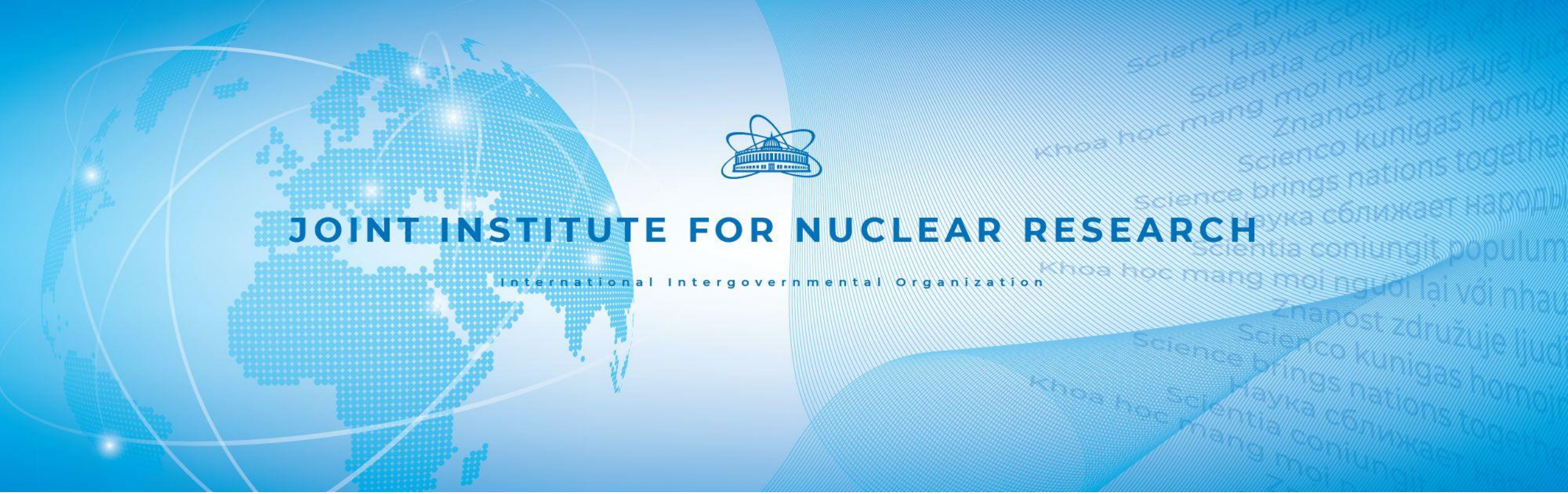


136th session of the JINR Scientific Council

Director's Report: News, Science, Prospects

Academician Grigory V. Trubnikov

12–13 September 2024, Dubna

Information on the Resolution of the Session of the JINR Committee of Plenipotentiaries

22–23 March 2024, Dubna

Chair of the Committee of Plenipotentiaries — Plenipotentiary of Georgia A. Khvedelidze

Session of the JINR Committee of Plenipotentiaries

22–23 March 2024

AGENDA

1. Director’s Report: News, Science, Prospects

Speaker — G. Trubnikov

2. Execution of the JINR budget for 2023 and draft of the revised budget of JINR for 2024

Speaker — N. Kalinin

3. Results of the meeting of the JINR Finance Committee held on 21 March 2024

Speaker — A. Omelchuk

4. Proposals for amending the Rules of Procedure of the JINR Finance Committee and the Rules of Procedure of the JINR Committee of Plenipotentiaries

Speaker — A. Kharevich

5. On the status of preparation and approval of the List of JINR officials

Speaker — A. Kharevich

6. On the decision of the Republic of Moldova to withdraw from JINR

Speaker — A. Khvedelidze

7. Amendments to the Regulation for the election of Directors and for the endorsement of appointment of Deputy Directors of JINR Laboratories

Speaker — S. Nedelko

Having heard and discussed the report presented by G. Trubnikov, JINR Director, the Committee of Plenipotentiaries took note of the information from the JINR Directorate about the recommendations of the 135th session of the JINR Scientific Council, the implementation of the current Seven-year plan for the development of JINR, the efforts of the Member States towards realization of JINR's large projects, the new scientific and technological results obtained, and about the most important events related to JINR's scientific research and educational activities and international cooperation.

The Committee of Plenipotentiaries noted the high efficiency of the Institute's activities in intensifying and expanding scientific cooperation with partner organizations of JINR Member States and Associate Members, increasing the level of interaction with the People's Republic of China, the United Mexican States, the Federative Republic of Brazil, and the Republic of India.

The CP appreciated with satisfaction the progress in implementing the current plan for research and development of the scientific infrastructure of JINR, the successful participation of the Institute in international collaborations, and achievements in strengthening international cooperation.

The CP supported the efforts of the JINR Directorate to renew and develop the social infrastructure of JINR and to create an international innovation park of science and technology in Dubna, including, in particular, the construction of a modern university campus and comprehensive development of the surrounding areas. The CP supported the initiative of the JINR Directorate to establish a new scientific journal published by JINR.

The Committee of Plenipotentiaries expressed gratitude to the IAEA and the JINR Directorate for supporting the initiative to hold a two-week internship at JINR within the framework of the IAEA Lise Meitner Programme in agreement with the IAEA.

The CP supported the efforts of the JINR Directorate in the development of international scientific and technical cooperation and the creation of an integrated scientific and technological space in the field of neutron research at the unique neutron sources, including research infrastructure of the “megascience” class.

The CP endorsed the accession of JINR to the Consortium for the project to develop an International Research Centre based on the MBIR and to the International Association “Interdisciplinary Center for Neutron Research PIK”.

The Committee of Plenipotentiaries endorsed JINR’s intensified participation in the International Decade of Basic Sciences for Sustainable Development (IDBSSD) under the auspices of UNESCO through JINR’s accession to the Earth Charter.

The CP approved the new editions of the Rules of procedure of the JINR Finance Committee and the new edition of the Regulation for the election of Directors and for the endorsement of appointment of Deputy Directors of JINR Laboratories.

The CP approved the revised budget of JINR for 2024 with the income amounting to M$ 214,125 and the expenditure amounting to M$ 286,818, taking into account the positive opening balance amounting to M$ 56,749, as well as the new forms of reports on the execution of the JINR budget.

The CP took note of the notification of the Republic of Moldova on its withdrawal from JINR and instructed the CP Chair to notify the Republic of Moldova about maintaining its full membership in JINR during 2024 and the entry into force of its withdrawal from JINR from 1 January 2025.

President of the Russian Federation Vladimir Putin launched technological run of NICA Collider

On 13 June, during his visit to JINR, **President of the Russian Federation V. Putin** visited the NICA complex, accompanied by **JINR DG, academician G. Trubnikov**, and got acquainted with the technological features of the assembly of NICA. After visiting MPD experimental facility, Vladimir Putin gave start to supply a test current to the magnetic system of the collider and MPD solenoid, initiating the technological launch of the NICA complex. Russia is co-founder (with JINR) of the NICA complex.

This crucial stage in the implementation of the NICA megascience project marks the beginning of preparations for the commissioning and start of the experimental program. Now testing is underway of all power supplies of the collider's superconducting magnets and the superconducting magnet of the first experimental facility - MPD (Multi-Purpose Detector).

At the MPD Experimental Hall, **Vladimir Putin** held a meeting with leading Russian and foreign scientists and winners of mega-grants for scientific research.

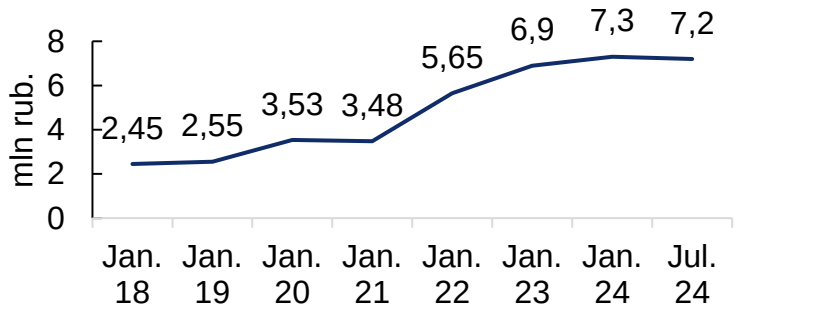
Council for Science and Education Chaired by President of Russia Took Place in Dubna

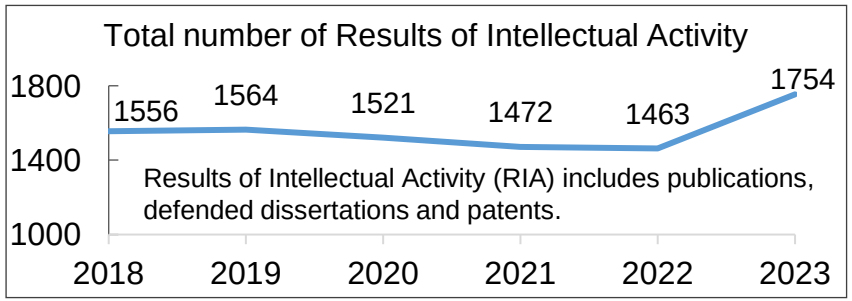
On 13 June, **President of the Russian Federation V. Putin** held a meeting of the RF State Council for Science and Education at JINR. The main issue on the agenda was the formation and implementation of national projects supporting technological sovereignty.

JINR Director, Academician G. Trubnikov expressed support for the list of crucial technologies prepared by the Government and the Russian Academy of Sciences on behalf of the President of Russia, speaking about the tools in demand to ensure Russia's national technological leadership. Also he announced well prepared JINR initiative to create the new University Campus and Innovation park in Dubna, which attracted serious interest.

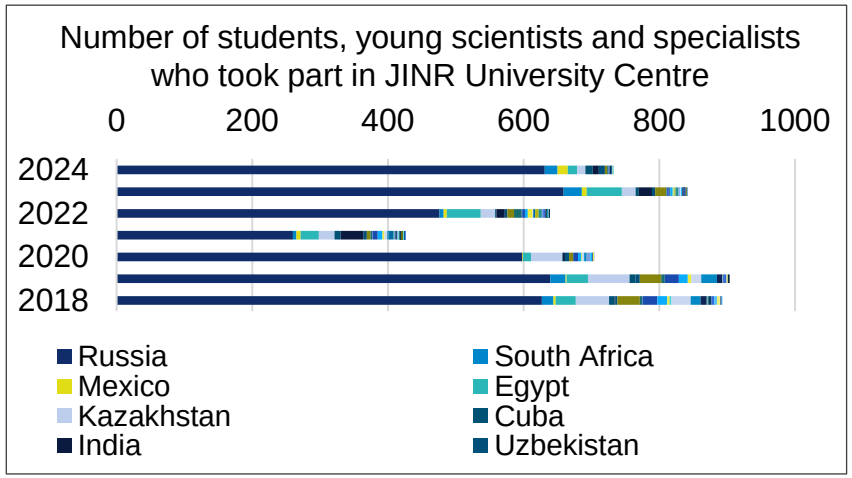
The President of the Russian Federation concluded the event by announcing that a decree will be signed in the near future to approve priority areas for scientific development in Russia.

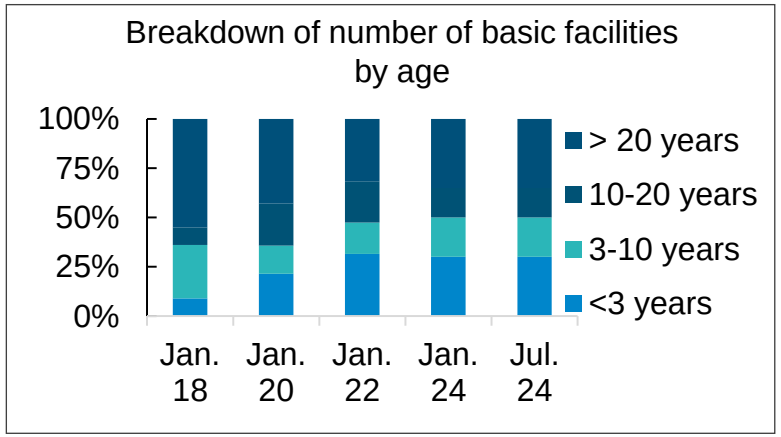
Monitoring Performance Indicators

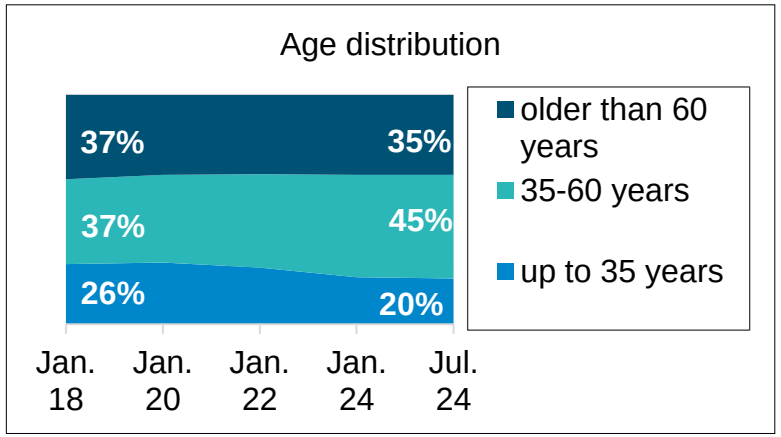


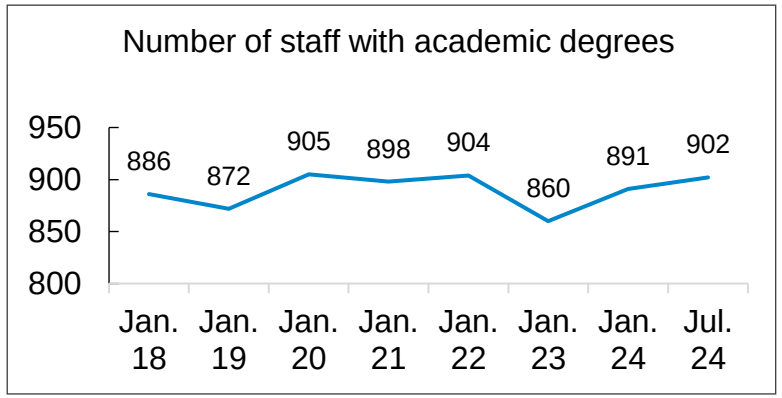


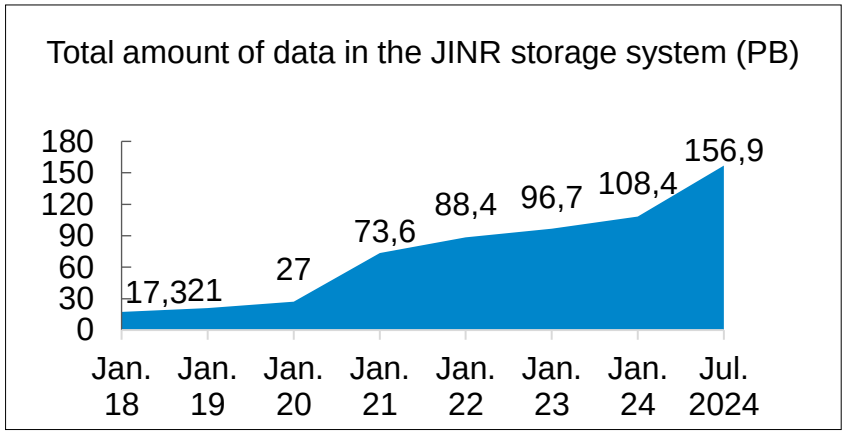
	2021	2022	2023	2024 Aug.
Number of publications by Scopus	1438	1347	1407	891

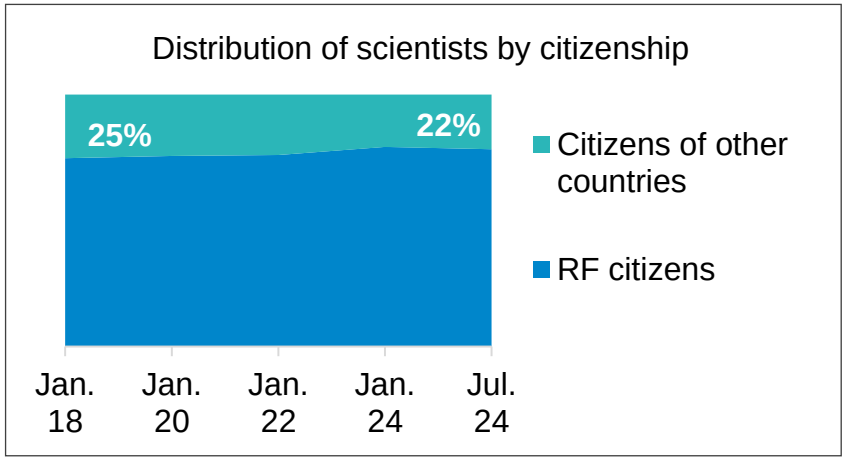


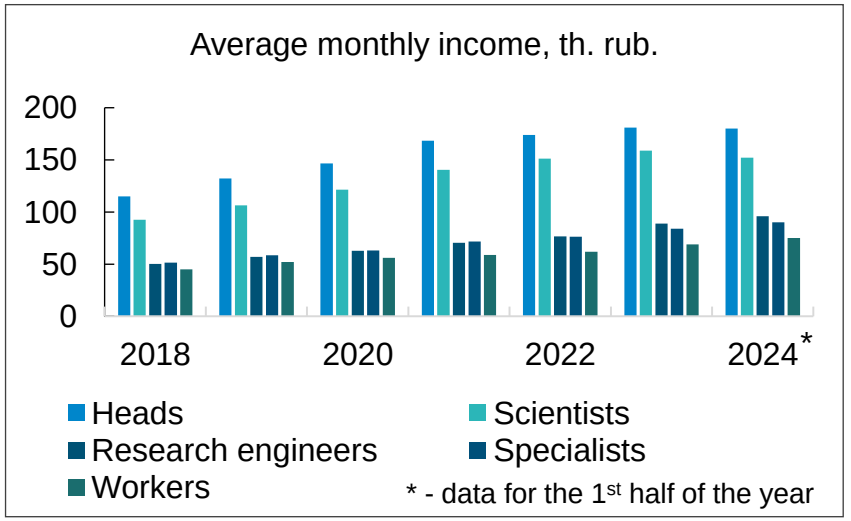












Meetings of the JINR Programme Advisory Committees

13−14 June, Dubna.
59th meeting of the PAC for Nuclear Physics
The PAC reviewed reports on the status of accelerators, including the U-400M cyclotron, which is currently undergoing modernization. The PAC heard the report about synthesis and study of the decay properties of isotopes of superheavy elements Ds and Lv. In addition, the commission heard reports on experiments conducted at the ACCULINNA-2 separator, including the detection of low-energy spectra of unbound nuclei, and proposed new projects such as the development of a nuclear bolometer for detecting neutrino interactions.

17 June, Dubna.
60th meeting of the PAC for Particle Physics
The PAC welcomed the plans to ensure full-fledged cooperation with CERN, as well as the efforts undertaken to establish new scientific connections with Mexico, Brazil, and China. The Committee approved the implementation of the Nuclotron-NICA project. The PAC considered reports on the MPD, BM@N, SPD projects at NICA, the COMET project at J-PARC.

24−25 June, Dubna.
59th meeting of the PAC for Condensed Matter Physics
The PAC endorsed the main directions of activities including work to outline the suite of necessary instruments of the IBR-2 facility. The PAC received information on the progress of obtaining a license to operate the IBR-2 reactor and on preparatory work to replace air-cooled heat exchangers in the secondary cooling circuit of the reactor. The PAC highly appreciated and supported the plans and efforts of the FLNP to resume operation of the facility in 2024-2025 and the resumption of the user programme in 2025.

Effective Potential in the Leading Logarithm Approximation and its Applications in Inflationary Cosmology

Kazakov, Iakhibbaev, Tolkachev // JHEP04(2023)128, JCAP09(2023)049.

Earlier the Coleman-Weinberg mechanism of symmetry breaking was considered only for non-scalar models while for the scalar theories the Higgs mechanism was used.

In the present work the Coleman-Weinberg result was generalized and the generalized RG equation was derived:

$$\frac{\partial \Sigma}{\partial z} = -\frac{1}{4}\left(\frac{\partial \Sigma}{\partial \phi^2}\right)^2, \quad \Sigma(0,\phi) = V_0(\phi)$$

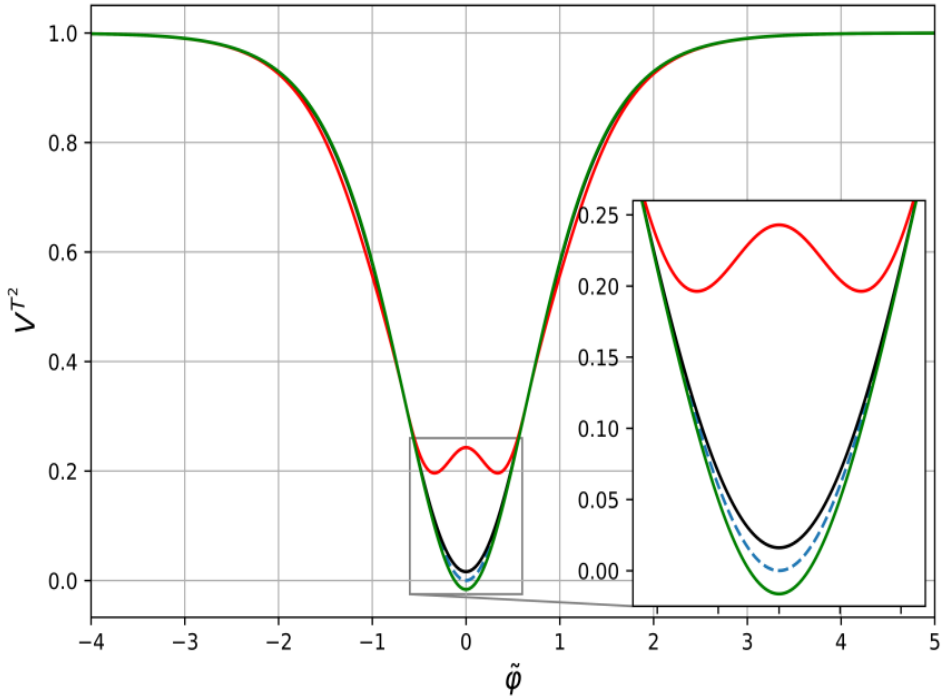
initial conditions

It was shown that for potentials from the theory of cosmological inflation of type $(\tanh(\varphi))^n$ the effect of breaking of the initial symmetry due to quantum corrections is observed.

Thus, for the first time it has been found that the Coleman-Weinberg mechanism works in the scalar theory.

Additionally, a change of the initial vacuum state (potential uplift on the figure) was found, which in cosmology corresponds to the cosmological constant Λ.

Thus, the presence of the cosmological constant can be explained by quantum corrections to the studied classical inflationary potential, which itself has no such feature.



Excitation-Energy Dependence of Fission-Fragment Neutron Multiplicity in the Improved Scission-Point Model

Pasca, Andreev, Adamian, Antonenko //
Phys. Rev. C 109, 044601 (2024).

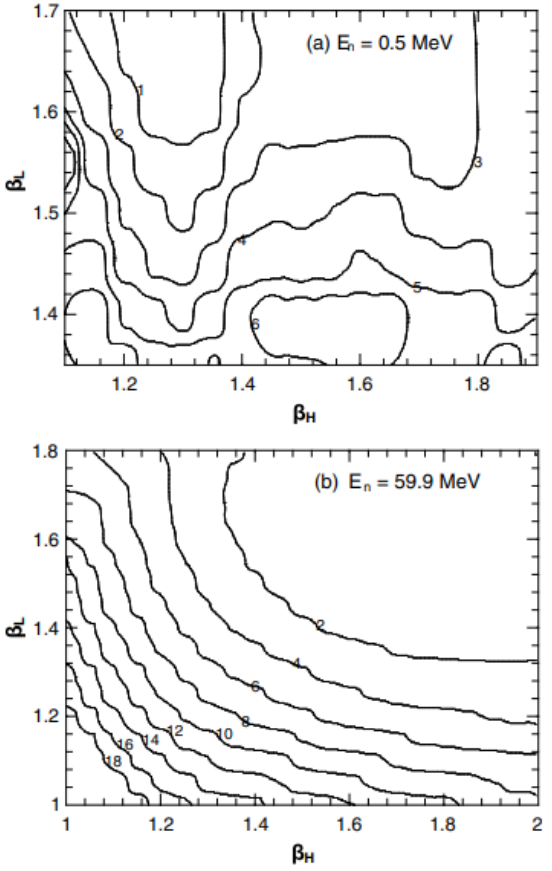
With the improved scission-point model the neutron multiplicity distribution from fission fragments in the reactions ^{238}U(n,f) and ^{235}U(n,f) is calculated as a function of the incident neutron energy.

The power of the developed model is in simultaneous description of the most of fission observables, namely, neutron multiplicity distribution, mass/charge distributions as well as the kinetic energy distribution of fission fragments.

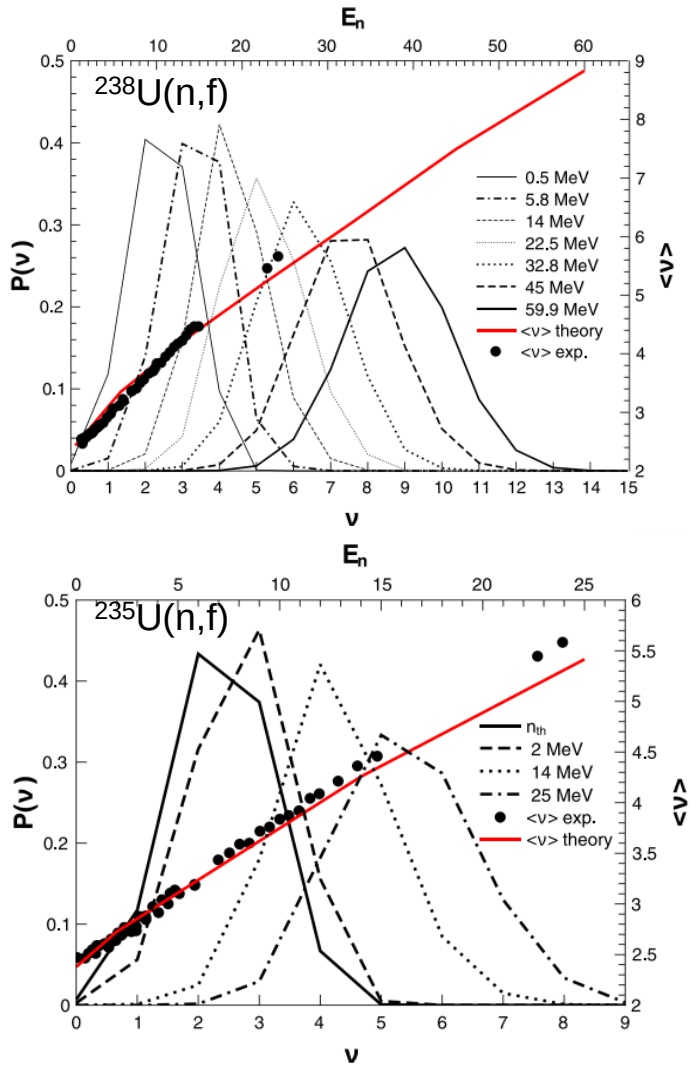
The influence of the “washing out” of shell structure in the fission fragments with increasing excitation energy is demonstrated.

The proposed approach gives a good description of fission observables in a wide range of excitation energies and can be applied for predictions in unmeasured energy region.

Potential energy surface of the system ^{99}Sr+^{140}Te as function of fragment deformations at different excitation energies



Neutron multiplicity distributions



Nucleus-2024: Fundamental problems and applications

On 1 July, the conference hall of BLTP at JINR hosted the opening of the 74th International Conference on Nuclear Physics, **“Nucleus-2024: Fundamental problems and applications”**. This is the largest annual conference in Russia covering all energy ranges and aspects of modern nuclear physics.

375 scientists, students, and postgraduates from leading nuclear research centres and universities of Azerbaijan, Bulgaria, China, Egypt, India, Kazakhstan, Russia, Slovakia, South Africa, Uzbekistan, and Vietnam gathered in Dubna to discuss the status and development tendencies of nuclear physics.

International Workshop Supersymmetries and Symmetries – SQS’24

On 29 July, the **Supersymmetries and Quantum Symmetries International Workshop (SQS’24)** started at the BLTP at JINR. This year, the event brought together **more than 80 specialists** in theoretical and mathematical physics participating both online and in person.

The Supersymmetries and Quantum Symmetries International Workshop **was established by Professor Victor I. Ogievetsky** (1928–1996). The Laboratory of Theoretical Physics at JINR has been holding the event since 1989. Since 1993, the meetings have become international.

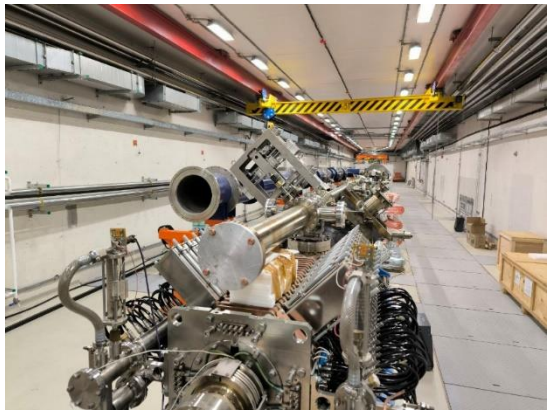
NICA Nuclotron-based Ion Collider fAcility

NICA: Technological Run is Progressing at the Collider Ring

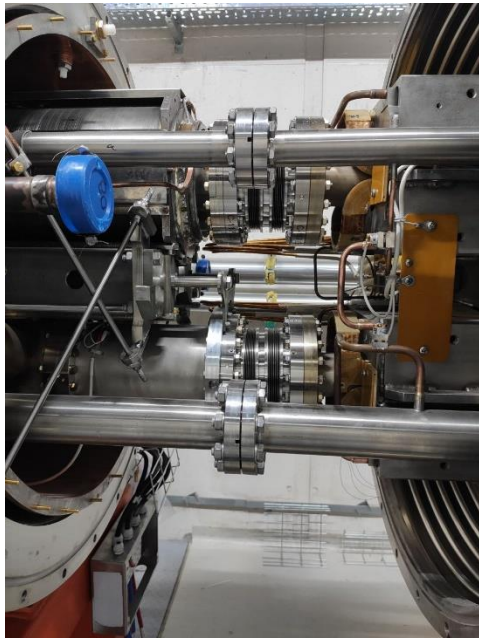
Magnet type	Need	Ready
2×ap Dipole units	80+1	84
2×ap Quadrupole units	46	46
4×ap Quadrupole units	12	12
BI vertical 1×ap dipole units	4	4
BI vertical 2×ap dipole units	4	4
Final focusing quadrupoles	12	12

Installation of the collider's magnetic cryostat system continues, including: RF stations, final focusing lenses, and the merging of the high-vacuum volume sections in the W and E arcs.

Final focusing quadrupole



RF1 and RF2 at the NICA ring. Preparations for their testing at the end of the year are ongoing.



NICA Nuclotron-based Ion Collider fAcility

NICA: Infrastructure Preparations are Ongoing

Power supplies are mounted at the collider. Completion – Dec'24

Ongoing:

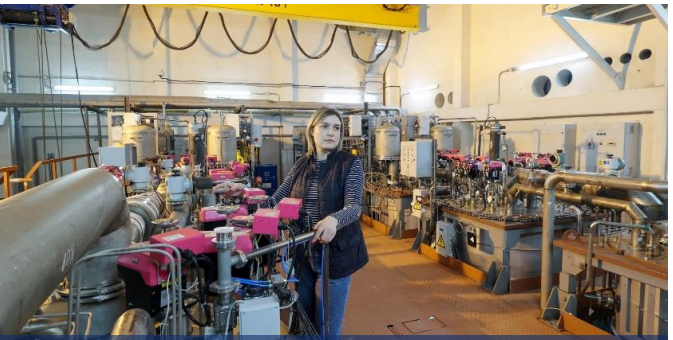
East part of the collider ring:

- The vacuum equipment of the isolation volume is being installed for QM;
- Ready to start the joining the beam chambers;
- Completion of the installation of the injection system – February 2025, the start of cryo-magnetic tests – March 2025.

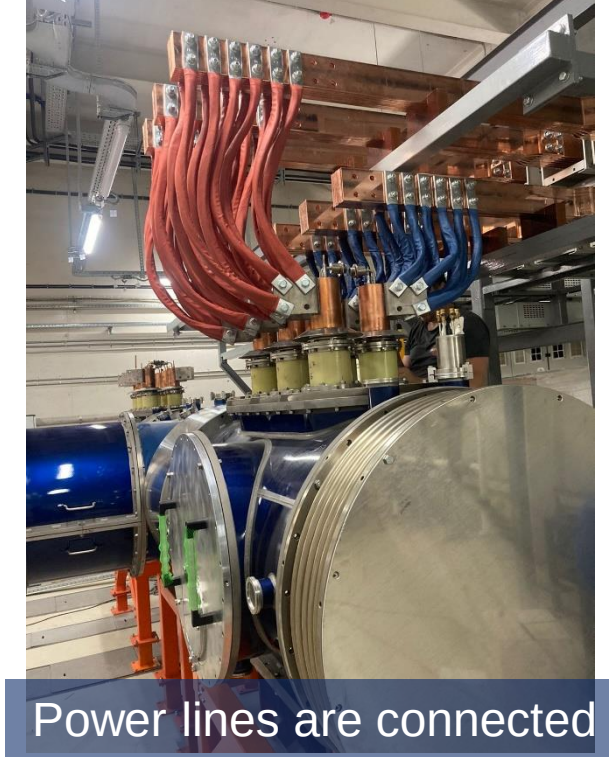
West part of the collider ring:

- Completion of installation of the magnetic cryostat system of the W-arc – December 2024; the start of cryo-magnetic tests – January 2025.

So that to detect the first Xe-beam collisions in the MPD in August 2025

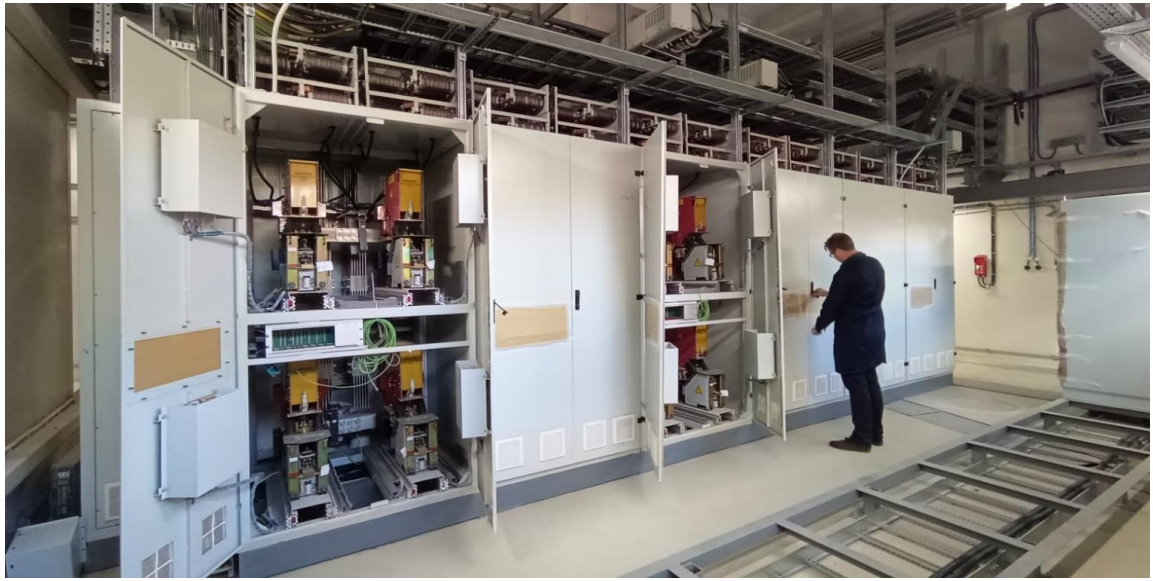


Cryogenic equipment in the collider building



Power lines are connected

A new compressor (1 of 4)



Energy evacuation system (including switches)

NICA: Multi-Purpose Detector

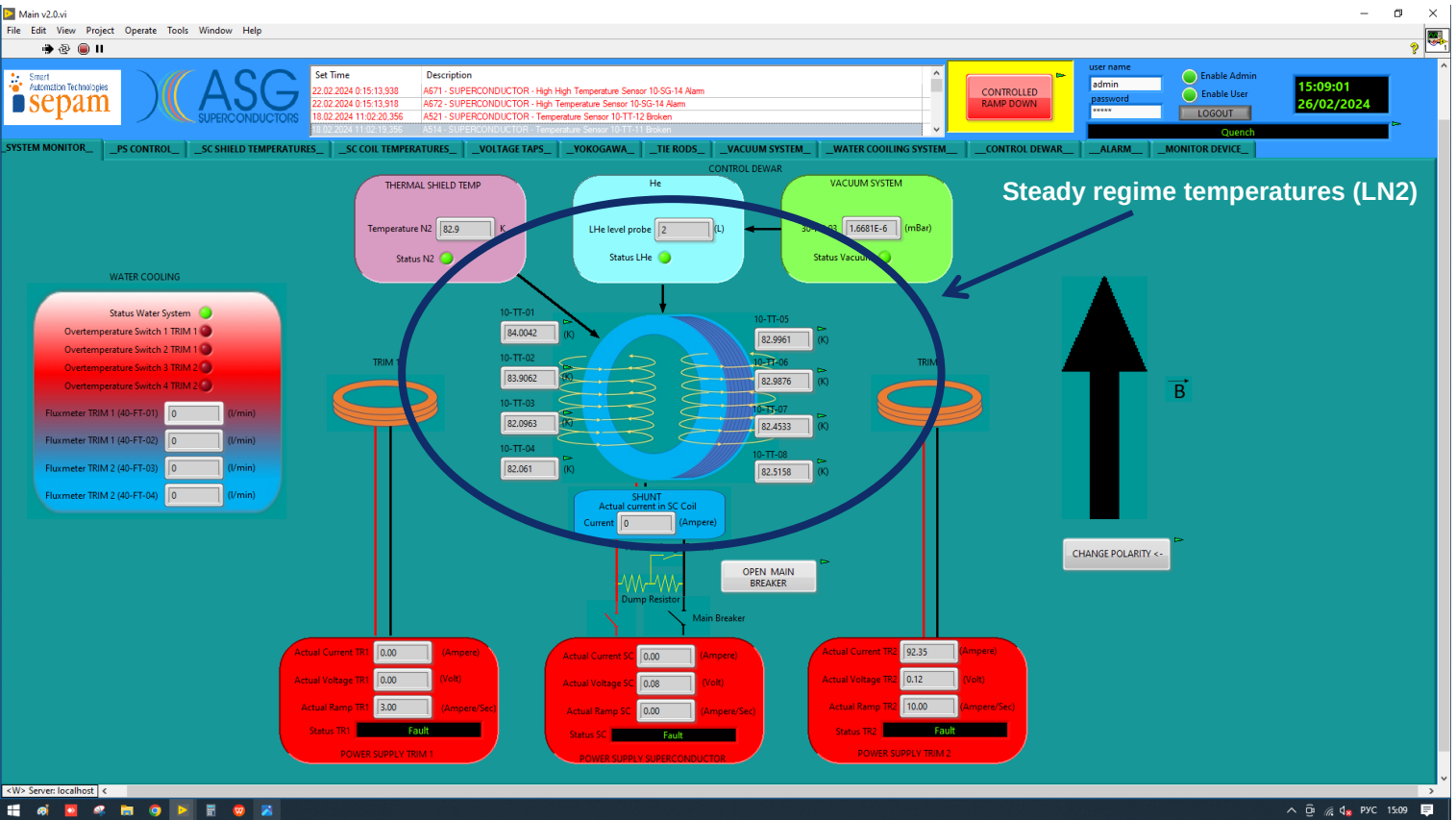
Nuclotron-based Ion Collider fAcility

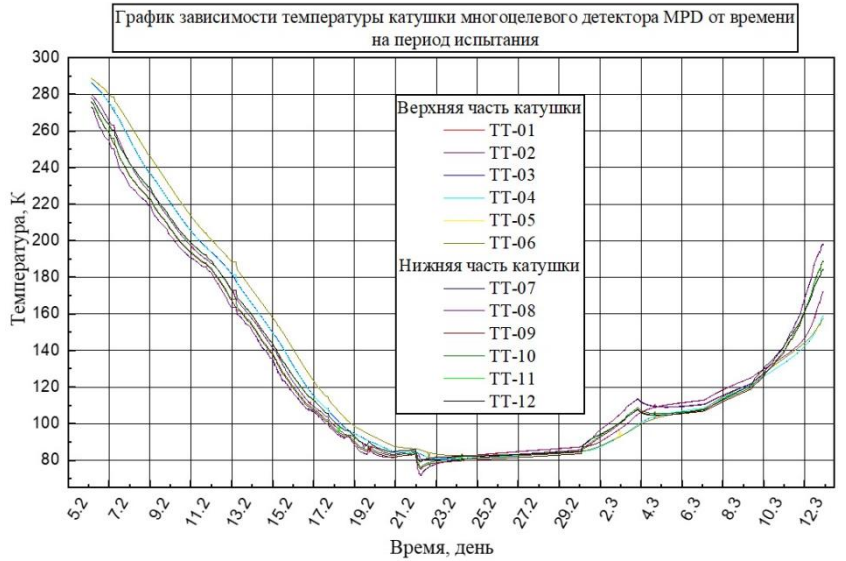
MPD Collaboration today:
***12** Countries,*
***> 500** participants,*
38** Institutes and **JINR

In February – March 2024 the Solenoid was cooled down to the temperature of ***72 K (below LN temperature)***

Cooling was carried out according to working scheme, with nitrogen circulating in the screens and helium gas in the Solenoid coil tubes.

During the cooling process, two main operating modes were worked out – down to liquid nitrogen temperatures and the transition to two-phase helium cooling.





The main achievements

- The cryogenic cooling system is functioning according requirements.
- The cooling rate was within the design parameters (0.6 K/h, design 1-3 K/h).
- No leaks at 80 K was found.
- The cooling cycle to reach 80 K took 15 days.
- Successful result of the test to hold the stable temperature of the solenoid only with nitrogen screens was achieved.
- The transition from the cooling mode with liquid nitrogen to two-phase helium without pressure jumps was demonstrated.
- Test on movement of the magnet without stopping cooling process from the “Service” position to the “beam” position (12m) was carried out successfully.

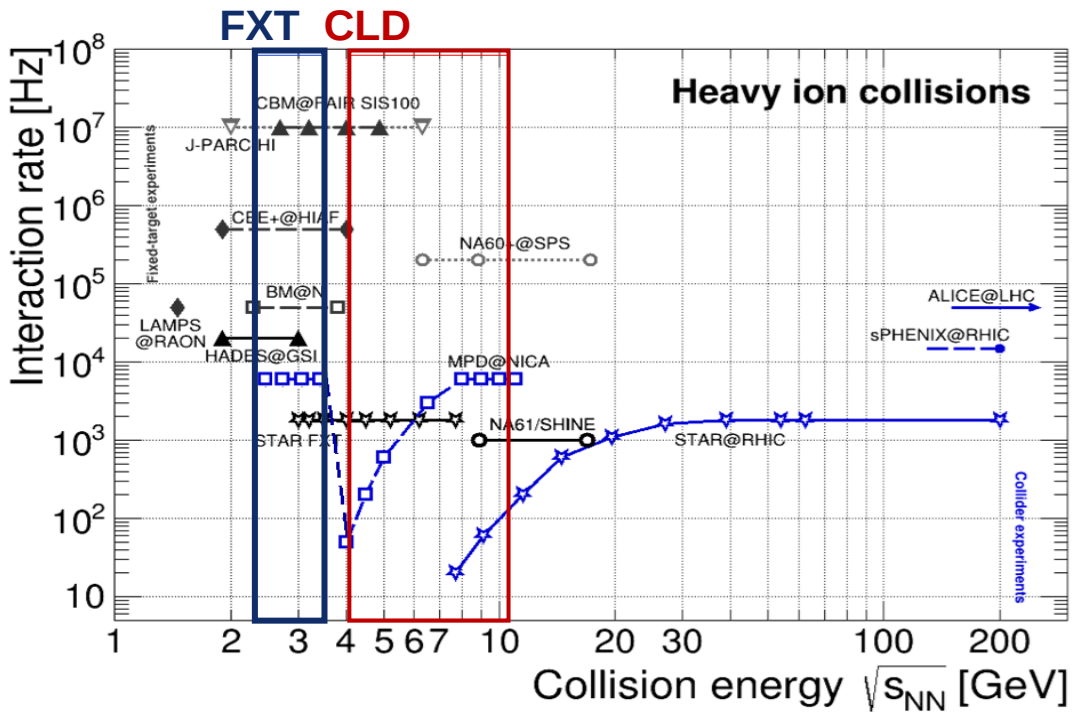
NICA: MPD Schedule

2024:

- February-March – cooling of Solenoid to LN2 temperatures;
- Autumn – cooling to LHe temperatures, magnetic field measurements, assembly and tests of detector subsystems.

2025:

- Installation of the carbon fiber support frame and detector subsystems (ECAL, TPC, TOF, FHCAL, FFD);
- Commissioning of the detector on the beam by July.



Work continues on developing computer/software infrastructure and analysis methods to analyze the first collected data sets:

- Centralized large-scale Monte Carlo productions;
- Data analysis Framework (Analysis Train);
- Physics feasibility studies in the collider and fixed-target configurations for a wide variety of observables.

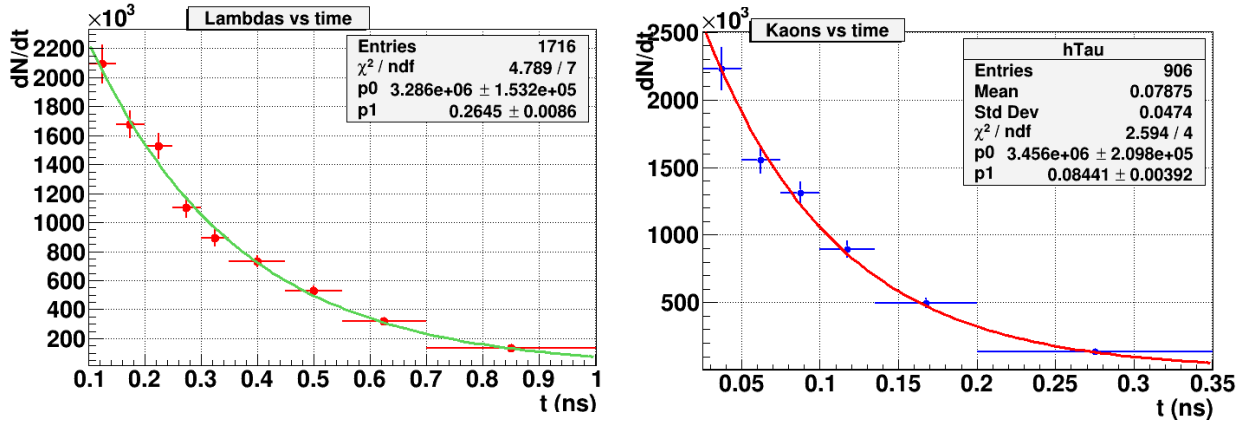
MPD in the collider and fixed-target modes from startup:

- Collider mode – two beams (Xe), $\sqrt{s_{NN}}$ = 4-11 GeV/n;
- Fixed-target mode – one beam (Xe) + thin wire (W, ~ 100 μm) at -85 cm:
  - extend energy range to $\sqrt{s_{NN}}$ = 2.4-3.5 GeV (overlap with HADES, BM@N, CBM);
  - higher event rate at lower energies (limited by MPD DAQ bandwidth).

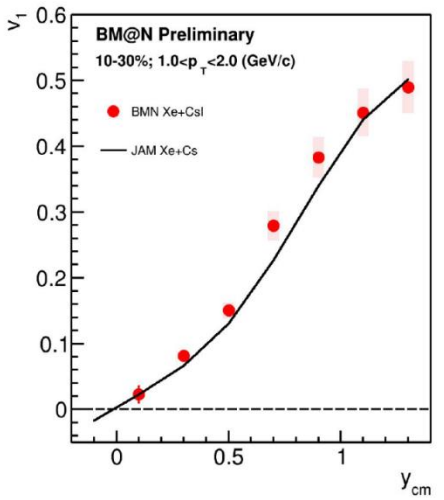
NICA: BM@N Experiment

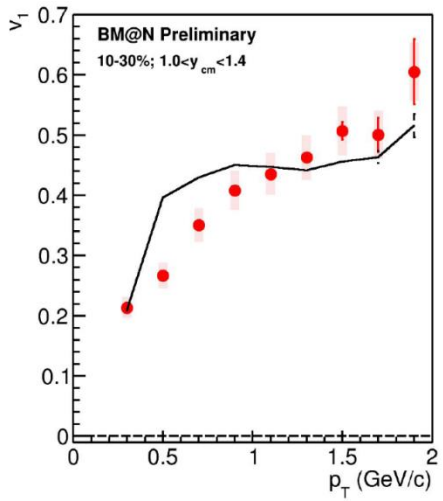
Results from the Xe+CsI run for Λ and K^0_s production and collective flow of protons were presented at the NUCLEUS-2024 conference

Detector paper has been published: NIMA 1065, 169532, August 2024

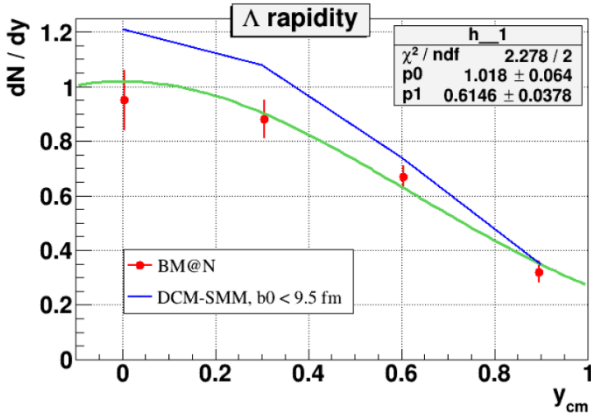


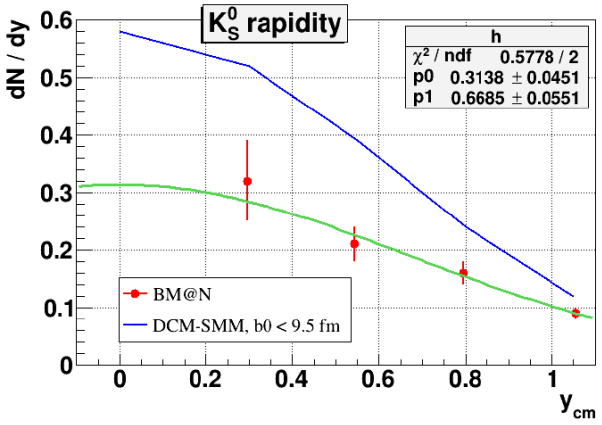
Measured lifetime is in agreement with PDG: 0.2632 ns for Λ, 0.0895 ns for K^0_s



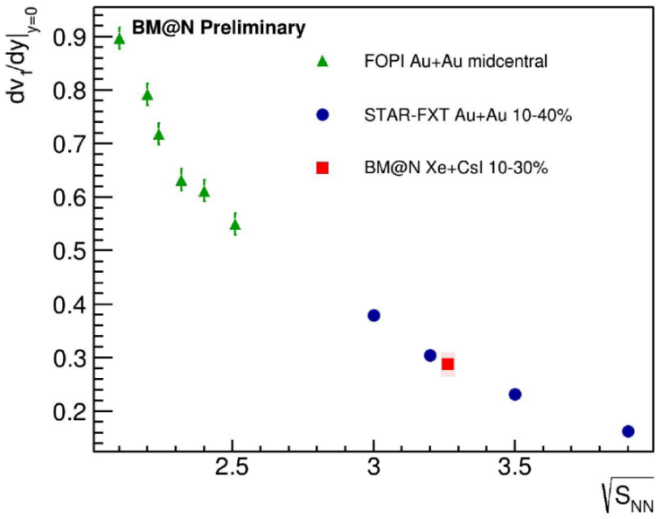


Direct flow of protons compared with the JAM model





Comparison with DCM-SMM model



BM@@N results for direct flow are in-line with the energy dependence of the world data

NICA Nuclotron-based Ion Collider fAcility

NICA: Spin Physics Detector

SPD Collaboration is growing:

New MoU signed with:

- InSTEC (Havana Univ., Cuba);
- BINP (Novosibirsk, Russia).

Contacts with new groups.

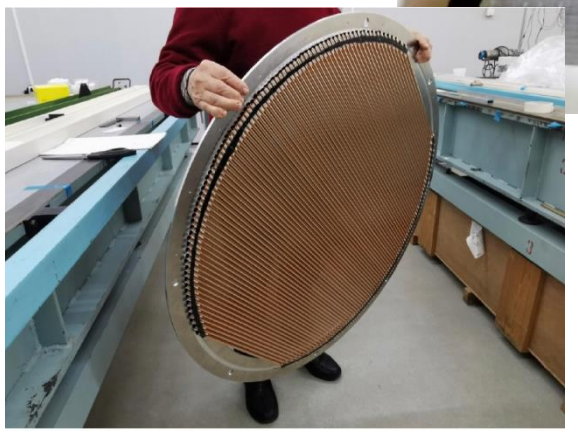
MoU under discussion and signing:

- iThemba LABS (South Africa);
- Cairo University (Egypt);
- HSE University (Moscow, Russia).

VII SPD Collaboration meeting in Almaty (KBTU, INP), May 2024

Progress of the project implementation:

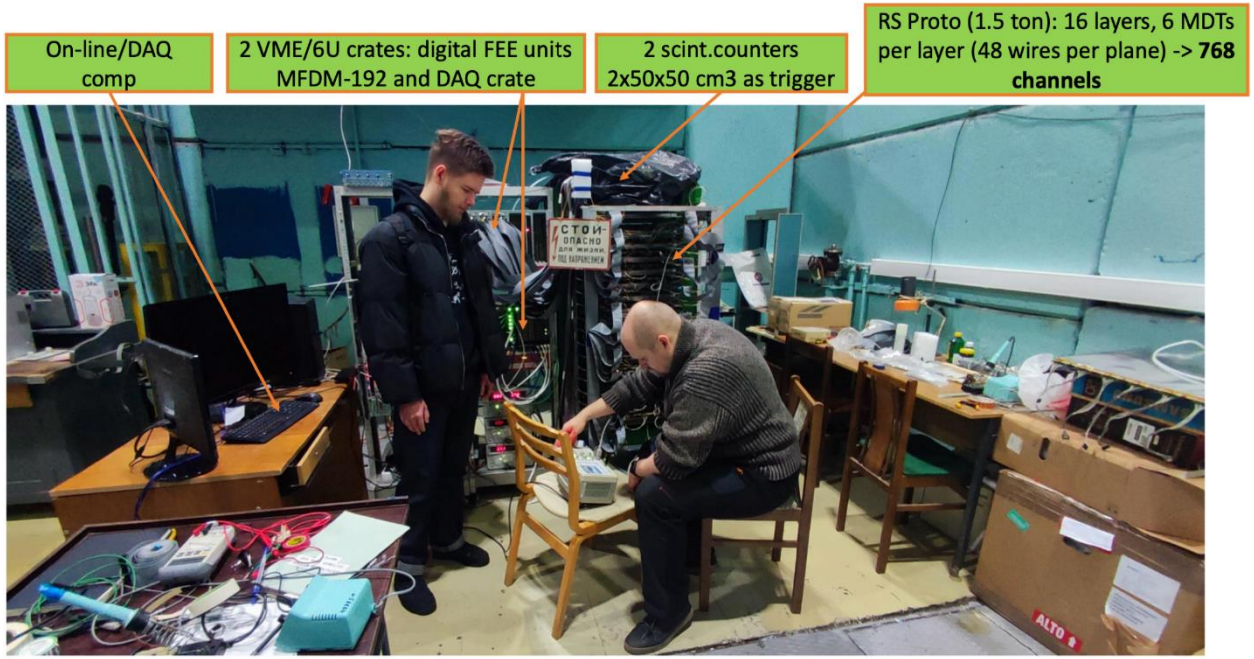
- Updated version of the SPD TDR has gone successfully through the review of the international DAC;
- Contacts with manufacturers of the main elements of the first-phase setup;
- Continuation of R&D on the phase-two setup;
- Works on creation of an assembly areas for Straw at JINR and INP (Almaty);
- Agreement to set up a laboratory to test aerogel detectors in AANL.



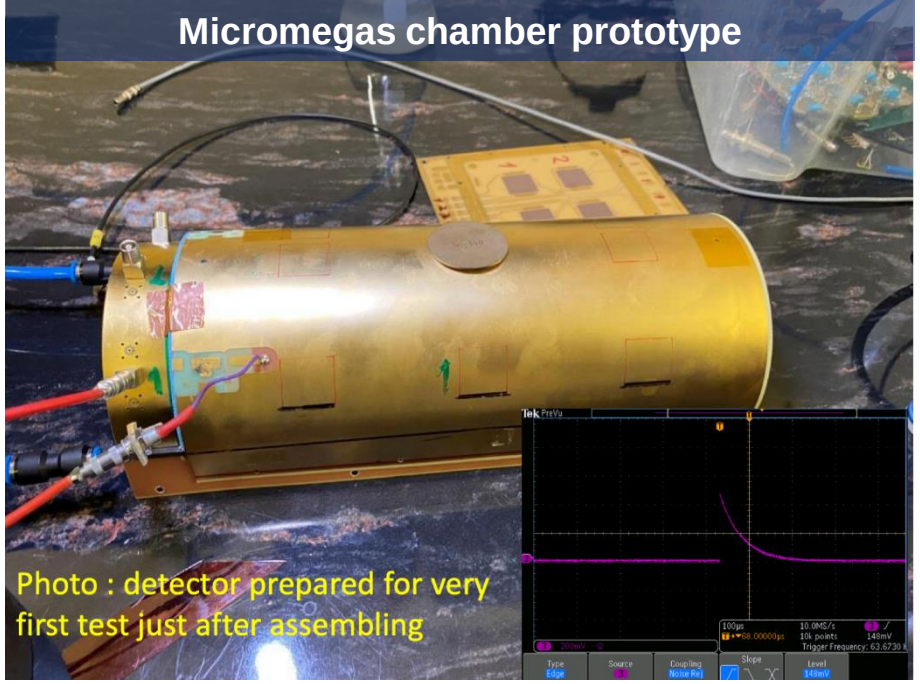
Prototypes of the calorimeter cells and SPD straw tracker endcap

Spin Physics Detector

- Preliminary version of the technical specification for the SPD superconducting magnet yoke (simultaneously part of the Range System);
- Full commissioning of the RS prototype (MDT detectors, analog and digital front-end electronics, DAQ) at Nuclotron test beam area, and initial data collection with cosmic muons;
- A prototype of the cylindrical Micromegas chamber for the Phase I has been built and is being tested;
- A test stand has been set up for DAQ and online-filer prototypes testing.



RS prototype at the SPD test beam area



NICA: Progress of the ARIADNA Project

ARIADNA – Applied Research Infrastructure for Advanced Developments at NICA fAcility

ARIADNA Collaboration Meetings

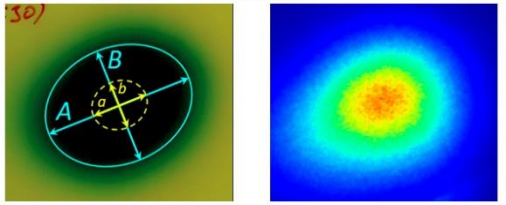
31 May 2024 **4–6 September 2024**

Meetings were held in a hybrid form; each of them was attended more than 100 scientists from research centers of JINR Member States.

Meetings were focused on the **ARIADNA research programme,** which was presented by representatives of leading participating organizations, as well as on **implementation of grants** received as a governmental support for doing research at NICA.

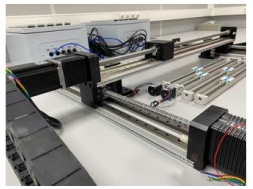
Development of the target station providing unique option of long-term radiation exposure to high-energy ion beams

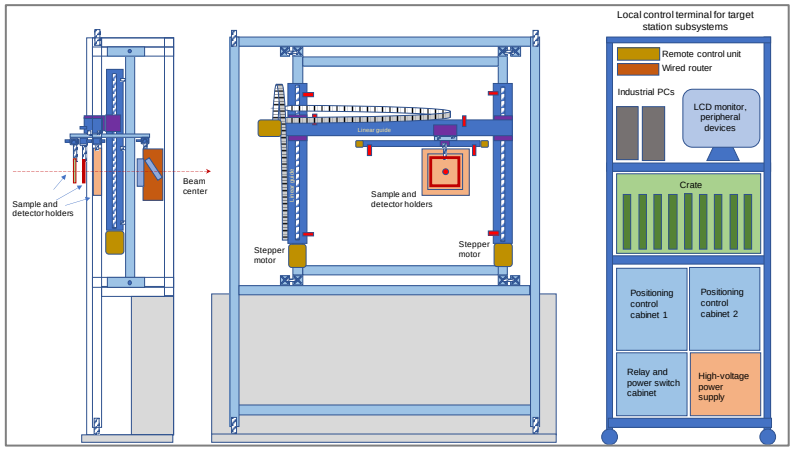
The target station is intended for use at the outgoing beam after the BM@N facility



$^{124}Xe^{54+}$
3.8 GeV/n

The prototype of the target station was tested during the NICA Run





Method for manufacturing of a light reflector
First join patent within the ARIADNA collaboration activity (JINR, FRC CP RAS, FRC PCP MC RAS and MEPhI)

IBMP Special-Purpose Laboratory for Space Research @ NICA: Ground-Based and Flight Experiments

Being a member of ARIADNA Collaboration, The Institute of Biomedical Problems of RAS develops a special-purpose laboratory for Space Research at JINR, which is based on the previously existing building belonging to IBMP.

A complementary research programme between NICA and IBMP is concentrated of problems radiation research and radiation protection in space. It implies both ground-based experiments at NICA ion beams and participation of members of ARIADNA team in BION-2M* biosatellite experiment scheduled for 2025.

**BION is a series of Soviet (later Russian) satellites designed for biological experiments in space environment.*

Similar experience:
Special-purpose laboratories in the field of applied research are efficient models of interaction between large accelerator facilities with space research organizations. NASA space agency organized a dedicated NSRL facility at Brookhaven National Laboratory (USA) operating in a similar way for many years.

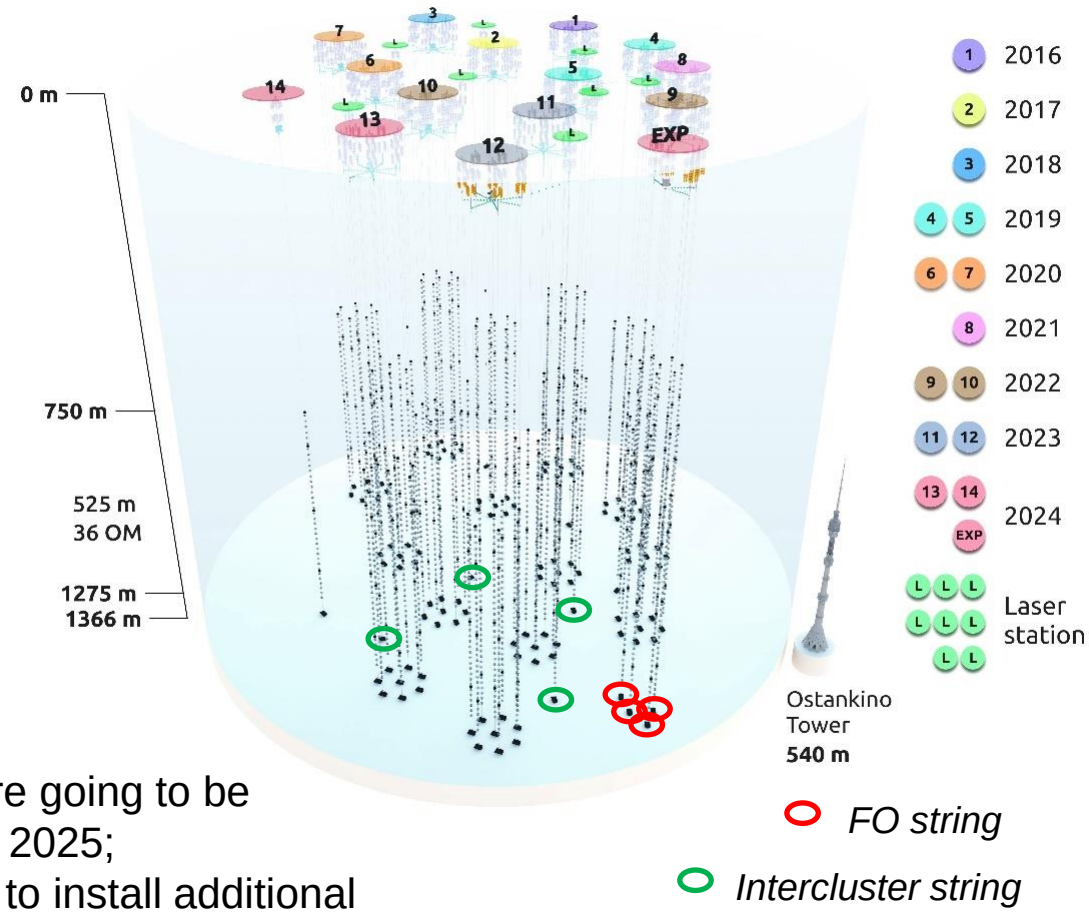
A core facility for the IBMP-NICA space research programme is the Building # 123 located at the DLNP site of JINR. The IBMP funded the complete renovation and equipping this laboratory with analytical instruments. The renovation was started in June 2023 and planned to be completed by January 2025.

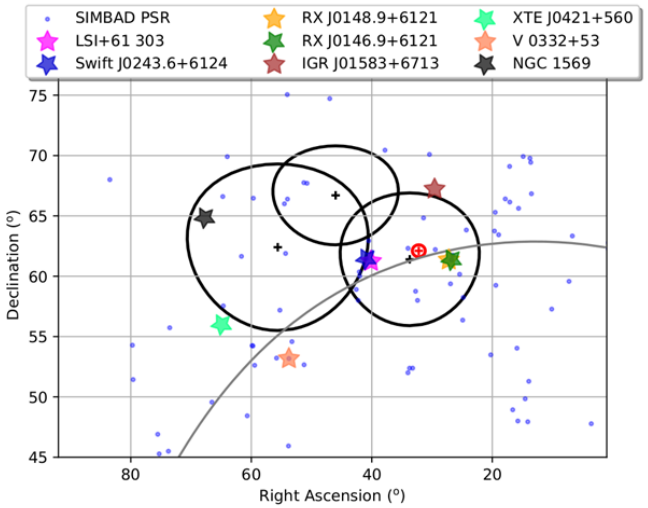
A full-scale demo version of the original BION satellite

Status of the Neutrino Detector Baikal-GVD

Total: 4,104 OM + 8 laser stations

- Currently, the deployment of the Baikal-GVD neutrino telescope is successfully underway. 13 full clusters are installed. The underwater structure of the installation contains just over 4,100 photodetectors;
- The production and technical base of the Baikal project ensures the deployment of **two clusters annually**;
- GVD has **developed shore infrastructure**: control centre, laboratories, workshops, deployment tools, living quarters;
- GVD is **testing ground** for the development the systems for next-generation telescope:
  - 4 strings with fiber-optic DAQ;
  - 4 inter-cluster strings.





Nearest plans:

- About 700 optical modules are going to be assembled for deployment in 2025;
- The collaboration is planning to install additional 2 new clusters, 2 garlands with new DAQ system and additional inter-cluster strings in case a good external conditions (weather and ice).

LINAC-200: New JINR DLNP Basic Facility is Being Prepared for Commissioning

- **Technically the machine is ready to RUN;**
- **This year the radiation safety systems as well as beam dumps are going to be finalized for official facility opening.**

LINAC-200 (up to 400 MeV at 2026 and 800 MeV further)

Electron beams for various tasks

Particle detectors R&D
(NICA, COMET, DLNP, FLNR, Serbia, Egypt, Sarov, Novosibirsk, Tomsk)

Education
(JINR University Centre)

Electron beam diagnostics, R&D and fundamental tasks

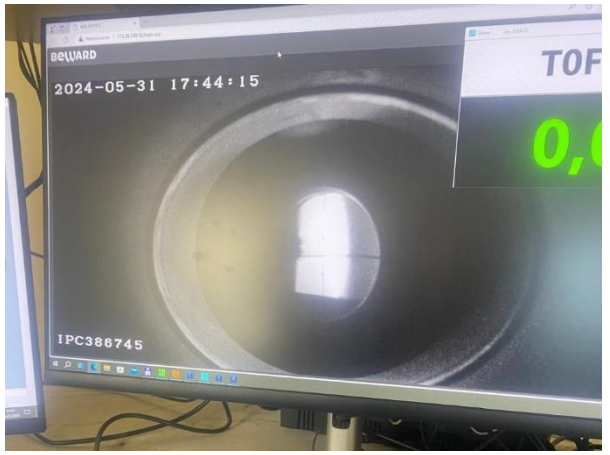
Applied research and Life Sciences
(LRB)

Nuclear physics experiments
(DLNP, FLNR…)

FLNR Accelerator Complex

Modernization of the U-400M has been completed !

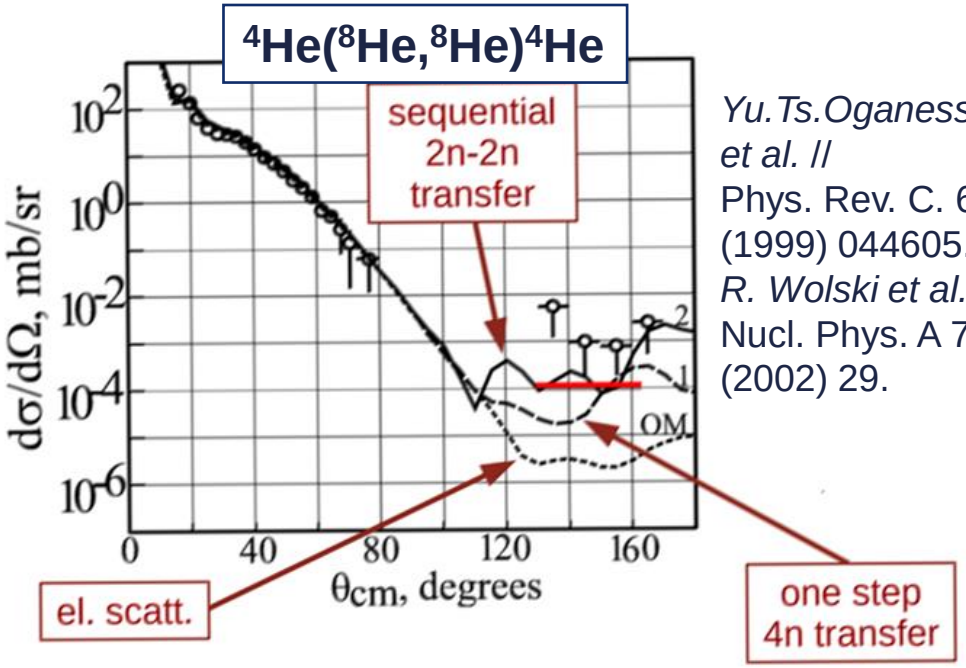
Launch 13.05.2024



First extracted beam (31.05.2024):
$^{40}Ar^{11+}$ (E = 39.2 MeV/n)

Acceleration and transportation of ^{16}O, ^{40}Ar, ^{132}Xe ion beams were carried out.

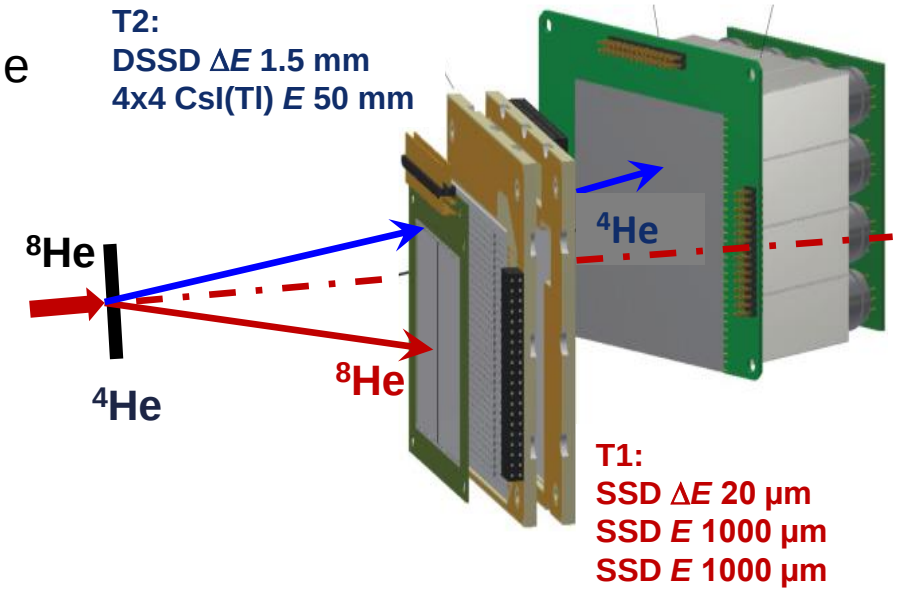
Cyclotron U-400M & ACCULINNA-2 separator



Yu.Ts.Oganessian et al. // Phys. Rev. C. 60 (1999) 044605.
R. Wolski et al. // Nucl. Phys. A 701 (2002) 29.

The first $^{4}He(^{8}He,^{8}He)^{4}He$ experiment at 25÷35 AMeV will be started in the Autumn of 2024.

The purpose is to study di-neutron and tetra-neutron correlations in ^{8}He nucleus



New Experimental Hall for U-400R

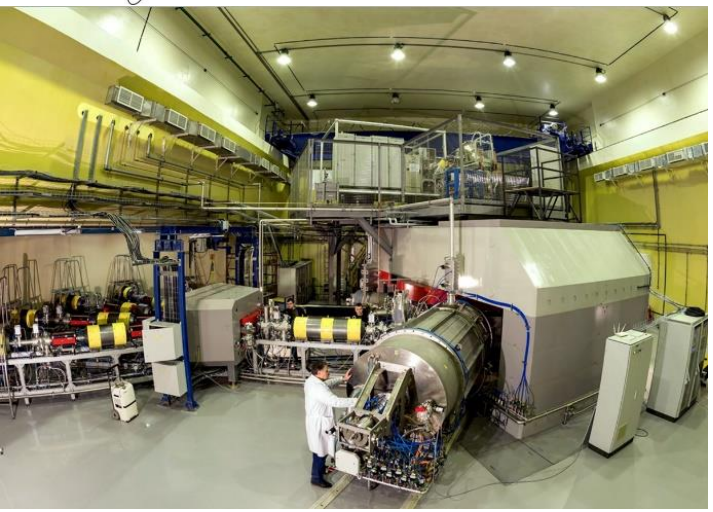
Construction work is in progress:

- Gallery from **U-400 cyclotron hall** to **new experimental hall** has been built.
- Construction the experimental hall continues on schedule.

Start of grillage pouring 21.12.23

New Experimental Hall 21.08.24

Experiments @ Superheavy Element Factory



DC280

(beam time in the first half of 2024: 2900 h)

Experimental programme is executed on schedule:

- High intensity ^{48}Ca beam (6 *pμA*).
- Production of ^{54}Cr beams (2 p*μ*A).
- Production of ^{50}Ti beams (1.5 p*μ*A).

Main experiments:

^{50}Ti + ^{242}Pu → ^{292}Lv*

^{54}Cr + ^{238}U → ^{292}Lv*

^{48}Ca + ^{206}Pb → ^{254}No*

(test of new 480 mm target)

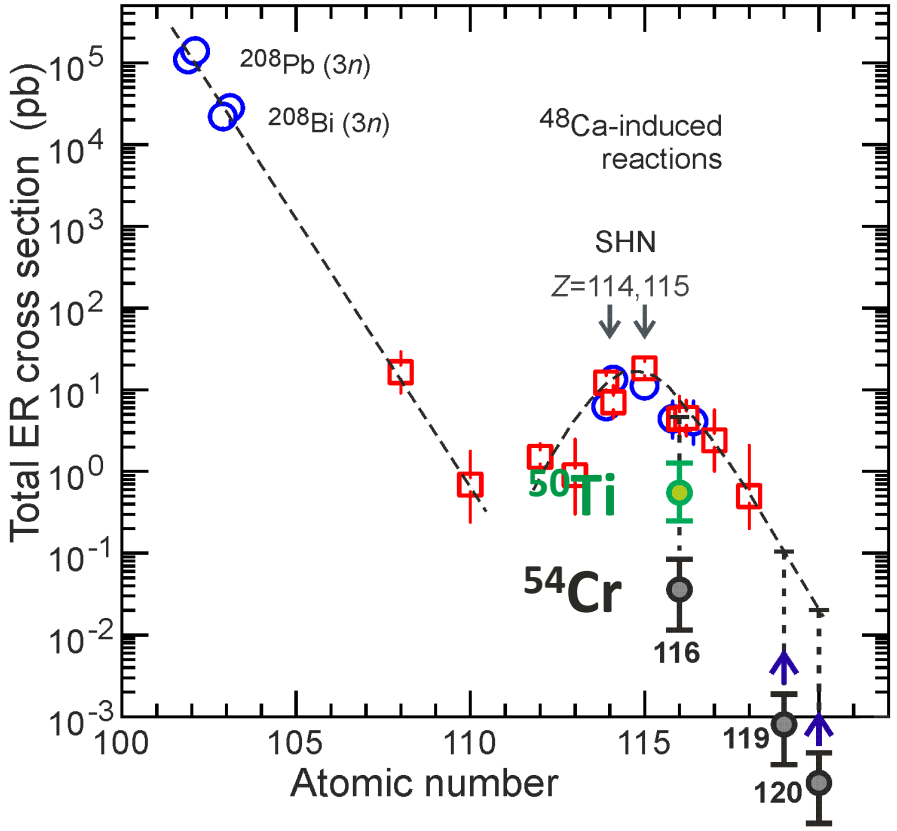
Synthesis of element $_{116}$Lv in different reaction

Purpose:

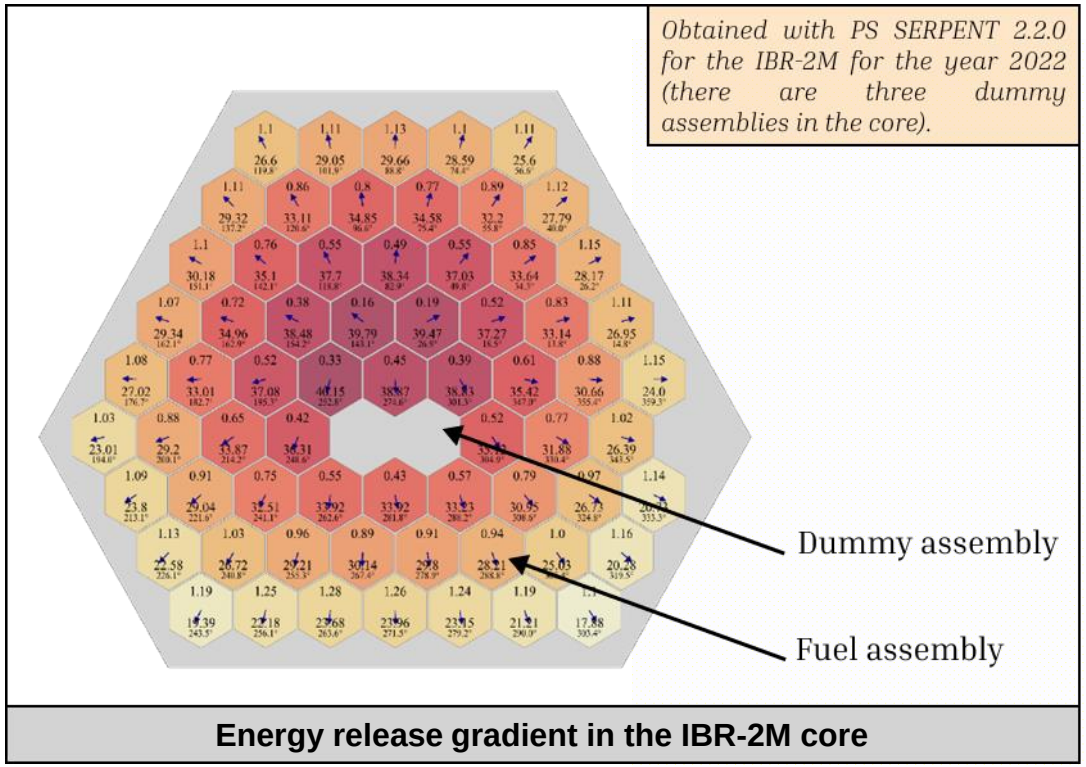
- Measurement of cross sections in comparison with ^{48}Ca+^{248}Cm leading to the same superheavy element 116;

Status:

- Decrease of cross section in transition from ^{48}Ca to
  ^{50}Ti ~10
  ^{54}Cr ~(+)150;
- Synthesis of new isotopes ^{289}Lv and ^{280}Cn in reaction ^{50}Ti + ^{242}Pu;
- The ^{50}Ti + ^{242}Pu experiment will be continued in the fall of 2024.



Investigations of Physical Processes in Pulsed Reactors



Energy release gradient in the IBR-2M core

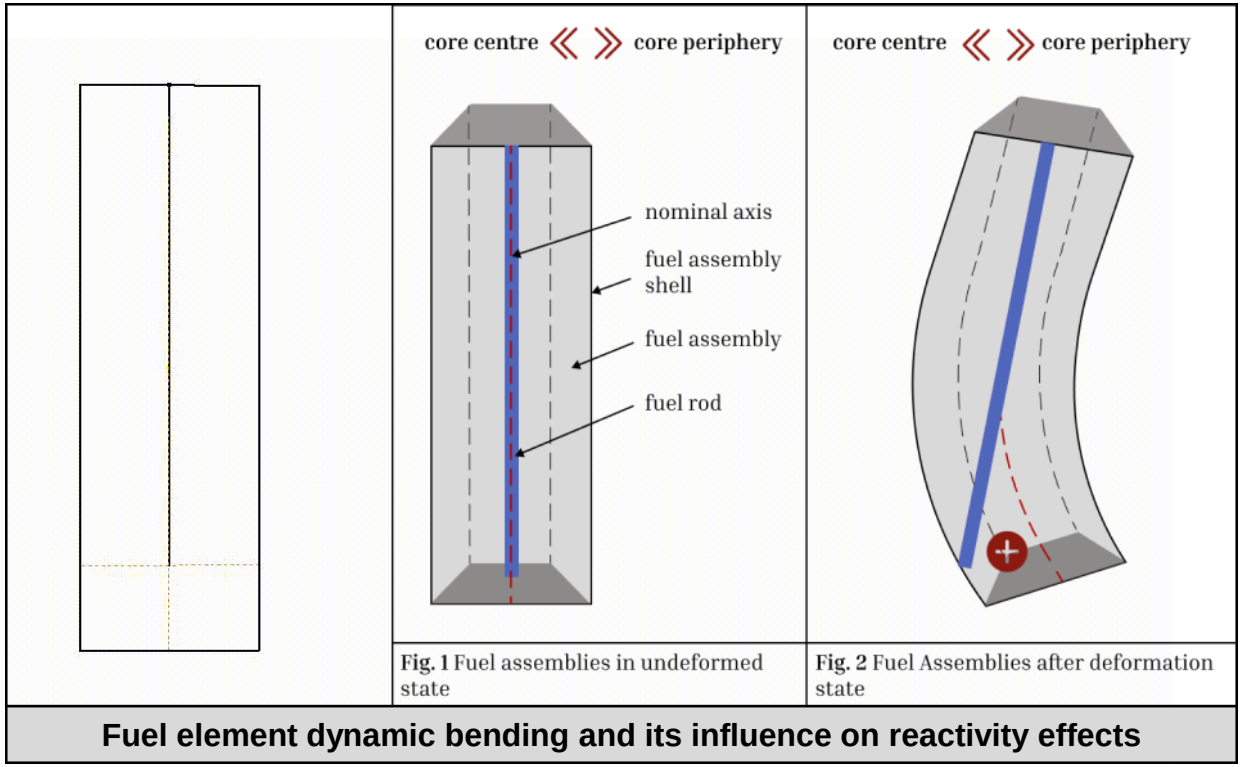


Fig. 1 Fuel assemblies in undeformed state

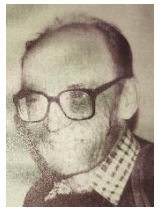
Fig. 2 Fuel Assemblies after deformation state

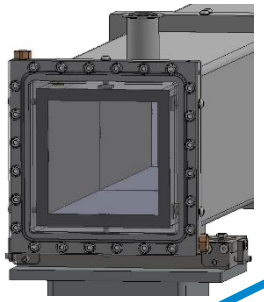
Fuel element dynamic bending and its influence on reactivity effects

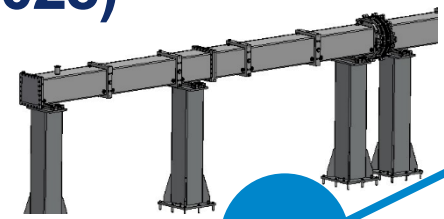
Plans for the development of new neutron source:

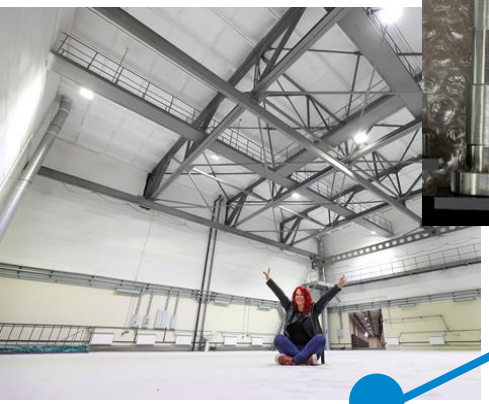
1) development of the concept of a new neutron source;
2) development of mathematical models describing the processes leading to fluctuations in pulse energy based on the experience of operating the IBR-2 reactor;
3) development of a scientific programme for a new neutron source with the concept of an instrument base;
4) development of the concept of a system for rapid change of the working substance.

New Inelastic Neutron Scattering Spectrometer in Inverse Geometry *BJN (Bajorek-Janik-Natkaniec)* (project 2021–2028)









One of the top five in the world

2028 Commissioning

2027 Instalation

2025–2027 Design and manufacturing of chopper and neutron guide

2023–2024 Development and manufacturing of the prototype

2023–2025 Purchase of materials for the secondary spectrometer (HOPG crystals, boron carbide block, frame,...)

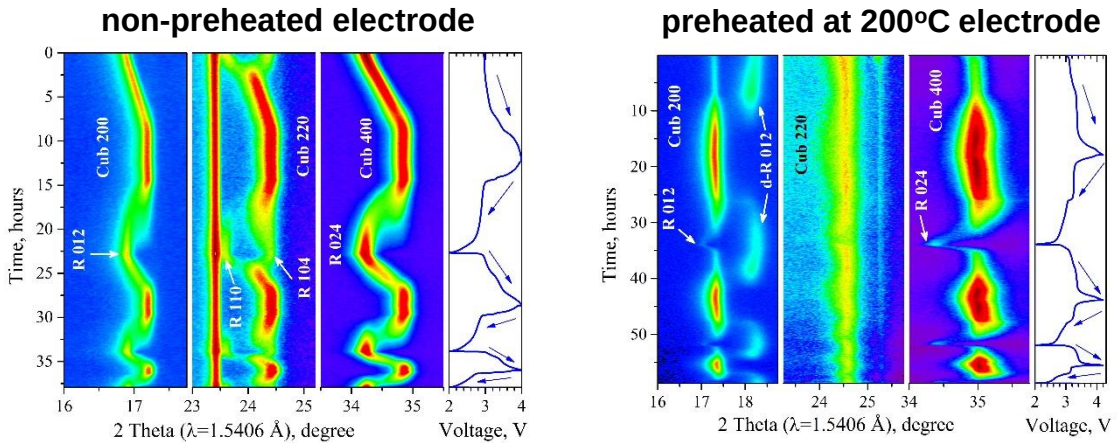
2023 Approvement of the 2nd part of the project by 134th session of the JINR SC

2020–2023 Preparation of Science case, Conceptual & Technical design, Demolition of old spectrometers and hall renovation

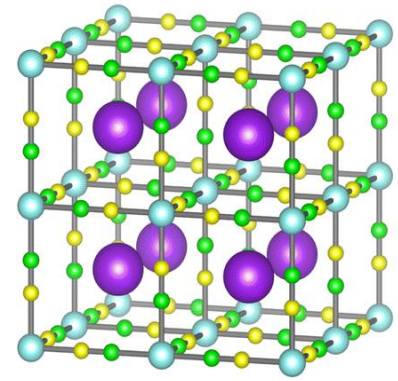
2020 Approvement of the 1st part of the project by 128th session of the JINR SC

Investigation of the Prussian white Cathode Material for Sodium Ion Batteries (SIB)

The chemical current **sources based on sodium ions** are considered as a **cheaper alternative to lithium-based current sources.**

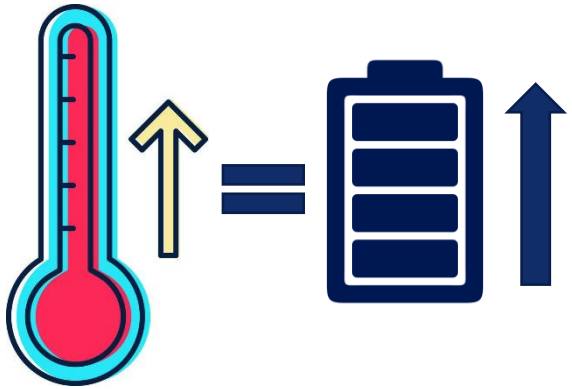


2D maps of diffraction pattens of the PW electrodes during charge – discharge cycles with different cycling rates.

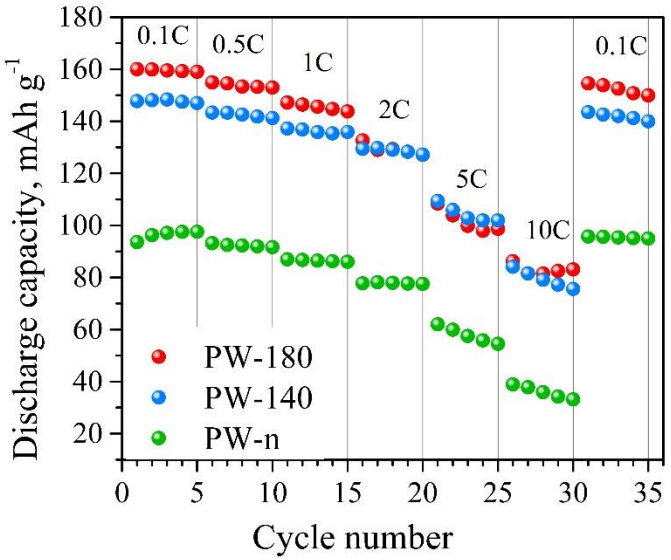


Structure of Prussian white

Preheating the electrodes promotes the formation of **dehydrated** rhombohedral d-R phase**,** resulting in **higher capacity** compared to electrodes without preheating.

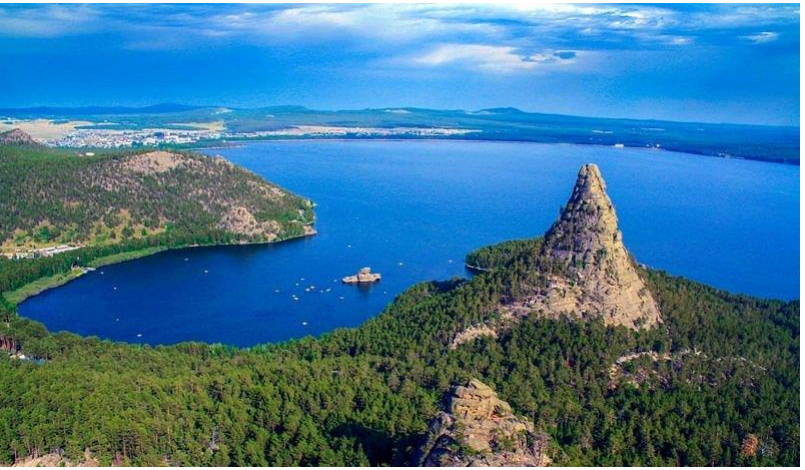


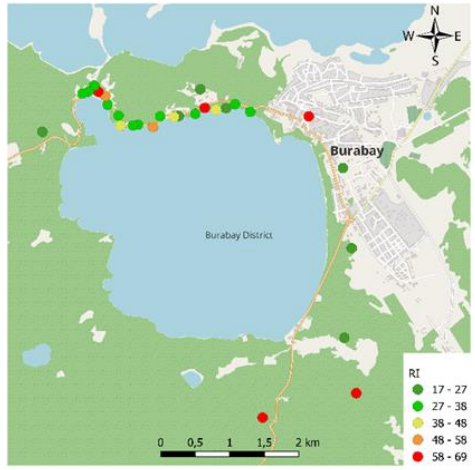
Capacity of the non-preheated (green), preheated at 140°C (blue) and 180°C (red) electrodes at different cycling rates.



N.Yu.Samoylova et al., J. Alloys Compd., 983, 173849 (2024)
https://doi.org/10.1016/j.jallcom.2024.173849

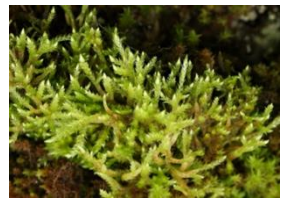
Investigation of the Air Pollution in Kazakhstan and Serbia Using Passive Moss Biomonitoring





The spatial distribution maps build for ecological risk index in moss samples collected in the Burabay State National Natural Park, Kazakhstan

Map of the sampling sites in Serbia



Moss and lichens samples

M. Nurkassimova et al. Environ Monit Assess 196, 442 (2024). DOI:*10.1007/s10661-024-12602-5*.

M. Aničić Urošević et al. Environ. Sci. Pollut. Res. 2024, https://doi.org/10.1007/s11356-024-34353-z.

Development of the Biological Approach for Rare Earth Elements Recovery from Wastewater

Arthrospira platensis

Ho(III), Er (III), Gd(III)

concentrations 10-30 mg/L

Cultivation for five days

Elemental analysis

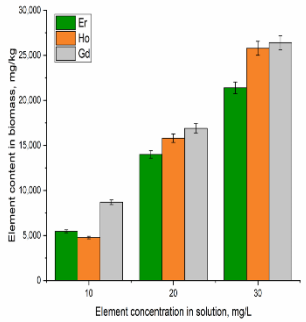
Biomass productivity

Antioxidant activity

Biochemical analysis

Total proteins, carbohydrates, lipids, and malondialdehyde

REGATA, IBR-2 reactor



I. Zinicovscaia et al. Microorganisms, 12, 122. (2024) https://doi.org/10.3390/microorganisms12010122.

IBR-2 Reactor

On 25 April 2024, a license was received from ROSTEKHNADZOR to operate the IBR-2 research nuclear facility for a period until 1 April 2032.

- Work has begun to replace the old heat exchangers. **First one was replaced in September 2024**;
- **Technical readiness** of the IBR-2 is planned for November 2024;
- Resumption of the **“User Programme”** is intended in spring 2025.

ФЕДЕРАЛЬНАЯ СЛУЖБА
ПО ЭКОЛОГИЧЕСКОМУ, ТЕХНОЛОГИЧЕСКОМУ И АТОМНОМУ НАДЗОРУ

ЛИЦЕНЗИЯ

Регистрационный номер ГН-03-108-4629 от 25 апреля 2024 г.

Лицензия выдана Объединенному институту ядерных исследований (ОИЯИ).

Местонахождение лицензиата: Московская обл., г. Дубна, ул. Жолио Кюри, д. 6.

Основной государственный регистрационный номер юридического лица (ОГРН) 1035002200221

Идентификационный номер налогоплательщика (ИНН) 9909125356

Лицензия дает право на эксплуатацию ядерной установки.

Объект, на котором осуществляется деятельность: исследовательская ядерная установка ИБР-2.

Основание для выдачи лицензии: заявление ОИЯИ от 24.11.2022 № 010-32/1419, решение Федеральной службы по экологическому, технологическому и атомному надзору от 05.04.2024 № 4629.

Срок действия лицензии до 01 апреля 2032 г.

Лицензия действует при соблюдении условий действия лицензии, являющихся ее неотъемлемой частью.

Руководитель органа лицензирования А.В. Трембицкий

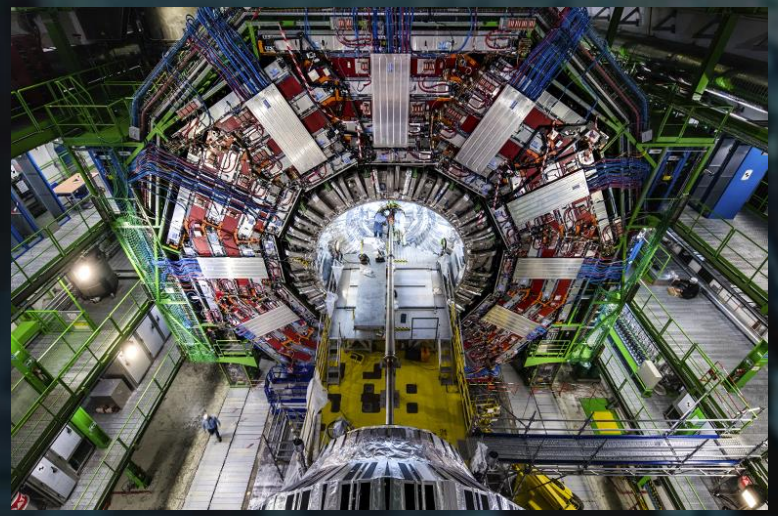
Серия А В №318926

70 Years of CERN

Scientific relations between CERN and JINR date back to 1957, were formalized in 1963. Since 1970, the traditional **CERN–JINR schools for young scientists** have given starting impulses for many scientific careers.

The **scientific contribution of JINR** to the overall CERN activities includes all areas of research and engineering. JINR has contributed to the **LHC machine** (dampers), to the experiments (**CMS**, **ATLAS** and **ALICE**) and to the WLCG, as well as to the non-LHC programme (**COMPASS**, **NA48**, **NA49**, **NA61**, **NA62** and **OPERA**). **Within CMS**, JINR initiated a collaboration scheme called **RDMS** (Russia and JINR Member States) which allowed a good coordination of the participation of these countries and made their contribution more visible. JINR has also been involved in common software development projects (**NICE**, **LabVIEW**, **EDH**) and participates in the **EGEE project**.

JINR has the status of **Observer** in the CERN Council **since 2014**.

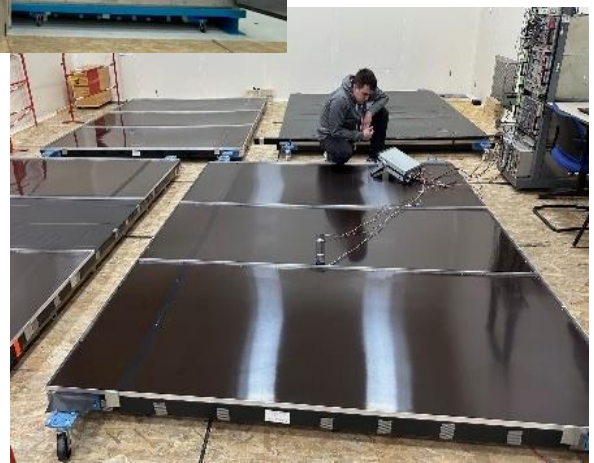


Selected Results from the External Experiments (CERN & BNL)

Collaboration with CERN is strengthening. The JINR-CERN bilateral Agreement is extended for the next five years. **JINR is actively working** on the second stage of the programme to upgrade the ALICE, ATLAS and CMS detectors at the LHC.

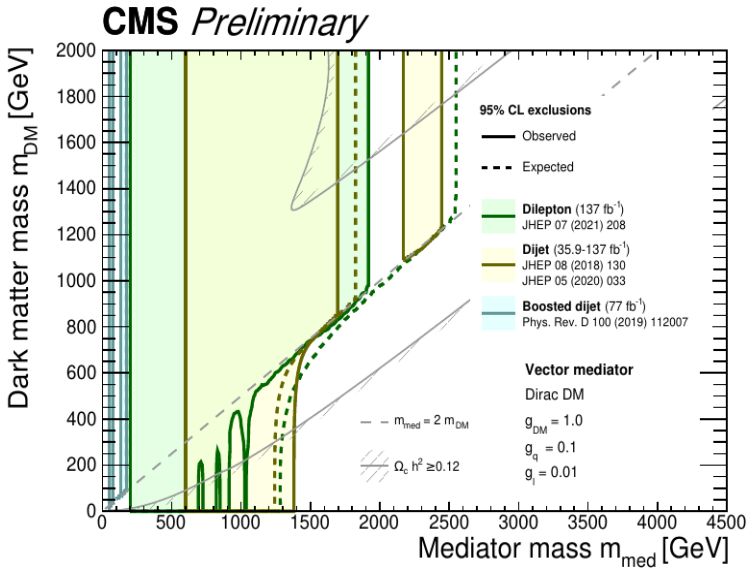
Visible contribution is made by the CMS team: thermally insulated chambers – a test facility for the High Granularity Calorimeter (HGCaL) – have been produced and assembled at CERN.

Thermally insulated chambers

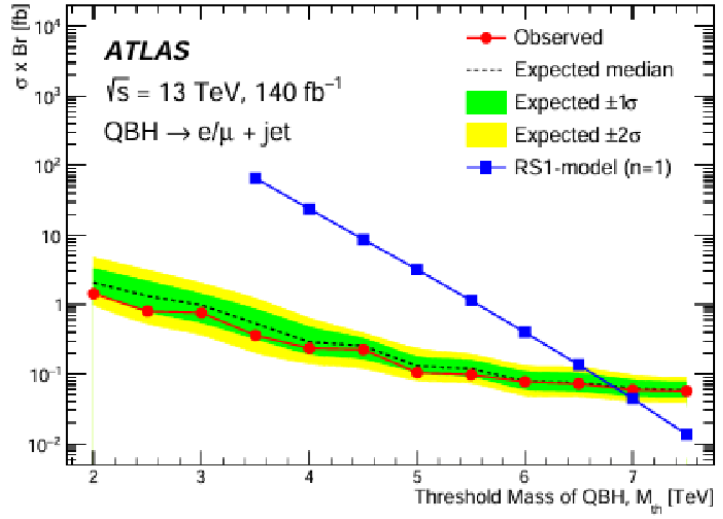


Trigger planes commissioning

New limits have been set on the masses of candidates for the dark matter particles m_{DM} and the particle-mediator of interactions with the dark matter sector m_{med}.

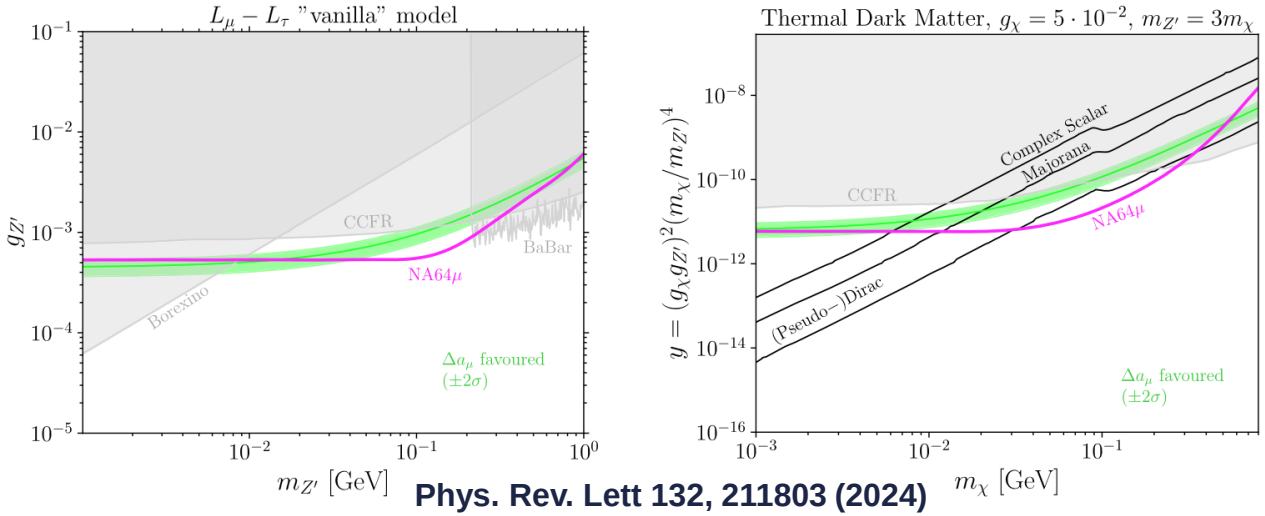


Searches for Quantum Black Holes: new mass & cross-section limits are set for the ADD and RS1 models as well as for model-independent approach.



Phys. Rev. D. 109 (2024) 032010

NA64 Experiment at SPS

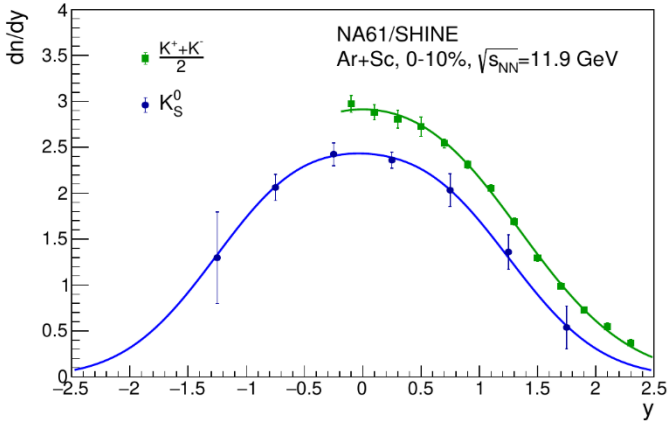


Phys. Rev. Lett 132, 211803 (2024)

Left: New exclusion limits are set on the coupling $g_{Z'}$ as a function of the $m_{Z'}$. Existing constraints from BABAR and from neutrino experiments are plotted.
Right: Exclusion limits obtained by the NA64μ experiment in the (m_χ, y) parameters space for thermal dark matter with $m_{Z'} = 3m_\chi$ and coupling $g_\chi = 5 \times 10^{-2}$.

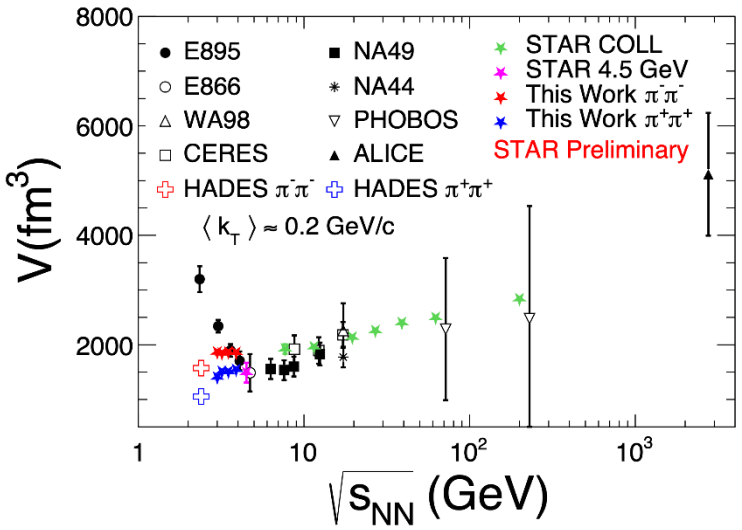
NA61 Experiment

Large violation of the flavour symmetry in the kaonic sector of multi-particle production was observed in Ar+Sc collisions.



More Selected Results

JINR's cooperation with Brookhaven National Laboratory is carried out within the framework of the **JINR-BNL/DOE** Cooperation Agreement, which is extended for 5 years until 2029.



Precise femtoscopic results from fixed target beam energy scan program in the region of high baryonic density were obtained with theoretical model developed at JINR by R. Lednicky and V. Lyuboshitz. New data allow to make mapping of femtoscopic volume in energy range from 3 to 200 GeV.

ATLAS Experiment

Search for Signals of the Quantum Black Holes

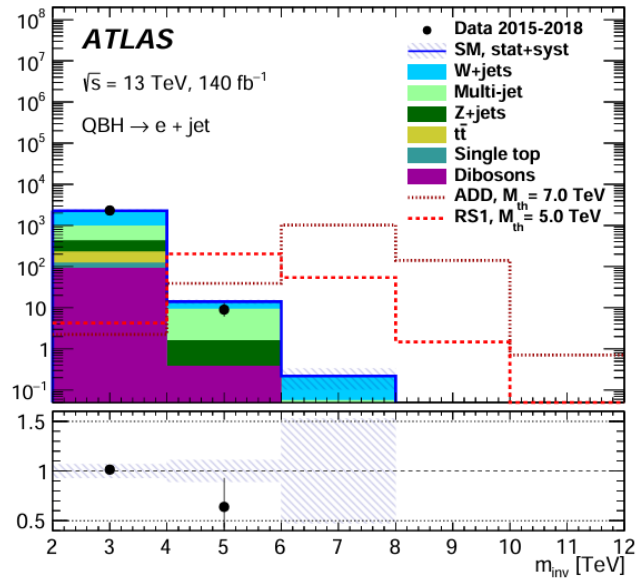
JINR team played a leading role in the search for Quantum Black Holes in lepton+jet final states at ATLAS.

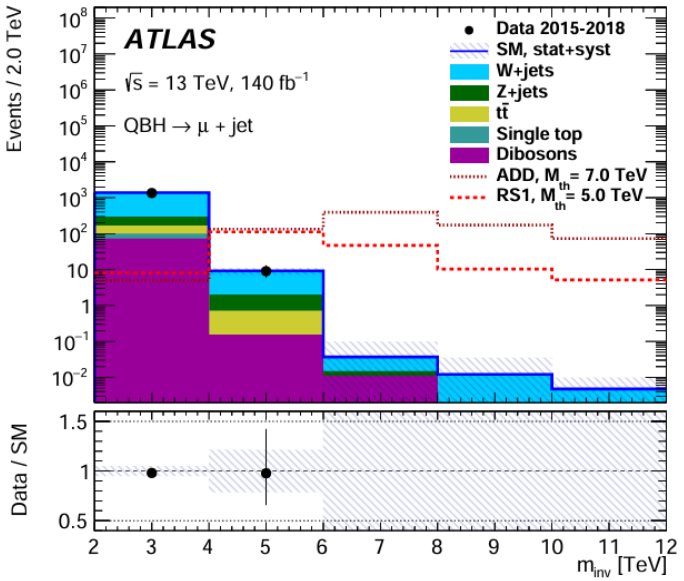
Newly published results are based on the full LHC Run2 data. Plots show invariant mass distributions of the electron+jet (top left) and muon+jet (top right).

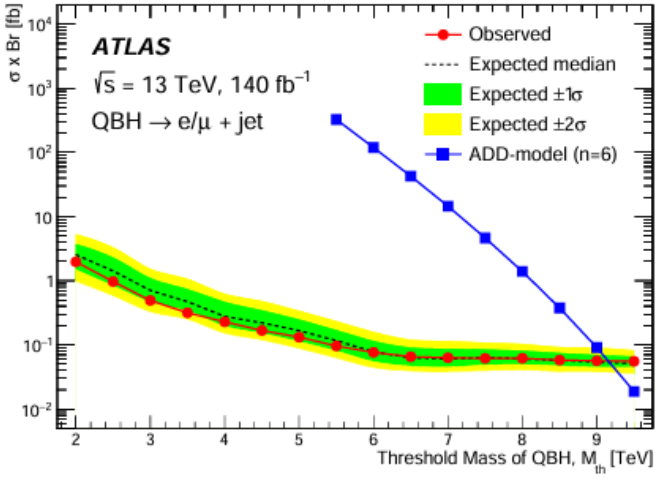
Predicted Quantum Black Hole signals in the **Arkani-Hamed-Dimopoulos-Dvali** (ADD) and **Randall-Sundrum** (RS1) models are shown.

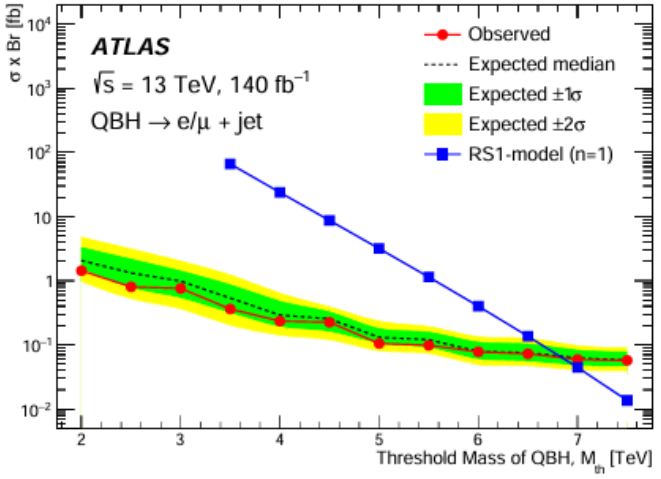
New mass and cross-section limits are obtained (bottom plots) using the combination of electron and muon channels.

Phys. Rev. D. 109 (2024) 032010







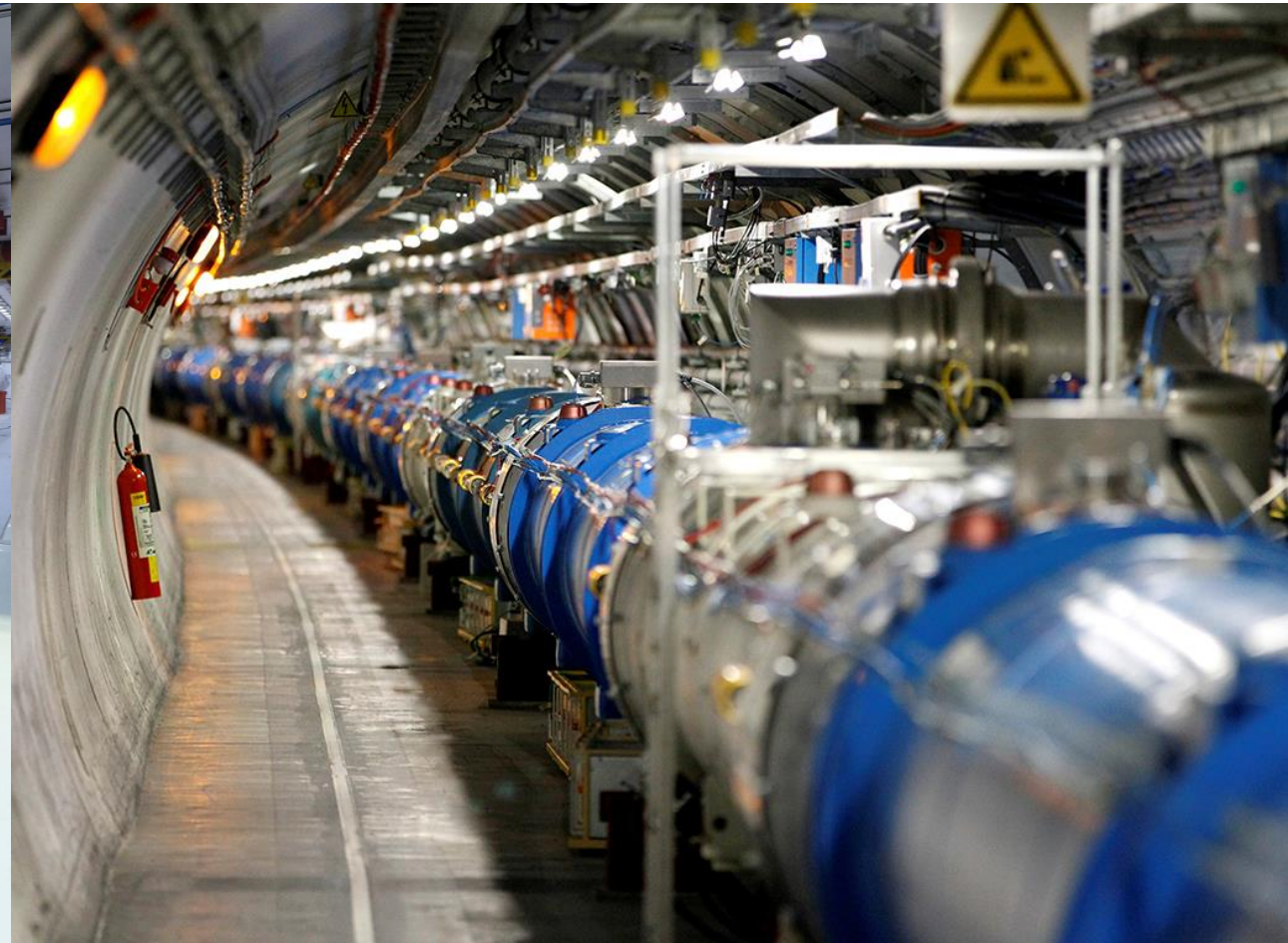


Channel	ADD $\sigma \times Br$ [fb]	ADD M_{th} [TeV]	RS1 $\sigma \times Br$ [fb]	RS1 M_{th} [TeV]	Model-independent $\sigma(m_{\text{inv}} > 5\ \text{TeV}) \times Br$ [fb]
Electron+jet	0.091	9.0	0.099	6.6	0.095
Muon+jet	0.083	9.0	0.087	6.7	0.084
Combined	0.056	9.2	0.061	6.8	0.052

JINR&CERN

“An important item on the June Council agenda was CERN’s International Cooperation Agreement with the Joint Institute for Nuclear Research (JINR), an intergovernmental organization located in Dubna, Russia, with which CERN has collaborated since 1957. As the Council decided not to terminate the agreement, the participation of JINR in CERN’s activities continues”.

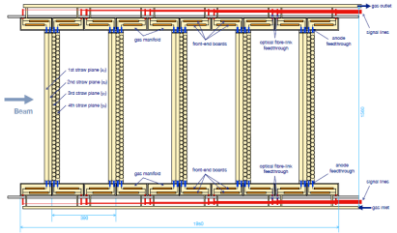
https://home.cern/news/opinion/cern/news-june-2024-cern-council-session



COherent Muon to Electron Transition (COMET) Experiment at J-PARC

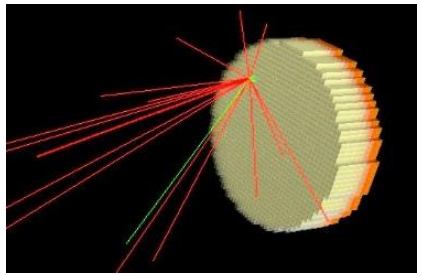
COMET Detector System and Requirements

Straw Tracker: 5 stations (Phase-I) ~2500 straw tubes, 9.75 mm diameter, 20 μm thickness.



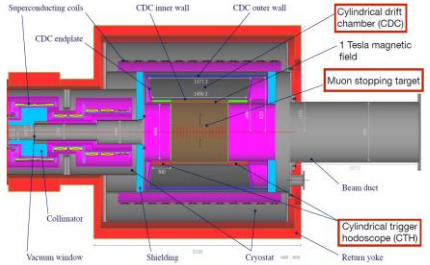
Requirements: Momentum resolution ≤ **200 keV/c**, space resolution ≤ **200 μm**.

ECAL (crystal type LYSO)



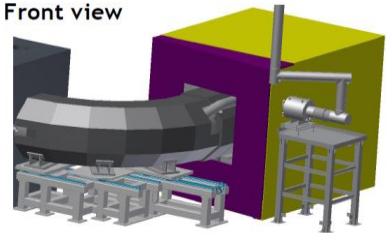
Requirements:
< **5%** ER at 105 MeV,
< **10 mm** space resolution,
< **100 ns** time resolution.

CDC (Cylindrical Drift Chamber)



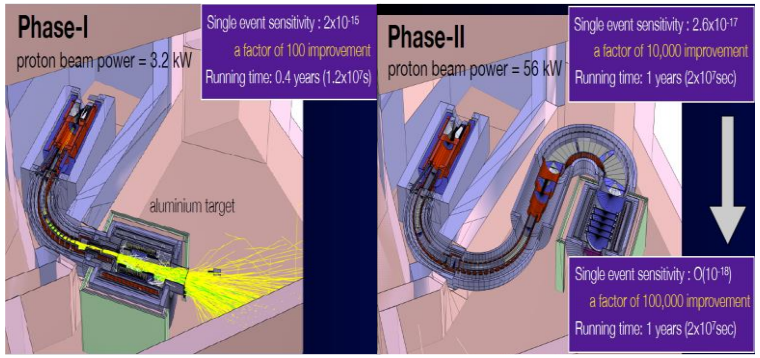
Requirements:
Spatial resolution < **200μm**,
Momentum resolution < **200 keV/c**.

CRV (Cosmic Ray Veto)



CRV two major parts:
scintillator-based detectors (SCRV) and Glass Resistive Plate Chambers (GRPC).
Requirement:
Efficiency **≥ 99.99%**.

Two-phase realization

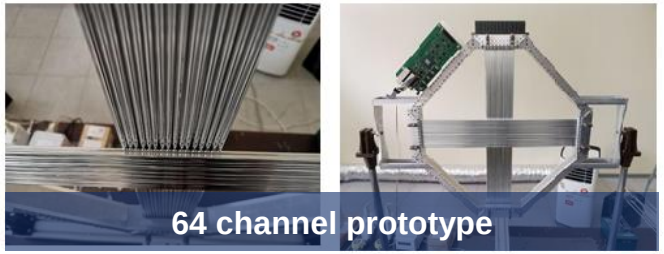


Phase-I (is planned in 2026) Goal:

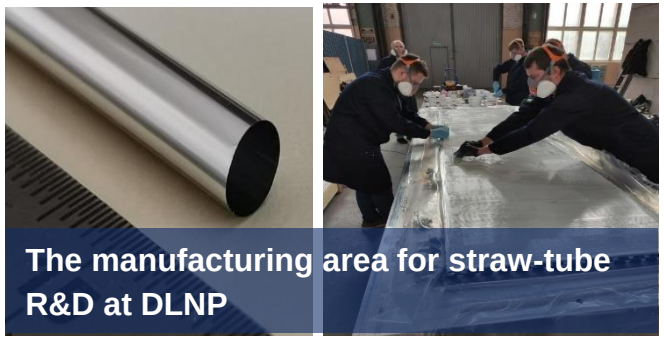
- Search for μ-e conversion, sensitivity at 2 x 10^{-15};
- Background Study for the full COMET Phase-II.

The complete set of tubes for Phase-I has been produced and tested:

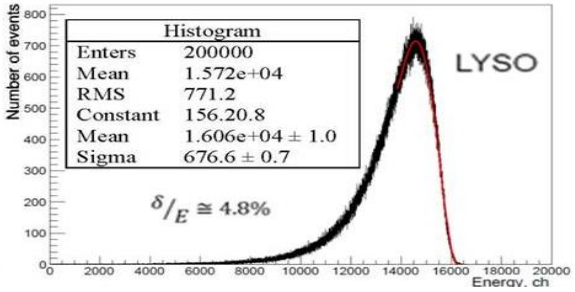
- 2,700 tubes of 20 μm wall thickness, Ø 9.8 mm, 120 and 160 cm length have been produced;
- These tubes passed all the tests and have been sent to Japan.



64 channel prototype



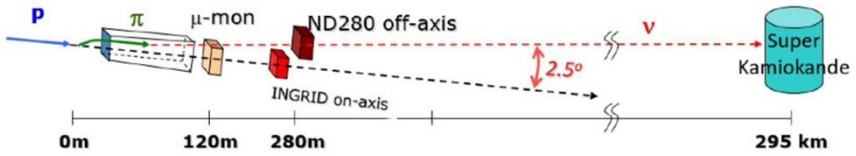
The manufacturing area for straw-tube R&D at DLNP



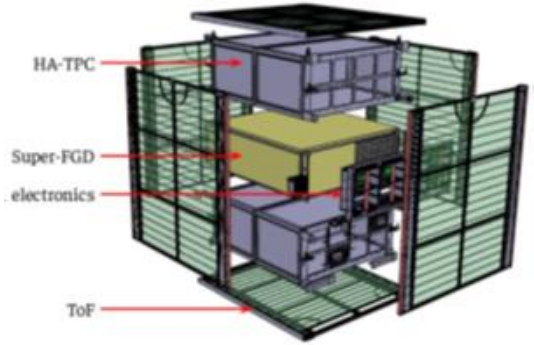
Energy resolution of the calorimeter on LYSO crystals at the 105-MeV electron beam (simulation using optical model)

The first CRV module is ready for cosmic test at J-Parc/KEK

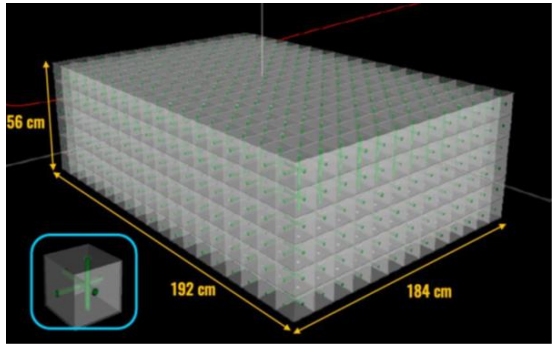
JINR Participation in the T2K Experiment



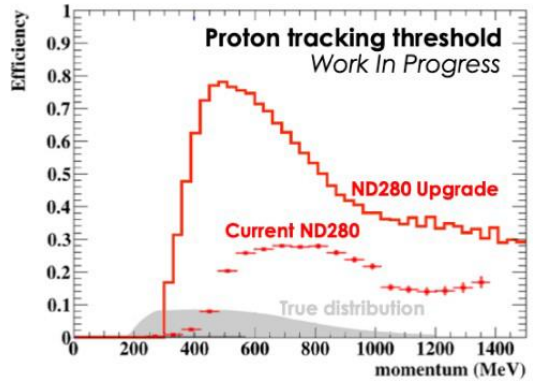
- The T2K (Tokai-to-Kamioka) is a world leading experiment in neutrino oscillation study;
- The T2K studies the oscillation of the neutrino beam produced at J-PARC and measured by the near detector ND280 and the far detector Super-Kamiokande.



The T2K upgrade: improved beamline parameters; new SuperFGD detector, High-Angle TPC, Time-of-Flight system



SuperFGD is a unique active target consisting of almost two million scintillation cubes measuring 1x1x1 cm^3

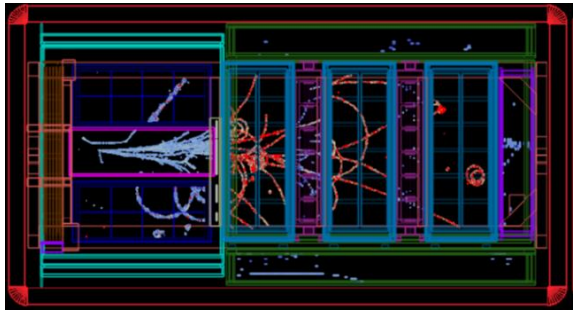


The upgraded ND280 has made it possible to significantly lower the threshold for proton registration

The T2K Collaboration has started data taking using the enhanced neutrino beam and new neutrino near-detectors from December 2023 Upgraded T2K goal is to make precise measurements of θ_{23} and Δm^2_{32} with an accuracy of 1.7° and 1%, respectively.

Contribution of the JINR group in the T2K:

- Design and creation of tooling for assembling an SuperFGD active target;
- Active participation in SuperFGD assembly at J-PARC;
- Investigation of the optical properties of the elements of the SFGD active target;
- Development and production of the SuperFGD calibration system;
- Participation in the study of yields of secondary particles from a graphite target (T2K replica target at CERN) in the NA 61/SHINE experiment at CERN;
- Analysis of data on the search for light dark matter;
- Performing studies to assess systematic errors in various kinds of analyzes on ND280 data.



Neutrino event registered in the near detector ND-280

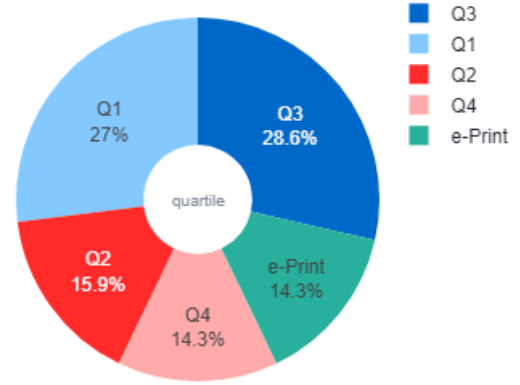
Govorun Supercomputer. Current Status

Total peak performance of the Govorun supercomputer:
1.7 PFlops for double-precision computations
26 PFlops for half-precision computations

Total capacity of the hierarchical storage: **8.6 PB**, Data IO rate: **300 Gb/s**

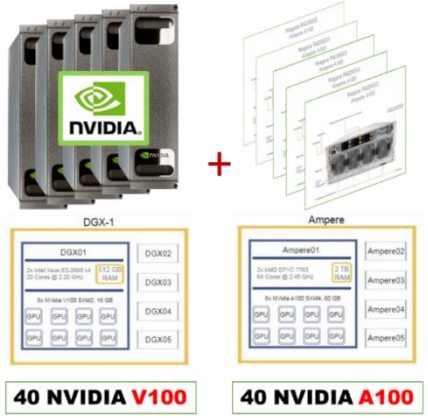
CPU component

163 hyperconverged compute CPU nodes;
8,552 compute cores (17,104 logical cores);
Total peak CPU performance: **800 TFlops** for double-precision computations.



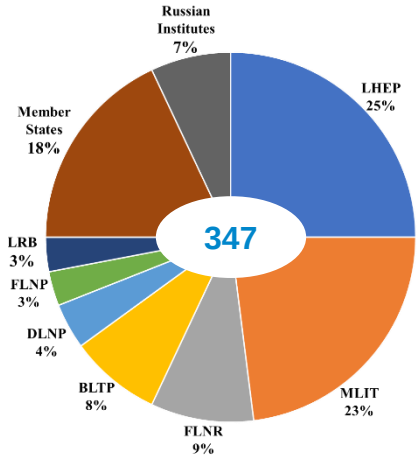
Over the past year, users of the HybriLIT heterogeneous platform have published **65 articles** in various fields:

- high-energy physics,
- biophysics and chemistry,
- neural network approach, methods and algorithms of machine learning and deep learning (ML/DL), etc.



GPU component

80 GPU accelerators;
Total peak GPU performance: **900 TFlops** for double-precision computations;
26 PFlops for half-precision computations.

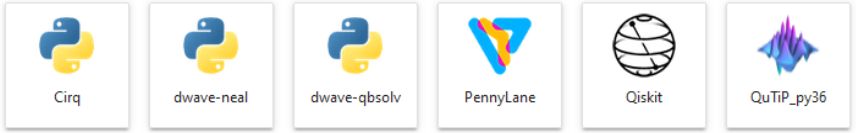


Since the beginning of this year, the number of Govorun SC users has increased by **35 users**, including from the Member States (Armenia, Belarus, Vietnam, Egypt, South Africa). The total number of Govorun SC users is currently **347 users** involved in the implementation of **25 themes** of the JINR Topical Plan.

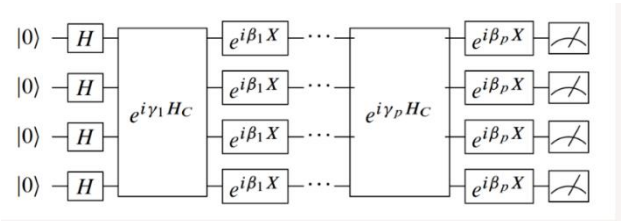
New Services of the ML/DL/HPC Ecosystem on the HybriLIT Platform

Quantum Computing Polygon

deployed on the ML/DL/HPC ecosystem of the HybriLIT platform

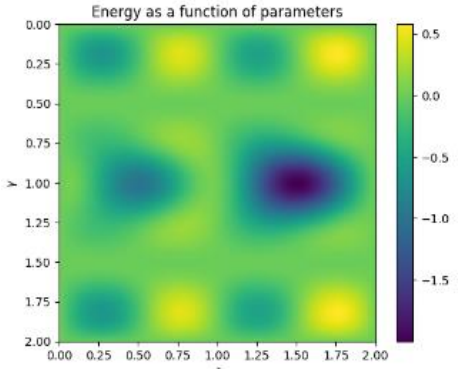


As an example, we present **a search for the ground state and its energy in the Ising model** with a longitudinal magnetic field using the quantum approximation optimization algorithm (QAOA).



A quantum circuit to the variation ansatz of QAOA

$$|\psi(\gamma,\beta)\rangle = \underbrace{U(\beta_p,B)U(\gamma_p,\mathcal{H})}_{p}\ldots\underbrace{U(\beta_1,B)U(\gamma_1,\mathcal{H})}_{1}H^{\otimes n}|0\rangle^{\otimes n}$$



Coincidence of state vector search and sampling search.

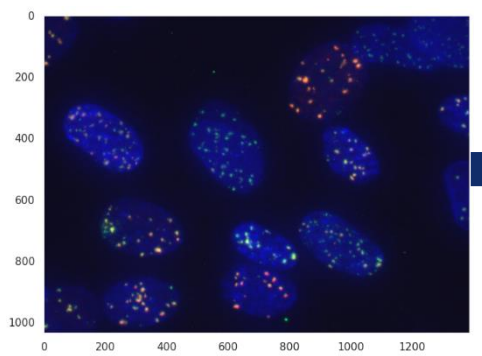
OpenMP for CPU computations and cuStateVec for GPU computations

Ising Model 3x3x3 lattice 27 qub	AMD EPYC 7763, 128 th.	Intel Xeon Platinum 8368Q, 128 threads	NVIDIA A100, cuStateVec
Comp. time	3 h 20 min	3 h 10 min	**14 min 35 sec**

Yu. Palii, A. Bogolubskaya, and D. Yanovich: Quantum Approximation Optimization Algorithm for the Ising Model in an External Magnetic Field // PEPAN, V. 55, N. 3. Pp. 600-602, 2024.

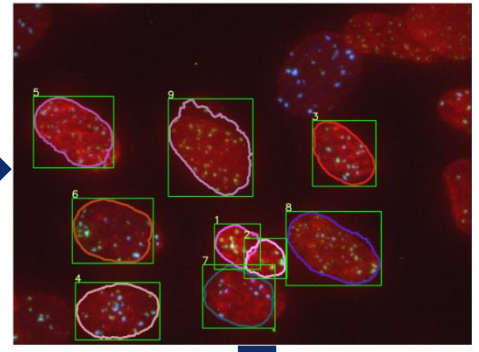
MOSTLIT

Service for FOCI detection and analysis

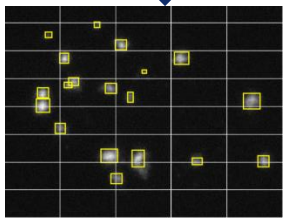


Stage 1

Neural Network 1



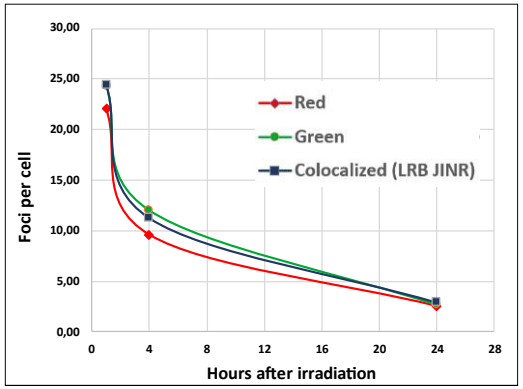
Stage 2



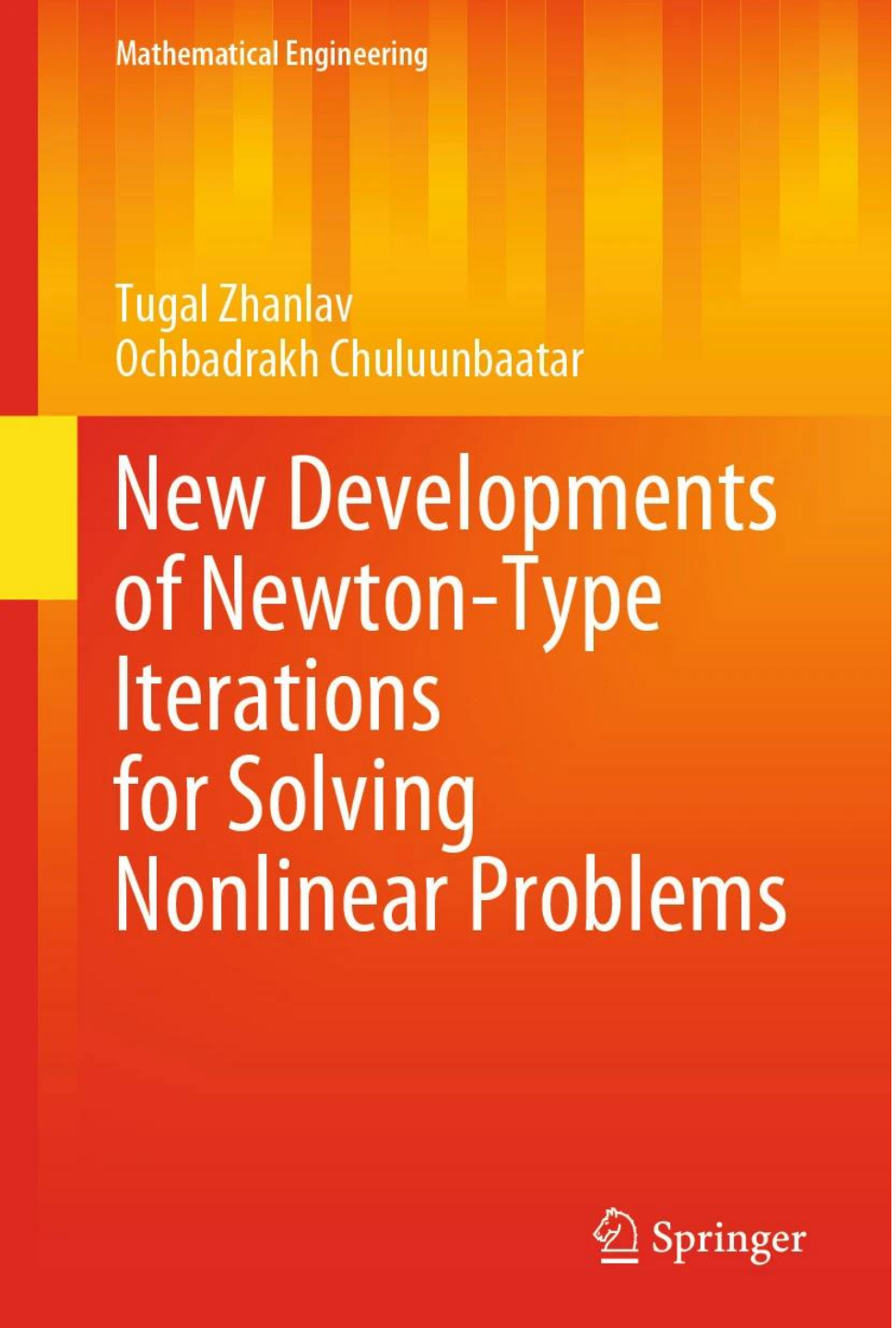
Neural Network 2 based on YOLO

A web service to extract cells from each data image and count the number of radiation-induced foci has been developed. The service functionality allows one to analyze a group of images of an experiment, provide analytical information about foci per cell in each image, average foci per cell, and some other parameters.

In collaboration with LRB JINR and the Burnazyan Medical Research Centre of the FMBA of Russia.



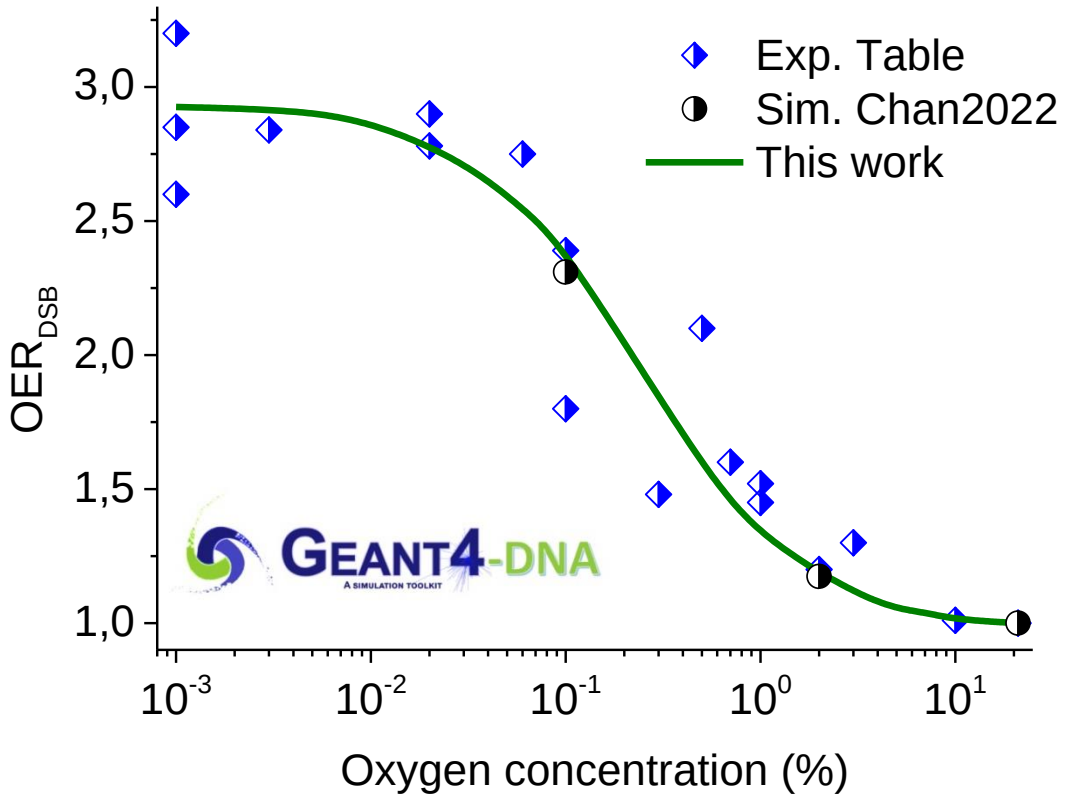
The web service is available at
http://mostlit.jinr.ru



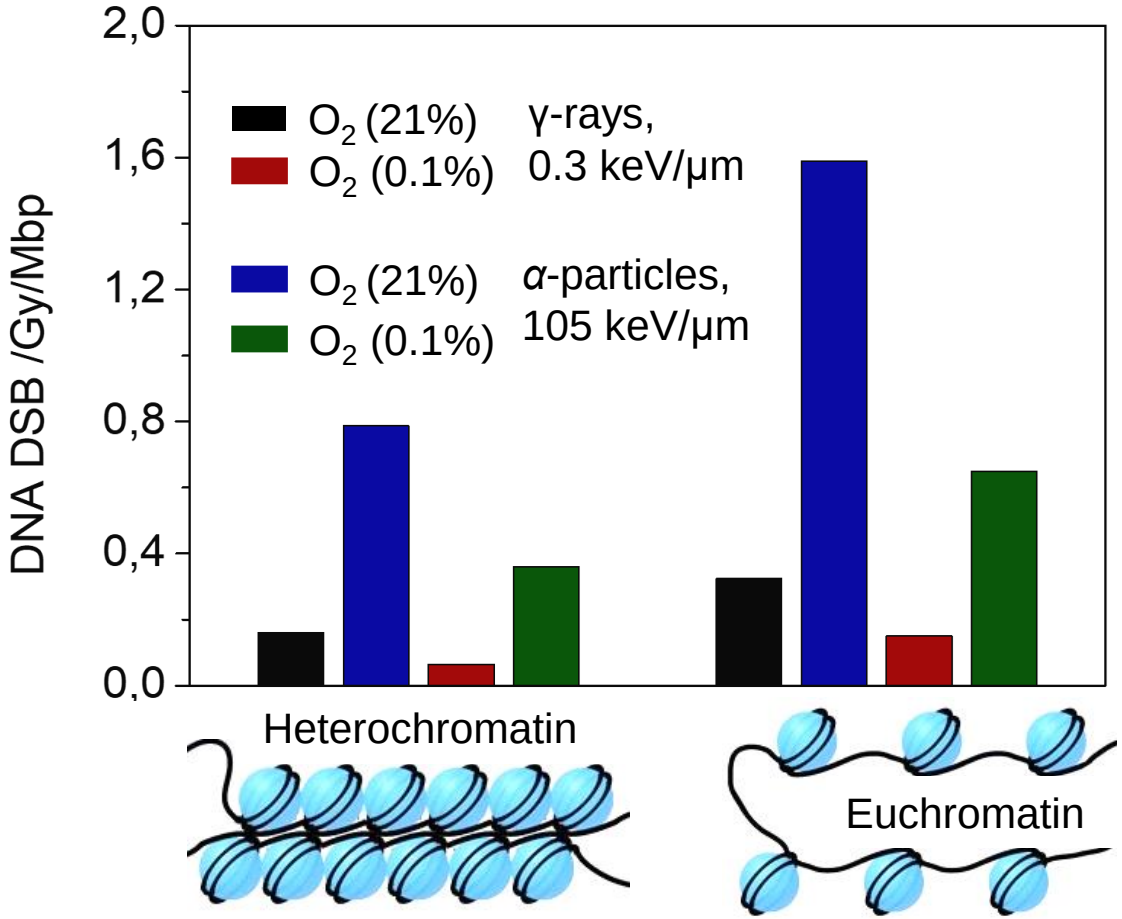
New Developments of Newton-Type Iterations for Solving Nonlinear Problems

Springer Nature Switzerland published a monograph “New Developments of Newton-Type Iterations for Solving Nonlinear Problems” by Mongolian Academicians Tugal Zhanlav and Ochbadrakh Chuluunbaatar (MLIT). This comprehensive book delves into the intricacies of **Newton-type methods for nonlinear equations**, offering insights into their convergence, accelerations, and extensions. **This monograph contains main results developed at MLIT and the National University of Mongolia**. Divided into three parts, the book explores higher-order iterations for nonlinear equations and their systems, and their applications in linear algebra and some nonlinear problems of theoretical physics. Emphasizing the pivotal role of iteration parameters in shaping convergence and expanding the domain, the authors draw from their extensive collaborative research to systematically compile and elucidate these findings.

New Developments in Geant4-DNA Simulation Toolkit: Oxygen-Dependent Damage and Chromatin Structure



Comparison of measured and calculated oxygen enhancement ratio OER determined by double strand break (DSB) yields after γ-irradiation.

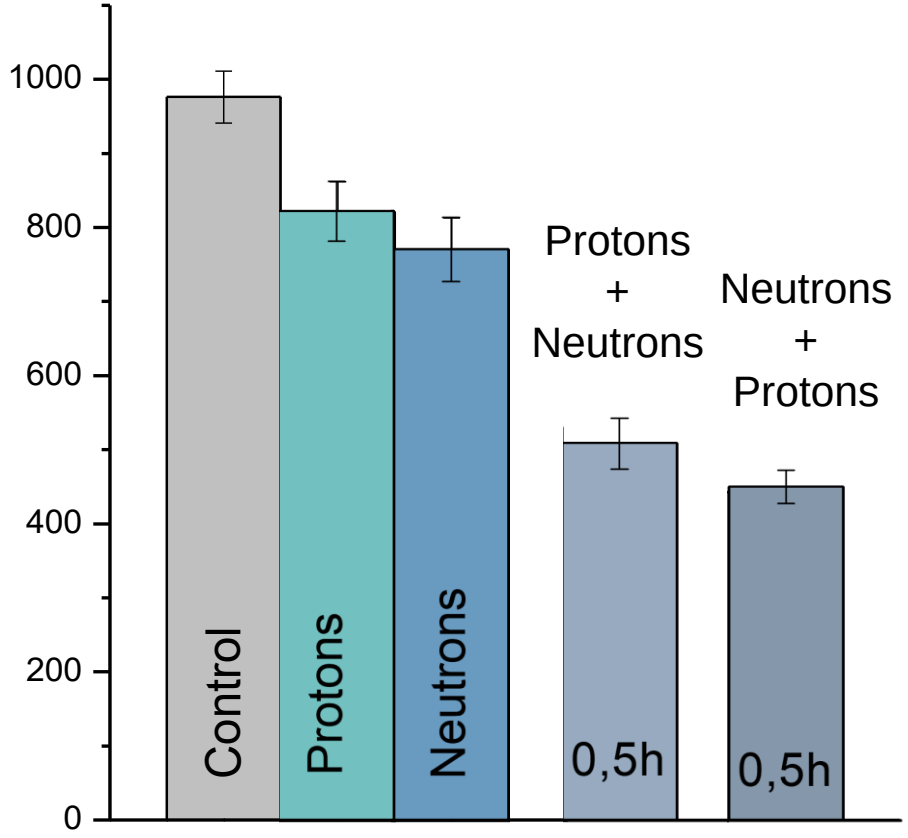


Effect of oxygen concentration and chromatin structure on amount of DNA double strand breaks induced by low- and high-LET radiations.

Effects of Combined Neutron and Proton Beam Radiation Exposure on the Breast Cancer Stem Cells *in vitro*

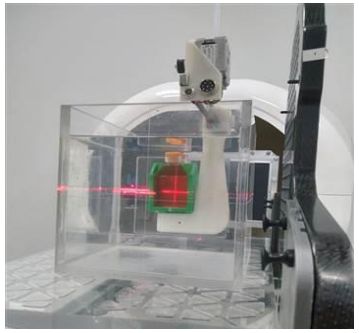
Combined exposure conditions			Synergism coefficient K_{synerg}
Contribution to the total equi-effective dose (EQD)	Sequence of radiation exposure	Time interval between irradiation sessions, h	
50% : 50%	protons + neutrons	0.5	**2.28**
	neutrons + protons	0.5	**2.71**

The most favorable results selected from different fractionation schemes in terms of *cancer stem cells elimination* for the combined action of protons and neutrons on the breast cancer cells MDA-MB-231.



The absolute number of *cancer stem cells* 48h after the irradiation of cell culture to the total EQD of 4.0 Gy.

Neutrons, 14.75 MeV



Protons, 105 MeV

Student Programmes March 2024 – September 2024

JINR-attached students, 435 participants

Advanced Engineering practicum
34 participants from Russia, Mexico, Vietnam & Serbia

International Student practice,
Stage 1, RSA, June, 19 participants

Stage 2, RSA, Vietnam, Mexico, etc.
September, 40 participants

START
Winter session'24, February – June, 26 participants
Summer session'24, June – November, 61 participants

INTEREST
Wave 10, February-April, 57 participants

Teachers and School Students

Scientific school for 23 physics teachers from Irkutsk, Saratov, and Voronezh regions, March

Scientific school for physics teachers,
July, 24 representatives from 14 regions of Russia

Plans for October:
School for Physics Teachers: North Ossetia and Rostov

Science School for School Students from Tomsk
June,10 participants

IV Science School for Students of the Children's University of the Egyptian ASRT,
September, 13 participants

JINR Postdoctoral Programme

- Attraction highly motivated young scientists with a PhD degree (obtained less than 5 years ago);
- 2 calls per year (spring and autumn) for the entire world scientific community;
- The original appointment will be for 1 year, with the possibility to renew it for another 2 years maximum (36 month in total);
- Up to 15 vacancies.

Before 2023 year:

- JINR employs **8 postdocs** for 3 years contracts from Belarus, Brazil, India, Korea and Russia.

2023-2024 years:

- 110 applications were received, **18 winners**;
- As of August 2024 JINR employs **16 postdocs** from Armenia, Bangladesh, Belarus, Brazil, Egypt, India, Korea, Pakistan, Russia, Syria, South Africa.

JINR Fellowship Programme

- Attraction talented scientists and engineers, expanding international cooperation (at least 3 years for master's degree and 5 years for PhD degree holders);
- Call in collaboration with a partner organization;
- The original appointment will be for 1 year, with the possibility to renew it for another 1 years maximum (24 month in total);
- Up to 25 vacancies.

Regional programmes:

1. for Arab countries with Arab Atomic Energy Agency;
2. for Asia-Pacific Region with Vietnam Academy of Science and Technology;
3. for Latin America Region with Ibero-American Federation of Physical Societies.

74 applications were received, **8 winners**.

As of August 2024:

- JINR employs **5 fellows** from Egypt, Vietnam and Jordan.

Launch of the Fellowship Programme on scientific fields is expected.

International School of Accelerator Physics: Cyclotrons

Within the framework of the school, **29 lectures** were given by leading experts from various scientific centres and organizations.

More than 25 lecturers from JINR, MEPhI, ITEP and Radiomedsintez Radiopharmaceutical Company took part in the school.

More than 50 full-time and 30 online participants from various organizations – JINR, NRNU MEPhI, PNPI NRC KI, IEA named after D. V. Efremov, Institute of Nuclear Physics (Kazakhstan), etc.

The main focus was on the mathematical aspects of diverse problems in fundamental and applied quantum technologies, such as:

- quantum information theory,
- quantum communications,
- quantum computing, simulation, and quantum algorithms.

More than 60 participants from Armenia, Belarus, Bulgaria, Great Britain, Georgia, Egypt, India, Kazakhstan, Moldova, Romania, Serbia, the Czech Republic.

Russia was represented by specialists from Voronezh, Kazan, Moscow, St. Petersburg, Tver, Chelyabinsk and Dubna.

32 reports (9 from JINR)

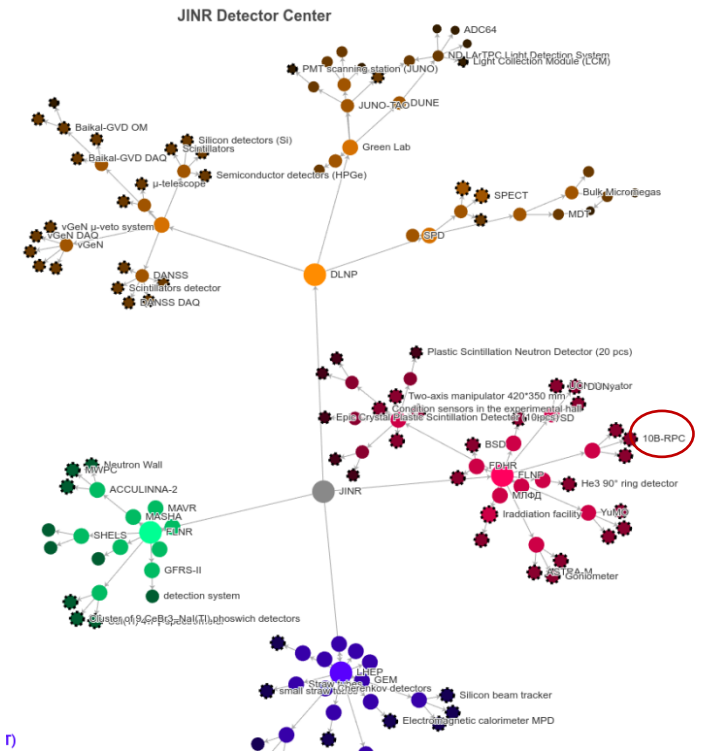
SCHOOL JINR

JINR Spring School of Information Technologies 2024

30 students from Russian universities

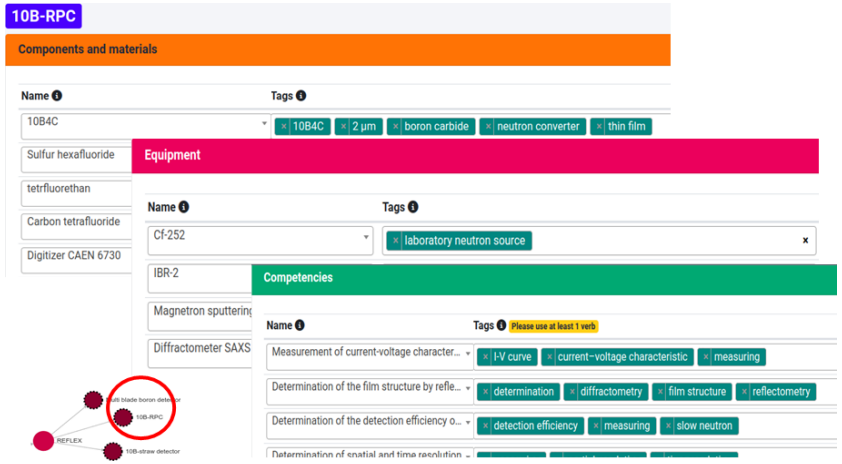
- Distributed and high-performance computing for the preparation, implementation and support of experimental and theoretical research carried out within JINR large research infrastructure projects;
- Modern methods and technologies for information processing and analysis;
- JINR Digital EcoSystem;
- Support and development of the JINR Multifunctional Information and Computing Complex (MICC).

Mapping of JINR Technology Domains. Detectors



- Interactive tool (Developed in MLIT) for Data Base creation & visualization;
- SSO-login. Today access is possible for JINR community only;
- Growing Team of participants;
- Low hanging fruits – “Where can I find necessary equipment, etc.”;
- Next steps: Accelerators; Smart search.

Technology = What is it made of (“**Components & Materials**”), How (“**Competencies**”), on what **Equipment.**



Big Science for Business

DOKAGENE

Machine learning

Центр водородных технологий

Центр водородной энергетики

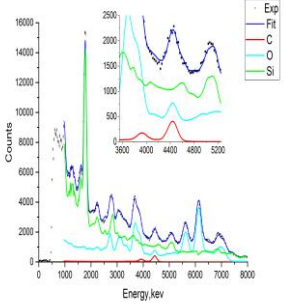
Hydrogen energy

ВЛАДИСАРТ

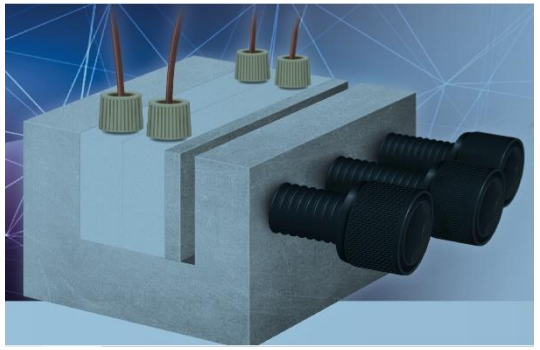
Modules for immunoenzyme preparations and vaccines

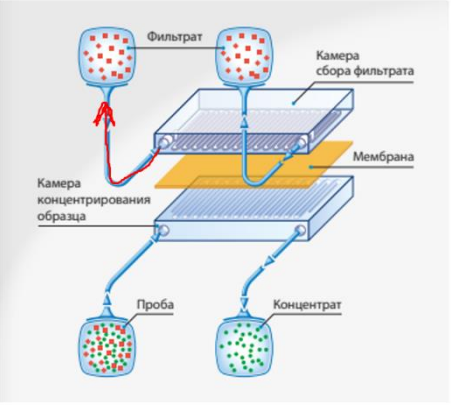
Sustainable Development. Mitigating Climate Change

Measurement of carbon concentration in soil without sample extraction & preparation.
“Tagged Neutron” based scanner (FLNP and Diamant LLC) on Unmanned transport platform (University “Dubna”).



Preparative tangential flow filtration system for R&D in Biotech (CAP of the FLNR)





Clear water

Реатрек

Carbon supersites

ДИАМАНТ

Proton therapy

РОСАТОМ

Implants

ГЛАЗНОЙ ЦЕНТР ВОСТОК-ПРОЗРЕНИЕ

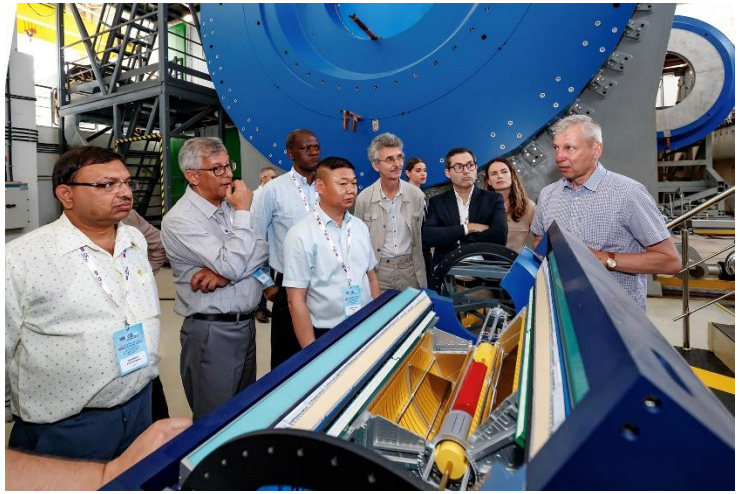
International Cooperation

2–3 July 2024

JINR hosted the 6th meeting of the **BRICS Working Group on Research Infrastructures and Megascience Projects**.

Representatives of all BRICS countries, including the new member states of this organization, attended the event. During the meeting, participants talked about the scientific and technological policies and strategies of the BRICS member states in terms of research infrastructure.

The meeting participants visited a number of large JINR facilities, such as the NICA accelerator complex, the Superheavy Element Factory, and the IBR-2 reactor with a spectrometer complex.



International Cooperation

Strengthening Partnerships

28 March 2024

Representatives of the **Hefei Institute of Physical Science** and the **Institute of Plasma Physics of the Academy of Sciences of the People's Republic of China** visited the Joint Institute for Nuclear Research.

1–2 July 2024

Director G. Trubnikov visited the **Institute of Plasma Physics of the Chinese Academy of Sciences**.

G. Trubnikov received the honour of planting a tree in the International Friendship Park on Science Island.

3 July 2024

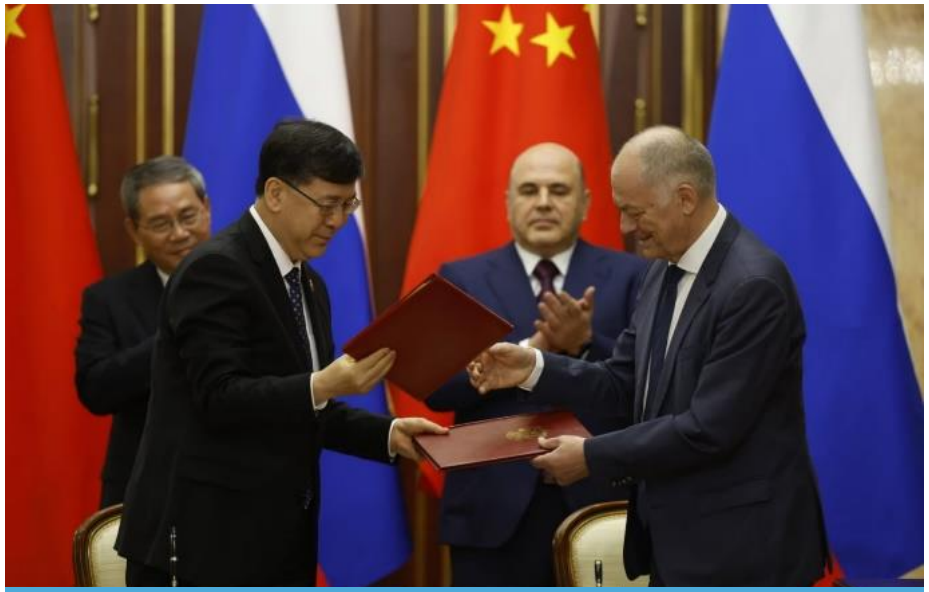
The 2nd meeting of the **JINR-China Joint Coordination Committee** was held in Shanghai, co-chaired by JINR Director G. Trubnikov and Vice-Minister of Science and Technology of China Long Teng.

The meeting participants heard a report on the activities of the Expert Working Group under the Committee and its recommendations on research projects that are of interest for both sides.

According to the decision of the Committee, eight projects that received the most support from experts will be launched in 2024.

International Cooperation

Strengthening Partnerships



The document was signed alongside the **29th Regular Meeting between Chinese and Russian Heads of Governments**. The aim of the new agreement is to develop cooperation between JINR and China in fundamental research, facilitate personnel exchange, and expand research opportunities.

On the Chinese side, the agreement was signed by **Minister of Science and Technology of China Yin Hejun**. **Russian Prime Minister Mikhail Mishustin** and **Premier of the State Council of the People's Republic of China Li Qiang** attended the ceremony.

21 August 2024

The **Joint Institute for Nuclear Research** and the **Ministry of Science and Technology of People's Republic of China** signed **an agreement** at the House of the Government of the Russian Federation.

The document provides for JINR and the Ministry of Science of China to jointly finance collaborative fundamental research projects at large scientific facilities. The parties identified eight joint projects:

1. The "Joint Programme on Theoretical Physics" project – the Institute of Theoretical Physics, Chinese Academy of Sciences;
2. The "R&D of high-energy Underwater Neutrino Telescope" project – the Institute of High Energy Physics, Chinese Academy of Sciences;
3. The "Neutron Scattering Technology and Multi-disciplinary Research" project – the Institute of High Energy Physics, Chinese Academy of Sciences;
4. The "Monolithic Si-Pixel Detector for Collider Experiments and Other Applications" project – Central China Normal University;
5. The "Key Technology Research on Superconducting Components of Heavy Ion Accelerators" project – the Institute of Modern Physics, Chinese Academy of Sciences;
6. The "Radiochemistry of Superheavy Elements" project – the Institute of Modern Physics, Chinese Academy of Sciences;
7. The "The synthesis of nuclei in the superheavy region" project – the Institute of Modern Physics, Chinese Academy of Sciences;
8. The "Physics studies at the JUNO experiment" project – the Institute of High Energy Physics, Chinese Academy of Sciences.

International Cooperation

Member States

22 March 2024

Vice-Minister of Science and Higher Education of Kazakhstan Darkhan Ahmed-Zaki visited JINR, participated in the CP session.

1 March 2024

The **JINR-Cuba Meeting on Applied Research and Human Capacity Building** took place in Havana under the chairmanship of the **Plenipotentiary of Cuba**, Gonzalo Walwyn Salas.

14 April 2024

G. Trubnikov and **President of the National Academy of Sciences of the Republic of Armenia** Ashot Saghyan signed an **agreement on cooperation** in the fields of fundamental science, information technology, innovation, and education.

20 March 2024

G. Trubnikov and **Director of the Alikhanyan National Science Laboratory** Gevorg Karyan signed an **agreement to expand cooperation** in fundamental science, information technology, innovation, and education.

21–22 March 2024

Deputy Minister of Science, Technology, and Environment of Cuba Armando Rodriguez Batista visited JINR, presented the decision of the Cuban Academy of Sciences to assign the status of corresponding member of the Academy to Yu. Oganessian.

19 April 2024

Deputy Directors of the Cuban Isotope Centre Rolando Agustin Serra Aguila and Jorge Caridad Cruz Arencibia visited JINR and discussed issues of developing cooperation in various fields with the representatives of the JINR Directorate.

International Cooperation

Member States

29 March 2024

JINR Director Grigory Trubnikov and the Rector of the Higher School of Economics (HSE) Nikita Anisimov signed an agreement outlining key areas of JINR-HSE cooperation.

26 June 2024

JINR renewed its agreement on cooperation with **ROSATOM** on the sidelines of the 2nd Obninsk NEW International Nuclear Forum and became an official member of the **Multipurpose Fast Neutron Research Reactor (MBIR) International Consortium**.

This year's event is part of the celebration of the 70th anniversary of the launch of the world's first nuclear power plant.

3 July 2024

Far Eastern Federal University (FEFU) hosted a meeting to sum up interim results of partnership with the Joint Institute for Nuclear Research in the frame of the agreement by JINR, FEFU, the Far Eastern Branch of RAS, and the Government of Primorsky Krai. JINR Scientific Leader, RAS Academician Victor Matveev represented the Joint Institute at the meeting.

On the same day, Victor Matveev received the title of Honorary Doctor of Far Eastern University.

International Cooperation

Deepening Ties with Latin America

28 February 2024

A Brazilian delegation headed by **Prof. Marcia Barbosa, State Secretary** for Policy and Strategic Programmes at the **Brazilian Ministry of Science, Technology and Innovation** visited JINR.

Main points of the meeting with the Directorate:

- mutual interest in cooperation in almost every research area in accordance with the JINR Seven-Year Plan;
- BRICS countries could use the Institute as a platform to collaborate multilaterally to advance national science and technology and train highly skilled specialists.

May 2024

A JINR delegation visited Brazil to participate in the **Autumn Meeting of the Brazilian Physical Society** and a seminar of the Faculty of Physics of the **Federal University of Santa Catarina**. The delegation also visited the institutes of the National Nuclear Energy Commission.

International Cooperation

International Organisations

4 April 2024

The JINR Information Centre at the headquarters of the **Arab Atomic Energy Agency (AAEA)** hosted its first joint JINR-AAEA scientific event, a meeting of the Tunisian society ***Women in Nuclear Tunisia***.

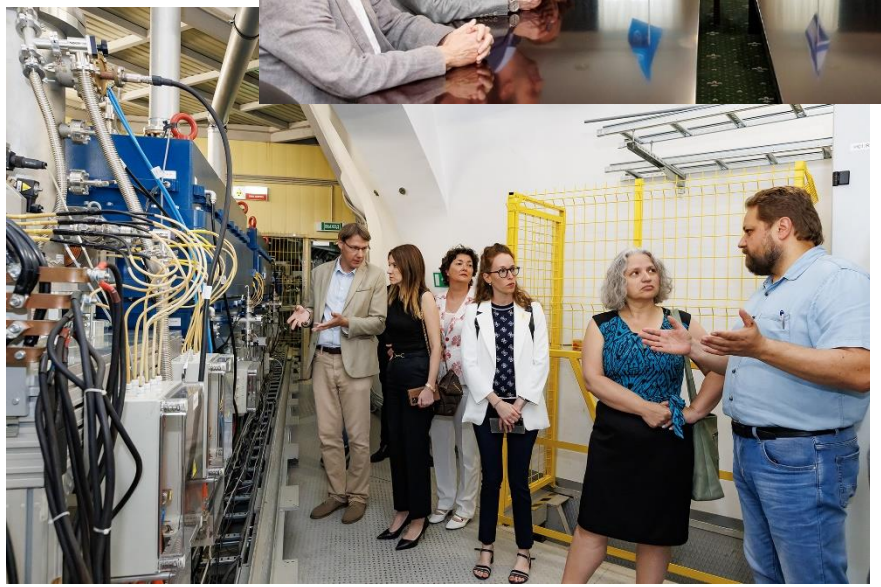
June 3–4 2024

The JINR hosted the stage of the regional School of the International Atomic Energy Agency (IAEA) and Rosatom on research reactors. At the JINR Neutron Physics Laboratory, foreign experts from 11 countries discussed the use of modern neutron sources to solve problems in the field of reactor physics.

Strengthening Partnerships

11 July 2024

Ambassador Extraordinary and Plenipotentiary of the State of Israel to the Russian Federation Simona Halperin visited the Joint Institute for Nuclear Research.



Awards

A team of authors with JINR participation received the prestigious **Galileo Galilei Award 2023 of Physica Medica** (European Journal of Medical Physics) for their work “Prediction of DNA rejoining kinetics and cell survival after proton irradiation for V79 cells using Geant4-DNA” as part of the Geant4-DNA International Collaboration.

FLNP JINR Leading Researcher M. Kiselev was awarded the **Pharmaceutics 2024 Best Paper Award** for the article “Methods of liposomes preparation: formation and control factors of versatile nanocarriers for biomedical and nanomedicine application”, co-authored with Senior Researcher at the University of Messina Domenico Lombardo (Italy).

By decree of the President of Mongolia dated 6 June 2024, Scientific Leader of the MLIT JINR **V. Korenkov** was presented with a state award, **the Friendship Medal**, for his contribution to the creation of a high-performance computing centre and the training of engineering and technical personnel at the Institute of Mathematics and Digital Technology of the Mongolian Academy of Sciences.

M. Frontasyeva, an employee of the neutron activation analysis and applied research sector of the FLNP JINR, took **5th place in the ranking of the best Russian scientists** in the field of environmental sciences for 2024, published by the leading scientific and educational platform Research.com.

On 4 February, the highest award of the Government of the People’s Republic of China for foreigners, **the Friendship Prize** was awarded to FLNP JINR Senior researcher **Yu. Gledenov** for his significant contributions to China’s modernization and development of international cooperation at the Great Hall of the People in Beijing.

Российская Академия Наук

The Veksler Prize of the Russian Academy of Sciences for 2024 awarded to A.Butenko, A.Sidorin and GT for the series of works “Multifunctional complex of heavy ion accelerators - NICA collider injector.”

A Festive Event Dedicated to the Beginning of the 2024–2025 Academic Year

On September 9, a festive event dedicated to the beginning of the 2024–2025 academic year took place in the building of the Moscow State University Branch in Dubna.

JINR Dissertation Councils: Turning 100th Defense

Since 1 September 2019, **102 dissertations** were defended in the JINR Dissertation Councils, including **80 PhD theses** and **22 Dr. Sc. Theses**.

In 2024, **11 dissertations** were defended, including **7 PhD theses** and **4 Dr. Sc. theses**.

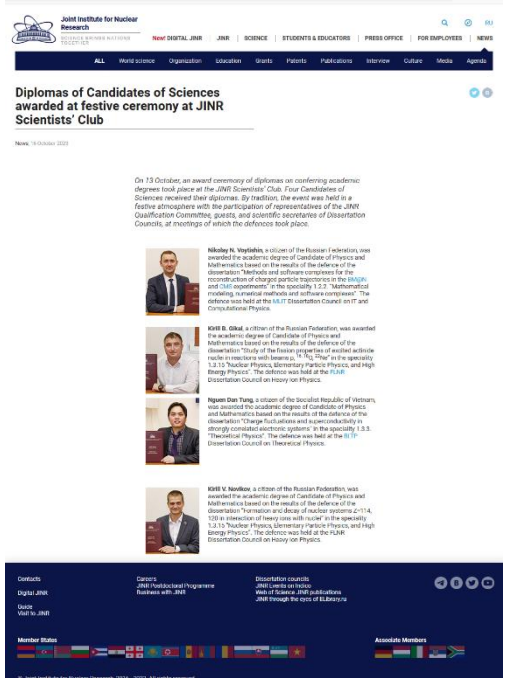
The JINR Qualification Committee pays special attention to self analysis of processes of getting academic degrees at JINR and acts in close coordination with the Higher Qualification Committee under the Ministry of Science and Higher Education of the Russian Federation.

JINR Qualification Committee holds round tables on the experience of independent awarding academic degrees.

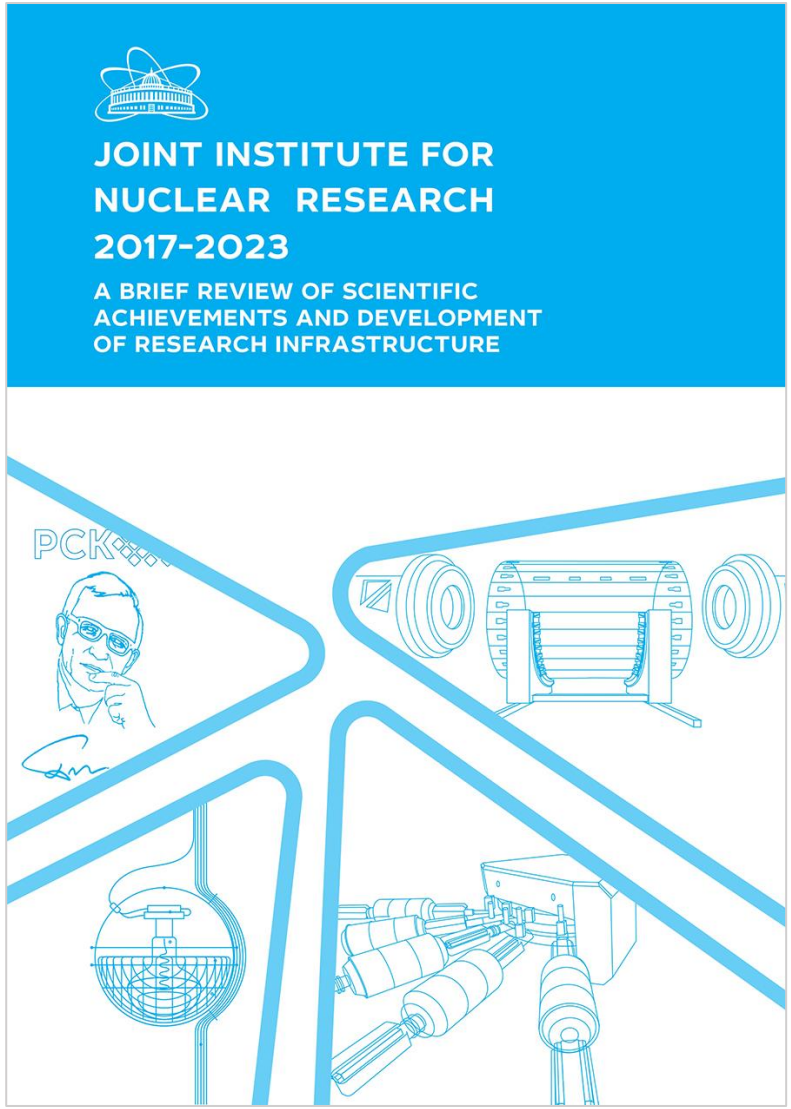
On 11 July, the a **Round Table with scientific secretaries of the JINR dissertation councils** was held. It was focused on the feedback of laboratories regarding the activity of local dissertation councils as well as on best practices in solving organizational issues.

Round table discussions summarize JINR's experience in independent conferring of academic degrees and provide a necessary ground for sharing this experience with the Ministry upon its request.

JINR regularly posts the information on new diploma awardees on the web



A Brief Overview of the Most Important JINR Results: the Fulfilled Seven-Year Period (2017-2023)



A brief review of scientific achievements and development of research infrastructure of the Joint Institute for Nuclear Research in 2017 – 2023 was published in English and Russian.

The publication provides an overview of the stages of development of the JINR infrastructure and main scientific projects. In addition, the achievements of the Joint Institute's employees honoured with prestigious scientific awards and prizes are presented. The JINR Development Monitoring chapter highlights significant statistical indicators reflecting the dynamics and rate of changes that took place in the Institute over the past seven years.

Scientific results were obtained in the following areas:

- heavy-ion physics;
- low-energy nuclear physics;
- theoretical physics;
- neutrino physics and astrophysics;
- condensed matter physics;
- neutron nuclear physics;
- radiation and radiobiological research;
- applied research and life sciences;
- information technology and computational physics.


Thank you for your attention!