JOINT INSTITUTE FOR NUCLEAR RESEARCH
1956

Introduction & Review

Dr. D. Kamanin, JINR

JINR – Egypt 01/03/2022

Several facts about Russian Federation – JINR host country

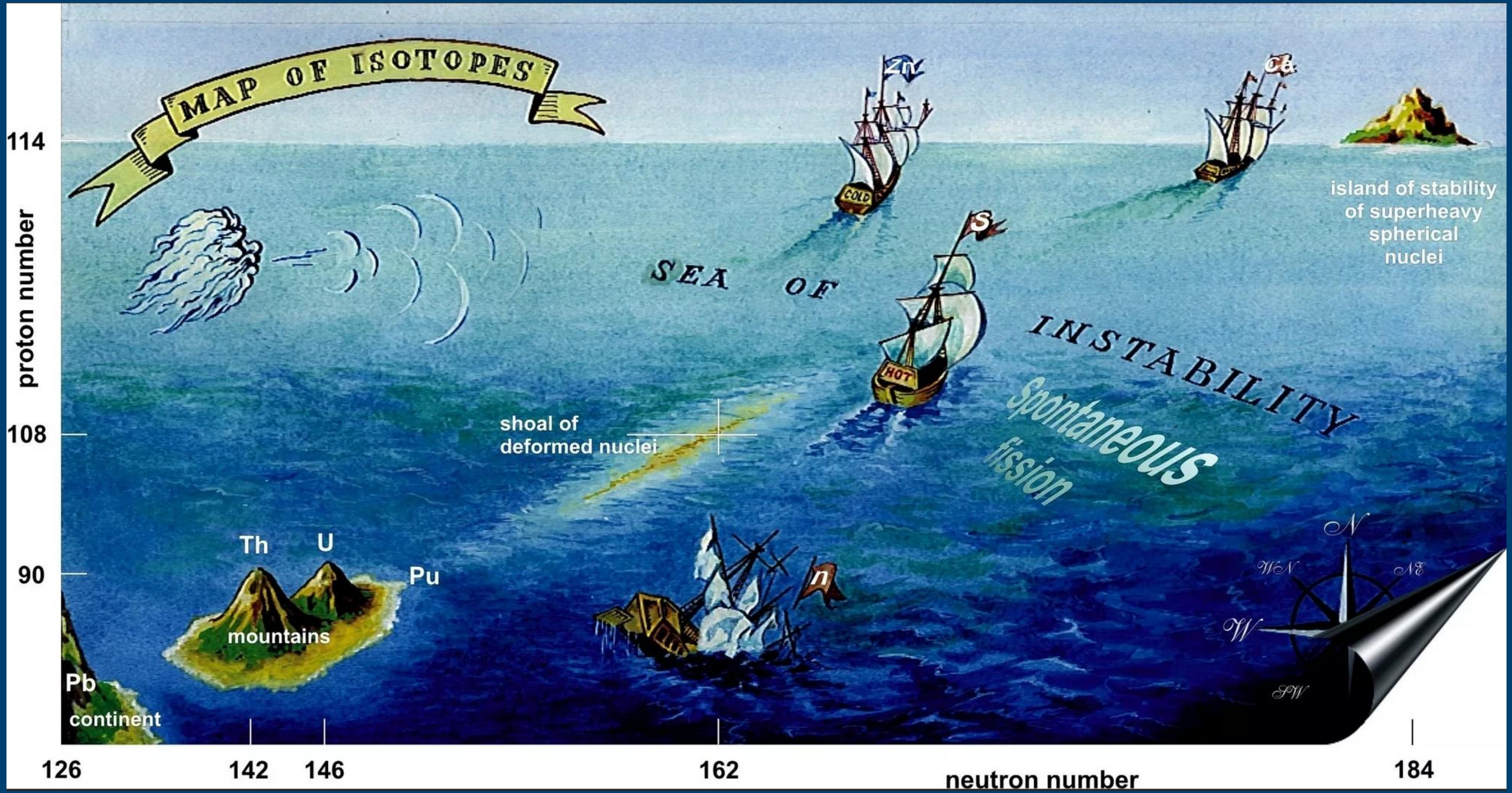
Distance from the westernmost to the easternmost point of Russian Federation ≈ 10 000 km

Distance from Moscow to Cape Town ≈ 10 000 km

Dubna is the center of European part of Russia

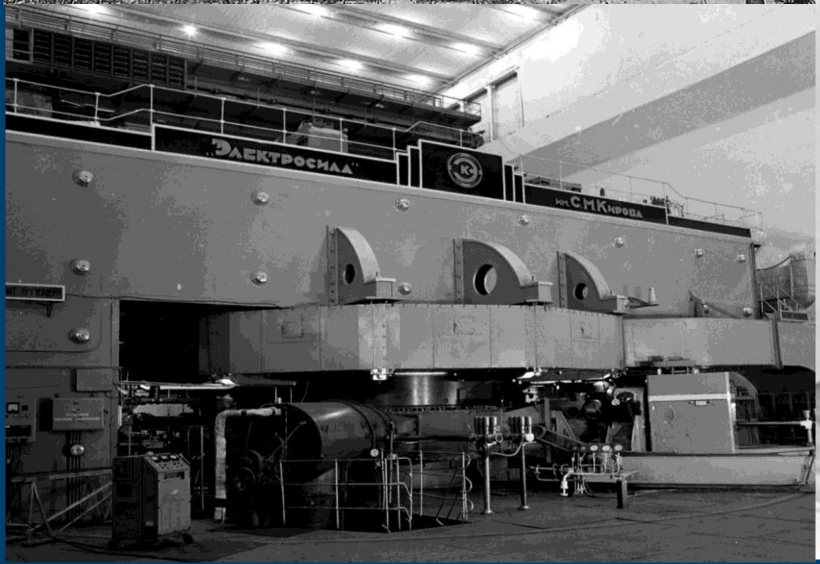
Welcome to Dubna – Island of Stability

History during 75 years and some geography




Hotel
JINR
SEZ “Dubna”
Moscow 115 km
Tver 75 km

Dubna early years - synchrocyclotron



1946 - a decision was made to develop the largest in the world at that time particle accelerator

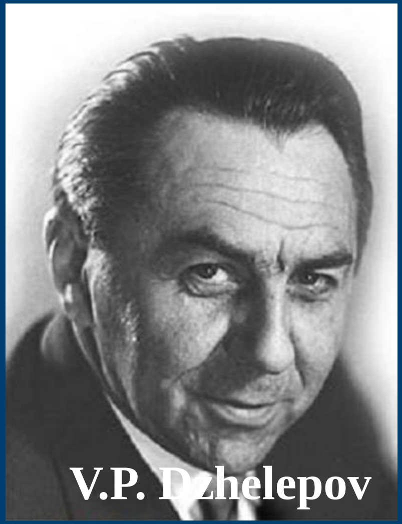
1946-1953 – Hydrotechnical Laboratory, branch of the Atomic Energy Institute

1946-1949 - building of the first accelerator in Dubna – **SYNCHROCYCLOTRON**

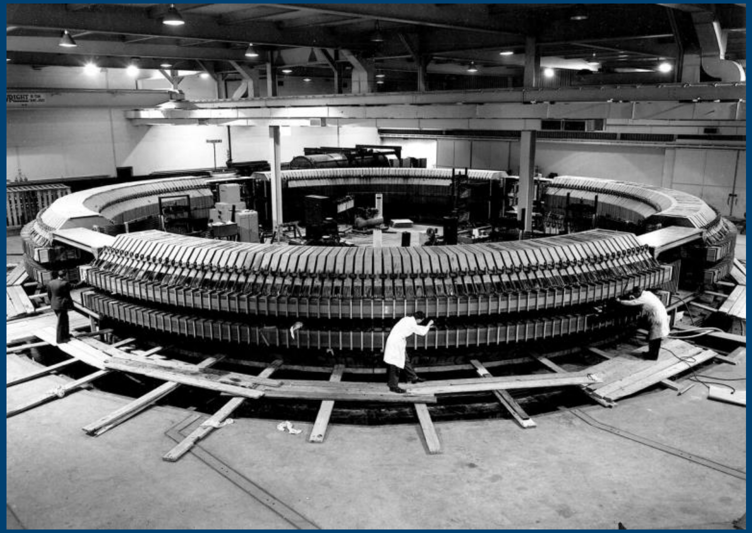
1946, December 14 – launch of the synchrocyclotron

1953 – establishment of the Institute of nuclear Problems of the USSR Academy of Sciences

Since 1956 – Laboratory of Nuclear Problems of JINR



DUBNA early years - synchrophasotron



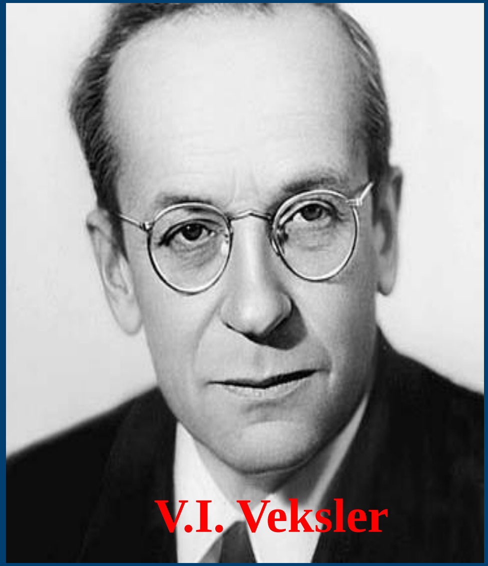
1944 - V.I. Veksler discovered the principle of autophasing, as a result of which the maximum energy significantly increased acceleration and it became possible to create a synchrophasotron

1949 - the beginning of **SYNCHROPHASOTRON** construction under the direction of V.I.Veksler

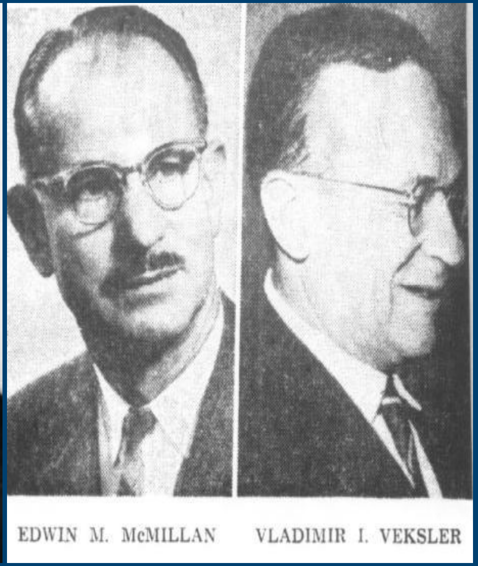
1953 - Electrophysical Laboratory of the USSR Academy of Sciences was established (EL)

March 26, 1956 – EL became part of JINR as the Laboratory of High Energy Physics

April 1957 - launch of the **synchrophasotron**. At that time it was the largest accelerator in the world.



V.I. Veksler



EDWIN M. McMILLAN VLADIMIR I. VEKSLER

JINR founding: International background

- 1949 – foundation of the **Council of Europe** to promote human rights, democracy and rule of law in Europe

1949, 14 December

- 1951 – foundation of the **European Coal and Steel community.** The goal - to regulate industrial production under a common authority. European integration launched which led to the European Union
- 1954, 29 September – the **European Organization for Nuclear Research (CERN)** was founded in response to the interest of many European countries and as a counterbalance to American superiority in the field of nuclear research
- 1955, April – Bandung Conference (Indonesia), Non-Aligned Movement milestone
- 1955, August - International Conference on the Peaceful Uses of Atomic Energy in Geneva
- 1954 – the principle of peaceful coexistence is introduced as one of the basics in international relations (5 postulate, China-India Agreement),
- 1956, February – 20th Congress of the CPSU: the principle of peaceful coexistence becomes the basis for foreign policy of the Soviet Union, JINR hosting country
- 1956, 26 March JINR was founded

1957, 15 March

- 1957, 29 July - IAEA was created in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology
- 1957, July – **Pugwash Conference**(Canada) united scientists from East and West to discuss jointly global issues.

Establishment of the Joint Institute for Nuclear Research

The Joint Institute for Nuclear Research (JINR) is an international intergovernmental scientific research organization established under the Convention signed on 26 March 1956 in Moscow to unite scientific and material potential of its Member States in order to study fundamental properties of matter

Contributions
of JINR founding countries in 1956

№ №	Country	Amount of equity participation
1	USSR	47,25%
2	People's Republic of China	20%
3	German Democratic Republic	6,75%
4	Polish People's Republic	6,75%
5	Romanian People's Republic	5,75%
6	Czechoslovak Republic	5,75%
7	People's Republic of Hungary	4%
8	People's Republic of Bulgaria	3,6%
9	People's Republic of Albania	0,05%
10	Democratic People's Republic of Korea	0,05%
11	Mongolian People's Republic	0,05%

The results of research carried out at the Institute can be used solely for peaceful purposes for the benefit of mankind.

JINR as an exhibition of Soviet science achievements in 1950es

Dag Hammarskjöld, 3rd Secretary-General of the United Nations, 1958

President of Egypt Gamal Abdel Nasser, 1958

Prime Minister of the United Kingdom Maurice Harold Macmillan and Soviet Minister of Foreign Affairs Andrey Gromyko, 1959

Maurice Thorez, leader of the French Communist Party, 1959

Nobel laureates - guests of JINR

№	Name	Country	NP receipt	Visit to JINR
1	Jean Frédéric Joliot-Curie	France	1935	1956
2	Paul Adrien Maurice Dirac	Great Britain	1933	1958
3	John Douglas Cockcroft	Great Britain	1951	1958
4	Isidor Isaac Rabi	USA	1944	1959
5	Patrick Maynard Stuart Blackett	Great Britain	1948	1959
6	Cecil Frank Powell	Great Britain	1950	1959
7	Owen Chamberlain	USA	1959	1960
8	Emilio Gino Segrè	USA	1959	1960
9	Niels Bohr	Denmark	1922	1961
10	Glenn Theodore Seaborg	USA	1951	1963
11	Edwin Mattison McMillan	USA	1951	1963
12	Yang Zhenning	China, USA	1957	1970
13	Burton Richter	USA	1976	1986
14	Karl Alexander Müller	Switzerland	1987	1989
15	Melvin Schwartz	USA	1988	1993
16	Ilya Prigogine	Belgium	1977	1999
17	James Watson Cronin	USA	1980	2006
18	David Gross	USA	2004	2016

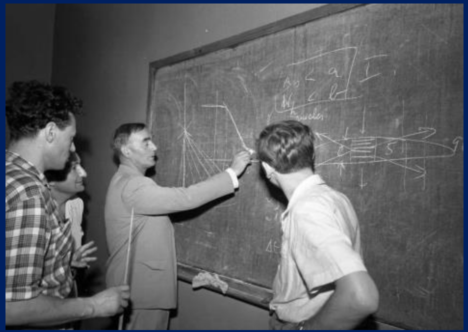

Paul Adrien Maurice Dirac


Owen Chamberlain


Isidor Isaac Rabi


John Douglas Cockcroft


Emilio Gino Segrè


Cecil Frank Powell


Burton Richter


Karl Alexander Müller


Melvin Schwartz


David Gross

The most important milestones in the history of JINR

Formation, 0+

Moscow, 26th March 1956

***12 countries - founders*:**
Albania, Bulgaria, China, Czechoslovakia, DPRK, German Democratic Republic Hungary, Mongolia, Poland, Romania, USSR, Vietnam

International legal framework: Intergovernmental Agreement on the Organization of JINR of 1956, The Convention on the Legal Status, Privileges and Immunities of Interstate Economic Organizations of December 5, 1980, the Charter of JINR, etc. regulatory and legal documents; Privileges and immunities of the Ministry of Defense, the highest governing body: the international governing Council-CPT, the priority of the decisions of the CPT over the legislation of the country of residence

New Era, 35+

Session of the Committee of Plenipotentiaries, Dubna, 17th March, 1993

New member states:

- *Belarus, Russia, Ukraine (December 1991)*
- *Armenia, Azerbaijan, Georgia, Kazakhstan, Moldova (March 1992)*
- *Uzbekistan (July 1992)*
- *Czech and Slovak Republics (March 1993)*

Associate members:
Germany (July 1991), Hungary (February 1993), Italy (December 1996)

Agreement between the Government of the Russian Federation and JINR on the Location and Terms of Operation of JINR in the Russian Federation
Ratified by the Federal Law of the Russian Federation January 2, 2000 N 39-FZ

Main features of the Agreement:
- inviolability of territory allocated to JINR and all JINR premises;
- non-resident status for JINR on the territory of RF;
- immunities and privileges, including tax, custom duty exemptions for JINR regular activities;
- tax exemptions for expat JINR staff members.

Today, 50+

New associate members:
Republic of South Africa(2005),
Republic of Serbia (2007),
Arab Republic of Egypt (2009)

15th December, 2018, ASRT, Cairo
Signing of the JINR-ARE road map

17th October, 2019, Dubna
Signing of the JINR-Serbia road map

New Member State
Arab Republic of Egypt (2021)

JOINT INSTITUTE FOR NUCLEAR RESEARCH
1956

What is the Joint Institute for Nuclear Research

Member States, Laboratories, Budget, Personnel, JINR-CERN

JINR Member States and Partner Network

Partner network – over 1000 destinations in more than 70 countries

19 Member States

Armenia	1956/1992
Azerbaijan	1956/1992
Belarus	1956/1991
Bulgaria	1956
Cuba	1976
Czech Republic	1956/1993
Egypt	**2021**
Georgia	1956/1992
Kazakhstan	1956/1992
DPRK (suspended 2015)	1956
Moldova	1956/1992
Mongolia	1956
Poland	1956
Romania	1956
Russian Federation	1956/1991
Slovakia	1956/1993
Ukraine	1956/1991
Uzbekistan	1956/1992
Vietnam	1956

5 Associated members

Germany	1991
Hungary	1993
Italy	1996
Serbia	2007
South Africa	2005

105 Db Дубний [262] Dubnium

Collaborating organizations from JINR Topical Plan 2021

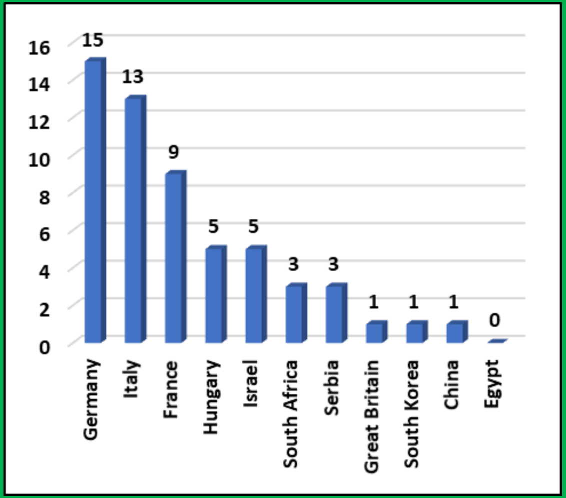
	Russia (host)	189
1.	USA	92
2.	Germany	63
3.	Italy	51
3.	France	44
4.	Romania	37
6.	Poland	34
7.	Japan	31
8.	Great Britain	25
9.	Belarus	24
10.	China	23
11.	Ukraine	22
12.	South Korea	22
13.	Czech Republic	21
14.	India	21
15.	Bulgaria	20
....		

Member States of EU **363**
New agreements 51

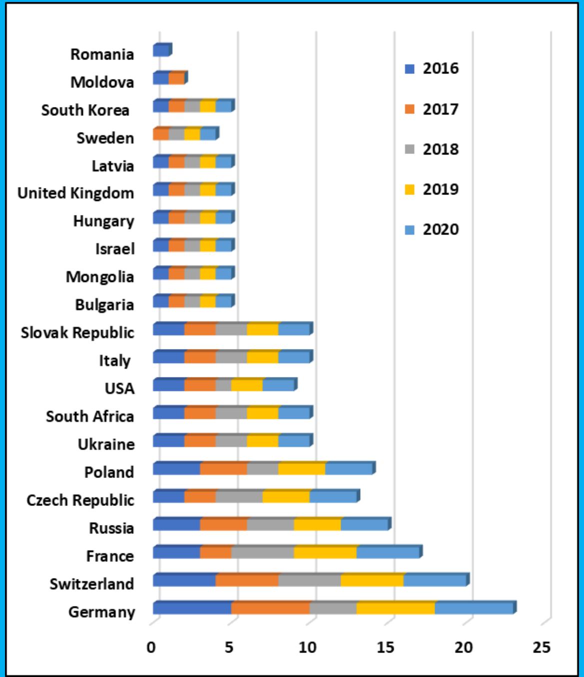
International JINR staff
1263 Researchers
from 33 countries
450 Expats
> 140 from EU Member States

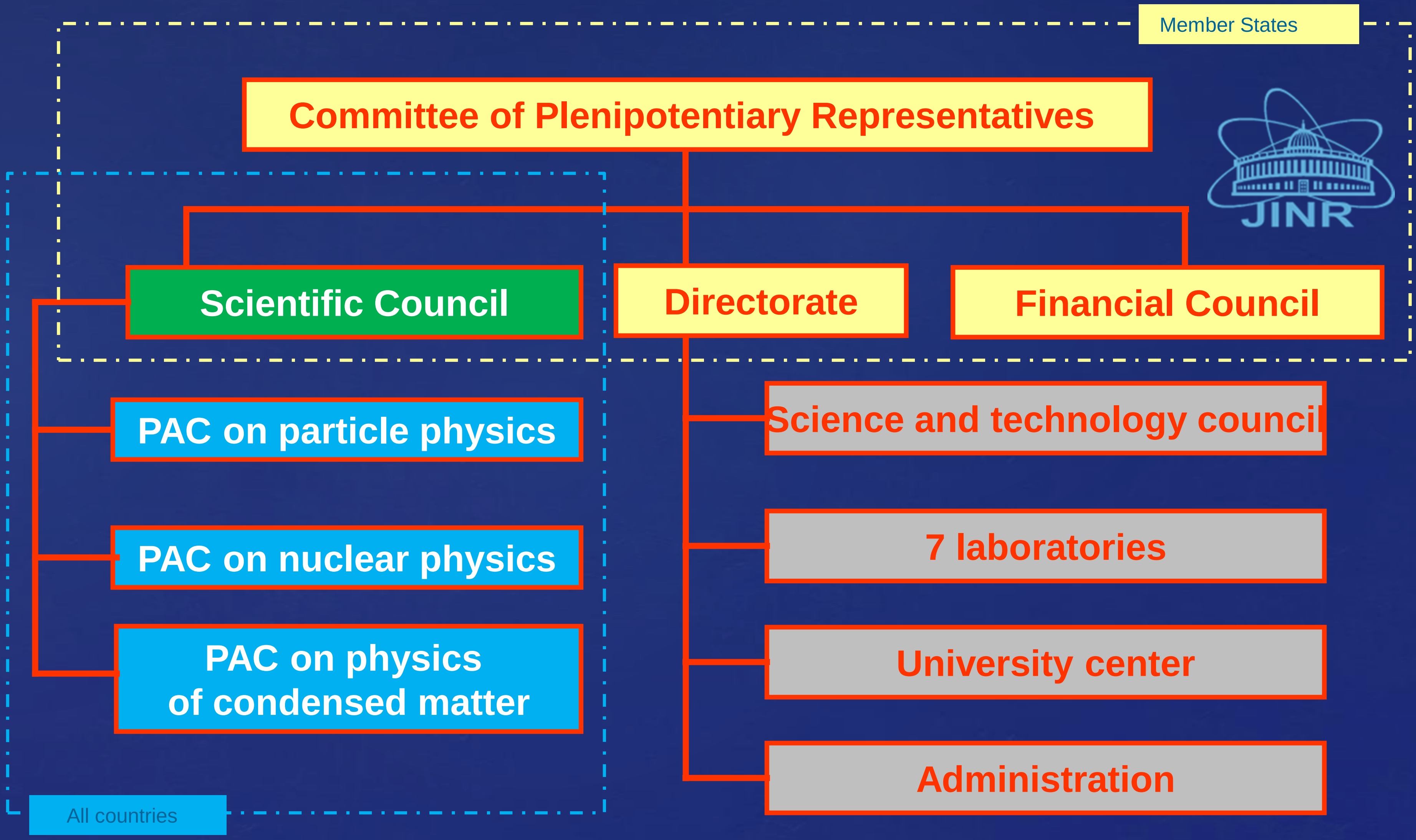
International Expertise in JINR Management

Non-member states
in SC sessions 2016-2020



Presence in PAC





JINR laboratories and research infrastructure

Bogoliubov Laboratory of Theoretical Physics

Dzhelepov Laboratory of Nuclear Problems

Flerov Laboratory of Nuclear Reactions

Frank Laboratory of Neutron Physics

Laboratory of Radiation Biology

Mescheryakov Laboratory of Information Technologies

Veksler and Baldin Laboratory of High Energy Physics

5 cyclotrons in FLNR

First full scale experiment 2021

Cyclotron DC-280 / Superheavy Elements Factory

Together with Tier-1 for CMS and cloud computing

Launched in 2018

Supercomputer "Govorun"

Reached 0.4 km^3 in 2021

Baikal Neutrino Telescope in Irkutsk

15 instruments, user-programme

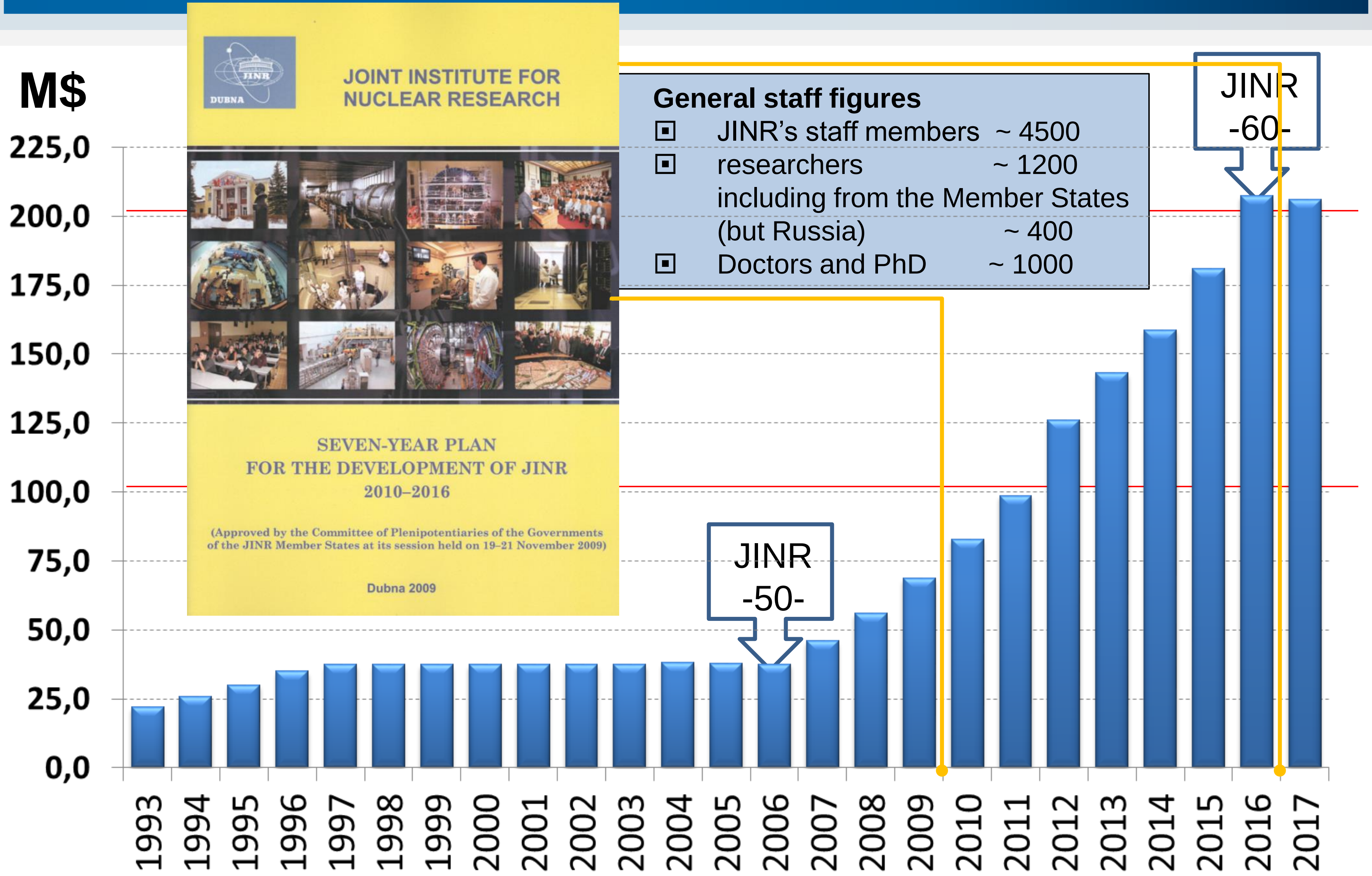
Full power in 2012

IBR-2 Pulsed Research Reactor

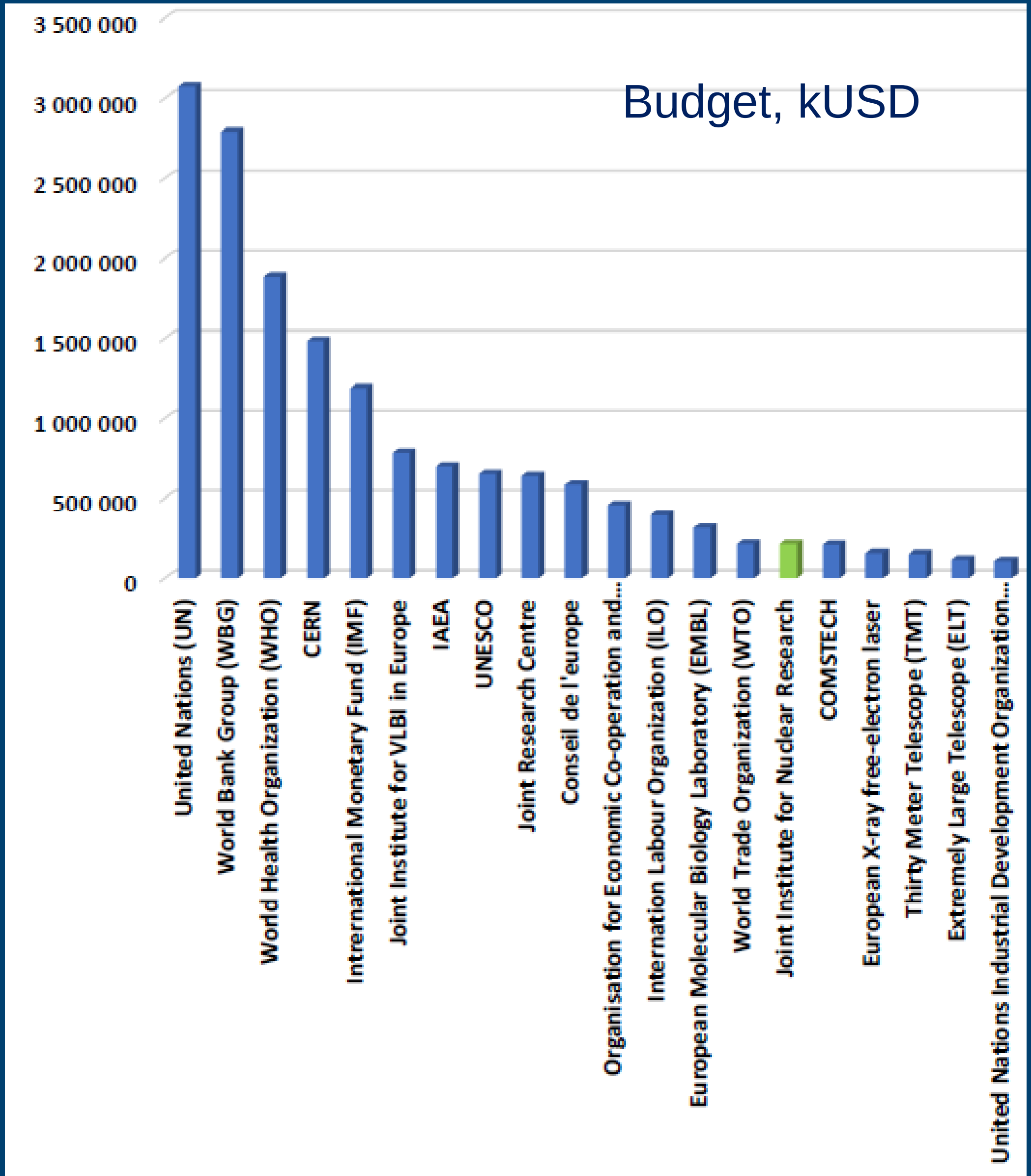
JINR budget dynamics since 1993

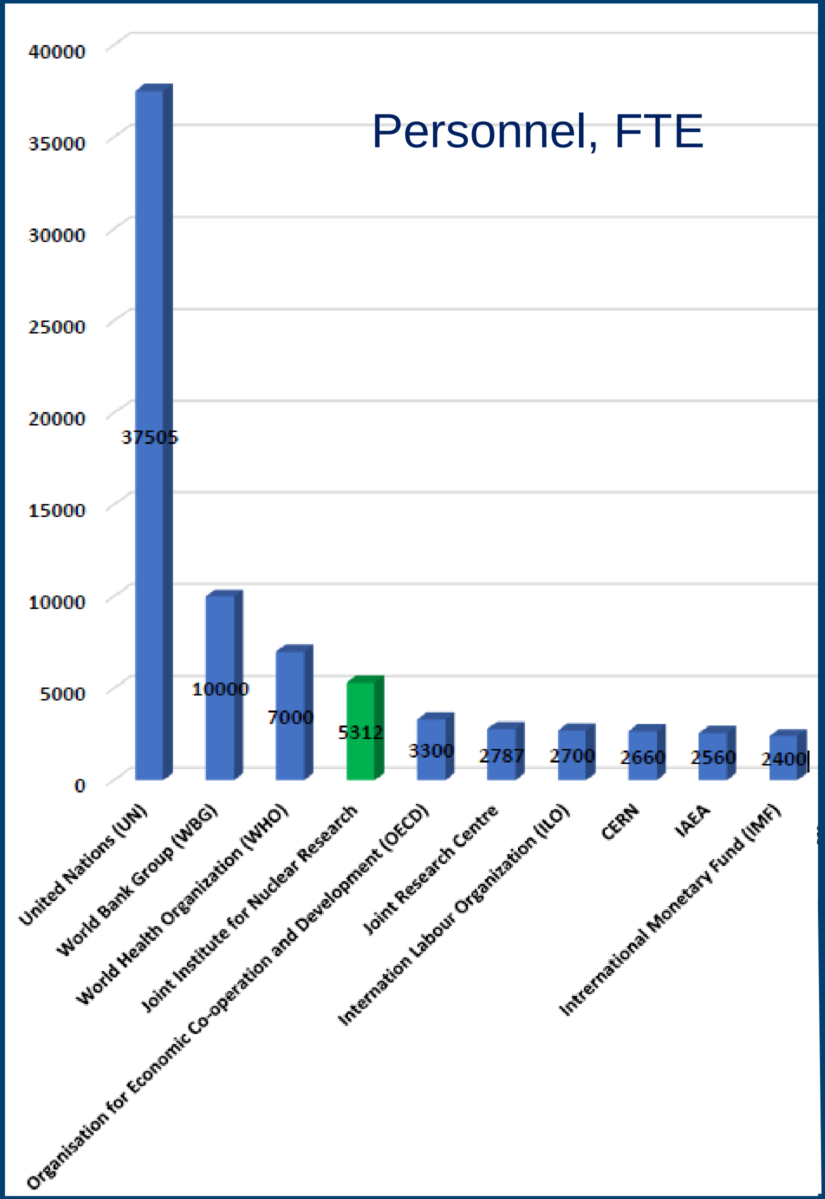
General staff figures

- JINR's staff members ~ 4500
- researchers ~ 1200
  including from the Member States (but Russia) ~ 400
- Doctors and PhD ~ 1000



JINR among other IGOs





Cooperation with CERN

CERN has been JINR's main partner in Particle Physics for over 50 years.
Dubna physicists are widely involved in more than
20 CERN projects, including 3 LHC experiments & LHC itself

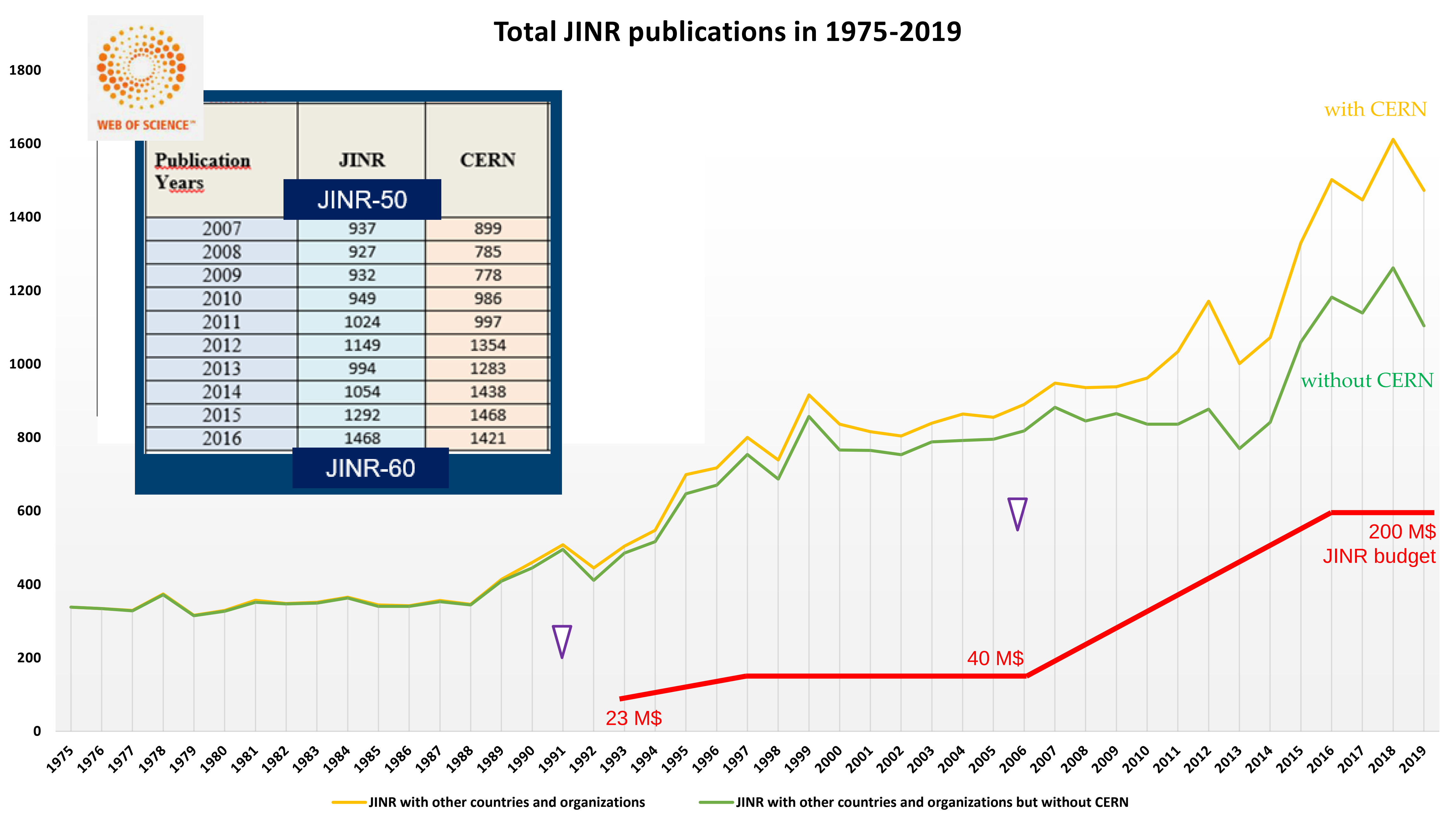
1963, JINR, Dubna
CERN Director-General
Prof. V.Weisskopf,
Prof. V.Dzhelepov and
Prof. B.Pontecorvo

2004, JINR Dubna
CERN Director-General Dr R.Aymar
meeting with
JINR director acad. V. Kadyshevsky

1971, Dubna
CERN Director-General Prof. W.Jentschke
and JINR Director Prof. N.Bogoliubov

2010: CERN – JINR mutual participation in their projects
2014: CERN – JINR reciprocal Observer status

Total JINR publications in 1975-2019

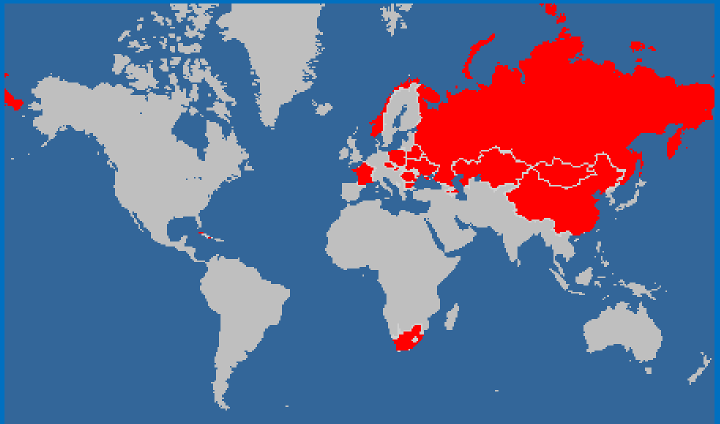


Publication Years	JINR	CERN
2007	937	899
2008	927	785
2009	932	778
2010	949	986
2011	1024	997
2012	1149	1354
2013	994	1283
2014	1054	1438
2015	1292	1468
2016	1468	1421

JINR is a part of global research coordination network

Major IGO partners of JINR

New strategic partnership



>100 international meetings/year

JINR works closely with ESFRI, ILL, ESS, XFEL, ApPEC, ICFA, ECFA and many others

BRICS

15-16 May 2017

Two-day meeting of the BRICS Working Group on Research Infrastructure and Mega-Science projects. Meeting was focused on cooperation within BRICS based on Research Infrastructures and Mega-Science Projects.

GSO

9-12 October 2017

The 10th Meeting of the Group of Senior Officials on Global Research Infrastructures. Main meeting task - the formulation of strategies and specifying the directions of RI development.

NuPECC

21-22 June 2019

The 95th meeting of the Nuclear Physics European Collaboration Committee (NuPECC). Meeting was devoted to implementation of the European Long Range Plan for nuclear physics and coordination of activities of nuclear physics centres in Europe

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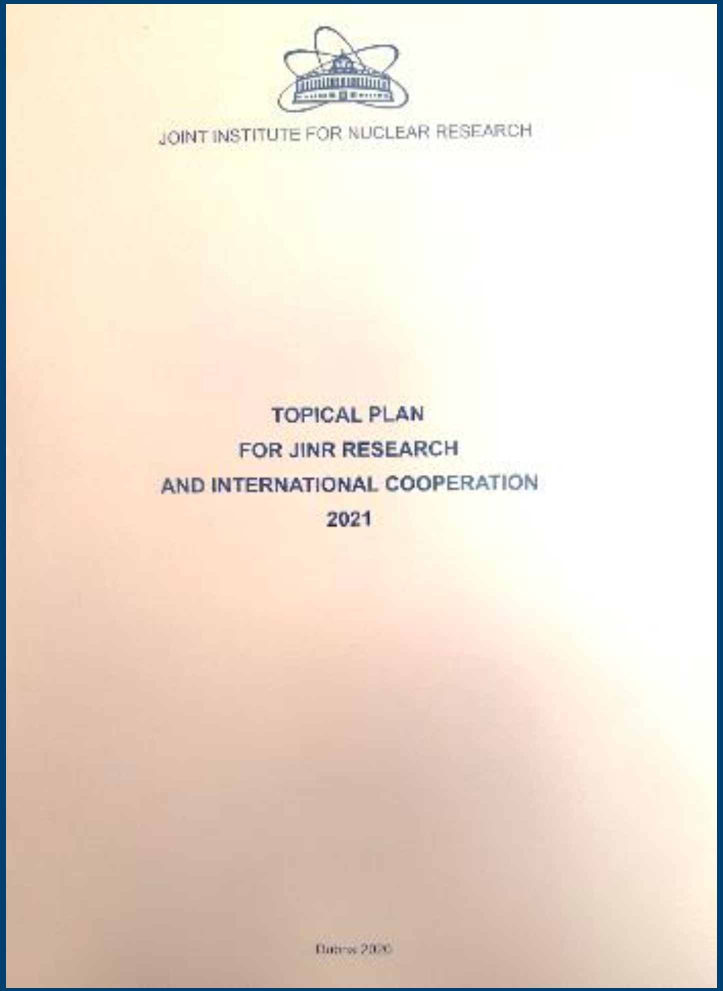
Research infrastructure of the Joint Institute for Nuclear Research


JOINT INSTITUTE FOR NUCLEAR RESEARCH

TOPICAL PLAN
FOR JINR RESEARCH
AND INTERNATIONAL COOPERATION
2021

Dubna 2020

http://www.jinr.ru/docs-en/

FLNR accelerator complex

Stable and radioactive nuclei, superheavy elements

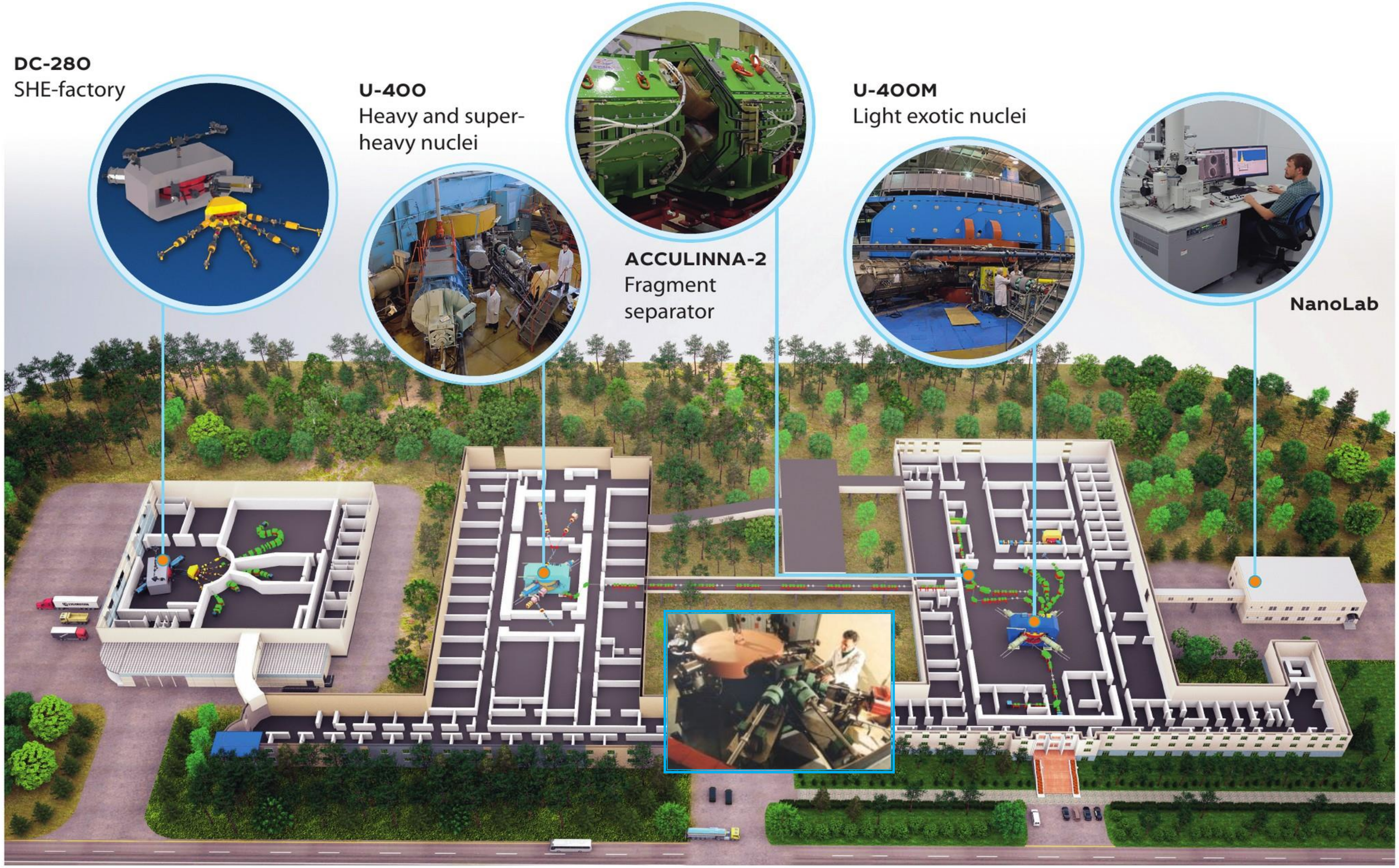
Study for Limits of nuclear matter

Radiochemistry

Nanotechnologies

Nuclear Medicine

Track membranes, Space, Electronics



International Union of Pure and Applied Chemistry

May 2012:
Official approval of the name *Flerovium* for element *114*
and the name *Livermorium* for element *116*

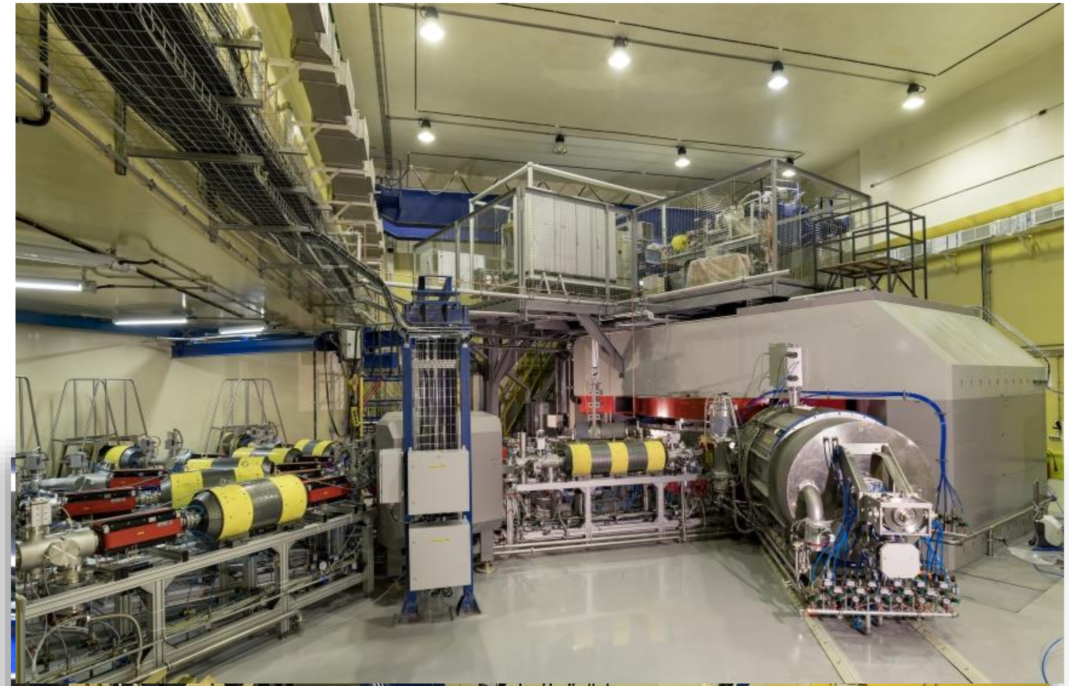
30th December 2015:
Approval of the discovery of new elements *113, 115, 117, and 118*

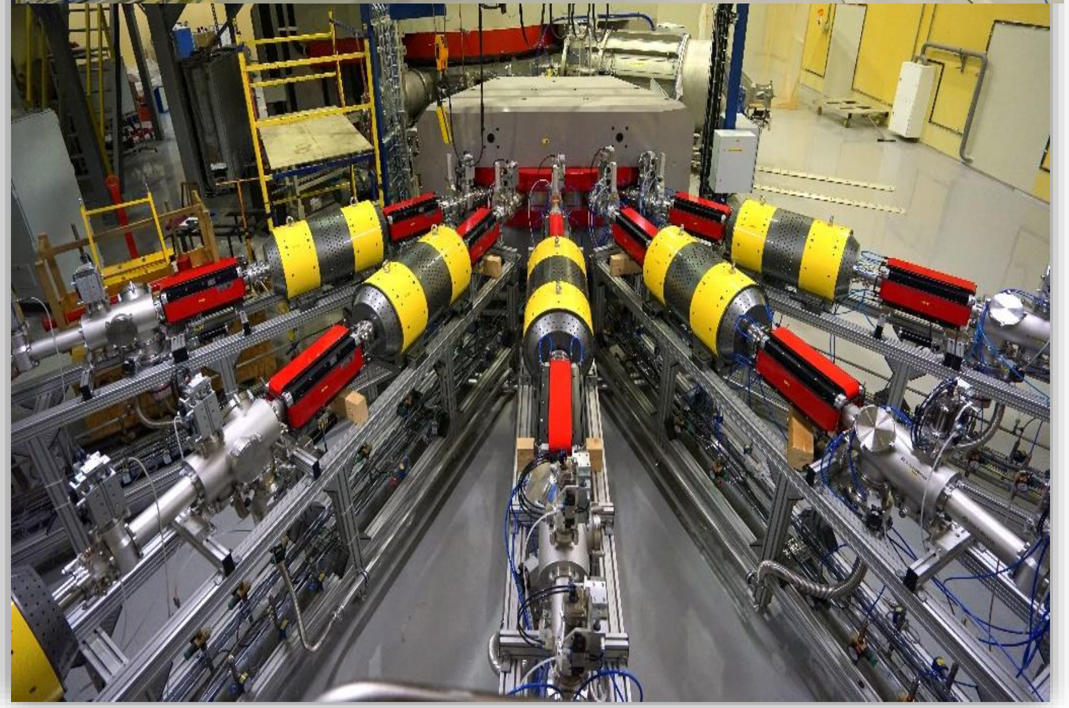
- element 113: RIKEN (Japan)
- elements *115* and *117*: JINR (Dubna) - LLNL (USA) – ORNL (USA) collaboration
- element *118:* JINR (Dubna) – LLNL collaboration.

28th November 2016:
IUPAC formally approved names and symbols of new elements:

Nihonium (Nh) for element 113,
Moscovium (Mc) for element **115**,
Tennessine (Ts) for element **117**, and
Oganesson (Og) for element **118**.

All these elements were synthesized for the first time at the U-400 accelerator complex of the Flerov Laboratory of Nuclear Reactions of JINR.





DC-280 cyclotron

DC280 (expected) E=4÷8 MeV/A		
Ion	**Ion energy [MeV/A]**	**Output intensity**
^{7}Li	4	1×10^{14}
^{18}O	8	1×10^{14}
^{40}Ar	6	6×10^{13}
^{48}Ca	6	$6,2\times10^{13}$
^{50}Ti	6	$3,1\times10^{13}$
^{54}Cr	6	2×10^{13}
^{58}Fe	5	1×10^{13}
^{124}Sn	5	2×10^{12}
^{136}Xe	5	1×10^{14}
^{238}U	7	5×10^{10}

First test beam – very end of 2018
Officially launched – 25 March 2019

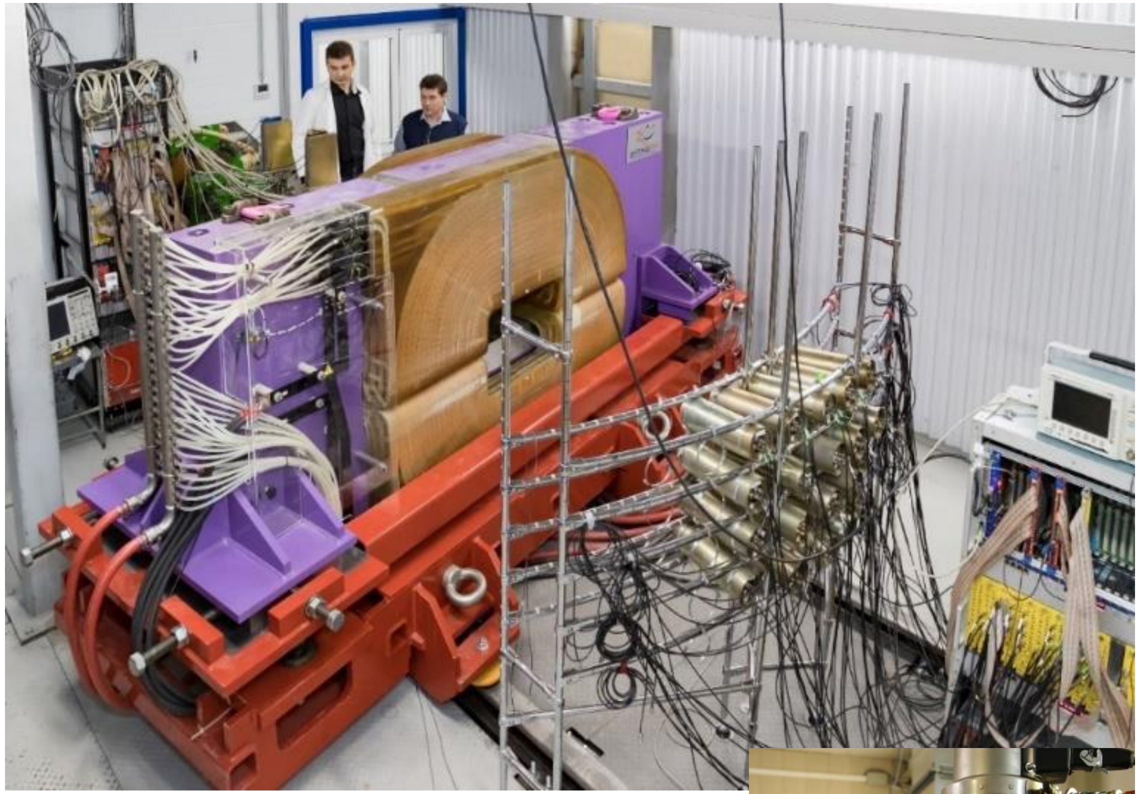
FRAGMENT SEPARATORS ACCULINNA-I, II

Experiments with radioactive beams with $Z \leq 36$

RIB*	Intensity, pps (at 1 pμA)	Energy, MeV/A
^{6}He	$4x10^{7}$	22
^{6}He	$1x10^{7}$	13
^{8}He	$8x10^{4}$	23
^{11}Li	$7x10^{3}$	33
^{14}Be	$2x10^{3}$	35
^{15}B	$4x10^{5}$	32
^{16}C	$2x10^{7}$	29
^{18}C	$1x10^{4}$	25
^{24}O	$2x10^{3}$	23
^{8}B	$2x10^{6}$	16
^{13}O	$1x10^{6}$	24
^{17}Ne	$2x10^{6}$	30
^{24}Si	$7x10^{3}$	12
^{28}S	$1x10^{3}$	38

* - expected RIB's characteristics at ACCULINNA-2; RIB's intensities for ACCULINNA-1 are lower by factor of ~20

http://aculina.jinr.ru/acc-2.php



Zero-angle magnet

experiments with radioactive-ion beams

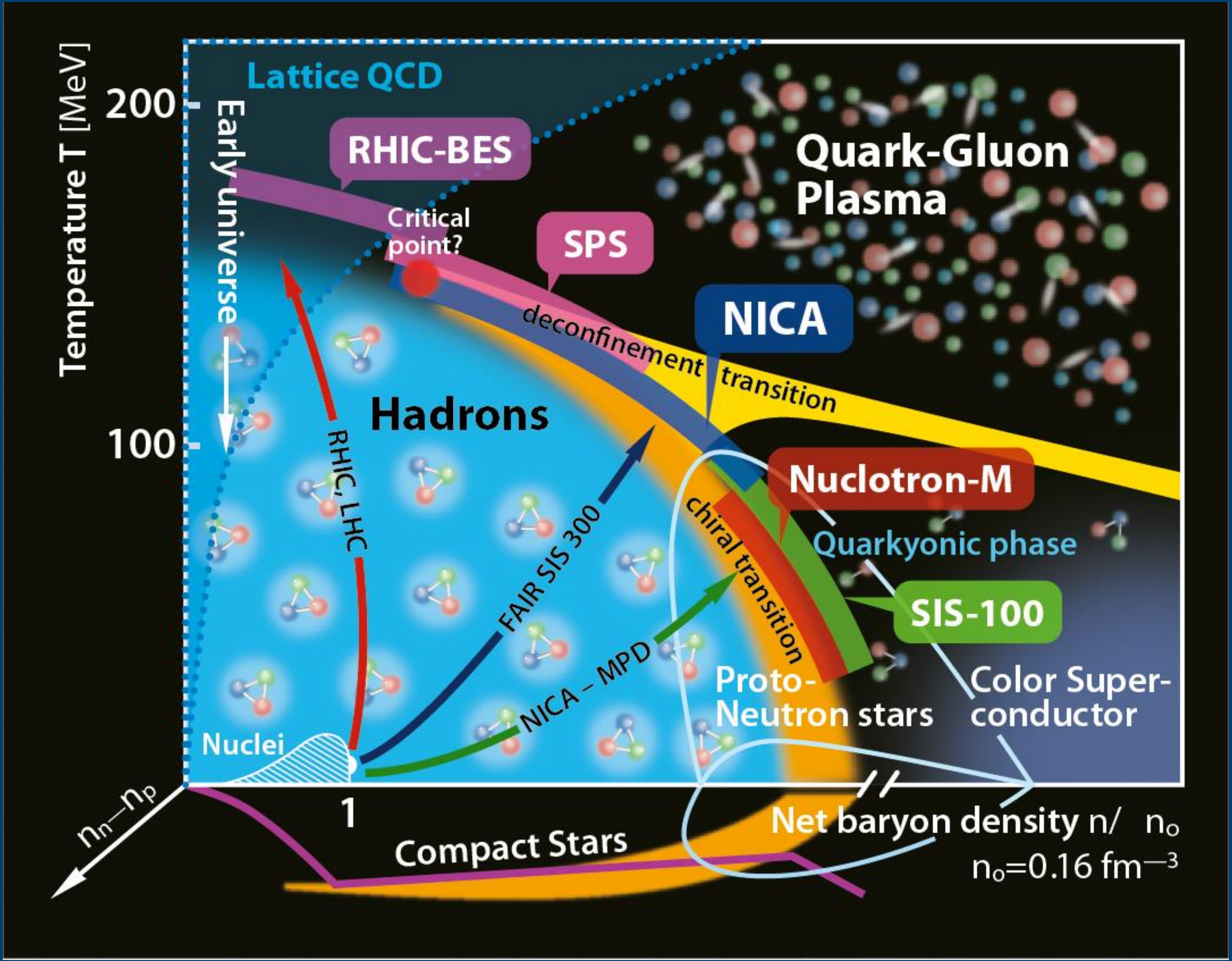
(2018) first experiments with ^{6}He и ^{9}Li:

^{6}He(d,^{3}He)^{5}H and ^{9}Li(d,p)^{10}Li

Cryogenic target system (tritium, deuterium)

NICA Layout

25 March 2016. NICA “corner stone” ceremony at LHEP JINR



Temperature T [MeV]
200
100
Lattice QCD
Early universe
RHIC-BES
Critical point?
SPS
NICA
Quark-Gluon Plasma
deconfinement transition
Hadrons
RHIC, LHC
FAIR SIS 300
NICA – MPD
chiral transition
Nuclotron-M
Quarkyonic phase
SIS-100
Proto-Neutron stars
Color Super-conductor
Nuclei
1
$n_n - n_p$
Compact Stars
Net baryon density n/ n_o
n_o=0.16 fm^{-3}

JINR flagship project – collider complex NICA

NICA basic configuration cost is about $500 mln.

Top-5
Contract allocations / industrial return in 34 countries / incl. 7 Member States

- Russia (host country)
1. Italy
2. Poland
3. Germany
4. Czech Republic
5. France

Location: JINR/Dubna

Photo: April 2021

Superconductor magnets fabrication and certification for NICA and SIS-100/FAIR

NICA booster delivered the first beam in December 2020

Impact of NICA superconductor accelerator on engineering infrastructure and industry, e.g.

1. Factory for SC magnets in JINR
-» new tasks for high precision mechanical industry in MS

2. Advanced cryogenic complex
-» highest productive He liquefier in RF @JINR

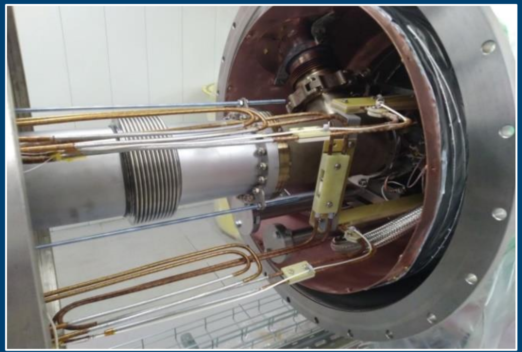
3. JINR know-how in fast oscillating superconductive magnets for accelerators
-» future project of superconductive magnet energy storage

Launched in 2016

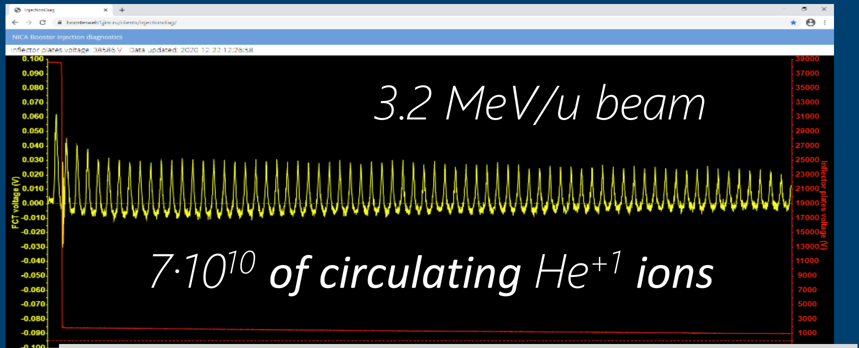
NICA: Booster commissioning. The first run

Technological start-up of the Booster, 23 December 2019

20 November 2020, start of technological run.
Russian Prime-minister Mikhail Mishustin



All SC magnets of the NICA Booster are manufactured, tested and installed in the tunnel inside the old Synchrophasotron playing the role of biological shield.



December 19th – first beam circulation @ Booster

Stimulating role of NICA detector collaborations

MPD Collaboration

12 countries
44 Institutes/Universities
>500 participants (485 authors)

5 Physics working groups:

- Global observables
- Light flavour & hypernuclei
- Correlations & fluctuations
- Electromagnetic probes
- Heavy flavour

December 25, 2020

BM@N Collaboration

10 countries
19 Institutes/Universities
255 participants

Extended physics programme of the ongoing experiment:

- Short-range correlations
- Hyperons & hypernuclei
- Heavy ion physics, etc.

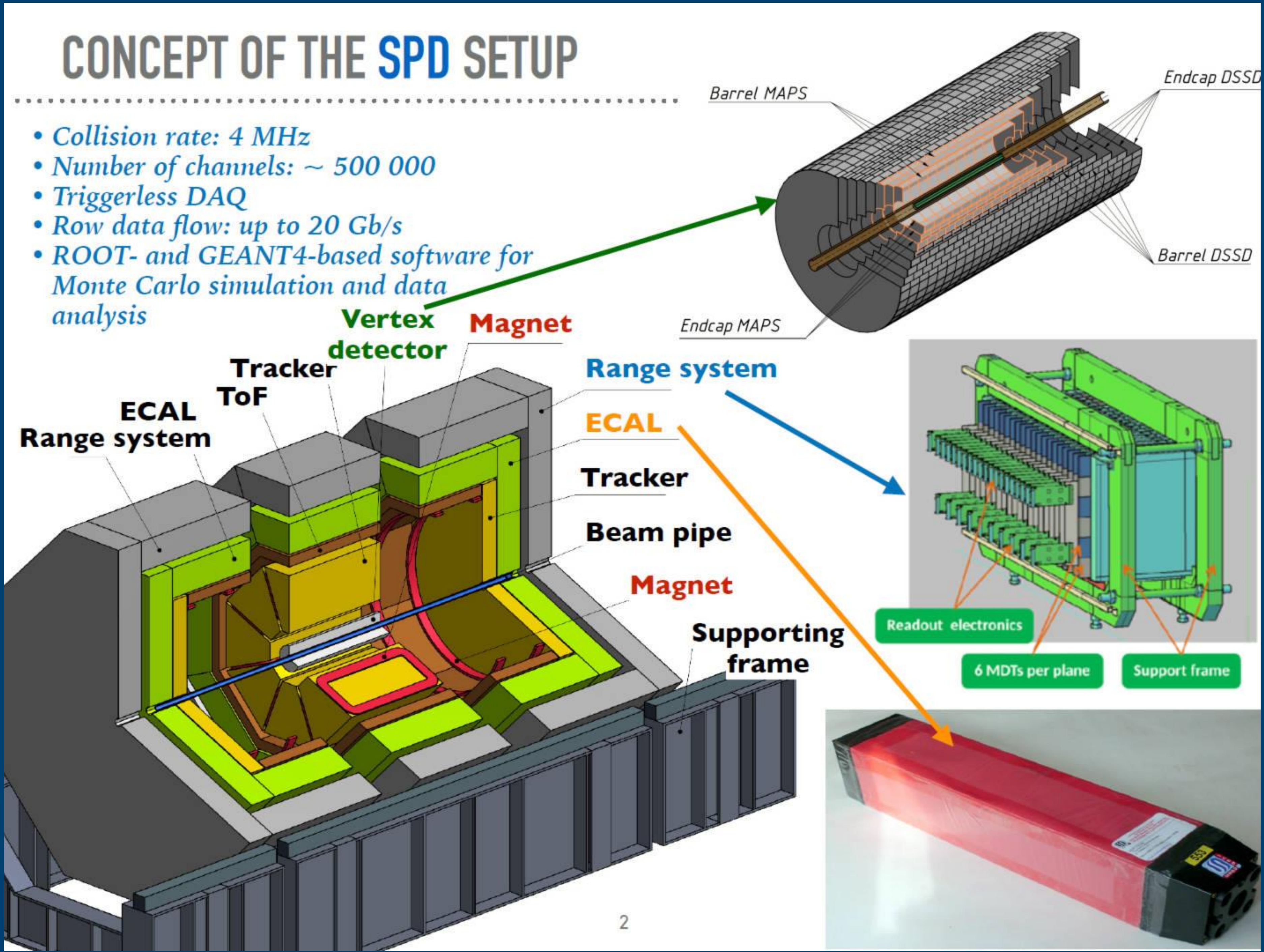
SPD Collaboration

10 countries
23 Institutes/Universities
~300 authors + individuals

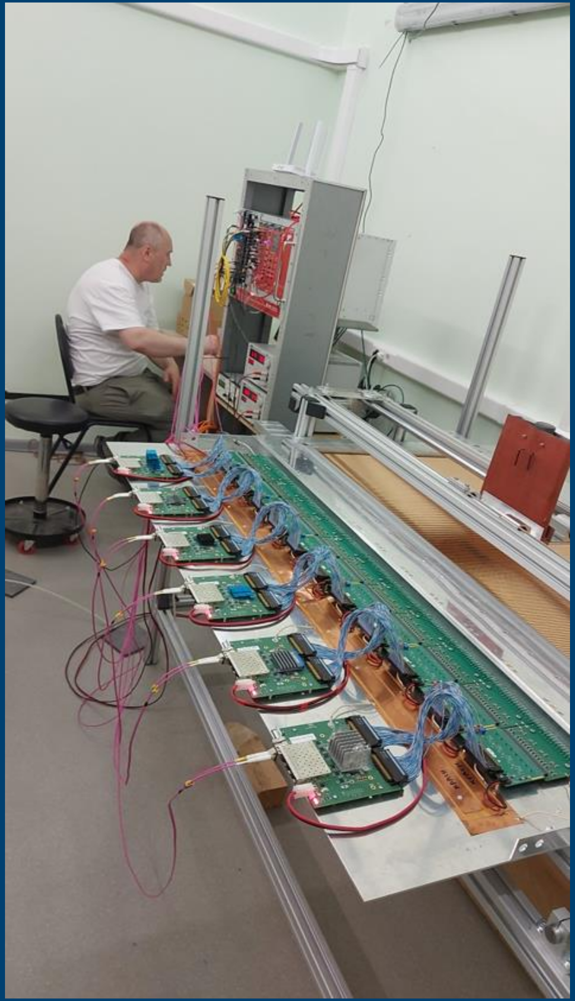
Physics goals:

- Gluon content in p and d
- Charmonia
- Open charm
- Prompt photons

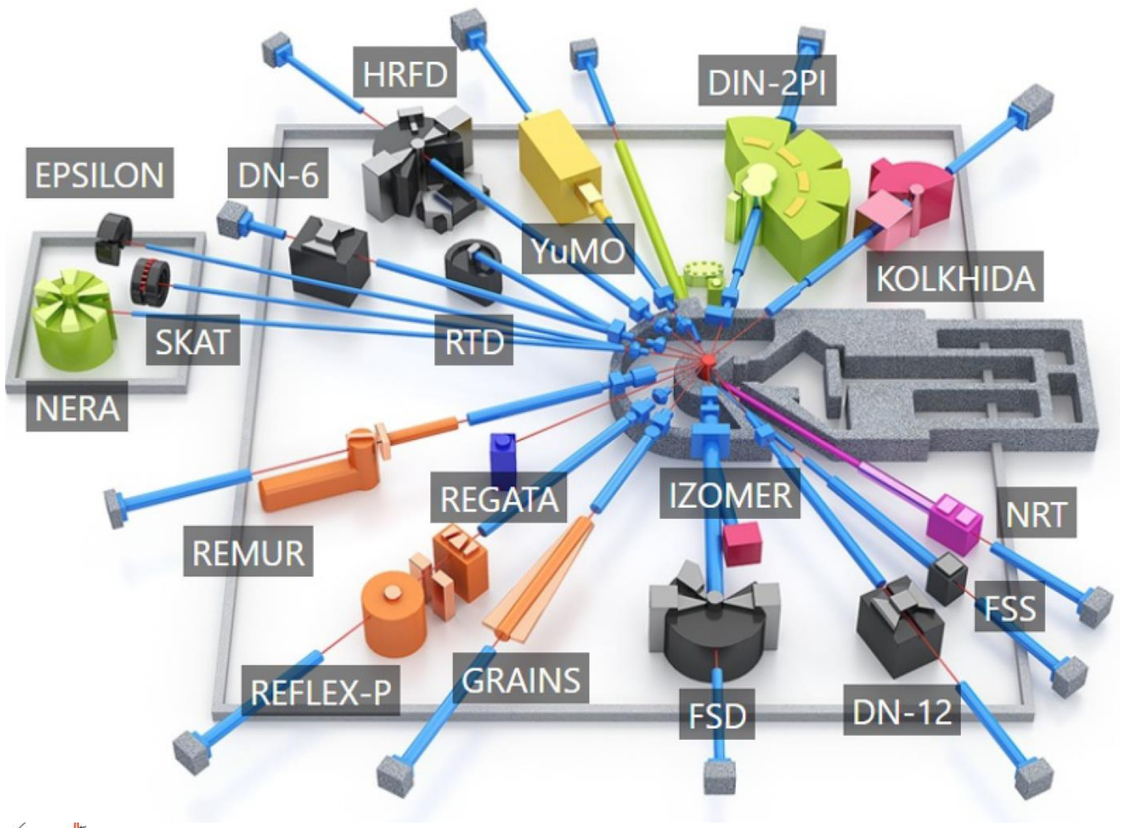
MPD fosters unique high technology industry, e.g.
Magnet Yoke - Vitkovice HM / Czech
Cryostat/SC coils - ASG Genova / Italy
MPD promotes creating intellectual clusters in Universities, e.g.
ECAL subsystem - University consortium in China
BD scintillator array - University consortium in Mexico
MPD demands development of local production, e.g.
Clean room labs for advanced semiconductor detectors


CONCEPT OF THE SPD SETUP
• Collision rate: 4 MHz
• Number of channels: ~ 500 000
• Triggerless DAQ
• Row data flow: up to 20 Gb/s
• ROOT- and GEANT4-based software for Monte Carlo simulation and data analysis
Barrel MAPS
Endcap DSSD
Barrel DSSD
Endcap MAPS
Vertex detector
Magnet
Tracker
ToF
ECAL
Range system
Range system
ECAL
Tracker
Beam pipe
Magnet
Supporting frame
Readout electronics
6 MDTs per plane
Support frame
2

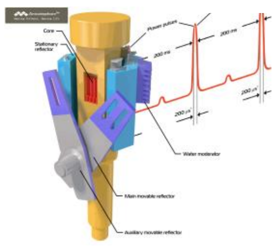
Recent SPD pictures



IBR-2M Spectrometers Complex



Diffraction (8)	HRFD, DN-6, RTD, DN-12, FSD, SKAT, EPSILON, FSS
Reflectometry (3)	REMUR, REFLEX, GRAINS
Small Angle Scattering (1)	YuMO
Inelastic Neutron Scattering (2)	NERA, DIN-2PI
Radiography and Tomography (1)	NRT
Neutron Activation Analysis (1)	REGATA
New instruments in development stage (2)	SANS-RT INS Spectrometer



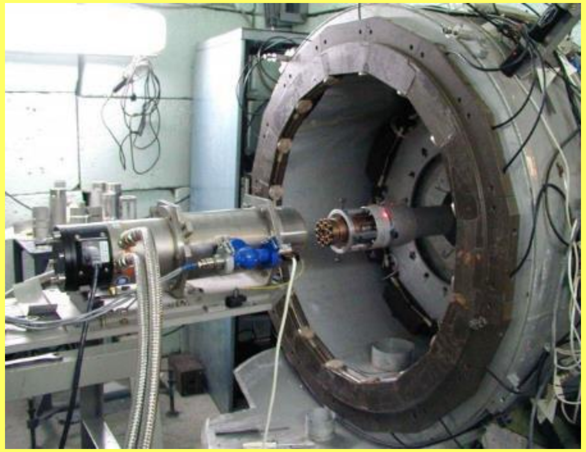
mean power 2 MW
pulse frequency 5 Hz
pulse width for fast neutrons 200 μs
thermal neutrons flux density on the moderator surface: 10^{13} n/cm^2 /s
maximum in pulse: 10^{16} n/cm^2 /s
reactor operation for physics experiments: ~2500 hr/year

The user policy of the IBR-2 is world friendly.
~200 proposals from ~20 countries are selected annually

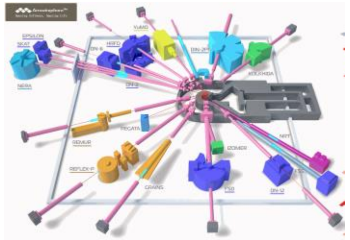
HRFD

Precise structural studies
crystalline materials usin
reverse TOF method, $\Delta d/d$ ~ 0.001

DN-12



Studies of structure and dynamics of condensed matter under extreme conditions (P ~ 7 GPa)



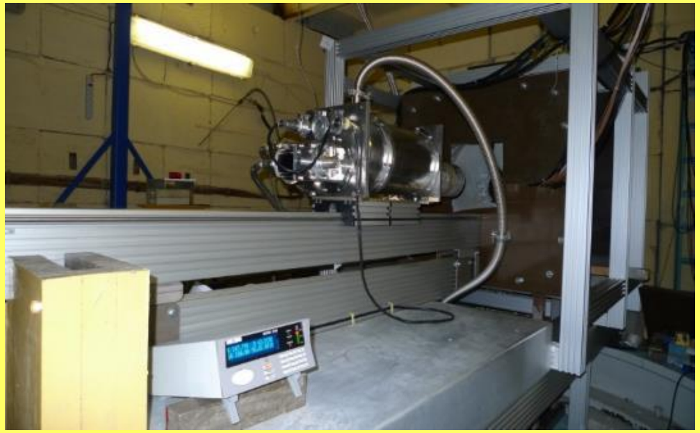
RTD

Real Time Diffractometer (RTD

Real time studies

DN-6

In operation since 2012

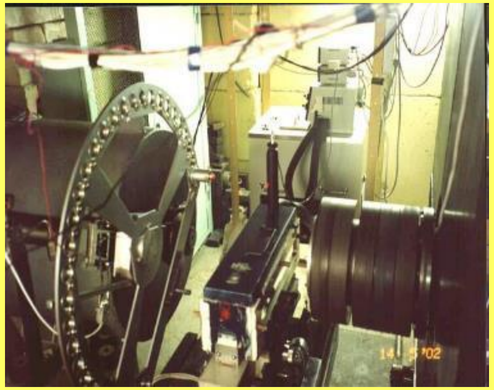


Structural studies at ultrahigh pressures (up to 30-50 GPa)

DIFFRACTION

SMALL ANGLE NEUTRON SCATTERING AND REFLECTOMETRY

YuMO - SANS



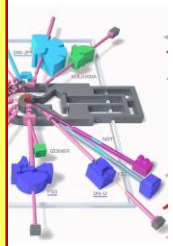
A study of structural characteristics of nanostructured materials, biological objects, polymers

REFLEX

Reflectometer with polarized neutrons

A study of structural properties of thin films and layered nanostructures

Reconstruction into Spin Echo Small Angle Neutron Scattering Spectrometer



REMUR

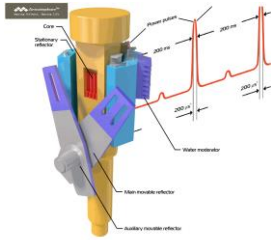
Reflectometer with polarized neutrons

A study of magnetization profile, magnetic and structural properties of layered nanostructures

GRAINS

Multifunctional reflectometer

A study of structural properties of liquid and soft matter interfaces



BAIKAL-GVD LAUNCHED!

On 13 March 2021, a ceremonial launch of the largest in the Northern hemisphere deep underwater neutrino telescope Baikal-GVD was held. This significant for the JINR and world science event has become one of the key events of the current Year of Science and Technology in Russia. Moreover, this day, the Ministry of Science and Higher Education of Russia and the Joint Institute for Nuclear Research signed a Memorandum of understanding for the development of the Baikal deep underwater neutrino telescope.

65
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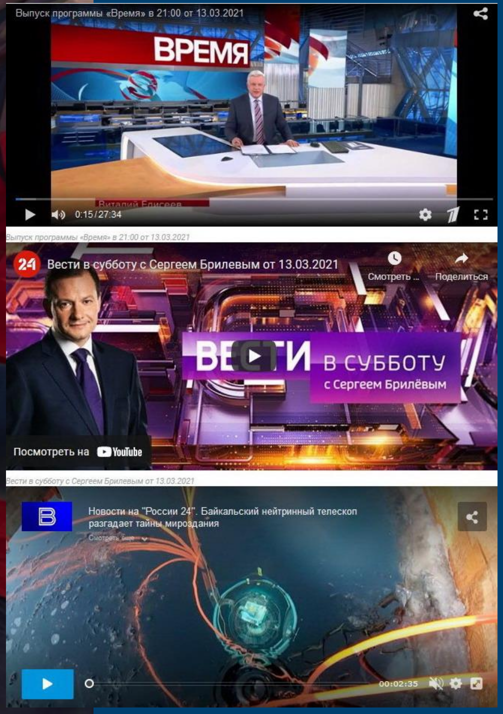
'21 Год науки и технологий



Очередной оптический модуль подготовлен к погружению

Центральный модуль секции

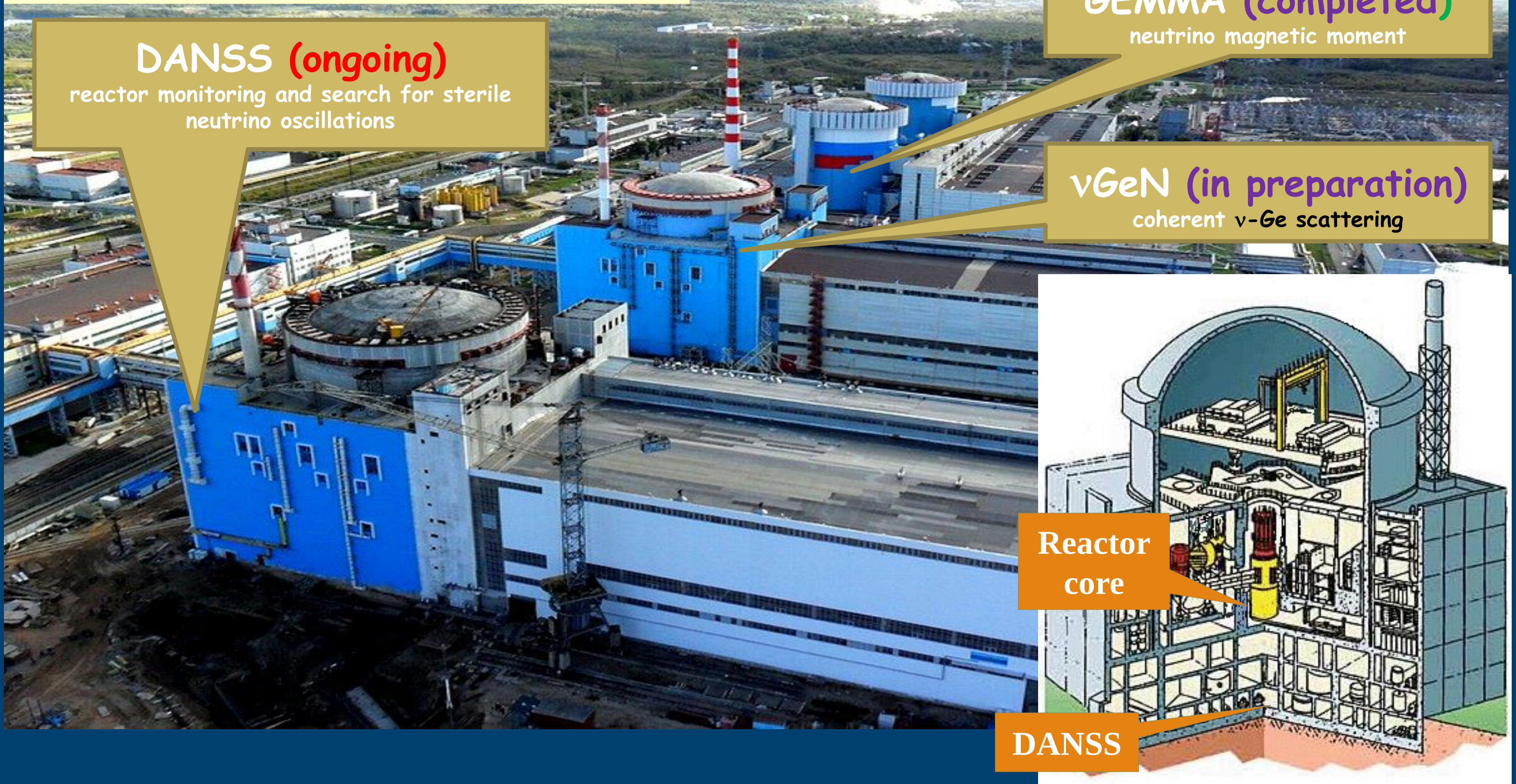
Гидроакустический модем

JINR

Neutrino experiments at Kalinin NPP

(Tver region, 285 km NW from Dubna)

- Pressurised Water Reactor (ВВЭР-1000)
- Thermal Power: 3 100 MW
- Neutrino Flux: $\sim 6\times10^{20}\ \bar{\nu}_e$ / 4π / day
- Campaign: 18 months



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JINR research
is not only Mega-Science and not only Nuclear

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BLTP

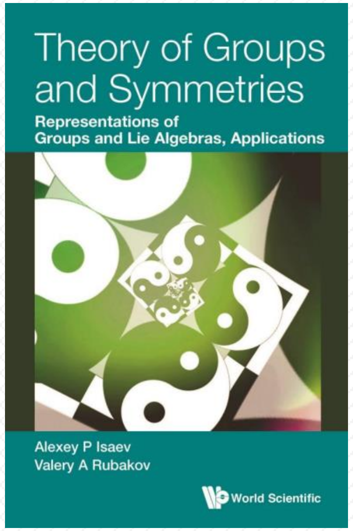
THEORETICAL PHYSICS

Theoretical physics on the basis of advanced mathematics, cross-disciplinary research, support of the JINR experimental program, interplay of research and education

Participation in the JINR flagship projects:

- Theory of hot and dense nuclear matter for NICA
- Analysis of production and properties of SHN
- Theory of neutrino physics
- Theory for material study with neutron beams
- Lattice QCD calculations with Supercomputer "GOVORUN"

2020 scientific activity:



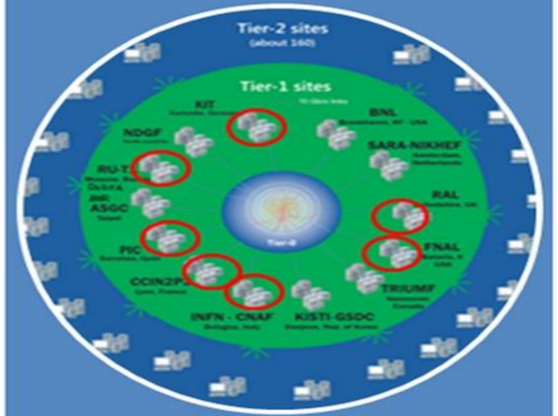
470 journal articles and conference proceedings, **1** monograph
>110 reports at **>60** conferences and workshops, including online

Fedor Šimkovic: ESET Science Award for 2020 - Outstanding individual contributor to Slovak science

Eugeny Mardyban: Scholarship of the President of the Russian Federation for young scientists and graduate students

Horia Pasca: “Ștefan Procopiu” Prize for Physical Sciences from the Romanian Academy

Multifunctional Information and Computing Complex at JINR



Grid-Tier1:
16 096 cores
13.7 PB disk
11.5+40 PB tape

Grid-Tier2 CICC:
7060 cores
4.9 PB disk

Cloud:
5000 CPU
60 TB RAM
3.1 PB disk

HybriLIT/ SC "Govorun":
860 TFlops for double precision
300 Gb/s Data IOrate

NICA off-line cluster and storage system

DATALAKE 7120TB EOS

dCache 18 PB + 51.5 PB tape

Network infrastructure: LAN: 100 Gbps WAN: 2x100 Gbps

ENGINEERING INFRASTRUCTURE

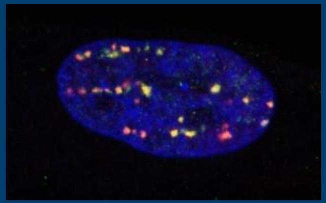
Research focus of the Laboratory of Radiation Biology

Since 2005 : LRB

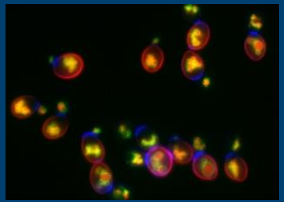
Leading centre for accelerator-based radiation biology in former Soviet Union and Eastern Europe

Development of innovations in radiation medicine and space research

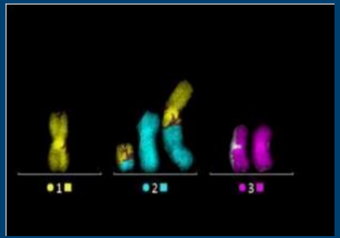
Molecular Radiobiology



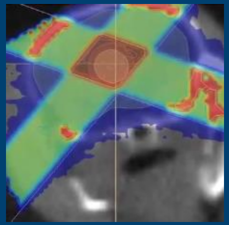
Radiation Genetics



Radiation Cytogenetics



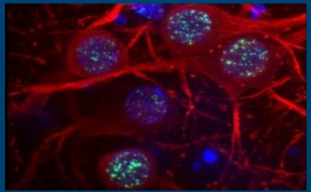
Clinical Radiobiology



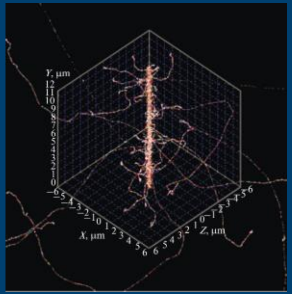
Radiation Physiology

Radiation Protection

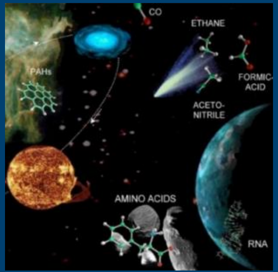
Radiation Neuroscience



Mathematical Modeling



Astrobiology



DLNP JINR Sector of Molecular Genetics of the Cell

SeqStudio Genetic Analyzer

Varioskan LUX multimode microplate reader

Affymetrix GeneChip system

Zeiss AxioVert microscope
with microinjection/micromanipulation system

COVID-19-RELATED RESEARCH @ JINR

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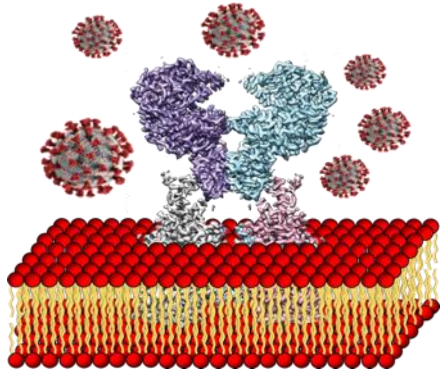
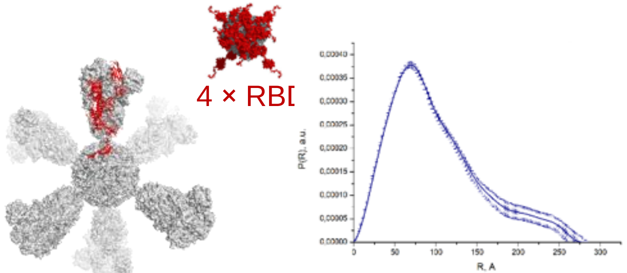
Effect of cell membrane composition on coronavirus invasion

- Investigation of changes in the structure and dynamics of cell membrane upon the pathogenic invasion:
  - Cell membrane of the increasing complexity comprised of its native proteins;
  - Impact of the addition of SARS-CoV-2 extracted proteins;
  - Effect of cholesterol and melatonin concentrations on SARS-CoV-2 invasion.
- Experimental methods:
  - Small angle neutron scattering (IBR-2);
  - Fourier Transform Infrared Spectroscopy and MD simulations (Taras Shevchenko National University of Kyiv).

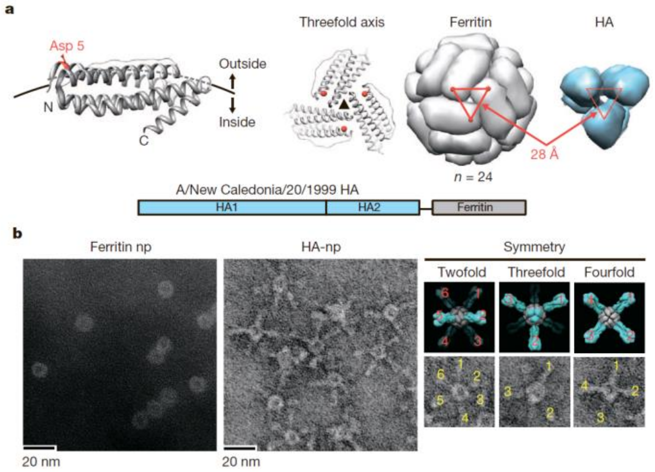


SARS-CoV-2 – apoferritin chimeric nanoparticle

The study of chimeric protein constructs apoferritin-receptor binding domain (RBD) of the S-protein SARS-Cov-2 by small-angle X-ray scattering (SAXS).



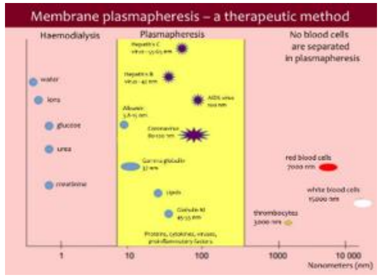
Pair-distance function P(R)



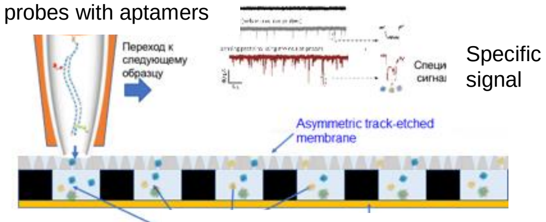
FLNR products, existing & potential, which can help during COVID-19 pandemic

Application of track membranes.

- Development of a cascade plasma apheresis processes based on track-etched membranes: (1) Separation of pathogenic components from plasma; (2) Use of the plasma from cured COVID-19 patients to immunize healthy people.

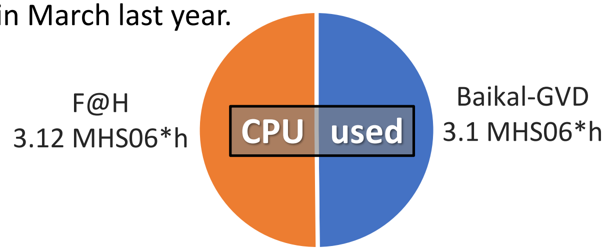


- Universal sensor for viruses and specific proteins, including COVID-19 (Cooperation with MISIS (Moscow) and Imperial College London).



Folding@Home for COVID-19 research

The JINR Tier1 and Tier2 grid clusters, which are part of WLCG, as well as cloud resources of the Member States' organizations, combined into the distributed information and computing environment, are involved in the Folding@Home COVID-19 project, which uses distributed computing for computer modelling of protein molecule coagulation. JINR joined the coronavirus 2019-nCoV study in March last year.



F@H and Baikal-GVD currently consume roughly the same amount of computing resources.

Team: Joint Institute for Nuclear Research

Date of last work unit	2021-02-08 09:06:58
Active CPUs within 50 days	895
Team Id	265602
Grand Score	29,749,171
Work Unit Count	12,913
Team Ranking	7053 of 255973
Homepage	http://www.jinr.ru/main-en/

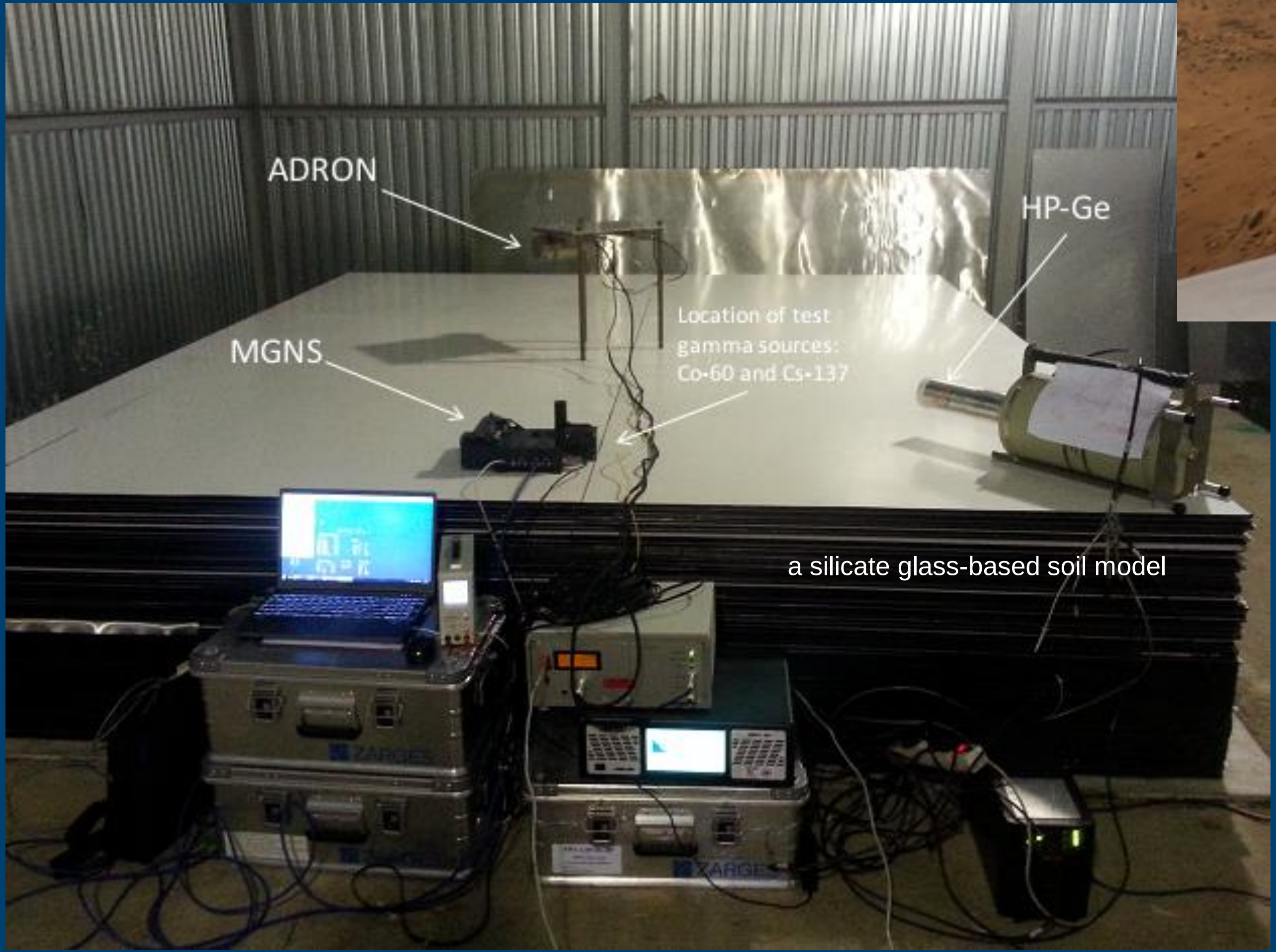
Team members

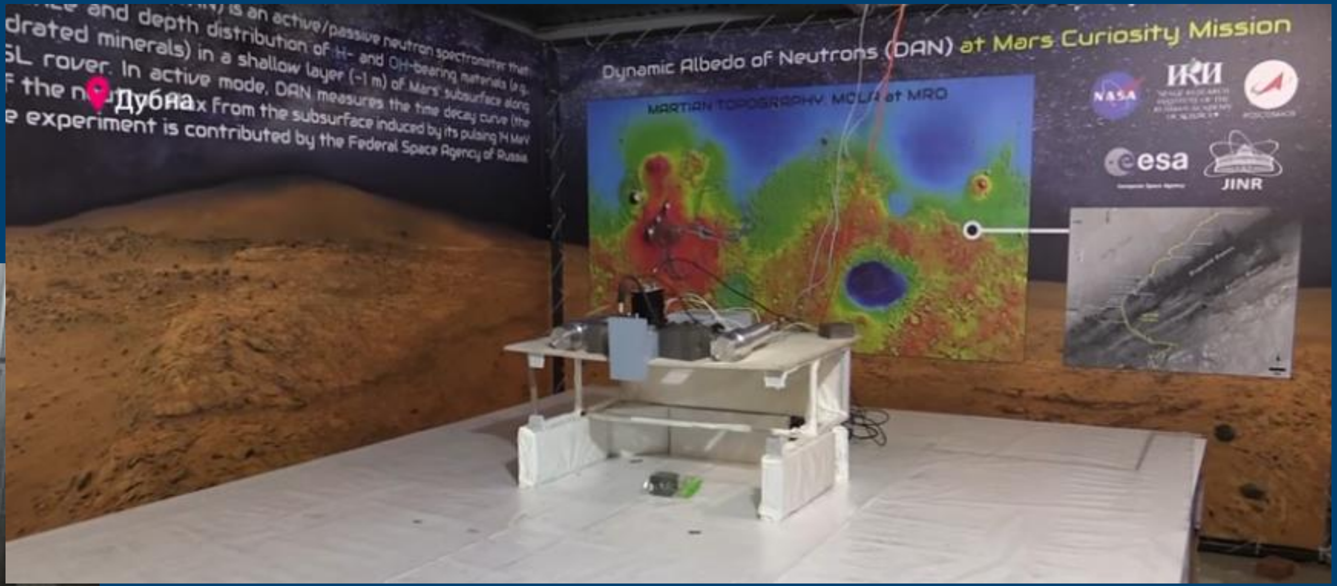
Rank	Name	Credit	WUs
75 307	CLOUD.JINR.ru	12,645,224	5,355
89 334	CLOUD.PRUE.ru	9,453,851	4,175
177 511	CLOUD.NOSU.ru	2,333,681	910
210 492	CLOUD.IPANAS.az	1,542,618	910
214 706	CLOUD.INP.by	1,465,167	599
247 633	CLOUD.INP.kz	1,012,919	413
268 713	CLOUD.STI-SCI.eg	805,425	380
322 494	DIRAC.REA-Parallel.ru	471,543	155
N/A	CLOUD.INRNE.bg	18,743	16

JINR cloud and Member States' Participation [1]

[1]https://stats.foldingathome.org/team/265602

Nuclear planetary science





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Short outlook into future

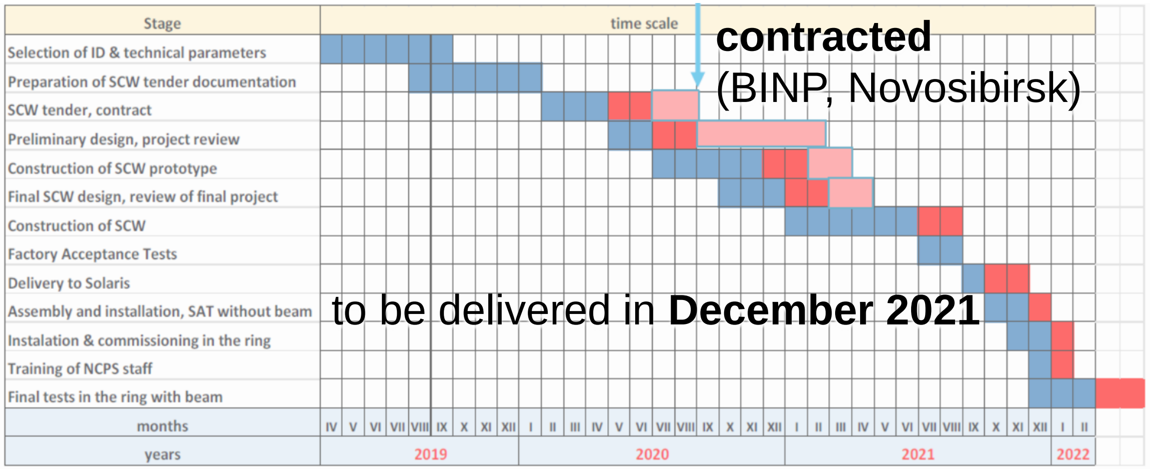
http://www.jinr.ru/docs-en/

SOLCRYS – A JINR FACILITY FOR STRUCTURAL RESEARCH AT SYNCHROTRON SOLARIS

The Polish national synchrotron centre SOLARIS

Krakow, Poland

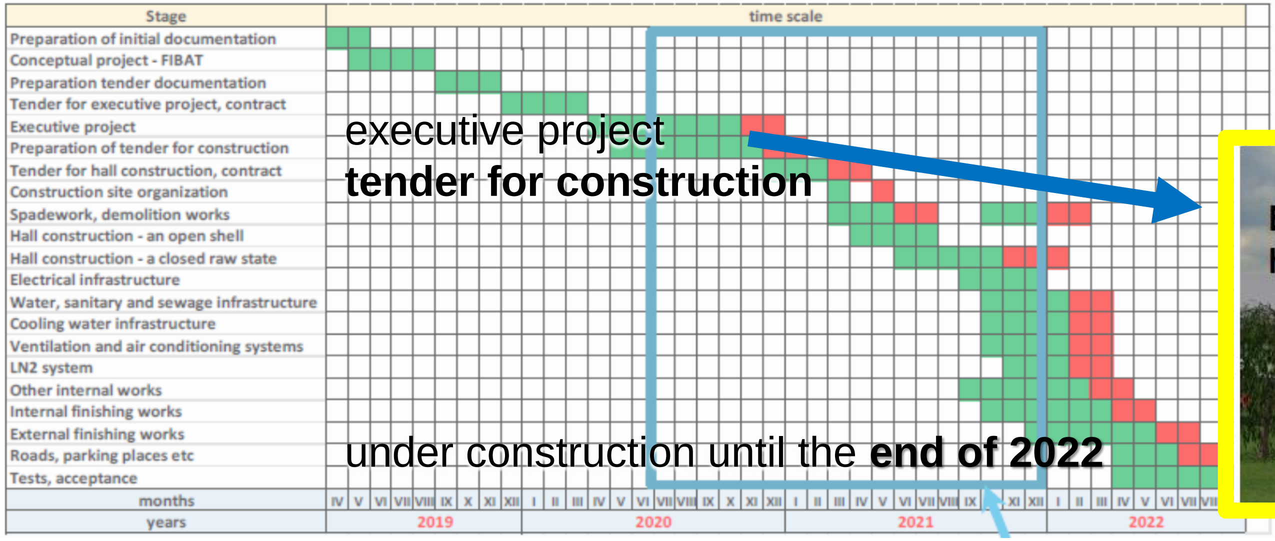
- **Synchrotron radiation source** (superconducting wiggler)



contracted
(BINP, Novosibirsk)

to be delivered in **December 2021**

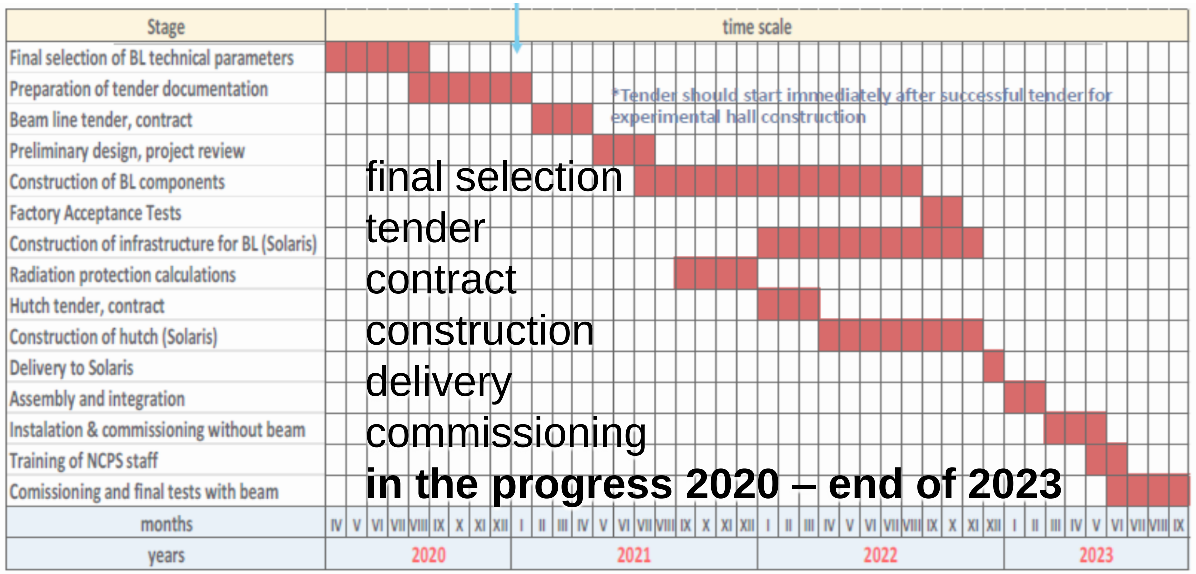
- **Experimental hall extension**



executive project
tender for construction

under construction until the **end of 2022**

- **Experimental beamlines**



final selection
tender
contract
construction
delivery
commissioning
in the progress 2020 – end of 2023

New: Innovation center

Main tasks:
Development of technologies and methods in the field of nuclear and radiation medicine, radiation materials science, advanced training of specialists for JINR Member States for radiation biology and medical physics.

Main stages:

- New facility: DC-140 cyclotron for electronic component testing, radiation material science, track pore membrane research and production, etc. (period of realization: 2021–2023);

- New facility: Radiochemical Laboratory Class-I for production of radioisotopes (Ac^{225}, ^{99m}Tc) for nuclear medicine in photonuclear reactions @ 40MeV Rhodotron accelerator (period of realization: 2022–2026);

- User facility (beam lines from MeV/u to GeV/u) @ NICA: radiobiological studies (400-800 MeV/n); radiation testing of semiconductor electronics (3; 150-350 MeV/n); nuclear physics data @ 1-4.5 GeV/n (period of realization: 2021–2024);

- Radiation biology: OMICS technologies and neuroradiobiological studies. Radiation neuroscience. Approaches to increase radiosensitivity: pharmaceuticals, transgene systems, targeted delivery (molecular vectors) and radionuclide;

- New facility for R&D in beam therapy: treatment planning; radiomodificators for photon and proton therapy, flash-therapy and pencil beam, other breakthrough technologies. 230 MeV SC p-cyclotron as a pilot facility for future medical centre. Period of realization: 2021–2024.

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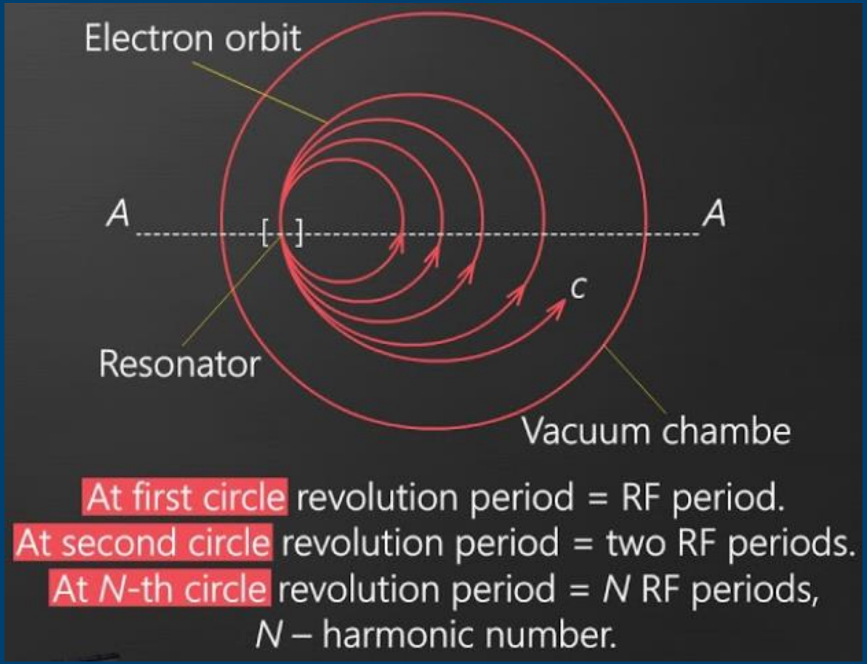
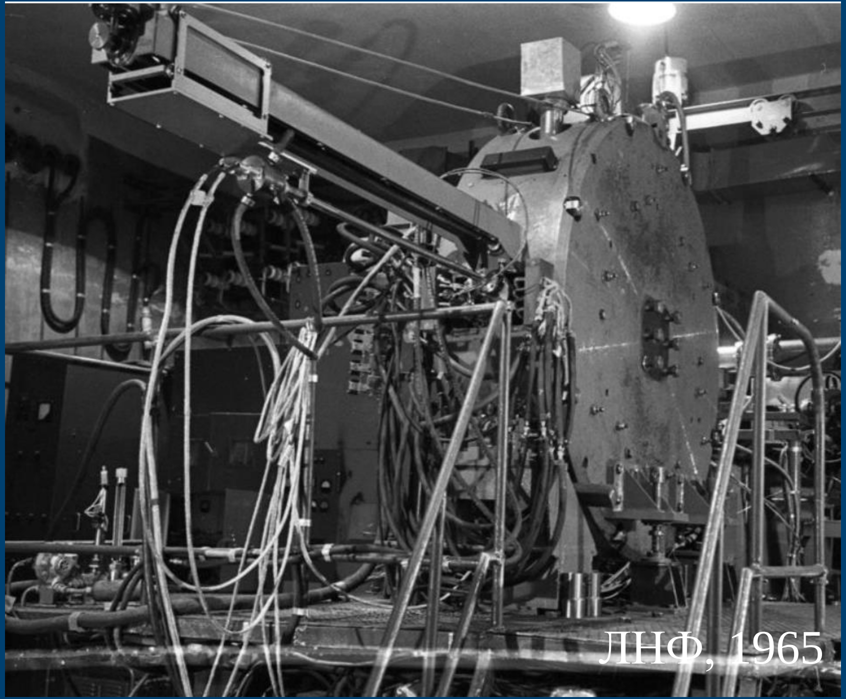
Knowledge and technology transfer to JINR Member States and partner countries

Microtron



- JINR own experience
- Havana
- Hanoi
- Prague
- Ulaanbaatar

Prague, 1982



ЛНФ, 1965

ЛЯР, 1984

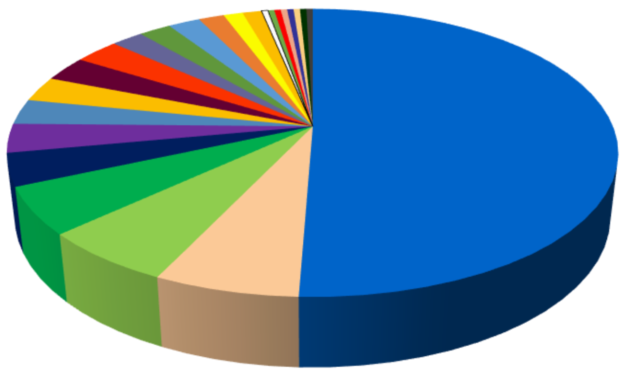
Kazakhstan: Cyclotron center in Nur-Sultan

- **2003:** Government decision to develop a cyclotron center in Astana
- **2004–2005:** Design and manufacture of equipment of DC-60 cyclotron
- **2006:** Delivery of equipment to Astana; mounting, tuning and adjustment; first beam generation

Research Infrastructure as a magnet for young talents

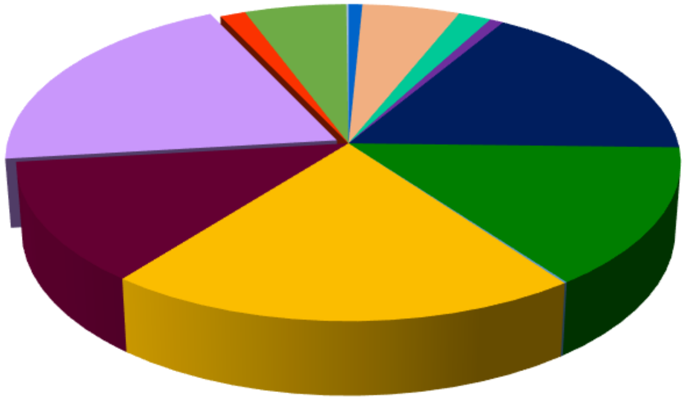
Summer Student Programme

247 participants in 2014-2019



International Student Practice

1716 participants since 2004



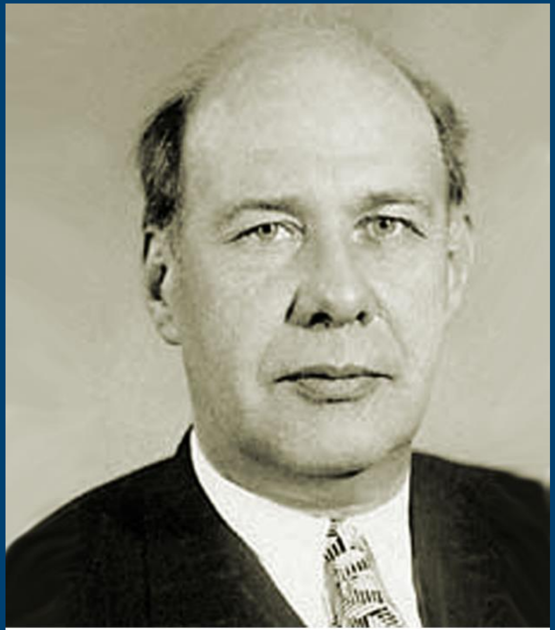
JINR Expertise for Member States and Partner Countries

* 19 training programs for science administration implemented during April 2017 - November 2021
* 238 participants from 30 countries and one IGO (59 participants from 5 countries 4x in 2021)

Universities	Rectors and Vice-Rectors	14
	Deans and directors of research units	43
	Local contact points	57
Research organizations	Directors and vice-directors	21
	Heads of departments	52
	Local contact points/experts	33
Governments and IGO	Minister, DG, CEO/ deputies	3
	Governmental & IGO officers	11
	JINR Board members	4

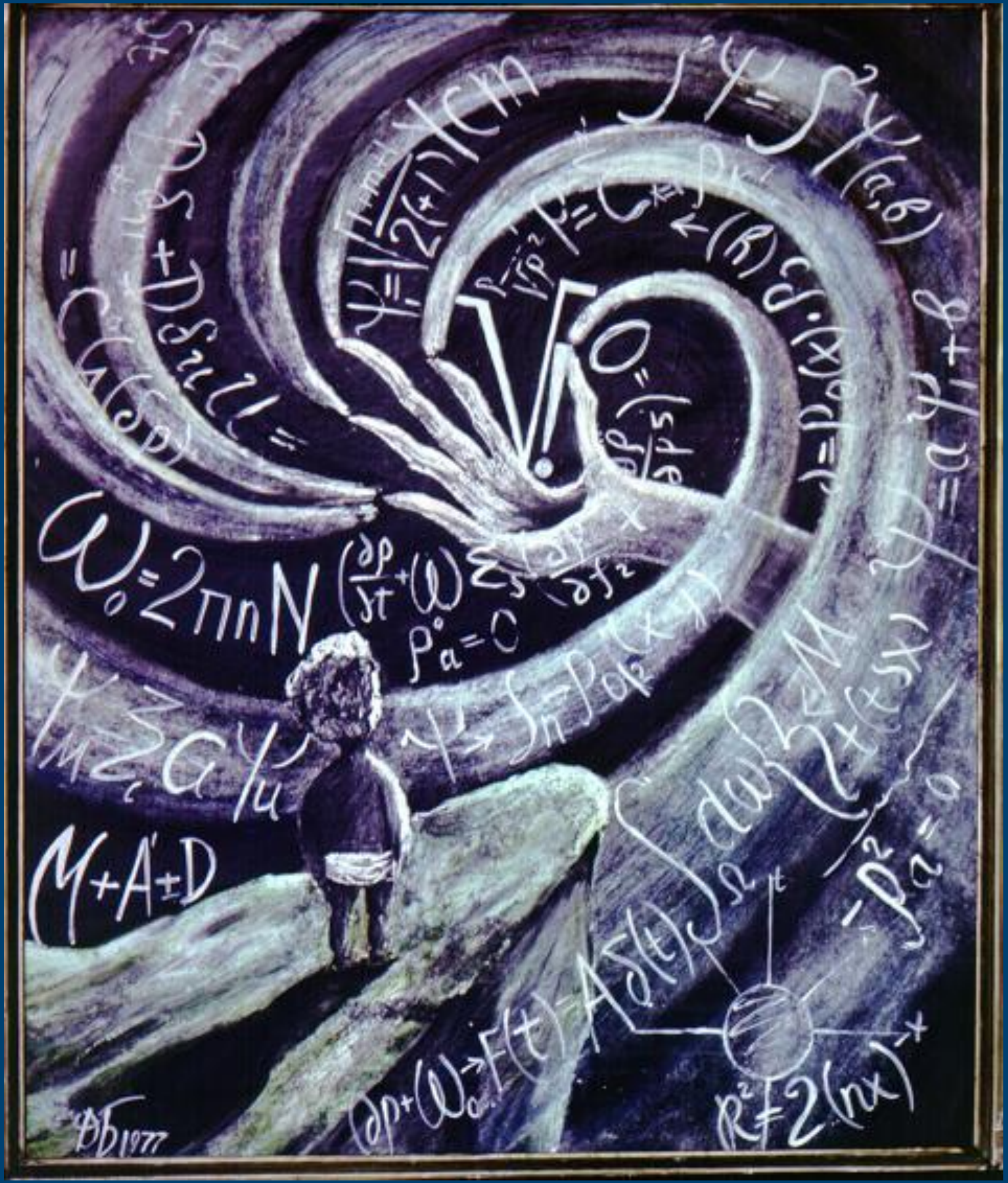
hosting country JEMS TOP5 sum over region emerging directions

The first JINR director about JINR foundation



Dmitry Ivanovich Blokhintsev

«We go to a completely new area and do not yet know what will come of it, but history teaches that when physicists go to a new area they never come out empty-handed”
D.I. Blokhintsev




Welcome to JINR!