Implementation of the Recommendations of the Scientific Council's 93rd and 94th Sessions

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95th session of the JINR Scientific Council
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Contents

Dear Members of the Scientific Council,

Honorary guests,

Colleagues,

Ladies and Gentlemen:

On behalf of the JINR Directorate, I would like to inform you about implementation of the recommendations of the Scientific Council's 93rd and 94th sessions.

The plan of my report is the following (see CONTENTS).

You see the report includes three sections. First of all, I'll inform you about the JINR scientific results of 2003. Then I'll inform you on main parameters of the JINR scientific programme of 2004. And, finally, in the conclusion I'll inform you about latest news.

Of course you know the documents of the two previous sessions of the JINR Scientific Council, and it is not necessary to remind you about the Council's recommendations. All the materials of the sessions and the reports presented are available on the Web-site of the Joint Institute for Nuclear Research.

You have also in your papers 10 preprints of the JINR Laboratories and Departments concerning scientific results of the last year and information on the future plans. In accordance with your recommendation that was made at the 91st session of the JINR Scientific Council, the preprints include a brief review of the JINR scientific results that were published in the refereed journals or in the proceedings of international conferences. The review is based on about 1500 articles by JINR scientists. These articles were published in journals and received by the JINR Scientific Library until December 2003 (about 75% of annual issues).

You have also the latest issue of the "JINR News" journal where you can find information about the current activities of the Joint Institute. I believe you will have time to read all these documents.

Let me draw your attention to the photo on the cover of the "JINR News". You see it was made in connection of the 50th anniversary of the Veksler-Baldin Laboratory of High Energies.

This anniversary was widely celebrated at JINR, and a dedicated conference was held on 2-4 October 2003. Many outstanding physicists, politicians and leaders of famous institutions visited the conference. They congratulated the staff and the Directorate of the Veksler-Baldin Laboratory of High Energies on the 50th anniversary of this Laboratory and wished them much success in the future.

I stop here these introductory remarks and switch to the main subject of my report dedicated to the scientific highlights of 2003. Due to the time limit, I will shortly inform you about the main results about the implementation of the Scientific Council's recommendations.

1 Highlights of 2003

Let me start with the information about the operation of the JINR facilities.

1.1 Operation of the JINR Facilities

The operation of the JINR facilities in 2003

Facility	Data in hours	
	Plan for year	Actual for year
Basic facilities		
Nuclotron	2500	2113
IBR-2	650	681
U400	4400	6420
U400M	2200	3246
Users' request facility		
Phasotron	2370	1805

You see that in 2003 the actual data are higher than those planned for IBR-2, U400 and U400M. The running time has grown substantially at the U400 cyclotron. The experiments on the synthesis of superheavy elements were supported among the first priority tasks at this complex. U400 operated for 6420 hours.

Other information about the status of and the nearest development plans for the JINR basic facilities will be presented today by JINR Chief Engineer G. Shirkov.

Corresponding member of the Russian Academy of Sciences G. Shirkov fulfilled successfully the duties of the Chief Engineer during the last year. So he will continue to act as JINR Chief Engineer until the completion of the term of office of the JINR Director.

1.2 Scientific Results

And now I switch to the presentation of the results obtained in 2003.

1.2.1 Relativistic Nuclear Physics

Three runs at the Nuclotron of the Veklsler-Baldin Laboratory of High Energies were carried out during 2003.

Obtaining in summer 2003 of the multicharged ion beam of Fe^{24+} at the Nuclotron gives a new quality for this accelerator. Recent progress in production of the multicharged ion beams is based on the success in the design and application of the new ion source "Krion-2" in "a string mode of operation". Tomorrow Professor E. Donets will inform you about this new phenomenon discovered by him.

Let me remind you that a year ago the polarized deuteron beam was accelerated and extracted from the Nuclotron. After this achievement the JINR research programme for the experiments on relativistic nuclear physics was transferred from the Synchrophasotron to the Nuclotron. I stress that the Synchrophasotron did not operate in 2003 and is prepared for outphasing.

The experiments are being carried out now on the internal and external beams of the Nuclotron. I inform you shortly about the experiment with the deuteron polarized internal beam.

The first experiment with this beam was carried out at the magnetooptical spectrometer MARUSYA that was put into operation in 2002. This spectrometer is used for studying rare subthreshold, cumulative processes and antimatter production taking into account the polarization of colliding objects and the multiplicity of nuclear fragments. Investigation of such processes is possible only with magnetooptical spectrometers of high acceptance and high selectivity of secondary particles. The experimental investigation of antimatter production at Nuclotron began in December 2003. The first experimental data on production of antiprotons and K^- in the reactions $p+Pb$, $p+Al$ were obtained.

1.2.2 Heavy-Ion Physics

The main attention in 2003 at the Flerov Laboratory of Nuclear Reactions was given to the experiments aimed at the synthesis of new elements in the reaction $^{243}Am+^{48}Ca$. Decays of elements 115 and 113 were observed in July - August 2003. Let me stress that the rather long lifetime (about 20 hours) of *Db* isotopes obtained in the α-decay chains of new element 115 allows us to investigate, in more detail, the chemical properties of this element. By the way, I have seen already the article entitled "Chemistry of ^{105}Db".

Tomorrow Professor Yu. Oganessian will make a detailed report on the prospects for the synthesis of superheavy elements at JINR.

It should be noted that the work on naming of new elements discovered at JINR is in progress. Very important discussions took place during the visit of Professor P. Steyn (South Africa), President of IUPAC, at JINR on 27 September 2003.

The programme on the synthesis of superheavy elements is widely supported. The ^{243}Am target material was provided by the Federal State Unitary Enterprise "State Scientific Centre of the Russian Federation – Research Institute of Atomic Reactors" (Dimitrovgrad) and by the U.S. Department of Energy through the Oak Ridge National Laboratory (Oak Ridge, TN). These studies were performed in the framework of the Russian Federation - U.S. Joint Coordination Committee for Research on Fundamental Properties of Matter. This work has been performed also with the support of grants from the Russian Foundation for Basic Research, the Russian Ministry for Atomic Energy and personally by Minister A. Rumyantsev.

1.2.3 IBR-2

I would like to note that Minatom supports the IBR-2 modernization in accordance with the JINR-Minatom Agreement signed in 2000. Minister A. Rumyantsev informed me personally that the "Mayak Plant" has completed the manufacturing of the fuel elements for IBR-2M.

The financial support of Minatom (10 million roubles) for the IBR-2 reactor modernization was contributed timely and in full volume. I inform you also that JINR funded the modernization of IBR-2 in the volume of 285 k$ (114%, planned for 2003), and compensated partially the debt accumulated in 2000-2002.

In 2003 one of the main tasks of the Frank Laboratory of Neutron Physics was the construction of the third movable reflector for the IBR-2 reactor. Status of this activity will be presented today by Chief Engineer G. Shirkov. I can only add that this work is being implemented in accordance with the schedule to start up of the IBR-2 reactor by July 2004.

1.2.4 IREN

For the IREN facility, the installation of supporting elements for a new electron linac in the IREN hall and the assembly of the first section of the linac was continued in 2003. I wish to inform you that there is an intention of Minatom and of the Russian Ministry of Industry, Science and Technologies to support the IREN construction. The frames of a funding programme were discussed several times with the members of the Directorate of the "Kurchatov Institute" and the corresponding Memorandum of Understanding is under signing. Hence, the "Kurchatov Institute" will participate in and contribute to the IREN project.

Detailed discussions took place during the visit of the President of the Russian Research Centre "Kurchatov Institute" Academician Evgeny Velikhov to the Joint Institute on 6 January 2004. Taking into account the results of the discussions I intend to ask the JINR Committee of Plenipotentiaries to establish the status of associate members of the Joint Institute for Nuclear Research for world-known large institutions such as the "Kurchatov Institute" in Moscow. I believe this step will help to coordinate the research programmes of different institutions based on the use of the JINR facilities.

1.2.5 Information technologies

Concluding the section of my report dedicated to the JINR basic facilities I inform you that the work to create the JINR GRID segment and to incorporate it into the global GRID structure is being actively implemented. The Gigabit Ethernet backbone with a new optical cable line, whose length is 10300 meters, began to operate at JINR in 2003 connecting 7 Laboratories and Administration Department.

1.2.6 Theoretical Physics

Now, I'll tell you about new results in theory that were obtained at the Bogoliubov Laboratory of Theoretical Physics.

A series of research was carried out which completes the solution of the problem of quantum-spin chain with a long-range interaction. The related model is named now the Inozemtsev system.

There was performed a theoretical analysis of the results of the polarized Semi-Inclusive Deep Inelastic Scattering experiments concerning the first moments $\Delta_1 q$ of the polarized quark distributions in nucleon. It was shown that HERMES results on the valence polarized distributions may indicate that the light quark sea is essentially asymmetric. It was argued that Next to Leading Orders QCD extraction procedure is necessary to get a reliable result on this quantity. A new theoretical procedure was proposed by Professor A. Sissakian and his colleagues Drs. O. Shevchenko and O. Ivanov. The validity of the procedure was confirmed by the respective simulations. The procedure is considered now for data from COMPASS.

Predictions are made for single spin azimuthal asymmetries in pion production from Semi-Inclusive Deep Inelastic Scattering off transversely and longitudinally polarized targets for the HERMES and COMPASS experiments. The *x*-dependence of the asymmetries is evaluated using the parton distribution functions from the chiral quark-soliton model. The overall normalization of the predicted asymmetries is determined by the information on the Collins fragmentation function extracted from the previous HERMES data on azimuthal asymmetries $A_{UL}^{\sin\Phi}$ from a *longitudinally* polarized target where the Sivers effect is shown to be strongly suppressed.

The single spin asymmetries A_{UL} from the *transversely* polarized proton target are found to be about 10% for positive and neutral pions at both HERMES and COMPASS. For a *longitudinally* polarized target it was obtained for COMPASS $A_{UL}^{\sin\Phi} \approx 0.5\%$ and $A_{UL}^{\sin 2\Phi} \approx 1.5\%$.

The preliminary data from HERMES agree with the predictions for π^+ but some disagreement is seen for π^- and especially for π^0. The reason for this is yet unclear.

These very interesting results were obtained under the guidance of Professor A. Efremov. He celebrated his 70th anniversary on 26 December 2003.

1.2.7 Condensed Matter Physics

New interesting results were obtained in experiments at the IBR-2 reactor. Phase separation, arising in the structures of perovskite manganites at cooling below the temperature of magnetic ordering, is at present one of the most intensively discussed issues of the physics of compounds with strong correlations between their structural, electrical and magnetic properties. The existence of a new type inhomogeneous state, appearing at low temperature in manganites, has been proved by Prof. V. Aksenov and physicists from the Frank Laboratory of Neutron Physics of JINR, the "Kurchatov Institute" and Moscow State University. In neutron diffraction experiments it was established that between the border regions of a phase diagram, which are ferromagnetic-metallic and antiferromagnetic-insulating, there exists an inhomogeneous mixture of both states with typical size of domains as large as several hundreds Angstrom.

1.2.8 Elementary Particle Physics

A team of LPP physicists headed by Prof. V. Kekelidze has made a considerable contribution to the NA48 experiment (CERN) where the most precise result on the measurement of the direct CP-violation effect has been obtained.

In the NA48/1 experiment, a new decay mode $K_S \to \pi^0 e^+ e^-$ has been observed. This result is based on the analysis of $4.2 \cdot 10^{10}$ K_S decays collected in 2002. Seven events of the decays $K_S \to \pi^0 e^+ e^-$ have been found in the region of $m_{ee} > 0.165$ GeV with only 0.15 background events.

In 2003 the first run was carried out in the new CERN beam line of charged kaons with the upgraded NA48/2 set-up. The main additional contribution of JINR to this experiment is the design and manufacture of the read-out electronics for the new unique high-performance coordinate detector – KABES, working in high intensity charged beams. High momentum and time resolutions of this detector have been reached.

Preliminary analysis of the collected data already shows that the systematical uncertainties of the measured asymmetry *Ag* are less than achieved statistical error.

Let me emphasize that many physicists from JINR participate in the CERN programme, including for LHC experiments, namely ATLAS, CMS and ALICE. The JINR physicists fulfil their tasks and obligations in due amount and time. I would like to illustrate my statement by three examples.

On 30 October 2003, the last 64th module of the central part of the 6-metre section for the Barrel part of the ATLAS Tile Calorimeter was installed at CERN. This section represents a hollow cylinder with an outer diameter of 8.5 meter, inner diameter of 4.5 meter, with the length of 6.4 meter and the total weight of about 1350 tons.

Therefore, JINR has completed the production and assembly of all the modules for the Barrel part of the ATLAS Tile Calorimeter.

Let me give another example. For the huge CMS detector, a great amount of brass was required. To solve this task, shells were transported from a base of the Russian Northern Fleet for utilization to St. Petersburg. There, at the "Krasny Vyborzhets" plant, the shell cases were melted into high-strength ingots of brass. Then these ingots were transported to Minsk, Belarus where the necessary product for the detector was manufactured at the "October Revolution" plant.

The final assembly of the detector was carried out by the international team of specialists and physicists of the Russia and Dubna Member States Collaboration (RDMS) at CERN.

JINR physicists are constantly seeking possibilities of implementing foreign technical orders at Russian plants, including at those located near Dubna.

Thus, I informed you a year ago that the iron yoke of the ALICE dipole magnet was manufactured at the Savelovo machinery plant (near Dubna) as a joint JINR-CERN project. The dipole magnet is an essential part of the ALICE forward dimuon spectrometer. The shipment of the 800 ton yoke of the ALICE dipole magnet and the subsequent assembly tooling to CERN was over in 2003. The last (14th) railcar left the Savelovo rail station on 29 December 2003.

1.2.9 Low- and Intermediate-Energy Physics

The main result of NEMO-3 project in 2003 is the start of the NEMO-3 detector at the normal working mode. Final tuning of detector, laser survey system and neutron shield installation were finished and from February detector is taking data under stable conditions. First results from the NEMO-3 were successively reported at different conferences (NANP03 (Dubna), NDM03 (Nara, Japan, June 2003), etc.). $2\nu\beta\beta$-signal of ^{100}Mo spectrum is presented on the slide. These data correspond to the best statistic in the world.

1.2.10 Nuclear Physics with Neutrons

Increased concern in air pollution with toxic heavy metals in industrialized countries has lead to establishing the international programme "Atmospheric Heavy Metal Deposition in Europe: — estimations based on moss analysis".

Since 1995 Dr. M. Frontasieva and physicists from the Department of the Neutron Activation Analysis of the Frank Laboratory of Neutron Physics has been involved in the European programme reporting results to the European Atlas from the moss survey. This Department has also initiated similar biomonitoring projects in Turkey, China and South Korea. Two more Asian JINR Member States — Mongolia and Vietnam — have revealed interest in biomonitoring studies in collaboration with the Dubna team.

1.2.11 Radiation and Radiobiological Research

Scientists from the Department of Radiation and Radiobiological Research participate in the development of new radiopharmaceuticals for cancer diagnostics and treatment. Thus, important results have been obtained in collaboration with the Institute of Biophysics of the Russian Ministry of Health. A new radiopharmaceutical for melanoma treatment was investigated in experiments with animals. Gamma-camera imaging as well as direct

measuring of radioactivity, accumulated in different organs of mouse, shows a very high accumulation of the compound in a tumour.

I inform you also that after the joint research studies of scientists from Dubna and Obninsk the production of ^{131}I-Methylene Blue radiopharmaceutical has been started at the State Scientific Centre "Karpov Institute" in Obninsk. Clinical investigations of this radiopharmaceutical will be conducted too.

1.2.12 Educational Programme

275 students from higher education institutions of JINR Member States attended studies at the JINR University Centre in 2003. Let me note that 148 students of the Dubna Branch of the Moscow Institute of Radio Engineering, Electronics, and Automatics have special studies on the new educational programme for engineers in the framework of activity for renewal of engineers' personnel, for example at IBR-2.

JINR continued its postgraduate programmes in 10 specialities of physics and mathematics. In 2003, the total number of PhD students at the UC was 70.

The UC regularly organizes schools for young scientists and joint seminars in research centres of Member States. Thus only in 2003 JINR successfully organized and held:

- jointly with CERN the "European School of High Energy Physics" in Tsakhkadzor (Armenia);
- the Second International Summer Student School in Memory of Bruno Pontecorvo at the holiday hotel "Dubna" in Alushta (Ukraine);
- Second International Summer Student School "Nuclear Physics Methods and Accelerators in Biology and Medicine" at the Adam Mickiewicz University in Poznan (Poland).

Let me note that, together with lectures given by leading scientists of the Joint Institute and other large research centres, students and postgraduates of our University Centre present their reports at these schools.

Thus, at the Second International Summer Student School "Nuclear Physics Methods and Accelerators in Biology and Medicine", all in all 32 student reports were presented. The following three presentations were ranked by the School participants themselves as the best ones:

- Anna Yudina (Moscow State University), "Magnetic resonance imaging (MRI) research at MSU's MRI and Spectroscopy Centre";
- Alexei Lipengolts (Moscow Engineering Physics Institute), "Boron neutron capture therapy research at the IRT reactor of MEPI";
- Alexandra Kłos (Poland), "Statistic analysis of results from *in vivo* dosimetry in radiotherapy with the use of electron beams".

All these conferences and schools for young scientists help to inform the JINR Member States about our educational programme.

I also wish to inform you that the lectures' programme of the "Dubna International Advanced School of Theoretical Physics" (DIAS-TH) started successfully in 2003. It was agreed with CERN to organize schools for young physicists in Dubna in 2004 in the framework of the DIAS-TH programme with invitation of lecturers and young scientists both from CERN and JINR Member States.

1.3 Conferences and Meetings

1.3.1 Conferences

56 conferences, workshops, schools and other meetings were organized by JINR in 2003. Some of them were organized in association with other research centres. These conferences took place in Dubna and in Armenia, Belarus, Bulgaria, the Czech Republic, Poland, the Russian Federation, the Slovak Republic, and Ukraine. On the slide you can see a list of some conferences.

As a remarkable event I would like to mention the 8th International Conference on Nucleus-Nucleus Collisions that took place in Moscow on 17-21 June 2003.

More than 4900 scientists were the participants of the above conferences, including about 400 physicists from the JINR Member States (without Russia) and about 600 scientists from other countries.

I would like to mention also that all the Memorial Conferences announced a year ago and dedicated to Professors D. Blokhintsev, V. Dzhelepov, B. Pontecorvo, G. Flerov, and I. Frank were successfully organized and were attended by many famous scientists. These conferences took place in 2003, naturally because these outstanding scientists collaborated during many years and worked jointly.

Only one remark: I. Frank, D. Blokhintsev and M. Markov were students of one and the same year at Moscow State University.

1.3.2 Exhibition "Science Bringing Nations Together"

Another important event that I would like to mention is the traditional JINR-CERN poster exhibition "Science Bringing Nations Together".

Since 1997, when the first joint exhibition of this series was held at the University of Oslo (Norway), CERN and JINR organize these exhibitions every year. It was shown also at UNESCO in 1998, at the UN Office in Geneva in 1999, in the European Parliament in Brussels in 2000, in the Russian State Duma in Moscow in 2001, and in the Ministry of Education and Science in Bucharest in 2002.

The recent joint exhibition was held at Yerevan University in Armenia.

In October 2003 the exhibition "Science Bringing Nations Together" was demonstrated at the Diplomatic Academy in Moscow.

The Directorates of JINR and CERN believe that the organization of these exhibitions contribute to the popularization of the scientific achievements of the two international centres and hope to continue this joint effort in the future.

Let me stop here the presentation of scientific achievements and important events which took place at JINR during 2003 and inform you briefly about the main features of the JINR scientific programme in 2004.

2 The JINR Scientific Programme in 2004

2.1 General information and "Topical Plan for JINR Research"

Documents concerning scientific programme are presented in the "Topical Plan for JINR Research" (Russian and English versions).

You can see the data on the research themes in the table in the next slide.

Table: Data on the research themes

Field of activity	Number of research themes
Theoretical physics	5
Elementary particle physics	26
Relativistic nuclear physics	11
Heavy-ion physics	3
Low- and intermediate-energy physics	3
Nuclear physics with neutrons	2
Condensed matter physics	5
Radiation and radiobiological research	2
Networking, computing, computational physics	3
Educational programme	1
Total:	61

In 2004 the scientific programme includes 61 research themes. In accordance with the PACs recommendations, the JINR Directorate opened 8 new themes and closed 2 themes. You can find the detailed information about all research themes in the documents mentioned above.

2.2 Priority Activities in 2004

The JINR Directorate, together with leaders of Laboratories and research projects and in accordance with the PACs recommendations, proposes the following list of priority activities in 2004 on which financial and manpower resources should be focused:

in-house facilities

– operation and development of the Nuclotron focused on the further efficiency of the complex and achievement of a wider range of accelerated nuclei for the users, development of the Nuclotron beam extraction system and of external beam lines;

– modernization of the IBR-2 reactor according to the schedule of activities approved by the Agreement between JINR and the Russian Ministry for Atomic Energy: final assembly and bench-tests of the new movable reflector MR-3, its assembly at a regular site near IBR-2 and the start-up of the reactor with the MR-3 in 2004;

delivery of the reactor's new fuel and organization at JINR of a working area for the assembly of fuel elements into fuel cassettes;

– reconstruction of the U400 accelerator, completion of Phase I of the Dubna Radioactive Ion Beams (DRIBs) project, implementation of work on the realization of Phase II of the project, start of physics experiments with radioactive ion beams;

facilities under construction

– decommissioning of the IBR-30 reactor and construction of the IREN facility according to the revised schedule of October 2003 and dedicated funding with a view to completion of its first stage in 2006;

– further development of JINR's telecommunication links, networking, computing and information infrastructure, including Grid technologies;

ongoing research programmes and projects

– studies in modern mathematical physics; theoretical studies in particle physics, nuclear physics, and condensed matter physics, first of all with a view to supporting experimental work in these fields;

– continued participation in frontier experiments aimed at studying the fundamental properties of elementary particles and their interactions, study of rare weak processes aimed at verification of the Standard Model of particle interactions and search for new physics phenomena beyond the Standard Model, precise measurement of direct CP-violation, studies of the nucleon structure as well as thorough investigations of neutrino properties and nature at high, low and intermediate energies, participation in high-energy experiments at accelerator facilities at IHEP (Protvino), CERN, DESY, BNL and FNAL;

– participation in construction of accelerator subsystems for the LHC as well as development of promising accelerator technologies;

– continuation of relativistic nuclear interaction studies focused on the search for manifestations of quark and gluon degrees of freedom in nuclei and on properties of nuclear matter at high energies, as well as studies of the spin structure of the lightest nuclei; in-house experiments mainly at the Nuclotron, as well as experiments at accelerators of other centres: CERN (SPS), BNL (RHIC), GSI (SIS), Uppsala University (CELSIUS), RIKEN;

– experiments on the synthesis of superheavy nuclei with Z=116 and 118 using the upgraded Gas-Filled Recoil and VASSILISSA separators, experiments on the chemical isolation and identification of superheavy elements with Z=112 and 114, study of the fusion-fission reactions with ^{48}Ca, ^{58}Fe, ^{64}Ni ions using the CORSET+DEMON facility, study of the structure of light exotic nuclei and of the mechanism of nuclear reactions with radioactive and stable ion beams using the ACCULINNA, COMBAS, MSP-144 and ISTRA set-ups, construction of the MASHA separator;

– research, development and manufacturing of neutron detectors, sample environment systems and data acquisition systems for the IBR-2 spectrometer complex; development of the FLNP local area network;

other items that deserve attention

– development of the JINR Educational Programme, including special-purpose training of specialists for the Member States; in particular, the new activity "Dubna International Advanced School of Theoretical Physics" and annually held summer student practical courses in JINR's fields of research;

– investigation of effects induced in biological objects by ionizing radiation with different linear energy transfers, participation in the development of new radiopharmaceuticals for cancer diagnostics and treatment.

I think the PACs Chairpersons will comment the list of priority activities.

2.3 Supplements to the 7-year Programme

As requested by the Scientific Council, the JINR Directorate published the final text of "The Programme of JINR's Scientific Research and Development for 2003–2009" in October 2003.

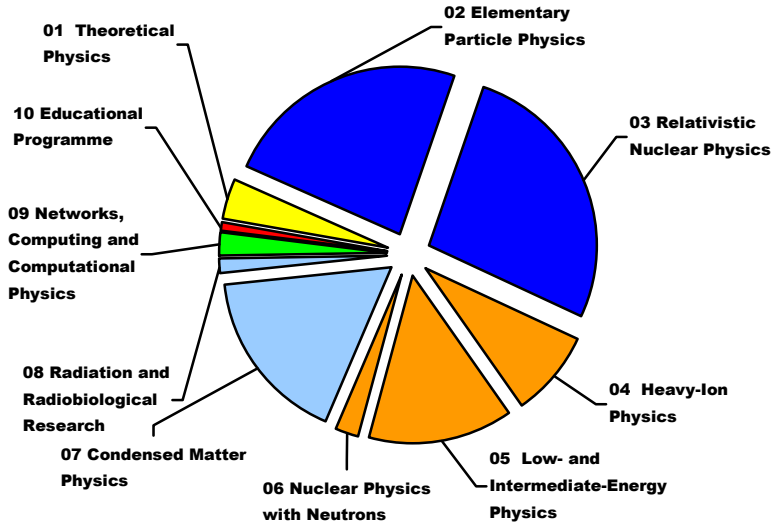
At the previous session, the Scientific Council welcomed the intention of the Directorate to further develop the Institute's perspective programme, in particular by working out three supplements (dedicated to the infrastructure, recruitment of young staff, and a booklet of projects and themes which will be prioritized).

The summaries of two supplements - the "Programme of the Development of the JINR Engineering and Technical Infrastructure" and "Young Staff at JINR" – are presented in written form at this session. These two documents were prepared by the working group headed by JINR Chief Engineer G. Shirkov, and he can answer your questions.

The booklet of JINR projects and themes was prepared for this session too and made available in advance in electronic version on the JINR Web-site since November 2003. In your materials you can find also the contents of the booklet on the paper and the full version of the booklet on a compact disk.

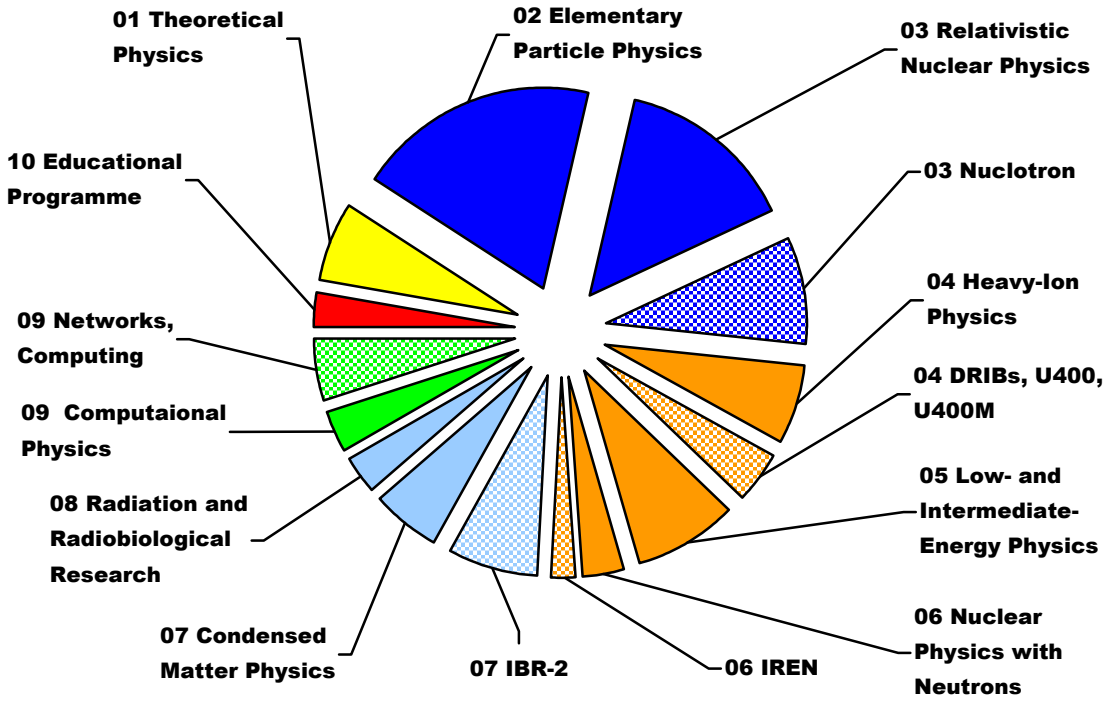
Abstract of 131 projects and research themes were collected in the booklet. All these projects were presented and discussed at the meetings of the Programme Advisory Committees during the last decade. Some projects have a status of "Expression of Interests" (for example, DELSY) and their further consideration and approval will be

provided in accordance with the JINR Rules. The distribution of projects and research themes over the JINR fields of activities is shown on the diagram.



Distribution of projects and research themes over the JINR fields of activities.

The distribution of manpower for projects and research themes over the JINR fields of activities is shown on the diagram. Let me stress that among 2700 people at JINR, who are working in the scientific sphere, 25% are the staff of the JINR basic facilities who are responsible for their operation and development.



Distribution of manpower for projects and research themes over the JINR fields of activities (large checker board pattern fill effect used for basic facilities).

I am inviting all members of the Scientific Council to comment these supplements during the general discussion which will be held today in the afternoon meeting.

3 Latest news in brief

The last section of my report concerns the latest news of important events of 2003. In the list of these events I would like to mention some scientific achievements of general interest.

3.1 Most notable developments in cosmology and particle physics

Let me start with the most notable developments in cosmology and particle physics. These sciences accumulate now new data about the Universe and its creation by using large colliders of charged particles and modern detectors

on the Earth observatories and in the satellites. My colleague and friend Academician V. Rubakov from the Institute of Nuclear Physics in Moscow sent me a week ago a short summary of these activities.

He marked the first detailed full-sky map of the cosmic microwave background, the microwave "echo" of the Big Bang. The map was created using the high precision data collected by the NASA's Wilkinson Microwave Anisotropy Probe satellite. The data indicate that the microwave "echo" occurred about 380000 years after the Big Bang and that the Universe is now about 13.7 billion years old. They also reveal that the earliest stars in the Universe were created just 200 million years after the Big Bang. The results also support the idea of an infinite, flat Universe that is made up of 4% ordinary matter, 23% dark matter and 73% dark energy.

The second news I wish to mention concerns a form of matter called the quark-gluon plasma, believed to have existed in the first microseconds after the birth of the Universe. New results were announced in June 2003 at the Brookhaven National Laboratory. Data from the PHENIX detector show that the production rate of high-p_T pions, scaled to account for the number of participating nucleons, is significantly suppressed in gold-gold collisions as compared to proton-proton or deuteron-gold collisions at the same energy per nucleon. The STAR data show the angular correlation between high-p_T particles produced in the same event. The recoil peak at 180°, clearly indicating the production of back-to-back jets in proton-proton and deuteron-gold collisions, is strikingly absent in the gold-gold data.

"This is a very exciting result that clearly indicates we are on the right track to an important scientific discovery," said Thomas Kirk, Brookhaven's Associate Laboratory Director for High Energy and Nuclear Physics, and I subscribe to his opinion.

Let me remind you that physicists from JINR participate in both PHENIX and STAR collaborations.

In 2003 physicists of the Veksler-Baldin Laboratory of High Energies in collaboration with BNL (USA) and Tsukuba University (Japan) manufactured and installed Cherenkov Counters with silica-aerogel radiator to extend particle identification on PHENIX up to 10 GeV/c.

You know that exotic baryon resonance Θ^+ was observed in different experiments with very narrow width and pentaquark structure. This particle contains two up quarks, two down quarks and a strange antiquark. Quantum numbers are undefined except of isospin (Θ^+ is an isosinglet). New data were obtained in 2003 by the HERMES collaboration in which JINR physicists participate. A new member of antidecuplet Ξ^{--} was observed in the NA49 experiment in which JINR physicists participate too. Among the co-authors of this new result I am glad to mention Professor A. Malakhov, Drs. B. Baatar, V. Kolesnikov and G. Melkumov from the Veksler-Baldin Laboratory of High Energies. Further theoretical and experimental work is needed to establish quantum numbers like spin and parity of observed resonances. Pentaquarks open a new window for our understanding of quarks and hadrons in the extreme conditions.

Concluding, I would like to mention the result announced on 8 January 2004 by the muon *g-2* collaboration at the Brookhaven National Laboratory. They concluded that, if all results for the *g-2* value are combined, the difference between theory and experiment is 2.8 standard deviation. I wish to emphasize that the experiments for measurements of magnetic moment of the muon are a good way to search for new physics beyond the Standard Model. The leading candidate for such new physics is supersymmetry – a theory which predicts that all the particles in the Standard Model have so-called superpartners.

Let me stop here the presentation of the notable developments in cosmology and particle physics. I switch to the presentation of some news concerning participation of JINR in the construction and development of the facilities in the JINR Member States.

3.2 Cyclotrons for Slovakia and Kazakhstan

Let me remind you that the Flerov Laboratory of Nuclear Reactions is the head laboratory for the construction of a cyclotron in the Slovak Republic now. Dušan Podhorský, President of the Slovak Office of Standards, Metrology and Testing, during the visit to Dubna on 11 December 2003, was informed about the status of the construction of this new facility. The opinion of the delegation about the Flerov Laboratory's activity was very positive.

A year ago the Scientific Council endorsed the proposal of Professor Kairat Kadyrzhanov, Plenipotentiary of Kazakhstan, concerning a cyclotron centre in Astana. Vice-Director A. Sissakian visited Kazakhstan on 3 December 2003 and participated in the meeting at the Ministry of Energy and Mineral Resources of the Republic of Kazakhstan where the project of a cyclotron for the L. Gumilev University in Astana was discussed. This work is under the control of the President of Kazakhstan, Nursultan Nazarbaev. So the Joint Institute continues to play its important role in the development of the scientific and technical facilities in Member States. The report on the "Project and research programme of the cyclotron complex for the L. Gumilev University (Astana)" will be presented tomorrow.

3.3 Meeting with the President of Romania, I. Iliescu

I believe you can agree with me that the round-table discussions and dedicated photo exhibitions, which took place at the Scientific Council's meeting in 2000-2003, significantly contributed to the popularization of the scientific achievements and cooperation between JINR and Member States. For example, the last round-table discussion "Romania at JINR" was held in June 2003.

I presented the booklet "Romania at JINR" to the President of Romania, Ion Iliescu during his visit to Moscow on 4 July 2003. During our meeting President I. Iliescu emphasized again the importance of scientific cooperation between JINR and Romanian research centres.

Now I will tell you about some news on the development of the partnership relations with physicists from countries which are planning to become an Associate Member of JINR.

3.4 Cooperation with India

Let me remind you that members of the JINR Directorate and scientific leaders of the Joint Institute had many contacts with the authorities of India and research centres of this country during the last three years.

I informed you a year ago that Prof. D.D. Bhawalkar, during his visit to Dubna on 27 September 2002, informed the JINR Directorate that India's Department of Atomic Energy and Department of Science and Technology have agreed in principle for India becoming an Associate Member of JINR, like Germany, for example.

I was invited to meet with Prof. B. Ramamurthy, Secretary to the Government of India, Department of Science and Technology, on 11 November 2003 in Moscow. He said that the Agreement on Cooperation between JINR and India can be signed in March 2004 in Bangalore (India). The Agreement and the prospects of cooperation were discussed also with Dr. R. Chidambaram (Bombay) and Dr. Pramod Shukla (Counselor, Science & Technology, Embassy of the Republic of India in Moscow) during their visit to JINR on 19 November 2003.

3.5 Cooperation with South Africa

Very important news concerns JINR relations with South Africa.

Over the last decade there have been established scientific contacts between the Joint Institute for Nuclear Research (JINR) and research centres in South Africa (SA), which I had an opportunity to witness during my visits to this country. At the meeting of the South Africa – Russia Joint Commission on Science and Technology held on 12 November 2003 in Moscow, Dr. Rob Adam, General Director of the Department of Science and Technology of South Africa, welcomed a preparation of an Agreement between South Africa and JINR. The JINR Directorate also welcome, in every possible way, the elaboration of such a document with a view to developing the JINR–SA scientific and technological collaboration.

I am glad to welcome the delegation of the Embassy of South Africa in Moscow, which is headed by Ambassador Mr. M.J. Seekoe, at this session of the Scientific Council.

Hence, the process for the establishment of cooperation between JINR and South Africa at the governmental level has started.

3.6 Initiative on CIS Summit

Members of the Scientific Council already know about the initiative to hold in Dubna a summit of the Commonwealth of Independent States (CIS) dedicated to the international cooperation in science and technology. I mentioned at the summer session that the Russian Ministry of Foreign Affairs informed me at the end of April last year:

"Your proposal for holding on the basis of JINR, in Dubna, of the summit of the Commonwealth of Independent States dedicated to international cooperation in science and technology has been forwarded to the CIS Executive Committee. This issue is planned to be included in the agenda of the CIS summit which is tentatively scheduled for June 2004 in Moscow."

I would like to say that this idea was conveyed by the leaders of the Russian State Duma. Many leaders and politicians of the Former Soviet Region were informed about this idea and supported it. Among them, for example, are S. Mironov, Speaker of the Federation Council of the Federal Assembly of the Russian Federation; V. Trubnikov, First Deputy Minister of Foreign Affairs of Russia and Federal Minister for the CIS Affairs; Nursultan Nazarbaev, President of Kazakhstan; Robert Kocharyan, President of Armenia; Islam Karimov, President of Uzbekistan. The Russian President V. Putin is aware of this matter. N.A. Plate, Vice-President of the Russian Academy of Sciences supported this initiative too.

3.7 SESAME: a research centre modeled on CERN and JINR

Concluding I would like to mentioned that in 2004 CERN will celebrate its 50^{th} anniversary.

The invaluable experience of CERN and JINR in overcoming political barriers and in fostering scientific cooperation is successfully applied (in much more difficult conditions) in the establishment, under the aegis of UNESCO, of the International Centre for Research and Advanced Technology in Jordan, where a new-generation synchrotron source, called SESAME, will be constructed.

The key role in the realization of this project belongs to the SESAME President, outstanding German scientist Herwig Schopper. Professor H. Schopper is a laureate of the Russian Order of Friendship (1997), of the Grand Cordon of the Order of Independence (Jordan, 2003), of the 2003 American Institute of Physics Tate Medal for International Leadership in Physics. He was Director-General of CERN in 1981-88 and a member of the JINR Scientific Council in 1993-2002. The creation of the new International Centre and of the SESAME facility, being an important contribution to the scientific, technological and economic development of all Middle East countries, will certainly contribute to bringing nations of this region together and to a peaceful settlement of the Middle East conflict.

So much for the information about the implementation of the recommendations of the Scientific Council's 93rd and 94th sessions, the main features of the JINR scientific programme in 2004, and latest news.

Thank you for your attention.