TOPICAL PLAN
FOR JINR RESEARCH
AND INTERNATIONAL COOPERATION
2013

Dubna 2012

Contents

Prepared by
N.A. Boklagova
L.K. Ivanova

All the themes in the Plan are listed by fields of research. Each theme is coded according to the JINR system of classification and contains the following information:

the first number *	-	the field of research
the second number **	-	the conventional number of Laboratory or other Division of JINR
the third number	-	the theme's ordinal number
the fourth and the fifth numbers	-	the years of the activity's beginning and completion

Each theme of the Topical Plan has 1st or 2nd priority. For the year 2013 the priorities were set for one year only in accordance with the recommendations of the Directorate and Programme Advisory Committees of JINR, of the Directorates and Science and Technology Councils of the Laboratories.

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* 01 - Theoretical Physics
02 - Elementary Particle Physics and
- Relativistic Nuclear Physics
03 - Nuclear Physics
04 - Condensed Matter Physics and
- Radiobiological Research
05 - Networking, Computing, Computational Physics
06 - Educational Programme
07 - Applied Research with Nuclear Physics Methods

** 0 - All-Institute Topics
1 - Veksler and Baldin Laboratory of High Energy Physics (VBLHEP)
2 - Dzhelepov Laboratory of Nuclear Problems (DLNP)
3 - Bogoliubov Laboratory of Theoretical Physics (BLTP)
4 - Frank Laboratory of Neutron Physics (FLNP)
5 - Flerov Laboratory of Nuclear Reactions (FLNR)
6 - Laboratory of Information Technologies (LIT)
8 - Science Organization Department (SOD)
9 - Laboratory of Radiation Biology (LRB)
10 - Multi Access Centre "Nanobiophotonics" (MAC "Nanobiophotonics")

Theoretical Physics (01)

01–3–1070–2009/2013	Priority: 1

Status: Approved for completion in 2013

Theory of Elementary Particles

Leaders: D.I. Kazakov
O.V. Teryaev

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, Canada, CERN, Czech Republic, Finland, France, Georgia, Germany, Hungary, ICTP, Italy, Japan, Kazakhstan, Mexico, Mongolia, New Zeland, Norway, Poland, Republic of Korea, Russia, Serbia, Slovak Republic, Spain, Sweden, Switzerland, Ukraine, United Kingdom, USA, Uzbekistan, Vietnam.

Scientific Programme

Further development of the quantum field theory approach in the framework of the Standard Model of fundamental interactions and its extensions. Lattice simulations for obtaining nonperturbative results in gauge theories. Elaboration of multiloop calculations in QCD, Electroweak theory, and Minimal Supersymmetric Standard Model. Theoretical predictions concerning the experimental observation of supersymmetry, the Higgs boson, investigation of the spin structure of the nucleon, T-odd spin effects, jet handedness, heavy flavor physics, vacuum structure in QCD, and hadron properties in dense and hot media. Elaboration of new phenomenological models to describe the hadron dynamics in the framework of general principles of quantum field theory incorporating basic experimental patterns. Theoretical support of current and future experiments at JINR, IHEP, CERN, GSI, DESY, and other physics centers.

Expected main results in 2013:

- Calculation of the amplitudes in the spontaneously broken $\mathcal{N} = 4$ supersymmetric Yang-Mills theory in the weak coupling regime.

  Calculation of the NLO correction to the BFKL equation in the Leigh-Strassler deformation of the $\mathcal{N} = 4$ SYM theory.

  Calculation of radiative corrections to the lepton production in proton-antiproton annihilation.

  Analysis of the parameter space of the Minimal supersymmetric Standard Model with account of accelerator and astrophysical data and investigation of possibilities of SUSY searches at the LHC.

  Analysis of recent data on the light and heavy Higgs searches at the LHC in the framework of the MSSM.

  Extraction of the axial and pseudoscalar form factors of the nucleon from a statistical analysis of accelerator data on neutrino and antineutrino interactions with nuclei.

- Finding the solutions of Evolution Equations for Transverse Momentum Dependent Parton Distribution Functions and exploration of relations between them for Semi-Inclusive Deep Inelastic Scattering and Drell-Yan processes in connection with the COMPASS experiment.

  The investigation of Q^2 evolution of the structure function F_2 at small x with the BFKL corrections taken into account.

  Investigation of higher twist contributions in the processes at low momentum transfer and their interplay with the modifications of perturbation theory, development of the methods of summation of their infinite series, search for the terms beyond the local Operator Product Expansion.

  Applications of QCD collinear factorization to the exclusive processes including the meson electroproduction, Higgs central exclusive production and deeply virtual deuteron breakup.

  Application of exact anomaly sum rules to the time-like formfactors and QCD matter.

- Calculation of the hadronic light-by-light scattering contribution to the muon g-2 due to a dynamic quark loop. These calculations complete all terms leading in $1/N_c$ approximation.

  Calculation of the differential rates and the forward-backward assymmetries for the rare decays of baryons containing heavy b-quark using the covariant quark model.

  Calculation of the quark anomalous magnetic moment contribution to the pion single spin asymmetries in proton-proton collisions.

- Calculation of vorticity in relativistic heavy-ion collisions in transport and hydrodynamic models.

  Investigation of particle distributions and collective effects in hadronic and heavy-ion collisions using the effectrive Levy-Tsallis statistics. Exploration of QCD analogs of multiple high energy hadron scattering in the dense nuclear medium.

List of activities:

Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1. **Standard Model and its extension**	**D.I. Kazakov** **E.A. Kuraev**
BLTP	A.B. Arbuzov, A.V. Bednyakov, A.V. Gladyshev, A.V. Kotikov, G.A. Kozlov, V.K. Mitrjushkin, V.A. Naumov, V.N. Pervushin, A.D. Popov, S.I. Vinitsky + 5 students
LIT	V.P. Gerdt
VBLHEP	V.G. Krivokhizhin
DLNP	D.Yu. Bardin, V.A. Bednyakov, L.B. Kalinovskaya
2. **QCD parton distributions for modern and future colliders**	**A.V. Efremov** **O.V. Teryaev** **D.V. Shirkov**
BLTP	S.V. Goloskokov, P.S. Isaev, S.V. Mikhailov, A.V. Nesterenko, A.V. Radyushkin, O.V. Selyugin, A.V. Sidorov + 3 students
VBLHEP	Yu.I. Ivanshin, I.A. Savin
DLNP	L.L. Nemenov, L.G. Tkatchev, A.S. Khrykin
3. **Physics of heavy and exotic hadrons**	**A.E. Dorokhov** **M.A. Ivanov**
BLTP	I.V. Anikin, I.O. Cherednikov, G. Ganbold, S.B. Gerasimov, G.V. Efimov, S.M. Eliseev, N.I. Kochelev, V.I. Korobov, V.A. Meshcheryakov, D. Minal, S.N. Nedelko, Yu.S. Surovtsev, S.A. Zhaugasheva + 3 students
VBLHEP	Yu.A. Panebratsev, M.V. Tokarev, V.A. Nikitin, Yu.I. Ivanshin, I.A. Savin, M.G. Sapozhnikov
DLNP	V.A. Bednyakov, N.B. Skachkov
4. **Mixed phase in heavy-ion collisions**	**A.S. Sorin** **D. Blaschke**
BLTP	A.S. Khvorostukhin, S.V. Molodtsov, A. Parvan, V.D. Toneev, M.K. Volkov + 3 students

LIT	Yu.L. Kalinovsky, Zh.Zh. Musulmanbekov
VBLHEP	V.D. Kekelidze
DLNP	G.I. Lykasov

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	RAU
		ANL
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	INP BSU
		JIPNR-Sosny
		NASB
		NC PHEP BSU
	Gomel	BelSUT
		GSU
		GSTU
Bulgaria	Sofia	INRNE BAS
		SU
Canada	Montreal	McGill
		UdeM
	Toronto	U of T
CERN	Geneva	CERN
Czech Republic	Prague	CTU
		CU
		IP ASCR
	Řež	NPI ASCR
Finland	Helsinki	UH
France	Lyon	UCBL
	Metz	UPV-M
	Montpellier	UM2
	Saclay	SPhN CEA
		DAPNIA
		IRFU
Georgia	Tbilisi	RMI TSU
Germany	Berlin	FU Berlin
		HUB
	Aachen	RWTH
	Bielefeld	Univ.
	Bochum	RUB
	Bonn	UniBonn
	Dortmund	TU Dortmund
	Erlangen	FAU
	Hamburg	DESY
	Heidelberg	Univ.

	Jena	Univ.
	Jülich	FZJ
	Kaiserslautern	TU
	Karlsruhe	KIT
	Regensburg	UR
	Rostock	Univ.
	Mainz	JGU
	Munich	LMU
	Tübingen	Univ.
	Wuppertal	Univ.
	Zeuthen	DESY
Hungary	Budapest	ELTE
		Wigner RCP
ICTP	Trieste	ICTP
Italy	Bari	INFN
	Naples	INFN
	Padua	UniPd
	Pavia	INFN
	Pisa	INFN
	Trieste	SISSA/ISAS
	Turin	UniTo
Japan	Tokyo	UT
	Kyoto	Kyoto Univ.
	Nagoya	Meiji Univ.
		Nagoya Univ.
	Tsukuba	KEK
Kazakhstan	Almaty	FAPI
	Astana	BA INP NNC RK
Mexico	Cuernavaca	UNAM
Mongolia	Ulaanbaatar	IPT MAS
		NUM
New Zealand	Hamilton	Univ.
Norway	Trondheim	NTNU
Poland	Krakow	NINP PAS
	Kielce	UJK
	Lodz	UL
	Otwock-Swierk	NCBJ
Republic of Korea	Seoul	SNU
Russia	Moscow	IMM RAS
		ITEP
		LPI RAS
		MSU
		MI RAS
		SCC RAS
		SINP MSU

	Moscow, Troitsk	INR RAS
	Belgorod	NRU BelSU
	Chernogolovka	LITP RAS
	Gatchina	PNPI
	Irkutsk	ISU
	Ivanovo	ISU
	Kazan	KFU
	Novosibirsk	IM SB RAS
		BINP SB RAS
	Perm	PSNRU
	Protvino	IHEP
	St. Petersburg	SPbSU
		SPbSPU
	Samara	SSU
	Saratov	SSU
	Sarov	VNIIEF
	Tomsk	TSU
		IHCE SB RAS
	Tver	TvSU
	Yoshkar-Ola	VSUT
Serbia	Belgrade	Univ.
Slovak Republic	Bratislava	CU
		IP SAS
	Košice	IEP SAS
Spain	Santiago de Compostela	USC
	Valencia	UV
Switzerland	Bern	Uni Bern
	Villigen	PSI
Sweden	Lund	LU
United Kingdom	London	QM
		Imperial College
	Canterbury	Univ.
Ukraine	Kiev	BITP NASU
	Dnepropetrovsk	DNU
	Kharkov	KFTI NASU
	Lutsk	VNU
	L'viv	IAPMM NASU
		IFNU
	Sumy	SumSU
USA	New York, NY	RU
		CUNY
	Argonne, IL	ANL
	College Park, MD	UM
	Minneapolis, MN	UofM
	Norman, OK	UO

	Newport News, VA	JLab
	Philadelphia, PA	Penn
	University Park, PA	Penn State
Uzbekistan	Tashkent	IAP NUU
		NUU
Vietnam	Hanoi	IP VAST

01–3–1071–2009/2013	Priority: 1

Status: Approved for completion in 2013

Nuclear Structure and Dynamics

Leaders:

V.V. Voronov
A.I. Vdovin
F. Simkovic

Participating Countries and International Organizations:

Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, China, Czech Republic, Egypt, France, Germany, Greece, Hungary, Italy, Japan, Kazakhstan, Moldova, Norway, Poland, Republic of Korea, Romania, Russia, Slovak Republic, South Africa, Spain, Sweden, Switzerland, Taiwan, Ukraine, USA, Uzbekistan.

Scientific Programme

The main goals are to investigate properties of atomic nuclei at the limits of their stability; to study dynamics of nuclear reactions and mechanisms of production of exotic nuclides; to investigate fundamental properties of exotic few-body nuclear, atomic and molecular systems;to study the behaviour of nuclear matter and its phase transitions at high temperature and density; to evaluate new methods of relativistic nuclear physics and apply them to analyze subnuclear and spin effects in few-nucleon systems.

Expected main results in 2013:

- Study of the effects of phonon-phonon coupling on properties of dipole pygmy resonance in $^{124-132}$Sn.

  Estimation of the neutrino mass from the shape of the electron energy spectrum near the endpoint in unique forbidden beta decay.

  Study of octupole and dipole collectivity through the interacting boson models.

  Study of β-decays in neutron-rich nuclei with Skyrme interactions.

  Calculations of transition densities and charge radii in odd spherical nuclei taking into account ground state correlations beyond the RPA ones.

- Explanation of the anharmonic effects in the spectra of the alternating parity bands of the U and Pu isotopes.

  To perform the microscopic calculation of level densities in superheavy nuclei and clarify influence on the survival of excited heaviest nuclei.

  Description of the experimental data on cluster decay probabilities from isomeric states in heavy nuclei and cross sections of synthesis of new superheavy nuclei in different reactions.

  Investigation of the structure of the heaviest known Borromean nucleus ^{22}C.

- Estimates for the rate of the $ppe \rightarrow d + \nu$ reaction at the Sun conditions and the corresponding neutrino flux.

  Calculations of angular distributions for outgoing particles in collisions of neutral atoms with nagative ions on the basis of the discrete representation for ionization processes.

  Study of universal properties of two-component four-body systems.

  Elaboration of a theoretical model for description of the Feshbach resonances with different tensor structures in optical traps.

  Sharpening the generic norm bounds on variation of the spectral subspace of a multichannel Hamiltionian associated with an isolated spectral component.

- The code based on SHASTA (SHarp and Smooth Transport Algorithm) for the Israel-Stuart hydrodynamics will be realized for the general case of finite baryon density.

  Description within the Tsallis non-extensive statistics of the transverse-momentum distributions of charged hadrons in pp collisions at the LHC.

  Investigation of quantum effects in short impulse intensive electromagnetic (laser) fields and their application to particle production.

  Simulation of the vorticity effect in heavy ion collisions and search for its signals at the collision energies reachable at the NICA.

List of activities:

Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1. **Nuclear Structure far from Stability Valley**	**V.V. Voronov** **A.I. Vdovin** **J. Kvasil**
BLTP	N.N. Arseniev, E.B. Balbutsev, A.A. Dzhioev, V.A. Kuz'min, L.A. Malov, S. Mishev, V.O. Nesterenko, A.P. Severyukhin, Ganev H., Shimkovic F., Dvornicki R. V.M. Shilov, A.V. Sushkov + 2 students
LIT	N.Yu. Shirikova, I.V. Molodtsova
FLNP	A.M. Sukhovoi, V.I. Furman
DLNP	V.B. Brudanin, V.G. Kalinnikov
FLNR	Yu.P. Gangrsky
2. **Nucleus-Nucleus Collisions and Nuclear Properties at Low Energies**	**R.V. Jolos** **S.N. Ershov**
BLTP	G.G. Adamian, A.V. Andreev, N.V. Antonenko, I.A. Egorova, S.I. Fedotov, V.G. Kartavenko, Sh. Kalandarov, A.K. Nasirov, R.G. Nazmitdinov, V.V. Pashkevich, T.M. Shneydman, A.S. Zubov+ 3 students
FLNR	L.V. Grigorenko, Yu.E. Penionzhkevich
3. **Exotic Few-Body Systems**	**V.B. Belyaev** **A.K. Motovilov**
BLTP	S.S. Kamalov, E.V. Kolganova, A.V. Malykh, V.S. Melezhik, V.V. Pupyshev, J. Revai, E.A. Soloviev, I.I. Shlyk + 3 students
DLNP	O.I. Kartavtsev
4. **Nuclear Structure and Dynamics at Relativistic Energies**	**V.V. Burov** **M. Gaidarov**
BLTP	S.G. Bondarenko, A.V. Frisen, L.P. Kaptari, A. Khvorostukhin, V.K. Lukyanov, A.S. Parvan, A.I. Titov, V.D. Toneev + 1 students
LIT	E.B. Zemlianaya

VBLHEP	A.I. Malakhov, N.M. Piskunov, Yu.A. Panebratsev, E.P. Rogochaya

Collaboration

Country or International Organization	City	Institute or Laboratory
Austria	Innsbruck	Univ.
Belarus	Minsk	IP NASB
Belgium	Brussels	VUB
Brazil	Florianopolis, SC	UFSC
Bulgaria	Sofia	INRNE BAS
	Shumen	US
Canada	Hamilton	McMaster
	Saskatoon	U of S
China	Beijing	ITP CAS
		PKU
Czech Republic	Prague	CU
	Řež	NPI ASCR
Egypt	Cairo	EAEA
	Giza	CU
France	Bordeaux	UB
	Caen	GANIL
	Orsay	CSNSM
		IPN Orsay
	Saclay	IRFU
Germany	Bonn	UniBonn
	Cologne	Univ.
	Darmstadt	GSI
		TU Darmstadt
	Dresden	HZDR
		MPI PkS
	Erlangen	FAU
	Frankfurt/Main	Univ.
	Hamburg	Univ.
	Giessen	JLU
	Leipzig	UoC
	Mainz	JGU
	Munich	TUM
	Regensburg	UR
	Rostock	Univ.
	Siegen	Univ.
	Stuttgart	Univ.
Greece	Thessaloniki	AUTH
	Athens	INP NCSR "Demokritos"
Hungary	Budapest	Wigner RCP

	Debrecen	Atomki
Italy	Bologna	Centro, ENEA
	Naples	INFN
	Messina	UniMe
	Perugia	INFN
	Turin	UniTo
Japan	Tokyo	UT
	Kobe	Kobe Univ.
	Morioka	Iwate Univ.
	Osaka	RCNP
		Osaka Univ.
	Shizuoka	SU
Kazakhstan	Almaty	INP NNC RK
		KNU
Moldova	Chişinău	IAP ASM
Norway	Bergen	UiB
	Oslo	UiO
Poland	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
	Warsaw	UW
		WUT
Republic of Korea	Seoul	SNU
Romania	Bucharest	IFIN-HH
		UB
Russia	Moscow	ITEP
		NNRU "MEPhI"
		MSU
		NRC KI
		SINP MSU
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Irkutsk	ISU
	Obninsk	IPPE
	Omsk	OmSU
	Saratov	SSU
	St. Petersburg	SPbSU
	Vladivostok	FEFU
Slovak Republic	Bratislava	CU
		IP SAS
South Africa	Pretoria	Unisa
	Stellenbosch	SU
	Cape Town	iThemba LABS
Spain	Palma	UIB
Sweden	Lund	LU

	Goteborg	Chalmers
Switzerland	Bern	Uni Bern
Taiwan	Taipei	NTU
Ukraine	Kiev	KINR NASU
		BITP NASU
USA	Argonne, IL	ANL
	Los Alamos, NM	LANL
	Notre Dame, IN	ND
	University Park, PA	Penn State
Uzbekistan	Tashkent	IAP NUU
		INP UAS
		Assoc."P.-S." PTI

01–3–1072–2009/2013	Priority: 1

Status: Approved for completion in 2013

Theory of Condensed Matter and New Materials

Leaders: V.A. Osipov
J. Brankov

Scientific leader: N.M. Plakida

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Belgium, Brazil, Bulgaria, Canada, Czech Republic, France, Germany, Hungary, India, Ireland, Italy, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovak Republic, Slovenia, Spain, Switzerland, Taiwan, Ukraine, USA, Uzbekistan, Vietnam.

Scientific Programme

Multiparticle models of solids taking into consideration strong electron correlations, electron-lattice, and spin interactions to describe spectra of quasiparticle excitations, phase transitions and kinetic phenomena in solids. In equilibrium and nonequilibrium media with strong correlations such as liquids and nuclear matter, the processes of multifragmentation, clusterization in phase transitions and the influence of surface effects on properties of clusters. In the theory of superconductivity, nonstandard mechanisms of pairing in metal-oxides, the problem of bipolaron stability in a polaron gas environment, the influence of strong electric fields and temperature gradients on elastic, magnetic, and thermal properties of granular superconductors. For a study of mechanisms of phase transitions caused by charge, orbital, and magnetic ordering in magnetic semiconductors and in metals with a large magnetoresistance, experimental data obtained at the Frank Laboratory of Neutron Physics, JINR, by neutron scattering and the μSR method will be used.

Nonlinear problems in multiparticle theory will be studied by using modern methods of the renormalization group theory, the inverse scattering problem, fractal geometry, and the conformal field theory. The main subjects of the study are integrable systems, equilibrium systems of the statistical mechanics, and dissipative systems far from the thermodynamic equilibrium. The aim of these investigations is to reveal common properties of the multiparticle systems associated with the ideas of self-similarity and universality.

The microstructure of amorphous state will be studied in the framework of the theoretical model where topological disorder is introduced via arrays of disclination dipoles and loops. The thermal properties of disclinated media are of primary interest. The electronic spectrum of carbon materials, fullerenes and nanotubes, will be examined within the field-theory model adapted to account for nontrivial geometry of these nanostructures. The model of random Josephson junction arrays will be studied and applied to describe high-temperature granular superconductors.

In the theory of finite quantum systems, local and low-dimensional states of matter obtained in modern experiments will be investigated. In particular, properties of quasiparticles in mesoscopic systems and the Bose-Einstein condensation in atomic traps will be studied.

Expected main results in 2013:

- Calculation of the superconducting transition temperature in the extended Hubbard model by taking into account the inter-site Coulomb repulsion and electron-phonon interaction.

  Study of the magnetic reorientation in sandwich structures of magnetic thin films within the Green function theory. Description of the process of coherent spin reversal in magnetic nanomaterials and estimation of the optimal conditions for ultrafast reversal.

  Calculation of the orbital excitations in vanadium perovskites and their manifestation in the resonant inelastic X-ray scattering spectra.

  Study of small-angle neutron scattering from multiphase fractal systems.

  Proof of instability of Nagaoka state towards the creation of the antiferromagnetic bubble via a first order phase transition, including a jump in the total spin.

Investigation of the influence of microwave radiation on the current-voltage characteristics of intrinsic Josephson junctions and temporal oscillations of the electric charge in superconducting layers.

Investigation of electron and heat transport through single and few-layer graphene contacts.

Description of the process of generation of quantum turbulence in bose-condensed systems of trapped atoms. Proposal of experiments on the detection of granular states in such systems.

- Evaluation of correlation functions of the Totally Asymmetric Simple Exclusion Process with the generalized update.

  Studies of asymptotic properties of the loop erased random walk.

  Application of the obtained asymptotics to calculation of new characteristics for Rise and Peel model: the distributions of clusters, length of connection and density of vertices.

  Derivation of the exponent characterizing the growth of the number of n-leg watermelons in the two-dimensional spanning tree.

  Finding a new type of boundary conditions for two-dimensional lattice spin systems which preserve the condition of integrability, and to solving the corresponding Yang-Baxter equation.

  Explicit construction of the Cartan calculi on the quantum groups of series SLq(n) and $SU_q(n)$, and to investigation of their structure theory and applications to integrable systems.

List of activities:

Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1. **Physical properties of complex materials and nanostructures**	**N.M. Plakida** **V.A. Osipov** **G. Röpke**
BLTP	J. Brankov, A.Yu. Cherny, A.V. Chizhov, V. Ilkovich, V.L. Katkov, O.G. Isaeva, W. Kleinig, E.A. Kochetov, D.V. Kolesnikov, S.E. Krasavin, A.L. Kuzemsky, V.A. Moskalenko, V.N. Plechko, J. Schmelzer, V.Yu. Yushankhai + 3 students
2. **Mathematical problems of many-particle systems**	**V.B. Priezzhev** **V.I. Yukalov**
	V.M. Dubovik, V.I. Inozemtsev, T.A. Ivanova, A.E. Patrik, A.M. Povolotsky, P.N. Pyatov, V.P. Spiridonov, P.E. Zhidkov + 2 students
FLNP	V.L. Aksenov, A.M. Balagurov

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	ANL
		YSU
Australia	Melbourne	Univ.
	Sydney	Univ.
Belarus	Minsk	IP NASB
		ICE MES RB
		JIMB NASB

		JIPNR-Sosny
		NASB
Belgium	Louvain-la-Neuve	UCL
Brazil	Brasilia, DF	UnB
	Sao Paulo, SP	USP
	Natal, RN	IIP UFRN
Bulgaria	Sofia	IMech BAS
		ISSP BAS
		SU
		INRNE BAS
Canada	Montreal	Concordia
	Quebec	ULaval
	Kingston	Queen's
	London	Western
Czech Republic	Řež	NPI ASCR
France	Paris	UPMC
	Marseille	UPC
	Nice	UN
	Valenciennes	UVHC
Germany	Bonn	UniBonn
	Bremen	Univ.
	Braunschweig	TU
	Dortmund	TU Dortmund
	Darmstadt	GSI
	Dresden	IFW
		MPI PkS
		TU Dresden
	Duisburg	UDE
	Leipzig	UoC
	Magdeburg	OVGU
	Rostock	Univ.
	Stuttgart	MPI-FKF
	Wuppertal	Univ.
Hungary	Budapest	Wigner RCP
India	Mumbai	TIFR
Ireland	Dublin	DIAS
Italy	Catania	UniCT
	Salerno	UniSa
Poland	Krakow	JU
	Warsaw	IPCh PAS
		WUT
	Katowice	US
	Poznan	AMU
		IMP PAS
Romania	Bucharest	IFIN-HH

	Timişoara	UVT
Russia	Moscow	MGTU MIREA
		NNRU "MEPhI"
		MSU
		PFUR
		SINP MSU
		MI RAS
		NRC KI
	Moscow, Troitsk	HPPI RAS
		INR RAS
	Belgorod	NRU BelSU
	Dubna	BMSUT MIREA
	Gatchina	PNPI
	Kazan	KFU
	Protvino	IHEP
	Saratov	SSU
	St. Petersburg	ETU
		IPTI RAS
		SPbSU
	Voronezh	VSU
Moldova	Chişinău	IAP ASM
Mongolia	Ulaanbaatar	NUM
Serbia	Belgrade	INS "VINČA"
Slovak Republic	Bratislava	IP SAS
	Košice	IEP SAS
		TUKE
Slovenia	Ljubljana	UL
Spain	Madrid	ICMM
Switzerland	Villigen	PSI
	Zurich	ETH
Taiwan	Taipei	IP AS
Ukraine	Kharkov	KFTI NASU
	Kiev	IMP NASU
		NUK
	L'viv	ICMP NASU
USA	Louisville, KY	UofL
	New York, NY	CUNY
	Rochester, NY	UR
	Tallahassee, FL	FSU
Uzbekistan	Tashkent	Assoc."P.-S." PTI
Vietnam	Hanoi	IMS VAST

01–3–1073–2009/2013	Priority: 1

Status: Approved for completion in 2013

Modern Mathematical Physics: Gravity, Supersymmetry, Integrability

Leaders: A.S. Sorin
A.P. Isaev

Scientific leader: A.T. Filippov

Participating Countries and International Organizations:

Australia, Austria, Armenia, Belarus, Belgium, Brazil, Bulgaria, Canada, CERN, Czech Republic, France, Germany, Greece, Hungary, ICTP, India, Italy, Japan, Mexico, Norway, Poland, Romania, Russia, Serbia, Turkey, Ukraine, United Kingdom, USA.

Scientific Programme

Superstring Theory is the most serious and worldwide pursued candidate for a unified theory of all fundamental interactions including Quantum Gravity and thus it is the principal source of the problems which are the subject of modern mathematical physics. The development of the theory involves the study of its surprisingly wide spectrum of possible regimes, vacua and exact classical and quantum solutions. Furthermore, the theory has applications in many directions including the nonperturbative regime of supersymmetric gauge theories, the mechanics and thermodynamics of black holes and cosmological models of the universe expansion. These are unique laboratories to check general ideas from unified theories. In particular, in order to accommodate and develop the new ideas in these sectors inspired by String Theory, it is crucial to use the powerful mathematical methods provided by the theory of Integrable Systems, Quantum Groups and Non-Commutative Geometry. The goals of the present new theme precisely belong to the bridging between these fields and further development of suitable schemes to be applied in this context.

Expected main results in 2013:

- Construction of the R-operator which acts in the tensor product of two infinite-dimensional (differential) representations of the conformal algebra so(p+1,q+1) and solves the Yang-Baxter equation. The use of this R-operator for formulation of the Integrable spin chains.

  Constructive description of pseudotoric structures on toric Fano varieties. Description of all possible pseudotoric structures on the base of the programme Macauley2. Description of exotic Lagrangian tori of the Chekanov type on toric Fano varieties. Studing the serie of Grasmannian varieties Gr(2, n) to establish the existance of pseudotoric structures. Description of these pseudotoric structures using the programme Macauley2.

- Construction of off-shell superfield formulations of the Pohlmeyer-reduced AdS_3xS^3 and AdS_5xS^5 superstrings in the SU(2|2) 2D superspaces and development of the corresponding quantization procedure.

  Construction and study of new models of N=4 and N=8 mechanics with the semi-dynamical spin variables, involving couplings to the background non-abelian gauge fields.

  Setting up new Landau-type models with extended worldline supersymmetry and finding out their implications in the quantum Hall effect, as well as their links with super Yang-Mills and superstring theories.

- Investigation of the vector fields originated from the dimensional reduction under generalization of gravitation theory in the Einstein-Eddington line and elucidation of the role of these fields in cosmology. Search and study of new integrable approximations in spherically symmetrical cosmologies.

  Description of cosmological accelerated expansion in the framework of the modified gravity, specifically, in the models with terms higher in curvature.

Elaboration of a rigorous method of spectral summation for quantum fields defined on the manifolds with nontrivial internal geometry and geometry of boundaries with the goal to calculate observed quantities, for example, vacuum energy.

Classification and construction of the extremal multicenter black hole solutions of the D=4 N=2 supergravities.

List of activities:

Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1. **Quantum groups and integrable systems**	**A.P. Isaev**
BLTP	S.A. Belev, R.M. Mir-Kasimov, S.Z. Pakulyak, G.S. Pogosyan, N.A. Tyurin + 4 students
2. **Supersymmetry**	**E.A. Ivanov**
BLTP	D. Cirilo, S.A. Fedoruk, S.O. Krivonos, M. Pientek, A.V Shcherbakov, A.O. Sutulin, B.M. Zupnik + 2 students
3. **Quantum gravity, cosmology and strings**	**A.T. Filippov** **V.V. Nesterenko** **A.S. Sorin**
BLTP	B.M. Barbashov, E.A. Davydov, B. Dimitrov, D.V. Fursaev, A.B. Pestov, I.G. Pirozhenko, A.D. Popov, E.A. Tagirov, P.V. Tretyakov + 3 students
LIT	I.L. Bogoliubsky, A.M. Chervyakov
VBLHEP	E.E. Donets
UC	S.Z. Pakuliak

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	YSU
Austria	Vienna	TU Vienna
Australia	Sydney	Univ.
Belarus	Minsk	IP NASB
		NC PHEP BSU
Belgium	Leuven	K.U.Leuven
Brazil	Sao Paulo, SP	USP
Bulgaria	Sofia	INRNE BAS
		SU
Canada	Montreal	McGill
		UdeM
	Edmonton	U of A
CERN	Geneva	CERN
Czech Republic	Prague	CTU
		CU

	Řež	NPI ASCR
France	Annecy-le-Vieux	LAPP
France	Annecy-le-Vieux	LAPTh
	Dijon	UB
	Lyon	ENS Lyon
	Marseille	CPT
	Nantes	SUBATECH
	Paris	ENS
		LPTHE
	Palaiseau	Polytech
	Valenciennes	UVHC
Germany	Berlin	FU Berlin
		HUB
	Bielefeld	Univ.
	Bonn	UniBonn
	Dortmund	TU Dortmund
	Hannover	LUH
	Jena	Univ.
	Leipzig	UoC
	Munich	MPI-P
	Potsdam	AEI
Greece	Athens	UoA
Hungary	Budapest	Wigner RCP
India	Calcutta	BNC
ICTP	Trieste	ICTP
Italy	Bari	INFN
	Frascati	INFN LNF
	Naples	INFN
	Padua	UniPd
	Pavia	INFN
	Pisa	INFN
	Salerno	UniSa
	Trieste	SISSA/ISAS
	Turin	INFN
Japan	Fukuoka	Kyushu Univ.
	Kyoto	KSU
		RIMS
		YITP
	Tsukuba	KEK
Mexico	Leon	UG
Norway	Trondheim	NTNU
Poland	Warsaw	CAC PAS
		UW
	Krakow	JU
		NINP PAS

	Lodz	UL
	Wroclaw	UW
Romania	Bucharest	IFIN-HH
Russia	Moscow	ITEP
		LPI RAS
		MSU
		MI RAS
		NRU HSE
		VNIIMS
	Moscow, Troitsk	INR RAS
	Chernogolovka	LITP RAS
	Petrozavodsk	PetrSU
	Protvino	IHEP
	St. Petersburg	PDMI RAS
		SPbSU
	Tomsk	TPU
Serbia	Belgrade	IP
		Univ.
Turkey	Istanbul	BU
	Izmir	IYTE
United Kingdom	London	Imperial College
	Cambridge	Univ.
	Durham	Univ.
	Liverpool	Univ.
	Southampton	Univ.
	York	Univ.
Ukraine	Kiev	BITP NASU
	Kharkov	KFTI NASU
USA	New York, NY	CUNY
		RU
		SUNY
	Baltimore, MD	JHU
	Cincinnati, OH	UC
	Clemson, SC	Clemson
	College Park, MD	UM
	Coral Gables, FL	UM
	Minneapolis, MN	UofM
	Norman, OK	UO
	Philadelphia, PA	Penn
	Piscataway, NJ	Rutgers
	Rochester, NY	UR

01–3–1074–2009/2013	Priority: 1

Status: Approved for completion in 2013

Research and Education Project "Dubna International Advanced School of Theoretical Physics (DIAS-TH)"

Leaders: A.S. Sorin
V.V. Voronov

Participating Countries and International Organizations:

Austria, Brazil, Bulgaria, Canada, CERN, Czech Republic, France, Germany, Greece, Hungary, India, Italy, Japan, Mexico, Poland, Romania, Russia, Serbia, Turkey, Ukraine, United Kingdom, USA, Vietnam.

The Bogoliubov Laboratory of Theoretical Physics (BLTP) has a good record of organizing international workshops and schools in Dubna. DIAS-TH organizes and supervises all educational programs for students, postgraduates, and young scientists at BLTP. It should function continuously and the standard short schools (about 3-4 a year) should be organized coherently. Other educational programs in Dubna such as the JINR University Center may also correlate with DIAS-TH (common programs on modern theoretical physics, workshops for students and young scientists, etc.).

The main goals of DIAS:

- Training courses for students, graduates, and young scientists in the JINR Member States and other countries (according to special agreements and grants).
- Looking for and supporting gifted young theorists in the JINR Member States; creating databases of students and young researchers.
- Organization of schools of different levels in Dubna and coordination with similar schools in Russia, Germany, and other European countries.
- Support of the JINR experimental programs by organizing lecture courses and review lectures on new trends in modern physics.
- Cooperation with the JINR University Center in training students and postgraduates as well as in organizing schools for students.
- Coordination of the research - training programs with workshops and conferences at JINR.
- Coordination with the schools and workshops supported by the European community, UNESCO and other organizations.
- Participation in nets of workshops and schools in Europe.
- Publication of lectures and discussions in different forms, in particular, with the use of modern electronic equipment, etc.
- Supporting the WEB page of DIAS-TH which should become the organizing center of the programs related to DIAS-TH.

The main topics of the DIAS activity should be centered around the most important directions of research at BLTP: Particles and Fields; Nuclear Theory; Theory of Condensed Matter; Modern Mathematical Physics.

Expected main results in 2013:

- Organization of three international schools and a research workshop at BLTP: XI Winter School on Theoretical Physics; XVII Research Workshop on Nucleation Theory and Applications; International School "Cosmology, strings and new physics" (in cooperation with Helmholtz Association); International School "Physics of Heavy Quarks and Hadrons" (in cooperation with Helmholtz Association).
- Organization of regular seminars for students and post-graduates at BLTP.
- Computer processing of video records of lectures, support of digital archive of video records.
- Support of Web-site of DIAS-TH.

List of activities:

Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1. **DIAS-TH**	**A.S. Sorin** **V.V Voronov**
BLTP	D. Blaschke, A.T. Filippov, A.P. Isaev, E.A. Kolganova, V.V. Nesterenko, V.A. Osipov, I.G. Pirozhenko, O.V. Teryaev, P.V. Tretyakov, A.A. Vladimirov, V.I. Zhuravlev + 4 students
LIT	V.V. Korenkov
UC	S.Z. Pakuliak
FLNP	V.L. Aksenov
VBLHEP	I.A. Savin, Yu.A Panebratsev
DLNP	V.A. Bednyakov
FLNR	Yu.Ts. Oganessian

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Austria	Vienna	Univ.
		TU Vienna
Brazil	Sao Paulo, SP	USP
Bulgaria	Sofia	INRNE BAS
		SU
Canada	Montreal	UdeM
	Edmonton	U of A
CERN	Geneva	CERN
Czech Republic	Prague	CTU
		IP ASCR
	Řež	NPI ASCR
France	Annecy-le-Vieux	LAPP
	Dijon	UB
	Lyon	ENS Lyon
	Marseille	CPT

	Nantes	SUBATECH
	Paris	ENS
		LPTHE
		UPMC
	Valenciennes	UVHC
Germany	Berlin	HUB
	Bonn	UniBonn
	Frankfurt/Main	Univ.
	Hamburg	DESY
	Hannover	LUH
	Jena	Univ.
	Leipzig	UoC
	Munich	MPI-P
	Potsdam	AEI
	Rostock	Univ.
	Zeuthen	DESY
Greece	Athens	UoA
Hungary	Budapest	Wigner RCP
India	Calcutta	BNC
Italy	Frascati	INFN LNF
	Padua	UniPd
	Pavia	INFN
	Pisa	INFN
	Salerno	UniSa
	Trieste	SISSA/ISAS
	Turin	INFN
Japan	Kyoto	KSU
		RIMS
	Tsukuba	KEK
Mexico	Leon	UG
Poland	Warsaw	UW
	Otwock-Swierk	NCBJ
	Wroclaw	UW
Romania	Bucharest	IFIN-HH
Russia	Moscow	ITEP
		LPI RAS
		MSU
		SCC RAS
		SINP MSU
		MI RAS
		VNIIMS
	Moscow, Troitsk	INR RAS
	Chernogolovka	LITP RAS
	Gatchina	PNPI
	Petrozavodsk	PetrSU

	Protvino	IHEP
	St. Petersburg	PDMI RAS
	Tomsk	TSU
Serbia	Belgrade	IP
		Univ.
Turkey	Istanbul	BU
Ukraine	Kiev	BITP NASU
	Kharkov	KFTI NASU
United Kingdom	London	Imperial College
	Durham	Univ.
	Cambridge	Univ.
	Southampton	Univ.
	York	Univ.
USA	New York, NY	CUNY
		SUNY
	Baltimore, MD	JHU
	College Park, MD	UM
	Cincinnati, OH	UC
	Coral Gables, FL	UM
	Minneapolis, MN	UofM
	Newport News, VA	JLab
	Philadelphia, PA	Penn
	Piscataway, NJ	Rutgers
	Rochester, NY	UR
	Salt Lake City, UT	U of U
Vietnam	Hanoi	IP VAST

Elementary Particle Physics and Relativistic Nuclear Physics (02)

02–0–1079–2009/2014	Priority: 1

Status: In-progress

Study of e^+e^- Interactions: Physics and Detectors

Leader: A.G. Olshevskiy

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, CERN, China, Czech Republic, France, Germany, Georgia, Japan, Italy, Poland, Russia, Switzerland, Ukraine, United Kingdom, USA.

Scientific Programme

Study of e^+e^- interactions from very low up to very high energies has always been considered as an important precision tool, complementary to hadron machines. The project to build the International Linear Collider (ILC) is considered by the high-energy physics community as the next step in accelerator-based particle physics. Development of the physics program and detector design and prototyping are a necessary step to participation in this worldwide activity.

Expected main results in 2013:

- Development of the methods and tools for calculation of complex processes.
- Fnalysis of calorimeter detector parameters.
- Design of slow control electronics.
- Data processing of the BES-III experiment.

List of projects:

Project	Leader	Priority (period of realization)
1. SANC	D.Yu. Bardin	1 (2003 – 2015)
2. BES-III	A.S. Zhemchugov	1 (2007 – 2013)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
ILC Project	**A.G. Olshevskiy**	Realization
DLNP	E.M. Syresin, G.A. Chelkov, A.S. Zhemchugov, N.B. Skachkov, N.V. Anfimov, A.N. Skachkova, Z.V. Krumshteyn, V.V. Chalyshev	
BLTP A.V. Efremov	S.B. Gerasimov, A.B. Arbuzov, D.I Kazakov, E.A. Kuraev, G.A. Kozlov, O.V. Teryaev	
VBLHEP I.A. Tyapkin	I.A. Tyapkin, Z. Sadygov, T.Yu. Bokova	
SCAR V.N. Samoilov	V.N. Samoilov	

SANC Project	**D.Yu. Bardin**	Realization
DLNP	L.V. Kalinovskaya, A.A. Sapronov, P. Christova, R.R. Sadykov, E.D. Uglov	
Experiment BES-III	**A.S. Zhemchugov**	Realization
DLNP	I.R. Boyko, D.V. Dedovich, Yu.A. Nefedov	
BLTP	E.A. Kuraev, O.V. Teryaev	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	ANL
Belarus	Minsk	NC PHEP BSU
Bulgaria	Sofia	INRNE BAS
	Shumen	US
CERN	Geneva	
China	Beijing	IHEP CAS
Czech Republic	Prague	CU
		CTU
France	Paris	UPMC
		College de France
	Strasbourg	IPHC
Germany	Hamburg	DESY
	Munich	MPI-P
	Zeuthen	DESY
Japan	Tsukuba	KEK
Italy	Turin	UniTo
Poland	Krakow	JU
Russia	Moscow	ITEP
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Novosibirsk	BINP SB RAS
	Tomsk	TSU
Switzerland	Villigen	PSI
	Bern	Uni Bern
Ukraine	Kharkov	ISC NASU
United Kingdom	Oxford	Univ.
USA	Gainesville, FL	UF

02–2–1098–2010/2015	Priority: 1
	Status: Extended

Study of Processes with Symmetry Violation

Leader:

A.S. Kurilin

Participating Countries and International Organizations:

Belarus, Japan, Republic of Korea, Russia, Slovak Republic, Taiwan, Ukraine, USA.

Scientific Programme

Test of Standard Model predictions. Investigation of rare decays of K-mesons. Search for the $K_L^0 \to \pi^0\nu\bar{\nu}$ decay with direct CP violation in experiments at JPARC and U-70 (SRC–IHEP.)

Expected main results in 2013:

- Development of GEANT4–based simulation, DAQ and data analysis software.
- Design and test of new detectors.
- Data taking and analysis of new data for the rare decay of K_L^0.
- Design of the KOTO setup for the experiment at JPARC (Japan).
- Design of the K_L^0 beam line for the experiment at U–70 (SRC–IHEP).

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Search for the $K_L^0 \to \pi^0\nu\bar{\nu}$ decay (KOTO experiment at JPARC)**	**A.S. Kurilin**	R&D Data taking Data analysis
DLNP	V.A. Baranov, V.A. Bednyakov, M.P. Chavleyshvily, S.V. Podolsky, A.G. Dolbilov, E.S. Kuzmin, A.S. Moiseenko, R.S. Medvedev, Yu.Yu. Stepanenko, S.Yu. Porokhovoy, V.M. Romanov	
BLTP	D.I. Kazakov, A.V. Gladyshev	
VBLHEP	A.I. Malakhov	
FLNP	V.N. Shvetsov, P.V. Sedyshev	
2. **KLOD experiment**	**Yu.Yu. Stepanenko**	Simulation
DLNP	S.V. Podolsky, R.S. Medvedev, V.M. Romanov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Gomel	GSU
	Minsk	NC PHEP BSU
Japan	Ibaraki	Ibaraki Univ.
	Kyoto	Kyoto Univ.
	Osaka	Osaka Univ.
		RCNP
	Saga	Saga Univ.
	Tsukuba	KEK
	Yamagata	Yamagata Univ.
Republic of Korea	Pusan	PNU
	Chongju	CBNU
	Seoul	SNU
Russia	Moscow	GPI RAS
		ARRICT
		SINP MSU
	Moscow, Troitsk	INR RAS
	Protvino	IHEP
Slovak Republic	Košice	IEP SAS
Ukraine	Kharkov	KFTI NASU
USA	East Lansing, MI	MSU
	Chicago, IL	UChicago
	Tempe, AZ	ASU
Taiwan	Taipei	NTU

02–2–1080–2009/2013	Priority: 1

Status: Approved for completion in 2013

Lifetime Measurement of $\pi^+\pi^-$ and $\pi^\pm K^\mp$ Atoms to Test Low-Energy QCD Precise Predictions

Leader: L.G. Afanasyev
Scientific leader: L.L. Nemenov

Participating Countries and International Organizations:

CERN, Czech Republic, Italy, Japan, Romania, Russia, Spain, Switzerland.

Scientific Programme

The experiment aims to measure the lifetime of $\pi^+\pi^-$ atoms ($A_{2\pi}$), observe πK atoms ($A_{\pi K}$), and measure their lifetime using the 24 GeV proton beam. The precise measurement of these quantities will enable us to determine the combination of s-wave pion–pion $|a_0 - a_2|$ and pion–kaon $|a_{1/2} - a_{3/2}|$ scattering lengths (with isospin 0, 2 and 1/2, 3/2, respectively) in a model-independent way. The precision of $A_{2\pi}$ lifetime measurement will be better than 6% and the difference $|a_0 - a_2|$ will be determined within 3% or better. The accuracy of $A_{\pi K}$ lifetime measurement will be at the level of 20% and the difference $|a_{1/2} - a_{3/2}|$ will be determined at the level of 10%. Low-energy QCD predicts these values with an accuracy about 2% for the pion–pion scattering lengths and about 10% for the πK scattering lengths. The pion–pion and pion–kaon scattering lengths have never been verified with the experimental data with the same level of precision. For this reason the proposed measurements will be a crucial check of the low-energy QCD predictions and our understanding of the nature of the QCD vacuum.

Expected main results in 2013:

- Dismantle of the DIRAC setup at the accelerator PS CERN and preparation of the detector movement to the accelerator SPS CERN.
- Completion of the processing of the 2008–2010 data for measurement of $\pi^+\pi^-$ atom lifetime.
- Processing of the data collected in 2011-2012 for observation of the long-lived states of the $\pi^+\pi^-$ atom.
- Processing of the data collected in 2011-2012 for measurement of the multiple scattering in thing foils with accuracy better than 1%.
- Preparation of the project for investigation of pi+pi- and πK atoms of the SPS accelerator, CERN.

List of activities:

Activity or experiment **Laboratory or other Division of JINR** **Responsible person**	**Leaders** **Main researchers**	**Status**
Experiment DIRAC	**L.G. Afanasyev**	Data taking Data analysis
DLNP	M.V. Zhabitsky, A.V. Dudarev, V.V. Kruglov, V.V. Karpukhin, E. Kulish, A.V. Kulikov, L.L. Nemenov, M.V. Nikitin	
LIT	P.V. Zrelov, O.V. Voskresenskaya, L.Yu. Kruglova	

Collaboration

Country or International Organization	City	Institute or Laboratory
CERN	Geneva	
Czech Republic	Prague	CTU
		IP ASCR
	Řež	NPI ASCR
Italy	Frascati	INFN LNF
	Messina	UniMe
	Trieste	INFN
Japan	Kyoto	KSU
	Tokyo	TMU
	Tsukuba	KEK
Romania	Bucharest	IFA
Russia	Moscow	SINP MSU
	Protvino	IHEP
Spain	Santiago de Compostela	USC
Switzerland	Bern	Uni Bern
	Zurich	UZH

02–0–1081–2009/2013	Priority: 1

Status: Approved for completion in 2013

A T L A S:
Physics Research at the LHC

Leaders: N.A. Russakovich
V.A. Bednyakov

Deputy: A.P. Cheplakov

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Canada, CERN, Czech Republic, France, Germany, Georgia, Greece, Israel, Italy, Netherlands, Russia, Slovak Republic, Spain, USA, Uzbekistan.

Scientific Programme

Many-sided and comprehensive investigations of superhigh-energy (7–14 TeV) proton scattering at the Large Hadron Collider with the ATLAS facility (created at the previous stage of the project) will yield utterly new and unique experimental data. Their analysis will allow solution to the most profound physical problems fundamentally important for world outlook.

JINR researchers will take part in solution of some of these problems within the project. Among the most important of them are the clarification of the origin of the elementary particle mass (Higgs mechanism) and search for and investigation of supersymmetry, which will allow an insight into the nature of galactic dark matter and the character of the evolution of our Universe. Other important problems are determination of the applicability boundaries of the modern standard model of elementary particles and observation of evidence for new physical phenomena, such as additional space dimensions or previously unknown particles and interactions. In addition, JINR researchers will get new results allowing more specific knowledge as to the properties of the already known elementary particles such as the W and Z bosons, the top quark, and others.

Implementation of this project aimed at solving highly important scientific problems will result in getting unique applied data.

The "by-products" worth noting are development, debugging, and experience in operation of systems for remote monitoring of highly complicated devices and development and practical use of the distributed computation system (grid) in a long-term, full-scale experiment.

Expected main results in 2013:

- Operation of the ATLAS detector and the remote monitoring system at JINR.
- Data development and analysis of the ATLAS data. The new physical results to be obtained in investigations of some key processes of the Standard Model,exotic physics, search for SUSY.
- Development of the ATLAS physics programme: simulation of physical processes, participation in the ATLAS working group, etc.
- Development of the project for JINR participation in the ATLAS upgrade programme.

List of projects:

Project	Leader	Priority (period of realization)
1. ATLAS	N.A. Russakovich V.A. Bednyakov	1 (2010 – 2014)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
Experiment ATLAS	**N.A. Russakovich** **V.A. Bednyakov** **A.P. Cheplakov**	Technical proposal
DLNP V.A. Bednyakov, J.A. Budagov, D.I. Hubua, G.A. Chelkov	A.L. Gongadze, I.R. Boyko, M.A. Demichev, Z.V. Krumshteyn, Yu.A. Koultchitski, I.A. Minashvili, M.I. Gostkin, G.L. Glonty, D.V. Dedovich, Yu.A. Nefedov, D.V. Kharchenko, Yu.A. Usov, M.Yu. Kazarinov, V.A. Kolesnikov, S.N. Malyukov, V.Yu. Batusov, E.V. Khramov, V.V. Lyubushkin, R.R. Sadykov, M.V. Chizhov, V.V. Glagolev, P.V. Tereshka, Z.U. Usubov, Yu.P. Ivanov, S.N. Karpov, Z.M. Karpova, M.V. Lyablin, A.B. Lazarev, G.I. Lykasov, A.F. Pikelner, A.A. Sapronov, A.N. Shalyugin, M.M. Shiyakova, V.B. Vinogradov, A.C. Zhemchugov, S.N. Baranov, Yu.L. Vertogradova, A.V. Ershova, N. Huseinov, L.K. Gladilin, I.V. Eletskikh, T.V. Lyubushkina, E.M. Plotnikova, E.D. Uglov	
VBLHEP A.P. Cheplakov, V.D. Peshekhonov	N. Dzhavadov, E.A. Ladygin, F.N. Ahmadov, V.V. Kukhtin, S.S. Parzhitsky, V.N. Pozdnyakov, B.G. Shaykhatdenov, A.G. Karev, N.G. Fadeev, L.A. Merkulov, V.V. Myalkovsky, E.V. Serochkin, A.A Soloshenko, N.I. Zimin	
LIT V.V. Ivanov, P.V. Zrelov, V.V. Korenkov,	I.N. Aleksandrov, N.I. Gromova, A.V. Yakovlev, V.M. Kotov, V.N. Shigaev, M.A Mineev, D.A. Oleynik, A.S. Petrosyan	
BLTP D.I. Kazakov	A.V. Gladyshev, A.V. Bednyakov, N.I. Kochelev, O.B. Teryaev	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	ANL
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	IP NASB
		NC PHEP BSU
		JIPNR-Sosny NASB
	Gomel	GSTU
Canada	Vancouver	TRIUMF
	Montreal	UdeM
CERN	Geneva	
Czech Republic	Prague	CU
France	Clermont-Ferrand	LPC-CF
	Orsay	LAL
Germany	Munich	MPI-P

Georgia	Tbilisi	HEPI-TSU
Greece	Athens	UoA
Israel	Rehovot	WIS
Italy	Pisa	INFN
Netherlands	Amsterdam	NIKHEF
Russia	Moscow	LPI RAS
		ITEP
		MSU
	Protvino	IHEP
Slovak Republic	Bratislava	CU
		IP SAS
Spain	Barcelona	IFAE
USA	Argonne, IL	ANL
Uzbekistan	Samarkand	SSU

02–0–1082–2009/2014	Priority: 1

Status: In-progress

JINR's Participation in Experiments at the Fermilab (Projects D0, CDF)

Leaders: G.D. Alexeev
V.V. Glagolev

Scientific leader: J.A. Budagov

Participating Countries and International Organizations:

Belarus, Bulgaria, Chile, Georgia, Greece, Italy, Romania, Russia, Slovak Republic, USA, Ukraine, Uzbekistan.

Scientific Programme

- Running and development of the forward muon system with electronics, data collection, and physics analysis (D0).
- Data processing; physics analysis, R and D with calorimeter elements on heavy crystals and extruded scintillator plates (CDF).

Expected main results in 2013:

- Development of the D0 software; data taking and analysis; measurement of the Ξ_b mass, preliminary results on proton structure functions.
- Data taking and analysis; new data for the top mass and for Very High Multiplicity studies.

List of projects:

	Project	Leader	Priority (period of realization)
1.	D0	G.D. Alexeev	1 (1997 – 2014)
2.	CDF	J.A. Budagov V.V. Glagolev	1 (1997 – 2014)

List of activities:

	Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1.	**Experiment DØ**	**G.D. Alexeev**	Data analysis
	DLNP	V.N. Abazov, D.V. Bandurin, G.A. Golovanov, I.N. Churin, L.S. Vertogradov, Yu.L. Vertogradova, A.Yu. Verkheev, N.I. Zhuravlev, D.E. Korablev, V.L. Malyshev, M.A. Patsyuk, Yu.P. Merekov, N.B. Skachkov, V.V. Tokmenin, Yu.N. Kharhzheev, A.M. Rojdestvenski, Yu.A. Yatsunenko	
	Experiment CDF	**J.A. Budagov** **V.V. Glagolev**	Data analysis
	DLNP	A.M. Artikov, V.Yu. Batusov, V.I. Kolomoets,	

	S.M. Kolomoets, M.V. Lyablin, Yu.A. Koultchitski, I.A. Suslov, F. Prokoshyn, A.V. Simonenko, D.I. Hubua, A.V. Sazonova, A.A. Semenov, I.E. Chirikov-Zorin, V.B. Flyagin, D.Sh. Chokhely, V.Yu. Baranov, Yu.I. Davydov, M.V. Lyablin, V.A. Bednyakov, V.V. Tereschenko, S.V. Tereschenko, N.S. Azaryan, Z.U. Usubov, S.N. Studenov, A.N. Shalugin, B.M. Sabirov
BLTP	G.A. Kozlov, D.I. Kazakov, M. Davydkov
LIT	V.V. Ivanov, P.V. Zrelov, V.V. Uzhinsky, A.M. Raportirenko
SCAR	V.N. Samoilov

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Belarus	Minsk	NC PHEP BSU
Bulgaria	Sofia	SU
Chile	Valparaiso	Univ.
Georgia	Tbilisi	HEPI-TSU
Greece	Athens	UoA
Italy	Pisa	UniPi
		INFN
	Udine	UNIUD
	Frascati	INFN LNF
Romania	Bucharest	IFIN-HH
Russia	Moscow, Troitsk	INR RAS
Slovak Republic	Bratislava	IP SAS
		CU
USA	Argonne, IL	ANL
	Batavia, IL	Fermilab
	Boston, MA	NU
	Charlottesville, VA	UVa
	New York, NY	SUNY
Ukraine	Kharkov	ISC NASU
Uzbekistan	Samarkand	SSU

02–2–1099–2010/2015	Priority: 1
	Status: Extended

Study of Neutrino Oscillations

Leader: Yu.A. Gornushkin
Deputy: O.Yu. Smirnov

Participating Countries and International Organizations:

Belgium, CERN, China, Croatia, Czech Republic, France, Germany, Hungary, Japan, Italy, Russia, Spain, Switzerland, Ukraine, USA.

Scientific Programme

- Search for long-baseline neutrino oscillation and study of neutrino oscillation parameters with the OPERA detector in the CNGS beam (CERN–Gran Sasso) OPERA project.
- Direct solar neutrino flux measurements with the BOREXINO detector – phase-II experiment.
- Measurement of the θ_{13} neutrino mixing angle in the Daya Bay experiment.

Expected main results in 2013:

- Scanning and analysis of the OPERA nuclear emulsion at JINR.
- Software development for the Target Tracker data analysis. Development of the Brick Finding software, analysis of the electronic detector data and event vertex location.
- Continuation of the data taking with the BOREXINO detector.
- Improvement of the position reconstruction algorithm for the BOREXINO detector.
- The study seasonal variations of the solar neutrino flux.
- Precise measurement of the pp-neutrino flux with total errors down to 15%.
- Improvement of the current results on the effective solar neutrino magnetic moment.
- Improvement of the current result on the $e \to \nu\gamma$ reactions.
- Development of Monte Carlo software for background simulation in the Daya Bay experiment.
- Participation in data analysis for θ_{13} mixing angle measurement in the Daya Bay experiment.

List of projects:

	Project	Leader	Priority (period of realization)
1.	OPERA	Yu.A. Gornushkin	1 (2010 – 2015)
2.	BOREXINO	O.Yu. Smirnov	1 (1996 – 2015)
3.	Daya Bay	D.V. Naumov	1 (2009 – 2014)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Experiment OPERA**	**Yu.A. Gornushkin**	Data taking
DLNP	S.G. Dmitrievsky, Z.V. Krumshtein, A.G. Olshevskiy, S.G. Zemskova, A.V. Chukanov, A.B. Sadovsky, D.V. Naumov, A.S. Sheshukov, A.A. Nozdrin	
VBLHEP	Yu.P. Petukhov	
LIT	G.A. Ososkov	
2. **Experiment BOREXINO**	**O.Yu. Smirnov**	Data taking
DLNP	K.A. Fomenko, D.V. Korablev, A.P. Sotnikov	
3. **Daya Bay Project**	**D.V. Naumov**	Data taking
DLNP	M. Gonchar, Yu.A. Gornushkin, I.P. Nemchonok, E.A. Naumova, A.G. Olshevskiy, O.Yu. Smirnov, O.B. Samoylov, D.V. Korablev	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belgium	Brussels	ULB
		VUB
	Geel	IRMM
	Leuven	K.U.Leuven
CERN	Geneva	
China	Beijing	IHEP CAS
		CIAE
Croatia	Zagreb	RBI
Czech Republic	Prague	CU
France	Annecy-le-Vieux	LAPP
	Lyon	IPNL
	Orsay	LAL
Germany	Heidelberg	MPIK
	Munich	MPI-P
Hungary	Budapest	Wigner RCP
Japan	Nagoya	Nagoya Univ.
Italy	Bari	UniBa
		INFN
	Genoa	INFN
	Naples	INFN
	Legnaro	INFN LNL
	Milan	UNIMI

		INFN
	Padua	UniPd
	Perugia	INFN
	Pavia	INFN
	Rome	INFN
	Trieste	INFN
Russia	Moscow	NRC KI
		ITEP
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
Spain	Valencia	UV
Switzerland	Bern	Uni Bern
USA	Cambridge, MA	MIT
	Berkeley, CA	Berkeley Lab
	Los Angeles, CA	UCLA
	Madison, WI	UW-Madison
	Princeton, NJ	PU
	Upton, NY	BNL
Ukraine	Kharkov	ISC NASU

02–0–1108–2011/2013	Priority: 1

Status: Approved for completion in 2013

Experiment PANDA at FAIR

Leader: A.G. Olshevskiy
Deputies: G.D. Alexeev
A.S. Vodopyanov

Participating Countries and International Organizations:

Belarus, Czech Republic, Germany, Italy, Russia, Ukraine.

Scientific Programme

The study of the exotic nuclear-matter states and nucleon structure in the PANDA experiment at FAIR.

Expected main results in 2013:

- Development of MC generators and optimization of the event analysis.
- Preparation of the documentation for magnet production.
- Development of the movable platform of the magnet.
- Preparation of the muon system TDR.

List of projects:

Project	Leader	Priority (period of realization)
1. PANDA	A.G. Olshevskiy	1 (2011 – 2014)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **PANDA Project**	**A.G. Olshevskiy**	Technical proposal
DLNP G.D. Alexeev	V.M. Abazov, N.B. Skachkov, N. Angelov, D.B. Pontekorvo, A.G. Samartsev, A.N. Skachkova, V.K. Rodionov, V.V. Tokmenin	
VBLHEP A.S. Vodopyanov	E.A. Strokovsky, M.G. Sapozhnikov, V.K. Dodokhov, E.K. Koshurnikov, G.S. Shabratova, M.Yu. Barabanov, V.A. Arefev, V.I. Astakhov, A.A. Efremov, V.I. Lobanov, Yu.Yu. Lobanov, P.V. Nomokonov, I.A. Alex, Yu.N. Rogov, R.A. Salmin, A.A. Feshchenko, M.K. Suleymanov, A.S. Galoyan	
LIT	Gh. Adam, V.V. Uzhinsky	
BLTP	A.S. Sorin, O.V. Teryaev, A.V. Efremov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
Czech Republic	Prague	CU
Germany	Darmstadt	GSI
Italy	Turin	UniTo
Russia	Protvino	IHEP
	Dubna	BSINP MSU
Ukraine	Kharkov	ISM NASU

02–2–1109–2012/2014	Priority: 1

Status: In-progress

Astrophysical Studies in the Space Experiments

Leader: L.G. Tkatchev

Participating Countries and International Organizations:

Belarus, Czech Republic, Japan, Mexico, Republic of Korea, Russia.

Scientific Programme

- The TUS space experiment has been proposed to measure the energy spectrum, composition and angular distribution of the Ultra High Energy Cosmic Rays (UHECR) at $E \approx 10^{19} - 10^{20}$ eV, to study the region beyond the GZK cutoff. Existence of these particles is beyond the Standard Model of particle physics and is of great interest. The study from the orbit is much more effective in comparison with the ground-based detectors. The existing world statistics is assumed to be increased by a factor of 2–3 during 3 years of the global data taking. The TUS detector will make it possible to study UHECP neutrino Extensive Air Showers (EAS) from the space orbit.

- The aim of the NUCLEON Project is direct CR measurements in the energy range 10^{11}-10^{15} eV and the atomic charge range up to Z≈40 in the near–Earth space to solve mainly the "knee" problem in the CR spectrum. The CR phenomena in this energy region are investigated in terrestrial experiments by measurement of EAS parameters or in balloon or space experiments. Below $\sim 10^{14}$ eV the spectrum and composition are known from direct observation with detectors placed in balloons and earth satellites. However, at higher energies the CR flux is smaller and more difficult for direct and needs observation. Precise measurement of the CR composition and anisotropy will help to test the existing theoretical concepts and will become a basis for further studies.

Expected main results in 2013:

- Participation in the complex tests of the in flight TUS apparatus on the Michail Lomonosov satellite.
- Participation in the data taking of the TUS experiment.
- Participation in production of the TUS on-line programs and off-line analysis.
- Participation in the complex tests of the NUCLEON trigger system at heavy ion and hadron beams at SPS CERN.
- Development of the MC simulation program for the neutron response for the HERO space detector. Development of on-line data handling programs. Participation in production of the HERO detector prototype and beam tests at CERN's SPS.

List of projects:

	Project	Leader	Priority (period of realization)
1.	TUS	L.G. Tkatchev	1 (2012 – 2014)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
Experiment TUS	**L.G. Tkatchev**	Realization
DLNP	V.M. Grebenyuk, S.V. Bektemerova, S.Yu. Porokhovoy, D.V. Naumov, A.V. Tkachenko, F.F. Grinyuk, M. Slunečhka, V. Slunečhkova, O. Bakina, A. Nikiforov	
VBLHEP	A.V. Skrypnik	
LIT	S.K. Slepnev	
Experiment NUCLEON	**L.G. Tkatchev**	Realization
DLNP	V.M. Grebenyuk, S.Yu. Porokhovoy, N.I. Kalinin, V.F. Boreyko, Nguen Man Shat, B.M. Sabirov, A.B. Sadovsky, Z.B. Krumshtein, A.V. Tkachenko, A.A. Timoshenko, N.S. Tolstoy	
VBLHEP	N.V. Gorbunov	
LIT	V.N. Shigaev	
Preparation of project "Showers of knowledges"	**G.A. Shelkov**	Project preparation
DLNP	A.V. Guskov, V.O. Gromov, A.S. Zhemchugov, N.N. Khovansky, V.G. Kruchonok	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
		IP NASB
Czech Republic	Prague	IP ASCR
		CU
Japan	Wako	RIKEN
Mexico	Puebla	BUAP
Republic of Korea	Seoul	EWU
Romania	Bucharest	ISS
Russia	Moscow	SINP MSU
		VNIIEM Corporation
	Dubna	Raduga
	Korolev	"Space Regatta" Consortium
Ukraine	Kharkov	ISM NASU

02–1–1106–2011/2013	Priority: 1

Status: Approved for completion in 2013

Investigations of Compressed Baryonic Matter at the GSI Accelerator Complex (Project CBM)

Leaders: A.I. Malakhov

Deputies: V.V. Ivanov
Yu.V. Zanevsky
V.P. Ladygin

Participating Countries and International Organizations:

Bulgaria, Germany, Mongolia, Poland, Romania, Russia, Slovak Republic, Uzbekistan, Ukraine.

Scientific Programme

Design and development of the superconducting dipole magnet, transition radiation and straw detectors for the CBM experiment at the GSI accelerator complex. Study of the multiparticle dynamics in heavy ion collisions at SIS100 and SIS300. Development of algorithms and software for the trigger, simulation and data analysis.

Expected main results in 2013:

- Design of the superconducting dipole magnet for the CBM experiment.
- Design and testing of the prototype transition radiation and straw detectors.
- Development of the algorithms and software for the trigger and data analysis.
- Simulation of the multiparticle dynamics in heavy ion collisions.

List of projects:

Project	Leader	Priority (period of realization)
1. CBM	A.I. Malakhov	1 (2011 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **CBM Project** **Design and manufacture of the superconducting dipole magnet, the transition radiation and straw detectors. Development of the algorithms and software for trigger, simulation and data analysis.**	**A.I. Malakhov**	Realization
VBLHEP	E.–M. Ilgenfritz, Yu.S. Anisimov, A.V. Alfeev, V.A. Alfeev, S.N. Kuznetsov, Yu.V. Zanevsky, V.F. Chepurnov, S.P. Chernenko, O.V. Fateev, V.N. Zryuev, G.A. Cheremukhina, V.P. Ladygin, T.A. Vasiliev, A.K. Kurilkin, P.K. Kurilkin,	

	A.P. Ierusalimov, A.P. Zinchenko, D.V. Peshekhonov, E.B. Plekhanov, V.N. Pozdnyakov, P.A. Rukoyatkin, S.V. Razin, V.D. Peshekhonov, G.D. Kekelidze, V.V. Myalkovsky, K.I. Davkov, S.S. Parzhitsky, N.S. Grigalashvili, I.V. Boguslavsky, V.M. Golovatyuk, E. Nazieva, V.M. Lysan, O.V. Rogachevsky, I. Mandjavidze, A.V. Shabunov, Yu.V. Gusakov, A.V. Bychkov
LIT	V.V. Ivanov, P.V. Zrelov, P.G. Akishin, E.P. Akishina, T.P. Akishina, V.P. Akishina, S.A. Baginyan, D.S. Golub, O.Yu. Derenovskaya, V.V. Ivanov (jr), P.I. Kisel, A.A. Lebedev, S.A. Lebedev, G.N. Ososkov, A.M. Raportirenko, T.P. Sapozhnikova, V. Sheinast
DLNP	V.A. Karnaukhov, V.V. Kirakosyan, Yu.L. Vertogradova, S.P. Avdeev, W. Karch
BLTP	D. Blaschke, V.V. Burov, S.G Bondarenko, V.D. Toneev

Collaboration

Country or International Organization	City	Institute or Laboratory
Bulgaria	Sofia	INRNE BAS
Germany	Darmstadt	GSI
	Dresden	HZDR
	Frankfurt/Main	Univ.
	Heidelberg	Univ.
Mongolia	Ulaanbaatar	IPT MAS
Poland	Warsaw	WUT
Romania	Bucharest	IFIN-HH
		INCDIE ICPE-CA
Russia	Moscow	ITEP
		SINP MSU
	Moscow, Troitsk	INR RAS
	Protvino	IHEP
Slovak Republic	Bratislava	IP SAS
		CU
Ukraine	Kiev	BITP NASU
Uzbekistan	Jizzakh	JSPI
	Samarkand	SSU

02–1–1096–2010/2014	Priority: 1

Status: In-progress

Study of Rare Charged Kaon Decays in Experiments at the CERN SPS

Leaders: V.D. Kekelidze
Yu.K. Potrebenikov

Participating Countries and International Organizations:

Belarus, Belgium, Bulgaria, CERN, Czech Republic, Germany, Mexico, Romania, Russia, Slovak Republic, United Kingdom, USA.

Scientific Programme

Realization of the NA62 Project allows to clarify CP–violation problem, to measure precisely very rare charged kaon decay to charged pions and two neutrinos, to carried out a search for supersymmetric particles and their partners with a goal to observe a physics beyond the Standard Model. In addition, precise characteristics of rare kaon and hyperon decays will be measured. A high resolution magnetic spectrometer based on the straw drift chambers working in vacuum will be designed and constructed on the stage of preparation of the experiment. Software for simulation, data processing and analysis will be developed.

Expected main results in 2013:

- Mass production of straw tubes will be continued.
- Three modules of the the straw detector will be produced and delivered to CERN.
- Software for the simulation of magnetic spectrometer and full set–up will be developed; system for detector calibration and event reconstruction will be upgraded; common software of the experiment will be developed.
- The fabrication and tests of straw detector modules in VBLHEP and CERN and on the particle beams will be continued.

List of projects:

Project	Leader	Priority (period of realization)
1. NA62	V.D. Kekelidze Yu.K. Potrebenikov	1 (2010 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Experiment NA62**	**V.D. Kekelidze** **Yu.K. Potrebenikov**	Construction of detector Simulation
VBLHEP	D.T. Madigozhin, S. Gevorgyan, A.I. Zinchenko, N.A. Molokanova, L.N. Glonti, I.A. Polenkevich, S.N. Shkarovsky, V.V. Tryanin, M.H. Misheva, E.A. Gudzovsky, V.P. Falaleev, Yu.P. Petukhov, A.A. Belkova, A.N. Shcherbakov, V.N. Gorbunova,	

	L.A. Slepets, S.A Movchan, V.I. Gursky, E.M. Kislov, S.V Khabarov, V.S. Khabarov, S.V. Sergeev, M.V. Zaytseva, S.V. Kilchakovskaya, V.V. Elsha, T.L. Enik, A.V. Vishnevsky, N.N. Shcherbakov, Yu.V. Gusakov, V.A. Bogdanov, V.M. Lysan, V.A. Samsonov, L.N. Tarasova, V.V.Tarasov, Yu.S. Kovalev, A.O. Kolesnikov, A.N. Sotnikov, N.I. Azorsky
DLNP	N.A. Kuchinsky, V.G. Kalinnikov, N.P. Kravchuk

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
Belgium	Louvain-la-Neuve	UCL
Bulgaria	Sofia	SU
		INRNE BAS
	Blagoevgrad	SWU
	Plovdiv	PU
CERN	Geneva	
Czech Republic	Prague	CU
Germany	Mainz	JGU
Italy	Florence	INFN
	Ferrara	INFN
	Frascati	INFN LNF
	Perugia	INFN
	Pisa	INFN
	Rome	INFN
		Univ. "Tor Vergata"
	Turin	INFN
Mexico	San Luis Potosi	UASLP
Romania	Bucharest	IFIN-HH
Russia	Moscow, Troitsk	INR RAS
	Protvino	IHEP
Slovak Republic	Bratislava	CU
United Kingdom	Birmingham	Univ.
	Bristol	Univ.
	Glasgow	US
	Liverpool	Univ.
USA	Chicago, IL	UChicago
	Fairfax, VA	GMU
	Evanston, IL	NU
	Menlo Park, CA	SLAC
	Merced, CA	UC Merced

02–0–1083–2009/2013	Priority: 1

Status: Approved for completion in 2013

CMS. Compact Muon Solenoid at the LHC

Leader: A.V. Zarubin
Scientific leader: I.A. Golutvin

Participating Countries and International Organizations:

Armenia, Austria, Belarus, Belgium, Brazil, Bulgaria, CERN, China, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, India, Iran, Italy, Mexico, New Zealand, Pakistan, Poland, Republic of Korea, Russia, Serbia, Slovak Republic, Bratislava, Spain, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, USA, Uzbekistan.

Scientific Programme

The CMS Collaboration has constructed a general–purpose detector to be operational at the start–up of the Large Hadron Collider (LHC/CERN) to exploit its full discovery potential. Study of fundamental properties of the matter in Super High Energy proton–proton and nucleus–nucleaus interactions.

The major activities of JINR are focused on the following directions:
– forward calorimetry, including endcap hadron, and preshower detector;
– forward muon stations with cathode strip chambers;
– development of Physics program to test SM and BSM.

Expected main results in 2013:

- Start up, maintenance, and operation of forward hadron calorimetry and ME1/1 muon station in experimental cavern at low luminosity and 7 TeV energy.
- Upgrade and technical support of the CMS detectors.
- CMS start up in LHC run, data taking and data quality monitoring.
- Processing and analysis of experimental data, development and improvement of muon and jet reconstruction algorithms.
- Development of software for GRID–based distributed system for data processing and analysis. Data transmission from CERN to JINR.

List of projects:

Project	Leader	Priority (period of realization)
1. CMS	A.V. Zarubin I.A. Golutvin	1 (2010 – 2014)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Forward calorimetry**	**A.V. Zarubin**	Commissioning Maintenance Data taking

VBLHEP	S.V. Afanasiev, M.G. Gavrilenko, I.A. Golutvin, N.S. Golova, I.N. Gorbunov, P.D. Bunin, A.G. Volodko, Yu.V. Ershov, N.I. Zamyatin, V.D. Kalagin, A.Yu. Kamenev, L.G. Kobylets, V.F. Konoplyanikov, A.M. Kurenkov, P.V. Moisenz, V.A. Smirnov, A.I. Malakhov, A. Mestvirishvili	
DLNP	M. Finger, M. Finger (Jn.), M. Slunečhka, V. Slunečhkova, A. Yanata, Z. Tsamalaidze	
2. **Forward muon station ME1/1**	**V.Yu. Karjavin**	Commissioning Maintenance Data taking
VBLHEP	S.E. Vasiliev, A.O. Golunov, I.A. Golutvin, N.V. Gorbunov, Yu.V. Ershov, A.V. Zarubin, A.Yu. Kamenev, A.M. Kurenkov, A.M. Makan'kin, V.V. Perelygin, D.A. Smolin	
LIT	V.V. Palchik	
3. **Upgrade of the CMS detectors**	**I.A. Golutvin**	Realization
VBLHEP	S.V. Afanasiev, N.V. Gorbunov, V.Yu. Karzhavin, A.M. Kurenkov, Yu.V. Ershov, S.E. Vasiliev, A.V. Zarubin, A.M Makan'kin, A.I. Malakhov, P.V. Moisenz, V.V. Perelygin, V.A. Smirnov	
LIT	V.V. Palchik	
4. **Reserch physics programme with the CMS Detector**	**S.V. Shmatov** **I.A. Golutvin**	Realization
VBLHEP	S.V. Afanasiev, M.G. Gavrilenko, I.N. Gorbunov, I.M. Gramenitsky, I.I. Belotelov, P.D. Bunin, A.V. Zarubin, A.Yu. Kamenev, V.F. Konoplyanikov, L.G. Kobylets, A.V. Lanev, P.V. Moisenz, M.V. Savina, A.I. Malakhov	
LIT	V.V. Korenkov, D.A. Oleynik, G.A. Ososkov, V.V. Palchik, A.Sh. Petrosyan	
BLTP	G.A. Kozlov, A.B. Arbuzov, A.V. Kotikov, E.A. Kuraev, A.V. Sidorov, A.V. Efremov, S.G. Bondarenko, R.S. Pasechnik, O.V. Teryaev	
DLNP	G.A. Golovanov, P.X. Khristova, M. Finger, M. Finger (Jr.), N.B. Skachkov, A.N. Skachkova, A.Yu. Verkheev	
5. **Development of software for distributed computation, data processing and analysis based on GRID–technology**	**V.V. Korenkov**	Realization
LIT	V.V. Mitsyn, V.V. Palchik, R.N. Semenov, E.A. Tikhonenko, I.A. Filozova	
VBLHEP	I.I. Belotelov, N.V. Gorbunov, A.O. Golunov, P.V. Moisenz, S.V. Shmatov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	ANL
Austria	Vienna	HEPHY
Belarus	Minsk	NC PHEP BSU
		JIPNR-Sosny
		NASB
		INP BSU
	Gomel	BelSUT
		GSU
Belgium	Louvain-la-Neuve	UCL
	Antwerp	UA
	Brussels	ULB
		VUB
	Mons	UMONS
Brazil	Rio de Janeiro, RJ	CBPF
		UERJ
		UFRJ
	Sao Paulo, SP	Unesp
Bulgaria	Sofia	SU
		INRNE BAS
CERN	Geneva	
China	Hefei	USTC
	Beijing	IHEP CAS
		PKU
Croatia	Split	Univ.
Cyprus	Nicosia	UCY
Czech Republic	Prague	CU
Estonia	Tallinn	NICPB
Finland	Helsinki	UH
		HIP
	Jyväskylä	UJ
	Oulu	UO
	Tampere	TUT
France	Annecy-le-Vieux	LAPP
	Lyon	IPNL
	Saclay	IRFU
	Strasbourg	IPHC
Georgia	Tbilisi	HEPI-TSU
		AIP
Germany	Berlin	HUB
	Aachen	RWTH
	Karlsruhe	KIT
Greece	Athens	INP NCSR "Demokritos"

		UoA
	Ioannina	UI
Hungary	Budapest	Wigner RCP
	Debrecen	Atomki
		UD
India	Mumbai	BARC
		TIFR
	Bhubaneshwar	IOP
	Chandigarh	PU
Iran	Tehran	IPM
Italy	Bari	INFN
	Bologna	INFN
	Catania	INFN LNS
	Florence	INFN
	Genoa	INFN
	Padua	INFN
	Pavia	INFN
	Perugia	INFN
	Pisa	INFN
	Rome	INFN
	Turin	INFN
Mexico	Mexico	Cinvestav
New Zealand	Auckland	Univ.
	Christchurch	UC
Pakistan	Islamabad	QAU
Poland	Warsaw	UW
	Otwock-Swierk	NCBJ
Republic of Korea	Kwangju	CNU
	Naju	DU
	Namwon	SU
	Seoul	KU
		Konkuk Univ.
		SNUE
	Chongju	CBNU
Russia	Moscow	ITEP
		LPI RAS
		SINP MSU
		NIKIET
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Protvino	IHEP
	Snezhinsk	VNIITF
	St. Petersburg	Electron
	Zhukovsky	MDB
Serbia	Belgrade	INS "VINČA"

Slovak Republic	Bratislava	STU
Spain	Madrid	CIEMAT
		UAM
	Oviedo	Uniovi
	Santander	IFCA
Switzerland	Zurich	ETH
		UZH
	Villigen	PSI
	Basel	Uni Basel
Taiwan	Taipei	NTU
	Chung–Li	NCU
Turkey	Adana	CU
	Ankara	METU
Ukraine	Kharkov	KFTI NASU
		ISC NASU
		KhNU
United Kingdom	London	Imperial College
	Didcot	RAL
	Bristol	Univ.
USA	Ames, IA	ISU
	Baltimore, MD	JHU
	Batavia, IL	Fermilab
	Blacksburg, VA	Virginia Tech.
	Boston, MA	BU
		NU
	Cambridge, MA	MIT
	Chicago, IL	UIC
	College Park, MD	UM
	Columbus, OH	OSU
	Davis, CA	UCDavis
	Gainesville, FL	UF
	Evanston, IL	NU
	Houston, TX	Rice Univ.
	Iowa City, IA	UIowa
	Lincoln, NE	UNL
	Livermore, CA	LLNL
	Los Alamos, NM	LANL
	Los Angeles, CA	UCLA
	Lubbock, TX	TTU
	Madison, WI	UW-Madison
	Minneapolis, MN	UofM
	Notre Dame, IN	ND
	Oxford, MS	UM
	Pasadena, CA	Caltech
	Pittsburgh, PA	Pitt

	Piscataway, NJ	Rutgers
	Princeton, NJ	PU
	Riverside, CA	UCR
	Rochester, NY	UR
	Tallahassee, FL	FSU
	Tuscaloosa, AA	UA
Uzbekistan	Tashkent	INP UAS

02–0–1085–2009/2013	Priority: 1

Status: Approved for completion in 2013

Study of the Nucleon and Baryon Structure at COMPASS–II, CERN and H1, DESY

Leader: A.P. Nagaytsev
Scientific leader: I.A. Savin

Participating Countries and International Organizations:

Armenia, Belarus, Belgium, Bulgaria, Canada, CERN, Czech Republic, France, Germany, Israel, Italy, Japan, Netherlands, Poland, Russia, Switzerland, United Kingdom, USA.

- Determination of the quark spin, gluon and quark orbital momenta contributions to the nucleon spin.
- Study of spin–dependent structure functions of the proton and neutron, including transversity, and its kinematical variables dependences.
- Sum rule tests for spin–dependent structure functions of the proton and neutron, QCD tests.
- Pion and kaon polarizabilities measurements.
- Search of new bound states of qluons and quarks.
- Construction of a hadron calorimeter, a muon system and straw tracking chambers for the COMPASS–II spectrometer.
- COMPASS–II software development and support of the CERN program library at JINR.
- Study of inclusive, exclusive and semi–inclusive processes in deep inelastic scattering of muons and electrons on polarized and unpolarized targets.
- Preparation for measurements of Generalized Parton Distributions and transverse hadron structure in Drell–Yan processes.

Expected main results in 2013:

- Participation in data taking in COMPASS–II spectrometer at CERN.
- Support of HCAL1 during 2013 run.
- Support of MW1 during 2013 run.
- Performance studies of the tracking detectors MWPC, STRAW, W4/5 for COMPASS–II.
- Project preparation on measurements of Generalized Parton Distributions and transverse hadron structure in Drell–Yan processes.
- Software development and simulation of the various reactions, studying in COMPASS–II. Analyzing of the COMPASS–II. data at JINR and publications preparation.
- Theoretical studies of spin effects in COMPASS–II.
- Measurement of dijet cross section and energy flow in deep–elastic scattering with a leading proton in the final state. Measurement of elastic ρ–meson cross section in deep–elastic scattering with a leading proton in the final state.

List of projects:

Project	Leader	Priority (period of realization)
1. COMPASS–II	A.P. Nagaytsev	1 (2011 – 2013)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
I. **Experiment COMPASS**	**A.P. Nagaytsev**	Data taking Data analysis
1. **Hadron calorimeter**	**I.A. Savin** **O.P. Gavrishchuk**	Maintenance
VBLHEP	O.P. Gavrishchuk, G.V. Meshcheryako, N.N. Vlasov, A.S. Yukaev	
2. **Electromagnetic calorimeter**	**A.P. Nagaytsev,** **Z.V. Krumshtein**	Preparation R&D
VBLHEP	O.P. Gavrishchuk, G.V. Meshcheryakov, N.N. Vlasov, A.S. Yukaev	
DLNP	I.E. Tchirikov–Zorin, N. Tchepurnov, N.V. Anfimov, T.V. Rezinko, N. Utkin, I. Orlov, V.V. Tchalyshev, Z.Ya. Sadygov	
3. **Muon system**	**G.D. Alekseev**	Maintenance
DLNP	V.K. Rodionov, N.I. Zhuravlev, N.A. Kutchinsky, V.L. Malyshev	
4. **Tracking systems**	**V.D. Peshekhonov** **G.D. Alexeev**	Maintenance
VBLHEP	V.A. Anosov, E.A. Garifyanov	
DLNP	V.K. Rodionov, N.I. Zhuravlev, N.A. Kutchinsky, V.L. Malyshev	
5. **Software development. Data analysis**	**E.V. Zemlyanichkina**	Realization
VBLHEP	I.A. Savin, V.Yu. Alexain, D.V. Peshekhonov, G.I. Smirnov, A.P. Nagaytsev, O.M. Kuznetsov, N.N. Vlasov, Yu.I. Ivanshin, A.Yu. Korzenev, M.G Sapozhnikov N.S. Rossijskaya, V.L. Rapatsky, A.A. Antonov	
DLNP	A.G. Olshevsky, A.V. Guskov, Z.V. Krumshtein, O.Yu. Shevtchenko, R.R. Akhunzyanov	
LIT	P.V. Zrelov, V.Yu. Lavrenteva	

6.	**Measurements of generalized parton distributions and transverse spin structure in Drell–Yan processes. Development of new electro-magnetic calorimeter**	**A.P. Nagaytsev** **I.A. Savin** **O.Yu. Shevchenko**	Realization
	VBLHEP	O.P. Gavrishchuk, A.A Antonov, G.V Meshcheryakov, N.N. Vlasov, O.M. Kuznetsov	
	DLNP	A.G. Olshevskiy, Z.V. Krumshtein, A.V. Guskov	
	LIT	P.V. Zrelov	
	BLTP	A.V. Efremov, O.V. Teryaev	
7.	**Preparation of the project on measurement of proton form–factor ratios at 13–15 GeV/c**	**A.P. Nagaytsev,** **I.A. Savin** **N.M. Piskunov**	Project preparation
	VBLHEP	O.P. Gavrishchuk, G.V. Meshcheryakov	
II.	**Experiment H1**	**M.N. Kapishin**	Data analysis
	VBLHEP	V.N. Spaskov, A.N. Morozov, D.A. Nikitin	
III.	**Theoretical studies**	**A.V. Efremov**	Realization
	BLTP	S.B. Gerasimov, O.V. Teryaev, A.V. Kotikov, A.E. Dorokhov, N.I. Kochelev, A.M. Sidorov	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	ANL
Belarus	Minsk	NC PHEP BSU
Belgium	Mons	UMONS
	Brussels	ULB
Bulgaria	Sofia	INRNE BAS
		SU
Canada	Vancouver	TRIUMF
	Edmonton	U of A
CERN	Geneva	
Czech Republic	Prague	CTU
France	Saclay	IRFU
Germany	Bielefeld	Univ.
	Bochum	RUB
	Bonn	UniBonn
	Freiburg	Univ.
	Hamburg	DESY
	Heidelberg	MPIK
	Munich	LMU

		TUM
	Mainz	JGU
	Erlangen	FAU
Israel	Tel Aviv	TAU
Italy	Turin	INFN
	Trieste	INFN
	Frascati	INFN LNF
Japan	Chiba	Toho Univ.
	Nagoya	Nagoya Univ.
	Osaka	OCU
	Sendai	Tohoku Univ.
	Tsukuba	KEK
	Yamagata	Yamagata Univ.
Netherlands	Amsterdam	NIKHEF
Poland	Warsaw	WUT
Russia	Moscow	SINP MSU
		LPI RAS
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Protvino	IHEP
Switzerland	Zurich	UZH
United Kingdom	Liverpool	Univ.
USA	Argonne, IL	ANL
	Boulder, WY	CU
	Cambridge, MA	MIT
	Pasadena, CA	Caltech

02–1–1086–2009/2014	Priority: 1

Status: In-progress

Strangeness in Hadronic Matter and Study of Inelastic Reactions Near Kinematical Borders (Project HyperNIS)

Leaders: E.A. Strokovsky
E.S. Kokoulina

Participating Countries and International Organizations:

Belarus, Czech Republic, Germany, Japan, Russia, Ukraine.

Scientific Programme

Strangeness in hadronic matter and study of boundary effects:
search of effects of hidden intrinsic polarized sea of strange quarks in nucleon;
study of stabilizing effects of strangeness in nuclear matter and properties of the lightest hypernuclei;
search for exotic baryons with positive strangeness;
study of multi–particle dynamics in inelastic proton–nucleon interactions with extremally high multiplicity.

Expected results:

- Data on production cross sections for hyper–fragments of relativistic nuclei. Data on the lifetimes and binding energies of the lightest hypernuclei ${}^{4}_{\Lambda}H$, ${}^{3}_{\Lambda}H$, ${}^{6}_{\Lambda}H$; search for ${}^{6}_{\Lambda}H$. Study of the decay channels, including non–mesonic decays of the ${}^{10}_{\Lambda}Be$ and ${}^{10}_{\Lambda}B$ hypernuclei.
- New experimental data on total and differential cross sections of ϕ and ω production in pp and np interactions at threshold. Study of mechanisms of the vector meson production in NN interaction at threshold. Data on the OZI–rule violation; its energy dependence and dependence on isospin of the NN system in the initial state at nucleon energies near the ϕ and ω production thresholds.
- Upgrade of the electromagnetic calorimeter, renewal of the magnetic spectrometer; upgrade of the data acquisition system; optimizing of the multiplicity trigger. Software development for reconstruction of high multiplicity events at drift tube tracker and magnetic spectrometer.
- Search and study of production of exotic baryons with positive strangeness ("pentaquarks") in pp and np interactions.
- Construction of the wide acceptance magnetic spectrometer NIS–GIBS with multi–tracking capability and time–of–flight particle identification system at the Nuclotron extracted beam.
- Measurements of the partial cross sections of pA interactions at multiplicity above 20. Study of multi-particle correlations, search for "ring–like" events (gluonic Cherenkov radiation). Study of multiplicity fluctuations in pA interactions for Bose–Einstein condensation search. Development of analytic and Monte–Carlo models for description of high multiplicity processes where non–perturbative evolution of quark–gluon matter and phase transitions are taken into account.
- Creation and test of electromagnetic calorimeter for soft photons (E<50 MeV) detection. Measurements of the soft photon yields in dependence upon charged and neutral particle multiplicities.

Expected main results in 2013:

- Development and modernization of the DAQ and tracking systems of the NIS–GIBS spectrometer. Monte–Carlo simulation of the reactions under study.
- Study of the setup characteristics at the extracted deuteron and ${}^{6,7}Li$ beams. Spectrometer calibrating by binary reactions first physical results.

- Data taking with the NIS–GIBS spectrometer at the extracted deuteron and $^{6,7}Li$ beams within the hyper–nuclear program.
- Analysis of data from LEPS spectormeter on vector–meson photoproduction by polarized photons in cumulative region.
- Upgrade of the SVD–2 setup:
  a) upgrade of the electronics of the spectrometer and modernizing of the data acquisition system for the drift tracker;
  b) renewal of the of the electromagnetic calorimeter;
  c) development of the software for the drift tracker and magnetic spectrometer;
  d) production of prototype of electromagnetic calorimeter for soft photon registration.
- Determination of the partial pA interaction cross sections and momentum spectra of the produced particles with multiplicity up to 30. Monte–Carlo simulation of the spectrometer and the soft photon calorimeter.
- Development of the analytic models for multiple particle production.

List of projects:

	Project	Leader	Priority (period of realization)
1.	HyperNIS	E.A. Strokovsky	1 (2010 – 2015)

List of activities:

	Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1.	**Experiment NIS**	**E.A. Strokovsky**	Realization Data taking
	VBLHEP	R.A. Salmin, M.G. Sapozhnikov, V.P. Balandin, S.N. Bazylev, P.A. Rukoyatkin, A.A. Feschenko, S.N. Plyashkevich, J. Lukstins, Yu.T. Borzunov, V.D. Aksinenko, A.I. Maksimchuk, V.B. Chumakov, V.Yu. Ivanenko, O.V. Okhrimenko, A.I. Golokhvastov, S.A. Avramenko, M.H. Anikina, A.V. Averiyanov, A.M. Korotkova, N.G. Parfenova	
	DLNP	A.N. Shalyugin, V. Tereschenko	
2.	**Experiment GIBS**	**J. Lukstins**	Realization Data taking
	VBLHEP	V.D. Aksinenko, O.V. Okhrimenko, R.A. Salmin, A.I. Maksimchuk, E.A. Strokovsky, S.N. Plyashkevich, A.A. Feschenko, S.A. Avramenko, A.I. Golokhvastov, M.H. Anikina, A.V. Averiyanov, A.M. Korotkova, N.G. Parfenova	
	DLNP	Yu.A. Batusov, V. Tereschenko	
	OCE	A.N. Parfenov	

3. **Excited nuclear matter study at U–70: finalizing of works (activity) on the "Thermalization" program, preparation project**	**E.S. Kokoulina** **V.A. Nikitin**	Realization Data analysis

VBLHEP	V.I. Kireev, N.F. Furmanets, V.V. Avdeychikov, Yu.A. Chentsov, I.A. Rufanov, V.A. Nikitin, M.V. Tokarev, Yu.P. Petukhov, A.N. Aleev, A.I. Yukaev, N.K. Zhidkov, V.B. Dunin, V.V. Pavlyuchkov
BLTP	E.A. Kuraev

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Belarus	Minsk	NC PHEP BSU
		JIPNR-Sosny
		NASB
	Gomel	GSTU
		GSU
Czech Republic	Prague	CTU
	Řež	NRI
		NPI ASCR
Germany	Frankfurt/Main	Univ.
	Munich	LMU
	Jülich	FZJ
Italy	Kosenza	UniCal
Japan	Osaka	RCNP
Russia	Moscow	SINP MSU
	Protvino	IHEP
	Syktyvkar	DM Komi SC UrD RAS
Ukraine	Kiev	BITP NASU

02–1–1093–2009/2015	Priority: 1
	Status: Extended

Development of High-Precision Straw Detectors

Leader:

V.D. Peshekhonov

Participating Countries and International Organizations:

Bulgaria, Germany, Georgia, Russia.

Scientific Programme

Investigation and development of tracking straw detectors with different pressure of its gas mixture for application in high luminosity accelerator experiments and for application in other fields.

Expected main results in 2013:

- Development of prototype based on the granulated straws with high pressure of gas mixture.
- Study of processes in the high pressure straws.
- Study of the planar prototype with ~4 m. sq. of its sensetive area.
- Development of the MBs and Gas Manifolds for the large size planar and wheel type straw chambers.

List of activities:

Activity or experiment **Laboratory or other Division of JINR** **Responsible person**	**Leaders** **Main researchers**	**Status**
STRAW Detectors	**V.D. Peshekhonov**	Realization
VBLHEP	A.B. Anisimov, E.V. Vasilieva, I.V. Boguslavsky, N. Grigalashvili, G.D. Kekelidze, Yu.V. Gusakov, V.M Lysan, E.A. Martyanova, V.V. Myalkovsky, E. Nazieva, S.S. Parzhitsky, K. Davkov, V. Davko S.V. Rabtsun	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Bulgaria	Plovdiv	PU
Georgia	Tbilisi	TSU
Germany	Darmstadt	GSI
Russia	Moscow	SINP MSU
	Moscow, Troitsk	INR RAS
	Protvino	IHEP

02–0–1065–2007/2014	Priority: 1

Status: In-progress

Development of the JINR Basic Facility for Generation of Intense Heavy Ion and Polarized Nuclear Beams Aimed at Searching for the Mixed Phase of Nuclear Matter and Investigation of Polarization Phenomena at the Collision Energies up to $\sqrt{s_{NN}}$= 11 GeV/n

Leaders: A.S. Sorin
V.D. Kekelidze

Deputies: G.V. Trubnikov
A.D. Kovalenko
I.N. Meshkov

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, CERN, Czech Republic, France, Georgia, Germany, Italy, Japan, Moldova, Poland, Romania, Russia, Slovak Republic, South Africa, Sweden, Ukraine, USA.

Scientific Programme

Investigation of the mixed phase transition phenomena in strongly interacting nuclear matter at extremely high nuclear densities, study of polarization phenomena in few–body nucleon systems and spin structure of quark matter, nucleon and light nuclei. Development of theoretical models of these processes and theoretical support of the experiments. Development of the Nuclotron accelerator complex, as a base facility for studying of relativistic nuclear collisions in the range of atomic masses A = 1–197. Development and construction of the heavy ion collider NICA, multipurpose (NICA/MPD) and spin (NICA/SPD) detectors for the collider experiments with heavy ions. Modernization of the extraction beam lines. Carrying out of experiments with nuclear beams and polarized deuteron beams at the Nuclotron.

Expected main results in 2013:

- Continuation and extension of the "White Paper" – project physics program. Continuation of theoretical sudies of non–perturbative QCD processes, development and tests of the models for the nuclear matter at high temperatures and densities aimed at investigation phases of nuclear matter, dynamics of nuclear collisions at extremely dense baryonic matter and observation this phenomena in P–odd parity and spin asymmetries.
- Continuation of works on the Nuclotron modernization in the framework of the Nuclotron–NICA project: modernization of the accelerator stations, design and construction of the beam injection/extraction systems, commissioning and tests of the new ion source KRION–6T, development and increase of the production rate of the cryogenics complex, full–scale modernization of the injection complex. Development of the system for beam diagnostics. Construction and tests of a new source for polarized particles. Annual dedicated machine development runs at Nuclotron on first priority tasks within running time of 400 hours.
- Continuation of the NICA project realization including: construction of new linear injector ($z/A \geq 0.14$) and booster synchrotron; R&D related to the collider magnetic system and development of the beam cooling systems; tests of the stochastic cooling system prototype at Nuclotron. Development of the infrastructure for the mass–production of the superconducting magnets for NICA and FAIR, modernization of the engineering infrastructure.
- Completion of the technical design project to put new injector, booster, collider and beam lines of the NICA complex. Development of the engineering infrastructure of the project.
- Preparation of the technical project of the MPD solenoid and the order for its manufacturing. Prototyping of the detector elements for the first stage of the project. Start of the MPD Technical Design Project preparation.

- Preparation of the Conceptual Design Project to study nucleon spin structure with SPD. Continuation of theoretical studies of the Matveev–Muradyan–Tavkhelidze–Drell–Yan processes, J/Ψ productions processes and other processes in light polarized nuclei collisions.
- Nuclotron runs dedicated to physics and machine development within running time of 2000 hous.
- Development of the NICA/MPD/SPD computer infrastructure.

List of projects:

	Project	Leader	Priority (period of realization)
1.	Nuclotron–NICA	G.V. Trubnikov	1 (2011 – 2015)
2.	MPD	V.D. Kekelidze	1 (2011 – 2015)
3.	BM@N	V.P. Ladygin	1 (2012 – 2013)

List of activities:

	Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1.	**Theoretical investigations, lattice QCD calculations and development of the models for description of prototypes of excited nuclear media under high temperatures and compression, dynamics of nuclear interactions at extreme dense baryon matter, spin and P–odd effects**	**A.S. Sorin** **O.V. Teryaev**	Realization
	BLTP	D. Blaschke, V.D. Toneev, A.V. Efremov, S.V. Molodtsov, A.S. Hvorostukhin, O.V. Teryaev, S.B. Gerasimov, M.K. Volkov, A. Parvan, E.A. Kuraev, Ya.N. Klopot, A.G. Oganesyan, A. Frisen, P.V. Buividovich	
	LIT	Yu.L. Kalinovsky, Zh. Musulmanbekov, E.G. Nikonov	
	DLNP	G.I. Lykasov	
	VBLHEP	V.D. Kekelidze, R. Lednický, E.–M. Ilgenfritz, Kh.U. Abraamyan, M.A. Kozhin, S.G. Reznikov, M.K. Suleymanov, V.N. Zhezher, O.V. Rogachevsky	
2.	**Nuclotron–NICA: development of the technological systems of the accelerator ring, injection complex and extracted beam channels in the framework of the NICA project**	**G.V. Trubnikov** **A.V. Butenko** **V.I. Volkov** **A.O. Sidorin** **I.N. Meshkov** **A.D. Kovalenko**	Realization
	VBLHEP	G.G. Khodzhibagiyan + 3 pers., N.N. Agapov, V.I. Batin + 5 pers., A.S. Averichev + 4 pers., V.I. Lipchenko, Yu.A. Mitrofanova, V.E. Sosulnikov, A.I. Pleshakov + 5 pers., E.Yu. Filippova, E.Yu. Ivanenko, D.V. Lobanov, A.I. Govorov + 7 pers.,	

V.V. Seleznev, R.G. Pushkar, K.A. Levterov, A.A. Voronin, V.A. Shurkhovetsky, Yu.V. Prostimkin, A.V. Smirnov + 3 pers., A.R. Galimov, E.V. Komogorov, A.V. Nesterov, G.L. Kuznetsov, O.A. Kunchenko, R.V. Pivin, A.M. Bazanov, E.I. Bugrinov, E.E. Donets, E.D. Donets, D.E. Donets, V.B. Shutov, V.A. Andreev, V.A. Isadov, S.V. Romanov, A.E. Kirichenko, B.V. Vasilishin, O.S. Kozlov, O.I. Brovko, A.M. Nikitin, V.M. Shumkov + 5 pers., O.V. Prozorov, A.V. Gromov + 3 pers., S.A. Rumyantsev, L.P. Skiba, A.N. Pisulina, I.V. Kudashkin, G.P. Reshetnikov, N.N. Blinnikov, L.E. Bogdan, K.N. Gurylev, E.V. Ivanov + 3 pers., Z.I. Smirnova, V.N. Karpinsky, A.L. Osipenkov + 3 pers., N.G. Kondratev, A.V. Kudashkin, A.A. Shurygin, Yu.M. Nozhenko + 3 pers., N.A. Filippov + 3 pers., A.S. Vinogradov, N.A. Blinov + 4 pers., A.Yu. Starikov, P.A. Rukoyatkin + 3 pers., N.I. Lebedev, E.V. Gorbachev, V.V. Fimuskin, G.D. Shirkov, V.V. Kobets, A.V. Alfeev + 3 pers., N.V. Semin, V.P. Chernyaev + 8 pers., A.A. Fateev + 3 pers., N.D. Topilin + 5 pers., A.V. Tuzikov, N.A. Shurkhno

3. **R&D work, construction of the prototypes and full–scale superconducting magnets for NICA booster and collider**

G.V. Trubnikov
G.G. Khodzhibagiyan
A.D. Kovalenko

R&D
Realization

VBLHEP

A.V. Butenko, A.V. Smirnov + 3 pers., A.R. Galimov, G.L. Kuznetsov, O.A. Kunchenko, P.V. Pivin, A.M. Bazanov, N.N. Agapov + 8 pers., V.I. Batin + 5 pers., D.S. Shvidky, V.N. Karpinsky, A.L. Osipenkov, P.I. Nikitaev, N.P. Bazyleva, B.D. Morozov, A.V. Kudashkin, N.A. Filippov + 2 pers., A.S. Vinogradov, N.A. Blinov, A.M. Donyagin, I.A. Eliseeva, A.Yu. Starikov, I.E. Karpunina, S.A. Dolgy, V.K. Alexeev, V.N. Surikov, N.A. Zhiltsova, N.D. Topilin, Yu.V. Gusakov, A.V. Shabunov, E.V. Muraveva, A.A. Makarov, Yu.A. Tumanova, T.F. Prakhova, V.V. Agapova, A.V. Buchkov, V.S. Korolev + 3 pers.

4. **Construction of the heavy ion source (KRION–6 T), construction of the polarized particle source (PPS) for the NICA complex**

E.D. Donets
E.E. Donets
V.V. Fimushkin

Realization

VBLHEP

V.B. Shutov + 3 pers., A.Yu. Ramzdorf, D.E. Donets, V.P. Vadeev, Yu.V. Prokofichev, L.V. Kutuzova, A.V. Vadeev, A.I. Govorov, V.V. Seleznev, A.V. Shabunov, K.A. Levterov, S.V. Prokhorov, S.N. Sedykh + 1 pers.

5. **Development and construction of the beam injection/extractin systems, beam transportation channels for NICA elements. Development of the control systems for beam diagnostics**

V.I. Volkov
V.A. Mikhaylov

Realization

	VBLHEP	B.V. Vasilishin, O.S. Kozlov, A.G. Kochurov, I.I. Kulikov, L.A. Leonov, S.A. Novikov, A.V. Eliseev, V.A. Andreev + 1 pers., V.M. Gorchenko, S.V. Mikhaylov, A.M. Butenko, G.M. Salnikova, V.A. Isadov, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, L.N. Komolov, I.V. Zaytsev, R.I. Kukushkina, V.S. Alexandrov, A.V. Tuzikov, E.E. Shirkova, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, L.I. Kosukhina, G.S. Sedukh, T.V. Rukoyatkina, V.V. Kovalev, N.V. Pilyar, G.E. Koroleva, M.E. Pushkin, E.V. Gorbachev, R.A. Smolkov, A.V. Alfeev, D.I. Sherstyanov, E.V. Rudnev, A.S. Isaev, I.Ya. Nefedev, V.S. Sungatulin, V.N. Karpinsky, A.L. Osipenkov	
6.	**Development of the cryogenic systems for Nuclotron–NICA**	**N.N. Agapov** **G.G. Khodzhibagiyan**	Projecting Realization
	VBLHEP	V.I. Batin + 6 pers., H. Malinovsky + 5 pers., V.M. Drobin, N.G. Anishchenko, Yu.T. Borzunov, A.V. Konstantinov, V.B. Chumakov, V.D. Bartenev, L.V. Petrova, E.A. Kulikov, A.S. Averichev + 4 pers., V.I. Lipchenko, V.E. Kurinov, D.S. Shvidky + 3 pers., Yu.A. Mitrofanova, V.E. Sosulnikov, A.I. Pleshakov + 5 pers., S.A. Smirnov, E.Yu. Filippova, E.Yu. Ivanenko, D.V. Lobanov	
7.	**Technical design and construction of the NICA injection complex**	**V.V. Kobets** **I.N. Meshkov** **V.A. Monchinsky**	Realization
	VBLHEP	A.V. Butenko, A.O. Sidorin, A.I. Govorov, V.V. Cekeznev, K.A. Levterov, N.D. Topilin, A.A. Makarov, A.I. Sidorov + 1 pers., A.A Fateev, G.I. Konnov, I.G. Lebedeva, S.N. Sedykh, A.P. Kozlov, V.V. Kosukhin, V.V. Seleznev	
8.	**Technical design and construction of the NICA booster synchrotron and its technological systems**	**A.V. Butenko** **V.A. Mikhaylov** **I.N. Meshkov**	Project preparation Realization
	VBLHEP	G.G. Khodzhibagiyan + 5 pers., A.V. Smirnov + 3 pers., A.R. Galimov, G.L. Kuznetsov, O.A. Kunchenko, R.V. Pivin, A.M. Bazanov, N.N. Agapov + 8 pers., V.I. Batin + 5 pers., D.S. Shvidky, V.N. Karpinsky, A.L. Osipenkov, O.I. Brovko, N.D. Topilin, Yu.V. Gusakov, A.V. Shabunov, E.V. Muraveva, A.A. Makarov, Yu.A. Tumanova, V.I. Volkov + 5 pers., B.V. Vasilishin, O.S. Kozlov, V.A. Andreev, A.V. Eliseev, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, A.V. Tuzikov, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, T.V. Rukoyatkina, E.V. Gorbachev, A.V. Alfeev, V.N. Karpisky + 3 pers., A.L. Osipenkov + 4 pers., A.S. Valkovich	
	DLNP	S.L. Yakovenko, E.V. Akhmanova, A.G. Kobets, A.Yu. Rudakov	

9.	**Technical design, R&D and construction of the heavy ion collider NICA with energy $\sqrt{s_{NN}}$ = 4÷11 GeV/n and average luminosity 1 $\cdot 10^{27}$cm$^{-2} \cdot s^{-1}$ on the base of Nuclotron**	**I.N. Meshkov** **G.V. Trubnikov** **A.O. Sidorin** **A.D. Kovalenko**	Project preparation Realization
	VBLHEP	G.G. Khodzhibagiyan + 5 pers., A.V. Butenko, A.V. Smirnov + 3 pers., A.R. Galimov, G.L. Kuznetsov, R.V. Pivin, A.M. Bazanov, N.N. Agapov + 8 pers, V.I. Batin + 5 pers., D.S. Shvidky, V.N. Karpinsky + 3 pers., A.L. Osipenkov, N.V. Semin, V.D. Kalagin, N.D. Topilin, Yu.V. Gusakov, A.V. Shabunov, E.V. Muraveva, A.A. Makarov, Yu.A. Tumanova, V.I. Volkov + 5 pers., B.V. Vasilishin, O.S. Kozlov, V.A. Andreev, A.V. Eliseev, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, A.V. Tuzikov, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, T.V. Rukoyatkina, E.V. Gorbachev, A.V. Alfeev, V.N. Karpinsky + 3 pers., A.L. Osipenkov + 4 pers., V.A. Monchinsky, O.I. Brovko + 3 pers., V.M. Zhabitsky, G.D. Shirkov, V.S. Alexandrov, A.V. Filippov, A.V. Tuzikov	
	DLNP	S.L. Yakovenko + 2 pers., A.Yu. Rudakov, A.G. Kobets, T.A. Stepanova, L.V. Soboleva, E.V. Akhmanova, A.A. Sidorin, S.A. Kostromin	
	LRB	G.N. Timoshenko, V.Yu. Shchegolev	
10.	**Design and construction of the MPD Detector. Optimization of the conceptual design, preparation of the Technocal Design Project. R&D and construction of the first–stage detector elements: time–projection chamber, time–of–flight system, electromagnetic calorimeter, zero–degree calorimeter, internal tracker**	**V.D. Kekelidze** **A.S. Sorin** **V.M. Golovatyuk**	Project preparation Realization
	VBLHEP	S.V. Volgin, N.M. Vladimirova, V.A. Babkin, S.N. Lobastov, Yu.I. Fedotov, H.U. Abraamyan, A.B. Anisimov, M.A. Kozhin, M.G. Kadykov, O.P. Gavrishchuk, N.A. Kuzmin, A.I. Yukaev, E.V Kostyukhov, Yu.V. Zanevsky, Yu. Lukstinsh, O.V. Fateev, A.M. Korotkova, S.P. Chernenko, V.F. Chepurnov, S.V. Razin, V.N. Zryuev, A.V. Averyanov, A.G. Bazhazhin, S.V. Vereshchagin, A.G. Litvinenko, A.Yu. Isupov, V.F. Peresedov, I.I. Migulina, V.A. Nikitin, O.V. Rogachevsky, V.D. Peshekhonov, K.V. Gertsenberger, Yu. Fedorishin, A.I. Zinchenko, Dzh. Drnoyan, I.A. Tyapkin, I.V. Gapienko, N.S. Grigalashvili, K.I. Davkov, G.D. Kekelidze, V.V. Myalkovsky, Yu.T. Kiryushin, S.A. Movchan, V.M. Lysan, S.V. Khabarov, V.S. Khabarov, A.V. Vishnevsky, Yu.K. Potrebenikov,	

		D.T. Madigozhin, N.A. Molokanova, I.A. Polenkevich, S.N. Shkarovsky, Yu.A. Murin, V.A. Vasendina, V.A. Budilov, V.A. Nikitin, N.K. Zhidkov, V.I. Yurevich, G.S. Averichev, D.N. Bogoslovsky, V.B. Dunin, L.G. Efimov, E.M. Kislov, A.A. Povtoreiko, V.V. Tihomirov, G.A. Yarygin, A.N. Zubarev, S.V. Bazylev, V.M. Slepnev, I.V. Slepnev, A.B. Shutov, A.E. Baskakov, A.V. Shchipunov, V.Yu. Rogov, N.A. Shutova, R.V. Nagdasev	
	DLNP	A.G. Olshevsky, Z.V. Krumshtein + 8 pers.	
	LIT	V.V. Ivanov, P.G. Akishin, S.A. Baginyan, P.I. Kisel, O.Yu. Derenovskaya, Zh.Zh. Musulmanbekov, A.M. Raportirenko, P.V. Zrelov	
11.	**Design and construction of the superconducting solenoidal and magnet yoke**	**A.S. Vodopyanov**	Project preparation Realization
	VBLHEP	A.A. Efremov, Yu.Yu. Lobanov A.F. Makarov	
12.	**Design and creation of the read–out and slow control system**	**S.V. Bazylev**	Project preparation Realization
	VBLHEP	V.M. Slepnev, I.V. Slepnev, A.E. Baskakov, A.B. Shutov, A.V. Shchipunov, V.Yu. Rogov, N.A. Shutova, R.V. Nagdasev, S.V. Sergeev, A.F. Mukhamatnabaev	
13.	**Preparation of the physical program and SPD detector project for studying of the spin effects at NICA complex**	**A.D. Kovalenko** **A.P. Nagaytsev** **I.A. Savin** **O.Yu. Shevtchenko**	Project preparation Realization
	VBLHEP	G.V. Meshcheryakov, O.P. Gavrishchuk, A.A. Antonov, R.V. Piven, E.V. Zemlyanichkina, N.S. Rossiyskaya, D.V. Peshekhonov, Yu.I. Ivanshin, I.A. Savin, R. Gushcherski, V.A. Nikitin, R. Lednický, V.N. Pozdnyakov, S.S. Shimansky, V.P. Ladygin, S.G. Reznikov, P.K. Kurilkin, A.K. Kurilkin, O.Yu. Shevtchenko + 2 students	
	DLNP	A.G. Olshevsky, A.V. Kulikov + 3 pers., Z.V. Krumshtein, O.N. Ivanov, G. Macharashvili	
	LIT	V.V. Palchik	
	BLTP	A.V. Efremov, O.V. Teryaev	
14.	**Development of computer infrastructure for NICA complex**	**Yu.K. Potrebenikov** **O.V. Rogachevsky**	Realization
	VBLHEP	B.G. Schinov, Yu.I Minaev, V.L. Svalov, V.F. Dyudyushko, D.T. Madigozhin, N.A. Molokanova, D.V. Peshekhonov, I.A Polenkevich, S.N. Shkarovsky, A.V. Filippov	
	LIT	M.V. Bashashin, D.V. Kekelidze, V.N. Shkundenkov, V.V. Korenkov	

15. **Technical design and development of the engineering infrastructure of Nuclotron–NICA**

I.N. Meshkov
V.D. Kalagin
G.V. Trubnikov
G.D. Shirkov

Projecting
Realization

VBLHEP	N.D. Topilin, A.V. Shabunov, E.V. Serochkin, A.A. Makarov, S.V. Rabtsun, N.V. Semin + 10 pers., V.M. Stepanov + 6 pers., A.M. Karetnik, V.P. Zabolotin, V.P. Chernyaev, A.N. Sotnikov, V.Yu. Shilov, M.I. Migulin, E.M. Khabarova, A.V. Alfeev, O.M. Timoshenko
DLNP	Yu.A. Budagov, S.L. Yakovenko
OCE	A.V. Dudarev + 1 pers.
AS&CC Office	S.O. Lukjanov, A.B. Vishnevsky
GA&C	Yu.N. Denisov

16. **Technical project preparation for the experiment. Baryonic matter at Nuclotron**

V.P. Ladygin
P. Senger
Yu.A. Murin

Realization

VBLHEP	V.V. Avdeychikov, A.V. Averiyanov, S.A. Avramenko, V.D. Aksinenko, P.G. Aksinenko, A.V. Alfeev, V.S. Alfeev, V.A. Babkin, S.N. Bazylev, V.P. balandin, I.V. Boguslavsky, V.A. Vasendina, T.A. Vasiliev, N.M. Vladimirova, A.V. Vishnevsky, S.V. Volgin, V.V. Voronyuk, V.I. Voskoboynik, O.P. Gavrishchuk, V.M. Golovatyuk, A.I. Golokhvastov, N. Grigalashvili, Yu.V. Gurchin, V. Davkov, K. Davkov, V.I. Demidova, V.B. Dunin, Yu.V. Zanevsky, A.I. Zinchenko, V.N. Zryuev, A.P. Ierusalimov, E.-M. Ilgenfritz, A.Yu. Isupov, Yu.-T. Karachuk, V.D. Kekelidze, G.D. Kekelidze, Yu.T. Kiryushin, E.S. Kokoulina, V.I. Kolesnikov, A.M. Korotkova, A.V. Kuznetsov, N.A. Kuzmin, A.K. Kurilkin, P.K. Kurilkin, E.A. Ladygin, V.P. Ladygin, N.B. Ladygina, S.P. Lobastov, Yu. Lukstinsh, A.I. Malakhov, V.V. Myalkovsky, Yu.N. Murin, V.A. Nikitin, P.V. Nomokonov, O.V. Okhrimenko, V.V. Pavluchkov, A.N. Parfenov, Yu.P.Petukhov, V.N. Pechenov, O.Yu. Pechenova, V.D. Peshekhonov, S.M. Piyadin, S.G. Reznikov, P.A. Rukoyatkin, I.A. Rufanov, A.V.Shabunov, V.M. Slepnev, I.V. Slepnev, S.Ya. Sychkov, A.A. Terekhin, A.V. Terletsky, V.V. Tikhomirov, N.D. Topilin, O.V. Fateev, Yu.I. Fedorov, V.S. Khabarov, S.V. Khabarov, A.N. Khrenov, S.P. Chernenko, A.V. Shutov, A.I. Yukaev
LIT	T.O. Ablyazimov, V.P. Akishina, P.G. Akishin, S.A. Baginyan, D.V. Belyakov, O.Yu. Derenovskaya, P.V. Zrelov, V.V. Ivanov, P.I. Kisel, A.M. Raportirenko, V. Sheynast
FLNP	E.P. Litvinenko
BLTP	A.S. Sorin, O.V. Teryaev

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	NC PHEP BSU
		Proscan
	Gomel	GSU
Bulgaria	Sofia	INRNE BAS
		ISSP BAS
		TU-Sofia
		LTD BAS
	Blagoevgrad	SWU
	Plovdiv	PU
CERN	Geneva	
Czech Republic	Liberec	TUL
	Prague	CU
France	Nantes	SUBATECH
Germany	Darmstadt	GSI
	Giessen	JLU
	Erlangen	FAU
	Frankfurt/Main	Univ.
		FIAS
	Regensburg	UR
	Jülich	FZJ
Japan	Nagoya	Nagoya Univ.
Georgia	Tbilisi	AIP
Italy	Turin	INFN
Moldova	Chişinău	SUM
		IAP ASM
Poland	Warsaw	ETI
		WUT
	Wroclaw	ILTSR PAS
	Lublin	MCSU
	Otwock-Swierk	NCBJ
Romania	Bucharest	INOE2000
		IFIN-HH
		INCDIE ICPE-CA
Russia	Moscow	LPI RAS
		ITEP
		Cryogenmash
		Geliymash
		NRC KI
		VNIINM
		IBMP RAS

	Moscow, Troitsk	INR RAS
	Belgorod	NRU BelSU
	Kazan	Compressormash
	Novosibirsk	BINP SB RAS
	Protvino	IHEP
	St. Petersburg	Neva-Magnet
	Syktyvkar	DM Komi SC UrD RAS
	Tomsk	NPI TPU
	Fryazino	ISTOK
Slovak Republic	Bratislava	IMS SAS
	Košice	PJSU
	Žilina	UŽ
South Africa	Cape Town	UCT
	Johannesburg	UJ
Sweden	Stockholm	SU
	Uppsala	TSL
Ukraine	Kiev	BITP NASU
	Kharkov	KhNU
		KFTI NASU
USA	Batavia, IL	Fermilab
	Upton, NY	BNL
	Stony Brook, NY	SUNY

02–0–1067–2007/2015	Priority: 1
	Status: Extended

Advanced Studies in New Generation of Electron–Positron Accelerators and Colliders for Fundamental and Applied Research

Leader: G.D. Shirkov
Deputies: G.V. Trubnikov
E.M. Syresin

Participating Countries and International Organizations:

Belarus, Bulgaria, CERN, Germany, Greece, Italy, Japan, Russia, Slovac Republic, United Kingdom, Ukraine, USA.

Scientific Programme

R&D work in particle accelerator physics and engineering, construction of the free electron laser with the aim to prepare proposals for the project of JINR participation in international collaboration on construction of the future Linear Collider (CLIC/ILC). Studies of free electron laser physics, development and construction of systems applied for formation and diagnostics of ultra short dense bunches in the linear electron accelerators. Studies of cryomodule components and SC cavities. High precision lase metrology. R&D for laser–plasma accelerators.

Expected main results in 2013:

- Development of technology, manufacturing prototypes and studies photo cathodes. Commissioning of the photoinjector prototype for electron linear accelerator and studies of the cathode quantum efficiency on this test stand (photocathode e–gun and laser λ=266 nm, τ_{puls}=75 ps; I = 15 A).
- Commissioning of linear accelerator of electrons (second stage) with electron energy up to 50 MeV. Commissioning of the electron beam diagnostics for energy and phase parameters measurement. Commissioning of the FEL prototype on the electron linac base and wiggler.
- Creation of seismoprotected 50 long laser fiducial line with space stability 100 microns. Explosion welding connection of Nb with stainless steel (new technology). Manufacturing of Nb – cavered 2 – layers "Cu Al" cavity prototype.
- Optimization of allocation of linear collider elements and related engineering, scientific and social infrastruction in Dubna, Moscow region.
- Low Energy Particle Storage Ring LEPTA: studies of the curculating positron beam dynamics and electron cooling of positrons, Positronium generation. Development of the project of slow positron channel for Doppler positron annihilation spectroscopy (DPAS). Construction of experimental station for DPAS.
- The FLASH undulator constructed at JINR is applied for infrared radiation generation and measurements of the electron bunch shapes. Investigation of electron beam and FEL physics: experimental work with coherent synchrotron radiation, construction and application of detectors on besis of micro channel plates for European XFEL and FLASH 2, construction of FEL photo injector laser system applied for formation of 3D ellipsoid shape bunches of light radiation.

List of projects:

Project	Leader	Priority (period of realization)
1. JINR participation in design, manufacturing and testing of the prototypes of linear electron–positron collider elements and FEL	G.D. Shirkov G.V. Trubnikov	1 (2013 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **R&D works at DC photoinjector prototype with electron energy up to 400 keV. Construction photoinjector laser system applied for formation of 3D ellipsoid shape bunches of light radiation**	**G.V. Trubnikov** **N.I. Balalykin**	Technical proposal Realization
VBLHEP	V.F. Minashkin, M.A. Nozdrin, V.G. Shabratov, A.V. Skrypnik, A.P. Sumbaev, V.A. Petrov	
DLNP	E.M. Syresin, R.S. Makarov	
2. **R&D works at dedicated test bench: electron linear accelerator up to 100 MeV for studies of accelerating structures properties and usage as FEL prototype. Laser–plasma acceleration technologies. Optimization of allocation of linear collider complex in Dubna region**	**G.D. Shirkov** **V.V. Kobets** **A.V. Dudarev**	Technical proposal Realization
VBLHEP	V.V. Kobets, V.G. Shabratov, A.V. Skrypnik, A.N. Ukhanov, V.F. Minashkin, M.A. Nozdrin	
DLNP	E.M. Syresin, R.S. Makarov, V.M. Romanov	
SCAR	V.N. Samoilov	
3. **R&D works fpr ILC cryomodule components and Nb–cavity optimal configuration; and for high precision laser metrology control of CLIC and ILC acceleration units alignment**	**J.A. Budagov**	Technical proposal Realization
DLNP	N.S. Azaryan, V.V. Glagolv, D.L. Demin, D.I. Khubua, V.I. Kolomoets, S.M. Kolomoets, M.V. Lyablin, V.M. Romanov, B.M. Sabirov, S.N. Studenov, A.V. Sazonova	

4. **LEPTA facility: electron cooling of positrons and Positronium generation. Development of Doppler positron annihilation spectroscopy**

I.N. Meshkov
S.L. Yakovenko

Technical proposal
Realization

DLNP: E.V. Akhmanova, A.G. Kobets, Yu.K. Akimov, V.I. Kaplin, V.N. Karpinsky, V.I. Lokhmatov, V.N. Malakhov, V.D. Morozov, V.N. Pavlov, A.Yu. Rudakov, A.A. Sidorin, L.V. Soboleva, T.A. Stepanova, V.I. Trubnikov

5. **Investigation on intense electron beams and FEL. Development and construction of systems applied for formation and diagnostic of ultra short dense bunches in the linear electron accelerators**

E.M. Syresin
O.I. Brovko
M.V. Yurkov

Technical proposal

DLNP: N.A. Morozov, A.F. Chesnov, R.S. Makarov, D.S. Petrov, V.M. Romanov

VBLHEP: G.V. Trubnikov, A.Yu. Grebentsov, E.V. Ivanov, M.N. Kapishin, O.A. Nozdrina, A.V. Shabunov

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
		BSUIR
		SPMRC NASB
		PTI NASB
		INP BSU
Bulgaria	Sofia	INRNE BAS
CERN	Geneva	
Germany	Darmstadt	GSI
	Hamburg	DESY
	Heidelberg	MPIK
	Zeuthen	DESY
Greece	Athens	UoA
Italy	Pisa	INFN
	Frascati	INFN LNF
Japan	Tsukuba	KEK
Russia	Moscow	SSDI
	Moscow, Troitsk	INR RAS
	Nizhny Novgorod	IAP RAS
	Novosibirsk	BINP SB RAS
	Ryazan	RSU
	Sarov	VNIIEF

Ukraine	Kiev	PEWI NASU
United Kingdom	Oxford	JAI
Slovak Republic	Bratislava	IEE SAS
USA	Upton, NY	BNL
	Batavia, IL	Fermilab

02–1–1097–2010/2015	Priority: 1
	Status: Extended

Study of Polarization Phenomena and Spin Effects at the JINR Nuclotron–M Facility

Leader: A.D. Kovalenko
Deputies: N.M. Piskunov
V.P. Ladygin
M. Finger (Jr.)
R.A. Shindin

Participating Countries and International Organizations:

Bulgaria, CERN, Czech Republic, France, Germany, Japan, Poland, Romania, Russia, Slovak Republic, Sweden, Ukraine, USA, Uzbekistan.

Scientific Programme

Methodical support of the experiments at polarized beams of the Nuclotron-M and NICA facilities, including development of polarimetery systems. Measurement of analyzing power for the reaction $p + CH_2$ at polarized proton momentum up to 7.5 GeV/c at the setup ALPOM–2. Measurement of tensor analyzing power and spin correlation in $d \to p$ reaction in the deuteron core area with the use of polarized ^3He target and polarized deuteron beam of the Nuclotron-M. Study of 2N– and 3N–correlations in deuteron–proton elastic scattering and deuteron break–up reactions at the Nuclotron internal target. Works on modernization of Saclay–Argonne–JINR polarized proton target (setup PPT). The analysis of set of the np spin observables at 0° (the total np cross section differences), using polarized targets and quasi-monochromatic relativistic 1.2–3.6 GeV neutron beams. Determination of the forward scattering NN amplitudes over this energy region. Comparison of the obtained data with QCD motivated model calculations. Study of charge-exchange processes in dp—interactions at the setup STRELA. Development of theoretical models for description of the simplest nuclear systems taking into account relativistic effects, meson and quark–gluon components of the internal movement. Theoretical analysis of experimental data obtained at Nuclotron-M. The study of the properties of strongly interacting matter utilizing polarization phenomena in hadron–nucleon and lepton–nucleon interactions, and in the decay of polarized radioactive atomic nuclei. Study of highly excited nuclear matter and collective effects in nuclear media; delta and other nucleonic resonance excitations on protons and nuclei. Preparation of the setup DELTA–LNS and data taking on the light neutral mesons production in polarized nucleons and nucleus interactions.

Expected main results in 2013:

- Preparation of the proposal on the construction low energy proton and deuteron polarimeter within the frames of the program: "Spin Physics Research Infrastructure at the Nuclotron".
- Completion of the approved projects and collaborative protocols within the frames of their real financial support, including:
  a) realization of the projects ALPOM-2 and DSS;
  b) experiments at the setups STRELA and DELTA–LNS, analysis of the collected data from DELTA–SIGMA setup;
  c) works test of the PPT infrastructure.
- Participation in the joint scientific programs and experiments, design and test of the new detectors and electronics for the use at COSY (Julich), SPS (CERN), RHIC (BNL), TJNAF (Newport News), FAIR (GSI) in accordance with the approved collaborative agreements.
- Construction of the development of the new methods to calculation of the amplitudes and polarization characteristics of deuteron fragmentation and deuteron elastic scattering on protons and nuclei taking into account FSI and relativistic effects.

List of projects:

Project	Leader	Priority (period of realization)
1. ALPOM-2	N.M. Piskunov	1 (2010 – 2015)
2. DSS	V.P. Ladygin A.I. Malakhov T. Yesaka	1 (2010 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Works on the program: "Spin Physics Research Infrastructure at the Nuclotron"**	**A.D. Kovalenko**	Realization
VBLHEP	V.P. Ladygin, S.G. Reznikov, P.K. Kurilkin, S.M. Piyadin, Yu.V. Gurchin, V.V. Glagolev, V.I. Sharov, A.I. Malakhov, A.P. Nagaytsev, I.A. Savin, A.N. Livanov, A.N. Morozov, R.A. Shindin, S.S. Shimansky, V.I. Fimushkin	
BLTP	V.V. Burov, V.K. Lukyanov, A.V. Efremov, O.V. Teryaev	
DLNP	M. Finger, M. Finger (Jr.)	
LIT	R.V. Polyakova + 1 student	
2. **ALPOM-2 Project**	**N.M. Piskunov** **E. Tomasi–Gustafsson** **C.F. Perdrisat**	Data taking
VBLHEP	V.V. Glagolev, I.M. Sitnik, A.A. Povtoreyko, Yu.P. Bushuev, D.A. Kirillov, P.A. Rukoyatkin, O.P. Gavrishchuk, S.N. Bazylev, Yu.T. Kiryushin	
3. **DSS Project**	**A.I. Malakhov** **V.P. Ladygin** **T. Yesaka**	Preparation Data taking
VBLHEP	S.G. Reznikov, T.A. Vasiliev, A.K. Kurilkin, P.K. Kurilkin, S.M. Piyadin, Yu.V. Gurchin, A.A. Terekhin, Yu.–T. Karachuk, A.N. Livanov, A.N. Khrenov, N.B. Ladygina, E.B. Plekhanov, A.P. Ierusalimov	
DLNP	G.I. Lykasov	
4. **Modernization of the polarized proton target infrastructure (setup PPT)**	**N.S. Borisov** **R.A. Shindin**	Preparation Data taking
VBLHEP	E.V. Komogorov, N.G. Anishchenko	
DLNP	N.S. Borisov, Yu.A. Usov, Yu.A. Plis, N.A. Bazhanov, A.N. Fedorov	
5. **Development of the Delta–Sigma setup for experiment in high intensity beams**	**A.D. Kovalenko** **V.I. Sharov** **R.A. Sindin**	Data analysis Project preparation

VBLHEP	A.N Morozov, E.V. Chernykh, P.K. Manyakov, L.B. Golovanov, Yu.T. Bozunov, V. Tchumakov, N.A. Kuzmin, I.P. Yudin	
DLNP	I.L. Pisarev, N.S. Borisov , Yu.A. Usov, M. Finger, M. Finger (jr.)	
FLNP	S.B. Borzakov, Ts. Panteleev	
BLTP	N.V. Kochelev, E.A. Kuraev	
LIT	R.V. Polyakova + 1 pers.	
6. **Experiments on the program STRELA**	**N.M. Piskunov**	Data taking
VBLHEP	V.V. Glagolev, N.M. Piskunov, L.B. Golovanov, Yu.P. Bushuev, A.A. Povtoreyko, D.A. Kirillov, S.N. Bazylev, V.L. Lyuboshits, P.K. Manyakov	
7. **Theoretical calculations of polarized processes**	**V.V. Burov** **V.K. Lukyanov**	Data analysis
BLTP	V.V. Burov	
VBLHEP	N.B. Ladygina, A.P. Ierusalimov	
8. **Spin effects in hadron-nucleon and lepton-nucleon interactions**	**M. Finger**	Data analysis
DLNP	E.I. Bunyatova, M. Slunečhka, V. Slunečhkova, M. Finger (Jr.), A. Yanata	
9. **Works on the program DELTA–2**	**A.B. Kurepin** **A.N. Livanov**	Modernization Data taking
VBLHEP	S.N. Bazylev, A.P. Ierusalimov, P.K. Manyakov, E.B. Plekhanov, V.P. Ladygin, Yu.S Anisimov, S.M. Piyadin	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Bulgaria	Sofia	INRNE BAS
		UCTM
CERN	Geneva	
Czech Republic	Prague	CU
		CTU
	Brno	ISI ASCR
	Liberec	TUL
	Řež	NPI ASCR
France	Saclay	IRFU
Germany	Dresden	TU Dresden
	Bochum	RUB
	Jülich	FZJ
Japan	Tokyo	UT

	Hiroshima	Hiroshima Univ.
	Osaka	RCNP
Poland	Otwock-Swierk	NCBJ
Romania	Bucharest	INCDIE ICPE-CA
Russia	Gatchina	PNPI
	Moscow	LPI RAS
		NRC KI
	Moscow, Troitsk	INR RAS
Slovak Republic	Bratislava	IP SAS
	Košice	IEP SAS
		PJSU
Sweden	Uppsala	TSL
Switzerland	Geneva	UniGe
	Villigen	PSI
Ukraine	Kharkov	KFTI NASU
USA	Upton, NY	BNL
	Newport News, VA	JLab
	Norfolk, VA	NSU
	Williamsburg, VA	W&M
Uzbekistan	Tashkent	INP UAS
		Assoc."P.-S." PTI

02–1–1087–2009/2014	Priority: 1
	Status: In-progress

Research on Relativistic Heavy and Light Ion Physics. Experiments at the Nuclotron, SPS and SIS18

Leader: A.I. Malakhov
Deputy: S.V. Afanasiev

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, CERN, China, Czech Republic, France, Germany, Japan, India, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovak Republic, Sweden, Switzerland, Tajikistan, USA, Uzbekistan.

Scientific Programme

Search for manifestation of quark-gluon degrees of freedom in collisions of relativistic nuclei and phase transitions in nuclei and exotic resonances. Study of nuclear multifragmentation processes. The Nuclotron internal target experiments: research using the two-arm EM Calorimeter. Asymptotics in nuclear collisions and nucleon clusters. Development of the data base of the bubble chamber data. Detector development for relativistic heavy-ion experiments at the CERN, BNL and GSI. Investigation of the interactions of nuclei at energy 20-158 GeV on a nucleon on NA61/SHINE experiment (SPS, CERN). Study of hadron production in hadron-nucleus interactions. Use of these data for precise predictions of neutrino fluxes in neutrino oscillation experiments at accelerators. Participation in HADES experimental programs. Obtaining the data on heat generation, neutron multiplication, spectra, fission and radiation capture in the model uranium blanket and target-converter. Studies of transmutation cross sections of radioactive nuclear wastes. Study of fragmentation of light stable and radioactive nuclei with beams of secondary nuclei and data analysis. Study of the properties strong interaction matter.

Expected main results in 2013:

- Continuation of experiments with the internal target at the Nuclotron. Preparation and carrying out of experiments with extracted beams at the Nuclotron. Development of the software for modeling and processing experimental data.
- Participation in realization NA61 project and operation of TOF system for this experiment. Study of hadron production in proton-carbon interactions at 30 GeV in the NA61/SHINE experiment at CERN. Use of these data for improved predictions of neutrino fluxes and precise determination of neutrino oscillation parameters in the T2K experiment in Japan.
- Participation in experimental data taking of $AuAu$ (1.25 GeV) with HADES spectrometer. Furter participation in data analysis of dp (1.25 GeV) and np (3.5 GeV). Application of the new gaseous detectors based on GEM in the field of research material structure.
- Experimental study of the properties of hot nuclei produced in the collisions of the relativistic deuterons with heavy target. Measuring and analysis of the relative velocity correlation functions of pairs of intermediate fragments created in the reaction The elaboration of the trigger system for determination of the total time–scale of hot nucleus disintegration will be done.
- Study of multiparticle dynamics in terms of masses and energies of colliding objects and centrality of interaction. Mathematical modeling of experiments on investigation of the properties of highly excited states of nuclear matter in relativistic nuclear collisions and the mechanism of quark hadronization in the process of pion pair production.
- Search for eta–mesic nuclei formed in pA collisions, the determination of the total cross section of eta–nucleus production in pA collisions and its energy and A–depedence, the construction and production of the neutron detector for this experiment.

- Analysis of 7–prong events in np–interactions using data given an exposure of the 1m H_2 bubble chamber (HBC) of the VBLHEP (JINR) to a quasimonochromatic neutron beam with P_n=5.20 GeV/c with the purpose to investigate 7–quark resonances in the $\Delta^{++}\pi^+\pi^+$ system.
  An investigation of the mechanism of an appearance of σ_0–mesons with m < 1 GeV/c^2 in the $np \to np\pi^+\pi^-$ reaction.
  An investigation of the mechanism of an appearence of 7–quark resonance conditions in the $\pi^-\pi^-$ system fron the reaction $np \to np\pi^+\pi^-$ reaction.
- Search and research of stable dibarions at the Nuclotron.
- Analysis of emulsions irradiated with the nuclear beams $^7Be, ^{10}C, ^{12}N$. Irradiation of emulsions with secondary beams of radioactive ^{11}C. Heavy nucleus exposure.
- Study of nuclear interactions depending on projectile mass and energy with the beams of relativistic nuclei at the Nuclotron and other accelerators with the photo-emulsion method. Study of fragmentation, multifragmentation, multiparticle production together with correlations between them at interaction of nuclei of various energies with photo-emulsion nuclei. Search for collective effects in central nuclear-nuclear collisions in photo-emulsions. Development of the project on further emulsion irradiation with beams of light radioactive nuclei and heavy ions.
- Investigation of the deuteron spin dichroism: measurements of the tensor polarisation of the high energy deuteron beam after interaction with un–polarized target.
- Search and study of new phenomena based on the data obtained using bubble chambers; Theoretical interpretation of these results. Creation of the data base of experimental data and educational programs in the field of relativistic nuclear physics.
- Study of deep subthreshold processe, applied and educational programs at MARUSYA setup. Construction of electromagnetic detector of MARUSYA setup and test channel and corresponding electornics for detector testing.
- Investigations with light and heavy ions for applied research.

List of projects:

Project	Leader	Priority (period of realization)
1. HADES	Yu.V. Zanevsky	1 (2010 – 2015)
2. NA61	A.I. Malakhov	1 (2012 – 2014)
3. FASA-3	V.A. Karnaukhov	1 (2013 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Experiment HADES**	**A.I. Malakhov** **Yu.V. Zanevsky**	Data taking Data analysis
VBLHEP	O.V. Fateev, S.P. Chernenko, C.V. Razin, V.P. Ladygin, A.K. Kurilkin, P.K. Kurilkin, T.A. Vasiliev, A.P. Ierusalimov, V.F. Tchepurnov, A.Yu. Troyan, Yu.A. Troyan, A.V. Belyaev	
BLTP	V.D. Toneev	
DLNP	G.I. Lykasov	

2. **Experiment NA61/SHINE**	**A.I. Malakhov** **G.L. Melkumov** **B.A. Popov** **S.A. Bunyatov**	Data taking Preparation Data analysis
VBLHEP	N. Agagabyan, B. Baatar, D.A. Artyemenkov + 2 students, D.K. Dryablov, A.Yu. Isypov, V.I. Kolesnikov, M.A. Kozhin, D.O. Krivenkov	
DLNP	N.V. Atanov, Yu.P. Ivanov, A.V. Krasnoperov, V.V. Lyubushkin, V.V. Tereshchenko, S.V. Tereshchenko	
3. **Experiment BECQUEREL**	**P.I. Zarubin**	Data taking
VBLHEP	V.V. Rusakova, D.A. Artemenkov, V. Bradnova, N.O. Kornegrutsa, D.O. Krivenkov, P.P. Kattabekov, L.Z. Mamatkulov, P.A. Rukoyatkin	
4. **Project FASA-3**	**V.A. Karnaukhov**	Preparation Data taking
DLNP	S.P. Avdeev, V.V. Kirakosyan, W. Kartch	
FLNR	G.V. Mushinsky, O.V. Strekalovsky	
VBLHEP	P.A. Rukoyatkin	
5. **Search for and study of η–mesic nuclei in pA collisions at the JINR VBLHEP Nuclotron**	**G.A. Sokol** **S.V. Afanasiev**	Preparation Data taking Upgrade
VBLHEP	S.V. Afanasiev + 4 students, Yu.S. Anisimov, V.I. Ivanov, A.S. Artemov, A.F. Elishev, A.Yu. Isypov, Z.A. Igamkulov, D.K. Dryablov, E.B. Plekhanov, V.V. Polyansky, S.S. Sidorin, L.M. Pavlyuchenko, A.M. Lvov, L.V. Kornyushina	
6. **Investigation of the deuteron spin dichroism**	**L.N. Zolin**	Data taking
VBLHEP	A.G. Litvinenko, V.F. Peresedov, A.Yu. Isupov, I.I. Migulina, P.A. Rukoyatkin + 3 pers.	
7. **Search and investigation of new phenomena using information obtained with bubble chambers and their theoretical interpretation. Creation of data base of experimental data and educational programs in the field of relativistic nuclear physics**	**A.A. Baldin** **V.V. Glagolev** **Yu.A. Troyan**	Data analysis
VBLHEP	A.V. Belyaev, V.V. Ilyushchenko, E.B. Plekhanov, A.Yu. Troyan + 2 pers., A.P. Ierusalimov, P.Zh. Aslanyan + 4 pers., S.G. Arakelyan, O.V. Rogachevsky, S.G. Stetsenko	
8. **Investigation of deep subthreshold processes, applied and educational programs at MARUSYA set up**	**A.A. Baldin**	Preparation Data taking

VBLHEP	V.A. Arefiev, P.Zh. Aslanyan, S.V. Afanasiev, A.V. Belyaev, B.N. Guskov, M.G. Kadykov, I.V. Kudashkin, A.I. Kudashkin, E.B. Plekhanov, I.V. Slepnev + 4 pers., S.G. Stetsenko, Yu.A. Troyan, A.Yu. Troyan, A.V. Shabunov, S.S. Shimansky, I.P. Yudin, E.E. Perepelkin, I.G. Voloshina, T.V. Shavrina	
BLTP	V.V. Burov, S.G. Bondarenko	
9. **Investigation with light and heavy ions for applied research**	**A.I. Malakhov**	Realization Preparation Data taking
VBLHEP	N.N. Agapov, Yu.S. Anisimov, A.D. Kovalenko, E.B. Plekhanov	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	ANL
		YSU
Belarus	Minsk	NC PHEP BSU
Bulgaria	Sofia	INRNE BAS
CERN	Geneva	
China	Beijing	IHEP CAS
		CIAE
	Wuhan	CCNU
Czech Republic	Prague	IMC ASCR
	Řež	NPI ASCR
France	Orsay	IPN Orsay
Germany	Darmstadt	TU Darmstadt
		GSI
	Dresden	HZDR
	Frankfurt/Main	Univ.
	Giessen	JLU
	Heidelberg	Univ.
	Munich	TUM
	Siegen	Univ.
Japan	Osaka	RCNP
	Tokyo	UT
	Tsukuba	Univ.
India	Jaipur	Univ.
	Mumbai	BARC
Kazakhstan	Almaty	IPT
Mongolia	Ulaanbaatar	IPT MAS
		NEA
Poland	Krakow	NINP PAS
	Lodz	UL

	Otwock-Swierk	NCBJ
	Warsaw	WUT
Romania	Bucharest	UB
		IFIN-HH
		INCDIE ICPE-CA
		ISS
	Constanţa	UOC
Russia	Moscow	SINP MSU
		LPI RAS
		ITEP
	Moscow, Troitsk	INR RAS
	Chernogolovka	ISMAN RAS
	St. Petersburg	KRI
	Sarov	VNIIEF
Slovak Republic	Bratislava	IP SAS
		SOSMT
	Košice	PJSU
Sweden	Lund	LU
Switzerland	Villigen	PSI
	Geneva	UniGe
	Zurich	ETH
Tajikistan	Dushanbe	TNU
		PHTI ASRT
USA	Berkeley, CA	Berkeley Lab
	Iowa City, IA	UIowa
	Norfolk, VA	NSU
	Upton, NY	BNL
	Williamsburg, VA	W&M
Uzbekistan	Tashkent	Assoc."P.-S." PTI
	Jizzakh	JSPI
	Samarkand	SSU

02–0–1066–2007/2015	Priority: 1

Status: Extended

Investigation of the Properties of Nuclear Matter and Particle Structure at the Collider of Relativistic Nuclei and Polarized Protons (Project STAR at RHIC)

Leaders: R. Lednický
Yu.A. Panebratsev

Participating Countries and International Organizations:

Armenia, Azerbaijan, Czech Republic, France, Germany, Kazakhstan, Russia, Slovak Republic, USA.

Scientific Programme

Investigation of the properties of nuclear matter with extremely high density and temperature, search for the signs of the quark deconfinement and possible phase transitions at the collisions of heavy nuclei at the energies of the Relativistic Heavy Ion Collider (RHIC). Measurement of spin dependent structure functions of nucleons and nuclei using polarized RHIC beams.

Expected main results in 2013:

- The data on heavy ion and polarized proton collisions taken in the STAR experiment at RHIC.
- Study of AuAu, UU, CuCu, and CuU collisions in the energy range 7-200 GeV.
- Measurements of event structure, collective variables, correlation characteristics, femtosopic correlation functions and high P_T processes.
- Measurement and simulation of spin dependent structure functions of nucleons and nuclei.
- Participation in JINR–BNL and JINR–CERN joint educational programs.

List of projects:

Project	Leader	Priority (period of realization)
1. STAR	Yu.A. Panebratsev R. Lednický	1 (2010 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Participation in the spin physics program in STAR experiment at RHIC**	**Yu.A. Panebratsev**	Data taking Data analysis
VBLHEP	M.V. Tokarev, T.G. Dedovich, A.O. Kechechyan, L.G. Efimov, A.N. Zubarev, V.V. Tikhomirov, V.B. Dunin, V.I. Yurevich, D.N. Bogoslavsky, G.A. Yarygin, A.A. Povtoreyko	

2.	**Simulation of physical polarization processes of jet, direct photon and strange particle production in STAR experiment at RHIC**	**M.V. Tokarev**	Realization
	VBLHEP	V.L. Lyuboshits, V.V. Lyuboshits	
	LIT	Zh.Zh. Musulmanbekov	
	BLTP	O.V. Teryaev, A.E. Dorokhov, S.V. Goloskokov	
3.	**The study of event structure, collective effects, femtoscopic correlations and high pT processes**	**R. Lednický** **Yu.A. Panebratsev**	Realization
	VBLHEP	P. Filip, M. Pakhr, M.V. Tokarev, Yu. Fedorishin, S. Vokal, O.V Rogachevsky, A.O. Kechechyan, N.Ya. Tchankova–Bnzarova, T.G. Dedovich, L.G. Efimov, I.–Zh. Bnzarov, G.S. Averichev, E.I. Shakhaliev, V.L. Lyuboshits, V.V. Kyuboshits, G.N. Agakishiev	
	LIT	G.A. Ososkov	
4.	**Participation in the heavy ion program in STAR experiment at RHIC**	**Yu.A. Panebratsev**	Data taking Data processing Data analysis
	VBLHEP	E.V. Potrebenikova, M.V. Tokarev, B.G. Shchinov	
5.	**Participation in JINR–BNL and JINR–CERN joint educational programs**	**Yu.A. Panebratsev** **E.V. Potrebenikova**	Realization
	VBLHEP	V.V. Belaga, N.E. Sidorov, K.V. Klygina, M.S. Stetsenko, P.D. Semchukov, A.V. Shoshin, E.I Golubeva	
	UC	S.Z. Pakulyak, I.A. Smirnova	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	ANL
Azerbaijan	Baku	IRP ANAS
Czech Republic	Prague	CU
	Řež	NRI
France	Nantes	SUBATECH
Germany	Heidelberg	Univ.
Kazakhstan	Almaty	IPT
Russia	Moscow	NNRU "MEPhI"
		ITEP
	Protvino	IHEP
	St. Petersburg	SPbSU
Slovak Republic	Košice	PJSU

USA	Argonne, IL	ANL
	Berkeley, CA	Berkeley Lab
	Detroit, MI	WSU
	Los Angeles, CA	UCLA
	New Haven, CT	Yale Univ.
	University Park, PA	Penn State
	Upton, NY	BNL

02–1–1088–2009/2013	Priority: 1

Status: Approved for completion in 2013

ALICE: Study of Interactions of Heavy Ion and Proton Beams at the LHC

Leader: A.S. Vodopyanov

Participating Countries and International Organizations:

Armenia, Bulgaria, CERN, China, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, India, Italy, Mongolia, Netherlands, Norway, Poland, Republic of Korea, Romania, Russia, Slovak Republic, South Africa, Sweden, Switzerland, Ukraine, United Kingdom, USA.

Scientific Programme

1. Participation in the completion of ALICE setup (Photon spectrometer PHOS, transition radiation detector TRD, assembly of the setup).
2. Realization of experiments at the LHC. Putting into opetration of the ALICE detector.
3. Physics research program at the ALICE detector.
4. Participation in the ALICE detector upgrade (photon spectrometer PHOS).

Expected main results in 2013:

- Participation in shifts for testing of detectors and data taking.
- Participation in the R&D for the upgrade of photon spectrometer PHOS.
- Participation in the physics project preparation. Physics simulation of heavy ions and protons interactions at LHC energies.
- Data analysis. Preparation of publications.
- Analysis of Cherenkov radiation data and preparation of publications.
- Participation at testing and integration of transition radiation detectors into ALICE.
- Upgrade, testing and supporting of GRID.

List of projects:

Project	Leader	Priority (period of realization)
1. ALICE	A.S. Vodopyanov	1 (2010 – 2014)
2. R&D for the ALICE Photon Spectrometer	A.S. Vodopyanov	1 (2010 – 2013)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Dipole magnet**	**A.S. Vodopyanov**	Realization
VBLHEP	A.A. Efremov, E.K. Koshurnikov, Yu.Yu. Lobanov, A.F. Makarov	

2.	**Particle detectors**	**A.S. Vodopyanov**	Realization
	VBLHEP	V.I. Astakhov, V.A. Arefiev, V.H. Dodokhov, P.V. Nomokonov, V.A. Budilov, N.A. Kuzmin	
	DLNP		
3.	**Physical process simulation and research programme**	**B.V. Batyunya**	Realization
	VBLHEP	M.Yu. Barabanov, Yu.A Belikov, M. Valya, S.S. Grigoryan, S.A. Zaporozhets, A.Yu. Isupov, A.G. Litvinenko, V.L. Lyuboshits, L.V. Malinina, I.I. Migulina, P.V. Nomokonov, T.A. Pocheptsov, E.B. Plekhanov, E.P. Rogachya, M.O. Suleymanov, A.G. Fedunov, G.S. Shabratova, Ya. Mushinski, K.P. Mikhaylov	
	DLNP	G.I. Lykasov	
	LIT	R.M. Yamaleev	
	BLTP	V.G. Kadyshevsky, A.V. Sidorov	
4.	**ALICE Computing in the distributed environment– GRID**	**A.S. Vodopyanov** **G.S. Shabratova**	Realization
	VBLHEP	B.V. Batyunya, S.A. Zaporozhets, T.A. Pocheptsov, M. Valya, A.G. Fedunov, B.G. Shchinov, G.G. Stiforo, G.S. Shabratova + 2 students (A.O. Kondrat'ev, A.S. Schelachyev)	
	LIT	V.V. Mitsyn, L. Val'ova	
5.	**Cherenkov radiation studies**	**A.S. Vodopyanov**	Data analysis
	DLNP		
6.	**Transition radiation detector**	**Yu.V. Zanevsky** **A.I. Malakhov**	Realization
	VBLHEP	L.G. Efimov, E.M. Kislov, Yu.A. Panebratsev, C.V. Razin, M.F. Tokarev, O.V. Fateev, V.F. Chepurnov, G.A. Cheremukhina, S.P. Chernenko, V.I. Yudin	
	BLTP	D. Blaschke	
7.	**Photon Spectrometer PHOS**	**A.S. Vodopyanov** **P.V. Nomokonov**	Realization
	VBLHEP	V.A. Budilov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	ANL
Bulgaria	Sofia	SU
CERN	Geneva	
China	Beijing	CIAE
	Wuhan	CCNU

Croatia	Zagreb	RBI
Czech Republic	Prague	IP ASCR
	Řež	NRI
Denmark	Copenhagen	NBI
France	Clermont-Ferrand	LPC-CF
	Lyon	UCBL
	Nantes	SUBATECH
	Orsay	IPN Orsay
	Saclay	IRFU
	Strasbourg	CRN
Germany	Darmstadt	GSI
	Heidelberg	Univ.
	Frankfurt/Main	Univ.
	Marburg	Univ.
	Münster	Univ.
Greece	Athens	UoA
Hungary	Budapest	Wigner RCP
India	Aligarh	AMU
	Bhubaneshwar	IOP
	Calcutta	VECC
		SINP
	Chandigarh	PU
	Jammu	Univ.
Italy	Bari	INFN
	Bologna	INFN
	Cagliari	INFN
	Catania	UniCT
	Legnaro	INFN LNL
	Padua	INFN
	Rome	INFN
	Salerno	INFN
	Turin	INFN
	Vercelli	UPO
Mongolia	Ulaanbaatar	IPT MAS
Netherlands	Amsterdam	NIKHEF
	Utrecht	UU
Norway	Bergen	UiB
	Oslo	UiO
Poland	Krakow	NINP PAS
	Warsaw	ETI
		WUT
	Otwock-Swierk	NCBJ
Republic of Korea	Gangneung	GWNU
Romania	Bucharest	ISS
Russia	Gatchina	PNPI

	Moscow	ITEP
		NNRU "MEPhI"
		NRC KI
		SINP MSU
	Moscow, Troitsk	INR RAS
	Novosibirsk	BINP SB RAS
	Protvino	IHEP
	Sarov	VNIIEF
	St. Petersburg	SPbSU
Slovak Republic	Bratislava	CU
	Košice	PJSU
South Africa	Cape Town	UCT
Sweden	Lund	LU
Switzerland	Lausanne	EPFL
United Kingdom	Birmingham	Univ.
Ukraine	Kharkov	KFTI NASU
	Kiev	BITP NASU
USA	Columbus, OH	OSU
	Oak Ridge, TN	ORNL

02–1–1107–2011/2013	Priority: 1

Status: Approved for completion in 2013

Development and Construction of the Prototype of a Complex for Radiotherapy and Applied Research with Heavy-Ion Beams at the Nuclotron-M

Leaders: S.I. Tyutyunnikov
J. Ružička
M.G. Kadykov

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Bulgaria, Czech Republic, India, Germany, Greece, Kazakhstan, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovak Republic, Ukraine.

Scientific Programme

The development new equipment for ion beam raster scanning. Investigation of some new aspects of radioactive waste transmutation and nuclear energy production. Investigation of thermal and hydrodynamics regimes for nuclear facilities.

Expected main results:

- Calculations and construction of the fast scanning system of this beam in XY–directions, manufacture and adjustment of the diagnostic equipment for the control of energy and spatial characteristics of carbon beam.
- Investigation of the physical characteristics of the assemblies: "a lead target plus grafit moderator" (set-up "Gamma–3"), a massive uranium target with a lead reflector – (set-up "Quinta"), a quasi infinite uranium target at energies of proton and deuteron beams in the interval from 0.6 up to 12.0 GeV from the Nuclotron. Data on the multiplicities and special distribution of energy–time spectra of neutrons. Investigation of possibilities of energy production and processing of radioactive waste on massive target of natural (depleted) uranium and thorium based on the basic principles of nuclear technology.
- Construction of superconducting elements for monitoring systems.

Expected main results in 2013:

- Engineering of the system for spatial monitoring of the carbon beam on the target in real time mode, construction of the model of this system and its test on the Nuclotron–M beam.
- Development and manufacturing of detector prototypes for measurement of carbon ion energy in the range E=100–250 MeV/n.
- Development of cryogenic metrological complex in VBLHEP:
  - Maintaining of cryogenic metrological complex in working condition;
  - Development of an innovative two–phase flow void fraction meter of helium;
  - Development of hardware and software to measure two–phase flows of helium.
- Study on the model structures of the efficiency of heating by microwave radiation FEL ferromagnetic nano–clusters of cobalt with a view to their possible use to destroy cancer cells.
- Study of generation and multiplication of neutrons in heavy targets (Pb and U) under irradiation by proton and deutron beams of the Nuclotron within the energy interval (0.6–12.0) GeV. Data taking on neutron energy spectra and their spatial distribution and radioactive waste transmutation rates in uranium

and lead targets with uranium blanket (set-up "Quinta") and in a lead target witn graphite moderator ("Gamma–3" set-up). Study of transmutation characteristics of highly toxic long–lived radioactive waste products (^{129}I, ^{237}Np, ^{238}Pu, ^{239}Pu and ^{241}Am) in neutron field of above mentioned targets.

- Study of structual material properties in neutron fields.
- Development of technical specifications and conduct a second stage of the design work to create experimental setup "Buran", based on the quasi–infinite depleted uranium target with mass of about 21 tonns.

List of projects:

	Project	Leader	Priority (period of realization)
1.	Study of deep subcritical electronuclear systems and feasibility of their application for energy production and radioactive waste transmutation	S.I. Tyutyunnikov	1 (2011 – 2013)

List of activities:

	Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1.	**Research and development of the system prototype for 2D scanning of carbon ion beam**	**A.V. Vishnevsky** **I.P. Yudin**	Realization
	VBLHEP	A.P. Sergeev, G.V. Dolbilov	
2.	**Development and manufacturing of two–dimensional detector, system for spatial monitoring of carbon ion beam in real time mode and creation of beam control systems in the scanning mode. Development of prototype for automated three–dimensional scanning beam**	**V.A. Vishnevsky** **N.I. Zamyatin**	Realization
	VBLHEP	A.V. Pilyar, A.V. Cheryemukhin, S.V. Khabarov	
3.	**Research of efficiency of biological cell destruction in metal nano-clusters of various structure by microwave heating. Study of its properties in dependence on duration and power of radiation spectrum**	**S.I. Tyutyunnikov** **S.N. Sedykh** **E.A. Perelshtein** **V.N. Shalyapin**	Realization
	VBLHEP	A.K. Kaminsky, I.A. Kryachko, V.V. Efimov, Yu.S. Kovalev, V. Dzhavadova	
4.	**Study of neutron generation and transmutation rates in heavy targets under proton and deuteron irradiation with the beam energy up to 6 GeV. Study of structual changes of materials in the neutron fields**	**M.G. Kadykov** **V.S. Pronskikh** **A.A. Baldin**	Data taking Data processing Upgrade

VBLHEP	N.M. Vladimirova, E.V. Kostyukhov, A.M. Makan'kin, I.I. Mar'in, I.V. Kudashkin, E.M. Pavlyuk, M. Paraypan, S.E. Vasil'ev, A.V. Vishnevsky, N.I. Zamyatin	
DLNP	J. Adam, V.M. Tsupko–Sitnikov, A.A. Solnyshkin, Zh. Hushvaktov	
LRB	V.Yu. Shchegolev	
FLNP	N.A. Gundorin, Yu.N. Kopatch, V.I. Furman	
LIT	A. Polansky, A.N. Sosnin	
RFMD	B.A. Shestakov, N.N. Kalyakin + 2 pers.	
5. **Construction of elements for monitoring of superconducting systems**	**Yu.P. Filippov**	Realization
VBLHEP	K.S. Panferov, I.D. Kakorin + 6 pers.	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	YSU
Australia	Sydney	Univ.
Belarus	Minsk	JIPNR-Sosny NASB IP NASB SPMRC NASB
Bulgaria	Sofia	INRNE BAS
Czech Republic	Řež	NRI
	Brno	BUT
	Prague	CTU
Germany	Darmstadt	TU Darmstadt
	Marburg	Univ.
	Jülich	FZJ
Greece	Thessaloniki	AUTH
India	Mumbai	BARC
	Jaipur	Univ.
Kazakhstan	Almaty	IPT INP NNC RK
Moldova	Chişinău	IAP ASM
Mongolia	Ulaanbaatar	IPT MAS
Poland	Warsaw	WUT
	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
Russia	Moscow	Atomenergomach
	Dubna	BSINP MSU IAS "Omega"

	Obninsk	MRRC
		IPPE
	St. Petersburg	KRI
	Tomsk	TPU
Romania	Bucharest	ISS
		UMF
		INCDIE ICPE-CA
	Iaşi	UAIC
Serbia	Belgrade	INS "VINČA"
Slovak Republic	Bratislava	SOSMT
		CU
Ukraine	Kharkov	KFTI NASU
	Uzhgorod	UNU

Nuclear Physics (03)

03–5–1094–2010/2014	Priority: 1

Status: In-progress

Synthesis and Properties of Nuclei at the Stability Limits

Leader: M.G. Itkis
Scientific leader: Yu.Ts. Oganessian

Participating Countries and International Organizations:

Belgium, Bulgaria, China, Czech Republic, Cuba, Finland, France, Germany, Hungary, Egypt, India, Italy, Japan, Kazakhstan, Mongolia, Poland, Romania, Russia, Serbia, Slovak Republic, South Africa, Spain, Switzerland, Sweden, Ukraine, United Kingdom, USA.

Scientific Programme

Synthesis and investigation of properties of nuclei at stability limits. Research into the mechanisms of heavy-ion induced reactions. The study of physical and chemical properties of heavy and superheavy elements.

Expected main results in 2013:

- Completion of the experiments on synthesis of the element 117 in the reaction ^{48}Ca + ^{249}Bk, data processing and analysis of results. Carrying out experiments on the synthesis of superheavy nuclei with Z>115 in the reactions with ions ^{48}Ca.
- Carrying out nuclear spectroscopy experiments for the isotopes of transfermium elements No, Md и Rf in asymmetrsic complete fusion reactions using modernized separator VASSILISSA + GABRIELA. Study of survival probabilities of compound nuclei with extremely high (more than 400 MeV) excitation energies.
- Carrying out experiments on chemical identification of the element 113.
- Measurements of isotope masses of the element 112 at the separator MASHA in the reaction ^{48}Ca + ^{238}U.
- Production and investigation of the properties of new neutron-rich heavy nuclei obtained in the transfer reactions. Study of exotic fission modes for heavy and superheavy nuclei..
- Research of the structure of light nuclei ^{9}He, ^{16,17}Ne, ^{27}S with the use of radioactive beams and a tritium target.
- Experimental studies of the excitation functions for cluster transfer reactions and for total reaction cross-sections with the d, ^{6,7}Li,^{12}C, ^{48}Ca beams. Creation of detection system based on the drift chamber for the magnetic spectrometer.
- Theoretical study of the mechanisms of heavy ion induced reactions.
- Development of the knowledge base on nuclear physics within the global computer network.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Synthesis of new elements at the gas-filled separator** FLNR	**V.K. Utyonkov** F.Sh. Abdullin, A.A. Voinov, A.M. Zubareva, V.I. Krashonkin, A.N. Polyakov, R.N. Sagaidak, V.G. Subbotin, A.M. Sukhov, Yu.S. Tsyganov, I.V. Shirokovsky	Data taking

2. **α-, β- and γ- spectroscopy of heavy nuclei at the separator VASSILISSA** — **A.V. Yeremin** — Data taking

FLNR: O.N. Malyshev, A.I. Svirikhin, I.N. Izosimov, V.I. Chepigin, M.L. Chelnokov, A.V. Isaev, I.M. Merkin, A.N. Kuznetsov, A.A. Kuznetsova, A.G. Popeko, E.A. Sokol, D.E. Katrasev, V.A. Sbitnev, V.M. Popov

3. **Chemical properties of heavy nuclides** — **S.N. Dmitriev** — Data taking

FLNR: V.Ya. Lebedev, N.V. Aksenov, Yu.V. Albin, G.A. Bozhikov, V.I. Vakatov, M.G. Voronyuk, G.K. Vostokin, I. Zvara, E.V. Krasnoyarova, Ch.G. Kim, K.V. Lebedev, O.V. Petrushkin, A.Yu. Prokhorova, A.V. Rykhlyuk, A.V. Sabelnikova, G.Ya. Starodub, E.E. Tereshatov

4. **Experiments at the separator MASHA. Laser spectroscopy of nuclei** — **A.M. Rodin** — Data taking

FLNR: L. Krupa, A.V. Belozerov, D.V. Vanin, A.V. Guljaeva, V.S. Salamatin, I. Sivachek, S.V. Stepantsov, S.A. Yukhimchuk, S.L. Bogomolov, S.G. Zemlyanoy, B.N. Gikal, A.V. Eremin

5. **The study of the processes of fission, quasifission and multinucleon transfer reactions. CORSET-DEMON, CORSAR, MiniFOBOS** — **M.G. Itkis** — Data taking

FLNR: E.M. Kozulin, A.A. Bogachev, V.V. Volkov, Yu.M. Itkis, T.F. Loktev, G.N. Knyazheva, A.G. Knyazev, N.I. Kozulina, I.V. Lebedev, K.V. Novikov, E.A. Rasinkov, O.V. Rudakov, S.U. Smirnov, D.V. Kamanin, I.A. Alexandrova, A.A. Alexandrov, V.E. Zhuchko, N.A. Kondratyev, E.A. Kuznetsova, Yu.V. Pyatkov, Yu.B. Semenov, A.O. Strekalovsky, O.V. Strekalovskiy, O.V. Falomkina

6. **Study of the structure of light nuclei near and beyond the drip line. Fragment-separator ACCULINNA, COMBAS** — **A.S. Fomichev** — Data taking

FLNR: G.M. Ter-Akopian, M.S. Golovkov, L.V. Grigorenko, A.V. Gorshkov, V.A. Gorshkov, S.A. Krupko, A.A. Bezbakh, Yu.L. Parfenova, S.I. Sidorchuk, R.S. Slepnev, G. Kaminsky, V. Chudoba, R. Wolski, P.G. Sharov, P. Jaluvkova, S. Enhbold, Yu.M. Sereda, A.G. Artukh, A.N. Vorontsov, S.A. Klygin, G.A. Kononenko, D.A. Kislukha, N.A. Tarantin, E. Batchuluun

LTP: S.N. Ershov, I.A. Egorova

7. **Reactions induced by stable and radioactive ion beams leading to the formation of exotic nuclei** — **Yu.E. Penionzhkevich** — Data taking

FLNR — S.M. Lukyanov, R.A. Astabatyan, G.F. Isaev, E.A. Voskoboinik, E.R. Markaryan, V.A. Maslov, N.K. Skobelev, Yu.G. Sobolev, M.P. Ivanov, Z.D. Pokrovskay, R.V. Revenko, D.A. Testov, V.I. Smirnov

8. **Theoretical study of mechanisms of heavy ion induced reactions** — **V.I. Zagrebaev**

FLNR — A.V. Karpov, A.S. Denikin, V.V. Samarin, Y Aritomo, E.A. Cherepanov, Yu.A. Muzichka, V.A. Rachkov, M.A. Naumenko

9. **Development and maintenance of the knowledge base on nuclear physics within the Internet** — **V.I. Zagrebaev** — Data taking

FLNR — A.V. Karpov, A.S. Denikin, V.V. Samarin, V.A. Rachkov, M.A. Naumenko

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	JIPNR-Sosny
		NASB
Belgium	Brussels	ULB
Bulgaria	Sofia	INRNE BAS
China	Beijing	PKU
Czech Republic	Prague	VP
		CTU
	Řež	NPI ASCR
Cuba	Havana	HITAS
Egypt	Giza	CU
Finland	Jyväskylä	UJ
France	Caen	GANIL
	Orsay	CSNSM
		IPN Orsay
	Saclay	SPhN CEA
		DAPNIA
	Strasbourg	CRN
		IPHC
Germany	Berlin	HZB
	Darmstadt	GSI
	Frankfurt/Main	Univ.
	Tübingen	Univ.
Hungary	Debrecen	UD
India	Manipal	MU
	New Delhi	IUAC

Italy	Catania	INFN LNS
	Legnaro	INFN LNL
	Messina	UniMe
	Naples	UNINA
Japan	Tokai	JAEA
	Wako	RIKEN
Kazakhstan	Almaty	INP NNC RK
	Astana	ENU
Mongolia	Ulaanbaatar	NUM
Poland	Warsaw	UW
	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
	Poznan	AMU
Romania	Bucharest	IFIN-HH
Russia	Moscow	GEOKHI RAS
		IPCE RAS
		MSU
		NNRU "MEPhI"
		MUCTR
		NRC KI
		SINP MSU
	Moscow, Troitsk	INR RAS
	Moscow, Zelenograd	RIMST
	Cheboksary	ChSU
	Dimitrovgrad	RIAR
	Gatchina	PNPI
	Obninsk	IPPE
	Sarov	VNIIEF
	St. Petersburg	KRI
		IPTI RAS
		SPbSU
		ITMO
	Voronezh	VSU
Serbia	Belgrade	INS "VINČA"
Slovak Republic	Bratislava	CU
		IP SAS
South Africa	Stellenbosch	SU
	Cape Town	iThemba LABS
	Pretoria	Unisa
Spain	Huelva	UH
	Madrid	CSIC
Switzerland	Villigen	PSI
Sweden	Goteborg	Chalmers
Ukraine	Kiev	KINR NASU
United Kingdom	Surrey	Univ.

USA	Argonne, IL	ANL
	Berkeley, CA	Berkeley Lab
	College Station, TX	Texas A&M
	East Lansing, MI	MSU
	Livermore, CA	LLNL
	Nashville, TN	VU
	Oak Ridge, TN	ORNL

03–0–1095–2010/2014	Priority: 1
	Status: In-progress

Accelerator Complex of Ion Beams of Stable and Radioactive Nuclides (DRIBs-III)

Leaders: G.G. Gulbekyan
S.N. Dmitriev
M.G. Itkis

Scientific leader: Yu.Ts. Oganessian

Participating Countries and International Organizations:

Belgium, Bulgaria, China, Czech Republic, Democratic People's Republic of Korea, Egypt, France, Germany, Italy, Kazakhstan, Mongolia, Poland, Romania, Russia, Serbia, Slovak Republic, South Africa, Ukraine, Uzbekistan.

Scientific Programme

Development of the FLNR cyclotron complex including a drastic extension of the experimental base of the Laboratory, development of accelerator systems in order to increase the intensity and improve the quality of beams of stable and radioactive niclides in the energy range from 5 to 100 MeV/nucleon, as well as for the raising stability of the cyclotron operation and reducing their power consumption.

Expected results in 2013:

- Carrying out experiments with beams of ^{48}Ca at the cyclotron U400.
- Carrying out experiments with beams of intermediate mass ions of the energy of 6 - 15 MeV/nucleon at the cyclotron U400M.
- Development of the high effective technology of gaining intense ion beams of Ti and Fe from the ion sources.
- Assortment of the main systems for the modernization of the cyclotron U400R.
- Carrying out of experiments with beams of the upgraded microtron MT25.
- Optimization of low-energy (<10 MeV) beam extraction from the microtron MT25.
- Development and testing of new methods intended for the diagnostics of the beams of stable and radioactive nuclides.
- Optimization of the transport systems of beams of stable and radioactive nuclides.
- Carrying out experiments with radioactive beams at the accelerators U400M and MT-25.
- Development of a new experimental hall, beam transportation systems, a high current accelerator and technical support systems.
- Development of a new fragment separator ACCULINNA-2.
- Modernization of the separator VASSILISSA, creation of a new facility - the velocity filter.
- Development of the requirement documentation to design a new gas-filled separator.
- Development of a gas catcher.
- Development of a new separating facility based on stopping the reaction products in gas and their laser ionization.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Development of the Complex of U400M and U400R**	**B.N. Gikal**	Preparation Data taking
FLNR	P.G. Bondarenko, S.L. Bogomolov, L.N. Gusev, G.N. Ivanov, S.V. Pashenko, M.V. Habarov, I.V. Kalagin	
LIT	V.V. Korenkov, P.G. Akishin, E.A. Airian	
DLNP	S.B. Vorozhtsov	
LRB	V.E. Aleynikov	
2. **ECR-ion sources development**	**S.L. Bogomolov**	Preparation
FLNR	A.A. Efremov, G.N. Ivanov, V.Ya. Lebedev	
VBLHEP	E.D. Donets, V.M. Drobin	
3. **MT25 microtron development**	**Yu.G. Teterev**	Preparation Data taking
FLNR	A.G. Belov, N.A. Kozlenko, S.V. Pashenko, M.V. Habarov, N.F. Osipov	
4. **Creation of the new experimental hall in FLNR**	**G.G. Gulbekian**	Preparation
FLNR	B.N. Gikal, V.A. Kostyrev, N.F. Osipov, P.G. Bondarenko, S.L. Bogomolov, L.N. Gusev, S.V. Pashenko, M.V. Habarov, I.V. Kalagin, V.A. Verevochkin	
5. **Development of the project ACCULINNA-2**	**A.S. Fomichev**	Preparation
FLNR	S.A. Krupko, A.V. Gorshkov, V.A. Gorshkov, G.M. Ter-Akopian, A.A. Bezbakh, Yu.L. Parfenova, S.I. Sidorchuk, R.S. Slepnev, G. Kaminsky, V. Chudoba, R. Wolski, M.S. Golovkov	
6. **Modernization of the separator VASSILISSA**	**A.V. Eremin**	Preparation
FLNR	O.N. Malyshev, A.I. Svirikhin, I.N. Izosimov, V.I. Chepigin, M.L. Chelnokov, A.V. Isaev, I.M. Merkin, A.N. Kuznetsov, E.A. Sokol, D.E. Katrasev, V.A. Sbitnev, V.M. Popov	
7. **Development of the gas catcher project**	**A.M. Rodin**	Preparation
FLNR	L. Krupa, A.V. Belozerov, D.V. Vanin, A.V. Guljaeva, V.S. Salamatin, I. Sivachek, S.V. Stepantsov, S.A. Yukhimchuk	
8. **Development of the project of a new gas-filled separator**	**A.G. Popeko**	Preparation

FLNR	O.N. Malyshev, A.I. Svirikhin, A.V. Eremin, A.V. Isaev, D.V. Vanin	
9. **Development of the project of a separator based on resonance laser ionization**	**V.I. Zagrebaev**	Preparation
FLNR	S.G. Zemlynoy, V.I. Zhemenik, G.V. Myshinskiy, E.M. Kozulin	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Belgium	Leuven	K.U.Leuven
	Louvain-la-Neuve	IBA
Bulgaria	Sofia	LTD BAS
		INRNE BAS
China	Lanzhou	IMP CAS
Czech Republic	Prague	VP
		CU
	Řež	NPI ASCR
Democratic People's Republic of Korea	Pyongyang	IFR SCNR
Egypt	Cairo	AASTMT
France	Caen	GANIL
	Grenoble	LPSC
	Orsay	IPN Orsay
Germany	Darmstadt	GSI
Italy	Catania	INFN LNS
Kazakhstan	Almaty	INP NNC RK
	Astana	BA INP NNC RK
Mongolia	Ulaanbaatar	NRC NUM
Poland	Krakow	NINP PAS
	Warsaw	UW
Romania	Bucharest	IFIN-HH
		N&V
Russia	Moscow	GPI RAS
		ITEP
	Nizhny Novgorod	IAP RAS
	Novosibirsk	BINP SB RAS
	Sarov	VNIIEF
	St. Petersburg	NIIEFA
	Vladimir	ELMAG
Serbia	Belgrade	INS "VINČA"
Slovak Republic	Bratislava	IMS SAS
South Africa	Cape Town	iThemba LABS
Ukraine	Kiev	KINR NASU
Uzbekistan	Samarkand	SSU

03–2–1100–2010/2015	Priority: 1
	Status: Extended

Non-Accelerator Neutrino Physics and Astrophysics

Leaders: V.B. Brudanin
A. Kovalik

Participating Countries and International Organizations:

Armenia, Belarus, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovak Republic, Ukraine, USA, Uzbekistan.

Scientific Programme

Search for and investigation of double-neutrino and neutrinoless modes of double beta-decay, clarification of the Majorana neutrino nature, absolute neutrino mass scale and hierarchies. Search for the neutrino magnetic moment and dark matter. Investigation of galactic and extragalactic neutrino sources, diffusive neutrino cosmic background, search for exotic particles (monopoles). Application of the neutrino detector for a distant investigation of process inside of the reactor core of Kalininskaya Nuclear Power Plant. Search for sterile neutrinos. Spectroscopy of nuclei far from stability. Development of new methods for charged and neutral particle detection.

Expected main results in 2013:

- Data taking in the 2β-decay measurements of ^{150}Nd, ^{116}Cd, ^{106}Cd, ^{100}Mo, ^{96}Zr, ^{82}Se, ^{48}Ca with the NEMO, TGV and GERDA spectrometers.
- Processing of experimental data and determination of $T_{1/2}(2\beta 2\nu)$ for ^{100}Mo, ^{82}Se and ^{76}Ge.
- Data taking with the GEMMA-II spectrometer at the Kalinin Nuclear Power Plant; getting an upper limit for the neutrino magnetic moment at the level of $\sim 2 \cdot 10^{-11}\ \mu_B$.
- In the EDELWEISS experiment a number of innovative improvements in the setup and detector's performances will be implemented. Forty of FID800 detectors will cumulative fiducial mass 24 kg will be installed in the upgraded EDELWEISS setup.The upgrade implies improved cryogenics, new cabling, installation of additional polyethelyne shield between the lead layer and the cryostat, supplementary muon veto modules, use of the new integrated DAQ and electronics, e.g. implemention of fast ionization channel with 40 MS/s. The goal of the project is to reach a WIMP-nucleon scattering cross-section sensitivity of $5 \cdot 10^{-45}$ cm^2. The detector research and development on longer term aims to reach a few 100 eV thresholds on both ionization and heat channels.
- Research and development of the semiconductor-based detecting systems for the GERDA and MAJORANA experiments. Beginning of data taking in the experiment on the search for the ^{76}Ge $2\beta 0\nu$-decay.
- Mounting of the NT1000 prototype string. Data taking and extraction of physical results with the NT200+ spectrometer.
- Investigation of the astrophysical S-factor and effective dd cross section in the 2–7 keV impact energy for the D_2O target.
- Investigation of KLL and KMM Auger electrons in ^{65}Zn, ^{67}Cu, ^{67}Ga and ^{152,154,155}Eu decays.
- Design and creation of the low-threshold (~ 200 eV) HPGe detector. Production of low-background plastic scintillators for the Super NEMO experiment.
- Design and creation of the reactor antineutrino detector DANSS.

List of projects:

Project	Leader	Priority (period of realization)
1. SuperNEMO	O.I. Kochetov	1 (2013 – 2015)
2. GEMMA–II	V.B. Brudanin	1 (2010 – 2015)
3. EDELWEISS–II	E.A. Yakushev	1 (2010 – 2015)
4. G&M (GERDA)	A.A. Smolnikov	1 (2010 – 2015)
5. BAIKAL	I.A. Belolaptikov	1 (2009 – 2015)
6. DANSS	V.B. Brudanin V.G. Egorov	1 (2011 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **SuperNEMO Project**	**O.I. Kochetov**	Data taking
DLNP	V.A. Bednyakov, V.E. Kovalenko, V.V. Timkin, V.I., Tretyak, F. Mamedov, I. Shermak	
BLTP	F. Simkovic	
2. **TGV Project**	**N.I. Rukhadze** **I. Shtekl**	Data taking
DLNP	V.G. Sandukovsky, I. Shtekl, F. Mamedov, I. Shermak	
BLTP	F. Simkovic	
3. **G&M (GERDA–MAJORANA Project)**	**A.A. Smolnikov** **K.N. Gusev**	Preparation Data taking
DLNP	V.G. Sandukovsky, V.B. Brudanin, A.A. Klimenko, D.R. Zinatulina, E.A. Shevchik, I.V. Zhitnikov, F. Mamedov, I. Shermak	
BLTP	F. Simkovic	
4. **GEMMA–II Project**	**V.G. Egorov**	Preparation Data taking
DLNP	V.B. Brudanin, D.V. Medvedev, N.S. Rumyantseva, M.V. Fomina	
FLNR	E.A. Sokol	
5. **EDELWEISS–II Project**	**E.A. Yakushev**	Data taking
DLNP	V.A. Bednyakov, S.V. Rozov, L.L. Perevoshchikov, D.V. Filosofov, A.V. Lubashevsky	
6. **BAIKAL Project**	**I.A. Belolaptikov**	Preparation Data taking
DLNP	I.A. Belolaptikov, V.B. Brudanin, K.V. Konishev, E.N. Pliskovski, B.A. Shaibonov, F.F. Sheifler	

7. **DANSS Project**	**V.B. Brudanin**	Preparation
DLNP	V.G. Egorov, D.R. Zinatulina, E.A. Shevchik, I.V. Zhitnikov, I.E. Smirnova, N.S. Rumyantseva, M.V Fominaa	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	YSU
Belarus	Minsk	NC PHEP BSU
Belgium	Leuven	K.U.Leuven
Bulgaria	Sofia	INRNE BAS
	Plovdiv	PU
Czech Republic	Prague	CTU
	Řež	NRI
Finland	Jyväskylä	UJ
France	Orsay	CSNSM
		LAL
Germany	Heidelberg	MPIK
	Mainz	JGU
Kazakhstan	Almaty	INP NNC RK
Mongolia	Ulaanbaatar	NRC NUM
		NEA
Poland	Krakow	NINP PAS
		AGH
	Lublin	MCSU
	Otwock-Swierk	NCBJ
Romania	Bucharest	IFIN - HH
		UB
Russia	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Voronezh	VSU
	Moscow	NRC KI
		VNIINM
		NNRU "MEPhI"
		LPI RAS
		ITEP
		SINP MSU
		INTRA
		RADON
	Sarov	VNIIEF
	St. Petersburg	SPbSU
		IPTI RAS
	Tomsk	NPI TPU
		IHCE SB RAS

Slovak Republic	Bratislava	CU
		IP SAS
Ukraine	Kiev	KINR NASU
	Kharkov	ISC NASU
USA	Irvine, CA	UCI
Uzbekistan	Tashkent	INP UAS
		IAP NUU
	Samarkand	SSU

03–2–1101–2010/2015	Priority: 1
	Status: Extended

Physics of Light Mesons

Leader:

A.V. Kulikov

Participating Countries and International Organizations:

Belarus, Bulgaria, Croatia, Canada, Czech Republic, Georgia, Germany, Italy, Kazakhstan, Netherlands, Poland, Romania, Russia, Switzerland, USA, Uzbekistan, Japan.

Scientific Programme

Investigation of strong, weak and electromagnetic interactions of elementary particles and light nuclei at intermediate energies with the aim of determining symmetries and dynamics of the interactions. Development and construction of setups for experiments at accelerators (JINR phasotron, PSI meson factory, COSY proton synchrotron) for obtaining new information and testing the present theoretical views in the topics. Development of projects for new experiments and experimental methods for intermediate–energy physics.

Expected main results in 2013:

- Processing of the experimental data for decays $\mu^+ \to e^+\gamma$ and $\pi \to e\nu$.
- Preliminary analysis of the process $\vec{p}d \to (pp)_s p\pi$ measured with a polarized beam. Measurements of the reaction $\vec{d}\vec{p} \to (pp)_s$n, at COSY.
- Data taking for $p+t$ fusion reaction using the muon catalysis method. Determination of yields of different reaction channels.
- Determination of branching ratios for reaction channels of pion interactions with the helium nucleus at incident pion energies 68 MeV, including the reaction channel with emission of a photon and the channel with Δ–isobar production. Estimation of the muon neutrino mass from π decay events; performing runs at the LNP phasotron.
- Study of the influence of the impurities on the acceptor parameters in the diamond–like and wide-gap semiconductors. Study of the properties of superparamagnetic ferritic nanoparticles in a non-magnetic matrices.
- Measurement of transverse asymmetries T and F in η photoproduction in the region of the S11(1535) resonance (circularly polarized photon beam and transversely polarized proton target)(GDH)
- Experiments with the "Active Target" (GDH)
- Measurement of A_N for the inclusive and exclusive reactions $\pi^- p \to \omega(782)\eta$ and $\pi^- p \to \eta'(958)$n.
- R&D on crystals for use in the experiment on $\mu - e$ conversion.

List of projects:

Project	Leader	Priority (period of realization)
1. SPRING	A.V. Kulikov	1 (2010 – 2015)
2. MEG–PEN	N.A. Kuchinskiy	1 (2010 – 2015)
3. MUON	V.N. Duginov	1 (2011 – 2013)
4. TRITON	D.L. Demin	1 (2011 – 2013)
5. GDH&SPASCHARM	Yu. Usov A. Kovalik	1 (2011 – 2013)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **MEG–PEN Project**	**N.A. Kuchinskiy**	Preparation Data taking
DLNP	V.A. Baranov, V.A. Kalinnikov, N.V. Khomutov, A.S. Korenchenko, S.M. Korenchenko, N.P. Kravchuk, E.S Kuzmin, A.S. Moiseenko, A.M. Rozhdestvensky, Z. Tsamalaidze, E.P. Velicheva, V.P. Volnykh, A.S. Khrykin	
2. **SPRING Project**	**A.V. Kulikov**	Data taking Data analysis
DLNP	V.I. Komarov, Yu.N. Uzikov, A.D. Volkov, O. Imambekov, G. Macharashvili, N. Kadaridze, S.N. Dymov, V.V. Shmakova, T.I. Azaryan, V.S. Kurbatov, D.A Tsirkov, M.V. Zhabitsky, Yu.V. Prokofichev	
3. **Experiment PAINUC**	**N.A. Russakovich** **G. Piragino**	Data taking Data analysis
DLNP	G.B. Pontecorvo, V.I. Lyashenko, N.S. Angelov, Yu.A. Batusov, P.N. Batyuk, I.A. Belolaptikov, T.D. Blokhintseva, A.V. Demyanov, V.A. Drozdov, V.N. Frolov, V.M. Grebenyuk, V.V Ivanov, V.E. Kovalenko, A.S. Moiseenko, A.M. Rozhdestvensky, S.A. Gustov	
LIT	V.V. Ivanov, S.A. Baginyan	
LRB	V.A. Panyushkin	
FLNP	V.A. Drozdov	
4. **MUON Project**	**V.N. Duginov** **T.N. Mamedov**	Data taking Data analysis
DLNP	E.I. Bunyatova, K.I. Gritsaj, A.I. Rudenko, G.D. Soboleva, V.A. Stolupin	
FLNP	M. Balasoiu + 2 pers.	
5. **TRITON Project**	**D.L. Demin** **V.V. Filchenkov**	Data taking Data processing
DLNP	A.M. Artikov, N.A. Baranova, A.I. Boguslavsky, V.P. Volnykh, N.N. Grafov, K.I. Gritsaj, V.N. Duginov, V.I. Kolomorets, A.D. Konin, A.P. Kustov, N.N. Kuchinskaya, T.N. Mamedov, A.I. Puzynin, A.I. Rudenko, A.V. Simonenko, S.V. Filin, V.A. Stolupin, Yu.A. Polyakov, S.A. Gustov, N.A. Shakun, E.V. Kolesov	
FLNR	S.A. Yukhimchuk	
LRB	V.B. Buchnev, V.Yu. Schegolev	

6. **GDH&SPASCHARM Project**	**Yu. Usov** **A. Kovalik**	Data taking Data processing
DLNP	N.S. Borisov, N.A. Bazhanov, A.N. Fedorov, Yu.A. Plis, A.B. Lazarev, A.B. Neganov, A.B. Sadovsky, I.V. Gapienko	
BLTP	S.B. Gerasimov, S.S. Kamalov	
7. **Preparation for the experiment on $\mu - e$ conversion**	**Z.B. Tsamalaidze**	R&D Realization
DLNP	P.G. Evtukhovich, A.S. Moiseenko, G. Macharashvili, V.G. Kalinnikov, A.V. Kulikov, E.P. Velicheva, S.N. Dymov, V.V. Shmakova, A.D. Volkov, V.P. Volnykh, B.M. Sabirov, N. Tsverava, L. Lukhumaidze, T. Toriashvili, I.L. Evtukhovich, Kh. Khubashvili	
LIT	A. Khvedelidze	
FLNP	A.A. Kustov	

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Belarus	Minsk	NC PHEP BSU
		BSU
Bulgaria	Sofia	SU
Czech Republic	Prague	CU
	Řež	NRI
France	Saclay	IRFU
Croatia	Zagreb	RBI
Canada	Vancouver	TRIUMF
Georgia	Tbilisi	HEPI-TSU
Germany	Aachen	RWTH
	Heidelberg	Univ.
	Jülich	FZJ
	Cologne	Univ.
	Dresden	HZDR
	Münster	Univ.
	Stuttgart	MPI-MF
Italy	Frascati	INFN LNF
	Ferrara	UniFe
	Rome	Univ. "La Sapienza"
	Turin	INFN
Japan	Kyoto	Kyoto Univ.
	Osaka	Osaka Univ.
	Tsukuba	KEK
Netherlands	Delft	TUDelft

Poland	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
Romania	Bucharest	IFIN - HH
	Timişoara	CFATR
Russia	Alexandrov	VNIISIMS
	Gatchina	PNPI
	Moscow	ITEP
		GPI RAS
		MSU
		SINP MSU
		NRC KI
	Moscow, Troitsk	INR RAS
	Sarov	VNIIEF
Switzerland	Zurich	UZH
	Villigen	PSI
USA	Charlottesville, VA	UVa
	Pittsburgh, PA	Pitt
	Tucson, AZ	UA

03–2–1102–2010/2015	Priority: 1

Status: Extended

Improvement of the JINR Phasotron and Design of Cyclotrons for Fundamental and Applied Research

Leaders: M.Yu. Kazarinov
G.A. Karamysheva

Scientific leader: L.M. Onischenko

Participating Countries and International Organizations:

Belgium, China, Poland, Japan, Uzbekistan.

Scientific Programme

Improvement of the JINR Phasotron and beam channels. Design of the cyclotrons for medical purposes. Development of the cyclotron method for high-current beam acceleration.

Expected main results in 2013:

- Manufacturing of the thermal protection system of the elements of the beam channels. Manufacturing of the electronic units of the automated beam channel control system.
- Computer simulations of the magnetic and accelerating systems of the superconducting synchrotron. Design of the superconducting magnet with field level about 5 T.
- The choice of key parameters of the FFAG accelerator with proton energy up to 250 MeV. Detailed study of the magnetic triplet to ensure dynamic similarity of the orbit.
- Carring out complex calculations of the NIRS-930 cyclotron using the developed software, preparation of proposals to increase the intensity and quality of the extracted beam.

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Improvement of the JINR Phasotron and beam channels**	**M.Yu. Kazarinov** **N.G. Shakun** **L.M. Onischenko**	Realization
DLNP	J.V. Savchenko, A.S. Vorozhtsov, S.B. Vorozhtsov, S.A. Gustov, A.V. Demyanov, G.A. Kononenko, N.A. Morozov, I.V. Mirokhin, Yu.A. Polyakov, V.I. Smirnov, E.V. Samsonov, V.M. Romanov, V.A. Utkin, N.S. Tolstoi, V.G. Sazonov	
2. **Design and modernization of the cyclotrons for medical purpose**	**Yu.G. Alenitsky** **G.A. Karamysheva** **N.A. Morozov**	Technical proposal
DLNP	N.S. Azaryan, A.S. Vorozhtsov, S.V. Gursky, S.B. Vorozhtsov, C.N. Dolya, O.V. Karamyshev, R.V. Galkin, D.S Petrov, O.E. Lepkina, O.V. Lomakina, S.G. Shirkov, N.L. Zaplatin, G.G. Kazakova, I.N. Kiyan, S.A. Kostromin, E.V. Samsonov, V.M. Romanov, V.G Sazonov, A.F. Chesnov	

LIT	I.V. Amirkhanov	
3. **Development of the cyclotron method for high-current beam acceleration**	**L.M. Onischenko** **S.B. Vorozhtsov**	Technical proposal
DLNP	Yu.G. Alenitsky, A.S. Vorozhtsov, N.L. Zaplatin, E.V. Samsonov, V.L. Smirnov, V.M. Romanov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belgium	Louvain-la-Neuve	IBA
China	Lanzhou	IMP CAS
Japan	Chiba	NIRS
Poland	Krakow	NINP PAS
Uzbekistan	Tashkent	INP UAS

03-4-1104-2011/2013	Priority: 1

Status: Approved for completion in 2013

Investigations in the Field of Nuclear Physics with Neutrons

Leaders: V.N. Shvetsov
Yu.N. Kopatch

Participating Countries and International Organizations:

Albania, Australia, Austria, Belarus, Belgium, Bulgaria, CERN, China, Czech Republic, Egypt, Finland, France, Georgia, Germany, Greece, Italy, Japan, Kazakhstan, Latvia, Macedonia, Moldova, Mongolia, Netherlands, Norway, Poland, Republic of Korea, Romania, Russia, Serbia, Slovak Republic, Slovenia, South Africa, Switzerland, Tailand, Turkey, Ukraine, United Kingdom, USA, Vietnam.

Scientific Programme

Experimental and theoretical investigations aimed at studies of fundamental properties of the neutron, symmetry breaking effects in neutron-induced reactions, and fundamental interactions of neutrons with nuclei. Application of neutron physics methods in other fields of science and technology. Development and construction of detectors of neutrons and other ionizing radiation, as well as applied methods in nuclear physics with neutrons. Development of the Intense REsonance Neutron Source (IREN) and of the experimental base at IREN and IBR-2M.

Expected main results in 2013:

Development of the IREN source:

- Providing the neutron beam from IREN for physical experiments. Test experiments with a prototype of uranium non-multiplying target.

Fundamental investigations of nuclear reactions with neutrons:

- Investigation of energy dependence of the radiative neutron capture cross section for the ^{207}Pb isotope in the energy region from thermal to 10 eV at the beam of the IREN facility for the purpose of detection of the negative p-resonance.
- Continuation of the program "Experimental determination of the cross sections and angular distributions of (n,p), (n,α) reaction products using fast neutrons with energies 4-6.5 MeV" at the facilities EG-5 FLNP JINR and EG-4.5 Peking University (^{35}Cl, ^{nat}Mg, ^{66}Zn, ^{144}Sm).
- Commissioning of the detector system "Romashka" at the IREN beam. Measurements of the gamma-ray yields fluctuations in neutron resonances.
- Investigation of prompt neutrons in fission of ^{235}U with the help of position-sensitive detector at the IREN facility and IBR-2M. Development of electronic apparatus for the combined pulse height/time-of-flight spectrometer. Obtaining of prompt fission neutron spectra of ^{235}U using the NE-213(BC-501) liquid scintillator and solid (p-terphenil) fast neutron detectors. Development of electronic apparatus for position -sensitive fission fragment detector with high position sensitivity ($\sim 0.2 - 0.5$ mm) suitable for neutron imaging.
- Measurement of the P-odd angular correlation coefficient in the reaction $^{10}B(n,\alpha)^7$Li at the cold polarized neutron beam with an accuracy better than 3×10^{-8} in order to determine (or set the limit on) the value of electro-weak pion-nucleon coupling constant f due to neutral currents in nucleon-nucleon interactions.
- Measurement of fission fragments and light particles using pixel detectors TIMEPIX.
- Measurement of T-odd effects for α-particles, neutrons and gamma-rays from fission at cold polarized neutron beams.

- Measurement of the intensity distribution of two-quantum cascades for the ^{238}U target at IREN. Determination of level density parameters.
- Measurement of leakage neutron spectra from a massive (515 kg) target of natural uranium irradiated by deuterons with energies of 1-8 GeV.
- Construction of a new α-spectrometer and testing of the technique of the (n, α) reaction measurements for neutron energies 10-14 MeV.
- Determination of the nuclear precession of the neutron as a function of energy for various nuclei. Measurements of the nuclear precession of the neutron at hydrogen for two energies of neutrons.
- Search for singlet deuteron in experiments at the mirror neutron guide of channel No 11B of the IBR-2M reactor.

Investigation of the fundamental properties of the neutron, UCN physics:

- Experimental investigation of the properties of background at the nn-scattering measurement facility and the methods of its suppression.
- Performing of tests of the AURA installation at the beam No 2 of IREN and test measurements of angular anisotropy of elastic scattering neutrons on the vanadium and light nuclei samples.
- Obtaining of new physical results in the experiment on verification of the equivalence principle.
- Setting of limits on the existence of short-range interactions at distances ~ 10 microns by the GRANIT spectrometer at ILL (Grenoble, France).
- An experimental study of the possibility of cold neutron accumulation at the end of a neutron beam in a cavity of solid methane.

Applied research:

- Elemental and isotopic analysis of cosmic objects, geological samples and boron ceramics by neutron spectroscopy.
- Irradiation of samples using the pneumatic transport system at the IREN facility.
- Continuation of measurements of yields of Mo-100 and Sn-117m medical isotopes at the bremsstrahlung electron beam at IREN.
- Precision investigations of oxygen distribution in nanolayers of titanium oxide.
- Mathematical and physical modeling and calibration of the DAN equipment complex intended for search of water ice from aboard the CURIOSITY Mars rover.
- Biomonitoring of atmospheric deposition of trace elements in some selected areas of Russia, countries of Eastern and Central Europe, Asia (Vietnam, Mongolia) and Africa (Egypt, SA). Continuation of investigations using NAA in ecology, medicine, biotechnology and development of new materials (synthesis of fine-crystalline diamonds and boron nitride).

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. Development of the IREN facility	**V.N. Shvetsov**	Upgrade
FLNP	Ju.K. Bulycheva, E.A. Golubkov, A.I. Grudinin, V.D. Denisov, V.A. Egorov, A.Zh. Korokin, T.L. Pikel'ner, G.N. Pogodaev, S.V. Pokrovskij, V.K. Pokrovskij, V.G. Pjataev, A.V. Sokolov, Zh.V. Sorokina, K.V. Udovichenko, D.P. Frolov, I.S. Yarovoj	
VBLHEP	A.P. Sumbaev, V.V. Kobets, V.F. Minashkin, V.G. Shabratov, V.A. Shvets, V.N. Zamrij, A.N. Skrypnik, J. Betscher	
DLNP	I.N. Meshkov	
2. Fundamental investigations of nuclear reactions with neutrons	**Yu.N. Kopatch**	Upgrade Data taking Data analysis
FLNP	F. Ahmadov, G.S. Ahmedov, N.V. Bazjazjima, S.B. Borzakov, Ju.M. Gledenov, N.A. Gundorin, Sh.S. Zeynalov, A.P. Kobzev, D. Mahajdik, Zh.V. Mezentseva, V.V. Novitsky, I.A. Oprea, K.D. Oprea, L.B. Pikel'ner, I.N. Ruskov, P.V. Sedyshev, M.V. Sedysheva, V.R. Skoj, A.M. Suhovoj, S.A. Telezhnikov, V.A. Hitrov, M. Tsulaja, I.A. Chepurchenko, V.P. Kudrjavcev, Ju.D. Mareev, B.A. Rodionov, I.M. Salamatin, Yu.N. Voronov, A.N. Lihachev, S.I. Negovelov, Ts.Ts. Panteleev	
LIT	O.V. Zeynalova	
DLNP	V.A. Stolupin	
3. Investigation of the fundamental properties of the neutron, UCN physics	**E.V. Lychagin**	Upgrade Data taking Data analysis
FLNP	G.G. Bunatyan, S.V. Gorjunov, V.K. Ignatovich, G.V. Kulin, D. Kustov, L.V. Mitsyna, A.Yu. Muzychka, G.N. Nehaev, Yu.N. Pokotilovskij, A.B. Popov, A.V. Strelkov, A.I. Frank, W.I. Furman, E.I. Sharapov	
4. Neutron activation analysis and applied research	**M.V. Frontasyeva**	Upgrade Data taking Data analysis
FLNP	Yu.V. Alekseenok, K.N. Vergel, Z.I. Gorjajnova, S.F. Gundorina, A.Ju. Dmitriev, A. Zhambalzhamc, I.I. Zinikovskaja, B. Njamsuren, T.M. Ostrovnaja, S.S. Pavlov, L.P. Strelkova, T. Chin	

Collaboration

Country or International Organization	City	Institute or Laboratory
Albania	Tirana	UT
Australia	Melbourne	Univ.
Austria	Vienna	IAEA
	Innsbruck	Univ.
Belarus	Minsk	INP BSU
		RI PCP BSU
Belgium	Geel	IRMM
	Brussels	ULB
Bulgaria	Sofia	INRNE BAS
	Plovdiv	PU
		UFT
CERN	Geneva	CERN
China	Beijing	IHEP CAS
Czech Republic	Prague	CEI
		CTU
Egypt	Cairo	EAEA
Finland	Jyväskylä	UJ
France	Cadarache	CC CEA
	Grenoble	ILL
		LPSC
	Saclay	LLB
	Strasbourg	IPHC
Georgia	Tbilisi	AIP
Germany	Darmstadt	GSI
	Dresden	HZDR
	Mainz	JGU
	Munich	TUM
	Tübingen	Univ.
Greece	Athens	AUA
Italy	Rome	ENEA
Japan	Kyoto	KSU
	Tsukuba	KEK
Kazakhstan	Ust-Kamenogorsk	TRCE
Latvia	Riga	IPUL
Macedonia	Skopje	UKiM
Moldova	Chişinău	IMB ASM
Mongolia	Ulaanbaatar	CGL
		NUM
Netherlands	Delft	TUDelft
Norway	Trondheim	NTNU
Poland	Gdansk	GUT
	Krakow	NINP PAS

	Lodz	UL
	Lublin	MCSU
	Opole	OU
	Otwock-Swierk	NCBJ
	Poznan	AMU
Republic of Korea	Pohang	PAL
	Taejon	KAERI
Romania	Bucharest	IFIN-HH
		INCDIE ICPE-CA
		ISS
		UB
	Baia Mare	NUBM
	Constanţa	NIMRD
		UOC
	Galaţi	UG
	Iaşi	UAIC
	Oradea	UO
	Piteşti	SCN
	Râmnicu Vâlcea	ICSI
	Târgovişte	UVT
Russia	Moscow	Atomenergomach
		GIN RAS
		IKI RAS
		ITEP
		NNRU "MEPhI"
		MSU
		NRC KI
		SINP MSU
	Moscow, Troitsk	INR RAS
	Borok	IBIW RAS
	Chernogolovka	IPTM RAS
	Dubna	"Dubna" Univ.
	Gatchina	PNPI
	Irkutsk	LI SB RAS
	Ivanovo	ISUCT
	Izhevsk	UdSU
	Magnitogorsk	MagTU
	Obninsk	IPPE
	Sarov	VNIIEF
	Snezhinsk	VNIITF
	St. Petersburg	FIP
		Hermitage
		KRI
	Tomsk	NPI TPU
	Tula	TSPU

	Voronezh	VSU
	Yekaterinburg	UrFU
Serbia	Belgrade	IP
		Univ.
	Novi Sad	UNS
Slovak Republic	Bratislava	IP SAS
		IEE SAS
		ILE SAS
		CU
	Zvolen	NFC-FRI
Slovenia	Ljubljana	GeoSS
South Africa	Pretoria	Necsa
		Unisa
Switzerland	Villigen	PSI
Thailand	Hat Yai	PSU
Turkey	Çanakkale	ÇOMU
Ukraine	Kiev	KINR NASU
		NBG NASU
		NUK
	Donetsk	DonIPE NASU
	Sevastopol	IBSS NASU
	Sumy	IAP NASU
	Uzhgorod	IEP
	Kharkov	ISM NASU
		KFTI NASU
United Kingdom	London	NHM
Vietnam	Hanoi	VNU
USA	Durham, NC	Duke
	Gettysburg, PA	GC
	Kingston, RI	URI
	Los Alamos, NM	LANL
	Oak Ridge, TN	ORNL

Condensed Matter Physics, Radiation and Radiobiological Research (04)

04-4-1069-2009/2014	Priority: 1

Status: In-progress

Investigations of Nanosystems and Novel Materials by Neutron Scattering Methods

Leaders: V.L. Aksenov
A.M. Balagurov
D.P. Kozlenko

Participating Countries and International Organizations:

Azerbaijan, Belarus, Bulgaria, Czech Republic, Egypt, France, Germany, Hungary, Japan, Latvia, Moldova, Mongolia, Norway, Poland, Romania, Russia, Serbia, Slovak Republic, South Africa, Switzerland, Taiwan, Ukraine, United Kingdom, Uzbekistan.

Scientific Programme

Investigations of structure, dynamics and microscopic properties of nanosystems and novel materials, interesting for fundamental research in the fields of condensed matter physics, chemistry, materials science, geophysics, and important for development of nanotechnologies in the fields of electronics, pharmacology, medicine, by neutron scattering and complimentary methods.

Expected main results in 2013:

Realization of the scientific program:

- Determination of the crystal and magnetic structure of functional and nanostructured materials demonstrating interesting physical phenomena and promising for technological applications in a wide range of thermodynamic parameters, clarification of the role of structural parameters and clusterization in the formation of physical properties.
- Determination of the parameters of crystal and magnetic structure of relaxor and frustrated multiferroics.
- Determination of magnetic properties of layered nanostructures in stationary and oscillating magnetic fields.
- Determination of structural characteristics of biocompatible magnetic fluids.
- Structural characterization and analysis of clusterization regimes in liquid dispersions of nanodiamonds and fullerenes.
- Determination of structural characteristics of carbosilane dendrimers promising for technological applications.
- Experimental and theoretical analysis of crystal structure and vibrational spectra of molecular complexes, including ion-inclusive materials, complexes with electric charge transfer, structural and dynamical parame-ters of hydrogen bonds in biologically active materials.
- Determination of structural and functional characteristics of biological nanosystems: proteins, DNA, RNA macromolecules and their complexes.
- Determination of nanostructure and diffusion properties of model lipid nanosystems for understanding drug delivery mechanisms through the upper layer of the skin.
- Determination of structural and dynamical characteristics of reactor materials including fuel compositions at high temperatures up to 2000 K.
- Determination of structural instability conditions of rock materials under the action of high pressures and temperatures, especially during polymorphic phase transformations, for the development of earthquake mechanism concept.

- Development of the model of solid polycrystalline materials for the prediction of elastic, strength and thermal properties, taking into account the effects of texture, inclusions, pores and microcracks. Quantitative description of crystallographic texture.
- Determination of residual stresses in construction materials of nuclear reactors, industrial materials and factory-made goods, composites, reinforced systems, metalloceramics, shape-memory alloys.
- Determination of local structure parameters of complex metallic clusters in oxide matrices.

Realization of the instrument development program for the IBR-2 spectrometers:

- Creation of the elements of the detector system, cryostat, set of high pressure cells of the DN-6 diffractometer.
- Creation of the polarizing system and sample units of the multifunctional reflectometer GRAINS.
- Modernization of the instruments SKAT/Epsilon, YuMO, HRFD, FSD, Reflex, NERA-PR, DIN-2PI, aimed at improving technical parameters – increase of neutron counting rate, reduction of background, improvement of experimental conditions.
- Modernization of the REMUR reflectometer – development of 2D polarization analysis, small-angle scattering mode, reduction of background.
- Reconstruction of the high intensity diffractometer DN-2 into a diffractometer for real-time measurements.
- Development and testing of neutron scattering techniques for studies of materials and nanosystems including radiography, spin-echo, standing waves, neutron magnetic resonance.

List of projects:

Project	Leader	Priority (period of realization)
1. RTD diffractometer	A.M. Balagurov	1 (2012 – 2015)

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Structure and Properties of Novel Crystalline and Nanostructured Materials**	**A.M. Balagurov** **D.P. Kozlenko**	Data taking
FLNP	A.I. Beskrovnyi, B.N. Savenko, E.B. Askerov, I.A. Bobrikov, N.O. Golosova, Zh. Gombo, S.G. Dzhabarov, S.E. Kichanov, M.L. Craus, N.V. Loshak, E.V. Lukin, G.M. Mironova, S.A. Samoilenko, E.A. Sivachenko, S.G. Sheverev	
2. **Magnetic colloid systems in bulk and at interfaces**	**M.V. Avdeev**	Data taking
FLNP	V.I. Petrenko, A.V. Nagornyi, A.V. Tomchuk, Zh. Narmandah, I.V. Gapon	
3. **Magnetism of layered nanostructures**	**Yu.V. Nikitenko**	Data taking
FLNP	S.V. Kozhevnikov, E.B. Dokukin	

4.	**Structure of carbon nanomaterials**	**V.L. Aksenov**	Data taking
	FLNP	T.V. Tropin, O.A. Kizima	
5.	**Atomic dynamics of nanosystems and materials**	**A.V. Puchkov (IPPE, Obninsk)**	Data taking
	IPPE (Obninsk)	I.V. Kalinin, V.M. Morozov, V.V. Savostin, A.G. Novikov, V.A. Semenov	
6.	**Molecular dynamics of biologically active materials, polymorphic phases of liquid crystals and nanomaterials for hydrogen energetics**	**D.M. Chudoba**	Data taking
	FLNP	I. Natkaniec, A. Pawlukojc, S. Zalewski, I.L. Sashin	
7.	**Computer modeling of physical and chemical properties of novel crystalline and nanostructured materials**	**A. Pawlukojc**	Data taking
	FLNP	D.M. Chudoba, V.Yu. Kazimirov	
8.	**Structural and functional characteristics of biological, colloid and polymer nanodispersed materials**	**A.I. Kuklin**	Data taking
	FLNP	M. Balasoiu, A.Kh. Islamov, T.N. Murugova, A.V. Rogachev, A. Raewska, Yu.E. Gorshkova, O. Ivan'kov, L. Anghel, R.V. Erhan, D.V. Solovyev, Yu.S. Kovalev	
9.	**Lipid nanostructures**	**M.A. Kiselev**	Data taking
	FLNP	E.V. Ermakova, N.Y. Ryabova	
10.	**Texture, composition and properties of Earth minerals and rocks**	**Ch. Scheffzuek**	Data taking
	FLNP	T.I. Ivankina, V.V. Sikolenko, R.N. Vasin, Z. Matthies, D.I. Nikolaev, T.A. Lychagina, A.A. Kruglov, D.M. Levin	
11.	**Residual stresses in bulk materials and factory-made goods**	**V.V. Sumin**	Data taking
	FLNP	G.D. Bokuchava, Yu.V. Taran, I.V. Papushkin, D. Aznabaev, B. Muhametuly, A.V. Tamonov	
12.	**Development of neutron methods of investigations of structure and dynamics of nanosystems and materials**	**V.I. Bodnarchuk Yu.V. Nikitenko D.P. Kozlenko**	Data taking
	FLNP	S.V. Kozhevnikov, S.P. Yaradaikin, S.E. Kichanov A.B. Rubtsov	

13. **Development of the complex of spectrometers of the IBR-2M reactor** — **A.M. Balagurov, D.P. Kozlenko** — Realization

FLNP: M.V. Avdeev, A.I. Beskrovnyy, A.I. Kuklin, V.I. Bodnarchuk, I. Natkaniec, D.M. Chudoba, Yu.V. Nikitenko, A.V. Petrenko, A.V. Puchkov, B.N. Savenko, V.V. Sikolenko, V.G. Simkin, V.V. Sumin, V.I. Sukhanov, Ch. Scheffzuek

14. **Creation of the diffractometer for studies of transient processes in real time at the IBR-2M reactor (RTD diffractometer project)** — **A.M. Balagurov** — Realization

FLNP: A.I. Beskrovnyi, V.V. Zhuravlev, G.M. Mironova

15. **X-ray spectroscopy** — **S.I. Tyutyunnikov** — Data taking, Realization

VBLHEP: V.N. Shalyapin, V.V. Efimov, E.A. Efimova

Collaboration

Country or International Organization	City	Institute or Laboratory
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	BSU
		INP BSU
		SPMRC NASB
		RI PCP BSU
Bulgaria	Sofia	IMS BAS
		IE BAS
		INRNE BAS
		ISSP BAS
Czech Republic	Prague	CTU
		IG ASCR
		IMC ASCR
		IP ASCR
	Řež	NPI ASCR
Egypt	Cairo	CMRDI
		EAEA
		NRC
		TIMS
	Giza	NILES CU
France	Saclay	LLB
Germany	Berlin	HZB
	Bayreuth	Univ.
	Bochum	RUB
	Darmstadt	TU Darmstadt
	Dortmund	TU Dortmund

	Dresden	IZFP-D
	Göttingen	Univ.
	Geesthacht	GKSS
	Halle	MLU
	Hamburg	DESY
	Freiberg	TUBAF
	Jülich	FZJ
	Karlsruhe	KIT
	Kiel	CAU
		IFM-GEOMAR
	Leipzig	UoC
	Rostock	Univ.
	Stuttgart	MPI-FKF
Hungary	Budapest	Wigner RCP
	Szeged	US
Japan	Nagano	Shinshu Univ.
Latvia	Riga	ISSP UL
		IPE
Moldova	Chişinău	IC ASM
Mongolia	Ulaanbaatar	IPT MAS
		MUST
Norway	Trondheim	NGU
Poland	Warsaw	INCT
	Krakow	JU
		NINP PAS
	Lublin	MCSU
	Poznan	AMU
	Siedlce	UNSH
	Szczecin	WPUT
	Wroclaw	WUT
		UW
Romania	Bucharest	IFIN-HH
		INCDIE ICPE-CA
		NIMP
		ISS
		UB
		UPB
		UTM
	Craiova	UC
	Cluj-Napoca	INCDTIM
		UBB
	Iaşi	NIRDTP
		UAI
		UAIC
	Piteşti	SCN

	Timişoara	LMF CFATR
		UVT
Russia	Moscow	GC RAS
		IBMC RAMS
		IC RAS
		IGEM RAS
		IGIC RAS
		IMET RAS
		INMI RAS
		IPCE RAS
		ITEP
		IPE RAS
		ISPM RAS
		NNRU "MEPhI"
		MIET
		MITHT
		MSU
		MUCTR
		NIKIET
		NRC KI
		SINP MSU
		VNIINM
	Moscow, Troitsk	HPPI RAS
		ISAN
		INR RAS
	Alexandrov	VNIISIMS
	Dolgoprudny	MIPT
	Chernogolovka	ISSP RAS
	Gatchina	PNPI
	Kazan	KNRTU
	Krasnoyarsk	IP SB RAS
	Nizhny Novgorod	UNN
		IPM RAS
	Obninsk	IPPE
	Petrozavodsk	IG KRS RAS
	Podolsk	GIDROPRESS
	Rostov-on-Don	RIP SFU
	St. Petersburg	IPTI RAS
	Sterlitamak	SSPA
	Tomsk	NPI TPU
	Tula	TSU
	Yekaterinburg	IMP UB RAS
		UrFU
Serbia	Novi Sad	UNS
Slovak Republic	Bratislava	CU

	Košice	IEP SAS
South Africa	Pretoria	Necsa
Switzerland	Villigen	PSI
	Zurich	ETH
Taiwan	Hsinchu	NSRRC
Ukraine	Kiev	IPMS NASU
		NUK
		ISC NASU
	Donetsk	DonIPE NASU
	Kharkov	IERT NASU
		KFTI NASU
United Kingdom	Didcot	RAL
Uzbekistan	Tashkent	INP UAS

04-4-1105-2011/2013	Priority: 1

Status: Approved for completion in 2013

Development of the IBR-2M Reactor with a Complex of Cryogenic Neutron Moderators

Leaders: A.V. Belushkin
A.V. Vinogradov

Participating Countries and International Organizations:

Argentina, Azerbaijan, Democratic People's Republic of Korea, Japan, Poland, Romania, Russia, Spain, Ukraine, United Kingdom, USA.

Scientific Programme

The theme main task is to increase the efficiency of use of the IBR-2M reactor at realization of the program of experimental investigations, maintenance of operational realibility and safety of the reactor, creation of a complex of cryogenic neutron moderators.

Expected main results in 2013:

- Maintenance of the IBR-2M reactor operation for physical investigations.
- Work on the prolongation of the service life of the technological systems of the IBR-2M reactor.
- Development of the system documentation for the reactor stationary system of radiation control.
- Developing of the cryogenic moderator for beams 7-11 (CM202) at the reactor operating on power. The beginning of work on the creation of a cryogenic moderator for beams 2-3 (CM203).

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Beginning of regular operation of the IBR-2M reactor**	**V.D. Ananiev** **A.V. Dolgikh** **A.V. Vinogradov**	Realization
FLNP	A.A. Belykov, S.A. Tsarenkov, V.G. Ermilov, S.V. Rudenko, Yu.N. Pepelyshev, V.A. Trepalin + 30 engineer, + 50 workers	
2. **Maintenance of the program of physical investigations**	**V.D. Ananiev** **A.V. Vinogradov** **A.V. Dolgikh**	Realization
FLNP	A.A. Belyakov, Yu.N. Pepelyshev, V.A. Trepalin, S.V. Rudenko + 30 engineers, + 50 workers	

3. **Installation of the cryogenic moderator for beams 7-11 (CM202) on its regular place. Carrying out of tests for the CM202 in cryogenic mode at the reactor operating on power. The beginning of work on the creation of a cryogenic moderator for beams 2-3 (CM203).**
V.D. Ananiev
E.P. Shabalin
A.A. Belyakov
Realization

FLNP — S.A. Kulikov + 15 engineers, + 15 workers

4. **Development of the system documentation for the reactor stationary system of radiation control**
A.V. Vinogradov
A.V. Dolgikh
Realization

RSD — S.V. Kulikov + 5 engineers

Collaboration

Country or International Organization	City	Institute or Laboratory
Argentina	Buenos Aires	CNEA
Azerbaijan	Baku	IRP ANAS
Democratic People's Republic of Korea	Pyongyang	IFR SCNR
Japan	Sapporo	Hokkaido Univ.
Poland	Krakow	AGH
Romania	Bucharest	IFIN-HH
Russia	Moscow	NIKIET
		Geliymash
		INEUM
		SYSTEMATOM
Spain	Valencia	UPV
Ukraine	Kiev	KINR NASU
United Kingdom	Didcot	RAL
USA	Indianapolis, IN	IUPUI

04-4-1075-2009/2014	Priority: 1

Status: In-progress

Novel Development and Creation of Equipment for the IBR-2M Spectrometer Complex

Leaders: S.A. Kulikov
V.I. Prikhodko

Participating Countries and International Organizations:

Bulgaria, China, Czech Republic, France, Germany, Hungary, Romania, Russia, Slovak Republic.

Scientific Programme

Calculation, research and development of the moderator complex and elements of spectrometers of the IBR-2M reactor; development of advanced neutron detectors, a new generation of data acquisition systems, computing infrastructure, cryostats and cryomagnetic systems, beam-forming and sample environment systems for condensed matter investigations in accordance with the plan for strategic development of JINR and the development programme for the IBR-2M spectrometers complex.

Expected main results in 2013:

- Obtaining and analysis of working characteristics of the cryogenic moderator for beams 7, 8, 10, 11; optimization of operation of the technological equipment.
- Creation of infrastructure on beams 13-14 for testing spectrometer equipment (installation and testing of neutron guide vacuum systems, installation and adjustment of Fourier choppers, development and manufacturing of a 64-channel «List Mode»-analyzer for FSS).
- Development of modules of the VITESS package for calculation of detectors with neutron time-focusing. Simulation of elements of a spin-echo spectrometer with pulsed magnetic fields.
- Development and manufacturing of equipment for the RTD diffractometer (shaft cryostat - diameter of ?18 mm, temperature range of 5?290 K; small-angle ring-shaped detector; data accumulation system for 2D PSD).
- Putting into operation of control systems for the HRFD, FSD and GRAINS spectrometers.
- Manufacturing and testing of a horizontal cryostat for DN-6. Development of a draft design of a cryostat for cryomagnetic investigations on the IBR-2 spectrometers.
- Development of a new monitor 2D PSD for obtaining thermal neutron beam profiles on the FLNP facilities.
- Development of a test neutron detector on the basis of ND screens and study of its characteristics with various types of photomultipliers and light-gathering schemes; selection of an optimum configuration.
- Completion of development and commissioning of new systems of data acquisition and accumulation from point detectors for the YuMO, HRFD and FSD spectrometers.
- Completion of work to install Sonix+ on the DN-6, RTD, SKAT, HRFD spectrometers.
- Putting into operation of a new file-server with extended disk space (more than 20 Tbyte); creation of a WiFi network in the main buildings of the Laboratory and the IBR-2 experimental halls.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Development and research of a new complex of moderators at the IBR-2M reactor. Commissioning of the complex of moderators at the IBR-2M on channels 7, 8, 10, 11 and adjustment of all operating systems of the cryogenic moderator complex**	**S.A. Kulikov** **E.P. Shabalin**	Realization
FLNP	M.V. Bulavin + 5 engineers, + 7 workers	
2. **Complex calculations of neutron spectrometers (from the moderators to the sample position)**	**S.A. Kulikov**	Realization
FLNP	E.P. Shabalin, S.A. Manoshin + 2 engineers	
3. **Completion of reconstruction of neutron guides on channel 7 at the IBR-2M reactor. Modernization, adjustment and testing of equipment for the EPSILON, SKAT and NERA-PR spectrometers; putting into operation, start of experiments. Joint JINR-BMBF project**	**A.V. Belushkin** **A. Schilling**	Realization
FLNP	V.V. Zhuravlev, V.I. Prikhodko, A.P. Sirotin, A.N. Chernikov + 4 engineers, K. Scheffzuek + 2 engineers, A.A. Bogdzel + 3 engineers	
4. **Creation of infrastructure for testing spectrometer equipment (scintillation and gas-filled neutron detectors, cryostats, etc.) on beams 13-14 at IBR-2M and carrying out the instrument development work, in particular, on high-resolution Fourier diffractometry**	**V.N. Shvetsov** **S.A. Kulikov** **A.M Balagurov**	Realization
FLNP	G.D. Bokuchava, A.N. Chernikov, V.V. Zhuravlev + 5 engineers, A.V. Churakov + 3 engineers	

5. **Commissioning of gas-filled position-sensitive detector systems at the IBR-2M spectrometers (REFLEX, H RFD, YuMO, GRAINS, DN-2, etc.) and at the cold moderator. Completion of development and commissioning of the ring-shaped multi-section detector at the DN-6 spectrometer. Completing the ASTRA scintillation detector with modules for the FSD diffractometer**

A.V. Belushkin
S.A. Kulikov

Realization

FLNP

V.N. Shvetsov, D.P. Kozlenko + 5 engineers, G.D. Bokuchava + 2 engineers, A.V. Churakov + 3 engineers, A.A. Bogdzel + 4 engineers, V.V. Zhuravlev, V.V. Kruglov, A.S. Kirilov + 1 engineer

6. **Development of control systems of spectrometers' equipment and sample environment systems at IBR-2M, creation of cryostats**

A.P. Sirotin

Realization

FLNP

V.V. Zhuravlev, A.N. Chernikov + 5 engineers

7. **Modernization of data acquisition systems of the IBR-2M spectrometers' complex. Development, enhancement and support of the Sonix+ software package and its introduction at the IBR-2M spectrometers. Development of the FLNP information-computing infrastructure in accordance with the strategy of development of the JINR computer network**

V.I. Prikhodko

Realization

FLNP

A.A. Bogdzel + 2 engineers, F.V. Levtchanovski + 2 engineers, A.S. Kirilov + 3 engineers, G.A. Sukhomlinov + 2 engineers

LIT

V.V. Korenkov + 2 engineers.

Collaboration

Country or International Organization	City	Institute or Laboratory
Bulgaria	Sofia	INRNE BAS
China	Mianyang	INPC CAEP
Czech Republic	Řež	NPI ASCR
France	Grenoble	ILL
	Saclay	LLB
Germany	Berlin	HZB
	Heidelberg	Univ.

	Magdeburg	OVGU
	Munich	TUM
	Karlsruhe	KIT
	Zeuthen	DESY
	Jülich	FZJ
Hungary	Budapest	Wigner RCP
Romania	Bucharest	INCDIE ICPE-CA
		IFIN-HH
	Târgovişte	UVT
Russia	Moscow	NNRU "MEPhI"
		NRC KI
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Yekaterinburg	IMP UB RAS
	Nizhny Novgorod	IPM RAS
	Obninsk	Branch KIPC
Slovak Republic	Bratislava	IMS SAS
Ukraine	L'viv	LPNU

04-5-1076-2009/2014	Priority: 1

Status: In-progress

Radiation Effects and Physical Basis of Nanotechnology, Radioanalytical and Radioisotope Investigations at the FLNR Accelerators

Leaders: S.N. Dmitriev
P.Yu. Apel

Participating Countries and International Organizations:

Belarus, Bulgaria, China, Czech Republic, Egypt, Germany, Hungary, Kazakhstan, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovak Republic, South Africa, Spain, Ukraine, United Kingdom, USA, Vietnam.

Scientific Programme

Study of effects produced by heavy ions in matter aiming at the development of nanotechnological applications of ion beams. Works related to life sciences: production of ultra-pure isotopes and research of the properties of practically important radionuclides. Modernization of the FLNR accelerator complex for the production of medical isotopes and development of methods of material modification.

Expected main results in 2013:

- Studies of radiation tolerance of nanostructured ZrN against impact of heavy ions of fission fragments energy.
- Studies of high density ionization effects on deuterium and helium porosity in silicon under swift heavy ion irradiation.
- Optimization of properties of asymmetric track membranes with several arrays of interseting pores for practical purposes such as plasmapheresis, water purification and others.
- Study of electrical asymmetry of nanopores, filled with electrolyte solutions, caused by heterogeneous distribution of electrical charge on surface.
- Development of the methodology for titanium dioxide deposition on the polyester track etched membranes study of structure, physico-chemical and photocatalytic properties of the synthesized membrane using thin films of titanium dioxide and noble metals.
- Instigation of gas permeation properties of heavy ion irradiated polymeric films (polyethelenetherephtelate, polyimide – MATRIMID and polymetilpenten) in system hydrogen/methane.
- Investigation of the 4 and 5 valenty element separation using nanostructure materials.
- Investigation of possibility of the ^{117m}Sn and ^{195m}Pt separations obtained in photonuclear reactions ^{118}Sn(γ,n) end ^{196}Pt(γ,n) using Szilard - Chalmers' method.
- Comissioning of the DC110 cyclorton for applied research in the framework of the Beta project.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Investigations of radiation damages in solids and formation of nanostructures**	**V.A. Skuratov** **P.Yu. Apel**	Data taking

FLNR	V.A. Skuratov, P.Yu. Apel, A.Yu. Didyk, V.K. Semina, O.L. Orelovich, V.V. Shirkova, G.N. Akap'ev, I.V. Blonskaja, L.I. Kravets, O.M. Ivanov, V.A. Shchegolev	
LIT	I.V. Amirhanov, I.V. Puzynin, V.N. Robuk	
FLNP	A.I. Kuklin	
2. **Investigation of materials with low energy ions using ECR ion source**	**V.F. Reutov**	Preparation
FLNR	V.F. Reutov, A.S. Sokhatsky	
3. **Production of ultra-pure isotopes**	**S.N.Dmitriev**	Data taking
FLNR	O.D. Maslov, G.Ya. Starodub, A.V. Sabelnikov, Yu.V. Albin, G.A. Bozhikov, G.K. Vostokin, M.V. Gustova, T.P. Drobina, V.A. Shchegolev	
4. **Radioanalytical studies**	**O.D. Maslov**	Data taking
FLNR	O.D. Maslov, A.V. Sabelnikov, M.V. Gustova, T.P. Drobina	
5. **Design of accelerator complexes for nuclear medicine and radiation physics**	**S.N. Dmitriev** **A.A. Chumbalov**	Preparation Manufacturing
FLNR	B.N. Gikal, I.V. Kolesov, A.A. Chumbalov	
DLNP	A.G. Molokanov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	BSU
		NC PHEP BSU
		RIAPP BSU
	Gomel	GSU
		GB NASB
		GEI
Bulgaria	Plovdiv	PU
China	Beijing	Beijing Fert Co
Czech Republic	Řež	NPI ASCR
Egypt	Cairo	TIMS
Germany	Darmstadt	GSI
	Quedlinburg	IST
		MiCryon Technik
Hungary	Budapest	ELTE
Kazakhstan	Almaty	INP NNC RK
		IPT

Moldova	Chişinău	IAP ASM
Mongolia	Ulaanbaatar	NUM
Poland	Warsaw	INCT
		ITR
		UW
	Lublin	MCSU
	Torun	NCU
Russia	Moscow	IC RAS
		MATI
		MIEM
		LPI RAS
		GPI RAS
		Technomedexport
		ISPM RAS
		MUCTR
		MSU
	Moscow, Troitsk	ISAN
	Dubna	Trackpore Technology
		IINC
	Novosibirsk	ISP SB RAS
	St. Petersburg	IPTI RAS
	Saratov	SSMU
Serbia	Belgrade	INS "VINČA"
Romania	Bucharest	INFLPR
Slovak Republic	Bratislava	BIONT
		CU
		IEE SAS
South Africa	Port Elizabeth	NMMU
Spain	Madrid	IA
	Valencia	UV
Ukraine	Kharkov	IERT NASU
	Simferopol	SIMPEX
United Kingdom	London	Middlesex Univ.
	Teddington	NPL
USA	Ann Arbor, MI	U-M
	Irvine, CA	UCI
	Oak Ridge, TN	ORNL
Vietnam	Hanoi	IP VAST

04–9–1077–2012/2014	Priority: 1

Status: In-progress

Research on the Biological Effect of Heavy Charged Particles with Different Energies

Leaders: E.A. Krasavin
G.N. Timoshenko

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, Czech Republic, Egypt, Italy, Japan, Moldova, Mongolia, Romania, Russia, Slovak Republic.

Scientific Programme

Theoretical and experimental research on the biological effect of heavy charged particles with different energies at JINR's basic facilities.

The research and development will include:

- Research on the effect of accelerated heavy ions of different energies on genetic structures.
- Research on the interaction between the main cataractogenic factors (ionizing radiation, ultraviolet radiation, and age) during lens opacity formation.
- Research on the effect of different doses of accelerated charged particles on the retina and central nervous system of experimental animals.
- Mathematical modeling of induced mutagenesis in bacterial and eukaryotic cells.
- Molecular dynamics modeling of spatial structures of complex protein aggregates participating in DNA repair in bacterial and higher eukaryotic cells.
- Working out radiation protection measures for new nuclear physics facilities, evaluation of their radiation environment, and development of radiation safety systems for them.

As the results:

- Acquisition of new data on the regularities and mechanisms of the initiation of molecular disorders in the DNA structure; DNA damage repair; and radiation-induced apoptosis in human cells under radiations with different linear energy transfer (LET).
- Decoding of the mechanisms underlying cell hypersensitivity and hyperresistance to low doses of ionizing radiation.
- Acquisition of comparative data on the regularities of the induction of gene and structural mutations in mammalian and yeast cells by radiations with different LET.
- Drawing up recommendations on the threshold doses of heavy charged particles able to damage the eye lens and retina. Development of the preventive measures against cataract in persons occupationally exposed to irradiation with heavy charged particles.
- Research on the character of the heavy charged particle-induced damage of central nervous system (CNS) cells and regularities of their death. Identification of the heavy charged particle-induced functional disorders in the CNS.
- Molecular dynamics modeling of radiation-induced conformational changes in biological structures.
- Mathematical modeling of the mutagenic effect of ionizing radiations with different LET on bacterial and mammalian cells.

- Calculation of the radiation shielding of new nuclear physics facilities; evaluation of the radiation environment and development of radiation safety systems.
- Research on the regularities in hematopoietic system damage formation in small laboratory animals with different irradiation schemes.
- Evaluation of the radiation load on interplanetary mission crew members' organisms depending on the solar cycle phase and shielding thickness.
- Estimation of the galactic radiation dose received by cosmonauts in different flight scenarios for working out the criteria and grounds of the radiation safety standards for interplanetary flights.
- Acquisition of new data on the performances of nanotechnology-based thermoluminescent detectors.

Expected main results in 2013:

- Continuation of research on the regularities of DNA damage induction and repair in human and mammalian cells in the presence of modifiers of DNA replication and repair synthesis.
- Continuation of research on the mechanisms of radiation-induced apoptosis and different ways of DNA damage repair under ionizing radiations of different qualities.
- Research on the regularities of the formation and repair of DNA double-strand breaks and clustered damage using the method of DNA foci.
- Acquisition of data on the regularities of gene and structural mutation induction in yeast cells by radiations of different linear energy transfer (LET).
- Acquisition of data on the regularities of the induction of structural damage in the HPRT gene in mutant subclones of mammalian cells by radiations of different LET.
- Continuation of research on the mechanisms of the action of low doses of radiation of different LET using modifiers of intracellular cytoprotector systems.
- Acquisition of data on the regularities in the functional disorders in the rodent retina induced by radiations of different qualities and mutagens.
- Evaluation of the biological effect of Bragg peak protons for the total irradiation of mice.
- Teoretical evaluation of the radiation load on interplanetary flight crew depending on the solar cycle phase and shielding thickness.
- Continuation of the development of methods of mathematical moderling of the heavy charged particle effect on the central nervous system and visual apparatus of mammals.
- Development of approaches to the formulation of a new concept of the risk associated with the effect of heavy charged particles of the space origin on living systems.
- Continuation of the development of models of the genetic control of the molecular mechanisms in bacterial and mammalian cells under ionizing radiations of different LET.
- Carrying out dosimetry physics experiments at the Nuclotron (VBLHEP) and U-400M cyclotron (FLNR).
- Molecular dynamics modeling of the structural and functional properties of DNA photolyase and P53 protein.
- Calculation of the NICA collider shielding using the GEANT4 code.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Radiobiological research at charged particle beams**	**E.A. Krasavin**	Data taking Realization Data taking
LRB	A.N. Abrosimova, S.V. Aksenova, E.V. Baranova, K.V. Belokopytova, O.V. Belov, A.V. Boreyko, A.N. Bugay, N.N. Budennaya, V.N. Chausov, N.A. Emelyanova, T.A. Fadeeva, R.D. Govorun, E.V. Ilyina, A.A. Ivanov, A.A. Khachenkova, A.N. Kokoreva, N.A. Koltovaya, O.V. Komova, I.V. Koshlan, M.S. Lyashko, E.A. Nasonova, A.Yu. Parkhomenko, V.M. Petrov, I.I. Ravnachka, N.L. Shmakova, N.V. Shvaneva, S.I. Stukova, M.A. Tuchina, S.V. Vorozhtsova, A.Kh. Yagova, E.M. Zaytseva, N.I. Zhuchkina + 2 engineers, + 6 workers	
2. **Radiation research**	**G.N. Timoshenko**	Preparation Data taking R&D
LRB	V.E. Aleinikov, L.G. Beskrovnaya, A.N. Golovchenko, A.R. Krylov, V.A. Krylov, E.N. Lesovaya + 10 engineers, + 2 workers	
3. **Photoradiobiological research**	**M.A. Ostrovsky**	
LRB	T.B. Feldman, D.M. Kryuchkova, P.V. Kutsalo, K.O. Muranov, N.B. Polyansky, Yu.S. Severyukhin, V.A. Tronov, Yu.V. Vinogradova + 1 engineers, + 1 workers	
4. **Computer molecular modeling**	**Kh.T. Kholmurodov**	
LRB	G.F. Aru, E.B. Dushanov, V.L. Korogodina + 1 workers	
5. **Training activity**	**V.E. Aleinikov** **E.A. Krasavin** **S.Z. Pakuliak**	
LRB	V.E. Aleinikov,M.V. Altaisky, O.A. Bakerin, E.V. Baranova, O.V. Belov, A.V. Boreyko, N.N. Budennaya, T.B. Feldman, R.D. Govorun, A.A. Ivanov, Kh.T. Kholmurodov, N.A. Koltovaya, O.V. Komova, M.M. Komochkov, I.V. Koshlan, Yu.V. Mokrov, M.A. Ostrovsky, A.Yu. Parkhomenko, V.M. Petrov, G.N. Timoshenko	
UC	S.Z. Pakuliak	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU

Belarus	Gomel	IRB NASB
Bulgaria	Sofia	IE BAS
		NCRRP
Czech Republic	Brno	IBP ASCR
	Řež	NPI ASCR
		NRI
Egypt	Giza	CU
	Cairo	ASRT
		EAEA
Italy	Udine	UNIUD
Japan	Yokohama	RIKEN
Mongolia	Ulaanbaatar	NUM
Poland	Warsaw	INCT
	Krakow	NINP PAS
Romania	Bucharest	UMF
		ISS
	Iaşi	UAIC
		IBR
Russia	Moscow	MSU
		MSMU
		IBMP RAS
		ITEP
Slovak Republic	Bratislava	CU

04–9–1112–2013/2015	Priority: 1
	Status: New

Research on Cosmic Matter on the Earth and in Nearby Space; Research on the Biological and Geochemical Specifics of the Early Earth

Leaders: E.A. Krasavin
A.Yu. Rozanov
V.N. Shvetsov

Participating Countries and International Organizations:

Italy, Norway, Poland, Romania, Russia, United Kingdom, USA.

Scientific Programme

Research and development will include:

- Biogeochemical studies of cosmic dust
- Studies of biofossils and organic compounds in meteorites and ancient terrestrial rocks
- Studies of cosmic matter with nuclear physics methods
- As a result of studying and generalizing the research materials on modern and fossil cosmic dust as well as ancient terrestrial objects and modern organisms of the extreme ecosystems, data will be obtained on the forms of ancient terrestrial and extraterrestrial life.

As the results:

- Obtaining new data on the amount of cosmic matter falling on the whole Earth's surface.
- Obtaining data on the dynamics of cosmic dust fallout on large territories.
- Evaluation of the following parameters of particles of extraterrestrial origin (focusing on carbonaceous chondrites): morphology, structure, size distribution, and elemental, isotopic, and mineralogical composition. Assessment of changes in these characteristics in different plates in different time intervals.
- Creation of a cosmic dust collection, where dust microparticles will be characterized by quantity (concentration) and the size distribution.
- Cosmic dust research with spacecraft at the altitudes of 300 - 600 km: data generalization; creation of a comparative collection that is necessary for the isolation of the space component of the samples from the Earth's surface.
- Obtaining new information on the role of microorganisms in the formation and evolution of life on the Earth and processes of weathering, precipitation growth, etc.
- Obtaining data on Archaean and Proterozoic microfossils (including possible eukaryotic organisms) from different regions and microfossils in ancient residual soils and volcanogenic sedimentary rocks. The new data will be compared with data on younger - Phanerozoic - rocks.
- Generalization of the obtained data on the forms of ancient terrestrial and extraterrestrial life.

Expected main results in 2013:

- Detection and study of biofossils and organic matter in meteorites and the most ancient terrestrial rocks.
- Development of methods of detecting microorganism remnants in Archean and Proterozoic rocks and evaluating the level of their organization.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Studies of biofossils in meteorites and ancient terrestrial rocks**	**A.Yu. Rozanov** **E.A. Krasavin**	Data taking Realization Simulation
LRB	+ 2 pers.	
2. **Biogeochemical and biological studies of cosmic dust**	**L.M. Gindilis**	Data taking Realization Simulation
LRB	+ 3 pers.	
3. **Cosmic matter research with nuclear physics methods**	**V.N. Shvetsov**	Data taking Realization Simulation
FLNP	I.A. Bobrikov, A.Yu. Dmitriev, P.V. Sedyshev, M.V. Frontasyeva	

Collaboration

Country or International Organization	City	Institute or Laboratory
Italy	Rome	Univ. "La Sapienza"
	Viterbo	UNTUS
Norway	Trondheim	NTNU
Poland	Poznan	AMU
Romania	Bucharest	UB
Russia	Moscow	IGEM RAS
		IKI RAS
		MSU
		PIN RAS
		SAI MSU
	Borok	IPE RAS
	Gatchina	PNPI
	Novosibirsk	BIC SB RAS
United Kingdom	Buckingham	UB
USA	Athens, AL	ASU

04–2–1103–2010/2015	Priority: 1

Status: Extended

Medical and Biological Research with JINR Hadron Beams

Leader: G.V. Mitsyn

Participating Countries and International Organizations:

Czech Republic, Israel, Poland, Romania, Russia.

Scientific Programme

Medico–biological and clinical research for the treatment of cancer patients with beams of heavy nuclear particles of the JINR Phasotron and for the accompanying diagnostics.

Expected main results in 2013:

- Continuation of clinical researches on proton therapy of cancer patients in room No 1. To evaluate the effectiveness of the conducted radiation treatment of different neoplasms.
- Development of hardware and software for verification of patient set–up based on an X-ray digital detector.
- Test of the prototype equipment for dynamic conformal irradiation of deep-seated tumours with the proton beam.
- Development and improvement of detectors and tools for clinical dosimetry of the medical hadron beams.
- Exploration of the possibilities of laser radioprotection against damage after exposure to ionizing radiation in experimental mice like C57VL/6.
- Investigations of the molecular spectra of gene mutations induced by radiation in animal and human cells induced by ionizing radiation of different quality.

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Medico–biological and clinical research for the treatment of cancer patients and accompanying diagnostics at the medical–technical complex of JINR**	**G.V. Mitsyn**	R&D
DLNP	S.V. Shvidky, I.V. Alexandrova, I.D. Alexandrov, A.V. Agapov, M.V. Alexandrova, K.P. Afanasieva, S.Yu. Bakaev, K.Sh. Voskanyan, V.N. Gaevsky, G.V. Donskaya, V.M. Breyev, D.M. Yendzhejchak, Ye.I. Luchin, S.V. Korablinova, I.I. Klochkov, L.N. Korovina, Ya.V. Kurgansky, N.V. Levkovich, G.V. Mytsin, A.G. Molokanov, L.N. Namolovan, S.A. Pisareva, M.V. Repin, D.K. Sobolev, S.S. Uglova, M.A. Zeitlina, K.N. Shipulin	

Collaboration

Country or International Organization	City	Institute or Laboratory
Czech Republic	Řež	NRI
Israel	Haifa	IOE
Poland	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
	Poznan	GPCC
Romania	Bucharest	UMF
Russia	Moscow	VIGG RAS
		IBMP RAS
	Dubna	RDH-9
	Obninsk	MRRC

04–10–1111–2013/2014	Priority: 1
	Status: New

Multimodal Platform for Raman and Nonlinear Optical Microscopy and Microspectroscopy for Condensed Matter Studies

Leader: G.M. Arzumanyan

Participating Countries and International Organizations:

Armenia, Belarus, Germany, Moldova, Romania, Russia, USA.

Scientific Programme

Experimental studies on optical analysis of condensed matter by Raman and nonlinear optical microscopy and microspectroscopy, including CARS (Coherent Anti-Stokes Raman Scattering) spectroscopy, which is sensitive to the vibrational signatures of molecules, typically the nuclear vibrations of chemical bonds. Research of optical properties, chemical analysis, surface morphology and other characteristics of condensed matter on the multimodal optical platform constructed on the basis of the confocal laser scanning microscope "CARS".

Expected main results in 2013:

- Development of a technique for registration and processing of reflected, transmitted, fluorescent, Raman and CARS signals (F-CARS and E-CARS) for different samples.
- Software development for 3D scanning and imaging.
- Study of structural aspects and their impact on optical properties of luminescent glass materials and nanoglassceramics.
- Identification and visualization of morphological changes on the surface of radiation-damaged silicon. Obtaining new data on the features of production of various microdamages on silicon surface by laser scanning and spectroscopy methods.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. **Final adjustment and functional launch of the multimodal optical platform**	**G.M. Arzumanyan**	Realization
MAC "Nanobiophotonics"	I.A. Kryachko, A.V. Filippov	
2. **Testing, data taking and processing**	**G.M. Arzumanyan**	Data taking
MAC "Nanobiophotonics"	I.A. Kryachko, K.Sh. Voskanyan + 2 engineers	
3. **Study of optical properties and structural features of luminescent glass materials and nanoglassceramics**	**G.M. Arzumanyan**	Data taking
MAC "Nanobiophotonics"	V.Vartic, F.V. Filippov + 1 engineer	
FLNP	Kozlenko D.P. + 2 engineers	

4. **Investigation of structural modifications and spectroscopic characteristics of the surface of silicon wafers induced by ionizing radiation.** — **G.M. Arzumanyan** — Data taking

   MAC "Nanobiophotonics" — I.A. Kryachko + 1 engineer

   FLNR — V.F. Reutov

5. **Preparatory works for creation of infrastructure with adequate tools to enlarge the optical platform studied objects, in particular, biological and biocompatible samples.** — **G.M. Arzumanyan** — Preparotory work

   MAC "Nanobiophotonics" — K.Sh. Voskanyan, I.A. Kryachko

   VBLHEP — S.I. Tjutjunnikov

   FLNP — M. Balasoiu + 2 engineers

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
		Inst. Physiology NAS RA
Belarus	Minsk	BSTU
		"SOLAR TII"
Germany	Jülich	FZJ
Moldova	Chişinău	TUM
Russia	Moscow	Intertech Comporation
	Moscow, Zelenograd	NT-MDT Co.
	St. Petersburg	NITIOM
Romania	Bucharest	IFIN-HH
		UPB
USA	Buffalo, NY	UB's ILPB

Networking, Computing, Computational Physics (05)

05–6–1048–2003/2013	Priority: 1

Status: Approved for completion in 2013

Information, Computer and Network Support of JINR's Activity

Leaders: V.V. Ivanov
V.V. Korenkov
P.V. Zrelov

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, CERN, Czech Republic, Democratic People's Republic of Korea, Egypt, Georgia, Germany, Moldova, Mongolia, Poland, Romania, Russia, Slovak Republic, South Africa, Sweden, Ukraine, USA, Uzbekistan.

Scientific Programme

Provision of theoretical and experimental studies conducted by the JINR Member State institutions at JINR and other scientific centres with modern telecommunication, network and information resources. In order to fulfill the task, there are foreseen: the development of telecommunication channels of JINR with the JINR Member States on the basis of national and regional telecommunication networks; fault-tolerant operation and further development of the high-speed and protected local area network of JINR; development and maintenance of the distributed high-performance computing infrastructure and mass storage resources; information, algorithmic and software support of the research-and-production activity of JINR; reliable operation and development of the JINR Grid-segment as part of the global Grid-infrastructure.

Expected main results in 2013:

- Development of the basic and backup fiber optics communication links JINR-Moscow. Connection of the prototype of the JINR Tier1 centre to the LHCOPN network.
- Comprehensive modernization of the central telecommunication node of the Institute's IT-infrastructure.
- Central Information and Computing Complex (CICC) performance and data storage system increase in accordance with the 7-year plan for the JINR development.

  The CICC modernization aimed at carrying out the broad spectrum of user requested computational tasks (parallel, distributed, etc.).
- Support and modernization of the hard- and software environment for information, algorithmic and software support of the research activity underway at JINR.

  Development and support of the library JINRLIB, parallel computing technologies included.

  Further development and support of the central information servers, participation in the development, design and maintenance of various information sites of workshops and conferences in a hosting mode.

  Maintenance and modernization of information systems and databases of scientific and managing structures.

  Promotion and maintenance of the unified information 1C 8.2 framework for administrative activities at JINR.

  Development of the paperless documentation system DoctorDoc.

  Creation of a hard- and software platform of the Russian version of the DBpedia project (a system of semantic information search on the basis of the Wikipedia databases).
- Maintenance of the reliable operation of the JINR Grid-segment within the regional, national and problem-oriented Grid-infrastructures.

  Contribution to the development of wider cooperation with the JINR Member States in frames of the currently active Grid projects (RDIG, WLCG, EGI, GridNNN, Russian Grid Network).

Development of soft- and hardware tools for the global monitoring of task performance and accounting of the resources within the grid-environment. Test exploitation of the monitoring system for the grid-sites of Tier3 level involved in the LHC data processing.

Creation at JINR of a Tier1 center prototype for the CMS experiment at LHC. Modernization and extension of the long-term data storage system. Testing the equipment, the required services and the system functioning as a whole.

Further extension of the distributed educational and research grid-environment and provision on its basis of specialists training in the field of Grid-technologies.

List of activities:

Activity or experiment **Laboratory or other Division of JINR** **Responsible person**	**Leaders** **Main researchers**
1. **JINR telecommunication data links**	**V.V. Korenkov** **A.G. Dolbilov**
LIT	K.N. Angelov, N.M. Egoshina, A.Yu. Zakomoldin
2. **JINR local area network**	**V.V. Ivanov** **N.N. Karpenko**
LIT	K.N. Angelov, B.A. Bezrukov, D.V. Belyakov, E.Yu. Bulaeva, A.G. Dolbilov, S.V. Gavrilov, L.I. Gorodnicheva, M.F. Ermakova, V.A. Kapitonov, G.A. Korobova, V.I. Krasnoslobotsev, N.N. Mischenko, L.A. Popov, Ya.I. Rozenberg, E.V. Toneeva, A.I. Churin, V.P. Sheyko
DLNP V.A. Bednyakov	A.G. Dolbilov, Yu.P. Ivanov
LRB V.A. Krylov	
BLTP A.P. Isaev	A.A. Sazonov
FLNP V.N. Shvetsov	V.I. Prikhodko, G.A. Sukhomlinov
VBLHEP Yu.K. Potrebenikov	B.G. Shchinov, Yu.P. Minaev
FLNR V.I. Zagrebaev	S.V. Pashchenko, G.G. Gulbekyan
UC S.Z. Pakuliak	I.N. Semeniushkin
SCAR V.N. Samoilov	
3. **JINR Central Information and Computing Complex**	**V.V. Ivanov** **V.V. Korenkov** **V.V. Mitsyn**

	LIT	N.S. Astakhov, S.A. Baginyan, S.D. Belov, A.G. Dolbilov, A.S. Vorontsov, A.P. Gavrish, N.I. Gromova, P.V. Dmitrienko, N.N. Karpenko, P.I. Kisel, I.A. Kudasova, O.N. Kudryashova, E.Yu. Kulpin, N.A. Kutovskiy, A.A. Lavrentiev, S.B. Marchenko, Yu.A. Nazarov, A.I. Radov, V.T. Razuvakina, T.F. Sapozhnikova, E.A. Tikhonenko, V.V. Trofimov, N.I. Chuadze, N.V. Chuenkova
4. **Development of programming environment for information, algorithmic, and software support of the JINR research-and-production activity**		**P.V. Zrelov** **V.V. Korenkov** **M.V. Bashashin**
	LIT	T.O. Ablyazimov, D.V. Belyakov, A.A. Bogolubskaya, N.N. Vorobieva, V.P. Gerdt, T.M. Goloskokova, D.S. Golub, N.A. Davyudova, A.G. Zaikina, T.N. Zaikina, L.A. Kalmykova, A.A. Karlov, S.A. Kretova, G.G. Musulmanbekov, E.A. Paschenko, V.V. Pervushov, L.V. Popkova, A.V. Prikhodko, V.M. Pushkina, A.M. Raportirenko, A.P. Sapozhnikov, T.F. Sapozhnikova, S.V. Semashko, R.N. Semenov, A.V. Sheyko, V.A. Stepanenko, T.A. Strizh, T.S. Syresina, I.A. Filozova, G.V. Shestakova, V.P. Shirikov, V.M. Yagafarova
	SOICO N.A. Russakovich	V.F. Borisovskiy
	UC S.Z. Pakuliak	
5. **Development of the JINR grid-segment**		**V.V. Ivanov** **V.V. Korenkov** **T.A. Strizh**
	LIT	S.D. Belov, V.A. Vasiliev, L. Valova, V.V. Galaktionov, N.I. Gromova, P.V. Dmitrienko, V.E. Zhiltsov, I.S. Kadochnikov, D.V. Kekelidze, I.A. Krokhotina, N.A. Kutovskiy, V.V. Mitsyn, S.V. Mitsyn, I.K. Nekrasova, D.A. Oleynik, A.Sh. Petrosyan, E.A. Tikhonenko, V.V. Trofimov, A.V. Uzhinskiy

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	ANL
		IIAP NAS RA
		YSU
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	NC PHEP BSU
		JIPNR-Sosny
		NASB
		BNTU
	Gomel	GSTU
Bulgaria	Sofia	INRNE BAS

		SU
	Blagoevgrad	SWU
CERN	Geneva	CERN
Czech Republic	Prague	IP ASCR
Democratic People's Republic of Korea	Pyongyang	IFR SCNR
Egypt	Giza	CU
Georgia	Tbilisi	GRENA
		TSU
		UG
Germany	Darmstadt	GSI
	Frankfurt/Main	Univ.
	Hamburg	DESY
	Karlsruhe	KIT
	Munich	LMU
	Zeuthen	DESY
Moldova	Chişinău	ASM
		IMCS ASM
		IAP ASM
		RENAM
Mongolia	Ulaanbaatar	II MAS
		MUST
		NUM
Poland	Krakow	CYFRONET
	Poznan	AMU
	Wroclaw	WUT
Romania	Bucharest	IFA
		IFIN-HH
		ISS
	Cluj-Napoca	INCDTIM
Russia	Moscow	CIT&S
		e-ARENA
		IOC RAS
		IPI RAN
		ISA RAS
		ISP RAS
		ITEP
		JSCC RAS
		KIAM RAS
		MPEI
		MSU
		RCC MSU
		RIPN
		NRC KI
		RSCC

		SINP MSU
		SRI "Voskhod"
	Moscow, Troitsk	INR RAS
	Cherkessk	NCSHTA
	Chernogolovka	SCC IPCP RAS
		LITP RAS
	Dubna	Adm. of Dubna
		BSINP MSU
		"Dubna" Univ.
		Raduga
		SEZ "Dubna"
		SCC "Dubna"
	Gatchina	PNPI
	Novosibirsk	BINP SB RAS
	Pereslavl-Zalesskiy	PSI RAS
	Protvino	IHEP
	Puschino	IMPB RAS
	St. Petersburg	FIP
		IHPCIS
		SPbSPU
Slovak Republic	Košice	IEP SAS
South Africa	Cape Town	UCT
Sweden	Lund	LU
USA	Arlington, TX	UTA
	Chicago, IL	UChicago
	Pasadena, CA	Caltech
	Upton, NY	BNL
Ukraine	Kiev	BITP NASU
		NTUU KPI
	Kharkov	KFTI NASU
Uzbekistan	Tashkent	IMIT UAS

05–6–1060–2005/2013	Priority: 1

Status: Approved for completion in 2013

Mathematical Support of Experimental and Theoretical Studies Conducted by JINR

Leaders: V.V. Ivanov
Gh. Adam
P.V. Zrelov

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Belgium, Brazil, Bulgaria, Canada, CERN, Chile, Czech Republic, Egypt, France, Georgia, Germany, Greece, Italy, Japan, Kazakhstan, Moldova, Mongolia, Poland, Portugal, Romania, Russia, Slovak Republic, South Africa, Sweden, Switzerland, Taiwan, Tajikistan, Ukraine, USA, Vietnam.

Scientific Programme

Performance of top research in the field of computational mathematics and computational physics aimed at solving specific problems arising in experimental and theoretical studies conducted with the participation of JINR. Simulations of physical processes within experimental installations. Algorithm implementation into efficient and reliable hardware adapted programs. The successful realization of such research efforts assumes: development of new mathematical methods and tools for modeling physical processes and experimental data analysis; creation of methods and numerical algorithms for modeling magnetic systems; elaboration of software and computer complexes for experimental data processing; elaboration of numerical algorithms and software for the simulation of complex physical systems; development of methods, algorithms and software of computer algebra; contribution to the development of the new generation computing tools. Application of the developed methods and algorithms to other topics in science and technology (nanotechnology, biology, medicine, economy, industry, etc.)

Expected main results in 2013:

- Mathematical modeling and development of algorithms and software for the investigation of transmutation and fragmentation processes of atomic nuclei.

  Database development for the "Cascade" package.

  Increasing the predictive quality of the basic program for the simulation of the LHC setups in the Geant4 toolkit by implementing quark-gluon string model and by fine tuning model parameters.

  Simulations of the scattering of radioactive isotopes of light nuclei by protons and nuclei within a hybrid microscopic model. Microscopic modeling of pion-nuclear elastic scattering.

  Extension of the SAS program to cope with the modernization of the electron accumulation channel of the YUMO spectrometer.

  New software development to manage the planned new type position-sensitive detector.

  Development of a dynamically adapted neural network architecture for changing environments.

- Elaboration of algorithms and software modules for highly precise solution of nonlinear 3D magnetostatic problems based on the use of nested meshes.

  Computer simulations of the superconducting dipole magnet CBM (FAIR, GSI), optimization of parameters of the superconducting dipole and quadrupole magnets of accelerators SIS100 (FAIR, GSI) and NICA (JINR).

  Computer modeling of the modernization of the spectrometric magnet for nuclear physics experiments.

  Optimization of the methods of modeling the beam dynamics for the multipurpose isochronous cyclotron.

- Development of fast algorithms for event reconstruction exploiting the today computer environments (experiments CBM and BM@N). Development of new methods for rare process identification in the CBM experiment.

  Modernization of the remote access to the Control Room ATLAS.

  Theoretical and numerical study of effects enabling derivation of improved accuracy on the $\pi\pi$-scattering lengths from the raw DIRAC experiment data.

  Development of methods and programs for the analysis of neutron-diffraction spectra obtained in IBR-2 experiments.

  Development of methods and programs for the analysis of rare events recorded during super-heavy element synthesis at the U400 accelerator.

  Further development of methods and programs for the analysis of the coincidence spectra recorded in experiments on isomeric stage search.

- Study of hadron properties within QCD motivated strong interaction models for the description of the hot and dense nuclear matter. Development of mathematical methods for the analysis of the quark-hadron phase diagram (NICA experiment).

  Development of computer programs to calculate products of the reactions under chiral phase transitions in few-nucleon systems (for the NICA installation).

  Study of spin scissors mode and the fine structure of M1 states in deformed nuclei.

  Development of a new method, similar to the scalar-tensor theory, over a spinor field.

  Mathematical modeling of the modifications of the superficial layers of materials exposed to pulsed ion beams and high-energy heavy ions.

  Estimation of the accuracy of the truncation of the intermediate particle spectra via the different three-body field-theoretical Faddeev-type equations.

  Investigation of double photoionization processes of N^2, H^2 and calculation of the associated observables.

  Development of parallel algorithms and software for numerical solution of the nonlinear heat conduction equation taking into account the axial symmetry.

  Application of the Newton method for mathematical modeling of irregular integro-optical waveguides.

  Numerical study of progressive waves in systems described by nonlinear Schroedinger equations.

  Numerical simulations of long Josephson junctions using the double sine-Gordon equation.

  Derivation of quantitative consistency criteria in Bayesian quadrature.

- Development of symbolic algorithms and programs for investigation and calculation of: (a) quantum interferences in models based on finite symmetry groups; (b) multiloop Feynman integrals with application to 4-loop massless integrals; (c) constraints in singular field theoretic models; (d) involutive polynomial bases by parallel methods based on the MPI technology.

  Computer algebra modeling of the hadron therapy facility.

- Extension of the built-in algorithmic tools for the Mathematica based QuantumCircuit emulator of quantum computations.

  Development of symbolic-numerical algorithms for the analysis of spectral and optical characteristics of spheroidal quantum dots in homogeneous electric field.

  Analytical and numerical studies of qubit entanglement and its topological stability in a laser field.

  Construction of local invariants for the system qubit-qutrit.

  Investigation of coherent spin dynamics in magnetic nanomolecules and nanoclusters.

  Development of methods for describing order and quasi-order in finite quantum systems.

  Development of theory of granulated and clustering matter.

  Development of a computer program for the DNA-protein complexes mapping and its application to problems concerning the formation of such complexes.

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers
1. **Mathematical methods and tools for modeling physical processes and experimental data analysis**	**V.V. Ivanov** **P.V. Zrelov**
LIT	E.V. Zemlyanaya, V.M. Karnaukhov, B.F. Kostenko, I.N. Kukhtina, V.Yu. Lavrentiev, K.V. Lukyanov, A. Machavariani, T.I. Mikhailova, V.I. Palichik, A. Polanski, A.S. Rakityanskaya, L.A. Siurakshina, Yu.S. Smirnov, A.G. Soloviev, A.N. Sosnin, V.V. Uzhinsky, V.P. Filinova, N.Yu. Shirikova
2. **Methods and numerical algorithms for magnetic systems modeling**	**P.G. Akishin**
LIT	I.V. Amirkhanov, R.V. Polyakova, O.I. Yuldashev, M.B. Yuldasheva
3. **Software and computer complexes for experimental data processing**	**V.V. Ivanov** **P.V. Zrelov**
LIT	T.O. Ablyazimov, V.P. Akishina, I.N. Aleksandrov, E.I. Aleksandrov, S.A. Baginyan, O.Yu. Derenovskaya, N.D. Dikoussar, I.M. Ivanchenko, A.A. Kazakov, P.I. Kisel, V.M. Kotov, L.Yu. Kruglova, A.A. Lebedev, S.A. Lebedev, M.A. Mineev, G.A. Ososkov, A.M. Raportirenko, V.S. Shigaev, O.O. Voskresenskaya, A.V. Yakovlev, V.B. Zlokazov
4. **Numerical algorithms and software for simulation of complex physical systems**	**Gh. Adam** **I.V. Puzynin**
LIT	S. Adam, E.A. Ayrjan, A.S. Ayriyan, I.V. Amirkhanov, I.V. Barashenkov, I.L. Bogolubsky, Vo Trong Thach, E.V. Zemlyanaya, Yu.L. Kalinovsky, N.V. Makhaldiani, I.V. Molodtsova, D.I. Podgainy, T.P. Puzynina, V.S. Rikhvitsky, V.N. Robuk, N.R. Sarkar, I. Sarkhadov, B. Saha, S.I. Serdyukova, O.I. Streltsova, Z.K. Tukhliev, A.M. Chervyakov, O. Chuluunbaatar, Z.A. Sharipov, R.M. Yamaleev
5. **Methods, algorithms and software of computer algebra**	**V.P. Gerdt**
LIT	A.A. Bogolubskaya, A.A. Gusev, S.A. Evlakhov, V.V. Kornyak, Yu.G. Palii, A.M. Raportirenko, V.A. Rostovtsev, O.V. Tarasov, A.M. Khvedelidze, D.A. Yanovich
6. **Computing tools of a new generation**	**V.V. Ivanov** **Gh. Adam**
LIT	E.A. Ayrjan, V.P. Gerdt, A.A. Gusev, O.A. Afanasiev, J. Deperas, P.V. Zrelov, M.I. Zuev, Yu.G. Palii, V.A. Stepanenko, A.M. Khvedelidze, E.P. Yukalova

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
		IIAP NAS RA
		RAU
	Ashtarak	IPR NAS RA
Australia	Sydney	Univ.
Belarus	Minsk	IM NASB
Belgium	Brussels	ULB
	Liege	ULg
Brazil	Sao Carlos, SP	IFSC USP
Bulgaria	Sofia	IMI BAS
		INRNE BAS
		SU
	Plovdiv	PU
Canada	Edmonton	U of A
	Toronto	IBM Lab
CERN	Geneva	CERN
Chile	Valparaiso	USM
Czech Republic	Řež	NPI ASCR
Egypt	Cairo	TIMS
France	Metz	UPV-M
	Nantes	SUBATECH
Georgia	Tbilisi	UG
		RMI TSU
		TSU
Germany	Berlin	HUB
		FU Berlin
	Aachen	RWTH
	Darmstadt	GSI
	Dresden	IFW
	Frankfurt/Main	Univ.
	Giessen	JLU
	Jülich	FZJ
	Kassel	Uni Kassel
	Marburg	Univ.
	Potsdam	IASS
	Regensburg	UR
	Tübingen	Univ.
Greece	Thessaloniki	AUTH
Italy	Turin	INFN
Japan	Osaka	Kansai Univ.
Kazakhstan	Almaty	INP NNC RK
		IPT

Moldova	Chişinău	IAP ASM
Mongolia	Ulaanbaatar	NUM
Poland	Krakow	AGH
	Otwock-Swierk	NCBJ
	Rzeszow	UR
Portugal	Coimbra	UC
Romania	Bucharest	IFA
		IFIN-HH
		ISS
		UB
	Cluj-Napoca	INCDTIM
Russia	Moscow	CC RAS
		ITEP
		NNRU "MEPhI"
		MSU
		PFUR
		SINP MSU
		VIGG RAS
	Belgorod	NRU BelSU
	Chernogolovka	LITP RAS
	Protvino	IHEP
	Puschino	IMPB RAS
		ITEB RAS
		IPR RAS
		ICB RAS
	Saratov	SSU
	St. Petersburg	FIP
		NIIEFA
	Tomsk	TSU
	Tver	TvSU
Slovak Republic	Košice	IEP SAS
		TUKE
		PJSU
	Prešov	PU
South Africa	Cape Town	UCT
	Pretoria	UP
Sweden	Stockholm	KTH
Switzerland	Zurich	ETH
Taiwan	Taipei	AS
Tajikistan	Dushanbe	TNU
		PHTI ASRT
	Khujent	KSU
USA	Argonne, IL	ANL
Ukraine	Kiev	BITP NASU
		IM NASU

	Kharkov	IERT NASU
		KFTI NASU
Vietnam	Hanoi	VNU

05–8–1037–2001/2014	Priority: 1

Status: In-progress

Analytical and Methodological Work to Assess the Prospects of Scientific Research and Cooperation in the Main Directions of JINR's Development. Organization of International Cooperation

Leader: N.A. Russakovich

Participating Countries and International Organizations:

Member States of JINR, non-Member States participating in JINR activities on the basis of bilateral agreements, and international organizations.

Scientific Programme

Preparation by the JINR Science Organization Department of analytical materials on the prospects of scientific research. Preparation of research plans. Preparation of scientific-organizational and methodological materials concerning project-topical and special-purpose financing of research programmes and projects. Application of data base systems for the analysis of results of theoretical and experimental research activities. Organization of international cooperation with the Member States of JINR, non-Member States participating in JINR activities on the basis of bilateral agreements, and with scientific research institutions with which JINR has collaboration agreements.

Expected main results in 2013:

- Analysis of the results of JINR's activities in the main directions of research. Preparation for publication of the JINR Topical Plan for Research and International Cooperation for 2014.
- Information and technical preparation of the JINR Web site. Further development of the data base information search system for JINR research themes and projects. Information support of the electronic system of protocols for scientific and technical collaboration.
- Development and application of software for automation of scientific and financial planning. Analysis of the use of budgetary resources by fields of research, themes, and research groups.
- Maintenance of interaction on issues of scientific research work with representatives of the Member States of JINR and non-Member States participating in JINR activities on the basis of bilateral agreements. Organization and holding of meetings on cooperation with international organizations.

List of activities:

	Activity or experiment **Laboratory or other Division of JINR**	**Leaders** **Main researchers**
1.	**Preparation for publication of the JINR Topical Plan for Research and International Cooperation for 2014**	**N.A. Russakovich** **V.A. Bednyakov**
	SOD	N.A. Boklagova, L.K. Ivanova, N.I. Sissakian
2.	**JINR internet-site activities maintenance**	**N.A. Russakovich** **V.A. Bednyakov**

SOD	N.A. Boklagova, L.K. Ivanova, L.I. Kalinina, T.B. Ivashkevich, O.K. Kronshtadtov, K.P. Moisenz, A.G. Nanev, N.I. Sissakian
AMISD	V.F. Borisovskiy, S.V. Kuniaev, P.V. Ustenko
Editorial office, weekly newspaper "Dubna: Science, Coperation, Progress"	E.M. Molchanov
LIT	P.V. Zrelov, L.A. Kalmykova, A.V. Prikhodko
3. **Automation of scientific planning**	**N.A. Russakovich**
SOD	N.A. Boklagova, L.K. Ivanova
AMISD	V.F. Borisovskiy, S.V. Kuniaev
4. **International cooperation**	**N.A. Russakovich**
IRD	D.V. Kamanin

Educational Programme (06)

06–0–1078–2009/2013	Priority: 1

Status: Approved for completion in 2013

Organization, Support and Development of the Education Process at JINR

Leaders: V.A. Matveev
S.Z. Pakuliak

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, Canada, CERN, Czech Republic, Germany, Kazakhstan, Moldova, Poland, Romania, Russia, Slovak Republic, South Africa, Ukraine, USA, Vietnam.

Scientific Programme

Support and development of the JINR Educational Programme in general (training of physicists and engineers in JINR's fields of research and in the interests of the Member States). Professional development, training and retraining of JINR engineering and technical staff. Promotion of physics research and of the Institute's activities among the youth of the JINR Member States including secondary school pupils.

Expected main results in 2013:

- Support and maintenance of the study process at the UC. Preparation and publication - as tutorials - of lectures given to the UC students and postgraduates. Getting the state accreditation of postgraduate professional education programs.
- Organization and holding of the Summer Student Practice in JINR's fields of research for students of higher education institutions of the JINR Member States. Participation in the organization and holding of international schools on nuclear physics and particle physics for young scientists.
- Cooperation with international funds (DAAD, etc.) for organizing student and postgraduate exchanges between the UC and foreign research centres regulated by special agreements.
- Development of the computer infrastructure for organizing and conducting training programs for data analysis in high-energy physics experiments.
- Offering lecture courses and practical classes in physics for secondary school pupils of Dubna and JINR Member States on the basis of the UC's school laboratory class.
- Organization of excursions to JINR and video-conferences for secondary school pupils from Member States. Development of the system of teaching English and French to JINR young staff.
- Work-out of training and education programs in relativistic nuclear physics and the microcosm physics.
- Participation in the activities of the Academician Alexey Sissakian education Center.

List of activities:

	Activity or experiment **Laboratory or other Division of JINR** **Responsible person**	**Leaders** **Main researchers**
1.	**Organization of the Education Process at JINR**	**V.A. Matveev** **S.Z. Pakuliak**
	DLNP A.G. Olshevskiy	G.A. Chelkov, V.B. Brudanin, V.G. Sandukovskiy

BLTP V.V. Voronov, A.S. Sorin	D.I. Kazakov, A.V. Gladyshev, V.A. Osipov, S.N. Nedelko
FLNP A.V. Belushkin, V.N. Shvetsov	B.N. Savenko, A.M. Balagurov, Yu.N. Kopach
VBLHEP R. Lednický, V.D. Kekelidze	I.A. Golutvin, S.V. Shmatov, M.G. Sapozhnikov, N.N. Agapov, E.B. Plekhanov, A.V. Filippov
FLNR S.N. Dmitriev	A.V. Eremin, V.I. Zagrebaev, A.G. Popeko, A.S. Denikin
LIT V.V. Ivanov	V.V. Korenkov, N.A. Kutovskiy, A.V. Uzhinskiy, V.A. Vasiliev, V.P. Gerdt
LRB E.A. Krasavin	O.V. Belov, I.V. Koshlan, V.E. Aleinikov
SOICO W. Chmielowski	M.G. Loschilov, D.V. Kamanin
2. **Developing of modern educational projects**	**Y.A. Panebrattesev**

Collaboration

Country or International Organization	**City**	**Institute or Laboratory**
Armenia	Yerevan	YSU
Belarus	Minsk	BSU
		NC PHEP BSU
	Gomel	GSU
Bulgaria	Sofia	SU
	Blagoevgrad	SWU
Canada	Edmonton	U of A
CERN	Geneva	CERN
Czech Republic	Prague	CU
		CTU
	Řež	NPI ASCR
Germany	Weingarten	Univ.
Kazakhstan	Almaty	KNU
Moldova	Chişinău	ASM
Poland	Krakow	JU
	Lodz	UL
	Poznan	AMU
Romania	Bucharest	UB
Russia	Moscow	MGTU MIREA
		NNRU "MEPhI"
		SINP MSU
	Belgorod	NRU BelSU
	Dolgoprudny	MIPT
	Dubna	"Dubna" Univ.
		BMSUT MIREA

		BSINP MSU
	Kostroma	KSU
	Lipetsk	LSTU
	Tver	TvSU
	Tula	TSU
Slovak Republic	Bratislava	CU
	Košice	PJSU
South Africa	Pretoria	Necsa
Ukraine	Kiev	BITP NASU
		NUK
USA	Upton, NY	BNL
Vietnam	Hanoi	VNU

Applied Research with Nuclear Physics Methods (07)

07–1–1110–2012/2013	Priority: 2
	Status: Extended

Tests of the Universal Multiphase Separationless Flow-Meter (RhUMB)

Leader:

Yu.P. Filippov

Participating Countries and International Organizations:

Russia

Scientific Programme

Experimental investigation of characteristics of the three–phase flows "oil–gas–stratum water"

Expected main results in 2013:

- Substantiation of the application of gamma densitometer as an additional source of the RhUMB's signal for the flows "oil–gas–stratum water" .
- Creation of the two–phase flow–meter based on the purchased gamma densitometer and its test at the experimental set–up of VNIIR with mixtures "oil–gas", "oil–water" and"water–gas".
- Preparation of the authorization–based documents to apply gamma densitometer in Russian Federation.

List of projects:

Project	Leader	Priority (period of realization)
1. RhUMD	Yu.P. Filippov	2 (2012 – 2013)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. **Preparation of the substantiation**	**I.D. Kakorin** **Yu.P. Filippov**	Realization
2. **Creation of the two–phase flow–meter based on gamma densitometer and narrowing device**	**A.M. Kovrizhnykh**	Realization
3. **Experimental investigations at the test bench of VNIIR**	**K.S. Panferov** **I.D. Kakorin**	Realization
4. **Preparation of the authorization–based documents jointly with IPTP**	**Yu.P. Filippov**	Realization

Collaboration

Country or International Organization	City	Institute or Laboratory
Russia	Dubna	IPTP
	Kazan	VNIIR

Alphabetic List of Collaborators

Albania

Tirana

UT (University of Tirana | http://www.unitir.edu.al/), 123

Argentina

Buenos Aires

CNEA (National Atomic Energy Commission | http://www.cnea.gov.ar/), 136

Armenia

Ashtarak

IPR NAS RA (Institute for Physical Research of the National Academy of Sciences of the Republic of Armenia | http://www.ipr.sci.am/), 164

Yerevan

ANL (Alikhanian National Laboratory | http://www.yerphi.am/), 10, 20, 33, 39, 56, 62, 88, 91, 94, 158

IIAP NAS RA (Institute for Informatics and Automation Problems of the National Academy of Sciences of the Republic of Armenia | http://www.iiap.sci.am/), 158, 164

Inst. Physiology NAS RA (L.A.Orbeli Institute of Physiology of the National Academy of Sciences of the Republic of Armenia | http://www.physiol.am/), 153

RAU (Russian-Armenian (Slavonic) University | http://www.rau.am/), 10, 164

YSU (Yerevan State University | http://www.ysu.am/), 20, 24, 75, 88, 99, 112, 146, 153, 158, 164, 171

Australia

Melbourne

Univ. (University of Melbourne | http://unimelb.edu.au/), 20, 123

Sydney

Univ. (University of Sydney | http://sydney.edu.au/), 20, 24, 99, 164

Austria

Innsbruck

Univ. (University of Innsbruck | http://www.uibk.ac.at/), 16, 123

Vienna

HEPHY (Institute of High Energy Physics of the Austrian Academy of Sciences | http://www.hephy.at/), 56

IAEA (International Atomic Energy Agency | http://www.iaea.org/), 123

TU Vienna (Vienna University of Technology | http://www.tuwien.ac.at/), 24, 28

Univ. (University of Vienna | http://www.univie.ac.at/), 28

Azerbaijan

Baku

IP ANAS (Institute of Physics of the Azerbaijan National Academy of Sciences | http://www.elm.az/physics/), 10, 39, 75, 131, 158

IRP ANAS (Institute of Radiation Problems of the Azerbaijan National Academy of Sciences | http://www.science.gov.az/), 91, 136

Belarus

Gomel

BelSUT (Belarusian State University of Transport | http://www.belsut.gomel.by/), 10, 56

GB NASB (Gomel Branch of the National Academy of Sciences of Belarus | http://www.gbnas.by/), 142

GEI (Gomel Engineering Institute of the Ministry for Energency Situations of the Republic of Belarus | http://www.gii.gomel.by/), 142

GSTU (Pavel Sukhoi State Technical University of Gomel | http://www.gstu.by/), 10, 39, 66, 158

GSU (Francisk Skorina Gomel State University | http://www.gsu.by/), 10, 35, 56, 66, 75, 142, 171

IRB NASB (Institute of Radiobiology of the National Academy of Sciences of Belarus | http://irb.basnet.by/), 147

Minsk

BNTU (Belarusian National Technical University | http://www.bntu.by/), 158

BSTU (Belarusian State Technological University | http://www.bstu.unibel.by/), 153

BSU (Belarusian State University | http://www.bsu.by/), 116, 131, 142, 171

BSUIR (Belarusian State University of Informatics and Radioelectronics | http://www.bsuir.by/), 79

ICE MES RB (Institute for Command Engineers of the Ministry for Emergecy Situations of the Republic of Belarus | http://kii.gov.by/), 20

Belgium

Brazil

Bulgaria

Georgia

Germany

Greece

Hungary

India

Japan

Portugal

Republic of Korea

Serbia

Ukraine