Team for the Future of NICA students internship in the JINR in Dubna (Russia)

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What is JINR

- JINR – Joint Institute for Nuclear Research
- International, intergovernmental organization
- 18 member states
- 6 associate members

Member states and associate members

JINR laboratories

- Veksler and Baldin Laboratory of High Energy Physics,
- Dzhelepov Laboratory of Nuclear Problems,
- Bogoliubov Laboratory of Theoretical Physics,
- Frank Laboratory of Neutron Physics,
- Flerov Laboratory of Nuclear Reactions,
- Laboratory of Information Technologies,
- Laboratory of Radiation Biology.

International cooperation

Collaboration with more than 1000 scientific centers and universities in 74 countries:

- CERN
- NASA
- DESY
- BNL
- UNESCO
- ROSKOSMOS

What is NICA?

NICA (Nuclotron-based Ion Collider fAcility) consists of:

- NICA innovation block
- Computer unit, computer networks and computing cluster
- Accelerator block (ion sources, booster synchrotron, ion synchrotron nuclotron, collider)
- Experimental setups:
  - Detector for study of Baryonic Matter at Nuclotron (BM@N)
  - MPD (Multi Purpose Detector)
  - Spin Physics Detector (SPD) for study of nucleon spin structure

NICA

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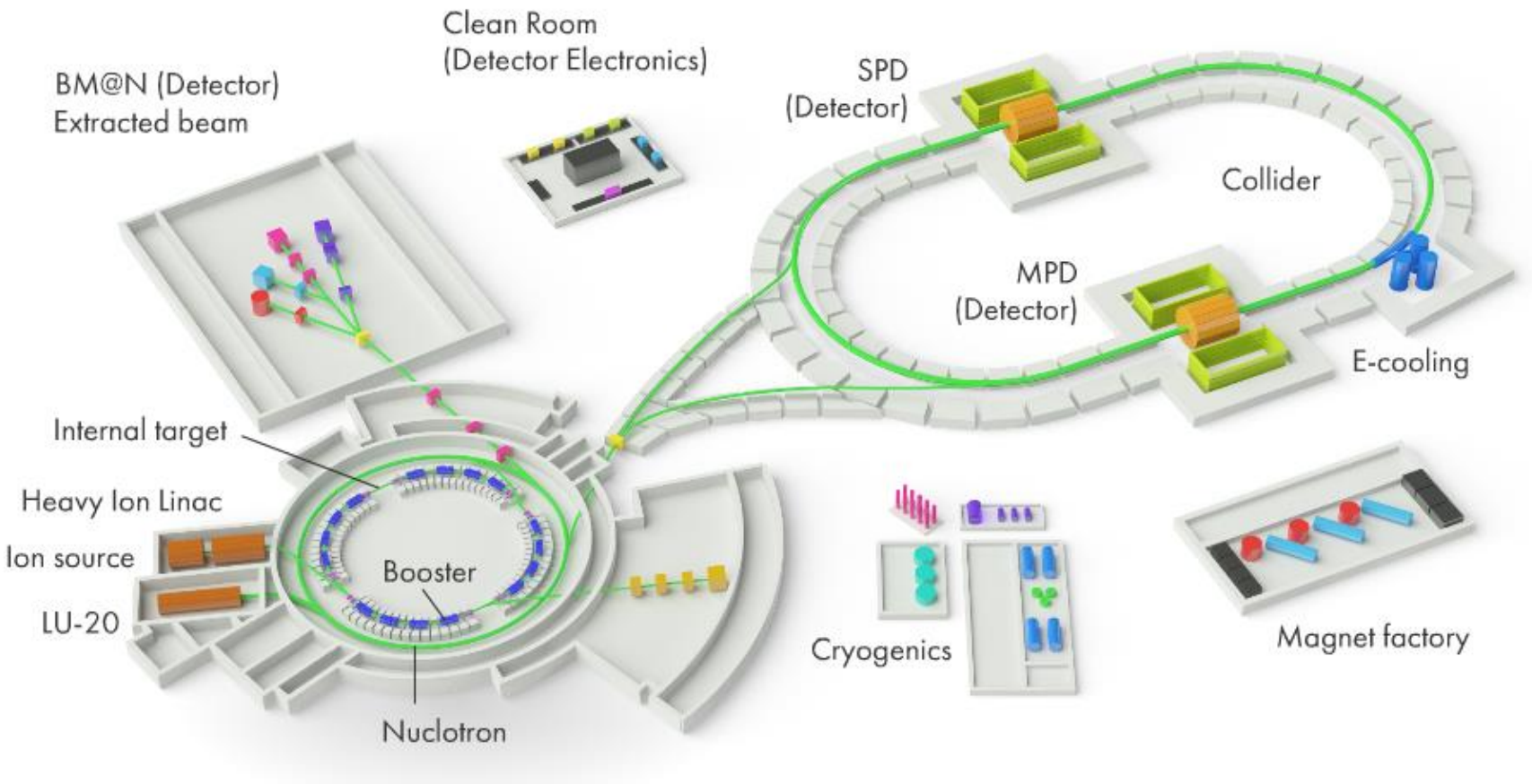
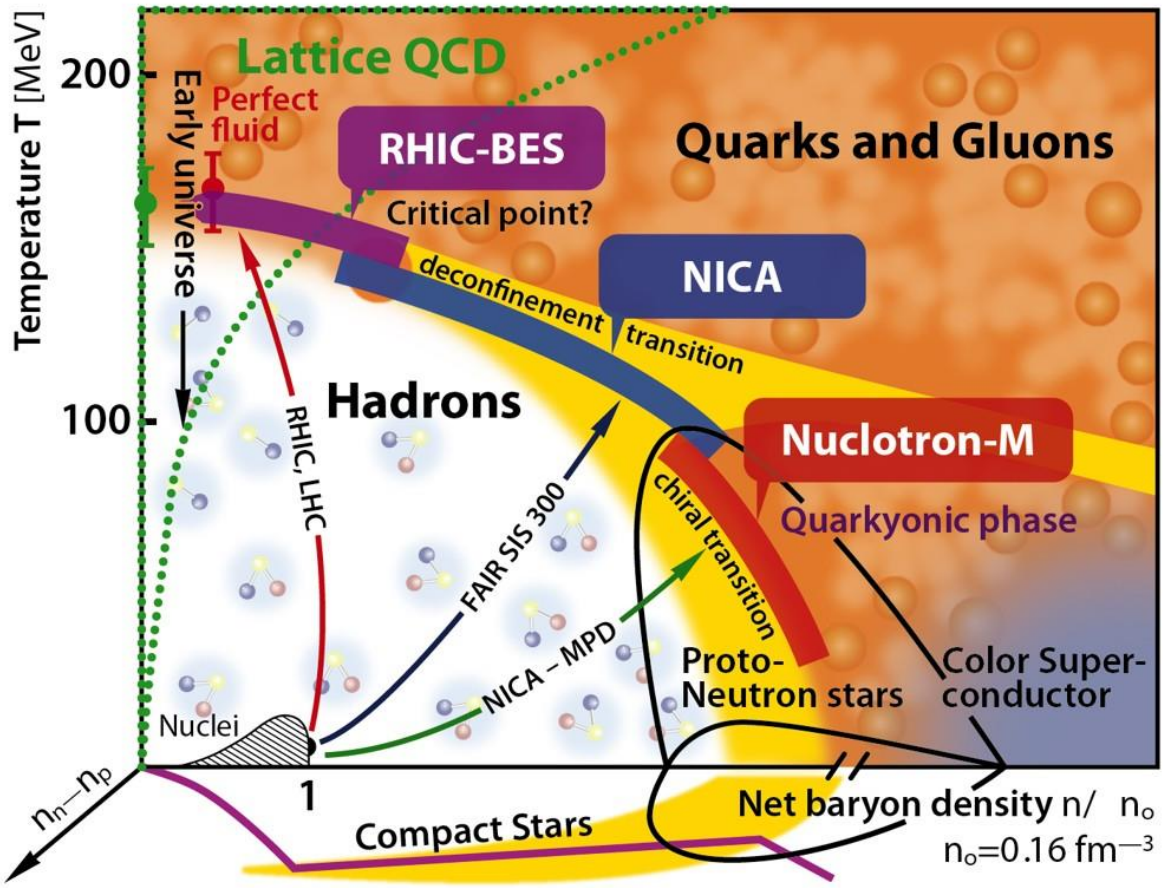


NICA research



NICA research

- Search and experimental study of phase transitions and critical phenomena in strongly interacting nuclear matter at extreme baryonic density
- Experimental study of the spin structure of nucleon and light nuclei
- Investigation of polarization effects in heavy ion collisions and few nucleon systems

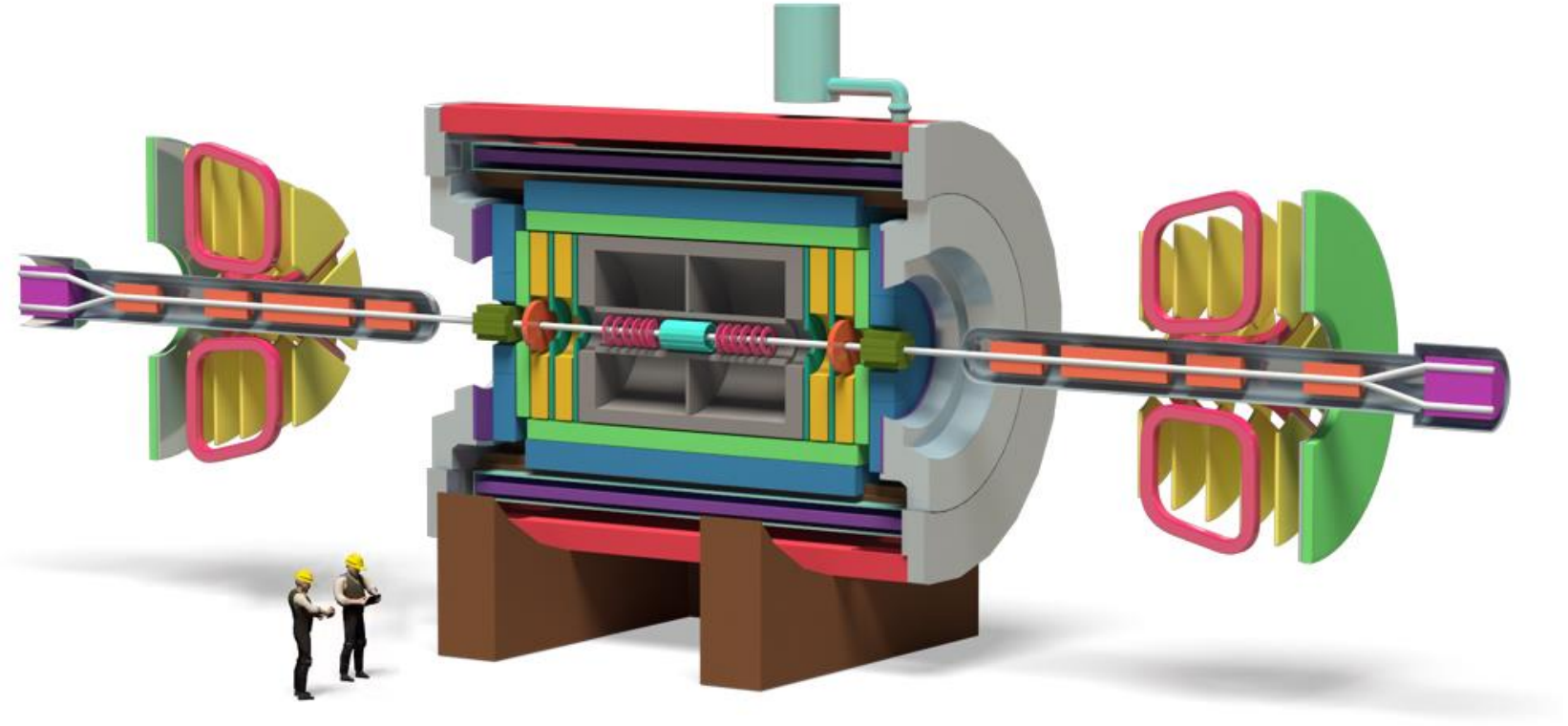
NICA research

- Investigation of reaction dynamics and studying modifications of hadron properties in nuclear matter.
- Study of the structure of the nuclei at short in nucleon distances, near-threshold strange hyperons production and search for hypernuclei of the Nuclotron extracted ion beams with fixed targets.
- Development of theoretical models of the studied processes and theoretical support of experiments.

What is MPD

- Designed for experiments on colliding beams of the NICA
- For the detailed study of the QCD phase diagram at high densities and temperatures
- To search for new states of hadron matter and phase transitions

MPD



Areas of engineering work

- NICA-MPD-Platform
- Cryogenics of the MPD
- Gas supply system for TOF (Time Of Flight) detector
- Cooling of the ITS (Inner Tracker System) and TOF detectors
- Equipment Database

MPD Physics

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G. Feofilov, A. Ivashkin — 1

Global observables

- Total event multiplicity
- Total event energy
- Centrality determination
- Total cross-section measurement
- Event plane measurement at all rapidities
- Spectator measurement

V. Kolesnikov, Xianglei Zhu — 2

Spectra of light flavor and hypernuclei

- Light flavor spectra
- Hyperons and hypernuclei
- Total particle yields and yield ratios
- Kinematic and chemical properties of the event
- Mapping QCD Phase Diag.

K. Mikhailov, A. Taranenko — 3

Correlations and Fluctuations

- Collective flow for hadrons
- Vorticity, Λ polarization
- E-by-E fluctuation of multiplicity, momentum and conserved quantities
- Femtoscopy
- Forward-Backward corr.
- Jet-like correlations

V. Riabov, Chi Yang — 4

Electromagnetic probes

- Electromagnetic calorimeter meas.
- Photons in ECAL and central barrel
- Low mass dilepton spectra in-medium modification of resonances and intermediate mass region

Wangmei Zha, A. Zinchenko — 5

Heavy flavor

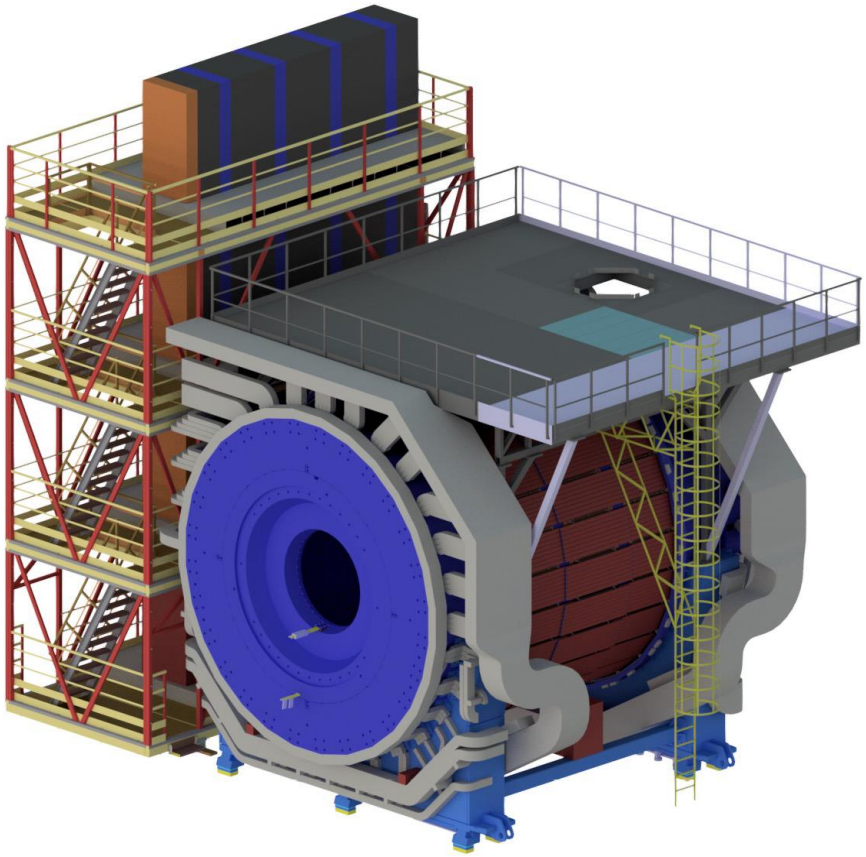
- Study of open charm production
- Charmonium with ECAL and central barrel
- Charmed meson through secondary vertices in ITS and HF electrons
- Explore production at charm threshold

MPD Cosmic Ray Detector

- Cosmic ray measurements in automation cycle using Python programming
- Automatic handler of the dosimetry detector with use of the FHT 6020 display and communication unit, RS-485 bus and the LabVIEW language

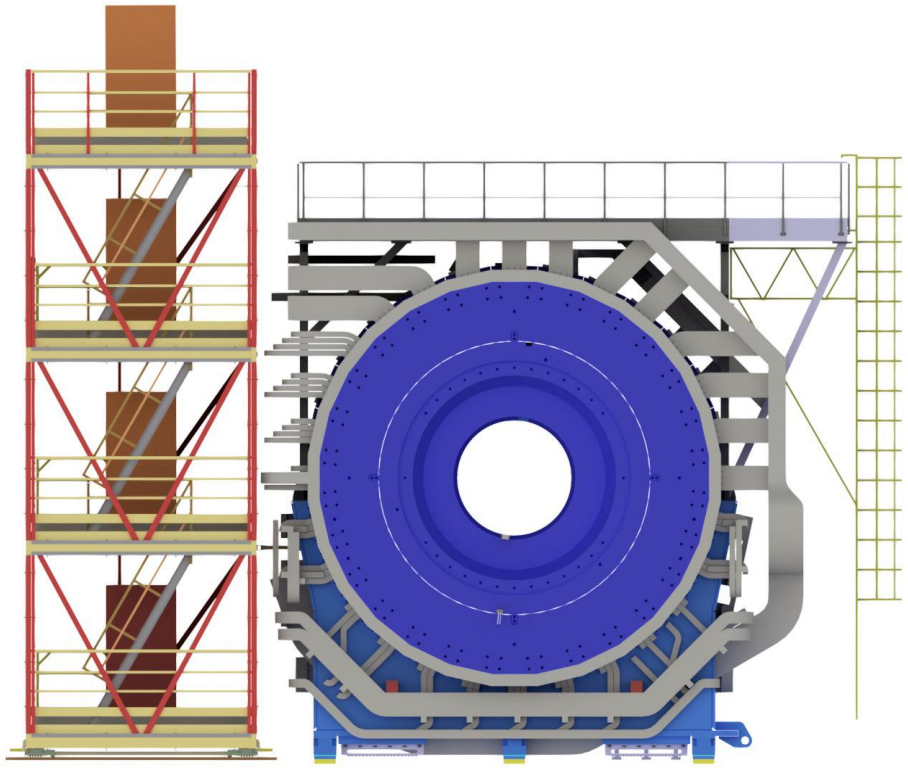
NICA-MPD-Platform

- Four floor structure
- Equipped with IT RACKs of various functions
- Provides working conditions for power supply systems, DAQ electronics, monitoring and control elements of the subdetectors.



Features of NICA-MPD-Platform

- Ducting system
- IT RACKS on the NMP
- Raised floor
- Power Supply
- Cooling System
- Structural Cabling
- Access control and management system
- Video based fire detection
- CCTV video surveillance system
- Emergency sound notification system
- Radiation monitoring system
- Magnetic field measurement system
- Autonomous fire extinguishing system
- Intelligent Power Distributor



Team for the Future of NICA

- From 3 months up to a year (in exceptional, justified cases – 2 months)
- Is concerning only NICA project, strictly connected with MPD
- Work with software from National Instruments, Autodesk, Oracle, Siemens, R&M, Swagelok and many more
- Topics connected with automatics, robotics, electronics, access systems, 3D printing, programming, high energy physics, database, operation of the detectors

Topics realized in previous years

- Temperature simulations and thermovision
- Software for data analysis from experiments
- Turning on and off of the RACKs
- Designing mechanical constructions
- Fire extinguishing system
- Gas systems
- Design of the pump on magnetic bearings
- Robots

Topics realized in previous years

- Oracle database
- Experiment Control System, SCADA
- Optical fiber laboratory, testing the optical fibers
- Development of 3D printing
- Measuring the magnetic field

This year's main themes

- Analysis of data from experiments MPD and BM@N including Monte-Carlo models
- High-performance computing: installation, maintenance, operation
- Programming (Java, LabView, WinCC, TIA Portal)
- 3D modeling and heat transfer simulations for prepared models
- Issues connected with database

Form of the internship

- Weekly meetings introducing to the topic of the work in the JINR
- Regular meetings in the seminar form to report on the status of work
- Individually scheduled meetings with the supervisor or in small groups
- At the end of the internship, 15 minutes presentation in english
- Preparation of technical documentation of the developed project
- Writing a publication and presenting the results during the conference

Opportunities

- Choice of the topic which can be topic of the diploma thesis
- Receiving the certificate confirming taking part in the internship and acquired skills and knowledge
- Unique experience from the renown research facility
- Taking part in the international conference

JINR

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Contact:

http://tefenica.jinr.ru

tefenica@jinr.ru

Sources

- REPORT on preliminary results of the implementation of the Agreement between the Government of the Russian Federation and the international intergovernmental research organization Joint Institute for Nuclear Research on the construction and operation of a complex of superconducting rings on colliding beams of heavy ions NICA (NICA complex) as of 01/01/2020
- TECHNICAL PROJECT OF THE OBJECT "NICA COMPLEX“
- Krystian Rosłon’s and prof. Adam Kisiel’s presentation from VII-th Collaboration Meeting of the MPD Experiment at the NICA Facility

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Thank you for your attention