{NN}) = 19.6 GeV from the RHIC's Beam Energy Scan will be presented.

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Memories of Mary

Helene Langevin-Joliot[None]

An address of Maria's Grandchildren,
Prof. Helene Langevin-Joliot
Prof. Pierre Joliot

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Modification of carbon (nano)materials by swift heavy ions

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It is known that ions of different energies interact with materials in different ways, i.e., ions in the keV energy range lose their energy via elastic nuclear collisions, while those with energies higher than 1 MeV/u, so-called swift heavy ions (SHI), transfer their energy predominantly to the electronic subsystem. Given the unique ability of SHIs to deposit huge amounts of energy along a small cylindrical volume surrounding an ion trajectory, a highly localized modification of the material is possible.

This presentation aims at reviewing the radiation effects in various carbon systems, with the main emphasis put on the new phenomena resulting from dense electronic excitation provoked by SHI-irradiation. These effects will be discussed on the example of three different carbon materials: highly oriented pyrolytic graphite (HOPG), graphene oxide (GO), and glassy carbon (GC). The specimens were characterized by the X-ray photoelectron (XPS), X-ray Auger electron (XAES), and Raman spectroscopies. Their surface morphologies were investigated by atomic force microscopy and scanning electron microscopy. In addition, the electrical properties of the GO structures were evaluated by two-contact resistance measurements.

SHI-irradiation of HOPG introduces point-like defects and leads to an increase in the interlayer spacing. At high fluences HOPG is transformed into loosely interacting, damaged graphene sheets that exhibit unusual Raman spectral behavior. One of the most important radiation-induced transformations of GO is its reduction to reduced graphene oxide (rGO) of improved electrical conductivity. Under SHI-irradiation the reduction process is highly localized, leading to the formation of nanometer-sized rGO spots. Assuming the localized reduction occurs along the ion trajectory through several GO sheets, the resulting structures can be considered as arrays of vertically-arranged graphene quantum dots embedded in a non-conducting matrix. For samples irradiated to high fluences with the most energetic ions the presence of sp-hybridized carbon chains was detected. No such structures were formed under low-energy ion bombardment, implying that sp-C formation takes place exclusively at the electronic stopping power regime. This assumption was further confirmed by investigating the cross-sectional damage profile of GC samples.

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Monte Carlo studies of the GEM acceptance and Developing of the Trigger System at BM@N

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BM@N Experiment is the first, which will be realize at the accelerator complex of **NICA-Nuclotron-M** in **Joint Institute for Nuclear Research** in Dubna, Russia.
The aim of the BM@N experiment is **to study interactions of relativistic heavy ion beam with fixed target**. Particles identification is provided by combining the information from Central Tracking modules (inside of analyzing magnet), Outer Tracking modules (outside magnetic field) and Time of flight detectors.
The Inner tracking modules are based on Silicon micro-strip sensors and **Gas Electron Multipliers** (GEM) detectors. The outer tracking system is based on the drift chambers and straw tube detector. Choosing the best configuration layout for both GEM and Si stations is one of the crucial issue for the tracking resolution. Thanks to the Monte Carlo simulations in terms of the GEM acceptance it was able to find adequate detectors arrangement.
Additional aim in BM@N experiment is **Short Range Correlation studies** via hard scattering in inverse kinematics. SRC- pairs are pairs of nucleons tied together inside of nuclei. It is proposed to apply the heavy-ions beam and proton fix-target to break up the pairs and observe all components after collision. This type of experiment requires particular detector setup for the defined kinematics of interaction. In that case the **high-effective trigger system** is essential. For SRC at BM@N experiment trigger system is based on scintillation modules. Constructing and testing them was an important step to collect proper data.

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NA61/SHINE facility at CERN SPS

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NA61/SHINE is a fixed target experiment operating at the CERN Super-Proton-Synchrotron (SPS). The NA61/SHINE Collaboration aims to study the properties of strongly interacting matter on the onset of deconfinement. The SPS beam energy range allows creating nuclear matter around the critical point. Beam momentum in the range 13A-150A GeV/c and a wide selection of the system size (p+p, Be+Be, Ar+Sc, Xe+La; Pb+Pb was measured previously by NA49) create a two-dimensional scan enabling systematically significant studies.

The NA61/SHINE experimental facility will be presented. Actual status of the detector together with recent hardware upgrades will be discussed. Recently, NA61/SHINE spectrometer was equipped with a new Vertex Detector, which allows for identification of open charm mesons produced in nucleus-nucleus collisions at SPS energies.

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NCBJ's contribution to the construction of large research infrastructures in Europe

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The National Center for Nuclear Research (NCBJ-Świerk, Poland) is a leading research center for basic and applied research, including interdisciplinary research, a center of high European interest with a unique large research infrastructure. NCBJ develops and complements its competences through active collaboration with leading global and European research institutions both in terms of infrastructure construction and participation in experiments in international teams using this infrastructure. In addition to a brief description of the institute itself, the presentation will show a few examples of NCBJ's contribution to the construction of large research infrastructures in Europe such as CERN, XFEL, ESS for simulation and hardware.

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National Instruments Technologies...

Maciej Antonik[1]

[1] *NAtional Instruments*

Under construction

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Network anayser control system

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The MPD (Multi Purpose Detector) is a part of NICA (Nuclotron Ion Collider fAcility) project in Dubna (Russia). Among many control systems, SCS (Slow Control System) is dedicated to handle and control parameters of the detector, which vary with relatively slow sample rate and do not depend on experiment being carried out.
I am going to describe on part of the rack network analyser control system and control code developed in LabVIEW enviroment. The network analyser LabVIEW automation program is one part of the whole coherent automation system, containing variety of subVI's connected by cluster links.

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New Results on Baryon and Meson Production at SPS Energies

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One of the main objectives of the NA61/SHINE experiment at CERN SPS is to search for the critical point on the transition line between the two phases of matter, the quark-gluon plasma and the hadron gas. In this talk we present first results on three new observables relevant for the properties of the system as it cools back from the QGP down to the hadronic phase, which recently enriched the NA61/SHINE strong interaction programme.

We investigate proton density fluctuations as a possible order parameter of the phase transition in the neighborhood of the critical point. To this end, we perform an intermittency analysis of the proton second scaled factorial moments (SSFMs) in transverse momentum space. A previous analysis of this sort revealed significant power-law fluctuations in the NA49 heavy ion collision experiment for the "Si"+Si system at 158A GeV/c. The fitted power-law exponent was consistent with the theoretically expected critical value, within errors, a result suggesting a baryochemical potential for the critical point in the vicinity of ~250 MeV. We now extend the analysis to NA61 systems of similar size, Be+Be and Ar+Sc, at 150A GeV/c.

We present the first ever measurements of Phi meson production in p+p collisions at 40 and 80 GeV/c, and most detailed ever experimental data at 158 GeV/c. We demonstrate the superior accuracy of the present dataset with respect to existing measurements. The comparison of p+p to Pb+Pb collisions demonstrates a non-trivial system size dependence of the longitudinal evolution of hidden strangeness production, contrasting with that of all the other mesons.

The electromagnetic (EM) effects on charged meson production give, for the first time, a consistent picture of the longitudinal evolution of the system at SPS energies. We discuss the role of energy-momentum conservation in the latter and discuss the system size dependence of EM effects as a possible new tool for studying the space-time evolution of the particle production and spectator fragmentation processes. This gives an extended update of the orginal proposal for studying EM interactions with NICA as discussed in 1.

1 A. Rybicki et al., Studying the interplay of strong and electromagnetic forces in heavy ion collisions with NICA, Eur. Phys. J. A52 (2016) no.8, 221.

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Noise testing and design of NIR radiation detector using PbS photoresistor

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Co-author(s): Krystian Roslon [2] ; Marek Peryt [1] ; Daniel Dabrowski [1]

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This work describes the built measurement system for the study of the sulfide-lead photoresistor (PbS), built detector and measurement results. In this thesis, the stages of comparison of the pre-amplification stages, the dynamics analysis of the applied system, the design and construction of the measuring system and the analysis of the received data were presented.

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Noise testing and design of NIR radiation detector using PbS photoresistor

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This work describes the built measurement system for the study of the sulfide-lead photoresistor (PbS), built detector and measurement results. In this thesis, the stages of comparison of the pre-amplification stages, the dynamics analysis of the applied system, the design and construction of the measuring system and the analysis of the received data were presented.

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Non-identical particle femtoscopy in STAR

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Heavy-ion collisions allow us to study the properties of nuclear matter – especially Quark-Gluon Plasma (QGP) state, where the quarks and gluons are deconfined. To study space-time parameters the method of femtoscopy is used. This method provides measuring the size of the particle-emitting source which is not measurable directly. From non-identical particles correlations, we can obtain information about the asymmetry in emission process between those two kind of particles.

In this talk I will present a status report of a STAR analysis of pion-kaon, pion-proton and kaon-proton correlations in Au+Au collisionss at √S{NN} = 39 GeV.

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ORACLE Technologies

Paulina Łopacińska[1]

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Under construction

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On the soft X-Ray diagnostic system for WEST tokamak

Rafal Dominik Krawczyk[1] ; Pawel Linczuk[2] ; Andrzej Wojeński[None] ; Tomasz Czarski[None] ; Krzysztof Pozniak[3] ; Maryna Chernyshova[None] ; Piotr Kolasiński[None] ; Grzegorz Kasprowicz[None] ; Wojciech Zabolotny[3] ; Michał Gąska[None] ; Karol Malinowski[None] ; Ewa Kowalska-Strzęciwilk[None]

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The technical issues considering the provision of fast heterogeneous acquisition and diagnostic system for soft X-ray are discussed. The system is designated for the deployment in WEST thermal fusion reactor in CEA. Cadarache, France. The advancement in development for data processing of computational back-end are presented. The ultimate objective is to provide a fast data processing mechanism for future control mechanism in order to sustain the reaction in the tokamak.

Welcome / **87**

Opening of the NICA days 2017 conference

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Our interests in NICA

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In the first part of my lecture I am going to briefly present an activity of National Centre of Nuclear Research in the field of high-energy nucleus-nucleus collisions, and in the second one a specific problem to be studied at NICA will be discussed. Specifically I am going to show how the isothermal compressibility of strongly interacting matter produced in nuclear collisions can be measured by means of multiplicity fluctuations of particles produced in the collisions.

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Particle identification (PID) and prospects for the study of event-by-event fluctuations in MPD

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Physics goals of Multi Purpose Detector (MPD) require excellent particle identification (PID) capability over as large as possible phase space volume. Identification of charged hadrons and light nuclei is achieved at momenta 0.1 – 3 GeV/c. PID uses measurements by a time-of-flight (TOF) which are

complemented by the energy loss (dE/dx) information from the time projection chamber (TPC). PID has phase space coverage $|\eta| \leq 1.6$. In my talk I will show some results of hadron and light nuclei identification and capability of the study of event-by-event fluctuations in MPD.

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Particle physics and heavy-ion physics at JINR, present and prospects

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The present and future activities at JINR in the field of particle and relativistic heavy-ion physics are shortly reviewed.

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Performance evaluation of developed GEM-based X-Ray diagnostic system

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The volume of data acquired from Gas Electron Multiplier (GEM) detectors increases with emerging demands for soft X-ray measurement of hot plasma. In order to reach the expectations of the high-quality measurement construction of high-throughput and low latency processing system is required. Overview and details of the current state of the art of the developed system will be presented. Prepared solution consists of dedicated acquisition hardware, FPGA preprocessing and High Performace Computing devices used for numerical processing. Providing low-latency data transmission is based on PCI Express technology together with the dedicated Linux driver.

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Perspectives of DCS and SCADA systems in high energy physics experiments.

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The article presents the architecture of DCS and SCADA systems and software components in the context of using them in physical experiments. The aspects of usability, performance and system security were discussed. It shows the possibilities of communication with other automation systems and the mechanisms of customization for problems in large industrial facilities.

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Perspectives of Model Predictive Control in high energy physics experiments

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The objective of this work is to shortly present Model Predictive Control (MPC) algorithms and to discuss their possible applications in high energy physics experiments. Firstly, the idea of MPC, its advantages and a few MPC formulations are discussed. The unique possibility of controlling complex multiple-input multiple-output processes with constraints is emphasised. Secondly, example possible applications of MPC in high energy physics experiments are discussed and a perspective of using MPC for the Nuclotron-based Ion Collider fAcility (NICA) accelerator is given.

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Positron annihilation studies of aluminum exposed to sandblasting

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Process involving bombarding a surface with dashing abrasive particles called sandblasting is often used in industry to clean surfaces of different objects by removing paints, impurities or corrosion products. It is the basic tool to remove oxides after heating of alloys being the future implant in prosthetics. Another important area of its application is an induction of nanocrystallization by previous sandblasting and annealing. The motivation of presented studies is characterization of subsurface layer modifications of sandblasted aluminum in dependency on the pressure in the stream of alumina particles and different treatment time. The experimental techniques were selected to provide wider discussion related to impact of sandblasting on changes generated below the surface. A kind of introduced defects and their depth profiles found using Positron Annihilation Spectroscopy techniques will be reported.

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Prospects of dilepton measurements at the NICA-MPD

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Abstract:
An excess of dileptons has been observed from the top RHIC energies of sqrt(s_NN) = 200 GeV down to the lowest SPS energies of sqrt (s_NN) = 9 GeV. The NICA facility under construction will allow to push the measurement of dileptons to much lower energies and to establish the onset of the low-mass excess related to chiral symmetry restoration and of the intermediate mass excess related to the QGP thermal radiation. I shall review the potential, challenges and prospects of these measurements.

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Proton femtoscopy

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Through experiments with heavy-ion collisions at high energies we can study the properties of nuclear matter under extreme conditions. The information on the sizes of the particle-emitting sources can be inferred via the method of femtoscopy. The femtoscopy method uses Quantum Statistics effects and the Final State Interactions to determine the space-time properties of the source. The radii of the sources extracted from two-baryon femtoscopy along with those obtained from two-meson and meson-baryon correlations provide complementary information about the source characteristics. In this talk, a status report of a STAR analysis of proton and antiproton femtoscopic correlations in Au+Au collisions at √s_NN of 39 GeV, 11.5 GeV and 7.7 GeV will be presented.

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R & M Technologies

Andrzej Zagójski[1]

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Under construction

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Radiation monitoring system for NICA Slow Control electronic equipment

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The NICA (Nuclotron-based Ion Colider fAcility) beam pipeline room will be adjacent to a chamber with its Slow Control electronic equipment. It is possible to appear a radiation exposure in that chamber in case of a leakage from the pipeline or any other reasons. It can destroy the control electronics when the radiation is strong enough, effecting in potential abnormality of the NICA devices functionality. This implies the necessity of instant monitoring of the level of scattered radiation in a Slow Control room and alarming about the threats. The prototype radiation monitoring system for Slow Control electronic equipment concept will be discussed in this presentation.

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Recent Results and future programs from STAR Experiment

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I will highlight recent results from STAR experiment at RHIC.
The results to be presented are: proton sea-quark and sign of
color interaction using W-boson, hard probes of QGP properties,
discovery of most vortical fluid using global hyperon polarization,
search for chiral magnetic effect (CME) and QCD critical point.
STAR's plan for future programs includes
isobar collisions and second phase of Beam Energy Scan (BES-II) to
strengthen our searches for CME and critical point,
longitudinal correlation study to quantify the temperature dependence
of viscosity and 3-dimension hydrodynamics, and Drell-Yan and other
Cold-QCD processes to study the gluon and quark contents of nucleons and nuclei –
an important scientific portal toward future Electron-Ion Collider.

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Reconstruction of Hypernuclei at NICA/MPD: a Feasibility Study

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The study of strangeness production in nuclear collisions is one f the main tasks of the NICA/MPD physics program. Essential signatures of excited and compressed baryonic matter could be provide by heavy strange objects.
Study of hypernuclei is important for:Understanding the strangeness degrees of freedom in hadronic systems; Study of all populated regions in the three-dimensional chart of the nuclides; hyperon-nucleus and hyperon-hyperon interaction can be investigated through hypernuclei.

The Monte Carlo simulations results presented show that the start version of the MPD Detector will provide good opportunity for reconstruction of hypernuclei in Au+Au colisions at NICA.

Registration of Participants / **2**

Registration

Participant registration of the “NICA days 2017” conference.
Publishing of conference materials
Additional information about the course of the conference and accompanying events.

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Science Club CAMAC - history and activity. Recruitment meeting.

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CAMAC Science Club, a short form of the name, was adopted by Computer Automated Measurement And Control, a standard of electronic modular apparatus.
CAMAC Science Club, was founded in 1984, on the initiative of students from the Institute of Physics of the Warsaw University of Technology.
Members are students, from different faculties. Open formula CAMAC Science Club, allows to carry out interesting and complicated research and engineering projects.
We will introduce the most important of them. Also plans for professional activity, international cooperation and working and recruitment policies.

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Sightseeing Queen Marysienka Palace in Wilanow, Warsaw

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Signing of the ”NICA-PL” Consortium Agreement

Rajmund Bacewicz[1] ; Viktor Matveev[2]

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Signing of the Addendum to the Framework Agreement between WUT and JINR

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Study of Onset of Deconfinement and Search for Critical Point by NA61/SHINE

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Recent results on hadron production properties, inclusive spectra and fluctuations,
in nucleus-nucleus at the CERN SPS will be reported.
The priority will be given to quantities relevant for the study of the onset of deconfinement
and search for the critical point.
I shall also report on the observation of a new phenomenon, the onset of fireball.

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Study of the MPD detector performance in p+p collisions at NICA

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Basic measurements of p+p collisions are required either, as a benchmark for the heavy-ion collision measurements, and to obtain a better understanding of light collision systems. In this work, the MC simulation and reconstruction of p+p collisions at $\sqrt{s}$ = 4 - 20 GeV was performed to explore the possibilities of using the Multi-Purpose Detector (MPD) to register data from p+p collisions at the energies range of NICA. The events were generated by using the code PHSD in HSD mode while the MPDRoot code was used to simulate and reconstruct the generated data. We present a preliminary performance analysis of MPD. The possibility of reconstructing neutral Lambda baryon from p+p, as one of the most promising observables in heavy ion collisions is also discussed.

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Swagelok Technologies

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Under construction

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The Future of Pharmaceutical Treatment of Disease

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The abstract is prepared.

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The STAR group at the Warsaw University of Technology: Research activities in the context of the NICA project

Daniel Kikola[None]

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I will present an overview of the STAR group at the Warsaw University of Technology, and its research activities in the context of the NICA project.

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The design brief of the Slow Control System for TOF-MPD

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The MPD (Multi Purpose Detector At NICA) experiment which is under construction at Laboratory of High Energy Physics at Joint Institute for Nuclear Research will be studying relativistic heavy ion collisions. Such experiments produce not only experimental data but also variety of operational parameters which should be monitored and controlled during regular functioning. For this purpose Slow Control System is needed. This presentation will show you the design brief of the Slow Control System which is preparing for TOF-MPD detector.

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The importance of science and scientists for the society - panel discussion

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Panel discussion lead: Prof. dr hab. Krzysztof Meissner, Faculty of Physics, University of Warsaw

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Three-phase power network analyzer n-43 for PXIe NI for Slow Control System of MPD-NICA

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It is very important to properly supply the electronic circuits; therefore, in the Polish Group of Experts at ZIBJ in Dubna, we devote major attention to the whole project of the Slow Control System. The sophisticated measurement system of the MPD-NICA experiment generates a lot of electrical impulses that interfere with sensitive electronics and may disrupt proper operation of the system.

The reduction of such interference in filtering systems will be much more effective if the power supply is properly designed from the first power supply circuit. An elementary condition that must be met is to ensure that loads of electrical phases are properly balanced. The principle is to minimize the current in the neutral wire. In this case, current flowing through one phase is equal to the amount of current flowing through the other phases and neutral current is close to zero. The second support condition is the zero current in the PE conductor (ground).

Presented project is an attempt to solve this problem. The designed analyzer measures the load on each phase. The collected data allow estimating the load during balancing process, both on the scale of one RACK and on the whole system. Another advantage of this approach is the ability to provide continuity of power for important experiments by monitoring power lines for energy reserves by switching the appropriate circuits.

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Time-of-Flight Identification System of the MPD and BM@N Experiments

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The identification of hadrons in experiments on the study of hot and dense baryonic matter is an important and complex task. Particles identification in the BM@N and MPD setups is performed by a time-of-flight system based on multi-gap RPC. The assembly and installation of the BM@N time-of-flight system is almost complete and has a time resolution of about 90 ps. The design of the MPD time-of-flight system is completed and mass production of detectors is now started.

Session 3; 9-nov 2017 / 56

Timing optimisation in Overlap Muon Track Finder firmware

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OMTF is one of CMS trigger subsystems, tasked with analysing detector data on the boundar of barrel and endcap regions.
OMTF firmware is running on large, high-end FPGA; consuming more than 80% of FPGA resources. Main algorithm runs at 160 MHz, while data transmission subsystems run at 80, 160 or even 250 MHz. With a large FPGA utilisation it can be considered high frequency, which poses problems in achieving timing closure. Moreover, there are many clock-domain-crossing (CDC) paths; mainly on the slow control and pulser/readout paths. CDC paths must be manually constrained. Failure to achieve timing closure, or to properly constrain CDC paths, may result in data transmission errors or even functional failure.
OMTF firmware went through major timing optimisation in previous months, which should substantially improve timing results, which will increase confidence in firmware processing capabilities.

Session 1; 7-nov 2017; / 82

Towards exascale simulations of quantum superfluids - new prospects for modelling nuclear processes

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Abstract
Superfluidity is a generic feature of various quantum systems at low temperatures.
It has been experimentally confirmed in many condensed matter systems, in 3He and 4He liquids, in nuclear systems including nuclei and neutron stars, in both fermionic and bosonic cold atoms in traps, and it is also predicted to show up in dense quark matter. The time dependent density functional theory (TDDFT) is, to date, the only microscopic method which allow to investigate fermionic superfluidity far from equilibrium.
The local version of TDDFT is particularly well suited for leadership class computers of hybrid (CPU+GPU) architecture. Using the most powerful supercomputers we are currently able to study a real-time 3D dynamics without any symmetry restrictions evolving up to hundred of thousands of superfluid fermions. It represents a true qualitative leap in quantum simulations of nonequilibrium systems, allowing to make quantitative predictions and to reach limits inaccessible in laboratories. During the talk I will review several applications and results concerning in particular nuclear collisions and induced fission.

I will also discuss dynamics of nuclear matter in neutron stars, dynamics of topological excitations in ultracold atomic clouds and prospects to produce a quantum turbulent flow.

Session 2(V); 8-Nov 2017; Visit to NCBJ / 83

Visit to National Center for Nuclear Research, Świerk

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Visit to National Center for Nuclear Research, Świerk

Session 1; 6-nov 2017; / 44

Vorticity and polarization in baryon-rich matter at NICA

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We study the structure of vorticity and hydrodynamic helicity fields in peripheral heavy ion collisions using the kinetic Quark-Gluon String and Hadron-String Dynamics models. We observe the formation of specific toroidal structures of vorticity field (vortex sheets). Their existence is mirrored in the polarization of hyperons of the percent order. Its rapid decrease with energy was predicted and recently confirmed by STAR collaboration. The energy dependence is sensitive to the temperature dependent term derived and discussed in various theoretical approaches. The antihyperon polarization is of the same sign and larger magnitude. The crucial role of strange vector mesons is also discussed.

Session 3; 6-nov 2017; / 86

Welcome Old-Polish dinner

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Welcome from the Director of NCBJ-Świerk

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Welcome to NICA 2017 Participants

Prof. V. Matveev, Director of JINR Joint Institute for Nuclear Research in Dubna, Moscow Oblast

Session 4; 7-nov 2017; / 52

What motivation could encourage a young girl to become a scientist?

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Will be prepared!

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Why are we building NICA?

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in preparation