PROJECT

Development of the open educational environment to support research priorities in nuclear physics

Project leader: Yu.A. Panebrattsev

Project authors from JINR:
S.N. Balalykin, V.V. Belaga, E.I. Golubeva, D.V. Kamanin, K.V. Klygina, A.O. Komarova, V.V. Korenkov, Yu.D. Orlova, M.P. Osmachko, S.Z. Pakuliak, E.V. Potrebennikova, P.D. Semchukov, N.E. Sidorov, O.A. Smirnov, A.V. Strekalovsky, T.G. Stroganova, N.I. Vorontsova, D.V. Zhuravleva.

Participating organizations:

National Research Nuclear University MEPhI
Dubna University
Institute of Physics, Kazan Federal University
Faculty of Applied Mathematics and
Control Processes, St. Petersburg State University
Stellenbosch University, RSA
UNISA, RSA
Sofia University, Bulgaria
INRNE BAS, Bulgaria
"InterGraphics" LLC

December 2016

Project summary

Project goals

- Attract talented young people and highly qualified specialists to work at JINR
- Use modern educational technologies to train specialists intending to work at JINR
- Implement the results obtained at JINR in the educational process in the State Members of the Institute
- Build brand awareness of JINR and the NICA project for a wider audience
- Develop educational content at the level of the leading research centers

Project tasks

- Develop online courses and new educational programs within the subject-matter of JINR projects on the basis of modern educational platforms
- Creation and development of multimedia educational resources for the JINR laboratories' websites
- Provide informational and educational support of the megaproject NICA
- Develop multimedia exhibits associated with the JINR subject-matter
- Develop a professional nuclear physics web-resource "Nuclear Science and Technology"
- Develop a e-learning tool "Virtual Laboratory of Nuclear Physics" intended for students

Over the past 10 years the project participants have taken part in the development of the following educational, popular-science and outreach resources:

- "RHIC Lessons" – multimedia e-learning tool developed together with the Brookhaven National Laboratory
- physics educational complex for the series "Academical school textbook" by "Prosveshchenie" Publishers" intended for school students of the 7^{th}–9^{th} grades and developed in cooperation with "Prosveshchenie" Publishers" JSC
- multimedia applications to the textbooks of the "SPHERES" project in physics, chemistry, and biology developed in cooperation with "Prosveshchenie" Publishers" JSC
- multimedia exhibits popularizing modern science presented at the world's leading sites
- Dubna Education Center named after Academician A.N. Sissakian. Participation in the educational program "School for Russian Physics Teachers"
- nuclear physics online courses for MOOCs Coursera and edX intended for university students and developed in collaboration with MEPhI
- project "Virtual Laboratory of Nuclear Fission"
- open lesson "NICA – Universe in the Laboratory" intended for Russian school students.

1. Introduction

The Joint Institute for Nuclear Research is an international research center, where unique basic facilities are being created and where scientists conduct research in the following up-to-date scientific fields: studies of condensed matter at the pulsed fast neutron reactor; search for new superheavy elements; research in neutrino physics; studies of relativistic nuclear collisions and construction of the superconducting collider NICA.

An extremely wide range of scientific and engineering, technological and technical challenges that JINR specialists are facing requires an integrated approach to the training of specialists coming to work in the laboratories and subdivisions of JINR. First of all, it is the development of training courses and new educational programs related to the priority fields of research at JINR. Therefore scientific and applied results obtained by the JINR laboratories could be integrated into the curriculum of undergraduate and post-graduate education. Such scientific findings and technological solutions should also be accompanied by popular-science and outreach projects intended for a wider audience, including school students. In the future, it will allow us to overcome a serious social problem – decline in young people's interest in scientific research and engineering professions.

Rapid development of information and communication technologies and widespread use of the Internet have led to a qualitative change in the educational technologies used around the world. The most popular form of training nowadays is blended learning, when a full-time educational process is complemented with computer-learning tools: online courses, interactive practicums and laboratory works, computer modelling tools and simulators. In this regard, the technological component of the educational process within the JINR subject-matter must conform to the most modern trends in this area.

The open educational environment to support research priorities in nuclear physics will be developed during the project implementation. It will include the following components:

- online courses and new educational programs within the subject-matter of JINR projects on the basis of modern educational platforms
- Multimedia educational resources for the JINR laboratories' websites
- informational and educational support of the megaproject NICA
- multimedia exhibits related to the JINR subject-matter
- professional nuclear physics web-resource "Nuclear Science and Technology"
- educational online resource "Virtual Laboratory of Nuclear Physics"

The developed online courses will allow forming a network of educational programs for joint training of master students, with the participation of JINR Member States universities. The courses will be developed in the MOOC (Massive Open Online Courses) format and made available on the corresponding open-source platforms.

In the development of courses and educational website sections, modern technologies of dynamic interactive 2D and 3D web-graphics will be used. The insurance of individual components compatibility of the open educational environment and creation of opportunities for their multiple usages will be provided by conforming to the international standards defining the requirements for educational content. In developing check and reference materials an LTI (Learning Tools Interoperability) specification will be used. It contains recommendations for the structure and rules of development of external educational applications for their further integration with a variety of learning management systems (LMS).

2. Current state of research on the stated topic

Nowadays, the problem of integration of science, education and innovation as one of the key knowledge-based factors in the development of the economy and society is very important. In the current environment solving the problem of integration of education and science presupposes establishing an efficient and sustainable interaction of universities with research centers and institutes, as well as with enterprises making high-tech products [1]. Integration of science and education is necessary to implement the competence-based approach, but its implementation should not change the methodology and goal-setting of processes. Increasing the amount of solved problems in the learning process and transferring them to the research area will give students an opportunity to directly enter the world of science, which would shorten the learning path and bring a dynamic component in the research [2].

The major international research centers – the European Organization for Nuclear Research (CERN) and the Brookhaven National Laboratory (BNL) – pay great attention to the development and implementation of educational programs for teachers, students and pupils. In addition to classroom sessions held within student practices, schools for physics teachers, open days, etc., CERN and BNL websites regularly make electronic educational resources – scientific and popular articles, video-lectures and interactive scientific and educational games – available for students and school children [3, 4, 5, 6, 7].

In the past four years, the most popular new educational technologies frequently used in the further educational process are massive open online courses (MOOCs). The world's leading American and European universities – Harvard University, Massachusetts Institute of Technology, Stanford University, etc. – have adopted these technologies. Today, the most extensive MOOC platforms are being developed by the US universities: more than 7 million users in edX, more than 4 million – in Udacity, and more than 21 million – in Coursera. In our country there are also several platforms offering open educational resources: "Open Education", "Universarium", "Lectorium".

However, when it comes to training specialists to work in the projects on the top-priority research fields and MEGASCIENCE projects, it is worth listing a number of problems that cannot be solved by the existing MOOC model:

- Survey of employers' (research centers') opinion in order to generate a list of positions for which young specialists are to be engaged and an appropriate set of skills that the applicants should master
- Generation of a list of courses to be studied and educational content, taking into account the requirements agreed both by teachers and employers – scientists and engineers
- Development of educational materials based on the knowledge of experts working directly in the field of interest and not teaching on a regular basis
- Development of training courses based on the results of individual research groups and experiments
- Prompt adaptation of teaching materials and practical tasks as a response to the rapidly changing technologies
- Search for subjects for scientific and engineering study and potential scientific supervisors as early as at the stage of doing relevant online-courses
- Formation of the employer's opinion based on the results of student's online-learning for continuation of their career in the research center (in the experiment).

To solve the above-mentioned problems it is proposed to develop the open educational environment to support research priorities in the field of nuclear physics at JINR in cooperation with the universities of the Member States and associated members, NRNU MEPhI, Dubna University, Kazan Federal University, St. Petersburg University and others.

References

1. Structure and management of the science educational center “informational and telecommunication systems: basic physics and mathematical supply”. Innovation educational program. R.G. Strognin, S.N. Gurbatov. University management: practice and analysis. 2007. — No. 2 (48). — p. 59–67.
2. Integration of science and education: trends and capabilities. L.V. Yurkina. Theory and practice of social evolution. Issue No. 2, p. 147 – 149, 2014.
3. CERN Accelerating science. Students&Educators [web resource]. https://home.cern/students-educators
4. Brookhaven National Laboratory’s Relativistic Heavy Ion Collider. A New Area of Physics [web resource]. https://www.bnl.gov/RHIC/education.asp
5. StarLite. RHIC Lessons [web resource]. http://www.star.bnl.gov/lite/education/lessons.php
6. Brookhaven National Laboratory’s Educational Programs. Science Learning Center Book and Web Resources [web resource]. https://www.bnl.gov/education/static/teacher-resources.asp
7. CERNLand [web resource]. http://www.cernland.net/

3. Description of the research plan

Solving the problem of integration of education and science presupposes establishing an efficient and sustainable interaction of universities with research centers and institutes. The main mission of the JINR laboratories is generating new knowledge. To develop successfully, the laboratories need to attract talented young people and highly qualified professionals to work at JINR. Moreover, there are highly skilled specialists currently working at JINR, who could share their knowledge through online courses intended for students from various universities of Russia and the Member States.

On the other hand, the universities are interested in training highly qualified specialists to work on scientific projects. For this purpose, it is necessary to solve the problem of cooperation between universities and research centers aimed at coordinating the relevant educational programs, as well as to integrate the results of modern experiments in the educational process in the form of special courses and electives, or as independent course units of the basic disciplines.

The JINR University Center (UC) can act as an integrator of such cooperation, as the UC includes JINR-based departments of the leading Russian universities. On the basis of the UC, together with JINR scientists and engineers, as well as specialists from the universities participating in the project, epy open educational environment to support research priorities in the field of nuclear physics can be created.

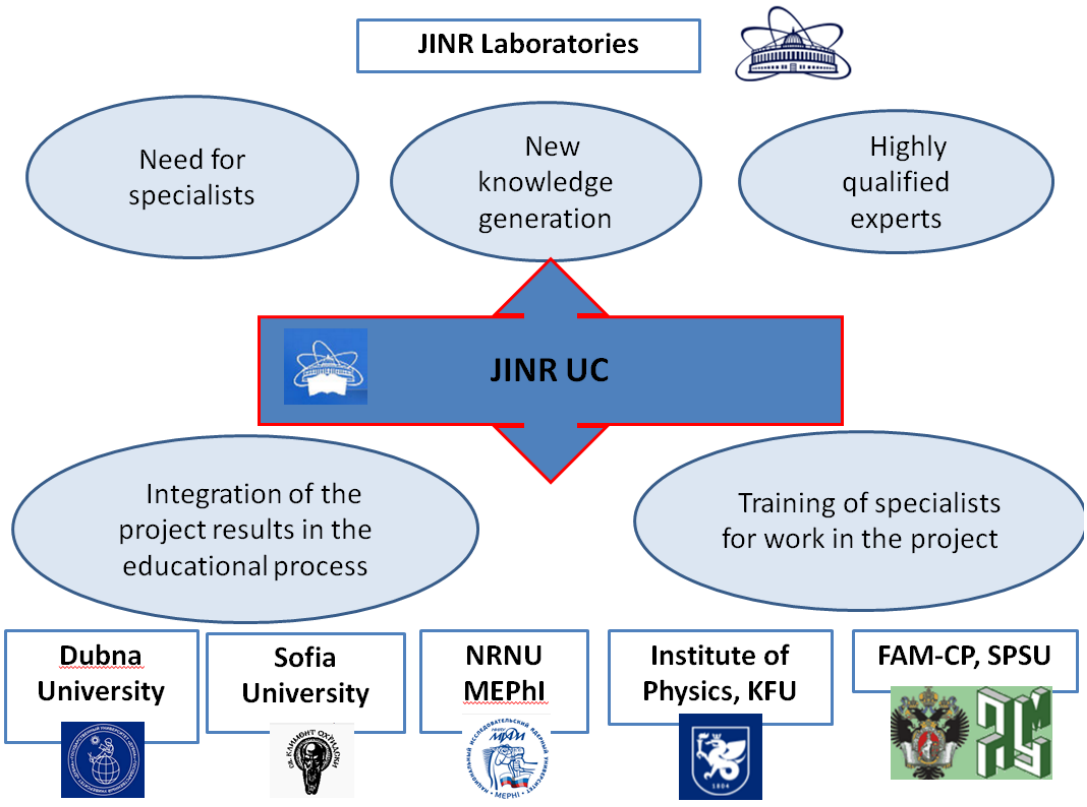

Fig. 1: Interaction between JINR and the universities participating in the project

Online courses and new educational programs within the subject-matter of JINR projects on the basis of modern educational platforms will be developed in the following scientific directions:

- Study of condensed matter using neutrons
- Neutrino physics. Deep-water experiment Baikal
- Heavy ion physics. Exotic nuclei. Radioactive beams

- Synthesis of new superheavy elements
- Heavy ion accelerator complexes
- Cryogenic technologies and their use in accelerating technics
- Distributed computing for Big Data
- Information technologies for the NICA project
- Medical and applied physics with heavy ions

To create and develop multimedia educational resources for the JINR laboratories' websites, there have been and will be developed interactive 2D-and 3D-models of the basic JINR facilities and physics setups, at which the research is conducted.

Informational and educational support of the megaproject NICA is aimed at training specialists to work at the accelerating complex NICA in the mid-term and long-term perspective. It is also necessary to include scientific and applied results obtained at NICA in the educational programs of undergraduate and postgraduate education. The expected scientific results obtained at the NICA collider will undoubtedly broaden the horizons of the world's knowledge about the structure and evolution of matter at the early stage of the Universe evolution and, in the light of experimental data, will allow one to answer the actual questions of the modern science, for example about nucleon spin nature and spin structure of the lightest nucleus – deuterium – at small distances. Such scientific findings and technological solutions should be accompanied by educational, popular-science and outreach projects intended for a wider audience, including school students. In the future, it will allow us to overcome a serious social problem – decline in young people's interest in scientific research and engineering professions.

The special attention will be paid to the development and promotion of the specialized site of the NICA project which will include as the actual project information as educational materials within the subject-matter of the NICA project for students and young scientists.

Building brand awareness of JINR and NICA for a wider audience is one of the most important tasks. A good solution to this problem is **creation of multimedia exhibits** associated with the JINR research topics and participation in a variety of Russian and international exhibitions, days of science, museum exhibitions. In 2016 alone, the exhibits devoted to the 60th anniversary of JINR were presented in the Slovak Technical museum, at the Science Festival in Moscow, in the Kazan Federal University, in many JINR Member States, at the Science Forum in RSA. This activity is planned to be further developed within the project framework.

Fig. 2. JINR exposition at the Science Forum in RSA

Development of the professional nuclear physics web-resource "Nuclear Science and Technology". When designing various Internet-resources, it is necessary to give special attention to the potential target audience of these resources. JINR participates in the major international experiments, which include research centers along with a large number of universities of different countries. Creating a community of students, postgraduates, and teachers interested in nuclear physics research, who see nuclear physics and particle physics as their future profession, will allow informing a large number of people about the studies conducted in various scientific centers of the world, including JINR. This will help to draw attention to the JINR activity and to simplify the way of getting up-to-date information about the existing opportunities of building a scientific career at JINR.

Development of the e-learning tool "Virtual Laboratory of Nuclear Physics" intended for students.

The goal of the e-learning tool for students "Virtual Laboratory of Nuclear Physics" is to include current scientific data into the educational process, to conduct virtual and online laboratory research using modern scientific equipment and data obtained from the existing physical facilities. As the project result the web resource, that allows including modern nuclear physics practicum into educational process in the universities of Russia, JINR Member States and RSA, will be developed. At the previous project stage "Virtual Laboratory of Nuclear Fission" have been developed. In the framework of the present project it is planned to extend topics of laboratory practicum on researches connected with neutron physics and gamma spectroscopy. The perspective direction of the present project is the creation of the Interactive environment for nuclear experiment modeling.

Fig. 3. Study of spontaneous nuclear fission using real and virtual equipment

The educational Internet-resource "Virtual Laboratory of Nuclear Physics" will help to solve the following tasks:

- to prepare students for a real experiment:
  - additional possibilities of visualization (for more detailed examination of an object or an event);
  - interactive training advantages;
  - opportunity to use different types of educational resources (texts, interactive models, animation, video);
  - self-assessment opportunities.
- safety-related issues in real experiments;
- possibility to use virtual laboratory practicums in remote training.

Bibliography of the project authors

1. V. Belaga, I. Lomachenkov, Yu. Panebrattsev, et al. Development of innovation educational resources on the base of the modern multimedia technologies.
   XV International Conference «Mathematics. Computer. Education», JINR, MSU, IMPB RAS, Dubna, Russia, Abstract book. Issue 15. – Moscow 2008, 2008.
2. V. Belaga, P. Semchukov, M. Stecenko, A. Shoshin. Development of software for functional opportunities for multimedia educational resource IEMC "Physics 7–9" for SFST,
   XV International Conference «Mathematics. Computer. Education», JINR, MSU, IMPB RAS, Dubna, Russia, Abstract book. Issue 15. – Moscow 2008, 2008.
3. V. Belaga, N. Vorontsova, I. Lomachenkov, N. Sidorov, M. Stecenko, M. Ushankova. Opportunities for the individual trajectory building using a multimedia educational resource.
   XV International Conference «Mathematics. Computer. Education», JINR, MSU, IMPB RAS, Dubna, Russia, Abstract book. Issue 15. — Moscow 2008, 2008.
4. V. Belaga, P. Semchukov, M. Stecenko. Development of software wrapper for a multimedia educational resource. // System analysis in science and education: digital magazine. 2009. Issue 2 [digital resource].
5. Artemenkov D.A., Belaga V.V., Lomachenkov I.A., Panebrattsev Yu.A., et al. Teaching methodological complex 'Physics – Spheres' as the component of modern interdisciplinary information educational environment.
   NEC`2009 – XXII International Symposium on Nuclear Electronics&Computing, JINR, CERN, INRNE BAN (Varna, Bulgaria, September 7–11, 2009): Proceedings of the Symposium. — Dubna: JINR, 2010.
6. V.V. Belaga, K.V. Klygina, Yu.A. Panebratsev et al. The collective modeling environment as the instrument for teamwork in classroom.
   NEC`2009 - XXII International Symposium on Nuclear Electronics&Computing, JINR, CERN, INRNE BAN (Varna, Bulgaria, September 7-11, 2009): Proceedings of the Symposium. — Dubna: JINR, 2010.
7. D. Artemenkov, V. Belaga, N. Vorontsova, V. Zhumaev, K. Klygina, I. Lomachenkov, Yu. Panebrattsev, M. Stecenko, A. Shoshin. Software for educational and methodological complex of the "Physics – Spheres" project of "Prosveshchenie" Publisher
   XVII International Conference «Mathematics. Computer. Education», JINR, MSU, IMPB RAS, Dubna, Russia, Proceedings – Izhevsk: SPC RCD, 2010. P. 378.
8. D. Artemenkov, V. Belaga, N. Vorontsova, V. Zhumaev, I. Lomachenkov, Yu. Panebrattsev, M. Stecenko, A. Shoshin. EMC "Physics – Spheres" – a part of the modern multidisciplinary informational educational environment.
   New informational technologies in education (NITE-Baikal): proceedings of the International Theoretical and Practical Conference (Ulan-Ude, July 12–14, 2010) – Ulan-Ude, 2010. — p. 222–223.
9. D. Artemenkov, V. Belaga, I. Lomachenkov, Y. Panebrattsev, N. Vorontsova, and V. Zhumaev. Hands-on Experiments and Elements of Modern Science in Course of School Physics. Proceedings of the 10 International Conference on the Hands-on Science HSCI'2013, Educating for Science and through Science. Kosice, Slovakia, p. 349.
10. S. Balalykin et al. Online science classroom. Proceedings of the 10 International Conference on the Hands-on Science HSCI'2013, Educating for Science and through Science. Kosice, Slovakia, p. 351.
11. V. Belaga, D. Kamanin, K. Klygina, A. Komarova, N. Mkaza, Y. Panebrattsev, Y. Pyatkov, A. Shoshin, A. Strekalovsky, O. Strekalovsky, N. Sidorov. Virtual Laboratory of Nuclear Fission. 11th International Conference on Hands-on Science. Conference Booklet. Science Education with and for Society. 2014 HSci. ISBN 978-989-98032-7-5. p.73

12. V. Belaga, P. Kochnev, N. Mkaza, Y. Panebrattsev, E. Potrebenikova, N. Sidorov. Web-Based Builder of Digital Educational Resources. HSCI2014. Booklet of the 11th Science Education with and for Society. International Conference on Hands-on Science. 21st-25th. Fábrica Ciência Viva Science Centre, University of Aveiro, Portugal. July 2014. ISBN 978-989-98032-7-5. p.65

13. V. Belaga, P. Kochnev, N. Mkaza, Y. Panebrattsev, E. Potrebenikova, N.Sidorov. Web-Based Builder of Digital Educational Resources. Proceedings of the 11th International Conference on Hands-on Science HSCI'2014. Science Education with and for Society. ISBN 978-989-98032-5-1. p.404 – 407

14. Victoria Belaga, Armen Kechechyan, Ksenia Klygina Anna Komarova, Noel Mkaza, Yury Panebrattsev, Dennis Sadovsky, Nikita Sidorov
Educational Project for the STAR Experiment at RHIC
International Conference on Hands-on Science: Brightening our future, HSCI2015, Funchal at Francisco Franco High School, Madeira Island, Portugal, July 27 – 30, 2015.
Proceedings of the 12th International Conference on Hands-on Science HSCI'2014. Brightening our future. ISBN 978-989-8798-01-5. p.244

15. Geidar Agakishiev, Victoria Belaga, Evgeny Dolgy et al.
Hardware-Software Complex "Virtual Laboratory of Nuclear Fission" –
Integration of Virtuality, Modern Equipment and Real Experimental Data
International Conference on Hands-on Science: Brightening our future, HSCI2015, Funchal at Francisco Franco High School, Madeira Island, Portugal, July 27 – 30, 2015.

16. Geidar Agakishiev, Georgy Averichev, Victoria Belaga, Evgeny Dolgy et al.
Hardware-Software Complex "Virtual Laboratory of Nuclear Fission" for LIS Experiment (Flerov Laboratory of Nuclear Reactions, JINR)
XXV Symposium on Nuclear Electronics and Computing - NEC'2015, 28 September – 02 October, 2015, Montenegro (Budva), Book of Abstracts, p.14

17. Victoria Belaga, Evgeny Dolgy, Armen Kechechyan et al.
Educational Project for the STAR Experiment at RHIC
XXV Symposium on Nuclear Electronics and Computing - NEC'2015, 28 September – 02 October, 2015, Montenegro (Budva), Book of Abstracts, p.23

18. Victoria Belaga, Ksenia Klygina, Yuri Panebrattsev
Web-based Builder of Digital Educational Resources
XXV Symposium on Nuclear Electronics and Computing - NEC'2015, 28 September – 02 October, 2015, Montenegro (Budva), Book of Abstracts, p.24

4. Human resources

To solve the subtasks of the project, the following human resources are required:

1. Online courses and new educational programs within the subject-matter of JINR projects on the basis of modern educational platforms

Participants:

- JINR UC (6 FTE)
- JINR LIT (2 FTE)
- Faculty of Applied Mathematics and Control Processes of Saint-Petersburg State University (FAM-CP of SPSU) (2 FTE)
- Institute of System Analysis and Management (ISAM) of Dubna University (5 FTE)
- "InterGraphics" LLC (8FTE)

It is suggested to start the development with a training course for 1-year master students:
"Modern problems in system analysis and management" (prof. E.N. Cheremisina)

The testing of the system can be carried out, for example, on the basis of master's programs of ISAM:

- 27.04.03-2 "System analysis of design and technological solutions"
  (Program supervisor: prof. V.V. Korenkov)
- 27.04.03-4 "Intelligent systems of Big Data processing"
  (Program supervisors: prof. E.N. Cheremisina, a.p. M.A. Belov).

Suggested list of courses:

1) Object-oriented programming for scientific research (C++)
2) UNIX programming
3) New generation networks and GRID-technology
4) Modern technologies of distributed computing systems
5) Modern technologies of Big Data system engineering
6) Data mining methods
7) Software engineering (in the development of Big Data systems)
8) Technologies of acquisition, storing and analyzing data in nuclear physics

2. Multimedia educational resources for JINR Laboratories' websites

Development of interactive educational resources for basic JINR facilities.

Participants:

- JINR FLNR (1 FTE)
- JINR FLNP (1 FTE)
- JINR DLNP (1 FTE)
- JINR UC (3 FTE)
- "InterGraphics" LLC (3 FTE)

3. Informational and educational support of the megaproject NICA

3.1 Development and support of the megaproject NICA website

3.2 Development of online courses within the NICA project subject-matter

Suggested list of courses:

- Basics of accelerator equipment
- Experimental methods of nuclear physics
- Introduction to the physics of relativistic nuclear collisions
- Application of cryogenics in accelerators
- Radiation medicine
- Radiation materials science
- Electronics for physics experiment

Participants:

- VBLHEP (9FTE)
- JINR UC (5FTE)
- Engineering and Science Department of Dubna University (5 FTE)
- FAM-CP of SPSU (5 FTE)
- KFU Institute of Physics (3 FTE)
- "InterGraphics" LLC (9 FTE)

4. Multimedia exhibits related to the JINR subject-matter

Suggested list of multimedia exhibits:

- NICA accelerating complex
- Superheavy Elements Factory
- Condenced matter research at the IBR-2 reactor
- GRID distributed computing
- Neutrino physics. Baikal experiment

Participants:

- FLNR (1 FTE)
- FLNP (1 FTE)
- LNP (1 FTE)
- JINR UC (3FTE)
- "InterGraphics" LLC (3 FTE)

5. Professional nuclear physics web-resource "Nuclear Science and Technology"

Development of informational and educational web-resource on the joint researches of JINR with BNL, CERN, GSI, RIKEN in the field of the relativistic nuclear physics and search for the QCD critical point, superheavy elements synthesis, exotic nuclei and radioactive beams.

Participants:

- VBLHEP (3 FTE)
- FLNR (1 FTE)
- JINR UC (3FTE)
- "InterGraphics" LLC (3 FTE)

6. Educational Internet-resource "Virtual Laboratory of Nuclear Physics"

6.1. Development of the web-resource «Virtual Laboratory of Nuclear Physics»
6.2. The creation of the Interactive environment for nuclear experiment modeling.
6.3. Integration the results of the project into the educational process at the Universities of Russia, JINR Member States and RSA.

Participants:

- JINR FLNR (2 FTE)
- JINR UC (5 FTE)
- Stellenbosch University (3 FTE)
- UNISA, Pretoria (3 FTE)
- NRNU MEPhI (1 FTE)
- Sofia University (2 FTE)
- INRNE BAS (1 FTE)
- "InterGraphics" LLC (3 FTE)

5. Project budget 2017–2019

Estimation of the total budget of the project, budget per year and expenses for each of the following categories:

(a) Construction of experimental equipment for students' practicum in Dubna:

15 000 × 3 years = 45 000 $

(b) Costs related to the allocation of experimental equipment and personnel (construction of new buildings, renovation of existing premises, etc.):

Not envisaged

(c) consumables and overheads;

2 000* 3 years = 6 000 $

(d) costs of the salary for the project/theme participants;

8 640 000 * 3 years = 25 920 000 RUB

(e) costs of third-party contractors under the item Research&Development

8 000 000 * 3 years = 24 000 000 RUB

(f) financing sources (internal and external resources);

JINR UC budget theme:
JINR infrastructure
VBLHEP budget theme: 1065 (NICA project)
VBLHEP budget theme: 1066 (STAR project)
RSA-JINR cooperation funds
Grants of Plenipotentiaries of JINR Member States

It is assumed that the cooperating educational organizations pay their teachers for the work related to the development of training courses and program content.

6. SWOT analysis

Internal factors	External factors
Strengths	**Opportunities**
1. Professionalism of the project participants	1. Participation in a priority project "Modern digital learning environment in the Russian Federation"
2. Established connections between the universities participating in the project	2. Possibility of entering the National Open Education Platform of the Russian Federation and international platforms Coursera, edX
3. Interest in the project results on the part of all the participants	3. Use of the results obtained at JINR in the educational process at universities of Russia and JINR Member States
4. Possession of technologies for project tasks' implementation	4. Building brand awareness of JINR and NICA for a wider audience
5. Availability of groundwork on all the tasks of the project	5. Increase in the number of students wishing to practice, write a thesis, enter a PhD program or work at JINR
Weaknesses	**Threats**
1. Generation of the list of online courses is in progress	1. Rapid changes in the regulations on the use of e-learning at universities
2. Rules for entering the National Open Education Platform have not been defined clearly (in progress)	2. Differences in the educational programs of Russian universities and universities of JINR Member States
	3. Force majeure