CERN and JINR have almost 60-years long history of fruitful collaboration in the field of the fundamental physics and scientific exchange

CERN – JINR
Scientific Cooperation Meeting
25 April, 2017
CERN, Geneva, Switzerland

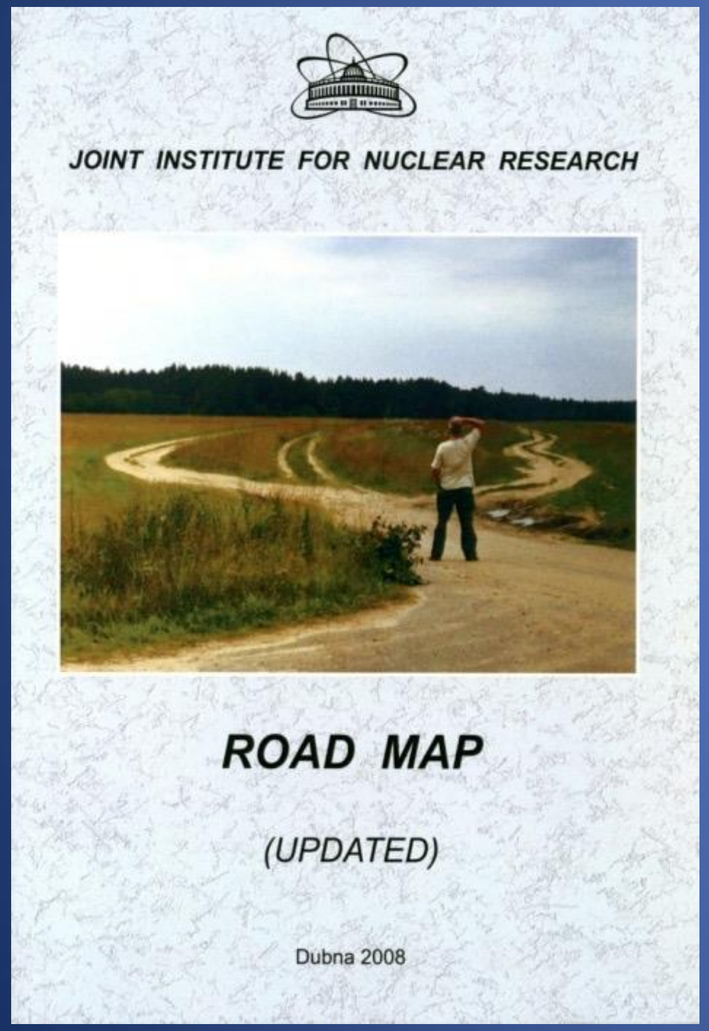
NEWS from JINR

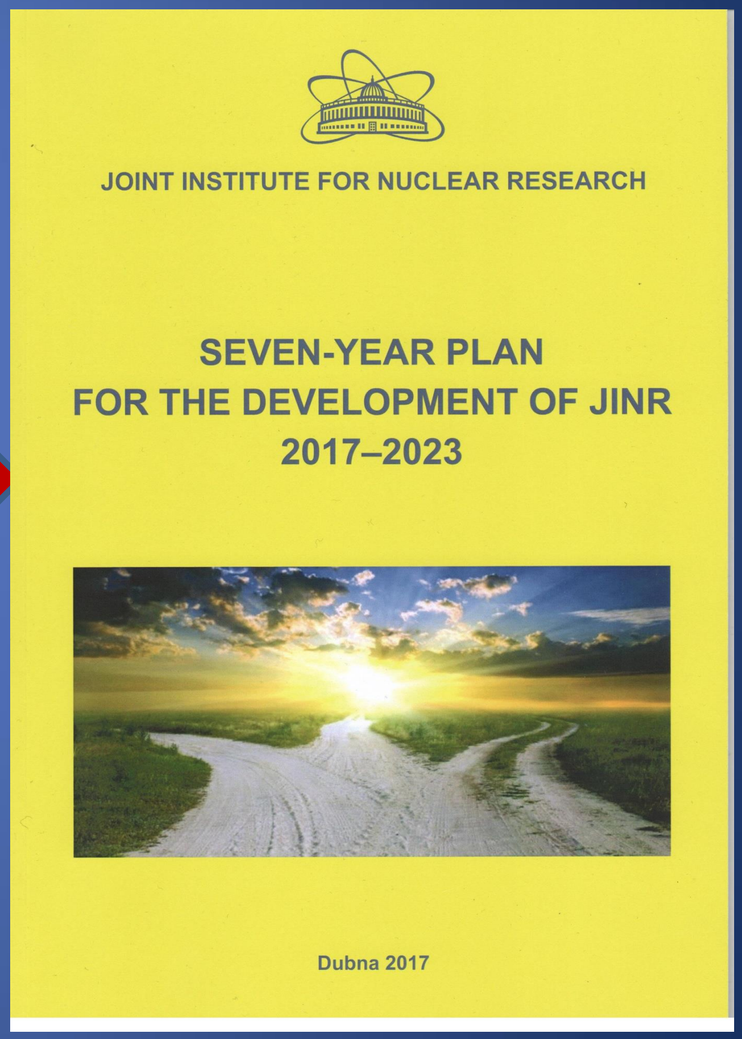
Victor A. Matveev

JINR – CERN strategic partnerships

- JINR actively participates in the LHC programmes including the ATLAS, CMS , ALICE and the Collider itself and planning to contribute to the LHC detectors upgrade.
- Besides, JINR participate in the four SPS projects:
- Compass-II (NA58) – nucleon spin structure, hadron spectroscopy (with interests to future SPD at NICA);
- NA61 – (intersects with BM@Nuclotrone and MPD);
- NA62 – CP-violation and rare decays;
- NA64 – search for the dark sector;
- Accelerator development: **CLIC**, **FCC**, precise laser metrology,
- Computing and Information Technologies, **WLCG, Tier-1**
- Neutrino platform, nTOF, DIRAC, Educ.Teachers program etc

New Seven Year Plan for the development of JINR (2017 – 2023) has been approved by the Committee of Plenipotentionaries of the Governments of the Member States of JINR in November 20, 2016 in Krakov, Poland.





Working Group is created for development of the JINR Long Range Strategy

Major objectives of the plan for the development of JINR in the next 7-years period (2017-2023):

- Focusing on the effective use of new and modernized basic facilities, built up under the previous 7-years plan (IBR-2M, SHE factory, DRIBs, IREN, Grid Tier-1, MICC);

-New fixed target facility at NUCLOTRON - BM@N (2017-2019);

- First stage of the NICA collider (2020) and full stage (2023);

- Full scale Gigaton Volume Neutrino Detector at the Baikal lake (2020);

- Development and application of the nuclear methods for Life Science and Medicine;

- Development of education programs, support of multidisciplinary studies;

- Extension of the international cooperation around basic facilities of JINR, further integration of these facilities to European and worldwide research infrastructure;

- Attracting new countries to the JINR family;

- Adjusting the general infrastructure and "modus operandi" of JINR accordingly to experience of best international research centers (CERN, Fermilab, INFN, GSI, CNRS, KEK and J-Park etc)

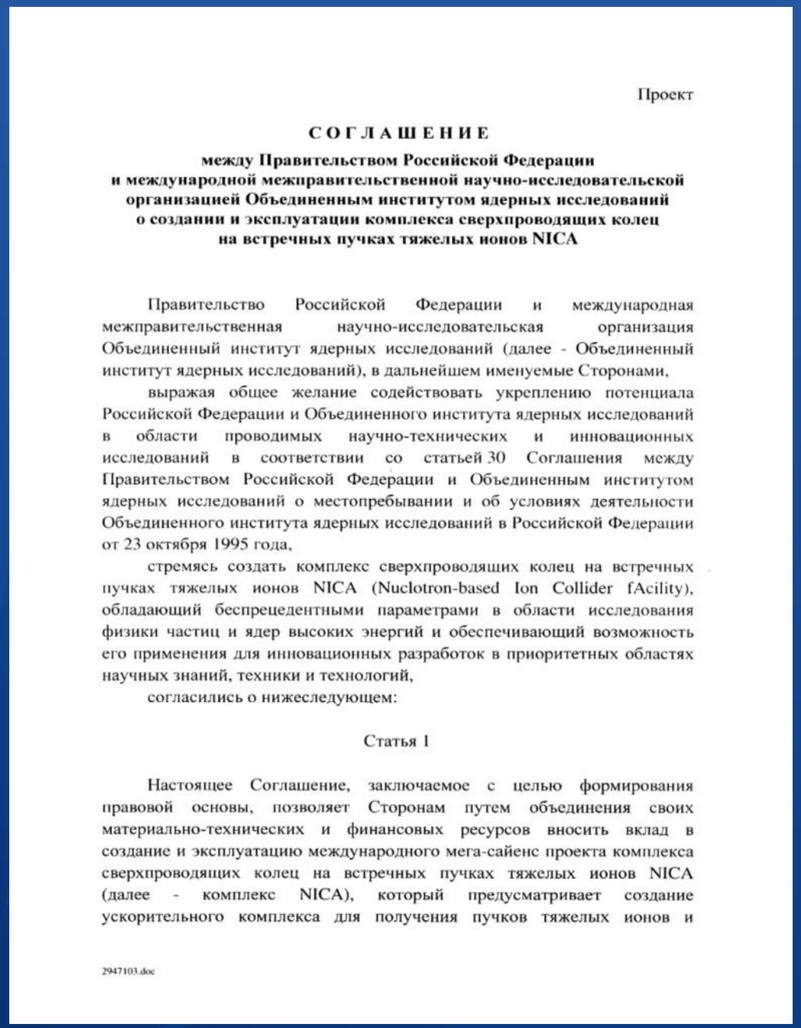
High Baryonic Density Frontier

Main targets of the NICA complex:

- **Study of hot and dense baryonic matter properties, search for critical phenomena;**
- **Investigation of nucleon spin dynamics and polarization phenomena.**

Agreement between Government of Russian Federation and JINR on realization of the international mega-sciences project of the superconducting heavy ion collider NICA

02 June 2016
the Agreement has been signed !



Проект

СОГЛАШЕНИЕ
между Правительством Российской Федерации и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований о создании и эксплуатации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA

Правительство Российской Федерации и международная межправительственная научно-исследовательская организация Объединенный институт ядерных исследований (далее - Объединенный институт ядерных исследований), в дальнейшем именуемые Сторонами,

выражая общее желание содействовать укреплению потенциала Российской Федерации и Объединенного института ядерных исследований в области проводимых научно-технических и инновационных исследований в соответствии со статьей 30 Соглашения между Правительством Российской Федерации и Объединенным институтом ядерных исследований о местопребывании и об условиях деятельности Объединенного института ядерных исследований в Российской Федерации от 23 октября 1995 года,

стремясь создать комплекс сверхпроводящих колец на встречных пучках тяжелых ионов NICA (Nuclotron-based Ion Collider fAcility), обладающий беспрецедентными параметрами в области исследования физики частиц и ядер высоких энергий и обеспечивающий возможность его применения для инновационных разработок в приоритетных областях научных знаний, техники и технологий,

согласились о нижеследующем:

Статья 1

Настоящее Соглашение, заключаемое с целью формирования правовой основы, позволяет Сторонам путем объединения своих материально-технических и финансовых ресурсов вносить вклад в создание и эксплуатацию международного мега-сайенс проекта комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA (далее - комплекс NICA), который предусматривает создание ускорительного комплекса для получения пучков тяжелых ионов и

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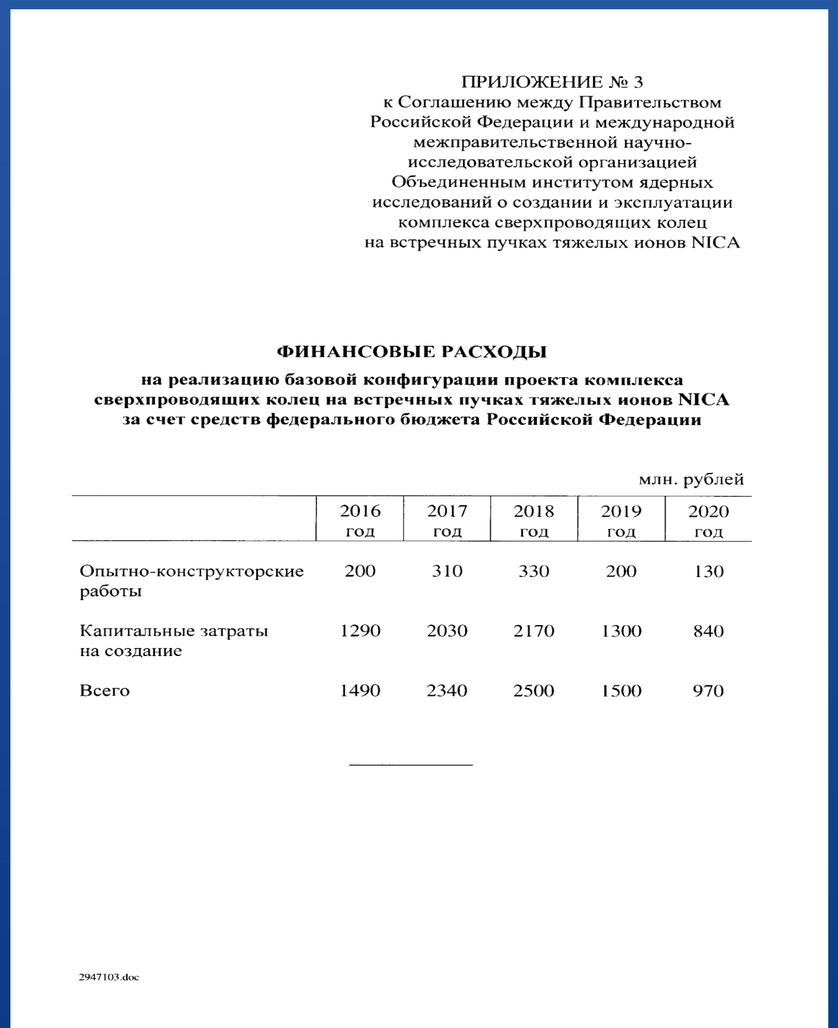

ПРИЛОЖЕНИЕ № 3
к Соглашению между Правительством Российской Федерации и международной межправительственной научно-исследовательской организацией Объединенным институтом ядерных исследований о создании и эксплуатации комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA

ФИНАНСОВЫЕ РАСХОДЫ
на реализацию базовой конфигурации проекта комплекса сверхпроводящих колец на встречных пучках тяжелых ионов NICA за счет средств федерального бюджета Российской Федерации

млн. рублей

	2016 год	2017 год	2018 год	2019 год	2020 год
Опытно-конструкторские работы	200	310	330	200	130
Капитальные затраты на создание	1290	2030	2170	1300	840
Всего	1490	2340	2500	1500	970

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V.V.Putin visit in June 2011

2016 - 2020
Joint investment:
17 500 MRub
(in 2013 prices)

Russian Federation:
8 800 MRub
JINR and others:
8 700 MRub

NICA International collaboration

Belarus
NC PHEP BSU (Minsk)
GSU (Gomel)
…
…

Germany
GSI (Darmstadt)
JLU (Giessen)
UR (Regensburk)
Frankfurt/Main Univ.
FIAS
FZJ (Julich)
FAU(Erlangen)

Bulgaria
INRNE BAS (Sofia)
TU-Sofia
SU
ISSP BAS
LTD BAS
SWU
PU (Plovdiv)
TUL (Blagoevgrad)

Ukraine
BITP NASU, KSU (Kiev)
KhNU, KFTI NASU (Kharkiv)

Russia
INR RAS (Moscow)
NRC KI (Moscow)
BINP RAS (Novosibirsk)
MSU (Mscow)
LPI RAS (Moscow)
St.Pet. Univ ersity
RI (St.Petersburg)
…
…

Poland
Tech.University (Warsaw)
Warsaw University
Fracoterm (Krakow)
Wroclaw University
INP (Krakow)

Czech Republic
TUL (Liberec)
CU (Prague)
Rzezh, …

RSA
UCT (Cape Town)
UJ (Johannesburg)
iThemba Labs

Australia
Azerbaijan
CERN
China
France
Georgia
Greece
India
Italy
Japan
Moldova
Mongolia
Romania
Serbia
Slovakia
USA

CERN-JINR cooperation Agreement

JINR–BMBF Agreement

JINR – INFN Agreement

Workshop in Dubna on Megaprojects - Russia, Italy, Germany, France, China, Egypt, South Africa Republic, others.

NICA – FAIR Agreement

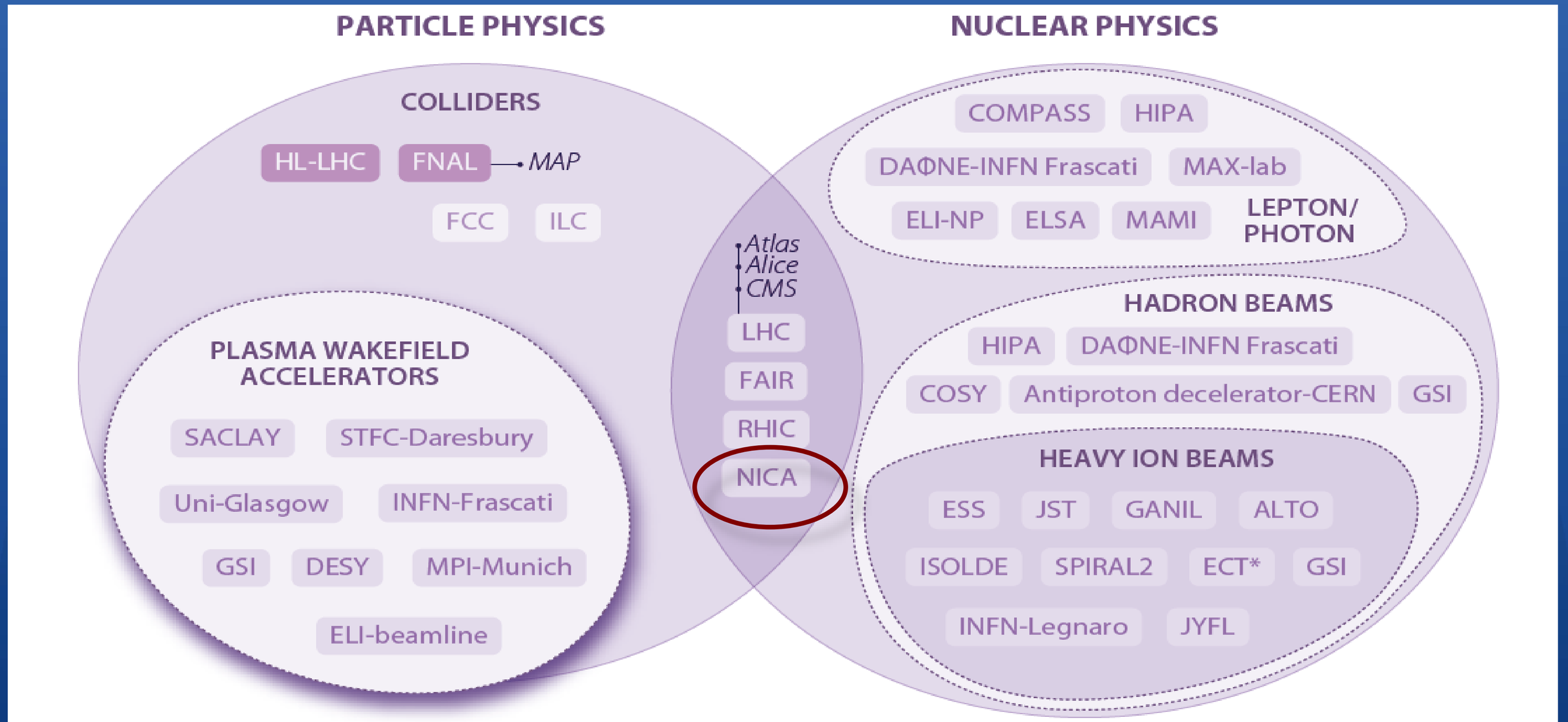
XX Intergovernmental Subcommission Russia-China on scienific and technological cooperation, Shanghai, 19-20 October,2016

RF was represented by vice-minister A.V.Lopatin Chineese vice-minister YIN Hejun had declared wish of China to join NICA.

Both vice-ministers agreed to ask RF and PRC Governments (level of Intergovernmental Commission) to initiate the procedure of signing the Agreement between PRC and JINR on NICA Collaboration.

JINR was represented by JINR vice-director G.Trubnikov.

ESFRI Road map 2016



NICA - FAIR – Complementary Projects

Recommendations (in a draft form)to be reported in the NuPECC Long range plan 2017
(Presentation by NuPECC Chair Angela Bracco, Darmstadt, January 13 2017)

... Strong support for the full exploitation of up-coming and existing facilities (see details on the next slides…)

... For the NICA facility complete construction and commissioning in order to study a hot and baryon rich matter in heavy ion collisions program at √s_NN = 4 - 11 GeV. Develop and bring into operation the on BM@N, MPD and SPIN detectors as well as to put into operation the SHE factory for search of a new stability regime for nuclei with Z beyond 118 (Og)

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:

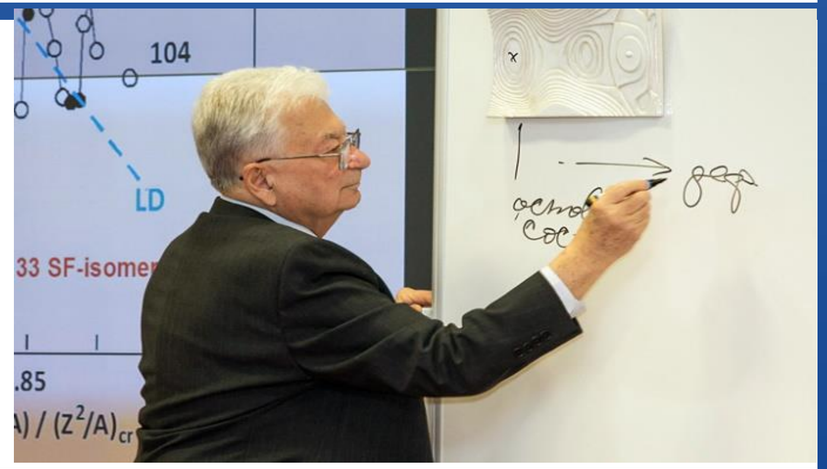
Approval of the discovery of new elements *113,115,117,and 118*

- **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 approved names and symbols of new elements:

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



Флеровий 114	Московий 115	Ливерморий 116	Теннессин 117	Оганесон 118
Fl	Mc	Lv	Ts	Og
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.

D.I. Mendeleev's Periodic table of elements (2016)

Бор 5	Углерод 6	Азот 7	Кислород 8	Фтор 9	Неон 10
B 10,81 Boron	**C** 12,011 Carbon	**N** 14,007 Nitrogen	**O** 15,999 Oxygen	**F** 18,998 Fluorine	**Ne** 20,18 Neon

Алюминий 13	Кремний 14	Фосфор 15	Сера 16	Хлор 17	Аргон 18
Al 26,982 Aluminum	**Si** 28,085 Silicon	**P** 30,974 Phosphorus	**S** 32,06 Sulfur	**Cl** 35,45 Chlorine	**Ar** 39,948 Argon

Никель 28	Медь 29	Цинк 30	Галлий 31	Германий 32	Мышьяк 33	Селен 34	Бром 35	Криптон 36
Ni 58,693 Nickel	**Cu** 63,546 Copper	**Zn** 65,38 Zinc	**Ga** 69,723 Gallium	**Ge** 72,630 Germanium	**As** 74,922 Arsenic	**Se** 78,971 Selenium	**Br** 79,904 Bromine	**Kr** 83,798 Krypton

Палладий 46	Серебро 47	Кадмий 48	Индий 49	Олово 50	Сурьма 51	Теллур 52	Иод 53	Ксенон 54
Pd 106,42 Palladium	**Ag** 107,87 Silver	**Cd** 112,41 Cadmium	**In** 114,82 Indium	**Sn** 118,71 Tin	**Sb** 121,76 Antimony	**Te** 127,60 Tellurium	**I** 126,90 Iodine	**Xe** 131,29 Xenon

Золото 79	Ртуть 80	Таллий 81	Свинец 82	Висмут 83	Полоний 84	Астат 85	Радон 8
Au 196,97 Gold	**Hg** 200,59 Mercury	**Tl** 204,38 Thallium	**Pb** 207,2 Lead	**Bi** 208,98	**Po** [209]	**At** [210]	**Rn** [222]

110	Рентгений 111	Коперникий 112	Нихоний 113
	Rg [282] Roentgenium	**Cn** [285] Copernicium	**Nh** [286] Nihonium

Флеровий 114	Московий 115	Ливерморий 116	Теннессин 117	Оганесон 118
Fl Flerovium	**Mc** Moscovium	**Lv** Livermorium	**Ts** Tennessine	**Og** Oganesson

105
Db
Dubnium

The 7th period of D.I. Mendeleev's Periodic table of elements is now complete
A substantial increase of experimental sensitivity is required to explore new period of Mendeleev's Table. ⇒ Superheavy elements (SHE) Factory

SHE Factory is included into the NuPECC Long-Range Plan

Super Heavy Elements (SHE) Factory

- Completion of the SHE Factory building and its engineering systems (*2016 – June 2017*)
  - Assembling the DC-280 cyclotron.
    - Installation of new Gas-Filled Recoil Separator. (*2016 – December 2017*)

- First experiments (*2018*)

DRIBS-III ACCELERATOR COMPLEX

Flerov Laboratory of Nuclear Reactions basic directions of research:

- Heavy and superheavy nuclei
- Light exotic nuclei
- Radiation effects and physical groundwork of nanotechnology
- Accelerator technologies

Fragment separator ACCULINNA-2:
The basic facility for light radioactive nuclei research

Construction: phase-one :

2015: assembled and tested with a primary beam;

2016: zero-angle spectrometer is delivered at FLNR;

2017: first run with a radioactive-ion beam;

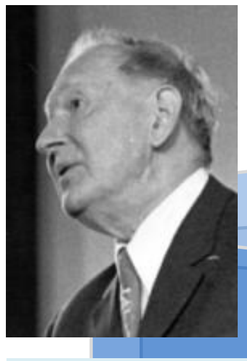
2017-2021: Further development:

- **RF kicker and detector arrays for particles, neutrons and gammas**
- **new cryogenic gas-vacuum system (including tritium target)**

Acculinna-II included into the NuPECC Long-Range Plan

Commissioned 13 April, 2017

BAIKAL - GVD project



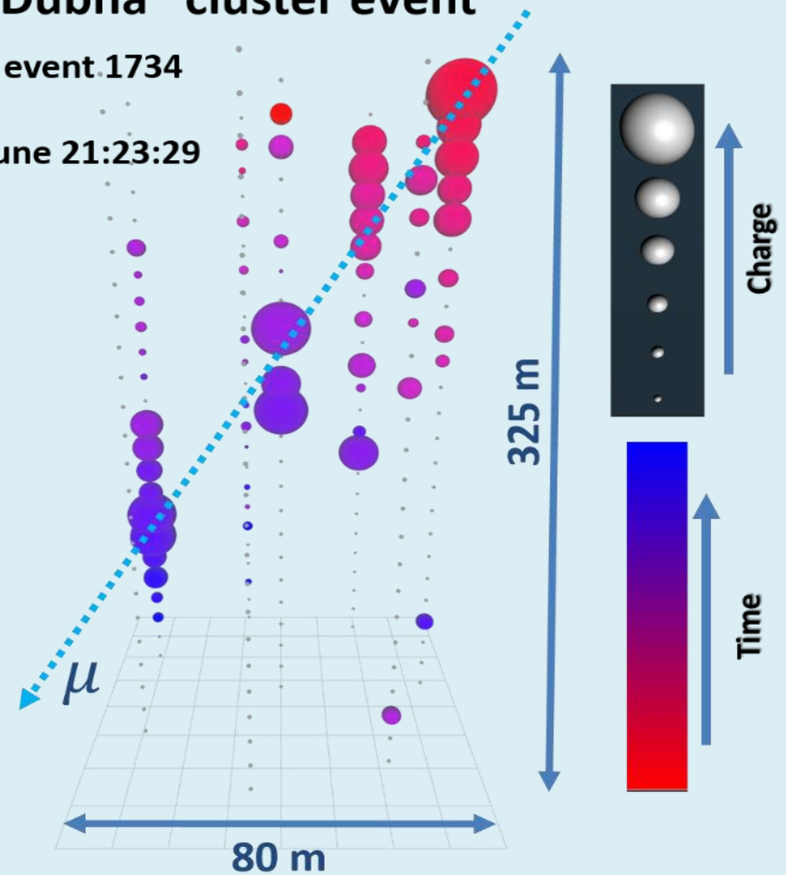
~2300 OM (2020)
8 clusters

300 m

“Dubna” cluster event

Run#229; event 1734

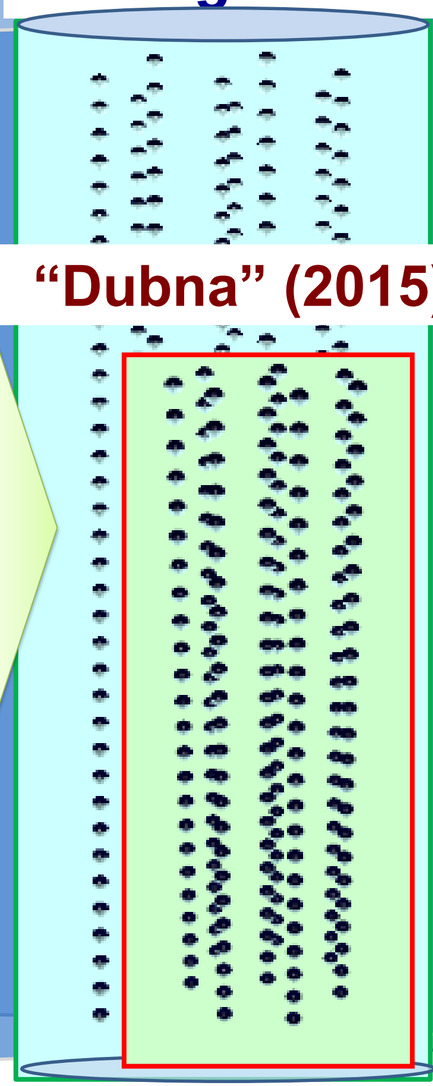
2015 15 June 21:23:29

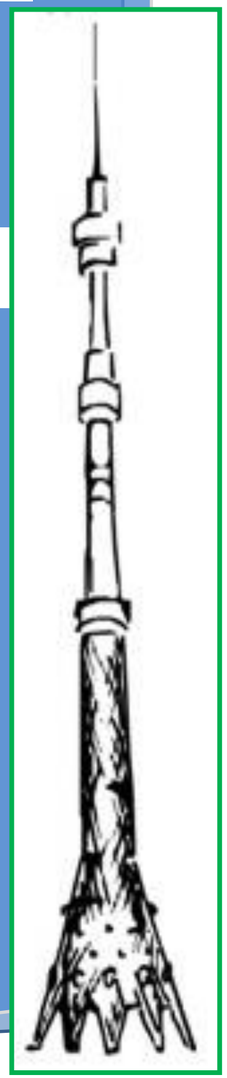


April 2017
Cluster №2

Since April 2016
taking data

“Dubna” (2015)





~600 m

~1 km

120 m

Neutrino experiments at Kalinin NPP

(Tveri region, 285 km from Dubna)

Pressurised water reactor;
Termal power 3 100 MW;
Neutrino flux ~ 6 10^{20} ν_e

GEMMA (Neutrino Magnetic Moment)

νGeN (Coherent ν-Ge scattering)

DANSS (reactor monitoring and search for sterile neutrino oscillations)

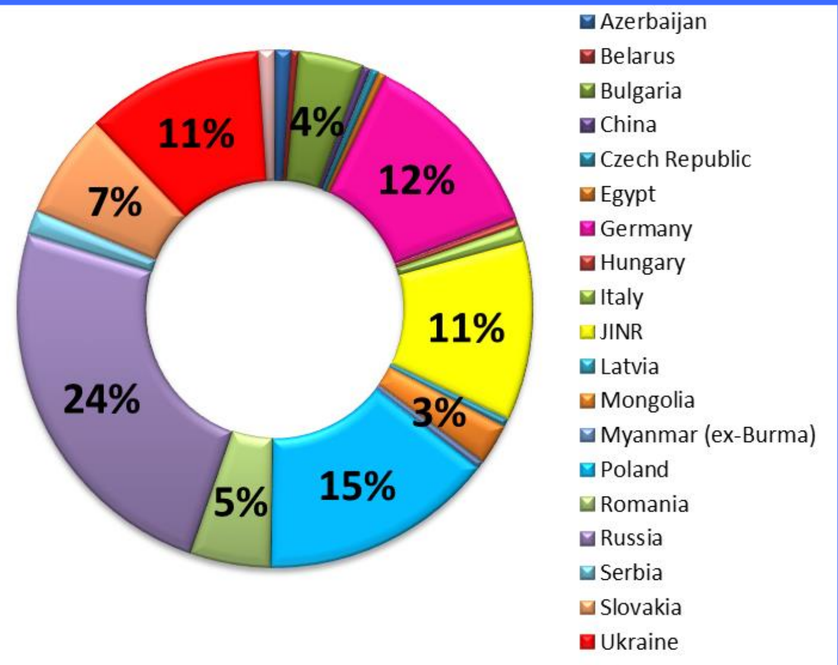
IBR-2: Pulsed reactor with fast neutrons

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 strategy research program in the field of neutron scattering

The user program at the spectrometer complex of the upgraded reactor IBR-2 is implemented successfully. At the reactor, specialists from many countries conduct experiments in physics, material science, biology, geology, etc.

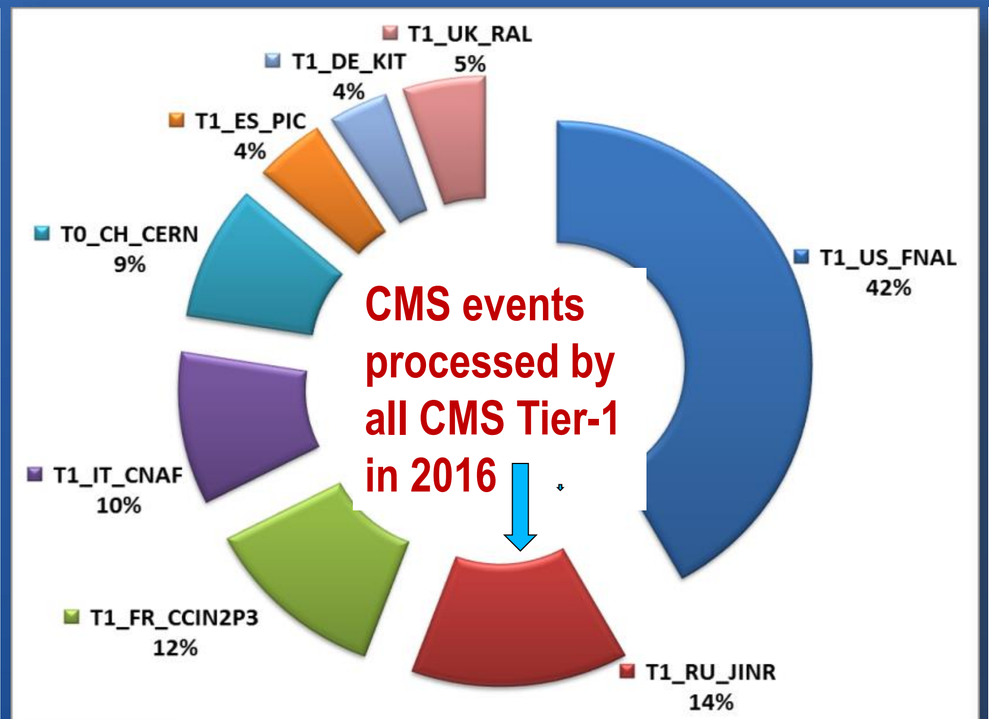
In 2016 - 197 proposals for experiments at the neutron beams came from 19 countries.

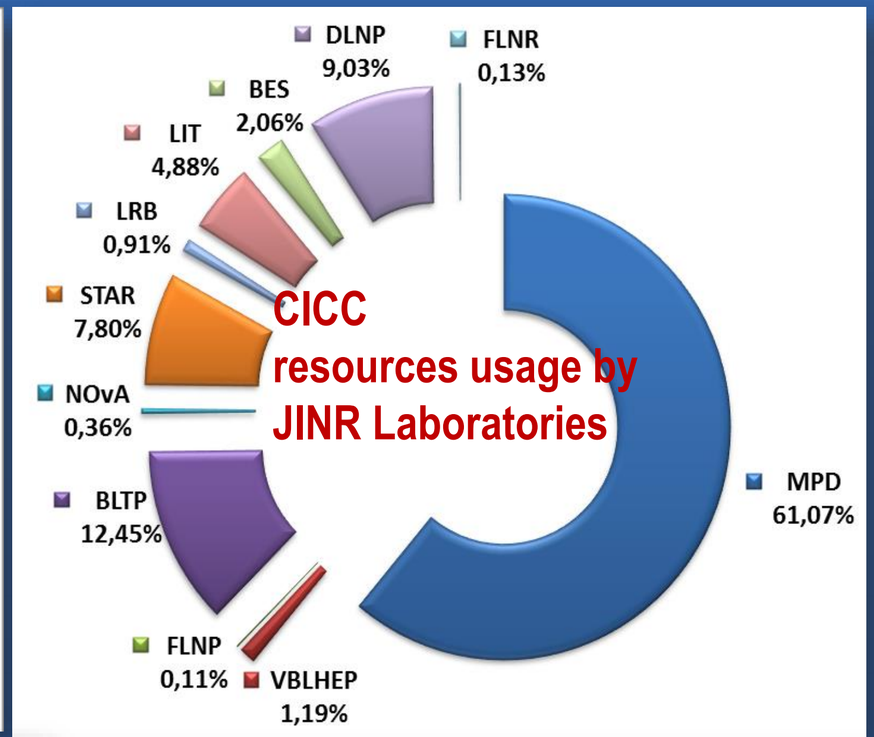


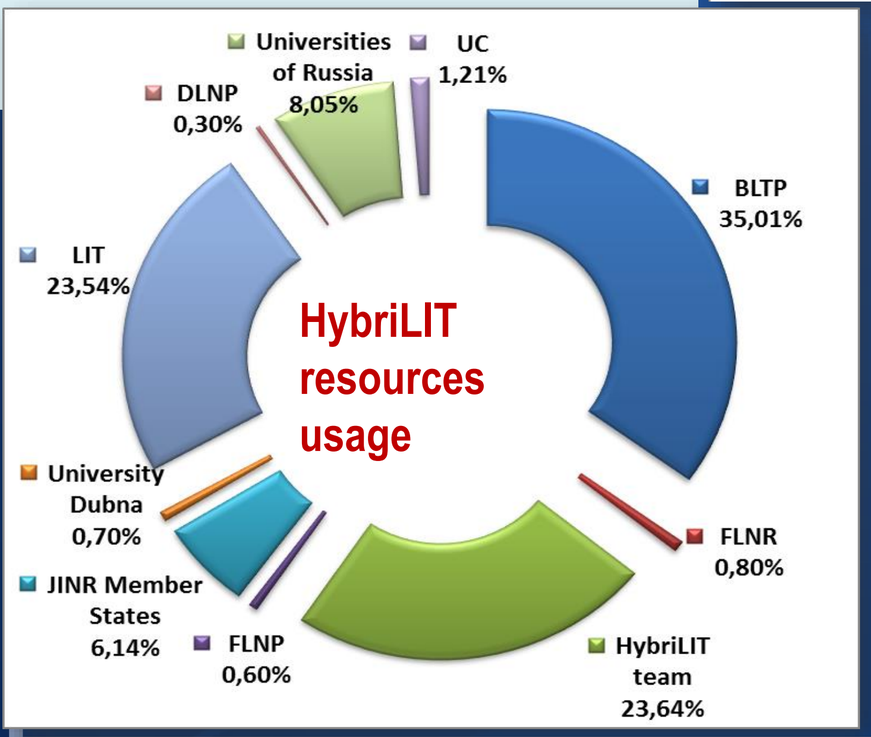
Computing – resources usage

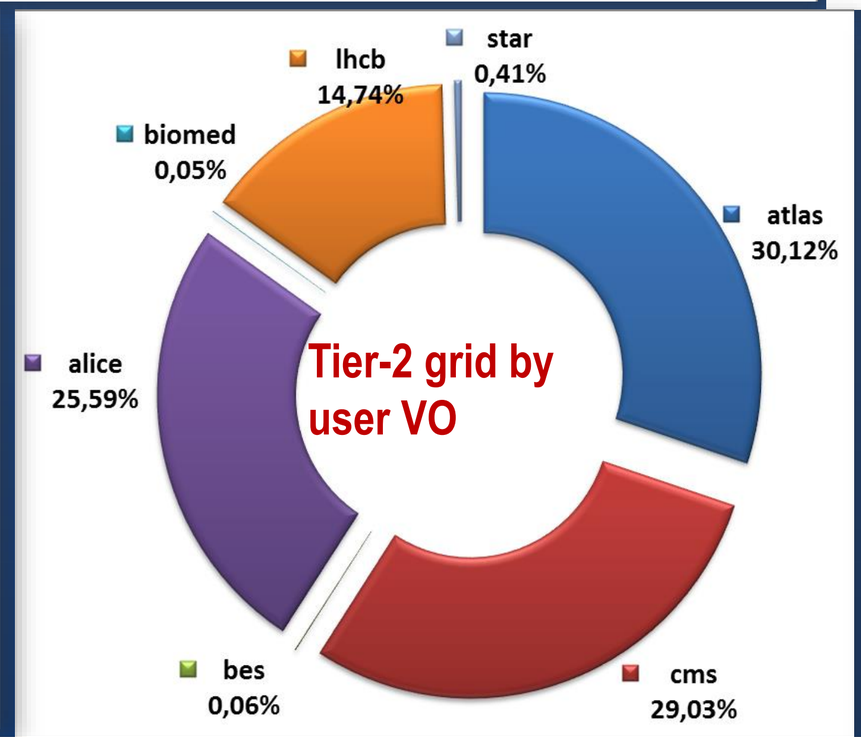
Experiments

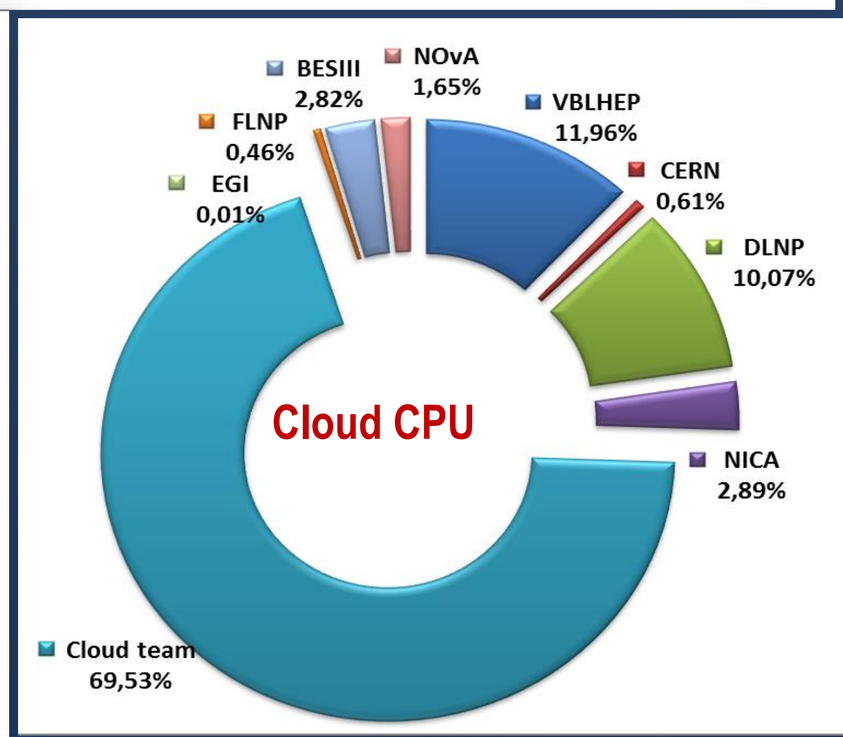
BM@N, MPD, CMS, ATLAS, ALICE, PANDA, CBM, STAR, COMPASS, NOvA, BESIII, DIRAC, Mu2e, NUCLON, TAIGA, WLCG (Worldwide LHC Computing Grid)











JINR University Centre

Attracting youth to science

JINR

UNIVERSITY CENTRE

EDUCATING FUTURE SCIENTISTS

25 YEARS

STUDENTS & POSTGRADUATES

International Student Practices

uc.jinr.ru (events)

Summer Student Programme

students.jinr.ru

Bachelor’s, Master’s & PhD theses at JINR

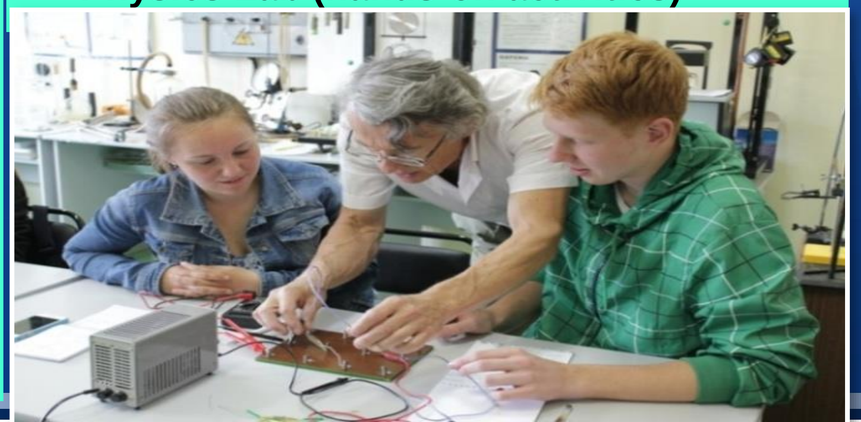
OUTREACH ACTIVITIES

International Scientific Schools for Physics Teachers at JINR and CERN

teachers.jinr.ru

For School Students

- Visits
- Video conferences
- Days of Physics
- Interschool Course of Physics and Maths
- Physics Lab (hands-on activities)



CERN – JINR Partnerships

"… the reciprocal granting of Observer status by CERN and JINR, as proposed by JINR, would further strengthen the close ties between the two organisations. The improved exchange of information and mutual consultation on programmes and strategies would create new synergies and provide a basis for even more intense and successful co-operation in the future ..."

CERN Council, September 2014

JINR is an Observer to CERN Council

CERN Council September 2014

CERN is an Observer to JINR CP

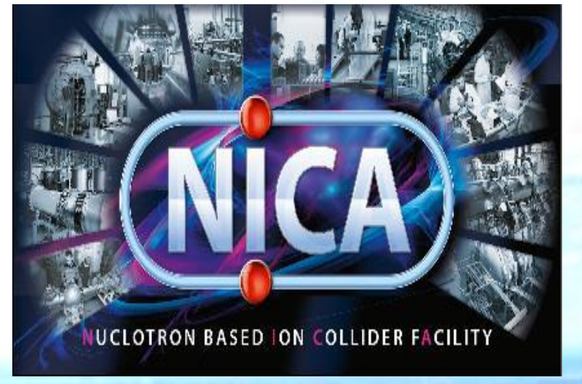
JINR CP November 2014

Great goal - to go along the bilateral road towards each other.

We are grateful to CERN Directorate and all staff for constant and effective support to members of JINR teams participating in CERN programmes and rediness to provide valuable help and expertise in realization of JINR projects

Thank you for your attention !

JINR - the International Intergovernmental Organization joining 18 member states and 6 associated states.
It is located in the city of Dubna in 120 km to the north from Moscow



Special Economic Zone

Volga River

JINR

Sluice

12 meters Dam

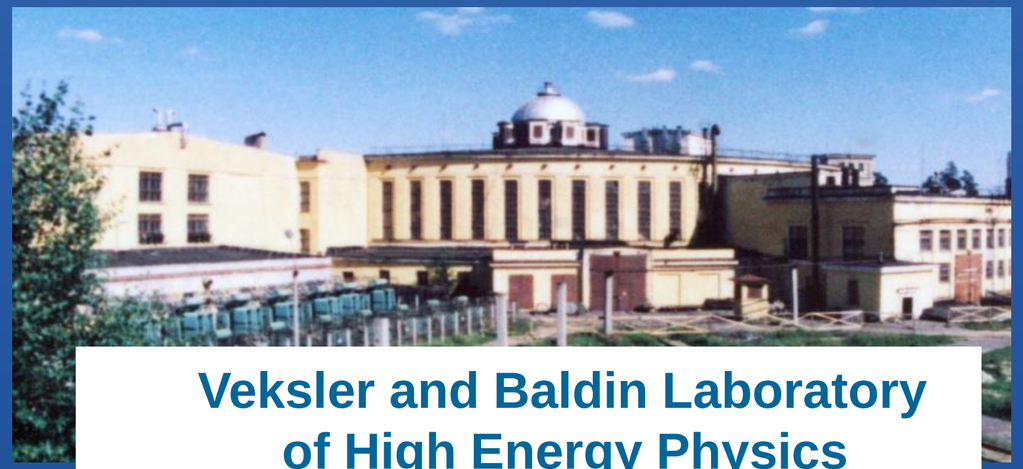
Water Power Station

Volga-Moscow Channel

"Ivan'kovskoe" Water Storage or the "Moscow Sea"

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

Dzhelepov Laboratory of Nuclear Problems



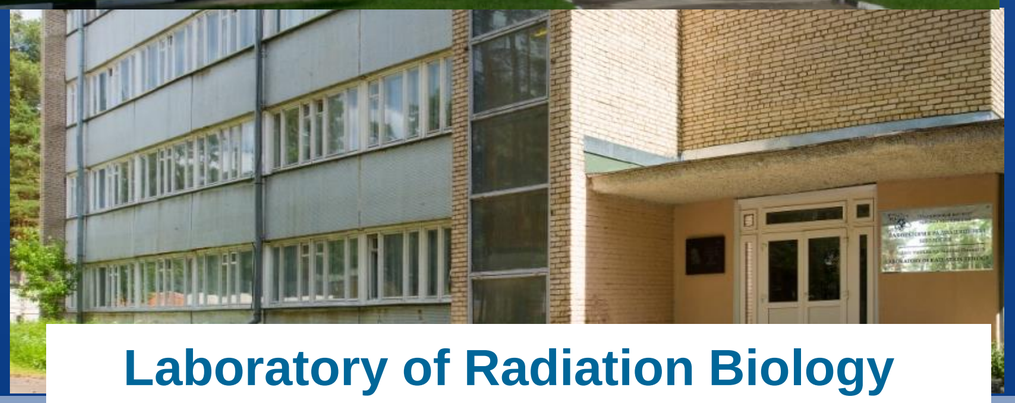
Veksler and Baldin Laboratory of High Energy Physics

Bogoliubov Laboratory of Theoretical Physics

Flerov Laboratory of Nuclear Reactions

Frank Laboratory of Neutron Physics

Laboratory of Information Technologies



Laboratory of Radiation Biology

JINR
University Centre

JINR Research Experimental Facilities

- **Heavy Ion Superconducting Complex Nuclotron-NICA**
  Physics of dense and hot baryon matter
  Spin structure and dynamics of nuclear matter
- **Intensive pulsed neutron breader reactor IBR-2 :**
  Condensed matter & Nuclear physics IRENA
- **High Power Cyclotron Complex and SHE Factory**
  Superheavy elements and Exotic nuclei
  Dubna Radioactive Ions Beam studies DRIBs
- **Complex of computing & information technologies**
  Tier-1 complex for LHC and NICA Big Data
- **Neutrino Gigaton Volume Detector GVD at Baikal lake**
  Neutrino Physics and Astrophysics Kalinin APS
- **Accelerator facility for radiobiology and medical studies**
  Hadron therapy, astrobiology, cosmic medicine