THE JOINT INSTITUTE FOR NUCLEAR RESEARCH

Short introduction

Dr. A. Zhemchugov, JINR UC

Stage 3 of the International Student Practice in JINR Fields of Research
JINR University Centre 10/09/2018

http://ucnew.jinr.ru/en/isp

60 years: Mission of JINR

Science Bringing Nations Together

5 Major Pillars:

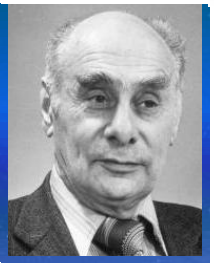
- Research
  Basic studies at the frontiers of knowledge
- International cooperation
  Combining world intellect and material resources
- Innovation
  Multi-disciplinary studies
  New instruments and technologies
- Education
  Training students, young scientists and engineers
- Outreach
  Promoting science in society worldwide

Establishment of the Joint Institute for Nuclear Research

The Joint Institute for Nuclear Research (JINR) is an international intergovernmental scientific research organization established through 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.

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

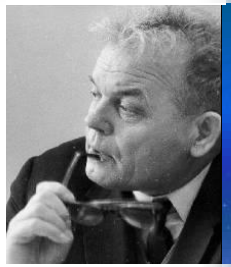
Founders of JINR



G.Flerov

V.Veksler

I.Frank

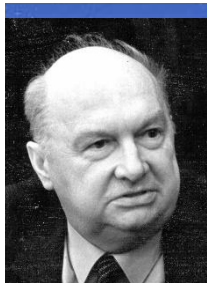


M.Meshcheryakov

V.Dzhelepov

N.Bogoliubov,
D.Blokhintsev

B.Pontecorvo



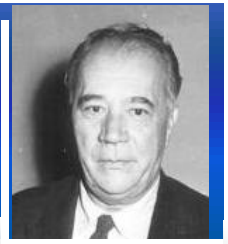
A.Baldin

L.Infeld

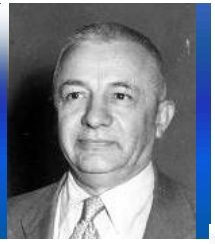
L.Janossy

Wang Ganchang

H.Niewodniczanski

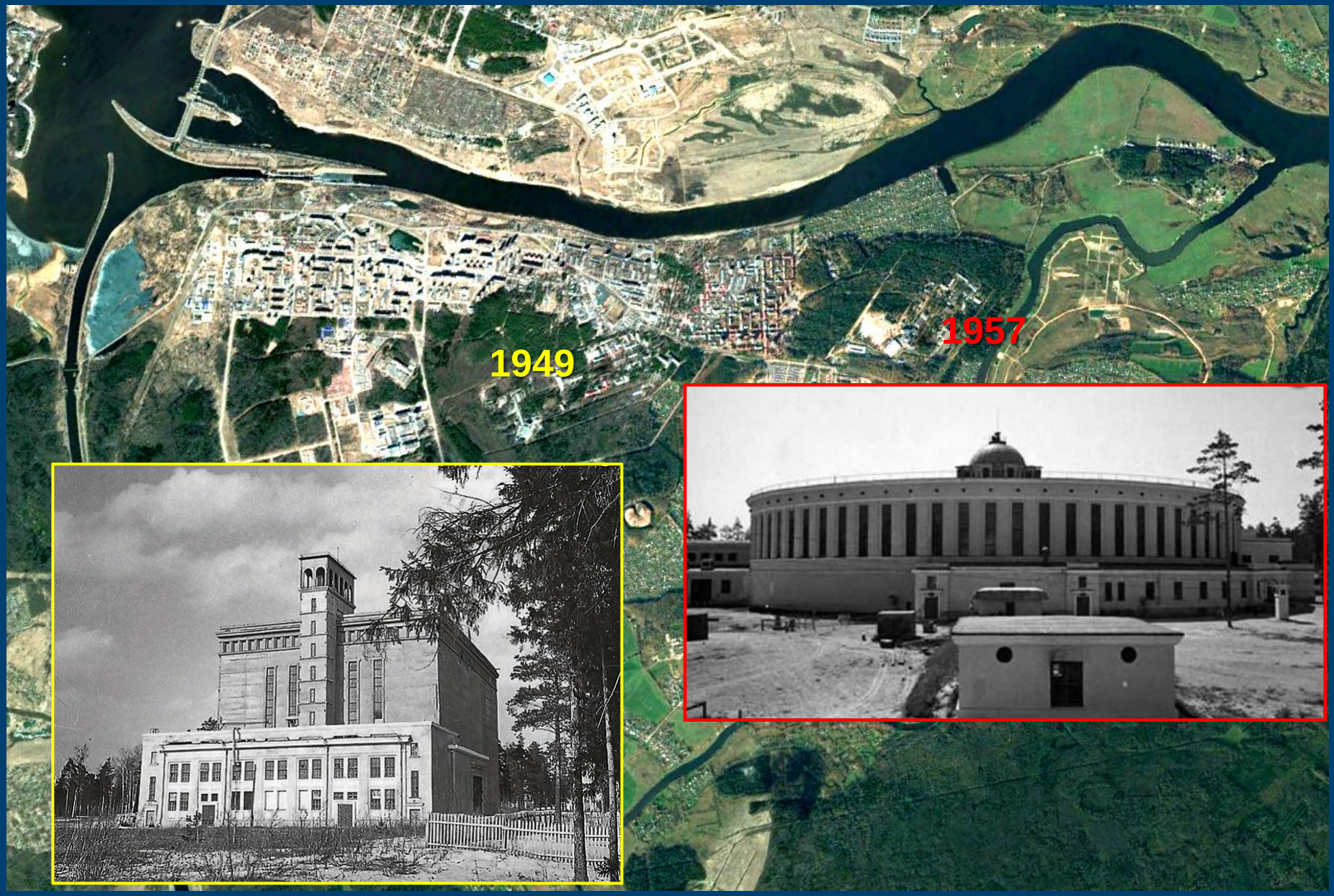


H.Hulubei



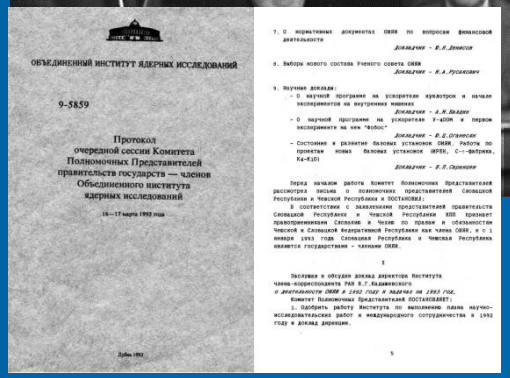
G.Najakov

Dubna – Island of Stability



1993–2018: 25 years of the New Era of the Joint Institute for Nuclear Research

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



ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

9-5859

Протокол
очередной сессии Комитета
Полномочных Представителей
правительств государств — членов
Объединенного института
ядерных исследований

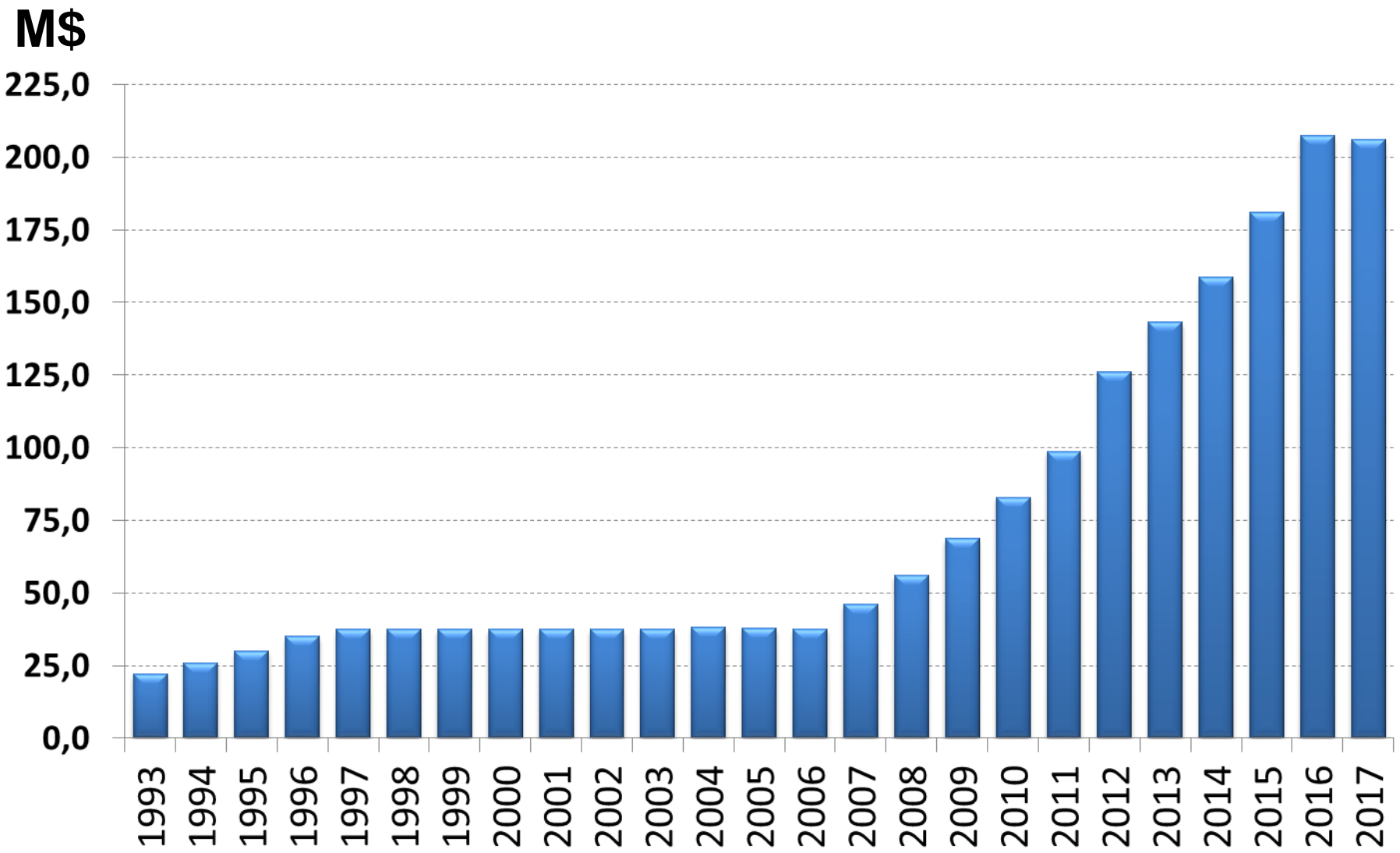
16—17 марта 1993 года

- Membership of Belarus, Russia, and Ukraine was approved at CP session in December 1991;
- Armenia, Azerbaijan, Georgia, Kazakhstan, and Moldova – March 1992;
- Uzbekistan – June 1992;
- Czech and Slovak Republics – March 1993;
- Associate members: Germany (July 1991) and Hungary (February 1993).

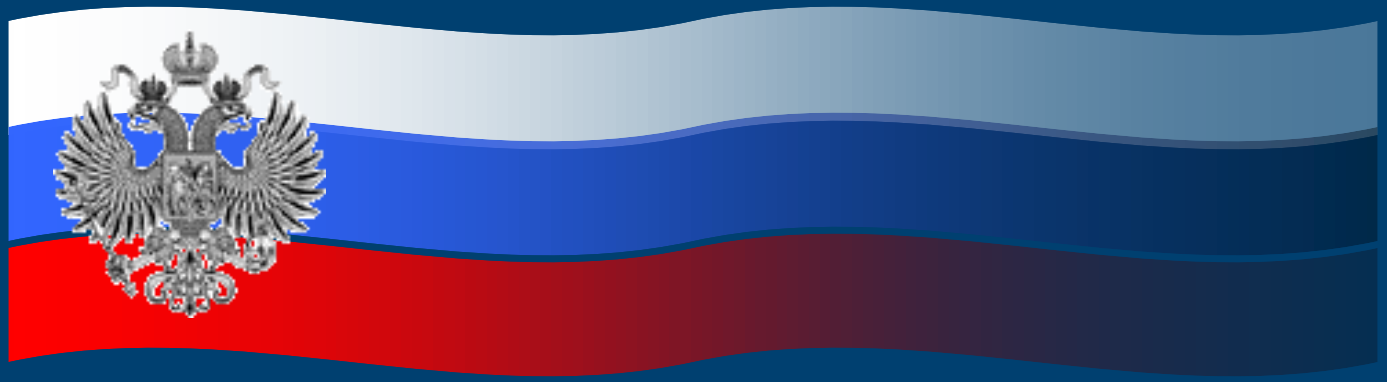
Early 1990's:

- ✓ Dramatic transformation of European socio-political landscape;
- ✓ Economies in transition in Central/Eastern Europe, Russia: social and economic challenges;
- ✓ New era of cooperation for JINR: new Member States and Associate Members.

JINR Budget 1993–2017



JINR – Russia Agreement

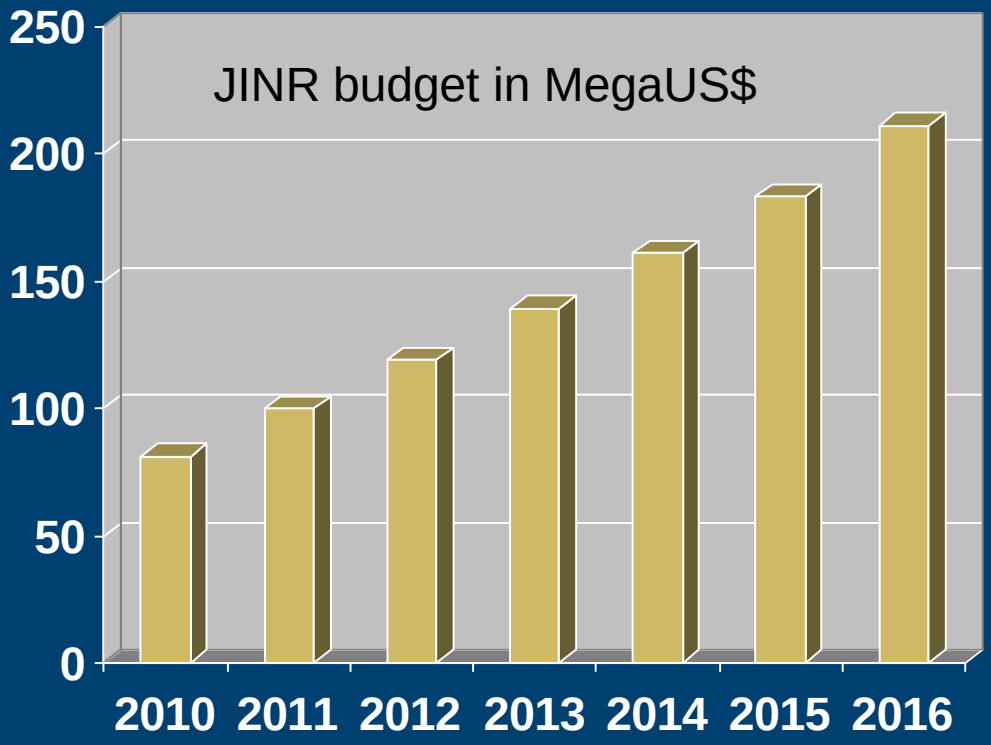


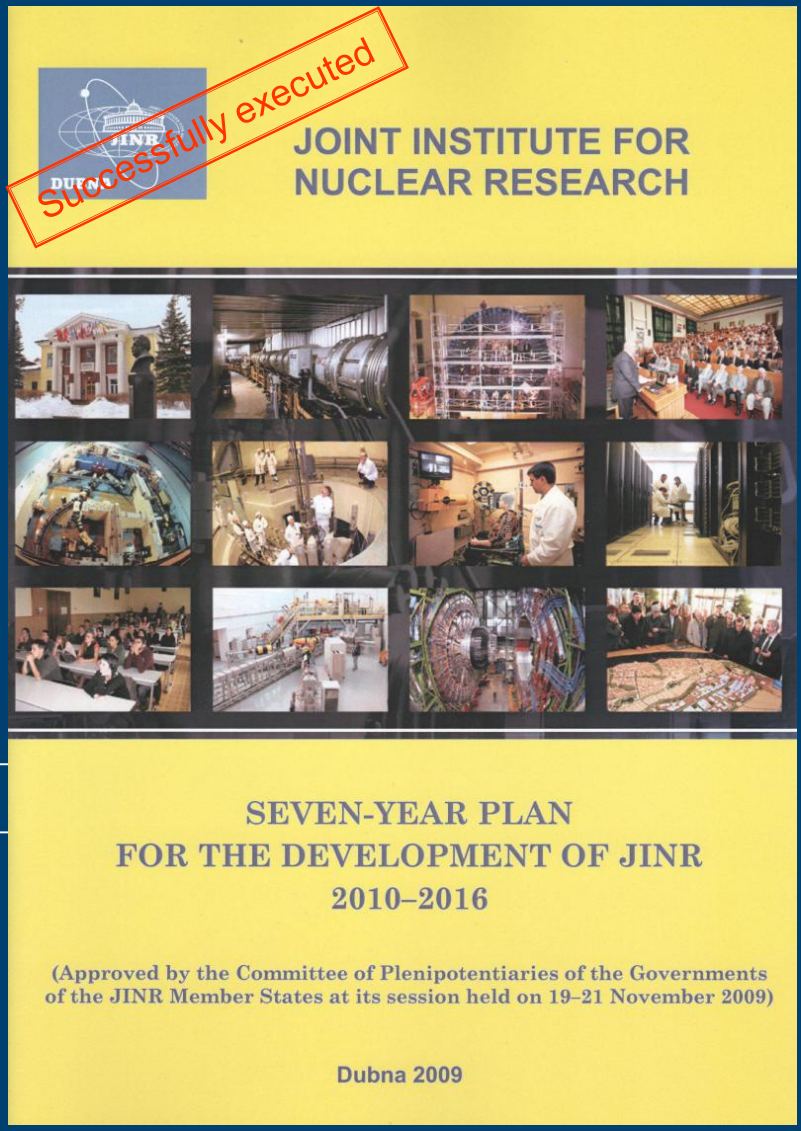
A very important for JINR Russian Federal law was signed by President V.Putin in 2000. This is ***"The Agreement between the Government of the Russian Federation and JINR on the Location and Terms of Activity of JINR in the Russian Federation".*** This Agreement grants privileges and immunities in accordance with established practice for international intergovernmental organizations.

JINR in figures

- JINR staff members ~ 4500
- researchers ~ 1200

  including those from the Member States (but Russia) ~ 400
- Doctors and PhDs ~ 1000





At present JINR has 18 Member States

Armenia
Azerbaijan
Belarus
Bulgaria
Cuba
Czech Republic
Georgia
Kazakhstan
D. P. Republic of Korea
Moldova
Mongolia
Poland
Romania
Russian Federation
Slovakia
Ukraine
Uzbekistan
Vietnam

Participation of Egypt, Germany, Hungary, Italy, Republic of South Africa, Serbia in JINR activities is based on bilateral agreements signed at the governmental level.

Cooperation with CERN

CERN has been JINR's main partner in Particle Physics for more than 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

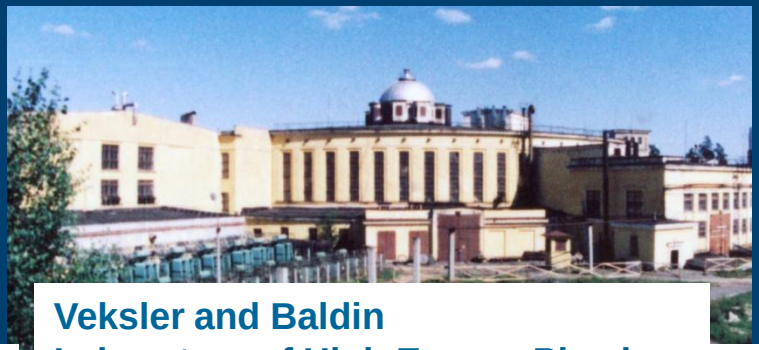
2004, JINR Dubna
CERN Director-General Dr R.Aymar
meeting with
JINR director acad. V. Kadyshevsky

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

JINR comprises 7 Laboratories, each being comparable with a large institute in the scale and scope of investigations performed

Dzhelepov
Laboratory of Nuclear Problems



Veksler and Baldin
Laboratory of High Energy Physics

Bogoliubov
Laboratory of Theoretical Physics

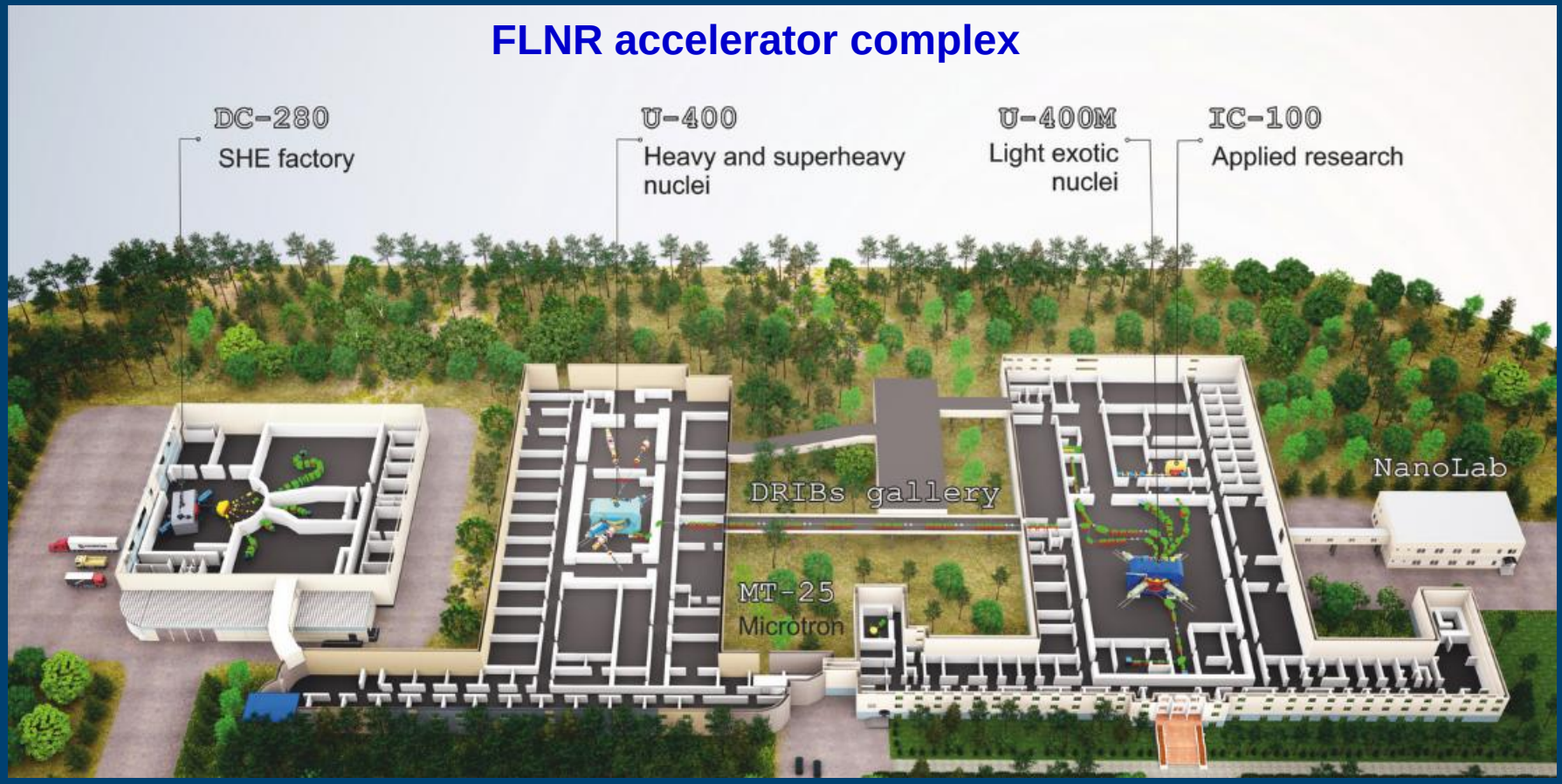
Frank Laboratory of Neutron Physics

Flerov
Laboratory of Nuclear Reactions

Laboratory of Radiation Biology

Laboratory of
Information Technologies

FLNR accelerator complex



IUPAC

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: main magnet assembling

15 September 2016: started

18 October 2016

18 January 2017

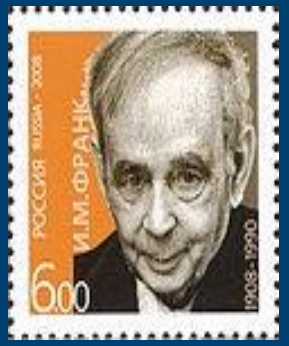
http://lideo.ru/embed/4655

Magnet of DC280 cyclotron is assembled and ready for testing!

Today: constructing the SuperHeavy Elements (SHE) Factory

- Completion of the SHE Factory building and its engineering systems (*April 2018*)
- Assembling the DC-280 cyclotron. Installation of new Gas-Filled Recoil Separator (*April – July 2018*)
- First experiments (*2018*)

IBR-2: Pulsed reactor with fast neutrons

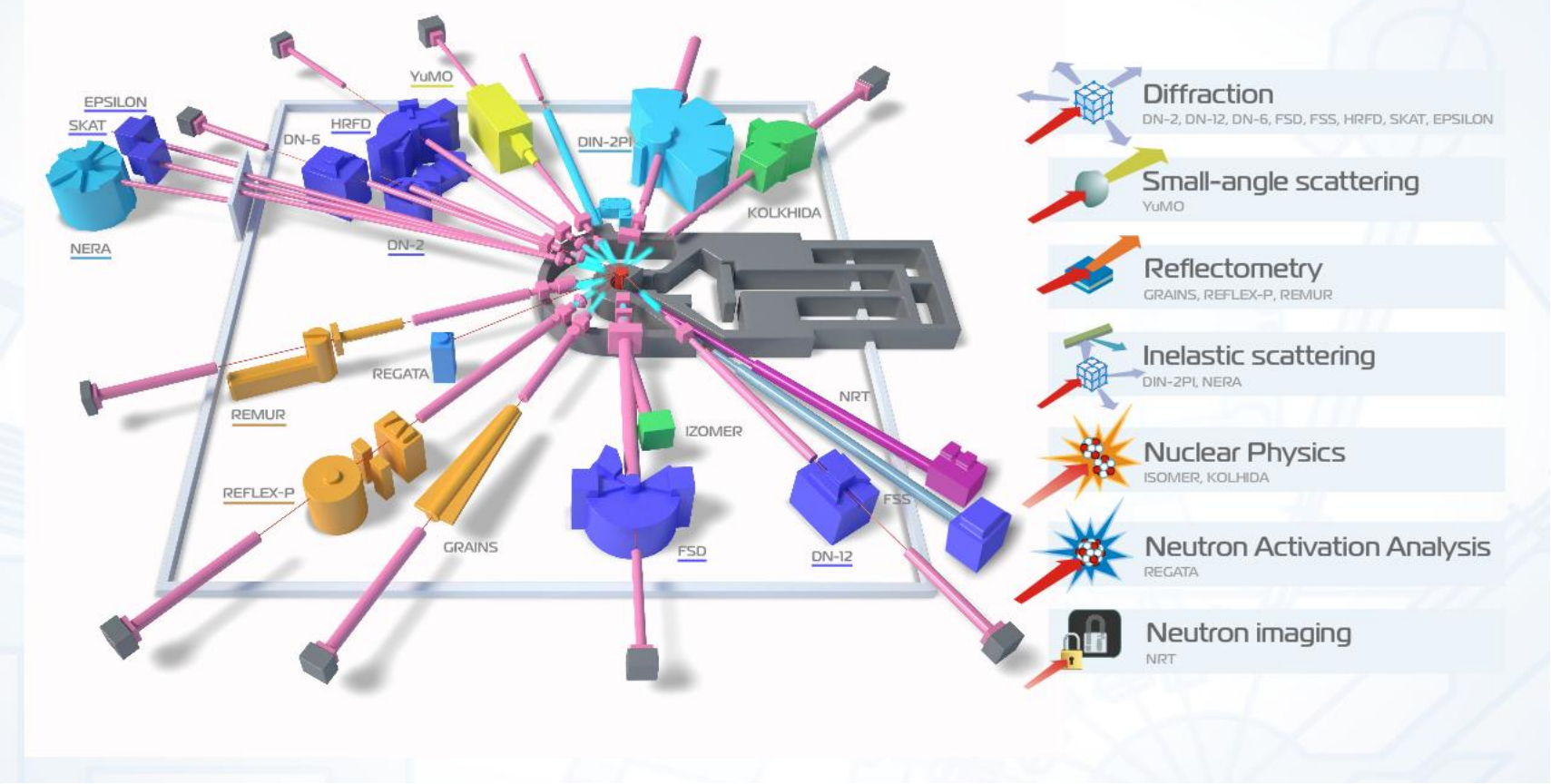


*mean power **2 MW***
*pulse frequency **5 Hz***
*pulse width for fast neutrons **200 μs***
*thermal neutrons flux density on the moderator surface: **10^{13} n/cm^2 /s***
*maximum in pulse: **10^{16} n/cm^2 /s***

IBR-2 is included in the 20-year European strategic research program in the field of neutron scattering

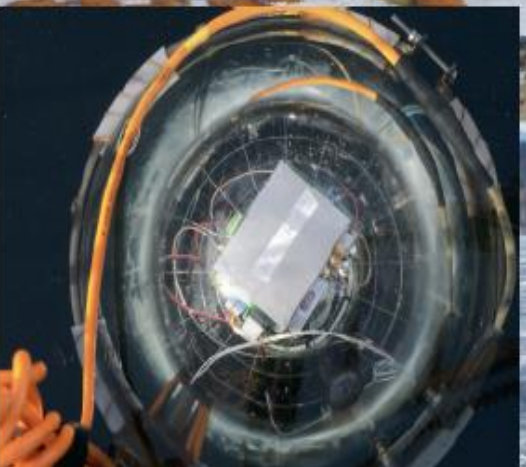
Facilities at IBR-2 reactor

15 instruments are in operation a the Spectrometer Complex of the IBR-2M Reactor



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

Assembling of the First Cluster of the GVD at the Baikal lake, Start at March 2015

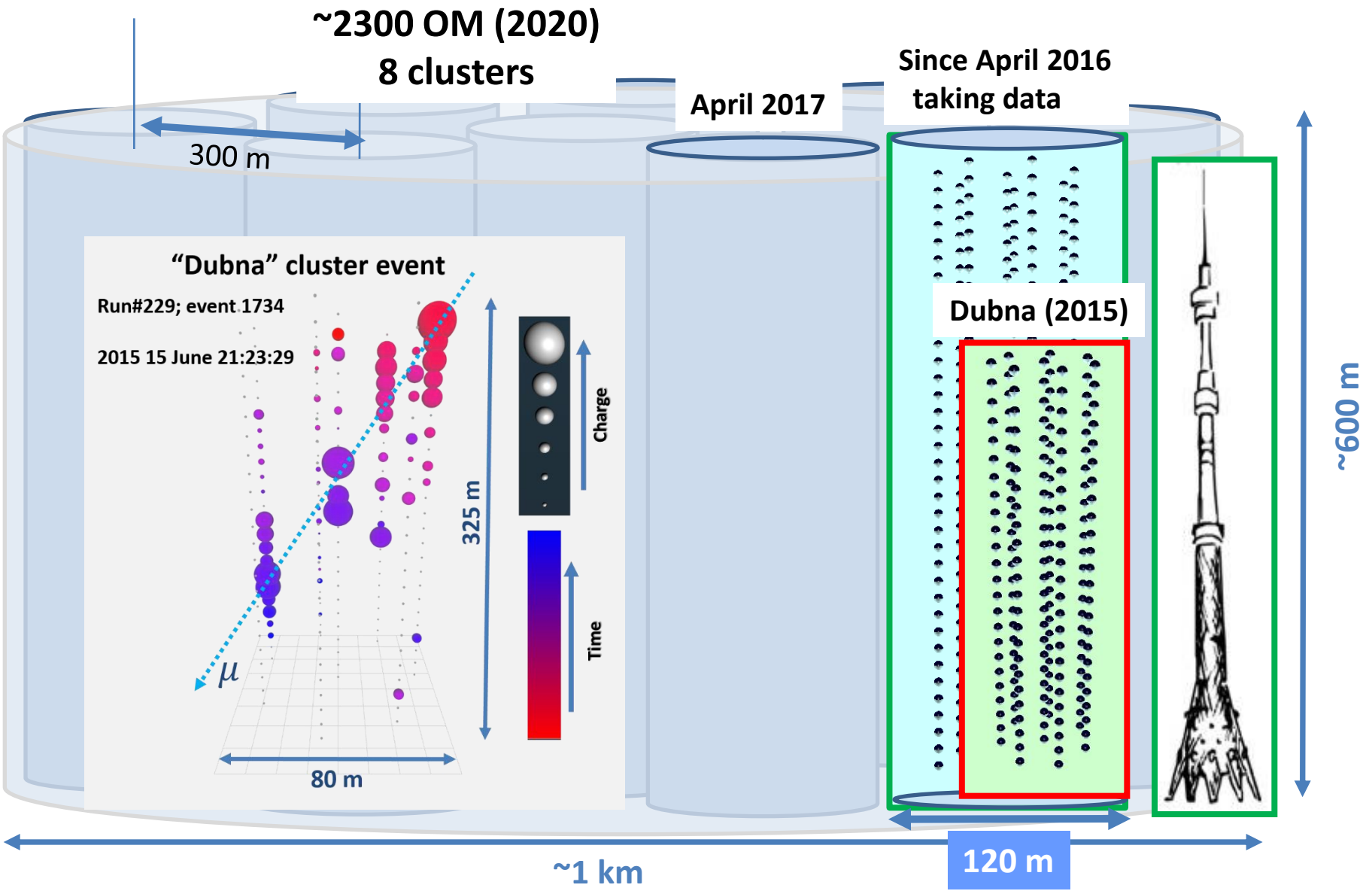


Бруно Понтекорво

JINR
Dzhelepov Laboratory for Nuclear Problems
INR of RAS
Institute for Nuclear Research of the Russian Academy of Sciences

M.A.Markov

Present and future of the BAIKAL-GVD



Merging of the Laboratory of High Energy and Laboratory of Particle Physics into the Veksler and Baldin Laboratory of High Energy Physics

Veksler & Baldin Laboratory of High Energy Physics

is founded on May 4-th 2008 in accordance with the decisions of the JINR Committee of Plenipotentiaries (27-28 Nov. 2007) by the JINR Director decree N 112 of February 19th, 2008

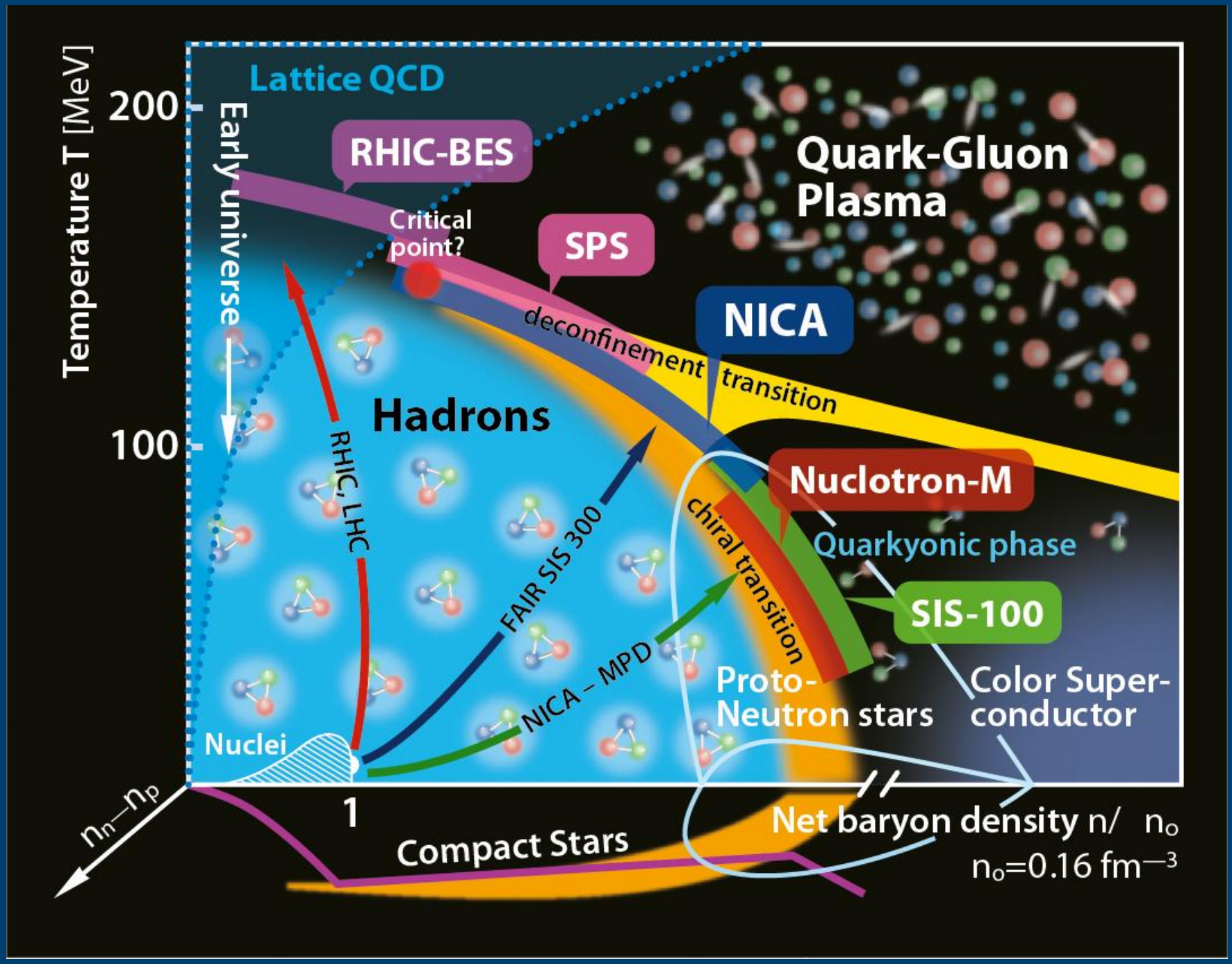
27 – 28 ноября 2007 г.

«Комитет полномочных представителей ПОСТАНОВЛЯЕТ:

… Одобрить предложение дирекции Института об изменении структуры ОИЯИ в связи с планами модернизации ускорительного комплекса нуклотрона и создания установки NICA. С целью концентрации кадровых и финансовых ресурсов на выполнении этой приоритетной программы ОИЯИ создать Лабораторию физики высоких энергий им. В.И. Векслера и А.М. Балдина, исключив из структуры Института Лабораторию высоких энергий им. В.И. Векслера и А.М. Балдина и Лабораторию физики частиц».

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
Nuclotron-M
chiral transition
Quarkyonic phase
SIS-100
Proto-Neutron stars
Color Super-conductor
Nuclei
$n_n - n_p$
1
Compact Stars
Net baryon density n/ n_o
n_o=0.16 fm^{-3}

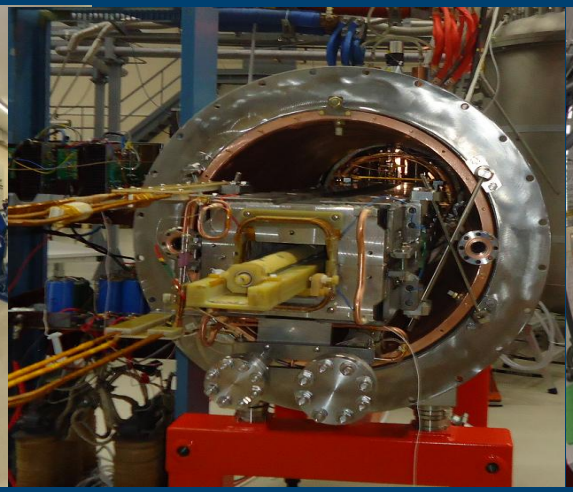
Infrastructure (SC magnets)

*~ 450 SC magnets will be assembled & tested in the workshop for **NICA** & SIS-100 **FAIR***

workshop ifor coil production

The technological line for SC magnet assembly and tests

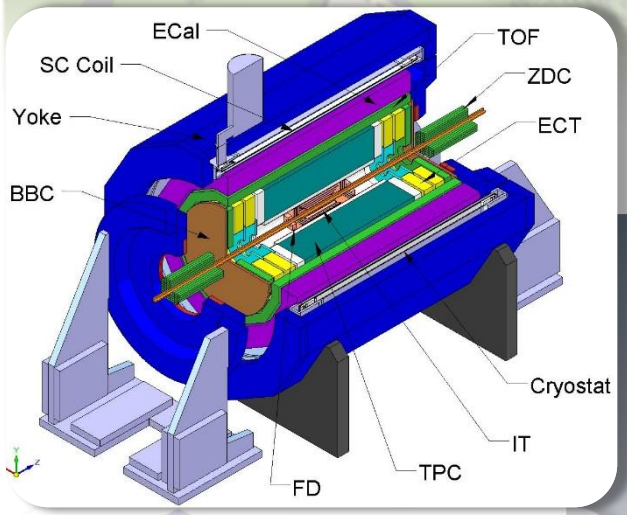
SC cable production workshop



Tests of the pre-serial dipole magnet: magnetic field measurements

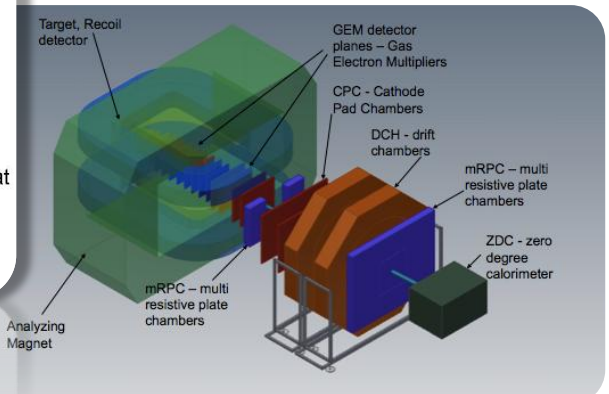
Status of the NICA complex realization

Nuclotron & channels	40%
Injection complex	49%
Booster	64%
Collider	18%
MPD	35%
BM@N	60%
SPD	2%
Infrastructure	39%
Innovation area	1%
IT & computing	25%



MPD

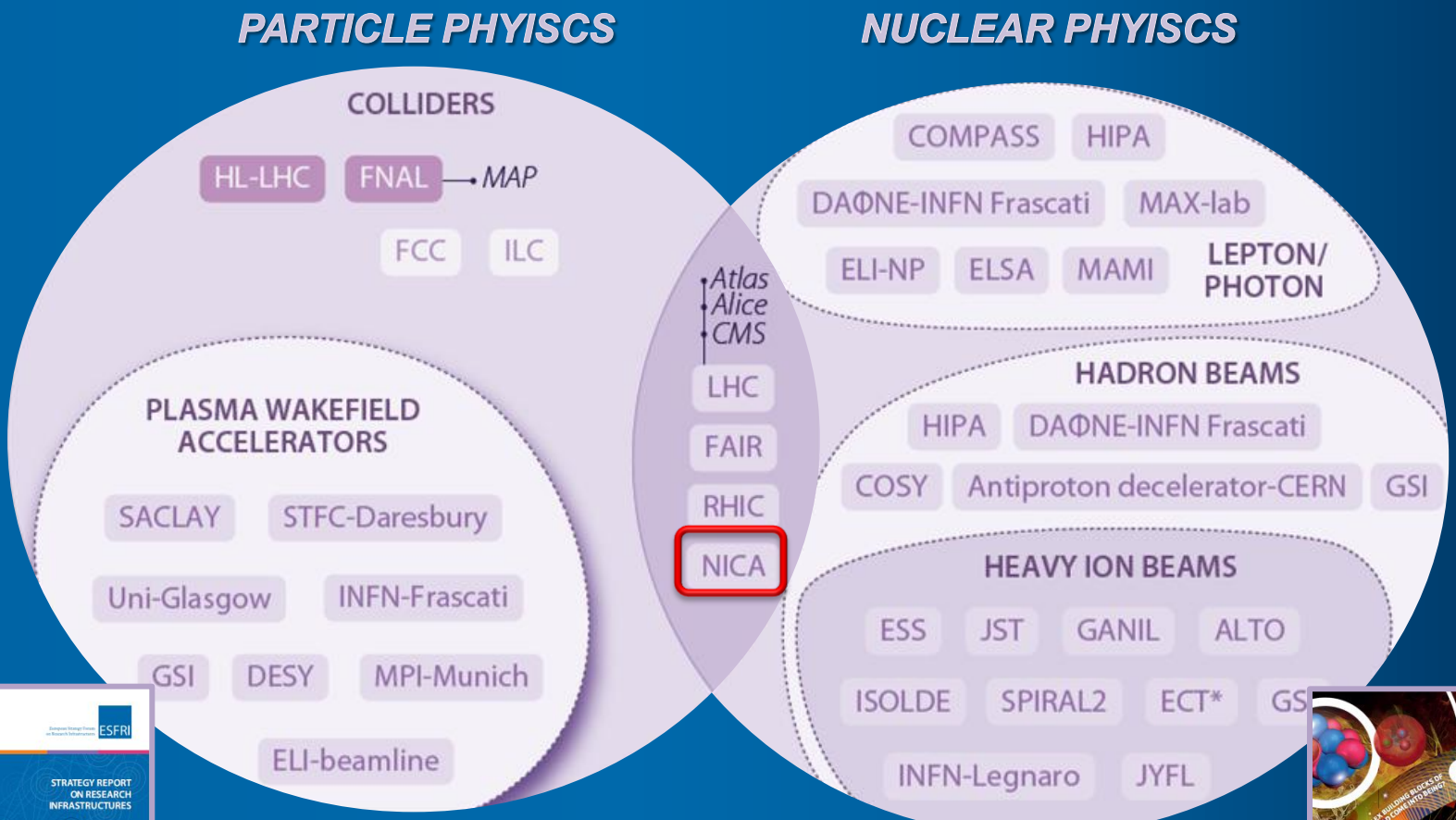
BM@N



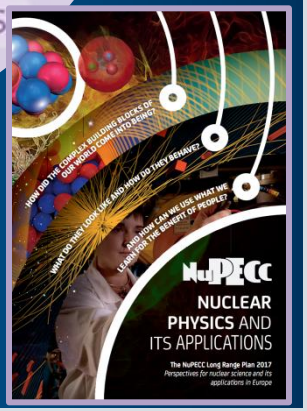
NICA Center

New issue of the ESFRI Roadmap

Main Research Infrastructure in Particle and Nuclear Physics

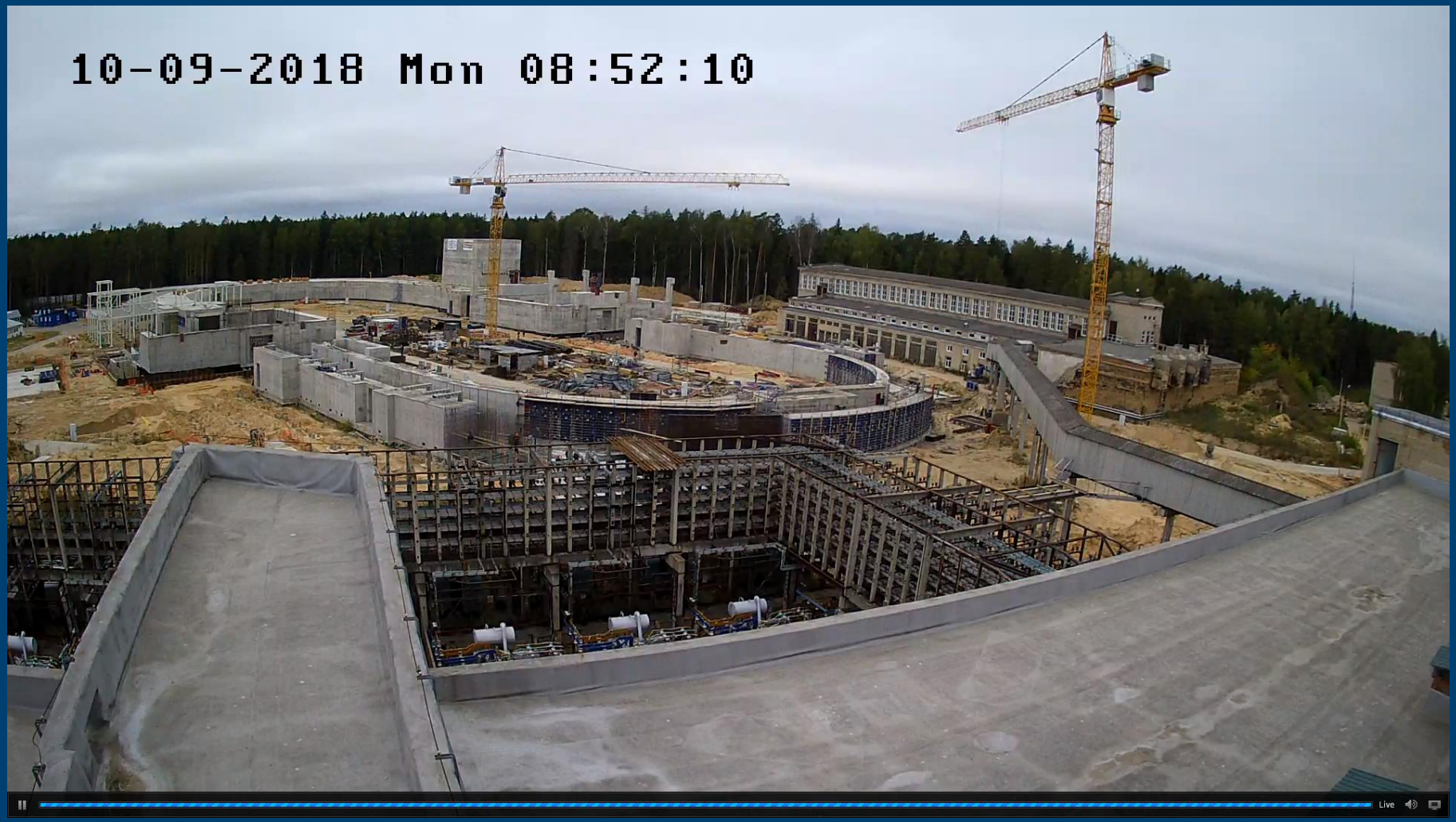


NICA – Complementary Project



NICA construction site a year ago

NICA construction site today



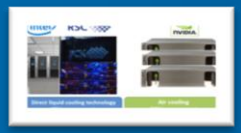
2000: Reorganization of the Laboratory of Computing Techniques and Automation (LCTA) into the Laboratory of Information Technologies (LIT)

Challenges before 2000:

- Transition of the developed countries worldwide to the unified information society
- Transition to distributed computing that ensures participation in the large-scale international research projects (LHC)
- The need to connect to computer networks for science and higher education
- Application of international standards
- Transition to electronic methods of particle detection

MICC main components

GRID



HPC

Cloud

Networking

Power@cooling

Laboratory today:

LAN	• 10 Gbps
WAN	• 100 Gbps + 2x10 Gbps
Tier-1	• 4160 core, • 5,4 PB disk, 9 PB tape
CICC-Tier-2	• 3640 core, 2PB disk
HPC-HybriLIT	•252 CPU, 77184 GPU cores, 182 PHI-cores, 2.4 TB RAM, 57.6 TB HDD, 142 Tflops
Cloud	• 700 CPU, 2 TB RAM

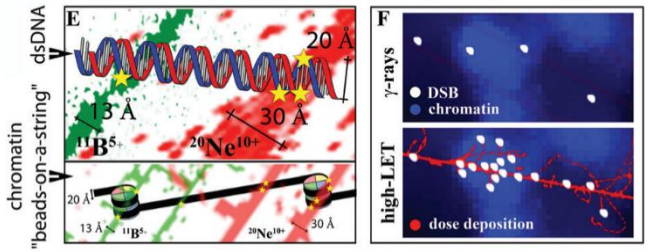
Now, LIT IT-infrastructure is one of the JINR basic facilities

Establishment of a new, seventh laboratory of JINR

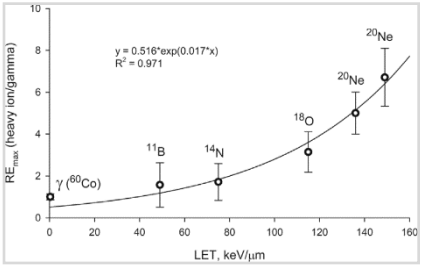
2005: Laboratory of Radiation Biology

Laboratory today:

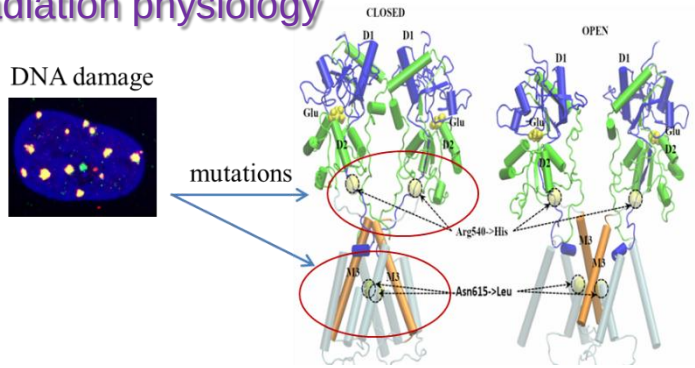
Molecular radiobiology



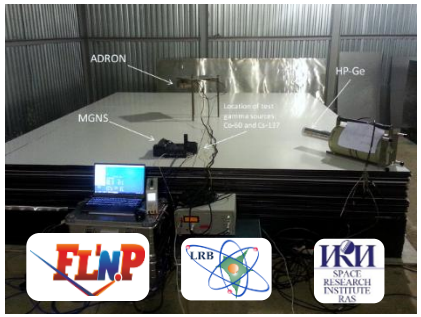
Radiation mutagenesis



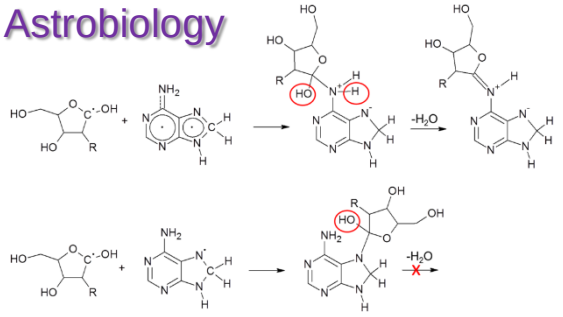
Radiation physiology



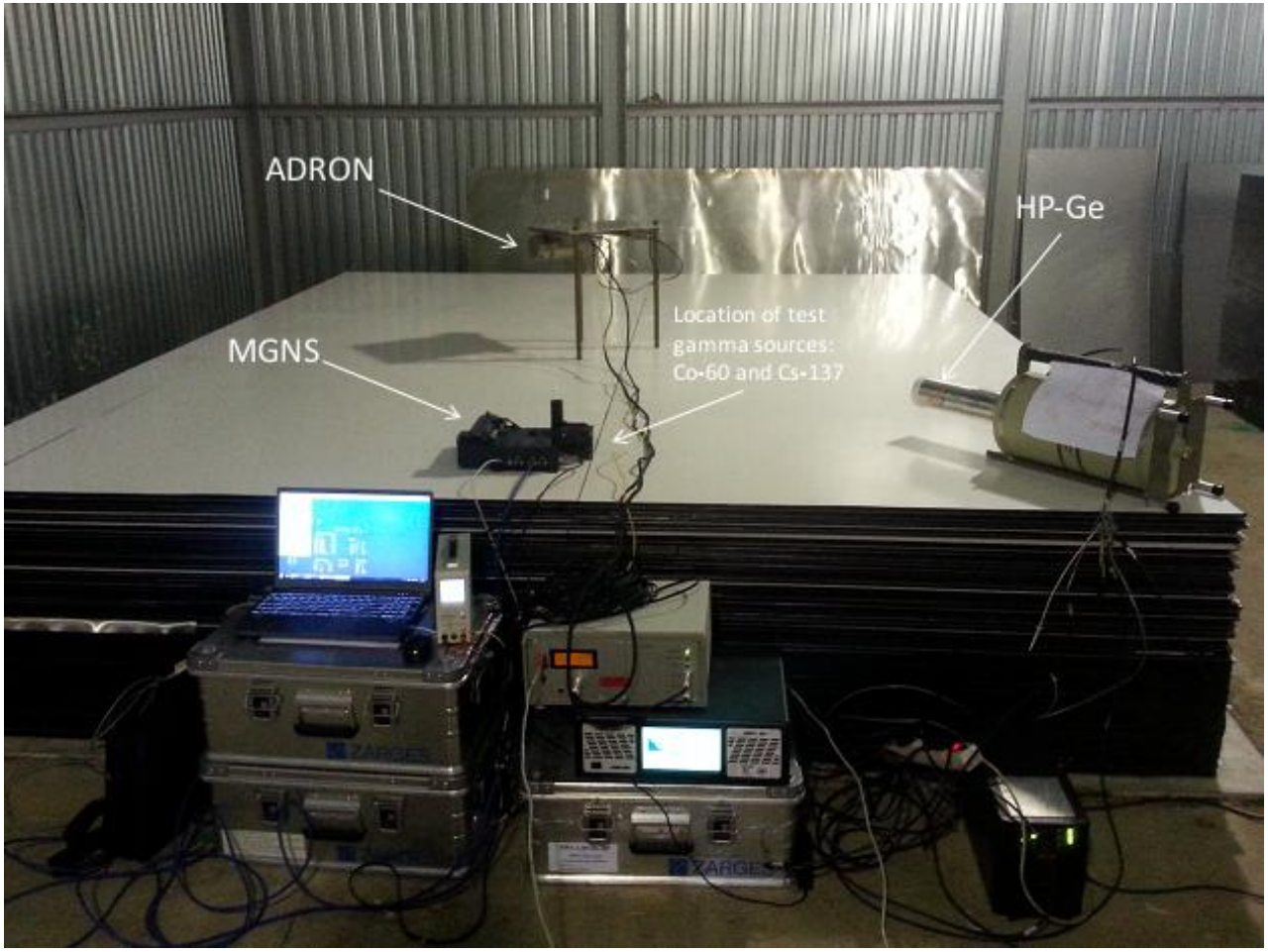
Nuclear planetary science



Astrobiology



Nuclear planetary science



In collaboration between the Space Research Institute (RAS) and FLNP (JINR), a *special facility has been constructed* at the LRB that can *model planetary soil* and allows testing prototypes of active neutron and gamma spectrometers.

The facility can use a neutron generator for soil model exposure. Inside the facility, a silicate glass-based soil model has been assembled.

JINR University Centre
Attracting youth to science

JINR UC Educational Programmes
Programmes for students and PhDs

SAINT PETERSBURG STATE UNIVERSITY

МФТИ

Казанский федеральный университет

- Attachment of students (about 2500 students and PhDs annually)
- International Student Practices (over 1400 participants since 2004)
- Summer Student Programme (205 participants since 2014 (62 in 2018)
- Engineering and Physics Training

Bringing people together

The Institute annually organizes up to 10 large conferences and more than 30 international workshops, as well as schools for young scientists, practice courses and schools for teachers – in total more than 100 international events per year, including 10 regular sessions of the JINR governing bodies.

Geography of JINR meetings in 2016

Science Bringing Nations Together

International Student Practice in JINR Fields of Research

Stage 3. 09-30 September 2018, JINR, DUBNA