



**INTERNATIONAL INTERGOVERNMENTAL ORGANIZATION**  
**МЕЖДУНАРОДНАЯ МЕЖПРАВИТЕЛЬСТВЕННАЯ ОРГАНИЗАЦИЯ**  
**JOINT INSTITUTE FOR NUCLEAR RESEARCH**  
**ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ**



[www.jinr.ru](http://www.jinr.ru)

**THE JOINT INSTITUTE FOR NUCLEAR RESEARCH**

*Prof. S. Pakuliak, JINR UC*

Stage 2 of the International Student Practice in JINR Fields of Research  
JINR University Centre 09/07/2018

<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

Basic  
Research

International cooperation

Innovations

Education

Outreach



# 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.



Albania



Bulgaria



China



Czechoslovakia



GDR



Hungary



D.P.R. Korea



Mongolia



Poland



Romania



USSR

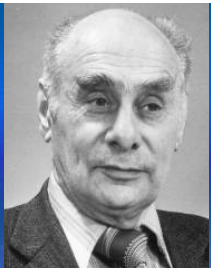


Vietnam



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

# Founders of JINR



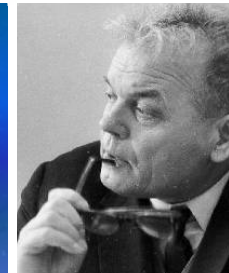
G.Flerov



V.Veksler



I.Frank



M.Meshcheryakov



A.Baldin



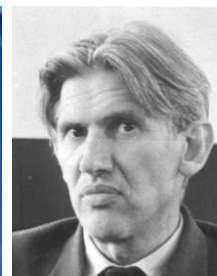
N.Bogoliubov,  
D.Blokhintsev



V.Dzhelepov



B.Pontecorvo



L.Janossy

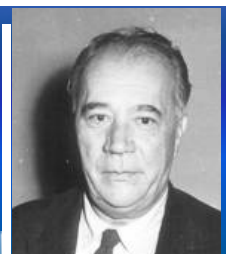


Wang Ganchang

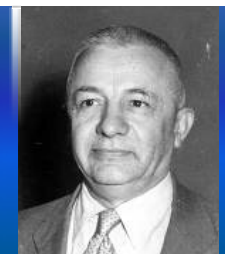
L.Infeld



H.Niewodniczanski



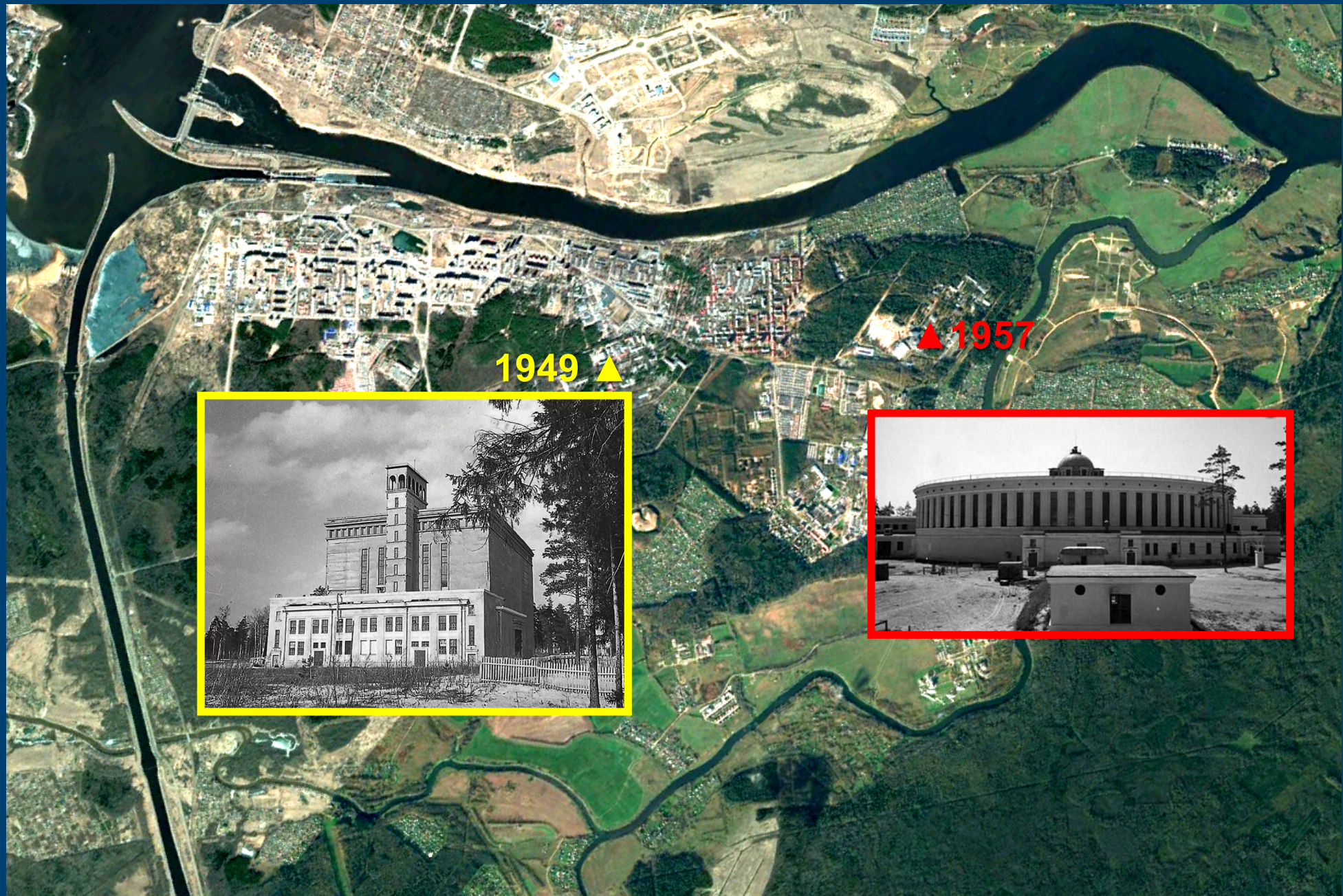
H.Hulubei



G.Najakov



# Dubna – Island of Stability

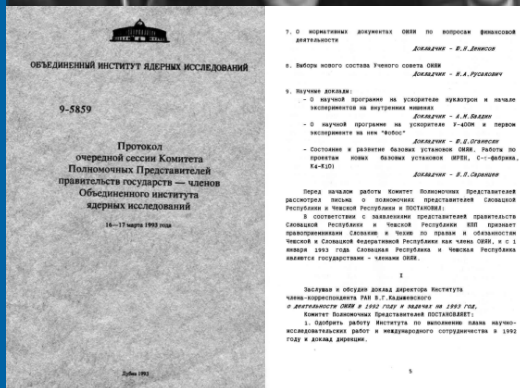




# 1993–2018: 25 years of the New Era of the Joint Institute for Nuclear Research



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



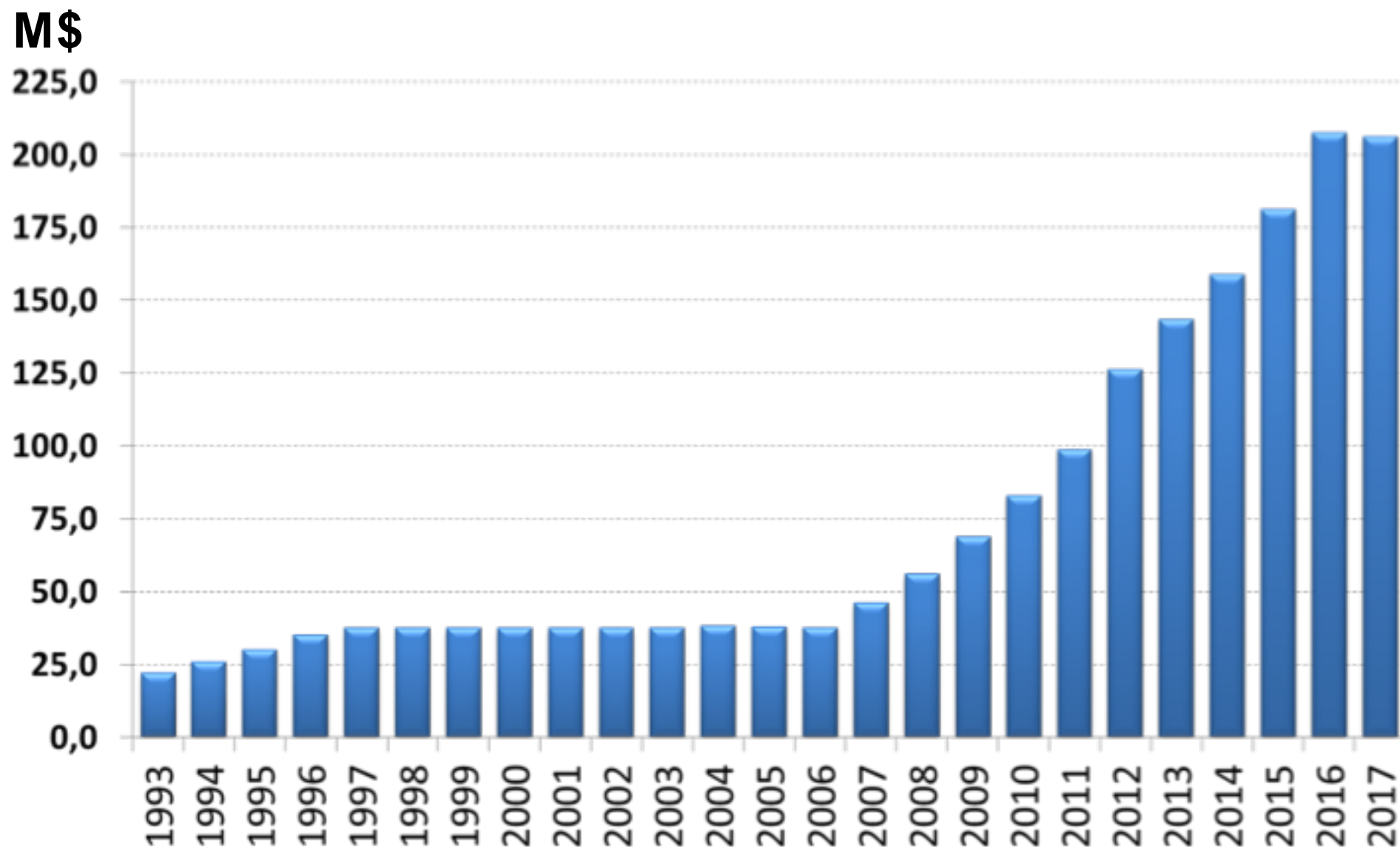
- Membership of Belarus, Russia, and Ukraine was approved at CP session in December 1991;
- Armenia, Azerbaijan, Georgia, Kazakhstan, and Moldova – March 1992;
- Uzbekistan – June 1992;
- Czech and Slovak Republics – March 1993;
- Associate members: Germany (July 1991) and Hungary (February 1993).

## 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



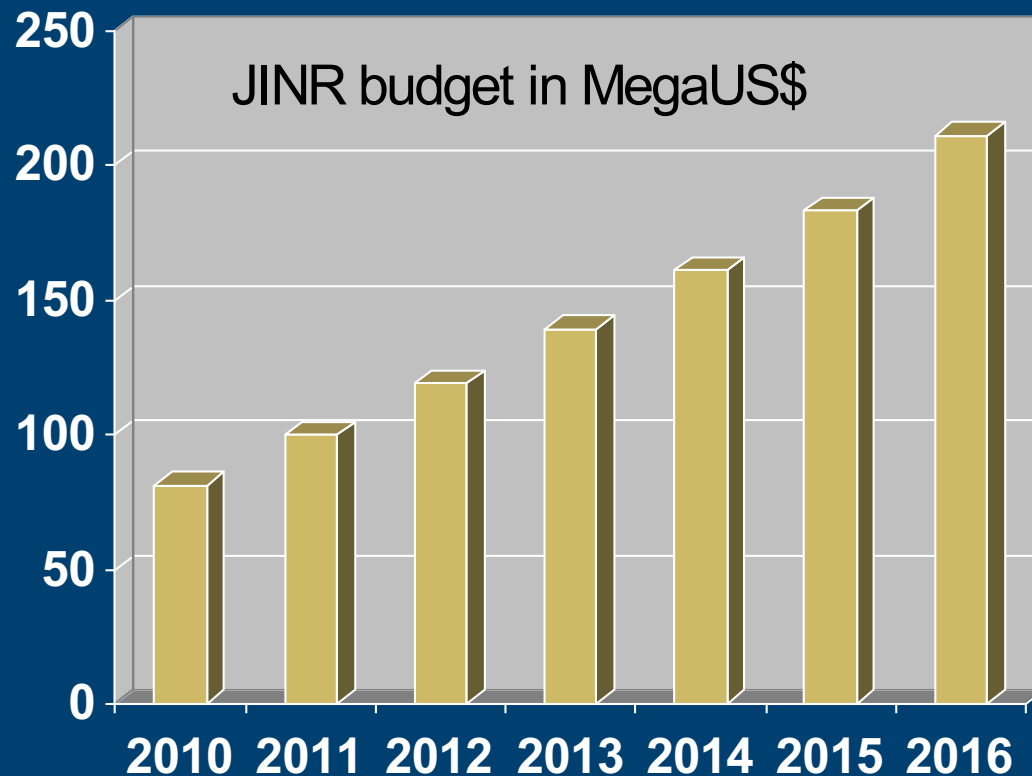
***“The Agreement between the Government of the Russian Federation and JINR on the Location and Terms of Activity of JINR in the Russian Federation” was approved in 2000.***

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

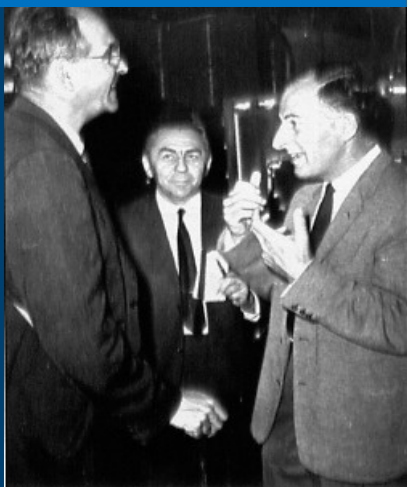
Participation of **Egypt, Germany, Hungary, Italy, Republic of South Africa, Serbia** in JINR activities is based on bilateral agreements signed at the governmental level.



# 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 vs CERN @ Web of Science®

JINR publication statistics		in comparison with CERN
2011 – 2017	2017	CERN 2017
<b>Total number of publications: 8 178</b> <b>Total number of citations: 97 711</b> <b>Excluding self-citations: 77 861</b> <b>Average citations per article: 11,95</b> <b>h-index: 106</b>	<b>Total number of publications: 1 260</b> <b>Total number of citations: 1 202</b> <b>Excluding self-citations: 837</b> <b>Average citations per article: 0,95</b> <b>h-index: 14</b>	<b>Total number of publications: 1 287</b> <b>Total number of citations: 1 694</b> <b>Excluding self-citations: 1 226</b> <b>Average citations per article: 1,32</b> <b>h-index: 15</b>

2016: JINR in comparison with CERN	
JINR	CERN
<b>Total number of publications: 1147</b> <b>Total number of citations: 1164</b> <b>Excluding self-citations: 948</b> <b>Average citations per article: 1.01</b> <b>h-index: 14</b>	<b>Total number of publications: 1186</b> <b>Total number of citations: 2241</b> <b>Excluding self-citations: 1829</b> <b>Average citations per article: 1.89</b> <b>h-index: 17</b>



# 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**



**Flerov**  
**Laboratory of Nuclear Reactions**



**Frank Laboratory of Neutron Physics**



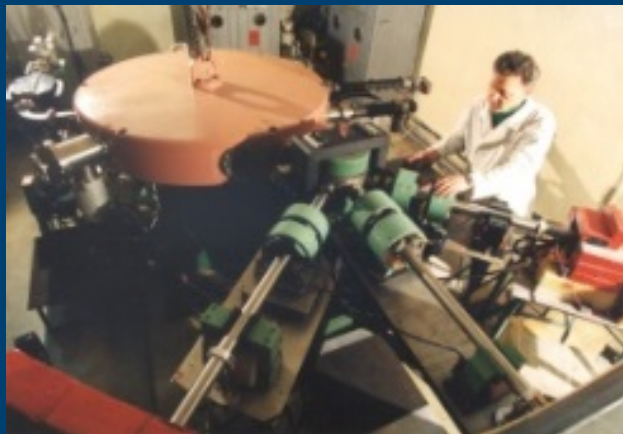
**Laboratory of Radiation Biology**



**Laboratory of**  
**Information Technologies**



# FLNR accelerator complex





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**

**30<sup>th</sup> 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.

**28<sup>th</sup> 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**.

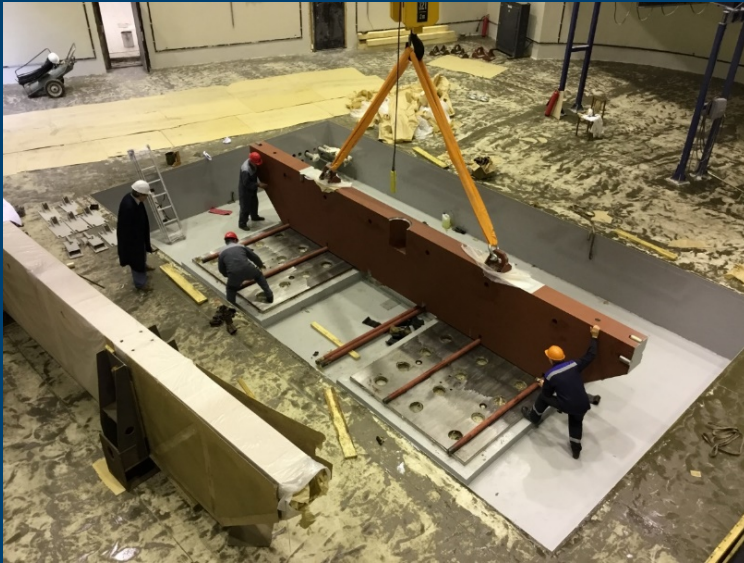
Флеровий <b>114</b>	Московский <b>115</b>	Ливерморий <b>116</b>	Теннессин <b>117</b>	Оганесон <b>118</b>
<b>Fl</b>	<b>Mc</b>	<b>Lv</b>	<b>Ts</b>	<b>Og</b>
Flerovium	Moscovium	Livermorium	Tennessine	Oganesson

**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



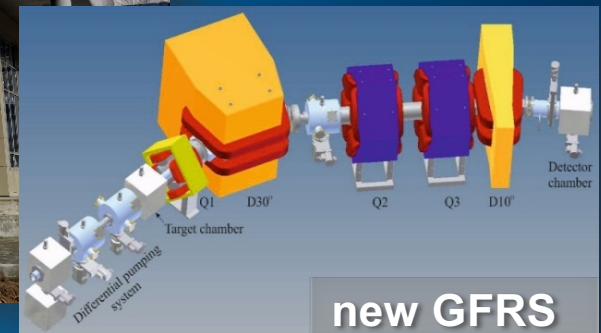
**Magnet of DC280 cyclotron is assembled and ready for testing!**



# Today: constructing the SuperHeavy Elements (SHE) Factory



DC-280



new GFRS

- ❑ 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*)

# Technology transfer to JINR Member States



CYCLOTRON CENTRE IN ASTANA  
(KAZAKHSTAN)  
LAUNCHED IN 2006

- **2003:** Government decision on the creation of a cyclotron center in Astana
- **2004–2005:** Designing and manufacturing of equipment of the DC-60 cyclotron
- **2006:** Delivery of equipment to Astana; mounting, tuning and adjustment; first beam generation



DC-60  
CYCLOTRON



# IBR-2: Pulsed reactor with fast neutrons

mean power **2 MW**

pulse frequency **5 Hz**

pulse width for fast neutrons **200  $\mu$ s**

thermal neutrons flux density on the moderator surface:  **$10^{13}$  n/cm<sup>2</sup> /s**

maximum in pulse:  **$10^{16}$  n/cm<sup>2</sup> /s**

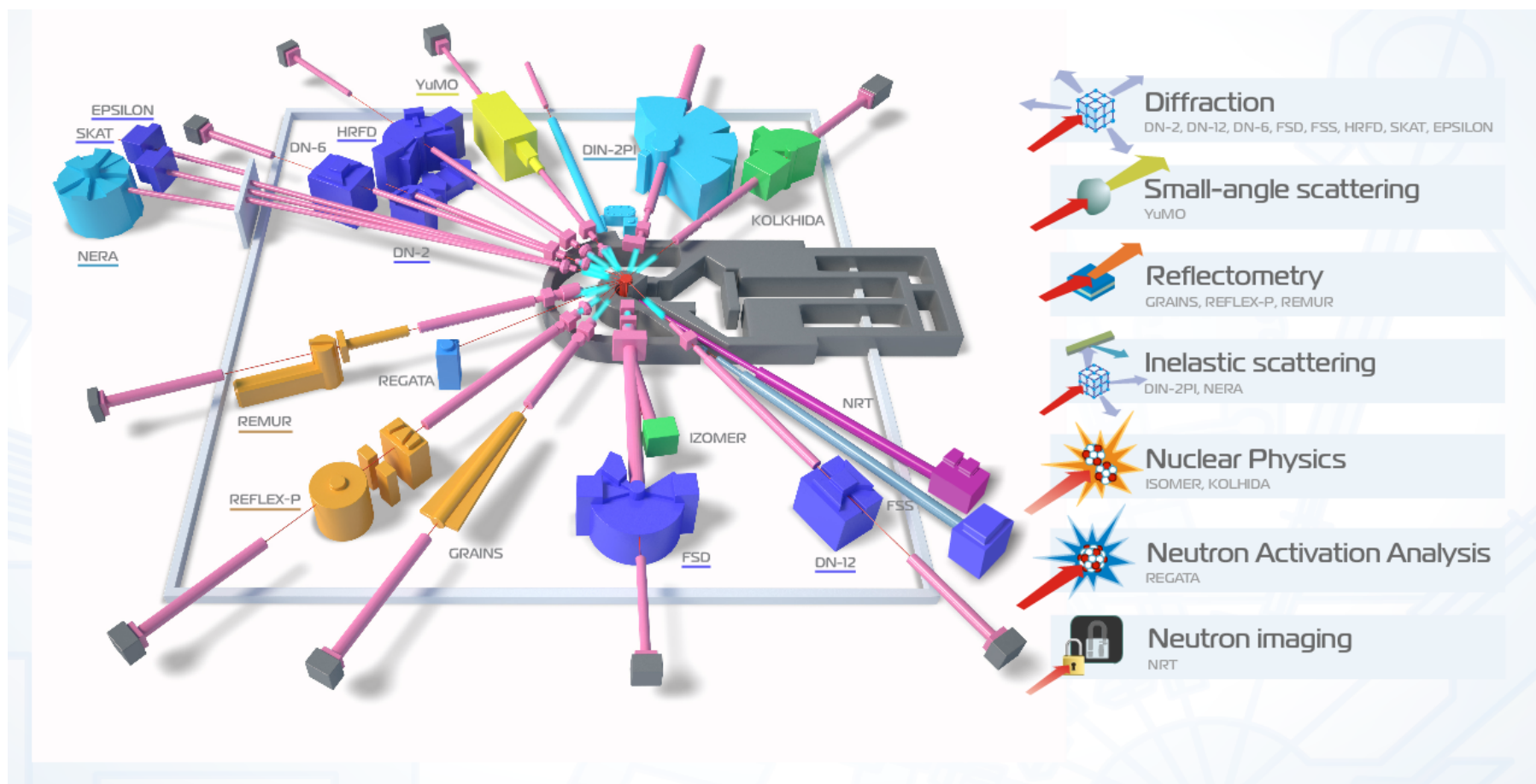


IBR-2 is included in the 20-year  
European strategic research program  
in the field of  
neutron scattering



# Facilities at IBR-2 reactor

15 instruments are in operation at 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



Typical works on the Baikal lake ice.

2015



15 июня Подмископы

**JINR**

Dzhelepov  
Laboratory  
for Nuclear  
Problems

**INR of RAS**

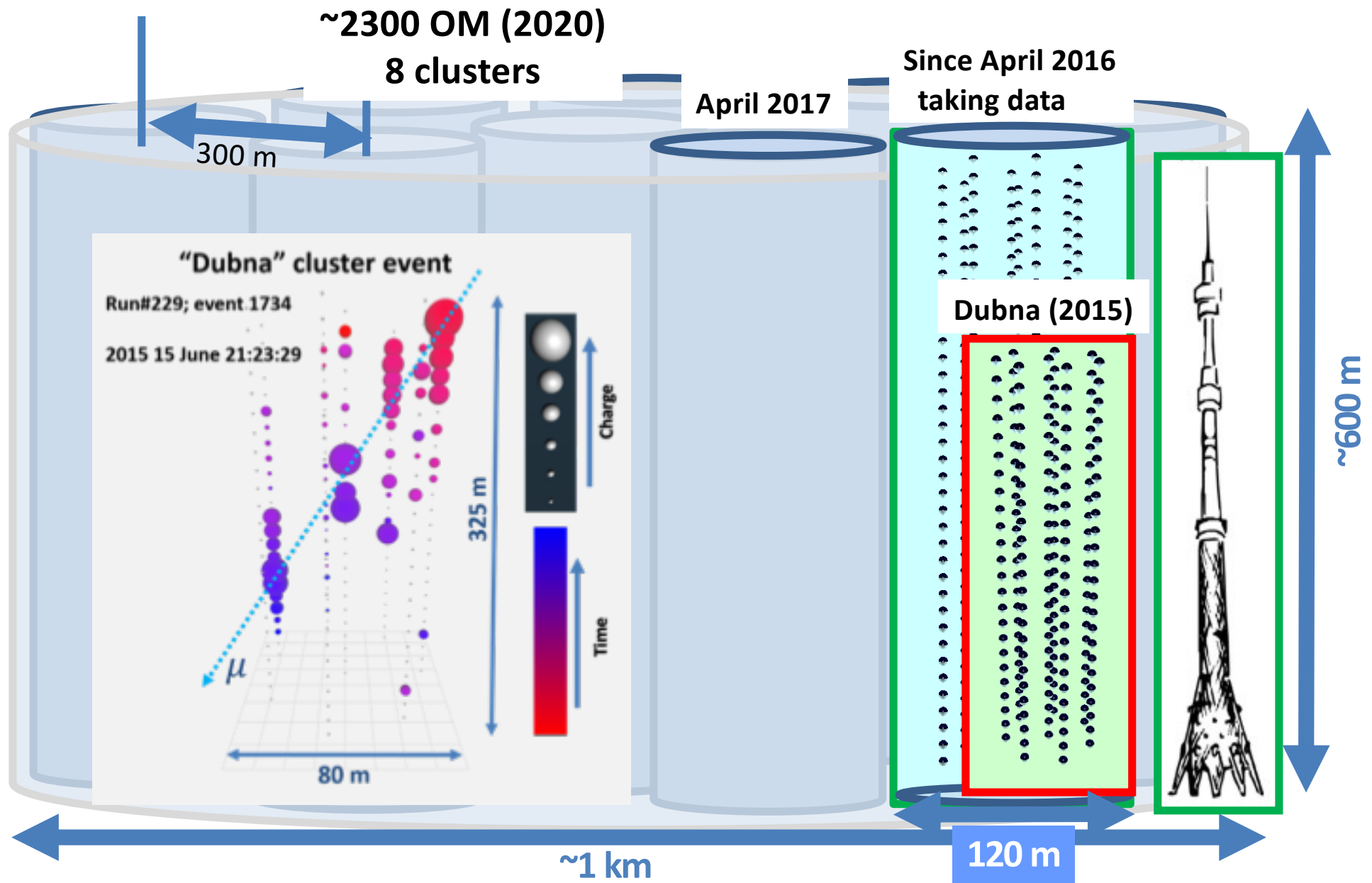
Institute for  
Nuclear

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».

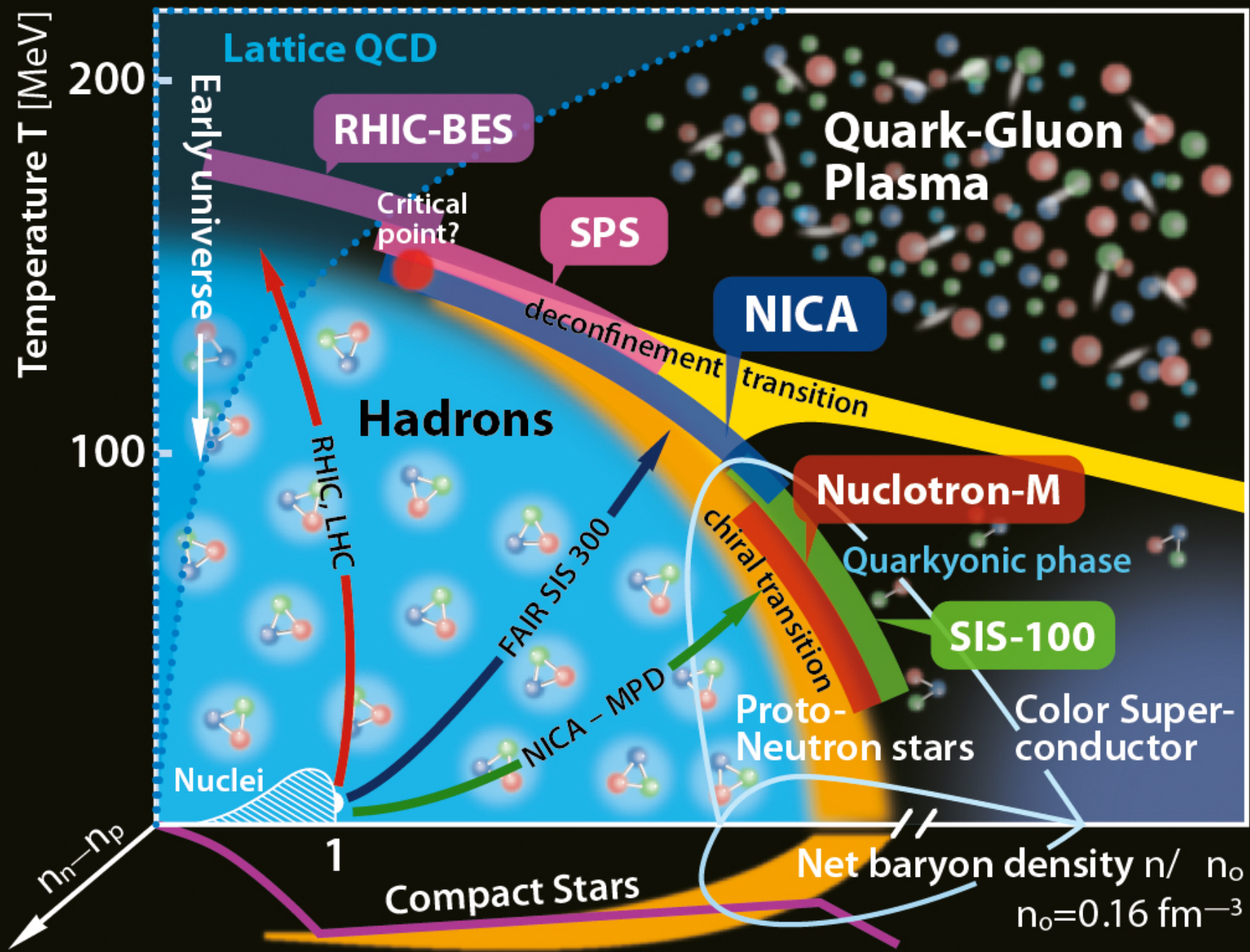


# NICA Layout



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







# Infrastructure (SC magnets)

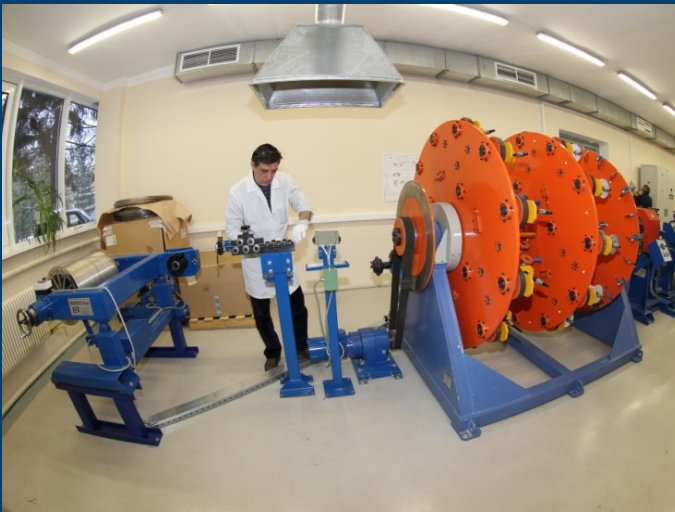
~ 450 SC magnets will be assembled & tested in the workshop  
for **NICA** & **SIS-100 FAIR**



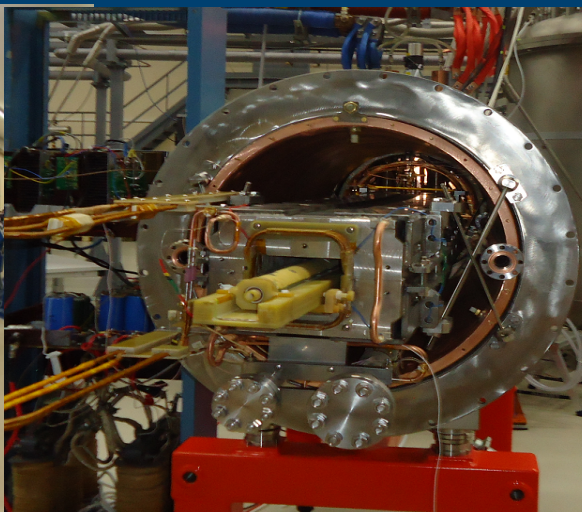
*workshop ifor coil production*



*The technological line for SC magnet assembly and tests*



*SC cable production workshop*



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

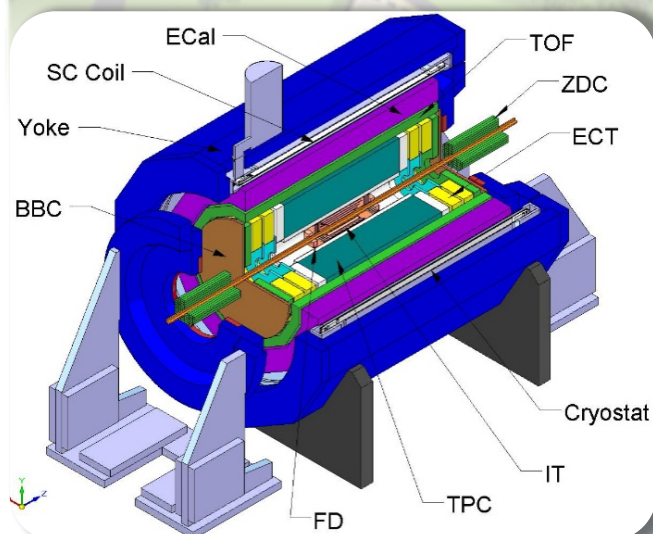




# Status of the NICA complex realization

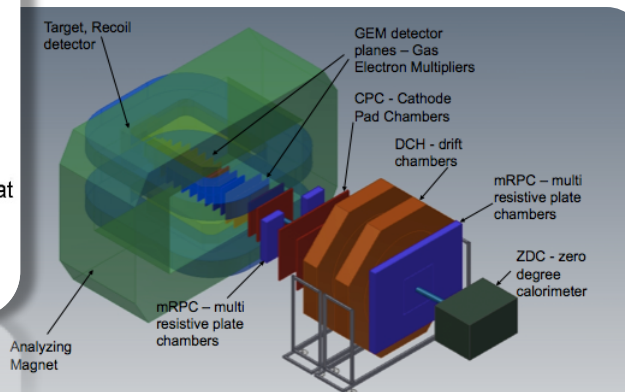


Nuclotron & channels	40%
Injection complex	49%
Booster	64%
Collider	18%
MPD	35%
BM@N	60%
SPD	2%
Infrastructure	39%
Innovation area	1%
IT & computing	25%



**MPD**

**BM@N**



V. Matveev



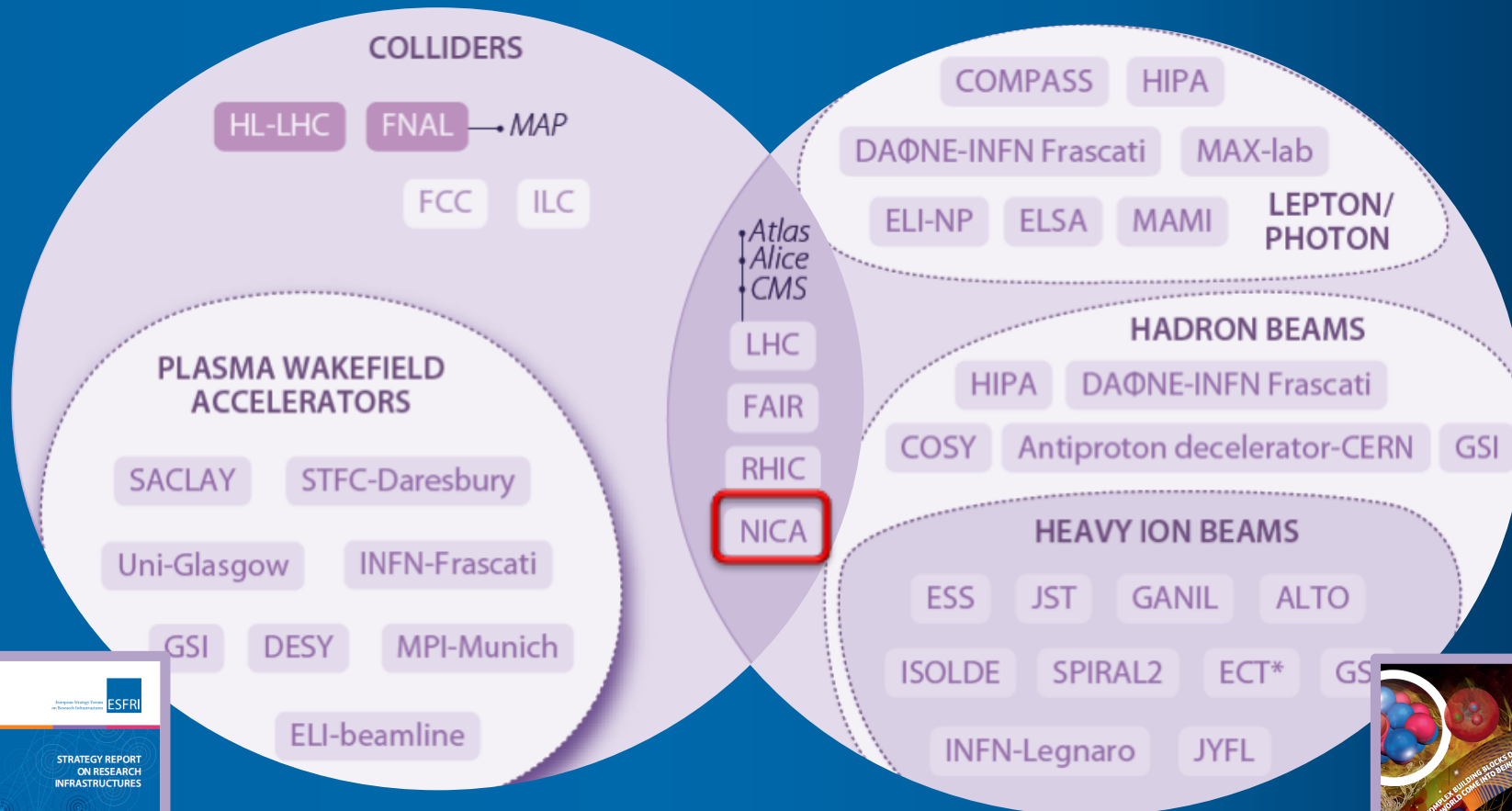
**NICA Center**

# New issue of the ESFRI Roadmap

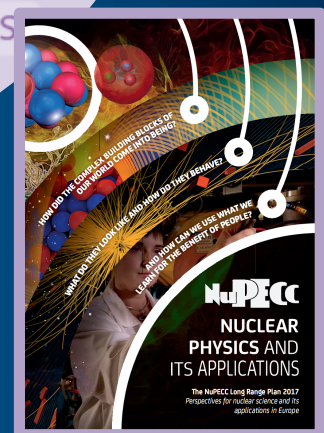
## Main Research Infrastructure in Particle and Nuclear Physics

### PARTICLE PHYSICS

### NUCLEAR PHYSICS



**NICA** – Complementary Project





Participants of HLC  
JINR: 25 year of New Era  
25/03/2018



NICA construction site a year ago

27/05/2017





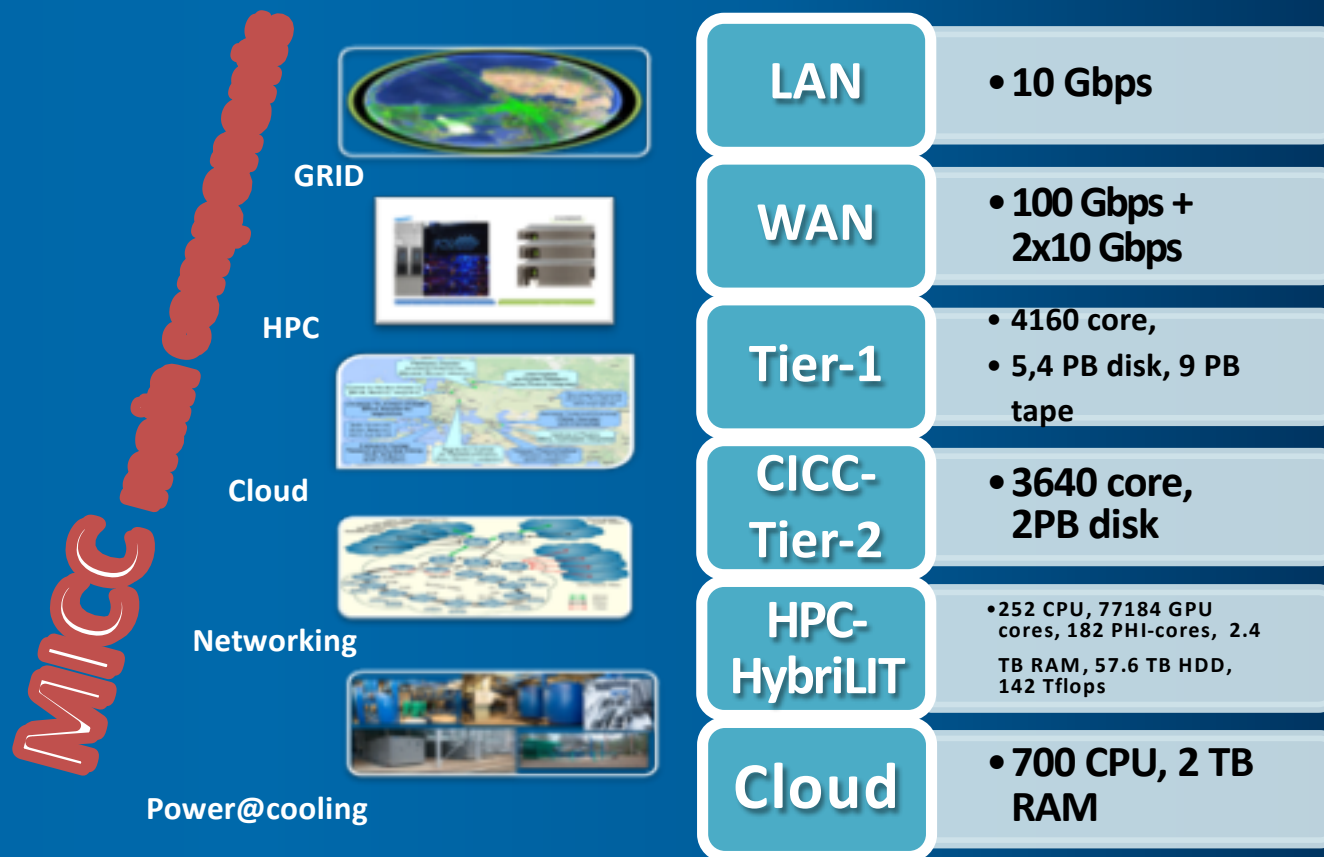
# Reorganization of the Laboratory of Computing 2000: Techniques and Automation (LCTA ) into the Laboratory of Information Technologies (LIT)



## 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

## Laboratory today:



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



# Establishment of a new, seventh laboratory of JINR

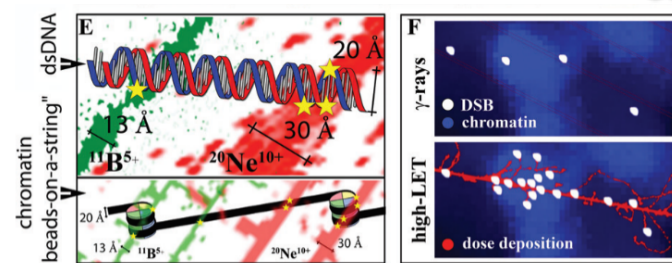
2005: Laboratory of Radiation Biology



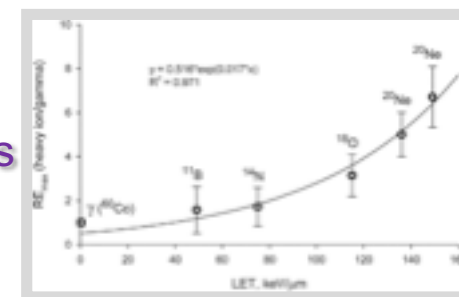
Laboratory today:



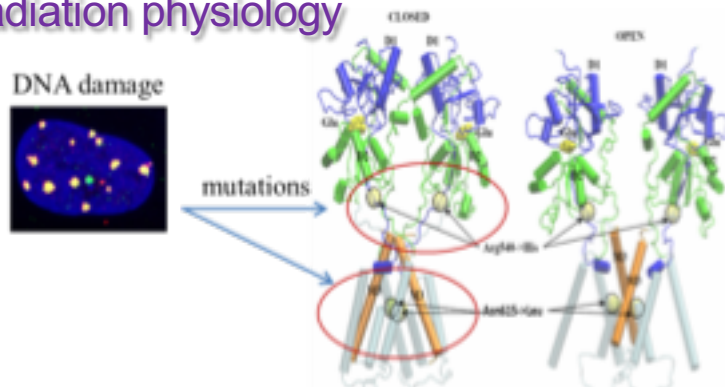
Molecular radiobiology



Radiation mutagenesis



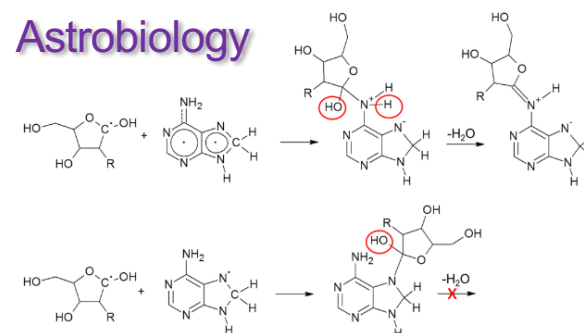
Radiation physiology



Nuclear planetary science

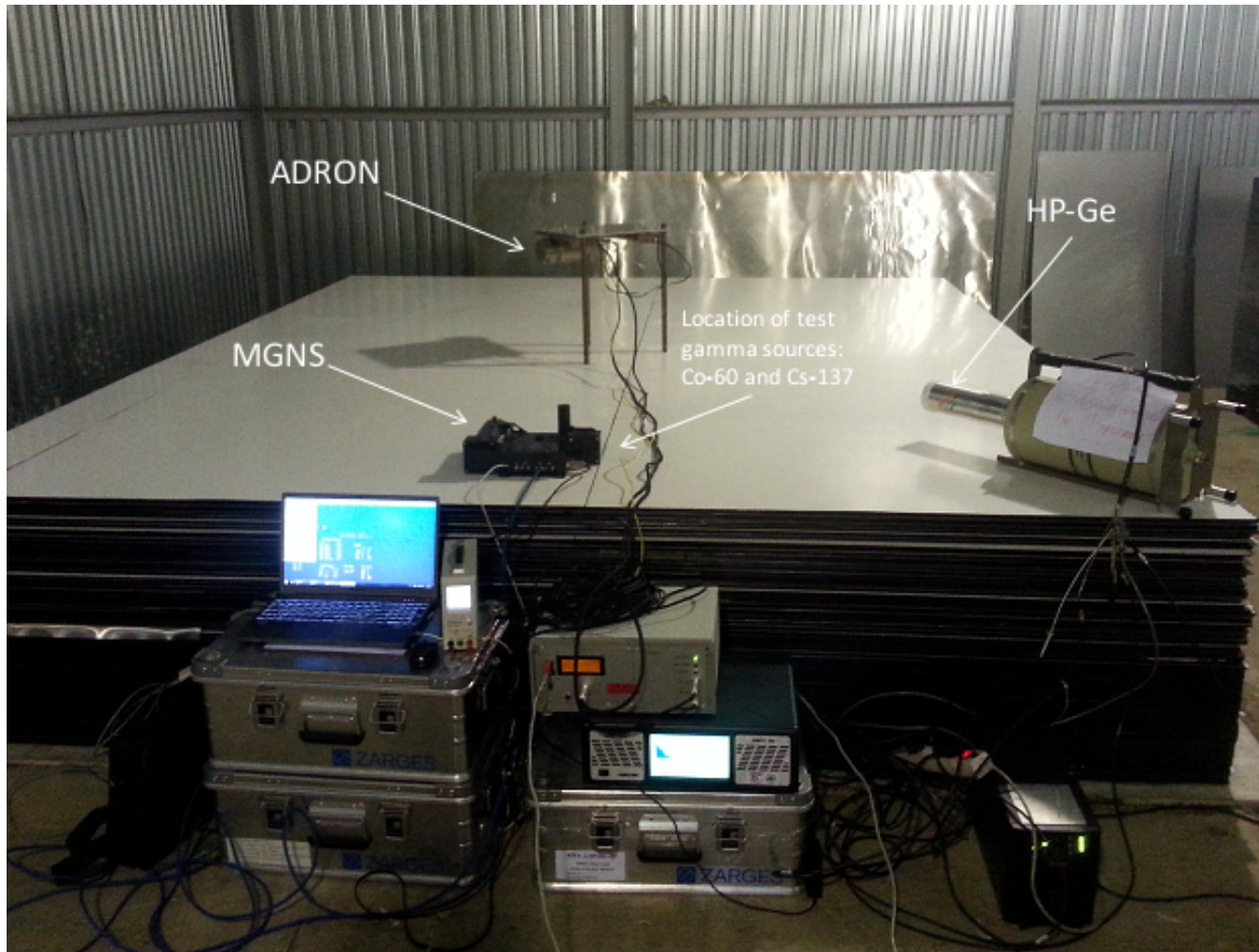


Astrobiology





# 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.



# INTERNATIONAL STUDENT PRACTICE IN JINR FIELDS OF RESEARCH

STAGE 2. 08-28 JULY 2018, JINR, DUBNA



JOINT INSTITUTE  
FOR NUCLEAR  
RESEARCH